

The Model Driven Enterprise:

Realizing the Business Benefits of OMG Standards

Austin, Texas



Model Based Systems Engineering Ecosystem

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No Magic, Inc

Presentation outline



- Model Based Systems Engineering
- MBSE benefits
- Cameo MBSE ecosystem overview

Systems Engineering



Systems engineering is an **interdisciplinary** field of engineering that focuses on how to design and manage **complex** engineering systems over their life cycles.

Wikipedia

MBSE Definition



“Model-Based Engineering (MBE): An approach to engineering that *uses models as an integral part of the technical baseline* that includes the requirements, analysis, design, implementation, and verification of a capability, system, and/or product throughout the acquisition life cycle.”



Final Report, Model-Based Engineering Subcommittee, NDIA, Feb. 2011

“Model-based systems engineering (MBSE) is the *formalized application of modeling* to support system requirements, design, analysis, verification and validation activities beginning in the conceptual design phase and continuing throughout development and later life cycle phases.”



INCOSE SE Vision 2020 (INCOSE-TP-2004-004-02, Sep 2007)



SE problems

- Complexity is growing faster than ability to manage it
- Knowledge is lost between projects and phases
- Difficult to assess completeness and consistency of information spread across documents
- System design emerges from pieces, not system architecture

MBSE should help to

- Enhance system design integrity
- Improve communication
- Increase productivity and quality while reducing risks
- More rigorous requirements traceability
- Make system design computer-readable
- Integrate analytical models
- Generate consistent documentation

Is modeling new?



- Models have been used as part of document-based systems engineering approach for many years
- The use of models has been limited to support specific types of analysis or selected aspects of system design
- The individual models have not been integrated into a model of the overall system

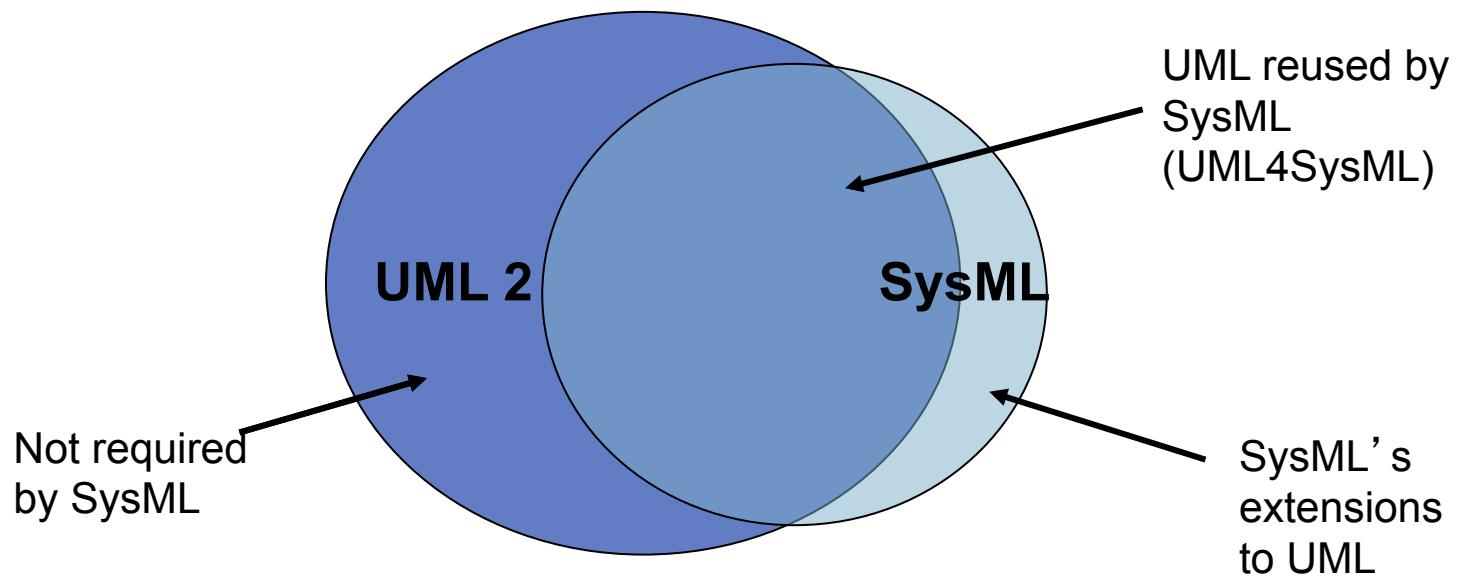
What is new ?

- the availability of **formal modeling languages** which can describe systems
- **engineering standards** and tools which enable **integration** of a system model with existing discipline models.

SysML - Systems Modeling Language



- OMG Systems Modeling Language (SysML) is a graphical modeling language for specification, analysis and design, verification and validation of systems.
- Developed by OMG and INCOSE
- Adopted by OMG in May 2006
- Implemented as a UML profile
- Supports XMI



SysML - a key MBSE enabler



- SysML enables MBSE
- MBSE typically uses SysML as a standard visual modeling language and lingua franca, but is not limited to it
- SysML is not intended and not capable to replace current investment in modeling in the other engineering disciplines.
- It is intended that SysML-based models be the framework for interoperating with these discipline models, thus enabling integrated model-centric engineering
- SysML is methodology and tool independent

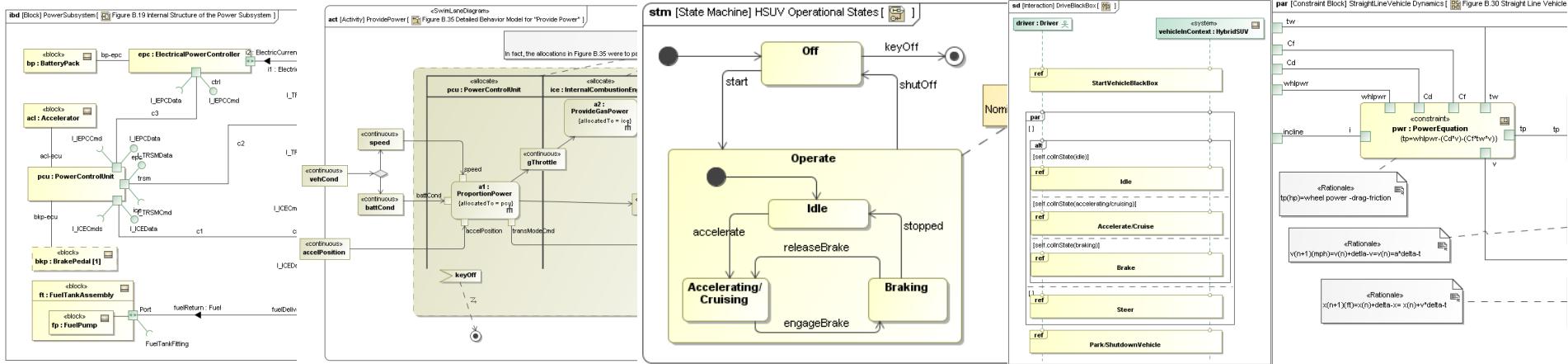
Cameo Systems Modeler



SysML in Cameo Systems Modeler



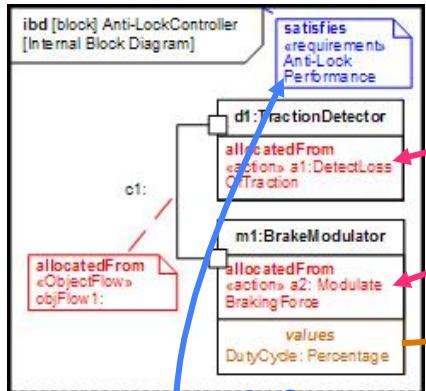
- The most standard compliant SysML implementation on the market:
 - Implementation of the latest SysML 1.4 spec
 - Implementation of all 9 SysML diagrams
 - Background validation of all SysML constraints
 - Most standard compliant UML/SysML XMI file
 - Requirements interchange, engineering analysis and more



System Model

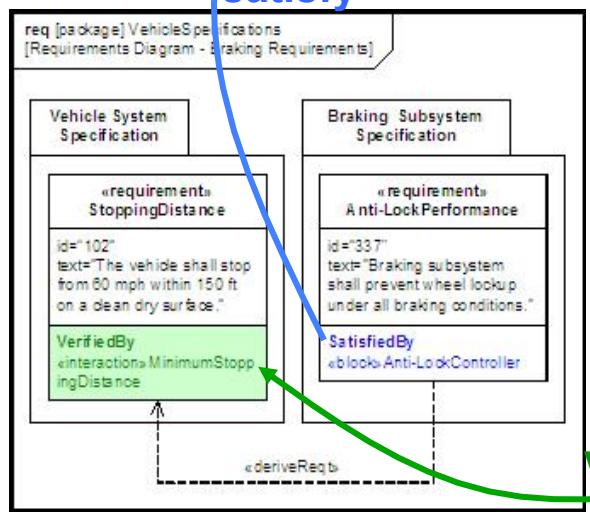


1. Structure

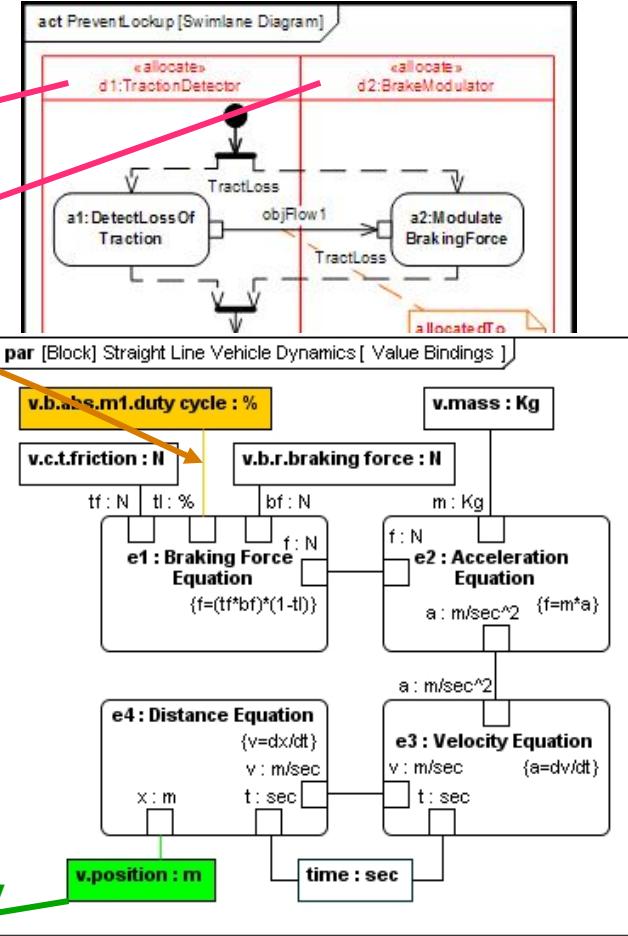


allocate
value binding

satisfy



2. Behavior



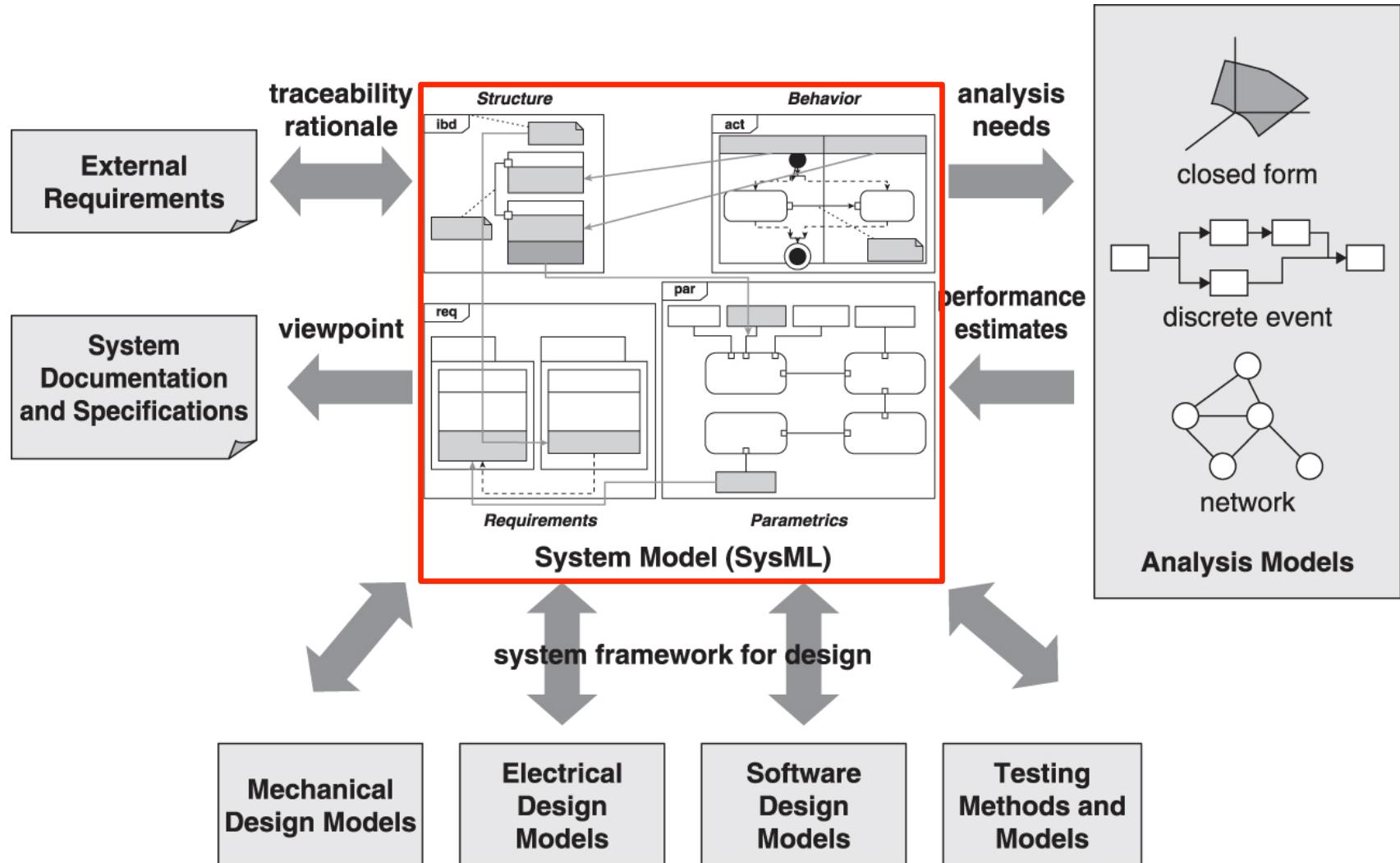
3. Requirements

Verify

A system model is an interconnected set of model elements that represent key system aspects including structure, behavior, requirements, and parametrics.

4. Parametrics

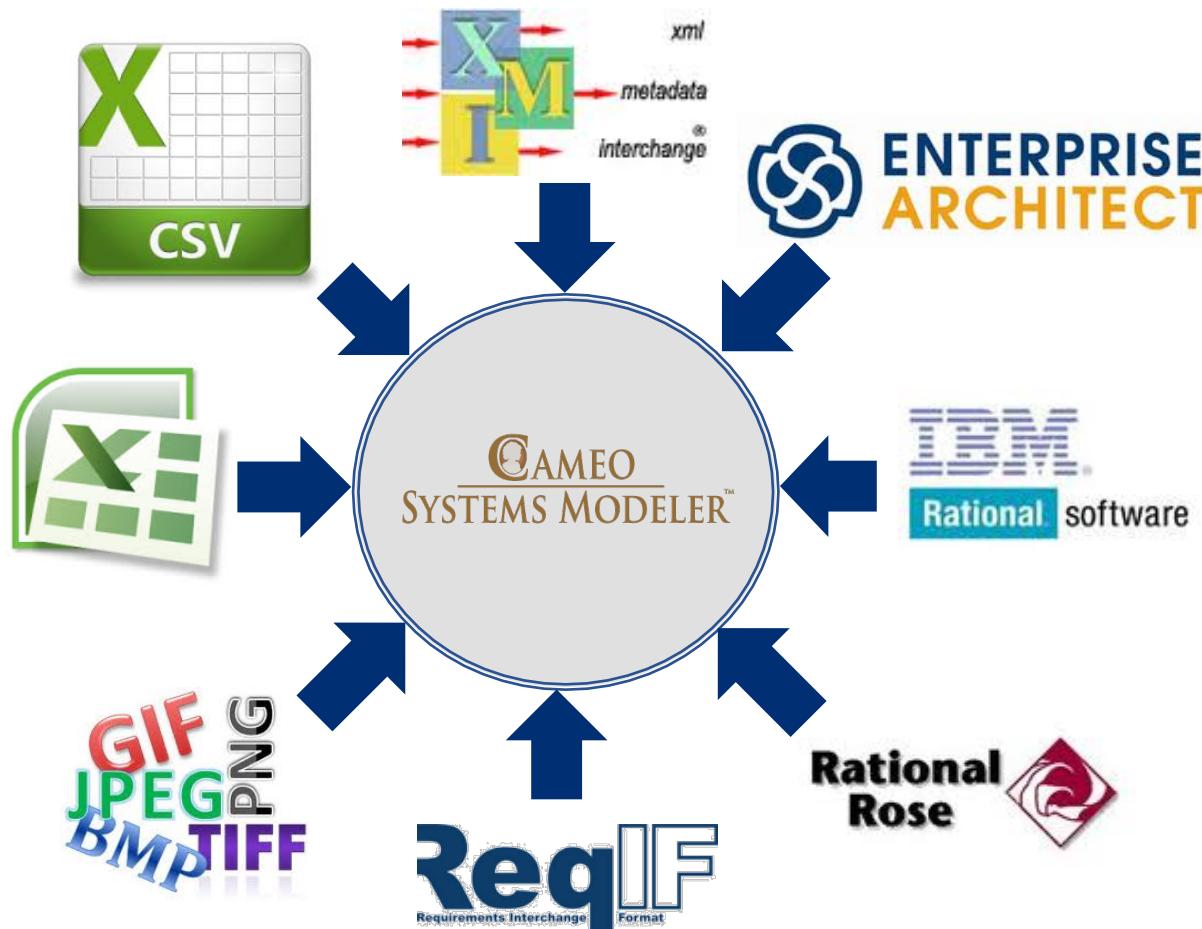
System Model as an Integration Framework



Cameo MBSE Ecosystem



Data Import



Documents to models



- Cameo Inter-op & Cameo Workbench:
 - Excel, Visio, Powerpoint
- Excel import/export options
 - CSV import plugin
 - **NEW** Excel import plugin
 - DataHub, Paramagic, Matlab, Model Center
 - Excel report templates

UML-based model migration



- XMI (XML Metadata Interchange)
 - Best results at OMG MIWG
 - Eclipse XMI is supported too
 - Diagrams not included
 - OMG DI (Diagrams Interchange) standard is coming
- Full model & diagrams import:
 - IBM System Architect & IBM Rational Rose
 - IBM Rhapsody
 - Sparx Enterprise Architect
 - Vitech CORE® (4.0 to 6.0 Versions Supported)

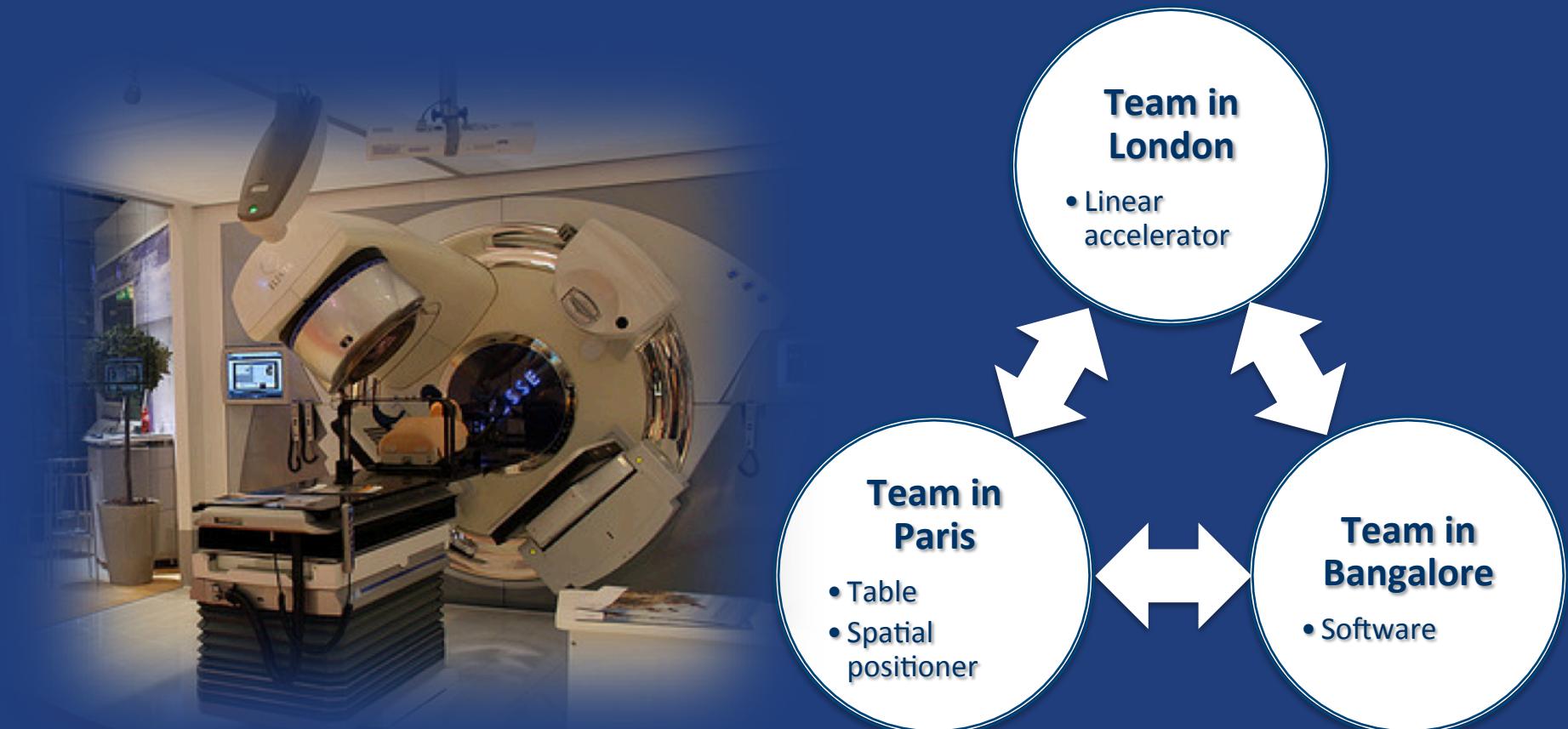
MBSE Ecosystem



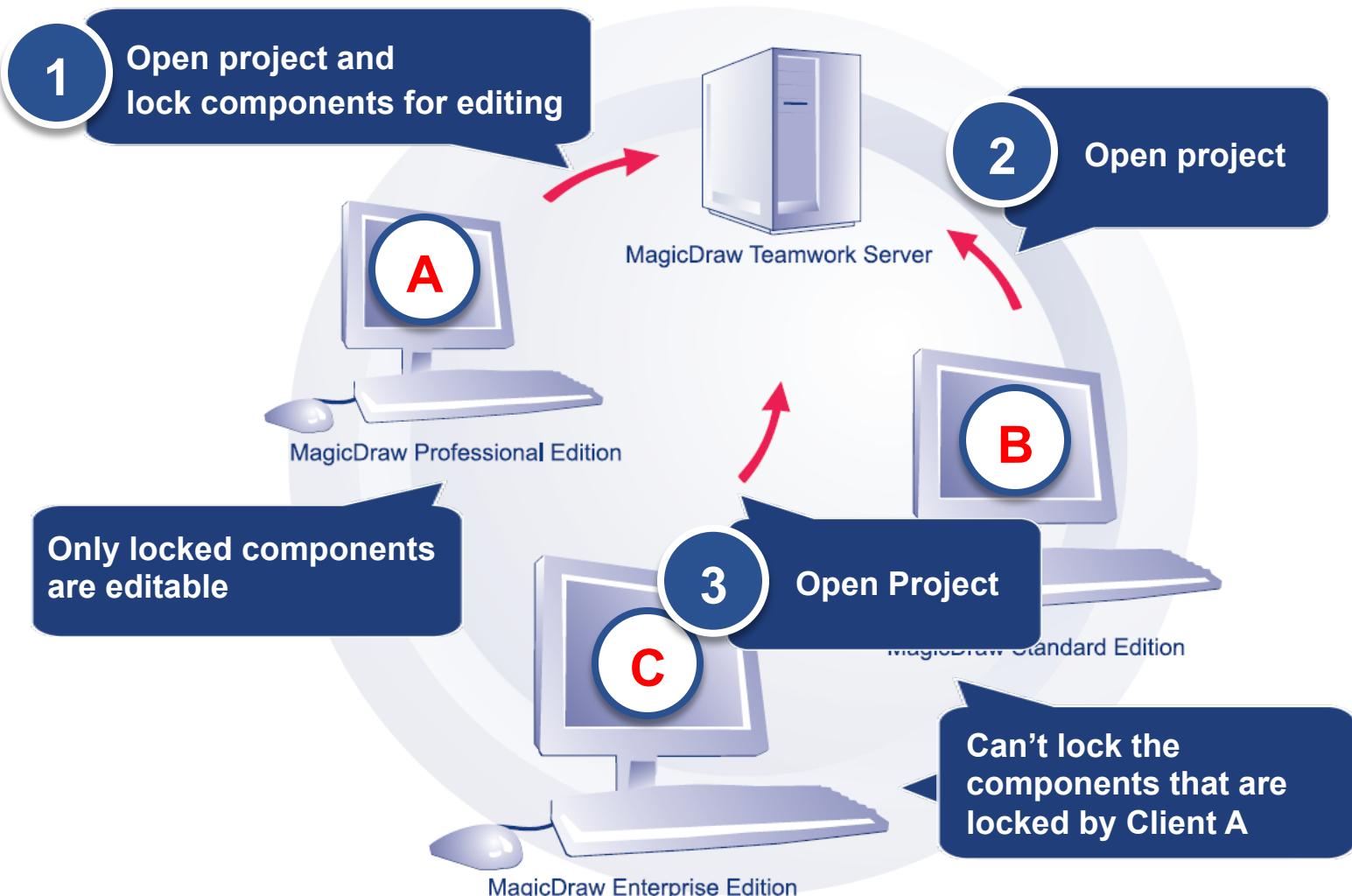
Scalability & performance



- Geographically distributed Teamwork Server



Teamwork Server Overview



Teamwork Server Overview (2)



Teamwork Server Benefits



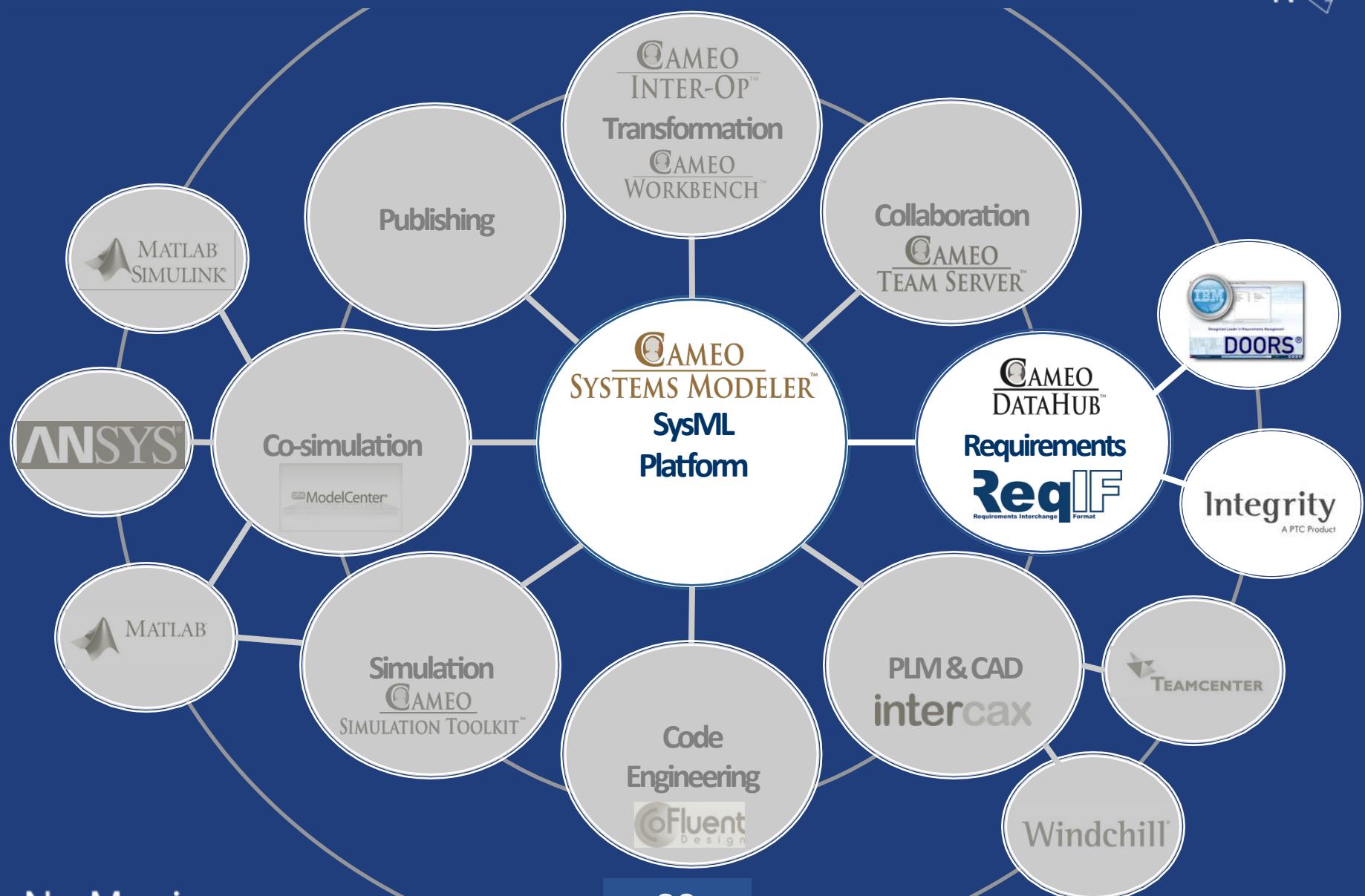
- **Global project repository**
 - Projects
 - Users
 - Permissions
- **Collaboration inside a project**
 - Locking/unlocking model elements
 - Seeing who has locked which elements
 - Submitting changes
- **Change management**
 - Versioning
 - Branching
 - Comparing
 - Merging

Coming soon



- **New generation Teamwork Server (CEDW)**
 - Distributed and infinitely scalable database
 - Element level versioning, partial loading
 - EMF based - multiple tools support
 - Web access for review and querying
- **Collaborative model review environment**

MBSE Ecosystem



Requirements management

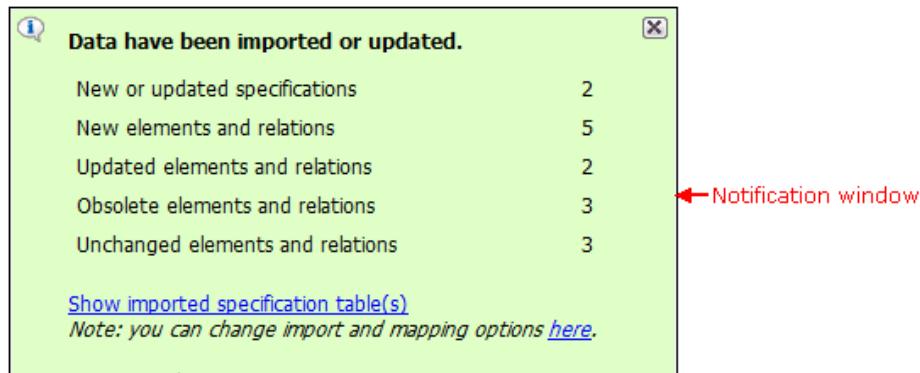


- **Cameo Requirements Modeler plugin**
 - Included into SysML plugin and Cameo Systems Modeler
 - Manages SysML Requirements
 - Diagrams, Tables, Matrices, Relation maps, reports
 - Traceability and Impact analysis
 - ReqIF import
- **Cameo DataHub**
 - Seamless two-way DOORS integration
- **CSV & Excel import**
- **OSLC is coming soon**

ReqIF import and update



- Requirements Interchange Format (ReqIF)
- ReqIF is a normative (OMG) XML-based data format
- DOORS, Integrity, Polarion, TeamCenter...



#	Hierarchy Id	Name	Status
1	1	Introduction	Updated
2	1.1	Scope	Unchanged
3	1.2	Asumptions(This Section Was Updated)	Obsolete
4	1.3	Exclusions	Obsolete
5	1.3.1	System Instances	Obsolete
6	2	Changes Made	Unchanged
7	2.1	Changes	Updated
8	3	Contents	Unchanged



Cameo DataHub



Four screenshots of Cameo DataHub interface are shown, each with a blue arrow pointing to a central 'Business Process Diagram' in MagicDraw UML.

- Microsoft Excel:** Shows a spreadsheet with requirements and a green 'Cameo DataHub' ribbon tab.
- Rational DOORS:** Shows a requirements management interface with a 'Rational DOORS' ribbon tab.
- Rational RequisitePro:** Shows a requirements management interface with a 'Rational RequisitePro' ribbon tab.
- MagicDraw UML:** Shows a UML interface with a 'MagicDraw' ribbon tab.

The central 'Business Process Diagram' in MagicDraw UML is a 'Credit Request' process:

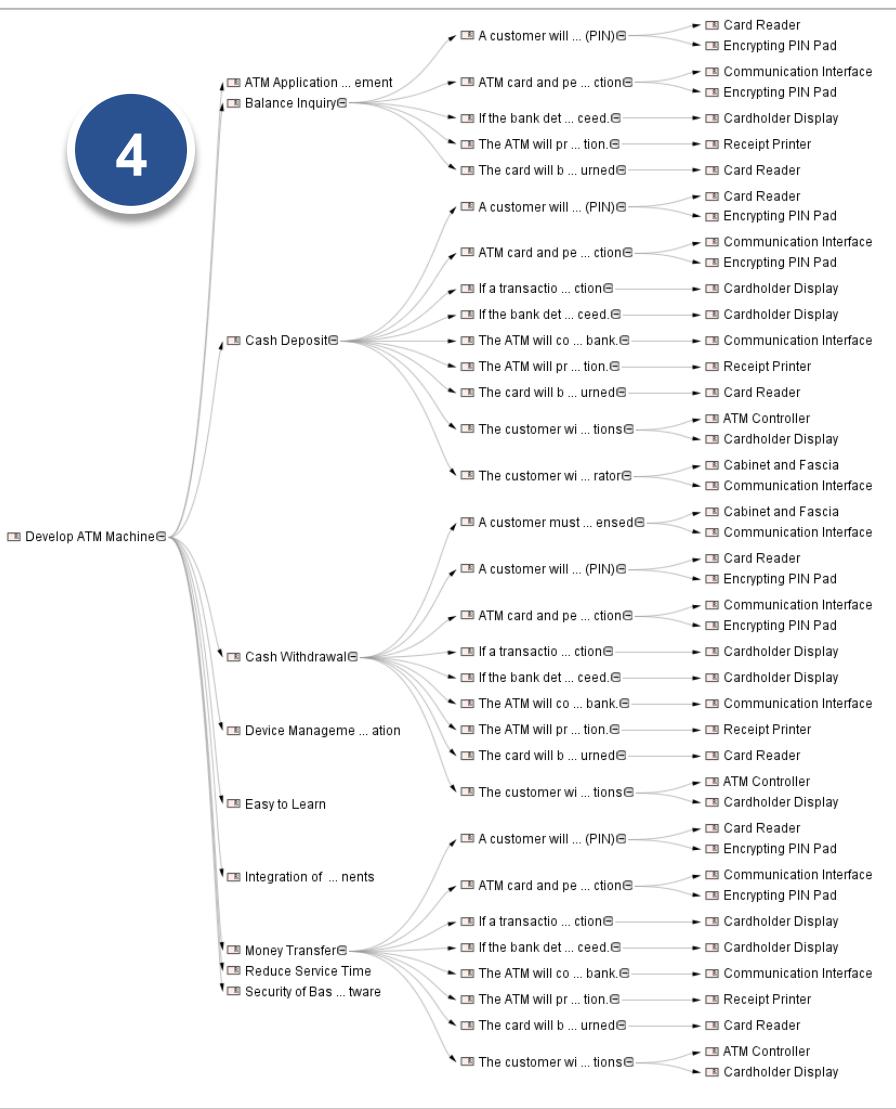
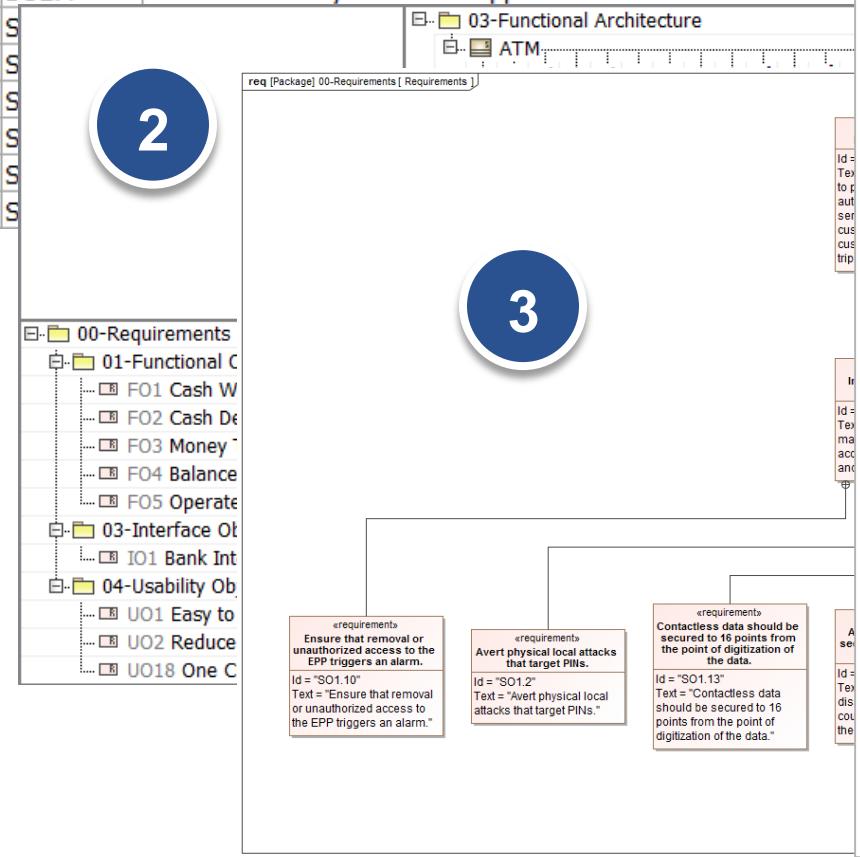
```
graph TD; Start(( )) --> ReceiveCreditReport[Receive Credit Report]; ReceiveCreditReport --> Decision{Type of Customer}; Decision --> NoPath[No]; Decision --> YesPath[Yes]; NoPath --> EstablishCredit[Established with prior credit]; EstablishCredit --> IncludeApologyText[Include Apology Text]; EstablishCredit --> IncludeHistoryTransactions[Include History of Transactions]; YesPath --> IncludeStandardText[Include Standard Text]; CreditReport[Credit Report] --> End(( ));
```

magicedraw® logo is displayed at the bottom of the MagicDraw interface.

Requirements in CSM



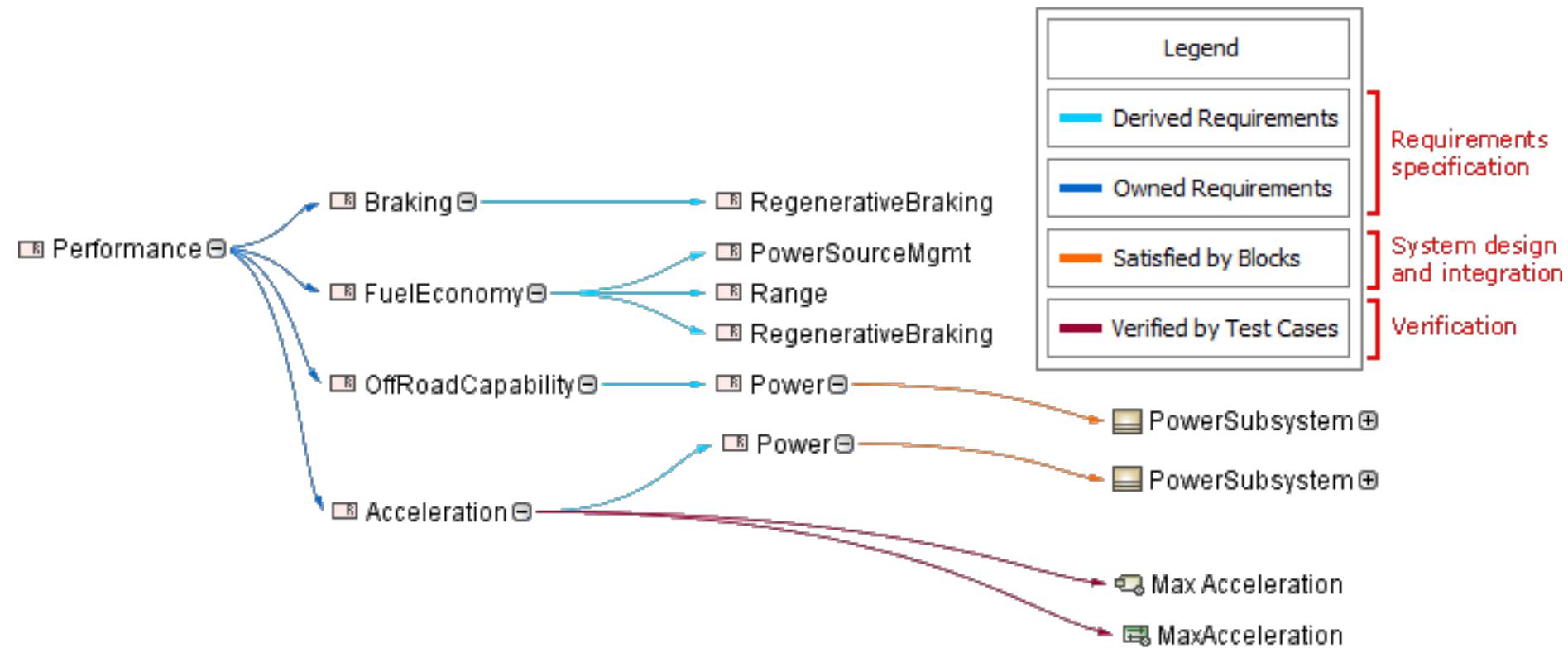
#	Id	Text
1	SC1	Avert magnetic-stripe skimming and PIN stealing
2		Prevent abuse of OS and reduce the attack surface of the AT
3		Prevent exploitation of public domain vulnerabilities in the Op
4	SC2	Reduce attack surface from public and private networks.
5	SO2.4	Prevent abuse by software suppliers.
6	S	
7	S	
8	S	
9	S	
10	S	
11	S	



Impact analysis



- Identification of the scope and impact of a change



Coverage analysis

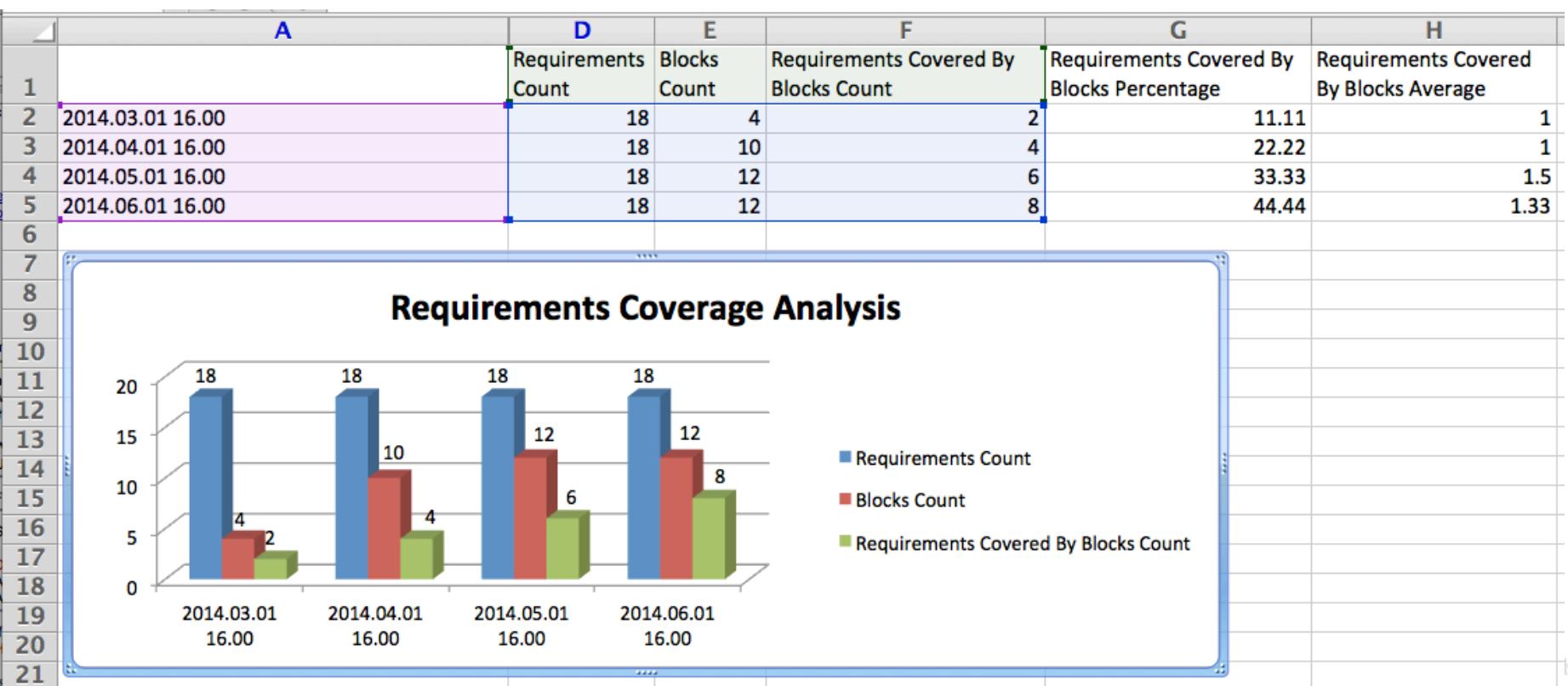


Use Cases | Data Metric Table | **Data Metric Table1** X

Calculate Metrics | Add Existing | Delete | Remove From Table | Show Metric Suites | Show Columns | Export | Filter | Criteria

Metric Suite: Reqs Satisfied by Blocks | Scope (optional): Drag elements from the Model B | Filter:

#	Date	Requirements Count	Blocks Count	Requirements Covered By Blocks Count	Requirements Covered By Blocks Percentage	Requirements Covered By Blocks Average
1	2014.03.01 16.00	18	4	2	11.11	1.00
2	2014.04.01 16.00	18	10	4	22.22	1.00
3	2014.05.01 16.00	18	12	6	33.33	1.50
4	2014.05.01 16.00	18	12	8	44.44	1.33



Compliance analysis



bdd [Package] Analysis [bdd_RequirementsCheck]

```
classDiagram
    class Vehicle {
        constraints padAnalysis, stopDistanceAnalysis
    }
    class wheel {
        "wheel : Wheel"
        class brake {
            "brake : Brake"
        }
        class pad {
            "pad : Pad"
            heat : kw
        }
        life : mi
    }
    requirement Stopping Distance {
        Id = "1"
        Text = "Four braking wheels shall be capable of stopping the vehicle from 60 miles per hour in less than 180 feet."
        upperBound = 180.0
    }
    requirement Brake Heating {
        Id = "2"
        Text = "Braking at 60 miles per hour shall not generate more than 53 kW of heat at each wheel."
        upperBound = 53.0
    }
    requirement Brake Pad Life {
        Id = "3"
        lowerBound = 36000.0
        Text = "Brake pads shall have a projected life of at least 36,000 miles under normal driving conditions, as per industry standard assumptions."
    }
    Vehicle "satisfy" Stopping Distance
    wheel "satisfy" Brake Heating
    wheel "satisfy" Brake Pad Life
```

Manage Parametric Diagrams Evaluate Designs

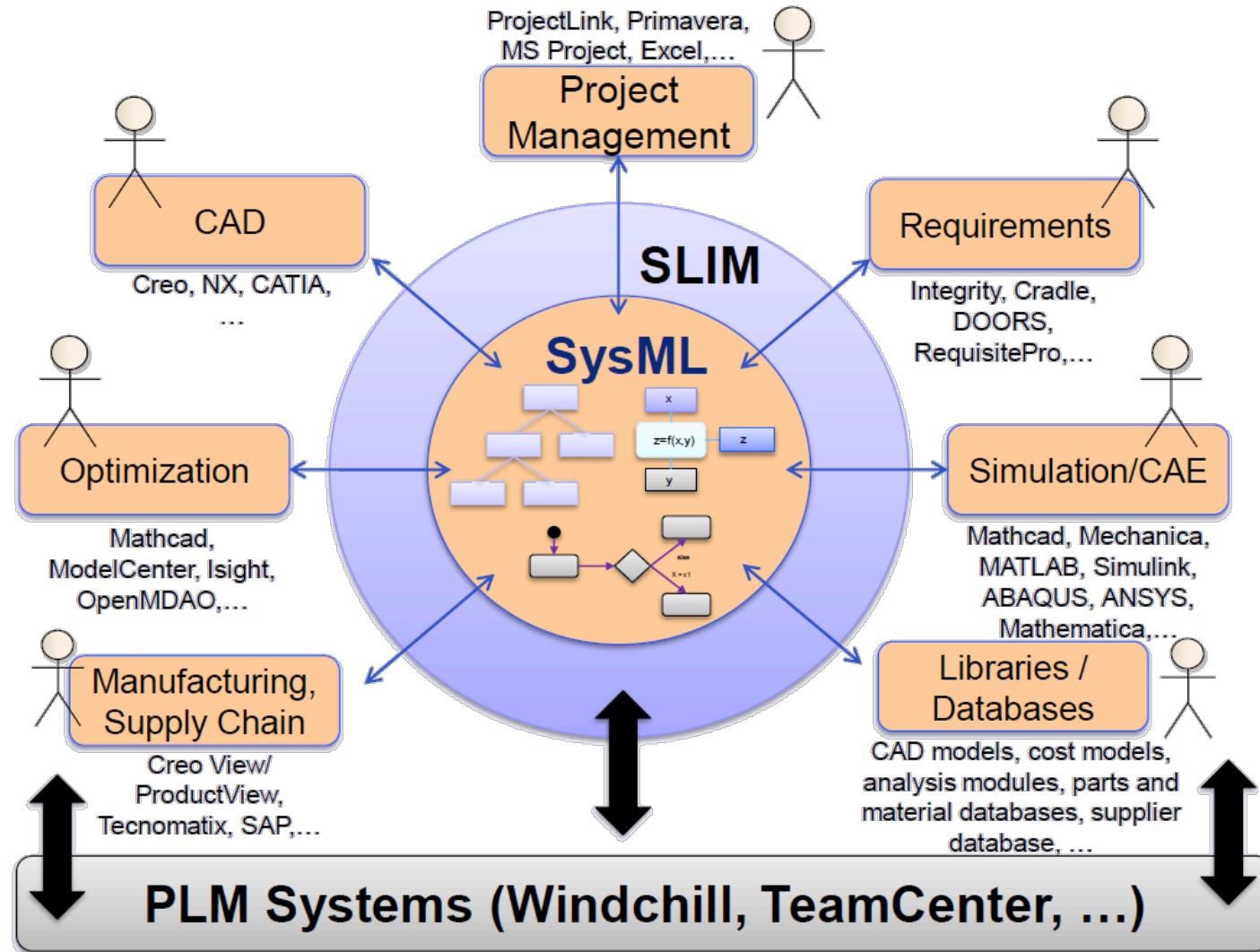
Bookmark <none>

Property	Bounds	Actual	Specification
Brake Heating	wheel.brake.pad.heat < 53.000 kw	52.704 kw	Braking at 60 miles per hour shall...
Brake Pad Life	wheel.brake.pad.life > 72,000 mi	36,016 mi	Brake pads shall have a projected...
Stopping Distance	stoppingDistance < 180.00 ft	174.22 ft	Four braking wheels shall be capa...
Center Length	(not specified)	3.0000 - 5.5...	The Pad Center Length shall be b...
Center Thickness	(not specified)	0.20000 - 0....	The Pad Center Thickness shall b...
Width	(not specified)	1.5000 - 2.5...	The Pad width shall be between 1...
Rotor Diameter	(not specified)	= 11.0	The brake rotors shall have a 11-i...
Tires	(not specified)	= 22.0	The tires shall have a 22-inch rolli...
Vehicle Weight	(not specified)	< 3,200.0	The vehicle weight shall be equal ...

MBSE Ecosystem



System Lifecycle Management (SLIM)



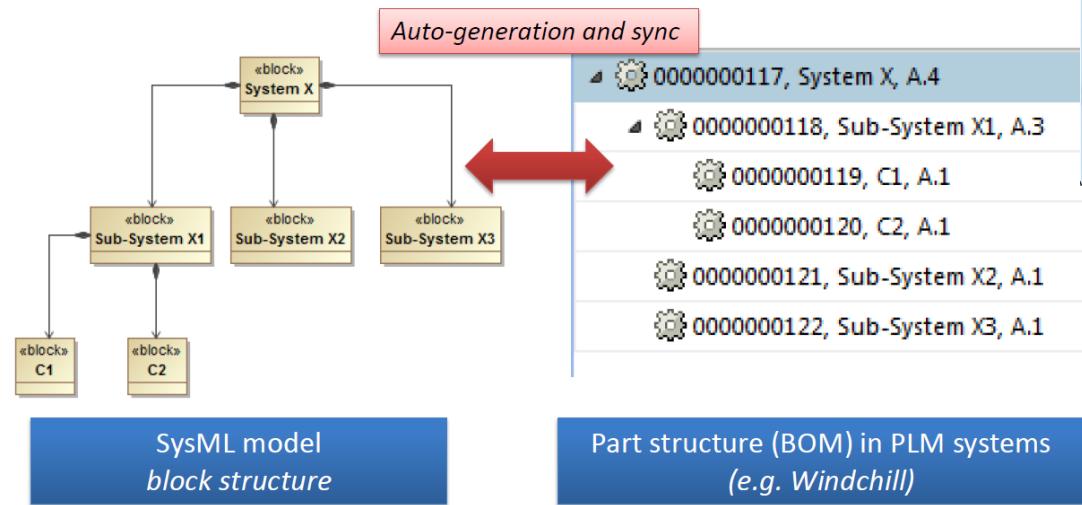
SLIM (2)

SLIM DASHBOARD - Project: Project UAV Demo 140502

Repository Manager Connection Manager Connection Browser Connection Summary Comparer

Repository	Type	URI	User Credential
MissionSoftware	LFS	C:\Users\Dirk\Docu...	
My Hard Disk	LFS	C:\Users\Public\Doc...	
MySQL-User	MYSQL	office.intercax.com:... dirk	
TC-Demo	TC	http://office.intercax... dirk	
TC-User	TC	http://office.intercax... manas	
WC-Vendor	WC	http://intercax-wc.in... manas	
WC_User	WC	http://intercax-wc.in... dirk	

[09:37:18] INFO Successful in generating BOM for item revision 004195/A;1-AltBlade
[09:37:19] INFO Successful in generating BOM for item revision 004196/A;1-Engine
[09:37:20] INFO Successful in generating BOM for item revision 004197/A;1-Fuselage
[09:37:21] INFO Successful in generating BOM for item revision 004198/A;1-test demo component Wide Angle IR detector



SLIM DASHBOARD - Project: Project UAV Demo 140502

Repository Manager Connection Manager Connection Browser Connection Summary Comparer

SysML Platform

UAV System

Platform

Aircraft_Platform

- Relations
- Value Properties
- body : Body
- elec : ElectricalSystem
- eng : Engine
- fs : FuelSystem
- pt : PowerTrain
- rtr : Rotor
- tail : TailAssembly

- AltBlade
- Battery
- BlackBox
- BlackBox1
- Body
- Cowling
- ElecSysController
- ElectricalSystem
- Engine
- FuelDistribution
- FuelSystem
- FuelTank
- Fuselage

WC-Vendor

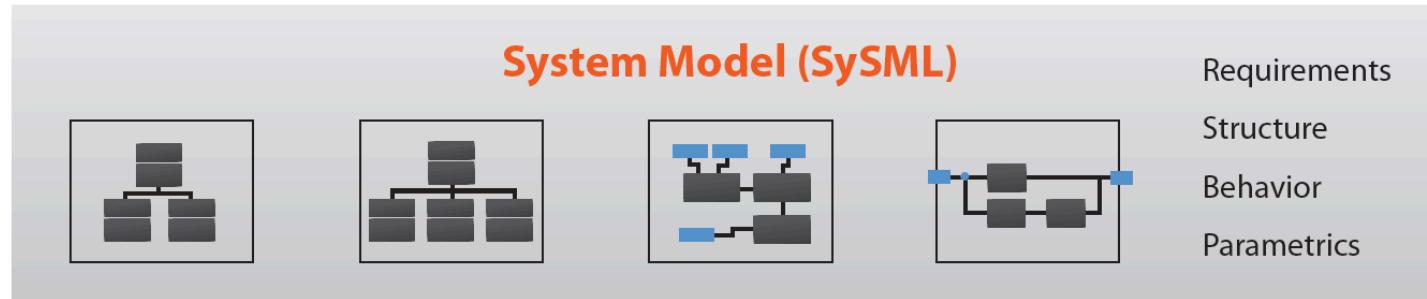
- HVAC
- HVAC MD-WC
- HVAC new
- HVAC WC-MD
- IntercaxWorldcar
- MyFirstSystem
- Project Uno
- Satellite
- Satellite Rose
- Satellite Test
- Satellite_User
- UAV SysML
- Part Structure (latest)
- Folders
- Aircraft_Platform
- Aircraft_Platform (A.1)
- Aircraft_Platform (A.2)
- Aircraft_Platform (A.3)
- Aircraft_Platform (A.4)
- Aircraft_Platform (A.5)
- Aircraft_Platform (A.6)
- Aircraft_Platform (A.7)
- Aircraft_Platform (A.8)

Conn ID Source Target Latest Target Comment

C2	Aircraft_Platform	Aircraft_Platform (A.8)	Aircraft_Platform (A.12)	The block Aircraft_Platform
	pt : PowerTrain	pt: PowerTrain (A.4)	pt: PowerTrain (A.4)	Part property pt a
	elec : ElectricalSystem	elec: ElectricalSystem (A.5)	elec: ElectricalSystem (A.5)	Part property elec
	rtr : Rotor	rtr: Rotor (A.7)	rtr: Rotor (A.7)	Part property rtr a
	eng : Engine	eng: Engine (A.1)	eng: Engine (A.1)	Part property eng
	bb : BlackBox	bb: BlackBox (A.3)	bb: BlackBox (A.3)	Part property bb
	body : Body	body: Body (A.5)	body: Body (A.5)	Part property body
	fs : FuelSystem	fs: FuelSystem (A.4)	fs: FuelSystem (A.4)	Part property fs a
	tail : TailAssembly	tail: TailAssembly (A.3)	tail: TailAssembly (A.3)	Part property tail a

[10:45:58] INFO Comparing SysML part property and Windchill part occurrence tail.
[10:45:58] INFO Part occurrences to be removed from Windchill part Aircraft_Platform (A.12) or part properties to be added b, bb]

Ready



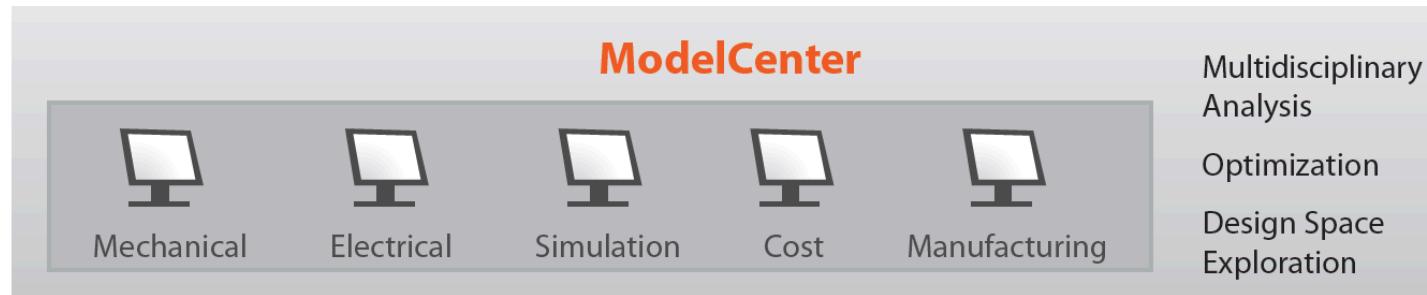
**Systems
Engineering
Model**

- Analysis Request
- System Requirements
- Analysis Specification



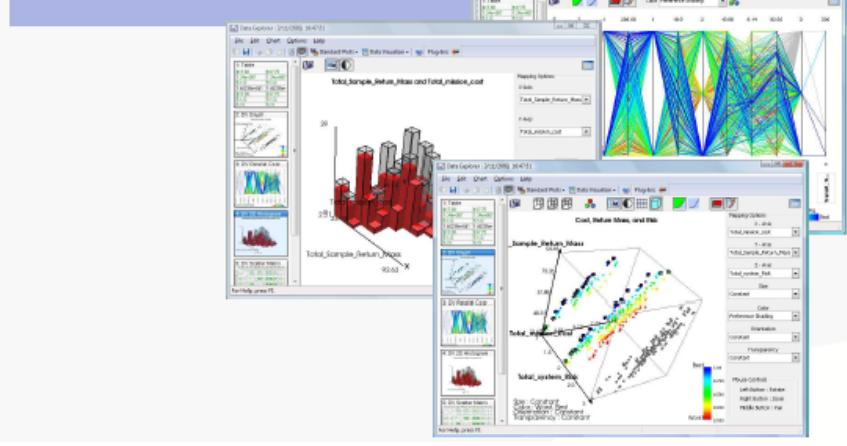
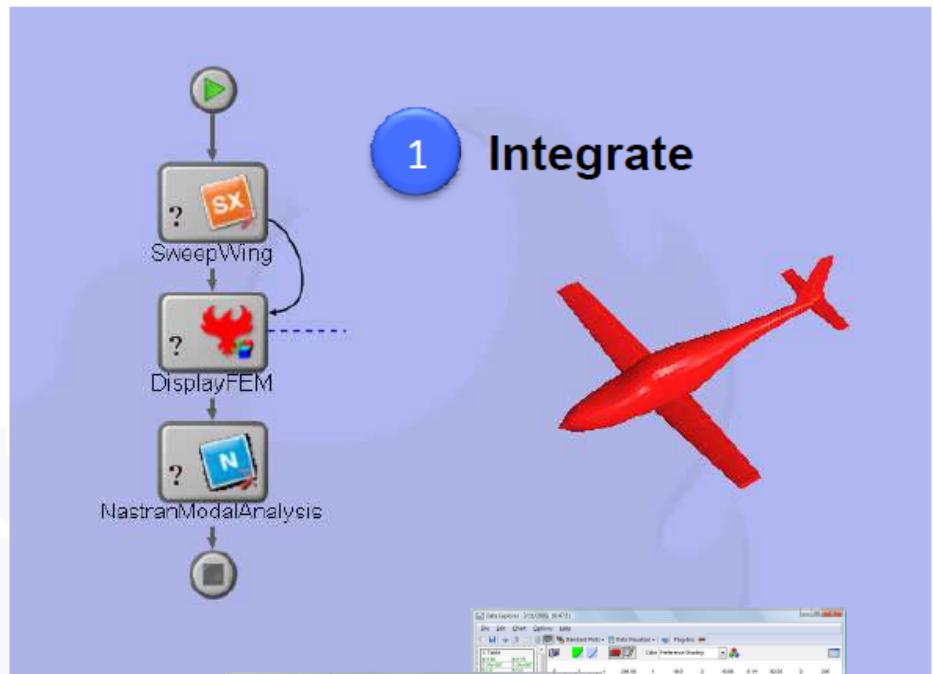
Bridge the Gap

- Performance Estimates
- Requirements Conformance
- Trade Study Results



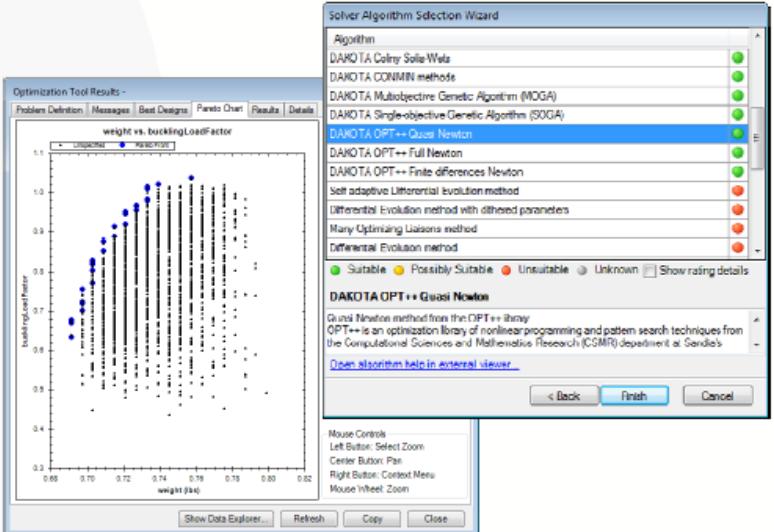
**Domain
Engineering
Models**

Model Center (2)



ModelCenter

2 Automate (DOE, Optimization)



3 Visualize and Find Better Designs

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Model Center (3)



Modeling and Simulation Tools



Abaqus



Adams



ANSYS



Catia



LS-DYNA



MSCNastran



NX



NXNastran



ProE

Product Design

- Given design parameters, predicts performance characteristics:
 - How much will it weigh?
 - How high can it fly?
 - What will it cost?
- Useful for designing hardware



- Matlab*
- Mathcad*
- Excel*
- In-house
- CAD



- ANSYS*
- Fluent
- Price*
- Seer*
- ACEIT*

Simulation

- Given performance characteristics, predicts how a system will react to various stimulus over time
 - Hit rate
 - Access times
 - Throughput
- Useful for designing systems



Interactive Simulation Framework



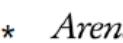
• STK*



• OpNet



• ProModel



• Arena



• Simulink*



• Extend*



• Vensim*

Model Center: MBSE Analyzer



The screenshot shows the Phoenix Integration MBSE Analyzer application window. The title bar reads 'Phoenix Integration MBSE Analyzer'. The menu bar includes 'Analyzer', 'Edit', 'View', 'Tools', and 'Help'. The top navigation bar contains five tabs: 'Welcome' (selected), 'Review Requirements', 'Manage Constraint Blocks', 'Manage Parametric Diagrams', and 'Evaluate Designs'. The main content area is divided into four quadrants:

- Review Requirements**: Check requirements conformance status.
- Manage Constraints**: Browse and import external analyses as constraint blocks.
- Manage Parametrics**: Browse and import parametric diagrams.
- Evaluate Designs**: Evaluate designs and perform trade studies by executing analyses.

Model Center: MBSE Analyzer



Phoenix Integration MBSE Analyzer

Analyzer Edit View Tools Help

Welcome Review Requirements Manage Constraint Blocks Manage Parametric Diagrams Evaluate Designs

Requirements

Bookmark: <none>

MagicDraw Plugin

File Edit Help

Project File: C:\MagicDrawExamples\CarBrakeDemo\CarBrakeDemo.mdzip

Load...

Select a Subject to Analyze

Data Analysis DesignBaselines Requirements Structure

- Brake
- Caliper
- Engine
- Pad
- Rotor
- Tire
- Transmission
- Vehicle
 - engine
 - par_VehicleAnalysis
 - transmission
 - wheel

Parametric Diagrams Selection Filter

Vehicle par_VehicleAnalysis

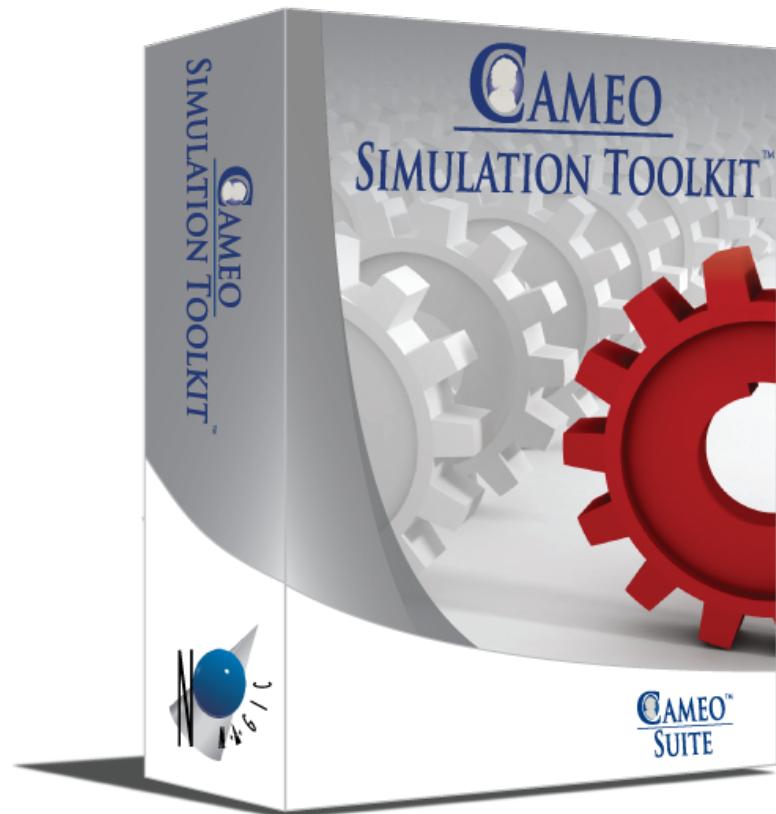
Property Units Original New Margin

Vehicle.grossWeight	lb	3200.0	3200.0	
Vehicle.numberOfWorkers	integer	4.0	4.0	
Vehicle.speed	mph	60.0	60.0	
Vehicle.wheel.brake.caliper.diameter	in	1.5	1.5	
Vehicle.wheel.brake.caliper.frictionForce	lb	30.0	30.0	
Vehicle.wheel.brake.caliper.pressure	psi	1000.0	1000.0	
Vehicle.wheel.brake.caliper.springForce	lb	50.0	50.0	
Vehicle.wheel.brake.pad.brakeMU	real	0.8	0.8	
Vehicle.wheel.brake.pad.centerLength	in	3.0	3.0	
Vehicle.wheel.brake.pad.thickness	in	0.275	0.275	
Vehicle.wheel.brake.pad.width	in	2.0	2.5	
Vehicle.wheel.brake.rotor.od	in	11.0	11.0	
Vehicle.wheel.tire.diameter	in	22.0	22.0	
Vehicle.wheel.tire.tireMU	real	0.9	0.9	
Vehicle.stopTime	s	3.959628	4.192547	
Vehicle.stoppingDistance	ft	174.223616	184.472064	4.47 ft
Vehicle.wheel.brake.torque	ft-lb	506.143751	478.024654	
Vehicle.wheel.brake.caliper.cost	usd	73.0	77.5	
Vehicle.wheel.brake.caliper.normalForce	lb	1687.145838	1687.145838	
Vehicle.wheel.brake.pad.cost	usd	3.3	4.125	
Vehicle.wheel.brake.pad.effectiveRadius	in	4.5	4.25	
Vehicle.wheel.brake.pad.heat	kw	52.704007	49.776006	3.22 kw
Vehicle.wheel.brake.pad.life	mi	36015.789222	47667.956324	1.17e+04 mi
Vehicle.wheel.brake.pad.surfaceArea	in^2	6.0	7.5	
Vehicle.wheel.brake.rotor.cost	usd	61.3	61.3	

Status Margin

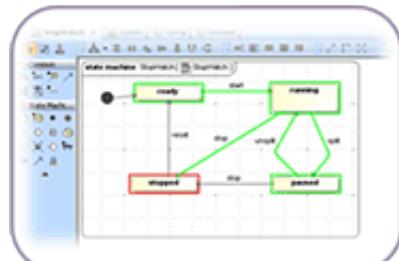
and .45 inches.	Unknown	
ches	Unknown	
5.5 inches.	Unknown	
ing the vehicle from 60 miles ...	Pass	5.78 ft
e more than 53 kW of heat at...	Pass	0.296 kw
st 36,000 miles under norma...	Pass	15.8 mi
an 3200 pounds.	Unknown	
	Unknown	
	Unknown	

Reset Values Create Components Run Now Save Save As...



— No Magic —

The Truth is in the Models™



**Software/Hardware
Engineer**

1 Simulate System Behavior

Run to gain understanding

2 Prototype User Interface

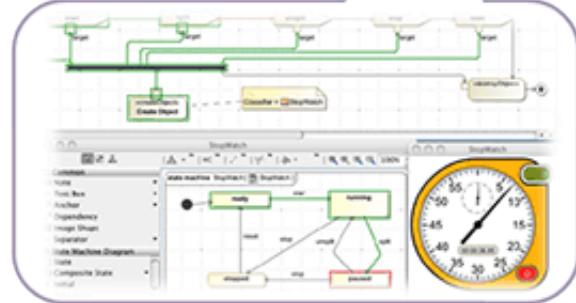
Understand the end-user use cases and find interaction bottlenecks



**Quality
Assurance
Engineer**

3 Automate Tests

Model and run test cases to verify requirements



Cameo Simulation Toolkit



- Model execution framework and infrastructure:
 - Model debugging and animation environment
 - Pluggable engines, languages and evaluators
 - User Interface prototyping support
 - Model driven configs and test cases
- The standard based model execution of:
 - Activities (OMG fUML standard)
 - Composite structures
 - Statemachines (W3C SCXML standard)
 - Actions/scripts (JSR223 standard)
 - Parametrics (OMG SysML standard)
 - Sequence diagrams (OMG UML Testing Profile)



Integration of analytical models



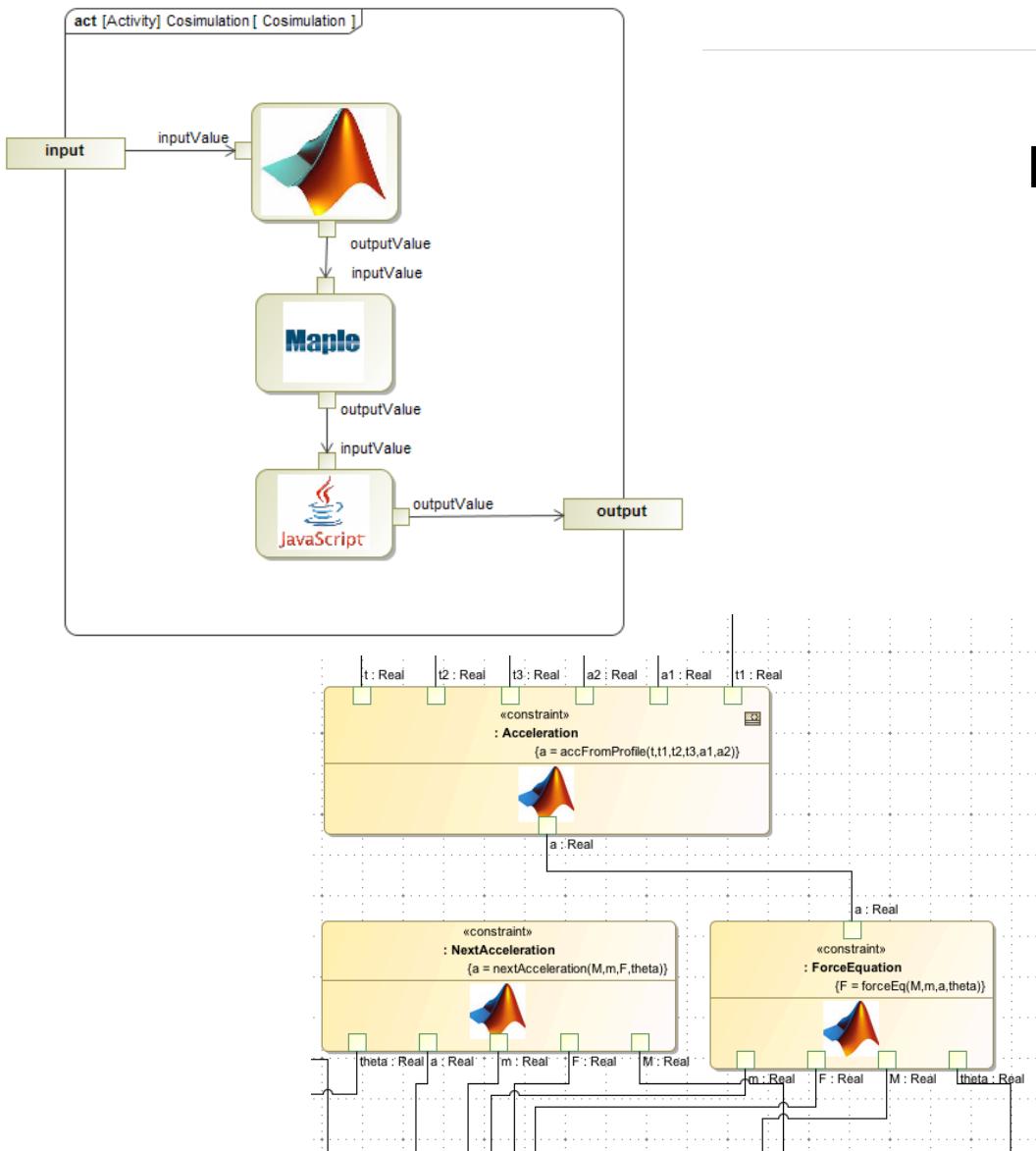
Wolfram *Mathematica*[®] 9



Maple[™] 18

The Essential Tool for Mathematics and Modeling

Cameo Simulation Toolkit



Math engines

- Matlab/Simulink
- Mathematica
- Maple
- Open Modelica

Scripting

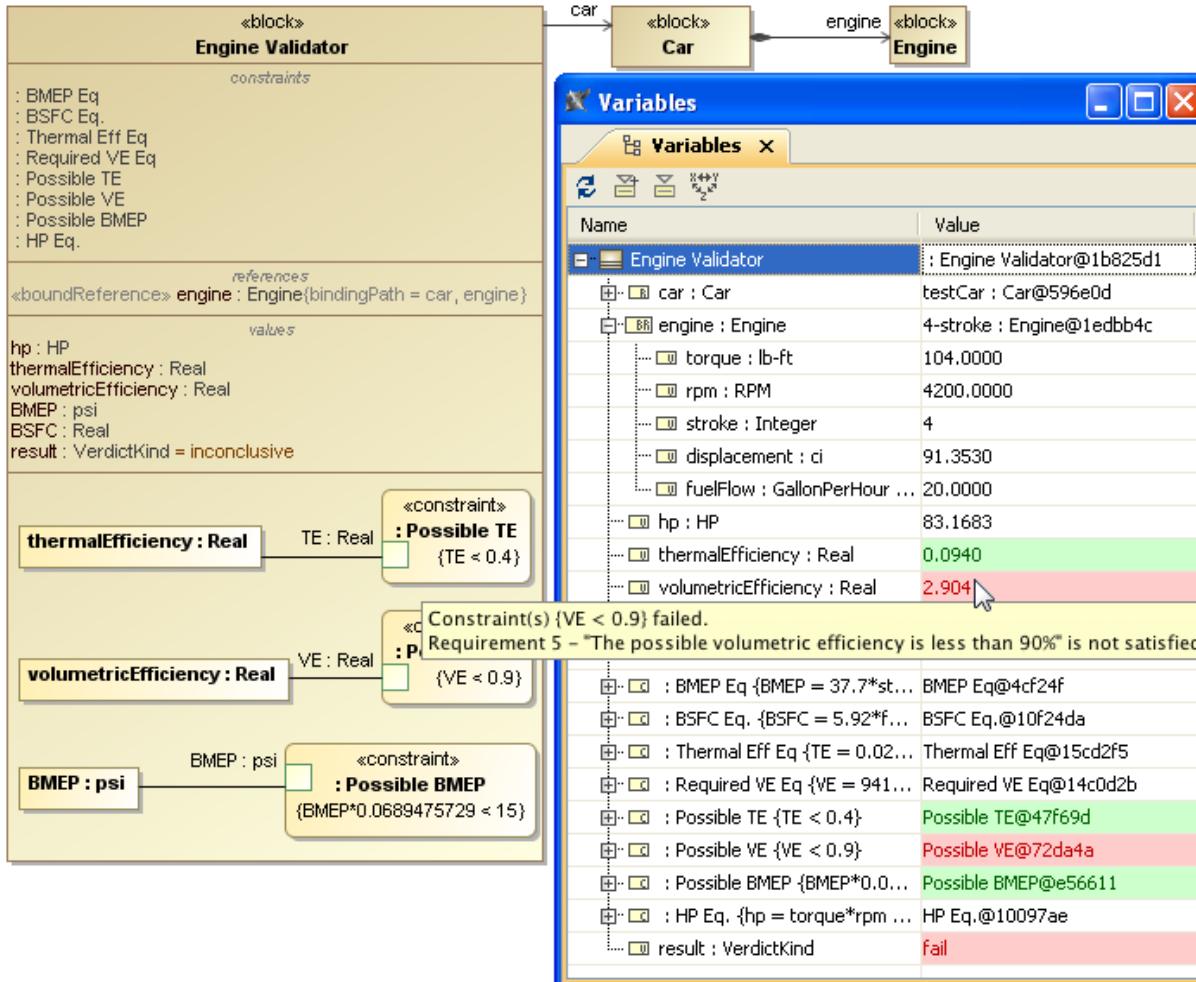
- Javascript
- Python
- Groovy
- Ruby

Engineering analysis



- Evaluate design alternatives
- Select the best set of parameters
- Verify system constraints
- Perform requirement compliance analysis
- Perform what-if analysis
- Execute SysML and UTP Testcases

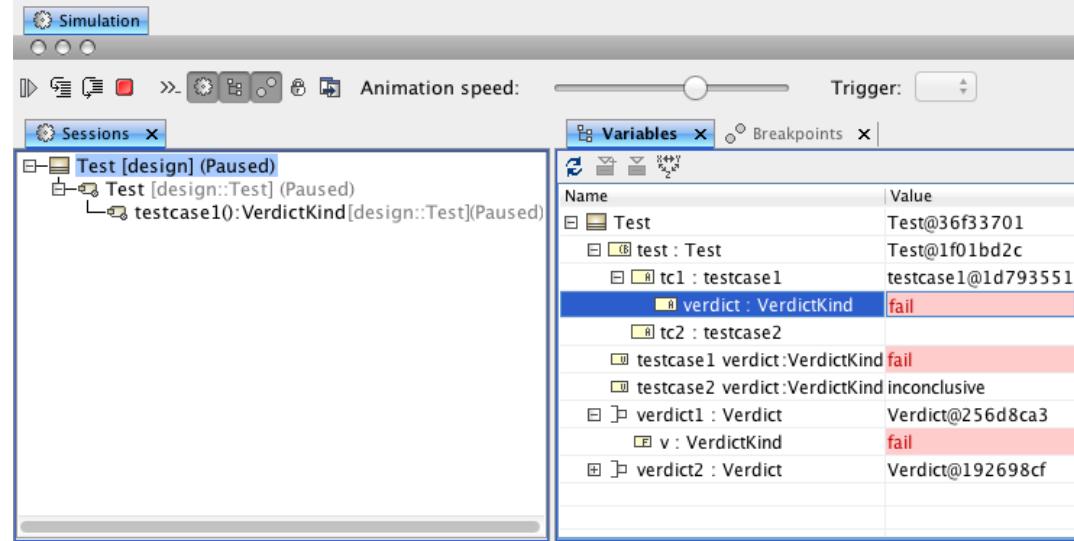
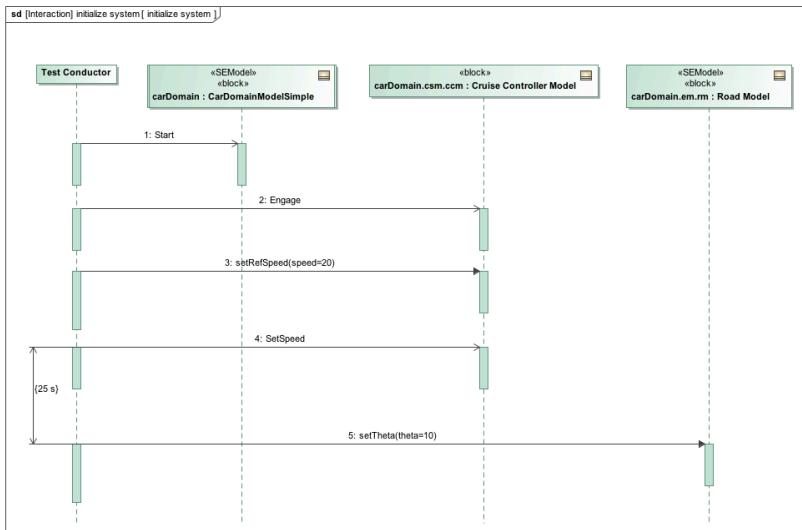
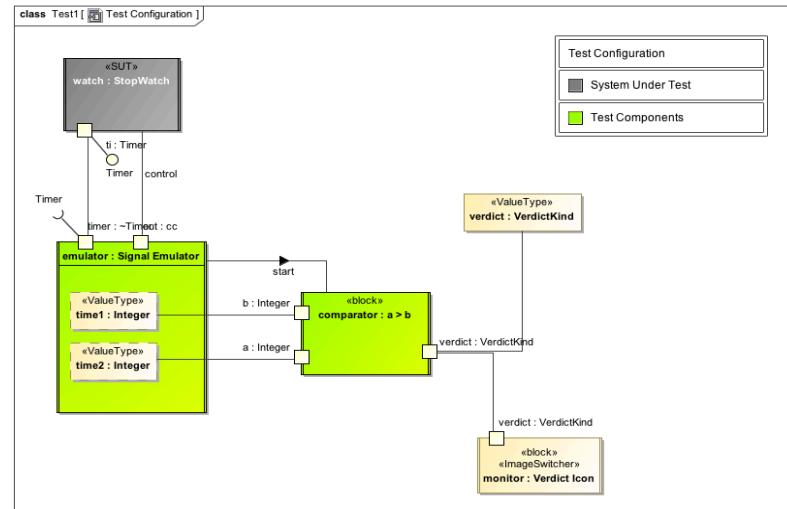
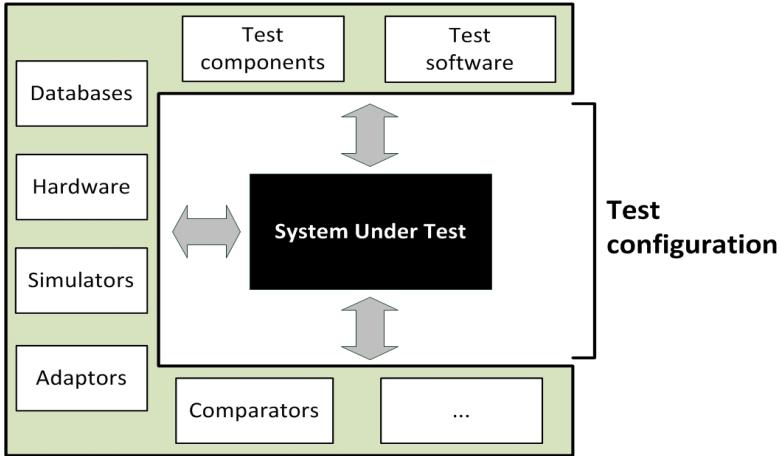
Constraints verification



Model-based testing



Test environment



Testing reports



Run Test

Instance Table

#	Name	Testcase1 verdict	Testcase2 verdict
1	Test at 2014.05.02 19.36	pass	pass
2	Test at 2014.05.02 19.49	pass	pass
3	Test at 2014.05.03 09.28	fail	fail
4	Test at 2014.05.03 09.33	pass	fail

Test

#	Test	testcase1 verdict	testcase2 verdict
2	Test at 2014.05.02 19.49	pass	pass
3	Test at 2014.05.02 19.36	pass	pass
4	Test at 2014.05.03 09.28	fail	fail
5	Test at 2014.05.03 09.33	pass	fail
6			

Add New Add Existing Delete Remove From Table Show Columns Export

Criteria

Classifier: Engine trade study Scope (optional): results Filter:

#	Name	Alternatives	Winner	Most Powerful Engine
1	ets at 2014.04.30 15.19	<ul style="list-style-type: none"> gas : GasEngine diesel : DieselEngine hybrid : HybridEngine 	<ul style="list-style-type: none"> hybrid : HybridEngine 	200.0
2	ets at 2014.04.30 16.24	<ul style="list-style-type: none"> gas : GasEngine diesel : DieselEngine 	<ul style="list-style-type: none"> gas : GasEngine 	190.0

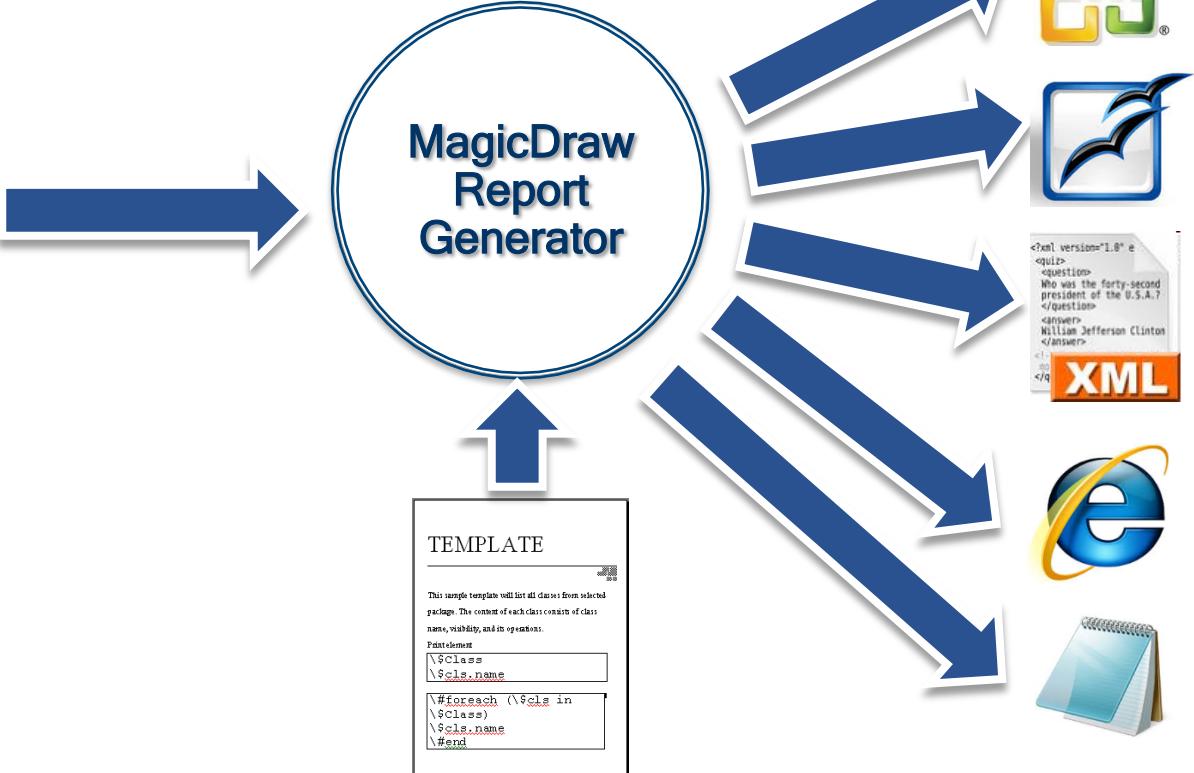
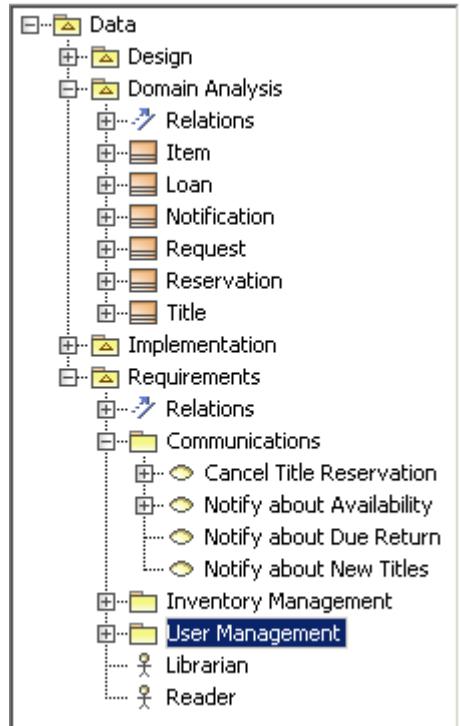
MBSE Ecosystem



MagicDraw Reports



- You can generate an HTML, Microsoft Office, Open Office, XML or any other simple text report from the model data



Web Publisher



The MagicDraw Web Publisher 2.0

Containment

- APE_Project
 - APE_Project_Content
 - Playground
 - QUDV Library
 - RequirementsBoilerPlates
 - SE2 Customization for SysML
 - SI ValueType Library
 - SDDefinitions
 - UI Modeling Customization
 - UML Standard Profile
 - APE_PartsCatalogue
 - DocBookProfile
 - Free Form Elements Profile
 - Matrix Templates Profile
 - ParametricExecutionProfile
 - SE2Definitions
 - SE2MARTE
 - SE2Profile
 - SE2QFTP
 - SimulationProfile
 - SysML
 - UI Prototyping Profile
 - APE

Diagram Specification Mode : Standard

QUICK SEARCH:

SysML Package Diagram APE_Project_Content

«ContentDiagram»
pkg [Model] APE_Project [APE_Project_Content]

Modification date 1/13/11 5:30 AM
Last modified by rkarban

«Project Views»
APE_Project_VIEWS

«System Model»
APE

«profile»
SE2Profile

«partcatalogue»
APE_PartsCatalogue

- PhysicalMedia
- Electronics
- Mechanics
- InterfaceTypes
- FlowSpecs
- Optics
- Software

«modelLibrary»
SE2Definitions

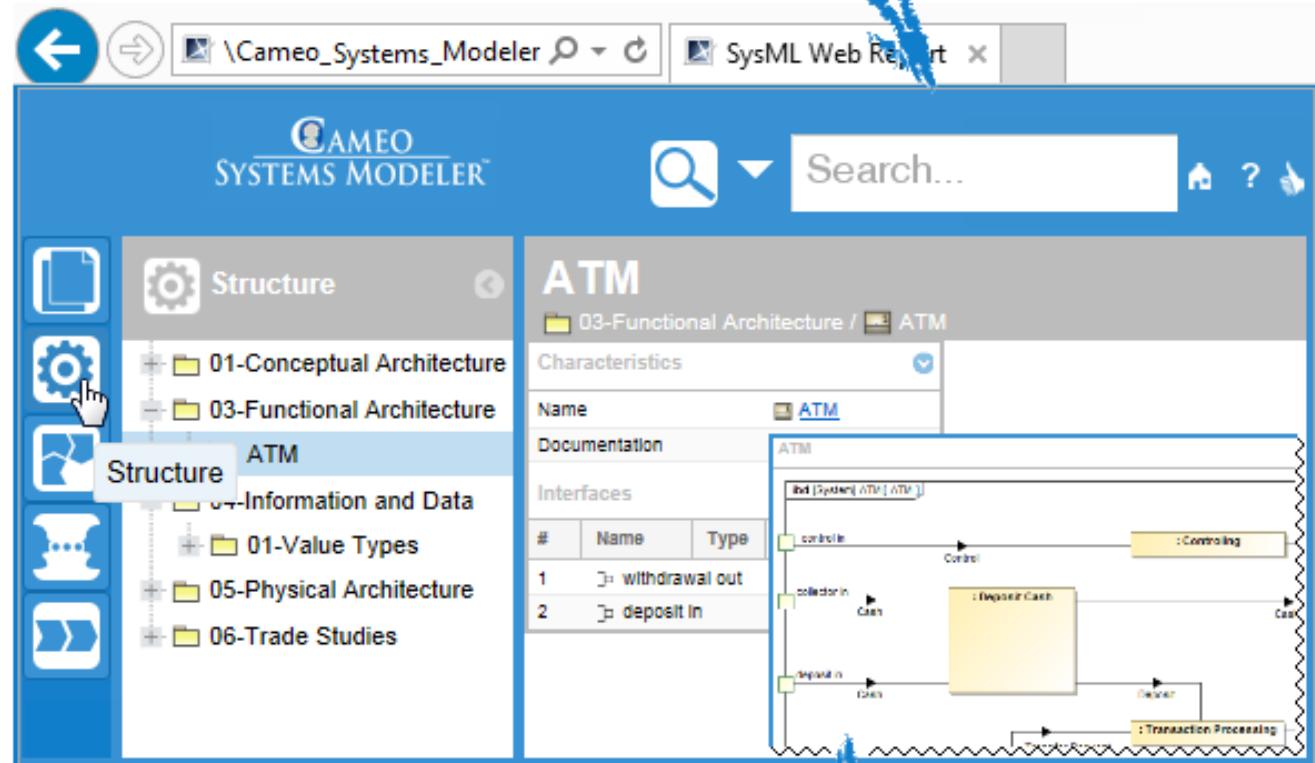
- Factors
- ValueTypes
- Enumerations
- Quantities
- Units

«modelLibrary»
RequirementsBoilerPlates

- TelescopeDomain
- UniversalDomain

Web Portal

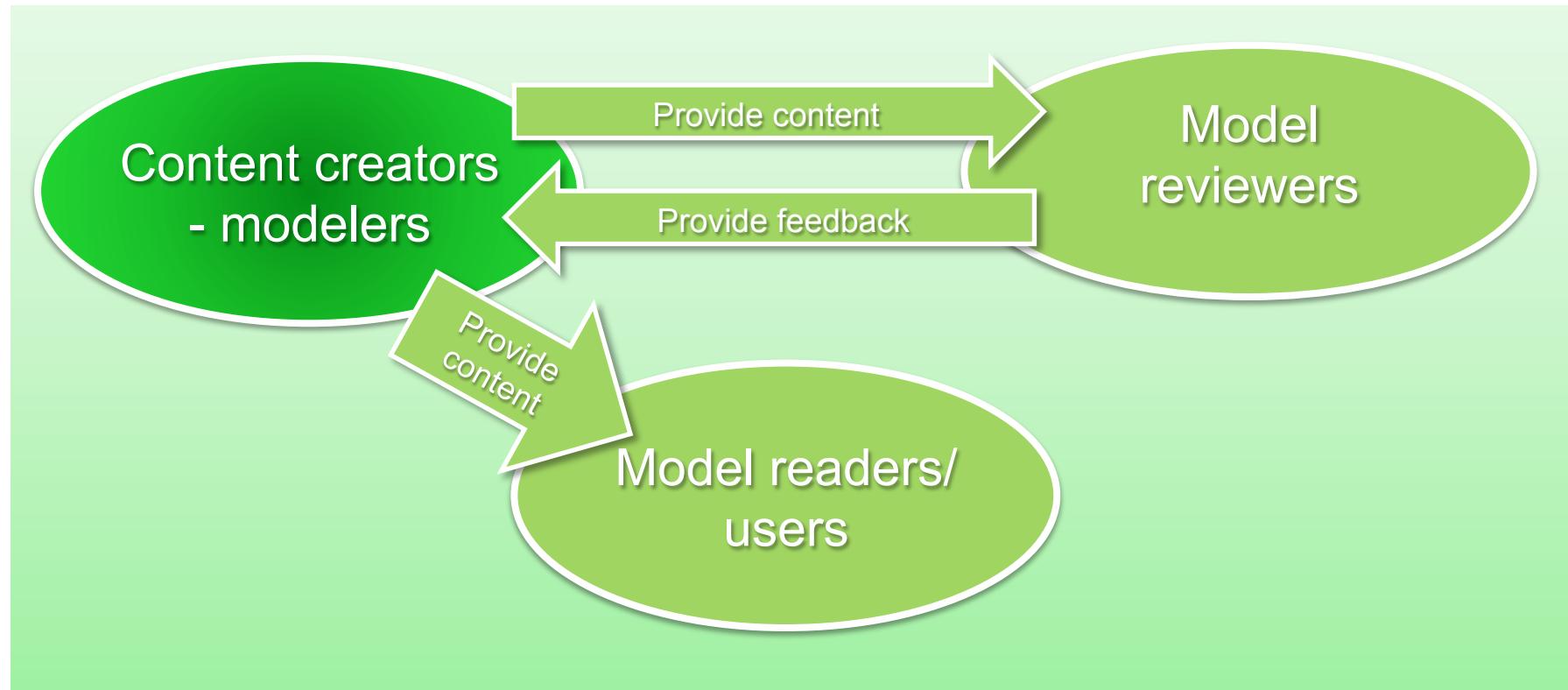
Easily access information by Quick Search!



Browse in clearly grouped content!

Discover the content which you or your colleagues have prepared!

Model reviews



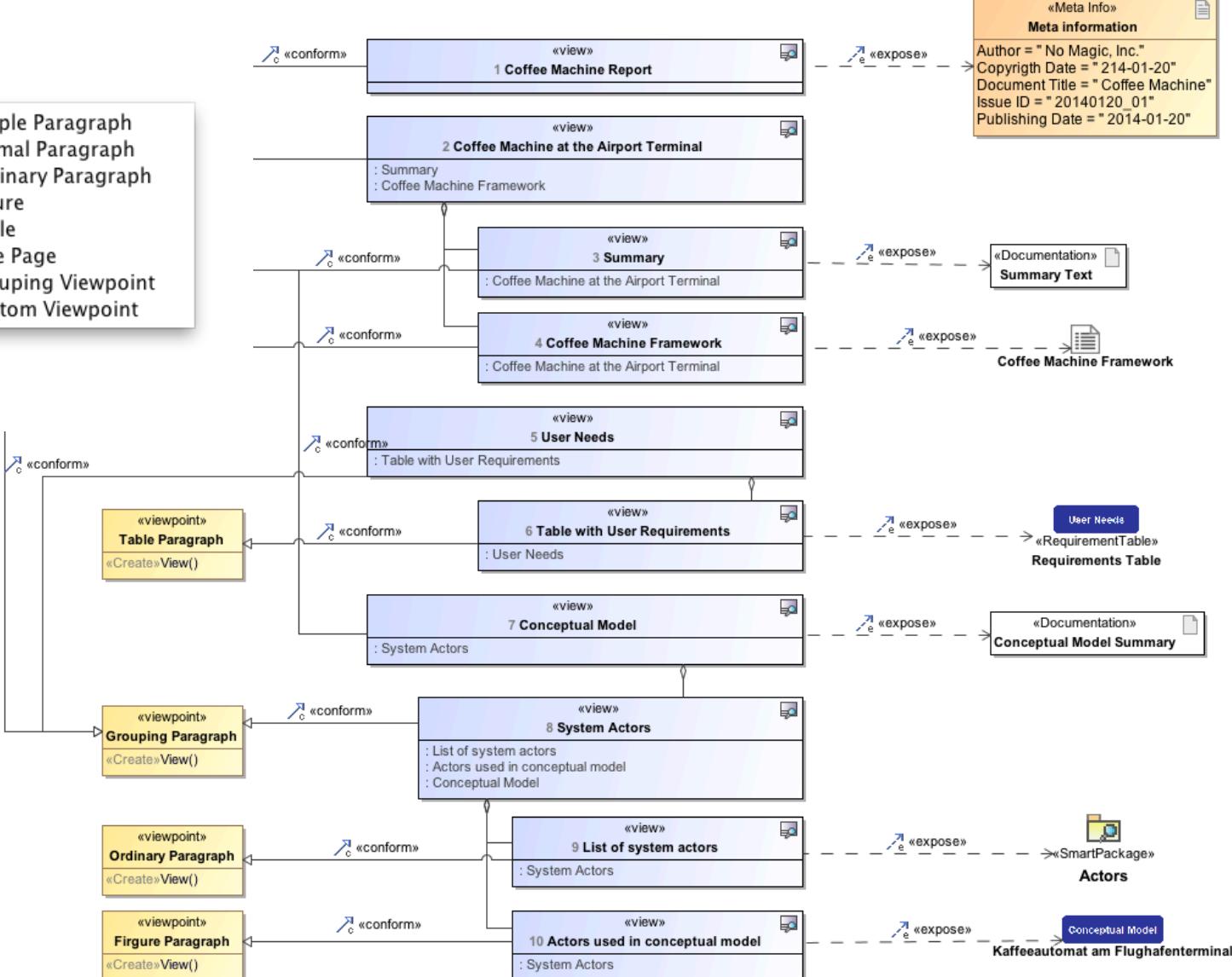
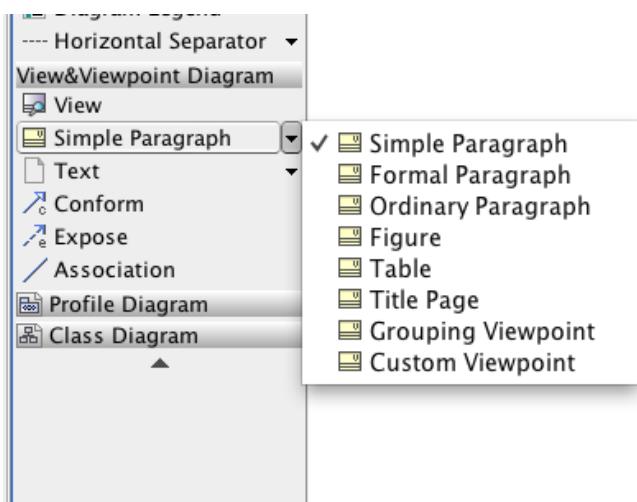
Model-based document generator



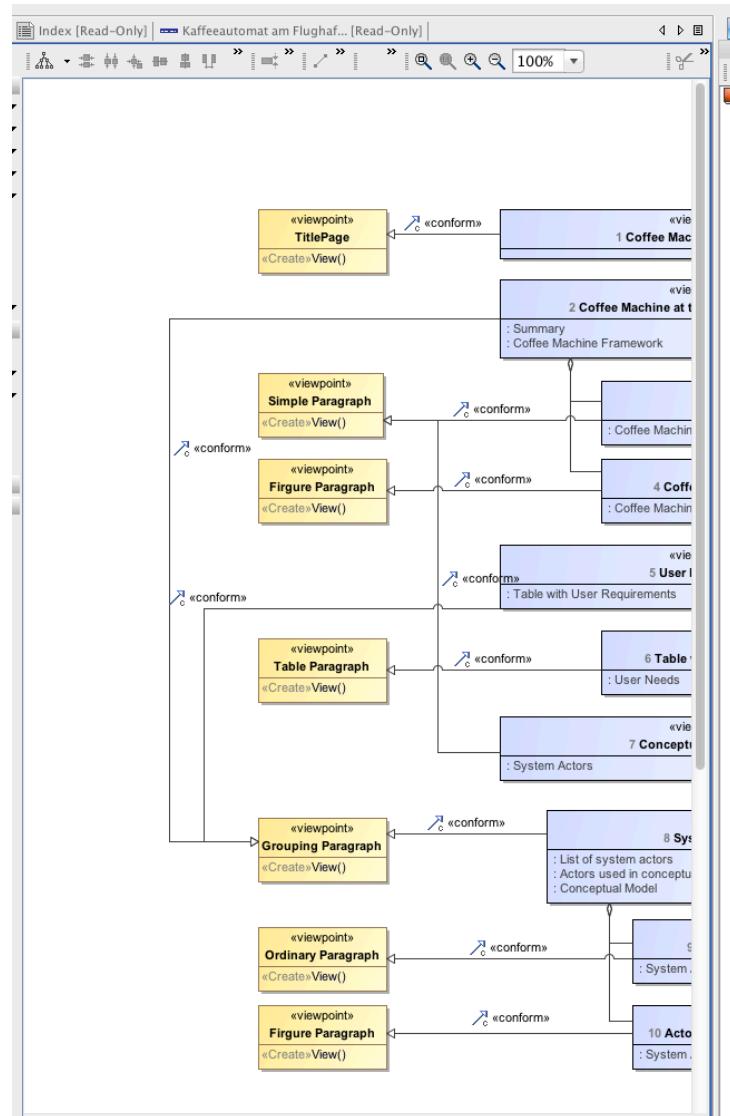
- Based on SysML 1.4 Views & Viewpoints
- Available as technology preview
- Predefined viewpoint methods
- Smart packages for queries
- DocBook XML
- Preview window
- HTML and PDF output
- API for custom methods

Also available from JPL and ESO

Model-based document generator



Model-based document generator



Model Based Report Preview

HTML	DocBook XML	Content	
		and employees quick and easy to use.	
12	UN12	UHT Milk	I want to UHT milk.
13	UN13	Freshly Ground	The coffee must be freshly ground.
14	UN14	Front Design	The front design is in a coffee brown tone with the images.
15	UN15	Coffee Temperature	The coffee must be hotter than 80 ° C when it flows into the cup. The coffee should not be hotter than 86 ° C as it flows into the cup.
16	UN16	Machine Maintenance	The machine should be filled and serviced only once a day. Maintenance should not take longer than 30 minutes.
17	UN17	Security	The device should not injure people.

Chapter 3. Conceptual Model

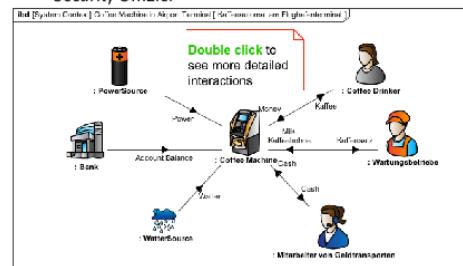
Table of Contents

1. System Actors

System actors are defined in the section below.

1. System Actors

- Mitarbeiter von Geldtransporten
- Passagiere
- Verwaltung vom Flughafen als Betreiber
- Coffee Drinker
- Wartungsbetriebe
- Gesundheitsamt
- Flughafen Mitarbeiter
- Security Offizier



Cameo Systems Modeler 18.0

