



ZEEKR

基于模型开发的面向服务的车载应用软件的设计与测试

魏旻, 极氪智能科技



2024 MathWorks
中国汽车年会

1.背景介绍

2.框架模型配置

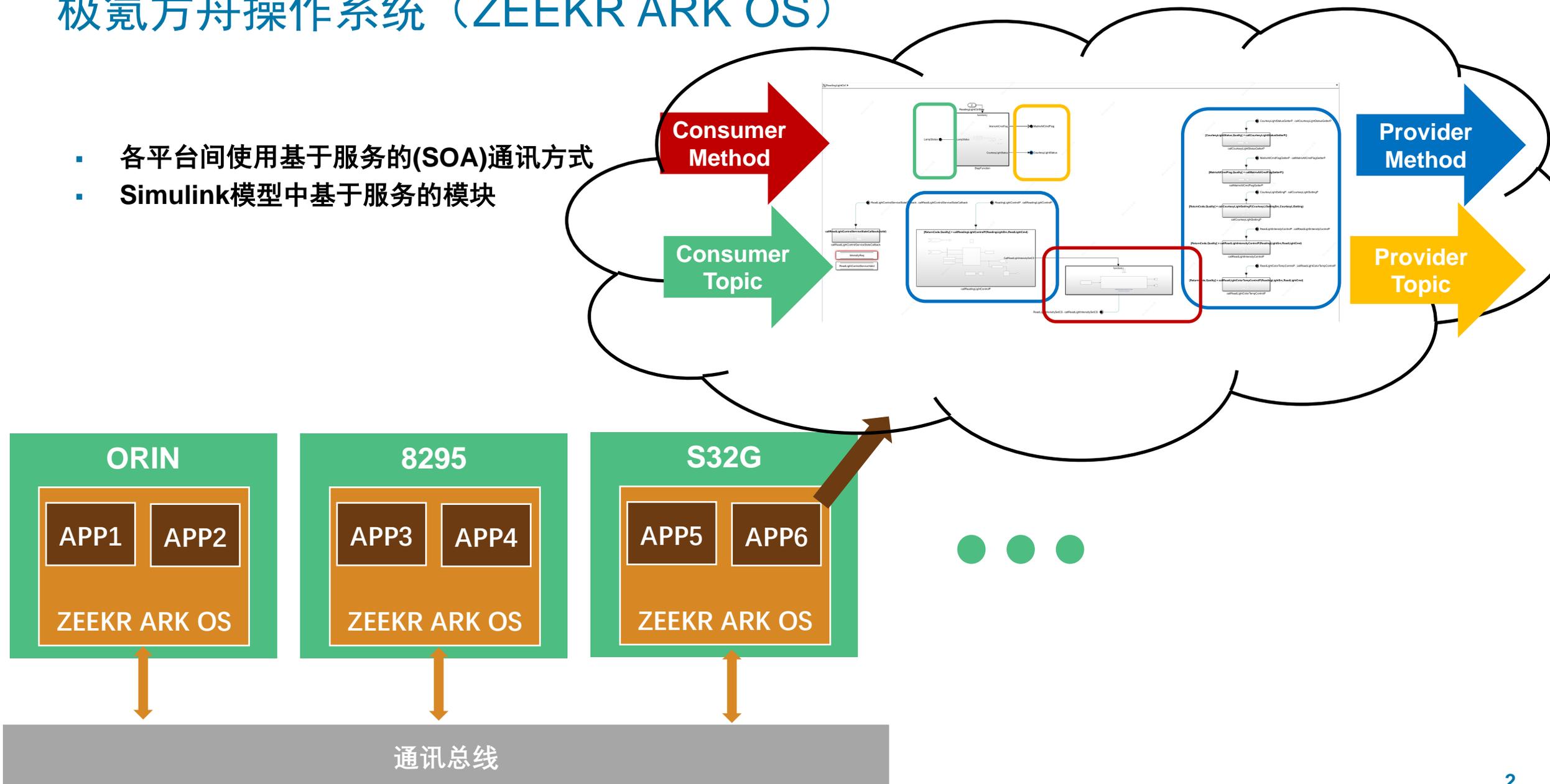
3.根据需求建模

4.模型测试

5.代码集成与测试

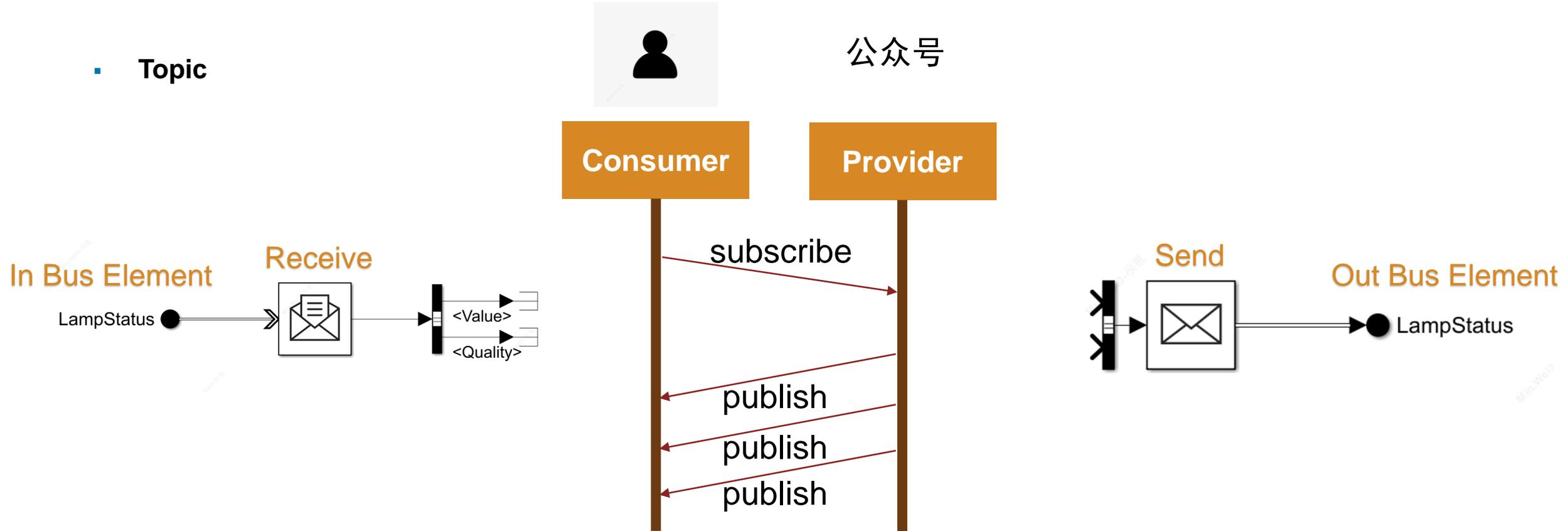
极氪方舟操作系统 (ZEEKR ARK OS)

- 各平台间使用基于服务的(SOA)通讯方式
- Simulink模型中基于服务的模块



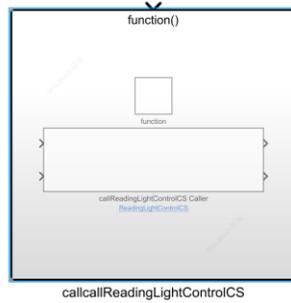
Simulink中服务化的接口

- **Topic**



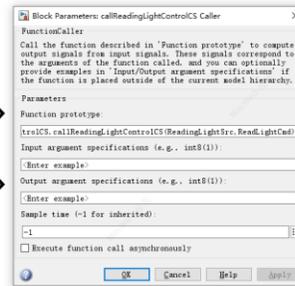
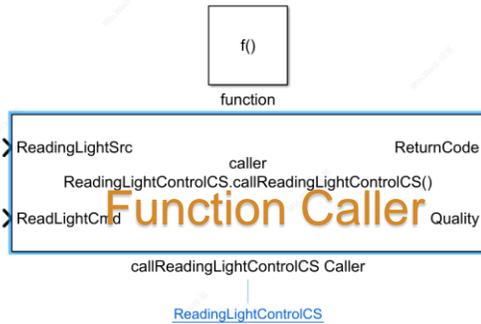
Simulink中服务化的接口

- Method**



ReadingLightControlCS . callReadingLightControlCS

Function Element Call



“一问一答”

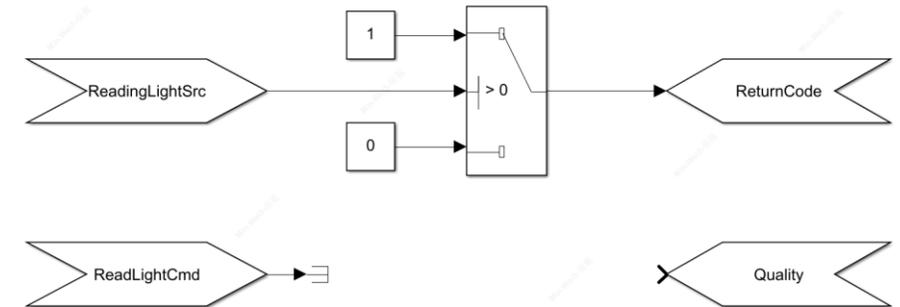
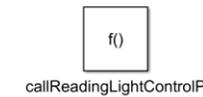
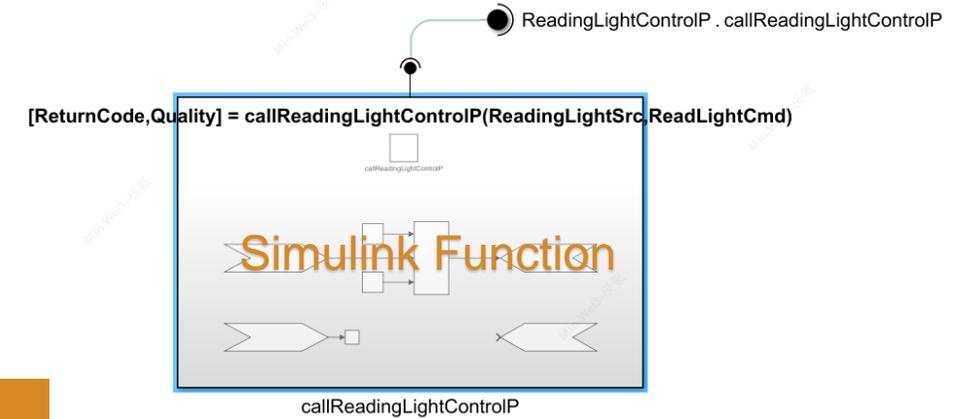
Consumer

Provider

request

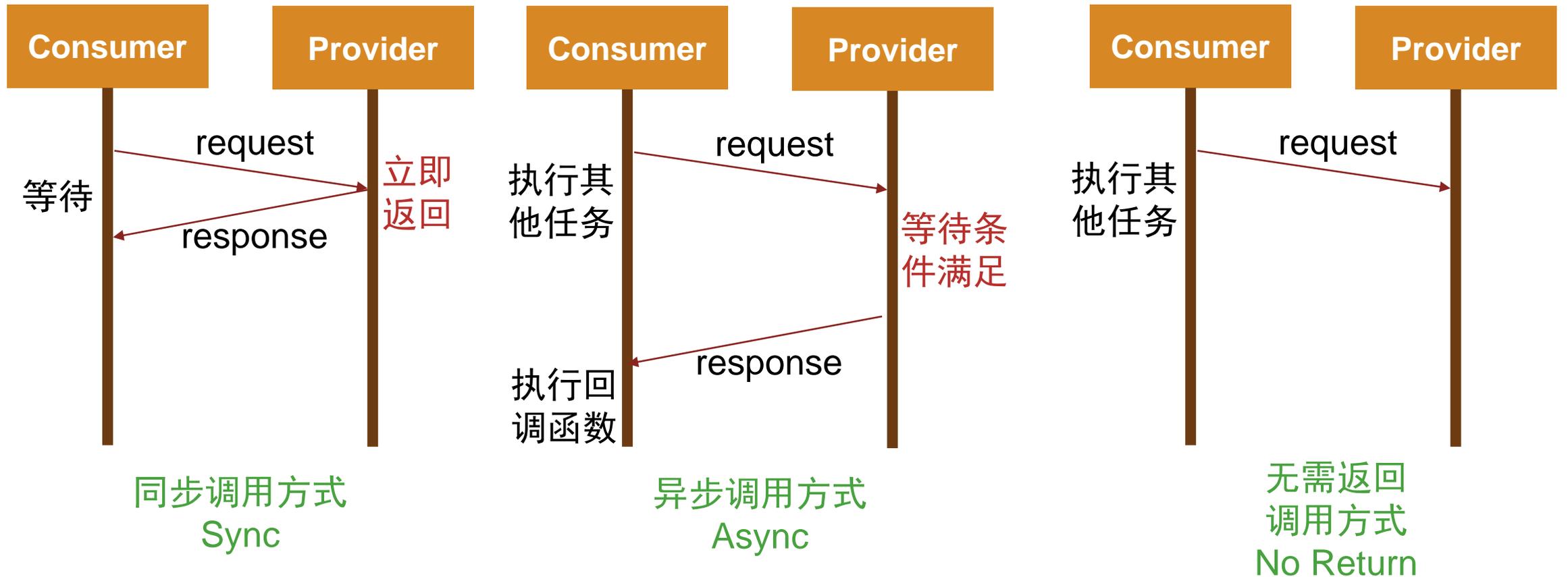
response

Function Element

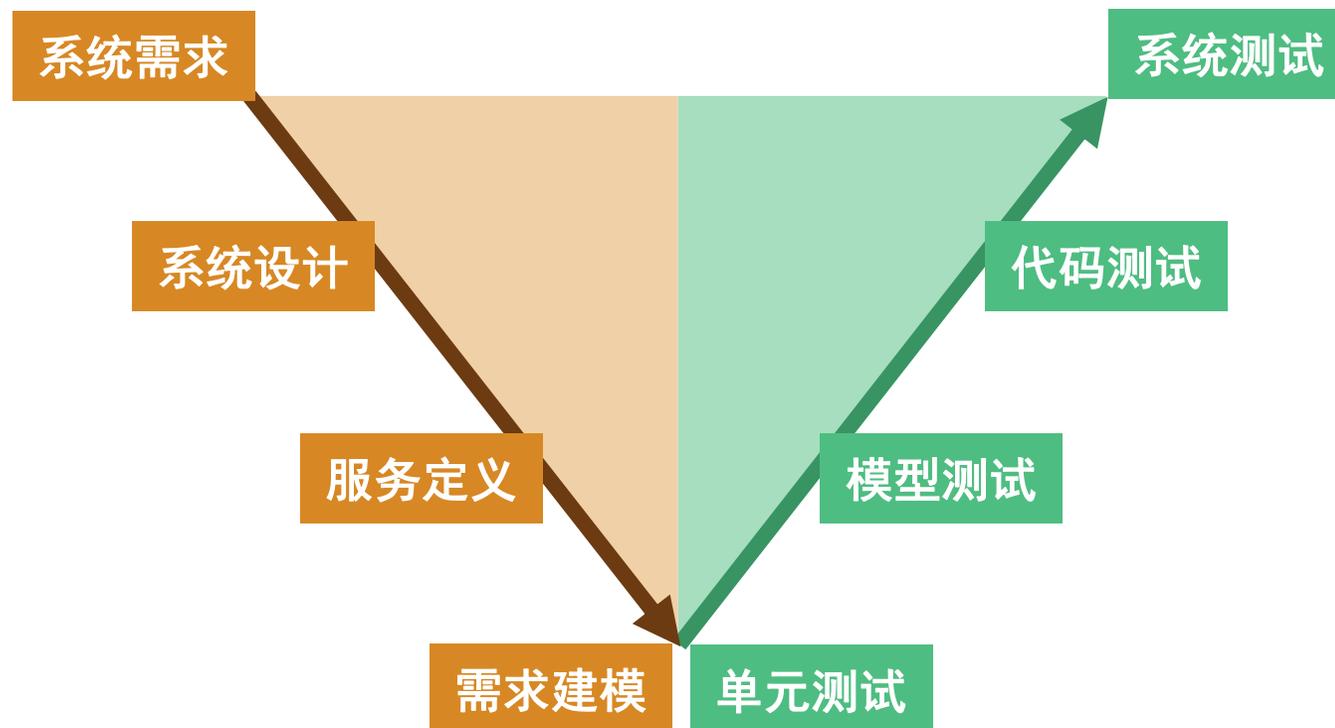


Simulink中服务化的接口

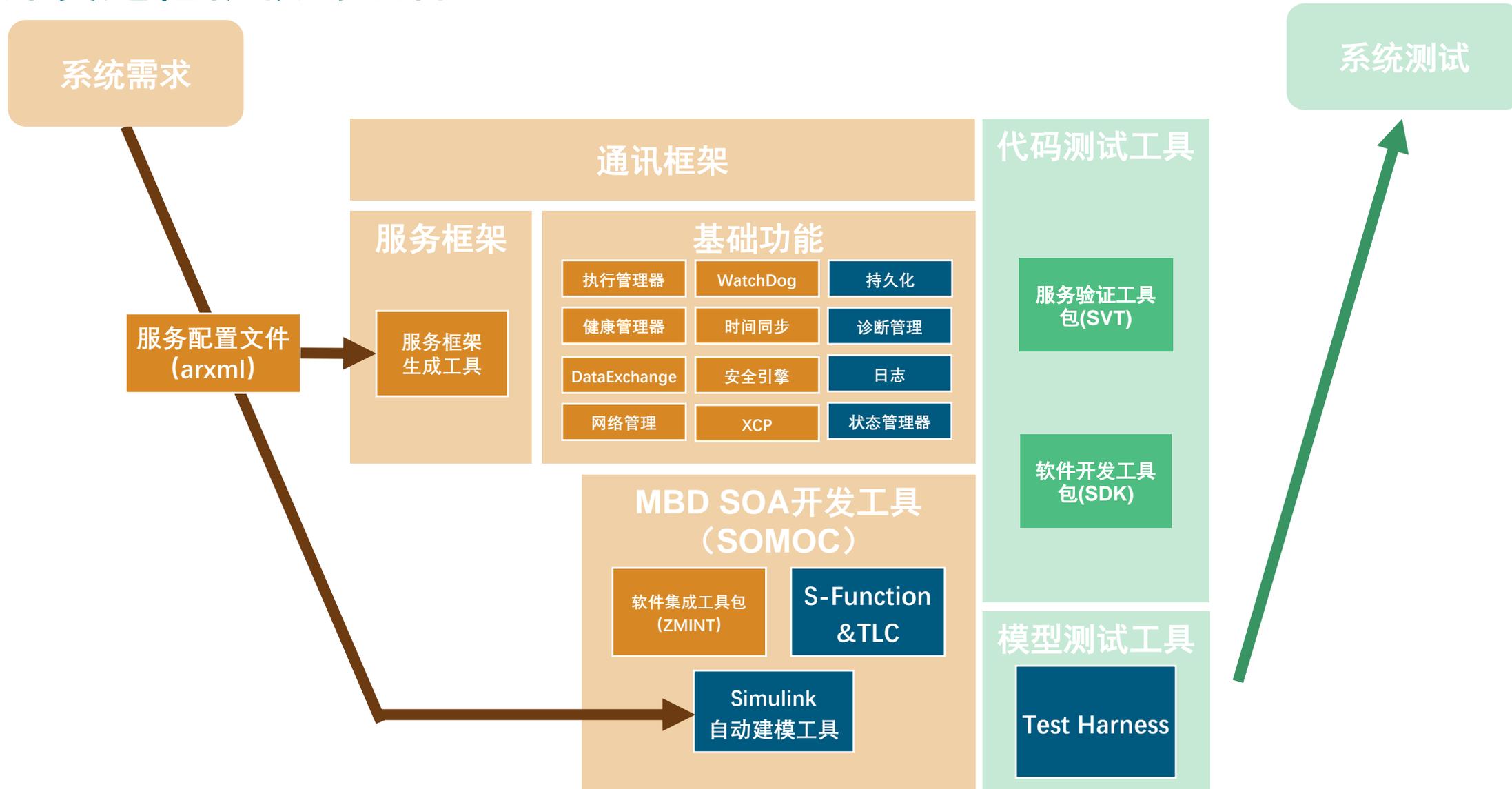
- Consumer Method的**三种调用方式**
- Provider Method的**两种返回方式**



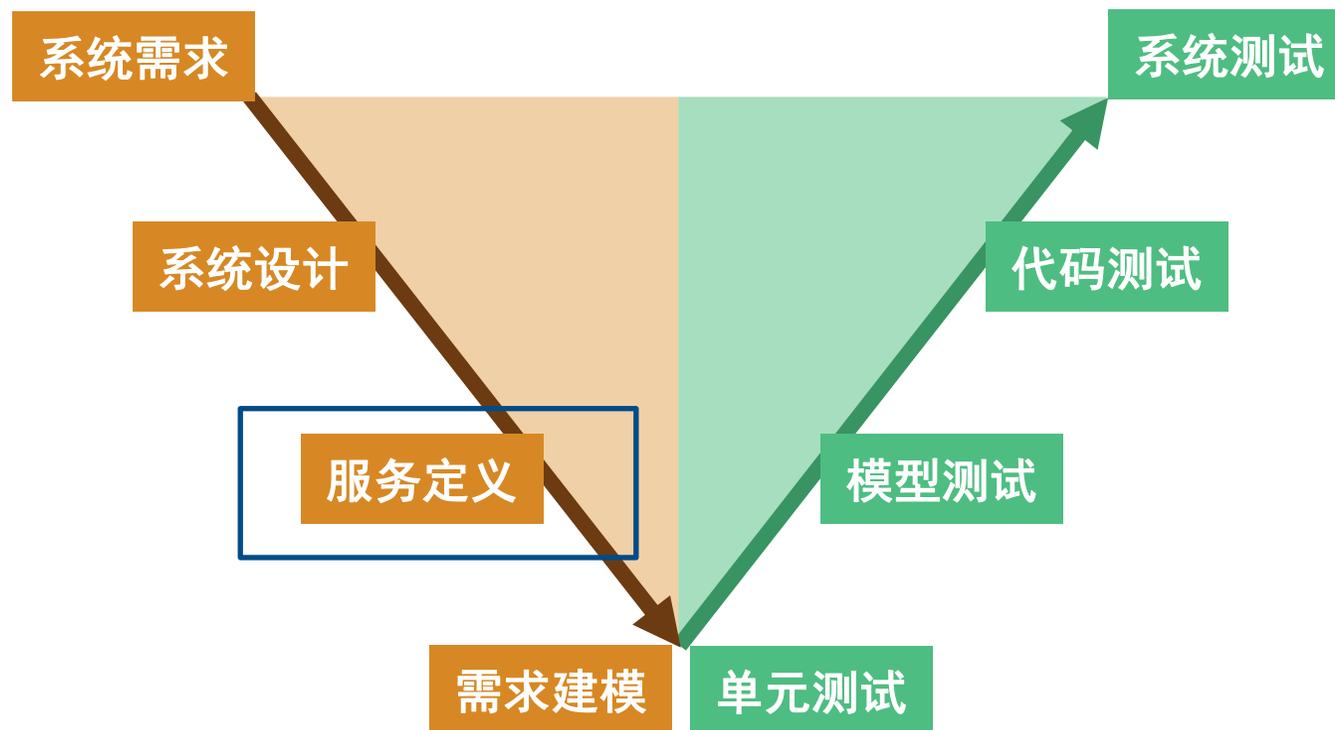
整体开发流程



开发过程依赖的组件



1. 背景介绍
2. 框架模型配置
3. 根据需求建模
4. 模型测试
5. 代码集成与测试



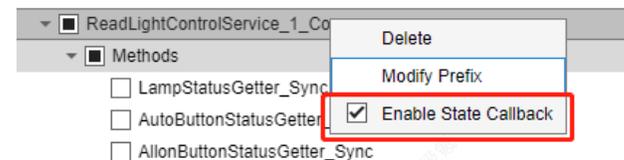
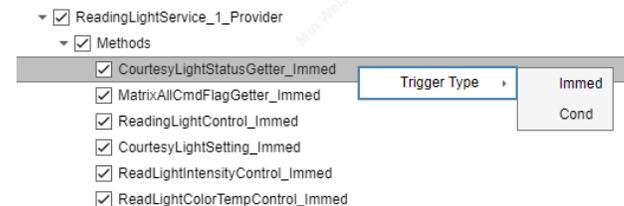
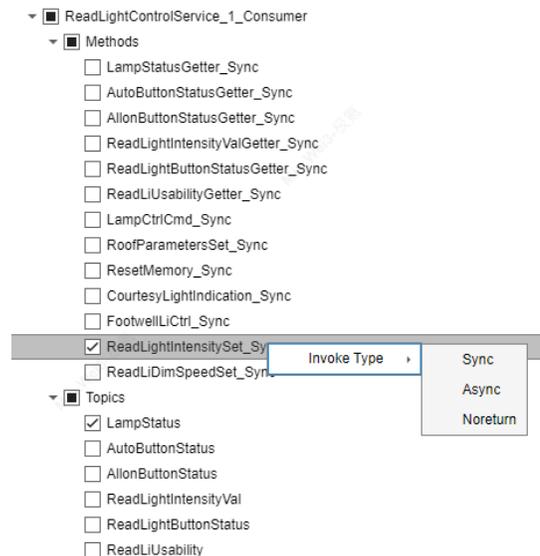
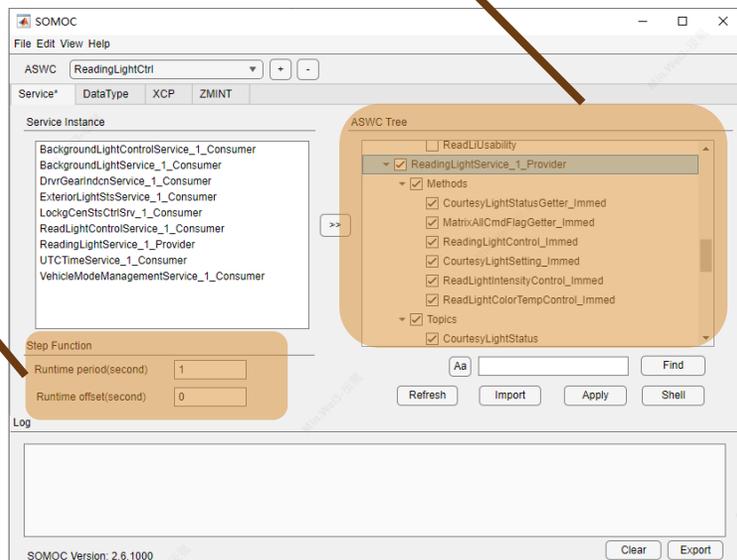
框架模型配置

配置服务接口

- C端选择需要的Method Topic
- C端Method的执行方式（同步、异步、无需返回）
- C端是否生成状态回调函数
- P端Method的返回方式（立即返回、条件返回）

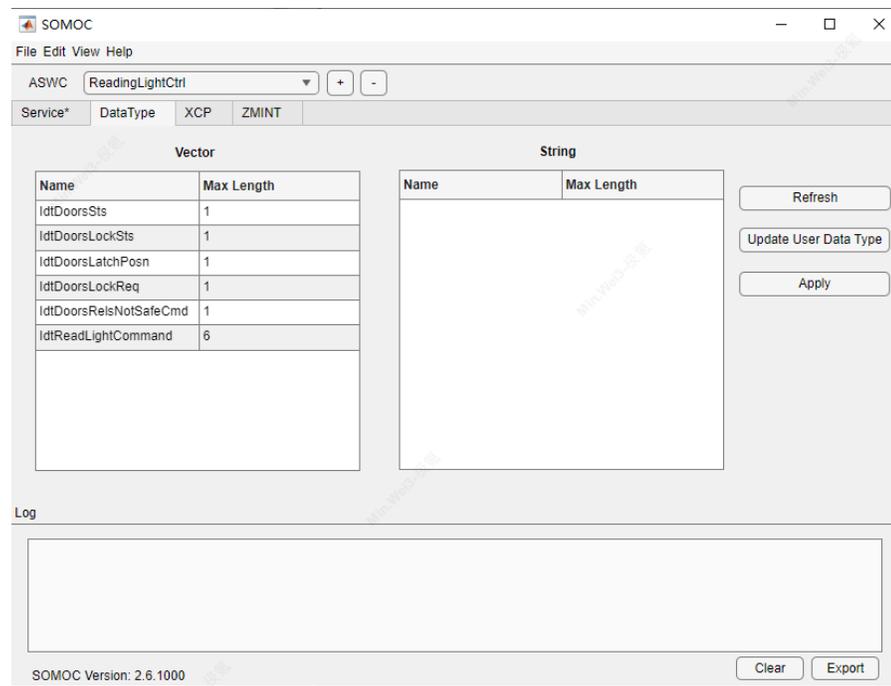
配置定时器

- 间隔时间
- 起始时间



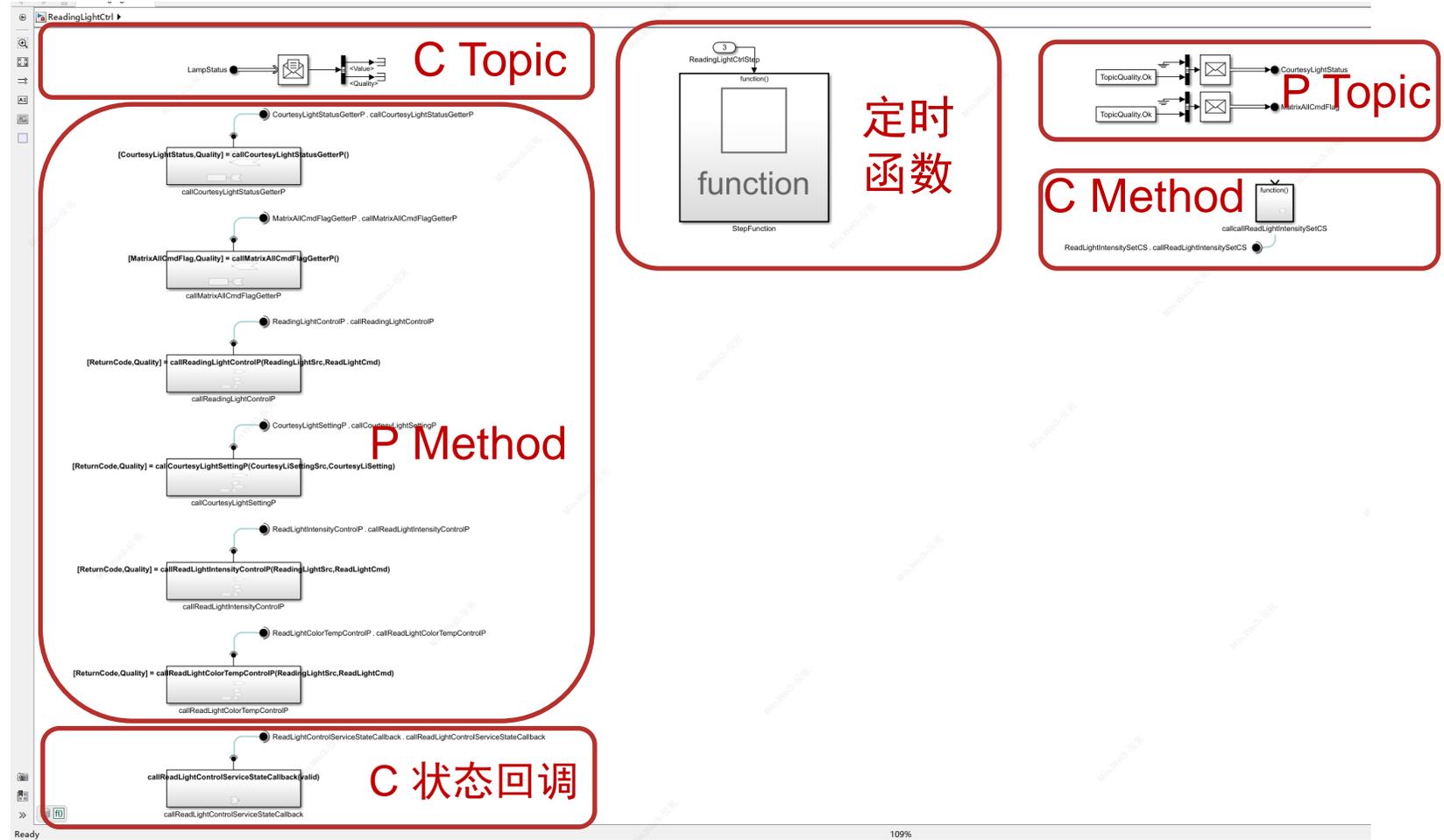
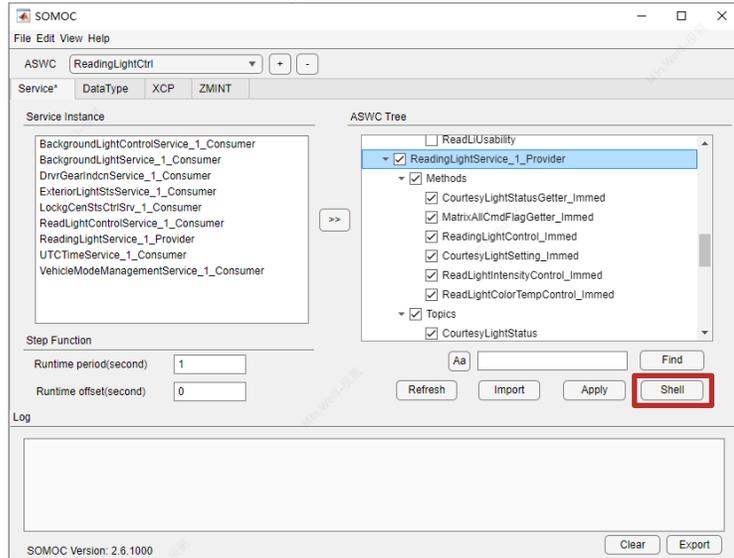
框架模型配置

- 配置特殊数据类型
 - 在Simulink中实现动态数组的最大长度
 - 在Simulink中实现字符串的最大长度

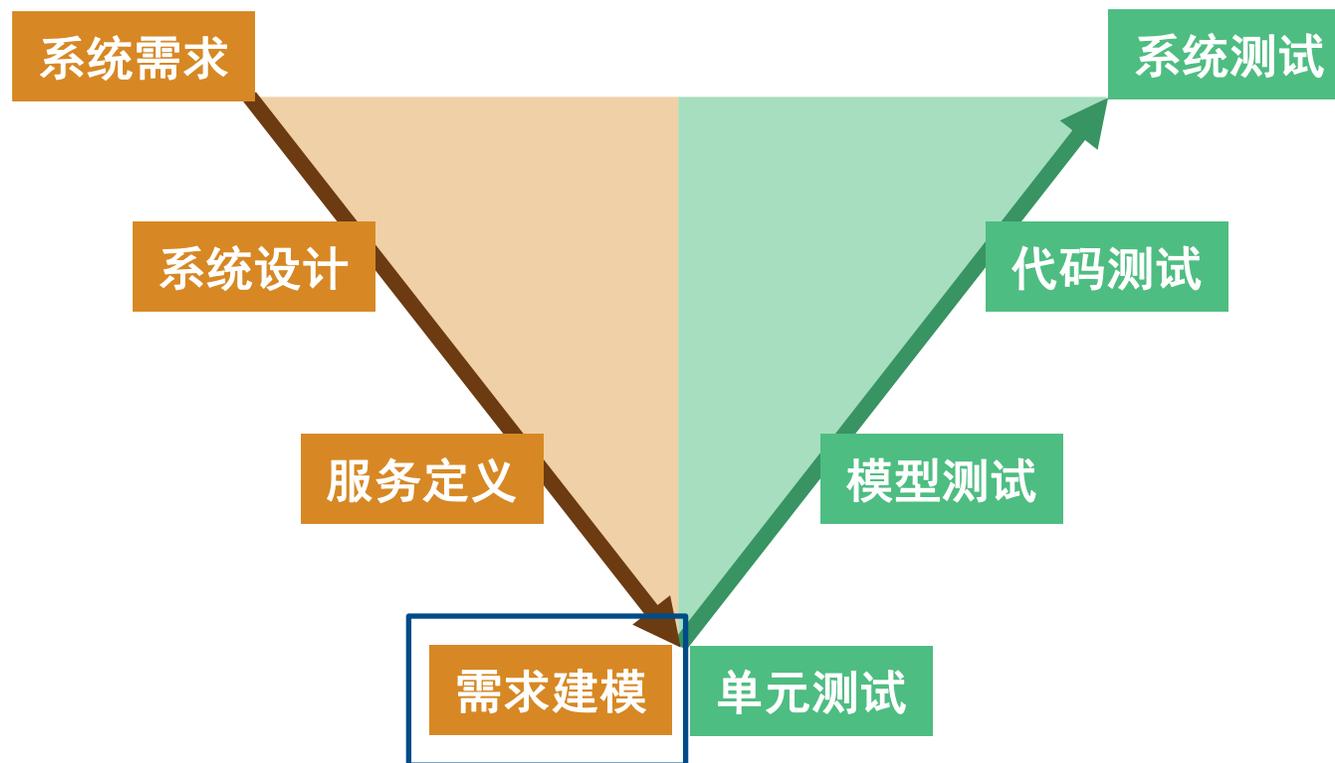


框架模型配置

- 生成框架模型

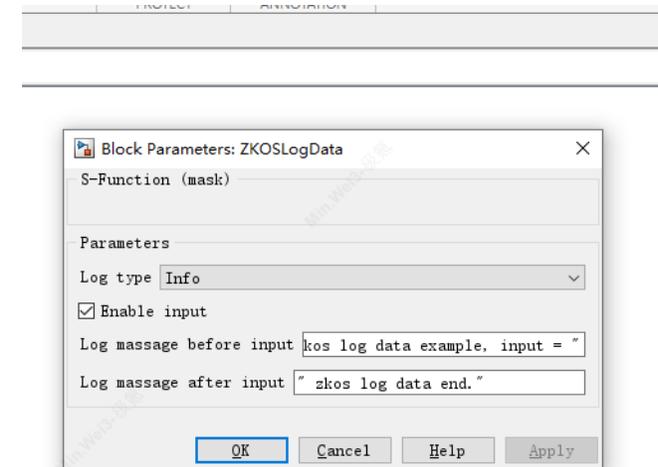
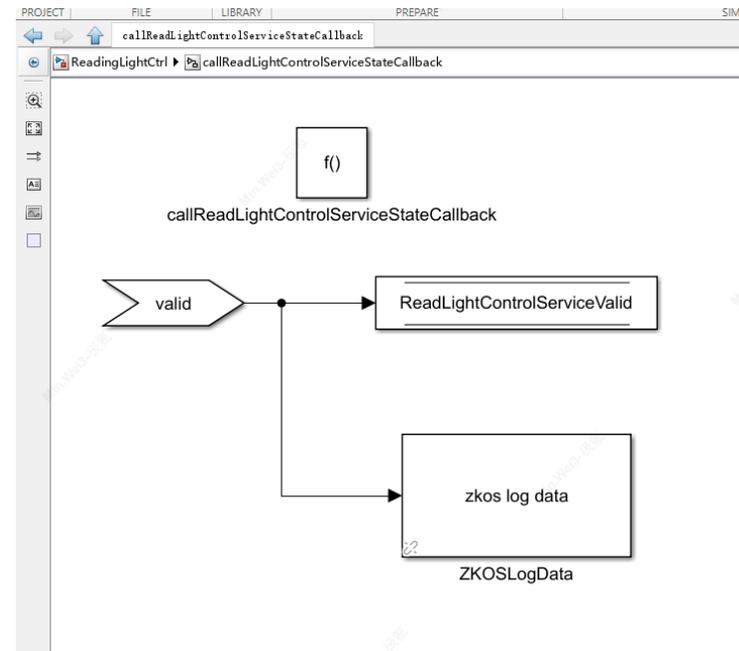
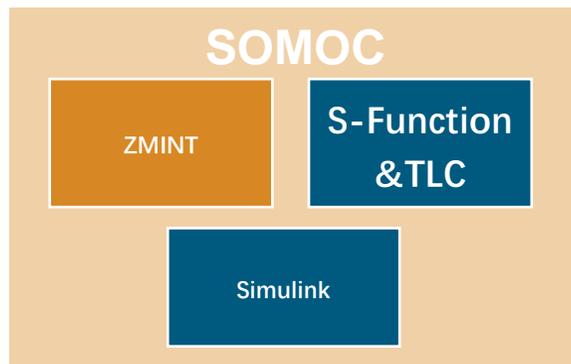
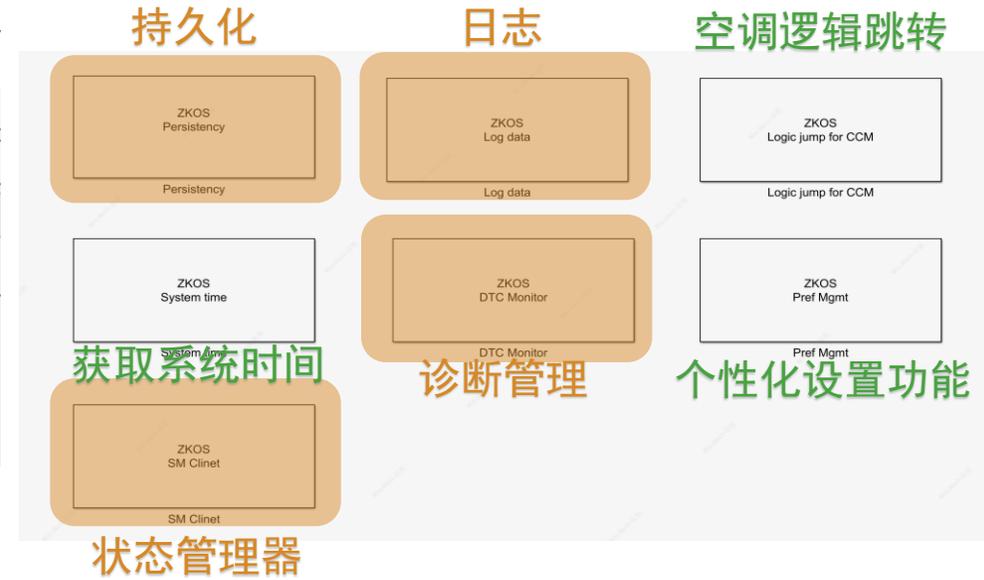
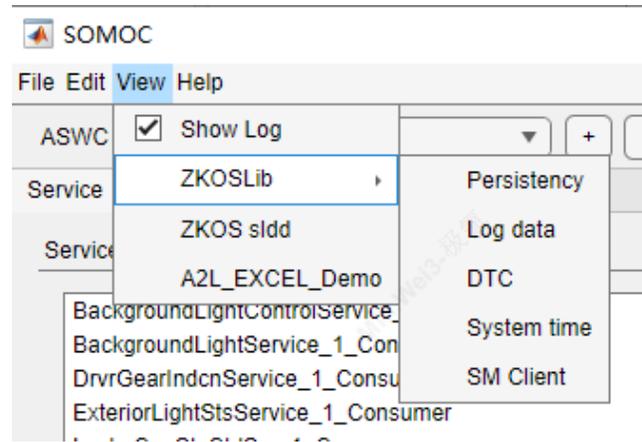


1. 背景介绍
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需求建模

- 集成ZEEKR ARK OS中间件模块
- 集成定制化业务模块



需求建模

S-Function&TLC

```

Editor - D:\jenkinsWorkspaceForSOMOC\workspace\toolchain\somoc\somoc-develop\Toolkit\Interface\LogInterface\log_data.c
log_data.c
1  #define S_FUNCTION_NAME log_data
2  #define S_FUNCTION_LEVEL 2
3  #include "simstruc.h"
4  #include "matrix.h"
5
6  #define GET_LOGTYPE(S)          (ssGetSFcnParam(S,0))
7  #define GET_ENINPUT(S)         (ssGetSFcnParam(S,1))
8  #define GET_LOGMESSAGEBEFOREINPUT(S) (ssGetSFcnParam(S,2))
9  #define GET_LOGMESSAGEAFTERINPUT(S) (ssGetSFcnParam(S,3))
10
11 /*-----*
12 * S-function methods *
13 *-----*/
14
15 /* Function: mdlInitializeSizes -----*
16 * Abstract:
17 * The sizes information is used to determine the S-function
18 * block's characteristics (number of inputs, outputs, states, etc.).
19 */
20 static void mdlInitializeSizes(SimStruct *S){
21     ssSetNumSFcnParams(S, 4); /* Number of S-function parameters */
22     ssSetSFcnParamTunable(S, 0, false);
23     ssSetSFcnParamTunable(S, 1, false);
24     ssSetSFcnParamTunable(S, 2, false);
25     ssSetSFcnParamTunable(S, 3, false);
26
27     ssSetNumContStates(S, 0); /* Number of continuous states */
28     ssSetNumDiscStates(S, 0); /* Number of discrete states */
29
30     /* 读取Mask中是否使能输入功能 */
31     char_T *enInput = (char_T*)malloc(mxGetNumberOfElements(GET_ENINPUT(S)) + 1);
32     mxGetString(GET_ENINPUT(S), enInput, mxGetNumberOfElements(GET_ENINPUT(S)) + 1);
33
34     if (strcmp(enInput, "on") == 0)
35     {
36         /* Initialize one input port with direct feedthrough */
37         if (!ssSetNumInputPorts(S, 1)) return;
38         ssSetInputPortDataType(S, 0, DYNAMICALLY_TYPED);
39         ssSetInputPortWidth(S, 0, 1);
40         ssSetInputPortDirectFeedthrough(S, 0, 1);
41     }
42     else
43     {
44         /* Initialize one input port with direct feedthrough */
45         if (!ssSetNumInputPorts(S, 0)) return;
46     }
47
48     /* Initialize one output port */
49     if (!ssSetNumOutputPorts(S, 0)) return;
50
51     /* Initialize one sample time */
52     ssSetNumSampleTimes(S, 1);
53
54     ssSetOptions(S,
55                 SS_OPTION_WORKS_WITH_CODE_REUSE |
56                 SS_OPTION_EXCEPTION_FREE_CODE);
57
58     free(enInput);
59 }
60 }
61

```

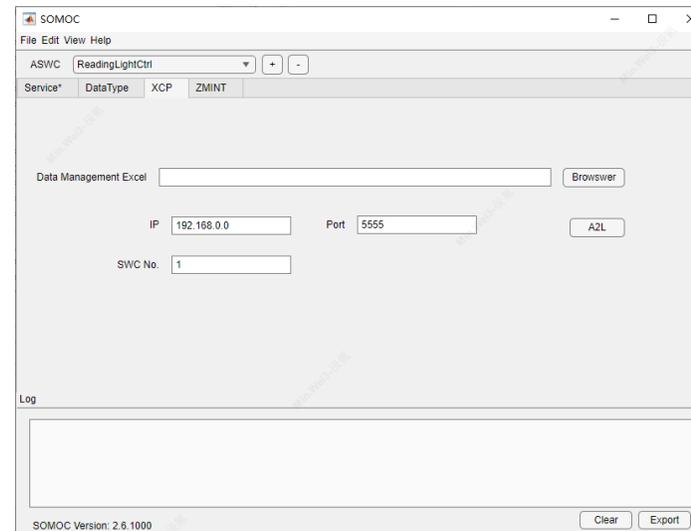
```

Editor - D:\jenkinsWorkspaceForSOMOC\workspace\toolchain\somoc\somoc-develop\Toolkit\Interface\LogInterface\log_data.tlc
log_data.c log_data.tlc
1  %implements "log_data" "C"
2
3  %function Outputs(block, system) Output
4
5  %assign T_logType = CAST("String", SFcnParamSettings.logType)
6  %assign T_enInput = CAST("String", SFcnParamSettings.enInput)
7  %assign T_logMessageBeforeInput = CAST("String", SFcnParamSettings.logMessageBeforeInput)
8  %assign T_logMessageAfterInput = CAST("String", SFcnParamSettings.logMessageAfterInput)
9  %assign modelName = LibGetModelName()
10
11 %assign logFunction = "LOGD"
12 %switch T_logType
13     %case CAST("String", "Debug")
14         %assign logFunction = "LOGD"
15         %break
16     %case CAST("String", "Info")
17         %assign logFunction = "LOGI"
18         %break
19     %case CAST("String", "Warn")
20         %assign logFunction = "LOGW"
21         %break
22     %case CAST("String", "Error")
23         %assign logFunction = "LOGE"
24         %break
25     %case CAST("String", "Fatal")
26         %assign logFunction = "LOGF"
27         %break
28     %case CAST("String", "Verbose")
29         %assign logFunction = "LOGV"
30         %break
31     %default
32         %break
33 %endswitch
34
35 %if T_enInput == CAST("String", "on")
36     %assign u0 = LibBlockInputSignal(0, "", "", 0)
37     %<logFunction> << %<T_logMessageBeforeInput> << %<u0> << %<T_logMessageAfterInput>;
38 %else
39     %<logFunction> << %<T_logMessageBeforeInput>;
40 %endif
41
42 %endfunction
43

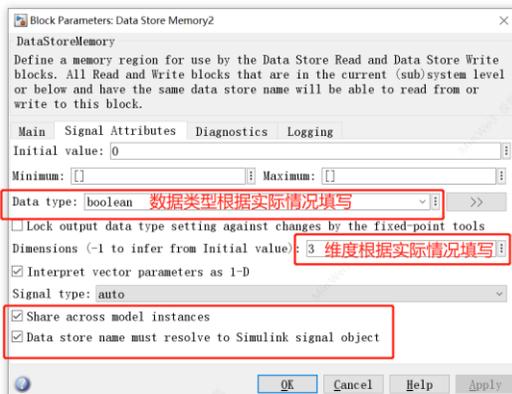
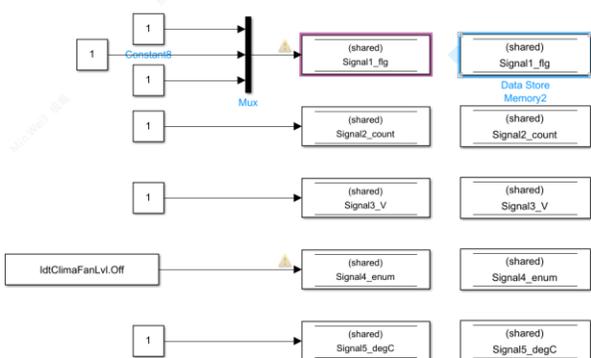
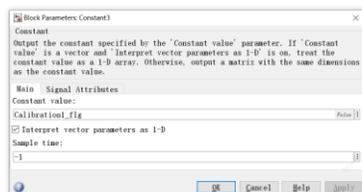
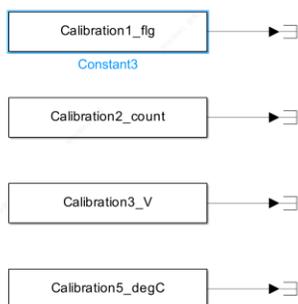
```

需求建模

- 支持以太网XCP的A2L文件生成（可选）
 - 使用Excel管理标定量与观测量，可以导出A2L文件
 - 在模型中创建标定量与观测量



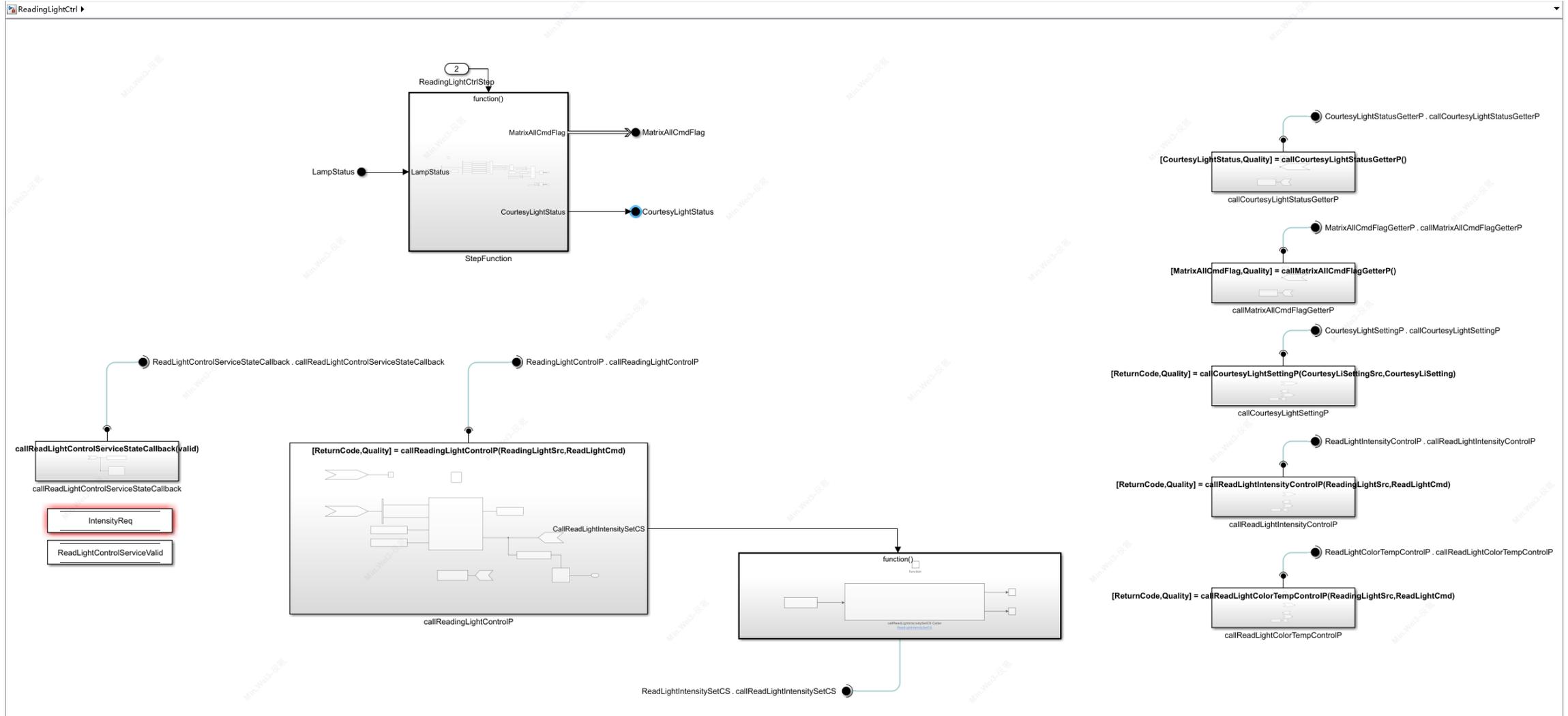
| | A | B | C | D | E | F | G | H | I | J |
|----|--------------------|--------------|----------------------|------|------|-------------|-------|-------------|--------------------------|--------------------------|
| 1 | Name | DefaultValue | DataType | Min | Max | Description | Unit | TableFormat | BreakpointsForDimension1 | BreakpointsForDimension2 |
| 2 | Calibration1_flg | 0 | boolean | 0 | 1 | | flg | Non | | |
| 3 | Calibration2_count | 1 | uint8 | 0 | 255 | | count | Non | | |
| 4 | Calibration3_V | 12 | single | 0 | 1000 | | V | Non | | |
| 10 | Calibration4_enum | | Enum: ldtClimaFanLvl | | | | enum | Non | | |
| 11 | Calibration5_degC | | ldtClimaCmptmtT | -199 | 200 | | degC | Non | | |



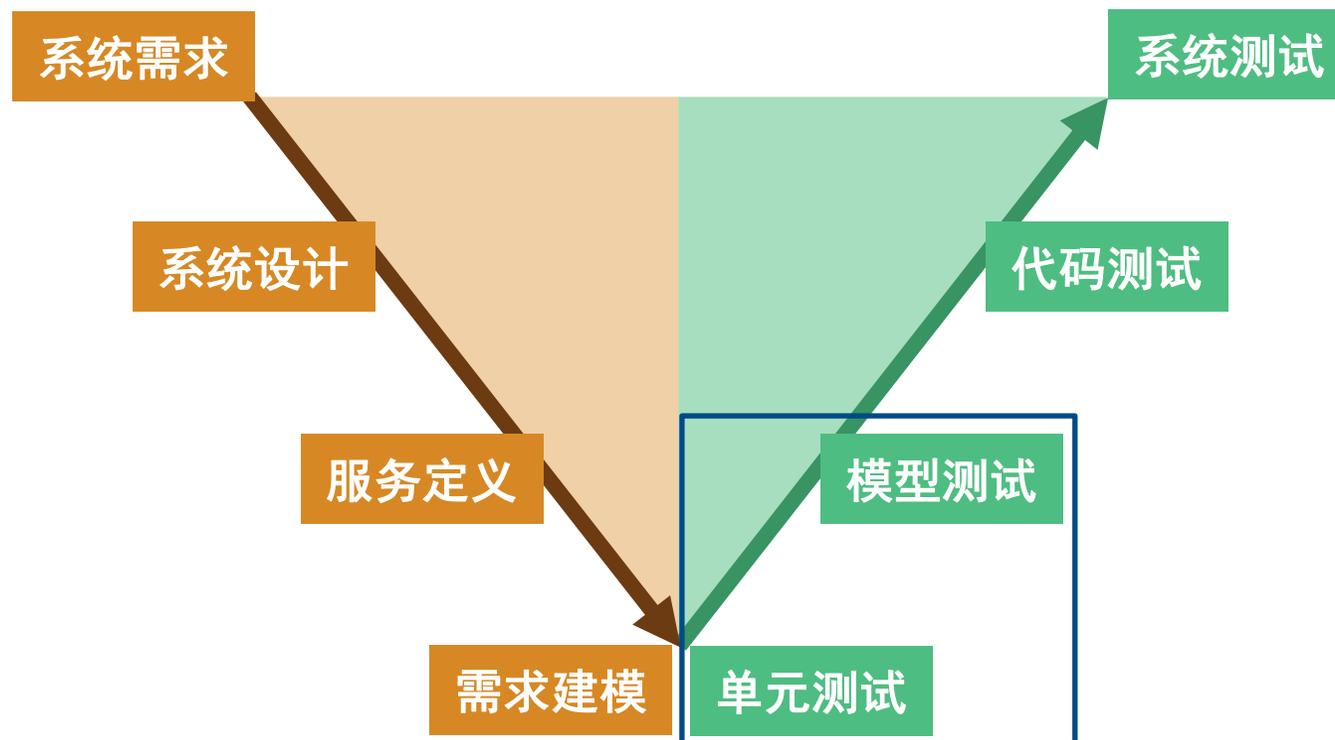
| | A | B | C | D | E | F | G | H |
|---|---------------|--------------|----------------------|------|------|-------------|-------|------------|
| 1 | Name | DefaultValue | DataType | Min | Max | Description | Unit | Dimensions |
| 2 | Signal1_flg | | boolean | 0 | 1 | | flg | 3 |
| 3 | Signal2_count | | uint8 | 0 | 255 | | count | 1 |
| 4 | Signal3_V | | single | 0 | 1000 | | V | 1 |
| 5 | Signal4_enum | | Enum: ldtClimaFanLvl | | | | enum | 1 |
| 6 | Signal5_degC | | ldtClimaCmptmtT | -100 | 200 | | degC | 1 |

需求建模

- 根据实际业务需求，搭建Method和Topic的运行逻辑

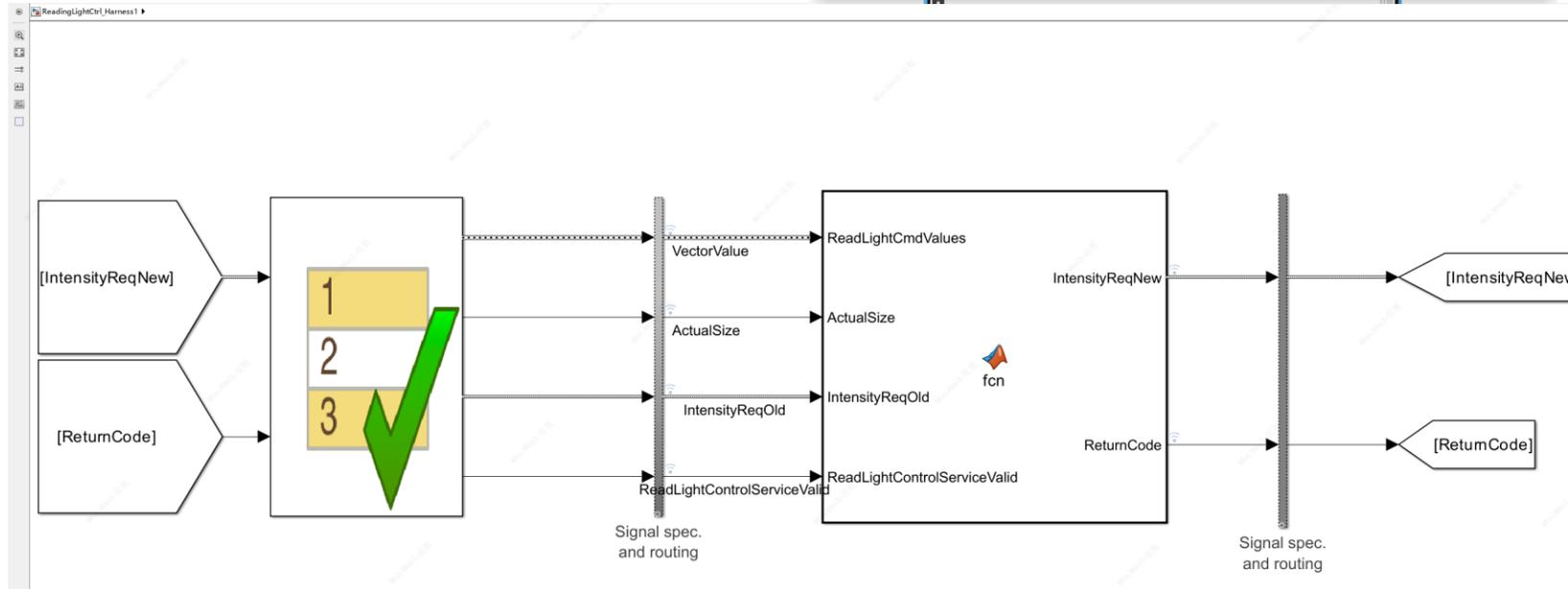
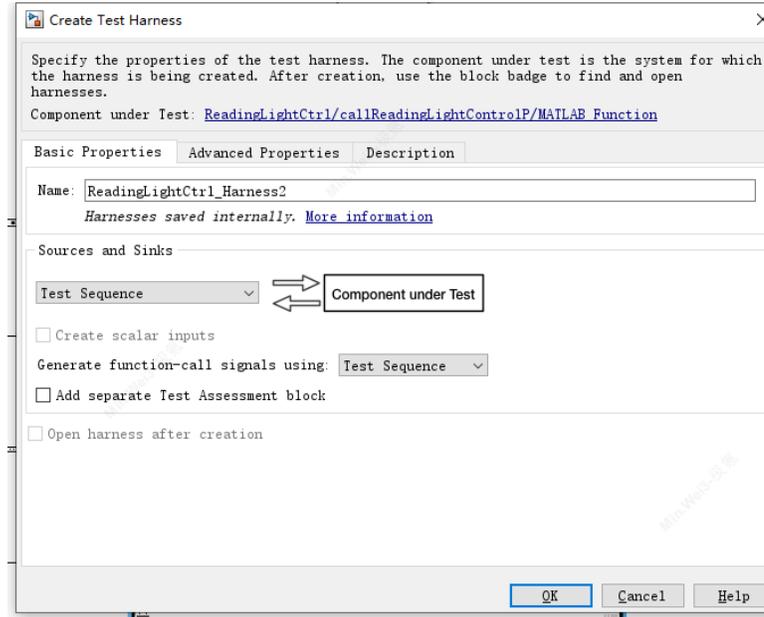


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单元测试

- Test Harness



单元测试

- Test Harness

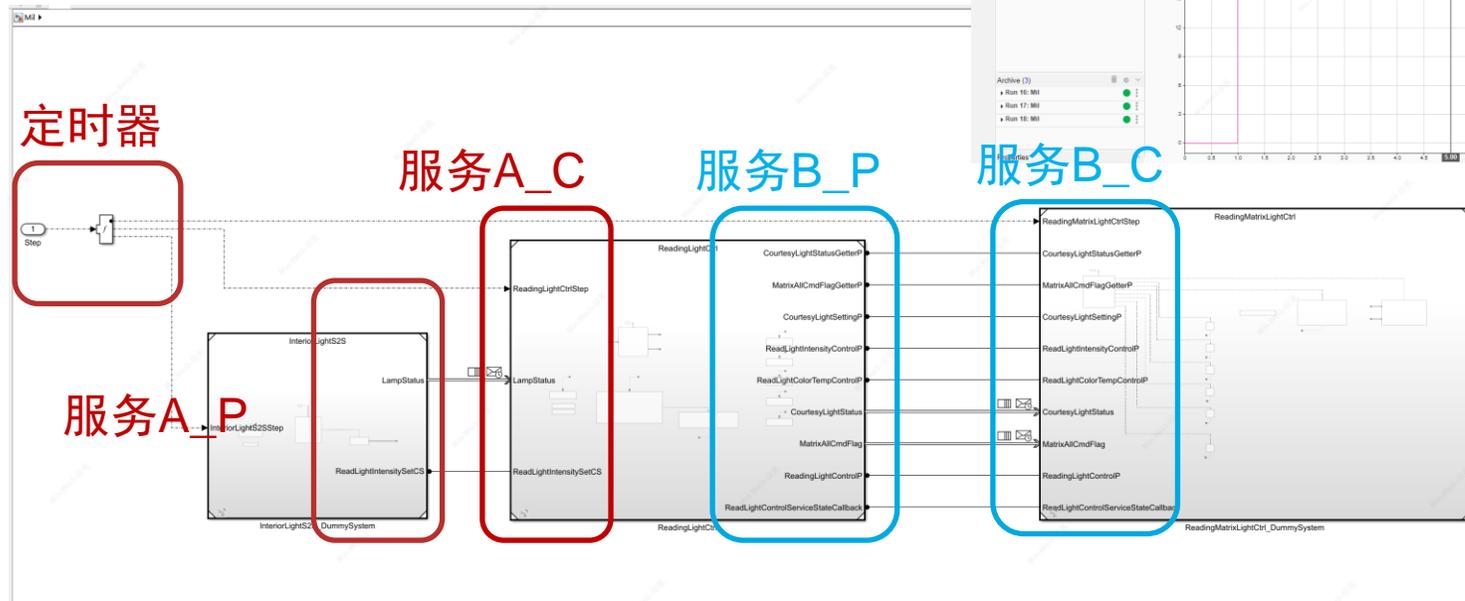
ReadingLightCtrl_Harness1/Test Sequence - Test Sequence Editor

| Step | Transition | Next Step | Description |
|--|----------------|-----------|-------------|
| <pre> Init %% Initialize data outputs. ReadLightCmdValues(1).ReadingLightId = IdtReadingLightId.FLreadingLight; ReadLightCmdValues(1).ReadingLightReq = uint8(0); ReadLightCmdValues = repmat(ReadLightCmdValues(1), 6, 1); % bus array ActualSize = uint16(0); IntensityReqOld.FLReadLightIntensityVal = uint8(0); IntensityReqOld.FRReadLightIntensityVal = uint8(0); IntensityReqOld.FL2ReadLightIntensityVal = uint8(0); IntensityReqOld.FR2ReadLightIntensityVal = uint8(0); IntensityReqOld.FL3ReadLightIntensityVal = uint8(0); IntensityReqOld.FR3ReadLightIntensityVal = uint8(0); ReadLightControlServiceValid = false; </pre> | 1 after(1,sec) | step_1 | |
| <pre> step_1 ReadLightReqOld = IntensityReqNew; ReadLightControlServiceValid = true; ReadLightCmdValues(1).ReadingLightId = IdtReadingLightId.FLreadingLight; ReadLightCmdValues(1).ReadingLightReq = uint8(20); ReadLightCmdValues(2).ReadingLightId = IdtReadingLightId.FL2readingLight; ReadLightCmdValues(2).ReadingLightReq = uint8(30); ReadLightCmdValues(2).ReadingLightReq = uint8(60); ActualSize = uint16(2); </pre> | 1 after(3,sec) | step_2 | |
| <pre> step_2 IntensityReqOld = IntensityReqNew; ReadLightCmdValues(1).ReadingLightId = IdtReadingLightId.FLreadingLight; ReadLightCmdValues(1).ReadingLightReq = uint8(40); ReadLightCmdValues(2).ReadingLightId = IdtReadingLightId.FR2readingLight; ReadLightCmdValues(2).ReadingLightReq = uint8(50); ReadLightCmdValues(3).ReadingLightId = IdtReadingLightId.FR3readingLight; ReadLightCmdValues(3).ReadingLightReq = uint8(60); ActualSize = uint16(3); </pre> | | | |

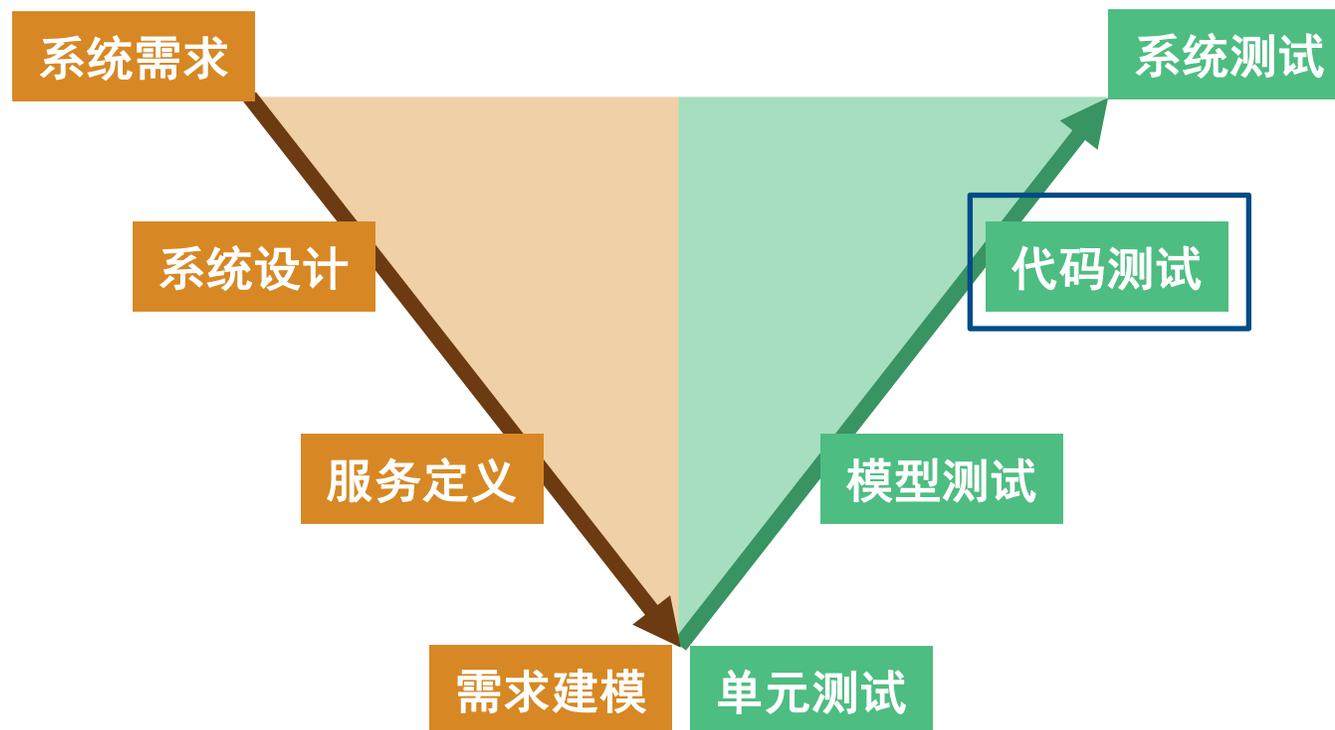


服务模型测试

- 建立对端模型



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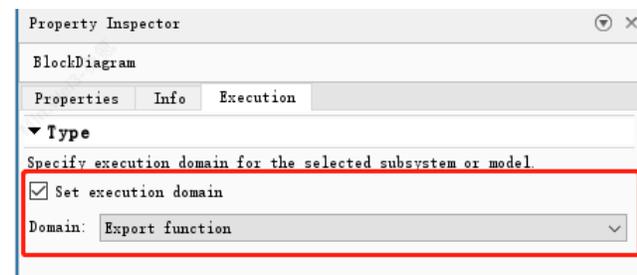
生成Simulink代码并集成到ZEEKR ARK OS

■ SOMOC自动配置模型参数

| Target selection | |
|--------------------------|----------------|
| System target file: | ert.tlc |
| Description: | Embedded Coder |
| Shared coder dictionary: | <empty> |
| Language: | C++ |
| Language standard: | C++11 (ISO) |

| Build process | |
|--|--------------------------|
| <input checked="" type="checkbox"/> Generate code only | |
| <input checked="" type="checkbox"/> Package code and artifacts | |
| Toolchain: | AUTOSAR Adaptive CMake |
| Build configuration: | Faster Builds |
| ▶ Toolchain details | |

| Code generation objectives | |
|-------------------------------------|-------------|
| Prioritized objectives: | Unspecified |
| Check model before generating code: | Off |

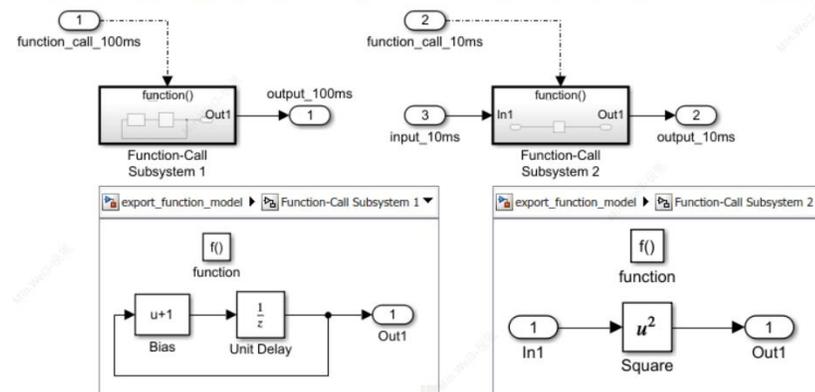


导出函数模型概述

R2024a

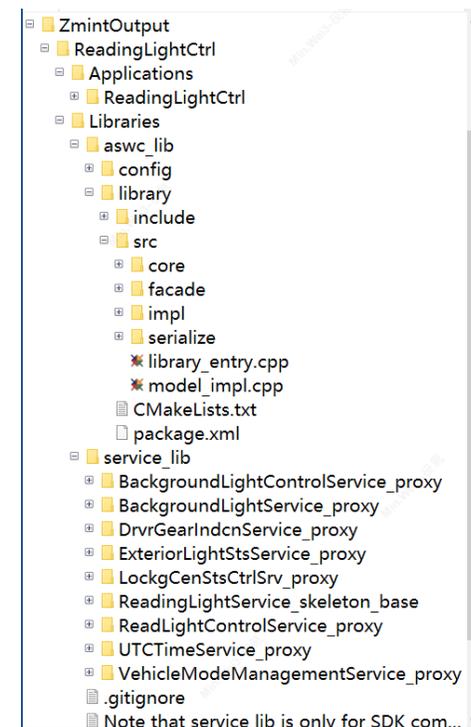
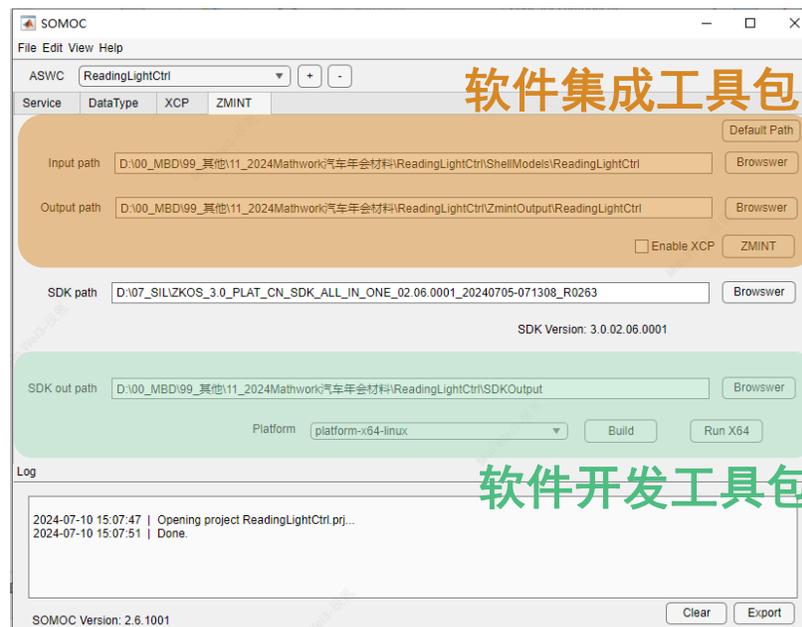
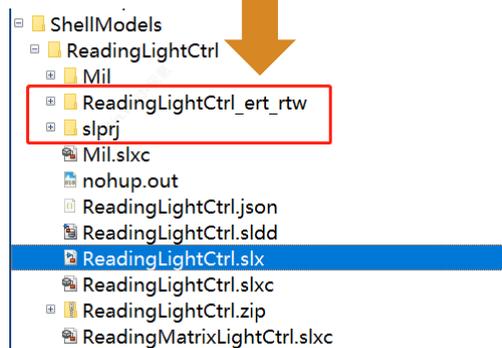
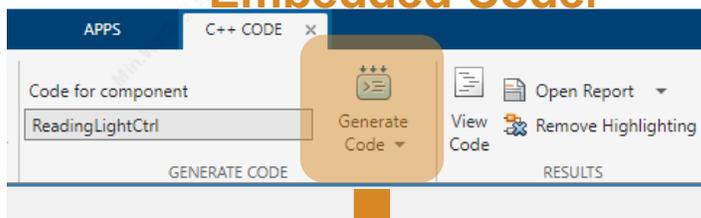
导出函数模型是 Simulink® 模型，它们可以生成可与外部环境和调度器集成的独立函数的代码。函数是使用 Function-Call Subsystem、函数调用 Model、Simulink Function、Message Triggered Subsystem 和 S-Function 模块定义的。

以下导出函数模型包含使用 Function-Call Subsystem 模块定义的两个函数。有关创建此模型的分步过程，请参阅 [Create Export-Function Model](#)。



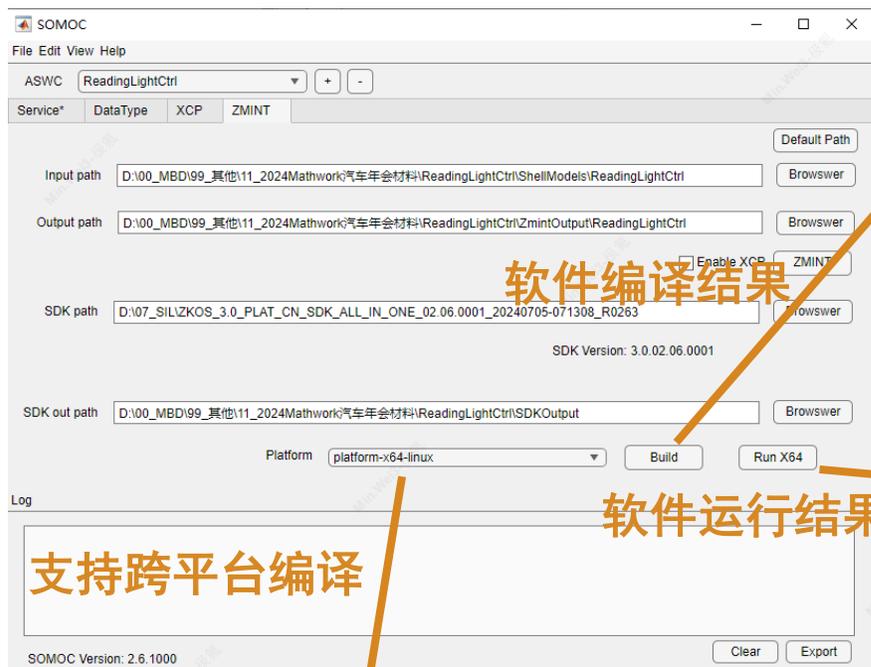
生成Simulink代码并集成到ZEEKR ARK OS

Embedded Coder



代码测试

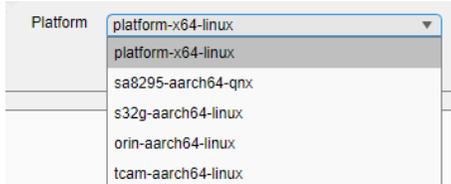
编译与运行APP



软件编译结果

软件运行结果

支持跨平台编译



```

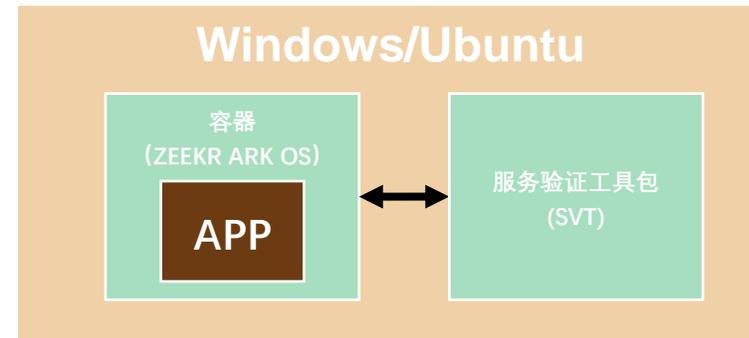
from D:\01\home\zkos_docker\D\00_MBD\99_其他\11_2024Mathwork汽车年会材料\ReadingLightCtrl\Zmi
from D:\01\home\zkos_docker\D\00_MBD\99_其他\11_2024Mathwork汽车年会材料\ReadingLightCtrl\Zmi
[01m[K/home/zkos_docker/D/00_MBD/99_其他/11_2024Mathwork汽车年会材料/ReadingLightCtrl/ZmintOutput/ReadingLightC
1673 | static bool [01:35m[KGetStructValueFromKV[m[K(std::shared_ptr<zkos::iper::kv::KeyValueStorage>4 keyV
|
| [01:35m[K-----[m[K
| [01:35m[K-----[m[K
[01m[K/home/zkos_docker/D/00_MBD/99_其他/11_2024Mathwork汽车年会材料/ReadingLightCtrl/ZmintOutput/ReadingLightC
1439 | static bool [01:35m[KSetStructValueToKV[m[K(std::shared_ptr<zkos::iper::kv::KeyValueStorage>4 keyVal
|
| [01:35m[K-----[m[K
[01m[K/home/zkos_docker/D/00_MBD/99_其他/11_2024Mathwork汽车年会材料/ReadingLightCtrl/ZmintOutput/ReadingLightC
1429 | static bool [01:35m[KGetStructValueFromKV[m[K(std::shared_ptr<zkos::iper::kv::KeyValueStorage>4 keyV
|
| [01:35m[K-----[m[K
[01m[K/home/zkos_docker/D/00_MBD/99_其他/11_2024Mathwork汽车年会材料/ReadingLightCtrl/ZmintOutput/ReadingLightC
1386 | static bool [01:35m[KSetStructValueToKV[m[K(std::shared_ptr<zkos::iper::kv::KeyValueStorage>4 keyVal
|
| [01:35m[K-----[m[K
[01m[K/home/zkos_docker/D/00_MBD/99_其他/11_2024Mathwork汽车年会材料/ReadingLightCtrl/ZmintOutput/ReadingLightC
1376 | static bool [01:35m[KGetStructValueFromKV[m[K(std::shared_ptr<zkos::iper::kv::KeyValueStorage>4 keyV
|
| [01:35m[K-----[m[K
[01m[K/home/zkos_docker/D/00_MBD/99_其他/11_2024Mathwork汽车年会材料/ReadingLightCtrl/ZmintOutput/ReadingLightC
1331 | static bool [01:35m[KSetStructValueToKV[m[K(std::shared_ptr<zkos::iper::kv::KeyValueStorage>4 keyVal
|
| [01:35m[K-----[m[K
[01m[K/home/zkos_docker/D/00_MBD/99_其他/11_2024Mathwork汽车年会材料/ReadingLightCtrl/ZmintOutput/ReadingLightC
1321 | static bool [01:35m[KGetStructValueFromKV[m[K(std::shared_ptr<zkos::iper::kv::KeyValueStorage>4 keyV
|
| [01:35m[K-----[m[K
[01m[K/home/zkos_docker/D/00_MBD/99_其他/11_2024Mathwork汽车年会材料/ReadingLightCtrl/ZmintOutput/ReadingLightC
1098 | static bool [01:35m[KSetStructValueToKV[m[K(std::shared_ptr<zkos::iper::kv::KeyValueStorage>4 keyVal
|
| [01:35m[K-----[m[K
[01m[K/home/zkos_docker/D/00_MBD/99_其他/11_2024Mathwork汽车年会材料/ReadingLightCtrl/ZmintOutput/ReadingLightC
1088 | static bool [01:35m[KGetStructValueFromKV[m[K(std::shared_ptr<zkos::iper::kv::KeyValueStorage>4 keyV
|
| [01:35m[K-----[m[K
make[2]: warning: Clock skew detected. Your build may be incomplete.
make[1]: warning: Clock skew detected. Your build may be incomplete.
---
Finished <<< readinglightservice_skeleton_impl [35.3s]
[0]rcolcon build [10/11 done] [0] ongoing[0]Starting >>> ReadingLightCtrl
[0]rcolcon build [10/11 done] [1] ongoing[0]Finished <<< ReadingLightCtrl [0.58s]
[0]rcolcon build [11/11 done] [0] ongoing[0]
Summary: 11 packages finished [39.0s]
1 package had stderr output: readinglightservice_skeleton_impl
[0] >> |

```

```

root@zkos-build: /home/zkos_docker/D/00_MBD/99_其他/11_2024Mathwork汽车年会材料/ReadingLightCtrl
start run EM!
start run PM!
[0]server done
[0]server running
[0]server done
parse json success: /usr/zkos///platform/modules/libraries//zkos_log/etc/logging_client.json
parse json success: ./etc/logging_client.json
ClientManager-3: config params missing 'log_dir_path!', use default path
Invalid number of arguments
comm_api ->Connect suc
2024/07/08 11:19:27.520402 2879667370 BC_A 0092 SVFW warn [140417699944192 servicemanagerclient.cpp : 152 SendToService
Manager TickHeartBeats SendToServerNotification failed, RegisterServiceRequest(app_name: readinglightctrl service_addr
: ark_service:///ReadLightControlService/1 register_status: kRegister ]]
2024/07/08 11:19:27.615061 2879668316 BC_A 0092 SVFW warn [140417699944192 servicemanagerclient.cpp : 152 SendToService
Manager TickHeartBeats SendToServerNotification failed, RegisterServiceRequest(app_name: service_addr: ark_service:
//ReadingLightService/1 register_status: kRegister ]]
2024/07/08 11:19:27.800040 2879670166 BC_A 0092 COMM error [140417429395200 tcp_role_client.cpp:457 TcpRole
Client connect 10.205.0.1:51889 failed: No route to host]
2024/07/08 11:19:30.520417 2879697370 BC_A 0092 SVFW warn [140417699944192 servicemanagerclient.cpp : 152 SendToService
Manager TickHeartBeats SendToServerNotification failed, RegisterServiceRequest(app_name: readinglightctrl service_addr
: ark_service:///ReadLightControlService/1 register_status: kRegister ]]
2024/07/08 11:19:30.615077 2879698316 BC_A 0092 SVFW warn [140417699944192 servicemanagerclient.cpp : 152 SendToService
Manager TickHeartBeats SendToServerNotification failed, RegisterServiceRequest(app_name: service_addr: ark_service:
//ReadingLightService/1 register_status: kRegister ]]
2024/07/08 11:19:33.520467 2879727370 BC_A 0092 SVFW warn [140417699944192 servicemanagerclient.cpp : 152 SendToService
Manager TickHeartBeats SendToServerNotification failed, RegisterServiceRequest(app_name: readinglightctrl service_addr
: ark_service:///ReadLightControlService/1 register_status: kRegister ]]
2024/07/08 11:19:33.615133 2879728317 BC_A 0092 SVFW warn [140417699944192 servicemanagerclient.cpp : 152 SendToService
Manager TickHeartBeats SendToServerNotification failed, RegisterServiceRequest(app_name: service_addr: ark_service:
//ReadingLightService/1 register_status: kRegister ]]

```



代码测试

▪ 服务验证工具包 (SVT)

The screenshot displays the Service Verification tool within the ZKOS IDE. The interface is divided into several sections:

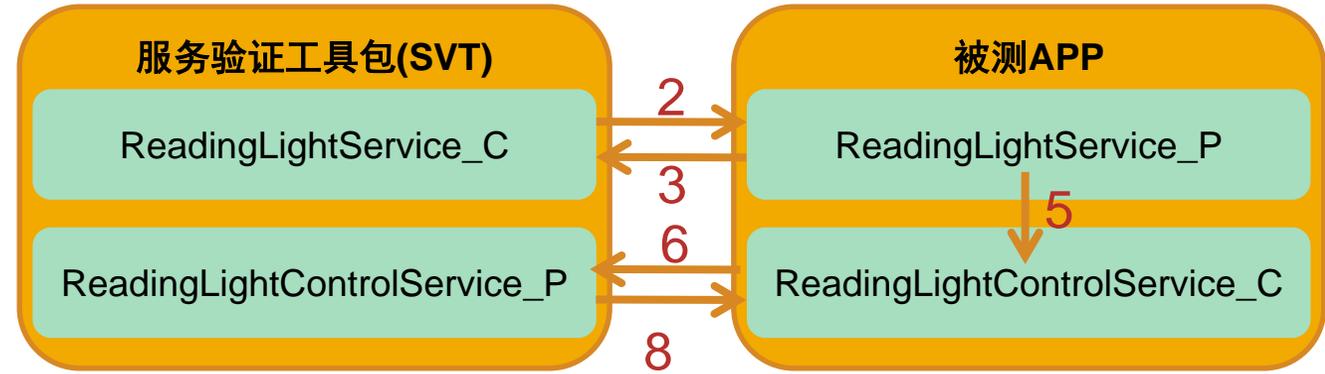
- Left Panel (Toolchain):** Shows the project structure under 'CODE GENERATOR' and 'COMPILATION DEBUGGING TOOLS'. The 'Service Verification' tool is selected under 'VERIFICATION DEBUGGING TOOLS'.
- Service List:** A tree view under 'ARXML File Path' shows a list of services, with 'ReadLightControlService_1' highlighted.
- Provider View:** The selected provider 'ReadLightControlService' is shown with a 'Start' button and a 'Publish' button.
- Topic Table:** A table with columns 'Topic Name' and 'Operations'. It lists several topics, each with a 'Publish' button.
- Request Data Display:** A table with columns 'Timestamp', 'Message Type', 'Method Name', and 'Operations'. It currently shows 'No Data'.

| Topic Name | Operations |
|--|------------------------------|
| <input type="checkbox"/> LampStatus | Parameter settings Publish |
| <input type="checkbox"/> AutoButtonStatus | Parameter settings Publish |
| <input type="checkbox"/> AllonButtonStatus | Parameter settings Publish |
| <input type="checkbox"/> ReadLightIntensityVal | Parameter settings Publish |
| <input type="checkbox"/> ReadLightButtonStatus | Parameter settings Publish |
| <input type="checkbox"/> ReadLiUsability | Parameter settings Publish |

| Timestamp | Message Type | Method Name | Operations |
|-----------|--------------|-------------|------------|
| No Data | | | |

代码测试

SVT 代码测试



Parameter settings

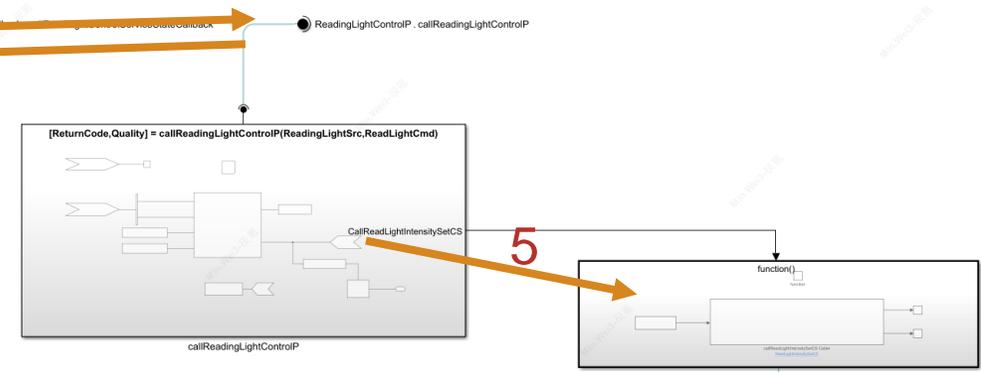
| Key | Value |
|-----------------|----------------|
| ReadingLightSrc | Softinput |
| ReadingLightId | FLreadingLight |
| ReadingLightReq | 30 |
| ReadLightCmd | 60 |

Request Data Display

| Timestamp | Message Type | Method Name | Operations |
|-------------------------|--------------|---------------------|------------|
| 2024-07-09 20:20:17 788 | response | ReadingLightControl | Detail |

```

1 {
2   "methods": [
3     {
4       "method_id": 1,
5       "protocol": "udp",
6       "method_name": "ReadingLightControl",
7       "output": {
8         "ReturnCode": true,
9       }, // 1 entries
10      "input": {}, // 5 entries
11    }, // 1 elements
12  ], // 1 elements
13 }
    
```



```

1 {
2   "methods": [
3     {
4       "method_id": 7,
5       "protocol": "udp",
6       "method_name": "ReadLightIntensitySet",
7       "input": {
8         "IntensityReq": {
9           "FLReadLightIntensityVal": 30,
10          "FRReadLightIntensityVal": 0,
11          "FL2ReadLightIntensityVal": 60,
12          "FR2ReadLightIntensityVal": 0,
13          "FL3ReadLightIntensityVal": 0,
14          "FR3ReadLightIntensityVal": 0,
15        }, // 6 entries
16      }, // 1 entries
17      "output": {}, // 5 entries
18    }, // 1 elements
19  ], // 1 elements
20 }
    
```

Request Data Display

| Timestamp | Message Type | Method Name | Operations |
|-------------------------|--------------|-----------------------|------------|
| 2024-07-09 20:20:17 781 | request | ReadLightIntensitySet | Detail |

代码测试

SVT 代码测试

Provider ReadLightControlService

| Topic Name | Operations |
|-----------------------|------------------------------|
| LampStatus | Parameter settings Publish |
| AutoButtonStatus | Parameter settings Publish |
| AllonButtonStatus | Parameter settings Publish |
| ReadLightIntensityVal | Parameter settings Publish |
| ReadLightButtonStatus | Parameter settings Publish |
| ReadLiUsability | Parameter settings Publish |

Request Data Display

| Timestamp | Message Type | Method Name | Operations |
|-----------|--------------|-------------|------------|
| | | | |

Parameter settings

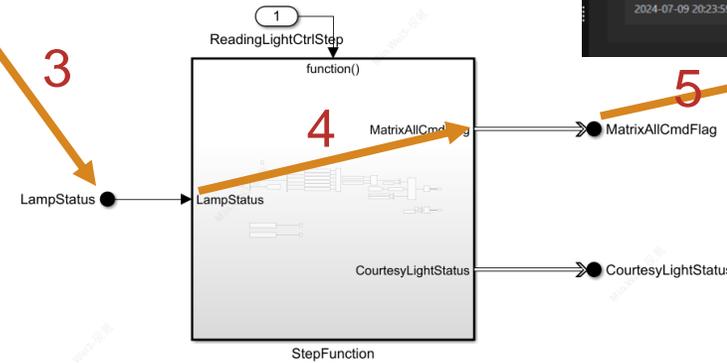
| Key | Value |
|-----------------------|-------|
| data | |
| FLReadingLightStatus | OFF |
| FRReadingLightStatus | OFF |
| FL2ReadingLightStatus | ON |
| FR2ReadingLightStatus | OFF |
| FL3ReadingLightStatus | OFF |
| FR3ReadingLightStatus | OFF |

Consumer ReadingLightService

| Topic | Method | Operations |
|---------------------|--------|----------------------------------|
| Topic Name | | Subscribe |
| CourtesyLightStatus | | Parameter settings Subscribe |
| MatrixAllCmdFlag | | Parameter settings Unsubscribe |

Request Data Display

| Timestamp | Message Type | Method Name | Operations |
|-------------------------|--------------|------------------|------------|
| 2024-07-09 20:23:59 785 | publish | MatrixAllCmdFlag | Detail |

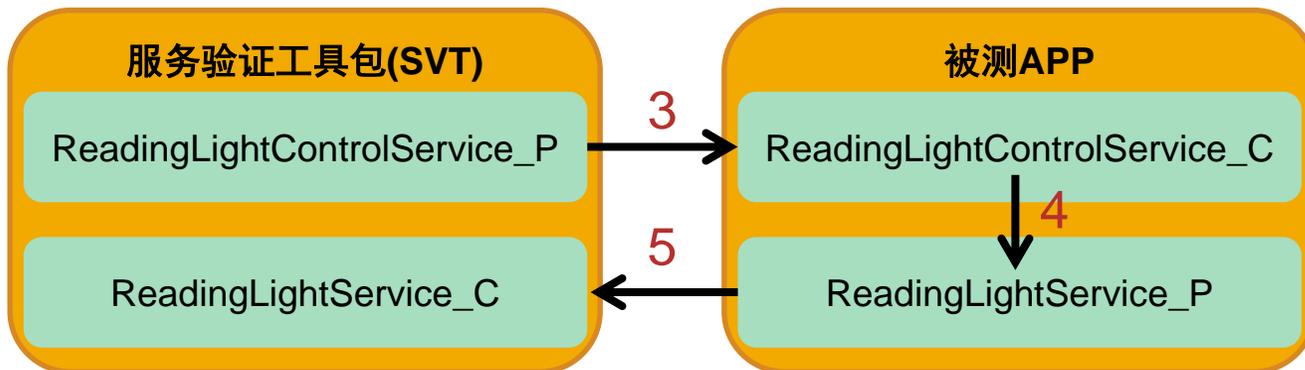


Request Data Display

```

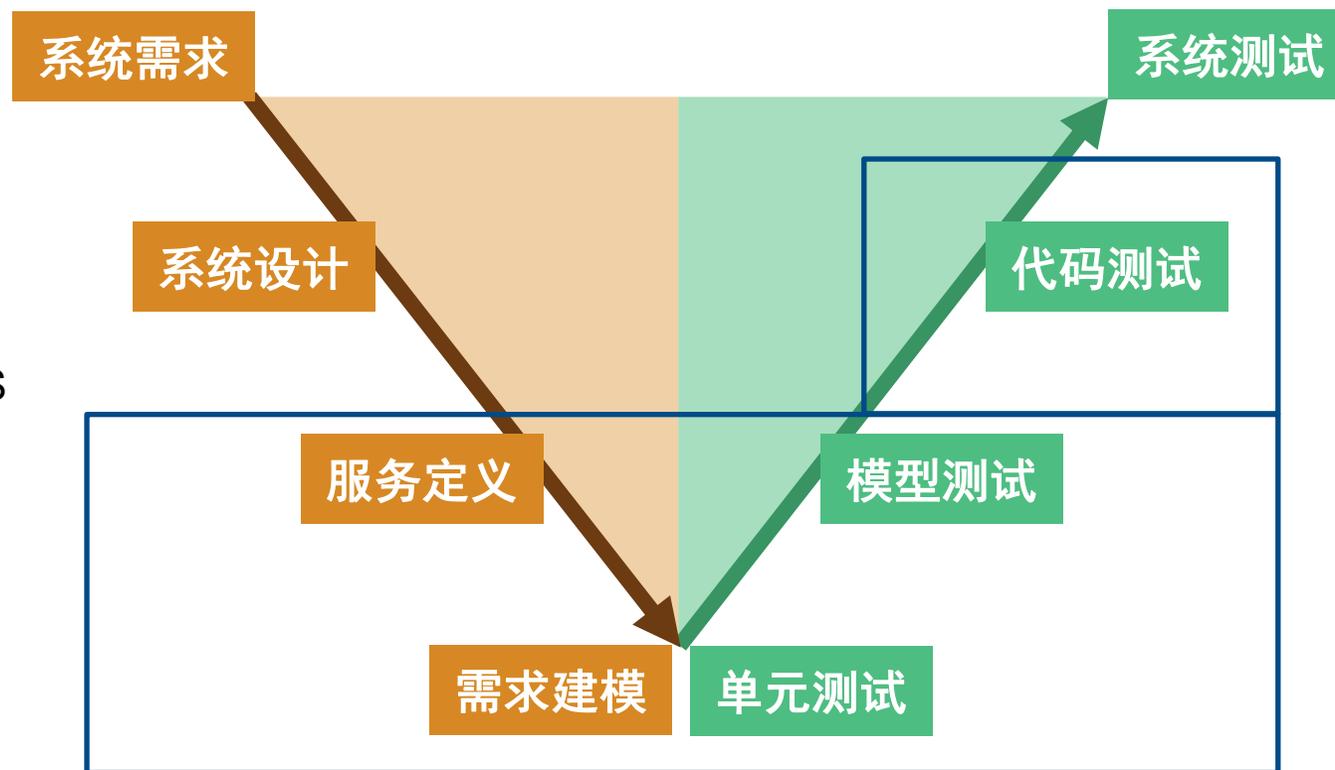
1 {
2   "fields": [
3     {
4       "topic_name": "MatrixAllCmdFlag",
5       "notifier_id": 36866,
6       "protocol": "udp",
7       "eventgroups": [
8         1, // 1 elements
9       ],
10      "input": {
11        "data": 1, // 1 entries
12      },
13      "output": {}, // 6 entries
14    }, // 1 elements
15  ] // 1 entries

```



6.总结

- ZEEKR ARK OS与MATLAB/Simulink结合
- 根据服务信息自动生成服务化的框架模型
- 使用S-Function&TLC封装ZEEKR ARK OS中间件模块
- 使用Test Harness进行测试
- 使用ZEEKR ARK OS的软件开发与测试工具包进行代码测试



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Thank you

