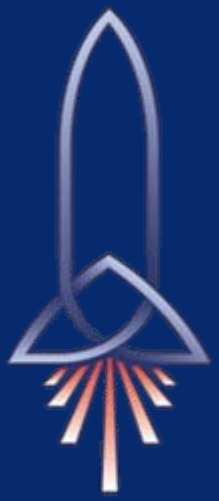

SpW-D

Steve Parkes, Albert Ferrer

Space Technology Centre, University of Dundee

Philippe Armbruster

ESTEC, ESA

Space Technology Centre
University of Dundee

Trade-Off Criteria

- Deterministic
  - Deterministic to 1 ms (at link speeds of 50 Mbits/s or higher)
  - Be able to collect data from several (e.g. ten) sensors within 1 ms
- Range of performances depending on application need
  - lower link speed implies lower performance

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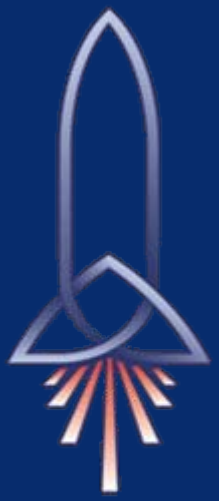
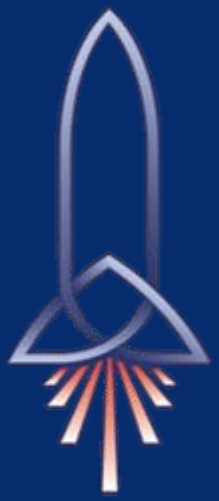
Trade-Off Criteria

- Efficient use of link bandwidth
  - Be able to achieve link bandwidth utilisation
  - Data transfer
    - At least 50% when transferring large amounts of data (e.g. 100 kbytes in length).
    - The higher the link utilisation the better.
  - Command and response
  - Be able to achieve link bandwidth utilisation
    - At least 20% when sending and receiving short commands (4 bytes in length).
    - The higher the link utilisation the better.



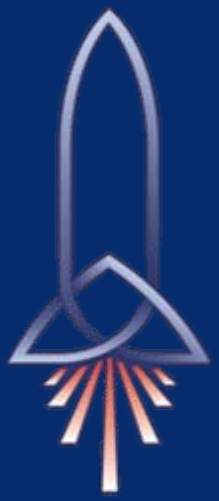
Trade-Off Criteria

- Random node access
  - Be able to decide at run time which nodes you want data from.
- Support concurrent data transfers
  - Linear increase in overall bandwidth with additional devices initiating data transfers.



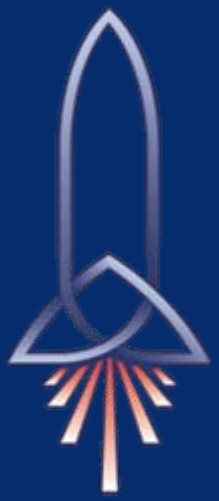
Trade-Off Criteria

- Simple
  - Easy to explain.
  - Concise specification.
  - As few operating modes as possible.
  - Simple specification of options and parameters to support interoperability.
  - Makes systems simple too



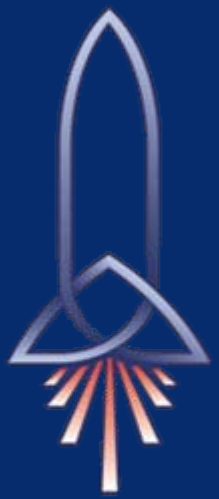
Trade-Off Criteria

- Operate using existing SpaceWire devices
  - As few constraints as possible on existing devices.
  - Target devices no functional constraints and minimal performance constraints.
  - Fewer or more relaxed performance constraints are better.



Trade-Off Criteria

- Be capable of detecting errors
  - Transaction not completed in time.
  - Failure of link to an initiating node?
- Be capable of recovering from errors??
  - Maintaining determinism
    - e.g. double transmission, possibly over different paths?
  - Without maintaining determinism.



Trade-Off Criteria

- What is missing?
  - Errors in time-codes and multiple masters
  - Multiple Initiators
  - Requirements on Initiators – time-synchronisation
  - How fast it can send a command and handle a response
  - Interoperability
  - Implementation agnostic
  - Coexistence with other time-distribution systems eg GPS i.e PPS and time-code from GPS
  - Able to handle full range of SOIS services
  - Able to partition network into SpaceWire and SpaceWire-D parts.

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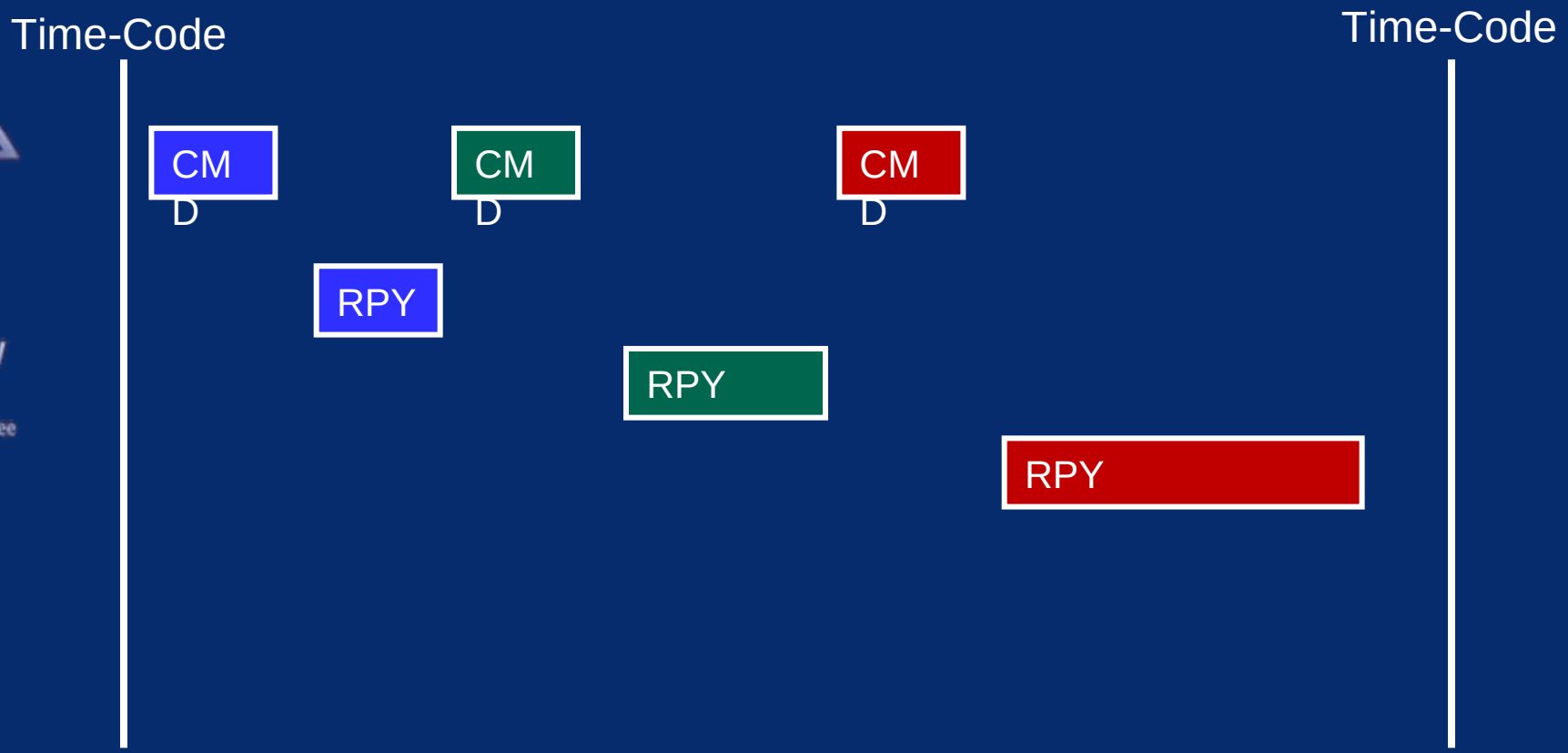
Trade-Off Criteria

Multiple Transactions in Single Time-Slot



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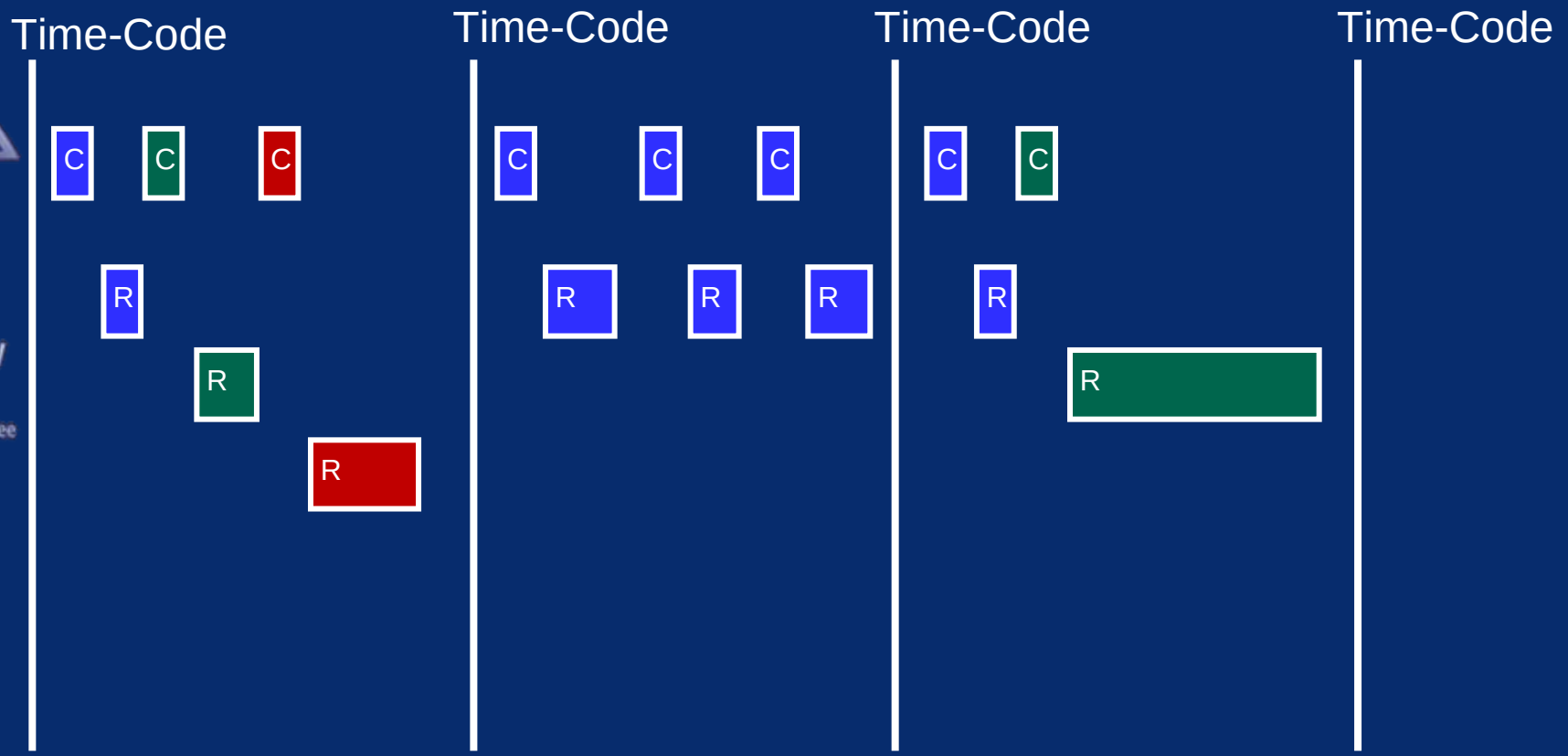
Multiple Transactions in Single Time-Slot



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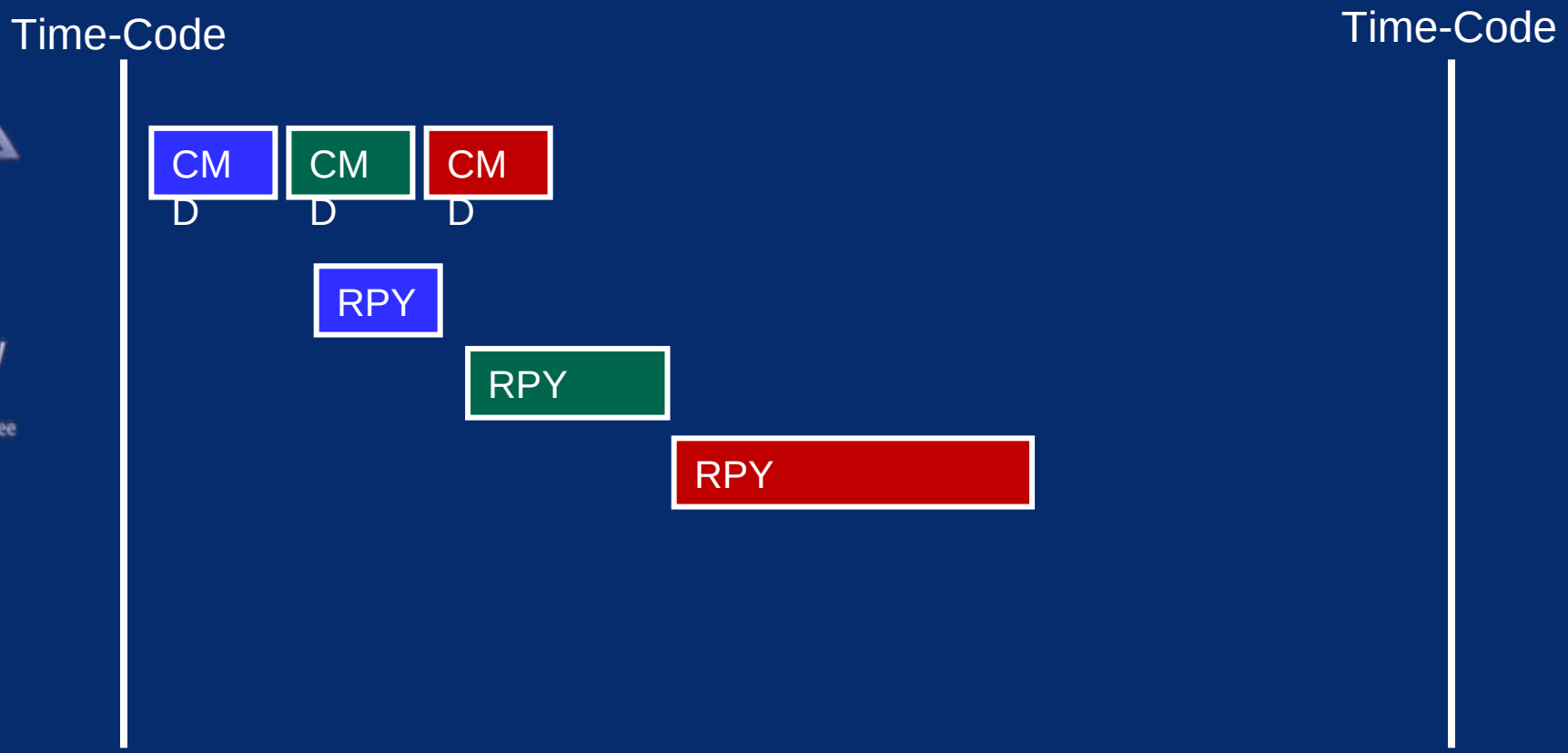
Multiple Transactions in Single Time-Slot



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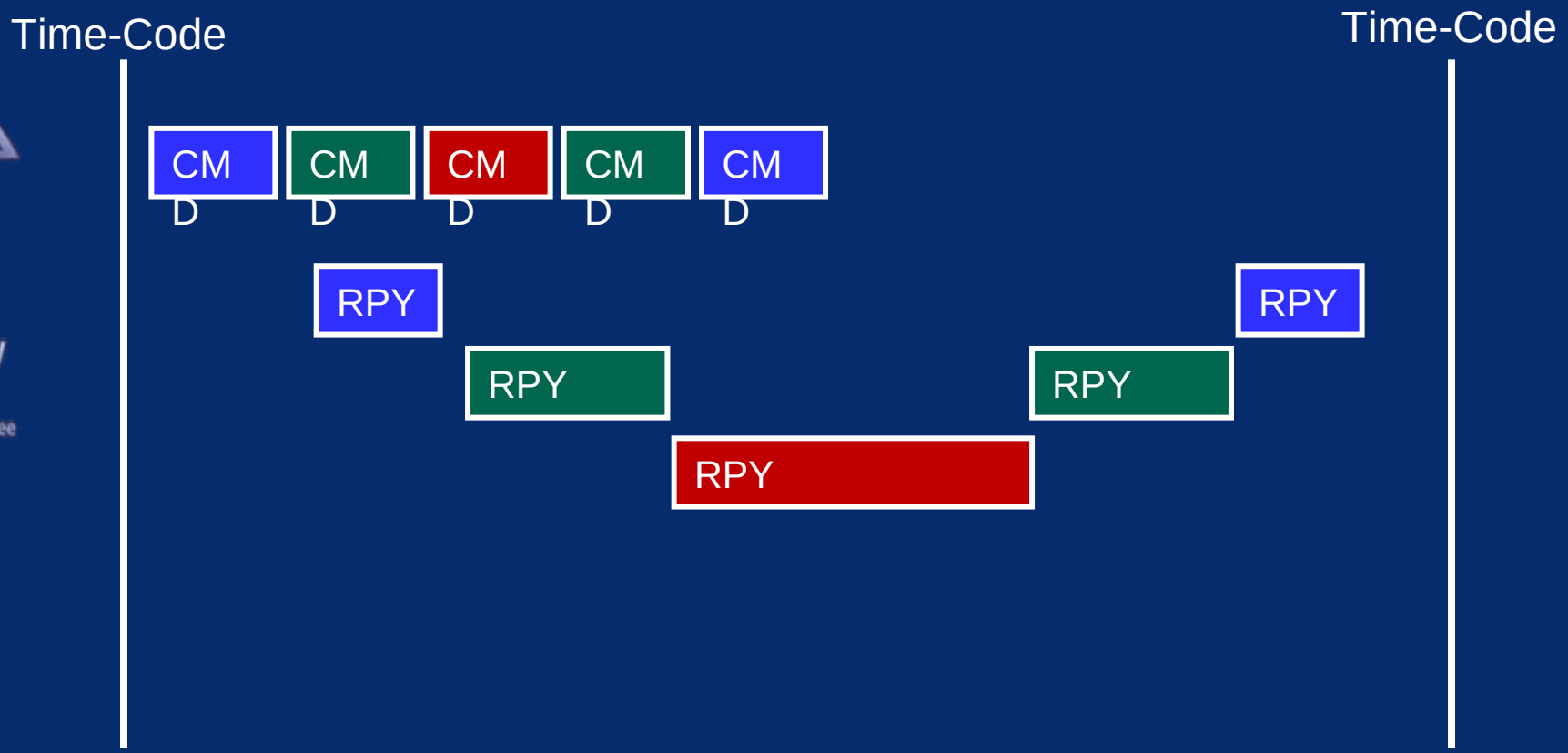
Multiple Transactions in Single Time-Slot



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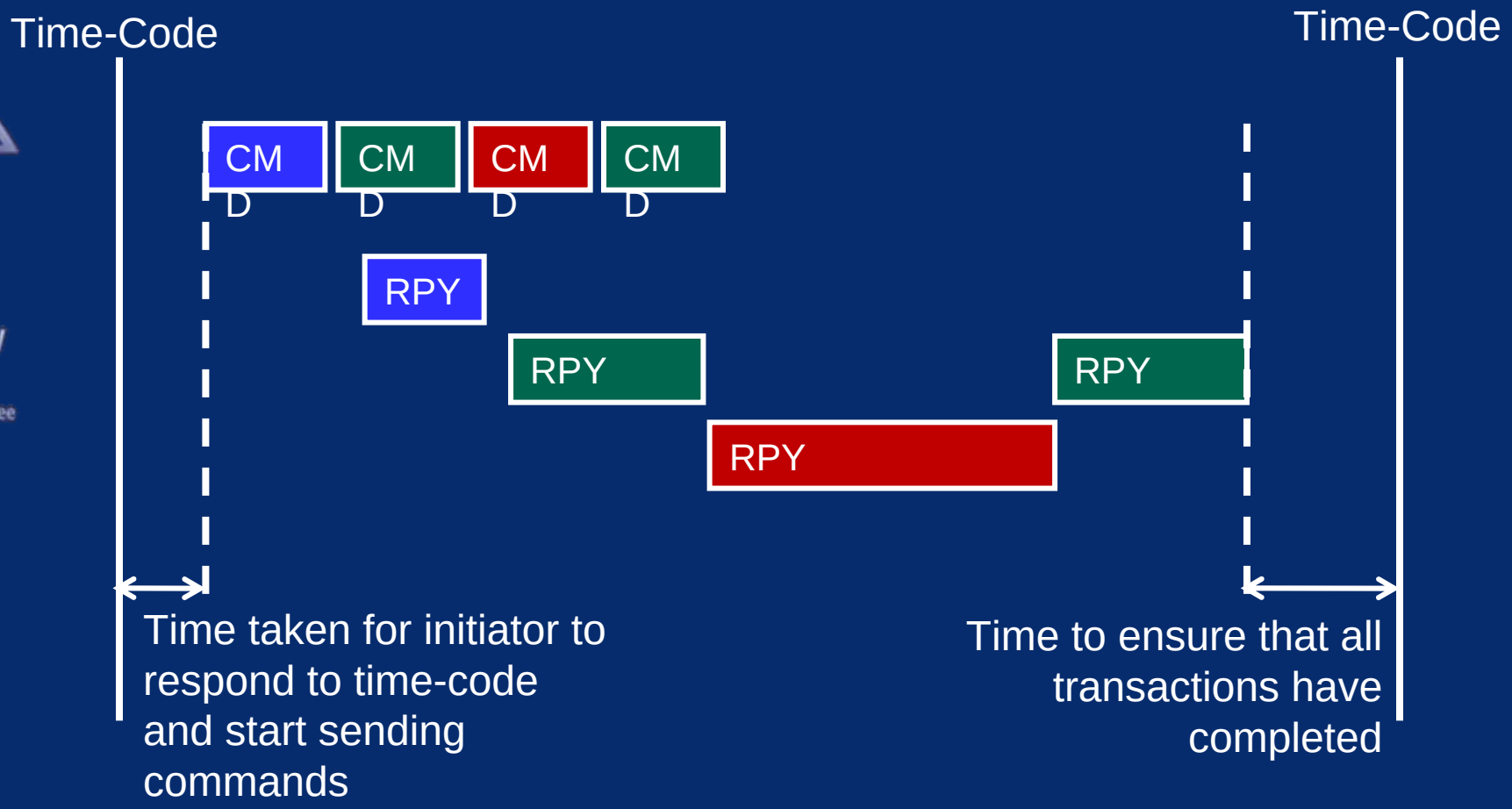
Schedule

- Schedule arranged to avoid conflicting use of network resources
- In a single slot can have
  - Parallel Initiators with specified Targets or groups of Targets
  - Single Initiator that can send commands to any Target

Initiator Response and Transactions Complete



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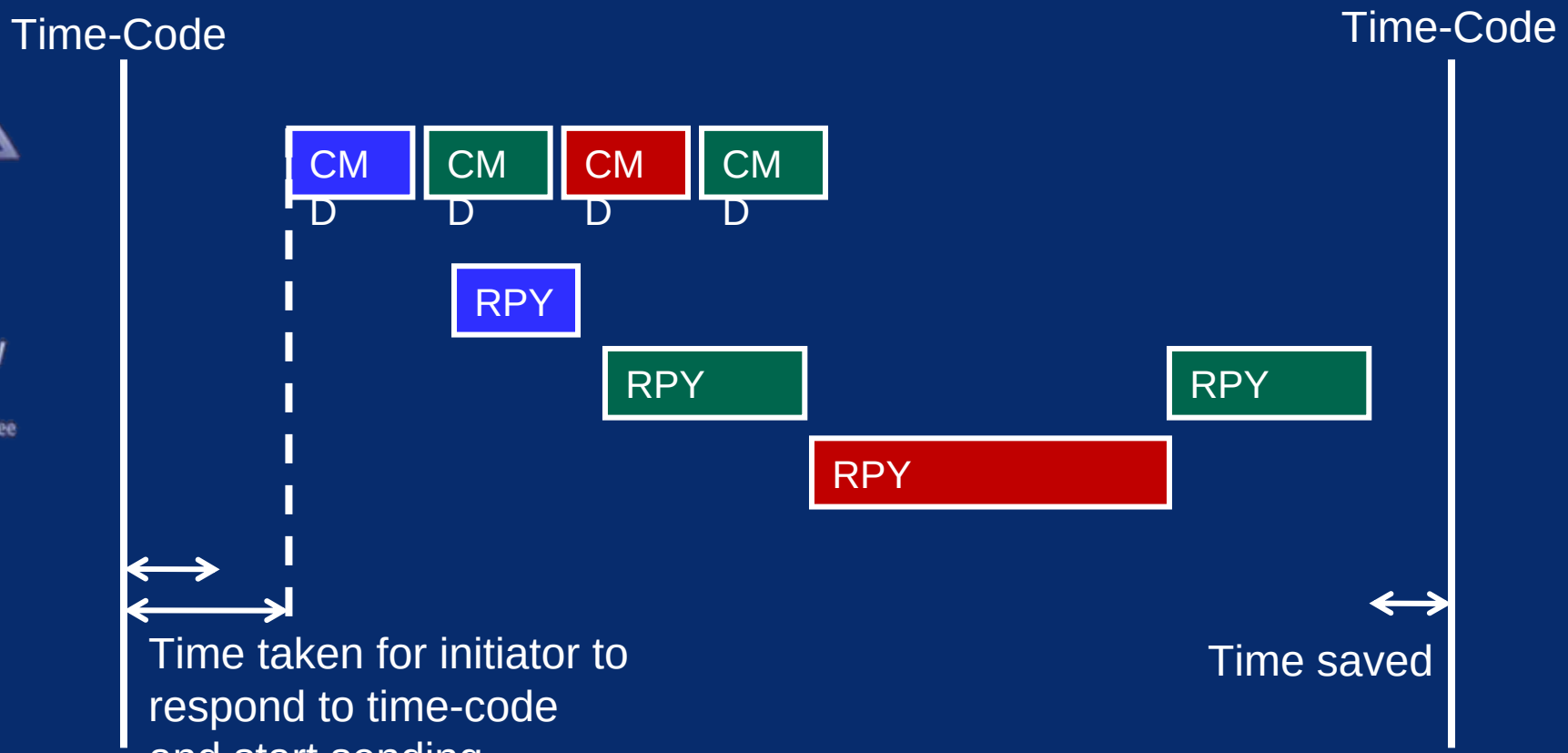
Initiator Response and Transactions Complete



Time to ensure that all transactions have completed

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Existing Hardware

- Targets
  - Any Target
    - Provided that it responds to a command reasonably quickly
  - Can now be more flexible on this
    - Provided it fits in the schedule
- Initiators
  - Have taken into account time for response to time-code
  - On time-code Initiator
    - Checks all transactions complete
      - Flags error if not
    - Readies commands for sending
    - Sends them after check interval (kill interval)

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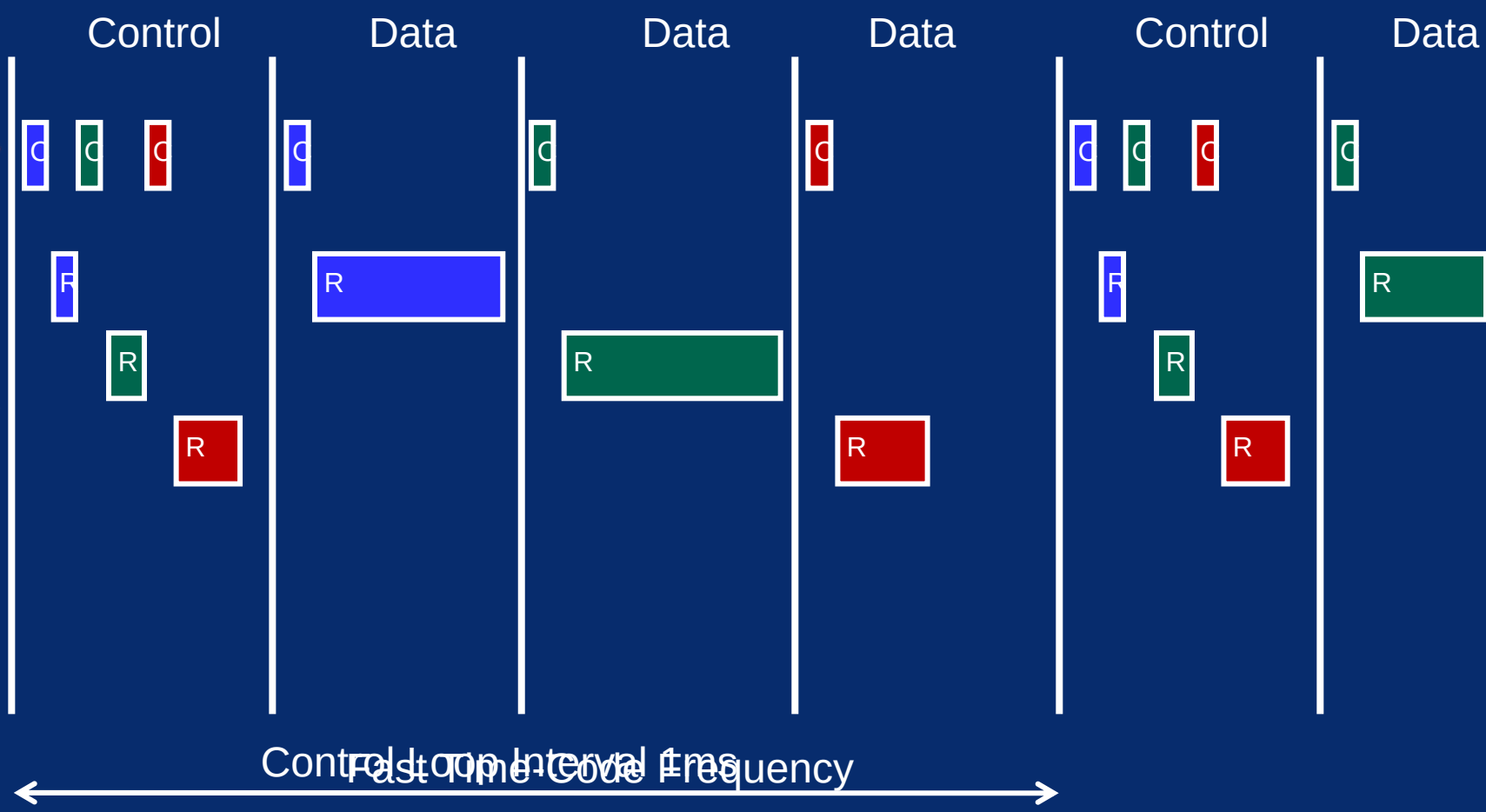
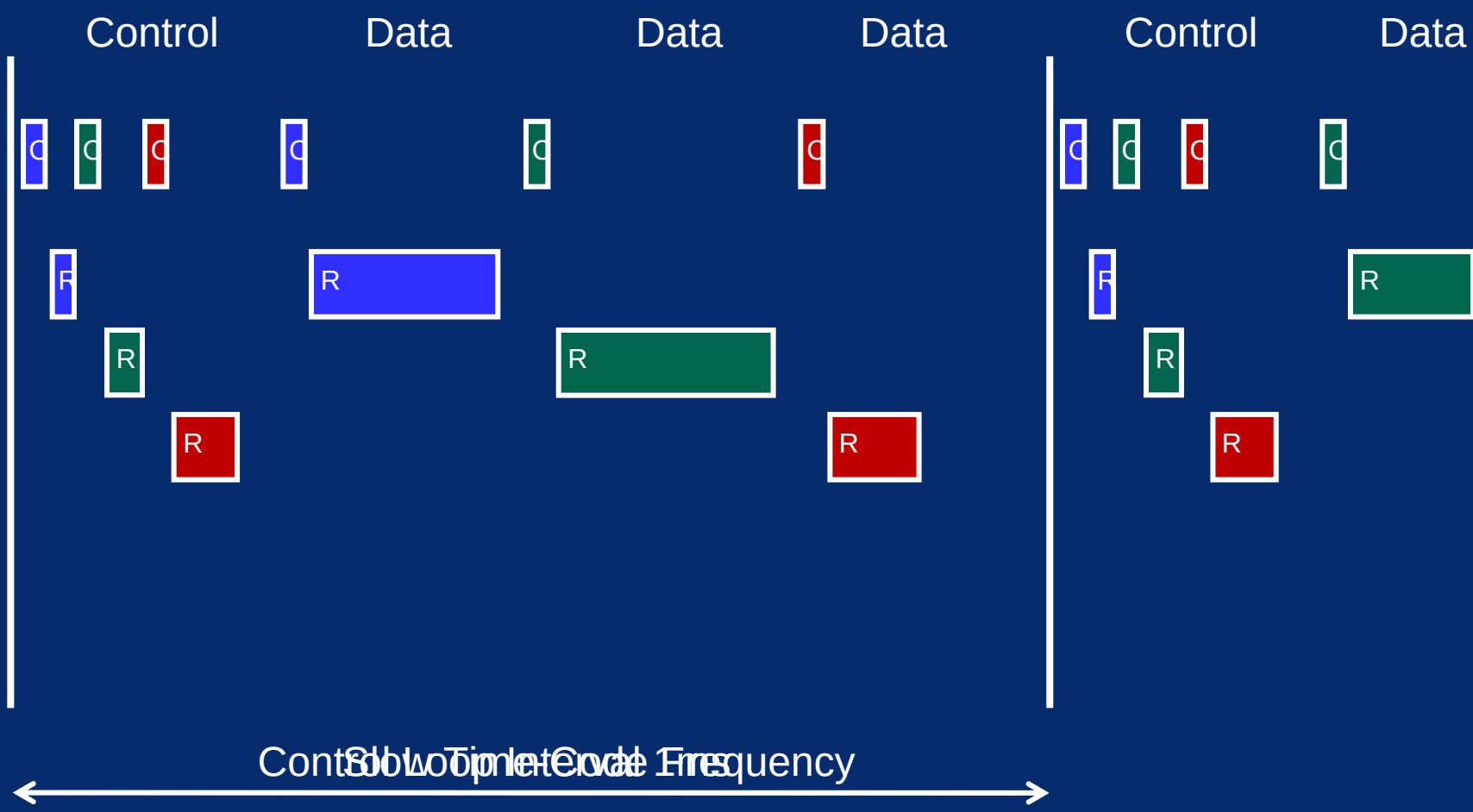
FDIR

- Initiator can check that all transactions completed by time next time-code received
- Can do this because RMAP transactions can provide acknowledgement
- If an error is detected,
  - Can notify network manager
  - If it happens again can cease sending and notify network manager
  - Etc.
- RMAP, time-code and schedule provide a means of detecting faults.

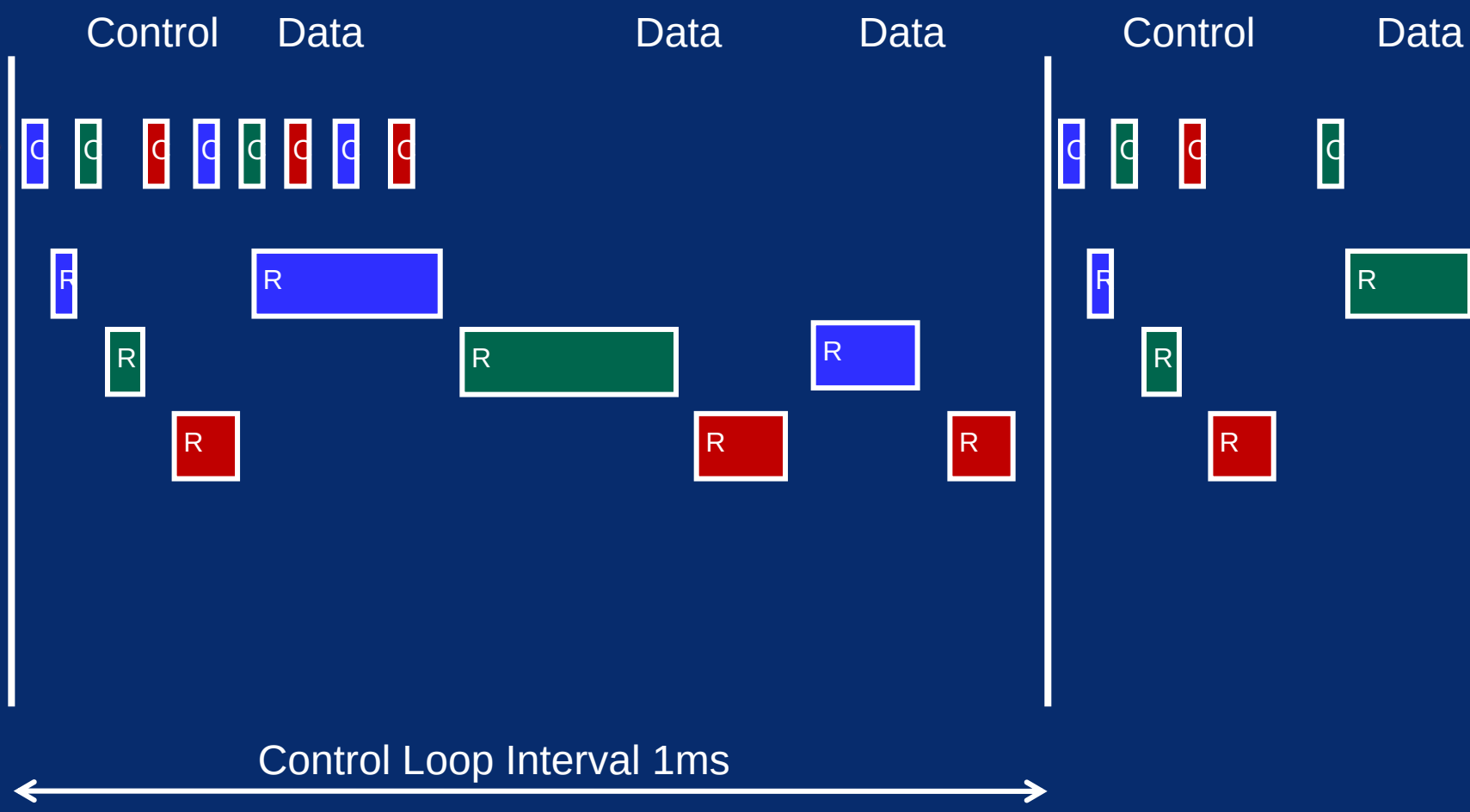
Control and Data Transfers



Control and Data Transfers



Control and Data Transfers



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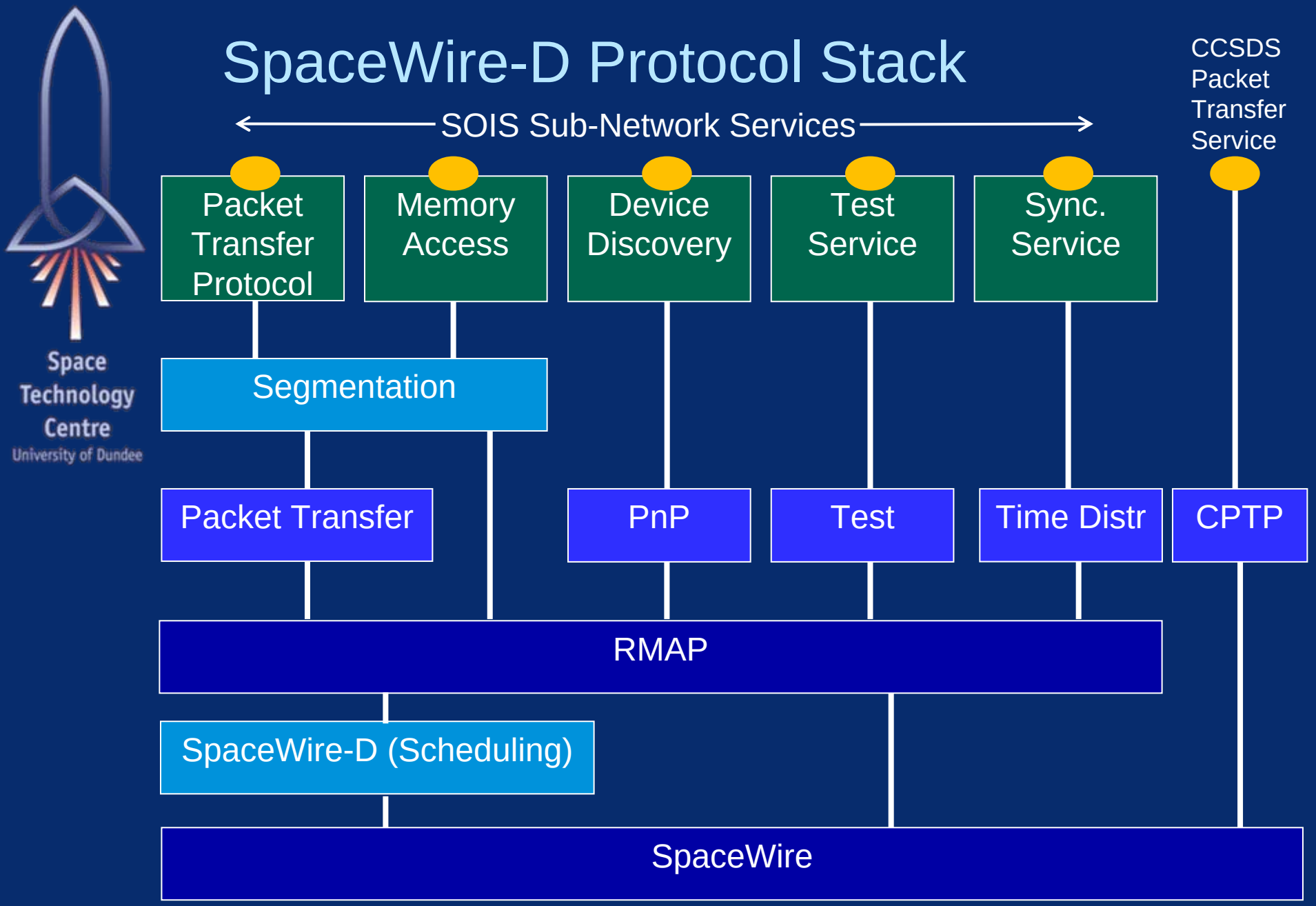
SpaceWire-D Protocol Stack



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Conclusion

- Built on SpaceWire and RMAP standards
- Uses time-codes to produce time-slots
- Schedules communication in time-slots
- Uses RMAP transactions
- Can support FDIR
- Simple to implement using existing devices
- Multiple transactions in slot
  - More efficient
  - Relaxes implementation constraints
- Supports SOIS sub-network services