Setting the Standard for Automation™

# District 12 & Qatar Section

# Interoperability: ISA-95 part 2 / B2MML use cases


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Standards

Certification

Education & Training

Publishing

Conferences & Exhibits

**ISA Automation Conference – Doha (Qatar) - 9 & 10 December 2012**

# Agenda

- ISA95 snapshot
- Case 1 : Large company (>100 plants)
- Case 2 : medium company (3 plants)
- Case 3 : small company (single facility)
- Conclusion

# ISA-95 pradigm : Scope / goal

This standard describes the interface content between manufacturing operations and control functions and other enterprise functions.

…. The goals are to increase uniformity and consistency of interface terminology and reduce the risk, cost, and errors associated with implementing these interfaces.

The standard can be used to reduce the effort associated with implementing new product offerings.

The goal is to have enterprise systems and control systems that inter-operate and easily integrate.

# ISA95 snapshot

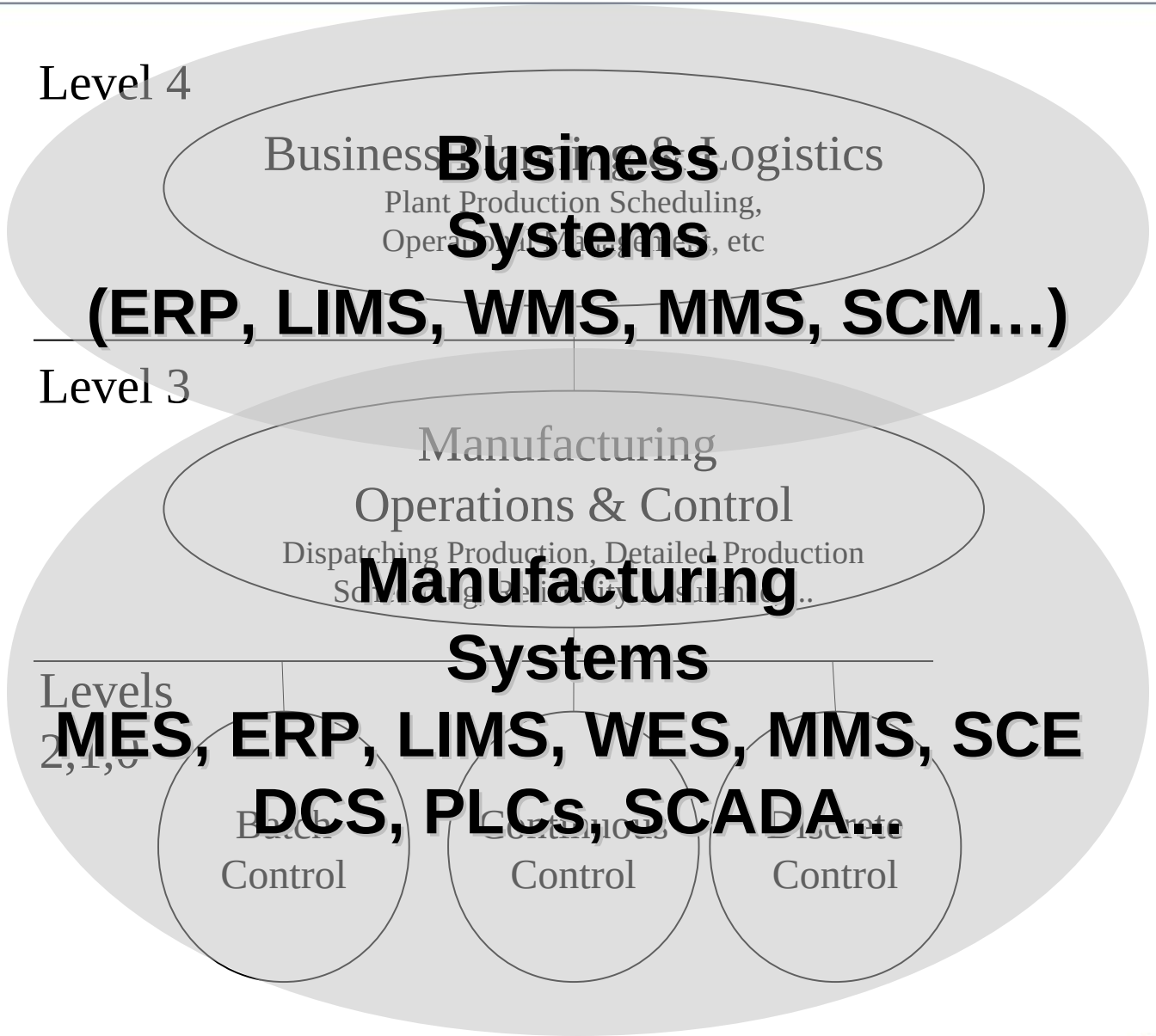
- B2M: Collaboration Business / Execution
  - Communication between execution systems (MES/MOM, DCS, MMS, LIMS, WES, SCADA,…) and business systems (ERP, SCM)
  - Master data management
- MES/MOM : Functional definition
- Data and Activity models
  - Description of resources, capability, products, work order requests and reports
  - Definition of operation management activities (MES)
- Applications:
  - User requirements and functional specification of MES and B2M interfaces
  - Native B2M connectors - MES/ERP (B2MML)
  - Possible basis for developing MES applications and software…

# What is ISA-95?

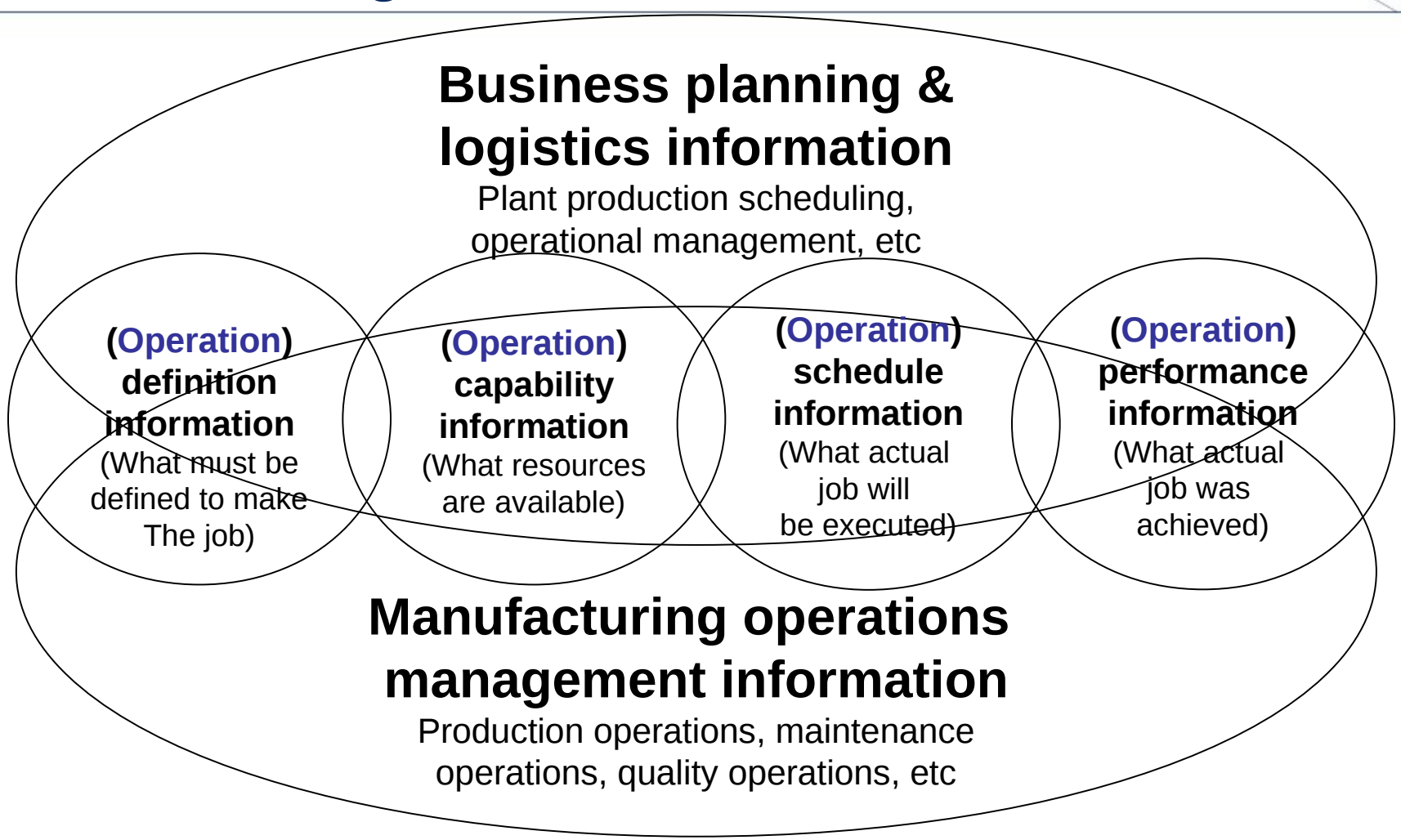
- US & International standard "**Enterprise - Control System Integration**"
- The ISA95 committee develops the ISA-95 standards
- The ISO/IEC JWG5 develops the international standard
- MSEA/WBF develops the XML implementation of the data models

| US standard | INTL Standard | Sub Title |
|---|---|---|
| ANSI/ISA-95.00.01: 2010 | IEC/ISO 62264-1: 2003 | Part 1: Models and Terminology" |
| ANSI/ISA-95.00.02: 2010 | IEC/ISO 62264-2: 2004 | Part 2: Data Structures and Attributes" |
| ANSI/ISA-95.00.03: 2005 | IEC/ISO 62264-3: 2007 | Part 3: Activity Models of Manufacturing Operations Management |
| ANSI/ISA 95.00.04 2012 | - | Part 4: Objects and attributes for manufacturing operations management integration |
| ASNI/ISA-95.00.05: 2007 | IEC/ISO 62264-5: 2010 (APUB) | Part 5: Business to Manufacturing Transactions |
| + B2MML V06 | | Business to Manufacturing Markup Language |

# Business-Operation systems Interface according to ISA95 part 2



# ISA-95 part 2 Models and terminology for manufacturing information




*Operations = Production, Maintenance, Quality, Inventory*

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# Context and challenge

- Central ERP system + hundreds of factories worldwide
- 3 selected control/MES vendors
- Difficult decision taken between
  - Let vendors taking care of integration
  - Adopt a company wide interoperability language : vendor neutral / company responsible ISA-95 interface
- Designed in Europe, developed in India, implemented and used everywhere

# Interface scope : 20 messages (phase 1)

| | ERP->MES | MES-> ERP |
|---|---|---|
| Production transaction | • Production Orders<br>• PO status change | • PO reports : material produced, consummed, down times<br>• PO status change |
| Logistics transactions | • Transfer Orders – in and inter plants | • TO reports and cancellation<br>• “Spontaneous” transfer<br>• Raw material reception |
| Inventory transactions | • Material status change<br>• Inventory response | • Material status change<br>• Inventory query |

# Work methodology

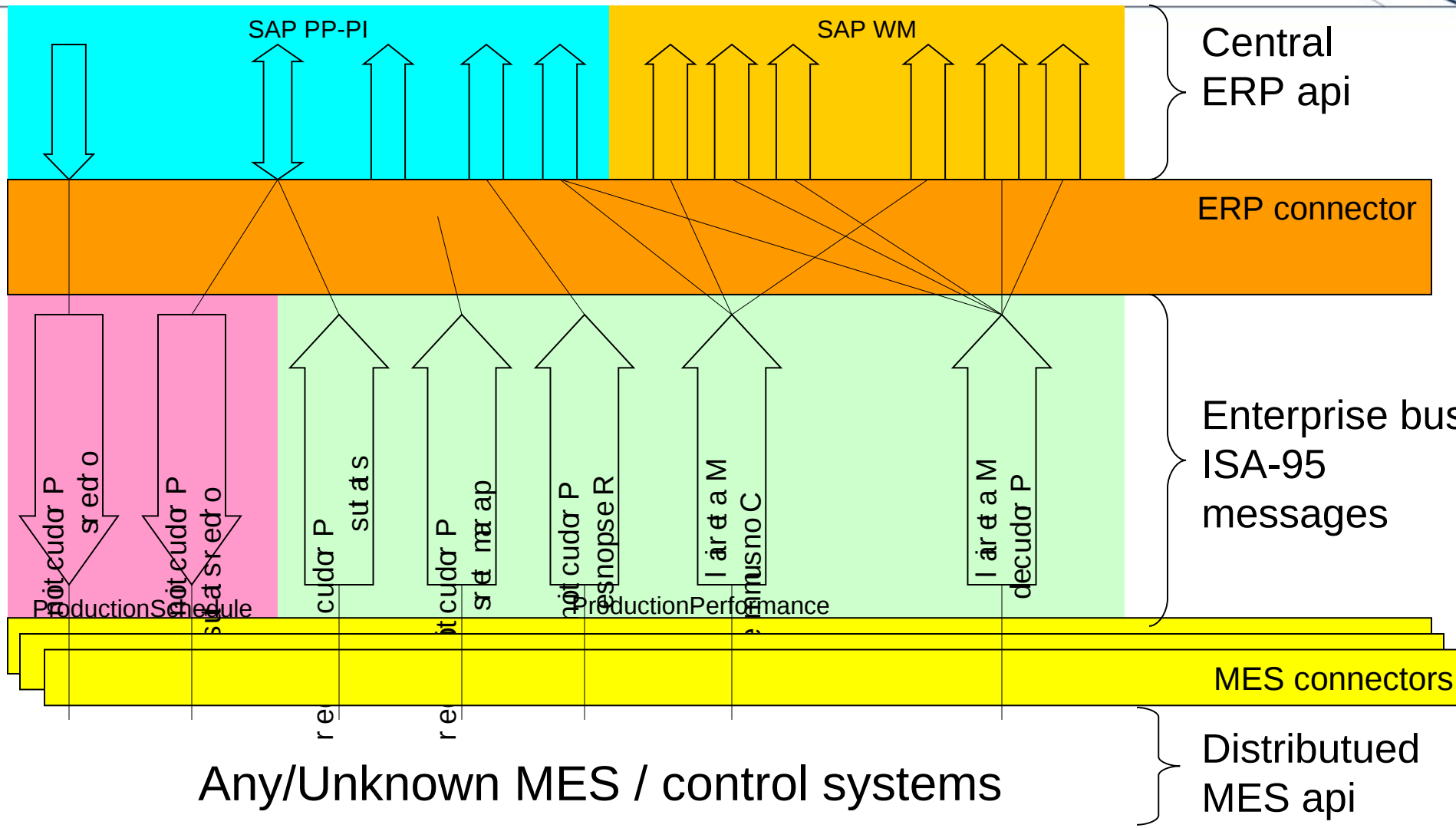
- Messages identification and content provided by ERP functional consultants
  - Factories IT, MES vendors / integrators were never invited!
  - Opportunistic design, no high level guidance
- Mapping of message through workshops involving
  - ERP consultants, ISA-95 expert
- Extension and adaptation of ISA-95, B2MML
  - Company specific B2MML and ISA-95 extensions to overcome their limitations at this time (2004) – a major input for the next releases
    - ISA-95: Handling of inventory (and other) operations types
    - B2MML: Custom extensions

# Specification structure

- Very simple:
  - we don’t care of systems but ERP
  - Everyone speaks SAP in the design team…
  - All other parties will just need to know ISA-95 (MES integrators)

```
+ISA-95 models (ex : Operations Schedule)
   +Message  (ex : Process Production orders)
      +Message rows
         - ISA-95 concept (ex : SegmentRequirement.ID)
         - SAP field (ex : Y_MES_H PPPI_CONTROL_RECIPE )
```

# Example


SAP PP-PI
SAP WM
Central
ERP api
ERP connector
Enterprise bus
ISA-95
messages
MES connectors
Distributued
MES api
Any/Unknown MES / control systems

# Outcome

- Outcome
  - Design of ERP/MES through ISA-95 like enterprise language
    - only needs to be considered from ERP – can ignore MES
    - No need for ERP / MES meetings
  - Interface deployed worldwide
  - « Perfect delivery »
    - the initial spec/schemas are still in use - no update after 8 years
  - Subsequent extension for Quality
- ISA-95 support : 40 days / 1 year
  - Detailed message definition, Functional specification writing
  - Many meetings…

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# Context and challenge

- Central ERP system + 3 factories in Europe
- ESB Messaging framework available but deemed too expensive  / complex => abandoned
- Objective :
  - Enterprise controlled interfaces
  - Integration implemented by MES vendor using native systems interfaces

# Interface scope : 14 messages

| | ERP->MES | MES-> ERP |
|---|---|---|
| Production transaction | • Production Orders<br>• PO change | • PO reports : material produced, consumed, |
| Inventory transactions | • Sync material lots | |
| Master data transactions | • Sync material definitions<br>• Sync Equipment definitions | |

# Work methodology

- Messages identification and content provided by company's business consultants
- Build a taxonomy of the enterprise language
- Provide a mapping
  - based on business terms
  - Providing translation in ERP and MES terminology
- Only 3 meetings to gather requirements and wrap up the whole detailed mapping specification

# Specification structure

- More elaborated
  - The goal is to be understood by Business, ERP and MES people
  - Still simple: only 2 systems involved
- Dictionary
  - Business terms with definitions

```
+ISA-95 models (ex : Operations Schedule)
   +Messages        (ex : Process Production orders)
      + message rows
         - ISA-95 concept (ex : SegmentRequirement.ID)
         - Business data
         - SAP data (ex : Y_MES_H PPPI_CONTROL_RECIPE )
         - MES data
```

# Outcome

- Outcome
  - A handy spec detailing all messages  in 3 languages : ERP, MES and Business
    - understandable by all stakeholders
  - Only a specification
    - No messaging involved,
    - Direct peer to peer connexion between MES and ERP  under vendor’s responsibility
- ISA-95 support: 15 days / 1 month
  - Detailed message definition

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# Context and challenge

- A complex interface project involving 7 different systems
  - The most complex among these 3 use cases
- Strictly limited budget for external support
  - 2 days workshop planned for knowledge transfer
  - Design to realized internally

# Interface scope : 20 messages

| | ERP/MDM/LIMS/SCADA ->MES | MES-> ERP/LIMS/SCADA |
|---|---|---|
| Production transaction | • PO reports<br>• Temperature reports | • deviation reports and ack<br>• Production orders |
| Logistics transactions | | • Material movements |
| Quality transactions | •Quality report | Quality order |
| Inventory transactions | • Material reception<br>• Material quality | • Weight control order |
| Master data transactions | • Sync material definitions | |

# Work methodology

Only 2 days budget :

- 1st day :
  - Teach ISA-95+B2MML: High speed knowledge transfer
  - Team's brain overload
  - Manager's desperation : "Find another way by tomorrow"
- 2nd day
  - All 20 messages identified and drafted
  - Definition of an XML enforced  company language +ISA-95 spirit
    - Using an ISA-95 (really simple) meta-model
- 3rd day (over-budget)
  - Review of the internal team work

# Specification structure

- Most sophisticated
  - Multiple systems involved

** Definition of a company specific language, from the actual interoperability needs – No ISA-95 involved, but its rational*

+Transaction class (ex: material master)
  +ISA-95-like* models (ex : Material)
    +Transaction Messages (ex : Create Material)
      + message rows
        - ISA-95 concept (ex : SegmentRequirement.ID)
        - Business data
        - Origin system data (ex : Y_MES_H PPPI_CONTROL_RECIPE )
        - Destination system

# Outcome

- Outcome
  - Full autonomy achieved in 3 days
  - Smart design
  - Low cost
- ISA-95 support : 3 days / 1week
  - Get the team thinking the ISA-95 way

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Different way of leveraging the ISA-95 standard

- Can be used for
  - Requirement specification (ISA-95)
  - Actual messages generation (BMML)
- Can represent
  - The canonical enterprise language
  - A meta language for a company specific language
- Is independent of the middleware technology
  - Peer-to-peer proprietary synchronous connexions
  - XML based asychronous messaging middleware
  - Other : text file transfer…
- Investment varies in large extend
  - Almost independent of the scope and complexity

# J. Vieille's Professional biography

37 years of experience  in Information support to industrial systems

- Control and management of industrial operations
  - Modular/Flexible Automation → ISA-88
  - Operations Management (MES/MOM) → ISA-95
  - IT Systems Interoperability → B2MML
- Industrial IT governance and Organization
  - Support to Business Operations and transformation
- Software solutions
  - Assessment and selection
  - Functional architecture design roadmap, technology acquisitions
- Information physics and systems theory

ISA

  - Past D12 Vice President and France section President
  - ISA-88 and ISA-95 member

# Thank You

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