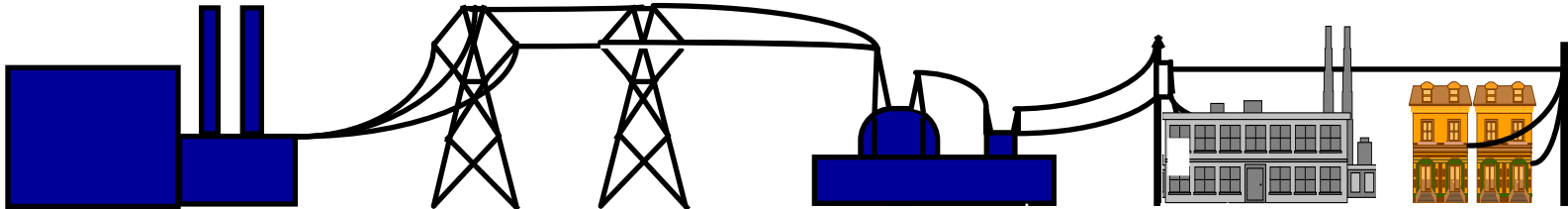


Introduction to CIM Software Tools and Methodologies

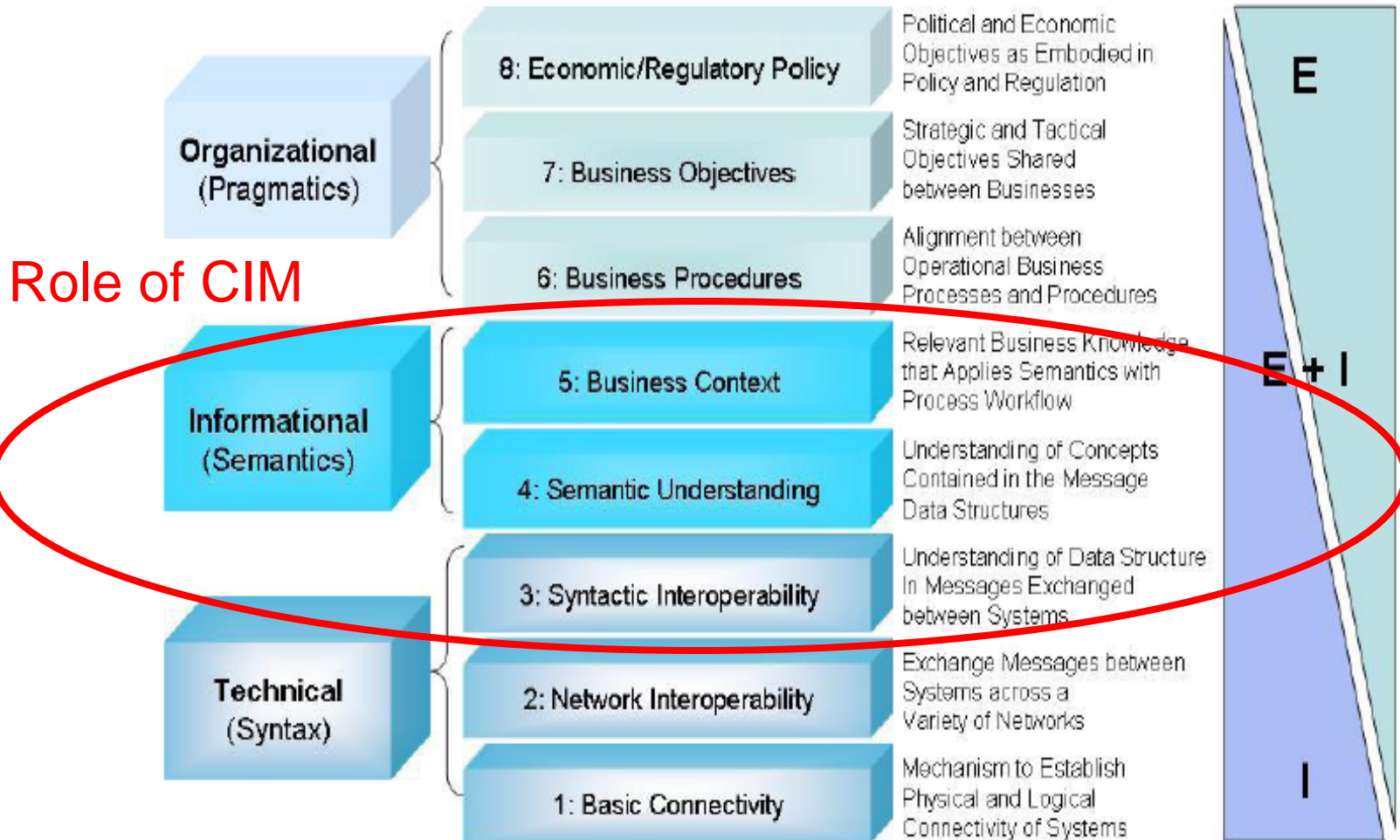
**EPRI Workshop
CIM Role in Smart Grid
for Transmission and Distribution
8-9 September 2010
EPRI, Washington D.C.**



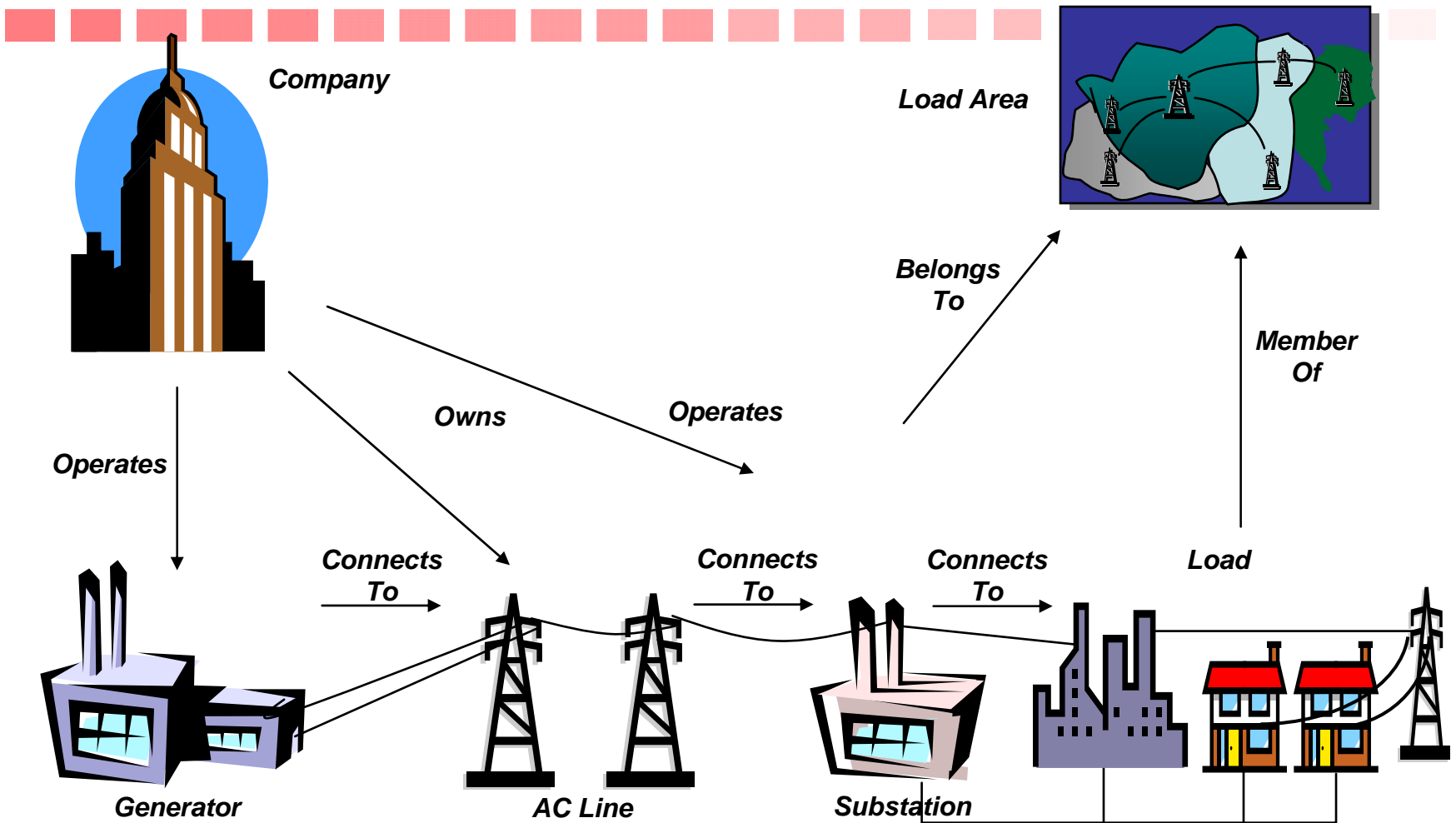
The IEC Common Information Model (CIM) - What Is It?

- A set of standards in enable system integration and information exchange based on a common information model

GridWise Interoperability Framework

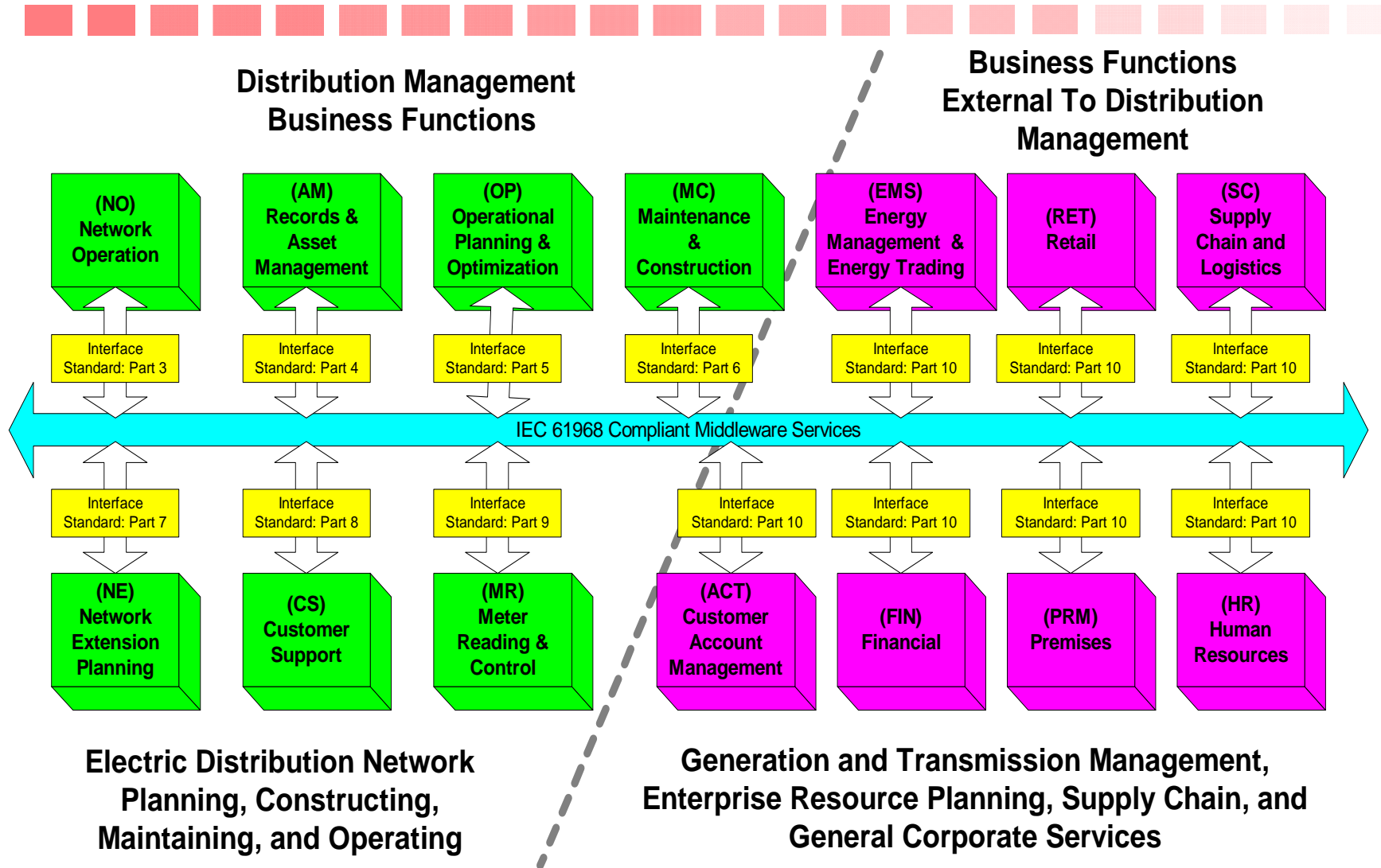


Sample Power System Model



The IEC 61968-1 Interface Reference Model (IRM) Provides The Framework For Identifying Information Exchange Requirements Among Utility Business Functions

All IEC 61968 Activity Diagrams and Sequence Diagrams are organized by the IRM



The CIM and Related Standards

- But the CIM standards are more than just an abstract **information model** expressed in UML
- **Profiles** for specifying a subset of the CIM classes and attributes for a specific business context at a specific system interface or system interaction
- **Implementation models**
 - Use of XML to create serialized files and messages
 - RDF Schema-based standards for power system model exchange
 - XML Schema-based standards for information message payloads
 - ETL based on CIM for data base access
 - DDLs for data tables




The IEC Common Information Model (CIM) - What Is It?


- A set of standards in enable system integration and information exchange based on a common information model
- A key differentiator: The CIM standards are based on an electronic information model defined in Unified Modeling Language (UML) representing real-world objects and information entities exchanged within the value chain of the electric power industry
 - Maintained by IEC in Sparx Enterprise Architect modeling tools
 - Provides common semantics for all information exchanges and data access
 - Referred to as Model-Driven Integration (MDI)



Modeling Platforms

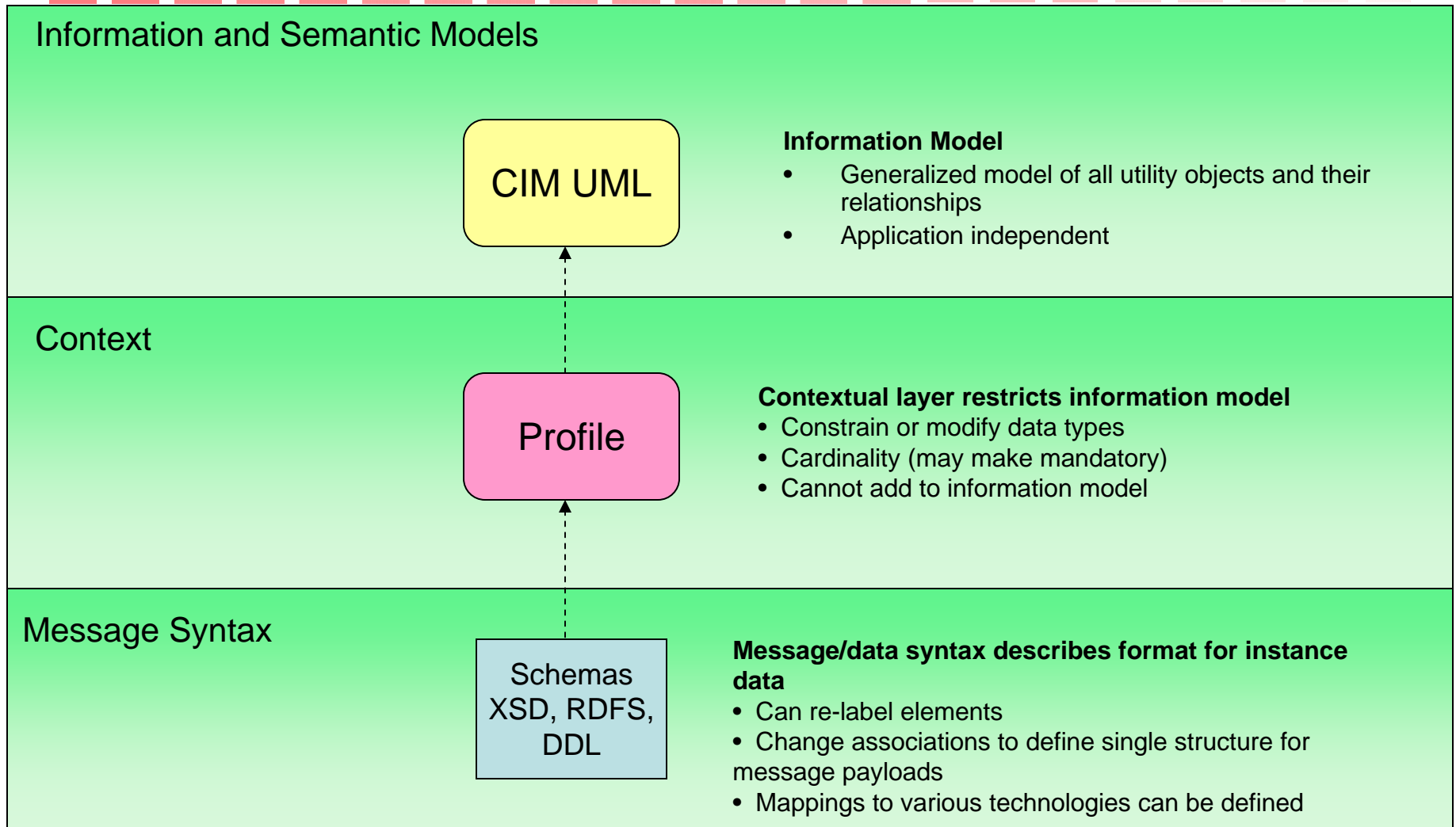
- 
- Enterprise Architect (EA) - Sparx Systems
 - Add-ins from third parties
 - CIMinEA, CiConteXtor, MD3i, CIM EA
 - Rational Software Architect (RSA) – IBM
 - Eclipse
 - Plug-ins from third parties
 - CIMTool, crxcat, JCleanCim, CIMCLipse

We Need An Organizing Framework

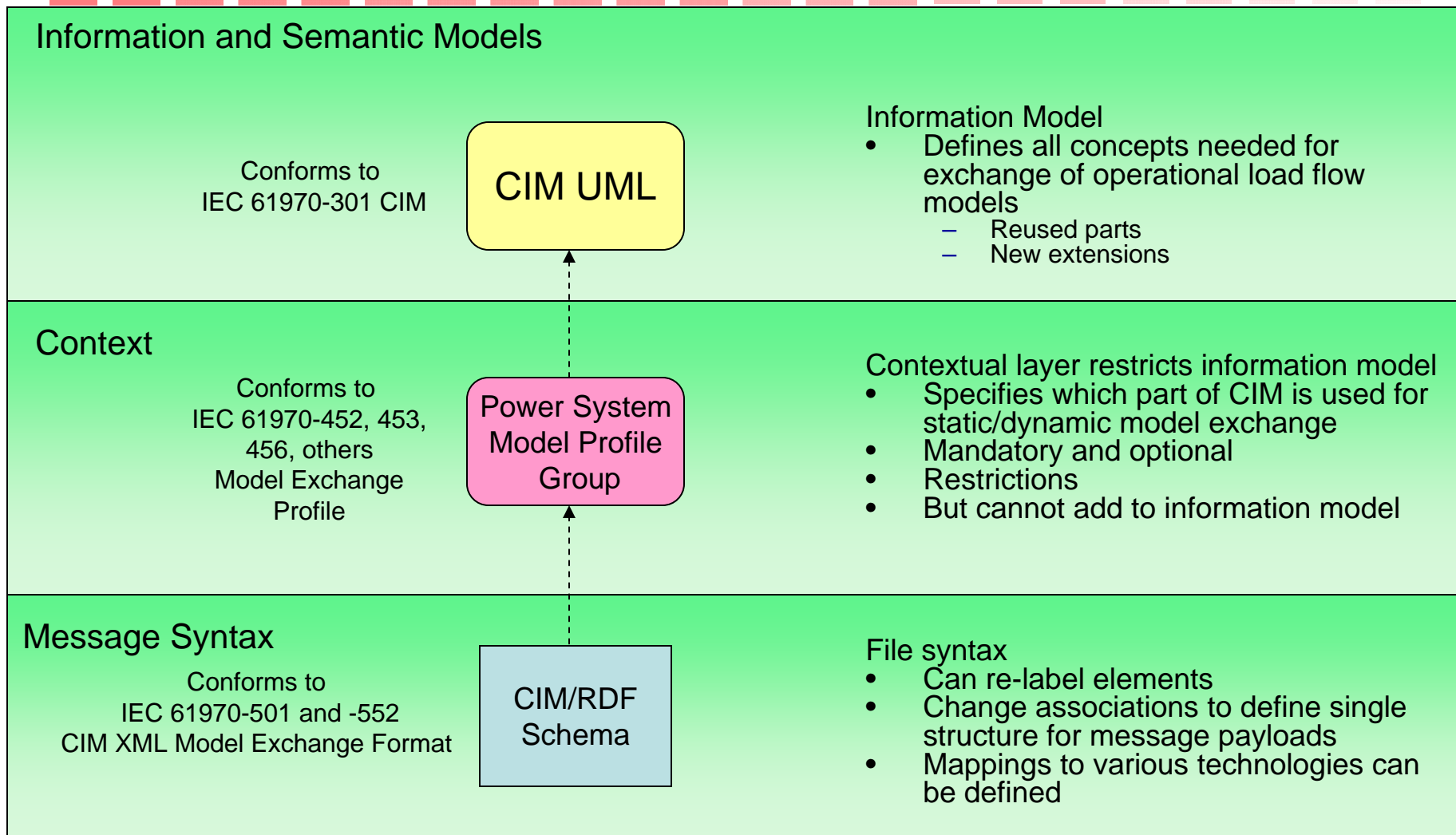
- 
- Layered Reference Architecture for TC57
 - Based on UN/CEFACT
 - Information Model
 - Contextual Model
 - Message Syntax
 - Rules for Message Assembly



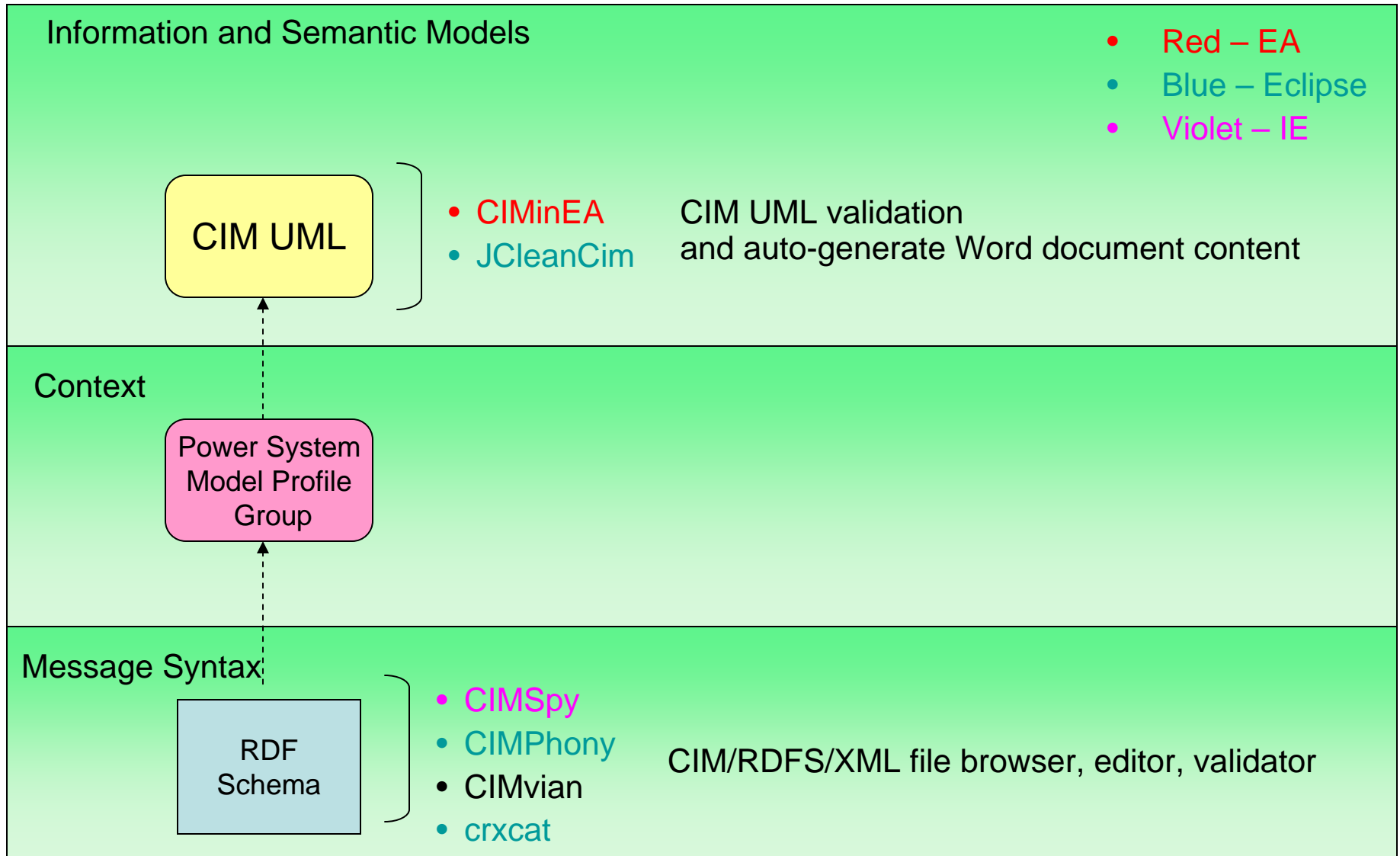
TC57 Layered Architecture



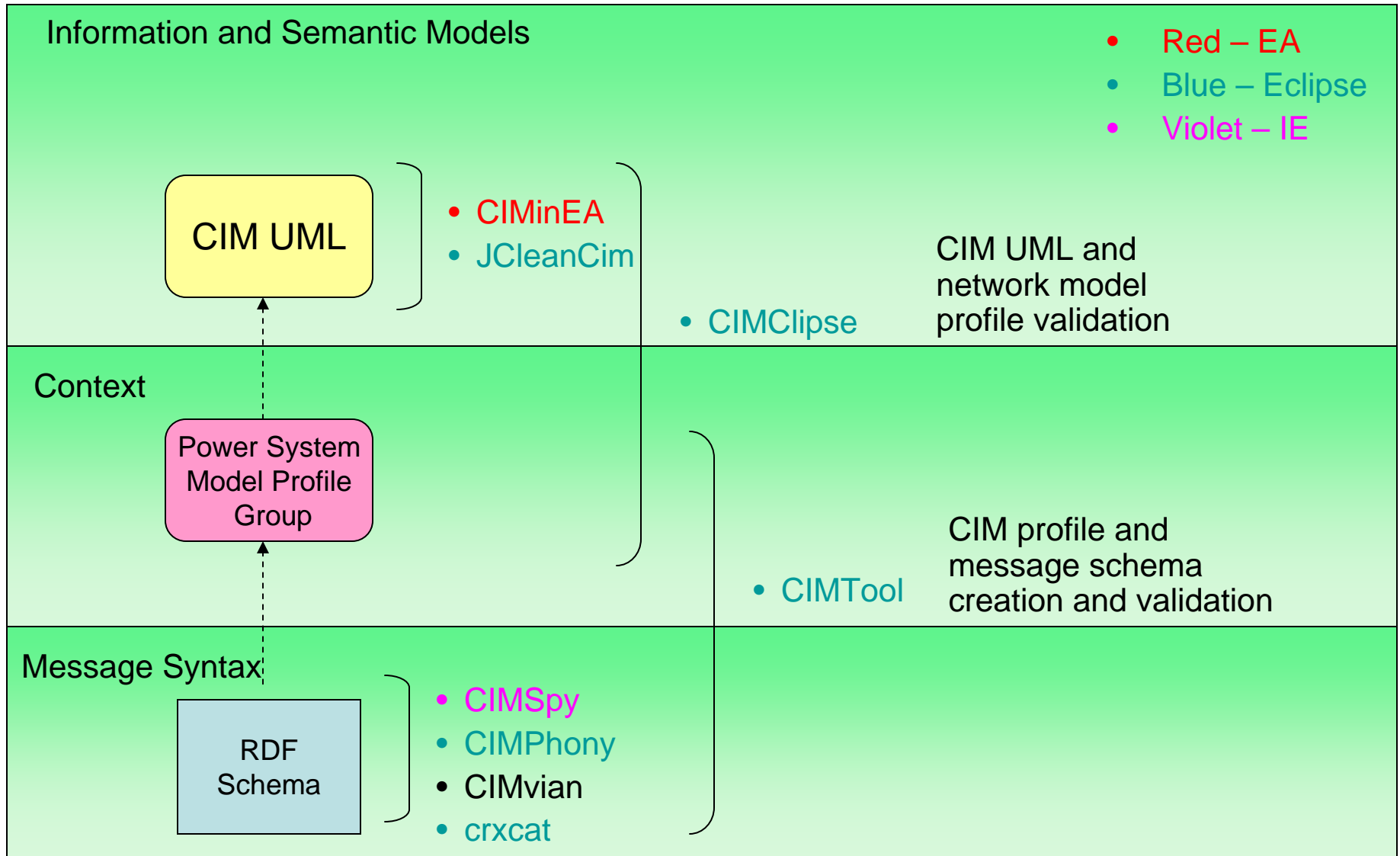
Example: Power Flow Network Model Exchange



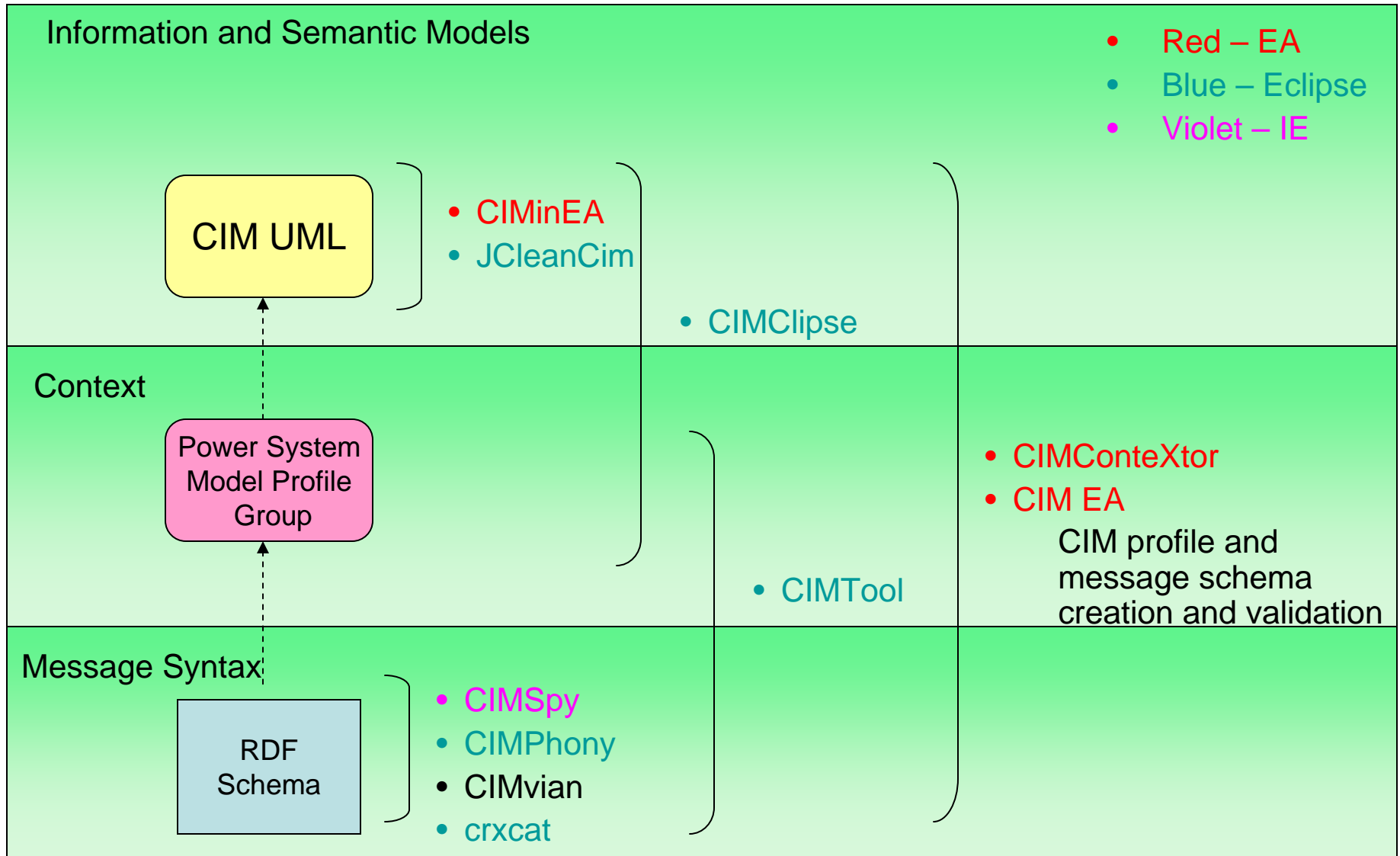
CIM Tools for CIM Power System Models



CIM Tools for CIM Power System Models



CIM Tools for CIM Power System Models

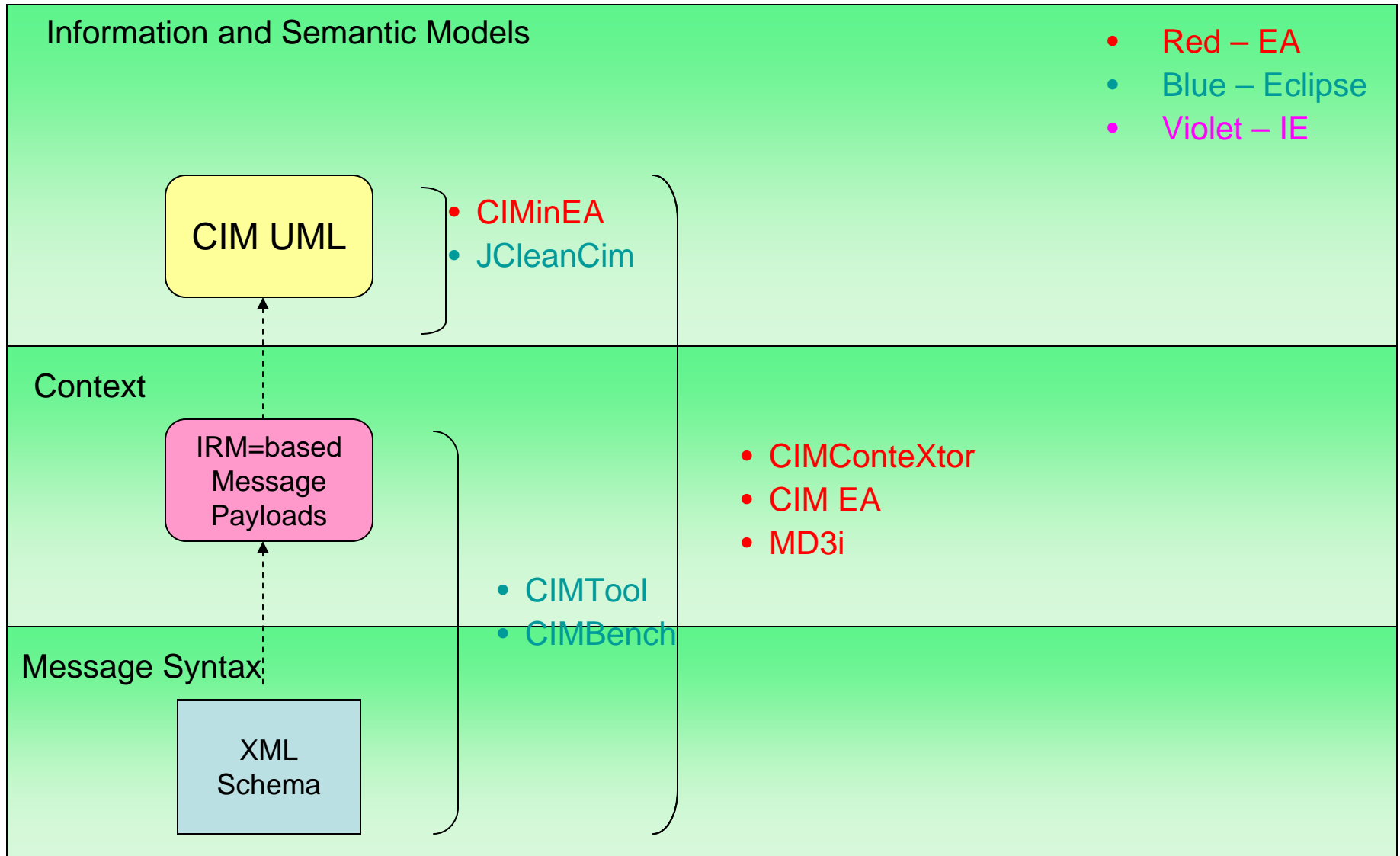


CIM Tools for Power System Models

- CIM/RDFS/XML file browser, editor, validator
 - CIMSpy, CIMPhony, CIMvian
 - Crxcat (CIM/RDF/XML file concatenator)
- CIM profile and message schema creation and validation
 - CIMTool, CIM EA, CimConteXtor, CIMBench
- CIM UML and network model profile validation
 - CIMCLipse
- CIM UML validation and auto-generate Word document content
 - CIMinEA, JCleanCIM



CIM Tools for CIM Message Payloads



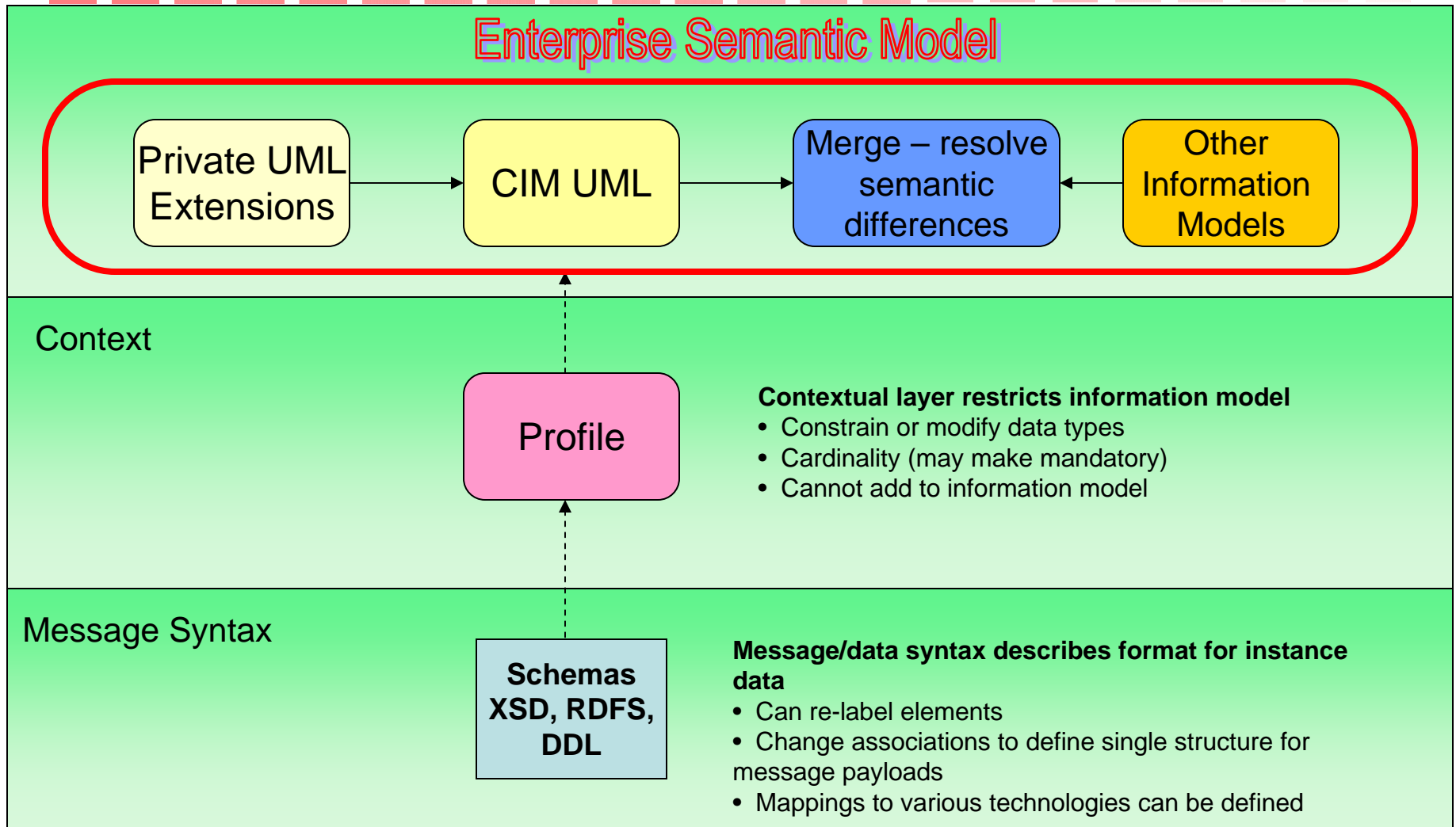
CIM Tools for XSD Message Payload Generation based on Extended CIM



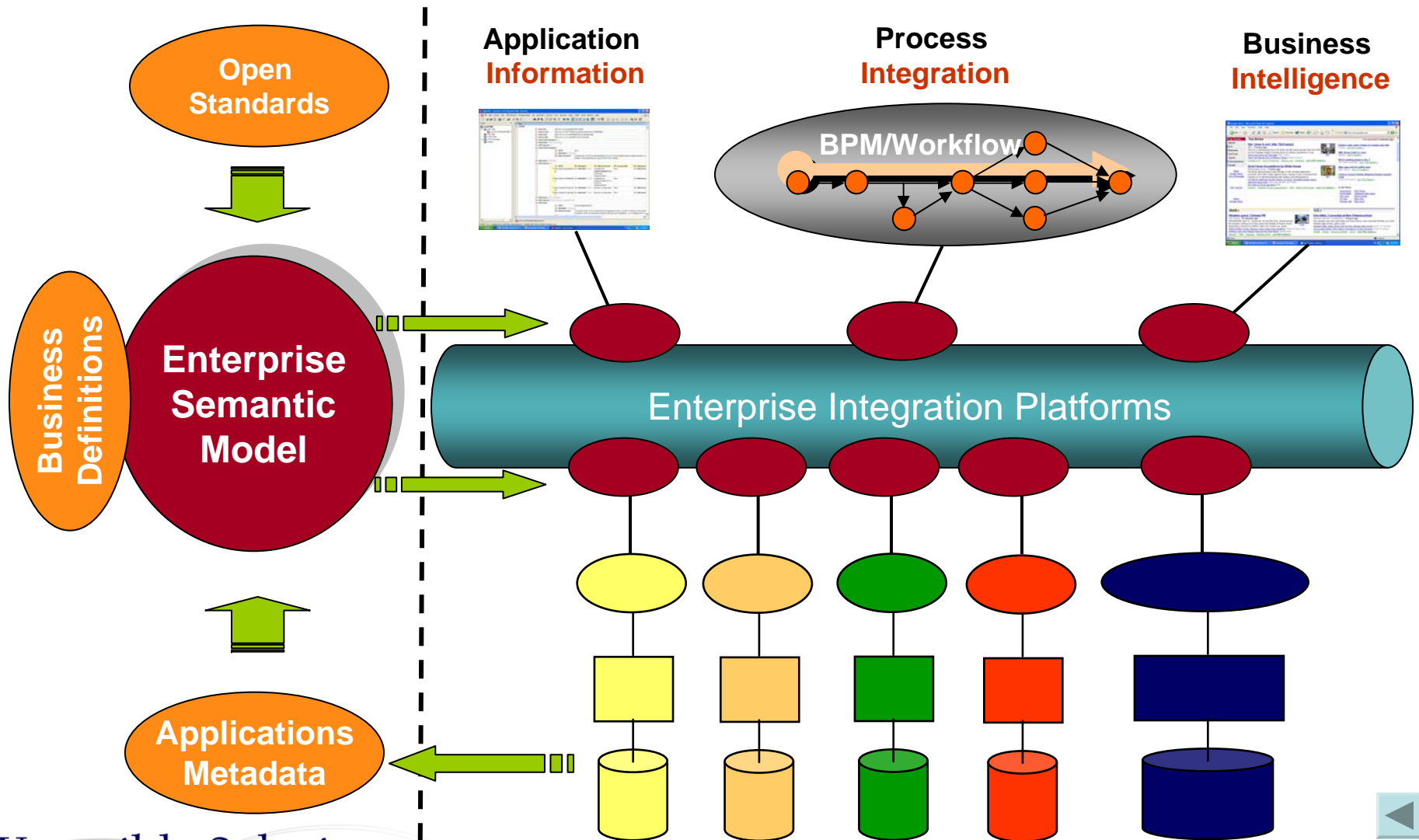
- Enterprise Add-ins
 - MD3i, CIM EA, CimConteXtor
- Eclipse Plug-ins
 - CIMTool

Enterprise Semantic Models

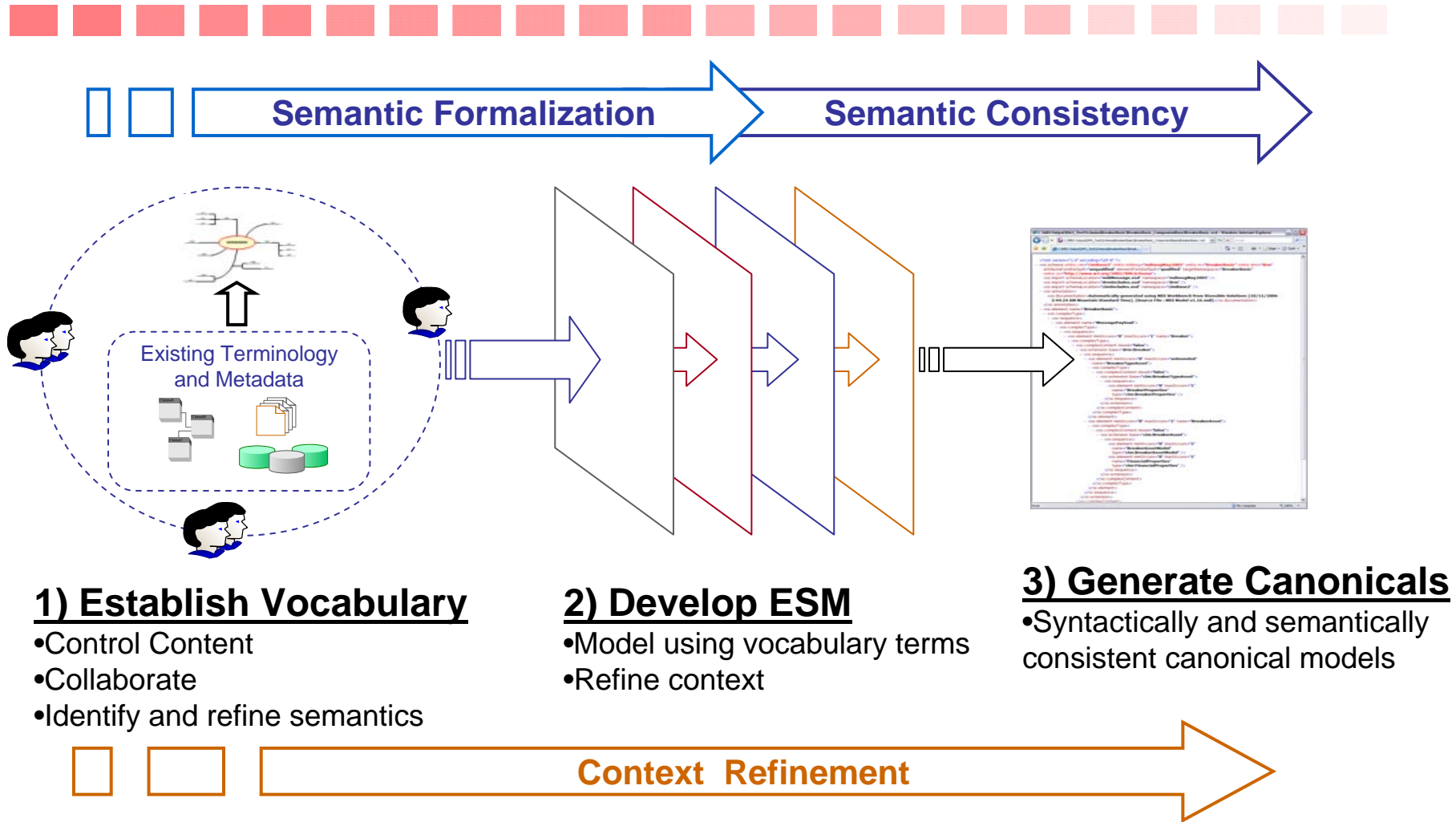
– CIM + Other Industry Standards



Role of Enterprise Semantic Model

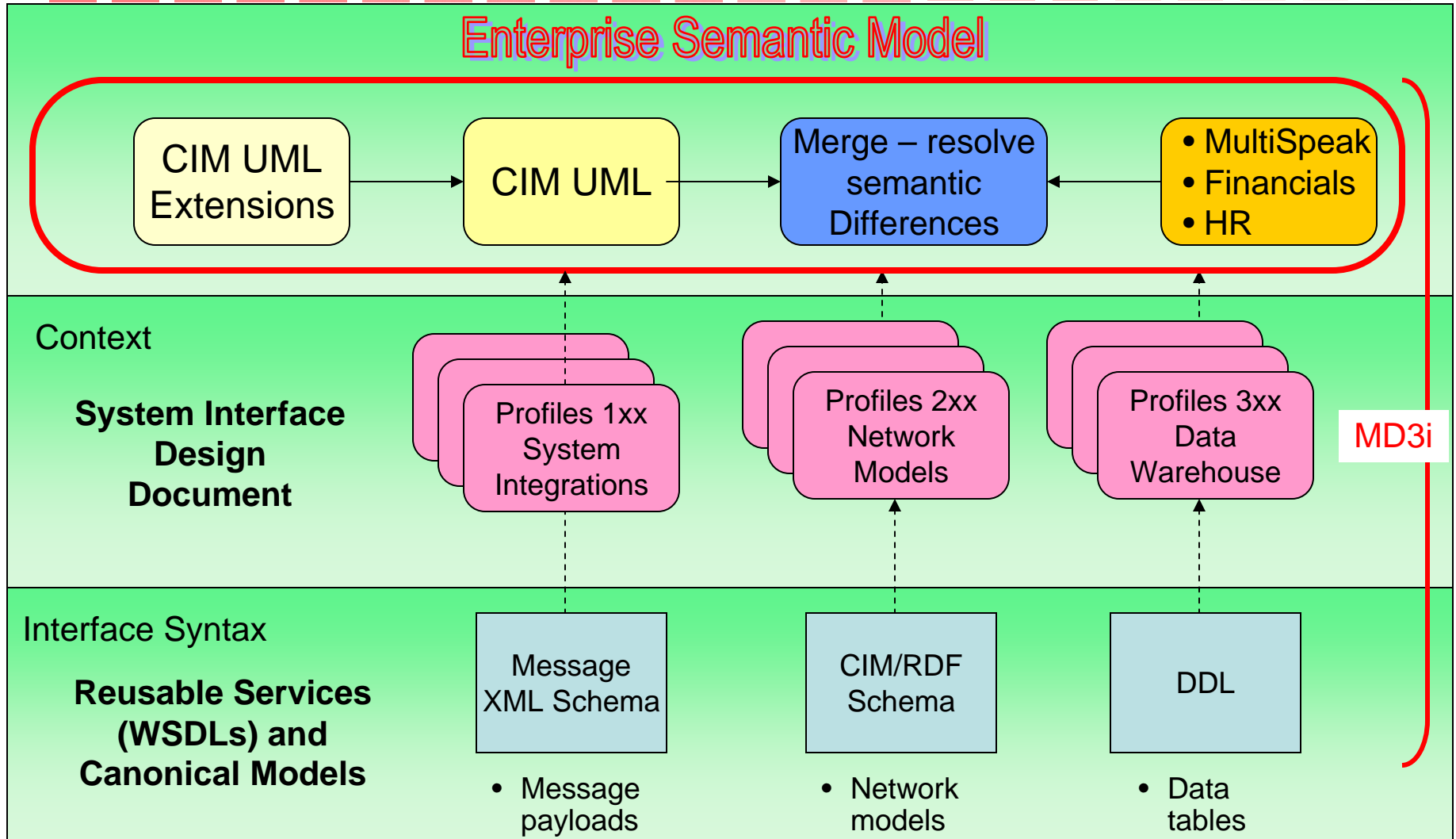


Building and Using an ESM for Generating Canonicals (XSDs, DDLs, others)



Let's Apply to a Utility Project

- Service Oriented Architecture (SOA)



CIM Tools

Name	Supplier	Purpose	Platform	Description	Source	Actively maintained	Links
Enterprise Architect (EA)	Sparx Systems	UML model management and maintenance		Visual modeling platform used to manage/maintain the CIM model and design artifacts, such as activity/sequence diagrams, profiles, message definitions. - comprehensive UML analysis and design tool - modeling for business, software, systems - full traceability from requirements to deployment - scalable, team-based repository - enterprise frameworks, BPMN, many third party add-ins available	Licensed for fee from Sparx System	Yes	http://www.sparxsystems.com.au
Rational Software Architect	IBM	UML model management and maintenance		Single tool platform to create, maintain, and govern industry information model-based message definitions and implementation code needed to process the message data	Licensed for fee from IBM	Yes	http://www.ibm.com/developerworks/rational/products/rsase
Eclipse	Eclipse consortium of companies. (Originally IBM)	Platform and modeling environment for developing Java-based plugins		Eclipse is: - An Integrated Development Environment (IDE) for Java providing tooling to manage workspaces; to build, launch and debug applications; to share artifacts with a team and to version code; and to easily customize the programming experience - A platform because it is not a finished application per se but is designed to be extended indefinitely with more and more sophisticated tooling built as plug-ins	Eclipse Public License	Yes	http://www.eclipse.org
CIM EA	Xtensible Solutions	CIM modeling and design	Enterprise Architect Add-in	CIM EA extends Enterprise Architect to provide a single environment in which users can manage the IEC Common Information Model (CIM), CIM Profiles, and CIM-based artifacts such as RDF and XSD message generation. With CIM EA, users can create and edit CIM Profiles as standard UML models and generate CIM-based artifacts from those models, all within Enterprise Architect.	Freeware	Yes	www.cimea.org
CIMBench	BTC and EWE, Germany	Develop and generate CIM-based XML schema for message payloads		Used for: - development of CIM-based XML schema - exploring the CIM - comparing CIM models	BTC	?	Contact wolfram.krause(at)ewe.de or ralf.walther(at)btc-ag.com


CIM Tools

CIMCLipse	Supelec and EDF, France	Umbrella name for tools used for CIM-related tasks on Eclipse or its plugins	Eclipse	Available tools include: - CIM UML/Ecore models compatible with the UML/Ecore layers of Eclipse - A tool to check that a network conforms to a profile using OCL - Tools to work with Rose MDL files inside Eclipse - ATL transformations used for promoting CIM UML to CIM Ecore, and other utilities	Open Source	Yes	http://www.di.supelec.fr/software/cimclipse
CimConteXtor	Andre Maizener	CIM UML model-based tool to transform UML model to message schemas	Enterprise Architect Add-in	Follows UN/CEFACT methodology with layering from information model to contexts to create RDFS, XSD, and HTML for message/file schemas	Freeware	Yes	Email to contact@zamiren.fr for download CIMinEA
CIMinEA	Tatjana Kostic	Create IEC document content, validation, Rose migration, and model merge	Enterprise Architect	Primarily used by IEC to create IEC-compliant standards documents from the CIM UML	Freeware	No - being replaced with	CIMinEA
CIMPhony	Open Grid Systems	Support for RDF, profiles, validation, transformation, Web services, topological processing, geographical visualization	Java-based OAGi Bundles with Eclipse-based UI	Framework for loading and interpreting CIM data in-memory and various tools built on top of framework for using CIM data. Tools include: - CIM/RDF XML import, view, and edit - Export RDF XML - validate network models in RDF XML (ENTSO-E, CPSM, CDPSM) - Create Difference models for incremental updates - Conversion between different network model instances - Create Google Map views of models with embedded geographical data	Open Source	Yes	http://cimphony.org/cimphony
CIMSpy	Power Info	CIM/RDF/XML file browser, editor, and validator	SE - IE 5+ on PC EE - distributed Web-based application	CIMSpy Standard Edition (SE) is a stand-alone DHTML client application (no internet connection) used for browsing and limited validation of CIM/XML files based on RDF schema to support EPRI CIM IOP Tests. CIMSpy Enterprise Edition (EE) is a web-based application	SE - Freeware under GNU public licenses	Yes	www.powerinfo.us/WebPages/opensource.html

CIM Tools

CIMTool	Langdale Consultant s	CIM profile and message schema creation and validation	Eclipse plug-in	Used to: * read and merge CIM and local UML models in XML form * browse models and check inconsistencies * generate equivalent OWL ontologies * create and edit profiles * generate XML schemas, OWL and RDFS ontologies for profiles * validate instances against profiles (including very large CIM/XML instances)	Open Source	Yes	www.cimtool.org/
CIMvian	UISOL	CIM RDF/XML graphical browser and editor	?	Tool to visualize and analyse CIM RDF schemas and CIM XML instance files.	Free license	?	uisol.com/uisol/CIMvian/CIMvian.htm
crxcat	Available on CIMug Sharepoint METI group site	CIM/RDF/XML file concatenation tool	Java code on Eclipse	Single purpose tool to concatenate CIM/RDF/XML files for input into tools that require a single document as input.	Freeware	?	crxcat
JCleanCim	Tatjana Kostic	CIM UML validation cleanup and documentation tool	Eclipse	Java application to create IEC standard compliant Word documents from UML model. Includes validation of UML model prior to auto-generating Word document. It is intended to be used in conjunction with CIMTool but not dependent on it (?)	Open Source	Yes	iCleanCim
MD3i	Xtensible Solutions	Methodology and tools to develop CIM-based ESM and generate design-time canonical data models.	Enterprise Architect Add-in	The MD3i Framework is an enterprise semantic modeling methodology combined with a set of design patterns, governance guidelines, industry standard models, and EIM best practices that Xtensible's customers use to establish and maintain a strategic EIM program. Used to: - create and maintain an Enterprise Semantic Model (ESM) based on the CIM - define contexts/profiles - auto-generate canonical models, including XML schemas for message payloads, power system network models, and data models/DDIs for data warehouses based on the ESM	No-cost license from Xtensible Solutions	Yes	xtensible.net/solutions/md3i-methodology

Concluding Remarks

- 
- Bottom line: CIM standards are different and much more powerful
 - Can be applied in many ways
 - Support many types of functions/applications through combination of reuse and extension
 - Architecture supports future, unknown applications
 - Modeling platforms and tools are available to applying CIM standards to utility projects
 - Power system network model exchange
 - System integration with extended CIM
 - System integration, data warehouse, and business intelligence based on Enterprise Semantic Model and SOA best practices
 - Key to achieving Smart Grid interoperability vision

Questions?



- Contact tsaxton@xtensible.net
- Thank you

Merci

