The Timed Asynchronous Model and its Application in Time-Triggered Protocols

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Time-Triggered Protocols (TTPs)

- Time-triggered vs. event-triggered communication
- Static scheduling
  - *TDMA* is used to guarantee transmission delay and jitter.
- Clock synchronization
  - Fault-tolerant internal synchronization generates a global time base.
- Composability
  - The sub-system property will not be invalidated after integration.
- Fail Silent
  - The bus guardian ensures that a node either delivers a message at the correct moment or not at all.

TTP/C

- Fault-Tolerant Units (FTUs)
- Node: Smallest Replaceable Units (SRUs)
  - *Host*
    - Application software
  - *Controller Network Interface (CNI)*
    - memory abstraction using DPRAM
  - *Autonomous Communication Controller*
    - MEssage Description List (MEDL)
    - BUS Guardian
- Communication Network
  - *Duplicated broadcast buses*

Timed Asynchronous(TA) model

- Each non-crashed process has a correct *hardware clock*.
- All the services are *timed*, i.e. having a time-out.
- Inter-process communication can only suffer *omission* or *performance* failures.
- Process can only suffer *crash* or *performance* failures.
- There is *no upper bound* on transmission and scheduling failures.

Objective

- *Implement TTP in timed asynchronous distributed systems*
  - *Uncertain communication*
    - *Datagram services*
  - *Less hardware support*
    - *Soft guardian*
    - *Clock synchronization*
- *Formal modeling based on TTP*