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MBSE Workshop

Model Management in PLM

Teamcenter Model Management

The Problem…
The Solution…
Where are we…
What's missing…

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Apollo Moon rockets vs. Gift Cards
Accelerating complexity…

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Apollo Guidance Computer (1966)

- 1st IC-based computer
- 2k core, 36k 'rope' memory
- 11.72 micro-second cycle
- 55 Watts
- 70 lbs
- 24" x 12.5" x 6.5"
- $$$$$$$$

Hallmark Card (today)

- 256mb+ memory
- ~2 ghz
- 1900 mAh (2 yrs)
- .085 oz
- 1" x 1" x .25"
- .$ <$1

Increasing complexity everywhere…

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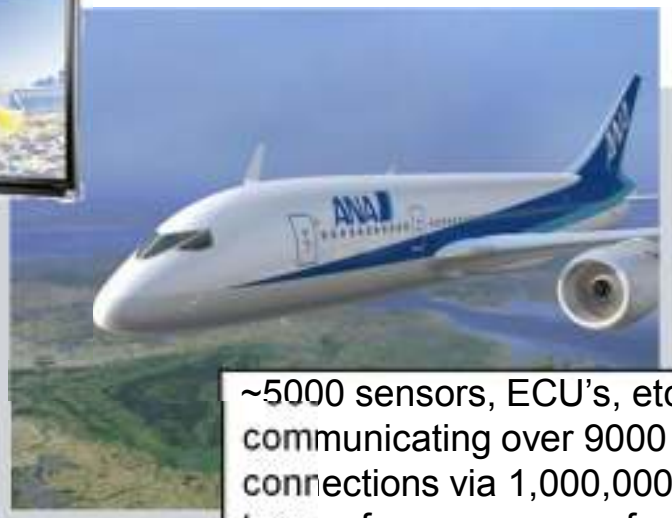
Deep Water Horizon

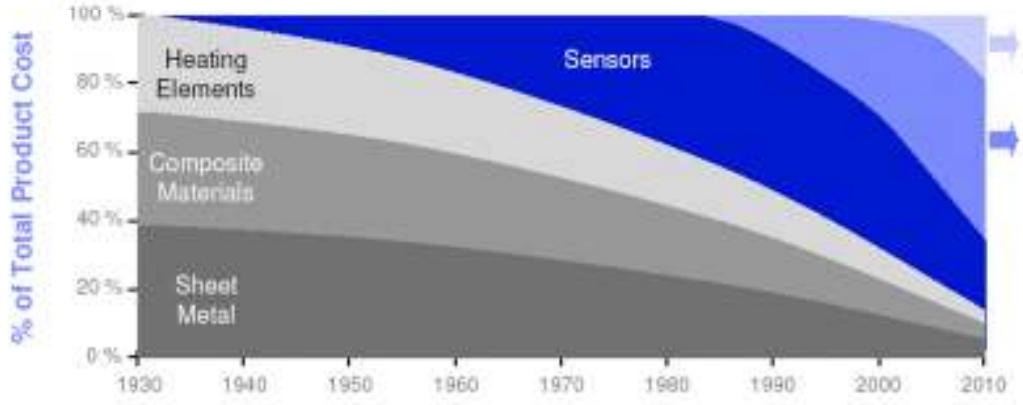
An Oregon man discovered that his year-old Toshiba flat-screen TV was emitting an international distress signal (121.5 mhz) picked up by a satellite, leading a search and ue operation to his Corvallis, Oregon,

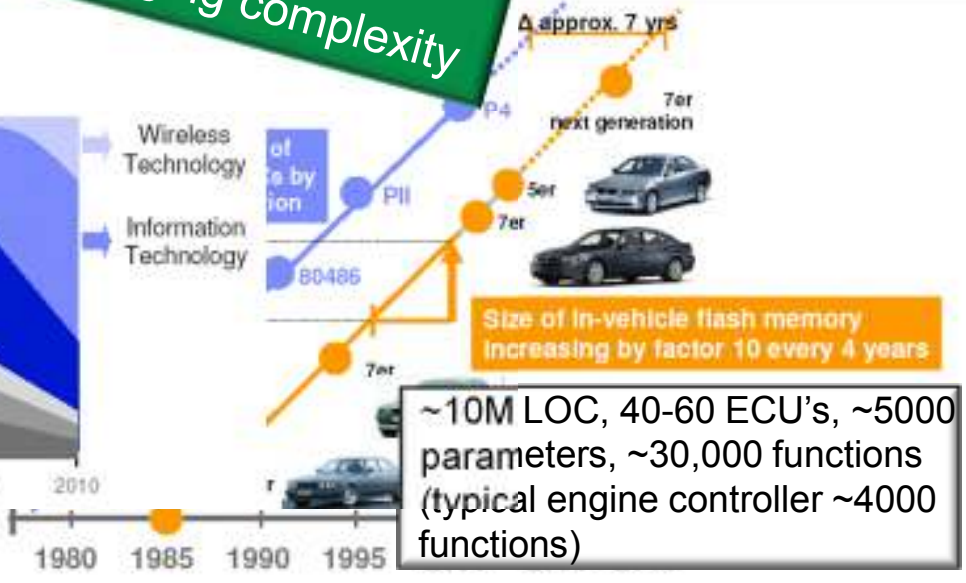


~5000 sensors, ECU's, etc. communicating over 9000 connections via 1,000,000+ types of messages, performing 2000+ functions—with each tail number different

Complexity everywhere…
SE is a process for managing complexity

Illustrative case example: Washers & Dryers





~10M LOC, 40-60 ECU's, ~5000 parameters, ~30,000 functions (typical engine controller ~4000 functions)

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Unmanaged complexity produces problems…

Failing to manage cross-domain interactions/interfaces show up as problems later→

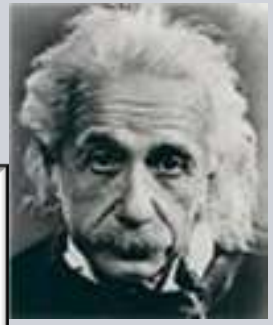
Ignoring the risk is no longer affordable…

- ✓ 17.8 million vehicle recalls in the US in 2012 (more recalls then vehicles sold
- ✓ Each recall costs $100/vehicle/recall ($1.8 billion/year) in direct costs

A sample list from the NHTSA recalls database…

- …recalls 1.3 million vehicles where engine controller may develop solder joint cracks due to vibration
- …recalls 1021 vehicles with automatic rear lid with leaking gas struts could cause injury…software update
- …recalls 3.6 million vehicles…speed control switch leaks and overheats
- …recalls 10,113 vans…brake lights don't come on after first time; brake control software update.
- …recalls 437 vehicles…seat sensor calibration error doesn't turn on air bags

The significant problems we face cannot be solved at the same level of thinking we were at when we created them.



Albert Einstein

[http://www.nhtsa.gov]

Challenges in the "New Normal"
Success is getting harder

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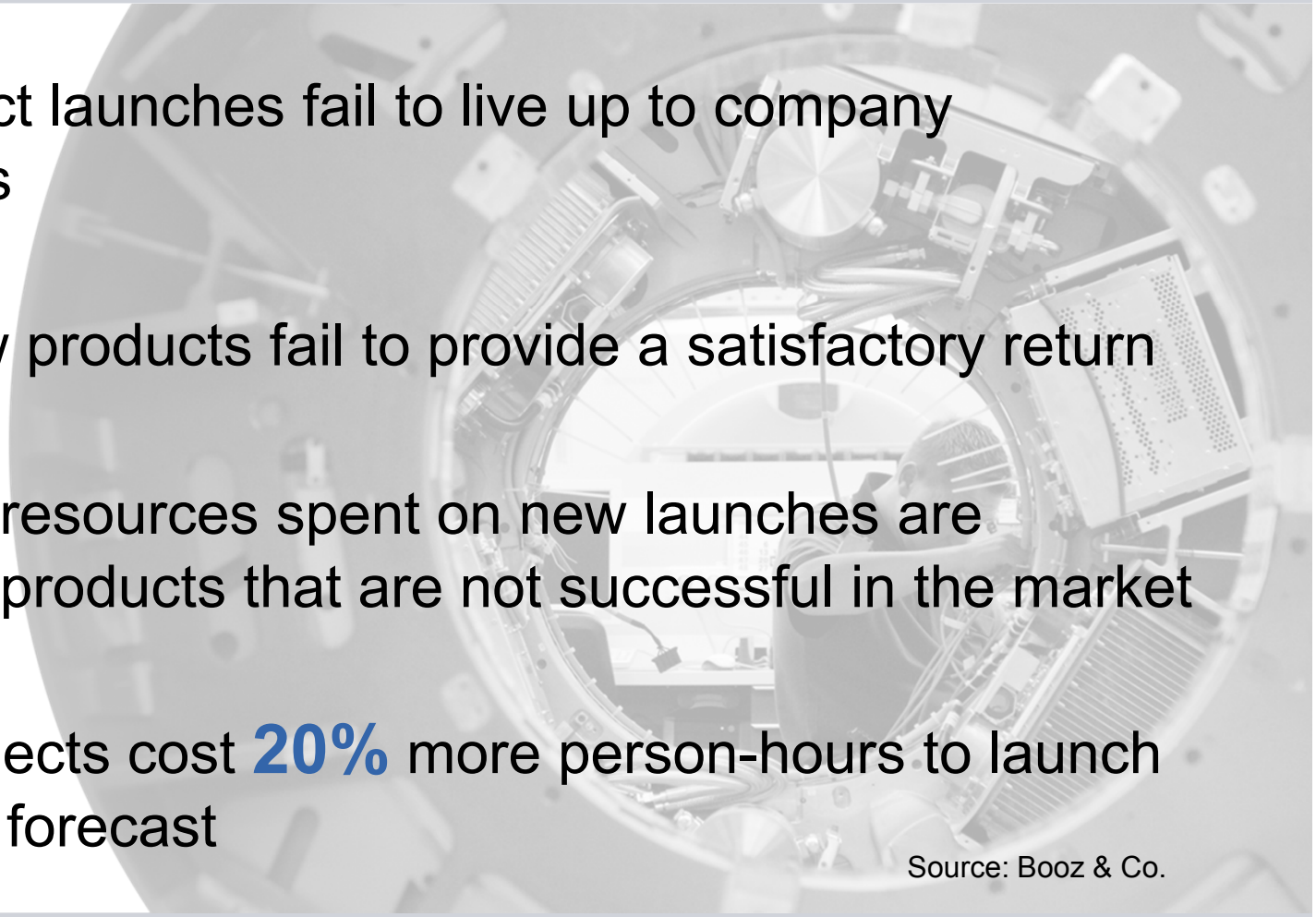

- **50%** product launches fail to live up to company expectations
- **33%** of new products fail to provide a satisfactory return
- **70%** of the resources spent on new launches are allocated to products that are not successful in the market
- **80%** of projects cost **20%** more person-hours to launch than initially forecast

Source: Booz & Co.

The systems engineering process to handle complexity

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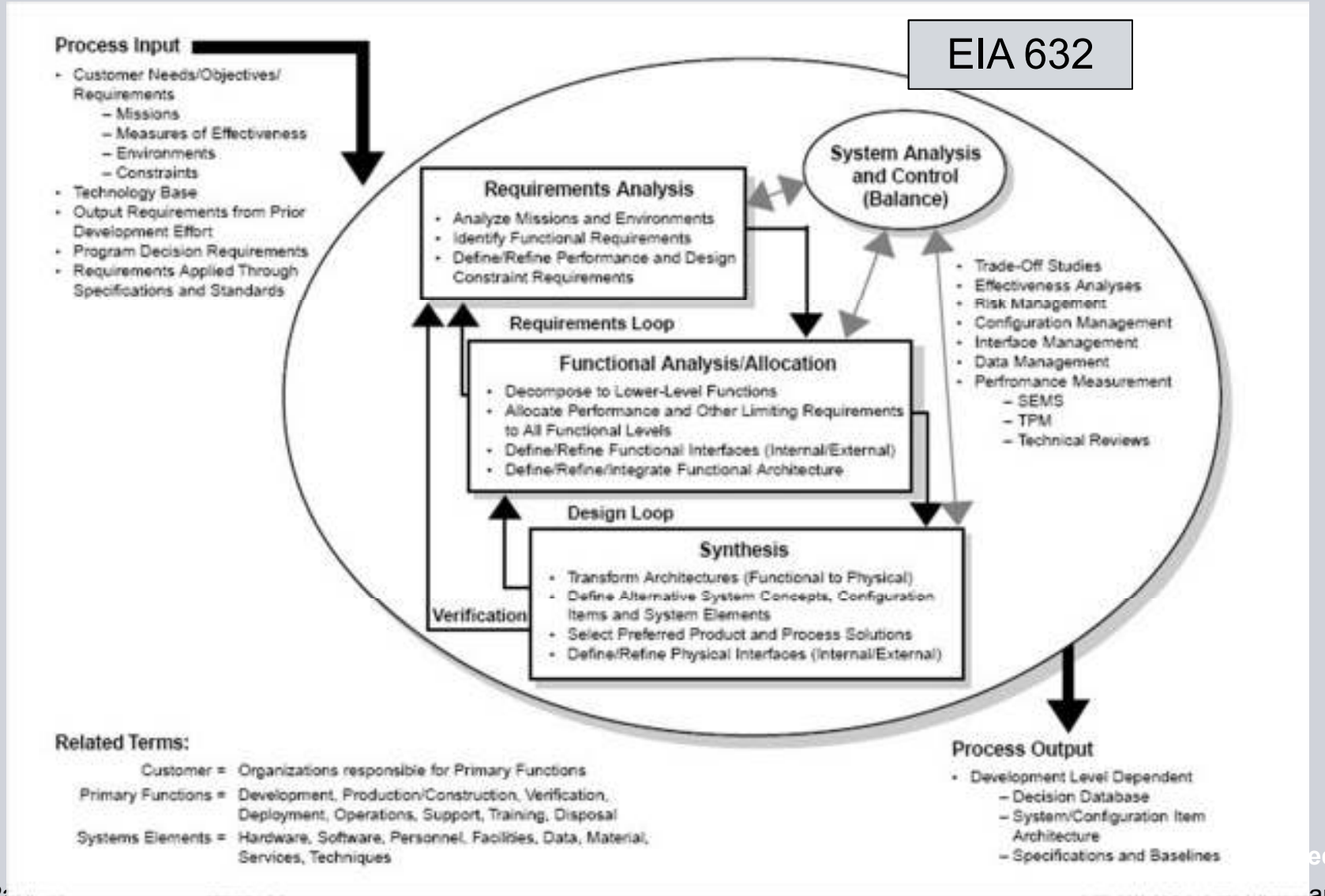
EIA-632, IEEE 1220, ISO 15288,...



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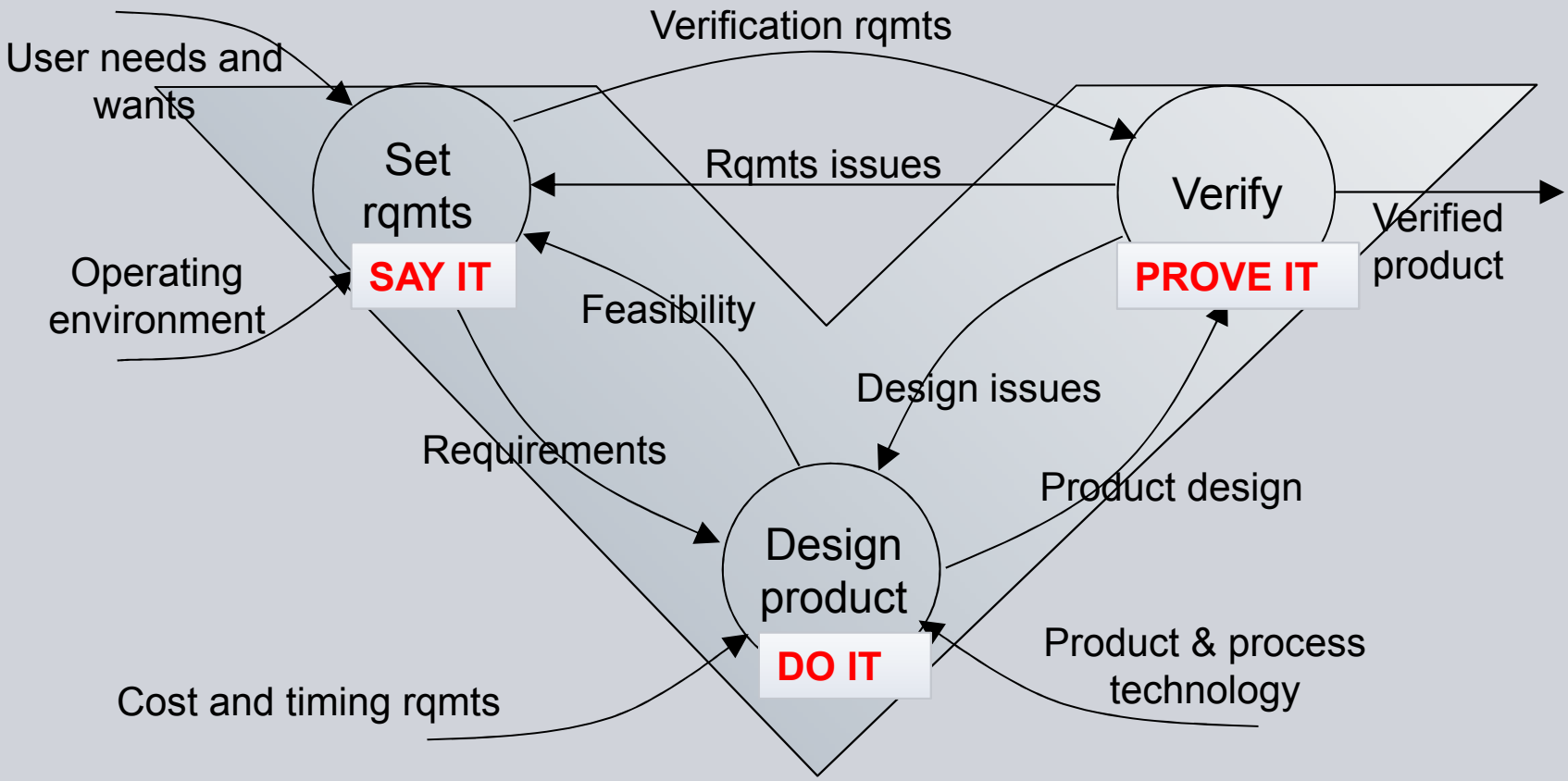
Requirements/Systems Engineering process…



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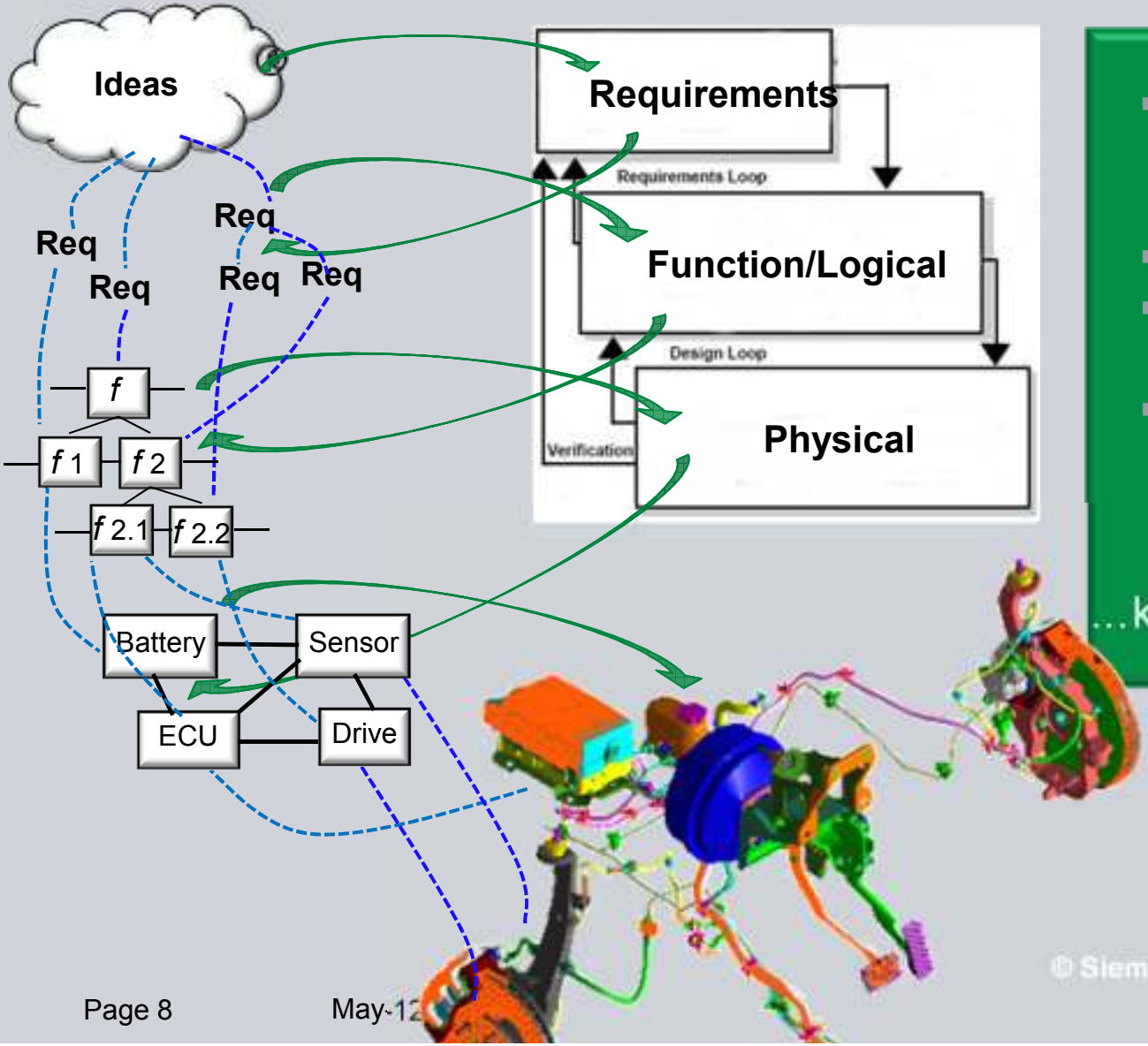
The Systems Engineering Process…



- FRAT (Commercial) vs RFAT (Mil/Aero, Energy,…)
- Captured requirements…
- Linking requirements to functions…
- Functions linked to physical alternatives/architectures

…keep going until realizable

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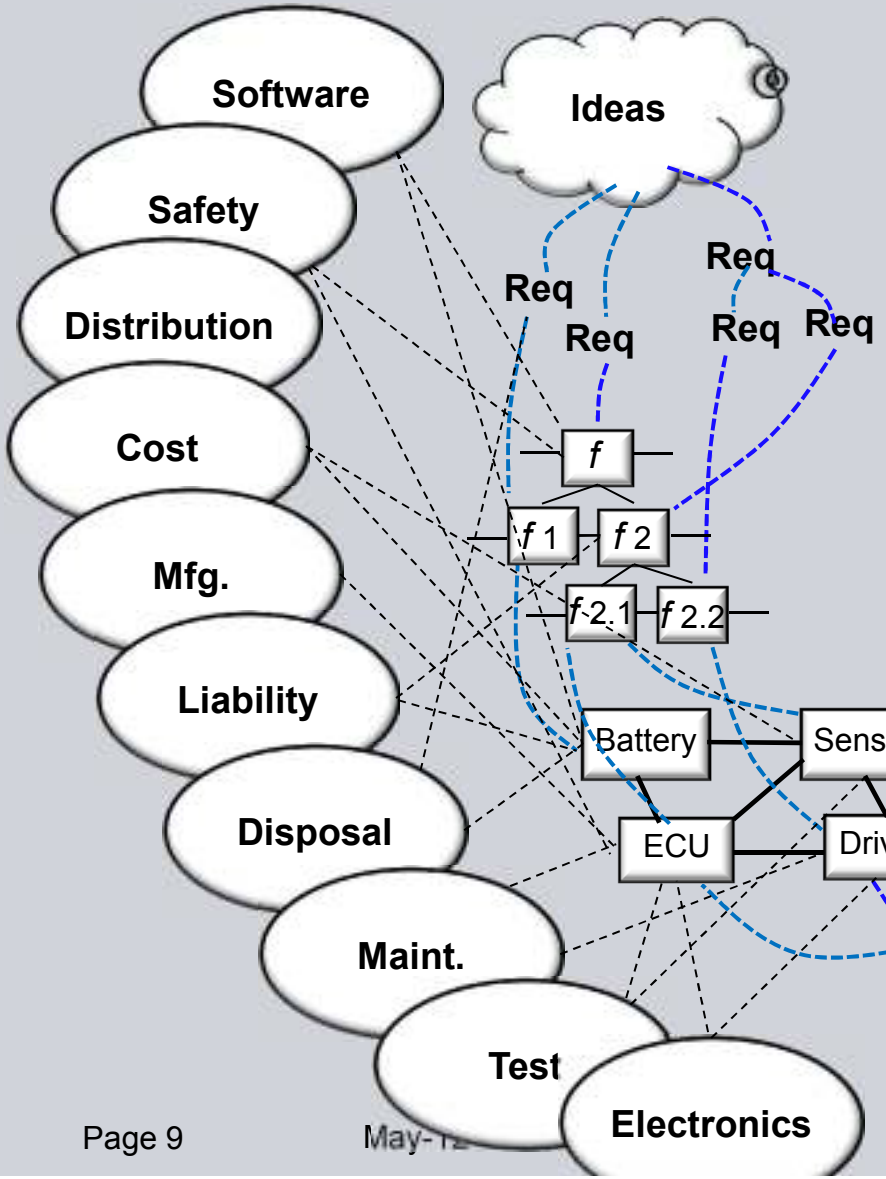
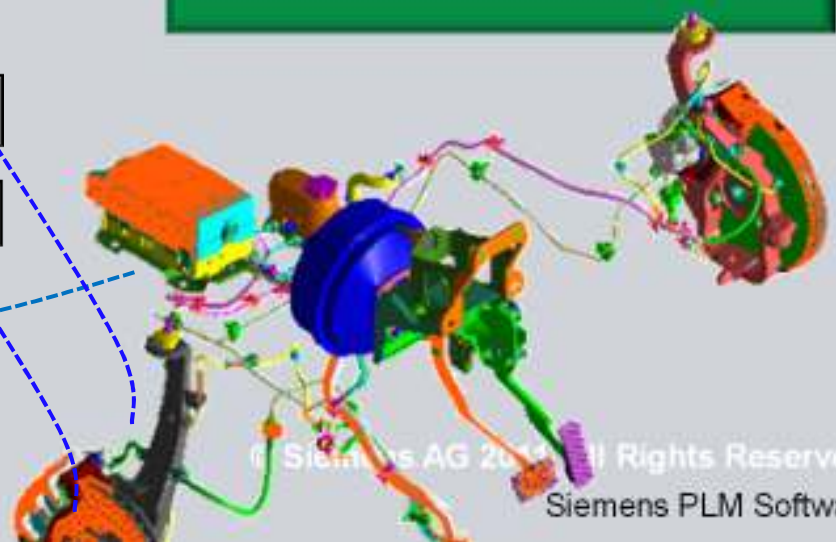
More than RFLP to worry about…



- More to a products life than RFLP…
- No decision is an island
- Need to worry about other views (safety, mfg, cost, test,…)
- Balance product performance against other views to achieve "global optimization"



…managing variation over time

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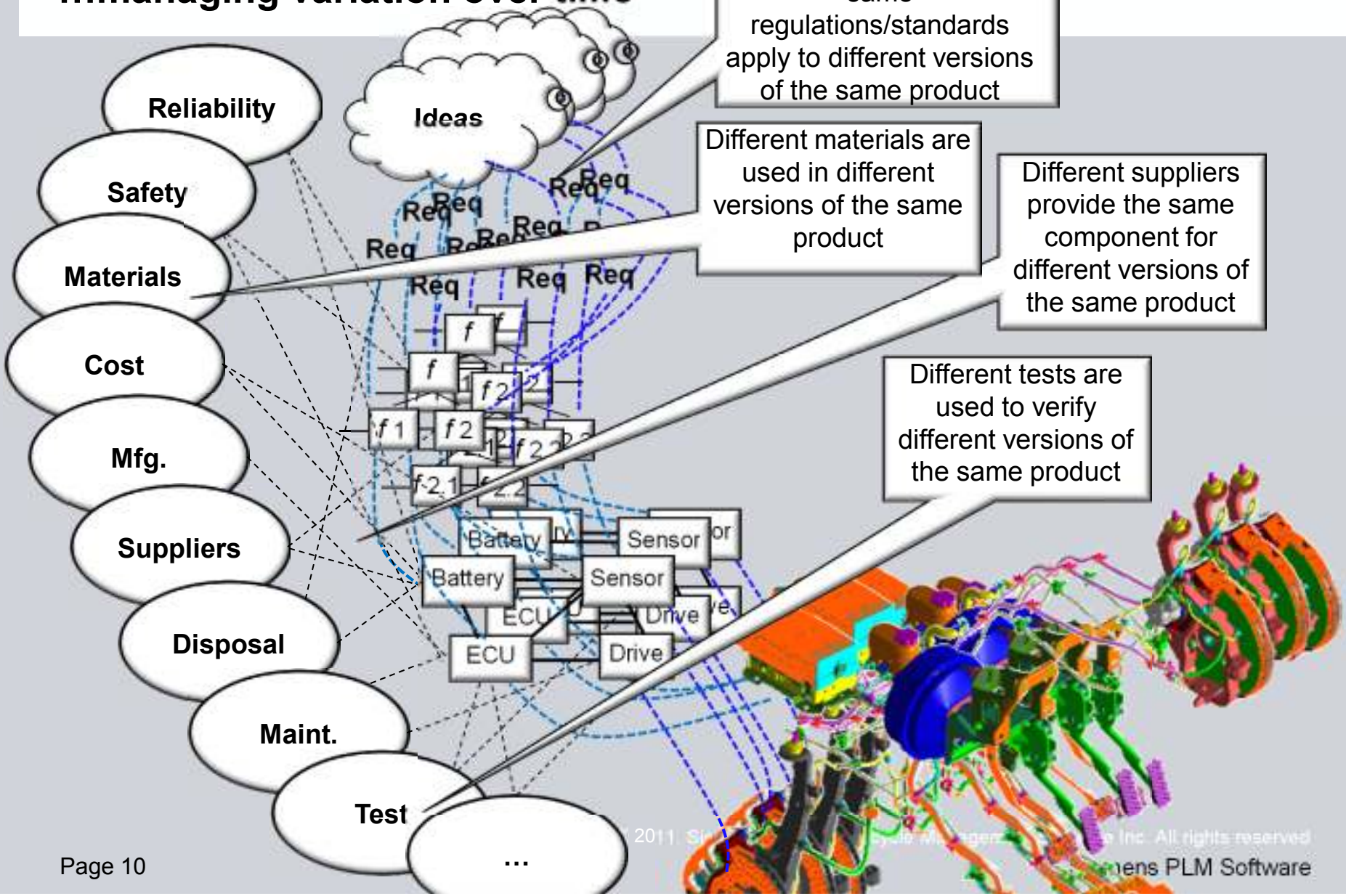

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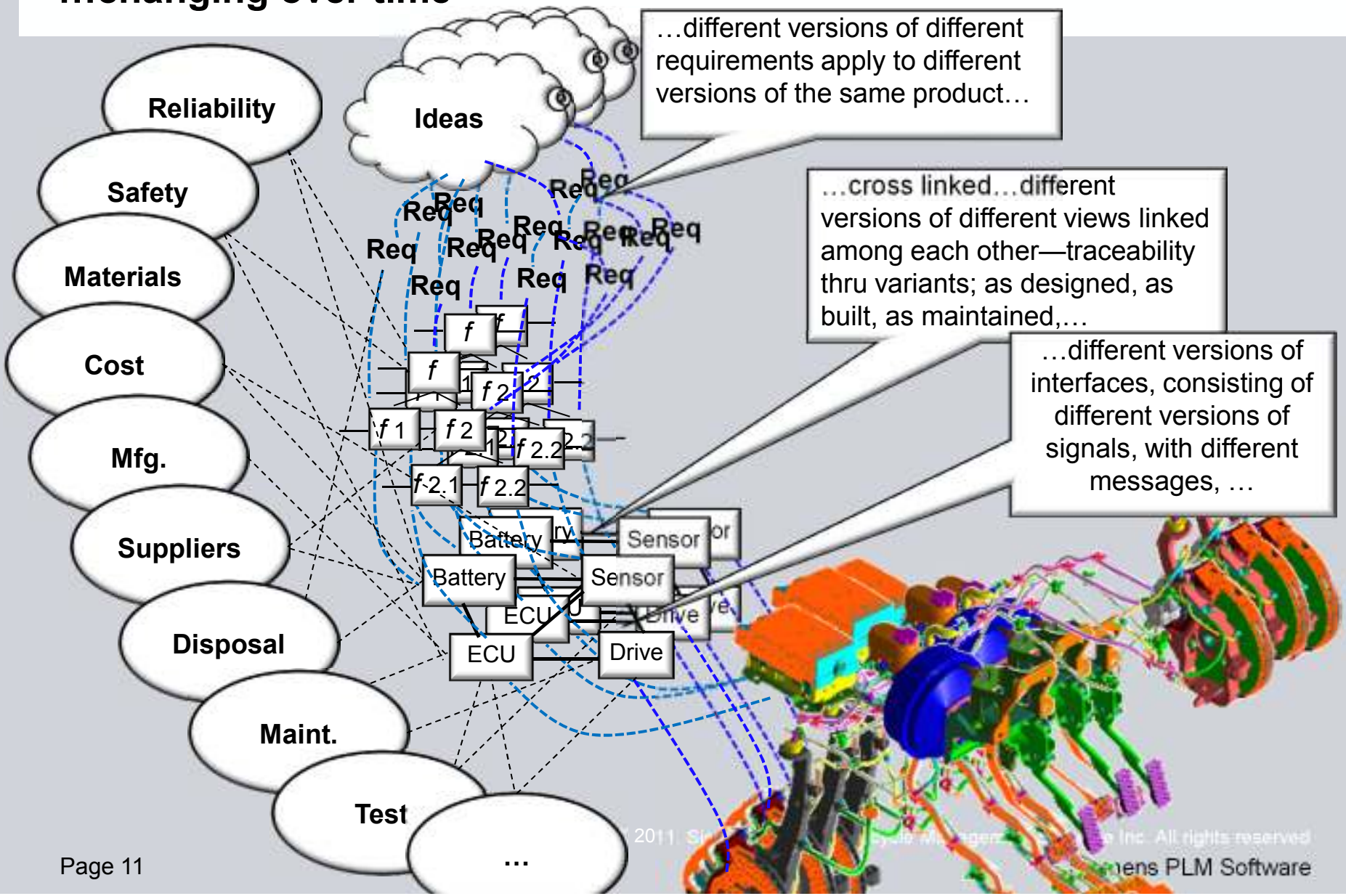
…changing over time[10]



PLM understands versions/variants/change…
RM & SE need to be integrated with PLM…
Up the 'what if' rate

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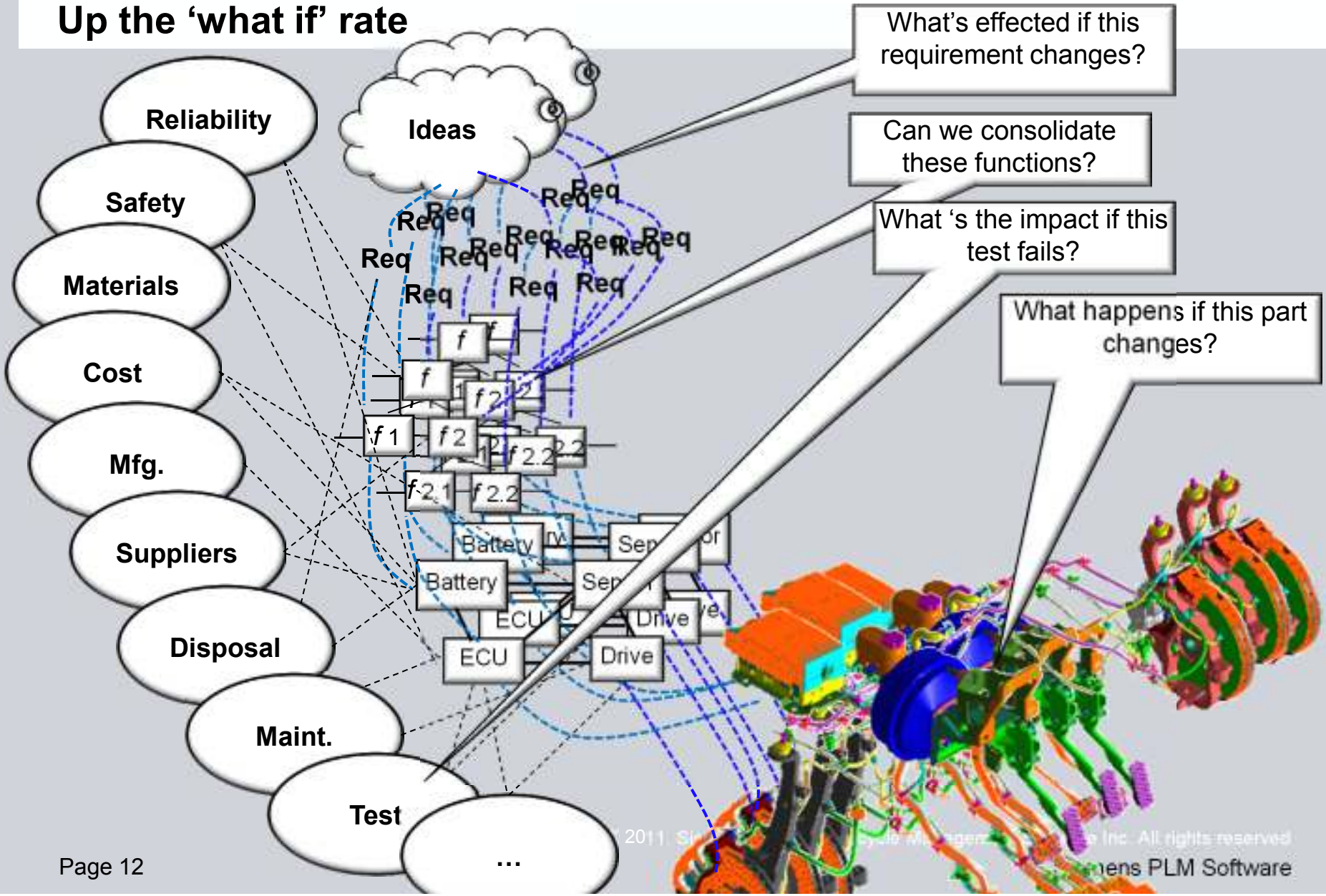

PLM is the place to bring these models together …to enable visibility

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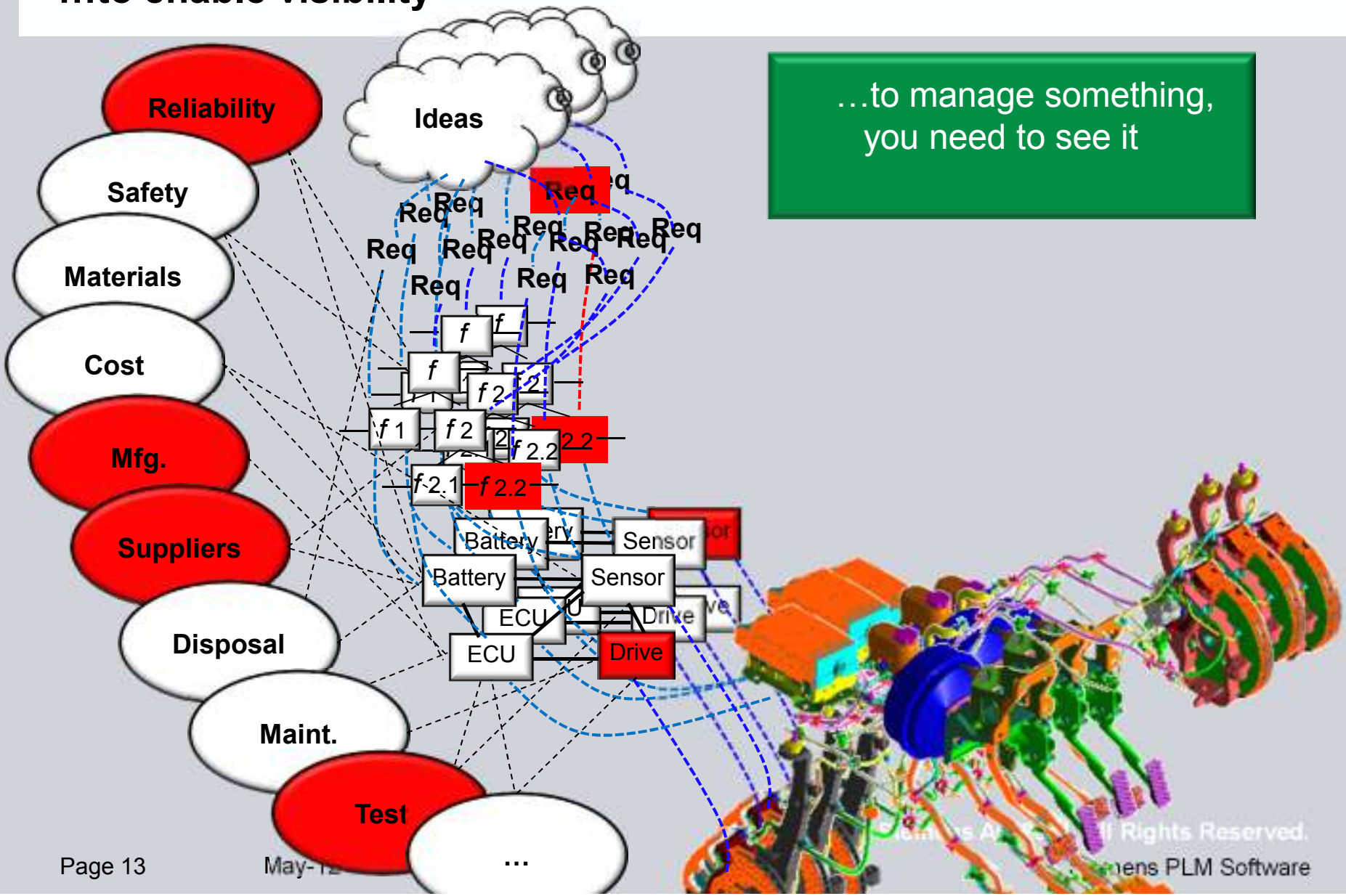
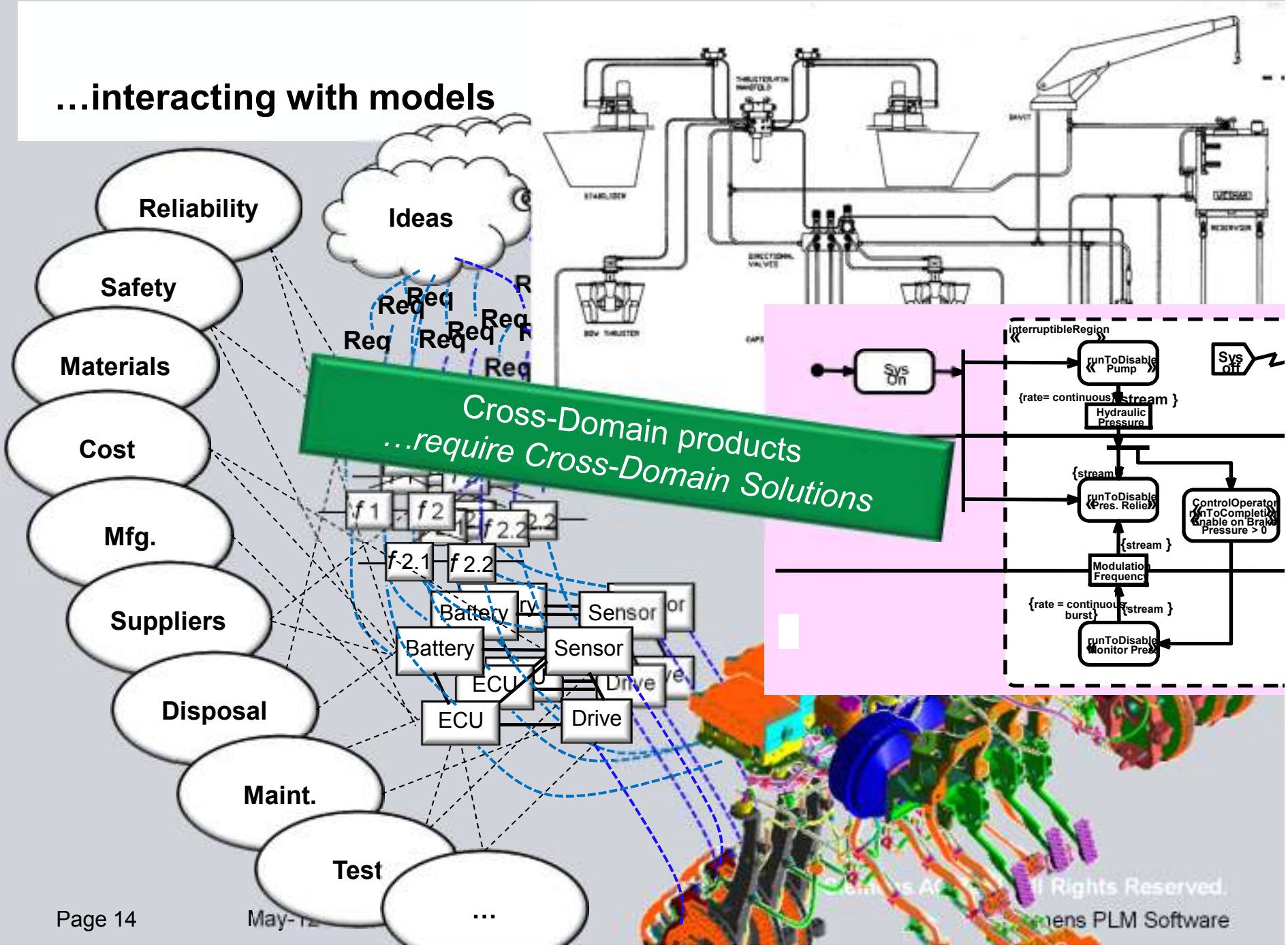


…to manage something, you need to see it

…interacting with models



About Siemens AG…
Four Sectors Cover the Global Trends –

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Industry

- Industry Automation

- Drive Technologies

- Customer Services

Infra-structure & Cities

- Rail Systems

- Mobility and Logistics

- Low and Medium Voltage

- Smart Grid

- Building Technologies

- Osram [1]

Energy

- Fossil Power Generation

- Renewable Energy

- Power Transmission

- Oil & Gas

- Energy Service

Health-care

- Imaging & Therapy

- Clinical Products

- Diagnostics

- Customer Solutions

1) IPO planned

Industry Automation Supporting Customers from Product Design to Production and Beyond

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Product Design and Engineering | **Production Engineering and Automation**

Industry Software

Manufacturing Automation | **Process Automation**

PL
Siemens PLM Software
Grindstaff (CEO)
Affuso (Chairman)

AS
Industrial
Automation Systems
Eberle (CEO)

CE
Control Components and
Systems Engineering
Kaul (CEO)

SC
Sensors and
Communication
Kumpfmüller (CEO)

WT
Siemens
Water Technologies
Dr. Löffler (CEO)

Teamcenter: Delivering Value Across Industries
56,000 Customers, Operating 6.0M+ Seats Across the Globe

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Teamcenter Leadership!
PLM Platform of Choice for Industry

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- **All of the top aircraft engine manufacturers…**
- **All of the top 10 High Tech Electronics…**

- **All of the top 10 Semi-conductor manufacturers…**
- **Most of the Top Shipbuilding companies…**

- **8 of the top 10 aircraft airframe manufacturers…**

- **10 of the top 15 Automotive OEM's…**

- **13 of the top 15 Automotive Suppliers…**

- **14 of the top 15 Machinery manufacturers…**

Managing Product Development means…
we have to manage product models

Where we are…
Model Configuration/Variant Management

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- Models associated with product elements (BOM's)
- Models configured with product structures
- Scalable to massive systems/systems of systems

Millions of parts
1000's of versions
100's of Workflows
100's – 10,000's of People

Where are we…
Requirements moving between physical, mfg, project, … models

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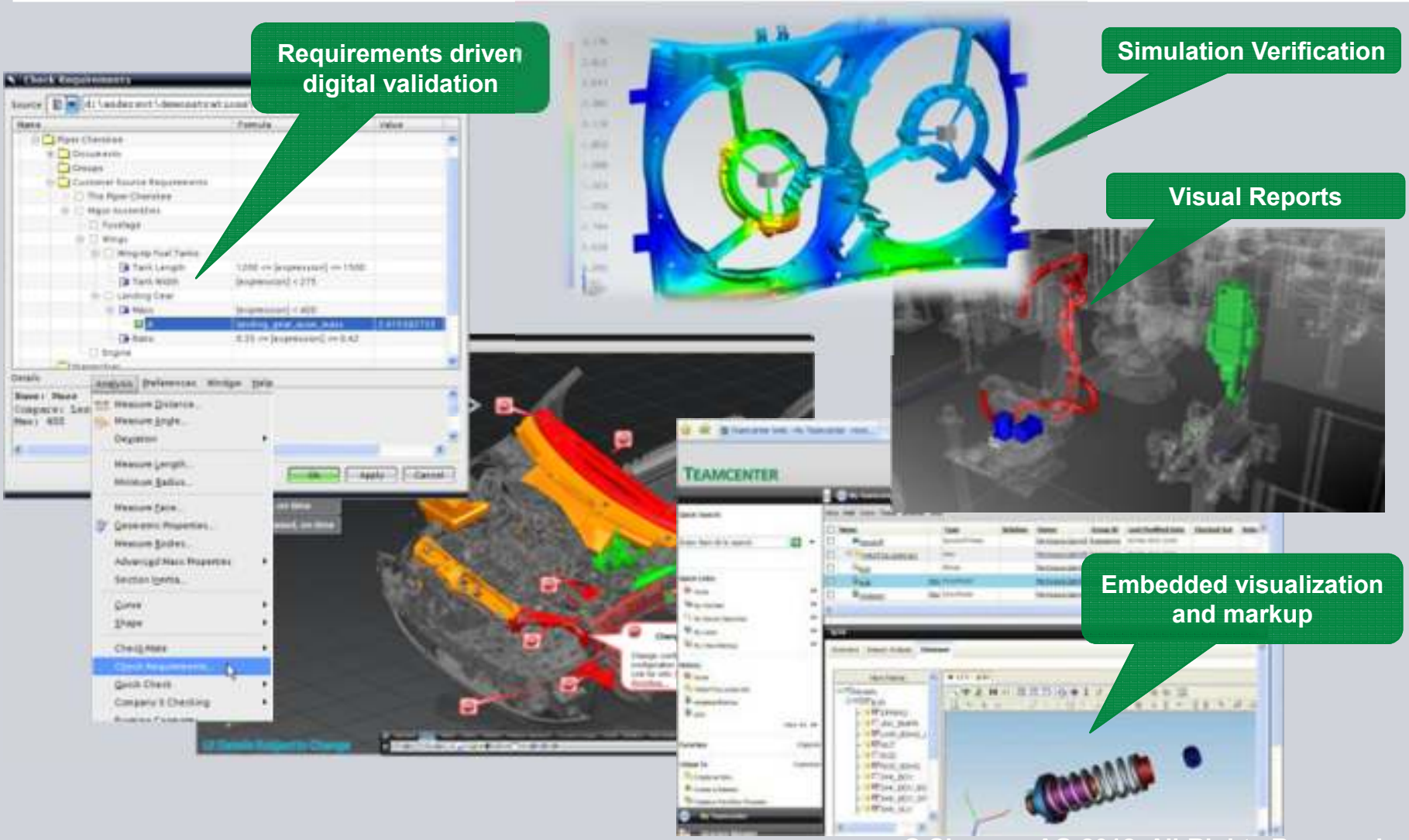

Vision: Integrated systems-oriented decision support…

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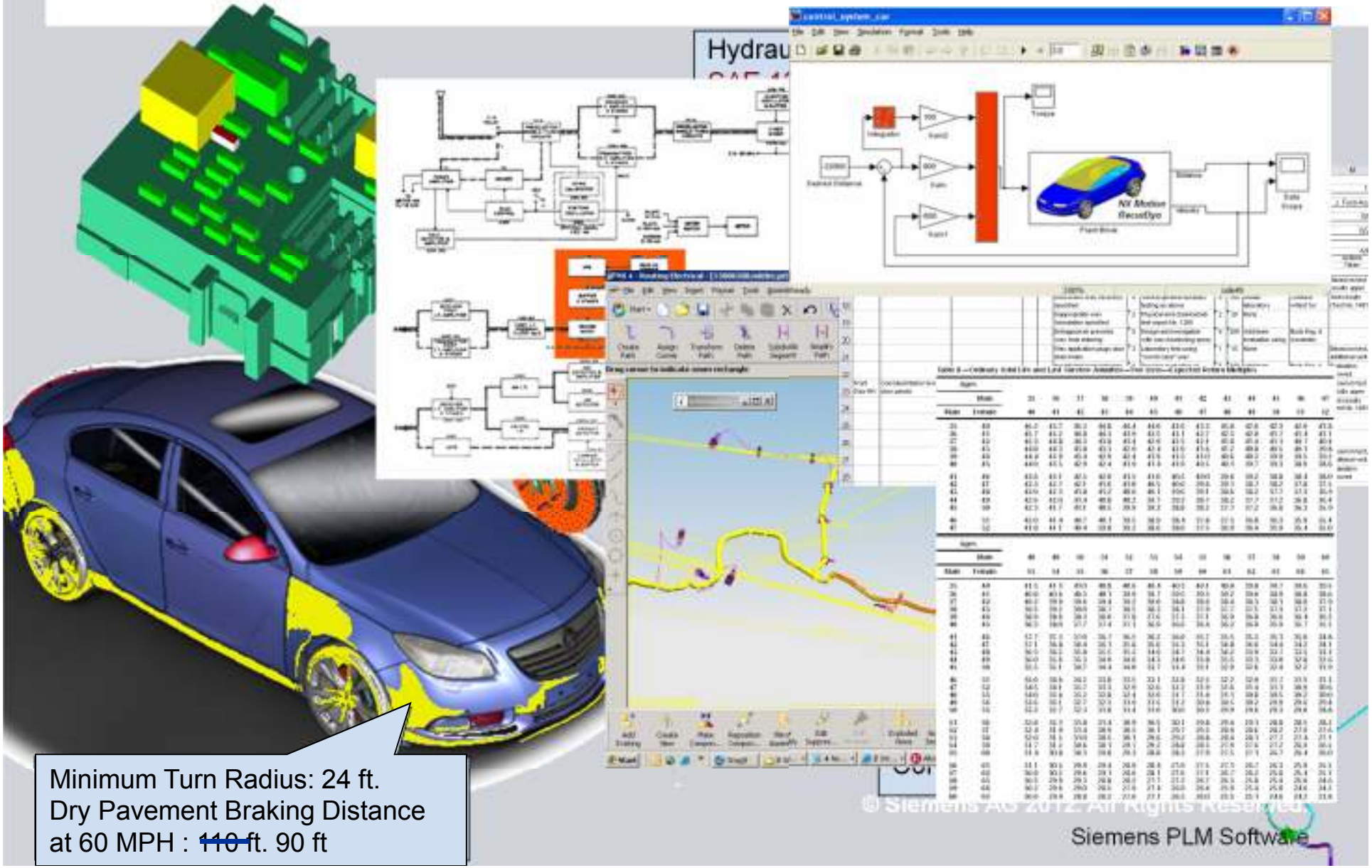
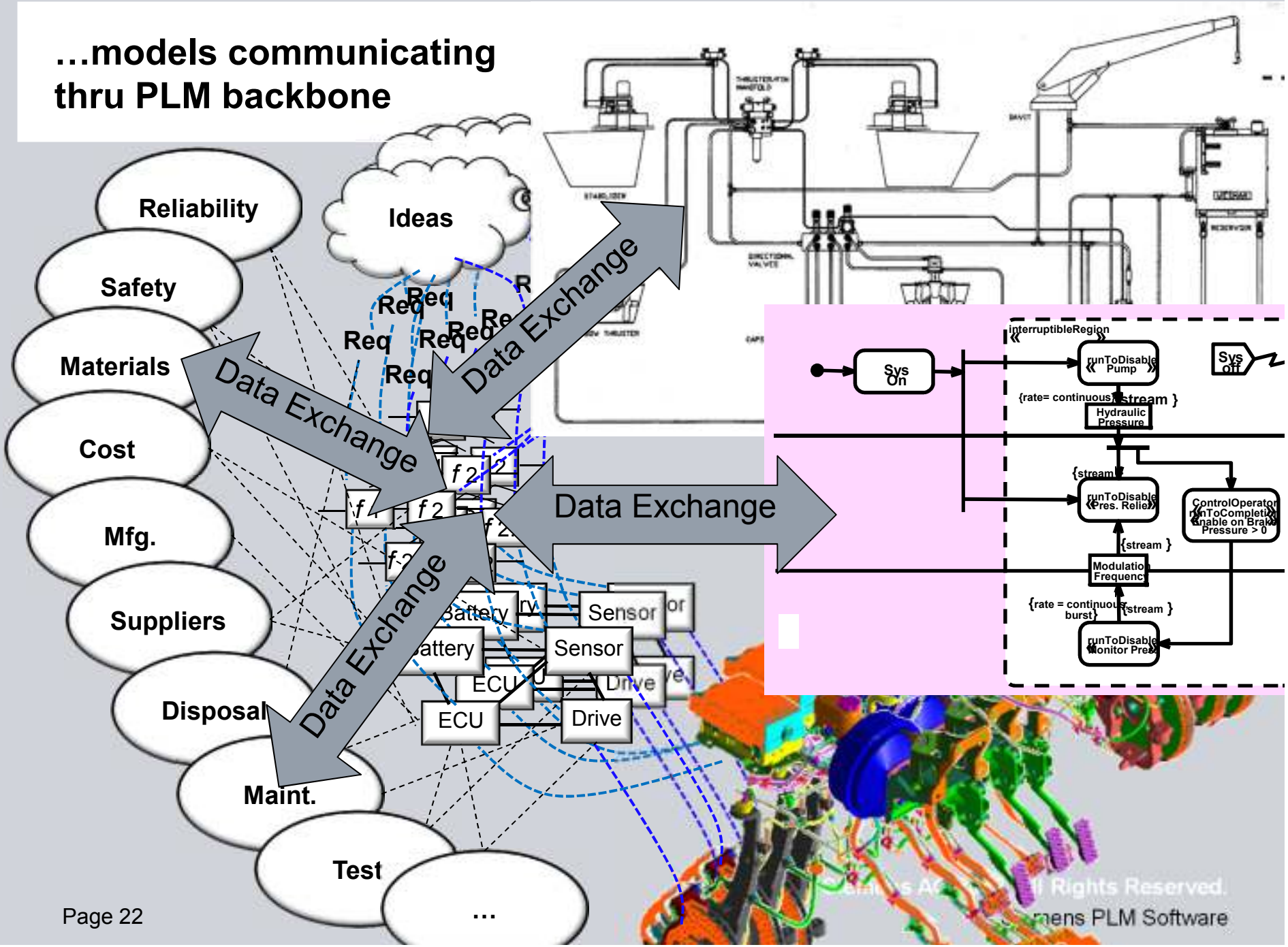


…models communicating thru PLM backbone



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What's missing…

- Interface configuration (consistent levels, messages, etc.)
- Fine-grained Model configuration (not just models on parts, but mapping of interfaces on parts) input/output, ground paths, vibration, corrosion,… including multiple-function components (speaker wire)
- What does a change to an interface/message mean to product configuration
- Standard model exchange (which standard is going to catch on…ISO-AP-233, RIF, OSLC, SLIM,…) plus existing XML/XMI, CSV,…)
- Pervasive exchange standard adoption
- Notation mapping/alignment (SysML, Block diagrams, OPM, DSM, FMEA,…)
- Granularity agreement (Cost vs Mfg vs …)
- System of system model exchange
- Model Fidelity/Confidence agreement (20x20 room)

In the meantime, this requires culture change…

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Documents

Document Generation

Disconnected System Models

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Thank You.