XML for Analysis

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Learning Objectives

As a result of this workshop, you will be able to:

- Understand the basics of Extensible Markup Language for Analysis (XMLA)
- Explain the benefits and typical application scenarios for XMLA in general
- Understand the specific features and tools of the SAP Business Information Warehouse (BW) XMLA provider
- Request OLAP metadata from BW with the Discover method
- Run multidimensional queries in BW using the Execute method
- Understand the basics of Multidimensional Expression grammar (MDX)
- Create C# proxies from the XMLA Web Services Description Language (WSDL) file
Learning Objectives continued

What this workshop will not teach:

- Details of Web (services) foundation technologies
  - XML (Extensible Markup Language)
  - SOAP (Simple Object Access Protocol)
  - SAX (Simple API for XML)
  - DOM (Document Object Model)
  - XSL (Extensible Stylesheet Language)
- Details on how to consume XMLA on a specific platform
  - .NET
  - J2EE
- Extensive MDX and OLAP domain knowledge

Agenda

Introduction
- XMLA defined, history of OLAP standards and XMLA
- XMLA Versions, architecture, foundation technologies
- BW XMLA provider
- Demo sample client

Discover
- Discover method, structure of XMLA metadata
- Exercises: browsing dimensions, levels, members

Execute
- Execute method, multidimensional expressions
- Exercises: a simple ranking list

WSDL
- XMLA WSDL
- Exercise: Generating code with a Service Description: Generating a C# proxy via WSDL which connects a .NET application to a BW Web service.
Introduction: What is XML for Analysis?

XMLA is a SOAP-based interface for exposing OLAP and Data Mining data sources as Web services. It advances some of the successful concepts of OLE DB for OLAP to a cross-platform Web service API.

The XMLA API defines 2 methods:

- **Discover**: Used to obtain metadata and information about a Web service
- **Execute**: Used to execute (M)ulti(D)imensional E(X)pressions (MDX) or provider-specific commands

Introduction: Simple Object Access Protocol (SOAP)

- Provides a standard packaging structure for transporting XML messages over various low-level protocols such as HTTP or SMTP.
- Defines encoding rules for mapping application data types into an XML format as well an RPC mechanism.
- SOAP can be regarded as the most important cornerstone of interoperability, as it provides an agreed-upon communication protocol between heterogeneous clients and servers.
Introduction: XMLA Architecture

- Client
  - UI
  - Client functions
  - Discover, Execute Calls

- SOAP HTTP
- Discover, Execute Calls
- Data
- Internet or LAN

- XML for Analysis Provider Implementation
- Discover, Execute Call Server

- Any client (Windows, Linux, Macintosh) at any location
- Any server (Solaris, Linux, Windows) at any location

Introduction: Why XMLA?

- There was still the need for a broadly applicable/accepted low-footprint OLAP API.
- Web services are gaining momentum:
  - Characteristics
    - XML-based (eliminates networking, OS or platform binding; interoperability; developers have begun to know XML well)
    - Loosely-coupled (client is not tied to WS directly; WS can change over time without compromising client’s ability to interact with the service)
    - Coarse-grained (structure of services is driven by a methodological rather than technical mindset)
  - Benefits
    - Simplifies connectivity and reduces cost by agreeing upon standards.
    - Enables data integration through XML.
    - Provides robustness and unification of interface technology.
    - Reduces the need for customization.
    - Assembles applications from standardized functional building blocks.
    - Provides full visibility of the value chain to all participants.
    - Integrates Intranet and Extranet.
Introduction: XMLA Versions

<table>
<thead>
<tr>
<th>Version</th>
<th>Date Release</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>April 2001</td>
<td>Initial Release of the Specification</td>
</tr>
<tr>
<td>1.1</td>
<td>November 2002</td>
<td>Minor Modifications after receiving feedback from actual use</td>
</tr>
</tbody>
</table>
| 1.2     | TBD         | Leveling???
|         |             | mdXML???

Introduction: XMLA application scenarios

Beyond E-commerce, there is an even greater need to share information.

Add value to your offering by providing self-service access.

Just-in-Time Inventory
- Consumer provides to a Supplier just-in-time inventory data reports exposed as Web services.
- Metrics represented in the reports alert about low inventory.
- The reports are interactive, so you drill into historic data, comparing today's fluctuation in stock levels with corresponding days in other weeks or months.

Market/Environment data
- Nielsen and others offer their services in the yellow pages.
- Integration and consumption of such data becomes much easier without requiring a very close business relationship with such service providers.

An electric utility company
- exposes its BI platform, so commercial and industrial customers can better understand their power consumption and related costs.

A financial services company
- provides BI Web services, so auditors and regulators have an appropriate level of visibility into the company's dealings.

A brokerage firm
- supports BI Web services so institutional investors can analyze (in a multidimensional way) the performance of financial instruments executed through the brokerage.
**Introduction: BW Open Analysis Interfaces**

- **OLE DB for OLAP**
  - Based on COM as protocol
  - Driver installation on clients
  - Windows platform only
  - MDX as query language
  - Available since BW 1.2B

- **OLAP BAPIs**
  - Business Application Programming interface
  - Based on RFC as protocol
  - Access library available on any SAP platform
  - MDX as query language
  - Available since BW 2.0A

- **XML for Analysis**
  - Based on XML as exchange format
  - Based on HTTP/SOAP as protocol
  - Any platform
  - MDX as query language
  - Available since BW 3.0A

**Introduction: Direct Access to InfoCubes**

Definition of BW Query not necessary but recommended

Available Objects:
- All basic InfoCubes and MultiProvider as CUBE
- All characteristics and key figures as DIMENSION / MEASURE
- But no navigational attributes and no restricted or calculated key figures

```
SELECT
  ( [Measures].[0D_DOCUMENT],
    [Measures].[0D_OORVALSC] ) ON COLUMNS,
  NON EMPTY
  [0D_PLANT].MEMBERS ON ROWS
FROM [0D_SD_C03]
WHERE
  ( [0CALMONTH].[200101],
    [0D_COUNTRY].[US] )
```

<table>
<thead>
<tr>
<th>JAN 2001, USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of documents</td>
</tr>
<tr>
<td>$224,000</td>
</tr>
<tr>
<td>Frankfurt</td>
</tr>
<tr>
<td>Manchester</td>
</tr>
<tr>
<td>Calgary</td>
</tr>
<tr>
<td>Chicago</td>
</tr>
</tbody>
</table>
**Introduction: SE37**

SE37 RSBB_URL_PREFIX_GET, Service URL:

![SE37 RSBB_URL_PREFIX_GET](image1)

**Introduction: SICF**

SICF Service Maintenance (sap/bw/xml/soap/xmla):

![SICF Service Maintenance](image2)
### Introduction: MDXTEST

**MDXTEST - MDX Testeditor**

[Image of the MDX Testeditor interface]

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### Demo Sample Client

**SOAP messages**

**SOAP Request**

```xml
                   xmlns:xsd="http://www.w3.org/2001/XMLSchema"
                   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <SOAP-ENV:Header/>
  <SOAP-ENV:Body>
    <xsi:schemaLocation="http://schemas.xmlsoap.org/soap/envelope/">
      <SOAP-ENV:Message/>
    </xsi:schemaLocation>
  </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

**SOAP Response**

```xml
                   xmlns:xsd="http://www.w3.org/2001/XMLSchema"
                   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <SOAP-ENV:Header/>
  <SOAP-ENV:Body>
    <xsi:schemaLocation="http://schemas.xmlsoap.org/soap/envelope/">
      <SOAP-ENV:Message/>
    </xsi:schemaLocation>
  </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```
Discover: Method Signature

Discover (  
    [in] RequestType As EnumString,  
    [in] Restrictions As Restrictions,  
    [in] Properties As Properties,  
    [out] Result As Rowset)

- **RequestType**: Specifies the structure and content of the Rowset returned in the Result parameter (DISCOVER_DATASOURCES, MDSHEMA_CUBES, MDSHEMA_DIMENSIONS...)
- **Restrictions**: Sets restrictions for columns of the Result, in order to filter the rows returned. Mandatory, but can be empty.
- **Properties**: Specifies a collection of XML for Analysis properties (return format of the Result set, timeout, locale in which the data should be formatted)

Discover: SOAP Example Discover Request

```xml
<SOAP-ENV:Envelope
    xmlns:SOAP-ENV='http://schemas.xmlsoap.org/soap/envelope/'
    SOAP-ENV:encodingStyle='http://schemas.xmlsoap.org/soap/encoding/'>
    <SOAP-ENV:Body>
        <Discover>
            <RequestType>MDSHEMA_CUBES</RequestType>
            <Restrictions>
                <RestrictionList/>
            </Restrictions>
            <Properties>
                <PropertyList>
                    <DataSourceInfo>DataSource=local</DataSourceInfo>
                    <Format>Tabular</Format>
                </PropertyList>
            </Properties>
        </Discover>
    </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```
Discover: OLE DB Schema Objects

OLE DB for OLAP
- Catalogs
- Schema
- Cubes
- Dimensions (Measures)
- Hierarchies
- Levels
- Members
- Properties

SAP BW
- InfoCubes
- Not supported
- Queries
- Characteristics (Keyfgs)
- Hierarchies (external)
- Numbered Levels or Dummy level names
- Characteristic Values
- Display Attributes

Discover: Mapping of Query Objects

BW Query
- Charact.1: Region
- Charact.2: Fiscal Year
- Charact.3: Customer
- Structure for Key Figs.
- Member1: Cost
- Member2: Sold Pieces
- Member3: Revenue
- Variable1: Cost Area

QUERY_CUBE structure
- Dimension1: Region
- Dimension2: Fiscal Year
- Dimension3: Customer
- Measures Dimension
- Measures
- Cost
- Sold Pieces
- Revenue
- SAP Variables Cost Area
Discover: Exercise 1

- Access cube metadata
- Access dimension metadata
- Access level metadata
- Access Member metadata

User Name: BW253-01 to -##
Password: init

Execute: Method Signature

Execute (  
  [in] Command As Command,  
  [in] Properties As Properties,  
  [out] Result As Resultset)

**Command**
Specifies a provider-specific statement to be executed. XML for Analysis multidimensional providers must support the mdXML language, but they can also support other commands as needed.

**Properties**
Specifies a collection of XML for Analysis properties:
- return format of the Result set
- timeout
- locale in which the data should be formatted
Execute: MultiDimensional EXpressions (MDX)

XMLA is a linguistic interface that uses MultiDimensional Expressions (MDX) for querying multidimensional Datasets

Parts of MDX statements:
- **FROM** clause -> selects a cube
- **SELECT** clause -> defines the axes
  - **ON COLUMNS** -> defines the columns axis
  - **ON ROWS** -> defines the rows axis
- **WHERE** clause -> filter conditions

Execute: MDX Example

```
SELECT
{ [Measures].[CKF_SI_PROFIT],
  [Measures].[OD_DOCUMENT],
  [Measures].[OD_OORVALSC]
} ON COLUMNS,
NON EMPTY
[OD_PLANT].MEMBERS
ON ROWS
FROM [0D_SD_C03/SAP_DEMO_ODBO]
WHERE
( [0CALMONTH].[200101],
  [OD_COUNTRY].[US] )
```

<table>
<thead>
<tr>
<th>JAN 2001, USA</th>
<th>Profit</th>
<th>Number of documents</th>
<th>Open orders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frankfurt</td>
<td>$752,517.00</td>
<td>10,000</td>
<td>$286,858.00</td>
</tr>
<tr>
<td>Manchester</td>
<td>$238,084.00</td>
<td>9,000</td>
<td>$26,884.00</td>
</tr>
<tr>
<td>Calgary</td>
<td>$228,487.00</td>
<td>9,000</td>
<td>$46,655.00</td>
</tr>
<tr>
<td>Chicago</td>
<td>$144,710.00</td>
<td>9,000</td>
<td>$165,855.00</td>
</tr>
</tbody>
</table>
Execute: More MDX

Basic Entities
- Members – items representing the occurrence of data
  - Examples: [City].[Las Vegas], [Time].[Year].[2003]
- Tuples – collections of members from multiple dimensions
  - Examples: {{City].[Las Vegas],[Time].[Year].[2003],[Event].[SAP TechEd 2003]}
- Sets – collections of tuple elements
  - Examples: {{City].[Los Angeles],[Time].[Year].[2002]},{City].[Las Vegas],[Time].[Year].[2003]},
- Values – numbers, strings
  - Examples: 5, “red”

Functions/Expressions that generate these Basic Objects
- Member value expressions
  - Examples: <member>.PARENT
- Set value expressions
  - Examples: TOPCOUNT(<set>,<index>,<numeric_value_expression>)
- Numeric value functions
  - Examples: MAX(<set>{, <numeric_value_expression>})

Execute: Exercise 2

- MDX Statement 1: Top five sales organizations based on order value
- MDX Statement 2: Sales organizations with incoming orders of greater than five million
Web Services Description Language (WSDL)

- XML grammar for describing Web services.
- WSDL documents can be used for generating implementation code, which therefore allows clients to automatically understand how to interact with a given service.

```xml
<definitions>
  <import>*
  <types>
    <schema></schema>
  </types>
  <message>*
    <part></part>
  </message>
  <PortType>*
    <input></input>
    <output></output>
    <fault></fault>
  </PortType>
  ...
</definitions>
```

WSDL: Exercise 3

- Exercise:
  Generating code with a Service Description:
  Generating a C# proxy via WSDL which connects a .NET application to a BW Web service.
Summary

- XMLA is a Web service API for OLAP and data mining
- XMLA advances concepts of OLE DB for OLAP
- The API consists of two methods: Discover, Execute
- Discover is used to access a provider’s metadata
- Execute is used to process MDX statements
- The current version of XMLA is 1.1
- XMLA is driven by the XMLA council

Further Information

On the SAP Help Portal:

Open Analysis Interfaces, including XMLA:
http://help.sap.com/:
  → SAP NetWeaver → SAP Business Information Warehouse → SAP BW 3.1/BI Content 3.2 Add-On (Select Language) → Open Analysis Interfaces

On the Internet:

XMLA council:
http://www.xmla.org/

World Wide Web Consortium (W3C) specification for SOAP:
http://www.w3.org/TR/SOAP/

W3C information on Extensible Markup Language (XML):
http://www.w3.org/XML/

W3C information on Web Services Description Language (WSDL):
http://www.w3.org/TR/wsd1

Related Workshops/Lectures at SAP TechEd 2003

BW204 – Universal Data Access via SAP BW Java Integration Functionality
  • Oct. 1, 2003, 4 pm, Room H11

On the Internet:

XMLA council:
http://www.xmla.org/

World Wide Web Consortium (W3C) specification for SOAP:
http://www.w3.org/TR/SOAP/

W3C information on Extensible Markup Language (XML):
http://www.w3.org/XML/

W3C information on Web Services Description Language (WSDL):
http://www.w3.org/TR/wsd1
Q&A

Questions?

Please complete your session evaluation and drop it in the box on your way out.

Thank You!

The SAP TechEd '03 Basel Team