Diagrams on the Web, OSS all the way: SysON & SysMLv2

Etienne Juliot

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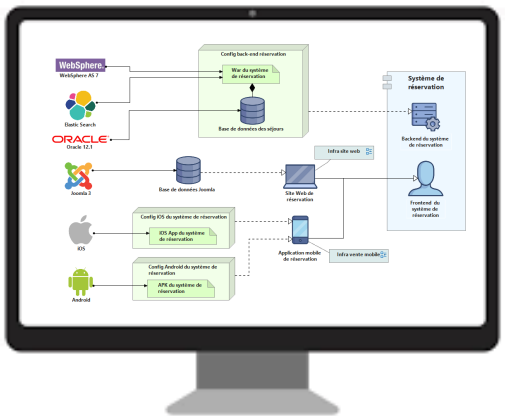
Obeo | Visual Tools for Designing Innovations

We develop cutting-edge **modeling** software
to empower teams **designing** or **transforming**
complex systems



Sirius Domain-Specific Modeling

Capella Model-Based Systems Engineering

OBEO SmartEA Continuous Enterprise Architecture

ECLIPSE FOUNDATION
Strategic Member

We are a global reference player
in the field of open-source

2500

Number of FTE days of
open-source contributions in 2023

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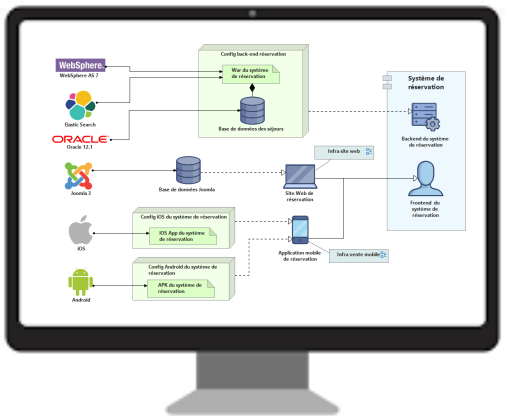

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Sirius — Domain-Specific Modeling

Capella
SysON — Model-Based Systems Engineering

OBEO SmartEA — Continuous Enterprise Architecture

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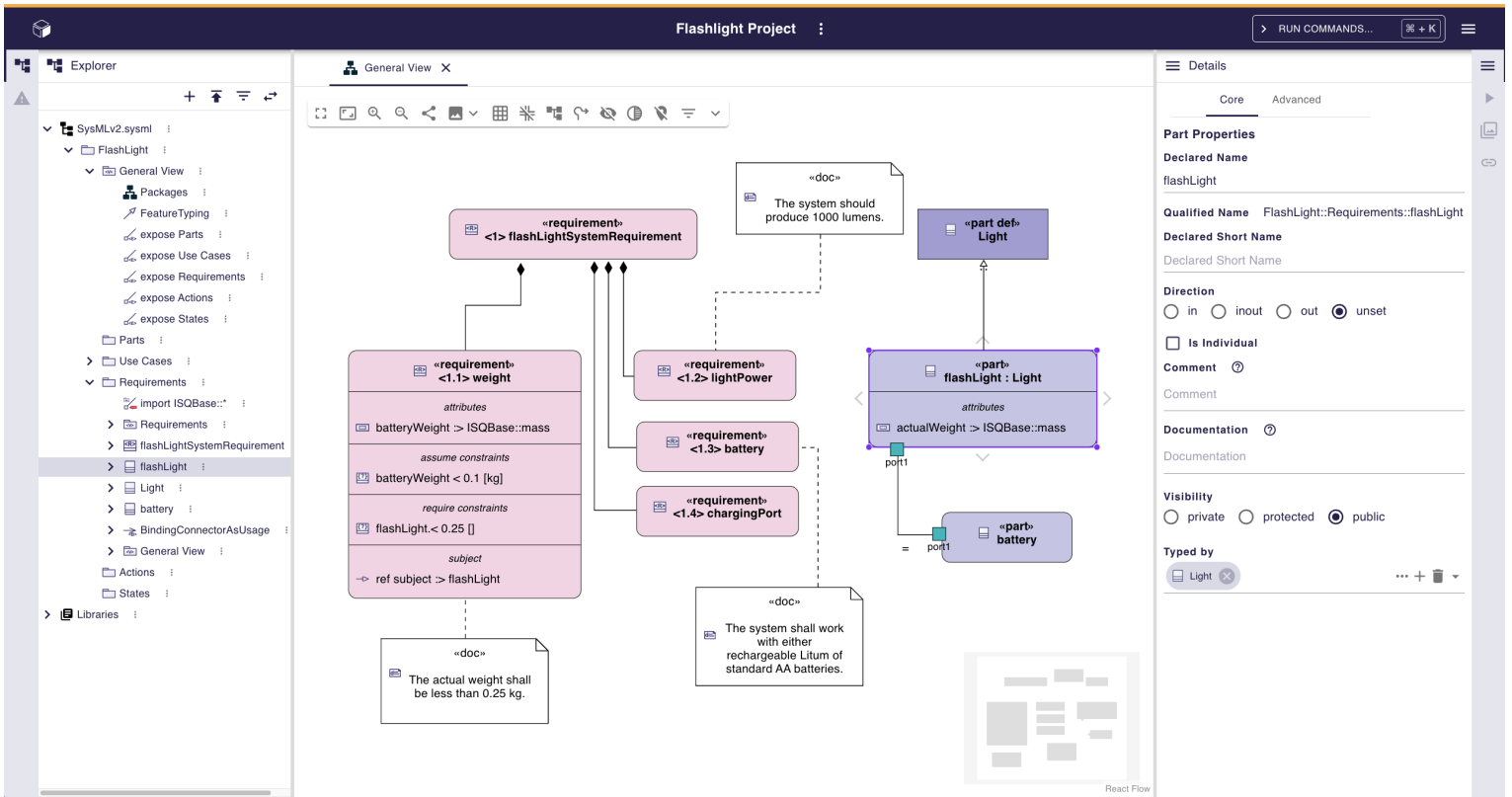
SysON

Open-source SysML V2 Modeling Tool

https://mbse-syson.org/

SysON | Web-based authoring tool available as open-source



Flexible by Design

SysML v2 Language concepts, REST API, interoperability textual format

Web-Based

Graphical, form-based and tabular structured editors in a web browser

Open Source

Hosted in the Eclipse community, to catalyze industrial collaboration

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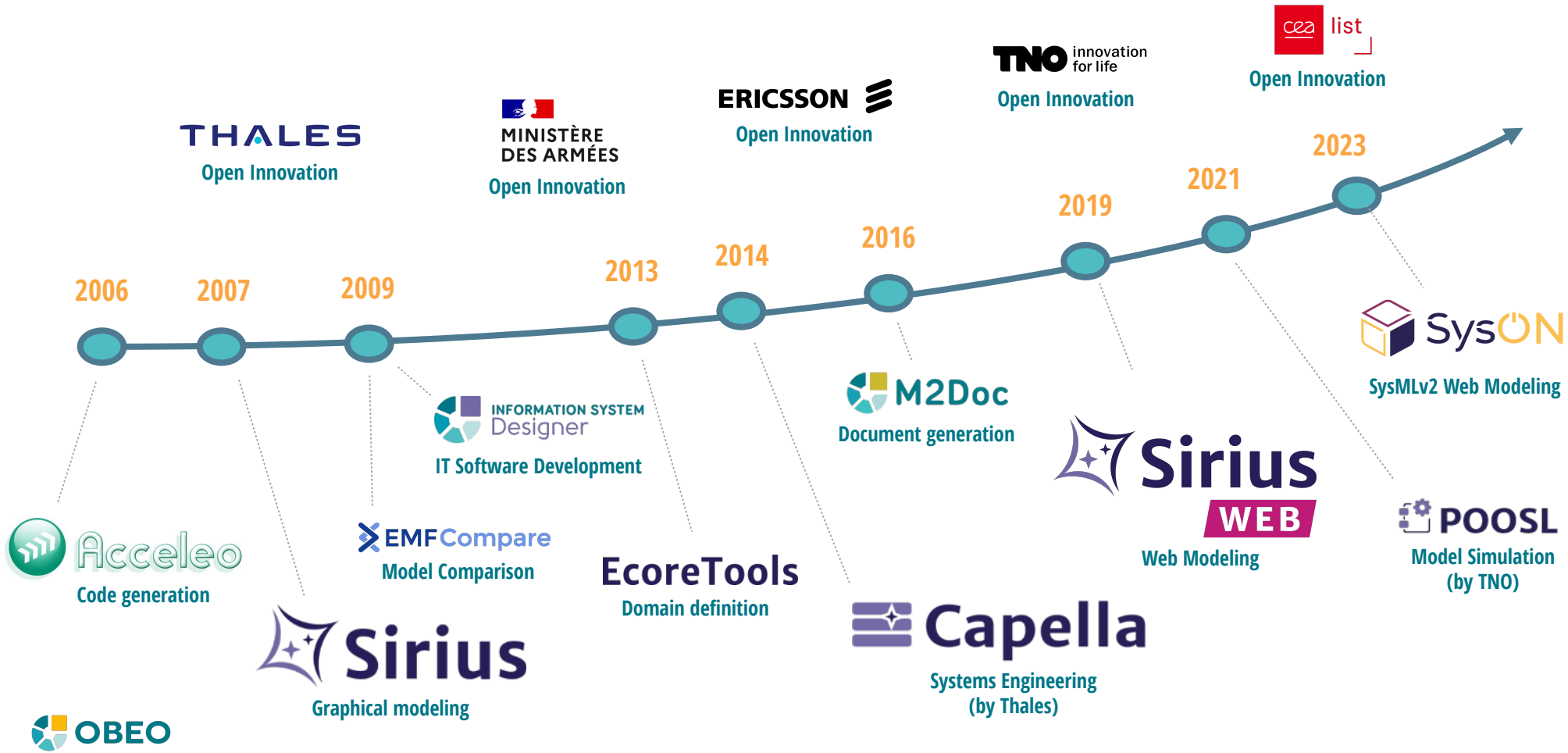
Open Innovation | Millions Lines of Code Contributed in Open-Source



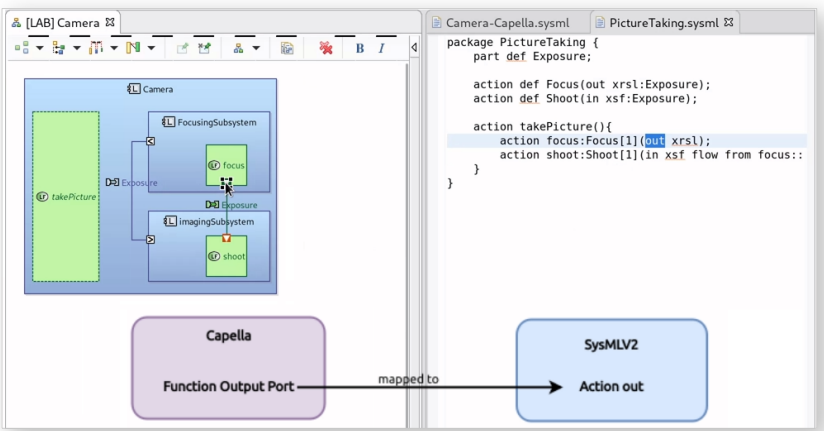
Obeo | Our involvement on SysML v2

OMG involvement

- Member of the OMG System Modelling Community (SMC)
- Member of the SysML v2 Submission Team (SST) since 2019 to design the language itself, including Diagram Interoperability
- Active in the Pilot implementation (including textual parser), which is a new “code first approach” for spec definition

Tooling development and prototyping

- Early studies (Siemens SMW add-on exposing Capella models through the SysML v2 REST API, CEA SysMLv2 serialization and extendibility studies, PoC with Langium, …)
- SysON project launched in 2024 with a release every 8 weeks
- Early Adopter Program with key SysMLv2 **spec authors to design SysON aligned with their mindset**
- Close loop with SST during SysON feature development



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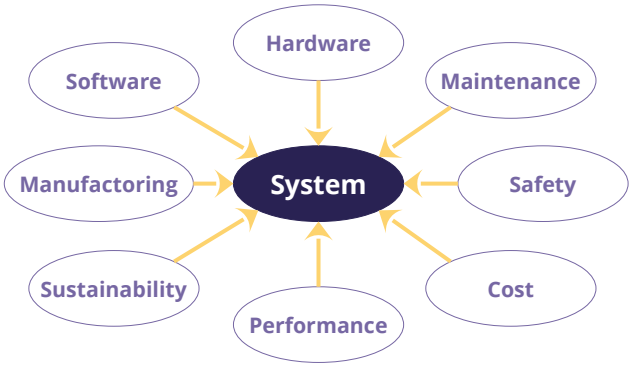
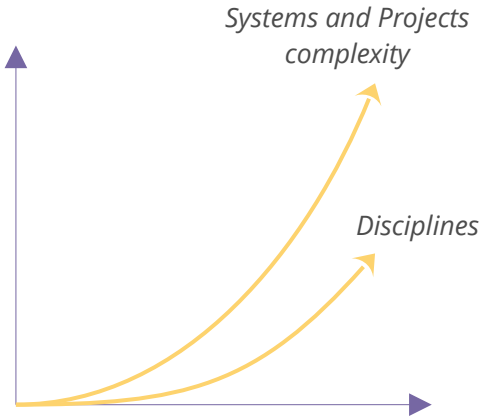
Model-Based
Systems Engineering

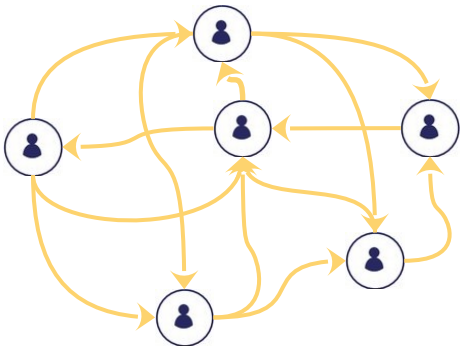
Systems' increasing complexity



Products rely on an increasing number of technologies and interconnected systems



It necessitates a multitude of engineering disciplines to cope with this complexity



Engineers must cope with more demanding customers and collaborate with more peers

This creates a communication and data challenge.
Architecture models are the key for adressing this challenge

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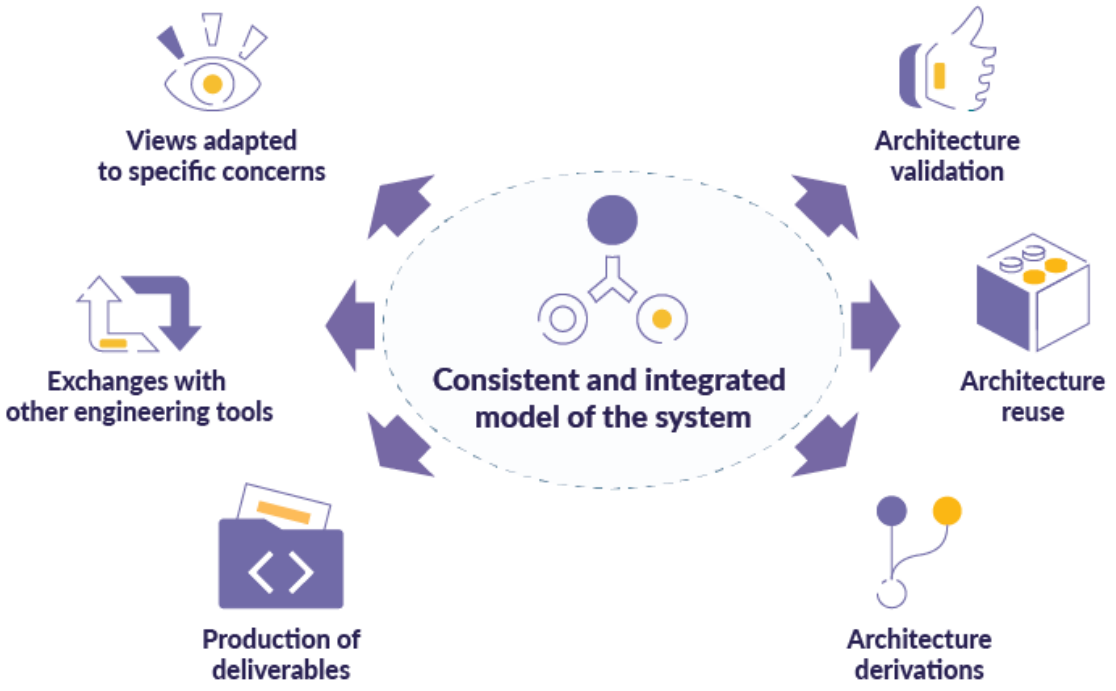
With MBSE, models are becoming central assets



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SysML v2

History and Vision

SysML V2 | Expected to be a game changer

- **SysML v1**
  - was released in **2007**
  - as a standard for model-based systems engineering (MBSE) to elevate the role of models as primary tools for communication and documentation.
  - defined as an extension of UML2, until v1.7
- **SysML v2**
  - was released in **2025/09**
  - is not an update of SysML V1. It is a complete “rewrite”.
  - is inspired by SysMLv1, Incose Vision, Capella
  - is defined as an extension of the Kernel Modeling Language (**KerML**)
  - has been specified as the next-generation systems modeling language to improve **precision**, **expressiveness**, and **usability**.

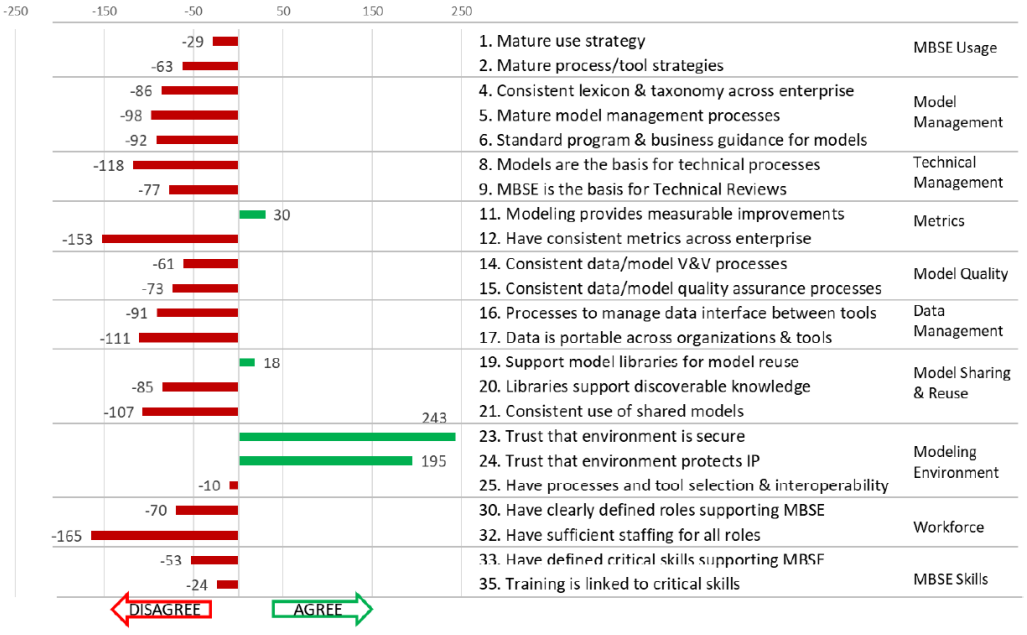

Figure E-5. Overall Capability Maturity Scorecard by Question.

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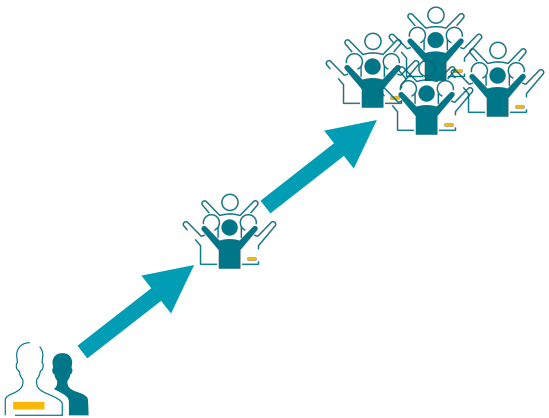
SysML V2 | Our vision

SysML v2 is a **key enabler** to enable Digital Engineering revolution:

- Wide **Interoperability**
- Foundations for **formal verification** and **AI interactions**
- Foundation for building libraries of **domain specific ontologies**
- Foundation for supporting **MBSE processes**

Authoring a SysMLv2 model should be easily accessible to every Systems Engineers and beyond.



Obeo aims to pave the way for the SE industry by providing an open-source foundational authoring tool.

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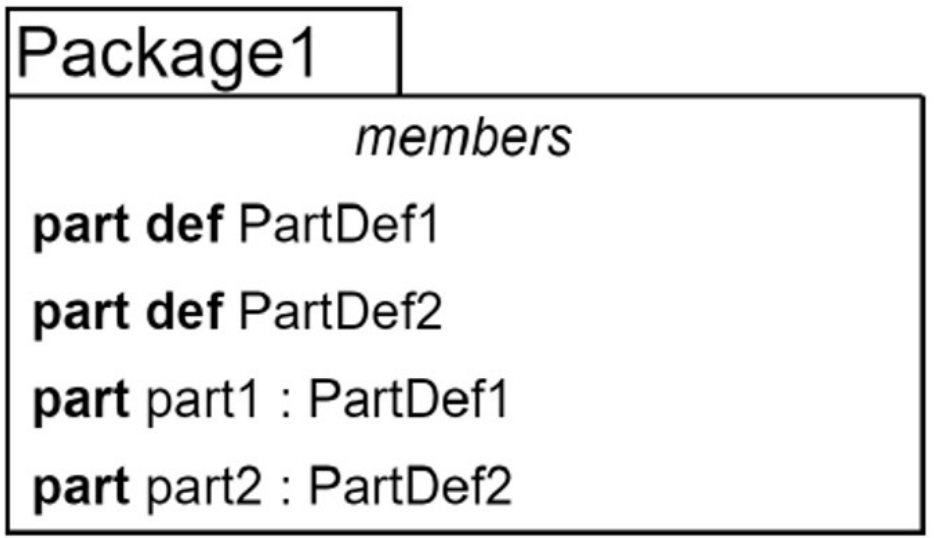
SysML V2 Main Evolutions | Textual and a Graphical notation

Package with members compartment		``` package Package1 { part def PartDef1; part def PartDef2; part part1 : PartDef1; part part2 : PartDef2; } ```

SysML V2 Main Evolutions | Textual and a Graphical notation

```
package Parts {
    part flashlight {
        attribute mass :> ISQBase::mass;
        attribute fov : Real;
        attribute illuminationLevel : Real;
        port cmdPort;
        port lightOutPort;
        port handPort;
        perform Actions::produceDirectedLight;
        exhibit state flashlightStates {
            state off;
            state on {
                do produceDirectedLight;
            }
            transition first start then off;
            transition off_To_on first off accept onOffCmd : OnOffCmd via cmdPort then on;
            transition on_To_off first on accept onOffCmd : OnOffCmd via cmdPort then off;
        }
        ref part battery [2] {
            attribute power :> ISQMechanics::power = Analysis::BatteryPower(v, i);
            attribute v :> voltage default 1.5 [V];
            attribute i :> electricCurrent default 2.1 / 30 [A];
            port dcPwrOutPort {
                out item dcPwr;
            }
            perform produceDirectedLight.provideDCPwr;
        }
        part switch {
            port cmdPort;
            port inPort {
                in item dcPwrIn : DCPwr;
            }
            port outPort {
                out item dcPwrOut : DCPwr;
```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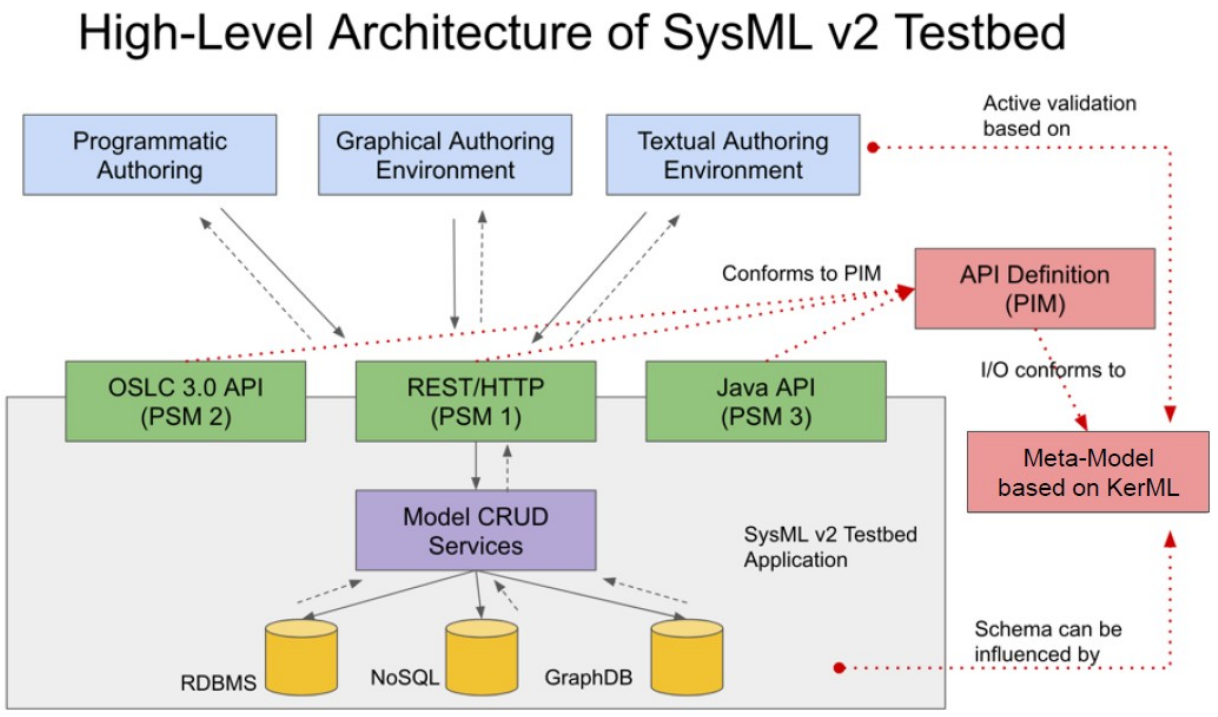
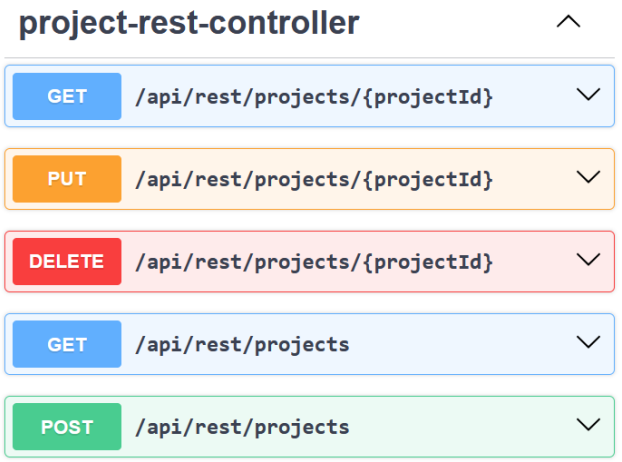
SysML V2 Main Evolutions | Harmonized syntax

SysML v1	SysML v2 (textual syntax keywords)	SysML v2 (metamodel concepts)
part property | block	part | part def	PartUsage | PartDefinition
value property | value type	attribute | attribute def	AttributeUsage | AttributeDefinition
proxy port | interface block	port | port def	PortUsage | PortDefinition
action | activity	action | action def	ActionUsage | ActionDefinition
state | state machine	state | state def	StateUsage | StateDefinition
constraint property | constraint block	constraint | constraint def	ConstraintUsage | ConstraintDefinition
requirement	requirement | requirement def	RequirementUsage | RequirementDefinition
connector | association block	connection | connection def interface | interface def	ConnectionUsage | ConnectionDefinition InterfaceUsage | InterfaceDefinition
use case	use case | use case def	UseCaseUsage | UseCaseDefinition

SysML V2 Main Evolutions | standardized API and services





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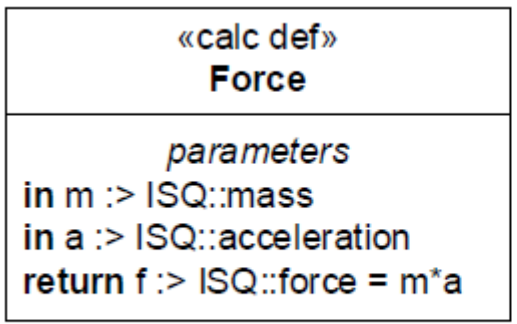
SysML V2 Main Evolutions | "Usage-Focused" modelling approach

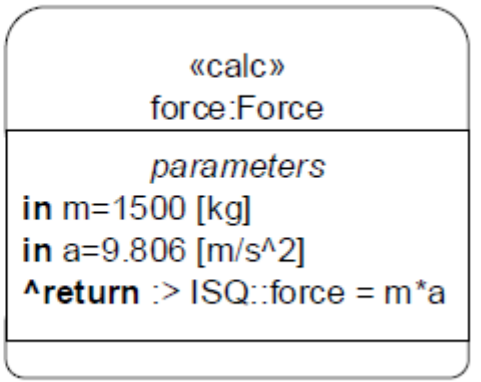
- **Enable direct modeling of "usages", more natural for a lot of non-software engineers**
- **"Definition oriented" modelling approach is still fully supported**
  - For more generic elements
  - To frame usage with constraints for more formal semantic
  - Obeo's interpretation: to enable reuse

SysML V2 Main Evolutions | Comprehensive set of extensible domain libraries

- **Mathematical, logical, utility functions**
  - integrated with textual expression language
- **Quantities, Units, Scales and Quantity Dimensions**
  - full ISO/IEC 80000 “SI”, US Customary
- **Time & Clocks, State-Space Representation, Basic Geometry**

```
flashLight.actualWeight < 0.25 [kg]
```





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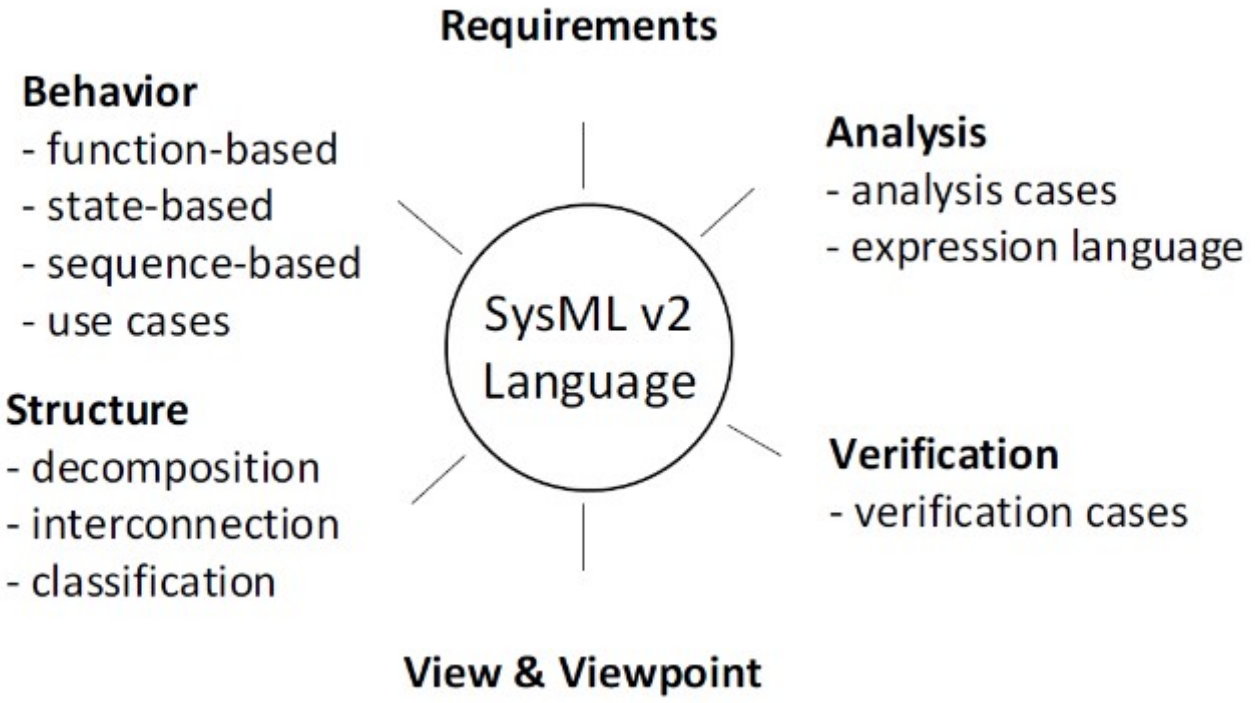
SysML V2 Main Evolutions | New concepts

- **4D modelling object life and spatial extent as Occurrences & Snapshots**
  - Including portions of life / extent, time-slices
- **Support for variation points and variants**
  - Enables PLE, product configurations, design alternatives, options, trade-offs, ..
- **Modelling of Individuals**
  - E.g., for serial-numbered items, 'digital twins', analysis/simulation executions
- **Viewpoints & Views**
  - Drive the visual rendering (diagram, table, docs, ...)
  - Possibility in include Views into Views to mix representations
  - aligned with ISO/IEC/IEEE 42010
- **Computable expressions**
  - For Validation, Constraints, Calculations, Requirement
  - Example: attribute f1 = Force (m=1500 [kg] , a = 9.806 [m/s ^2]);

SysML V2 Main Evolutions | Language capabilities



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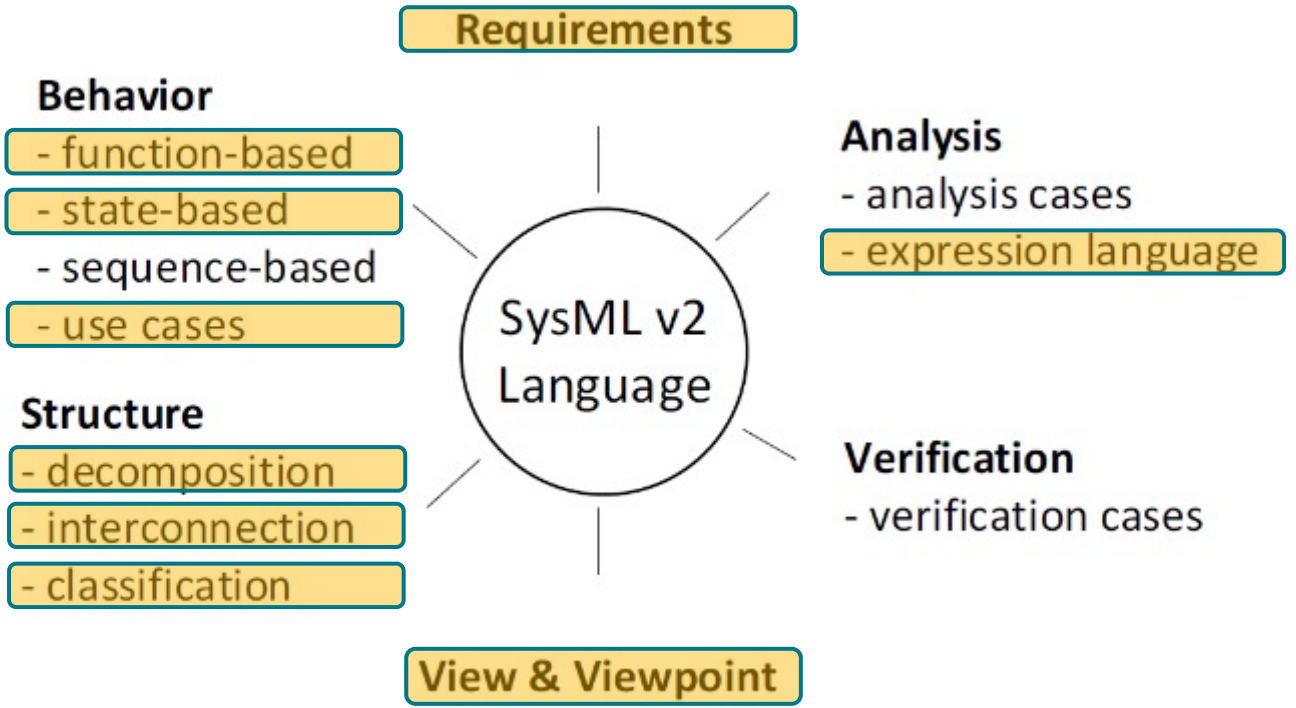
SysML V2 Main Evolutions | What we will show today



SysML V2 Main Evolutions | Standard Views

General View	Show everything. The main one.
Interconnection View	“Component” based diagram
Action Flow View	Behavior
State Transition View	
Sequence View	Simplified to illustrate only one path
Geometry View	STEP-like 3D
Grid View	
Browser View	

SysML V2 Main Evolutions | What we will show today

General View	Show everything. The main one.
Interconnection View	“Component” based diagram
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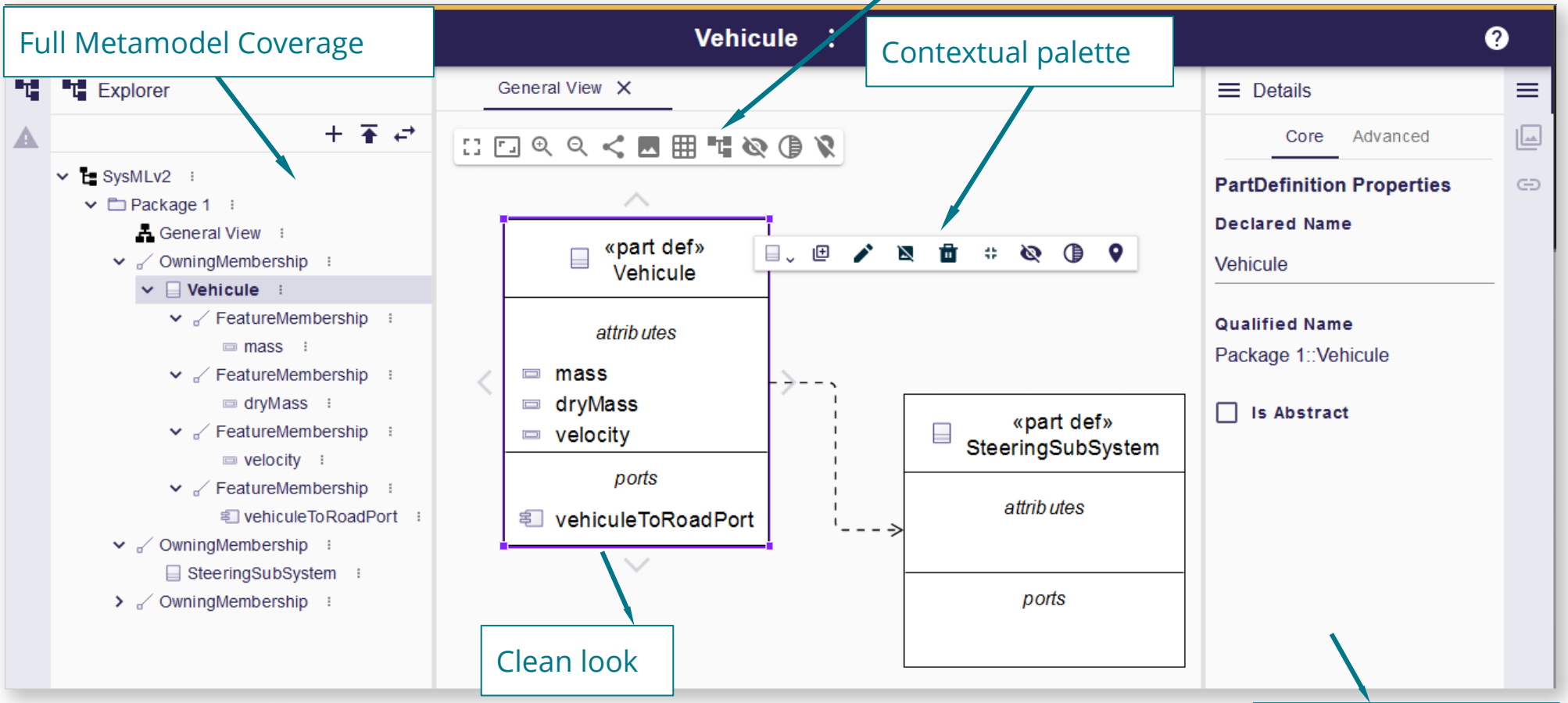
Grid View	
Browser View	

SysON

Status and Roadmap

SysON | Modern Web based Experience



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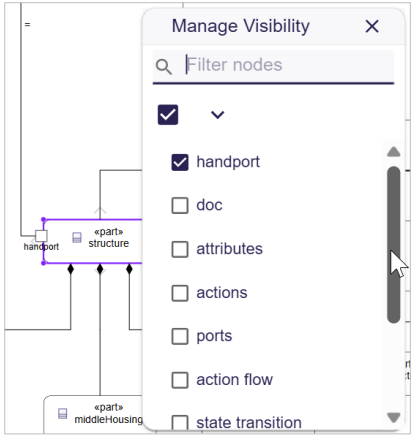
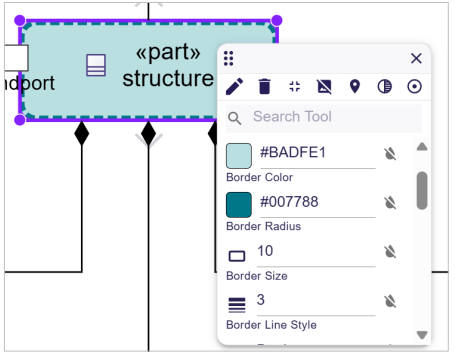
SysON | Status and roadmap

Project Lead: Obeo and CEA (French Atomic Energy Authority)

- SysON is in the development stage:
  - Not a rush to provide strong foundations: alignement with new SysMLv2 + KerML author's spirit while highly customizable
  - Focus on easy and scalable User eXperience
  - **Release every 2 months**

- Continuous improvements:
  - **"Glitch" fixes for smooth daily usage**
  - Follow every OMG SysML V2 specification version
  - New contextual palette
  - Compartments visibility management
  - View support
  - Object appearance customization
  - Full layout preservation on model import/export
  - Export to PNG, SVG
  - Extend supported objects
  - Improve textual notation import
  - Query model
  - Model validation
  - Library management
  - APIs
  - ….





SysON | Benefits of Open Source

Industrial **benefits** from a **robust and high-quality** open-source SysML v2 modelling environment:

- **Easier access** to education, academia, and experimentation
- **Mitigating vendor lock-in** / simplify the sharing of data and modelling environments
- Enhanced sustainability and **long term availability** of the tool
- Enabling **industrial collaboration**, investments sharing and improved product **roadmap influence**
- **Lowering the price expectations** for foundational capabilities
- Encouraging investments and competition on **higher value capabilities**
- **Technological enabler** for third-party addons fostering a **rich ecosystem**

80-90%	100M	31M	55%	65%	100%
Open source makes up 80-90%of applications	GitHub hosts 100M repositories	GitHub users	%companies leverage open source in production	%firms contributing to open source projects	%productivity improvement seen by firms contributing to open source

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SysON | Features overview

Project Management	
Projects Browser	✅
Project Editor	✅
SysML V2 Views	
General View	✅ *(Partial)*
Interconnection View	✅ *(Partial)*
Action Flow View	✅ *(Partial)*
State Transition View	✅ *(Partial)*
Sequence View	❌
Geometry, Grid, Browser View	❌
KerML/SysML v2 Libraries	✅

Diagram Management	
Contextual Palette, Direct Edit, Multi-Selection, Reconnect, Hide/Fade, Collapse/Expand, Drag&Drop, Compartments, Custom Shapes, Assisted Layout (Auto-Layout, Ruler, Grid, Align, Distribute...)	✅
Edit Graphical Properties, Undo/Redo, Copy/Paste	✅ *(Partial)*
Collaboration & Interoperability	
Share Links (Projects, Diagrams...)	✅
Concurrent authoring	✅
Download/Upload JSON	✅
Download/Upload SysML v2 JSON	❌
Download/Upload SysML v2 textual format	✅ *(Partial)*

ⓘ *Status of SysON 2026.1*

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SysON | Architecture and technological choices

Deployed on a Web Server

- Easy installation via complete Docker container
- Build on top of **Sirius Web**, relying on mainstream web technologies
  - React, Material UI, Typescript, GraphQL, Spring, PostgreSQL ...

Frontend

React

Vite

Material UI

TypeScript

Protocols

HTTP

Websocket

GraphQL

Backend

Spring
(Framework, MVC, Data)

EMF-JSON

Java

PostgreSQL

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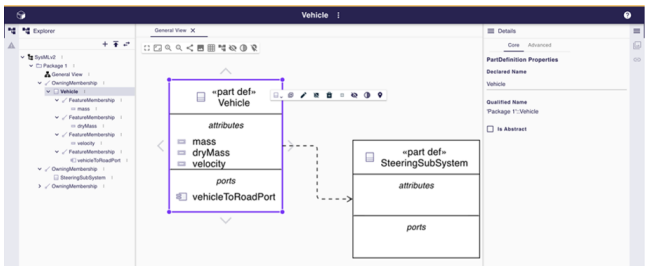
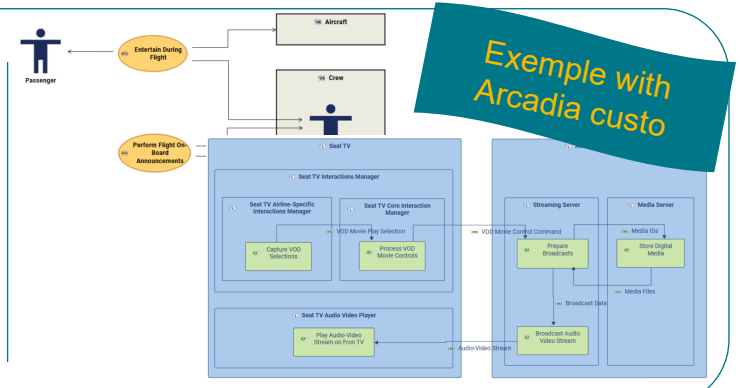
Flexible-by-Design | 3 levels of customisation

Out of the box



Customized / Extended



Integrated

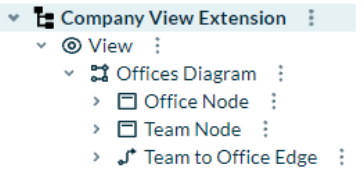
- **SysMLv2 standard customisations:**
  - **Extensibility**: SysML v2 libraries + metadata
  - **Interoperability**: REST standard APIs
  - **Customization**: SysON is built on Sirius Web
- **Specific Domain Specific Editors:**
  - Editors acts as a **wrapper** focus on your lib
  - Add new language concepts, new diagrams, new tools, new behaviors
  - Dramatically simplify guidance
- **Embed into a hosted application**
  - Reuse SysON Components
  - Add your own specific UX or back-end

Flexible-by-Design | Making-of: leveraging Sirius Web

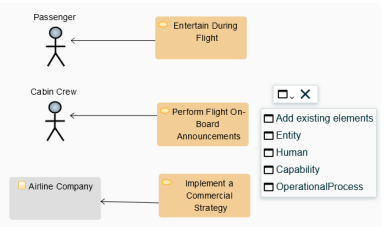
- The 3 pillars of MBSE: Language, Tool but also **Method**
- Sirius Web is a Low Code Modelling platform
  - Eased customization for method/process support
  - Eased integration thanks to its component based architecture

SyML v2 meta-model + SysON editors specification = SysON editors

Additional specification



Additional/enhanced editors



Inspired by Sandy Fridenthal's SysML v2 Starter Model overview :

https://www.omgwiki.org/MBSE/doku.php?id=mbse:incose_mbse_iw_2025
see «SysML v2 Introductory Training »

Roadmap | A new version every 8 weeks

Teaching & Experimenting

SysML 2.0 Compliance

Industrial Collaborations

Continuous evolutions :

- Continue to integrate latest SysML v2 publications
- Improve layout and auto-layout
- Add missing SysML concepts
- Fully support the views
- Interactions with textual notation
- Import/Export of model
- Validation rules
- …

Obeo Strategy | Combining the strengths of SysMLv2 and Capella

- ✔ Well defined Semantic to ease simulation and validation
- ✔ Focus on interoperability
- ✔ Good extensibility
- ✔ Trigger significant interest

- ✔ Methodological guidance
- ✔ Simple to ramp-up
- ✔ Mature & field proven
- ✔ Wide & Growing adoption (900+)

Deliver a comprehensive

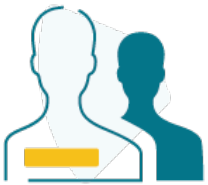
Capella + SysMLv2 experience

that combines the strengths of both

Obeo Enterprise for SysON | Enterprise Add-ons

Security & Permissions

Ensure that sensitive projects remain accessible only to authorized users



Team Collaboration

Multi-user modeling with real-time tracking of ongoing activities.

Project Lifecycle

Reliable project governance, traceability, and historization

+ AI Assistant: Benefit from AI as an interactive Copilot with you in the loop.

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AI Live Demo

Prompt :

Create the architecture of a London Double-Decker Bus

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SysON | In a Nutshell

Standard Compliant

A pure SysML V2 and
KerML implementation

Modern UX

A modern technological stack,
an intuitive user experience

Web & Collaborative

No desktop deployment,
naturally collaborative

Extensible

Integrate SysON with your
processes and tools

Open-Source

Lower costs and easier access
and collaborations

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