Innovative Product Development – Relational Product Development –

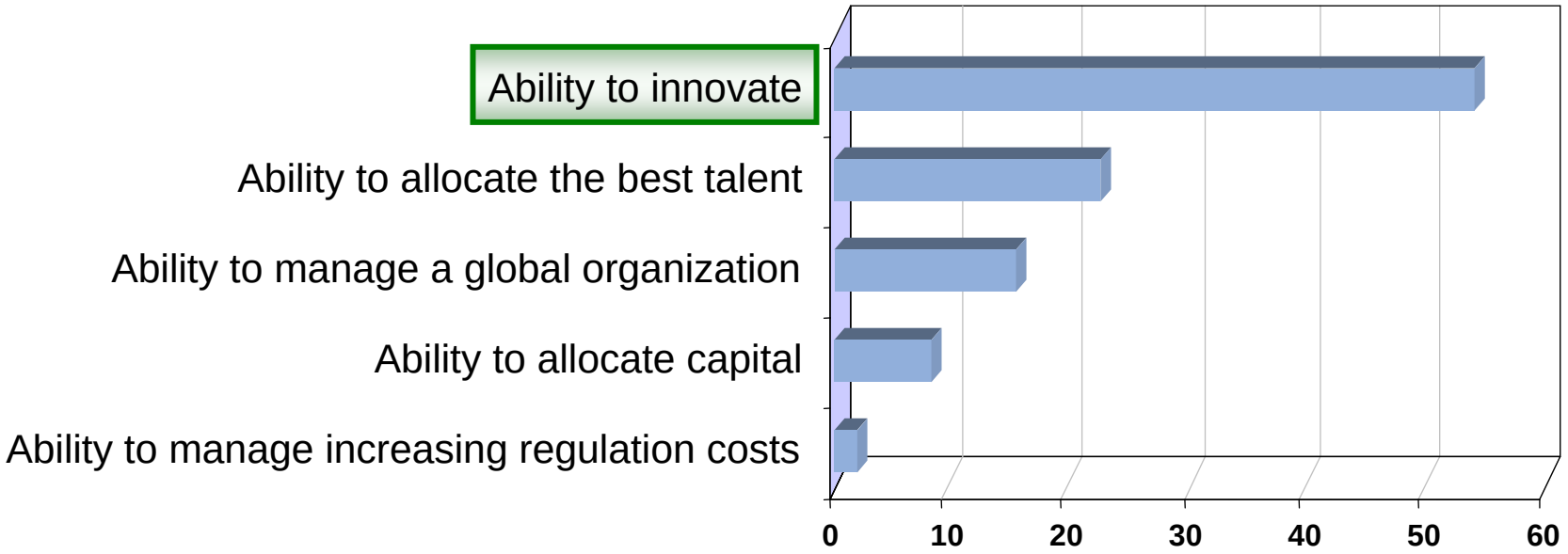
IBM PLM Solutions

Apr.12th 2007

Agenda

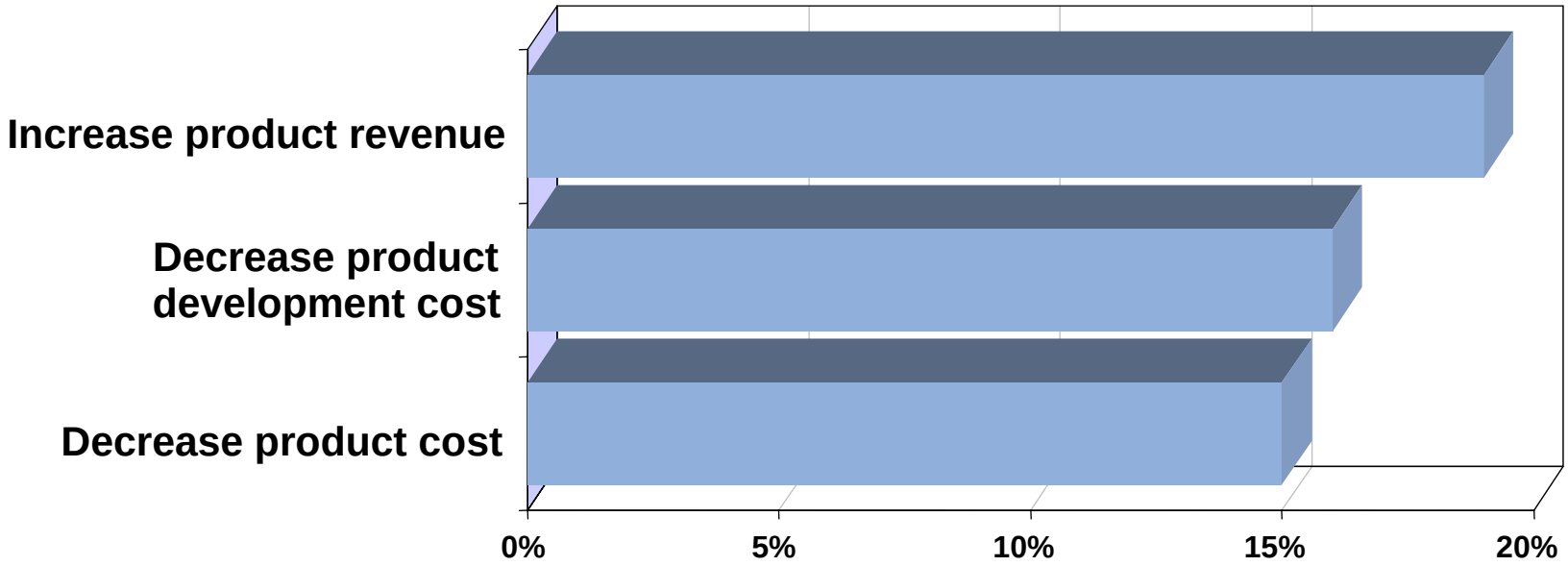
- Industry Environment & RPD
- Why RPD?
- RPD Roadmap for Achieving the Vision

CIOs and CTOs recognize innovation as the most important capability for growth



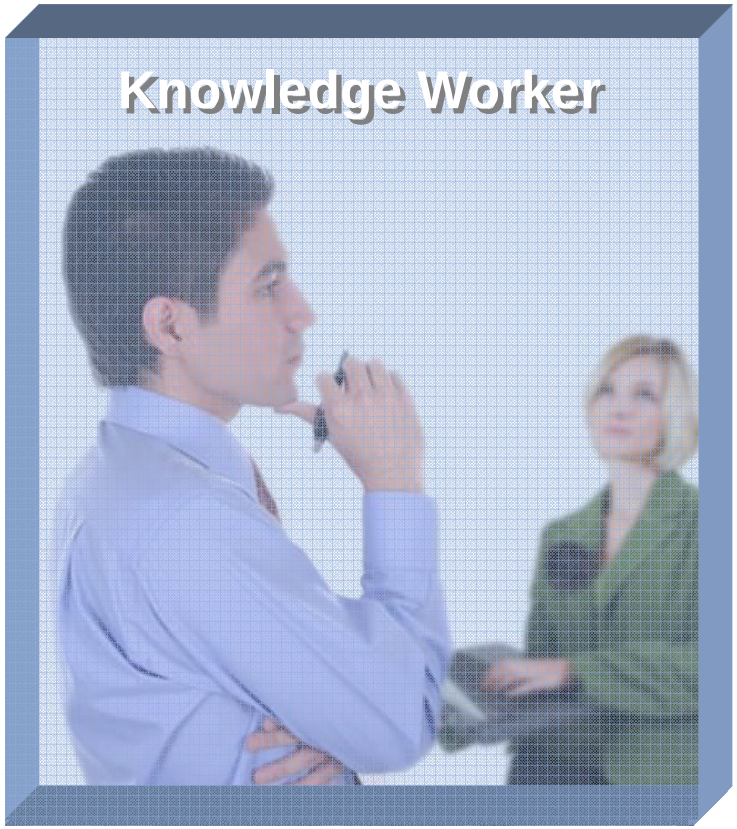
Source: March 2005 McKinsey Quarterly survey of 9,345 global executives

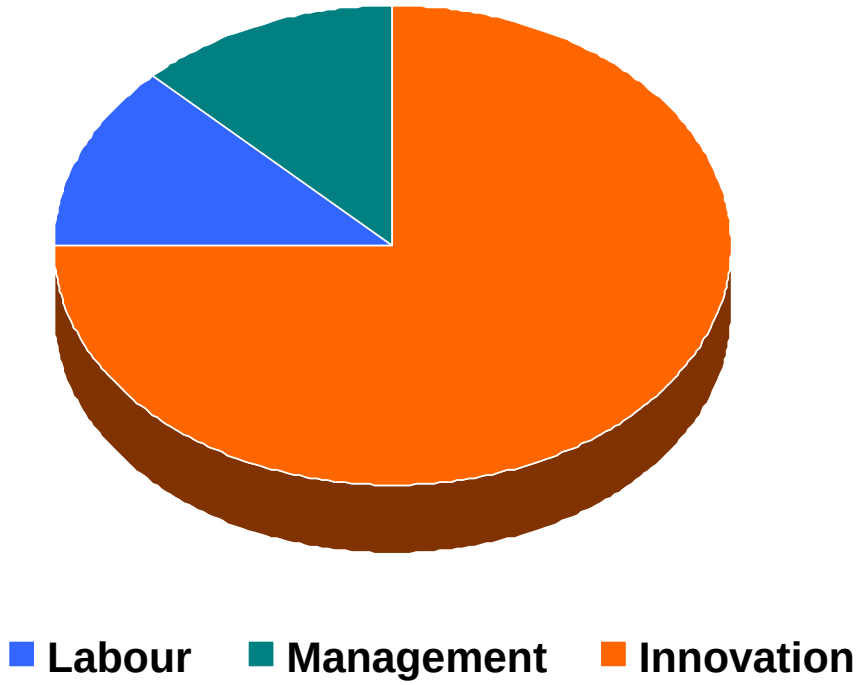
Improved innovation = Improved business results



Source: Aberdeen Group, September 2005

Fundamental Shift: Craftsman to Knowledge Worker
Improving the Innovation Ratio

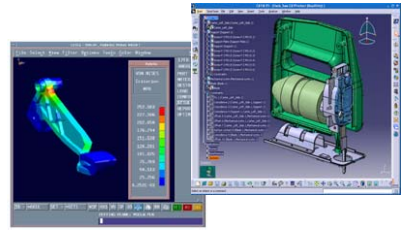




Product Development capabilities have evolved as a source of competitive advantage…

	1970 - 1980	1980 - 2000	2000 beyond
Business Drivers	Productivity Improvement Task Automation	Design Reuse Cost Reduction Cycle Time Reduction	Globalization Profit Margins Rapid Response
Virtual Product Development	2D CAD Ad Hoc Data Management No Org/Process Change	3D CAD PDM Org/Process Tweaking	Relational Design VPDM Org/Process Transformation
Business Value	Accuracy Product Quality	Time and Cost Improvement - Efficiency	Rapid Innovation Resource Optimization Shareholder Value

… and a response to Engineering requirements



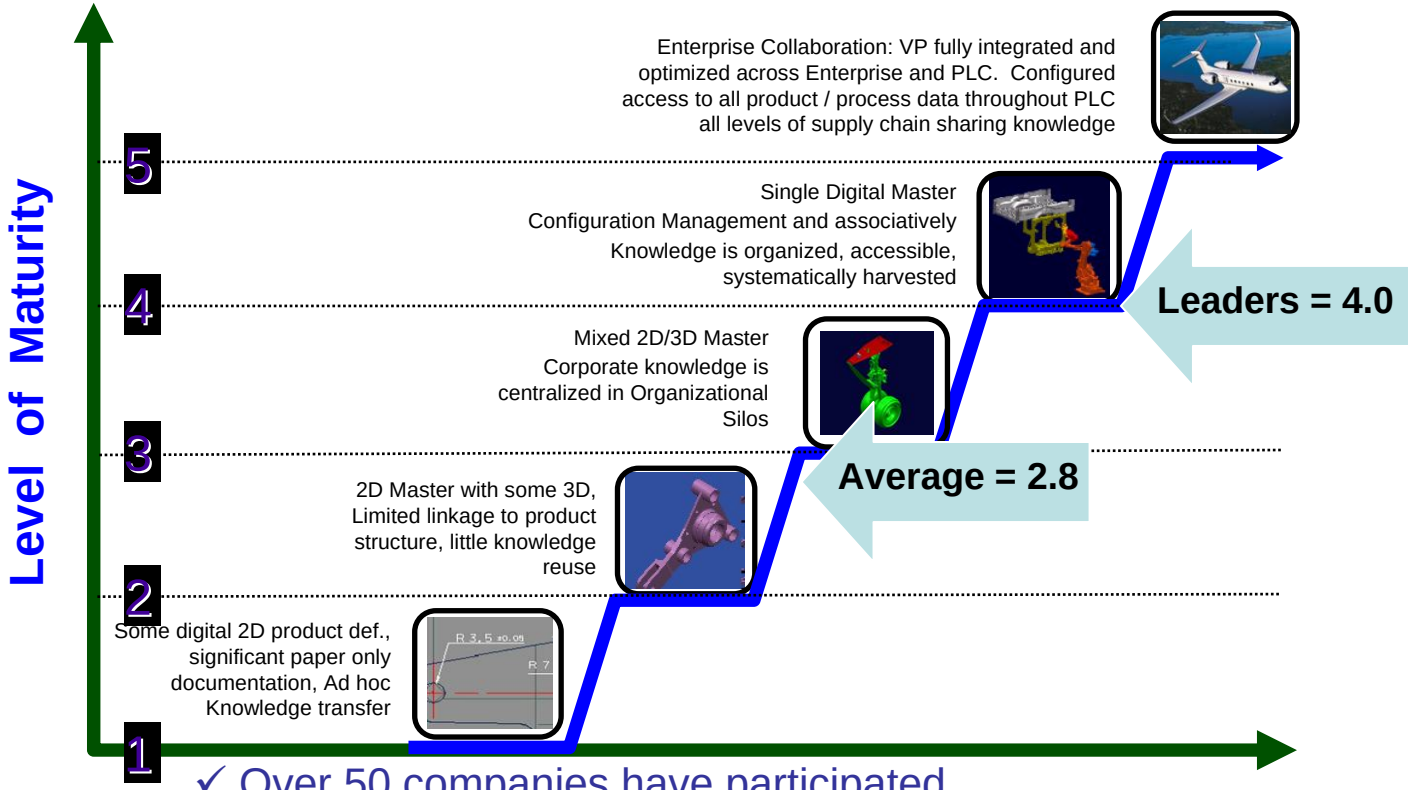
Yesterday

- From a world where Engineers are working in single model files, which contain all the geometric information to define that model (3D, 2D etc.)
- Where there were no structural components to define real assemblies
- Where it was sufficient for the data management system to understand the relationships between CAD models

Today

- To a world where Engineers are Working in the context of assemblies
- Where associativity and knowledge is spread across the geometry of the entire product - both inside and between parts
- Where data management systems now need to manage the relationship between both geometry features, the associated models, and metadata

Global PLM Capability Benchmark



✓ Over 50 companies have participated

✓ Over 220 competencies measured in terms of Organization, Process, Technology, Practice and Performance capability

1. Use the Virtual Product as a master reference for all product lifecycle management activities
2. Use of the Virtual Product Throughout the Entire Lifecycle
3. Use the Virtual Product to develop and simulate the production process
4. Manage the Virtual Product and its configuration
5. Manage your company's knowledge and reuse your experience
6. Optimize the IT infrastructure and systems
7. Integrate the Virtual Product in business and project management
8. Optimize the Organization & Human Resource to support the VP environment
9. Measure and manage the value added by the Virtual Product
10. Use the Virtual Product across the Extended Enterprise

PLM Capability Chasm

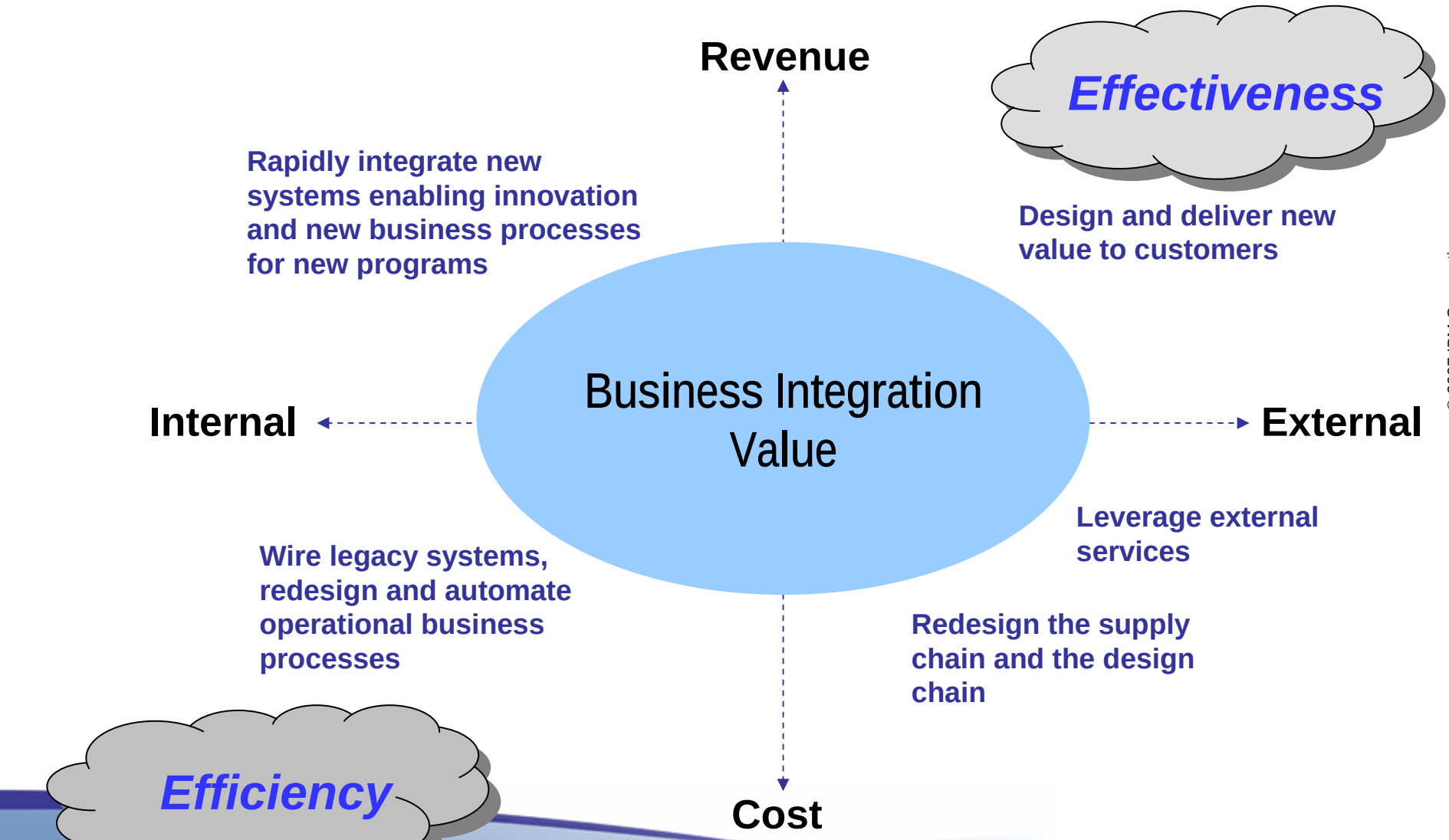
Below Level 3	Above Level 3
Medium to Advanced Technology	Medium to Advanced Technology
Existing Processes	*Optimized* Processes
Existing Organization	*Optimized* Organization

World Class PLM

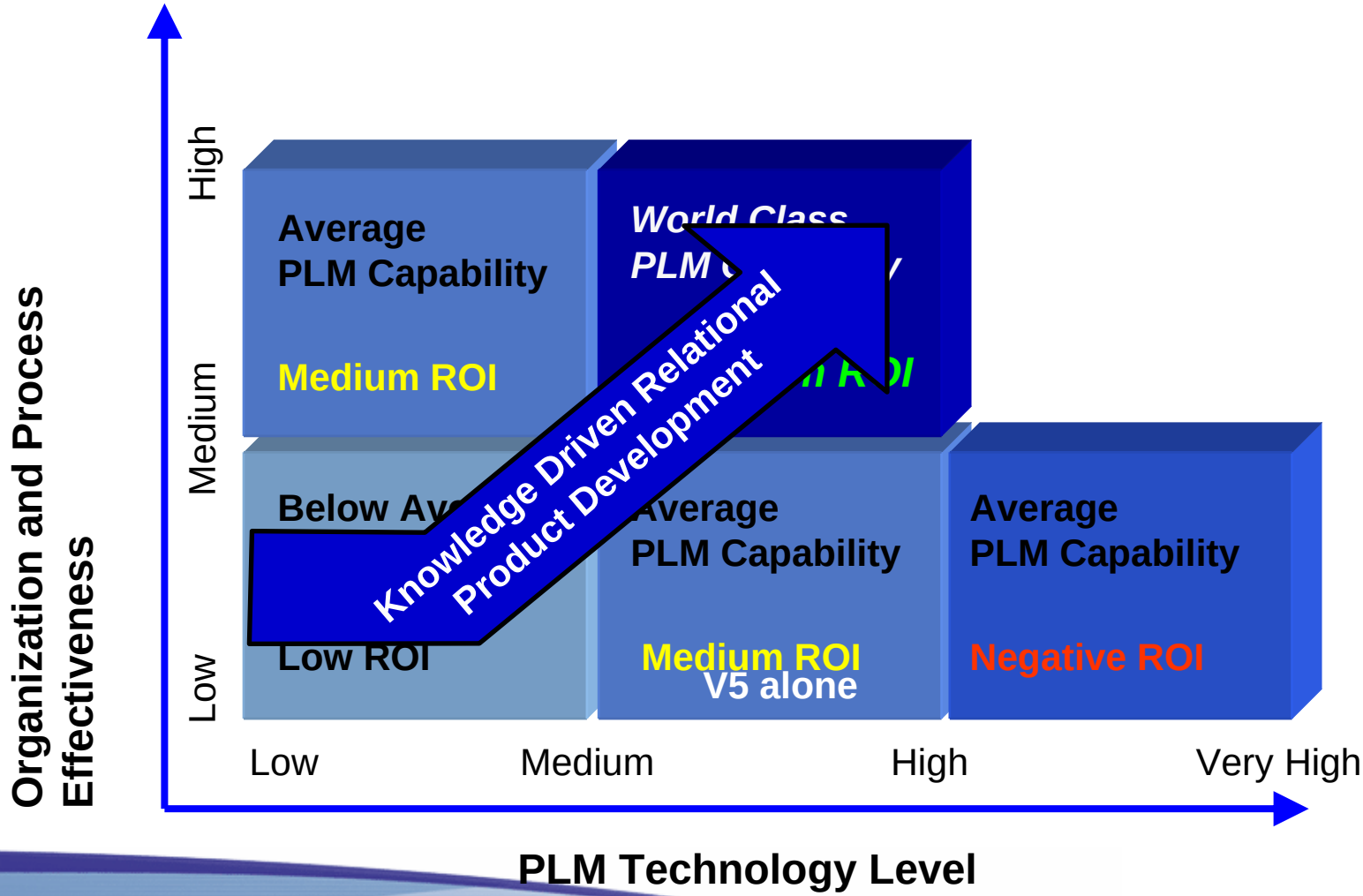
"High Tech, High Touch"

Tom Peters, Re-Imagine!

The Value of Enterprise Effectiveness



World Class PLM is more than Technology



Relational Product Development – Definition Description

- **Relational Product Development (RPD) is an advance PLM solution that consists of a relational information structure that is pervasive, configured, managed and deployed across the Product Creation Environment.**
  - RPD represents a “state-of-the-art” methodology which leverages a company's product knowledge of geometric and non-geometric behavioral relationships to optimize delivery of products to market according to desired performance.
  - RPD is an applied science, where company specific business characteristics becomes the cornerstone to a new paradigm for optimized new product introduction.
  - RPD is an enabling environment for fostering ***Innovation***

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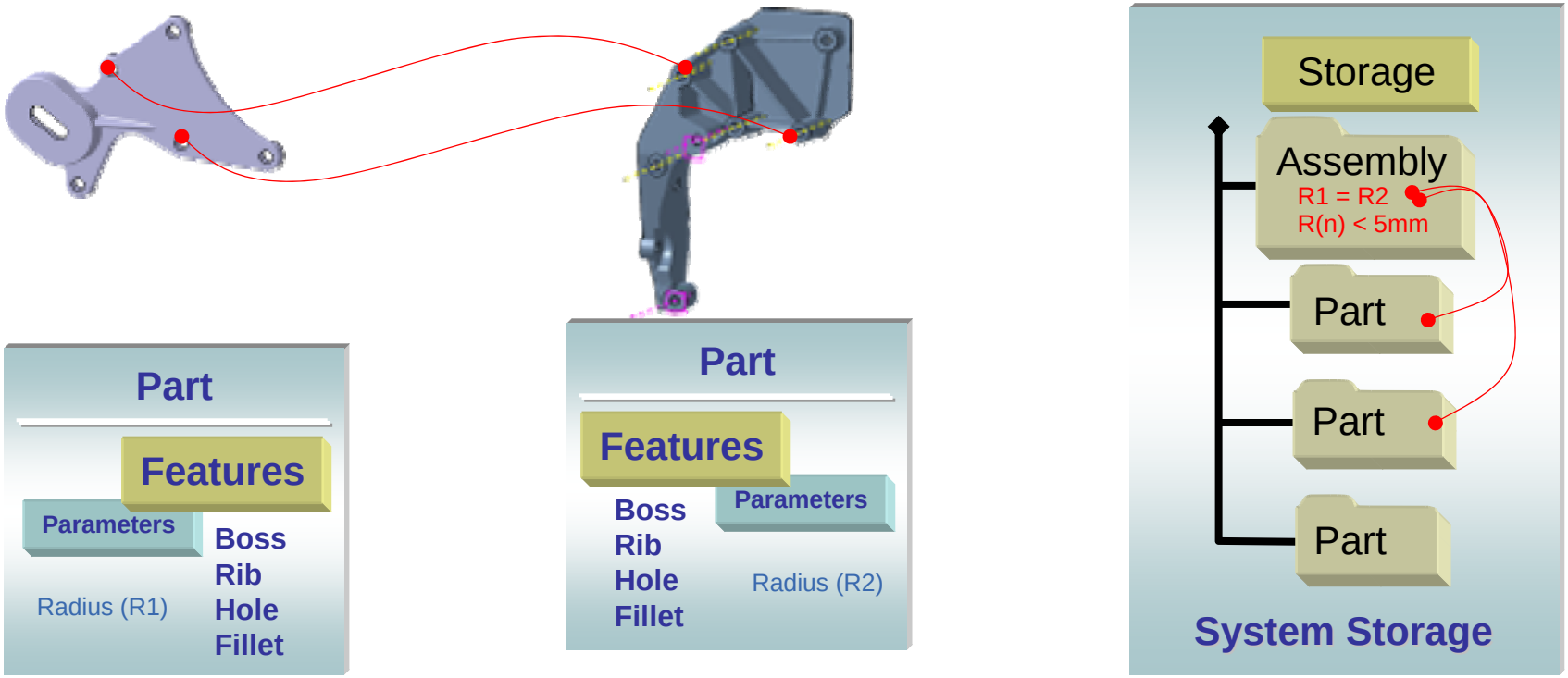
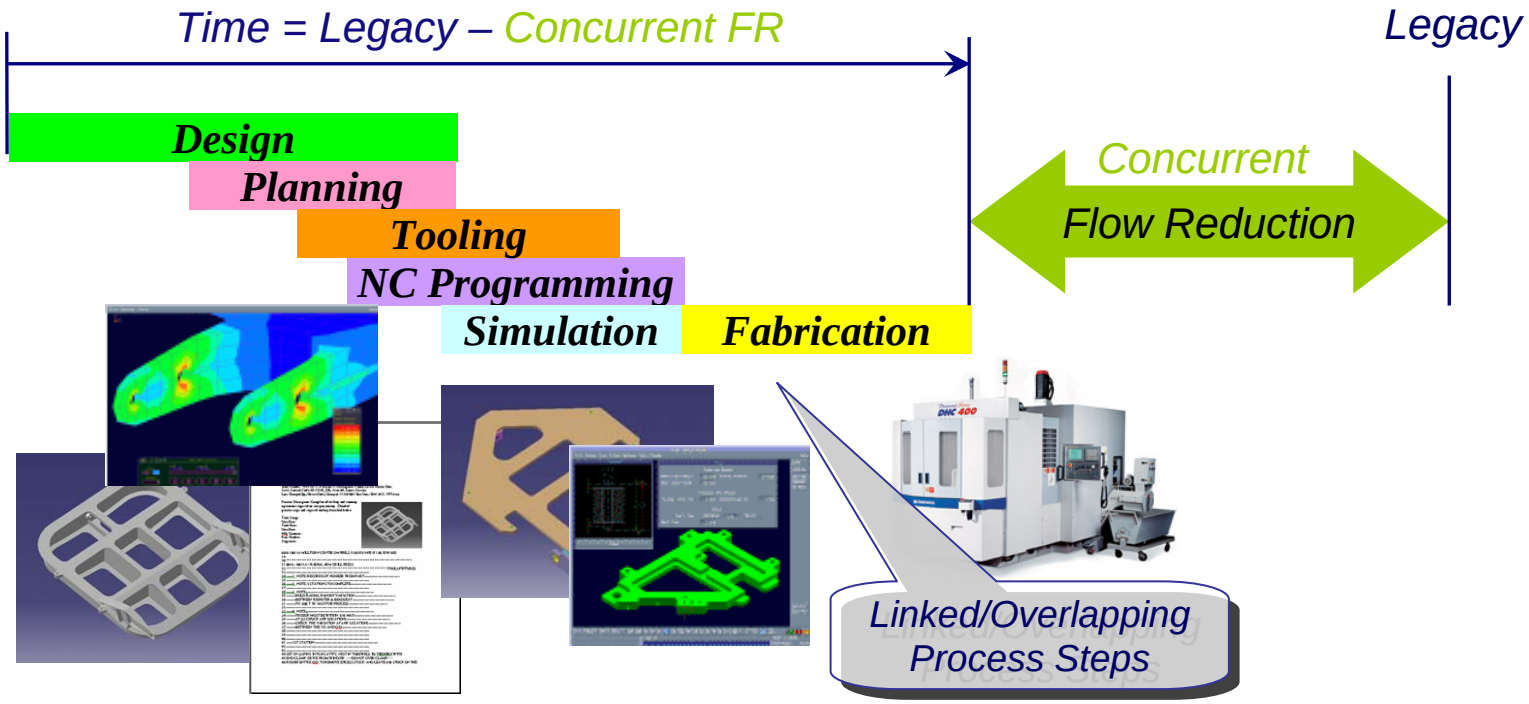
- Industry Environment & RPD
- Why RPD?
- RPD Roadmap for Achieving the Vision

Authoring in Context – Relational Design Basics



RPD Concurrent and Derivative Process Value

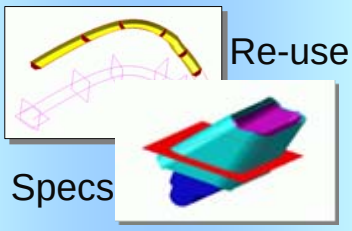
RPD Concurrent Process



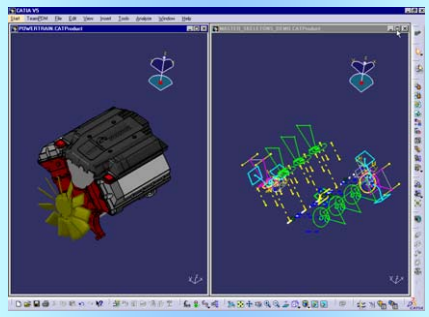
- *Reduced Job Flow for Faster Completion*
- *Fosters De-Coupled Development*
- *Common Data Source: Enables Cross-Functional Relationships*
- *Virtual Production: Engineering, Design, Manufacturing, Support*

Classes of Imbedded Knowledge

Component / Feature Catalogs

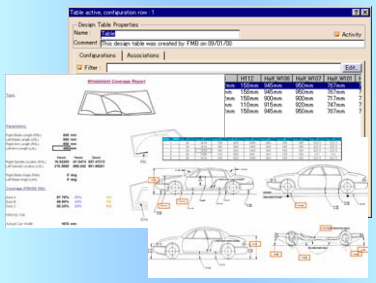


Architectural Skeletons

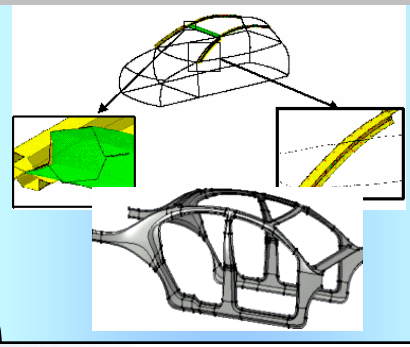


Knowledge

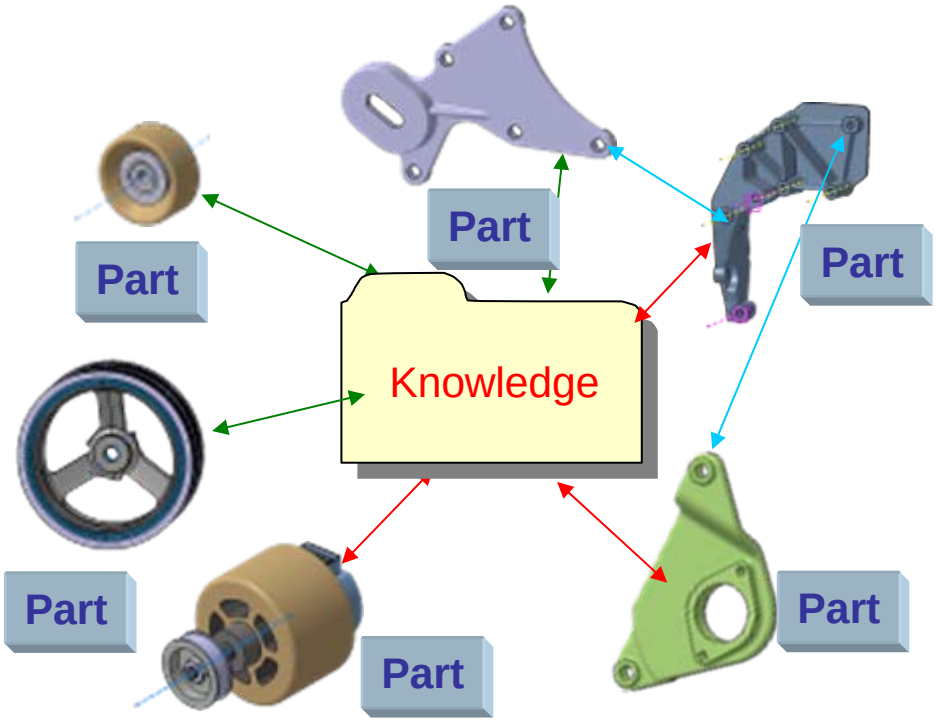
Rules / Laws

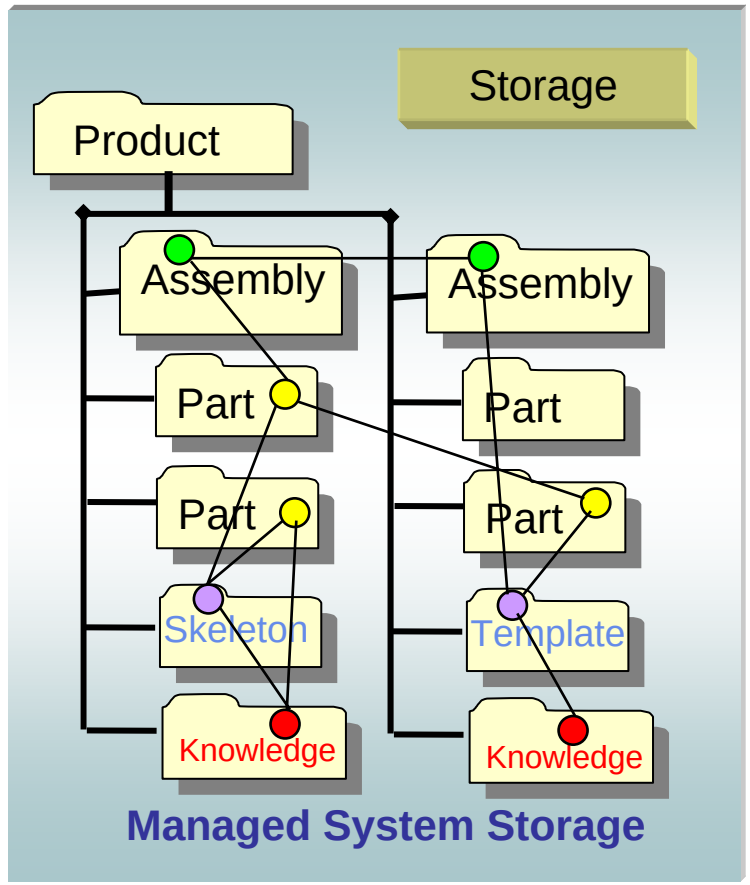


Concept Templates



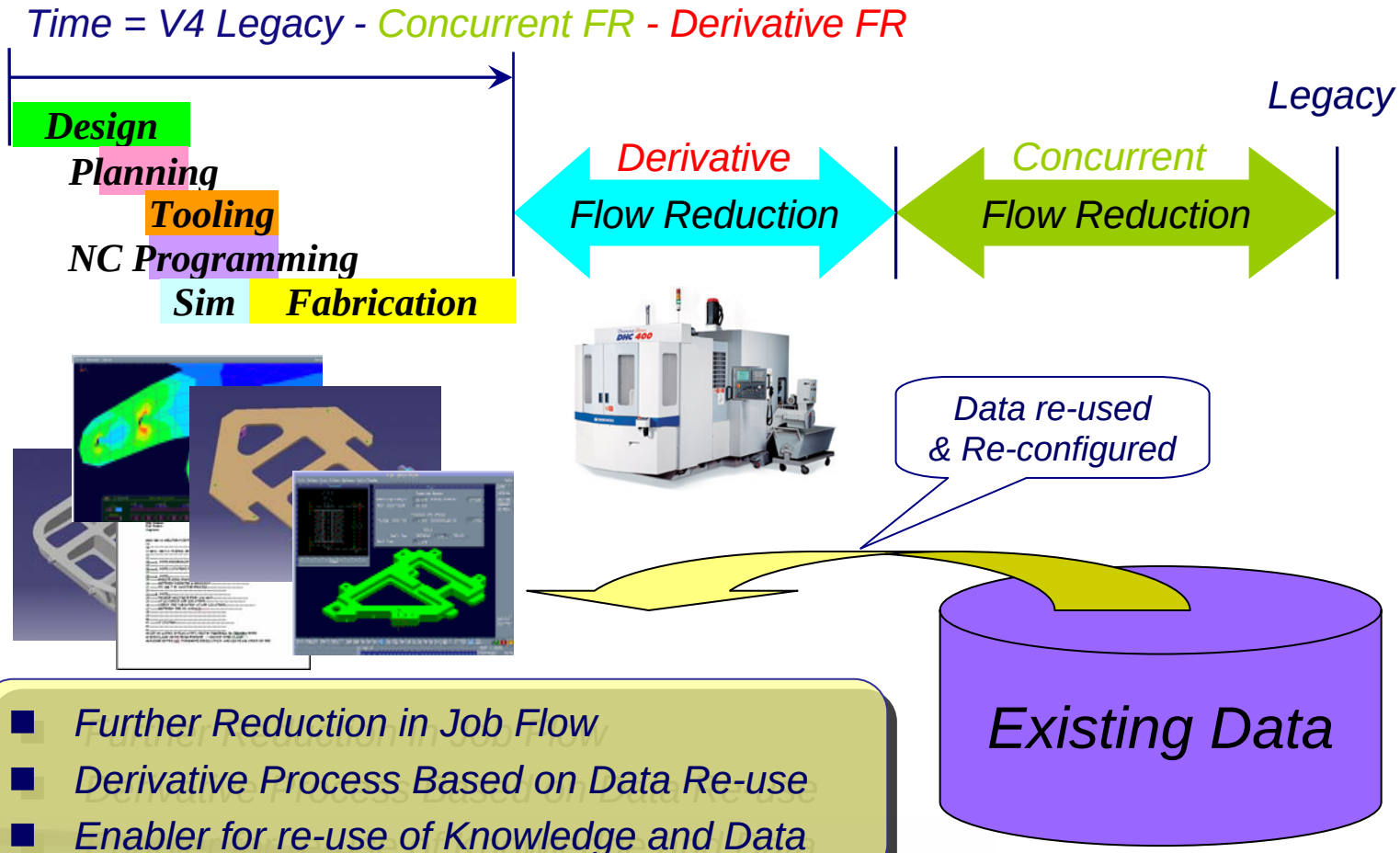
Knowledge Driven Relational Authoring





RPD Concurrent and Derivative Process Value

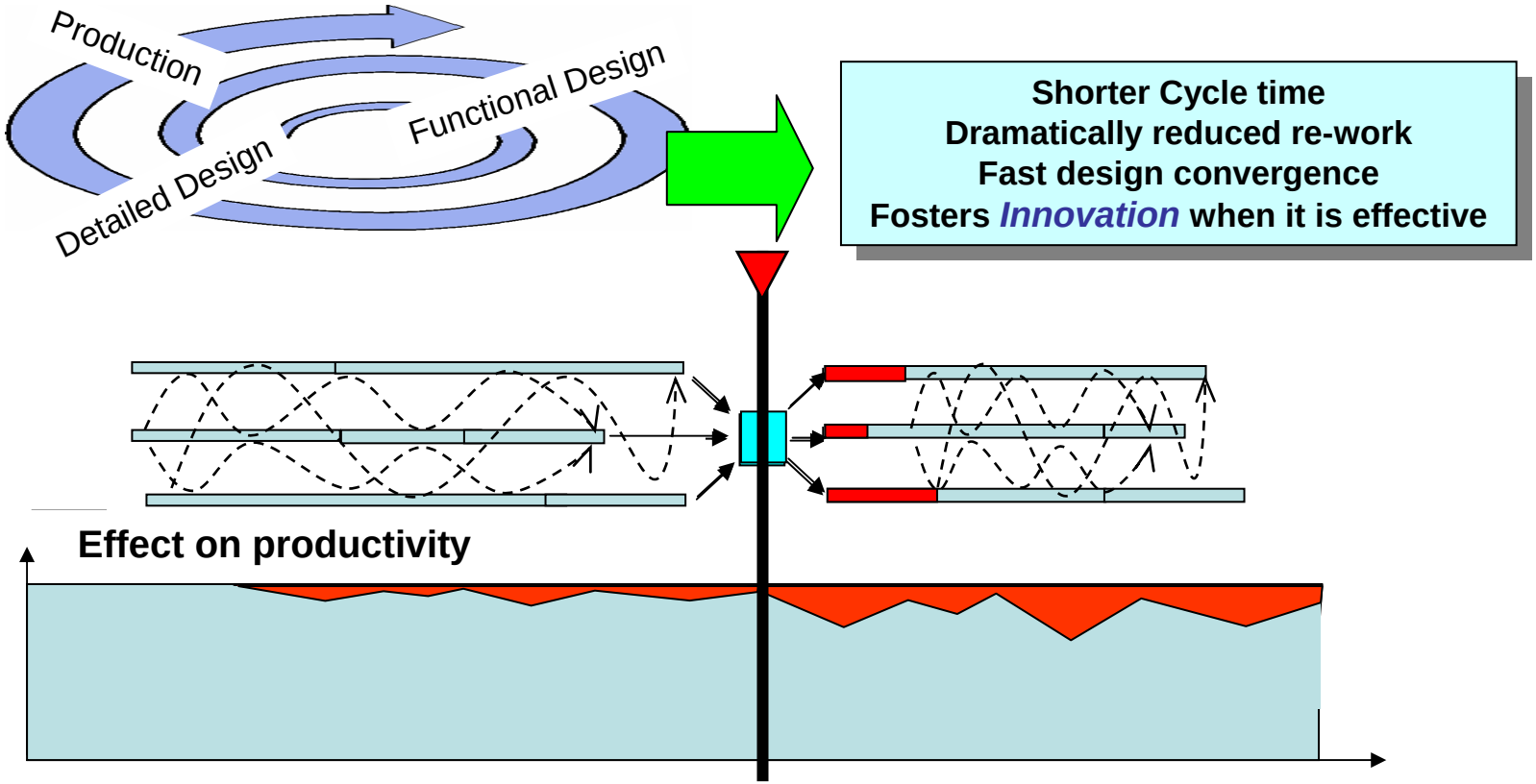
RPD Derivative Process



- *Further Reduction in Job Flow*
- *Derivative Process Based on Data Re-use*
- *Enabler for re-use of Knowledge and Data*

Spiral Development for Concurrent Engineering

Highly concurrent (Spiral Development)

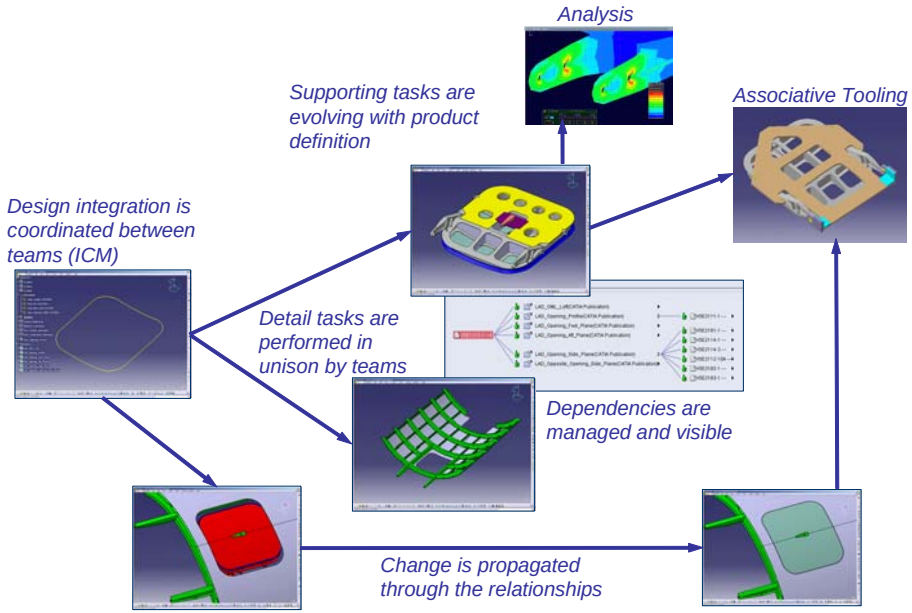


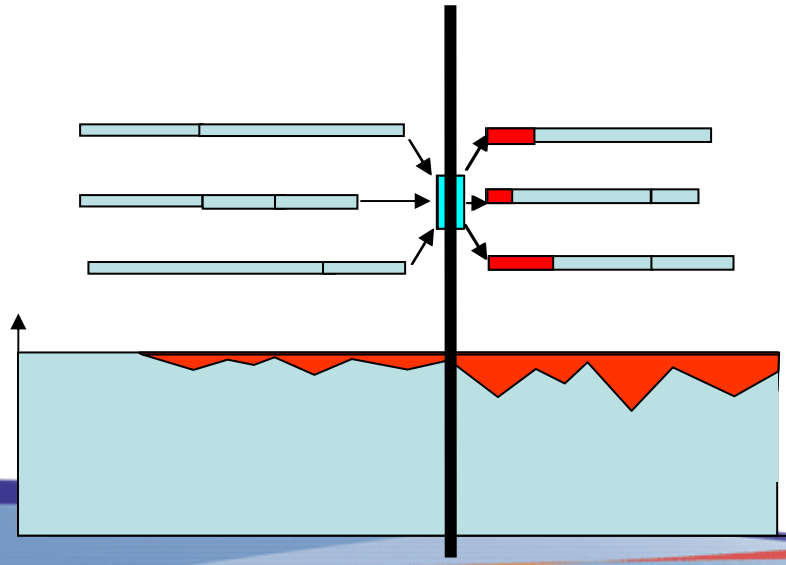
Behavior Modeling – a Process View

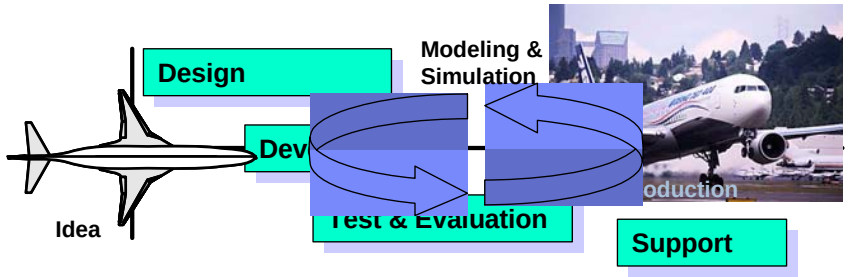
- Design in Configured Context

Development activities can be performed simultaneously due to relational modeling within a common database. Creating linked/overlapping process steps can result in:

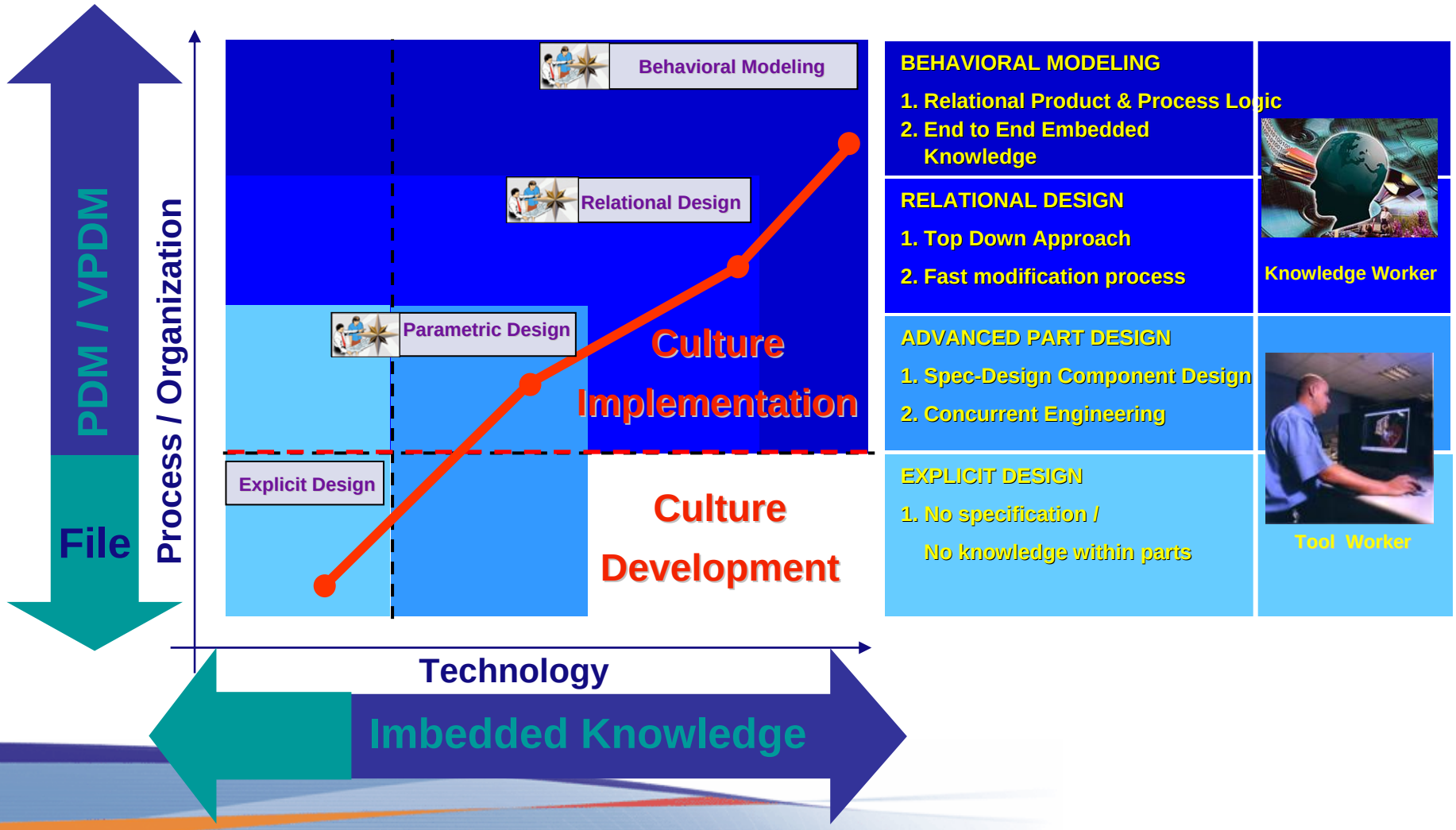
- Reduced Job Flow for Faster Completion
- Cause and effect relationships (visibility of change)





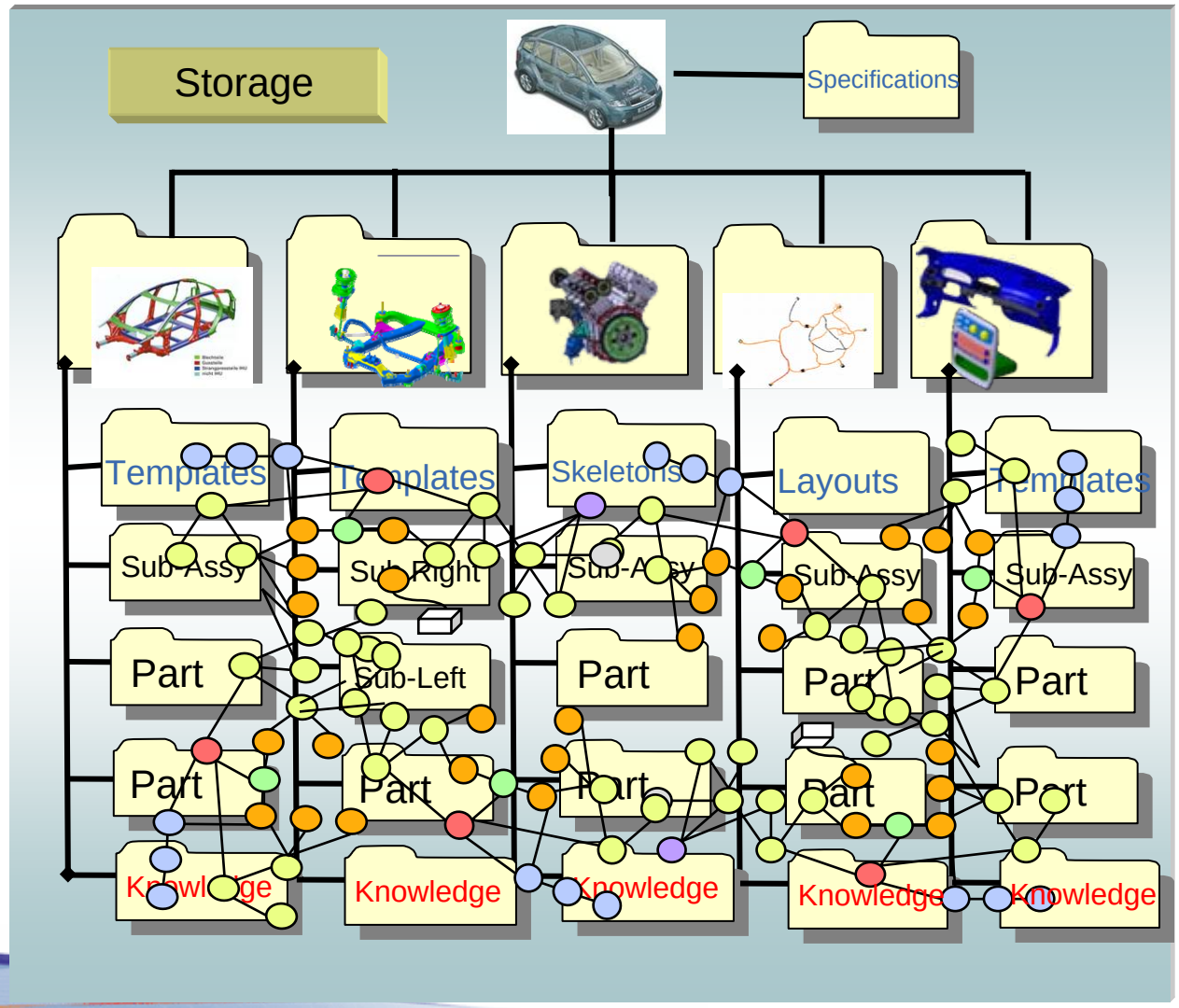


The Evolution Towards RPD is a Business Transformation…



The Relational Product

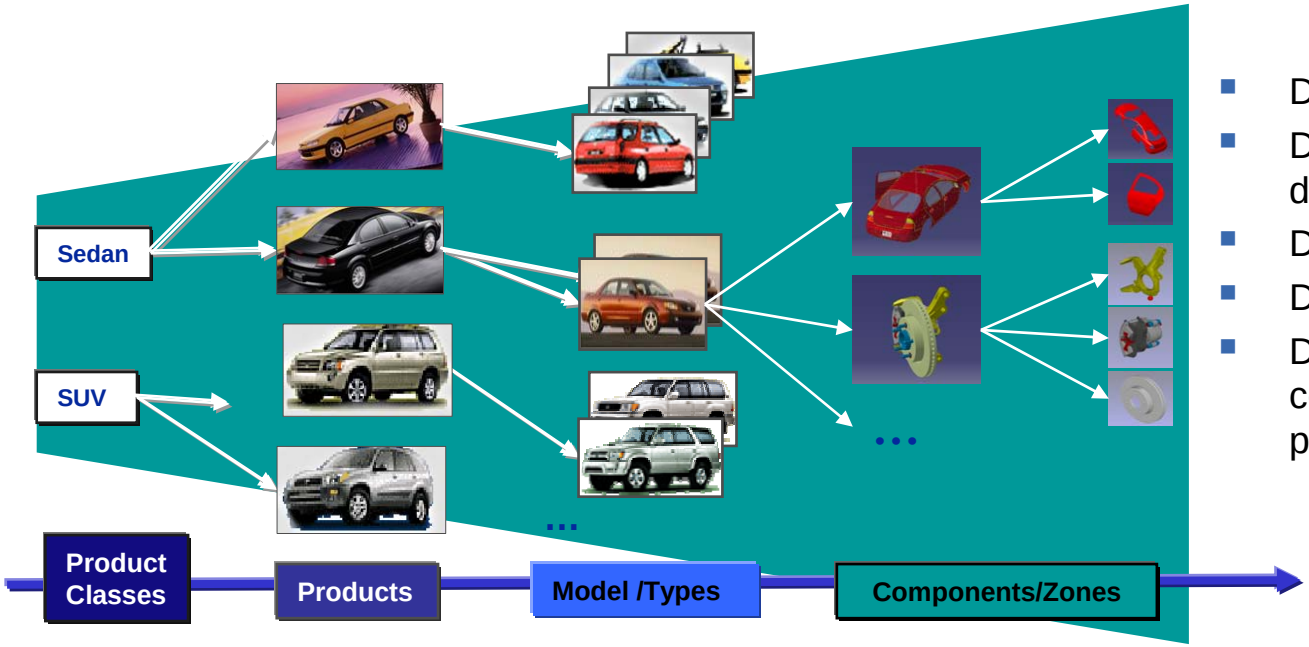
VPDM Storage System Relational BOD View



Product Configuration Management

Defining and managing corporate product definition

- Product Definition (PDC) provides functions for defining product family, product component, and product zone structures

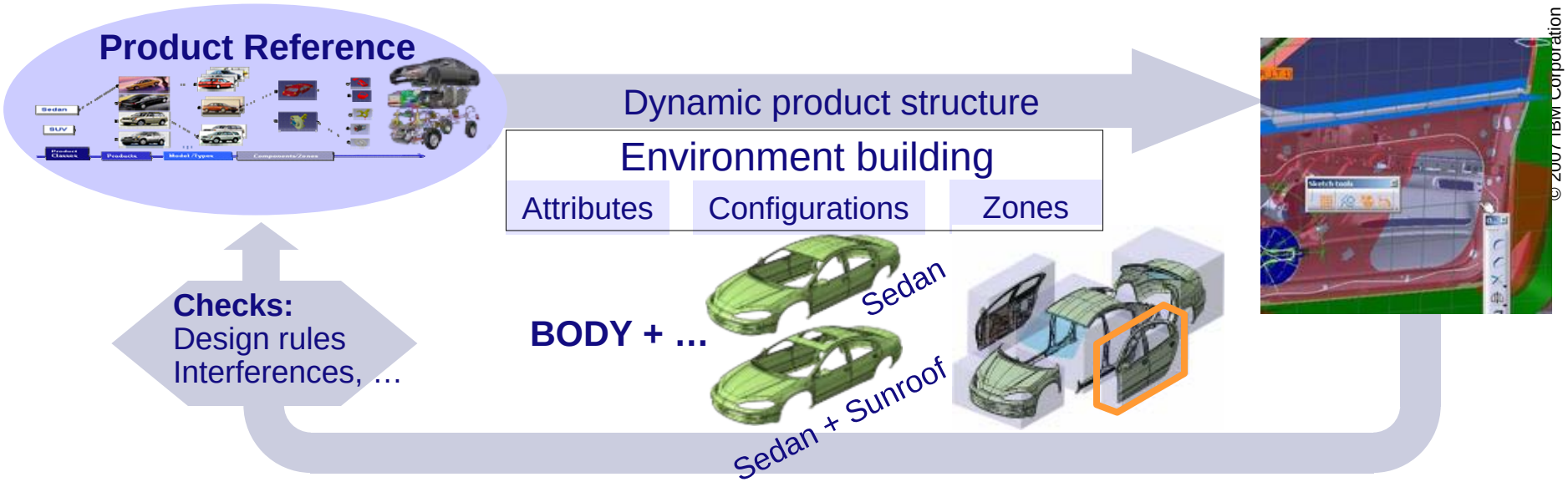


- Define family of products
- Define products corporate dictionary of product variants
- Define product and models
- Define option packaging rules
- Define product specification, a configuration criteria to filter the product structure. For examples:
  - CCAR EX - 2005– 4 doors – US
  - Mountain Bike – Sport - Deluxe

Product diversity with optimized use of standard components

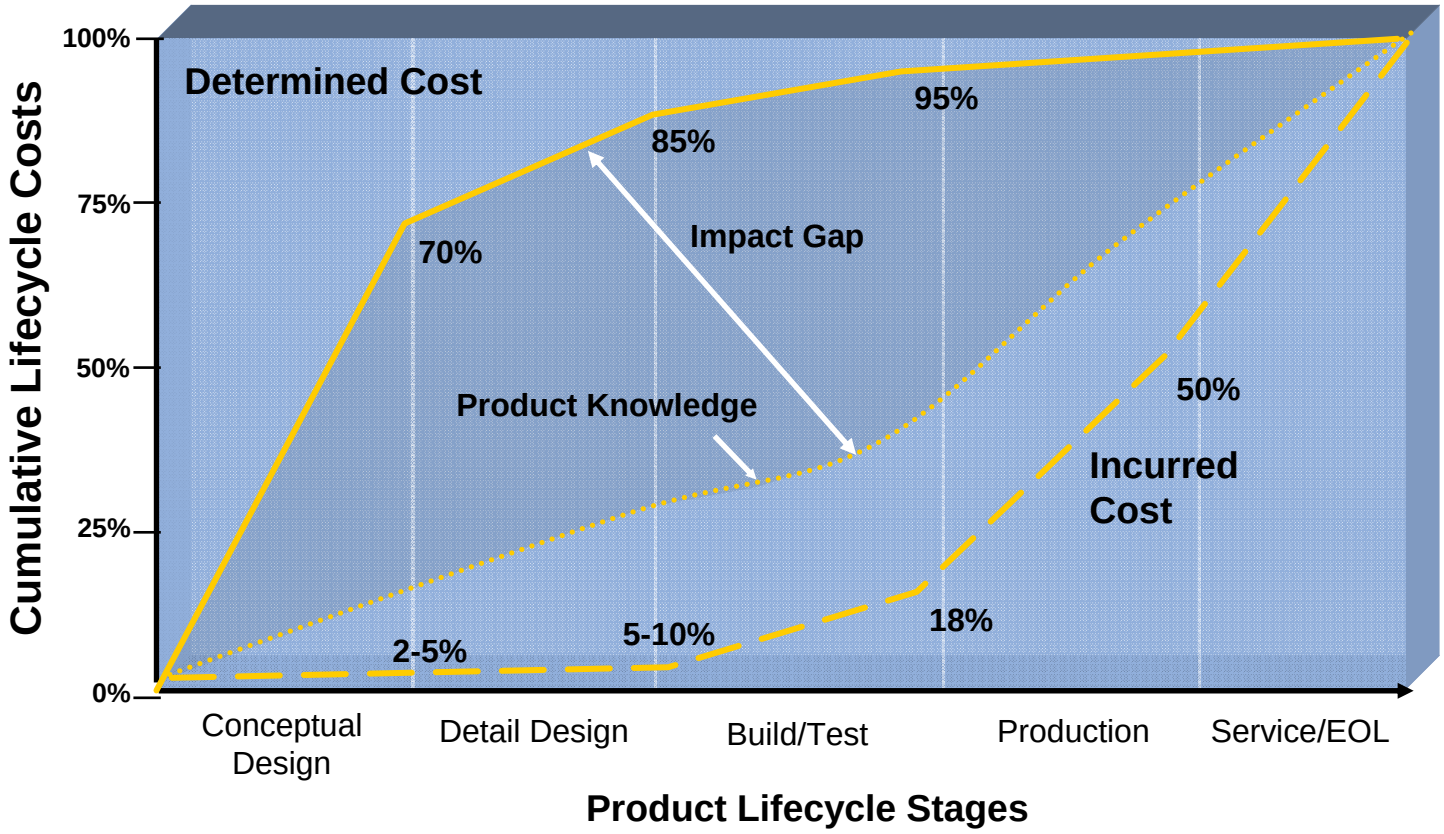
Design in Configured Context

- **Direct and complete product access for all users**
- **Configured product structure for concurrent engineering**
- **Support complex product development processes: variant, milestone, engineering change, part versioning, product configuration**



- Benefits:
  - **Scale concurrent engineering within complex products**
  - **Ensure configuration compliance and accuracy with enterprise and product rules**
  - **Greater design accuracy, fewer design errors**
  - **Lean and efficient design processes**

Knowledge is the leverage point



Source: Institute for Defense Analysis

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RPD Solution Methodology

Business — Focus — Technical

1 Executive Workshops

Executives

2 Capability and Needs Assessment

Managers

3 Strategic Roadmap

Architects

4 Technology Roadmap

Champions

5 Implementation and Training

Developers

✓Workshop
✓Guides

✓Assessments

RPD Deliverables

✓RPD Plan

✓Tools

✓Methodology

✓Reports

✓Implementation Plan

PLM Engineering Desktop

Enterprise Integration

RPD focuses on delivering Business Value

	RPD Key Benefits
Business Management	Achieve key program business goals (Time, Cost , Quality, Weight, Fuel Efficiencies, etc.) in the most efficient and effective manner.
Product Portfolio Management	Maximize market penetration opportunity by configuring optimal product definition mix. Actively manage the Portfolio against critical trade-offs.
Product Architecture and Integration	Facilitate in-process architectural trade-offs and specification validation while maintaining integration control.
Product Systems Engineering	Optimize the creation of new components while preserving architectural compliance. Effectively manage reuse and outsourcing trade-offs.
Performance Analysis	Assure product behavior and performance characteristics meet all set goals for the duration of the product lifecycle.
Assembly Analysis	Optimize assembly productivity, scalability and improve quality. Accelerate time to profit through launch ramp up fidelity.

Relational Product Development Framework

Work Streams \ RPD Practices Domains	Product and Process Knowledge	Product Authoring	Product Management	Product and Process Verification
Business Management	Program Management	Program Notebook	Sales Configuration Control	Product Assurance
Product Portfolio Management	Product Architecture Specification	Market Driven Dimensional Specification	Options & Variant Management	Regulatory Compliance & Homologation
Product Architecture and Integration	Product Consolidation & Variation	Zone Definition & Product Specifications	Systems Integration & Management	Physical Integration Confirmation
Product Systems Engineering	Subsystem Outsourcing & Carryover	Component & System Definition	Functional Integration of Systems & Components	Component & System Confirmation
Performance Analysis	Certification Reuse	Analytical Modeling	Analytical BOM	Certification
Assembly Analysis	Flexible Manufacturing	Assembly Modeling	Manufacturing Process Management	Try-out & Prove-out Simulations

Relational Product Development Summary

Relational Business and Process Logic
Business and process logic to provide consistent and cohesive thread to help weave together myriad of corporate assets relevant to Relational Product Development.

Behavioural Modeling and Methodology
Ensure a consistent PLM modelling process and methodology, to support the development composed of software, hardware, workers and information components

Organizational Transformation
Modular construct for education and training to support the RPD paradigm, processes and modeling methodology

Quality Deployment Process
Ensures RPD implementation for repeatability with minimal variation

Dassault Aviation

Physical prototype: eliminated

- 66% Tooling costs

Aircraft assembly time: -50%

"Thanks to PLM, we created an absolutely perfect definition of the aircraft, When we reached the assembly stage, from the first aircraft, we had the quality that previously took us several dozen aircrafts to achieve."
Christian Decaix, Executive Vice-President, Operations

Pratt and Whitney

Elimination of maintenance prototypes:
- $500 K / engine program

Assembly design time: - 20%

Clashes resolved in early design: 70%

"With IBM and Dassault Systèmes PLM solutions, we can now perform advanced virtual maintenance simulations. We no longer need physical prototypes."
Mario Modafferi, director Engine Design,
Pratt & Whitney

Northrop Grumman

-15% : Cost to correct errors during production

Change process execution costs: -15%*

+ 25% Performance to schedule

"In shipbuilding, all things positive begin with predictable business. We needed new processes and a Product Lifecycle Management (PLM) solution to help us minimize costs from the early bidding process to the servicing phase 25 years down the road."

Arnie Moore, Vice President of Engineering,

Relational Product Development Summary of Benefits

- 25% and more process improvements from concurrency
- 40% and more process improvements for Derivatives
- Clashes resolved in early design have been increased to 70%.
- Engineering design physical prototypes have been eliminated.
- Change process execution costs have been reduced by 15-30%.

*Thank **You!***