IDIF Implementors Forum

Industrial Data Implementors Forum

Larry McKee
IBM/PDES, Inc.
June 28, 2000
Bordeaux, France

Agenda

- Introductions
- Open Issue Review- L . McKee
  - The BIG Issues- L. McKee
    - AP Interoperability
    - Unified PDM Schema
    - Modularity
    - Upwards Compatibility
    - Solid Model History
- Epistle Implementors Report- M. West 1PM
- ISO 15926 and ISO 10303- M. West
- Shipbuilding Implementors Report- R. Wood/B. Gischner
- CAx/PDM Implementors Forum- L. McKee
- XML and Express-X- M. Maier 3:30PM
- Drafting Demonstrations- W. Haas/Y. Manchu

Our Charter

Provide an open forum to discuss implementation concerns and lessons learned about all aspects of PDE (product data exchange) standards. Special emphasis is placed on implementation problems that are independent of specific product modeling/ description systems.

The committee evaluates technical problems that interfere with the implementation of the standards and proposes solutions via the approved change processes. In the event that a major problem is identified, this committee will propose temporary recommended practices, provide feedback to the appropriate technical committee or recommend the issue to appropriate technical committees for disposition.

The committee is concerned with the enhancement of data interchange standards to incorporate capabilities being added to current product modeling systems. It also serves as a body of experts when other committees need information on specific product modeling/ description systems and maintains relationships with all SC4 technical committees, industry consortia organizations and other standards committees as appropriate.

Further, while this committee encourages dissemination of information on appropriate products and toolkits, it shall not allow marketing and advertising of products or product comparisons.

The Exploder

- **The implementors forum exploder is hosted at NIST in the US**
- **Mail is sent to the exploder by addressing it to:**

  step-imp@cme.nist.gov
- **To join the exploder send a mail message to**

  majordomo@cme.nist.gov

  In the body of the message (NOT the Subject!) type:

  subscribe step-imp

The Web Site

- **Can be found at: http://impforum.aticorp.org**
- **Has the charter, issue log, minutes of last meeting, and slides from last meeting**
- **STEP background material**
- **Forum FAQ**
- **Links to many STEP places**

IDIF Implementors Forum

Welcome to the Industrial Data Implementors Forum Home Page

The Industrial Data Implementors Forum (IDIF) is an active and passive, virtual and meeting based discussion group which monitors the implementability of product data standards.

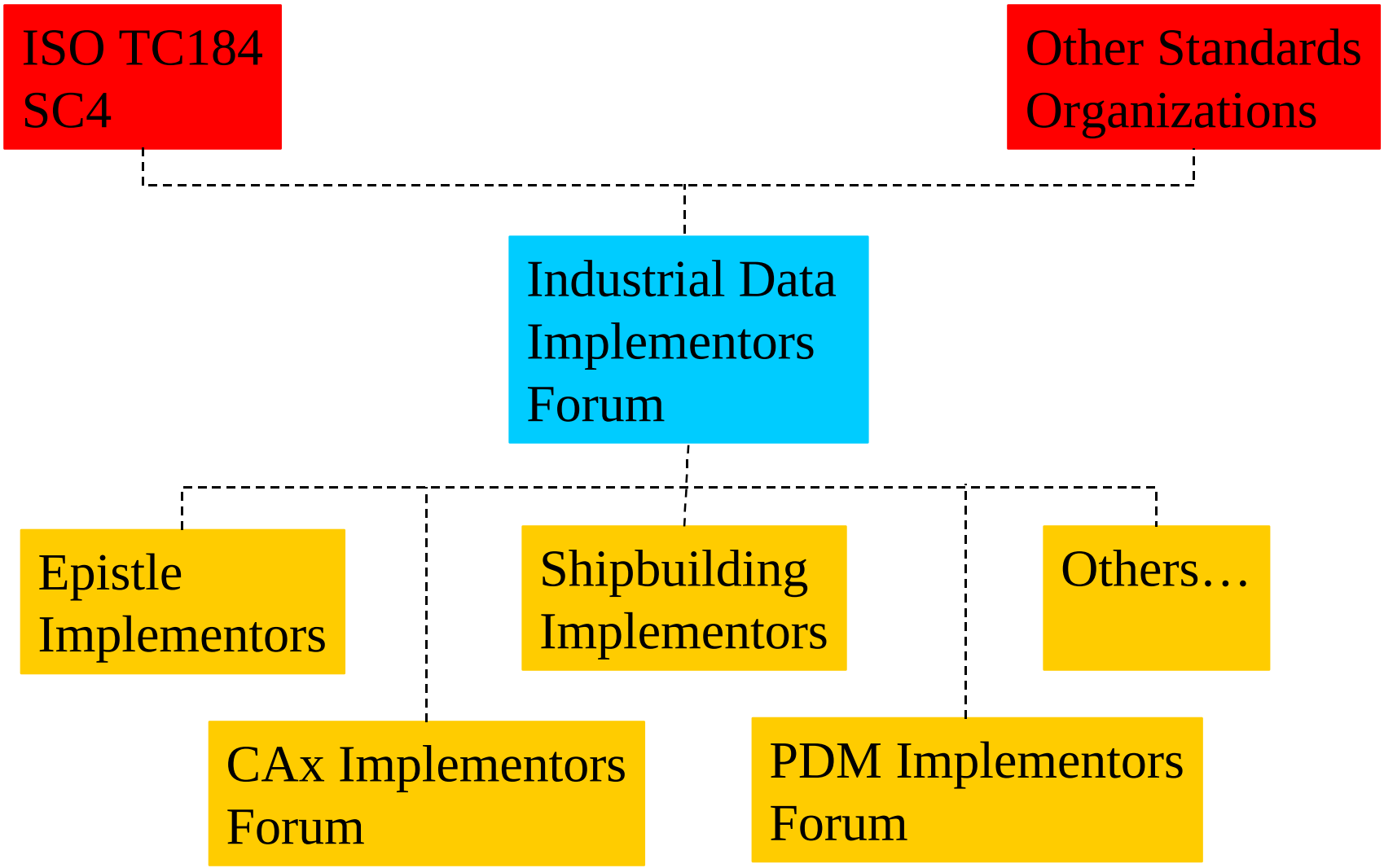
The forum is centered on the ISO TC184/SC4 product data standards but takes lessons learned from past and present activity in IGES, SET, VDA/FS and other product data standards. Most of the current discussions are on implementation of the ISO 10303 (STEP) data standard.

Charter
Issue Log
Minutes of Last Physical Meeting
Slides from the Last Meeting (6 MB Zipped)
Future Meetings
PDES/ STEP Information
FAQs
Information Links

For more information, please send an e-mail to Larry McKee

[IDIF Home | ISO TC184/SC4 Home Page | ISO Home Page]

Relationships



Issue Log Review

Issues

- ***Summary- 45 Issues - 4 Open***
- **Issue: 016 Polyline**
  - Open- Needs Exploder Discussion
- **Issue: 036 AP Identities**
  - Open- Big Issue
- **Issue: 044 Solid Model Construction History**
  - Open- Big Issue
- **Issue: 045 STEP File Meta Data**
  - Open- More appropriate in Quality Committee

New Issues???

The BIG Issues

The BIG Issues

- **AP Interoperability**
  - **Unified PDM Schema**
  - **Modularity**
- **Upwards Compatibility**
  - **Changes in Progress**
  - **Part 21 Amendment**
  - **Short names**
- **Solid Model History**

AP Interoperability

Agenda

- **AP Interoperability**
- **Unified PDM Schema**
- **Modules**

AP Interoperability

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- The Process
  - Identify Focus Areas of Overlap between APs
  - Identify specific issues
  - Resolve Issues
  - Test Resolutions
  - Standardize resolutions
- Integrated Resource Changes for Interoperability
- AP Changes for Interoperability
  - Some of the current techniques exhibited in AP 214
- Focus areas
  - Unified PDM schema
  - Modules/ Extensions
- Part 21 extensions to support AP Interoperability

The Unified PDM Schema and Modules

Larry McKee

Unified PDM Schema Goal

- ***What is the goal?***
  - **Establish a core set of entities in STEP which support PDM**
  - **Introduce this core to Shipbuilding and PLCS AP projects**
  - **Harmonize with OMG, CALS, and MIL-STD2549**
  - **Test these entities via demos, pilots, and roundtables**
  - **Factor the resulting entities and supporting structures back into existing APs as core modules to enable interoperability**

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Unified PDM Schema Plan

- Develop the Unified PDM schema
  - version 1.1 established - anticipate maintenance release 1.2
- Review the schema with PDES, Inc., ProSTEP, JSTEP, STEP AP, and other SC4 requirements owners for buy-in consensus
  - review and resolution of AP214 DIS issues
  - resolution of issues on STEP IR Parts 41, 43, and 44
  - review within ISO 10303 SC4/WG3 technical forum
- Develop test versions of modules and AP schemas
  - Unified PDM schema to be several modules …
- Test the schema in demos, pilots, and roundtables
  - PDM implementor forum, EuroFighter, STEPwise, STAMP, ...
- Work the schema into the APs within ISO through modules and resource part, AIC, and AP changes
  - Modules, AP extensions, AP revisions, new AP development

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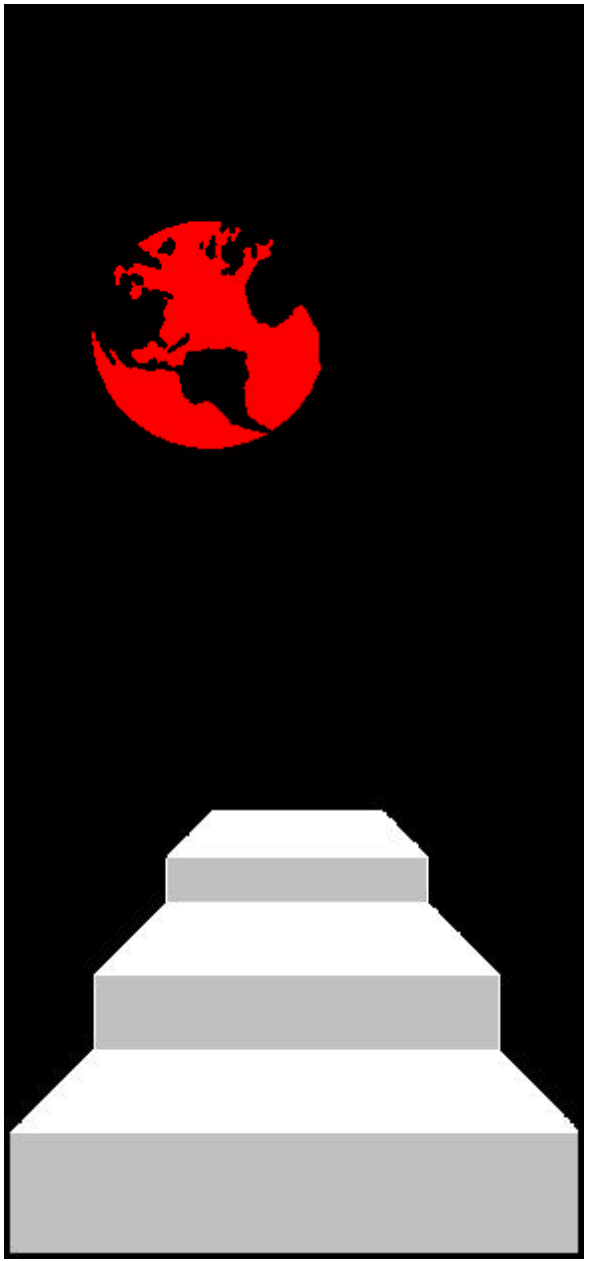
Upwards Compatibility

Upwards Compatibility

- 40 SeriesNew Editions
  - The 40 series DISs remain upwards compatible from at LEAST a physical file perspective
  - SDAI upwards compatibility has been compromised
    - Attribute name changes
  - Parts 43 and 44 are in final edit
  - Parts 42 and 41 require completing a ballot
- 40 Series TCs
  - There are Technical Corrigenda proposed to correct EXPRESS errors in the 40 series parts
  - These are currently upwards compatible
- 203 TC
  - Corrects Express errors
  - Now 203 Amendment 1
    - At ISO, to start 2 month ballot at any time



Part 21 Amendment Contents

Prepared by:
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(518) 276-2848 (518) 276-8471 fax
info@steptools.com http://www.steptools.com

Requirements

- **P21 itself upward compatible**
- **Short name capability for entities, defined types And enumeration item names**
  - **Partially addressed by the Technical Corrigendum, need to add one sentence to P21, and APs need to start defining them.**
- **Remove all external mapping conformance class**
- **Remove scope construct**
- **AP conformance class in header**
- **Default language for file in header**
- **AP interoperability -- multiple data sections**
- **Out for DIS Ballot which ends shortly**

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AP/Module Development and Validation

Prepared by Rogerio Barra
ATI/PDES, Inc.

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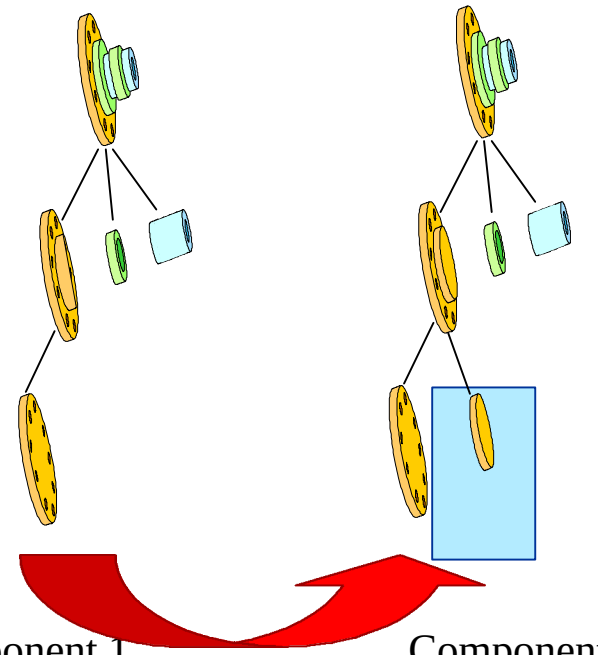
Product Data Management (PDM)



USAGE SCENARIOS

- **Exchange bill of materials**
- **Exchange only the information that has changed (net change)**
- **Exchange configuration management data**

MILESTONES

Q2 00 4th round of PDM-IF testing completed

Q3 00 Submit to ISO as Tech Spec

TECHNICAL LEAD

Larry McKee -- Modules

Jim Kindrick -- Usage Guide

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PDM
Recent Accomplishments

- **Published release 4.1 of PDM Schema Usage Guide**
  - **Addressed issues raised against release 4.0**
- **Coordinated with AP214 team resolution of interoperability issues related to rules**
- **PDM modules**
  - **Issued three module updates**
- **AP203 AM1 (AKA TC3) has been drafted and sent to ISO for a 2 month ballot**
  - **Fixes Express errors in 203 and incorporates TC Express fixes to 41,42, 43, and 44**

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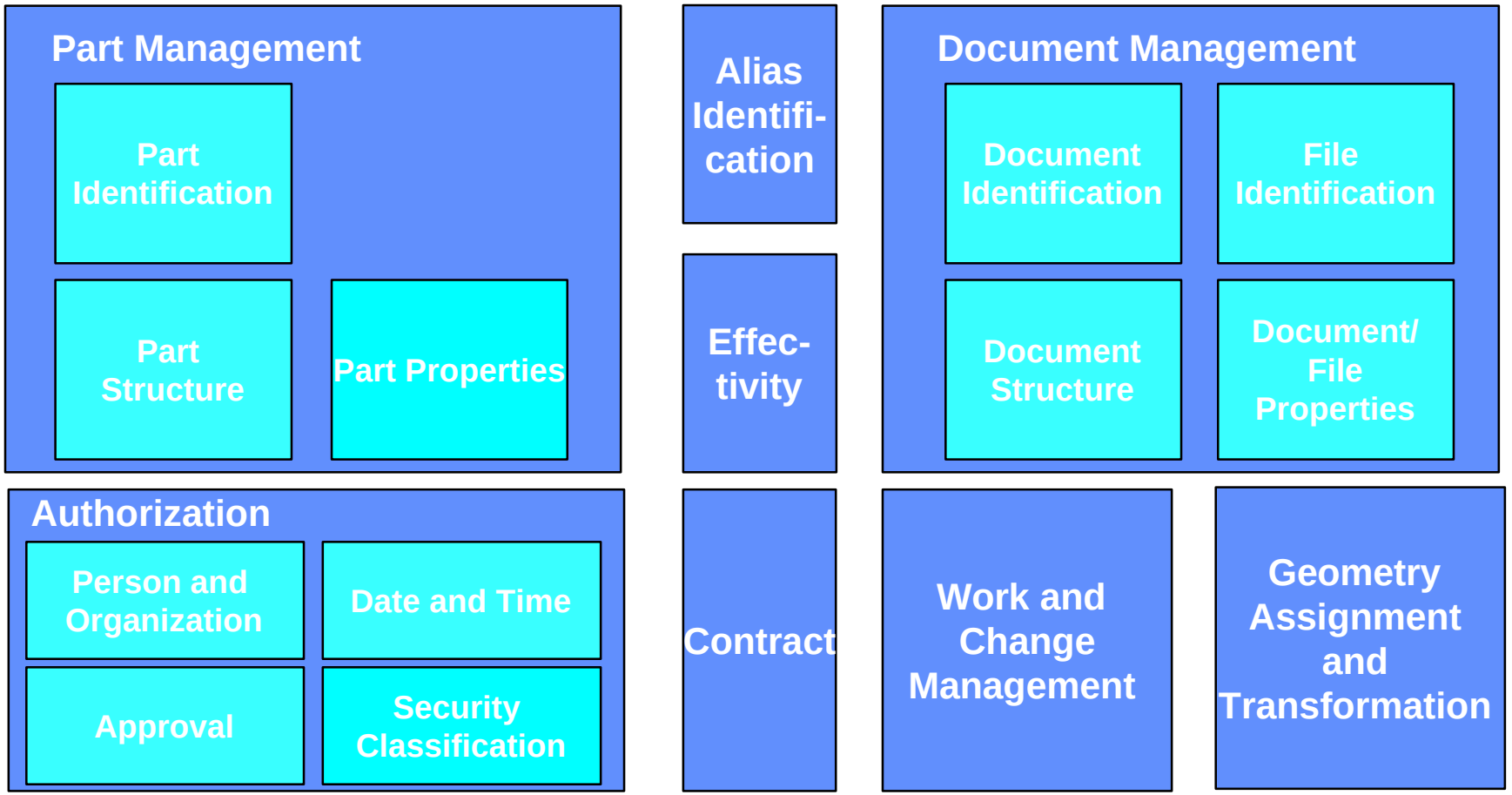
Scope of the PDM modules



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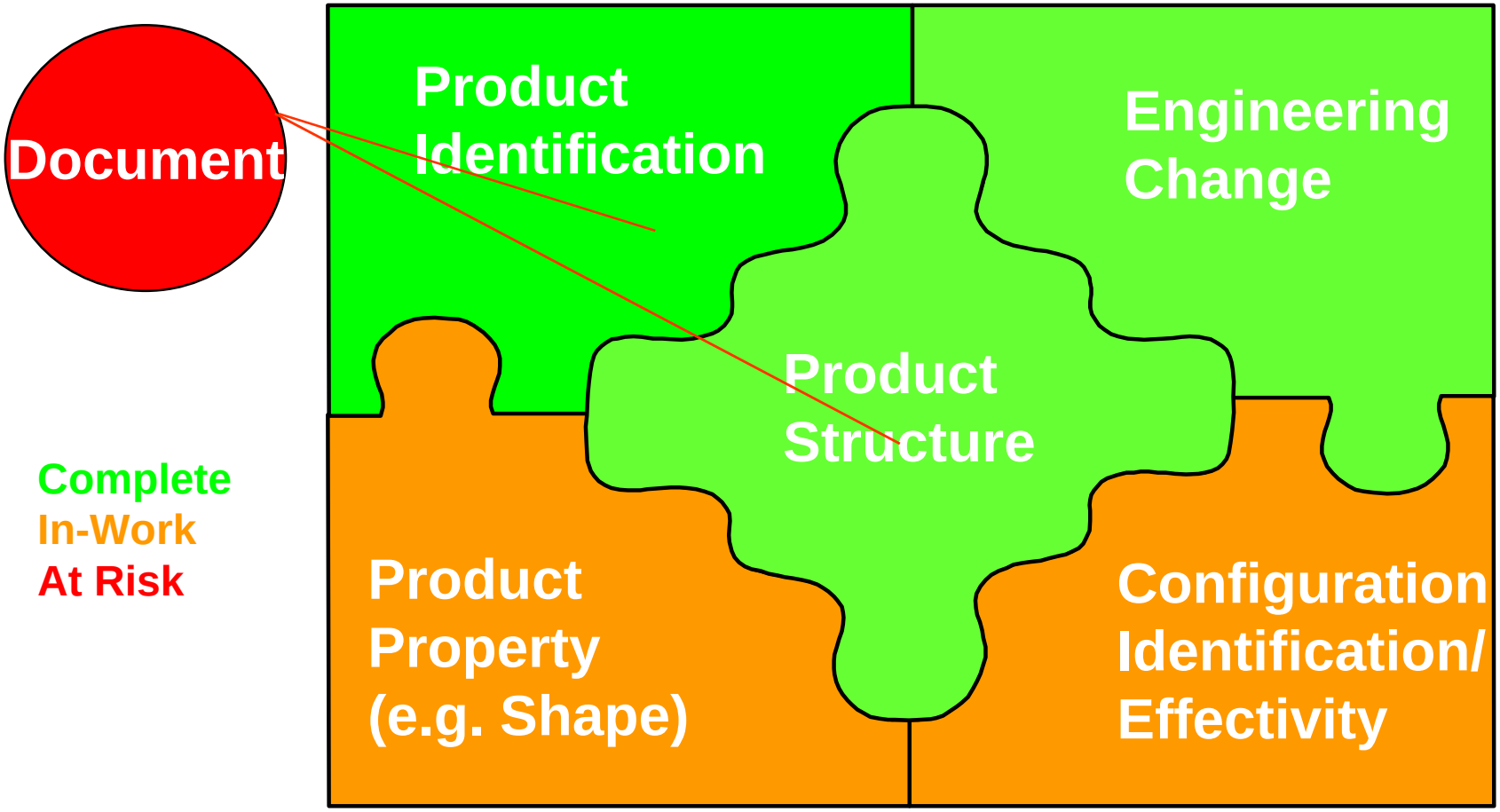
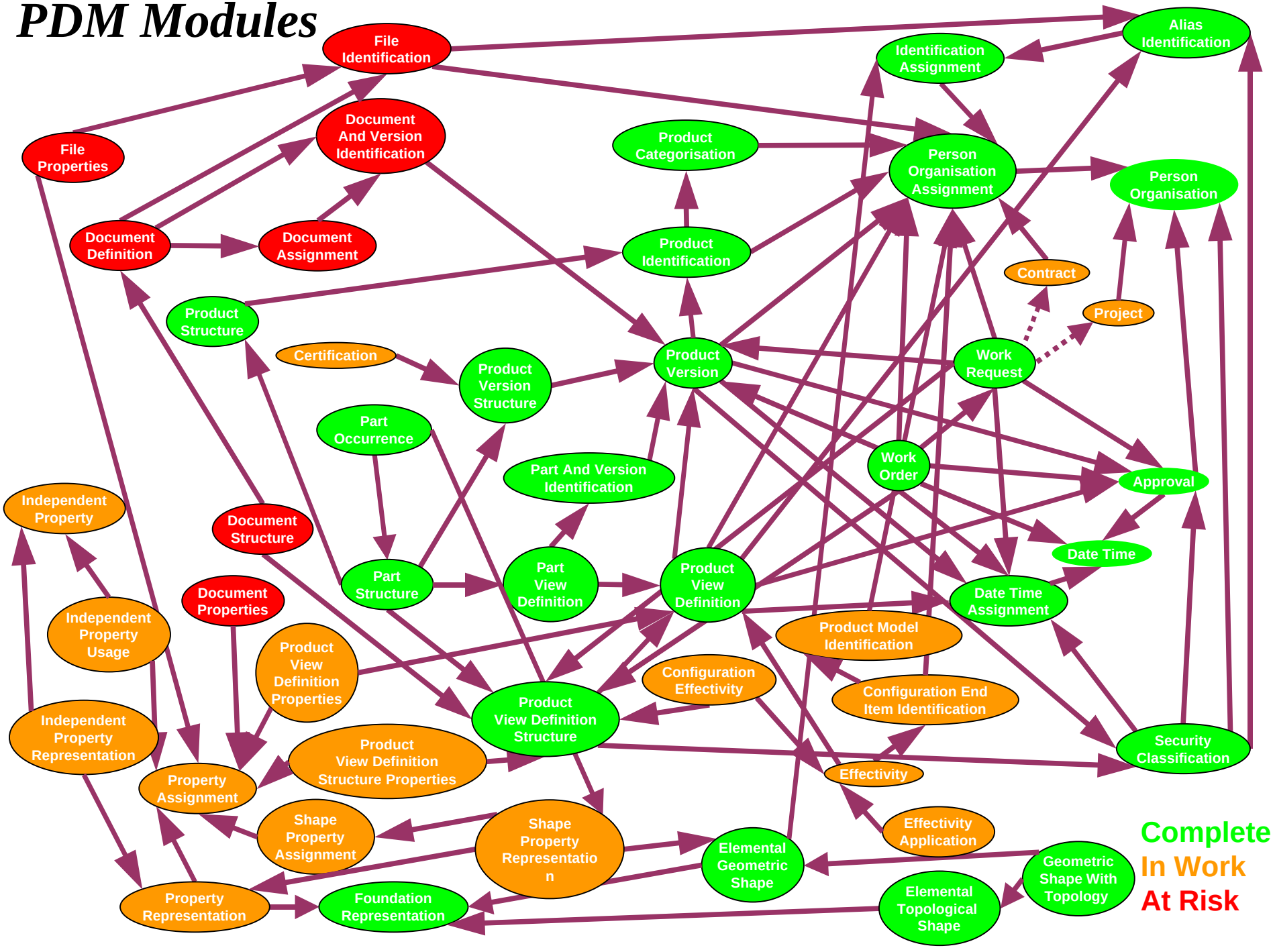
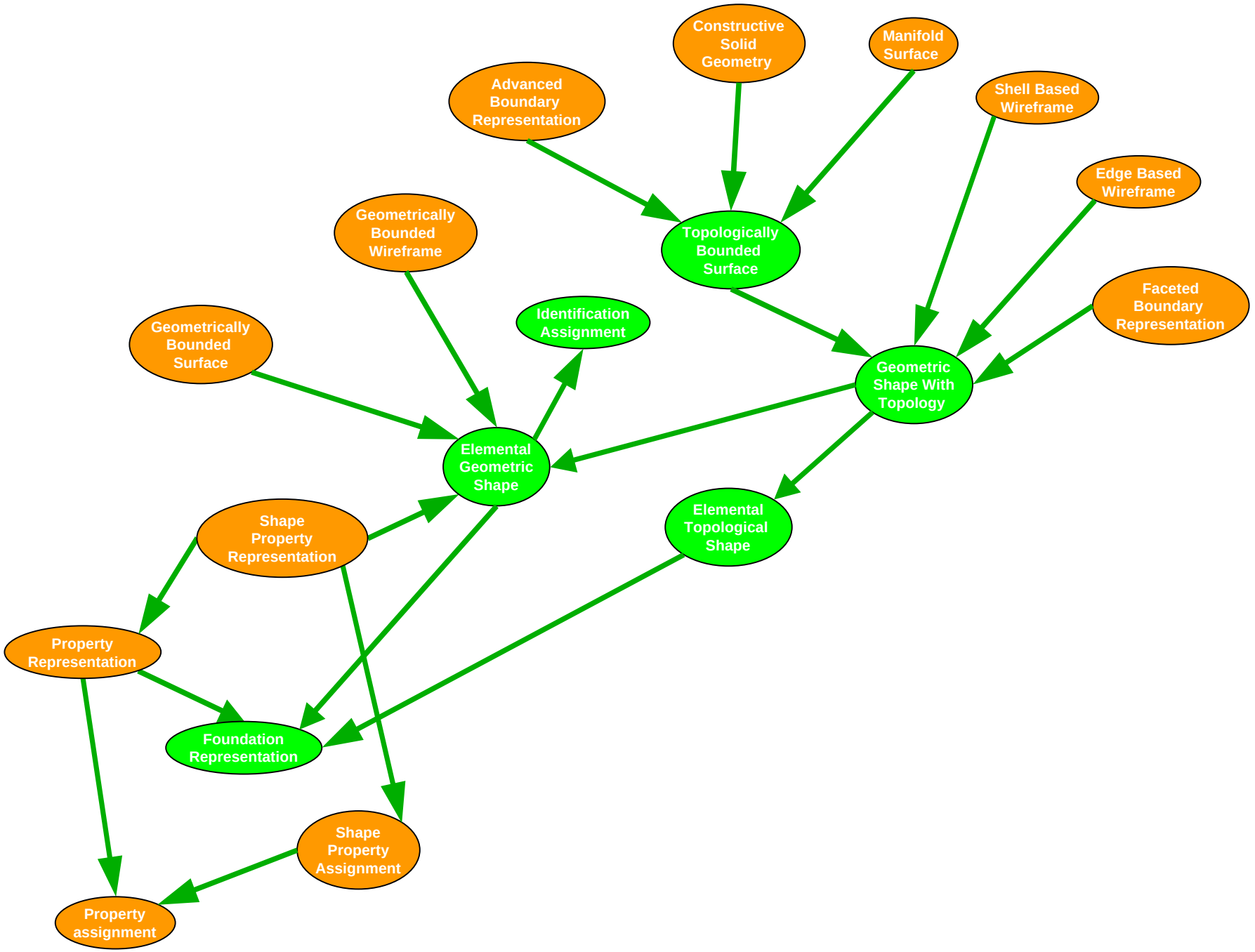
PDM Functional Areas



PDM Modules


File Identification
Alias Identification
Identification Assignment
File Properties
Document And Version Identification
Product Categorisation
Person Organisation Assignment
Person Organisation
Document Definition
Document Assignment
Product Identification
Contract
Project
Product Structure
Certification
Product Version Structure
Product Version
Work Request
Part Occurrence
Part And Version Identification
Work Order
Approval
Independent Property
Document Structure
Date Time
Part Structure
Part View Definition
Product View Definition
Date Time Assignment
Document Properties
Independent Property Usage
Product View Definition Properties
Product Model Identification
Configuration Effectivity
Configuration End Item Identification
Independent Property Representation
Product View Definition Structure
Security Classification
Product View Definition Structure Properties
Effectivity
Property Assignment
Shape Property Assignment
Shape Property Representation
Effectivity Application
Elemental Geometric Shape
Geometric Shape With Topology
Property Representation
Foundation Representation
Elemental Topological Shape
Complete
In Work
At Risk


Constructive Solid Geometry
Manifold Surface
Advanced Boundary Representation
Shell Based Wireframe
Edge Based Wireframe
Geometrically Bounded Wireframe
Topologically Bounded Surface
Faceted Boundary Representation
Identification Assignment
Geometrically Bounded Surface
Geometric Shape With Topology
Elemental Geometric Shape
Elemental Topological Shape
Shape Property Representation
Property Representation
Foundation Representation
Shape Property Assignment
Property assignment

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PDM
Plans for the Next Quarter

- **Publish maintenance release of PDM Schema Usage Guide**
- **Submit PDM suite of modules as Technical Specification**
  - **Product Identification- OK**
  - **Product Shape- OK**
  - **Product Structure- OK**
  - **Document- At Risk**
  - **Engineering Change- OK**
  - **Configuration/Effectivity- In Work**

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PDM Challenges

- **Balancing high priority near-term requirements**
  - **Have expanded resources**
- **Mapping Complexity**
  - **Team experience/knowledge of APs 203/214/232**
- **Interface/linkage points with other modules**
  - **Added module joint sub-team call**

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Geometric Dimensioning and Tolerancing (GDT)

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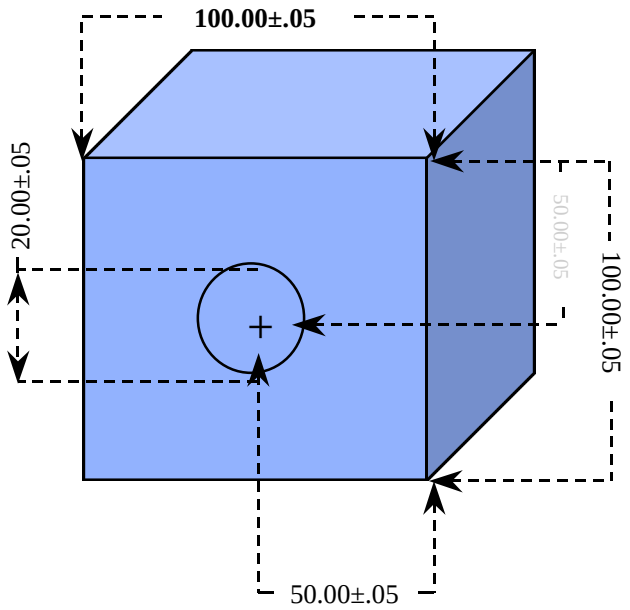
Dimensional Tolerances



USAGE SCENARIOS

- **Identify critical dimensions and tolerances for components**
- **Provide Dimensions/Tolerance data independently of orthographic drawings**
  - **e.g., for Coordinate Measuring Machine programming**

MILESTONES

Q3 99 Recommended Practices complete

Q3 00 First round testing

Q1 01 Submit to ISO as Tech Spec

TECHNICAL LEAD

Tom Hendrix/Mike Strub

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GDT
Recent Accomplishments

- **Updated DDT Recommended Practices**
  - **Harmonized with AP214 FDIS GDT mapping changes**
    - **Agrees with Recommended Practices for Model Viewing**
- **Completed Geometric Tolerancing team draft**
  - **Based on AP214 T2**
    - **Excludes placed datum targets, which are representation**

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GDT
Recent Accomplishments

- AP214 and AIC 519 accepted some GDT comments
- Developed 9 properties modules
  - Several releases for team review
  - Harmonization agreement with EACM
  - Includes shapes needed by GDT

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GDT
Plans for the Next Quarter

- **Continue development of Properties modules**
  - **Anticipate several more reviews**
- *** Complete work on GDT deliverables**
  - **Delayed due to refocus on properties modules**
  - **Geometric Tolerancing AM, Placed Datum Targets AM, Recommended Practices for Geometric Tolerancing**
- **Maintain DDT module**
  - **AP214 FDIS changes and AM Team core modules**

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GDT Challenges

- **Resources**
  - **Mike Strub left the team in March**
- **Harmonization with AP210**
  - **Probably irreconcilable with AP214**
- **Vendor commitment to GDT remains weak**
  - **Continue to promote vigorously**

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Drafting

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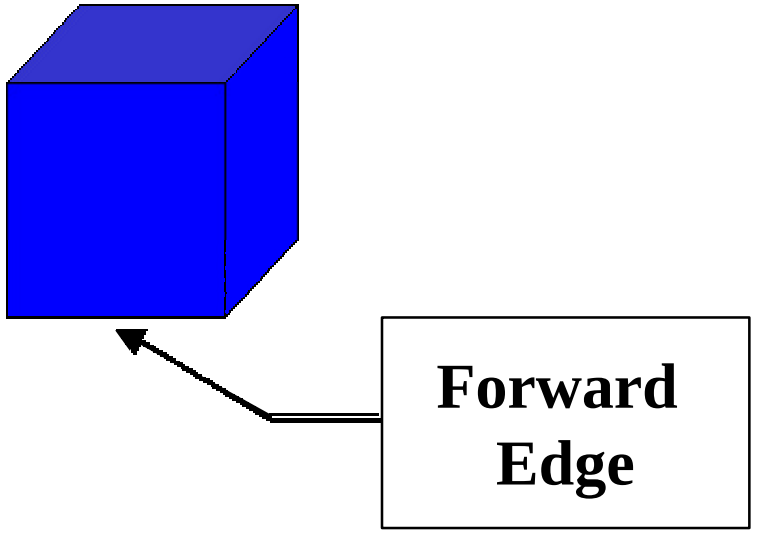
Drafting Annotation/Notes



USAGE SCENARIOS

- Portray attributes, concepts about parts not captured geometrically
- Provide reference information
- Add process information/clarifications
- Identify peculiarities of design
- Identify design constraints
- Present tolerances

MILESTONES

Q1 00 CAx-IF testing for Associative Text completed

Q3 00 Submit associative text to ISO as Tech Spec (TS)

Q1 01 Submit add'l drafting modules as TSs

TECHNICAL LEAD

Rogerio Barra

PDES, Inc.®

Drafting
Recent Accomplishments

- **Set of modules for Shape Appearance and Layers successfully completed ISO Technical Specification ballot**
- **Harmonized recommended practices documents with Japanese project MOSLA**

Drafting
Plans for the Next Quarter

- **Register Shape appearance and layers modules as Technical Specifications**
  - **Need to address ballot issues**
- **Complete documentation for Associative Text module**
  - **Vendor interest improving**
  - **Modules for shape aspect being developed as part of PDM modules**
- **Continue supporting CAx-IF testing**

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Drafting Challenges

- **Resource availability**
  - **New resource quickly getting knowledgeable**
- **Vendor commitment**
  - **Coordinate with ProSTEP and Japanese projects**

Geometric Validation Properties

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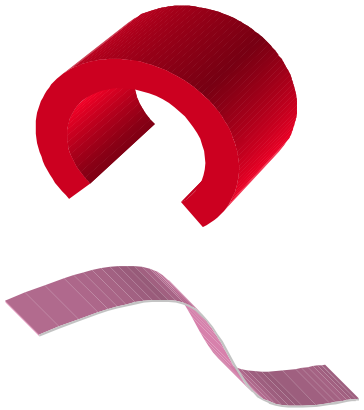
Geometric Validation Properties



Volume & centroid (x,y,z)

Surface area

USAGE SCENARIOS

•Geometric Properties can be calculated from the geometric definition, they are exchanged to enable the validation of translation processes

• Enables highlighting geometry whose properties have changed beyond a user supplied tolerance(s)

- User investigates geometry that changes outside the specified tolerance

MILESTONES

Q2 99 Usage guide complete

Q3 99 AEA Pilot testing began

Q1 00 CAx-IF testing complete

Q2 00 Submit to ISO as TS

TECHNICAL LEAD

Rogerio Barra

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Geometric Validation Properties Plans for the Next Quarter

- ***Produce a module corresponding to this capability**
  - **Resource availability an issue**
  - **Requires properties modules that are being developed as part of PDM suite of modules**

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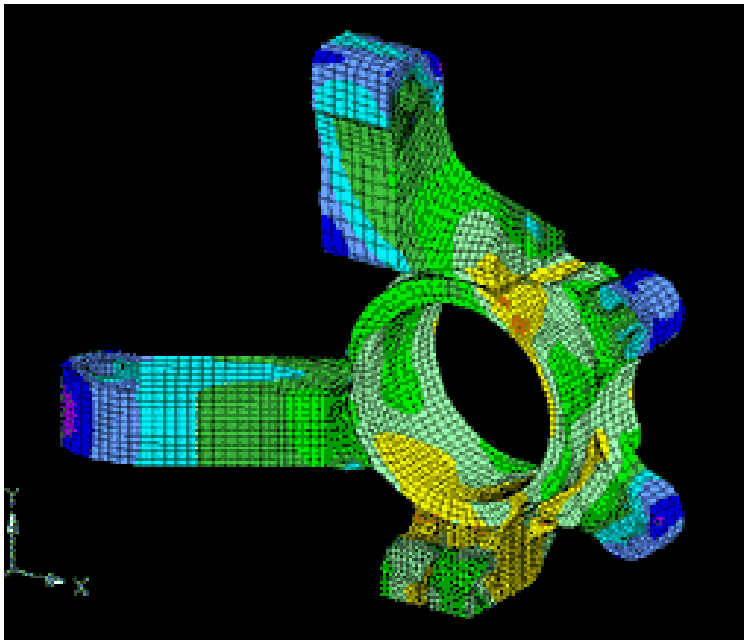
Geometric Validation Properties Challenges

- **Preparing module for ISO process**
  - **Leverage experience with shape appearance and layers modules**

Engineering Analysis



USAGE SCENARIOS

- **CAE to CAE Exchange**
- **AP209 to represent CAE/CAD/PDM**
- **AP209 for Long Term Data Retention**

MILESTONES

Q3 99 Initiated EA pilot

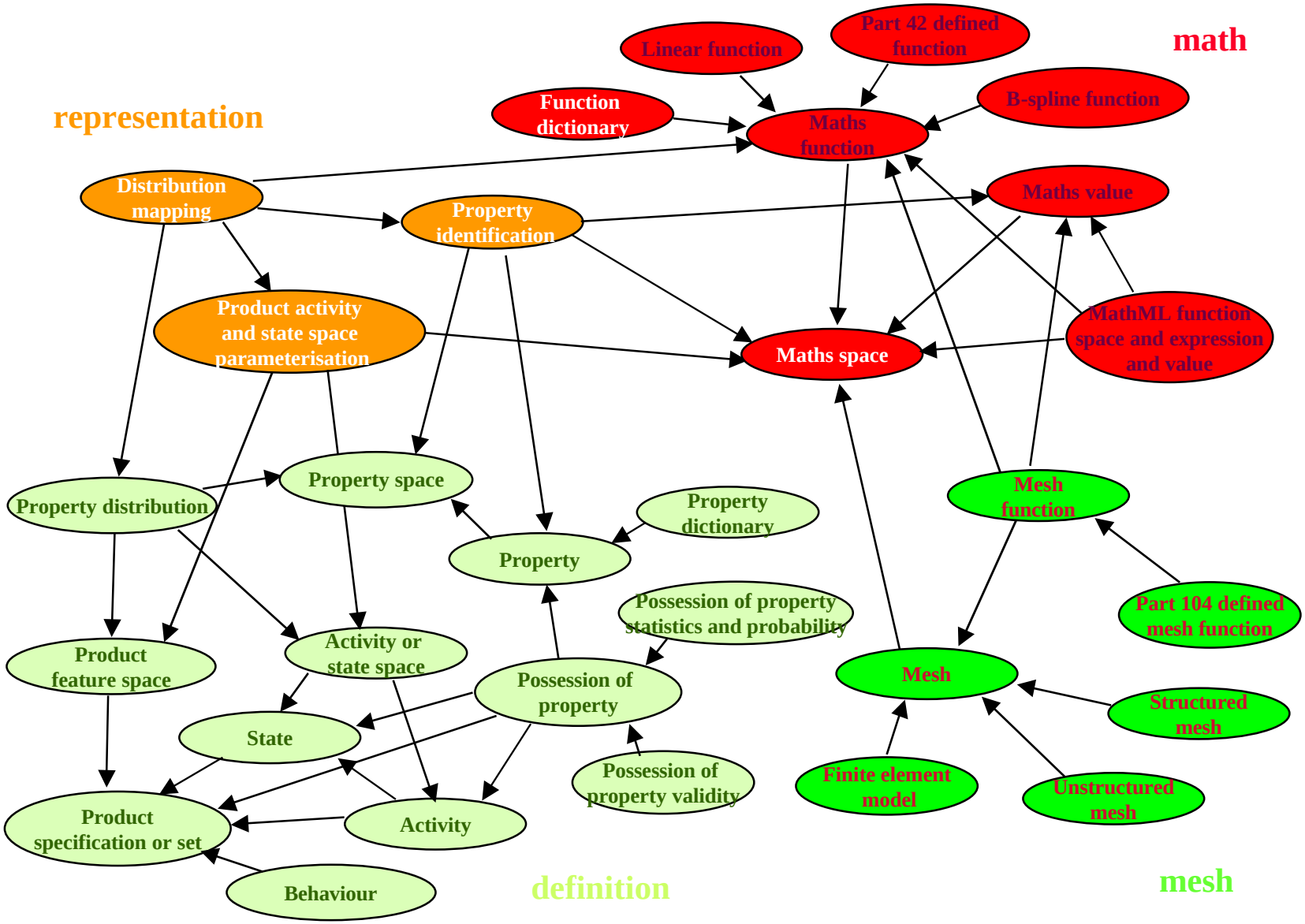
Q4 99 AP209/Part 104 DIS ballots unanimously approved

Q1 00 1st draft EACM modules complete

TECHNICAL LEAD

Keith Hunten/David Leal

EACM Modules



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Engineering Analysis
Recent Accomplishments

- **AP209/Part 104 unanimously passed DIS ballots**
  - **They will be registered as IS**
- **Significant progress in EA Core Model (EACM) modules**
  - **Produced ARM of 27 modules**
  - **Completed interpretation of 9 modules**

Engineering Analysis
Plans for the Next Quarter

- Address DIS ballot issues
- Initiate Abstract Test Suite (ATS) 309
  - Resource availability an issue
- Complete first draft of EACM modules suite

Engineering Analysis Challenges

- Gaining vendor support for AP209
  - Continue encouragement from industrial users through pilot project, AP209 brochure, and web site
- Supporting broad range of analysis requirements
  - Utilize modular approach with AP209/EACM foundation
- Completion of AP209 ATS documentation
  - Canvas EA pilot companies for support

Solid Model Construction History

Prepared by Bill Anderson
ATI/PDES, Inc.

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Solid Model Construction History Recent Accomplishments

- **Productive meetings with CAD vendors and team members at PDES, Inc. Offsite**
- **Vendor representatives from Dassault, SDRC, UG, Autodesk, Spatial**
  - **Discussed vendor responses to questions of access to history information**
  - **Modeling approach was presented and discussed for vendor feedback**
  - **Dassault and SDRC representatives believe that construction history exchange is feasible with current modeling approach**

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Solid Model Construction History Recent Accomplishments

- **Published Feature-Based Construction Operations document**
- **Initiated workshop with vendors at ISO Parametrics Meeting June 29-30**
- **Successful ISO Parametrics Workshop at NIST May 15-17**
  - **Stabilized models**
  - **Determined scope of initial implementation**
  - **Part 21 file creation progress for test part**

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Plans for the Next Quarter

- **Complete EXPRESS corrections to ISO document on history-based modeling**
  - **Model has been in state of change**
  - **Plan to complete in June**
- **Publish joint PDES, Inc./ProSTEP document for vendors and users before Spring Offsite**
  - **Replaced in priority list by offsite preparation**
  - **Superseded by Implementors' Guide to be published by June 15**

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Solid Model Construction History Plans for the Next Quarter

- **Publish Implementors' Guide for Construction History by June 15**
  - **Integrated schema using latest AP203, Part 108 (Parametrization and Constraints on Geometry), Feature-Based Construction Operations, Frame-work for History-Based Models, and Part 42 Ed. 2**
  - **Part 21 file for sample test part**

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Solid Model Construction History Plans for the Next Quarter

- **Facilitate Construction History Workshop with vendors and developers at June ISO Meeting**
  - **Discuss Implementors' Guide at workshop and update based on vendor feedback**
  - **Obtain commitments for participation from major vendors**
- **Obtain commitments from a few major vendors to begin initial implementation**

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Solid Model Construction History Challenges

- **Obtain commitments from major vendors to participate in ISO Workshop and for some to begin initial implementation**
  - **Follow up with vendor contacts and solicit help from users**
- **Develop integrated model and publish Implementor's Guide by June 15**
  - **Maintain close communication with developers through conference calls and e-mail**

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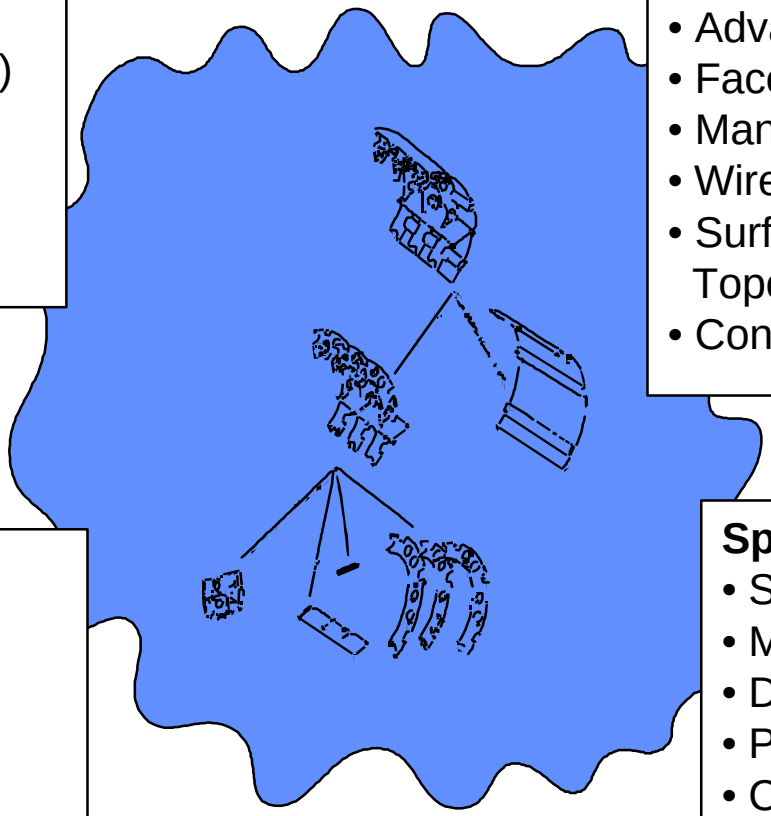
AP203 Edition 2 Configuration Controlled Design

AP203
Configuration Controlled Design

Configuration Management
- Authorization
- Control(Version/Revision)
- Effectivity
- Release Status
- Security Classification
- Supplier

Geometric Shapes
- Advanced BREP Solids
- Faceted BREP Solids
- Manifold Surfaces with Topology
- Wireframe with Topology?
- Surfaces and Wireframe without Topology
- Constructive Solid Geometry?



Product Structure
- Assemblies
- Bill of Materials
- Part
- Substitute Part
- Alternate Part

Specifications
- Surface Finish
- Material
- Design
- Process
- CAD File Reference

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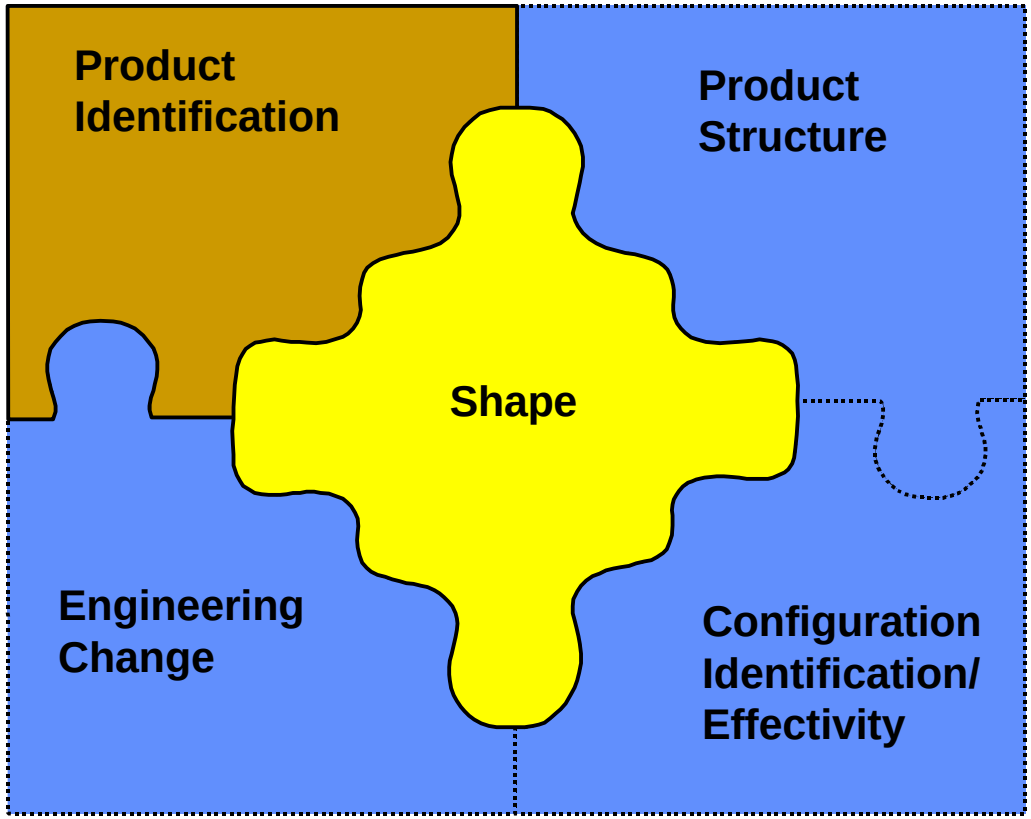
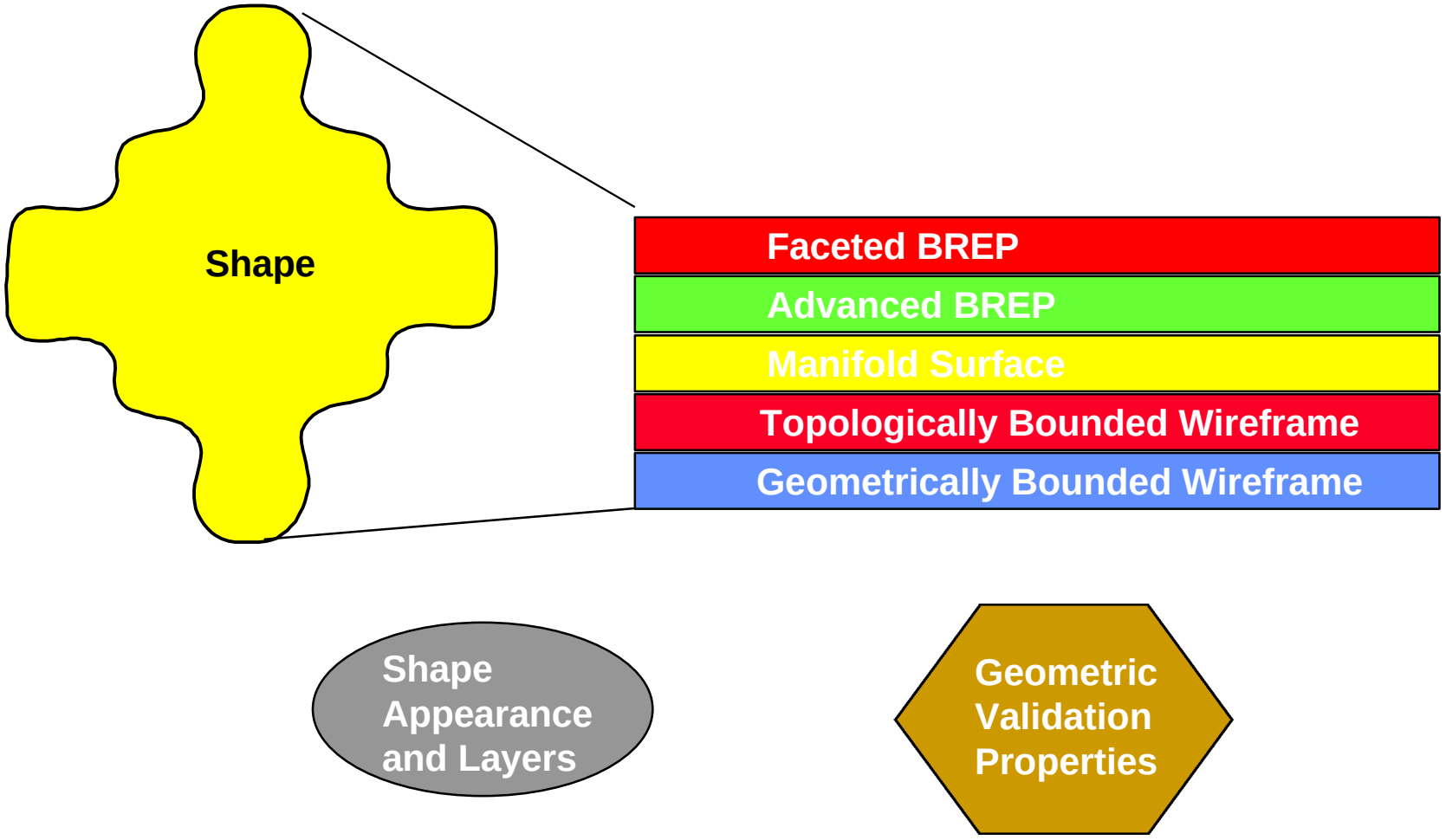
AP203 Edition 2
Basic Functions



AP203 Edition 2
Shape/Extended Functions



AP203 E2
Conformance Classes

- **Minimum of 12 Classes**
  - **Product Identification plus 5 shape types**
  - **All PDM plus 5 shape types**
- **Maximum of 24**
  - **The above plus each shape type can have color or not**

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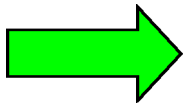
AP203 E2 Challenges

- **Resources**
  - **.25 person effort is barely enough**
- **Post CD support**
  - **Work through modules team**

To EPISTLE IMPLEMENTORS BRIEF

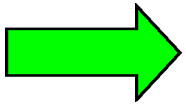


CAx and PDM IF Testing

Larry McKee
IBM/PDES, Inc.

Vendor Translator Information

- **Information on the latest releases of vendors STEP translators can be found at:**
  - **http://pdesinc.aticorp.org/vendor.html**
- **CAD Best practice information can be found at:**
  - **http://www.cax-if.org/bestprac/practice.html**
  - **http://public.prostep.de/BP/**



AP 203 Certified Translators

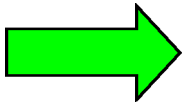
- As of February 4, 2000, 4 CAD vendors had passed certification for ISO 10303-203 CC6a
- These are:
  - AutoCAD Mechanical Desktop Version 4
  - CATIA 4.2.2
  - Theorem Solutions CADDS 5
  - Unigraphics V16
  - SolidWorks 2000
- Contact the vendors or USPro for additional details

Open Discussion

Draughting Demonstrations

W. Haas- Haas and Partner

Y. Manchu- Toshiba



Backups

Issues

- ***Summary- 45 Issues - 4 Open***
- **Issue: 001 Scope**
  - Closed, SEDS
- **Issue: 002 Scope**
  - Closed, SEDS
- **Issue: 003 Integers**
  - Closed, SEDS
- **Issue: 004 ARM vs AIM**
  - Open
- **Issue: 005 Vertex Loop**
  - Closed. Resolved
- **Issue: 006 Conformance Classes**
  - A-Closed,B- Closed,C- Closed, D-SEDS,E-Closed,F-SEDS

Issues...

- **Issue: 007 Model Tolerance**
  - Closed. Being worked by the Accuracy Team
- **Issue: 008 Cooperative Use of APs**
  - Closed-Forwarded to WG10
- **Issue: 009 External Mappings**
  - Closed. Unpersuasive.
- **Issue: 010 Property Definition**
  - Closed. Unpersuasive.
- **Issue: 011 Uncertainties and Context**
  - Closed. Worked by Accuracy Team
- **Issue: 012 Model degradation**
  - Closed. Withdrawn.

Issues...

- **Issue: 013 Bounded Surfaces**
  - Closed, Accepted
- **Issue: 014 Mapping Documentation**
  - Closed. Unpersuasive.
- **Issue: 015 Processor Documentation**
  - Closed, Accepted
- **Issue: 016 Polyline**
  - Open
- **Issue: 017 Circular Arc**
  - Closed. Accepted.
- **Issue: 018 Surface Intersections**
  - Closed. Accepted

Issues...

- **Issue: 019 Scope**
  - Closed, SEDS
- **Issue: 020 Layers and Groups**
  - Closed. Withdrawn
- **Issue: 021 Implementors Agreement**
  - Closed. Accepted
- **Issue: 022 Units**
  - Closed. Will use accuracy team recommendation.
- **Issue: 023 Sphere Topology**
  - Closed. Accepted
- **Issue: 024 Part 21**
  - Closed. Accepted.

Issues...

- **Issue: 025 Angular Units**
  - Closed. Accepted
- **Issue: 026 Part 21 and Schemas**
  - Closed, SEDS
- **Issue: 027 Pcurve in Class 2**
  - Closed. AP 203 to use latest AICs
- **Issue: 028 Processor Usage**
  - Open
- **Issue: 029 Annotation**
  - Closed, SEDS
- **Issue: 030 Complex Instances**
  - Closed, SEDS

Issues...

- **Issue: 031 Implicit ANDOR**
  - Closed. SEDS
- **Issue: 032 Advanced BREP**
  - Closed. SEDS
- **Issue: 033 SDAI Iteration**
  - Closed, SEDS
- **Issue: 034 Non-manifold Solids**
  - Closed. Unpersuasive.
- **Issue: 035 Weight Unit**
  - Closed, Submit SEDS if needed.
- **Issue: 036 AP Identities**
  - Open
- **Issue: 037 Schema Identification**
  - Closed, SEDS

Issues...

- **Issue: 038 Symetrical Parts**
  - Closed, Accepted
- **Issue: 039 Best Translation Practices**
  - Closed. Done by others.
- **Issue: 040 EXPRESS Precision**
  - Closed, SEDS
- **Issue: 041 Defining New Conformance Class**
  - Closed, Can be done by TC/Ammendment/New edition
- **Issue: 042 Use of Surface Entities**
  - Closed. Combine with #41.
- **Issue: 043 Use of Kanji in Part 21**
  - Closed. Being Worked by WG11.

Issues...

- **Issue: 044 Solid Model Construction History**
  - Open- Big Issue
- **Issue: 045 STEP File Meta Data**
  - Open- More appropriate in Quality Committee

Formalization of the International Industry STEP Centers Organization

- **ISC Concept**
  - **Formalize the STEP Centers so that they can develop and promote Advanced Industry Standards within ISO SC4**
  - **Work toward a fast track process so that Advanced Industry Standards can go straight to DIS/FDIS ballot cycles**
  - **Form a group similar to the Object Management Group (OMG) that can submit standards directly to SC4 for fast tracking**
- **Concept in early discussion stage among STEP Centers**

Geometric Accuracy

Geometric Accuracy

STEP for shape is in production!

- Exchange of solids has proven to be as good as direct translators
  - Must use the latest translators and must have good models

Exchange rates over 90% (reported at 93-97%)

Accuracy problems minimal at present and either require model fixes or CAD kernel fixes

Users should look to system model checking process or third party model checker to validate shape

This is the first BIG issue to be subdued!!!!

Geometric Accuracy Example

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- The following example is provided to give additional background on the nature of the problems encountered in the representation and exchange of Boundary Representation (B-rep) solid models.
- Figure 1 shows an "idealized" solid model. Vertex A "is" the intersection of edge curves e1, e4, and e5 and edge curve e1 "is" the intersection of face surfaces F1 and F2.

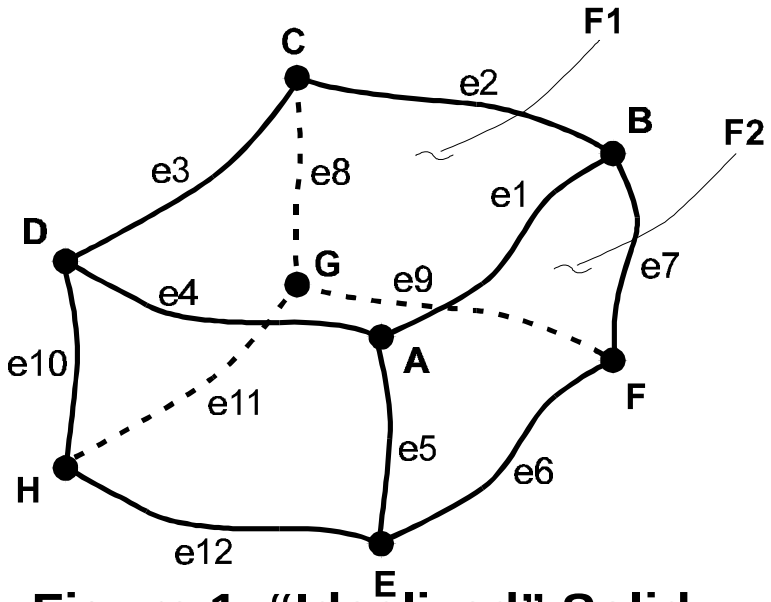

Figure 1. "Idealized" Solid

Geometric Accuracy Example (Cont'd)

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- **Operations and algorithms are used to create solids resulting in vertices that may not lie exactly on edge curves and edge curves that may not lie exactly on surface intersections. The "actual" or "real" solid may have gaps, etc as in Figure 2.**
- **Scenario: CAD-X creates the valid solid in Figure 2 using a tolerance of .003mm to determine if vertices are on edge curves. Topology structures would state A and B are start and end vertices of edge curve e1, B and C are start and end vertices of e2, etc. Edge curve e1 forms the boundary of F1 and F2, etc.**

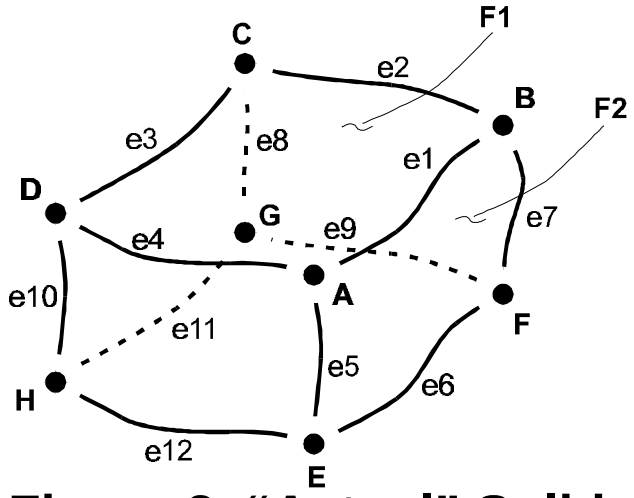

Figure 2. "Actual" Solid

Geometric Accuracy Example (Cont'd)

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- Since CAD-X used a .003mm tolerance criteria for determining if a vertex in on an edge curve, a sphere of radius .003mm centered at A will contain "end segments" of e1, e4, and e5 as in Figure 3. Thus, A is on e1, e4, and e5 in CAD-X.
- A STEP file is created containing the geometry and topology structures to define the solid. The STEP file is translated into CAD-Y which uses .001mm for determining vertex/edge curve relations. Now, a sphere centered at A of radius .001mm in CAD-Y does not contain points on e1, e4, or e5. Thus, CAD-Y indicates vertex A does not lie on any edge curves and the solid is invalid.

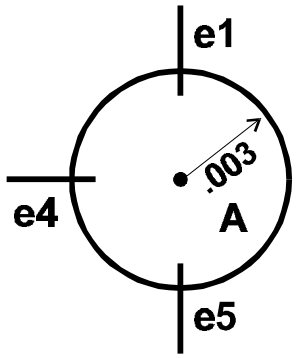

Figure 3

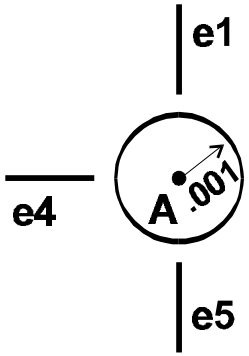

Figure 4

Geometric Accuracy Example (Cont'd)

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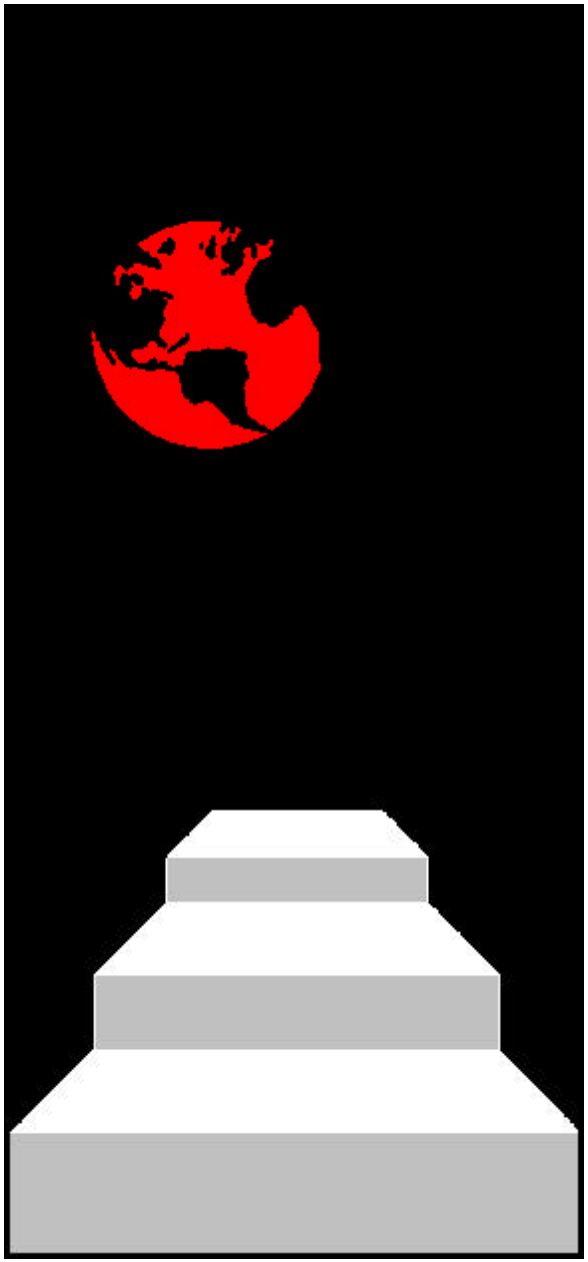
- If CAD-X sends the .003 mm tolerance value (uncertainty value in STEP) in the file then CAD-Y would be alerted that it may need to perform some operations , such as reintersect the edge curves e1, e4, and e5, or associated surfaces, in order to calculate a vertex point within .001mm of the edge curves.
- The situation for edge curves that fail to be exactly on surfaces is more complex. Generally, surface-to-surface intersection algorithms require an iterative approach that converges on a solution. The 3-D points output will generally be on one surface and be within some tolerance of the other. The accuracy of that curve may be increased by increasing the density of the points output from the algorithm.



Part 21 Amendment Contents

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Requirements

- **P21 itself upward compatible**
- **Short name capability for entities, defined types And enumeration item names**
  - **Partially addressed by the Technical Corrigendum, need to add one sentence to P21, and APs need to start defining them.**
- **Remove all external mapping conformance class**
- **Remove scope construct**
- **AP conformance class in header**
- **Default language for file in header**
- **AP interoperability -- multiple data sections**

P21 Upward Compatible

- **Use general version identification mechanism introduced by the TC.**
  - **Introduce a new implementation value '3;1'**
  - **Note that '3;2' will not be needed since CC2 is gone.**

Remove CC2 and Scope

- **Remove/edit the specifications from the relevant document sections.**
- **P21 CC2 (All External Mapping)**
  - **Affected Clauses: 5.3, 9.2.1, 11.2.5.1**
- **Scope**
  - **Affected Clause: 10.3**

Multiple Data Sections

- **Formalizes the multiple-data section proposal first circulated last year.**
  - **Current single data section P21 files are still completely legal.**
  - **When multiple sections used, data in each is defined by a single schema (although a list is used as with file_schema.) Each section can have a name. If used, the names must be unique.**
  - **References between sections legal. Type compatibility of references an EXPRESS issue, not Part 21.**
  - **Header file_schema contains the complete list of schemas used by the file.**

Multiple Sections - Extension Schema

```
ISO-10303-21;
HEADER;
/* some header entities omitted */
FILE_SCHEMA (('CONFIG_CONTROL_DESIGN', 'EXTENSIONS'));
ENDSEC;

DATA ('AP-203 Data', ('CONFIG_CONTROL_DESIGN'));
#19=PERSON('099-111-2222','Jones','Tom',$,$,$);
#20=ORGANIZATION($,'Foo','Foo Bar Inc.');
#21=PERSON_AND_ORGANIZATION(#19,#20);
ENDSEC;

DATA ('Local Extensions', ('EXTENSIONS'));
#100=SOME_EXTENSION_ENTITY (#19, #21);
ENDSEC;
ISO-10303-21;
```

Multiple Sections - One Schema

```
ISO-10303-21;
HEADER;
/* some header entities omitted */
FILE_SCHEMA (('CONFIG_CONTROL_DESIGN'));
ENDSEC;

DATA ('People', ('CONFIG_CONTROL_DESIGN'));
#19=PERSON('099-111-2222','Jones','Tom',$,$,$);
ENDSEC;

DATA ('Organizations', ('CONFIG_CONTROL_DESIGN'));
#20=ORGANIZATION($,'Foo','Foo Bar Inc.');
ENDSEC;

DATA ('The Rest', ('CONFIG_CONTROL_DESIGN’));
#21=PERSON_AND_ORGANIZATION(#19,#20);
ENDSEC;
ISO-10303-21;
```

Multiple Sections - Multiple APs

```
ISO-10303-21;
HEADER;
/* some header entities omitted */
FILE_SCHEMA (('CONFIG_CONTROL_DESIGN',
              'ASSOCIATIVE_DRAUGHTING'));
ENDSEC;

DATA ('AP-203 Data', ('CONFIG_CONTROL_DESIGN'));
#19=PERSON('099-111-2222','Jones','Tom',$,$,$);
#20=ORGANIZATION($,'Foo','Foo Bar Inc.');
#21=PERSON_AND_ORGANIZATION(#19,#20);
ENDSEC;

DATA ('AP-202 Data', ('ASSOCIATIVE_DRAUGHTING'));
#100=PERSON_ROLE ('an AP-202 person role');
#101=DRAUGHTING_PERSON_ASSIGNMENT(#19, #101,
           (/* some things assigned */));
ENDSEC;
ISO-10303-21;
```

AP Conformance Class in Header

- **Add section_context entity**
  - **Associates context strings with a section. Could contain numeric conformance class designations, or other keywords defined by the AP.**
  - **For multiple data sections, repeat as needed. For name is null ($) for single, unnamed section.**
  - **Not mandatory, may be used if desired. If used, must appear after the standard three header entries.**

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('),'3;1'); /* note new impl level */
FILE_NAME('foo','1998-02-24T16:15:31',('),('),'','','');
FILE_SCHEMA (('CONFIG_CONTROL_DESIGN',’SOME_OTHER_AP’));
SECTION_CONTEXT (’sect1’,(‘1’,’5’,’6’));
SECTION_CONTEXT (’sect2’,(‘CC-XYZ’));
ENDSEC;
```

Default Language in Header

- **Add section_language header section entity.**
  - **Associates a default language with a data section.**
  - **Language must be identified using ISO 639 names, all uppercase as with file_schema.**
  - **For multiple data sections, repeat as needed. For name is null ($) for single, unnamed section.**
  - **Not mandatory, may be used if desired. If used, must appear after the standard three header entries.**

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('),'3;1'); /* note new impl level */
FILE_NAME('foo','1998-02-24T16:15:31',('),('),'','','');
FILE_SCHEMA (('CONFIG_CONTROL_DESIGN'));
SECTION_LANGUAGE (‘section1’,'DEUTCH');
SECTION_LANGUAGE (‘section2’,’US-ENGLISH’);
ENDSEC;
```

Certification Testing

US Pro Testing Details

US PRO

- Scope
  - STEP AP203 cc1a, cc6a for initial test period
- Initial Test Period
  - Six months or up to six products/applications
- Cost for initial test period $5,000
  - Pre and Post Processor
- Up to two re-tests if required
  - Cost of re-test $2,500 per preprocessor
  - Cost of re-test $2,500 per postprocessor
- Common sense will prevail
  - No re-test required for misinterpretations, typos, etc.

Testing Process

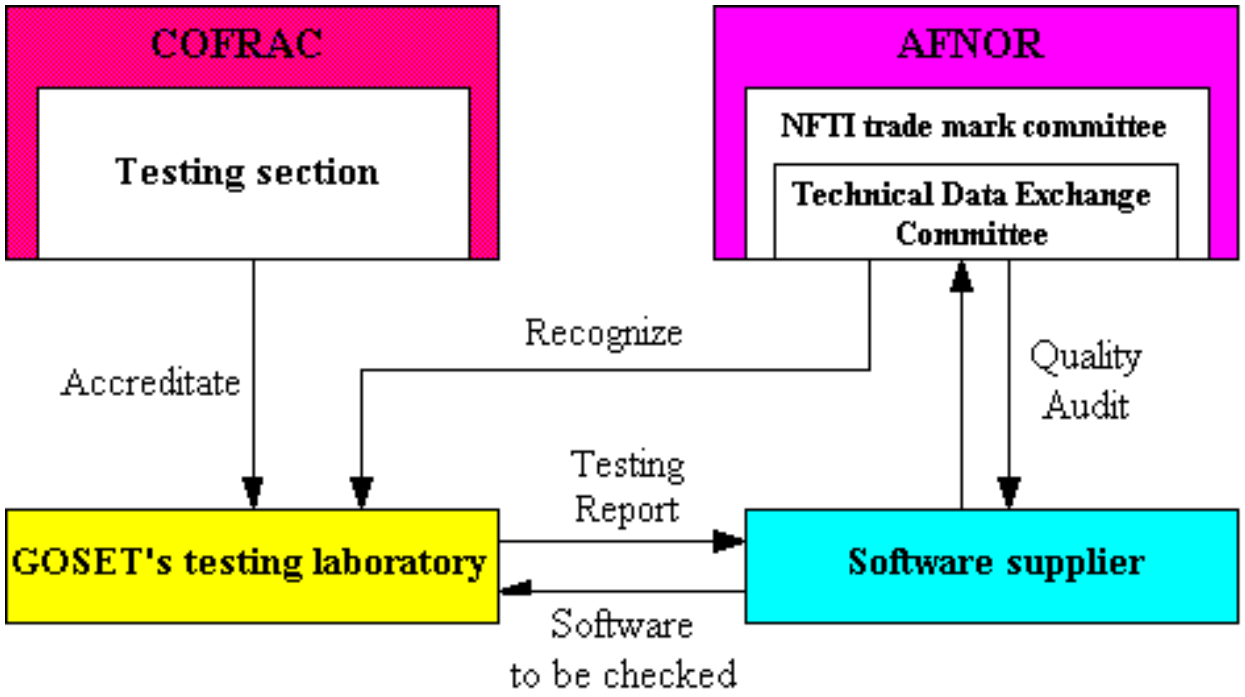
US PRO

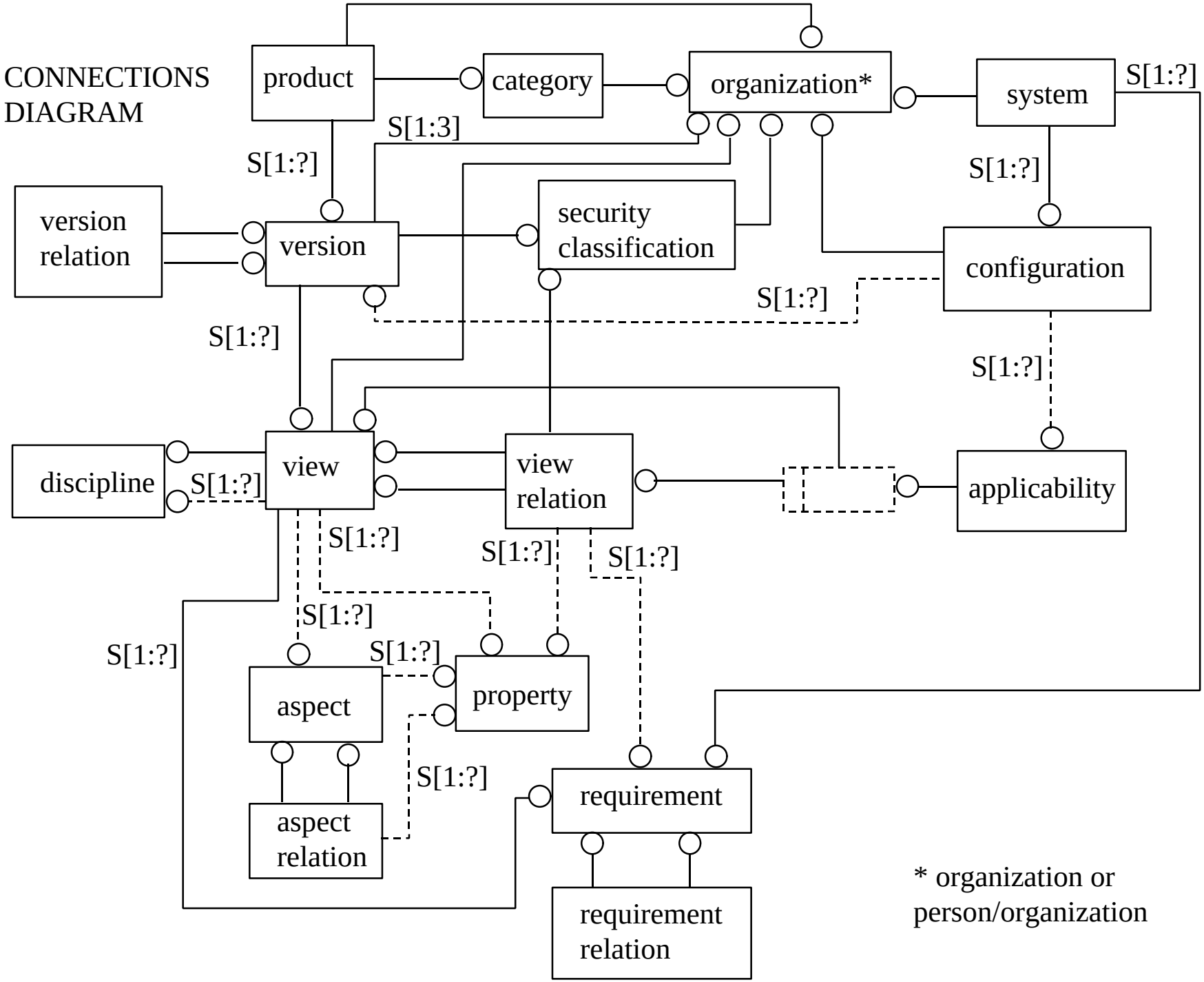
- **Sample test data available on certification web site at no cost**
  - **Vendors encouraged to process sample data first**
  - **Test analysis not included on free site**
  - **STEP structure checker, other tools available on other sites**
- **Official testing:**
  - **Apply to US PRO for test account**
  - **Account established with “live data”**
  - **Ten business days allowed to process and submit data files**
  - **Results available from test lab within ten business days**
  - **Debriefing conference call to explain results**
  - **Re-test if necessary or apply for use of the mark**

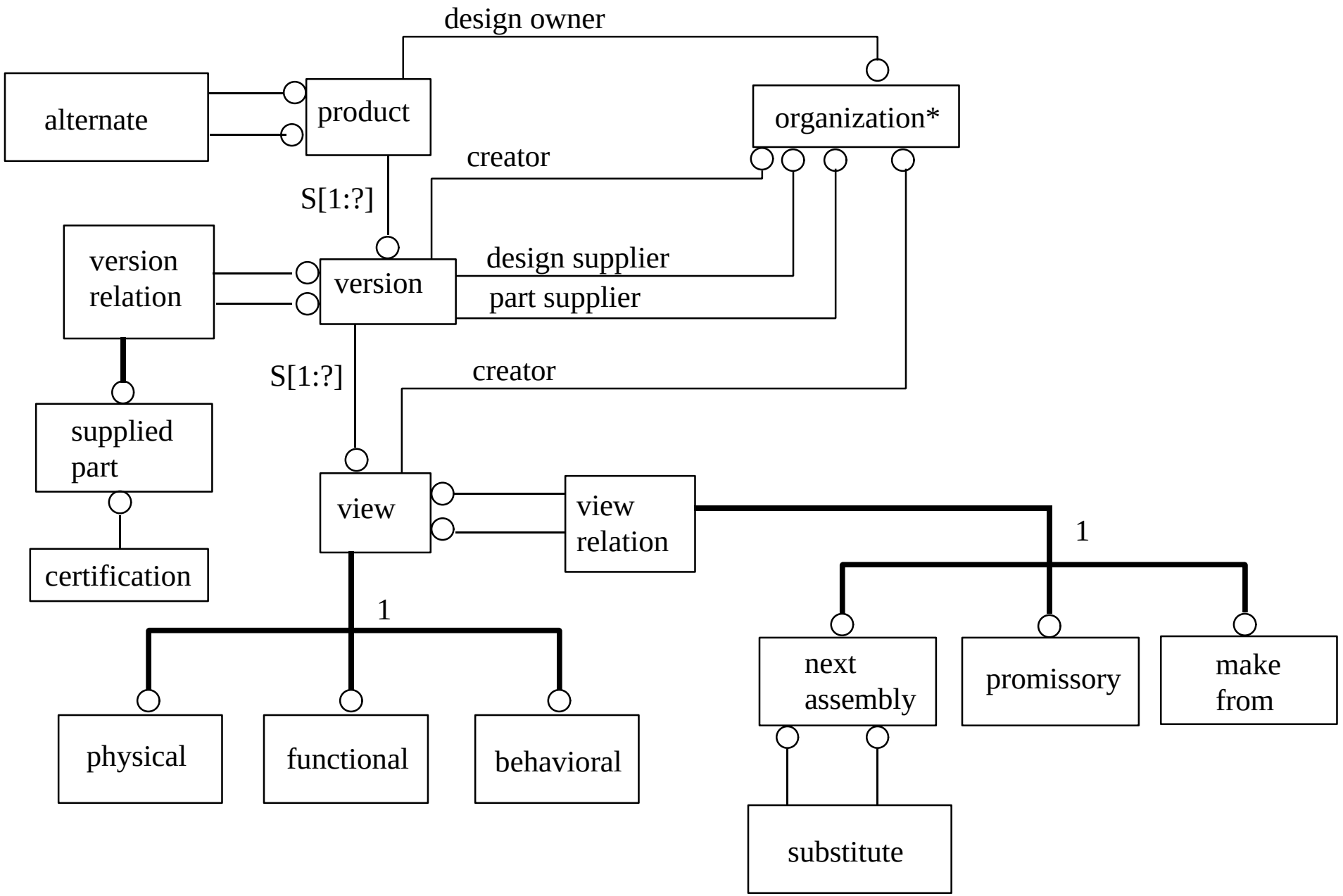
Goset Testing Details

- **Scope**
  - **STEP AP203 all classes using the French Z68-333 standard(currently)**
- **International Recognition**
  - **The device thus put in place for tests and the certification of interface SET and STEP AP 203 constitutes a world first.**
  - **The accreditation of GOSET's laboratory by the COFRAC ensures the recognition of the test reports in 16 countries.**
  - **Moreover, partnership agreements signed with AFNOR and its counterparts ensure an international recognition of NFTI Technical data exchange certificates**

Testing Body Relations




CONNECTIONS DIAGRAM
product
category
organization*
system
S[1:?]
S[1:3]
S[1:?]
S[1:?]
version relation
version
security classification
configuration
S[1:?]
S[1:?]
S[1:?]
discipline
S[1:?]
view
view relation
applicability
S[1:?]
S[1:?]
S[1:?]
S[1:?]
S[1:?]
S[1:?]
aspect
property
S[1:?]
aspect relation
requirement
requirement relation
* organization or person/organization


design owner
alternate
product
organization*
creator
S[1:?]
version relation
version
design supplier
part supplier
S[1:?]
creator
supplied part
view
view relation
1
certification
1
next assembly
promissory
make from
physical
functional
behavioral
substitute

An Assembly
Parts List

ASSEMBLY NUMBER	CAGE	REVEO	DATE	EN/EO NUMBER	NOUN
2828292-1	QQQQQ	-	940102	EN111111	BOX

ITM	REF DES	QTY	UM	CAGE	DWG/DOC NUMBER	PART/DOC NUMBER	*----------NOUN----------*	S Y	P L	C H
001		1	01	QQQQQ	2828288	2828288-1	REAR PANEL			D
002		1	01	QQQQQ	2828289	2828289-1	FRONT PANEL			A
003		2	01	USA	3800000	3800000-1	PANEL		G	D
004		1	01	QQQQQ	2828290	2828290-1	BOTTOM PANEL			D
005		1	01	QQQQQ	2828291	2828291-1	ACCESS PANEL			D
005		1	01	QQQQQ	2828291	2828291-2	ACCESS PANEL		S	D
006		4	01	88888	1100000	1100000-1	SCREW	V	N	D
006		4	01	98989	2200000	2200000-1	SCREW	V	K	D
				QQQQQ	6-0001-120	6-0001-120	MATERIAL BRAZING		R	R
					7865000_BOX	7865000_BOX	CAD SYSTEM MODEL OF BOX ASSEMBLY			R

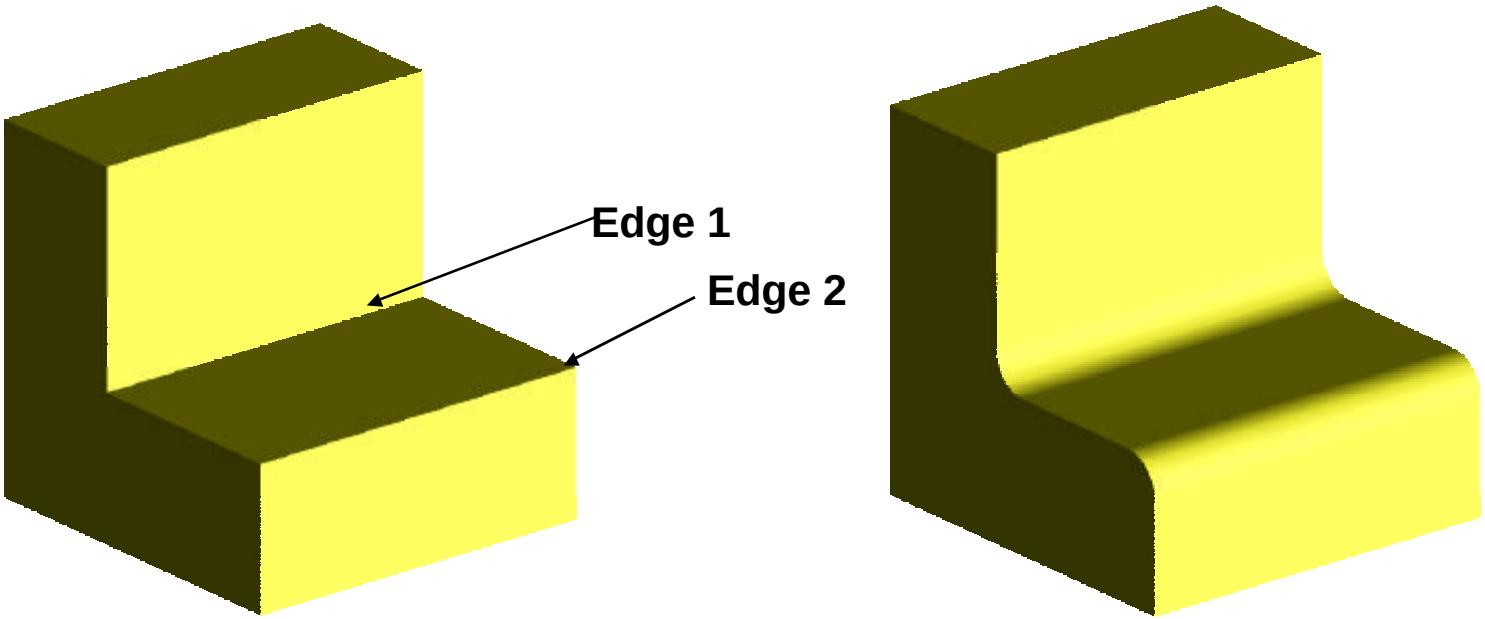
UNIT OF MEASURE (UM)	SYMBOL CODE (SY)	PLANNING CODE (PL)
01= PIECE EA.	FOR GOVERNMENT	K= ALTERNATE ITEM P= BULK MATL
11= INCH	STANDARD ITEMS:	(ALL OTHER PL CODES ARE FOR
12= FEET	E= ELECTROSTATIC SENSITIVE	REFERENCE ONLY) EG:
18= CUBIC FOOT	H= HEAT SENSITIVE	G= GOVT FURN ITEM J= AS REQD
21= METER	S= SOLVENT SENSITIVE	L= DO NOT FILL N= VEND FURN
26= MILLIMETER	M= MULTISENSITIVE	R= REFERENCE Z= DUMMY CONN.
31= OUNCE(AVDP)	FOR OTHER ITEMS:	X= DO NOT GENERATE S= SUBSTITUTE
35= OUNCE(TROY)	V,E,H,S,M= VENDOR ITEM- SEE	
41= GRAM	CONTROL DRAWING	CHARACTER CODE (CH)
44= CUBIC CENTIMETER	E,H,S,M= ALSO INDICATES PROCESS	A= WITH PARTS LIST
59= FLUID OUNCE	SENSITIVITY AS	D= WITHOUT PARTS LIST
66= CUBIC INCH	INDICATED ABOVE.	R= FACTORY REFERENCE

An Application List

APPLICATION LIST APPLICATION LIST ISSUES ARE INDEPENDENT OF DRAWING CHANGE LETTERS CONTRACT NO: XXXXXX-XX-X-XXXX	PDES, INC. CHARLESTON,SC CAGE CODE: PDESI	MODEL: TEST CI NO: TESTCI NOMENCLATURE: TEST ASSEMBLY	DRAWING NO. AL2828289 DWG SIZE: J / REV: B / AL ISSUE: AL DATE: 1999/08/30 AL SHEET: 1

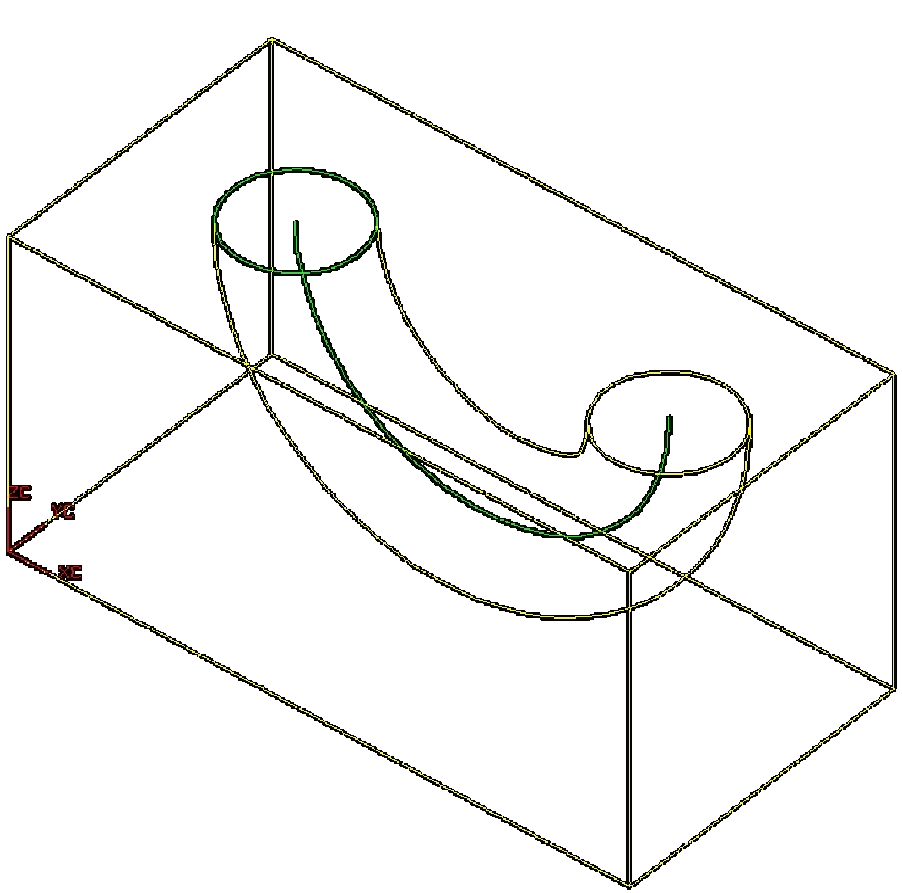
CONFIGURATION/ PART	MODEL	SECTION	EFFECTIVITY FROM - THRU	REV	END ITEM QTY	ENA CUM QTY	NEXT ASSEMBLY DRAW/ENA	CONFIGURATION ITEM NO.
2828289-1	TEST	FA362	T001-005	A	0001		2828289	
			T005-007	B				
			D001 , S001	A				
2828289-2	TEST	FA362	T001-005	A	0001		2828289	
			T005-007	B				
			D001 , S001	A				
2828289-3	TEST	FA362	T001-005	A		0000001	2828290-1	
			T005-007	B				
			D001 , S001	A				
2828289-4	TEST	FA362	T001-005	A		0000001	2828290-1	
			T005-007	B				
			D001 , S001	A				

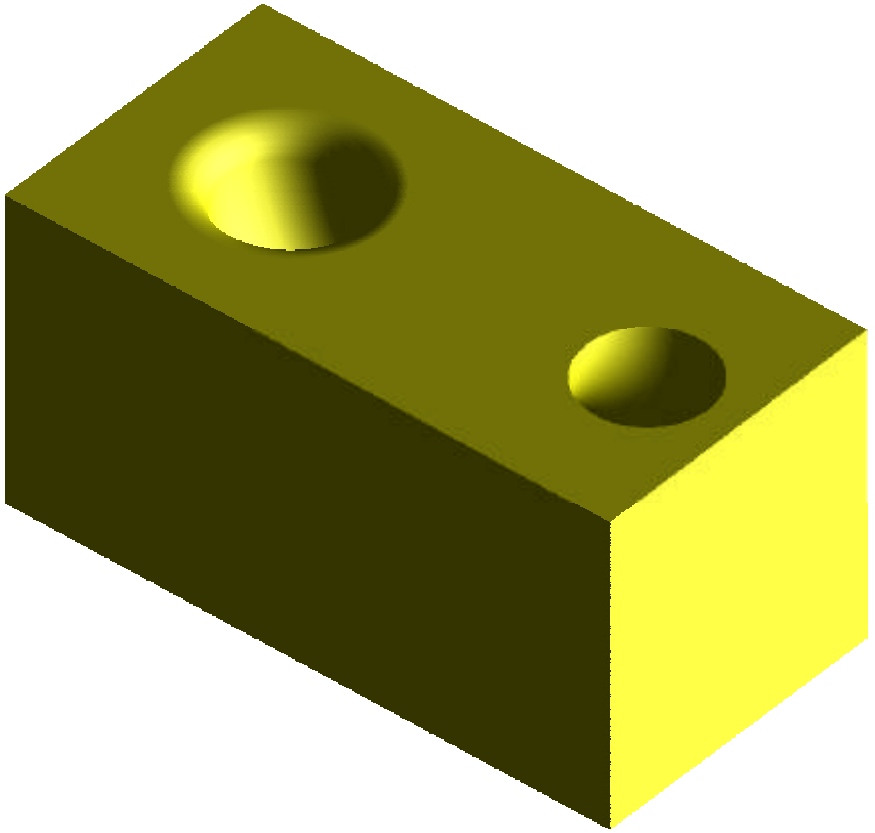
Edges Lost from Filleting



Since Edges 1 and 2 are 'lost', their identities must persist in STEP for editing in native system

Toroidal Passage and Fillet





The two entry holes must be ‘distinguished’ in order that the fillet is identified with correct hole

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