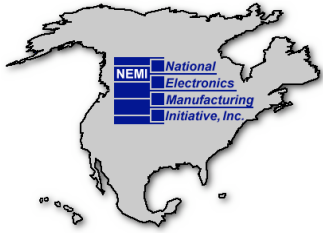




Spanning the Virtual Factory: Managing Supply Chain Communications

*NEMI Free Forum
APEX
April 1, 2003*

*Barbara Goldstein, NIST
bgoldstein@nist.gov
301-975-2304*



Agenda

Product Lifecycle Information Management: Business Trends and Anticipated Technology Needs

Barbara Goldstein, NIST

The PDX Standard at Work: A View From the Field

Doug Furbush, Georgia Tech

NIST Internet Commerce for Manufacturing Testbed: Exploring Supply Chain Integration in Manufacturing Using E-Commerce Standards and Technologies

John Messina, NIST

Connect with and Strengthen Your Supply Chain

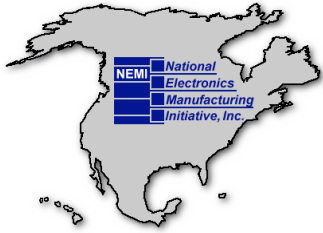


Product Lifecycle Information Management: Business Trends and Anticipated Technology Needs

Barbara Goldstein, NIST

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301-975-2304



Agenda

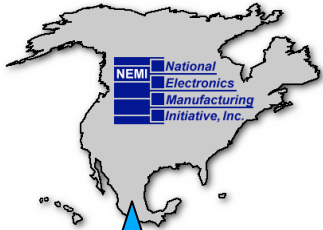
What is the National Electronics Manufacturing Initiative

Product Lifecycle Information Management – Highlights from Industry’s Roadmap

What’s Changed Since Previous Roadmaps

NEMI’s PLIM Project Portfolio

Connect with and Strengthen Your Supply Chain



National Electronics Manufacturing Initiative



NEMI **Roadmaps** the Needs of the North American Electronics Industry.

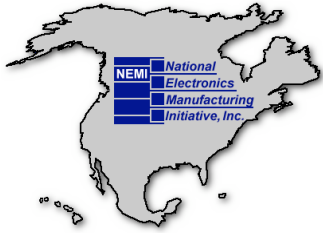
NEMI **Identifies Gaps** in the North American Infrastructure.

NEMI **Stimulates R&D Projects** to fill these Gaps.

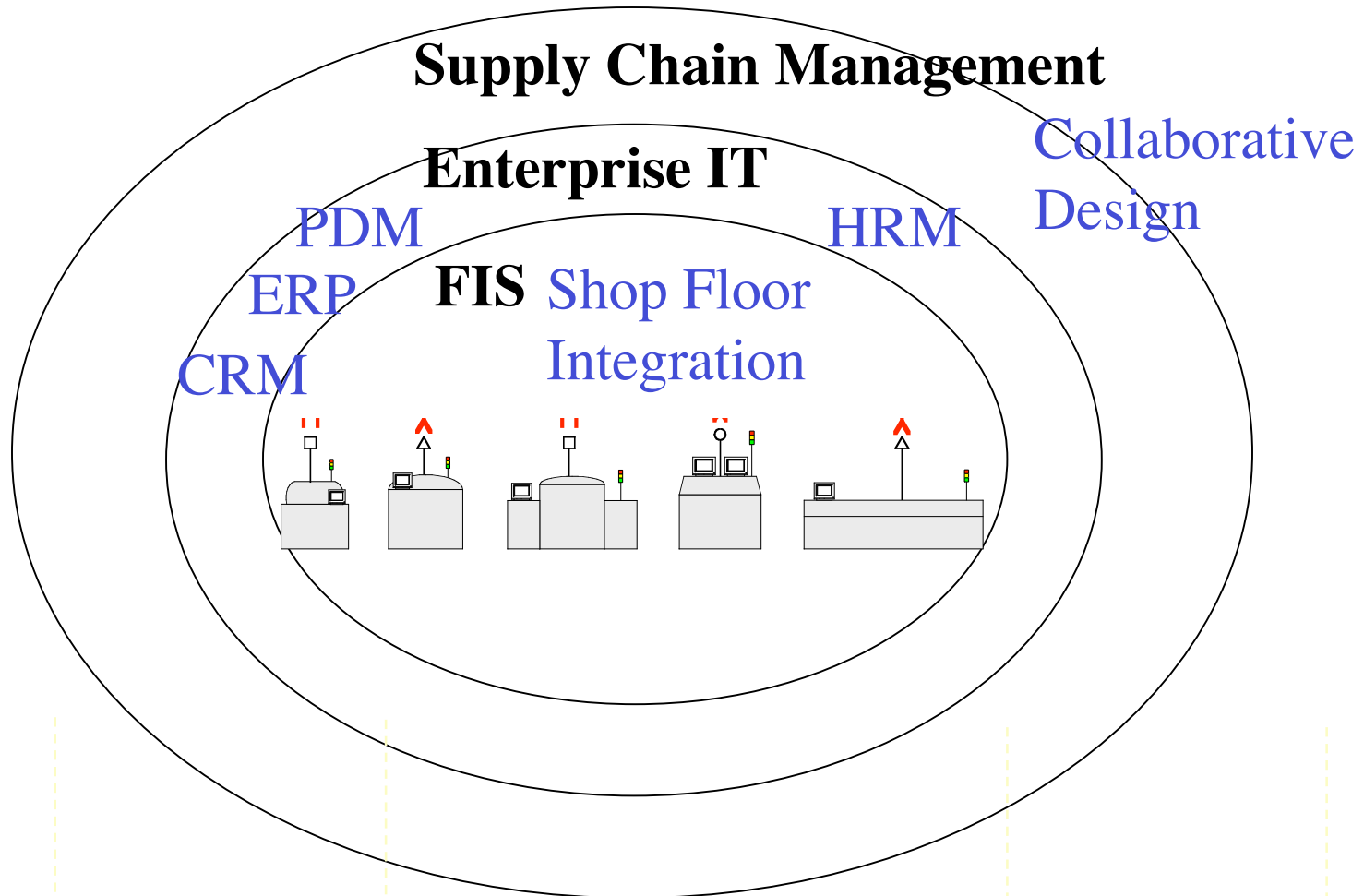
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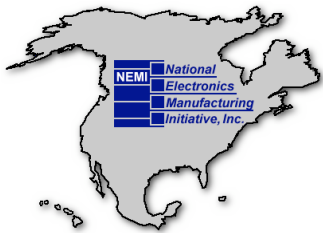
Connect with and Strengthen Your Supply Chain



Product Lifecycle Information Management

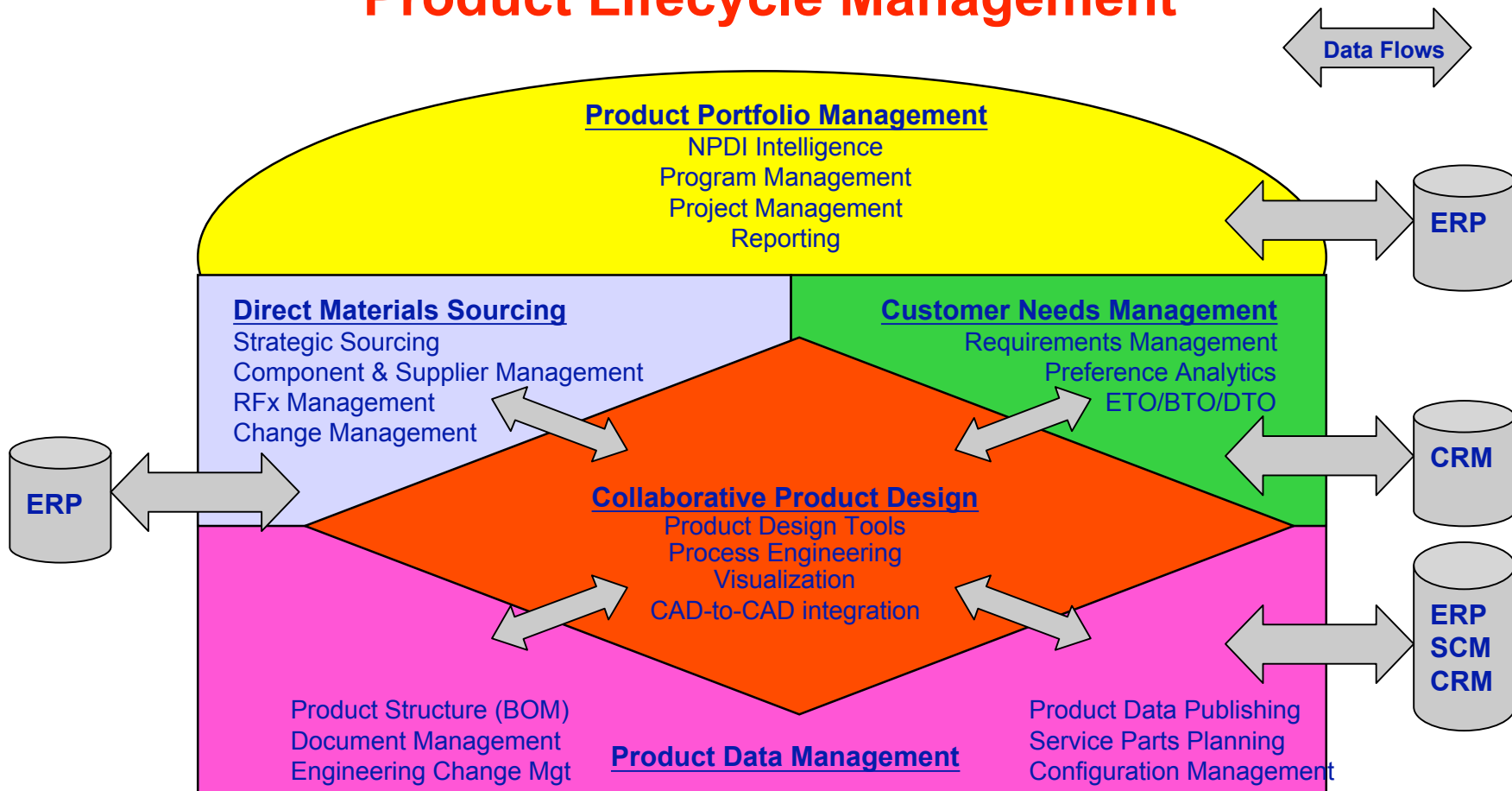


Connect with and Strengthen Your Supply Chain

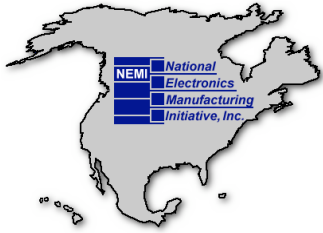


We Lucked Into a New Buzz Word

Product Lifecycle Management



Connect with and Strengthen Your Supply Chain



Companies Participating Included

**Alan Weber &
Associates**

Cadence

Celestica

**Collaborative
Synergies**

Compaq

E2open

Intel

Connect with and Strengthen Your Supply Chain

Mentor Graphics

Meta Group

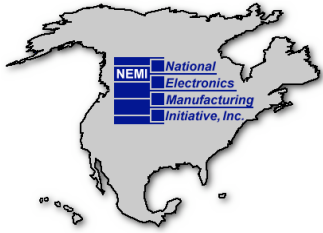
NIST

Nortel Networks

Sanmina-SCI

**Supply Chain
Council**

Teradyne



Where We Looked for Guidance

Questionnaire

www.supply-chain.org/NEMI/NEMI_1.asp

Supply Chain Council

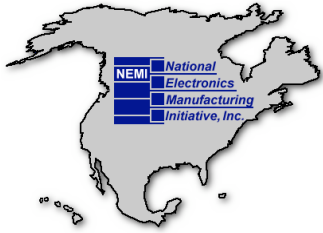
- Case studies from SCC World 2002

NEMI Engineering Collaboration Forum

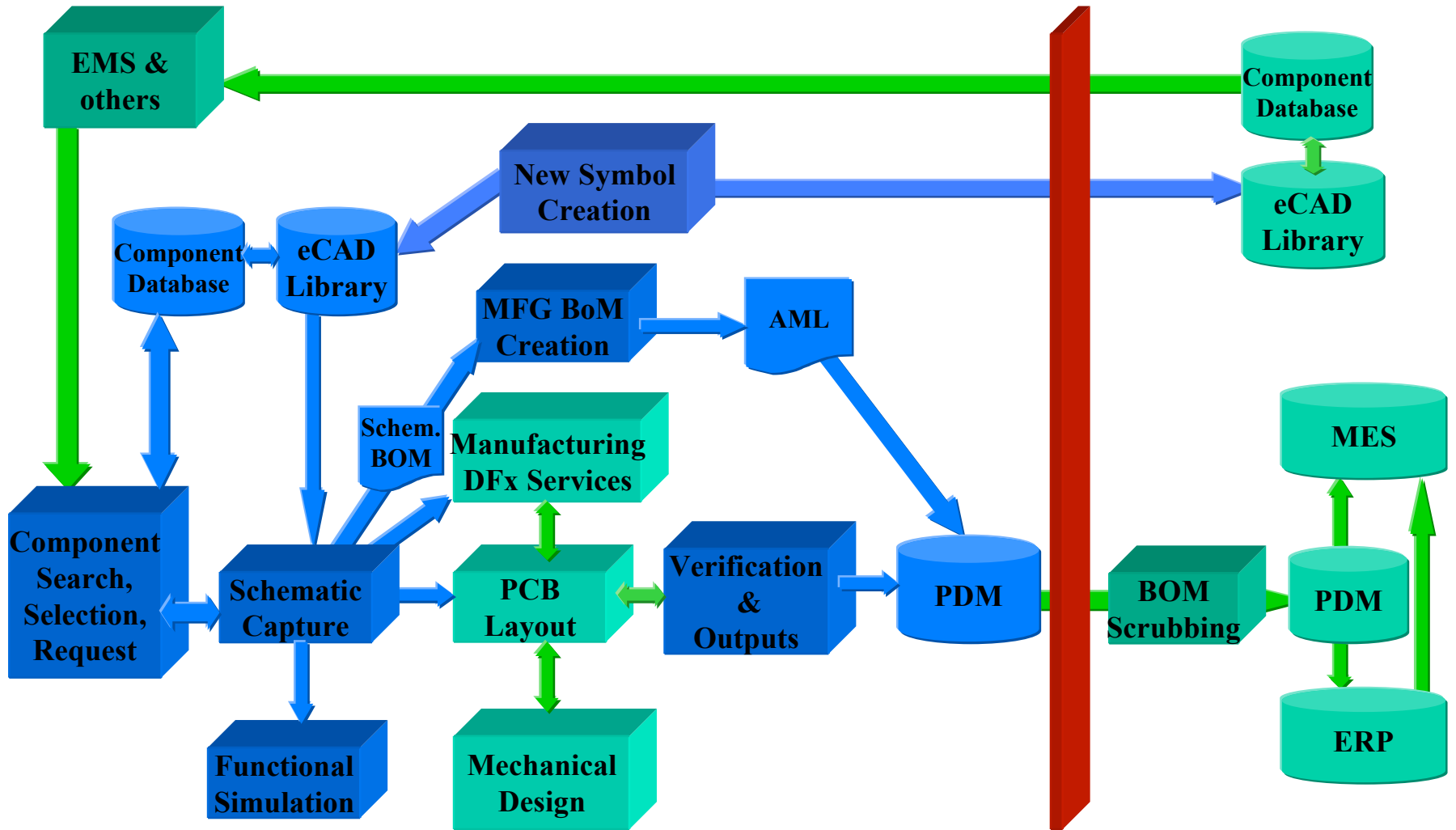
NEMI “Perfect BoM” Task Group

Ourselves ☺

Connect with and Strengthen Your Supply Chain



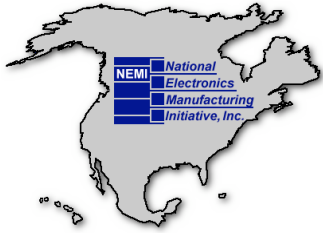
Perfect BOM Team: Design to Manufacturing BoM Flow



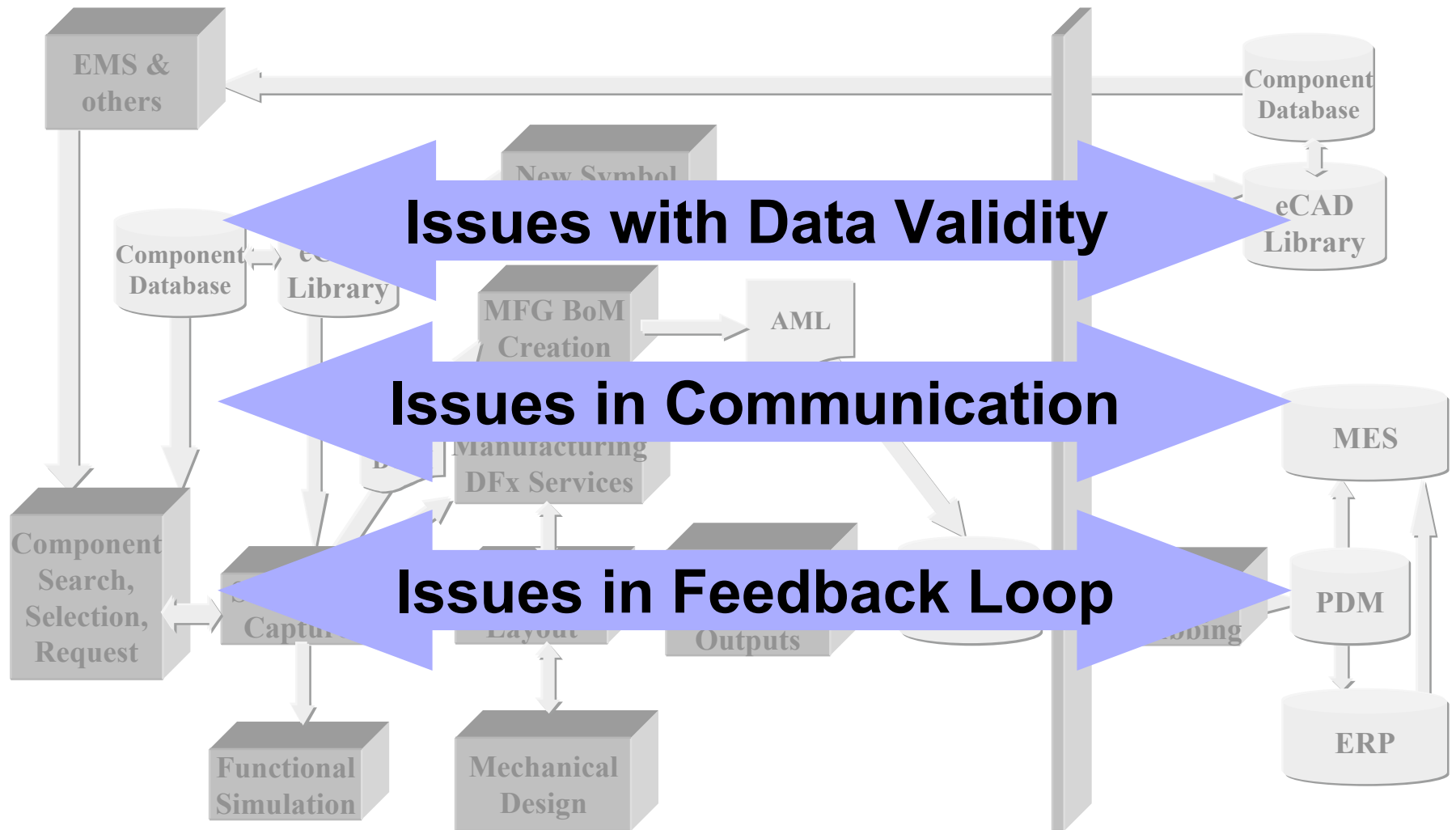
Blue - OEM

Green - EMS/Design Services

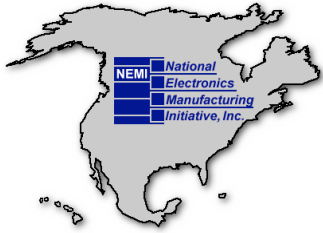
Connect with and Strengthen Your Supply Chain



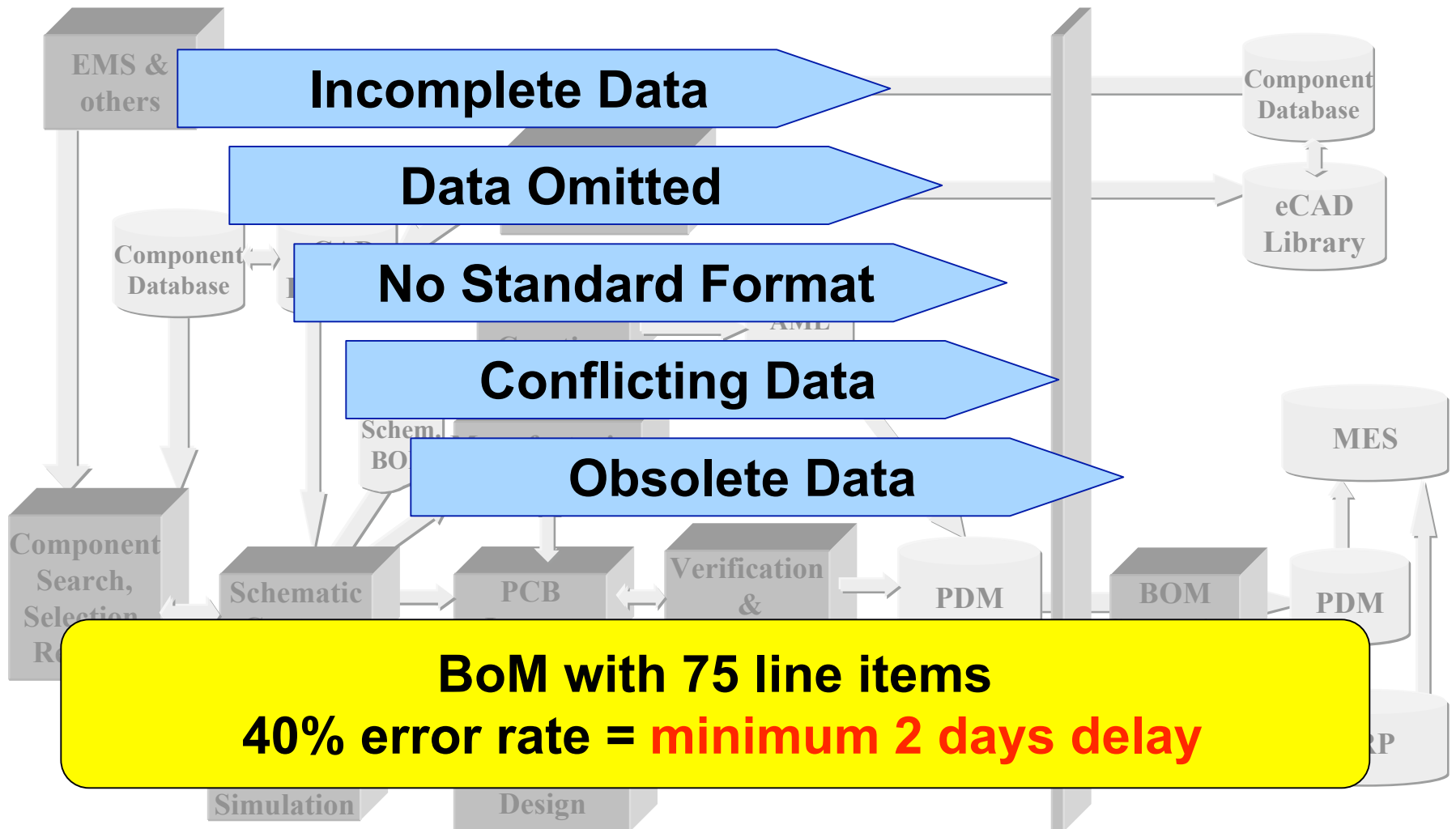
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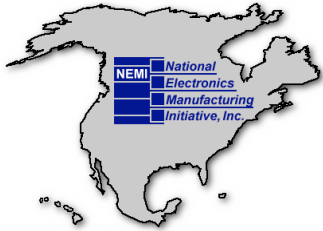
Connect with and Strengthen Your Supply Chain



Perfect BOM Team: Design to Manufacturing BoM Flow



Connect with and Strengthen Your Supply Chain



Perfect BOM Team: BoM Defect Observations

**BoM
Released
To EMS**

**Neutralize
& Validate
BoM**

**Inconsistent
format**

Hard copies

**Inconsistent
with CAD
files**

**Foreign
language**

80%

**Validate
& Set Up
Components**

**Inconsistent
content**

**Invalid
supplier info**

**Incomplete
information**

**Missing
information**

**Customer-
specific Info**

40%

**Source
Material**

Allocations

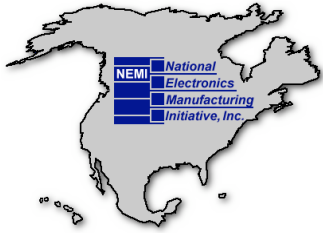
**Supplier
withholds
customer
information**

**Obsolete
parts**

20%

**Material
Pipeline
Established
(all parts
ordered)**

Connect with and Strengthen Your Supply Chain

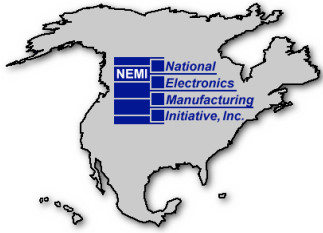


Factors Shaping Business Climate: Stating the Obvious

- **Economic Downturn**

*...is pressuring companies into risky
and innovative business models*

Connect with and Strengthen Your Supply Chain

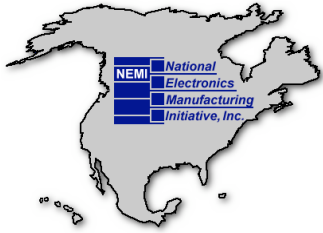


More Factors Shaping the Business Climate

- Emergence of the Original Design Manufacturer (ODM)
- Commoditization of electronics
- Globalization of outsourcing
- Rapid construction and decommissioning of plants
- Distributed liability and postponement of ownership
- Management of product end of life
- Market solutions based on standards
- Web Services gaining momentum

– *or are they?*

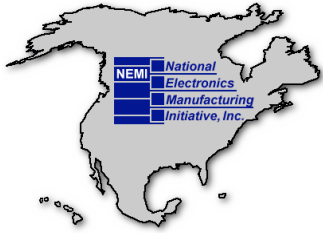
Connect with and Strengthen Your Supply Chain



Metrics of Interest in OEM / ODM Type of Relationship

- **Time required to perform back end software integration and testing when initiating a new partnership with an EMS or ODM**
- **Cost to bring new EMS or ODM online**
- **Cost of B2Bi (Business to Business integration) gateway implementation**

Connect with and Strengthen Your Supply Chain



Metrics in an OEM / EMS Type of Relationship

Actual vs. quoted costs:

material

standard cost

Non-Recurring Engineering

Actual delivery against promised for the period

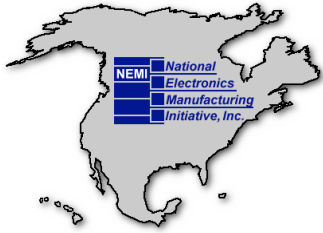
NPI

Interval from product data receipt (from OEM) to data loaded into EMS systems, including ERP/MRP (ready to order)

NPI

Interval for DfX (Design For ...) analysis (includes product data load into requisite EMS systems) and report

Connect with and Strengthen Your Supply Chain



Key Issues are (still) Political

- **Standardization**

- Pace never keeps up with technological change
- But somehow we have too many of them anyway

- **Standards convergence**

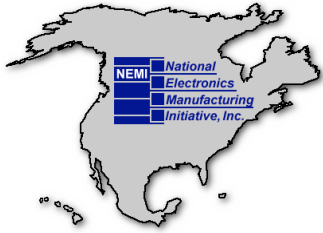
- **Standards adoption**

- Value of standard **DEPENDS** on adoption

- **Inherent conflict between outsourcing objectives and the IT it requires**

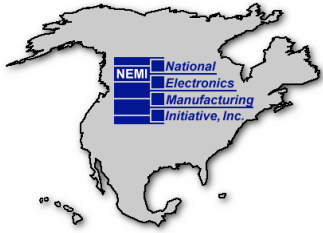
- Outsourcing promotes silos of expertise
- Collaboration is by definition multi-disciplinary

Connect with and Strengthen Your Supply Chain



But, Technically Speaking, We Still Have Gaps

- **Available to Promise – the holy grail**
 - **Available to Build:** *knowledge from across supply chain & local inventory that parts are available*
 - **Clear to Build:** *parts in place; clear to go*
- **Third party logistics**
- **Collaboration standards & tools**
- **Business process integration / exchange**
 - Lack of distinction between public & private processes
- **Design for Postponement, Configure to Order**
Connect with and Strengthen Your Supply Chain



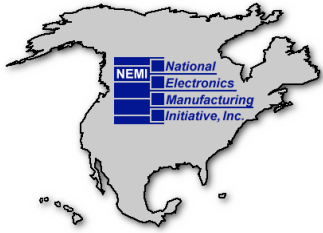
So, What We Need Is To...

- **Adopt and promote available standards for value chain interaction**
- **Develop new standards (only) when necessary**
- **Contribute to efforts that encourage the convergence of disparate standards efforts**
- **Lay the groundwork for collaborative business process integration**

Connect with and Strengthen Your Supply Chain



So, What's New?



Factory Information Systems Technology Drivers – 1996

“Factory Information Systems cost too much, they are inflexible and we do not understand how they work.”

December 1996 NEMI Roadmap

Technology Drivers:

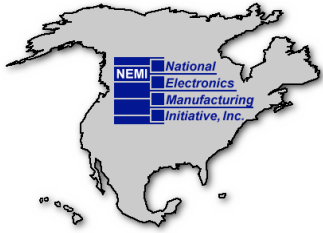
Complexity *requires flexible, high-capital factories with best-of-breed software*

Competition *forces shortened Concept-to-Market and Order Fulfillment cycle times*

Cost *requires increased factory utilization and efficient processes*

Customer expectations *demand custom products at mass-production prices*

Globalization *has created distributed supply chains, facilities and partnerships*
Connect with and Strengthen Your Supply Chain



FIS Technology Drivers – 1998

- **Management by Exception**

- FIS applications need to alert managers to potential problems in time to take corrective action.

- **Quicker turn of prototypes into volume production**

- Automating New Product Introduction (NPI) process is a high priority for manufacturers.

- **Growth of Contract Manufacturing (CM)**

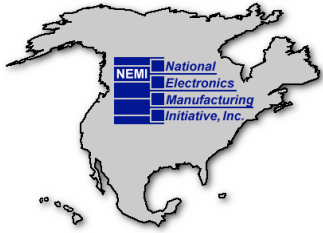
- Requires new efficiencies and greater breadth in Supply Chain communication.

- **Customer frustration with integration issues**

- Creating a demand for complete solutions from single vendors.

Thanks to Bill Swanton, *Are Electronics Plants Outgrowing Their Software?*, AMR Report.

Connect with and Strengthen Your Supply Chain



Supply Chain, FIS, Enterprise IT - 2000

A shift in focus from unit cost to total delivered cost and life-cycle product cost

Addition of “design for supply chain management” to DFX

Y2K drove IT investment!

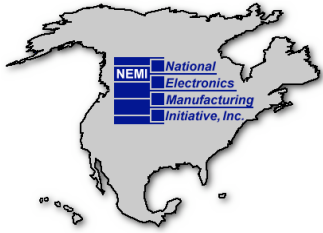
Emergence of ASP's, early starts at collaboration tools

Critical skilled labor shortage

Growth through acquisition has focused attention on internal integration

COTS implementation dropped from months to weeks

Connect with and Strengthen Your Supply Chain



What's Changed in Last 2 Years

Expansion in scope of EMS role

- From OEM to ODM (Outsource Design Manufacturer) model
- EMS branding of designs

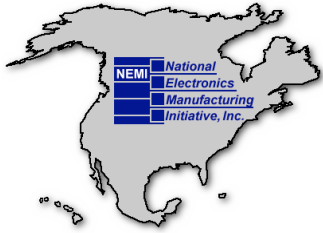
Availability of new standards, some NEMI initiated

- PDX for BOMs, engineering changes, genealogy
- CAMX for shop floor integration
- but adoption is still an issue!

Evolution of consortia-based standards

- RosettaNet Partner Interface Process specifications
- ebXML, OASIS
- Open Application Group

Connect with and Strengthen Your Supply Chain



What's Changed in Last 2 Years (continued)

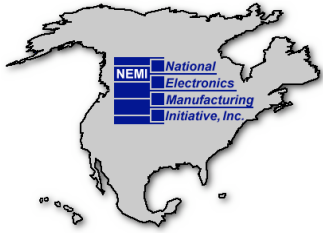
Web Services gaining momentum

- Allow for integrated outsourced operations,
- Accelerate business process negotiation
- Web Services Architecture:
 - Service providers – describe services in XML-based WSDL.
 - Service requestors – customers.
 - Service brokers – automated matchmaker function.
- *New project idea*: wrap PDX PIPs in SOAP, turn them into web services & create win for ebXML & RN.
 - If that made sense to you, join our TIG!!

Buzzwords are changing

- What's hot: PLM, XML, web services, collaboration
- What's not: B2B, EAI, EDI, ASP, exchange, stock options
- But issues are remarkably constant!

Connect with and Strengthen Your Supply Chain



What's Changed in Last 2 Years (continued)

Outsourcing increasingly global

- Even design is moving off-shore
- Low cost labor still a driver
- China, China, China
- Moving physical product around world stresses logistics systems

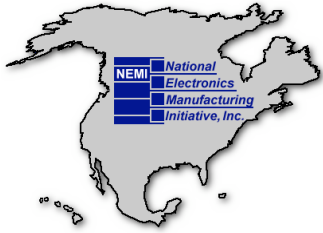
Standards are a competitive factor – believe it or not!

Money is not the issue

- Need for an IT budget seems well-understood

Collaboration technology key for competitive advantage

Connect with and Strengthen Your Supply Chain



National Electronics Manufacturing Initiative

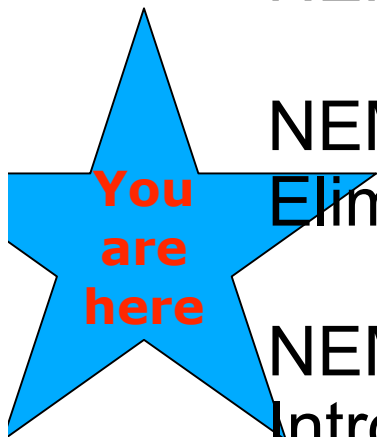
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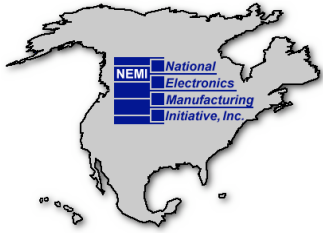
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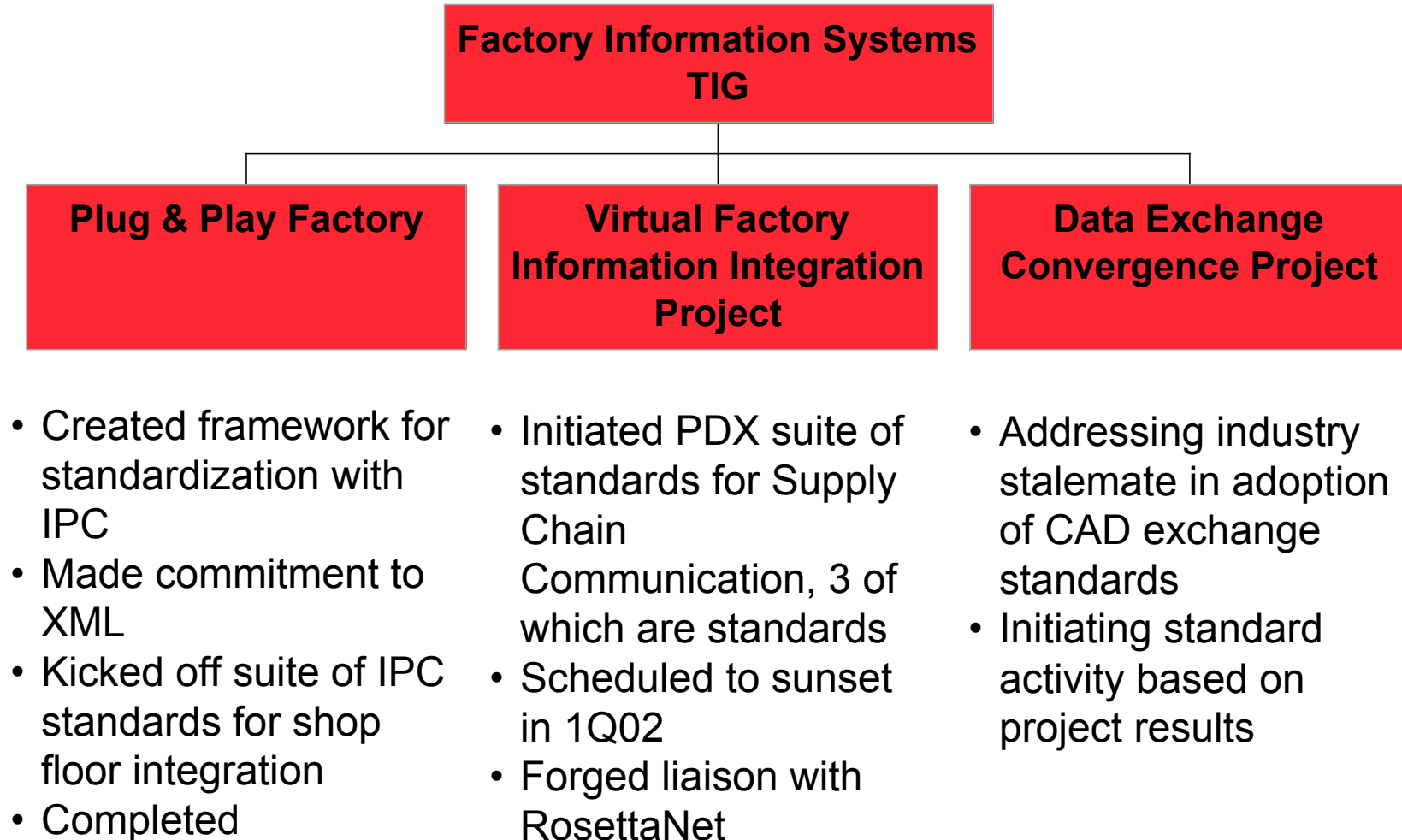
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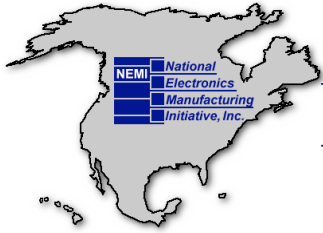
Connect with and Strengthen Your Supply Chain



NEMI's PLIM Project Portfolio



Connect with and Strengthen Your Supply Chain



IPC / NEMI Standards Collaboration

Plug & Play

GenCAM

Plug & Play

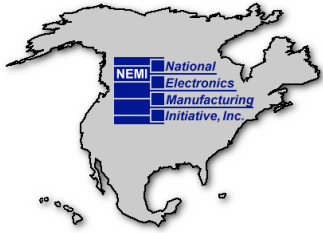
Virtual Factory

Convergence

IPC Number/ Function	-xxx1 <u>Generic</u>	-xxx2 <u>Administ</u>	-xxx3 <u>Document</u>	-xxx4 <u>Board Fabricatn</u>	-xxx5 <u>Bare Bd Test</u>	-xxx6 <u>Assembly Manufact</u>	-xxx7 <u>Assembly Test/Insp.</u>	-xxx8 <u>Comp. & Materials</u>	-xxx9 <u>Informat. Modeling</u>
IPC-2500 <u>CAMX</u> Framework	IPC-2501 PINS								
IPC-2510 <u>GenCAM</u> Product Data	STANDARD	STANDARD	STANDARD	STANDARD	STANDARD	STANDARD Rev A.	STANDARD Rev A.	STANDARD Rev A.	STANDARD
IPC-2520 <u>Quality</u> Product Data				STANDARD					
IPC-2530 <u>SRFF</u> Process Data Recipe file	DRAFT								
IPC-2540 Shop <u>Floor</u> Communicate	STANDARD					STANDARD	Interim Final		
IPC-2550 <u>Execution</u> Communicate	PROPOSED STANDARD			DRAFT		PROPOSED STANDARD			
IPC-2560 <u>Enterprise</u> Communicate									
IPC-2570 <u>Supply Chain</u> Communicate	STANDARD		PLANNED			STANDARD	PROPOSED STANDARD	STANDARD	

IPC-2580
Offspring

Connect with and Strengthen Your Supply Chain



Virtual Factory Information Interchange Project

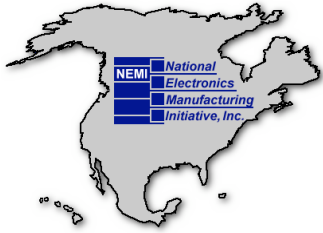
Objective: to define or identify standards which when implemented will shorten the time and reduce the cost to establish and maintain information exchange partnerships across the electronics manufacturing supply web.
Builds on the NEMI Plug & Play Factory Project.



and Strengthen You



Home of the 1996 Olympic Village
Georgia Institute of Technology



Product Data eXchange (PDX)

IPC 2571

Requirements for Product Data eXchange
Standard

IPC 2571 DTD

Combined **DTD** for the IPC 2571, 2576, 2578

IPC 2576

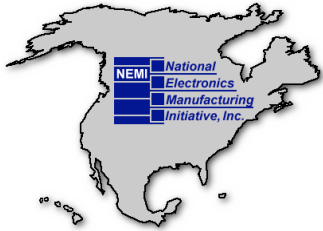
Sectional Requirements for the Supply
Chain (B2B) Communication of As-Built
Product Data (**Genealogy**)
Standard

IPC 2577

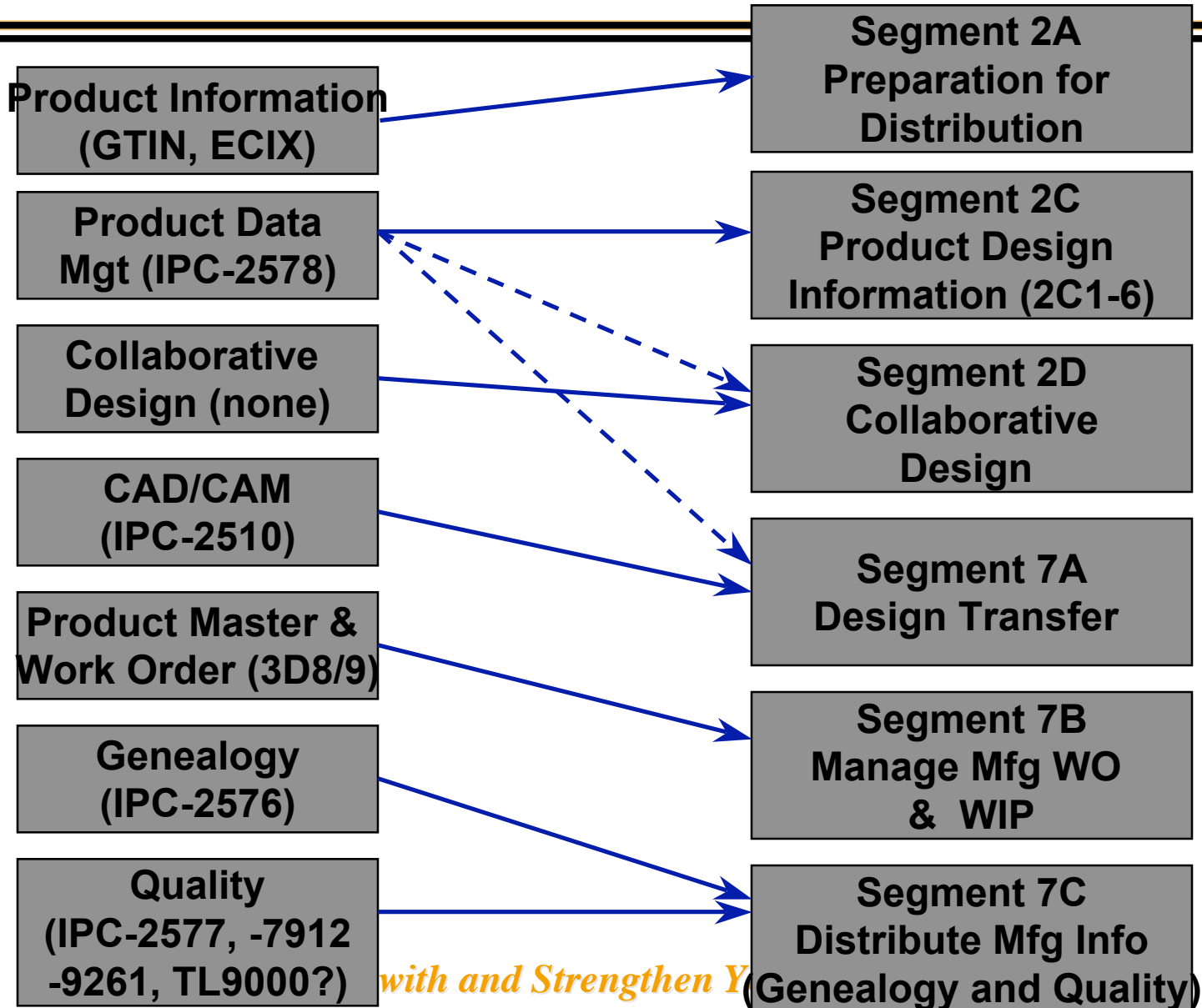
Product Manufacturing **Quality** Exchange
Proposal

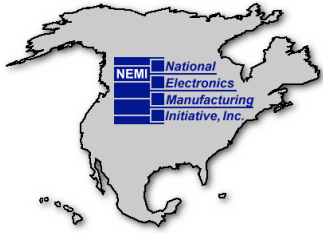
IPC 2578

Sectional Requirements for **Bill of Materials**
Data eXchange (PDX) *Standard*



Leveraging Partnerships – RosettaNet





And Now, For Something Completely Different

**Product Lifecycle Information Management:
Business Trends and Anticipated Technology Needs**

Barbara Goldstein, NIST

The PDX Standard at Work: A View From the Field

Doug Furbush, Georgia Tech

**NIST Internet Commerce for Manufacturing Testbed:
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