# TopNet pilot demonstrations: first returns of experience
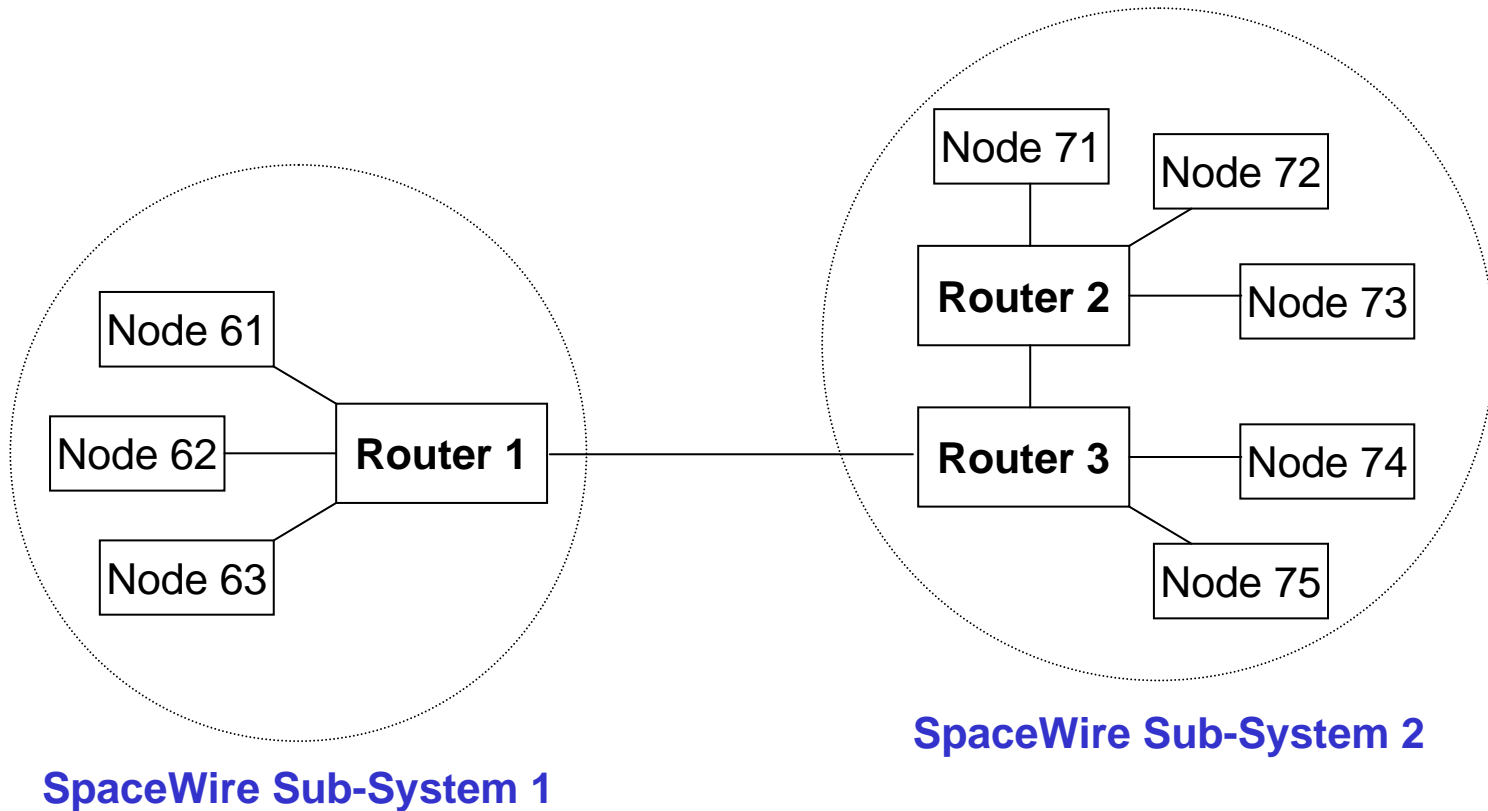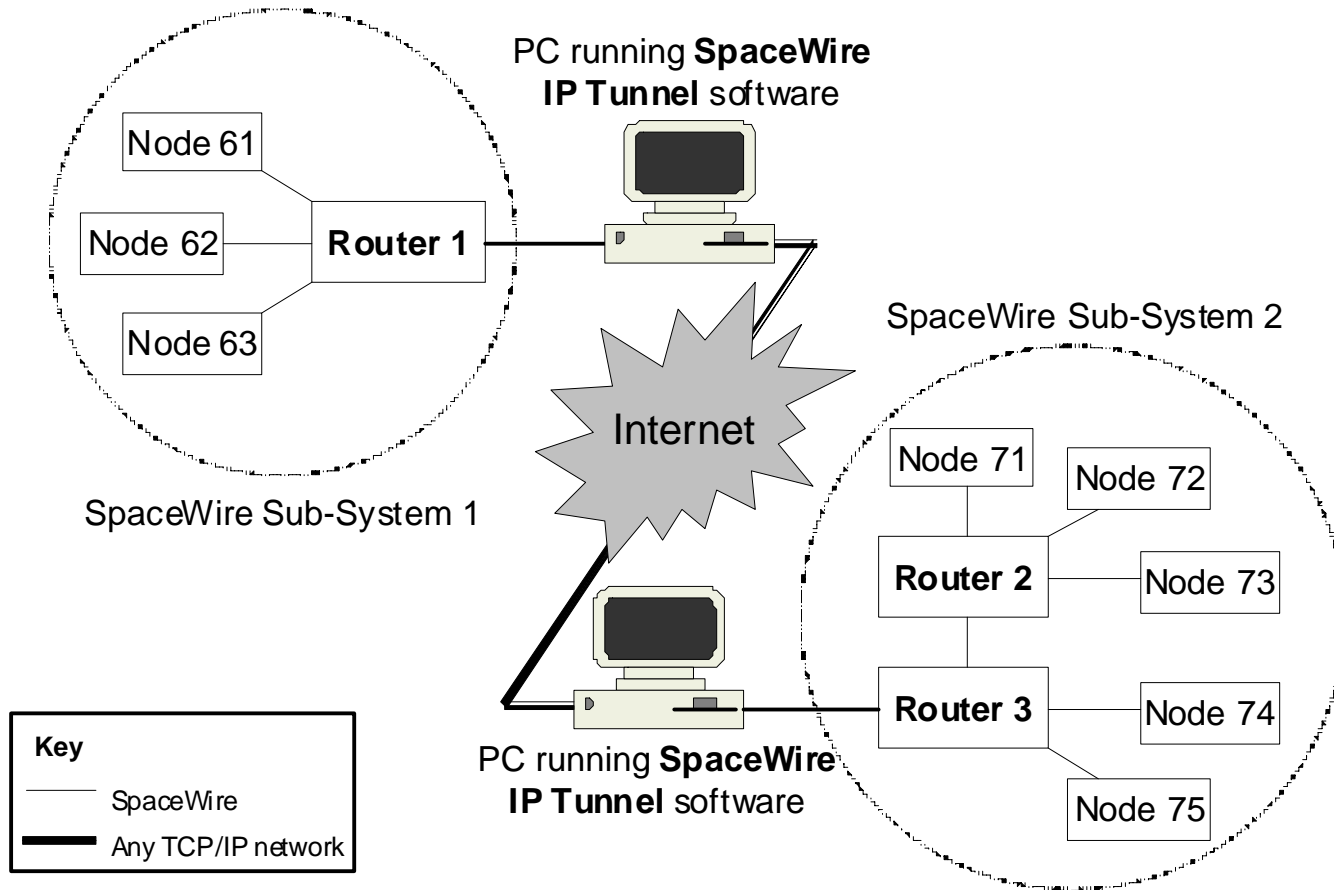
**Vitulli R.** - TEC-EDP

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# SpaceWire System



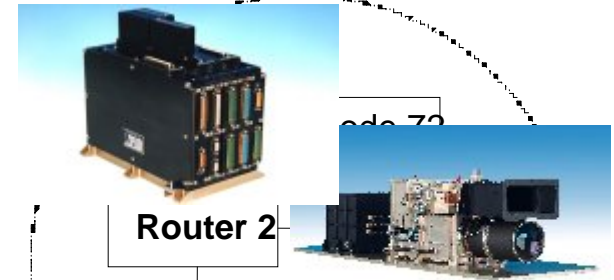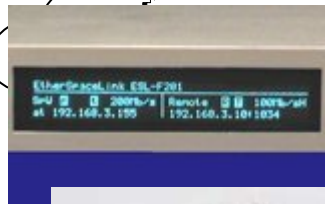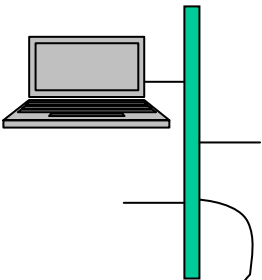**SpaceWire Sub-System 2**

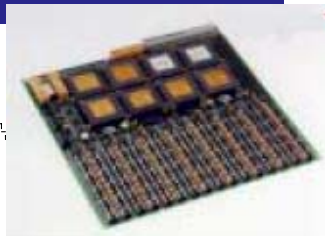**SpaceWire Sub-System 1**

# SpaceWire Tunnel Concept

# TOPNET implementation



SpaceWire Sub- System2

Router 2

Router 3

Node 74

SpW Ethernet Bridge

SpW IP Tunnel

Router 1

SpaceWire Sub- System 1
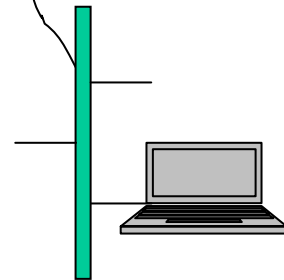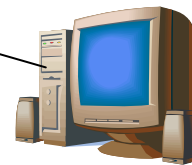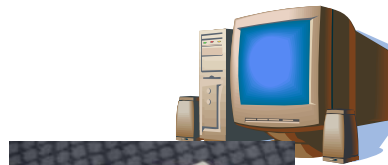
# Aims of IP Tunnel

- To provide support for remote, decentralised integration of SpW-based, satellite onboard data-handling sub-systems using the internet to connect the geographically separated sub-systems.

- To provide a means for monitoring the traffic flowing through the SpaceWire IP Tunnel.

- To enable higher level protocols running over SpaceWire, through a SpaceWire IP Tunnel or through a multi-port SpaceWire interface, to be analysed and displayed.

# Time-Code and N-Char Sequencing

- Inside SpaceWire CODEC
  - Time-codes have priority
  - they jump the transmit and receive queues
- Not possible to ensure full synchronisation of time-codes and data without modifying the SpaceWire CODEC
- IP Tunnels must preserve N-Char / Time-code ordering
- The best way is to use a modified SpaceWire-USB Brick, in order to keep time-code to N-Char ordering

# Link Start/Disconnect

- IP Tunnels must be completely transparent

- Tunnel devices shall support notification of "link start" and "link disconnect" to the other end of the Tunnel

- Also link start/disconnect notification has been implemented in the modified SpaceWire-USB Brick

# TopNet: Virtual Satellite Integration (3Pilot activities)

**Involvement of different actors in 3 parallel _pilot activities_ for _decentralized integration_ of SpW-based data handling sub-systems that are geographically separated**

Test bench in location 1

Internet

HR Camera EM in location 2

On-Board Computer EM in location 3

# TopNet Pilot activities: 3 parallel contracts

- 4Links
  - RAL
  - SAAB Space
- THALES Alenia Space
  - Cannes
  - Toulouse
  - Milan
- EADS ASTRIUM
  - ➢ Toulouse
  - ➢ Friedrichschafen
  - ➢ Stevenage
  - Galileo Avionica (Florence)
  - EADS Sodern (Paris)

# First feedback

- First feedback from users:
  - Easy to use
  - Several improvements suggested
  - 22 Software failures identified at the moment

# SpW IP Tunnel Improvements

- Keep-alive timer
- Context sensitive help
- Connection via Proxy Server
- Latency check
- Protocol Analyser Time Resolution
- Chat Window

# GUI Improvements

- Protocol Analyser Traffic Display
- Network Error Dialog
- Visual Representation of Network Topology
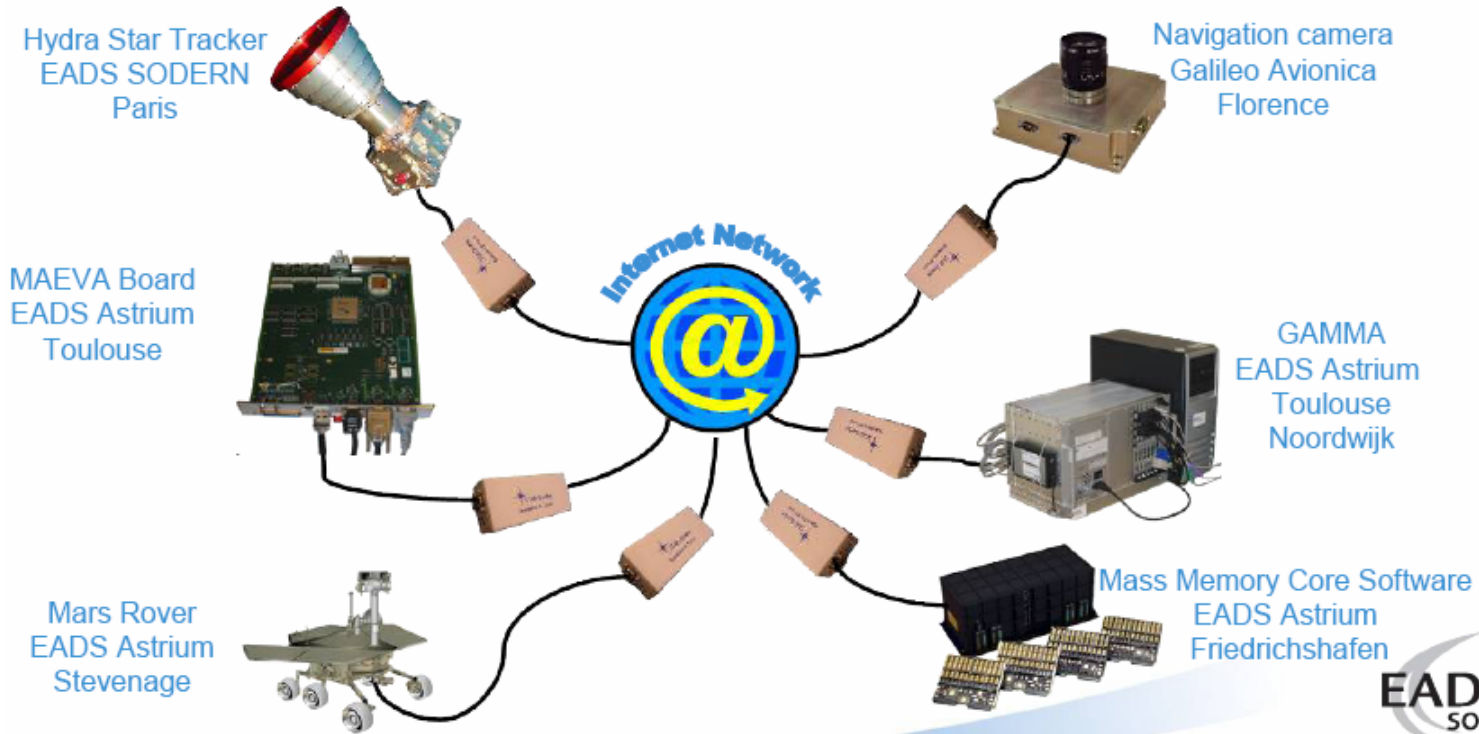- Edit Network Topology Visually

# Operation of Tunnel behind firewall Tunnel Server
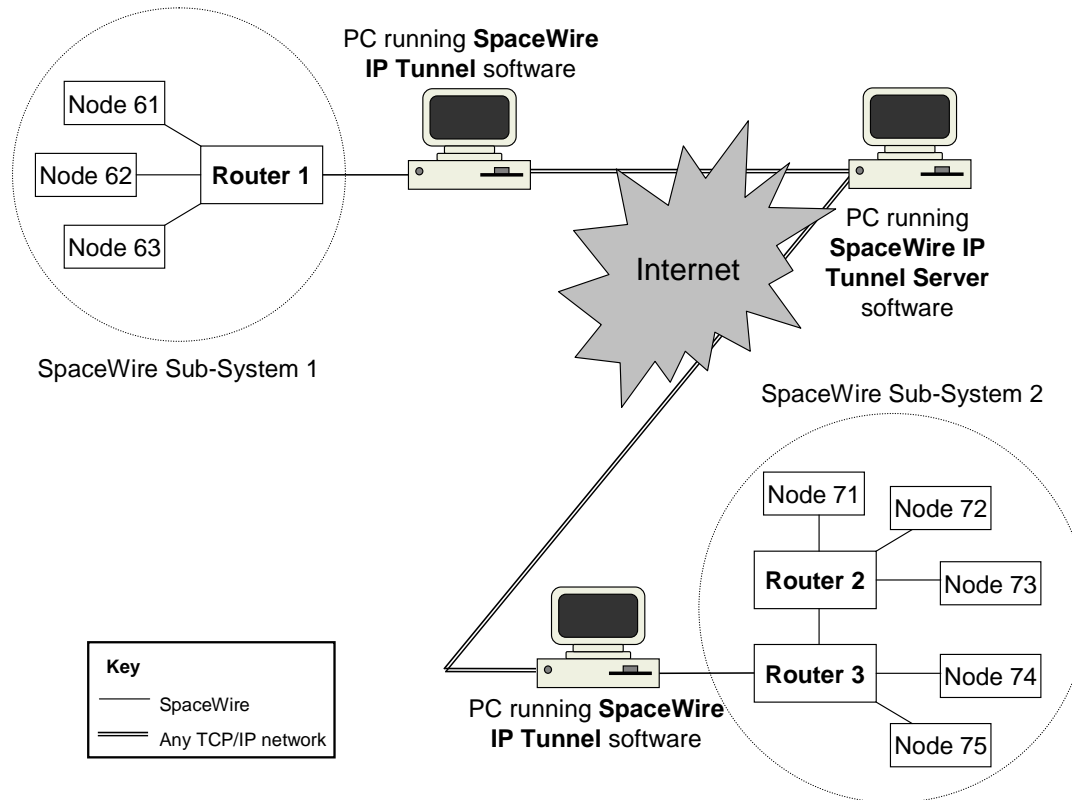
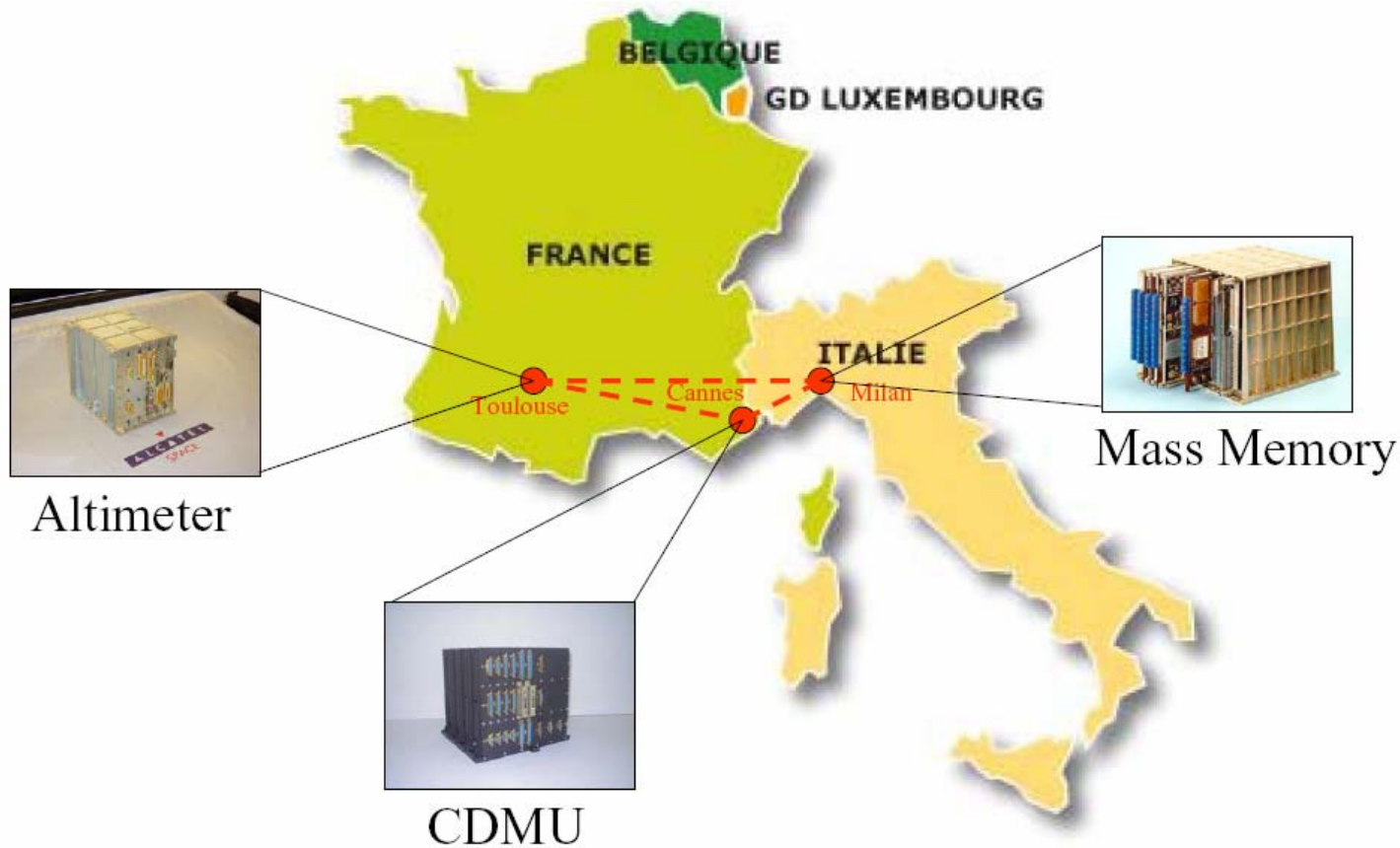# TopNet: first returns of experience -EADS ASTRIUM



*By courtesy of: EADS ASTRIUM*

# TopNet: first returns of experience -EADS ASTRIUM

- Identified problems in the initial experiments:
  - Connection (firewall, network configuration)
  - Windows vs Linux (version mismatch)
  - Plug-in (lack of documentation, missing information)
  - Others (system hangs in some cases)

# TopNet: first returns of experience
# - THALES



Altimeter

Mass Memory

CDMU

# TopNet: first returns of experience - THALES

- Restriction due to Internet bandwidth:
  - maximum data rate included between 3 and 4 Mbits/s
- Use of RMAP (PING) to estimate additional latency introduced by the Tunnel:
  - Direct connection: 15 milliseconds
  - Tunnel connection: between 40 and 60 milliseconds
- Internet latency can affect **Isochronous** operation and **Real Time** operation
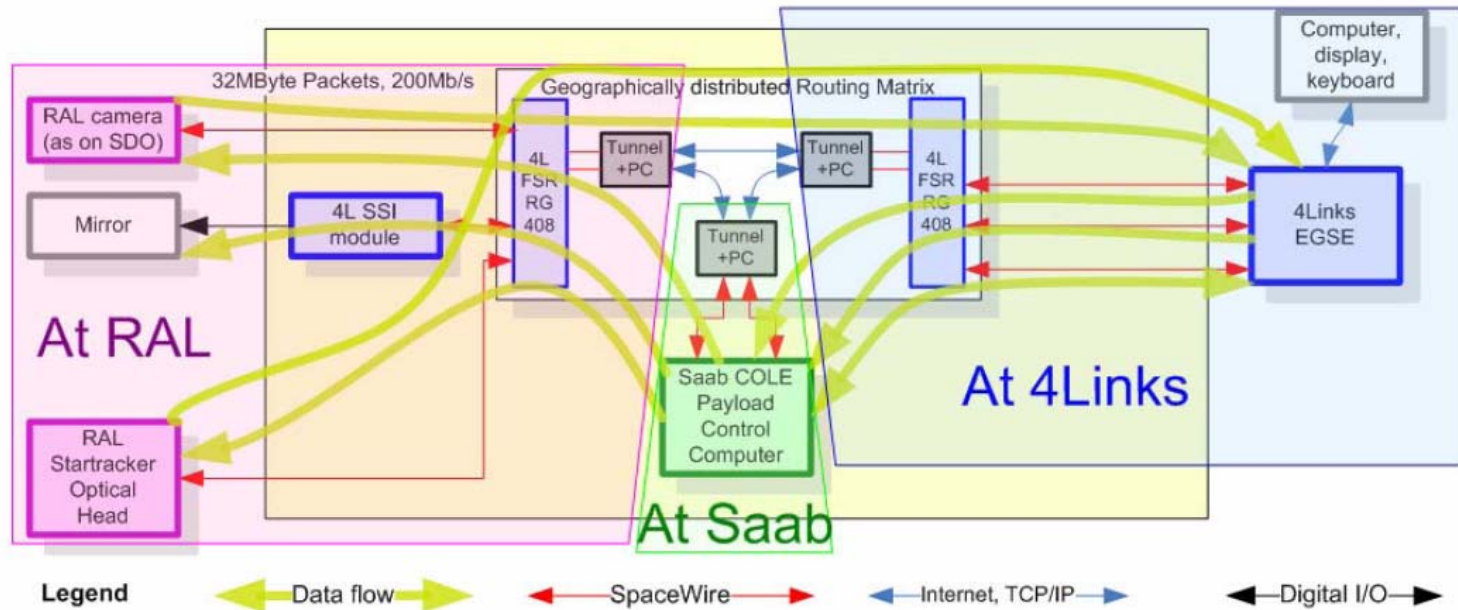
# TopNet: first returns of experience - THALES

Thales experiment will use Timecodes to synchronize the equipments **-> Synchronisation problem**?

– Risk to have variable latencies more or less important because of Internet throughput

– Risk to have a bad synchronisation of equipments using time diffusion principle (time-codes, OBT)

# TopNet: first returns of experience
# - 4Links



*By courtesy of: 4Links*

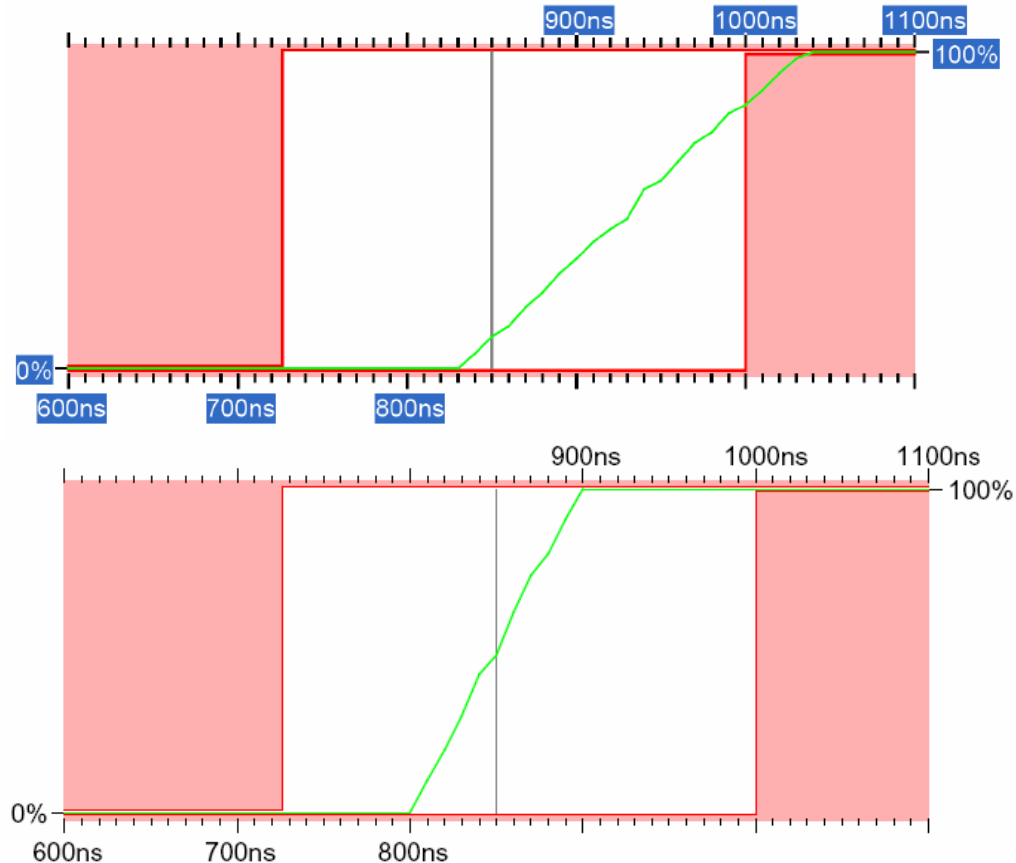# TopNet: first returns of experience - 4Links

- Software

- ECSS non-conformance

- Transparency
  - Behaviour
  - packet size limits

# TopNet: first returns of experience
# - 4Links

Timeout

non-conformance



*ECSS clause 8.11 requires a timeout period of 850ns nominal - within limits of 727 to 1000ns. Stasis periods less than 727ns must never be detected as timeouts. Stasis periods more than 1000ns must always be detected as timeouts.*

# TOPNET 2G

- Automatic updates
- Improvement for the installer
- Microsoft certified USB driver
- Windows Vista
- Management of large packets
- Improvement of the Statistics window

# Thanks for your attention

## Announcement

On-Board Payload Data Compression Workshop
OBPDC 2008      26 - 27 June 2008
ESA/ESTEC  - Noordwijk, The Netherlands

http://www.congrex.nl/08c20/