



Eclipse p3com

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Agenda

Motivation

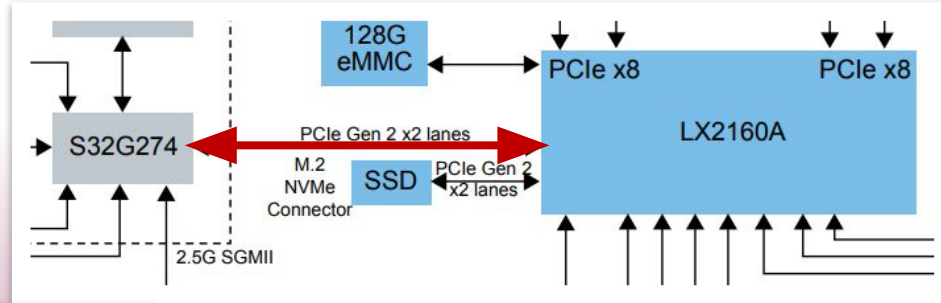
Eclipse Cyclone DDS and Eclipse iceoryx

Eclipse r3com

Initial benchmarking results

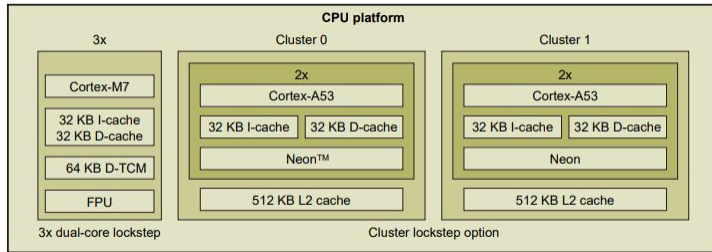
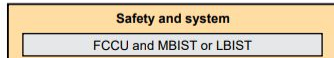
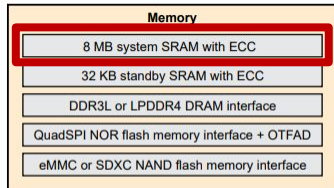
Motivation

- SDV platforms often contain platform-specific HW interfaces for data transfer
- For example:
 1. PCI Express bus on automotive development platform (>800 MB/s bandwidth)
 2. SRAM memory unit accessible from both application and real-time cores
- Much better throughput than ethernet, but much more difficult to use (no socket API)



NXP S32G block diagram

NXP BlueBox 3 block diagram



Eclipse Cyclone DDS and Eclipse iceoryx

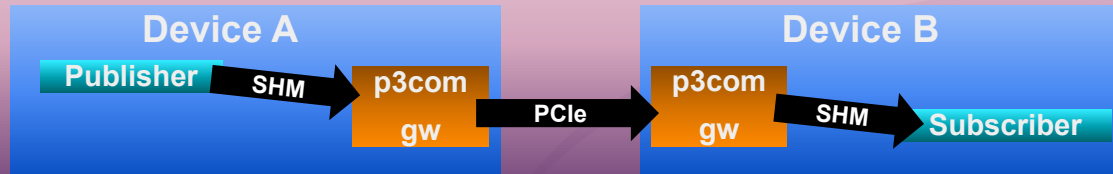
- Established open-source middleware projects
- **Eclipse Cyclone DDS**: Data Distribution Service protocol and API implementation
- Widely used in robotics and IoT
- Default middleware in ROS2
- **Eclipse iceoryx**: inter-process-communication middleware
- Implementation based on shared memory, with zero-copy support
- Lower-level abstractions, no QoS, but high performance
- Automotive quality and safety (WIP)
- By default, **Eclipse Cyclone DDS** uses UDP/IP, but it has optimization for inter-process communication:



- **Eclipse iceoryx** integrates into **Eclipse Cyclone DDS** to implement this efficiently

Eclipse p3com

- Idea: **Enable middleware libraries to leverage the performance of platform-specific interfaces**
- Analogous to how Cyclone DDS leverages SHM via iceoryx
- **Eclipse p3com** is an extension of **Eclipse iceoryx** that works over PCIe, IPCF, UDP, TCP...
- **P**ortable – Linux, FreeRTOS
- **P**luggable – modular “transport layer” architecture
- **P**ublish/subscribe **co**munication
- **p3com** consists of:
 - **platform-agnostic** infrastructure (discovery system, iceoryx endpoints, ...)
 - **platform-specific** transport layers (useful as is, or as examples for other platforms)
- Implemented as a “gateway” daemon process forwarding iceoryx traffic over transport layers



Initial benchmarking results

- Using **Eclipse Cyclone DDS** ShmThroughput benchmark, with SHM enabled
- Running on NXP BlueBox 3 platform, communication between LX2 and S32G

Payload size	Cyclone DDS vanilla* LX2 -> S32G	p3com PCIe LX2 -> S32G	p3com PCIe S32G -> LX2
4 kB	487 Mbit/s	121 Mbit/s	224 Mbit/s
64 kB	676 Mbit/s	1501 Mbit/s	2528 Mbit/s
256 kB	622 Mbit/s	4346 Mbit/s	5259 Mbit/s
1 MB	646 Mbit/s	5562 Mbit/s	6962 Mbit/s

* no QoS optimization for maximum UDP/IP throughput in Cyclone DDS

- Small payload performance worse than UDP/IP
- Large payload performance almost fully saturates bus bandwidth (8 Mbit/s)



THANK YOU!