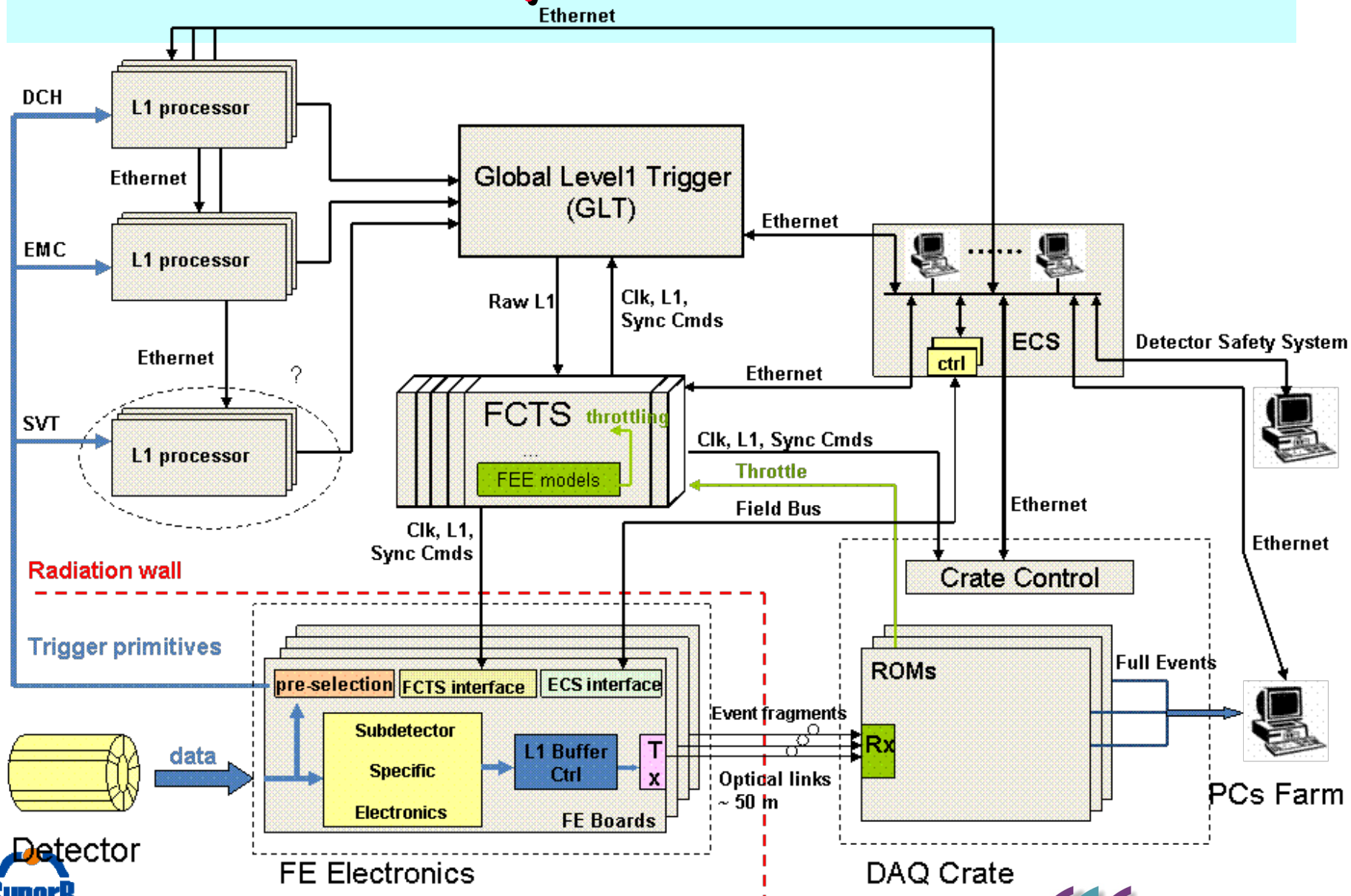
PROPOSAL FOR FTCS & ECS

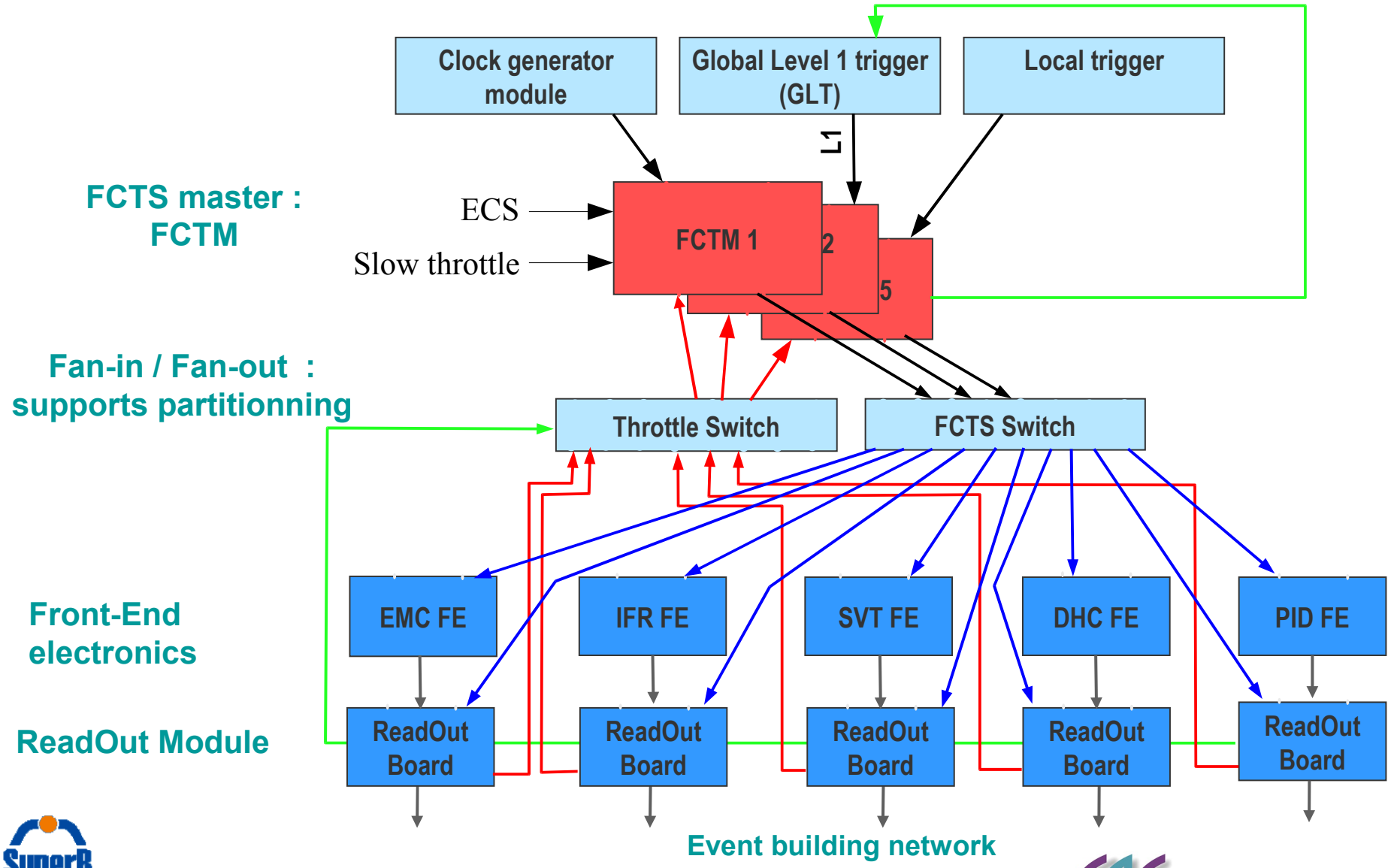
FCTS requirements

- Synchronizing the experiment with the machine.
- Delivering and buffering the clock to the experiment.
- Dealing with the raw L1 trigger decision.
- Throttling the latter.
- Permits the partitionning the system into independent subsystems or groups of subsystems.
- Generating programmable local trigger for calibration and commissioning.
- Generating different commands (calibration pulse, reset, BxID and event ID).
- Managing the stack of IP addresses for PC farm.
- Keeping trace of all event-linked data to put in the event readout

Overall system achitecture

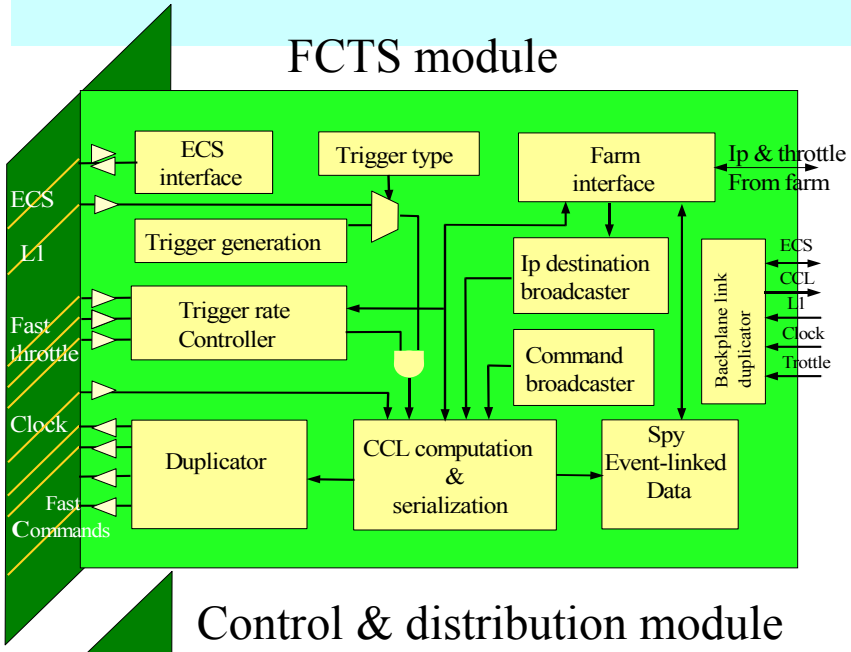


FCTS Architecture

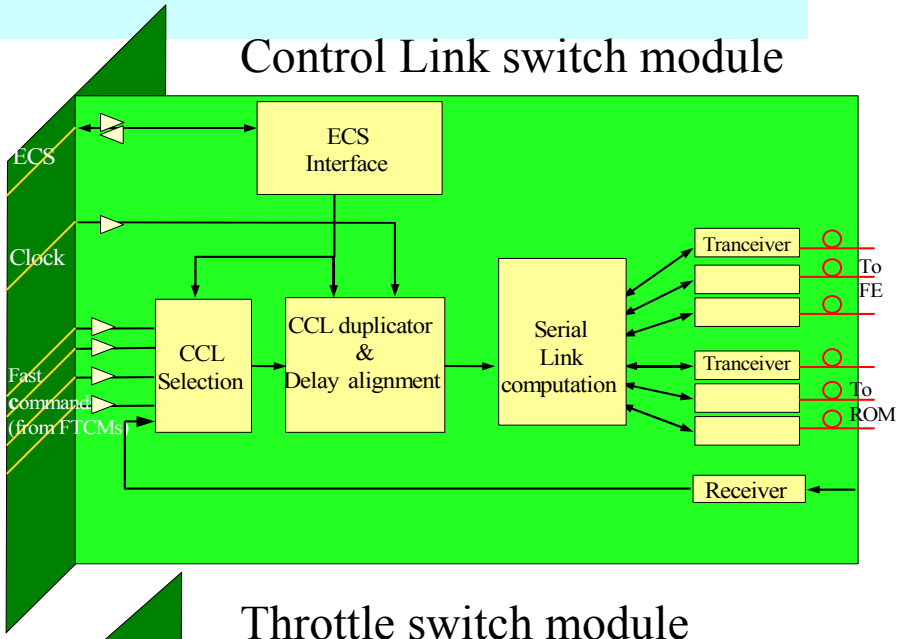


FCTS Boards

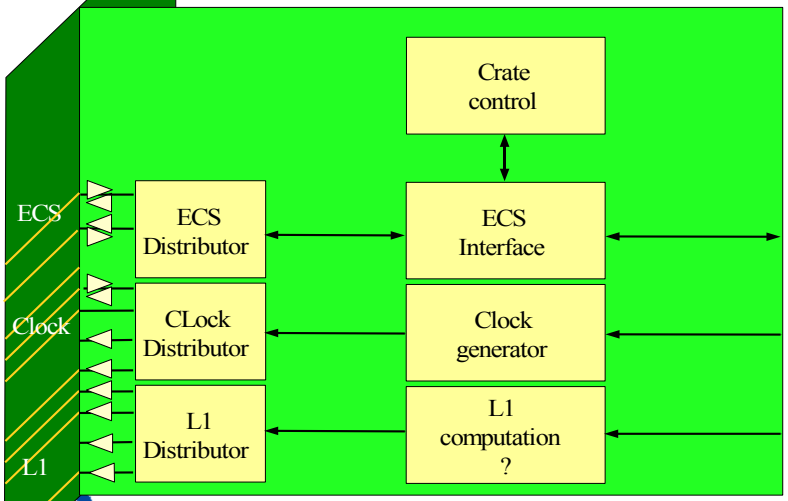
FCTS module



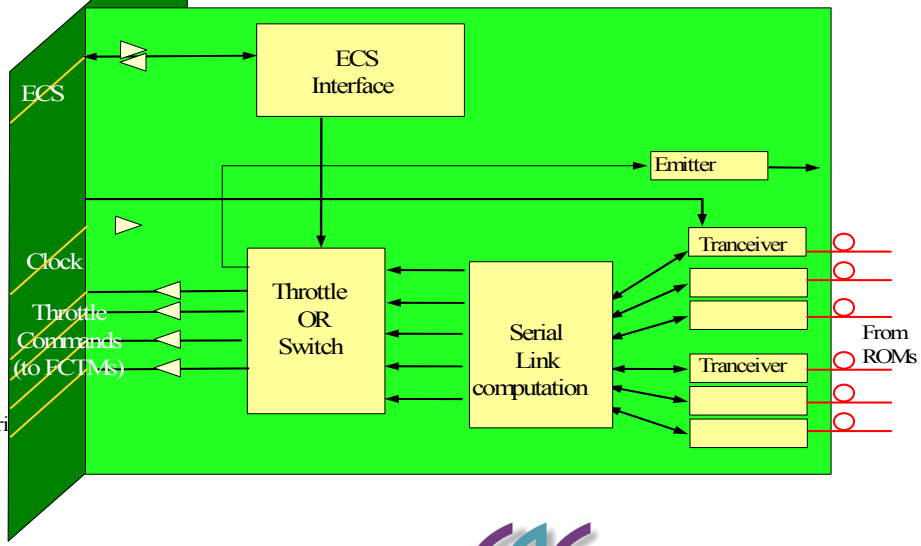
Control Link switch module



Control & distribution module

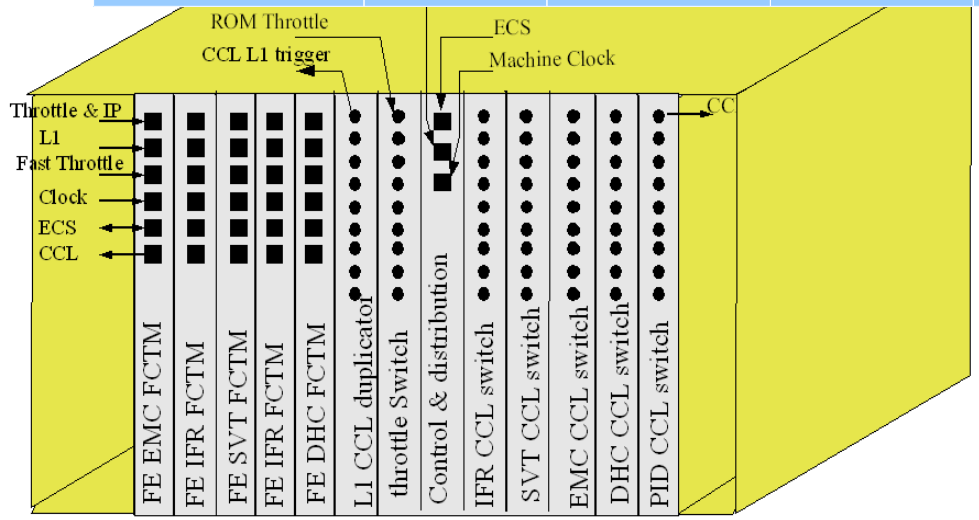


Throttle switch module



Crate version 1

Physical slot	1	2	3	4	5	6	7
Logical slot	7	6	5	1	2	3	4
Slot type	Ctrl. Swit.	FCTM	Thro. Swit.	Ctrl & distr	Ctrl. Swit.	FCTM	Thro. Swit.
		6 - 5	6 - 5	1 - 2	3 - 2	3 - 2	
	6 - 7	6 - 7		1 - 3		3 - 4	3 - 4
				1 - 4			
				1 - 5			
				1 - 6			
				1 - 7			



Custom crate:

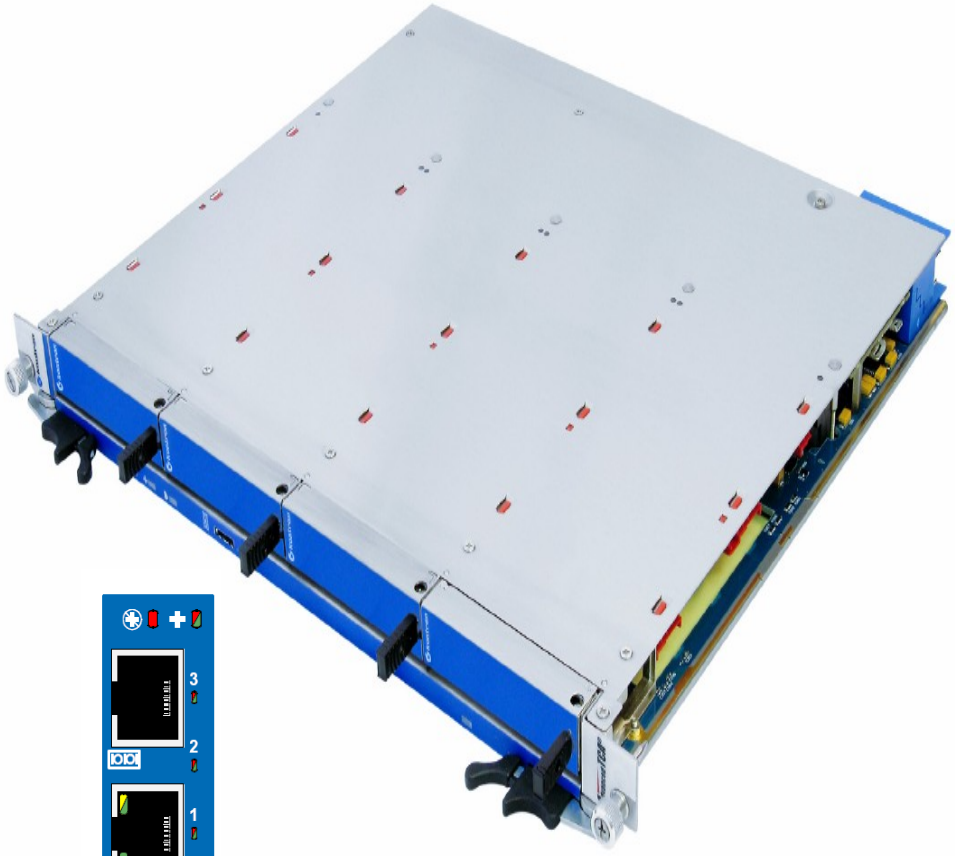
9U crate.

Custom backplane.

Easy board design.

Cost???

FCTS crate version 2



ATCA Standard: 2 solutions

1) “custom“ use.

2) Full standard compatibility

ATCA Backplane

Interconnection diagram for ATCA Dual-Dual Star 14 Slots Backplane:

Dual Star BASIC INTERFACE & Dual-Dual Star FABRIC INTERFACE

	SLOT TYPE	NODE	NODE	NODE	NODE	NODE	HUB	HUB	HUB	HUB	NODE	NODE	NODE	NODE	NODE	SLOT TYPE
	PHYSICAL SLOT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	PHYSICAL SLOT
	LOGICAL SLOT	13	11	9	7	5	3	1	2	4	6	8	10	12	14	LOGICAL SLOT
CONNECTOR	P20	NP	NP	NP	NP	NP	NU	NU	NU	NU	NP	NP	NP	NP	NP	Fabric Channel 15
		NP	NP	NP	NP	NP	NU	NU	NU	NU	NP	NP	NP	NP	NP	Fabric Channel 14
		NP	NP	NP	NP	NP	14-3	14-1	14-2	14-4	NP	NP	NP	NP	NP	Fabric Channel 13
	P21	NP	NP	NP	NP	NP	13-3	13-1	13-2	13-4	NP	NP	NP	NP	NP	Fabric Channel 12
		NP	NP	NP	NP	NP	12-3	12-1	12-2	12-4	NP	NP	NP	NP	NP	Fabric Channel 11
		NP	NP	NP	NP	NP	11-3	11-1	11-2	11-4	NP	NP	NP	NP	NP	Fabric Channel 10
		NP	NP	NP	NP	NP	10-3	10-1	10-2	10-4	NP	NP	NP	NP	NP	Fabric Channel 9
		NP	NP	NP	NP	NP	9-3	9-1	9-2	9-4	NP	NP	NP	NP	NP	Fabric Channel 8
	P22	NU	NU	NU	NU	NU	8-3	8-1	8-2	8-4	NU	NU	NU	NU	NU	Fabric Channel 7
		NU	NU	NU	NU	NU	7-3	7-1	7-2	7-4	NU	NU	NU	NU	NU	Fabric Channel 6
		NU	NU	NU	NU	NU	6-3	6-1	6-2	6-4	NU	NU	NU	NU	NU	Fabric Channel 5
		4-13	4-11	4-9	4-7	4-5	5-3	5-1	5-2	5-4	4-6	4-8	4-10	4-12	4-14	Fabric Channel 4
		3-13	3-11	3-9	3-7	3-5	4-3	4-1	4-2	3-4	3-6	3-8	3-10	3-12	3-14	Fabric Channel 3
	P23	2-13	2-11	2-9	2-7	2-5	2-3	3-1	3-2	2-4	2-6	2-8	2-10	2-12	2-14	Fabric Channel 2
		1-13	1-11	1-9	1-7	1-5	1-3	2-1	1-2	1-4	1-6	1-8	1-10	1-12	1-14	Fabric Channel 1
		1-13	1-11	1-9	1-7	1-5	1-3	ShMC	ShMC	1-4	1-6	1-8	1-10	1-12	1-14	Base Channel 1
		2-13	2-11	2-9	2-7	2-5	2-3	2-1	1-2	2-4	2-6	2-8	2-10	2-12	2-14	Base Channel 2
		Not Applicable Connector populated						3-1	3-2	Not Applicable Connector populated						Base Channel 3
								4-1	4-2							Base Channel 4
								5-1	5-2							Base Channel 5
								6-1	6-2							Base Channel 6
	P24	Not Applicable Connector not populated						7-1	7-2	Not Applicable Connector not populated						Base Channel 7
								8-1	8-2							Base Channel 8
								9-1	9-2							Base Channel 9
								10-1	10-2							Base Channel 10
								11-1	11-2							Base Channel 11
								12-1	12-2							Base Channel 12
								13-1	13-3							Base Channel 13
								14-1	14-2							Base Channel 14
								NU	NU							Base Channel 15
								NU	NU							Base Channel 16
	PHYSICAL SLOT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	PHYSICAL SLOT
	LOGICAL SLOT	13	11	9	7	5	3	1	2	4	6	8	10	12	14	LOGICAL SLOT
	SLOT TYPE	NODE	NODE	NODE	NODE	NODE	HUB	HUB	HUB	HUB	NODE	NODE	NODE	NODE	NODE	SLOT TYPE

FABRIC INTERFACE CHANNEL

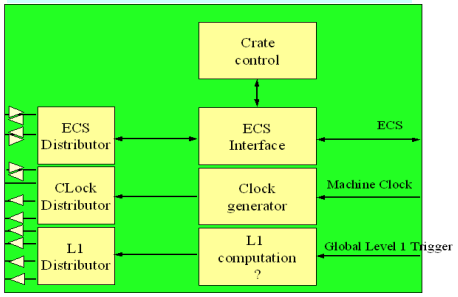
BASE INTERFACE CHANNEL

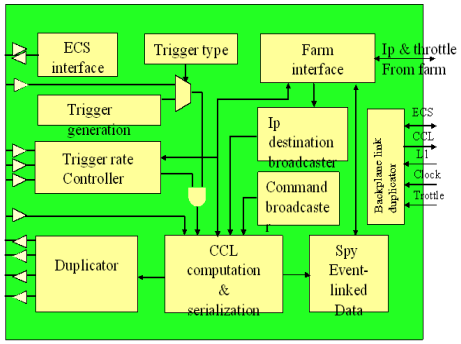
INTERFACE

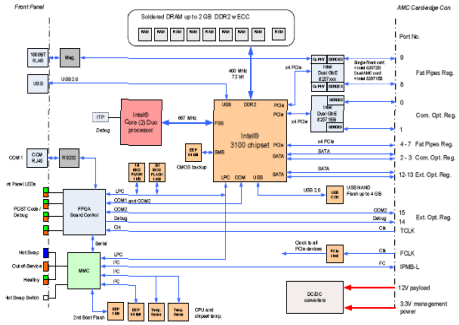
LEGEND:

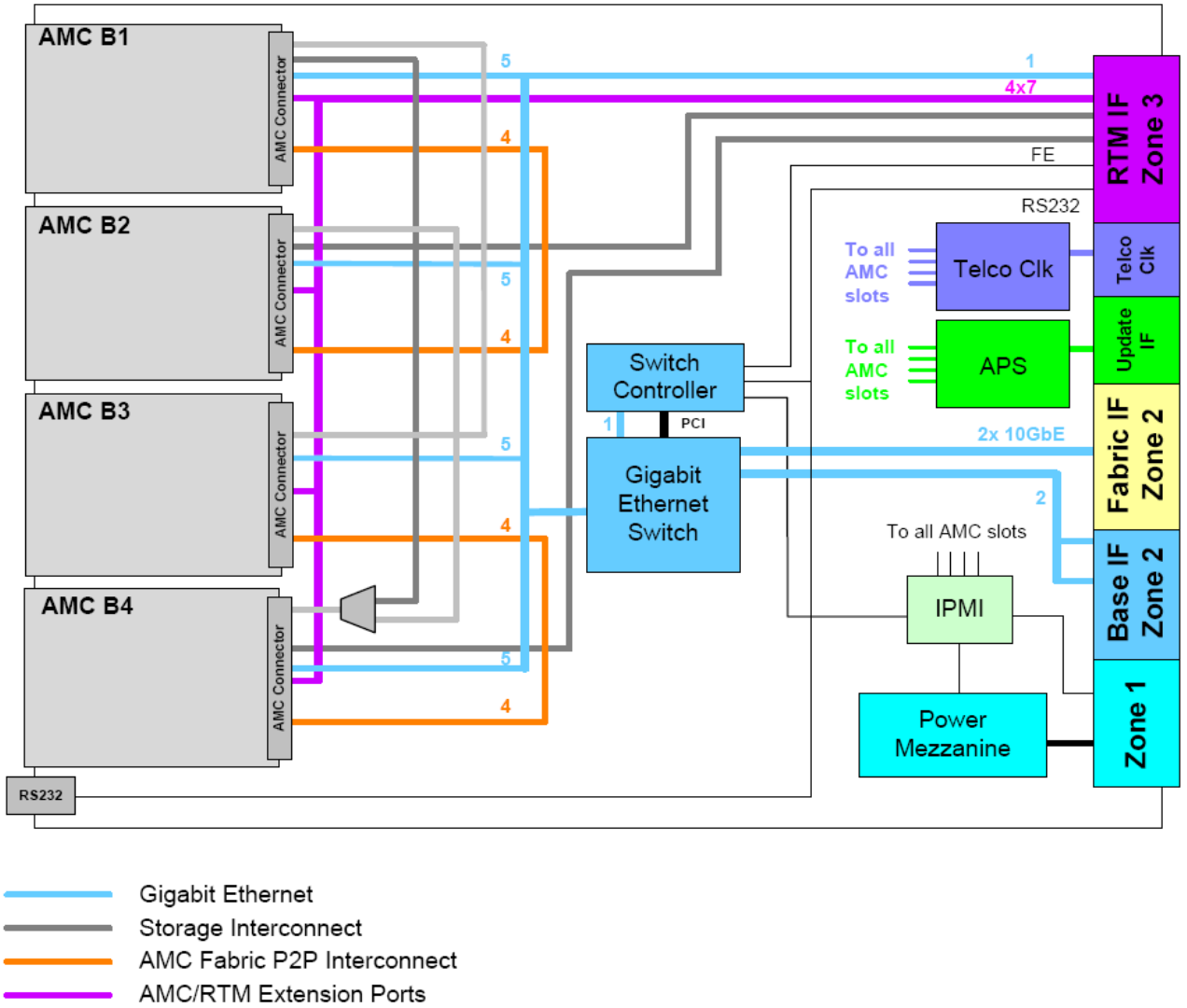
- 8 Differential Pairs for the Fabric Interface Channel : 4 Tx pairs + 4 Rx pairs routed in cross-over
  - X-Y
  - Y-X
  - Port X-Y is routed always to port Y-X
- 4 Differential Pairs for the Base Interface Channel : 2 Tx pairs + 2 Rx pairs routed in cross-over
  - X-Y
  - Y-X
  - Port X-Y is routed always to port Y-X
- NP - Not populated
- NU - Not used
- ShMC - Ethernet links routed to the IPM Sentry Shelf Manager

Kontron carrier board AT8404



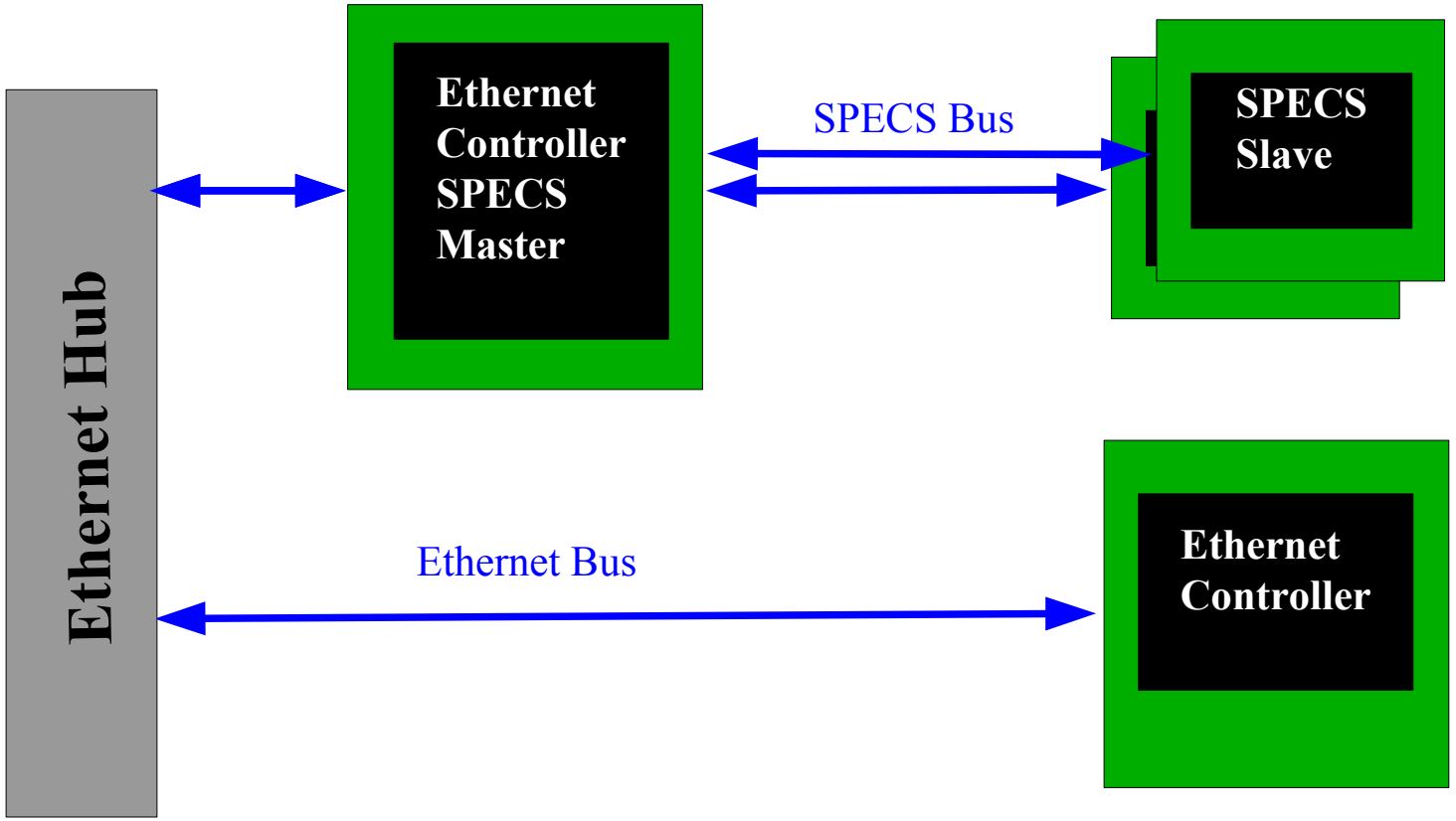




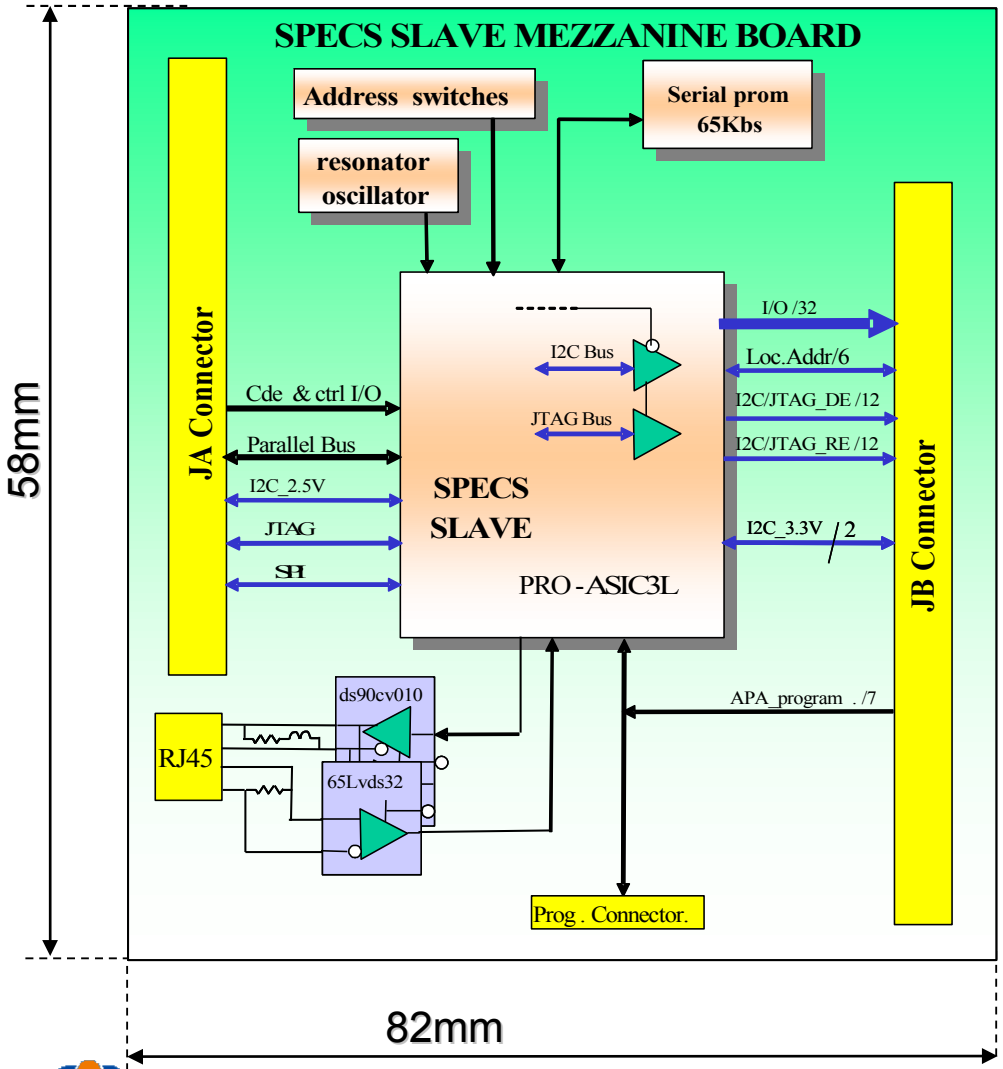


Gigabit Ethernet
Storage Interconnect
AMC Fabric P2P Interconnect
AMC/RTM Extension Ports

SPECS system



SuperB SPECS slave implementation



FPGA ProASIC3L from ACTEL.
Triple voting register.

Transfert rate: 10Mbits/s

Address: Local address switch.
Broadcast address capability.

On board clock: Crystal resonator

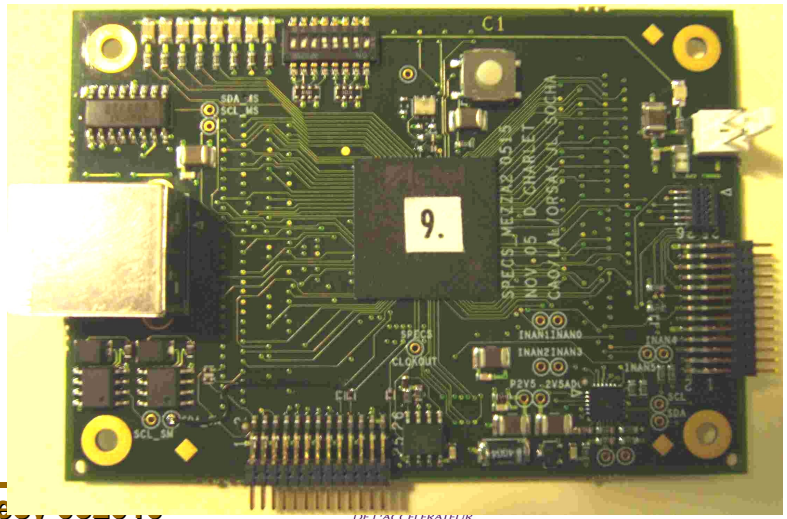
Programmable clock for SPECS readback:

Long distance capability: 120m cat6 cable

User Serial EEPROM: 65Kbits capacity

JTAG bus, I2C bus, SPI Bus

chip selects: Common to all serial busses.



Possible solution for off-detector area

Hardware

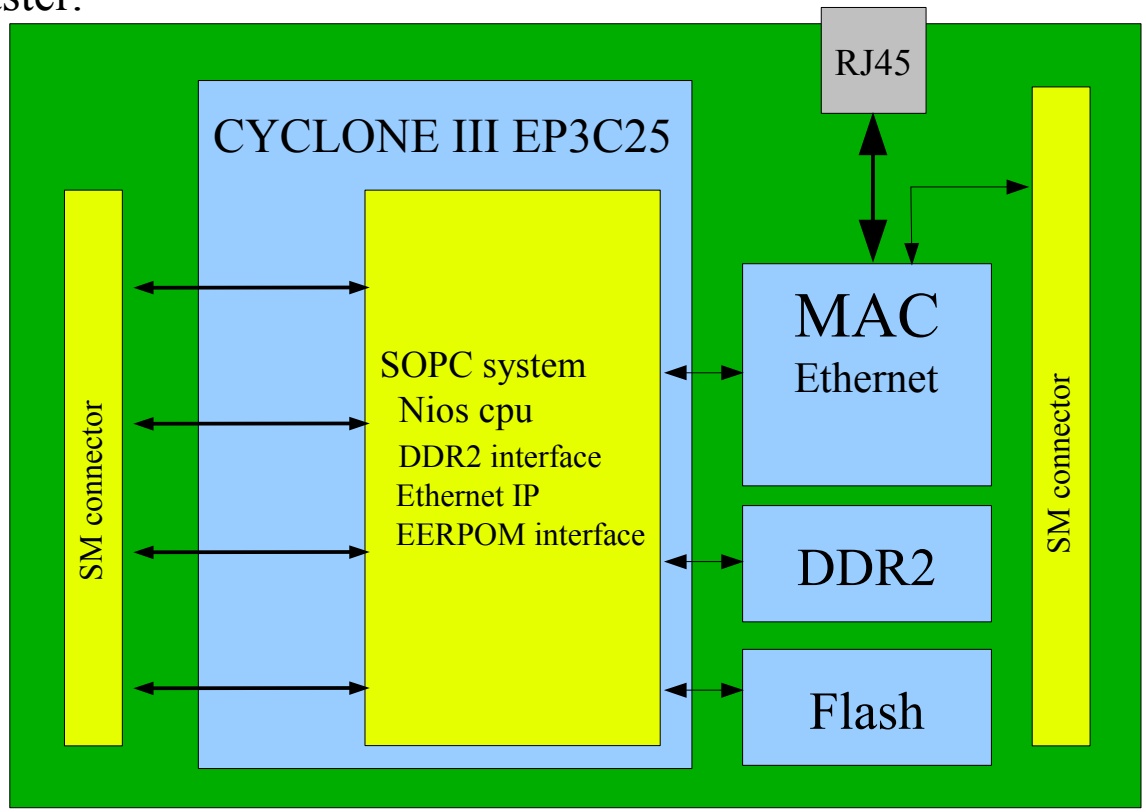
- Based on Ethernet SPECS master.
- SM connector.
  Parallel bus,Configurable.
  I/O ligne, I2C bus, SPI bus.
  JTAG bus.
- 32MBytes DDR2 memory.
- 16MBytes Flash memory.

Firmware

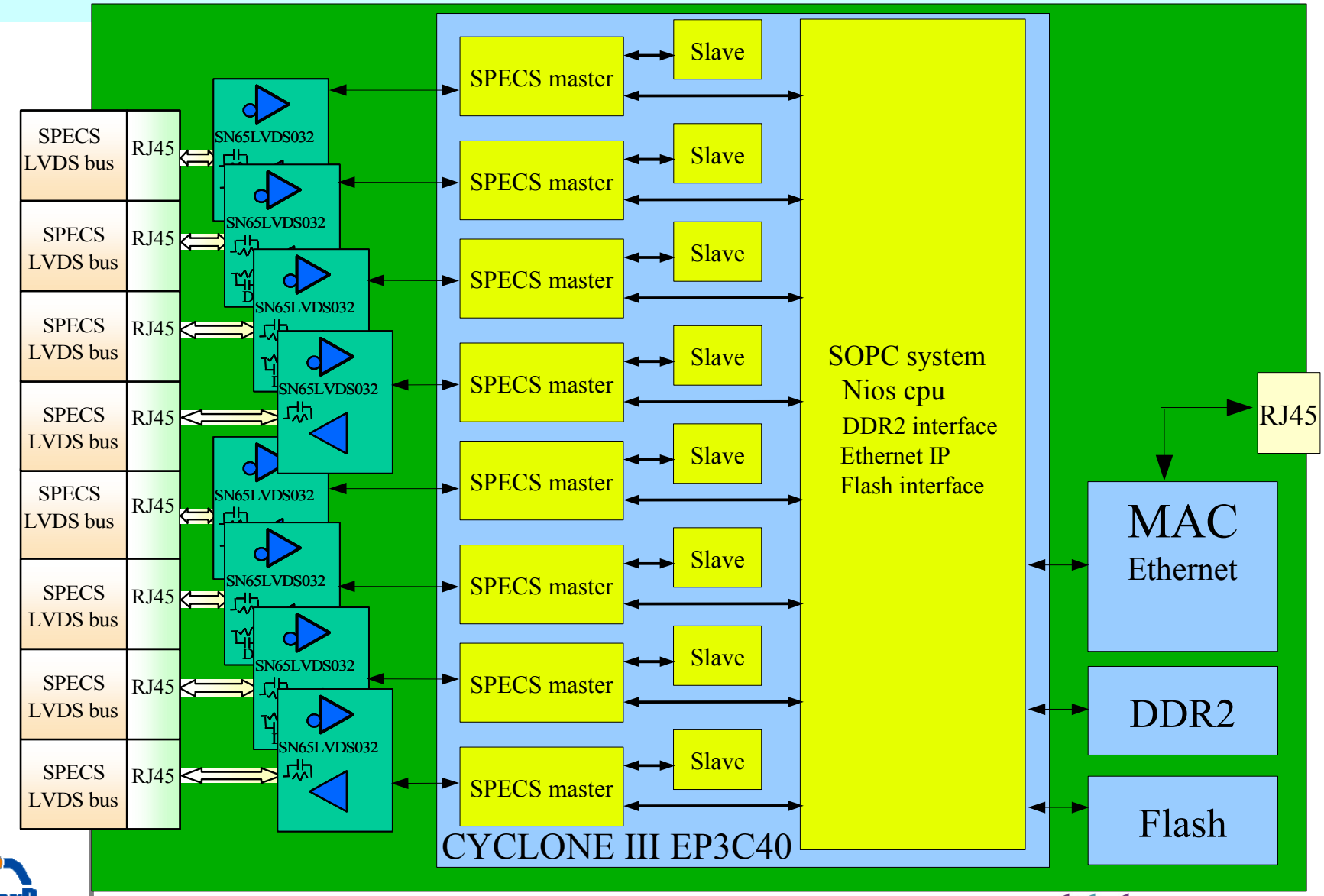
- Ethernet reconfiguration.
- Cyclone III EP3C25F324.
- Base on NIOS II processor.

Soft

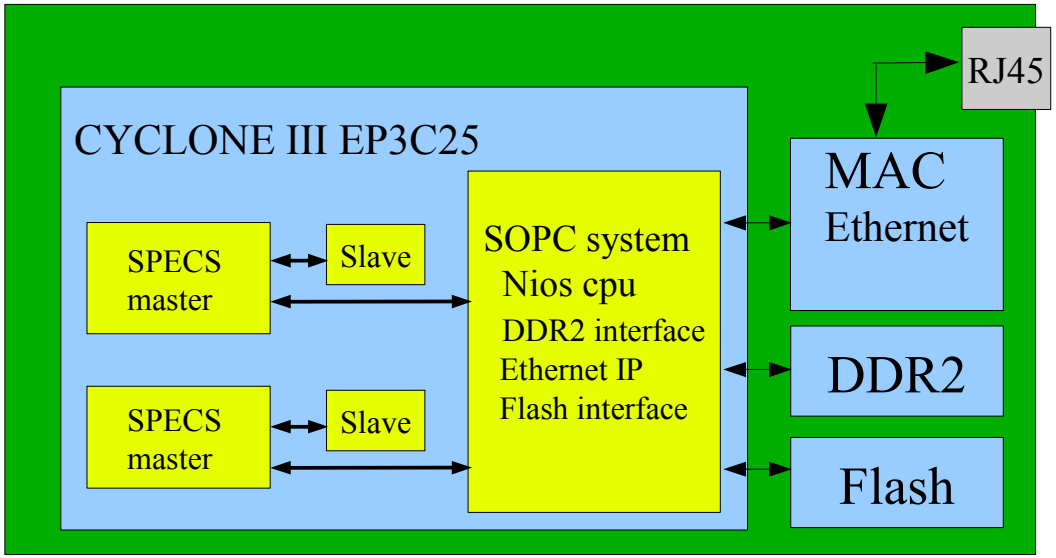
- OS µclinux.
- DIM server.
- SPECS library.
- SPECS users library.

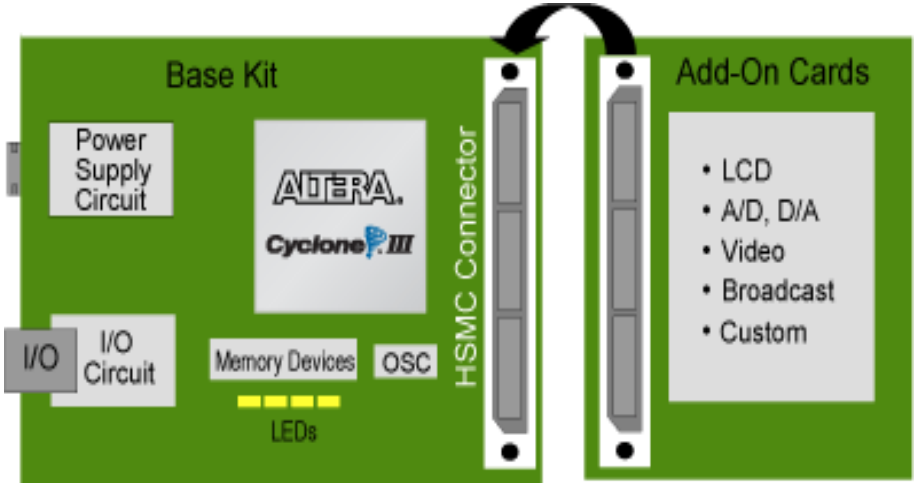


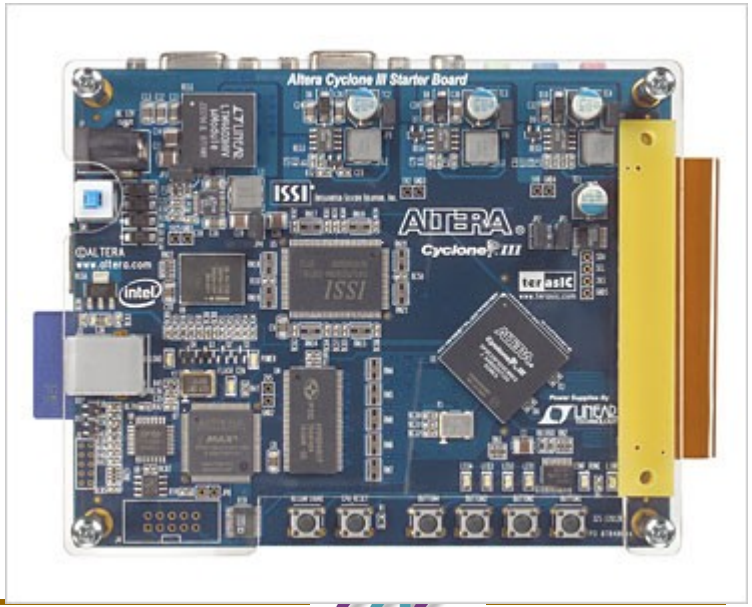
Ethernet SPECS master



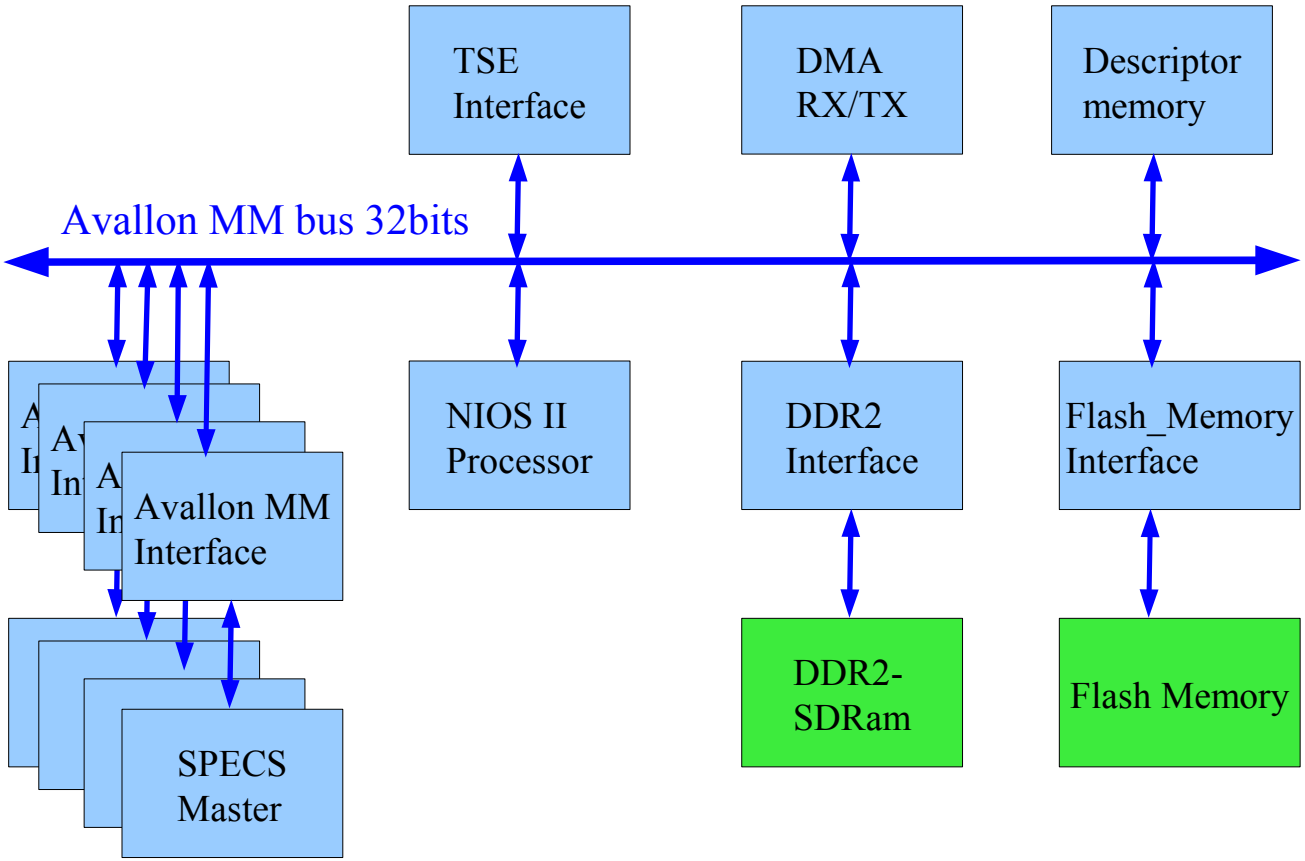
Ethernet SPECS master status







SPECS master firmware



Conclusion

- We have different options for the FCTS system:
  - Full custom backplane and boards
  - Standard ATCA crate backplane and custom boards.
  - Fully standard ATCA system
- At this time, there is no strong argument againts the adequate custom solution
  - This will of course be further studied

- Off-detector ECS board development.
  - Ethernet-based master is now running
  - Slave mezzanine is being studied