S100 Working Group 5

Taunton, United Kingdom (3-6 March 2020)

KHOA S-100 Testbed Project

1. General Information

- Name of testbed: KHOA S-100 Testbed Project
- Location of testbed: Busan, ROK
- Time and duration of testbed: Ongoing S-100 testbed project
- Contact person(s): Yong Baek, ybaek@korea.kr (Project Manager)
- Testbed website: N/A
- Organization(s) involved : KHOA (Korea Hydrographic and Oceanographic Agency)
- Funding program and budget: KHOA
- Last Edited/Updated: January 30, 2019

2. Executive summary

In relation to the decision to use the Lua-based Portrayal Catalogue, the S-100 TestBed Project of the KHOA updated their tool applying the Lua-based Portrayal Process to the KHOA S-100 Viewer. NIWC provided the Lua Scripting Reference for support of SW based on C++ and described the results applied to KHOA S-100 Viewer.

3. Testbed Information

3.1 The type of user group(s) involved in the test

The relevant user groups of the KHOA S-100 Testbed will be S-100WG members, TSM members, S-100 standard infrastructure development associates, and S-100 product standards development members.

3.2 Details of the S-100 testbed solutions

Through a test, it tests S-100 standard infrastructure such as S-100 registry, FCB, PCB, and validates that S-100 TDS production tools, validation tools, and packaging tools can be enabled.

In addition, data formats such as 8211, GML, BAG, and HDF-5 are used in the S-100 standard, so S-100 Testbed can test S-100 TDS using that data format.

4. Testbed Methodology

4.1 Methodology used for data collection

The following data is prepared for the application of Portrayal Catalogue based on Lua to KHOA S-100 Viewer:

- S-101 ENC Test data
- S-101 FC, PC
- Lua Scripting Reference

4.2 Summary information on testbed respondents / participants

None

4.3 Procedure used in the testbed

4.3.1 Technical solutions used

None

4.3.2 Standards

- S-100 Universal Hydrographic Data Model, ver. 3.0.0
- S-101 ENC Electronic Navigational Chart (ENC)

5. Testbed Results

5.1 Procedure for applying Lua Scripting Reference

To apply the Lua Scripting Reference to the KHOA S-100 Viewer, the KHOA team carried out the following activities:

- LuaScriptingReference C++ code analysis
- LuaScriptingReference INPUT XML/Drawing Instrumentation (LUA) data analysis
- Updated an input XML for an KHOA S-100 Viewer that matches the input XML of the LuascriptingReference
- Handling the Drawing Instrument (LUA) in the KHOA S-100 Viewer

- Validated the KHOA S-100 Viewer application results
- To improve performance, replaced Input XML information in LuaScriptingReference with SENC
- To improve performance, replaced FC on LuaScriptingReference with system FC
- Validated the KHOA S-100 Viewer final results

Lua Scripting Reference has a structure to derive the Drawing Instrumentation by referring to Lua Rule files when input XML and Feature Catalogue are entered in the Reference Code.

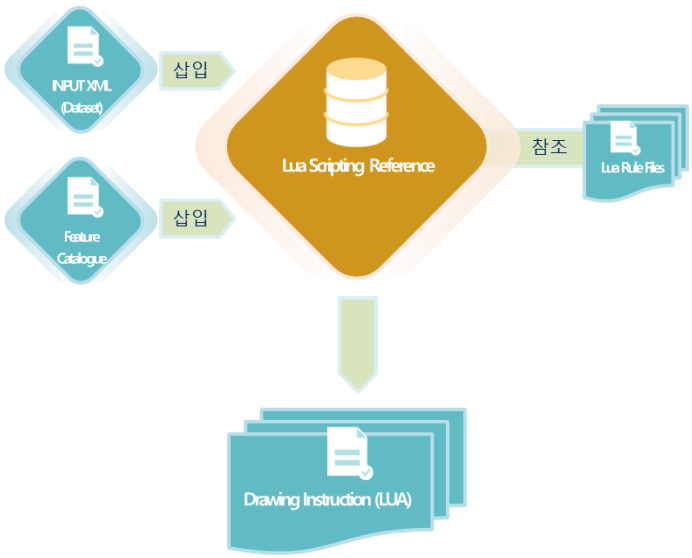

Fig. 1 Structure of Lua Scripting Reference

In accordance with the Lua Scripting Reference structure of Fig. 1, the KHOA team designed a procedure that applies LSR in two stages:

(1) Phase 1

- Create Input XML according to LSR's instructions for use
- Enter the created input XML and Feature Catalogue into the LSR.

(2) Phase 2

- SENC information is transferred to LSR without generating input XML Document
- System FC is transferred to LSR, not FC XML files
- Update the contents of the Host function

5.2 Results of applying Lua Scripting Reference

In Phase 1, S-101 ENC was converted to SENC and Input XML was generated using SENC data.

The S-101 Feature Catalogue file was also entered into the LSR along with Input XML. LSR derived the Drawing Instruction by referring to Lua Rule files. Using this result, S-101 ENC marked successfully as shown in Fig. 2.

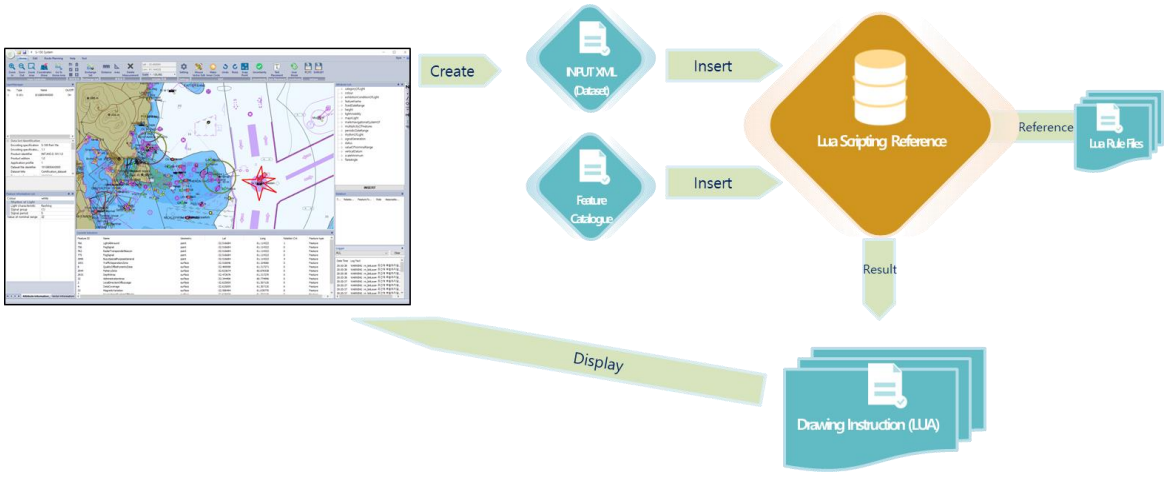

Fig. 2 Approach of Phase 1

Next, in Phase 2, the SENC delivered the information directly to the LSR, without generating the Input XML Document. Feature Catalogue also delivered FC data from System FC not XML files to LSR, to derive the Drawing Instructions in accordance with LSR procedures. S-101 ENC display results were the same as Phase 1.

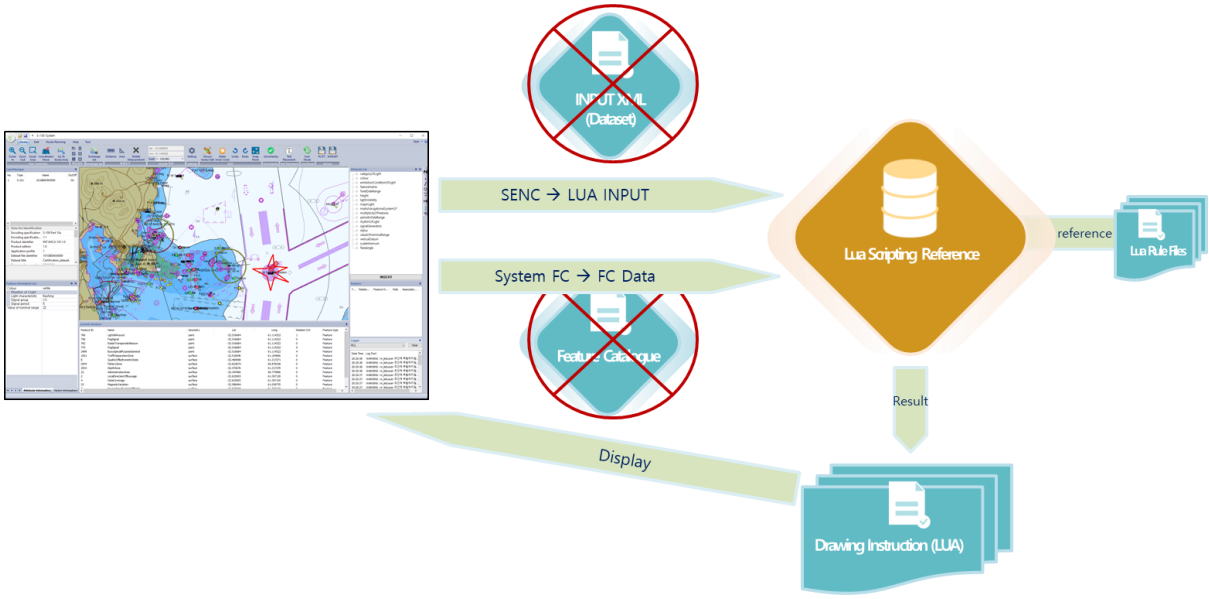

Fig. 3 Approach of Phase 2

S-101 Viewer representation with Phase 1 and Phase 2 were the same, but there was a difference in processing time. Compared to Phase 1 method, Phase 2 method has about 41% improvement in processing speed.

Cell Name (file size)	Round	Using Input XML Case (ms)			Using SENC Case (ms)			comparative processing time (%)
		Input XML Creation Time	Drawing Instruction Processing Time	Total spend time	Input XML Creation Time	Drawing Instruction Processing Time	Total spend time	
101US004NC55M (70KB)	1	17	104	121	-	81	81	67%
	2	15	101	116	-	80	80	69%
	3	16	106	122	-	78	78	64%
101KR00647C05 (484KB)	1	103	311	414	-	267	267	64%
	2	105	320	425	-	262	262	62%
	3	103	301	404	-	272	272	67%
101KR004G3E00 (1176KB)	1	282	739	1,021	-	553	553	54%
	2	278	730	1,008	-	554	554	55%
	3	279	735	1,014	-	571	571	56%
101KR004G3B30 (1764KB)	1	361	1265	1,626	-	953	953	59%
	2	363	1272	1,635	-	991	991	61%
	3	360	1258	1,618	-	933	933	58%
101KR004G3E20 (2945KB)	1	776	2254	3,030	-	1511	1,511	50%
	2	762	2351	3,113	-	1493	1,493	48%
	3	771	2226	2,997	-	1517	1,517	51%
Total Average								59%

5.3 Error in S-101 Lua Rules

Fig. 1 is the result of displaying of KR1F0000 according to the Lua based S-101 PC, confirming that Depth Area near the coastline is greyed out. Depth Area is grayed out as the default background color of the KHOA S-100 Viewer. During the processing Lua rules, an error occurred in Depth area and that area was not displayed.

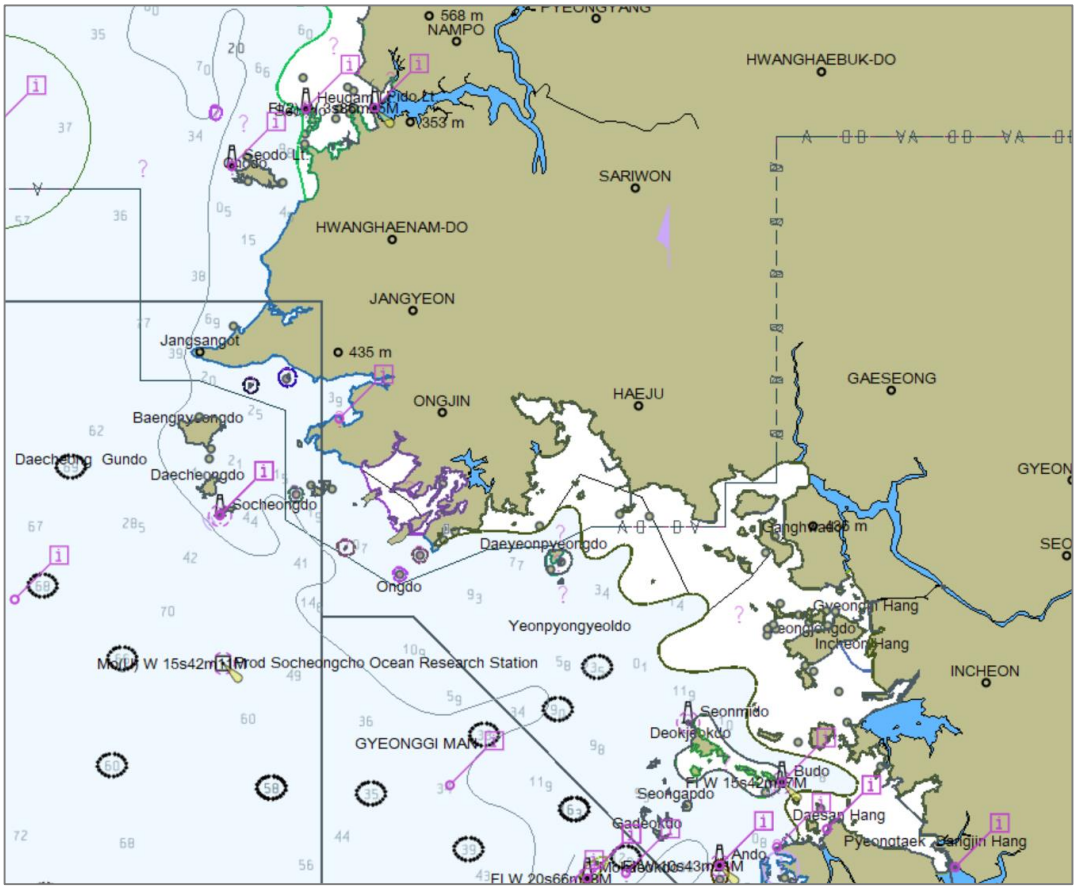

Fig. 4 Case of Lua error

Among Lua files, SEABED01.lua uses a real type value, and the real type value is defined as a table type in the Lua Rules.

```
-- Main entry point for CSP.
function SEABED01(feature, featurePortrayal, contextParameters, depthRangeMinimumValue, depthRangeMaximumValue)
    Debug.StartPerformance('Lua Code - SEABED01')

    local Colour = 'DEPIT'
    local Shallow = true

    if (contextParameters.TwoShades) then
        if (depthRangeMinimumValue >= scaledDecimalZero and (not depthRangeMaximumValue or depthRangeMaximumValue > scaledDecimalZero)) then
            Colour = 'DEPVS'
        end
```

Below is part of the DEPARE03.lua. If DepRangeMinimumValue of DepthArea is not found, -1.0 is assigned to DepthRangeMinimumValue to call SEABED01 Function in Lua Rules. But -1.0 is the real type value not table type value, so an error occurred when comparing the table type and real type in SEABED01.lua.

```
-- Main entry point for CSP.
function DEPARE03(feature, featurePortrayal, contextParameters)
    Debug.StartPerformance('Lua Code - DEPARE03')

    local depthRangeMinimumValue = feature.depthRangeMinimumValue or -1.0
    local depthRangeMaximumValue = feature.depthRangeMaximumValue

    SEABED01(feature, featurePortrayal, contextParameters, depthRangeMinimumValue, depthRangeMaximumValue)

```

It is judged that the above errors are not caused by clarifying the handling of undefined / unknown. It is necessary to clarify the handling of undefined/unknown within Lua.

It is necessary to take the following form:

```
local depthRangeMinimumValue = -1.0
if (feature.depthRangeMininumValue != nil) then
        if (feature.depthRangeMinimumValue == unknown) then
                // do unknown attribute work
        else then
                depthRangeMinimumValue = feature.depthRangeMinumumValue
        end
end
else then
        // do undefined attribute work
end
```

6. Conclusions and Recommendations

6.1 Conclusions

In relation to the provision of LuaScriptingReference C++ Code provided by the NIWC for the C++ based SW development team, the KHOA team focused on applying LSR to the KHOA S-100 Viewer. In order to check LSR applicability, we divided it into Phase 1 and Phase 2. Input XML and Feature Catalogue are delivered based on KHOA S-100 Viewer's data structure. We checked 35% improvement over Phase 1 method in Phase 2.

6.2 Recommendations

NIWC was grateful for providing LSR, allowing the KHOA team to apply Lua-based S-101 PC to the KHOA S-100 Viewer. LSR may need to be updated as the S-101 PC changes, and the IHO also needs to check whether LSR needs to be maintained continuously.

7. Publications

N/A

8. Reference Material

S-100 Edition Ver. 4.0

S-101 ENC Product Specification, FC/PC, TDS

Lua Scripting Reference Document