Introduction to SysML

Part 9.0: SysML and Interoperability

With Examples using Magicdraw, ParaMagic and Syndeia

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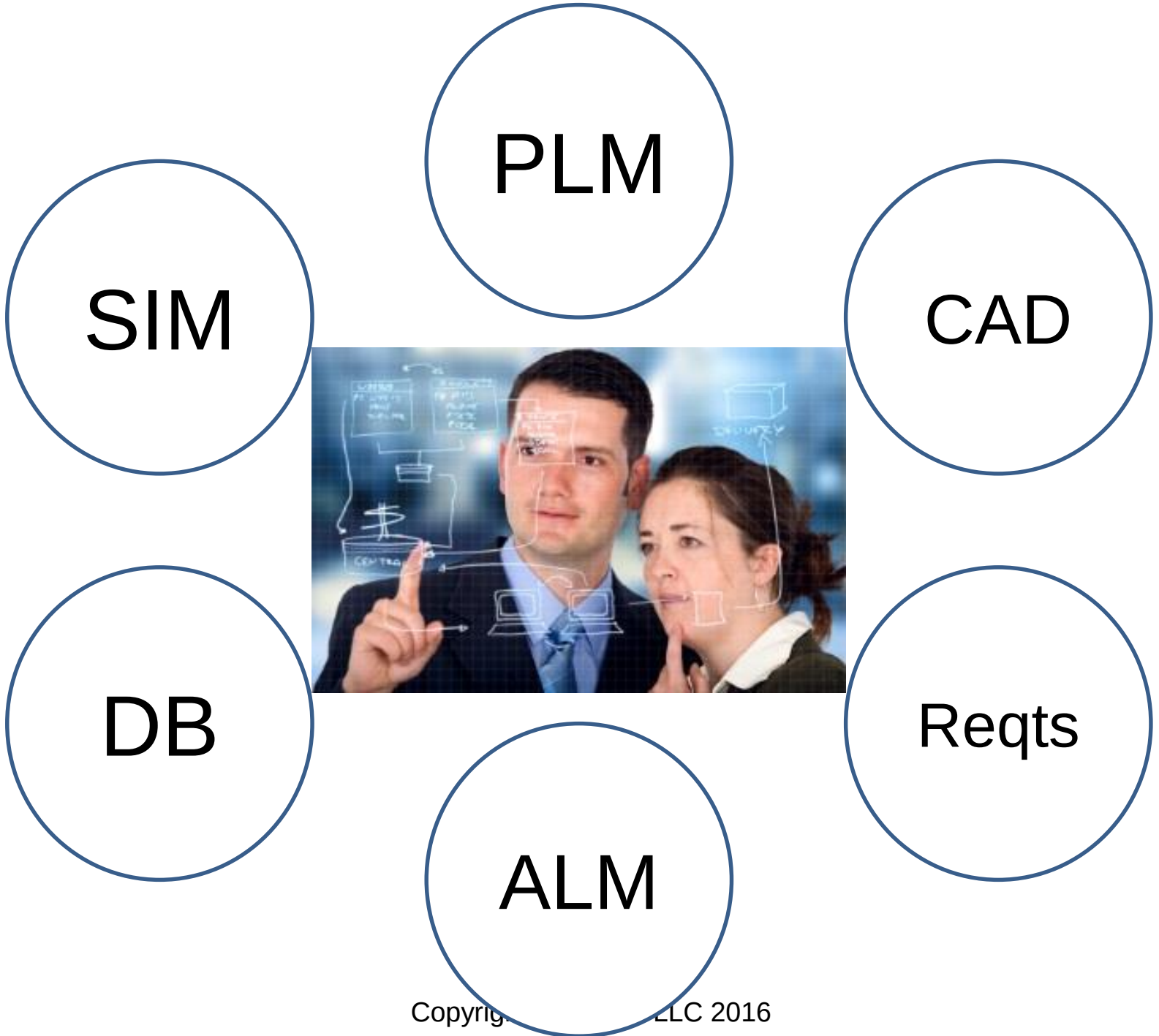
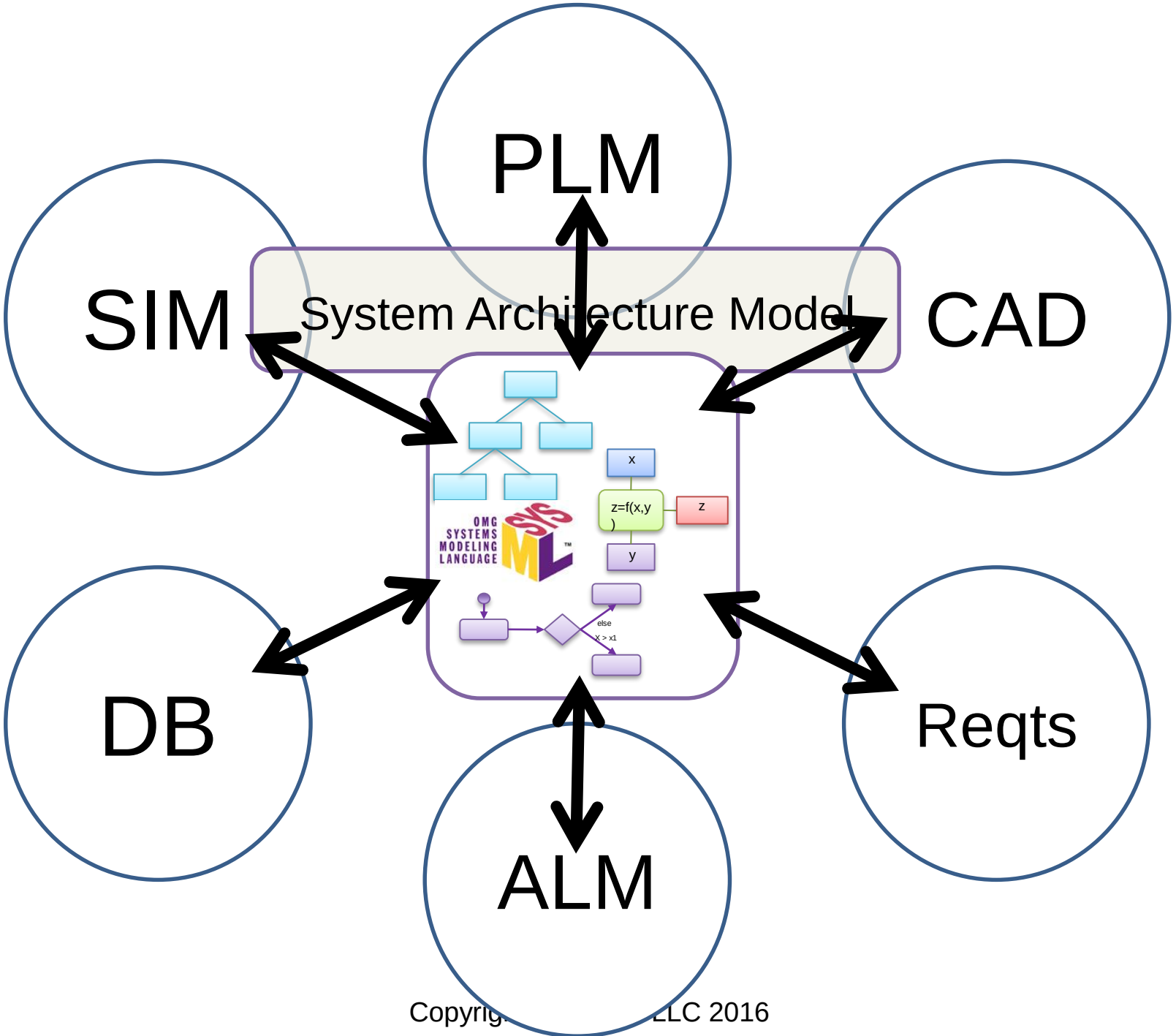
Learning Objectives

- Describe Use Cases where Systems Engineers can use SysML Models in combination with other engineering tools
- Describe how SysML supports those Use Cases

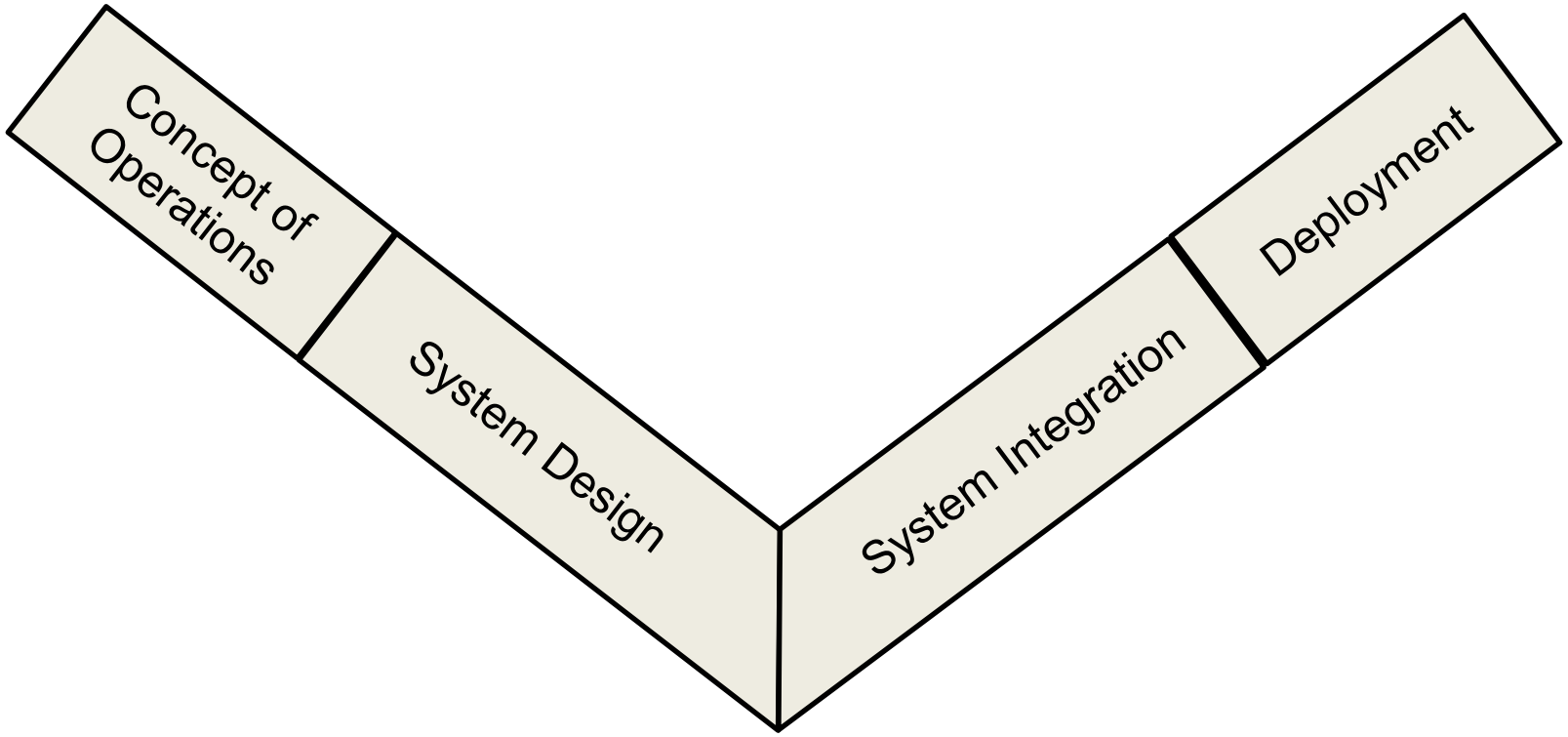




Practical Issues in Interoperability

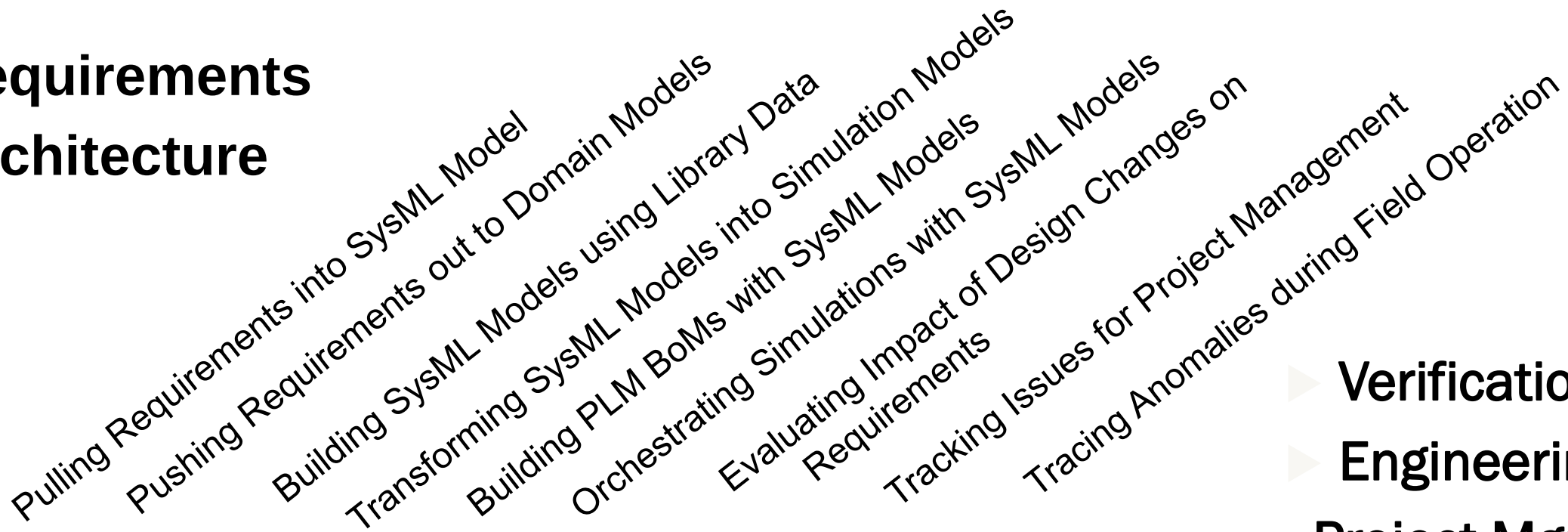
- Where does the data live?
- Who has access to it?
- How do you know when things change?
- Which is better, full vs piecemeal integration?
- What is the best way to query and visualize?

Systems Engineering V Model



Systems Engineering Use Cases

- **Requirements**
- **Architecture**



- Verification
- Engineering & Project Mgmt

Concept of Operations	System Design	System Integration	Deployment

Pulling Requirements into the SysML Model

- Objectives: Pulling requirements into SysML model to
  - Build relationships with other system elements
  - Build relationships with requirements from other repositories
  - Connect requirements with verification analyses
- Approaches – connections with Reqt Mgmt tools, PLM, databases
- Issues – scaling, selective information transfer
- Example – Syndeia Teamcenter requirements import

Pushing Requirements out to Domain Models

- Objectives: Pushing requirements from SysML model to
  - Design tools to establish design constraints
  - Analysis tools to establish test conditions
- Approaches – connections with CAD/CAE tools
- Issues – text-based requirements not enough
- Example – Syndeia MagicDraw to CAD requirements by geometry

Building SysML Models using Library Data

- Objectives: Use existing data from PLM and databases
  - Build SysML part structures
  - Compare and update SysML model
- Approaches – connections with PLM and databases
- Issues – master ownership of data, access and security
- Example – Syndeia Windchill and MySQL to MagicDraw for UAV

Architecture

Building PLM BoMs with SysML Models

- Objectives: Use SysML part structure and requirements to
  - Seed PLM Bill of Materials
  - Compare and update SysML and PLM models
- Approaches – connections with PLM
- Issues – selective synching, customized PLM schemas
- Example – Syndeia MagicDraw to Teamcenter for UAV

Verification

Transforming SysML Models into Simulation Models

- Objectives: Use SysML activity and internal block diagrams to
  - Create simulation models
  - Compare and update SysML and simulation models
  - Reverse Use Case – sim models to SysML
- Approaches – connections with Simulation tools
- Issues – mapping concepts (e.g. ports, buses, item flows)
- Example – Syndeia MagicDraw to Simulink for UAV

Orchestrating Simulations with SysML Models

- Objectives: Use SysML parametric diagrams to
  - Orchestrate and execute simulation and analysis models
- Approaches – connections with simulation tools and math solvers
- Issues – generating trade studies and optimization problems
- Example – ParaMagic execution of Home Heating

Evaluating Impact of Design Changes on Requirements

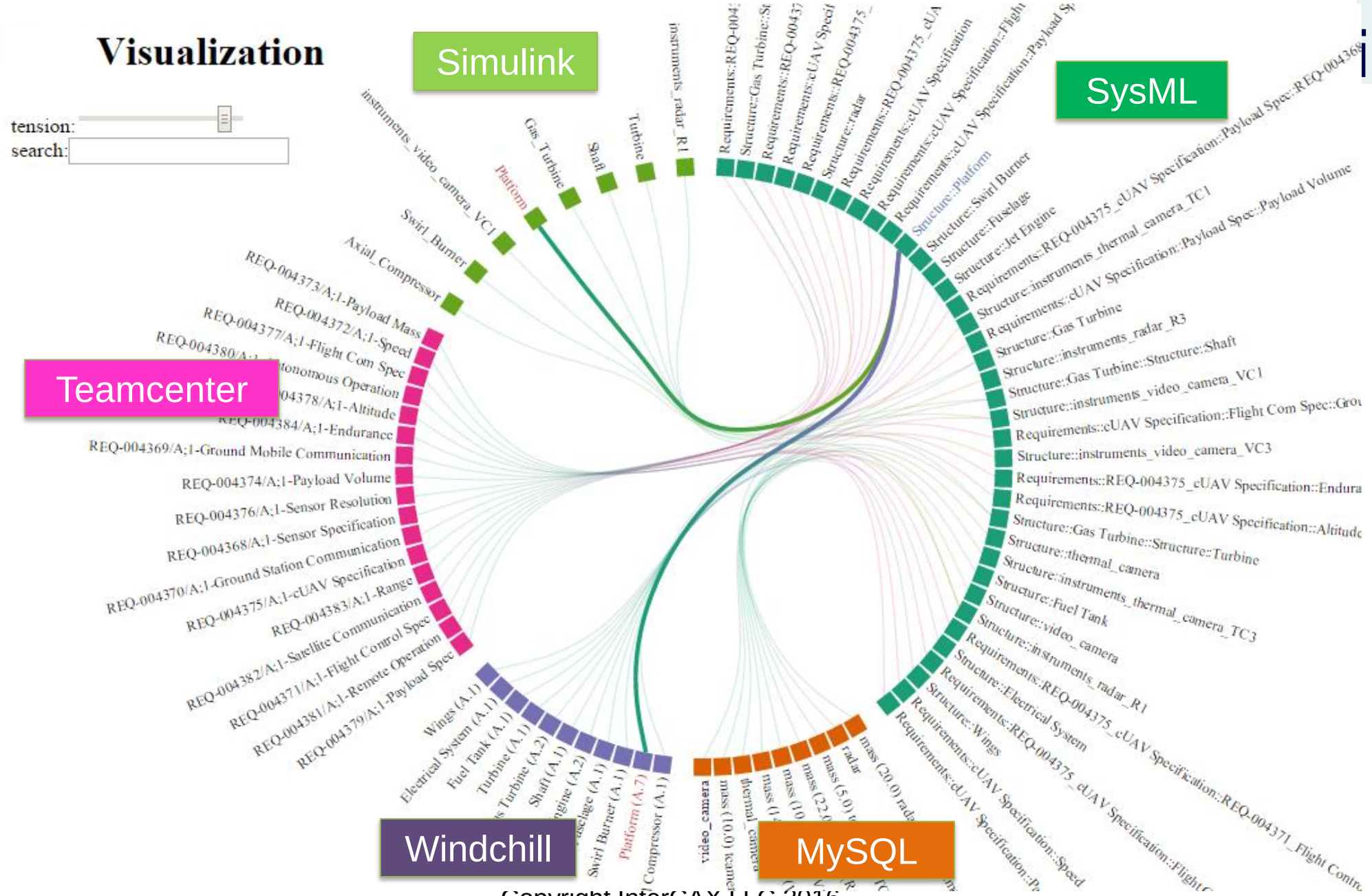
- Objectives: Pull design parameters into SysML model to
  - Evaluate impact on system requirements
- Approaches – connections with CAD tools
- Issues – parameter conversion between different data models
- Example – Syndeia NX to MagicDraw import of car design

Tracking Issues for Project Management

- Objectives: Pull issue tracking info into SysML model to
  - Identify existing issues by part, function or reqt
- Approaches – connections with PM tools
- Issues – most important use cases?
- Example – Syndeia MagicDraw query to JIRA

Tracing Anomalies during Field Operation

- Objectives: Identify extended linkages from function to structure and requirements to
  - Identify source of problems during Field Operations
  - Identify impact of requirement changes on design
- Approaches – connections with all external tools and repositories
- Issues – connection storage, graph databases, visualization
- Example – next-generation interoperability visualizations



Recap

- At the end of the lecture/demonstration, you should be able to
  - Identify some of the key use cases where you, as a Systems Engineer, need to connect your Systems Architecture model with Domain models
  - Describe the role that these issues play
    - Visualization
    - Data access and security
    - Conceptual mapping
    - Selective synchronization
  - Discuss benefits and costs of interoperability

Questions?

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