Revolution or Evolution of SCADA, EMS, MMS and DMS Systems

Definitely, Maybe

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State of the Utility Industry

- A lot of Hype and positive energy around Smart Grid Initiative and Utility Industry in General
- Large Companies are investing in Smart Grid, R&D…
  - Examples
    - » Cisco, GE, Google, IBM, Microsoft, Oracle, SAP, …
- Traditional Vendors' approach is perceived as "evolutionary"
  - Example
    - CIGRE Study Committee D2, Working Group 24. "EMS Architectures for the 21st Century" December 12, 2008.

Definitely, Maybe

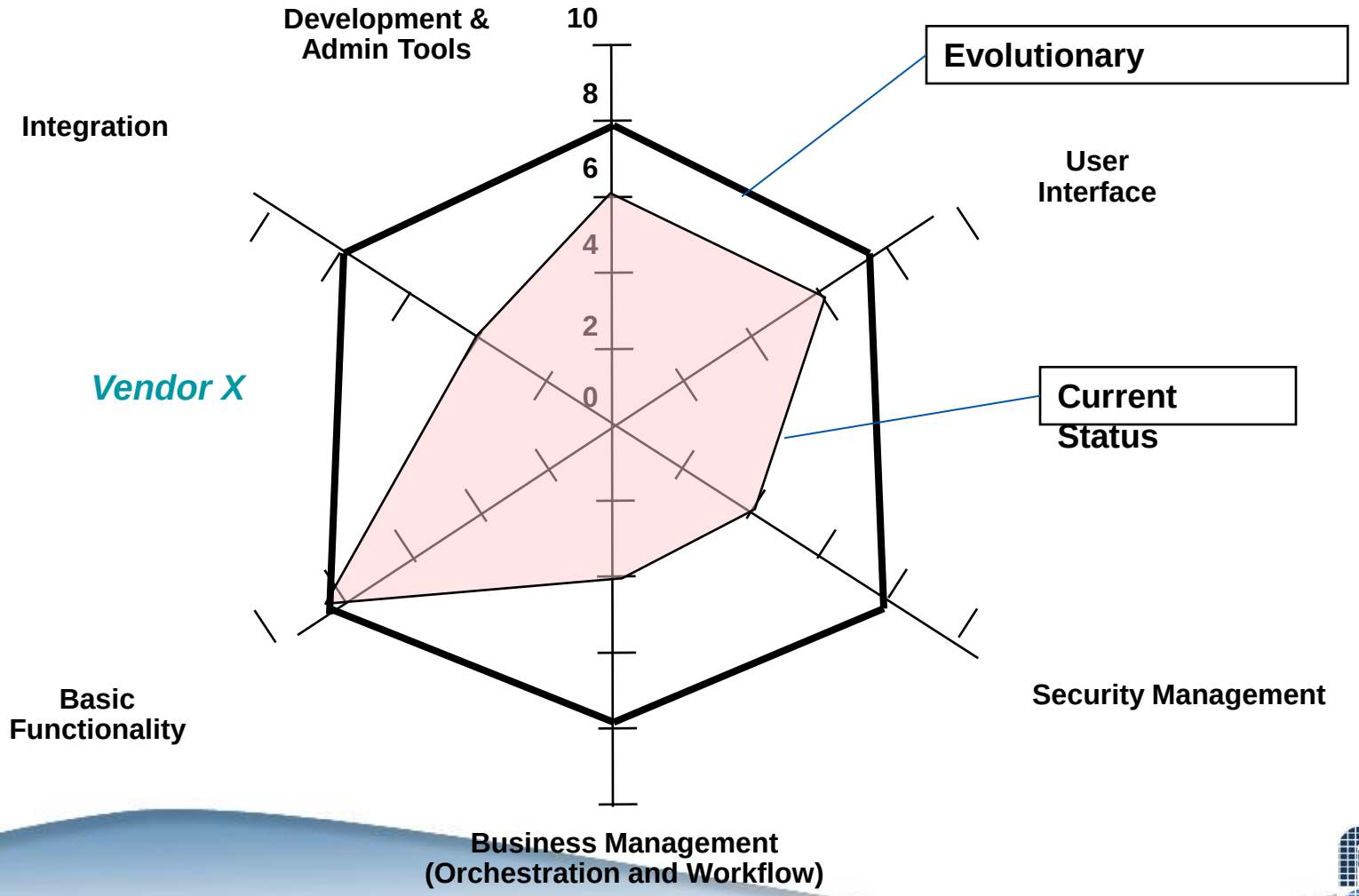
- Can an “evolutionary” Approach meet Smart Grid requirements and expectations?
- Can “evolutionary” approach process large amount of data with low latency (with required SLA)?
- Can “evolutionary” approach resolve operational challenges issues with renewable generation?

- Revolutionary approach is needed

Some Characteristics of Next Generation Systems

- Explosion of Data for Processing
  - Frequency
  - Volume
  - Low latency
- Data Acquisition and Synchronization
- Requires Two-Way Communications and Greater bandwidth with lower latency
- New generation of applications are expected to process information that was not available in the past
- New standards are needed

State of The Current and Next Generation (evolutionary) Systems

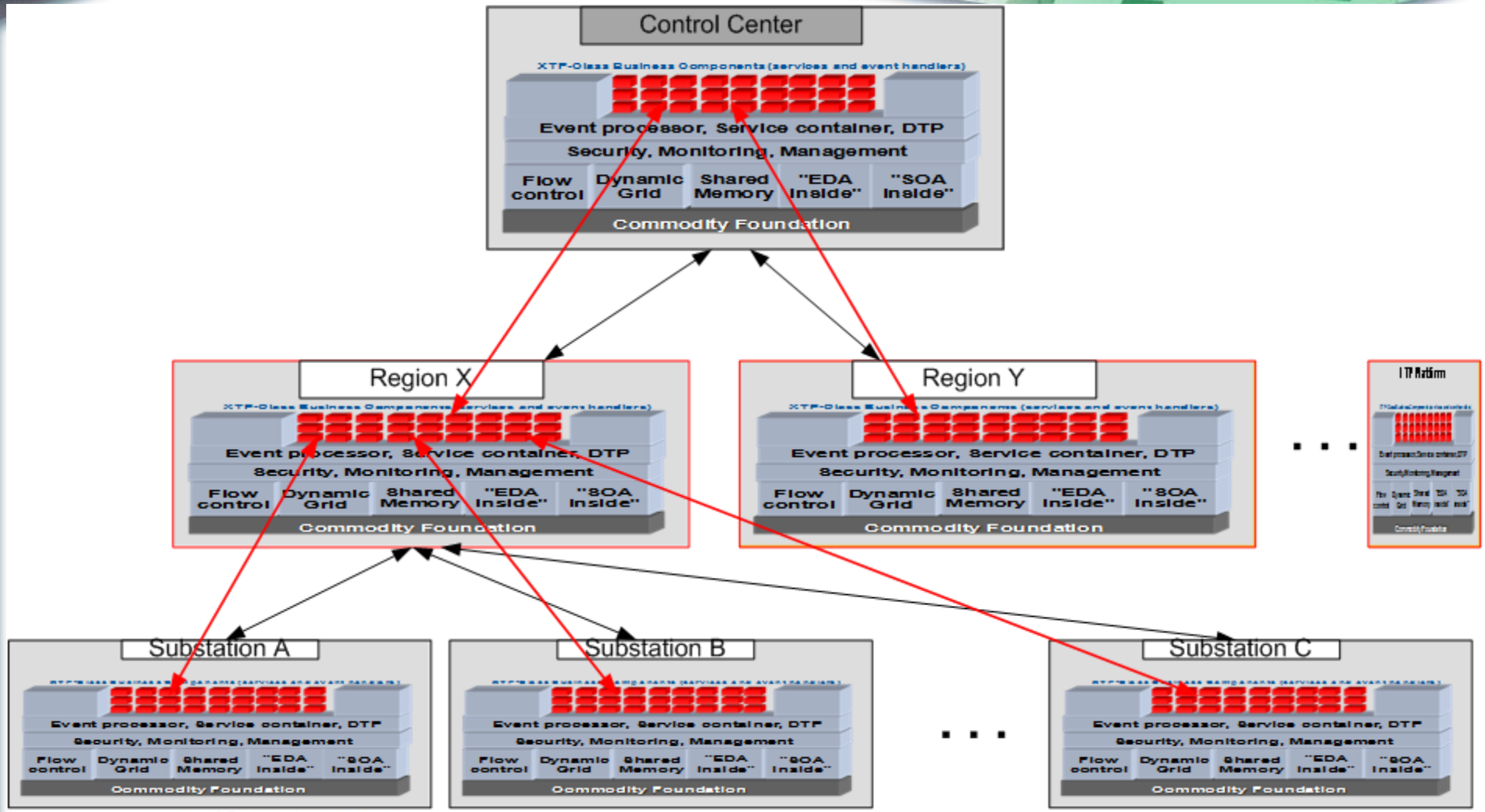


Next Generation Energy Systems Platform

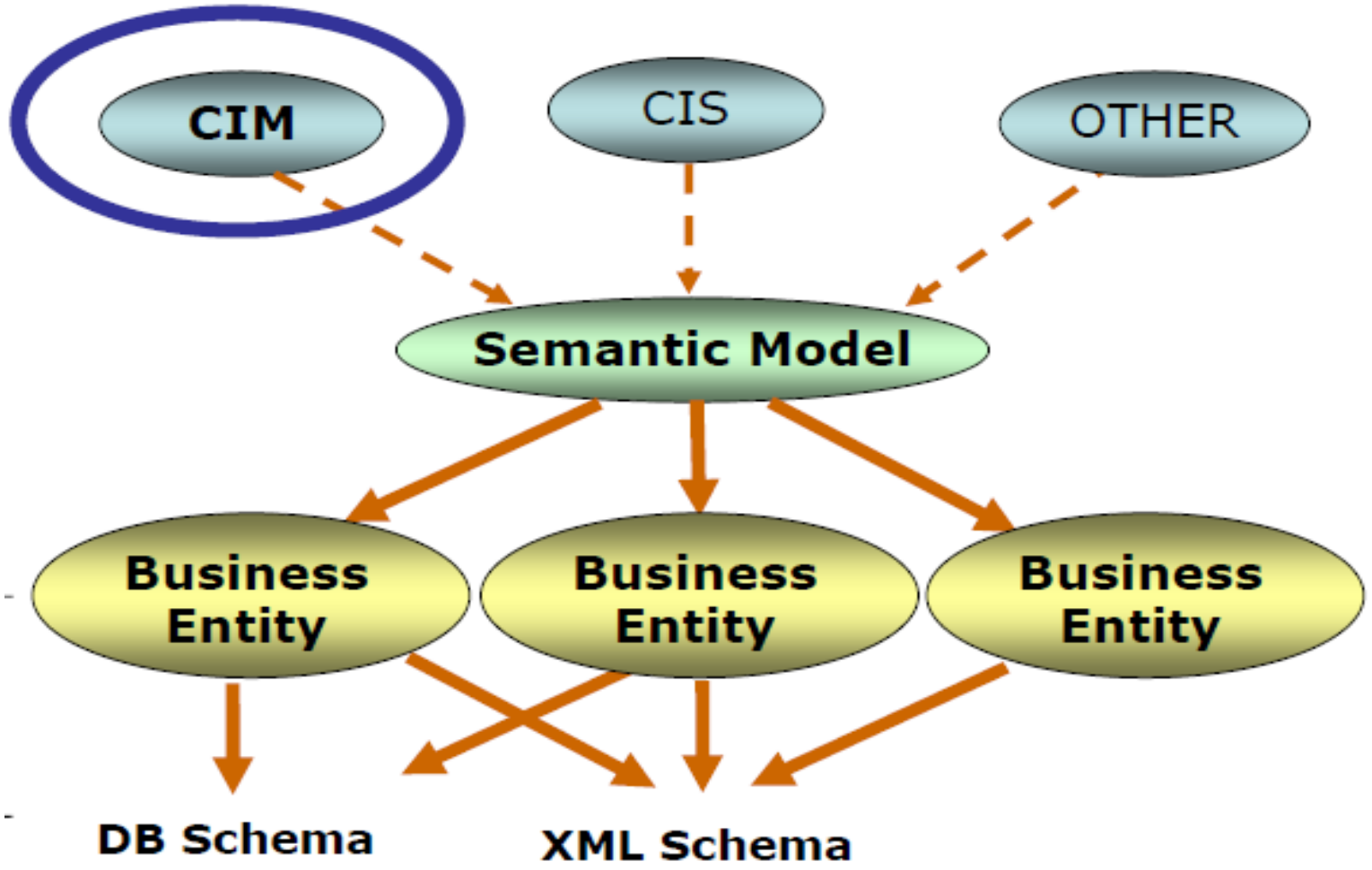
"The Next Generation energy platform is seen as a high-performance, highly distributed operational data management infrastructure that encompasses hierarchically clustered gateways / agents with distributed memory resident data sources to provide very low-latency, predictable, high-throughput data sharing and event distribution.

The platform is envisioned as dynamic massive server networks (dynamic grid), massive distributed and replicated memory spaces, use of event-based internal architecture for intra-systems communications (EDA and CEP inside) and use of an extensible modularity of platform technology (SOA inside)."

Next Generation Platform

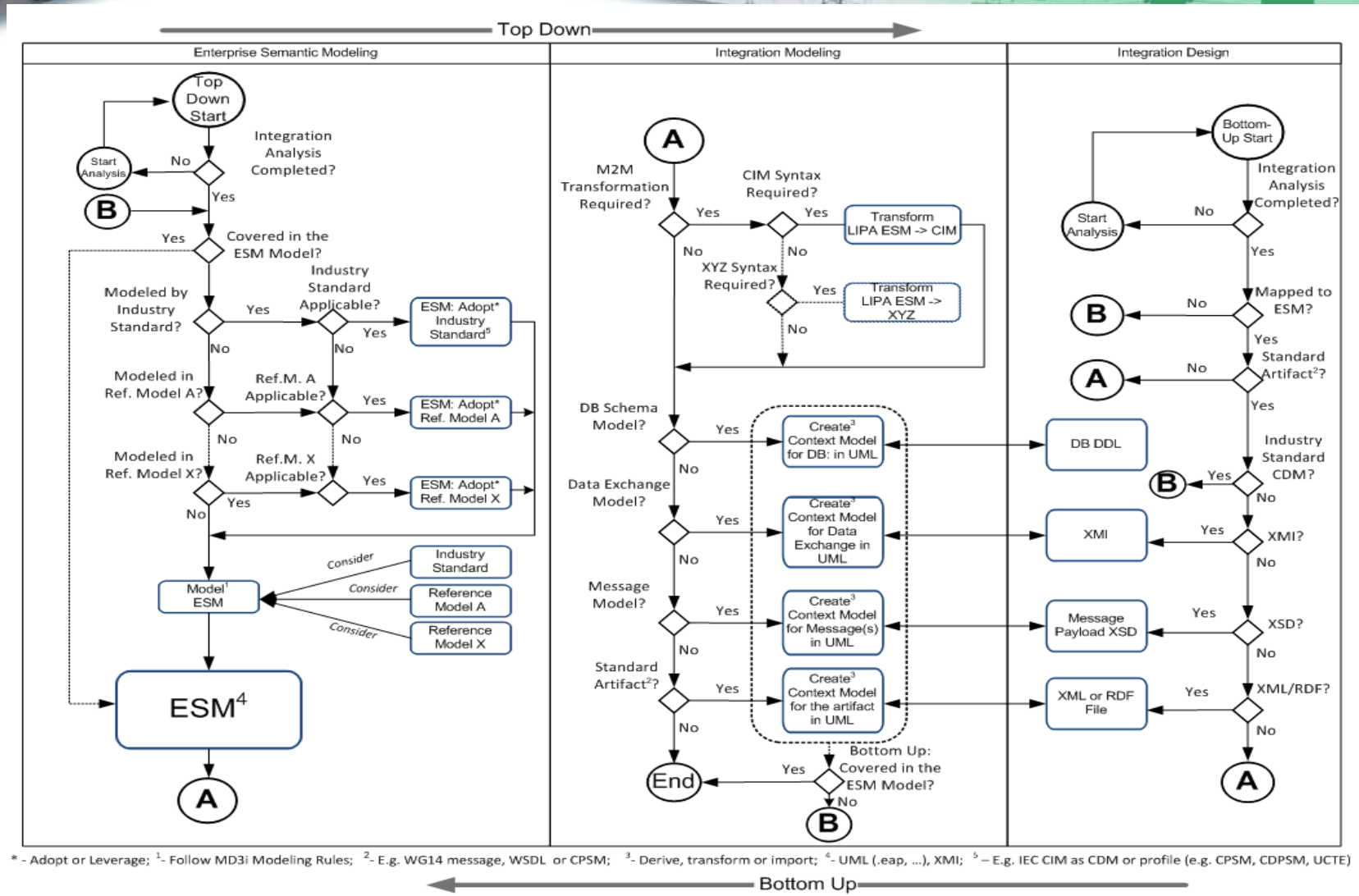


Role of Enterprise Semantic Model and Standards



Source: Xtensible Solutions

ESM Dynamics



* - Adopt or Leverage; [1]- Follow MD3i Modeling Rules; [2]- E.g. WG14 message, WSDL or CPSM; [3]- Derive, transform or import; [4]- UML (.eap, ...), XMI; [5] – E.g. IEC CIM as CDM or profile (e.g. CPSM, CDPSM, UCTE)

Interoperability and Role of Standards

- Good news
  - Need for new standards is widely recognized
- Bad news
  - It takes time to develop fundamentally sound standards
- Typical steps include:
  - Data Usage Analysis
  - Semantic Modeling
  - Integration Modeling
  - Implementation
- Solution
  - **INSTRUMENTALIZATION OF SEMANTIC LAYER**

Instrumentalization of Semantic Layer

- WHAT
  - Make as much as possible interoperability decision at semantic layer
- SO WHAT
  - Make integration modeling and implementation transparent
- NOW WHAT
  - Focus on Semantics for areas where there is no standard.
  - Pay Attention to Data Mediation and Semantic Integrator tools

CIM Compliance Realities

- Lack of consistent and clear compliance rules
- CIM is not consistently leveraged on large scale integration projects
- Misperception of CIM Usage and compliance makes vendors hesitant to address compliance
- They all “smoke” CIM however most of them don’t “inhale” it.
- A fair amount of ambiguities at the different levels
- A need to promote CIM usage beyond network model exchange

CIM Formal Definitions (1)

- **Definition 1** - CIM Definition
  - *A CIM is a 4-tuple:* ***C = (E, A, P, R)***
    - ***where***
      - E *is set of Entities in CIM:* $E = \{e_i \mid 1 \leq i \leq n, e_i \subset E\}$
      - A *is set of Attributes in CIM:* $A = \{a_j \mid 1 \leq j \leq m, a_j \subset A\}$
      - P *is set of attribute data Properties in CIM* $P = \{p_k \mid 1 \leq k \leq o, p_k \subset P\}$
      - R *is set of Relationships in CIM* $R = \{r_l \mid 1 \leq l \leq q, r_l \subset R\}$
      - n *– number of entities in CIM*
      - m *– number of attributes in CIM*
      - o *– number of attribute data properties in CIM*
      - q *– number of relationships in CIM*

There is nothing more practical than a good theory

CIM Compliance Assessment Rules (1)

- Semantic Compliance
  - **Rule 1** - A necessary condition for CIM semantic compliance is the ability to map directly or using a simple translation, data elements of an information model to the respective attributes of the CIM.

    Supposing Definition 4 and according to Definition 5, CIM Compliance Levels are

If $10 < t_{\%} < 20$ *then CL = 1*

Else if $20 < t_{\%} < 30$ *then CL = 2*

Else if $30 < t_{\%} < 40$*then CL = 3*

Else if $40 < t_{\%} < 50$ *then CL = 4*

Else if $50 < t_{\%} < 60$ *then CL = 5*

Else if $60 < t_{\%} < 70$ *then CL = 6*

Else if $70 < t_{\%} < 80$ *then CL = 7*

Else if $80 < t_{\%} < 90$ *then CL = 8*

Else if $90 < t_{\%} < 99$ *then CL = 9*

Else if $t_{\%} = 100\%$ *then CL = 10*

CIM Compliance Assessment Rules (3)

- Syntactic Compliance
  - ***Rule 3*** *- A necessary condition for CIM compliant syntactic interoperability between two systems is the existence of semantically compliant sender and receiver as well as when both systems (sender and receiver) can process standard message structure/payload and those derived from CIM*

Supposing Definition 4 and according to Definition 7, CIM Compliance Levels are

If $10 < t_{\%} < 20$ *then CL = 1*

Else if $20 < t_{\%} < 30$ *then CL = 2*

Else if $30 < t_{\%} < 40$ *then CL = 3*

Else if $40 < t_{\%} < 50$ *then CL = 4*

Else if $50 < t_{\%} < 60$ *then CL = 5*

Else if $60 < t_{\%} < 70$ *then CL = 6*

Else if $70 < t_{\%} < 80$ *then CL = 7*

Else if $80 < t_{\%} < 90$ *then CL = 8*

Else if $90 < t_{\%} < 99$ *then CL = 9*

Else if $t_{\%} = 100\%$ *then CL = 10*

Integration Readiness Assessment

Complexity of Integration vs. Compliance Levels (Traditional Integration Tools)

Integration Complexity	Description	Semantic Compliance Levels				Syntactic Compliance Levels			
		2	4	7	10	2	4	7	10
High	No Semantic Model, No Endpoints	✓	✓			✓	✓		
Med/High	No Semantic Model, Some Endpoints	✓	✓			✓	✓		
Medium	Semantic Model, Some Endpoints			✓			✓		
Med/Low	Semantic Model, Endpoints			✓				✓	
Low	Semantic Model and standard based Endpoints			✓	✓			✓	✓
Zero Coding Effort*	Plug & Play				✓				✓
Zero effort	True Plug & Play								✓

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Questions

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