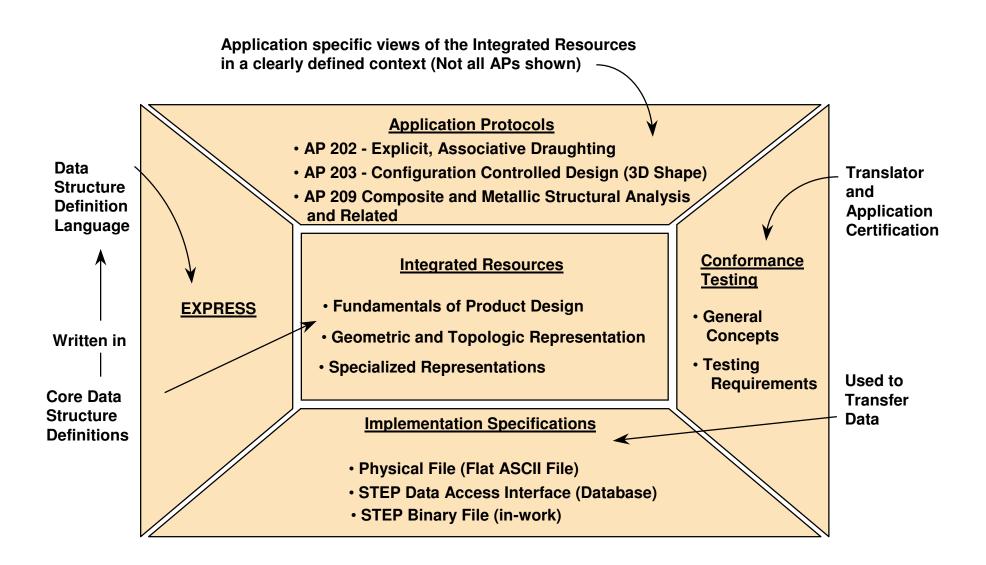
AP209 Modular Edition 2 Update for AIAA CGNS Team 1/5/2007

Keith Hunten, P.E. Lockheed Martin Aeronautics Co.

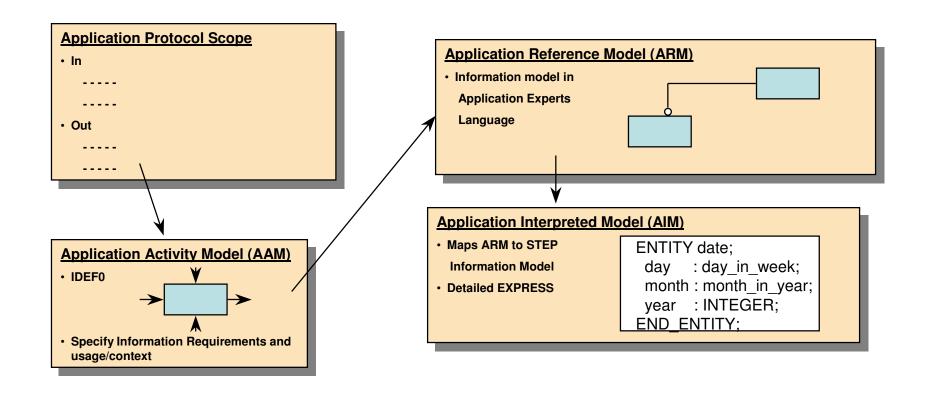
Overview

- Overview of STEP Architecture
- AP209 E2 Modularization Approach and Progress
- High Level AP209 E2 Engineering Analysis Composition
- Applicable Recent Integrated Resource Developments
- Remaining Tasks
- Future Cooperation

Elements of the ISO 10303 STEP Standard



STEP Application Protocol (AP) Components



Conformance Classes

Defines requirements for software implementing the AP

Test Cases/Suites

· Used to certify software implementations

Applicable Recent Engineering Analysis Integrated Resource Developments

- Parts 50 and 51provide the mathematical basis for the definition and representation of fields and expressions
 - Including external binary format representation
- Parts 52 and 53 provide the remaining basis for structured and unstructured meshes
 - Part 110 adds further detail for Fluid Dynamics
- Part 107 provides the linkage between existing Part 104
 - based FEA and the above

Part 50: Mathematical constructs

Part 51: Mathematical description

Part 52: Mesh based topology

Part 53: Numerical analysis

Part 104: Finite element analysis

Part 107: FEA definition relationships

Part 110: Mesh based computational fluid dynamics

Modularization Approach and Progress

Primary Objective

- Modify/include existing modules (203 E2, PDM)
- Create Materials, and Composites modules from AP209 E1
- Create FEA modules from AP209 E1
- Create Engineering Analysis Core Model (EACM) Fields modules from newly developed STEP Integrated Resources
- Create Structured/Unstructured Grids and Analyses from STEP integrated resources derived from the integration of the AIAA CGNS standard and EACM
 - Fluid Dynamics and Heat Transfer (ESA STEP/TAS TBD) are initial goals
- Create Implementation and AP modules (TBD)

Progress

 Application Reference Models (ARMs) have been created, compiled, and EXPRESS-G diagrams drawn for all but the Implementation and AP modules

• Stretch Objective

Create Nonlinear Analyses by enhancing IRs and Modules (TBD)

High Level AP209E2 Engineering Analysis Modular Composition*

Analysis Identification

Analysis_assignment

Analysis_characterized

Analysis_identification

Analysis_product_relationships

Retention_period

Analysis Shape

Analysis_shape

B_spline_volume

Finite_element_shape

Non_manifold_surface

Fields and Properties

FEA_definition_relationships

FEA_material_aspects

CFD_specified_general_property

Analysis Model

Analysis

Analysis_representation

External_analysis_representation

Finite_element_model

CFD model

Mesh_connectivity

Mesh_topology

Product_analysis

Analysis Control and Results

CFD_conditions

CFD_equations

CFD results

Finite_element_analysis

Mesh_function

* See backup charts for complete high-level planning model

Analysis Model, Control, and Results

Remaining Tasks

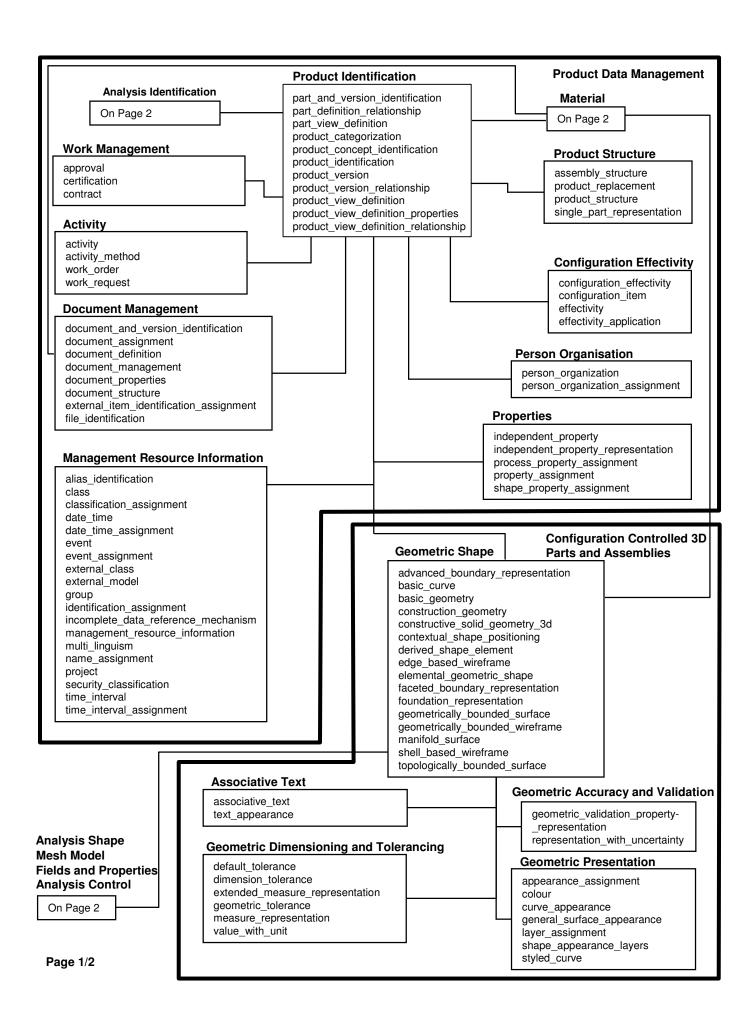
- Complete the copying of ARM object and attribute definitions into modular publishing format
- Copy in existing ARM-AIM mapping tables
- Create mapping tables for new CFD and mesh-based numerical analysis modules
- Create final long form EXPRESS AIM (implementation form)
- Send out for ISO ballot

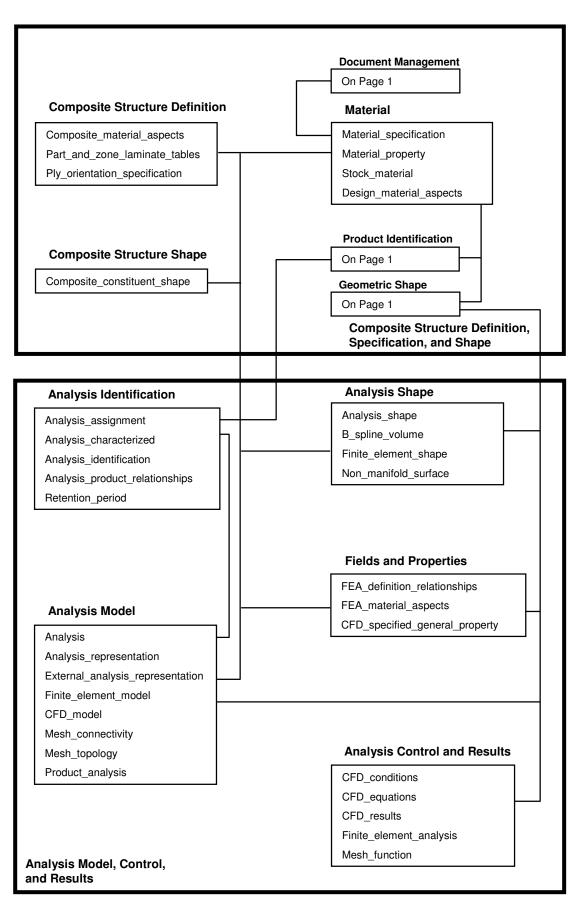
Potential Areas of Cooperation

- STEP has been creating an new Binary implementation form based upon HDF-5
 - David Price of EuroSTEP has been doing this under VIVACE funding
 - CGNS has as well
- Experience has taught us that in order to really get widespread implementation a high-level API must be developed
 - ISO STEP Engineering Analysis team would definitely like to get a lessons learnt and advice from CGNS team on their experiences with this
 - Since the CGNS model was (fairly) faithfully used in the integration with other STEP IRs we should be able to come very close, if not exactly, to the existing CGNS API for the CFD subset

Backup Slides

AP209 E2 High Level Planning Model





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