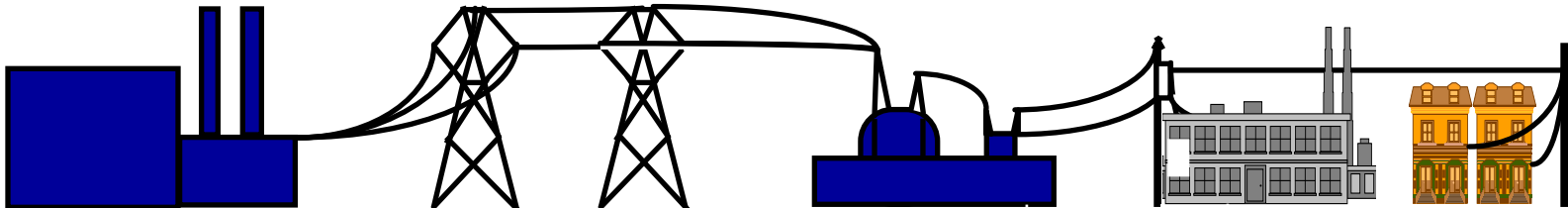


# Introduction to CIM Software Tools and Methodologies

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**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?

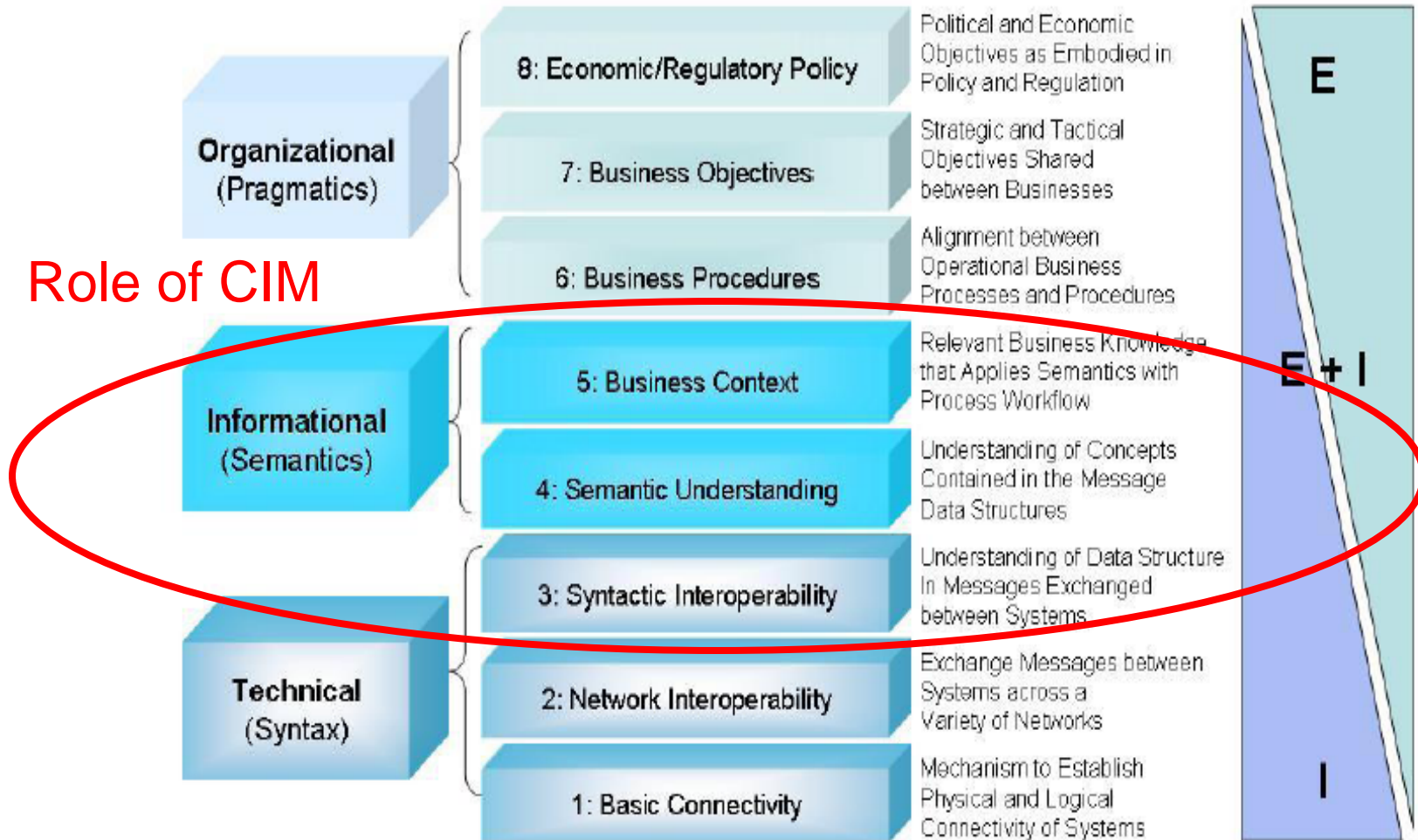


- A set of standards in enable system integration and information exchange based on a common information model

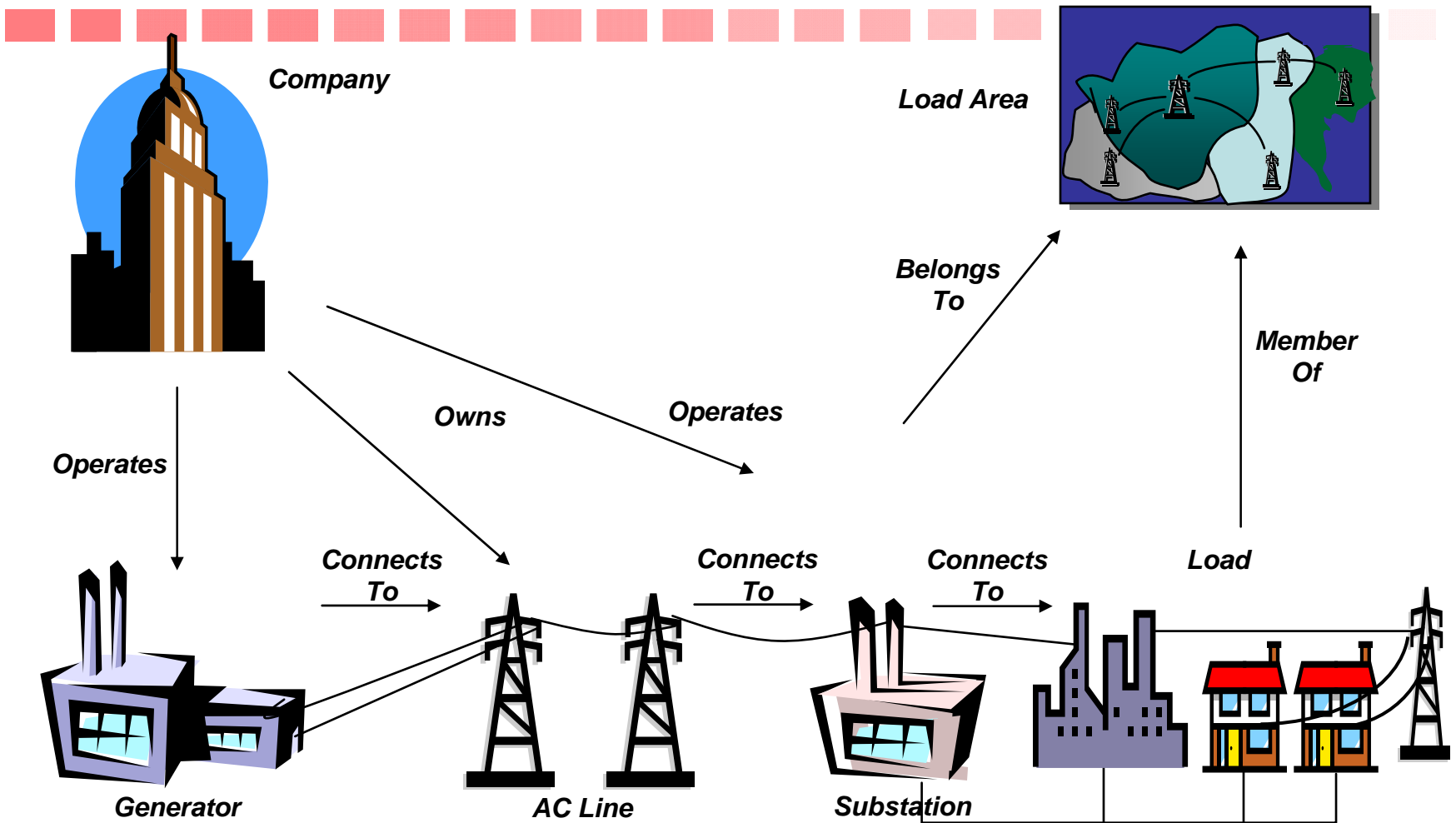
# GridWise Interoperability Framework



Role of CIM

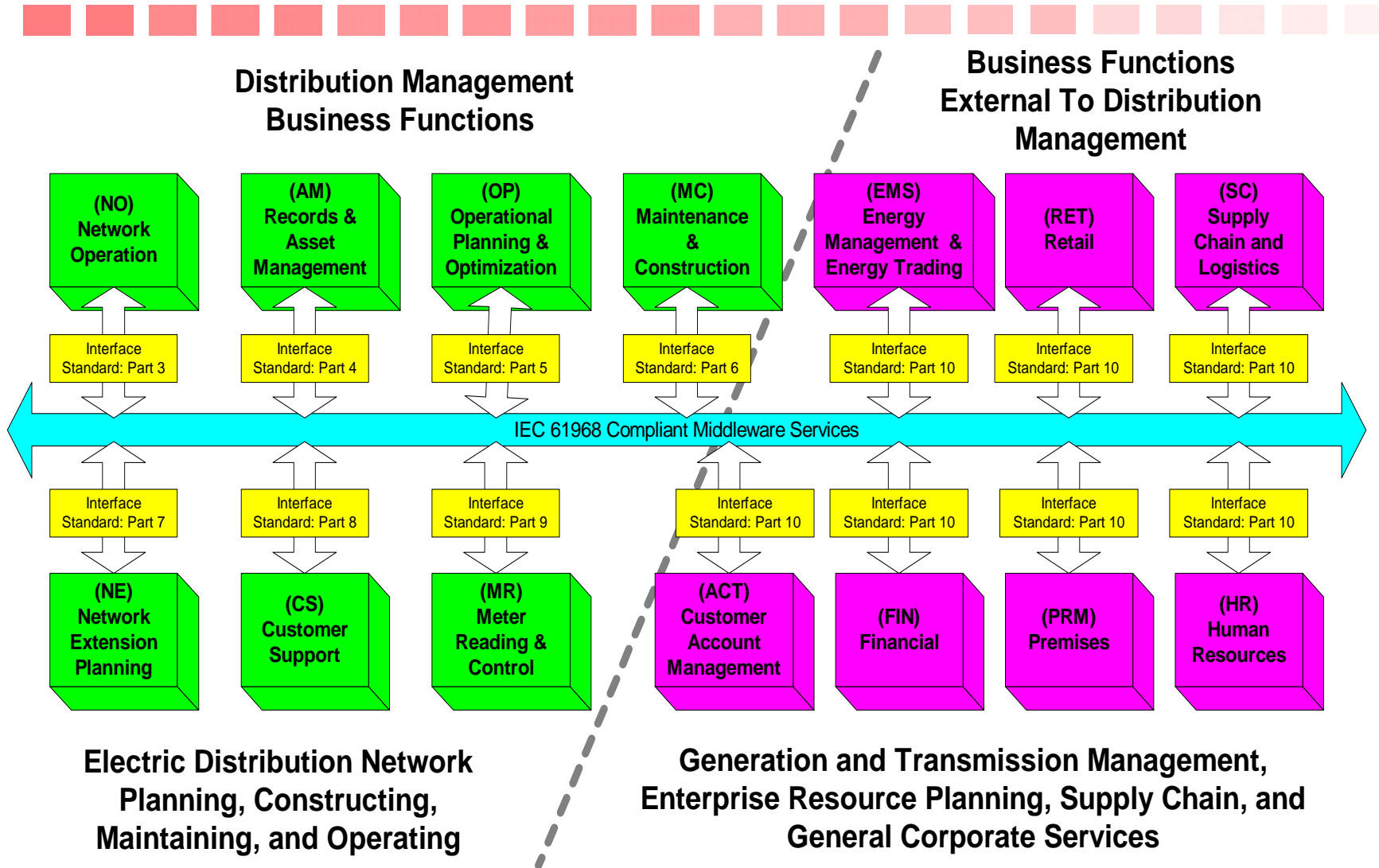


# Sample Power System Model



# 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

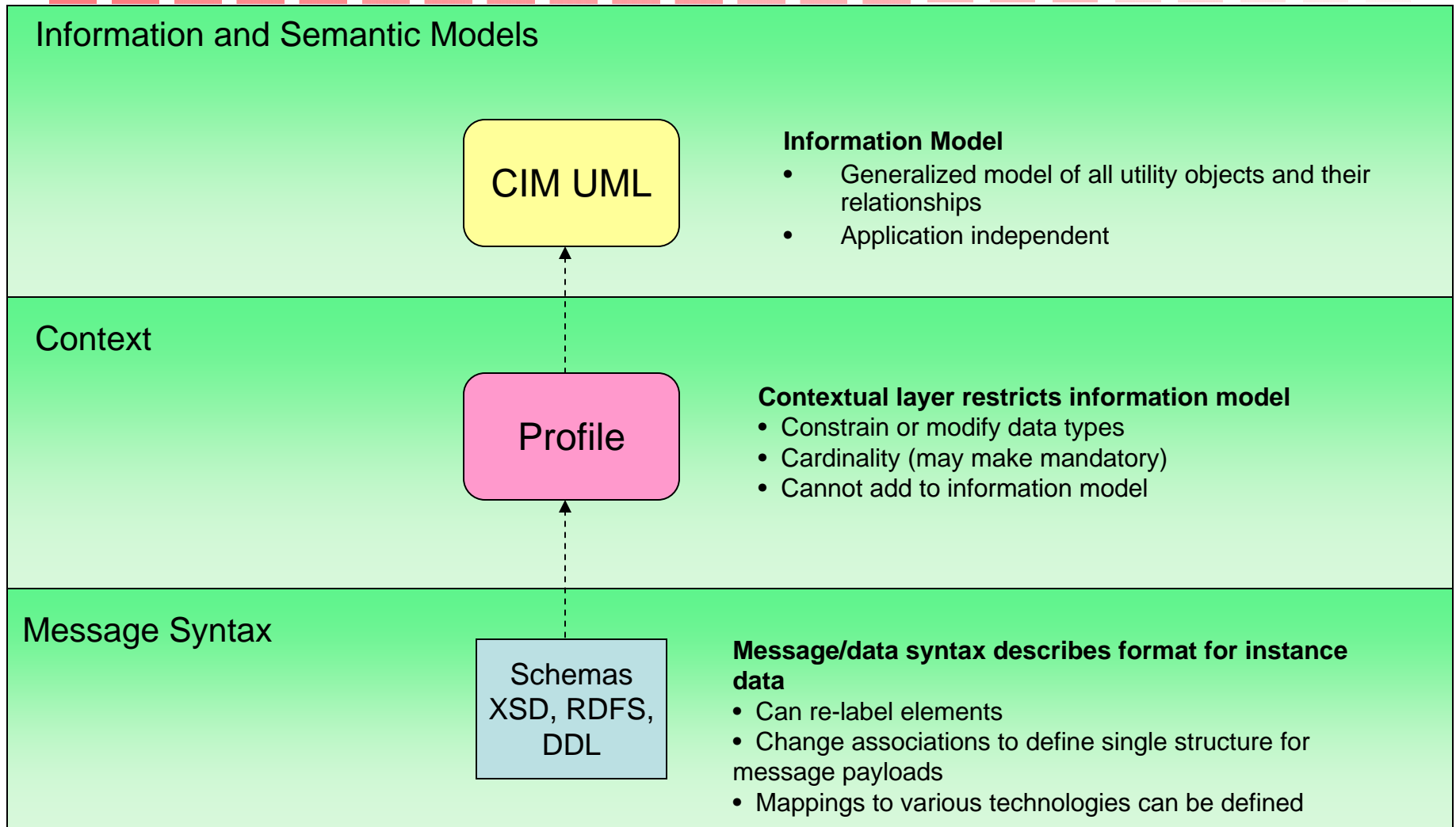


# We Need An Organizing Framework

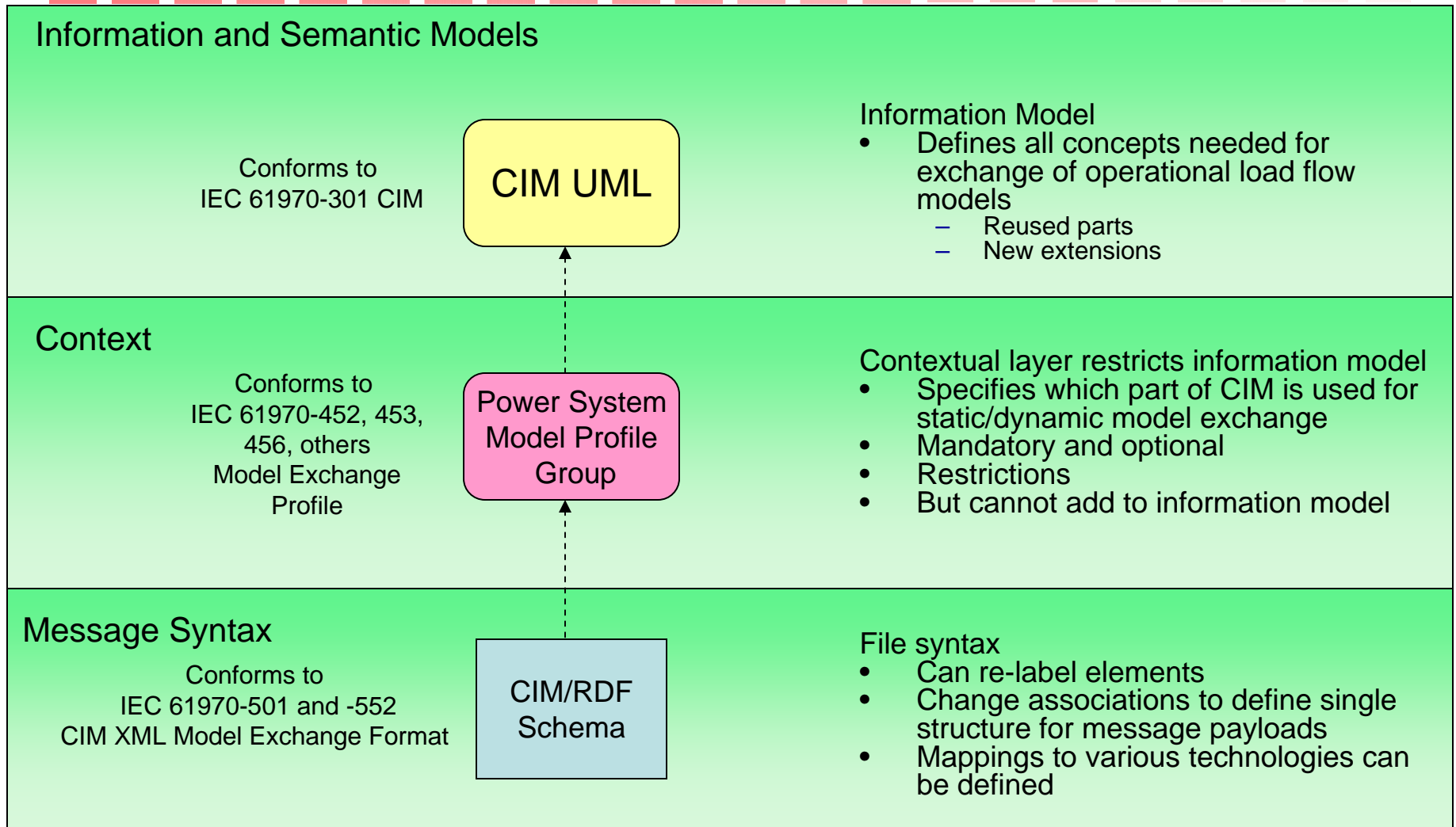
- 
- Layered Reference Architecture for TC57
  - Based on UN/CEFACT
    - Information Model
    - Contextual Model
    - Message Syntax
      - Rules for Message Assembly



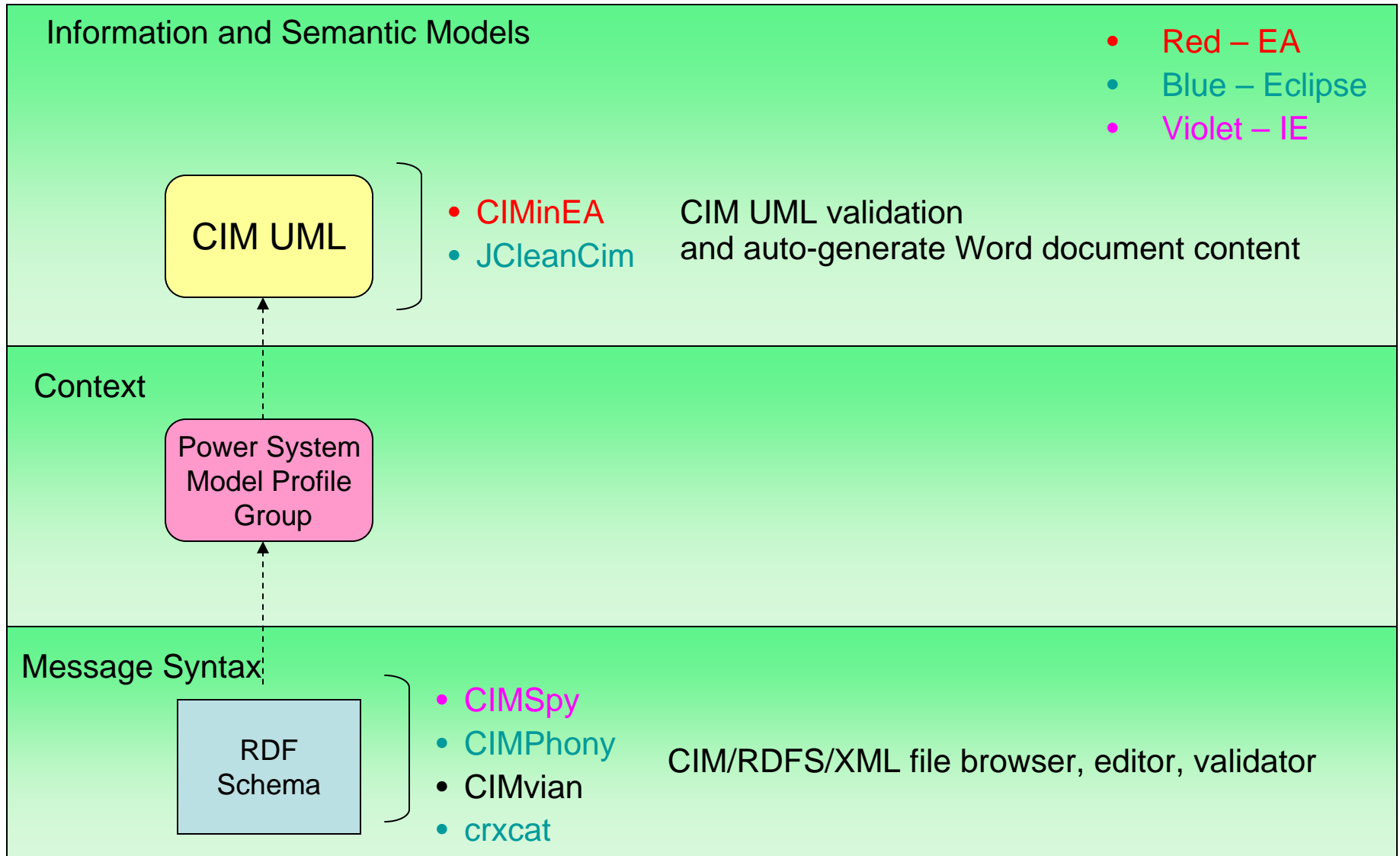
# TC57 Layered Architecture



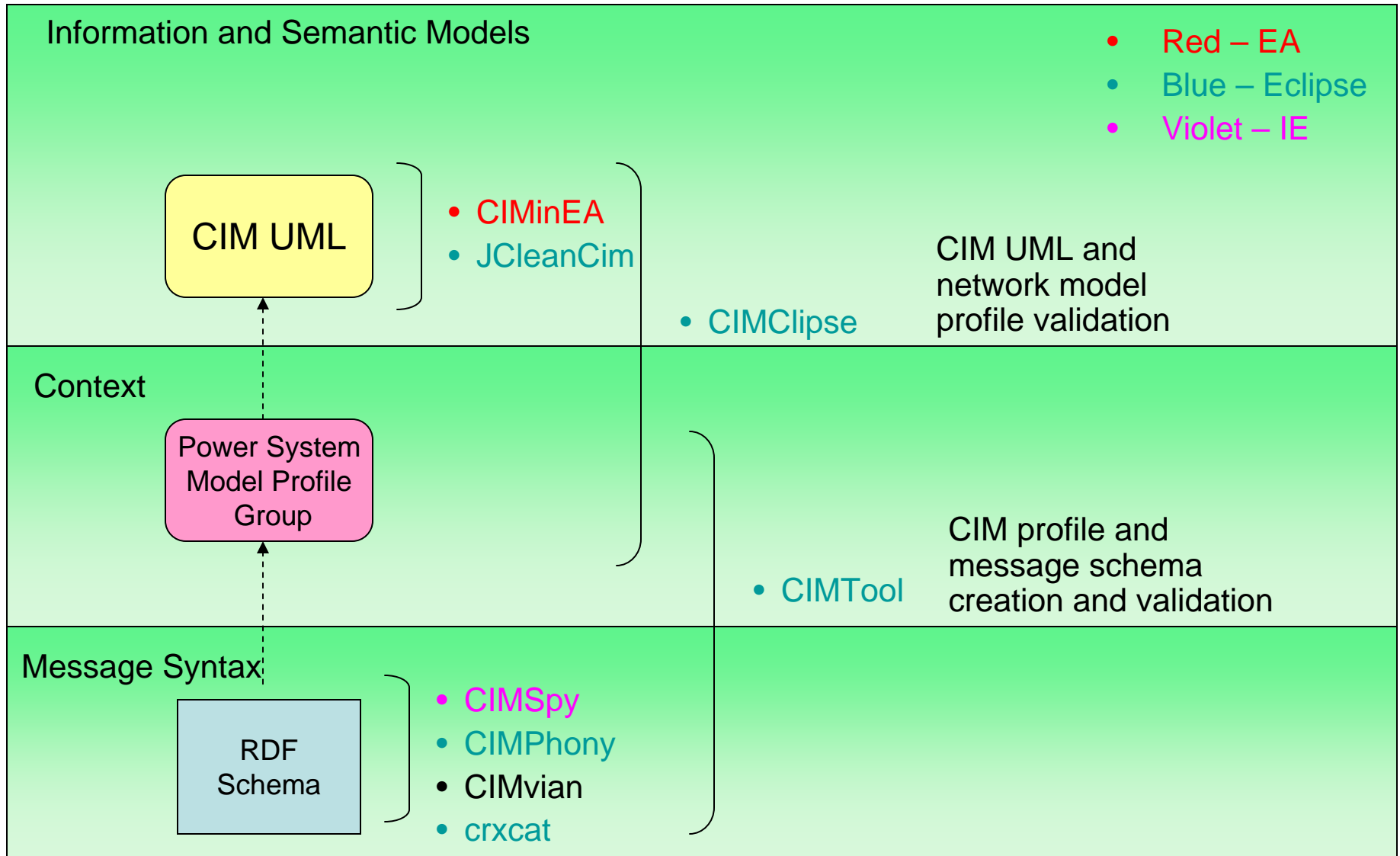
# Example: Power Flow Network Model Exchange



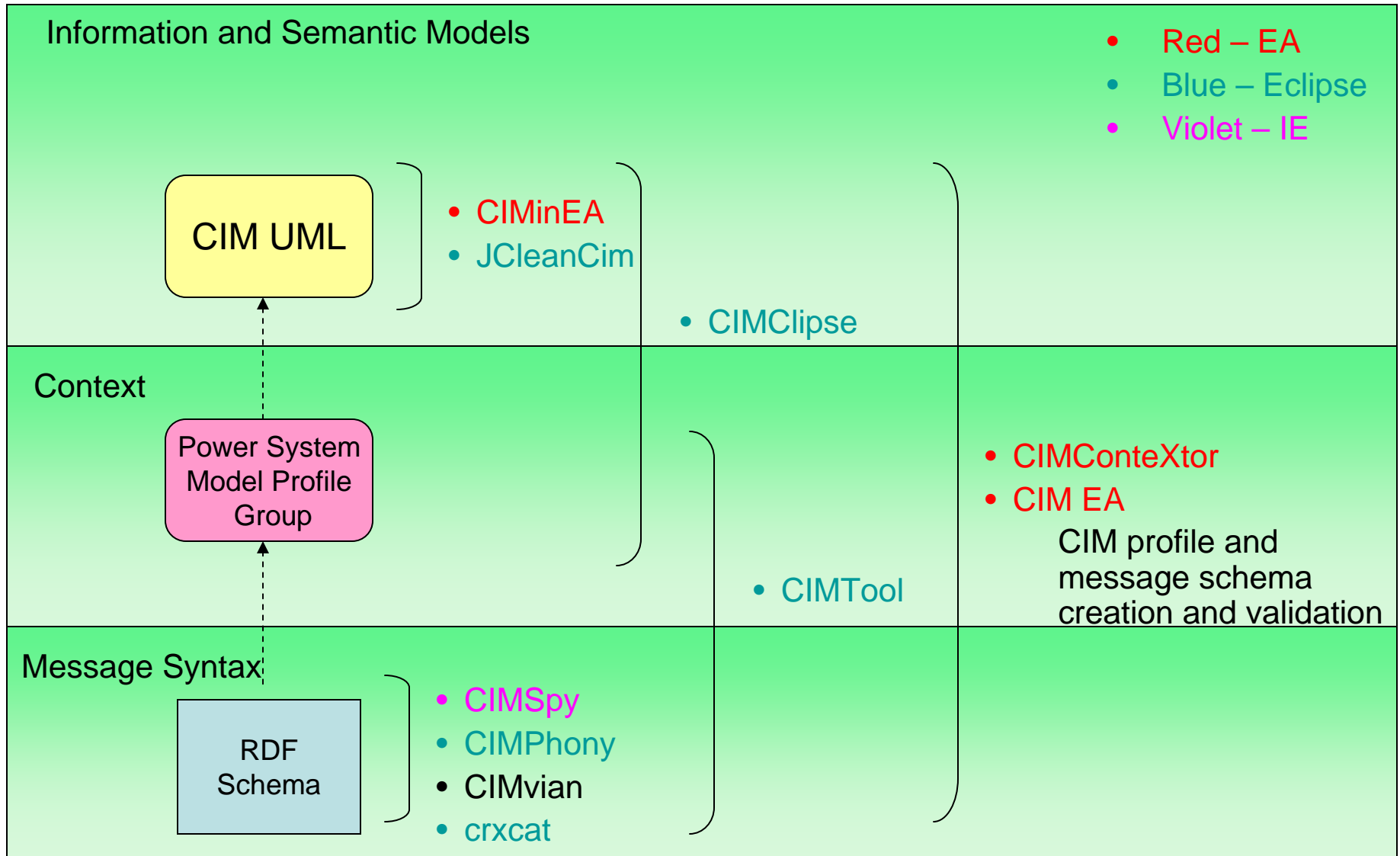
# CIM Tools for CIM Power System Models




# CIM Tools for CIM Power System Models



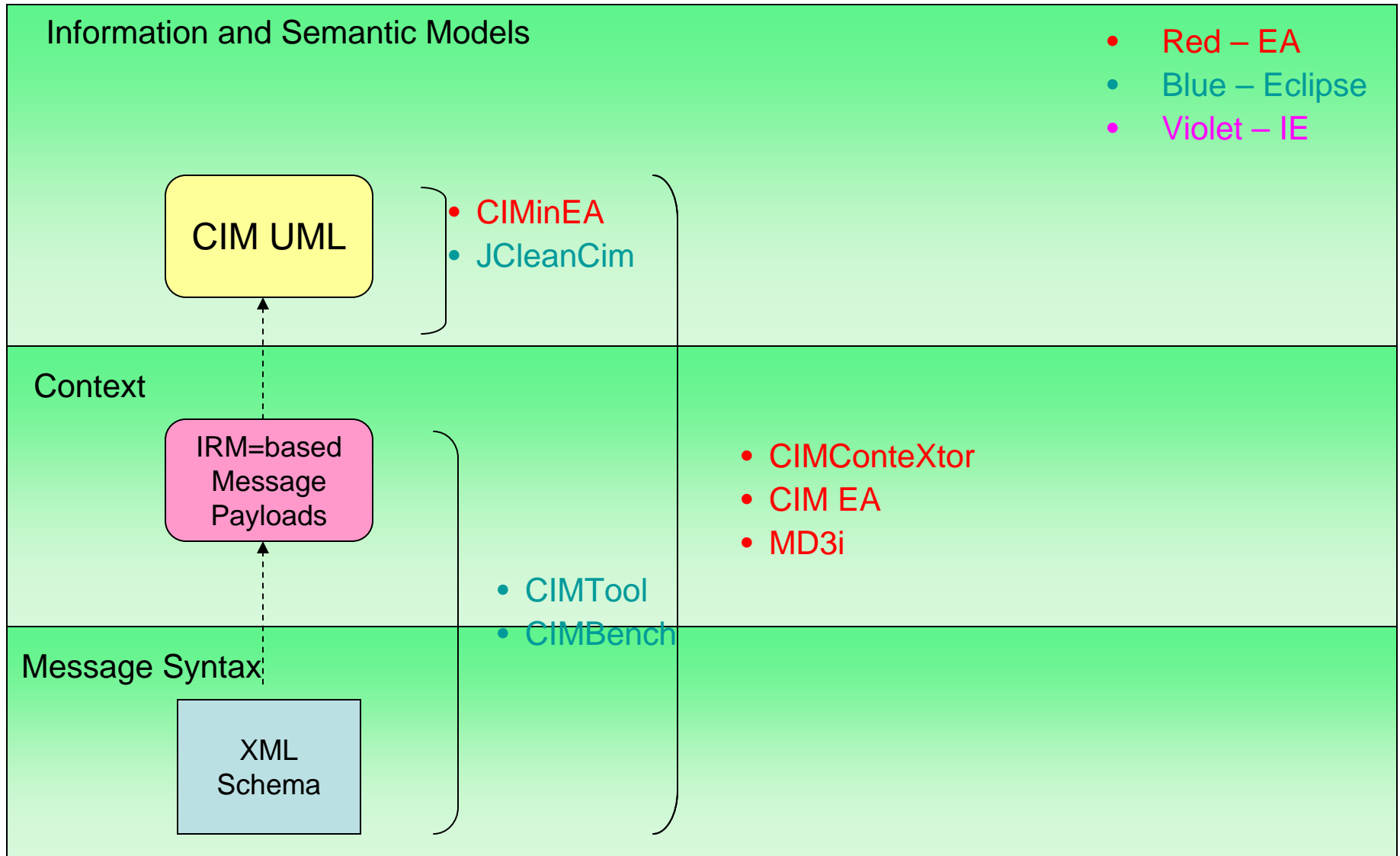
# CIM Tools for CIM Power System Models



# 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





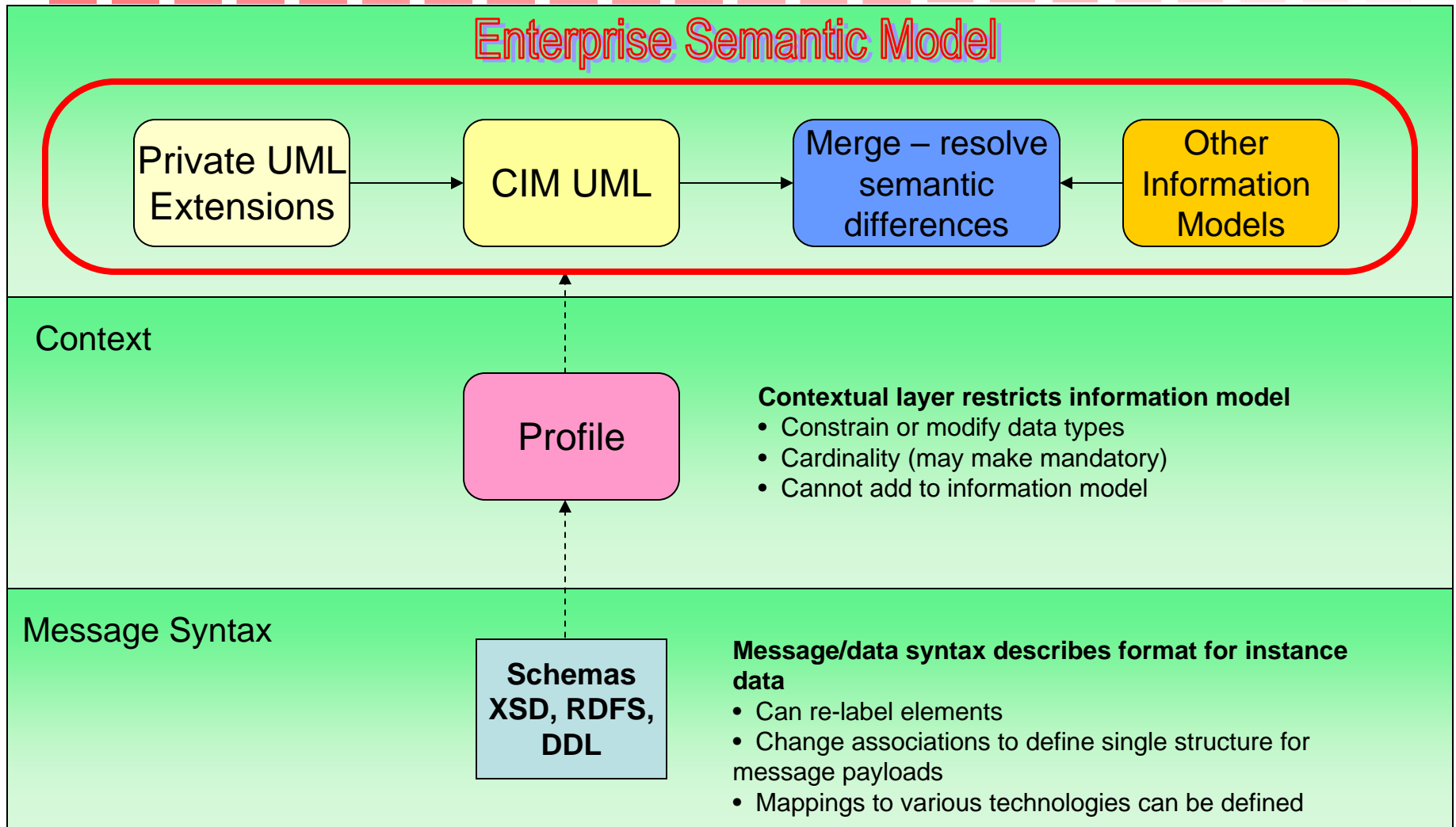
# CIM Tools for XSD Message Payload Generation based on Extended CIM



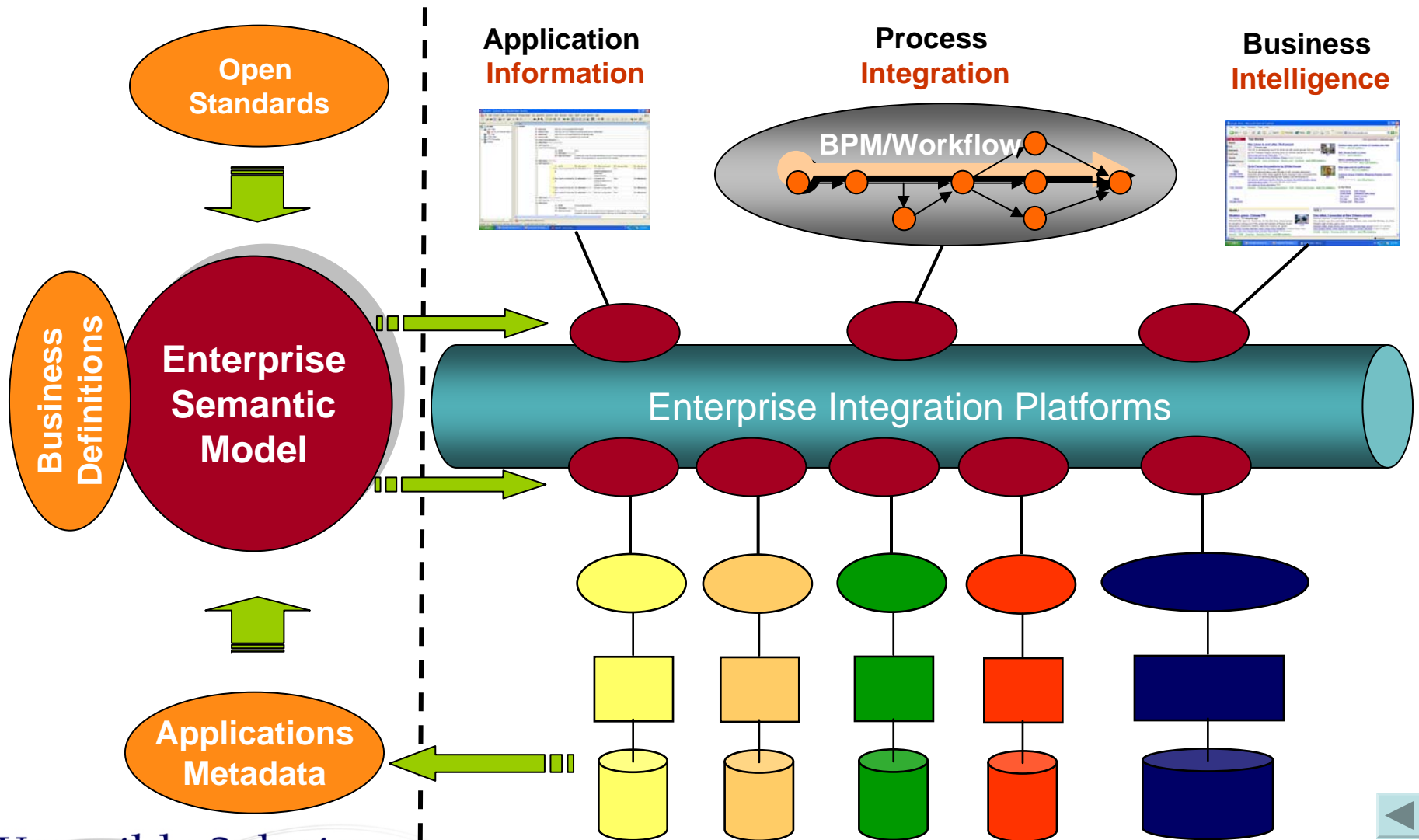
- Enterprise Add-ins
  - MD3i, CIM EA, CimConteXtor
- Eclipse Plug-ins
  - CIMTool

# Enterprise Semantic Models

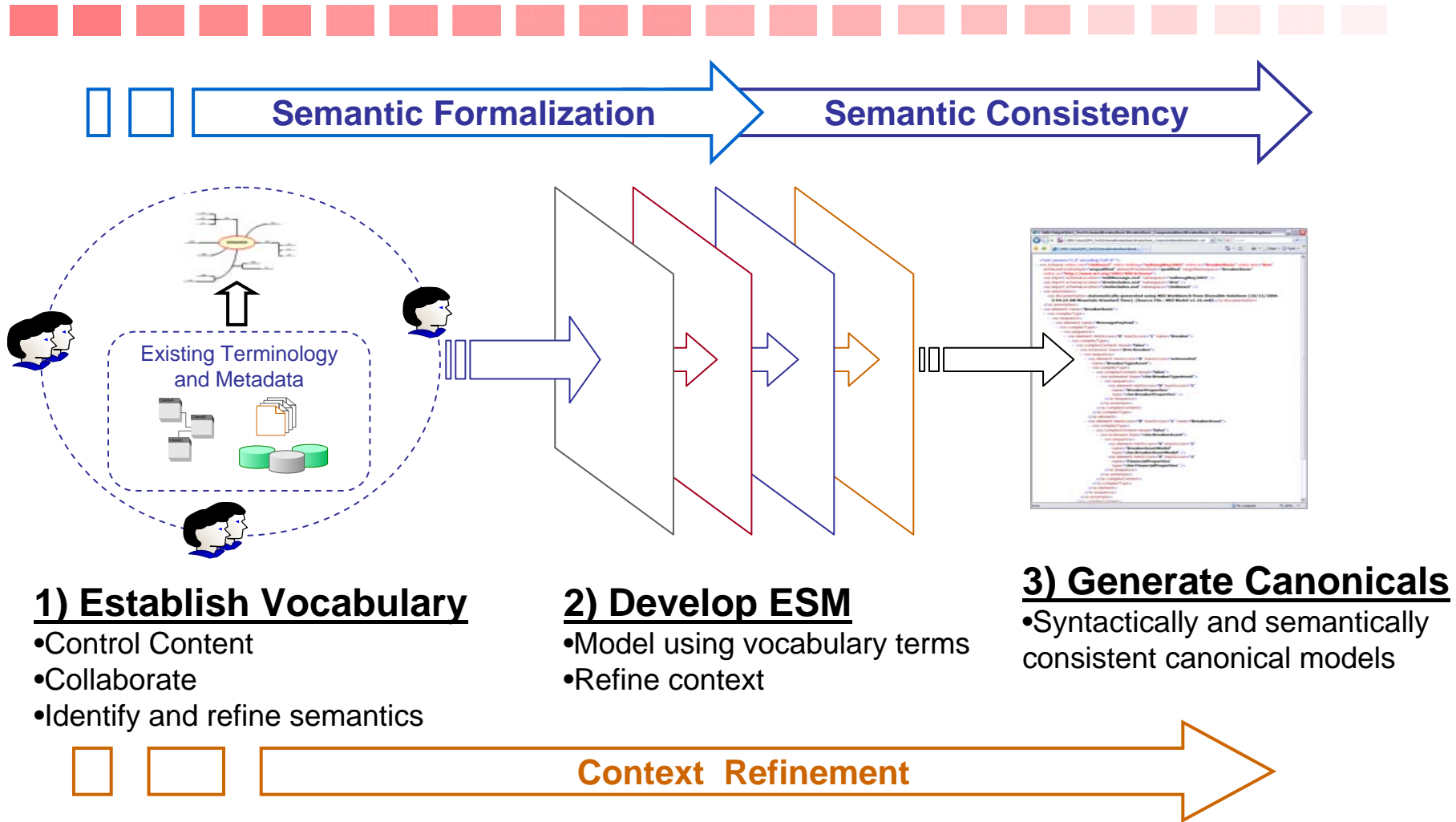
## – CIM + Other Industry Standards



# Role of Enterprise Semantic Model

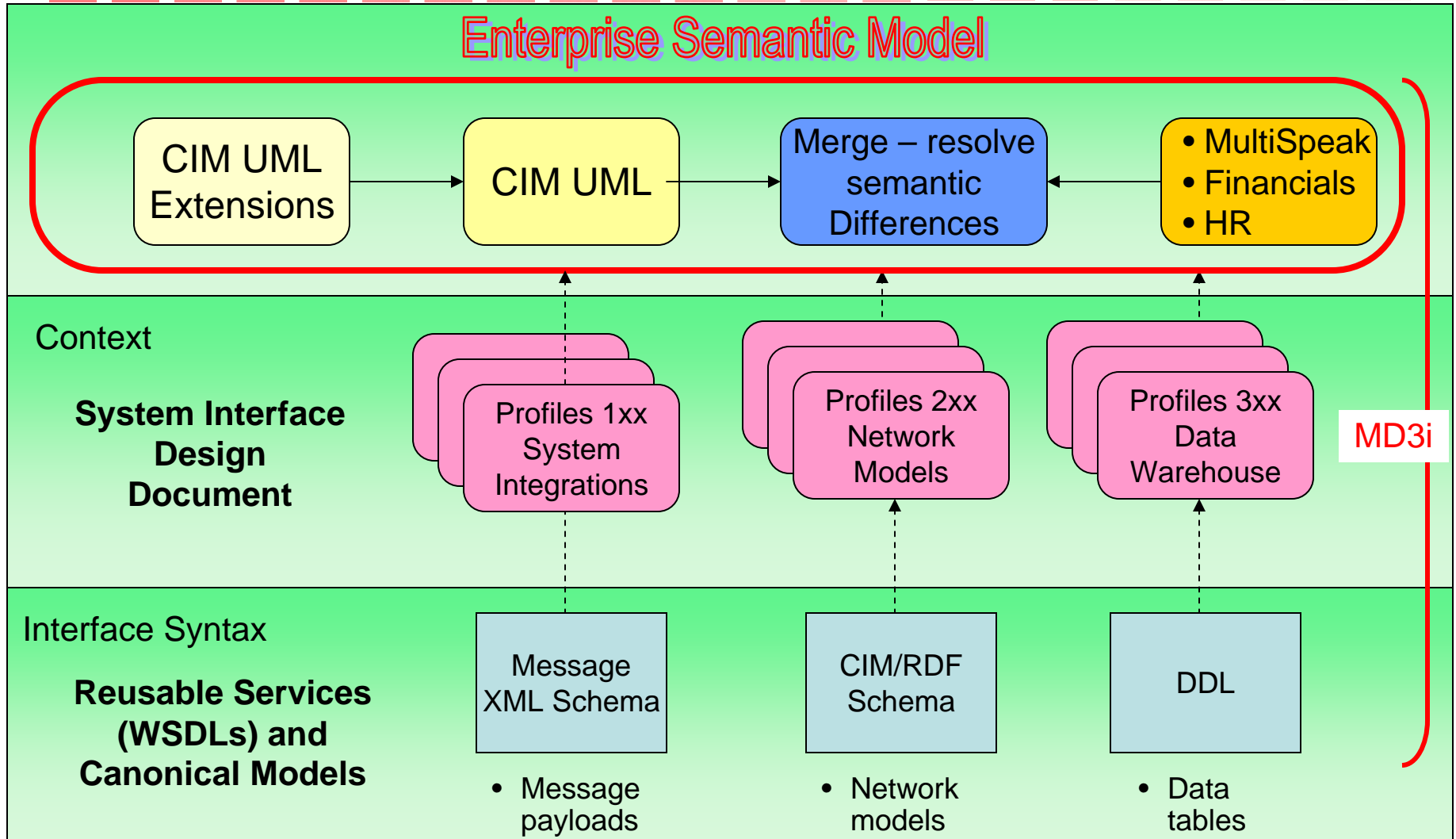


# Building and Using an ESM for Generating Canonicals (XSDs, DDLs, others)



# Let's Apply to a Utility Project

## - Service Oriented Architecture (SOA)



# CIM Tools

Name	Supplier	Purpose	Platform	Description	Source	Actively maintained	Links
<b>Enterprise Architect (EA)</b>	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	<a href="http://www.sparxsystems.com.au">http://www.sparxsystems.com.au</a>
<b>Rational Software Architect</b>	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	<a href="http://www.ibm.com/developerworks/rational/products/rsase">http://www.ibm.com/developerworks/rational/products/rsase</a>
<b>Eclipse</b>	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	<a href="http://www.eclipse.org">http://www.eclipse.org</a>
<b>CIM EA</b>	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	<a href="http://www.cimea.org">www.cimea.org</a>
<b>CIMBench</b>	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

<b>CIMCLipse</b>	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	<a href="http://www.di.supelec.fr/software/cimclipse">http://www.di.supelec.fr/software/cimclipse</a>
<b>CimConteXtor</b>	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	<a href="mailto:contact@zamiren.fr">Email to contact@zamiren.fr for download</a> <a href="#">CIMinEA</a>
<b>CIMinEA</b>	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	<a href="http://cimphony.org/cimphony">http://cimphony.org/cimphony</a>
<b>CIMPhony</b>	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	<a href="http://cimphony.org/cimphony">http://cimphony.org/cimphony</a>
<b>CIMSpy</b>	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	<a href="http://www.powerinfo.us/WebPages/opensource.html">www.powerinfo.us/WebPages/opensource.html</a>



# CIM Tools

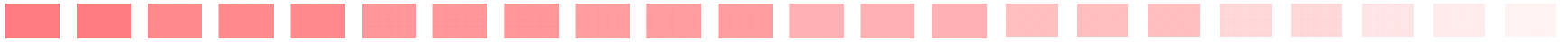
<b>CIMTool</b>	Langdale Consultant s	CIM profile and message schema creation and validation	Eclipse plug-in	Used to: * read and merge CIM and local UML models in XML form * browse models and check inconsistencies * generate equivalent OWL ontologies * create and edit profiles * generate XML schemas, OWL and RDFS ontologies for profiles * validate instances against profiles (including very large CIM/XML instances)	Open Source	Yes	<a href="http://www.cimtool.org/">www.cimtool.org/</a>
<b>CIMvian</b>	UISOL	CIM RDF/XML graphical browser and editor	?	Tool to visualize and analyse CIM RDF schemas and CIM XML instance files.	Free license	?	<a href="http://uisol.com/uisol/CIMvian/CIMvian.htm">uisol.com/uisol/CIMvian/CIMvian.htm</a>
<b>crxcat</b>	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	?	<a href="http://crxcat">crxcat</a>
<b>JCleanCim</b>	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	<a href="http://iCleanCim">iCleanCim</a>
<b>MD3i</b>	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	<a href="http://xtensible.net/solutions/md3i-methodology">xtensible.net/solutions/md3i-methodology</a>



# 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](mailto:tsaxton@xtensible.net)
- Thank you

*Merci*

