METHOD AND APPARATUS FOR PROVIDING A MECHANICAL MEANS TO SUPPORT CARD SLOTS CAPABLE OF ACCEPTING CARDS OF MULTIPLE FORM FACTORS

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ABSTRACT

An embodiment of the invention may comprise a reconfigurable chassis with one or more first card slots capable of being populated with a first mechanical form factor card, one or more second card slots capable of being populated with the first mechanical form factor card or with a second mechanical form factor card, and a mechanical slot adaptor configured to occupy at least one second card slot, where the mechanical slot adaptor is configured to provide mechanical support for the second mechanical form factor card in the second card slot.

Related U.S. Application Data

Provisional application No. 61/487,434, filed on May 18, 2011.
Controller Card Slot

Card Slot Type 1

Card Slot Type 1

Card Slot Type 1

Card Slot Type 1

Card Slot Type 1

Card Slot Type 2

Card Slot Type 2

Card Slot Type 2

Card Slot Type 1

Card Slot Type 1

Card Slot Type 1

Card Slot Type 1

Card Slot Type 1

Card Slot Type 1

Card Slot Type 1

Controller Card Slot
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FIG. 2
FIG. 3

Controller Card

Port Card

Port Card

Port Card

Port Card

Port Card

Port Card

Port Card

Port Card

Port Card

Controller Card
FIG. 4

402

Controller Card

Port Card

Port Card

Port Card

Port Card

Port Card

Port Card

Switch Card

Switch Card

Switch Card

Switch Card

Port Card

Port Card

Port Card

Port Card

Port Card

Controller Card
FIG. 5
METHOD AND APPARATUS FOR PROVIDING A MECHANICAL MEANS TO SUPPORT CARD SLOTS CAPABLE OF ACCEPTING CARDS OF MULTIPLE FORM FACTORS

RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Application 61/487,434 filed on May 18, 2011, the contents of which are incorporated by reference in its entirety.
[0002] This application incorporates by reference the U.S. Application [TBD], entitled MULTI-CONFIGURABLE SWITCHING SYSTEM USING MULTI-FUNCTIONALITY CARD SLOTS, Attorney Docket Number 02495.000120, filed on even date herewith.

BACKGROUND

[0003] 1. Field
[0004] Example aspects described herein relate generally to communications equipment, and more specifically to a mechanical means to support card slots capable of accepting cards of multiple form factors.
[0005] Due to the continued increase in the operating speed and memory capacity of processors, such as personal computers, workstations, and servers, current communications systems are challenged to deliver data to these processors at continually higher speeds.

[0006] 2. Description of Related Art
[0007] Typical communications systems include collections of interconnected access nodes that communicate with one another using a software protocol structure. These nodes may be interconnected using one or more network switches included in a switch fabric.

SUMMARY

[0008] A mechanical chassis to support circuit packs (cards) of differing mechanical dimensions in the same slot of an equipment chassis is described. The mechanical chassis comprises at least one chassis type and at least one mechanical slot adaptor mechanism. The chassis may be used in a switching system containing both port (interface) cards and switch cards.

[0009] An embodiment of the invention may comprise a reconfigurable chassis with one or more first card slots capable of being populated with a first mechanical form factor card, one or more second card slots capable of being populated with the first mechanical form factor card or with a second mechanical form factor card, and a mechanical slot adaptor configured to occupy at least one second card slot, where the mechanical slot adaptor is configured to provide mechanical support for the second mechanical form factor card in the second card slot.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The teachings claimed and/or described are further described in terms of exemplary embodiments. These exemplary embodiments are described in detail with reference to the drawings. These embodiments are non-limiting exemplary embodiments, in which like reference numerals represent similar structures throughout the several views of the drawings, and wherein:

[0011] FIG. 1 is a frontal diagram depicting an exemplary reconfigurable chassis according to one embodiment of the invention.
[0012] FIG. 2 is a diagram depicting an exemplary reconfigurable chassis according to another embodiment of the invention.
[0013] FIG. 3 is a diagram depicting an exemplary configuration for a reconfigurable chassis.
[0014] FIG. 4 is a diagram depicting an exemplary configuration for a reconfigurable chassis.
[0015] FIG. 5 is a diagram depicting an exemplary configuration for a reconfigurable chassis.
[0016] FIG. 6 shows an exemplary slot adaptor in accordance with an embodiment of the invention, which is removed from a chassis.
[0017] FIG. 7 shows an alternative view of an exemplary slot adaptor in accordance with an embodiment of the invention, which is removed from a chassis.
[0018] FIG. 8 shows two exemplary slot adaptors in accordance with embodiments of the invention, which are placed partially into a chassis.
[0019] FIG. 9 shows two exemplary slot adaptors in accordance with embodiments of the invention, which are placed completely into a chassis.
[0020] FIG. 10 shows two exemplary slot adaptors in accordance with embodiments of the invention, which are placed completely into a chassis with cards placed into the slot adaptors.

DETAILED DESCRIPTION

[0021] Various example embodiments of a mechanical means to support card slots capable of accepting cards of multiple form factors will be described with respect to FIGS. 1 to 10.
[0022] A description of example embodiments of the invention follows.

[0023] FIG. 1 is a frontal diagram depicting an exemplary reconfigurable chassis according to one embodiment of the invention. There is shown a reconfigurable chassis 100 comprising two controller card slots 102, a first plurality of card slots 104 capable of being populated with circuit packs (cards) of a first mechanical form factor (a port card, for example), and a second plurality of card slots 106 capable of being populated with cards of the first mechanical form factor or with cards of a second mechanical form factor (a switch card, for example).

[0024] FIG. 2 is a diagram depicting an exemplary reconfigurable chassis according to another embodiment of the invention. There is shown a reconfigurable chassis 200 comprising two controller card slots 202, a first plurality of card slots capable of being populated with cards of a first mechanical form factor 204, and a first and second set of a second plurality of card slots 206A and 206B capable of being populated with cards of the first mechanical form factor or with cards of a second mechanical form factor.

[0025] FIG. 3 is a diagram depicting an exemplary configuration for a reconfigurable chassis. In FIG. 3, there is shown a first configuration where the reconfigurable chassis 300 may be similar to the reconfigurable chassis 100 or 200, where the first and second plurality of card slots 304 and 306 are populated with port cards. Since there are no switch cards in the first configuration, there may not be a need for interconnections between the port cards. Alternatively, each port card...
may be connected to a dedicated paired port card using an electrical interconnection between paired cards.

FIG. 4 is a diagram depicting an exemplary configuration for a reconfigurable chassis. In FIG. 4, there is shown a second configuration where the reconfigurable chassis 400 may be similar to the reconfigurable chassis 200, where the first plurality of card slots 404 are populated with port cards, the first set of the second plurality of card slots 406A are populated with switch cards, and the second set of the second plurality of card slots 406B are populated with port cards.

FIG. 5 is a diagram depicting an exemplary configuration for a reconfigurable chassis. In FIG. 5, there is shown a third configuration where the reconfigurable chassis 500 may be similar to the reconfigurable chassis 200, where the first plurality of card slots 504 are populated with port cards, and the first and second set of the second plurality of card slots 506A and 506B are populated with switch cards.

FIGS. 6 through 10 illustrate example embodiments of the invention for removable mechanical slot adapter. FIG. 6 shows a slot adapter removed from a chassis. FIG. 7 shows an alternative view of a slot adapter removed from a chassis. FIG. 8 shows two slot adapters placed partially into a chassis. FIG. 9 shows two empty slot adapters placed completely into a chassis. FIG. 10 shows two slot adapters placed completely into a chassis with cards placed into the slot adapters.

The interior of the chassis contains card guides for each card slot of the chassis. There is a set of card guides for the first plurality of card slots, and a set of card guides for the second plurality of card slots. The removable mechanical slot adapter slides into card guides of the second plurality of card slots. One or more mechanical slot adapters may be placed into the second plurality of card slots so that those card slots become capable of accepting cards of the second mechanical form factor.

FIG. 6 occupies two slots of chassis 800 (FIG. 8), and may provide mechanical support for six cards of second mechanical form factor (two cards on each of three tiers). (Alternatively, the slot adapter shown in FIG. 6 may provide mechanical support for three “double-wide” cards.) When the slot adapter 600 is removed from two slots of the second plurality of card slots, two cards of the first mechanical form factor can be inserted into the two slots formerly occupied by the slot adapter 600. Although the slot adapter 600 shown in FIG. 6 occupies two slots of the chassis 800, an alternative embodiment of a slot adapter includes one that occupies a single slot of the chassis, wherein either two or three cards of the second mechanical form factor can be inserted into the slot adapter occupying a single slot of the chassis. In another embodiment, a slot adapter may occupy two slots of the chassis, but house only four cards of the second mechanical form factor.

A chassis may be constructed such that it can house either a single slot adapter or multiple slot adapters (e.g., two, three, four, etc.). In a chassis that can support two slot adapters, a first slot adapter can be placed in a first set of the second plurality of card slots, and a second slot adapter can be placed in a second set of the second plurality of card slots. In such a configuration, switch cards may be placed in the first slot adaptor, and port cards can be placed in the second set of the second plurality of card slots. This configuration provides the ability to place more port cards into the chassis than the configuration that uses both a first and second slot adapter.

Alternatively, in a chassis that can support two slot adapters, neither a first or second slot adapter need be placed into the first or second set of the second plurality of card slots. Generally, a chassis may comprise slots able to accept various slot adapters. Some slots may be able to accept more than one type of slot adapters, some slots may be able to accept only one type of slot adapter, and some slots may not be able to accept any slot adapters at all.

As shown in FIG. 6, the slot adapter 600 may contain both a left rigid support wall 670 and a right rigid support wall 675, both extending from the top of the slot adapter 600 (top rigid support wall 680) to the bottom of the slot adapter 600 (bottom rigid support wall 685). The top rigid support wall 680 and the bottom rigid support wall 685 may both extend from the front 684 of the slot adapter 600 to the rear 682 of the slot adapter 600.

The chassis 800 additionally contains a printed circuit board (PCB) backplane assembly 970 (FIG. 9) that is populated with electrical connectors that mate with corresponding connectors located on the cards of the first and second mechanical form factors, when the cards of the first and second mechanical form factors are inserted into the chassis 800. When a card with the first or second mechanical form factor is inserted into a slot of the chassis 800, electrical connector on the card will mate with a corresponding connector on the backplane PCB, providing electrical connectivity between the card and the backplane. Among the second plurality of card slots there may be a first connector on the backplane used to connect to cards of the first mechanical form factor, and there may be a second connector on the backplane used to connect to cards of the second mechanical form factor. The second connector on the backplane may be offset horizontally from the first connector on the backplane.

The slot adapter 600 may be constructed such that a first card of the second mechanical form factor is placed directly above a second card of the second mechanical form factor in the slot adapter 600. For such a slot adapter, a rigid intermediate support wall 665 may be located between the first and second cards of the second mechanical form factor, wherein the rigid support wall extends from the front of the slot adapter 684 to the rear of the slot adapter 682. Additionally, the slot adapter 600 may contain integrated card guides 660 for both the first and second cards of the second mechanical form factor, wherein the card guides 660 provide a means of properly aligning the first and second cards of the second mechanical form factor so that electrical connectors located at the rear of the cards of the second mechanical form factor can properly engage with mating connectors on the backplane in the chassis 800.

The top rigid support walls 680, the bottom rigid support walls 685, and intermediate rigid support walls 665 may additionally contain ventilation holes 690 that may allow air flow through the slot adapter 600 for cooling purposes.

The rigid left support wall 670 and the rigid right support wall 675 may contain substantially large cut-outs 645 that may allow air to flow through the cut-outs for cooling purposes.

The slot adapter 600 may additionally contain an upper alignment runner 610 and a lower alignment runner 710.
(FIG. 7). The alignment runners 610, 710 may be made of plastic or some other suitable material, and are attached to the top rigid wall 680 and the bottom rigid wall 685. As illustrated in FIG. 8, the upper and lower alignment runners 610, 710 slide into the card guides 840 located on the bottom and top of the interior cavity of the chassis 800.

[0040] The chassis 800 and removable mechanical slot adaptor 600 contain a mechanical means to secure the removable mechanical slot adaptor 600 to the chassis 800 once the mechanical slot adaptor 600 is completely inserted into the chassis 800. The slot adaptor 600 may contain at least one mechanical tab 620, 880, 885, 930, 935 with securement slots 630, 892, 960 that allow mechanical screws to be used to secure the slot adaptor 600 to threaded holes on the chassis 800.

[0041] The slot adaptor 600 may additionally contain an upper alignment pin 640, 720, 870 and a lower alignment pin 646, 725, 875, located on the upper and lower tabs 885, 880 of the slot adaptor 600. The alignment pins 640, 646, 720, 725, 870, 875 slide into alignment pin holes 865 located on the chassis, further aligning the slot adaptor 600 to the chassis cavity.

[0042] The removable mechanical slot adaptor 600 contains an open rear cavity that allows the connectors on the backplane assembly 970 to make direct mechanical and electrical contact with the electrical connectors located on the cards 1020 of the second mechanical form factor.

[0043] All the slots in the chassis 800 may be spaced equally apart. For a chassis with equally spaced slots, slots in the first plurality of card slots have the same spacing between them as the slots in the second plurality of card slots. This same spacing is between a card slot in the first plurality of card slots that is adjacent to a card slot in the second plurality of card slots. Therefore, the slot adaptor 600 of this invention is designed for a chassis whose non-controller card slots are all equally spaced apart. For example, the card slot spacing may be the same between all 14 non-controller card slots shown in FIG. 2. For a shelf containing equally spaced card slots, it may be advantageous for the cards of the second mechanical form factor to be narrower than the cards of the first mechanical form factor. This is because the left and right rigid support walls 670, 675 of the slot adaptor 600 take up physical space in the card slots of the second plurality of card slots.

[0044] Once the slot adaptor 600 is secured to the chassis 800, the second mechanical form factor cards 1020 may be inserted into the open cavity 910 at the front of the slot adaptor 600. The slot adaptor may contain at least one

[0045] mechanical fastening mechanism for each card plugged in the adaptor. The mechanical fastening mechanism may consist of a screw 1030 and threaded tab 650, where the screw 1030 is attached to each card 1020 plugged into the adaptor 1010, and the screw 1030 is screwed into a threaded tab 650 on the slot adaptor 600.

[0046] The second mechanical form factor cards 1020 may additionally contain a pull handle 1040 used to remove the card from the chassis 800.

[0047] The chassis 800 additionally may contain a third plurality of card slots, wherein the third plurality of card slots provide a means to house cards that are a fraction of the height of the cards of the first mechanical form factor, and wherein no slot adaptor is used to house the cards of the third plurality of card slots. For example, the chassis could contain some permanent mechanical means 890 (FIG. 8) used to support cards that are approximately half of the height of the cards of the first mechanical form factor. In the interior cavity of the chassis 800 shown in FIG. 8, a first half-height card could be placed above the permanent support structure 890, while a second half-height card could be placed below the permanent support structure 890. In one embodiment, the cards of the second mechanical form factor are able to be placed in the third plurality of card slots. In another embodiment, the cards of a third mechanical form factor are placed in the third plurality of card slots.

[0048] In the above descriptions, various aspects of the invention have been described with reference to specific example embodiments. The specification and drawings are accordingly to be regarded in an illustrative rather than in a restrictive sense. It will, however, be evident that various modifications and changes may be made without departing from the broader spirit and scope of the present invention.

[0049] In addition, it should be understood that the figures illustrated in the attachments, which highlight the functionality and advantages of the present invention, are presented for example purposes only. The architecture of the example aspect of the present invention is sufficiently flexible and configurable such that it may be utilized (and navigated in ways other than that shown in the accompanying figures).

[0050] Although example aspects of this invention have been described in certain specific embodiments, many additional modifications and variations would be apparent to those skilled in the art. It is therefore to be understood that this invention may be practiced otherwise than as specifically described. Thus, the present example embodiments, again, should be considered in all respects as illustrative and not restrictive.

What is claimed:
1. A reconfigurable chassis comprising:
   one or more first card slots capable of being populated with a first mechanical form factor card,
   one or more second card slots capable of being populated with the first mechanical form factor card or with a second mechanical form factor card, and
   a mechanical slot adaptor configured to occupy at least one second card slot, wherein the mechanical slot adaptor is configured to provide mechanical support for the second mechanical form factor card in the second card slot.

2. The chassis of claim 1, wherein each of the first and second card slots comprise card guides configured to position cards and the mechanical slot adaptors that are inserted into the first and second card slots.

3. The chassis of claim 2, wherein the mechanical slot adaptor comprises at least one of a top alignment runner and a bottom alignment runner configured to guide the mechanical slot adaptor into the card guides.

4. The chassis of claim 1, wherein at least one of the chassis and mechanical slot adaptor is configured to secure the mechanical slot adaptor to the chassis when the mechanical slot adaptor is inserted into the chassis.

5. The chassis of claim 1, wherein the mechanical slot adaptor comprise at least one mechanical tab with securement slots that allow mechanical screws to be used to secure the mechanical slot adaptor to threaded holes on the chassis.
6. The chassis of claim 5, wherein the mechanical tab comprises at least one alignment pin configured to align the mechanical slot adaptor to the chassis.

7. The chassis of claim 1, wherein the mechanical slot adaptor is configured to occupy one or more of the second card slots.

8. The chassis of claim 5, wherein the mechanical slot adaptor is configured to hold at least two of the second mechanical form factor cards for each of the second card slots it occupies.

9. The chassis of claim 1, wherein the one or more second card slots comprise a first set of second card slots and a second set of second card slots.

10. The chassis of claim 9, wherein no mechanical slot adaptor is placed in the first set of the second card slots and the second set of the second card slots.

11. The chassis of claim 9, wherein a mechanical slot adaptor is placed in at least one slot of the first set of the second card slots and the second set of the second card slots.

12. The chassis of claim 11, wherein switch cards are placed in at least one of the mechanical slot adaptors in at least one of the first set of the second card slots and the second set of the second card slots.

13. The chassis of claim 1, wherein the chassis comprises a backplane configured to receive at least one of the first and second mechanical form factor cards.

14. The chassis of claim 13, wherein the removable mechanical slot adaptor comprises a rear opening to allow connectors on the backplane to make electrical contact with corresponding electrical connectors on the received second mechanical form factor cards.

15. The chassis of claim 13, wherein the backplane comprises a first connector to connect to the first mechanical form factor card and a second connector to connect to the second mechanical form factor card.

16. The chassis of claim 15, wherein the second connector is off-set from the first connector to allow insertion of cards into the first connector and the second connector.

17. The chassis of claim 1, wherein the cards of the second mechanical form factor are narrower than the cards of the first mechanical form factor.

18. The chassis of claim 1, wherein the mechanical slot adaptor has both a top rigid support wall and a bottom rigid support wall, and both the top and bottom rigid support walls extend from a front of the mechanical slot adaptor to a rear of the mechanical slot adaptor.

19. The chassis of claim 18, wherein the mechanical slot adaptor is configured to receive a first of the second mechanical form factor cards placed directly above a second of the second mechanical form factor cards received by the mechanical slot adaptor.

20. The chassis of claim 19, wherein, within the mechanical slot adaptor, a rigid intermediate support wall is located between the first and second cards of the second mechanical form factor, and wherein the rigid intermediate support wall extends from the front of the mechanical slot adaptor to the rear of the mechanical slot adaptor.

21. The chassis of claim 20, wherein the rigid intermediate support wall comprises ventilation holes.

22. The chassis of claim 19, wherein the mechanical slot adaptor comprises card guides for both the first and second cards of the second mechanical form factor.

23. The chassis of claim 18, wherein at least one of the both the top and bottom rigid support walls comprises ventilation holes.

24. The chassis of claim 1, wherein the mechanical slot adaptor has both a left rigid support wall and a right rigid support wall, and wherein the left and right rigid support walls extend from a top of the slot adaptor to a bottom of the slot adaptor, and comprise cut-out sections.

25. The chassis of claim 1, wherein the mechanical slot adaptor contains at least one mechanical fastening mechanism for each card plugged in the adaptor.

26. The chassis of claim 25, wherein the mechanical fastening mechanism comprises a screw and threaded tab, wherein the screw is screwed into a threaded tab on the mechanical slot adaptor to secure each card.

27. The chassis of claim 1, wherein the chassis additionally contains a third plurality of card slots, the third plurality of card slots provide a means to house cards that are a fraction of the height of the cards of the first mechanical form factor, and no mechanical slot adaptor is used to house the cards of the third plurality of card slots.

28. The chassis of claim 27, wherein the cards of the second mechanical form factor are able to be placed in the third plurality of card slots.

29. The chassis of claim 1, wherein each card of the second mechanical form factor comprises a pull handle, used to remove the card from the chassis.