About Intercax

- Georgia Tech spin-off 2008
- **Locations**: Tech Square, Atlanta (HQ); Pune IT Park, Pune, India
- **Focus**: Software for MBE/MBSE
  - *Syndeia* – MBSE (SysML) + PLM/CAD/CAE/Data/Simulations
  - SysML parametric solvers
    (e.g. ParaMagic, Melody, Solvea, ParaSolver)
- Training, consulting, custom apps
  - 4000+ participants since 2008
- Customers
  - Gov.: NASA, DoD, DoE, DoC
  - Commercial: aero, auto, transportation, consumer goods, energy, mfg., healthcare
INCOSE SE Vision 2025

Interconnected
Interdependent
Complex

INCOSE SE Vision 2025
http://goo.gl/uE5OS9
Where is the system architecture / blueprint?

Use of models in systems engineering IS NOT model-based systems engineering (MBSE)
• MBSE = Unified model of the system versus series of disconnected documents or document-based flows between models (DBSE)

• System docs and views can be generated from this unified model

• DBSE > MBSE ⇔ 2D > 3D CAD

• Models in SE ≠ MBSE
DBSE > MBSE > MBSE++

• OMG SysML – www.omgsysml.org
  • Widely adopted as a standard for modeling, analyzing, and developing system architecture

• However
  • Most of the detailed engineering carried out in domain-specific tools and repositories, such as in PLM, ALM, Req. Mgt., Databases, Simulation environments, Project Management, CAD, CAE, and other tools

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What is MBSE++

Connect architecture model (SysML) with domain-specific models

**Total System Model (TSM)** as a digital blueprint of the system connecting models across disciplines, tools, and version-management systems

Goal: Seamless traceability between disciplines across the system lifecycle
Total System Model (TSM) – Digital Blueprint, Twin,…

TSM evolves as each of the version-managed models evolve
6 Principles of MBSE++


1. Heterogeneous and Decentralized Data
2. Capturing and Maintaining High-Level System Architecture
3. Spectrum of Model-Based Connections
4. Unified Framework for Model-Based Connections
5. From Traceability to Impact
6. Many Users, Many Views
Syndeia = Software Platform for MBSE++

Search, Connect, Access, Transform, Compare, Sync, Visualize models in the TSM

We will Illustrate 6 principles of MBSE++ using Syndeia

Syndeia 3.0 released July 2016 – www.syndeia.com
Connect & dive into enterprise repositories & models.
Drag and drop to connect and generate models

Drag-n-Drop

Switch repos

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Syndeia opens models in native repositories (e.g. Teamcenter)
Compare and bi-directional synchronization across connected models
Interactive Graph of Total System Model

Teamcenter

Simulink

GitHub

JIRA

SyML

MySQL repositories
- DB ICAX 1 (0 artifacts)

File system repositories
- Simulink (8 artifacts)
- Simulink_Shared (0 artifacts)
- Excel (0 artifacts)
- SampleDocs (0 artifacts)
- Creo_Models (0 artifacts)
- NX_Models (0 artifacts)

Windchill repositories
- WX ICAX 1 (0 artifacts)

GitHub repositories
- Github ICAX 1 (4 artifacts)

DOORS-NG repositories
- DOORS NG ICAX 1 (0 artifacts)

Teamcenter repositories
- TC ICAX 2 (12 artifacts)
- TC ICAX 1 (11 artifacts)

JIRA repositories
- JIRA ICAX 1 (7 artifacts)

SyML model elements

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Explore your neighbors

Subject artifact whose neighbors we are exploring (highlighted in red)

Click to expand (fetch and show connections) or collapse (hide connections) an artifact. Green highlight implies collapsed state.
Explore your neighbors (cont.)
Connection to 3D CAD models

Drag-n-drop to generate & connect

Example model from PTC Creo 3.0
Connection to Simulation

Drag-n-drop to generate & connect
GitHub Server

- Your public repositories
- Your organization repositories

Git Repositories

- Git Branch
- Git Commits (on the branch)
- Git Files/Folders (on the branch)

Connection to software (Git)

Tags
Syndeia 1.0 (SLIM)  
Jul 2014

Syndeia 2.0  
Jul 2015

Syndeia 3.0  
Jul 2016

Syndeia 3.0

- [www.syndeia.com](http://www.syndeia.com)
- Syndeia in 3 mins: [https://youtu.be/_RZ4lHDtdN8](https://youtu.be/_RZ4lHDtdN8)
- Syndeia for UAV problem (30 mins): [https://youtu.be/Fu1w6sQviko](https://youtu.be/Fu1w6sQviko)
Syndeia leverages open standards, open frameworks, and open APIs

• Systems Modeling Language
  • MagicDraw, Rhapsody, Enterprise Architect, Integrity Modeler

• REST Web Services

• JSON

• JDBC

• ISO STEP 10303

• Apache projects (multiple)

• OSLC

• FMI

• ... and others
Questions / Comments

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ADDITIONAL INFORMATION
Model-Based Connection Patterns

• What is the purpose of model-based connections?

  Reference Connections
  Track/compare/sync versions of connected elements

  Data Map Connections
  + Track/compare/sync element attributes

  Function Wrap Connections
  + Track/execute connection elements

  Model Transform Connections
  + Track/compare/sync element structure (multi-level)
Intra-Model and Inter-Model Connections

- Model-based connections are building blocks of interoperability

- Types of connections
  - **Inter-model** connections are between elements in different models / tools e.g. SysML block – PLM part
  - **Intra-model** connections are between elements in same model / tool, e.g. SysML block – SysML requirement