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Modular Tray for Data Center

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ABSTRACT

This disclosure describes a modular, reconfigurable, data-center tray capable of holding a wide range of payloads. The tray includes a subframe that attaches to a main base frame (chassis) that serves as a universal primary platform. The subframe can be swapped out with any new subframe as long as the new subframe utilizes at least some of the interfaces in the primary frame. The subframe includes bays capable of hosting modules of varying functionality, e.g., input-output modules, GPU modules, power-supply modules, etc. The described tray enables the simultaneous development of multiple products for different use cases. The tray can be reconfigured quickly. It can be extended with a larger subframe to fit deep-rack applications and to accommodate additional hardware such as CPUs, PCBAs, active cooling, etc. The tray improves operator ergonomics and safety, and produces economies of scale.

KEYWORDS

- Data center
- Modular tray
- GPU tray
- Peripheral component interconnect express (PCIe)
- Ergonomics
- Field replaceable unit (FRU)

BACKGROUND

Product development life cycles can span between one to three years depending on complexity. The number of engineers in a given organization sometimes does not scale with a growing portfolio of products being developed by the organization. A standardized platform over which hardware can be reused for multiple use cases can enable a growing product portfolio to be supported by a sub-linearly growing engineering team. In the context of data centers, various products in the roadmap can require hardware payloads that widely vary in weight, e.g., between twenty pounds (a typical server module) and one hundred and twenty pounds (a typical GPU accelerator module).

Accessibility, ergonomics, and serviceability of field replaceable units (FRU) are critical aspects of system design. In particular, the larger the number of physical movements required to access a component, the lower its accessibility and serviceability. For example, GPU trays used in data centers typically require unfastening several screws before an operator can access a GPU. Another example is the use of non-captive fasteners, which can become separated and lost inside or between systems and trays, potentially introducing electrical hazards.

DESCRIPTION

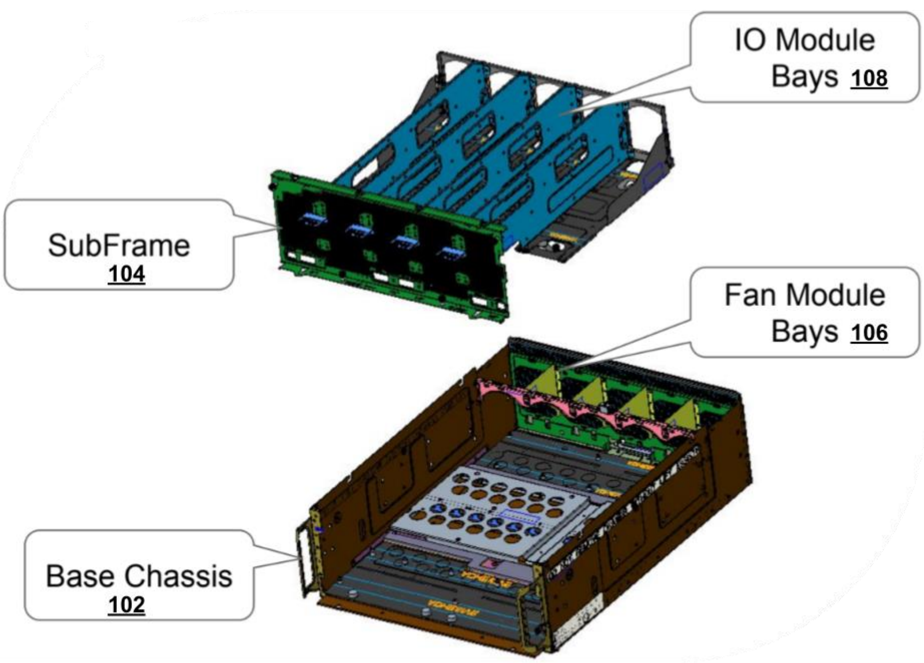

Fig. 1: Heavy modular tray

This disclosure describes a highly modular and reconfigurable tray (illustrated in Fig. 1) that is capable of holding a wide range of payloads, e.g., between the weight of a typical server (30-40 lb.) to that of a full GPU accelerator (90-110+ lb.). The tray includes a subframe (104, also referred to as an inner cage assembly) that attaches to a main base frame or chassis (102, also referred to as the primary frame or system frame). The subframe can be swapped out with any new subframe as long as the new subframe utilizes some or all of the interfaces in the primary frame. The subframe includes one or more bays (108) capable of hosting modules of varying functionality, e.g., input-output modules, GPU modules, power-supply modules, etc. The base frame includes modules for hosting fans (106) and is described in greater detail below.

(a)

(b)

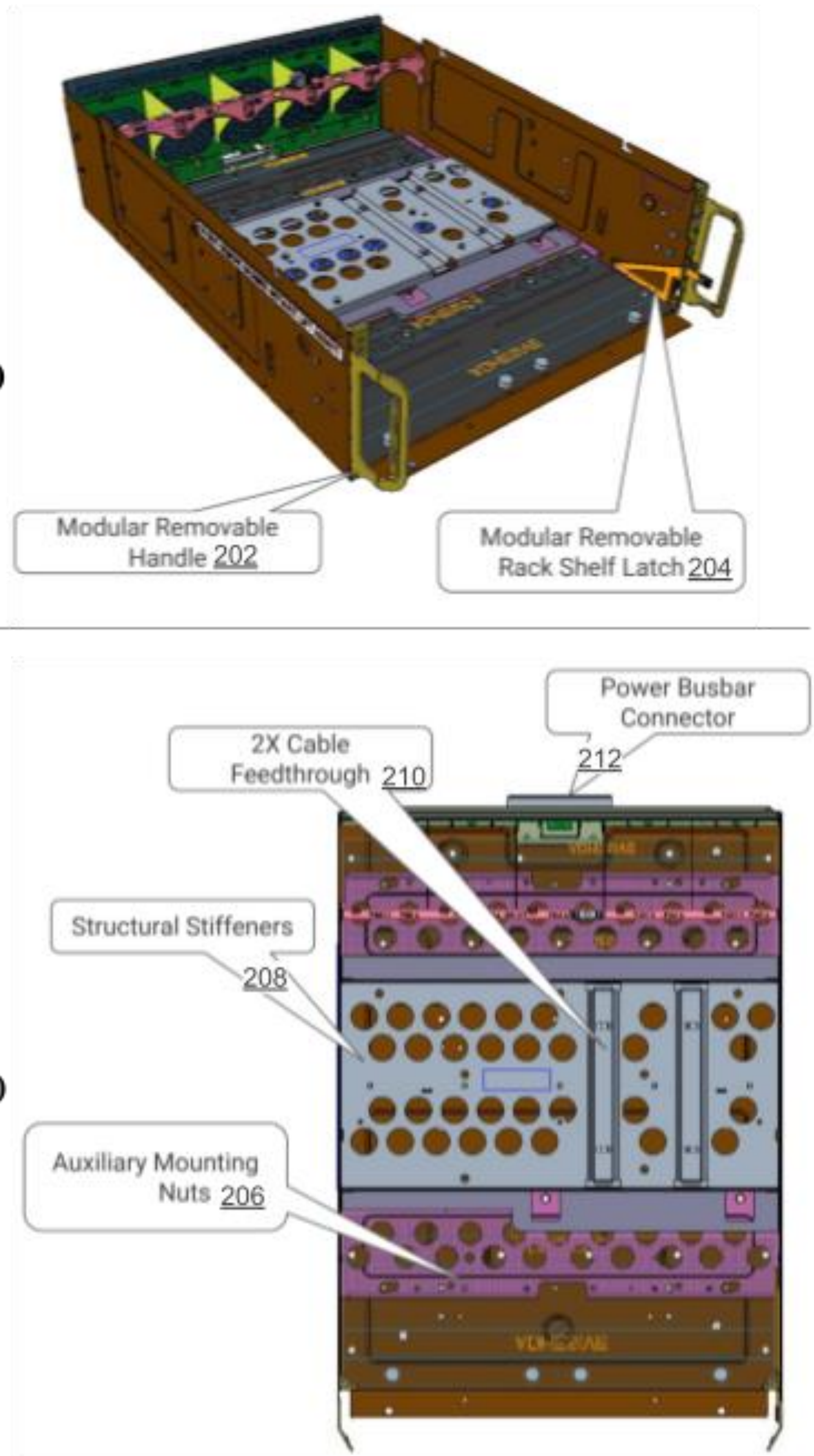

Fig. 2: Base frame: (a) perspective view; (b) top view

Fig. 2(a) illustrates a perspective view and Fig. 2(b) illustrates a top view of the base frame. The base frame includes modular, removable handles (202) and rack-shelf latches (204). It also features auxiliary mounting nuts (206), structural stiffeners (208), cable feedthroughs (210), power bus connectors (212), etc., which enable the modularity and the reconfigurability of the tray.

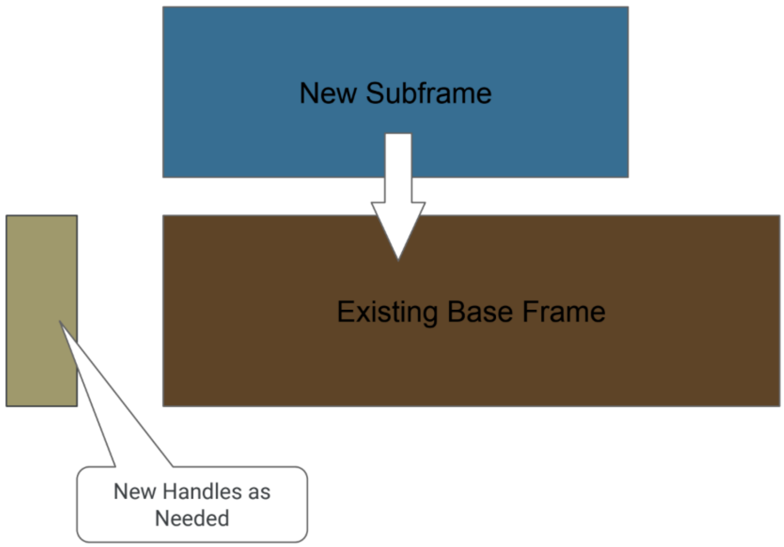

Fig. 3: Schematic diagram of a new subframe being fitted into an existing base frame

Fig. 3 illustrates schematically a new subframe being fitted into an existing base frame (chassis). The new subframe can have features, functionality, and architecture different from previously hosted subframes as long as the architecture is within the design volume. New handles can be fit as necessary.

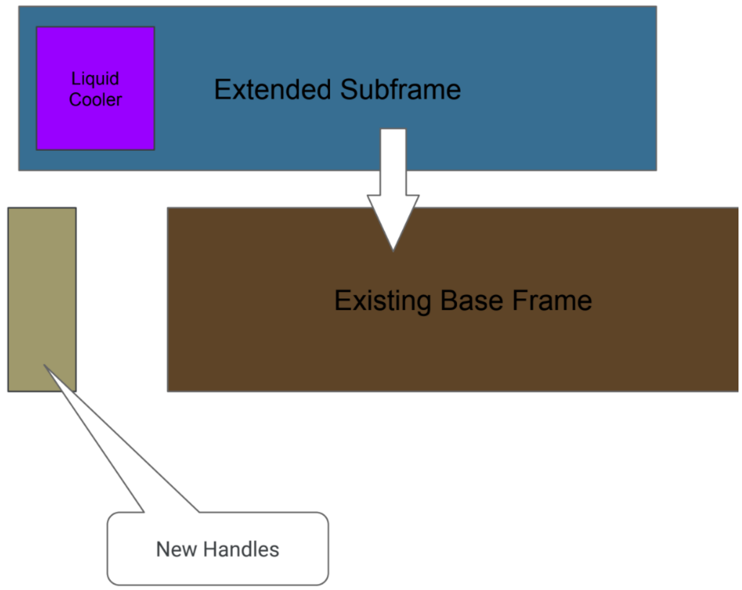

Fig. 4: New subframe can extend the existing chassis

Fig. 4 illustrates schematically that the new subframe to be hosted in the existing base frame or chassis can extend the base frame. Such an extension finds application in extended racks or deep racks, where the extended subframe can enable additional hardware to be accommodated. For example, Fig. 4 illustrates that additional hardware such as a liquid cooler heat exchange can be added to the tray. New handles can be fit as necessary.

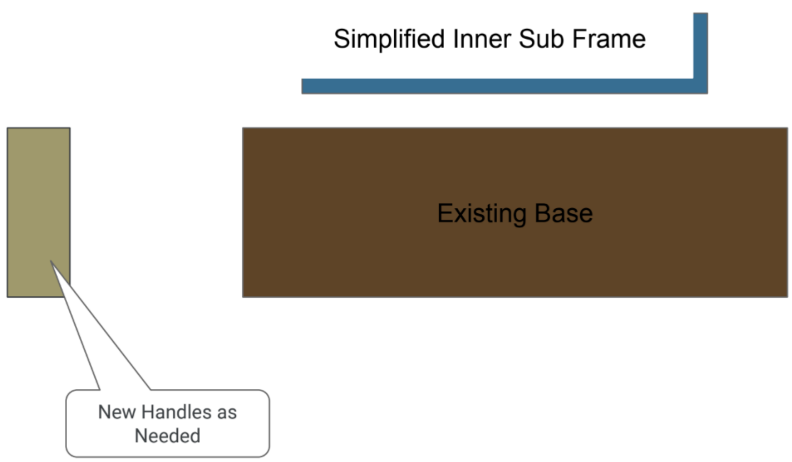

Fig. 5: Simplified subframe

Fig. 5 illustrates schematically the possibility of a simplified inner subframe being hosted by an existing base frame. New handles can be attached to accommodate the simplified inner subframe.

Some advantages of the described modular tray include:

- Multiple products can be simultaneously developed for different use cases.
- The tray can be reconfigured quickly, as the time required to disassemble the tray and its onboard components is relatively small.
- The tray can be extended with a larger subframe to accommodate more internal hardware such as CPUs, PCBAs, disc storage, memory devices, hardware accelerators, etc.
- The tray produces economies of scale because it is standardized across present and future products.
- The modular inner frame improves ergonomics and operator safety.
- The modularity of the tray enables the development of new systems that operate on a universal primary frame platform.
- An increased payload limit is possible based on the extent of structural reinforcement, enabling a high degree of design fungibility for heavy systems.
- The tray is adaptable for deep rack applications.
- The tray is configurable for any main PCBA that fits within the product footprint with the use of an adapter.
- The tray can accommodate additional hardware including active cooling hardware.
- The subframe can have varying and widely different functionality, e.g., GPU module, input-output module, data storage module, power supply module, network interface card, etc.

CONCLUSION

This disclosure describes a modular, reconfigurable, data-center tray capable of holding a wide range of payloads. The tray includes a subframe that attaches to a main base frame (chassis) that serves as a universal primary platform. The subframe can be swapped out with any new subframe as long as the new subframe utilizes at least some of the interfaces in the primary frame. The subframe includes bays capable of hosting modules of varying functionality, e.g., input-output modules, GPU modules, power-supply modules, etc. The described tray enables the simultaneous development of multiple products for different use cases. The tray can be reconfigured quickly. It can be extended with a larger subframe to fit deep-rack applications and to accommodate additional hardware such as CPUs, PCBAs, active cooling, etc. The tray improves operator ergonomics and safety, and produces economies of scale.