Driving the Next Generation
Of Lean Thinking

Virtually Perfect 2010

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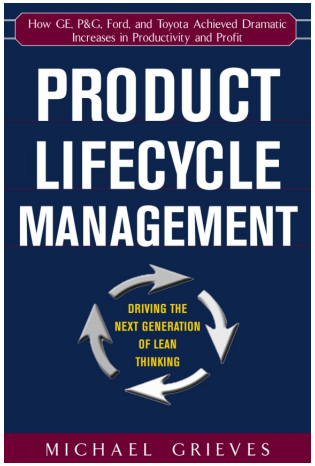
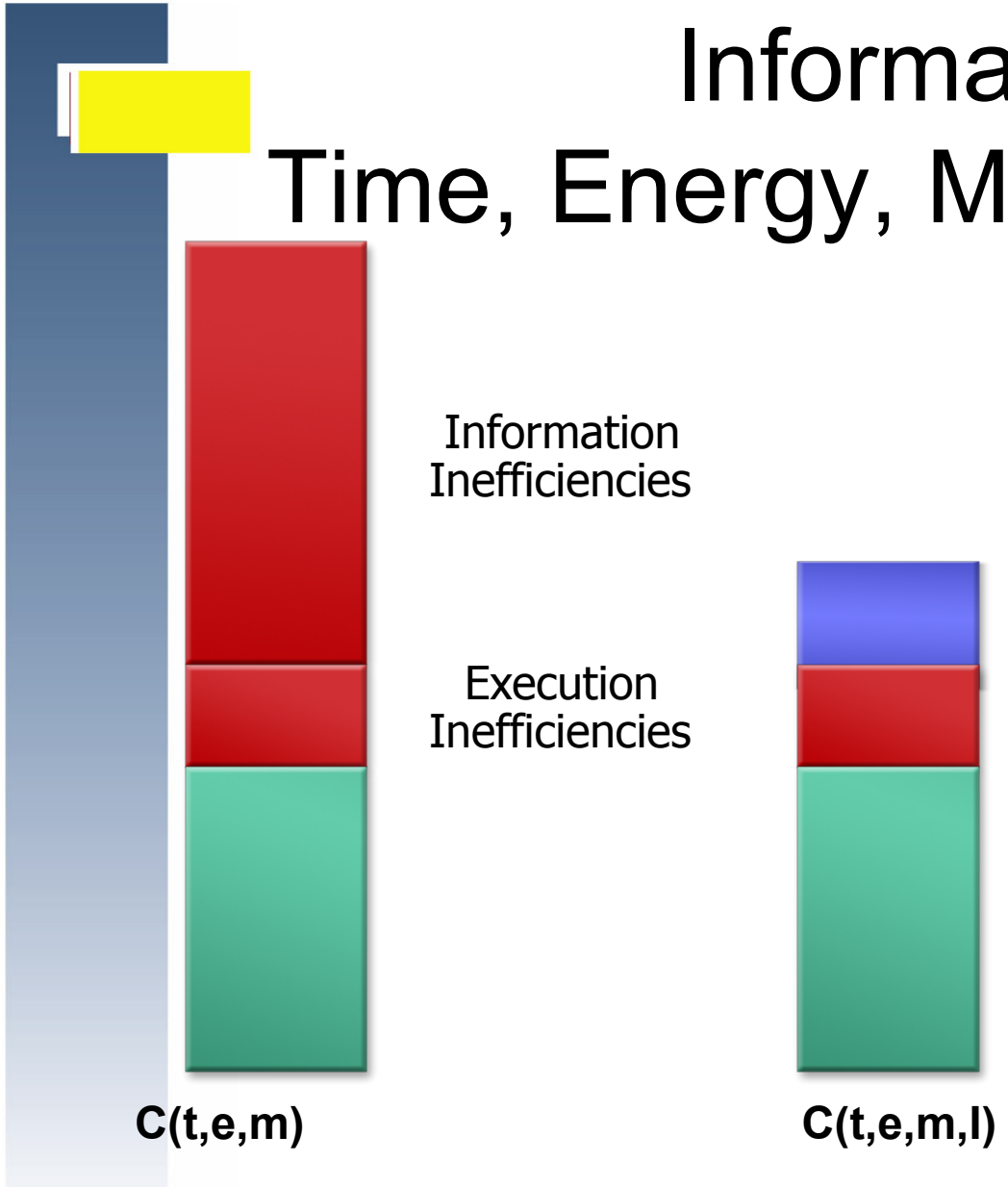


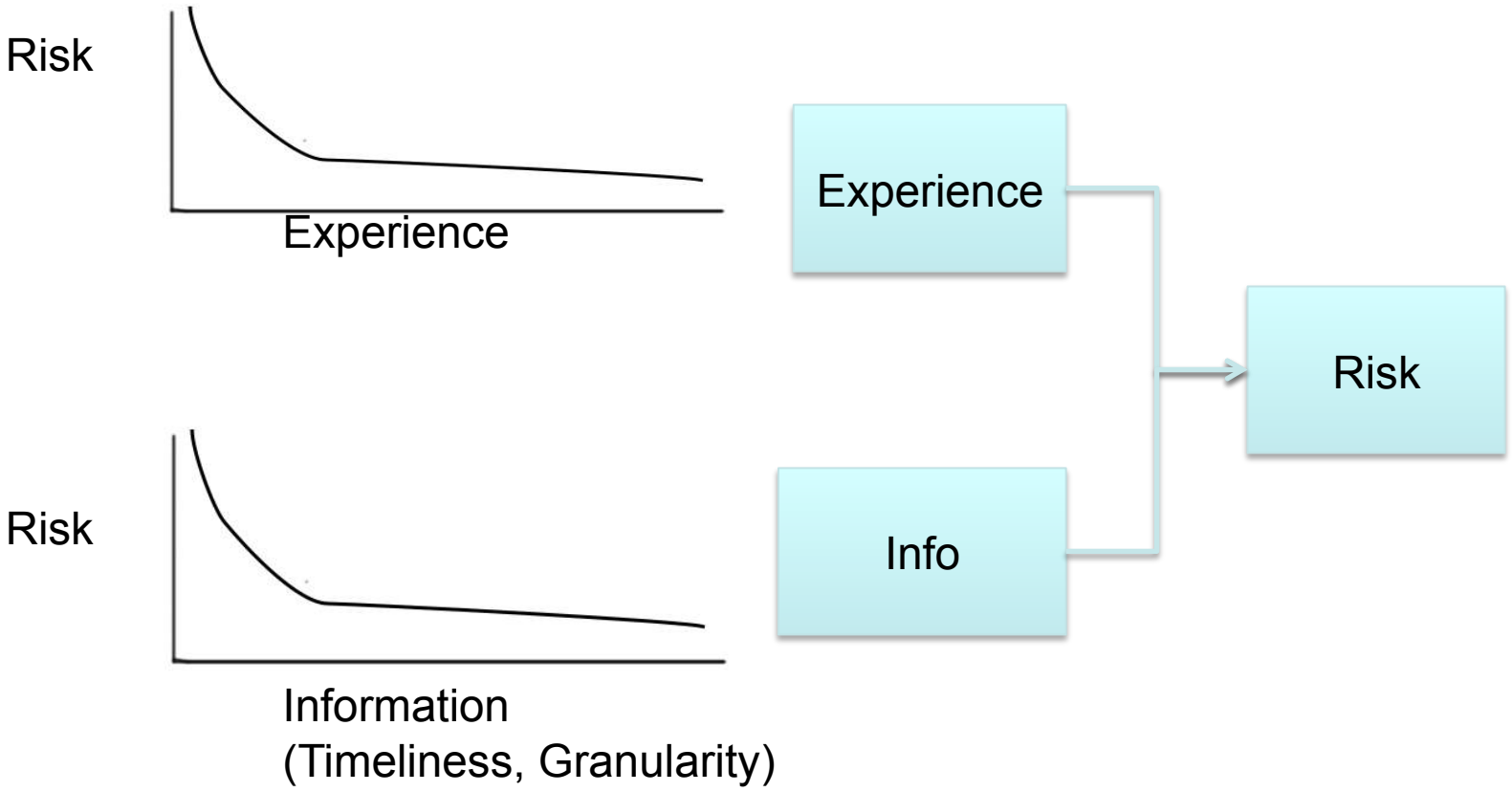
Information as Time, Energy, Material Trade-off



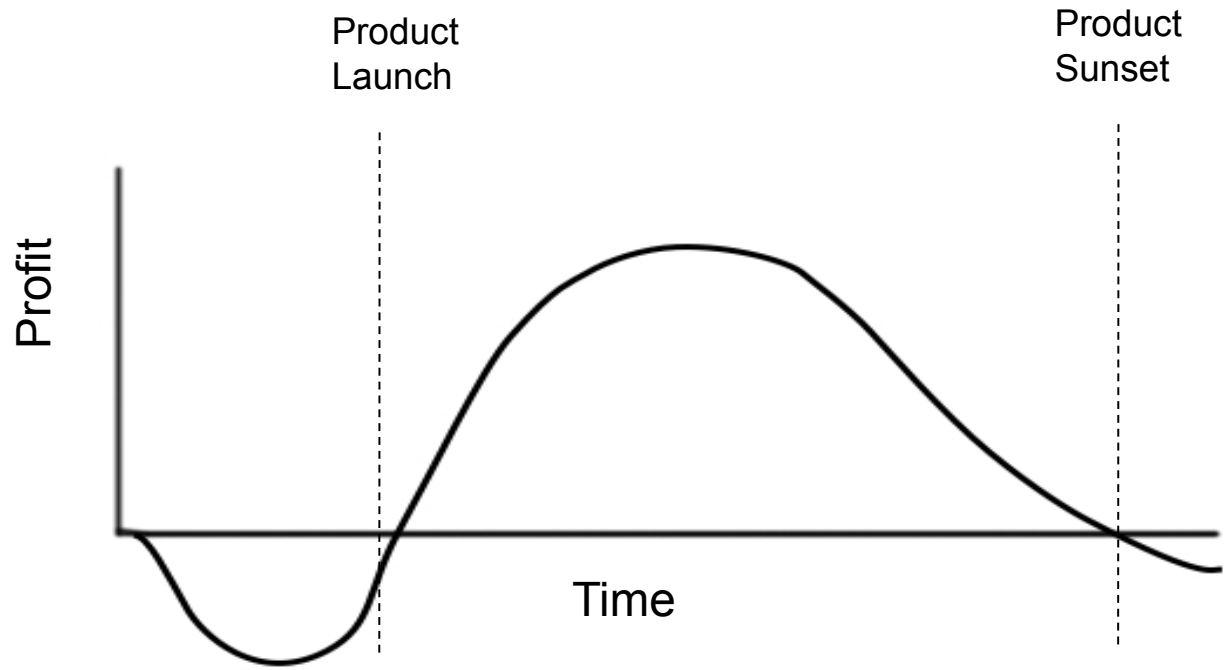
Information
Inefficiency
Efficiency

$$\int_0^\infty C(I)dt < \int_0^\infty C_w(t,e,m)dt$$

Risk vs. Experience and Information



Product Lifecycle Classic Profitability Curve



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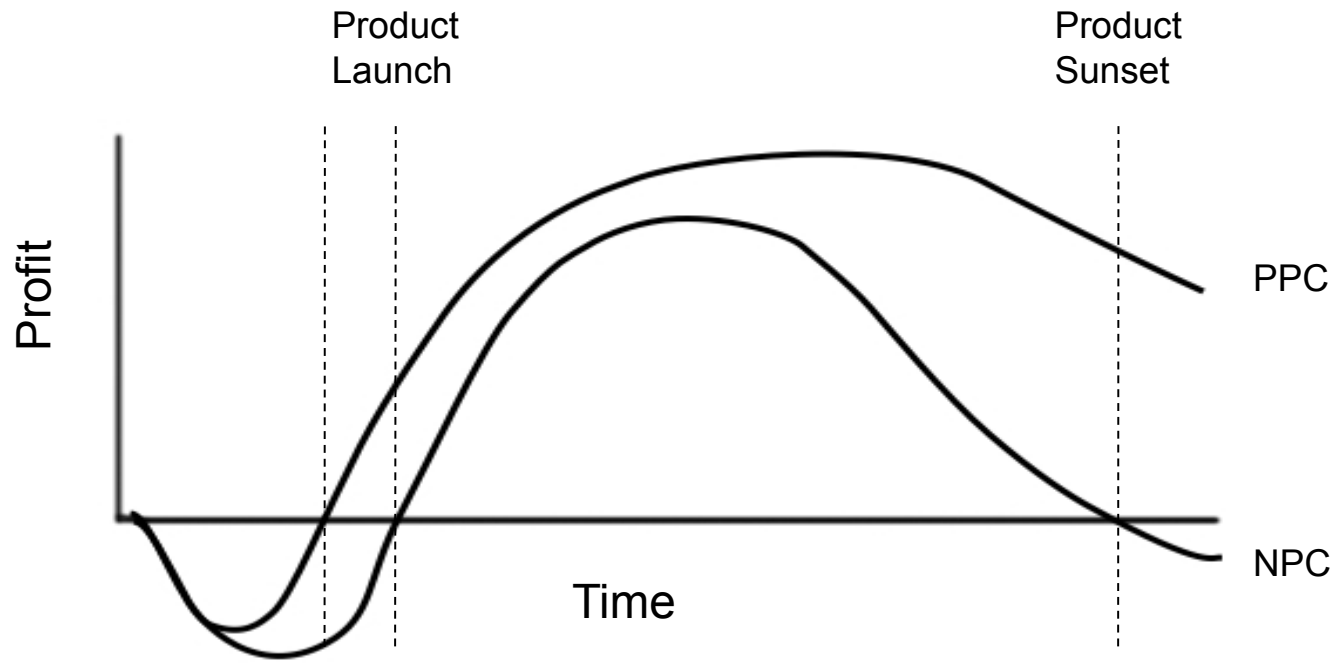
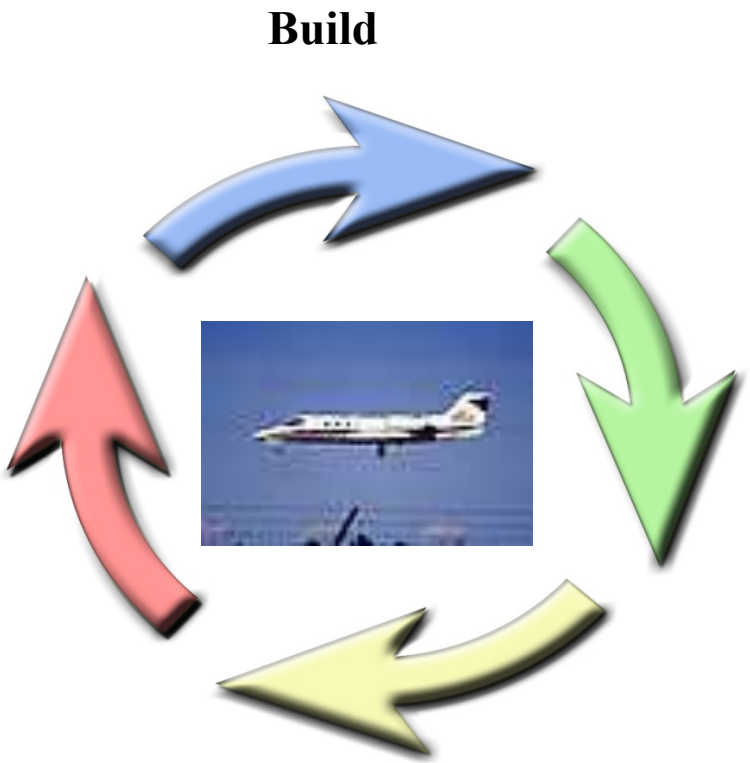
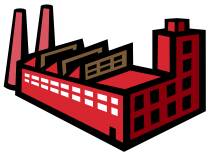
Product Lifecycle
PLM Profitability Curve

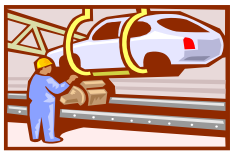


Product Lifecycle – 4 Phases



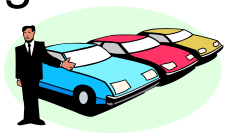
PLM Model





Manufacturing Engineering

Manufacturing & Production



Product Engineering

Sales & Distribution

Info Core

Concept Eng & Prototyping

Service & Support

Requirements Analysis & Planning

Disposal & Recycling

User Perceived Value

Source: **PLM: Driving the Next Generation of Lean Thinking (McGraw-Hill, 2006), p. 41**

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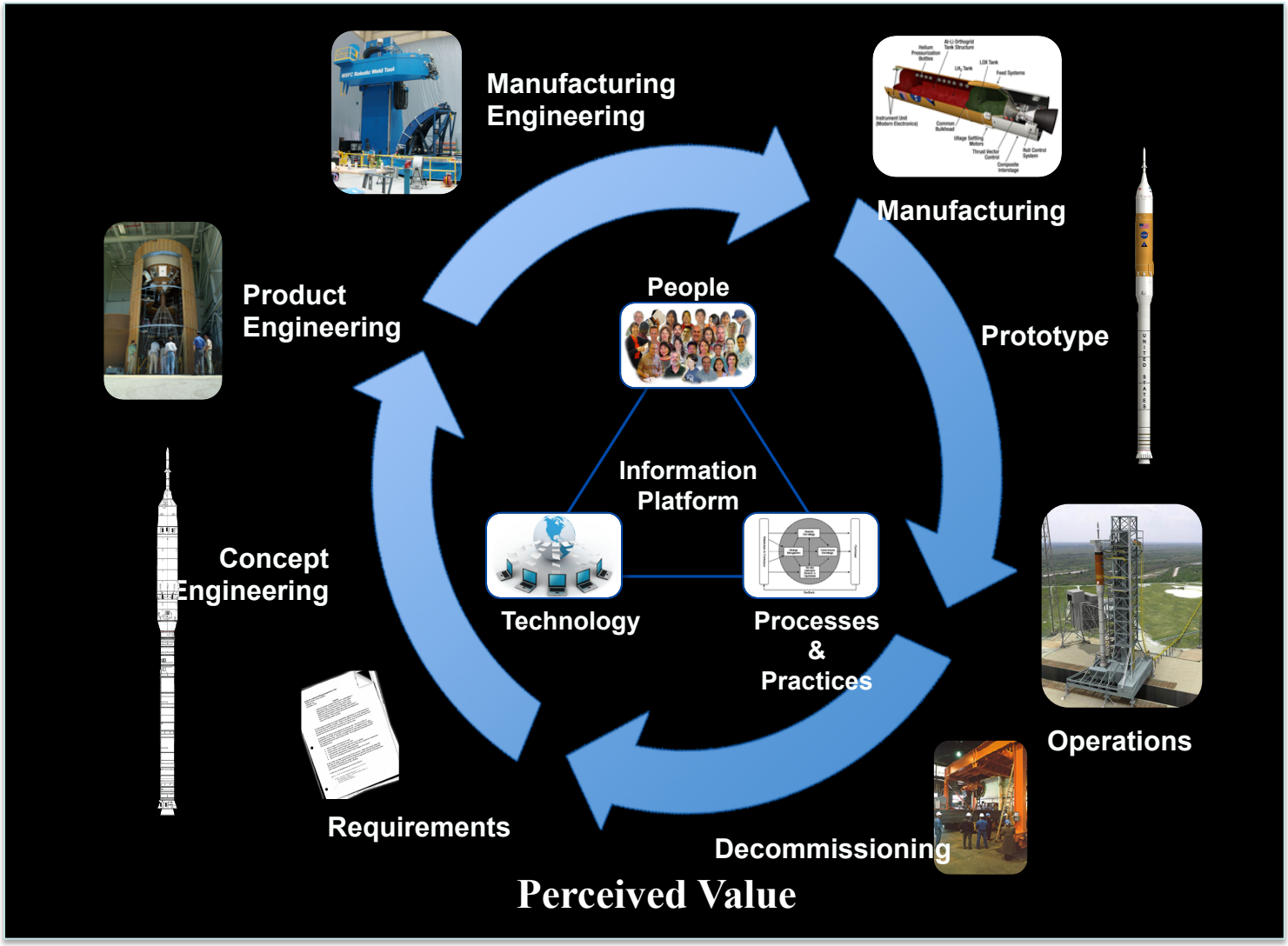
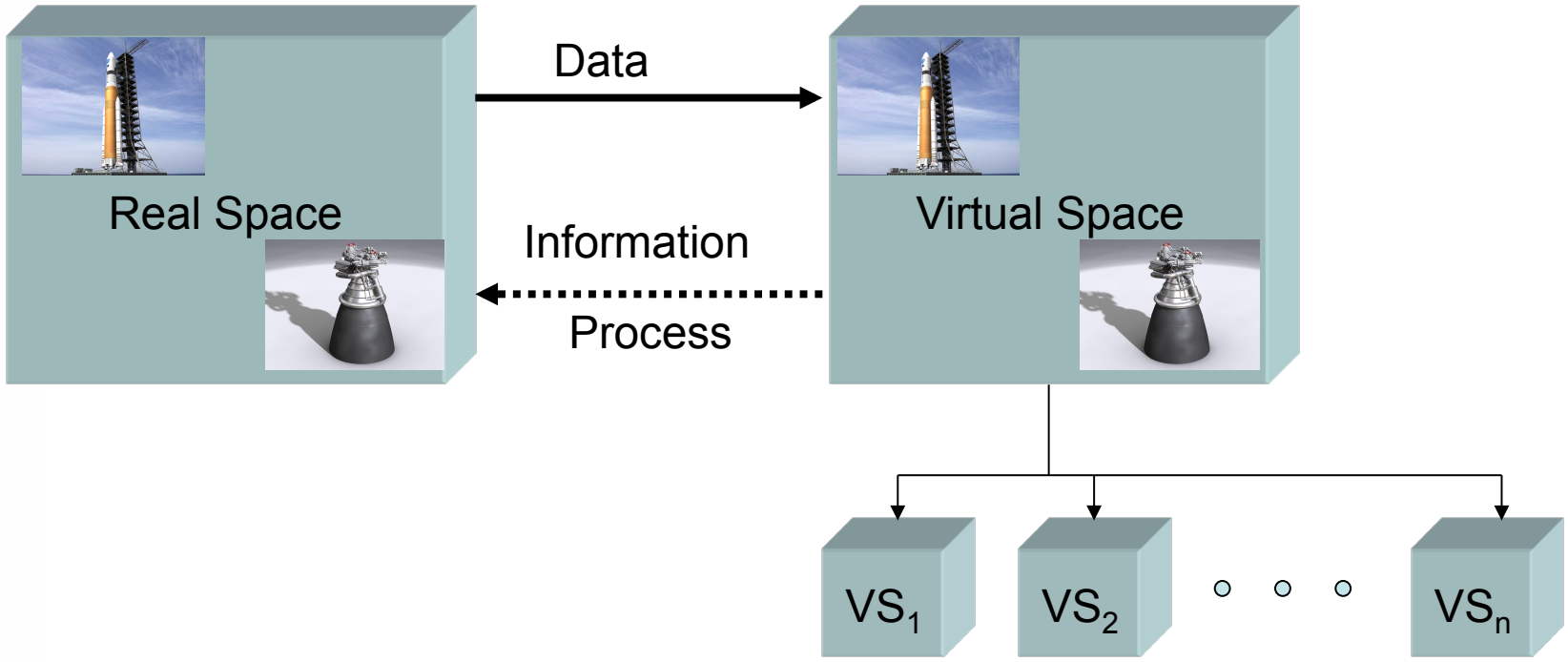
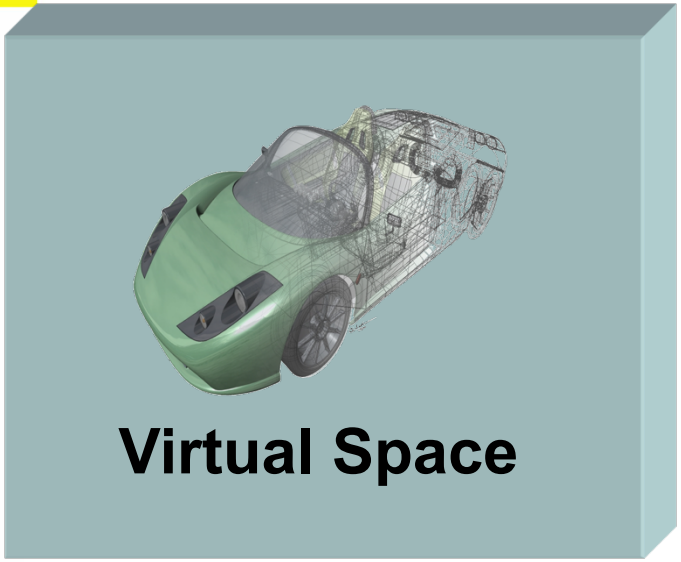
PLM Model



Information Mirroring: Physical *and* Virtual Products



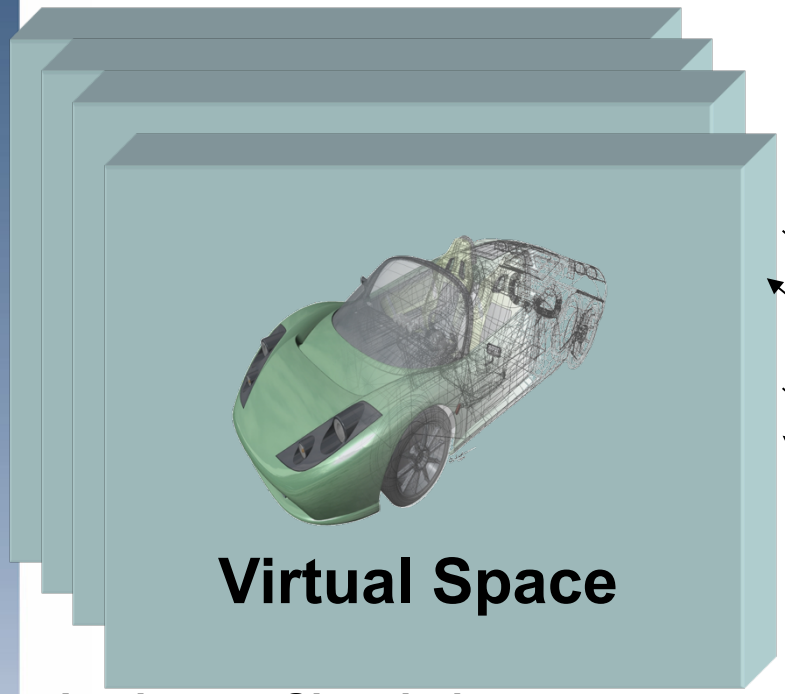
Federated Virtual Space

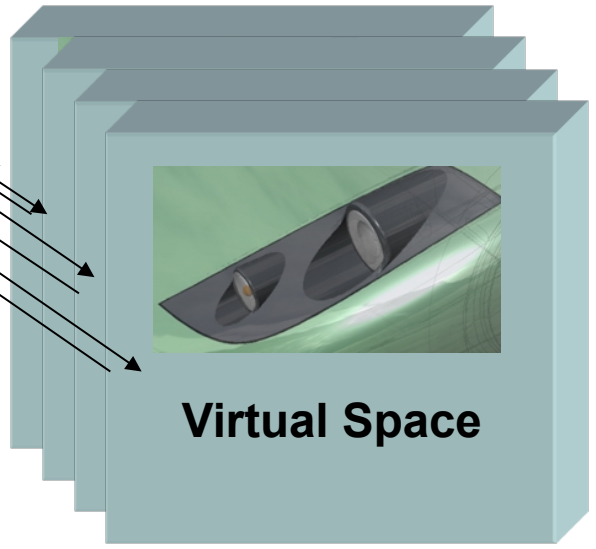


- Implement Singularity
- Monitor Traceability
- Perform Translation
- Enforce Security
- Transmit Efficiently

Federated Virtual Space

- Overall efficiency (n*m)-(n+m)
- Individual efficiency n|m→1





- Implement Singularity
- Monitor Traceability
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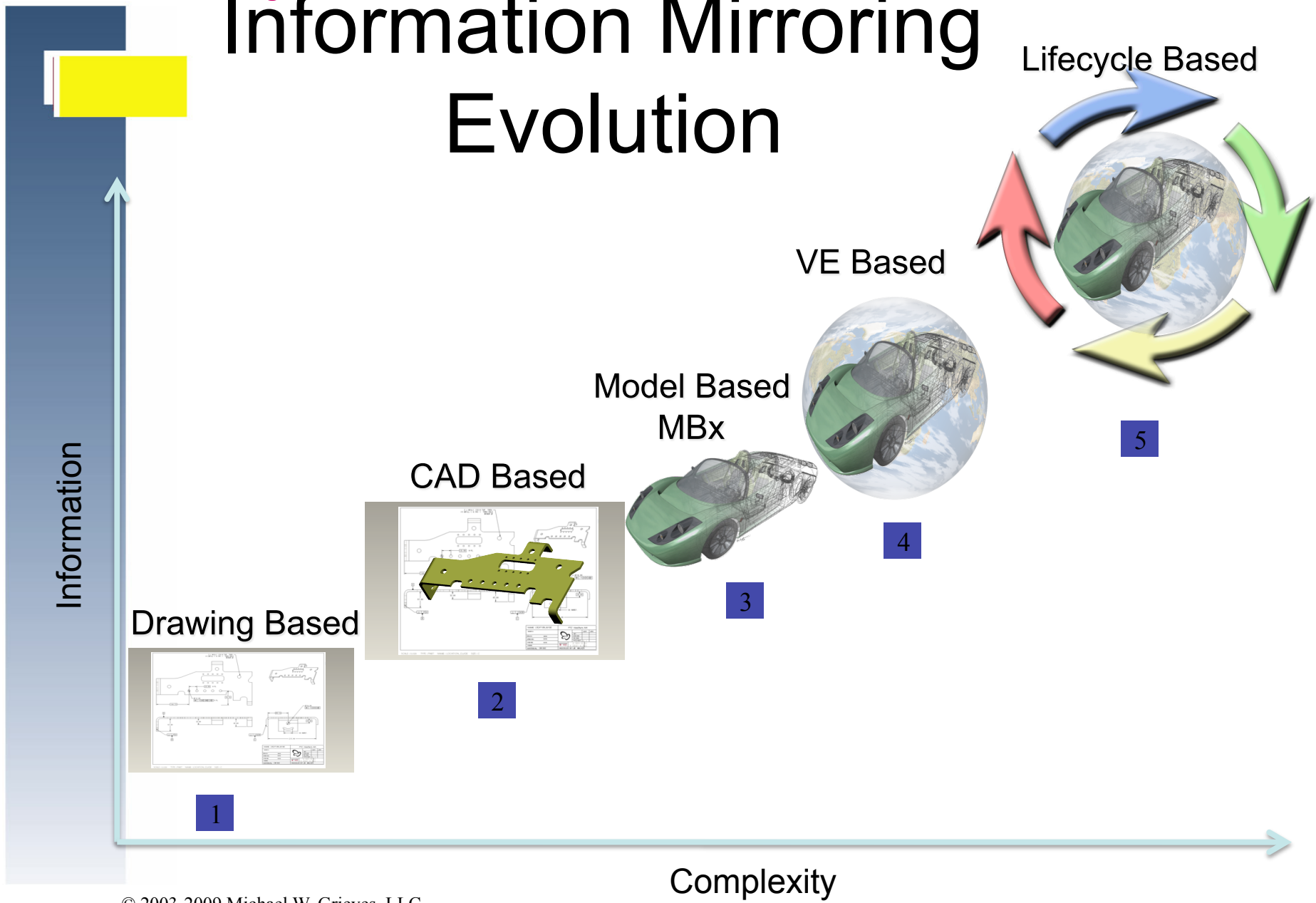
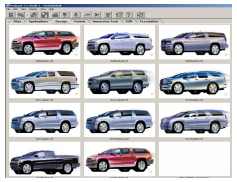
Information Mirroring Evolution



Example - GM Progression

1 Design 2D/3D



2 Data Mgmt

3 Styling DMU

4 Model Quality & Iteration Capability

5 Math Made Visible

6 Advanced Visualization & Collaboration

Tool Integration

Dual Product/PSM Value

- Instantaneous / Simultaneous supply chain (net) availability
- BoP validation (Eng/Mfg)
- Longitudinal manufacturing validation
- Sustainment efficiencies
- Product liability mitigation

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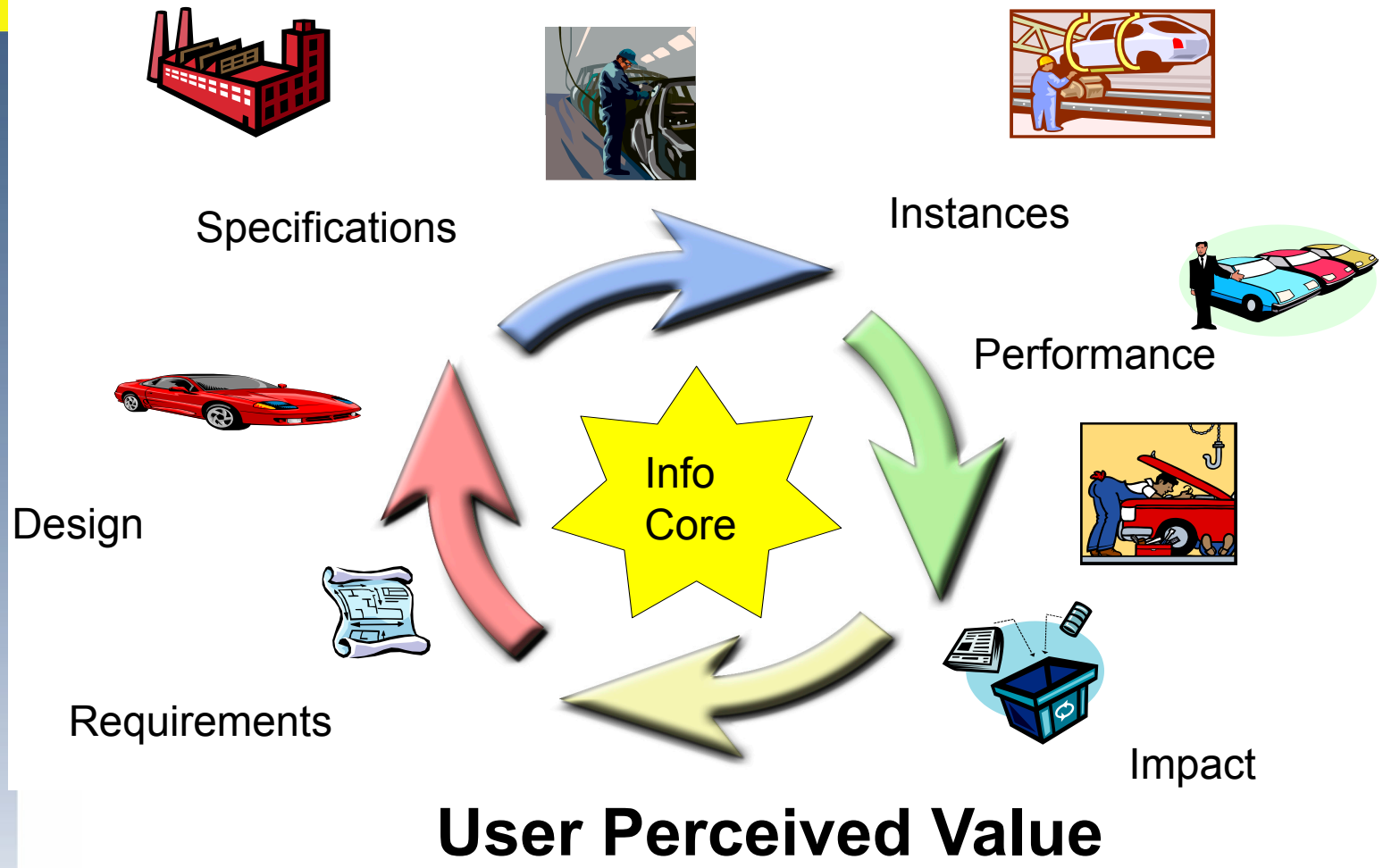
PLQ Model



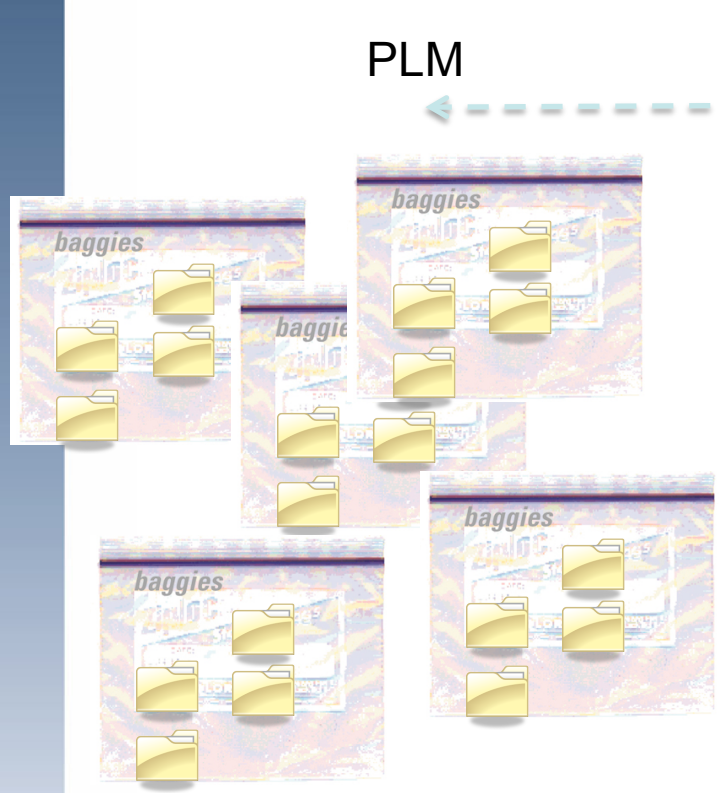
User Perceived Value

Product Lifecycle Quality (PLQ): A Framework within Product Lifecycle Management (PLM) for Achieving Product Quality. IJMTM. Vol 19, Nos 3/4, 2010

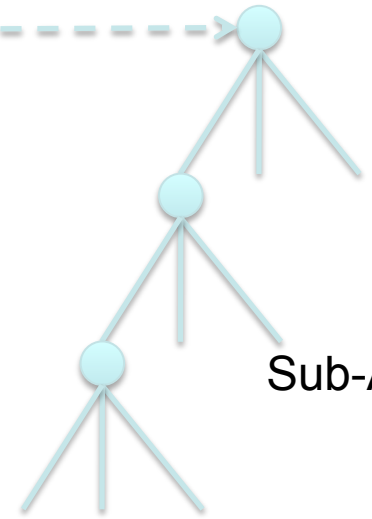
PLM Informational Structures

Create	Requirements
	Product Structure – CAD/BOM
	Mechatronics – Schematics/Code
	Eng Testing & Analysis
	Product Creation Workflow
Build	Bill of Process
	As-builts
Support	As-maintained
	Bill of Service
	Operational State Changes (OSC)
	Product Operational Instructions (POI)
Dispose	Bill of Disposal

Current Model to BoM Correspondence



PLM ??? BoM



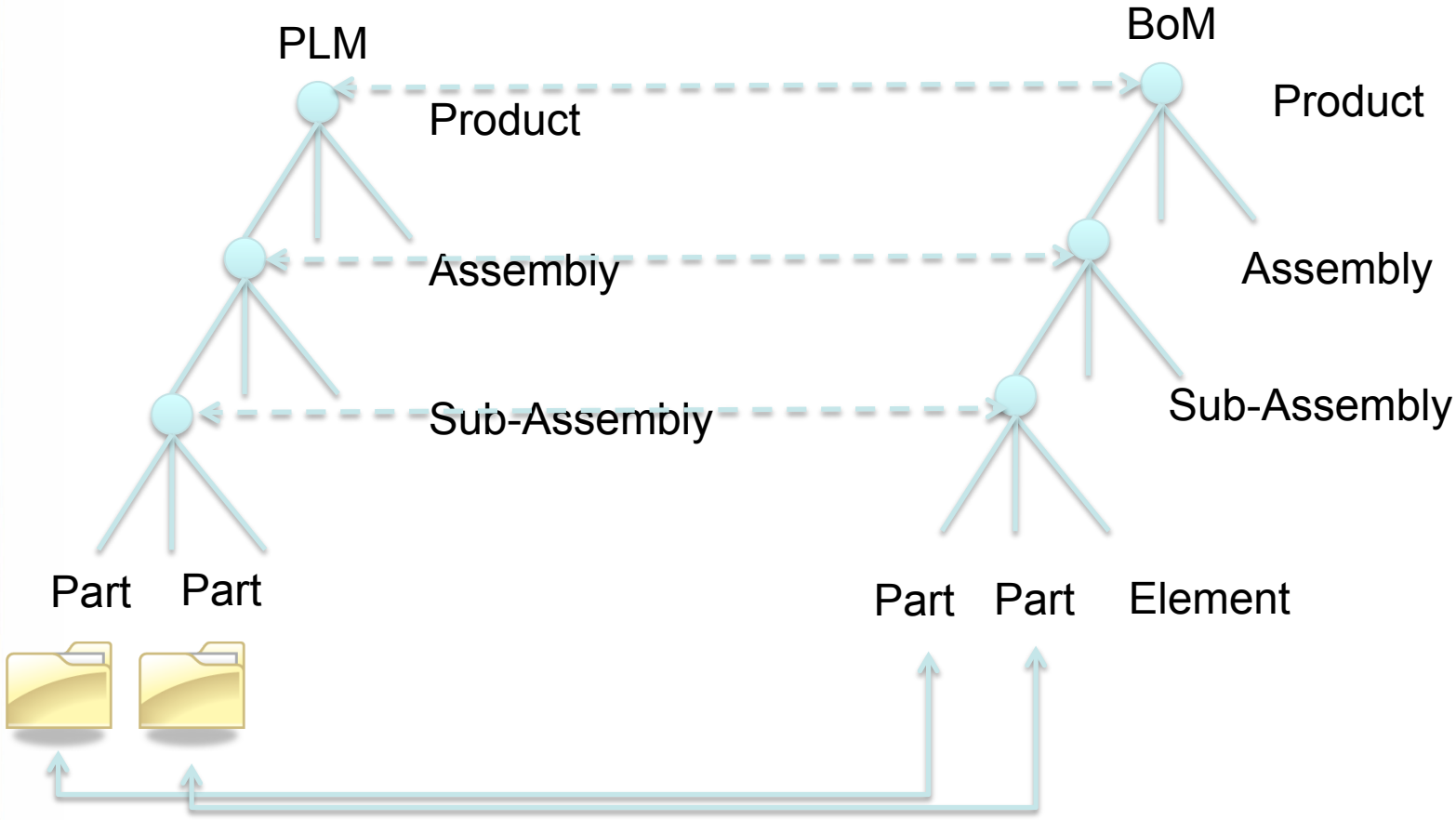
Product

Assembly

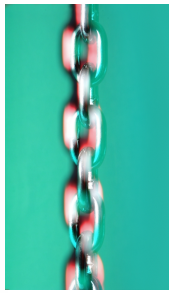
Sub-Assembly

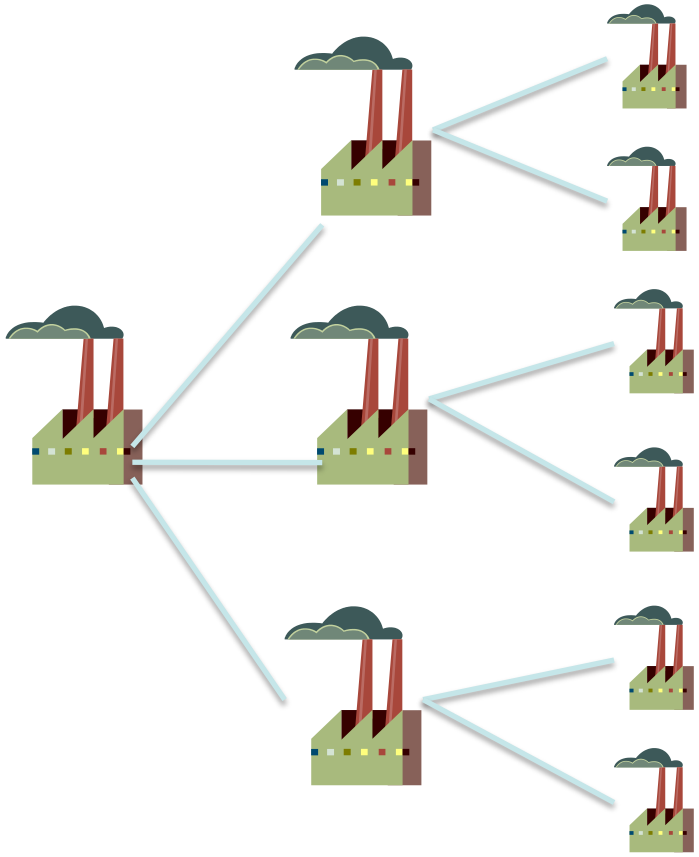
Part Part Element

Desired Model to BoM Correspondence

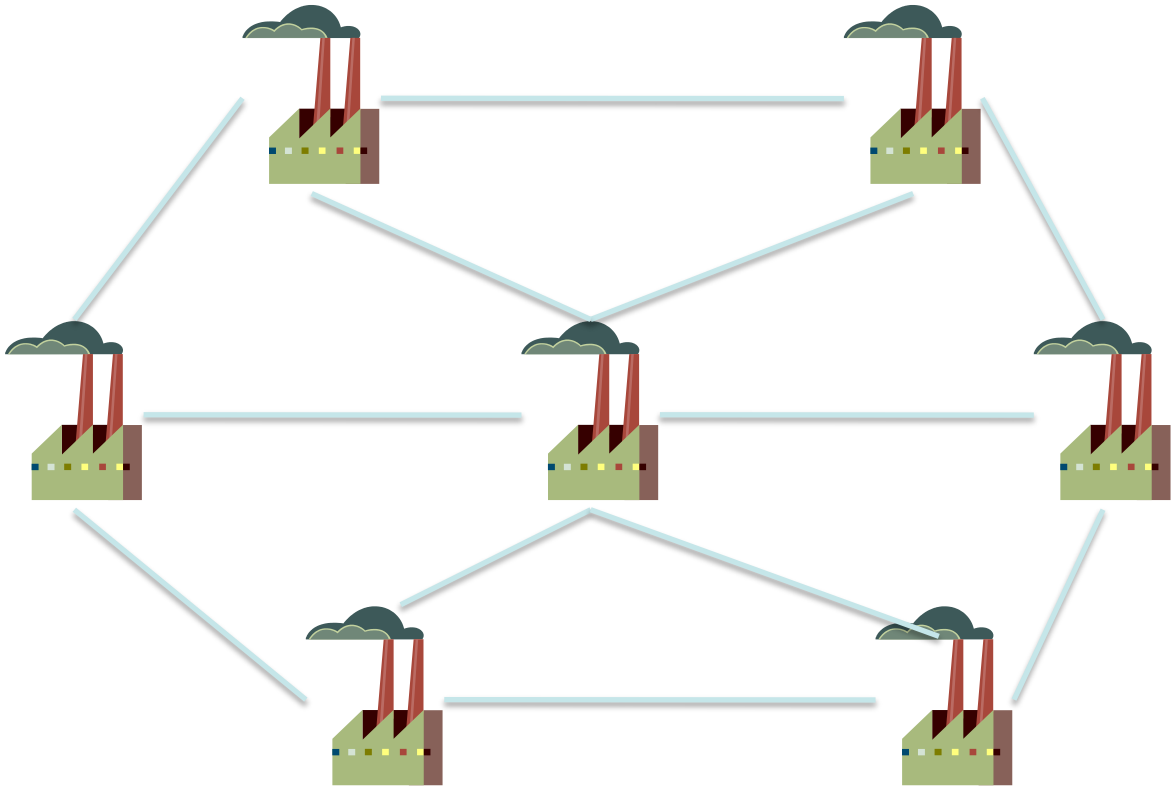


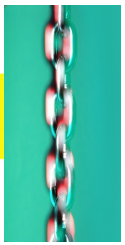
Supply Chain





Supply Net





Supply Chain vs. Net

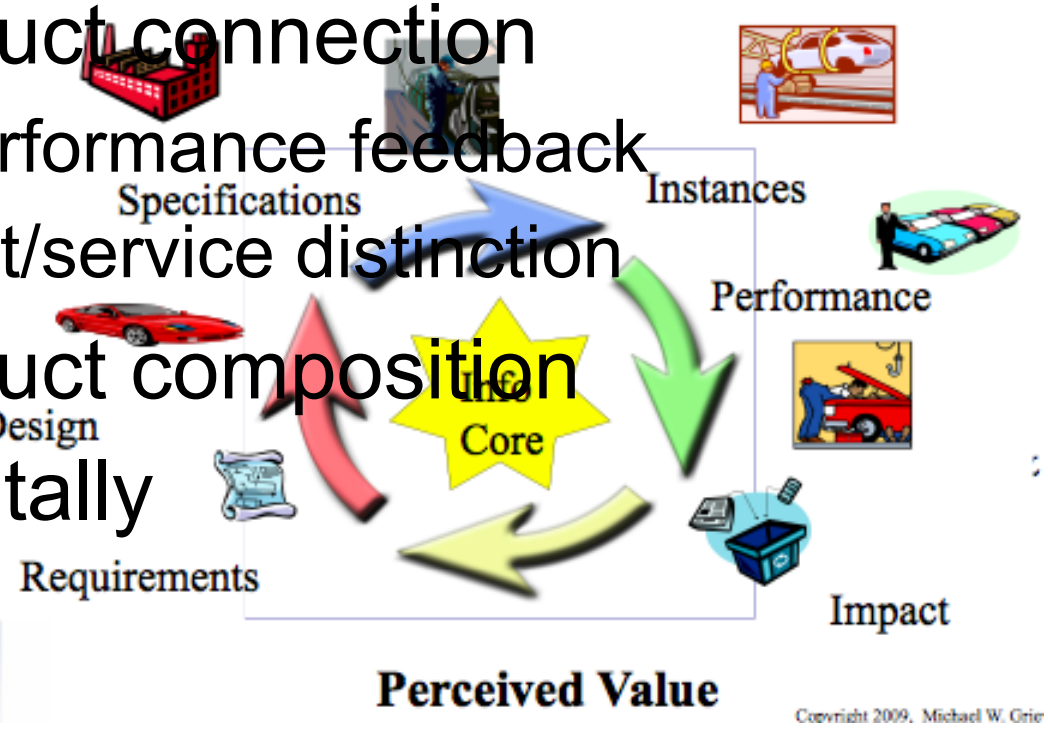
Chain	Net
Materials based	Digital based
Low visibility	High visibility
Sequential	Integrative
IS int – None to low	IS int – med to high
Product precedes info	Info precedes product

Supply Net Benefits

- Time Savings – Labor & Calendar
- Resource Savings
- Early issue identification
- Fosters integrative approach
- Designs can remain open longer
- Long term view of product
- Product knowledge retention

Re-Think Products

- Revisit meeting customer perceived value
- Extend product connection
  - Develop performance feedback
  - Blur product/service distinction
- Extend product composition
- Develop digitally



Required Turbulence Skills

- Leadership
- Sensemaking
- Team building
- Morale management
- Communication

People

- Reassess skills *and* temperament
  - MH4S
  - W4F
- Educate
- If you don't trust, don't keep
- De-silo organizations
- Find reasons to cross-pollinate
- Cut more than less

Technology - Users

- Keep abreast of advances
- Reappraise and update strategic plans
- Look for quantum leaps
- Negotiate with future in mind

Technology - Providers

- Invest in customers
  - Advise not abandon
  - Create innovative revenue models
- Time to educate
- Create consortiums
- R&D for new markets
- Network

Bridging the Gap

Driving the
Of Lea

Virtually Perfect:

Driving Innovative and Lean Products through PLM

- Virtually Priceless
- Virtually Real
- Virtually Human
- Virtually Informed
- Virtually Present
- Virtually Connected

Source: Delmia Corporation

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