Composable GIS and E-Commerce Services in Crisis Management Systems – Using the COMBINE MDA Approach

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Open GIS Consortium
Spatial connectivity
for a changing world.

www. opengis.org

- The COMBINE MDA Approach
- Crisis Management Systems
- ISO/TC211 and OpenGIS Consortium
- ACE-GIS project
- OpenGIS Geospatial Objects (GO-1) Initiative
- PIM Models for services – mapping to XML and web services
- Conclusion – The MDA approach is recommended + need for further work

ist
information society technologies

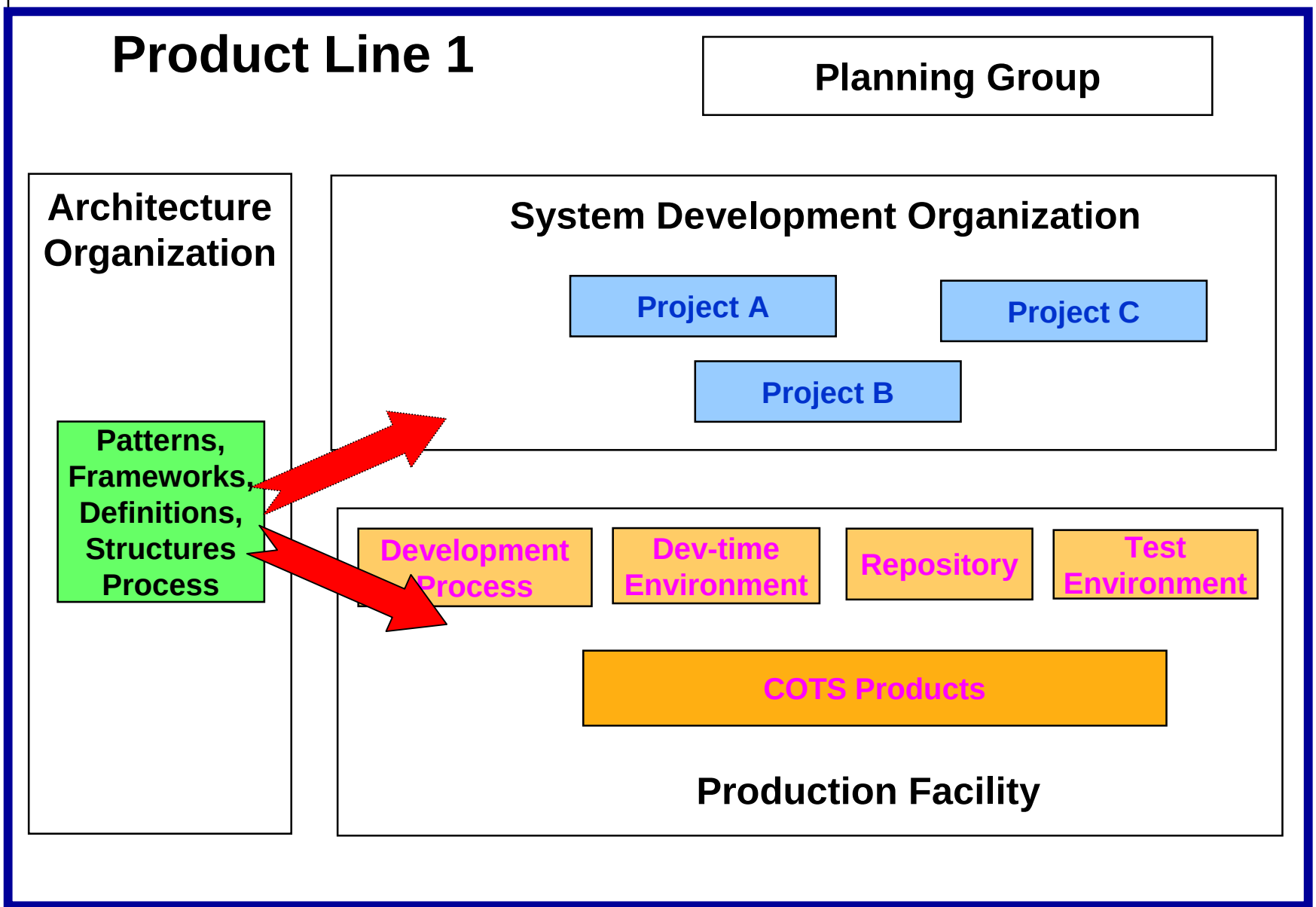
Abstract

The European project ACE-GIS (Adaptable and Composable GIS and E-Commerce services) addresses a Model Driven Architecture approach to the specification and development of semantic interoperable services for Crisis Management and Environmental planning systems. The methodology and tool-support for service-oriented architecture specification is provided by the COMBINE project (Component-Based Interoperable Enterprise system development), with enhancements for model-based composition, using UML activity diagrams and mappings to BPEL4WS/BPML. The underlying standard services are based on the OGC Open Web Services for GIS components, and on a Web service infrastructure with extended ebXML Registry/Repository support.

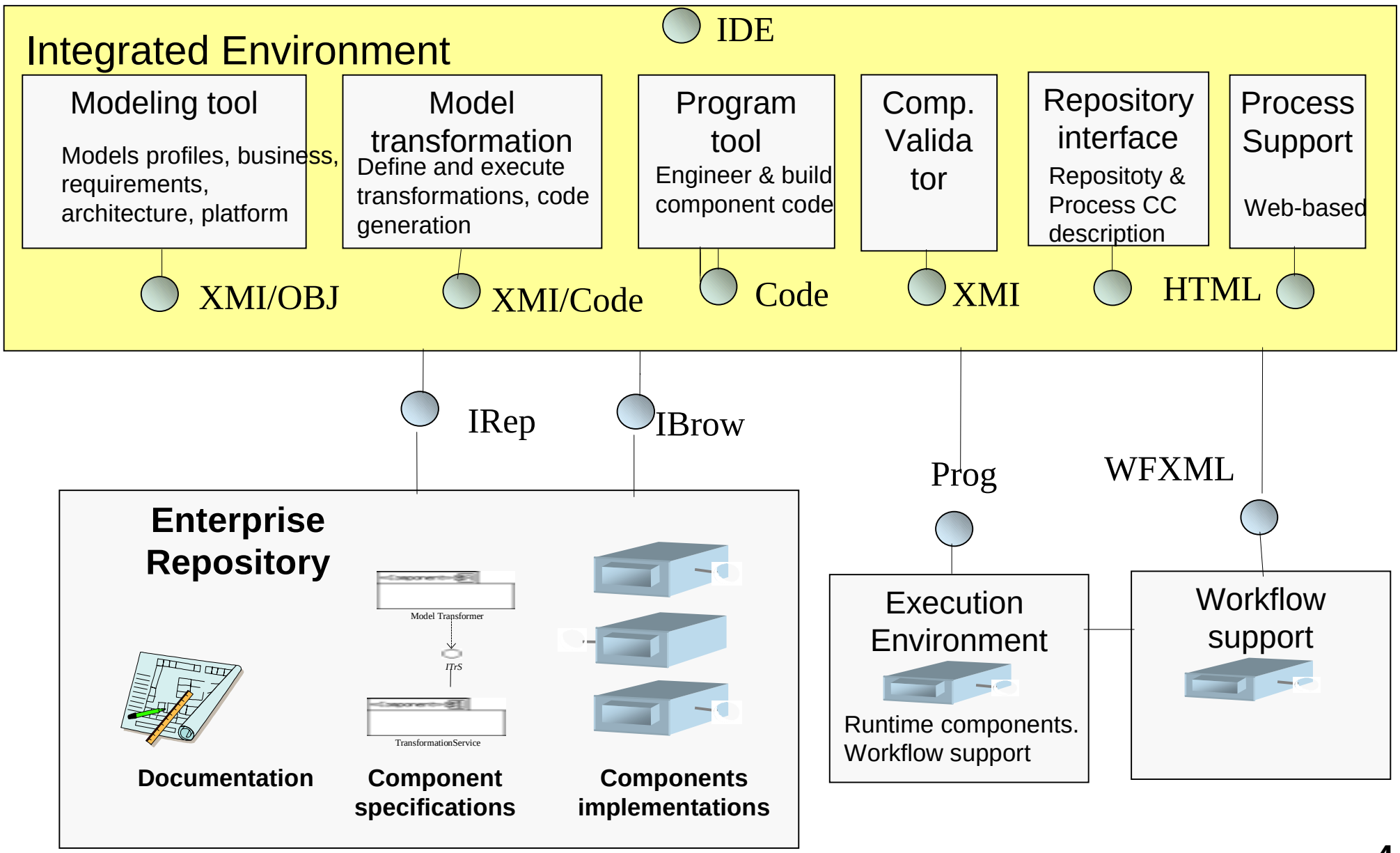
See: www.opengroup.org/combine, www.agegis.net,

www.omg.org/mda, www.opengis.org

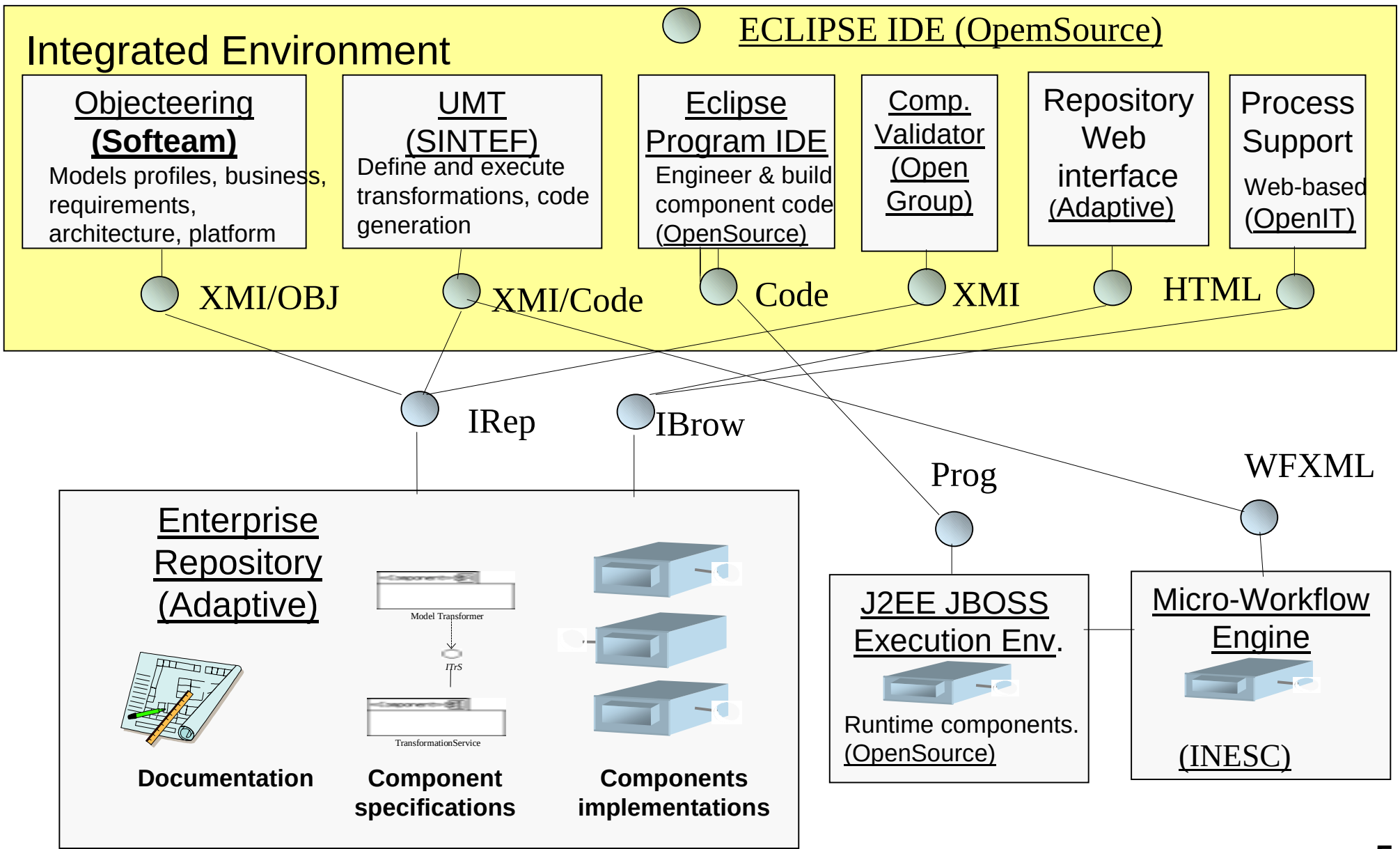
COMBINE Component Centre



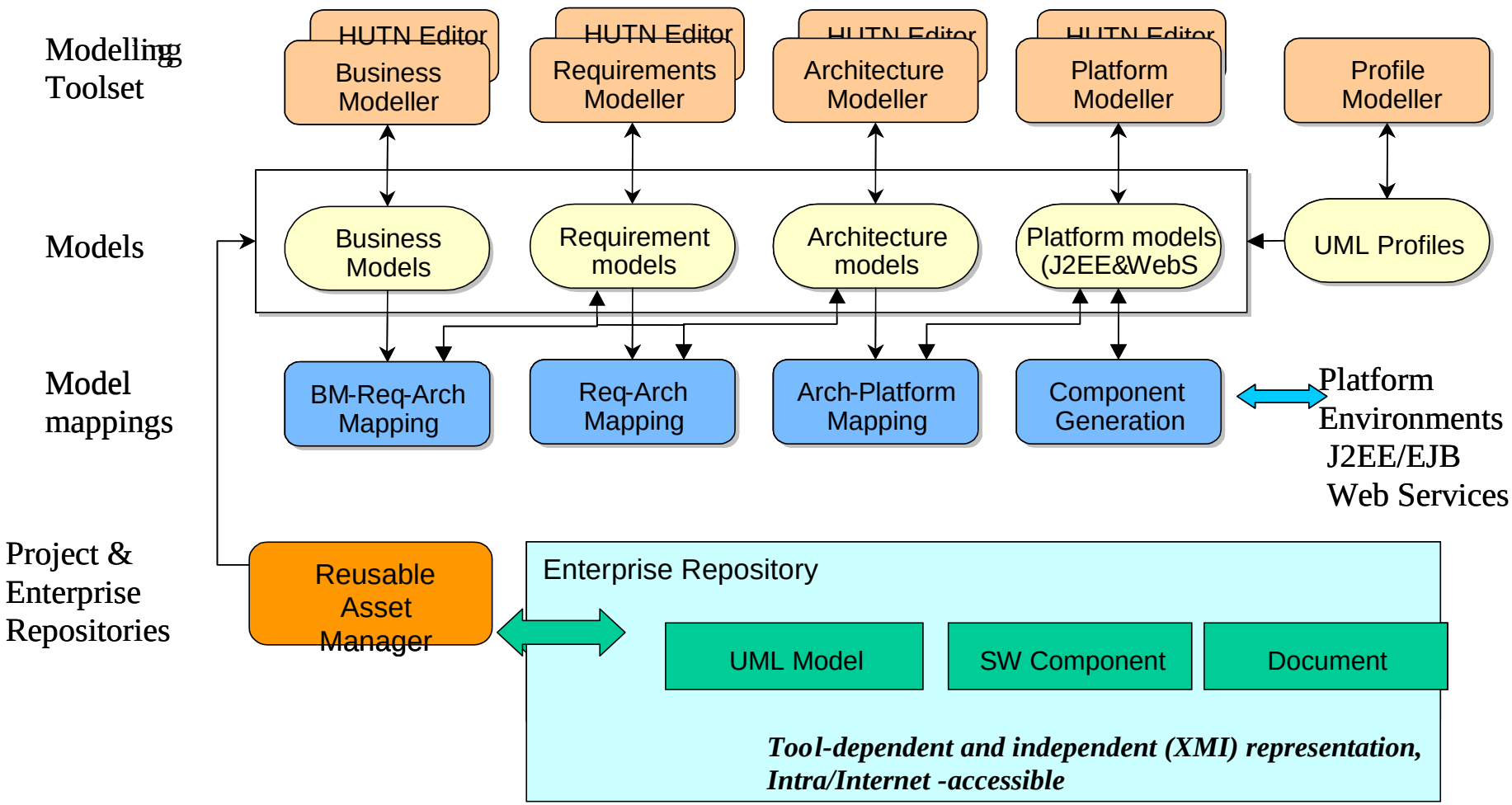
COMBINE Framework for Production Facility



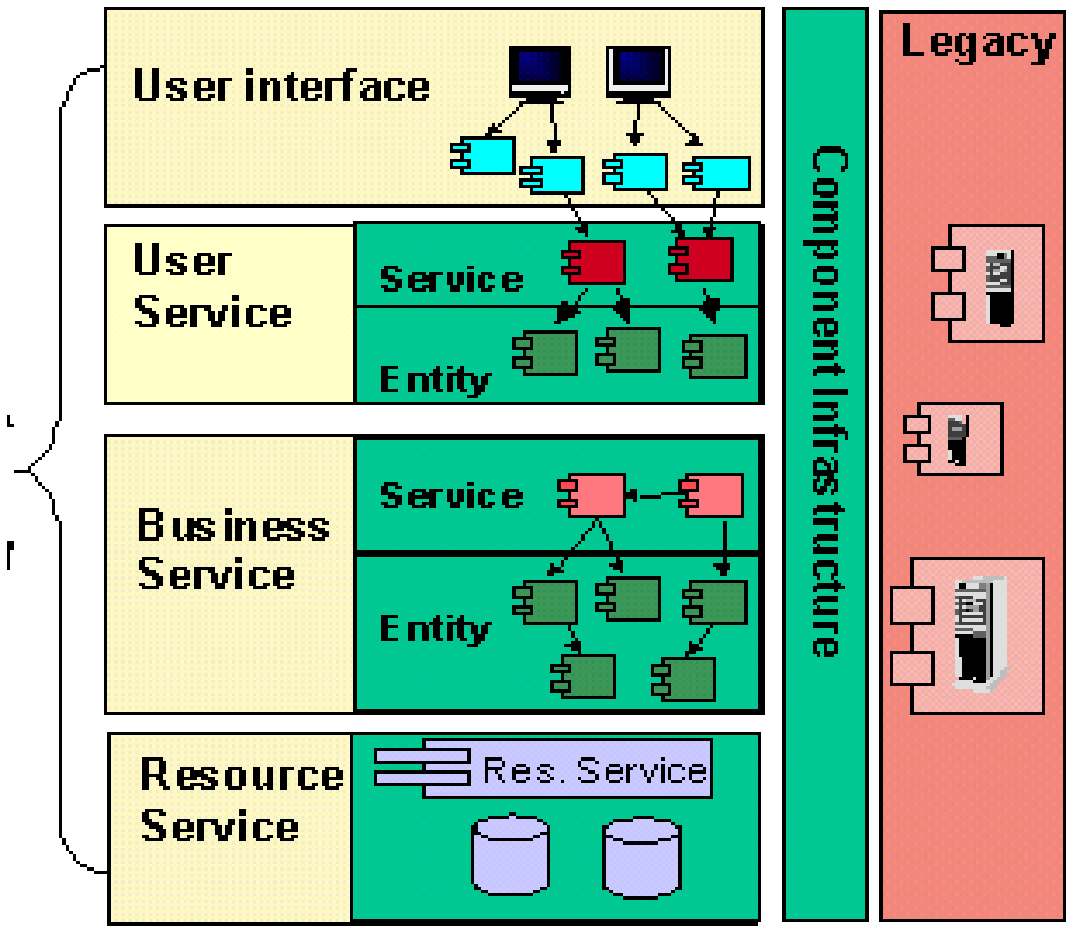
Component Centre Parts



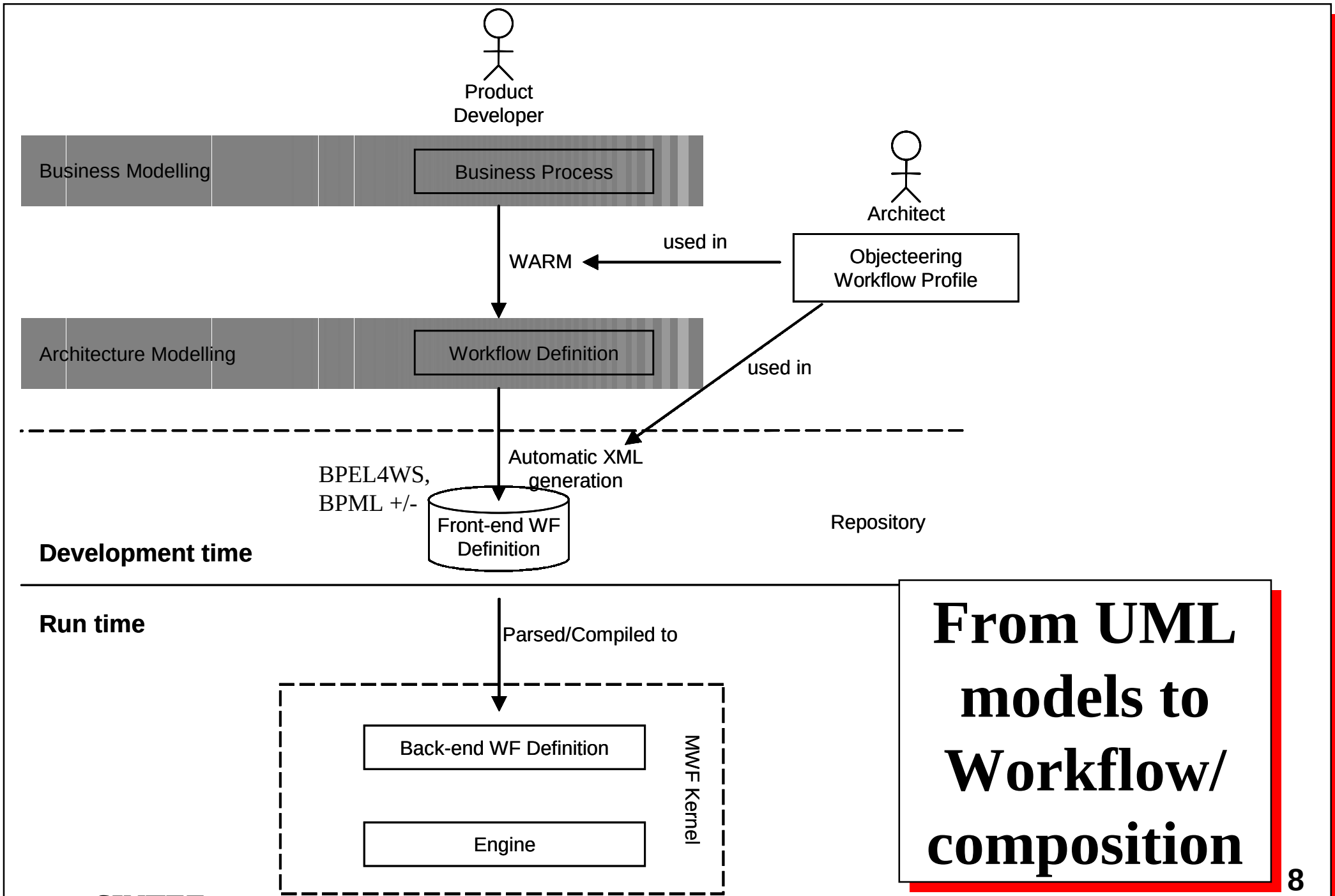
COMBINE MDA Approach



COMBINE Component types

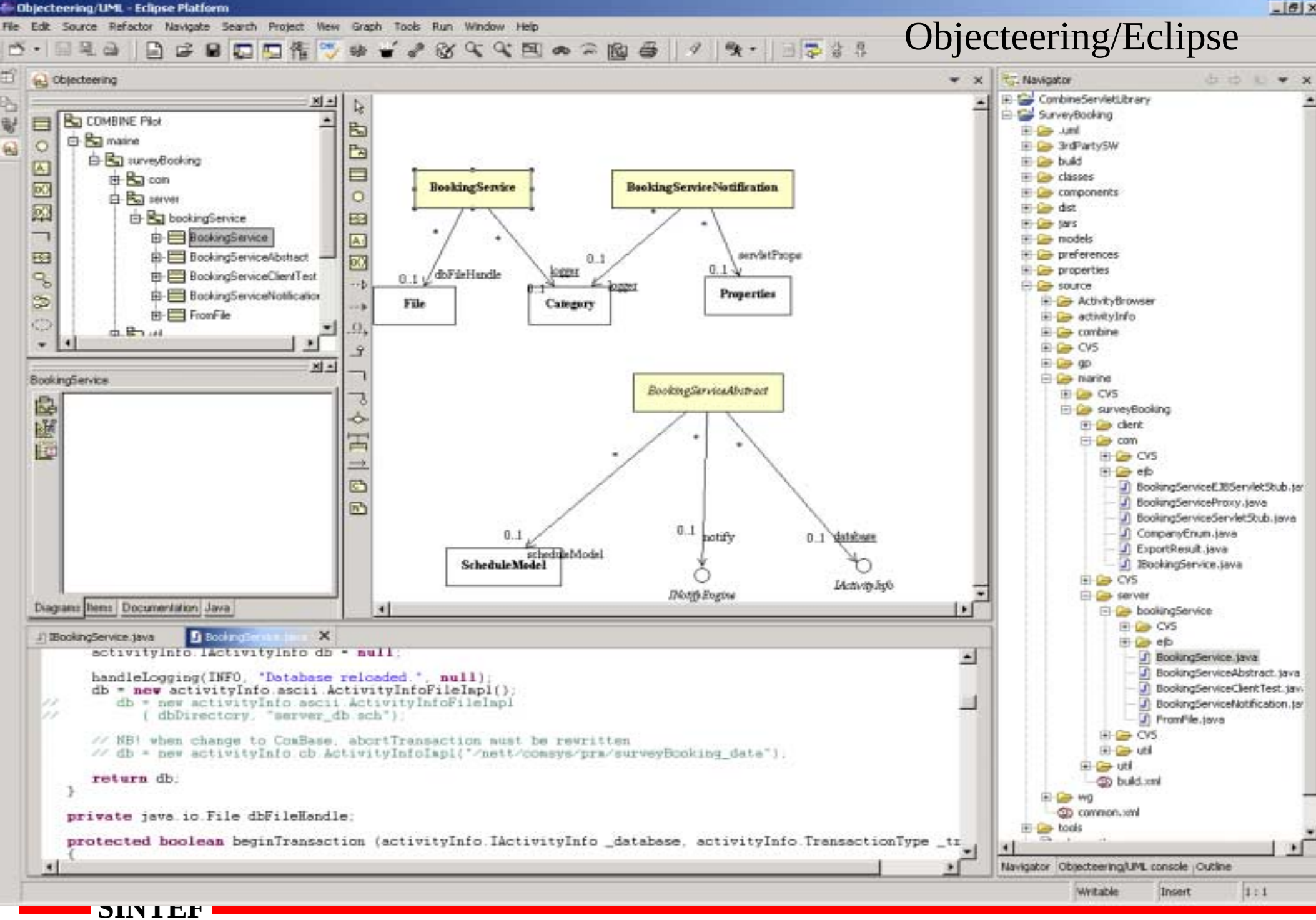


COMBINE Component Architecture



From UML models to Workflow/ composition

Objecteering/Eclipse

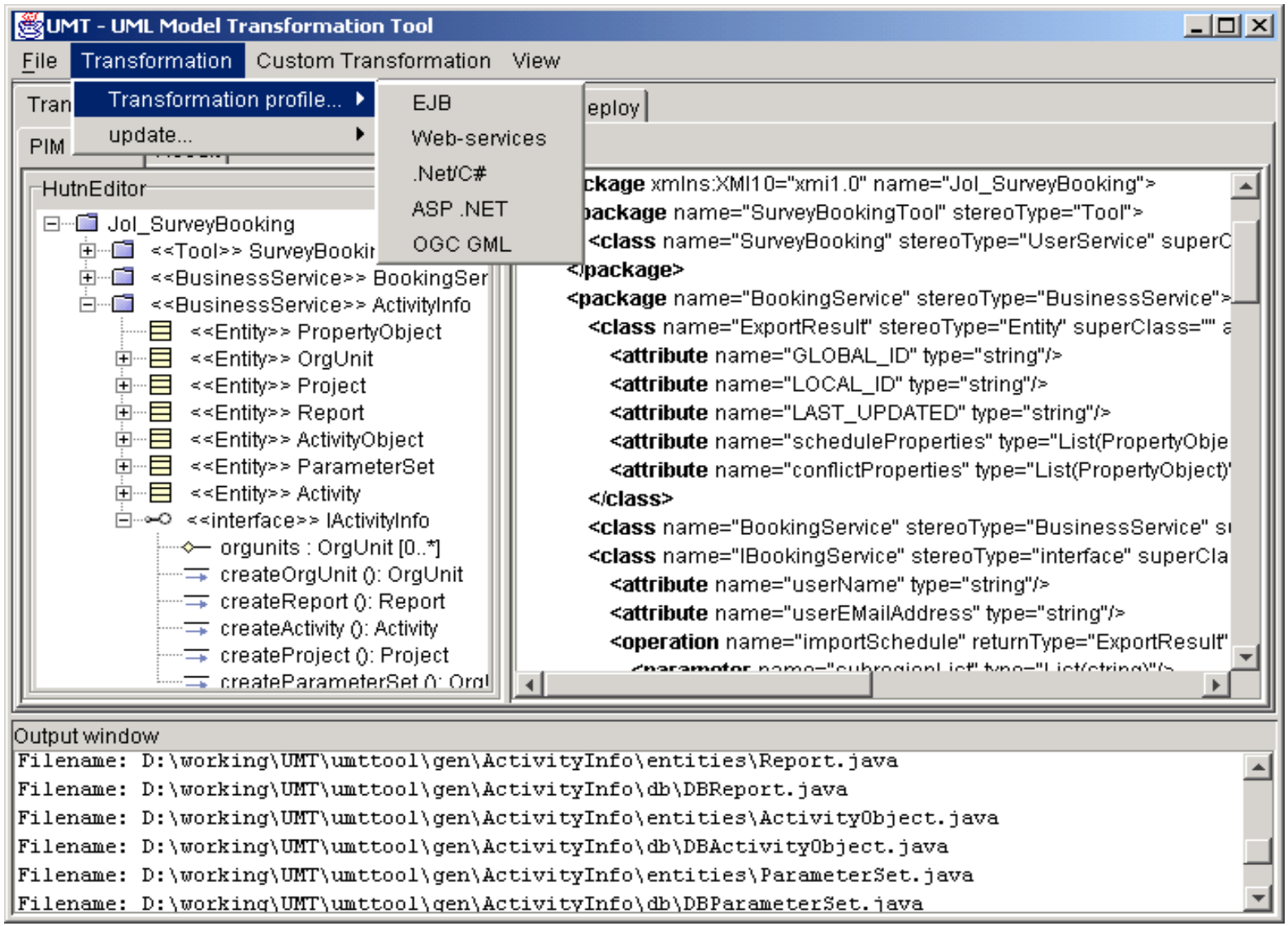


UML Model Transformation tool

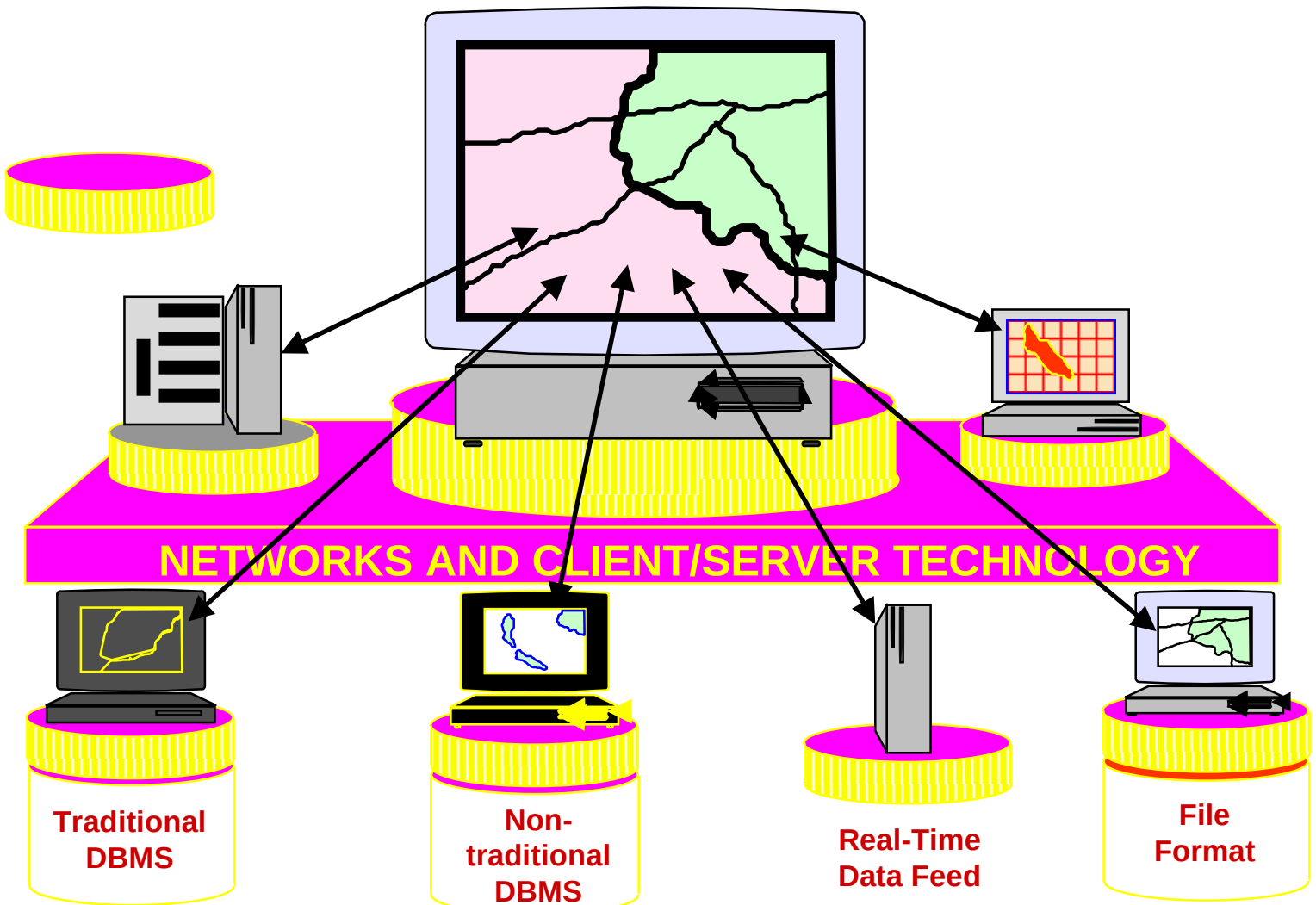
XMI →
← XMI

code generation

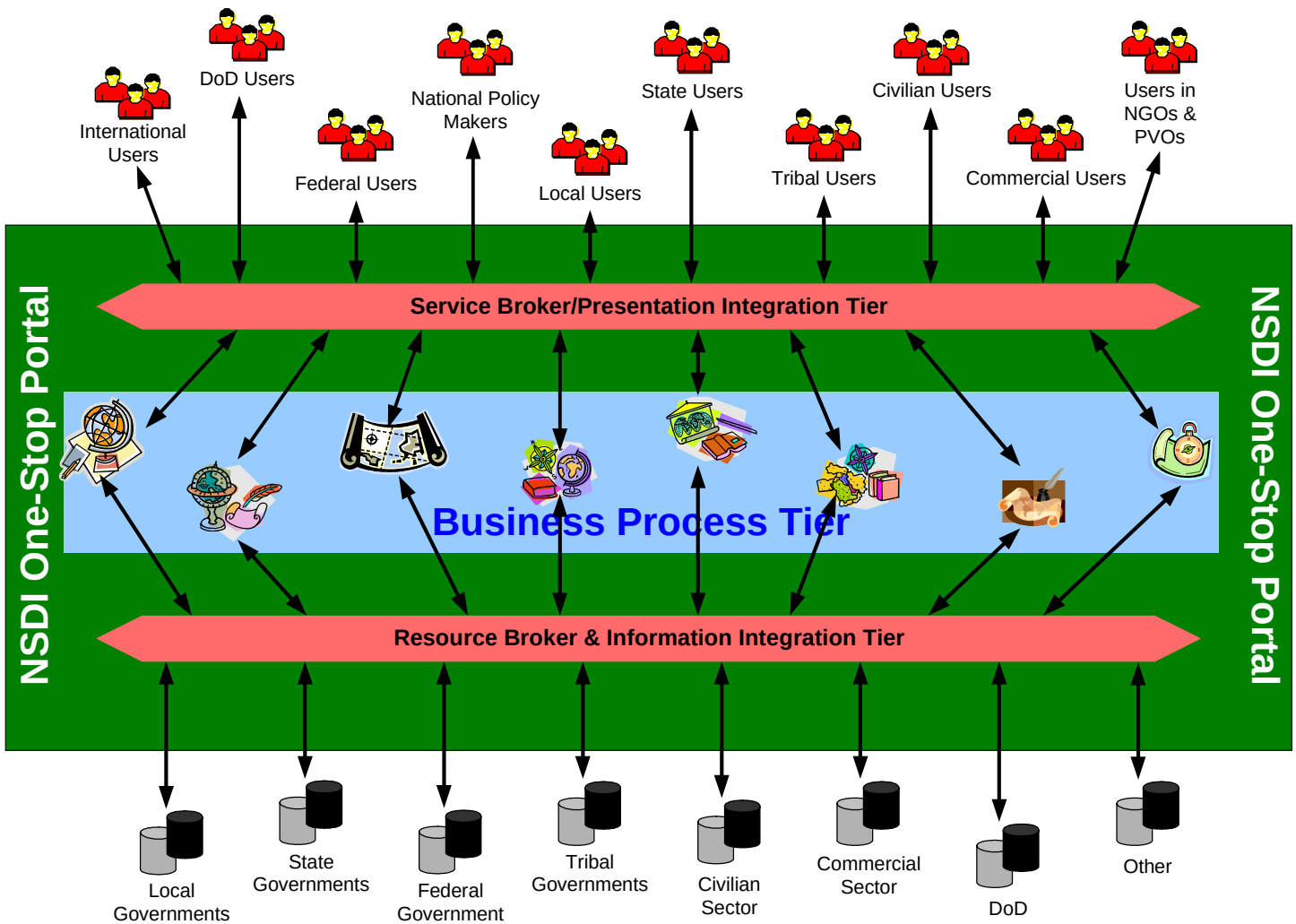
model transformations



Problem Goal: Transparent Access to Heterogeneous Geodata and Geoprocessing Services



The Geospatial Community interoperability vision



Individuals, organizations, and systems of all user agencies (Federal, state, local, NGOs, etc.) participating in the Homeland Security Information System

Tools, services, etc. offered by any participating agency for the use of all. Hosting, support, etc., to be provided by the offering agency or by a commercial service under contract. A distributed, virtual environment.

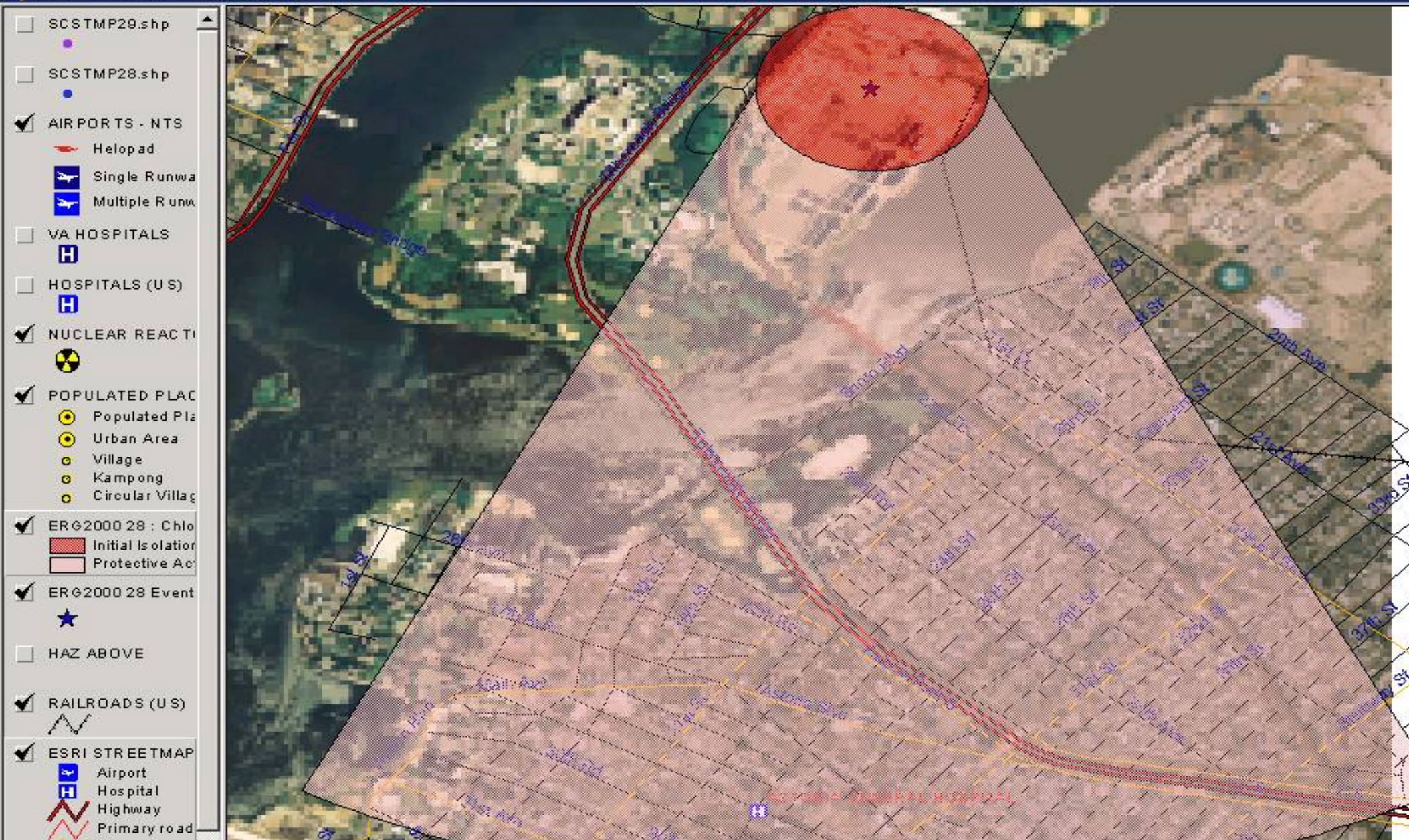
Resources offered by any participating agency or available from commercial providers under contract. Can range from a simple data server to a complete legacy system that provides needed information.

DTRA/FEMA Consequences Assessment Tool Set with Joint Assessment of Catastrophic Events - Beta Version: 100 Build 4 DEC:11:2001

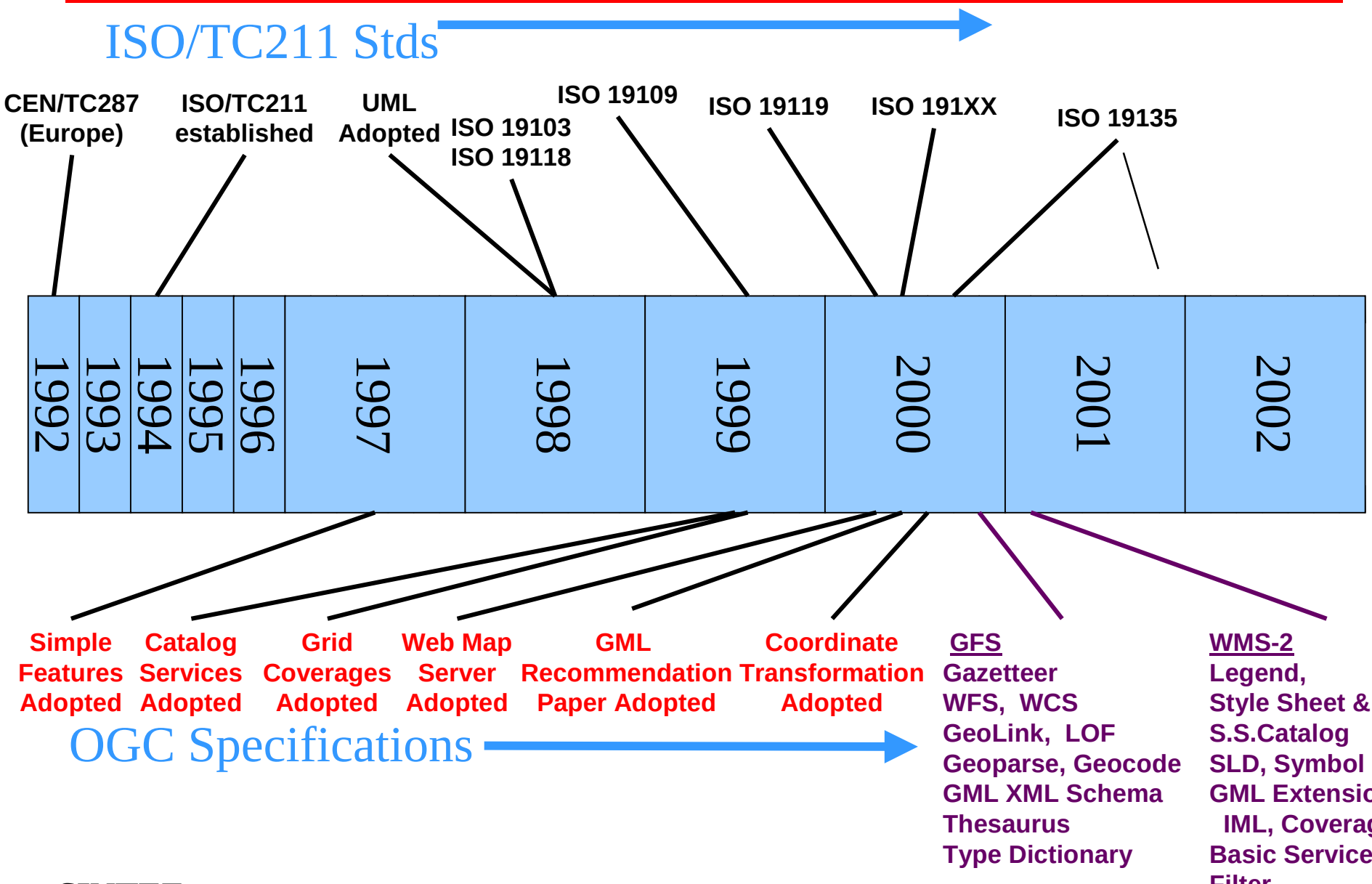
File Edit View Theme Analysis Surface Graphics Window Help CATS Control Hazard Consequence(s) RRS Cj Themes

Scale 1: 17,459

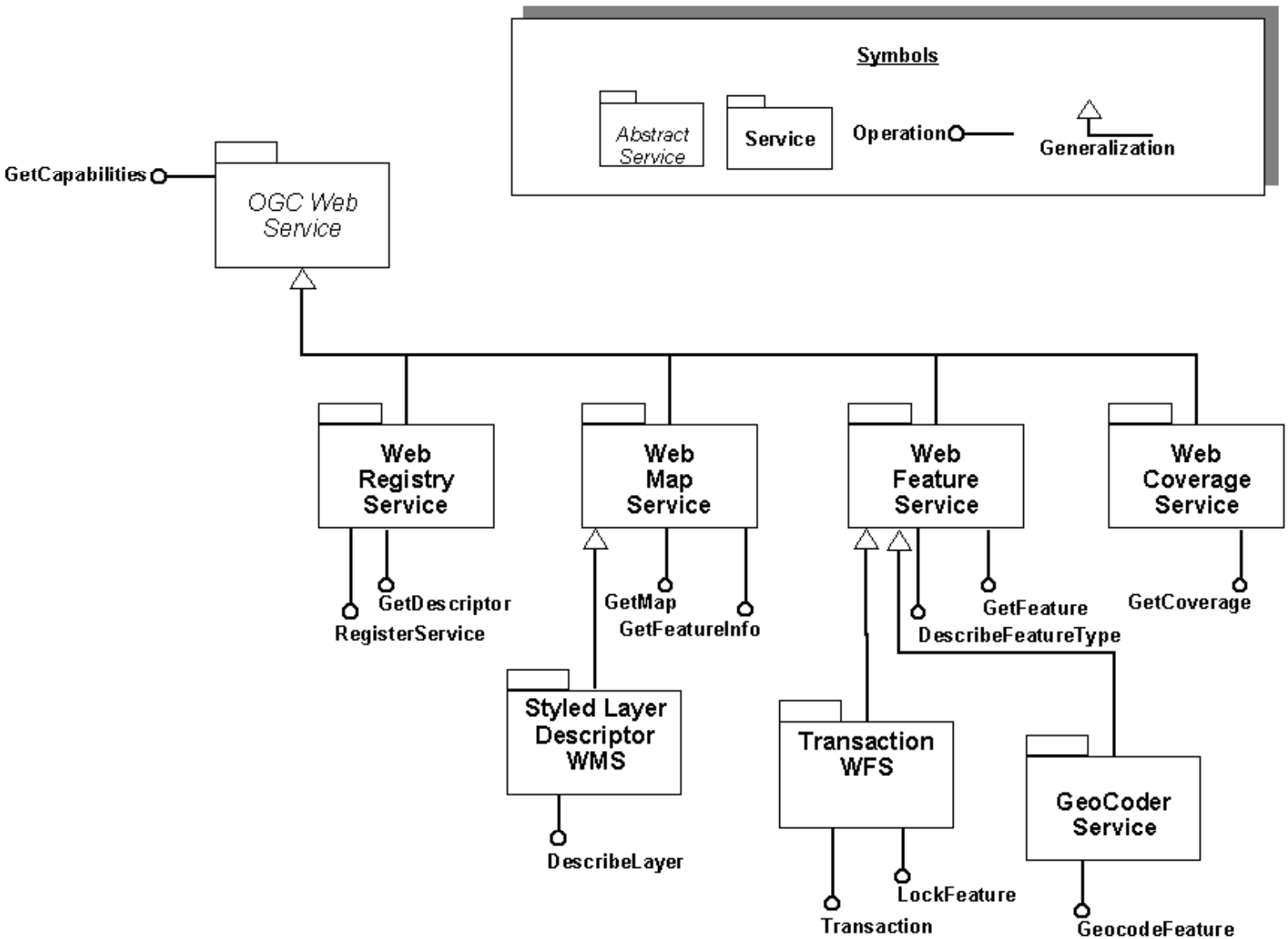
CATS Analysis View 1.00000000



ISO/TC211 & OGC – “Standard services”



OpenGIS Web Services



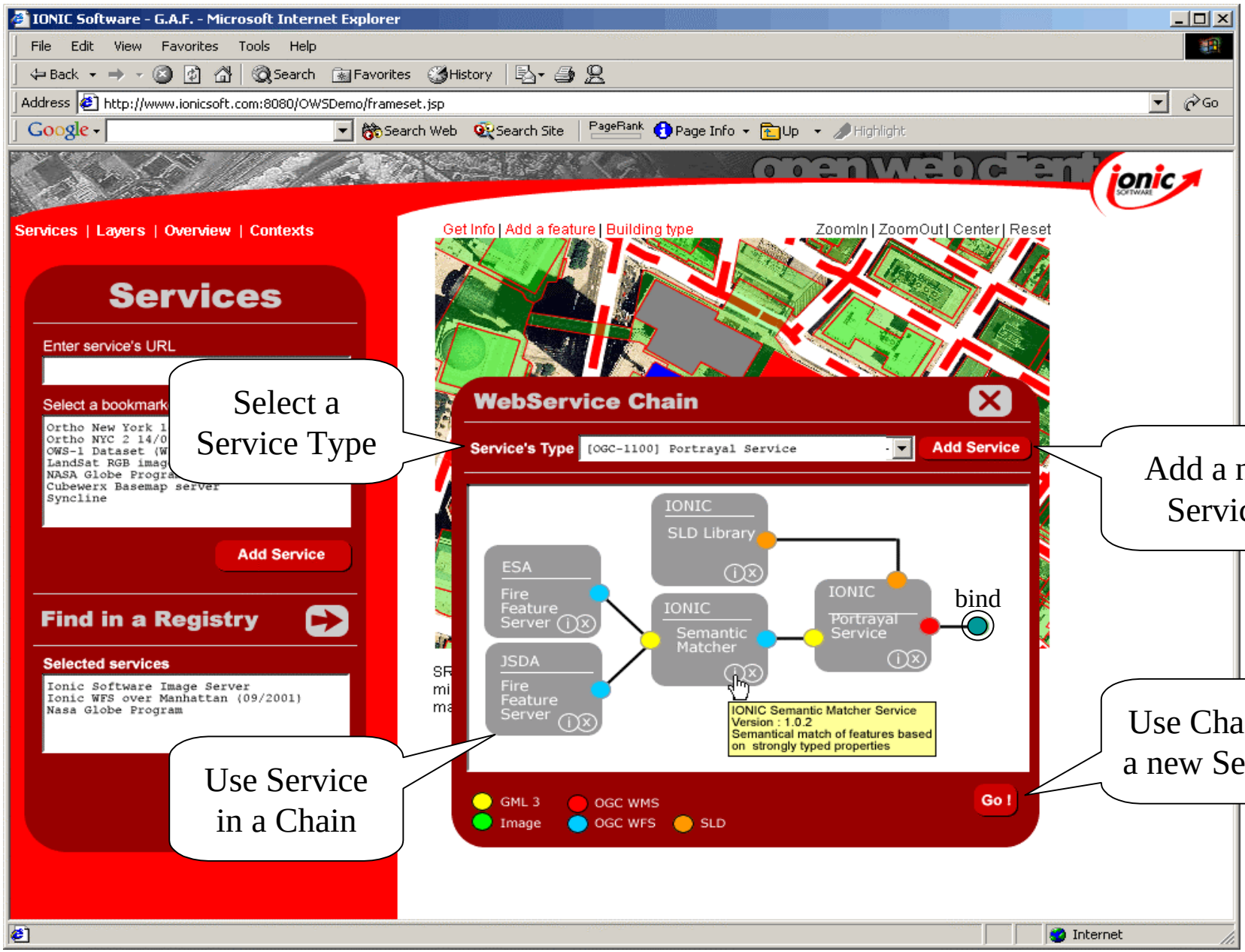
Starting point:
Dynamic search in registry and binding to services

My preferred services

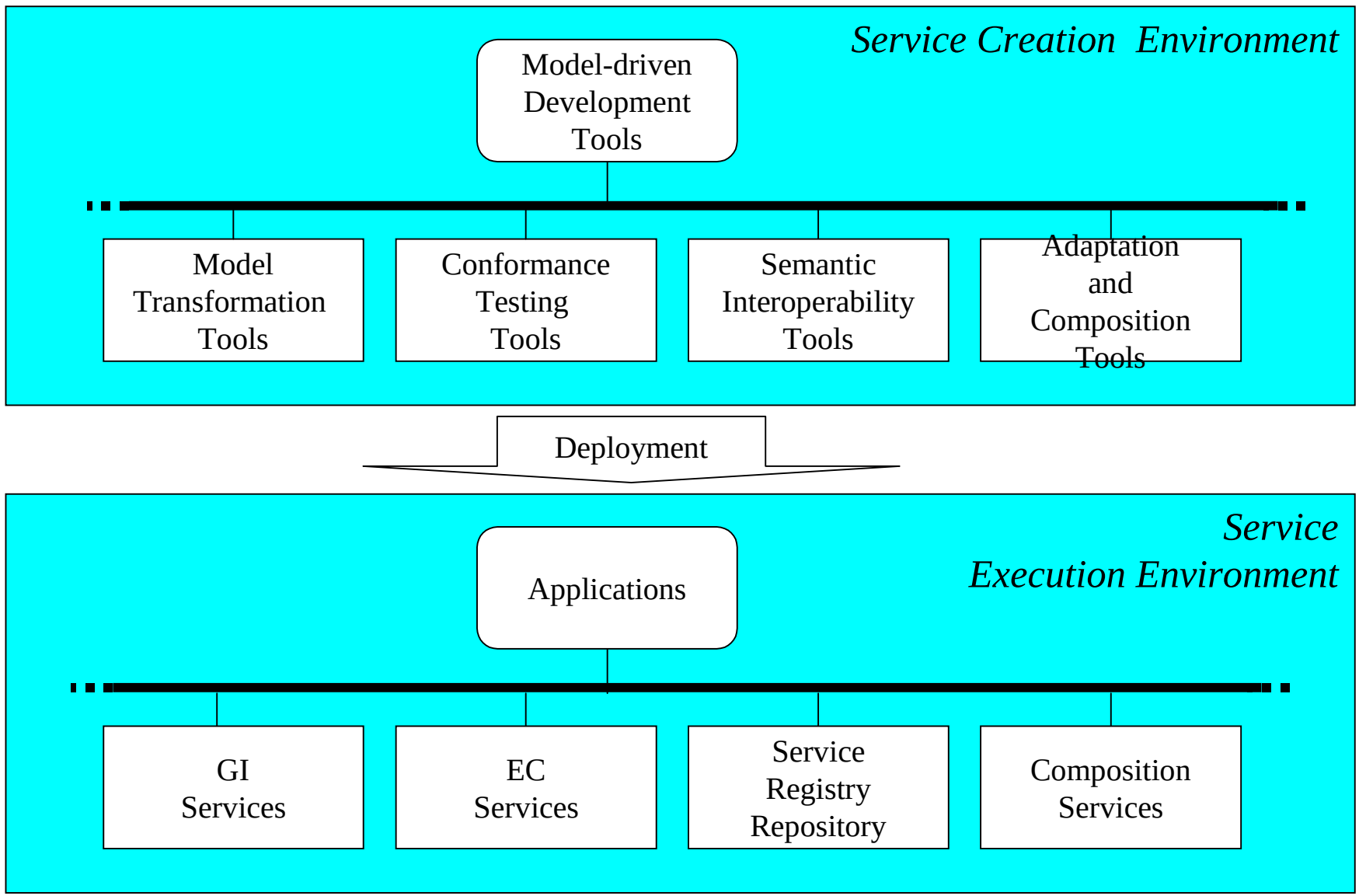
Currently binded services

Select and bind discovered Service

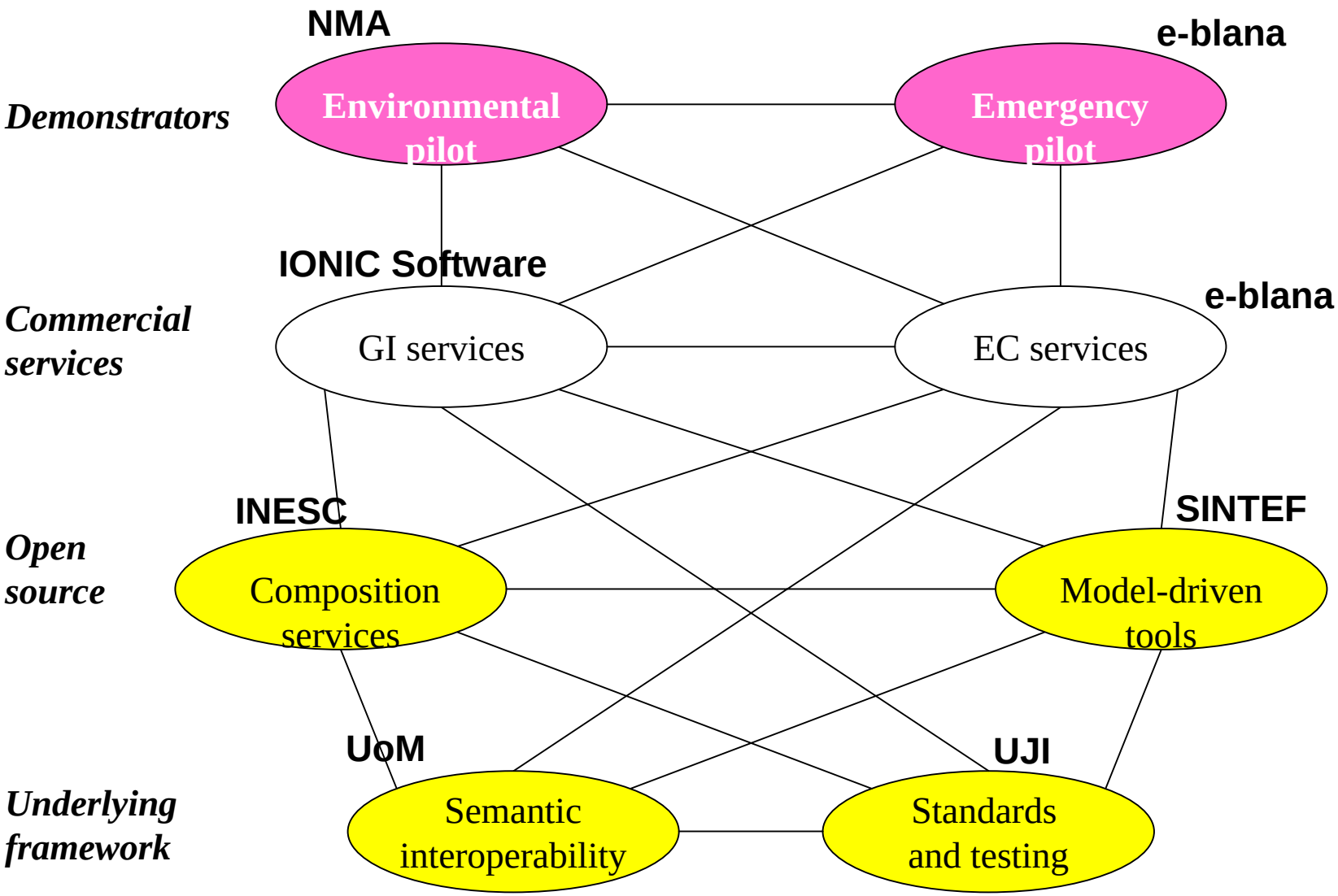
Composition extension



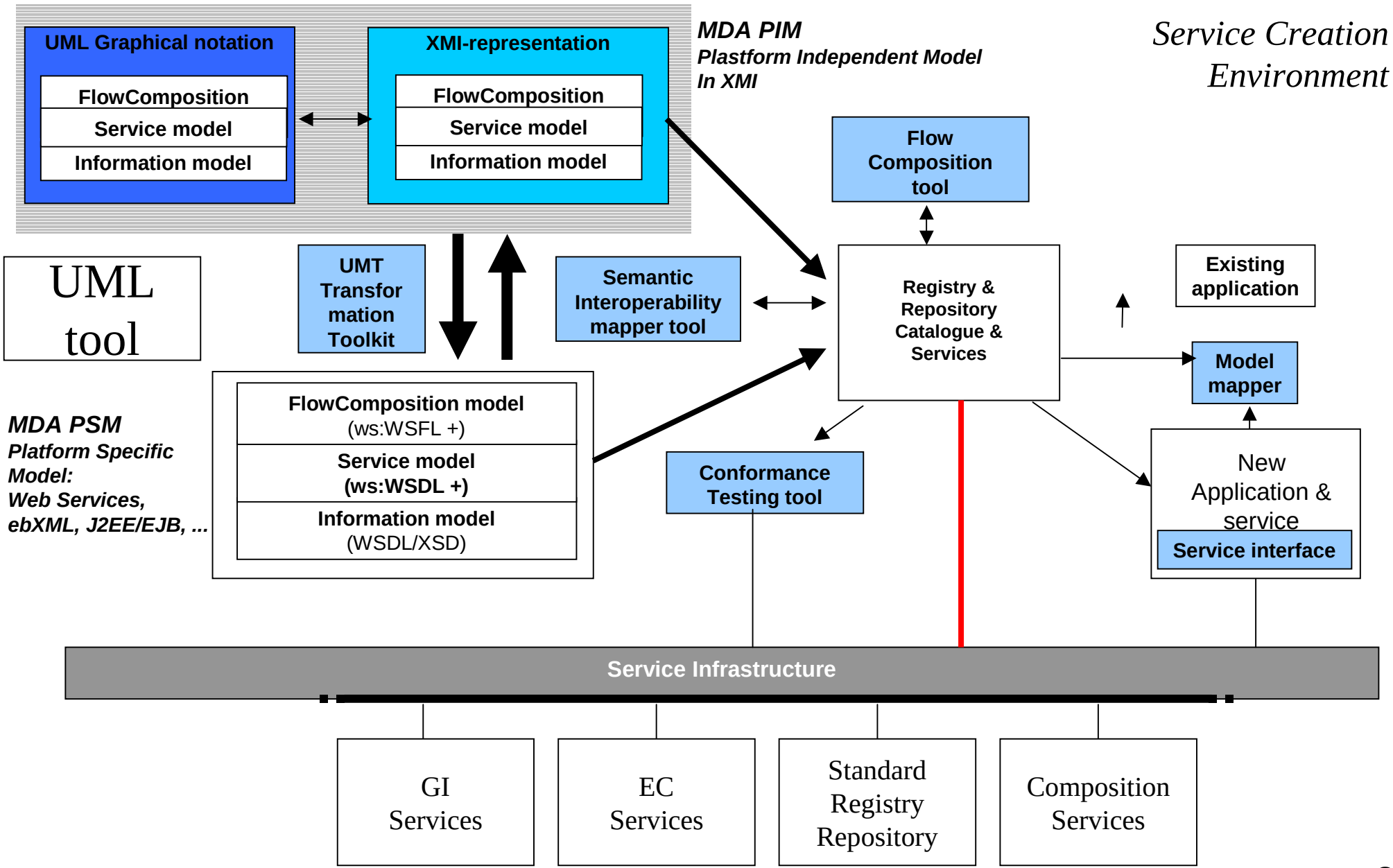
ACE-GIS Principal Architecture



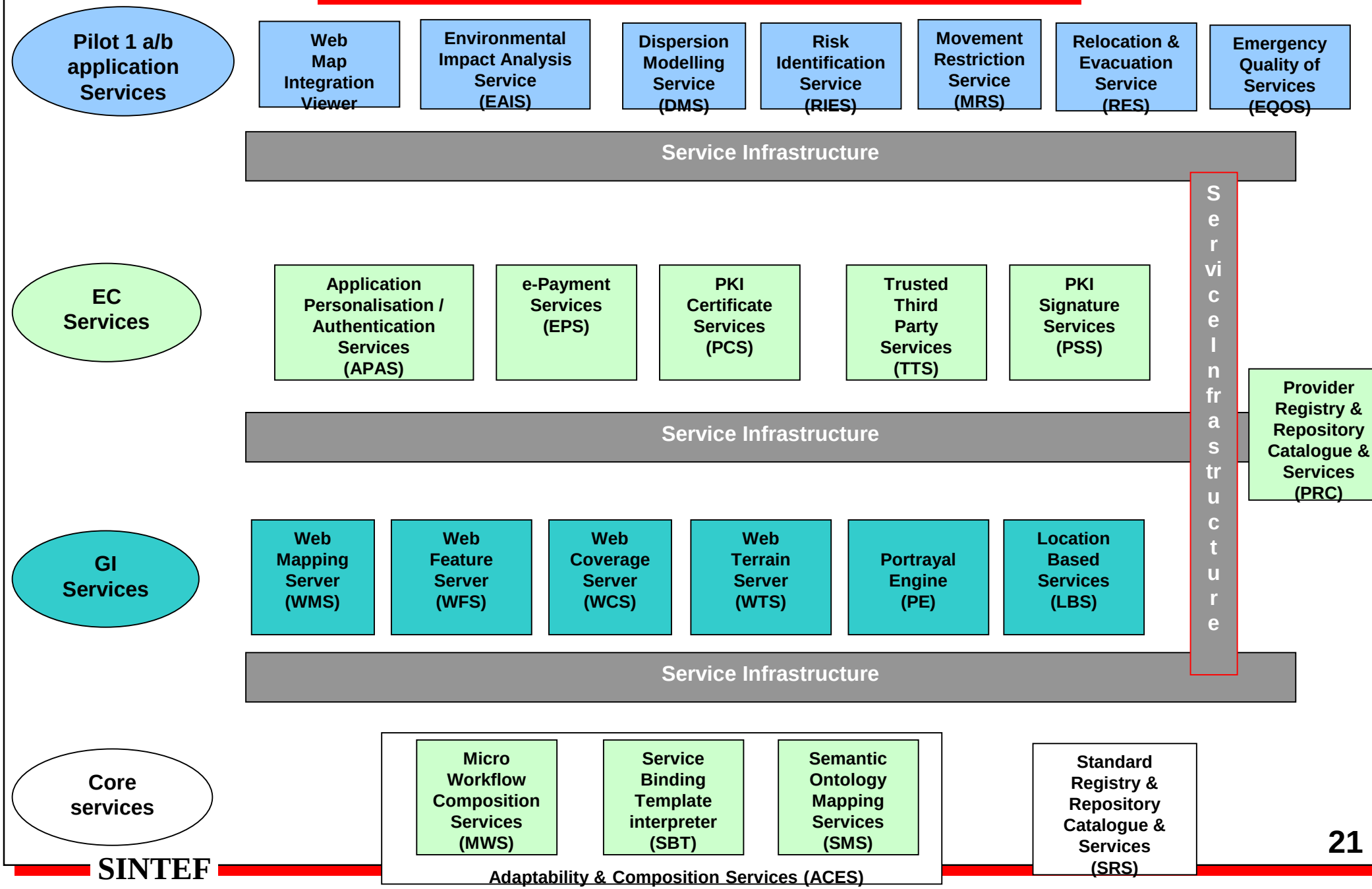
ACE-GIS Work areas and partners



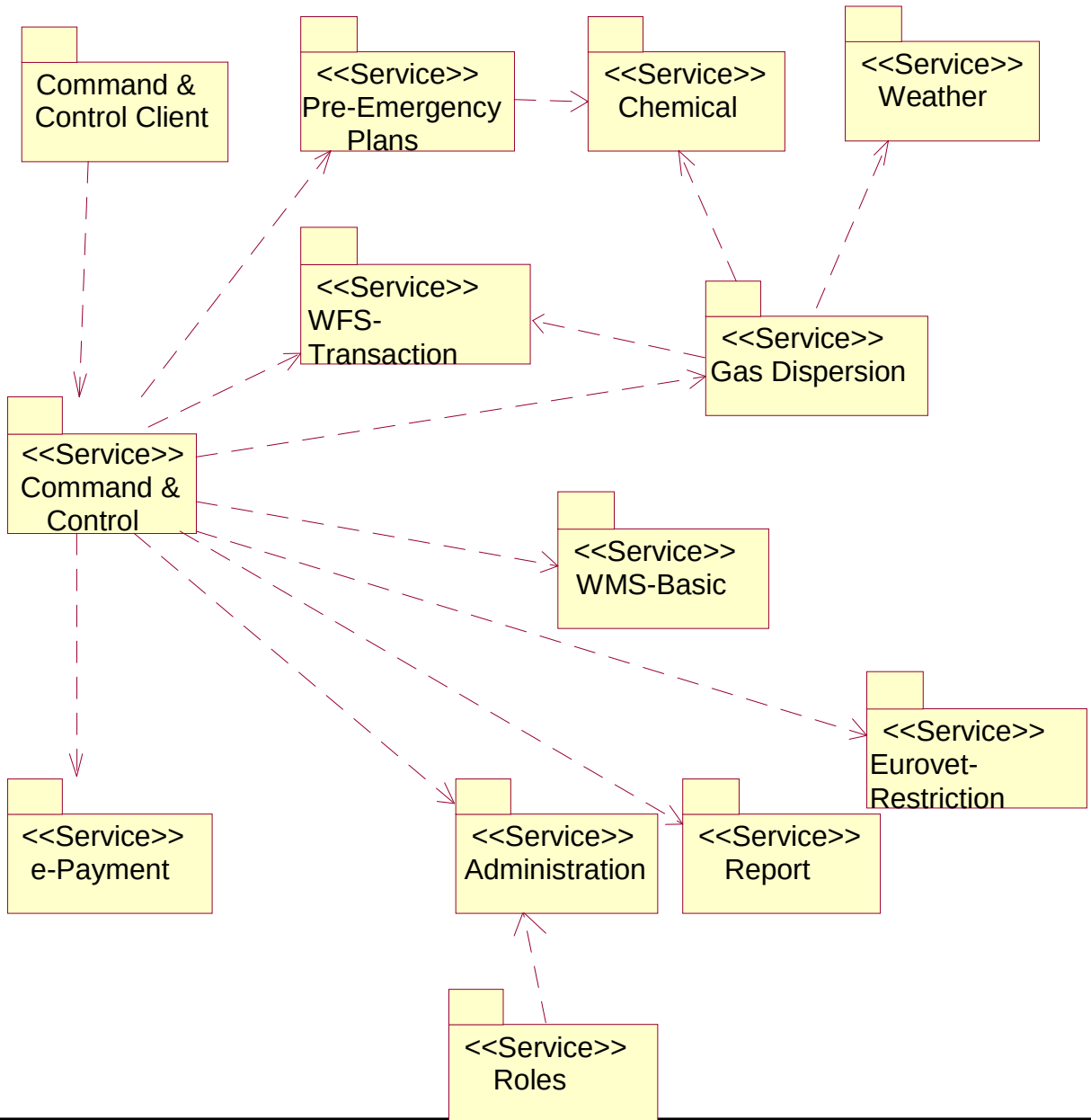
ACE-GIS Service creation



ACE-GIS Service execution



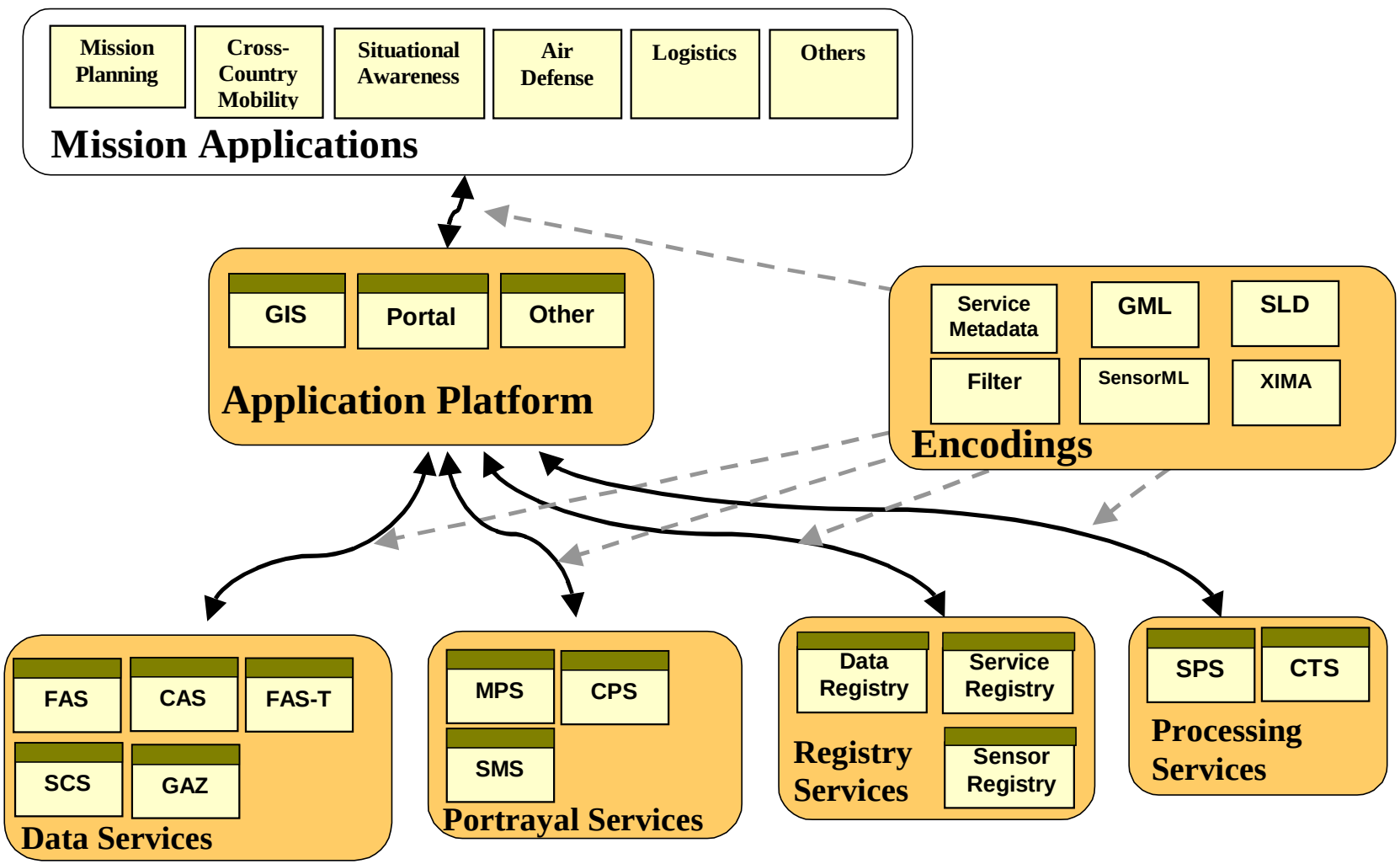
ACE-GIS Crisis Management Pilot Demonstrator



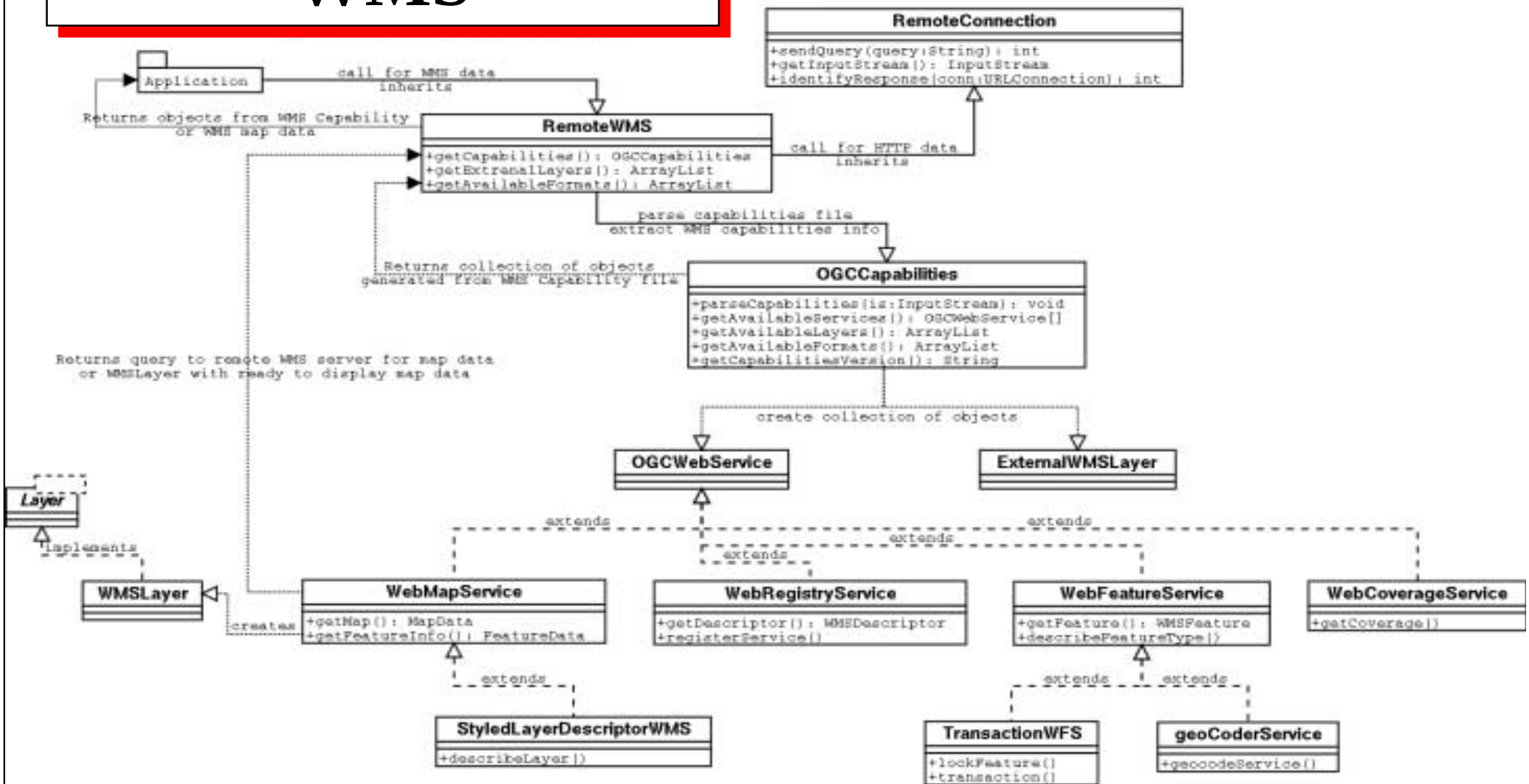
OGC – GO-1 – Geospatial Objects Initiative
February 2003 – June 2003

- **Develop a set of standard objects for the development of applications using geographic data**
- **Develop an architecture for distributed geographic processing that is independent of the implementation platform**
- **Develop processes to generate implementation platform specific profiles of the abstract architecture**
- **Validate that the architecture and profiling processes can be used to create working implementations**
- ***Trying out MDA principles for Web services and Java***

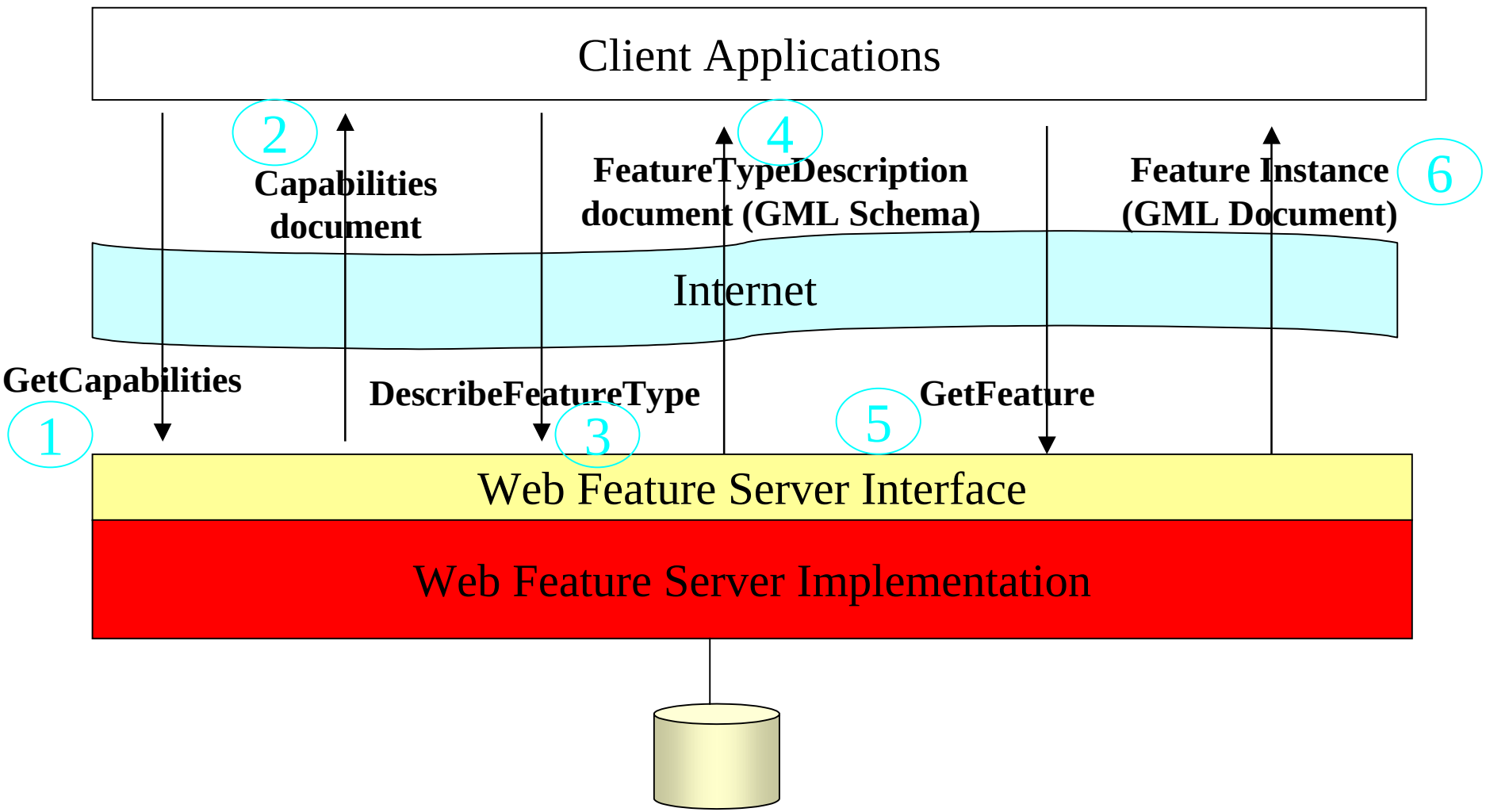
OGC GO-1 Architecture
Computational View - Service Framework



GeoTools2: WMS

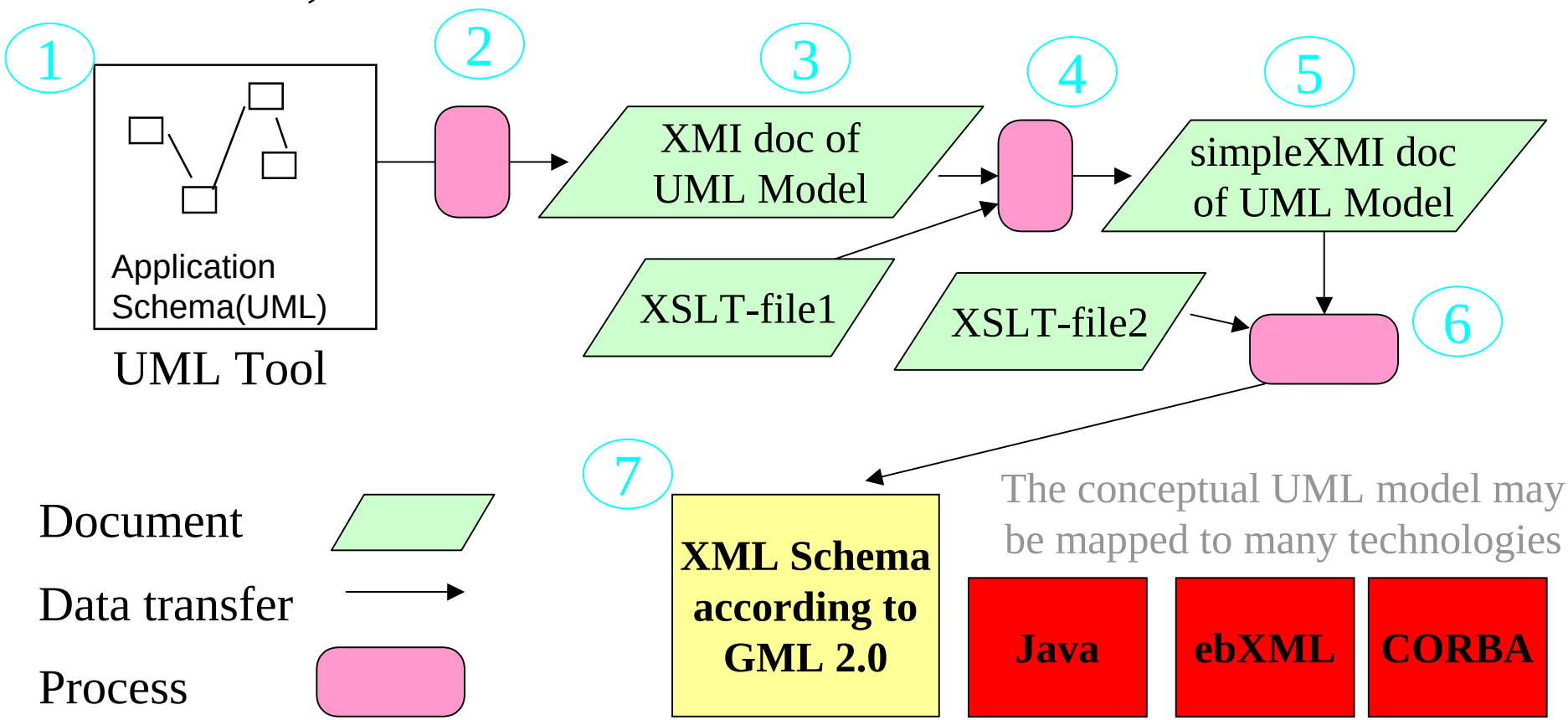


OGC Web Feature Server - A web service

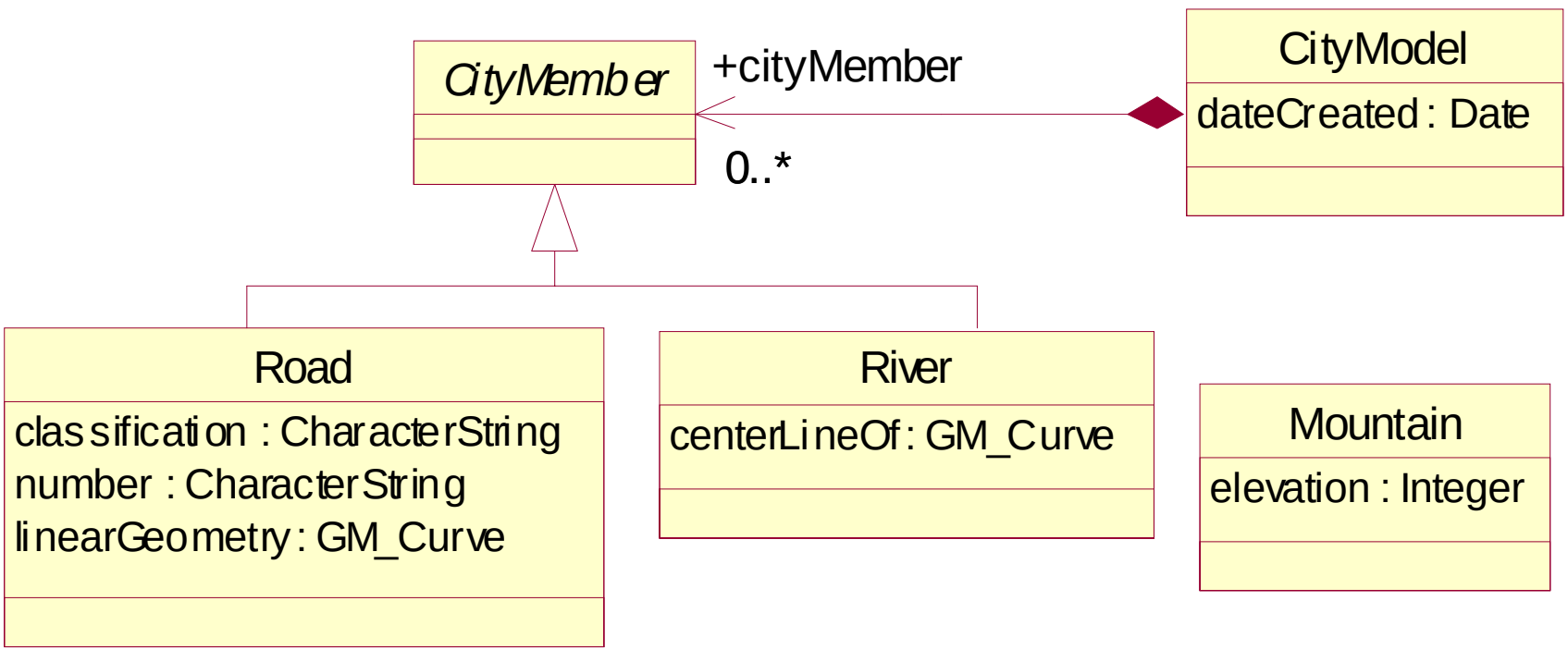


Use of COMBINE UMT tool - XSLT-based code generation from UML to GML for data exchange

ISO 19109, ISO 19103



ISO/ TC 211 Conceptual UML model



Extract from the GML2.0 spec. city application schema example

```
<complexType name="RiverType">
   <complexContent>
     <extension base="gml:AbstractFeatureType">
        <sequence>
          <element ref="gml:centerLineOf"/>
        </sequence>
     </extension>
</complexContent></complexType>
<complexType name="RoadType">
  <complexContent>
     <extension base="gml:AbstractFeatureType">
       <sequence>
          <element name="linearGeometry" type="gml:LineStringPropertyType"/>
          <element name="classification" type="string"/>
          <element name="number" type="string"/>
       </sequence>
     </extension>
</complexContent> </complexType>
```

SimpleXMI - reducing the complexity of XMI

```
<class name="Road" superClass="CityFeature" abstract="false">
        <attribute name="classification" type="CharacterString"/>
        <attribute name="number" type="CharacterString"/>
        <attribute name="linearGeometry" type="GM_Curve"/>
</class>
<class name="River" superClass="CityFeature" abstract="false">
        <attribute name="centerLineOf" type="GM_Curve"/>
</class>
<class name="CityModel" abstract="false">
        <attribute name="dateCreated" type="Date"/>
        <relationship name="cityMember" otherClass="CityFeature"
                cardinality="0..*" collectionType="set"
                aggregationType="composite"/>
</class>
```

Advantages with a model-driven approach

- **Always up-to-date UML models documenting the underlying platform realisations**
- **Easier to read and understand UML models than XML Schema**
- **Technology changes, conceptual models stay the same**
- **The same UML model may be used to generate multiple output formats (ISO 19118, GML, XMI, Web Services, CORBA, ebXML, DCOM, J2EE, C++…)**

Conclusion

The OMG MDA approach is suitable for the specification of services and information models for multiple platforms, including web services

- ***Tool and methodology support is emerging (ref. COMBINE ++)***
- ***Further needs:***
- **Well defined rules and tools for creating platform-independent service and information models**
- **Well defined rules and tools for mappings to platform-specific models for the most important platforms: Web services/XML, CORBA, J2EE/EJB, SQL, ...**
- **A version of XMI (2.0?) that can produce human readable (HUTN) XML – similar to the handcreated XML schema specifications currently being made – (necessary to be accepted in the ”XML” communities)**
- **A tool-independent model diagram interchange format that can be used to support interoperability between multiple UML tools (the diagram interchange RFP! + more consistent XMI implementations)**
- **Composable security services – to support composable Crisis management and GI services**