

System Composer™ Release Notes



MATLAB® & SIMULINK®



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### *System Composer™ Release Notes*

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# R2021b

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**Version: 2.1**

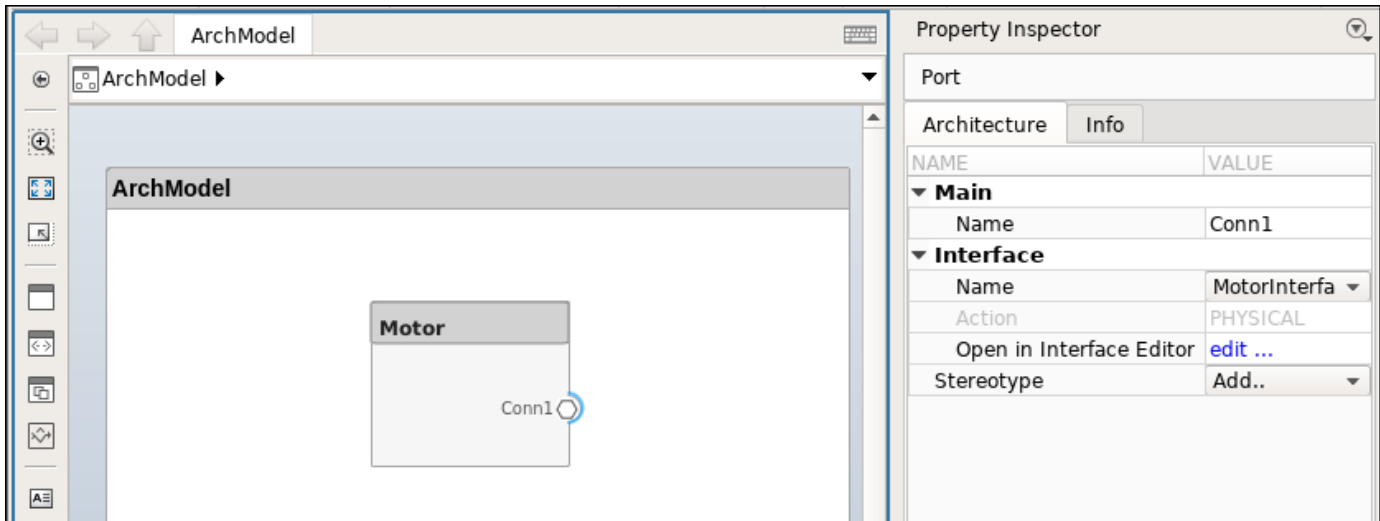
**New Features**

**Bug Fixes**

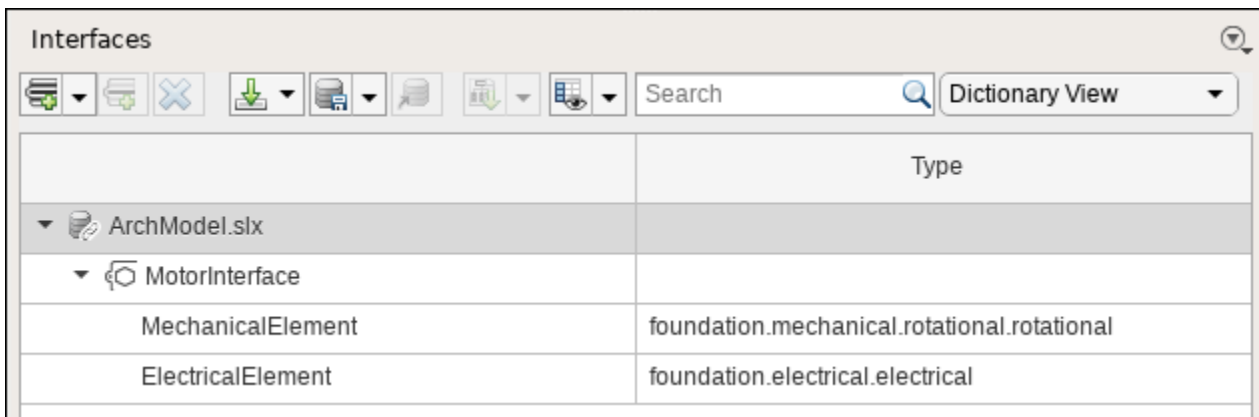
**Compatibility Considerations**

## Physical Interfaces with Simscape: Create physical interfaces, ports, and connections on components

In R2021b, you can create physical interfaces, ports, and connections on components in architecture models and implement physical behaviors using Simscape™. To implement physical behaviors, add Simulink® subsystem behavior to a component.



Physical port interfaces can be aggregated from multiple Simscape domains.



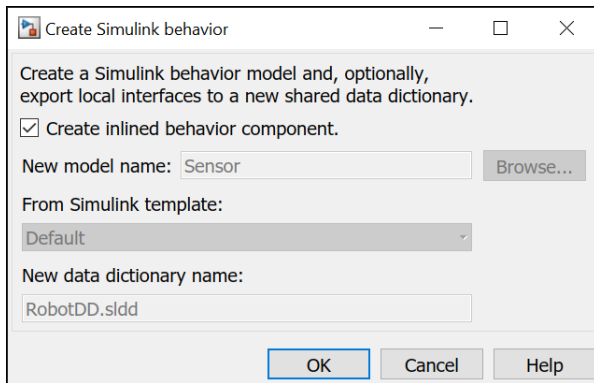
For more information, see “Describe Component Behavior Using Simscape”.

## Simulink Subsystem Component: Add Simulink and Simscape behaviors to components

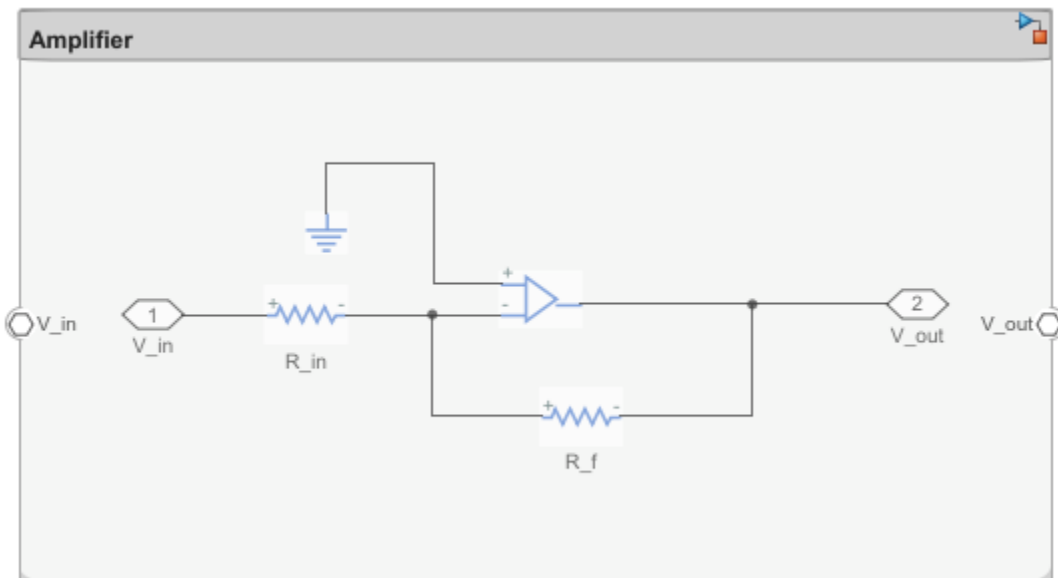
Create a Simulink subsystem that is part of the parent System Composer architecture model by adding Simulink subsystem behavior to a component.

In previous releases, Simulink behaviors were implemented as references to separate Simulink models. In R2021b, Simulink behaviors can also be described within the same model as the architecture through subsystem components.





Subsystem components are required to author Simscape component behaviors with physical ports, connections, and blocks. For example, this amplifier physical system uses electrical domain blocks inside a subsystem component in a System Composer architecture model.



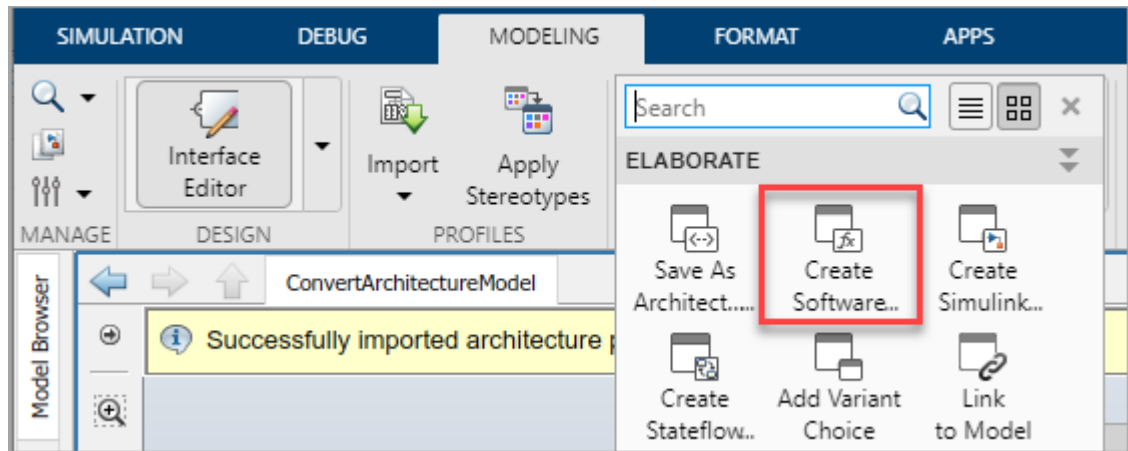
For more information, see “Create Simulink Behavior Using Simulink Subsystem”.

## Create software architectures from existing components

In R2021b, you can create a software architecture model from an existing component in System Composer.

To create a software architecture model from a component, you can use these two methods:

- 1 To create a software architecture model from the toolstrip:
  - a Right-click the component and select **Create Software Architecture Model**.
  - b Select the component, and, on the toolstrip, click **Create Software Architecture Model**.



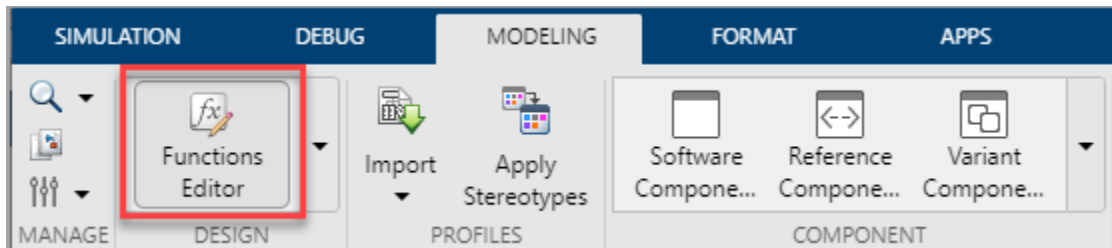
- 2 To create a software architecture programmatically, use the `createArchitectureModel` function.

For more information, see “Create Software Architecture from Architecture Model Component”.

## Functions Editor: Visualize component functions in software architectures

Use the Functions Editor to edit the simulation execution order and sample time of functions with inherited sample time (-1) in your software architecture.

Open the Functions Editor from the toolstrip.



Use the Functions Editor to:

- Update your software architecture model to automatically populate functions from any reference components.
- Arrange the execution order of the functions. Use the up and down arrows or drag and drop functions to sort them in the desired order.
- Edit sample times of the functions. Specify their period in the table.
- Order functions based on their data dependencies. Select **Order functions by dependency** check box.

Functions Editor

Functions

Order functions by dependency

Execution Order	Function Name	Software Component	Period
2	Export_Function_function_call_100ms	Export_Function	0.1
1	Export_Function_function_call_10ms	Export_Function	0.01
3	Rate_Based_D1	Rate_Based	0.2
4	Rate_Based_D2	Rate_Based	0.4

To get functions programmatically, use the new `systemcomposer.arch.Function` object.

For more information, see “Simulate and Deploy Software Architectures”.

## Value Types as Interfaces: Describe atomic pieces of data

In R2021b, you can apply a value type to a port to use it as a port interface. A value type is a description of an atomic piece of data. Data interfaces in System Composer are composite and structured with elements.

Interfaces

Dictionary View

	Dimensions	Units	Complexity	Minimum	Maximum	Description
Composite Data Interface Add signal interface						
Value Type Add Value Type						
Physical Interface Add physical interface						

Using a value type as an interface means the interface has a top-level type, dimension, unit, complexity, minimum, maximum, and description.

Interfaces

Dictionary View

	Type	Dimensions	Units	Complexity	Minimum	Maximum	Description
ArchModel.slx							
air_speed	double	1	m/s	real	0	45	

You can also assign the type of data elements in data interfaces to value types and reuse the value types any number of times.

For more information, see “Create Value Types as Interfaces”.

For the new value type object, see `systemcomposer.ValueType`.

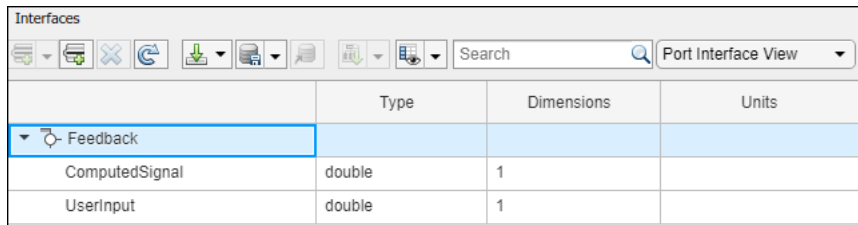
## Compatibility Considerations

This table shows the new API and the corresponding deprecated API in this release.

New	Removed	Rationale
systemcomposer.interface .DataInterface	systemcomposer.interface .SignalInterface	The class for a data interface has been renamed.
systemcomposer.interface .DataElement	systemcomposer.interface .SignalElement	The class for a data element has been renamed.

## Owned Interfaces: Define interfaces local to ports

In R2021b, you can author locally defined interfaces that do not need to be reused, called owned interfaces. Owned interfaces are local to specific ports and are not shared in a data dictionary or the model dictionary. Owned interfaces represent a value type or data interface with attributes that describe a port.



	Type	Dimensions	Units
Feedback			
ComputedSignal	double	1	
UserInput	double	1	

For more information, see “Define Owned Interfaces Local to Ports”.

## Compatibility Considerations

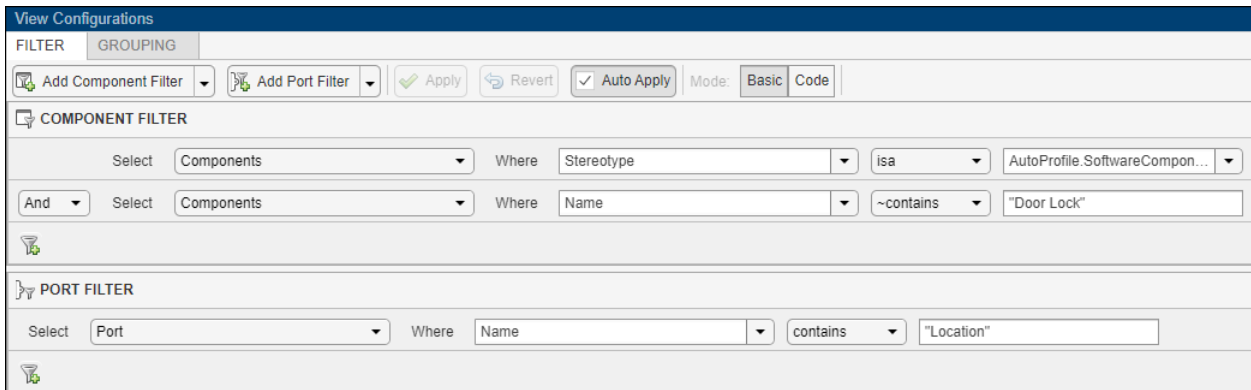
This table shows the new API and the corresponding deprecated API in this release.

New	Removed	Rationale
createInterface	createAnonymousInterface	To better support owned interfaces, the term <code>anonymous</code> is being deprecated.

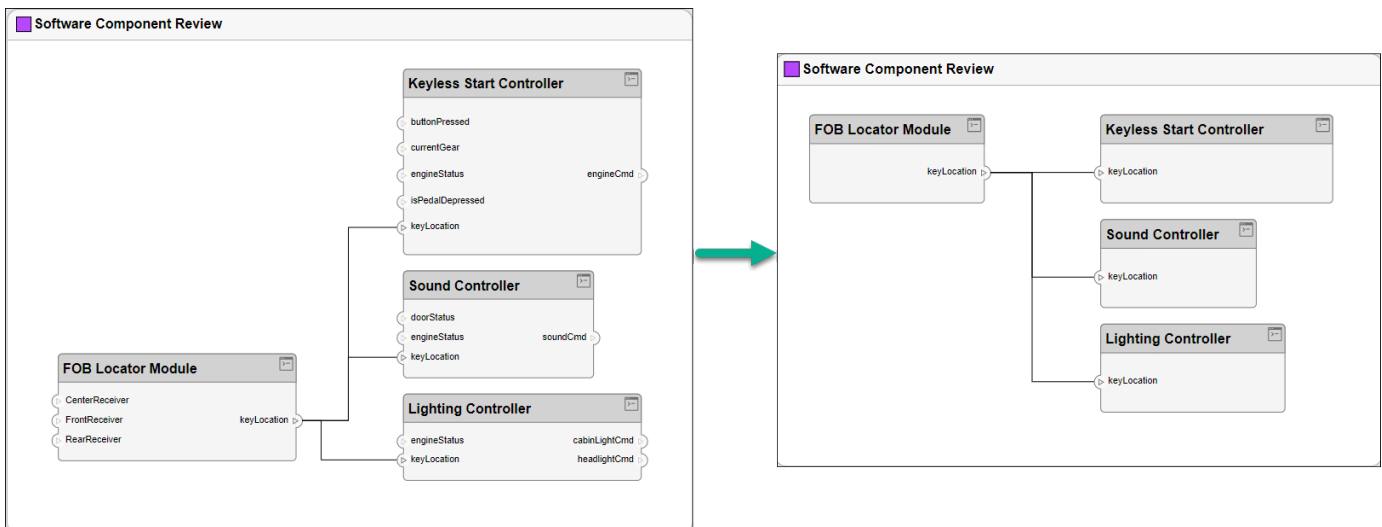
## Architecture Views: Add port filters

In R2021b, you can filter ports in addition to components in architecture views using names, stereotypes, and property values.

The **View Configurations** panel now has an option to filter by a component filter or a port filter. You can also select the **Auto Apply** check box to automatically apply filters.



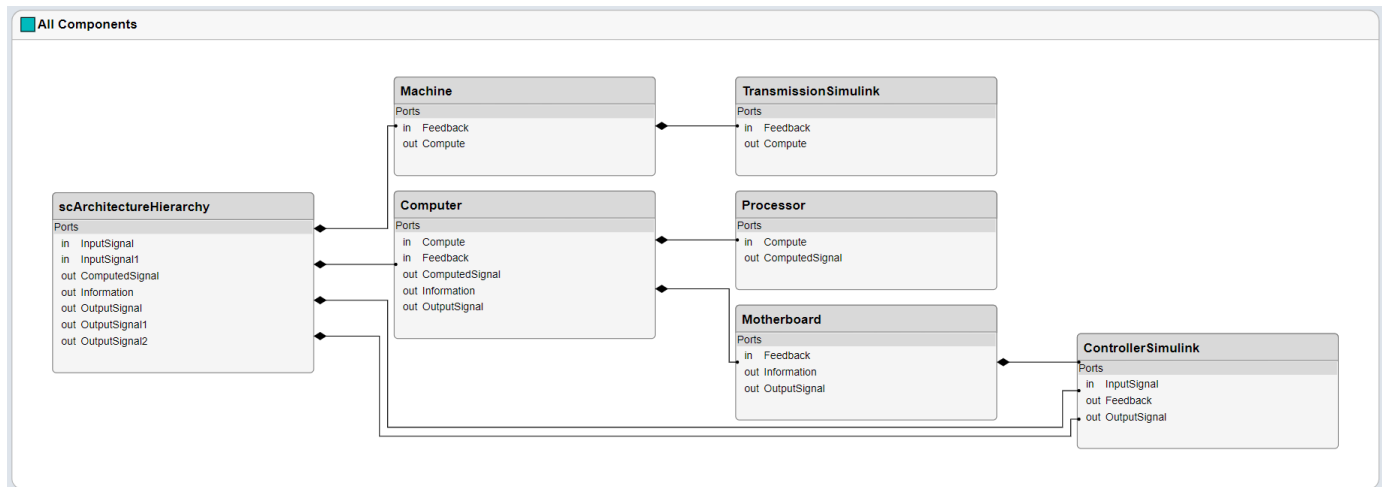
An architecture view is created using the additional query in the **Port Filter** box. The view is filtered to show all components with ports with "Location" in the name.



For more information, see "Create Architecture Views Interactively".

## Architecture Hierarchy: Display the hierarchy of unique component types

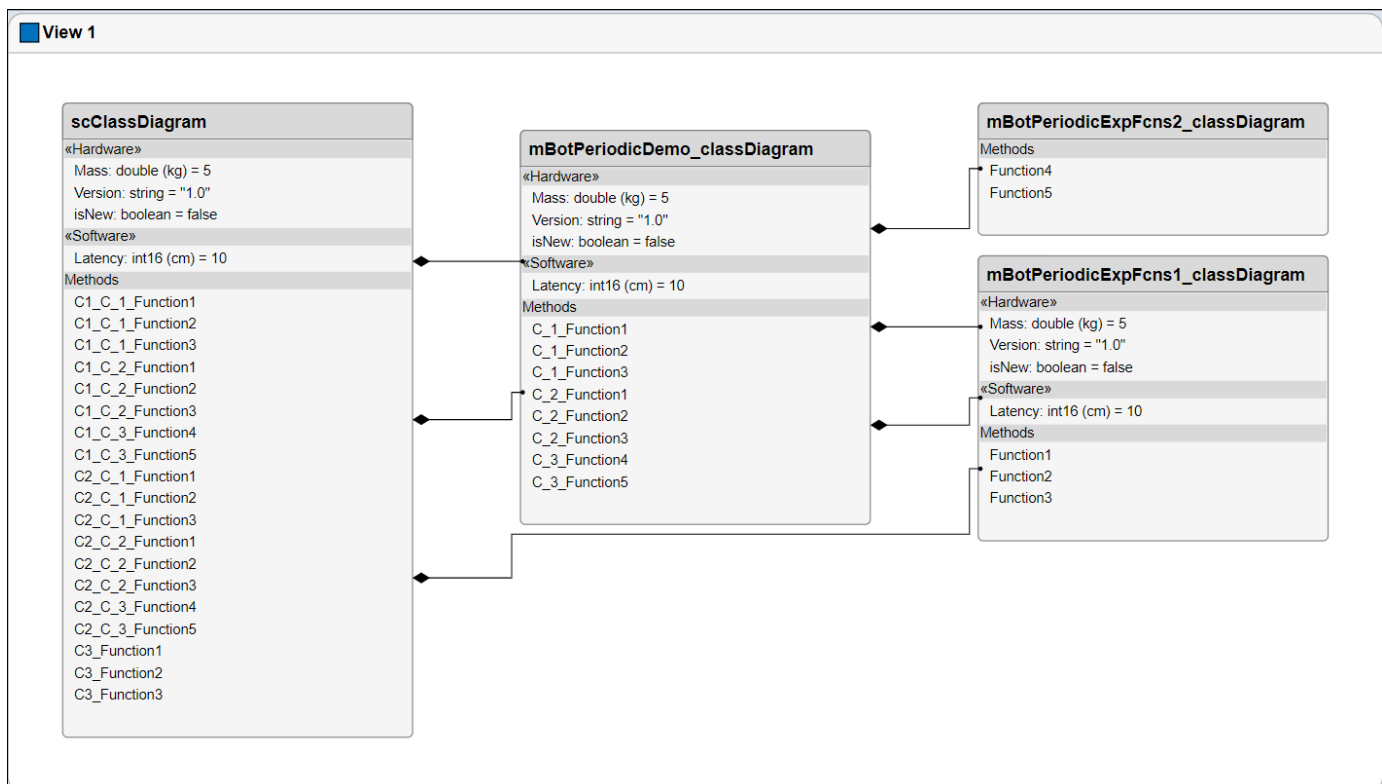
You can now visualize the hierarchy of architecture types of architecture models. Architecture hierarchy diagrams display unique component architecture types and their relationships using composition connections. In an architecture hierarchy view, each referenced model is represented only once.



For more information, see “Display Component Hierarchy and Architecture Hierarchy Using Views”.

## Class Diagrams: Display software architecture model as a class diagram

You can now visualize a software architecture model as a class diagram. A class diagram is a graphical representation of a static structural model that displays unique architecture types of the software components optionally with software methods and properties. Class diagrams capture one instance of each referenced model and show relationships between them.



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For more information, see “Class Diagram View of Software Architectures”.

## Import and export software architectures

In R2021b, you can import and export software architectures.

- To import a software architecture to your model, use the `systemcomposer.importModel` function.

```
archModel = systemcomposer.importModel(modelName,importStruct)
```

If the `domain` field of `importStruct` is "Software", the `importModel` function creates a new software architecture based on the structure of the MATLAB® tables.

- To export an existing software architecture, use the `systemcomposer.exportModel` function.

```
exportedSet = systemcomposer.exportModel(modelName)
```

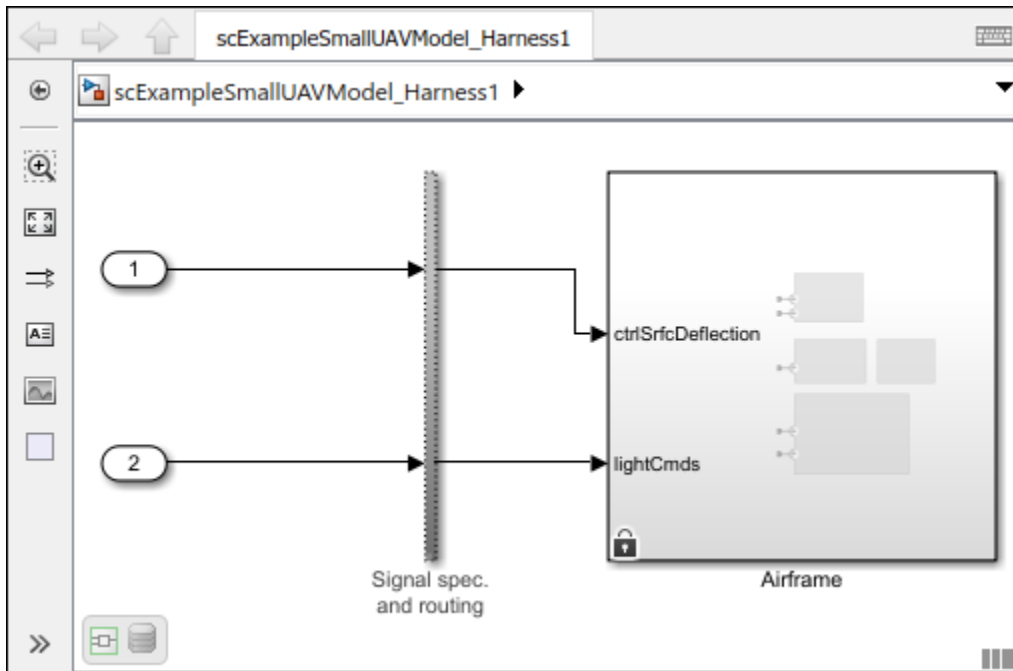
The `exportModel` function returns a MATLAB structure with the following fields:

- `components`, `ports`, `connections`, `portInterfaces`, and `requirementLinks` as MATLAB tables that capture components, ports, connections, port interfaces, and requirement links of the exported architecture.
- `domain` with value "Software" to indicate that the exported architecture is a software architecture.

## Test harnesses for System Composer components

In R2021b, you can create test harnesses for System Composer components in addition to Reference Component blocks.

A test harness enables you to isolate individual blocks for functional testing, behavior testing, and implementation-independent interface testing for requirements defined in System Composer using Simulink Requirements™. You can continue to manage your system interfaces inside the test harness and maintain synchronization with the System Composer model.



A Simulink Test™ license is required to create a test harness for a System Composer component to validate simulation results and verify design.

For more information, see “Verify and Validate Requirements Using Test Harnesses on Components”.



# R2021a

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**Version: 2.0**

**New Features**

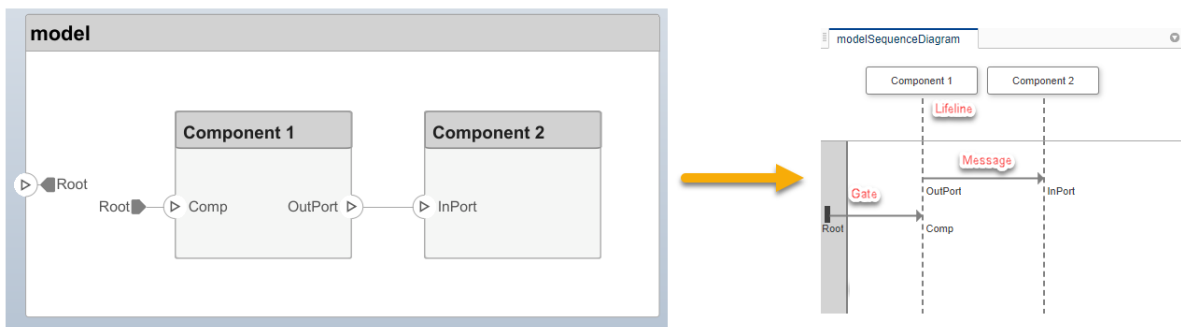
**Bug Fixes**

**Compatibility Considerations**

## Sequence Diagrams: Describe system behavior as a sequence of interactions between components

You can use sequence diagrams in System Composer to describe the expected system behavior as a sequence of interactions between components of a system. You can create multiple sequence diagrams to represent different operational scenarios of the system. New lifelines or interactions authored on the sequence diagram are automatically reflected as new components or connections in the architecture model.

Sequence diagrams are available in the Architecture Views Gallery and support these features:



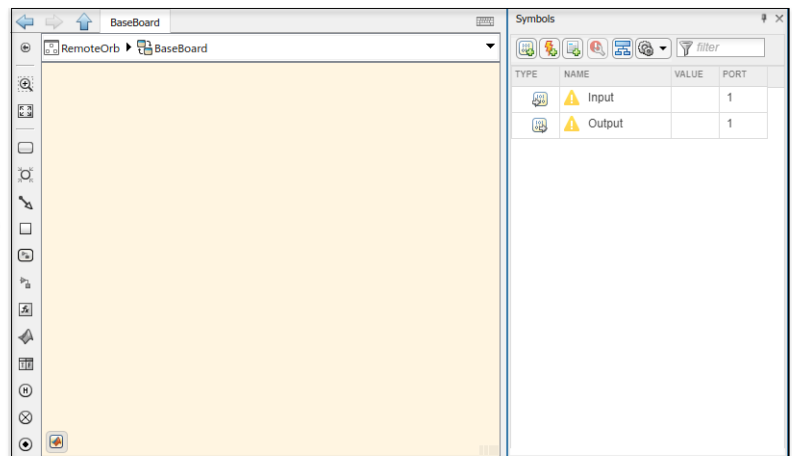
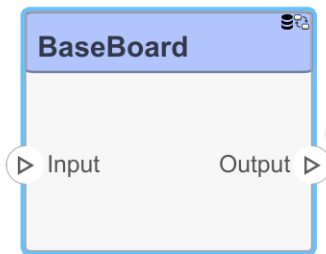
- Add lifelines to represent components and show what the component does in terms of events received and events sent out.
- Create child lifelines for child components.
- Add messages between lifelines that correspond to a connection between ports to show how components interact. These messages can have triggers and constraints attached to them.
- Create messages from root architecture ports to any lifeline component.
- Use the co-creation workflow. The software generates components and connections as you author new lifelines and messages in the sequence diagram.
- Make a marquee selection of messages and create a fragment. Click the **Add Operand** button to add operands for more complicated semantics like if-else branching or looping.
- When a mismatch occurs from the architecture model the sequence diagram references, click the **Check Consistency** button to highlight lifelines pointing to missing components for manual reconciliation.

For more information, see Define Sequence Diagrams.

## State Charts: Describe component behavior using Stateflow charts to represent modes of operation

In R2021a, you can add Stateflow® chart behavior to a component in a System Composer architecture model.

- Add Stateflow chart behavior to a component.



- The new Stateflow chart behavior for a component is embedded within the same .slx file as the parent architecture model, reducing the need for multiple model files.

For more information, see [Add Stateflow Chart Behavior to Architecture Component](#).

## Software Architecture: Simulate and deploy software functions from System Composer

Use System Composer to author software architectures composed of software components, ports, and interfaces. Design your software architecture model, define the execution order of functions from your components, simulate your design at the architecture level, and generate production code. For more information, see [Author Software Architectures](#).

For an example that shows how to author the software architecture of a throttle position control system in System Composer, see [Modeling the Software Architecture of a Throttle Position Control System](#).

## Updates to the Architecture Views Gallery and APIs

The Architecture Views Gallery updates include UI improvements and new APIs for views.

- Use View Properties on the right of the views gallery when a view is selected. Properties include Name, Color, and Description.

VIEW PROPERTIES	
Name	Value
<ul style="list-style-type: none"> <li>Main           <ul style="list-style-type: none"> <li>Name: Key FOB Position Dataflow</li> <li>Color: <span style="color: blue;">■</span></li> <li>Description: </li> </ul> </li> </ul>	

- Create and define the **Filter** and **Grouping** for views in **View Configurations** at the bottom of the views gallery.
- **Group By** multiple property values.

VIEW CONFIGURATIONS	
FILTER	GROUPING
<input checked="" type="checkbox"/> Apply Query <input type="checkbox"/> Revert Changes	
<input checked="" type="checkbox"/> Add Group By <input type="checkbox"/> Remove Group By	
Group By	
1	AutoProfile.BaseComponent.ReviewStatus
2	AutoProfile.SoftwareComponent.ImplementationLanguage

- New views APIs are available to streamline creating views programmatically. The new API allows you to add elements to the view independent of ordering and to remove elements cleanly. Existing APIs are deprecated.

For more information, see [Create Architecture Views Interactively](#) and [Create Architectural Views Programmatically](#).

## Compatibility Considerations

This table shows the new API and the corresponding deprecated API in this release.

New	Removed	Rationale
createView	createViewArchitecture	The new object <code>systemcomposer.view.View</code> is created with a name and optionally with a query, grouping criteria, and the option whether to include references. The <code>Root</code> property of a <code>View</code> object is a <code>systemcomposer.view.ElementGroup</code> object.
addElement	addComponent	The <code>addElement</code> method is used to populate the view manually and exists under the <code>systemcomposer.view.ElementGroup</code> object.
removeElement	removeComponent	The <code>removeElement</code> method is used to depopulate the view manually and exists under the <code>systemcomposer.view.ElementGroup</code> object.
createSubGroup	createViewComponent	The <code>createSubGroup</code> method is used to add subgroups under the main <code>systemcomposer.view.ElementGroup</code> object.

## Performance and Scalability Improvements

In R2021a, there are performance and scalability improvements for System Composer features.

- Model-building APIs including `connect`, `addPort`, `addComponent`, and `addVariantComponent` now perform operations faster.
- Queries that query for model elements with specific stereotypes and model elements that satisfy constraints on stereotype property values now perform better. For examples, see `Find Elements in a Model Using Queries`.
- Interface editor scalability enhancements include loading improvements and an improved user experience on interface search, sort, expand, and collapse.

## Interface Editor enhancements

In R2021a, the Interface Editor features three enhancements.

- Use multiple columns to track interface element properties. Column names include: `Type`, `Dimensions`, `Units`, `Complexity`, `Minimum`, `Maximum`, and `Description`.

Interfaces							
	Type	Dimensions	Units	Complexity	Minimum	Maximum	Description
▼  exMobileRobot.slx							
sensordata							

- Show and hide columns by toggling the button.
- After creating interface elements, you can edit the properties in the columns from the Interface Editor.

Interfaces							
	Type	Dimensions	Units	Complexity	Minimum	Maximum	Description
▼  exMobileRobot.slx							
▼  sensordata							
motorSpeed	double	1	m/s	real	[]	[]	

For more information, see Define Interfaces.

# R2020b

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**Version: 1.3**

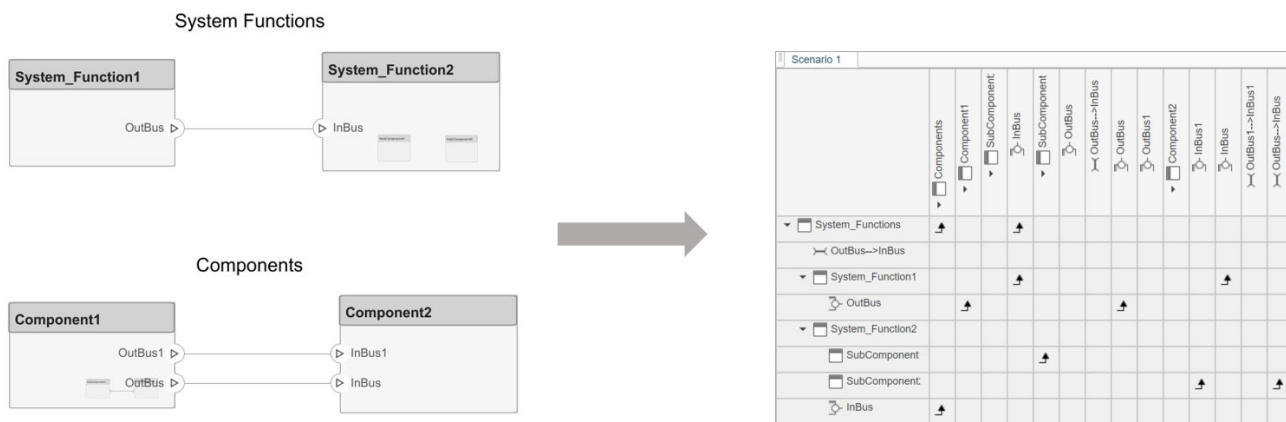
**New Features**

**Bug Fixes**

## Model to Model Allocations: Establish traceable and directed relationships between architecture elements in source and target models

System Composer allocations allow you to establish a direct relationship from architecture elements in one model such as components, ports, and connectors, to architecture elements in another model. For more information, see [Create and Manage Allocations](#).

You can use allocations to establish relationships from software components to hardware components and to indicate the deployment strategy. You can allocate different instances of components, ports, and connectors and use the allocation to perform various analyses such as resource-based allocation analysis. For an example, see [Allocate Architectures in a Tire Pressure Monitoring System](#).



An allocation set is a collection of allocation relationships between two models. The allocation set is stored with the `.mldatax` file extension. You can create an allocation set in the Allocation Editor. Upon the allocation set creation, a matrix appears where the source model elements are the rows and the target model elements are the columns. You can open the allocation editor from the **Allocation Editor** button in the toolbar or by typing the `editor` command in the MATLAB command window.

## Enhanced workflows with Architecture Views

In R2020b, workflows for authoring and generating multiple views are enhanced to simplify view editing and filtering. There are six enhancements:

- You can start editing a view after selecting the view in the **View Browser** pane.
- You can add components from the composition tree in the **Model Components** pane by dragging and dropping them from the composition tree.
- You can use the keyboard shortcut **Delete** to delete components from the view.
- You can use the **Group** button in the toolbar to create a view component based on the selected components.
- You can ungroup components by using the **Ungroup** button in the toolbar.
- View filtering is now placed in a separate pane in which you can customize the query and apply it to your view.

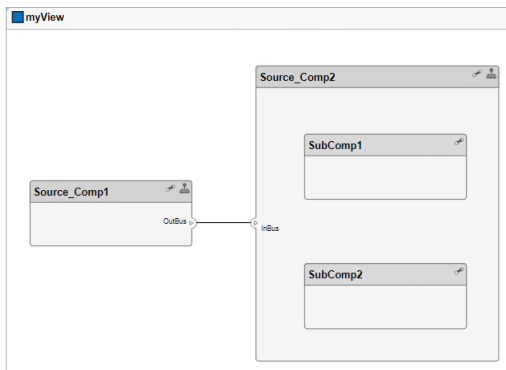
For more information, see [Create Architecture Views Interactively](#).



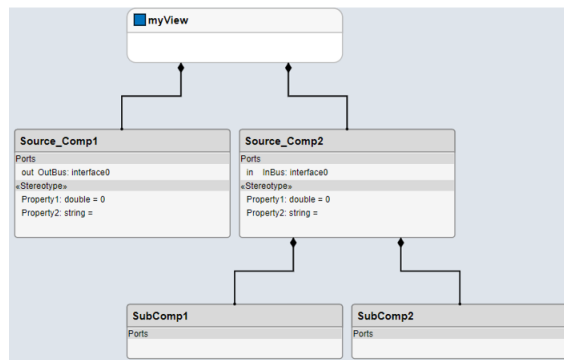
## Hierarchy Views: Display component hierarchy as a tree diagram

The Hierarchy View allows you to visualize component hierarchy together with component stereotypes, stereotype properties, and the reference type a component instantiates. Hierarchy diagrams show the same set of components visible in the component diagram view, and components are selected and filtered in the same way. Any component diagram view can be optionally represented as a hierarchy diagram. The Hierarchy View flattens the component diagram view and displays in a tree form. You can see the Hierarchy View by selecting **Hierarchy diagram** in the Architecture Views Editor.

Component diagram



Hierarchy diagram



The hierarchy diagrams show a single root, which is the view specification. The root corresponds to the containing system box shown in the component view. The lines between components originate from the parent component with the filled diamond symbols that are used in UML compositions and end with a terminating dot at the child component.

For more information, see [Display Component Hierarchy Using Hierarchy Views](#).

## Referenced Data Dictionaries: Organize interfaces in a hierarchy of data dictionaries

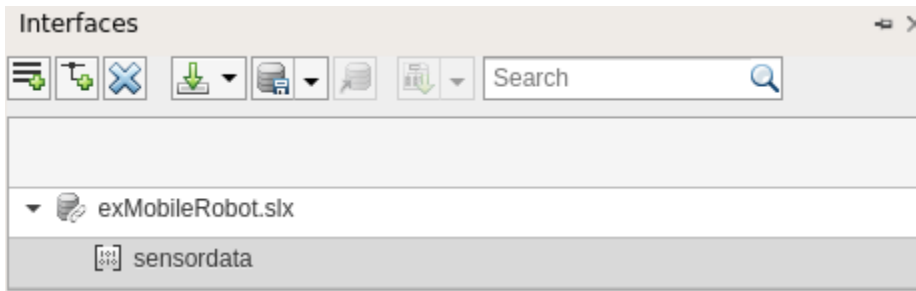
In R2020b, an interface data dictionary can reference other data dictionaries, creating a hierarchy in which the dictionary aggregates interfaces defined in its referenced dictionaries. A System Composer model linked to the root (top-level) dictionary of a hierarchy can access and use interfaces defined in the root as well as any of the dictionaries it references directly or indirectly.

For more information, see [Save, Link, and Delete Interfaces](#).

## Interface Editor enhancements

In R2020b, there are three enhancements to the Interface Editor.

- The **Interfaces** pane is now placed at the bottom of the model window.

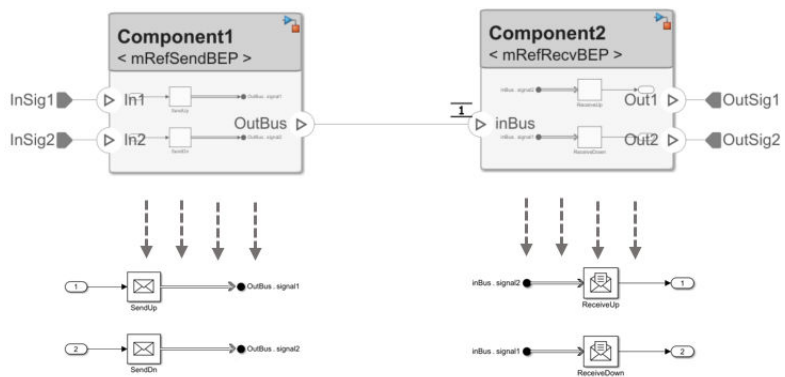


- You can search the interface table on the first column.
- You can sort interfaces and specify the sorting criteria.

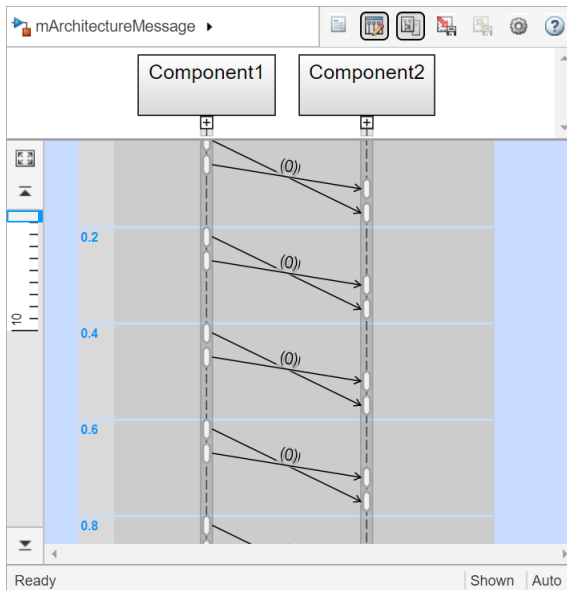
For more information, see Define Interfaces.

## Support for component behavior using Simulink models with message input and output

You can define component behavior by linking a Simulink behavior model with message input and output. For more information about Simulink messages, see Simulink Messages Overview (Simulink).



Use the **Sequence Viewer** tool to visualize events that represent the flow of messages, functions calls, and state transitions. To activate event logging, on the **Simulation** tab, in the **Prepare** section, select **Log Events**. To visualize the logged events, go to the **Review Results** section and select the **Sequence Viewer**.



## Stereotype-Based Styling: Style connectors based on stereotypes and use custom icons for component stereotypes


In R2020b, there are two stereotype-based styling enhancements in the Profile Editor:

- You can style architecture connectors using the stereotype settings. You can style connectors by using connector, port, or port interface stereotypes. Customize styling provides various color and line style choices. Connector styles are also reflected in architecture and spotlight views.

**Stereotype Properties**

Name:

Applies to:

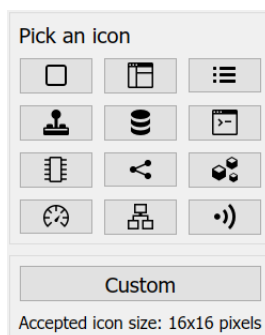
Connector style:  

Base stereotype:

Abstract stereotype

Description:

- You can use custom icon images for component stereotypes. Custom icons support .png, .jpeg, or .svg image files of size 16-by-16 pixels. The custom icons are displayed as badges on the components for which the stereotypes are applied.



For more information, see [Define Profiles and Stereotypes](#).

## Support for protected models as component behaviors

In R2020b, you can link a component in your architecture model to a protected Simulink model to create component behaviors. You can convert an already linked Simulink behavior model to a protected model, and this change is reflected after refreshing the model.

For more information, see [Implement Components in Simulink](#).

## Import and export requirement links along with the architectural models

In R2020b, you can:

- Export your architecture models with requirement links to your system requirements.

When you export your architecture model using the `exportModel` function, the output structure has a `requirementLinks` field that contains all the link information present in the model.

- Import links to requirements and reconstruct them in your System Composer model using `importModel`.

You can import requirement links to your model by using the new `requirementLinks` argument in `systemcomposer.importModel(modelName, components, ports, connections, interfaces, requirementLinks)`.

For more information, see [Import and Export Architecture Models](#).

# R2020a

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**Version: 1.2**

**New Features**

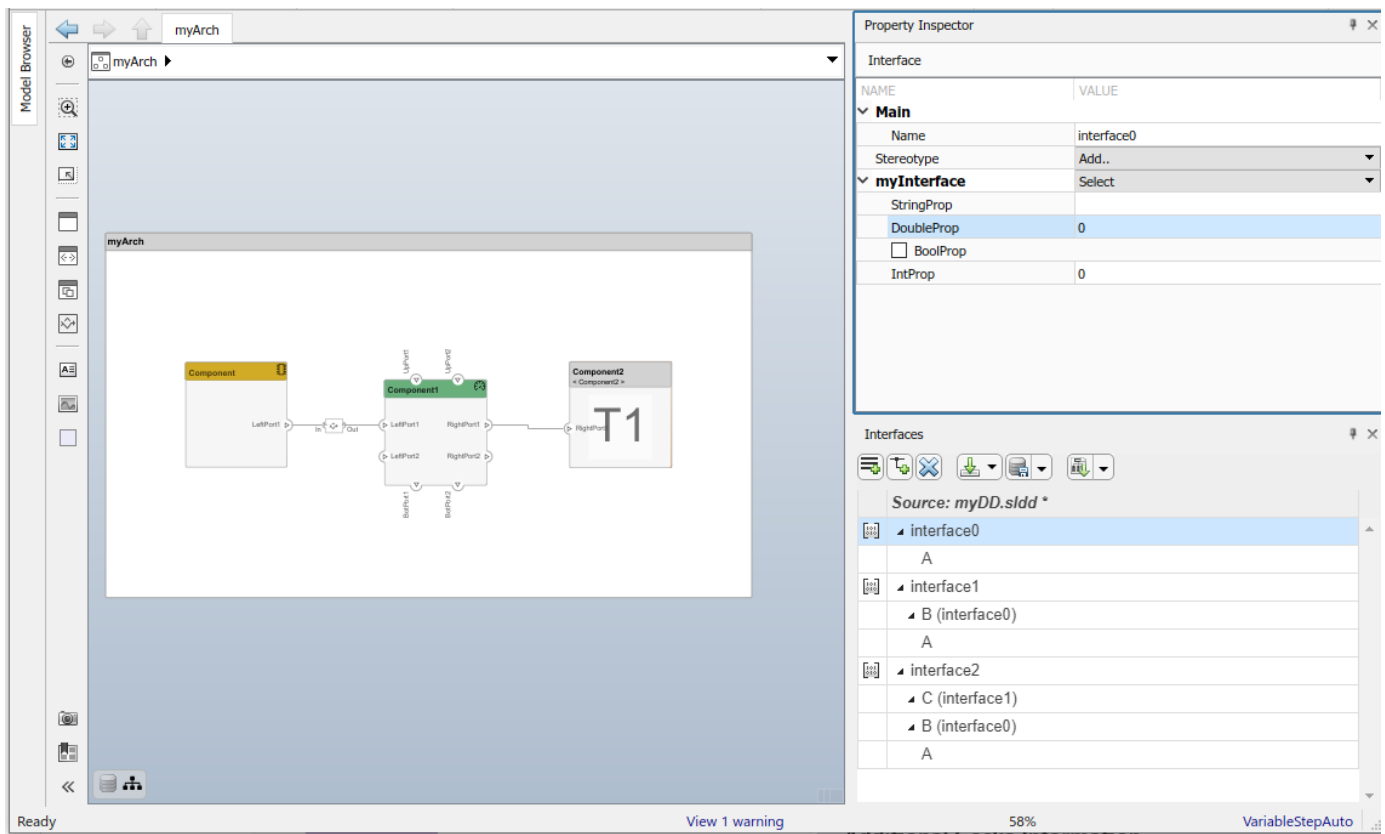
## Stereotype-Based Styling: Associate a color with component stereotypes

Profiles and stereotypes are used to apply custom metadata on the architecture model elements. Element styling is an additional visual cue that indicates applied stereotypes. Use a preconfigured set of color options for component stereotypes to style the architecture component headers.



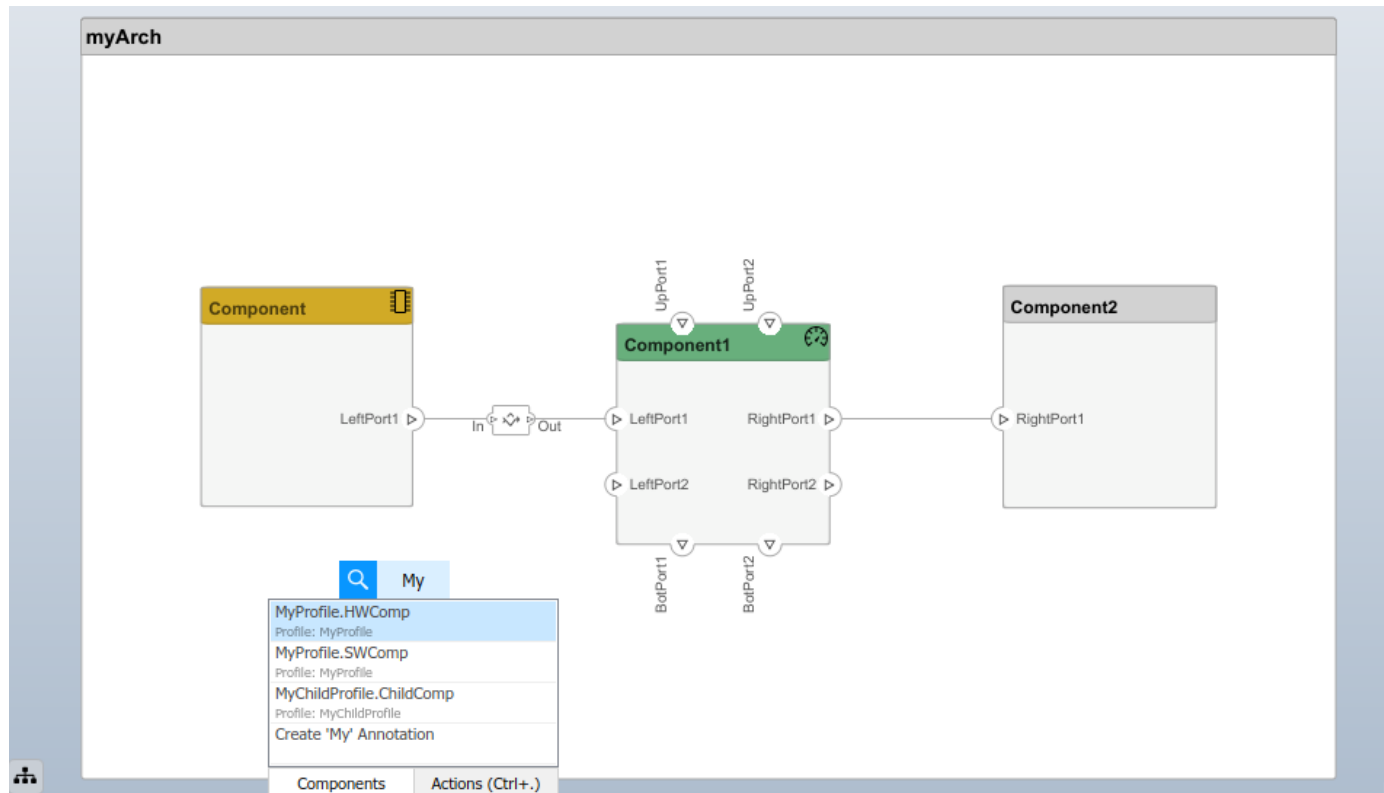
## Interface Stereotypes: Apply stereotypes for custom metadata on interface objects

In R2020a, you can add stereotypes containing custom properties to port interfaces. Architecture profiles can be imported into shared dictionaries to create and manage stereotyped interfaces that are shared across multiple models, which enables collaborative workflows. Specify stereotypes that apply to interfaces in the Profile Editor. You can view and edit stereotype properties in the Property Inspector.



## Quick Insert Stereotypes: Insert stereotyped components directly by typing on the canvas

You can now insert components preconfigured with all available component stereotypes in the profiles applied to a model using the quick insert capability of the System Composer canvas, which is enabled by typing into an empty location in the canvas.



## Model Templates for Referenced Models: Select from preconfigured templates when creating new referenced architecture or behavior models

To maintain specialized settings when creating Simulink behaviors or new architecture models linked to components, you can choose to use an existing template model from the palette of available template models on the Simulink start page. Specialized settings can include configuration parameters such as the solver type, diagnostic settings, and code generation settings. Use the template to specify copyright annotations and organizational styles.

## Requirements on Component Ports: Link requirements to component ports

In R2020a, you can link requirements to ports in a System Composer model using the Requirements Perspective. Create requirement sets, organize requirements into hierarchies, and link requirements to components and ports using Simulink Requirements. Annotate architecture models with requirement information and navigate to the source requirement.



Requirements - scExampleSmallUAVModel

Index	ID	Summary
1.2	#11	Communications
1.3	#14	Payload Capabilities
1.4	#15	Construction
1.5	#26	Data
1.5.1	#27	Engine Status

## Partial Architecture Model Load: Improved loading for large models

System Composer now loads the architecture part of the model without completely loading the underlying block diagrams of models that are linked to components. For example, opening an architecture model with hundreds of reusable components and behaviors no longer loads every block diagram in the model hierarchy. Models are fully loaded when System Composer workflows need them or you choose to open them explicitly.



# R2019b

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**Version: 1.1**

**New Features**

**Bug Fixes**

## Architecture Views

You can author and generate multiple views for specific viewpoints for design, analysis or communication. Create a view by writing queries against the model using the System Composer model query language. See [Creating Architecture Views Interactively](#).

## Interface Adapter

Visually specify an interface mapping between components with different but compatible interfaces. For example, map a signal with different interface names. See [Interface Adapter](#).

## Import and Export Architecture Models

Import a system architecture into System Composer using Microsoft® Excel® spreadsheets or MATLAB tables. The tables define components, ports, and connections. See [Importing and Exporting Architecture Models](#).

## AUTOSAR Software Architecture

AUTOSAR Composition Editor: Author compositions, simulate functional behavior with basic software services using Composition Editor.

Support for architecture and composition modeling for the AUTOSAR Classic Platform. You can:

- Create AUTOSAR architecture models.
- Use AUTOSAR composition editor to add and connect Composition and Component blocks.
- Link AUTOSAR components to Simulink Requirements.
- Define AUTOSAR component behavior by creating or linking Simulink implementation models.
- Configure AUTOSAR scheduling and simulation, including AUTOSAR Basic Software services.
- Generate and package composition AUTOSAR XML description and component code.

# R2019a

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**Version: 1.0**

**New Features**

## Introducing System Composer

System Composer enables the definition, analysis, and specification of architectures and compositions for model-based systems engineering and software design. With System Composer, you allocate requirements while refining an architecture model that can then be designed and simulated in Simulink.

System Composer lets you create architecture models that describe a system in terms of components and interfaces. You can also populate an architecture model from the architectural elements of Simulink designs or C/C++ code. You can create custom live views of the model to study specific design or analysis concerns. With these architecture models, you can analyze requirements, capture properties via stereotyping, perform trade studies, and produce specifications and ICDs.

## Composition Editor

Author and edit architecture models in the Composition Editor. Model physical and logical architecture of a system. Create a visual representation of components, ports, and connections and specify information exchange between components with interfaces. Decompose components to add detail and define hierarchical relationships. Create reusable architectures.

## Spotlight Views

You can create Spotlight views to analyze component dependencies and hierarchy. A Spotlight view is a simplified view of a model that captures the upstream and downstream dependencies of a specific component of interest. You can shift the spotlight to a different component from within the Spotlight view. You can also trace an element from the Spotlight view back to the composition.

## Linking Simulink Behavior Models

You can use Simulink models with System Composer to define component behavior by creating or linking to a Simulink behavior model. Take advantage of System Composer architecture editing and analysis capabilities for Simulink behavior models by exporting them as architecture models.

## Linking and Managing Requirements

You can link components to requirements using the Requirements perspective. Create requirement sets, organize requirements into hierarchies, and link requirements to components using Simulink Requirements. Annotate architecture models with requirements information and navigate to the source requirement.

## Stereotypes and Profiles

You can create stereotypes as extensions of components, ports, and connections by defining additional properties. Use Profile Editor to define profiles as self-consistent sets of stereotypes. Import profiles into architecture models. Assign stereotypes to model elements.

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## **Architecture Model Analysis**

You can use MATLAB analytics with System Composer API to write scripts to generate data that can be used for trade studies or for verifying nonfunctional requirements.

