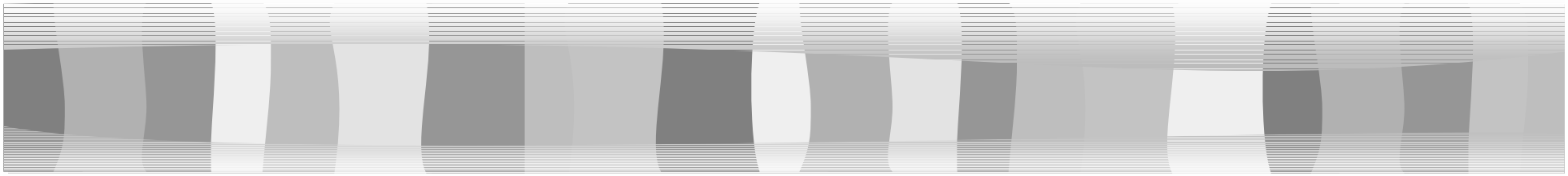
Decomposing the Dashboard Example for a Distributed Implementation



Jason Shamberger

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Mentor: Dr. Alberto Ferrari

Outline:

- Motivation for a distributed system
- CAN specification
- Behavioral modeling
- Mapping to architecture
- Simulation and results
- Synthesis
- Conclusion

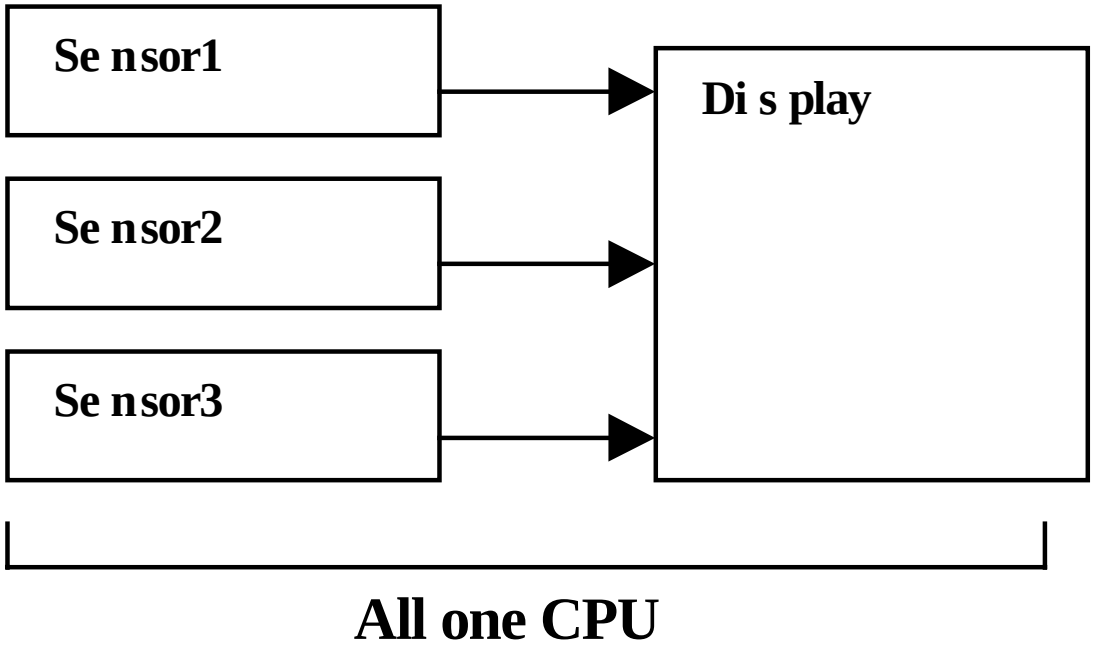
Goal of Project

- Evaluate POLIS for designing a distributed real-time system
  - By using POLIS, we can explore different network architectures and then move directly to synthesis
- Motivation: As more electronics are in modern cars, need to use network to share communications

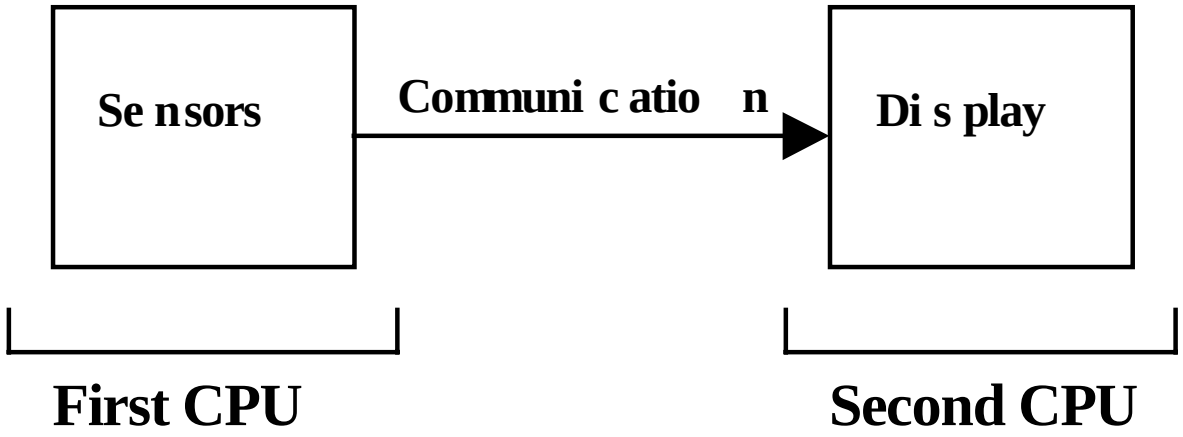
Controller Area Network (CAN)

- Used for communication with real-time constraints
- Small amounts of data - up to 8 bytes of data per packet
- Total packet size up to 120 bits
- Higher priority device always transmits first

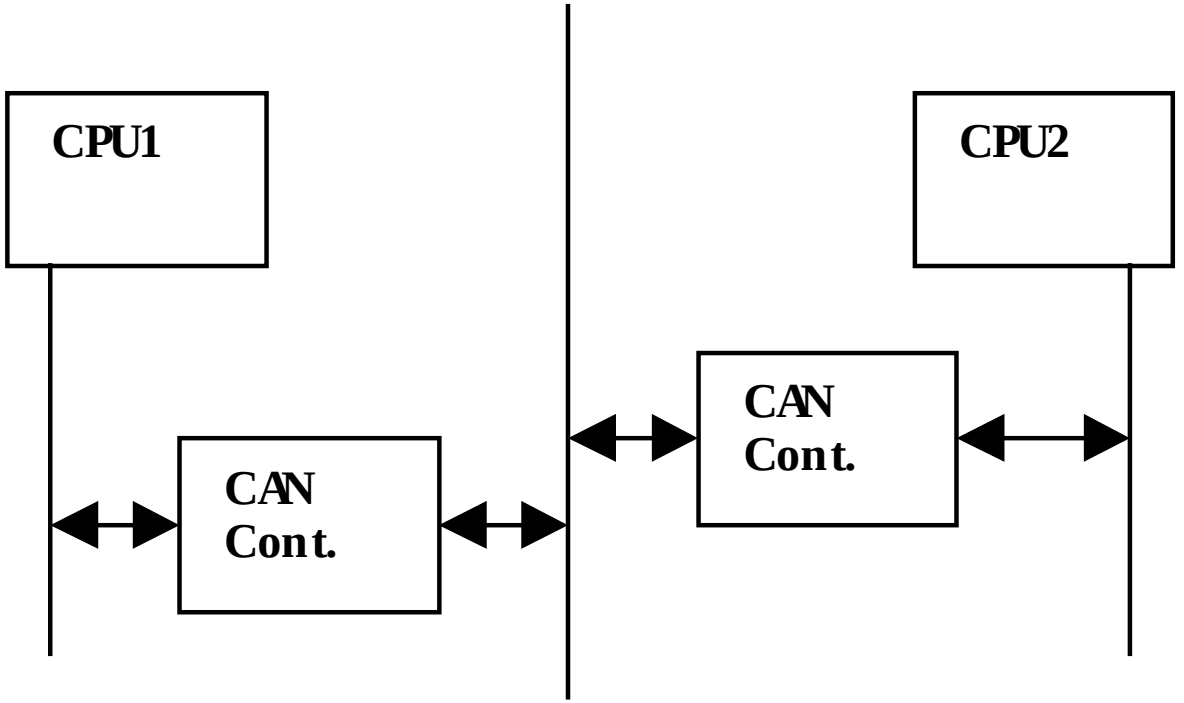
Original design of dashboard



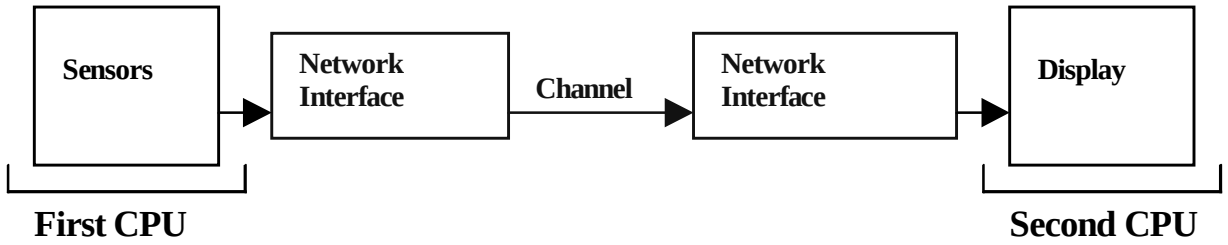
New dashboard design



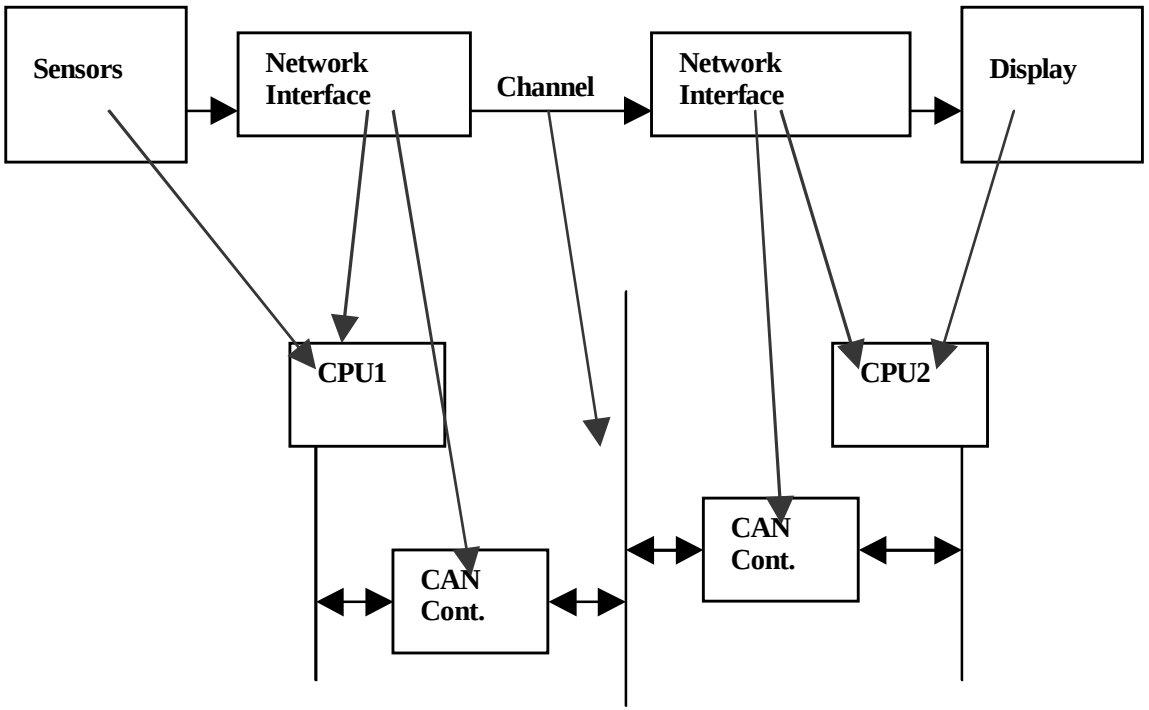
Architecture Proposed



Communication Refinement



Architecture Mapping



Modeling in POLIS

- CAN controller only stores one packet from each sender
- Give different priorities to different types of data
  - High priority: belt alarm, fuel alarm, water alarm
  - Low priority: speedometer, tachometer, odometer

Modeling in POLIS

- Assume the CAN bus already has traffic on it
- Traffic distribution:
  - High frequency small data (1 packet) at regular intervals
  - High frequency small data (1 packet) with Poisson distribution
  - Low frequency, larger data (multiple packets)

Modeling in POLIS

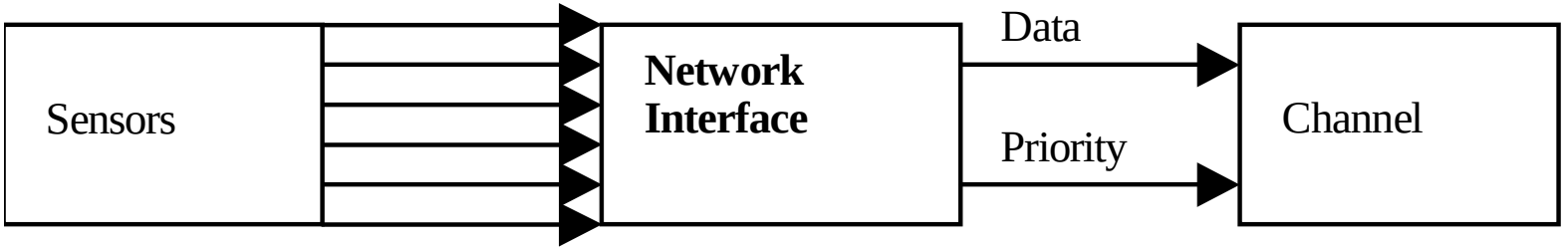
- Ensure that traffic + dashboard messages do not exceed total bandwidth
- Place the dashboard system on the same CAN bus and see what priority is necessary for dashboard to function satisfactorily

Results of Traffic Modeling

- Assume small delay in data is ok, goal is to avoid losing packets
- Measured number of overwrites in network controller - lost data

	75% Bandwidth	**90% Bandwidth**
Initial Priorities	38 overwrites	341 overwrites
Engine Speed Highest Priority	0 overwrites	16 overwrites

Synthesis



- For simulation, network interface is modeled by a CFSM which muxes inputs onto network channel
- Replace mux with code to call APIs of CAN controller

Conclusion

- POLIS can be used to model a distributed system
- The network can be simulated and design decisions made
- Move directly on to synthesis (hopefully)