Relational Product Development

Preparation for Relational Design with PLM V5

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IBM PLM Solutions

Agenda

- ***What is RPD?***
  - ***Why RPD?***
  - ***What is it?***
  - ***How RPD works***
- ***RPD Relational Design***
  - ***The core of 'Relational Product Development'***
  - ***Relational Design Dependencies***
- ***RPD Deployment***
  - ***Business Value***
  - ***RPD Framework***
  - ***RPD Capabilities and Roadmaps***

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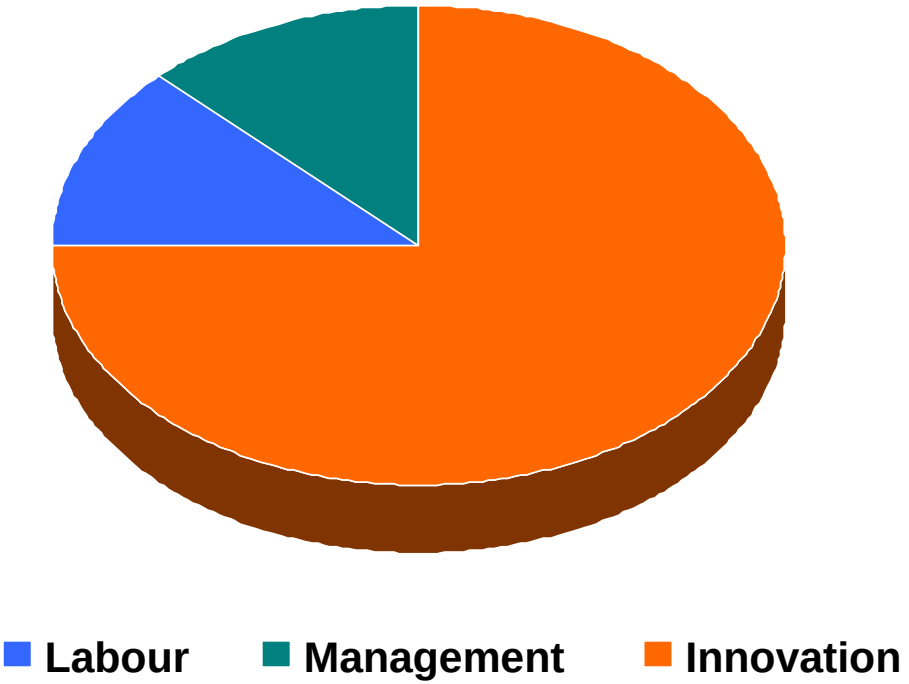
Fundamental Shift: Craftsman to Knowledge Worker Improving the Innovation Ratio



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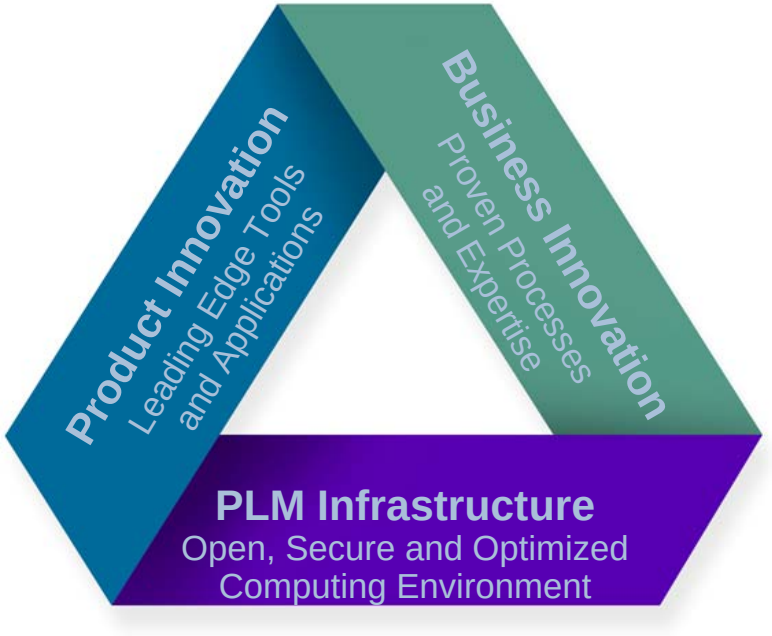
Why RPD?

- ***Innovation provides business wide benefits in time, cost and quality improvements.***
- ***Customers request that IBM provide business problem solutions rather than point solutions.***
- ***There's more to PLM V5 than just using the tools….a strategy is required behind the enabling technology to achieve value!***

It requires a culture to make it happen,
the tools and infrastructure to let it happen,
and business processes to do it right.



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Relational Product Development

A methodology for product development.

which accelerates the creation of innovative products, at an optimized cost, and with improved quality

by leveraging proven product knowledge along with geometric and behavioral relationships to shape and optimize products according to desired performance.

What is RPD?

- ***It reduces the risk and expense by using tried and tested methods***
- ***It provides an appropriate, production ready, and scalable environment that enables relational design and more***
- ***An opportunity to transform and optimize business processes, and reduce cost while increasing overall quality***
- ***Improves the ability to innovate and the speed in which we do it***

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What is RPD?

A more detailed view…

- ***The Basis of RPD***
  - ***RPD is based on Relational Design & management of relational data***
- ***IBM RPD introduces a higher level of "practice" than relational design***
- ***Customer success with PLM V5 depends on the ability to change***
  - ***Business change***
    - *Transformation, culture, decision-making, commitment, thought process*
  - ***Organizational change***
    - *Roles, activities*
  - ***Operational change***
    - *Education, methods, policies, etc…*

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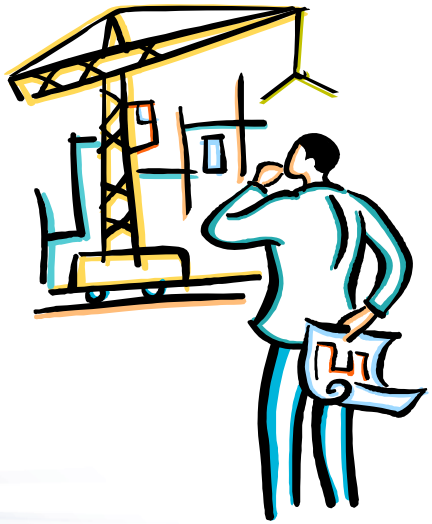
Relational Product Development (a technical view)

- ***What is Relational Product Development (RPD)?***
  - ***A building-block approach to success through strategy***
  - ***It is based on Relational Design in a business context***
- ***What is Relational Design?***
  - ***Associative, Parametric, and Knowledge driven design***
- ***How are RPD and Relational Design aligned?***
  - ***RPD is optimization of Relational Design***
  - ***And, it is NOT limited to design only***
    - *i.e. Manufacturing, Collaboration, etc*



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The RPD Solution Deployment Model

Business ***Focus*** **Technical**

1	2	3	4	5
Executive Workshops	Capability and Needs Assessment	Strategic Roadmap	Technology Roadmap	Training and Implementation
Executives	**Managers**	**Architects**	**Champions**	**Developers**

Cascading levels of detail

- The RPD Solution Deployment Model is comprised of five phases
- Each phase is designed to meet the requirements of a person(s) or team at an organizational level or role with content related to that specific level
- As we progress through the phases, a cascading level of detail is produced

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- ***RPD Relational Design***
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  - *RPD Framework*
  - *RPD Capabilities and Roadmaps*

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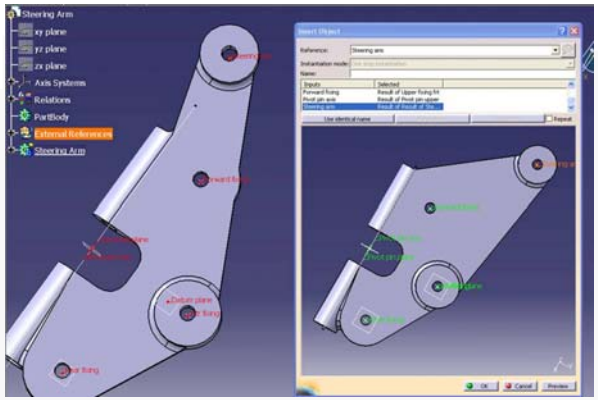
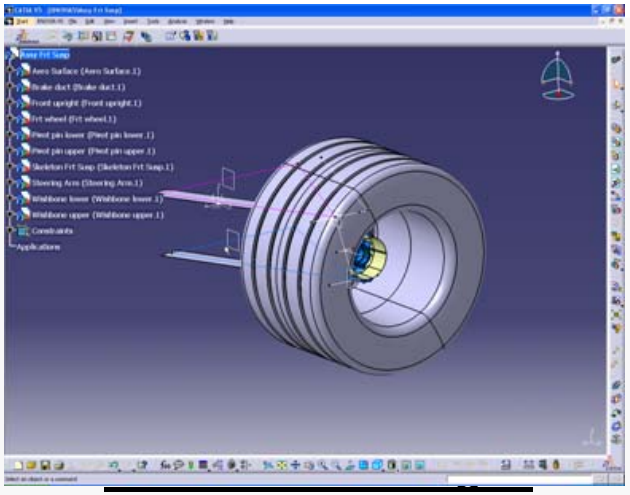
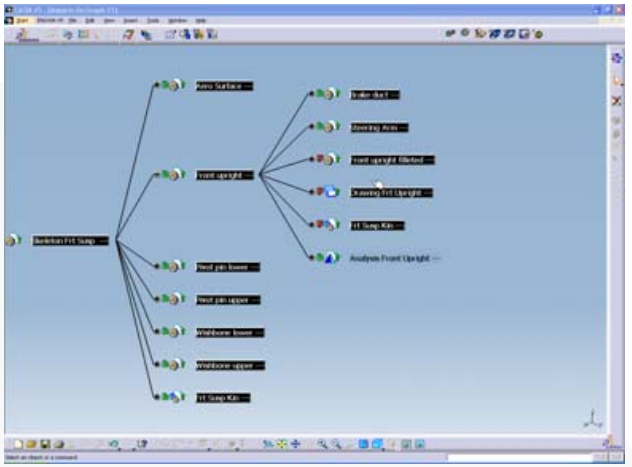
RPD Relational Design - The core of 'Relational Product Development'

At the core 'Relational Product Development' models :-

- *Geometric, Non-geometric and Knowledge relationships at the design feature level*
- *Across parts, assemblies and configurations*







These relationships that model product behavior represent your company's intellectual capital

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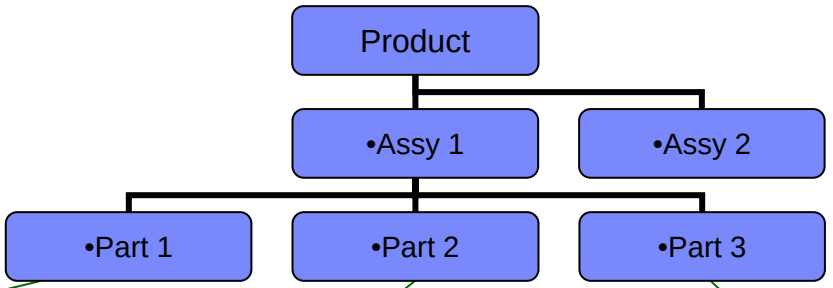
A deeper level of understanding is required

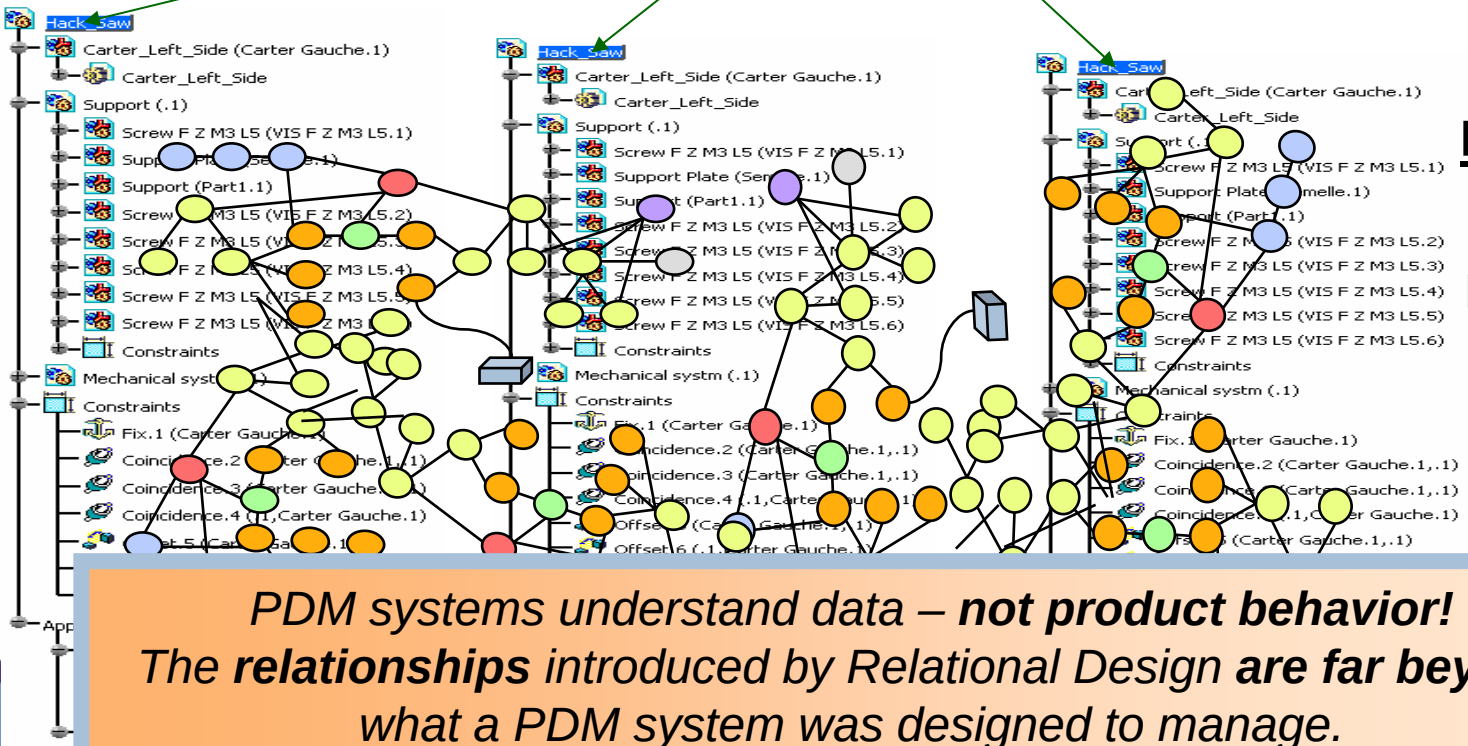
Part and Assy Level



PDM level

BoM 'Graph'
One of many possible product structures

Sub - Part (Feature) Level



Required level

'Bill of Design' Relational Graph

*PDM systems understand data – **not product behavior!***
*The **relationships** introduced by Relational Design **are far beyond** what a PDM system was designed to manage.*

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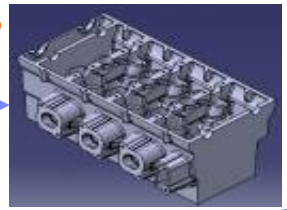
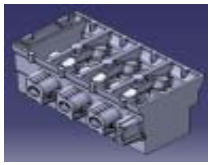
Cylinder Head Example



Complete machined head



Complete rough head

Only this part belongs in the BOM:

Machined head slice

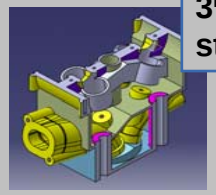
5th step

Head slice detailed design

Rough head slice

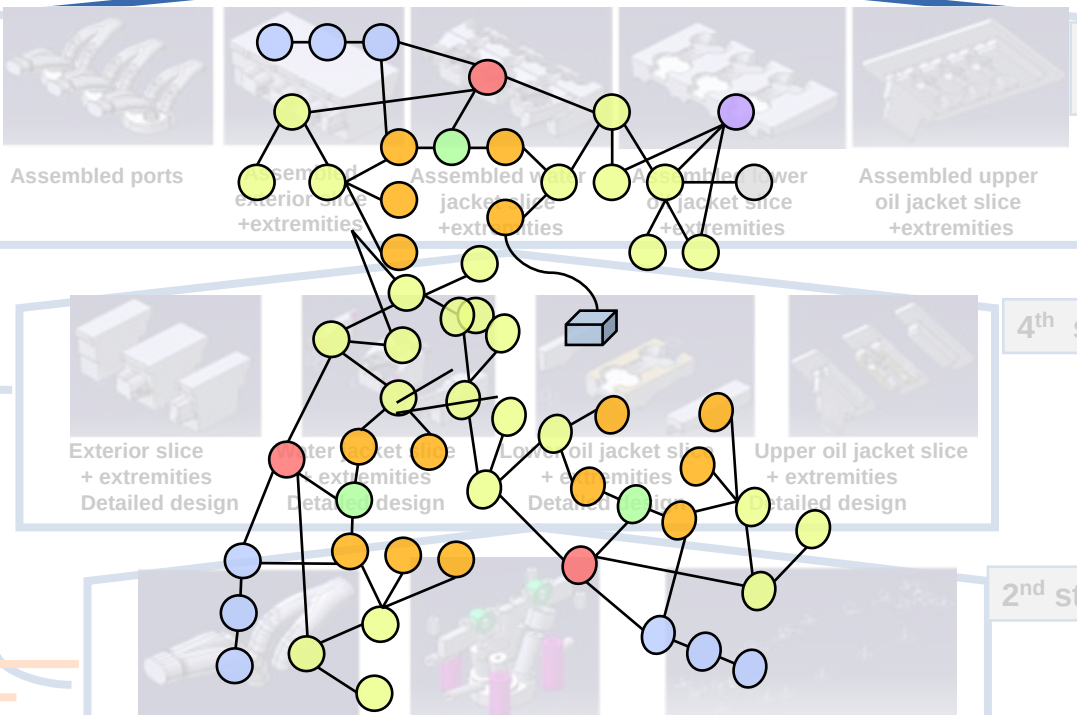
Ports only

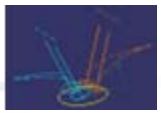
Machinings



3rd step

Head slice Functional design





1st step

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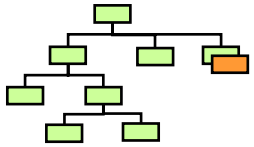
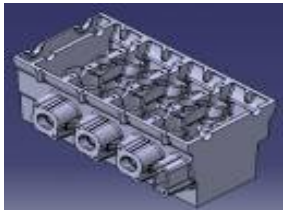
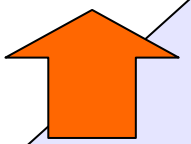
Cylinder Head Example



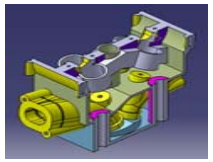
BOM
"Bill Of Material"

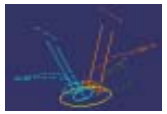


engine
oil pan
carburetor
flaps
housing
block
cyl head

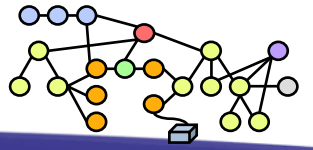


skeleton
cyl head
head slice
machined
machining
rough
ports
oil jacket





BOD
"Bill Of Design"



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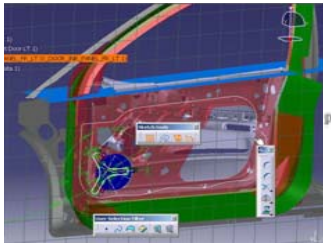
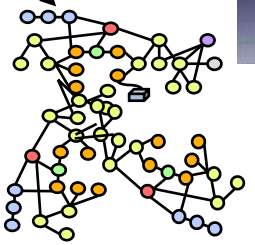
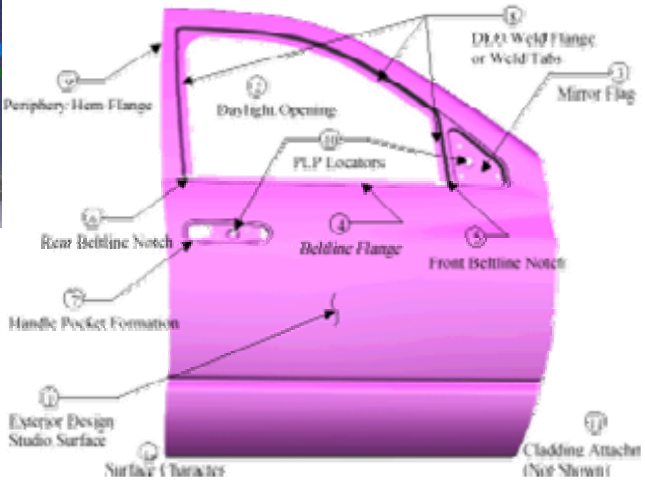
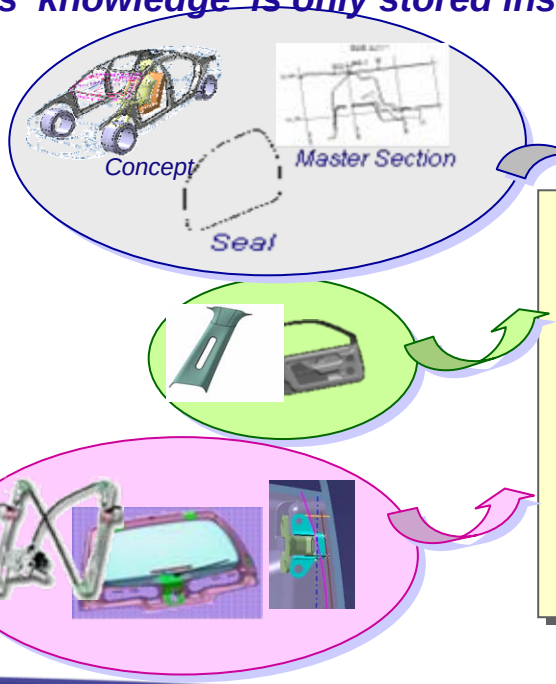
Door Example

- ***Imagine changing the door trim assembly:***
  - ***What other parts are impacted??***
    - *Lock / Handle mechanisms*
    - *Window mechanism*
    - *Airbags*
    - *Fixings*
    - *Etc.*
- ***This 'knowledge' is only stored inside CATIA / ENOVIA***

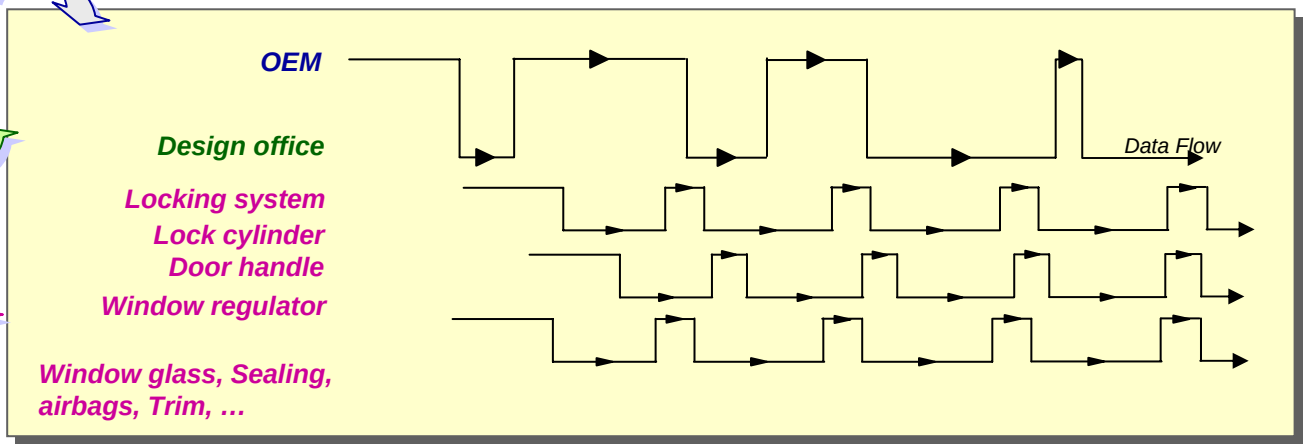








Need to manage and maintain all these links and relationships – across disciplines and down the supply chain



- More than 10 mechanical components are coming from system suppliers
- Represents 300 parts. Each ones represents from 10 to 40 versions

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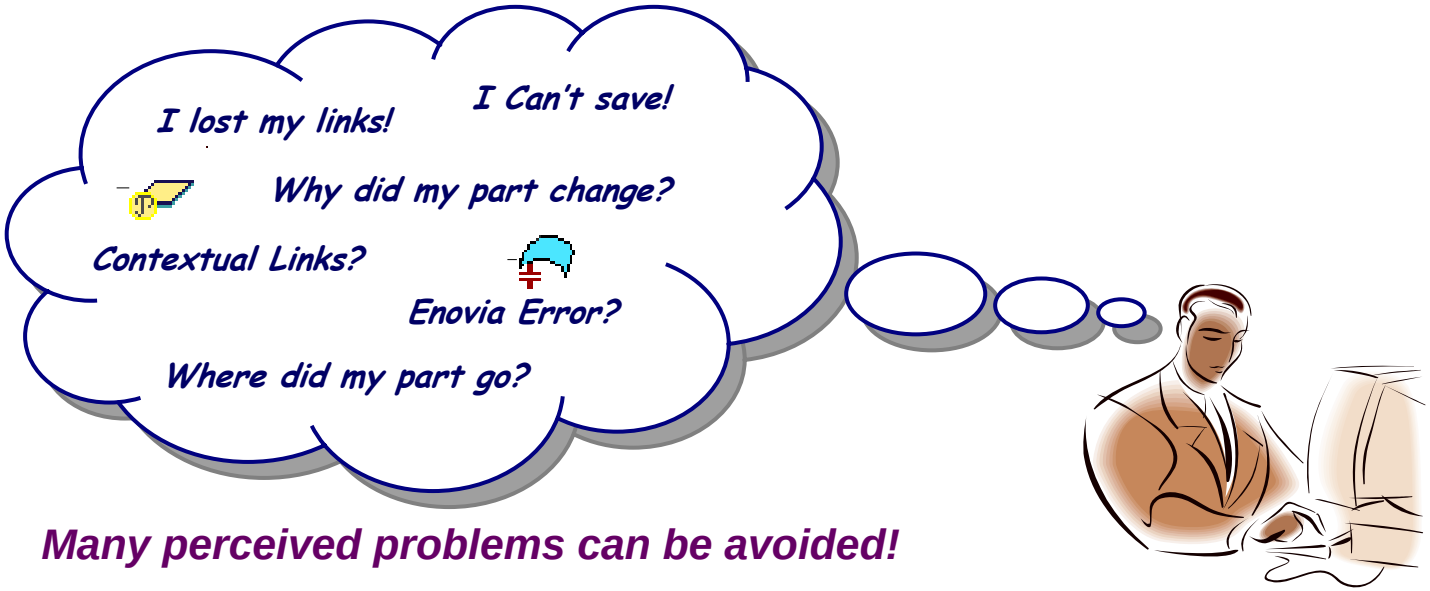
Relational Design and its dependencies

- ***Relational Design can also be challenging and complex***
  - ***It is not widely understood***
  - ***Can be overwhelming and intimidating***
  - ***May be problematic if care is not taken***



Many perceived problems can be avoided!

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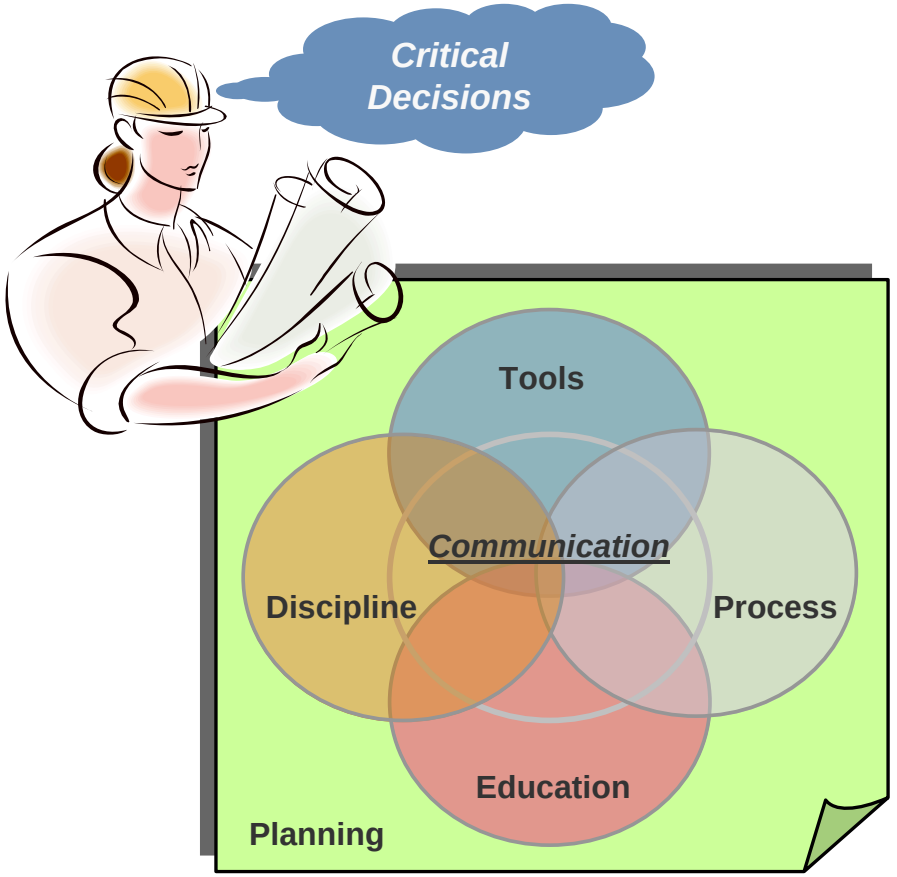
Relational Design is Dependant on Several Things

- ***Some of the keys to success with Relational Design include:***
  - ***Tools & Technology***
    - *PLM V5 (ENOVIA / CATIA)*
  - ***Process and Methodology***
    - *Best Practices*
  - ***Quality Education***
    - *Tools, RPD methods*
  - ***Discipline & Compliance***
    - *Acceptance*
  - ***Solid Planning***
    - *Qualified Decisions*
  - ***Communication***
    - *Lessons Learned*

Organization



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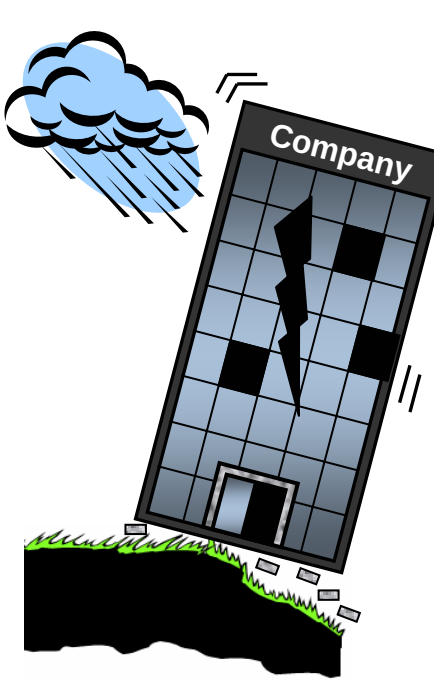
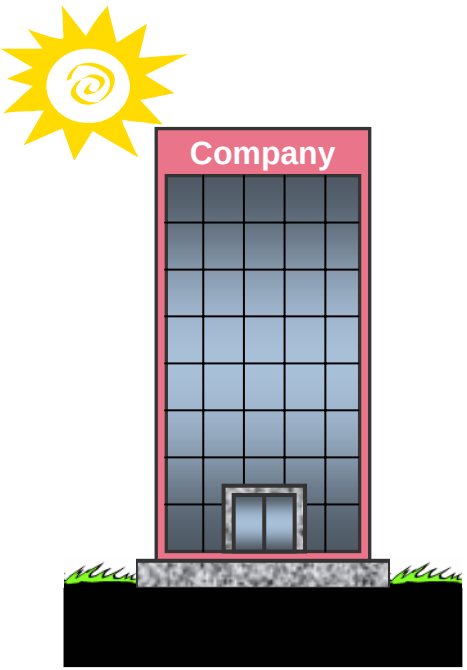
Constructing a Solid Relational Design Foundation

- ***Success in Relational Design is dependant on a solid foundation***
- ***Poor construction and bad planning can result in failure!***
- ***Key to success:***
  - ***Quality design***
    - *Approach / Format*
  - ***Good planning***
    - *Link Architecture*
  - ***Solid construction***
    - *Methods*
  - ***Execution & Discipline***
    - *Compliance*
    - *Skills*



Weak Foundation



Solid Foundation

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  - ***RPD Capabilities and Roadmaps***

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RPD Deployment - Business Value

1. Executive Workshops

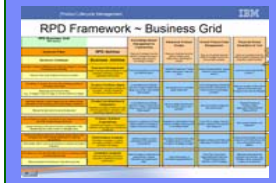
2. Capability and Needs Assessment

3. Strategic Roadmap

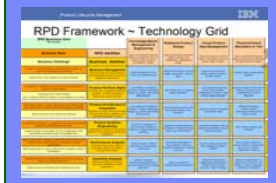
4. Technology Roadmap

5. Implementation and Training

RPD Framework



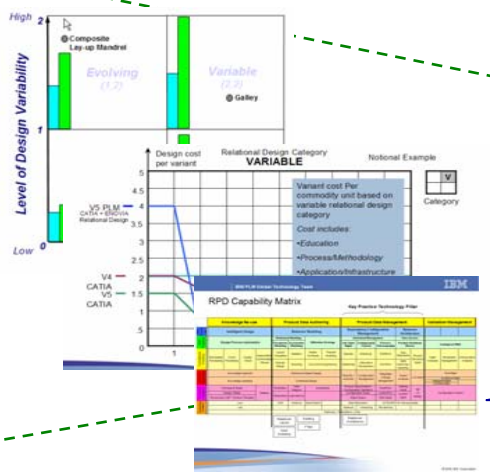
Business Drivers



Technological Capabilities

"Process Level"

"Product Level"



Converging degree of detail, accuracy and solution delivery = Increased Customer 'Confidence'

FAST TRACK

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Relational Product Development Framework

Work streams \ RPD Practices	Business Logic & Knowledge Re-Use	Product Authoring	Product Relational Management	Verification / Validation
Business Management	• Parallel Dev • Decoupled Dev	• Program notebook	• Sales configuration	• Product cost
Product Portfolio Management	• Product Architecture Specification	• Market/ Dimensional mgmt	• Rules/Options Variants	• Regulatory Compliance / Homologation
Product Architecture and Integration	• Platform Consolidation • Product Variants	• Zone Definition and Product Specifications	• Systems Integration and Management	• Physical Integration Confirmation
Product Systems Engineering	• Subsystem Outsourcing • Carryover	• Component / system Definition	• Functional Integration of sys/components	• Component / system Integration
Performance Analysis	• Optimized Recertification	• Analytical modeling	• Analytical BOM	• Certification
Assembly Analysis	• Flexible Manufacturing	• Assembly Modeling	• Manufacturing Process Mgmt	• Prove-out/ Try-out Simulations

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RPD focuses on delivering Business Value

	RPD Key Benefits
Business Management	Better business decisions based on inter-dependant business/customer requirements e.g., Time, Cost and Quality objectives.
Product Portfolio Management	Facilitate early conceptual design and innovation. Actively manage the Portfolio and critical trade-offs.
Product Architecture and Integration	Facilitate in-process architectural trade-offs and specification validation while maintaining integration control.
Product Systems Engineering	Automate the creation of component definition while preserving architectural compliance.
Performance Analysis	Eliminate unnecessary prototypes.
Assembly Analysis	Optimize assembly productivity, scalability and improve quality.

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RPD is linked to your critical Business Drivers

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Relational Product Development Framework

RPD Practice Domains

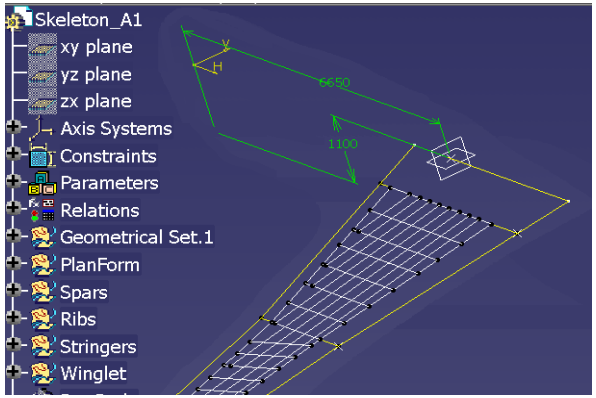
Product Authoring

Work Streams

Product Portfolio Management	Market Driven Dimensional Specification	The integrated transfer of key product dimensional characteristics from product portfolio management into product definition.

- Practices within this intersection:

  Skeletal Driven Design



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Relational Product Development Framework

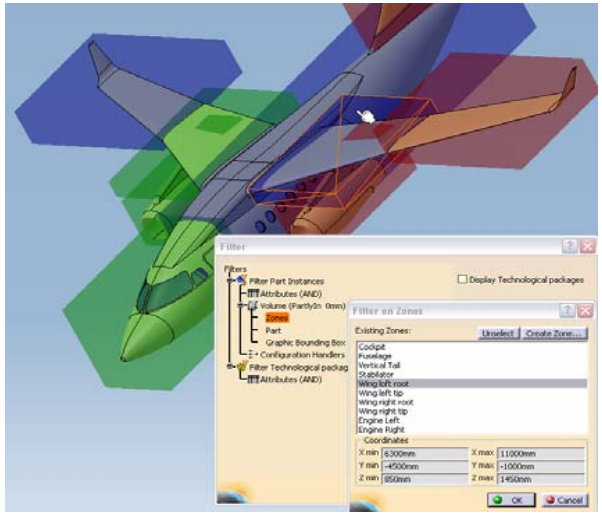
RPD Practice Domains

Product Management

Work Streams

Product Portfolio Management	The holistic application of complex product configuration options against a set relationally linked product assets .	Options & Variant Management

- Practices within this intersection:
  - Variant Management
  - Configuration Management



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Relational Product Development Framework

RPD Practice Domains	Product And Process Knowledge	Product Authoring
Work-Streams		
Product Architecture & Integration	Product Consolidation & Variation	The consolidation of product programs under common platform constructs, for minimizing the proliferation of components while maximizing the number of unique products in the market.

- Practices within this intersection:
  - Commonality & Re-use
  - Knowledge Re-use

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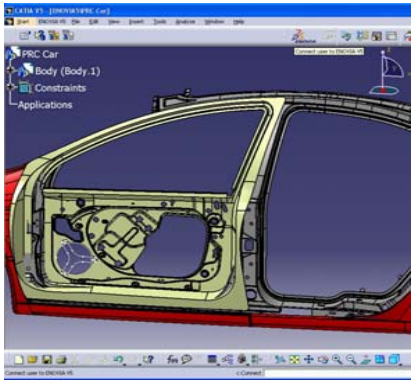
Relational Product Development Framework

RPD Practice Domains	Product Authoring
Work Streams	
Product Systems Engineering	Component & System Definition

The component, sub-system and systems development performed within the context of architectural product constraints and component manufacturing requirements.

- Practices within this intersection:
  - Relational Design
  - Design in Context
  - Concurrent Engineering
  - Behavior Modeling
  - Design Integration/Interface Management
  - Relational Manufacturing
  - Drafting
  - 3D only Design
  - Trade Study
  - Relational Data Management (relational architecture)



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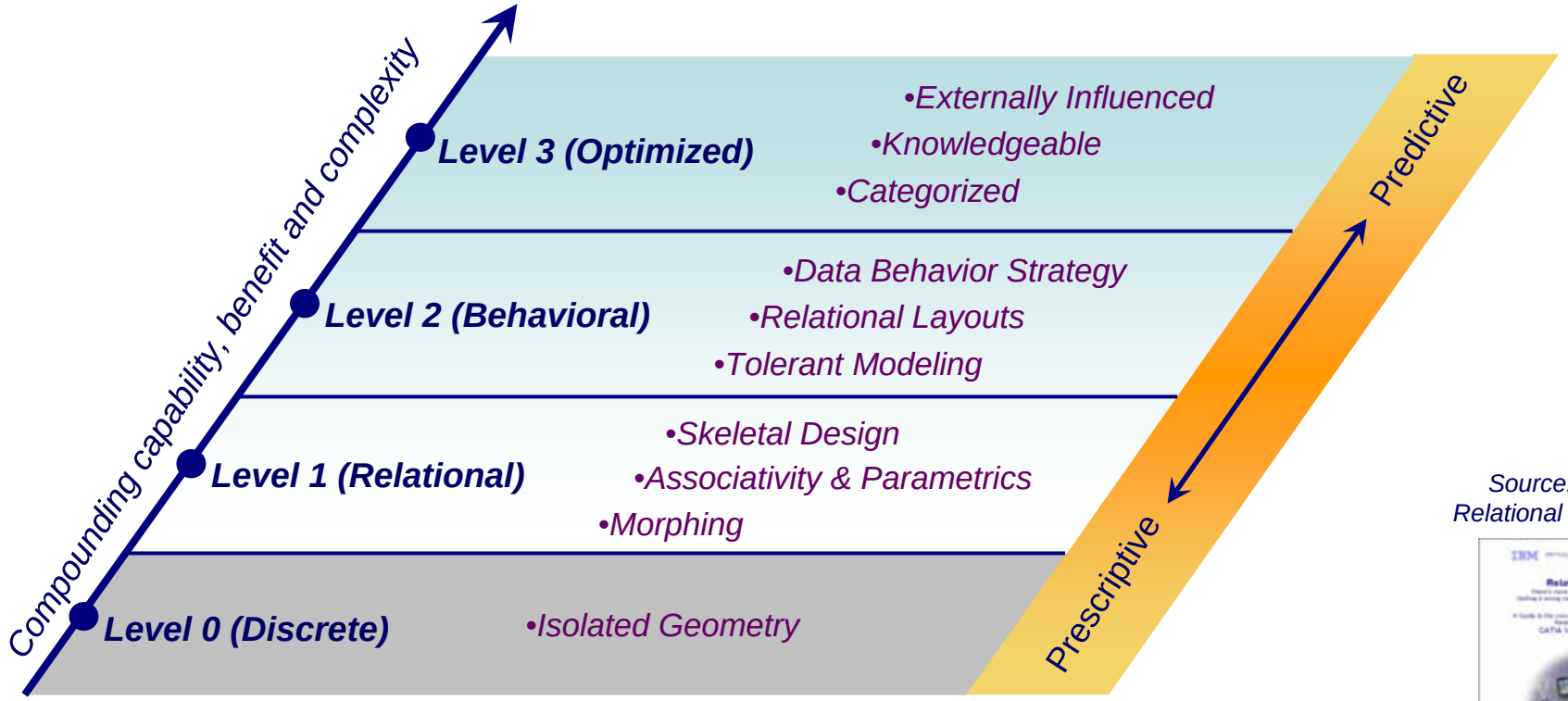
Relational Design Levels

- Relational Design Level is a qualification placed on the degree of investment in relational modeling for a given task



Source: IBM RPD Relational Design Guide

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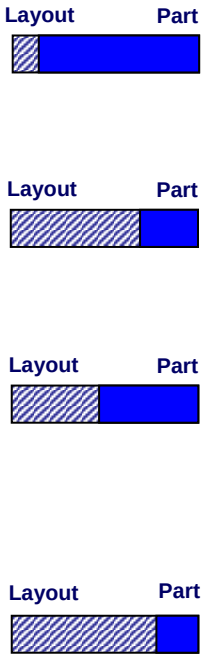
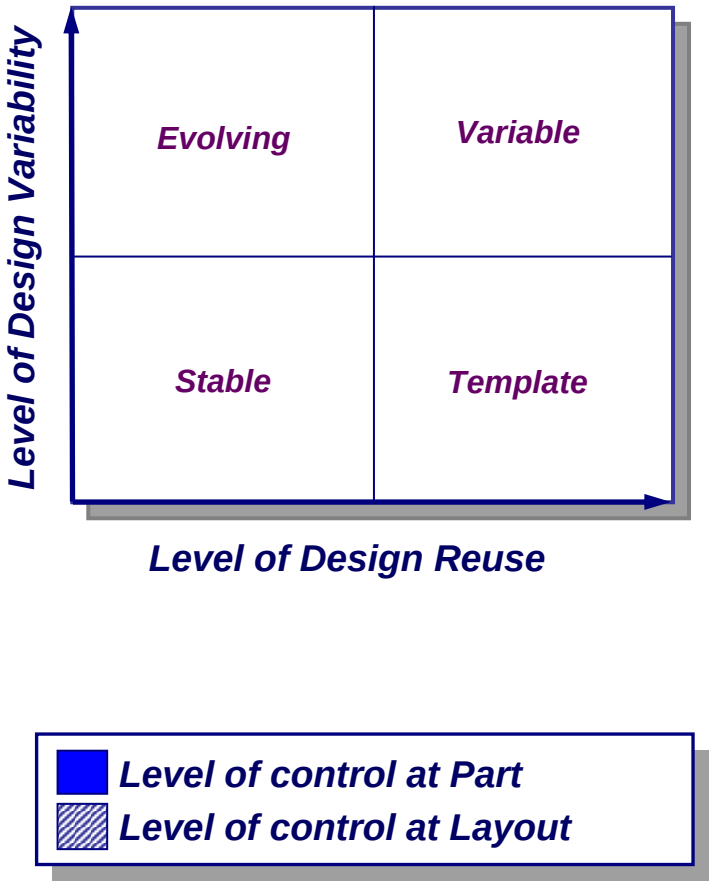
Relational Design Categories



- Stable
  - Loft, Skeleton driven (original)
  - Completely unique
- Evolving
  - Virtually unique
  - Susceptible to Change (concurrent)
- Template
  - Mostly Layout driven
  - Uniqueness in part (CATPart)
  - Reusable concept
- Variable
  - PT, PC, UDR
  - Layout (controlling assy.)
  - Copy/paste break link
  - Reusable fidelity



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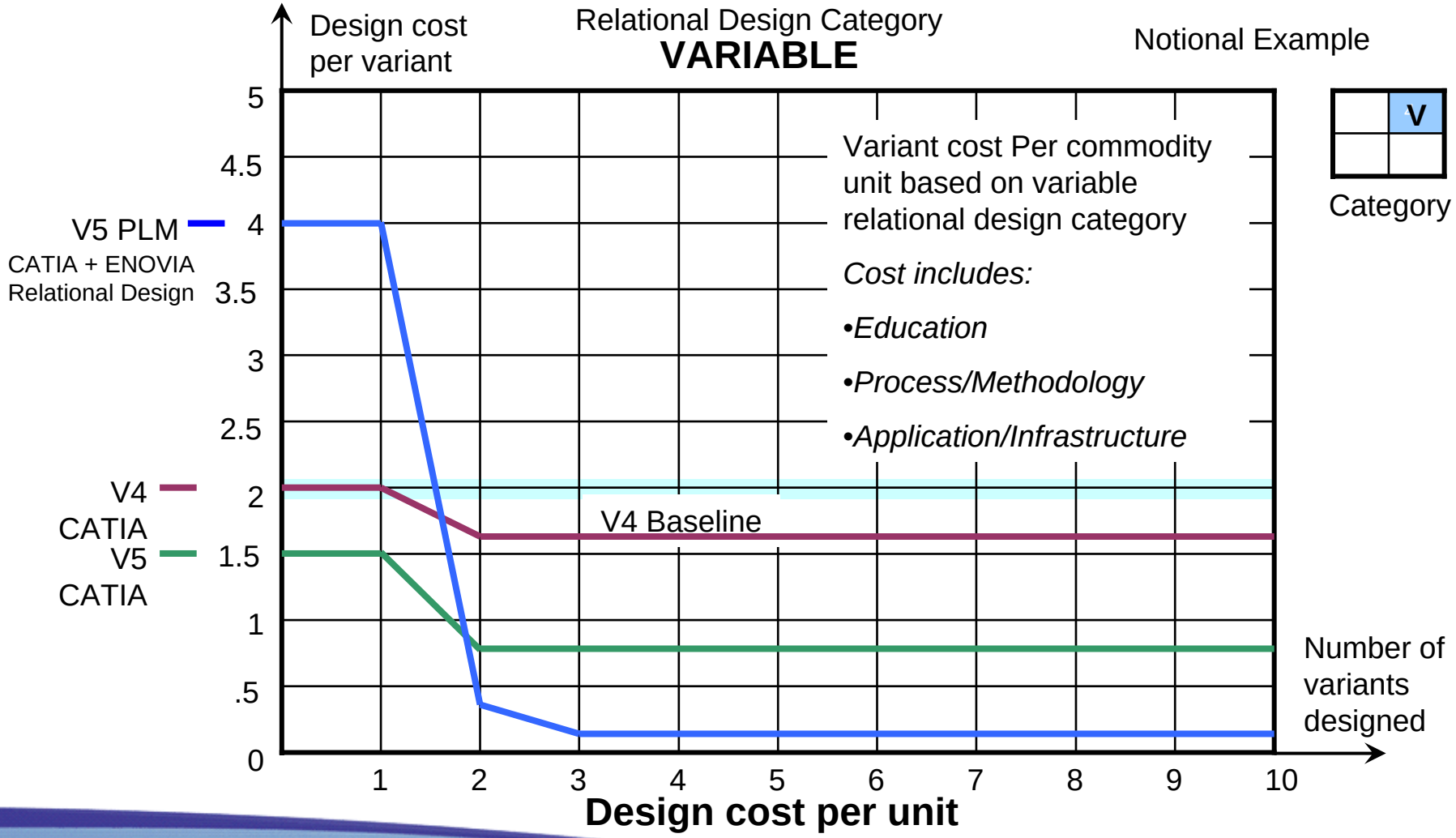
Relational Design Categories



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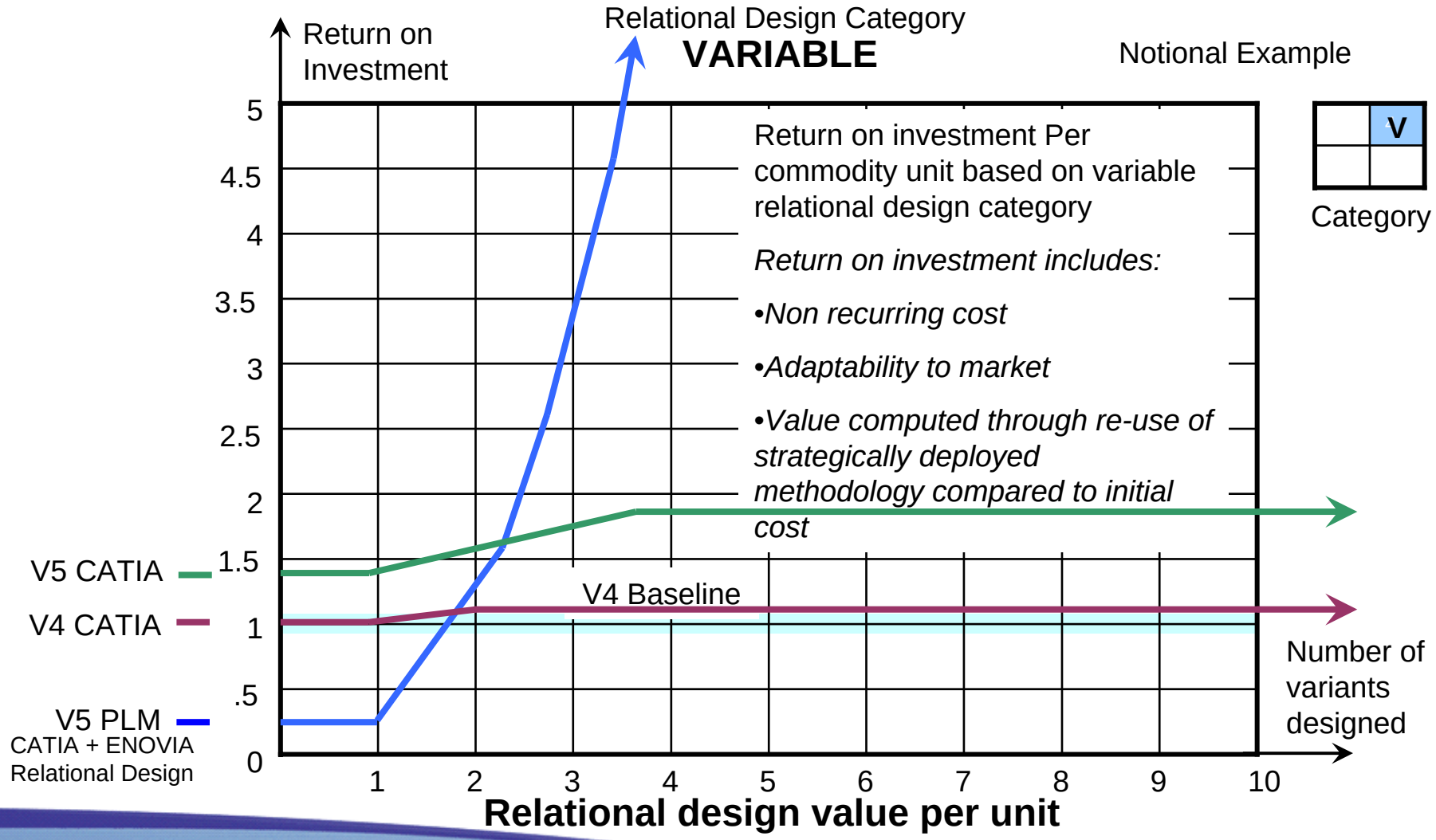
Relational Design Categories



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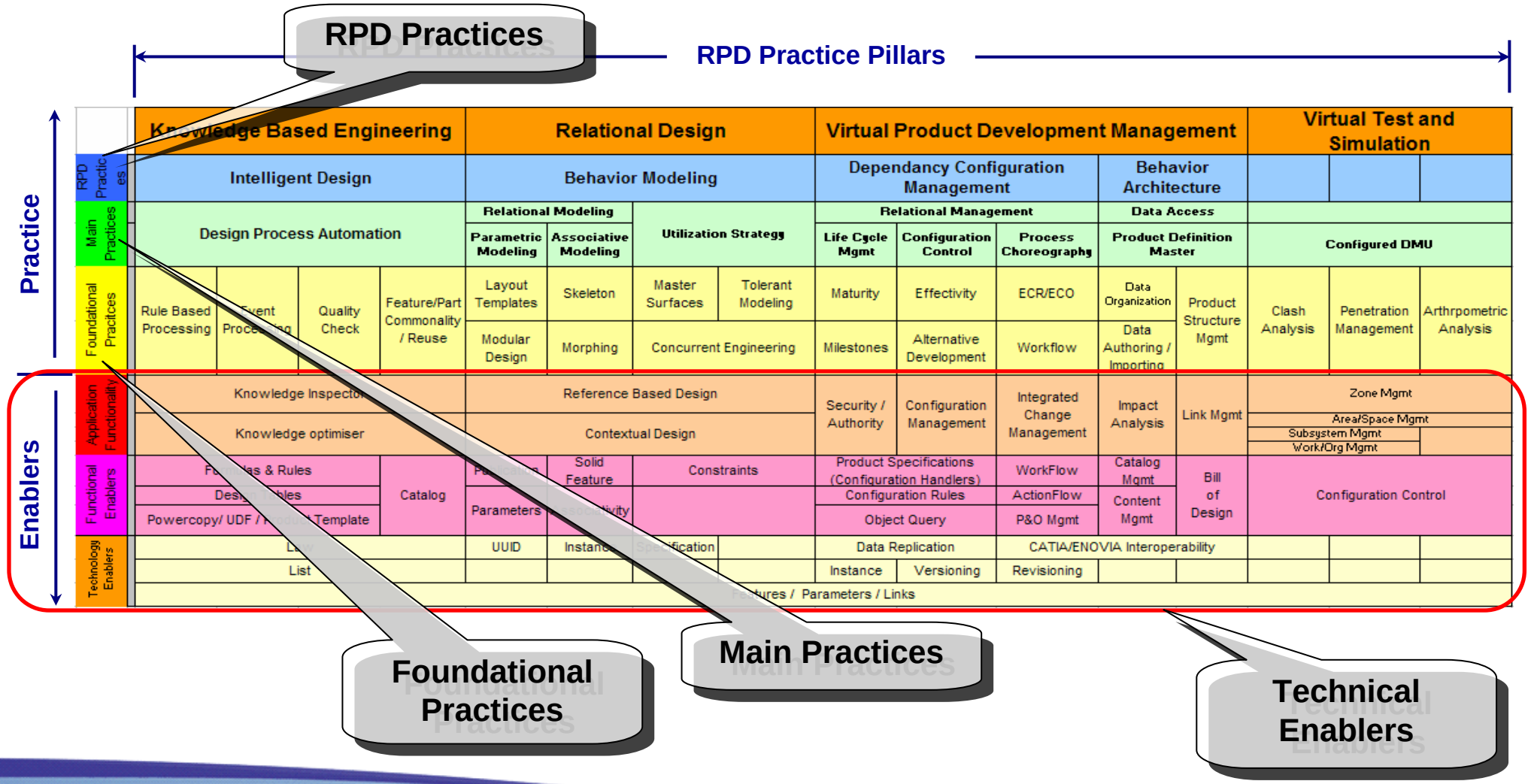
RPD Capability Matrix



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Legacy Practice – Product Design (RD Level 0 - Configured)

	Knowledge Re-use				Product Data Authoring				Product Data Management					Validation Management		
RPD Practices	Intelligent Design				Behavior Modeling				Dependancy Configuration Management			Behavior Architecture				
Main Practices	Design Process Automation				Relational Modeling		Utilization Strategy		Relational Management			Data Access		Configured DMU		
					Parametric Modeling	Associative Modeling			Life Cycle Mgmt	Configuration Control	Process Choreography	Product Definition Master				
Foundational Practices	Rule Based Processing	Event Processing	Quality Check	Feature/Part Commonality / Reuse	Layout Templates	Skeleton	Master Surfaces	Tolerant Modeling	Maturity	Effectivity	ECR/ECO	Data Organization	Product Structure Mgmt	Clash Analysis	Penetration Management	Arthrpometric Analysis
					Modular Design	Morphing	Concurrent Engineering		Milestones	Alternative Development	Workflow	Data Authoring / Importing				
Application Functionality	Knowledge Inspector				Reference Based Design				Security / Authority	Configuration Management	Integrated Change Management	Impact Analysis	Link Mgmt	Zone Mgmt		
	Knowledge optimiser				Contextual Design									Area/Space Mgmt		
														Subsystem Mgmt		
														Work/Org Mgmt		
Functional Enablers	Formulas & Rules			Catalog	Publication	Solid Feature	Constraints		Product Specifications (Configuration Handlers)		WorkFlow	Catalog Mgmt	Bill of Design	Configuration Control		
	Design Tables				Parameters	Associativity			Configuration Rules		ActionFlow	Content Mgmt				
	Powercopy/ UDF / Product Template								Object Query		P&O Mgmt					
Technology Enablers	Law				UUID	Instance	Specification		Data Replication		CATIA/ENOVIA Interoperability					
	List								Instance	Versioning	Revisioning					
	Features / Parameters / Links															

Relational Layout

Drafting

FT&A

Solid Modeling

Relational Architecture

Legend

Absolute

Decision ?

Enabled

V5 Unique !

A As-Is Capabilities

Example:

- 3D CAD modeling
- Drawing Based
- Document level PDM

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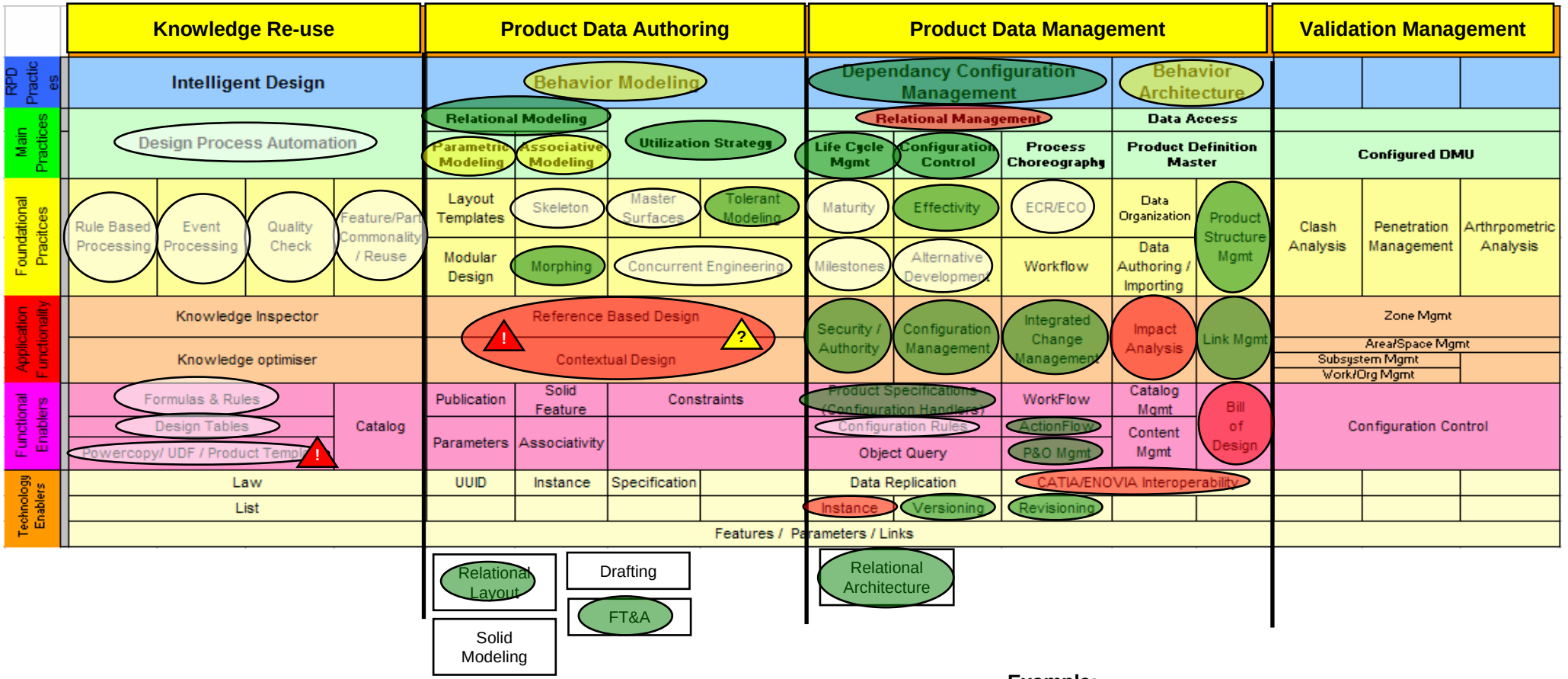
RPD Practice – Relational Design (RD Level 2 - Configured)



Legend

Absolute | Decision ? | Enabled | V5 Unique !

B To-Be Capabilities

Example:

- Relational Modeling
- 3D Tolerancing
- Dependency level VPDM

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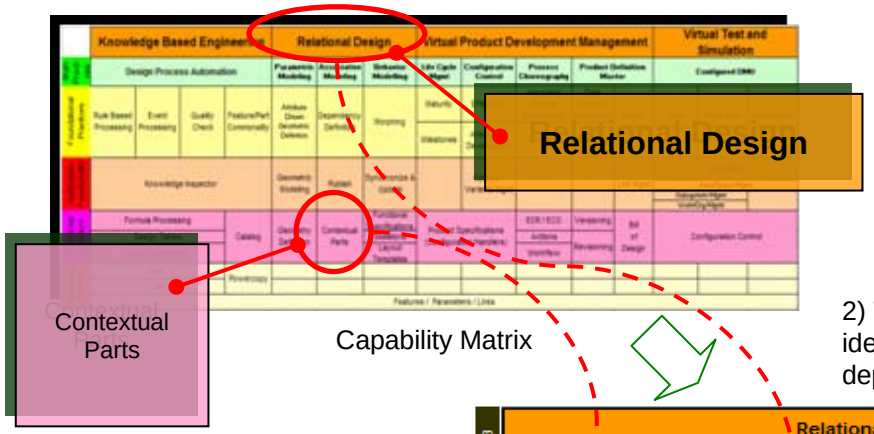
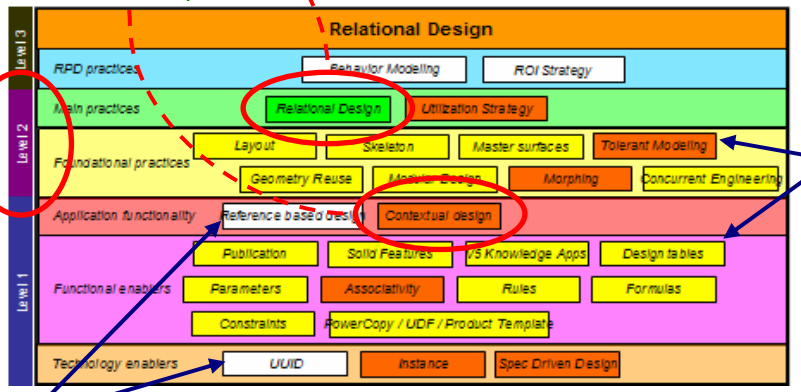
Capability Matrix and Dependencies Maps

1) Lets say that “Relational Design” and “Contextual Parts” (design in context) has been selected as necessary capabilities….

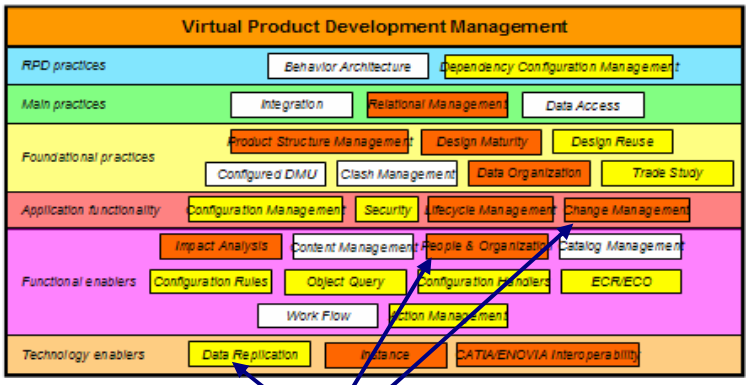


Capability Matrix

2) These items would then be identified as primary dependencies….



Relational Design Dependency Map



4) Which would connect to relevant dependencies within the other Dependency Maps….

3) In turn, this would identify absolute and potential sub-dependencies within the Dependency Map….

- *Primary dependency*
- *Absolute dependency*
- *Potential dependency*
- *No dependency*

Note that level of Relational Design is considered within the dependency model!

Mutually exclusive items will be respected. i.e. contextual vs. reference design

Continued on the next slide!

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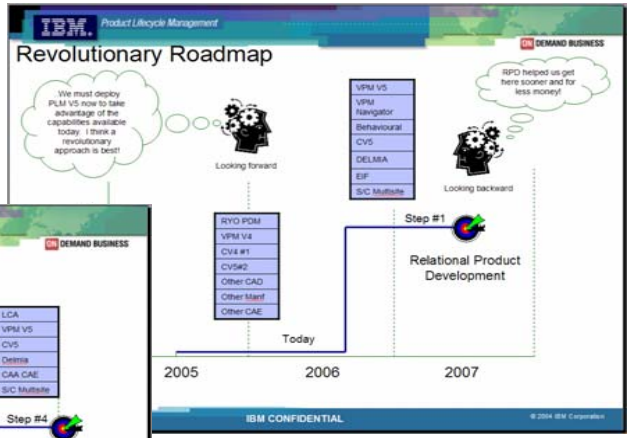
RPD Solution Roadmaps

Information collected from the Dependency Maps and other sources are used to establish the customer unique RPD Roadmaps….

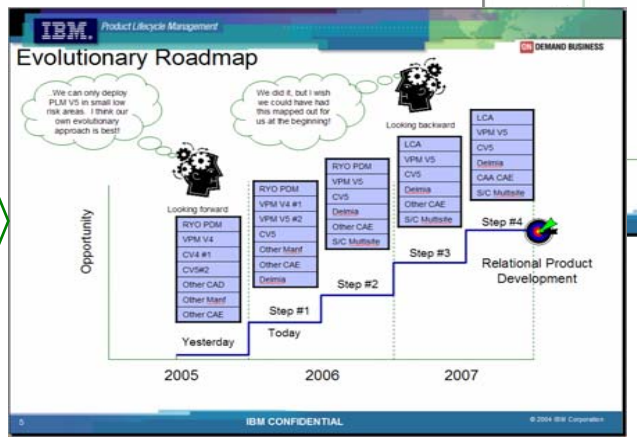
Time & Schedule

Programs & Projects



RPD Strategic Roadmap

Company Technology & Transformation Plans



This would be the basis for the overall implementation strategy which includes Technology required (applications), Supporting infrastructure (IT, org, etc..), Timeline, etc….(RPD Phase 3)

Detailed customer implementation plan (RPD Phase 4)

The RPD Capability Matrix and Dependency Maps provide detailed "technology" input into roadmap development. There are other considerations which must be integrated into the overall plan however. These can include:

- Business goals and drivers
- Program/project selection
- Risk management
- Culture: Evolution / Revolution
- Schedule
- Appetite
- Other influencers, etc…

RPD Roadmap Generator tool is being considered!

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*Thank **You!***

Relational Product Development

Overview
A methodology for product development which leverages proven product knowledge along with geometric and behavioral relationships to shape and optimize according to desired performance

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.

Behavioral Modeling & Methodology
Ensure a consistent PLM modeling 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

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