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Source: Manas Bajaj

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oose.

Consultancy and training company for Systems and Software Engineering

Headquarter in Hamburg, Germany

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Who am I? Tim.Weikiens@oose.de

Executive Board Member oose
MBSE Consultant & Trainer
Book author
Co-Developer of SysML 1 & 2
Co-Chair of SysML 1.7 RTF
Co-Lead of the SysML v2 Team
Author of SYSMOD & VAMOS
Lecturer of MBSE master courses
Owner of publishing company MBSE4U
Founder X4Planet

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Motivation for SysML v2: New challenges – Old Problems

Digital Thread

Digital Twin

AI4SE

MBPLE

Precision

Simulation & Analysis

*Model
Interoperability*

***The systems engineering modeling language
of the future should not be based on
a 30-year-old modeling language created for
object-oriented software development.***

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Who is responsible for SysML?

UNIFIED MODELING LANGUAGE™

OMG SYSTEMS MODELING LANGUAGE™

MODEL DRIVEN ARCHITECTURE®

30 Years

IGNITING INNOVATION

Since 1989

Object Management Group®

www.omg.org/spec

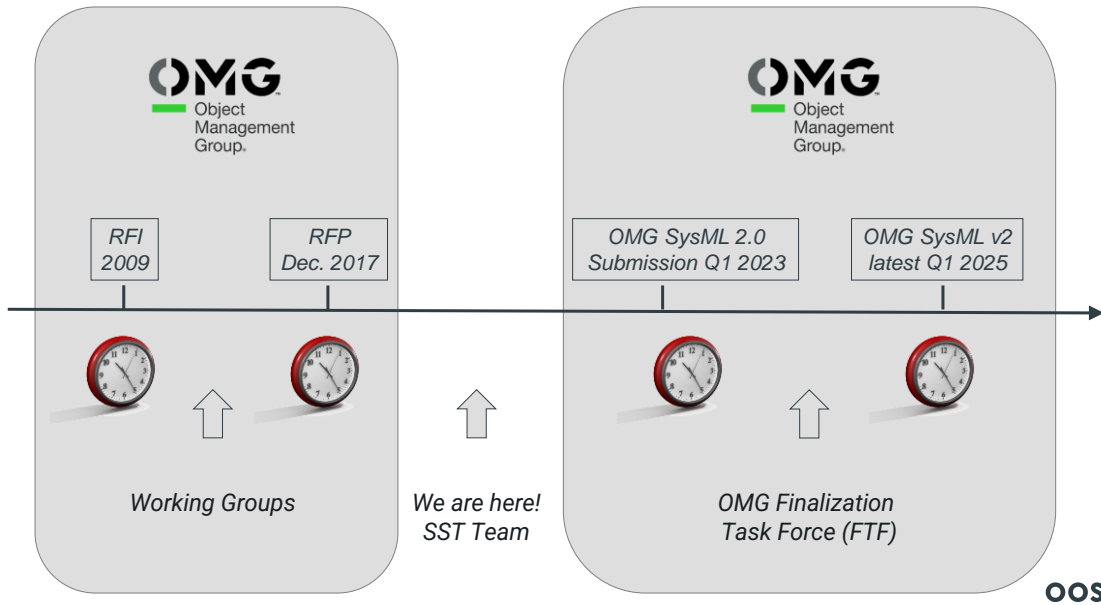
BPMN™

DMN™ Decision Model & Notation™

M.O.F. Meta-Object Facility™

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Roadmap SysML v2



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SST Participating Organizations

SST

Academia/Research End User | Tool/Training Vendors Government Rep | INCOSE rep *

215 people from 85 organizations (Oct. 2022)

Source: SST

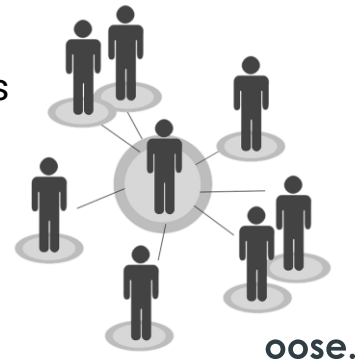
- Aerospace Corp
- Airbus
- ANSYS medini
- Aras
- Army Aviation & Missile Center
- Army CBRND
- U.S. Army DEVCOM Armaments Center
- BAE
- BigLever Software
- Boeing
- Budapest Univ of Tech and Economics (BME)
- CalTech CTME
- CEA
- Contact Software
- Defence Science and Technology Group
- DEKonsult
- Delligatti Associates
- Draper Lab
- Elparazim
- ESTACA
- Ford
- Fraunhofer FOKUS
- Galois
- General Motors
- George Mason University
- GFSE
- Georgia Tech/GTRI
- IBM
- Idaho National Laboratory
- IncQuery Labs
- Intercax
- Itemis
- Jet Propulsion Lab
- John Deere
- KTH Royal Institute of Technology
- LieberLieber
- Lightstreet Consulting
- Lincoln Lab
- Lockheed Martin
- MathWorks
- Maplesoft
- Mercury Systems
- Mgnite Inc
- MID
- MITRE
- ModelAlchemy Consulting
- Model Driven Solutions
- Model Foundry
- Naval Postgraduate School (NPS)
- NIST
- No Magic/Dassault Systemes
- OAR
- Obeo
- OOSE
- Ostfold University College
- Phoenix Integration/ANSYS
- PTC
- Qualtech Systems, Inc (QSI)
- Raytheon
- Rolls Royce
- Saab Aeronautics
- SAF Consulting *
- SAIC
- SEI
- Siemens
- Sierra Nevada Corporation
- Simula
- Space Cooperative
- Sodius Willert
- System Strategy *
- Tata Consultancy Services
- TES
- Thales
- Thematix
- Tom Sawyer
- Twingineer
- UFPR
- University of Western Switzerland (Rosas Center)
- University of Cantabria
- University of Alabama in Huntsville
- University of Detroit Mercy
- University of Kaiserslautern / VPE
- Vera C. Rubin Observatory
- Vitech
- 88solutions

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Team structure

SST Team is divided in 6 tracks with track leads:

1. Project Management – Ed Seidewitz, Sandy Friedenthal
2. Requirements V&V – Sandy Friedenthal
3. Transformation – Yves Bernard, Tim Weilkiens
4. Metamodel Development – Karen Ryan
5. API/Services Development – Manas Bajaj
6. Pilot Implementation – Ed Seidewitz

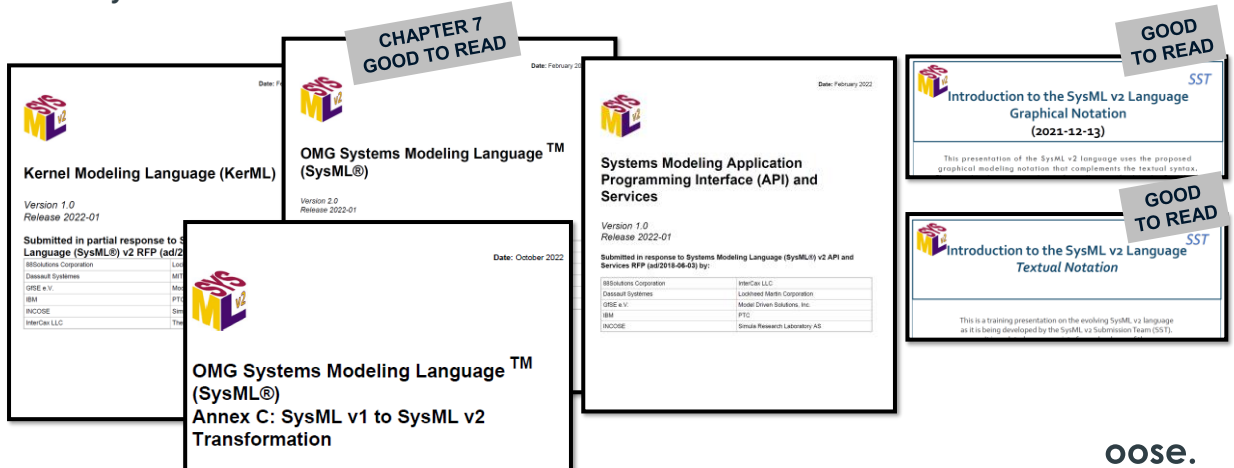


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SysML v2 Documents

<https://github.com/Systems-Modeling/SysML-v2-Release>

The SysML v2 Release contains 6 documents:



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SysML v2 Language Architecture

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CONCRETE SYNTAX

ABSTRACT SYNTAX

SEMANTICS

13.11.2022

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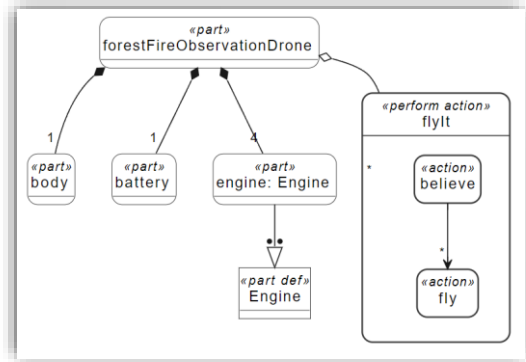
Concrete Syntax of SysML – The Faces of SysML

```

part forestFireObservationDrone {
  part body;
  part battery;
  part engine[4];
  perform action flyIt {
    first start;
    then action believe;
    then action fly;
    then done;
  }
}
part def Engine;

```

Textual Notation



Graphical Notation

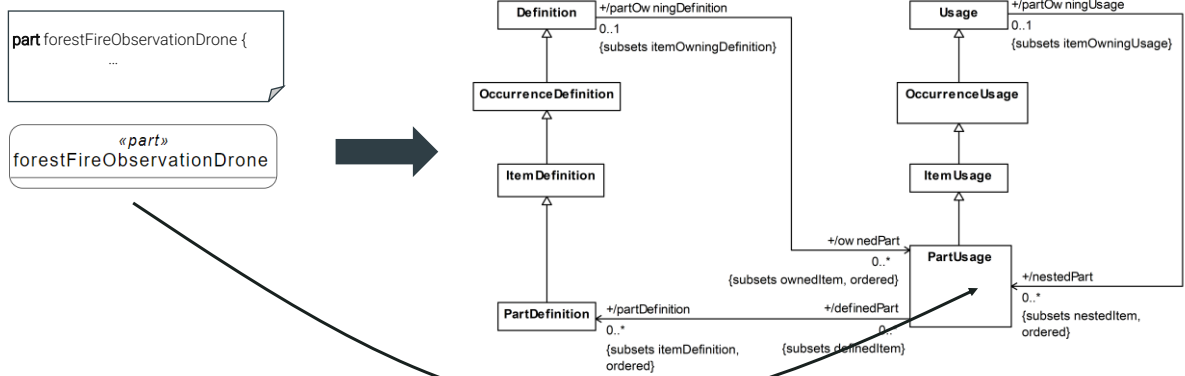
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Abstract Syntax

SysML v2 Architecture

The abstract syntax defines the data structure of the model.



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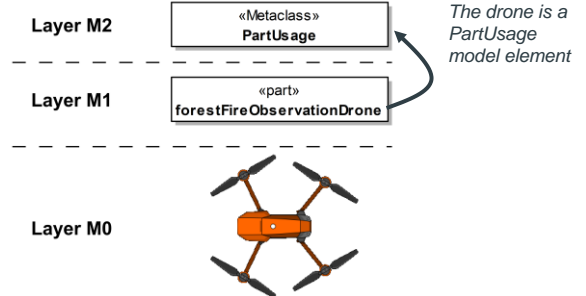
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Architecture Layers

Layer M2 represents the elements that specifies M1 elements.
for example, a metaclass PartUsage specifying the model element part „drone“

Layer M1 represents the elements that specifies M0 elements.
for example, a SysML v2 part specifying the drone to be built

Layer M0 represents the real or virtual elements.
for example, a real drone or a drone to be built



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Kernel Modeling Language (KerML)

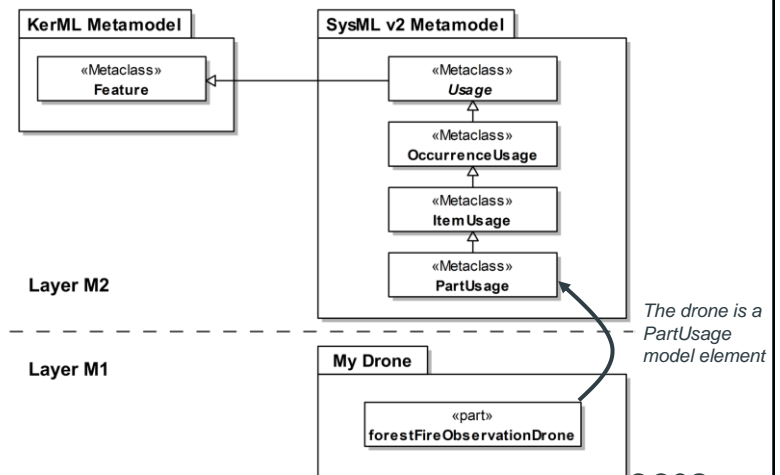
SysML v2 is based on KerML.

KerML is a modeling language to create modeling languages.

KerML covers common concepts like Feature, Membership, ...

SysML covers systems engineering concepts.

KerML could also be used to define other modeling languages like UML v3 or BPMN v3.



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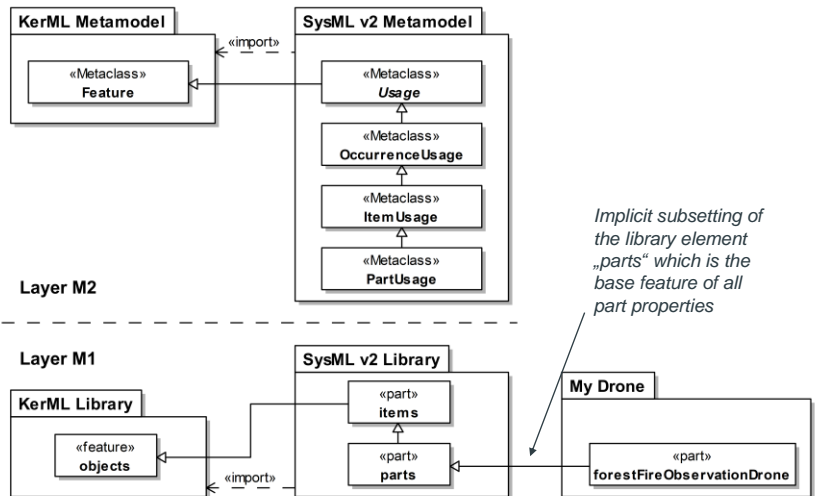
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Model Libraries

The KerML and SysML v2 libraries define semantics and structures for M0 on the user model level M1.

As a model user, you must not care much about them. The tools implicitly set the relationship:

```
1 show forestFireObservationDrone
PartUsage forestFireObservationDrone (2bd1003c-6747-404a-83fe-ff18540b194)
[Subsetting (implicit)] PartUsage parts (86388e11-8a66-4670-b375-a699abc9f811
```



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One more layer: Meta Object Facility (MOF)

Layer M3 represents the elements that specifies M2 elements.

for example, a Class to specify the metaclass PartUsage.

Layer M2 represents the elements that specifies M1 elements.

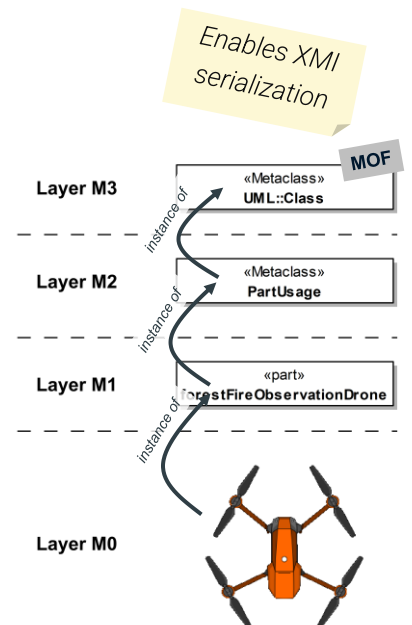
for example, a metaclass PartUsage to specify the model element part „drone“

Layer M1 represents the elements that specifies M0 elements.

for example, a SysML v2 part to specify the drone to be built

Layer M0 represents the real or virtual elements.

for example, a real drone or a drone to be built



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Quick Start

SysML v2 Pilot Implementation



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Overview SysML v2 Pilot Implementation

- Purpose: Proof of Concept of the SysML v2 specification
- Who? Developed by the SysML Submission Team
- What?
 - SysML v2 Modeling Tool based on Eclipse or Jupyter Lab
 - Textual Editor, Graphical views
- License? GNU Lesser General Public License
- What is it not? Full SysML v2 Tool for industrial usage
- How to get it? <https://github.com/Systems-Modeling/SysML-v2-Release>

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Ready to use: The SysML v2 Lab

- SysML v2 Pilot Implementation based on Jupyter Lab
- Provided as a free online service for the community
- Hosted by oose; enabled by the community
 - Pilot Implementation by the SST
 - Docker container by gorenje
 - Server hosted by oose
- Will be open and free to use as long as no misuse happens
- Save your data! Regular restarts of the server will clean everything.

www.sysmlv2lab.com

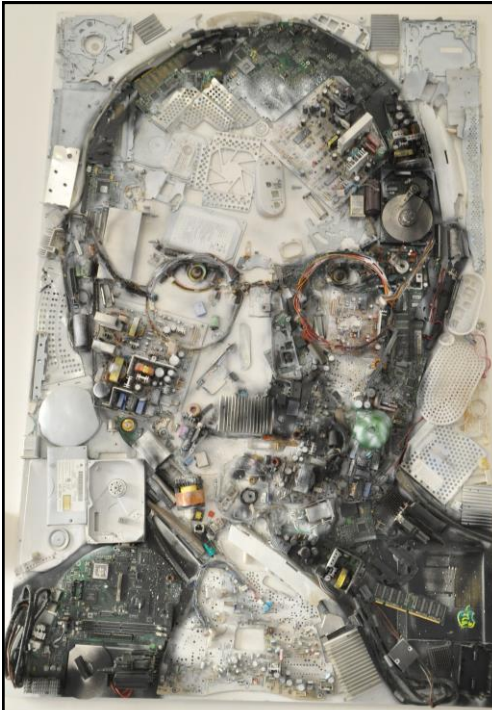
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SysML v2 Lab

The screenshot displays the SysML v2 Lab interface, which is a Jupyter Lab environment. On the left, a file browser shows a directory structure with folders like 'doc', 'install', 'kernel', 'notebooks', 'sysml', and 'sysml/library'. The main area is divided into two panes. The left pane shows a text editor with the title 'The SysML v2 Lab' and content explaining the service and how to start. The right pane shows a SysML diagram titled 'eVehicle_LogicalArchitecture' with a hierarchical structure of components and their relationships. The diagram includes a 'package' element 'eVehicle_LogicalArchitecture' containing several 'part' elements: 'body', 'battery', 'engine', 'transmission', 'frontAxle', and 'rearAxle'. Each part is further detailed with its own set of components and relationships, forming a complex logical architecture.

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Two more Things...

The SysML v1 to v2 Transformation

and

The SysML v2 API

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Transformation SysML v1 to SysML v2

The SysML v2 specification will include transformation rules to map a SysML v1 model to SysML v2.



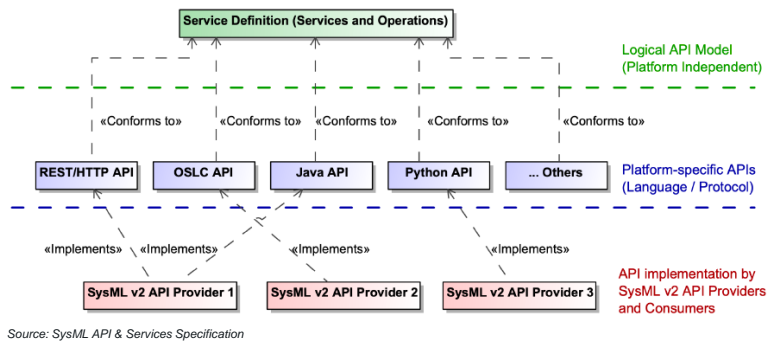
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SysML v2 API and Services

Provide a standardized, and tool-independent API and basic services to access a SysML model.

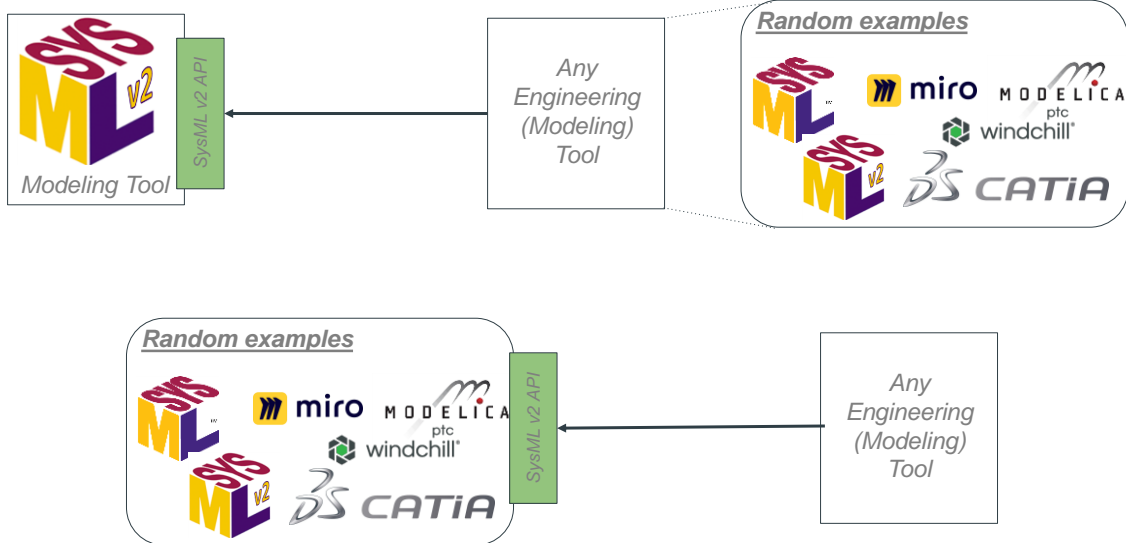
The standard will make it possible to write applications using the API and services independent of a specific SysML tool.



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SysML v2 API & Services: Usage scenarios



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