XML Metadata Interchange
(OMG XMI)
Distributed Metadata Interchange for the WEB Generation

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Topics Covered

- Why XML is important for metadata enthusiasts?
- XML Overview
- OMG Metadata Architecture
- OMG XML Metadata Interchange (XMI)
- XMI and the future
Unisys

• Global services and technology company
  – 1998 Revenues : $7.2 Billion
  – www.unisys.com

• Services, Systems and Software for the enterprise

• Use of metadata and object repositories for software and systems integration
  – www.marketplace.unisys.com/urep

• Committed to specifying and implementing open standards for enterprise software integration
  – OMG MOF, UML, XML, LDAP, XMI, CORBA, COM, EJB...
‘Muddleware’ Architects Dilemma

Middleware (Tuxedo, TIP, DCOM, IIOP, RMI, EJB, COM+, App Server …)
Information Models (MOF, UML, CWM, OIM, RSM, BAPI, XML, XMI….)

Distributed, Heterogeneous, Client/Server!
Multiple Clients, Servers, Tools, O/S, Databases, Repositories, Object Models

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Component Development
Life Cycle - Why Metadata matters!

Architecture Centric, Use case driven
Iterative and Incremental

- Business Modeling—Model the business, Select Application packages
- Legacy Discovery/Transformation—(re)model legacy systems
- Domain Modeling—Define software (domain) models

Distributed Objects + Meta Data Repositories

- Create New Business Logic—Design, code, integrate, test
- Build Components—Select middleware, create components
- Assemble Components—Integrate, package into deployable form
- Deploy Application—Move into operational environment and manage
The Rising Role of XML

- Why the excitement?
  - Simple packaging of data and metadata
  - Easier to use and comprehend than traditional metadata technologies (relational and object repositories)
  - The link to the web and promise of common vocabulary (tags) appealing
  - All vendors (even warring distributed object camps) have jumped on the bandwagon
- XML has a role in each of the phases just described
- XML breaks the need to tie into a single infrastructure
eXtensible Markup Language (XML)

- XML technology
- XML example
- XML and the industry
- XML benefits
- XML and the OMG
XML technology

- Open standard by the W3C.
- Markup language based on SGML.
- Combines data & metadata for information interchange.
- Simple, flexible, eXtensible.
- Tags form a tree information structure.
- DTD provides the tag rules.
**XML example**

Document

```xml
<Auto>
  <Make> Ford </Make>
  <Model> Mustang </Model>
  <Year> 98 </Year>
  <Color> blue </Color>
  <Price> 25000 </Price>
</Auto>
```

**DTD**

```xml
<!Element Auto (Make, Model, Year, Color, Price)>
```
XML and the Industry

- Standards
  - W3C open standard on Feb 10, 1998.
  - OMG XMI - March 23, 1999
  - Additional standards in progress:
    - XLink/XPointer, Namespaces, XSL, RDF, DOM, SAX, Web-DAV

- Support is exploding
  - 40+ books on Amazon.com in < 1 year
  - XML supported by Adobe, ArborText, DSTC, HP, IBM, Microsoft, Netscape, Oracle, Platinum, Unisys, Select, Sun, Xerox
  - Web, publishing, repositories, modeling, databases/warehouses, services, financial, health care, semiconductors, ...
XML benefits

- XML is system & vendor independent
- Proven with HTML on the web
- Metadata delivery via the web
- Validation, tool support, low cost of entry
- Advanced linking across the net
- Stylesheets for views, transforms
- Widespread industry support

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Object Management Group

- Open, vendor-neutral, international, widely-recognized, rapid standardization process
- Over 800 members
- Approx. 90 technology processes underway, ranging from networking infrastructure to Air Traffic Control
- Strong liaison with ISO, ITU-T, W3C, TINA-C, etc.
- Liasion recently established with the Meta Data Coalition
Why OMG for Metadata Standards?

- OMG understands heterogenous interoperability & technology evolution
  - OMA, CORBA, IIOP, UML, XMI, MOF…
  - OMG is not just about CORBA anymore!

- Open standards process that works
  - Strong architectural foundation in CORBA, MOF, and UML
  - XMI happened from inception to adoption in about a year

- The place where technology integration via an open process is happening rapidly
  - XMI Unifies UML, MOF and XML so developers can model, manage and publish metadata to the web in a standard manner
OMG Repository and Modeling Architecture

- Tools, Applications, Repositories, Registries
- MetaModels (UML, CWM…)
- XML Metadata Interchange (XMI)
- Meta Object Facility (MOF)
- CORBA Object Services
- Internet
- CORBA
  - CORBA/COM Interworking
- Java
- CORBA/COM Interworking
OMG Distributed Metadata Architecture

Repositories
Tools
Applications

Repository Common Facility

MOF
XMI
UML, CWM

Object Request Broker & the Internet

Object Services (Naming, Transactions…)

Information (Meta)Models
Purpose and Benefits of XMI

• Purpose
  – Vendor and middleware neutral open interchange format for metadata in distributed environments
  – Start with modeling and programming metadata, expand to datawarehouse, components, registries…

• Benefits
  – Works with the Internet and builds on existing industry standards (XML, UML, MOF…)
  – Easy for vendors to implement in current products
  – Loosely coupled architecture
  – Breaks the wall between incompatible tools, repositories and applications across the Internet
XMI: The Players

• Technology Submitted by:
  Unisys, IBM, DSTC, Oracle, Platinum, Fujitsu, Softeam, Reccerca, Daimler-Benz

• Technology Submission Supported by:
  Genesis, Inline, Rational, Select, Sprint, Cayenne, Sybase, Xerox, MCI Systemhouse, Boeing, Ardent, Aviatis, ICONIX, Integrated Systems, Verilog, Telefonica I+D, Universitat Politecnica de Catalunya, NCR, Nihon Unisys, NTT
Open Interchange with XMI

6 bridges written by 6 vendors.

N*N-N = 30 bridges written by N = 6 vendors. Versioning issues.

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Overview of XMI

- Use W3C Extensible Markup Language (XML) for the transfer syntax and interchange format
  - Specify XML Document Type Definitions (DTD) to enable transfer and verification of
    - MOF based meta(models) and their instances (Allows use of XMI in new domains - Data Warehouse, Components, Business Applications…)
    - UML based models (using UML DTD)
  - Specify a precise MOF to XML mapping
    - Allows interchange of any MOF based metamodell and corresponding models (MOF--> XML Stream)
    - Enables automatic generation of DTDs for any MOF based metamodell (MOF --> XML DTD)
- Use UML for (meta)model design
OMG Meta Object Facility (MOF)

- OMG’s Repository interoperability standard
- Uses UML notation and modeling constructs
- Allows Information (meta) model design using UML
- Provides distributed metadata service APIs (MOF to CORBA IDL transformation rules)
- Provides distributed metadata interchange using XMI (MOF to XML transformation rules)
- The transformation rules are part of the standard
XML Simplified

XML Streams (Models) (Many - based on each metamodel DTD)

UML 1.1 DTD
CWM DTD
MOF 1.1 DTD

XML DTD (MetaModels) (1 per metamodel used for validation)

Validate

XML Syntax and Encoding
MOF Metadata Definitions & Management
UML Metamodel Analysis & Design
Let us Pretend that this is a trivial (meta)model or schema
As a Metamodel based on MOF
UML Object Diagram

<table>
<thead>
<tr>
<th>Business: Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>name = Business</td>
</tr>
<tr>
<td>visibility = public</td>
</tr>
<tr>
<td>...</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Customer: Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>name = Customer</td>
</tr>
<tr>
<td>...</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>update: Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>name = update</td>
</tr>
<tr>
<td>scope = instance</td>
</tr>
<tr>
<td>...</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>id: Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>name = id</td>
</tr>
<tr>
<td>multiplicity = ( {1, 1} )</td>
</tr>
<tr>
<td>...</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CustId: DataType</th>
</tr>
</thead>
<tbody>
<tr>
<td>name = CustId</td>
</tr>
<tr>
<td>...</td>
</tr>
</tbody>
</table>
Tags from metamodel,
Content from model

<Model>
  <name>Business</name>
  <visibility xmi.value="public"/>
  <Class>
    <name>Customer</name>
    <feature>
      <Attribute>
        <name>id</name>
        <multiplicity>
          <XML.field>1</XML.field>
        </multiplicity>
      </Attribute>
    </feature>
    </Class>
  </Model>
As an XML Document Fragment

<!-- Document Prologue, etc. -->
<Model xmi.id="a1"><name>Business</name><visibility xmi.value="public"/>
<ownedElement>
  <Class xmi.id="a7"><name>Customer</name>
    <feature>
      <Attribute><name>id</name>
        <multiplicity><XMI.field>1</XMI.field></multiplicity>
        <type><DataType href="|a247"/></type>
      </Attribute>
      <Operation><name>update</name>
        <scope xmi.value="instance"/>
      </Operation>
    </feature>
  </Class>
</ownedElement>
</Model>
XMI Works
XMI Interoperability Demo : Nov 98

Interchange validated using UML DTD
Distributed Object Repository Architecture (Unisys UREP)

Unisys IntegratePlus Integration Framework

- Component Browser
- Rose
- VB
- Select
- JBuilder

Repository Services Interface (C++, C..)

- C++ I/F
- IMI
- COM I/F
- IDL I/F
- Java I/F

OO API, TCP/IP & RPC, HTTP, CORBA, EJB, DCOM

Repository Object Model

- Relational Database
- Object-Rel Database

Information Model
- Repository Services Metadata, (MOF), Name, Version
- Technology & Tool Models CWM, UML
- Business Models OWD, ODF

Unisys IntegratePlus Integration Framework

- CORBA
- DCOM

Desktop Objects
- ActiveX, Java

Technical & Business Objects

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XMI: Concept to Standard to Implementation in record time

12/97 SMIF (Stream based Model Interchange Format) RFP issued by OMG
07/98 Initial submissions (XMI, CDIF, UOL)
10/98 Revised submission (XMI)
11/98 Proof of concept demonstrations
01/99 OMG Technology Adoption begins
03/99 Initial implementations arrive

29 Co-submitters and supporters
XMI Evolution

• Managed by OMG Process
• XMI Revision Task Force
  – xmi-rtf@omg.org
  – Members tracking W3C progress
• What is ahead?
  – Evolve with XML (Eg: Namespaces, XML Schema…)
  – Evolve with MOF and UML
OMG & Meta-Data Coalition

• Microsoft joins MDC and transfers OIM
• Have established liaisons with each other
• Joint OMG/MDC meeting in Philadelphia 3/23
• Collaboration has begun
  – MDC already using OMG UML as a foundation for its Open Information Model
  – Additional collaboration areas under discussion
    • OMG Common Warehouse Metadata Interchange RFP
    • MDC Business Rules and Knowledge Management Models
  – Some companies are members in both organizations
• Next few months will be interesting!
Summary of Object Repository Industry Efforts and XMI Directions

- Repositories and Tools will be used to construct integrated software suites (build, manage, execution)

- Partial list of Object Repository efforts underway
  - Unisys Universal Repository - UREP : 2Q95 {OO: MOF, XMI, COM}
  - IBM TeamConnection : 1996 {OO: MOF, XMI}
  - Microsoft/Platinum/CA Repository : 1Q97 {OO: COM, MOF, XML}
  - Oracle Repository : 1999? {OO: MOF, XMI}

- Other Repositories (non object)
  - PR/MVS and PR/OEE
  - ViaSoft Rochade
  - Softlab Enabler
  - Many tool specific repositories

{OO} Implies Object Orientation is foundational and not an ‘after thought’
XMI and OMG Current Efforts

- The following standard DTDs are now available on www.omg.org
  - OMG MOF 1.1 & UML 1.1
- The following proposed DTDs are being readied in 1999
  - OMG MOF 1.3 & UML 1.3 (June)
  - OMG CORBA Component Model (August)
  - OMG CORBA Interface Repository (August)
  - OMG Common Warehouse Metadata Interchange - CWM (September)...
XMl and the OMG - The Future

Domain

- Electronic Commerce
- Telecom
- Manufacturing
- Utility
- Financial
- Transportation
- Simulation
- Life Sciences

Platform

- UML
- CORBA
- CWM - Data Warehouse
- Business Objects
XML Bandwagon Accelerates

- Vendors and consortia rally around W3C XML
  - OMG XMI for platform and domain technologies
  - XML/EDI
  - Metadata Coalition
  - Microsoft ‘BizTalk’, SUN Java/XML efforts, IBM XML4J…
  - Enterprise Application Integration
- XML Servers
  - Object Design & Poet XML Repository
  - Blue Stone XML server...
XMI Summary

- The OMG standard for exchanging (meta)data between tools, repositories and applications
- Works with and builds on existing industry standards (W3C XML, OMG UML & MOF)
- Leverages UML & MOF in the design phase
- Use XML for implementing interchange
- Easy to implement and integrate with existing metadata repositories across the Internet
- Technology and middleware neutral
- OMG Adoption - Completed on March 22, 1999
OMG Metadata Summary

UML Understand

MOF Manage

XMI

XML eXchange
Question & Answers