MBSE Initiative Update

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SE Evangelist, Siemens

Wasatch Chapter
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INCOSE IW 2020 MBSE Workshop Cross Cut: SE Transformation & MBSE Initiative Activities and Meetings - For lastest version visit this LINK

Lightening Round Talk

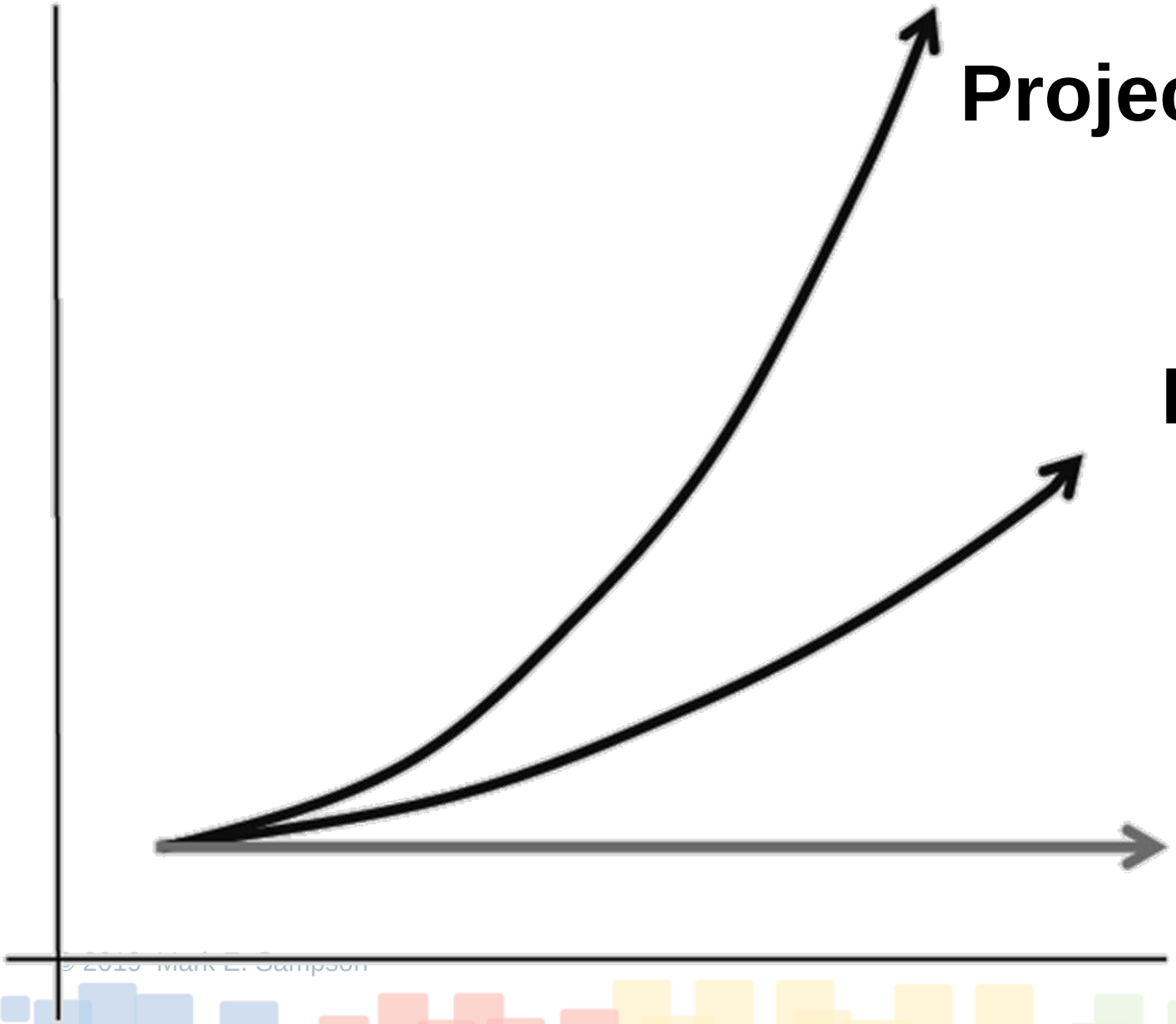
Has related session(s)

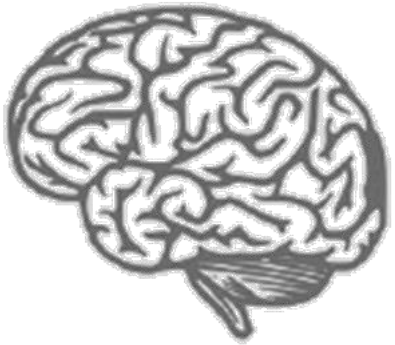
Saturday January 30, 2021

Start	End	MBSE Iniatitive	Transformational, Cross Cutting, Challenge Teams, Collaborations, DEIX...	Tool Integration and Model Lifecycle Mgmt (TIMLM) & NAFEMS-INCOSE SMSWG WG, SETDB	Requirements WG	MBX Ecosystems/OpenMBEE, Model-Based Capabilities Matrix, PM-SE Integration	Space Systems WG, MBSE Patterns WG Activities, Architecture WG & EA	Natural Systems, Training, Knowledge Management WGs	Social Systems, Complex Systems, Systems Security INSIGHT, Production & Logistics	Systems Science
8:00	10:00									
10:00	10:30	**Break**								**Break**
10:30	11:00	Opening: MBSE Initiative Update (Mark Sampson) Salon E	OOSEM Process Model Demonstration (Howard Lykins)		Requirements WG Closed Meeting (Tami Katz)			Intro to Natural Systems (Curt McNamara)	Introduction to Social Systems WG (Erika Palmer, Randy Anway)	Systems Science WG (Javier Calvo-Amodio, James Martin)
11:00	12:00	MBSE Keynote Speaker: Dr. Willy Donaldson (Culture Change Panel) Salon E								
12:00	13:00	**Lunch**								**Lunch**
13:00	13:10	Opening: Inspire MBSE Lightning Talks Salon E			Requirements WG Open Meeting (Tami Katz)		Space Systems Working Group Outreach CubeSat System Reference Model (Alex Levi)	Function Based Methods in Natural Systems & SE (Curt McNamara)	Complexity and Social Systems WG (Erika Palmer, Randy Anway)	Systems Science WG (Javier Calvo-Amodio, James Martin)
13:10	13:30	TBD Salon E								
13:30	13:50	TBD Salon E	DEIX WG Planning Session (Frank Salvatore)	SE Tools Database (John Nallon)						
13:50	14:10	TBD Salon E								
14:10	14:30	TBD Salon E								
14:30	15:00	TBD Salon E								
15:00	15:30	**Break**								**Break**
15:30	15:40	Opening:Inspire MBSE Lightning Talks Salon E		SE Tools Database (John Nallon)	Requirements WG Open Meeting (Tami Katz)					Systems Science WG (Javier Calvo-Amodio, James Martin)
15:40	16:00	TBD Salon E								
16:00	16:20	TBD Salon E								
16:20	16:40	TBD Salon E								
16:40	17:10	SE Inspire MBSE Lightning Speaker Interaction/Q&A Salon E								
17:10	17:30	MBSE Workshop Wrap up & Look ahead (Mark Sampson & Troy Peterson) Salon E								
18:00	21:00									

A failure to communicate…

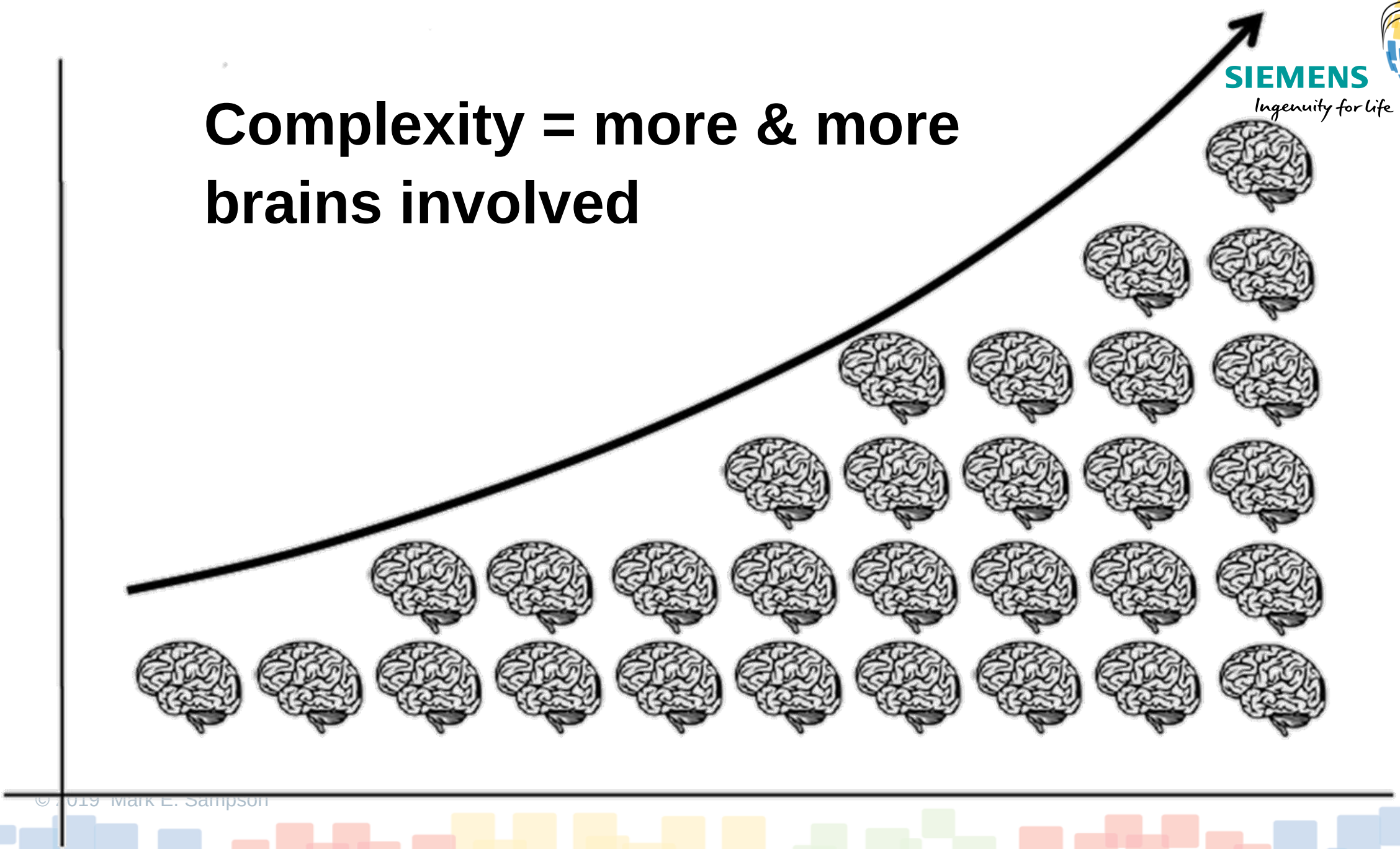
Start Integrated, Stay Integrated



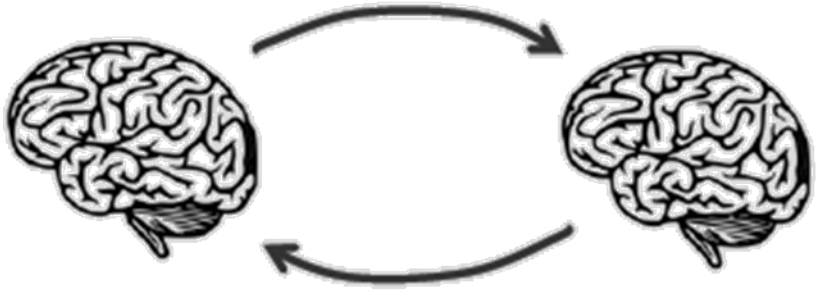


[Fostering MBSE, Bonnet, Navas INCOSE MBSE Workshop 2020]

Complexity = more & more brains involved

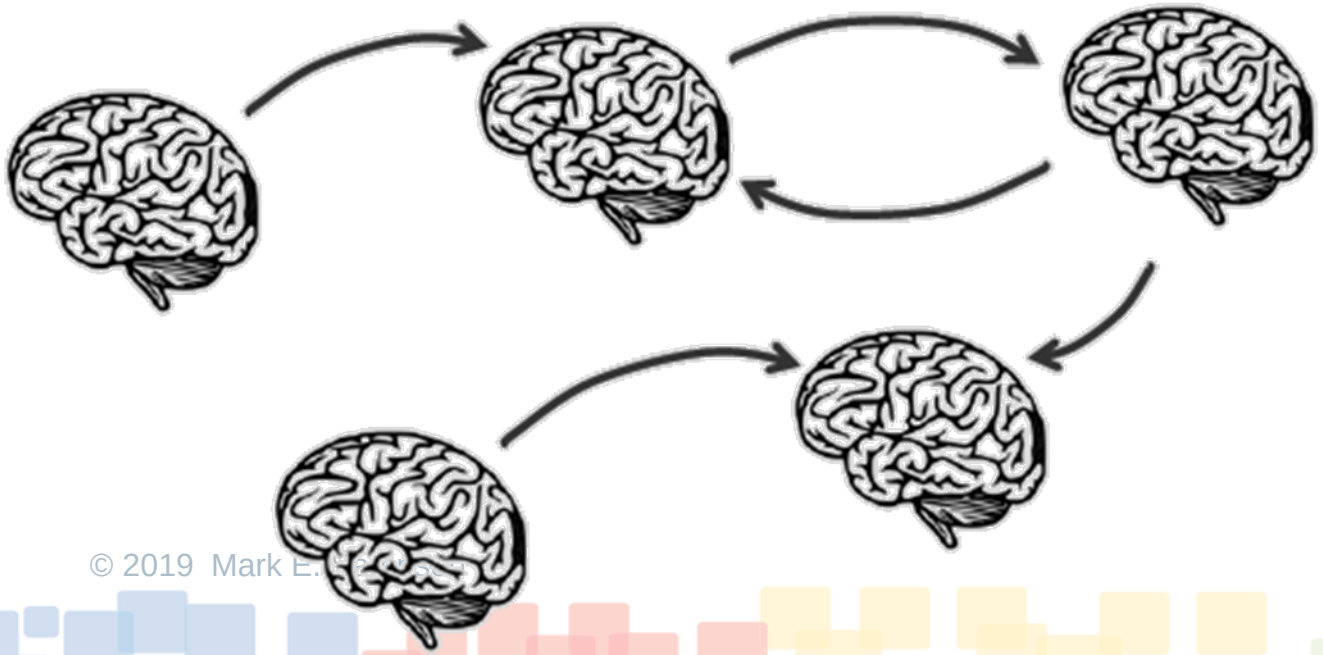


Doing more, with more constraints, less time



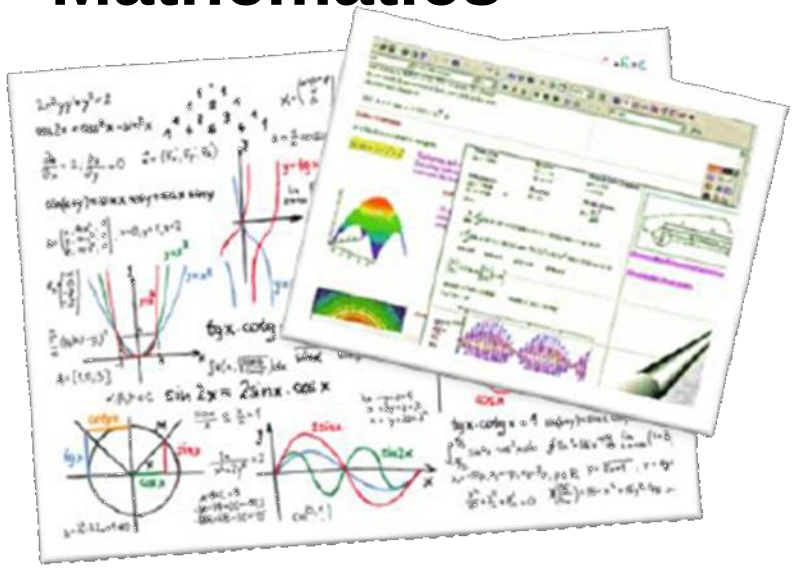
Dealing with very demanding customers

Interacting with more people



Communication & Information Management Problem

Mathematics



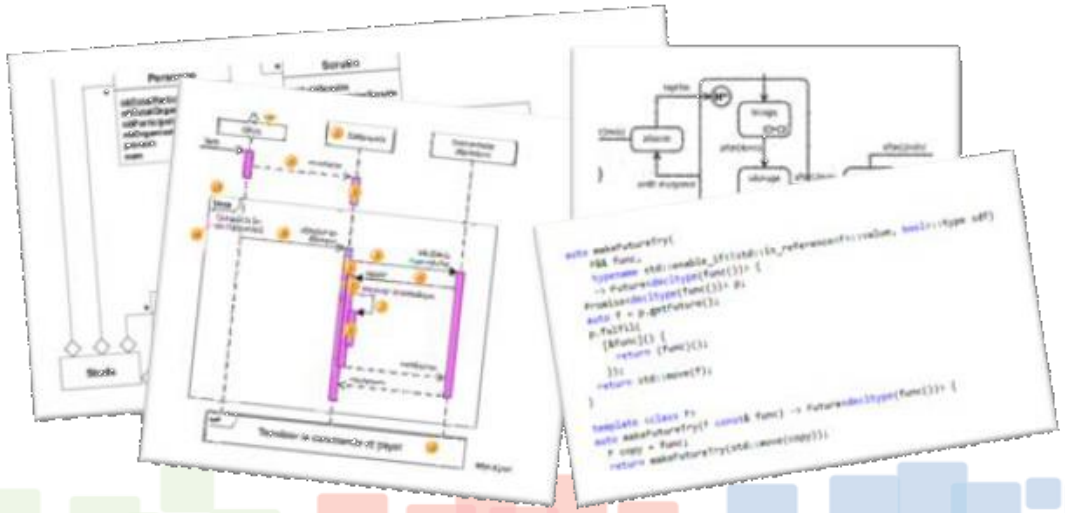
Construction

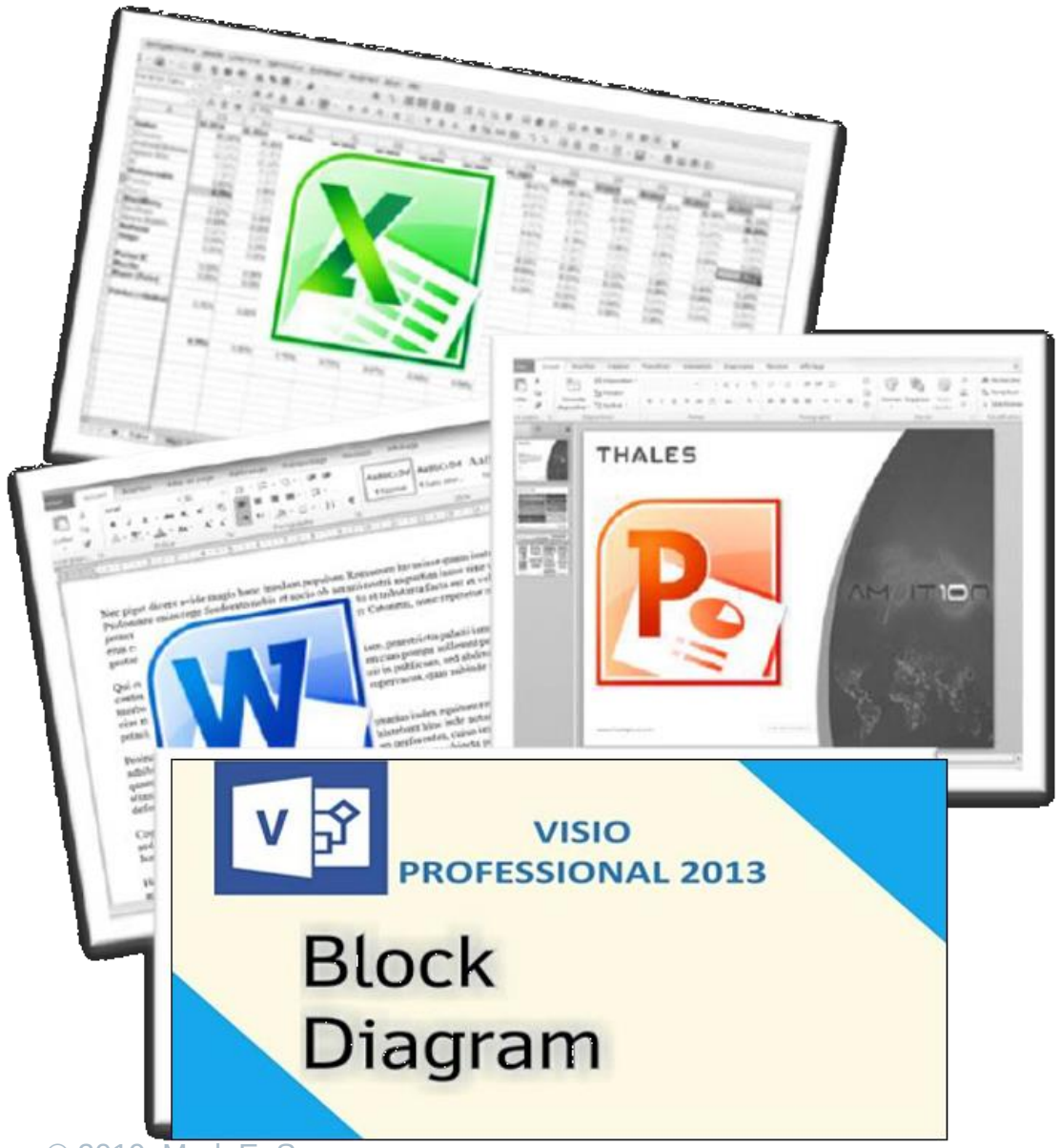
SIEMENS
Ingenuity for life

Language

Electronics

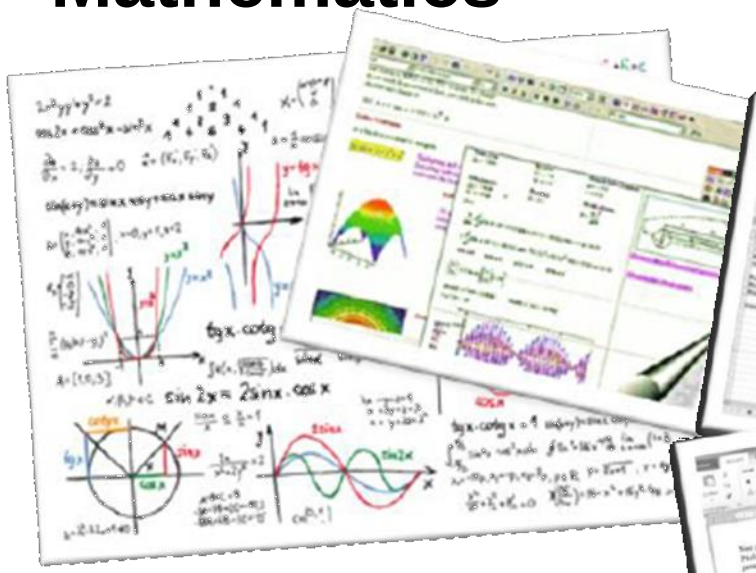
Software



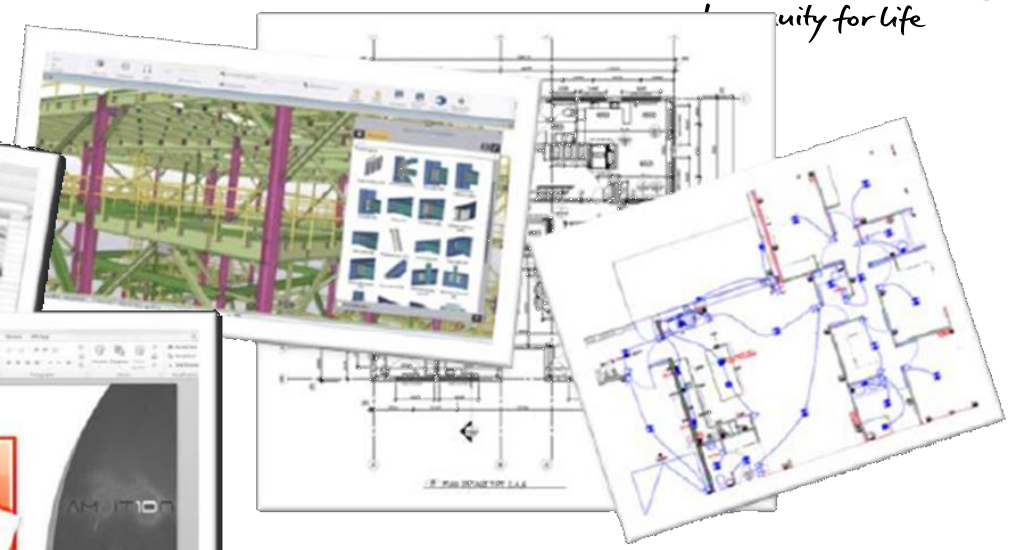


Systems Engineering

Mathematics



Construction



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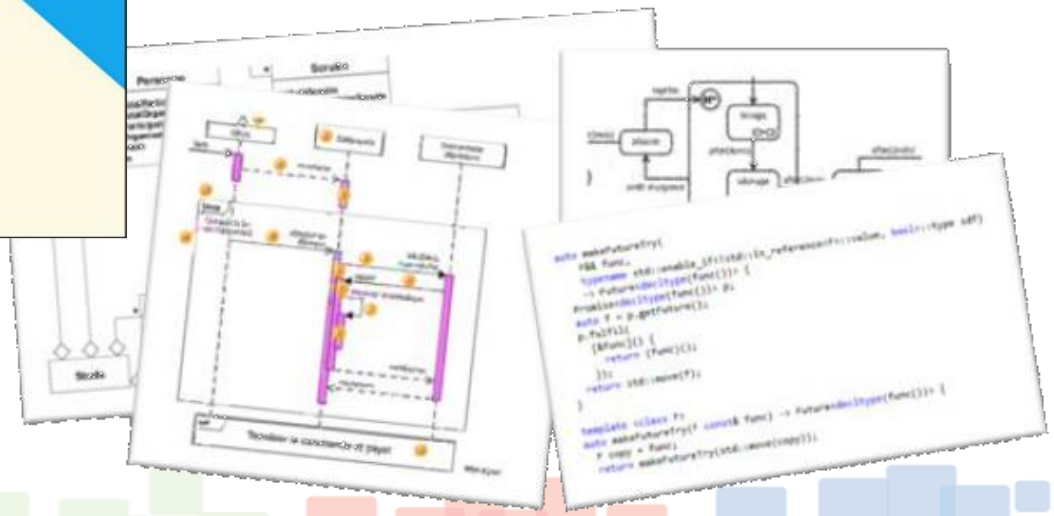

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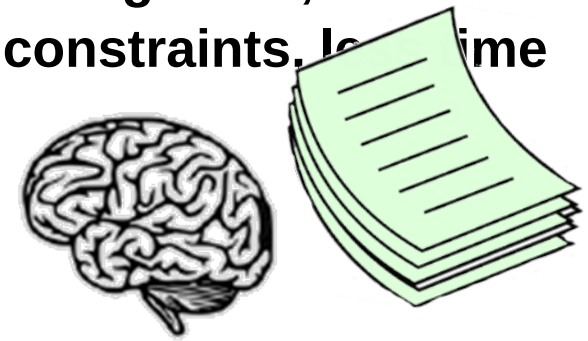
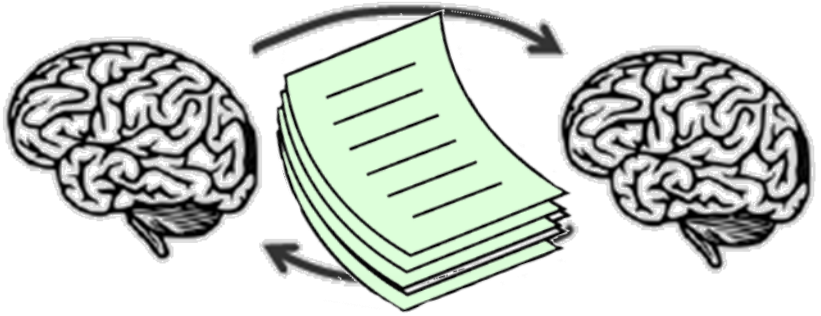
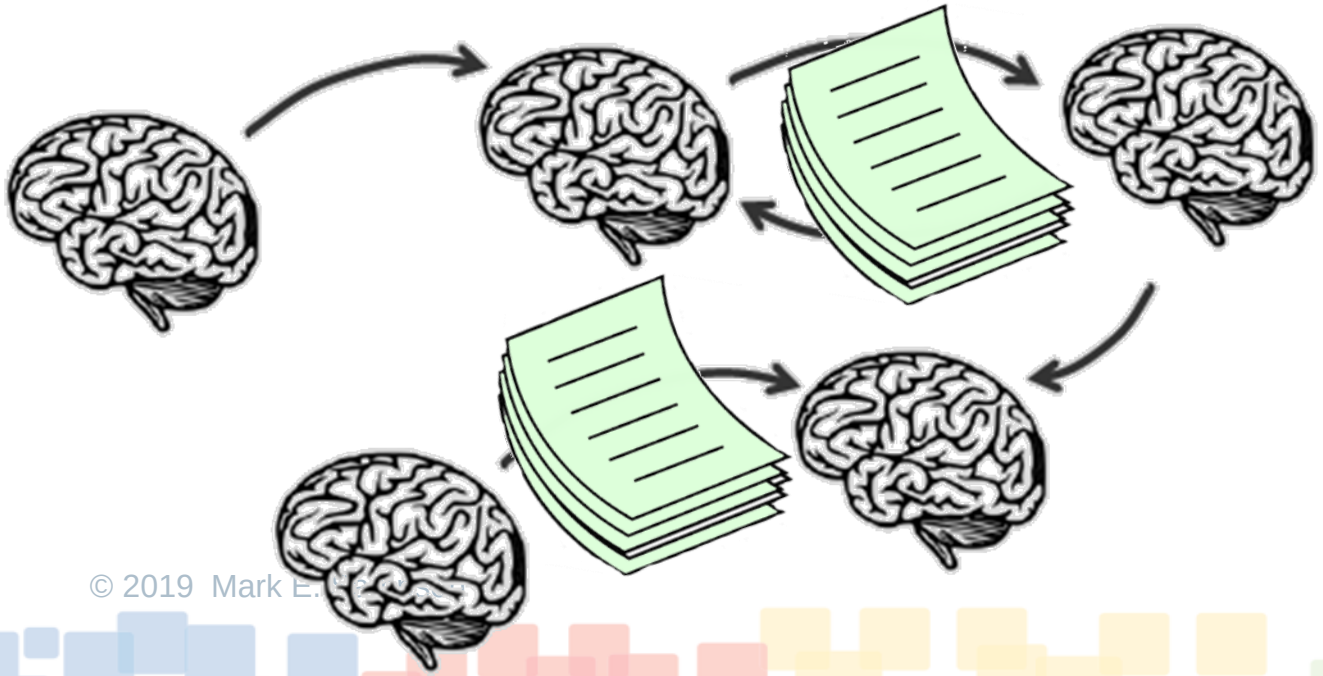




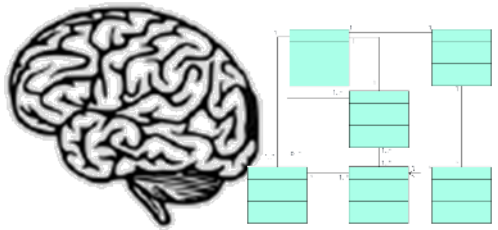
Dealing with very demanding customers

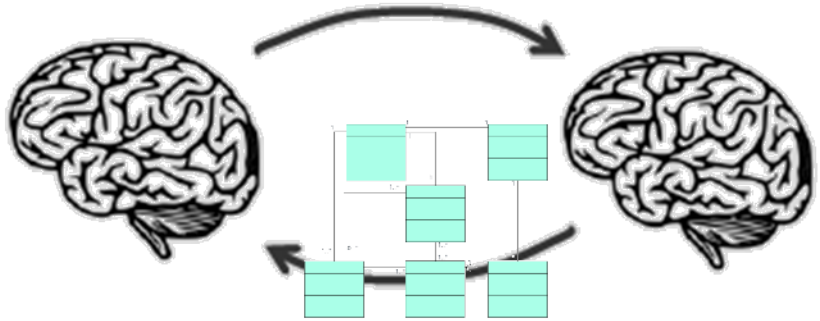
Interacting with more people



Documents don’t scale…

Doing more, with more constraints, less time





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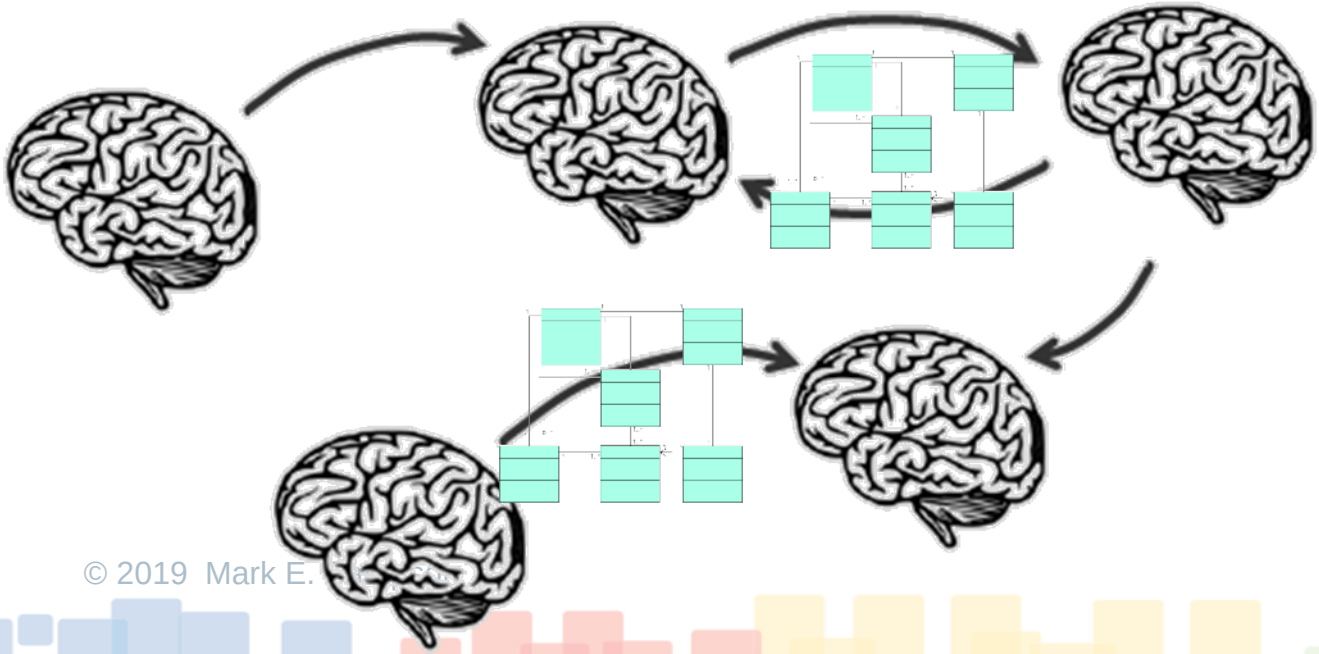
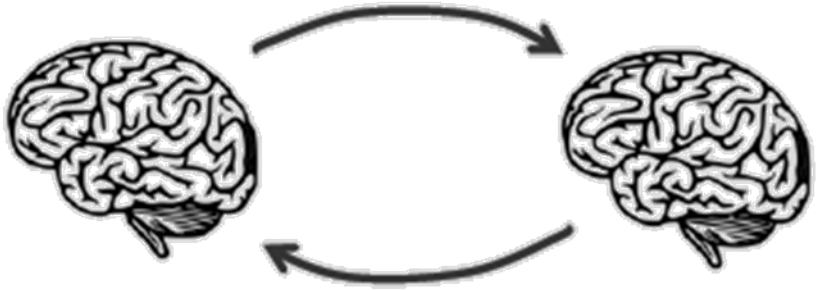


Models without common methods/grammar can’t communicate meaning

Doing more, with more constraints, less time



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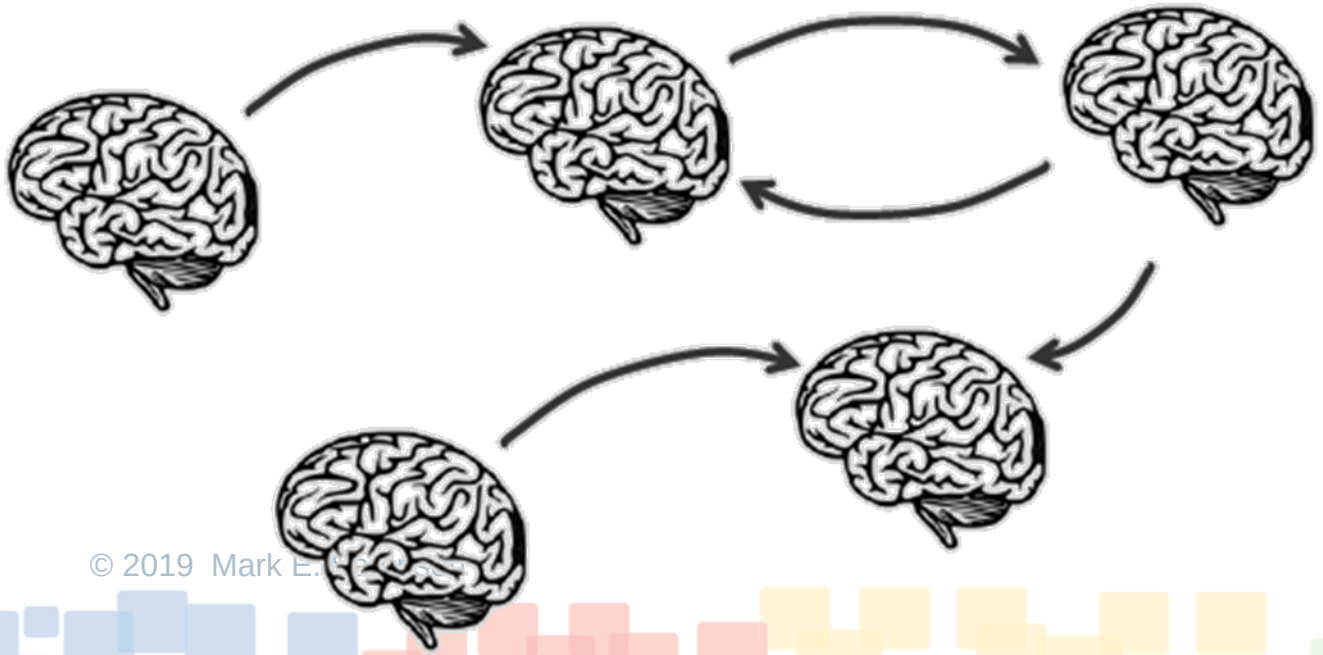

This is not an Engineering Problem…

We have a Communication & Information Mgmt Problem

Integrated MBSE Vision
What does the integrated digital thread look like…

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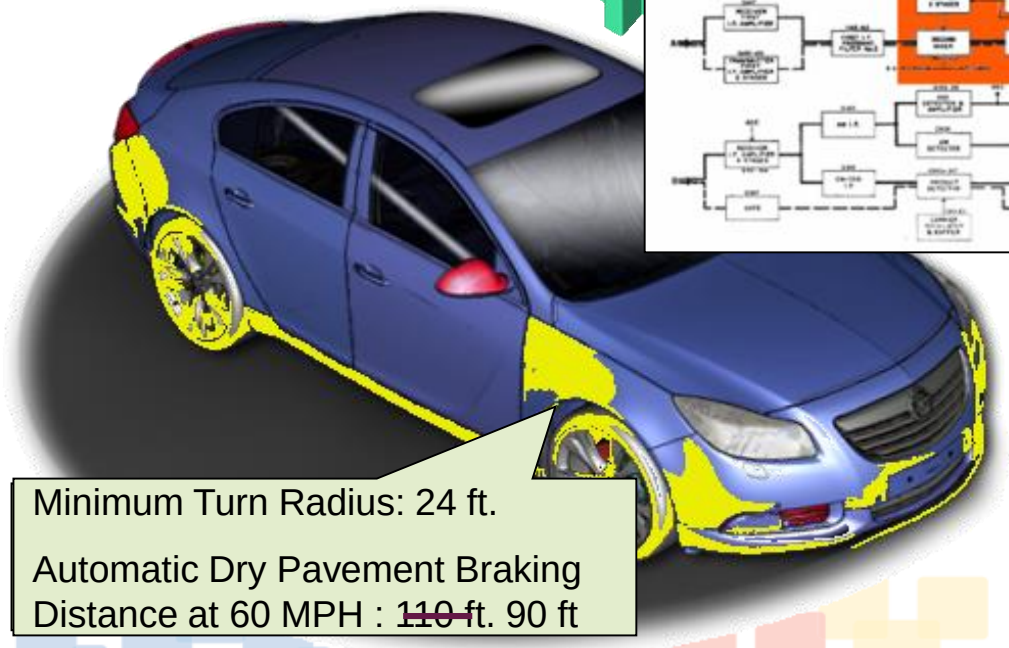
Ingenuity for life

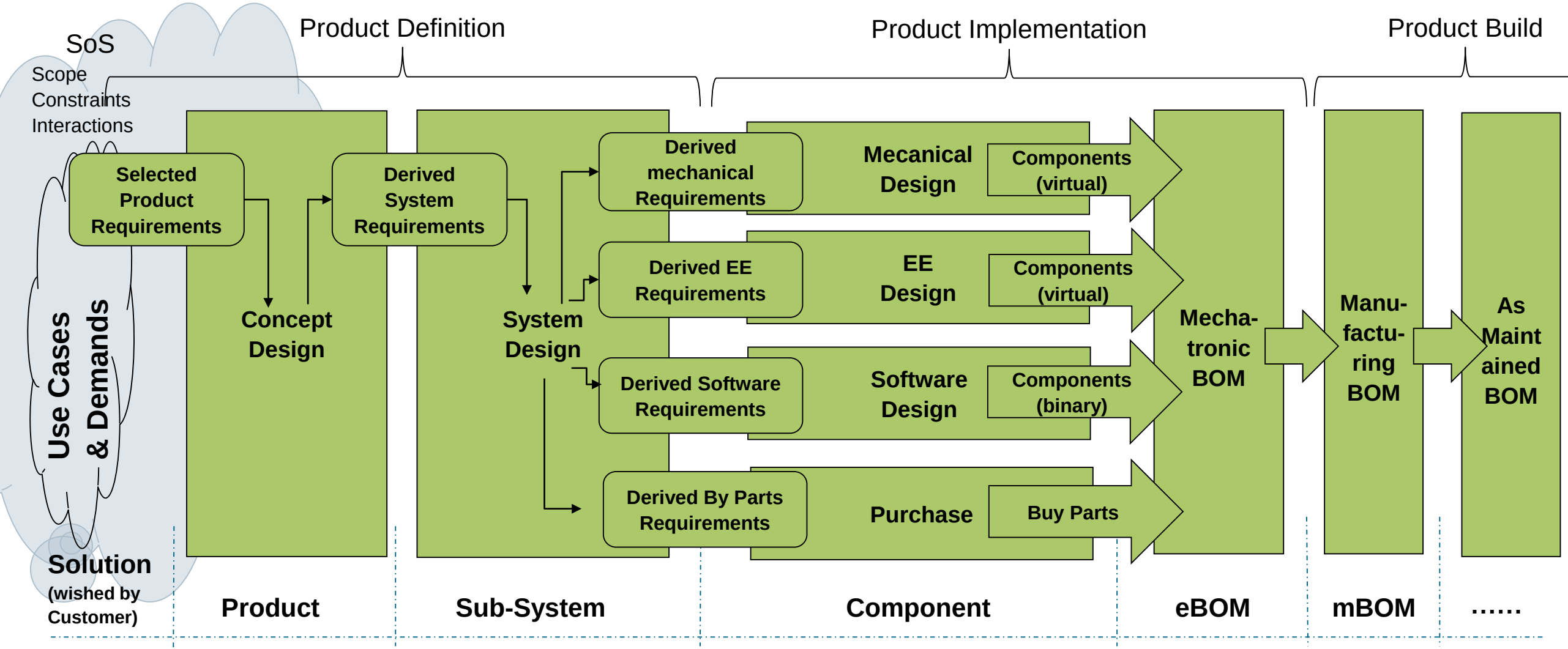
Hydraulic Fluid:
SAE 1340 not-compliant



Minimum Turn Radius: 24 ft.

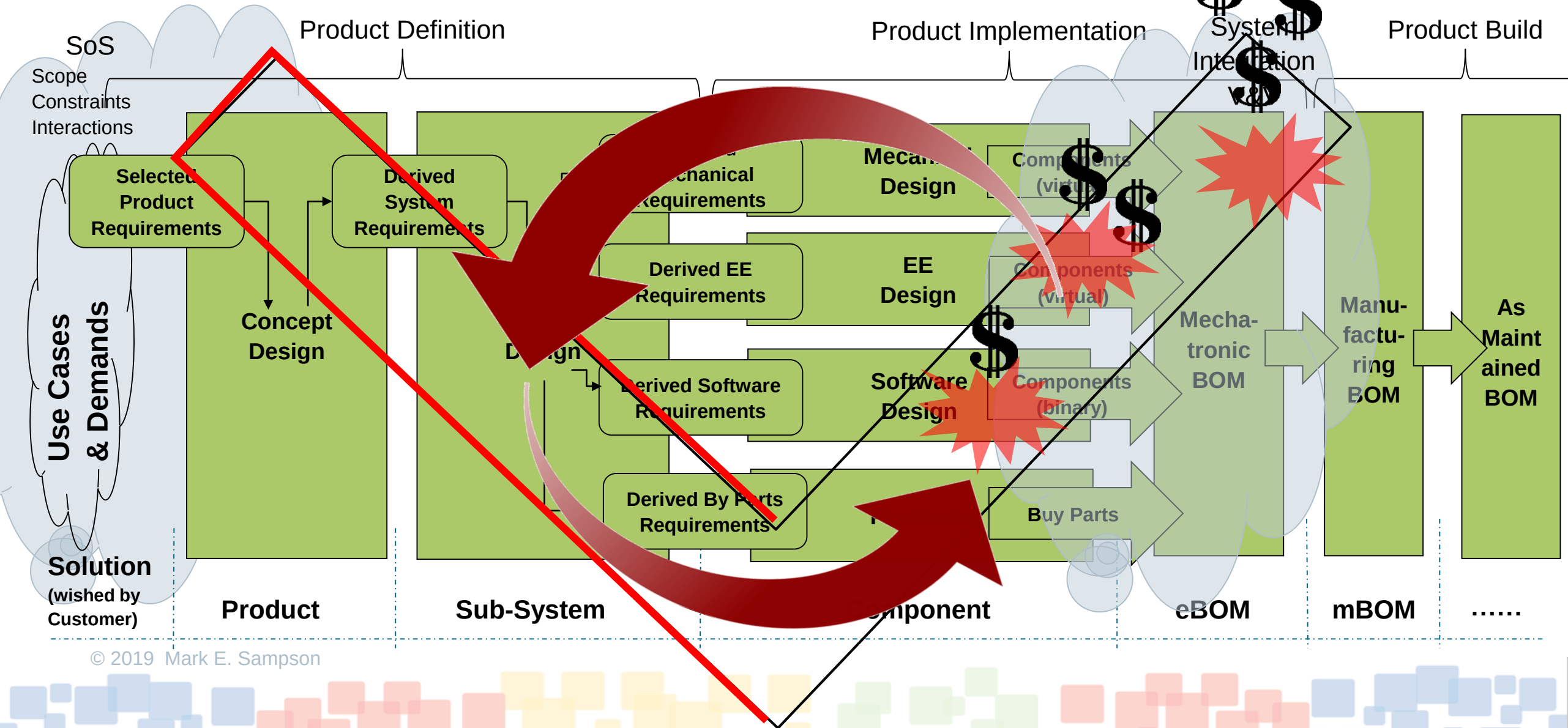
Automatic Dry Pavement Braking Distance at 60 MPH : ~~110 f~~t. 90 ft

MBSE Process…
Shift left…

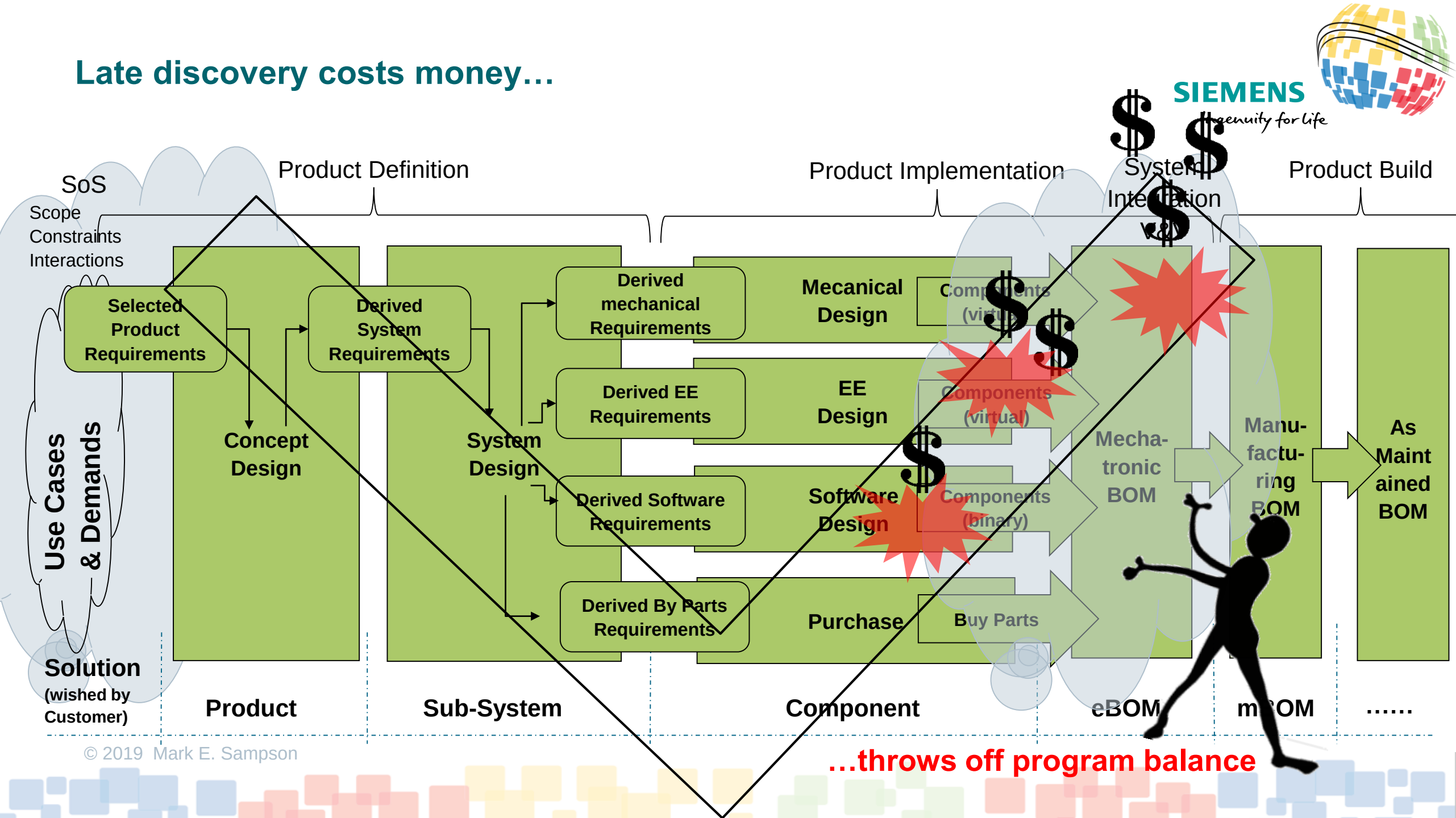


Failure to communicate architecture downstream…

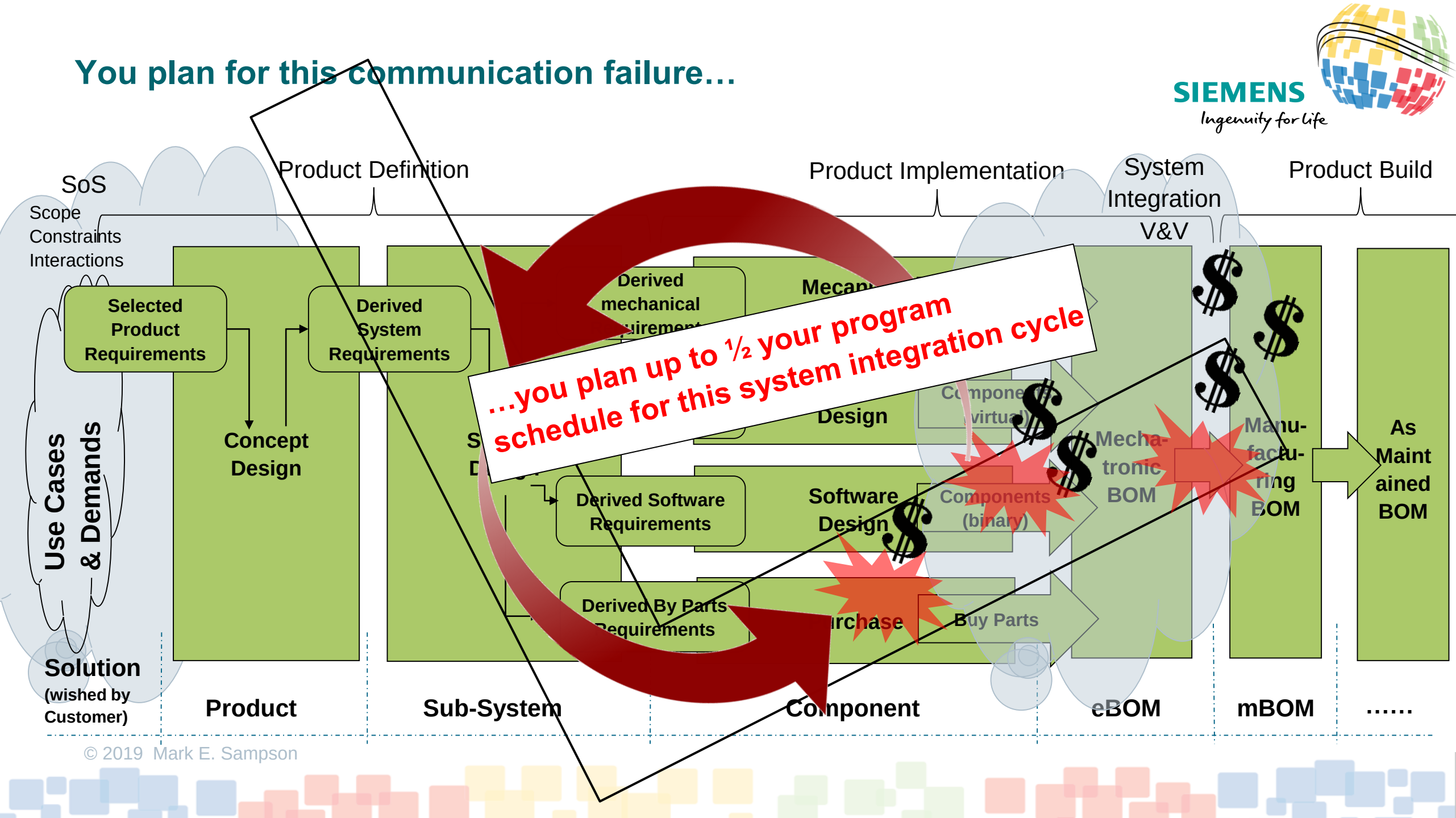
Late discovery of integration problems



Late discovery costs money…



You plan for this communication failure…



Unprecedented complexity: Autonomous Vehicle Validation

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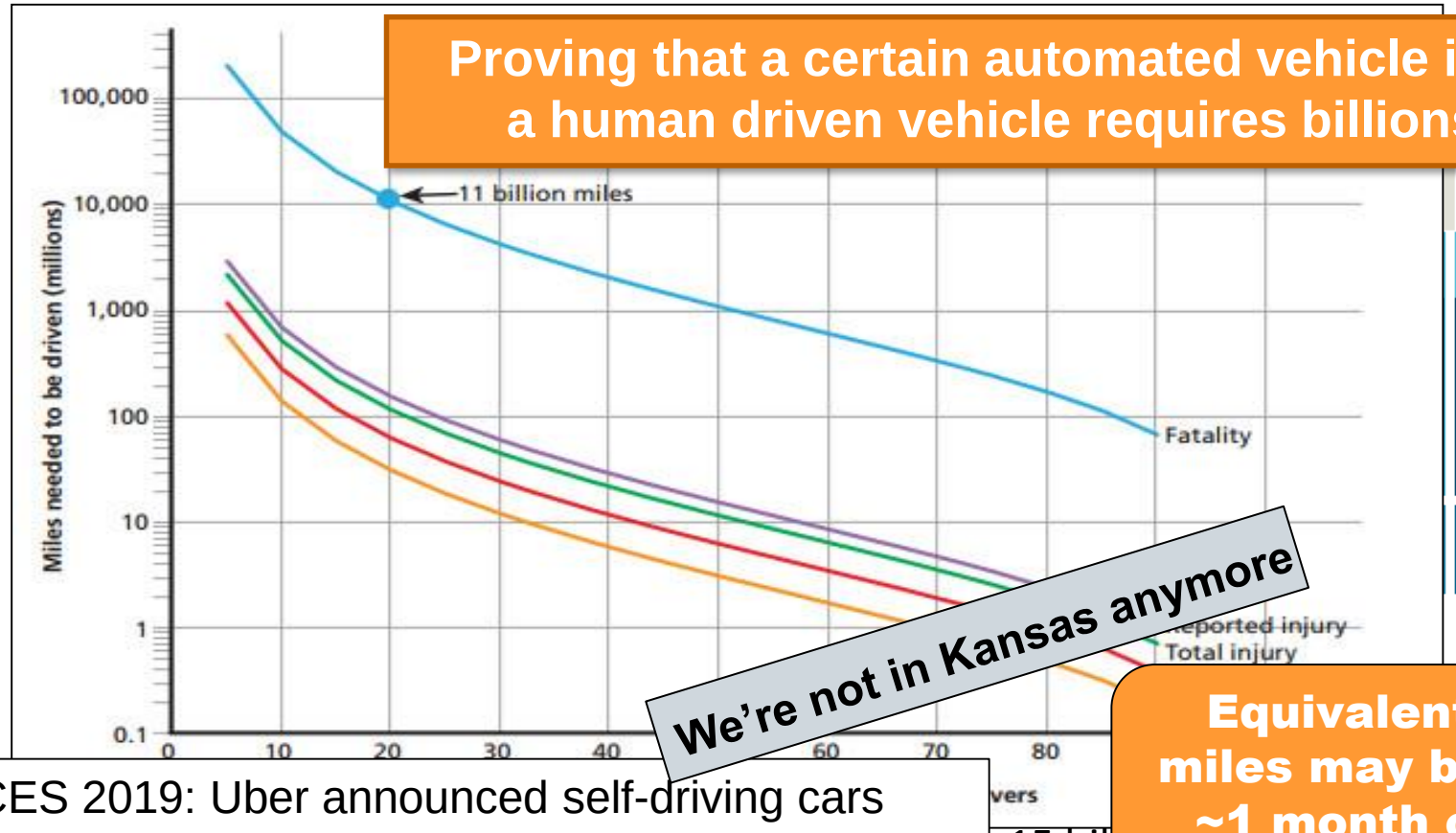
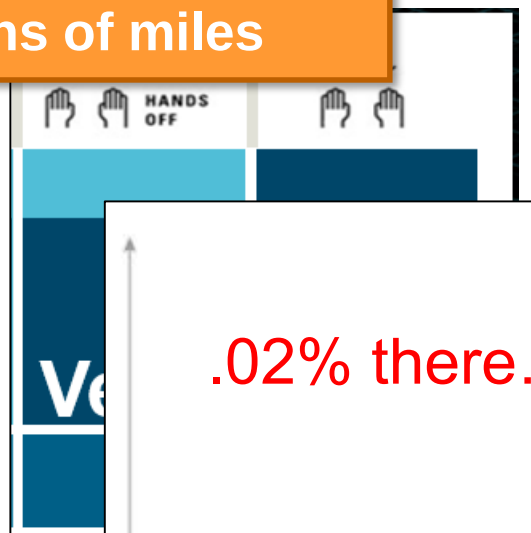
Proving that a certain automated vehicle is safer than a human driven vehicle requires billions of miles



We're not in Kansas anymore



Equivalent 'virtual' miles may be driven in ~1 month on Digital Twins

CES 2019: Uber announced self-driving cars flying its banner have logged more than 50,000 passenger trips and more than 2 million autonomous miles to date, with the most recent million miles being driven over the course of 100 days.

Unprecedented Product Complexity: becoming unaffordable…
Norm was right (Augustine's Law #16)

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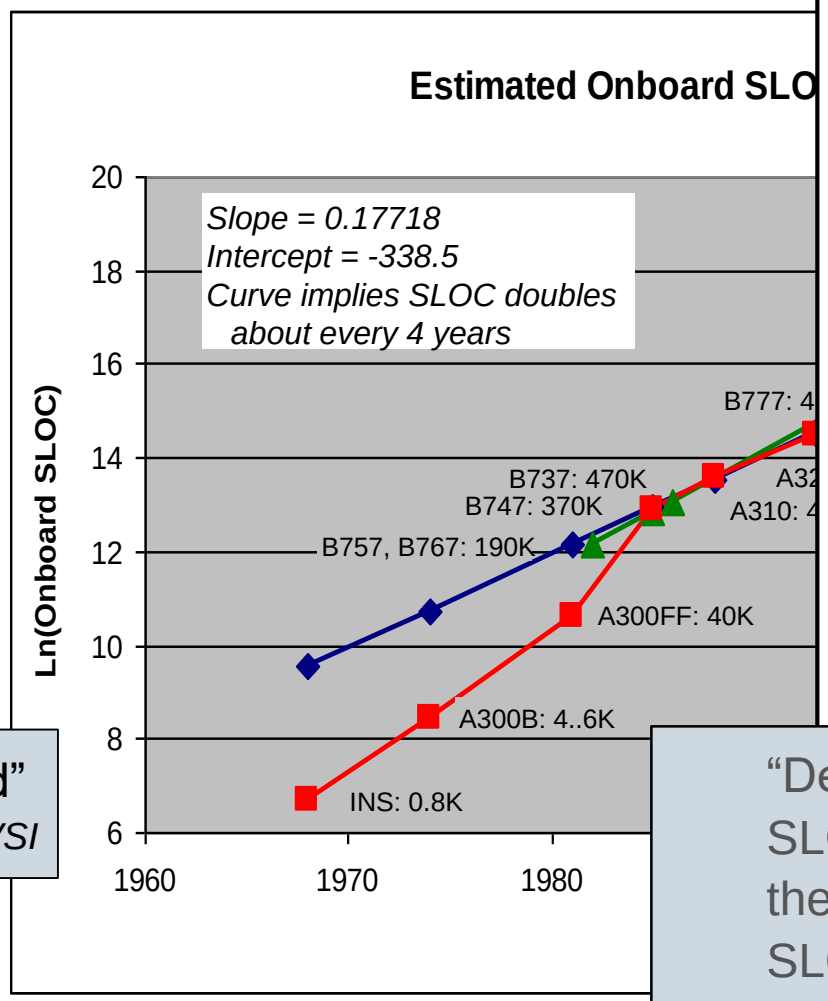
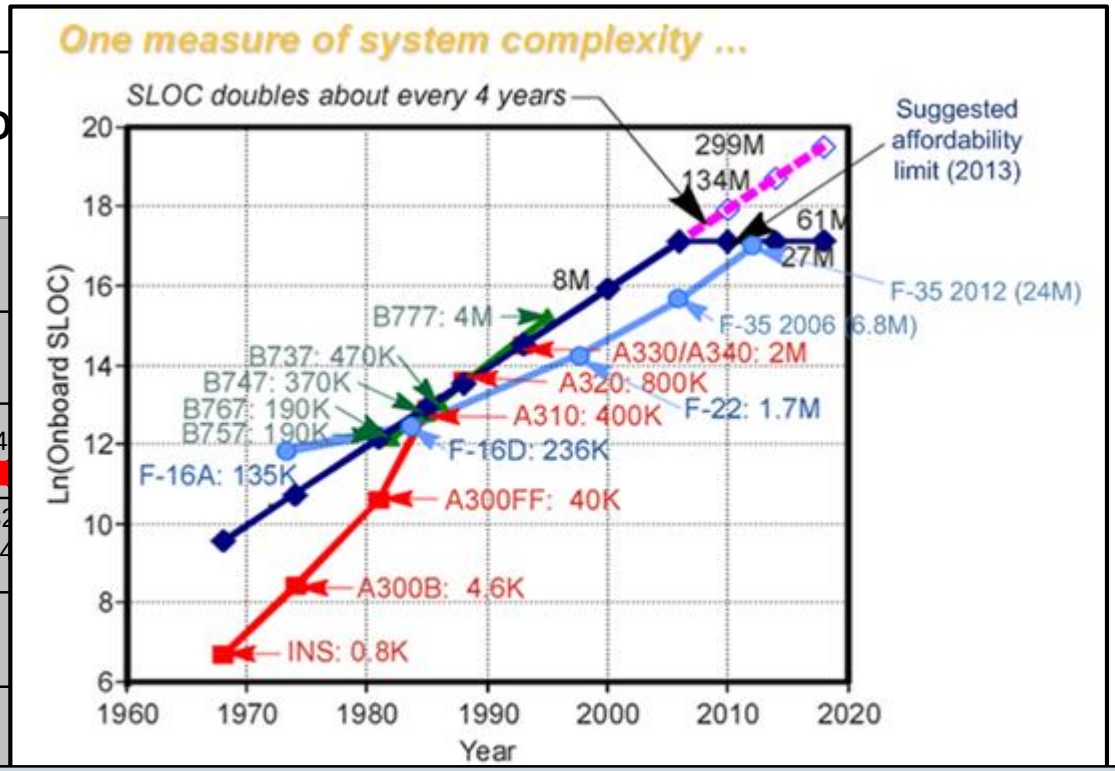




"Integrate, then build"
AVSI

"Development effort, which increases exponentially with SLOC, is increasing at an alarming rate. For example, the F35 has approximately 175 times the number of SLOC as the F16. But, it is estimated to have required 300 times the development effort"

Do you see the problem?

Integrated MBSE Value: Unforeseen Cross-domain Impacts

"…recalls SUVs because drivers are accidentally turning them off while driving". Placement of transmission selection/radio next to each other ($1.4M in direct costs)

NHTSA reports record number of cars (47m) recalled in 2019
25% are never repaired

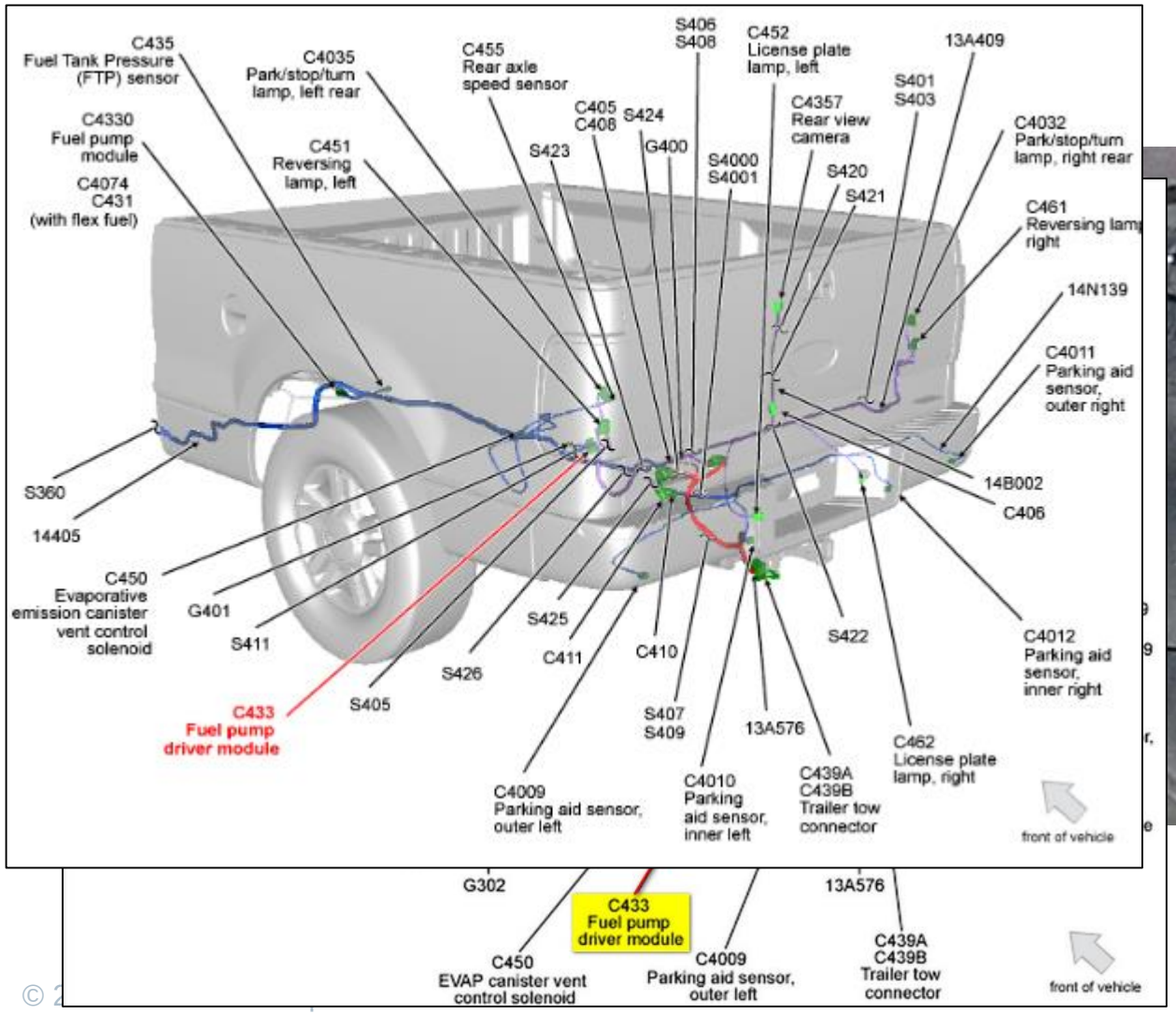
Do you see the problem?

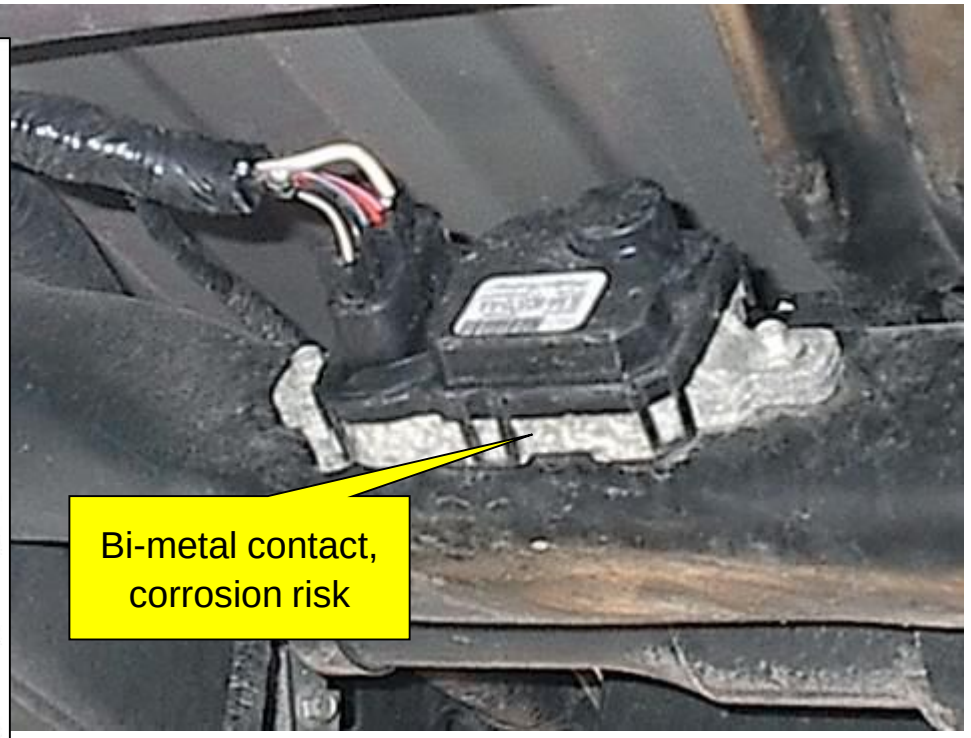
Case Study: Fuel Pump Control Module

Fuel pump control module bad placement…

- Resulting in Bi-Metal Corrosion, failed ECU
- 86,000 vehicles recalled.. $8.6 Million direct costs

How about now?
Even when you were evaluating places to put it.





Hidden costs from communication failures…
Solving the same problems over & over

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Problem resurface metric: how long does a problem once solved take to come back

- Auto: ~3 years
- High Tech ~6 mo.
- Aero ~15 years

Cross-Domain problems result from:

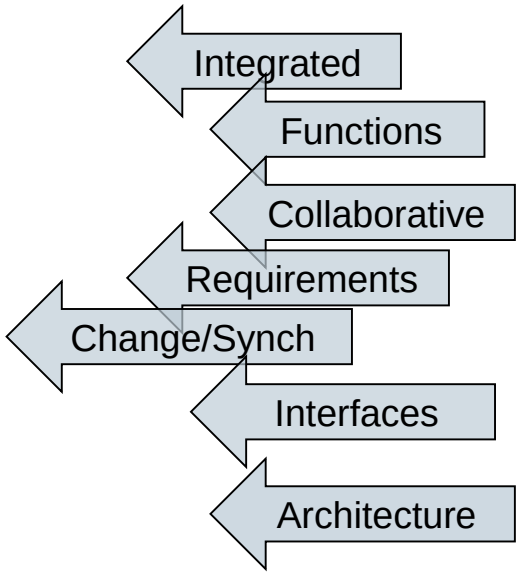
- Siloed/Disconnected Decisions
- Form follows function, Problems follow functions
- Everyone involved, including purchasing
- Disconnected requirements
- Uncommunicated change
- Happen at domain/organizational boundaries
- Migrate with people (overt or covert)
- Missing/disconnected product architecture

Integrated
Functions
Collaborative
Requirements
Change/Synch
Interfaces
Architecture

"Water on the knee"

How bad is your communication problem?

MBSE Maturity



Disintegrated----------Integrated

Disconnected Commnication with documents

Communication Continuum

Continuous Communication with models

System Modeling/Architectu					
PLE/Configuration (variation)		documents, spreadsheets	Disconnected variation rules	Integrated varia n rules	into architecture decisions
Technical Risk (RAMS, cost,…)	None	Risk documents, spreadsheets	Integrated Risk Management Plans with aspects of RAMS (FMEA)	Standalone RAMS with FMECA Dash boards	Integrated RAMS, continuous risk assessment/alarms with dashboards
Interface Management	ICD in docs	Managed interfaces	Standard-based Interface library	Reused interfaces	Functions/logical allocation drives interface definitions
Logical Modeling	Logical description documents	Logical hierarchy	Isolated logical behavior models	Integrated logical behavior modeles	Logical architecture with allocation with traceability
Parameter Management	Unmanaged spreadsheets	Managed spreadsheets	Parameter library	Integrated with functions	Reusable parameter library with traceability
Feature/Functional Modeling	Functional description docs	Function hierarchy	Isolated functional behavior models	Integrated functional modeling	Functional arch with allocations & Traceability
Characteristic/Target Mgmt	None	Uncontrolled Excel/Docs	Controlled targets	Distributed targets/constraints	Integrated targets, budgets, with compliance reports
Change Management	Document-based change process	Isolated models included in change	Impact analysis & suspicion mgmt	Metrics with History for improvement	Project level reuse, starting point for next project
Requirement Management	Uncontrolled spreadsheets & docs	Managed Docs	Standalone solutions (disconnected)	RM/traceability exchange	Connected, configured, cross-domain traceability with reuse
Model Management	Uncontrolled, rules-of-thumb, hieristics	Uncontrolled, behaivor models	Shared model repository	Integrated, component library	Model reuse with controlled parameters
Verification & Validation	Minimum to no planning	Manually testing everything	Isolated validation simulations	Integrated simulation (HIL, SIL)	Focused testing, reuse results, swap out models
Design Management	unmanaged Cax/SW models	Locally Mananged CAX/SW	Enterprise repositories	Integrated models (MIL, SIL,…)	Cross-domain design/optimization
CMMI Staged Levels:	**(1) Initial**	**(2) Managed**	**(3) Defined**	**(4) Qualitative**	**(5) Optimizing**

Where are we?

Everyone has a communication problem

Capability Assessment:	Basic Disintegrated	Low	Medium	High	Advanced Integrated
System Modeling/Architecture	PPT in docs	Disconnected Visio models	Sys Models with Simulations	Multiple model exchange/optimize	Integrated architecture models for cross-domain sim/optimize
PLE/Configuration (variation)	None	Variation documents, spreadsheets	Disconnected variation rules	Integrated variation rules	PL variation definition built into into architecture decisions
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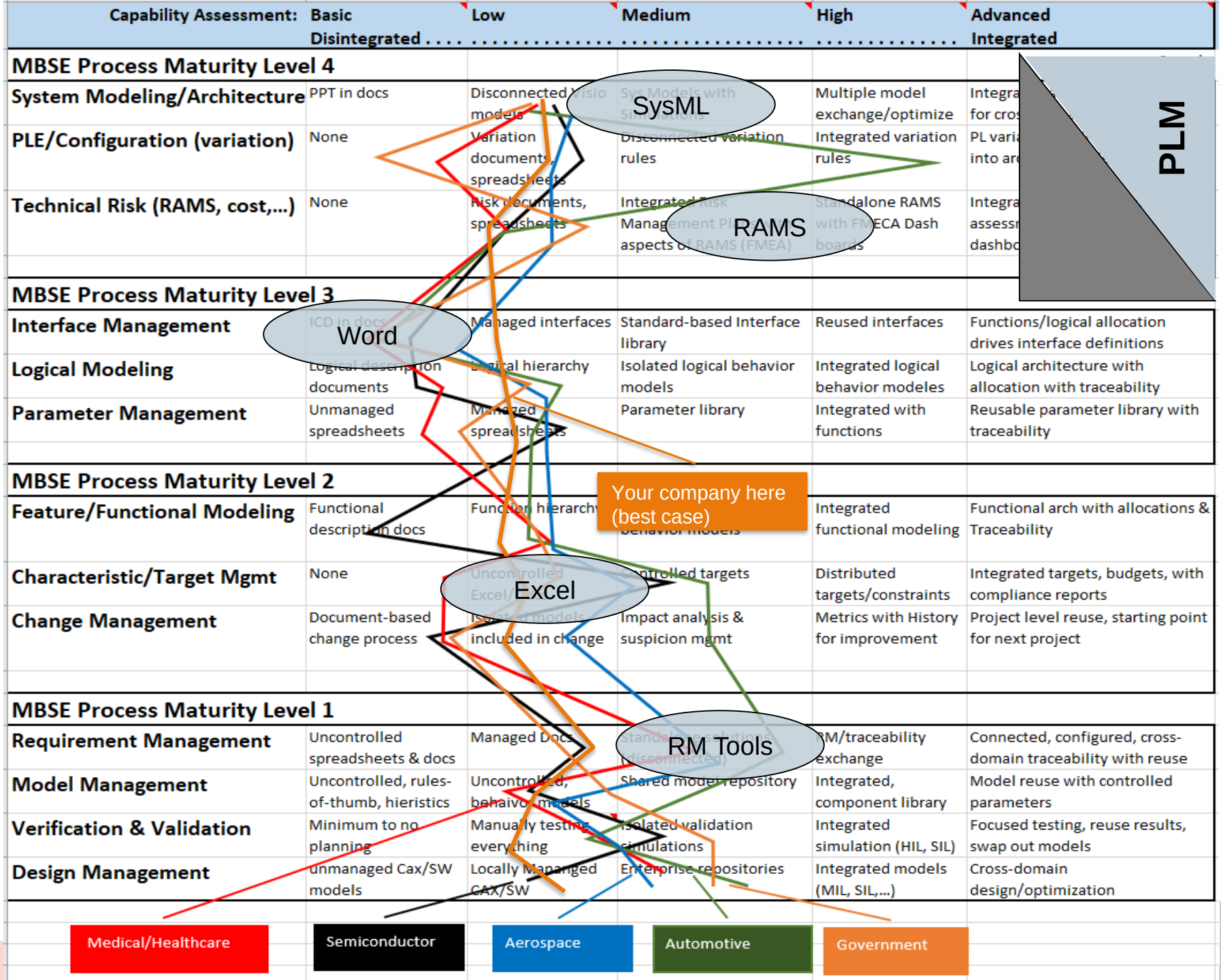
Avg Organization (best case)

Best Auto (best case)

Best Aero (best case)

PLM Required to solve your communication problem…

- Different tools speak different languages
- Tool specific integrations are not scalable (NxN problem)
- Digital thread between different tools carried by PLM with integrated systems methodology
- Thru infrastructure defined by Product Architecture that is part of PLM



Summary…
You don't have an engineering problem, you have a knowledge communication/management problem

Today's products are built by everyone/everywhere…

- Documents aren't scalable
- Disconnected models provide knotholes
- SysML v1 doesn't scale

Symptoms:

- Half your program schedule is spent on system integration (supplier collaboration?)
- Tedious communication via meetings (inter-team and intra-team)
- Uncommunicated change
- Innocent impact understanding
- …

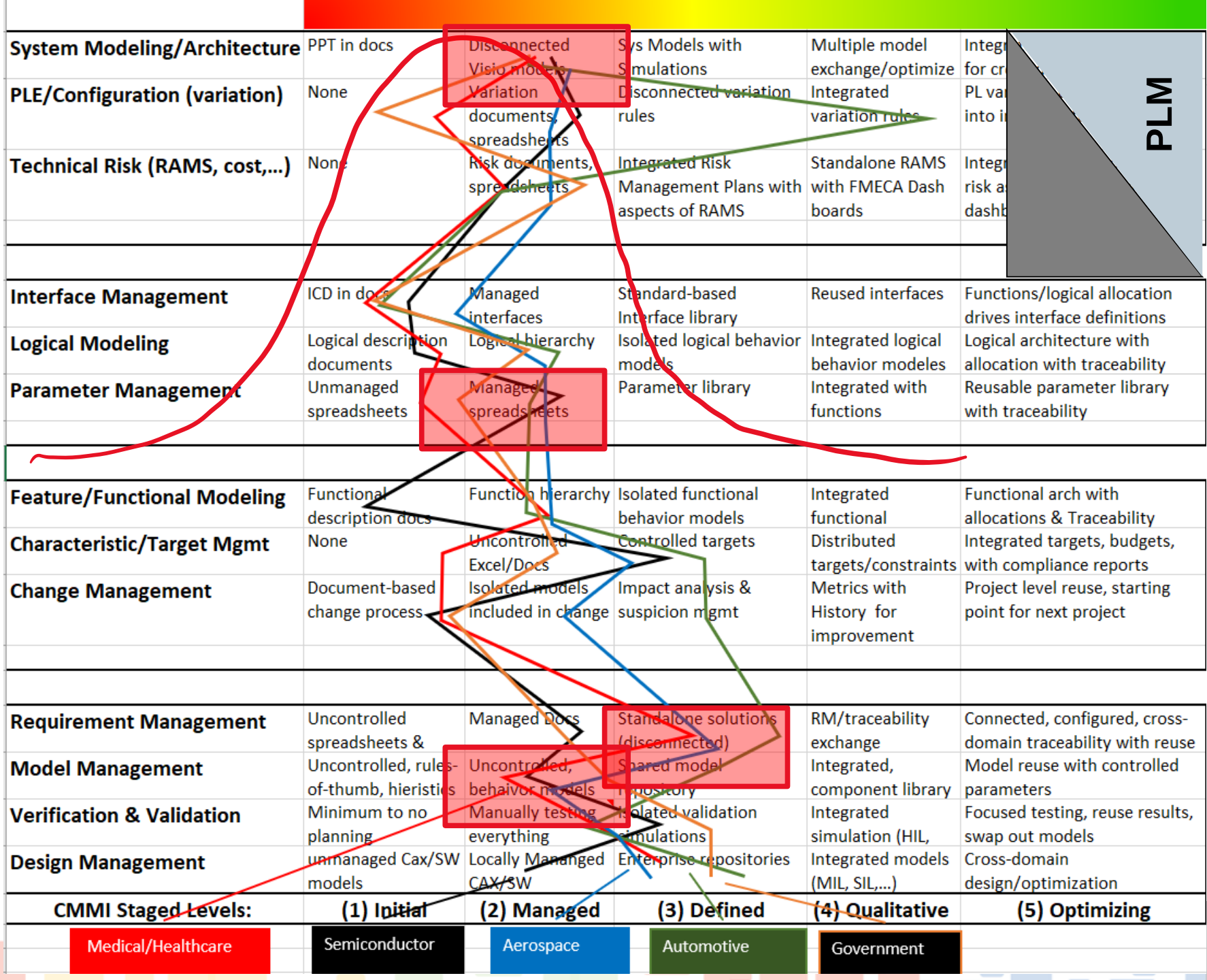
An integrated product architecture/blueprint with requirements is mandatory

- Delivered thru PLM
- Allocated through suppliers for continuous feedback

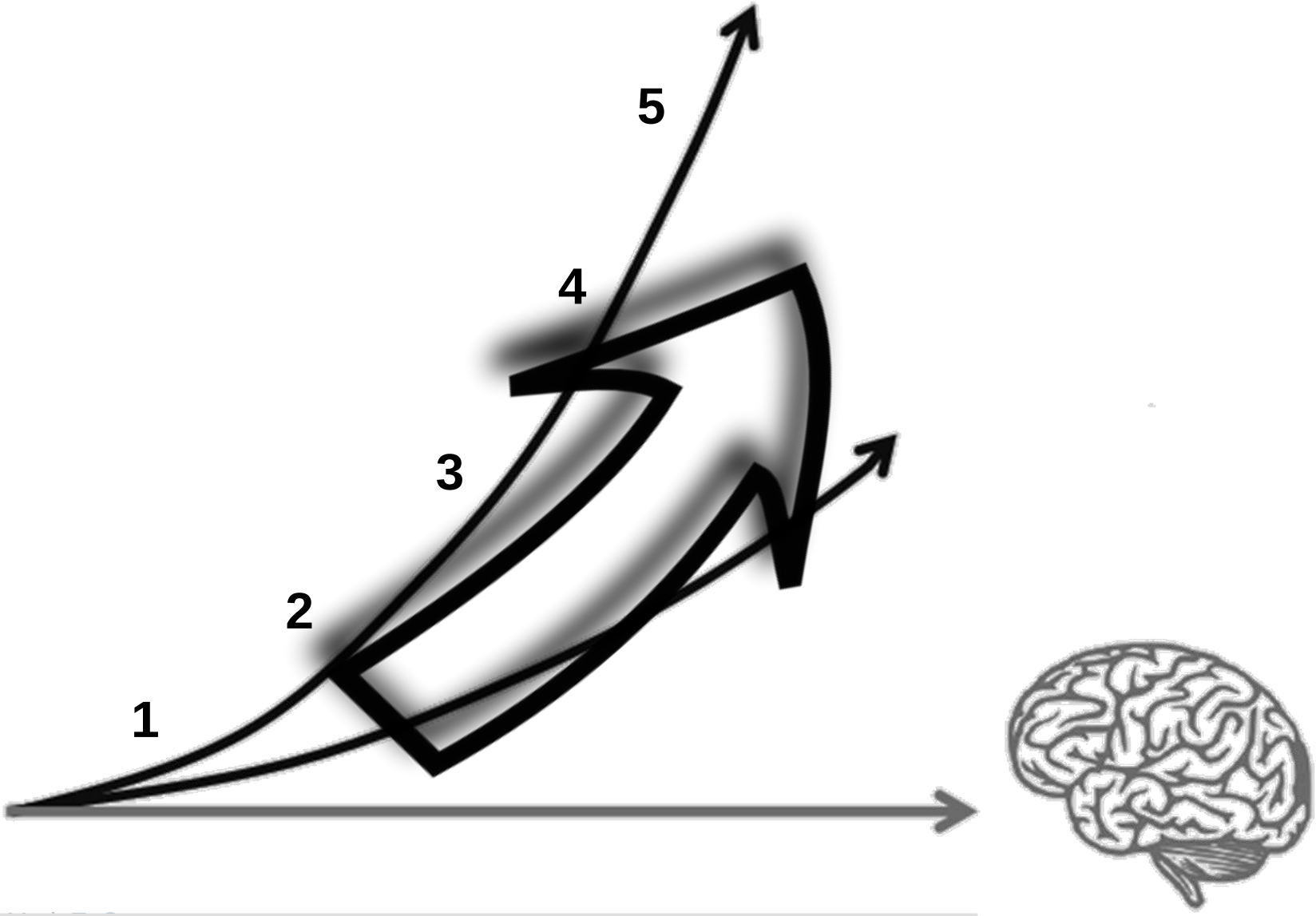
…to start integrated, stay integrated

How to start solving your communication problem…

Possible starting spots…
To solving your communication problem



…enabling continuous communication



SIEMENS
Ingenuity for life

Thank you