

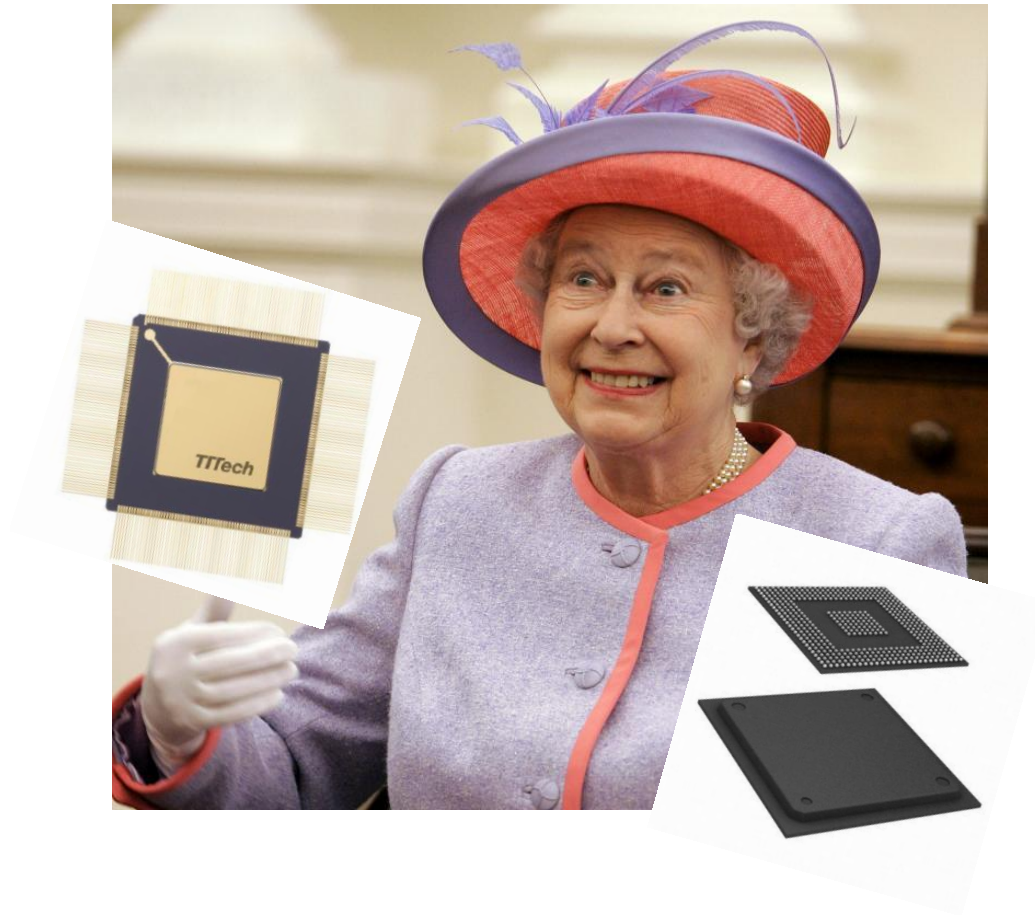
# Exhibition + Space Products Development 2016-18 (Overview)

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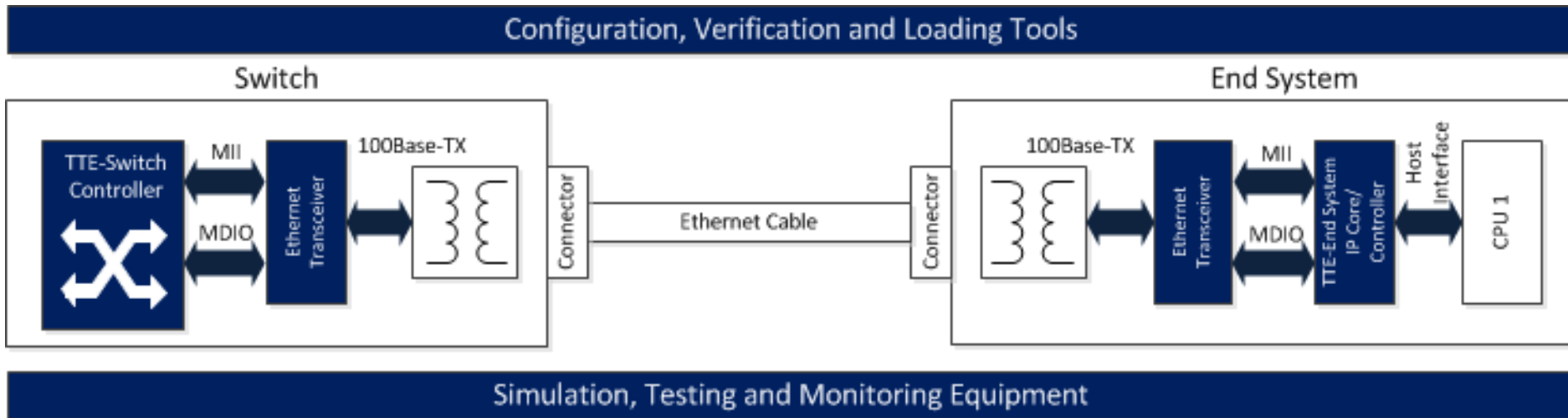
Product Management

ESA ADCSS - October 18<sup>th</sup>, 2016

# The Royal TTEthernet Society Presents...



# Network Building Blocks



- ✓ Switch and End System
- ✓ Embedded Software (Drivers, Firmware)
- ✓ Transceiver (Physical Layer)
- ✓ Cabling + Connectors
- ✓ Configuration/Loading and Verification Tools
- ✓ Development, Testing and Monitoring Equipment

## ✓ TTE-**Switch** Controller

- Partly funded via ESA FLPP-3 (up to tape-out)
- Space grade ceramic package (CQFP 256)
- HiRel plastic package

## ✓ TTE-**End System** Controller

- Space grade ceramic package (CQFP 256)
- HiRel plastic package (PBGA 400) for high-volume programs
- a/k/a “TTC” in Ariane 6 avionics

# TTE-Controller SoC

## End System

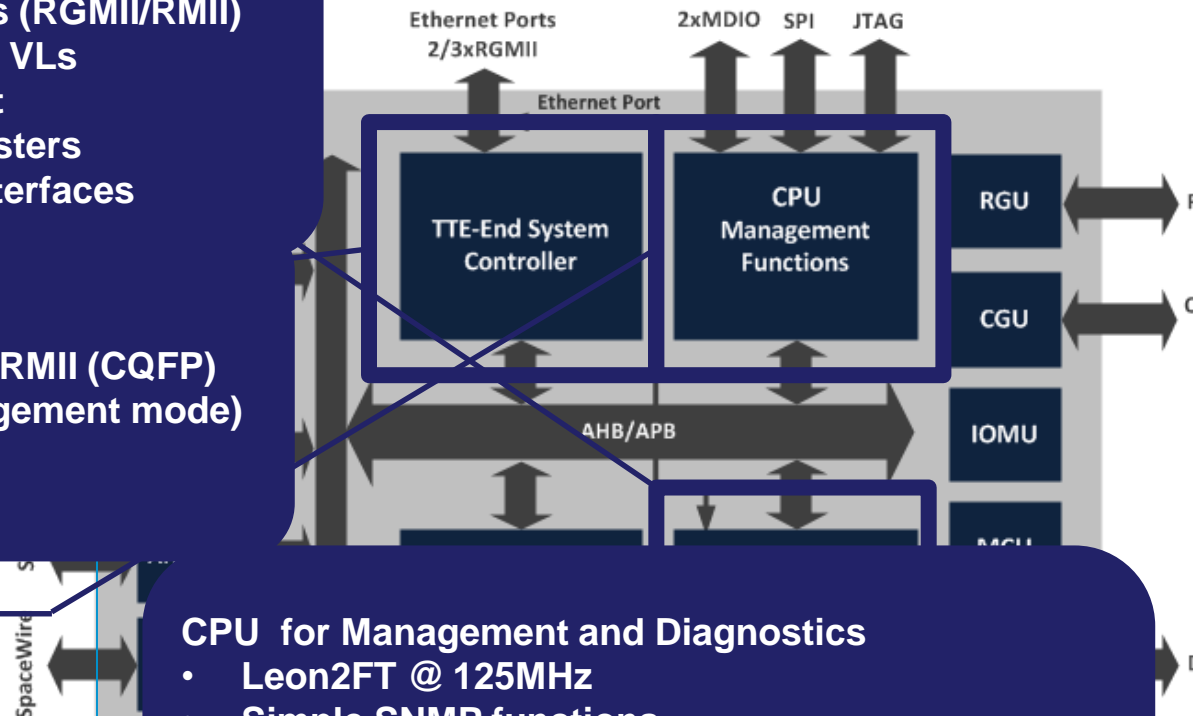
- 1
  - 3 x 10/100/1000Mbps ports (RGMII/RMII)
  - 256 send VLs, 512 receive VLs
  - IP/UDP/ARINC653 support
- 2
  - Diagnosis and status registers
  - PCI, (Q)SPI, SpaceWire interfaces

## Switch Commander

- 6 x 10/100/1000 RGMII/RMII
- 19 x 10/100 RMII (PBGA) 12x10/100 RMII (CQFP)
- 1 x 10/100 on-chip (for E/S in management mode)
- 4096 VLs (messages)
- 1MB frame memory

## 4 CPU

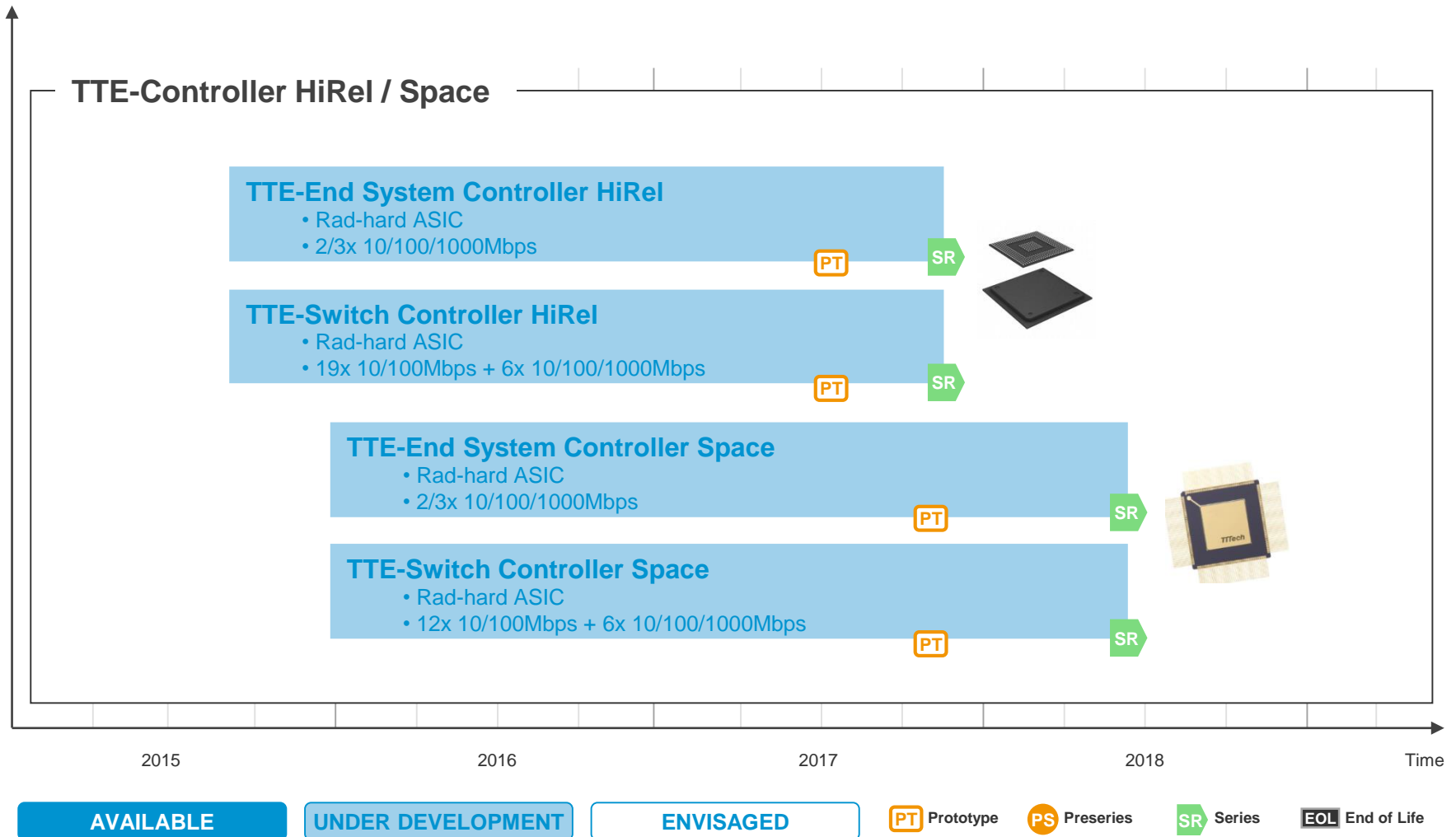
- Management &
- Diagnostics



## CPU for Management and Diagnostics

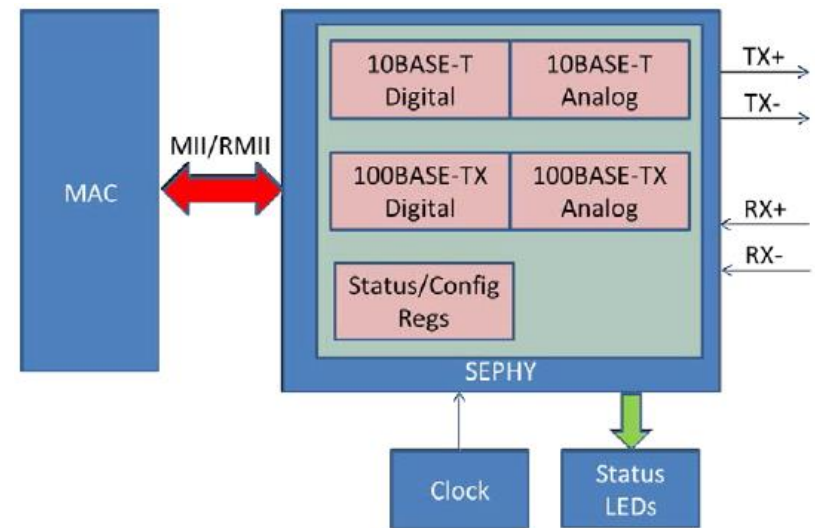
- Leon2FT @ 125MHz
- Simple SNMP functions
- Simple TFTP data loading
- Bootloader
- Switch driver
- End System driver
- User tasks

# Chip Product Roadmap



# Ethernet PHY for Space

- ✓ COTS Ethernet PHY radiation characterization (ESA TRP)
- ✓ SEPHY (EU project led by Arquimea) – [www.sephy.eu](http://www.sephy.eu)
  - ✓ European solution
  - ✓ 1<sup>st</sup> step 10/100Mbit/s
    - ✓ 150nm SOI mixed signal process (Atmel)
    - ✓ First samples in Q2/2017
  - ✓ 2<sup>nd</sup> step 10/100/1000Mbit/s



| PARAMETER | MIN | TYP | MAX | UNIT                   | COMMENTS |
|-----------|-----|-----|-----|------------------------|----------|
| TID       | -   | 100 | 300 | Krad                   |          |
| SEL       | 60  | -   | -   | MeVcm <sup>2</sup> /mg |          |
| SEU/SET   | 20  | -   | -   | MeVcm <sup>2</sup> /mg |          |

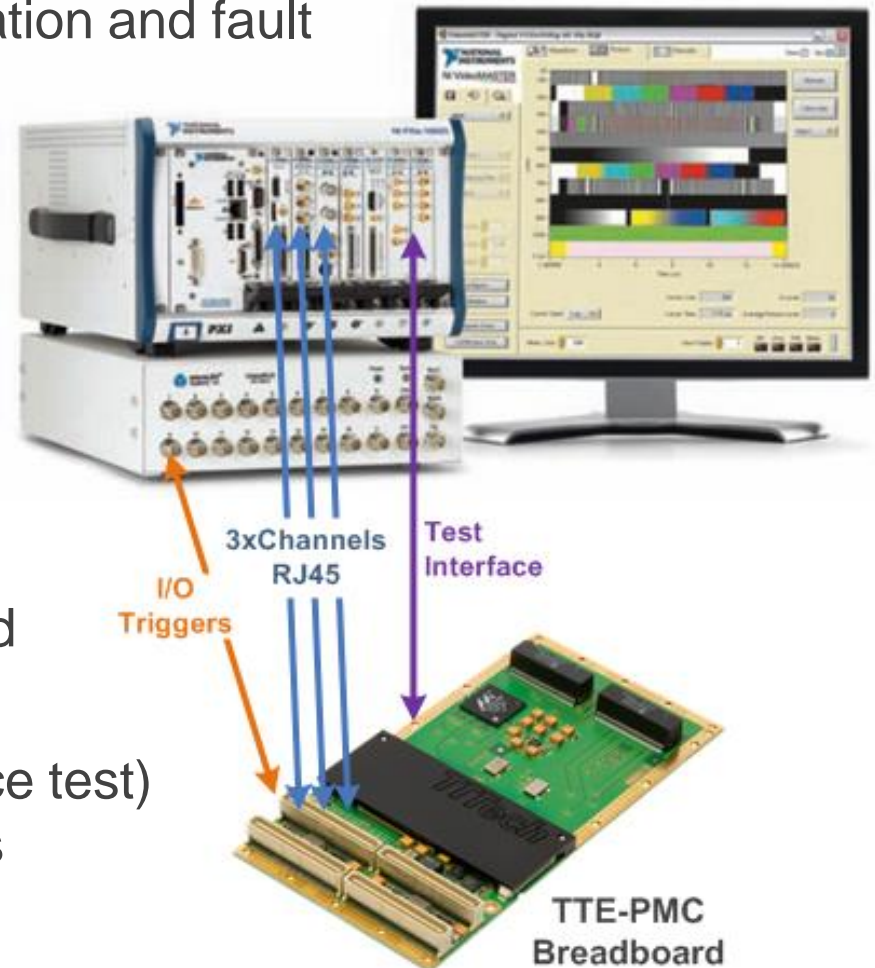
- ✓ Further development planned
- ✓ Two 19" high-performance TTEthernet switches (**TTE Switch A664 Lab**) with 24 ports and configuration/diagnostic (SNMP) interfaces
- ✓ 4 Linux-based PCs with triple channel TTEthernet capability
- ✓ Copper Gigabit Ethernet (10/100/1000Mbit/s) compliant interfaces
- ✓ TTEthernet Tools for network planning, schedule generation and configuration, loading (TFTP, ARINC 615-A)
- ✓ Example application, documentation





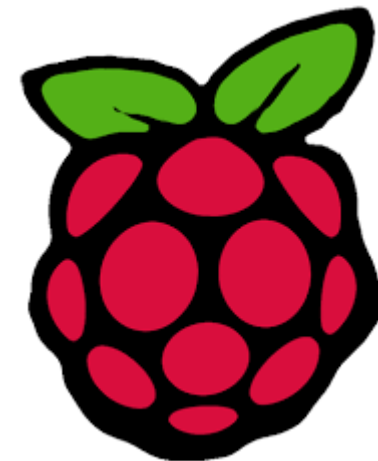
# TTEthernet Test Bed (ESA GSTP)

- ✓ Modular integrated test bed for network-level testing (determinism, synchronization and fault tolerance mechanisms)
- ✓ Assess end-to-end communication performance (worst case latency, jitter)
- ✓ Single switch as well as multi-hop domains
- ✓ Ability to inject errors
- ✓ Enables to derive malfunction and errors in early prototypes
- ✓ Verification (and future compliance test) of tested components and boards



# Exhibition: Deterministic Ethernet as Basis for DIMA and Mixed-Criticality Systems

- ✓ Strict partitioning (data communication, memory)
- ✓ Synchronization for optimized distributed computing
- ✓ Built-in fault-tolerance
- ✓ Sample applications (rotorcraft, launchers)
- ✓ Standardization
- ✓ More affordable development equipment/  
simpler tooling



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