# Redundant Frames Without Elimination

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# Purpose

Last meeting a use case was solicited for "Frame Replication without Elimination"

This presentation:

- Provides a/the use case for this feature

- Provides a Sample System

- Provides an alternative approach

Note: based on previous discussion, the End Station behavior may be outside the scope of IEEE802.1Q

**ARINC 664 P7 - Section 3.2.6.1**

**Use of sequence numbers for deduplication**

- One-Byte sequence number suffix **per stream**
  - 0 RESET
  - 1-255 sequences
- End-Devices either use
  - "first-valid wins" and forward one packet to application (check for seq no {+0 +1 +2} )
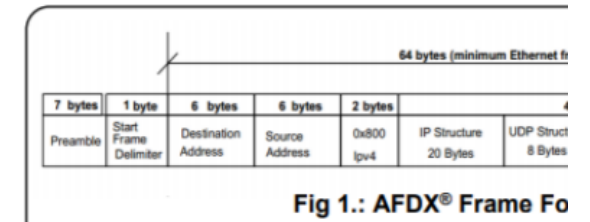  - or forwards both packets to application

> Does aerospace industry need this option?

| 7 bytes | 1 byte | 6 bytes | 6 bytes | 2 bytes | | |
|---------|--------|---------|---------|---------|---|---|
| Preamble | Start Frame Delimiter | Destination Address | Source Address | 0x800 Ipv4 | IP Structure 20 Bytes | UDP Struct 8 Bytes |

64 bytes (minimum Ethernet fr...)

**Fig 1.: AFDX® Frame Fo...**

Reference: IEEE P802.1DP Features by Abdul Jabbar
https://www.ieee802.org/1/files/public/docs2021/dp-jabbar-profile-features-0921-v01.pdf

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# Typical ARINC 664p7 Redundancy (Refresher)

- ARINC 664 Part 7 has redundant LANs comprised of one or more switches

- ARINC 664 Part 7 end stations (typically) duplicate frames on transmission and eliminate redundant frames on reception

- Hosted Applications typically see a single frame on reception and transmission.  Redundancy is transparent to the applications

- This is probably >95% of a typical ARINC 664 Part 7 network
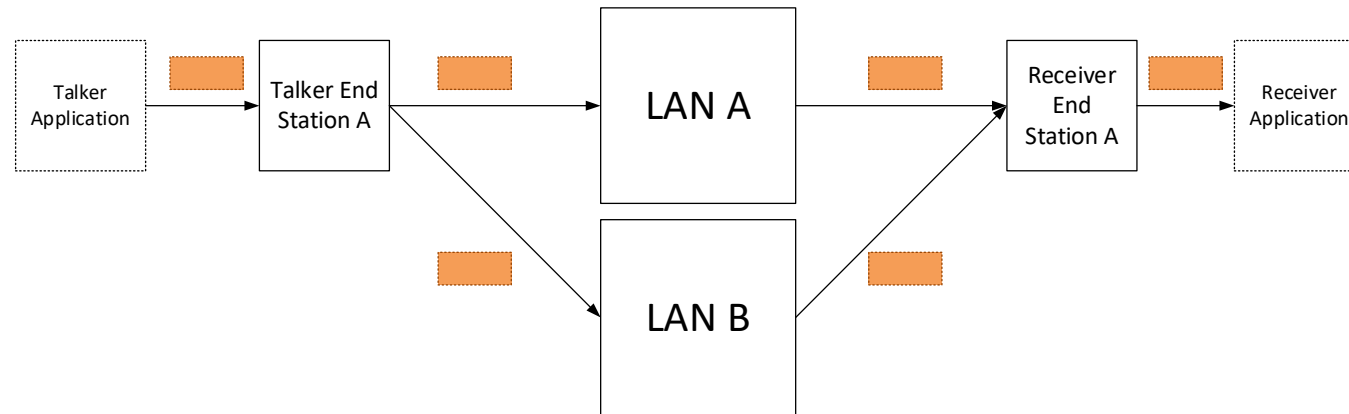


## Except...

# Use Case: Frame Replication without Elimination

- Sometimes, it is necessary to shut off the elimination of redundant frames

  - Still have talker end station make redundant frames.

  - Disable elimination in Receiver End Station

  - Pass up multiple frames to Receiver Application

    - In ARINC 664p7, they are sent up on separate "Communication Ports" or sockets so the application can differentiate
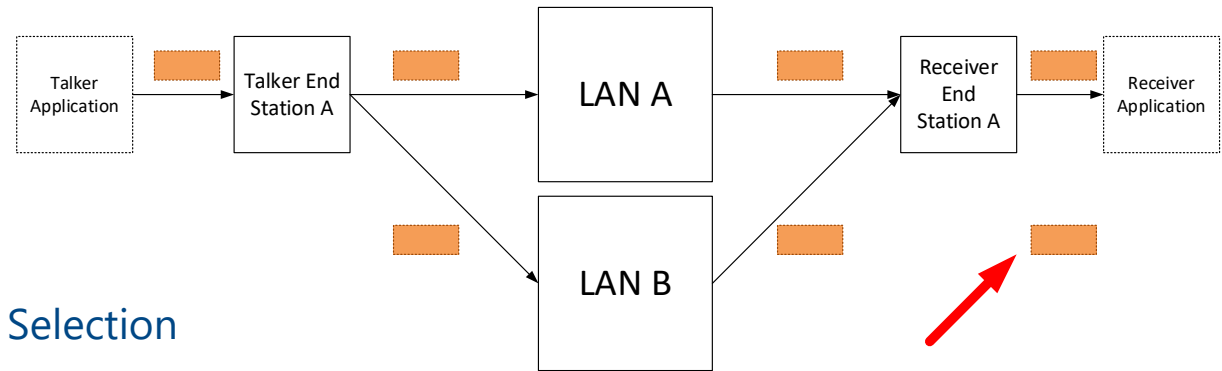


- Receiver Application is responsible for Source Selection

  - Could be based on integrity checks of payload or other mechanisms

- Generally, this would be driven by the safety process/analysis

  - "No Single Fault" concerns with LAN and/or

  - Probability of failures.  LAN redundancy is typically there for availability, not integrity

# Use Case: Frame Replication without Elimination – Sample System

The following diagram depicts a common system layout:

- Redundant Sources of Data (e.g. Aircraft Sensors)

- Redundant Destinations of Data (e.g. Displays)
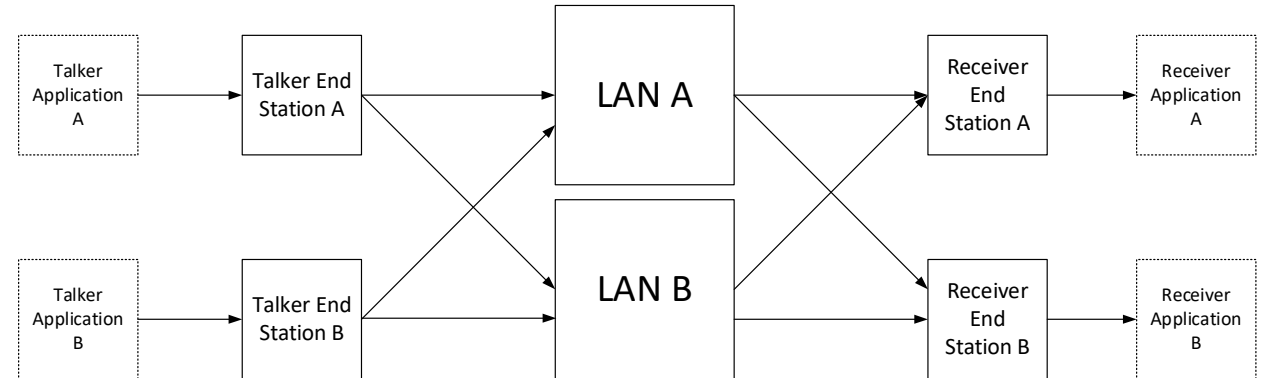
Redundancy of sources and destinations can help availability and integrity

- Backup copy in case of "loss" failure mode

- Voter to detect "integrity" failure modes

Redundant LAN with full FRER can expose system to single point "integrity" failure modes within LAN

- Disabling "Replication Elimination" can allow receiver application to vote (or other approaches) to address "integrity" concerns

# Alternative Approach

- Start Redundant copy at source application

- Use Separate TSN Streams for separate LANs
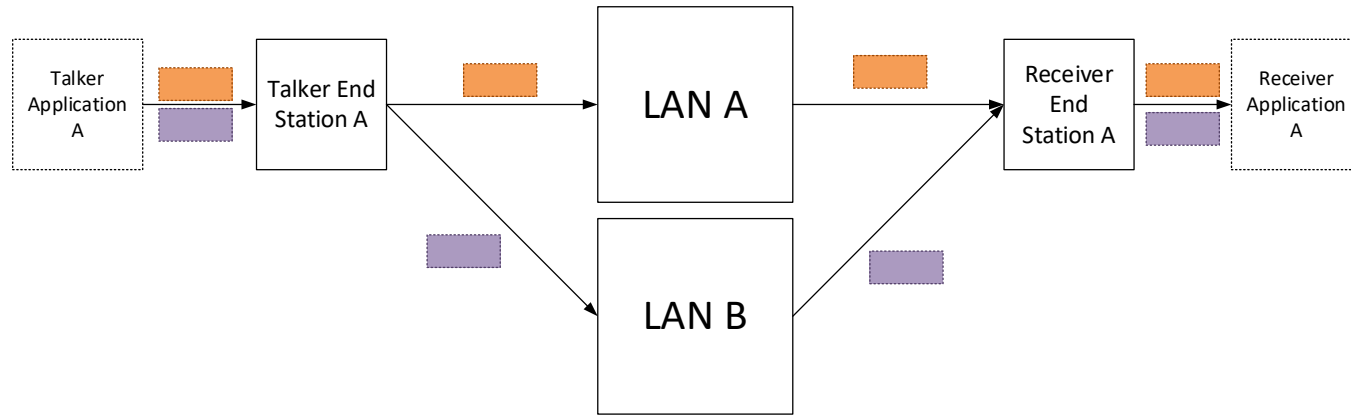


Potential Downsides

- Talker Application needs to do two "sends"

# Conclusion

- Use case for "Redundant Frames Without Elimination" provided

- This scenario occurs in Avionics systems today
  - Driven by safety requirements

- Alternative implementations can also mitigate the safety concern
  - TSN provides other tools that can help in this scenario

# Thank You!