Google

Overview of Flatbed in Open Rack V2.0

Support for 12V IT Payloads in 48V Power Distribution Racks

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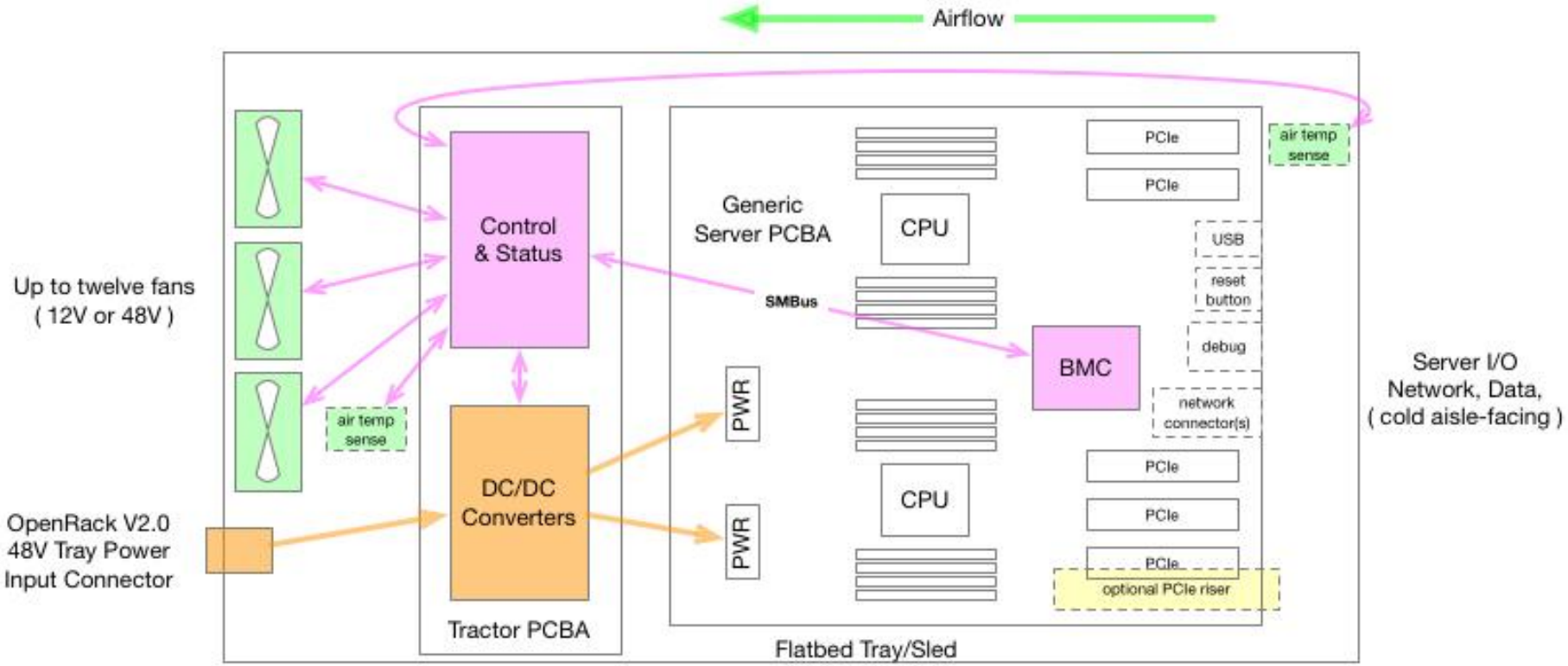
What is Flatbed?

A ***toolbox*** of components to provide standardized ***"shim" interfaces*** between Off-The-Shelf Server Motherboards and deployed higher-level rack infrastructure (OpenRack Version2.0)

- Sheetmetal tray options (aka the "sled")
  - Various widths and server motherboard mounting hole locations
  - Shielded or open-top tray design
- Power supply with 12V or ATX outputs
- Fans, heatsinks, ducting, with associated mechanical brackets
- Miscellaneous adapters and breakouts between Motherboard and other HW
  - PCIe riser cards
  - Air temperature sensors
  - Other (TBD)

What Is a “Typical” Flatbed Implementation?



Motivations for Flatbed

- Flatbed provides an incremental migration path from 12V to 48V racks using existing, proven 12V IT payloads
- Fast implementation of a broader range of payloads in OpenRack Version2.0
- OpenBMC & re-usable HW adapters ease SW re-use by focusing on bridging between open, standard interfaces.

Overview of Flatbed Proposed Specification: What is Covered?

- Tray/Sled Mechanical
  - Maximum Dimensions
  - Thermal Considerations
- Tractor PCBA
  - Power Conversion (Hotswap, DC/DCs, Monitoring)
  - Control/Monitoring Path, including Thermal Control (Fans, Sensors)
  - Interface to Motherboard for Control & Status
- Server Motherboard Minimum Requirements

Highlights: Flatbed Mechanical Details

Features to enhance rapid prototyping, configurability

- Standardized tray designs
  - Fans, power entry, Tractor PCBA typically hard located
  - Flexible electrical cable routing & attachment features
  - Airflow fairings: fast 3-D printed prototype to low-cost production path
- Heatsinks
  - Standardized CPU attachments at the socket and chip retention interface
    - Traditional heatsinks: Design can tradeoff BOM cost vs. height vs. tray level fan power
    - Heatpipe or evaporator based designs: Design can customize interconnections & radiators

Highlights: Thermal Control

- Front to Back airflow (architectural requirement)
- Multiple zone control with support for independent sensors, fans
  - Tractor PCBA implementation supports up to twelve independent fans (PWM, tach)
  - Tractor PCBA implementation supports up to four remote I2C air temperature sensors
  - Main thermal control loop is implemented on BMC with Tractor PCBA functioning as an aggregated fan/sensor controller
- Custom heatsinks and fairings may be used if required

Minimum Required Features:
Server Payloads - Mechanical Requirements

- Maximum mechanical dimensions
  - Width: up to 19.5”
  - Depth for “co-planar” tray layouts:
    - Up to 15.9” depth for shallow ORv2 option (30” Rack depth)
    - Up to 21.4” depth for deep ORv2 option
  - Height agnostic
- Front-to-rear airflow direction (DIMMs, PCIe slots, heatsink fins)
- CPU socket and retention mechanism match vendor reference designs
  - Standardized heatsink interface details
- “Most” PCIe slots located at front (those used for NIC and other external I/O)

Minimum Required Features:
Server Payloads - Electrical Requirements

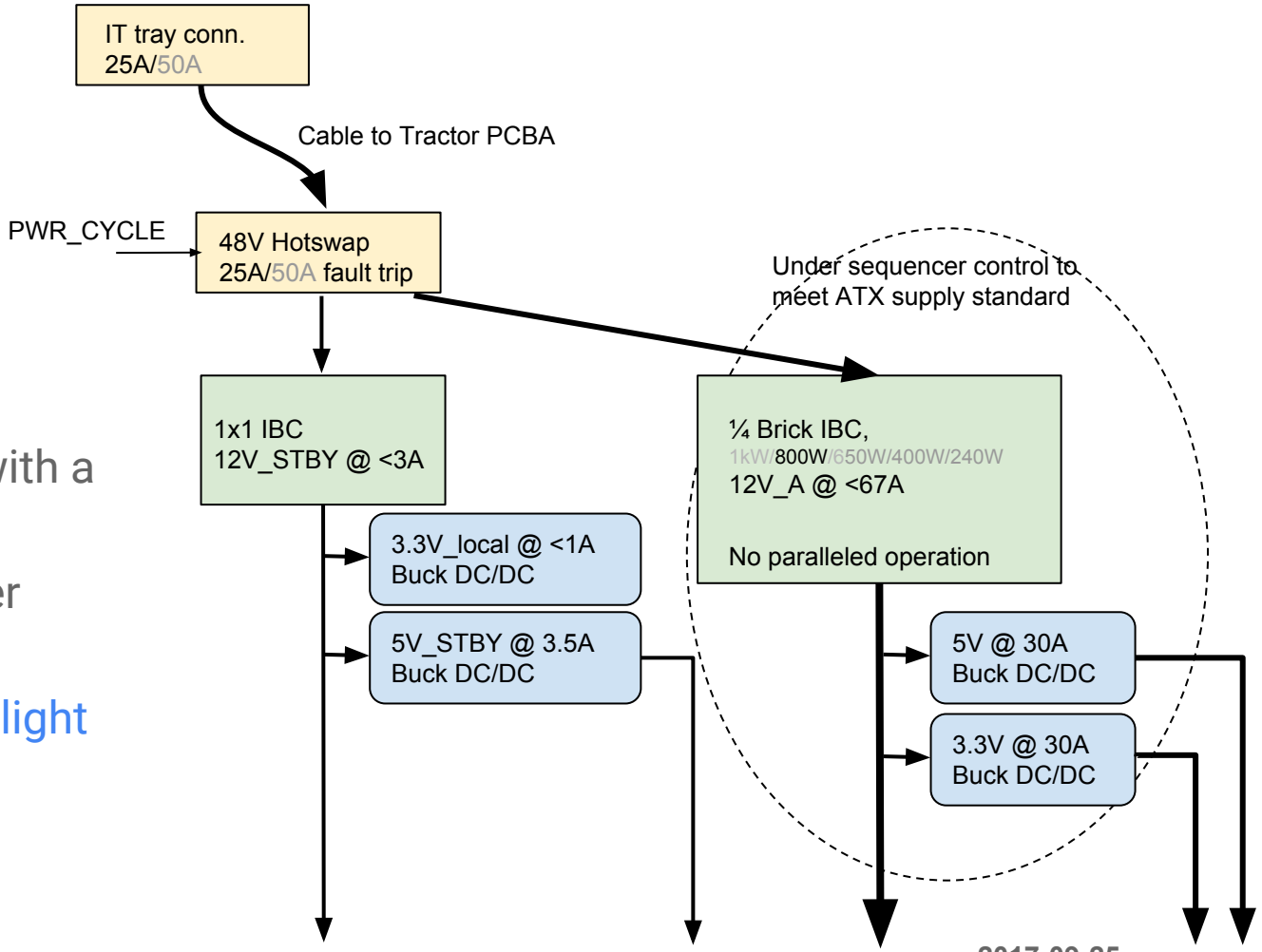
- PCIe slots
  - PCIe RSVD pin usage generally fits under “soft” requirements.
- 100Base-TX compatible RJ45 connector routed to BMC for NC-SI
- At least one “clean” SMBus accessible on a header for Tractor PCBA interface
  - Clean = empty address space. Existing I2C EEPROMs, expanders, and cascaded muxes on the Payload are particularly difficult to work around.
- BMC that can boot Linux, support OpenBMC
  - Upgrade via software
- Power input must be **12V + 12V_STBY** *or* **ATX/EPS12V**

Highlights: Tractor PCBA

- 48V power input, fusing, and hotswap
- Supply outputs to payload: 12V or ATX/EPS12V
- Fan control + connectors
- Miscellaneous digital communications & breakouts between Motherboard and other HW, through the PCBA comms block
  - PSU enable and powergood (ATX PSU standard signals)
  - SMBus (main communication link)
  - Other (optional, TBD, GPIOs)

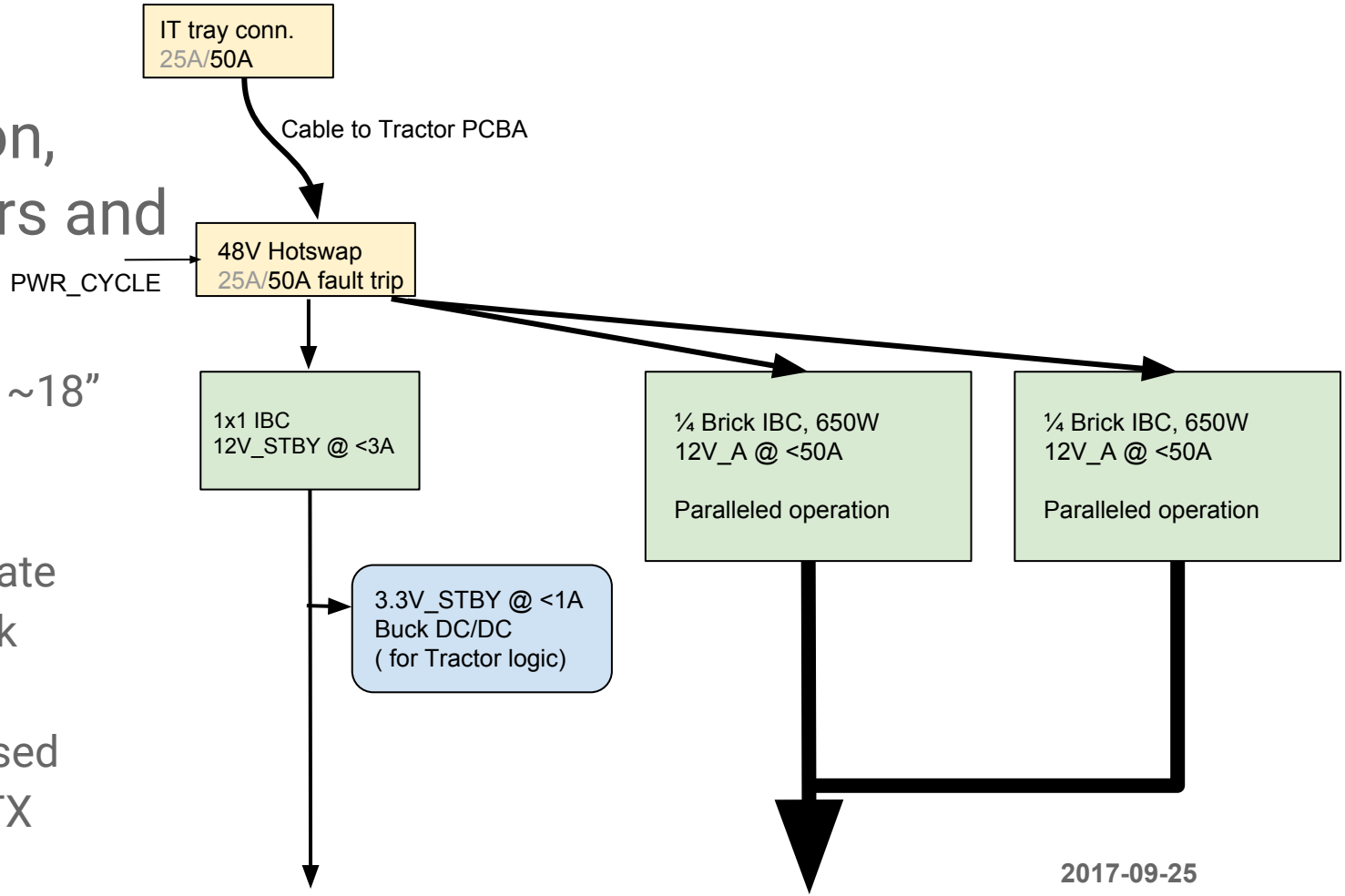
Tractor-ATX
Up to ~1000W
Power Option

- Target width 7.5” with a 9.5” fallback
- ATX/EPS12V power outputs
- Stuffing options in light gray.

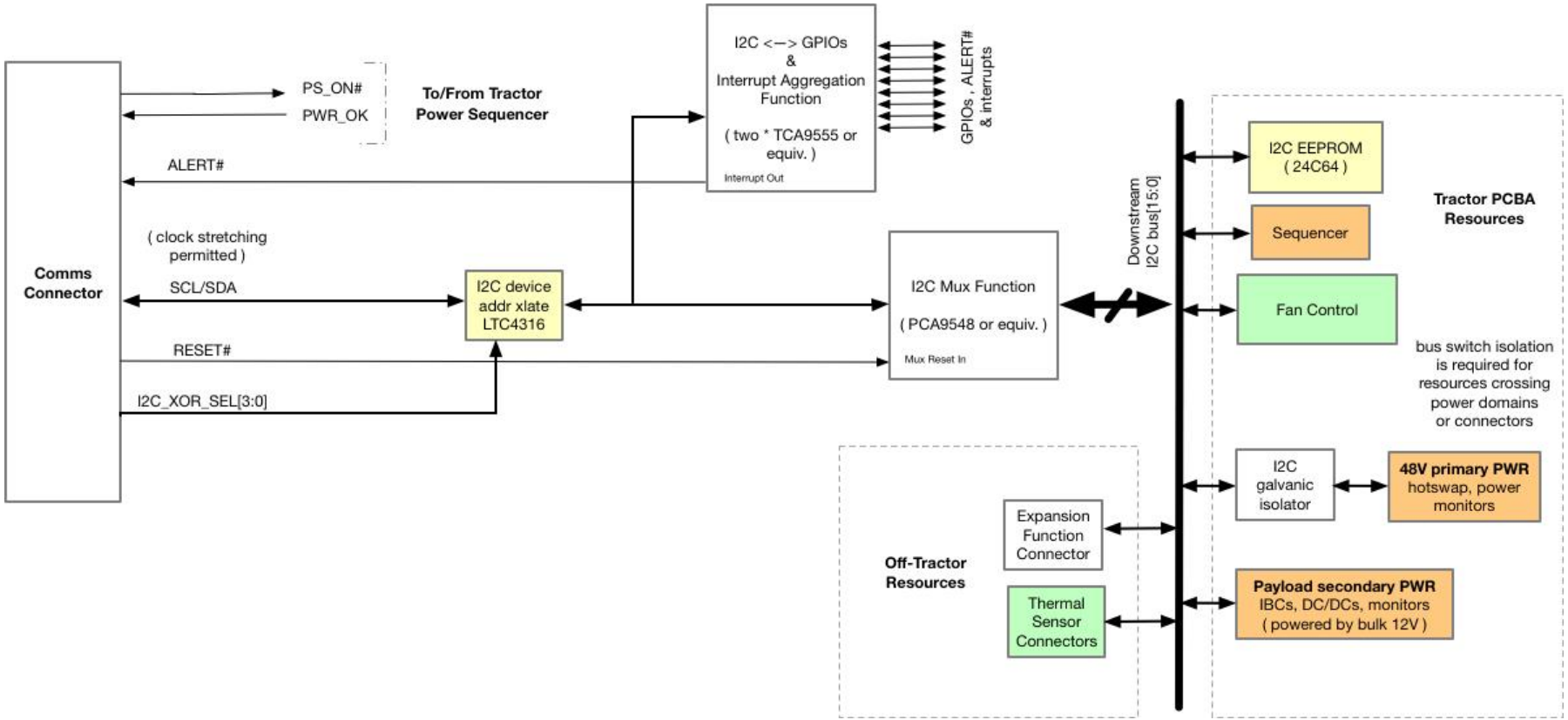


Tractor-12V Power Option, Large Servers and Appliances

- Target width ~18”
- Modular and scalable
- Can depopulate 5V/3.3V Buck DC/DCs and sequencer used in Tractor-ATX



Tractor PCBA Control and Communications



Flatbed Software: Management and OpenBMC

- OpenBMC support for Tractor to be upstreamed for easy integration with existing and future OCP servers
- Single I2C interface for BMC-to-Tractor Control/Status
  - Any BMC or uC has access to the same Tractor/Flatbed resources
  - Different Flatbed+Payload variants can execute similar BMC code
    - Fewer dependencies on free BMC GPIOs or server connector I/O (fans, sensors)
- Tractor can support a uC in the “I2C device address xlate” block implementation
  - Supports payloads with special requirements or without BMCs
  - Local Tractor uC option can unload monitoring tasks from motherboard BMC
    - High sample rate monitoring or control loops
    - Interrupt aggregation