L. Koblyakova, Yu. Sheynin, D. Raszhivin

Real-Time Services in Networked Embedded Systems

SpaceWire protocol

SpaceWire is a spacecraft communication network based in part on the IEEE 1355 standard of communications. It is coordinated by the European Space Agency (ESA)

SpaceWire standard is supported and developed in collaboration with international space agencies including NASA, JAXA and RKA.

- Speed 5-400 MBit/s
- Segment length up to 10 m
- Full-duplex channels
- Built-in system functions for on-board systems with distributed architecture:
  - Time codes
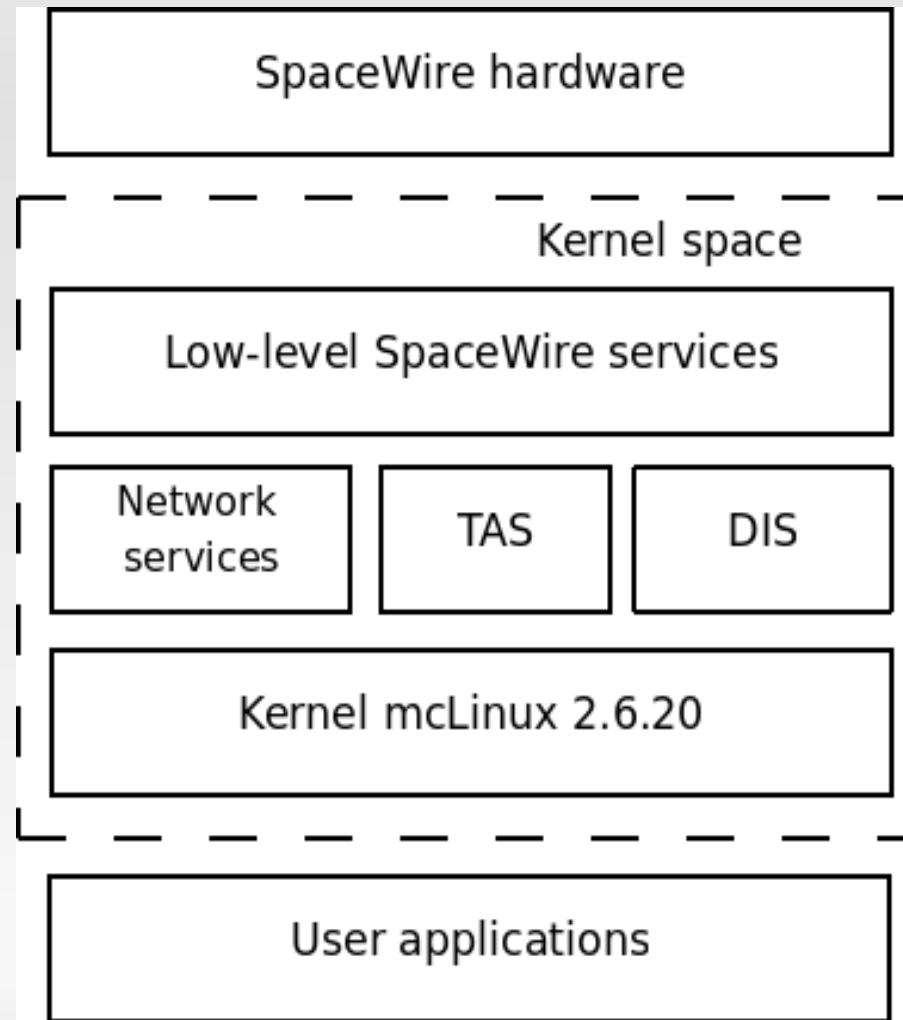 - Interrput codes

ECSS-E-50-12A

24 January 2003

EUROPEAN COOPERATION

ECSS

FOR SPACE STANDARDIZATION

Space engineering

SpaceWire - Links, nodes, routers and networks

OS Linux architecture with SpaceWire services

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┌─────────────────────────────────────────┐
│          SpaceWire hardware             │
└─────────────────────────────────────────┘

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                              Kernel space
│  ┌─────────────────────────────────────┐ │
   │    Low-level SpaceWire services     │
│  └─────────────────────────────────────┘ │

│  ┌──────────┐ ┌──────────┐ ┌──────────┐ │
   │ Network  │ │   TAS    │ │   DIS    │
│  │ services │ │          │ │          │ │
   └──────────┘ └──────────┘ └──────────┘
│                                          │
   ┌─────────────────────────────────────┐
│  │      Kernel mcLinux 2.6.20          │ │
   └─────────────────────────────────────┘
│                                          │
└ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─┘

┌─────────────────────────────────────────┐
│            User applications            │
└─────────────────────────────────────────┘
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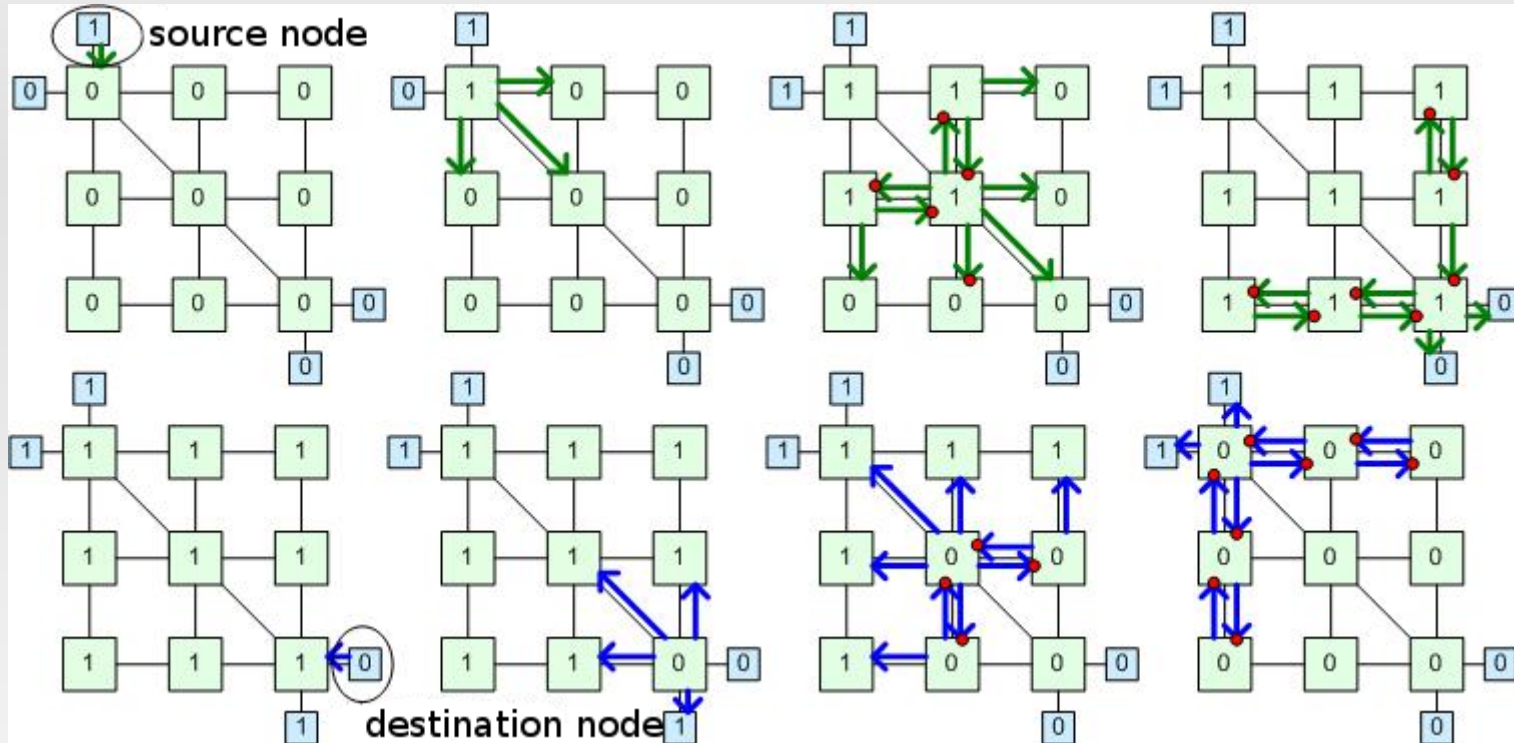
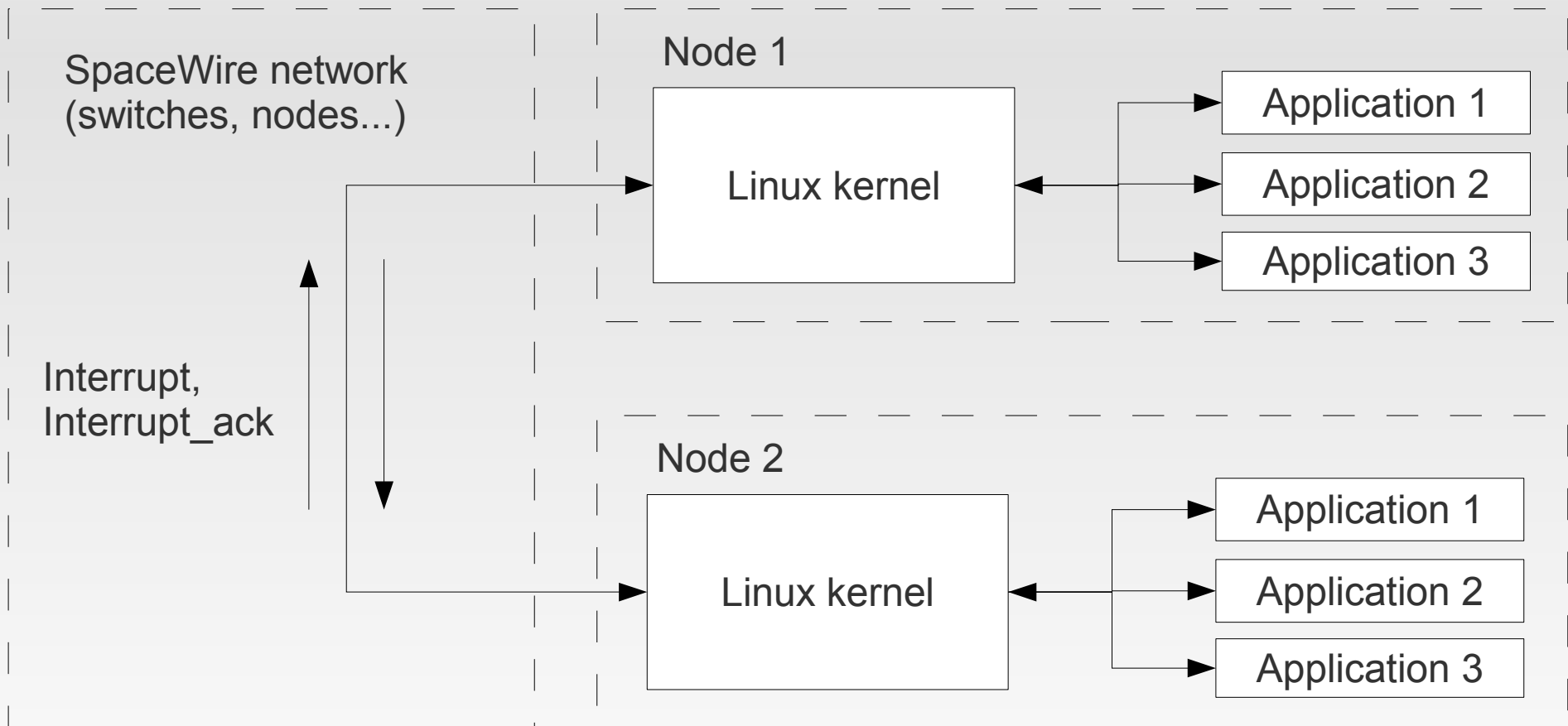# SpaceWire network example
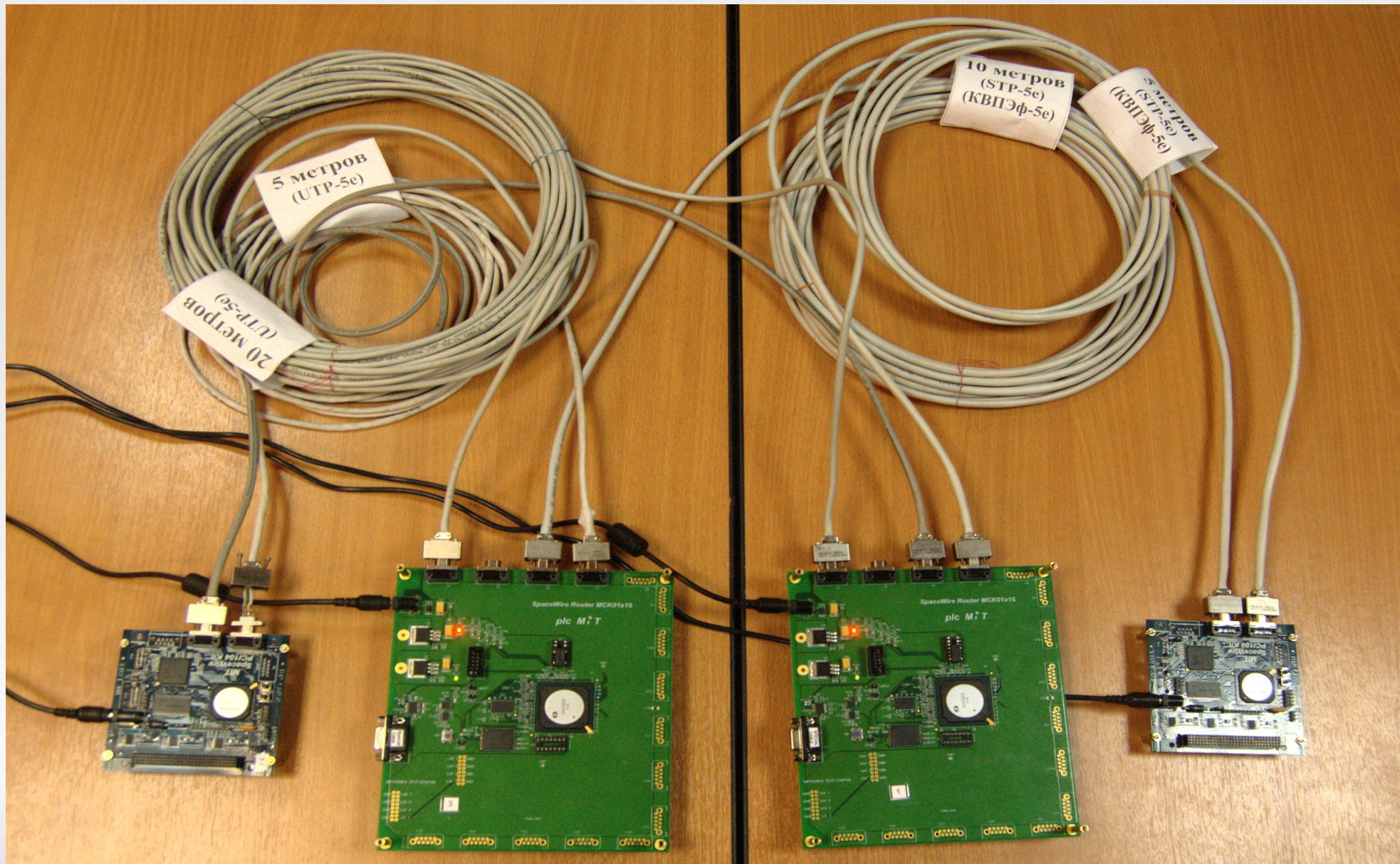
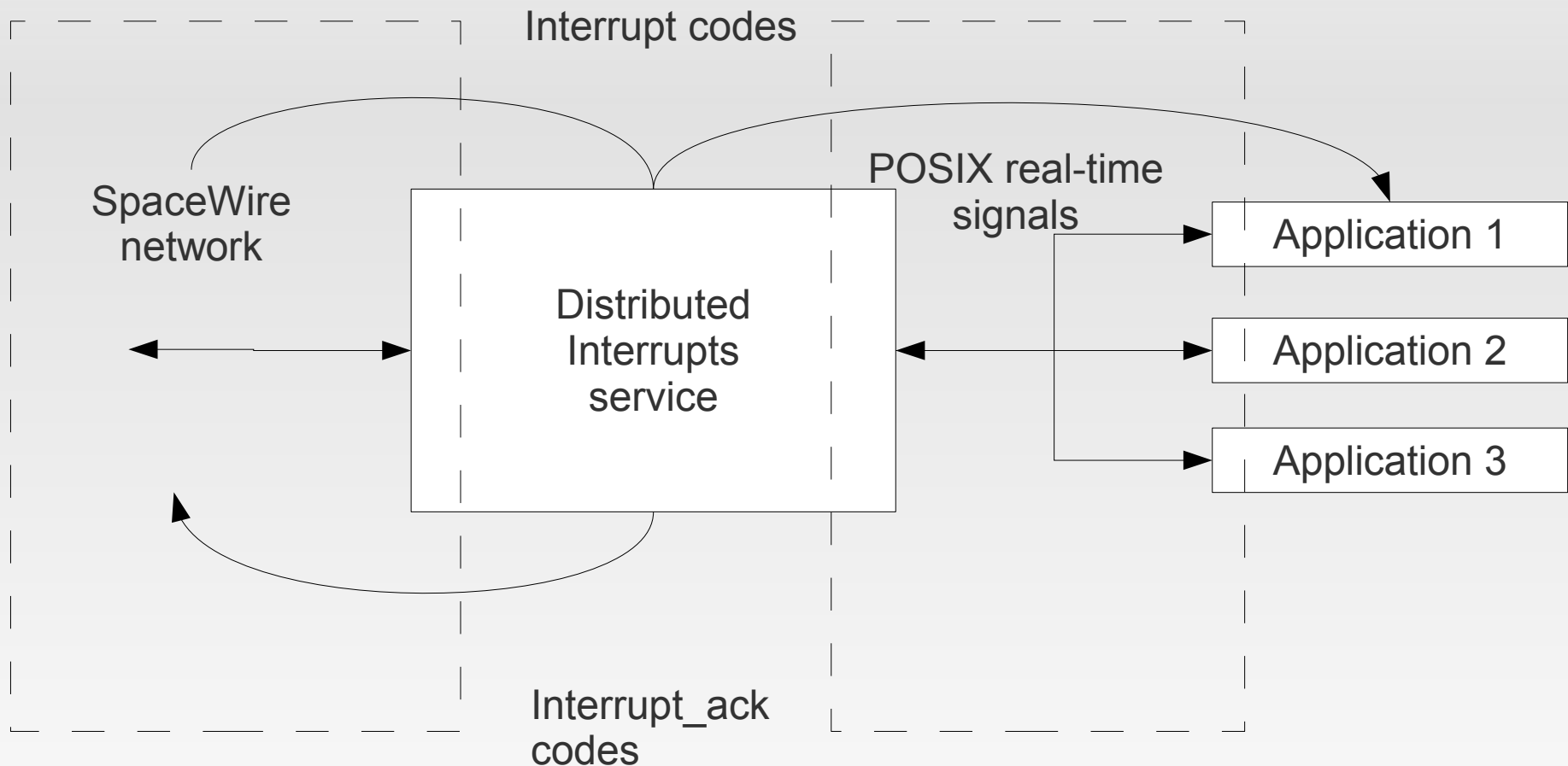# SpaceWire Distributed interrupts

Distributed interrupts mechanism intended for reliable and rapid transmission of signals with acknowledgement. It is included in the second edition of the SpaceWire standard.
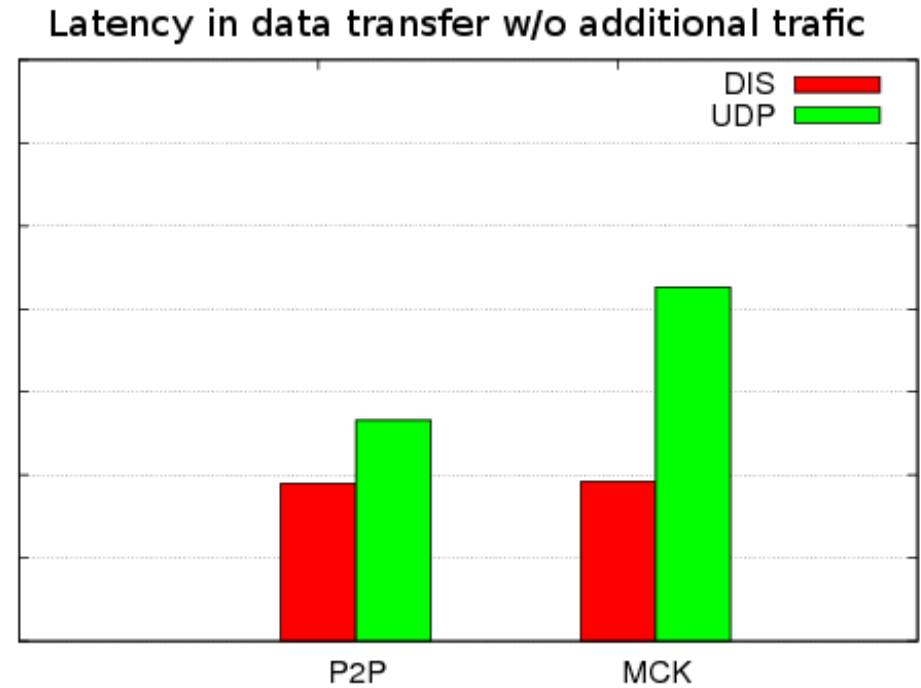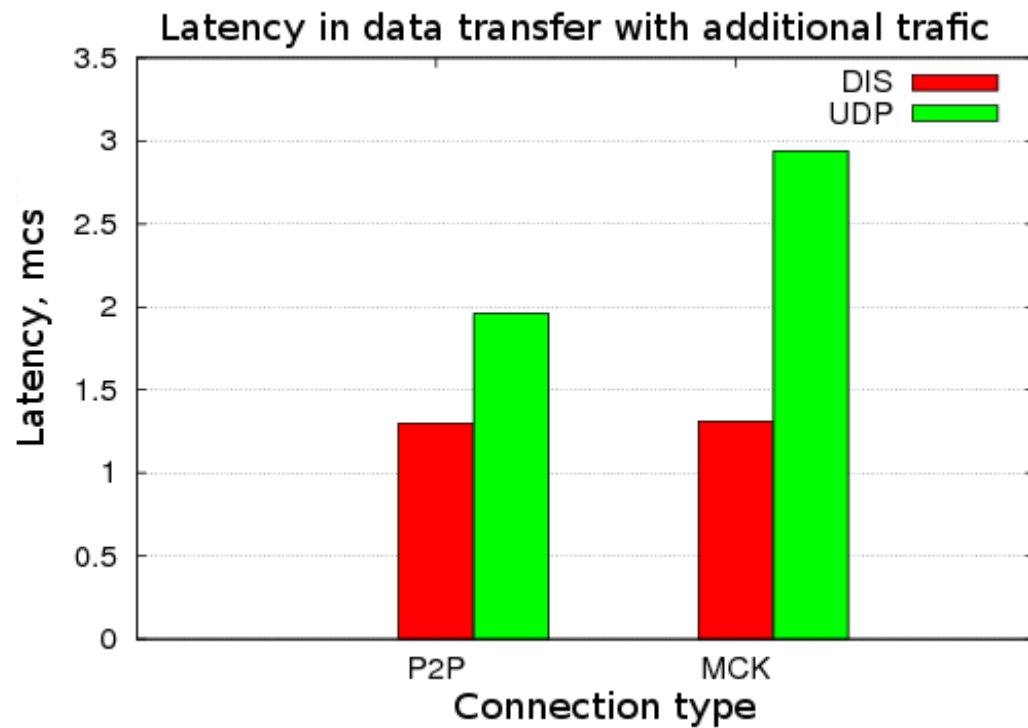
Distributed interrupts as service
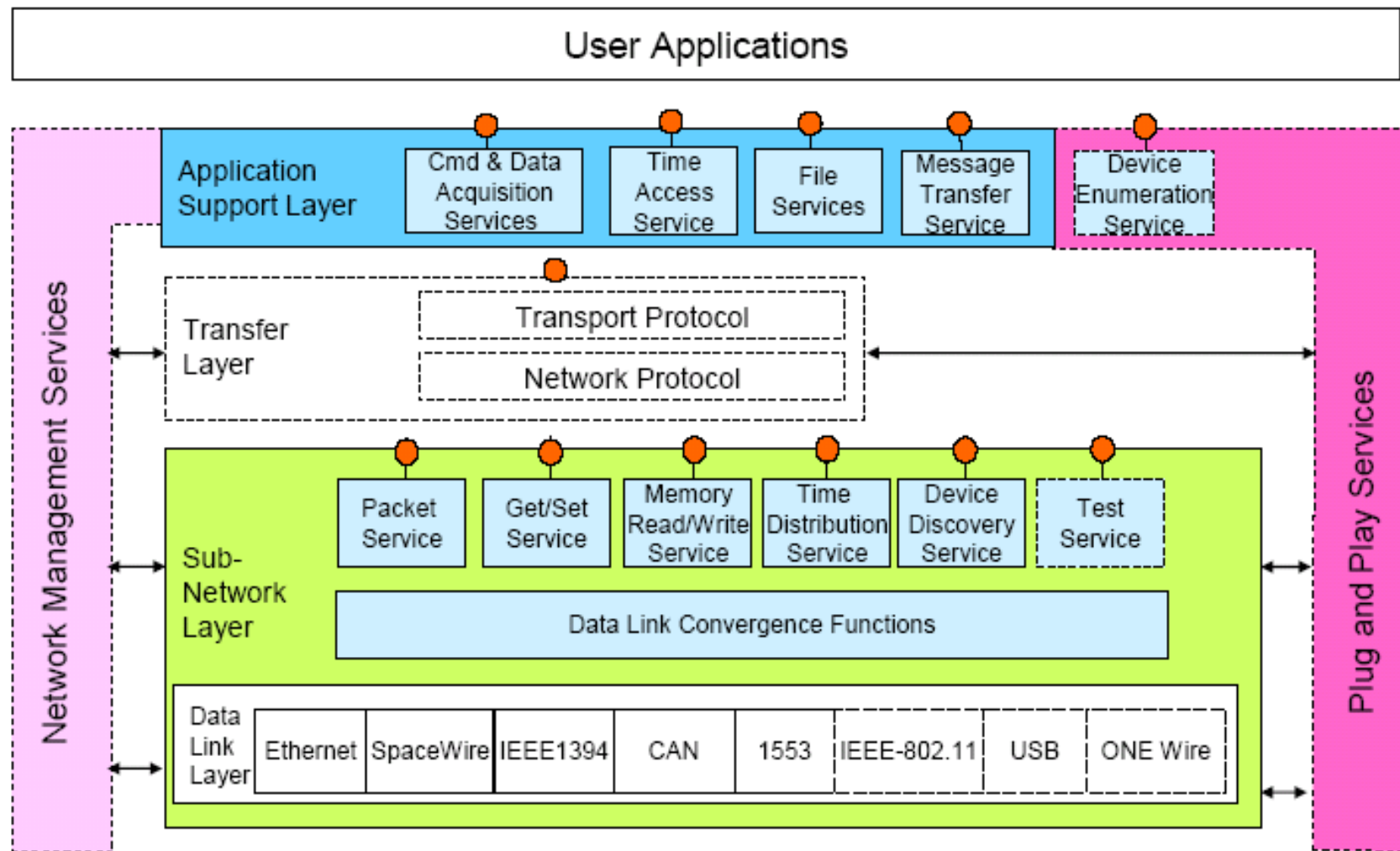
Architecture of distributed interrupts service

Characteristics of the service

Spacecraft onboard interface services
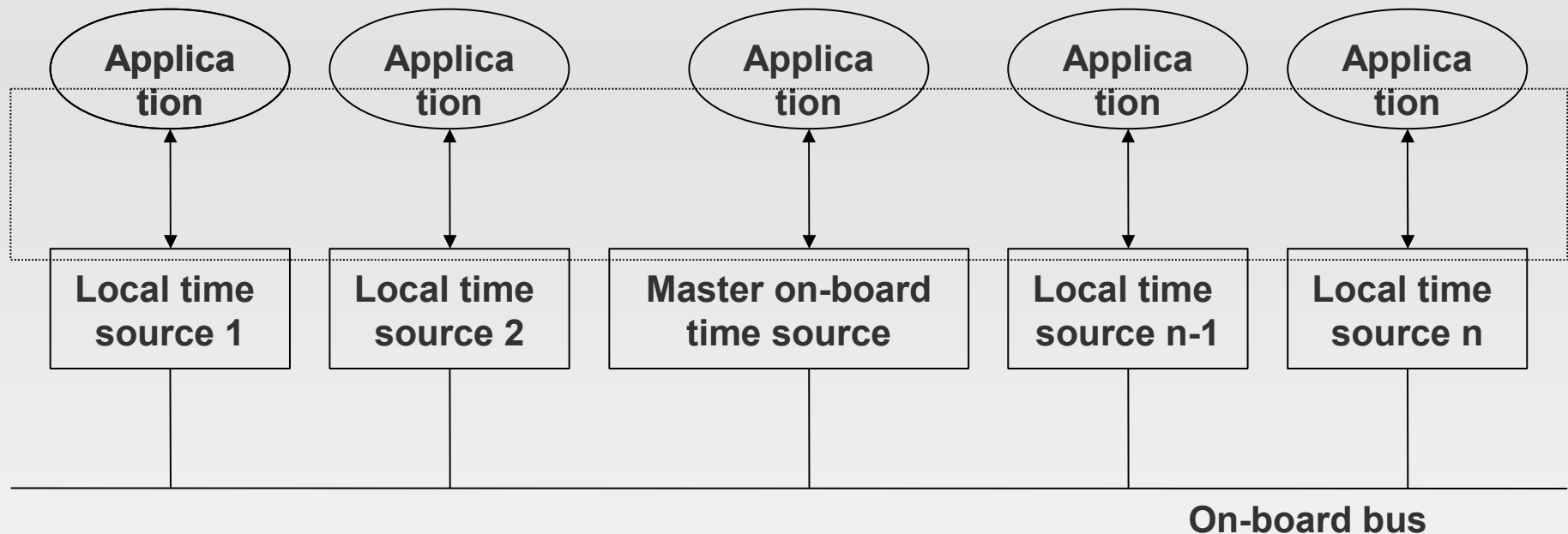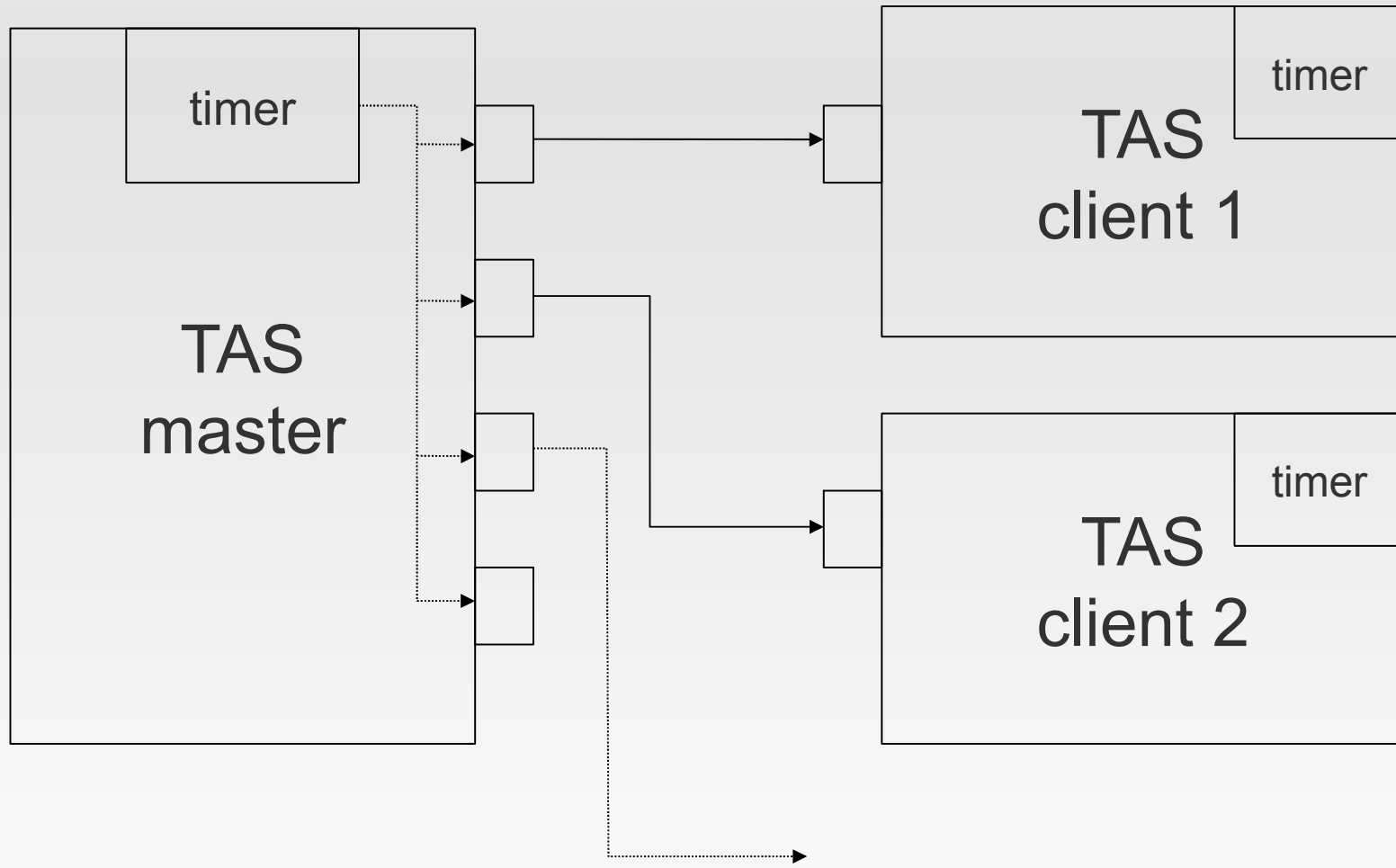
Architecture of time access service

consists of clients and the master of time, in which the time counter is implemented in hardware

Time access service primitives

- TAS_TIME.request
- TAS_ALARM.request
- TAS_CANCEL_ALARM.request
- TAS_METRONOME.request
- TAS_CANCEL_METRONOME.request
- TAS_TIME.indicaion
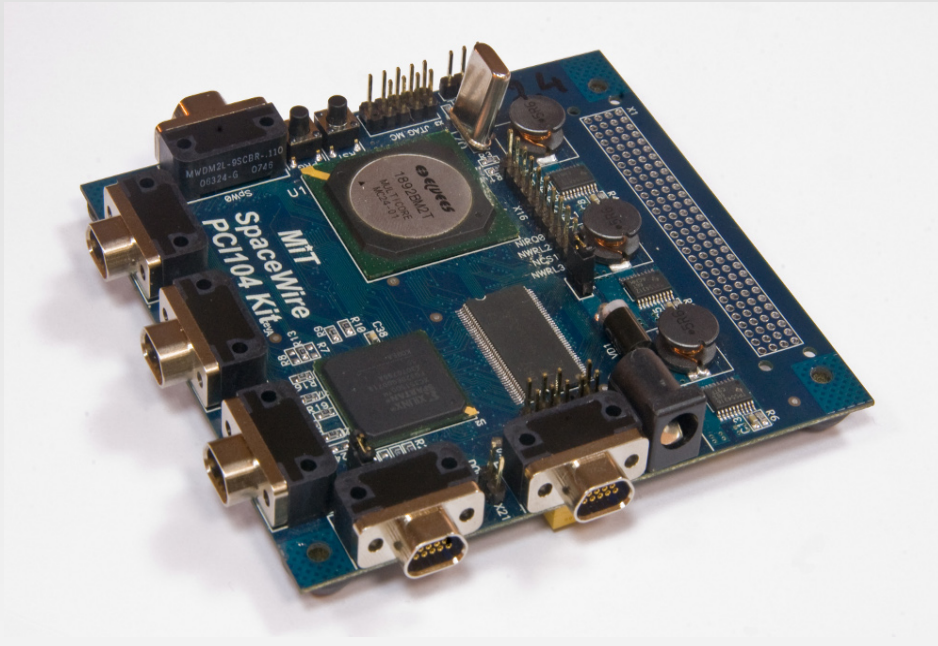
Time access service realization
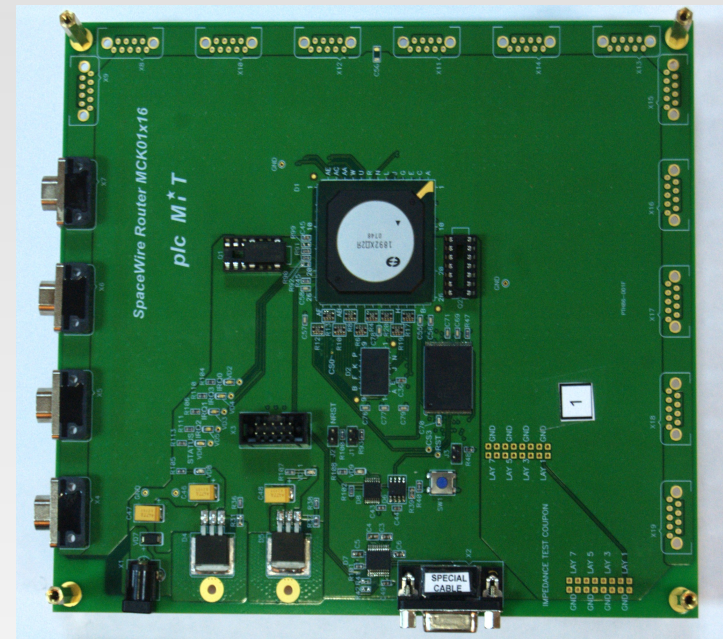
Thank you for your attention

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SpaceWire boards

MC24EM board with
MCB01 bridge

MCK-01EM board with
MCK01 switch