

# XML Metadata Interchange (XMI)

Proposal to OA&DTF RFP - 3

Stream based Model Interchange Format (SMIF)

Co-Submitters

Unisys, IBM, Oracle, DSTC, Platinum

Supporters

Select Software, Inline Software, Rational Software

**OMG TC Meeting, Orlando : June 10, 1998**

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# Topics Covered

- Introduction & History
- Overview of Proposal
- Requirements and proof of concept
- An overview of XML (or why XML?)
- Proposal Details
- Summary

# Introduction

- In November 1997, the MOF and UML were adopted as OMG standards.
- The specifications included metamodel and set of CORBA interfaces for manipulating MOF based meta objects and UML based models
- However a file/stream based interchange format was not specified (time constraints...)
  - In December 1997, the SMIF RFP was issued
- Several LOIs and 3 potential submissions CDIF, UOL, XMI began emerging

# XMI Submission History/factoids

- <2/98 : Unisys and IBM independently evaluate XML and other interchange options
- 2/98 : Unisys and IBM begin collaboration
- 4/98 : Oracle, DSTC and Platinum join
- 5/98 : Select Software joins  
Early discussions with other submitters
- 6/98 : XMI submission preview (Orlando)  
Rational Software, Sybase, Inline join

# Overview of proposal

- 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
    - UML based models (using UML DTD)
    - MOF based metamodels (using MOF DTD)
- Specify a precise MOF to XML mapping
  - Use of OCL to specify stream production rules
  - Allows interchange of any MOF based metamodel
  - Enables automatic generation of DTDs
- Use MOF as metameta model and

# OMG Metamodeling Architecture and XMI

|    |                           |                    |
|----|---------------------------|--------------------|
| M3 | MOF<br>MetaMetaModel      | MOF-XML<br>Mapping |
| M2 | UML or other<br>MetaModel | UML DTD            |
| M1 | Model                     | Document           |
| M0 | Instances                 |                    |

- DTDs defined for MOF, UML
- MOF metamodel DTD generation
- Models are XML documents with a DTD
- Document and DTD interchange

# OMG Repository Architecture

Tools, Applications

MetaModels (UML, BOCA, CWM...)

Repository Meta Object Facility (MOF)

CORBA Object Services

CORBA

# Potential XMI Usage Scenarios

- Interchange of UML and other MOF compliant models between
  - modeling and design tools, generators..
  - Between tools and repositories
  - Between repositories
- Publish design meta data on the web
  - Leverage XML/HTML infrastructure that already exists
- Use in addition to/instead of MOF based CORBA interfaces to meta objects
  - XMI allows disconnected/occasionally connected users

# Summary of mandatory RFP Requirements

| <b>Requirement</b>                   | <b>Requirement addressed</b>   |
|--------------------------------------|--|
| Use MOF as metameta model            | MOF is the metametamodel (M3)<br>Precise mapping from MOF to XML specified               |
| Syntax and Encoding                  | Specified in concrete XML DTDs for UML and MOF models<br>Specified in MOF to XML mapping |
| Referenced Concepts (unambiguous id) | Use of Xlinks, Xpointers and URLs as needed (also see MOF spec Section 6)                |
| UML & MOF Support                    | UML and MOF DTDs, Proof of concept with multiple modeling tools                          |
| International codesets               | XML supports Unicode   |

# Proof of Concept (prototypes)

- Unisys
  - UML DTD for exchange of models to and from Select Enterprise and UREP UML 1.1 repository
  - MOF DTD for exchange of metamodels
  - Auto generation of DTDs from MOF repository
- IBM
  - UML DTD for exchange of models to and from Rational Rose
- DSTC
  - Auto generation of DTDs from MOF

# Technology Alternatives Considered

- Transfer Format
  - CDIF
  - *XML*
  - UOL
  - Other
- Potential for integrating ideas concepts from other submissions over next few months
- Next we will cover “Why XML?”

# Overview of XML and importance to OMG

# eXtensible Markup Language

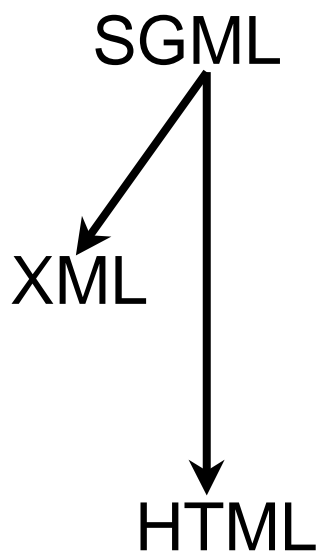
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- XML technology
- XML example
- XML and the industry
- XML benefits
- XML and the OMG



# XML technology

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- 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

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## -Standards

- W3C open standard on Feb 10, 1998.
- International ISO character sets
- Additional standards in progress:
  - XLink/XPointer, Namespaces, XSL, RDF, DOM, SAX, Web-DAV

## -Support is exploding

- 27 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

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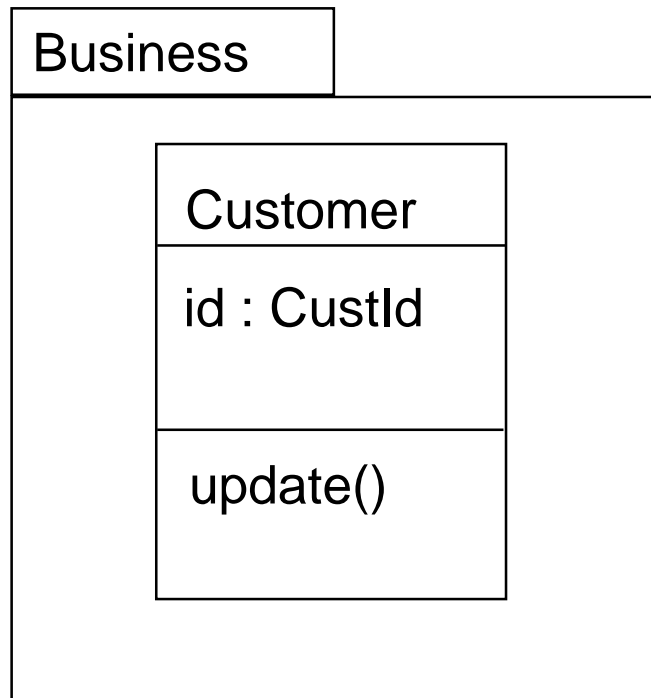
- XML is system-independent, vendor independent, proven with HTML on the web.
- Metadata delivery via the web
- Validation, tool support, low cost of entry
- Advanced linking
- Stylesheets for views, transforms



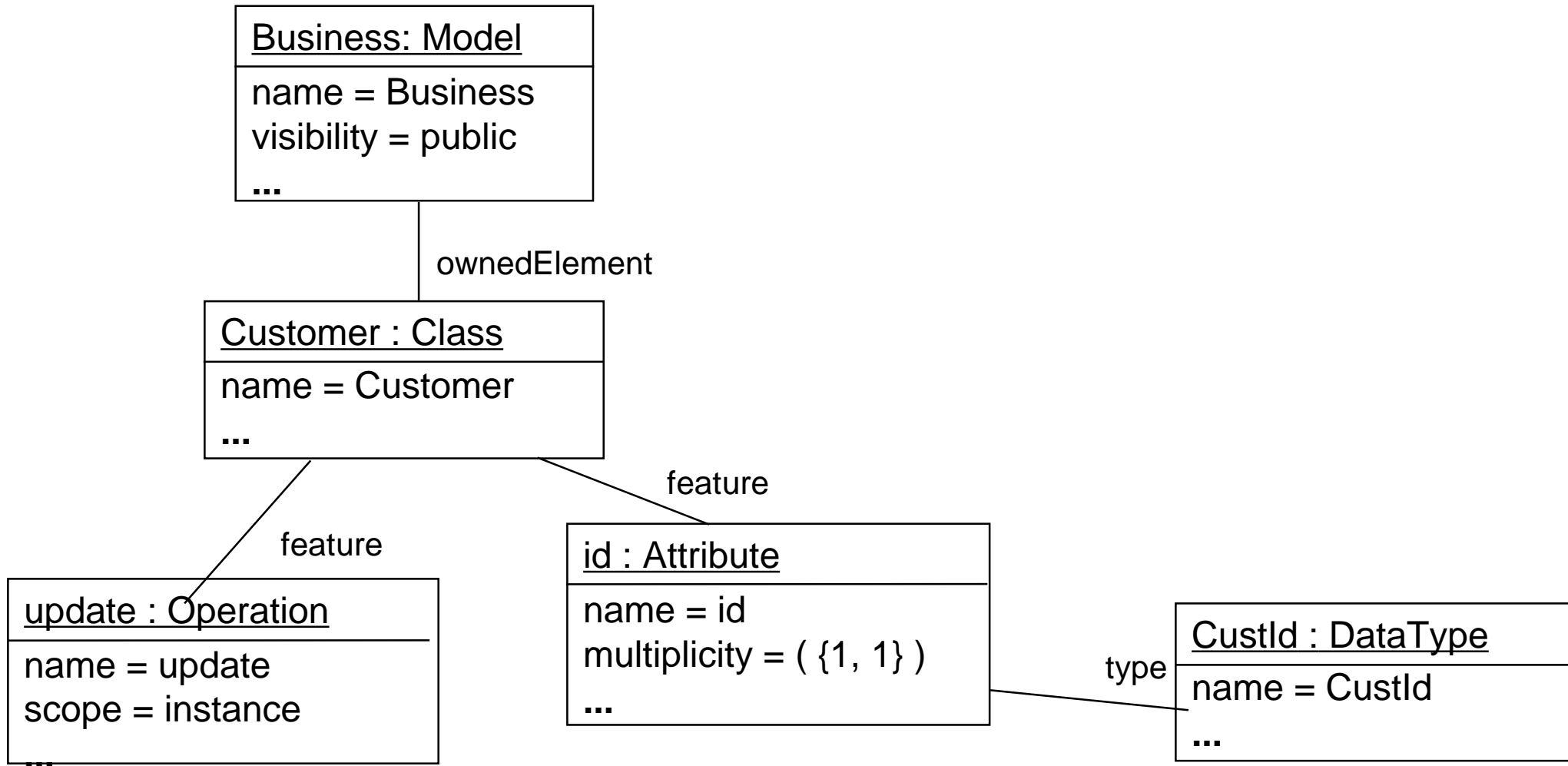
# XMI drill down with examples

## MOF-XML mapping rule sample

# Abbreviated Example

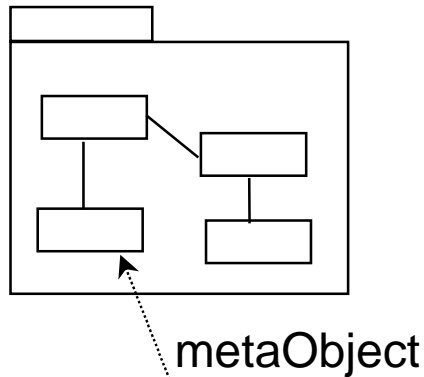


# As a metamodel instance

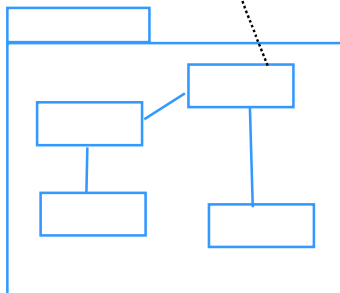


# Tags from metamodel, content from model

Meta  
model



*Model*



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

# As an XML Document Fragment

```
<!-- Document Prologue, etc. -->
<Model id="a1"> <name>Business</name><visibility value="public"/>
  <ownedElement>
    <Class id="a7"><name>Customer</name>
      <feature>
        <Attribute>
          <name>id</name>
          <multiplicity><field> 1</field><field> 1</field></multiplicity>
          <type><reference ref="http://www.distant.com/basic.xml#a47"/>
        </Attribute>
        <Operation><name>update</name>
          <scope value="instance"/>
        </Operation>
      </feature>
    </Class>
  </Model>
```

# XML Production Rules

- Formally Defined as OCL Query
- Query inputs:
  - a RefObject (an object whose metaclass is defined via MOF elements)
  - metamodel name, version, etc., for Document Prologue
- Returns XML Document

# Example Production Rule

ObjectElement(obj : RefObject) : Sequence(string)

ObjectElement(obj) =

```
Sequence { ObjectStart(obj.metaObject()),  
           ObjectContents(obj.metaObject(), obj),  
           ObjectEnd(obj.metaObject()) }
```

*<obj.metaObject().name id = 'objld()'> Object-Contents()*

*</ obj.metaObject().name >*

# DTD Fragment

```
<!ELEMENT Class (name, visibility, isAbstract, isLeaf, isRoot, isActive,  
participant?, realization?, specification?  
generalization?, specialization?, stereotype?,  
constraint?, provision?, requirement?, template?,  
templateParameter?, ownedElement?,  
taggedvalue?, feature?)>
```

```
<!ATTLIST Class 'id ID #REQUIRED'>
```

```
<!ELEMENT name (#PCDATA)>
```

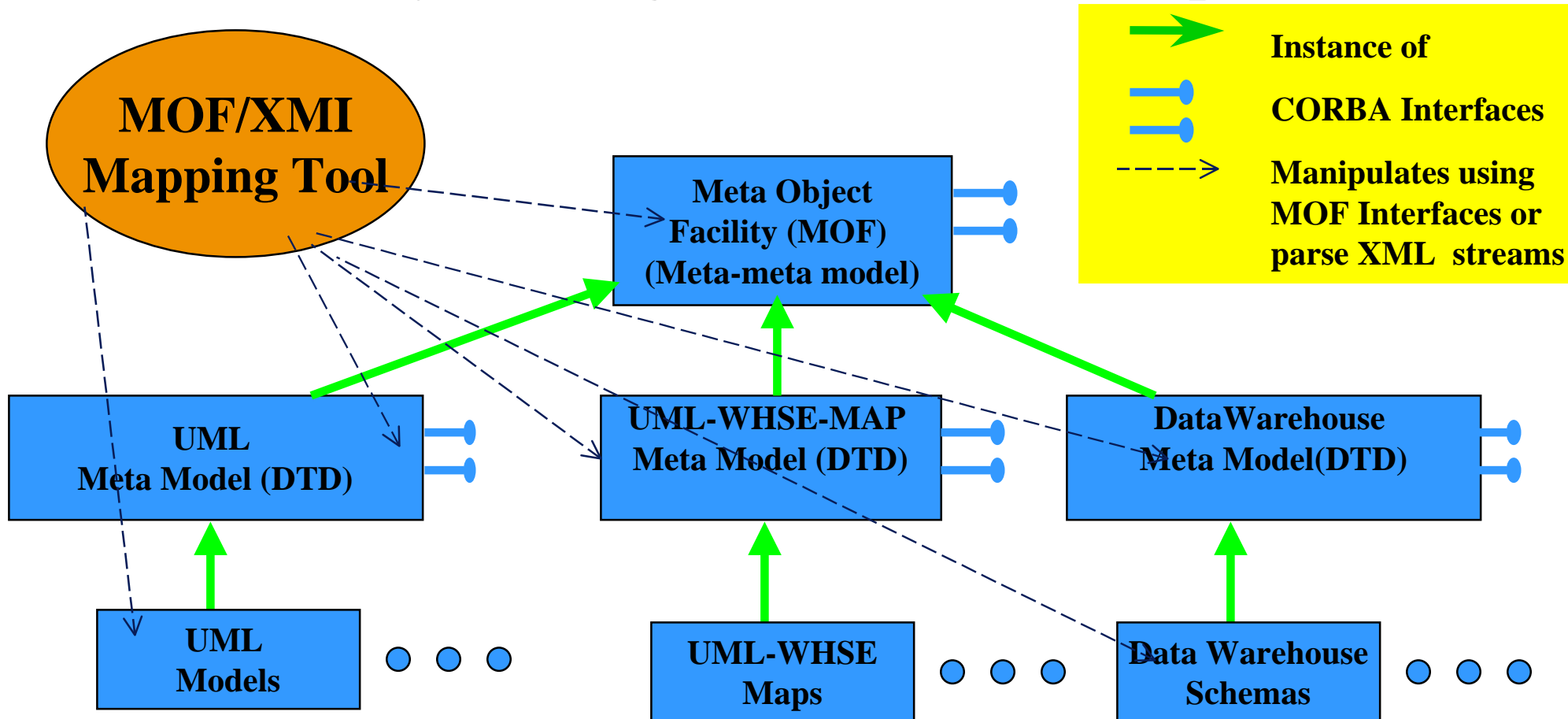
```
<!ELEMENT generalization (reference)*>
```

```
<!ELEMENT feature (Attribute | Operation | Method | Reception)*>
```

...

# XMI Usage Scenario

(or why do we go thru all these hoops!)



# Summary: XML proposal and the OMG

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- Synergy with OMG metamodeling architecture
  - DTD  $\Leftrightarrow$  Metamodel
  - Document  $\Leftrightarrow$  Model
- OMG leverage of XML:
  - standardize key metamodels and convenient transfer format for UML, MOF and more
  - create industry standard metamodels/DTDs
  - leadership for standardizing object-oriented information interchange of the future
- OMG CORBA interchange - XML interchange for metadata

# For more information

- Stay tuned to Helsinki meeting
  - For complete specification and more gory details
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  - [sbrodsky@us.ibm.com](mailto:sbrodsky@us.ibm.com)
- XML Information
  - [www.w3c.org](http://www.w3c.org)
- UML and MOF Information
  - [www.omg.org](http://www.omg.org)

# Questions & Comments

