



TELCERT

Technology Enhanced Learning: Conformance - European Requirements & Testing



THE *Open* GROUP



ISTITUTO DI SCIENZA E TECNOLOGIE
DELL'INFORMAZIONE "A. FAEDO"



Fraunhofer

Institut
Graphische
Datenverarbeitung



UNIVERSITÄT
KOBLENZ · LANDAU

OpenUniversiteitNederland



boltoninstitute



TELCERT Workshop

Application Profiling Tools

Kevin Riley

eLoki Ltd



TEL CERT Team



- Kevin Riley, eLoki Ltd - Project Manager
- David Rose, The Open Group - Consortium Manager
- Chris Herrmann, University of Koblenz-Landau
- Roy Cherian, University of Bolton
- David Scholefield, The Open Group



Agenda

09:00 Registration & coffee

09:30 **Welcome & orientation:** Prof. Oleg Liber, U. Bolton

09:40 **TELCERT overview** - Kevin Riley, eLoki Ltd

Developing a profile

Chris Herrmann, University of Koblenz-Landau

10:20 **Basic steps and operations**

10:40 **SchemaProf demonstration**

11:00 **Working through an example – hands-on**

12:00 **Lunch**

Conforming with the profile

Roy Cherian, University of Bolton

12:45 **Overview of the Content Re-Engineering Tool**

13:00 **Content Re-Engineering Tool demonstration**

13:20 **Working through an example – hands-on**

Testing for conformance with the profile

14:00 **The benefits of conformance testing** - David Rose, The Open Group

14:30 **Coffee**

14:50 **Overview of the Test System** - David Scholefield, The Open Group

15:30 **Demonstration of the Test System** - David Scholefield, The Open Group

16:00 **Discussion**

16.30 **Close**



My Presentation



- Project Overview
- IMS Application Profiles
- TELCERT Extensions for Conformance Testing
 - Phase I
 - Phase II
- Model-based Testing



Project Overview



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Background

- Part-funded by the European Commission under the 6th Framework Programme
- Duration 30 months
- Start Date 1st January 2004
- €3m budget
- Strategic Objective 2.3.1.12 '*Technology-enhanced learning and access to cultural heritage.*'



Consortium



- The Open Group
(prime contractor)
- Apple Computer
- Bolton Institute
(CETIS)
- CNR/ISTI
- European Institute for
e-Learning
- eLoki Ltd
- Fraunhofer Institute
for Computer Graphics
- Open University of the
Netherlands
- University of Koblenz-
Landau



Origins of the Project

- Growing use and maturity of e-Learning technology specifications (something to test)
- Growing volume of testing incurred by large implementers (cost of test)
- Experience (ability to test)
 - Open Group – SIF
 - ADL Co-Lab - SCORM
- Economies of scale vs. localisation? Need to balance
 - Convergence (reuse of technology)
 - Meeting precise community requirements



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Who Needs Profiles?

- Europe 728m people (Population Reference Bureau 2002)
 - *Northern Europe 96m*
 - *Western Europe 184m*
 - *Eastern Europe 301m*
 - *Southern Europe 147m*
- European Union 378.5m people (eurostat 2002)
- United States 287.4m people (PRB 2002)
- Japan 127.4m people (PRB 2002)
- UK 60.2m people (PRB 2002)

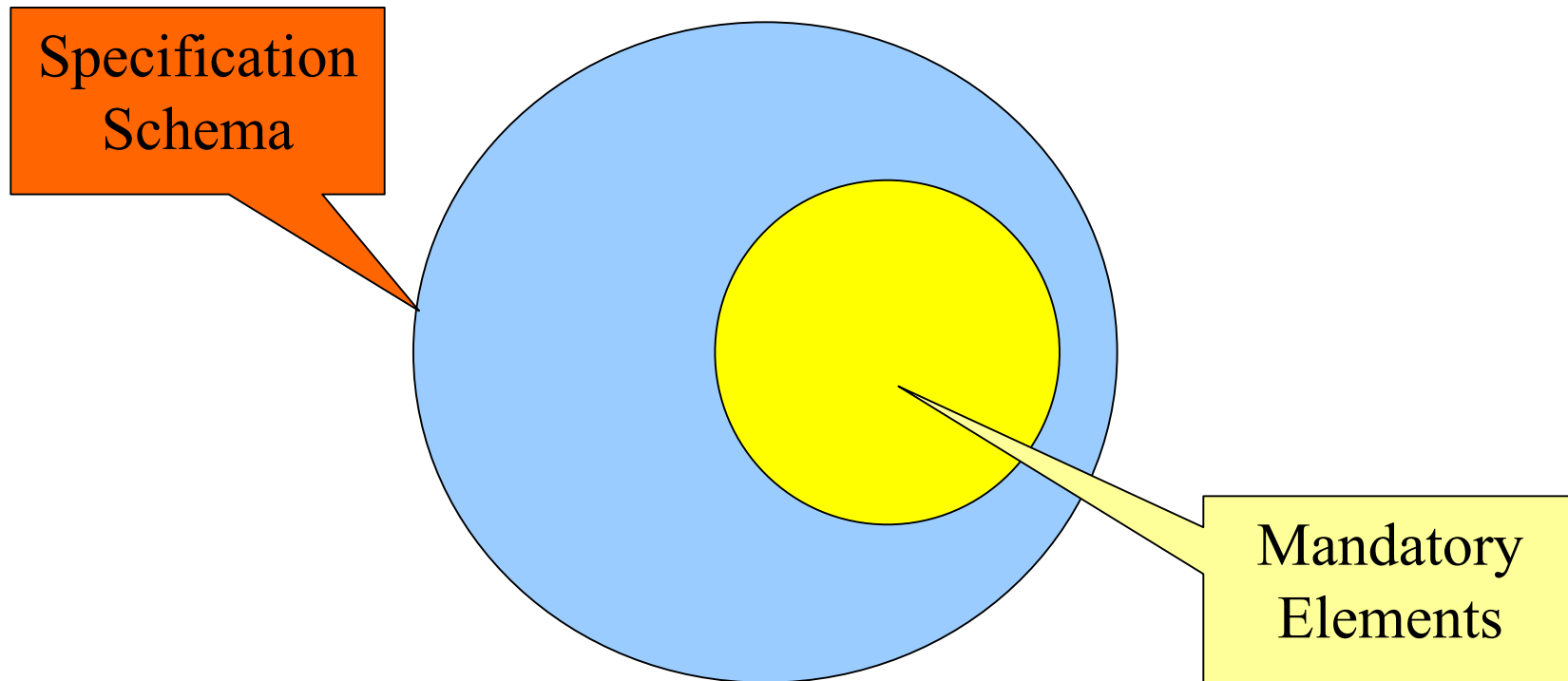


IMS Application Profiles



Learning Specification

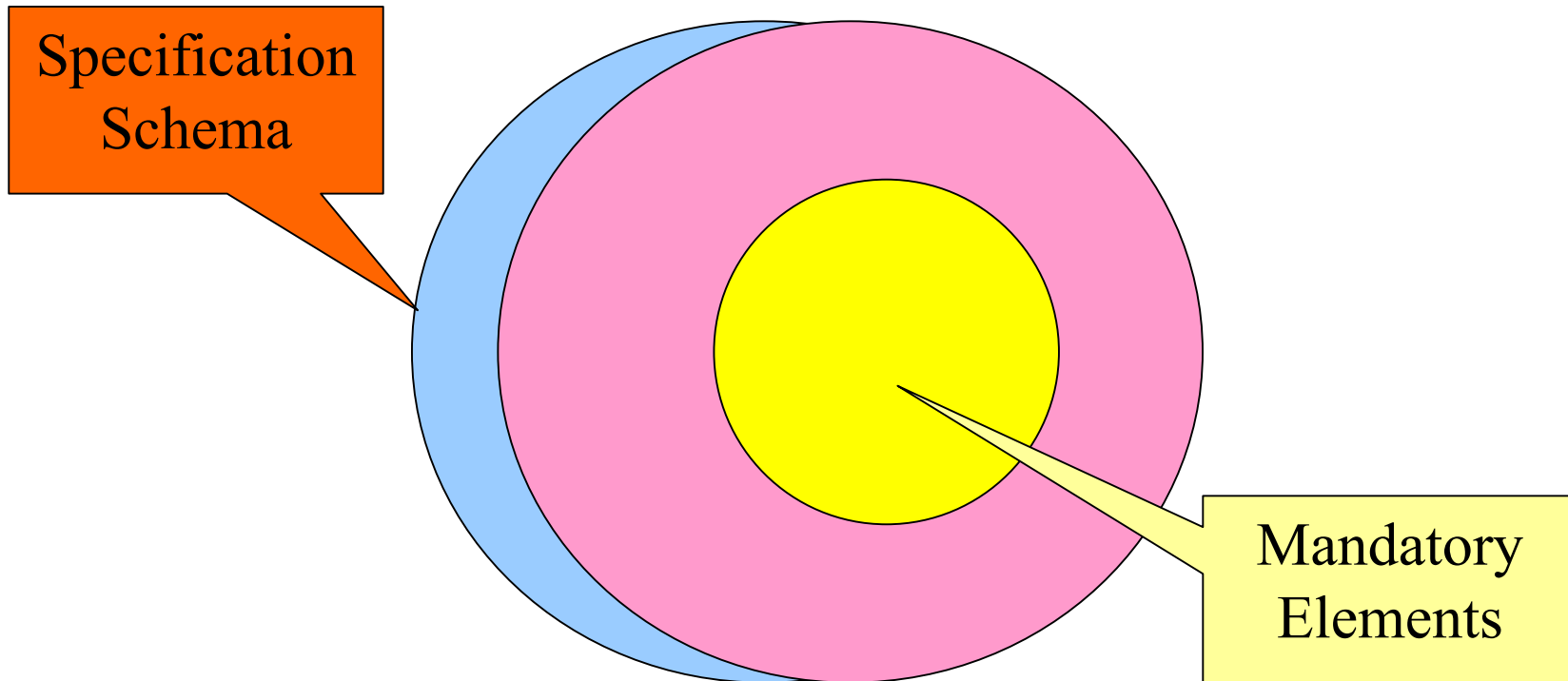
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Community Requirement

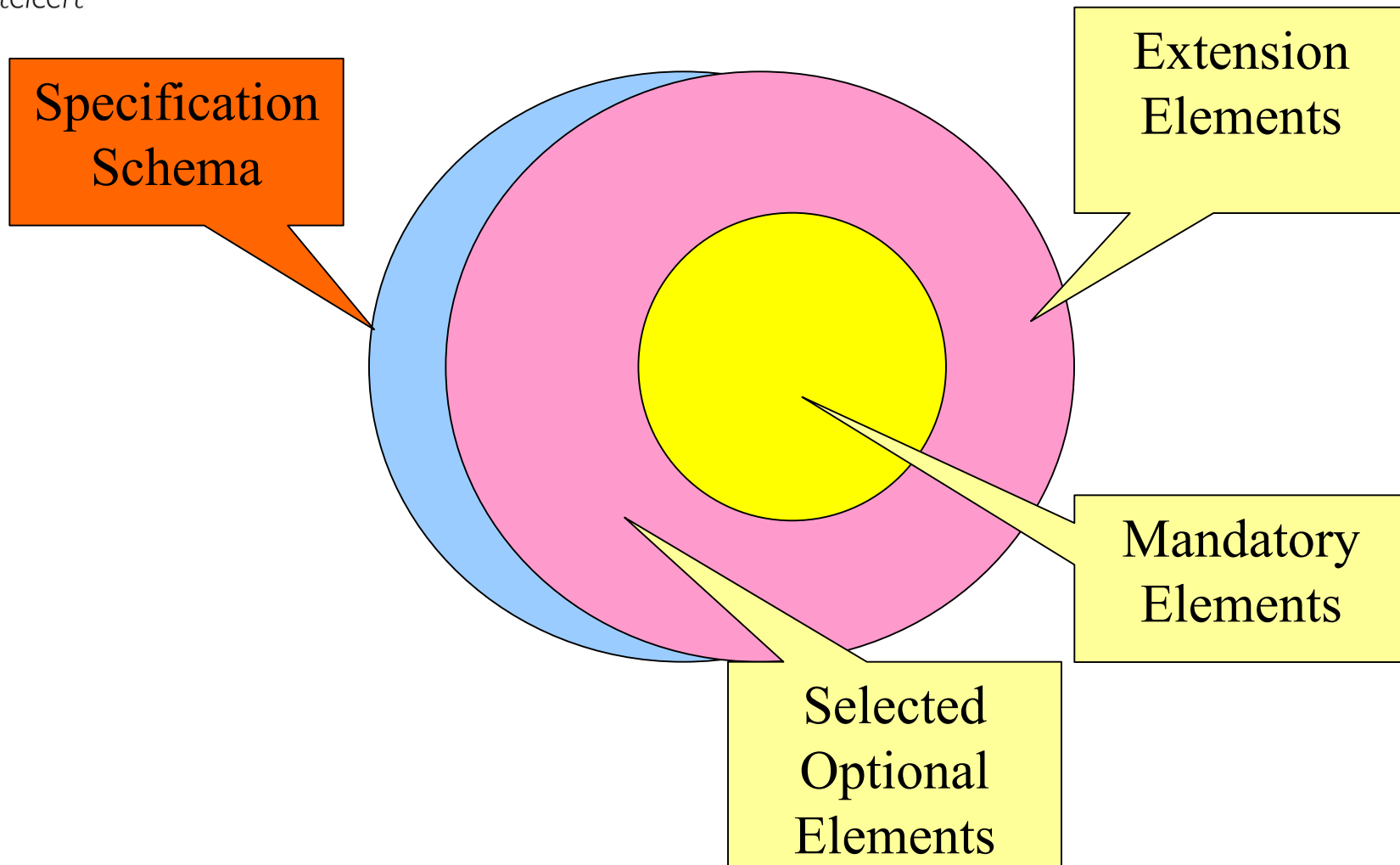
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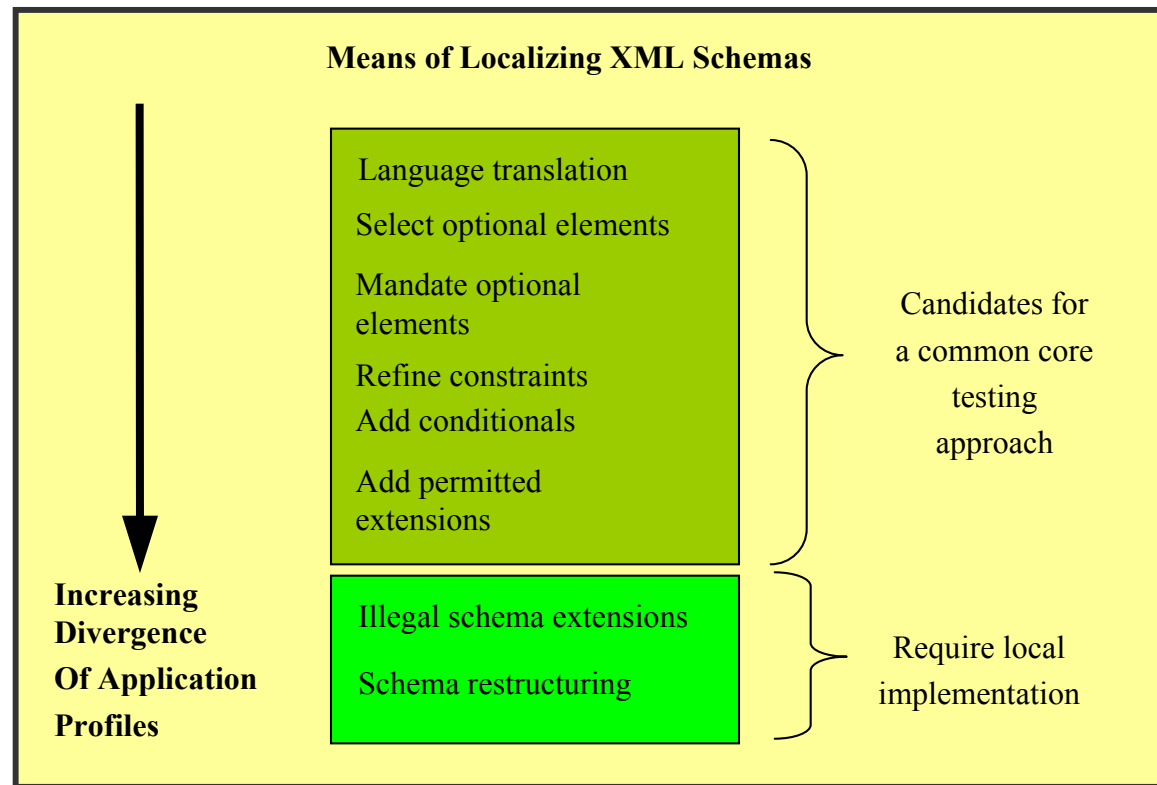
Application Profile Schema

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Permitted Actions

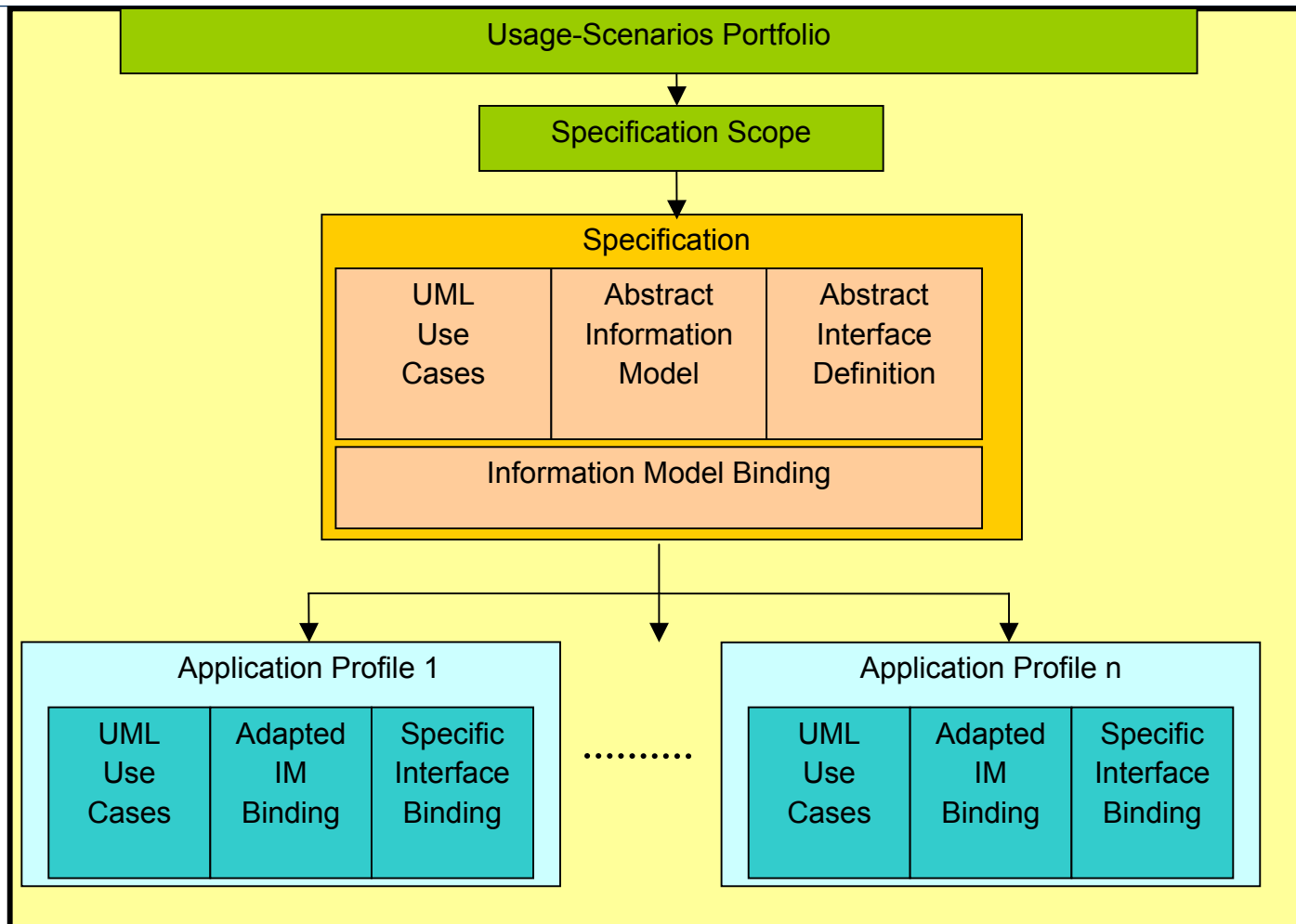


[Source: IMS International Conformance Program, "Application Profile Guidelines" document]



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Schema + Technology Binding



[Source: IMS International Conformance Program, "Application Profile Guidelines" document]



Profiling a Specification

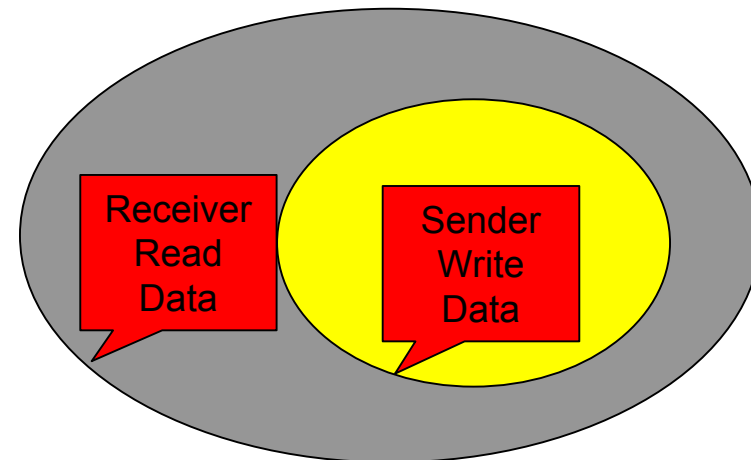
- (static) Specifications define a set of compliant data (documents)
- Usually by an information model and by an XML binding
- Profiles modify these definitions and hence the resulting data set
- Static data are the payload of dynamic communication



Types of Profiles



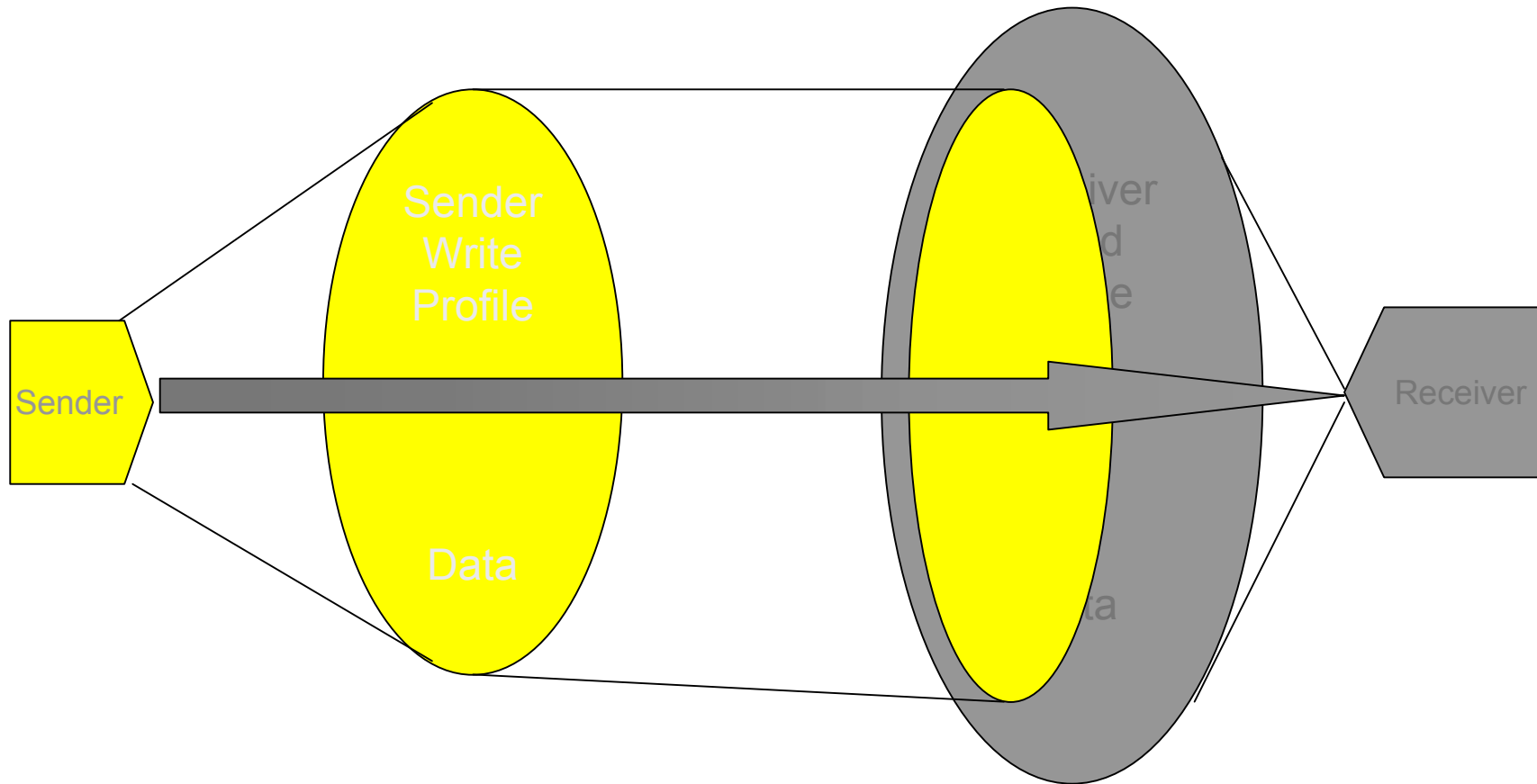
- Data Profile
- **Bound Data Profile**
- Data of a Profile
- Interoperability:
- Receiver
 - Read Profile
- Sender
 - Write Profile





Communication

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Compatibility Types

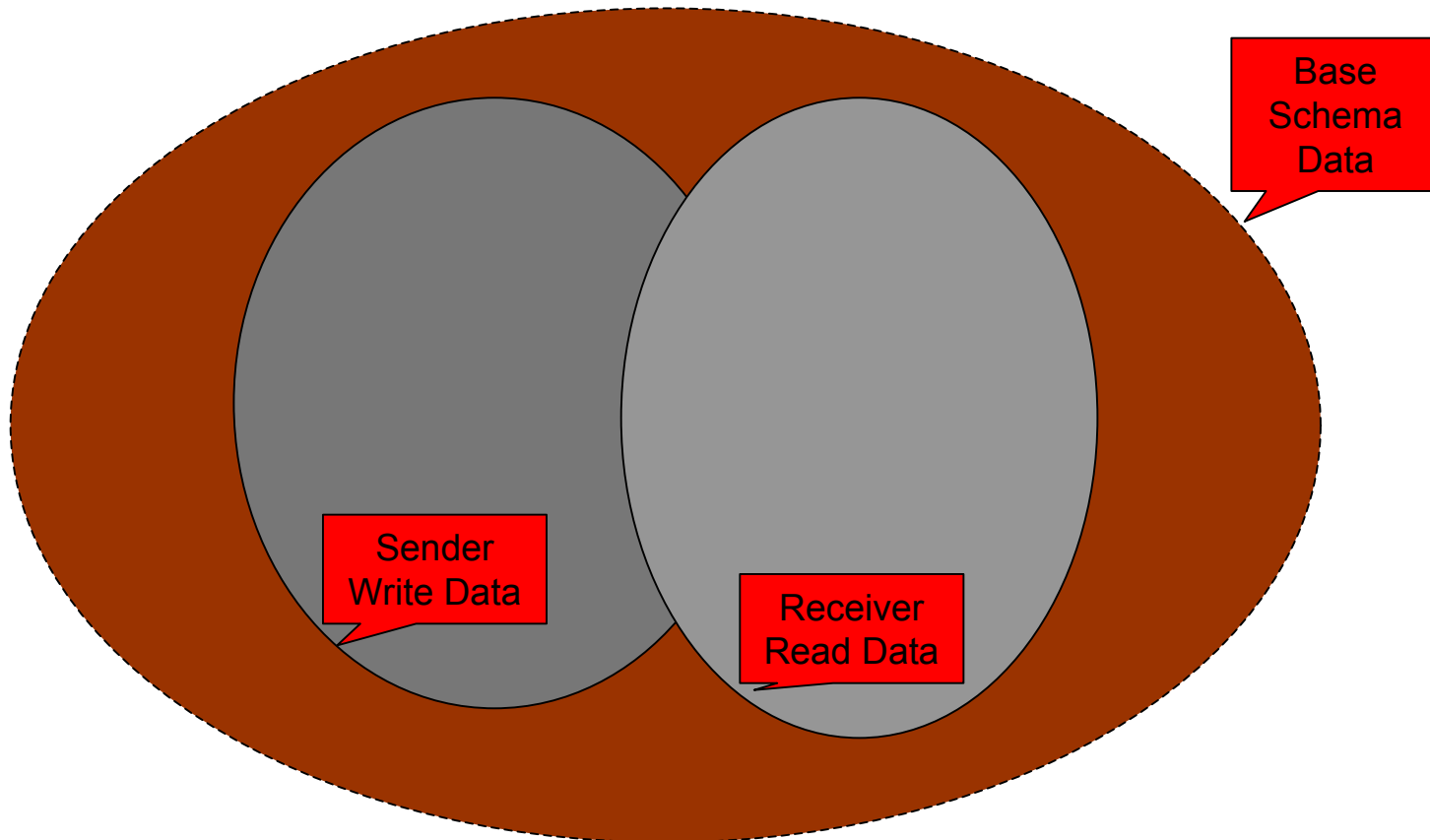


- Profile can be
 - Restrictive
 - Extensive
 - Incompatible
- Application can be w.r.t. an application profile
 - Read compliant
 - Write compliant
 - Incompliant



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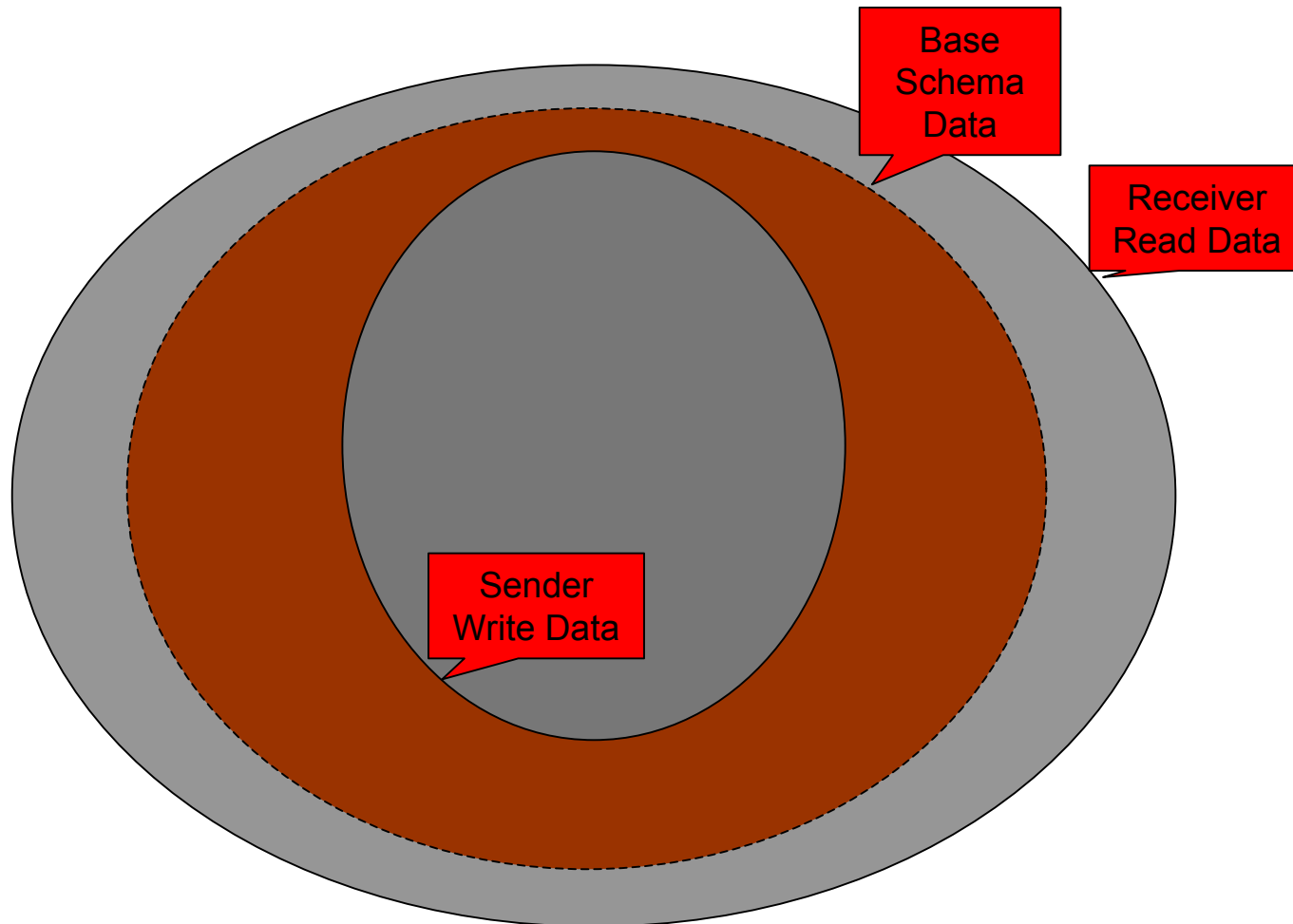
Restrictive may be BAD!





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The Recommendation



Recommended: Restrictive Write, Extensive Read



Components of APs



- Base Schema
- Modifications
 - XML schema modifications
 - XML non-schema modifications
 - Additional constraints



Schema Modifications



- Modify the XML schema
- Cardinality modifications
 - Optional/mandatory/forbidden
- Fixing string values
- Attribute properties modifications
 - Required/optional/fixed
 - Admitted values
- Definition of new simple types
 - Restriction by facets, unions, lists



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Global vs. Local Modifications

- Specification re-use elements by reference
- By default modifications change all occurrences
- By *activating* a reference it is replaced by new copy of the referenced item.
- The copy of the item has the same name but a new type which can be modified



Extensions



- Mild extensions: Specify additional elements or attributes at namespaces at extension points:
This is restrictive!
- Extending enumerations with new values: This is extensive!
- Wild extensions: Introducing new elements at places where there is no wildcard:
DISCOURAGED – by making it difficult to encode



Vocabularies



- In line vocabularies given as enumerations
- Referenced vocabularies
 - `<source>Vocabulary</source>`
 - `<value>Item</value>`
 - Fixing Vocabulary by fixing `<source>` value



Non-Schema Modifications

- Modifications may depend on conditions
- Conditions are given by XPATH expressions
- Conditions are evaluated in instance documents whenever a conditionally modified tag is found
- First true condition fires
- Otherwise base schema applies
- Translate into Schematron rules



Annotations



- Global annotations for profile
 - Name
 - Scope
 - Policy
 - Conformance
 - General
- Local annotations for modifications
 - Explanation
 - Rationale



Ways of Domain Profiling

- Import of other XML schemas
 - e.g. IEEE LOM
 - Supported by SchemaProf and STT
- Inclusion of namespaces at extension points
 - Possible in SchemaProf
- Inclusion of profiles at extension points
 - New in SchemaProf 3.x



Additional Constraints



- Package format (zip, tar...)
- Existence of required resources
- Existence of referenced targets
- Vocabulary usage



Future Work



- Profiling the data model directly from the UML model
 - Work around – profile from the auto-generated WSDL
- Domain profiling (ISO Profiles)
- Technology profiling
 - Web services
 - ...



TELCERT Extensions for Conformance Testing



Phase I Scope

Testing content, data and metadata:

- Builds on IMS Application Profile Guidelines
- SchemaProf - documenting the implementation profile and the conformance requirement
- CRT (Reload) – building real test cases
- Test Data Generator – constructing negative cases
- Test System – applying tests, constraints and conditionals



Phase I Deliverables

- Examples developed
 - Content Packaging,
 - European Diploma Supplement,
 - Learning Design
- Tools – SchemaProf, CRT, Test Data Generator
 - Open source, design documentation
- Test System – Open Group platform



Phase II Scope

Adding web services for data exchange

- Service-Oriented Architectures
- Profiling of specifications expressed in UML 2.0
- Builds on IMS WSDL auto-generation tool
- Extend with:
 - Protocol State Model (PSM) - behaviour
 - Object Constraint Language (OCL) – pre/post conditions
- Model-based testing
 - Derive test suite directly from the UML representation



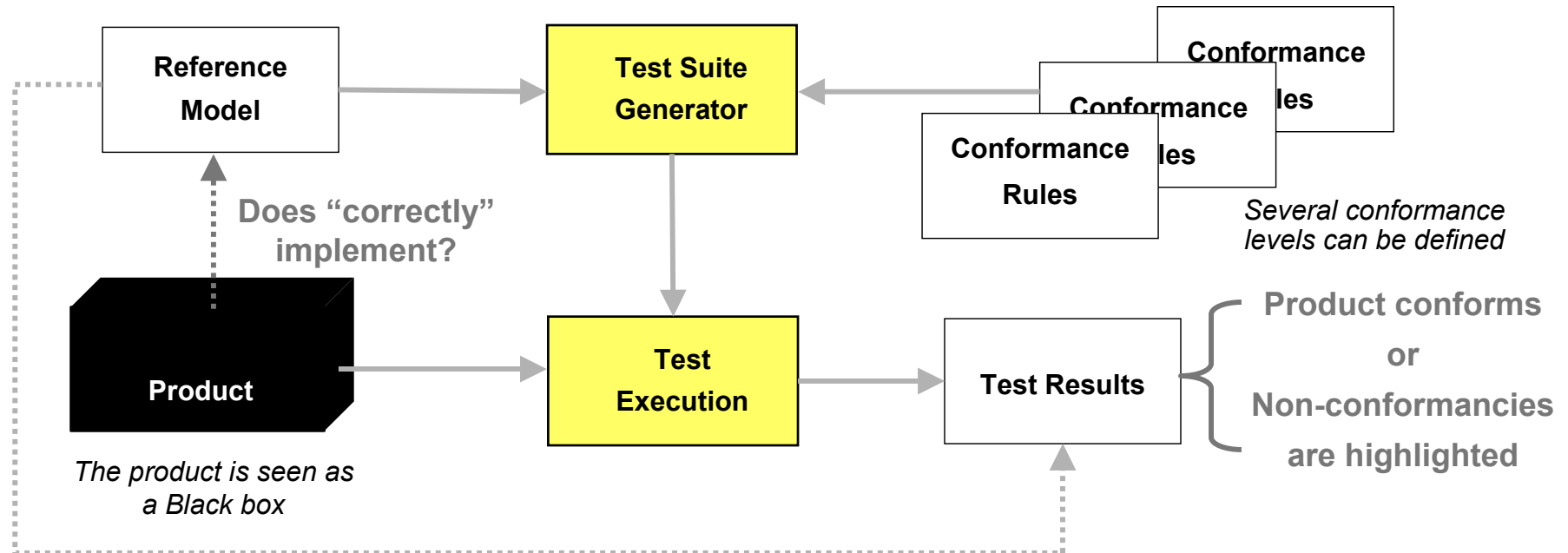
Phase II Testing



- Repository web services
 - Content Packaging
 - European Diploma Supplement
- Tools Interoperability services
 - Trial something more ambitious



Testing for Conformance



- *Conformance rules define what is a "correct" (conformant) implementation*
- *How can a test suite be algorithmically derived from the model?*
- *Ideally, the test system should be sound (a conformant product will never be rejected) and exhaustive (any non-conformance will be detected)*



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Questions



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