MATLAB EXPO

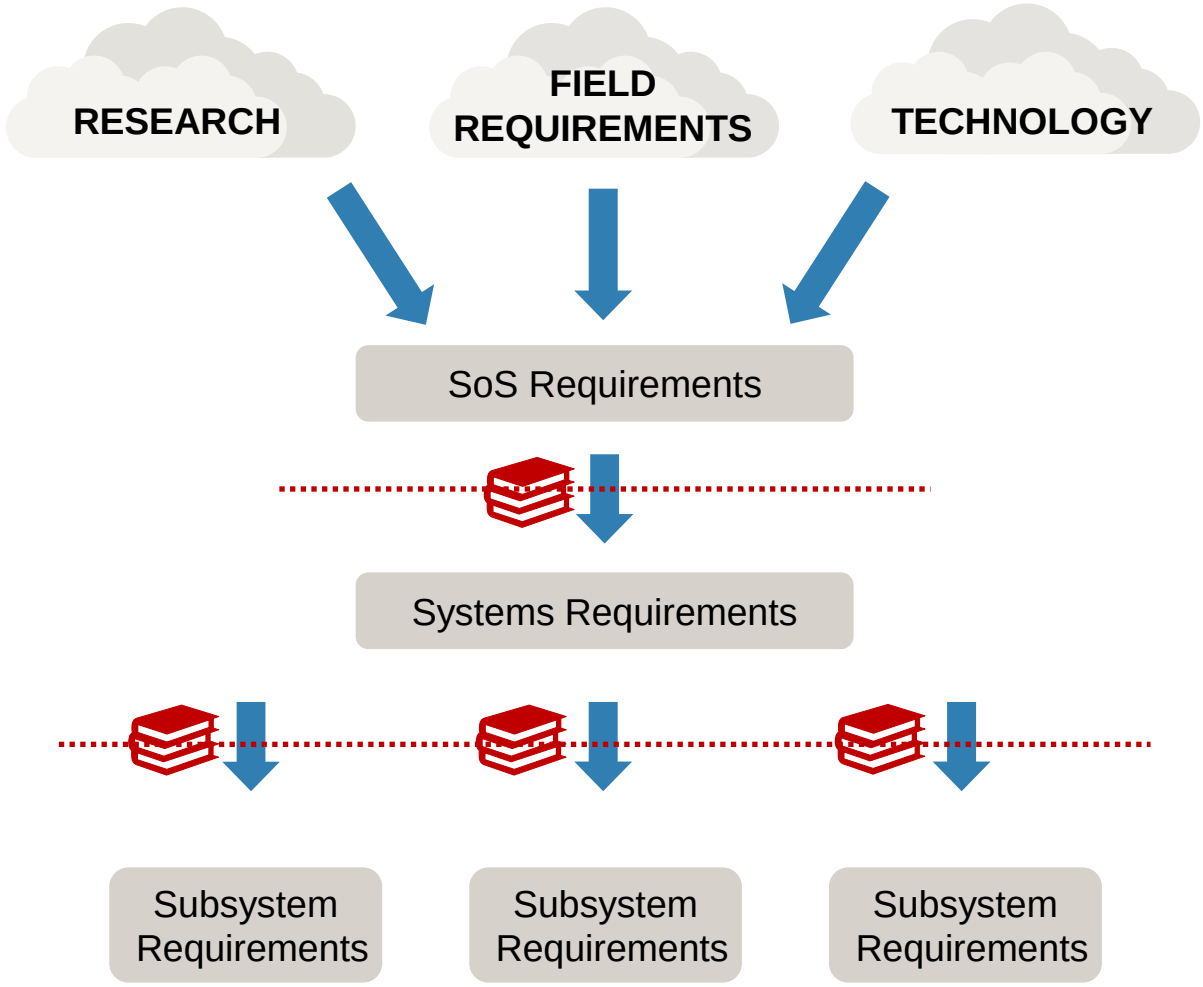
2024.06.11 | 그랜드 인터컨티넨탈 서울 파르나스

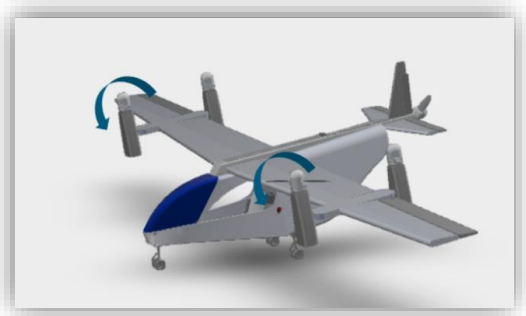
DDS Blockset 및 System Composer를 활용한 무인항공기 시스템의 분산 시뮬레이션과 아키텍처 설계

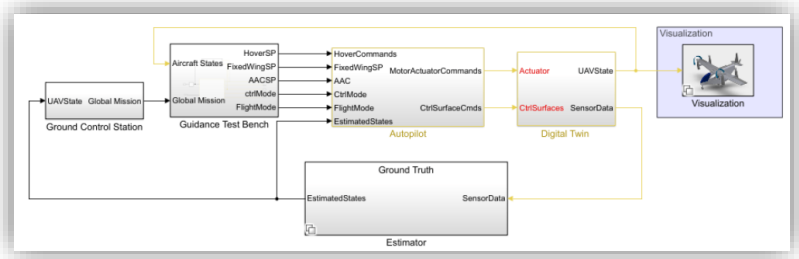
유성재, 매스웍스코리아

MathWorks

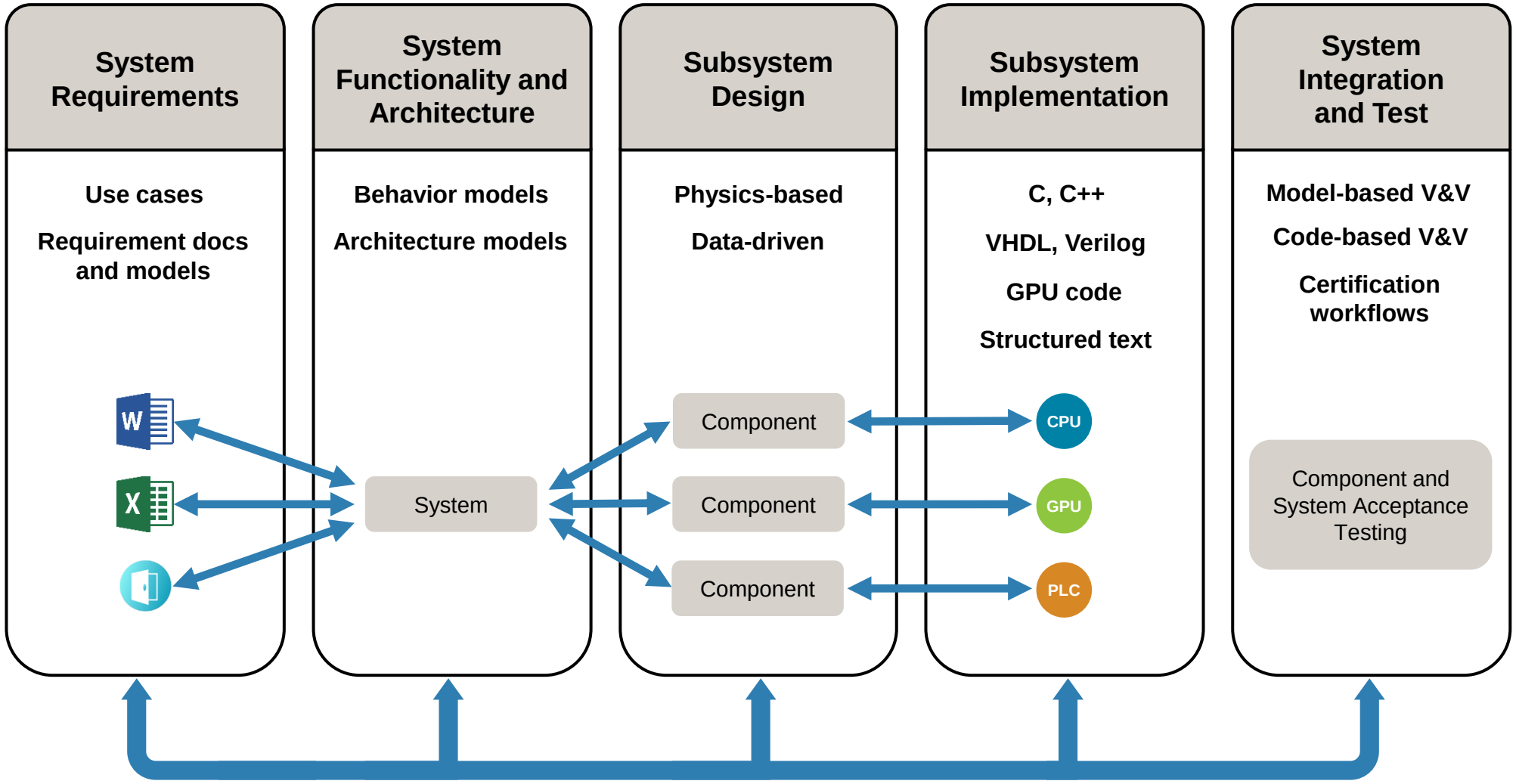
System of Systems
Challenges are bigger as the perspective grows



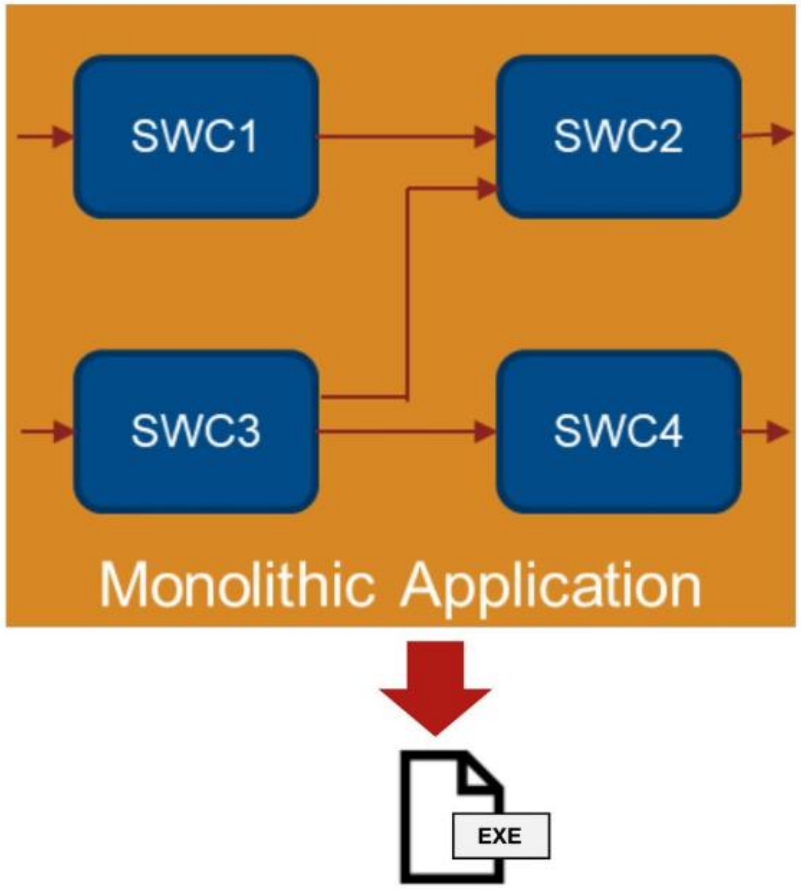




Model-Based Design

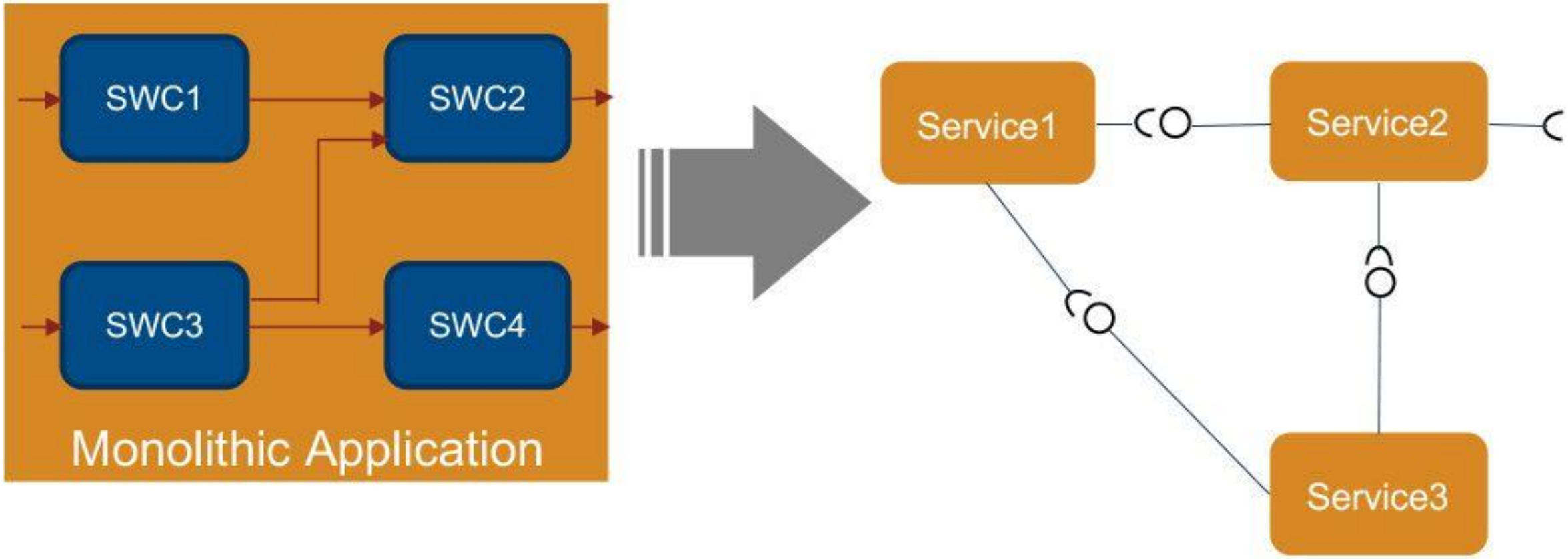


Monolithic Application

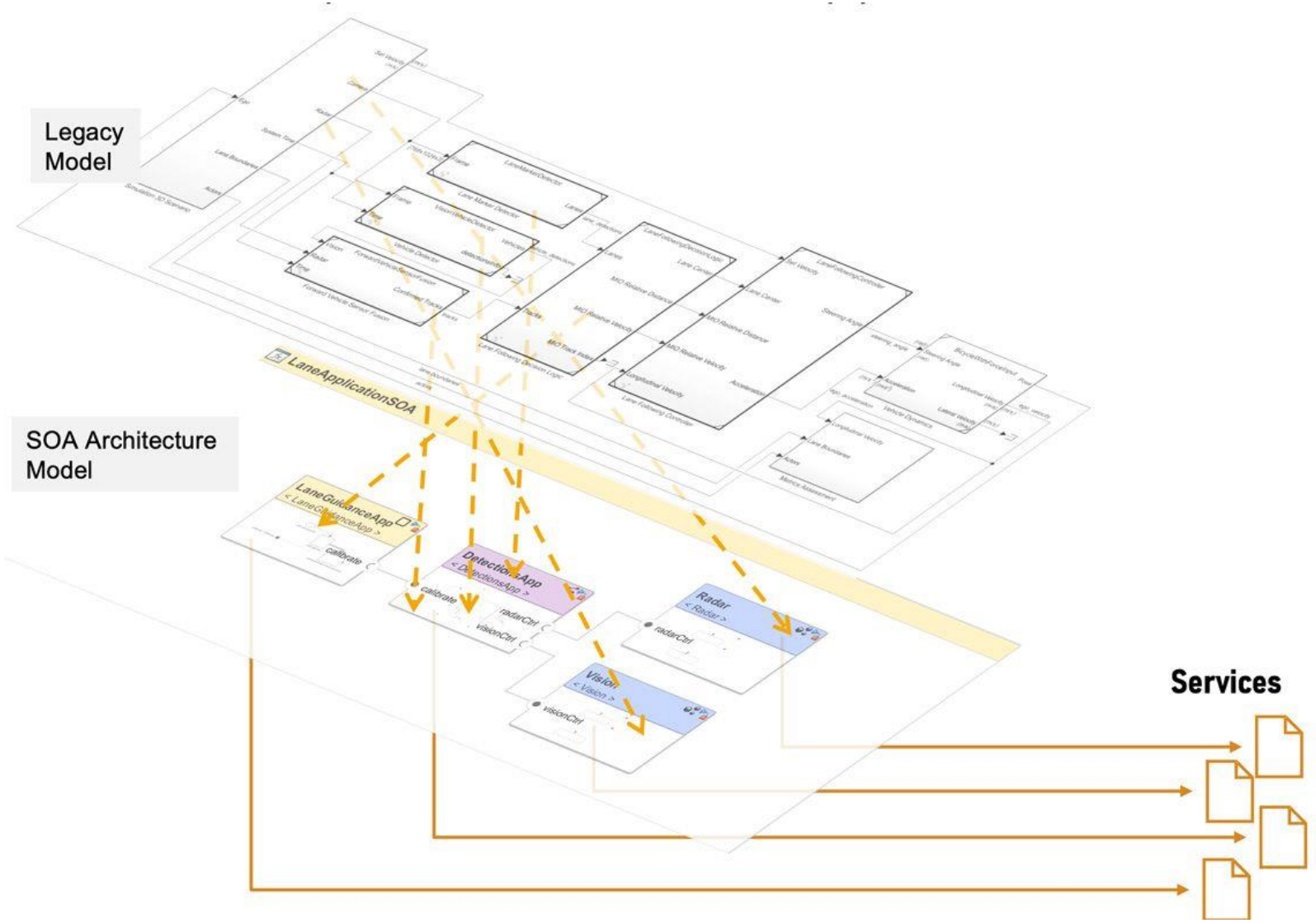


- No/minimal SW reuse
- High SW-HW coupling
- Monolithic update

SOA (Service Oriented Architecture)

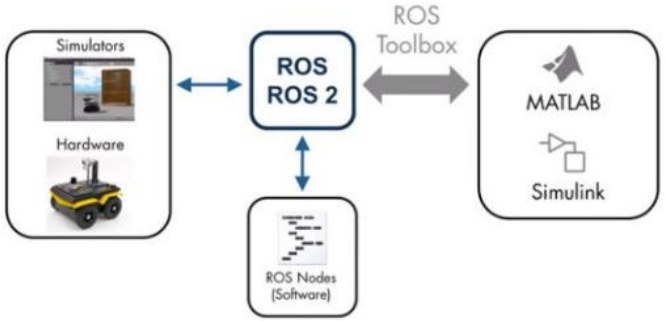


Migration from Legacy Model to SOA Architecture Model



Middleware Support

ROS / ROS2

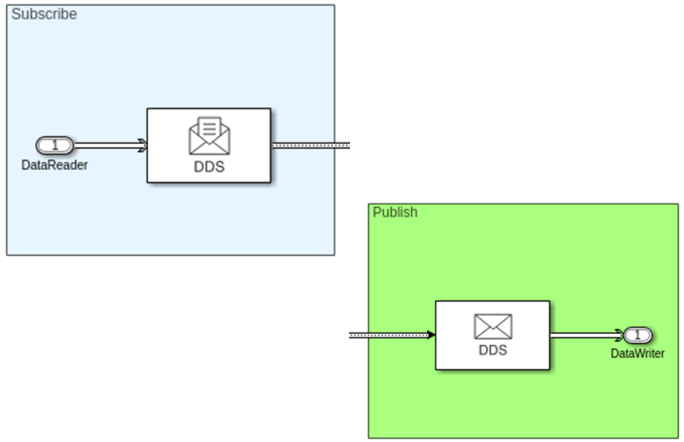


[Get Started with ROS Toolbox](#)

ROS Toolbox

R2019b

DDS

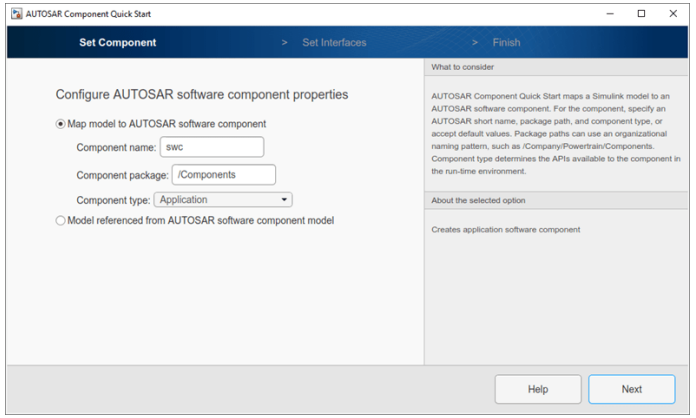


[DDS Blockset Shapes Demo](#)

DDS Blockset

R2021a

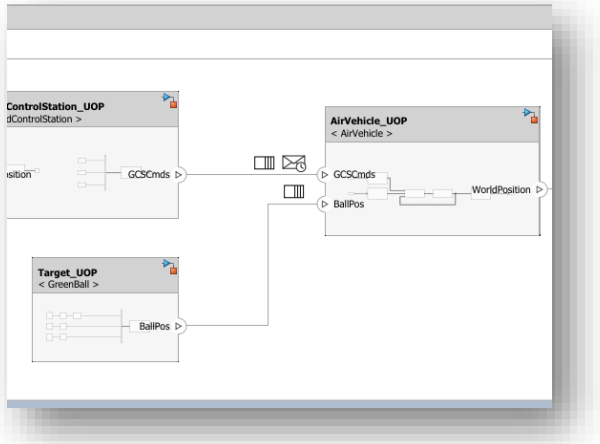
AUTOSAR



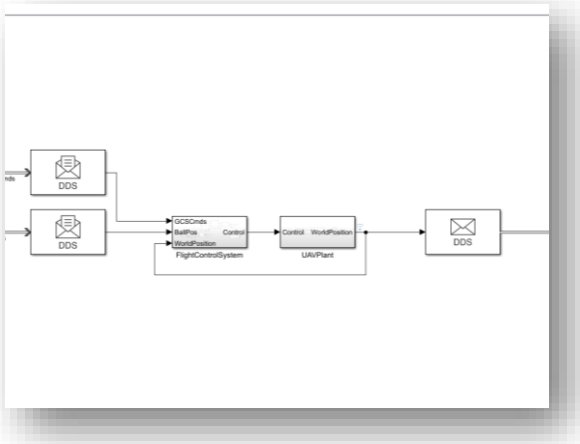
[Create and Configure AUTOSAR Software Component](#)

AUTOSAR Blockset

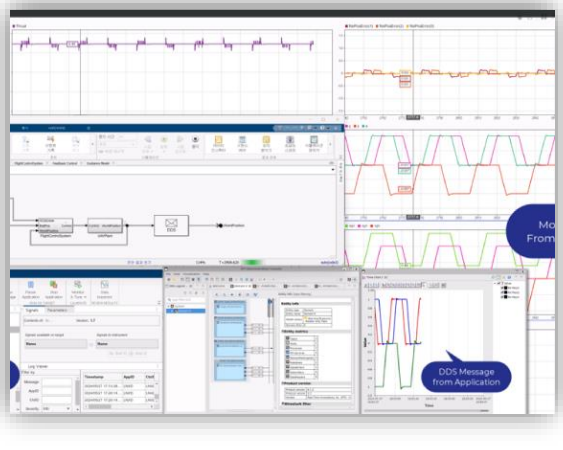
From System Architecture to deployment of DDS Application



Architecture



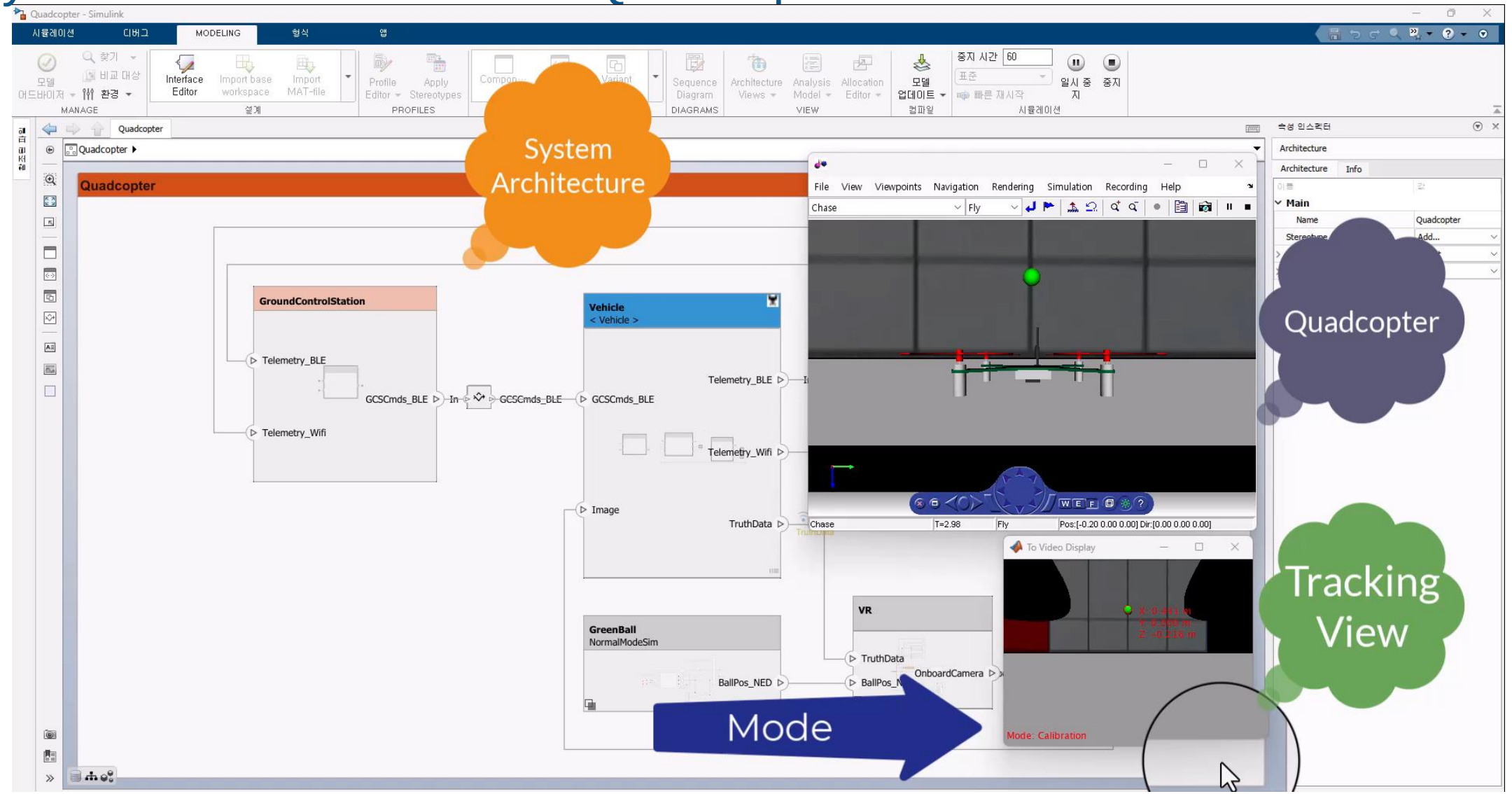
DDS Model & Simulation



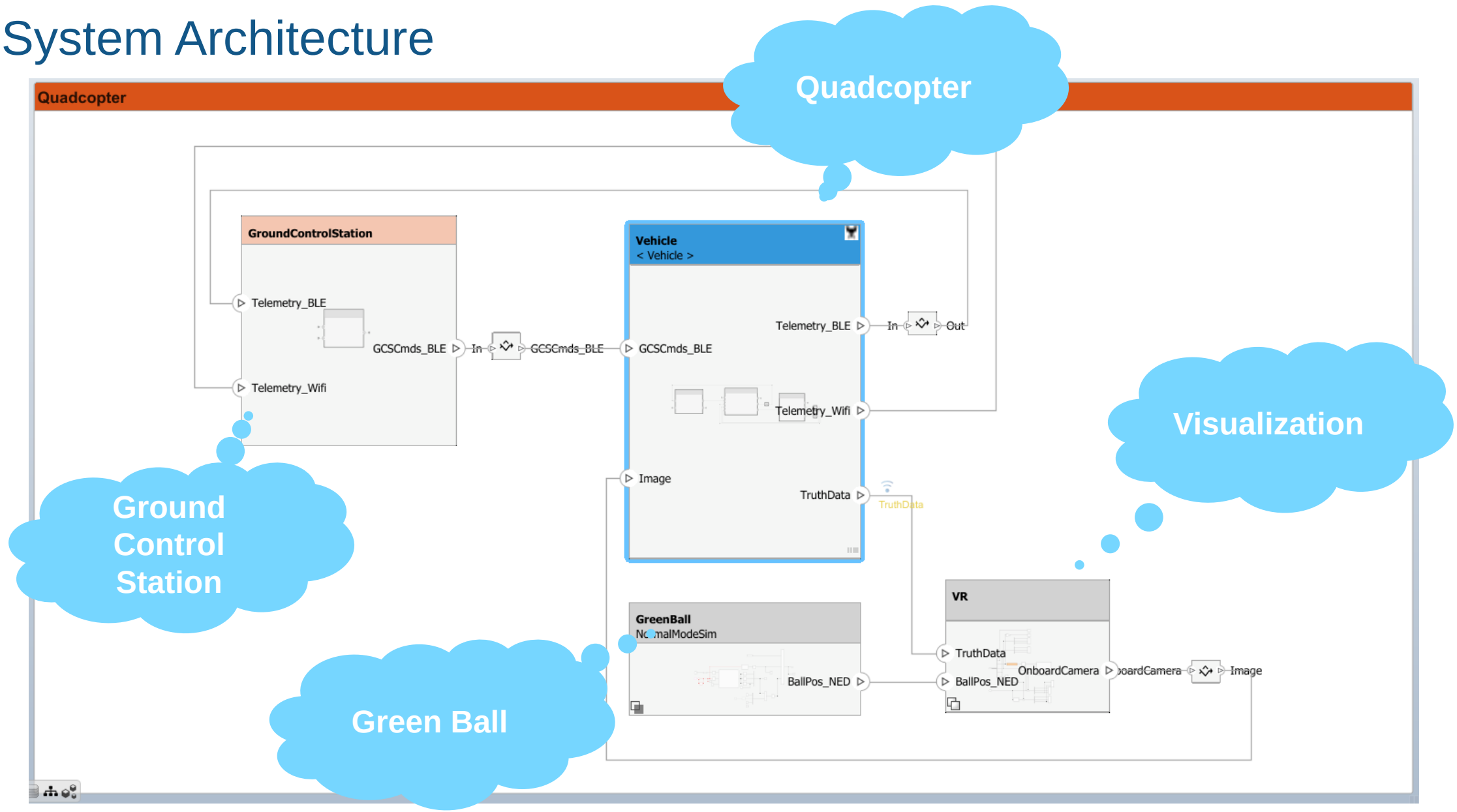
Deployment & Monitoring

System Composer

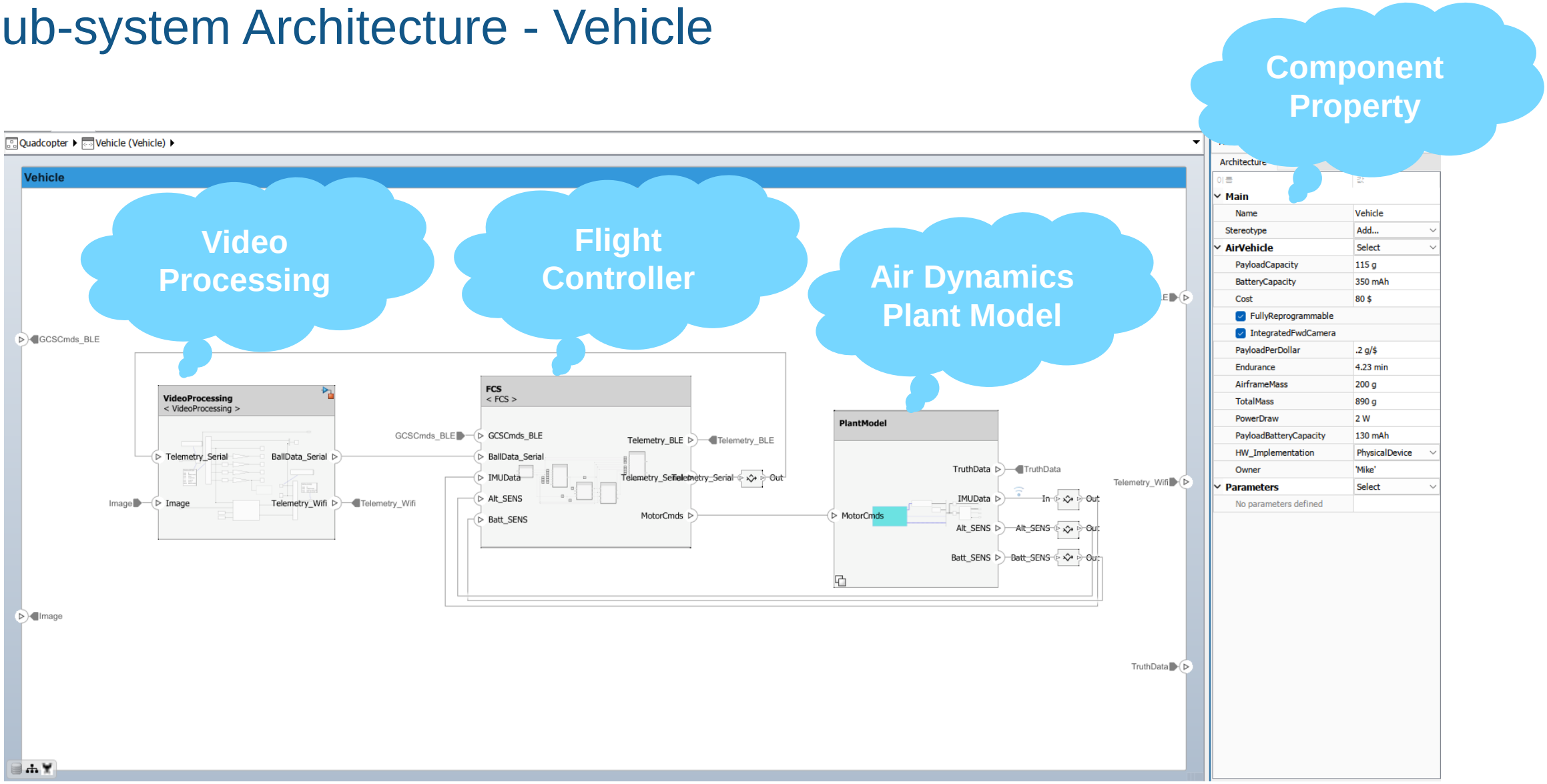
System-Level Simulation - Quadcopter



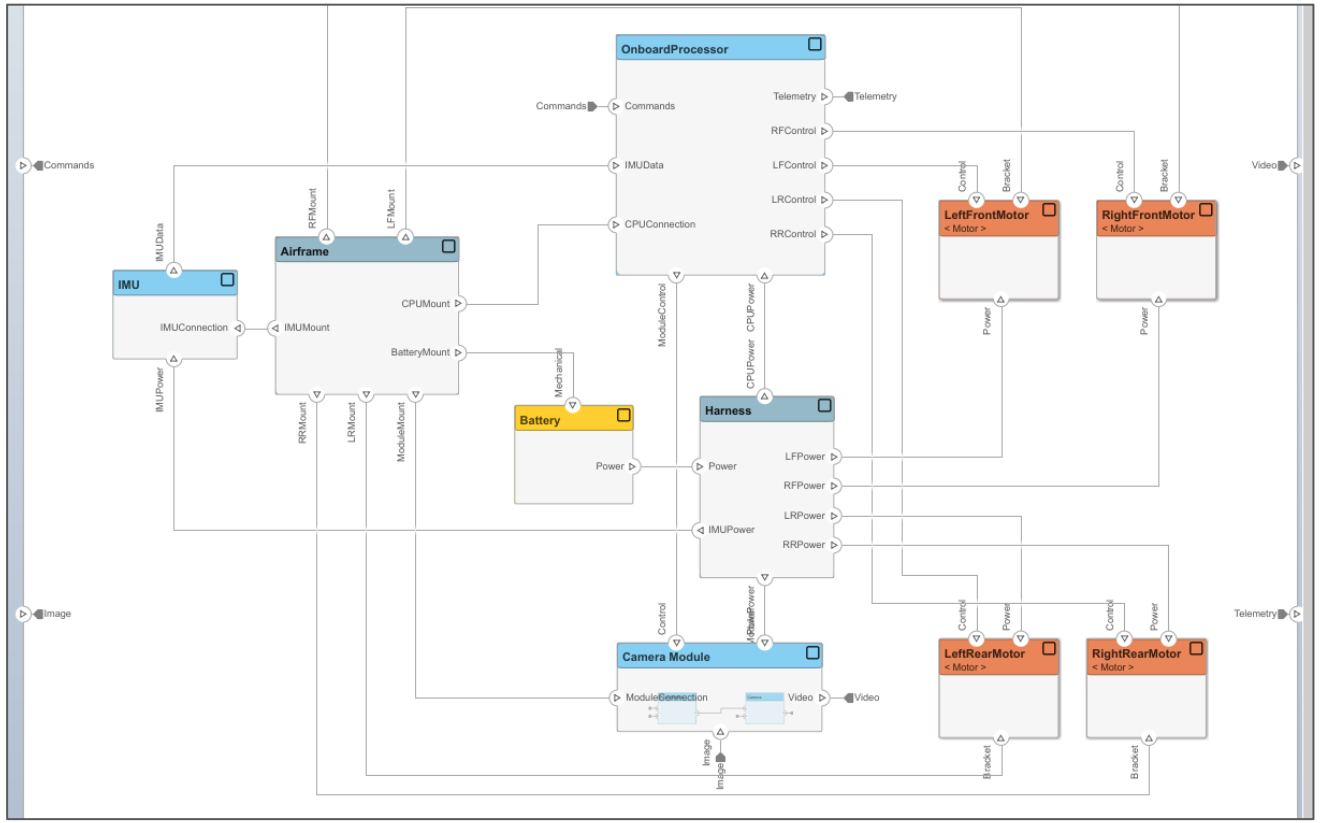
System Architecture



Sub-system Architecture - Vehicle



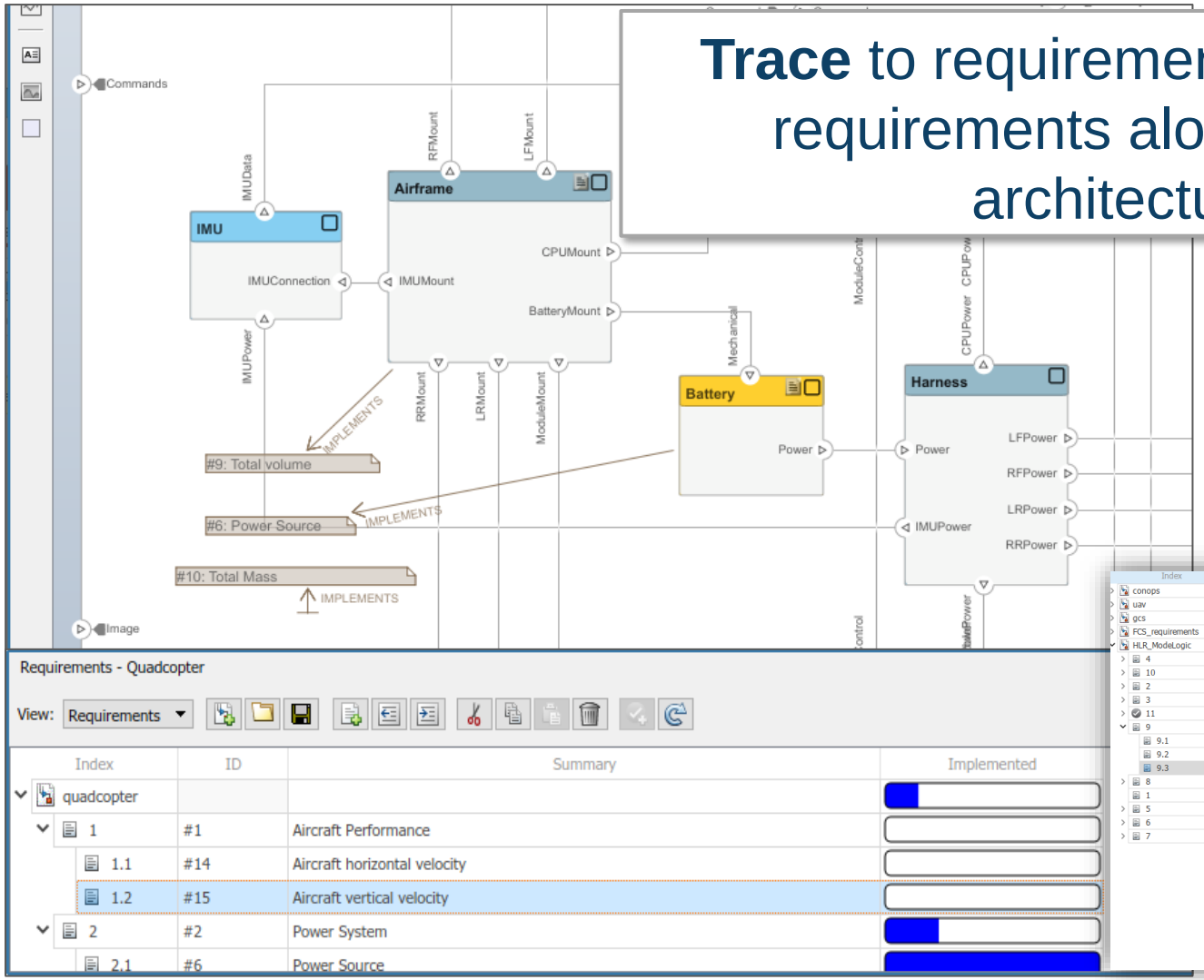
Sketch Architecture & Elaborate Incrementally

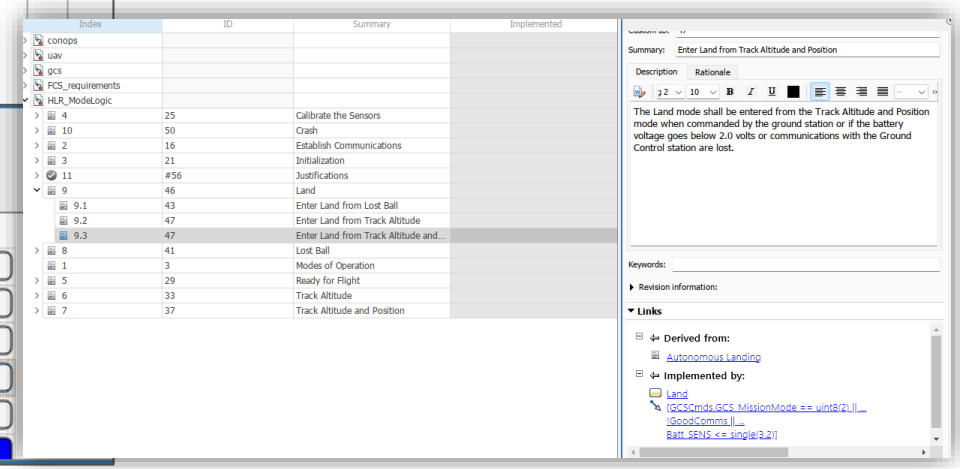


Sketch system interfaces and elaborate incrementally

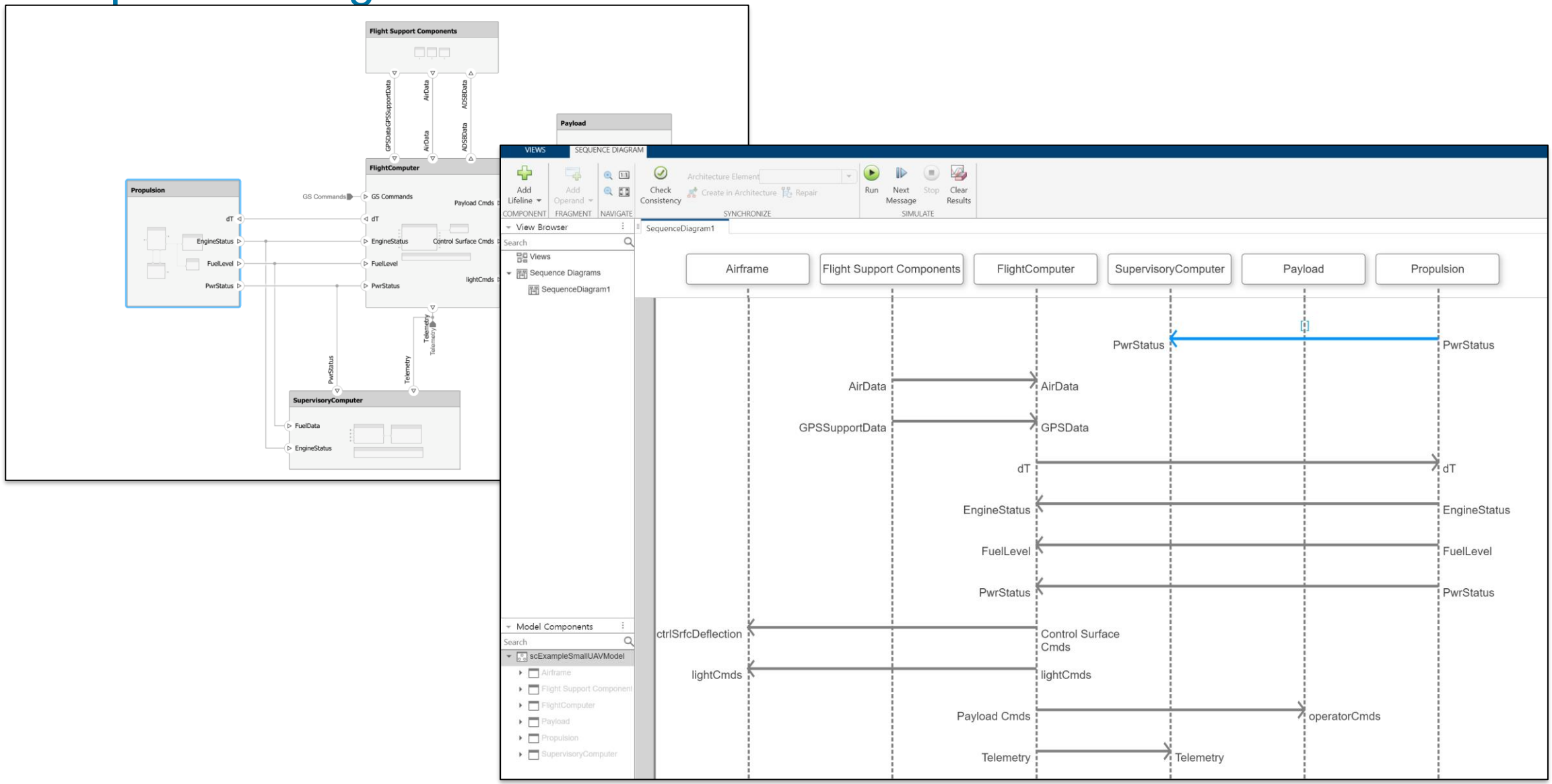
Sketch Architecture & Elaborate Incrementally

Trace to requirements and refine requirements alongside the architecture





Sequence Diagram



Activity Diagram

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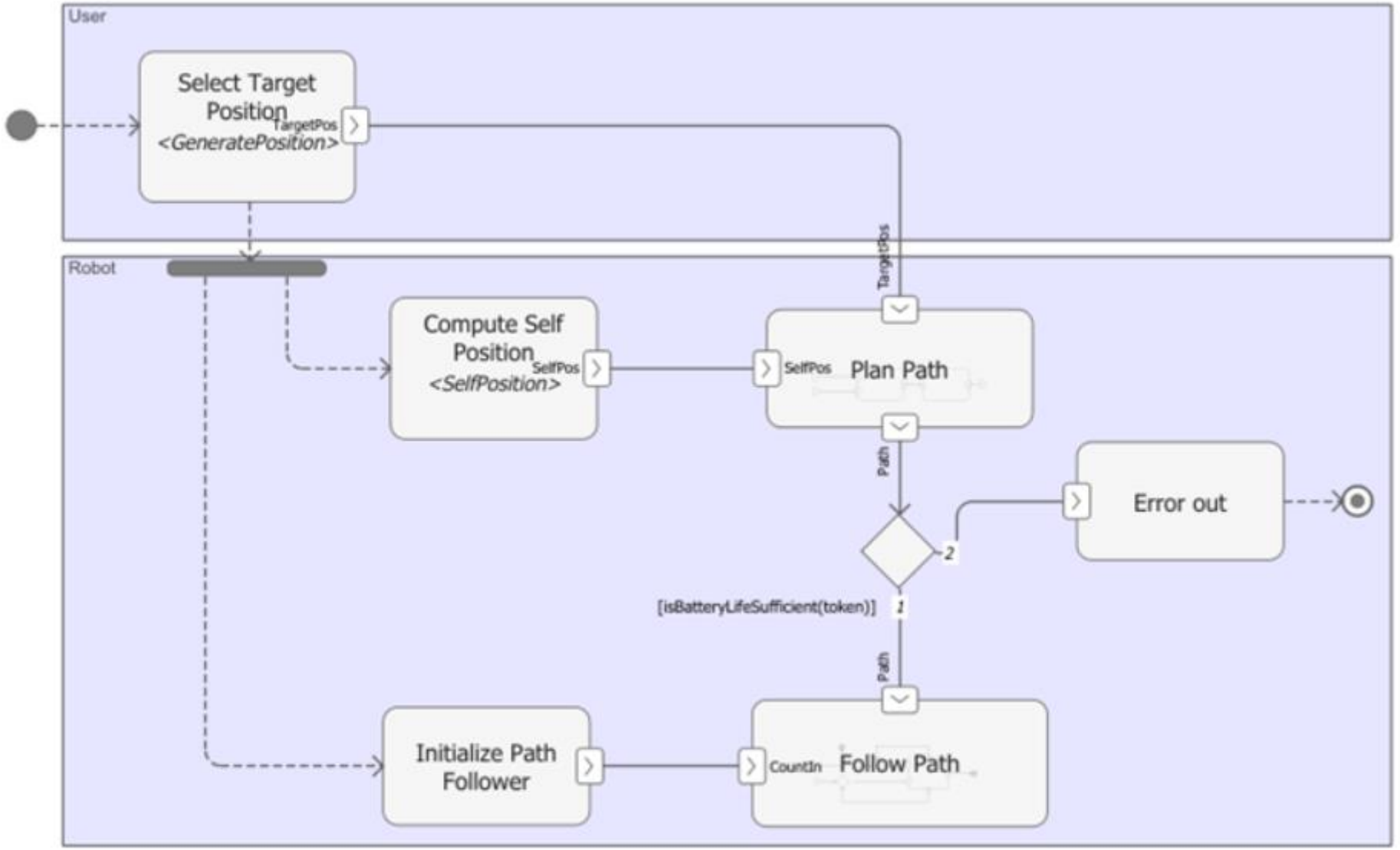
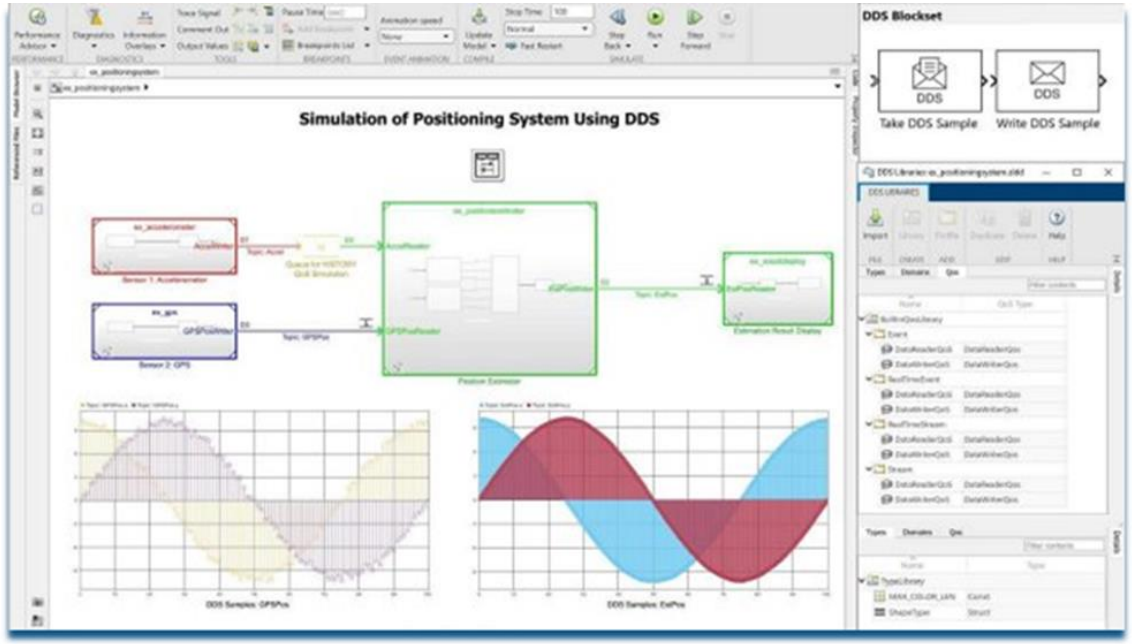


DDS Blockset

Data Distribution Services (DDS)

Data Distribution Services (DDS) uses SOA methodology, and directly addresses publish and subscribe communications for real-time and embedded systems.

DDS addresses the needs of applications that require real-time data exchange in industries like aerospace and defense, automotive, and robotics.



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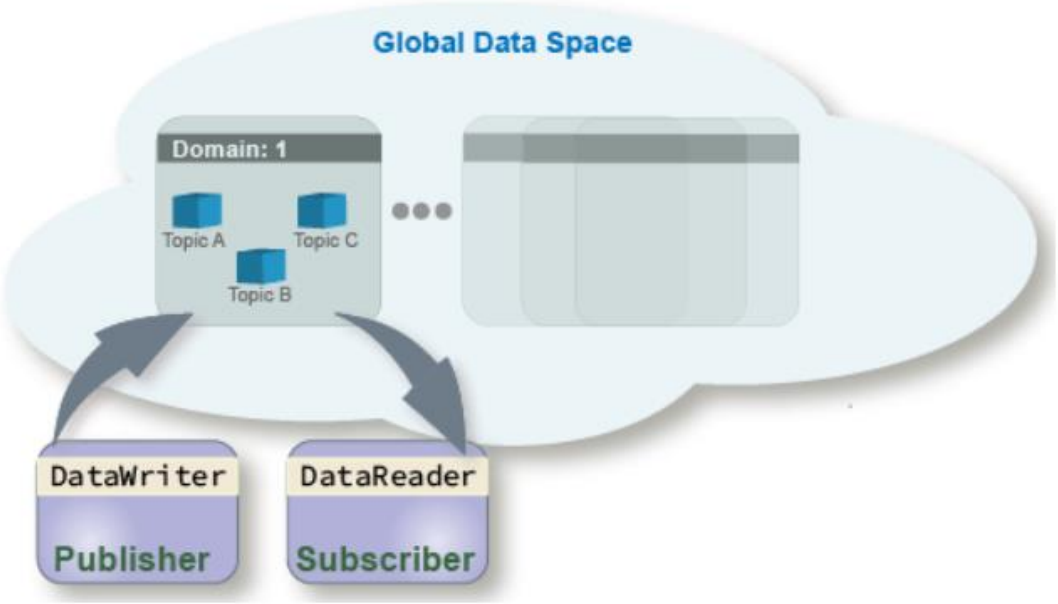
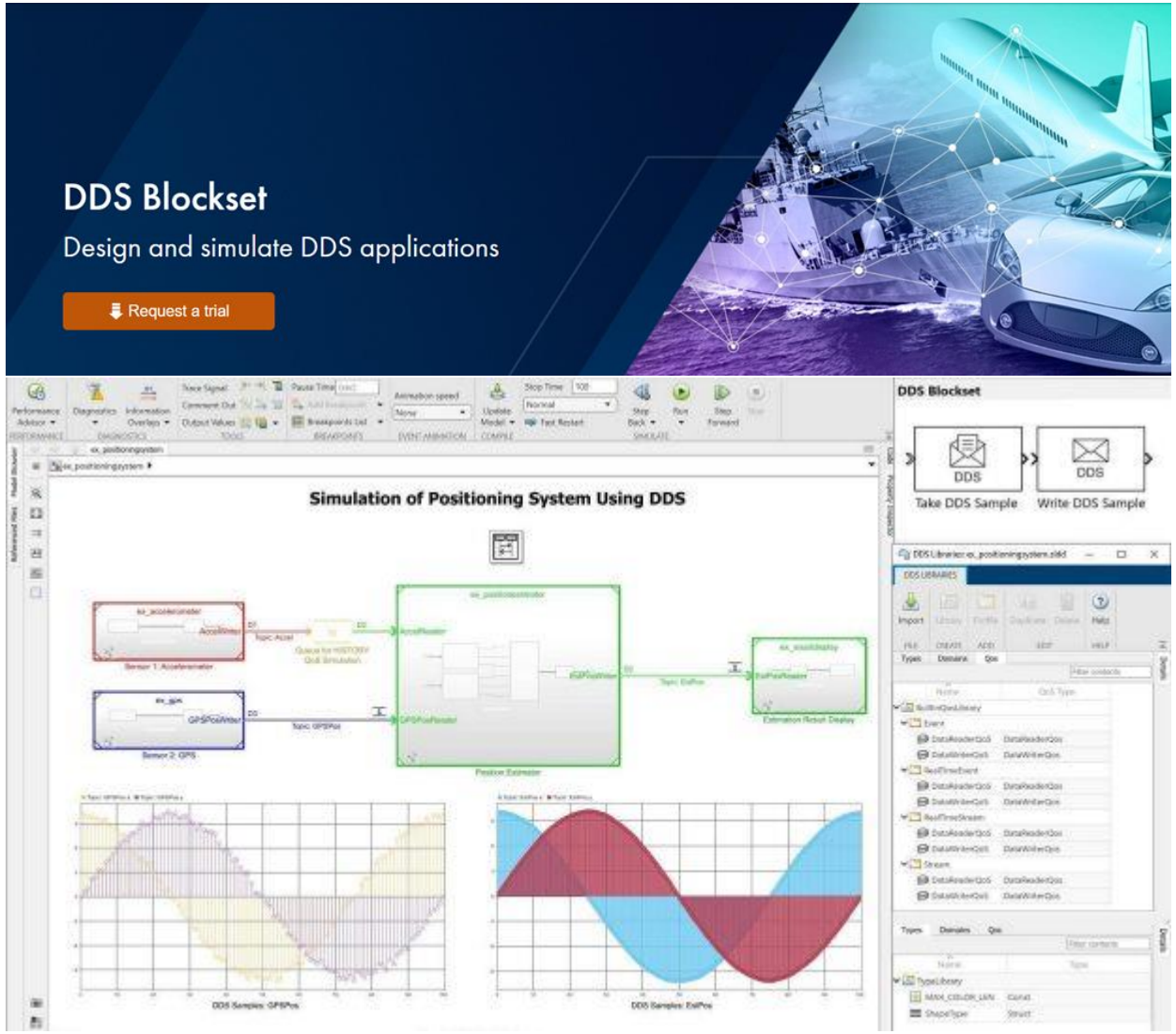
DDS : Publishers and Subscribers



- Publishers : Applications that send data
- Subscribers : Applications that receive data

DDS Blockset

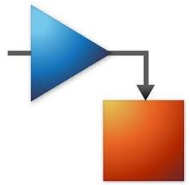
FOR	System and algorithm engineers
WHO	Develop software for DDS (Data Distribution Service) based embedded systems
Provides	• Apps and blocks to model and simulate DDS software applications • DDS dictionary to manage DDS definitions • API to Import and Export DDS definitions • C++ production code generation with DDS APIs (with Embedded Coder)
DDS Blockset fully integrates with third-party DDS stacks including RTI Connext and eProsima Fast DDS	



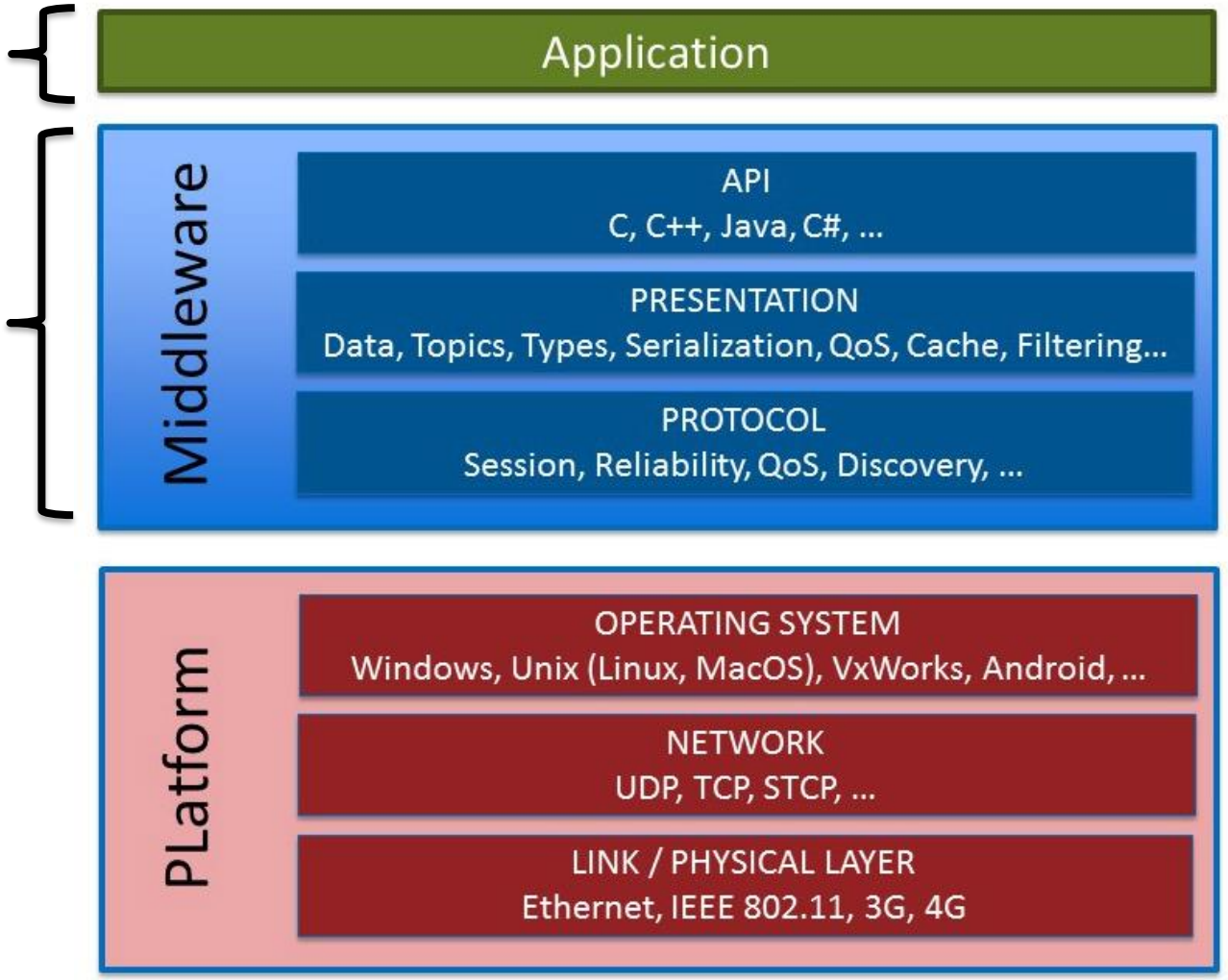
DDS Blockset is supported for all platforms - Mac, Windows and Linux

DDS Layered Architecture

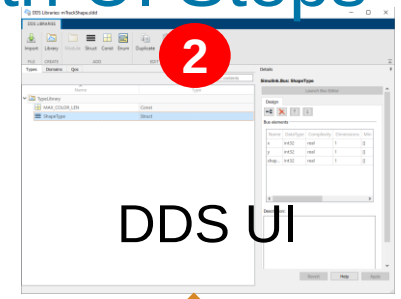
- DDS implemented in 3rd party libraries
- Application generated from Simulink model
- Code from Simulink model links to 3rd party DDS Libraries
- Open source and paid implementations

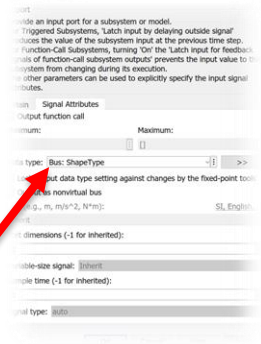


DDS Libraries



User Workflow with UI Steps



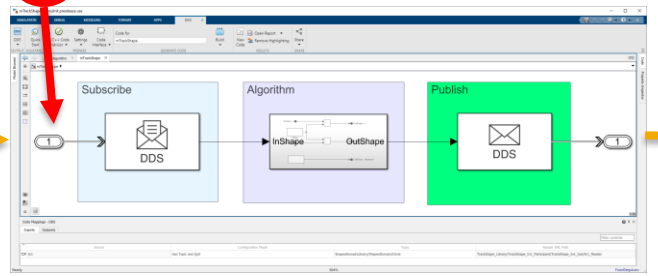


3

Import

1

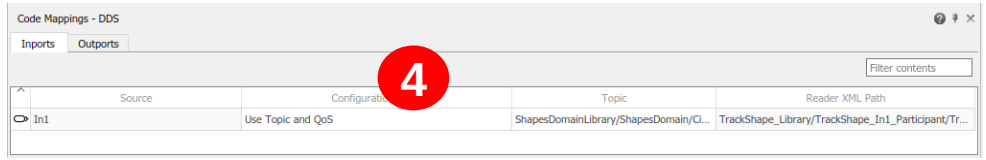
Simulink Data Dictionary



5

Generate

C++

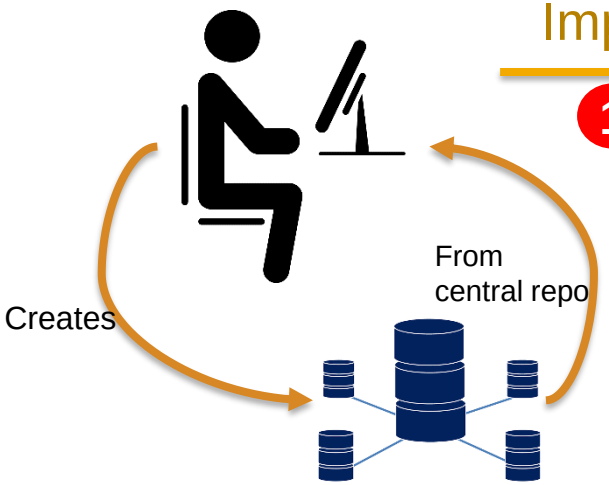


4

6

Deploy

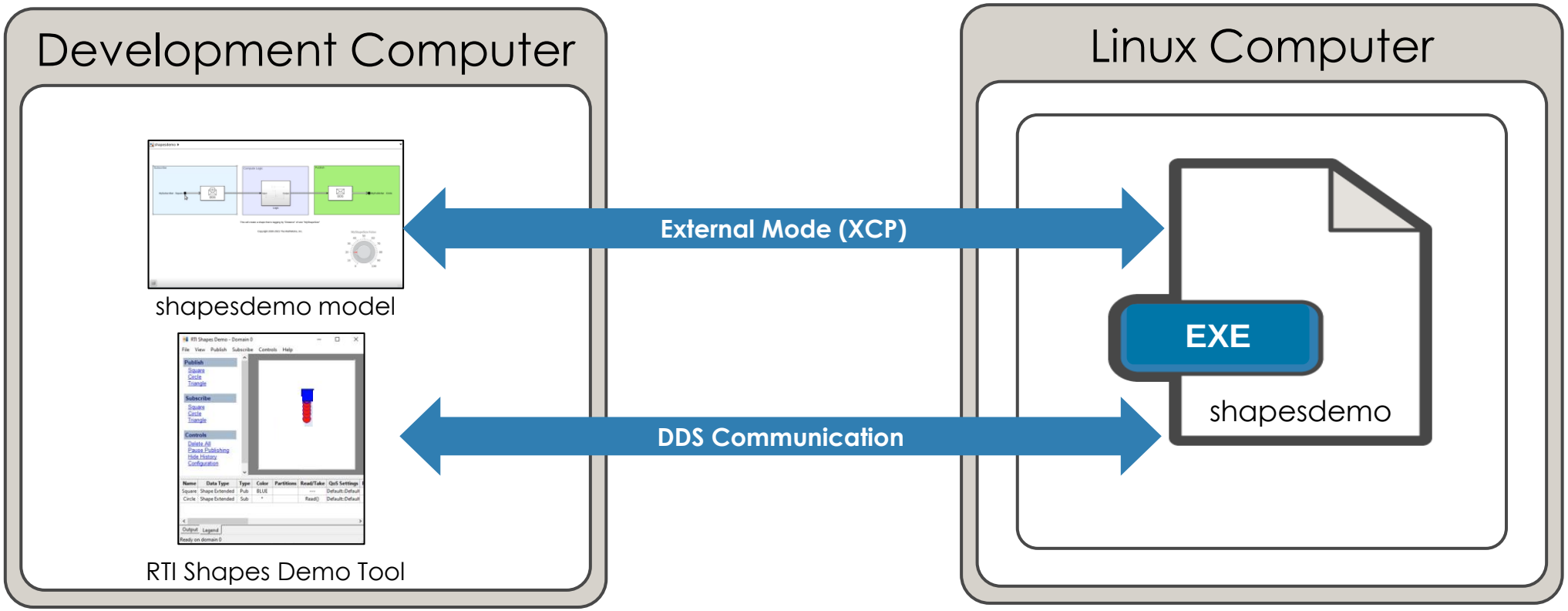
XML
+
Vendor
support



Interface definitions
QoS definitions
(DDS XML or IDL)

DDS Databus

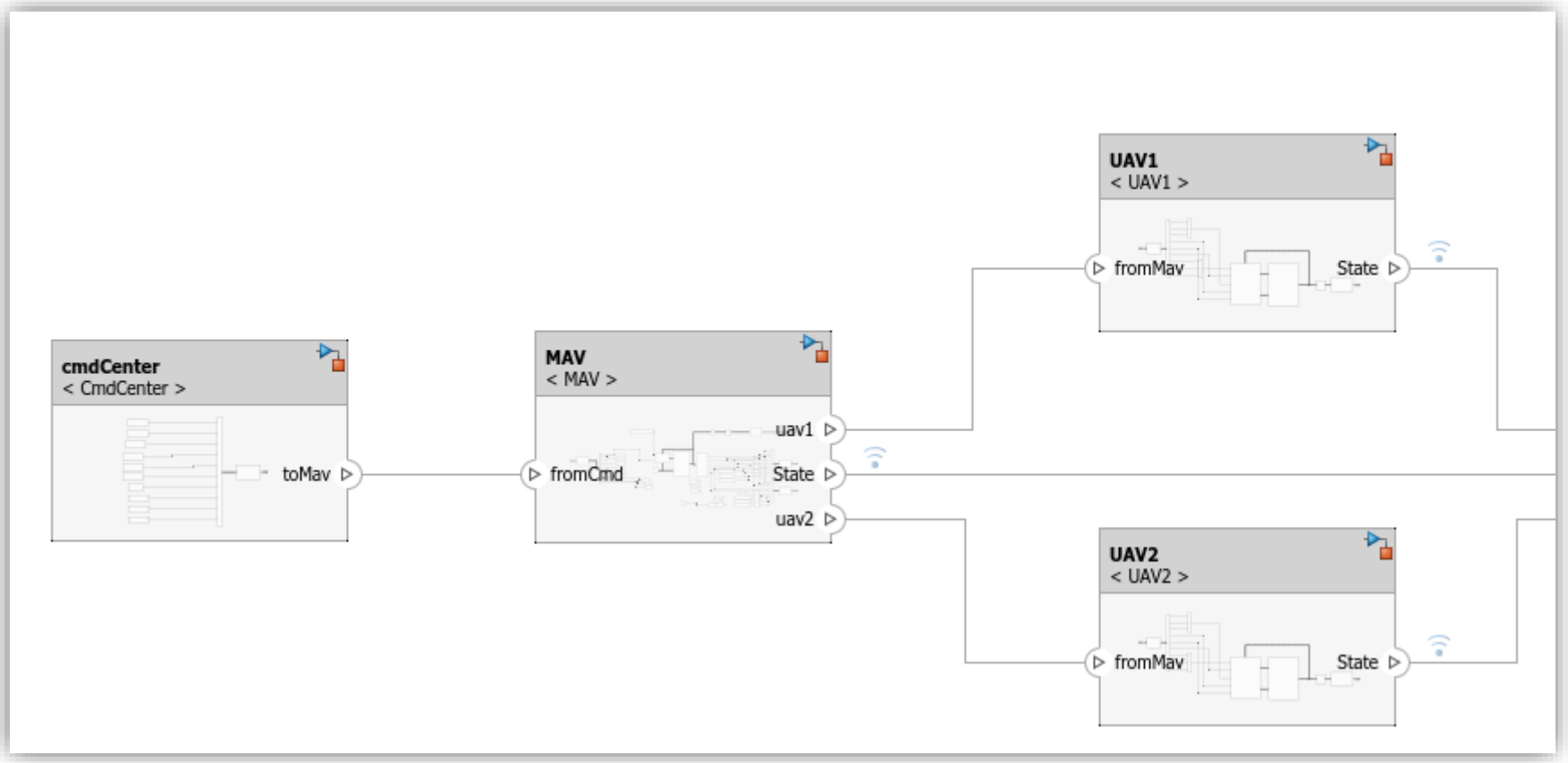
Deploy DDS Application to Linux Target



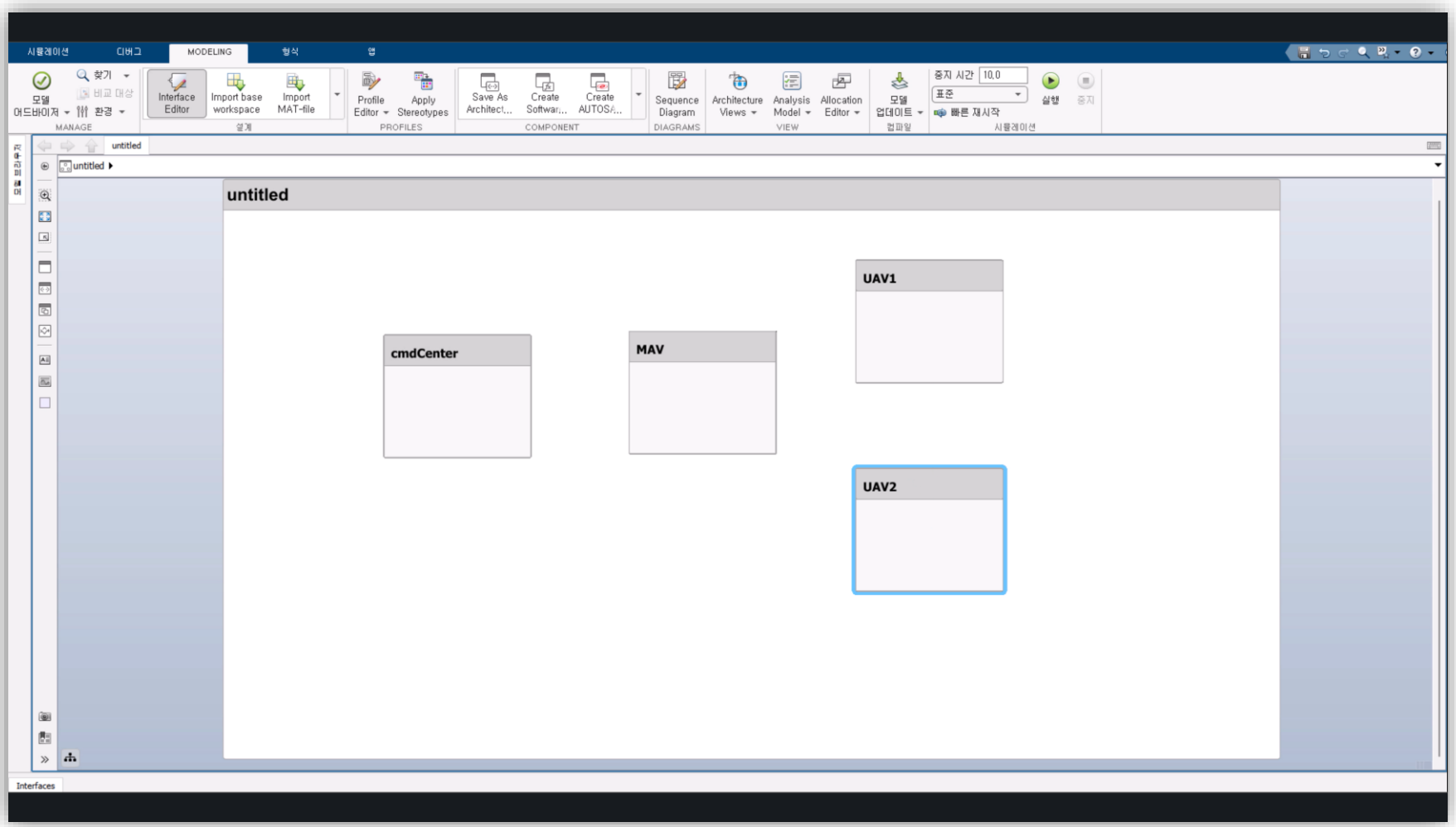
Embedded Coder Support Package for Linux Applications

DEMO

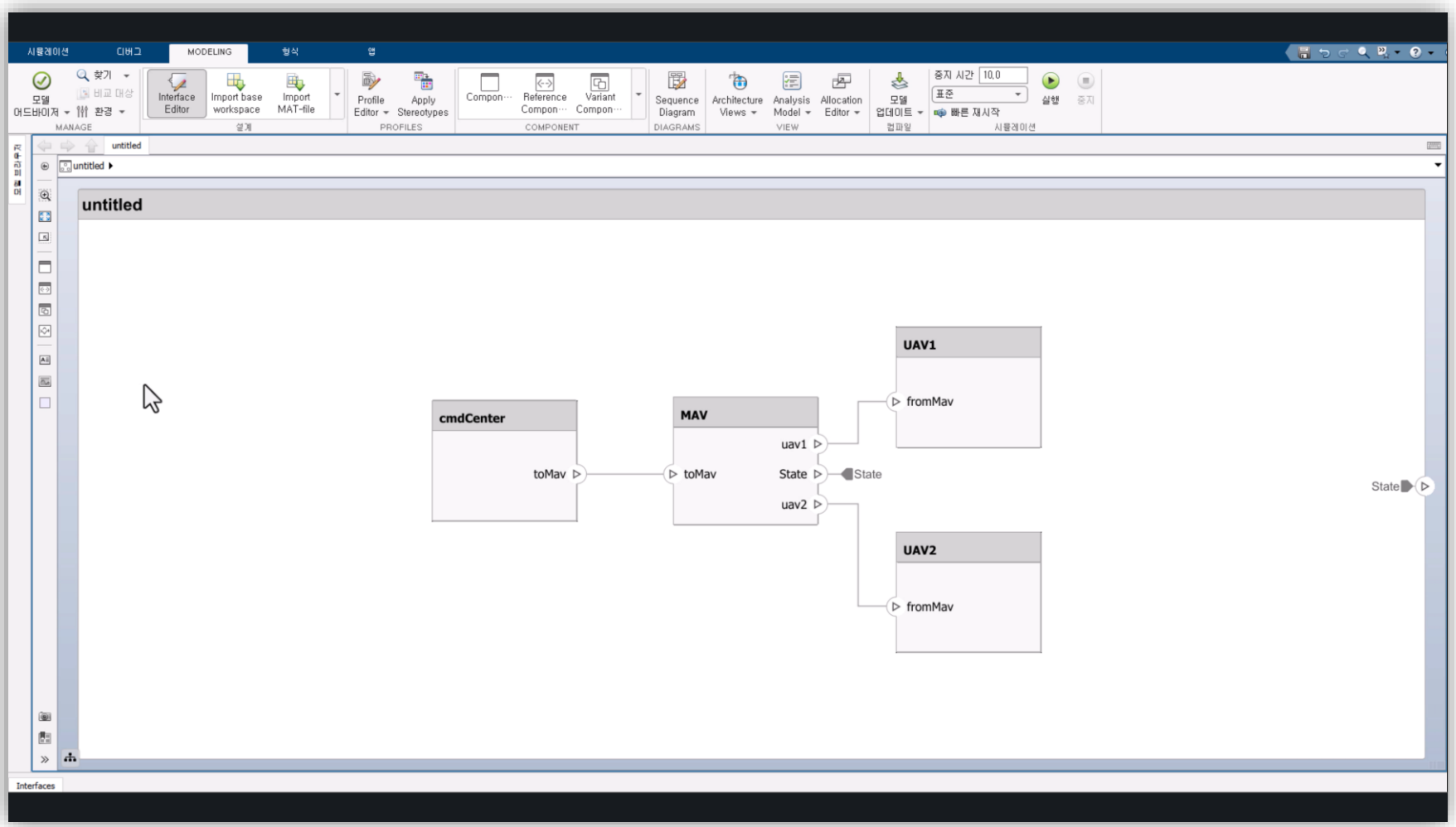
System Architecture of Multiple Aircraft Systems



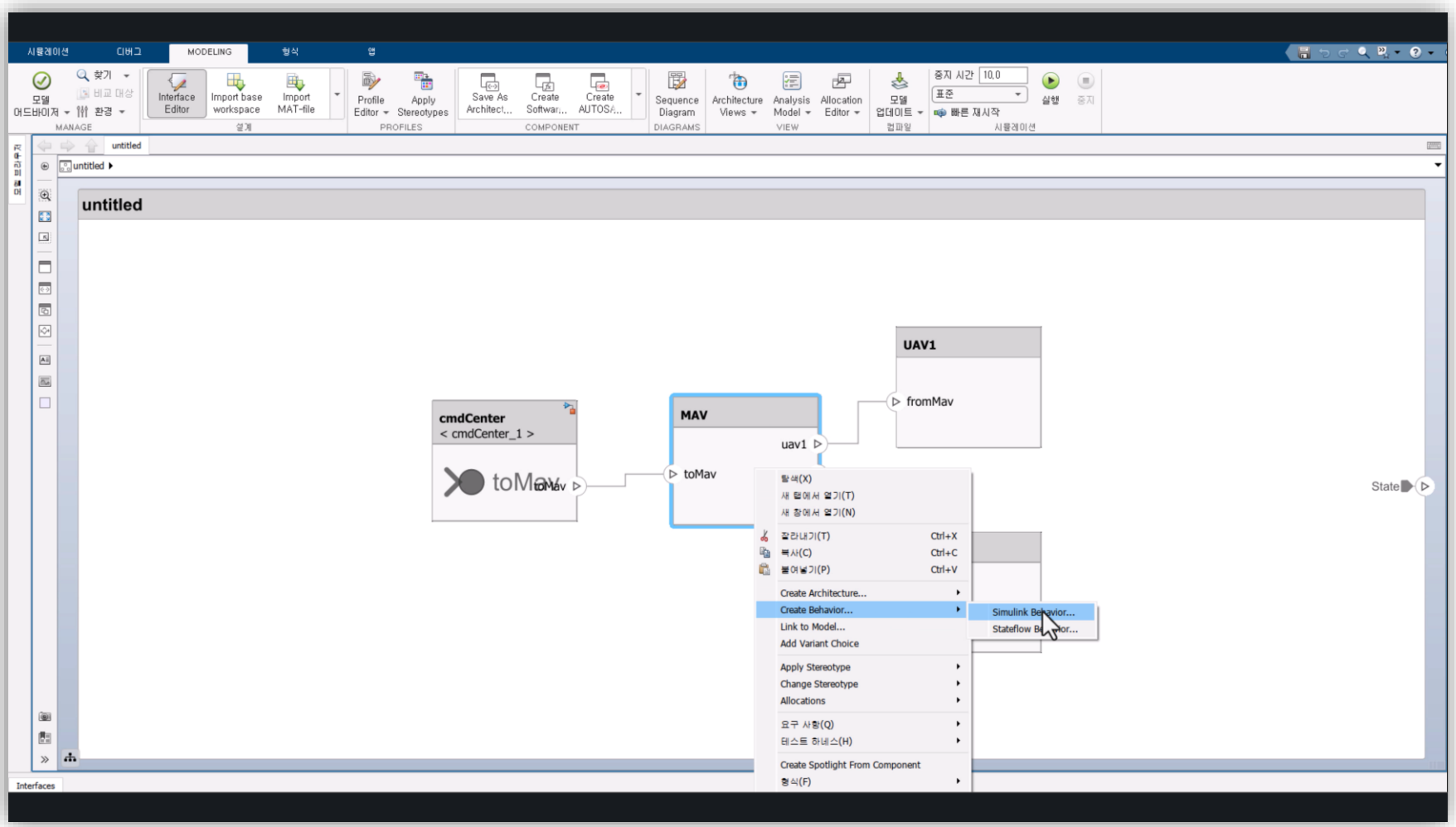
Architecture : Component Creation



Architecture : Port and Connection

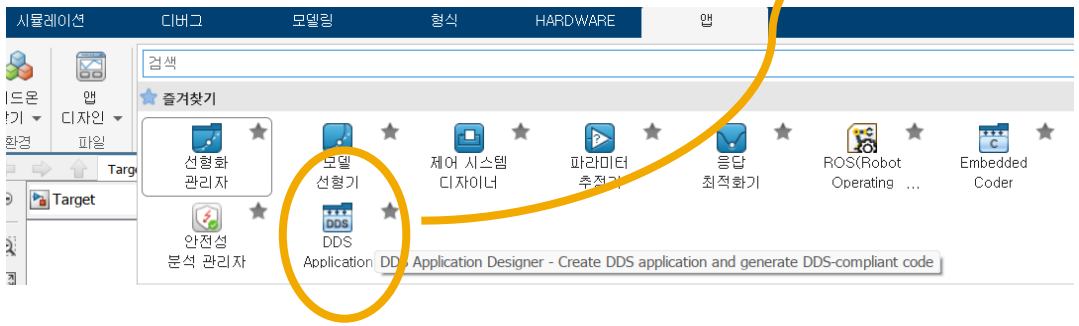


Component : Behavior Model Creation

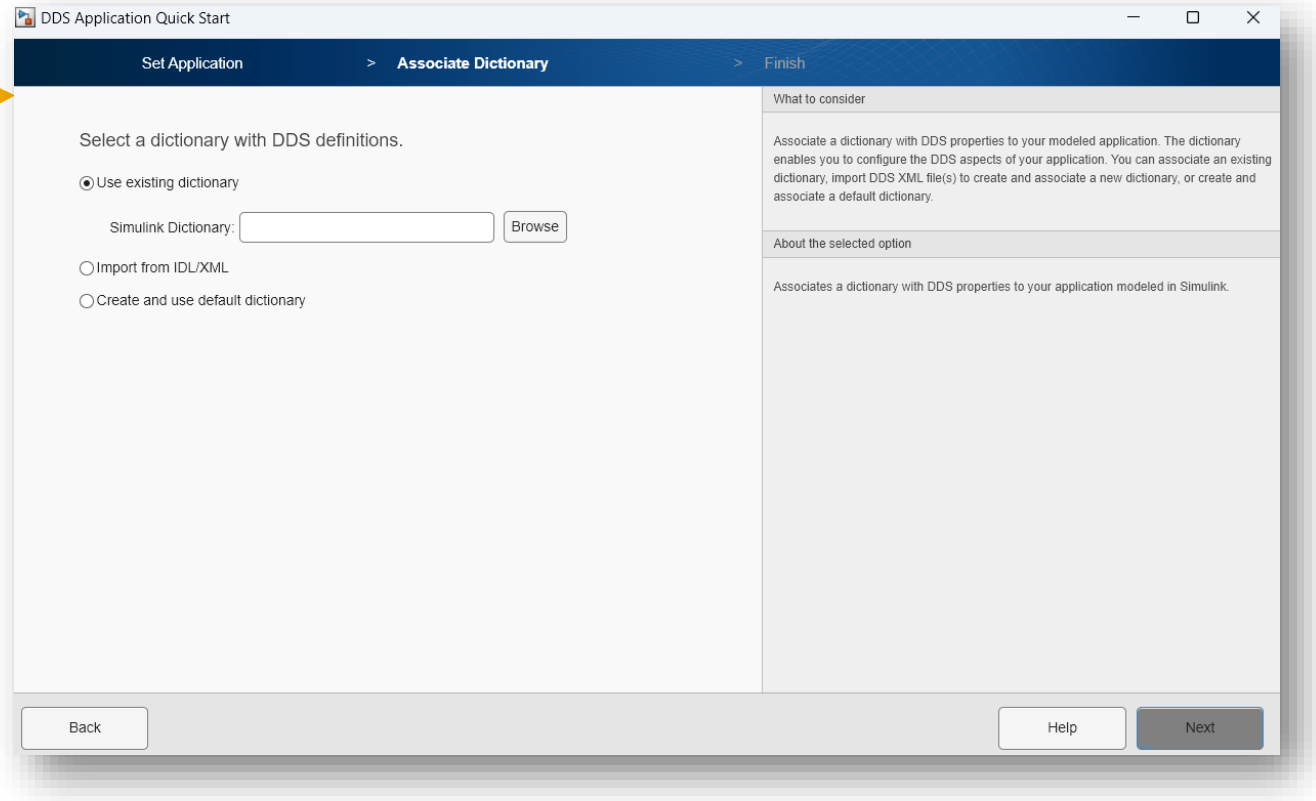


Component : Import DDS Interface definitions

- Import DDS definitions from XML or create new Definitions



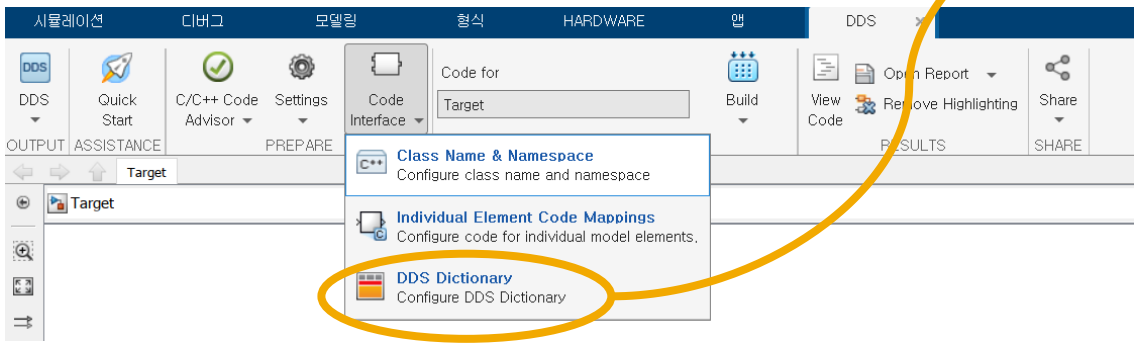
DDS Application Designer

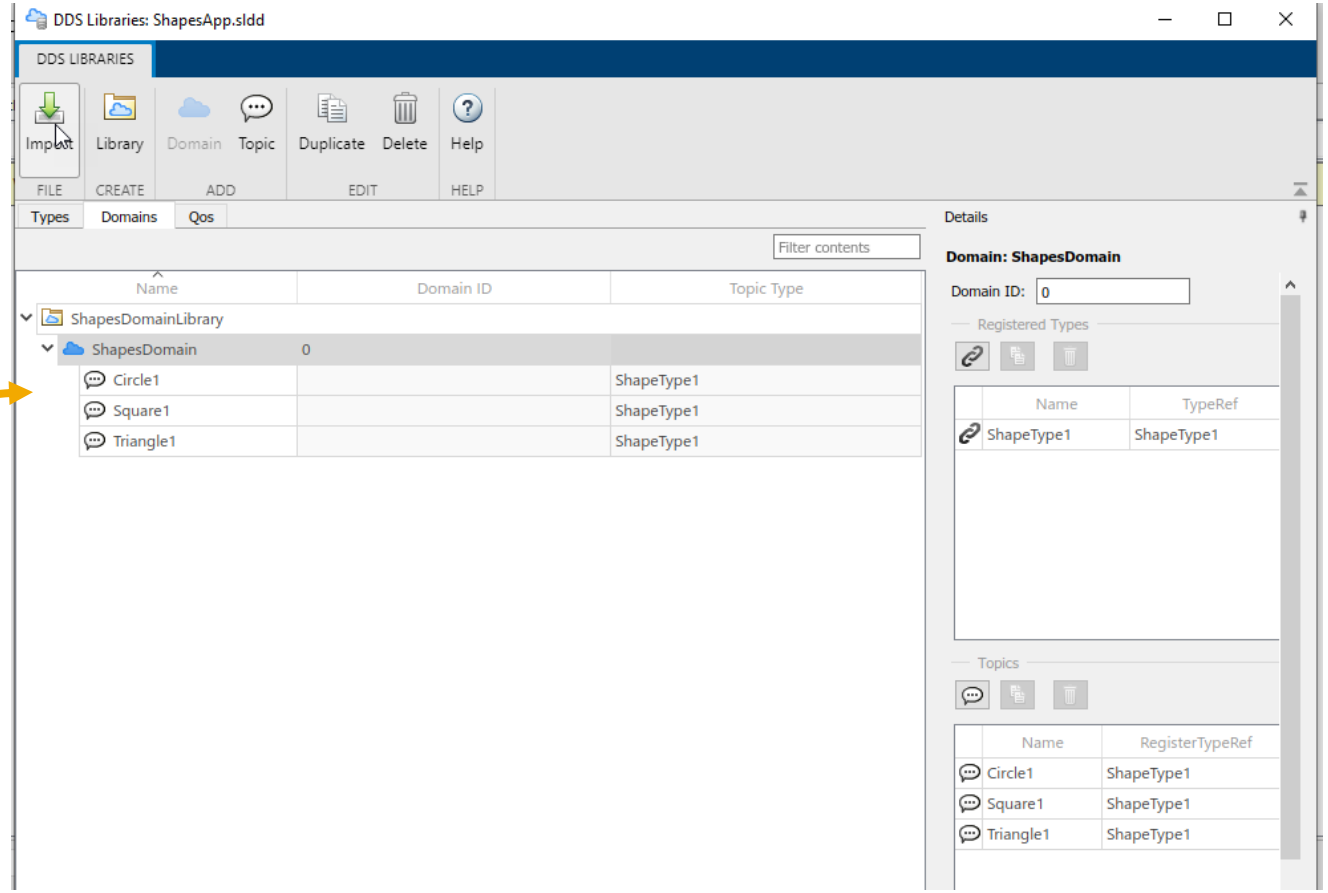


Component : Import DDS Interface definitions

- Import DDS definitions from XML or create new Definitions

- Define/Modify DDS definitions in DDS Dictionary
  - Topic Types
  - Domains
  - QoS





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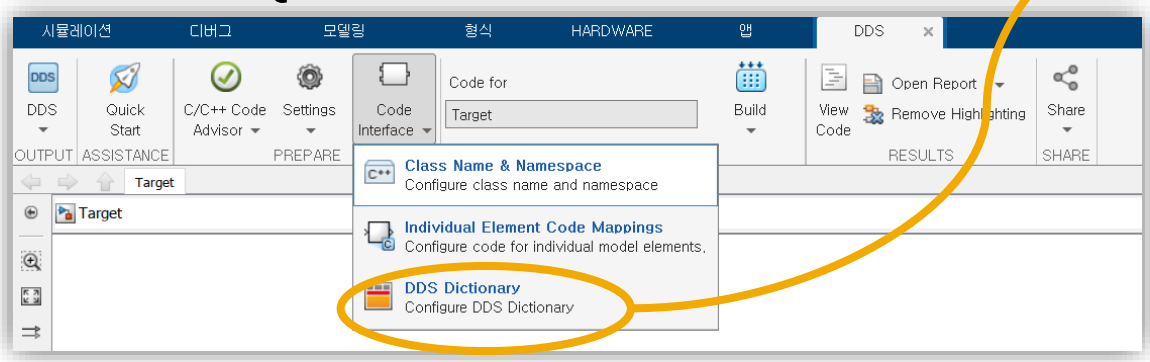
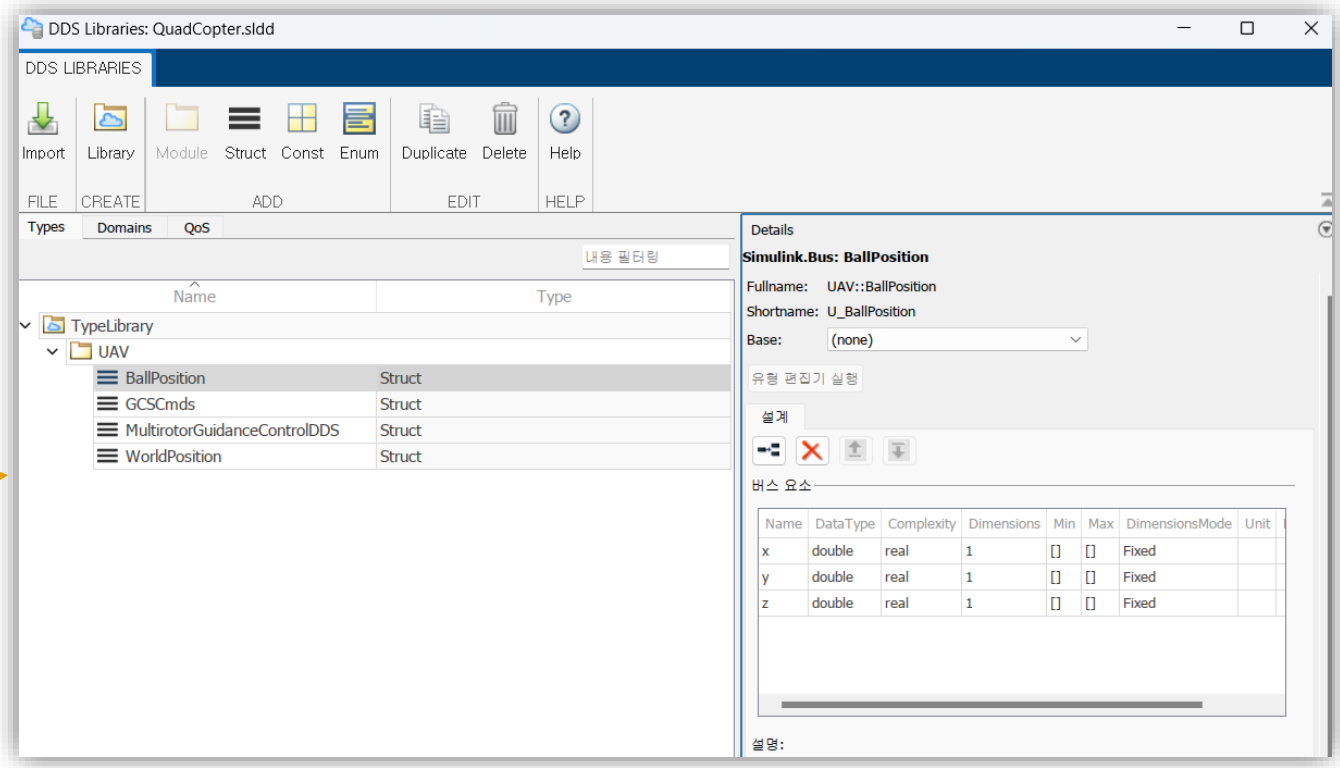
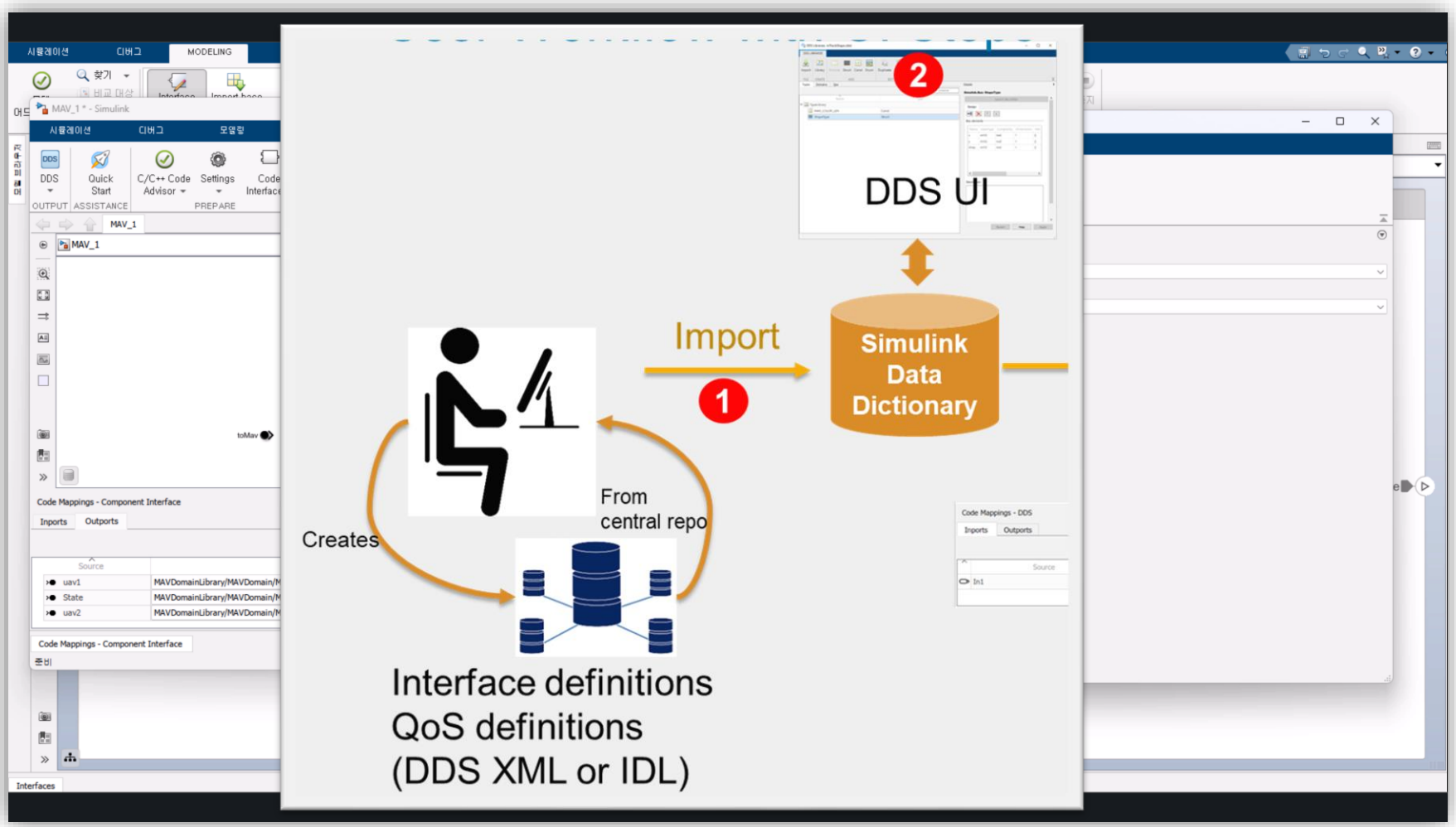




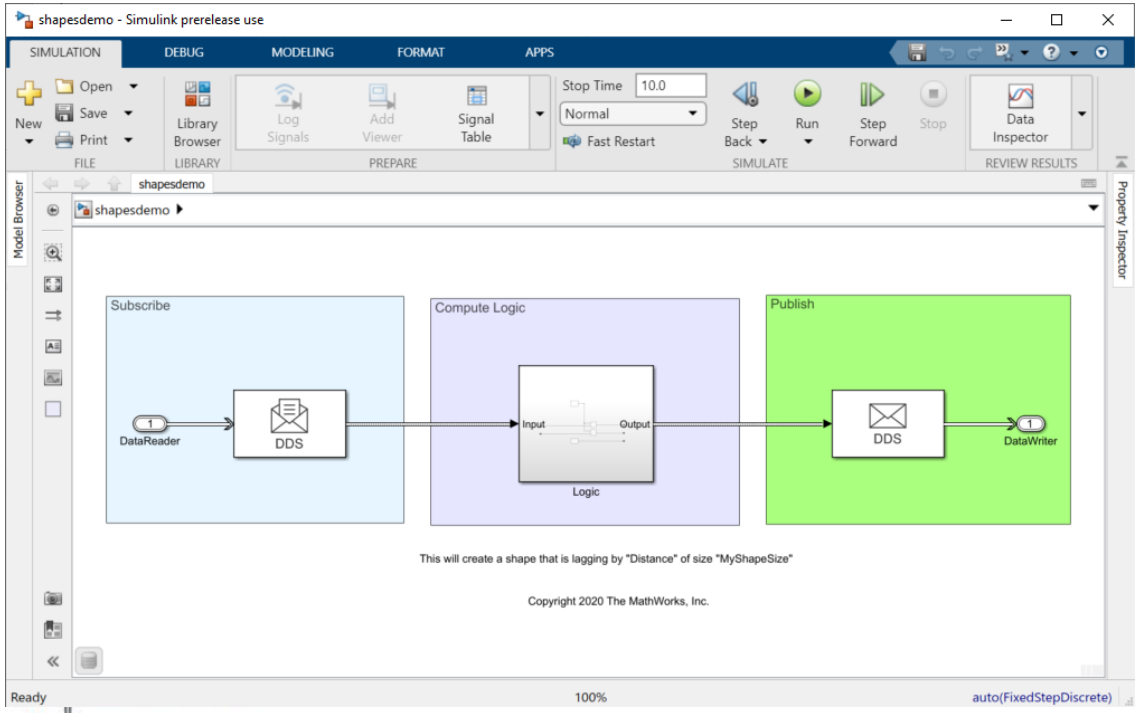
Component : Import DDS Interface definitions

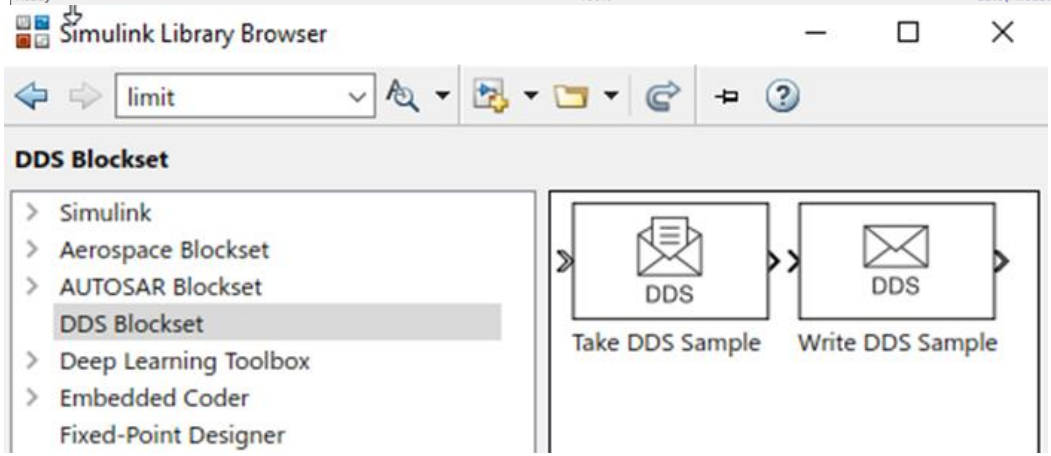


Component : Model DDS Application

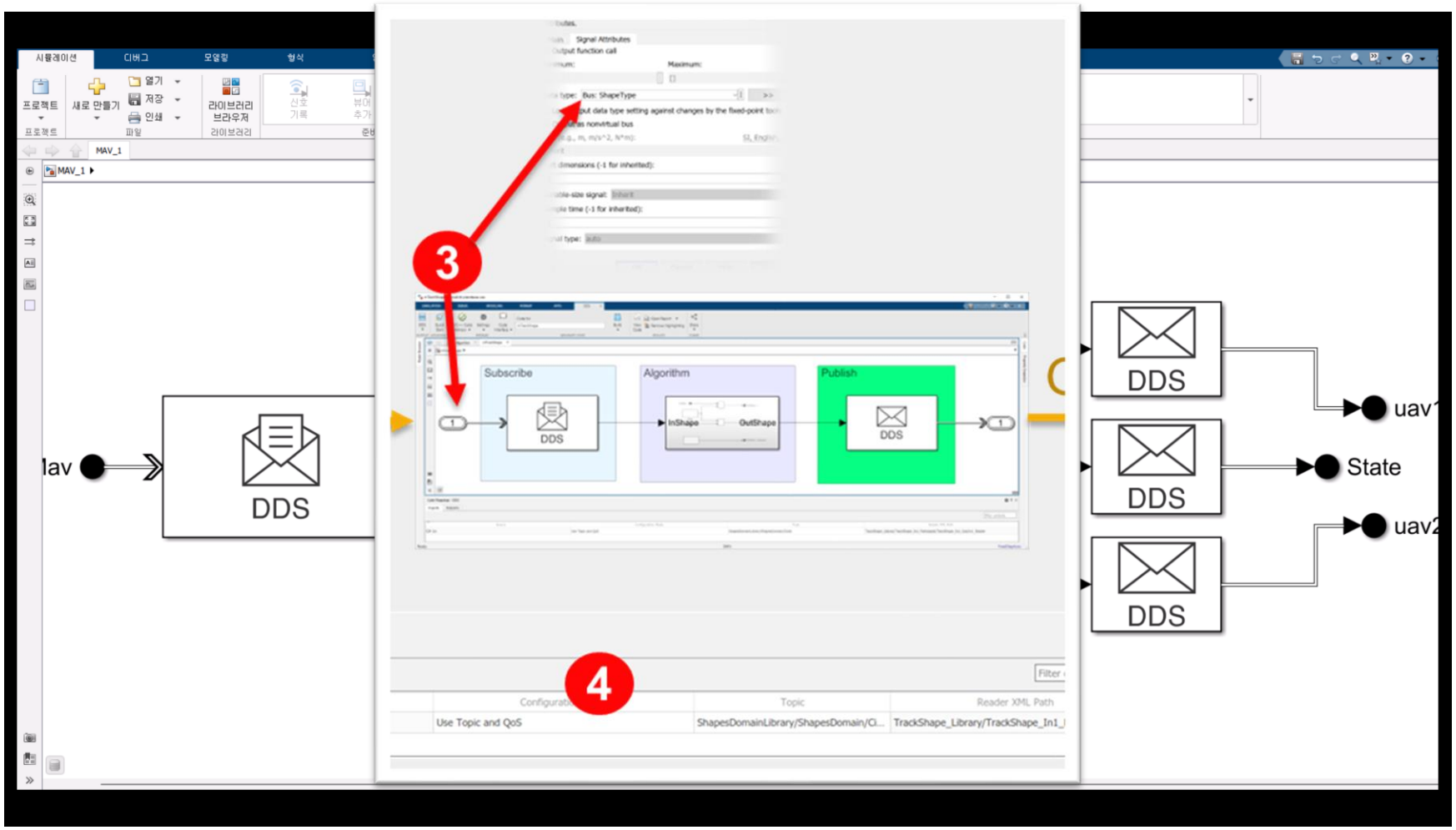
- Import DDS definitions from XML or create new Definitions
- Define/Modify DDS definitions in DDS Dictionary
- Model applications

Use DDS Blocks to model a Publisher or Subscriber





Component : Model DDS Application



Component : Deployment of DDS Application

- Import DDS definitions from XML or create new Definitions
- Define/Modify DDS definitions in DDS Dictionary
- Model applications
- Simulate DDS models including QoS
- Generate DDS executables and deploy on a DDS network

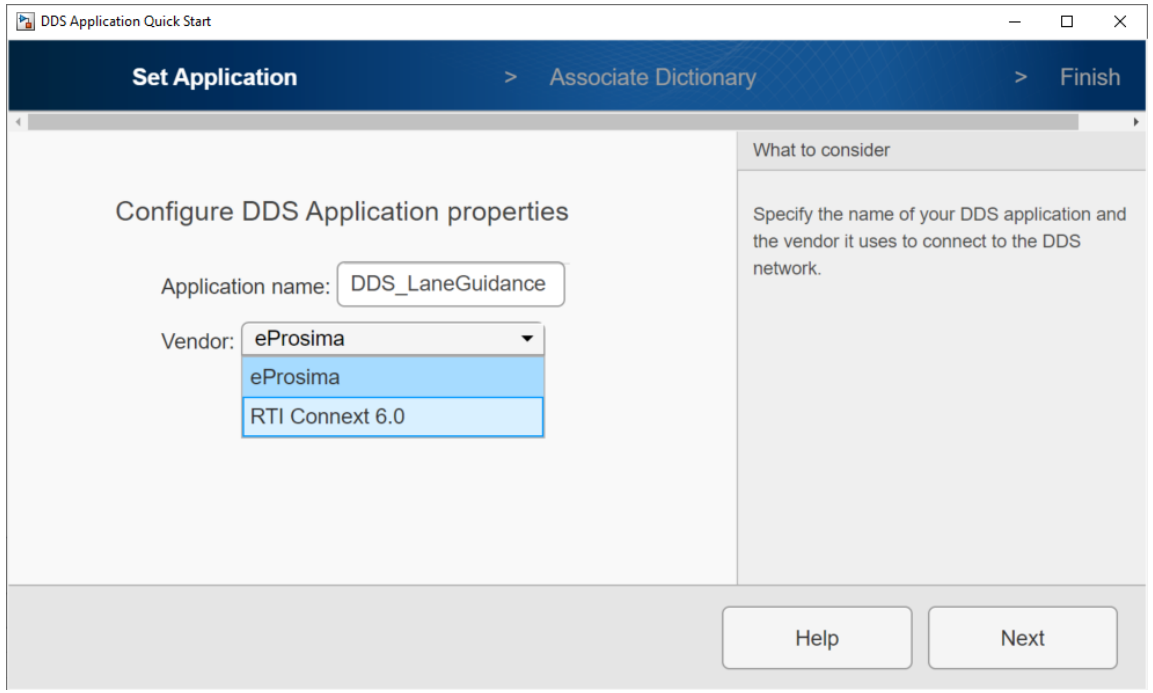
```
bool writeWithWriter(const PosType* data, std::string participantName, std::string wr
    DDS_DataWriter* writer = getWriter(writerName, participantName);
    PosTypeDataWriter* fooWriter = PosTypeDataWriter_narrow(writer);
    if(!fooWriter) {
        return false;
    }
    const DDS_ReturnCode_t ret = PosTypeDataWriter_write((PosTypeDataWriter*)writer,
    return (ret == DDS_ReturnCode_t::DDS_RETCODE_OK);
};
bool createParticipant(std::string participantName) {
    if (participants.find(participantName) == participants.end()) {
        DDS_DomainParticipant* participant =
            DDS_DomainParticipantFactory_create_participant_from_config(
            DDS_TheParticipantFactory, participantName.c_str());
        if(!participant) {
            return false;
        }
        participants[participantName] = participant;
    }
    return true;
};
```

With Embedded coder, generate

- C++ production code with DDS APIs
- XML or IDL files from Simulink models to deploy

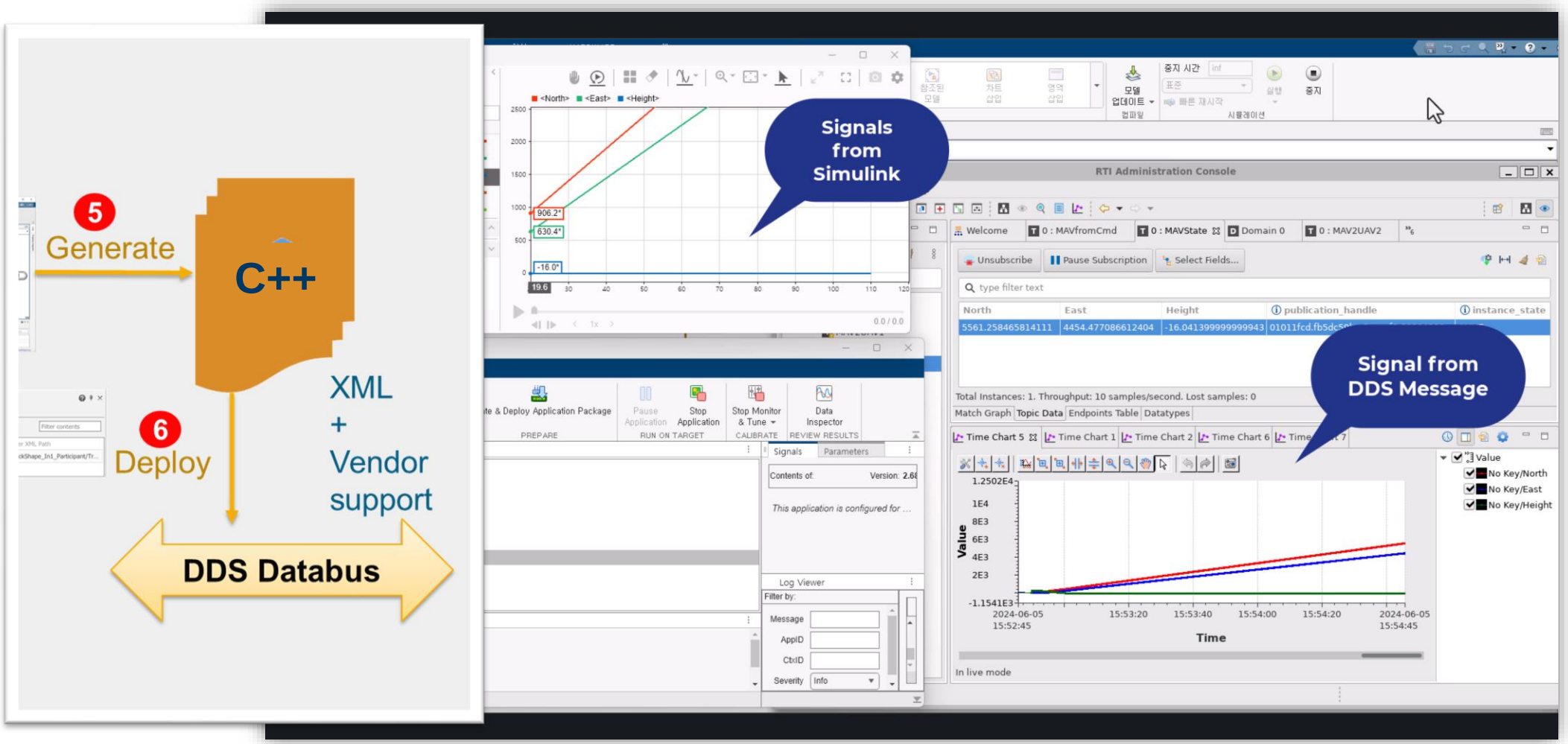
Component : Deployment of DDS Application

- Import DDS definitions from XML or create new Definitions
- Define/Modify DDS definitions in DDS Dictionary
- Model applications
- Simulate DDS models including QoS
- Generate DDS executables and deploy on a DDS network

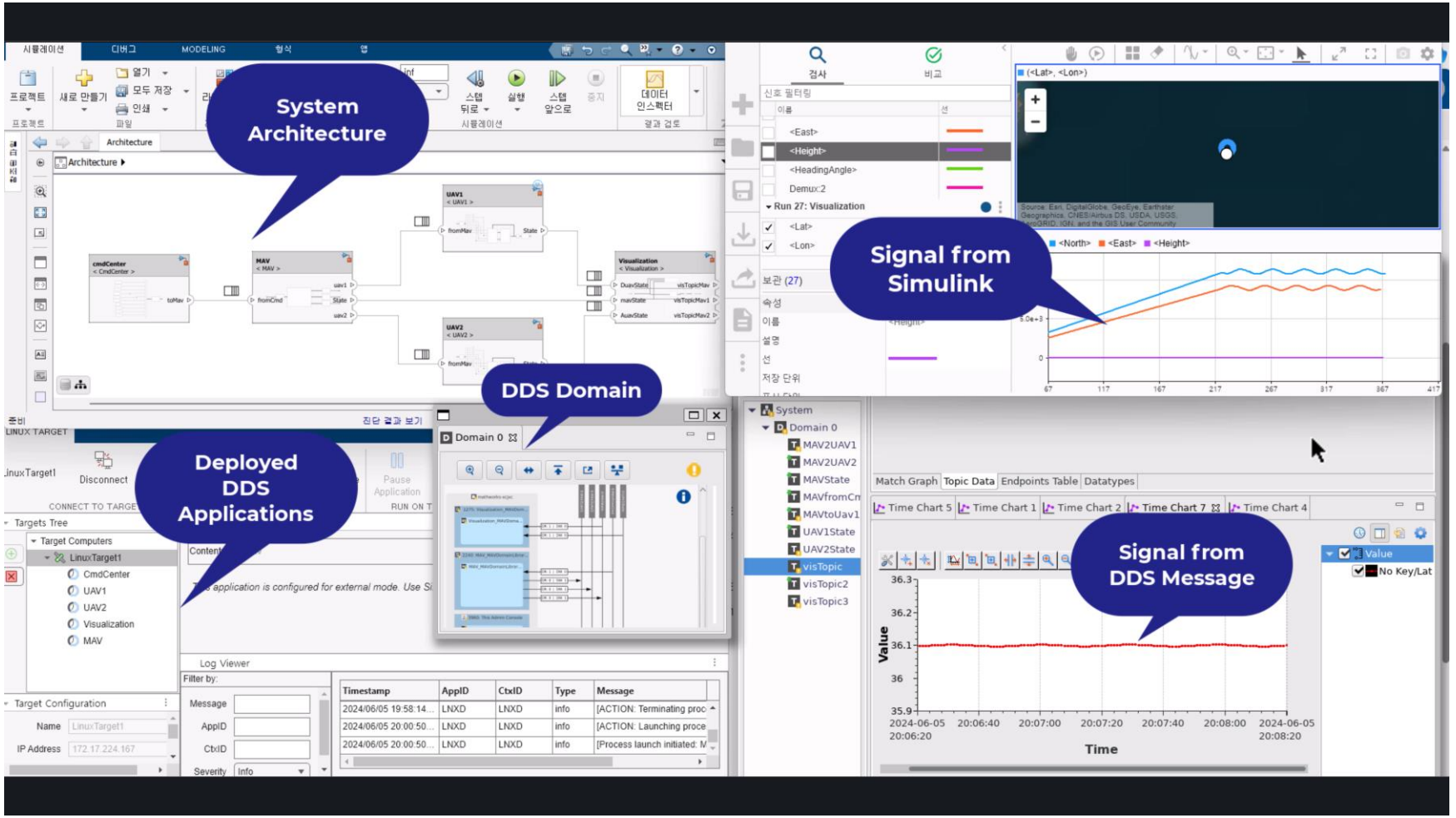


Full integration with third-party DDS stacks including RTI Connext and eProsima Fast DDS

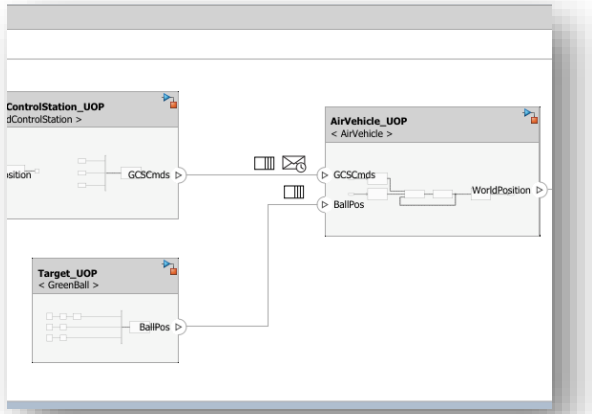
Component : Deployment DDS Applications (Single Application)



System : Deployment of DDS Applications

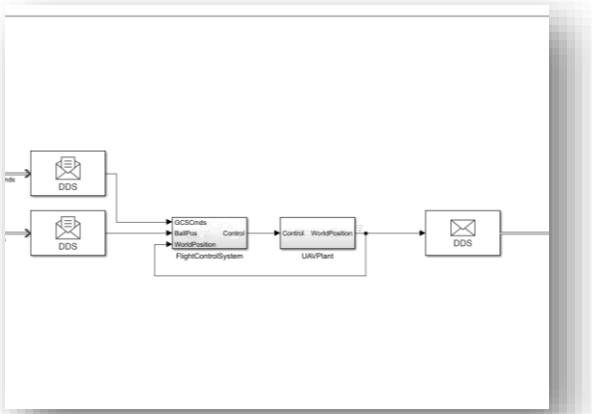


Key Takeaways



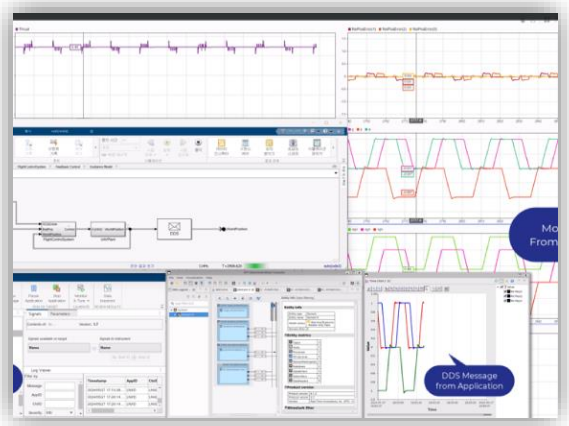
Architecture

System of Systems architectures are evolving, pushed by need for advanced, complex functions



DDS Model & Simulation

New, **service-oriented architectures** are required to **master complexity** and enable **frequent updates**



Deployment & Monitoring

You can **design, simulate and generate code** to deploy service-oriented applications in **Simulink**, **reusing your existing expertise and models**

DEMO Booth


MATLAB EXPO
DDS Blockset을 활용한 무인기 분산 시뮬레이션
유성재, 매스웍스코리아
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한재훈, 매스웍스코리아
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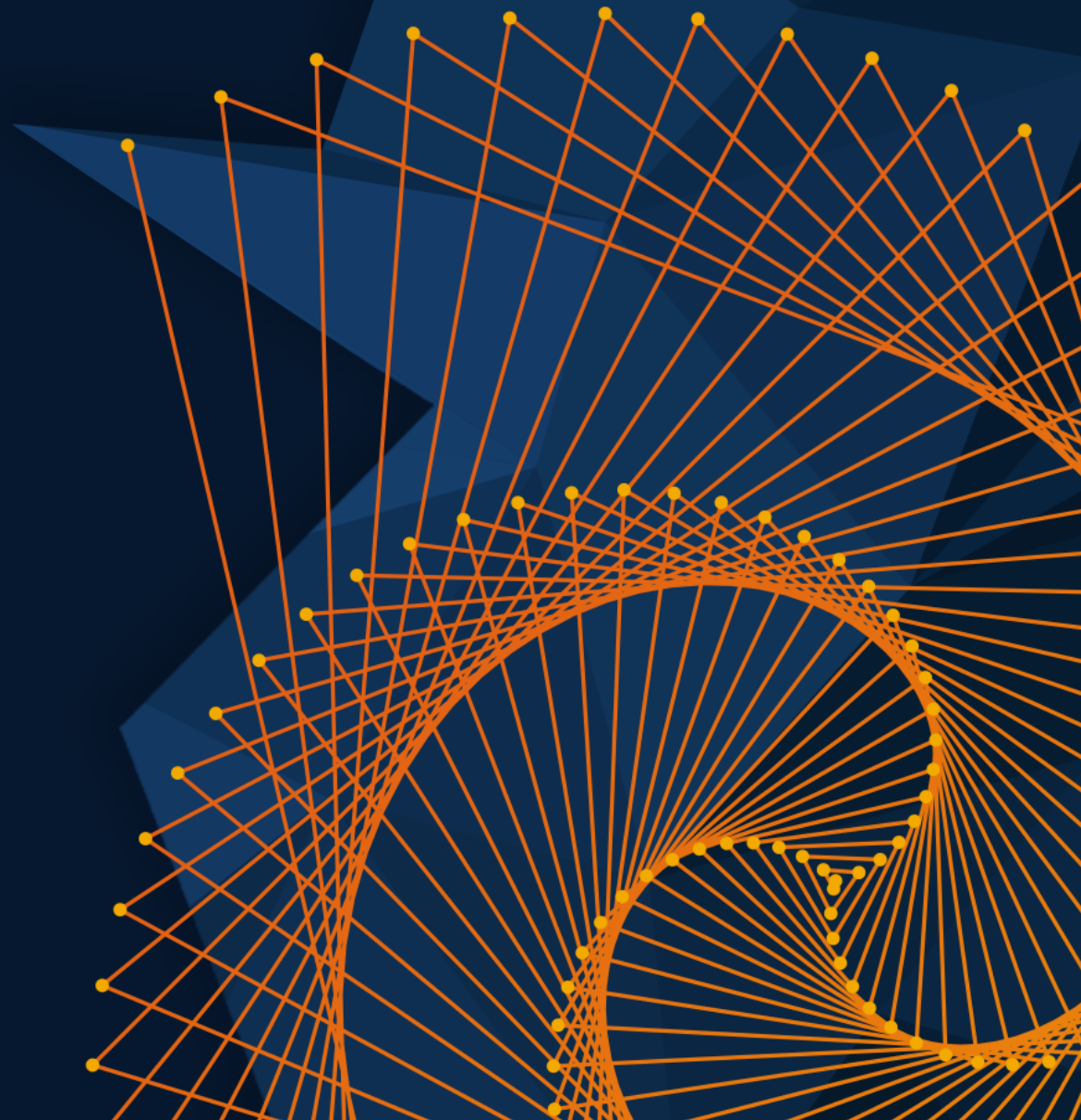
MATLAB EXPO



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