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