F07 Developing DB2 Applications using Web Services and Messaging

Connie Nelin, Senior Technical Staff Member, IBM

Today's database applications are more complex than simple data access. Customers need to develop applications which access information from a variety of traditional and nontraditional sources. Such systems have a wide variety of uses, from linking together disparate applications, to disseminating real-time information, to integrating communications with external partners. Often such uses combine database operations with messaging operations and web services in the same applications. This presentation will cover new support and new development tools that simplify building these complex applications. It will show how you can develop synchronous and asynchronous applications that mix traditional SQL and Stored Procedures with XML, Messaging and WebServices.

F07

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IBM Data Management Technical Conference

Anaheim, CA **Sept 9 - 13, 2002**

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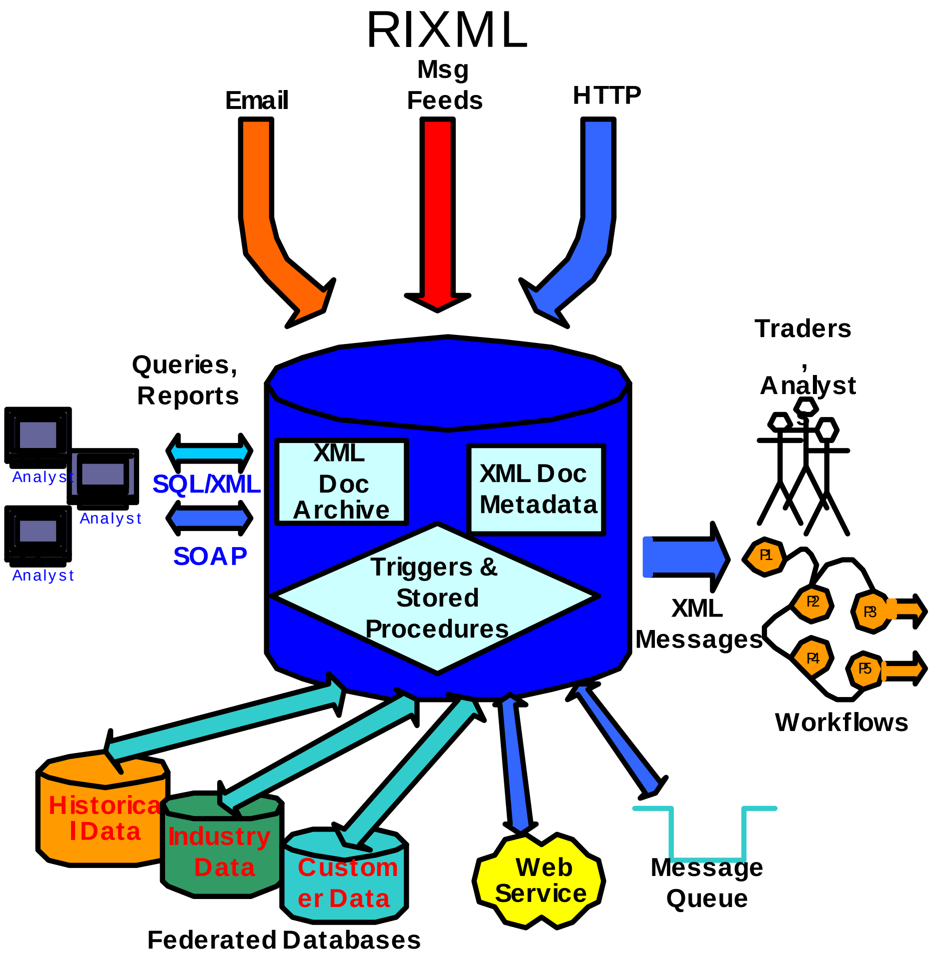
Outline

- New Types of Applications
- DB2 Application Development
- DB2 and XML
- DB2 and Web Services
- DB2 and Messaging
- Pulling it all Together

Today’s Applications

- **Information Consolidation**
  - Gather raw research, transforming to RIXML if needed.
- **Information Federation**
  - Federate historical, current, customer data for Portals, Active Analysis
  - Federate information from news feeds, market and research sites
- **Deep Analysis**
  - Construct classification models, historical trends, research accuracies
  - Text mining and analysis
- **Active Analysis, Active Data**
  - If important market information (scoring), Email notifications to key customers
  - Notify traders, correlate to other core information and report
- **Portal**
  - Provide internal and external customers with a query interface to provide alerts and allow for search over federated metadata and structured/unstructured sources.



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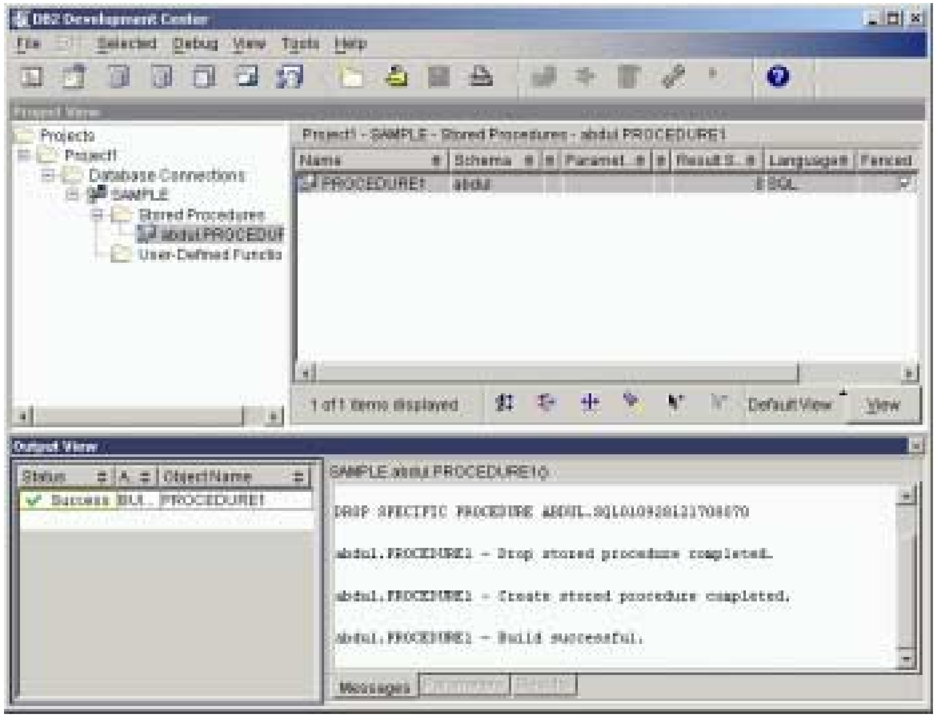
- Pulling it all Together

Today’s Development Tools

- Many Choices Available:
  - – DB2 Development Center
  - – DB2 Microsoft Visual Studio Add-ins
  - – Web Sphere Studio Application Developer
    - As well as other Web Sphere Studio offerings
- Many Languages Available
  - – Java, SQL, C/C++, COBOL, Basic, ….

DB2 Development Center



Project1 - SAMPLE - Stored Procedures - abdul.PROCEDURE1

Name	Schema		Paramet...		Result S...	Language	Fenced
PROCEDURE1	abdul				0	SQL	✓

Status	A...	Object Name
✓ Success	BUI...	PROCEDURE1

SAMPLE.abdul.PROCEDURE1()

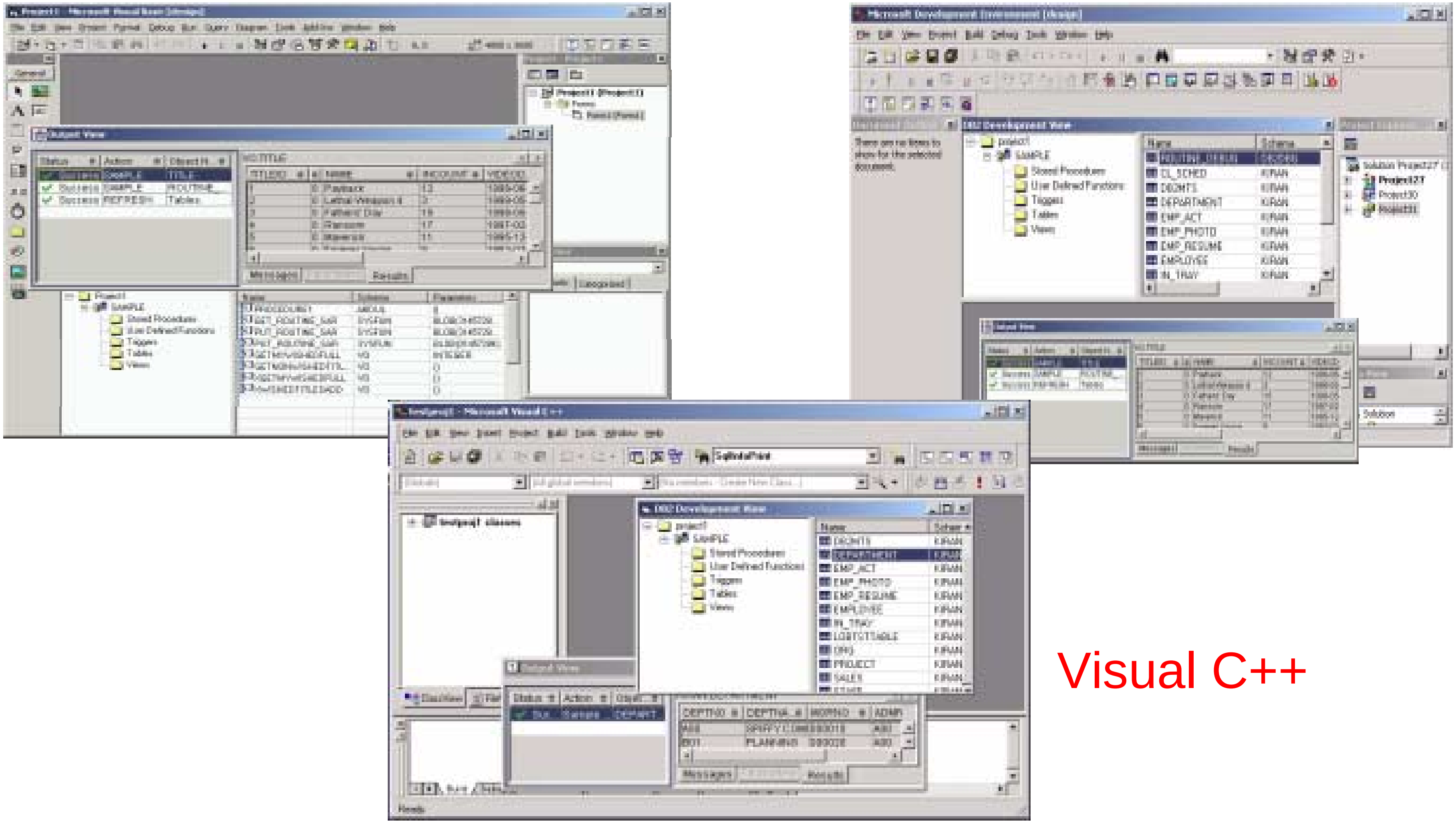
```
DROP SPECIFIC PROCEDURE ABDUL.SQL010920121708070

abdul.PROCEDURE1 - Drop stored procedure completed.

abdul.PROCEDURE1 - Create stored procedure completed.

abdul.PROCEDURE1 - Build successful.
```

- Support for DB2 family
  - Follow on to Stored Procedure Builder
- Support for SPs, UDFs
  - SQL, Java
- Support for live and disconnected development

DB2 Microsoft Visual Studio Add-ins

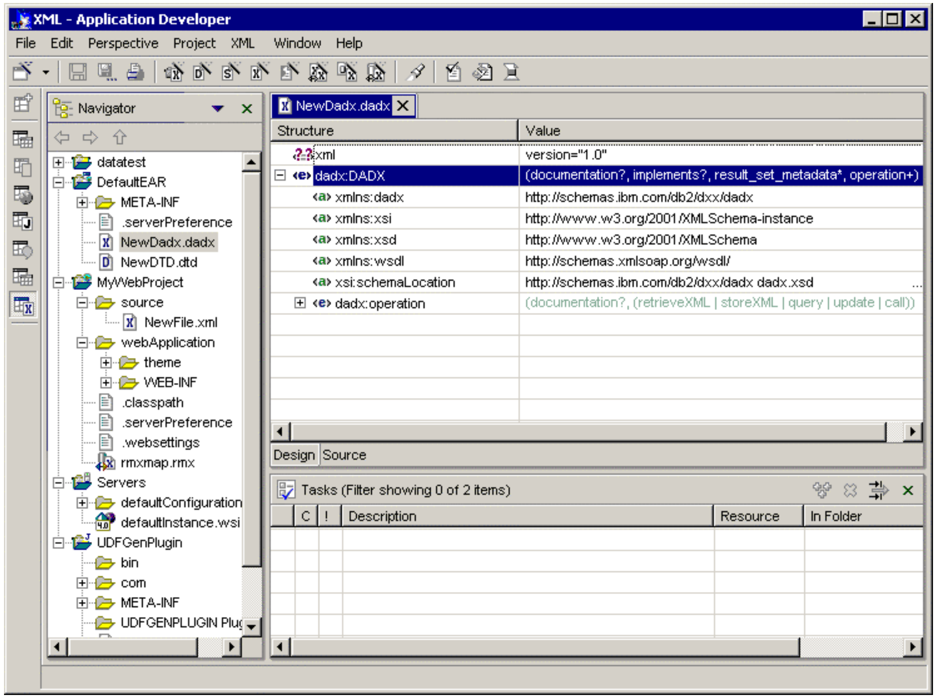
Visual Basic

Visual InterDev



Visual C++

WebSphere Studio Application Developer



Structure	Value
xml	version="1.0"
dadx:DADX	(documentation?, implements?, result_set_metadata*, operation+)
xmlns:dadx	http://schemas.ibm.com/db2/dxx/dadx
xmlns:xsi	http://www.w3.org/2001/XMLSchema-instance
xmlns:xsd	http://www.w3.org/2001/XMLSchema
xmlns:wsdl	http://schemas.xmlsoap.org/wsdl/
xsi:schemaLocation	http://schemas.ibm.com/db2/dxx/dadx dadx.xsd ...
dadx:operation	(documentation?, (retrieveXML | storeXML | query | update | call))

	C	!	Description	Resource	In Folder

- Relational Schema Center
  - Tables, SPs, UDFs
- XML Tooling
  - XML extender tooling – DAD
- Web Services Tooling
  - Web Service data access – DADX
  - Web service UDF client & wizard
- JSP DataTags
- Debugging

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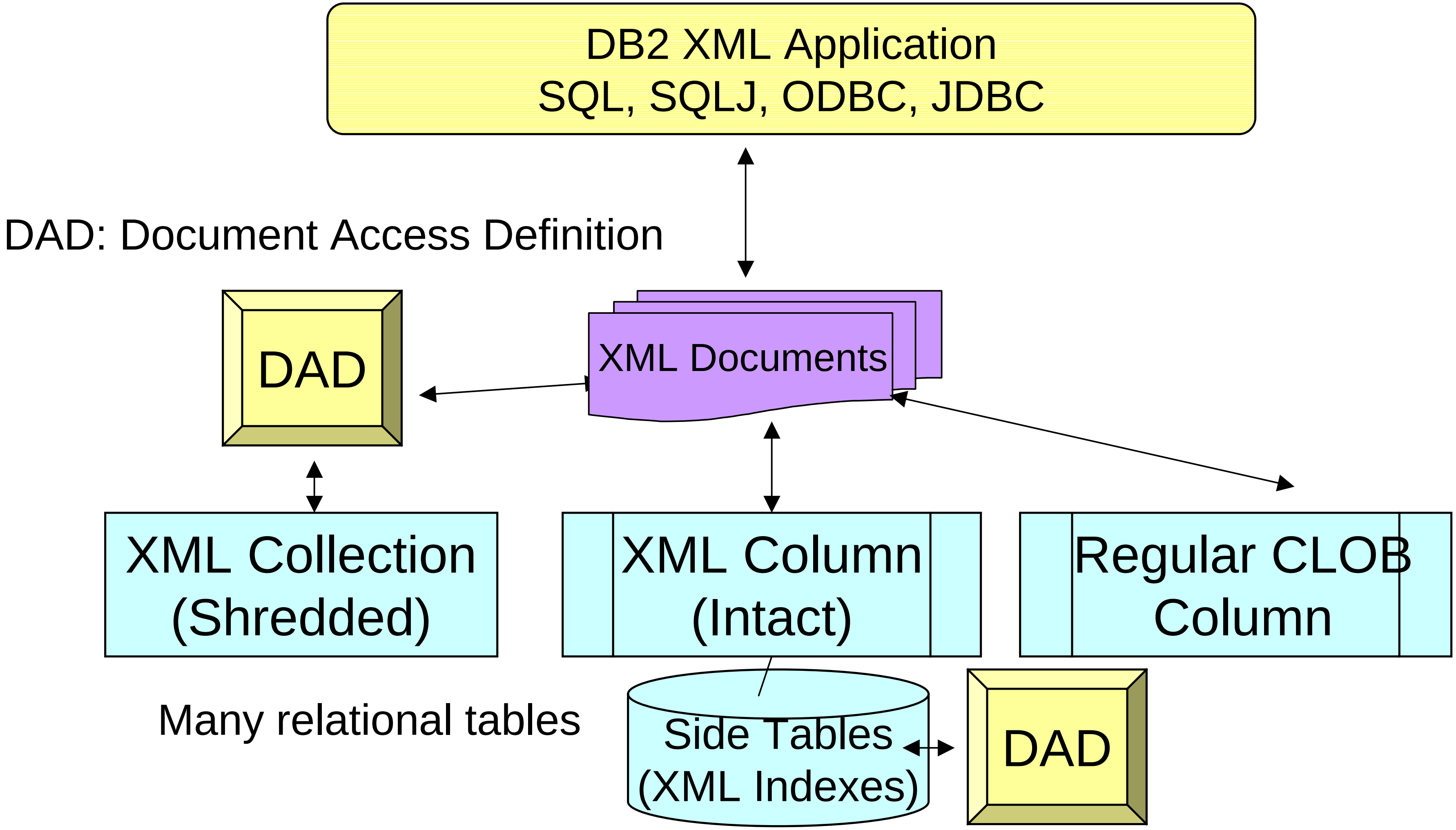
Why XML & DB2?

- XML is a key 'data interchange' format
  - B2B, B2C, Intra enterprise, Inter enterprise
  - Business critical information
- DBMS provides
  - Large scale storage / Management
  - Transformation / Aggregation
  - Interrogation / Analysis of data
- Combine strengths of both worlds

XML Storage in DB2 Today

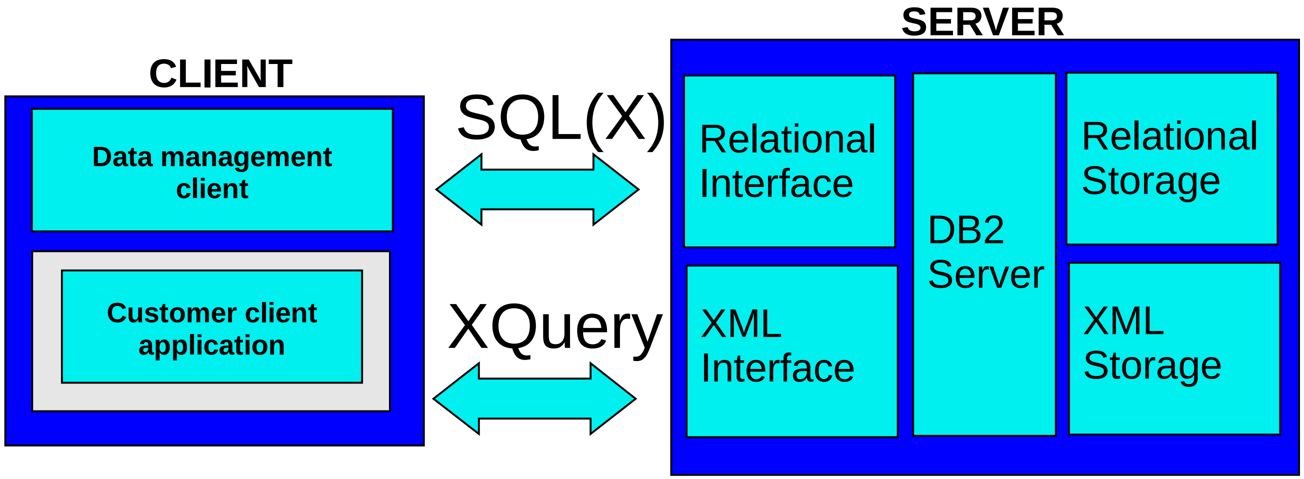
- Store/retrieve whole XML documents
  - As XML column (entire document) or collection of fields
  - As externally managed files using DB2 UDB Data Links Manager
- Compose or decompose and store/retrieve portions
  - stored procedures dxxGenXML/dxxShredXML for collection of fields
- Document Access Definition (DAD)
  - Shape
  - Scope
- XML data types
  - XMLVARCHAR, XMLCLOB, XMLFILE (file name)
- Search: fast and powerful search/indexing on XML

XML Storage in DB2



XML in DB2 Future

- XML capabilities "inside" the engine
- Performance, performance, performance
- "Feels" relational and/or XML
- Both SQL flavor and fully XML flavor
- XML *is* DB2 internals
- XML Extender becomes one with the data engine



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Web Services

- New distributed computing platform
  - Built on existing network infrastructure including XML, HTTP and more
- Self-contained, self describing, modular service that can be published, located and invoked across the Web
  - E.g. airline schedules, currency conversion, supplier quotes
- Enable component-oriented, distributed applications

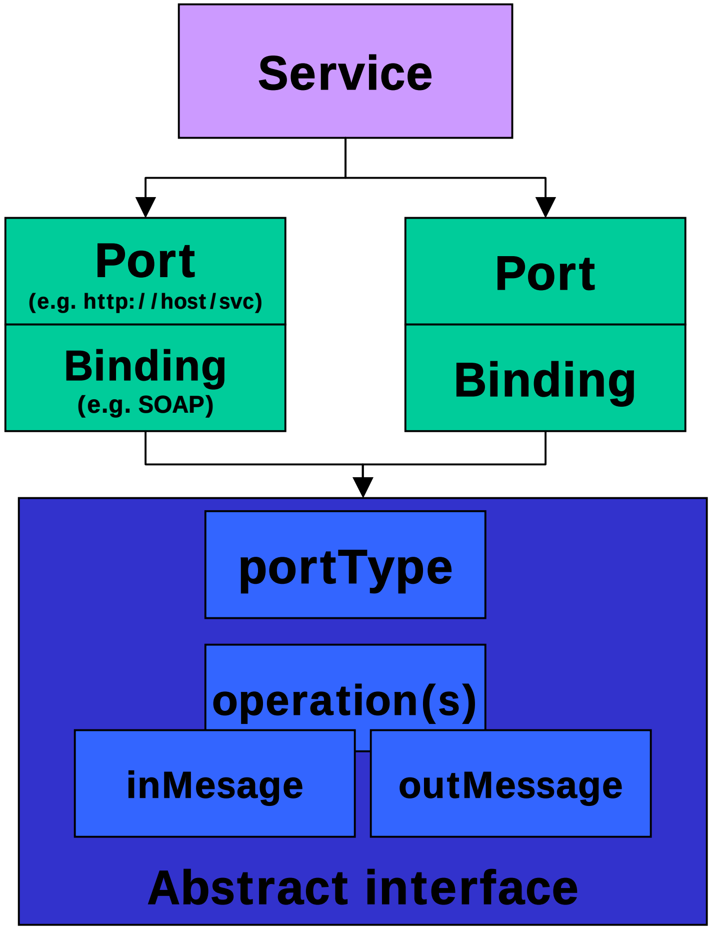
Web Services

- SOAP – Simple Object Access Protocol
  - Messaging/communication protocol for Web services
- WSDL – Web Services Description Language
  - Language used to describe Web services, as well as how to connect to and use them
    - Describes interface including method name, parameters, and binding information
    - Describes meta information about the Web service, such as network location, protocol,
- UDDI – Universal Description, Discovery, and Integration
  - Registering and discovering Web services

WSDL Model

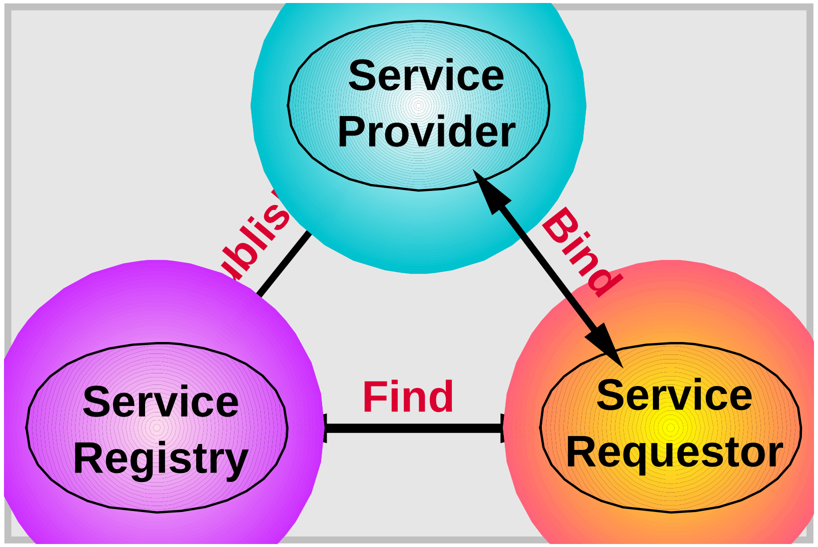
- A WSDL description has three basic parts:

- **Abstract interface:**
  - Abstract definition of a service (set of operations)
- **Protocol bindings**
  - Define how to access it.
  - Multiple per portType:
  - SOAP, JMS, direct call.
- **Deployed service access ports**
  - Where to access it.



Web Services Concepts

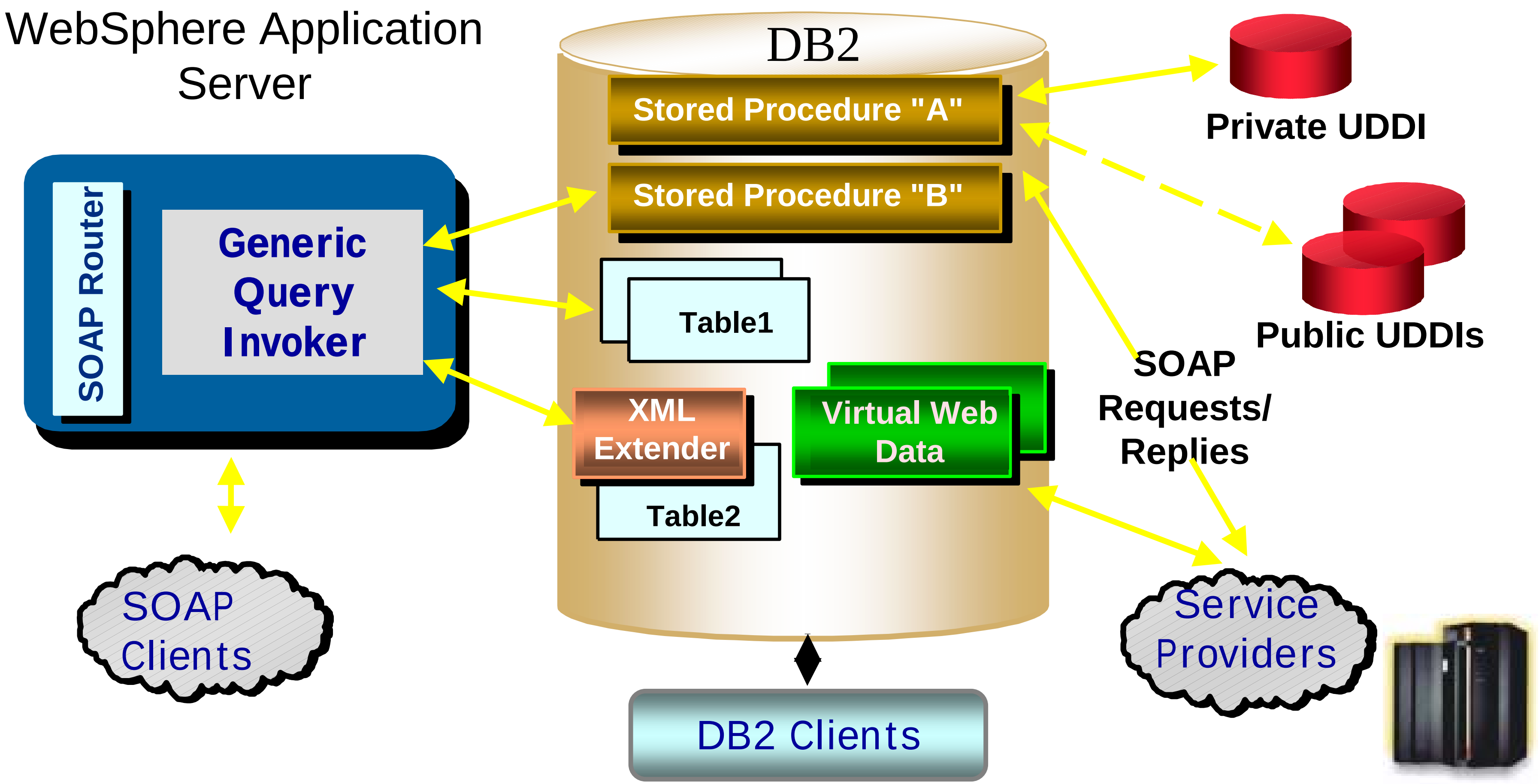
- **Service Requestor**
  - FINDS required services via the Service Broker
  - BINDS to services via Service Provider
- **Service Provider**
  - provides e-business services
  - PUBLISHES availability of these services through a registry
- **Service Registry**
  - provides support for publishing and locating services
  - like telephone yellow pages



Why DB2 and Web Services?

- Allowing Web service access to DB2
  - Helps businesses more easily integrate their current business processes and data
- Allowing Web service access from DB2
  - Allow new classes of real-time data sources to be integrated into SQL processing

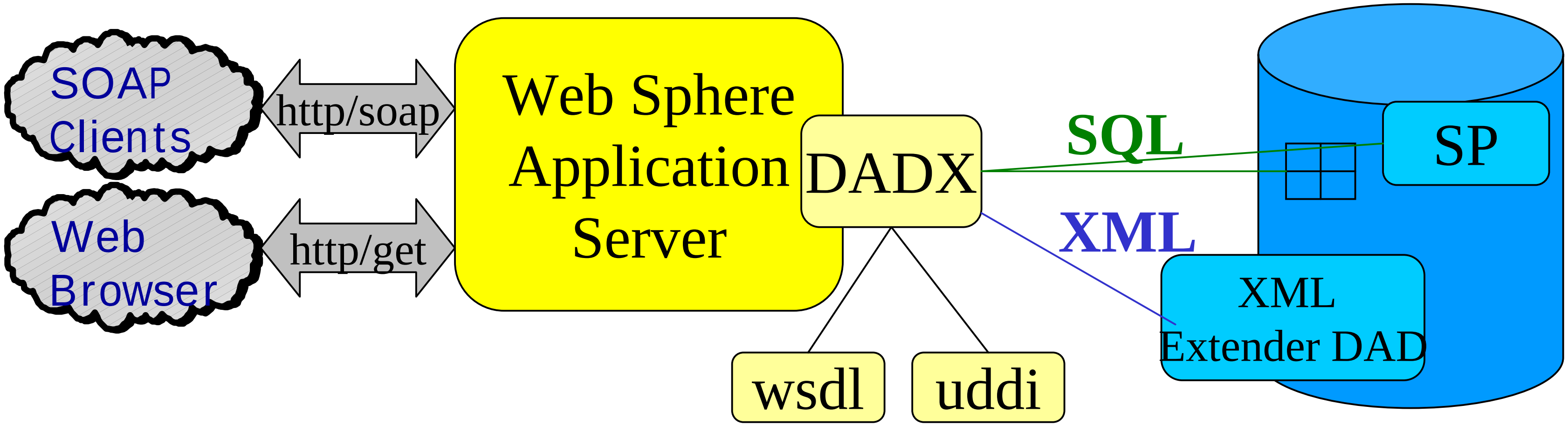
DB2 Web Services



DB2 / Web Service Integration

- Development integrated into Web Sphere Studio
- Web service access to DB2:
  - Available on Windows NT, Windows 2000, AIX, Sun Solaris, OS/390
    - Coming on Linux
- Web service access from DB2:
  - Coming soon

Accessing DB2 from Web Services

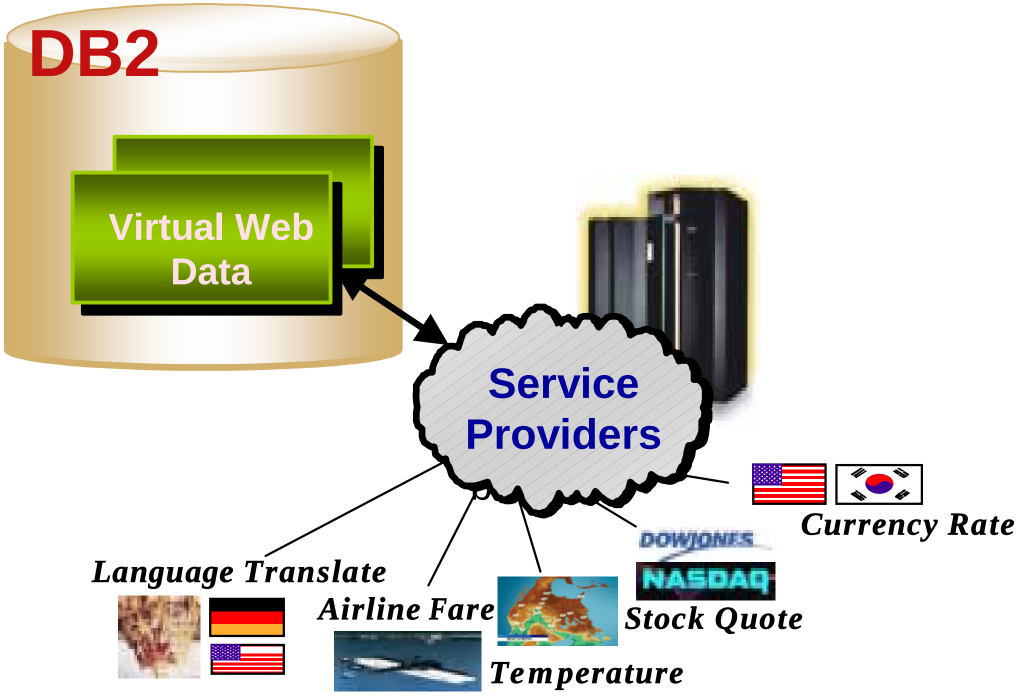


- Two types of web services operations supported:
  - XML-based query or storage
    - XML document stored in DB2 table or composed on retrieval
    - Requires XML extender
  - SQL-based operations
    - Query, Insert, Update, Delete or Call

DADX Example

```
<?xml version="1.0" encoding="UTF-8"?>
<DADX   xmlns=http://shemas.ibm.com/db2/dxx/dadx>
   <wsdl:documentation>
         Simple query example
   </wsdl:documentation>
   <operation name="listDepartments">
      <wsdl:documentation>
         List departments
      </wsdl:documentation>
      <query>
         <SQL_query> select * from department</SQL_query>
      </query>
   </operation>
</DADX>
```

Accessing Web Services from DB2



SELECT city, GetTemperature(city)

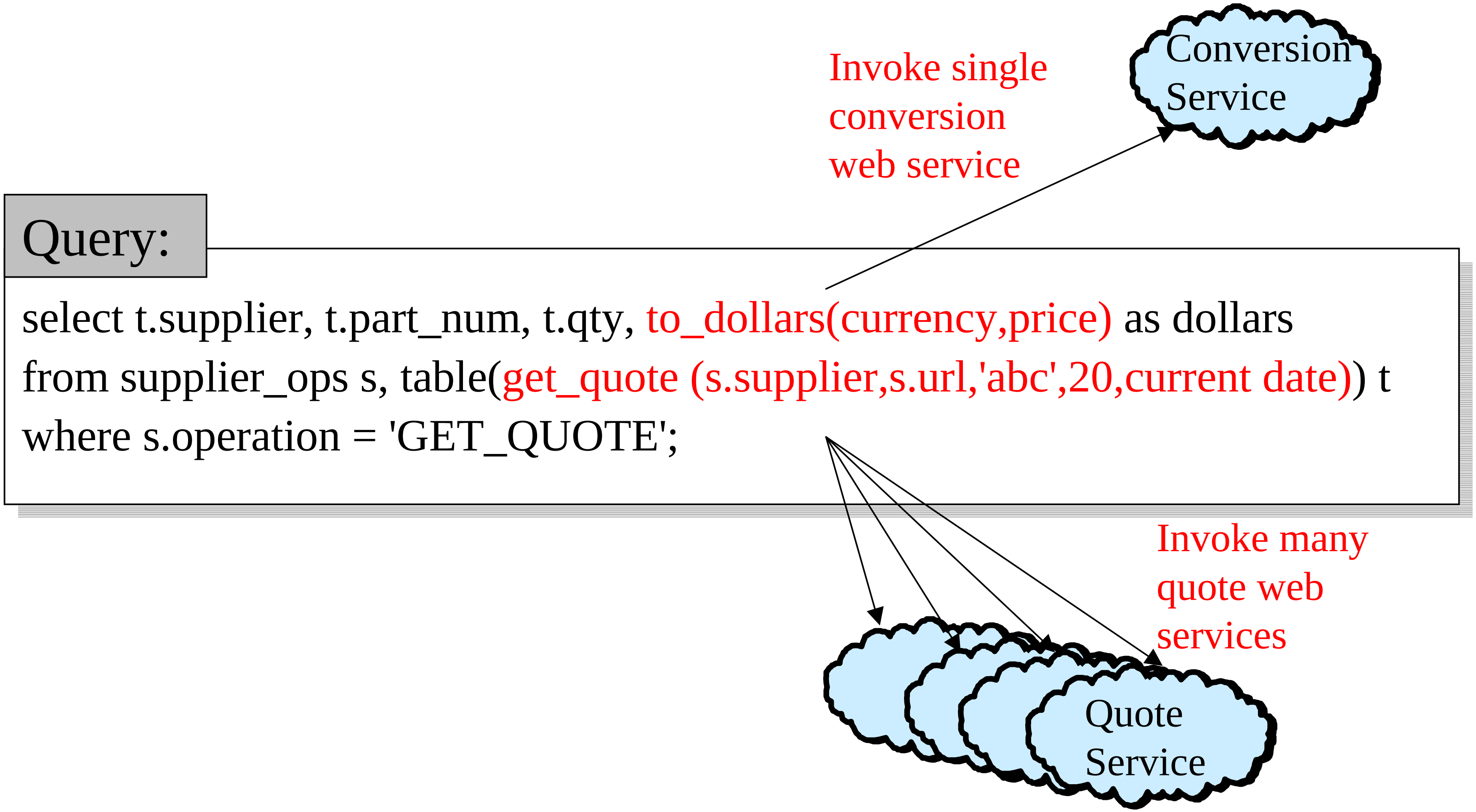
FROM location

- Integrate SQL statements and Web Service invocations
- Support for generating SQL scalar and table UDFs based on wsdl web service description
  - Command line version
  - Tooling integrated into Web Sphere Studio

Accessing Web Services from DB2

- Early Binding UDF
  - Generate UDF bound to a specific provider
    - Example: UDF invokes “ACME” getQuote service
      - Values getQuote()
- Late Binding UDF
  - Generate UDF bound with provider as parm
    - Example: UDF invokes getQuote service from any provider that has one
      - select a.busname, t.partNum, t.qty, t.dueDate, t.price, t.date
      - from
      -     webservice_summary a,
      -     table(getQuote(a.accesspoint,'M123', 5, '10/10/01')) t
      - where
      -     a.servicename='Quotation_Service'

Web Service UDF Invocation



Invoke single conversion web service

Conversion Service

Query:

```
select t.supplier, t.part_num, t.qty, to_dollars(currency,price) as dollars
from supplier_ops s, table(get_quote (s.supplier,s.url,'abc',20,current date)) t
where s.operation = 'GET_QUOTE';
```

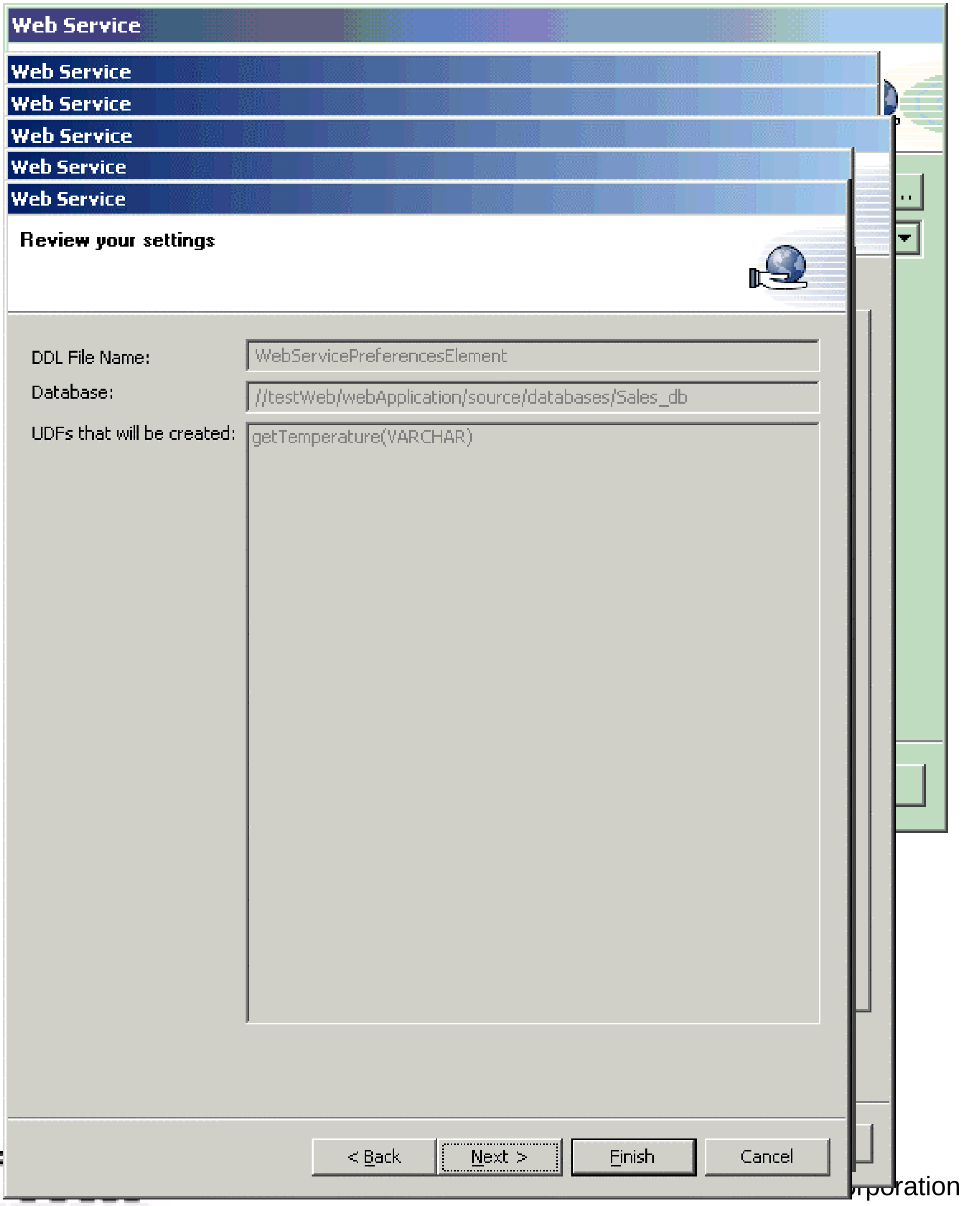
Invoke many quote web services

Quote Service

Web Service UDF Example

```
CREATE FUNCTION GetTemp (zipcode VARCHAR(5))    RETURNS DECIMAL
     (5,2)
  LANGUAGE SQL CONTAINS SQL   EXTERNAL ACTION NOT
     DETERMINISTIC
       RETURN
    WITH
     --1. Construct XML input using SQLX publishing functions
      soap_input (in)
          AS
       (VALUES XMLElement('<zipcode>' || zipcode || '</zipcode>')),
     --2. Submit SOAP request with input parameter and receive response
       soap_output (out)
         AS
       (VALUES soaphttp ('http://services.xmethods.net/soap/servlet/rpcrouter',
        '', 'urn:xmethods-Temperature', 'getTemp', (SELECT in FROM soap_input)))
     --3. Shred XML output using advanced SQLX functions
       select XMLSerialize(XMLExtract(out, '/return/text()'))
       from soap_output;
```

Developing a UDF Web Service Client



Review your settings

DDL File Name: WebServicePreferencesElement

Database: //testWeb/webApplication/source/databases/Sales_db

UDFs that will be created: getTemperature(VARCHAR)

1) Identify WSDL

2) Identify Database

3) Map WSDL ops to UDFs

4) Specify options

5) Map parameters

6) Finish

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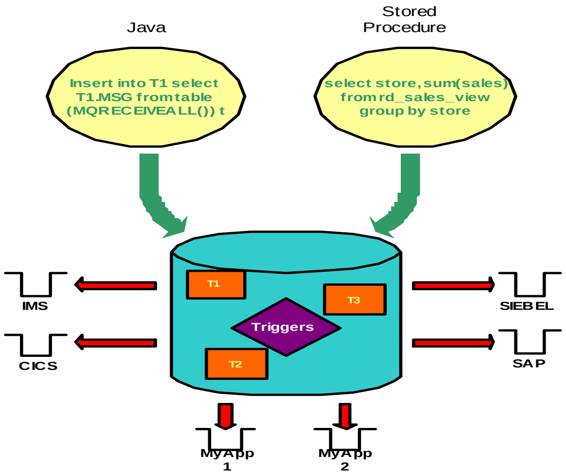
Why DB2 and WebSphere MQSeries

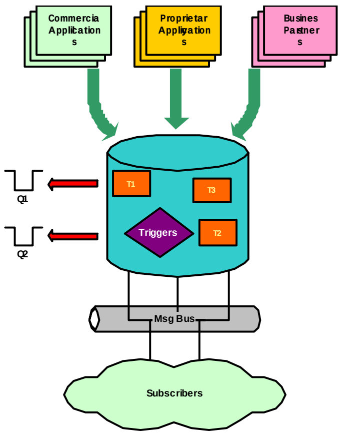
- Provide a simple way to access MQSeries from database applications
  - Leverage the set-oriented nature of SQL with messaging
  - Simplify the creation of operational data stores and data warehouses for business intelligence
  - Publish database changes
- Provide an introduction to the MQSeries Family to database programmers and administrators
  - Integration with MQSeries, MQSeries Pub/Sub, WMQI

DB2 & MQ Series

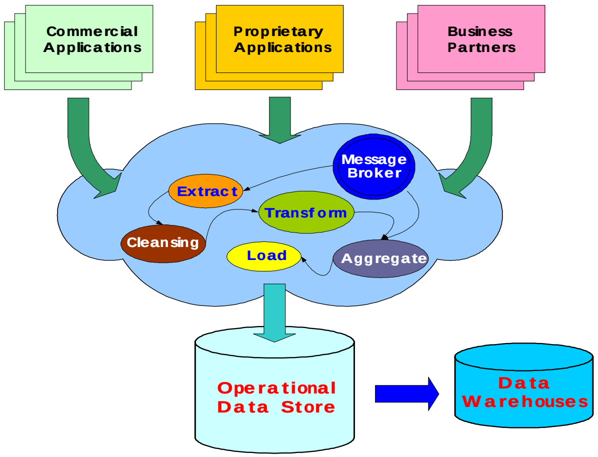
Query Integration


Java
Stored Procedure
Insert into T1 select T1.MSG from table (MQRECEIVEALL()) t
select store, sum(sales) from rd_sales_view group by store
T1
T3
Triggers
T2
IMS
CICS
SIEBEL
SAP
MyApp 1
MyApp 2

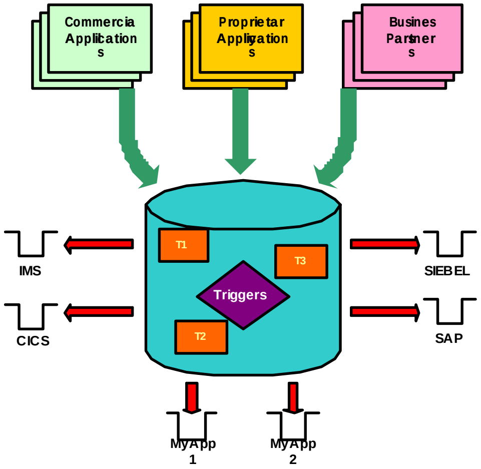
Event Notification



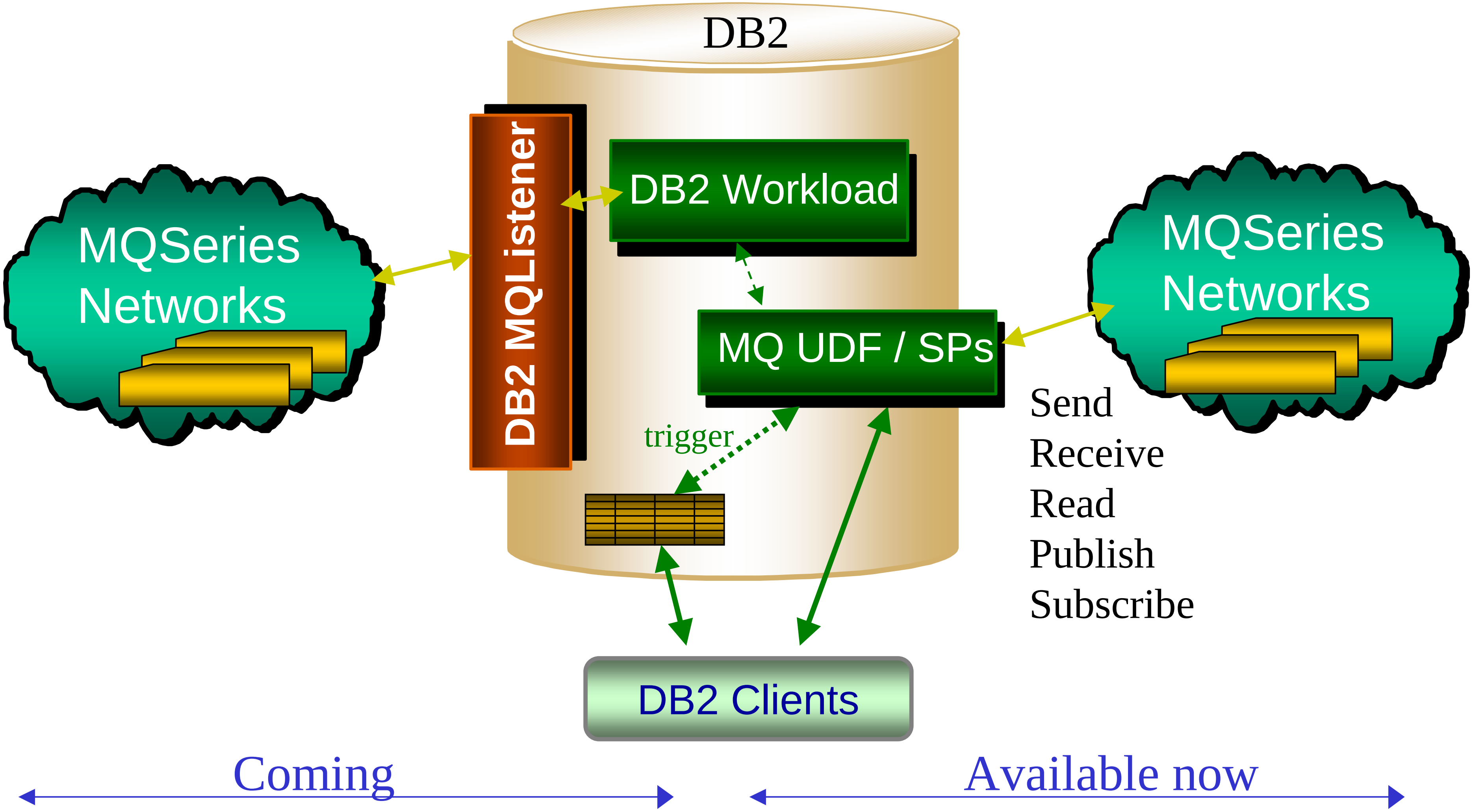
Information Aggregation



Information Forwarding



DB2 / MQ Integration



Send
Receive
Read
Publish
Subscribe

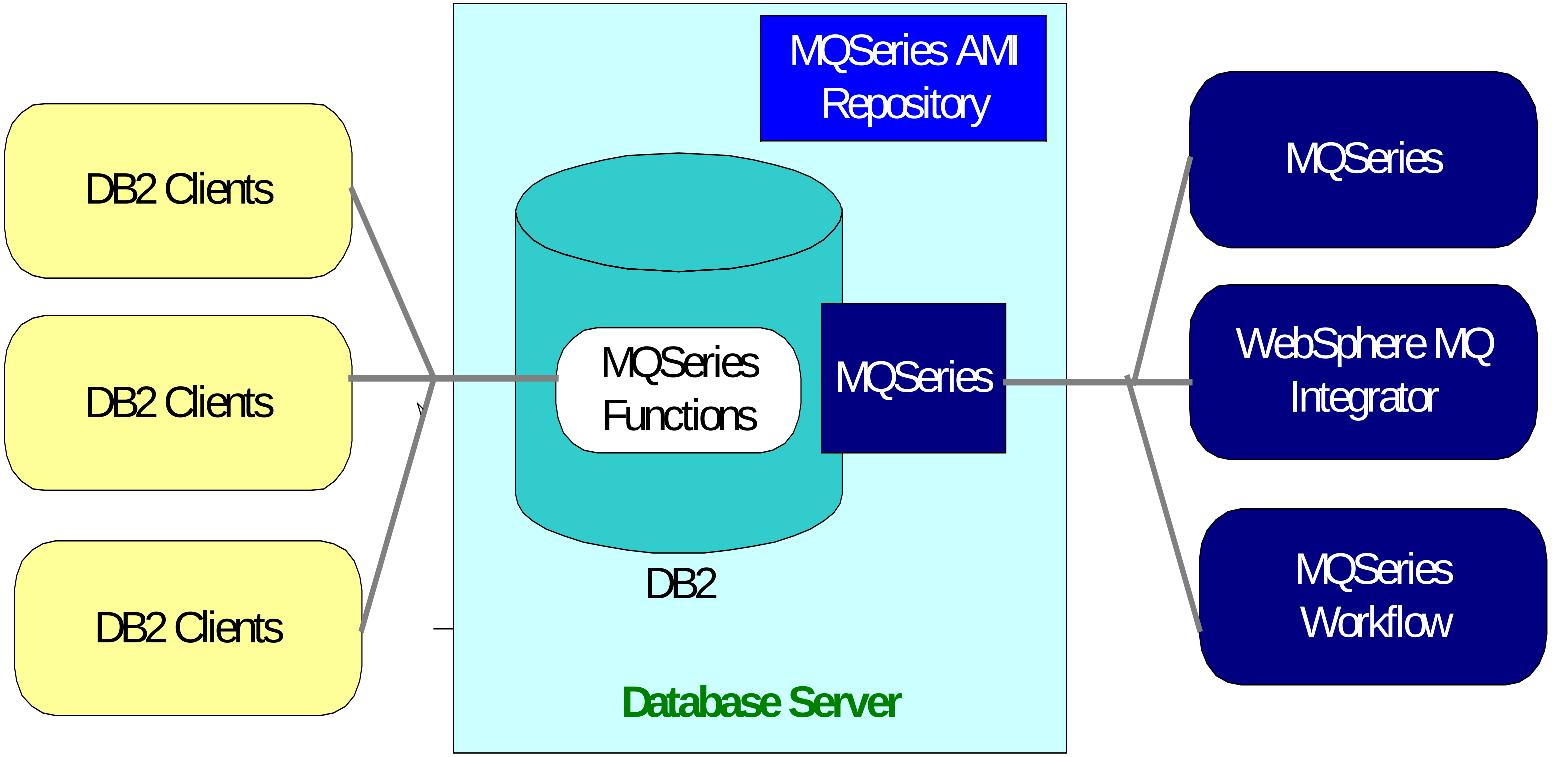
DB2 / MQ Series Integration

- MQAssist Wizard to facilitate construction of table functions and views
- Allows MQSeries as a source of information for a DB2 Data Warehouse
- Available on Windows NT, Windows 2000, AIX, Sun Solaris, HP-UX, OS/390, Linux
- DB2 ships limited use MQSeries (Win/Unix)

DB2 / MQ Series Integration

- The basic functions are implemented as User Defined Functions (UDFs)
  - Written in C / Optimized for performance
  - Win/Unix:
    - Schema: DB2MQ (full names of functions DB2MQ.*)
    - Must be installed using the ENABLE_MQFUNCTIONS
  - 390
    - Schema DB2MQ1C and DB2 MQ2C
    - Must install APAR: PQ59549
- The XML related UDFs depend on the XML Extender
  - Must be installed with the ENABLE_MQXML
  - XML Extender is a separate, optional installation that must precede this command
- Default queues, service points and policies are provided

DB2 / MQSeries Integration – Basic Configuration

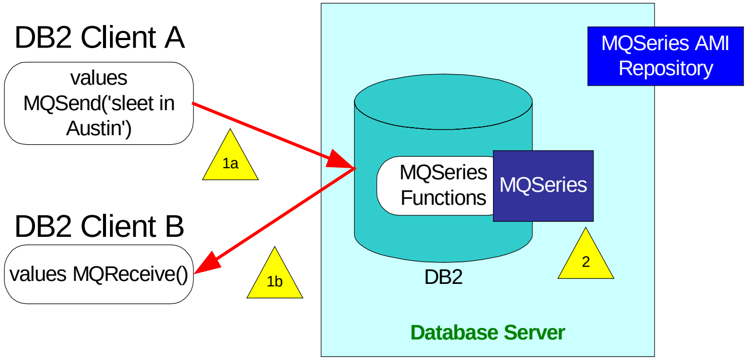


Basic Messaging Functions

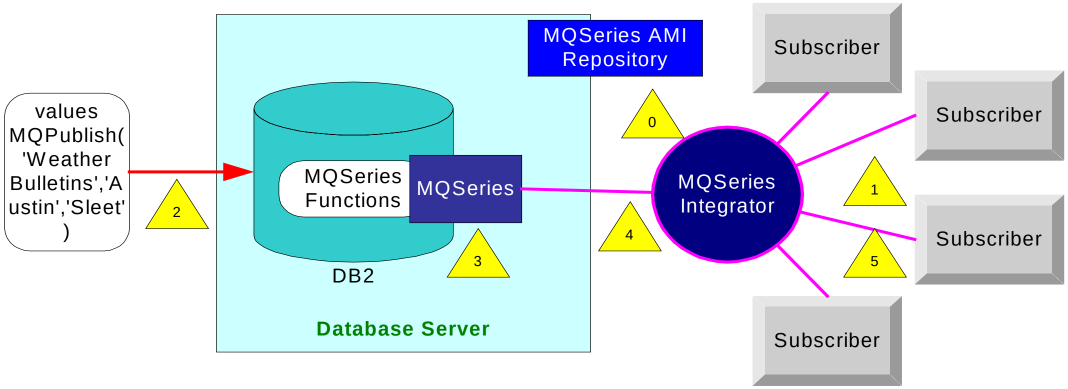
- DB2MQ.MQSend - send a message
- DB2MQ.MQRead, DB2MQ.MQReadAll - non-destructive read
- DB2MQ.MQReceive, DB2MQ.MQReceiveAll - destructive read
- DB2MQ.MQPublish - publish a message of a particular topic
- DB2MQ.MQSubscribe – register interest in a give topic

MQSeries Integration

- MQSeries server executes on the same machine as the DB2 Server
- DB2 clients may be local or remote.
  - standalone applications, WebSphere servlets or EJBs
  - local stored procedures



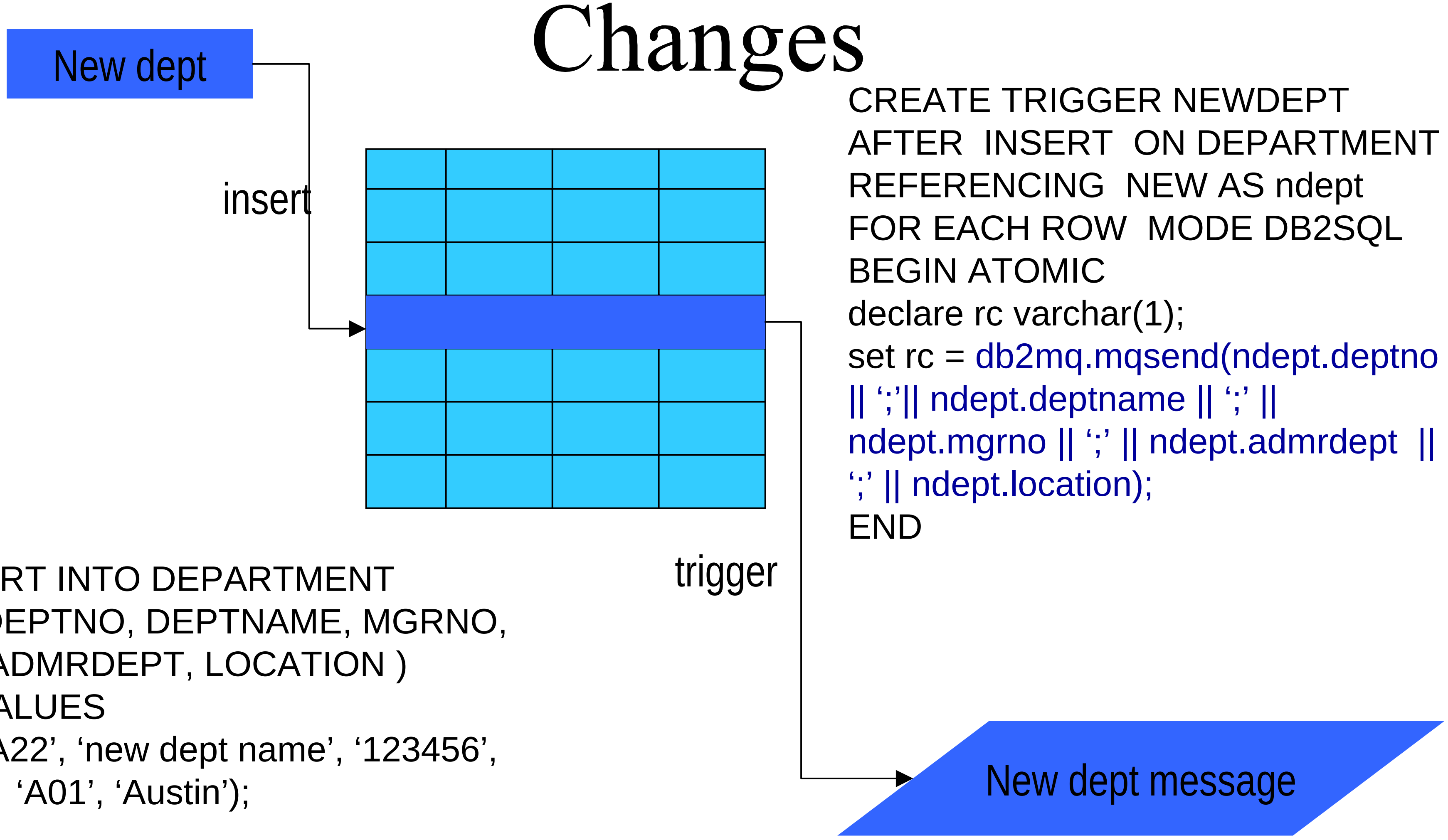
Basic Local Messaging



Simple Data Publication

- Supports both MQSeries publish/subscribe and MQSI V2
- Publication may be on-demand or automated through triggers
- Subscribers can register one or more topics

Easy Notification of Database Changes



```
CREATE TRIGGER NEWDEPT
AFTER  INSERT  ON DEPARTMENT
REFERENCING  NEW AS ndept
FOR EACH ROW  MODE DB2SQL
BEGIN ATOMIC
declare rc varchar(1);
set rc = db2mq.mqsend(ndept.deptno
|| ‘;’|| ndept.deptname || ‘;’ ||
ndept.mgrno || ‘;’ || ndept.admrdept  ||
‘;’ || ndept.location);
END
```

```
INSERT INTO DEPARTMENT
  (  DEPTNO, DEPTNAME, MGRNO,
     ADMRDEPT, LOCATION )
   VALUES
  ( ‘A22’, ‘new dept name’, ‘123456’,
      ‘A01’, ‘Austin’);
```

DB2 and XML Messages

- MQSendXML
  - Send a message
- MQReadXML / MQReadXMLAll, MQReadXMLCLOB / MQReadAllXMLCLOB
  - Non-destructive read
- MQReceiveXML / MQReceiveAllXML, MQReceiveXMLCLOB / MQReadAllXMLCLOB
  - Destructive read

XML Messages

- Example
  - Reads an XML message from the queue
  - Decomposes the message using the DAD file
  - Store the untagged data fields into database tables that are specified in the DAD
- CALL db2xml.DXXMQSHRED(serviceName,
  :policyName,
  :dadFileName,
  :status)

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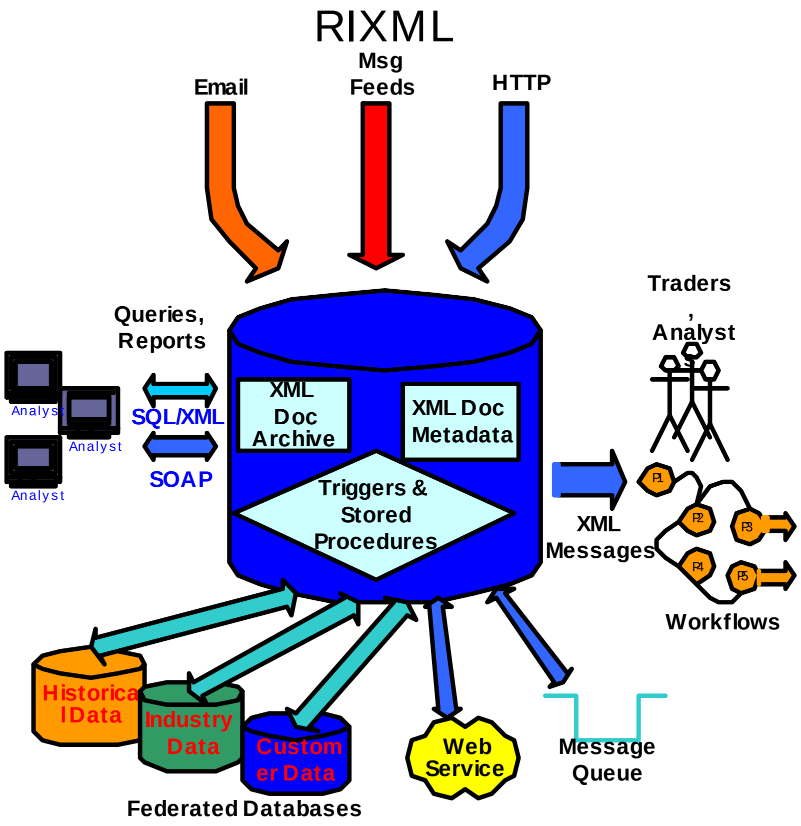
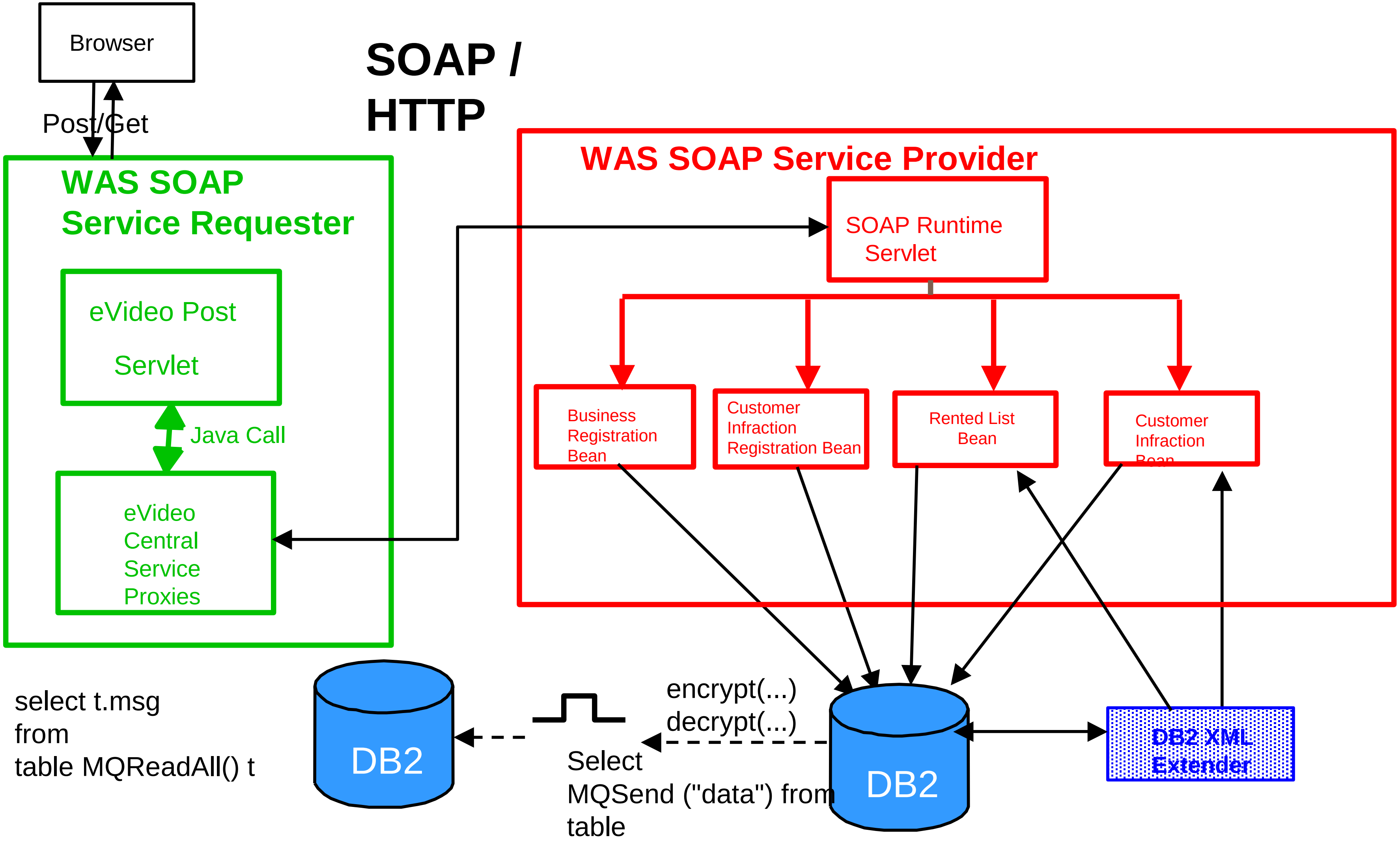
Bringing it all Together: Today's Applications

- Information Consolidation
  - – Gather raw research & transform
- Information Federation
  - – Federate all types data
- Deep Analysis
  - – Classification, mining and analysis
- Active Analysis, Active Data
  - – Real-time scoring and correlation
- Portal
  - – Query and search interface over federated sources.



Bringing it all Together - eVideoCentral



Browser

Post/Get

SOAP / HTTP

WAS SOAP Service Requester

eVideo Post Servlet

Java Call

eVideo Central Service Proxies

WAS SOAP Service Provider

SOAP Runtime Servlet

Business Registration Bean

Customer Infraction Registration Bean

Rented List Bean

Customer Infraction Bean

select t.msg
from
table MQReadAll() t

DB2

encrypt(...)
decrypt(...)

Select
MQSend ("data") from
table

DB2

DB2 XML Extender

Where to get more information

- DB2 web site
  - www.ibm.com/software/data/db2
    - Watch this area for latest information
- WebSphere Studio web site
  - www.ibm.com/software/webservers/studio
- DB2 Developers Domain www.ibm.com/software/data/developer/
  - Running DB2 Web Services on WebSphere Application Server Advanced Edition
  - DB2 MQ XML Functions: Using MQSeries and XML Extender from DB2 Applications
  - Using the MQSeries(R) Assist Wizard
  - Using MQSeries from DB2 Applications