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A 'Standards' Foundation for Interoperability

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A ‘Standards’ Foundation for Interoperability

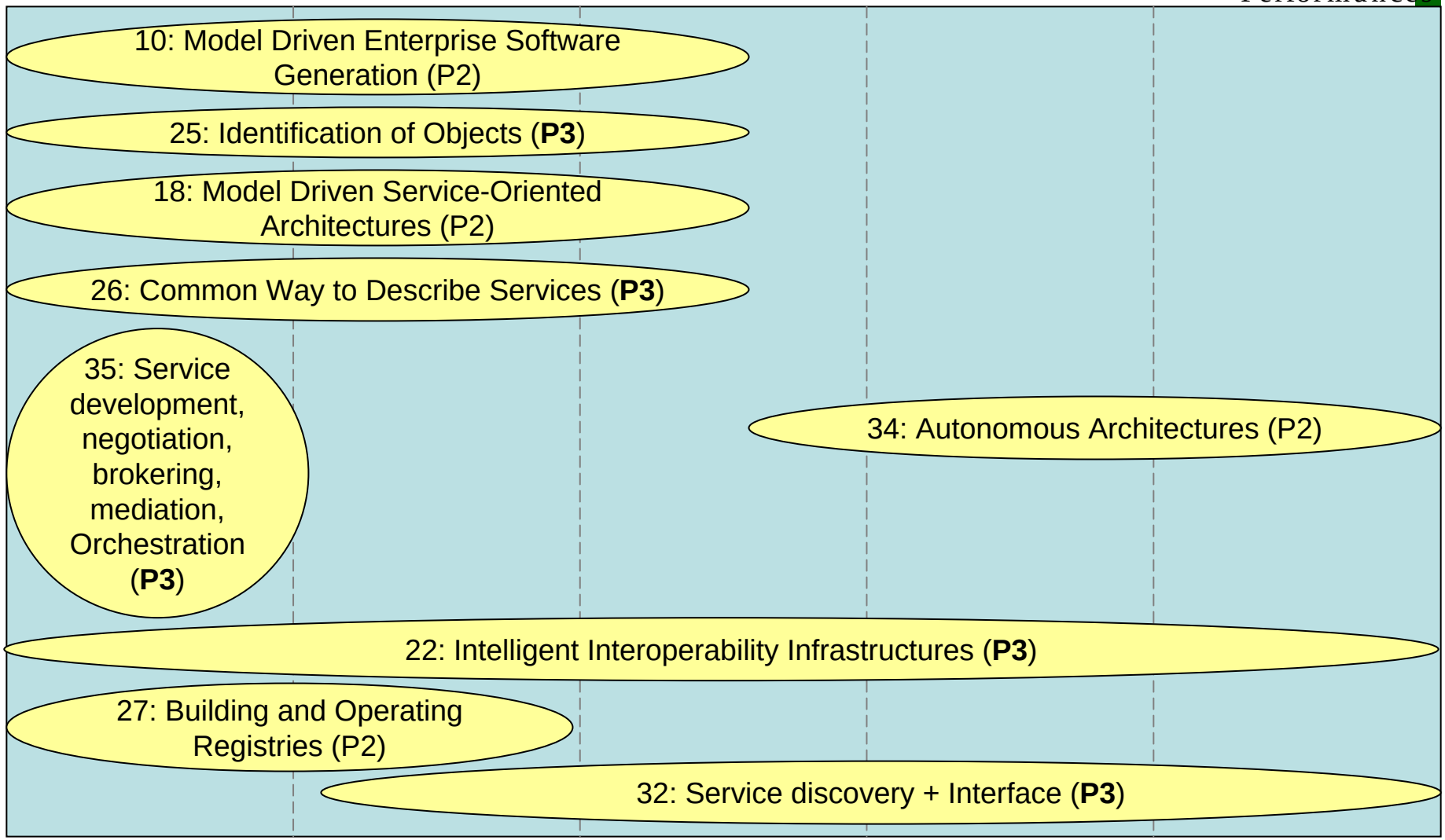
- Backdrop
- Dialog Terms
- Actors
- Past Performances
- On with the Show

IDEAS Gap Analysis

- EC FP6 project (deliverable D3.4, .5, .6)
  - Interoperability Development for Enterprise Application and Software
- Gap – "missing pieces in research, technology and standardization to achieve a particular goal"
- 36 Gap categories in 3 domains – Enterprise Model, Architecture & Platform, Ontologies

IDEAS Road map (Fig 13)

Backdrop
Dialog
Actors
Performances



NACFAM E-Manufacturing

- Interoperability problem is more complex because it requires agreement on certain common principles and features before truly interoperable solutions can emerge.
- Solutions must…have the trust and acceptance of the industrial and software communities.
- Requires a mechanism to convene the right decision makers to produce the necessary agreement.

The supply chain effect

- High costs of interoperability particularly impact small and medium sized suppliers
- They often have to maintain redundant and costly software packages in order to communicate with their large EOM customers.
- Large manufacturing companies have pushed costs onto SME's by requiring "standardization" around their preferred systems.

Source: Exploiting E-Manufacturing: Interoperability of Software Systems Used by U.S. Manufactures, NACFAM, Feb. 2001

Systems and Components

- Isolated
  - Proprietary [unique] implementations
  - Require human mediation to interact
- Unified
  - Direct component connections
  - Same conceptual representations
  - Same decomposition level distinctions
  - Emergent properties indistinguishable
  - Operates without human mediation

Systems and components

- Integrated
  - Indirect connections using transformations
    - A-priori knowledge of communication protocols
    - Dependent upon specific interfaces
  - Many distinct elements working together
    - Different conceptual representations
    - Emergent properties distinguished
  - Require human intervention to arrange syntax and semantics
  - Local focus (within enterprise)

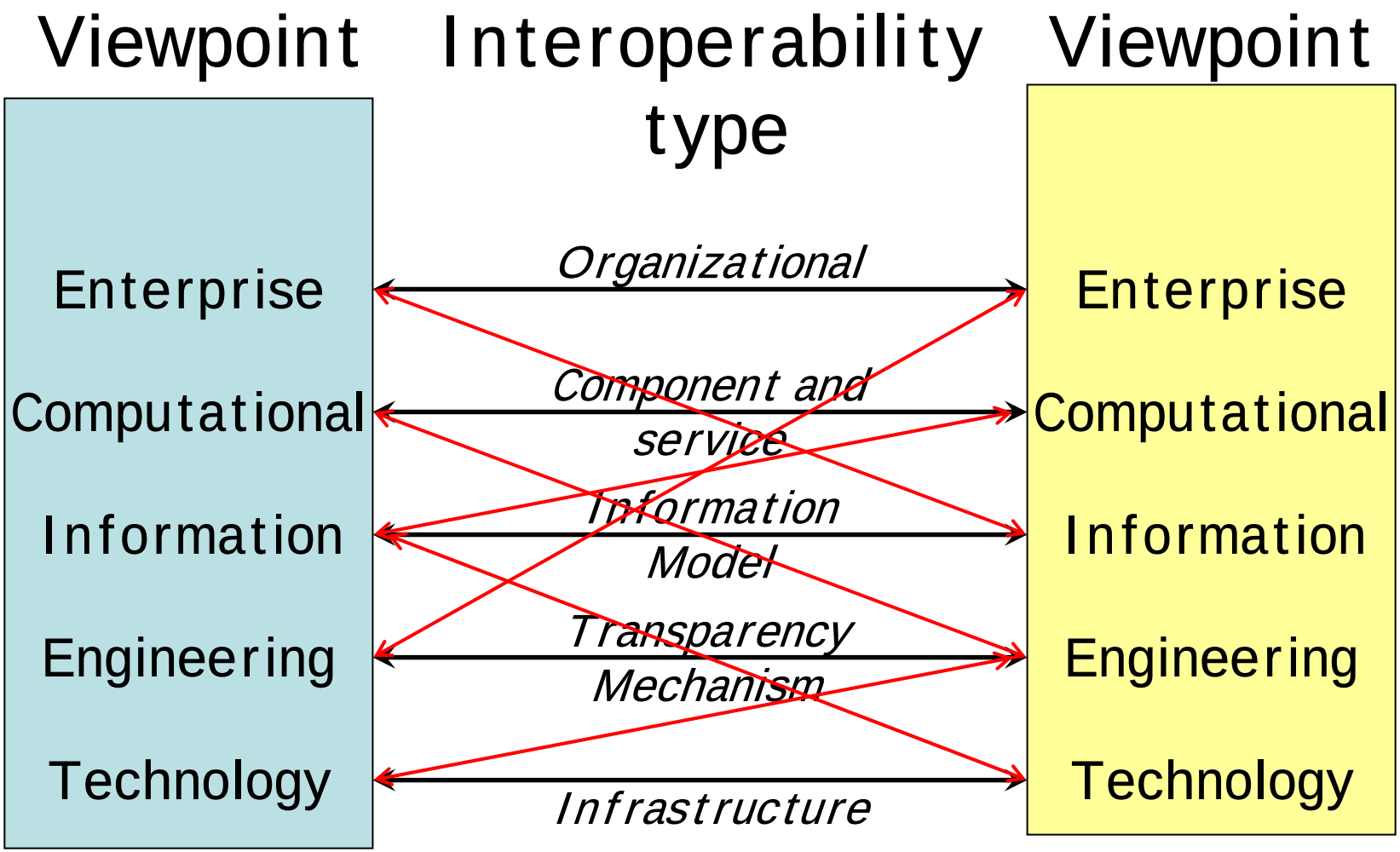
Systems and components

- Interoperable
  - Dynamic configuration of interaction
  - Minimal human intervention required for semantics
  - Automated agents interact & work on behalf of each other
  - Emergent properties result from interaction
  - Global locus (beyond an enterprise)
  - Multi-dimensional scope

Interoperable defined

- The ability of different types of computers, networks, operating systems, and applications to work together effectively, without prior communication, in order to exchange information in a useful and meaningful manner. There are three aspects of interoperability: semantic, structural and syntactical.
  library.csun.edu/mwoodley/dublincoreglossary.html

Multi-dimensional ODP



WG1 Interoperability

- A process, not an end
- Improvement always possible
- Levels of granularity, semantics, capability, and transaction load
- Successful interoperation
  - elicits desired behavior
  - within parameters deemed important
  - by humans operating the enterprise
- Choreography of interoperability act

The vocabulary problem

- SC5 Vocabulary Study – 2004 report
- 38 terms with multiple definitions in 7 Standards of SC5
- 51 Keywords detected in ISO 15745-1
  - 11 defined in section 3 with 5 of those defined in other SC5 standards
  - 9 normative references as additional definition sources
- Defining 'Resource'
  - 15745 series & others include consumables
  - 15704 & others do **not** include consumables

Resource – term usage

- Resource word use in 12 SC5 standards
  - 730 usage instances
  - 48 two word clusters used at least 5 times
    - 15 qualified
    - 15 as qualifier
    - 18 by proximate association only
- 12 other words analyzed
  - material, class, process, capability, object, model, segment, control, device, enterprise, production, profile

Who's standards

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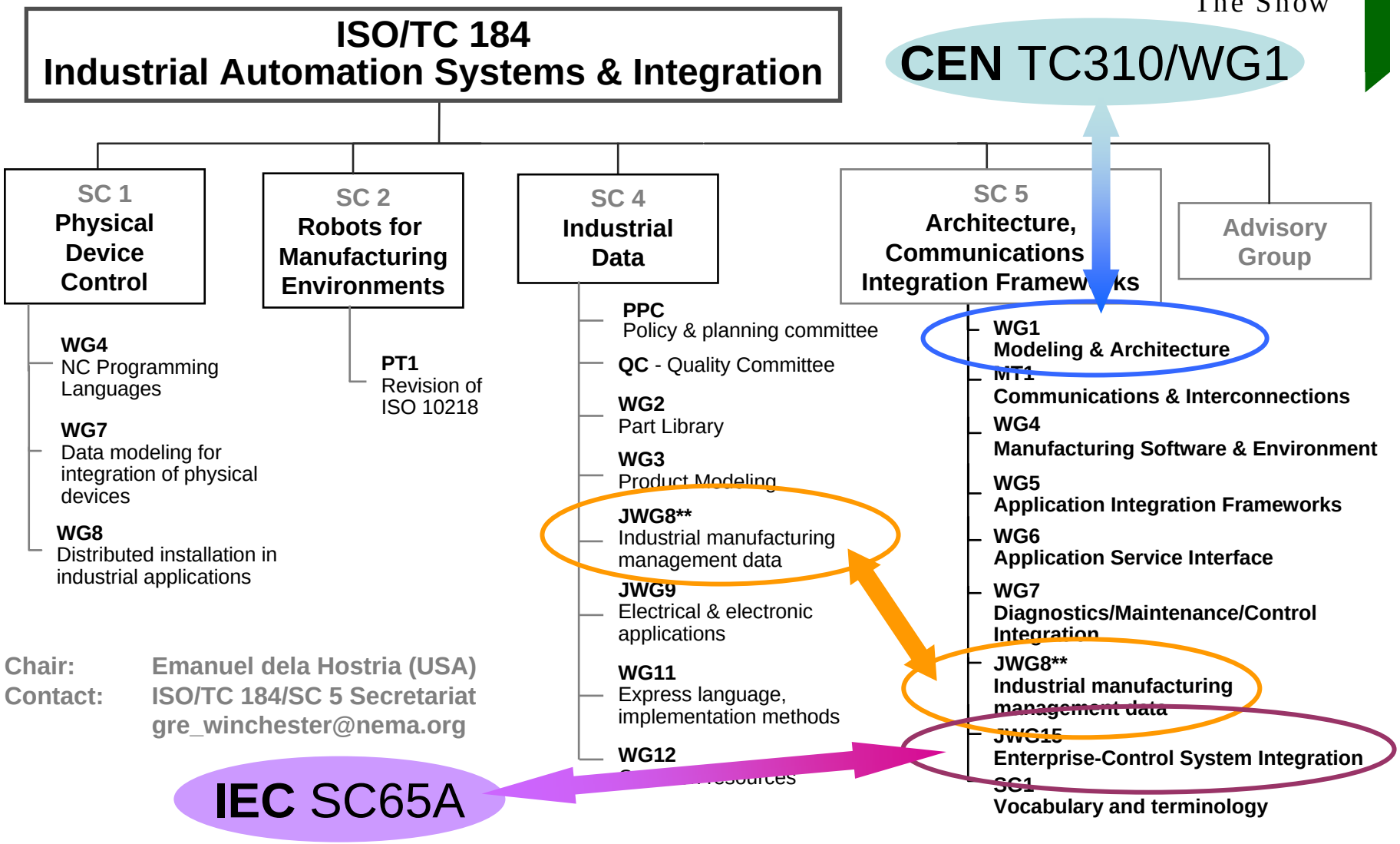
The Show



Industrial Data – SC4

- ISO 10303 - STEP (Standard for the exchange of product model data)
  - EXPRESS language and bindings
  - Conformance and testing
  - Common resources
  - Industry specific application protocols
- Over 100 documents with more coming

STEP success*

- Potential $928 million (2001$) savings per year by reducing interoperability problems in the automotive, aerospace, and shipbuilding industries in US
- ~ 17% ($156 million) of potential benefits quantified within scope of study are being realized
- Expect 75% benefit by 2010

(* 2002 Gallaher study results)

Why STEP succeeds

- Avoidance cost savings accounted for approximately half of the potential benefits of STEP
- 80% of avoidance costs were labor costs associated with the use and support of redundant CAx systems
- Mitigation costs resulting from file transfer and data reentry accounted for the balance of benefits

Process description

- ISO 18629
  - TC184 SC4/SC5 collaboration in JWG8
- PSL (Process specification language)
- Targets process information exchange
- Process information representation
- Process and model independence
- Lexicon, ontology, and grammar
- Different approach than ISO 10303
- 8 documents in various approval stages

Application integration

- ISO 15745 – Open systems application integration framework
- Application integration framework
  - Elements and rules for integration requirements using integration models
  - Application interoperability profiles as interface specifications
- UML based integration models
- XML schemas for profile templates

Profiles for integration

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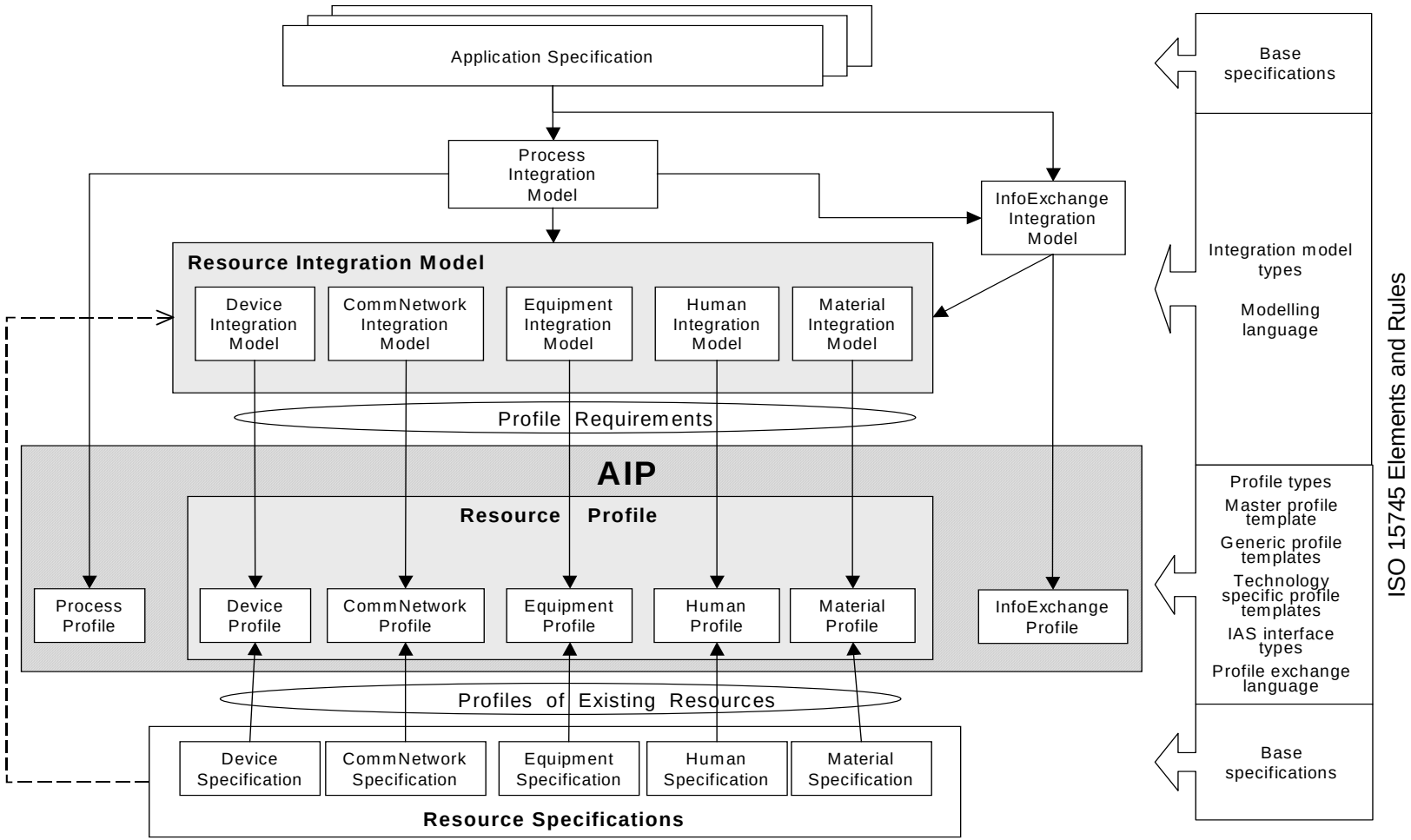

Source: ISO 15745-1 Figure 2. Profile development using ISO 15745

Software capability

- ISO 16100 – Manufacturing software capability profiling for interoperability
  - Characterization of software interface requirements
  - Software unit capability elements and rules
  - IDEF0, UML models and XML profile schemas
- Manufacturing software units shall interoperate with one another, in support of a manufacturing activity, when the services requested by the former can be provided by the latter, using the same operating environment.

Capability classes

- Manufacturing Capability classes
  - Domain, Application, Information, Process, Resources, Activity, Function, Software Unit
- Software Capability classes
  - Computing system, Environment, Architecture, Design Pattern, Datatype, Interface/Protocol
- Role Capability class

Basic concepts & rules

- ISO 14258 – Concepts and rules for enterprise models
  - Identifies basic notions of: Life-cycle, recursion, and iteration
  - Identifies concepts for structure and behavior representation using views
  - Places focus of standards for interoperability on inter-process communication.

Generalizing standards

- ISO 15704 – Requirements for enterprise-reference architectures and methodologies
- Merging of previous work - PERA, GRAI GIM, CIMOSA, and GERAM
- Presents principles for enterprise architecture
- Expands ISO 14258 concepts and adds notions of life history and genericity.

ISO 15704 review

- Amending to add new views for user specific concerns
  - Economic view and Decision view
- Systematic review to begin in 2005
  - harmonization with other WG1 efforts
  - expansion of some topics
- General Enterprise Reference Architecture and Methodology (GERAM) update

Scope of GERAM

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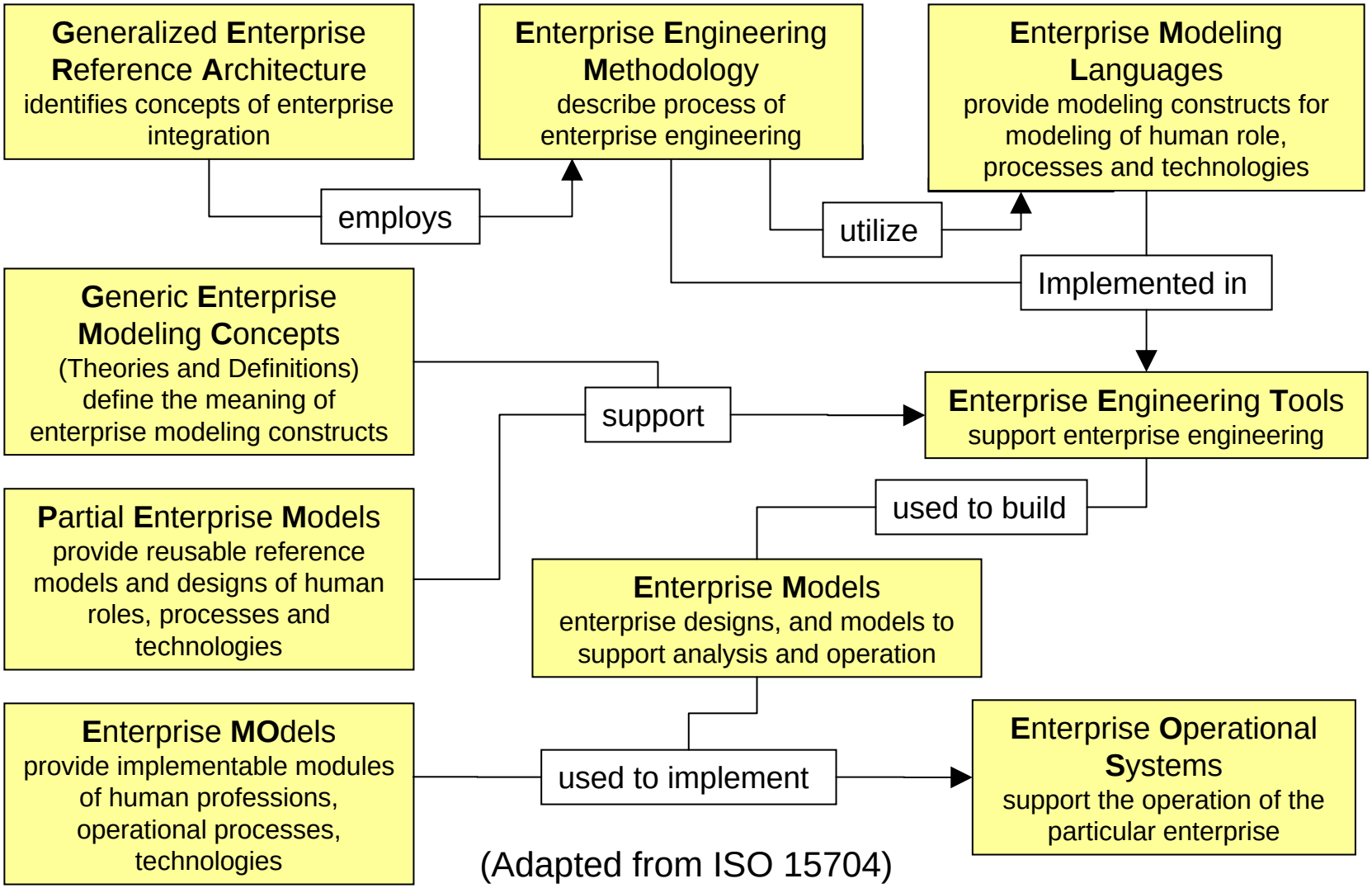
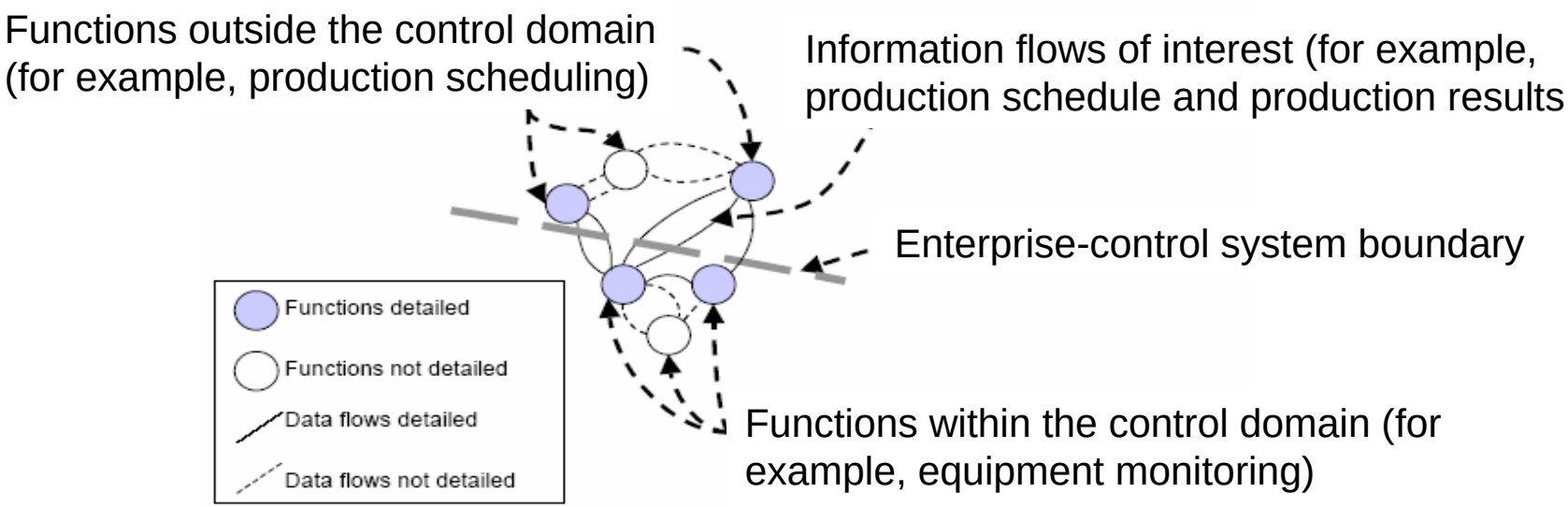


(Adapted from ISO 15704)

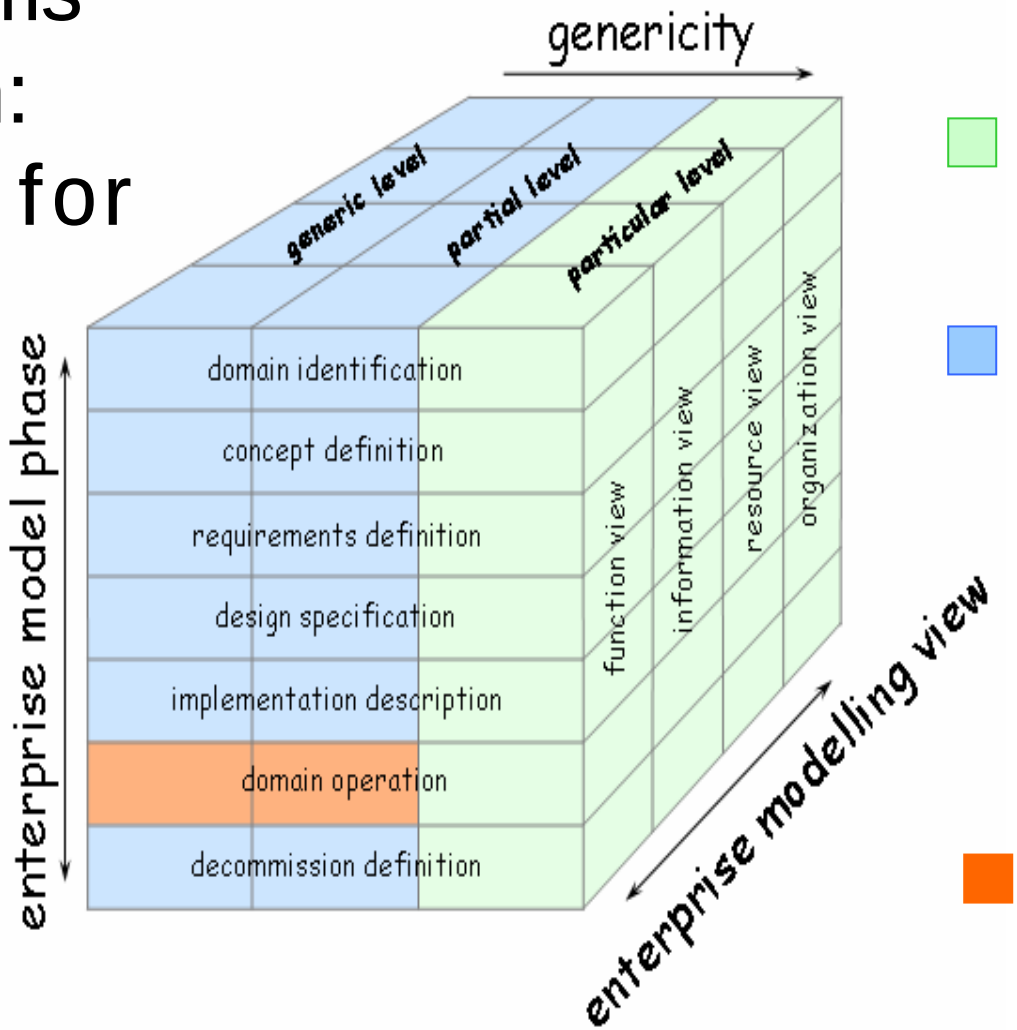
A boundary standard

- ISO 62264 Enterprise-control system integration
  - Object models for interfaces between enterprise business systems and manufacturing control systems



ISO/FDIS 19439

CIM Systems Integration: Framework for Enterprise Modelling



Particular level

Reference Catalog

not defined at the domain operation phase

ISO/DIS 19440

- Constructs for enterprise modelling
  - common semantics enable model unification
  - usable across phases of model development
  - support process-oriented approach
- Templates for specialization and organization into structures for a specific purpose

On with the show

- WG1 participant presentations – Bernus, Chen, Kosanke, Martin, and Shorter
- Get involved in standards development
  - target research toward identified gaps
  - document practice in standards terms
  - serve as working group participant
- http://forums.nema.org/~iso_tc184_sc5
- http://www.tc184-sc4.org
- IEC, IEEE, OMG, CEN, etc.