

# **High Tech Tools to Polish Project Performance: Trends in Design, Construction & Facility Management**

Martin Fischer, Associate Professor  
Civil & Env. Eng., Stanford Univ.  
<http://www.stanford.edu/~fischer>

with contributions from:

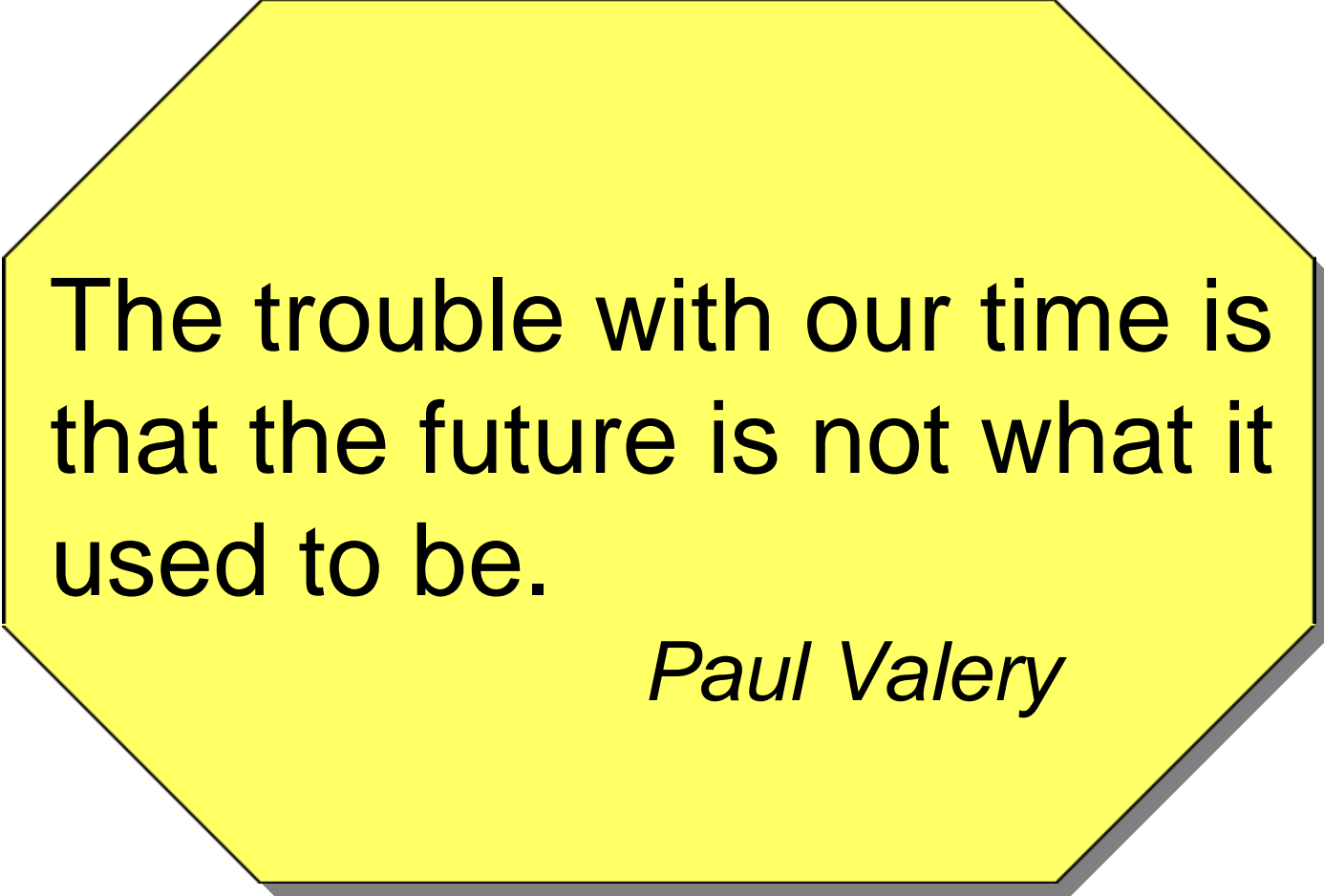
Dr. Florian Aalami, Exec. VP, Buildpoint  
<http://www.buildpoint.com>

Dr. Hans Björnsson, Prof. & Director, CIFE, Stanford Univ.  
<http://www.stanford.edu/group/CIFE>

Dr. Benedikt Schwegler, Exec. Director, R&D, WDI

# CEOs worry about their firm ...

- being marginalized in 5 years
- not having the right skills to compete
- not finding the right people
- not having a migration path to a new business model
- being overtaken by low cost providers
- not being able to meet the investment requirements for new technology



The trouble with our time is  
that the future is not what it  
used to be.

*Paul Valery*

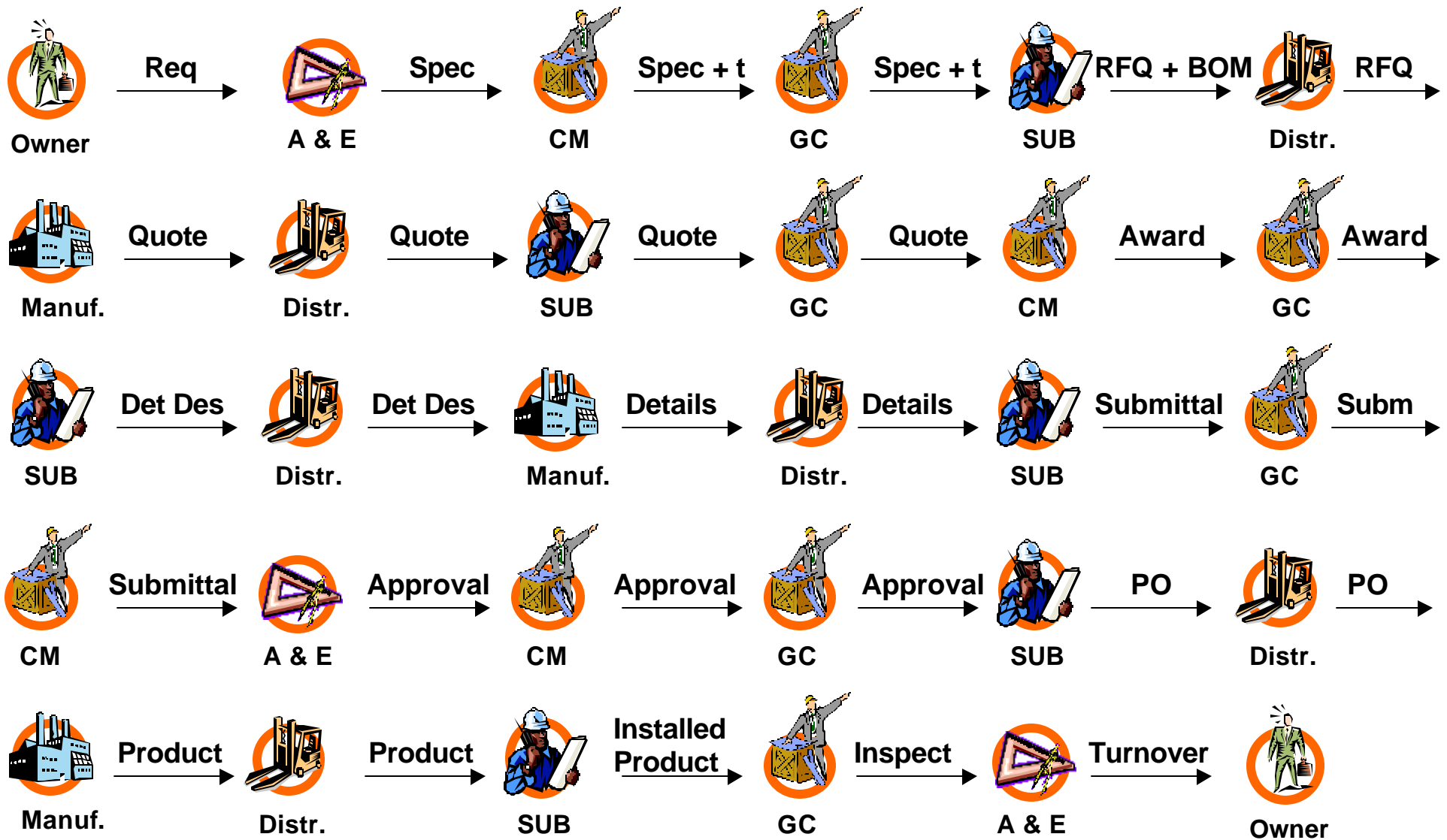
# What assets are more valuable than your data and knowledge?

- DBOO - provide value through information
- Extend life-time of design and construction data
- Reduce transaction costs to find, interpret, and display existing data
- Pay attention to data front-ends
- Justify investment in 3D model

# Agenda

- Supply and Demand Chains in Construction
- e-commerce
- The role of the Internet
- The role of Information Technology
  - Object models vs. drawing documents
  - Intelligent 3D models
  - 4D models
  - Virtual Reality
- The IT-smart AEC organization

# You can't always get what you want, but if you try sometime, you get what you need



# The Matching Game

---

Producer

Customer



Manuf.



Manuf.  
Rep.



Distr.



SU  
B



GC



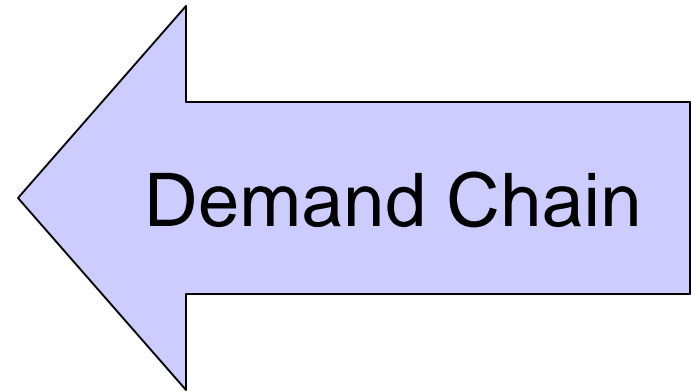
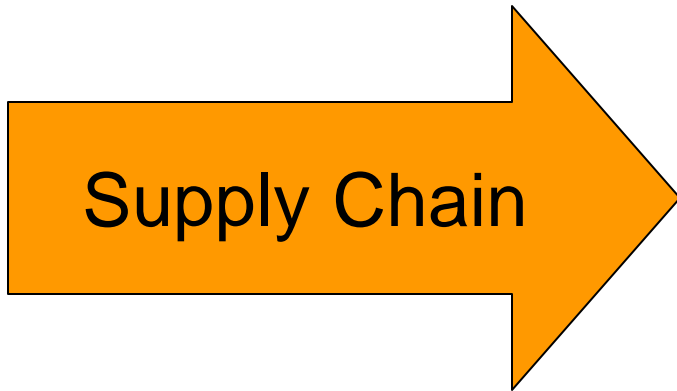
CM



A & E



Owner



# The Matching Game

Producer

Customer



Manuf.



Manuf. Rep.



Distr.



SUB



GC



CM



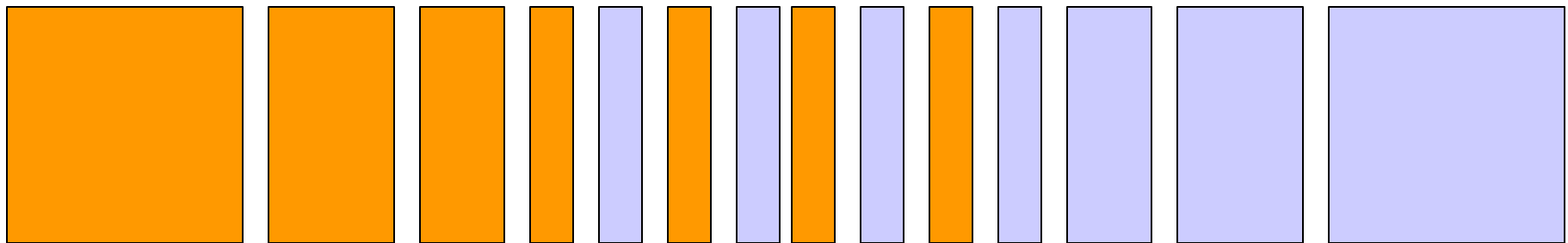
A & E



Owner

Supply Chain

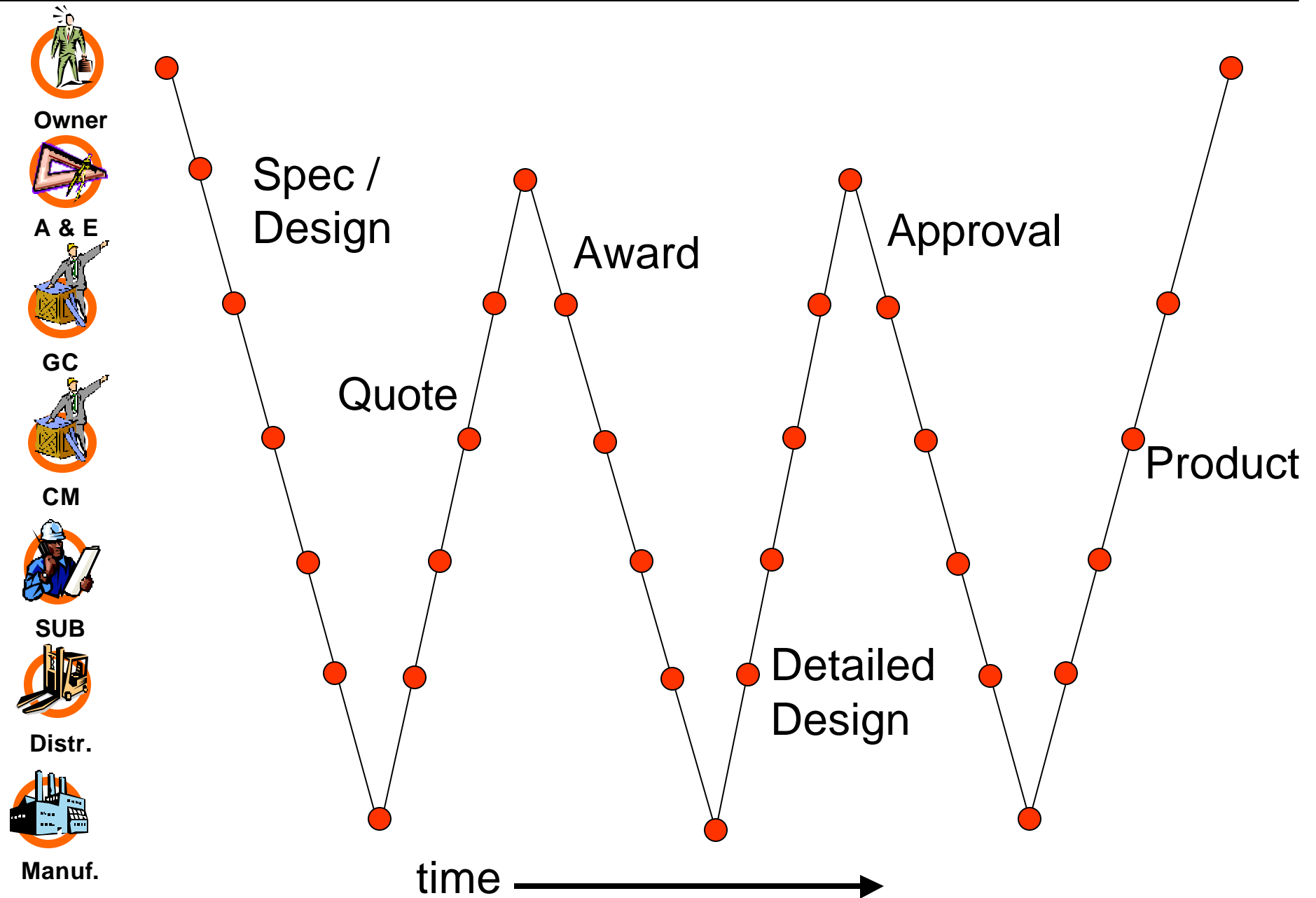
Demand Chain



e-Commerce Supports  
Integrated Supply & Demand Chains



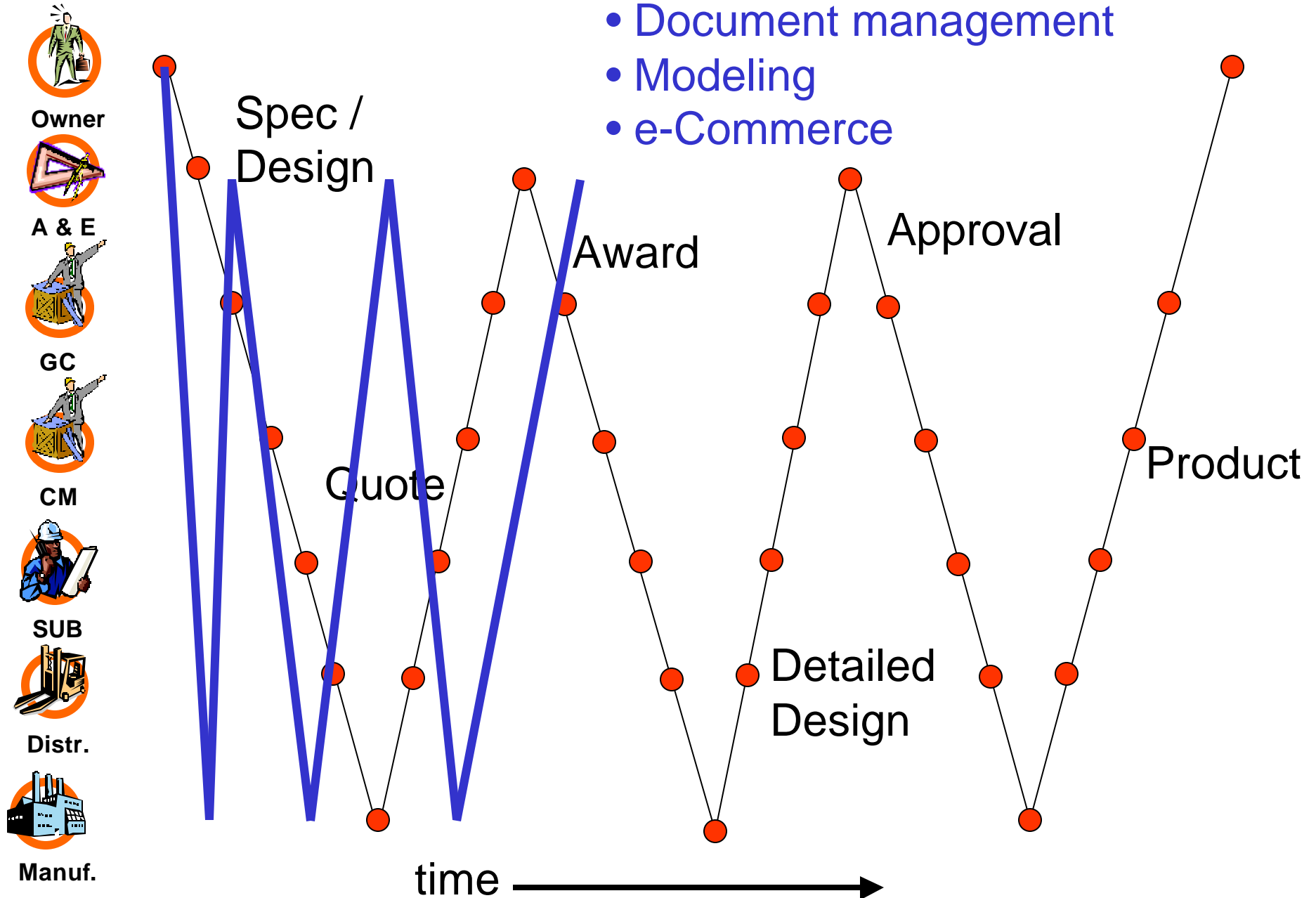
# The Road to Success



# The Road to Success

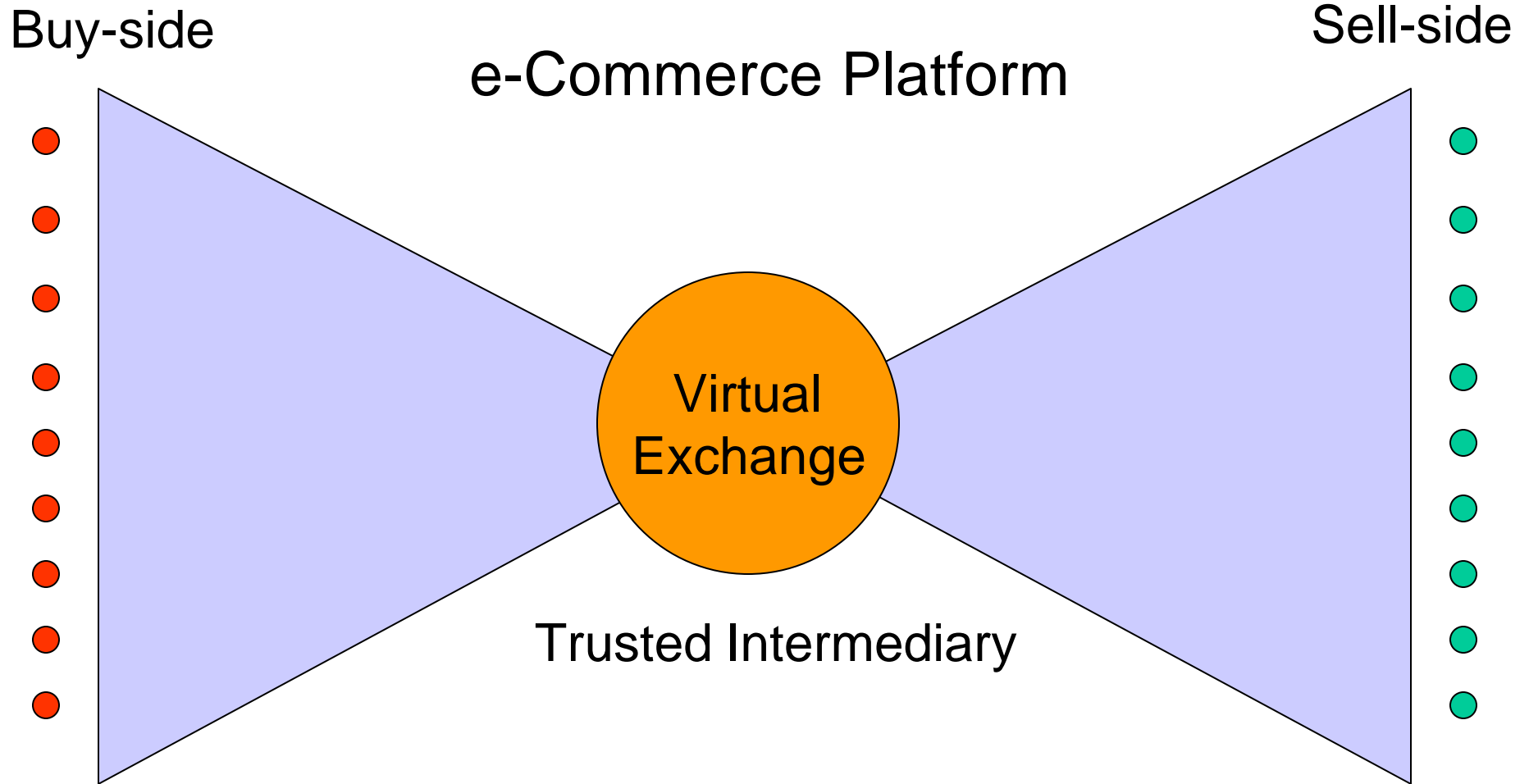
Improved process through:

- Document management
- Modeling
- e-Commerce



# e - Market Places

---



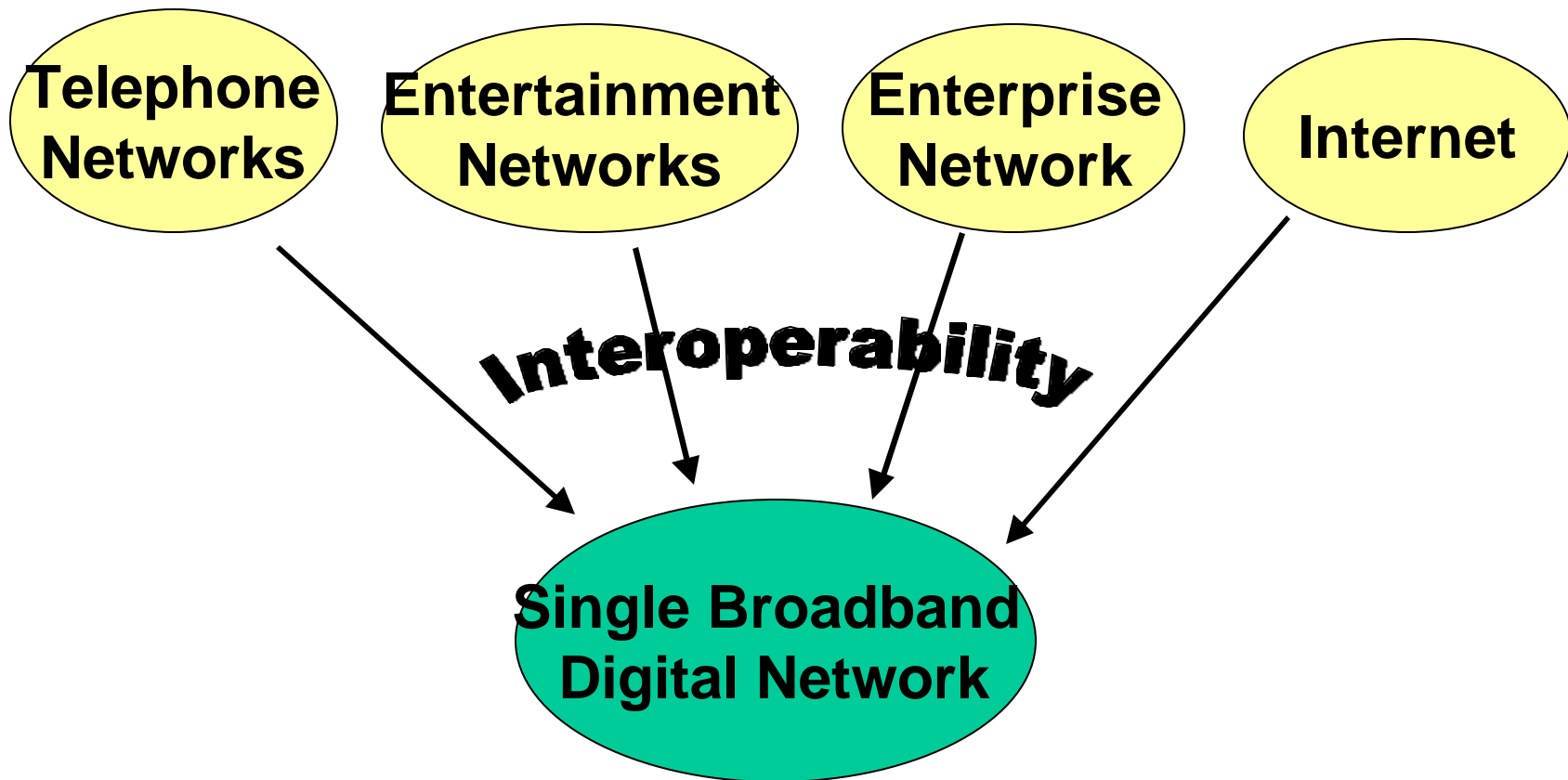
# Vision

- Fast, secure data-, picture-, sound-, and video-communication readily available anywhere; fiber for high-quality video and wireless for simple video for households
- Small, fast, high capacity, portable units, capable of interpreting input by voice, handwriting and gestures as well as by keyboard. These units will work with 3D/VR and with several co-residing operating systems.

# Vision

- Learning intelligent software agents search for information, organizes information and keeps us informed
- Secure personal identification and encryption are commonplace; voice recognition, fingerprints etc.
- Smart communicating products and materials everywhere (“distributed intelligence”)

# Computer-communications

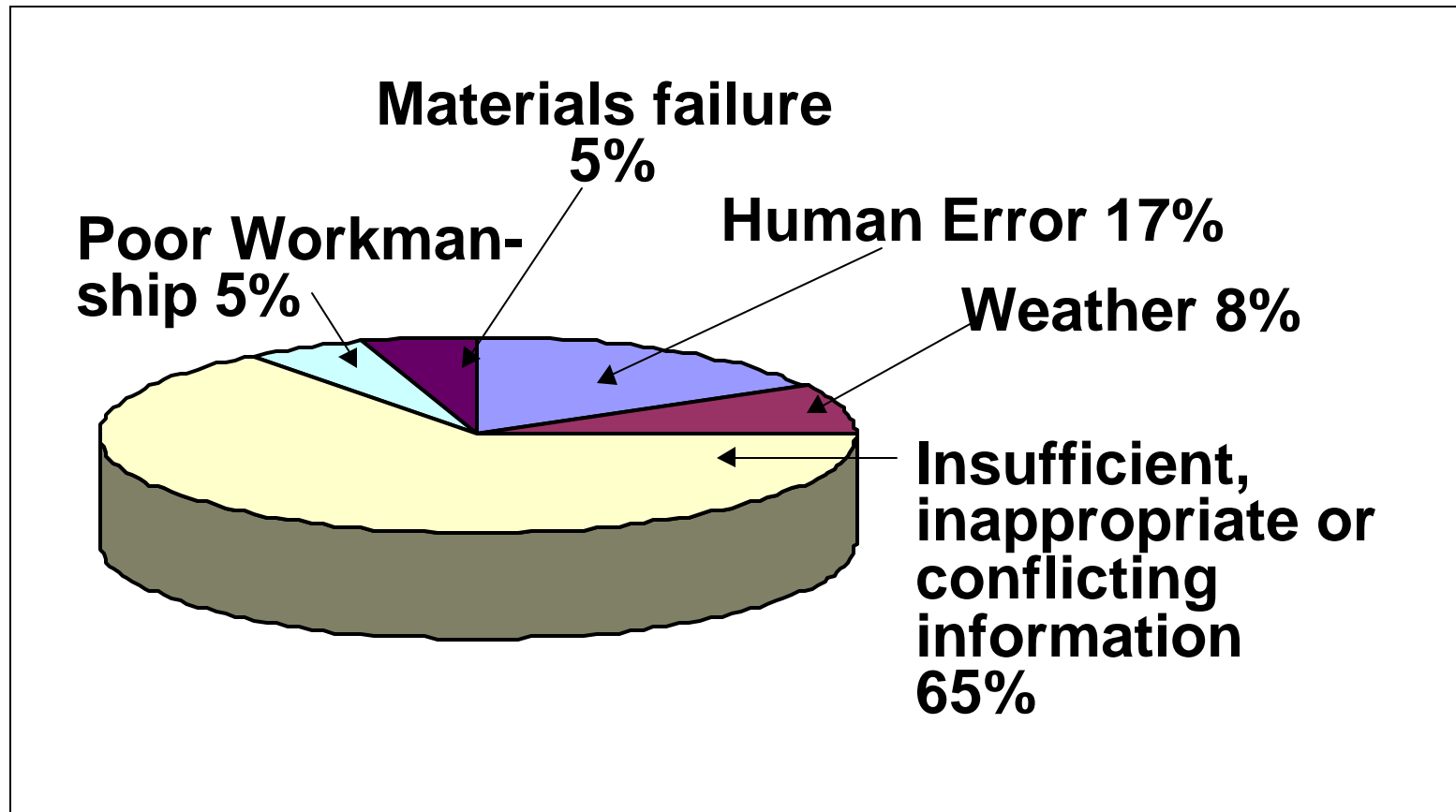


# Network Economy

Source: Business 2.0, June 1999

- Matter – It matters less
- Space – Distance has vanished
- Time – It is collapsing
- People – They are the crown jewels
- Growth – It is accelerated by the network
- Value – It rises exponentially with market share
- Efficiency – The middleman lives, "infomediaries" replace intermediaries
- Markets – Buyers are gaining dramatic new powers and sellers new opportunities
- Transactions – It is a one on one game
- Impulse – Every product is available everywhere

# Reasons for Contractor Rework



Source: CSIRO Building, Construction and Engineering, 1998



# IT can help

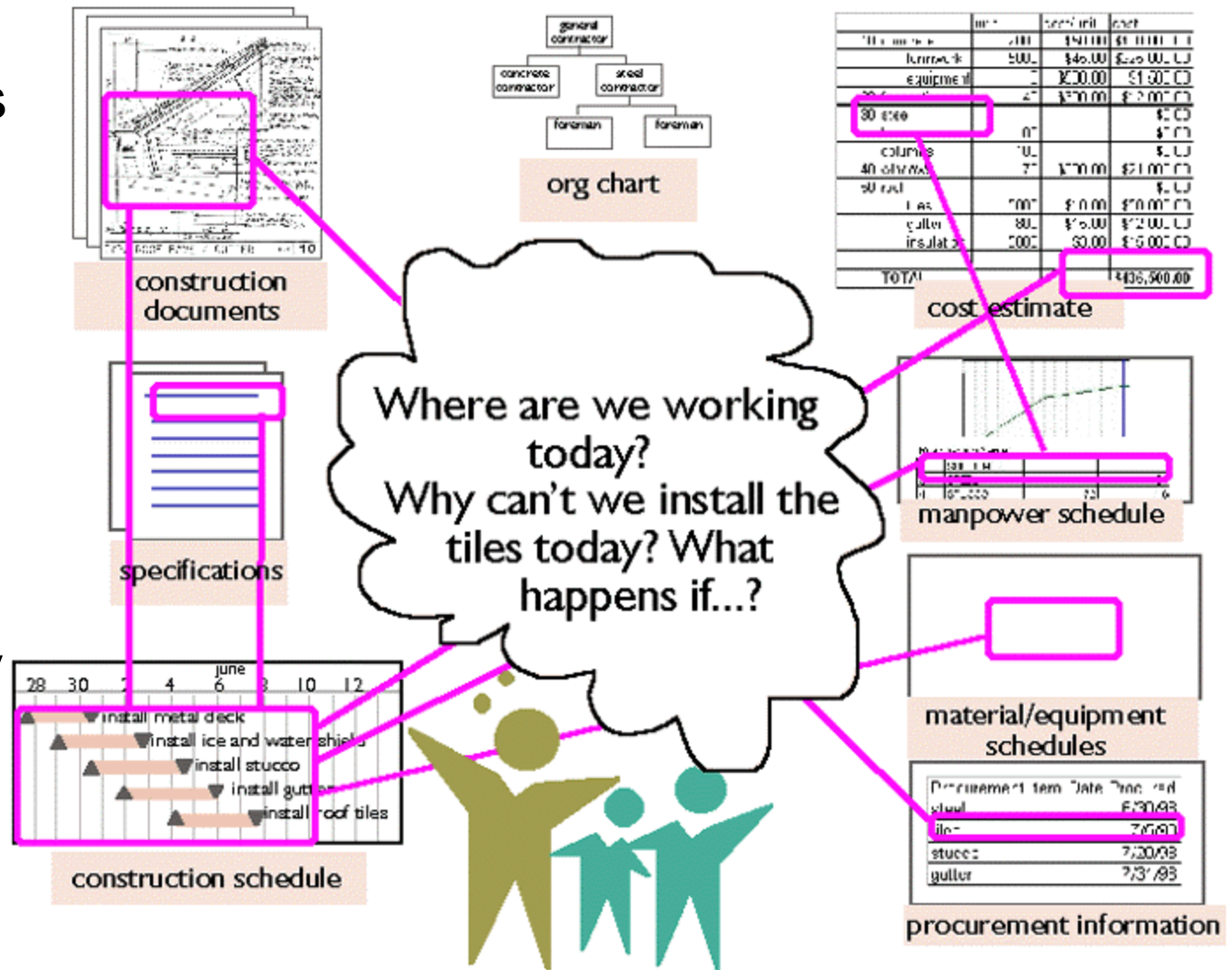
- The major bottlenecks in the AEC industry are information and IT related
- The major opportunities in the AEC industry for increased productivity are information and IT related

# IT can help

- The major bottlenecks in the AEC industry are information and IT related.
- The major opportunities in the AEC industry for increased productivity are information and IT related.

# Providing Visual Interaction and Access to Your Data

- Decision making involves relating a variety of information
- Project information exists in many forms and in many locations
- No single “context” clearly communicates this information and relationships in an effective form



# Current Practice

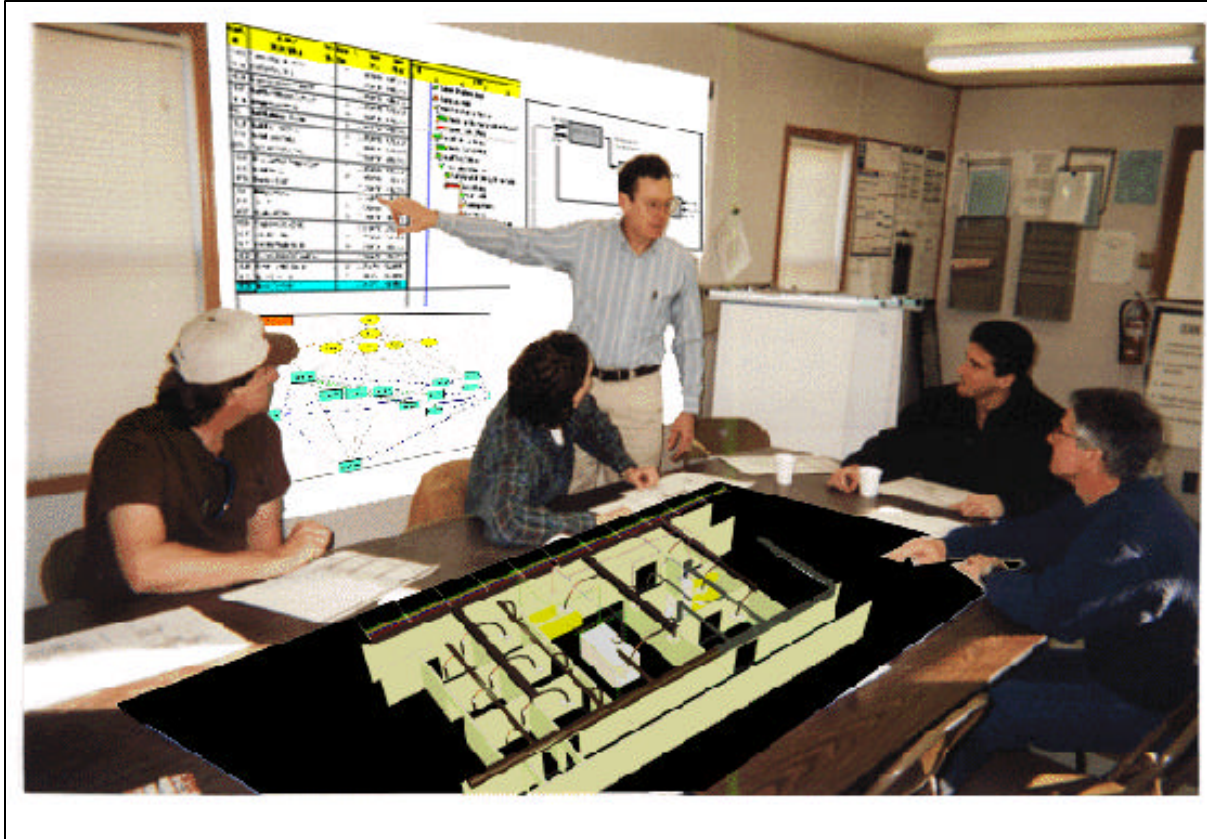


Inflexible 3D  
model

Project Data

- Local
- Not  
integrated

# Vision 2005



Virtual 3D  
model

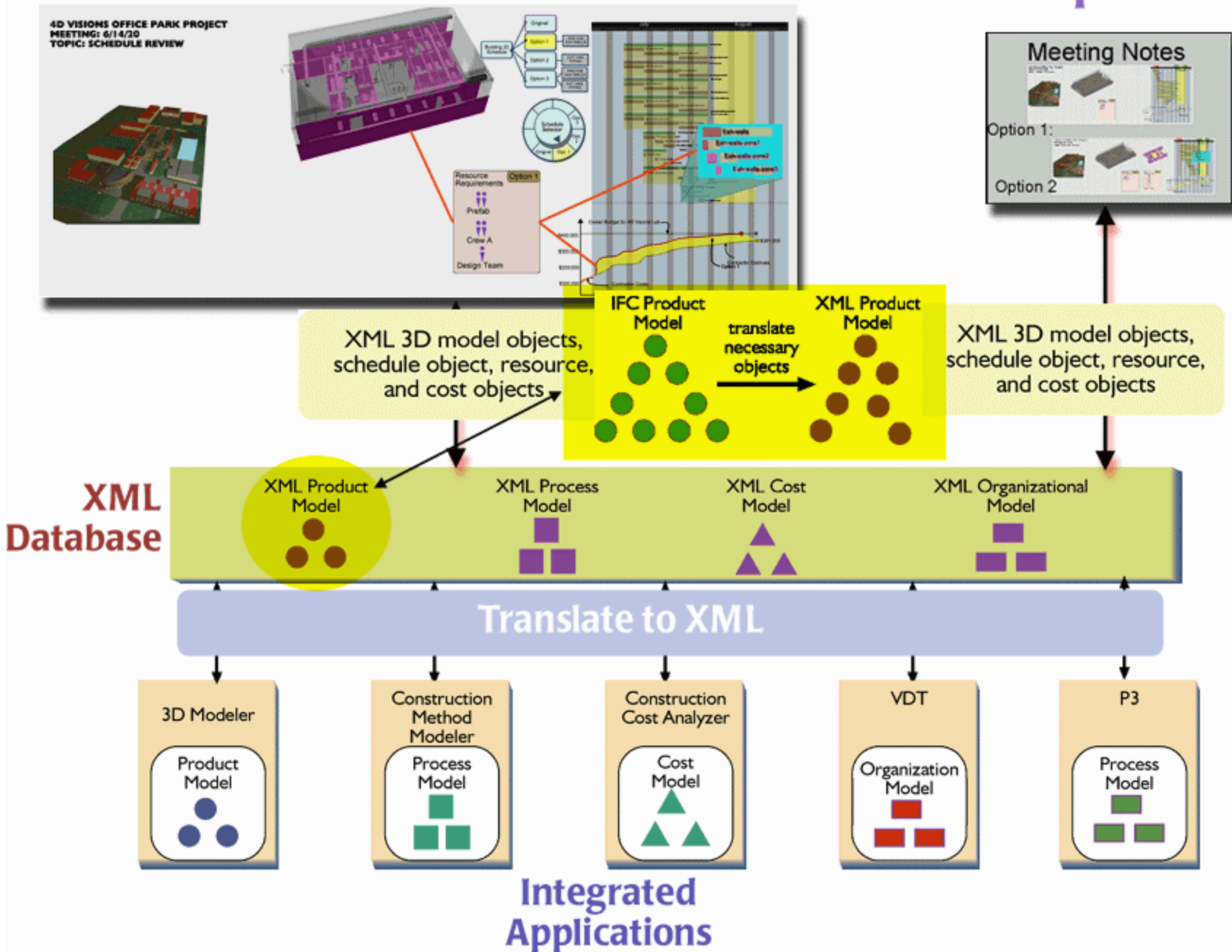
- Flexible
- Integrated with project organization

Project Data

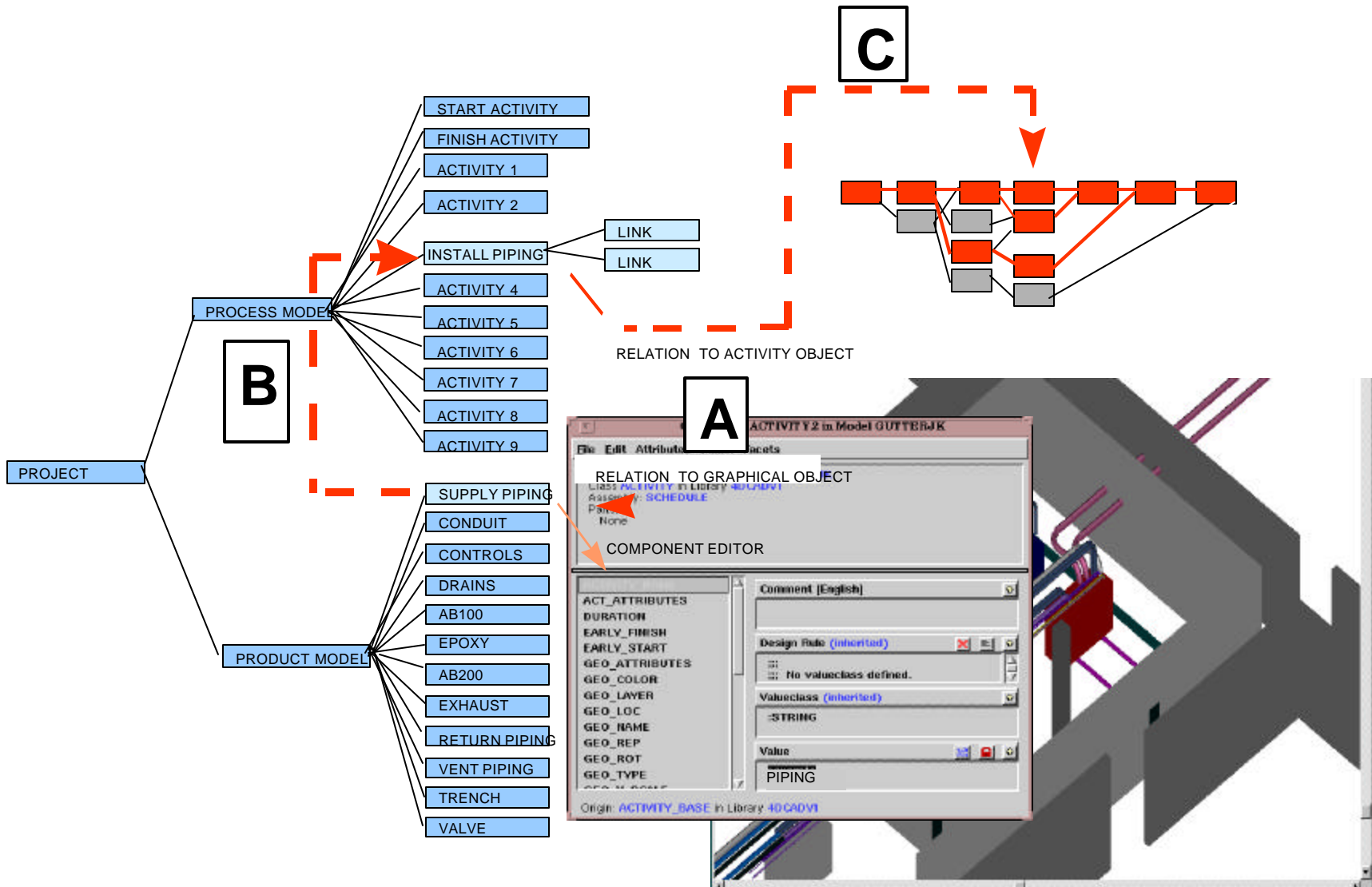
- Worldwide
- Integrated

# Interactive Mural

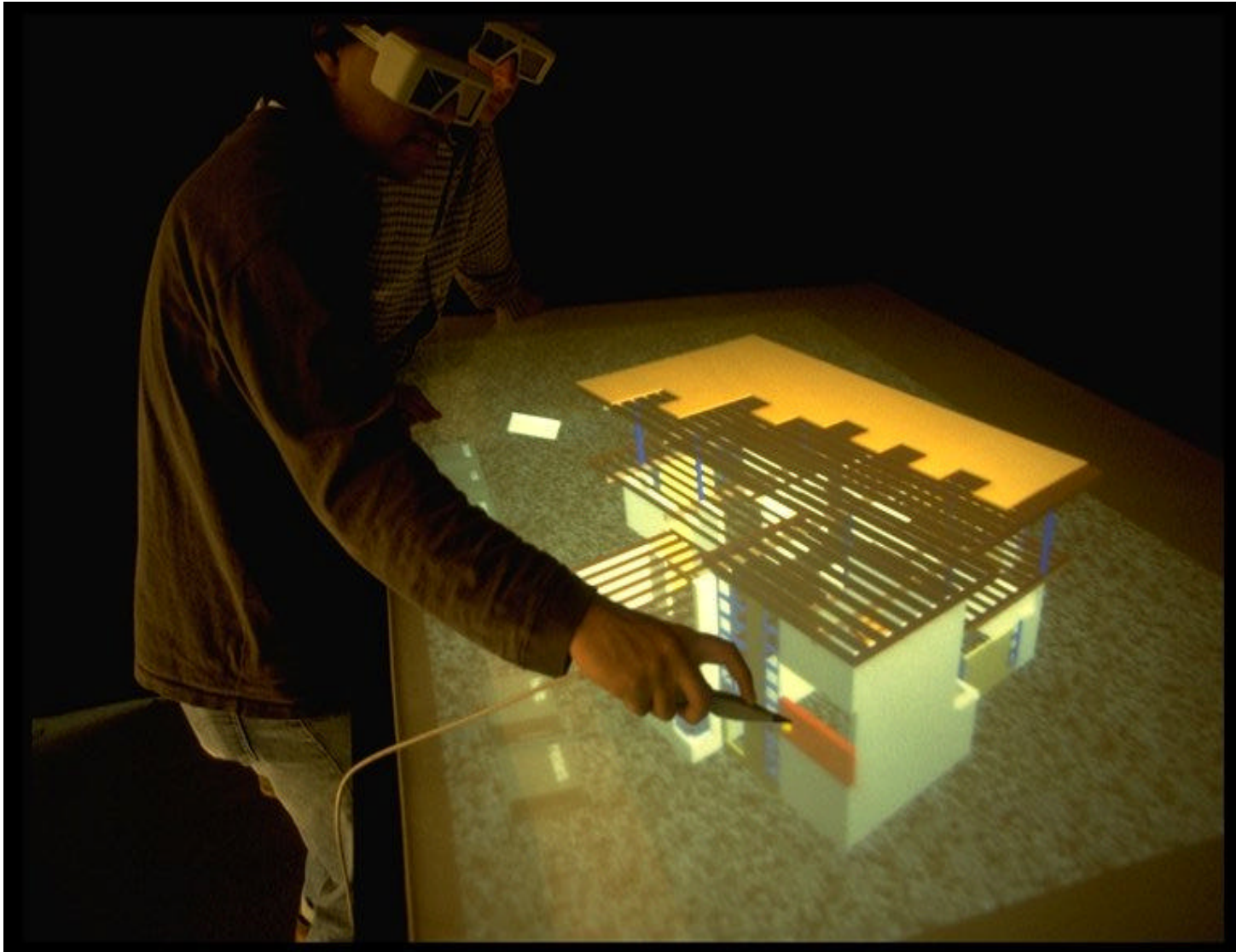
# Desktop/Webtop



# Software Objects



# Interactive 4D Production Planning Environment on the Responsive Workbench

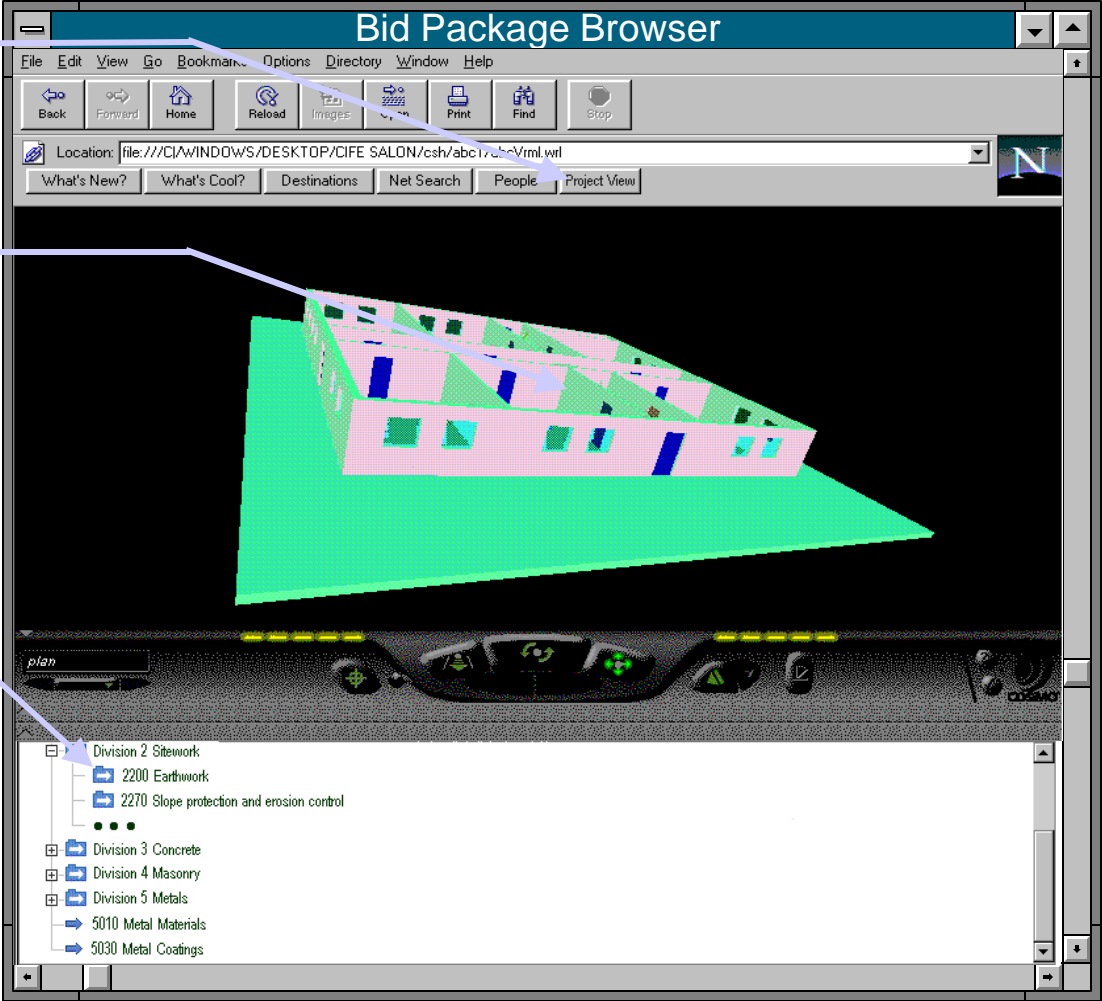




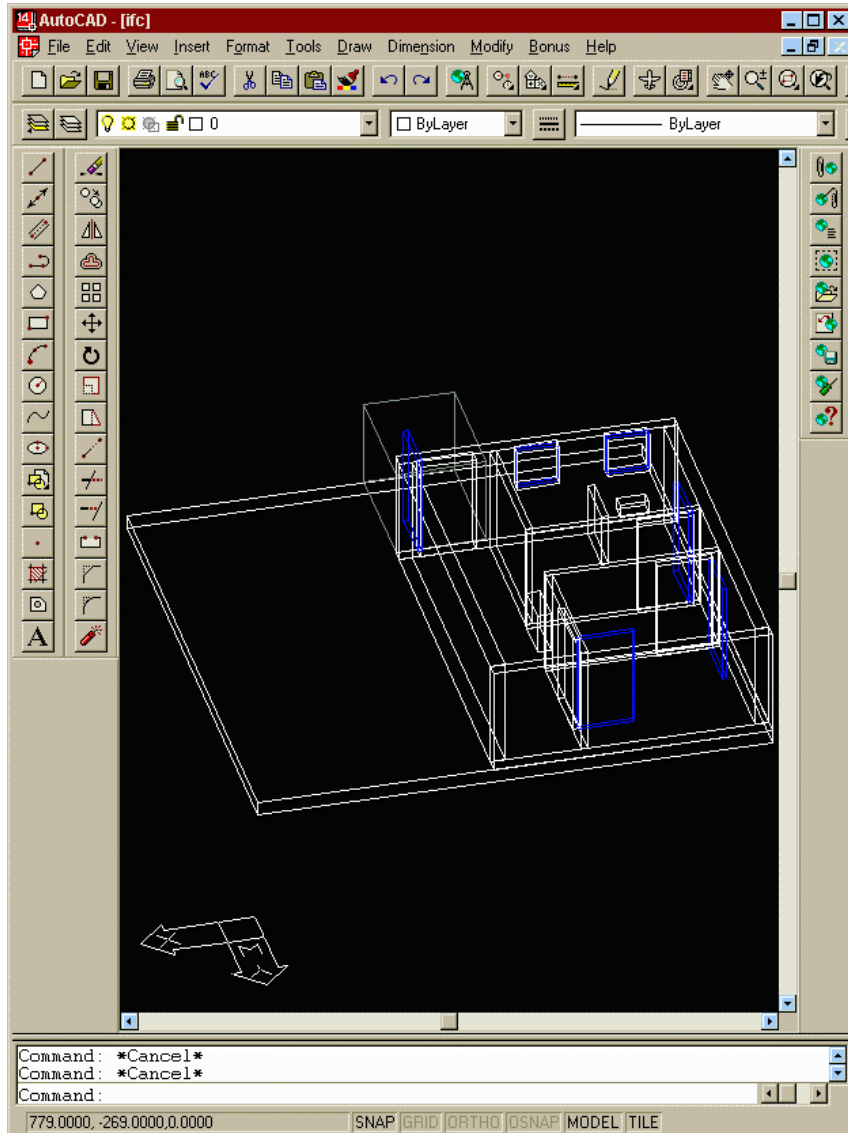
# Bid Package on the Web

Menu for project views by discipline in 3D design model

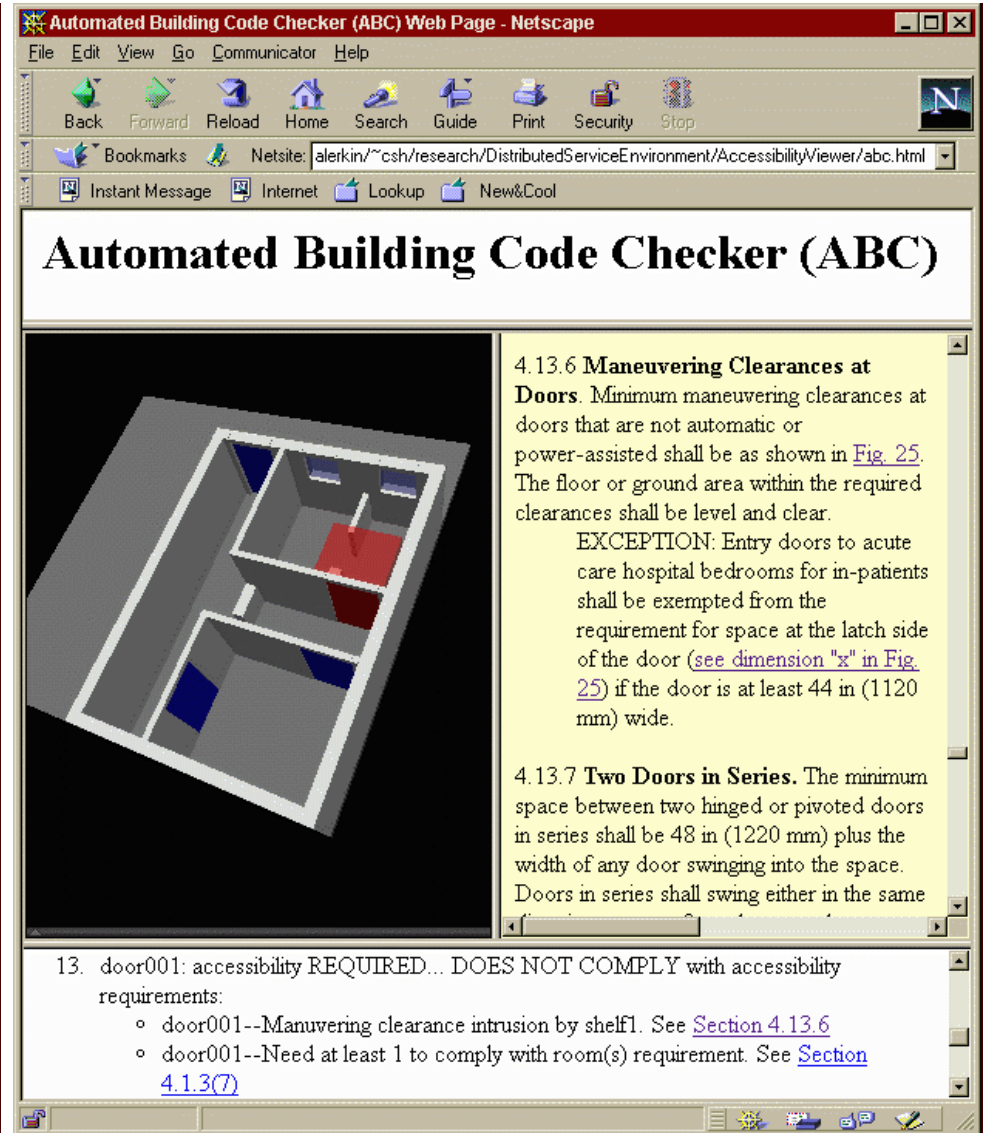
Expandable index to specifications



# Online Code Compliance Checking

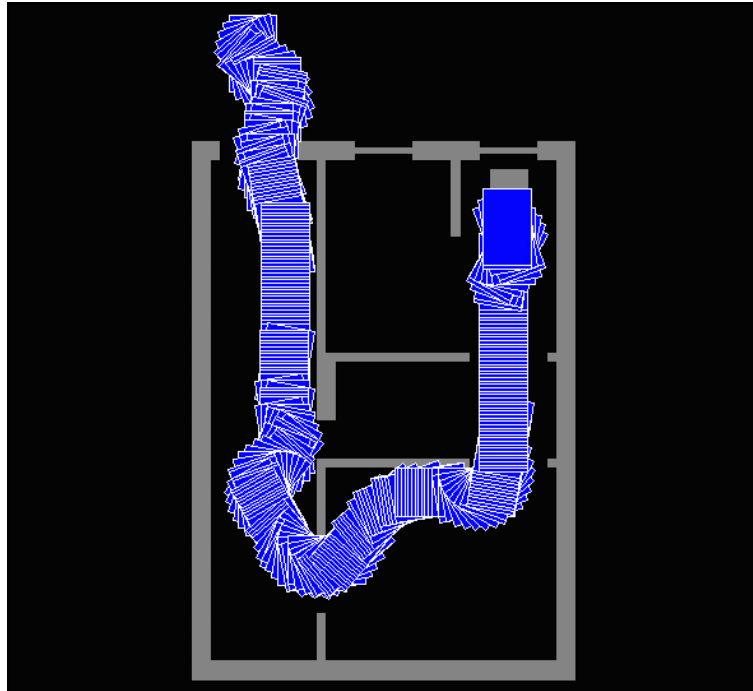


CAD Model



Compliance Checker

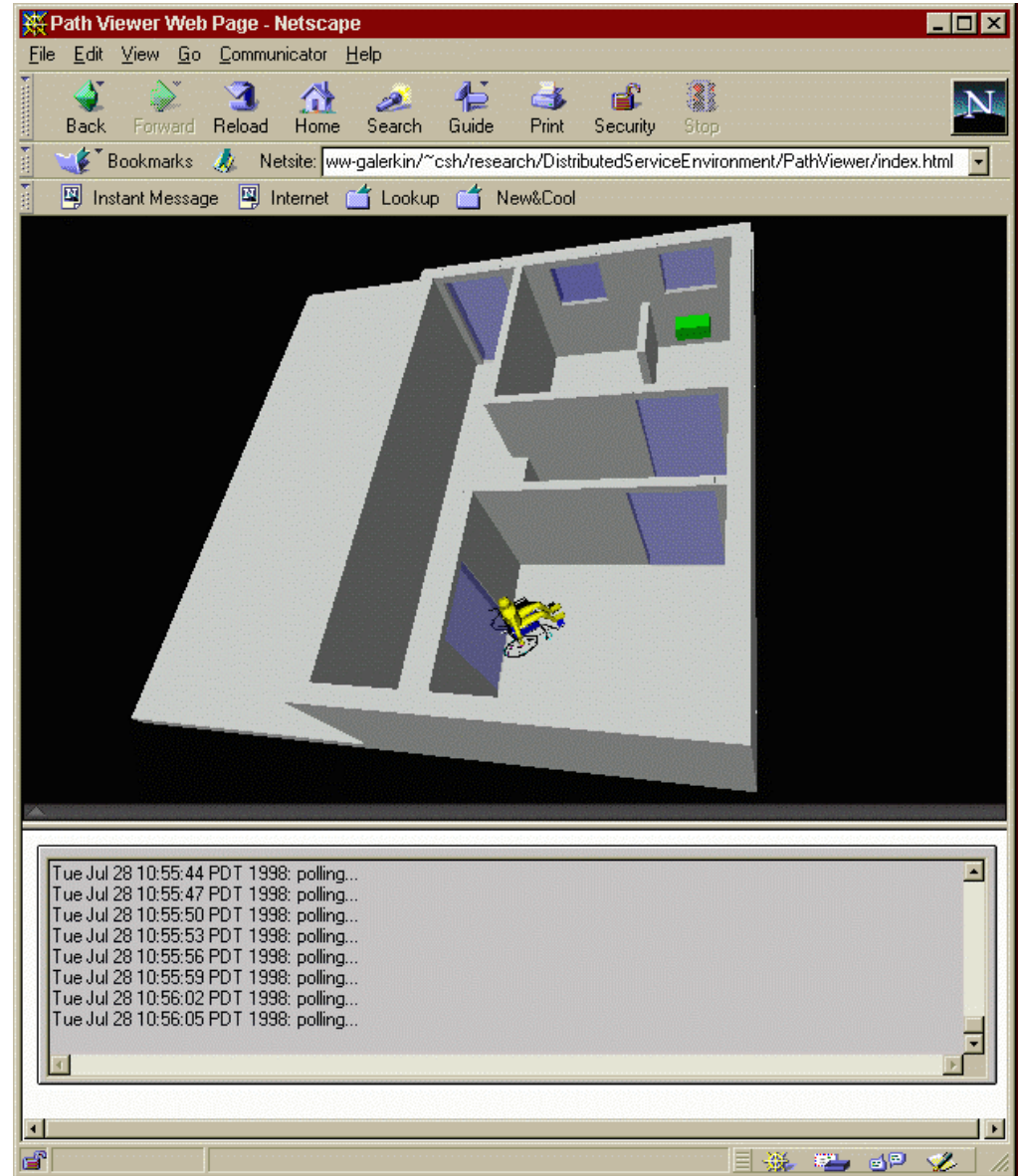
# Online Performance Simulation



Motion Planner

Wheel chair accessibility

(VRML viewer)



## Internet Mediated Synchronous/Asynchronous

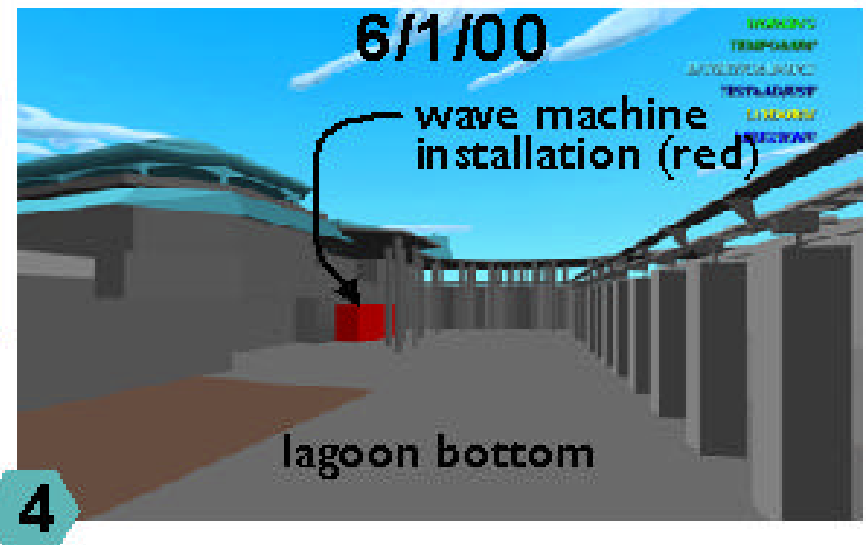
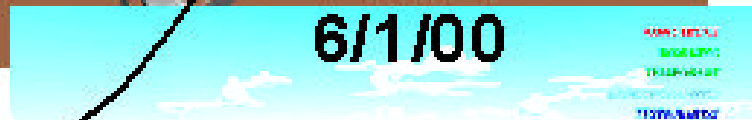
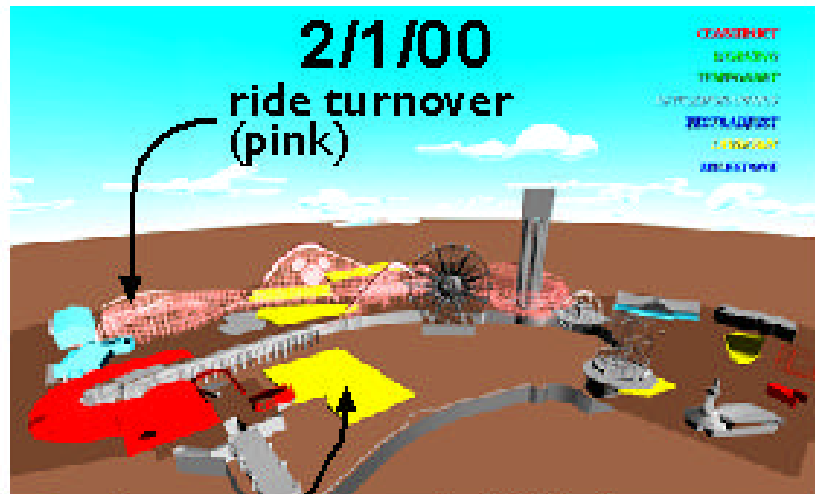
- Collaboration
- Communication

## Videoconferencing

- Face-to-Face Meetings
- Meetings in Cyberspace
- Distance Learning Lectures
- Presentations to the Client

The image is a composite of three windows from a computer desktop. The top-left window is AutoCAD - PVIEW, showing a 2D architectural drawing of a building's floor plan with a blue highlighted area. The bottom-left window shows a 3D wireframe model of a building structure with a blue highlighted area. The right side of the image is dominated by a ProShare Video window. The top part of this window shows a video feed of two people in a meeting. Below the video feed is a control panel with buttons for 'Hang Up', 'Clear', 'Split', 'Help', 'Options', 'Info', and 'Share Document'. The bottom part of the ProShare window shows a network diagram with nodes labeled 'CIFE Members', 'Automation', 'Integration', 'Education', 'Mgt. of Tech.', 'Funds', 'Sponsors (Industry & Government)', and 'Faculty & Students'. The diagram includes a key for 'Research Thrust Area' with categories like 'Sponsored Research' and 'Seed Research'. The ProShare window also displays 'Call in progress 00:23:13 CIFE, Graffiti' and 'Local'.

# 4D Visualizations



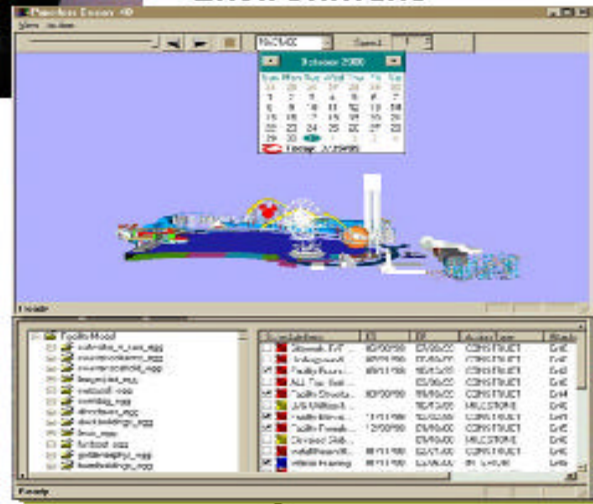
current section of lagoon under construction (red)

interior and exterior work on facility (light blue)

# 4D Environments Used on WDI Project



VR Cave 4D Environment

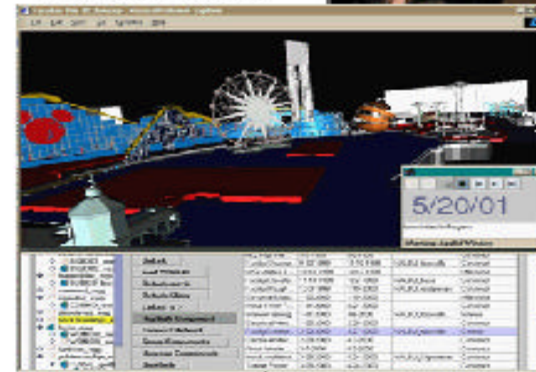


Desktop 4D Environment

changes to 3D model

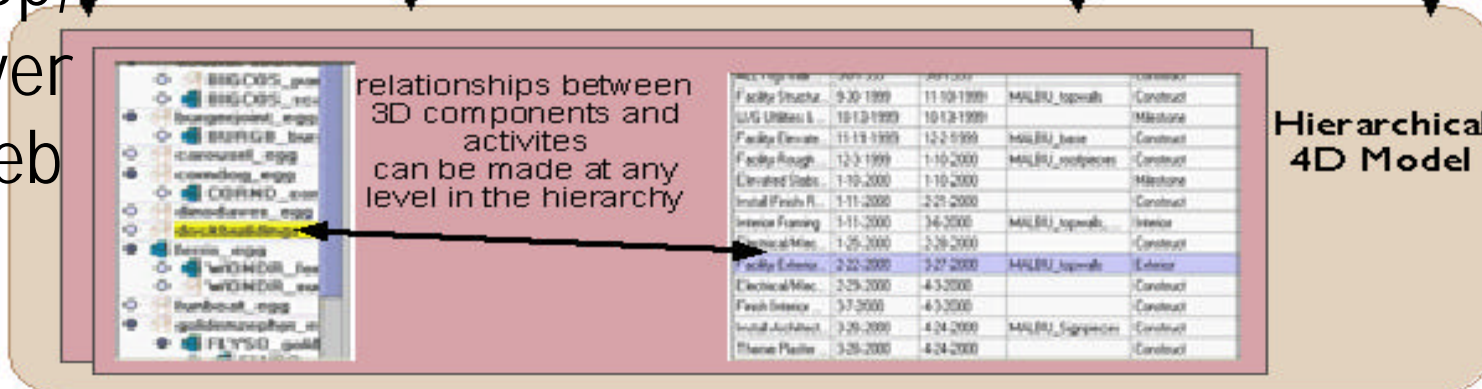


Weptop 4D Environment

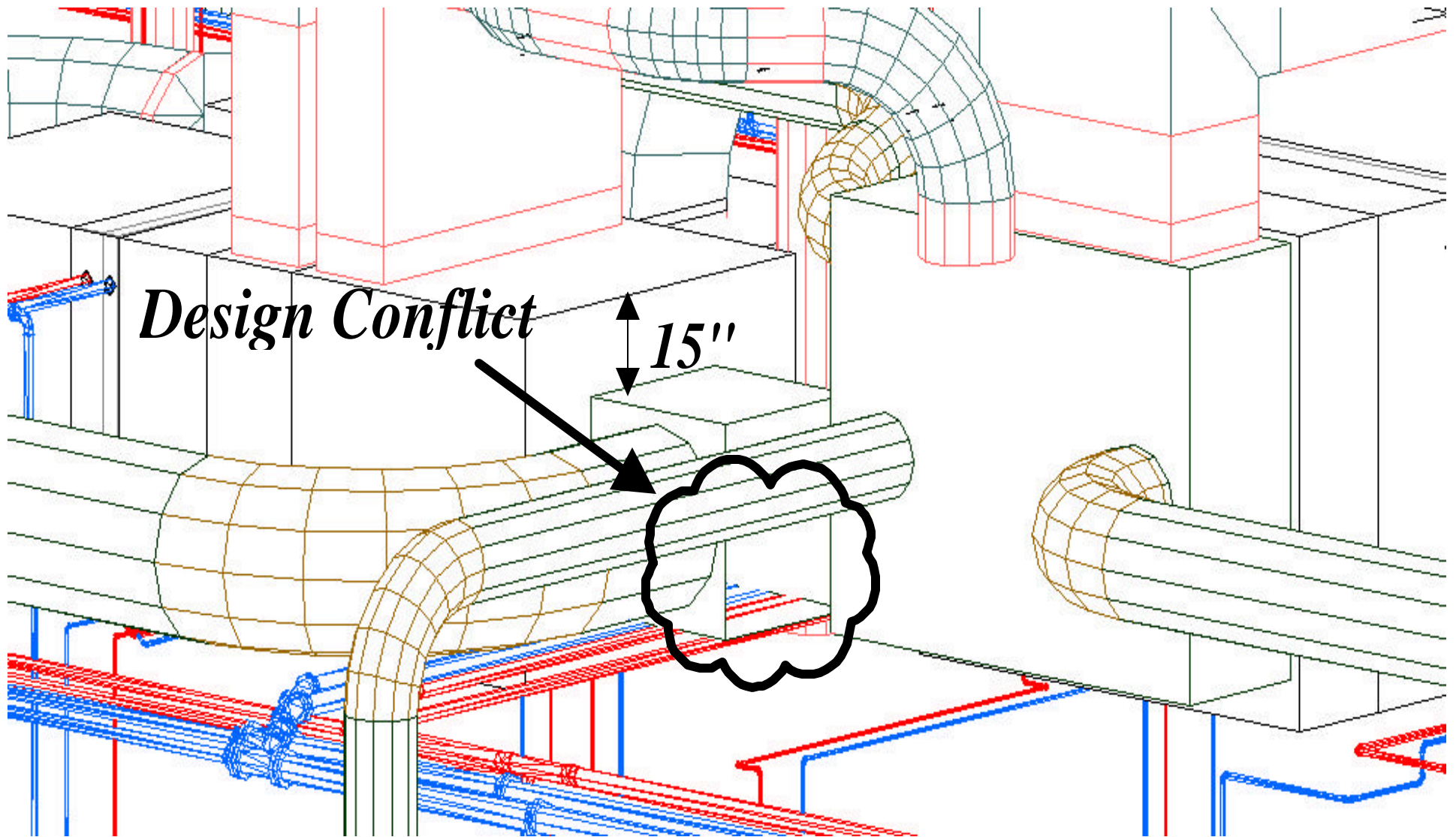


VR Cave 4D Environment

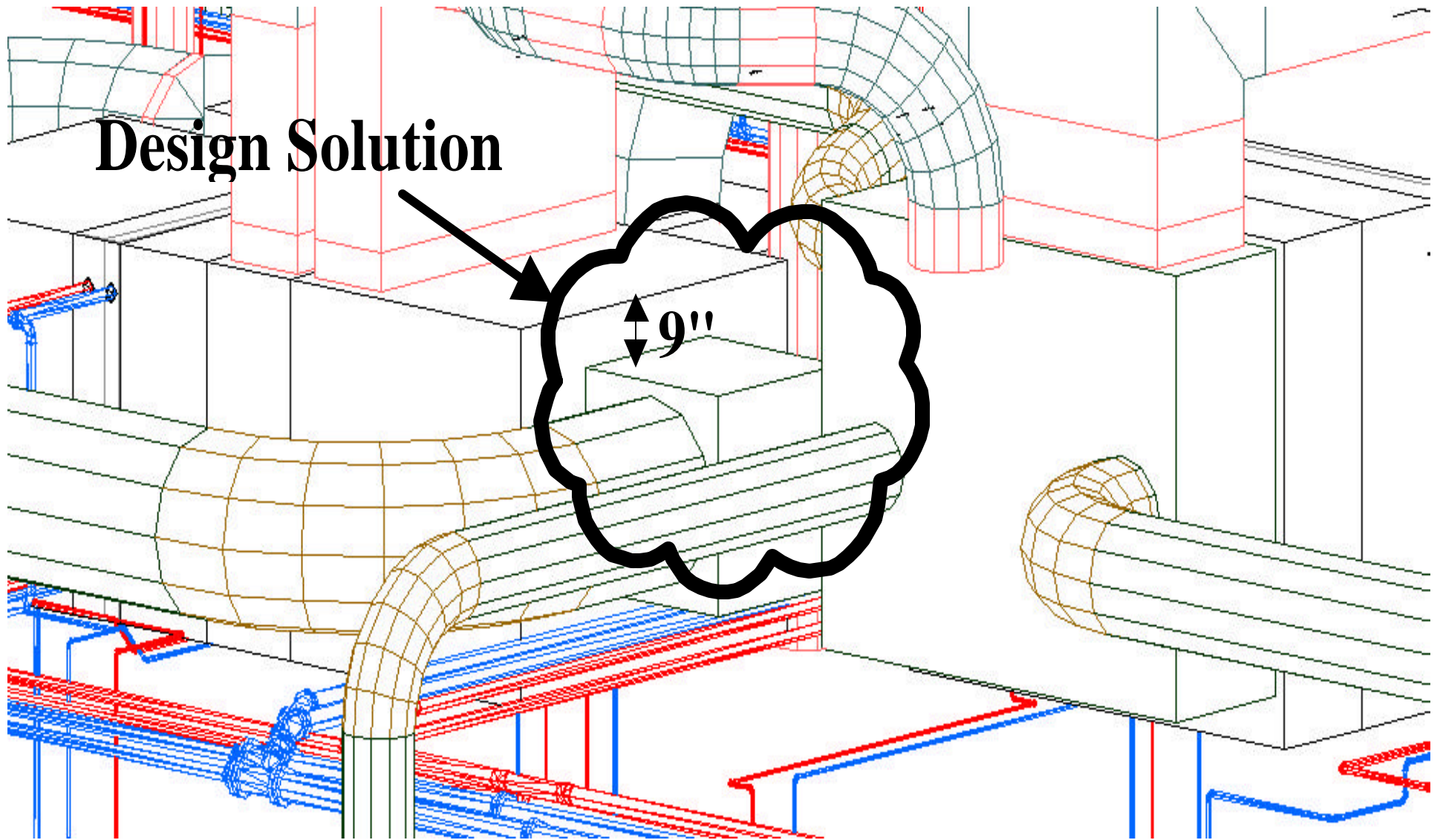
Models in a Cave, on the desktop, and over the web



# Problems discovered together ...

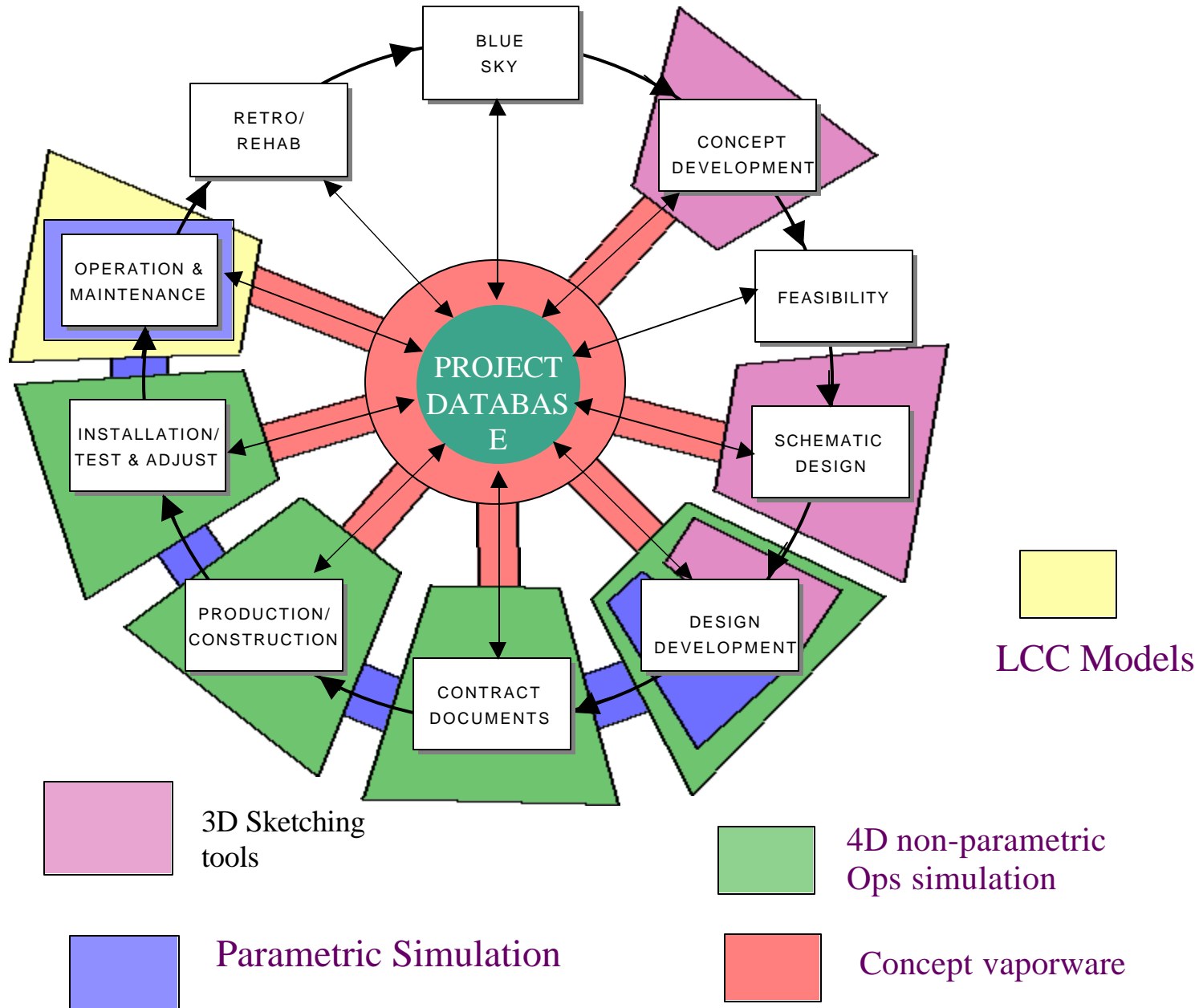


... are solved together

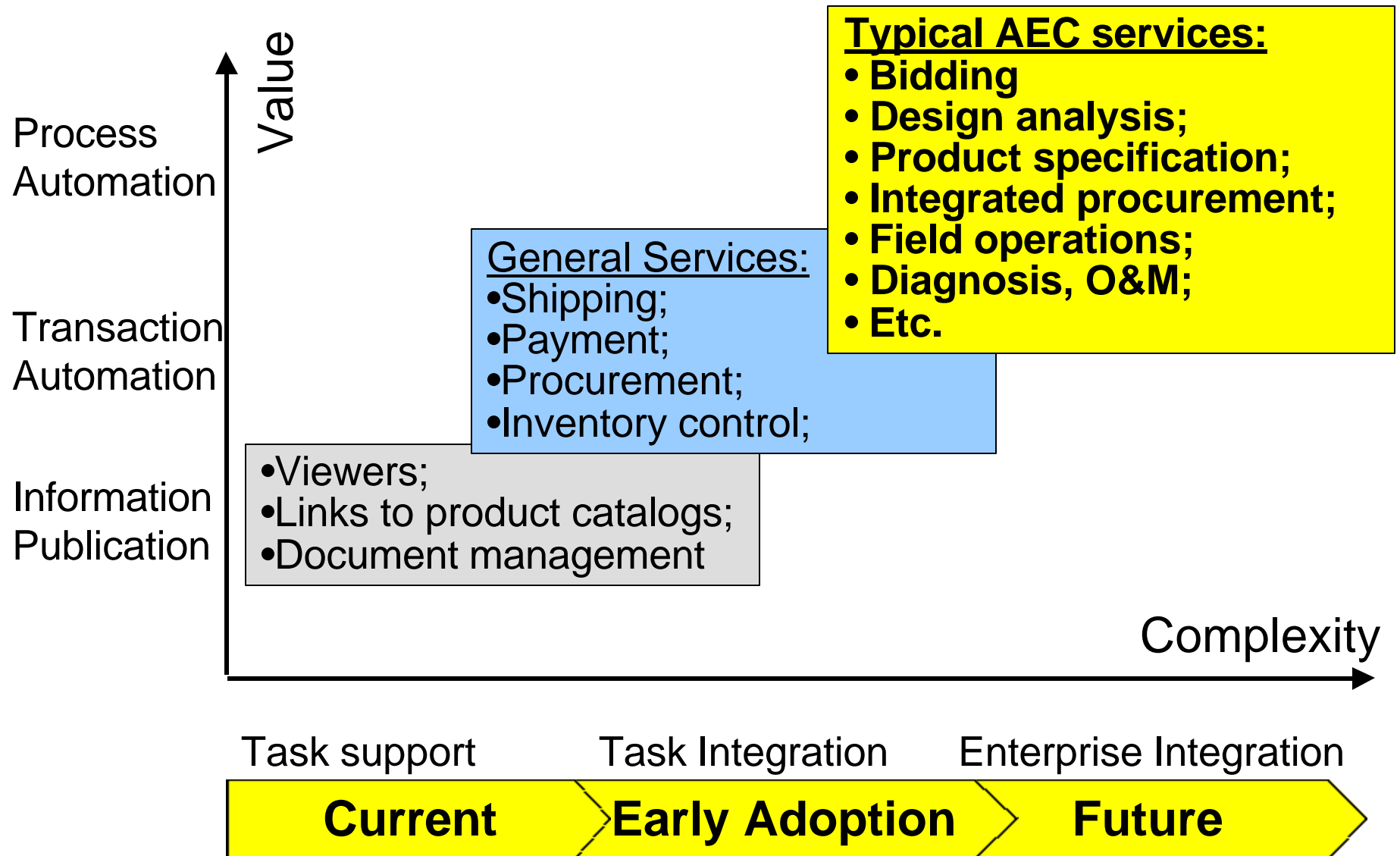




# Status of Modeling Tools Today



# Business Processes on the Web



# What can you do with Computer Models and the Internet?

## *Business Impact*

<i>Business value</i>	<b>Compression of Time</b>	<b>Overcoming Geographic Restrictions</b>	<b>Restructuring Relationships</b>
<b>Efficiency</b>	Accelerate Processes	Gain Economies of scale	Bypass some Intermediaries
<b>Effectiveness</b>	Reduce Float Time	Add Global Control	Replicate Scarce Knowledge
<b>Innovation</b>	Provide Service Excellence	Develop New Markets	Build Networks

# The IT-smart AEC organization ...

- makes IT a business-driven line activity, not a technology-driven staff function
- makes IT investments like other investments - on the basis of value
- drives simplicity and flexibility throughout the technology environment
- demands near-term business results from own development efforts and lines up with universities for long-term research
- drives constant productivity improvements
- builds a business-smart IT organization and an IT-smart business organization

# Help your CEO and ...

- Do your next project in 3D and 4D
  - use imperfect tools
- Share the results
  - CIFE, CERF provide neutral ground
  - give feedback on “4D Wishlist” at <http://randd.disney.com:1492/WISH-List2.HTM>
- Go beyond 3D and 4D: try out the building in the computer
  - life cycle modeling
  - operations simulation