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Excerpts from CNS/ATM-1 Package SARPs Validation Exercise Specifications

(Information Paper)

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SUMMARY

This Information Paper presents some examples of validation exercise specifications developed in the frame of the European Strategy for CNS/ATM-1 Package SARPs Validation. These high-level specifications are considered to be an essential part of the validation material to be either inserted in or referenced by the ATN Validation Report.
Annex A contains three validation exercises with their associated configuration topologies. These high-level specifications are intended for experimentation. Similar exercise specifications exist for simulation. Some examples can be found in ATNP WG2/WP 197.

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1. Introduction

This Information Paper presents some examples of validation exercise specifications developed in the frame of the European Strategy for CNS/ATM-1 Package SARPs Validation. These high-level specifications are considered to be an essential part of the validation material to be either inserted in or referenced by the ATN Validation Report.

In agreement with the defined strategy, the specifications obey the following principles:

a) exercises are related to the validation objective reference(s) they are meant to validate. The validation objectives are contained in ATNP WG2/WP 201.

b) a high level description of the configuration(s) is provided. Conventions have been adopted in the context of the European Validation Strategy for a common representation of topologies and profiles.

c) a high level specification provides the main scenarios and give the definition of pass/fail criteria.

The realisation of validation exercises on a real platform requires additional specification details such as: actual configuration parameters, actual test values, profile definitions, etc. This can be provided as a separate "detailed specification" document, or as a refined re-issue of the high-level specification document.

Annex A contains three validation exercises with their associated configuration topologies. These high-level specifications are intended for experimentation. Similar exercise specifications exist for simulation. Some examples can be found in ATNP WG2/WP 197.

Annex A: Validation Exercise Specifications

1. Exercise 9: Air-Ground Route Selection

1.1 Exercise Reference

This exercise is given the following reference: AVE_409.

1.2 Objective Reference(s)

This exercise aims at covering part of objective AVO_422 and part of objective AVO_245.

1.3 Configuration

The configuration consists of one airborne and one ground RD connected through a Mode-S and an AMSS subnetwork. Both RDs each contain one end system and one router. The end systems will implement the connection-oriented transport protocol and may also implement the connectionless transport protocol.

A possible configuration is shown in AVC_206 (see appendix).

1.4 Specification

This exercise will assess air-ground data transfer, when two alternative air-ground routes are available.

One single BIS-BIS connection will be established between the air-ground and the airborne BIS over two air-ground subnetworks. The BIS-BIS connection over Mode-S will be ground initiated and the BIS-BIS connection over AMSS will be air-initiated. After successful establishment of the BIS-BIS connection, a transport connection will be established and data exchanged for a long time period (one hour or more) between a ground and an airborne application process.

Two different scenarios shall be tested.

Scenario 1: Data is transferred under normal condition. The air-ground subnetwork is selected according to the traffic type.

Scenario 2: In a second test scenario, the Mode-S link shall be cut-off several times during the (long time period) data transfer. It shall be examined, how the BISs react, when BIS-BIS connection remains, but one of the two subnetwork fails.

The traffic over Mode-S and AMSS will be analysed. In particular, the route selection behaviour, i.e. way that the airborne and air-ground BIS select one or the other air-ground subnetwork shall be examined.

It shall be examined, what happens to transport connections and the application data transfer (communication break-down or significant delays, etc..).

Note: This exercise could include additional scenarios with a similar configuration for testing the case, where the NON-IDRP option is used in the airborne BIS.

1.5 Expected Results

Logs showing the updating of FIB contents in the air-ground and the airborne BIS.

Analysis of BISPDUs exchanged between the air-ground and the airborne BIS.

Analysis of TPDUs exchanged between the two end systems.

2. Exercise 10: Mobile Handover

2.1 Exercise Reference

This exercise is given the following reference: AVE_410.

2.2 Objective Reference(s)

This exercise aims at covering objective AVO_426.

2.3 Configuration

The configuration consists of one airborne and two ground RDs. Both ground RDs contain an air-ground router. The airborne RD and one ground RD (RD2) contain an ES hosting an application, which uses connection-oriented transport protocol for data transfer. The airborne end system can be reached from RD1 directly over Mode-S via router R2 or through RD3 over AMSS via a second router R3.

Note 1: The end systems may also implement the connectionless transport protocol

A possible configuration is shown in AVC_207 (see appendix).

Note 2: A more realistic scenario could be tested with two different Mode-S subnetworks instead of one Mode-S and one AMSS.

2.4 Specification

This exercise will assess the mobile handover from one ATN air-ground router to another ATN air-ground router.

A simple scenario will simulate the following flight situation. An aircraft which is in contact with the ground leaves the coverage of a Mode-S subnetwork, but requires to keep contact to the ground. Before leaving the Mode-S coverage and closing the connection over Mode-S subnetwork, a new connection will be established over AMSS and another air-ground router.

This exercise shall examine the behaviour of the air-ground transport connection in case of mobile handover. It shall be evaluated, if a mobile handover will be transparent to the user, i.e. the mobile handover does not have impact on the transport connection or user data transfer.

Note: This exercise could include additional scenarios with a similar configuration for testing the case, where the NON-IDRP option is used in the airborne BIS.

2.5 Expected Results

Logs showing the updating of FIB contents in the air-ground and the airborne BIS.

Analysis of BISPDUs exchanged between the air-ground and the airborne BIS.

Analysis of TPDUs exchanged between the two end systems.

3. Exercise 11: ATN Priority: Case of a Connectionless Transport Protocol

3.1 Exercise Reference

This exercise is given the following reference: AVE_501.

3.2 Objective Reference(s)

This exercise aims at covering objectives AVO 451, AVO_452 and AVO_453.

Note: The ATN priority mechanisms defined in section 2.6 of [REF 1] is currently under revision, see [REF 9].

3.3 Configuration

The configuration used for this exercise shall at least consist of two RDs, each containing either one end system hosting two different applications or each containing two different end systems with one application. The effect is that two different applications using different priority can communicate simultaneously.

A possible configuration is shown in AVC_208 (see appendix).

Note: This exercise could also use a configuration containing an airborne and ground RD as shown in AVC_206 to test ATN priority under mobile subnetwork conditions.

3.4 Specification

The two applications shall specify different priority (e.g. highest and lowest priority parameter value) for their communication and both shall continuously exchange data over the same network.

Note: The network protocol priority is expressed as a value between 0 (lowest priority) and 14 (highest priority) and indicates the relative importance of a particular NSDU to other NSDUs in transit. The transport protocol priority is expressed as a value between 0 (highest priority) and 14 (lowest priority) and indicates the relative importance of a particular TSDU or transport connection. The application specifies a transport priority value, which has to be mapped (by the transport layer) onto the corresponding network priority value

This exercise should permit to verify the feasibility of defining and managing different transport priorities in the ATN. Furthermore, it will assess the priority based forwarding in case of normal network condition, degraded QOS condition and network congestion.

The exercise will consist in exchanging TPDUs of different priorities and verifying the correct order of delivery of this data, first when the network is not congested, then with an increasing traffic load, and finally in congestion situation.

This exercise will have three scenarios. In the first scenario the network operates under normal conditions. In a second scenario, the QOS of the network degrades, e.g. by increasing the error rate using the IP trouble maker. In a third scenario, the network shall (partly) become congested so that not all of the packets generated can be transmitted.

In the first scenario, the queuing mechanism in the routers will be evaluated. It shall be validated, that higher priority packets are queued before lower priority packets and forwarded first.

In the second scenario, the impact of QOS digression on lower and higher priority packets shall be compared. It shall be validated that higher priority packets have their QOS less degraded than lower priority packets.

In the third scenario (case of network congestion), it shall be validated that a router discards lower priority packets first and higher priority packets last.

The exercise shall also verify that routing information is handled at the highest priority.

3.5 Expected Results

The data exchanges between any ES of any RD should be correct.

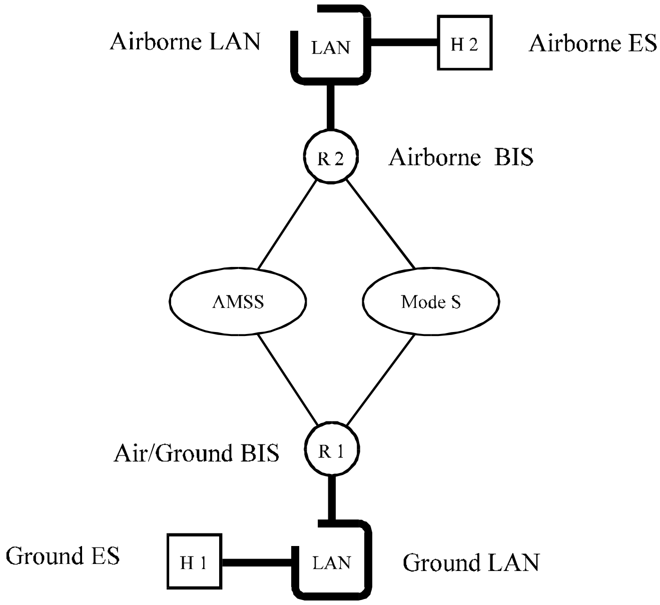
The RIBS and FIBs of the different systems will be analysed.

The order of messages delivery will be verified.

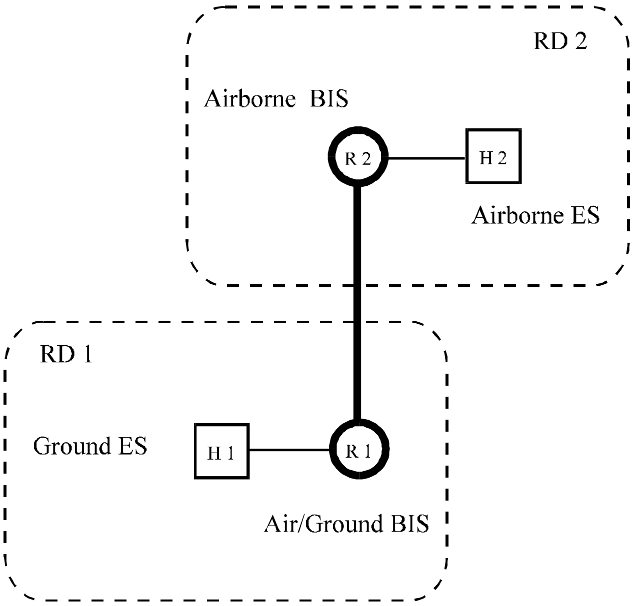
The correct mapping of transport priorities to network priorities will be assessed by this exercise.

The order of discarding in case of congestion will be verified.

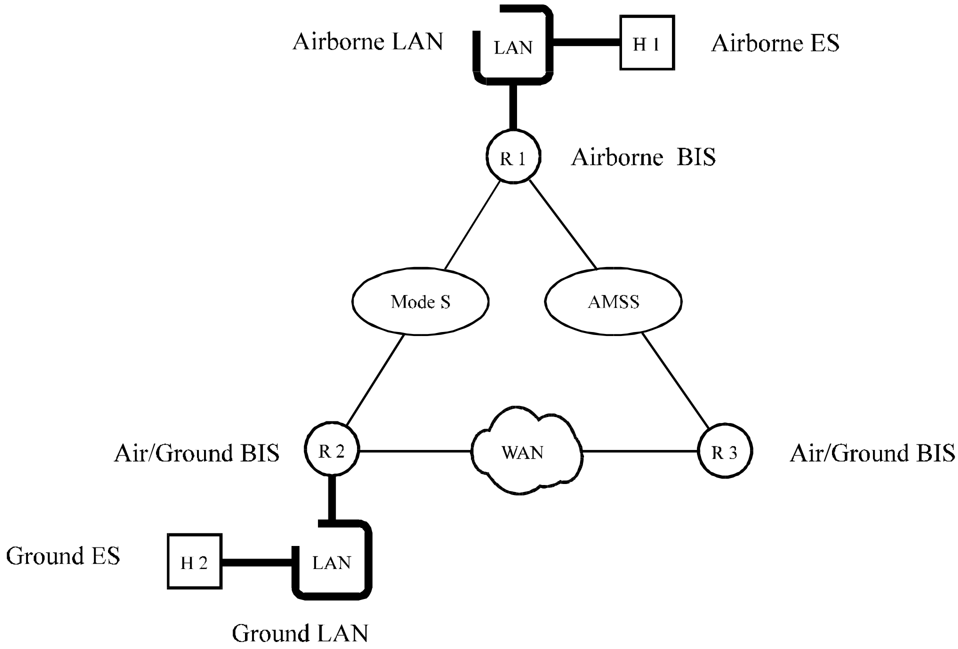
4. Configurations



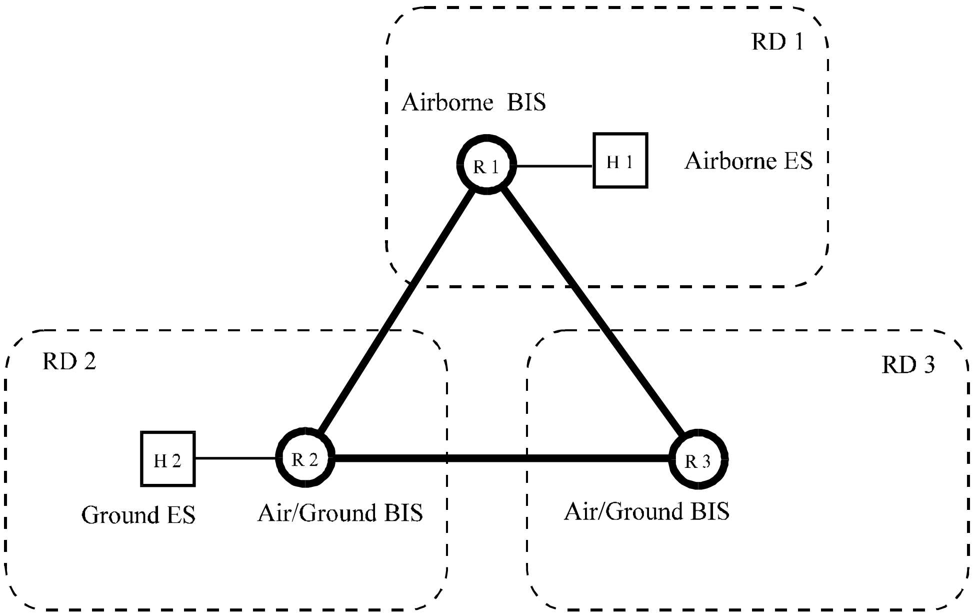
AVC_206: Physical Configuration



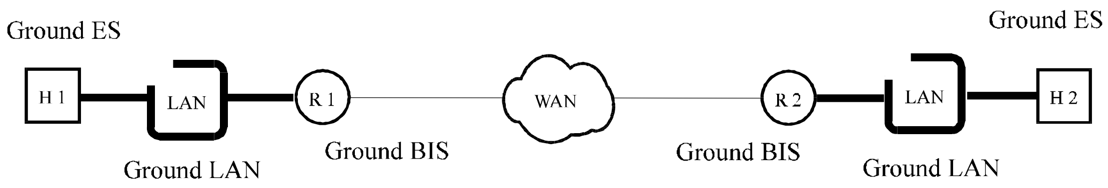
AVC_206: Routing Configuration



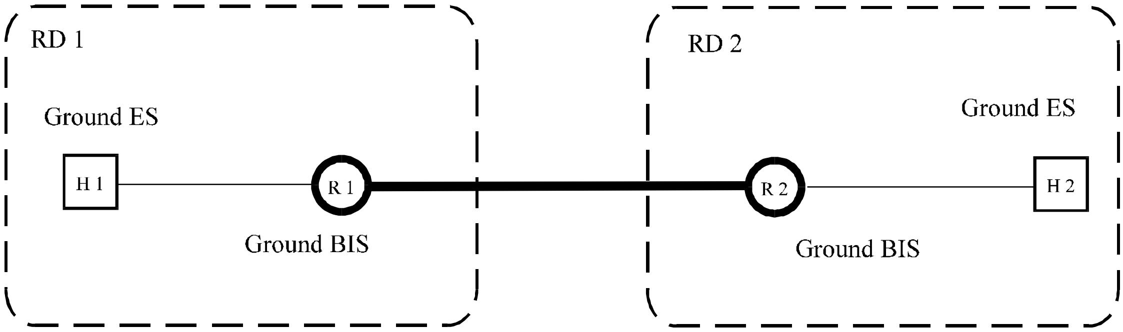
AVC_207: Physical Configuration



AVC_207: Routing Configuration



AVC_208: Physical Configuration



AVC_208: Routing Configuration