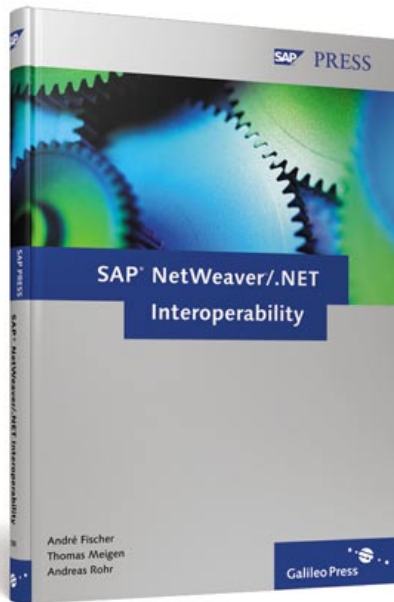


Andreas Rohr, Thomas Meigen, André Fischer

# SAP NetWeaver™/Microsoft .NET™ Interoperability



  
Galileo Press

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Bonn • Boston

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*Information is an important commodity for companies. For this reason, providing information plays an important role from the perspective of interoperability and integration. This chapter discusses the options for integrating products with an emphasis on information management of Microsoft and SAP (BI and KM).*

## 4 Information Integration

Microsoft and SAP offer products that can manage or process data and information in both unstructured and structured forms. For SAP, this involves SAP NetWeaver Business Intelligence and the SAP NetWeaver Portal (formerly SAP Enterprise Portal), including knowledge management (KM); for Microsoft, this means the SQL Server, Microsoft Exchange Server 2003, and the SharePoint products.

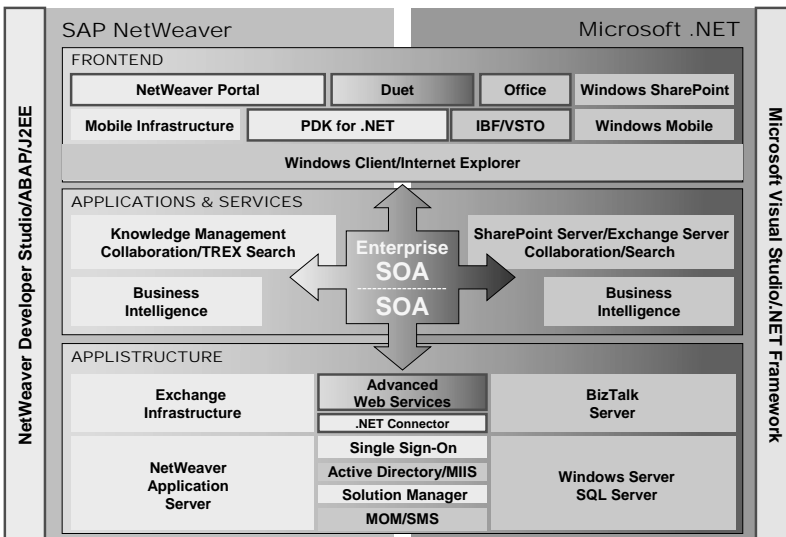


Figure 4.1 Information Interoperability between SAP and Microsoft

Figure 4.1 shows the many different combinations of interoperability scenarios between Microsoft and SAP products and systems; some will be reviewed in this chapter.

### 4.1 SAP Business Information Warehouse

The *SAP Business Information Warehouse (BW)* is the central component of *SAP NetWeaver Business Intelligence (BI)*. This is SAP's *data warehouse* solution and its job is to provide company data, the so-called business content, in a processed and structured way. These solutions can include structured data from SAP ERP systems and data from third-party systems.

Components of SAP BW Figure 4.2 shows the components of SAP BW. It consists of:

- ▶ SAP BW Server
- ▶ Open Hub Services
- ▶ Business Explorer (BEx) Suite
- ▶ Administrator Workbench



Figure 4.2 Overview of the Components of SAP BW

Within the SAP BW Server, the following components play a role in the movement of structured data:

- ▶ Persistent Staging Area (PSA) with the Staging Engine
- ▶ Operational Data Store (ODS) with the ODS objects
- ▶ InfoCubes, that is, the OLAP Cubes of SAP BW

Two routes must be considered for integration scenarios, in addition to the display of data via the SAP BW frontend, for the Business Explorer (BEx) Suite: the route of the data into SAP BW, and the route of the data out of SAP BW; in other words, accessing SAP BW data from outside. This will be discussed in Sections 4.1.2 and 4.1.3 respectively.

But first, we will look at an integrated Microsoft/SAP solution that has existed since the introduction of SAP BW: The SAP BW Business Explorer Suite (BEx Suite).

#### 4.1.1 Business Explorer Suite (BEx Suite)

The Business Explorer Suite is the first point of contact for SAP BW users. It offers a range of tools for SAP BW data consumers to define and compile queries, reports, and analyses (see Figure 4.3).

Components of the  
BEx Suite

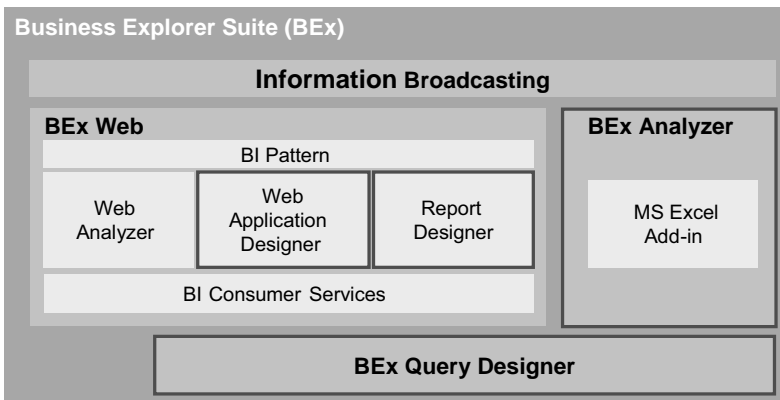


Figure 4.3 Elements of the Business Explorer Suite

The following BEx components will be discussed in further detail:

- ▶ BEx Analyzer
- ▶ BEx Query Designer

- ▶ BEx Report Designer
- ▶ BEx Web Application Designer

While the *BEx Analyzer* is an add-in for Microsoft Excel, the last three components mentioned are particularly interesting because they are applications that were recently developed for the current version of Visual Basic .NET and are based on the Microsoft .NET Framework.

**BEx Query Designer**

The *BEx Query Designer* (see Figure 4.4) is a stand-alone desktop application for defining multidimensional data queries from SAP BW. Here it provides functions for selecting the data basis (InfoCubes), defining the key figures and dimensions of the query and storing the defined query both in an Excel workbook and on the SAP BW system.

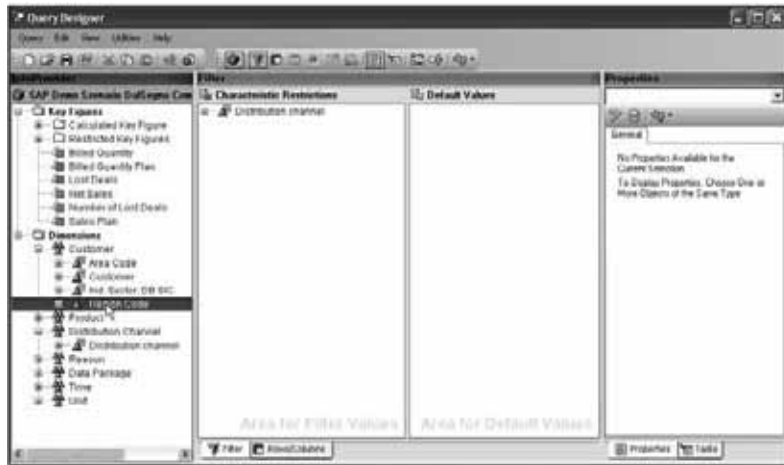


Figure 4.4 BEx Query Designer

**BEx Report Designer**

The *BEx Report Designer* is the BEx Suite tool for creating reports. It draws on the queries that were previously created with the BEx Query Designer (see Figure 4.5).

The reports created with the BEx Report Designer control the *drill-down* and *drill-up* functions, which navigate within multidimensional data structures, as well as the *slice and dice function*. These functions support the possibility of individual views. Here, *slice* describes the possibility of cutting individual slices from the OLAP Cube, while *dice* describes a view shift or a "tipping" of this view.



Figure 4.5 BEx Report Designer

The *BEx Web Application Designer* is a desktop application for creating Web applications that contain or show SAP BW-specific content. SAP describes the elements of such a Web application as *Web Items*, which may be tables, queries, diagrams, reports or cards, which create a HTML page with BW-specific content. Furthermore, the BEx Web Application Designer can also create these Web Items as iViews directly in the portal (Figure 4.6).

BEx Web  
Application  
Designer

The *BEx Analyzer* is different from the tools previously described because it is an add-in for Microsoft Excel. It both enhances Microsoft Excel with SAP BW functions and uses the full range of Excel functions. It offers a possible frontend next to Web applications created by the BEx Web Application Designer and the SAP NetWeaver Portal (see Figure 4.7). Like the other BEx components, the BEx Analyzer has been considerably reworked and is available in a new version for Microsoft Excel 2003 and SAP NetWeaver BI.

BEx Analyzer

The current version of Bex Analyzer differs from its predecessors in a number of ways.

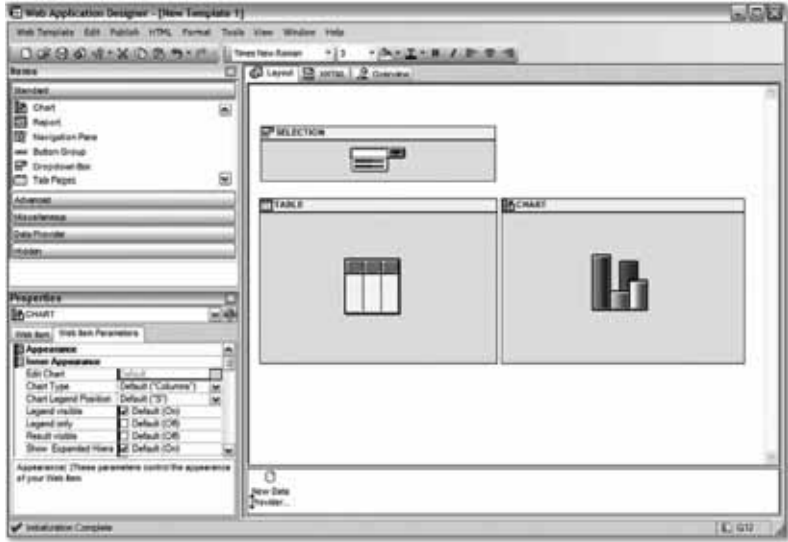


Figure 4.6 BEx Web Application Designer

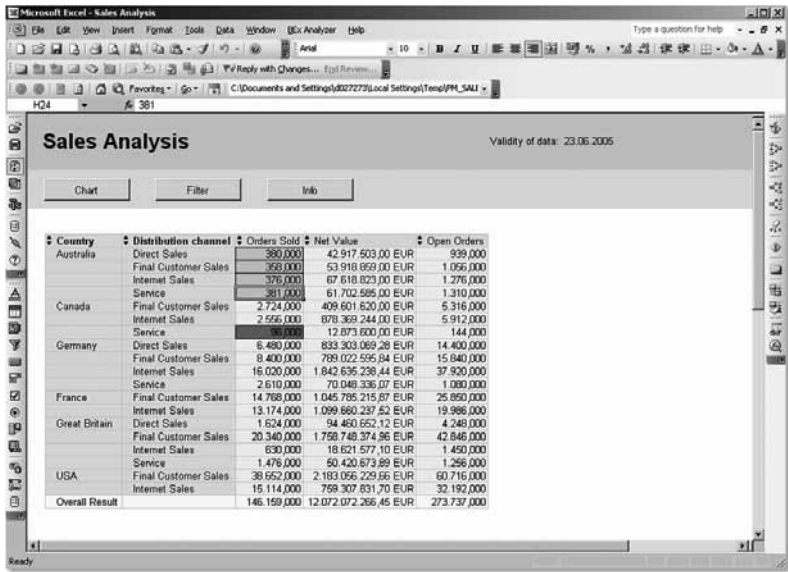


Figure 4.7 Excel and the New BEx Analyzer

**Design mode** Design mode is the most outstanding new feature. It supports the creation of BI applications directly in Excel and its operation is similar to that of the BEx Web Application Designer. Figure 4.8 provides

a primary insight into design mode. Each BI InfoProvider can be integrated into Microsoft Excel here. SAP delivers a range of design items for creating Excel-based applications, which are objects that call data from data providers. The two most important ones are the analysis table, which displays the results of a query, and the navigation area, which provides access to all the characteristics and structures in the query that can be used for navigation and analysis.

Additional design items include, among others, a dropdown box, a checkbox group and a radiobutton group, which allow you to set a filter through a dropdown box, a check box or a selection button.

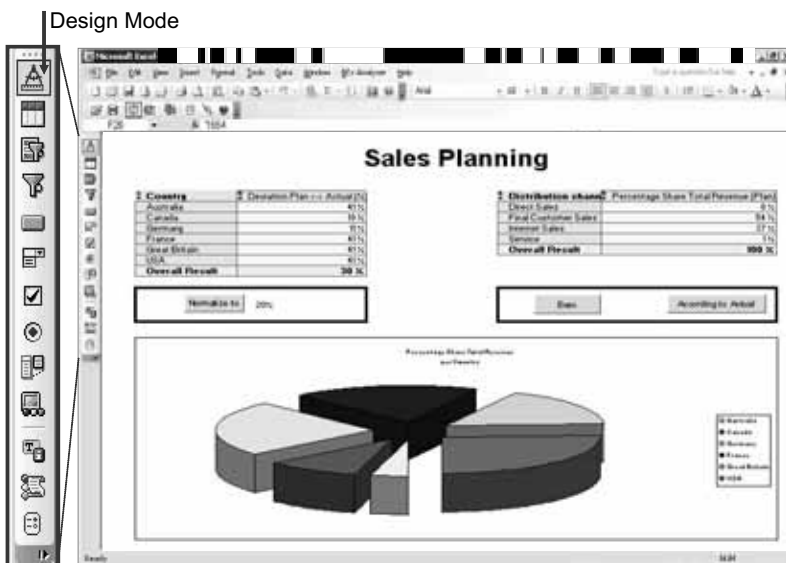


Figure 4.8 Design Mode of the New BEx Analyzer

The integration with Microsoft Excel has been further improved. In analysis mode you can run OLAP analyses on queries that have been created with the BEx Query Designer. The results of the query are shown in the design item *analysis table*. In this table, together with the design item *navigation area* and other design items, you can navigate through the context menu by a simple drag and drop or using symbols, such as sorting, opening or closing hierarchies.

Furthermore, it is now possible to activate each InfoProvider from Excel; in earlier versions it was only possible to access InfoCubes or the corresponding queries or query views.

User  
interaction  
(analysis mode)

Local calculations can easily be inserted by the user through the context menu into the Excel Workbook, which will present a subset of the options available in the Query Designer. The formulas are created using an intuitive dialog box with simple buttons. The calculations created in this way can be stored together with the Excel Workbook.

If a query has been defined as ready for input in BEx Query Designer, you can insert data into the cells that are ready for input. Planning functions are executed in this way.

Excel formatting and formulas

BEx Analyzer also offers a new function that allows the native formatting possibilities that Excel provides to be fully used for BEx Workbooks. This includes, among other things, the use of blank rows and different fonts. Each cell in the result set is described by the Excel function `BexGetData`. The combination of Excel formatting and formulas allows high-quality formatted workbooks to be created. These functions can be used for every query, and every query view or Info Provider (see Figure 4.9).

	Year to Date					
	Variance in Mio EUR			Variance in %		
	vs Last Cycle	vs Previous year	vs Budget	vs Last Cycle	vs Previous Year	vs Budget
<b>Total Revenue</b>	<b>39.7</b>	<b>39.7</b>	<b>56.3</b>	<b>4.9 %</b>	<b>4.9 %</b>	<b>7.4 %</b>
<b>Total Net Sales</b>	<b>37.7</b>	<b>37.7</b>	<b>57.4</b>	<b>4.7 %</b>	<b>4.7 %</b>	<b>7.3 %</b>
Indirect Sales	1.8	1.8	2.1	59.0 %	59.0 %	79.4 %
Sales to Other Division	0.5	0.5	-0.8	7.5 %	7.5 %	-8.0 %
Sales to Own Division	35.5	35.5	55.9	4.5 %	4.5 %	7.2 %
<b>Total Other Revenues From Indirect Sales</b>	<b>2</b>	<b>2</b>	<b>0.9</b>	<b>59.7 %</b>	<b>59.7 %</b>	<b>15.8 %</b>
Revenue From Indirect Sales Royalties	0.5	0.5	0.2	22.7 %	22.7 %	6.2 %
<b>Revenue From Telex Sales</b>	<b>1.4</b>	<b>1.4</b>	<b>0.5</b>	<b>100.0 %</b>	<b>100.0 %</b>	<b>58.5 %</b>
Other Revenue From Indirect Sales	0.1	0.1	0.2	10.0 %	10.0 %	18.2 %
<b>Total Costs</b>	<b>-46.3</b>	<b>-46.3</b>	<b>-30.5</b>	<b>-11.4 %</b>	<b>-11.4 %</b>	<b>-7.3 %</b>
% of Sales						
Total Costs for Production	-47.1	-47.1	-30.5	-12.1 %	-12.1 %	-7.5 %
Costs Own Division	-2.8	-2.8	-2.4	-44.7 %	-44.7 %	-56.6 %
Manufacturing Costs	0.8	0.8	2.5	19.5 %	19.5 %	44.4 %
Variances & Write-offs	2.3	2.3	-4.5	11.7 %	11.7 %	-35.3 %
<b>Total Other Related Costs</b>	<b>8.8</b>	<b>8.8</b>	<b>6.3</b>	<b>6.3 %</b>	<b>6.3 %</b>	<b>-8.2 %</b>
Amortization Related to Marketable Products			0.2	-1.1 %	-1.1 %	8.0 %
Royalties On Licensed Products	0.8	0.8	-0.2	6.3 %	6.3 %	-1.6 %
Other Product Related Costs						
<b>Gross Profit</b>	<b>-4.6</b>	<b>-4.6</b>	<b>27.8</b>	<b>-1.6 %</b>	<b>-1.6 %</b>	<b>7.6 %</b>

Figure 4.9 Formatted Excel Workbook with Additional Local Excel Authorizations (Created in Formula Mode)



### 4.1.2 Uploading Data in SAP BW

There is no point in having a data warehouse without data—it must be filled with data uploaded from different source systems. And you can't talk about the data warehouse area without discussing extraction, transformation and loading (ETL). With SAP BW, this is done in the first stage in the *Persistent Staging Area* (PSA). Here, the data is first stored unchanged using different tools. So, we are already in the SAP BW data loading process, which we will look at more closely.

Generally, the data loading process is always controlled from SAP BW. It is the active system. This means that the data loading process must be defined and saved in SAP BW but is also executed by SAP BW by using the "Pull" procedure.

Pull procedure

The data loading process is defined by:

- ▶ a source system
- ▶ an InfoSource as the target
- ▶ one or several DataSource(s) from the source system
- ▶ the assignment of the DataSource and InfoSource
- ▶ the update rules
- ▶ the transfer rules

Figure 4.10 shows an example of the source system selecting data. Figure 4.11 shows the application of the update and transfer rules.



Figure 4.10 Selecting the Source System

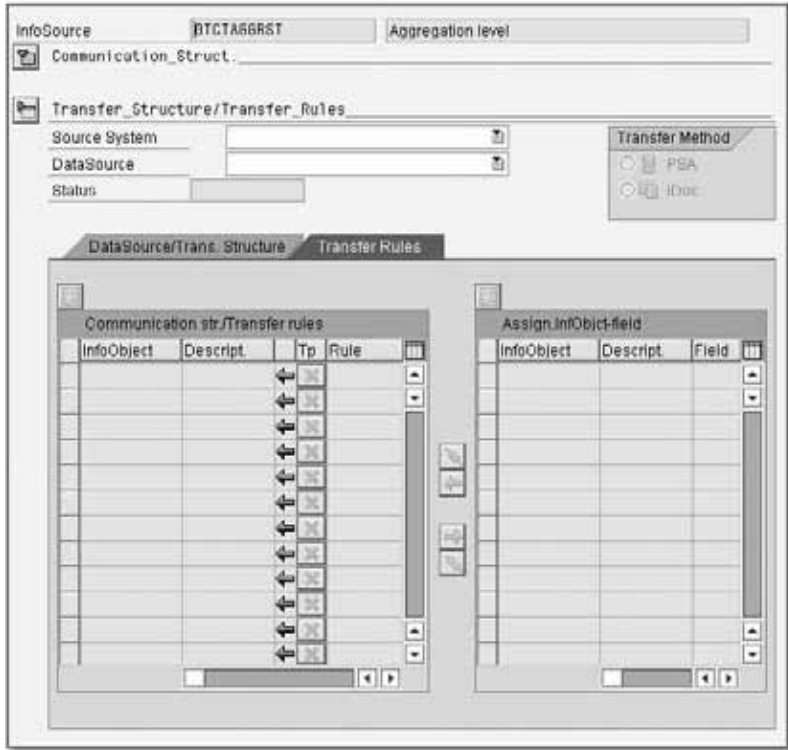


Figure 4.11 Fixing the Transfer Rules

Data that has been uploaded into the SAP BW staging area is consolidated in the next step and written in cleaned-up form either to Info-Cubes or the *Operational Data Store* (ODS) objects, as illustrated in Figure 4.12.

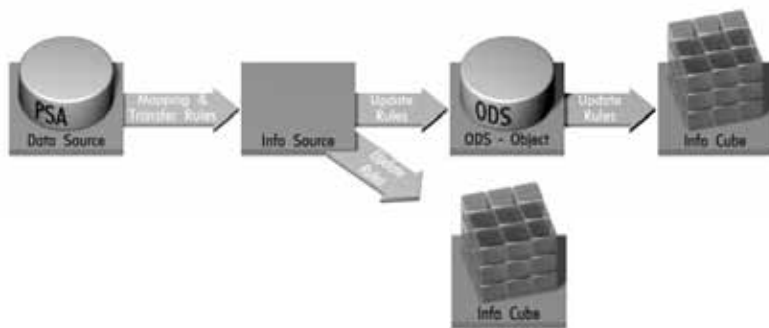


Figure 4.12 From the Staging Area to the InfoCubes

There are various ways to upload external data into the PSA of the SAP BW Server. Often a flat-file import is used. However, the corresponding data can also be uploaded using the *Staging BAPIs* (BW-STA) (see Figure 4.13). These business object methods play a decisive role in the data loading process.

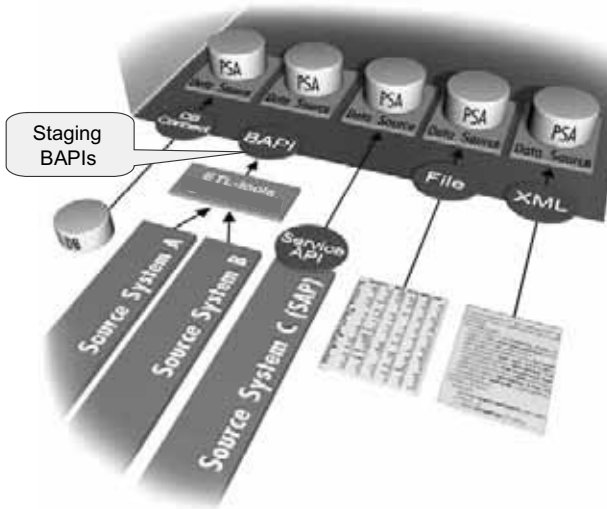


Figure 4.13 Staging BAPIs

Their methods are described as *Staging BAPIs*:

- ▶ Business Object InfoObject
- ▶ Business Object SourceSystem
- ▶ Business Object DataProvider
- ▶ Business Object InfoSourceTrans
- ▶ Business Object InfoSourceTransXfer
- ▶ Business Object InfoSourceMaster
- ▶ Business Object InfoSourceMasterXfer
- ▶ Business Object InfoSourceHirchyXfer

All of these objects can be accessed and used using the BAPI interface previously discussed in Chapter 2 with Microsoft Visual Studio 2003 and the SAP Connector for Microsoft .NET 2.0. Figure 4.14 shows the objects in the Visual Studio 2003 server explorer. By doing this,

an application based on the .NET Framework could externally define and manage the data loading process.

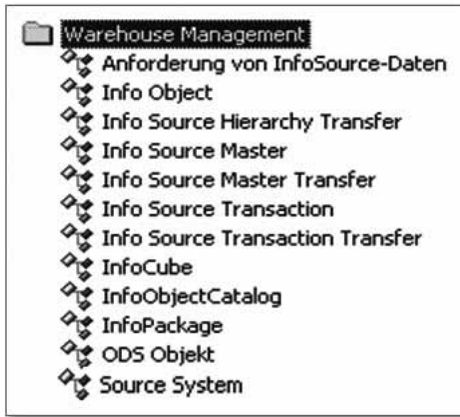


Figure 4.14 Staging BAPI in the Server Explorer

**SOAP transfer** In the age of XML, SOAP and Web services there is yet another variant for uploading the data into SAP BW—SOAP-based transfer of data. Unlike the Pull method, which is the primary data loading function for SAP BW (in which the data loading process is controlled from SAP BW), in this variant the data is delivered from outside into an inbound queue in SAP BW. This inbound queue is the Delta queue of the Service API for SAP BW, which means that the data is loaded using the Delta process. This variant is only an addition to the actual uploading of (mass) data, which runs in the file transfer, for example. You must take this into account accordingly (see Figure 4.15).

The starting point in this variant is a DataSource file. When you define the transfer rules you have the option of specifying that it is a DataSource with a SOAP connection. An XML DataSource is then generated in the Workbench. This is required for the Delta queue and is intended for loading the Delta data records. For this XML DataSource, a function module (RFC) is also generated that posts the incoming data. This RFC is created in the function group `/BIO/QI<xml-datasource>` and has the name `/BIO/QI <xml-datasource>_RFC`, where `<xml-Datasource>` is the name of the XML DataSource. This DataSource is also the import parameter of the RFC.

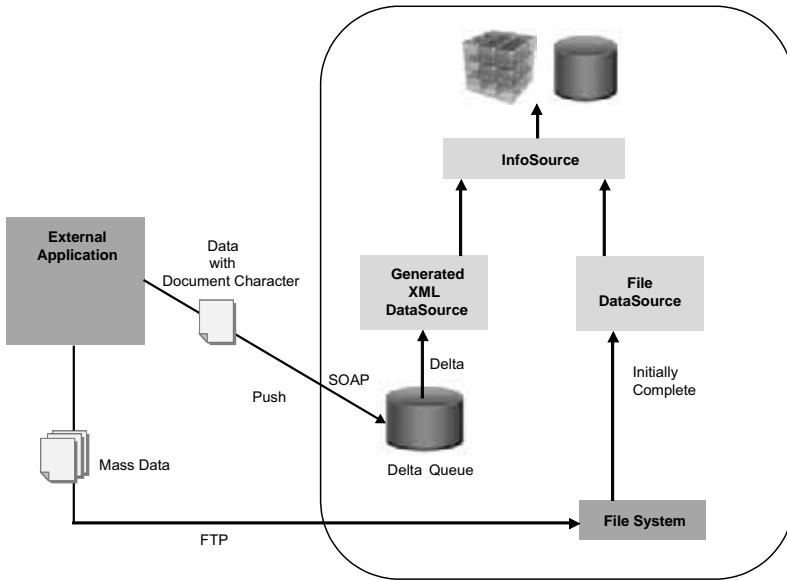


Figure 4.15 SOAP Transfer Process

This RFC can now be activated from outside after the activation of the data transfer, e. g., via a web service. From the Delta queue, the data is processed further with the staging methods already described.

However, you must be aware of the following restriction: only flat structures can be used during this SOAP-based transfer. In particular, hierarchy data cannot be transferred by this means.

Restriction during the SOAP transfer

### 4.1.3 Open Analysis Interfaces

Now, since SAP BW is an open architecture, there are a number of possibilities to access the SAP BW data for reporting purposes through an alternative frontend tool.

*SAP BW Open Analysis Interfaces* play the most important role here. They provide a group of interface technologies that allow external applications to address queries to the SAP BW system MDX processor. MDX stands for *MultiDimensional Expression* and is a query language for multidimensional data similar to the SQL syntax. An MDX query always returns a multidimensional result set (see Figure 4.16).

MDX

The SAP BW Open Analysis Interfaces include:

- ▶ OLAP-BAPI
- ▶ XML for Analysis (XMLA)
- ▶ OLE DB for OLAP (ODBO)

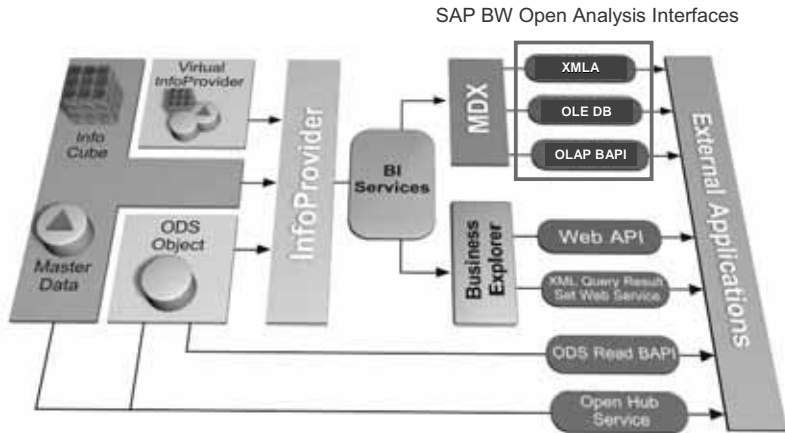


Figure 4.16 Overview of SAP BW Open Analysis Interfaces

**OLAP-BAPI** Let's first look at the OLAP-BAPIs. As in the Staging area, SAP has also provided business objects and methods in the OLAP area. Specifically, there are two OLAP Business Objects:

- ▶ `MDDataProviderBW`  
The Business Object `MDDataProviderBW` provides a multidimensional provider for BW metadata and master data.
- ▶ `MDDataSetBW`  
The Business Object `MDDataSetBW` returns a result set for multidimensional queries.

Figure 4.17 shows the relevant methods of the two OLAP Business Objects. These objects and BAPIs, like the other BAPIs previously mentioned, can be accessed via Microsoft Visual Studio 2003 and the SAP Connector for Microsoft .NET 2.0.

**Sample application** In a VB .NET sample application we want to use the Business Object `MDDataProviderBW.Get_Cubes` to list all SAP BW InfoCubes and their metadata. In the VS project, the Business Object `MDDataProviderBW.Get_Cubes` is added to the SAP proxy through the Server

Explorer. A WindowsForm must then be drafted. Figure 4.18 shows this sample form.

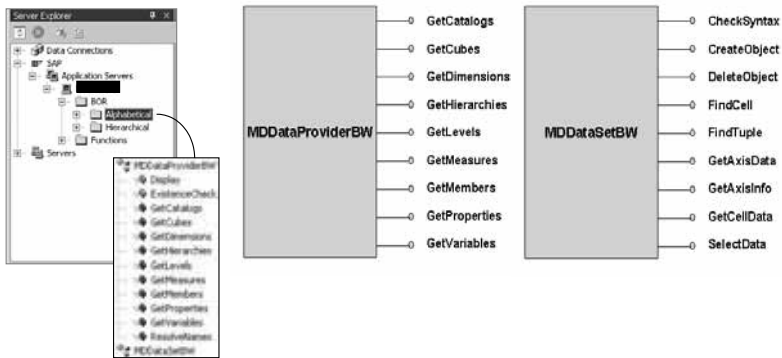


Figure 4.17 The OLAP-BAPI Methods



Figure 4.18 OLAP Sample Cube MiniBrowser

By clicking on the button **Show SAP BW Cubes** we execute the following VB .NET function:

```
Private Sub Button1_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) _
    Handles Button1.Click

    'BAPI parameters
    Dim ds_cubtab As BAPI6110CUBTable = New BAPI6110CUBTable
    Dim ds_ret2 As BAPIRET2

    'SAP BW connection data
    Dim bw_system As New SAP.Connector.Destination
    bw_system.AppServerHost = "sapwebas640"
```

```

bw_system.Username = "BCUSER"
bw_system.Password = "MINISAP"
bw_system.Client = 400
bw_system.SystemNumber = 0

'Establish connection to BW
Dim sap_bw_proxy As New SAPProxy1(bw_system.Connection-
String)

'BAPI call
sap_bw_proxy.Bapi_Mdprovider_Get_Cubes("", "", _
"", ds_ret2, _ ds_cubtab)

'Display result in DataGrid
DataGrid1.DataSource = ds_cubtab
DataGrid1.Refresh()
End Sub

```

The BAPI call `sap_bw_proxy.Bapi_Mdprovider_Get_Cubes` returns the SAP table `ds_cubtab` based on the `BAPI6110CUBTable` definition, which contains all the InfoCubes in the SAP BW system that are activated. The SAP table is assigned to the DataGrid as a data source, and after a refresh it displays the results in Figure 4.19.

**XML for analysis**

A further variant for small datasets is the specification *XML for Analysis (XMLA)*, which also belongs to the group of SAP BW Open Analysis Interfaces and allows web-service-based access to SAP BW data.

*XML for Analysis* is a protocol specified by Microsoft and is now supported both by Microsoft and by SAP in version BW 3.0. It is automatically available as a web service after the SAP BW system is installed.

Inf_Data_Std	Data_Used_By	Cube_Type	Cube_Name	Created	Lit_Schema	Discpnt	Cub_Name	Cube_Url	Schema_Used
19700101000		CUBE	\$08WTCF01	20060319170	BW Technical Content F01		INFOCUBE		BCUSER
19700101000		CUBE	\$08WTCF02	20060319170	BW Technical Content 2		INFOCUBE		BCUSER
19700101000		CUBE	\$08WTC_C01	20060319170	BW Statistics (1.2)		INFOCUBE		BCUSER
19700101000		CUBE	\$08WTC_C02	20060319170	BW Statistics - OLAP		INFOCUBE		BCUSER
19700101000		CUBE	\$08WTC_C03	20060319170	BW Statistics - OLAP - DetailNav		INFOCUBE		BCUSER
19700101000		CUBE	\$08WTC_C04	20060319170	BW Statistics - Aggregates		INFOCUBE		BCUSER
19700101000		CUBE	\$08WTC_C05	20060319170	BW Statistics - W/MI		INFOCUBE		BCUSER
19700101000		CUBE	\$08WTC_C06	20060319170	BW Data Slice		INFOCUBE		BCUSER
19700101000		CUBE	\$08WTC_C07	20060319170	Requests in the InfoCube		INFOCUBE		BCUSER
19700101000		CUBE	\$08WTC_C08	20060319170	BW Statistics: Condensing InfoCus		INFOCUBE		BCUSER
19700101000		CUBE	\$08WTC_C10	20060319170	BW Statistics		INFOCUBE		BCUSER
19700101000		CUBE	\$08WTC_C11	20060319170	BW Statistics: Deleting Data from		INFOCUBE		BCUSER

Figure 4.19 Result of the OLAP-BAPI Call



XMLA does not require any local client components. It allows platform-independent access to the SAP BW system using Internet technologies. Specifically, this means that a web service activates the XMLA interface, which transfers the query to the MDX processor (see Figure 4.20).

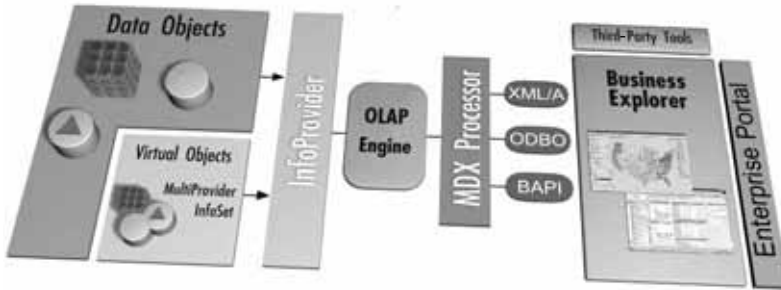


Figure 4.20 XMLA and the MDX Processor

The URL of the web service is formatted as follows:

*[http://\[host\]:8000/sap/bw/xml/soap/xmla](http://[host]:8000/sap/bw/xml/soap/xmla)*

You can call up a description of the web service using the corresponding URL of the WSDL file:

*[http://\[host\]:8000/sap/bw/xml/soap/xmla?wsdl](http://[host]:8000/sap/bw/xml/soap/xmla?wsdl)*

The following SAP BW XMLA methods can be accessed, as shown in Figure 4.21: XMLA methods

- ▶ Discover  
This method is used to query metadata and master data. It corresponds to the BAPI MDDataProviderBW.
- ▶ Execute  
This method is used to execute MDX commands and obtain the corresponding result set. It corresponds to the BAPI MDDataSetBW.

The third variant is a fat-client variant that is based on the COM protocol and can only be used on a Windows platform. It uses the SAP BW OLE DB Provider, which must first be installed on the Windows system. This can be done by installing the SAP BW frontend.

OLE DB for OLAP  
(ODBO)

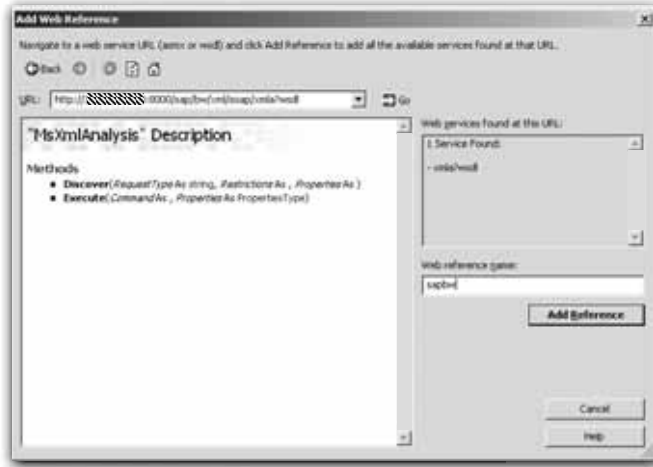


Figure 4.21 Methods of the XMLA Web Service

The corresponding setup<sup>1</sup> installs the following components of the SAP BW frontend, which are required by the SAP BW OLE DB Provider:

- ▶ *Mdrmsap.dll*: SAP BW OLE DB for OLAP Provider library
- ▶ *Mdrmdl.dll*: Service library for establishing a link to the SAP server
- ▶ *Scerrl.dll*: Error processing library
- ▶ *Mdxpars.dll*: MDX parser library
- ▶ *Librfc32.dll*: SAP-RFC library
- ▶ *Wdtlog.ocx*: SAP-RFC logon dialog component
- ▶ *Saplogon.ini*: SAP connection parameter file

**Mdrmsap.dll** The last three components should be familiar after reading Chapter 2, but the key role here is *Mdrmsap.dll* as the provider library. This provider library establishes a connection from the consumer client to the OLAP BAPIs (previously described) and their methods on the BW server, and allows online access to the desired InfoCubes.

For example, we can use the SAP BW OLE DB for OLAP Providers from the Office application Excel 2003, as shown in Figure 4.22.

<sup>1</sup> The setup is located, among other places, on the SAP-GUI installation CD. It is installed with the SAP BW frontend.

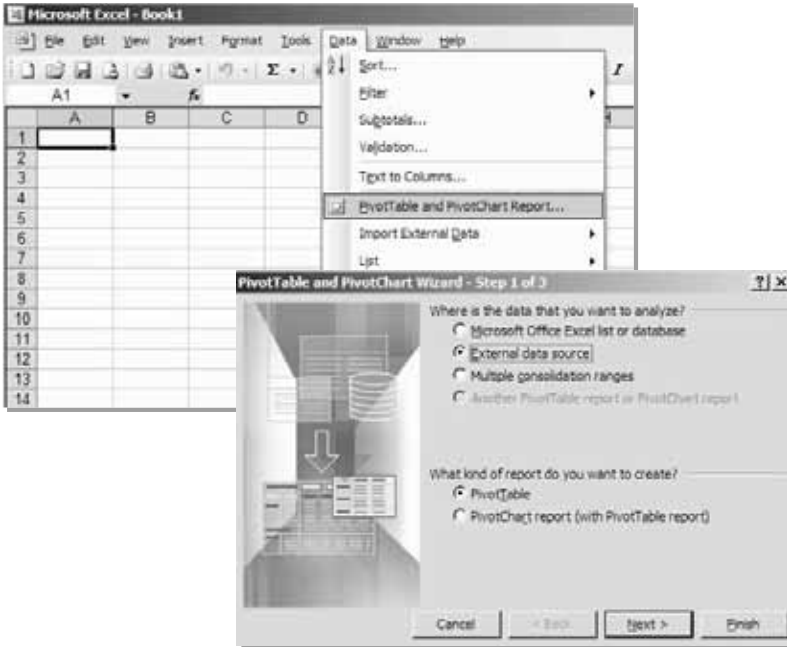


Figure 4.22 Excel and SAP OLE DB Providers

The result can then be evaluated in a pivot table, as you can see in Figure 4.23.

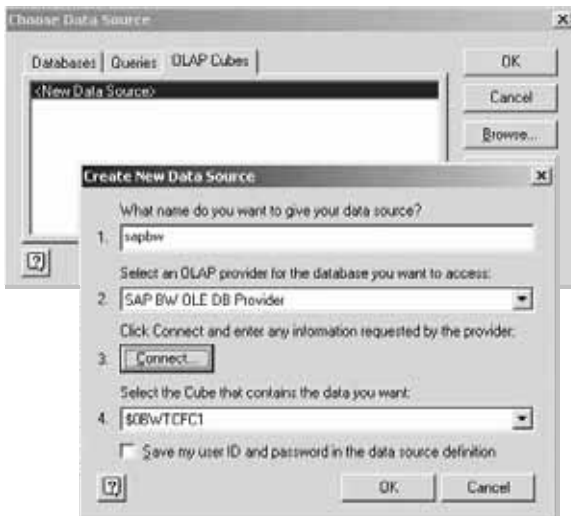


Figure 4.23 SAP OLE DB—Data in a Pivot Table

**ODS-BAPI** Another variant for accessing SAP BW system data does not belong to the SAP BW Open Analysis Interfaces, nor is it based on the multidimensional MDX processor, because it will not access multidimensional data. This variant involves using the *ODS Read BAPI*. As described in Section 4.1.4, data management is relational in the ODS and is not multidimensional.

SAP's ODS methods allow data to be read from these ODS objects and used further, including the following methods and function modules:

- ▶ `ODSObject.GetList`  
Returns a list of the ODS objects
- ▶ `ODSObject.ReadData`  
Reads the data from the selected ODS object
- ▶ `ODSObject.ReadDataUC`  
The corresponding Unicode variant

Just like the previously described BAPIs, the ODS-BAPIs can also be accessed through Microsoft Visual Studio 2003 and the SAP Connector for Microsoft .NET 2.0 and integrated in a Windows application on a Microsoft .NET framework.

**Example** In the following example we will create a simple ODS browser in the form of a Microsoft .NET-based Windows application. The application will show the ODS objects from the SAP BW system that are currently active. The SAP Connector for .NET activates the function `BAPI_ODSO_GETLIST`. This is the ABAP function of the `ODSObject.GetList` BAPI (see Figure 4.24).

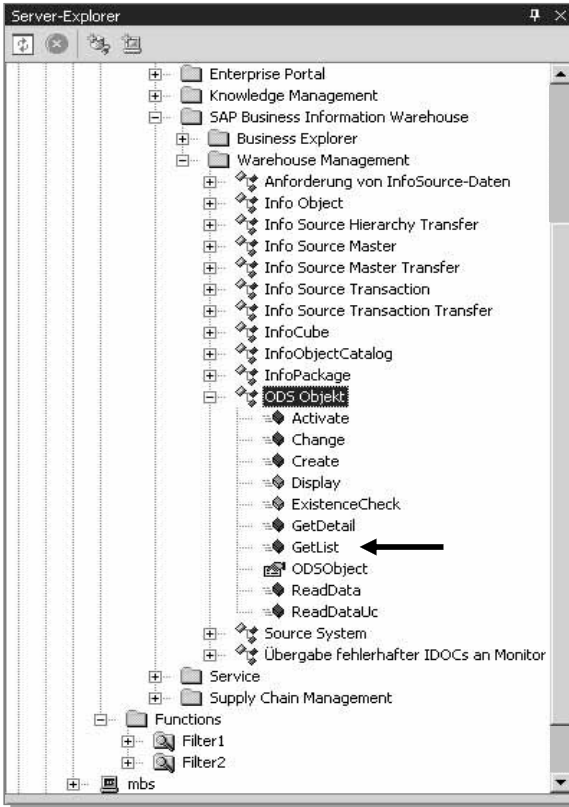


Figure 4.24 ODS-BAPI in the Server Explorer

Click on the button to call the ODS-BAPI to trigger the event.

```
Private Sub Button1_Click(ByVal sender _
As System.Object, ByVal e As System.EventArgs) _
Handles Button1.Click
'BAPI call parameters
Dim ods_ret2 As BAPIRET2
Dim ods_ltab As New BAPI6116LTable
Dim ods_sl16tab As New BAPI6116SLTable
Dim ods_sl00tab As New BAPI6100SLTable

'SAP BW connection data
Dim bw_system As New SAP.Connector.Destination
bw_system.AppServerHost = "sapwebas640"
bw_system.Username = "BCUSER"
bw_system.Password = "MINISAP"
bw_system.Client = 400
```

```

bw_system.SystemNumber = 0

'Establish connection to BW
Dim sap_bw_proxy As New SAPProxy1(bw_system.Connection-
String)

'BAPI call
sap_bw_proxy.Bapi_Odso_Getlist("A", ods_ret2, ods_ltab, _
ods_sl16tab, ods_sl100tab)

'Display result in DataGrid
DataGrid1.DataSource = ods_ltab
DataGrid1.Refresh()

End Sub

```

The primary function of this example is that the BAPI call `sap_bw_proxy.Bapi_Odso_Getlist` returns the SAP table `ods_ltab` based on the BAPI6116Ltable definition, which contains all of the active ODS objects of the SAP BW system that is activated. The SAP table is assigned to the DataGrid as a data source, and after a refresh it displays the results in Figure 4.25.

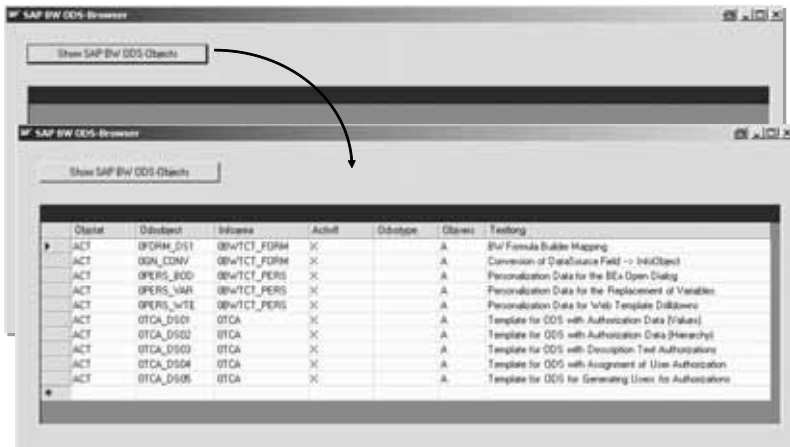


Figure 4.25 Result of the ODS-BAPI

#### 4.1.4 Open Hub Service

While the previously discussed interfaces of the SAP BW Open Analysis Interfaces and the ODS-BAPI can be used to connect frontend

tools for the reporting, SAP offers the interface *Open Hub Service* for exporting data from BW. The Open Hub Service allows data to be distributed from a SAP BW system into non-SAP data-marts, analytical applications and other applications (see Figure 4.26).

Open Hub Services are components that must be specially licensed by SAP customers.

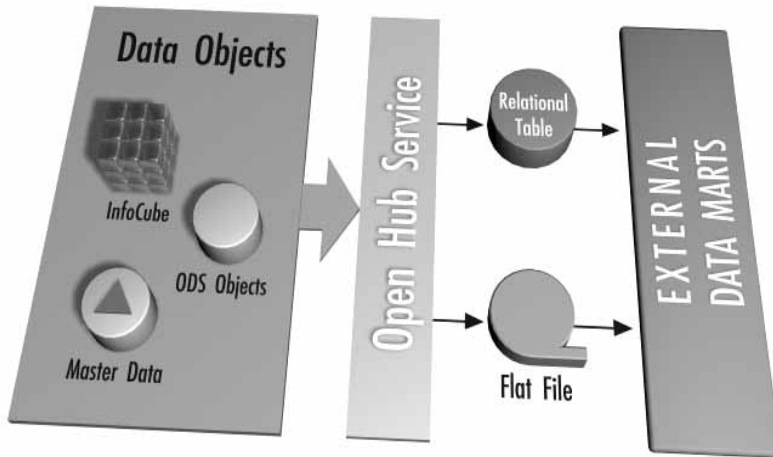


Figure 4.26 Classifying the Open Hub Service

The Open Hub Service can be called in the SAP BW Administrator Workbench (Transaction RSA1), as shown in Figure 4.27.

When you use the Open Hub Service, its primary task is to define an *InfoSpoke* (see Figure 4.28). Within the *InfoSpoke* we define the:

- ▶ Open Hub datasource
- ▶ Extraction mode
- ▶ Objective—the Open Hub destination

As the Open Hub datasource we can use both ODS objects and InfoCubes, but also BW metadata.

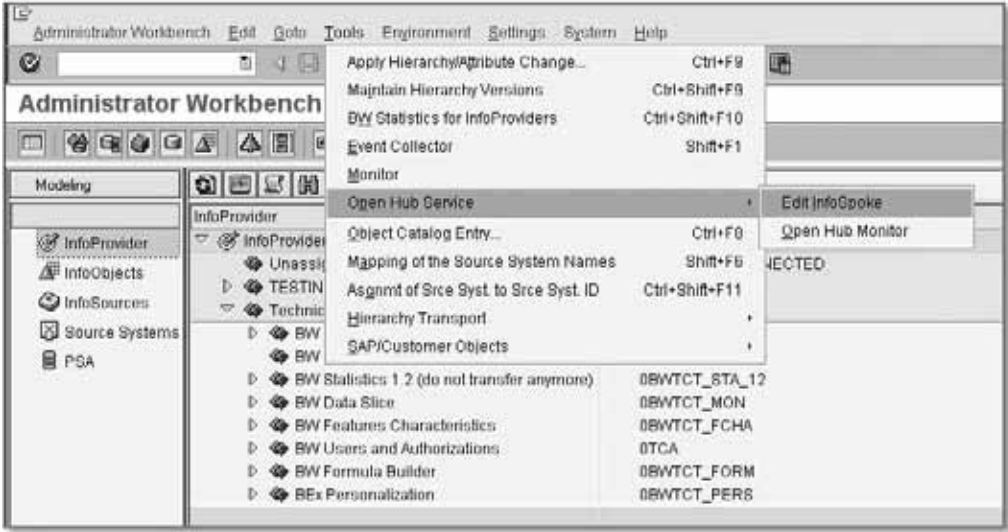


Figure 4.27 Calling the Open Hub Service

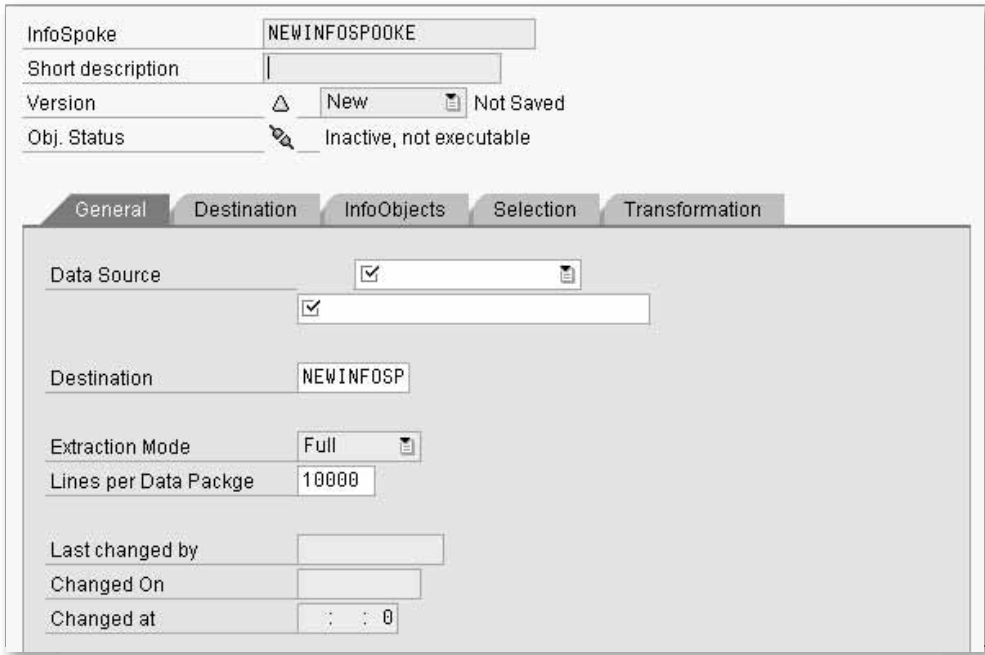


Figure 4.28 Defining the InfoSpoke



With extraction you have the option of either full mode or delta mode. In delta mode, the system only copies the data that has been newly added since the last extraction, while in full mode all data is copied from the defined data source.

Full mode,  
delta mode

As possible Open Hub destinations, an InfoSpoke can either use relational database tables with the prefix /BIC/OHxxx (xxx is the technical name of the destination) or flat CSV files.

If the data is unloaded into flat SQL server tables, they can be loaded with little effort into the corresponding Microsoft Analysis Services MOLAP Cube using the Microsoft OLE DB Provider for SQL Server for example.

Figures 4.29 and 4.30 show such an example for the Microsoft SQL Server 2000 Analysis Services.

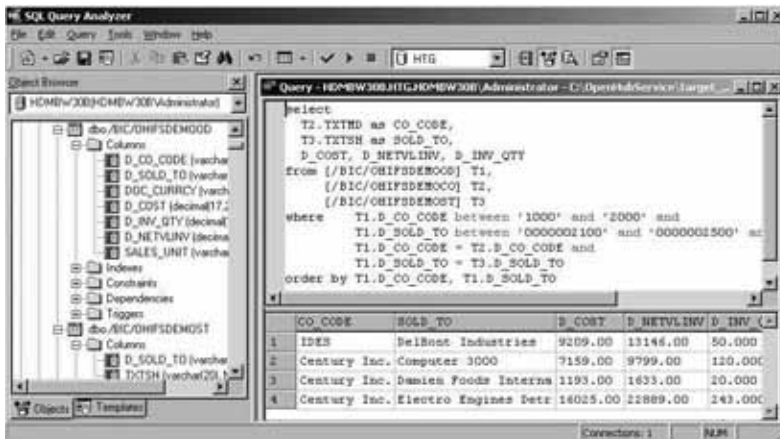


Figure 4.29 Accessing the Extracted BW Tables

Starting with version SAP BW 3.5, an API is offered for the Open Hub Service that helps automate the exchange of data with external programs.

Open Hub Service  
API

Here, the data is first extracted into a database table in the BW system (destination type DB table). Once the extraction process has finished, the third-party tool (RFC destination and Open Hub destination) receives a notification. This extraction process can be started both by the SAP system and the external system.

Functionality



Figure 4.30 Generating MS-AS-OLAP Cubes

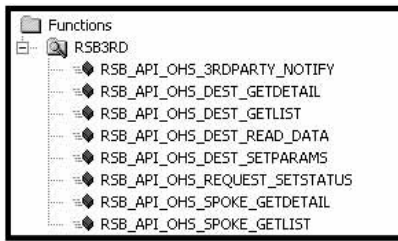


Figure 4.31 Open Hub Service APIs in Visual Studio 2003

The following Open Hub Service APIs are available in the form of RFCs and could be activated using the SAP Connector for .NET (see Chapter 2), as illustrated in Figure 4.31:

- ▶ **RSB\_API\_OHS\_DEST\_SETPARAMS**  
 This API copies the parameters of the third-party tool required for the extraction to the BW system. These parameters are saved in a parameter table in the BW system in the metadata of the Open Hub destination.
- ▶ **RSB\_API\_OHS\_3RDPARTY\_NOTIFY**  
 This API sends a notification after the extraction to the third-party tool. It transfers the Open Hub destination, Request ID, name of

the database table, number of extracted data records and time stamp. Furthermore, a parameter table can also be provided containing parameters that are only relevant for the third-party tool.

▶ **RSB\_API\_OHS\_REQUEST\_SETSTATUS**

This API sets the status of the extraction into the third-party tool in the Open Hub Monitor. If the status is red, it means that the existing table was not overwritten; if the status is green, the request was processed.

▶ **RSB\_API\_OHS\_DEST\_GETLIST**

This API returns a list of all Open Hub destinations.

▶ **RSB\_API\_OHS\_DEST\_GETDETAIL**

This API determines the details of an Open Hub destination.

▶ **RSB\_API\_OHS\_DEST\_READ\_DATA**

This API reads the data from the database table in the BW system.

Optionally:

▶ **RSB\_API\_OHS\_SPOKE\_GETLIST**

This API returns a list of all InfoSpokes.<sup>2</sup>

▶ **RSB\_API\_OHS\_SPOKE\_GETDETAIL**

This API determines the details of an InfoSpoke.

The data extraction process can also be started from the third-party tool using the process chain API `RSPC_API_CHAIN_START`. The notification to the external system is sent via `RSB_API_OHS_3RDPARTY_NOTIFY`.

The external system now reads the data from the BW table and finally copies the status of the extraction with the API `RSB_API_OHS_DEST_SETSTATUS` to the monitor.

#### 4.1.5 Microsoft SQL Server 2000 and 2005

Another option is to use Microsoft SQL Server as a database for the SAP system and also for an SAP BW system. For *Information Integration*, the additional SQL Server components of *Microsoft SQL Server Analysis Services* and, more recently, the *Microsoft SQL Server Reporting Services* are also important.

Additional  
components

<sup>2</sup> In the forthcoming BW version, the architecture will be changed in such a way that it will no longer be possible to use InfoSpokes. However, the option of the Open Hub Destination will remain.

Analysis Services, which have been available since SQL Server 2000, are data warehouse enhancements that can be installed if required. Analysis Services for OLAP and data mining functions offer an intermediate layer between the relational database and report applications, such as Microsoft Excel. Reporting Services complement the SQL Server with sophisticated (Web) reporting functions based on ASP.NET and have been offered for download by Microsoft only to SQL Server customers since 2004 as an addition to Microsoft SQL Server 2000.

Outlook Microsoft  
SQL Server 2005

At the time of publication, Microsoft SQL Server 2005 is available. In general terms, this version offers improved functions compared with its previous version; however, it would go beyond the scope of this chapter to attempt to list all of these improvements. Nevertheless, a number of new developments are interesting in the area of SAP Information Integration.

First, the *SQL Server Enterprise Manager* was replaced with the *SQL Server Management Studio*, which will be the primary tool for SQL Server 2005 administration. Furthermore, SQL Server Management Studio also replaces the functions of the previous *SQL Query Analyzer*. Figure 4.32 shows the user interface of the new SQL Server Management Studio.

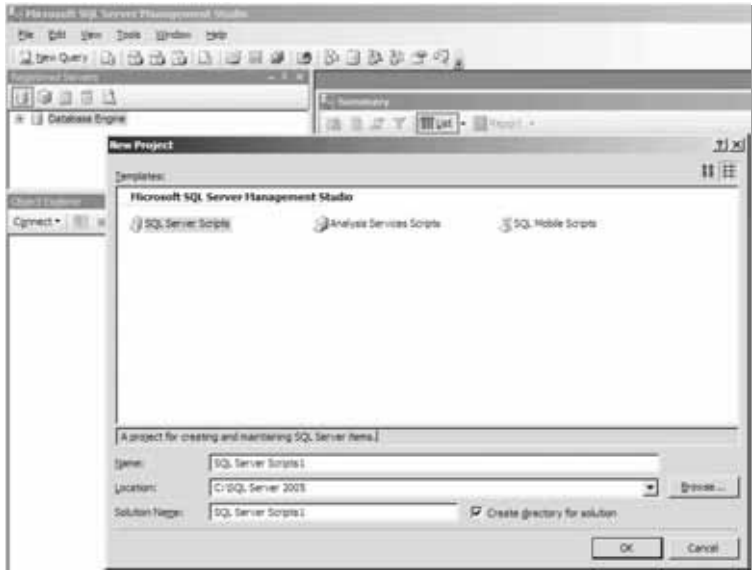


Figure 4.32 User Interface of the SQL Server Management Studio

Even more important for our topic of SAP integration is the fact that application development has been strengthened with Microsoft SQL Server 2005. It is separate from the database administration and has a separate development environment with the *Business Intelligence Development Studio*. This studio is in Visual Studio 2005 with SQL Server-specific add-ins and corresponding project templates.

SQL Server Integration Services are also newly added and they replace the previous DTS jobs. Integration Services provide data procurement and are developed in the Business Intelligence Development Studio. These services offer developers of ETL solutions additional controls and new functions. What DTS developers will like is the fact that the days of Visual Basic ActiveX-Script are over, as it is now possible to work with VB .NET. Figure 4.33 shows the user interface of Business Intelligence Development Studio for creating an Integration Services solution.

SQL Server  
Integration  
Services

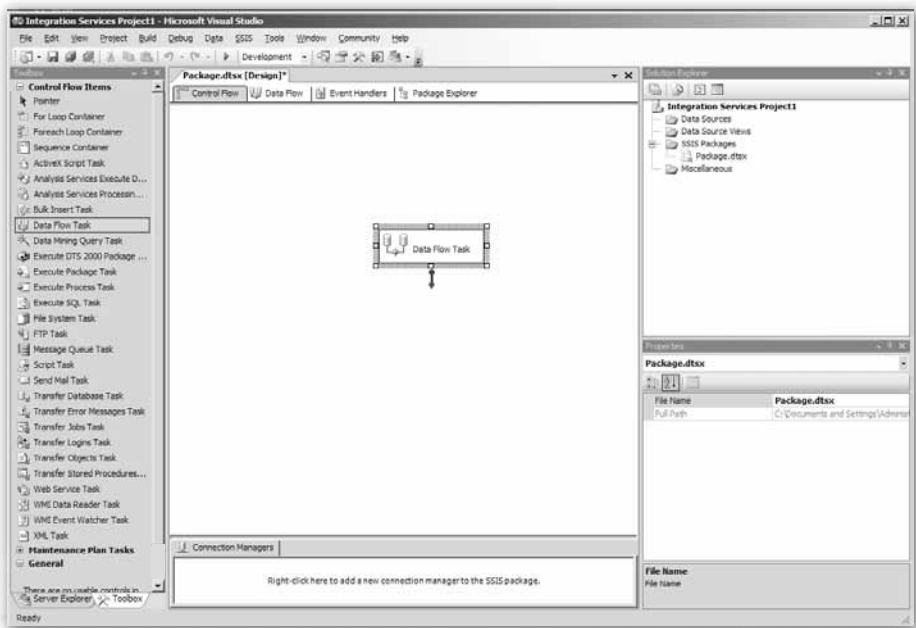


Figure 4.33 Integration Services Project in the BI Development Studio

The Microsoft SQL Server Integration Services can also be used as an ETL tool for SAP BI if the data from the external sources is first imported into an SQL Server database through the standard interface

SAP BW DB Connect. However, customers must have a suitable SQL Server license to do this. If the SAP BW system is based on the SQL Server and the SQL Server Runtime license has been obtained by SAP, this SQL Server license may *not* be used, because it does not allow any access to data outside the SAP system.

**SAP integration** There is a new version of SAP integration in addition to the SQL Server 2000 possibilities. Microsoft has made a Data Provider available, that you can use to locally access the data of the relevant system. It is roughly comparable to a driver for an ODBC data source.

In March 2006, an SAP-related Data Provider was delivered by Microsoft together with the *SQL Server 2005 SP1 CTP*. The full name is *Microsoft .NET Data Provider 1.0 for SAP NetWeaver Business Intelligence*, the shortened form is *Microsoft .NET Data Provider 1.0*.

This Data Provider was certified by SAP in June 2006.<sup>3</sup> It uses the XMLA interface to access SAP BI data. So, it is possible to use the reporting services as a client for SAP BI. Figures 4.34 and 4.35 show examples of the steps required in the report assistant of SQL Server 2005.

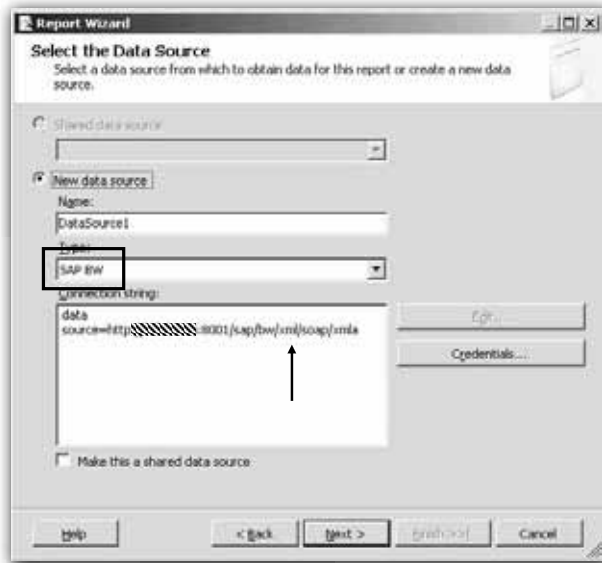


Figure 4.34 Creating an SAP NetWeaver BI Data Source (1)

3 See <http://www.sap.com/partners/directories/searchsolution.eps>.



Figure 4.35 Creating an SAP NetWeaver BI Data Source (2)

## 4.2 SAP Knowledge Management

While structured data is handled with a Data Warehouse solution such as SAP BW, other tools are used for unstructured data and documents.

Within SAP NetWeaver, SAP Knowledge Management (KM) as a component of the SAP NetWeaver Portal, supports the user in managing unstructured data, by finding it and incorporating it into the company's work processes. These unstructured data stocks, such as Office and PDF documents contain corporate knowledge that must be organized transparently and in an easy to access way. Retrieval-ability and re-usage are very important here, regardless of whether the documents are stored in the KM itself or in another document management system, since this will determine whether you achieve a goal-oriented handling of this knowledge.

Handling  
unstructured data

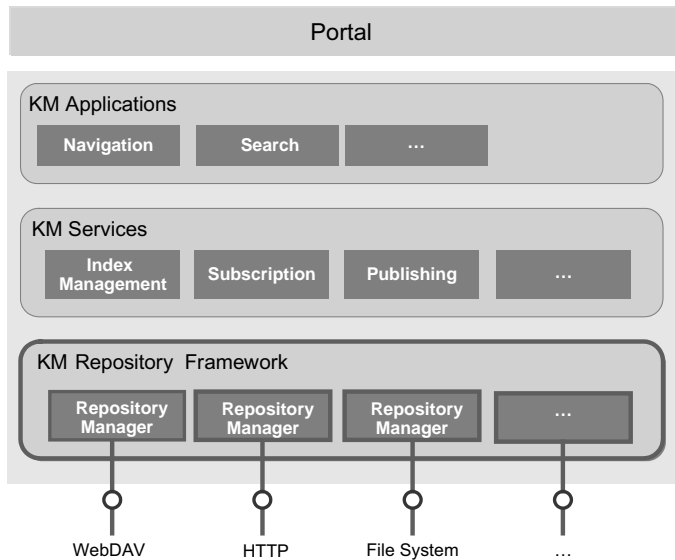
The SAP KM therefore has the following tasks and functions:

- ▶ Data integration
- ▶ Data processing
- ▶ Data access

First, we must clarify in general terms how the data integration of external data runs into the SAP KM.

Repository  
Manager

As is illustrated in Figure 4.36, the *SAP KM Repository Framework* is responsible for the data integration of SAP KM. This forms an abstraction layer between the KM and different manufacturers' document storage systems. As well as offering functions for storing and editing documents, it provides the so called *Repository Managers*. A Repository Manager is used to access relevant data sources and integrate the data in the Portal—ideally through open protocols such as the WebDAV protocol,<sup>4</sup> the most common open standard for exchanging documents. These protocols look after basic operations such as reading, copying or deleting files or data. A Repository Manager must be configured for each data source being incorporated.



**Figure 4.36** Classification of the KM Repository Framework

4 WebDAV stands for *Web-based Distributed Authoring and Versioning* and is an enhancement of HTTP-1.1. As an open standard, it supports the provision of files on the Internet or intranet.



In the standard version, SAP delivers the following Repository Managers for accessing Microsoft-based repositories:

Accessing  
Microsoft-based  
repositories

### 1. File system Repository Manager

The file system Repository Manager allows you to access Windows-based file servers. Here, the file system Repository Manager allows both read and write access to Windows file systems.

### 2. WebDAV Repository Manager

The WebDAV Repository Manager allows read and write access to repositories that support the WebDAV protocol. You can add the following repositories using the WebDAV Repository Manager:

- ▶ Microsoft Exchange Server (public folders)
- ▶ Microsoft Internet Information Server (Windows file systems published via WebDAV)
- ▶ Microsoft Windows SharePoint Services 2.0 with Microsoft's **Windows SharePoint Services (WSS) Connector for WebDAV**

### 3. Web Repository Manager

The Web Repository Manager allows read access to documents that are saved on a Web server such as an Internet Information Server (IIS).

When you access the documents through the Portal, the same authorizations should apply for users as those in the Windows operating system whose documents you want to integrate into the KM (e. g., read, write or delete authorizations). If the SAP NetWeaver Portal is being run on a Unix platform, note the functional restrictions for the file system Repository Manager listed in Table 4.1.

Figure 4.37 shows examples of the parameters that must be entered for a Repository Manager. Required parameters are the name of the Repository Manager and the prefix used to identify the Repository Manager responsible for a data source. Requirements to use additional parameters will depend on the type of relevant Repository Manager. For example, for a Repository Manager for a WebDAV access, an HTTP system must first be created in the Portal System Landscape with the corresponding system ID and cache. These details must then be given to the WebDAV Repository Manager as parameters.

Parameters for the  
Repository  
Manager

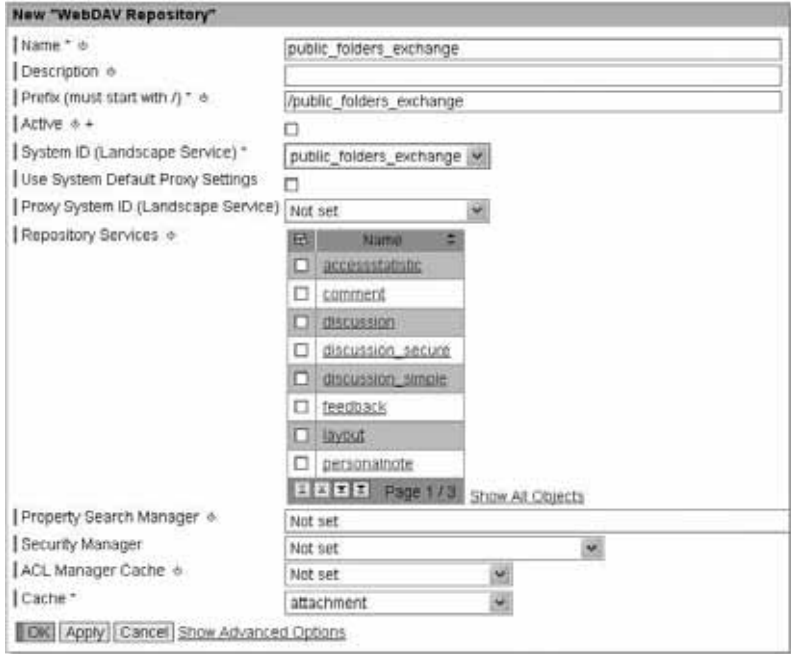


Figure 4.37 Parameters of a Repository Manager

The user accesses the data that has been integrated with the KM Repository Framework through the SAP NetWeaver Portal's interface. Here, users can access the folders of the KM Repository according to their user authorizations (see Figure 4.38).

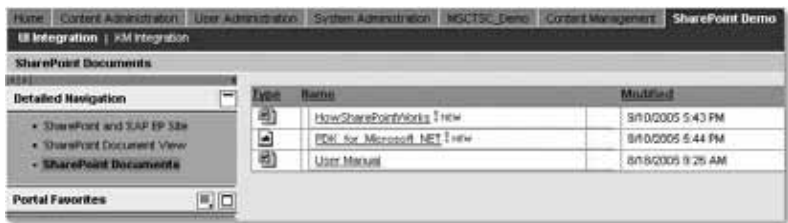


Figure 4.38 SAP KM User Interface

SAP KM provides a flexible user interface for navigating in the system. While a standard layout is stored in the profile, the Explorer for end users is flexible in that it changes the layout within the iView from folder to folder when the user navigates in the repositories being used.

### 4.2.1 File System Repository Manager

To integrate documents into a NetWeaver Portal on the Unix operating system platform with the File System Repository Manager, Active Directory must be running in the function level *Windows 2000 Mixed Mode*. If you are using Windows as the operating system platform for your NetWeaver Portal, as well as the function level *Windows 2000 Mixed Mode*, you can use the function modes *Windows 2000 native* and *Windows Server 2003*. The last two modes mentioned are also referred to as *Windows Server 2000* and *2003 Native Mode*.

Function modes  
of the Active  
Directory

If the File System Repository Manager is used in the Portal, a Windows system must be configured to allow the Portal users to maintain the user mapping. Table 4.1 shows an overview of the availability of the File System Repository Manager, depending on the function mode of the Active Directory.

SAP NetWeaver Portal operating system	Windows		Unix	
	Windows 2000 Mixed Mode	Windows 2000 Native Mode and Windows Server 2003	Windows 2000 Mixed Mode	Windows 2000 Native Mode and Windows Server 2003
Active Directory function level				
File system mount service with Windows 2000 security manager	X	X	X (except for HP/UX) <sup>5</sup>	Not supported
Microsoft IIS through the WebDAV Repository Manager	X	X	X	X

Table 4.1 Accessing Windows File Systems Taking Windows Access Authorizations into Account

For SAP Portals running on a Unix-based operating system that integrate the Windows file systems, instead of the File System Repository Manager you can connect the file systems through the IIS and the WebDAV Repository Manager, if the file systems are published through the IIS with WebDAV.

<sup>5</sup> The current release restrictions for NetWeaver 2004 and NetWeaver 2004s can be found in SAP Notes 709354 and 853509.

### 4.2.2 WebDAV Repository Manager

The configuration of the WebDAV Repository Manager is identical for all repositories, except for the URL included. All repositories are based on IIS, but have different WebDAV implementations. Since all repositories are technically based on the IIS, a user assignment can be used for authenticating the access. If the Active Directory has been upgraded to the Windows Server 2003 function level, you can use single sign-on (SSO) with the SSO22KerbMap module. Once the authentication is successful, it uses a SAP Logon Ticket to create corresponding Kerberos tickets based on the mechanism specified by *Kerberos Constrained Delegation using Protocol Transition*.

#### Configuring the HTTP System and the WebDAV Repository Manager

Configuring the HTTP system

First, we must define an HTTP system in the portal system landscape before configuring the WebDAV Repository Manager, as shown in Figure 4.39. The system landscape is edited with the *System Landscape Editor*. Go to **System Administration • System Configuration • System Landscape** to reach the area for administering the portal's system landscape. In the detailed navigation, select **Knowledge Management • Content Management** and in the subareas **Global Services • System Landscape Definitions • Systems • HTTP System**.

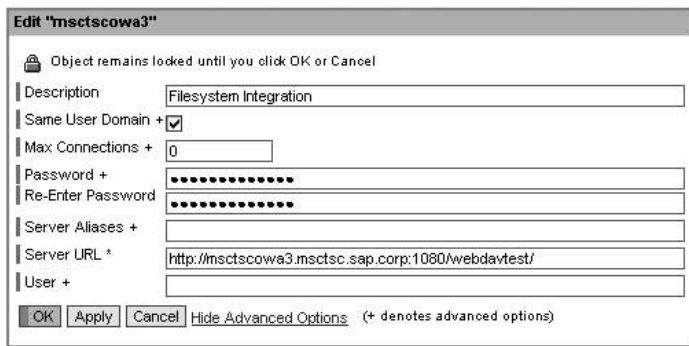


Figure 4.39 Editing an HTTP System

Ensure that the option **Same User Domain** is activated for the single sign-on with SAP Logon Tickets. The various options for authenticating against the WebDAV repositories will be outlined next.

Three options are available for specifying the authentication information (credentials) for the WebDAV Repository Manager and Web Repository Manager:

Authentication options

1. The authentication information is given statically in the underlying HTTP system with the parameters **User** and **Password**.
2. The credentials stored in the user mapping used.
3. Single sign-on is used, based on SAP Logon Tickets.

If a central user is maintained in the HTTP system, you can access the system with the credentials of this central user; that is, all portal users will access the repository with the same access rights. If a user name and password are maintained in the HTTP system, these details will have the highest priority and any other user assignments will be disregarded.

User credentials in the definition of the HTTP system

If the user assignment is used, each user must maintain his or her own authentication information (user name and password) for this system. For service users, such as the user `index_service`, the user assignment must be performed by the system administrator.

User assignment

To use a user assignment, a *WebDAV Repository Manager System Template* must be created and a WebDAV system must be set up in the portal's system landscape based on this template.

If you use the single sign-on option **Same User Domain**, with each WebDAV request, a SAP Logon Ticket will be sent to the WebDAV repository. Systems that accept SAP Logon Tickets can be integrated for the authentication of users, such as other SAP portals. With the SSO22KerbMap Module, we also can use SAP Logon Tickets for SSO to an IIS.

Single sign-on with SAP Logon Tickets

Since all three of Microsoft's WebDAV repositories are based on IIS, we can use SAP Logon Tickets for SSO when accessing them, and users don't have to maintain any user assignments (see Figure 4.40).

If the SSO option was chosen using SAP Logon Tickets, service users must be created in Active Directory, for example the `index_service` user. Note that the attribute used for identifying the user in Active Directory and specified in the configuration file *SSO22KerbMap.ini* of the SSO22KerbMap module is maintained for Active Directory users. If such a user does not yet exist, it must be created.

Configuring the SSO22KerbMap Module

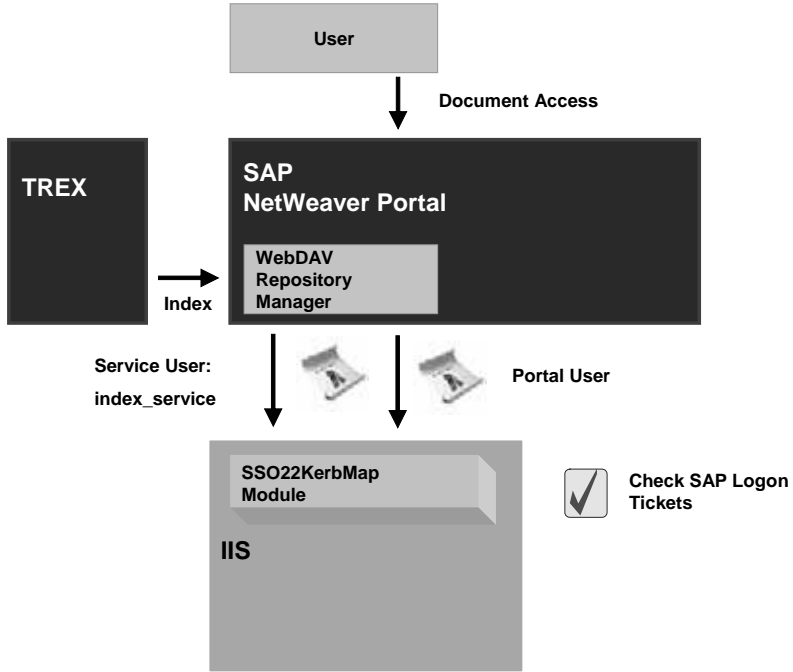


Figure 4.40 WebDAV Repository Manager—Single Sign-On with SAP Logon Tickets

For example, if the attribute `userprincipalname` is used as the user name for the SAP Portal, a user must be created in Active Directory whose `userprincipalname` has the value `index_service`, or the `userprincipalname` of an existing user must be changed in the Active Directory to the value `index_service`.

### Configuring the WebDAV Repository Manager

The configuration of the WebDAV Repository Manager then takes place. In the portal's *System Landscape Editor*, choose **Knowledge Management • Content Management** in the detailed navigation. In the subareas, choose the option **Repository Managers** and under **Topics** choose **WebDAV Repository**. Figure 4.41 shows the parameters of a WebDAV Repository Manager to access a Windows file system published by an IIS.

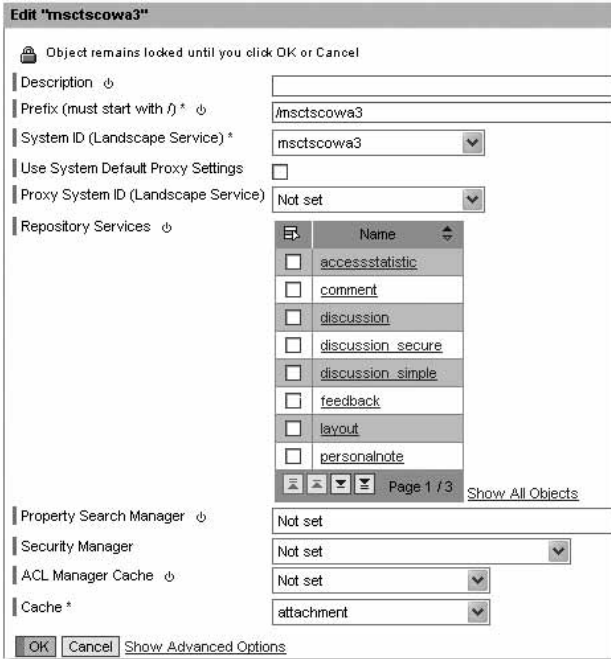


Figure 4.41 WebDAV Repository Manager

## KM Integration of Windows File Systems Through IIS and WebDAV

WebDAV is an optional component that is not automatically installed with IIS 6.0. If WebDAV was not installed during the installation of IIS 6.0, it must be added after the IIS installation.<sup>6</sup> Finally, we must create a virtual directory on an IIS website. Through this virtual directory we can either publish a local directory or share on another server through the UNC name. Let's look at accessing the directory `C:\inetpub\WebDAVTest` (see Figure 4.42).

The directory `C:\inetpub\WebDAVTest` is published through IIS on the server `msctscowa3.msctsc.sap.corp` by the virtual directory `WebDAVTest`. The directory can be accessed through the following URL via WebDAV:

`http://msctscowa3.msctsc.sap.corp/WebDAVTest`

<sup>6</sup> WebDAV Publishing Directories (IIS 6.0), <http://www.microsoft.com/technet/prodtechnol/WindowsServer2003/Library/IIS/002a6134-27a4-42e5-ba0b-27d9a4440c0b.mspx?mfr=true>.

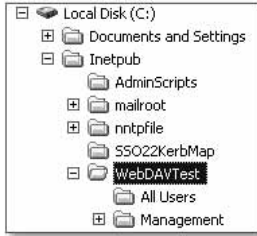


Figure 4.42 Windows File System

The *WebDAVTest* directory contains two subdirectories—*All Users* and *Management*. The security settings are chosen so that only members of the Management group have access to the *Management* directory, while all users can access the *All Users* subdirectory. *Windows Integrated Authentication* was configured for virtual directory *WebDAVTest* in the IIS. Figure 4.43 shows the result for a user who is a member of the Management group, and for a normal user. As you can see, the *Management* directory is not shown to the normal user.

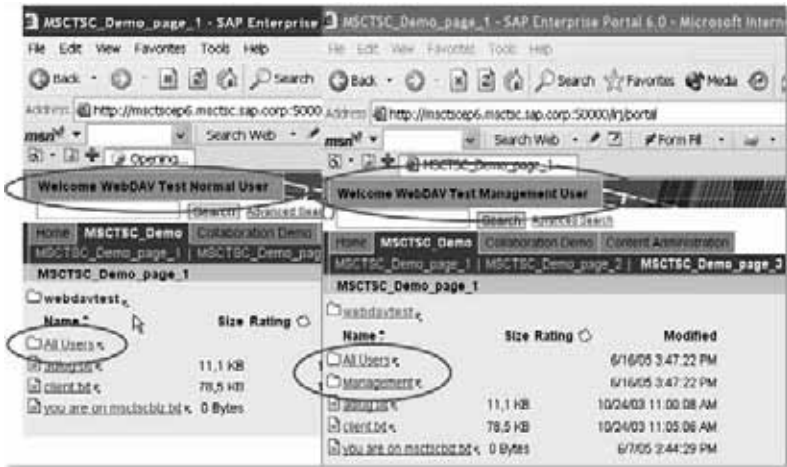


Figure 4.43 Accessing the Windows Repository with Windows Authorizations

### KM Integration of Microsoft Windows SharePoint Services

SharePoint Services

KM SharePoint integration is becoming more popular. This is due to the increasing prevalence of Microsoft Windows SharePoint Services in real or virtual teams, as well as the installation of a company-wide portal based on the SAP NetWeaver Portal. Often, SharePoint Ser-



vices have replaced the previous departmental directories (file shares) and contain, among other things, the corresponding Office documents that were previously stored on Windows file servers. To allow this unstructured data to also be available as content in the portal, you can incorporate it into the SAP NetWeaver Portal using the SAP-KM functionality.

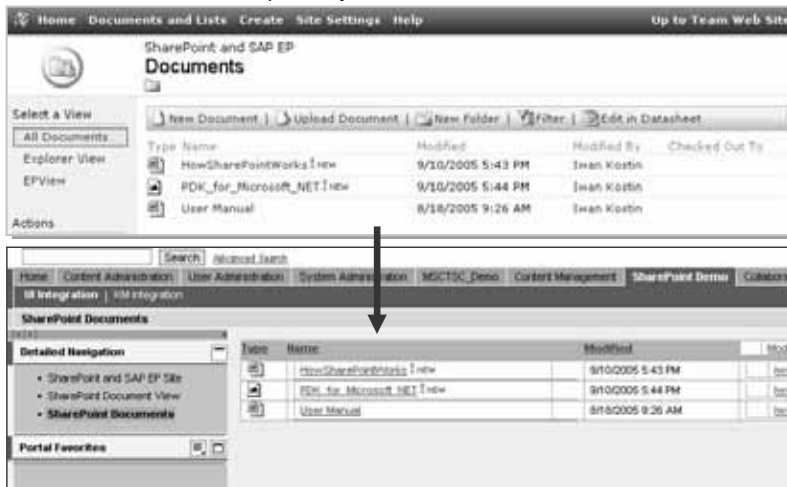
To now access the content of the SharePoint Services, it is important to know how the data is stored in SharePoint Services and how "external" access is possible. SharePoint Services work with the WebDAV protocol; this standard was implemented by Microsoft for SharePoint Services, however not completely.

To offer WebDAV in the same scope as SAP KM, Microsoft announced the *Windows SharePoint Services Connector for WebDAV*. We had access to a beta version of this connector while writing this book. Using the Windows SharePoint Services Connector for WebDAV by Microsoft, it is possible to integrate Windows SharePoint Services by setting up a WebDAV Repository Manager in the SAP KM Repository Framework (as shown in Figure 4.36 above).

Windows  
SharePoint  
Services Connector  
for WebDAV

Figure 4.44 shows the result of this integration.

#### SharePoint Document Repository



Integrated SPS Documents in the Portal

Figure 4.44 Displaying SPS Documents in the SAP NetWeaver Portal

Here you can see two views of the data stored in SharePoint, which illustrate how Microsoft SharePoint Services documents are shown within the KM user interface and how they are available to the user when accessed through Windows SharePoint Services.

### KM Integration of Microsoft Exchange

In Chapter 3 we discussed the integration possibilities of Microsoft Exchange Server 2003 elements in relation to *Portal Integration*, *Collaboration* and the Exchange Server's email and calendar functions.

Integrating public folders

However, if we now want to integrate additional elements, such as public folders as content, it is also possible to set up a WebDAV Repository Manager here because Microsoft Exchange Server 2003 already fully supports WebDAV technology in the standard system. This option is particularly interesting for companies that distribute information internally through public folders. It must be stressed that the idea is not to integrate individual mailboxes using SAP KM.

The procedure to incorporate this is similar to the previously described SharePoint variant. First, we must set up a new HTTP system; specify the Exchange Server URL here. To use the public folders, the following notation must be used for Microsoft Exchange Server 2003:

```
http://[Exchange Server]:[Port]/public/
```

The WebDAV Repository Manager is then configured for accessing the Microsoft Exchange Server. Figure 4.45 shows the result.



Figure 4.45 Displaying the Public Folders of Exchange in the Portal

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