



# **The development of EGSE COTS products for high-speed O/B interfaces for advanced Spacecraft and Instruments**

25-27 September 2012  
SESP, ESA-ESTEC, Noordwijk

# Overview

- Introduction
- O/B Interface EGSE Heritage
- Wizardlink – A Crash Course
- First Generation Wizardlink Front-End
- Development of a Generic Platform
- Second Generation Wizardlink Front-End
- Platform Deployments
- Future Development
- Summary

# Introduction

- Need for High-Speed Interfaces
- Ever increasing on-board data-rates, e.g.:
  - Sentinel-1 : ~1.28Gbps
  - Sentinel-2: ~ 1.10Gbps

Sentinel-1 - courtesy of ESA

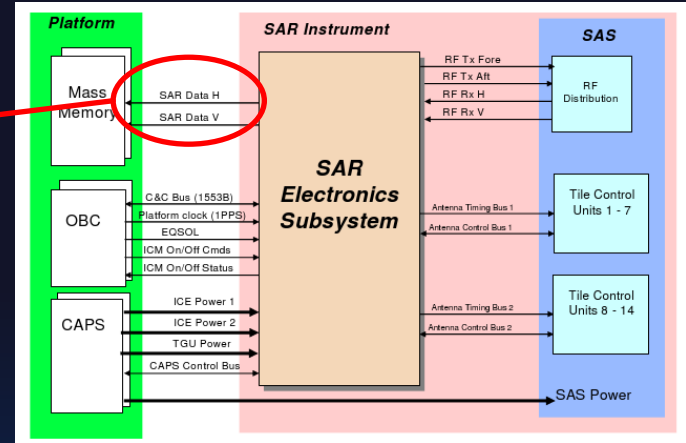


ESA - P. Carril

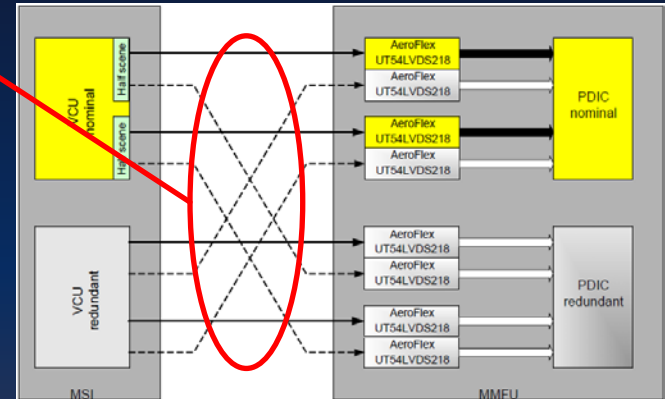
Sentinel-2 - courtesy of ESA



ESA - P. Carril



Sentinel-1 SAR to Mass Memory

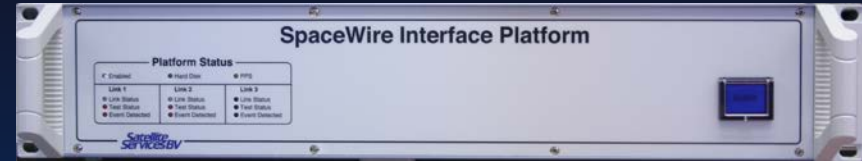


Sentinel-2 MSI to Mass Memory

- EGSE to meet current and future Spacecraft

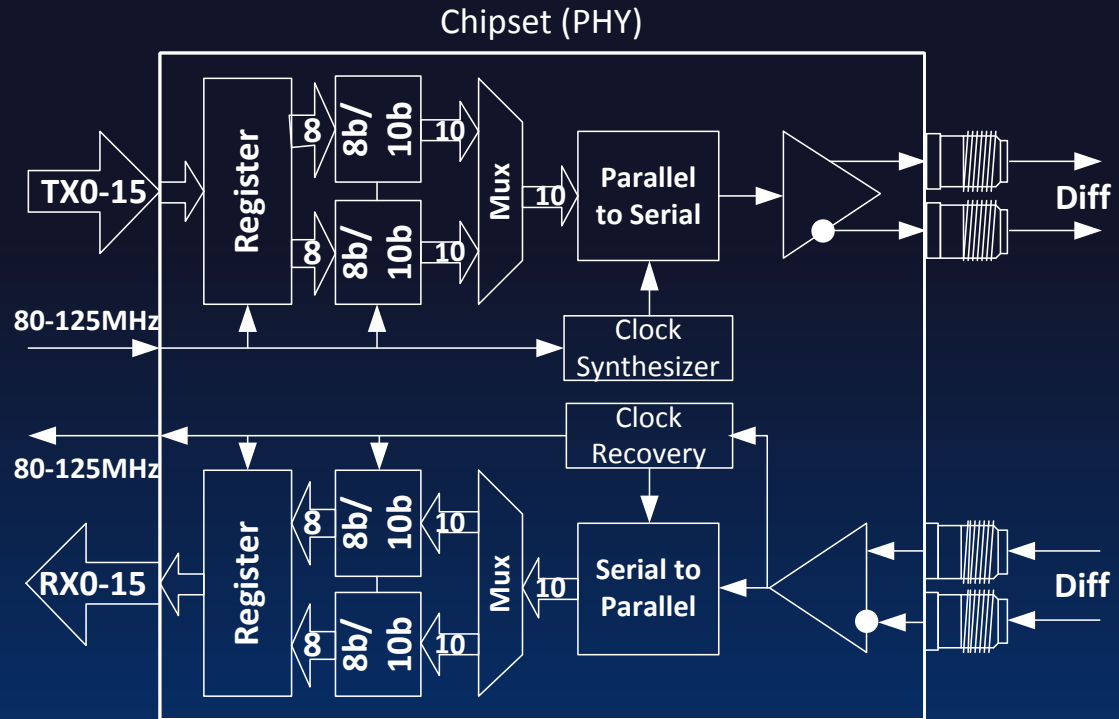
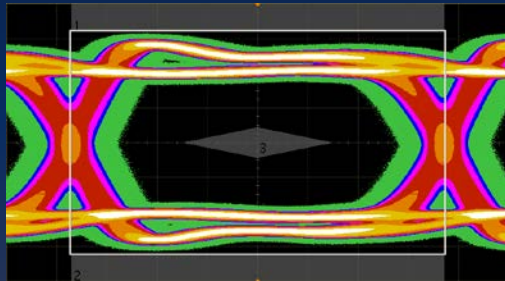
# O/B Interface EGSE Heritage

- Low-rate on-board interfaces (e.g.):
  - UART (<2Mbps)
  - ML16/DS16 (<10Mbps)
  - PacketWire (<20Mbps)
- Medium-rate on-board interfaces (e.g.):
  - SpaceWire (up to 200Mbps)
- High-rate on-board interfaces (e.g.):
  - SERDES (up to 1.575Gbps)
  - Parallel LVDS (up to 1.6Gbps)
  - Wizardlink (up to 2Gbps)



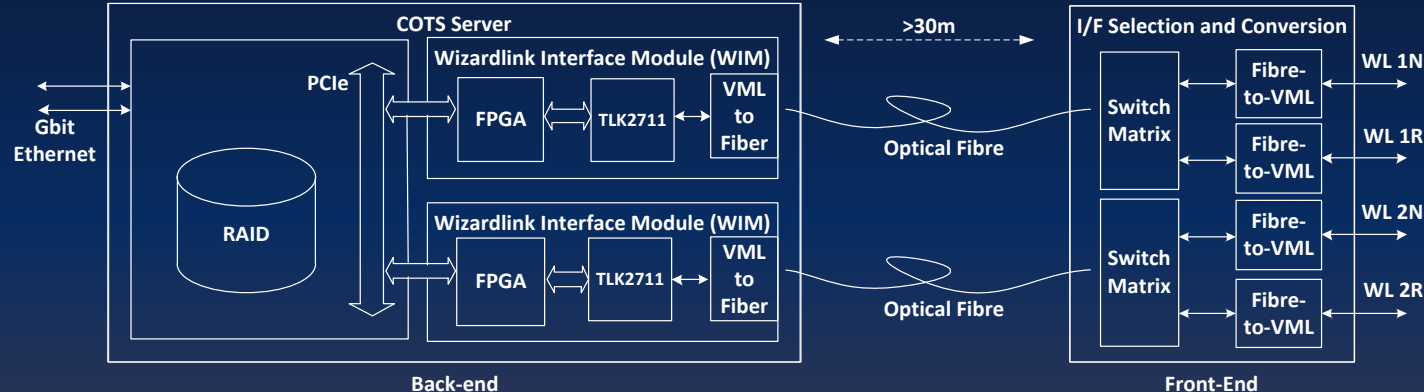
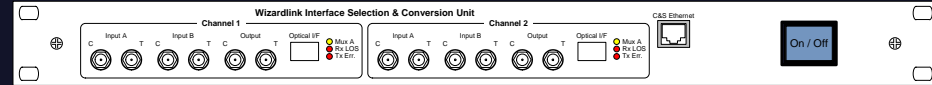
# Wizardlink – A Crash Course

- Chipset from Texas Instruments (TLK2711)
- Commercial and Space
- Bi-directional point-to-point
- 50Ω Controlled Impedance
- 16-bit data bus
- 8b/10b encoding
- Parallel-to-serial and serial-to-parallel
- Reference clock between 80 and 125 MHz
- Data-rates up to 2Gbps
- Data rate is 16 x reference clock
- Link rate is 20 x reference clock



# First Generation Wizardlink Front-End (I)

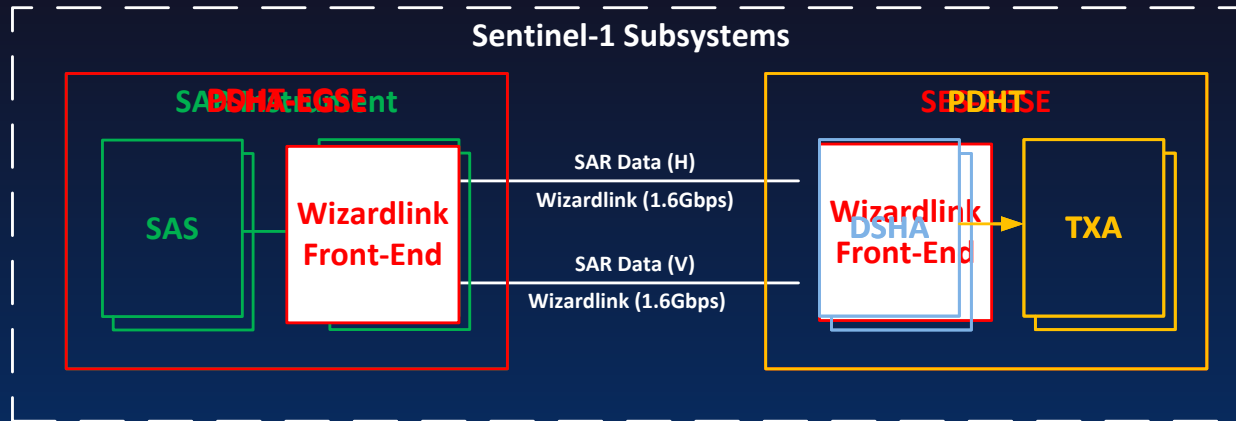
- Developed in 2008
- Important EGSE consideration: distance to UUT >30m
- Split front-end from back-end
- Fiber optic I/F between front- and back-end
  - Commercial coax cables (to UUT)
- Protocol handling in back-end
- Back-end COTS server
- Wizardlink implemented on a PCIe card
- Front-end performs switching and conversion



# First Generation Wizardlink Front-End (II)

Delivered for multiple Sentinel-1 EGSEs:

- SAR Electronics Subsystem (SES) EGSE (Astrium Portsmouth)
- Data Storage & Handling Assembly (DSHA) EGSE (TAS-I Milan)
- Payload Data Handling and Transmission (PDHT) EGSE (TAS-I Rome)

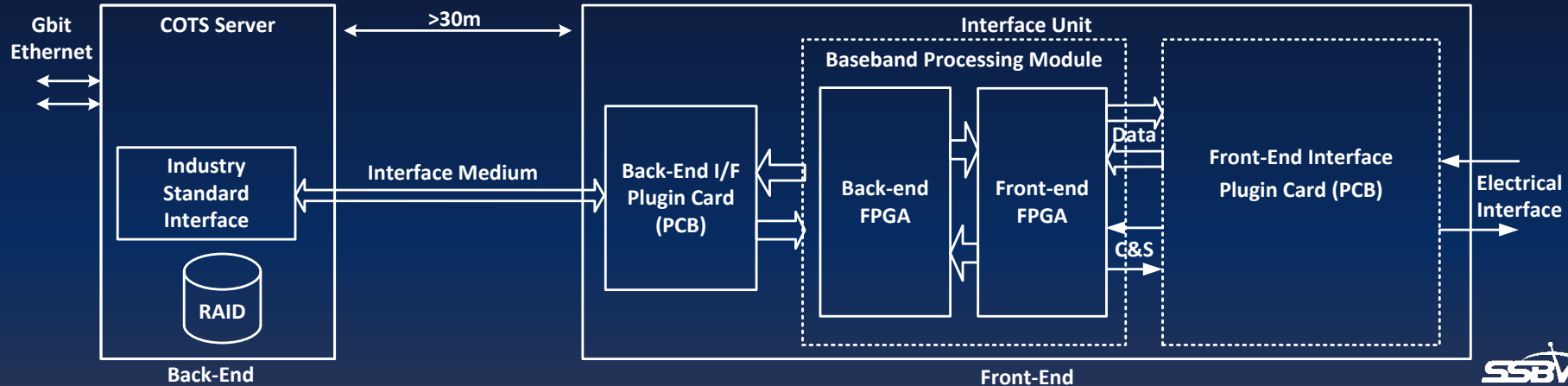


SAR : Synthetic Aperture Radar  
SAS : SAR Antenna Subsystem  
SES : SAR Electronics Subsystem

PDHT : Payload Data Handling and Transmission  
DSHA : Data Storage & Handling Assembly  
TXA : X-Band Transmission Assembly

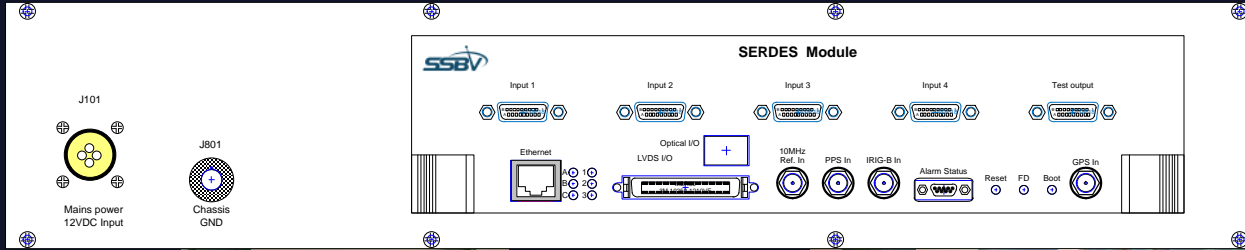
# Development of a Generic Platform (I)

- Easy expansion to different electrical interfaces
- Protocol Customisation
- COTS Back-end Server
- Industry Standard Back-end Interface
- Common “Baseband Processing Module” (PCB):
  - Front-end FPGA (protocol customisation)
  - Back-end FPGA (data transportation)
  - Data time-stamping
- Back-End I/F (plugin board):
  - Multi-Gigabit Fiber Optic
  - Gigabit Ethernet with hardware TCP/IP
- Front-End I/F (plugin board):
  - SERDES Interface (Aeroflex UT54LVDS218)
  - Spacewire Interface (Serial LVDS) – 8 Parallel Links
  - Parallel LVDS
  - Wizardlink Interface (Texas Instruments TLK2711)





# Development of a Generic Platform (II)



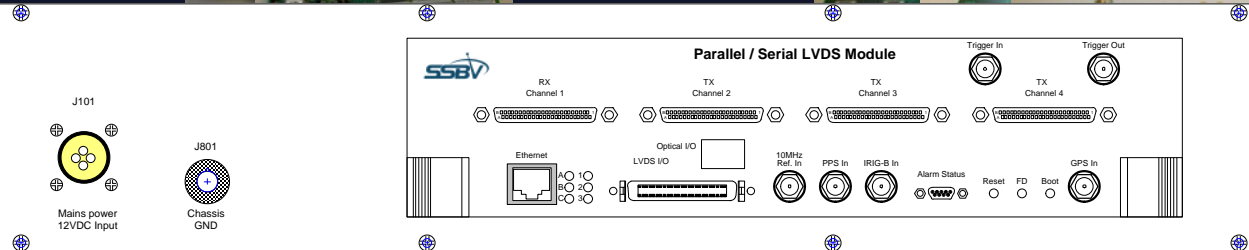
SERDES Interface Unit

SERDES

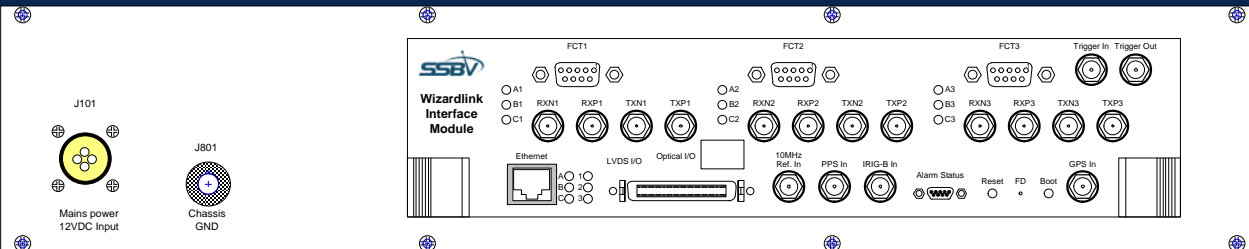
Parallel/Serial LVDS

Wizardlink Interface Module

Wizardlink



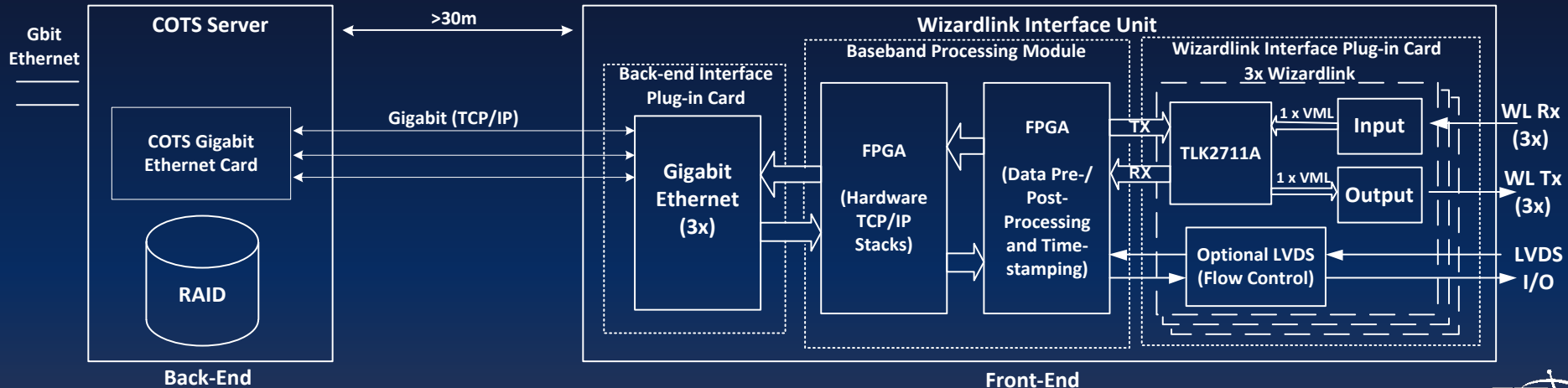
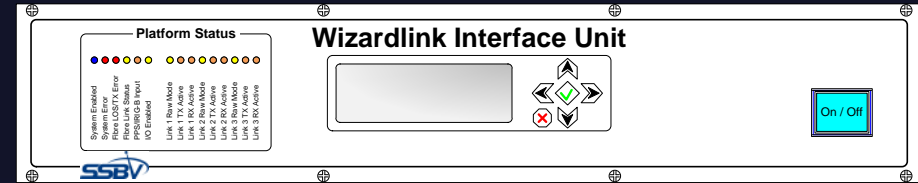
Baseband Processing Module



Wizardlink Interface Unit

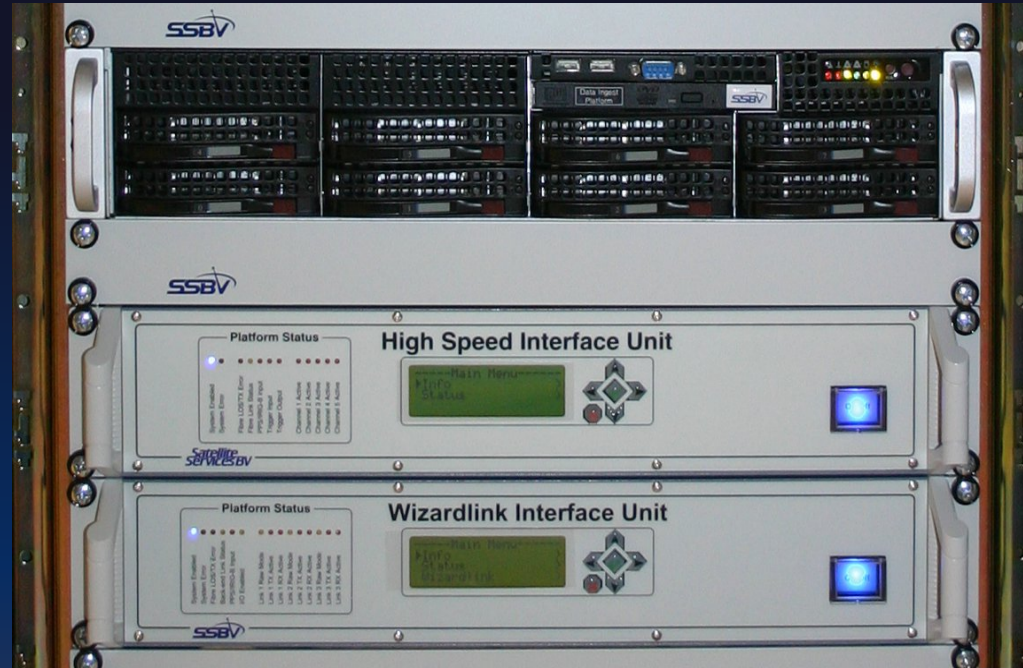
# Second Generation Wizardlink Front-End

- Based on generic hardware platform
- Additional improvements over 1<sup>st</sup> generation:
  - Three Wizardlink interfaces
  - Sync or Async Clocking
  - Support “link teaming”
  - Support RAW link character acquisition
  - Individual in- and output control



# Platform Deployments

- Proven in large number of programmes:
  - Sentinel-1 (SES-EGSE, PDHT-EGSE, DSHA-EGSE)
  - Sentinel-2 (MSI-EGSE, RF-SCOE)
  - GAIA (Spacewire-SCOE, PLM-EGSE)
  - SeoSAT (X-Band SCOE)
  - AS250 (X-Band SCOE)
  - EarthCARE (RF-SCOE, MMFU-EGSE)
  - Non-ESA programmes (various SCOE's)



# Future Development

- Current platform is ready for future protocols/interfaces
- Such as SpaceFibre:
  - Standard being defined (ECSS-E-ST-50-XXX Draft D)
    - SpaceWire Packets over SpaceFibre
    - Virtual Channel Layer (Packet TX/RX with QoS)
    - Broadcasting Layer (time/sync/events)
    - Up to 2Gbps data rate (lane)
    - Link teaming (multiple lanes)
    - Wizardlink or other SERDES (physical)
    - Copper or Fiber (medium)
  - Generic Platform Developments:
    - SpaceFibre physical layer
      - Wizardlink Front-End already available
      - Fiber optic Front-End to be developed
    - CODEC Implementation in a firmware core
- **Limited effort and low risk!**

# Summary

- First Generation Wizardlink Front-End
  - Sentinel-1 EGSE's
- Development of a Generic Platform
  - SERDES, Parallel LVDS, Wizardlink
  - Various EGSE's
- Future Development
  - SpaceFibre
  
- Meet us at our booth



**Thank you for your attention**



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