

# The Product Data eXchange Standard: PDX Overview & Adoption

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# *Outline*

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Business Drivers for PDX

What is PDX?

PDX Adoption

Plans for PDX V2.0

Material Declaration & PDX – Dries D’hooghe  
(postponed for tomorrow’s session)



# *Need For Intelligent Data*

Highly organized, Integrated, related, clear



Offspring, EDIF, AP210, IPC350

EDA DBs, Alg, Men, RR, ...

CAM DBs, GenCAD, PDW, FATF

BOMs, CPLs, Netlists

Gerber, drill,

Plots... HPGL, PS, PDF, ...

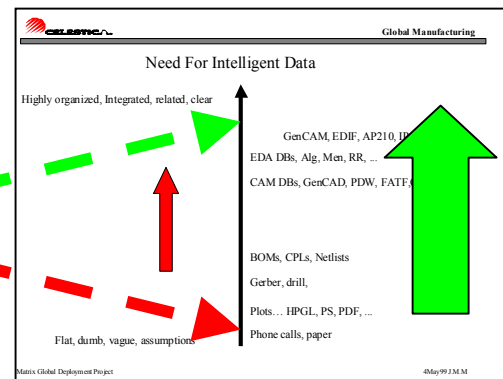
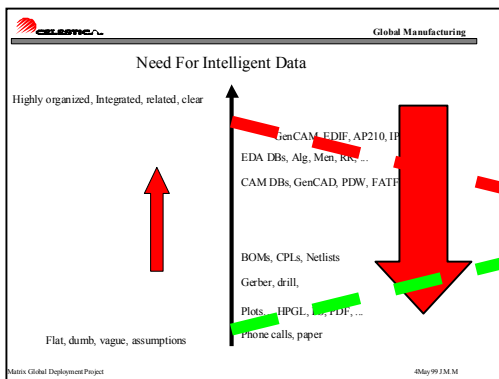
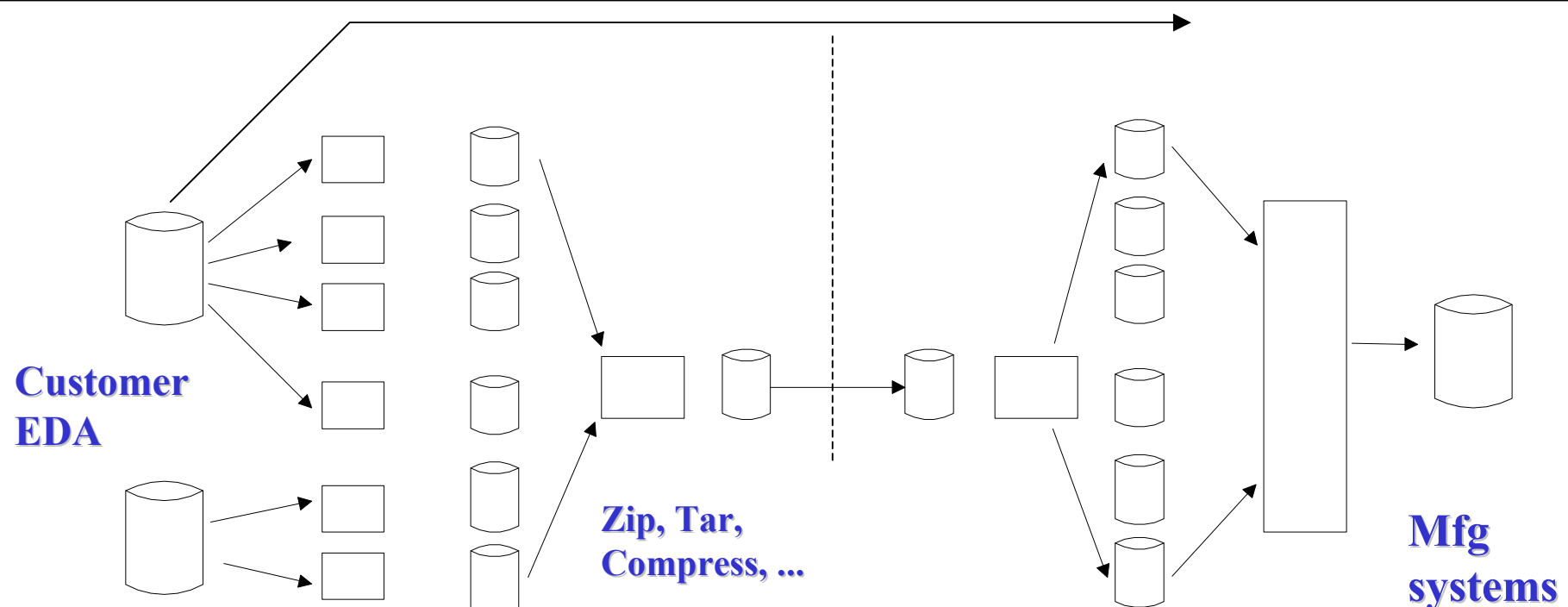
Phone calls, paper

Flat, dumb, vague, assumptions

*Connect with and Strengthen your Supply Chain*



# Typical Data Transfer Process



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# *Cost of Product Data Reverse Engineering?*

Gross estimate (incoming product data only...)

- 5000 design packages in 1998 (50% with CAD ...)
- 2500 need reverse eng from reports (avg of 4 days ...)
- 10,000 md (30-50 my)
- assume 10 x error in estimate ... (**still 3-5 man-years**)
- CAD path is better but not perfect either ...(1 day ... 1 my)

Revenue flow ...

- \$3B in revenue 1998 (about \$8M/day)
- assume 10 large customers (\$800K/day)
- how much is a 4 day slip worth to OEMs? EMSs? Suppliers?
- What if reverse eng is not done correctly?



## Business Drivers:

# *In Search of the Perfect BoM*

### 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%**

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Business Drivers:

# *Cost of Imperfect Interoperability*

Planning Report 04-2  
Economic Impact of  
Inadequate Infrastructure  
for Supply Chain  
Integration

Prepared by:  
RTI International  
for

National Institute of  
Standards & Technology

Program Office  
Manufacturing Engineering Laboratory  
Electronics and Electrical Engineering Laboratory  
June 2004



- \$3.9B annual cost to electronics industry
- < 1% of the total inefficiency resulted from purchase costs and annual expense from software
- Costs due to:
  - *inefficient integration*, the unavailability of a suitable standards infrastructure leads to excessive capital investment, duplication of effort, higher than optimal staffing and support levels, and inadequate organizational flexibility.
  - *incomplete integration*, key elements of a comprehensive system are missing, or improved systems are only implemented for a subset of supply-chain partners.

Available at: <http://www.nist.gov/director/prog-ofc/report04-2.pdf>

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## PDX Structure:

# *What is PDX?*

- A **simple** standard
- Initiated and developed by NEMI
- Standardized by IPC
- XML format
- Used to exchange BOM, change order, as-built configuration & quality information.



## PDX Structure:

# *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

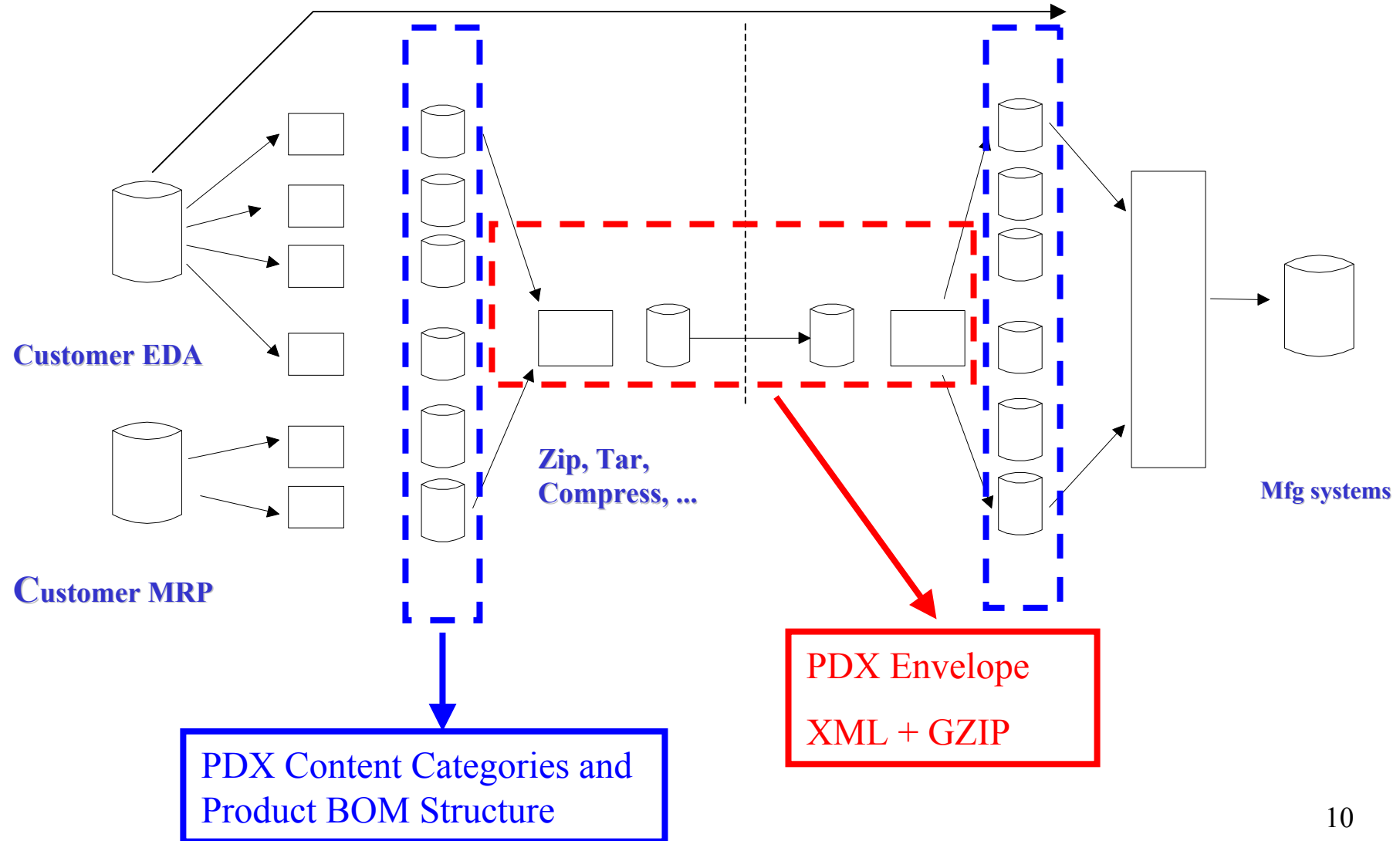
Product Manufacturing **Quality** Exchange  
*Draft*

IPC 2578

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



## Conserving Intelligence During Data Transfer

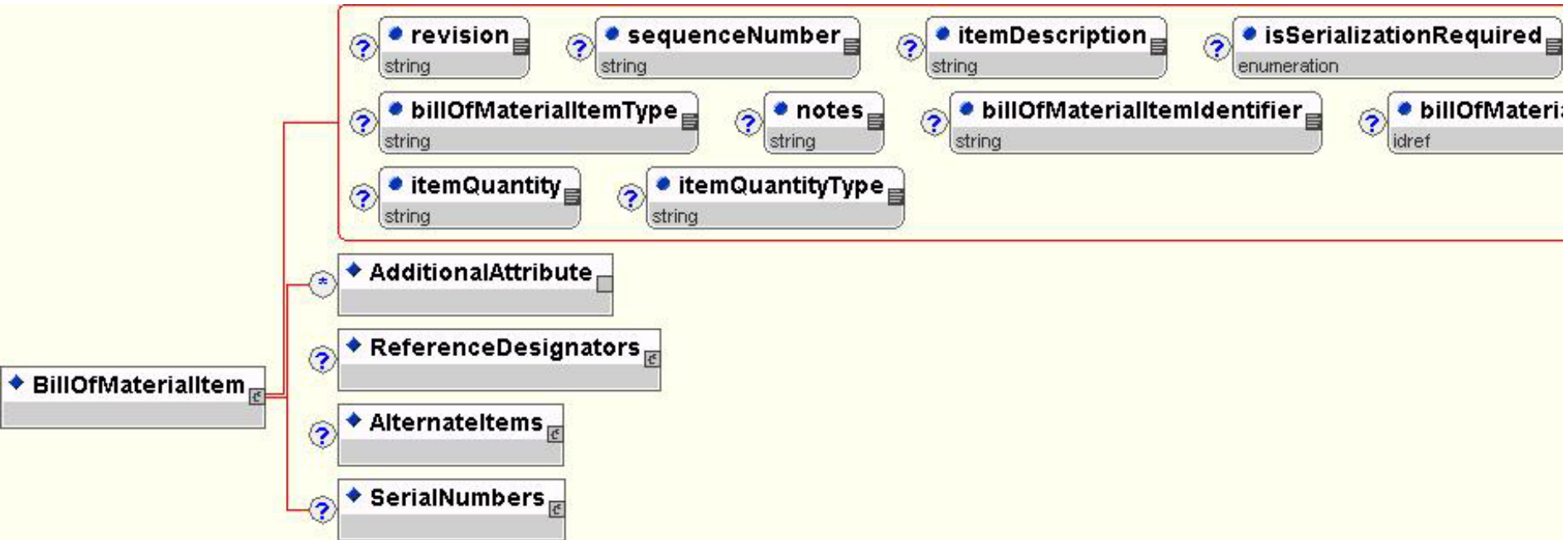


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# PDX Structure:

## *A Standard BOM - A Closer Look*





## PDX Structure:

# *Integration With Other Standards*

## **RosettaNet**

- Cluster 7 manufacturing standards harmonized with PDX 1.0
- PDX quality standard being aligned with PIP 7C6
- Collaboration on BOM-level tracking of environmental information beginning

## **Other IPC Web Standards**

- Discussions with 2581 team held; no structural incompatibilities between 2581 and PDX found
- Detailed mapping between PDX and 2581 required
- Transition PDX from XML DTD to XML Schema in 2.0



# PDX Structure:

## *IPC Integration: [webstds.ipc.org](http://webstds.ipc.org)*

IPC Number/ Function	-xxx1 Generic	-xxx2 Administ	-xxx3 Document	-xxx4 Board Fab	-xxx5 Bare Bd Test	-xxx6 Assembly Manufact	-xxx7 Assy Test/Insp.	-xxx8 Comp. & Mat'ls
IPC-2500 CAMX Framework	<a href="#">IPC-2501</a> Published		<a href="#">IPC-2503</a> Working Draft					
IPC-2510 GenCAM Product Data	<a href="#">IPC-2511A</a> <a href="#">IPC-2511B</a> Published	<a href="#">IPC-2512A</a> Published	<a href="#">IPC-2513A</a> Published	<a href="#">IPC-2514A</a> Published	<a href="#">IPC-2515A</a> Published	<a href="#">IPC-2516A</a> Published	<a href="#">IPC-2517A</a> Published	<a href="#">IPC-2518A</a> Published
IPC-2520 Quality Product Data				<a href="#">IPC-2524</a> Published				
IPC-2530 SRFF Process Data	<a href="#">IPC-2531</a> ANSI Draft							
IPC-2540 Shop Floor Communication (CAMX)	<a href="#">IPC-2541</a> Published	<b>Shop Floor – Oct 01</b>				<a href="#">IPC-2546</a> Published <a href="#">IPC-2546A2</a> 2 <sup>nd</sup> ballot	<a href="#">IPC-2547</a> Published	
IPC-2550 Execution Communication (MES)	<a href="#">IPC-2551</a> Working Draft			<a href="#">IPC-2554</a> Working Draft		<a href="#">IPC-2556</a> PIN Submitted		
IPC-2560 Enterprise Communication								
IPC-2570 Supply Chain Communication (PDX)	<a href="#">IPC-2571</a> Published	<b>PDX - Nov 01</b>				<a href="#">IPC-2576</a> Published	<a href="#">IPC-2577</a> Final draft	<a href="#">IPC-2578</a> Published
IPC-2580 Application Specific Data	<a href="#">IPC-2581</a> Published	<b>CAD/CAM - March 04</b>						



## PDX Adoption:

# *News From the Field*

### **Lucent**

- Uses PDX for all exchanges that don't involve direct CAD access
- Monthly average:
  - 565 Outbound PDX Exchanges (approx 95% of all outbound transactions)
  - 75 Inbound PDX Exchanges (approx 65% of all inbound transactions)

### **Celestica**

- Processing approximately 650 PDX transactions/month
- At least 16 unique customers conducting exchanges

### **Agile Software**

- Offer free PDX viewer
  - Over the last year, 2,666 distinct users downloaded the PDX viewer

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**PDX 2.0:**

# *Keeping Up With User Needs*

## **Expanded BOM Level Information Tracking**

- **Regulated Environmental Attributes**
  - Material content
  - Power consumption
  
- **Costs**
  - To support on-going dialog and cost management, not RFQs
  - To support lifecycle decisions:
    - making large last-time buys
    - grey market acquisitions
  - **20 optional cost fields**
    - Learning
    - Set-up
    - Materials
    - Processing



**PDX 2.0:**

## *Keeping Up With User Needs*

### **Role-based access, views and generation of PDX packages**

- **One product, multiple production sites**
  - **Vary product content of a single product per mfg location**
    - **Treat as a single product with different sets of information**
    - **Eg:**
      - » **effectivity dates & dispositions**
      - » **AMLs**
      - » **item attributes**
  - **PDX currently would treat as separate BOMs**
- **As designed, as built – already supported in PDX 1.0**

### **Support for archiving**

- **PDX was designed for transfer**



**PDX 2.0:**

# *Creating a Foundation for Growth*

## **Transition from XML DTD to XML Schema**

- Enable better automated data validation

## **Model PDX in UML**

- Facilitate comparison with and mapping among IPC standards
- Facilitate future evolution of the standards
- Enables automatic schema generation

## **Adhere to IPC guidelines and directions**

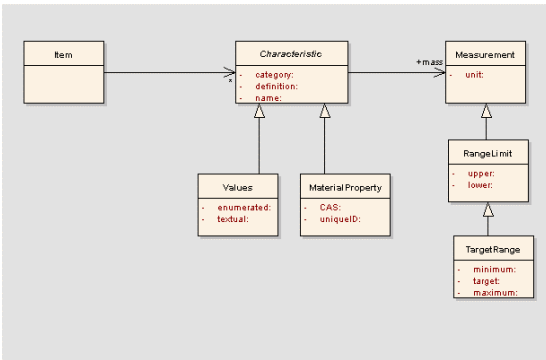
- Comply with IPC style sheet (IPC 2503)

**WHILE ENABLING A LOW-COST TRANSITION FOR  
PDX INSTALLED BASE**

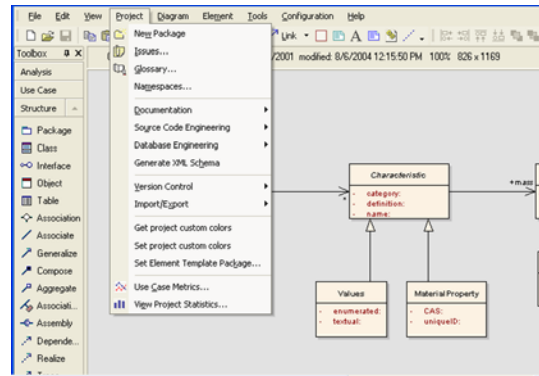


# IPC Vision:

# Standardizing UML, Generating Schema



## UML MODEL



## AUTOMATIC SCHEMA GENERATION

```

<xs:extension base = "Characteristic">
  <xs:sequence>
    <xs:element name = "MaterialProperty.CAS" type = "xs:string"/>
    <xs:element name = "MaterialProperty.uniqueID" type = "xs:string"/>
  </xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name = "Measurement" type = "Measurement"/>
<xs:complexType name = "Measurement">
  <xs:sequence>
    <xs:element name = "Measurement.unit" type = "xs:string"/>
  </xs:sequence>
</xs:complexType>
<xs:element name = "TargetRange" type = "TargetRange"/>
<xs:complexType name = "TargetRange">
  <xs:complexContent>
    <xs:extension base = "RangeLimit">
      <xs:sequence>
        <xs:element name = "TargetRange.minimum" type = "xs:string"/>
        <xs:element name = "TargetRange.target" type = "xs:string"/>
        <xs:element name = "TargetRange.maximum" type = "xs:string"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
  
```

## XML SCHEMA



**PDX Futures:**

# *Schedule for PDX 2.0*

**That depends on you**



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