

Betting on Software-Enabled Strategies to Disruptively Revitalize Manufacturing Industries

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Key Issues

- Which five business strategies will do the most to revitalize manufacturing industries?
- What are the top six priorities that manufacturers must address to deliver software enabled physical products?
- How are software categories and standards evolving to succeed at software-enabled physical products?

1. Leverage Product Life Cycle Analytics to Continuously Learn and Improve Brand Value

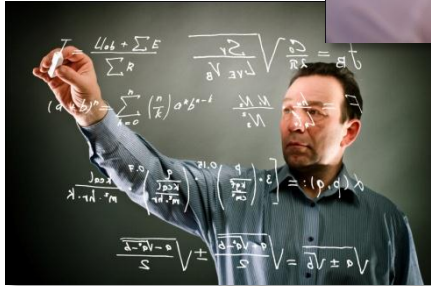
On time?
On budget?



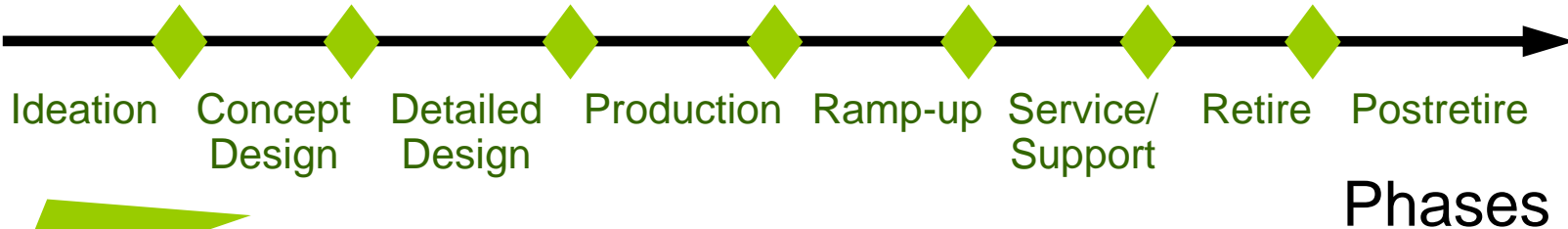
Meeting
specs?



Customers
pleased?
Revenue as
expected?



Quality
targets
met?



Knowledge and Content Reuse

2. Employ Social Media to Accelerate Product Innovation



Local Motors Leverages Open Source Design and Microfactories to Innovate New Vehicles

• Objective

- Lead in product design by cocreation
- Design and build "cool" niche vehicles

• Approach

- Provide expertise in open source design
- Build products at microfactories
- Provide a Web-based platform for cocreation

- Results

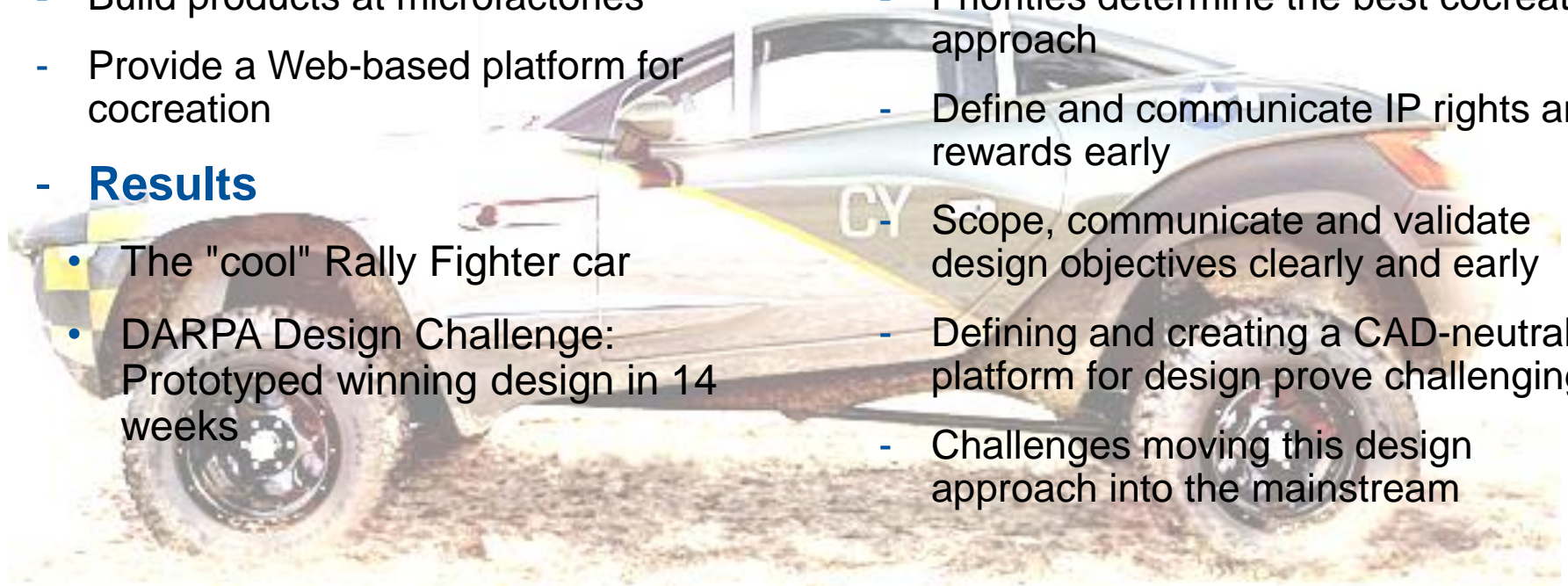
- The "cool" Rally Fighter car
- DARPA Design Challenge: Prototyped winning design in 14 weeks

• Critical Success Factors

- Focus on design by cocreation
- Ability to form design communities
- Microfactories

• Lessons Learned

- Priorities determine the best cocreation approach
- Define and communicate IP rights and rewards early
- Scope, communicate and validate design objectives clearly and early
- Defining and creating a CAD-neutral platform for design prove challenging
- Challenges moving this design approach into the mainstream

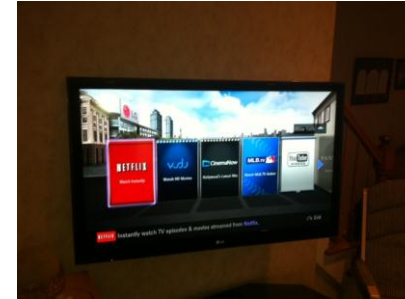
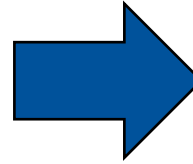


3. Identify Opportunities for Products as Services to Produce New Revenue Streams

Entertainment



Tapes and DVDs

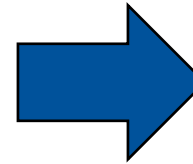


Video streaming

Automotive



Car auction

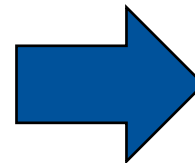


Zipcar renting

Recreation



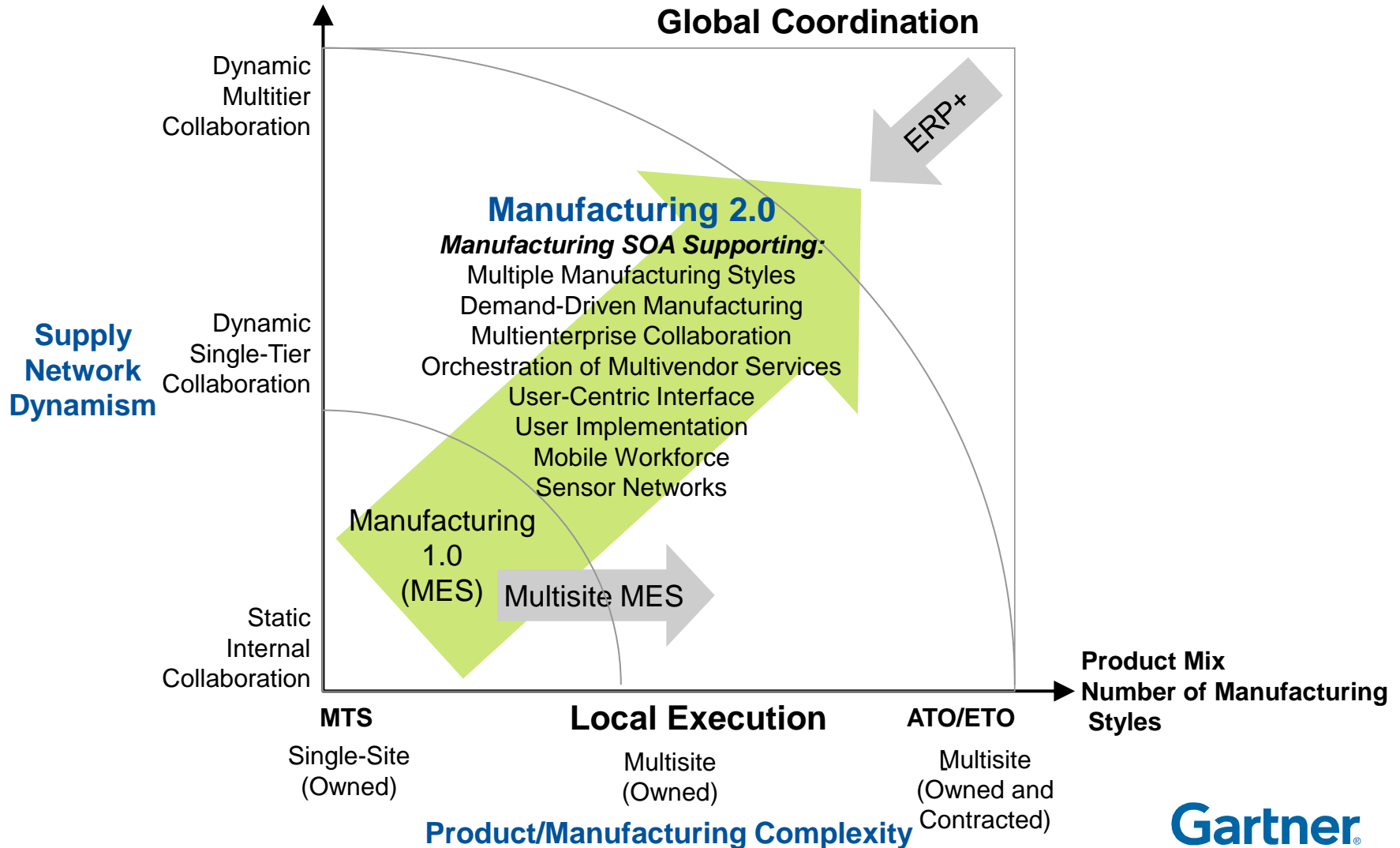
Buying books



E-readers

4. Implement Manufacturing 2.0 to Become More Agile and Fulfill Local Market Needs

Degree of Contract Manufacturing
Rate of NPDI



5. Incorporate Software to Deliver the Value of Manufactured Products

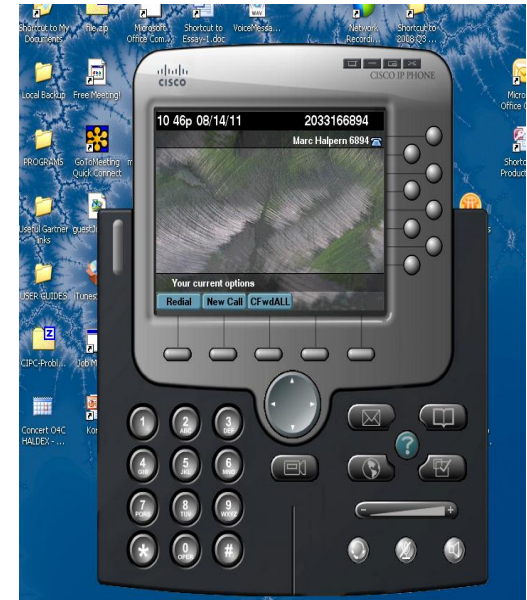
Processors on Wheels



Physical Software



Soft Products



- 10 million lines of code
- 50 ECUs
- 30,000 calibration parameters
- Four or more vehicle BUS systems

- Virtualized physical products
- Electromechanical human-machine interfaces

- Software replaces mechanical HMIs
- Unlimited virtual products on PCs and mobile devices

Action Summary of Business Initiatives That Can Revitalize Manufacturers

1. Leverage product lifecycle analytics to continuously learn and improve brand value
2. Employ social media to accelerate product innovation
3. Identify opportunities for products as services to produce new revenue streams
4. Implement manufacturing 2.0 to become more agile and fulfill local market needs
5. Incorporate software to deliver the value of manufactured products

1. Use Marketing Intelligence and Systems Engineering to Define Products

Processors on Wheels



- 10 million lines of code
- 50 engine control units (ECUs)
- 30,000 calibration parameters
- Four or more vehicle BUS systems

Physical-Software



- Virtualized physical products
- Electromechanical human-machine interfaced (HMIs)

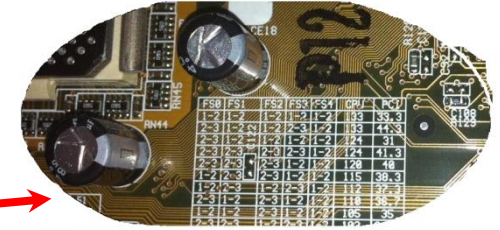
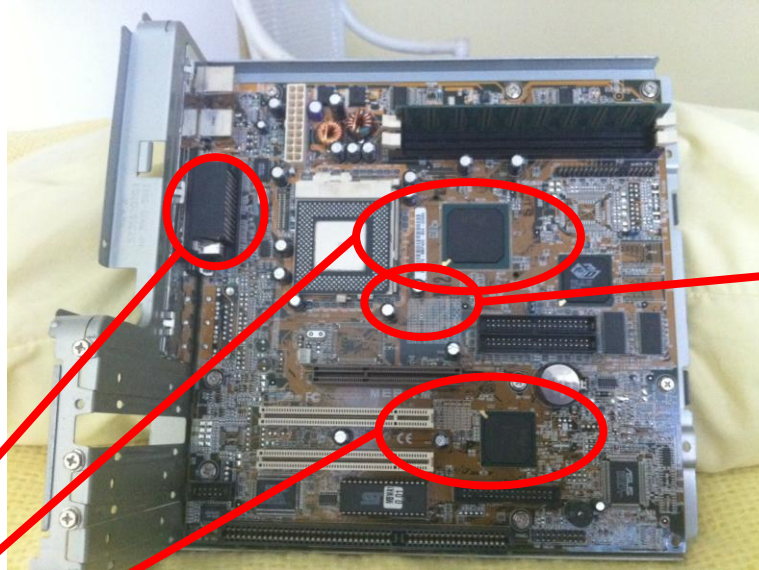
Medical Devices



- Wristwatch/heart monitor and training
- Transmits data via Internet access

2. Prioritize Supply Chain Collaboration for Software Development and Compatibility

Connectivity to networks



Documentation of settings requires supplier collaboration

Modules with embedded software from international suppliers



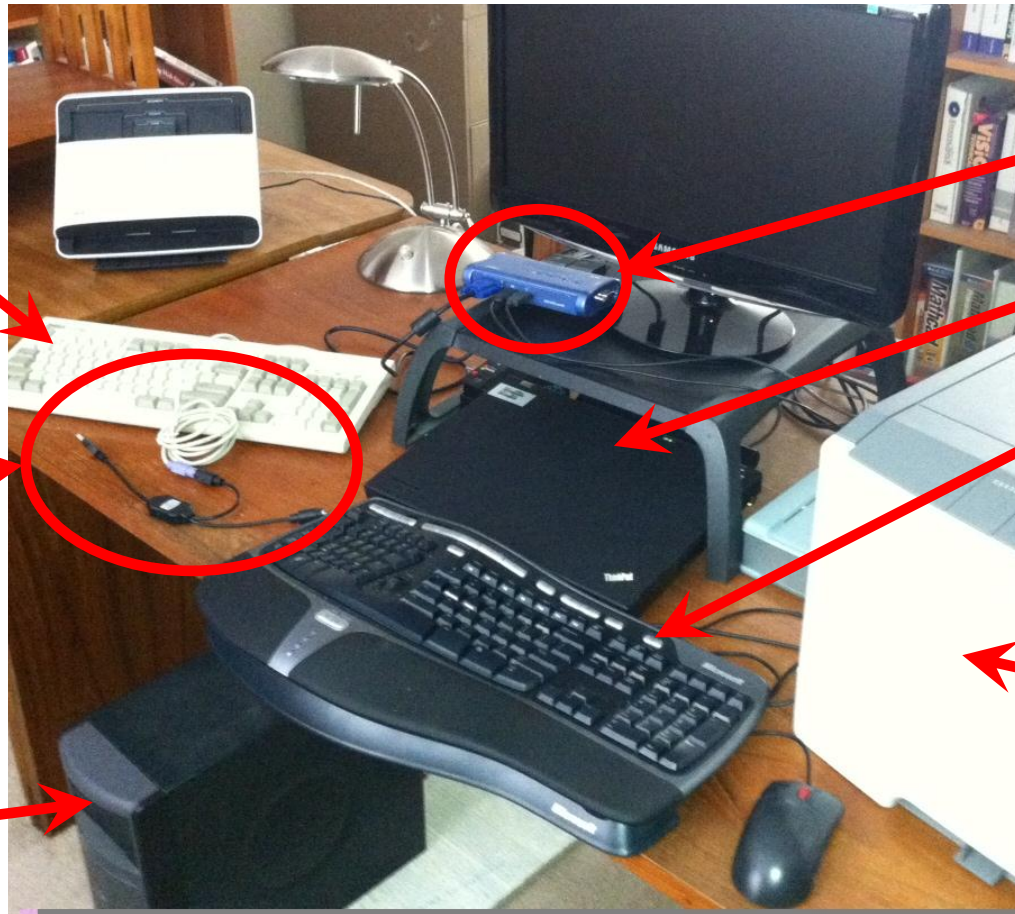
Java applications

GUI software

Interfaces to accessory products

3. Plan for Software Demands That Are Appropriate for Product Service Life

If upgrading a home office is challenging, imagine upgrading software-dependent aircraft, autos, trucks and factory machinery!



1. Introduced KVM Switch.

2. Gartner laptop connected to KVM switch not working with old keyboard.

5. Purchased new keyboard with KVM-compatible driver software.

6. Introduced new printer.

4. Driver software update for old keyboard not available.

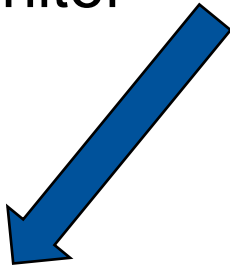
3. New mechanical interface needed between KVM switch and old keyboard.

7. OS update needed to connect second PC to KVM switch and new printer.

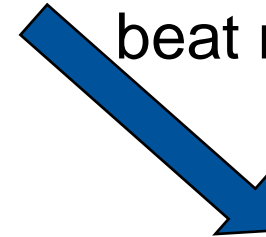
4. Address Privacy Risks

Life Fitness Treadmill

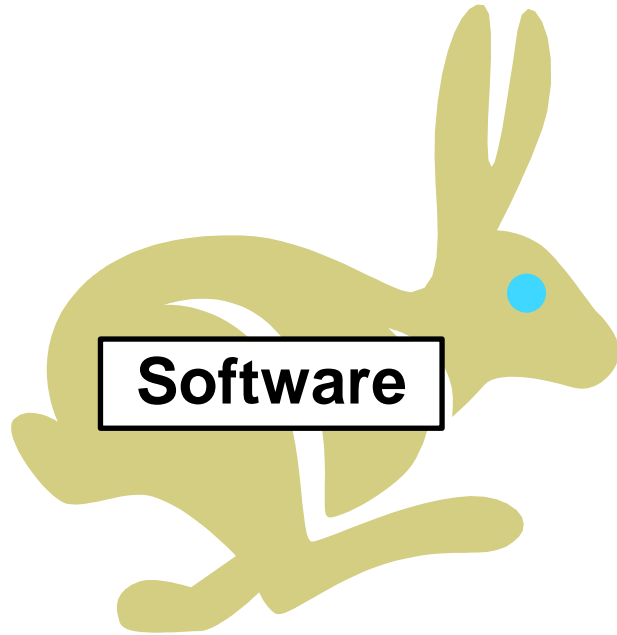
Without remote heart beat monitor



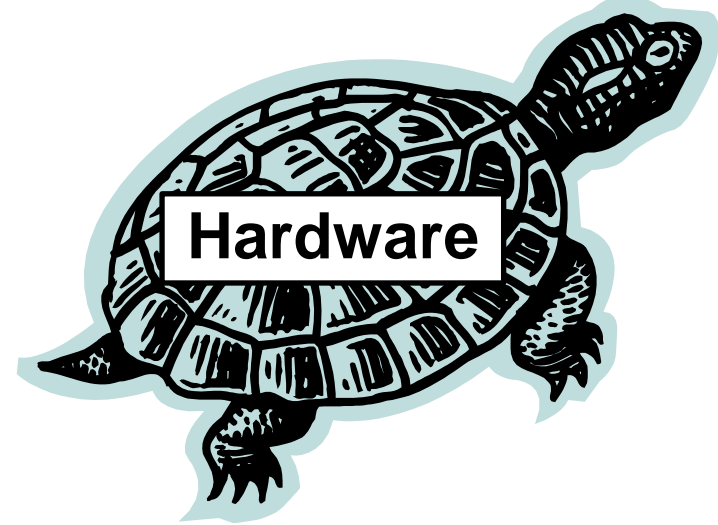
Unexpectedly “senses” remote heart beat monitor



5. Start Software Development Earlier in the Product Development Cycle

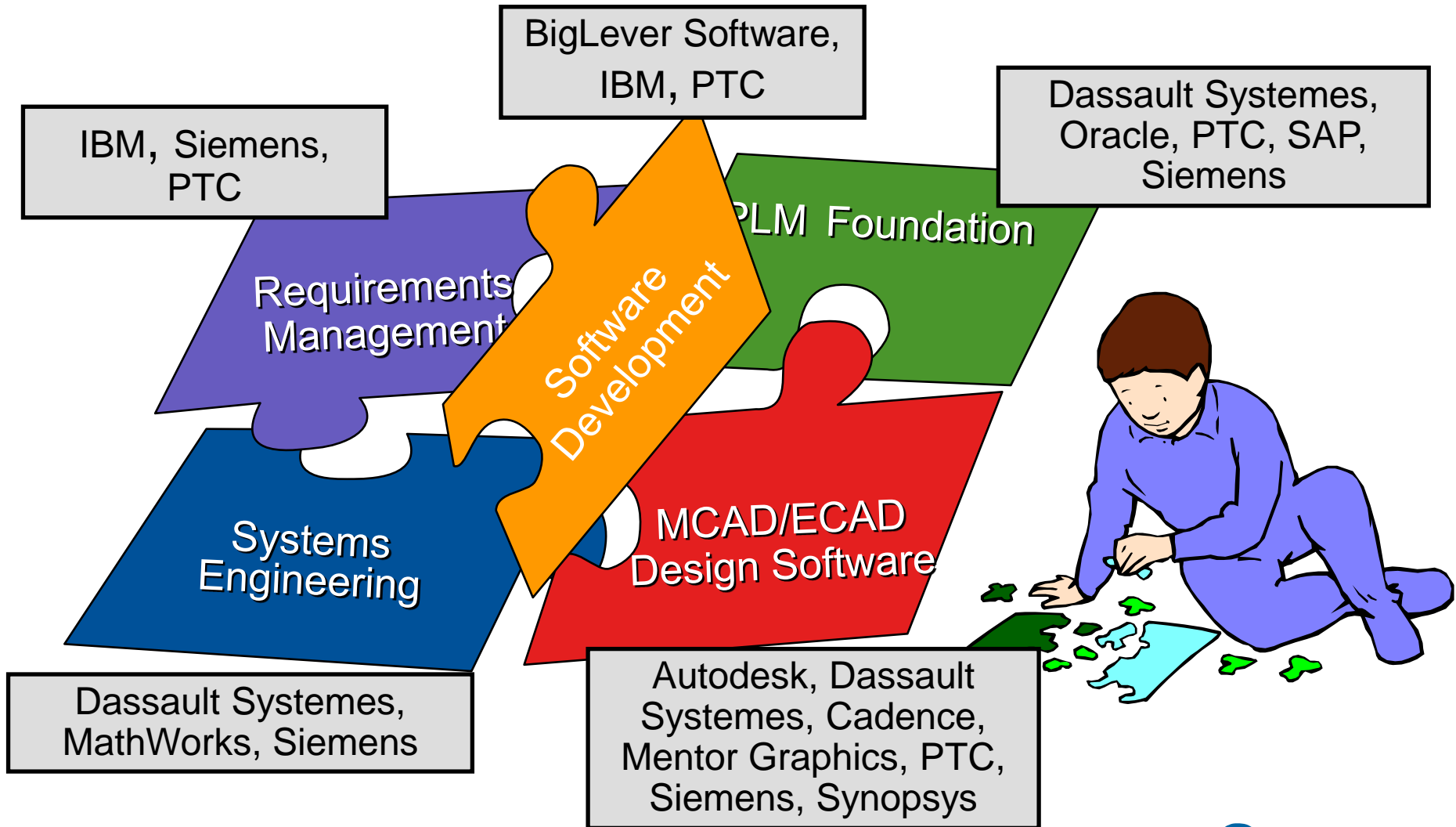


- More "fluid" agile development
- Less predictable schedules
- More likely cause for launch delays
- More defects than hardware!



- Longer lead times
- Clearer physical/functional constraints
- Higher capital investments
- Better understood processes

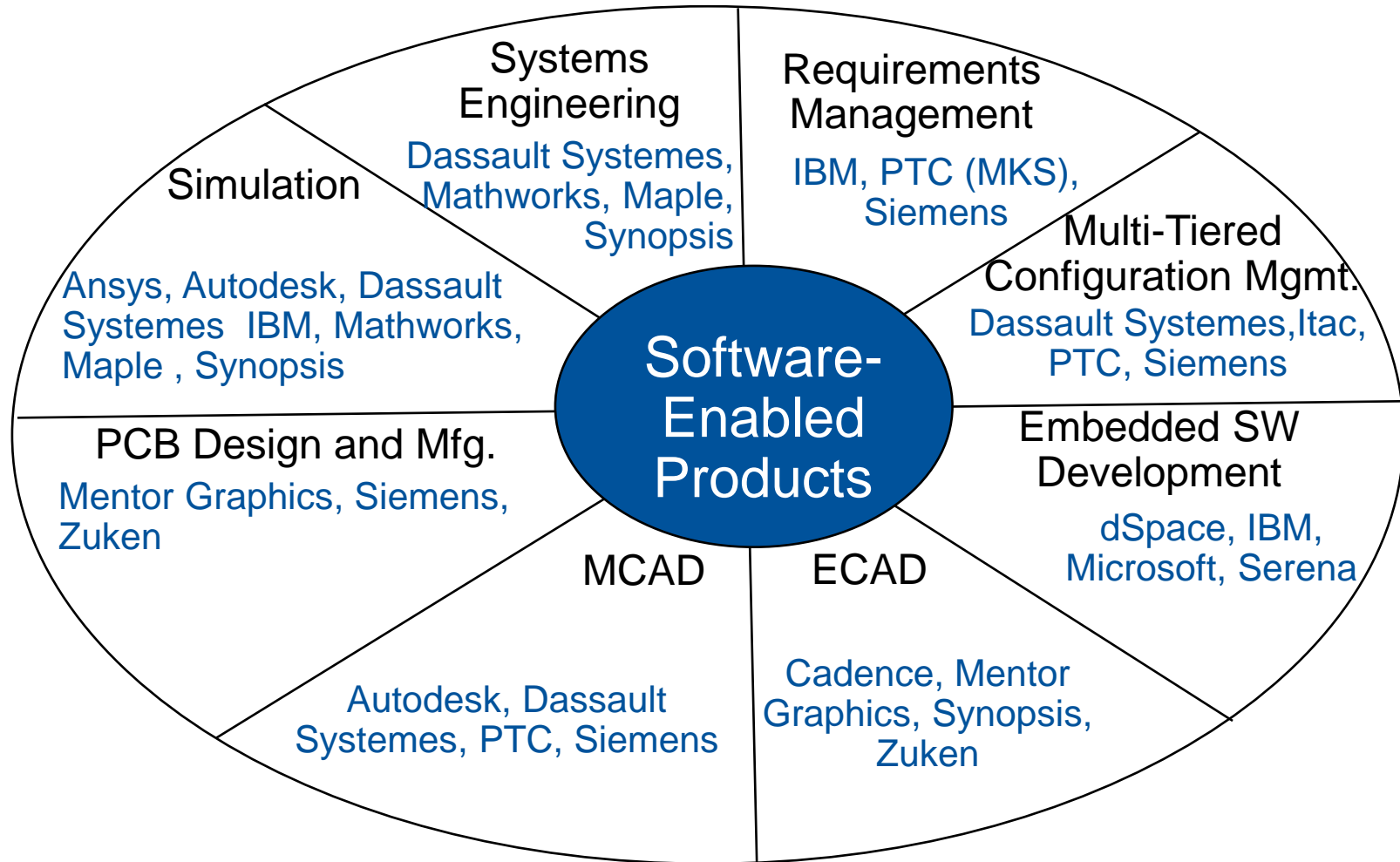
6. Enable Software Development Tools as Part of Value Chain PLM Software Application Stack



Action Summary to Incorporate Software as Part of Manufactured Products

1. Use marketing intelligence and systems engineering to define products.
2. Prioritize supply chain collaboration for software development and compatibility.
3. Plan for software demands that are appropriate for product service life.
4. Address privacy concerns
5. Start software development earlier in the product development cycle.
6. Enable software development tools as part of the value chain product life cycle management (PLM) application stack.

Application Categories Vital to Software-Enabled Product Design



Key ISO Standards and Consortia to Study and Adopt for Software-Enabled Products

- ISO 10303 – STEP
 - AP 239 – Product lifecycle support
 - AP 233 – Requirements and systems engineering
 - Heavy leverage of AP 239 data models
 - Designed to be neutral vs DODAF, MODAF, SysML, UML, IDEF
 - AP 210 – Electronic assembly, interconnect, packaging
- ISO 26262 – Functional safety standard for automotive
 - Software testing and verification procedures
- Organizations of note
 - INCOSE – International Council on Systems Engineering
 - MISRA – Motor Industry Software Reliability Association
 - AUTOSAR – Automotive Open Systems Architecture

Top Level Summary and Recommendations

- Revitalizing manufacturers involves software at multiple levels
 - IT responsibilities become more central business operations
- Software as part of manufactured products demands a shift of application priorities
 - Need more focus to requirements management, systems engineering, model-based design, and systems simulation
- The growing role of software increases the complexities of product design and lifecycle support
 - Invest more focus on AP 233 and AP 210 as well as AP 239
 - Participate in industry-specific software quality groups

Related Gartner Research

- **Key Issues for Manufacturers Redefining Themselves Through Software-Enabled Strategies, 2011**
Marc Halpern (G00210782)
- **Hype Cycle for Manufacturing Product Life Cycle and Operations Management, 2011**
Simon F. Jacobson, Marc Halpern, Leif Eriksen (G00214960)
- **Manufacturing 2.0: A Fresh Approach to Integrating Manufacturing Operations With DDVN**
Simon F. Jacobson, Leif Eriksen, Phannee Kim (G00206860)
- **Cool Vendors in Product Design and Life Cycle Management, 2011**
Marc Halpern (G00212421)
- **Cool Vendors in Manufacturing Operations, 2011**
Simon F. Jacobson, Leif Eriksen (G00211331)