DNV·GL

VERIFICATION REPORT

ICCP interface of the NetVision FEP version 2.7.5

Adnet, Croatia

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Objective: Verification ICCP Interface of the NetVision FEP

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	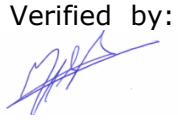	
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1 INTRODUCTION

Adnet has implemented the IEC 60870-6 TASE.2 (ICCP) data communication protocol for the communication between control centres. Adnet asked DNV GL to verify this ICCP interface in the Adnet NetVision FEP Server with firmware version 2.7.5, further referred to as SUT. The scope for this ICCP test is ICCP version 1996-08 (Edition 1) and version 2000-08 (Edition 2) and the following conformance blocks:

- Block 1 – Basic Services
- Block 2 – Extended Dataset Condition Monitoring
- Block 5 – Device Control

Chapter 2 gives an overview of the test configuration, test description and test cases. In chapter 3 an overview of the test results and in chapter 4 the detailed test results are described. The conclusions and recommendations are described in chapter 5.

1.1 References

The referenced and normative documents are:

[1] IEC 60870-6-503 TASE.2 Services and protocol; Edition 3. 2014

[2] IEC 60870-6-702: Functional profile for providing the TASE.2 application service in end systems; Edition 2; 2014

[3] IEC 60870-6-802 TASE.2 Object models; Edition 3; 2014

Other Documentation:

[4] TASE.2 Protocol Interoperability for NetVision FEP Server v2.7.5; 14 February 2019

2 TEST CONFIGURATION AND TESTCASES

2.1 Configuration for testing

The test configuration consists of the local Adnet EMS system, a redundant pair of Adnet NetVision FEP servers, two DNV GL ICCP test simulators, connected via a LAN network. To capture the TASE.2 data the Ethernet Hub is a non-Switchable Hub. Figure 1 gives an overview of the test configuration.

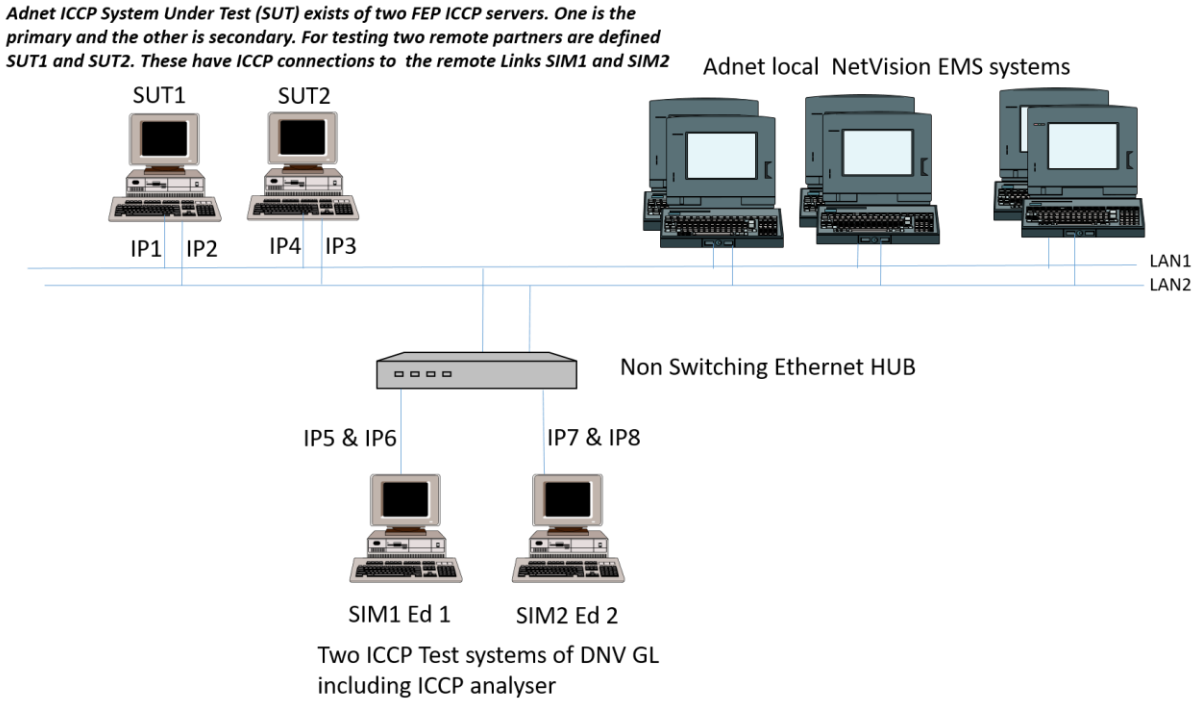


Figure 1: Test Configuration

The IP-numbers used are defined as below.

- SUT1: IP1=192.168.178.1 and IP2=192.168.178.2
- SUT2: IP3=192.168.178.3 and IP4=192.168.178.4
- SIM1: IP5=192.168.178.5 and IP6=192.168.178.6
- SIM2: IP7=192.168.178.7 and IP8=192.168.178.8

2.2 DNV GL test systems

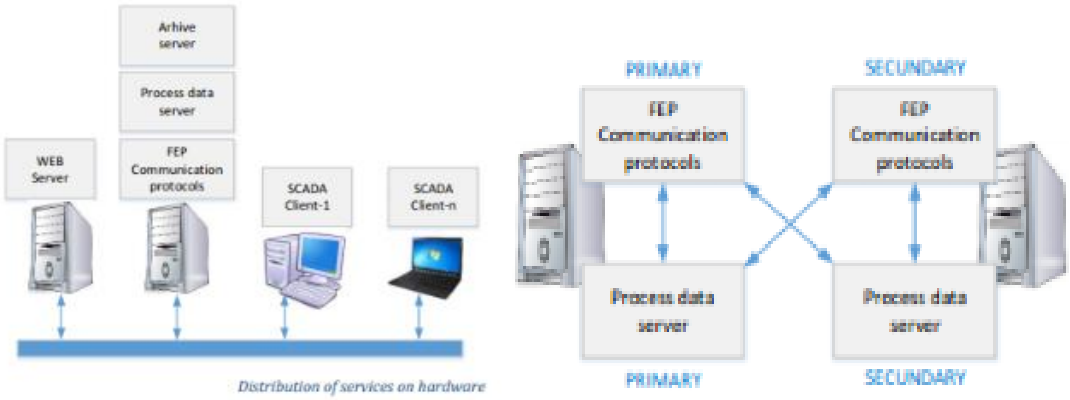
The two ICCP test systems supplied by DNV GL consist of two laptop computers running simultaneously the DNV GL ICCP simulator software and the ICCP analyser software. One of the simulators supports Edition 2 of the ICCP test software (SIM2). The other one supports the Edition 1 of the software (SIM1).

The ICCP Test simulators are configured to set-up of the ICCP links with the Adnet systems and simulate the ICCP traffic to test the ICCP interface. SIM1 and SIM2 have different configurations and different Data objects and should act as two different remote partners.

DNV GL ICCP analyser captures and analyses the ICCP communication traffic. It displays the ICCP communication packets in human readable format, automatically analyses the packets, and reports the detected errors as it contains all ICCP and under laying protocol definitions.

2.3 Adnet ICCP systems (SUT1 and SUT2)

The NetVision SCADA system is using a Client-server architecture. Several servers and clients can be installed on one machine, or they can be installed in a distributed fashion, on as many machines as there are services or clients. This makes the system distributed and scalable. Critical components can be made redundant in a dual configuration, installed on two machines (dual hot standby). The distributed system architecture is shown below. The same architecture is used for testing.



Distribution of services on hardware

The ICCP implementation is redundant on the server level where one server is primary, and the other server is in hot standby mode. The servers are also redundant on connection level with double LANs.

For the interoperability test, the Webserver for interacting with the process data server is used to change values or display the received values from the SIM1 and SIM2 simulators.

For testing, two partners (SUT1 and SUT2) are configured and running on the primary FEP server. When problems arise, a switchover will take place to the secondary FEP server.

The Adnet ICCP systems are configured as shown in Figure 1 and Appendix 1. The I/O database of the Adnet ICCP system has been configured by the Adnet expert at DNV GL test lab as follows:

- The database on the local Adnet EMS host has some minimal configuration requirements that must be implemented. This includes defining the number of active communication channels, their identification, the network name of the Adnet nodes etcetera;
- The Adnet ICCP database is configured in accordance with the remote partners. This includes the configuration of a set of agreed upon data points, data and transfer sets defining the points, reporting frequency etc.

2.4 Configuration files

Appendix 1 describes for the association parameters for both links between Adnet system (ICCP servers SUT1 and SUT2) and DNV GL SIM1 and SIM2 ICCP simulators

2.5 Test Description

This paragraph gives an overview of the test groups, which are part of the ICCP test. The test procedures of each group apply only for testing the functional aspects of the implementation and will follow the requirements of the conformance blocks (CB) 1, 2 and 5. It is not a "complete" conformance test, as defined by ISO as for other IEC protocols is available and will therefore not result in a certificate.

In each test case of a test group, the functionality is observed and compared to the applicable ICCP standard documents. Performance aspects are not tested. Redundancy testing are included in the ICCP test.

The test groups are:

1) Associations (CB1)
2) Periodic Data Transfer (CB1)
3) Spontaneous Data Transfer (CB2)
4) Remote Commands (CB5)
5) Connection Management (CB1)
6) Configuration Errors (Negative testing)
7) Redundancy (General)
8) Documentation (General)

3 OVERVIEW OF TEST RESULTS

This chapter gives an overview of the test results. The tests are passed when the test case could be executed with or against the SUT, which operates and follows the ICCP standard. The configuration error tests are passed when the SUT reports/logs the error and continues normal operation after the error has been resolved.

In case other behaviour has been seen a remark and/or improvement has been added.

The possible test result are:

1) **√** = Passed
2) **√, remark** = Passed with remark
3) **√, improve** = Passed with recommendation
4) **X** = Failed
5) **X, remark** = Failed with remark

The detailed test results are described in chapter 4.

Test Group	Test Case and number	Result/Remarks
Association, $4.1	4.1.1 SUT ICCP System Start-up Test	√
	4.1.2 Start Association (Remote Partner Link Online/Offline	√
	4.1.3 Association Abort	√
	4.1.4 Multiple partners (associations)	**√, remark**
	4.1.5 WAN Network Error	√
	4.1.6 Association Conclude	√
Periodic data, $4.2	4.2.1 Receive Periodic Data Point	√
	4.2.2 Send Periodic Data Point	**√, improve**
Spontaneous data, $4.3	4.3.1 Receive Spontaneous Data	√
	4.3.2 Send Spontaneous Data	**√, improve**
	4.3.3 Possibility to send same signal to SIM1 and SIM2 (with different object name)	√
	4.3.4 Possibility to send same signal to SIM1 and SIM2 (with same object name)	√

Test Group	Test Case and number	Result/Remarks
Remote commands, $4.4	4.4.1 Send Remote Commands	√
	4.4.2 Receive Remote Commands	√
Connection management, $4.5	4.5.1 SUT ICCP System Start-up after power failure	√
		√
Configuration errors, $4.6	4.6.1 Association Parameters Mismatch	√
	4.6.2 ICCP version mismatch	√
	4.6.3 Data Set with mismatching data value name, type or scope	√
	4.6.4 Too many data values in data set	√
	4.6.5 Other configuration mismatches	√
	4.6.6 Command mismatches	√
Redundancy tests, $4.7	4.7.1 Switch over at SIM1	√
	4.7.2 Switch over at SIM2	√
	4.7.3 Switch over between LAN's	√
	4.7.4 Behaviour of FEP1/2 when it crashes/will be stopped	√
Documentation and version control, $4.8	4.8.1 Documentation	**√, remark**
	4.8.2 Version control	√

4 TEST RESULTS

This chapter describes the test results of the executed ICCP test cases. For each test group the details are described in a separate paragraph. Each test case starts with a *Title name* then the *Type of Test* is given followed by *References [2]* and by *Conformance Building Blocks.* Then *Test Objectives* are given and finally the *Results* and *Remark/Improvement* when applicable.

4.1 Association Tests

Test 4.1.1: SUT ICCP System Start-up Test

Type of Test

- [**X**] Standard
- [ ] DNV GL
- [ ] Customer specific

References

- PICS Tables A.1

Conformance Building Block

- Test Associations (CB1)

Test Objectives

Verify that SUT becomes operational when the EMS system is started.

Results

Passed

Test 4.1.2: Start Association (Remote Partner Link Online/Offline Control)

Type of Test

- [**X**] Standard
- [ ] DNV GL
- [ ] Customer specific

References

- PICS Tables A.1, A.2, A.3, A.48, A.52, A.53, A.54

Conformance Building Block

- Test Associations (CB1)

Test Objectives

Verify that a client connection to a remote partner can be made online (ON) and offline (OFF) from the EMS display.

Results

Passed

Test 4.1.3: Association Abort

Type of Test

- [**X**] Standard
- [**X**] DNV GL
- [ ] Customer specific

References

- PICS Tables A.1, A.2, A.3, A.48, A.52, A.53, A.54, A.57

Conformance Building Block

- Test Associations (CB1)

Test Objectives

Verify that an association can be properly aborted.

Results

Passed

Test 4.1.4: Multiple partners (associations)

Type of Test

- [**X**] Standard
- [**X**] DNV GL
- [ ] Customer specific

References

- PICS Tables A.1, A.2, A.3, A.4, A.5, A.7, A.8, A.48, A.52, A.53, A.54

Conformance Building Blocks

- Test Associations (CB1)
- Test Periodic Data Transfer (CB1)
- Test Spontaneous Data Transfer (CB2)

Test Objectives

Verify that the SUT can set up connections with more than 2 remote partners. Tested with 4 remote partners

Results

Passed with Remark (see below)

Remark:

It showed that each configuration requires unique combination of TSEL/SSEL/PSEL for the Server part of the configurations.

For dual connections (combined on one connection), it showed that the TSEL for client/server needs to be the same for the Client and Server and must thus be unique within the FEP.

When activating an updated configuration for one partner it breaks the connections with other partners also. This is a consequence of handling multiple partners in one process and letting the process restart.

Test 4.1.5: WAN Network Error

Type of Test

- [**X**] Standard
- [**X**] DNV GL
- [ ] Customer specific

References

- PICS Tables A.1, A.48, A.52, A.53, A.54, A.57

Conformance Building Blocks

- Test Associations (CB1)
- Test Periodic Data Transfer (CB1)
- Test Spontaneous Data Transfer (CB2)

Test Objectives

Verify that a break in the WAN network connection properly aborts a connection and the associated data points are marked as Telemetry failed on the EMS Database. When the network failure is resolved, the connection is re-established

Results

Passed

Test 4.1.6: Association Conclude

Type of Test

- [**X**] Standard
- [**X**] DNV GL
- [ ] Customer specific

References

- PICS Tables A.1, A.2, A.3, A.17, A.48, A.52, A.53, A.54, A.3

Conformance Building Blocks

- Test Associations (CB1)
- Test Periodic Data Transfer (CB1)
- Test Spontaneous Data Transfer (CB2)

Test Objectives

Verify an association can be properly concluded.

Results

Passed

4.2 Periodic Data

Test 4.2.1: Receive Periodic Data Point

Type of Test

- [**X**] Standard
- [ ] DNV GL
- [ ] Customer specific

References

- PICS Tables A.4, A.5, A.7, A.8, A.38

Conformance Building Block

- Test Associations (CB1)
- Test Periodic Data Transfer (CB1)

Test Objectives

Verify that analogue and status values are received from the remote EMS partner as per requested periodicity.

Results

Passed

The mapping of quality bits from ICCP to SUT is as follows for all data types:

- Held → Bad Remote Src
- Suspect → Bad Remote Src
- Invalid → Bad Remote Src
- Computed → Good Calculated
- Manually → Good Manual Entry
- Estimated → Good Calculated
- Held + Computed → Bad Calculated
- Held + Manually → Bad Manual Entry
- Held + Estimated → Bad Calculated

Test 4.2.2: Send Periodic Data

Type of Test

- [**X**] Standard
- [ ] DNV GL
- [ ] Customer specific

References

- PICS Tables A.4, A.5, A.7, A.8, A.38

Conformance Building Block

- Test Associations (CB1)
- Test Periodic Data Transfer (CB1)

Test Objectives

Verify that the data for periodic analogues or status values are send to the remote partner in the desired interval.

Results

Passed with recommendation

The mapping of quality bits from SUT to ICCP is as follows for all datatypes:

- Held ← Bad
- Telemetered ← Good
- Telemetered + Computed ← Good Calculated
- Telemetered + Manually ← Good Manual Entry
- Held + Computed ← Bad Calculated
- Held + Manually ← Bad Manual Entry

Improvement

The Adnet system does not signal a TransferSet-Start with some unexpected parameters.

- Interval-condition used and Interval-value = 0

The logging shows this receiving but it results in not sending periodic data. It would be better if this situation would reject the TransferSet-Start.

4.3 Spontaneous Data

Test 4.3.1: Receive Spontaneous Data

Type of Test

- [**X**] Standard
- [ ] DNV GL
- [ ] Customer specific

References

- PICS Tables A.4, A.5, A.7, A.8, A.38

Conformance Building Blocks

- Test Associations (CB1)
- Test Spontaneous Data Transfer (CB2)

Test Objectives

Verify that the data for analogue or status point is reported on change of value (COV) or state for a connected link.

Results

Passed

Test 4.3.2: Send Spontaneous Data

Type of Test

- [**X**] Standard
- [ ] DNV GL
- [ ] Customer specific

References

- PICS Tables A.4, A.5, A.7, A.8, A.38

Conformance Building Blocks

- Test Associations (CB1)
- Test Spontaneous Data Transfer (CB2)

Test Objectives

Verify that the data for analogue or status points defined as an exception point is transferred on change of value to the connected remote partner.

Results

Passed with recommendation

Improvement

OnIntegrity with Integrity=0, was not rejected but was not sending integrity data. We recommend to reject this combination.

OnChange with RBE=false and OnIntegrity with Integrity=30, was not sending events. We recommend to reject this combination.

Test 4.3.3: Possibility to send same signal to SIM1 and SIM2 (with different object name)

Type of Test

- [ ] Standard
- [**X**] DNV GL
- [ ] Customer specific

References

- PICS Tables A.4, A.5, A.7, A.8, A.38

Conformance Building Blocks

- Test Associations (CB1)
- Test Spontaneous Data Transfer (CB2)

Test Objectives

Verify that the data for a specific status point **SUT1_SIM1_061_S** in SUT1 server and status point **SUT2_SIM2_061_S** in SUT2 server defined also as an exception point is transferred on change to both connected remote partners SIM1 and SIM2 when that value is updated in Local EMS system.

Results

Passed

Test 4.3.4: Possibility to send same signal to SIM1 and SIM2 (with same object name)

Type of Test

- [ ] Standard
- [**X**] DNV GL
- [ ] Customer specific

References

PICS Tables A.4, A.5, A.7, A.8, A.38

Conformance Building Blocks

- Test Associations (CB1)
- Test Spontaneous Data Transfer (CB2)

Test Objectives

Verify that the data for a specific status point **SUTX_SIM_062_S** defined as an exception point is transferred on change of value to both connected remote partners SIM1 and SIM2 when that value is updated in Local EMS system. An extra objective is that an object name with $ character must be useable within Adnet system

Results

Passed

4.4 Remote Commands

Test 4.4.1: Send Remote Commands

Type of Test

- [**X**] Standard
- [ ] DNV GL
- [ ] Customer specific

References

- PICS Tables A.2, A.12

Conformance Building Blocks

- Test Associations (CB1)
- Test Periodic Data Transfer (CB1) and /or Test Spontaneous Data Transfer (CB2)
- Test Remote Commands (CB5)

Test Objectives

Verify that the SUT can issue remote status, discrete and set point commands, via the Select Before Operate (SBO) procedure or Non-SBO (Direct Execute) procedure and can set/get a tag. Verify the error messages when the remote partner does not process the command or within the configured time. Verify if the SUT can change a remote tap changer position.

Results

Passed

Test 4.4.2: Receive Remote Commands

Type of Test
- [**X**] Standard
- [ ] DNV GL
- [ ] Customer specific

References
- PICS Tables A.2, A.12

Conformance Building Blocks
- Test Associations (CB1)
- Test Periodic Data Transfer (CB1) and /or Test Spontaneous Data Transfer (CB2)
- Test Remote Commands (CB5)

Test Objectives

Verify that the SUT can handle status, discrete and set point commands from remote partner, via the Select Before Operate (SBO) procedure or Non-SBO procedure and handle set/get a tag. Verify the error messages when the remote partner does not send the operate messages after the select within the configured time.

Results

Passed

4.5 Connection Management

Test 4.5.1: SUT ICCP System Start up after power failure

Type of Test
- [ ] Standard
- [ ] DNV GL
- [**X**] Customer specific

References
- n/a

Conformance Building Block
- Test Associations (CB1)
- Test Connection Management (CB1)

Test Objectives

Verify that the SUT re-establishes the connections with the EMS and automatically connects to the remote partners after a power failure or restart.

Results

Passed

4.6 Configuration Errors

Test 4.6.1: Association Parameters Mismatch

Type of Test
- [**X**] Standard
- [ ] DNV GL
- [ ] Customer specific

References
- PICS Tables A.52, A.53, A.54

Conformance Building Block
- Test Associations (CB1)

Test Objectives

Verify that the SUT reports an understandable error message when a configurable association parameter does not match with the remote system.

Results

Passed

Test 4.6.2: ICCP Version Match

Type of Test
- [**X**] Standard
- [ ] DNV GL
- [ ] Customer specific

References
- PICS Tables A.43

Conformance Building Block
- Test Associations (CB1)

Test Objectives

Verify associations are established only when the ICCP Version matches between client and server.

Results

Passed

Test 4.6.3: Data Set with mismatching data value name, type or scope

Type of Test

- [**X**] Standard
- [ ] DNV GL
- [ ] Customer specific

References

- PICS Tables A.4, A.5

Conformance Building Block

- Test Associations (CB1)

Test Objectives

Verify the SUT reports an understandable error messages when it creates a dataset transfer on the remote system with a mismatching data value name or scope. Verify that removing the mismatching data value from the data set and retrying to create the dataset transfer is successful. If only the data value type is mismatching, the dataset is created but on each datavalue transfer the SUT should report an error.

Results

Passed

Test 4.6.4: Too many data values in data set

Type of Test

- [**X**] Standard
- [ ] DNV GL
- [ ] Customer specific

References

- PICS Tables A.5

Conformance Building Block

- Test Associations (CB1)

Test Objectives

Verify the SUT reports understandable error messages when the system administrator configured to many data values in one data set (e.g. there could be a fixed limit of 300 points per dataset but depends on the data object length). Further on the maximum possible number of objects in a dataset is depending on the Max MMS PDU length.

Results

Passed

Test 4.6.5: Other configuration mismatches

Type of Test

- [**X**] Standard
- [ ] DNV GL
- [ ] Customer specific

References

- PICS Tables A.4, A.5, A.11

Conformance Building Block

- Test Associations (CB1)

Test Objectives

1) Object name not available
2) Data type not matching (in config) but name matching
3) Scope not matching (in config) but name matching
4) DSTS (Data Set Transfer Set) with Interval=3
5) Number of TS
6) Number of DS
7) Number of variables
8) Asking for special variables

Results

Passed

Test 4.6.6: Command mismatches

Type of Test
- [**X**] Standard
- [ ] DNV GL
- [ ] Customer specific

References
- PICS Tables A.4, A.5, A.12

Conformance Building Block
- Test Associations (CB1)

Test Objectives
1) Data type not matching
2) Scope not matching
3) Command ON while ON
4) Command OFF when OFF
5) Command BETWEEN is not allowed
6) SBO without doing the Execute (select time out)

Results
Passed

4.7 Redundancy Tests

Test 4.7.1: switch over at SIM1

Type of Test
- [**X**] Standard
- [ ] DNV GL
- [ ] Customer specific

References
- PICS Tables A.1, A.2, A.3, A.52, A.53, A.54, A.55, A.56, A.57

Conformance Building Block
- Test Associations (CB1)

Test Objectives
Verify that SUT1 reconnects to SIM1 to the other IP-number.

Results
Passed

Test 4.7.2: switch over at SIM2

Type of Test

- [**X**] Standard
- [ ] DNV GL
- [ ] Customer specific

References

- PICS Tables A.1, A.2, A.3, A.52, A.53, A.54, A.55, A.56, A.57

Conformance Building Block

- Test Associations (CB1)

Test Objectives

1) Verify that SUT2 reconnects to SIM2 to the other IP-number.

Results

Passed

Test 4.7.3: switch over between LAN's

Type of Test

- [**X**] Standard
- [**X**] DNV GL
- [**X**] Customer specific

References

PICS Tables A.1, A.2, A.3, A.52, A.53, A.54, A.55, A.56, A.57

Conformance Building Block

- Test Associations (CB1)

Test Objectives

1) Verify that SUT1/2 switchovers from LAN1 to LAN2 when LAN1 is malfunctioning and vice versa

Results

Passed

Test 4.7.4: Switchover between Primary FEP and Secondary FEP when FEP failed/crashes or is stopped

Type of Test

- [**X**] Standard
- [ ] DNV GL
- [ ] Customer specific

References

PICS Tables A.1, A.2, A.3, A.52, A.53, A.54, A.55, A.56, A.57

Conformance Building Block

- Test Associations (CB1)

Test Objectives

Verify that SUT1 and SUT2 ICCP links will switch-over from Primary ICCP FEP to Secondary ICCP FEP when Primary ICCP FEP server crashes or is stopped. When Primary FEP server is restarted afterwards and then Secondary FEP server is stopped, the connections will be initiated again to the Primary FEP server.

Results

Passed

4.8 Documentation and version control

Test 4.8.1: Documentation

Type of Test

- [ ] Standard
- [**X**] DNV GL
- [ ] Customer specific

References

- n/a

Conformance Building Block

- n/a

Test Objectives

Verify that the TASE.2 Protocol Interoperability for NetVision FEP Server v2.7.5 document [4] is complete and up to date with the SUT user interface. Verify the documentation contains a functional specification and the mapping of ICCP quality codes from/to EMS codes.

Results
Passed with recommendation

Improvement

At the tested moment, the documentation is limited.

Test 4.8.2: Version Control

Type of Test
- [ ] Standard
- [**X**] DNV GL
- [ ] Customer specific

References
- n/a

Conformance Building Block
- n/a

Test Objectives
Verify the version number of the applicable SUT software parts, API and driver's matches with the documentation.

Results
Passed

The tested component versions were:

- NetVision FEP Server 2.7.5
- Triangle Microworks ICCP .NET Protocol Components 4.4.0

See the TASE.2 Protocol Interoperability for NetVision FEP Server v2.7.5 document [4] for supported functionality.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The following can be concluded:

- 27 test cases from the 8 test groups were passed and executed without or with retest, remarks or improvements. All the test cases are based on the functionality used by Adnet conform their PICS document [8].
    - 23 test cases were passed without remarks and improvements
    - 4 test cases were passed with remarks or improvements
        - 2 test case with remarks
        - 2 test cases with improvements
- As SUT does not support all aspects from the standard, the documentation [8] needs to mention what is not supported.
- The following limitations should be part of the documentation
    - Attributes of Data types
        - Estimated: not supported
        - Abnormal: not supported
        - Timestamp invalid: not supported
        - Number of decimals: explain difference Scada diagrams and other screens
    - Commands
        - Taggable (**GetTag**): not supported when receiving
        - Taggable (**SetTag**): not supported when sending

5.2 Recommendations

The following remarks and improvements are recommended:

- Add rejection of receiving TransferSet-Start with specific conditions that cannot be handled, indicating that it cannot be handled to the remote side.
- Add limitations to the documentation

APPENDIX 1: ASSOCIATION PARAMETERS SIM1/2 AND SUT1/2

SUT1		
SUT1 IP Adresses	**192.168.178.1 and 192.168.178.2**	
	Client	**Server**
Local Name	Local	Local
Remote Name	Local	Local
Bilateral Table ID	**SUT1_SIM1_01**	**SUT1_SIM1_01**
Local DomName		**SUT1_LOC**
Remote DomName	**SIM1_LOC**	
Association Name	Client-SUT1	Server-SUT1
Local AR_Name	Local	Local
Remote AR_Name1	Local	Local

SIM1		
SIM1 IP Adresses	**192.168.178.5 and 192.168.178.6**	
	Client	**Server**
Local Name	Local	Local
Remote Name	Local	Local
Bilateral Tale ID	**SUT1_SIM1_01**	**SUT1_SIM1_01**
Local DomName		**SIM1_LOC**
Remote DomName	**SUT1_LOC**	
Association Name	Client-SIM1	Server-SIM1
Local ARName	Local	Local
Remote ARName1	Local	Local

OSI Definition of SUT1 Server

SUT1-Server	
AP_Title*	**1 1 10**
AE_Qualifier	**01**
Psel*	**00 00 00 10**
Ssel*	**00 01**
Tsel*	**00 01**

OSI Defintion of SUT1 Client

SUT1-Client	
AP_Title*	**1 3 9999 11**
AE_Qualifier	**01**
Psel*	**00 00 00 26**
Ssel*	**00 27**
Tsel*	**00 28**

OSI Definition of SIM1 Server

SIM1-Server	
AP_Title*	**1 3 9999 04**
AE_Qualifier	**01**
Psel*	**00 00 00 16**
Ssel*	**00 17**
Tsel*	**00 18**

OSI Definition of SIM1 Client

SIM1-Client	
AP_Title*	**1 1 12**
AE_Qualifier	**01**
Psel*	**00 00 00 12**
Ssel*	**00 01**
Tsel*	**00 01**

Legend:

*: These variables need to be changed for multiple remote partners.

Local: These parameters are local and can be any value, they are not exchanged

Remarks:

1) For this link the two single direction association solution is chosen

SUT2		
SUT2 IP Adresses	**192.168.178.3 and 192.168.178.4**	
	Client	**Server**
Local Name	Local	Local
Remote Name	Local	Local
Bilateral Table ID	**SUT2_SIM2_02**	**SUT2_SIM2_02**
Local DomName		**SUT2_LOC**
Remote DomName	**SIM2_LOC**	
Association Name	Client-SUT2	Server-SUT2
Local AR_Name	Local	Local
Remote AR_Name1	Local	Local

SIM2		
SIM1 IP Adresses	**172.168.178.7 and 172.168.178.8**	
	Client	**Server**
Local Name	Local	Local
Remote Name	Local	Local
Bilateral Tale ID	**SUT2_SIM2_02**	**SUT2_SIM2_02**
Local DomName		**SIM2_LOC**
Remote DomName	**SUT2_LOC**	
Association Name	Client-SIM2	Server-SIM2
Local ARName	Local	Local
Remote ARName1	Local	Local

OSI Definition of SUT2 Server

SUT2-Server	
AP_Title*	**1 1 20**
AE_Qualifier	**01**
Psel*	**00 00 00 20**
Ssel*	**00 01**
Tsel*	**00 01**

OSI Defintion of SUT2 Client

SUT2-Client	
AP_Title*	**1 1 20**
AE_Qualifier	**01**
Psel*	**00 00 00 20**
Ssel*	**00 01**
Tsel*	**00 01**

OSI Definition of SIM2 Server

SIM2-Server	
AP_Title*	**1 1 22**
AE_Qualifier	**01**
Psel*	**00 00 00 22**
Ssel*	**00 01**
Tsel*	**00 01**

OSI Definition of SIM2 Client

SIM2-Client	
AP_Title*	**1 1 22**
AE_Qualifier	**01**
Psel*	**00 00 00 22**
Ssel*	**00 01**
Tsel*	**00 01**

Legend:

*: These variables need to be changed for multiple remote partners, e.g. for remote partner 2, AP_Title values 20, 22, Psel values 20, 22, etc.

Local: These parameters are local and can be any value, they are not exchanged

Remarks:

1) For this link the one dual direction association is chosen. Adnet takes the initiative to establish the connection.

About DNV GL

Driven by our purpose of safeguarding life, property and the environment, DNV GL enables organizations to advance the safety and sustainability of their business. We provide classification and technical assurance along with software and independent expert advisory services to the maritime, oil & gas and energy industries. We also provide certification services to customers across a wide range of industries. Operating in more than 100 countries, our professionals are dedicated to helping our customers make the world safer, smarter and greener.