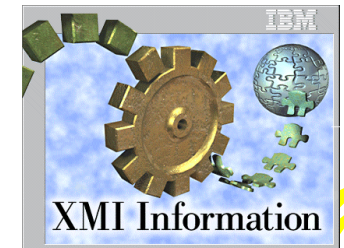


XML Metadata Interchange (OMG XMI) Distributed Metadata Interchange for the WEB Generation

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Meta-Data Conference

April 19-22, Atlantic City

Topics Covered

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

Unisys

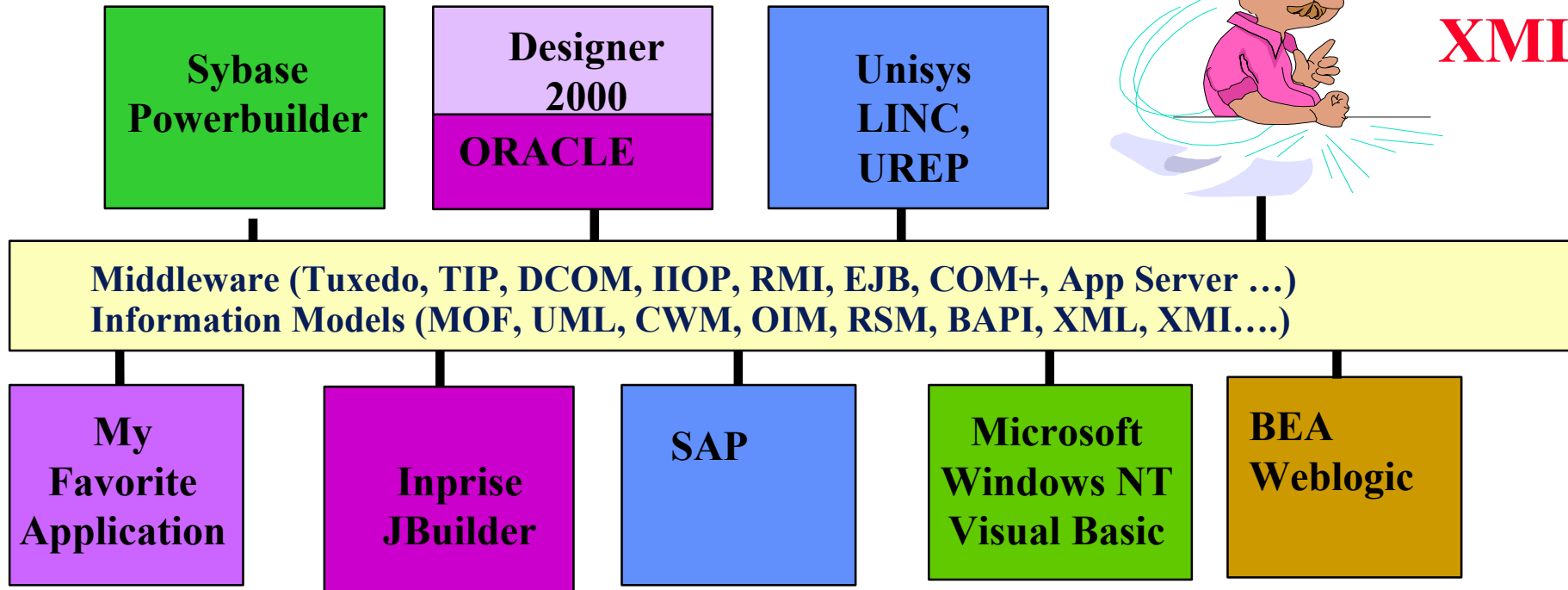
- Global services and technology company
 - 1998 Revenues : \$7.2 Billion
 - *www.unisys.com*
- Services, Systems and Software for the enterprise
- Use of metadata and object repositories for software and systems integration
 - *www.marketplace.unisys.com/urep*
- Committed to specifying and implementing open standards for enterprise software integration
 - *OMG MOF, UML, XML, LDAP, XMI, CORBA, COM, EJB...*

'Muddleware' Architects Dilemma

Architect



XML!



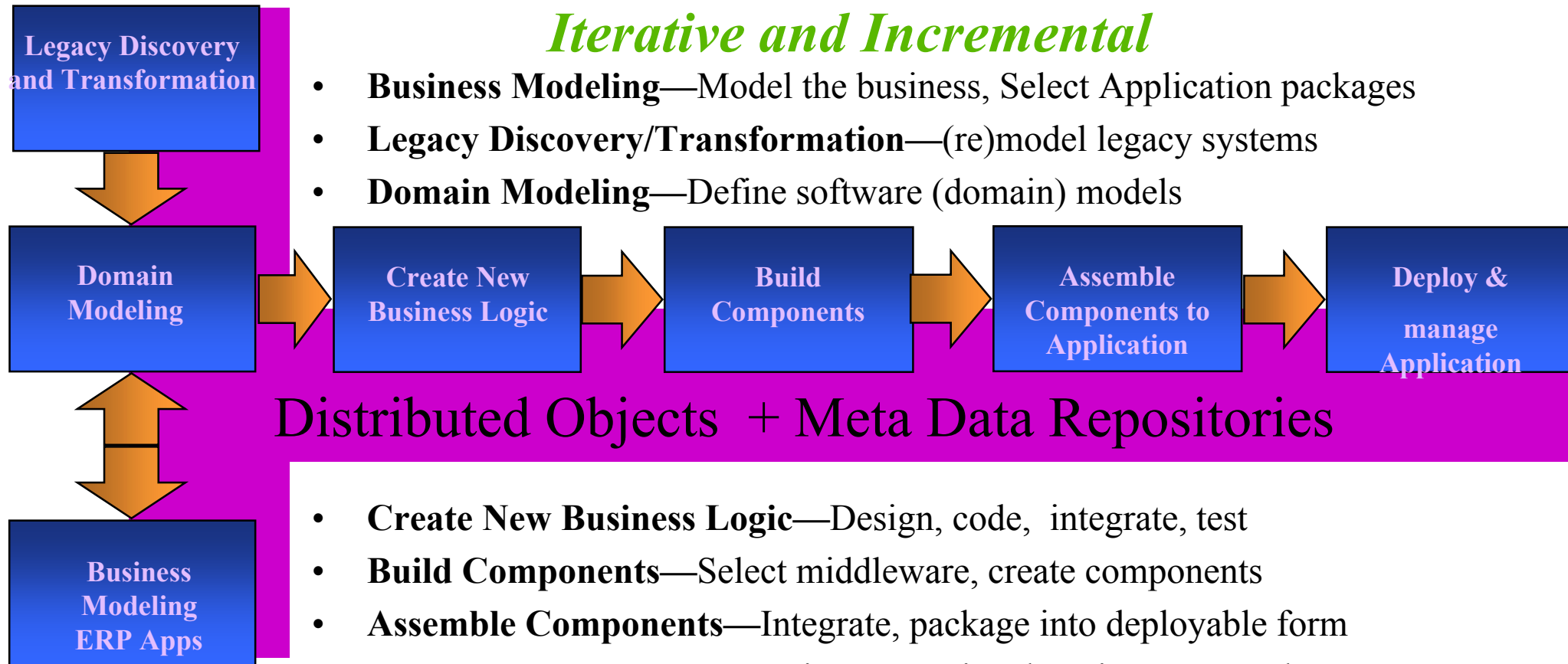
Distributed, Heterogeneous, Client/Server !

Multiple Clients, Servers, Tools, O/S, Databases, Repositories, Object Models

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



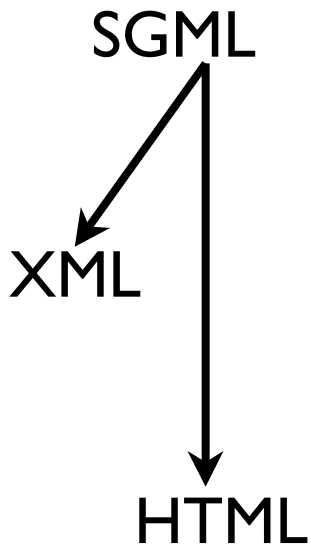
The Rising Role of XML

- 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

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

DTD

```
<!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

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.
- Liaison 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

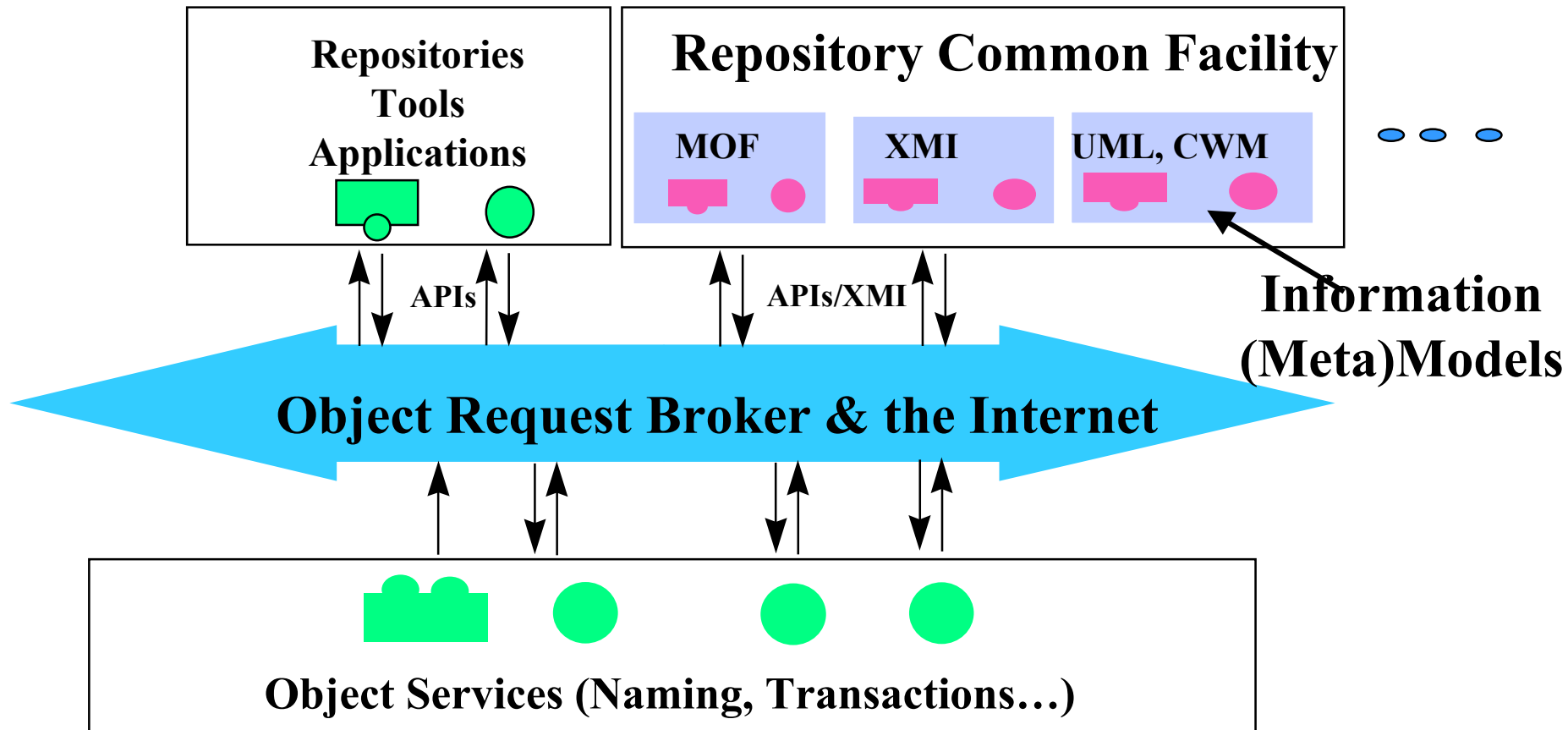
Internet

CORBA
CORBA/COM Interworking

Java



OMG Distributed Metadata Architecture



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

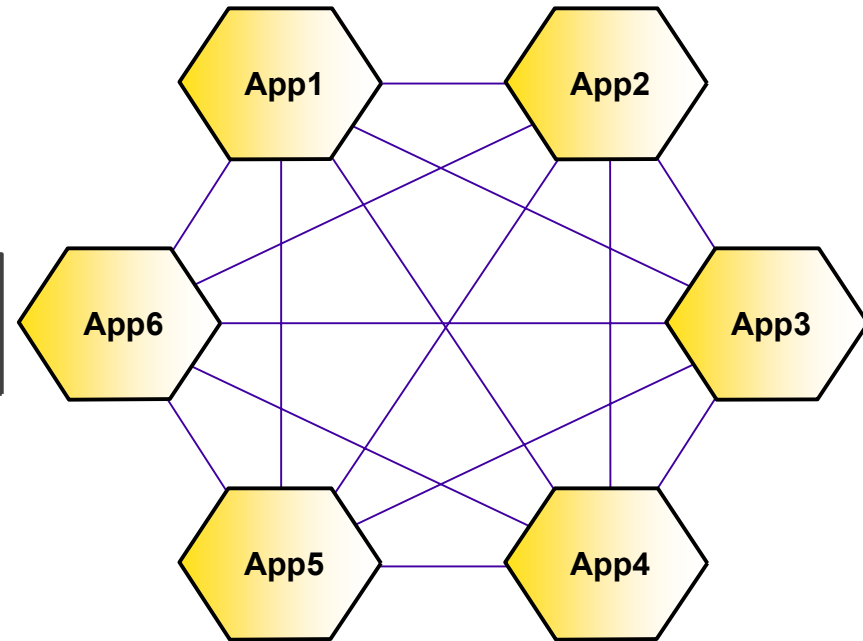
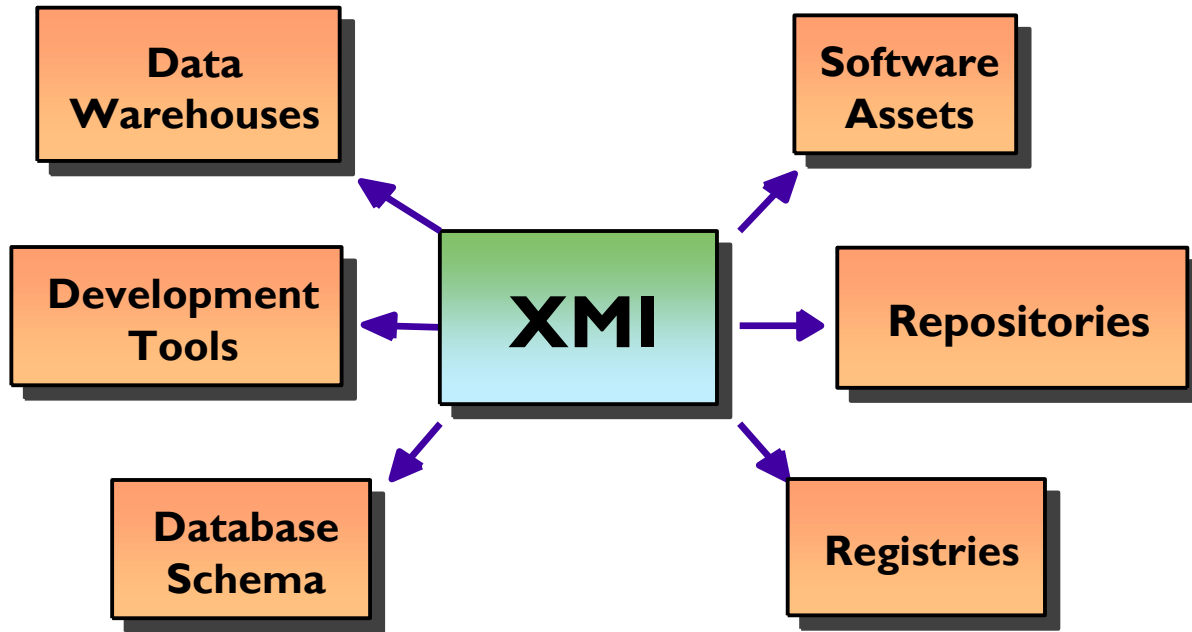
- Technology Submitted by:

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.

Overview of XMI

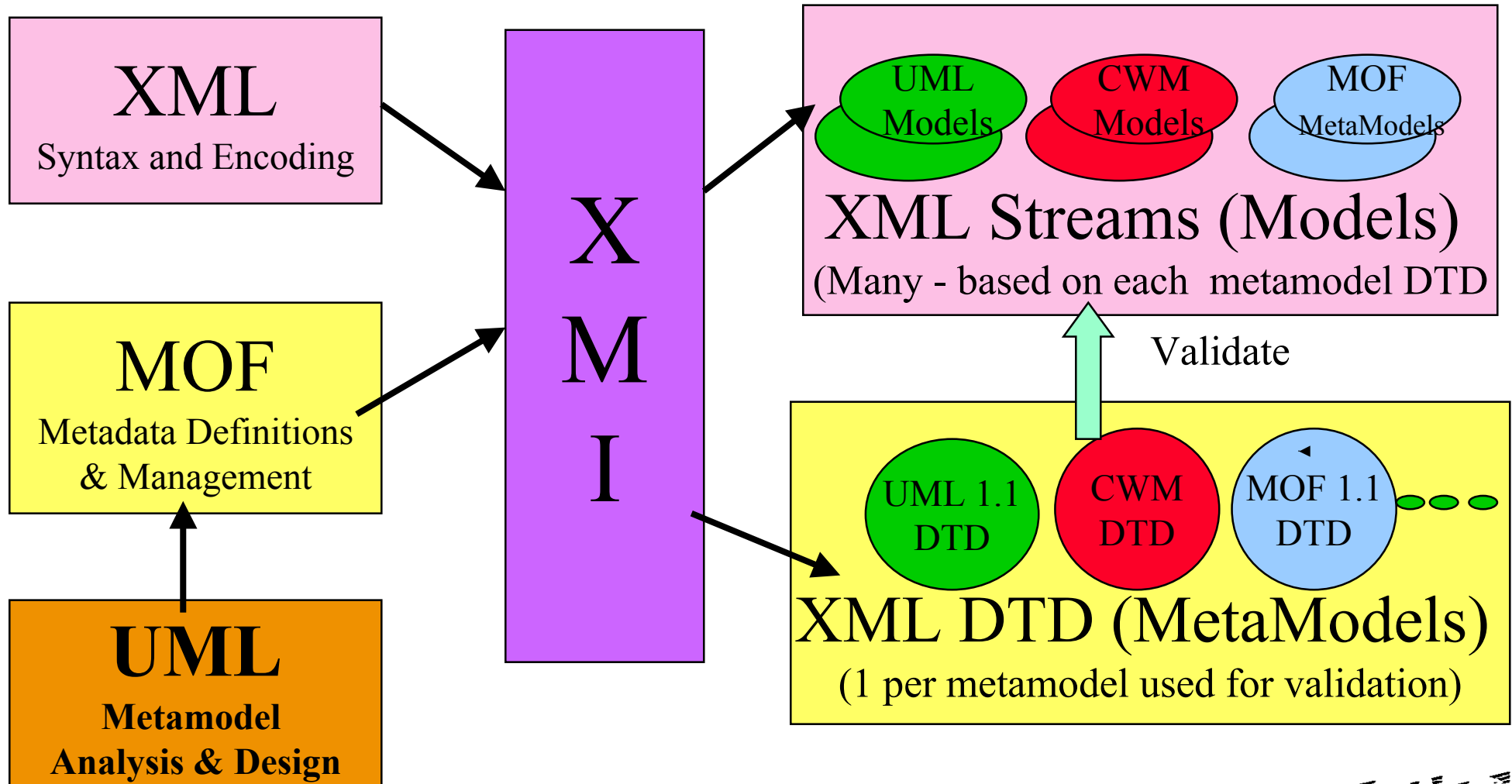
- **Use W3C Extensible Markup Language (XML) for the transfer syntax and interchange format**
 - **Specify XML Document Type Definitions (DTD) to enable transfer and verification of**
 - **MOF based meta(models) and their instances (Allows use of XMI in new domains - Data Warehouse, Components, Business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

OMG Meta Object Facility (MOF)

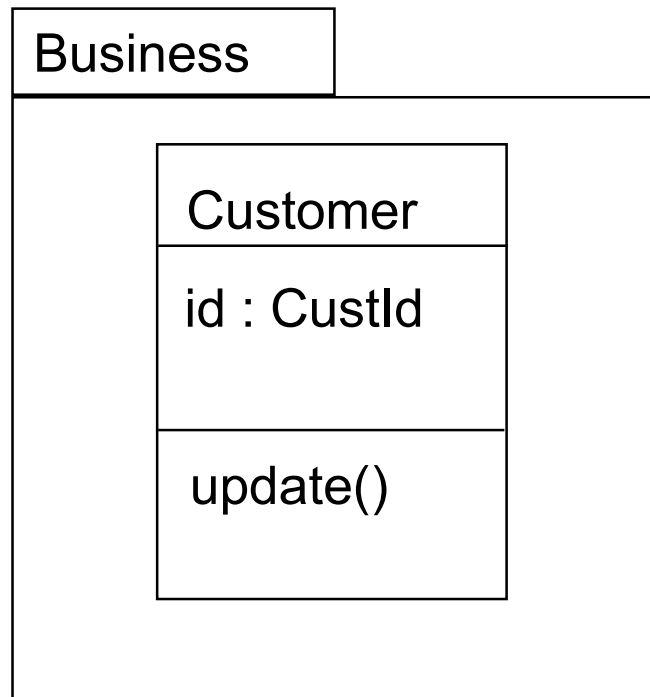
- OMG's Repository interoperability standard
- Uses UML notation and modeling constructs
- Allows Information (meta) model design using UML
- Provides distributed metadata service APIs (MOF to CORBA IDL transformation rules)
- Provides distributed metadata interchange using XMI (MOF to XML transformation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

XMI Simplified

WWW.OMG.ORG : ad/98-10-05, ad/98-10-06

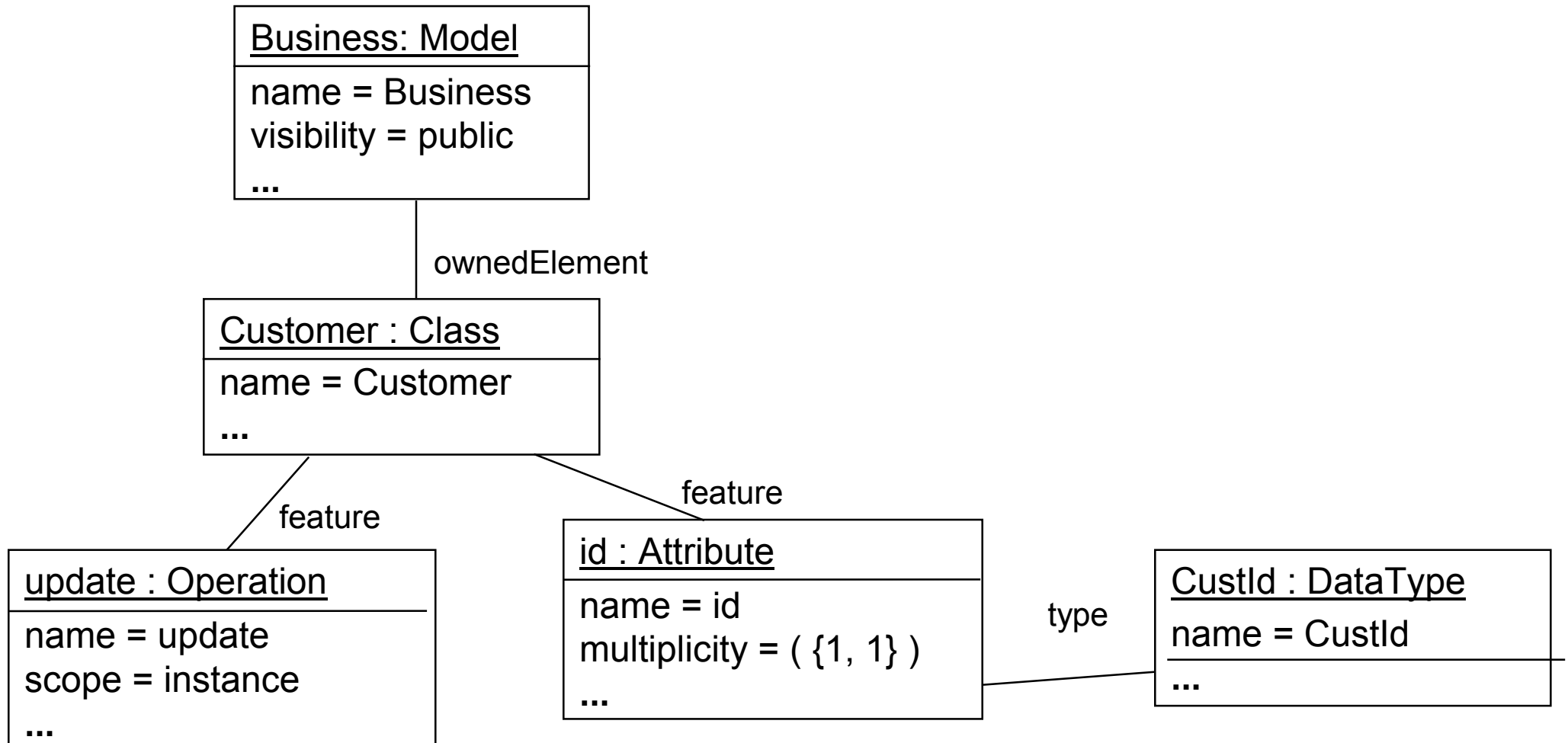


XMI - Hello World! UML Class Diagram



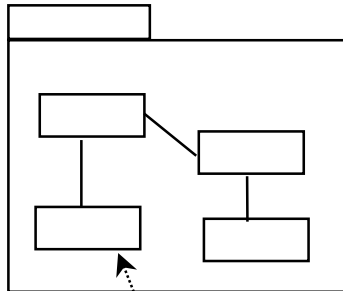
Let us Pretend that this is a trivial (meta)model or schema

As a Metamodel based on MOF UML Object Diagram



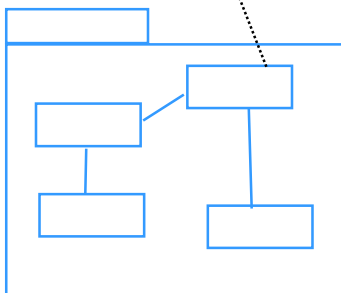
Tags from metamodel, Content from model

Meta
model



metaObject

Model



```
<Model>
  <name>Business</name>
  <visibility xmi.value="public"/>
  <Class>
    <name>Customer</name>
    <feature>
      <Attribute>
        <name>id</name>
        <multiplicity>
          <XMI.field>1</ XMI. field>
          < XMI. field>1</ XMI. 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>
            < 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>
```

UML DTD Fragment (UML 1.1 DTD)

<!ELEMENT Class (name, visibility, isRoot, isLeaf, isAbstract, isActive, XMI.extension*, constraint*, requirement*, provision*, stereotype*, elementReference*, collaboration*, partition?, template?, view*, presentation*, namespace?, behavior*, binding? implementation*, generalization*, specialization*, parameter*, structuralFeature*, specification*, associationEnd*, participant*, createAction*, instance*, classifierRole*, realization*, classifierInState*, taggedValue*, ownedElement*, feature*)?>

<!ATTLIST Class XMI.element.att; XMI.link.att;>

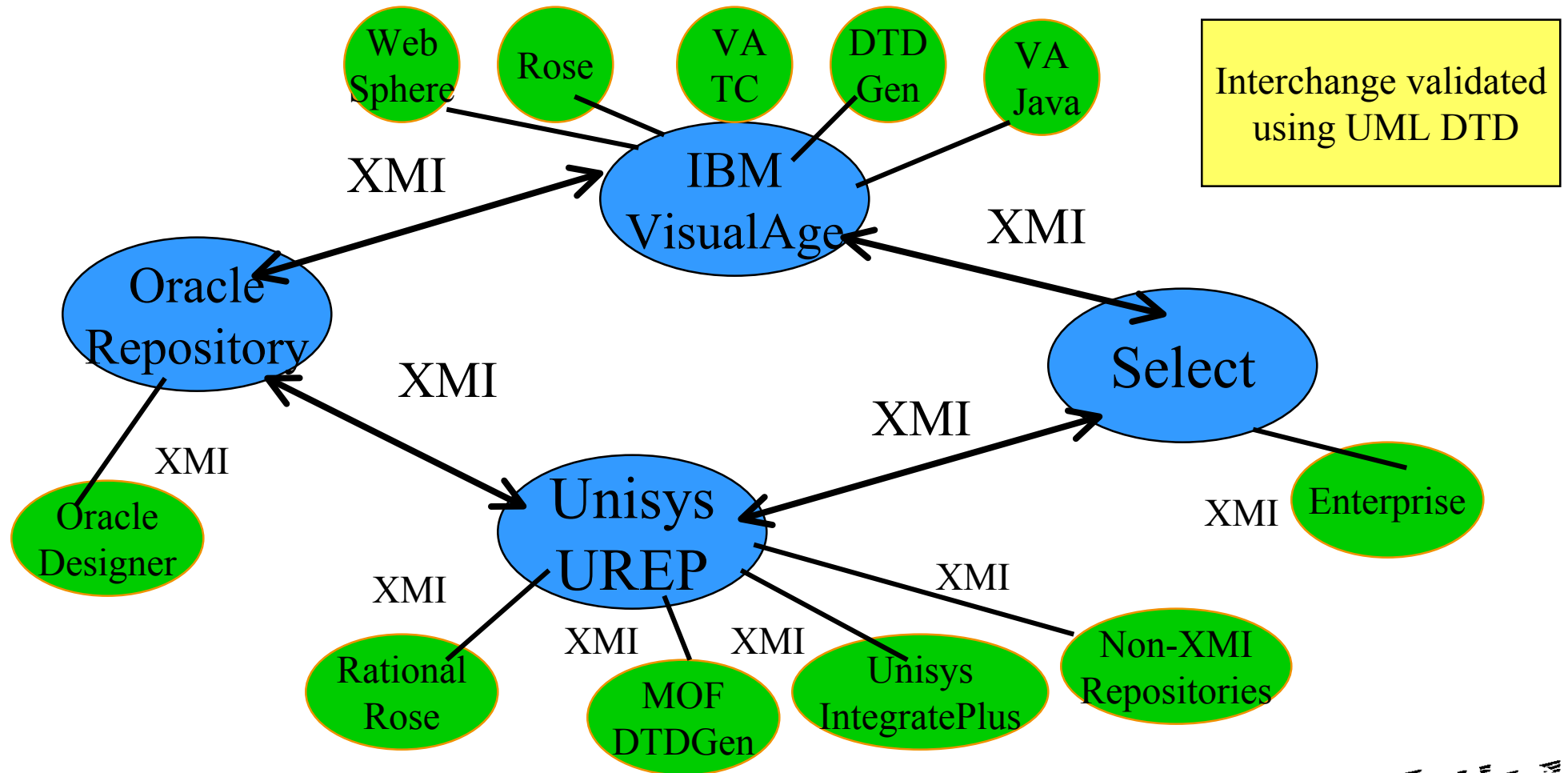
<!ELEMENT name (#PCDATA | XMI.reference)*>

<!ELEMENT feature (Feature| StructuralFeature| Attribute| BehavioralFeature| Operation| Method Reception)*>

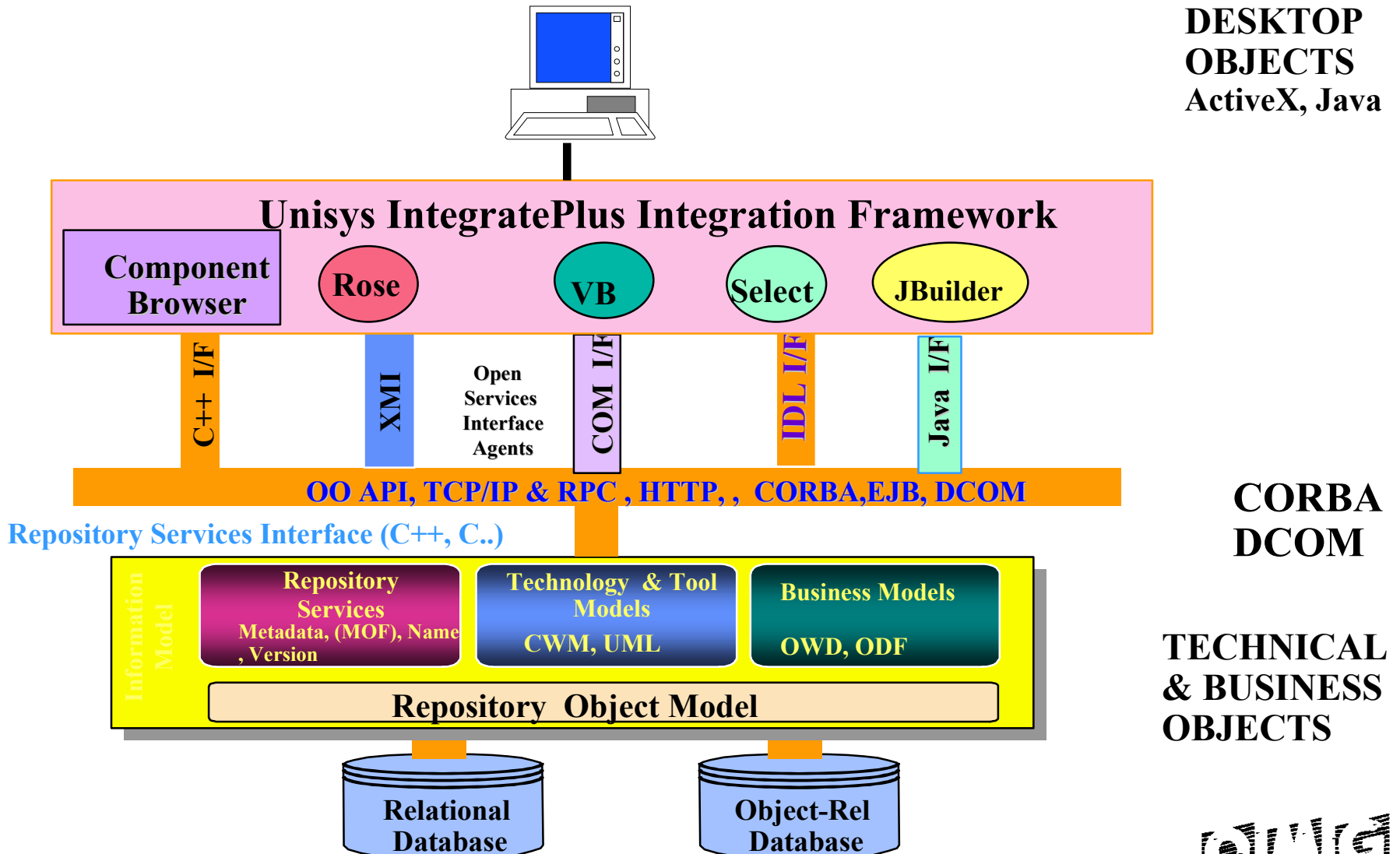
...

XMI Works

XMI Interoperability Demo : Nov 98



Distributed Object Repository Architecture (Unisys UREP)



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

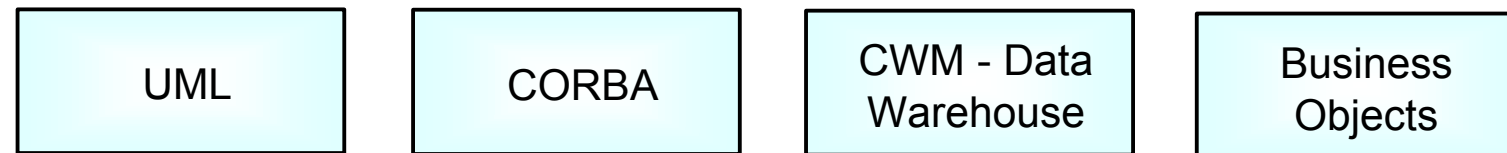
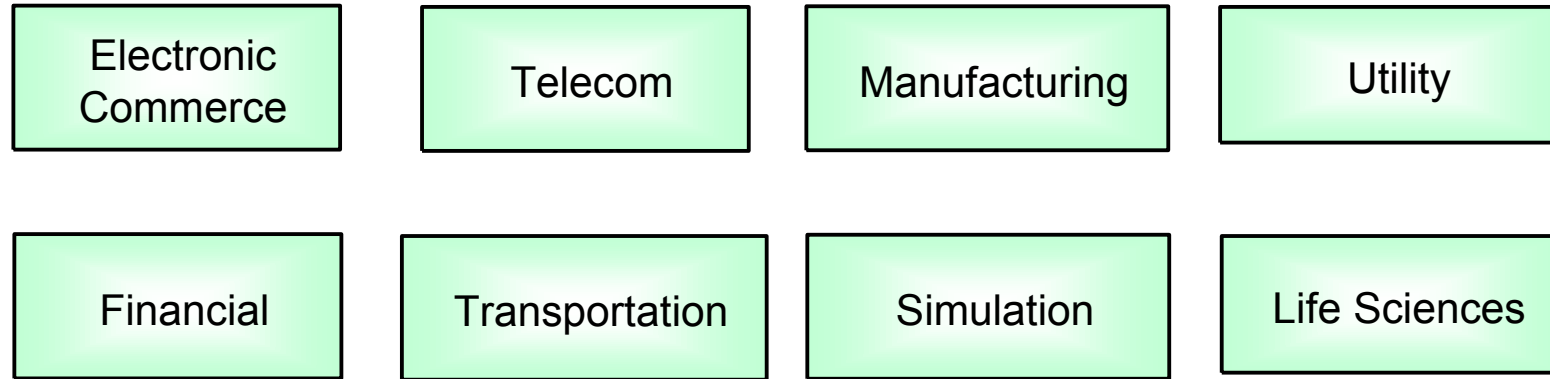
{OO} Implies Object Orientation is foundational and not an 'after thought'

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)...

XMI and the OMG - The Future

Domain



Platform

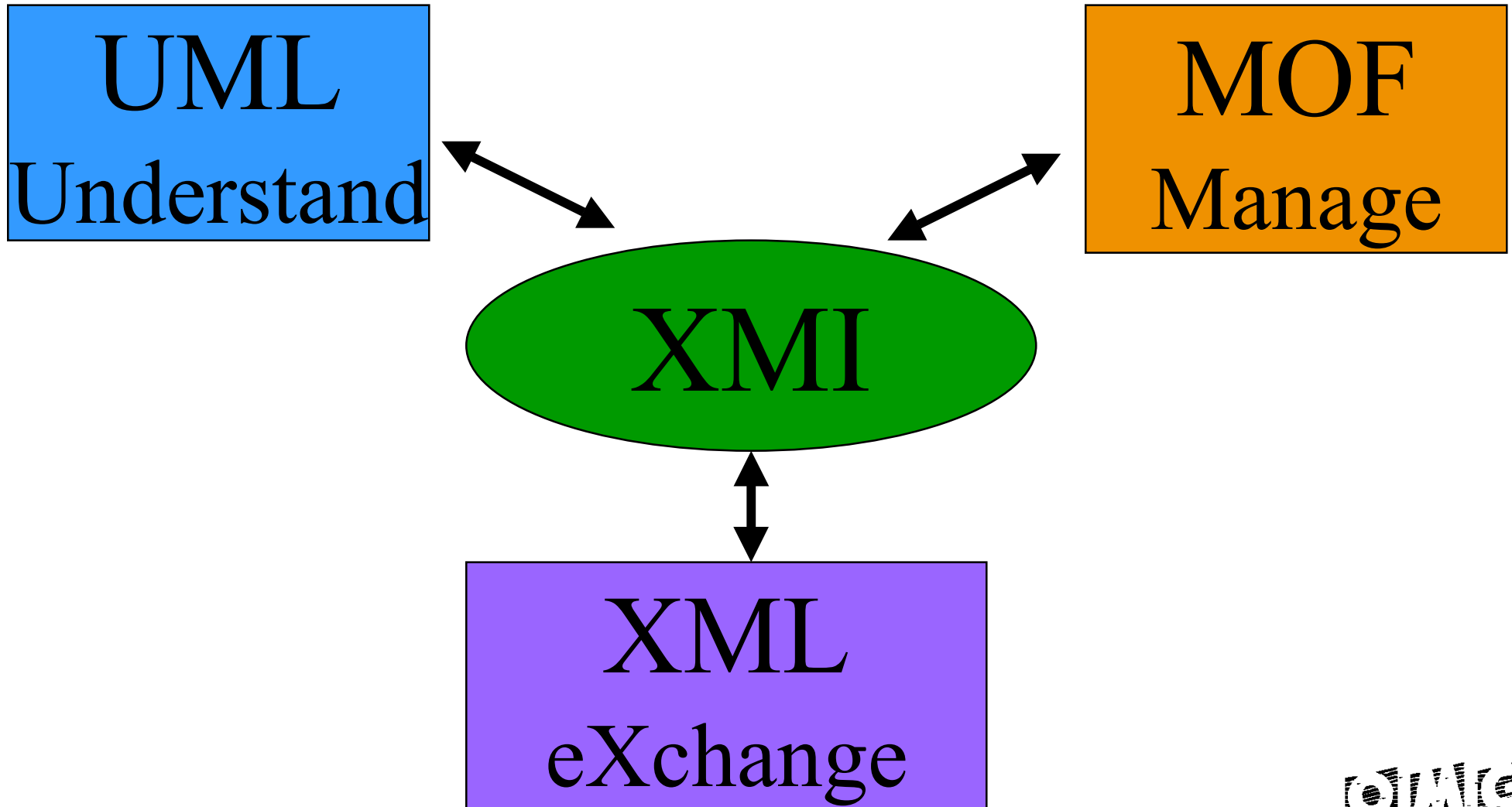
XML Bandwagon Accelerates

- 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



Question & Answers

