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Rack transporter

ABSTRACT

This disclosure describes a rack transporter for relocating data center racks. The rack transporter includes a power source and provides network connectivity to a rack in active use during relocation of the rack. The rack transporter is moved to a current location of the rack and the rack is mounted onto the rack transporter. Electrical and network connections are established between the rack transporter and the rack. Upon successful verification of the electrical and network connections to the rack transporter, the rack is decoupled from local power and network connections. The rack transporter and mounted rack are moved to the target location. The rack is physically moved into place and connected to local power and network connections at the target location. Upon verification of local power and network connections at the target location, the power and network connections from the rack transporter are decoupled and the rack is unmounted from the rack transporter.

KEYWORDS

- Rack transporter
- Server rack
- Data center
- Server move
- Auxiliary power
- Auxiliary network connection
- Rack relocation

BACKGROUND

Finding contiguous spaces in data centers for expansion and deployment of multirack systems such as clusters and accelerators can pose a challenge since deployed racks in active use in data centers can be difficult to move. During initial setup, racks in data centers are typically wheeled in in an un-commissioned state. Subsequent relocation of a rack involves draining all active loads from the rack, depopulation of the rack, and transportation to the new location, followed by spinning up (commissioning) the rack at the new location. Current techniques of relocation involve significant effort and server downtime.

DESCRIPTION

This disclosure describes a rack transporter that allows relocation of an active serving rack within a data center. The rack transporter is equipped with on-board power and networking capabilities.

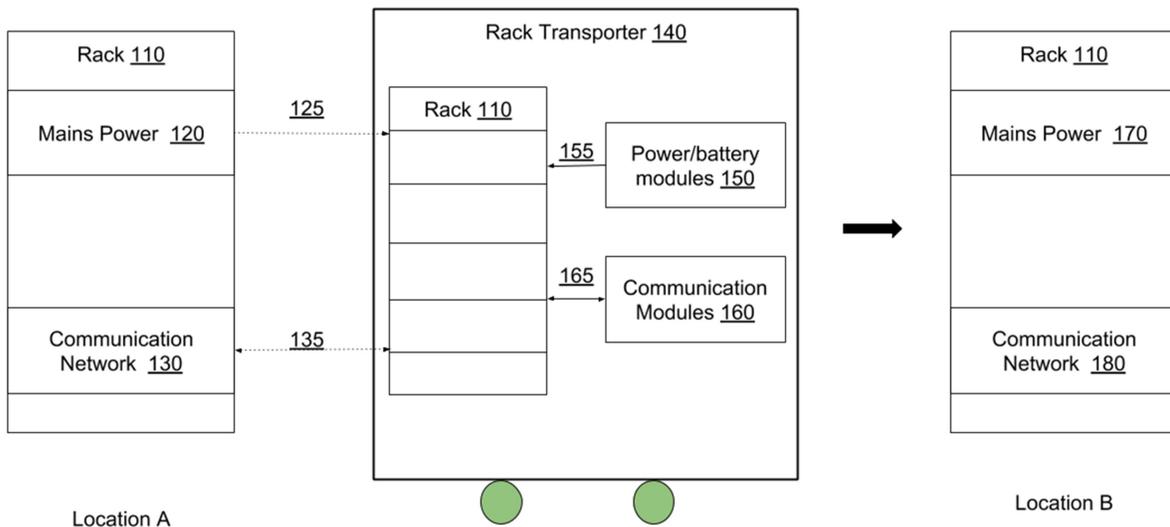


Fig. 1: A rack transporter provides utility connections during relocation

Fig. 1 illustrates operation of the rack transporter (140). In this illustrative example, a rack in active use (110) is to be relocated within a data center from Location A to Location B.

At Location A, a mains supply (120) provides power (125) to the rack. The rack is coupled (135) to a communications network (130).

The rack transporter includes power/ battery modules (150) that provide power (155) for rack transporter propulsion and also power the servers within the rack. The batteries are similar to batteries already in use in data centers. An integrated power source such as propane, fuel cell, or diesel/gasoline internal combustion engine (with flexible tubing to carry exhaust outside the data center) can also be utilized. The rack transporter includes communication modules (160) that provide network connections (165) to the rack.

Relocation of the rack is initiated by a move of the rack transporter proximal to the initial location of the rack (Location A, in this example). The rack transporter is mounted to the rack. An electrical connection is established between the rack transporter and the rack to provide power to the rack during relocation. Any interruption in mains power during relocation is bridged by the power source in the rack transporter.

A network connection is established between the rack (for example, using a top-of-rack switch or similar networking equipment) and a flexible optical cable assembly routed by the rack transporter. The flexible optical cable assembly carries network traffic to the rack during transit.

Electrical and network connections to the rack are verified and tested. Connection speed from the optical umbilical is tested by the transmission and/or reception of payloads of test data. Upon verification of adequate auxiliary power and network connectivity for the transit (including a buffer period), the relocation is authorized, and the rack is unplugged from the fixed local communications network (130) and mains power (120).

The rack transporter can be configured to be fully autonomous wherein blind-mating electrical and network connections are used to unplug the rack autonomously without human interaction. Alternately, human assistance may be obtained to perform and verify disconnection of local power and communication.

Upon disconnection of local power and network connections, the rack transporter (along with the mounted active rack) commences transit. The rack transporter utilizes speed(s) that enable transit within a sufficiently short period of time while mitigating any risk from damage to mechanically sensitive components on board the rack such as rotating media. In the event that moves is likely to prove too damaging to rotating media hard drives, all drives in the rack can be commanded to park their drive heads during the move and the cluster master is commanded to pause performing of writes to the rotating media contained in the rack being moved. After the rack is verified as reinstalled in the new location, the hard drive heads can be safely unparked. Hydraulic, pneumatic, or mechanical spring-based padding can be provided in the rack transporter for rack placement to dampen any induced vibration. The rack can be mechanically clamped to a rack frame provided in the rack transporter in multiple vertical spots to prevent tipping.

The rack transporter can be configured for autonomous locomotion or for human assisted locomotion, e.g., using a joystick or pull-assist.

Upon reaching a target location (Location B, in this illustrated example), the mounting process is reversed. The rack is physically moved into place and connected to local power (170) and network connection (180) at the destination location. The local power and network connection to the rack are verified. Upon verification, power and network connections from the

rack transporter are decoupled and the rack is unmounted from the rack transporter. The rack transporter is then relocated to a location of a new task or to a storage location.

In some configurations, the rack transporter does not include a power source on board and routes electrical power to the rack utilizing a flexible high amperage electrical cable. Power to the rack moving device (and payload) can be provided through floor rails mounted under-grade and accessible via rubber flap/slits running down a length of the data center floor. Ceiling rails or lateral telescoping arms to a wall of the datacenter can also be used. Electrical and fiber optic cables can also be integrated into a single cable routed to the rack.

In some configurations, the umbilical (power and/or network) cable(s) are configured to rest directly on the floor of the data center during transit of the rack transporter. A retraction mechanism capable of actuation allows the cable(s) to be retracted.

In some configurations, the rack transporter includes cable routing robots to keep the power and/or data cables aloft and properly routed for moving racks between buildings on a data center campus. The cable routing robots can be configured for varying relocation distances. For example, a cable routing robot for a large distance move (e.g., >100m cable length required) can include an optical umbilical assembly that uses long-distance fiber cabling and optics vs. traditional short-haul fibers. The cable routing robots can include active-powered optical bridges and/or optical amplifiers to enable the switch between light transport modes and/or frequencies to enable communications signals to reach required distances.

In some configurations, the rack transporter includes optical switches that can facilitate direct communication with a production network to enable control and interrogation of the rack transporter from a central monitoring location.

CONCLUSION

This disclosure describes a rack transporter for relocating data center racks. The rack transporter includes a power source and provides network connectivity to a rack in active use during relocation of the rack. The rack transporter is moved to a current location of the rack and the rack is mounted onto the rack transporter. Electrical and network connections are established between the rack transporter and the rack. Upon successful verification of the electrical and network connections to the rack transporter, the rack is decoupled from local power and network connections. The rack transporter and mounted rack are moved to the target location. The rack is physically moved into place and connected to local power and network connections at the target location. Upon verification of local power and network connections at the target location, the power and network connections from the rack transporter are decoupled and the rack is unmounted from the rack transporter.