Lessons Learned from Avionics Redundancy Management Methods as Input for IEEE 802.1CB

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Example Redundancy Management Service: ARINC 664-p7

ARINC 664-p7 is an avionics standard for using Ethernet in an airplane.

In simple terms it operates as follows:

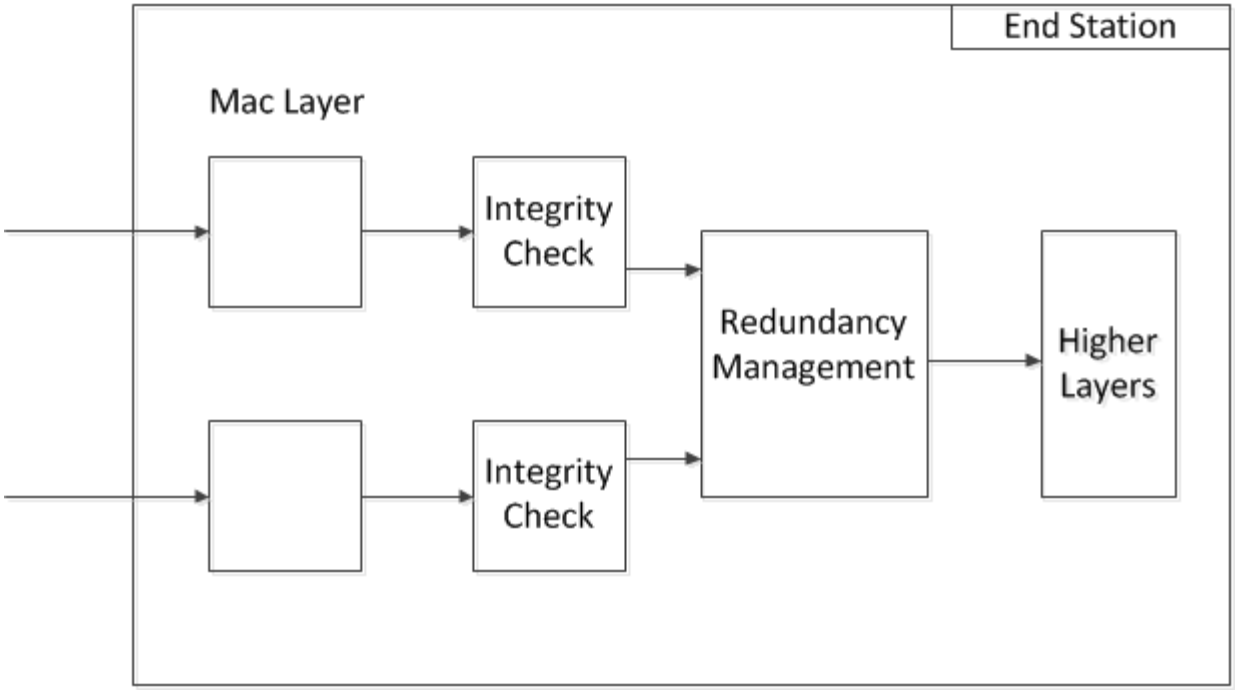
ARINC 664-p7 uses sequence numbers to identify matching copies of redundantly transmitted frames.

The transmitting end station is connected to two networks and sends the same frame with the same sequence numbers on both networks.

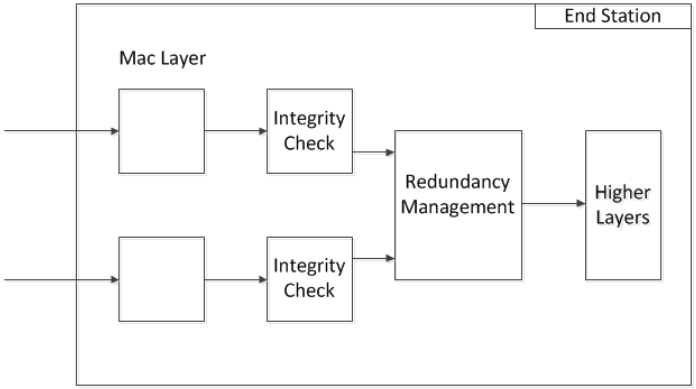
The redundancy management at the receiving end station is split into two subroutines:

1. “Integrity Checking”
2. “Redundancy Management”

ARINC 664-p7
Some more detail



ARINC 664-p7
Some more detail (cont.)



Each frame uses a 1 byte Sequence Number, which is positioned just before the FCS of the frame.

Sequence Number cycles from 1 to 255

Integrity checking is used to identify whether the sequence number in a received frame is “plausible” i.e., within a configurable window (e.g., +1 or +2) higher than the sequence number in the previously received frame

Redundancy Management forwards the first received copy of a frame to the host which matches the integrity check and throws away all other copies with the same sequence number for a configured time (started at the reception of the first frame).

Lessons Learned

Redundancy Management requires precise knowledge of the communication latency and jitter of the messages on the redundant paths through the network.

In certain cases the loss of a frame on one network can cause the loss of its copy on the redundant network.

Sometimes, loss of communication requires to restart the sequence numbering.

The ARINC 664-p7 redundancy mechanism is very well studied by academics and industry due to its importance and criticality for avionics systems.

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