intercax

System Lifecycle Management

Syndeia™ for MBSE

(formerly SLIM)

No Magic World Symposium
Allen TX, Jun 9, 2015

Manas Bajaj, PhD
Chief Systems Officer
manas@intercax.com
www.intercax.com

- Commercial spin-off from Georgia Tech in 2008
- Located in Atlanta, GA
- SysML-Centric Model-Based Systems Engineering
- InterCAX business model
  - Standard software products for systems engineering
    - Parametric Solvers (e.g. ParaMagic for MagicDraw)
    - Syndeia (formerly SLIM) – PLM/CAD/CAE Integration
  - Training, consulting and custom development
- Government customers: NASA, DoD, DoE
- Corporate customers: primarily defense, aerospace, automotive, transportation, consumer goods, energy

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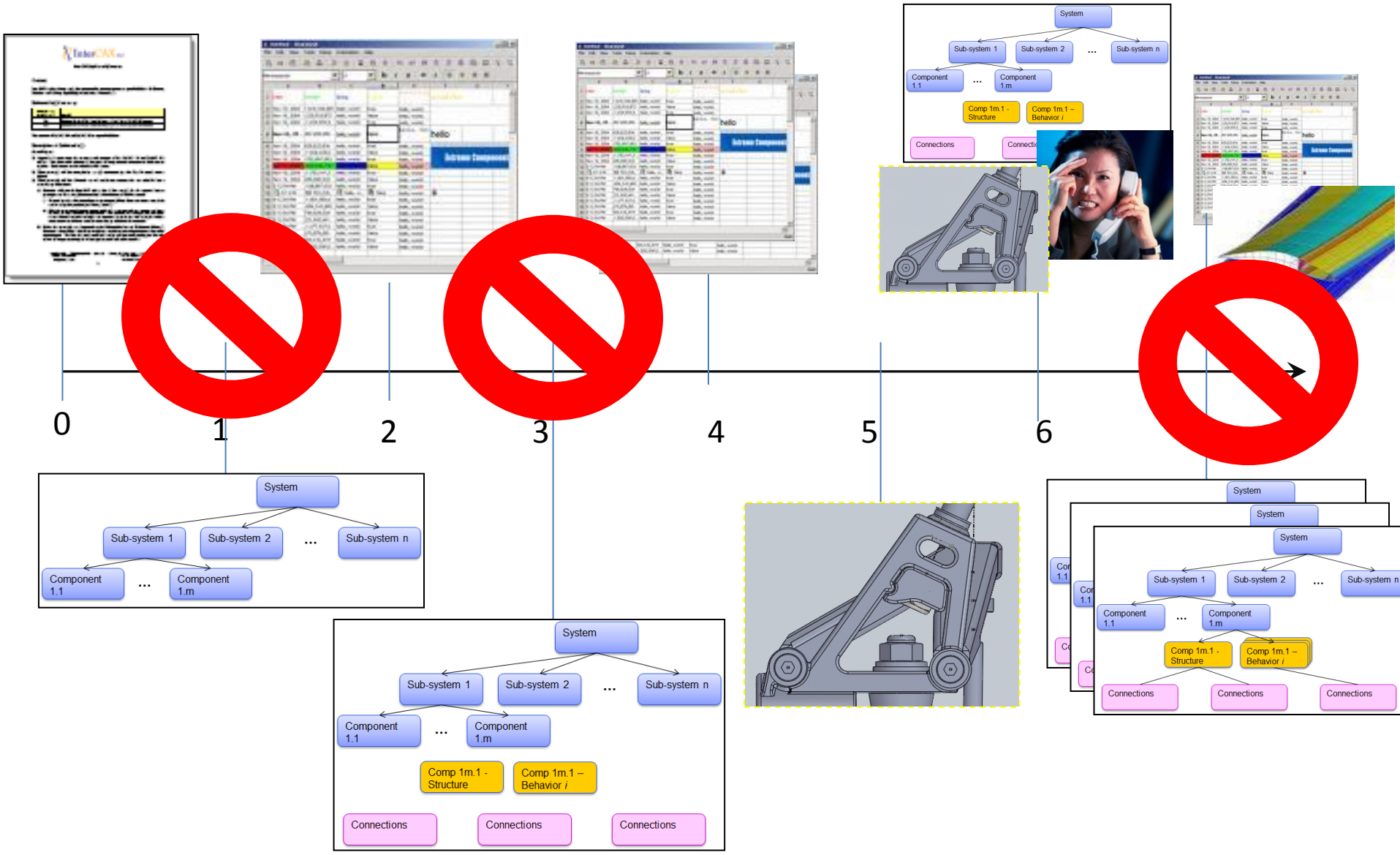
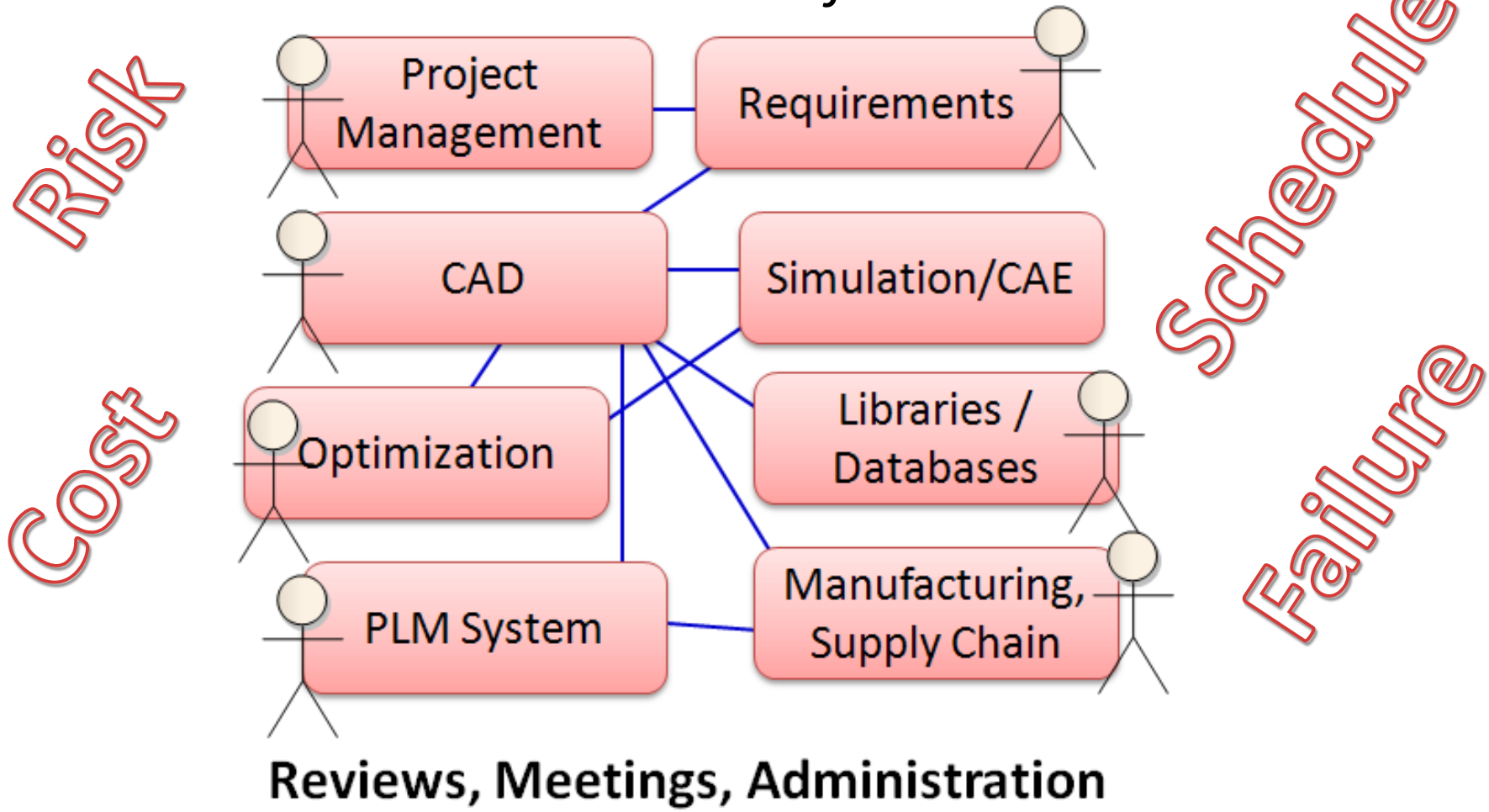
A week in the life of a system engineer



Challenge

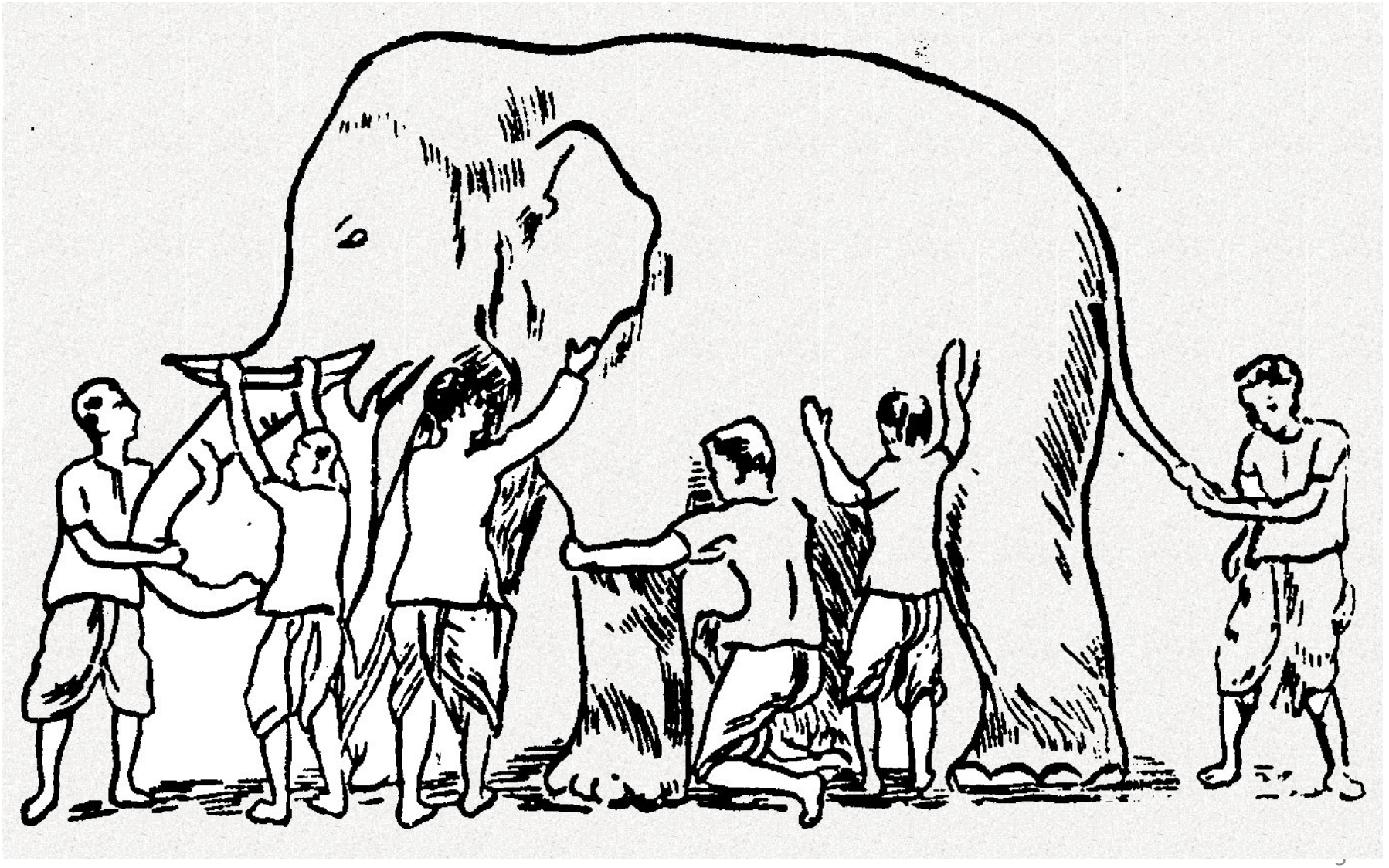
Point-to-Point Ad-Hoc Information Flows



Use of models in systems engineering **IS NOT** model-based systems engineering (MBSE)

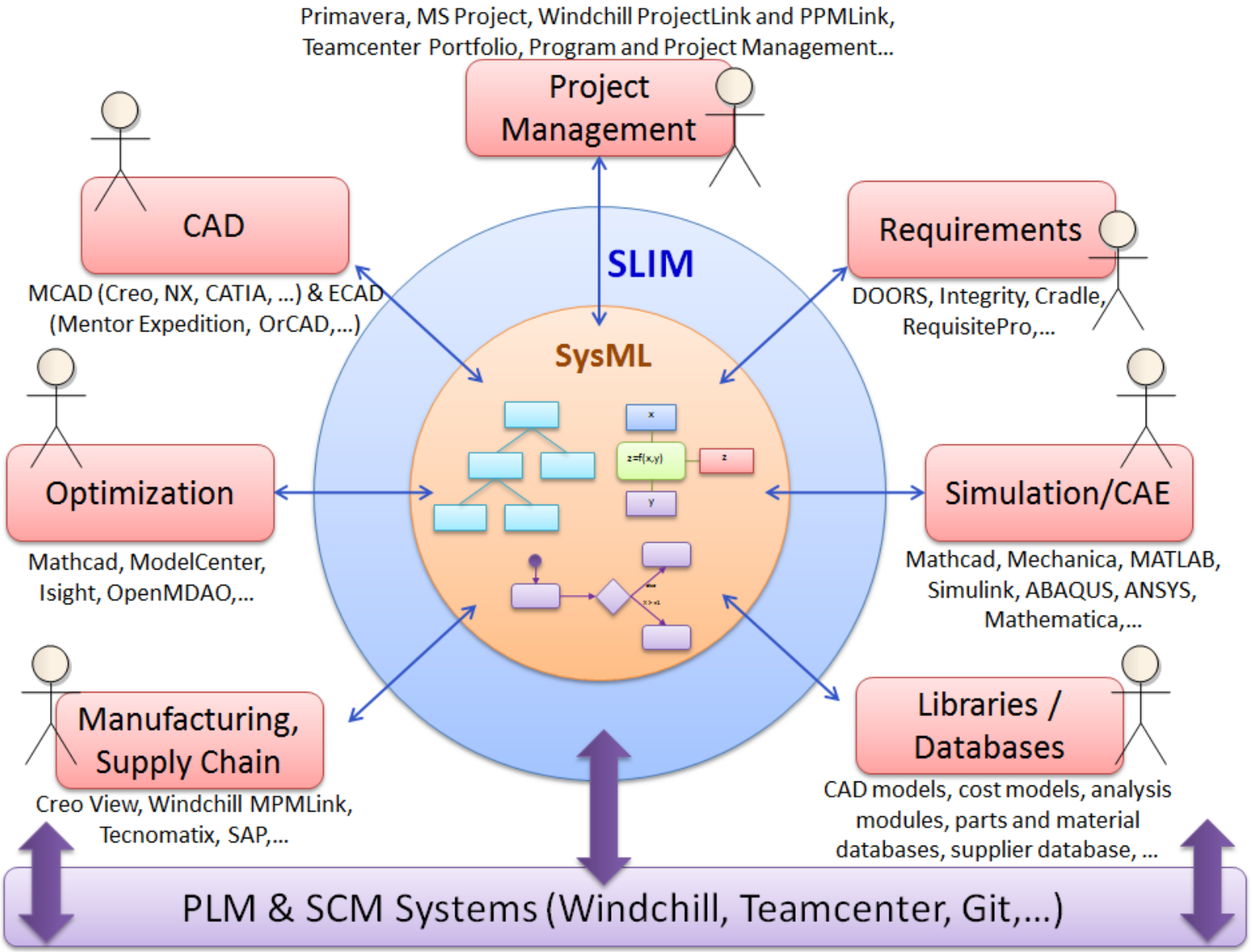
Wait, wait, don't tell me…

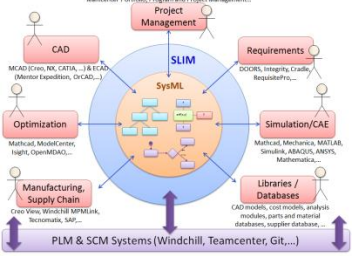
It is a **rope**, It is a **wall**, It is a **pillar**….



System LIfecycle Management (SLIM)

Enabling Model-Based Systems Engineering





Total System Model

Bill-of-Systems (BOS)

TOTAL SYSTEM MODEL (TSM)

2012-07-12, 1000h US ET

B.20

Documents & Spreadsheets

Connections based on Reference, Data Map, Function Wrap, Model Transform, and Composite patterns

B1

CAD model (Creo, NX, CATIA,...)

SysML

v35

Requirement models

MATLAB / Simulink & Mathematica models

C2

CAE (FEA/CFD) models

Rev 7

v3

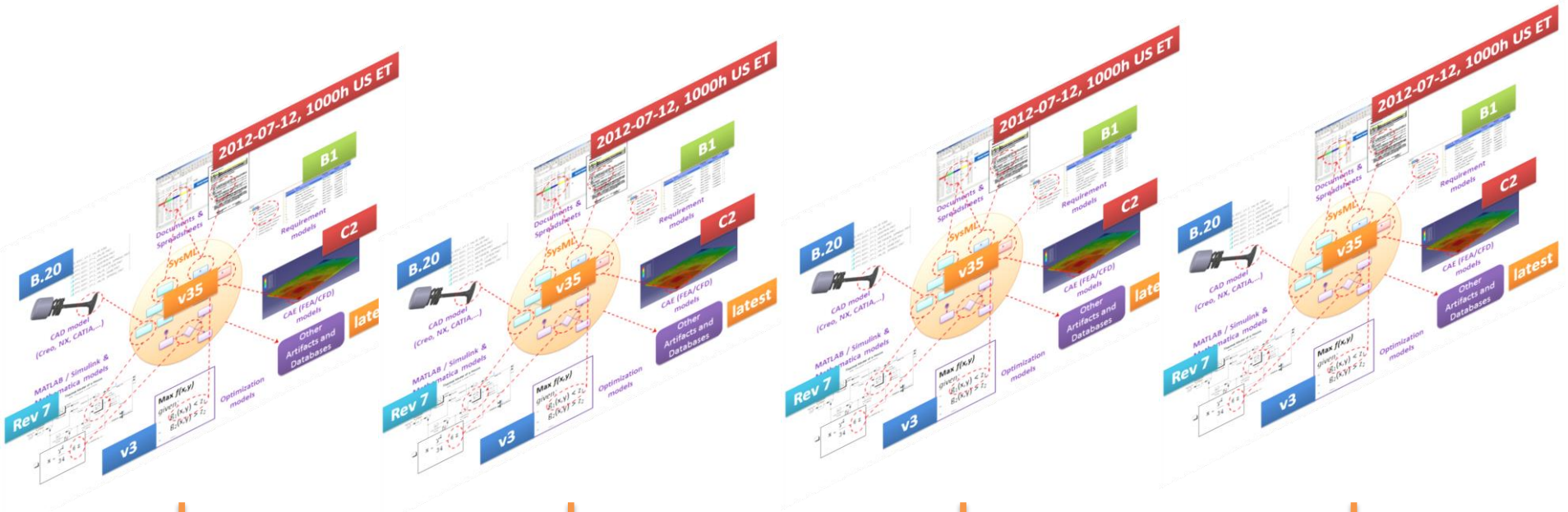
Max *f(x,y)*
given:
- $g_1(x,y) < z_1$
- $g_2(x,y) > z_2$
- ....

Optimization models

Other Artifacts and Databases

latest

Total System Model History



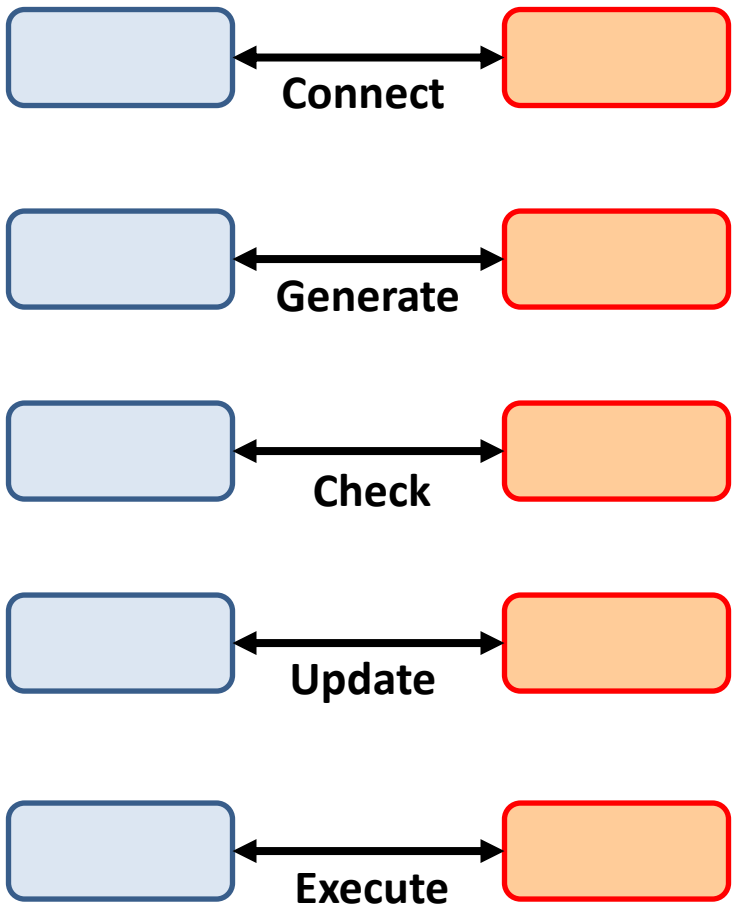
T1 T2 T3 T4

(Baseline B1) ***(Baseline B2)***

Timeline

Technical Data Packages auto-generated from TSM graph

Basic Syndeia Functions



Description

Syndeia creates a connection between existing elements in the SysML element and repository. This may be a simple traceable link or a detailed data mapping between element attributes. These connections are stored and managed by Syndeia .

Syndeia generates an element on one side from an element on the other. SLIM manages a persistent connection between them.

Syndeia checks for changes at the repository end of a connection. This may include generation of a difference report.

Syndeia updates the element at one end of the connection based on the element at the other end. This may include changes in the element structure or attribute values.

Syndeia triggers execution of an element (e.g. a MATLAB function) managed in the repository as part of a SysML model execution.

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Hello Syndeia !

Demonstrate as a plugin for MagicDraw

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Hello Syndeia ! – Demo Part 1

- Launch SLIM
- Connect and view
  - Windchill
  - Teamcenter
  - MySQL
  - Local File System
- Search
- Open

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Hello Syndeia ! – Demo Part 2

- Story of Sam Video
  - Generate TC requirements from SysML
  - Generate SysML block structure from WC
  - Generate SysML blocks from MySQL
  - Compare and sync with WC
  - Simulink use cases and demo
  - CAD (NX and Creo) use cases and demo
  - Visualization of Total System Model

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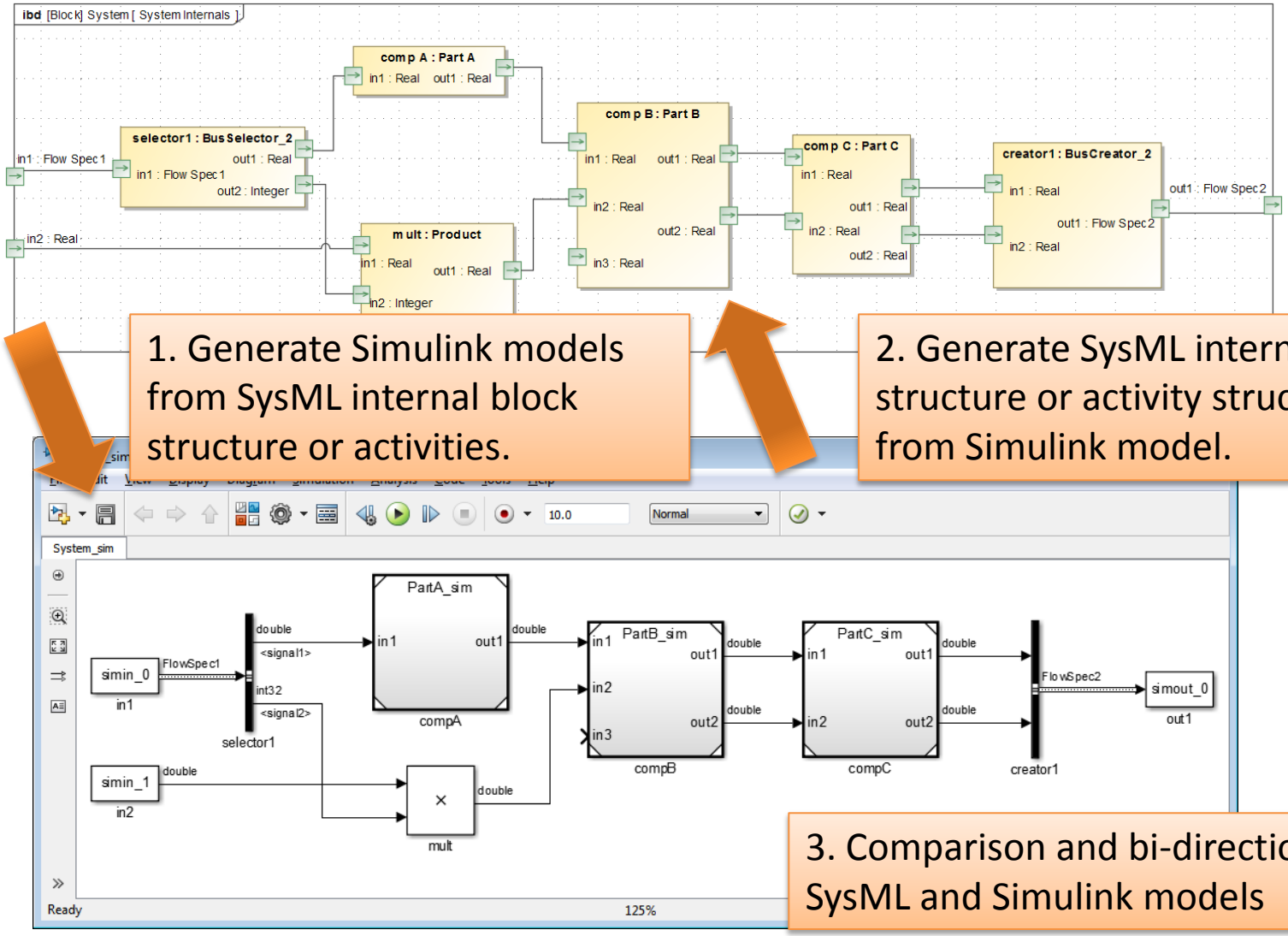
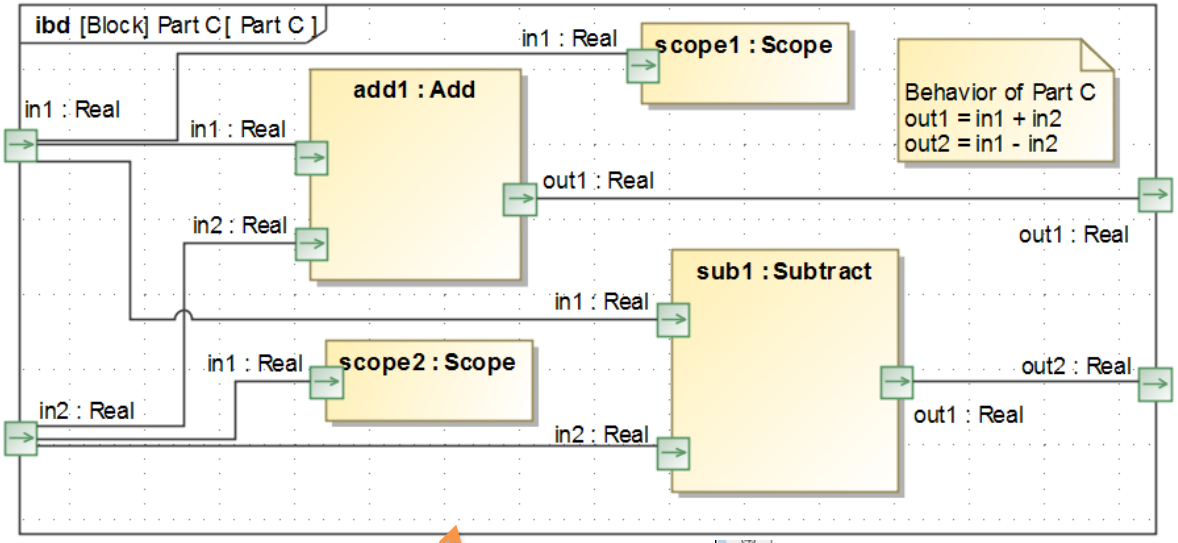
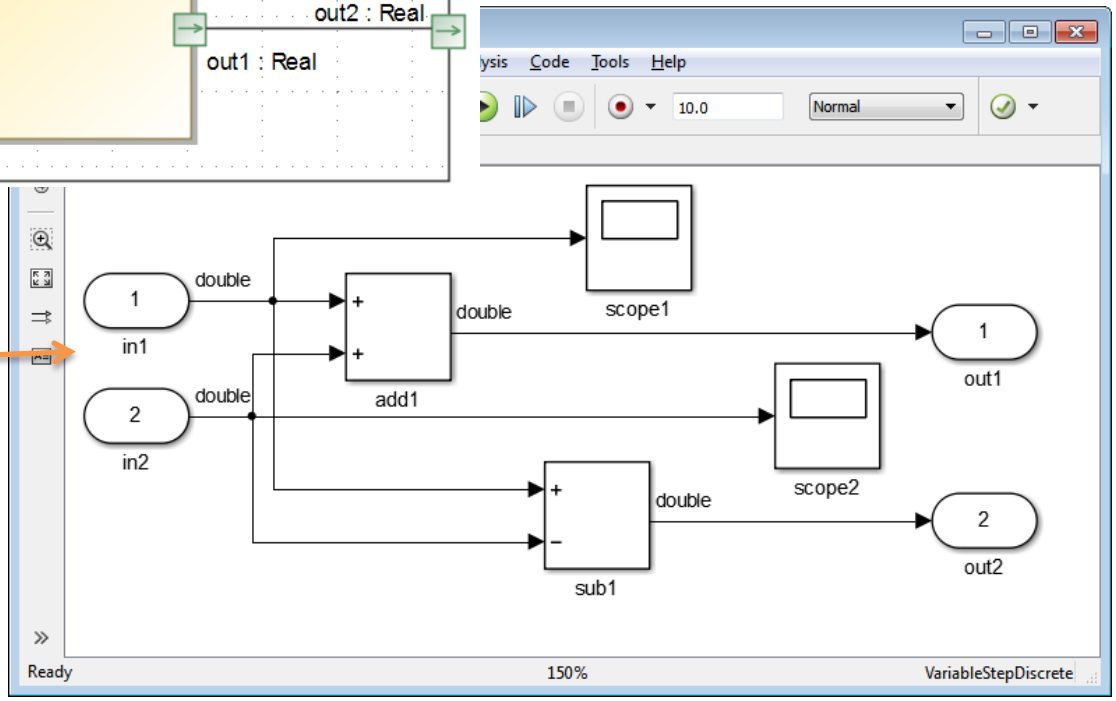
SysML-Simulink Model Transform



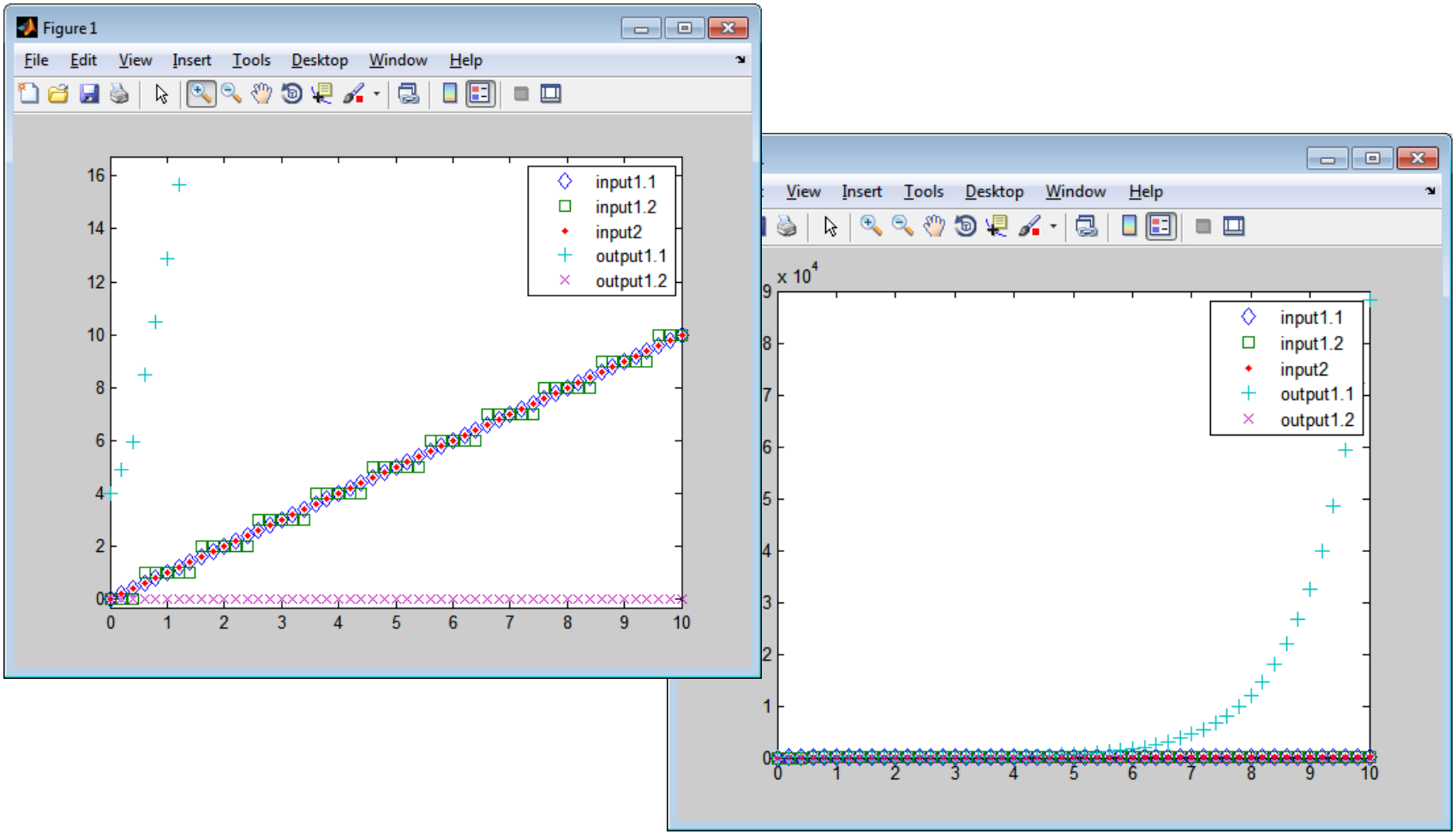
SysML-Simulink Model Transform

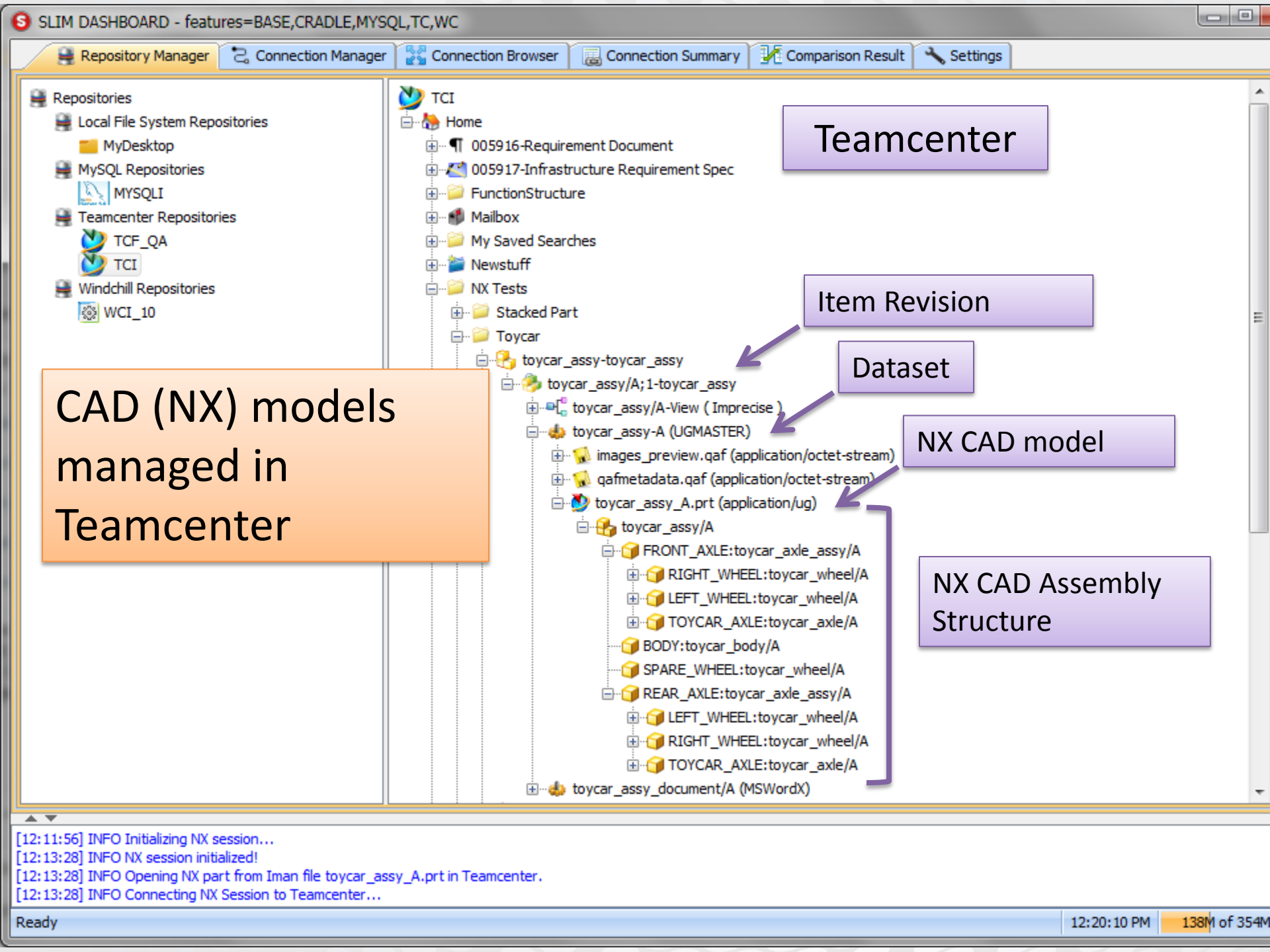




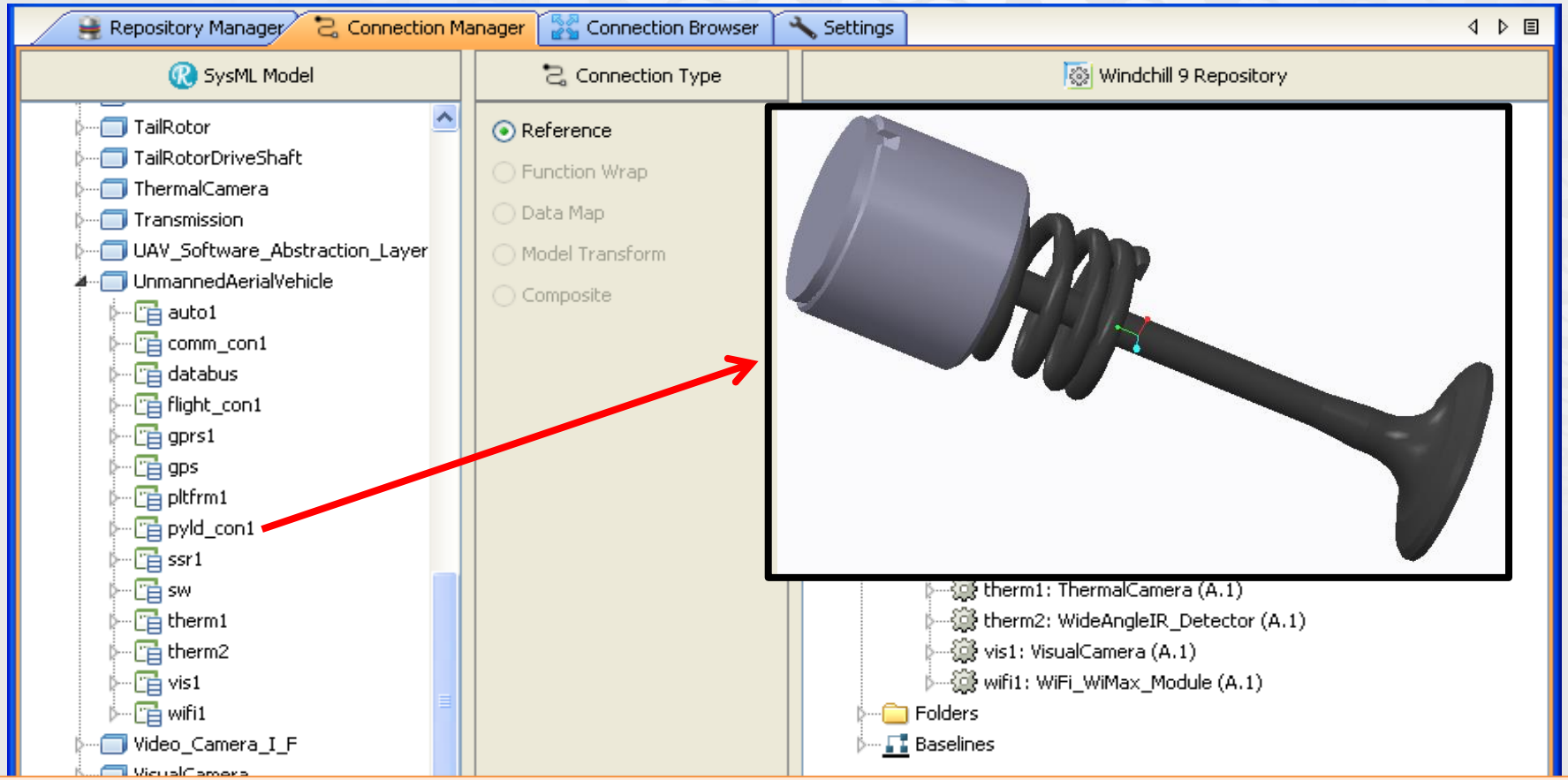
4. Use SysML blocks representing Simulink library blocks to generate fully executable Simulink model (see next slide)

Execution of Simulink model generated from SysML




SLIM DASHBOARD - features=BASE,CRADLE,MYSQL,TC,WC
Repository Manager
Connection Manager
Connection Browser
Connection Summary
Comparison Result
Settings
Repositories
Local File System Repositories
MyDesktop
MySQL Repositories
MYSQLI
Teamcenter Repositories
TCF_QA
TCI
Windchill Repositories
WCI_10
TCI
Home
005916-Requirement Document
005917-Infrastructure Requirement Spec
FunctionStructure
Mailbox
My Saved Searches
Newstuff
NX Tests
Stacked Part
Toycar
toycar_assy-toycar_assy
toycar_assy/A;1-toycar_assy
toycar_assy/A-View (Imprecise)
toycar_assy-A (UGMASTER)
images_preview.qaf (application/octet-stream)
qafmetadata.qaf (application/octet-stream)
toycar_assy_A.prt (application/ug)
toycar_assy/A
FRONT_AXLE:toycar_axle_assy/A
RIGHT_WHEEL:toycar_wheel/A
LEFT_WHEEL:toycar_wheel/A
TOYCAR_AXLE:toycar_axle/A
BODY:toycar_body/A
SPARE_WHEEL:toycar_wheel/A
REAR_AXLE:toycar_axle_assy/A
LEFT_WHEEL:toycar_wheel/A
RIGHT_WHEEL:toycar_wheel/A
TOYCAR_AXLE:toycar_axle/A
toycar_assy_document/A (MSWordX)
Teamcenter
Item Revision
Dataset
NX CAD model
NX CAD Assembly Structure
CAD (NX) models managed in Teamcenter
[12:11:56] INFO Initializing NX session...
[12:13:28] INFO NX session initialized!
[12:13:28] INFO Opening NX part from Iman file toycar_assy_A.prt in Teamcenter.
[12:13:28] INFO Connecting NX Session to Teamcenter...
Ready
12:20:10 PM
138M of 354M

Integrating systems modeling with CAD (1/3)



Use Case 1 – If a SysML element is connected to a CAD model, SEs can visualize the CAD model in SysML

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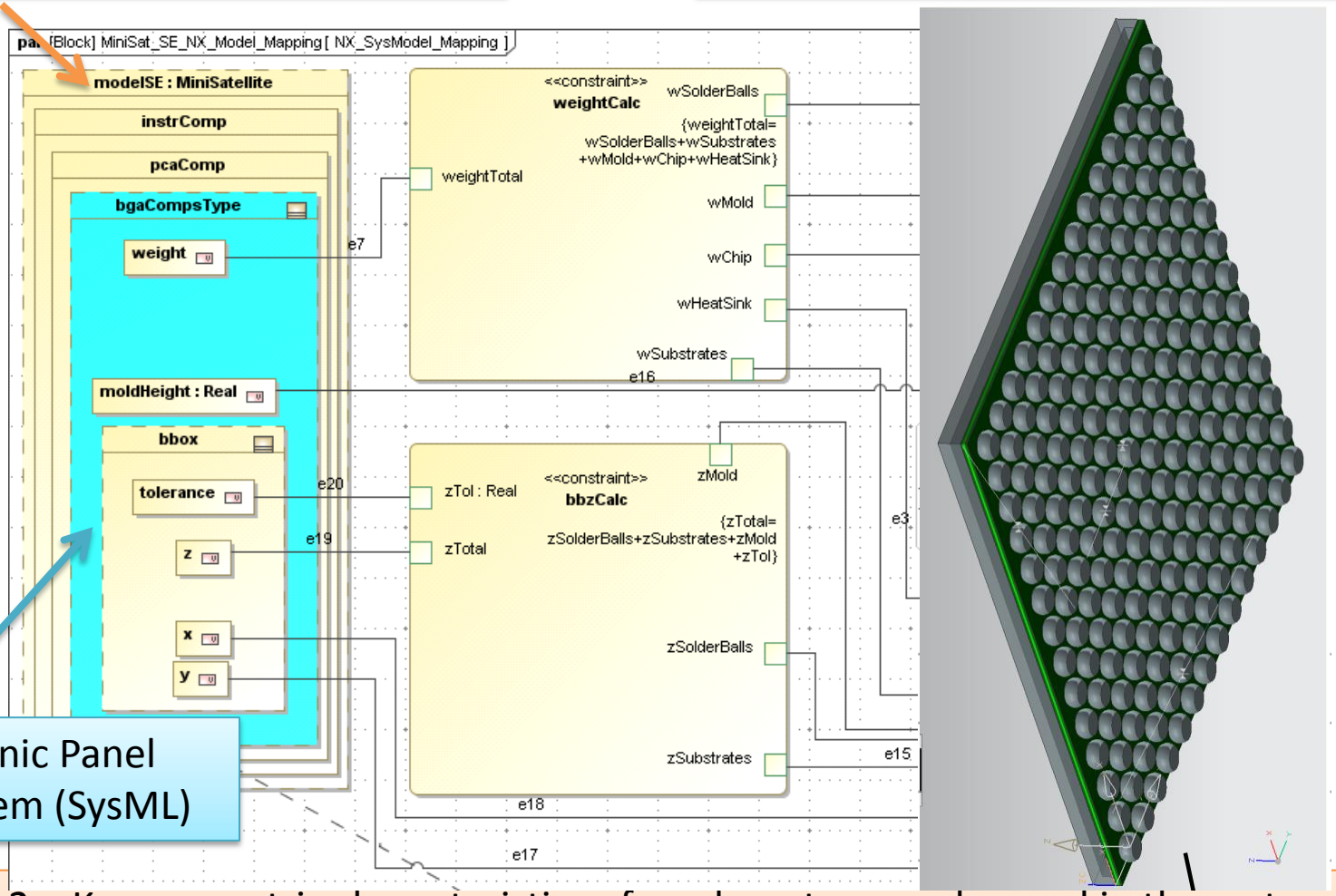
Integrating systems modeling with CAD (2/3)

Satellite System Model (SysML)

Electronic Panel Assembly (NX)



Electronic Panel Sub-System (SysML)

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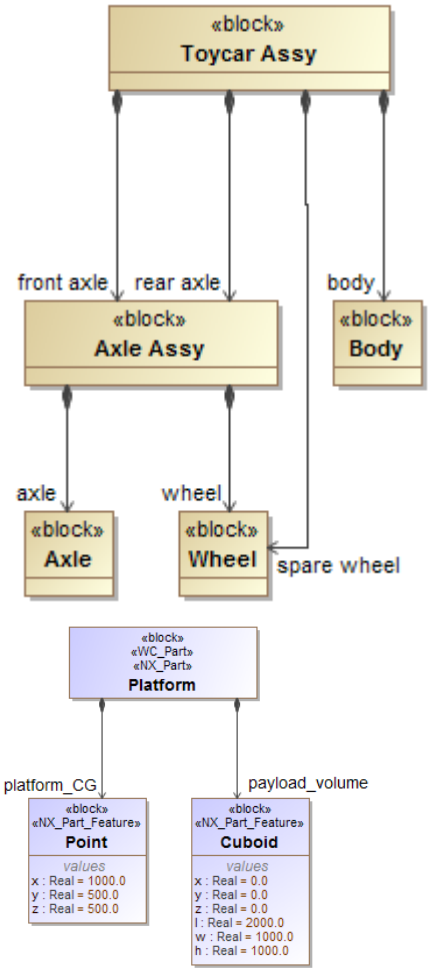
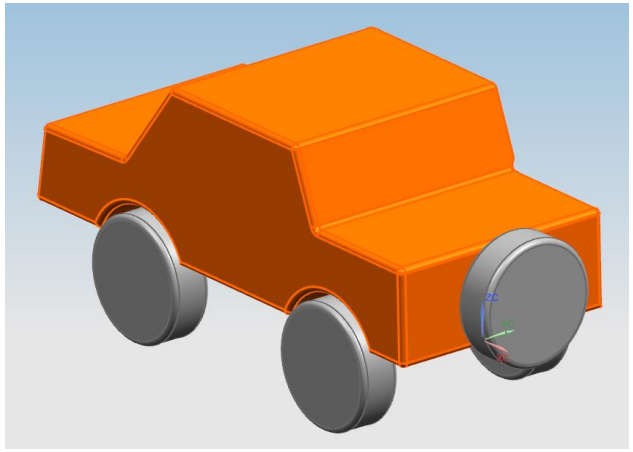
Use Case 2 – Key geometric characteristics of a sub-system can be read in the system (SysML) model to facilitate system-level analyses, roll-ups, and requirement verification. Examples of these characteristics include mass/volume, bounding box, feature sizes, center-of-gravity, and moment-of-inertias.

Integrating systems modeling with CAD (3/3)



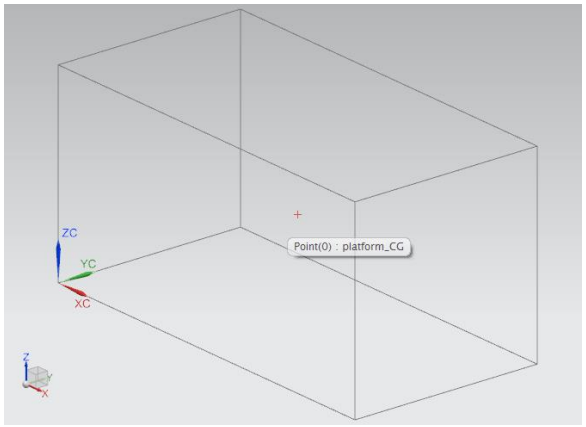
A

Use existing assembly definitions in your architecture



Seed system constraints (bounding boxes, keepout-zones,…) from the architecture

B



Use Case 3 – (A) System-level representation of hardware sub-systems can be derived from CAD models and used in the SE (SysML) model, such as for roll-ups and requirement verification, (B) System-level requirements/constraints on a hardware sub-system can be used to seed a CAD model for designers

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Syndeia 2.0 arriving Jun 29, 2015

Build the Total System Model with bi-directional generate, compare, sync

Syndeia / SLIM 1.0	Syndeia 2.0
Windchill (PTC)	**Windchill**** (PTC)
Teamcenter (Siemens)	**Teamcenter**** (Siemens)
MySQL (Oracle)	MySQL (Oracle)
Excel (Microsoft)	Excel (Microsoft)
	NX (Siemens)
	Creo (PTC)
	Simulink (Mathworks)
	Search / Open / …

Try out Syndeia

- Download Syndeia plugin for MagicDraw
  - Go to www.intercax.com/slim
  - Follow instructions to download
  - Step-by-step tutorials to get started
- Demonstration
  - Story of Sam (INCOSE IW, Jan 2015) http://goo.gl/B91MYP

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Summary

- **Collaborative development of Total System Model**
- Concurrent in **multiple repos** - SysML, PLM, Databases
- Multiple version mgt. and config. control systems
- **Drag-n-drop** approach to connect models (usability)
- Algorithms to **compare models** and **bi-directional sync**
- **Visualization** of Total System Model
- **Parametric analyses** & **trades** from the TSM
- Seed **simulation** models (Simulink) from architecture
- Seed **CAD** models (NX/Creo) from system architecture
    - **Communicate requirements as geometry**

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We would love to hear from you…

Manas Bajaj, PhD
Chief Systems Officer
manas@intercax.com

Dirk Zwemer, PhD
President
dirk@intercax.com

web www.intercax.com
email info@intercax.com
blog www.intercax.com/blog
Twitter @intercax | LinkedIn intercax-llc

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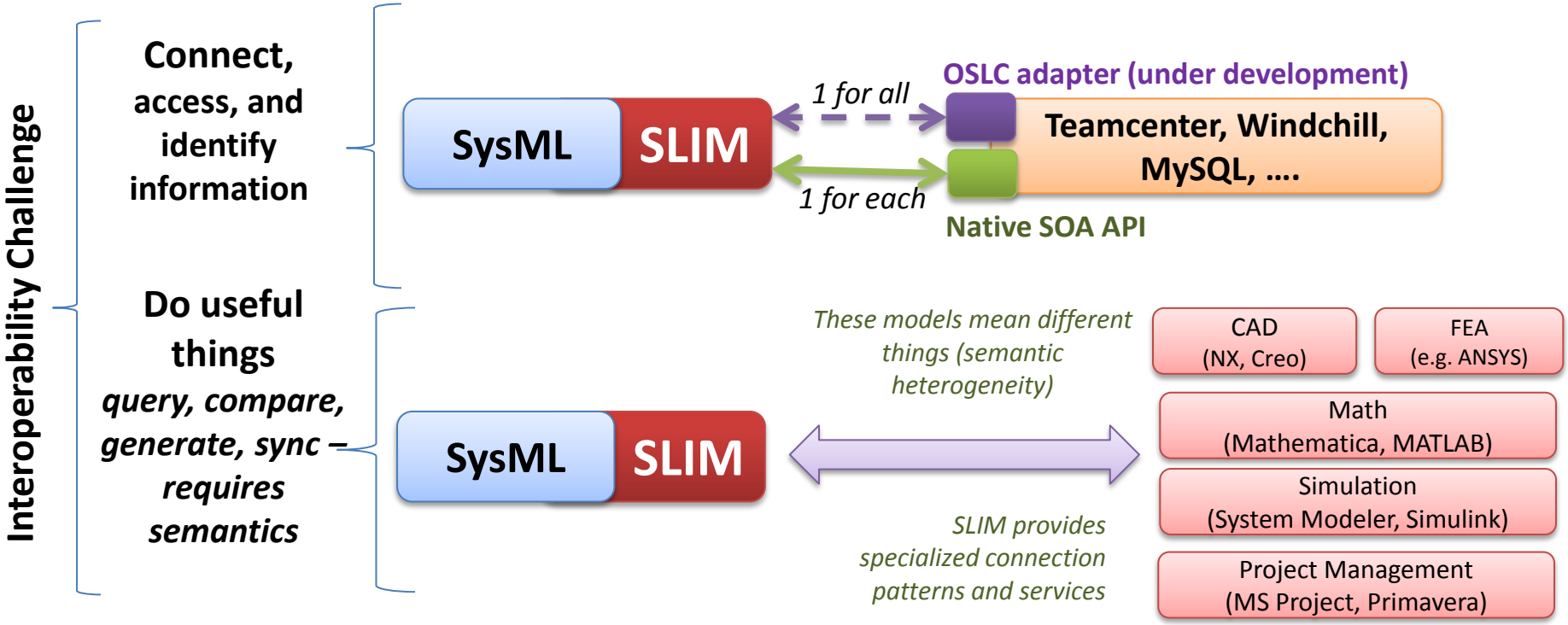
SLIM and OSLC are Complementary

- SLIM = Software for integrated MBSE (UI + API)
- OSLC = Specs + REST API in various PLM/ALM areas
- InterCAX is a member of the OSLC working group



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