Collaboration in Academia - Distributed Product Development Using PLM Tools

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Presented at NDES March 3-4, 2003 Chicago, IL

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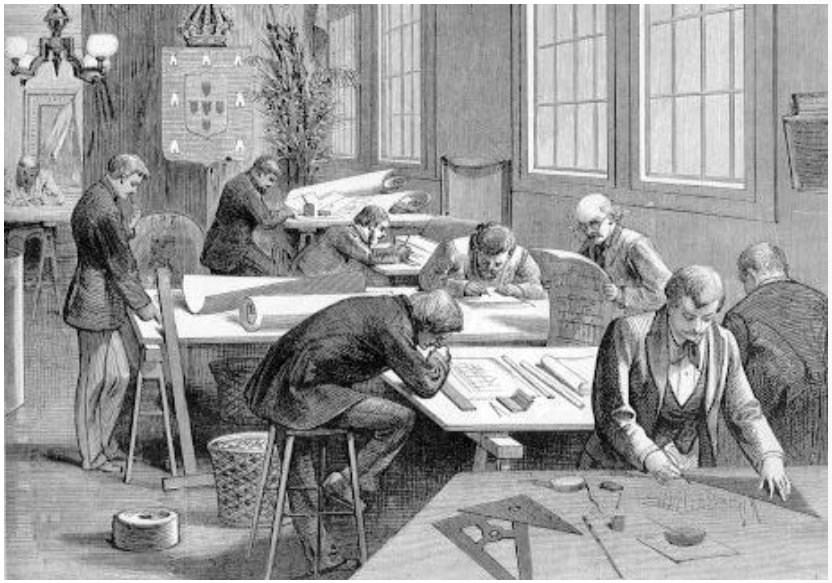
Engineering Education of the Past

- Specialized
- Theoretical
- Empirical
- Product Focused
- Focused on Individual Learning



Engineering Education of Tomorrow

Set or Reflect Industry Trends!

- ❑ Multidisciplinary Teamwork
- ❑ Project Management Skills
- ❑ Practical Experience and Industry Contact
- ❑ Distributed
- ❑ Students focused on Product and Process

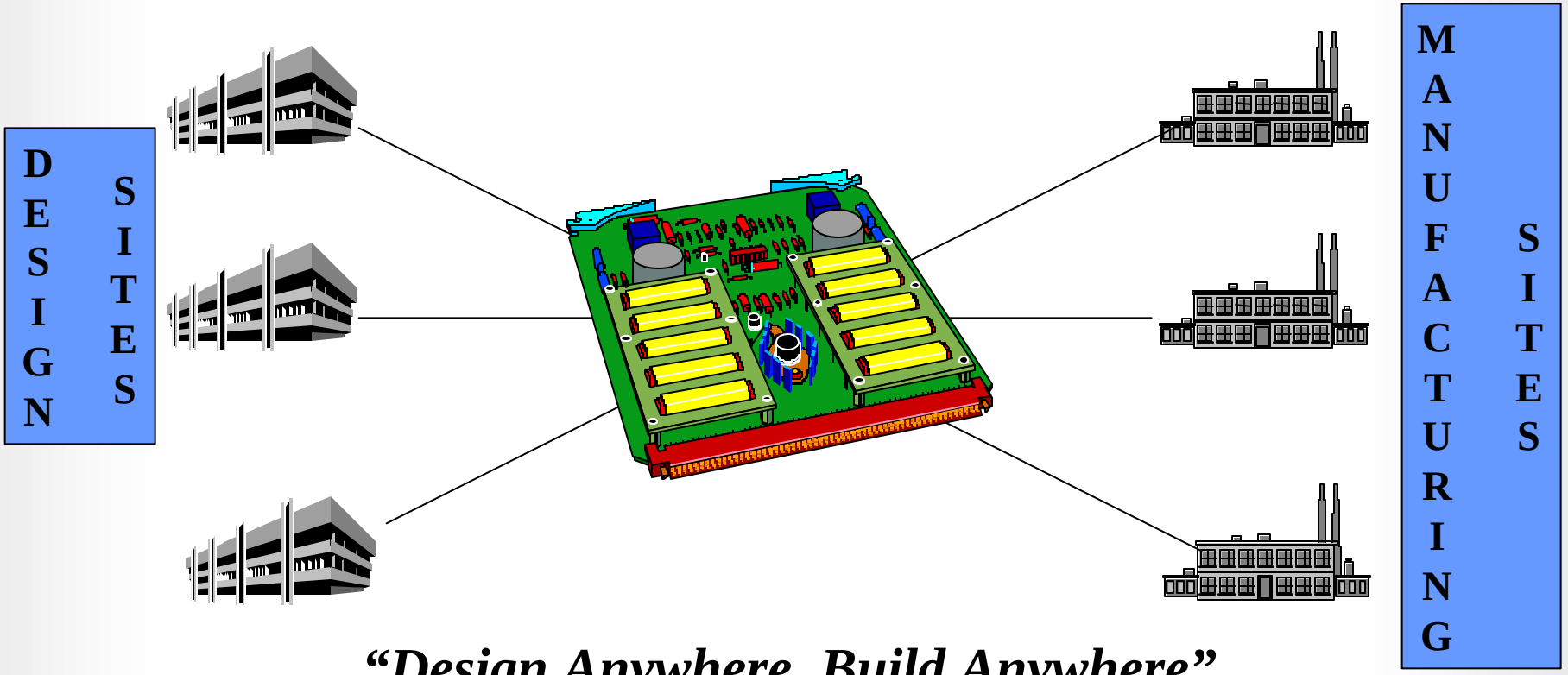
The e-University Environment

GT PORTAL

- News and Information
- Web mail
- Registration
- Forms
- Billing
- Grades
- Library (Literature Search)
- Distance Learning

Design and Manufacturing Flexibility

STEP - STandard for the Exchange of Product model data



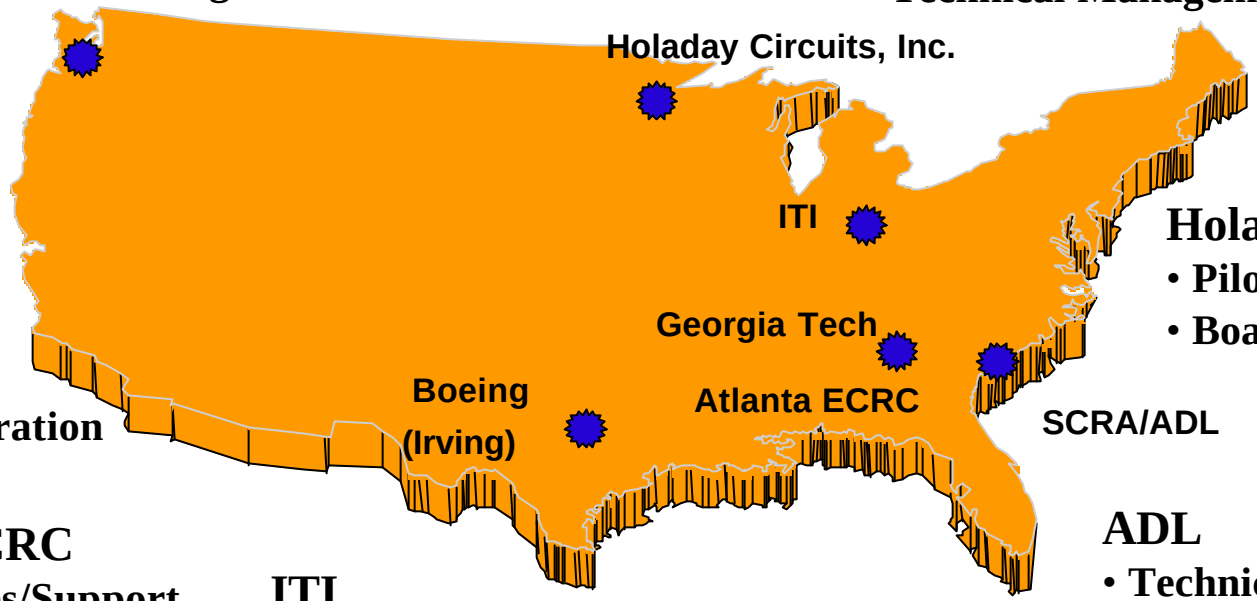
"Design Anywhere, Build Anywhere"

Distributed Development Demo

Team InteGrated-Electronic Response (TIGER)

Boeing
- Pilot DoD Prime
- Software Enhancement, Integration

SCRA
- Software Enhancement, Integration
- Technical Management



Holaday
- Pilot SME
- Board Mfg. Expert

Georgia Tech
- Analysis Tools
- Software Integration

Atlanta ECRC
- EC Services/Support
- Technology Transfer

ITI
- Software Development, Integration

ADL
- Technical Support
- Management Support

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TIGER Integrated Product Team Solutions

Requirement	Solution
Distributed Sites	Internet Communications
Heterogeneous ECAD Systems	STEP AP210 Product Data Standards
Diverse Assembly & Fabrication Capabilities	STEP AP220 Manufacturing Data Standards
Diverse Business Systems	EDI Standards
Issue Resolution	Internet/STEP Negotiation Facility
Small-and-Medium (SME) Limited Resources	ECRC Training/ Service Bureau Access to TIGER Tools

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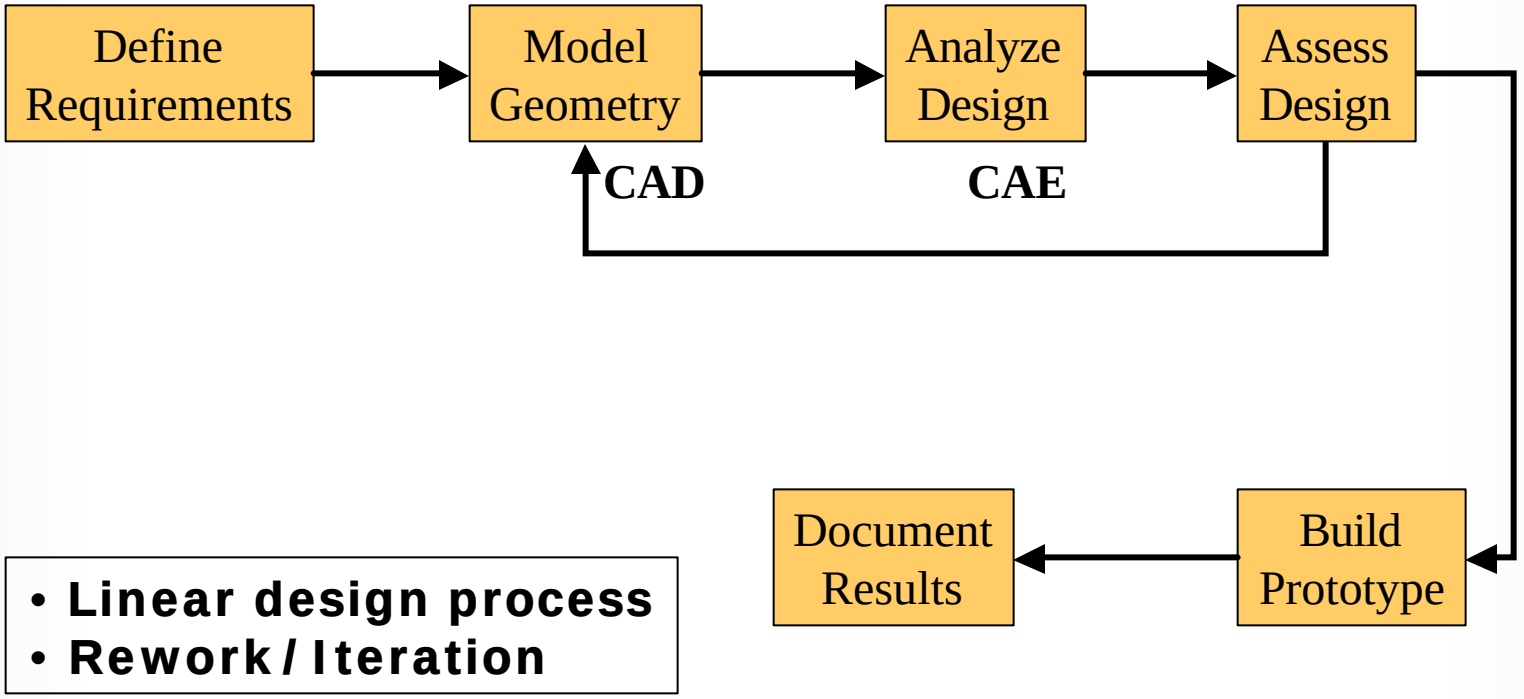
TIGER-based Electronic Commerce Summary

- Demonstrates:
  - Synergistic Electronic Data Interchange (EDI)
  - Technical Data Interchange (TDI)
  - Concurrent/Collaborative Engineering
- Addresses challenges of Prime/Supplier interaction
- Enables advanced collaboration between Suppliers and Primes
- Helps Small Businesses gain competitive edge

Typical CAD/CAE Design Project of Today

(1-3 person team, single site)



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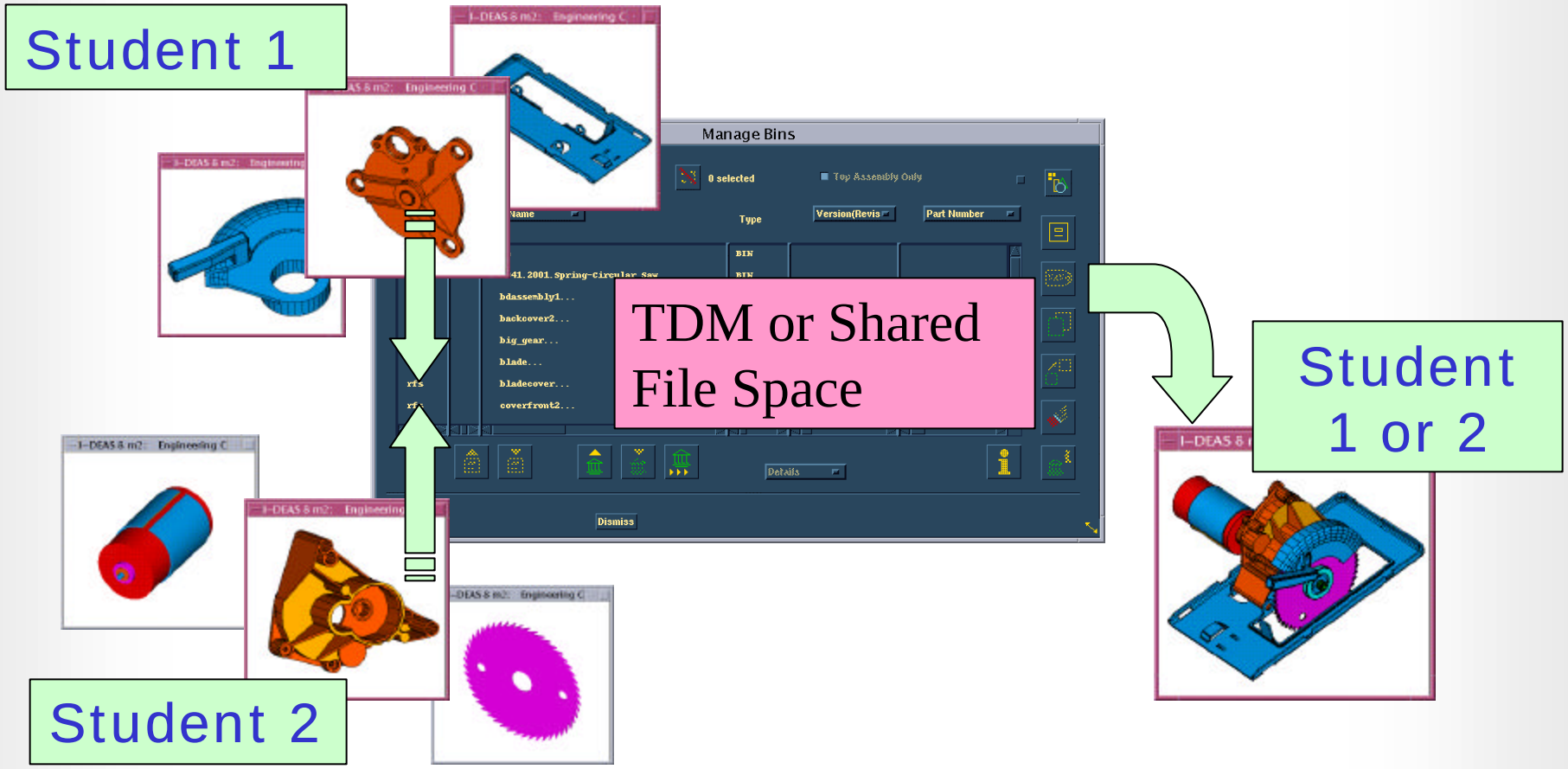
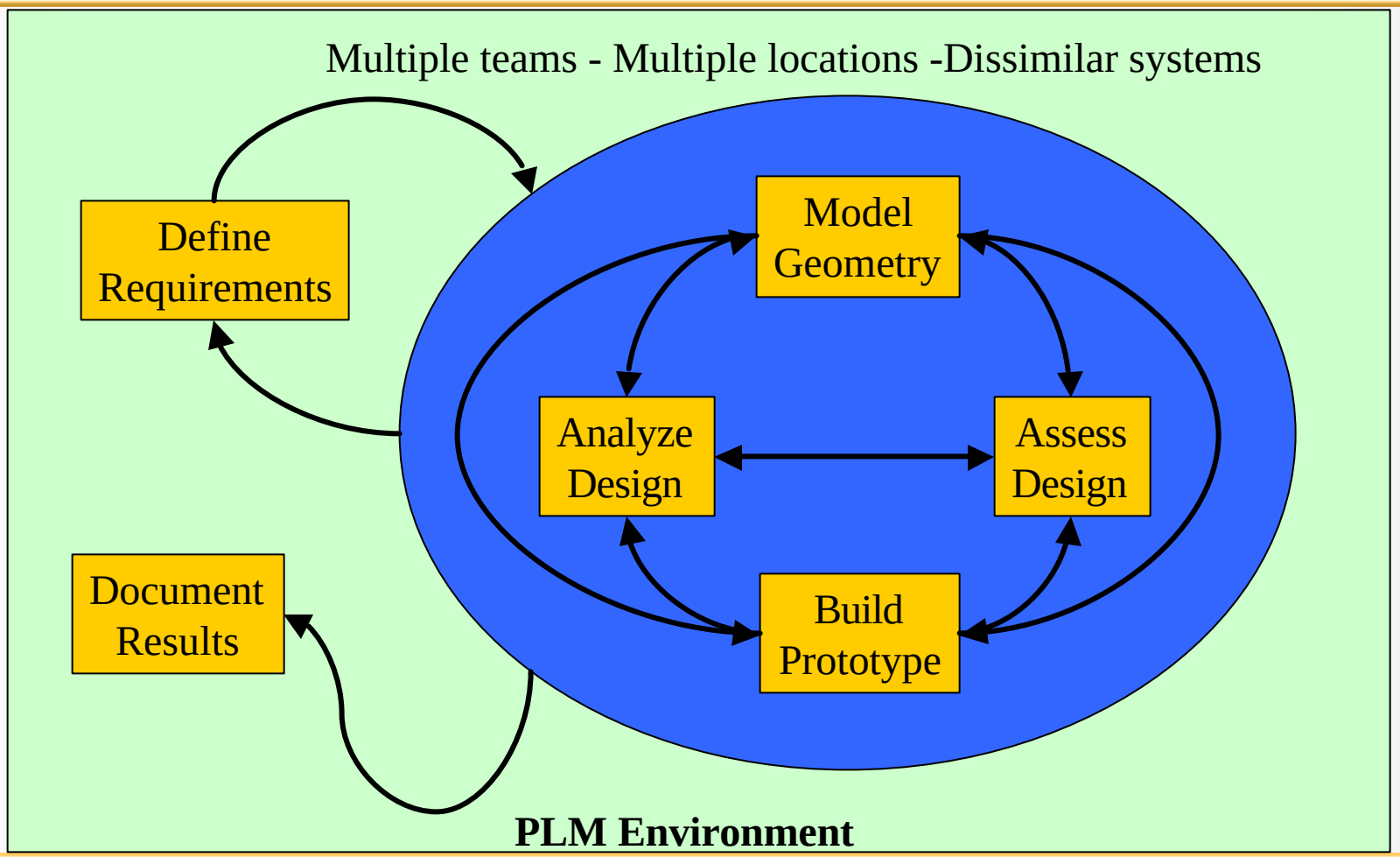


Role of PLM in Education

- Manage information in the design process
- Enhance collaboration
- Foster multidisciplinary environment
- Enhance processes not automate
- Preserve knowledge for reuse

PLM-enhanced CAx Design Project



PLM Research at Georgia Tech

- The Logistics Institute
  - Continuing Education
  - Distance Learning
  - Short courses for Industry
- Electronic Commerce Resource Center
  - e-Commerce short courses for small businesses
- Numerous Research Centers on PLM Issues
  - Aerospace System Design Lab (ASDL)
  - Systems Realization Lab (SRL)
  - Rapid Prototype Manufacturing Institute (RPMI)
  - Engineering Information Systems Lab (EISLab)

PLM Graduate Course Emphasis at Georgia Tech

- Statistics
  - 50+ Faculty (emphasis dependent on sponsor interests)
  - 100+ Graduate students
- Graduate Courses in PLM Technology
  - Engineering Data Management (ME)
  - Computer Aided Design (ME)
  - Engineering Design (ME)
  - Human Integrated Systems (ISyE)
  - Managing the Resources of the Technological Firm (MGT)
  - etc.
- Graduate Certificate of Excellence in Enterprise Integration
  - ISYE, ME, MGT

MS/PhD Students in High Demand!

Summary of CAx/PxM in Academia

Traditional

Geometry (2D & 3D)

Finite Element Analysis

Single Vendor Focused
Individual Student Projects
On-campus teams

Result

Individual knowledge of specific CAD/CAE systems.

Future

Geometry (2D & 3D)
Data Exchange Standards (STEP)
Finite Element Analysis
Product Lifecycle Management
Multiple Vendor Focused
Team Projects
Intercollegiate teams
etc.

Result

Experience with distributed collaborative multi-disciplinary engineering projects using multiple systems.
etc.

ME4041 - Interactive Computer Graphics and Computer-aided Design

Prerequisite: senior standing, ME2016 - Numerical Methods.
Principles of interactive computer graphics hardware and software.
Programming for interactive graphics with application to the solution of thermal and mechanical design problems.

Enrollment: 60 students per semester (three sections)

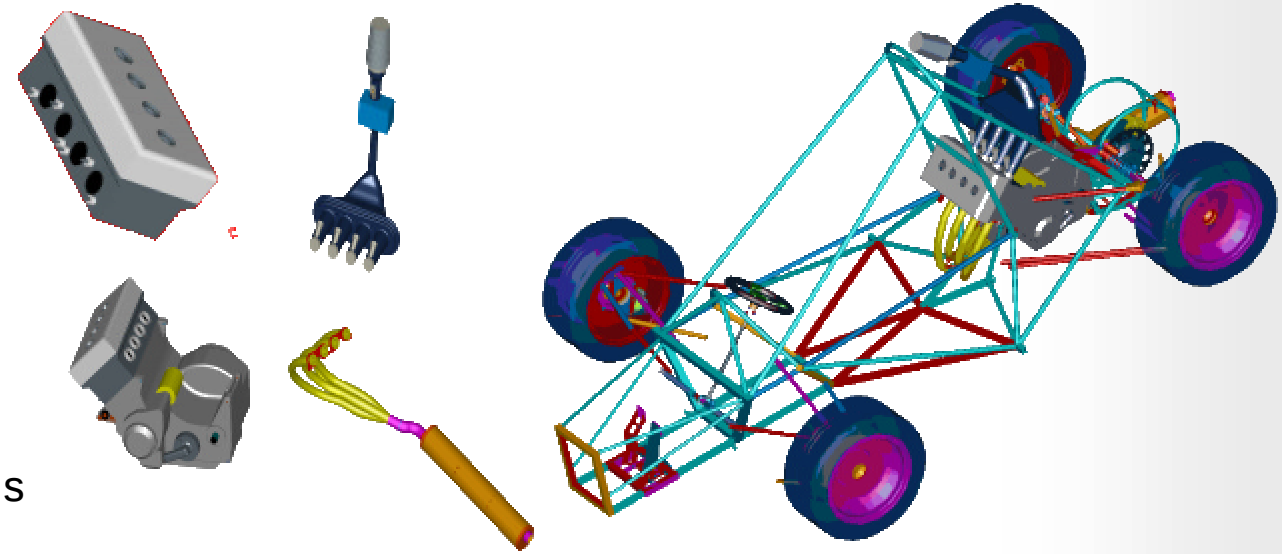
Webpage: http://www.cad.gatech.edu/courses/me4041.html

Projects: Groups of 2-3 students

- Parametric Solid Modeling
- Parametric Assembly
- Finite Element Analysis

Team Collaboration: Formula SAE Project

- Project conducted in the summer of 2000.
- Virtually design and build (reverse engineer) a mini-Formula car.
- 8 student groups:
  - Engine
  - Intake system
  - Chassis
  - Front suspension
  - Front brakes
  - Rear suspension
  - Drivetrain
  - Steering and pedals



- Communication through meetings, email and a team web page.
- Part numbering schema created to keep track of the numerous parts involved.

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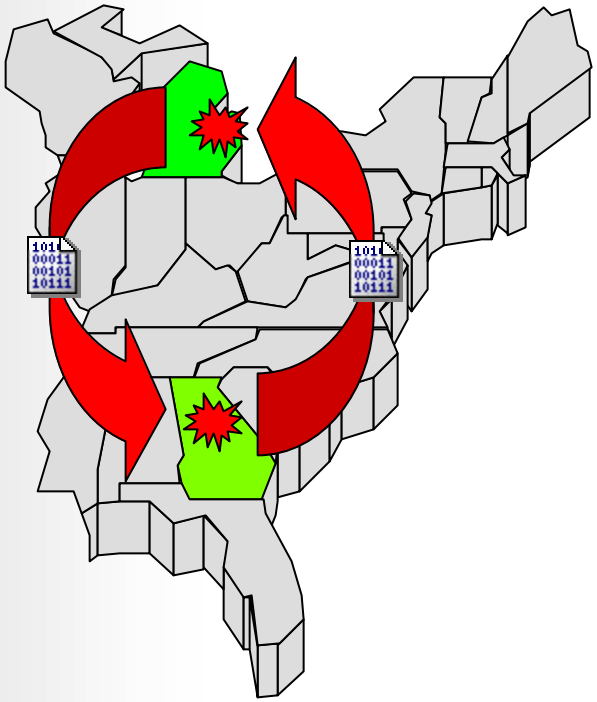
Intercollegiate Collaboration: Power Tools

Objectives:

- Demonstrate current technologies integrating CAD/CAE/CAM/PDM.
- Develop a methodology to foster distributed collaborative engineering.

- Promote collaboration between students at engineering institutes.
- Promote collaboration between students and industry.

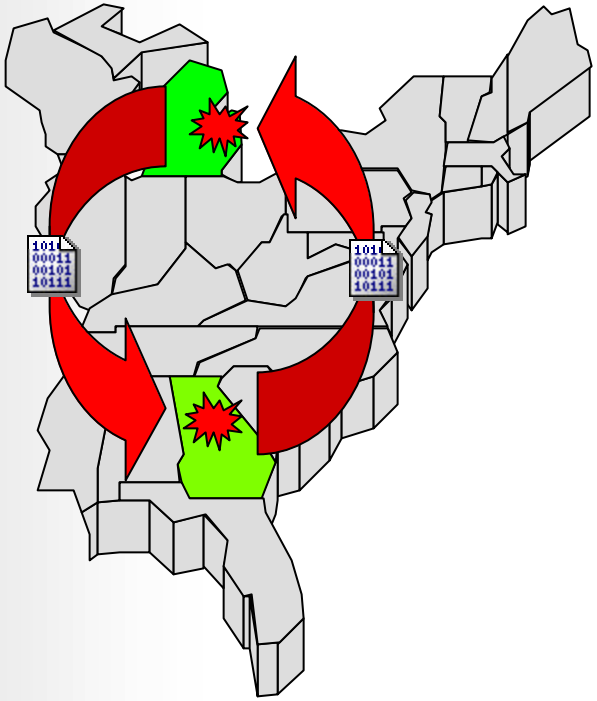
Intercollegiate Collaboration: Power Tools



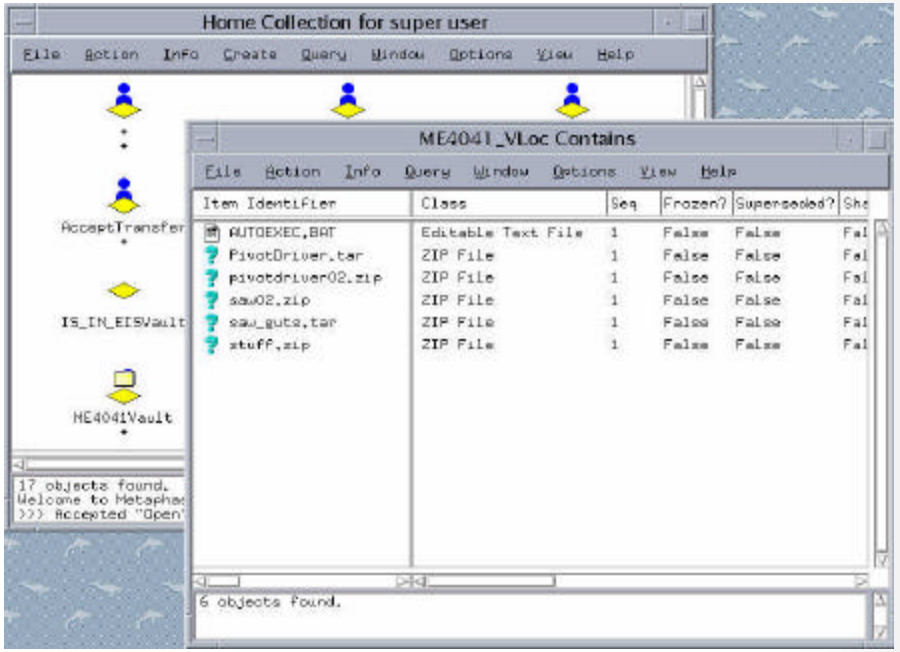
Parametrically model two systems

- Circular saw
  - 2 students at GT - internal parts
  - 2 students at Kettering Univ - external parts and assemblies
- Cordless screwdriver
  - 2 students at Kettering Univ - internal parts
  - 2 students at GT - external parts and assemblies

Intercollegiate Collaboration: Power Tools

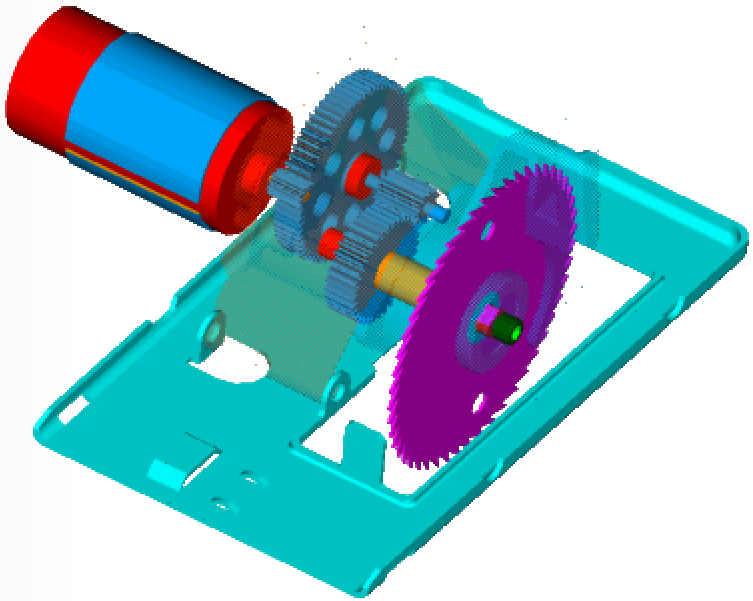


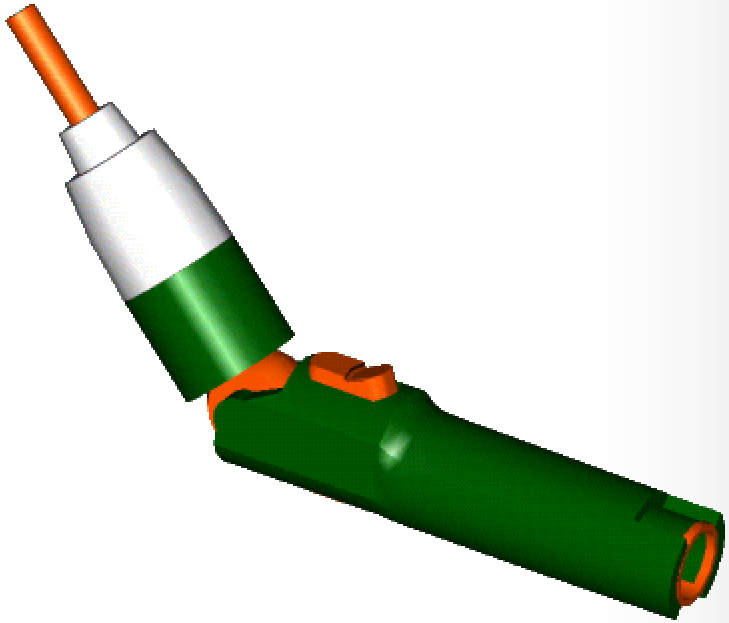
- Data exchanged locally using TDM.
- Data exchanged between schools using PLM (Metaphase).



Intercollegiate Collaboration: Power Tools

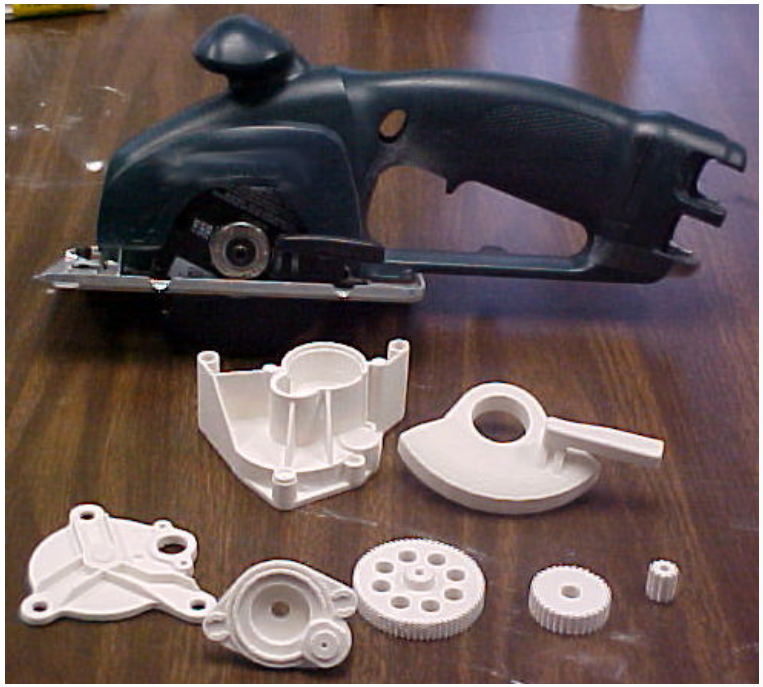
Students completed assemblies in Distributed Concurrent Collaborative environment





Intercollegiate Collaboration: Power Tools

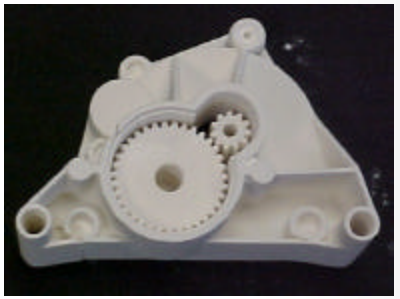
Students rapid prototyped parts from CAD models

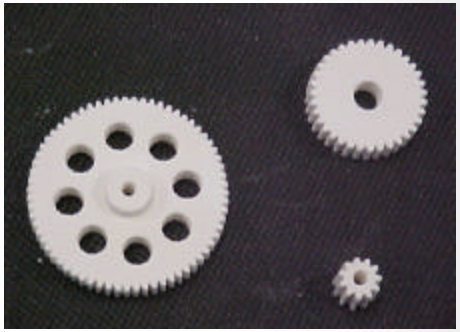


Intercollegiate Collaboration: Power Tools

Summary/Problems

- Communication: need more “on-demand,” “real-time” interaction between students
  - video conference? chat server?
- Fully utilize Product Lifecycle Manager
  - synchronize schedules
  - manage workflow
- More effective web management system
  - pre-formed templates?
  - CAD neutral web based viewing
- How to share CAx data w/o data loss?
  - STEP Not IGES!

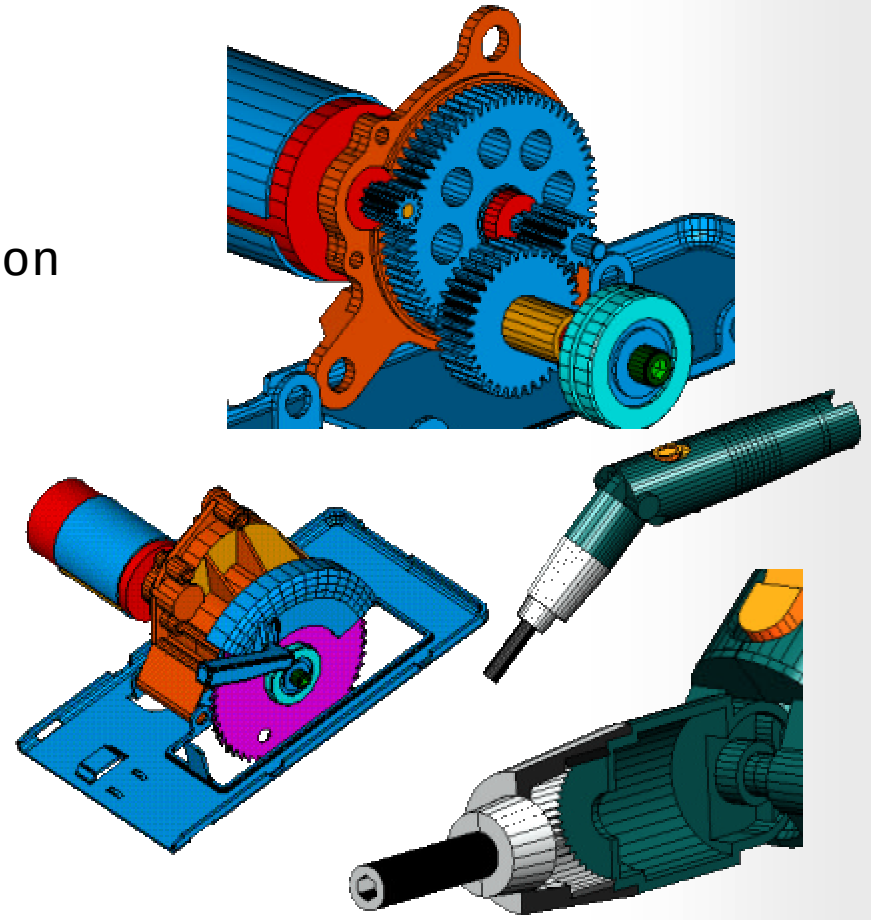




Intercollegiate Collaboration: Power Tools

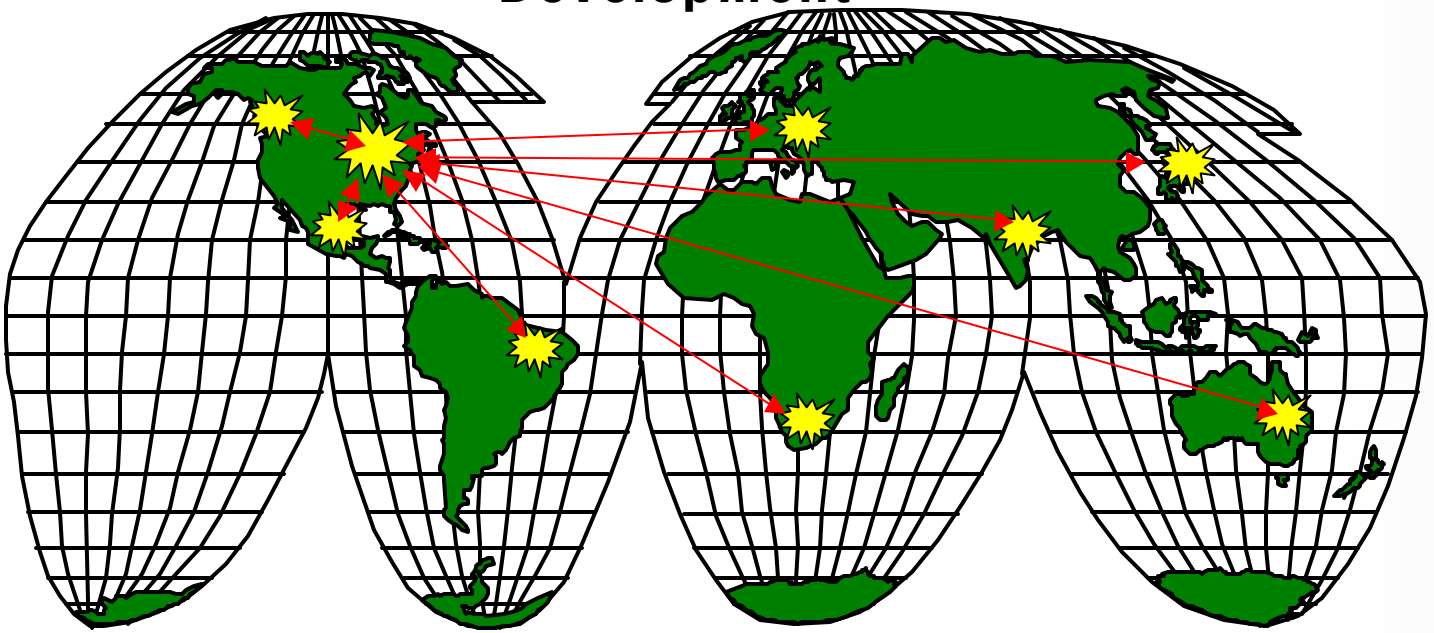
Future Directions:

- Include other CAD/CAE packages
- Interactive Internet Communication
- Create multi-disciplinary project
  - Design
  - Manufacturing
  - Marketing
  - Industrial Design
  - …?
- Involve more Industry Partners
- Involve more Institutions



The proposed “Grand Experiment”

Multidisciplinary Distributed Concurrent Collaborative Product Development



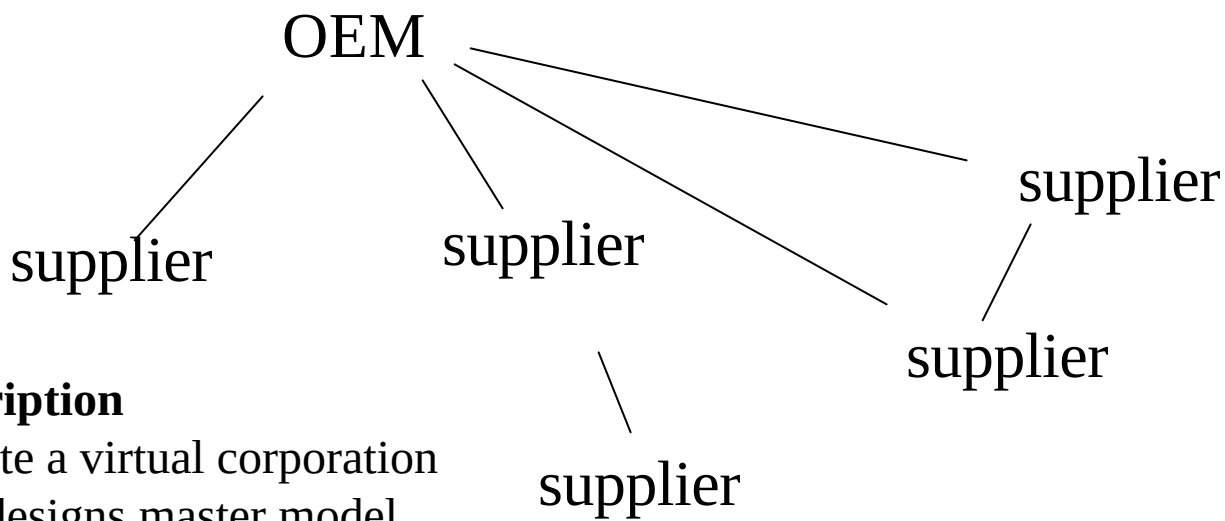
Involves: Industry Partner(s)
Software Vendor(s)
Universities

The proposed “Grand Experiment”

Problem statement:

How to leverage information technology to manage and conduct multidisciplinary distributed collaborative concurrent product development using a flexible, modular and robust design process?

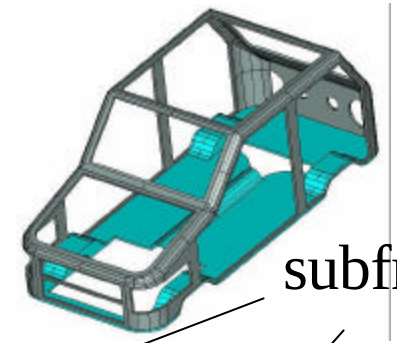
The proposed "Grand Experiment"



Project description

- Simulate a virtual corporation
- OEM designs master model
- Multiple suppliers
- Duration 2+ years
- Multiple CAx packages
- STEP
- Subsystems will need to be redesigned as suppliers and requirements change

The proposed "Grand Experiment"



subframe

engine

drivetrain

rear suspension

brakes

steering

front suspension

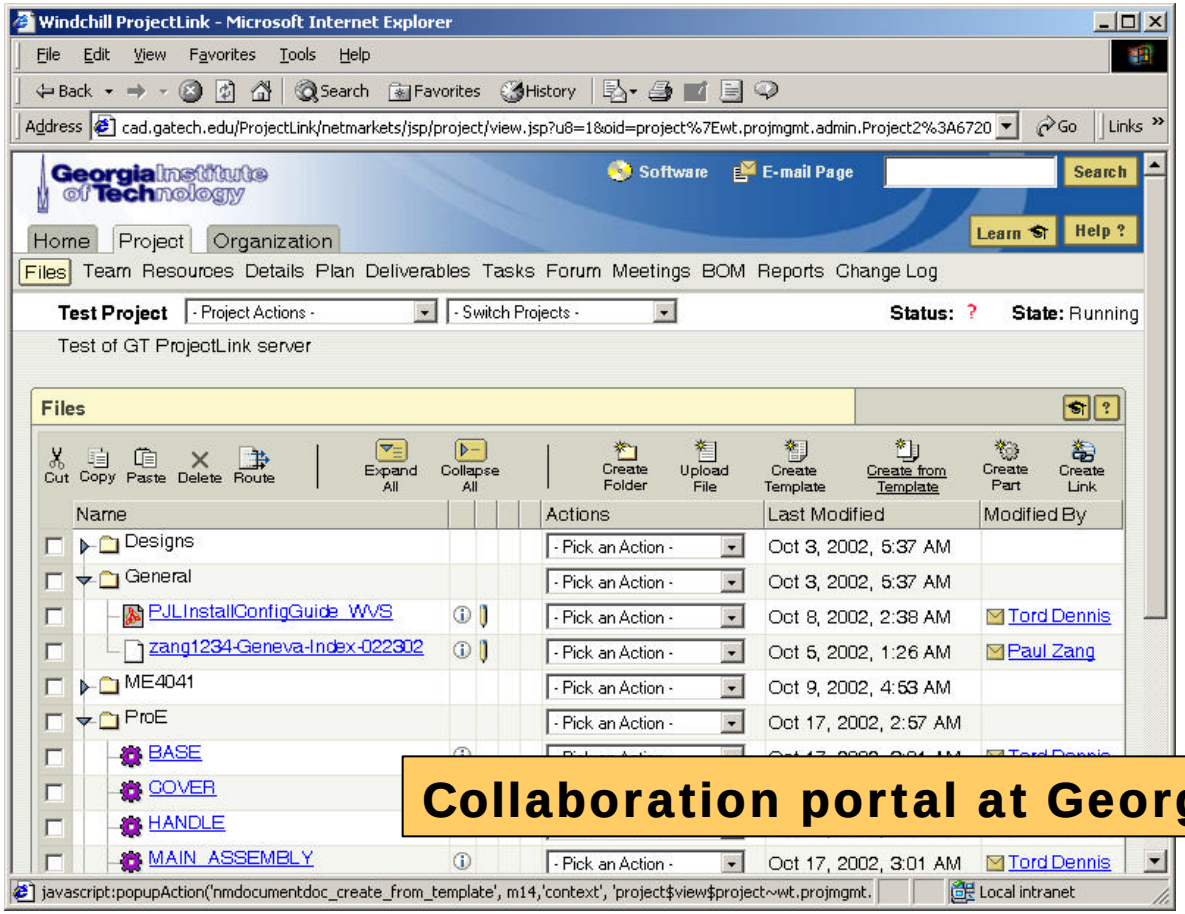
brakes

body panels

seats

Multidisciplinary effort:
- ME, EE, IE
- Mgt, ID
- Mkt, Mfg, etc.

The proposed “Grand Experiment”



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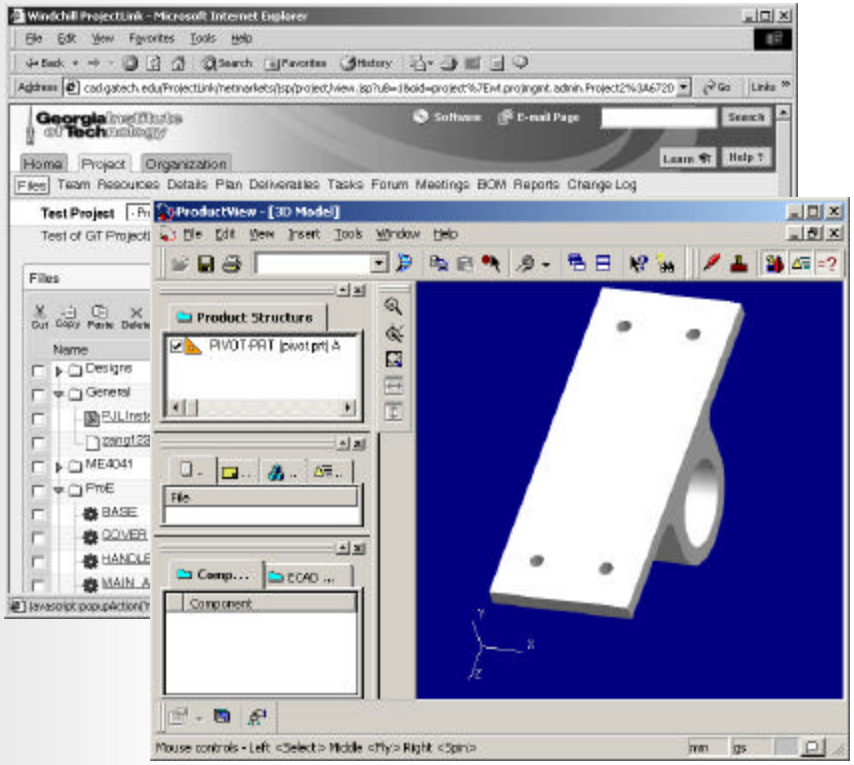
The proposed “Grand Experiment”



ProjectLink® server attributes

- ✓ **Lightweight viewer**
- ✓ **Multivendor CAD files**
- ✓ **Versioning**
- ✓ **Team organization**
- ✓ **Workflow administration**
- ✓ **Centralized storage location**
- ✓ **Security**
- ✓ **Meeting center**
- ✓ **Web-browser access**
- ✓ **STEP data interchange**

ProjectLink is a registered trademark of PTC

The proposed “Grand Experiment”

Objectives:

- Develop model for training the engineer of the future
  - ✓ Incorporate more IT in undergraduate and graduate courses
  - ✓ Deploy latest CAx/PxM technology at universities
  - ✓ Foster intercollegiate collaboration
  - ✓ Foster multidisciplinary collaboration
  - ✓ Develop curriculum workflow management templates
  - ✓ Study aggregate project management
  - ✓ Preserve knowledge for reuse

The proposed “Grand Experiment”

Objectives:

- Explore PLM implications for Industry
  - ✓ Understand how IT can be used to bridge the distributed communication gap
  - ✓ Understand team interdependence
  - ✓ Explore top-down and bottom-up design issues
  - ✓ Understand barriers to integrating different technology
  - ✓ Explore standards to facilitate information exchange (STEP)
  - ✓ Understand supply-chain management issues
  - ✓ Understand security issues relating to data management
  - ✓ Develop guidelines/best practices for integrating PLM into the design process

Questions?

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