SAP Business Information Warehouse Functions in Detail

Version 4.0 SAP BW 3.5
November 2004

This Document

Version	Date of Last Change	Release Status
Version 1.0	30.09.2002	SAP BW 3.0B
Version 2.0	October 2003	SAP BW 3.1Content
Version 3.0	April 2004	SAP BW 3.5
Version 4.0	November 2004	SAP BW 3.5

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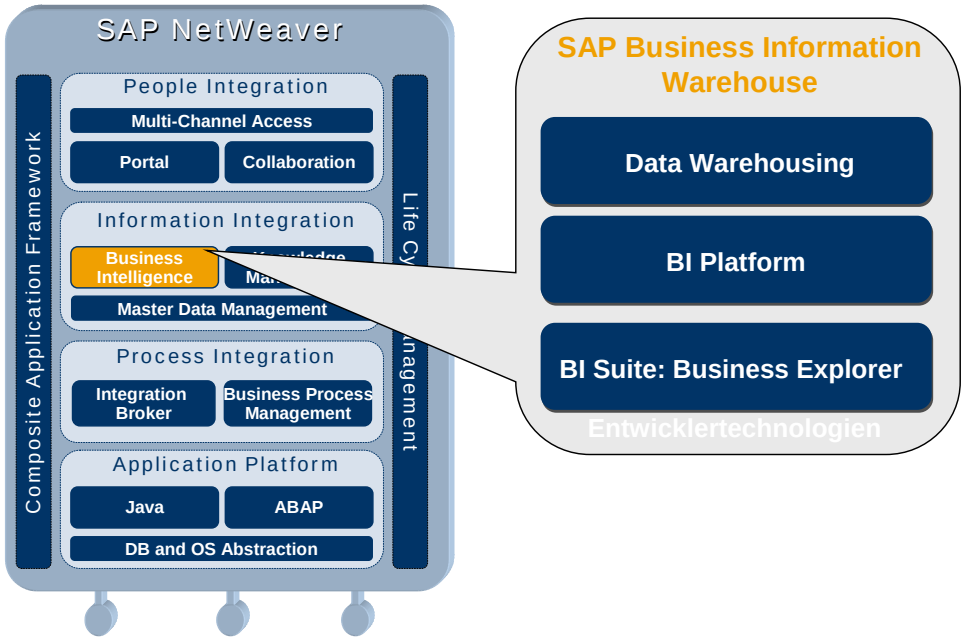
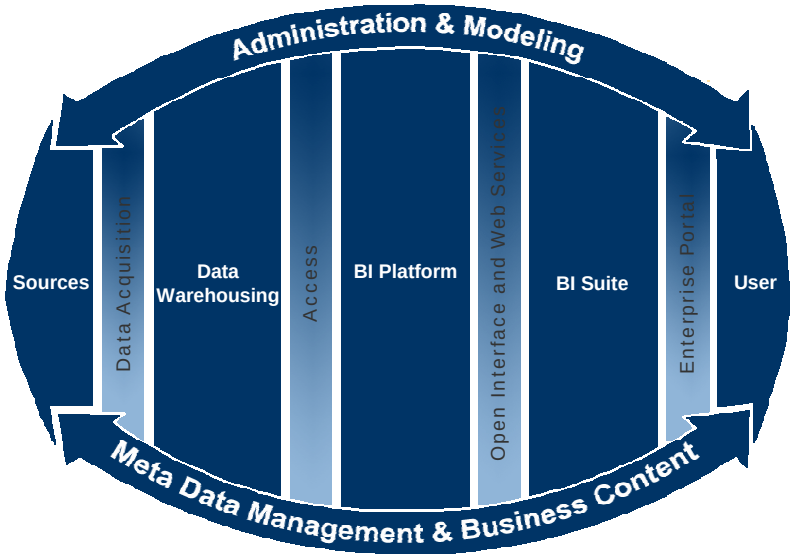
Introduction

Reporting, analysis and interpretation of business data is a central focus for companies that wish to guarantee competitiveness, optimize processes and be able to react quickly and in line with the market. As the following graphic illustrates, **SAP Business Information Warehouse (SAP BW)**, as a core component of SAP NetWeaver data warehousing functionality, provides both a business intelligence platform and a suite of business intelligence tools.



With the tool set provided, relevant business information can be integrated into SAP BW and transformed and consolidated there. SAP BW enables analysis and interpretation as well as the distribution of this information. Based on this analysis, sound decisions can be made and goal-oriented activities can be initiated. With extensive predefined information models provided for the various roles in a company (BI Content), SAP BW also increases the usability of these analyses and enables a quick, cost-effective implementation. The core areas of SAP BW are illustrated in the following graphic:



The functions in detail document is aimed at people who have little experience with SAP BW and are looking for an overview of the features SAP BW provides. Knowledge of data warehouse and business intelligence solutions, as well as an awareness of Internet standards and standardized communication technologies is assumed. The functions in detail document summarizes the most important functions and tools provided by SAP BW as of release 3.5 and offers an overview of the ways in which these functions and tools can be used. BI Content, delivered for SAP BW, is not discussed in this document.

You can find additional information about SAP BW functions in the SAP BW documentation in the SAP Help Portal, at http:\\help.sap.com under *SAP NetWeaver → SAP NetWeaver → Information Integration → SAP Business Information Warehouse*. You will also find the documentation for the BI content there.

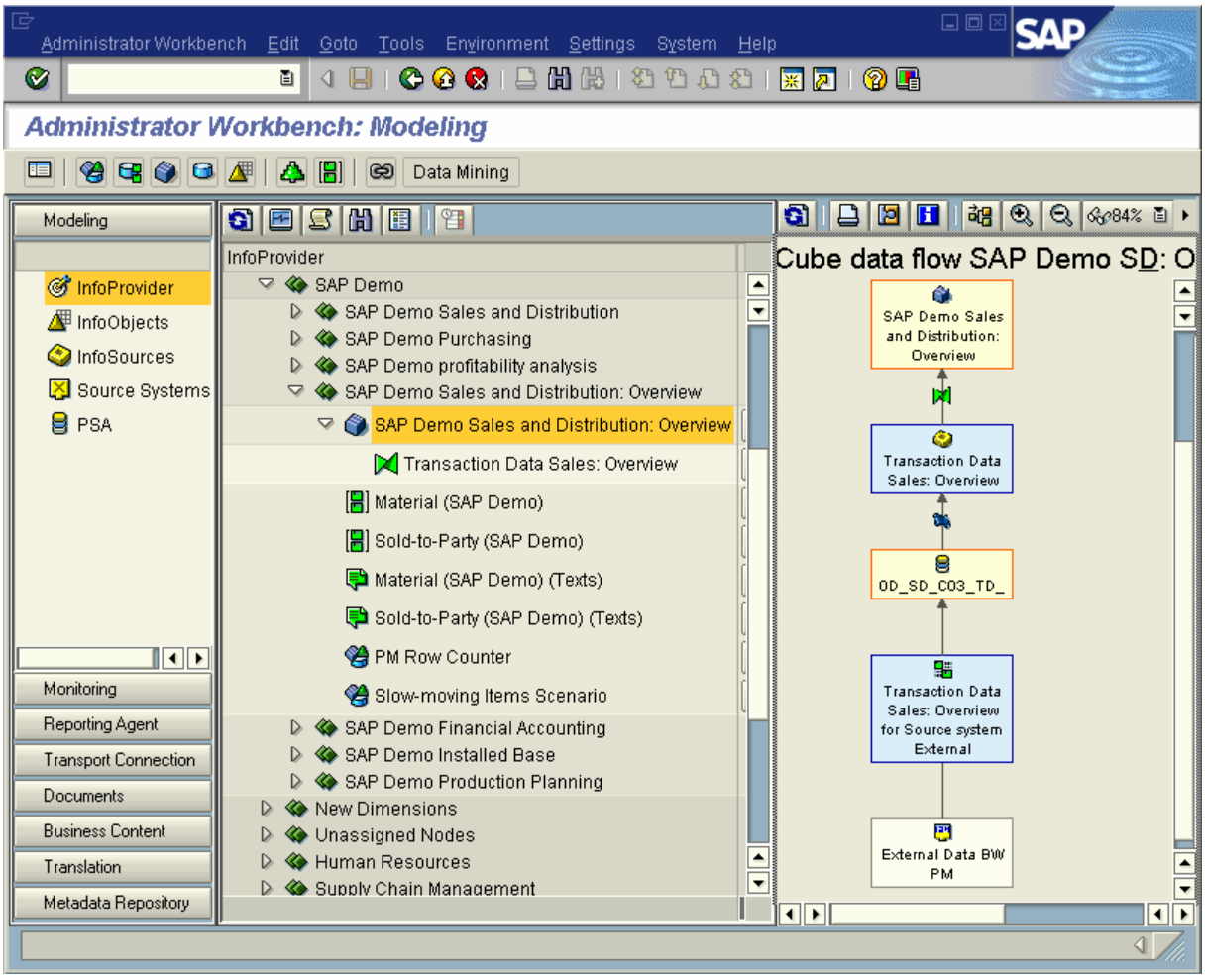
You can also find more information regarding SAP BW product documentation in the SAP Service Marketplace at Internet address http://service.sap.com/bw in the rubric *Documentation*. Here you will find links to the most up-to-date documentation and to the SAP BW glossary. Links to the *Documentation Enhancements* (any changes in the documentation) are also available here.

1 Data Warehousing

Data warehousing in SAP BW represents the integration, transformation, consolidation, cleanup and storage of data. It also signifies the extraction of data for analysis and interpretation. The data warehousing process includes data modeling, data extraction and the management of the data warehouse management processes.
In the following sections of this chapter **data modeling**, **data retrieval**, and **data warehouse management** in SAP BW are discussed in more detail. First we will introduce the central tool for data warehousing tasks in SAP BW – the Administrator Workbench.

1.1 Administrator Workbench

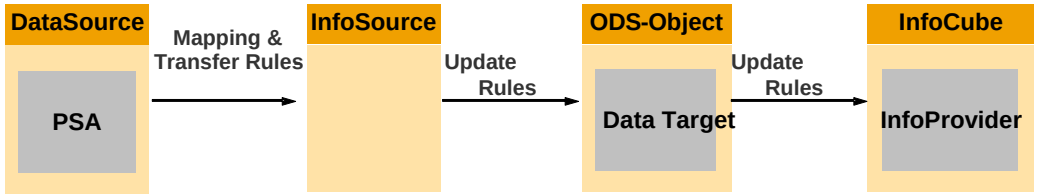
The **Administrator Workbench** within SAP BW is the central tool for executing tasks in the data warehousing process. Data modeling functions, as well as functions for the controlling, monitoring and maintenance of all the processes in SAP BW that are linked to data retrieval, storage, and processing, are made available through the **Administrator Workbench**.
The following screenshot shows the Administrator Workbench with its various functional areas on the left-hand side, an overview of the available BW objects (InfoProvider in this case) in the middle, and a view of the dataflow for the selected object on the right-hand side.



1.2 Data Modeling

The data model is fundamental to answering those questions relevant to an organization using the SAP BW. The data model describes the data flow of the relevant business information from the source to the analyzable object in SAP BW. In modeling you can create and edit the objects and rules for the Administrator Workbench that are required for data transfer, updating and analysis. You can also execute functions connected to them.

The following graphic illustrates the data flow in SAP BW:



The individual components of the model will be explained in the next sections of this chapter.

1.2.1 DataSource

Sources that extract data for the SAP Business Information Warehouse are connected to the SAP BW as source systems. The key element of the SAP BW information model in the source system is the **DataSource**. This describes data that is provided from a source system to a business unit. Technically speaking it contains a number of logically related fields arranged in a flat structure (the extract structure), used to transfer data into the BW.
The BW-relevant metadata in the DataSource is transferred into the BW according to the type of source system. Where the source system is a SAP system, the metadata is copied from the source system. Where the source system is a flat file, the metadata is defined directly in the BW.
On the request of the SAP BW, data is transferred from the source system into the SAP BW in the transfer structure. The transfer structure is a selection of DataSource fields that eventually contain information relevant to decision-making about a business process.

1.2.2 Persistent Staging Area Table

The physical store for data entering the SAP BW from source systems is the Persistent Staging Area table (PSA table). The data is then stored in a transparent, relational database table in the SAP BW.
A PSA table is created for every source system DataSource. The request data is stored in the PSA table in the same format as the corresponding DataSource transfer structure. The PSA table also contains key fields for the data request ID, the data package number, and the data record number. The data format remains essentially unchanged in comparison to the source system in the PSA table, that is, no conversion routines or transformations occur. In some circumstances a conversion may be necessary in order to ensure that data in the SAP BW is consistent. For example, if the source system date format differs from the YYYYMMDD (19991231) format used in the SAP BW.
The data records in BW are transferred directly to the transfer structure when you load data using the PSA table. Data is written to the PSA table from the transfer structure, and stored there. Data can be written to data targets from the PSA table by using transformations.
You can check the data for the request in the PSA table either manually or using a program. You can then change incorrect data records so that they are not written to the data targets. This gives you the opportunity to correct update errors or validate data before it is processed in BW.

1.2.3 InfoSource

In BW, an InfoSource, in comparison to a DataSource, records independently of the source system the quantity of all the data available for a business transaction or a type of business transaction (for example, cost center accounting). An InfoSource is a quantity of logically related InfoObjects summarized into a single unit. It is available in the form of the communication structure. InfoSources contain either transaction data or master data (attributes, texts and hierarchies).

Mapping and Transformation

In BW a DataSource is mapped to an InfoSource. If logically related fields exist in various source systems, they can be grouped together into a single InfoSource in BW. In this way, several DataSources are mapped to one InfoSource.

In the maintenance of transfer rules for a combination of DataSources and InfoSources, individual fields in the DataSource are mapped to the corresponding InfoObjects in the InfoSource. Information on how the data from the DataSource is to be transferred into the InfoSource is also stored here. The data that is uploaded is transformed by transfer rules. An extensive library of transformation functions

that contain transaction logic can be applied here to cleanse data and render data analyzable. These rules can be applied easily using formulas. Coding is not necessary. (Also see the chapter on Update Rules).

There are basically two types of InfoSources:

- InfoSources with flexible updating: These can update data into any data targets (except hierarchies). Update rules are created for this InfoSource. This allows master data to be updated into a master data ODS object, where the data can be cleaned up and consolidated. Also see the chapter on ODS Objects.
- InfoSources with direct updating: These can write master data (characteristics with attributes, texts or hierarchies) for an InfoObject directly (without update rules) to the master data table.

A data target can be defined by several InfoSources that in turn can be defined by several source systems.

1.2.4 Update Rules

Update rules specify how data (characteristics, time characteristics, key figures) is updated from InfoSources into data targets. You are therefore connecting an InfoSource with a data target. An update rule must be specified for each key figure and the corresponding characteristics of the InfoCube. For an ODS object, it must be specified for the data and key fields, and for an InfoObject it must be specified for the attribute and key fields.

With the update type, you control whether a key figure or data field is updated in the InfoProvider. The following update types exist:

1. No update
2. Addition, minimum or maximum
3. Overwriting (with ODS objects and InfoObjects only)

You use the calculation method to control whether and how a characteristic / key figure or a data field / key field should be updated in the data target. There are several options:

- Source InfoObject: The field is filled directly from the selected source InfoObject of the communication structure.
- Constant: The field is not filled by the communication structure, but directly with the specified value.
- Formula: The key figure / data field / attribute is updated with a value determined using a formula. The transformation library, in collaboration with the formula builder, enables you to easily create formulas, without using ABAP coding. Over 70 predefined formulas are available in various categories, such as functions for character strings, date functions, basic functions, mathematical functions and so on.
- Master data attribute of: The data field / attribute is updated by reading the master data table of an characteristic contained with a key and a value in the communication structure and containing the corresponding data field / attribute as attribute. The attributes and their values are read from the key, these are then returned.
- Routine: The field is filled by the update routine you wrote. This allows you to create a routine with a single return value or a return table, or a routine with unit calculation.
- Initial value: The field is not filled. It remains empty.

These calculation methods are also available with transfer rules.

It is also possible to translate currencies for key figures when updating into InfoCubes. Also see the chapter on currency translation.

Another option for more complex transformations, where the calculation methods available are not sufficient, is to create a start routine that is then executed for each data packeage at the beginning of the update. You can, for example, use the start routine to generate internal tables that you can then use for key figure and characteristic routines.

1.2.5 InfoObjects

Business evaluation objects are called InfoObjects in BW. These are divided into characteristics (customer), key figures (business volume), units (currency, units of measure), time characteristics (fiscal year), and technical characteristics (request number).

InfoObjects are the smallest units of BW. They structure the information needed to create data targets.

Characteristics are evaluation groups like, for example, company code, product, customer group, fiscal year, period, or region. These provide opportunities for categorizing the dataset and act, in this way, as reference objects for key figures. The characteristics determine the level of detail in which the key figures are managed in the data target. A data target generally only contains a partial quantity of the characteristic values from the master data table. Master data comprises the permitted values of a characteristic – the characteristic values.

Key figures deliver the values that are to be analyzed in a query. Key figures can be quantities, amounts or number of items. They constitute the data part in a data target.

Units give the values of the key figures meaning. A currency key is always assigned to key figures of the type *Amount* and key figures of type *Quantity* always receive a unit of measurement.

Time characteristics are characteristics like date and fiscal year.

Technical characteristics only have a structural use within BW. Request numbers in the InfoCube are one example. They are taken when you load a request and help you find the request at a later date. The request concept is discussed in more detail in the chapter on the Scheduler.

Special Features of Characteristics:

If characteristics have attributes, texts, or hierarchies at their disposal then we speak of master data-bearing characteristics. Master data is data that remains unchanged over a long period of time. It contains information that is always needed in the same way. This master data can be referenced in all data targets. It also makes it possible to create characteristics with references. The reference characteristic delivers attributes, master data, texts, hierarchies, data type, length, number and type of compounded characteristics for the newly-created characteristic. One case where this is necessary is the elimination of internal business volume. Also see the chapter on eliminating internal business volume on this.

A hierarchy is always created for a characteristic. This characteristic is the basic characteristic for this hierarchy. As with attributes, hierarchies give characteristics a structure. For example, company location can be an attribute of *Customer*. You can then use these to form customer groups for a specific region. You can also define a hierarchy to make the structure of the characteristic *Customer* more clear in its overview. Also see the chapter on hierarchies.

Special Features of Key Figures:

A key figure is given additional properties that influence not only the load process but also the query display. The assignment of a fixed or variable currency, determination of the aggregation and exception aggregation for non-cumulative key figures and the number of decimal places in the query are important here.
InfoObjects are used in the following BW objects:

1. Component of an InfoSource:
   An InfoSource is always a quantity of logically related InfoObjects. InfoObjects can be used in as many InfoSources and InfoCubes / ODS objects as you want.
2. Composition of a data target:
   A data target is comprised of a quantity of InfoObjects.
   In an InfoCube, the characteristics, units and time references largely form the key fields while the key figures form the data part of the fact table of an InfoCube.
   In an ODS object, characteristics generally form the key fields, however, they can also be included in the data target together with the key figures, the units and time references.
3. InfoObject attributes

1.2.6 Data Targets

A data target is an object into which data is loaded. Data targets are the physical objects that are relevant during data modeling and when loading the data.

Data targets are:

- Basic InfoCubes
- Transactional InfoCubes
- ODS Objects
- InfoObjects (characteristics with attributes, texts or hierarchies).

A distinction is made between:

- Data targets for which queries can be defined. These are called InfoProviders.

- Pure data targets for which no queries can be created or executed. An InfoCube might only be used as a data source for another InfoCube. This is also possible for ODS objects and InfoObjects.

1.2.6.1 InfoCube

Object that functions as a data target and as an InfoProvider.

An InfoCube describes (from a reporting point of view) a self-contained dataset, for example, of a business-orientated area. This dataset can be evaluated using a BEx query.

There are various types of InfoCubes:

1. Physical data stores:
   - (Basic) InfoCubes
   - Transactional InfoCube
2. Virtual data stores:
   - RemoteCube
   - SAP RemoteCube
   - Virtual InfoCubes with Services

Only Basic InfoCubes and transactional InfoCubes physically contain data in the database. InfoCubes with virtual data stores simply display logical views of a dataset. The type of InfoCube is not important from a reporting point of view since the InfoCube is accessed as an InfoProvider here.

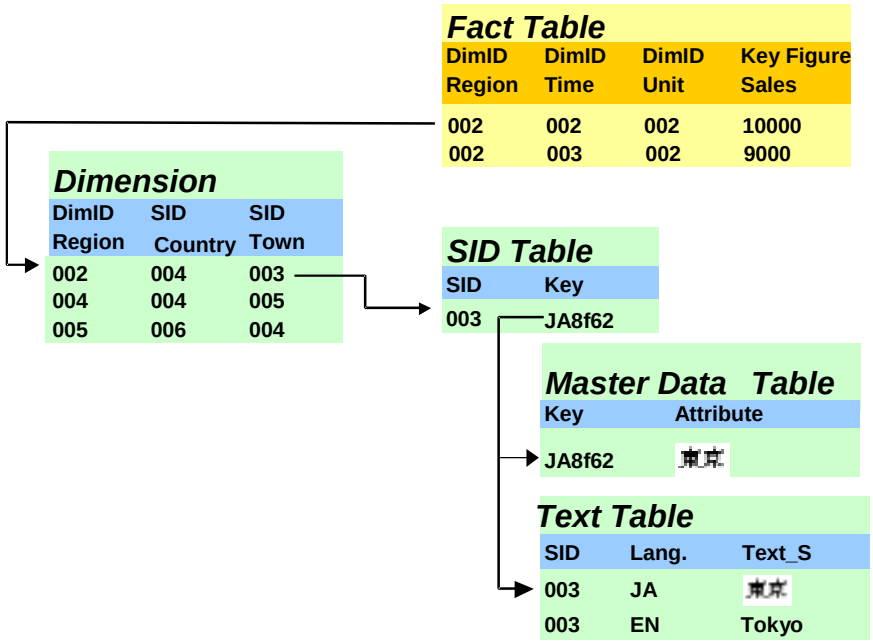
InfoCubes group a set of InfoObjects together. All InfoObjects (characteristics and key figures) are available across all InfoCubes. Characteristics refer to the master data with their attributes, texts, and hierarchies.

An InfoCube consists of a number of relational tables that correspond to the star schema: A fact table in the center that contains the key figures of the InfoCube with several dimension tables around it, in which the characteristics of the InfoCube are stored. This InfoCube structure is optimized for reporting.

The fact table and the dimensions are linked to each other using identifying, abstract numbers (dimension IDs), which are found in the key of the particular database table. As a result, the key figures of the InfoCube relate to the characteristics of the dimension. The characteristics determine the granularity (the degree of fineness), in which the key figures are managed in the InfoCube.

Logically related characteristics are grouped together in one dimension (district and area, for example, belong to the dimension *Region*). By adhering to this design criterion, dimensions are, to a large extent, independent of each other, and dimension tables – in comparison to fact tables – have a relatively small data volume, which is beneficial for performance. The fact table and dimension tables are both relational database tables.

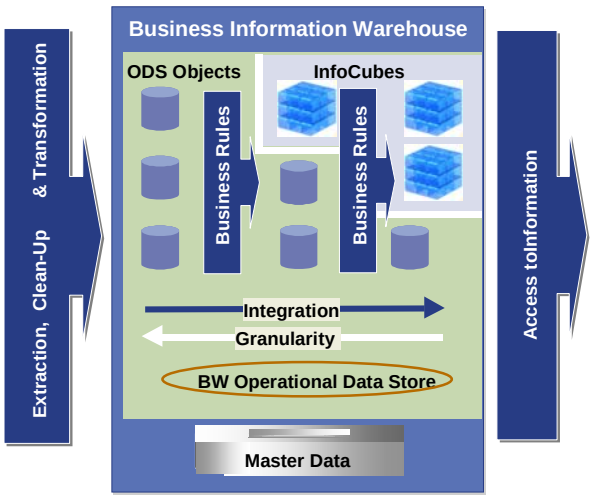
Extract from an InfoCube star schema:



1.2.6.2 ODS Object

An ODS object acts as a storage location for consolidated and cleaned-up data (transaction data or master data, for example) on the document (atomic) level.

This data can be evaluated using a BEx query.



The following ODS object types can be differentiated:

1. Standard ODS Object
2. Transactional ODS object: The data is immediately available here for reporting without you having to activate it yourself. The transactional ODS object only consists of a table of active data and does not contain its data in versioned form. To define a BEx query based on a transactional ODS object, you have to create an InfoSet for the transactional ODS objects.

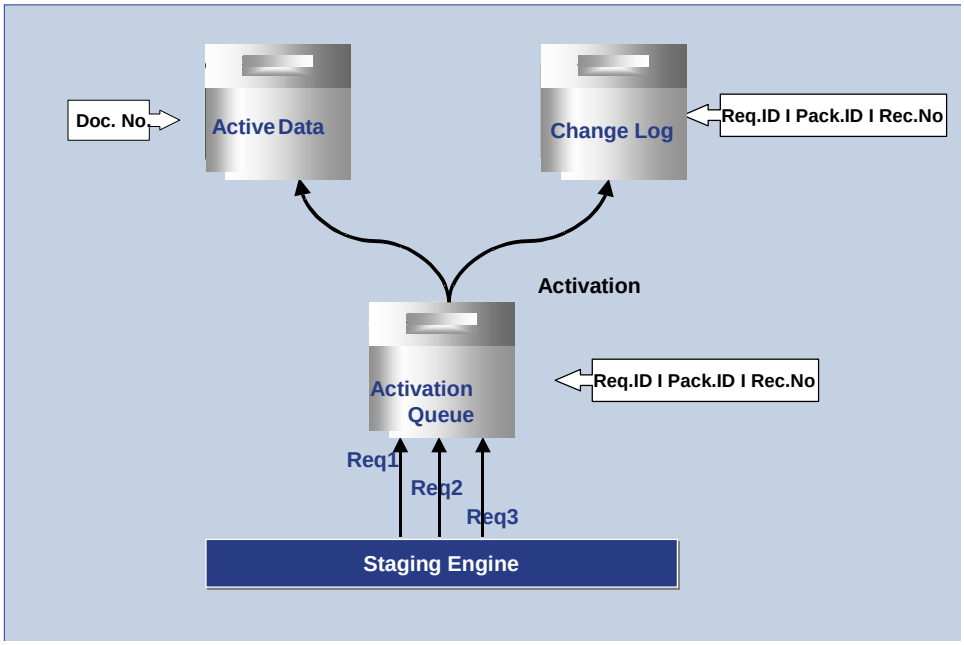
An ODS object contains key fields (for example, document number / item) and data fields that can also contain character fields (for example, order status, customer) as key figures. The data from an ODS object can be updated with a delta update into InfoCubes and/or other ODS objects or master data tables (attributes or texts) in the same system or across different systems.
Unlike multi-dimensional data storage using InfoCubes, the data in ODS objects is stored in transparent, flat database tables. Fact tables or dimension tables are not created. The cumulative update of key figures is supported for ODS objects, just as it is with InfoCubes, but with ODS objects it is also possible to overwrite data fields. This is particularly important with document-related structures, since changes made to documents in the source system do not apply solely to numeric fields such as order quantity, but also to non-numeric fields such as goods receiver, status, and delivery date. To map these changes in the BW ODS objects, the relevant fields in the ODS objects must also be overwritten and set to the current value.
Every ODS object (excluding transactional ones) is represented on the database by three transparent tables:

Active data: A table containing the active data (A table)

Activation queue: For saving ODS object data records that are to be updated but that have not yet been activated. The data is deleted after the records have been activated.

Change log: Contains the change history for updating delta from the ODS object into other data targets, such as ODS objects or InfoCubes for example.

The tables containing active data are constructed according to the ODS object definition, meaning that key fields and data fields are specified when the ODS object is defined. Activation queue and change log are the same in their structure. They have the request ID, package ID and the record number as a key.



This graphic shows how the various ODS object tables interact when data is loaded:

Data can be loaded simultaneously from several source systems as parallel insert is facilitated by a queuing mechanism. The key allows records to be labeled consistently in the activation queue.

Data arrives in the change log via the activation queue and is written to the active data table when activated. During activation, the requests are sorted according to their logical keys. This ensures that the data is updated in the active data table in the correct request sequence.

1.2.6.3 Performance-Optimized Data Target Modeling

There are a number of functionalities in modeling data targets to support you in improving the load and query performance of your BW system.

1.2.6.3.1 Optimizing Performance for InfoCubes

The InfoCube structure is optimized for reporting. In addition, various database-related functions help you achieve a good load and query performance.

Partitioning

By using partitioning you can split up the whole dataset for an InfoCube into several, smaller, physically independent and redundancy-free units. Thanks to this separation, performance is increased when reporting, or also when deleting data from the InfoCube. The availability of this function depends on the database being used.

Database and Aggregate Table Indexes

Even with an increasing number of data records in an InfoCube, you can improve load and query performance by checking and, where necessary, repairing the indexes. This is attributed to the increasing demands on the system for maintaining indexes. The indexes that are created in the fact table for each dimension allow you to easily find and select the data. When initially loading data into the InfoCube you should not create the indexes at the same time as constructing the InfoCube. Instead, do this afterwards.

Just as for the indexes of the fact table, you can maintain the indexes of the aggregation tables.

Database Statistics
The database statistics are used by the system, to optimize the query performance. You should keep the database statistics up-to-date for this reason.

It is recommended that you always update the statistics if you have loaded more than a million new records in the InfoCube since the last update.
You can automatically recalculate the database statistics after each load/ after each delta upload.

Compressing InfoCubes

For performance reasons, and to save space on the memory, summarize a request as soon as you have established that it is correct, and is no longer to be removed from the InfoCube.

When you load data into the InfoCube, entire requests can be inserted at the same time. Each of these requests has its own request ID, which is included in the fact table in the packet dimension. This makes it possible to pay particular attention to individual requests. One advantage of the request ID concept is that you can subsequently delete complete requests from the InfoCube.
However, the request ID concept can also cause the same data record (all characteristics agree, with the exception of the request ID) to appear more than once in the fact table. This unnecessarily increases the volume of data, and reduces performance in reporting, as the system has to aggregate with the request ID every time you execute a query.

Using compressing, you can eliminate these disadvantages, and bring data from different requests together into one single request.

1.2.6.3.2 Optimizing Performance for ODS Objects

The load performance for ODS objects can be optimized by adhering to the following guidelines:

1. Creating SIDs

   In the following cases you can avoid creating SIDs and thereby improve performance:
   - If you are only using the ODS object as a data store, do not set the BEx Reporting indicator.
   - If you use line items (for example, document number, time stamp) as characteristics in the ODS object, flag these as *Attribute Only* in the characteristic maintenance.

2. DB partitioning in active data tables (A table):

   By partitioning by database level, you can delete data from the ODS object much more quickly. As a partitioning criterion, choose the characteristic by which you want to delete.

3. Indexing:

   In certain cases query performance can be optimized by creating additional secondary indexes.

4. Activating data in the ODS object:

   You can make the following specifications in Customizing in order to improve performance when activating data in the ODS object:
   - the maximum number of parallel processes when activating data in the ODS object as when creating SIDs
   - the minimum number of data records for each data package when activating data in the ODS object, meaning you define the size of the data packages that are activated

- the maximum wait time in seconds when activating data in the ODS object. This is the time when the main process (batch process) waits for the dialog process that is split before it classifies it as having failed.
- the server group that needs to be used when activating the data in ODS objects in parallel

5. Loading unique data records:
   If you are only loading unique data records (that is data records with a unique key combination) into the ODS object, you are able to improve load performance by setting the relevant indicator in ODS object maintenance. The records are then updated more quickly as the system no longer checks whether the record is available.

For more information on performance, see the *Performance Optimization* chapter and the document *BW 3.x/2.x Performance Tuning* in the SAP Service Marketplace under *BW → Performance.*

1.2.7 InfoProvider

An InfoProvider is an object for which queries can be created or executed in the Business Explorer. InfoProviders are the objects or views that are relevant for reporting.

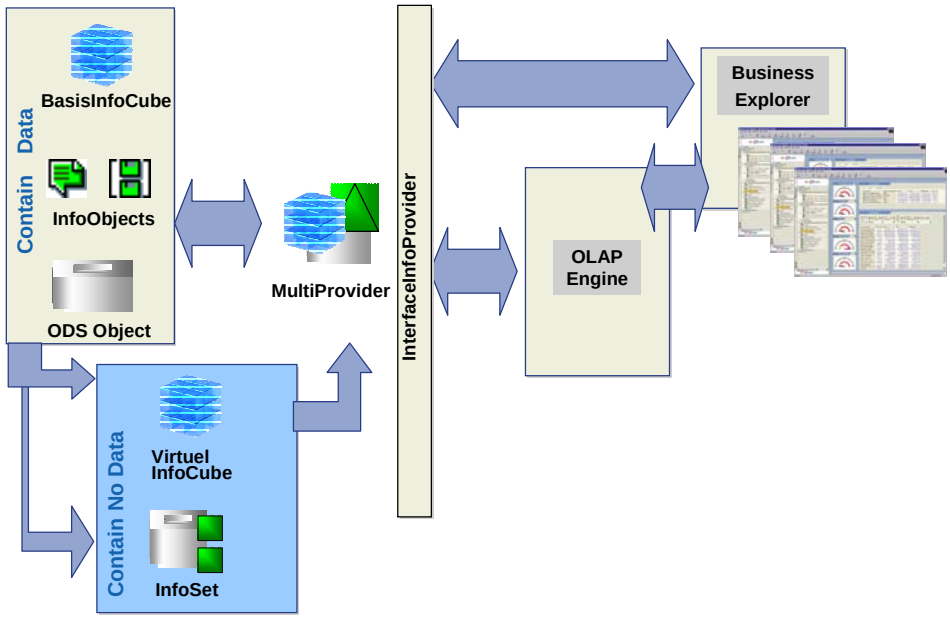
However, objects that physically contain data also fall under the term InfoProvider. These are also called data targets:

- InfoCubes
- ODS Objects
- InfoObjects (characteristics with attributes, texts or hierarchies):
  A characteristic is an InfoProvider when it has master data and has been explicitly selected as an InfoProvider in InfoObject maintenance.

On the other hand, they can also be objects that do not physically store data, but which display logical views, such as:

- Virtual InfoCubes:
  - RemoteCubes
  - SAP RemoteCubes
  - Virtual InfoCubes with Services
- InfoSets
- MultiProviders

The following graphic gives an overview of BW objects that can be used in reporting. They are divided between pure data targets containing data and InfoProviders that only display logical views, in which no data is contained. In the Business Explorer, the system only accesses one InfoProvider. It is not important here how the object is defined.



1.2.7.1 InfoSet

An InfoSet is a type of InfoProvider that consolidates data from several ODS objects and/or InfoObjects (characteristics and master data). It is a semantic layer above data targets.

Using activated InfoSets, you can define queries in the Business Explorer. An InfoSet enables reporting using combinations of master data-bearing characteristics and ODS objects.

ODS objects and/or InfoObjects (characteristics with master data) are connected in the InfoSet using join conditions (equal join condition). A join condition determines the combination of records from the individual objects that are included in the resulting set and how the join conditions have to be defined so that all the existing objects are either directly or indirectly linked to one another. Only those values are displayed in the query for which values are available in both of the tables connected in the join. (An exception to this is the left outer join but this is only to be used in special cases anyway). Here, values are also considered that only exist in the featured tables).

Example: You have defined an InfoSet using an ODS object that contains the characteristic *Plant* and the characteristic *Plant*. You also want to access the attributes of *Plant* in the evaluation. If an ODS object record contains an instance for *Plant,* for which no entry exists in the corresponding master data table, this record is not displayed in the query.

If one of the InfoObjects in a join contains a time-dependent characteristic, this is a time-dependent or temporal join. You can map time gradients in a query using temporal joins. With all other InfoProviders, data is defined for query key dates. With InfoSets using temporal joins, data can be evaluated for particular dates selected by you.

Example: In addition to a key figure, an ODS object also contains a posting data and a time-dependent characteristic. Now you want the record for the time-dependent characteristic be determined according to the posting date, which is different in every record of the ODS object. InfoSets enable this through temporal operands.

Unlike the classic InfoSet, an InfoSet is a BW-specific view of data. Classic InfoSets are not objects from the BW Repository, they are objects from the SAP Web application server.

1.2.7.2 SAP RemoteCube

An SAP RemoteCube is a RemoteCube that allows the definition of queries with direct access to transaction data in other SAP systems.

Also see the RemoteCube chapter. Using the SAP RemoteCube and RemoteCubes can reduce administration expenses on the BW side and can save memory space, as the data is not loaded into the BW.

SAP RemoteCubes are defined based on an InfoSource with flexible updating. They copy the characteristics and key figures of the InfoSource. Master data and hierarchies are not read directly in the source system. They are already replicated in BW when you execute a query.

Use SAP RemoteCubes if:

- You need very up-to-date data from an SAP source system
- You only access a small amount of data from time to time
- Only a few users execute queries simultaneously on the database.

Do not use SAP RemoteCubes if:

- You request a large amount of data in the first query navigation step, and no appropriate aggregates are available in the source system
- A lot of users execute queries simultaneously
- You frequently access the same data.

1.2.7.3 RemoteCube

A RemoteCube is an InfoCube whose transaction data is not managed in the Business Information Warehouse but externally. Only the structure of the RemoteCube is defined in BW. The data is read for reporting using a BAPI from another system.

Using a RemoteCube, you can carry out reporting using data in external systems without having to physically store transaction data in BW. You can, for example, include an external system from market data providers using a RemoteCube.

1.2.7.4 Virtual InfoCubes with Services

A virtual InfoCube with Services is an InfoCube without its own physical data storage in BW. A user-defined function module is used as a data source. The properties of the DataSource can be defined more precisely with a number of options.
A virtual InfoCube with services can be used if you want to display data from non-BW data sources in BW without having to copy the data to the BW structures. The data can be either local or remote. You can also change the data with your own calculations before passing it to the OLAP processor.
This function is used primarily in the SAP Strategic Enterprise Management (SEM) application.

In comparison to the RemoteCube, the virtual InfoCube with services is more generic. It offers more freedom (through the possible use of a function module) but is therefore also more costly to implement as there are no fixed default parameters as there are with a RemoteCube.

1.2.7.5 MultiProviders

A MultiProvider is a type of InfoProvider that combines data from a number of InfoProviders and makes them available as a whole to reporting. The MultiProvider does not contain any data itself, its data comes from the InfoProviders on which it is based that are grouped by a union operation.

You can, for example, combine two InfoCubes in a MultiProvider: You have an InfoCube with actual data for a logically closed business area, and an equivalent InfoCube with plan data. You can combine the two InfoCubes into one MultiProvider, enabling you to compare actual- and planned data in a query.

A MultiProvider can consist of different combinations of the following InfoProviders: InfoCube, ODS object, InfoObject and InfoSet. The data for these objects is grouped by a union operation in the MultiProvider, as a result of which, the union of set of the data sets involved is formed. That is, all values in these datasets are combined. As a comparison: InfoSets are created using joins. These only combine values that appear in both tables. In contrast to a union, joins build the intersection of the featured tables See the example in the InfoSet chapter on this.

In a MultiProvider, every characteristic in every InfoProvider involved should correspond to one characteristic or navigation attribute (as long as these are available). If it is not otherwise clear, you have to define the InfoObject which the characteristic of the MultiProvider should be assigned to.

There are homogeneous and heterogeneous MultiProviders:

A homogeneous MultiProvider consists of InfoProviders that have the same characteristics and key figures. For example, an InfoProvider can include the data from the year 2001, and a second can include data from 2002. In this case, the MultiProvider serves to partition a dataset.

A heterogeneous MultiProvider consists of InfoProviders that only have some of the characteristics and key figures in common. An example of this is a purchasing scenario that includes the subprocesses order, delivery, and invoicing. Each of these subprocesses has its own (private) InfoObjects (for example, delivery location, receipt number). However, they also have cross-process InfoObjects, such as customer and order number. Here each subprocess models its own InfoProviders that are executed together by means of a MultiProvider.

1.3 Data Retrieval

Data retrieval belongs to the data warehousing processes within the BW. SAP BW makes mechanisms from various different sources available for data retrieval. Here you can differentiate as to whether the SAP BW is the target or source of the data transfer: If data from different sources is provided for transfer to a SAP BW system, the SAP BW system is the target of the data transfer. If the data for the SAP BW is provided for distribution within SAP BW or for distribution to analytical applications or other applications, the SAP BW system is the source or hub in regard to data transfer.
The following sections describe possible sources from which data can be transferred into a SAP BW, and the ways in which data from a SAP BW can be transferred into additional systems or applications.

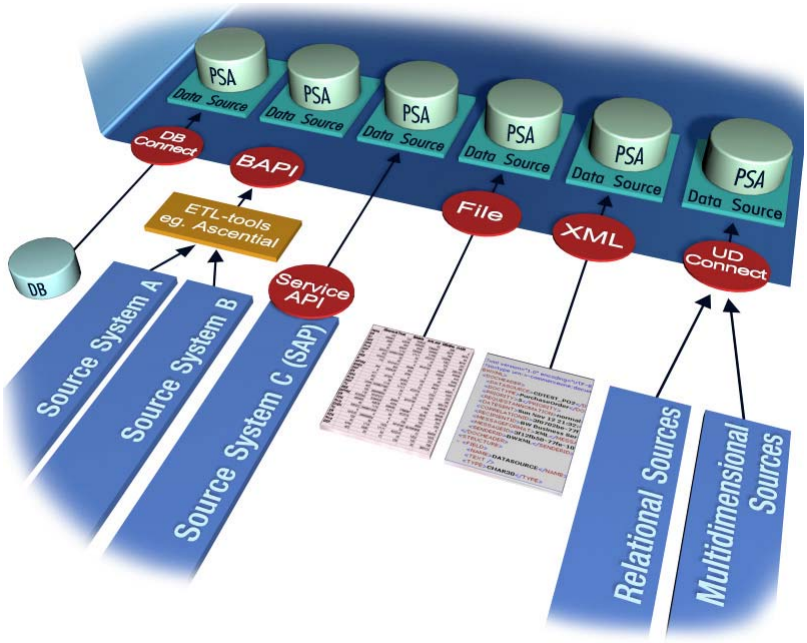
The extraction and transfer of data to a SAP BW normally occurs as a result of a request from the SAP BW (pull). How to define a data request of this sort and monitor the load process in SAP BW is discussed in the process management section of the **Data Warehouse Management** chapter.

1.3.1 SAP BW Source Systems

The SAP BW provides a broad set of functionalities that support data extraction at application and file or database level. Equally, it offers open interfaces for third-party tools that deliver complementary functions. The following sources can be used for data transfer into the SAP BW:

- SAP systems, including SAP Business Information Warehouse systems
- Non-SAP systems for which data and metadata transfer is implemented using third-party tools.
- Flat files
- XML Files
- Multidimensional sources, such as a MS Analysis Server connected using UD Connect.
- Database tables from relational database management systems (RDBMS)

The various sources can be connected to the SAP BW in the Administrator Workbench. The connection to the data sources occurs using the sources systems that are defined in SAP BW.
The following graphic illustrates the openness of SAP BW in relation to sources supported for data transfer.



1.3.1.1 Transferring Data from SAP Source Systems

The integration of SAP application-level components (such as SAP R/3, mySAP Customer Relationship Management or mySAP Supply Chain Management) with SAP BW is based upon the **BW Service API (SAPI)** technology package. This delivers the framework for a comprehensive data replication based on data extraction, with application logic.
The Service API allows you to:

- Make SAP application extractors (DataSource elements) available as a basis for the transfer of data into a BW
- Define generic data extractors and DataSources
- Perform data transfer into the SAP BW with parallel processes
- Implement intelligent delta processes and use a delta source as a temporary storage for changed data records
- Access source system data directly from the BW without having to store this physically in the BW.

BW SAPI technology is implemented within the BW architecture for the following jobs:

- For transferring data and metadata from SAP source systems
- For SOAP-Based Transfer of Data
- For transferring data between data targets within a SAP BW or into an additional SAP BW system (data marts)

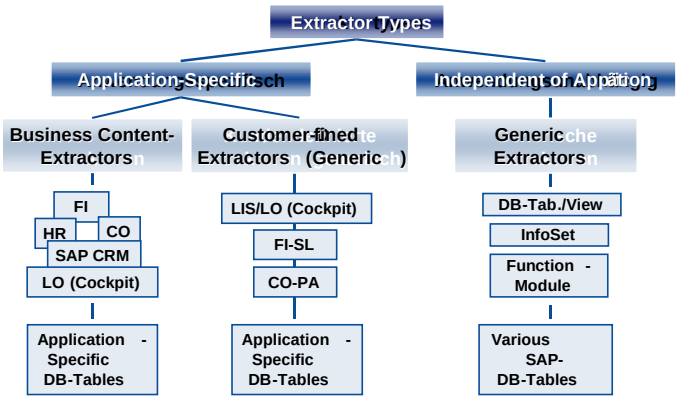
SAPI functionality is delivered with SAP software components R/3 plug-in and plug-in basis. Communication between the SAP source system and the SAP BW is only possible if the appropriate R/3 plug-in or plug-in basis is installed in the source system. If these are installed the following functions are available to you in the SAP source system in relation to **Customizing for Extractors**:

- Definition of control parameters for the data transfer, such as the package size or the number of parallel processes
- Restriction of authorizations for extraction from particular DataSources
- Delta-Queue monitor
- Transfer of SAP delivered Business Content into the active version.
- Definition of application-specific customer-defined DataSources and the amendment of additional settings for application-specific DataSources.
- Definition of generic DataSources and, where necessary, the amendment of settings for a delta transfer
- Editing options for DataSources, including the setting of field selectability, showing/hiding fields, addition of additional fields to the DataSource (append), or extraction testing.

DataSources and Extractors

The DataSource makes the source system data for a business unit available to the SAP BW on request. The data is in a flat structure. It describes the properties of the extractor assigned to it in relation to the transfer of data. The DataSource, with its relevant properties, is replicated in the SAP BW. During the extraction the extractor fills the flat structure of the DataSource with the source system datasets.

The transfer of data is supported by various types of extractor:



Application-specific extractors extract data from particular tables that are connected to the appropriate application. There are application-specific extractors, each of which are hard-coded for the DataSource that was delivered with BW Business Content, and which fill the structure of that DataSource. These are referred to as **Business Content extractors and DataSources**. There are also generic extractors, with which you can extract more data from the SAP source system and transfer it into BW. A generic extractor can fill different DataSources. There is generic data extraction in various application areas of the SAP source system, for example, logistic cockpit CO-PA (operating concerns) and FI-SL. In the case of generic data extraction from SAP applications, we refer to **customer-defined extractors and DataSources**.

Regardless of the particular application, you can generically extract master data (attributes, texts) or transaction data from all transparent tables, database views, or SAP query InfoSets from a customer's own function module or from domains (texts only) or using the function module. You can generate user-specific DataSources here. These are **generic extractors and DataSources**.

Delta Transfer

When large data volumes are involved, you must use the delta method to be able to extract data from the source system efficiently. When you use delta processes, only data records that have been changed since the last data request, are newly accrued, or are to be deleted are transferred into the SAP BW.

The delta method is a DataSource feature, specifying how data is to be transferred to a data target. For example, they deduce for which data targets a DataSource is suitable, how data is updated, and in what ways it has to be serialized. With **additive delta,** for example, the values of key figure fields for a predetermined key are added in the BW. DataSources with this delta method type can supply ODS objects and InfoCubes with data. When transferring the **new status of changed records** the values of the key figure fields for a predetermined key are overwritten. DataSources having this type of delta method can write data into ODS objects and master data tables. When updating to an ODS object, serialization of the loading process that is generally parallelized may be necessary. Delta processes can be set for both application-specific and generic data extraction. The following example shows how the transferred data records look for the Delta process described:
The following data record is available in BW for a customer request:

Document number (Key field)	Document position (Key field)	...	Order quantity	Unit of measure	...
100001	10		200	Unit	

The order quantity of the position is now increased by 10 %.
With the **new status for a changed record**, the transferred data record appears as follows:

Document number (Key field)	Document position (Key field)	...	Order quantity	Unit of measure	...
100001	10		220	Unit	

With **additive** delta the transferred data record appears as follows:

Document number (Key field)	Document position (Key field)	...	Order quantity	Unit of measure	...
100001	10		+20	Unit	

The SAPI **delta queue** plays an important role in delta transfer. It acts as a data store for change records in the source system. If the application supports this, data from a posting system is saved in the delta queue in an intermediary phase. It is loaded to the SAP BW at a later time on the request of the SAP BW. Real data extraction then takes place asynchronously when the delta is calculated. Only the data that is in the delta queue when the request is made is read. The delta queue is used even if an application does not perform this “push” into the delta queue. Delta is then made available to the delta queue by the extractor on request from a SAP BW and is loaded into the SAP BW. The delta queue allows several target systems to be provided with delta. Furthermore, incorrect delta transfers can be repeated as the data from the last extraction procedure is, in each case, stored in the delta queue.
You determine whether or not a delta transfer into the SAP BW is to take place in the Scheduler. This controls the data load process. Before a delta transfer is possible, the delta method has to be initialized. This creates the delta management for the DataSource. You execute initialization with the scheduler.

Remote Access
You can use SAP RemoteCubes to analyze transaction data even when this data does not physically exist in the BW, but is loaded into it. Only the structure of the SAP RemoteCube is defined in BW. You can then access transaction data for an SAP system directly, useful in reporting.

1.3.1.2 Transferring Data Between Data Targets Within a SAP BW or into Additional SAP Systems – Data Mart Interface

The data mart interface makes it possible to update data from one data target into another.

You have the following options:

- Data exchange of several BW Systems: The data-delivering system is then referred to as the *source BW,* the data-receiving system as the *target BW.* The individual Business Information Warehouses arranged in such a way are called data marts. In this way, the data targets for the source BW are drawn up as source systems.
- Data exchange between BW systems and additional SAP systems APO systems, for example
- Data distribution within a BW system (myself connection): Updating data from a data target into a further data target

Data marts can be used in different ways:

- they save a subset of the data for a data warehouse in another database, and wherever possible in a different location;
- they are smaller units of a data warehouse which mean better manageability and maintenance of the individual data warehouses can be obtained;
- they are stored as intentionally redundant segments of the (logical, global) overall system (data warehouse), which, for example, undertake a separation of data in relation to task areas.

A Business Information Warehouse embodies a source system for another Business Information Warehouse when:

- It provides metadata
- It retrieves transactional and master data

An export DataSource is needed to transfer data from a source BW into a target BW. This export DataSource for InfoCubes and ODS objects includes an extract structure, which contains all the characteristics and key figures of the data target. Export DataSources for master data contain the metadata for all attributes, texts and hierarchies for an InfoObject.

1.3.1.3 Transferring Data from Flat Files

SAP BW supports the transfer of data from flat files, files in ASCII format (**A**merican **S**tandard **C**ode for **I**nformation **I**nterchange) or CSV format (**C**omma **S**eparated **V**alue). If, for example, budget planning for a company's branches takes place in Microsoft Excel®, this plan data can be loaded into the SAP BW so that a plan-actual comparison can be performed. Flat file data can be transferred to the SAP BW from a work station of from an application server. The transfer of data into the SAP BW takes place using a file interface. Defining and updating metadata (the DataSource) for flat files has to be done manually in the SAP BW. For a correct transfer of data to be possible, the structure of the flat file and metadata (the transfer structure of the DataSource) defined in the SAP BW have to correspond to one another. It is also to be noted here that the sequence of InfoObjects has to correspond to the sequence of the columns in the flat file.

Delta transfer is supported for flat files with flexible updating. You determine whether and which delta methods are supported by maintaining the transfer structure. With **additive delta** the extracted data is added in the BW. DataSources with this delta method type can supply ODS objects and InfoCubes with data. When transferring the **new status for changed records,** the values are overwritten in the BW. DataSources having this type of delta method can write data into ODS objects and master data tables.

Before you load data from a flat file you are able to check, whether the metadata definition in BW and the structure of the CSV or ASCII file to be loaded correspond to one another. You do this using the preview function. From the preview, you can then run a simulation of the data loading process. This allows you to check the update process.

1.3.1.4 Transferring Data Based on the Simple Object Access Protocol (SOAP)

As a rule, data transfer in SAP BW takes place using a data request that is sent from SAP BW to the source system (pull from the scheduler). You can also send the data to the data through external controls. This is called a data push in the SAP BW.

The push of data is possible for several scenarios:

- Transferring data using the SOAP service of the SAP Web AS
- Transferring the Data Using A Web Service
- Transferring Data Using SAP XI

In all three scenarios, data transfer takes place using transfer mechanisms that use a so-called XML DataSource (DataSource with SOAP connection) and it is XML based.

The data push occurs in an inbound queue in SAP BW. The SAP BW uses the delta queue of the Service API as the inbound queue. To transfer the data, you generate an XML DataSource on the basis of a DataSource for a flat file source system. This DataSource, which is also called a DataSource with SOAP connection, has an interface to supply the delta queue. For the XML DataSource, the system generates an RFC-compatible function module. This runs the data update in

the delta queue of the DataSource. From there, you can further process the data using a delta request from the Scheduler in SAP BW and update it to the data targets.

1.3.1.4.1 Transferring Data Using the SAP Web AS SOAP Service

You can send data from external applications directly to the SOAP service of the SAP Web Application Server (which integrates the data into SAP BW) in XML format using the Internet transfer protocol HTTP. In SAP BW, the data is written to the delta queue, and from there it can be processed further and can be updated to the desired data targets. Web applications that provide XML data according the SOAP protocol, can, for instance, be used as sources for the SAP BW.

The transfer of XML files into the BW is suitable for regular BW services with **limited amounts of data for each call**. An example would be the transfer of „delta“ document data. We recommend transferring initial or regular mass data to SAP BW using one of the other source system types.
The SAP BW uses the SOAP service provided with the SAP Web application server as the basis for the solution. Using this service, XML files that are sufficient for the SOAP protocol can be transferred to RFC-capable function modules in the ABAP environment. On the basis of the RFC-compatibility, this type of function module can now be automatically accessed by using one of the assigned HTTP handlers from SAP for supporting the SOAP log. The SOAP service checks the data that came in as an XML file for syntactical correctness and transfers it to a transfer structure in the ABAP dictionary. Then the data has to be provided according to an XML schema definition that is derived from the definition of the DataSource (and its fields) for which the RFC-compatible function module was generated.

1.3.1.4.2 Transferring Data Using A Web Service

Using the Web Service Creation Wizard delivered with the SAP Web application server, you can generate Web services for data loading based on the above function modules for XML-compatible DataSources. In this way, you can send data to the delta queue of SAP BW using Web services and then you can process further from there and then update to the desired data targets. The Web services provide you with WSDL descriptions that can be used independent of the communication technology used to push data into SAP BW.

1.3.1.4.3 Transferring Data Using SAP XI

With the SAP Exchange Infrastructure (SAP XI), you can create cross-system business processes. Within the overall architecture of SAP NetWeaver, SAP XI solves the problems of process integration. The integration of SAP XI and SAP BW allows you to send data from various sources to the delta queue of SAP BW using SAP XI. The use of SAP XI offers you central maintenance of message flow between the logical systems in your system landscape. You also have the option of transforming message content between the source and SAP BW. This scenario offers you another advantage, because in contrast to both of the scenarios described above, you can be assured that the data is delivered only once and in the correct sequence (called Full Quality of Service). This is ensured when you use proxies during communication between SAP XI and SAP BW. Proxies are executable components for the interfaces for communication with the SAP XI Integration Server that are generated in the application systems. If communication takes place via an RFC or SOAP adapter, Full Quality of Service is not obtained.

In SAP XI, you create message interfaces for data exchange between the source or SAP BW and SAP XI at design time. The message interface for data exchange with SAP BW is generated based on the RFC-compatible function module of the XML DataSource. Then a proxy is generated for this interface in SAP BW. Afterwards, data transfer (source) and/or receiver processing (SAP BW) is implemented for the interfaces. During configuration, you set the process that has previously been defined across systems for one concrete system landscape. The relevant objects are structured in the form of configuration objects, then they are organized and stored in SAP XI. You can now send data to the integration server of SAP XI. SAP XI transfers this data during runtime to the SAP BW using proxy communication. In SAP BW, the data is written to the delta queue and can be processed further from there and then updated to the desired data targets.

1.3.1.5 Transferring Data from a System Using Third-Party ETL Tools – Staging BAPIs

Open interfaces, the staging BAPIs, are available in the SAP BW to enable the extraction of data and metadata from non-SAP sources at application level. BAPIs (Business Application Programming Interfaces) are standardized programming interfaces that offer external access to the business processes and data of a SAP system. These interfaces make it possible to connect different third-party tools (for example **E**xtraction, **T**ransformation, **L**oading) to the SAP BW. In this way data from, for example, an Oracle® application can be transferred into SAP BW and analyzed there. In addition to a number of licensed third-party tools, we also have a strategic partnership with Ascential™ DataStage.

The metadata can be defined or updated manually in the SAP BW by maintaining the transfer structure. When you access the BAPIs with a third-party tool this tool can also read the source system metadata automatically, without a request from the SAP BW. It can also define the metadata and transfer this to the SAP BW using the BAPIs. SAP BW offers additional interfaces, with which third-party tools can create metadata in the BW system.
Data transfer can result from a data request from the SAP BW or can be activated by a third-party tool using BAPIs. The third-party tool loads the data from the external system and transforms this into the relevant SAP BW format. Make sure that the structure of the transfer structure and the structure of the data structure correspond to each other. Transformations for technical cleanup (for example, date conversion) are to be executed at the extraction tool level.

1.3.1.6 Transferring Data from Database Management System Tables / Views - DB Connect

DB Connect allows you to use a database connection as a source system connection for the SAP BW, which can then be used to transfer data from this DBMS into a SAP BW system. Multiconnect functionality, technology delivered with mySAP technology components, is used here. When initiating a BW Application Server from the SAP kernel the system opens a connection to the database management system (DBMS) on which the SAP system runs by default. With Multiconnect you are able to open database connections in addition to the SAP default connection and access external databases using these connections. DB Connect makes it possible to use tables and views for data transfer from database management systems supported by SAP. (You can find information on supported DBMS in the SAP BW documentation). Data from a purchasing application, for example, can then be loaded into SAP BW and analyzed if the application runs on a system that is based on a DBMS. DataSources are used to make data known to the BW, where it is then processed in the same way as data from other sources.
With DB Connect, you can load data from a DBMS supported by SAP, by:

- linking a database to the BW as a source system, thus creating a direct access point to external DBMS
- making metadata known to the BW by generating a DataSource.

When using DB Connect, a data request is only possible via the selections (for example, time stamp) that are determined in the Scheduler for data requests.

Note:

To be able to use the DB Connect functions, you need to have installed a database-specific DB Client as well as the database-specific Database Shared Library (DBSL) for the respective source-database management system (DBMS) on the BW Application Server, providing that the BW DBMS and the source DBMS are different.

1.3.1.7 Transferring Data with UD Connect

UD Connect (Universal Data Connect) offers you the opportunity of accessing both non-SAP data sources and SAP data sources using the SAP Web AS J2EE connectivity. Using UD Connect, you can connect a number of relational and multi-dimensional data sources to SAP BW for analyzing. Regardless of the type of data source, UD Connects transfers the data as flat data.
In SAP BW, a wizard in InfoSource maintenance is used to generate a generic DataSource with a source-specific function module with which the data can be read and then transferred to SAP BW. These DataSources can also serve as a data supplier for SAP RemoteCubes. This means that direct analyses of data sources connected via UD connect are possible without having to physically save the data on the database of SAP BW.

To connect to the data sources, UD Connect can use the BI Java Connectors, which are available for various drivers, protocols and providers as a resource adapter.

- BI JDBC Connector
- BI ODBO Connector
- BI SAP Query Connector
- BI XMLA Connector

UD Connect is comprised of two main parts: The java component is located in SAP Web AS and is responsible for communication between data sources and SAP BW. The ABAP component is located in SAP BW. For data sources with their source objects, a connection to the SAP Web AS J2EE Engine is created. The data sources and the source objects available there are then addressed via the BI Java Connectors. The Connectors support various drivers, protocols and providers. UD Connect provides stateless session beans using the SAP Java Connector (JCo) that enable communication between the data sources and the BW server. On the basis of an RFC connection between SAP BW and the SAP Web AS J2EE Engine, the session beans can call function modules in SAP BW or can be called by the function modules.

1.3.2 SAP BW as Source System

A BW system can act as a source system for additional BW systems. A BW can also act as a source system for additional applications. The Open Hub Service is available for this purpose.

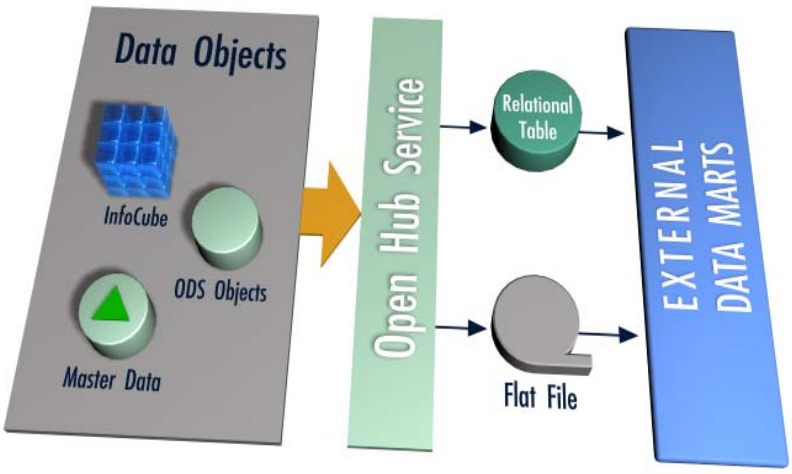
1.3.2.1 SAP BW as Source System for Additional SAP BW Systems – Data Mart Interface

See the chapter Transferring Data Between Data Targets Within a SAP BW or to Additional SAP Systems - Data Mart Interface.

1.3.2.2 Open Hub Service

The open hub service enables you to distribute data from a SAP BW system in non-SAP data marts, analytical applications, and other applications. With this, you can ensure controlled distribution using several systems. The central object for the export of data is the InfoSpoke. Using this, you can define the object from which the data comes and into which target it is transferred.

Through the open hub service SAP BW can be used as the hub of an enterprise data warehouse. The distribution of data is manageable by centrally monitoring the distribution status in the BW system.



BW objects such as InfoCubes, ODS objects, or InfoObjects (attributes or texts) can act as data sources for the open hub service. Database tables (from the database server in the BW system) or flat files in CSV format can be selected as open hub destinations. The data can be extracted from the

database into a non-SAP system through APIs using a third-party tool. Both a full and a delta mode are also available as the extraction mode.
The central object for the export of data is the InfoSpoke.
In the InfoSpoke, the following aspects are defined:

- From which open hub data source the data is extracted,
- In which extraction mode (full or delta)
- Into which open hub destination the data is delivered
- And which data selection is to be used for extracting from data sources.

The open hub destination contains all information about a target system for the data of a data source, such as the destination type, the name of the flat file or the database table, and so on.

You also have the option of transforming the data to be transferred by using a Business Add-In (BAdI). The original structure for transfer is thereby the InfoObject list. Possible scenarios for using a transformation would be, for example, the reading of texts or a currency conversion. Data should be formatted target-specifically.

If you activate and execute your InfoSpoke, a request is created. This request is displayed in the open hub monitor where you can check the extraction status.

1.4 Data Warehouse Management

The SAP BW Administrator Workbench is the central access point for managing data warehouse processes. In particular, it makes available the tools and functions for **metadata management** and **process management**. Data Warehouse Management in the SAP BW comprises the maintenance of authorizations, the metadata repository, document management, transporting, tools for activating SAP Business Content, technical content, an analysis and repair environment, and tools required for process management.

1.4.1 Authorizations

An authorization allows a user to carry out a certain activity in the Business Information Warehouse. Each authorization refers to an authorization object and defines one or more values for each field that is contained in the authorization object. Individual authorizations are summarized into authorization profiles by system administration. You can copy the roles delivered by SAP and adjust them when you want. The system administrator creates these authorizations and enters them into individual users' master records in the form of profiles.

The authorizations in the Business Information Warehouse are based on the standard SAP authorization concept.

With authorization checks, any functions or objects in the system can be protected. With an authorization check, when you perform a certain action, the system compares the values for the individual fields of an authorization object that are assigned to the user, with the values that are provided for the execution of an action in the program. A user is only authorized to carry out an action if the authorization check has been successful for every field in an authorization object. In this way, complex checks of the user authorization can be carried out.

There are differences in authorizations for working in the Administrator Workbench and for working with the Business Explorer:

As an administrator, you will need special authorizations in the Business Information Warehouse and in the source system, which you can determine in the user settings. Authorization profiles and authorization objects are delivered for this that control the authorization for working with individual objects.

Reporting authorizations for working with the Business Explorer come from the authorization objects that you have to create for each query/InfoProvider. Only when the user has had the appropriate authorizations assigned to him/her can he/she define and execute a query or navigate in an existing query. Using the corresponding authorization object, you can specify here whether a user has display authorization or change authorization.

The following BW roles are templates that make it easier to create authorizations:

- BW Administrator (development system):

The task area of the BW administrator in the development system covers, among other things, maintaining the source system, uploading Metadata, executing queries for the statistics InfoCube and maintaining aggregates.

- BW Administrator (production system):
  The BW administrator in the production system is mainly responsible for maintaining the connection to the source system and executing queries for the statistics InfoCube.
- Modeler (development system):
  The BW modeler in the development system works on the data model. She/ he is responsible for designing the data targets and InfoProvider, InfoObjects, InfoSources and the data flow, as well as defining communication structures and transfer and update rules.
- Operator (production system):
  The main task of the BW operator in the production system is to upload data from the source system and monitor the results.
- Reporting Developer (development system):
  The main task of a reporting developer is to design the queries for the reports you want. She/ he creates authorization objects for these reports.
- Reporting User:
  The reporting user executes queries using the BEx Analyzer or in the Web.

1.4.2 Metadata Repository

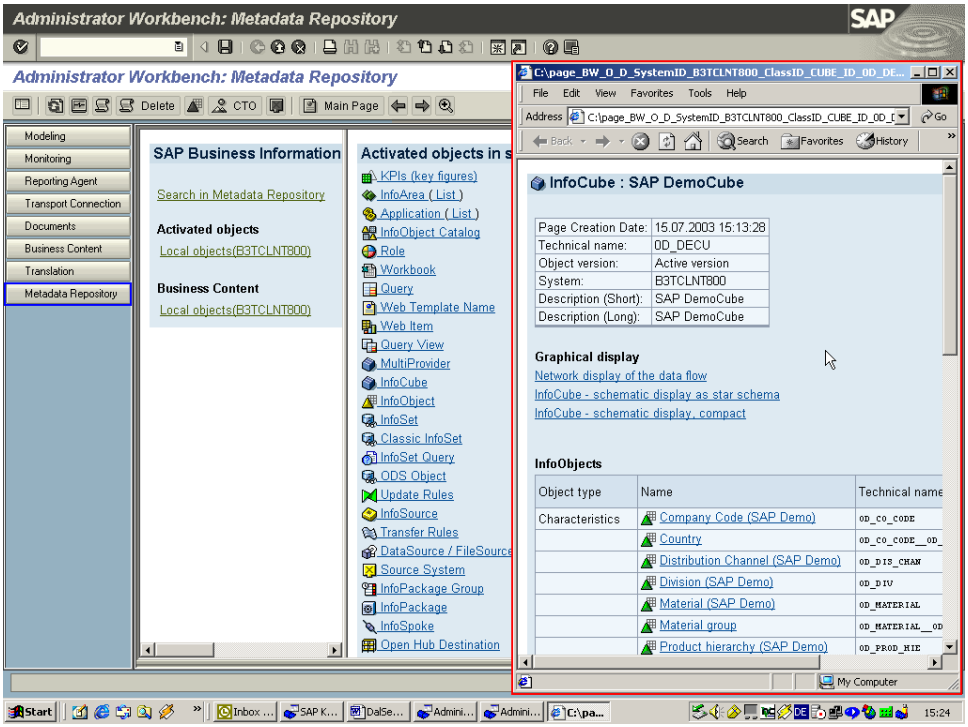
With the HTML-based metadata repository, you can display information on the metadata objects in the Business Information Warehouse centrally. In particular this metadata includes important object properties and their relationships to other objects.

The metadata repository is implemented as an HTTP service. You can call the information on the metadata objects of SAP BW in the Web browser of any object using a URL (see ICF Services in SAP BW).

The following functions are available in the *Metadata Repository* functional area of the Administrator Workbench:

- Display information on active objects in the BW system or on the Business Content objects delivered by SAP See transports for additional information on the different versions.
- Display the information about metadata objects graphically in various formats (VML and SVG).
- Search in the metadata repository.

The following graphic shows the functional areas of the Administrator Workbench metadata repository and, outlined in red, information on the SAP DemoCube InfoCube as it is displayed as a HTML page in the Web browser.

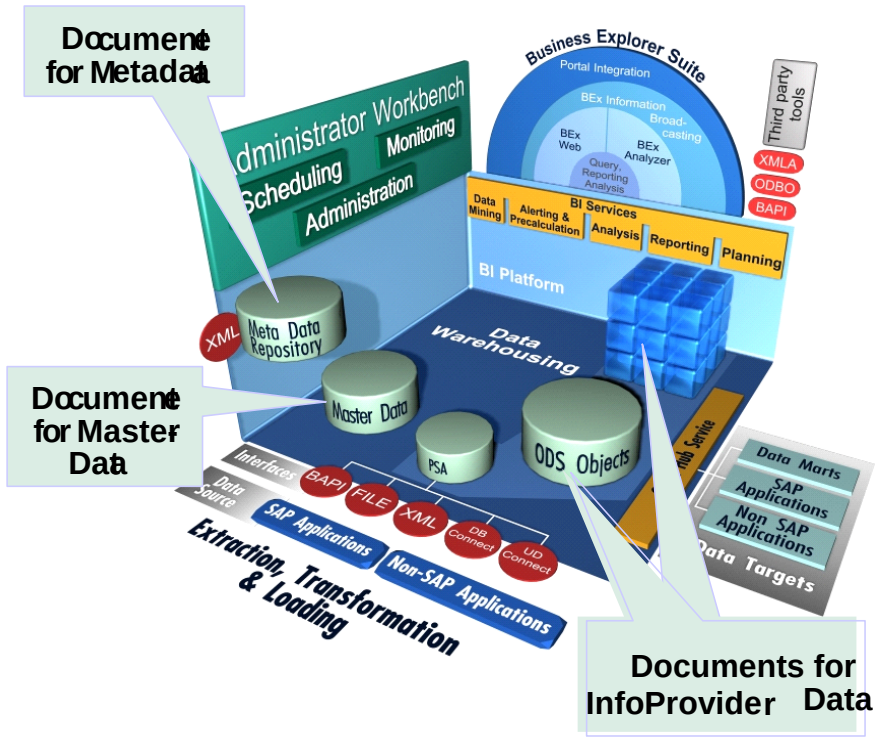


Information on the metadata objects can also be used independently of the BW system by exporting the relevant HTML pages to a local directory. Consultants can use this function, for example, to document the system status arrived at in their project. Another example is information on the Business Content objects delivered by SAP, which a customer may want to be available independently of the BW system. The complete HTML documentation on activated or Business Content objects can be exported from the *Metadata Repository*. From other functional areas of the Administrator Workbench (*Transport Connection, Business Content*), HTML documentation for a particular metadata object can be exported. The look-up depth can be defined freely.

The BW transport connection supports the exchange of metadata objects between various systems in XML format. An ICF-Service is also available at sap/bw/xml/cwm. You can request the metadata using the HTTP service.
In the BW documentation administration, you can create documents for metadata objects and select them for display as online documentation (see document management).

1.4.3 Document Management

Information on BW objects can be managed in the form of documents. The following graphic shows the BW objects (metadata, master data and InfoProvider data) and the corresponding document classes that can be selected.



The following are typical examples of documents that can be created for various BW objects:

- *For Metadata*: Online documentation (also available as HTTP service and can be addressed using a logical URL; see ICF Services in SAP BW), explanations ("characteristic ABC means..."), history/changes
- *For master data:* Graphics for personnel numbers, descriptions and technical specifications of materials, original documents for order formulas, documentation for versions (planned, actual, budget).
- *For InfoProvider data:* Comments on various characteristic values ("Sales for material 4711 in Germany were poor in May, because ...", "In May the following key figures were interesting: Delivery quantity – Explanation ..., Outstanding payments - ...")

In the *Documents* functional area of the Administrator Workbench, the following functions are available for document management:

- Creating documents
  One or more documents can be created in different formats and languages for an individual BW object. You can also list documents in the system according to various search criteria, display

them in a preview, change them in the system or in a local storage area, and, if required, delete them with all their versions.

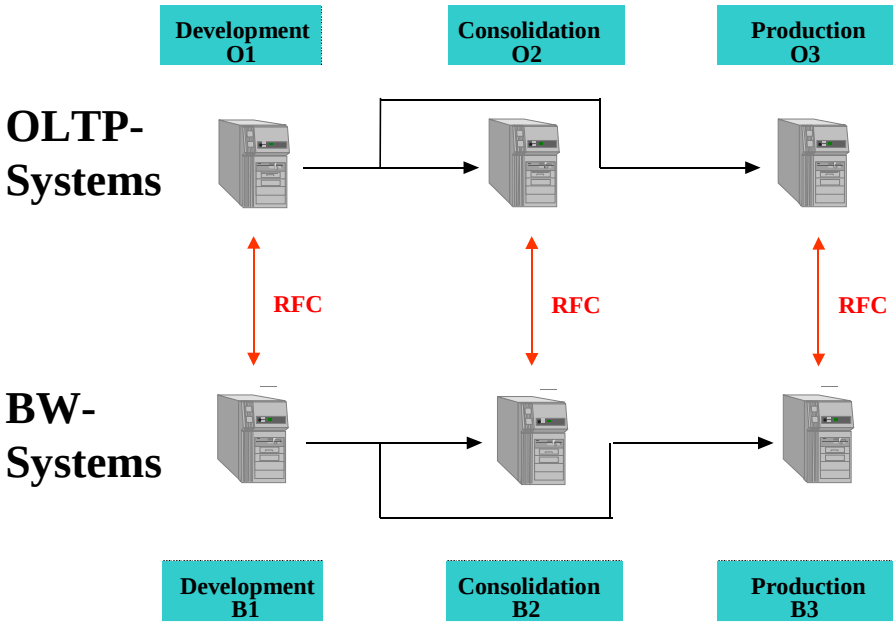
- Importing documents
  To use a file that you have created in an application outside of the BW system (Microsoft Office, for example) as a document for a BW object, you can import the file into the BW document management area.
- Exporting documents
  Documents can be copied to a local store or checked out to be edited locally (with a lock), and then imported again later.
- Hyperlinks to Documents
  Both documents from outside the BW system and other documents on BW objects can refer to a document on a BW object. The only prerequisite is that documents are available in formats that support hyperlinks.
- Searching in Documents
  You can use Altavista® syntax to run full-text searches in documents for any document class, including the generated documentation for metadata.
  The following prerequisites must be fulfilled in order to search:
  - The SAP search machine TREX must be installed, as the BW uses its functions to search in documents.
  - Documents for metadata must have been generated
  - Documents to be searched need to have been regularly indexed All words contained in the documents are included in the index here. It handles documents in all languages. An individual index is built for each language.
- Administration of Document Management in BW
  Document management applies to documents from all the document classes. It comprises functions that are necessary or useful at the beginning of a project, after an upgrade to a BW system, or while you are working on a project.
  A **storage category** (the physical storage medium for the files) can be determined for each document class. You can select either the BW database or, if you use a HTTP interface, an external content server.
  There are various functions that you use in document management to enable you to check and change the status of the **index** and the index job for a search in documents.

Note: Documents can also be created, displayed and searched for using a full text search in reporting (see the section Window Web Items under BEx Web Application Designer and Using Documents in Web Applications).

1.4.4 Transports

Business Information Warehouse development projects are not usually executed in a productive system, but in a system landscape with one or more development and test systems. You can use the transport connection to collect newly created or changed Business Information Warehouse objects in the corresponding development system, before transporting them into the required target system (normally a test or productive system), via the *Change and Transport Organizer (CTO).*

The following graphic illustrates the transport process using a typical system environment, which has one BW system for development, one for consolidation and one for production. Each of these systems is linked to a corresponding OLTP (*Online Transaction Processing*) source system, in which the operative data is managed. This can, for example, be a SAP R/3 system. (BW systems are OLAP systems, see *Business Intelligence Platform*: OLAP.)



You can only transport between OLTP systems (O1,O2,O3) or between BW systems (B1,B2,B3). Communication between OLTP systems and BW systems takes place via the RFC (Remote Function Call).

BW objects are transported as logical objects (TLOGO objects) from a BW source system into a BW target system. Generated objects such as master data tables are not transported but are generated again in the target system.

There are various versions of transport-relevant BW objects:

Version	Meaning
A (ctive)	Active version
M(odified)	Modified version
T(ransport)	Transport version for the import of source system-dependant objects
D(elivery)	SAP delivery version for Business Content objects (see Installing Business Content)

Only those objects that are in the active version are exported from the development system. When importing into the target system, these objects, dependent on object type, are either imported directly into the active version, in a modified version, or in the ‘T’ version.

You can choose from the following transport strategies:

- Standard transport: As a new BW object is created, the developer determines, in a number of dialog windows, whether and with which package the object is to be transported.
- BW transport: The objects are first created automatically as local objects. Transport-relevant objects are only collected at the time of the first transport.

1.4.5 Installing Business Content

The concept of transporting and using different versions of SAP objects is also relevant to the delivery and application of SAP Business Content.

SAP delivers Business Content in the SAP Delivery Version (D version). When importing into the target system, these objects are either imported directly into the active version (A version), or into a modified version (M version). Customer-specific changes are saved in the modified version (M version). In order to be able to use the Business Content that has been delivered or modified with

customer-specific changes, the customer has to convert the required objects into the active version (A version).

In the Administrators Workbench you are able to select (‘collect’) and activate (‘transfer’) the Business Content objects delivered by SAP in the functional area *Installing Business Content.* Here customers can determine which Business Content objects they want to copy, adjust with the objects containing customer-specific changes, or not transfer at all. The system automatically includes all required objects and the sequence in which you activate them.

1.4.6 Technical Content

SAP BW also delivers **technical content** along with the Business Content. Objects included, on the one hand, are those that make it possible to analyze processes in the BW system and to optimize performance (BW statistics, BW data slices, BW features characteristics). On the other hand, special ODS objects are also included in the technical content in which data is provided, for example, for the personalization of the BEx or for generating reporting authorizations.

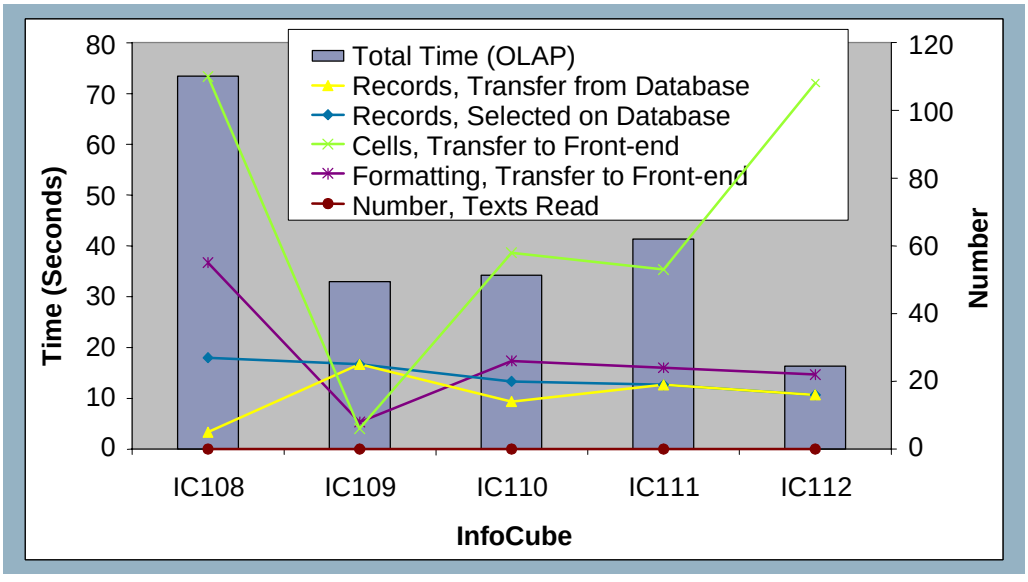
BW statistics provides data for reporting from the data warehousing (warehouse management) and OLAP areas, from several BW statistics InfoCubes, using a BW statistics MultiProvider. In the context of technical content, suitable BW statistics queries and charts are delivered for analyzing the data. You install BW statistics in the same way that you install Business Content in the Installing Business Content functional area of the Administrator Workbench.
BW statistics offers the system administrator comprehensive possibilities to:

- Get an overview of how InfoCubes, ODS objects, InfoObjects, InfoSources, source systems, queries, and aggregates are used
- Calculate the run time of queries
- Improve the way in which aggregates are selected and used, to reduce the effort involved in updating them

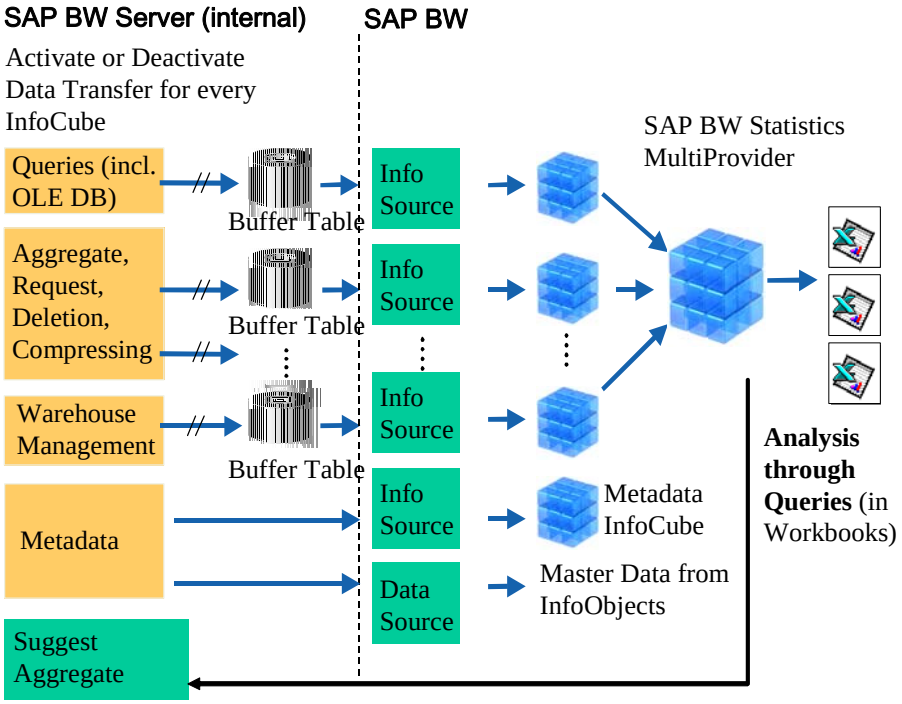
Example: The *Diagram: OLAP Records per InfoCube* offers an overview of usage and performance of the Business Information Warehouse (OLAP) by InfoProvider. Presentation this graphically allows a quick overview with reference to the following questions:

- Which InfoProviders were used frequently? The overall time for each InfoProvider is displayed as a bar.
- How high was the number of data records for each InfoProvider? Ideally, the lines “records selected from database“ and “records transferred from database” should have about the same gradient. However, if less records were clearly transferred from the OLAP processor than were selected from the database (as is the case here with InfoCube 108), you are able to use other queries to check which BEx queries are causing this in BW statistics. These can then be defined again, if necessary.

Diagram: Records OLAP per InfoCube (0BWTC_C10_Q051)



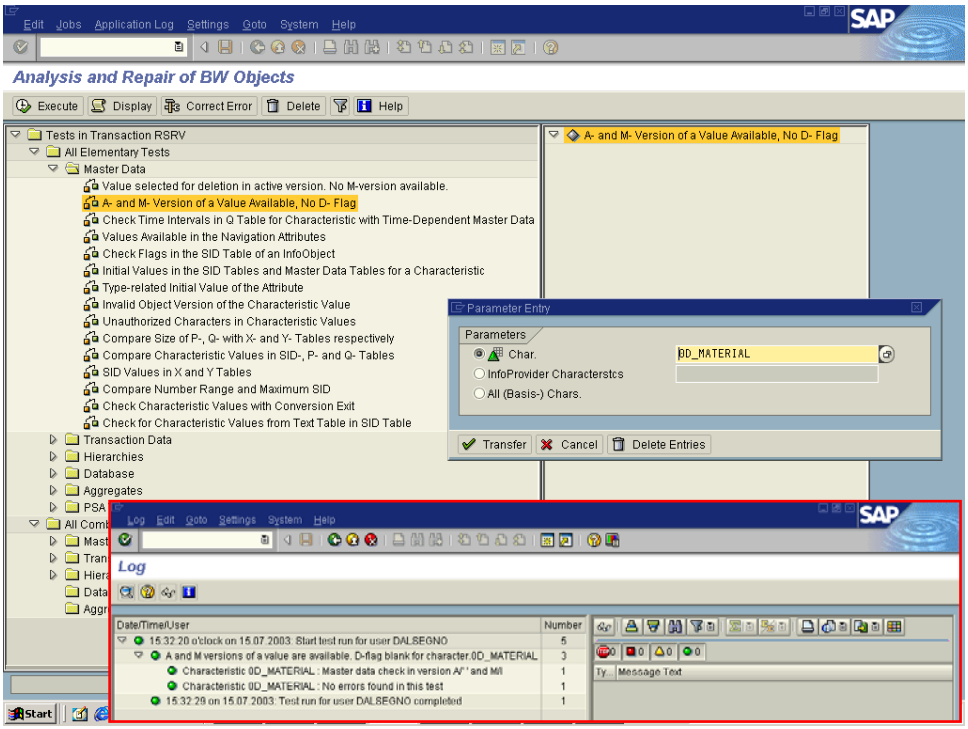
The following graphic offers an overview of the dataflow for BW statistics. For reporting, the BW statistics MultiProvider is used as an InfoProvider. The individual BW Statistics InfoCubes are filled from various InfoSources. Extractors are used to load the data.



The data input is not noted by default but can be activated or deactivated individually for each InfoProvider in the OLAP and warehouse management areas. In this way, you can avoid unnecessarily large datasets, even with large installations. Saved data can be deleted again.

1.4.7 Analysis and Repair Environment

The Business Information Warehouse includes a comprehensive test and repair environment for consistency checks with data and metadata stored in a BW system.
You can select elementary or compiled tests. An elementary test is a test that cannot be divided any further into smaller tests and, therefore, can only be executed in its entirety. On the other hand, a compiled test specifies according to the parameter entry which elementary tests need to be run.
Elementary tests apply to master and transaction data, ODS objects, hierarchies, database (indices, parameters, statistics), aggregates, PSA tables and documents. Essentially the tests examine the foreign key relationships between the individual tables of the enhanced star schema in the BW system.
In the left-hand screen area the following graphic shows the tests you can select in the analysis and repair environment. In the right-hand screen area it shows an elementary test with the dialog box for setting parameters below it and, outlined in red, the output from the test.



A selection of tests is called *test package.* Users are able to save (with or without locks for external changes), load, and delete test packages. They can also be scheduled for later or regular execution in background processing (see process chains).
The output from the test is stored on the database and is available for later comparison tests.
Some tests can repair errors and inconsistencies. This makes use of the fact that some of the information has been saved redundantly. If the information has not been saved redundantly, automatic correction cannot be done.

1.4.8 Process Management

1.4.8.1 Scheduler

The SAP BW scheduler is the tool used for load and update processes. It is the link between the source system and the SAP BW. Data is usually loaded into the SAP BW from the source system upon request from the SAP BW. Using the scheduler, you can determine the data request, also called **request**. You can determine when and from which InfoSource, DataSource, and source system, data (transaction data, master data, texts or hierarchies) is requested and updated.

The principle behind the Scheduler makes use of the functions of SAP background processing. The data request can be scheduled either straight away or it can be scheduled with a background job and started automatically at a later point in time.

When requesting data, create an **InfoPackage** in the SAP BW Administrator Workbench. In the InfoPackage you set the conditions for the scheduling of the data request. An InfoPackage is only ever assigned to an InfoSource, DataSource and source system. In the InfoPackage you also determine the parameters for the data transfer and updating to the SAP BW (dependant on the source and the type of data). You can determine the data that is to be transferred using selection conditions. For example, only data from controlling area 001, for period 10.1997. Variable selection conditions are also possible such as time selections (last year or last month), ABAP routines or variables. In addition, you can determine:

- How data is to be posted: Is it to be loaded in the PSA table only, for example, or is the stored data to be provided automatically after it has been successfully loaded into the PSA table?
- Which data targets are to be updated (when more than one data target is connected to the InfoSource)? And which functions are to be executed in a data target when the data request is updated (for example, are identical requests in an InfoCube to be deleted automatically after the new request has been successfully loaded)?

- How data is updated: Is all data that corresponds to the selection criteria determined in the scheduler to be requested (full update) or only data accumulated in the source since the last data request (delta update), or is a delta method to be initialized?
- How incorrect or duplicated data records are to be dealt with.

If data is to be transferred from a flat file, use the file-specific settings for data transfer in the scheduler. If data is to transferred from external sources using a third-party administrator extraction tool, use the BAPI-specific settings in the scheduler. You can determine load process settings specifically for hierarchies in the scheduler.

Checks for incorrect data records are executed in the fundamental processing steps in the BW. These include the transfer and update rules and the updating of data into master data, text, and hierarchy tables, or into InfoCubes.

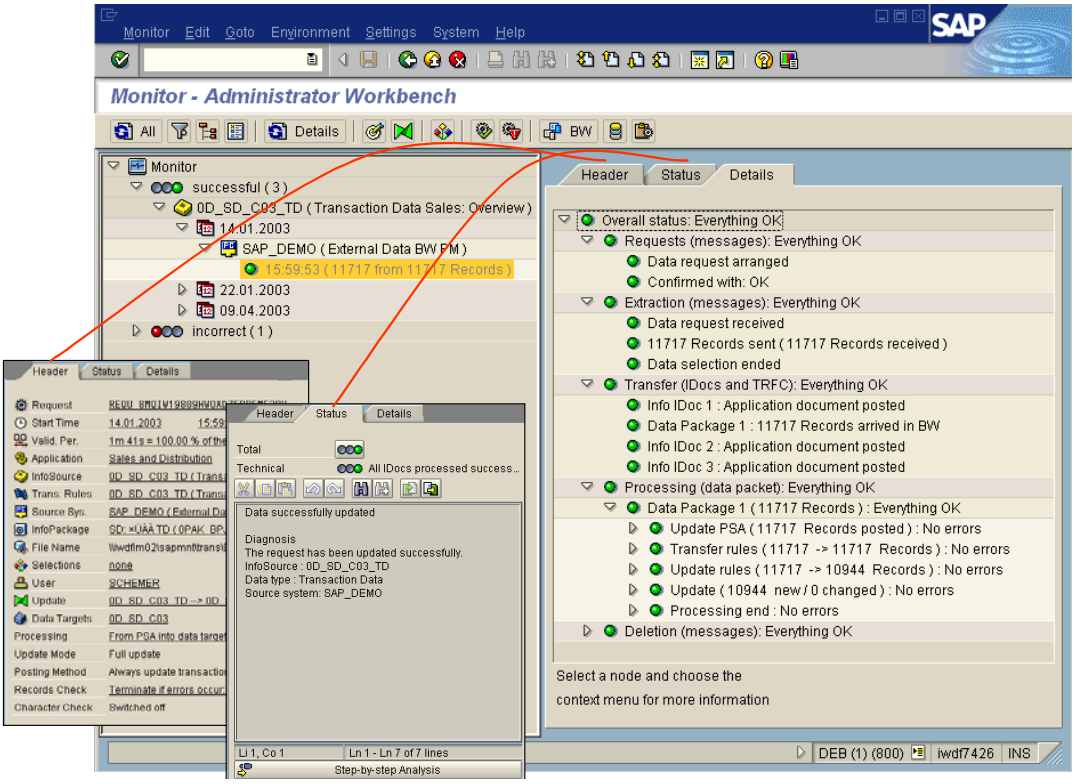
SAP BW error handling, which is also determined in the scheduler, allows you to control the system behavior when calling up faulty data records. In the case of errors, the BW system can react in one of three ways. When errors occur, you are able to determine whether

1. the update is terminated for the entire data package and the data is not released for analysis
2. the valid data records are updated, but are only made available for analysis if they are released manually
3. the valid records are made available for analysis immediately.

With options 1 and 2 a new request that is only read into the PSA is formed from the incorrect records. Here you can edit the records of the new request in the PSA and start the update manually.
If errors arise when an InfoCube is updated, new requests are generated for incorrect records. The incorrect records are booked in the PSA under these new requests. These new requests entered the InfoCubes for which there were incorrect records as data targets. If, for example, a record was booked into two InfoCubes by mistake, a request is generated for this record that contains both InfoCubes as data targets. In the PSA tree, the requests appear as successfully booked in the PSA. In the PSA tree, the requests appear as successfully booked in the PSA.

1.4.8.2 Monitor

You can use the Administrator Workbench Monitor to check BW loading and processing processes. Here, in addition to the header information for a request, information about the technical and full status of the request is displayed, as well as detailed information about the status for individual processing steps in the data request.

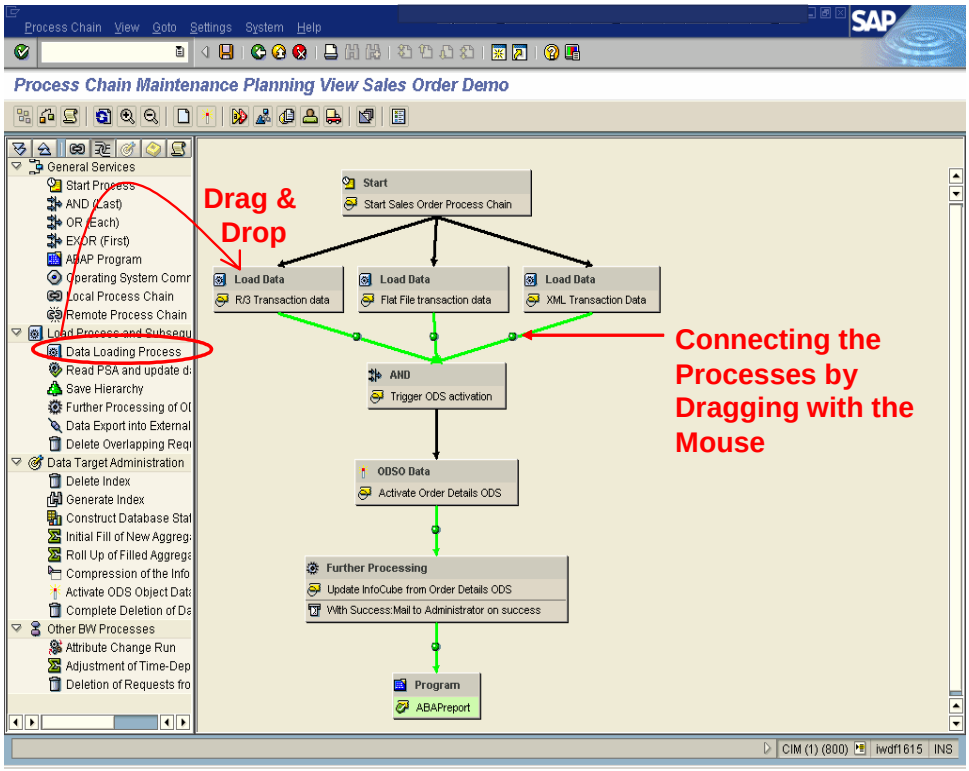


If errors occur in a request, the analysis result is displayed in the monitor. You are offered the most effective check or action suggested by this analysis via a direct jump out of the Monitor. You are also able to make a step-by-step analysis using the Monitor assistant function. To support your error analysis you can also simulate the update in the Monitor, and activate here debugging in the transfer- and update rules.

1.4.8.3 Process Chains

In and operative BW system, in addition to the loading process, there are a number of processes that occur regularly, for example loading processes such as the execution of an InfoPackage, processes for data target administration such as filling aggregates or reporting agent processes such as precalculating Web templates.

With the background processing system, BW processes or jobs can be scheduled for certain times, for certain dates, according to certain predecessor jobs or according to event. Beyond that, SAP BW supports graphic modeling of the BW process using process chains. Process chains allow you to control several interconnected processes. A process chain is a sequence of processes that wait in the background for an event. Some of these processes trigger a separate event that starts other processes in turn.



When you use process chains you are able to:

- automate the complex schedules in BW with the help of the event-controlled processing
- visualize the schedule by using network applications
- centrally control and monitor the processes.

In addition to the BW processes, a customer's own programs can be integrated into process chains. In addition, a customer's processes can also be integrated by implementing interfaces in process chains. You can also include process chains in other process chains, so-called meta chains.

A process chain is comprised of a start process, the individual applications processes and collection processes that can be added to the process chain using Drag&Drop.

- With the start process you define the start of your process. All other chain processes are scheduled to wait for an event.
- Application processes are processes that are automated in the process chain maintenance. They represent BW activities typically executed in the operative use of BW, for example, load processes, processes in data target administration, or Reporting Agent processes.
- Collection processes are treated differently by the process chain management. They allow several chain strings to be combined to form one individual string. In this way, they replace multi-field scheduling of the actual work processes.

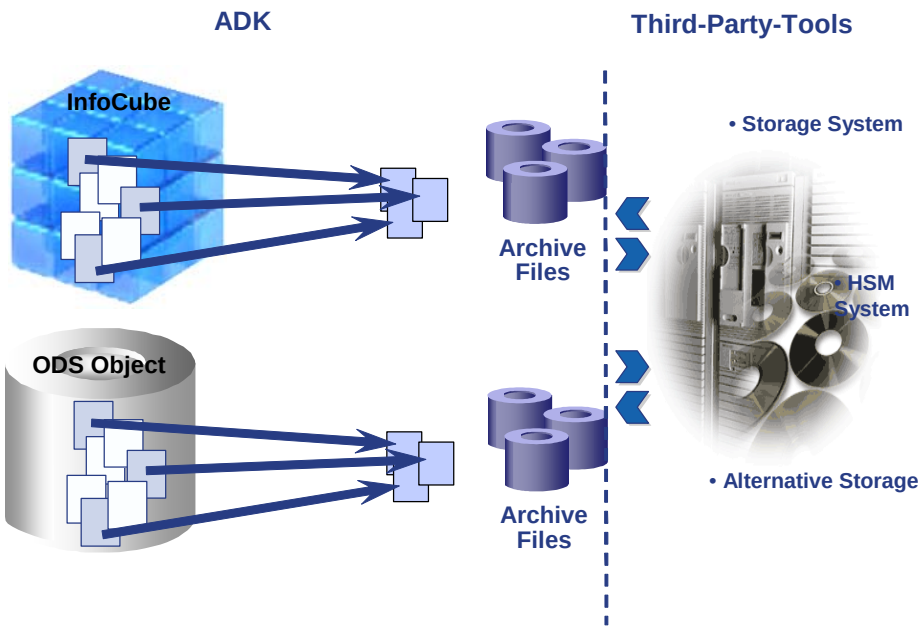
Processes are connected via events, signals to background controlling, that start a successor process after being triggered by a predecessor process. The connections can be created by simply dragging with the mouse.
In this way, process chains facilitate the centralized and concise scheduling of all processes in the SAP BW.

1.4.8.4 Data Archiving

Data archiving allows you to simplify the administration of InfoCubes and ODS objects and to improve performance.

The Archive Development Kit (ADK) is used here. The ADK is a tool from SAP NetWeaver used in the development of archiving solutions and stages the runtime environment for archiving. Its main purpose is to read and write data into and out of archive files. The ADK guarantees platform- and release-independence for the archived data.

Data archiving in BW is designed for use with data that is no longer important for on-going analysis processes, but which is still needed for the construction of new data targets or may need to be used for analysis again in exceptional circumstances.



To archive data from InfoCubes and ODS objects you first have to create an archiving object as a data target. InfoCubes and ODS objects usually contain a self-enclosed dataset for a specific business-related area. For this reason, an individual archiving object is generated for each data target.

The archiving run itself consists of a write, store and delete phase. Archive data is created for a specific archiving object during the write phase, after a verification phase the data is deleted from the database, before being stored in a storage system as defined in Customizing.

Data from InfoCubes is transformed from the star-schema table into a flat format that only contains the actual characteristic attributes. Therefore, the archive is not affected by any reorganization of the IDs in the star schema. With ODS objects, only data from the active data table is archived.

Archived data can also be extracted from BW archives again. There is also the option in the Scheduler to read data from archives and call up input help for existing archive files.

2 Business Intelligence Platform

The Business Intelligence Platform offers a technological infrastructure, along with various analytical technologies and functions:
Online Analytical Processing (OLAP) is used for information preparation of large amounts of operative and historical data. The OLAP processor enables allow multi-dimensional analyses according to various business perspectives.
The *Metadata Repository* enables information on metadata objects for the BW system to be displayed in running system or to use them independently of BW system operation.
With Business Planning and Simulation (BW-BPS), you create planning applications. The areas of application range from simple manual data entry to complex planning scenarios.
Special analysis processes such as data mining can be realized with the Analysis Process Designer (APD). Using an analysis process, information can be combined in the BW system to generate new information.
The Reporting Agent is a tool used to schedule reporting functions in the background.

2.1 OLAP

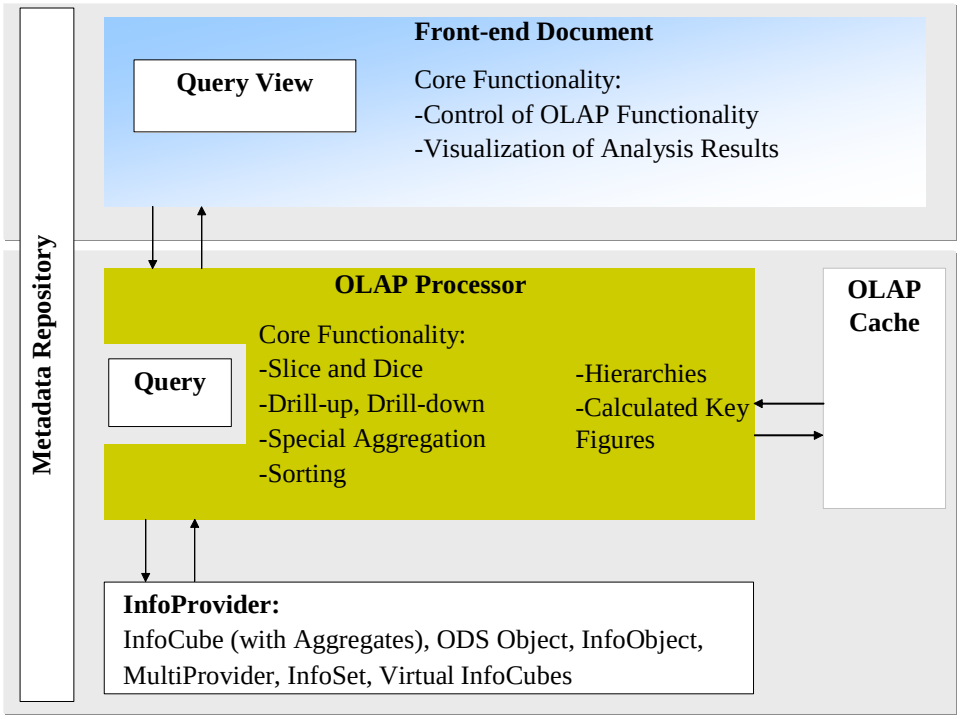
The SAP Business Information Warehouse uses OLAP technology for the analysis of data held in the data warehouse. *Online Analytical Processing* marks the BW as a *decision support system*. OLAP allows decision-makers to quickly and interactively analyze the multidimensionally modeled data appropriate to business considerations.

InfoProviders allow this data to be viewed. As data is stored in InfoCubes optimized for the reading of data, InfoCubes and MultiProviders for InfoCubes should be the preferred InfoProvider.

2.1.1 The OLAP Processor

The OLAP processor, a component of the BW server, lies between the end user and the database. It makes the multidimensionally formatted data available to both the BW frontend and, using special open analysis interfaces, to third-party administrator frontends also. For this reason, the OLAP processor is optimized for the analysis and reporting of very large datasets too. Users are able to request ad hoc individual views of business-relevant data using the Business Explorer (see OLAP Reporting).

The following graphic displays the status and tasks of the OLAP processor within the data processing process as a multidimensional analysis is executed:



Queries are the basis of all analysis in the SAP BW. To formally define a multidimensional request, a query determines:

- The structure – analog to a worksheet (see Structures, Restricted Key Figures, Calculated Key Figures, Exception Cells)
- The filter that affects this structure, as well as
- The navigation space (free characteristics) (see Restricting Characteristics).

SAP BW has a number of analysis and navigation functions for the formatting and valuation of a company's data. These allow the user to formulate individual requests on the basis of multi-dimensionally modeled datasets (InfoProviders). Subsequently the user is able to view and evaluate this data from different perspectives during the runtime. The overall functionality for retrieving, processing and formatting this data is provided by the OLAP processor.

The following table offers an overview of the OLAP functions and services implemented in the Business Information Warehouse. You can find additional information under Special OLAP Functions and Services, and in the Business Intelligence Suite: Reporting and Analysis section.

OLAP Function	Operations in Detail
Navigation	• Drill down to characteristic / structure element. Remove element drill down from the view (*dice*) • Expand (*drill down*) and hide (*drill up*) hierarchy nodes • Exchange drill down elements (*swap*)
Filters	• Restrict (*slice*) characteristics to selections (single value, value range, hierarchy element, exclusion)
Aggregation	• *Standard Aggregation*: Default, key figure-dependant calculation formula for the aggregation of single result values • *Exception Aggregation* (Special aggregation setting in relation to a particular characteristic. For example, aggregation average of account balance with reference to the characteristic time) • *Local Aggregation* or *Local Calculation* (for example, the calculation of individual values displayed for norming from the overall result)
Layout	• Layout of the characteristics as key / identifier • Display / suppress results rows • Change position of hierarchy nodes (up / down)
Result-dependent selection and layout	• *Threshold values (Exceptions)* (Highlighting of uncommon variance in key figure values in color) • *Conditions*: Key figure-dependent restriction of characteristics according to defined conditions
Structuring	• Hierarchical assignment of characteristic values with drill down for more than one element ('*universal display hierarchy*')
Generic and business analysis functions	• *Sorting* regarding characteristics and key figures • *Calculated Key Figures* and *Formulas* (enables statistical and mathematical calculation on the basis of key figure values, among other things) • *Currency Translation* • *Elimination of internal business volume* (business elimination of internal transactions)
Concepts for optimizing runtime	• *Non-Cumulatives* • *Aggregates* • *OLAP Cache* (adjustable in the *cache mode* (dependent on query))
Integrated additional functions	• *Variables* for parameterization and increased reusability of queries • *Report-Report Interfaces* for navigation in different reports • Authorization concept for controlling user authorizations with reference to accessing data

2.1.2 Special OLAP Functions and Services

In the following sections some of the special OLAP functions of the SAP Business Information Warehouse are described in more detail.

2.1.2.1 Aggregation

To calculate the value of key figures, the data from the InfoProvider has to be aggregated at the detail level for the query. It is possible that formulas also have to be calculated. In this case, several characteristics have to be aggregated. For each key figure, one selected characteristic can be aggregated with another rule.

The OLAP engine in the BW proceeds as follows:

1. Standard aggregation is executed first. This can be set in the key figure definition. Possible types if aggregation are summation (SUM), minimum (MIN), and maximum (MAX). Minimum and maximum can be set, for example, for date key figures.
2. The aggregation of a selected characteristic takes place after the standard aggregation (exception aggregation). Possible exception aggregations available are average, counter, first value, last value, minimum, maximum, no aggregation, standard deviation, summation and variance. Cases where exception aggregation would be applied include, for example, storage non-cumulatives that can not be summed by time (on this, also see the chapter non-cumulatives), or counters that count the number of characteristics for a particular characteristic.
3. Aggregation by currency and units is executed last. If two figures are aggregated unequally with different currencies or units, the system marks this with '*'. On this, also see the chapter on currency translation.

Formulas are only calculated after figures have been fully aggregated. There are three exceptions to this rule:

- When the time for calculating the key figure has been selected so that the calculation of the formula is to take place before aggregation.
- When a formula variable is used with replacement from the value of an attribute in a calculated key figure.
- With a currency translation that was set in the query designer.

2.1.2.2 Local Calculations

You use this function to recalculate the single values displayed in a report according to particular criteria. These local calculations include only those numbers in the calculation that appear in the current view of the report. In this way, you override the standard OLAP processor calculations.
Note: These **local calculations only change the display of the values.** With the following calculations, such as formulas, the system does not use these values changed for the display. Instead it uses the original values returned by the OLAP processor.
For example, you can create a ranked list from a report showing the revenues for your products. Your products are then arranged according to their revenues and given a ranked position:

Calculate Single Values as Ranked List

Product	Revenue
Automatic umbrella	$ 70.086
Multifunctional-Pen	$ 71.260
Laptop-Backpack	$ 77.063
Matchsack	$ 60.752
A4 Writing Case	$ 63.776
Bottle fastener	$ 53.740
Candy tin	$ 66.352
CoffeMug	$ 71.438
Business Card Case	$ 75.719
Mousepad	$ 64.545
Lamy Pencil	$ 67.613
Overall Result	**$ 742.344**

Product	Revenue
Automatic umbrella	5
Multifunctional-Pen	4
Laptop-Backpack	1
Matchsack	10
A4 Writing Case	9
Bottle fastener	11
Candy tin	7
CoffeMug	3
Business Card Case	2
Mousepad	8
Lamy Pencil	6
Overall Result	**$ 742.344**

You can also use local calculations to create a report with an active condition that shows the top 5 products by revenue. As a result, the total sum is displayed for all products, since conditions have no influence on results. In this case, you can locally calculate the sum of the top 5 products:

Calculate Results as Summation

Product	Revenue
Laptop-Backpack	$ 77.063
Business Card Case	$ 75.719
CoffeMug	$ 71.438
Multifunctional-Pen	$ 71.260
Automatic umbrella	$ 70.086
Overall Result	**$ 742.344**

Product	Revenue
Laptop-Backpack	$ 77.063
Business Card Case	$ 75.719
CoffeMug	$ 71.438
Multifunctional-Pen	$ 71.260
Automatic umbrella	$ 70.086
Overall Result	**$ 365.566**

Calculate local single values:
With single values, you can normalize query data for a key figure for different results of this key figure. The data is displayed as a percentage of the result.

You can also create ranked lists for single values. The characteristic values are sorted according to the key figure you have selected, and given a ranking.

You can locally calculate the maximum/minimum key figure values for a characteristic. In other words, the largest/smallest value (such as revenue) is displayed for this characteristic (let's say 'customer') for all characteristic values (customer 1, customer 2,…).

You can also count all values (where necessary also excluding the zero values). You can also locally calculate the average of all values (possibly with exclusion of the zero values). You can also suppress single values- only the values are displayed.

Calculating results locally:

With results, as with single values, you can also display the maximum/minimum value of the corresponding area. You can also count the number of values of the corresponding areas (where necessary whilst excluding the zero values). You can also calculate the average of all values of the corresponding area (possibly with exclusion of zero values).
You can also display the sum of the values of the corresponding area, suppress the result or display the result for the highest/lowest value for the corresponding area.
With results, you can also use functions *Standard Deviation* and *Variance.* You can also sum rounded values. This function especially makes sense when you have created a scaling factor for key figures. This is because there can be a significant difference between the sum calculated by default and the locally calculated value of the rounded values.

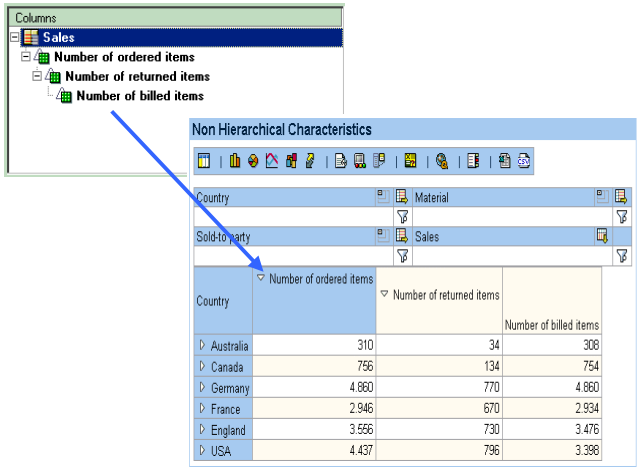
2.1.2.3 Hierarchies

Data modeling offers different opportunities for modeling hierarchical structures (also see InfoObjects):

- In the dimensions of an InfoCube or in an ODS object
  Example: Time dimension. By defining them, the InfoObjects *Calendar Day*, *Calendar Month*, and *Calendar Year* form a hierarchy: 09.04.2003 04.2003 ? 2003.
- In the attributes of a characteristic
  Example: By defining them, the InfoObjects *Material*, *Material Group*, *Material Type*, and *Industry Sector* form a hierarchy. So that they can be used as hierarchy levels in the query, the attributes have to be defined as navigation attributes.
- By structuring the characteristic values of a characteristic in a tree format (characteristic hierarchies)
  Example: Hierarchies of cost centers that are compiled in cost center groupings.

Furthermore, **the query definition** offers various opportunities to arrange hierarchical structures for reporting:

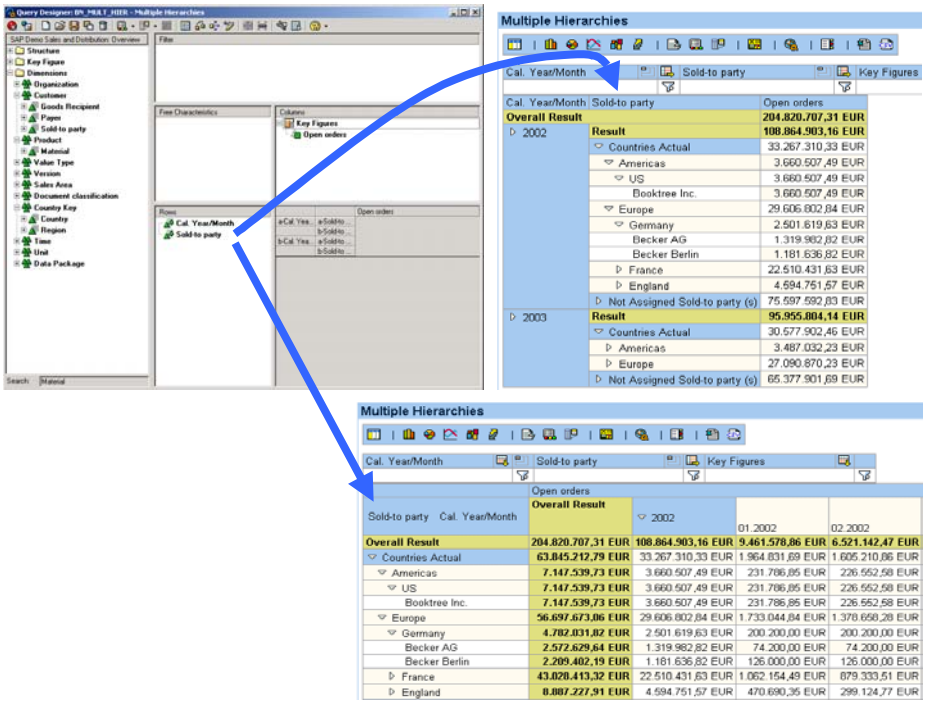
- The hierarchical layout of all objects from one or both axes (rows and columns) (display as hierarchy; universal display hierarchies) Using these functions, the ways of modeling hierarchical structures named above, can be displayed in the query in essentially the same way.
- Key figure hierarchy. The following graphic offers one example of a key figure hierarchy in a column:



Country	Number of ordered items	Number of returned items	Number of billed items
Australia	310	34	308
Canada	756	134	754
Germany	4.860	770	4.860
France	2.946	670	2.934
England	3.556	730	3.476
USA	4.437	796	3.398

- The selection of a characteristic hierarchy as the active *presentation hierarchy* for each characteristic, if this is to be presented hierarchically. In contrast to the universal display hierarchy, the *Presentation Hierarchy* displays the values according to a tree structure that was defined in data modeling.

The following graphic shows how two characteristics may be used with a presentation hierarchy in the rows of a query, and how characteristics in the row and column axes can be swapped.

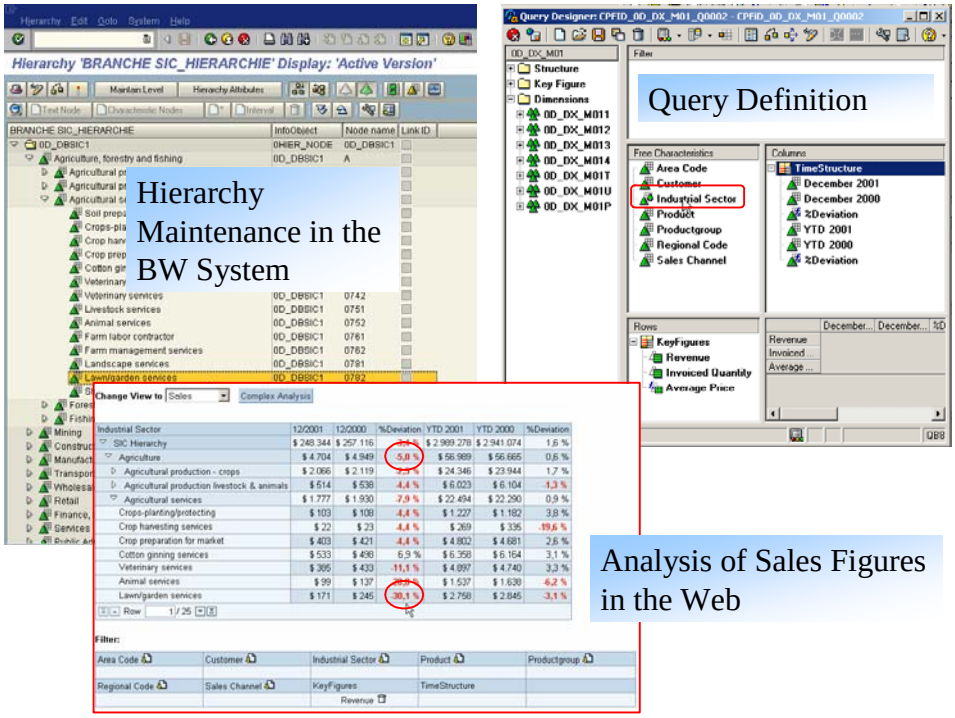


- The restriction of a characteristic to a characteristic hierarchy or to a hierarchy node of its characteristic hierarchy (also see Query Design, Variable Types and Restricting Characteristics).

The topic in the following sections is **characteristic hierarchies**. The following graphic uses a simple example to show how characteristic hierarchies can be edited and used:

- Editing a hierarchy to the hierarchy basic characteristic *Industry Sector* in the BW system.

- Using this industry sector hierarchy as a presentation hierarchy in a query definition in the Query Designer.
- Navigation possibilities along the presentation hierarchy when analyzing particularly poor sales figures in December 2001 for a particular landscape area.



Characteristics, for which hierarchies are allowed, are called hierarchy basic characteristics. All characteristics that reference to a hierarchy basic characteristic automatically inherit its hierarchies. A hierarchy basic characteristic can have any number of hierarchies. Like master data, characteristic hierarchies can be used in all InfoProviders.

Hierarchies can be loaded:

- Into the BW system from a source system (using the Scheduler or Process Chains)
- Into another BW system from a BW system (using the Data Mart Interface).

Hierarchies can also be created and edited in the BW system.

Hierarchies for a hierarchy basic characteristic can be made both *version* and *time dependent.* In this way, you can do both - you can set the name of the hierarchy, the version and the key date and leave some of it variable. For example, if the name of the hierarchy is set and various versions are given with one actual and multiple plan hierarchies, in reporting, the end user can select a version for a pre-defined hierarchy (that is a fixed hierarchy name). Accordingly, the end user can select a pre-defined key date in a query in order to evaluate a pre-defined hierarchy for the desired key date. Typical application cases for the use of version or time-dependent hierarchies are cost centers and cost element hierarchies.

BW offers the following possibilities regarding the structure of characteristic hierarchies:

- In contrast to hierarchies in the dimensions or in the attributes, both *balanced* and *unbalanced* characteristic hierarchies can be processed without restriction.
- *Leaves* can be used several times in a characteristic hierarchy.
- A subtree, lying under its corresponding original node, can be attached in a hierarchy several times by using link nodes.
- Interval. This option makes it possible to use intervals instead of a quantity of leaves when processing a hierarchy structure.

In some applications (Finance applications, for example) it is desirable to be able to select, on a node by node basis, whether a key figure's sign is to be returned or not. To do this, the *Return Sign* attribute can be loaded for the hierarchy. In the query, the sign can then be returned in formulas by multiplying it with a formula variable (substitution path from the hierarchy attribute *Return Sign*).

For time characteristics, the BW system will have already generated numerous hierarchies. The required selection of these virtual time hierarchies can be activated from the complete list of suggestions. In reporting, some hierarchies are only available after they have been activated.

2.1.2.4 Currency Translation

Currency translation enables the translation of posted data records from the source currency into a target currency, or by repeated translation into different target currencies. It is based on SAP Web application server functionality for currency translation.

Currency translation makes it possible to translate key figures with currency fields, which exist in the source system in various different currencies, into a single currency in the BW system. For example, the local or group currency. A further usage is the currency difference report. Here you can compare the current exchange rate with the rates valid for the posting date and calculate the impact of changes to the exchange rates.

Currency translation is based on currency translation types, in which the corporate rules for translation are set. It is a combination of different parameters (source and target currency, exchange rate type, and time base for the translation) that establish how the exchange rate for the translation is executed.

- The exchange rate type distinguishes exchange rates that are valid in the same time frame next to each other, for example, the bid rate, ask rate or middle rate.
- The source currency is the currency that is to be translated. The source currency is determined from the data record or a specified InfoObject (dynamically). The target currency can either be set in the currency type, delivered with an InfoObject, defined by a variable or not chosen until the time of translation.
- The time reference for the currency translation can be either fixed or variable. If the time reference is fixed, then the point in time for the exchange rate determination is independent of the data. The fixed time can be the current date, a fixed key date or the time reference from the variable (variable to 0DATE). If the time reference is variable, then the point in time for the exchange rate determination comes from the value for a time characteristic. In addition, the *query key date* can be chosen as a time reference. Then the key date is used that is determined in the query properties in the Query Designer.

The currency translation type is stored in a reusable form and is available for currency translation in the update rules for InfoCubes, and in the Business Explorer.

You can specify in the update rules those key figures or data fields for which a currency translation is to be performed during the update. In special cases it is possible to perform a currency translation using customer-defined routines in the transfer and update rules.

In the Business Explorer you can:

1. Determine a currency translation in the query definition
2. Translate currencies during the query runtime Translation in the Business Explorer is more restricted than in the query definition.

2.1.2.5 Elimination of Internal Business Volume

This function allows you to eliminate internal business volume. For example, the sales revenues made between two cost centers that lie in the same area of a hierarchy, is no longer displayed in the report.

For every key figure a key figure with a reference can be created whose (internal) value is to be eliminated. You have to create a rule to specify when a value is considered as internal. You define this rule by pairs of characteristics (sender and receiver) where each pair references to the same characteristic. A value is then considered to be internal when the value of the sender characteristic belongs to and returns the selection variant of the receiver characteristic. The value “not assigned“ always means external.

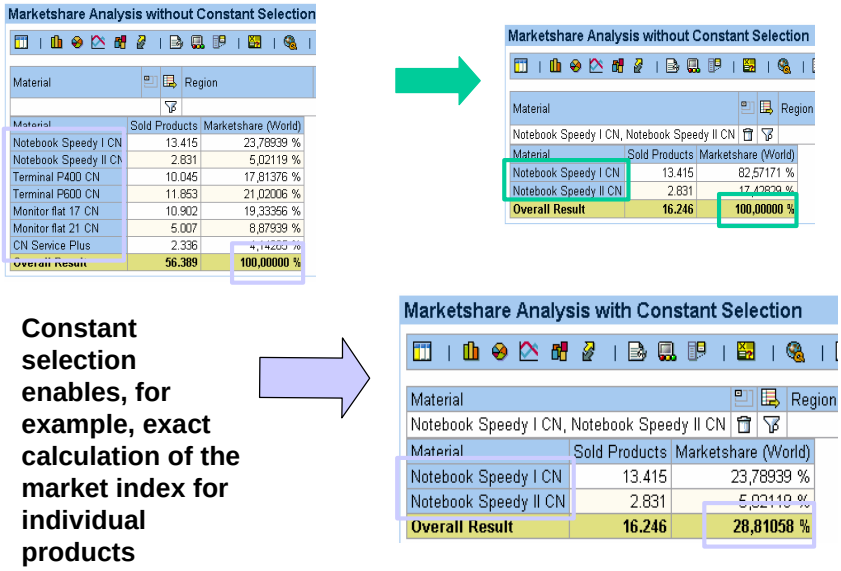
Even if several pairs of characteristics have been defined, you can still define whether or not the value is an internal value, if the rule is valid for all or only one pair of characteristics.

Elimination using hierarchies can be visualized in the report. The internal business volume is eliminated at the hierarchy-level under which the respective pairs of characteristics are assigned.

2.1.2.6 Selecting Constants

In query design, you use selections to determine which data you want to display for the report runtime. You can then alter the selections during runtime using navigation and filters – that is, you can restrict the selections further. The function *Constant Selection* allows you to mark a selection independent of

other filters. This means that navigation and filtering have no effect on the selection for the runtime. In this way, you can easily select reference sizes that you cannot change for the rest of the runtime.
You can use the *Constant Selection* function to specify the **market index**, for example.
You do not want to see the absolute sales revenue in a product list (product is in drilldown), but a normalized sales revenue (that is, related to) a specific product group. Using the *Constant Selection* function, you can select the sales revenue of a specific product group as the constant for the drilldown. You can now relate the sales revenue of the individual products in the group to the sales revenue of the product group and, for example, determine the revenue from each individual product sales revenue as a proportion of the sales revenue for the group.



Constant selection enables, for example, exact calculation of the market index for individual products

Constants selection can also be used to create a **slow-movers list**:
You can define a query based on a MultiProvider in which all products are shown that have not been sold in a particular time frame and of which only a few have been sold. In other words, characteristic values should also be displayed in the query for which there is no transaction data or only very few values in the selected period.
You can define entire selections as constants for structural components and cells. Such a selection remains in place in the navigation regardless of all filters. Moreover, you can define components of selections, that is, single InfoObjects and their filter values, as constant. The selection remains constant only with regard to this InfoObject in navigation and filtering. However filters affect other characteristics. Note that you cannot select an entire restricted key figure as a constant, only its InfoObjects.

2.1.2.7 Reporting Authorizations

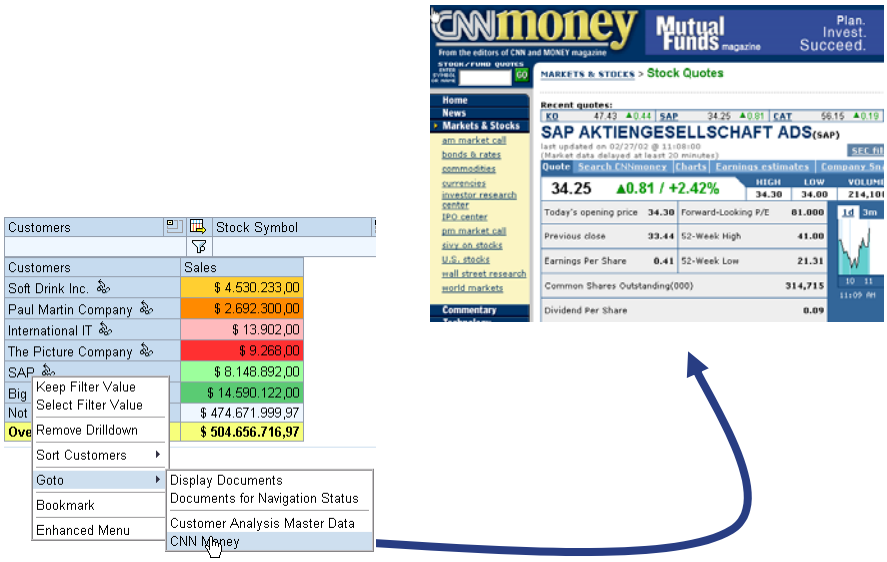
Working with the Business Explorer is controlled through reporting authorizations. Authorization objects must first be created for this reporting authorization. An authorization object includes up to 10 authorization fields which are used to determine whether a user is allowed to execute a specific action on a specific BW object. As soon as an authorization object has been saved, it may be checked when executing a query.
Only when the user has had the appropriate authorizations assigned to him/her can he/she define and execute a query or navigate in an existing query. Authorizations for working with a query are checked in the dialog when you open a query. Authorizations for individual objects are also checked when a query is opened.
Also see the chapter on authorizations on this topic.

2.1.3 Report-Report Interface

With the report-report interface you are able to flexibly call a jump target (*receiver*) online from a BW query (*sender*), within or outside of the Business Information Warehouse. Jump targets can be queries, transactions, reports, or Web addresses.

Example: You want to request master data on your cost center report (*sender*) from a R/3 system (receiver). You want to request the up-to-date stock market data for your listed customers from the Internet, and use it in a BEx query with your customer's up-to-date sales figures (*sender*).

Jump targets that have been assigned to a BW query are available and can be selected in the BEx Web Application Designer and in the BEx Analyzer via the context menu under the *Goto* function. The following graphic shows an example of a Web jump target:



Parameterization of the target action is taken from the context of the cells from which you jumped. You can parameterize how a BEx Query or BEx Web Application is called using input variables that are filled from the selection conditions and element definitions of the selected cell of the sender query.

2.1.4 Performance Optimization

Various functions support you in improving the performance of your BW system. A distinction can be made between database-, query and load performance.

As well as the functions executed here, some functions of the **Report Agent** (see Pre-calculating Web Templates, Pre-calculating Pre-calculated Value Set Type Characteristic Variables) and different data target modeling functions also affect performance. -

2.1.4.1

2.1.4.2 Non-Cumulatives

A non-cumulative is a non-aggregating key figure on the level of one or more objects that are always displayed in relation to time. Examples of non-cumulatives are headcount, account balance and material stock.
The way you model the storage of non-cumulatives in BW depends on the scenario. Depending on how frequently the non-cumulatives change and for which total count of objects you wish to determine non-cumulatives, you have to decide between one of two options:

- Inventory management with non-cumulative key figures
- Inventory management with normal key figures (flow key figures)

Inventory management with non-cumulative key figures:

It is recommended that you use non-cumulative key figures for areas in which non-cumulatives rarely or do not regularly change completely, for example with warehouse stock (retail) or with the number of employees.

With the use of non-cumulative key figures, an absolute non-cumulative value (so-called marker) and all non-cumulative changes are saved in the fact table for the InfoCube. In this way, the data retention and the data volume in the data loading process is optimized, because only when a non-cumulative

has changed due to a transaction is a data record loaded into the InfoCube for it. An evaluation of non-cumulatives at any particular time can then be done in BW queries using non-cumulative key figures.

Modeling of non-cumulatives with non-cumulative key figures:

A non-cumulative key figure is modeled in SAP BW with the associated field for non-cumulative change or the associated fields for in- and outflows in the InfoObject maintenance. You can determine the current non-cumulative or the non-cumulative at a particular point in time. You can do this from the current, end non-cumulative and the non-cumulative changes and/or the inflows and outflows.

Which option you choose depends on how you want to evaluate the non-cumulative key figure. If you only wish to evaluate the non-cumulative, or the non-cumulative changes as well as the non-cumulative using a particular time period, choose modeling as a non-cumulative value with non-cumulative changes. If you also want to evaluate the inflows and outflows separately, then choose modeling as a non-cumulative key figure with inflows and outflows.

The key figures for non-cumulative changes or for the inflows and outflows are normal flow key figures. For both aggregation and exception aggregation they have 'summation'.

Non-cumulative key figures always have summation as standard aggregation (aggregation behavior on the database, for example with compressing or rolling up aggregates), but they have an exception aggregation (in reporting) that is disparate to summation with reference to a time characteristic, since it would not make sense to summarize non-cumulatives about time. On this, see the exception aggregation example cited in the chapter Aggregation.

Only the currently valid end non-cumulative (so-called markers) and the non-cumulative change are stored on the database. This end non-cumulative is always updated when the non-cumulative InfoCube is compressed (see the section on *Compressing InfoCubes* in the chapter Optimizing Performance for InfoCubes).

When this is evaluated in reporting, the non-cumulative is calculated from the current end non-cumulative and the corresponding non-cumulative changes for the specified time. An evaluation is generally possible for any point in time. The validity period for non-cumulatives is normally the minimal and maximal values loaded for the time characteristic. However, it is also possible to control the validity period more closely.

Inventory Management with Normal Key Figures (Flow Key Figures)

If the non-cumulatives change frequently, you should use inventory management with normal key figures, that is cumulative values. Absolute non-cumulatives for all objects for specific key dates (for example, end of the month) are kept in InfoCubes. These absolute non-cumulatives can then be determined from an ODS object that is continuously being supplied with non-cumulative changes.

In this case, the inventory settlement for the runtime of the query and the updating of the markers is done by compressing within the administration of an InfoCube with non-cumulatives.

2.1.4.3 Aggregates

To improve the performance of query execution, the Business Information Warehouse enables you to save the dataset of an InfoCube on a database in compressed form redundantly and persistently in an aggregate in the database. Aggregates make it possible to access InfoCube data quickly in reporting.

BW supports different storage physical storage concepts:

- ROLAP (Relational Online Analytical Processing), the storage of multi-dimensional data in a relational database, see (ROLAP) Aggregate, analog to InfoCube.
- MOLAP (Multidimensional Online Analytical Processing), the storage of multi-dimensional data in a relational database, see MOLAP Store.

It is not possible to hold MOLAP aggregates *and* ROLAP aggregates *simultaneously* for one InfoCube. However a MultiProvider can obtain its data from InfoCubes that have partly ROLAP and partly MOLAP aggregates. Before making a decision about whether it is better to create MOLAP- or ROLAP

aggregates for an InfoCube, you need to check the prerequisites for both options. The availability of this function depends on the database being used.

Aggregates that are to be available in reporting need to be activated beforehand (in background processing) and filled with data. When navigating, the different results are consistent. Aggregates are transparent to the end-user as the OLAP Processor finds the optimal aggregates for the relevant request.

An aggregate is built from characteristics and navigation attributes of an active InfoCube. It can contain time-dependent components (attributes or hierarchies). It can be grouped by all the values of a characteristic or navigation attribute, or by the nodes of a particular level of a characteristic hierarchy. Aggregates can also be filtered according to individual values.

2.1.4.3.1 (ROLAP) Aggregate

A (ROLAP) aggregate is an aggregate of an InfoCube that is physically saved in a relational database.

As many aggregates as is necessary can be defined for an InfoCube. For the creation of an aggregate, the system can generate and automatically optimize proposals based on the BEx queries created for the selected InfoCube, or based on the data collected in BW Statistics (see Technical Content). You can subsequently edit the proposed aggregates individually.

If new data packages (requests) are loaded into the underlying InfoCube, they are not immediately available with an aggregate in reporting. To provide the aggregate with the new data from the InfoCube, you must load the data into the aggregate tables at a time which you can set. After this transaction, the new data is available for rolling up in reporting.

If hierarchies or attributes of characteristics change after loading master data, you can manually start the adjustment of the aggregates affected by the changes. Or this can be automatically scheduled in process chains. Aggregates remain consistent.

The Administrator Workbench supplies an overview of the status of all aggregates available in the BW system in the *Monitoring* function area.

When using aggregates, pay attention to the balance between advantages and disadvantages: Aggregates improve query performance but lengthen the load time. To optimize an InfoCube, it therefore needs to be checked regularly whether or not additional aggregates are missing and can therefore be deleted. Also, you can set in the *Modeling* function area of the Admin Workbench for each InfoCube whether the associated aggregates are to be automatically compressed when the data is being filled or after the data packages have been uploaded. Otherwise the aggregates are only compressed with the InfoCube (see the section on *Compressing InfoCubes* in the Optimizing Performance for InfoCubes chapter).

2.1.4.3.2 MOLAP Store

A MOLAP aggregate is an aggregate of an InfoCube, whose data is physically stored in a MOLAP store.

In contrast to ROLAP aggregates, MOLAP aggregates do not allow filter conditions for characteristics. The definition of a MOLAP aggregate only relates to the selection of characteristics, in which the system does not summarize. (The system summarizes in characteristics that are not selected).

The BW MOLAP store uses Microsoft Analysis Services and therefore represents a platform-specific method of optimizing query performance. The BW MOLAP is only available for a Microsoft SQL Server. BW InfoCubes for which MOLAP aggregates are to be created are basically subjected to two conditions: They may only contain a certain number of characteristics, navigation attributes and hierarchies and may not use certain BW objects (such as time-dependent objects or non-cumulative values).

The structure of MOLAP aggregates for an InfoCube is comprised of two levels in contrast to the direct derivation of many ROLAP aggregates: In the first step, precisely one MOLAP cube, the ‚MOLAP aggregate' is derived; from this as many MOLAP aggregates as required can then be derived.

2.1.4.4 OLAP Cache

Caching is a means of improving the query performance. The query results and navigational states calculated by the OLAP processor are saved as highly compressed data in the cross-transaction

cache. The OLAP processor can access the data stored in the cache with similar query requests. Because cache access occurs much quicker in comparison to database access, this speeds up the execution of the query. At the same time, the database instance is credited. On the other hand, building and keeping the data in the cache also requires a certain amount of effort. For this reason it makes sense to especially save those queries in the cache that are often requested or the calculation of which requires a large amount of effort due to their complexity. The cached data can be kept subdivided into the main memory, an application server or in the network. Settings for the OLAP cache can be made at different times and with different areas of validity: The system-wide valid settings for the OLAP cache are designated as global cache parameters. These are centrally specified in the course of implementing the BW system and can be adjusted later, if necessary. The global cache parameters can be “overridden” during operation for the BW system using cache-relevant settings (*cache modes)* for an InfoProvider/ for a query.
In the *OLAP* cache monitor from the Business Information Warehouse, the global cache parameters are displayed, as well as the storage used for the query runtime objects and the fundamental, current cache structure.

2.1.5 Open Analysis Interfaces

SAP Business Information Warehouse offers an open architecture into many directions. You can extract data from various systems into a BW system and evaluate this data with various front end tools for reporting.

The SAP BW Business Intelligence Suite provides you with flexible Reporting and analysis tools for strategic analysis and decision-making support in your Corporation (see Business Intelligence Suite: Reporting and Analysis).

You can use the *Open Analysis Interfaces* to access data stored in BW using frontend tools provided by 3rd parties: These interfaces have restrictions in view of the following properties to different degrees:

- XML for Analysis (XML/A) is platform-independent and supports Unicode UTF8.
- OLAP BAPIs (*Business Application Programming Interfaces*) require a platform supported by SAP and support Unicode.
- OLE DB (*Object Linking and Embedding Database*) for OLAP and ADO MD (*ActiveX Data Objects MultiDimensional*) require MS Windows and do not support Unicode.

All interfaces are based on MDX (MultiDimensional Expressions). MDX is a query language developed by Microsoft for queries using multi-dimensional data.

The frontend tools can send query requests to the MDX processor in the BW system using these interfaces. This passes the query on to the OLAP processor. The OLAP processor accesses the InfoProvider.

The results of coordinating development between third party administrators and the SAP Business Information Warehouse are checked in a test and are certified. However, the integration of 3rd parties does not have the same degree of integration that the SAP BW Business Intelligence Suite can offer.
SAP BW outputs pre-configured information models as Business Content. This model reflects the business experience of SAP and expedites the implementation of the Business Information Warehouse. For third party administrators, the use of this information model is restricted to InfoProviders. Standard queries, workbooks and Web templates are not offered. Accordingly, decision-makers have to take a longer implementation time into account.

2.1.5.1 XML for Analysis

XML for Analysis is a protocol specified by Microsoft which is used for the exchange of analytical data between client applications and servers via HTTP and SOAP (Simple Object Access Protocol). It is used as a Web service. In contrast to OLE DB, XML for Analysis provides universal data access to any data source over the Internet, without a special component having to be installed client-side.

The implementation of XML for Analysis in SAP BW 3.0 is based on the Microsoft XML for Analysis specification, version 1.0. The *Discover* method set in this specification is used to request metadata and master data; this matches OLAP BAPI *MDDataProviderBW.* You can use the method *Execute* to execute MDX commands and receive the appropriate result set; this matches OLAP BAPI *MDDataSetBW.*

XML for Analysis is automatically available after installing an SAP BW system 3.0 as a Web service. The URL for the service is <Protocol>://<Server>:<Port>/sap/bw/xml/soap/xmla. You can use the URL <Protokoll>://<Server>:<Port>/sap/bw/xml/soap/xmla?wsdl to call up a description of the Web service. The Web service is based on the SAP Web Application Server (WAS) technology.

2.1.5.2 Web Service for Access to Query Data

With the Web service for access to query data, the description of the navigational state and the resulting set of a query or a query view can be requested in XML format when you enter a query name or a query view name. The structure of the XML corresponds to the structure that is made available within the Web API in the table interface area. The Web service is automatically available after installation of a SAP BW system and can be used independent of the front-end tools. It represents an additional option for requesting query data. In contrast to the Web service XML for Analysis, an MDX does not have to be formulated for this Web service, for example to be able to read a query view that has already been saved.

2.1.5.3 OLAP BAPIs

The SAP BW OLAP BAPIs are defined as methods of SAP Business object types in the BOR (*Business Object Repository*) and are implemented as RFC (*Remote Function Call)*-enabled function modules. The methods available for selection can be divided into two groups and so can be assigned to the appropriate BAPIs: The methods to request the BW metadata and master data are summarized in the Business object *MDDataProviderBW:* the methods to execute multi-dimensional results sets and from fetch data in the Business object *MDDataSetBW.*

The OLAP BAPIs are called up from the provider of the OLE DB for OLAP for the Business Information Warehouse.

2.1.5.4 OLE DB for OLAP and ADO MD

OLE DB for OLAP works as a front end interface for BW when the following points of varying importance occur:

- Support on the side of the producers of OLAP providers and consumers
- Setting OLE DB architecture for reusable and parallel components
- Using SAP BW OLAP BAPIs to drive generic OLAP tools.
- Simplification of requests to application development by means of ADO MD
- Execution of OLAP services for each provider without having to transform data.

2.2 Business Planning and Simulation (BW-BPS)

In many companies, planning is an unsatisfactory process. This can lead to a lack of acceptance of planning results, lack of dependability of planning data, heterogeneous planning tools or performance problems in processing of mass data. There can be more difficulties because the comparison between the planning and actual data is too complex and the coordination of the planning process is too difficult. The cause of this is frequently lack of integration due to isolated planning applications and difficulties in including organizational changes in the planning process.

The customer requirements and SAP BW Business Planning and Simulation solutions upon which successful planning must be based, can be summarized into the following four columns.

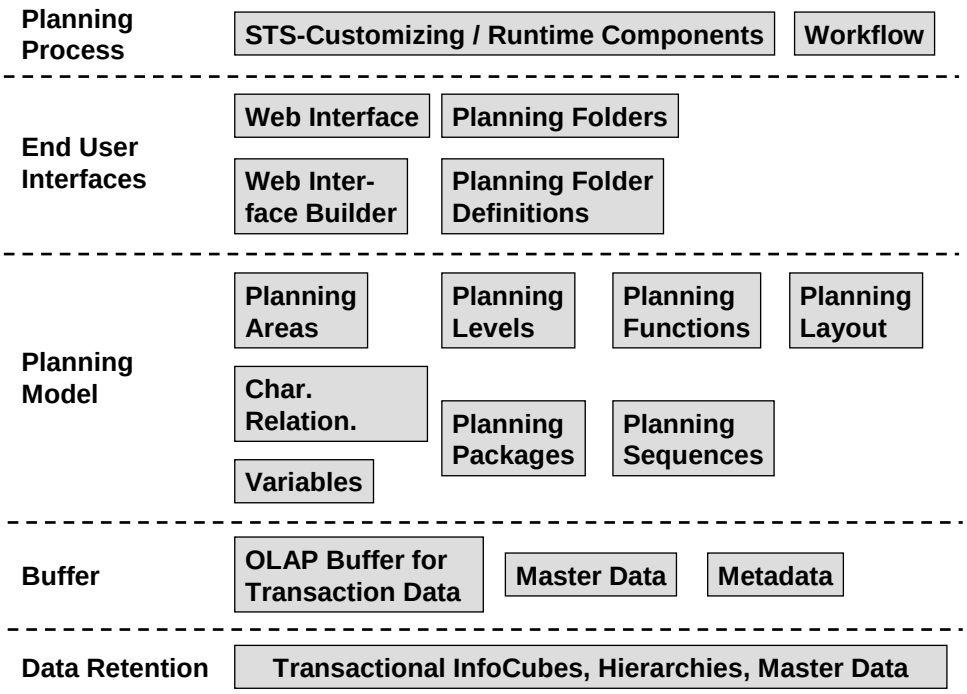
Goal	Reliability of planning data	Acceptance of planning data	Flexibility and speed	Coordination of the planning process
Obtained through	• Data integrity • Modeling flexibility of the organizational structure • Quick adaptation to organizational changes • Confirmation of entered plan data	• Self-explanatory functions • Quick access to plan data • Immediate validation of planning results • Immediate analysis of planning (plan/actual	• Simulation based on alternative assumptions • Distribution of compressed data • Rolling forecast • Functioning processing of mass data	• Clear responsibilities • Option of tracing back through to plan development • Integration of planning and business

		comparison)		process
Support in BPS software	Modeling	Manual Planning	Planning Functions	Process control

Business Planning (BW-BPS) enables you to produce planning applications. You can either develop your own planning application or use the Business Content delivered by SAP. The area of application stretches from simple data input through to complex scenarios with data extraction, automatic planning preparation, manual data input, controlling the planning process, and retracting plan data. The architecture of BW-BPS is structured so that you are able to implement simple scenarios without great effort but are equally able to build sophisticated business-wide planning processes. Planning applications are built from the following components:

- A data basis for storing transaction and master data
- Layouts for manual data input in SAP GUI and on the Web
- Planning functions for editing transaction data
- Characteristic relationships with which you define consistency conditions for your planning application
- Planning packages and variables with which you define the work list for a planner
- A Status and Tracking System and a connection to the SAP Workflow for controlling the planning processes
- Retractors and extractors for exchanging plan data with the ERP system. These components are delivered with the Business Content.

The following figure offers an overview of the BW-BPS architecture:



2.2.1 Data Basis

Key figures, characteristics and InfoCubes are used as underlying objects for planning Thus planning accesses the same master data as BW. Data retention also takes place in InfoCubes that can be filled with data with the same methods as BW. However, the InfoCubes used in planning are transactional InfoCubes. They can be released using a switch either for planning or for the data load process via staging. You can put a transactional InfoCube to use directly in reporting and then use it as a source for further data staging processes.

In BPS, each InfoCubes is assigned a planning area. A planning area can also include multiple (single) areas that are turned into a multi-area so that simultaneous access to several underlying InfoCubes is possible. Read access is also possible for non-transactional InfoCubes, for example to be able to run a planned-actual comparison.

2.2.2 Modeling

Planning takes place on various „levels“ in every company. On the management level, the data is planned and evaluated on a high aggregation level and strategic objectives are set using it. On lower levels the data is always planned in more detail and, on the lowest level, we most often speak of operational detailed planning. It is essential that on the one hand, data entry and evaluation be possible on these various levels, and on the other hand, that data consistency remain guaranteed: Data has to be entered by the respective manager on the correct aggregation level. The data on the higher levels of aggregation has to be cumulated correctly and distribution on a more detailed level has to be possible.

This concept is realized using the level concept in BPS. Planning levels are created in BPS that correspond to exactly one aggregation level of data within an InfoCube and thus illustrate the business context of a planning area. Planning levels are defined by the selection of participating characteristics and key figures, but general selections can also be set.

With a planning level you can create layouts for manual planning or planning functions for automatic processing of the data. An aggregation of the data to a higher aggregation level is done by the system automatically. Distribution of a level that is aggregated higher to detailed levels can be done manually or via a planning function.

2.2.3 Data Selection

Data selection is done with individual planning packages. Within one level you can define various planning packages and assign them to the respective users. You can make the selection of data dynamic using variables. However, these have to be restricted to the respective level.

The planning package takes the characteristics and key figures selected in the planning level and serves to further restrict characteristics whose values have not already been restricted in the planning level. At the same time the planning package describes the data area on which the planning functions are to operate.

In this way you can break down the sales planning according to customers by including the characteristic *customer* in the planning level. You can restrict the characteristic in different planning packages in such a way that each package can be processed by the employee who is responsible for the relevant customer.

2.2.4 Manual Planning

You use manual planning for the manual entry of plan data and to display data which already exists. You plan key figure values that are assigned to a combination of characteristic values.

Like other planning functions, manual planning also operates within one planning level. It works on data that is restricted by the planning package. Which key figures and characteristics are actually available for planning depends on the respective planning level.

You can use Microsoft Excel or the SAP tool ALV Grid as the interface for manual planning. Layouts are usually included in the planning applications. In the GUI you use planning folders for this purpose, and in the Web you use Web interfaces.

You create a planning layout and decide which characteristics or key figures should be used in the individual rows of the layout. Here you have a number of options. You can determine whether the system should fill the rows using the existing records within the selection (which is defined by the package) or the theoretically possible records, or whether you want to determine the structure of the rows yourself (for example, contribution margin schema). You can create multiple columns in a layout in which the key figure values are displayed. General selections (for example, planning year when you plan for only one year) are displayed in the header area. With the use of variables and the dynamic columns and rows, you have the option of structuring the layout dynamically yourself.

Other important features include calculation of user-defined totals (for example interim results over quarters) and the option of commenting on individual plan figures and then displaying these comments in reporting as well.

2.2.5 Planning Functions

Planning functions change the transaction data in a planning package. Each planning function is assigned to just one planning level. There are various types of planning function (for example, copy, distribute, delete, formula). Parameter groups are created for a planning function. Those characteristics that are to be changed are determined when a planning function is defined The values of those characteristics are determined when a parameter group is defined.

With a copy version you determine which characteristics are to be changed during copying and select the Version characteristic. When determining the parameter group you determine that version 001 is to be copied to version 002.

Apart from predefined planning functions, the „Fox“ (Formula Extension) formulas should also get special mention. This allow you to create and realize more complex formulas and functions easily. In addition to the usual mathematical functions, business functions (such as markdowns) and methods (such as methods of reading variable values) and simple programming instructions (such as “do” statements and if statements) are also available.

If multiple planning functions are to be executed one after the other, you can put them together in planning sequences. Planning sequences can also be processed in the background.

2.2.6 Variables

You can use variables to simplify data selection and customizing. Variables are defined within a planning area and can be used in all planning levels, planning layouts and planning functions of this area.

You can create the following types of variables:

Characteristic
You select one or several characteristics from the characteristic pool of the planning area and enter with which values of these characteristics the variable should be replaced at the time of execution.

- Attribute

  By selecting attribute values, the characteristic values of the underlying basic characteristic can be selected (for example all articles that belong to an article group selected as an attribute value).

- **Hierarchy**
  By selecting a hierarchy node, you can define characteristic values for the hierarchy-defining characteristic.

- **Number**
  A variable of this type can adopt a numeric value. With this you can make the revaluation factor in a planning function variable, for example.

Variables can be defined with various replacement types. They can contain cross-user fixed values or user-dependent values. However, these values can also be set using exits or using the characteristic authorizations.

2.2.7 Hierarchies and Attributes

In BPS, you can use hierarchies that are defined in BW for the selection of data and also for hierarchical preparation of data. Hierarchies can also be used to define characteristic relationships (see below).

You also have the option of generating hierarchies using the BPS. These hierarchies are not saved in BW and only exist at runtime. They are used in manual planning for the execution of a manual distribution („budgeting“).

Attributes can also be used in the selection of data in levels or packages. The values of an attribute can be displayed in layouts, for example the cost center groups for a cost center. Attributes can also be used to define characteristic relationships.

2.2.8 Characteristic Relationships

Generally there are relationships between characteristics used in planning. This means that one cost center is always assigned to exactly one cost center group. You can use characteristic relationships to model these relationships in the system. In this way you can

- check whether specific characteristic relationships are valid (combination check)
- Automatically fill characteristics that are not included in a level (characteristic derivation)
- Only automatically generate the valid combinations in a layout (combination proposal)

Characteristic relationships can be defined using a hierarchy, master data attributes, reference data or exits.

If a characteristic relationship changes, which will then change the valid characteristic combinations, the system provides planning functions that either delete all of the invalid combinations or repost using the new, valid combinations.

2.2.9 Front Ends

Various front ends are available in BPS that are generally used by different user groups. Thus the planning workbench offers all of the options to execute layouts and planning functions, but it is usually only used for superusers as the interface to execute the planning. Web interfaces and planning folders are available for other users. In both tools, you can combine planning layouts, planning functions and variables in one or several screens and create planning applications suitable for end users.

2.2.10 Status and Tracking System

The status and tracking system in BW BPS helps you to monitor the progress of your planning tasks.

The planning process in the Status and Tracking System is divided into the following elements:

Subplan:
A specific business subarea of business planning, for example profit planning, balance sheet planning, cost center planning.

Planning session:
A single program run of the iterative planning process where with every iteration a better adjustment of deviating plan values is aimed for (for example, requisition note vs. resource assignment, sales key figures vs. sales targets). A planning session in the status and tracking system is used to create versions of the different planning cycles. A particular subtask can change status several times (for example new, for approval, rejected, for approval, approved) within a planning session. A planning session is completed when all the subtasks contained in it have got the status “approved”.

Organizational hierarchy:
Part of the hierarchical organizational structure of your company, which describes the employees involved in the planning process and their corporate relations. Every hierarchy node represents a person responsible for a specific subplan within the planning process. At the same time, the hierarchy serves as a guiding line for the approval process of a subplan and for performing status-dependent notification management.

The Status and Tracking System is a Web-based application, which is exclusively designed for execution in a Web browser. As a result, you can execute the work where the system supports you, wherever you are and without any special installations on your PC. On the other hand, you make the Customizing of subplans and the planning sessions belonging to them in the BW System.

2.3 Analysis Process Designer

In SAP BW, data from a wide range of databases from the systems available in the company is collected, consolidated, managed and prepared for evaluation purposes. This data often has further, valuable hidden potential.

This is completely new information that is displayed in the form of meaningful interrelationships between the data that are either too well hidden or too complex to be discovered just by looking at the data or through intuition.

Using the Analysis Process Designer (APD) it is possible to look for and identify these hidden or complex relationships within the data in a simple way. Various data transformation methods are provided for this purpose, such as statistical and mathematical calculations, data cleanup or structuring processes, and so on.

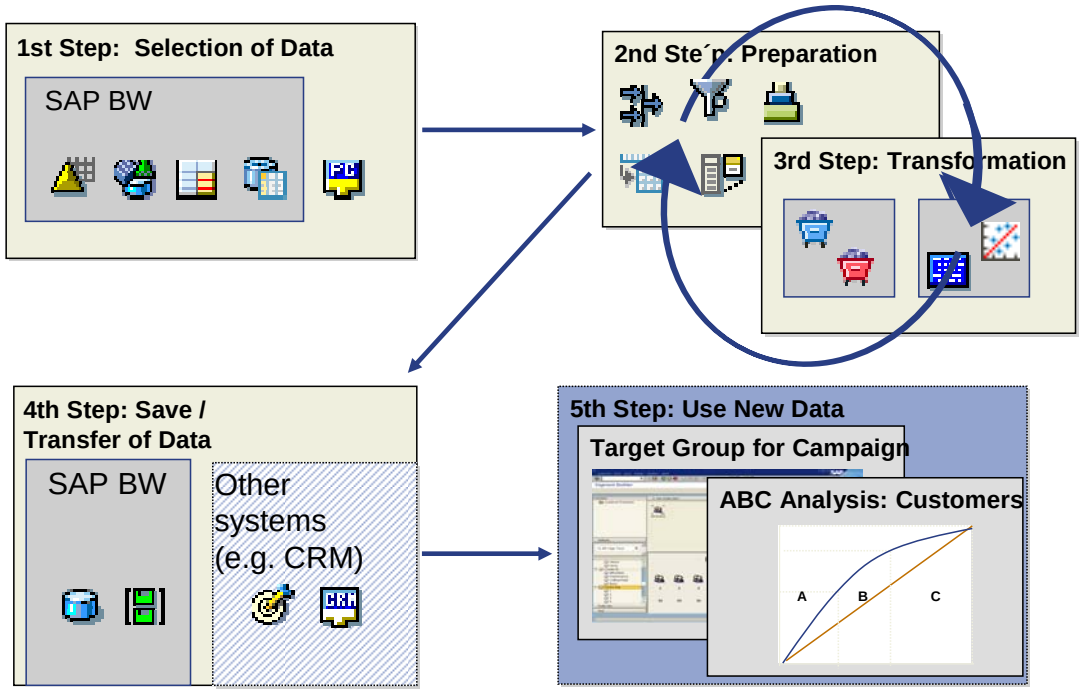
The analysis results can be saved in BW data targets or in a CRM system. It is available for all decision and application processes and can thus be of great significance (strategically, tactically and operatively).

Some examples of analysis processes are the calculation of ABC classes, determination of frequency distribution or obtaining scoring information.

The analysis process designer is the application environment for the SAP Data Mining solution. The following data mining functions are integrated into the APD.

- Creating and changing data mining models
- Training of data mining models with various BW data (data mining model as data target in the analysis process)
- Execution of data mining methods such as prediction with decision tree, with cluster model and integration of data mining models from third parties (data mining model as transformation in analysis process)
- Visualization of data mining models

The analysis process designer is a workbench with an intuitive, graphic user interface for the creation, execution and monitoring of analysis processes. Analysis processes can be created with Drag&Drop. From various data sources available in the BW system, data can be combined in multiple individual steps, then transformed and prepared for analysis so that they can be saved again in data targets in the BW system (transactional ODS object or InfoObjects with attributes) or in a CRM system. Various data sources, transformations and data targets are available for this purpose.
The following graphics illustrates the various steps in the analysis process designer:



2.4 Data Mining

With data mining, you can determine interesting patterns and connections that are difficult to track down in large data sets. Data mining delivers discoveries and connections that were previously hidden or left out as they were not considered analyzable.

Since each company has different requirements from data mining, it is not possible to deliver models for predictions. However, using the data mining methods provided by SAP BW, you can create your own models according to your requirements and uncover information that is relevant for decision-making from the data in your SAP BW. For example, you can analyze the behavior of customers and predict trends by recognizing and using patterns in their behavior. You can then answer questions such as the following:

- Which customers should we choose for which offers and when?
- Which customers are we in danger of losing?
- How high is the cross-selling potential for a new product?

You can create your own models using the following data mining methods, available in SAP BW:

- Decision tree
- Clustering
- Association analysis
- Scoring
- Weighted Table Scoring
- ABC classification

Decision trees depict data on categorical (non-continual) scales. The rules for portraying data are determined through training on historical data, where category assignment is already know.

Clustering divides data up into homogeneous groups. The model tries to structure data globally with the aim of partitioning the data into clusters.

You can use **association analysis** to uncover the effects of association and therefore cross-selling opportunities, for example. When searching for associations, objects are considered that have information environments that are only basically comparable. Statements are made in the form of rules using partial structures in the data. Unlike the decision tree classification, in clustering and association analysis, the models are determined on the basis of the data itself.

Scoring data is portrayed on continuous scales. Data can subsequently be broken down into classes, if necessary. The scoring function can either be determined using weighted score tables or specified through training on historical data as the linear or non-linear regression of a target figure.

In the **ABC classification**, data is displayed divided into the classes A, B, C, and so on. Threshold values and classification rules can also be used here. The classified results are displayed in the form of an ABC chart or an ABC list.

Unlike with classification, in clustering and association analysis, the models are determined on the basis of the data itself.

You can train the models that you create for these data mining methods on historical data. The model learns from this data in that it uncovers previously unknown patterns. You can either export the result of this learning process into another system (association rules), or use the result as a prediction with other data, for which certain information is missing (clustering, decision trees).

You train models and execute predictions on the basis of BW queries. You assign these to the model as data sources for the relevant process.

2.5 Alert Management and Background Services for Reporting

The Reporting Agent, a Business Information Warehouse tool, can be scheduled for various services for Reporting in the background. Usually, the flow comprises the definition of settings for the required Reporting functions, the assignment of individual settings for scheduling packages for the background processing and the scheduling of scheduling packages as a job in the area of a process chain (see Process Chains). The following devices are supported:

2.5.1 Evaluating Exceptions

If an exception threshold value is exceeded or not reached, the system triggers a specific follow-up action. For example:

- *Send Message:* One or more responsible persons are informed by email, sms or fax.
- *Alert Monitor Entry*: One or more contact people are informed by an alert monitor entry. You can also edit alert texts on a query view level (on the level of a saved navigation status of a query in other words) or on the level of an individual exception cell. If a resource needs to come from the alert monitor, then the URL of the affected resource can be assigned to the appropriate alert monitor entry.
- *Export:* You can use a BAdI (*Business Add-In*) belonging to the Reporting Agent to export the data of an alert and to use it as a work item in a customer-specific workflow.

2.5.2 Printing Queries

In order to print queries in the background, you can specify *print settings* in the Reporting Agent for formatting printing, as well as specify the *print layout* for displaying query InfoObjects.

2.5.3 Pre-calculating Web templates

If a BEx Web application is created in the Web browser based on a pre-calculated Web template, then you can access the pre-calculated data without having to execute an OLAP query. This means that access time is considerably reduced and strain on the application server is relieved.

2.5.4 Precalculating Characteristic Variables of Type Precalculated Value Sets

The Reporting Agent enables you to fill pre-calculated value set variables with values for characteristic values in the background. Furthermore, the pre-calculated value sets are available as variable values in BEx queries.

2.5.5 Managing Bookmarks

The bookmarks created in the system can be displayed/deleted for all users of the BW system. However, it is not possible to create bookmarks with the Reporting Agent. (Users can do this using the context menu in BEx Web Applications.)

2.5.6 Crystal Reports Queries

The Reporting Agent allows you to pre-calculate BEx queries (as “useful queries”) for Crystal reports in the background.

2.6 ICF Services in SAP BW

Services are delivered with SAP BW that are based on the Internet Communication Framework (ICF) of the SAP Web Application Server (Web AS). ICF services are HTTP services that are used for the execution of HTTP request handlers.
The HTTP services in SAP BW enable either the display or the exchange of data from SAP BW via a URL. Some of these services are implemented as Web services.
The SAP BW delivers the following HTTP services:

1. Display of metadata for BW objects (see Metadata Repository)
2. Exchange of metadata between various systems (see Metadata Repository)
3. Display of user-defined online documentation for metadata objects (see Document Management)

The following services are implemented as Web services:

1. XML for Analysis
2. Web Service for Access to Query Data
3. Web services for the Status and Tracking System of BW-BPS

You are also able to create Web services for data loading yourself (see Transferring Data Using a Web Service).

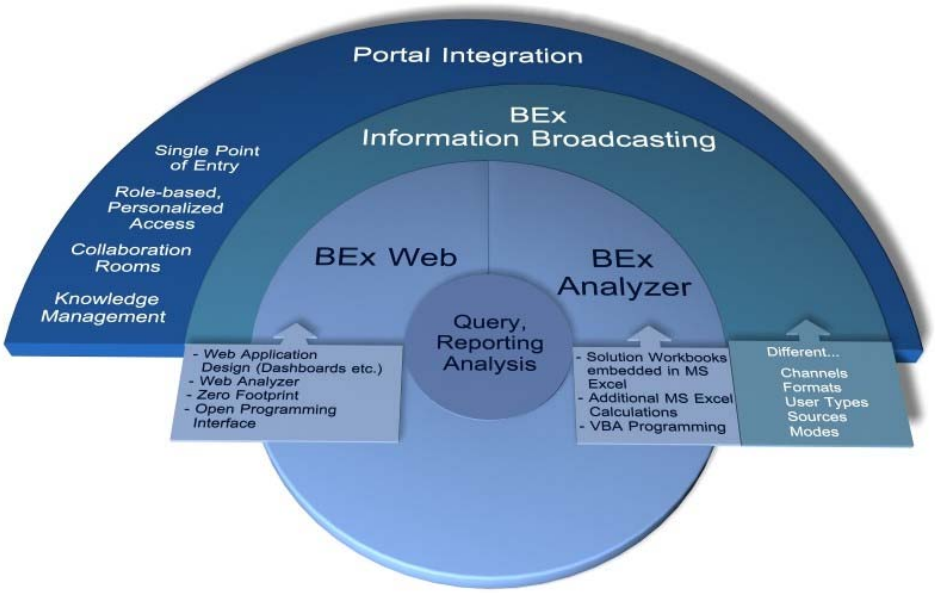
3 Business Intelligence Suite: Reporting and Analysis

The ***Business Explorer*** (BEx) is the SAP BW Business Intelligence Suite that provides flexible reporting and analysis tools for strategic analyses and decision-making support within a company. These tools include query, reporting and analysis functions. As an employee with authorization for the Business Explorer, you can evaluate old and current data to varying degrees of detail and from different perspectives on the Web and also in MS Excel.

Using BEx Information Broadcasting, you can distribute the business intelligence content from SAP BW as a precalculated document with historical data or as links with live data by e-mail or you can publish it to the Enterprise Portal.

The Business Explorer allows a broad spectrum of users access to information in the SAP BW using the Enterprise Portal, the Intranet (Web application design) or mobile technologies (mobile telephones with WAP or I-mode capabilities, personal digital assistants).

The following overview shows the functional areas of the Business Explorer that will be explained in more detail in the following sections:



Queries, Reporting and Analysis

The data in the Business Information Warehouse is structured into self-contained business data areas (InfoProviders). You analyze the dataset of the Business Information Warehouse by defining queries for InfoProviders in the BEx Query Designer .
Analyzing data on the basis of multi-dimensional data sources (OLAP reporting) makes it possible to analyze several dimensions at the same time (like, for example, time, location, product) You have the option of carrying out any number of variance analyses (for example, plan-actual comparison, fiscal year comparison). The data, displayed in the form of a table, serves as the start point for a detailed analysis to answer a variety of questions. A large number of interaction options such as sorting, filtering, swapping characteristics or calculating values locally allow flexible navigation through data for the runtime. You can also display data in graphics (for example, bar charts or pie charts).

In addition, you can evaluate geographical data (for example, characteristics such as customer, sales region, country) on a map called the BEx Map. The BEx map is the BW geographical information system (GIS) that is integrated into the Business Explorer. It displays geo-relevant data graphically on a map. Using enhanced navigation options (“geographical drilldown”), regional information can be evaluated easily at different levels of detail. A map shows the spatial proximity of places and regions, allowing geographical connections to be more clearly represented.

Furthermore, using Exception Reporting, you can establish those objects that deviate from the norm or are critical, send messages automatically (through background processing in the Reporting Agent) about deviating values by email or SMS, or calculate the values at a glance in an Alert Monitor.

3.1 Query Design

As a basis for the data analysis, defined queries for the different InfoProviders. By selecting and combining InfoObjects (characteristics and key figures) in a query, you determine the way in which you navigate through and evaluate the data in the selected InfoProvider.
The definition of queries allows you to evaluated InfoProvider data quickly and accurately.

The standard, desktop-based tool for defining and editing queries is the BEx Query Designer. In the Web environment, an Ad-hoc Query Designer is also available. This enables you to create and change queries on the Web on an ad-hoc basis.

Essential components of the query definition:

The selections in the filter have a limiting effect on the whole query. With the filter definition, you select characteristic values from one or more characteristics or from a key figure. With the filter definition, you select characteristic values from one or more characteristics or from a key figure. The filter selection cannot be changed by the navigation. You choose free characteristics for the navigation and determine the content of the rows and columns of the query. You use this selection to determine the data areas of the InfoProvider over which you want to navigate. The arrangement of the contents of the rows and columns also determines the default view of the query and, with it, the rows and columns axes in the results area.

After it is inserted into the Web browser, a query is displayed in the default initial view. By navigating through the query, you can generate different views of the InfoProvider data, by dragging one of the user-defined characteristics into the rows or columns of the query, for example, or by filtering a characteristic according to a single characteristic value.

The BEx query designer encompasses the following functions. These are looked at in more detail in the subsequent sections:

- You are able to use the queries that you define in the query designer for OLAP reporting (multidimensional) and also for tabular reporting
- You are able to parameterize the queries by using variables for characteristic values, hierarchies, hierarchy nodes, texts of formulas
- You are able to define structures which form the matrix for the axes of the table (rows/columns)
- You are able to select InfoObjects more precisely by:
  - In the left-hand screen area the following graphic shows the tests you can select in the analysis and repair environment. In the right-hand screen area it shows an elementary test with the dialog box for setting parameters below it and, outlined in red, the output from the test.
  - Calculating and restricting key figures
  - Defining exception cells
  - Defining exceptions
  - Defining conditions
- You can use the following objects locally or save them for later use: structures, calculated key figures and restricted key figures.

3.1.1.1 Tabular and Multi-dimensional Query Display

You are able to design a query for both OLAP reporting (multidimensional display) and for tabular reporting (tabular display).

Characteristics and key figures are displayed in the columns in the tabular display. Unlike the multidimensional display, there are no rows in the display and no free characteristics for navigation. You can use filters in the tabular display and assign characteristics, key figures and attributes freely in the columns – as in the following example:

Distribution channel	Incoming orders value	Billing value	Goods Recipient	Material	Material group	
Final Customer Sales	16.458.557,90 EUR	16.248.491,72 EUR	Adecom SA	Terminal P600 CN	198	Terminals
	4.664.716,16 EUR	4.573.256,23 EUR	1014	Terminal P400 CN	198	Terminals
	2.276.822,85 EUR	2.232.184,59 EUR	1017	Terminal P400 CN	198	Terminals
	848.012,68 EUR	831.384,05 EUR	Becker Berlin	Notebook Speedy II CN	199	Notebooks
	9.579.888,95 EUR	9.220.799,41 EUR		Monitor flat 17 CN	2	Flatscreens
	5.839.606,99 EUR	5.569.572,76 EUR	1170	Monitor flat 17 CN	2	Flatscreens
	822.232,56 EUR	809.846,57 EUR	1191	Notebook Speedy II CN	199	Notebooks
	3.861.674,73 EUR	3.683.102,80 EUR	1193	Monitor flat 17 CN	2	Flatscreens
	708.854,01 EUR	685.988,43 EUR	1280	Monitor flat 17 CN	2	Flatscreens
	35.849.616,31 EUR	31.558.383,69 EUR	Booktree Inc.	Terminal P600 CN	198	Terminals
	6.774.951,02 EUR	6.642.110,23 EUR	1322	Terminal P400 CN	198	Terminals
	8.732.877,46 EUR	8.438.722,31 EUR	Bush Distribution	Terminal P600 CN	198	Terminals
	3.437.322,67 EUR	3.376.714,97 EUR		Monitor flat 17 CN	2	Flatscreens
	1.406.274,05 EUR	1.339.309,57 EUR	1390	Monitor flat 17 CN	2	Flatscreens

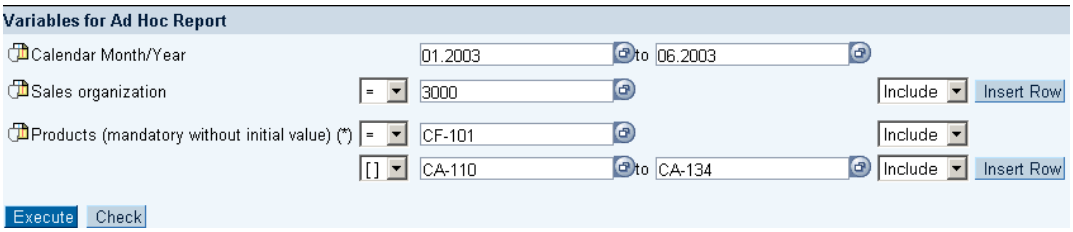
It is therefore possible, for example, to put a key figure column in between two characteristic columns. The column display is determined when the query is designed and cannot be altered. In tabular reporting, the interaction options are limited to *filters, filtering* and *drilldown according to*, *sorting according to*, and navigation in hierarchies. Navigation functions that would change the geometry of the tabular list (that is the number and position of the columns), such as swapping or adding drilldowns, are not permitted in tabular reporting.

The tabular display of queries is especially suited to formatted and formula-based reporting with the integration of Crystal Enterprises (for example, to display material index in list form). It is important in formatted reports that you can specify the layout design to one pixel and also have convenient print options. Also see the section Formatted Reporting: Integration of Crystal Enterprise.

3.1.1.2 Variables

Variables enable you to customize queries flexibly (parameterize the query). If you use variables in the Query Designer, do not select any fixed characteristic values, hierarchies, hierarchy nodes, texts, or formula elements. Instead, set up variables as place holders. These are then filled with values when the query is running (when you insert the query into a workbook, when you refresh the workbook or when you execute the query on the Web.

When you execute a query the variable screen appears. You can enter the values desired here:



You can use one query definition as the foundation for many different queries if you use variables.

Variable Types

There are different variable types depending on the object for which you want to define variables. These types specify where you can use the variables. You are then able to use *Characteristic value variables*, *hierarchy node variables* and *hierarchy variables* when restricting characteristics. *Text variables* represent a text and can be used when describing queries, for example. *Formula variables* represent numerical values and can be used in formulas. For example, use a formula variable for the interest rate to process the current interest rate as early as when executing the query.

Processing Types

The processing type determines how a variable is filled with a value at query runtime. Processing normally results from a *Manual Input*. This means that when starting the query you are able to either enter the desired values for the variables in the variable screen or copy the value suggested for the variables. Alternatively there is the *Replacement Path* processing type. You determine the replacement path when you define the variables. This defines the values with which variables are to be automatically replaced when the query is executed. Furthermore variables can also be filled with values derived from the *Authorization*s of the user.

For special customer requirements an interface (Customer Exit) is provided, which makes it possible for them to set up their own processing type. With SAP BW Business Content, pre-defined variables are delivered that contain the *SAP Exit* processing type.

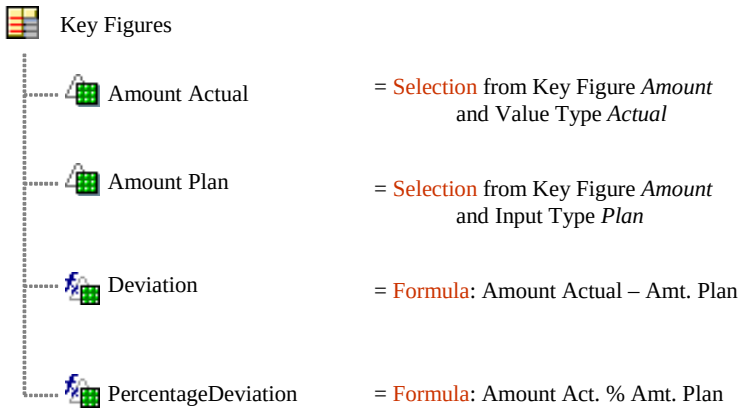
Variables are reusable objects. This means that when you define a variable for a query in the Query Designer, this variable can be used in all other queries.

3.1.1.3 Structures

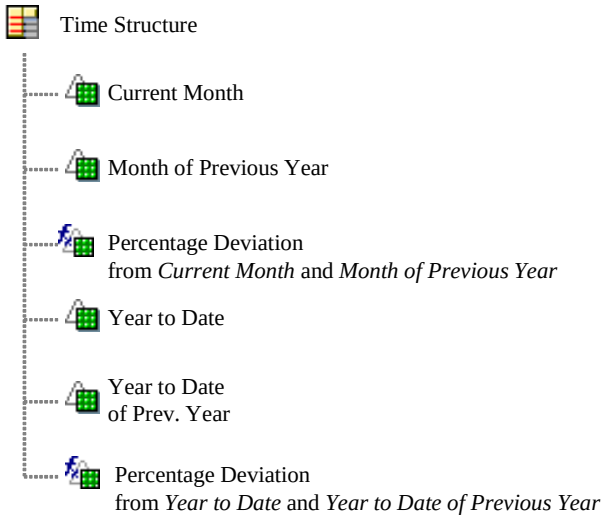
Structures are objects that arise in the Query Designer and are freely definable.

A structure forms the framework for a table's axis (column or row)- It is made up of structural components. A distinction is made between key figure structures and characteristic structures.

A key figure structure can, for example, be a plan / actual comparison:



The following time structure is an example of a characteristic structure:

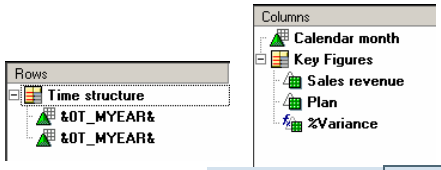


Structural components of key figure structures are always based on key figure selections (basis key figures, restricted key figures and calculated key figures), while structural components of characteristic structures are not able to contain any key figure selections.

The way a structure is formed determines the sequence and no. of key figures/characteristic values on the rows/columns of the query. In addition, you can freely combine structures with other characteristics on the axes. In the execute query, you can then navigate within the structures and set filters if you so choose..

When using 2 structures, for example, a key figure structure in the columns and a characteristic structure in the rows, the result is a table whose cells are fixed defined.

In the following example you see a query with two structures, where the key figure structure is additionally combined with the characteristic *Calendar Month* on the column axis:



Key Figure Structure Freely Combined with the Characteristic *Calendar Month* in the columns

Characteristic Struct. in the Rows

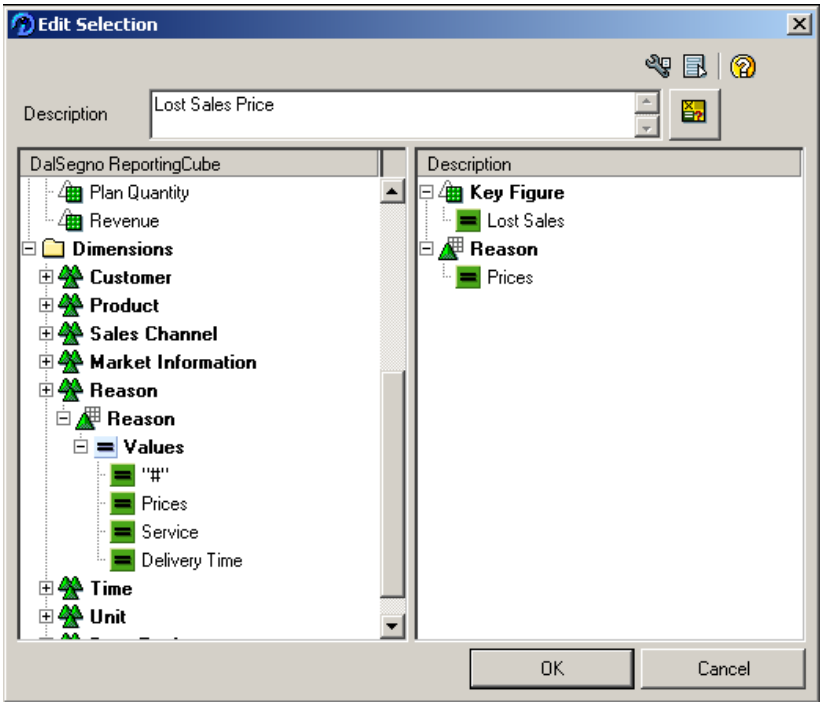
Calendar month	SEP			OCT		
	Sales revenue	Plan	%Variance	Sales revenue	Plan	%Variance
2000	$ 245.955	$ 230.702	6,6 %	$ 240.252	$ 232.801	3,2 %
2001	$ 250.832	$ 239.696	4,6 %	$ 250.834	$ 248.366	1,0 %

While the key figures are forced to be modeled in the form of a structure for the query indeed, the use of a characteristic structure remains optional. The difference between a characteristic structure and the use of characteristics on an axis exists in the fact that you already with the characteristic structure the number and sequence of characteristic values in the query definition determine. When using a characteristic on an axis, the system displays all related characteristic values that are booked in the query. You can restrict the selection of certain characteristic values by filtering.

You can use structures in several different queries. You have to save them in the InfoProvider for reuse. When you use a reusable structure in a query, the structure is not copied, but rather the reference to it. Changes made to reusable structures affect all queries in which reusable structures are used.

3.1.1.4 Restricted Key Figures

You can also restrict the key figures of the InfoProvider in the Query Designer. The key figures that are restricted by one or more characteristic selections can be basic key figures, calculated key figures or key figures that are already restricted.
In the following example there are various reasons for sales figures not being attained: high price, bad service, delivery times that are too long. By limiting the key figure *Lost Sales* with the characteristic selection *Price*, the analysis of the lost sales is limited to those that resulted from the price being too high:



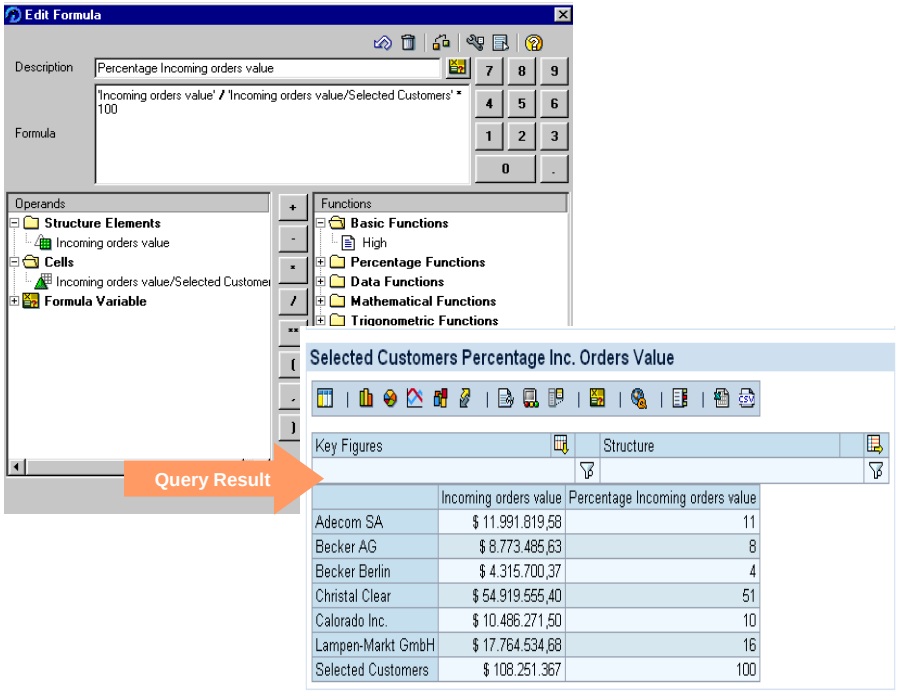
Restricted key figures are reusable objects that you can use for all queries in an InfoProvider.

You can also mark a selection as constant. This means that navigation and filtering have no effect on the selection for the runtime. In this way, you can easily select reference sizes that you cannot change for the rest of the runtime. Also see the section on selecting constants.

3.1.1.5 Calculated Key Figures

You can recalculate the key figures of an InfoProvider in the Query Designer using formulas. Calculated key figures consist of formula definitions containing basic key figures, restricted key figures or precalculated key figures.

In the following example you see the definition of a calculated key figure and the query executed:



You can use the following elements as operands in the formulas:

- the structure elements that you have already defined for the structure (*Incoming Orders Value* in the exmple above)
- the cells that you have defined as exception cells (*Incoming Orders Value/ Selected Customers* in the example above)
- All form variables

You can use basic functions, percentage functions (for example, percentage deviation or percentage share), data functions (for example, value without dimensions, that is unit and currency are hidden), mathematical functions, trigonometric functions, Boolean operators (<, <=, <>, ==, >, >=), and specific calculations (IF-THEN-ELSE) as operators.

Restricted key figures are reusable objects that you can use for all queries in an InfoProvider.

3.1.1.6 Exception Cells

When you define selection criteria and formulas for structural components and there are two structural components of a query, generic cell definitions are created at the intersection of the structural components that determine the values to be presented in the cell. Cell-specific definitions allow you, along with implicit cell definition, to define explicit formulas and selection conditions for cells and in this way, to override implicitly created cell values. This function allows you to design much more detailed queries.

In addition, you can define cells that have no direct relationship to the structural components. These cells are not displayed and serve as containers for help selections or help formulas.

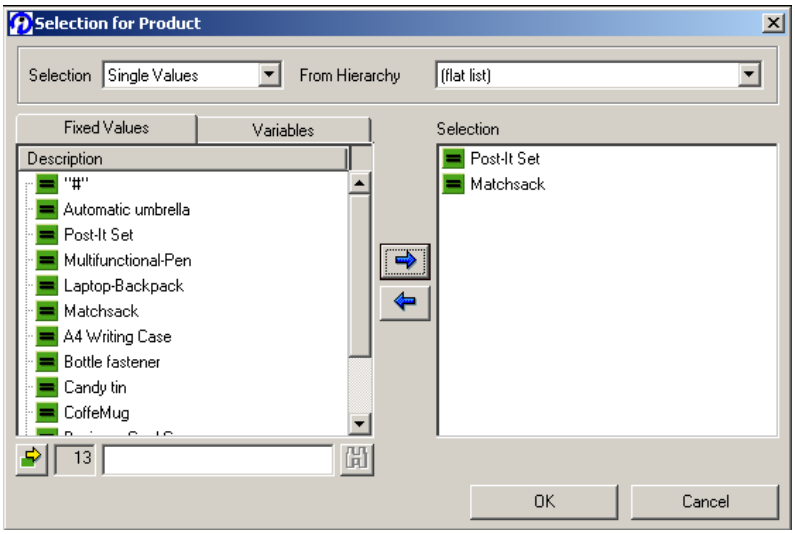
Note that you can define exception cells only for queries with two structures. In one structure you use, for example, the characteristic values and in the other, the key figures. If these prerequisites are

fulfilled, you can define cells. A cell is the intersection of two structure elements. If a drilldown characteristic has two different characteristic values, then the cell definition always takes effect at the intersection between the characteristic value and the key figure. The term *Cells* in this context is not to be confused with the term *Cells* in MS Excel.

3.1.1.7 Restricting Characteristics

When defining a query, you can restrict characteristics to single characteristic values, value ranges, hierarchy nodes or characteristic value variables.

In the following example you see how the characteristic *Product* is restricted to the characteristic values *Post-It Set* and *Matchsack*. The evaluation of the query then does not take place for the whole product pallet, but is restricted to the two products *Post-It Set* and *Matchsack*.



You can also restrict the characteristic by excluding characteristic values. For example, you could set it so that the evaluation of the query takes place for all products except *Post-It Set* and *Matchsack*.

You can choose variables instead of fixed values when selecting characteristic values. These act as benchmarks and are only filled with fixed values when the query is executed. As well as selecting fixed values, you can also select single value variables, variable value areas, and variable hierarchies and hierarchy nodes.

3.1.1.8 Exceptions

You can define exceptions in the Query Designer. In exception reporting you select and highlight objects that are in some way different or critical. Results that fall outside a set of predetermined threshold values (exceptions) are highlighted in color. This enables you to identify immediately any results that deviate from the expected results.

In the following example the cells marked in red show you that the percentage deviations for the current month between 2000 and 2001, with reference to revenue and invoiced quantity, are under 0% (each –3.4%):

Exceptions:

%Abweichung aktueller Monat
%Abweichung aufgelaufenes Jahr (Year to Date YTD)

	12/2001	12/2000	%Deviation	YTD 2001	YTD 2000	%Deviation
Revenue	$ 248.476	$ 257.254	-3,4 %	$ 2.990.775	$ 2.942.482	1,6 %
Invoiced Quantity	57.003 PC	59.018 PC	-3,4 %	686.108 PC	823.354 PC	-16,7 %
Avg. Price	$ 4,36 /PC	$ 4,36 /PC	0,0 %	$ 4,36 /PC	$ 3,57 /PC	22,0 %

The definition of an exception consists of:

- determining threshold values or intervals that are given a priority (bad, critical, good). The priority given to an exception corresponds to pre-assigned colors that become more “intense” the greater the deviation. The nine shades use the traffic light colors red, amber and green. These traffic light colors are also used in the Alert Monitor to display the results of exception reporting
- Determining cell restrictions. You use the cell restrictions to specify for which evaluation (cell area) you want the condition to apply.

Exception reporting makes it possible to determine critical objects for a query at runtime and in the background processing. This means that exceptions for a large number of queries can be evaluated in the background. These exceptions are scheduled for background processing in the Reporting Agent of the Administrator Workbench. Also see the section Evaluating Exceptions.

3.1.1.9 Conditions

You are also able to formulate conditions in the query designer. Conditions are understood as the restricting of displayed query data according to criteria formulated in the condition. You are able to restrict the view of the data in this way so that you only see the part of the results area that you are interested in.
For example, you can define a condition for a query that displays your top 3 products in terms of greatest net revenue. For each of these products you want to see the top 3 sales channels:

Product	**Sales Channel**	Net sales
Business Card Case	Fax	$ 193.355,63
	Telefon	$ 141.351,99
	Internet	$ 116.797,09
	Result	**$ 451.504,71**
Coffee Mug	Fax	$ 184.753,60
	Telefon	$ 133.827,02
	Internet	$ 107.072,33
	Result	**$ 425.652,94**
Multifunctional-Pen	Fax	$ 188.481,56
	Telefon	$ 130.798,51
	Internet	$ 105.197,62
	Result	**$ 424.477,69**
Overall Result		**$ 1.301.635,34**

You can define several conditions for one query. More than one condition is linked logically with AND. The average set of conditions is displayed in the query. In other words, a characteristic value is only displayed when it meets all (active) conditions of the query. You can activate and deactivate these conditions while you are analyzing the query.

Conditions help you restrict how you view query data in the following way:
- Threshold value: An entry is filtered independently of other entries if its reference value supersedes a specified threshold value.
- Ranked Lists: Here, all lines of the displayed list are considered and their relationship to each other decides whether the lines are displayed. Ranked lists are automatically displayed in sorted form after the condition is activated.

You can specify whether conditions are evaluated for all characteristics in the drilldown or only for specific characteristics or characteristic combinations defined for specific drilldowns. A condition consists of an operator and a value that relates to the operator.

The following operators are available for conditions with threshold values:

- Is equal to
- Is not equal to
- Is less than
- Is greater than

- Is less than or equal to
- Is greater than or equal to
- Is between (is in the interval)
- Is not between (is not in the interval)

You can choose from the following operators for ranked list functions:

- **Top N, Bottom N**: The ranked list is arranged according to a particular number.

Example:

Customers: Top 3 or bottom 5 sales volumes
You get a list of the three customers with the highest sales, and also the five customers with the lowest sales.

- **Top percent, bottom percent:** The ranked list is arranged according to a particular percentage.

Examples:

Material: Top 25% of sales revenue
You get a list of the strongest 25% of materials, related to revenue.
Material: Bottom 25% of sales revenue
You get a list of the strongest 25% of materials, related to revenue.

- **Top total, bottom total:** The ranked list is arranged according to a particular totals value.

Example:

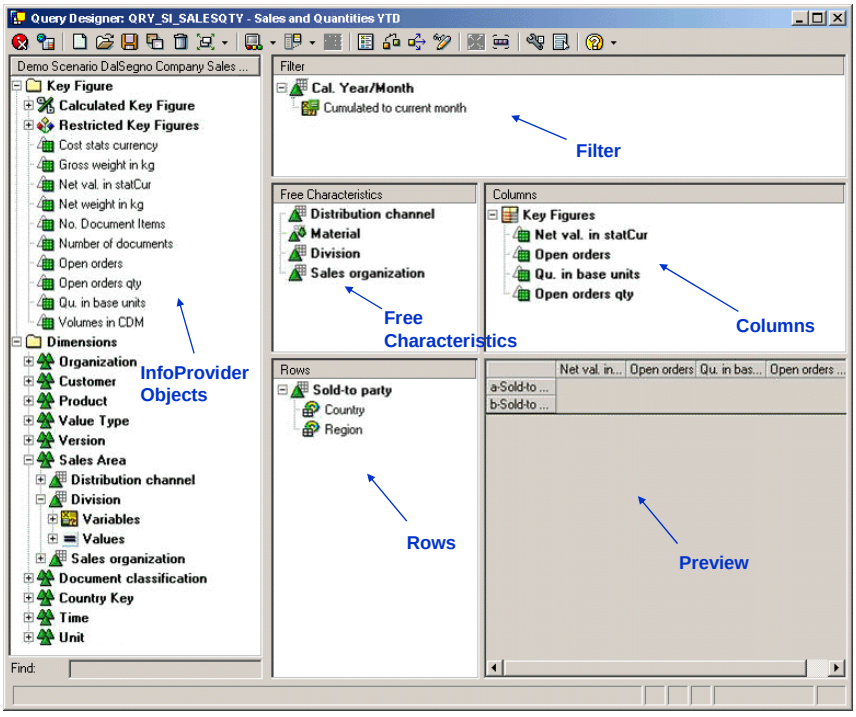
Products: Top total 20,000 EUR of sales volume

You get a list of products with the lowest sales volume, whose combined sales volume makes a total of 20,000 EUR. First, all sales volumes are sorted in descending order and then totals are formed until the threshold value of 20,000 is exceeded. Those products that exceed the 20,000 EUR threshold are left in the list.

3.1.2 The BEx Query Designer

The tool which you use to define queries is called the BEx Query Designer. The Query Designer is a standalone desktop application that you can also call up from other applications, such as the BEx Analyzer and the BEx Web Application Designer.

The BEx Query Designer includes in addition to a toolbar for calling up individual functions (for example, tabular display, defining exceptions/conditions, and query properties), several screen areas. On the left are all of the objects of the InfoProvider for which you are defining the query. When you are defining a query, you drag the selected objects from the InfoProvider using Drag&Drop into the areas *Columns, Rows, Free Characteristics* or *Filter.* In the lower right area of the screen is a preview that displays the results area of the query using the start view that you have chosen.



Proceed as follows to create a query:
You can expand/compress the InfoProvider directory by clicking on the plus/minus symbol. You can use either drag and drop or the clipboard (Ctrl C – Ctrl V) to move characteristics and key figures for the InfoProvider into the Query Designer directory (*Filter, Rows, Columns, Free Characteristics).* Use the right mouse button to call up all functions that are available in the current context menu. of an element.

You define queries by:

- **Selecting an InfoProvider for which the query is defined**
- Selecting reusable structures that already contain characteristic or key figure combinations (for example, contribution margin schema)
- **Selecting characteristics from the InfoProvider**
- Restricting selected characteristics to characteristic values, characteristic value intervals, or hierarchy nodes
- Using variables for characteristic values, hierarchies, hierarchy nodes, formulas and texts or defining new variables where necessary.
- **Selecting key figures from the InfoProvider**
- Formulating calculated key figures
- Restricting key figures by combining them with characteristics
- Defining exception cells
- **Arranging the characteristics and key figures in rows or columns and thereby establishing an initial view for the query analysis.**

The steps that are not printed in bold are optional. You do not necessarily have to use these functions.

You can save the query in your favorites or in the roles assigned to you. You can then analyze the query data in the Business Explorer. You can

- Display the query on the Web in the default view with one click
- Use the query as a data provider for Web items and analyze the query data in an individually-tailored Web application.
- Insert the query into a workbook and analyze it in the BEx Analyzer (MS Excel-based).

You also have the option of publishing the query in different ways so that the query is available to other users as well.

- **Publishing to Roles**
  You can select a role into which you wish to publish the query. The system saves a link to the current query in the selected role.
- **Publishing to the Portal**

You can publish the query to the Enterprise Portal. There you have several selection options. For example, you can publish the query to your Portfolio or you can put it in a collaboration room.

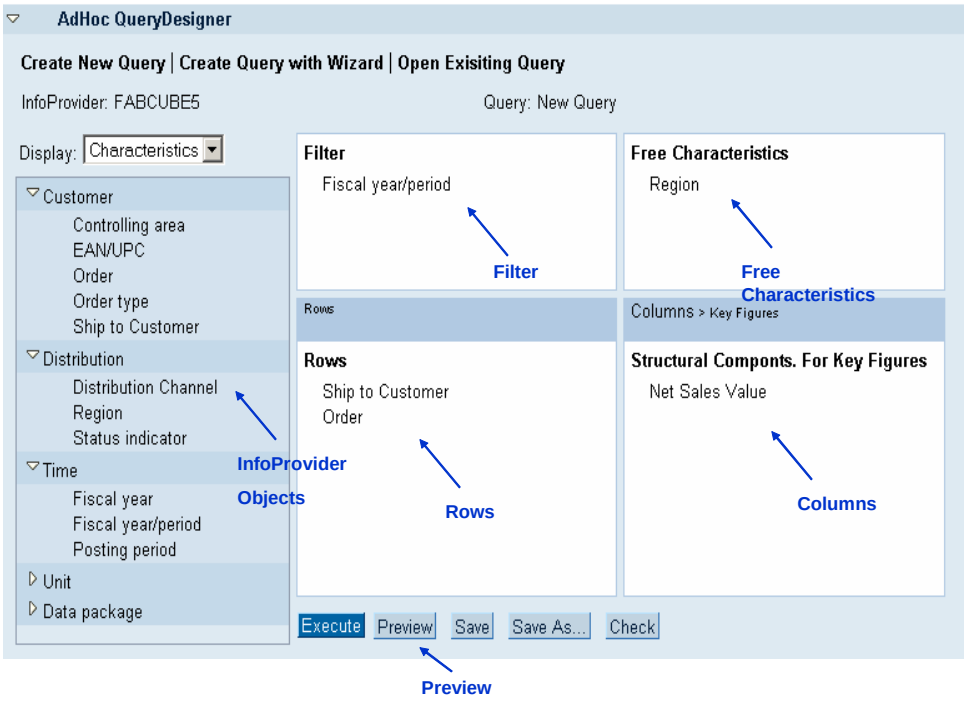
- **BEx Broadcaster**
  The BEx Broadcaster is a web application for the precalculation and distribution of queries, Web templates and workbooks. You can precalculate the query that you have edited in the Query Designer or you can generate an online link. You can distribute the generated document or the link by e-mail or you can export them to the Enterprise Portal. You can also precalculate and distribute other queries, Web templates or workbooks.

3.1.3 Ad-hoc Query Designer

The Ad-hoc Query Designer enables you to create and change queries in a Web application on an ad-hoc basis. You can also access data in a Web application without leaving the Web environment.

The Ad-hoc Query Designer is split into several areas, just like the BEx Query Designer. On the left are the objects of the InfoProvider for which you are defining the query. Using a dropdown box, you choose whether you want to see the characteristics, the key figures, or the structure of the InfoProvider in the selection.

When you are defining a query, you use the context menu to assign the selected objects from the InfoProvider into the areas *Columns, Rows, Free Characteristics* or *Filter* arranged on the right-hand side. You can review the structure of the query without data in the *Preview* window.



You can also define the queries using a wizard that takes you through the entire process, step by step.

The Ad-hoc Query Designer enables you to:

- Create queries by assigning characteristics from an InfoProvider to rows, columns, filters, and free characteristics, and including key figures from the InfoProvider in the key figure structure of the query.
- Restrict or filter key figures and characteristics
- Use predefined key figure structures and restricted or calculated key figures in the query
- Set or change query properties and key figure/characteristic properties in the query
- Create or change conditions and exceptions
- Use queries in a tabular display

Moreover, you can execute queries in your Web application using the Ad-hoc Query Designer, without saving them first.
When compared with the BEx Query Designer, the Ad-hoc Query Designer has the following restrictions when creating or changing queries:

- You cannot integrate variables into the query directly. However, you can use variables in reusable structures, or restricted or calculate key figures, which are used in the Ad-hoc Query Designer
- The query can contain only **one structure.** This structure must be the key figure structure and be in the rows or columns of the query.
  - You cannot use key figures or key figure structures in the filter.
  - You cannot define exception cells, since this requires two structures.
  - You cannot **create** reusable structures or restricted or calculated key figures in the Ad-hoc Query Designer.

3.2 BEx Web

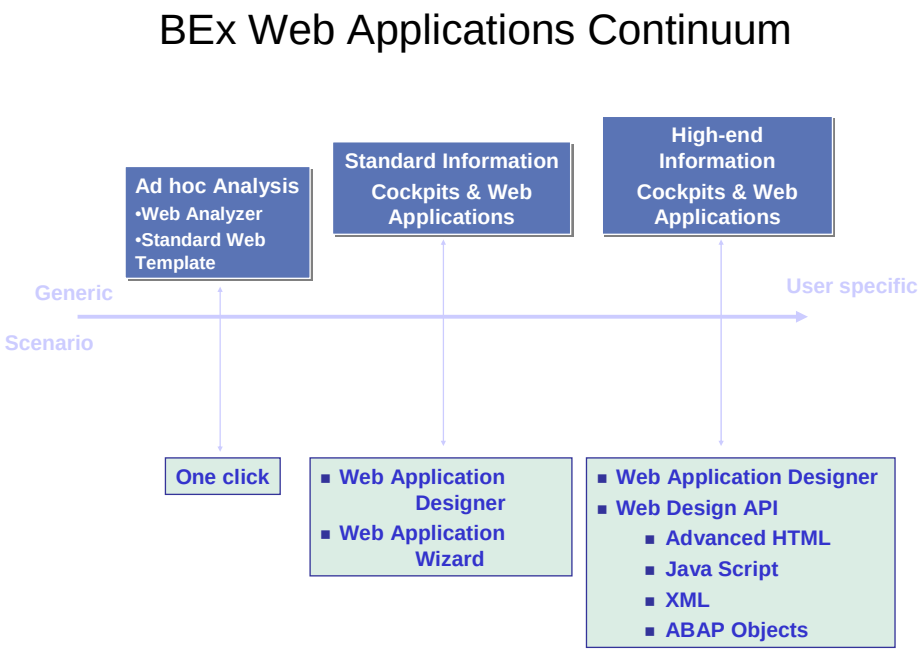
BEx Web includes all BEx tools that are used to create Web-based applications or that display Web applications themselves. The BEx Web is comprise of the following components:

- Web Application Design (see Web Application Design)
- BEx Web Application Designer (see BEx Web Application Designer)
- Web Design API (see Web Design API)
- BEx Web Applications (see Analysis & Reporting: BEx Web Applications)
- BEx Web Analyzer (see BEx Web Analyzer)
- BEx Mobile Intelligence (see BEx Mobile Intelligence)

3.2.1 Web Application Design

Web application design allows you to use generic OLAP navigation for your BW data in Web applications as well as in business intelligence cockpits for simple or highly individual scenarios.

The following overview shows the broad spectrum of BEx Web application design:



Ad-hoc Analysis

You can display queries with one click on the Web from the BEx Analyzer, the Query Designer, or the Ad-hoc Query Designer. These ad-hoc reports are inserted into a standard Web template that enables generic OLAP analysis in the navigation block and in tables as well as enabling intuitive and user-specific operation. Also see the section Standard Web Template for Ad-hoc Analysis.

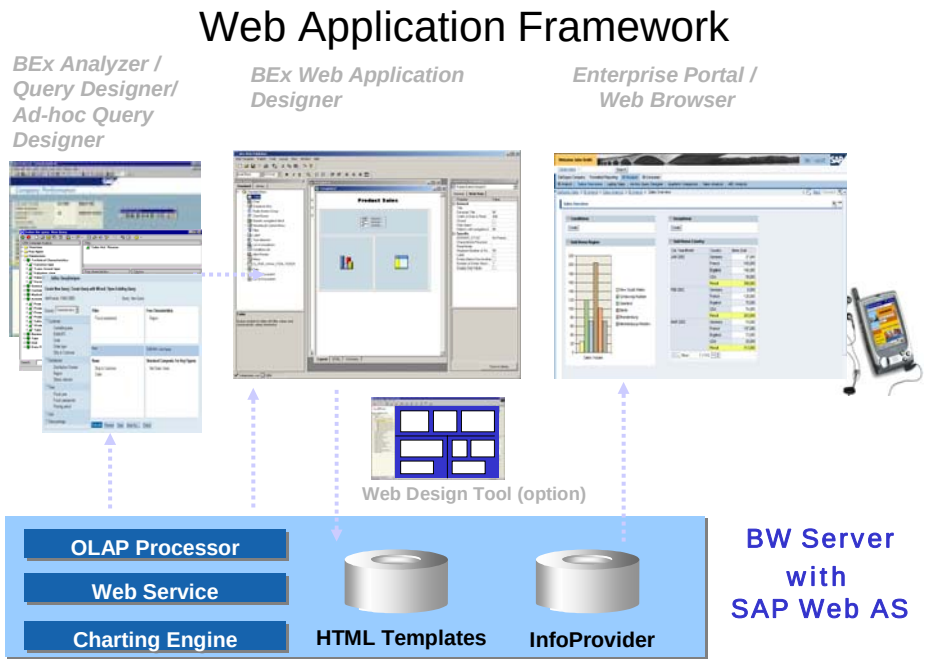
Standard Web Applications and Information Cockpits

Using the Web Application Designer and the Web application wizard, which is integrated into the Web Application Designer, you can define your own Web applications and present them graphically in different ways. As well as analyses in the pivot table, you can analyze data using various charts and on maps. You can refine the navigation using dropdown boxes, checkboxes and a range of other Web items. You can also structure the layout of Web applications by using texts and images. See also the BEx Web Application Designer section.

High-end Web Applications and Information Cockpits

You can use a Web design API to structure highly individual Web applications and create sophisticated applications using advanced HTML, Java Script, XML and ABAP objects. See also the Web Design API section.

The following graphic illustrates the basic concept of Web Application Design with the Web Application Designer as the central tool:



You can use the BEx Web Application Designer to create an HTML page that contains BW-specific content, such as tables, charts or maps. These objects, which retrieve BW data from a data provider and make it available in a Web application as HTML, are known as Web items.

You can save the Web applications as a URL and access them from an intranet or on mobile devices. In addition, you can save Web applications as iViews and integrate them into an enterprise portal.

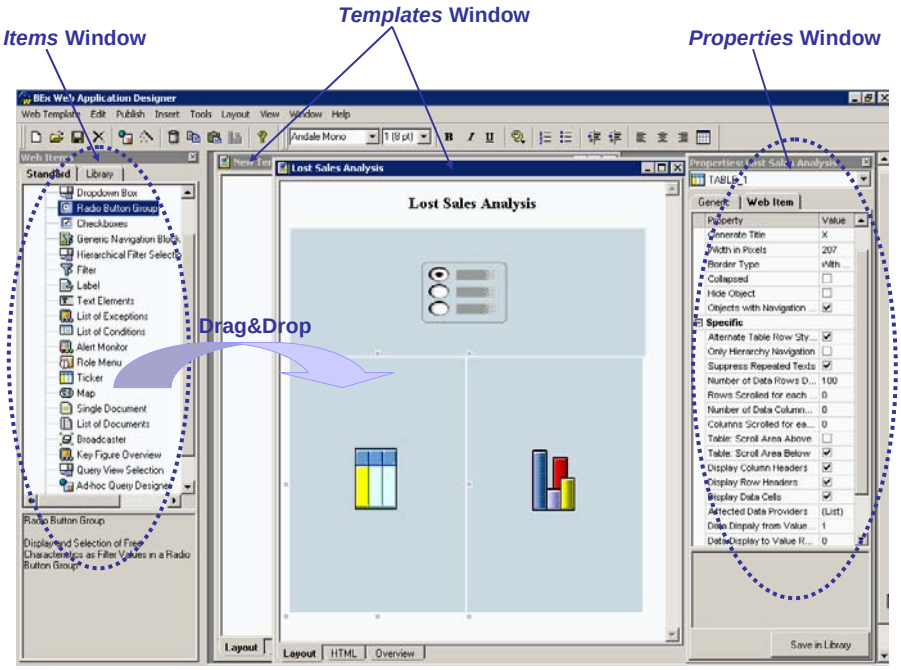
The Web application wizard is an assistant that is integrated into the Web Application Designer. You can use this to help you create Web applications using a step-by-step procedure and to simplify design activities. The Web application wizard helps you to work with Web application design confidently and create your first Web applications.

The following section provides a more detailed description of the Web Application Designer as a central tool in Web application design.

3.2.1.1 BEx Web Application Designer

The BEx Web Application Designer is a desktop application for creating Web applications with BW-specific contents. Using the BEx Web Application Designer, you can create an HTML page simply and easily that contains contents such as various tables, graphics or maps. This HTML page (called a Web

application in what follows) provides the basis for not only Web applications with complex interaction, but also for Web Cockpits and iViews.



As well as menu bars and application toolbars, the BEx Web Application Designer consists of three basic screen areas:

- The *Web Items* window
- The *Template* window
- The *Properties* window

The ***Web Items*** **window** contains a pool of Web items that you can use to create your Web application. A Web item is the visualization type (for example, tables, maps, graphics) used to display data from a data provider. These Web items are available to you as master Web items. You choose a master Web item from the list, assign a data provider to the Web item and edit the attributes. You have now created your own Web item that your can add to your Web template or save in the Web item library to be used again.

In the top part of the *Items* window, divided into two tab pages, are the selection option categories for Web items:

- **Selection of master Web items**

  Tables, **Charts** and **Maps** are three of the most important Web items with which you are able to display data. The tables display the values of a query view in the Web application in the form of a pivot table. Characteristics and structures can be displayed in both the rows and the columns. The chart displays values in the form of a graphic. Different types of graphics can be used to display data such as bar charts, histograms, pie charts, line charts, scatter diagrams, area diagrams, portfolios and tachometers...The Chart Designer is available for you to make settings in the charts.

  The map displays the geo-relevant values of a query view in the form of a map. Using enhanced navigation options (“geographical drilldown”), regional information can be evaluated at different levels of detail. Also see Analyzing Business Data Using Map and Chart Web Items.

  The Web item **Generic Navigation Block** displays the navigational state of a query view in the Web application in the form of a table. All characteristics and structures in the query view are listed in the table and their filter values are displayed. You are able to change the

navigational state. You can also transfer characteristics and structures to or from an axis (rows or columns). Equally you are able to filter according to single values and remove the filter again.

The Web item **Filter** displays the filter values that have been generated by navigating in a query view in a Web application. You also use filters to select individual values.

You can use the **List of Exceptions** and **List of Conditions** Web items to display the status of the exceptions and/or conditions for a query view in the form of a table.

Using the **Alert Monitor** Web item you are able to display query views, which were found during background processing by the Reporting Agent, as a list or a hierarchy in a Web application. You can jump to the query views and instantly see eye-catching key figure values that differ from defined threshold values. You can also set filters. Also see Alert Monitor.

Document integration in Web applications takes place using the **Individual Document** and **List of Documents** Web items. The individual document Web item allows you to display individual documents in the Web application that you have created in the Administrator Workbench or the master data maintenance for master data. Documents can then be created in different formats and versions. List of documents allows you to call up or create context sensitive information for the transaction data used in the Web browser. Also see Using Documents in Web Applications and Document Management.

You are able to generate and change queries in a Web application ad-hoc using the **Ad-hoc Query Designer**, which you integrate into a Web template as a Web item. Also see Ad-hoc Query Designer.

The **ABC Classification** and **Simulation/Prediction** Web items allow you to set data mining methods in the Web application. ABC classification allows you to classify objects (customers, products, or employees) on the basis of a specific measurement item (sales or profit) using specific classification rules. Simulation prediction enables you to make predictions in the dialog box for individual customer records based on models and defined using services such as the *Decision Tree, Scoring* and *Clustering*. Also see the Data Mining section.

Alongside these, other diverse Web items exist that allow you to both analyze data in a Web application and navigate in a Web application comfortably. These include the Web items **Hierarchical Filter Selection**, **Dropdown Box**, **Radio Button Group** and **Checkboxes**.

With the Web item **Query View - Selection** you can switch from a data provider (query or query view) and its visualization (for example in a table) to another data provider that may be visualized differently (for example in a chart) in one step. You can switch by selecting an entry in a dropdown box.

The **Key Figure Overview** Web item is used to offer you a selection of important business key figures. For each key figure, you have the option of navigation in the associated Web templates. The data provider for this Web item is the *Measure Builder* from the SAP-SEM component *Corporate Performance Monitor* (SEM CPM). The key figures that are displayed in the Web item are defined in the Measure Builder and are put together as a catalog.

Using the **Web template** Web item, you can manage consistent sections in your Web applications centrally and simply in a Web template and you can integrate them into any Web template as needed. In this way, you can define for example a header or footer section with the company logo and heading as a Web template and you can integrate this Web template into your Web applications as the *Web Template* Web item.

Using the **Broadcaster** Web item, you can precalculate Web templates, queries and workbooks and distribute them by e-mail or in the Enterprise Portal (see BEx Information Broadcasting).

The **Object Catalog of the Web Application** Web item is used to generate information on the current Web template properties, data providers and the Web items used in the Web template as XML. You can use the **Data Provider – Information** Web item for XML generation of query result data or the navigational state of a query. The XML generated in this way is displayed in the source text of the Web application. You can also generate a description of the navigational state and the result set of a query in XML format using the Web Service for Access to Query Data or you can extract it with an export command from the Web API reference.

You can find a list and description of **all** the Web items available in the Web application designer in the SAP BW documentation.

- **Selection of Web items from those saved in the library**

  If you integrate a Web item into your Web template and you have defined your settings, you might want to use this Web item again in this form in other Web templates without having to define all the settings over again. The BEx Web Application Designer enables you to use your own version of a Web item as the Web template for other items. For this purpose, you store this Web item as a template and insert it in a library that you can organize yourself.

  You can also create, display, and edit documents for your library and also for the individual Web items saved in your library.

Underneath the selection area is the help area with the explanatory text for the Web item that you selected in the top part of the screen.

The ***Template* window** contains the Web templates that you edited in the design process and that form the basis for your Web applications.
A Web template is the HTML page that you use to determine the structure of the Web application. (The HTML page published on the Web is called a Web application.)
At the bottom of the *Template* window there are three tab pages that you can use to change the view of the template or the current HTML editor.

- *Layout*

You determine the layout of the Web application here.

- *HTML*

In the HTML view, you can edit the HTML that corresponds to the layout view of a Web template directly. Alternatively, you can also edit the HTML with an external HTML editor.

- *Overview*

In the overview view, all of the Web items used in the Web template are listed with information about the master Web item, the data provider and the query or view.

In the ***Properties* window**, you define the properties of Web templates and Web items. It is divided into three areas:

- In the header of the window in the dropdown box, you see the selection for which you want to define properties – for the Web template or for specific Web items.
- In the middle area, you specify the properties for Web templates or for specific Web items – depending on the dropdown box settings. You can, for example, determine the context menu entries in the Web application for the Web template using the properties dialog box. You can also determine which stylesheet is used to display the Web application in this area. You are able to select stylesheets from a list of stylesheets stored on the BW server. Alternatively you can also revert back to another server, such as your own Web server.
- The lower screen area displays context-sensitive help.

3.2.1.1.1 From Web Template to Web Application

The Web template is formed at the starting point of Web application generation. The Web template is an HTML document that is used to define the structure of a Web application and that contains placeholders for Web items, Data Providers and BW URLs.

In the course of the design process, you change this Web template by embedding placeholders for Web items and Data Providers. You can make these changes in the HTML view.

In the following section you will find a description of the steps you follow to generate a Web application.

Integrating Web Items and Changing the Settings and Layout

The master Web items on the standard tab pages are used as templates. By incorporating a Web item using Drag&Drop into your Web template, it becomes a concrete version of a Web item called an object. The Web item has a name and certain standard properties that you can change as required.

Data Binding and Selecting a Query/Query View

The data provider provides the data for your Web item. You can assign a data provider to multiple Web items.

The data provider is a dynamic object that delivers current data for one or more Web items at runtime. You define the start view of the data provider by selecting a query or stored query view.

The data provider concept makes it possible to exchange the data source for a Web item easily. By means of navigation, that is changing the drilldown, the Web item always displays the current drilldown data. If a particular data provider is assigned to more than one Web item, the changes affect all the Web items involved.

Store, Execute and Publish the Web Template

You need to save your Web template before you execute it as during runtime (triggered by calling up the URL) Object Tags are replaced by concrete HTML with information according to the Web item and Data Provider settings. Thereby the Web template on the Web application server is accessed.

Alternatively you can execute the Web template in the Web browser. When it is executed, the Web template becomes a Web application, that is, the Web template is saved on the Web Application Server and a URL is generated for this Web application.

You can also integrate Web templates into the Enterprise Portal in various ways:

- You are able to publish the Web templates to a role to call them up based on roles in an Enterprise Portal.
- However, you are also able to integrate your Web templates directly into the Enterprise Portal using a save dialog which contains various views of an Enterprise Portal in which a Web template can be saved. Depending on the view (My Portfolio, CM Repository view, Collaboration Room, Portal Content, Portal Roles), iViews are either generated in the portal, or links are generated in Knowledge Management. For more information see the section on BEx Information Broadcasting.
- You can also call the BEx Broadcaster with which the queries and Web applications can be precalculated and distributed. For more information, see the section on integration into the Enterprise Portal.

To familiarize yourself with the process of generating Web applications, the **Web Application Wizard** is available to guide you, step by step, right through to publishing a Web application in the Web.

3.2.1.1.2 Designing the Layout of Web Templates

You are able to change your Web template layout in the same way as when using the HTML editor. You have the following options:

Arranging Web Items on the Page

- You can change the size of the placeholders.
- You can align the Web items horizontally.
- You can drag Web items using Drag&Drop to the required position to regroup the Web items within the Web template.

Arranging Web Items using an HTML Table

To arrange Web items next to and below one another you can use an HTML table. You can lay out this grid according to your requirements and drag different Web items into the individual cells of the table, according to whether your Web items are arranged horizontally or vertically.

Enhancing Web Templates with Texts

As well as inserting and arranging Web items, you can also enhance the Web template with texts and format them.

Enhancing Web Templates with Images

You can include images in your Web templates (such as company logos) that are stored in the MIME repository. The image formats that are supported are GIF (Graphics Interchange Format), JPEG (Joint Photographic Expert Group) and BMP (BitMaP).

3.2.1.1.3 Processing Web Templates Further

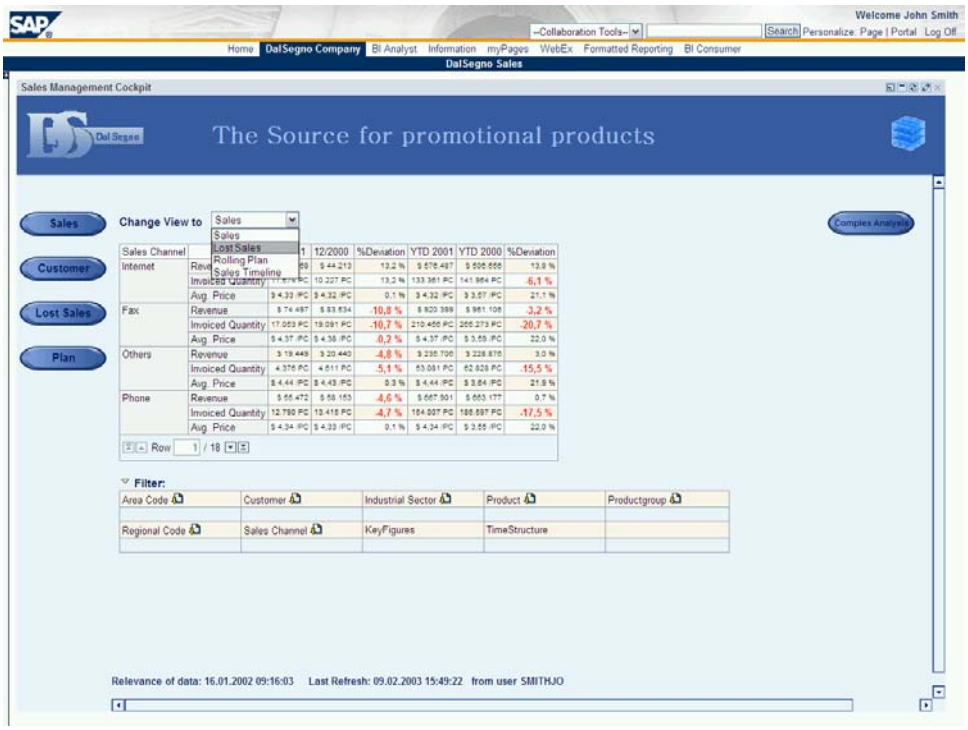
You have the following options for editing the HTML of a Web template:

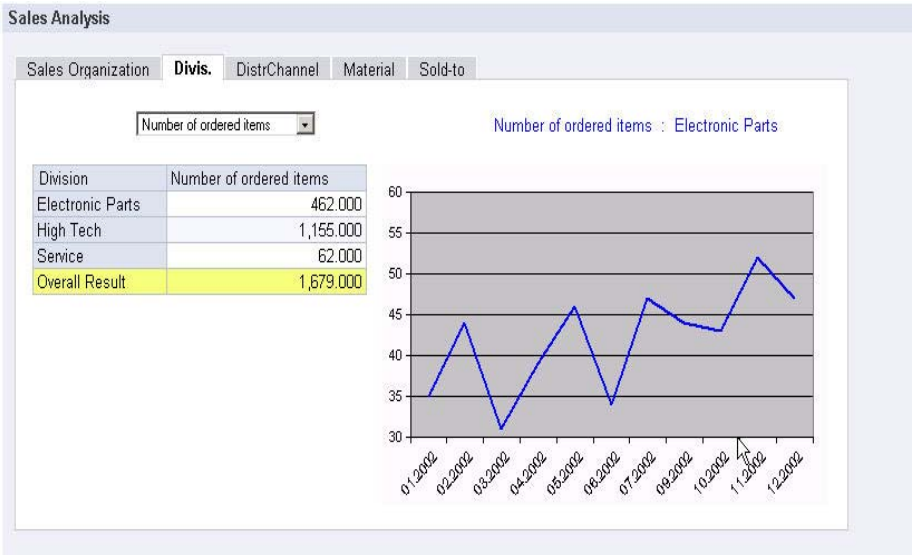
- You can edit the Web template **directly** in the HTML view of the Web Application Designer. Switch to the HTML view in the *Template* window. From the HTML view, you can also switch to *Text Mode*. The text mode is an editor mode for the Web Application Designer with which you can edit purely the text of a Web template using the functions of the Web Design API.
- You can also edit the Web template with an external HTML editor.

3.2.1.2 Web Design API

The Business Explorer Web Application Design enables you to apply generic OLAP navigation to BW data in Web applications and Business Intelligence Cockpits for simple and highly specialized scenarios. You can implement highly individual scenarios with customer-defined interface elements by using standard markup languages and Web design APIs. Web application design comprises a broad spectrum of Web-based business intelligence scenarios, which you can adjust to meet your individual needs using standard Web technologies.

The following graphics show examples of customer-defined interfaces that have been adjusted to meet specific needs using the Web Application Design.





The Web template is formed at the starting point of Web application generation. The Web template is the structure of a HTML page and contains command URLs as well as placeholders for Web items and data providers (the object tags). Data providers are usually created first, followed by Web items and command URLs for an HTML page. In the Web template, you determine from which data provider and in what way (Web items) the BW data is displayed. You also determine which additional operations are possible (BW URLs).

Using the Web Design API you can adjust and enhance your Web templates, and thereby your Web applications, to suit your own requirements.

The following section looks at the main options provided by the Web Design API. You can find more detailed information with coding samples in the SAP BW documentation.

Object Tags

By using object tags, you can determine properties of Web templates, create data provider and Web items in a Web template, and supply them with parameters. The following object tags play an important role in BEx Web Applications:

- Object Tag for the Properties of Web Templates

The properties of a Web template can be defined in an object tag. The properties of the Web template also include all properties of the context menu. These properties can also be transferred via URL when calling up the Web template.

- Object Tag for Data Provider

The parameters that you need for creating a data provider are available in the Web Application Designer. You can add additional properties to send a command to the DataProvider before calling up the page for example.

- Object Tag for Web Items
  The parameters that you need for creating a Web item are available in the Web Application Designer. You can add additional properties to adjust the size of the Web item at a later point, or to set a title, for example.

Command URLs

In addition to object tags, you can also set command URLs in a Web template.

You can use command URLs to change the statuses of Data Providers or properties of Web items. Additionally, you can also realize a number of other navigation options (such as the Report-Report interface, export as Excel file, call ups or other Web templates).

Command URLs are usually visualized via text hyperlinks/ pushbuttons.

A distinction can be made between different **command types:**

- Commands to change attributes of a Web item
- DataProvider-dependent commands
- Commands for Web templates

Command Sequences
Many users want to change more than one object in different ways with one command. With the previous functions a user was not able to use a single command to filter one data provider by the fiscal year 1999, and another data provider by the fiscal year 2000.

A command sequence allows you to add new commands to an original command. Data is requested from the OLAP processor and the HTML page is sent back to the Web Browser only after all of the commands have been processed.

Using Forms
With HTML forms you can integrate input fields easily into an HTML page. You can also use this HTML technology to create BEx Web applications. By using forms, you can set customized parameters when calling up Web applications. Do this by creating an HTML document with a form from which the actual Web application URL is called up with set parameters.

Use of JavaScript Functions
You can execute commands or command sequences with JavaScript as well as by using <SAP_BW_URL> tags. Another JavaScript application is the enhancement of the context menu to include customer-specific entries. With the JavaScript function, you can define the logon language and thereby take the different input formats of the various languages into consideration in JavaScript.

Web Design API for Tables
In addition, using a Web design API, you can change the display of tables or navigation blocks in Web applications.

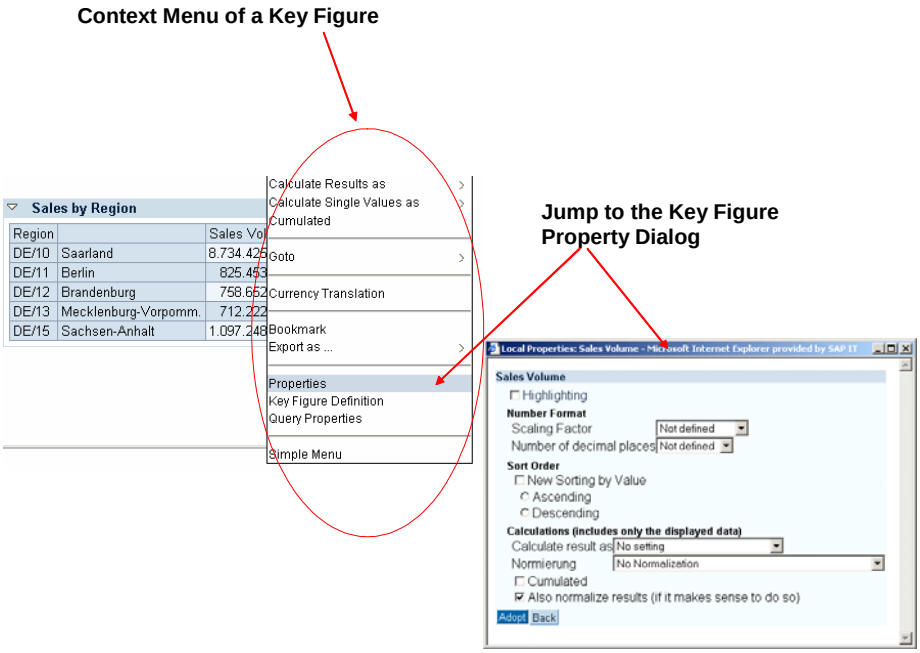
The Web Design API enables you to modify individual cell data (characteristic values, column headers, value cells, and so on) with relation to content, display and navigation options.
The range of options includes making simple changes to the display, and making data-specific enhancements to the navigation options and display. You use ABAP objects to execute the technical implementation.

3.2.2 Analysis & Reporting: BEx Web Applications

BEx Web Applications are Web-based applications from the Business Explorer for data analysis, reporting and analytical applications on the Web. If you have formatted your data in the BEx Web Application Designer using Web items (table, filter, chart, map, document, and so on), you can now access them on the intranet or using an Enterprise Portal.

3.2.2.1 Context Menu

You use various navigation functions to change the view of data displayed in a Web application to suit your needs. Various navigation functions are available, depending on the Web Items that have been included in the Web application. Each navigation function is characterized by a symbol.
There is also a context menu for the Web items Navigation Block, Table, Chart, List of Exceptions, List of Conditions, and Label that you can call up by clicking with the right mouse button on a cell text (characteristic, characteristic value, structural component, description of an exception, description of a condition).
The following illustration shows the context menu for a key figure. From the context menu you can, for example, jump to the key figure properties dialog box.



The context menu offers various functions depending on the cell context, the Web item used and the settings of the Web template in the Web Application Designer. Functions in the context menu:

- **Back**
- **Back to Start**
- **Forward**
- **Keep Filter Value**
  Has the effect that you see only the data for a characteristic value. The characteristic value itself is removed from the drilldown.
- **Keep Filter Value on Axis**
  Has the effect that you see only the data for a characteristic value. The characteristic value itself remains in the drilldown.
- **Select Filter Value**
  You can filter the Web application according to different values.
- **Filter and Drilldown according to -> Characteristic**
  You can fix a characteristic to a value in one step (meaning to filter it) and drilldown according to another characteristic on the same axis (row axis or column axis).
- **Drilldown -> Across or Down**
  You can choose this function in the navigation block or on a label for characteristic descriptions (for example, country) in order to drill down the characteristic in the axes for the columns or rows.
- **Add drilldown according to**
  You can add a characteristic (for example, *Region*) to the drilldown at a specified position.
- **Swap Characteristic 1 / Structure 1 with -> Characteristic 2 / Structure 2**

You can use this function to swap a characteristic / structure with another characteristic / structure.

- **Remove Drilldown**
  You use this function to remove a characteristic from the drilldown.
- **Swap Axes**
  You use this function to swap the query axes. If you have characteristics in the rows and key figures in the columns and you choose *Swap Axes*, then the key figures are displayed in the rows and the characteristics are displayed in the columns.
- **Expand/Collapse Hierarchy Nodes**
- **Drilldown Nodes According to <next object on the axis>**

In a hierarchically displayed characteristics, you can drilldown on a hierarchy node according to the next object on the axis and see the values relating to this object underneath it.

- **Expand hierarchy**

You use this function to show the different levels of the hierarchy. Alternatively, click on the hierarchy symbol to expand the hierarchy.

- **Activating /deactivating hierarchies**

You use this function to switch active hierarchies on and off.

- **Sort in Ascending/Descending Order**

You can use this function to sort structural component values by ascending or descending order

- **Sort -> Characteristic 1**

You can use this function to sort characteristic values or attributes for a drilldown characteristic in descending or ascending order. You can sort by the key or the name.

- **Calculate Result As...**

  You use this function to recalculate the results rows and single values that are displayed in the query according to the following criteria:

Summation / Maximum / Minimum / Count All Values/ Count all values < > 0 / Average of All Values / Average of All Values < > 0 / Standard Deviation / Variance / Suppress Result / First Value / Last Value

Also see the Local Calculations section.

- **Calculate Single Values As...**

You use this function to recalculate the single values that are displayed in the query according to the following criteria:

Normalize result/ Normalize total result/ Normalize query sum./ Ranked list/ Olympic ranked list

Also see the Local Calculations section.

- **Cumulated**

You use this function to cumulate the individual cells in an area. The first value is added to the second value, the result is added to the third value, and so on. In the columns, the cells are cumulated from top to bottom, and in the rows, the cells are cumulated from left to right. With blocks of single values, that is, a drilldown in both the rows and the columns, the values are cumulated from top to bottom and from left to right.

This function is particularly useful with drilldowns on time characteristics (months, for example). Using the function *Calculating Single Value as → Normalize Results*, and *Sort → Descending*, on the corresponding value column, you get a cumulated list that is often described as an ABC list.

- **Goto**

This function enables you to jump to documents and jump targets using the Report-Report Interface.

- **Export As CSV File / MS Excel 2000 File**

  MS Excel 2000 File.

  You can export query data to MS Excel 2000.

  The query data is embedded in the BEx Analyzer as with queries: The navigation status does not change and the formatting is transferred. You can see the filter restrictions and the data in the table. Exceptions are highlighted in color in the same way as on the Web.

  You can also use the BEx Analyzer BW functions to continue navigating.

  CSV File

  You can export the query data into a CSV (**c**omma **s**eparated **v**alue) file.

In contrast to exporting to MS Excel 2000, you do not see the context of the numbers and you cannot see the filter data. The query formatting (such as the exceptions being displayed) is not transferred to the CSV file.

- **Bookmark**

This function enables you to store a particular navigational state of the Web application so that you can access it later.

- **Bookmark with data**

  This function enables you to store a particular navigational state of the Web application so that you can access it later. When you call up the bookmark URL later, not only does the retained navigation status appear in the Web application, but also the historical data from the time the bookmark was set.

- **Distribuite → by E-Mail / via Enterprise Portal**

  You can precalculate the Web application at a specific time or you can generate an online link and send it to the desired recipients by e-mail.

  You can also put the Web application in the Enterprise Portal as a precalculated file or as an online link. You come to the broadcasting wizard which supports you in making the necessary entries for distribution with step-by-step instructions. If you wish, you can also get to the BEx Broadcaster from the broadcasting wizard, where you can make additional detailed entries. There you can select another Web application, a query or a workbook for precalculation and distribution.

- **Properties**

You can make various settings for the characteristic or key figure here.

- **Key Figure Definition**

This function provides information about how a concrete number is concatenated in your Web application. You can check whether data has been loaded and analyze errors.

- **Query Properties**

You can make various settings that effect the query during runtime here.

- **Currency Translation**

You can specify the currency into which the key figures and structure components of a query are to be translated.

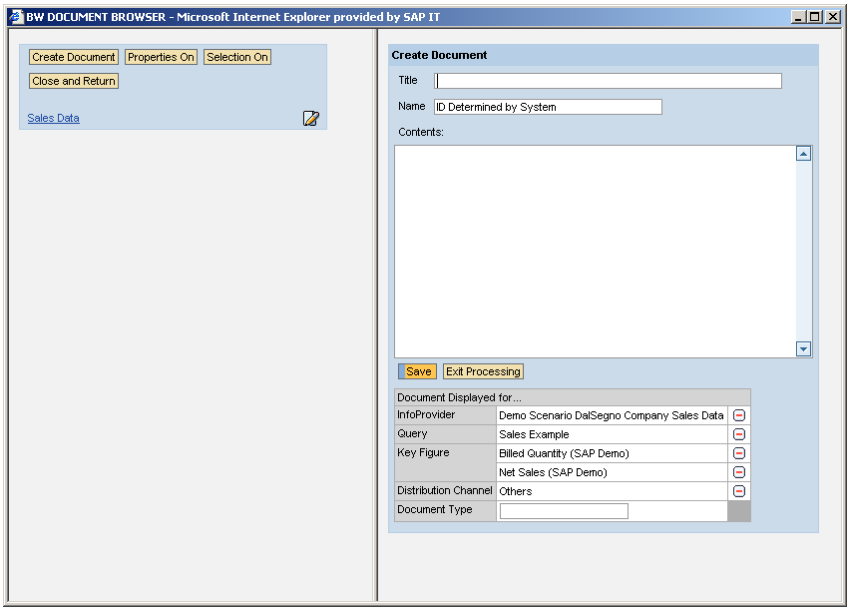
There is also the option of determining a more basic version of the context menu with a restricted number of functions. If you want the context menu to contain more functions, you can add an enhanced menu. In the context menu itself, you can then use the menu entries *Enhanced Menu* and *Basic Menu*, to toggle between the two versions. The basic menu contains a subset of the enhanced menu.

3.2.2.2 Using Documents in Web Applications

You can comment on and enhance the business data that you have provided (for example, in a table in your Web application) with information such as texts, diagrams and graphics, using the Web items *Single document* and *List of documents* (see Document Management.

You can use the *Goto* function to display documents for different objects that were created in the Administrator Workbench, in the master data maintenance, or in the Web application, and then create new documents.

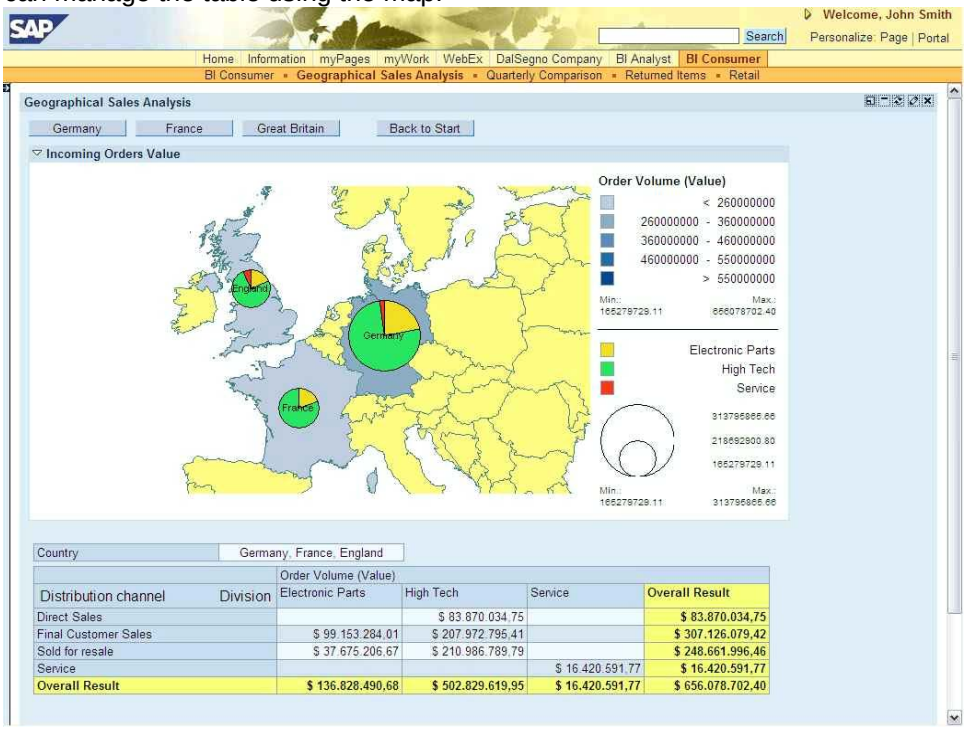
You can also display document links for the content of a cell in a report as long as there are documents for cells. When you click on a document link the document is displayed in a separate browser window. The document links can be contained in the *Table, Navigation Block* and *Text Elements* Web items. See Document Management on this topic.



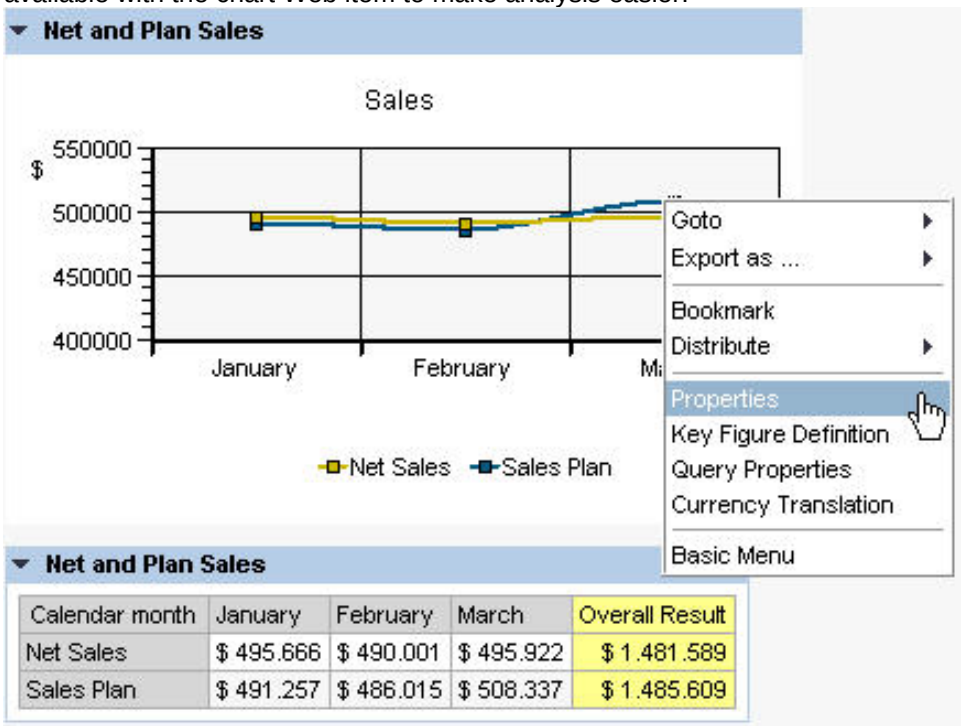
3.2.2.3 Analyzing Business Data Using Map and Chart Web Items

With the map Web item you are able to analyze your business data from a geographical perspective. There are several navigation options available within a map on the context menu, as well as various interactive options for other items of your Web application. These all help to simplify your geographical

analysis. If you have included the Web item *Table* in your Web application along with the map, you can manage the table using the map.



Using the Web item *Chart*, you can format data in a Web application visually, making it easier to interpret. You can choose from a number of different types of diagram (bar chart, histogram, line chart and pie chart or portfolio, tachometer, quadrant and so on), and can add the chart title, data labels and captions. As with the Web item map, different navigation options from the context menu are also available with the chart Web item to make analysis easier.

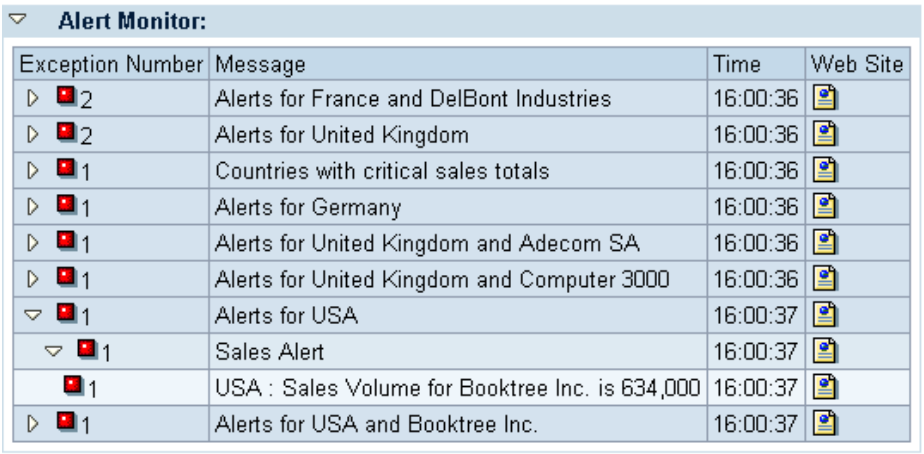


3.2.2.4 Ad-hoc Query Designer

You use the *Ad-hoc Query Designer* Web item to create and **change** your Web application queries directly on an ad-hoc basis. See Ad-hoc Query Designer on this.

3.2.2.5 Alert Monitor

With the help of the Alert Monitor Web item, you can go to the query views generated in Exception Reporting and the Reporting Agent processes and see at a glance any noticeable, deviating key figures from defined threshold values.



Alert Monitor:

Exception Number	Message	Time	Web Site
2	Alerts for France and DelBont Industries	16:00:36	
2	Alerts for United Kingdom	16:00:36	
1	Countries with critical sales totals	16:00:36	
1	Alerts for Germany	16:00:36	
1	Alerts for United Kingdom and Adecom SA	16:00:36	
1	Alerts for United Kingdom and Computer 3000	16:00:36	
1	Alerts for USA	16:00:37	
1	Sales Alert	16:00:37	
1	USA : Sales Volume for Booktree Inc. is 634,000	16:00:37	
1	Alerts for USA and Booktree Inc.	16:00:37	

3.2.2.6 Data Mining

You can also use data mining methods in Web applications to predict customer behavior or to divide customers into three classes according to sales (A, B and C). The *What-if Prediction* and *ABC Classification* Web items help you to do this. See Data Mining on this.

3.2.2.7 Variables in Web Applications

Using a variable screen, you can fill variables with values when you display the Web application in the Web browser. You can personalize the values for the individual components of the Web application or for the entire Web application. Using variables allows you to wait until the Web application is actually displayed in the Web browser before you fill individual parts of the query or the entire query with values. Variables act as placeholders for characteristic values, hierarchies, hierarchy nodes, texts, and formula elements, and can be processed in many different ways. There are variables with automatic substitution, substitution from authorizations, or variables that are ready for input. Also see Variables.

3.2.2.8 Standard Web Template for Ad-hoc Analysis

Queries that you display on an ad-hoc basis on the Web from the BEx Analyzer, the Query Designer or the Ad-hoc Query Designer are displayed in a standard Web template.
In the standard Web template you can open a query or a query view or you can save a query view. You can change the view of the data analysis using tab pages (tabular or graphical). You can also request information on the selected data provider (query or query view) and you can call the BEx Broadcaster, for example to precalculate or distribute queries. You can find a detailed description of the functions that the standard Web template provides can be found under BEx Web Analyzer. In contrast to the BEx Web Analyzer, however, you cannot define new queries in the standard Web template for ad-hoc analysis.
The standard Web template for ad-hoc analysis is available by default. However, you can change this Web template, adjust it to your requirements and then specify it as the standard Web template for ad-hoc analysis.

3.2.2.9 Accessibility

Accessibility means unrestricted access and working methods for physically impaired users of SAP systems. One focus of accessibility is general system availability for special user groups such as blind, visually impaired, or mobility impaired users. It also gives the physically impaired user the opportunity to personalize various system settings, such as the screen display, according to their own requirements.
The generated HTML of BEx Web applications is adapted for output through electronic tools (assistive technology). Accessibility is possible only through the use of screen readers. BEx Web Applications support the use of assistive technology. To this end, calling a URL for an Web application is provided with a parameter for this.

3.2.2.10 Web Browser Dependencies

The features you can use for analysis in Web applications are dependent on which browser you are using.

Requirements for unrestricted features

For the full range of features with context menus, snippet operations – which include loading changed components of HTML pages - and the enhanced geo-navigation bar with maps can be used only with up-to-date Web browsers that support DOM (Document Object Model) level 2 (with dynamic generation of DOM objects), ECMA 262 script (specification for scripting language), HTML 4.0 and CSS 1.0. The reference Web browsers are the Microsoft Internet Explorer (MS IE) and the Netscape Navigator (NS) in the current Windows implementations (MS IE 6.x and NS 6.x). Instances of these Web browsers on other systems, such as Apple Macintosh or Linux can react differently.

Minimal Requirements

You can use Web applications on Web browsers that satisfy the HTML 3.2 standard and support the basic functions of CSS 1.0 (Cascading Style Sheets).

Web Browsers and Features

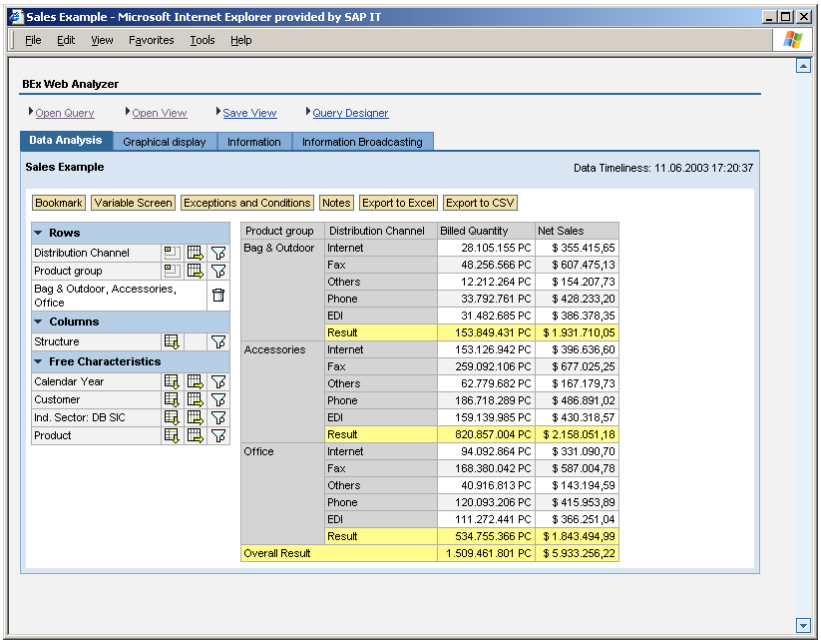
The complete range of functions of the context menu and the Ad-hoc Query Designer, as well as flicker-free navigation, are possible with Internet Explorer 6.x and 5.x as well as Netscape Navigator 6.x.

With Internet Explorer 4.x and Netscape Navigator 4.x, there is a restriction in the Web item *Hierarchical Context Menu* – you cannot load branches of the hierarchy dynamically.

Web browsers such as Internet Explorer 3.0 or Netscape 3 do not support context menus in BEx Web Applications but rather only restricted navigation using symbols.
For more information about Web browser dependencies, see the SAP Service Marketplace, BW alias, under *SAP BW 3.5* → *Frontend* → *Frontend Compatibilitie*s.

3.2.3 BEx Web Analyzer

The BEx Web Analyzer is a standalone, comfortable Web application for data analysis that you can call up using an URL or as an iView in the Enterprise Portal.



The Web analyzer offers a wide range of functions for data analysis via various tab pages and the associated view-specific toolbars:
In the *Tabular View*, you can use the **Functions of the Navigation Block and Context Menu in the Table**. At the same time, using the application toolbar that is part of the view, you can save **Bookmarks** for a navigational state, display the **Variable Screen** to choose other variable values as needed, define **Exceptions and Conditions** or display existing ones, call the **Document Browser** where you can create documents for the navigational state or change and delete existing documents, and **Export Data** into an MS Excel 2000 or CSV file for further processing. In the *Graphic Display*, query data are displayed in the form of a graphic and you can choose between **Various Graphic Types**. You can also save the navigational state for a bookmark in this view and you can export the data into an MS Excel 2000 file. If you want to display **Information for the Data Provider (Query or Query View)**, you can use the *Information* view. Finally, you can use all the functions of the **BEx Broadcaster** using the *Information Broadcasting* view. In this view, you can **precalculate and distribute** various objects with **Business Intelligence Content** (Web templates, queries, workbooks) (see BEx Information Broadcasting).
In addition to the functions that are available through the various views and that are also available in the Standard Web Template for Ad-hoc Analysis, you can use links to **open other queries or query views**, **save a query view** or you can **define a new query** using the Ad-hoc Query Designer.

3.2.4 BEx Mobile Intelligence

With the help of BEx Mobile Intelligence, you can access your Web applications on the move. You need one of the following devices:

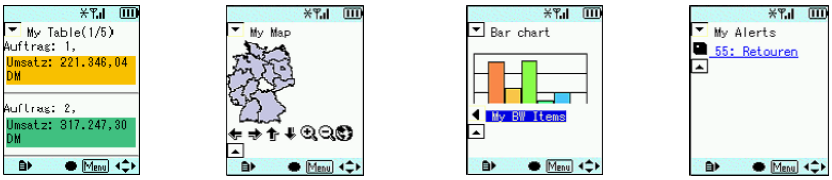
- PDA (Personal Digital Assistant) with Microsoft Windows CE 3.0 Operating System and Pocket Internet Explorer
- WAP-enabled mobile telephone (such as BlackBerry)
- i-Mode-enabled mobile telephone
- Mobile device with an EPOC32 operating system (for example, Nokia Communicator 9210)

Some handheld devices, such as Palm Pilots, are also supported. The type of support depends on which browser is installed for the system.

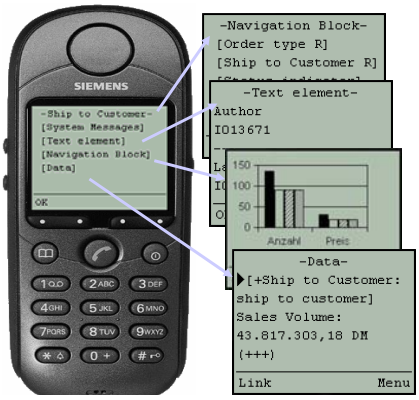
Above all, these devices are employed with online scenarios. Using them Offline is also often possible. One example being the download of precalculated pages to a mobile device. The offline scenario mostly relates to PDAs and can also be used for laptops.

Web applications on mobile devices can look something like:

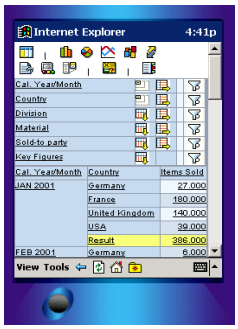
iMode Applications:



WAP Applications:



PDA Application:



The Wireless Application Protocol (WAP) is used as the basis for data transfer with WAP-enabled devices and the Hypertext Transfer Protocol (HTTP) with PDAs. The Wireless Markup Language (WML) for WAP-enabled devices, the Hypertext Markup Language (HTML) without stylesheets and with restricted Java Script for PDAs, and the Compact Hypertext Markup Language (cHTML) for i-Mode-enabled devices, form the descriptive language basis.

Mobile Intelligence with WAP

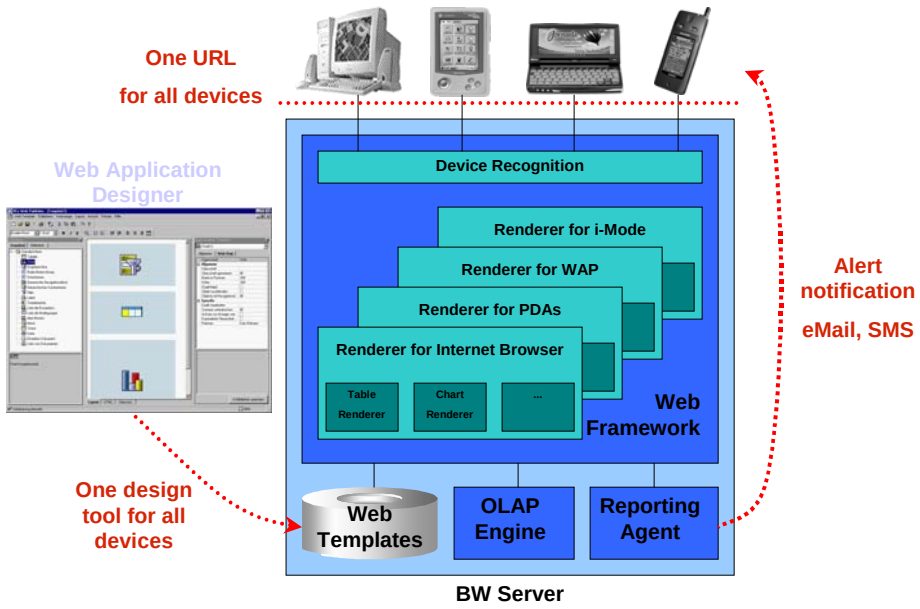
1. You connect to your mobile terminal with a WAP service provider by using your mobile terminal (for example, a WAP compatible mobile telephone). This allows you to use a WAP gateway or WAP server, enabling you to transfer contents from the Internet to the mobile device.
2. In addition, the WAP-gateway passes on the requested URL to the BW Web Application Server.
3. In the URL HTTP request, the BW server notes that WML is requested instead of HTML.
4. In the BW server, the data is converted into WML.
5. The result is returned to the WAP gateway, which then converts the WML text data into a compressed by the code, sending it to the mobile device.

Compressing the data reduces transfer time.

Mobile Intelligence with HTTP

Mobile Intelligence with HTTP has the same process as with the Web applications. You create a Web application using the BEx Web Application Designer and call the URL from your mobile device.

The following graphic describes the interactions in mobile intelligence:



The same URL is used to call up BEx Mobile applications as with BEx Web applications. The BW server automatically recognizes which device made the request (PDA, WAP, i-Mode or normal desktop browser), and generates a device-specific HTML or WML page. For this reason, BEx Mobile applications are normal BEx Web applications and are created in the same way as BEx Web applications in the BEx Web Application Designer.

However, there are restrictions on the various Web items that are supported by mobile devices. Not all of the Web items available in the Web Application Designer are supported because of the various display options for the mobile end devices currently on the market.

You should also take into account when you create the Web application that the display options of some devices are severely limited by the size of the display and also by their ability to display colors. Some display options are taken into account by *Automatic Output Optimization* for mobile applications. Automatic output optimization adjusts, for example, Web items in a Web template to the size of the display on the output device.

Normally, you only need to adjust the range of data for mobile use.

3.2.4.1 Automatic Device Recognition

Automatic device recognition is a service that assigns different mobile devices to a device class and enables device-specific output of the Web application. Each device communicates with the BW system using the HTTP protocol. As well as the proper URL there is also a device-specific recognition in the HTTP header (user agent) of the HTTP request, which is evaluated by automatic device recognition. After the BW system has identified the mobile device, it optimizes the output of the mobile application in accordance with the device type.

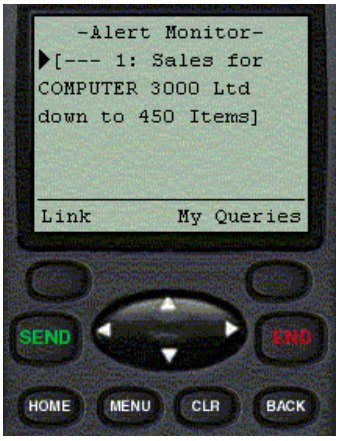
The output is adjusted to suit the different device classes as a form of optimization. For example- with PDA devices, context menus are shown on a separate page, with WAP and I-Mode devices, the Web items are automatically distributed amongst several pages. You can create device-specific Web templates in the Web Application Designer using naming conventions. In cases where a particular device requests a Web template, for which there is a device-specific Web template, this device-specific Web template is automatically used.

3.2.4.2 Alert Scenario

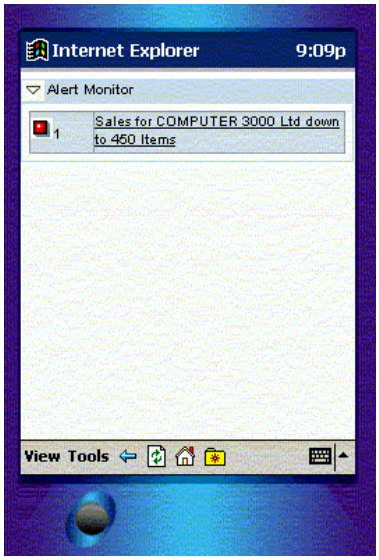
An additional function of mobile intelligence is the ability to send a message using SMS or E-mail to a mobile terminal as soon as a defined exception occurs in the mobile application. By doing this, you highlight the business situations that require close attention.

If you included an exception in your mobile application, you can use the Reporting Agent to send an SMS or email to your mobile end device when the exception occurs. The *Alert Monitor* Web item displays a list of exceptions. It can be restricted to the current user and to a particular number of alerts.

Alert Monitor of a WAP-Compatible Device:



Alert Monitor on a PDA Device:



After receiving the SMS or email message, you can use your mobile device to access the Web applications involved via the Alert Monitor. This allows you to analyze them in more detail.

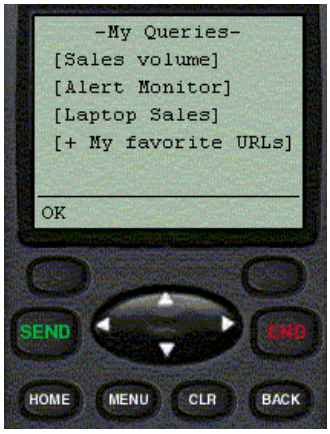
3.2.4.3 Online Scenario

You need a fast access to your Mobile Applications when retrieving them online. Entering URLs is difficult with mobile devices. For this reason, you need a central entry point from where you can navigate to your mobile applications. This central entry point is provided, in particular, by the Web items *Role Menu* and *Alert Monitor.*

To do so, create a mobile application consisting of only one Web item, *Role Menu* or *Alert Monitor.* You save the associated URLs in your mobile device using the browser's bookmark functionality in your mobile device.

In the *Role Menu,* Web applications, queries and external links that you can jump to for the role selected are displayed.

Role Menu on a WAP-Compatible Device:



Role Menu on a PDA Device:

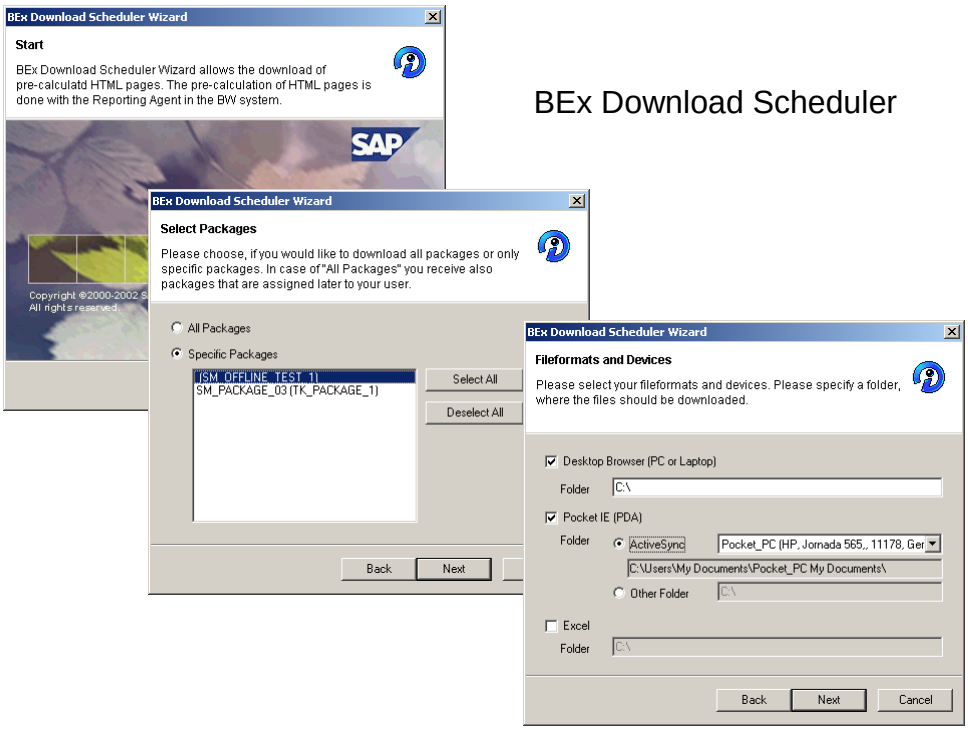
The *Alert Monitor* displays the list of queries in which an exception was found in the Reporting Agent (see Alert Scenario section above). The Alert Monitor entries represent a way into the appropriate queries that are displayed with the Standard Web template.

3.2.4.4 Offline Scenario

You can either access your Web applications online (for which you need a connection to the BW Web Application Server) or offline (no connection) as a precalculated document.

Using the BEx Broadcaster you can precalculate Web templates and queries in various output formats and filter settings and then distribute them by e-mail. Depending on which settings you make, you can generate static documents or documents with navigation options using a filter. You can also publish the precalculated documents with the historical data to the SAP Enterprise Portal. In the Enterprise Portal, employees from a company can add evaluations, feedback, personal notes, and so on to the documents or they can use the documents when working together in collaboration rooms. You can also download the documents to your PC from the Enterprise Portal. You can find more information in the BEx Information Broadcasting section.

Beyond that, you can precalculate Web applications using the Reporting Agent. Once pre-calculation is complete, the pre-calculated HTML pages (HTML for Web browser or HTML for Pocket IE) can be picked up from the BW server. You can then download the pre-calculated HTML pages onto your PC desktop using the BEx Download Scheduler, a wizard that takes you through the process step-by-step. Alternatively, you can use the wizard to schedule the download for later.



BEx Download Scheduler

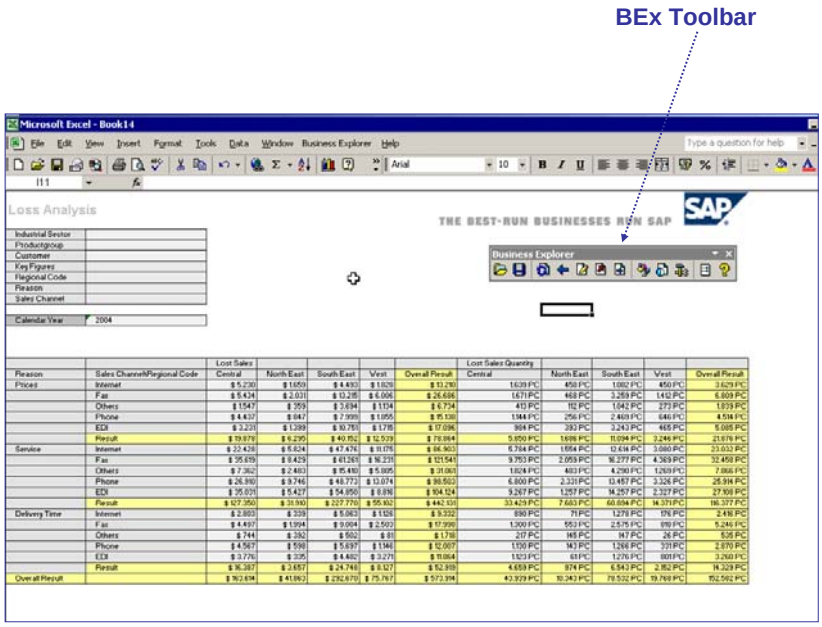
You can now use pre-calculated Web templates offline and transfer them to a PDA device (using Microsoft ActiveSync).
When adding the Web item *Dropdown Box* to your Web template and using a control query in the Reporting Agent, you can then navigate in the pre-calculated Web templates to the degree provided by the filter values in the dropdown box. However, navigation with the context menu is not possible.

You can also access the precalculated data generated with the Reporting Agent online using the parameter DATA_MODE. You add the parameter DATA_MODE with the associated value (for example http://your AppServer:yourPort/SAP/BW/Bex?) to the URL generated by the BEx Web Application Designer. CMD=LDOC&TEMPLATE_ID=yourTemplate&DATA_MODE=STORED). If you have used variants in the precalculation or you have precalculated documents with various filter values, when you are calling the Web template with the precalculated data, in addition to specifying the parameter DATA_MODE, you also need to specify the associated parameter and values for the variable or filter.

3.3 Analysis & Reporting: BEx Analyzer

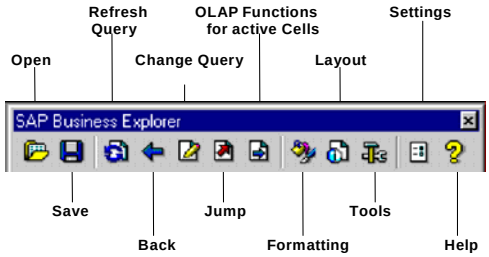
The Business Explorer Analyzer (BEx Analyzer) is the analysis and reporting tool of the Business Explorer that is embedded in Microsoft Excel.
You can call up the BEx Query Designer in the BEx Analyzer, in order to define queries. Subsequently, you can analyze the selected InfoProvider data by navigation to the query created in the Query Designer and create different query views of the data. You can add the different query views for a query or for different queries to a work book and save them there. You can save the workbook in your favorites, in one of the roles you assigned in the BW Server, or on locally on your computer. You can also Precalculate and Distribute Workbooks.

You can also start the queries in a standard view, which SAP provides via the Standard Web Template for Ad-hoc Analysis in the Web browser, send the URL or navigate further in the Web. Similarly, you can export the Web query to MS Excel 2000.



3.3.1 BEx Toolbar

You can reach the BEx Analyzer functions for navigating in and analyzing query data from the BEx toolbar. You can use it to reach the BEx Open dialog box to open existing queries, or the BEx Query Designer to create or change existing queries.



The following functions are available in the BEx toolbar:

The **Open** function takes you to the BEx Open dialog box. You can open workbooks, queries, stored query views and exceptions from here.

The **Save** function enables you to store query views in a workbook.

To arrange characteristics and key figures in rows and columns, as well as changing free characteristics in a query, or the definition of the query, you can use the functions **Change Query (Local View)** or *Change Query (Global Definition).*

With the **Goto** function, you can display exceptions that are found in the query in the alert monitor, jump to a previously stored view of a query, reach jump targets using the Report-Report Interface, and activate the function *Repeat Jump on Double Click* in order to reach a store view of the query data.

If you want to underline the type of data contained in a cell and therefore want to highlight the structure of the result delivered, you can use the **Formatting** function.

You can use the **Layout** function to attach a diagram or a map and change the appearance of the query in the workbook.

Using the functions under **Tools**, you can (among other things) display the query in a default view in the Web browser, call the query designer, insert, copy and remove queries, and activate SAP sheet protection. From there you can also call the BEx Broadcaster, which you can use to precalculate and distribute workbooks (see BEx Information Broadcasting).

The functions under **Settings** enable you to determine whether there is a connection to the BW server, information about the BW server is displayed, a new workbook has been embedded empty, a list is created or a template is used as a base, OLAP functions are available with a right mouse click, or whether warnings are suppressed by the server.

Finally, as a special analysis and reporting feature, you can use the **OLAP functions** which you can call from the BEx toolbar and which are described in more detail in the following section.

3.3.1.1 OLAP Functions for Active Cells

If you choose **OLAP functions for active cells**, you call the OLAP functions in the Business Explorer. They are available on the cells for the filter and results areas of a query. The context menu you call, depends on whether you select a cell in the filter area of the query, or a cell in the results area of the query.

Functions in Filter Cells

The selection of functions that are available from the context menu of the filter cells depends on the navigational status of the selected characteristic. In this way, you can find or remove a filter value, display various drilldown states along the rows or columns of the results area, or display the properties of the query.

Results Cell Functions

The selection of functions available from the context menu of the cells in the query results area, depends on the position and contents of the individual cell. The selection of functions that are available, depends on whether you have selected a cell that is related to a characteristic, a cell containing a characteristic value, for example, or whether you have selected a cell that is related to a structure element (key figure), a cell containing a key figure name, for example. In addition to the navigation functions

- Back
- Back to start
- Keep as filter value
- Filter and drilldown according to
- Add drilldown according to
- Swap ... with ...
- Active hierarchy
- Expand hierarchy

there are also context sensitive functions:

- **Sort**

You use this function to sort the characteristic values or attributes for a drilldown characteristic (the rows and columns) according to various criteria, ascending or descending, for example. It is possible to sort according to the key, the name, a display attribute, or a displayed value column.

- **Calculate Single Values/Results**

You use this function to recalculate the results rows and single values that are displayed in the query according to specific criteria (such as normalization, ranked lists, averages, variance). These local calculations include only those numbers in the calculation that appear in the current view of the report. In this way, you override the standard OLAP processor calculations. Also see the Local Calculations section.

- (Characteristic) → **Suppress Hierarchy Nodes**

If the characteristic has an active display hierarchy, you use this function to determine whether you want to suppress the hierarchy nodes *never*, *always*, or *conditionally*.

- (Characteristic) → **Node Position**

If the characteristic has an active display hierarchy, you position the hierarchy nodes either above or below the leaves.

- (Characteristic) → **Cumulated Display**

When you call this function, the system sorts the list in ascending order by key. All the structure elements (key figures) are subsequently aggregated to the *n+1* characteristic value, one after the other, for each of the *n*th characteristic values. With time characteristics, the missing characteristic values are included wherever necessary.

- (Characteristic) → **Normalizing to**

It is possible to normalize the query data from all key figures for various results for this key figure – the results are displayed as percentages.

- **Goto**

You use this context menu function to access documents (documents for master data and characteristic values as well as documents about the navigational state), as well as jump targets using the Report-Report Interface.

- **Exceptions**

You activate / deactivate exceptions for a query.

- **Currency Translation**

You translate according to a target currency or a database currency.

- **All Characteristics**

This is where you make the following settings for all characteristics:

  - **Results Rows Position**
    You choose whether you want the results rows displayed on the top/left or bottom/right of the screen.
  - **Suppress Results Rows**
    You determine whether the results rows are suppressed *never, always* or *conditionally*. Conditional suppression means that the results rows are not displayed if the corresponding area contains only one characteristic value.
  - **Suppressing Zeros**
    If you switch this function on, cells containing a zero value (0.00) are left empty.
  - **Normalization**
    You can normalize the query data for a key figure for different results of the key figure – the data is displayed as a percentage of the result. The normalization process refers to a particular characteristic each time, and has various settings independently for each characteristic.
  - **Undo**
    It is possible to cancel individually the settings for the characteristic display, for the results rows, and for normalizing single characteristics. Alternatively, it is also possible to undo all the changes made to settings, for all characteristics at once.

- **Properties**

You use this function to make settings affecting the display, interaction, and column width. Technical information for the query or the workbook is found under *Information*.

3.3.2 Evaluating Query Data

The BEx Analyzer offers convenient functions for evaluating and presenting InfoProvider data interactively. The first view of the data shows the allocation of characteristics and key figures or structures in the rows and columns of the query definition. Using the **navigation functions** described above (expand hierarchy, filter a characteristic by a characteristic value and so on) you are able to look at and evaluate data from different perspectives. You change the query locally and thereby create new views of the query data.

The main navigation functions are:

- Displaying a hierarchy
- Filtering a characteristic by a characteristic value
- Drilling down according to a characteristic and changing the drilldown status
- Filtering a characteristic and drilling down by another characteristic

- Distributing the characteristics and key figures along the row axes and the column axes of the query
- Putting the characteristics and key figures in order
- Hiding and showing key figures
- Activating and deactivating conditions and exceptions
- Evaluating geographical data (for example, characteristics such as customer, sales region, country) on a map.

In addition, you can use the editing functions in Microsoft Excel in order to set up individual format templates, to print results areas, or to create graphics.
If you have created the required view of the data for the InfoCube, you can save it in the workbook and store it, for example, in your favorites.

You can also process the queries further in Microsoft Excel or display them in the Web browser in a default view.

3.3.3 Queries in Workbooks

Queries are inserted into workbooks so you can display them. When you insert a query, a link is made between the cell areas of the worksheet and the data of the InfoProvider upon which the query is based. A link therefore exists between the Business Explorer and the Business Information Warehouse Server (BW Server).

When inserting a query into the workbook, a VBA routine is automatically generated in the workbook. You can also connect the Business Explorer with your own VBA programs (Visual Basic for Applications).

Additionally, you can create workbook templates, into which you can insert your queries. Workbook templates can contain pre-determined items for the area of the query, formatting settings, logos, VBA macros, and so on.

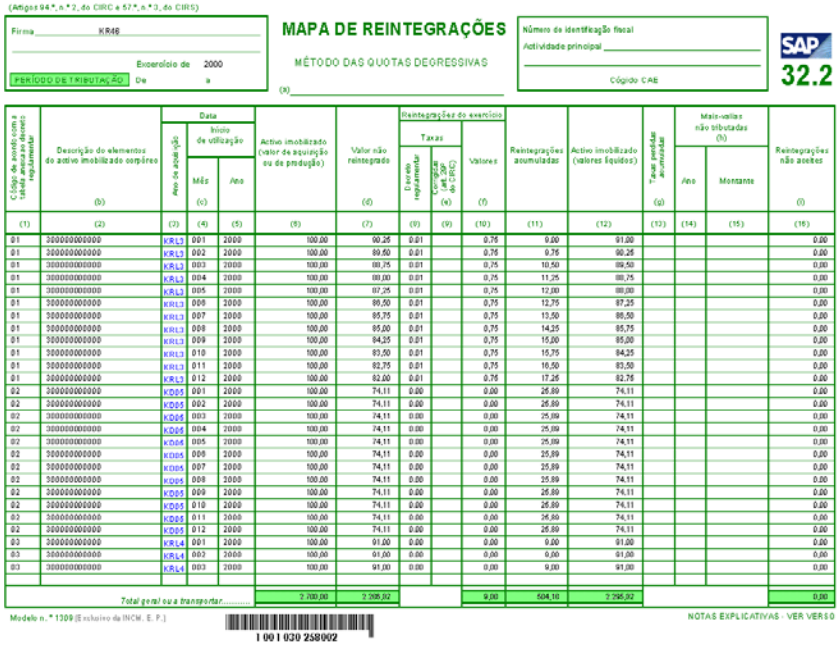
3.3.4 Precalculating Workbooks

You can precalculate and distribute workbooks with the BEx Broadcaster, which is a Web application you reach using the BEx toolbar. The system generates MS Excel workbooks with historical data. You determine the time of precalculation: You can precalculate the workbooks at a predefined time or whenever the data in the underlying InfoProvider changes. You can send the precalculated workbooks by e-mail or you can export them to the Enterprise Portal to make them available to employees in your company (see BEx Information Broadcasting).

3.4 Formatted Reporting: Crystal Enterprise Integration

The integration of “Crystal Reports – SAP Edition” into BW enhances the functional area of the Business Explorer. With Crystal Reports, you can now create formatted reports. It is important in formatted reports that you can specify the layout design to one pixel and also have convenient print options.

In the following graphic you see an example of a formatted report on the basis of a legitimate compulsory formula:



(Artigos 94.º, n.º 2, do CIRC e 57.º, n.º 3, do CIRS)

Firma KR46

Exercício de 2000

PERÍODO DE TRIBUTAÇÃO De a

MAPA DE REINTEGRAÇÕES

MÉTODO DAS QUOTAS DEGRESSIVAS

(a)

Número de identificação fiscal

Actividade principal

Código CAE

SAP 32.2

Código de acordo com a tabela anexa ao dec. regulamentar	Descrição dos elementos do activo imobilizado corpóreo	Data: Ano de aquisição	Data: Início de utilização: Mês	Data: Início de utilização: Ano	Activo imobilizado (valor de aquisição ou de produção)	Valor não reintegrado	Reintegrações do exercício: Taxas: Decreto regulamentar	Reintegrações do exercício: Taxas: Corrigidas (art.º 32.º do CIRC)	Reintegrações do exercício: Valores	Reintegrações acumuladas	Activo imobilizado (valores líquidos)	Taxa perdas acumuladas	Mais-valias não tributadas (h): Ano	Mais-valias não tributadas (h): Montante	Reintegrações não aceites
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(9)	(9)	(10)	(11)	(12)	(g)	(14)	(15)	(16)
01	300000000000	KRL3	001	2000	100,00	90,25	0,01		0,75	9,00	91,00				0,00
01	300000000000	KRL3	002	2000	100,00	89,50	0,01		0,75	9,75	90,25				0,00
01	300000000000	KRL3	003	2000	100,00	88,75	0,01		0,75	10,50	89,50				0,00
01	300000000000	KRL3	004	2000	100,00	88,00	0,01		0,75	11,25	88,75				0,00
01	300000000000	KRL3	005	2000	100,00	87,25	0,01		0,75	12,00	88,00				0,00
01	300000000000	KRL3	006	2000	100,00	86,50	0,01		0,75	12,75	87,25				0,00
01	300000000000	KRL3	007	2000	100,00	85,75	0,01		0,75	13,50	86,50				0,00
01	300000000000	KRL3	008	2000	100,00	85,00	0,01		0,75	14,25	85,75				0,00
01	300000000000	KRL3	009	2000	100,00	84,25	0,01		0,75	15,00	85,00				0,00
01	300000000000	KRL3	010	2000	100,00	83,50	0,01		0,75	15,75	84,25				0,00
01	300000000000	KRL3	011	2000	100,00	82,75	0,01		0,75	16,50	83,50				0,00
01	300000000000	KRL3	012	2000	100,00	82,00	0,01		0,75	17,25	82,75				0,00
02	300000000000	KDD5	001	2000	100,00	74,11	0,00		0,00	25,89	74,11				0,00
02	300000000000	KDD5	002	2000	100,00	74,11	0,00		0,00	25,89	74,11				0,00
02	300000000000	KDD5	003	2000	100,00	74,11	0,00		0,00	25,89	74,11				0,00
02	300000000000	KDD5	004	2000	100,00	74,11	0,00		0,00	25,89	74,11				0,00
02	300000000000	KDD5	005	2000	100,00	74,11	0,00		0,00	25,89	74,11				0,00
02	300000000000	KDD5	006	2000	100,00	74,11	0,00		0,00	25,89	74,11				0,00
02	300000000000	KDD5	007	2000	100,00	74,11	0,00		0,00	25,89	74,11				0,00
02	300000000000	KDD5	008	2000	100,00	74,11	0,00		0,00	25,89	74,11				0,00
02	300000000000	KDD5	009	2000	100,00	74,11	0,00		0,00	25,89	74,11				0,00
02	300000000000	KDD5	010	2000	100,00	74,11	0,00		0,00	25,89	74,11				0,00
02	300000000000	KDD5	011	2000	100,00	74,11	0,00		0,00	25,89	74,11				0,00
02	300000000000	KDD5	012	2000	100,00	74,11	0,00		0,00	25,89	74,11				0,00
03	300000000000	KRL4	001	2000	100,00	91,00	0,00		0,00	9,00	91,00				0,00
03	300000000000	KRL4	002	2000	100,00	91,00	0,00		0,00	9,00	91,00				0,00
03	300000000000	KRL4	003	2000	100,00	91,00	0,00		0,00	9,00	91,00				0,00
	Total geral ou a transportar.....				2 700,00	2 295,92			9,00	504,16	2 295,92				0,00

Modelo n.º 1309 (Exclusivo da INCM, E. P.)

1 00 1 020 258002

NOTAS EXPLICATIVAS - VER VERSO

Formatted reporting

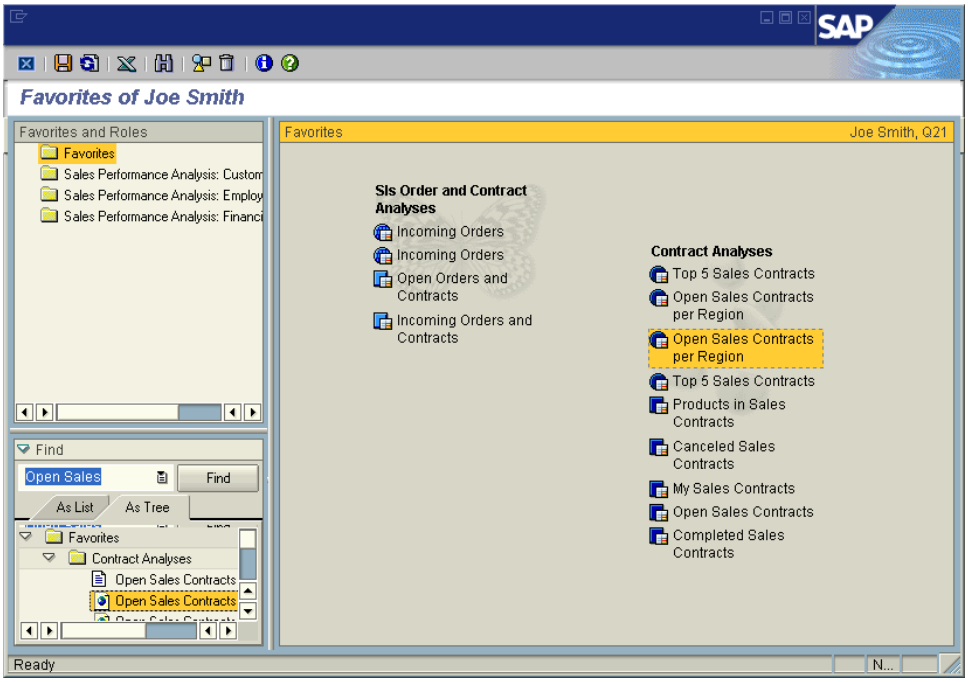
- Denotes the layout of reports using master data, ODS objects and multi-dimensional InfoProviders
- Contains every degree of freedom for formatting reports and enables you to assign report elements to a degree of one pixel It is especially suitable for form-based reports and printed reports
- Only offers very limited analytical functions You can specify the options for interaction only when you design the report

With BW, the customer receives Business Content, not only in the form of pre-defined OLAP queries, but also as formatted reports, Crystal Reports, that were created by SAP on the basis of existing BW queries.
These formatted reports display the full range of formatting elements and correspond particularly well to the requirements of form-based reports. Using the *Crystal Enterprise* server component, you can publish these reports on the Web, making them available to your users. This integration is supported by SAP technology in the areas of authentization, single-sign on and multi-language capability.

3.5 BEx Browser

The Business Explorer Browser (BEx Browser) is a tool for organizing and managing workbooks and documents.

Using the BEx Browser, you can access all types of documents in the Business Information Warehouse that are assigned to your role or that are stored in your favorites. You can select and open documents in the BEx Browser or store and manage new documents in the BEx Browser.



You can work with the following types of document in the BEx Browser:

- BW workbooks
- Documents that are stored in the Business Document Service (BDS)
- Links (references to file system, shortcuts)
- Links to Internet sites (URLs)
- SAP transaction calls
- Web applications and Web templates

You can determine the spatial (positioning on the screen) and graphical (colors, symbols) presentation of all folders and their contents. You can maintain your favorites and add new folders or objects to your favorites. These favorites then also appear in your user-specific initial menu (SAP Easy Access User Menu). You can create shortcuts in the BEx Browser to specific files on your PC and also store BEx Browser objects as links on your Windows desktop (using Drag&Drop).

Moreover, you can replace the existing folder symbols in the BEx Browser with company-specific images and insert your own logo into the BEx Browser.

Role Menu in Web Applications

If you do not want to use a desktop tool like the BEx browser to organize and manage documents when working in the Web environment, role menus are also available to you as an organizational tool. The Web item *Role Menu* in Web applications enables you to display the contents of roles and favorites of a user and access them on your various Web applications or Internet pages. The role menu is also particularly suited to calling mobile applications as start pages on mobile devices.

Preview

Integration into an Enterprise Portal provides new opportunities for managing and organizing documents from SAP BW and other systems using a single point of entry. The preparation of information is also based on user roles in the company in the Enterprise Portal. User-specific personalization of the Portal in relation to content and display also plays an important role. In this way, the Enterprise Portal logically follows on from the BEx Browser, which is not being developed any further. For more information, see the Integration into the Enterprise Portal section.

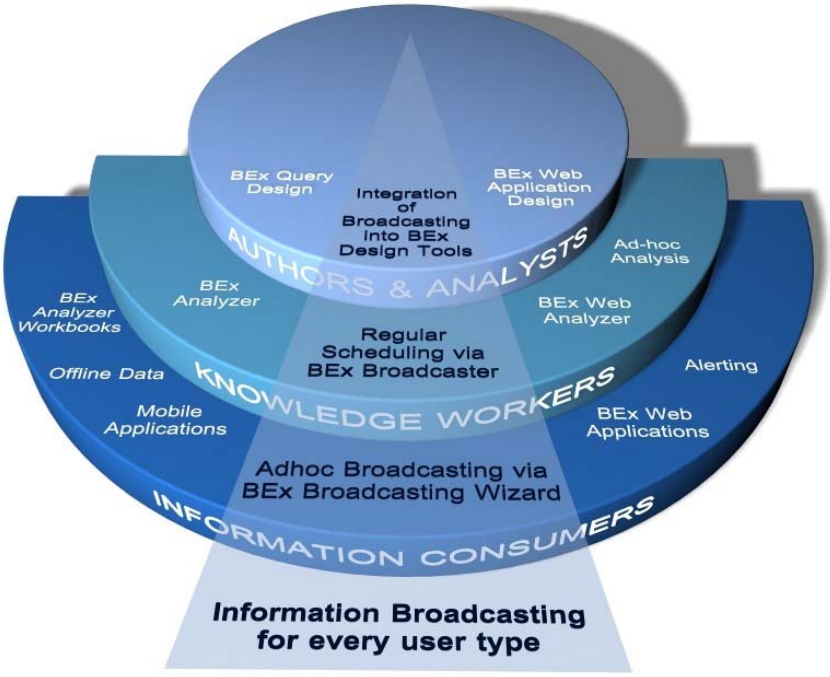
3.6 BEx Information Broadcasting

BEx Information Broadcasting allows you to make objects with business intelligence content available to a wide variety of users according to your needs.

With the BEx Broadcaster, you can precalculate BEx Web Applications, queries and workbooks and then publish them to the SAP Enterprise Portal or distribute them by e-mail. In addition to the precalculated documents that contain historical data, you can also generate online links to queries and Web applications.

From the design tools BEx Query Designer and BEx Web Application Designer, you can publish queries or Web templates to any BW role or directly to the Enterprise Portal.

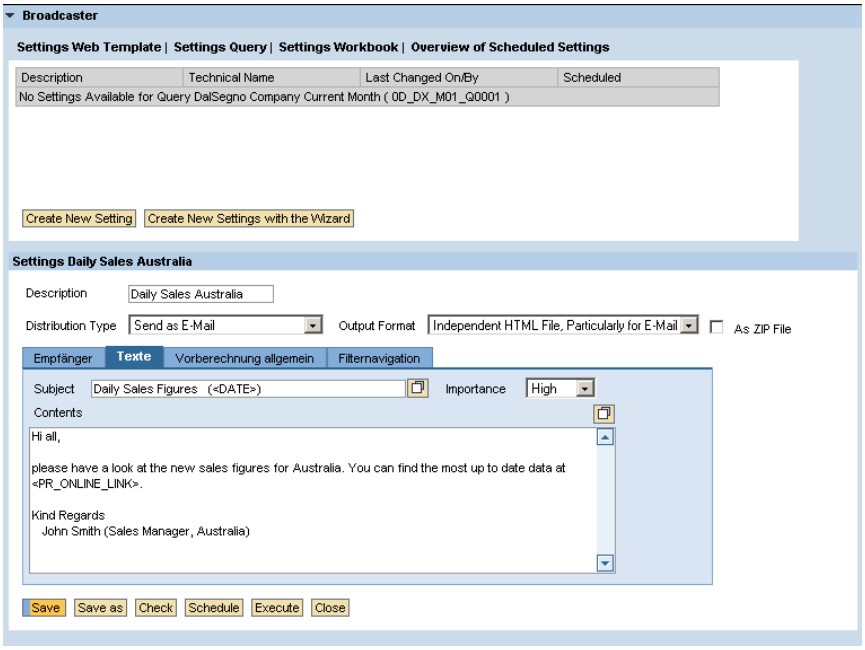
BEx Information Broadcasting is available in the various areas of the Business Explorer (BEx). The following overview illustrates how a wide spectrum of users has the possibility of distributing information:



3.6.1 BEx Broadcaster

The BEx Broadcaster is the tool for the precalculation and distribution of queries, Web templates and workbooks. When you distribute a query, Web application or workbook, you create a broadcast setting for it in which you determine, among other things, various parameters for the output format, for filter settings and for type of distribution.

In the upper area of the broadcaster, existing broadcast settings for the respective BW object (query, Web template or workbook) are displayed. If you create a new broadcast setting, then input fields appear in the lower area of the screen in which you can make your desired settings.



Depending on the application from which you call the BEx Broadcaster, the associated BW object is preset and you can start with the settings for distribution. However, if you want to distribute another BW object, you can select the desired BW object and distribute it.

You can call the BEx Broadcaster from the following areas:

- BEx Query Designer
- BEx Web Application Designer
- BEx Analyzer
- Standard Web Template for Ad-hoc Analysis
- BEx Web Analyzer

In BEx Web Applications, you can use the context menu to get to the broadcasting wizard, which is an assistant that helps you make the settings for distribution by providing step-by-step instructions. In the broadcasting wizard, you can also jump to the BEx Broadcaster to make more detailed settings. It is also possible to jump to the broadcasting wizard from the BEx Broadcaster.

From a technical viewpoint, the BEx Broadcaster is a Web item that you can insert into any Web application.

3.6.1.1 Output Formats

The following output formats are available to you for queries and Web applications:

Standalone HTML File
The system generates an MHTML file. All the components of the entire HTML page are combined in one file. The recipients are not able to navigate further in the generated file.
HTML with Separate MIME Files
The components of the HTML page are generated by the system in single files. The recipient can navigate between the various filter views for the query or the Web application.
Online Link to Current Data
The system generates a URL to the current navigational state of the query or Web application. Recipients can call the query or Web application and navigate further in it.

For workbooks, the output format is an **MS Excel File**. When they open the file, recipients get the formatted workbook in which they can navigate further.

To precalculate workbooks and generate MS Excel files, you need to install a precalculation server, which requires Windows with MS Excel 2000.
With all output formats it is possible to generate ZIP files. To generate ZIP files you need to install the SAP Internet Graphics Server (IGS) 6.40, which runs on various platforms.

3.6.1.2 Filter Settings

If you wish to have navigation options using filter values in the precalculated document, you can either enable filter navigation using individual characteristics or using a control query:

Filtering Using Selected Characteristics
The system precalculates multiple documents with different filter settings according to your selected settings. You can specify a maximum of two characteristics with their associated filter values. You can also insert an unfiltered view.
Filtering Using Control Queries
The system precalculates multiple documents with various filter settings. Filtering corresponds to the characteristic combinations of the specified control query.

3.6.1.3 Sending by E-mail

If you want to distribute the precalculated document or online link by e-mail, in addition to the various options for specifying recipients (via roles, SAP user name, e-mail address), you can also enter the text for the contents of the e-mail and the subject line manually or using text variables. You can also specify the importance of the e-mail and make settings for the language in which the document is to be generated.

3.6.1.4 Exporting to the Enterprise Portal

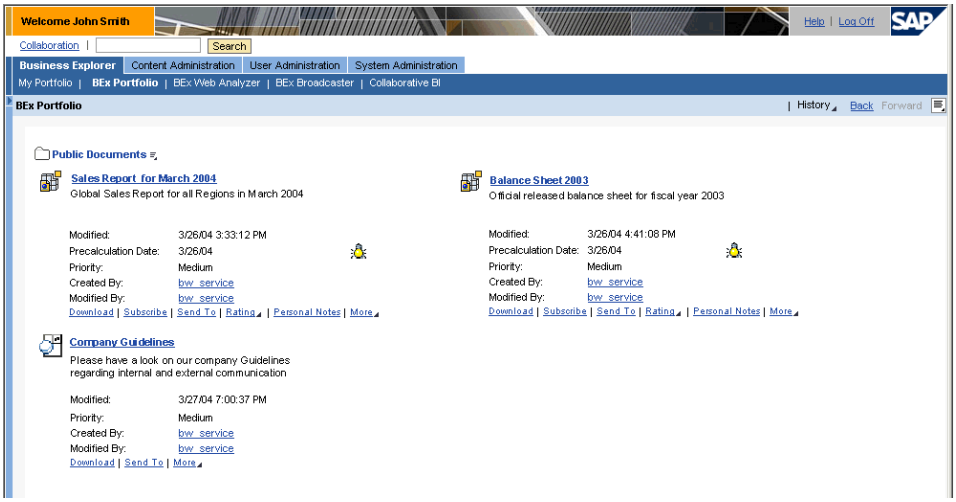
If you want to export the precalculated documents or online links to the SAP Enterprise Portal to make it available to your employees there, you can put it in a collaboration room or in a folder in Knowledge Management (KM folder).

The KM folders *Personal Documents* and *Public Documents* are especially useful for this purpose. In the SAP Enterprise Portal you access business intelligence information ideally from a central start page, for example in the BEx Portfolio, that presents the contents of the KM folder *Public Documents* with the special layout *Broadcasting*. The *Broadcasting* layout, which you can use for any KM folder, has been tailored to the special needs of users that use business intelligence content in the Enterprise Portal.

In the BEx Broadcaster, in addition to specifying the KM folder as the storage in the Enterprise Portal, you also specify the importance and language of the document or online link. This information is then displayed in the corresponding KM folder, for example in the BEx Portfolio with the *Broadcasting* layout.

When you are working with documents in the Enterprise Portal, the various functions of Knowledge Management are available. You can add ratings, evaluations, feedback and/or personal notes to the documents.
If you use the collaboration functions, you can have discussions with other employees using the precalculated documents or online links or you can work together in collaboration rooms. Using subscriptions, you can be automatically informed of changes to a document.

The *Business Explorer* portal role, which contains the BEx Portfolio, among other things, provides examples of the various options that are available to you when you are working with content from SAP BW in the Enterprise Portal.



3.6.1.5 Scheduling Broadcast Settings

You can either distribute the broadcast settings for the queries, Web applications or workbooks immediately or at a specific time. The users can select from various times preset by system administration. Users with the proper authorizations can set the time for scheduling of distribution themselves and can set period scheduling as required.
They can also determine that distribution be performed when there is a data change in the underlying InfoProvider.

3.6.2 Publishing Queries and Web Applications

In addition to the option of distributing the queries and Web applications using the BEx Broadcaster, the BEx Query Designer and the BEx Web Application Designer offer more distribution options.
Once you have created and saved a query or Web application, you can either make it available to other users that have BW roles or to users in the Enterprise Portal.

Publishing in a BW Role
The system saves a link to the current query or Web application in the BW role you have chosen.
Publishing in the Enterprise Portal
The save dialog appears, containing various views of the portal into which a Web template or a query can be saved. Depending on the view, the system generates either iViews in the portal or links in Knowledge Management.
The following views are available for selection in the save dialog:
My Portfolio
With *My Porfolio*, the system generates a link in Knowledge Management under the user's personal folder.
CM Repository View
With *CM Repository View* the system generates a link in Knowledge Management under the KM folder /documents.
Collaboration Room
Under *Collaboration Room*, a user's assigned rooms are displayed. The rooms can be created with the collaboration function and individual users or groups can be assigned to them. The system generates a link in Knowledge Management under the selected Collaboration Room.
Portal Content
With *Portal Content* the system generates an iView of the BEx Web Application or the query in the portal content catalog.
Portal Roles

The *Portal Roles* view displays the user's assigned portal roles. This view combines creation of iViews in the portal content catalog and assigning the iViews to a portal role or portal page. You can also generate links in Knowledge Management in the *Portal Roles* view.

For more information about options for integration into the SAP Enterprise Portal, see the section: In Integration into the Enterprise Portal.

4 Integration into the Enterprise Portal

You can integrate the business contents of the SAP Business Information Warehouse seamlessly into a SAP Enterprise Portal. The SAP Enterprise Portal enables you to access applications from other systems and sources, such as the Internet or Intranet. Using a single entry point, you can reach structure and unstructured information. Business data from data analysis is available in addition to content from Knowledge Management, from the Internet and from the Intranet.

The integration of SAP BW content into the SAP Enterprise Portal enables you to work more closely and more promptly with company colleagues when you need to do so. For example, this can be helpful when you need to insert notes and commentary for key figures and reports, run approval processes automatically, and in doing so, take part in decisions within a broad company context.

The provision of information is based on user roles in the company. Since the SAP Business Information Warehouse uses the role concept, a simple integration of SAP BW content into the portal can occur, and the SAP BW users see your SAP BW role in the portal of the same content.

Furthermore, you can also use the iView concept to integrate SAP BW applications and bring individual Web applications from SAP BW as an iView into the portal. There you can display and use them from a page in the portal, together with iViews from the SAP BW system or other systems.

BEx Information Broadcasting enables you to precalculate BEx Web applications, queries and workbooks and then to distribute them into the SAP Enterprise Portal. You can also generate online links to queries and Web applications and then publish them to the Enterprise Portal. The BEx Portfolio, based on Knowledge Management, forms the central entry point for access to business intelligence information in the SAP Enterprise Portal.

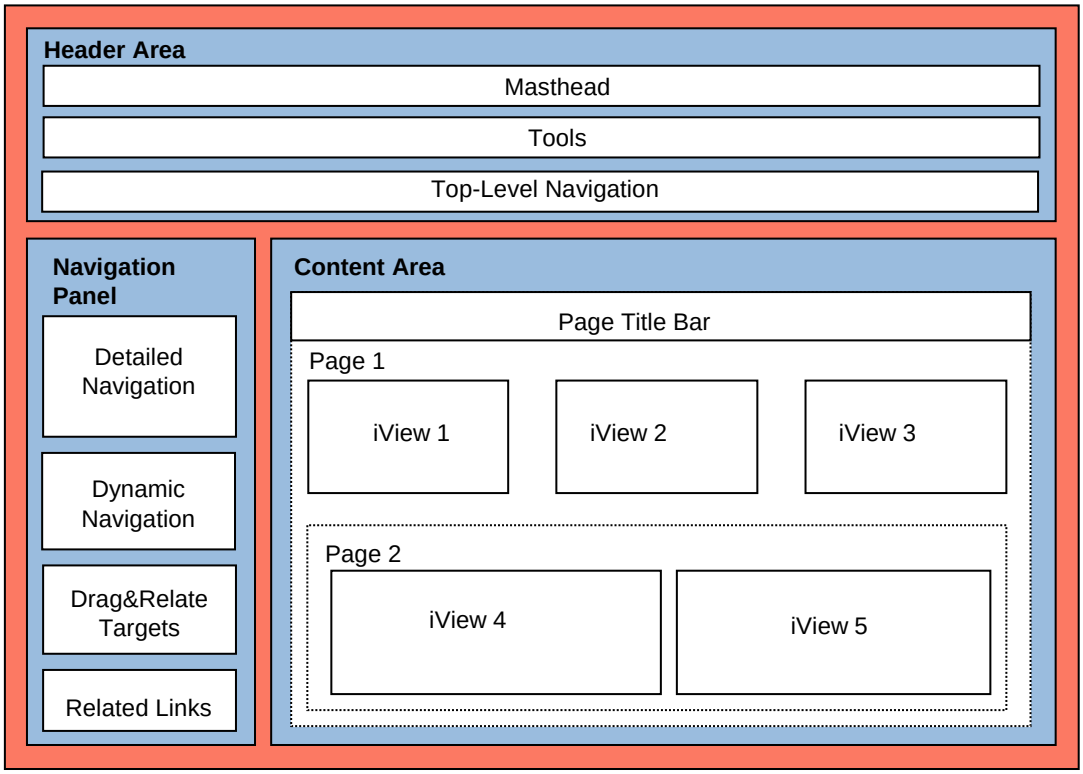
Using the repository managers for BW documents and BW metadata, you can integrate documents and metadata created in SAP BW into the Enterprise Portal and make it available to the users together with other documents from Knowledge Management.

The unification concept for the portal enables you to directly set contents from the SAP BW system with contents from other systems or from the Internet in relation to one another. With Drag&Relate you can link data together across system limits in order to obtain additional information.

4.1 Integration Options

The portal desktop refers to the entire portal screen including content and layout. As is shown in the following graphic, the portal desktop is divided into three main areas: header area, navigation panel and content area.

Portal Desktop



Portal Desktop

Integration of SAP BW and SAP EP mostly concentrates on the content area. In addition, the navigation panel also has a number of options for integration of BW content.

4.1.1 Displaying Content from SAP BW in the Enterprise Portal

The following types of content from SAP BW can be included in the content area of the Enterprise Portal:

BEx Web Application as an iView
You can use the BEx Web Application Designer, the BEx Query Designer or the Portal Content Studio to generate iViews with BEx Web Applications. A BEx Web Application as an iView displays the current data for the BW report. From a technical viewpoint, there is a direct call of the BEx Web Application in the BW system. You can combine the BEx Web Application as part of a portal page with other iViews from other systems in an iView.

Precalculated BEx Web Application as a Document in Knowledge Management
Using the BEx Broadcaster, you can precalculate BEx Web Applications and then store them as a document in Knowledge Management. The precalculated BEx Web Applications contain historical data for specific times. These documents can also be displayed in an iView.

BEx Web Application as a Link in Knowledge Management
Using the BEx Broadcaster and the BEx Web Application Designer, you can create links to BEx Web Applications in Knowledge Management. The links display the current data for the BW report. In contrast to BEx Web Applications as an iView, the call occurs indirectly via the repository manager for BW metadata.

BW Workbooks
You can include BW workbooks in the portal using the Portal Content Studio or SAP role upload. When the workbooks are called from the portal they open in a separate MS Excel window.

BW Documents
Documents and metadata created in SAP BW (especially documentation for metadata) can be integrated into Knowledge Management of the SAP Enterprise Portal using the Repository Manager. There they are displayed for the end user together with other documents in a directory structure. Single documents can also be displayed as an iView.

Web Interface (from BW-BPS)
A Web interface (from BW BPS) is a web-enabled planning application in the form of a business server page application (BSP application) that is created using the Web Interface Builder. You are able

to combine a Web interface as an iView (part of a portal page) with other iViews, such as BEx Web applications, for example.

Collaboration functions can also be applied to BEx Web applications as documents and links. Collaboration with BEx Web Applications as an iView is not possible.

4.1.2 Calling Content from SAP BW in the Enterprise Portal

The portal desktop is the entry page for calling content form SAP BW in the Enterprise Portal. The header area includes the initial navigation bar, which contains all initial folders for the assigned portal roles for a user. The initial entry takes place via the portal roles.

When a folder is selected, either an iView, a portal page in the content area or a subfolder in detailed navigation is displayed.

The following options are available to you when you call content from SAP BW.

- The BEx Web Applications as iViews are started directly from portal roles or portal pages.
- You can include the BEx Web Applications as documents and links in Knowledge Management (KM) as an iView. You can also display the documents and links for selection using the *BEx Portfolio* iView or KM navigation iViews.
  With the KM navigation iView, a complete folder from Knowledge Management is displayed. The KM navigation iView enables execution of collaboration functions on these documents and links. The BEx Portfolio is a special visualization of the KM navigation iView that is tailored to the needs of business intelligence users.

When portal roles are used, navigation is done via the initial navigation bar and detailed navigation. In contrast to this, navigation in Knowledge Management folders is done via the content area.

4.1.3 Content from SAP BW in the Navigation Panel

In addition to *Detailed Navigation*, the navigation panel also includes iViews for *Dynamic Navigation, Drag&Relate Targets* and *Related Links* that can also contain content from SAP BW.

Detailed Navigation automatically appears as it is needed if the second level of a portal role contains a folder with iViews and portal pages and thus further levels.

The three iViews *Dynamic Navigation, Drag&Relate Targets* and *Related Links* appear in the navigation panel when the displayed portal page or the iViews contain associated links to iViews. You can set up the links to iViews on the portal page and on each individual iView. All of the portal page links and the iViews they contain are shown in the navigation panel and are displayed as *Dynamic Navigation, Drag&Relate Targets* and *Related Links.*

With *Dynamic Navigation*, iViews themselves are displayed in the navigation panel. With *Drag&Relate Targets* and *Related Links*, the display is a list of links.

4.1.4 Generating Content from SAP BW for the Enterprise Portal

A wide spectrum of users have the option of publishing BW content to the Enterprise Portal. The tools are customized for various groups of users:

Overview of User Groups – Tools

User Groups	**Tools**
Information Consumer	Broadcasting Wizard
Knowledge Worker	BEx Broadcaster
Authors and Analysts	BEx Query Designer BEx Web Application Designer BEx Broadcaster

Administrators	Portal Content Studio KM Content SAP Role Upload

Information Consumers use the broadcasting wizard for ad-hoc distribution of BEx Web applications or queries as precalculated documents or links to Knowledge Management.

Knowledge Workers and authors can publish BW reports within SAP BW using the tools from the Business Explorer and can publish them to the Enterprise Portal:

- Web Applications are created with the **BEx Web Application Designer**. Here you can call the BEx Broadcaster for precalculation and distribution or you can publish the BEx Web applications directly to the Enterprise Portal as iViews or as links to Knowledge Management.
  Using the Web items ***Role Menu*** and ***Alert Monitor***, you can call content from SAP BW directly from a BEx Web Application that you have integrated into the portal as an iView. In the *Role Menu,* BEx Web applications, queries and external links of the selected role are displayed, to which you can jump. The *Alert Monitor* displays the list of queries in which an exception was found in the Reporting Agent. The Alert Monitor entries represent a jump option into the appropriate queries that are displayed with the standard Web for ad-hoc analysis template.
  You can insert both Web items into a BEx Web Application with the BEx Web Application Designer. Afterwards you can include this BEx Web Application in the portal as an iView. Due to the possibility of calling other content, both Web items are especially useful when they are included in dynamic navigation.
  You can also display alerts from SAP BW in the SAP Alert Framework Inbox in the Enterprise Portal that is the basis of the SAP Alert Framework of the SAP Web Application Server.
- Queries that are also used in BEx Web Applications can be created with the **BEx Query Designer**. Here you can also call the BEx Broadcaster or you can publish the BEx Web applications directly to the Enterprise Portal as iViews or as links to Knowledge Management.
- Precalculated documents and links to BEx Web Applications or queries in Knowledge Management are generated with the **BEx Broadcaster**.
- The **BEx Analyzer** is the platform for generating and editing BW workbooks. To precalculate and distribute BW workbooks to the Enterprise Portal, call the BEx Broadcaster from within the BEx Analyzer.
- Authors of planning applications generate the Web interfaces using the **Web Interface Builder from BW-BPS**. The Web interfaces can then be intergrated into the Enterprise Portal using the Portal Content Studio.

Portal administrators use the tools from the Enterprise Portal to integrate BW content:

- The **Portal Content Studio** is a tool within the portal that enables manual inclusion of content from SAP BW and specific setting of properties for iViews (for example for the portal cache for performance optimization). You can edit portal objects created in the Business Explorer with the Portal Content Studio.
- The **KM Content** from the *Content Administration* role in the SAP Enterprise Portal is the central environment in the Enterprise Portal for managing and creating content in Knowledge Management. In KM content, you get access to various BW documents in Knowledge Management.
- You can also integrate content from SAP BW into the Enterprise Portal using **SAP Role Upload**.

4.1.5 Working with Content from SAP BW in the Enterprise Portal

The Enterprise Portal offers a variety of options of communicating and collaborating with other portal users.

In **Collaboration Rooms**, groups of users can exchange context-relevant applications and information. The content from SAP BW can also be included there.

Discussions enable exchange of ideas on a specific topic using a document in Knowledge Management. Using BEx Information Broadcasting, you can precalculate BEx Web Applications and

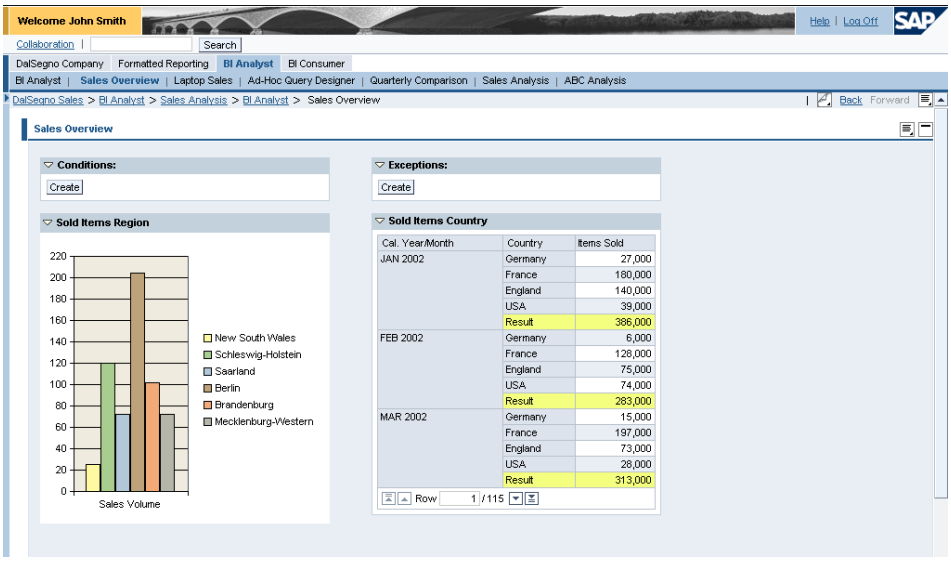
then store them as precalculated documents or links in Knowledge Management. You can have discussions based on these documents and links.

In addition to collaboration, Knowledge Management offers various functions for working with documents. You can add **ratings**, **valuations**, **feedback** and/or **personal notes** to the documents.

Subscriptions are especially significant for the precalculated documents that were automatically created with BEx Information Broadcasting. Using the subscription, the user can be automatically informed of each change (for example due to a new precalculation).

The various options for including collaboration functions with documents and links are clarified in the *Business Explorer* portal role.

The following example shows how you can work in the Enterprise Portal with BW content.



4.2 Unification in the Portal: Drag&Relate with BW Content in the Enterprise Portal

The unification concept is a concept aimed at integrating information sources within the SAP Enterprise Portal. The concept for the portal enables you to directly relate content from SAP BW directly to content from other systems or from the Internet. With Drag&Relate you can link data together across system limits in order to obtain additional information.
The function *Drag&Relate (D&R)* enables you to execute BW applications or other transactions with BW content (as filter values) across system boundaries by connecting data from one application with data in another application. You select a business object (for example, order) by clicking on it and dragging it into another object (for example, an iView with a link to an external Web site) in the *Drag&Relate Targets* area of the navigation panel and the system executes the action (for example, displays the delivery status of the order).

In contrast to the function *Jump via Report-Report Interface* in which the complete navigation status is transferred to the target, only one object and one key can be transferred with Drag&Relate. For example, you can drag the characteristic *Material* (0MATERIAL) to an R/3 transaction that contains information on the material. This navigation is made possible by the 1:1 key relationship between 0MATERIAL and the corresponding business object repository (BOR) object BUS 2001. For example, you can also drag the characteristic *Customer* 0CUSTOMER to an R/3 transaction that contains information on the characteristic if 0MATERIAL is a display or navigation attribute of 0CUSTOMER. To enable D&R between a BW characteristic and a BOR object, a 1:1 key relationship is required between a characteristic and a BOR object or between an attribute of the characteristic and the BOR object.

If you publish to the Enterprise Portal using the BEx Web Application Designer or the BEx Query Designer iViews, then these iViews are standard Drag&Relate targets and you can select these iViews as targets in other iViews.

You assign the iViews to a page. The selected targets for the current page appear in the *Drag&Relate Targets* area in the navigation panel. In the Drag&Relate enabled iViews, the D&R links appear automatically with the symbol and you can perform Drag&Relate in the associated targets. The Drag&Relate function with BW content in the Enterprise Portal enables the following navigation:

D&R from a BEx Web application to another BEx Web application (in the same BW system):
Click on the Drag&Relate symbol for a characteristic in the iView and drag it (by holding down the left mouse button) from the iView to another iView from SAP BW (BEx Web application) in the *Drag&Relate Targets* area of the navigation panel. The iViews are swapped and the iView to which you have dragged the characteristic using Drag&Relate is displayed, filtered by this characteristic.

D&R from a BEx Web application to objects in other systems:
If you have defined a correlation between the BW objects and objects from other back-end systems, you can Drag&Relate objects to and from these systems. The correlations can be created automatically, manually or using foreign key relationships.

The other system can, for example, be a SAP R/3 system. D&R from a BEx Web application to a SAP R/3 transaction:

Click on a characteristic (for example, sold-to party) in the iView and drag it (by holding down the left mouse button) from the iView to a SAP R/3 transaction in the *Drag&Relate Targets* in the navigation panel. The SAP R/3 system transaction is displayed and shows you the relevant information from this transaction for this characteristic (for example, the customer *Motormarkt Stuttgart GmbH*).

D&R from a SAP R/3 transaction to a BEx Web application:
You choose the D&R object (material, for example) in the R/3 transaction and drag it (by holding down the left mouse button) from the transaction to a BW query or a BEx Web application in the *Drag&Relate Targets* area in the navigation panel. The query or Web application is filtered according to the object (material, for example) and is displayed on the portal page.

D&R from a BEx Web application to a Web site:

If you have inserted an iView with the URL of a Web site in the *Drag&Relate Targets* area, you can drag the D&R link to this Web site.

D&R to www.yahoo.de:

The characteristic Order has a logical relationship to the characteristic *Customer* and the Yahoo search site is connected to the customer information text.

Click in the Web application on the symbol of the characteristic *Order* and drag it (by holding down the left mouse button) from the iView to the URL www.yahoo.de in the *Drag&Relate Targets* area in the navigation panel. The Yahoo! Web site appears with the text for the customer.

5 Development Technologies

SAP BW provides various developer technologies:

- The Open Analysis Interfaces provide you with various interfaces for connecting front-end tools from third-parties.
- The Web Design API and the table interface enable you to create highly individualized scenarios and sophisticated applications with customer-specific interface elements.
- The BI Java SDK enables you to create analytical applications with which you can access both multidimensional (Online Analytical Processing or OLAP) and tabular (relational) data. You can also edit and display this data.
- The BI Java Connectors, which are a group of four JCA-enabled (J2EE Connector Architecture) resource adapters, implement the APIs of the BI Java SDK and enable you to connect the applications that you have created with the SDK to various data sources.

5.1 BI Java SDK

With the Business Intelligence Java Software Development Kit (BI Java SDK) you can create analytical applications with which you can access both multidimensional (Online Analytical Processing or OLAP) and tabular (relational) data. You can also edit and display this data. This was created for Java developers that have experience with business intelligence and who use business intelligence to fulfill their current requirements.
Although the primary intention of the SDK is to simplify programming with the BW OLAP engine within a Java environment, the application programming interfaces (APIs) can also be used to access non-BW and even non-OLAP data sources, such as relational JDBC data sources. This allows programmers to work with a single uniform approach throughout the development of an application.
The BI Java SDK provides an object-oriented framework in which to:

Connect to a variety of data sources

Access master- and metadata

Create and execute complex queries

Render and access query results sets

A driver-based architecture supports access to different data formats using a variety of protocols, for example:

JDBC (Java Database Connectivity)

OLE DB for OLAP

SAP Query

XML for Analysis (XMLA)

The BI Java SDK can be a solution in the following cases:

When information that you need for an analytical application is stored in SAP BW but is available only in disparate objects.

When you do not have the requisite time or budget to quickly develop an additional InfoProvider for a particular application.

BW does not offer the inherent simulation capabilities you need. When the usage of variables in formulas and the deployment of Business Planning and Simulation (BPS) seem like overkill for a rather simple business problem, although BW offers these solutions.

When Java developers wish to leverage their know-how and the flexibility of custom application design together with the ease of integration and deployment of SAP NetWeaver.

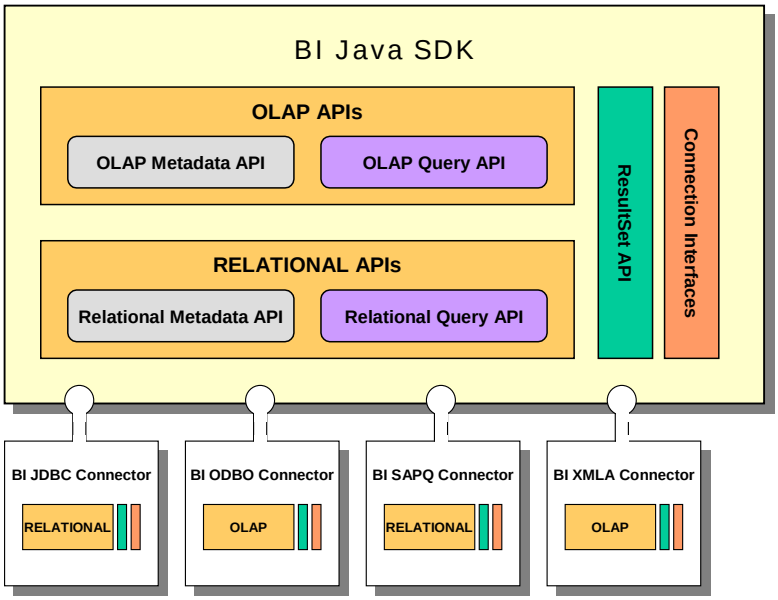
When you want to integrate data from both relational and multidimensional (OLAP) data sources into one application.

When you want to create an analytical application that includes data from a non-SAP data source.

5.1.1 Components of the SDK

5.1.1.1 Application Programming Interfaces

The following diagram illustrates the APIs of the BI Java SDK:



As pictured above, the BI Java SDK consists of the following APIs:

1. OLAP APIs:
   - OLAP metadata API, for accessing OLAP metadata
   - OLAP query API, for creating, processing, navigating queries against an OLAP data source.
2. Relational APIs:
   - Relational metadata API, for accessing relational metadata
   - OLAP query API, for creating, processing, navigating queries against a relational data source.
3. Common ResultSet API, for accessing and rendering OLAP or relational results sets
   - Connection interfaces

5.1.1.2 Documentation

A complete documentation set is shipped inside the SDK distribution package. It includes a Developer's Guide with step-by-step tutorials, Javadocs including package and overview documentation, and an HTML navigation that ties the SDK distribution package and its documentation together. Launch the package from the ***index.html*** file located in the root of the unpackaged distribution archive.

5.1.1.3 Examples

SDK examples provide easy-to-use Java servlets that demonstrate many aspects of our query APIs, as well as step-by-step connection instructions. Refer to the SDK's HTML documentation set, or the Developer's Guide, both included in the distribution package, for complete descriptions of the examples.

5.1.2 Overview of the SDK Architecture

The SDK's components are architected to simplify the integration of data from diverse data sources by displaying a unified metadata model and common access interface. We leverage the concepts of open

standards such as the Java Metadata Interface and the Common Warehouse Metamodel to support accessing and representing metadata. This approach hides the complexity and details of the underlying communication and access protocols (such as HTTP), enabling you to focus instead on your specific business requirements.

This approach also allows for applications to be written only once for different types of data sources and operating systems.
Developers therefore do not need to understand the specifics of a particular system.
Our driver-based architecture allows you to use a set of connectors, the BI Java Connectors, to connect applications to SAP data sources such as the SAP Business Information Warehouse, as well as to non-SAP data sources such as relational JDBC-based databases.

An additional key architectural feature of the SDK is the use of OLAP and Relational Query Models. These models provide interfaces for defining complex multidimensional or relational queries without negotiating the details and complexity of the specific query language—for example, MDX in the case of OLAP data sources. You need only interact with a simplified command processor.

5.2 BI Java Connectors

BI Java Connectors are a group of four JCA (J2EE Connector Architecture)-compliant resource adapters. They implement the BI Java SDK's APIs and allow you to connect the applications you build with the SDK to heterogeneous data sources.
You need at least one BI Java Connector in order to use the BI Java SDK or UD Connect with a data source. The BI Java Connectors can be deployed onto SAP NetWeaver's J2EE Web Application Server.
Four BI Java Connectors are available:
BI JDBC Connector, for connecting to relational JBDC data sources
BI ODBO Connector, for connecting to OLE DB for OLAP-enabled data sources
BI SAP Query Connector, for connecting to data from SAP operational applications
BI XMLA Connector, for connecting to XMLA-enabled data providers such as SAP BW

Connector Overview

Connector	Access To	Technology Based On	System Requirements
BI JDBC Connector	Relational data sources: over 170 JDBC drivers *Examples:* Teradata, Oracle, Microsoft SQL Server, Microsoft Access, DB2, Microsoft Excel, text files such as, for example, CSV files	Sun's JDBC (Java Database Connectivity) –the standard Java API for relational data base management systems (RDBMS).	JDBC driver
BI ODBO Connector	OLAP data sources: OLE DB for OLAP-compliant data sources *Examples:* Microsoft Analysis Services, SAS, Microsoft PivotTable Services	Microsoft's OLE DB for OLAP – the established industry standard OLAP API for Windows platform.	Microsoft Windows 2000 / NT / XP
BI SAP Query Connector	SAP operational applications *Examples:* Data in transactional systems such as R/3, Ad-hoc- and Operational Reporting	SAP Query -- a component of SAP's Web Application Server that allows you to create custom reports without any ABAP programming knowledge	SAP JCo
BI XMLA Connector	XMLA-compliant OLAP data sources	Microsoft's XMLA (XML for Analysis) --	None

	Examples: MS Analysis Services, Hyperion, MicroStrategy and BW 3.x	Web services-based, platform-independent access to OLAP providers. Exchanges analytical data between a client application and a data provider working over the Web, using a SOAP-based XML communication API.	

6 Glossary

Administrator Workbench

Tool for controlling, monitoring, and maintaining all of the processes connected with data staging and processing in the Business Information Warehouse.

aggregate

Saves the dataset for an InfoCube redundantly and persistently to the database.

When an aggregate is built from the characteristics and navigation attributes of an InfoCube, the data can be grouped according to various aggregation levels. Characteristics that are not used in the aggregate, are brought together.

New data is loaded using logical data packages (requests) in an aggregate. In regard to loading data, we differentiate between filling and rolling up.

Aggregates make it possible to access InfoCube data quickly in Reporting. Aggregates also thus help to improve performance.

aggregation level

Virtual InfoProvider in SAP BW. Aggregation levels are used in planning as InfoProviders, allowing you to plan data manually or make changes to data using planning functions.
An aggregation level contains a set of characteristics and key figures from a real-time InfoCube. The InfoCube characteristics that are not contained in the aggregation level are aggregated. Selections can be specified for the characteristics in an aggregation level. The following restrictions apply with key figures in an aggregation level:
Only key figures that can be totalled can be used. Key figures with the data type TIMS or DATS cannot be used.

Alert Monitor

Monitoring tool to display exceptions the threshold values of which were exceeded or not reached.

The anomalous exceptions are found in background processing with the Reporting Agent and are displayed as follow-up actions in the alert monitor. Exceptions are displayed both in the BEx Analyzer and the Reporting Agent Scheduler of the Administrator Workbench. In addition, you can display exceptions as alert monitors in a Web application .

Meaning in Web applications:

A Web item that displays the query views found using the Reporting agent in the background. They are displayed as a list or a hierarchy in a Web application. You can jump to the query views and instantly see eye-catching key figure values that differ from defined threshold values. You can also set filters.

analysis process

Calculation of data transformations on mass data within an analytical application.
An analysis process enables:

- Reading and combining data from any data sources in the BW system
- Serial switching of transformations
- A preview of calculated data at a specific part of the process
- Saving calculation results

Analysis Process Designer

Tool for modeling an analysis process.

The analysis process designer provides a graphic interface for modeling analysis processes. An analysis process is created using nodes and data flow arrows. The nodes stand for data sources, transformations and data targets. The data flow arrows model a sequence in which data is read and transformed.

attribute

InfoObjects that are logically subordinate to a characteristic and that cannot be selected in the query.

Special forms of attributes include navigation attributes and display attributes. Navigation attributes can be selected in the query; display attributes can not be used as standalone characteristics - instead they can only be displayed for the characteristic to which they are assigned as an attribute.

Example:

You can assign the attributes

- ‘Cost center manager’ (characteristic as attribute)
- ‘Size of cost center in square meters' (key figures as attribute)

to a cost center.

BEx Broadcaster

Tool for precalculation and distribution of queries, Web templates and workbooks.
Using the BEx Broadcaster, you can generate both precalculated documents and online links and distribute them by E-mail or publish to the Enterprise Portal.

BEx Download Scheduler

Assistant for downloading precalculated Web templates as HTML pages from the BW server to the PC.

BEx Information Broadcasting

Function that allows you to provide business intelligence information to a wide spectrum of users. Distribution of information takes place either by e-mail or in the Enterprise Portal, which serves as the central entry point and enables functions of knowledge management and collaboration while working with content from SAP BW.

BEx Map

A geographic information system (GIS) of the Business Explorer that allows you to display data with a geographic reference (for example characteristics such as customers, sales region, country) together with relevant business key figures on a map and to evaluate it there.

BEx Mobile Intelligence

Use of Web Applications for mobile devices that have an online connection to the BW system.

BEx Portfolio

KM navigation iView that contains the layout “ Broadcasting” , which is tailored to the special needs of users that use business intelligence content in the Enterprise Portal.
The BEx Portfolio indicates a generally accessible KM folder under /documents.

BEx Query Designer

Tool to define queries that area based on a selection of characteristics and key figures (InfoObejcts) or reusable structures from an InfoProvider.

You can parameterize the queries in the BEx Query Designer by defining variables for characteristic values, hierarchies, hierarchy nodes, texts of formulas. You are able to select InfoObjects more precisely by:

- Restricting characteristics and key figures by characteristic values, characteristic value intervals, and hierarchy nodes.
- Defining calculated and restricted key figures for reuse.
- Defining structures for reuse
- Defining exceptions
- Defining conditions
- Defining exception cells

All queries that you define in the BEx Query Designer can be used for both OLAP reporting and for tabular reporting.

BEx Web Analyzer

Standalone BEx Web application for data analysis that can be called using an URL or as an iView in the Enterprise Portal.

BEx Web Application

Web-based application of the Business Explorer for data analysis, reporting and analytical applications in the Web.

You can prepare and display your data in various ways in the BEx Web Application Designer with a number of Web items (table, filter, chart, map, documents, etc.). In this way you can create Web applications such as BI Cockpits separately and access them via the Intranet or an Enterprise Portal.

BEx Web Application Designer

A desktop application for creating Web pages using BW content.

Use the BEx Web Application Designer to create a HTML page that contains BW-specific content, such as tables, charts or maps. This HTML page functions as a basis for Web applications with complex interactions, such as BI cockpits. You can save the Web applications as a URL and access them from an intranet or on mobile devices. In addition, you can save Web applications as iViews and integrate them into an enterprise portal.

Business Content

Pre-configured set of role and task-relevant information models based on consistent metadata in the SAP Business Information Warehouse. Business Content provides selected roles within a company with the information they need to carry out their tasks.

These information models essentially contain roles, workbooks, queries, InfoSources, InfoCubes, ODS objects, key figures, characteristics, update rules and extractors for SAP R/3, mySAP Business Applications and other selected applications.

Business Explorer

SAP Business Information Warehouse component that provides flexible reporting and analysis tools for strategic analyses and decision-making support within a company.

Business Explorer Analyzer

Analysis and reporting tool for the Business Explorer that is embedded in Microsoft Excel.

In the Business Explorer Analyzer, you can analyze the selected InfoProvider data by navigation to the query created in the BEx Query Designer and create different query views of the data.

Business Explorer Browser

Tool for organizing and managing workbooks and documents.

Using the Business Explorer Browser (BEx Browser), you can access all types of documents in the Business Information Warehouse that are assigned to your role or that are stored in your favorites.

You can work with the following types of document in the BEx Browser:

- BW workbooks
- Documents that are stored in the Business Document Service (BDS)
- Links (references to file system, shortcuts)
- Links to Internet sites (URLs)
- SAP transaction calls
- Web applications and Web templates
- Crystal Reports

Business Intelligence Cockpit

Abbreviation: **BI cockpit**

Synonyms: **Web cockpit, information cockpit**

Web-based „control panel“ with business intelligence content that - similar to a cockpit in an airplane - displays an overview of all of the business data that is relevant for a company’s management.

With the Business Explorer Web application designer, you can create individual BI cockpits that display the relevant data in tables, charts or on maps. Critical data that has exceeded defined thresholds can be seen clearly at a glance via an alert monitor integrated into the BI cockpit. Beyond that, you have the option of inserting additional information about the business data in the form of documents, sketches, or hyperlinks.

BI cockpits provide the following options:
- Data from various data sources can be combined and visualized in a number of ways (tables, charts, maps, etc.)
- Structure (BI contents) and unstructured (documents, etc.) information complement one another
- Personalized entry: Parameters are automatically filled with user-specific values (for example in relation to cost centers, regions, and so on).
- Role-specific variants: different BI cockpits for various roles

You have a quick overview of various types of business information like on the front page of a newspaper. You can perform detailed requests using the easy-to-use navigation elements, such as hyperlinks, dropdown boxes, buttons, and so on.

Business Planning and Simulation

Abbreviation: **BW-BPS**

Components of the SAP Business Information Warehouse that provide flexible tools for creating planning applications in companies. The main elements are: :

- OLAP-based multidimensional modeling
- Planning functions
- User interfaces for all employee roles
- Management of the planning process

Retraction of plan data to operational systems

characteristic

Type of InfoObject.

Evaluation groups such as company code, product, customer group, fiscal year, period, or region.

Characteristics provide classification options for the dataset. An InfoCube generally only contains a partial quantity of the characteristic values from the master data table. Master data comprises the permitted values of a characteristic – the characteristic values. Characteristic values are discrete names.

The characteristic “region” has the following values, for example:

- North
- Central
- South

classic InfoSet

View of a dataset that can be evaluated using the InfoSet query.

A Classic InfoSet determines which tables or fields within a table an InfoSet Query refers to.

The Classic InfoSet for BW corresponds to the InfoSet as an element of the SAP query from the SAP Web application server. Classic InfoSets were called InfoSets before BW 3.0. After BW 3.0, however, InfoSet refers to the new InfoProvider for BW.

communication structure

The communication structure is independent of the source system and has the structure of an Info Source. It contains all InfoObjects that belong to an InfoSource.

Data is updated in the InfoCubes from this structure. In this way, the system always accesses the actively saved version of the communication structure.

The technical properties (such as length, type) of the communication structure fields correspond to those of InfoObjects from the Business Information Warehouse.

data mart interface

Enables the updating of data from a data target into another data target.

The data mart interface enables updating on the one hand, within a BW system (myself system) and on other hand, between multiple systems. When using multiple BW Systems, the system delivering the data is referred to as the *Source BW,* the system receiving the data is then the target BW*.* The individual Business Information Warehouses arranged in such a way are called data marts.

data provider

An object that provides data for one or more Web items.

A data provider reflects a query's navigation status for a specific point in time. The initial view of a data provider corresponds to the query view. You can change the status of the *data provider* by navigating through the data or by setting parameters for the call up.

data request

Designates:

- The request that is transmitted to the source system via the scheduler, and
- The amount of data and information that result from this request in SAP BW and in the source system, and
- the load process.

data target

Data load view of a BW object with physical data storage.
These objects include InfoCubes, ODS obejcts and InfoObjects (characteristics with attributes, texts or hierarchies). They are different from pure data targets for which queries cannot be created or executed and data targets for which queries can be defined. The latter are also called InfoProviders.

DataSource

Object that provides the SAP BW with the data for a business unit.
Technically speaking it contains a number of logically related fields arranged in a flat structure used to transfer data into the BW.

DB Connect

Enables connection between different relational database management systems and the transfer of data from tables or views from these database management systems into the SAP Business Information Warehouse.

delta queue

Data store in the source system of a BW.
The data records written to the delta queue automatically via an update process in the source system or after a data request from BW via extraction by means of a function module.
When there is a BW Scheduler delta request, the data is transferred into BW.

delta process

Property of the extractor. Indicates how the data will be transferred. As a DataSource attribute, it specifies how the DataSource data is passed on to the data target. From this you can derive, for example, for which data a DataSource is suited, and how the update and serialization are to be carried out.

dimension

Grouping of classification groups (characteristics) that logically belong together as regards content, under one generic term.

When defining an InfoCube, characteristics for dimensions are grouped together to store them in a table of the star schema (dimension table).

EPOC32

32 Bit, multi-threading operating system that is optimized for mobile devices such as Smartphones and PDAs. EPOC32 is from Symbian, which is a joint venture developed by Ericsson, Motorola, Nokia and Psion.

extractor

A program that fills the extraction structure of a DataSource with the data from the SAP source system datasets.

extract structure

Structure in which data from a DataSource is staged in the source system.

The extract structure contains the quantities of the fields that are offered by an extractor in the source system for the data loading process into BW.

fact table

Table in the cent the start scheme of an InfoCube.

The data portion contains all key figures for the InfoCube and the key is formed using links to the entries for the dimensions of the InfoCube.

foreign key relationship

The relationship that exists between particular fields of a table ‘A’, and the key fields of a table ‘B’, when all the foreign key values that occur in ‘A’ correspond to the primary key values in ‘B’

The BW analysis and repair environment checks this as the criteria for referential integrity.

hierarchy

Tree-like structuring of the characteristic values of a characteristic. Example: Hierarchies of cost centers that are compiled in cost center groupings

You can set characteristic hierarchies in Reporting in the following ways:

- As a presentation hierachy for a characteristic if this is to be displayed as a hierarchy
- As a selection for certain characteristic values if a characteristic is to be restricted to a hierarchy or hierarchy node

Hierarchies can be loaded into the BW system or create din the BW system on hierarchy basic characteristics. They can be used across InfoProviders.

InfoCube

Objects that function both as a data target and as an InfoProvider.

An InfoCube describes (from a reporting point of view) a self-contained dataset, for example, of a business-orientated area. This dataset can be evaluated using a BEx query.

An InfoCube is a number of relational tables, that are summarized according to the star schema: a large fact table in the middle and several dimension tables on the periphery.

InfoObject

Business evaluation objects (customers, sales revenues...) are known in BW as InfoObjects.

InfoObjects are divided into characteristics, key figures, units, time characteristics and technical characteristics (for example, request number).

InfoPackage

Describes which data for an DataSource should be requested from a source system. You can use selection parameters to select specific data (for example, exclusively controlling area 001 in period 10.1997).

An InfoPackage can request the following data types:

- Transaction data
- Attributes for master data
- Hierarchies for master data
- Master data texts

InfoProvider

Analysis view of a BW object for which queries can be created or executed in SAP BW.

One type includes objects that contain physical data These are known as data targets such as InfoCubes, ODS objects and InfoObjects (characteristics with attributes, texts or hierarchies). The other type includes objects that do not represent physical data storage, such as InfoSets, RemoteCubes, SAP RemoteCubes and MultiProviders.

InfoSet

InfoProvider: A semantic layer above ODS objects and InfoObjects (characteristics with master data), that allows you to create reports on these objects, particularly on the joins between these objects.

Unlike the classic InfoSet, this view of the data is BW specific. InfoSets are created and changed in the InfoSet builder. Reports can be defined using the Query Designer based on InfoSets.

InfoSource

A quantity of all available data for a business event or type of business event (example: cost center accounting).

An InfoSource is a quantity of information that logically belongs together, summarized into a single unit. InfoSources contain transaction data and master data (attributes, texts and hierarchies).

An InfoSource is always a quantity of logically related InfoObjects. The structure in which these are stored is called a communication structure.

InfoSpoke

Object for the export of data within the open hub service.

The following aspects are defined in the InfoSpoke:

- From which open hub data source the data is extracted,
- Into which extraction mode
- Into which open hub destination the data is delivered.

Internet Communication Framework (ICF)

HTTP framework that provides an ABAP interface for HTTP requests.

A message handler is addressed by the framework via a URL that can be used to address the message.

key figure

Value or quantity.

In addition to the key figures saved in the database, you have the option of defining calculated (derived) key figures in the Business Explorer. Such key figures are calculated using a formula from the key figures of the InfoCube.

Examples of key figures:
Sales, fixed costs, sales quantity or number of employees

Examples of derived key figures:

Sales per employee, deviation in percent or contribution margin.

master data ID

Internal key of type INT4 that you use for master data from master-data bearing characteristics, especially for hierarchy nodes and for characteristic names.

Master data IDs (SIDs) and characteristic values are stored in a master data table (SID table).

Information about time-independent or time-dependent master data that is stored in a P- or Q table is saved again in an X or Y table.

master Web item

Template for a Web item.

The master Web item determines the type of the Web item (for example, table, filter, chart, map, and so on) and includes default values for the attribute of each Web item. The various master Web items are available on the „standard“ tab page in the BEx Web Application Designer and in the BEx Web Application Wizard. You choose a master Web item from the list, assign a data provider to the Web

item and edit the attributes. You have now created your own Web item that your can add to your Web template or save in the library to be used again as needed. The Web items saved in the library can then adopt the character of a master Web item and can be used as a template for other Web items.
Example:
You take the „Chart“ master Web item and create various master Web items for your library: bar charts, column charts, pie charts, tachometers and so on.

message interface

An interface object in Exchange Infrastructure that describes the communication between application components.

It references one (synchronous communication) or two message types (asynchronous communication) and can also reference fault message types.

The description of a message interface can be retrieved using Web Services Description Language (WSDL).

Message interfaces are not platform-specific. They are used to generate proxies for various platforms.

Metadata Repository

Provides central access to information about metadata objects for the Business Information Warehouse:

- About active objects in the system (activated objects)
- About the SAP delivery objects in the system (Business Content)

The Metadata Repository provides the following functions:

- Searching for metadata
- Exporting HTML pages
- Graphical object display

Further functions for metadata:

- Metadata exchange between various systems (transport connection)
- Creation of documents for metadata objects and the option of displaying them as online documentation (*document management)*

metadata

Data about data. Metadata describes data models.

MOLAP

Multidimensional Online Analytical Processing

Multidimensional data storage in special data structures that are based on arrays or cubes.

MOLAP is used mostly in comparison with or as an alternative to ROLAP.

MOLAP aggregate

Aggregate of a MOLAP cube.

The aggregate – like the MOLAP cube itself – is stored in a MOLAP store.

MOLAP cube

Basic cube, the data of which is physically store in a MOLAP store.

monitor

The monitoring tool of the Administrator Workbench

Using the monitor, you can oversee the data request and processing in the Business Information Warehouse.

multi-planning area

Planning area that combines the characteristics and key figures of several planning areas.
A multi-planning area does not contain its own data, instead it is completely based on the data of the standard planning area, which is defined in the same system. The planning areas combined in a multi-planning area can be identified by a characteristic that is generated automatically within the multi-planning area and can be referred to for selection purposes.

MultiProvider

Type of InfoProvider that combines data from a number of InfoProviders and makes them available as a whole to reporting.

The MultiProvider does not contain any data itself, its data comes from the InfoProviders on which it is based that are grouped by a union operation. It can be comprised of different combinations of InfoProviders.

MultiProviders are, like InfoProviders, the objects or views that are relevant for reporting.

Myself System

System that is connected to itself for data extraction using the data mart interface.

In this way, the user can update data from one data target into other data targets.

navigation

Analysis of the InfoProvider data by displaying different views of the data for a query or a Web application.

With the aid of the various navigational functions, such as:

- Keep as filter value
- Add drilldown according to

you can generate different views of the data (query views) that are presented in the results area of the query or in a Web application. Switching between the different views is called navigation.

object tag

A placeholder in the Web template that begins with <object> and ends with </object>.

You can use object tags to create data providers and Web items in a Web template.

ODS object

Object that acts as a storage location for consolidated and cleansed transaction data on a document (atomic) level.

An ODS object describes a consolidated dataset from one or more InfoSources. This dataset can be evaluated using a BEx query.

An ODS Object contains a key (for example, document number/item) as well as data fields that can also contain character fields (for example, customer) as key figures. The data from an ODS object can be updated with a delta update into InfoCubes and/or other ODS objects in the same system or across different systems.

Unlike multi-dimensional data storage using InfoCubes, the data in ODS objects is stored in transparent, flat database tables.

OLAP reporting

Reporting based on multidimensional data sources (InfoProviders).

OLAP reporting allows you to analyze several dimensions at the same time (such as time, location, product and so on). The goal of OLAP reporting is the analysis of key figures, such as an analysis of sales of a specific product over a specified period of time. The business questions that you have are formulated into a query that contains key figures and characteristics that are required for analysis and to answer the question. The data, displayed in the form of a pivot table, serves as the start point for a detailed analysis to answer a variety of questions.

A large number of interaction options, such as sorting, filtering, swapping characteristics or recalculating values allow flexible navigation through data for the runtime.

In the Business Information Warehouse, you can analyze data in the Business Explorer in the following areas:

- in the BEx Analyzer in the form of queries
- In BEx Web Applications

open hub service

Service that enables you to share data from an SAP BW system with external data marts, analytical applications, and other applications.

With the open hub service you can ensure the controlled distribution and consistency of data over several systems.

operational data store

A data administration layer that saves data in flat, transparent tables.

This layer can make data available in realtime and enables operational reporting.

persistent staging area table (PSA Table)

Transparent database table in which request data is stored in the form of the transfer structure. A PSA is created for each DataSource and each source system. It is the storage location for incoming data in BW. Requested data is saved, mostly unchanged, to the source system.

planning package

Selection of data in which planning functions operate.
A planning package is used to define a selection for those characteristics where no selection was already defined in the planning level. In the case of a complete data selection in the planning level, a planning package must also be available in order to execute planning functions.

planning sequence

List of user-defined planning functions or parameter groups that are processed sequentially in the order determined by the list.
Planning sequences are used to execute recurrent complex planning tasks as efficiently as possible. These can be defined both locally within a planning area and globally across several planning areas.

process chain

Sequence of processes that are scheduled in the background to wait for an event. Some of these processes trigger another event that can start other processes in turn.

query

Collection of a selection of characteristics and key figures (InfoObjects) for analysis of the data of an InfoProvider.

A query always refers exactly to one InfoProvider, whereas you can define as many queries as you like for each InfoProvider.

You define a query in the BEx Query Designer by selecting InfoObjects or reusable structures of an InfoProvider and determining a view of the data (query view) by distributing filters, rows, columns and free characteristics. You save the start view of the query defined in the Query Designer in your favorites or roles. You use this saved Query View as the basis for data analysis and reporting in the BEx Web Analyzer, in BEx Web Applications, in BEx Mobile Intelligence or in formatted reporting.

RemoteCube

InfoCube whose transaction data is not managed in the Business Information Warehouse but externally.

Only the structure of the RemoteCube is defined in BW. The data is read for reporting using a BAPI from another system.

Reporting Agent

Tool for scheduling reporting functions in the background. The following functions are available:

- Evaluating Exceptions
- Printing Queries
- Pre-calculating Web templates
- Precalculating characteristic variables of type precalculated value sets
- Precalculation of queries for Crystal reports
- Managing bookmarks

RFC

Remote Function Call.

RFC is a SAP interface protocol based on CPI-C. It is used to simplify the programming of communication processes between systems.

With RFCs, predefined functions can be called and executed on a remote system – or within the same system.

RFCs manage the communication process, parameter transfer and error handling.

ROLAP

Store for multidimensional data in a relational database in tables that are organized in a stare scheme. The opposite of ROLAP is MOLAP.

SAP BW Service API

Technology package in the SAP source system that enable high integration of data transfer from SAP source systems into a BW system.

The Service API allows you to:

- Make SAP application extractors available as a basis for the transfer of data into a BW.
- Carry out generic data extraction.
- Implement (intelligent) delta methods
- Access source system data directly in BW (RemoteCube support)

Abbreviation: SAPI

SAP Exchange Infrastructure

With the SAP Exchange Infrastructure (SAP XI), you can create cross-system business processes.

Within the overall architecture of SAP NetWeaver, SAP XI solves the problems of process integration. To be more precise, it enables different versions of SAP and non-SAP systems from different vendors running on different platforms (for example, Java ABAP, and so on) to communicate with each other.

SAP XI is based on an open architecture, primarily uses open standards, (in particular those from the XML and Java environments), and offers services that are essential in a heterogeneous and complex system landscape: runtime infrastructure for exchanging messages, configuration options for managing business processes and the flow of messages, and options for transforming the content of messages between senders and receivers.

SAP Java Connector

A middleware component that facilitates the development of SAP-enabled components and applications in Java.

The SAP Java Connector (JCo) supports communication with the SAP server in two directions: Inbound (Java calls ABAP) and Outbound calls (ABAP calls Java).

SAP JCo can be deployed with desktop and (Web) server applications.

SAP Web Application Server (SAP Web AS)

A key functional area of mySAP Technology that supports native Internet technology, such as HyperText Transfer Protocol (HTTP), eXtensible Markup Language (XML), and Java as well as ABAP.

AP Web Application Server enables fast development of individual Web applications with server-side scripting technologies; provides a scalable and reliable Web application infrastructure that delivers Web services at high performance and ensures an e-business solution is always online; supports Web access via a Web browser and a range of mobile devices.

SAP Web AS J2EE Engine

The SAP proprietary Java application server, complying with the Java 2 Enterprise Edition standard.

SAP XI Integration Server

Server that contains a centrally configured Integration Engine as well as other integration services, and that is only used for integration purposes.

scheduler

Using the scheduler you can determine when and from which InfoSource, DataSource, and source system, data (transaction data, master data, texts or hierarchies) is requested and updated.

SOAP

Simple Object Access Protocol. The current SOAP specification can be found on the homepage of the World Wide Web Consortium (W3C).

source system

System that is available to the Business Information Warehouse for data extraction.

staging

Data retrieval processes in a data warehouse.

standard Web template

A Web template that is used as the default for Web display of specific BEx functions.
The following standard Web templates are available in the Business Explorer:

- Standard Web Template for Ad-hoc Analysis
- Standard Web Template for Broadcasting
- Standard Web Template for Precalculation of Queries
- Standard Web Template for the Document Browser

You can specify any Web template from the SAP Reference IMG as a standard Web template for the respective function.

Status and Tracking System

Web-based component of SAP BW Business Planning and Simulation (BW-BPS). Function to monitor the status of the planning process:

- Status management for planning steps
- Workflow functions

tabular reporting

Reporting based on one-dimensional tables, meaning the analysis is restricted to one dimension and its attributes.

Unlike OLAP reporting, when designing a query in tabular edit mode of the BEx Query Designer, you can arrange the columns any way you wish. For example, you can put a characteristic column between two key figure columns. The column display is determined when the query is designed and cannot be altered. In tabular reporting, the interaction options are limited to filters, filtering and drilling down according to, sorting according to, and navigation in hierarchies. Navigation functions that would change the geometry of the tabular list (that is the number and position of the columns), such as swapping or adding drilldowns, are not permitted in tabular reporting.

TLOGO object

Logical transport object combining several table entries that are transported together.
Example: The TLOGO object „InfoObject“ is comprised of table entries for the InfoObject table, the characteristic table, the text table and the basic characteristic table.

transfer structure

Structure in which the data from the sources system is transferred to the Business Information Warehouse.

It provides a selection of the extract structure fields for the source system.

transfer rule

With the aid of the transfer rules, you can determine how the fields of the transfer structure are assigned to the InfoObjects of the communication structure.

variable

Parameters of a query that are created in the BEx Query Designer and are not filled with values (processed) until the query is inserted into a workbook.

Variables act as placeholders for characteristic values, hierarchies, hierarchy nodes, texts, and formula elements, and can be processed in many different ways.

Variables in the SAP Business Information Warehouse are global variables, meaning that they are uniquely defined and are then available for the definition of all queries.

WAP gateway

Network component to connect the mobile phone network with the Internet.

WAP server

Server that provides WML content.

In BEx Mobile Intelligence the BW server functions as a WAP server.

Web item

An object that gathers information from a data provider and makes it available as HTML in a Web application.

Examples:

Generic navigation block, table, filter, text elements, alert monitor, map, chart, and so on.

Web template

An HTML document that determines the structure of a Web application.

It contains placeholders for Web items, data providers and BW URLs.

workbook

File with several worksheets (term from Microsoft Excel terminology).

You insert one or more queries into the workbook so that you can display them in the Business Explorer Analyzer. You can save the workbook in your favorites or roles.

XMI

XML Metadata Interchange

XML-based standard format for exchanging metadata between UML (Unified Modeling Language)-based modeling tools and MOF (Meta-Object Facility) based metadata repositories in shared heterogeneous development environments. The exchange takes place either in the form of data flows or in the form of files.

Alongside UML and MOF, XMI forms the core of the Metadata Repository architecture of the Object Management Group (OMG).

You can find the current XMI specification on the OMG homepage.

XML

Extensible Markup Language

XML is a developed subset of the Standard Generalized Markup Language (SGML) for applications in the World Wide Web.

XML documents consist of entities that include either analyzed (parsed) or non-analyzed (unparsed) data. An analyzed entity contains text that is a sequence of characters. There are the following types of characters:

- Character data
- Markup (start tags, end tags, tags for empty elements, entity references, character references, comments, delimiters for CDATA sections, document-type declarations and processing instructions).

You can find the current XML specification on the homepage of the World Wide Web Consortium (W3C).

Numerous standards for special tasks are being developed (for example XLink, XPointer; XSL, XSLT; DOM).

XML for Analysis

A protocol specified by Microsoft for exchanging analytical data between client applications and servers via HTTP and SOAP as a service in the Web.

XML for Analysis is not restricted to any particular platform, application, or development language.

XML for Analytics enables direct communication between a third-party Reporting tool connected to BW and the OLAP (*Online Analytical Processing*) processor.