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Needs for Concurrent Engineering

Concurrent Engineering
Information Sharing
Integrated DB

- Design
  CAD/CAM
- Plan/Concept
  MIS/CAD
- Marketing
  EDI/EC/
- Sales, A/S
  EDI/EC/
- Logistics
  EDI/EC
- Material Flow
- Maintenance
- Facility
- Training
- Production Plan
  CIM/MRP
- Mfg/Ass’y
  JIT
Needs for Concurrent Engineering

Goal Changes in Industry

Reduced time
(90’s-2000’s)

Improved product quality
(80’s-90’s)

Lower production cost
(70’s-80’s)
### Needs for Concurrent Engineering

- In order to reduce the lead time for product development, it is easier to reduce the process time by process control than the development activity time by application tools.

- The process time can be reduced by concurrent engineering.
Needs for Concurrent Engineering

- Sequential
- Parallel
- Integration

Concept → Design → Analysis → Mfg → Ass’y → Suppliers

Concept → Design → Analysis → Mfg → Ass’y → Suppliers

Concept → Data Share → Mfg → Analysis → Suppliers

Reduction

Lead Time
Needs for Concurrent Engineering

Cost of a Change During Life Cycle

Number of Changes During Life Cycle

With PDM & Concurrent Engineering

Without PDM

PDM with CE can reduce change cost
A tool that helps people manage both product data and product development process.

PDM systems keep track of the masses of data and information required to design, development, manufacture, and then support and maintain products.
The Concept of PDM

Functions

◆ Manages all product-related information
  ➢ Digital files
    - Electronic documents: specifications, configurations, purchasing orders
    - CAD Drawings, models, parts, assemblies
    - CAE analysis
    - Part information, NC programs, and process plans
  ➢ Images and hard-copy documents
  ➢ Database records

◆ Manages the process-related information
  ➢ Product release process
  ➢ Change management process
  ➢ Approval process

◆ Manages data throughout the product life cycle

Sales & Marketing ➔ Conceptual design ➔ Detailed design ➔ Prototype & test ➔ Production ➔ Delivery A/S
Examples of Products

- Manufactured products: automobiles, computer
- Projects: building, bridge, highway
- Plants: oil refinery, offshore platform
- Facilities: airport, railway system
- Assets: utility distribution network
  - electricity, telecoms, water, gas
- Others: chemistry, pharmacy, food processing
The Concept of PDM

In system viewpoint

Application User
- CAD/CAM, NC, Purchasing
- Documentation, Etc.

Private Files
- data
- control

PDM User
- Multiple Applications

PDM System
- Meta-Database

Managed Files
Functions of PDM

Data Vault and Document Management

Workflow and Process Management

Product Structure Management

Classification & Retrieval

Utilities: Communications, Data transport, Data translation, Image services, Administration
One logical database maintained by the PDM system via meta-data
**Data Vault & Document Management**

**Relationships among Documents**

- **Specification**
  - product spec.
  - standards (ISO, ANSI, etc.)

- **Product Drawing**
  - components
  - sub-assembly
  - assembly

- **Jig & Fixture Drawing**
  - tools
  - jig, fixture
  - gauge

- **Eng. Change**
  - ECR
  - ECO
  - ECN

- **Inspection**
  - inspection spec.
  - Test results

- **Quality Spec.**
  - Inspection spec.
  - quality mgmt spec.

- **Process plan**
  - machining
  - assembly

- **Work Instruction**
  - work standard
  - maintenance
  - operation manual
• Business process modeling - also known workflow (ex. electronic approval)
• Repetitive workflows and processes are programmed to route data and work packages automatically, to control and monitor processes, and to provide management reporting.
• It defines and controls engineering changes to product configurations, part definitions, other product data, data relationships, and data versions and variations.
Workflow & Process Management

Workflow Examples

- Design release management
- Engineering Change Requests (ECRs)
- Engineering Change Orders (ECRs)
- Engineering reviews
- Document production cycle
- Purchasing cycle
- Bid preparation
- Contracts management
- Update of quality plans & procedures
- Problem tracking and resolution
Workflow & Process Management

Document Release and Approval Process

New Document → Design Manager → Submit for Checking → Approver A → Approver B → Approver C → Issue

Not Correct → Author

Finished → Not Approved

Planned → W.I.P → Check → Approve → Released
◆ Product structure creation/maintenance
  ➤ Part-to-part-to-document relationship (BOM+)

◆ Product structure variations
  ➤ Multiple product structure views
  ➤ Versions, options, and effectivities

◆ Product structure integration
  ➤ Configuration control
  ➤ BOM synchronization with MRP, CAD,...
  ➤ Analysis tools (cost roll-ups,...)

◆ Product structure browse/reporting
Product Structure Management

Model 1

Model 2

Phone Receiver

Rev A

Rev B

Detail Design Drawing

Test Data

Analysis Report

Marketing Definition
It is difficult to reuse existing parts data as the number of data increases.
Systematic management can be achieved by standardization of parts classification.
Grouping of similar parts according to geometry, process, or functions.
Grouping methods: combination of attributes, group technology, clustering, etc.
- It is used to define and control product development projects.
- It gives us an overview of the complex tasks that arise when we work on limited-period cost and capacity-intensive projects.
- Work Breakdown Structure (WBS) is used to define the structure for organizing and controlling the project and split the project into a hierarchy of individual elements.
PDM system in a Network Environment
### PDM Development Standards

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<th>PDM System Element</th>
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<tr>
<td><strong>Data Architecture</strong></td>
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<td>Application Layer</td>
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<td>SPEP/PDES, SGML/XML, CCITT G4, CGM</td>
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<tr>
<td>Physical Layer</td>
<td>SQL, RDA</td>
</tr>
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</table>
Effects of PDM

Projected Benefits
(40% of More of Respondents)

Percentage survey respondents

Faster Time-to-Market
Reduced Change Costs
Less Scrap
Standard Usage
Part
Improved Product Quality
Relationship with Other Systems

- ERP
- CAD
- PDM
- QA
- CAPP
**Difference between CAD & PDM**

**PDM**
- Focuses on multiple representations of structure, documents, models, etc.
- Manages processes & workflows
- Users are from many disciplines
- Political issues are prevalent

**CAD**
- Focuses on part and assembly design
- Produces the product design
- Users are designers, engineers, & detailers
- Local control, solution focus
Functional Comparison between CAD & PDM

**PDM**
- ✓ Part/product information
- ✓ Drawing title block
- ✓ Part attributes
- ✓ Product structure/configuration management
- ✓ Classification & retrieval
- ✓ Process/workflow mgt. (incl. change mgt.)
- ✓ Vault mgt. (parts/documents)
- ✓ Image services (view/mark-up)

**CAD**
- ✓
- ✓
- ✓
- ✓
- ✗
- ✗
- ✗
- ✓
Difference between ERP & PDM

- Product configuration/BOMs are core to both
- Many users are beginning to see the overlap
- Manufacturing companies always have ERP
- As PDM implementations expand, overlap with ERP increases (users, tech.)
Functional Comparison between ERP & PDM

**PDM**
- ✓ Part/product information
- ✓ Product structure/configuration mgt.
- ✓ Classification
- ✓ Process/workflow mgt. (incl. change mgt.)
- ✓ Vault mgt. (parts-documents)
- ✓ Image services (view/mark-up)
- ✓ program mgt.
- ✕ product routings (mfg. processes)
- ✕ product costing

**ERP**
- ✓
- ✓
- ✓
- ✕
- ✕
- ✕
- ✓
- ✓
Data Exchange between ERP & PDM

- Information flow is two way
  - Engineering/technical data to ERP
  - Commercial/logistics data to PDM
- Ownership and authority to change must be very clear
### Market Growth & Shares

- **27% growth in 1998** (to $1.4 billion), solid growth.
- **Growth forecasted through 2003 at 16%**.
- **Market Shares in 1998.**
  - SDRC (Metaphase) 7%
  - Documentum (Documentum) 6%
  - IBM (PM6000) 6%
  - Engineering Animation 6%
  - Aspect Development 5%
  - Parametric Technology Corp (Winchill) 3%
  - Unigraphics Solutions (IMAN) 3%
  - Intergraph 3%
  - MatrixOne (MatrixOne) 2%
  - INSO (Sherpa), SAP, Baan, CoCreate, etc.
• **Use of multimedia data**
  - CAD, image, text, video, audio, DB, etc.

• **Integration in distributed heterogeneous computing environments**
  - PDM Enabler by use of CORBA
  - Jflow (joint workflow) by use of CORBA
  - PDML by use of XML

• **STEP-based PDM**
  - to improve data exchangeability among PDM and CAD systems
  - Version 1.1 announced in Oct., 1998 by PDES & ProSTEP.
  - PDM schemas designed by adopting common parts of AP203, AP214, and AP232.
Technology Trends

• Internet-based PDM
  - accessible in distributed heterogeneous computing environments
  - Windchill of PTC
• Use of object-oriented paradigm
  - UML for modeling
  - object-oriented DBMS, object-relational DBMS
• Integration with other applications
  - CAD, ERP, etc.
• Knowledge Based System
  - Knowledge management, data mining