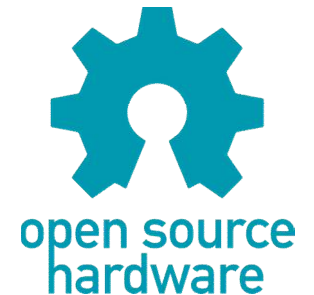


FireCube Micro Cluster Product Definition

V0.2 XIAOHAI LI DEC-2017



Reversion History

Version	Date	Description
0.1	2016-05-19	First draft.
0.2	2017-12-06	Update AP/SW/FE board architecture, chassis spec.

Background

Micro Chassis System

- The goal of FireCube project is to design an ARM based micro chassis system which combines the computing power of ARM application processor, real-time capability of ARM MCU, and the integrated GPGPU & VPU for multi applications like IoT center, computing cluster, industrial, robotic, DAQ, and auto-test system.

Project Code

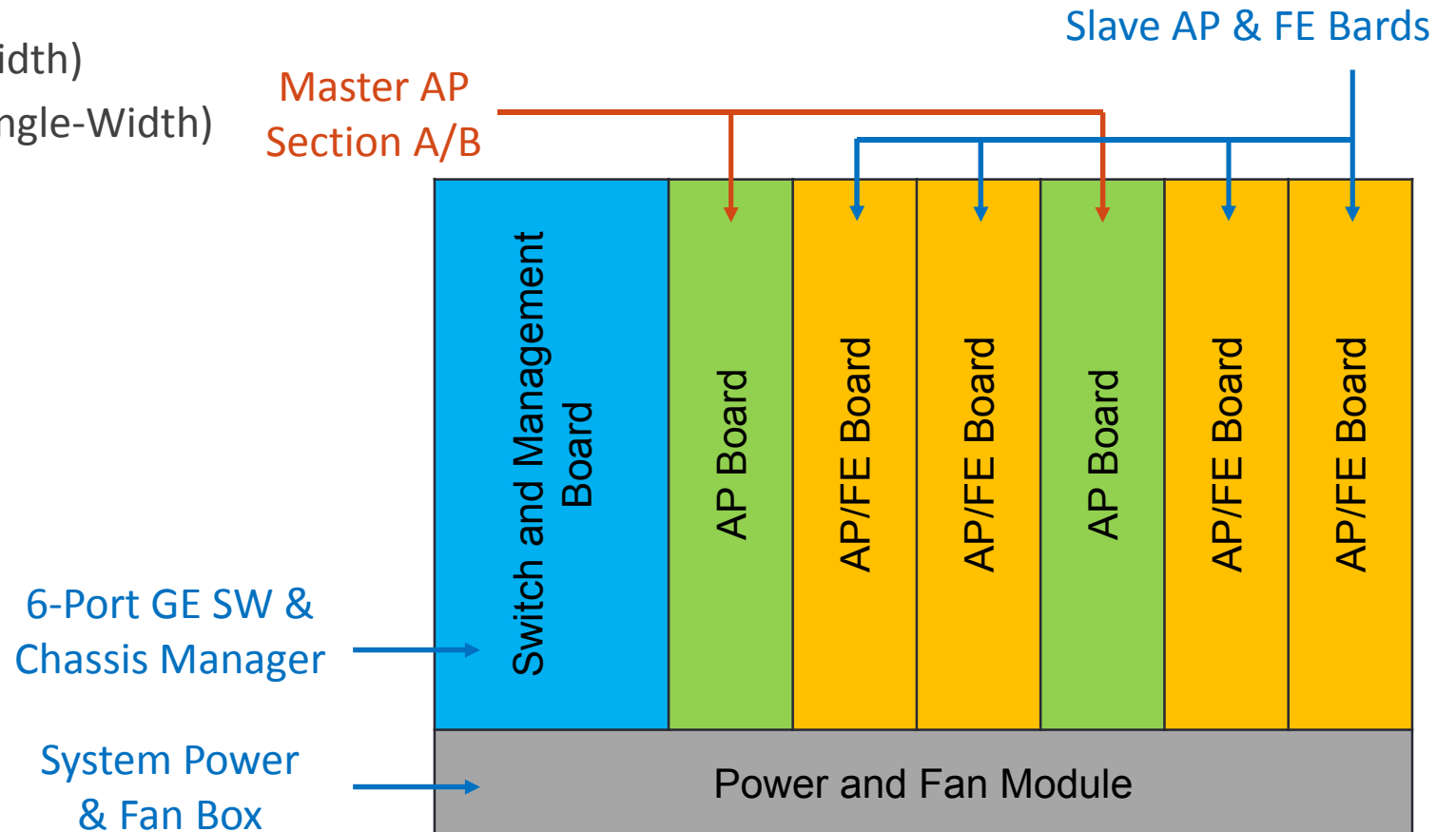
- FireCube Micro Cluster



Micro Chassis Architecture (1)

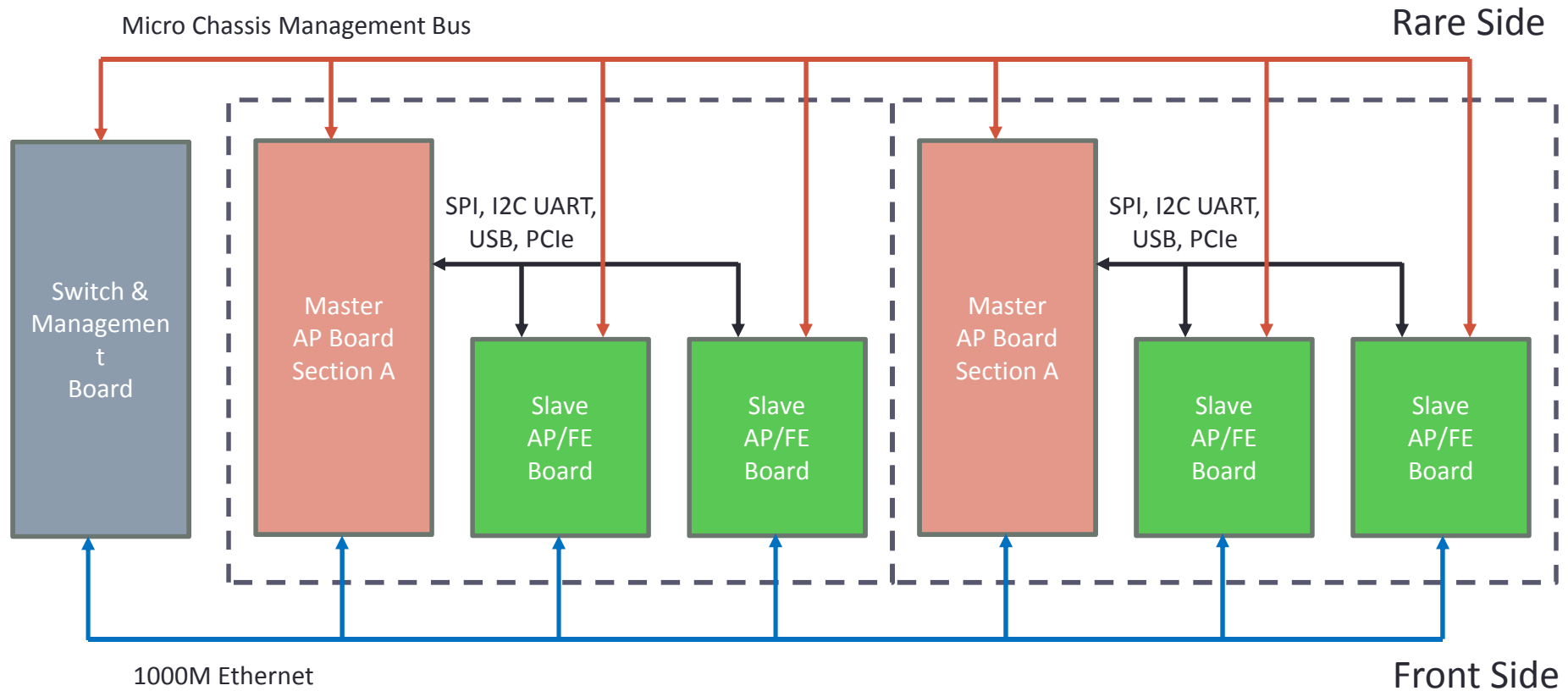
Chassis Overview

- 1 switch board slot (Dual-Width)
- 6 application board slots (Single-Width)
- 12V DC input
- 4-6 Fans with speed control
- Size: 160 x 200mm



Micro Chassis Architecture (2)

System Block Diagram



Board Definition

Application Boards

- Switch and Management Board
 - Low cost processor (H3, A388, etc.)
 - Integrated 6 to 8 ports GE switch
 - Chassis manager (RMC)
- Application Board
 - High performance processor
 - GPGPU/VPU acceleration
 - Storage, and wireless communication
- Analog Front End Board
 - Real-time capable MCU, CPLD/FPGA as sensor hub and data buffer
 - Analog signal amplifying and filtering
 - Low jitter clock
- I/O Expansion Board
 - A passive board that extend the backplane signals to front panel

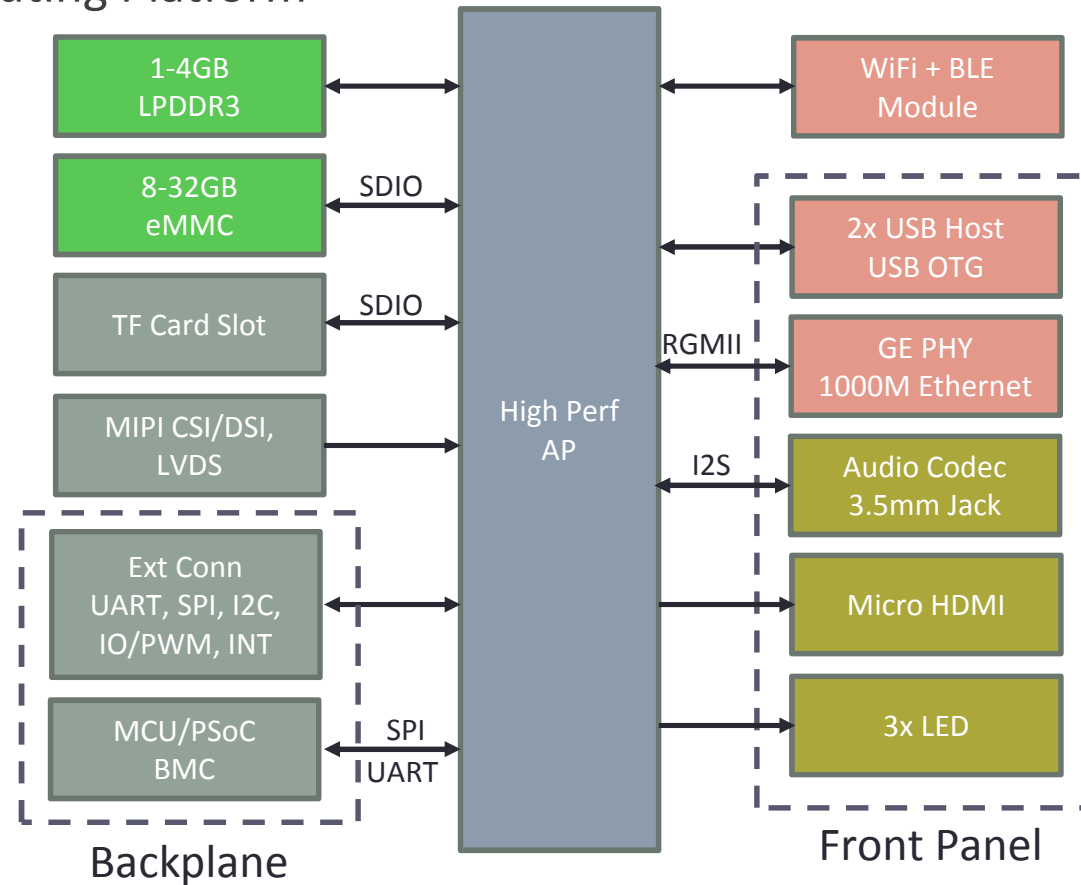
Board Definition

Chassis Infrastructure

- Passive Lite Weight Backplane
 - Power distribution and signal interconnection between boards
 - Micro chassis management bus and slot identification
 - Mechanical connection to each part of chassis
 - Short length, high-speed signals: USB, PCIe
- Power Distribution and Fan Control Board
 - 12-24V input (max 120W), distributed to each application board
 - 3.3V (max 16W) standby power for chassis management
 - Intelligent fan speed monitoring and control (MCU)

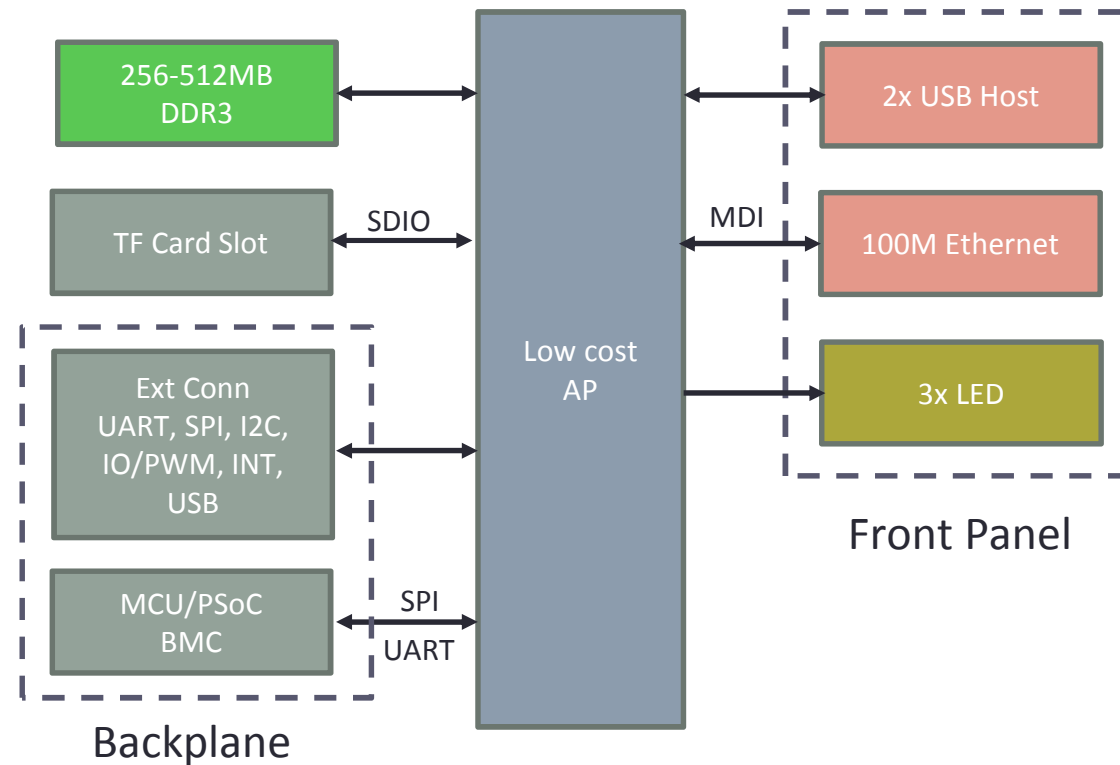
Application Board (1)

Fennec Generic Computing Platform



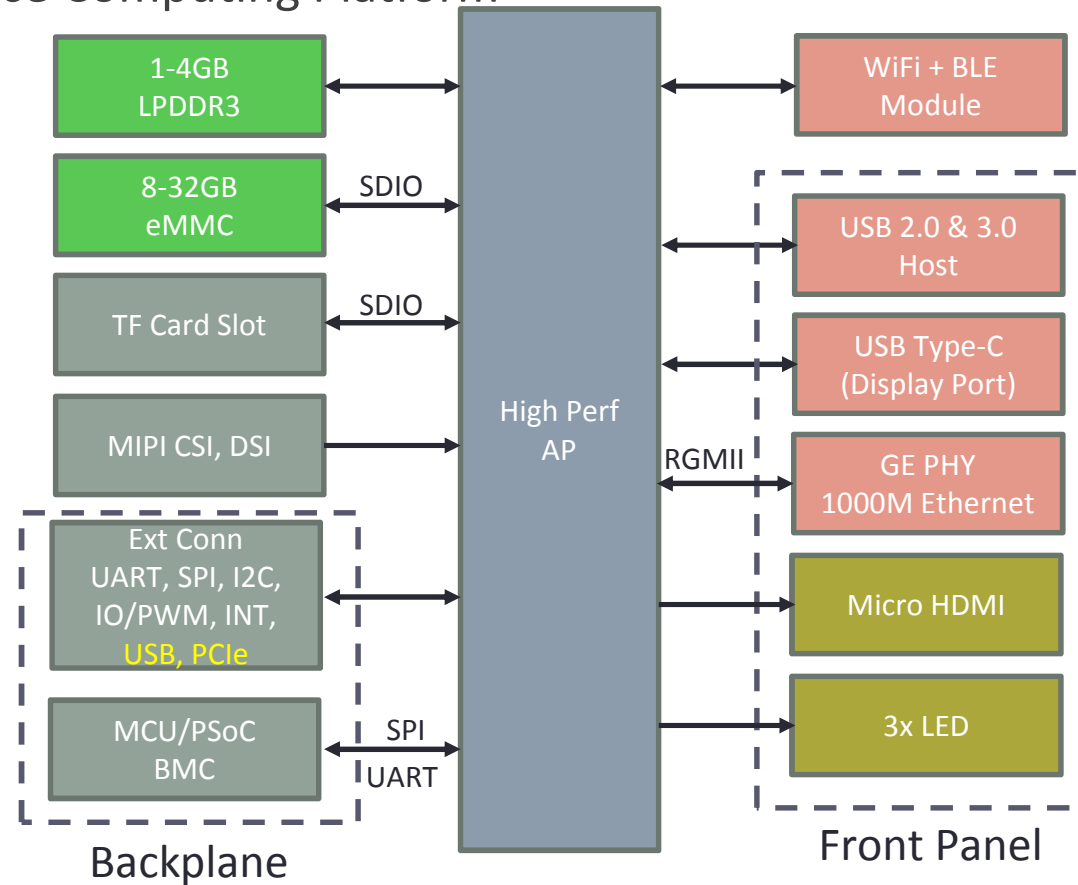
Application Board (2)

Ultra Low Cost uC Platform



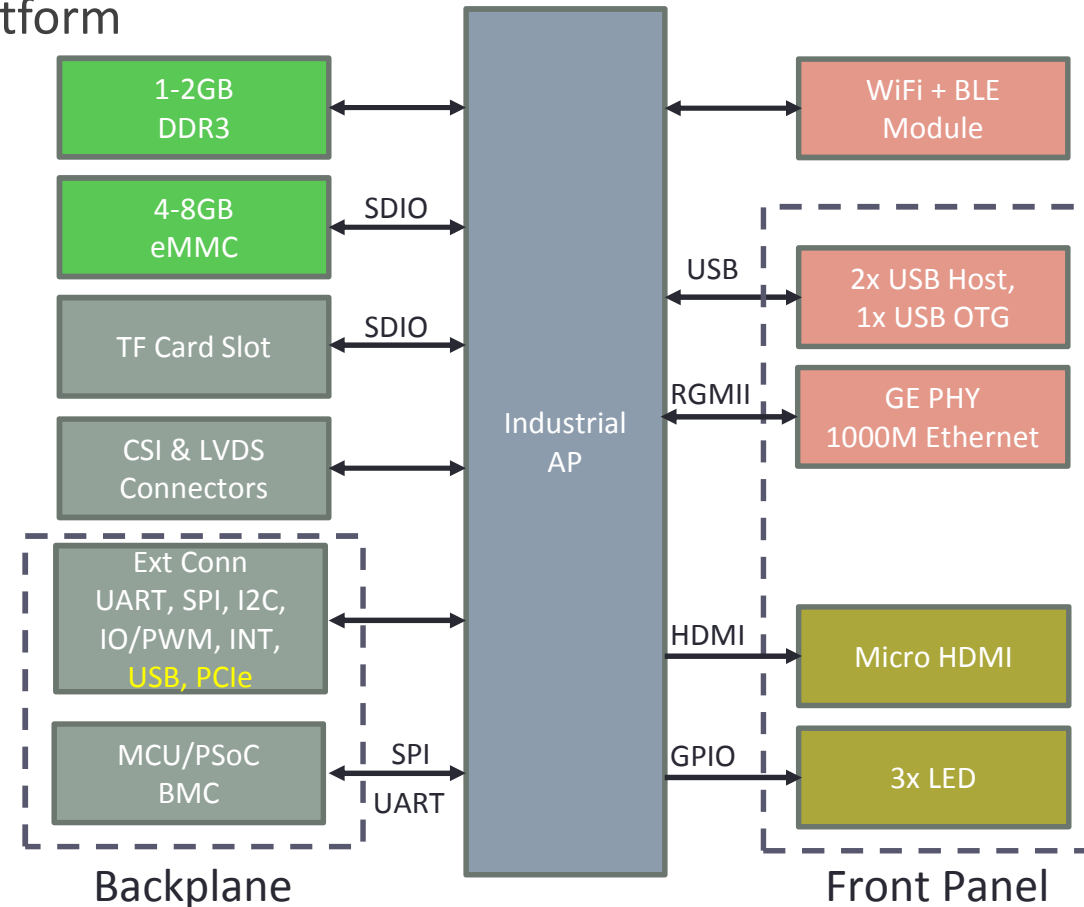
Application Board (3)

Jackal High Performance Computing Platform



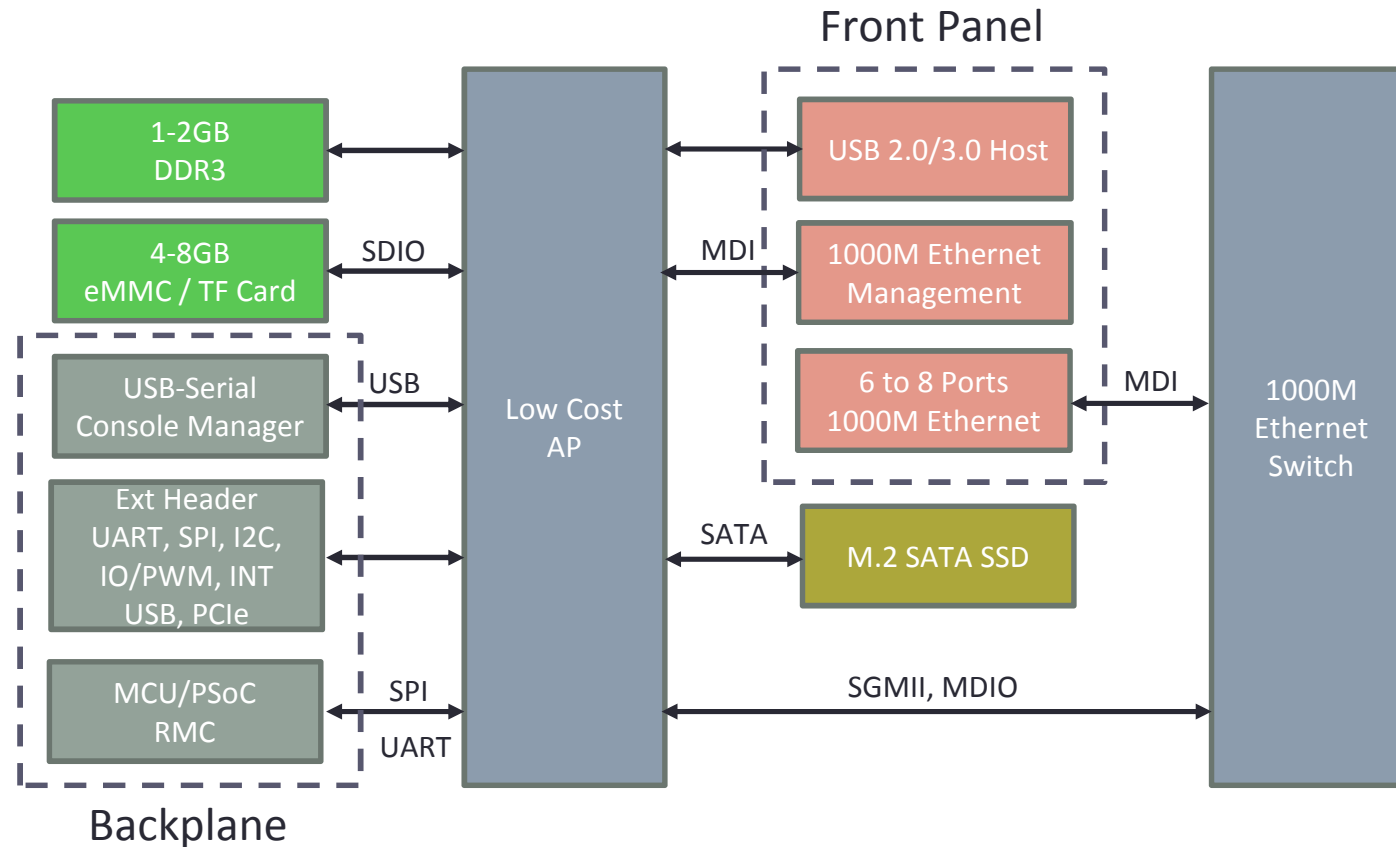
Application Board (4)

Kestrel Industrial Platform



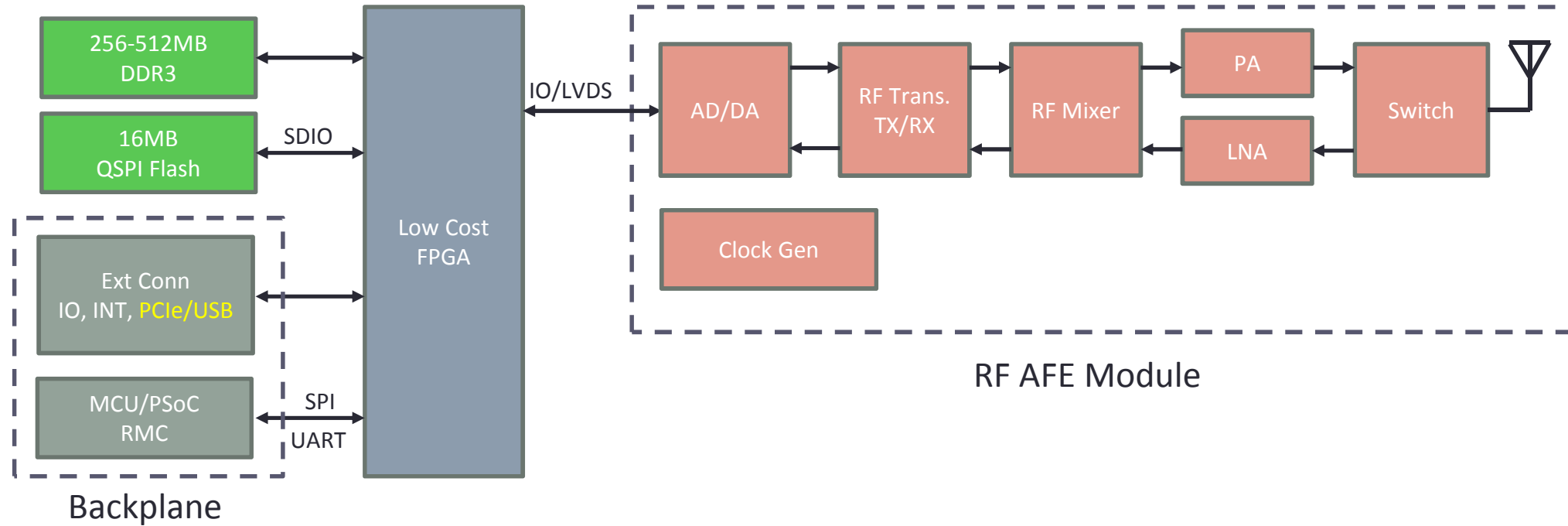
Switch & Management Board (1)

Octopus SW Platform



Front End Board (1)

SDR Platform (TBD.)



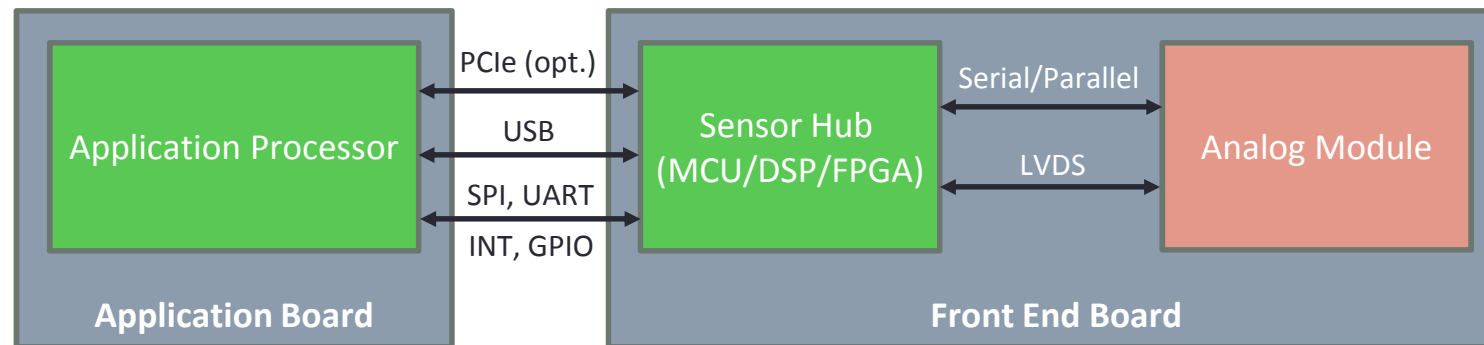
AP-FE Data Flow

Sensor Hub <--> Analog Module

- Serial or parallel interface for low speed AD/DA
- Multi lanes LVDS for high speed AD/DA

AP Board <--> FE Board

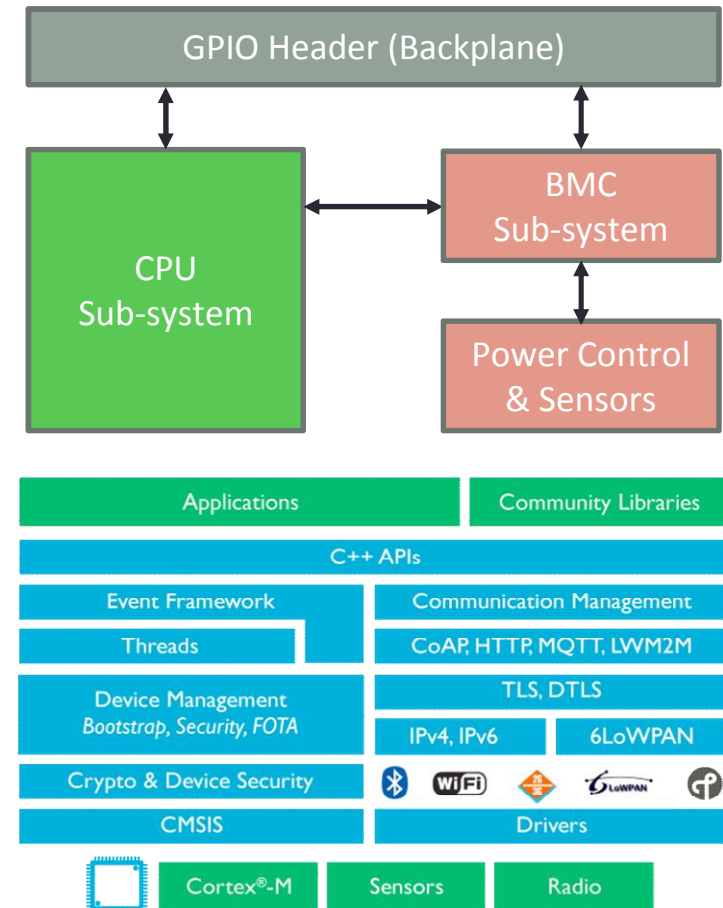
- SPI/QSPI for low bandwidth communication
- USB 2.0 Full (480Mbps) for mid-BW, PCIe (up to Gen2 5.0GT/s) for high-BW



Chassis Management

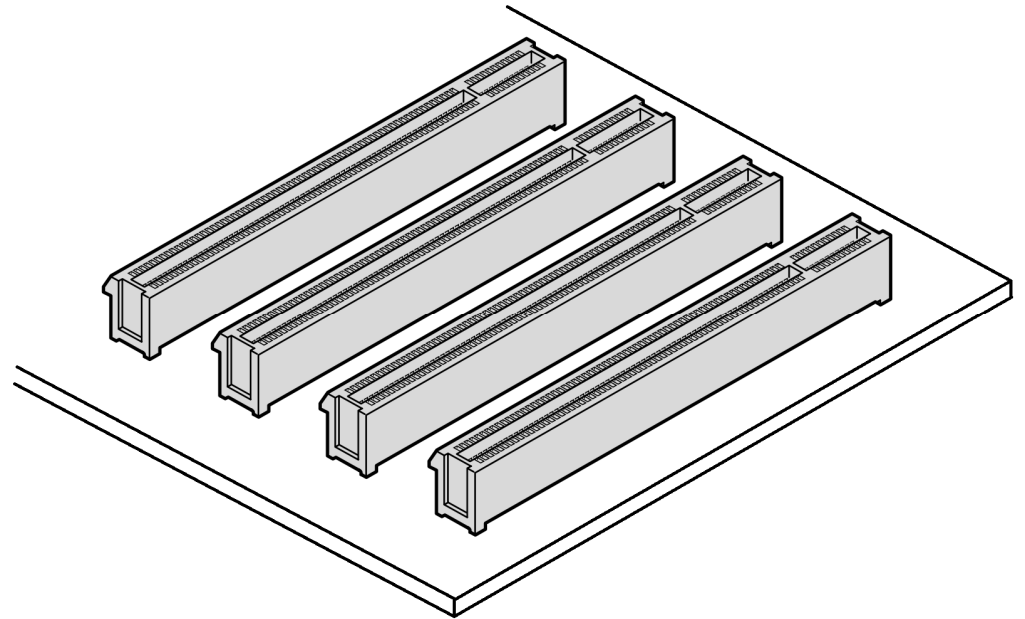
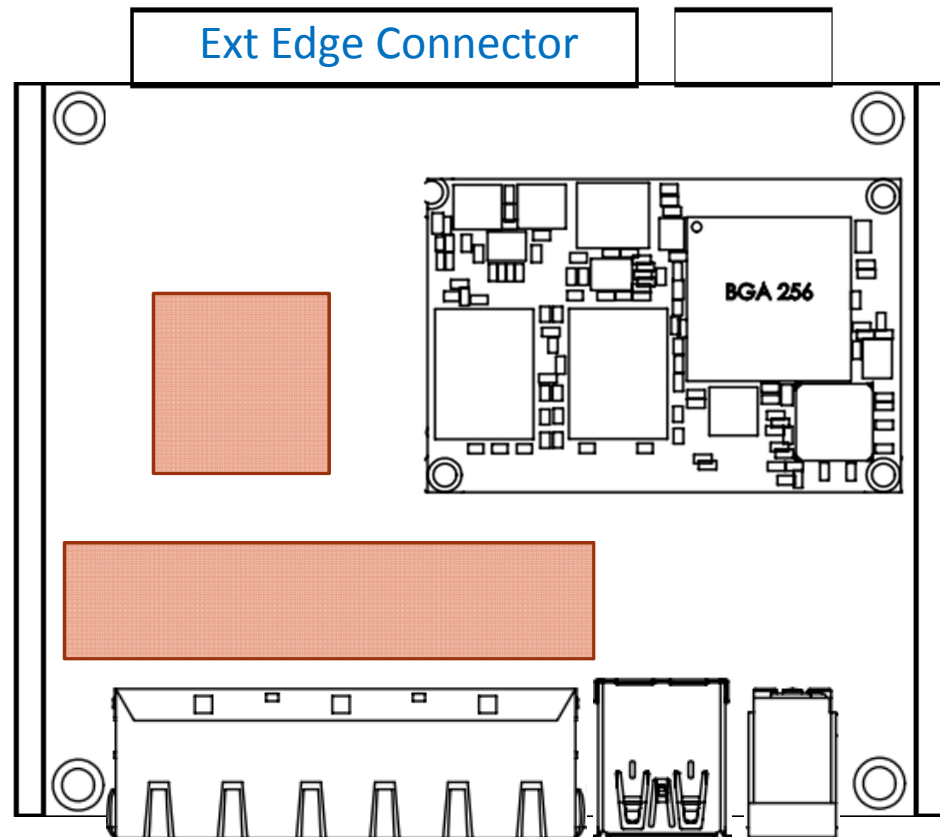
BMC/RMC

- Reduced chassis management functions
 - Communication with RMC via backplane (I2C)
 - Accessible by CPU via SPI/UART & interrupt GPIO
 - Monitor onboard voltage of each power stage & temperature
 - I2C Digital temp sensor under heatsink near CPU
 - Control main 12V power from backplane
 - Use MOSFET to switch on/off major 12V
 - 12V input OV protection circuits
 - Independent 3.3V power supply for BMC
 - Selected from backplane or onboard 3.3V
- MCU selection
 - [STM32F411CEU6](#): High performance, cost effective (\$4.5)
 - [PSoC](#): Flexible, high cost
- Software stack
 - Mbed OS + Mbed TLS
 - Implement FRU, power control, and sensor/event reporting



Mechanical Specification

Blade Mechanical Drawing & Backplane Connection



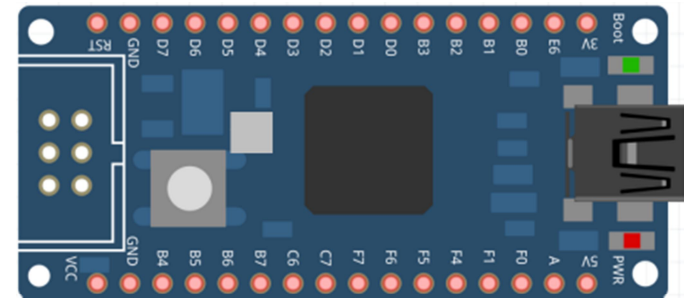
Debug Backplane Toolkits

Debug Backplane Board

- Simulated backplane to provide single AP board debug function
- 5V & 3.3V power supply
- I/O expansion: GPIO header and MCMB interface
- Slot ID and board configuration

RMC Kit F411

- Core board with F411 MCU for RMC development
- On-board Li battery charging
- USB device interface
- ARM MBED compatible



FireCube Roadmap (Deprecated!)

Phase 0 Kick-start	Phase 1 Basic System Build-up			Phase 2 Stable System	
Fennec BD HW 1.0	Fennec BD OS/SW 1.0			Fennec BD HW 1.1	Fennec BD OS/SW 1.1
	Kestrel BD HW 1.0	Kestrel BD OS/SW 1.0		Kestrel BD HW 1.1	Kestrel BD OS/SW 1.1
		Octopus BD HW 1.0		Octopus BD OS/SW 1.0	
Debug BP HW	Backplane HW 1.0			Backplane HW 1.1	
	PFB HW		PFB SW		
	Chassis Mechanic (3D Print)			Chassis Mechanic (Metal)	
	I/O Expansion BD HW		SSD Expansion BD HW		
RMC KIT HW	Chassis Management SW 1.0 (Draft)		Chassis Management SW 1.1 (Stable)		