



SiriusCon

18th of June, 2020

LIVE 2020

The SmartMDSD Toolchain: Model-Driven Software Development for Robotics Software Systems

Prof. Dr. Christian Schlegel

christian.schlegel@thu.de

www.servicerobotik-ulm.de

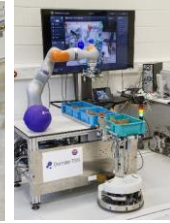
Dr. Alex Lotz

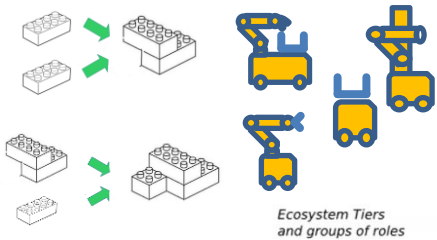
alex.lotz@thu.de



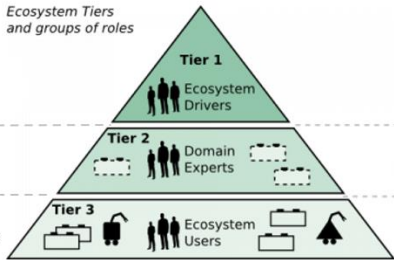
The SmartMDSD Toolchain

Model-Driven Software Development for Robotics Software Systems





The SmartMDSD Toolchain



Tier 1 content:
domain-independent

Tier 2 content:
domain-specific

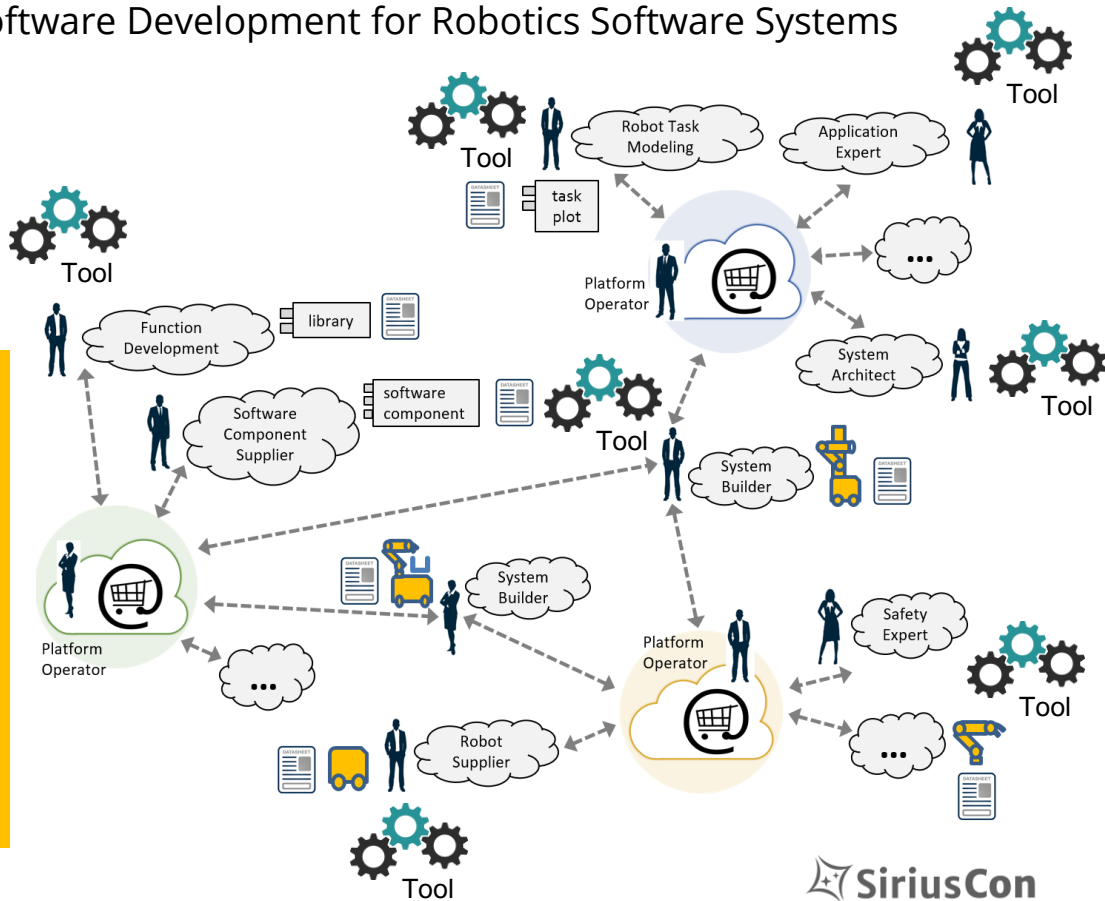
Tier 3 content:
components and systems

Models and Model-Driven Software Engineering

- to enable **separation of roles** and **composition**
 - to manage interfaces between assets and roles
 - to provide an outside view on assets (blocks with ports)
- => what you need to know as user of an asset
=> do not comprise all the details (not 100% models)

Thus,

- models in the form of digital data sheets
- a model-driven approach for guidance such that the different roles can focus on their asset and that they can rely on tooling to ensure conformance to interfaces defining composability in the ecosystem



The SmartMDSD Toolchain

Model-Driven Software Development for Robotics Software Systems

Composing a Robotics Application in a Day:

A low code approach

We make Robotics Software Systems Engineering easier!

- **one-click download** of the full Open-Source Eclipse-based development environment
- **start development with zero installation effort**
- comes with Gazebo-Simulator and all kinds of components, stacks, pilot applications, tutorials, etc.
- skill-based engineering, task-level coordination, robot fleet coordination, graphical tools for end-users
- fully middleware-agnostic: ACE, DDS, OPC UA, etc.
- mixed-port component as migration path: link to ROS, I4.0 OPC UA, etc.

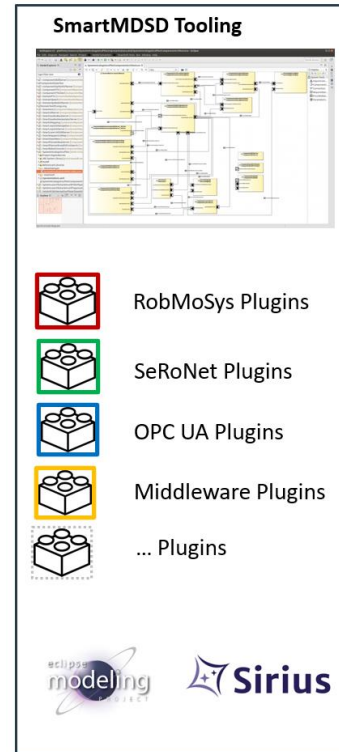
<https://wiki.servicerobotik-ulm.de/start>

<https://wiki.servicerobotik-ulm.de/smartmdsd-toolchain:start>

<https://www.youtube.com/user/RoboticsAtHsUlm/videos>



Service Robotics Ulm
autonomous mobile service robots



separation of roles



building blocks with data sheets:

- selection
- composition
- configuration
- implementing
- modification



import / export of

- service-definitions
- S/W-components
- robot systems
- applications



The SmartMDSD Toolchain

Model-Driven Software Development for Robotics Software Systems



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 732410.

<https://robmosys.eu>
<https://robmosys.eu/wiki/open-call-2>
<https://discourse.robmosys.eu>
<https://robmosys.eu/wiki>



conforms to



Gefördert durch:



Bundesministerium
für Wirtschaft
und Energie

aufgrund eines Beschlusses
des Deutschen Bundestages




<https://www.seronet-projekt.de/plattform/tooling.html>



The SmartMDSD Toolchain

Model-Driven Software Development for Robotics Software Systems



MembersWorking GroupsProjectsMore

Download

Home / Projects / Eclipse Modeling Project / Eclipse SmartMDSD

Eclipse SmartMDSD

OverviewDownloadsWho's InvolvedDeveloper ResourcesGovernanceContact Us

Tooling developed in this project is the "SmartMDSD Toolchain", an Eclipse-based Integrated Development Environment (IDE). The model-driven SmartMDSD Toolchain provides support and guidance to apply structures and best-practices the composition of software building blocks to robotics systems. This project will maintain the eclipse-based tooling and necessary infrastructure (e.g. meta-models, code-generators).

Underlying methodology

The SmartMDSD Toolchain supports users in applying the necessary structures to enable composition in an robotics ecosystem. The tooling enables domain experts to model robotics domain structures, enables component suppliers to provide software components and enables system builders to flexibly combine and re-combine ("compose") them to new applications according to their needs.

Main target is the SmartSoft Framework


SmartMDSD covers the complete workflow from domain structures and interface definitions, to component development, to system composition. SmartMDSD will mainly support the "SmartSoft Framework", a service-oriented component-based framework for software development in service robotics. However, it also outreaches to make use of the ROS framework and OPC UA.

SmartMDSD conforms to the structures proposed by the European Union's Horizon 2020 research and innovation programme "RobMoSys" (<https://robmosys.eu/>) and BMWi/PAiCE "SeRoNet" (<https://www.seronet-projekt.de>).

For more information, see the following resources:

- http://robmosys.eu/wiki/baseline:environment_tools:smartsoft:smartmdsd-toolchain:start
- <https://www.youtube.com/watch?v=JIYPJXmop3U>
- Dennis Stampfer, Alex Lotz, Matthias Lutz, and Christian Schlegel. "The SmartMDSD Toolchain: An Integrated MDSD Workflow and Integrated Development Environment (IDE) for Robotics Software". In: Journal of Software Engineering for Robotics (JOSER): Special Issue on Domain-Specific Languages and Models in Robotics (DSLRob) 7.1 (July 2016). ISSN 2035-3928, pp. 3–19. URL: <http://joser.unibg.it/index.php/joser/article/view/91>

Licenses:
Eclipse Public License 2.0



**ECLIPSE
INCUBATION**

RELATED PROJECTS

Project Hierarchy:

- » Eclipse Modeling Project
- » Eclipse SmartMDSD

The SmartMDSD Toolchain

Model-Driven Software Development for Robotics Software Systems

<< Demo by Alex Lotz >>

Thanks for listening to
Christian Schlegel and Alex Lotz

Any questions?

Please wait a few seconds before
we automatically bring you to the next session

Next Talk:

Sirius to the Web with Obeo Cloud Platform (Obeo)

If you want to keep talking with the speakers of actual talk, you will have to come back to this session by opening the SiriusCon agenda menu in the top left-hand corner



SiriusCon

18th of June, 2020

LIVE 2020

Model-Driven Software Development for Robotics Software Systems - Eclipse SmartMDSD Toolchain Demo

Alex Lotz

CTO at Toolify Robotics GmbH
and Member of Servic robotics Ulm

lotz@toolify.eu

#SiriusCon

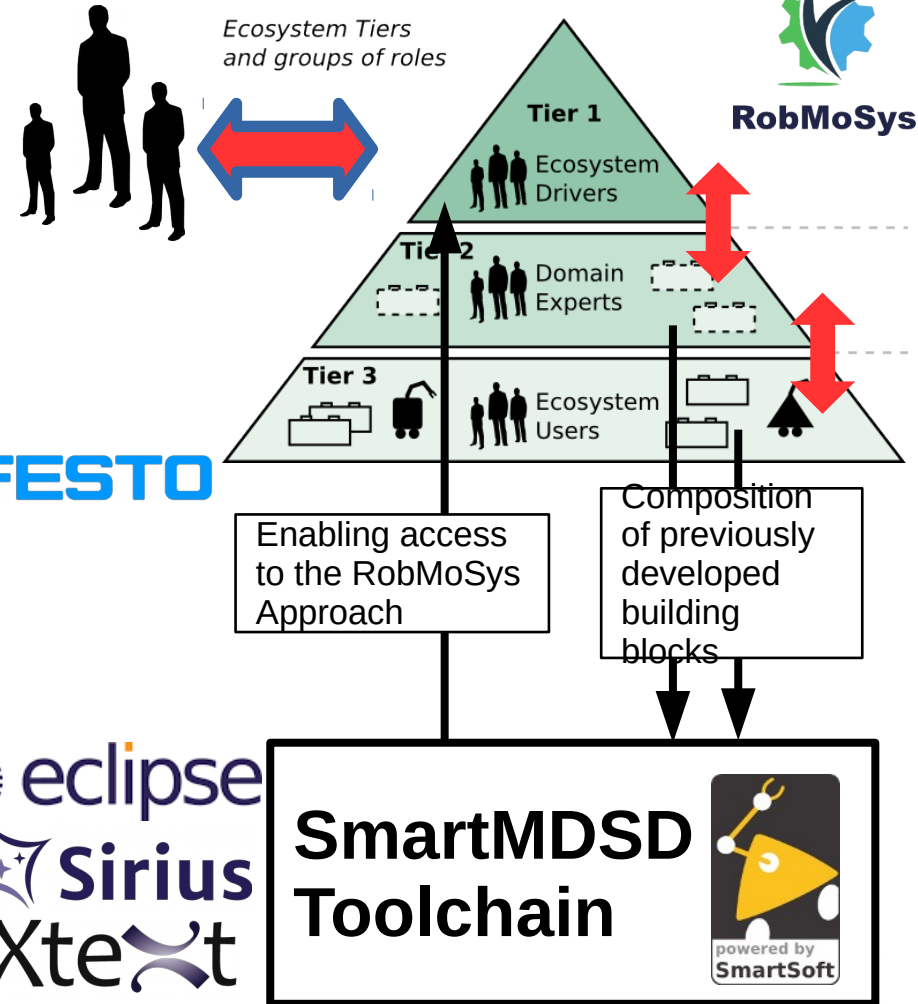


What is the SmartMDSD Toolchain

- The SmartMDSD Toolchain is an Integrated Development Environment (**IDE**) for robotics software to support system composition according to the structures of RobMoSys.
- Strong in building **real systems**
- Very **mature**, Used in Products delivered by **FESTO**

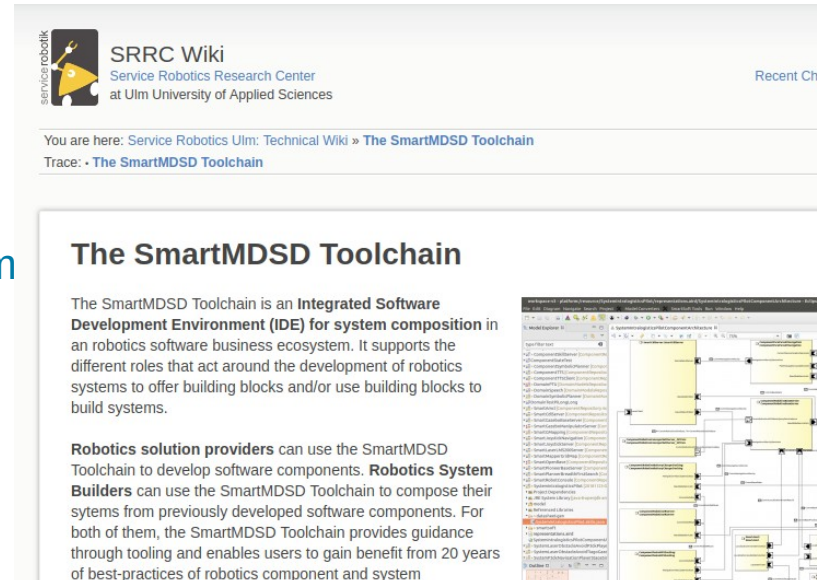


Industry 4.0 Intralogistics Pilot




Where to get the **SmartMDSD Toolchain**

- **SmartMDSD Toolchain easy entry:**
 - Available as standalone installation, and
 - As pre-installed, **ready-to-go virtual machine image:**
 - https://robmosys.eu/wiki/baseline:environment_tools:smartsoft:start
- **Tutorials:**
 - <https://wiki.servicerobotik-ulm.de/tutorials:start>
- **YouTube Videos at:**
 - <https://www.youtube.com/user/RoboticsAtHsUlm>



The screenshot shows a web browser displaying the SRRC Wiki page. The header includes the SRRC Wiki logo and the text 'Service Robotics Research Center at Ulm University of Applied Sciences'. Below the header, a breadcrumb trail reads 'You are here: Service Robotics Ulm: Technical Wiki » The SmartMDSD Toolchain' and 'Trace: » The SmartMDSD Toolchain'. The main content area is titled 'The SmartMDSD Toolchain' and contains a paragraph describing it as an 'Integrated Software Development Environment (IDE) for system composition in an robotics software business ecosystem'. It also mentions that 'Robotics solution providers' and 'Robotics System Builders' can use the toolchain. On the right side of the page, there is a diagram showing a complex system architecture with various components and their interconnections.

service robotik  SRRC Wiki
Service Robotics Research Center
at Ulm University of Applied Sciences

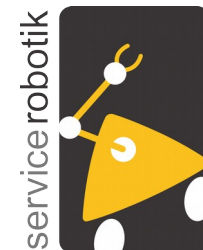
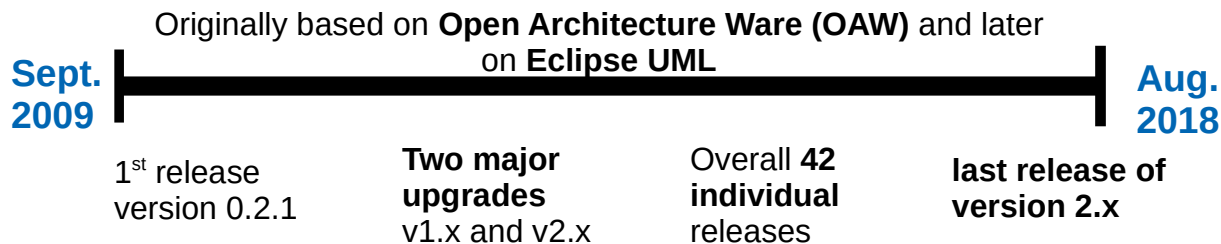
You are here: Service Robotics Ulm: Technical Wiki » The SmartMDSD Toolchain
Trace: » The SmartMDSD Toolchain

The SmartMDSD Toolchain

The SmartMDSD Toolchain is an **Integrated Software Development Environment (IDE)** for system composition in an robotics software business ecosystem. It supports the different roles that act around the development of robotics systems to offer building blocks and/or use building blocks to build systems.

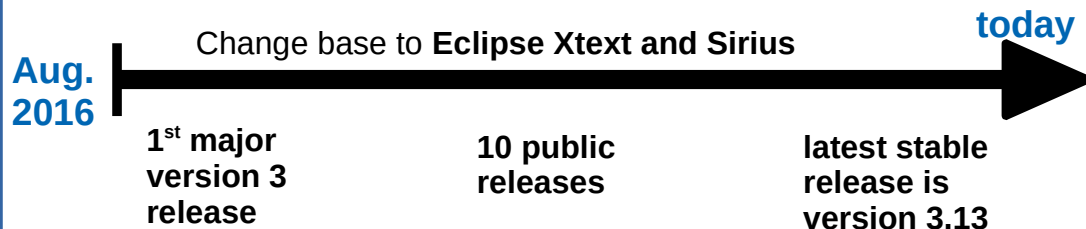
Robotics solution providers can use the SmartMDSD Toolchain to develop software components. **Robotics System Builders** can use the SmartMDSD Toolchain to compose their systems from previously developed software components. For both of them, the SmartMDSD Toolchain provides guidance through tooling and enables users to gain benefit from 20 years of best-practices of robotics component and system

The SmartMDSD Toolchain – A brief history

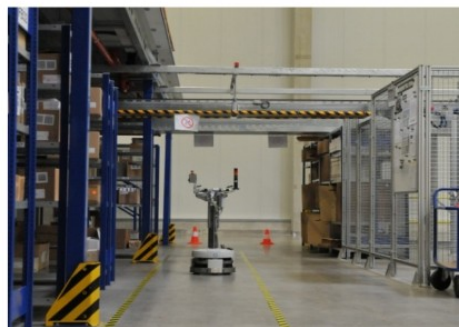
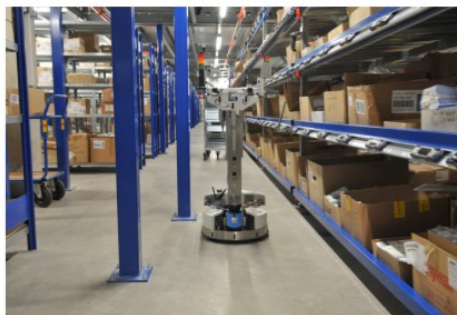
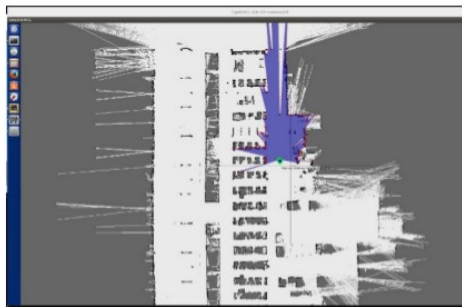


Statistics:

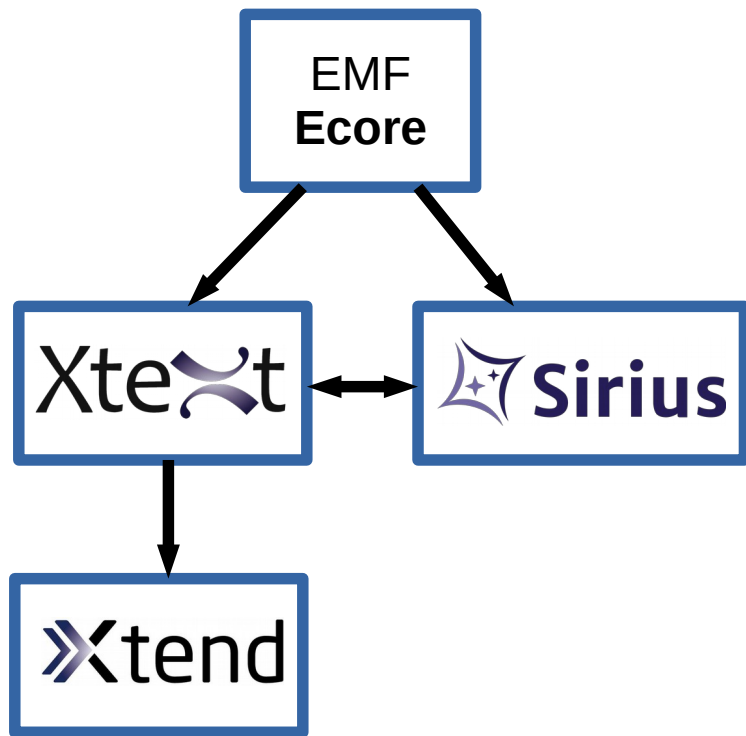
- **Four major generations** over the **past 11 years**
- About **50 public releases**
- Changing base technologies **from OAW, over UML, to Xtext and Sirius**
- Now a **public Eclipse Project**



Applications built with the **SmartMDSD Toolchain**



Our primarily used **Eclipse Modeling Tools**



*Developed **Robotics DSL contents:***

- **33 EMF Ecore** Metamodels
- **25 Xtext** based textual grammars
- **15 Xtend** based code generators
- **4 Sirius** based graphical diagram types

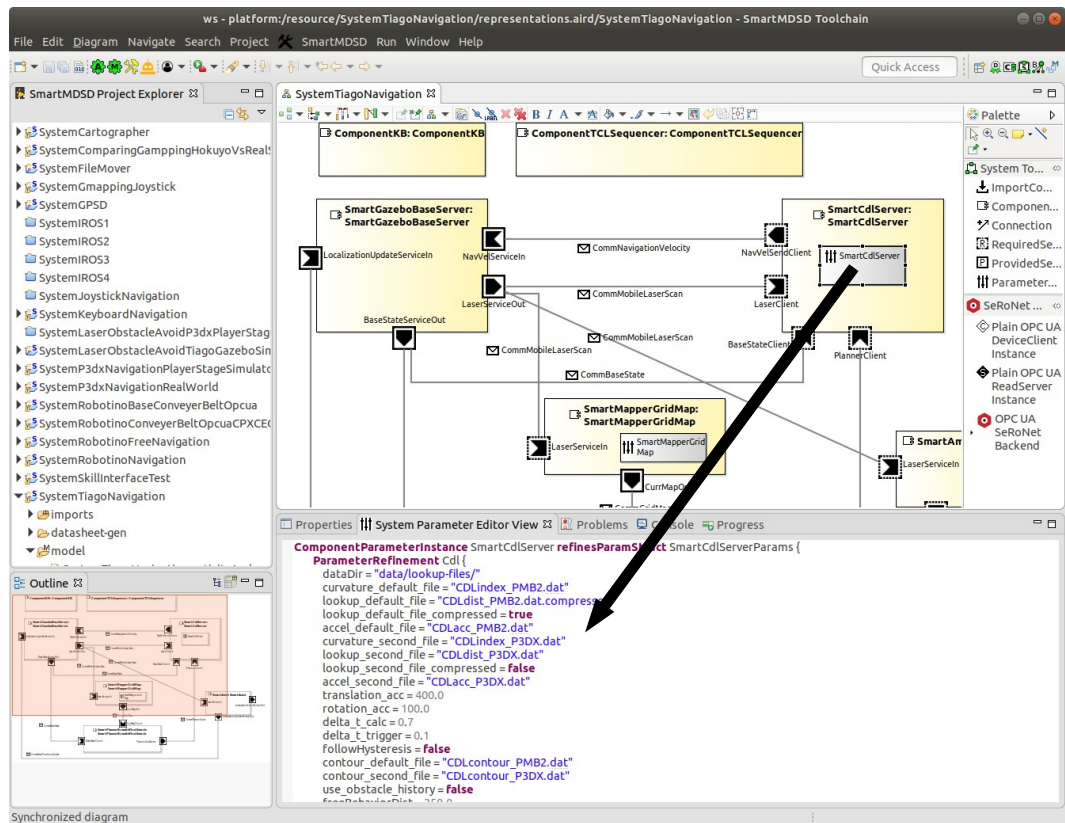
Robotics Domain Knowledge
consolidated with partners from all
over Europe within the Horizon
2020 flagship project **RobMoSys**:
<https://robmosys.eu/>



RobMoSys

Our 5 cents on **Graphical vs. Textual** Modeling

- **Textual models** for **lower-level abstractions** close to code
- **Textual models** for **serializing the semantic part** of models
- **Graphical models** for **higher-level abstractions** when models can be expressed in a **block-port-connector** manner
- No general exclusion of either graphical or textual model types, but rather **using both representation types in combination**



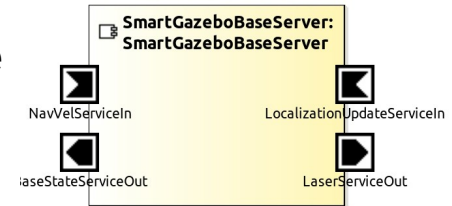
Lesions learned from using **Eclipse Sirius**

Pros:

- Huge **usability improvement** compared to basic GMF based modeling
- Since Sirius version 6.x, major improvement of the **Properties View**
- Decent **synchronization between Sirius and Xtext** (at least as long as you know the common pitfalls like the correct usage of the **transactional editing domain**)

Possible limitations:

- **Integration of textual models within graphical models** can be further improved (e.g. easier integration of textual model editors within graphical model elements)
- Missing **autorotating bordered node images**: The image of a bordered node should autorotate depending on at which side of the parent container node the bordered node is attached to



Thanks for listening to
Alex Lotz

Any questions?

Please wait a few seconds before
we automatically bring you to the next session

Next Talk:

Sirius to the Web with Obeo Cloud Platform (Obeo)

If you want to keep talking with the speakers of actual talk, you will have to come back to this session by opening the SiriusCon agenda menu in the top left-hand corner