

Claims:

- 1) A rack mount computer equipment configured for installation into a data center, the rack mount equipment comprising:
 - a) a nonplanar chassis comprising a plurality of sides;
 - b) a plurality of heat generating components, each of the heat generating components being installed within the chassis;
 - c) a plurality of heat transmitters, each being thermally connected to at least one of the plurality of heat generating components; and
 - d) a first rail thermal connector projecting from a first of the sides of the chassis,

a portion of each of the plurality of heat transmitters being contacted to the first rail thermal connector and arranged along the length of the first rail thermal connector in such a way that each portion of each of the plurality of heat transmitters is contacted to a different area of the rail thermal connector;

the first rail thermal connector being configured to be received by a counterpart channel in a rack enclosure when the rack mount computer equipment is installed in the rack enclosure, the counterpart channel comprising a first surface and a second surface opposite the first surface;

the rack mount computer system being configured such that when installed within the rack enclosure the first rail thermal connector can be urged against the first surface of the counterpart channel without engendering either a lateral movement in the rack mount computer equipment or requiring the first rail thermal connector to move in a direction normal to the first side of the chassis;

the rack mount computer equipment being configured for installation into a data center.
- 2) The rack mount computer equipment of claim 1, the rack mount computer equipment further comprising:
 - e) a second rail thermal connector projecting from a second of the sides of the chassis, the second side being opposite to the first side;

the rack enclosure comprising a second counterpart channel and the second rail thermal connector being configured to be received by the second counterpart channel when the rack mount computer equipment is installed in the rack enclosure;

the second counterpart channel comprising a third surface and a fourth surface, the fourth surface being opposite to the third surface;

the rack mount computer equipment being configured such that when installed within the rack enclosure, the first rail thermal connector can be urged against the first surface of the counterpart channel and the second rail thermal connector can be urged against the third surface of the second counterpart channel without engendering a lateral movement in the rack mount computer equipment and without requiring either the first rail thermal connector or the second rail thermal connector to move in a direction normal to the first side or second side of the chassis.

- 3) The rack mount computer equipment of claim 1, wherein the first rail thermal connector is a fixed body and is fixed with respect to the chassis.
- 4) The rack mount computer equipment of claim 2, wherein the first rail thermal connector and the second rail thermal connector are fixed bodies and wherein the first rail thermal connector and the second rail thermal connector are fixed with respect to the chassis.
- 5) The rack mount computer equipment of any of claims 3 or 4, wherein at least one of the plurality of heat transmitters is fixably mounted to the first rail thermal connector to provide a thermal path allowing heat to travel via the at least one of the plurality of heat transmitters from at least one of the heat generating components to the surface of the first rail thermal connector being urged against the first surface crossing only fixed thermal interfaces.
- 6) The rack mount computer equipment of any of claims 1 to 5, wherein the first rail thermal connector further comprises an urging means, the urging means being adapted to urge the first rail thermal connector against the first surface when the rack mount computer equipment is installed in the rack enclosure.
- 7) The rack mount computer equipment of claim 6, the urging means comprising a movable portion, the movable portion being adapted to urge the first rail thermal connector against the first surface when the rack mount equipment is installed in the rack enclosure.
- 8) The rack mount computer equipment of any one of claims 6 or 7, the urging means comprising a spring disposed between the first rail thermal connector and the second surface of the counterpart channel when the computer equipment is installed in the rack enclosure.
- 9) The rack mount computer equipment of any of claims 1 to 8, wherein the first rail thermal

connector can be urged against the first surface of the counterpart channel by urging the first rail thermal connector in a direction substantially normal to the first surface.

10) A rack mount computer equipment comprising:

- a) a rack mount chassis configured for installation into a cooling rack enclosure in a data center, the rack mount chassis comprising a plurality of sides;
- b) a heat generating component installed within the chassis;
- c) a heat transmitter, the heat transmitter being in thermal contact with the heat generating component;
- d) a rail thermal connector comprising:
 - i) a surface;
 - ii) two lengthwise ends;
 - iii) a thermally conductive surface on said surface, the thermally conductive surface being thermally connected to the heat generating component via the heat transmitter;

the rail thermal connector projecting from a side of the chassis along a length of a first of the sides of the chassis and the rail thermal connector being configured such that it is contacted by the heat transmitter from within the chassis, the rail thermal connector being adapted to be received by a channel in the cooling rack enclosure when the rack mount equipment is installed within the cooling rack enclosure;

the channel comprising a first surface being cooled and a second surface being opposite the first surface, the span of the channel lying between the first and the second surfaces;

the heat transmitter being contacted to and in thermal contact with the rail thermal connector at a location between the two lengthwise ends of the rail thermal connector, the location on the rail thermal connector being distinctly separate from either of the two lengthwise ends;

the rail thermal connector being adapted to bring the thermally conductive surface into thermal contact with the first surface of the channel when the rack mount equipment is installed within the cooling rack enclosure;

the rail thermal connector being adapted to allow urging the thermally conductive

surface against the cooled surface by applying an urging force to the rail thermal connector when the rack mount equipment is installed in the cooling rack enclosure;

the rail thermal connector being adapted to remain generally immobile relative to the chassis in the direction substantially normal to the side of the chassis that the rail thermal connector projects from when the urging force is applied.

- 11) The rack mount equipment of claim 10, wherein the rail thermal connector further comprises an urging means, the urging means being adapted to urge the rail thermal connector against the first surface when the computer system is installed in the cooling rack enclosure.
- 12) The rack mount computer equipment of claim 11, the urging means comprising a spring located between the rail thermal connector and the opposing surface of the channel when the computer system is installed in the cooling rack enclosure.
- 13) The rack mount computer system of any of claims 10 to 12, the rack mount equipment being configured in such a way that when installed in the cooled enclosure urging the thermally conductive surface against the first surface of the channel limits movement of the chassis or movement of the rail thermal connector to being in a direction substantially normal to the first surface.
- 14) A rack mount computer system configured for use in a data center, the rack mount computer system comprising:
 - a) a nonplanar rack mount chassis configured for installation into a cooling rack enclosure in a data center, the cooling rack enclosure comprising a generally u-shaped channel comprising a first surface, a second surface and an open side, the nonplanar rack mount chassis comprising a plurality of sides;
 - b) a first and second heat generating component installed within the chassis;
 - c) a first and second heat transmitter, the first heat transmitter being in thermal contact with the first heat generating component and the second heat transmitter being in thermal contact with the second heat generating component, and;
 - d) a rail thermal connector projecting from at least one of the plurality of sides of the chassis, the rail thermal connector comprising:
 - i) two lengthwise ends;

- ii) a first and a second area, at least the first area lying between the two lengthwise ends, the first and second areas being separate and arranged along the length of the rail thermal connector;

the first heat transmitter being contacted to and being in thermal contact with the first area and the second heat transmitter being contacted to and being in thermal contact with the second area;

the rail thermal connector being adapted to be received by the generally u-shaped channel when the computer system is installed in the cooling rack enclosure;

the second surface being opposite to the first surface, both the first surface and the second surface being adjacent to the open side of the channel with the span of the channel lying between them, the first surface being substantially perpendicular to the face of the cooling rack enclosure that the channel transverses;

the rail thermal connector being adapted to be urged against the first surface by applying an urging force to the rail thermal connector in a direction substantially normal to the first surface when the computer system is installed in the cooling rack enclosure.

- 15) The rack mount computer system of claim 14, the rack mount computer system being adapted to allow the rail thermal connector to be urged against the first surface without engendering movement in the rail thermal connector relative to the chassis in a direction normal to the side of the chassis when the computer system is installed in the cooling rack enclosure.
- 16) The rack mount computer system of claim 15, the rack mount computer system being adapted to allow the rail thermal connector to be urged against the first surface without requiring the chassis to move in a direction normal to the side of the chassis from which the rail thermal connector projects when the computer system is installed in the cooling rack enclosure.
- 17) The rack mount computer system of claim 14, the rack mount computer system being configured to allow the rail thermal connector to be urged against the first surface with the only movement of the chassis or rail thermal connector being in a direction normal to the first surface when the computer system is installed in the cooling rack enclosure.
- 18) The rack mount computer system of any of claims 14 to 17, wherein at least the first heat transmitter comprises a condenser portion and an evaporator portion.
- 19) The rack mount computer system of any of claims 14 to 18, wherein at least a portion of the

first heat transmitter is not in contact with the chassis.

- 20) The rack mount computer system of any of claims 14 to 19, the rail thermal connector comprising a continuous physical thermal path between the surface of the rail thermal connector that is brought into physical contact with the first surface of the channel and the first area of the rail thermal connector, the continuous physical thermal path crossing only fixed thermal interfaces.
- 21) The rack mount computer system of any of claims 14 to 20, the rail thermal connector being adapted to be a fixed body between the surface of the rail thermal connector being brought into physical contact with the first surface of the channel and the first area of the rail thermal connector.
- 22) The rack mount computer system of claim 21, the rail thermal connector being a solid article comprising of a thermally conductive material.
- 23) The rack mount computer system of any of claims 14 to 22, the rail thermal connector further comprising a movable portion, the movable portion being operable to urge the rail thermal connector against the first surface by being braced against the second surface when the rack mount equipment is installed in the rack enclosure.
- 24) The rack mount computer system of claim 23, the movable portion comprising a spring configured to brace the rail thermal connector against the second surface.
- 25) The rack mount computer system of any of claims 14 to 24, wherein the rail thermal connector is immovable relative to the chassis in a direction normal to the side of the chassis that the rail thermal connector protrudes from.
- 26) The rack mount computer system of any of claims 14 to 25, the rail thermal connector being fixed in relation to the chassis.
- 27) The rack mount computer system of any of claims 14 to 26, the rail thermal connector being continuous along its length.
- 28) The rack mount computer system of any of claims 14 to 27, the rail thermal connector being discontinuous along its length.
- 29) The rack mount computer system of any of claims 14 to 28, the rack mount computer system being configured as a computer server, a compute server, a storage server, a server blade,

compute blade, a storage blade, a network switch, a network router, a network appliance, a power supply, a power converter, a power management system, a power distribution unit or a power shelf.

30) The rack mount computer system of any of claims 14 to 29 being installed in a data center.

Claims

- 1) Rack mountable equipment of a type which can be cooled by installation into a cooling rack enclosure, the equipment comprising:
 - a) a heat generating component;
 - b) a heat transmitter;
 - c) a rail adapted to be received by a channel in an enclosure when the equipment is installed in the enclosure;
 - d) a thermally conductive surface located on the rail, the thermally conductive surface thermally connected via the heat transmitter to the heat generating component; and
 - e) a mean for urging a portion of the thermally conductive surface against a coolable surface of the channel, the thermally conductive surface being sufficient for the purpose of cooling the rack mountable equipment.
- 2) The rack mountable equipment of claim 1, wherein the channel is U-shaped.
- 3) The rack mountable equipment of claim 1 or 2, wherein the mean for urging a portion of the thermally conductive surface against the coolable surface of the channel is a mechanical mean.
- 4) The rack mountable equipment of claim 3, wherein the mechanical mean is a handle or a lever adapted to push the thermally conductive surface against the coolable surface of the channel.
- 5) The rack mountable equipment of claim 3, wherein the mechanical mean is a spring insert inserted between the rail and an opposing surface of the channel.
- 6) The rack mountable equipment of claim 1, wherein the mean for urging a portion of the thermally conductive surface against the coolable surface of the channel comprises

magnetic fasteners, wherein the thermally conductive surface is located on the rail or on a side wall of the enclosure.

- 7) The rack mountable equipment of claim 1, wherein gravity acts as the mean for urging a portion of the thermally conductive surface against the coolable surface of the channel.
- 8) The rack mountable equipment of any one of claims 1 to 7, wherein the rail projects from a side of the enclosure.
- 9) The rack mountable equipment of any one of claims 1 to 8, further comprising a second rail adapted to be received by a second channel in the enclosure when the equipment is installed, the second rail being located on an opposite side of the equipment that the first rail is located on.
- 10) The rack mountable equipment of claim 9, wherein a second thermally conductive surface is located on the second rail.
- 11) The rack mountable equipment of any one of claims 1 to 10, wherein the coolable surface is cooled by flowing a coolant liquid within the cooling rack enclosure.
- 12) A cooling rack enclosure into which rack mounted equipment can be installed, the rack mounted equipment being of a type which can be cooled by installation into a cooling rack enclosure and which comprises a rail comprising a thermally conductive surface, the rack enclosure comprising:
 - a) a channel adapted to receive the rail of the rack mounted equipment when the equipment is installed into the enclosure; and
 - b) a coolable surface disposed on a surface of the channel in such a way that the coolable surface is adjacently located to the thermally conductive surface when the equipment is installed into the enclosure,

the channel being adapted to receive an urging mean for urging a portion of the thermally conductive surface against the coolable surface of the channel, the thermally conductive surface being sufficient for the purpose of cooling the equipment.

- 13) The rack enclosure of claim 12, wherein the channel is U-shaped.
- 14) The rack enclosure of claim 12 or 13, wherein the mean for urging a portion of the thermally conductive surface against the coolable surface of the channel is a mechanical mean.
- 15) The rack enclosure of claim 14, wherein the mechanical mean is a handle or a lever that pushes the thermally conductive surface against the coolable surface of the channel.
- 16) The rack enclosure of claim 14, wherein the mechanical mean is a spring insert inserted between the rail and an opposing surface of the channel.
- 17) The rack enclosure of claim 12, wherein the mean for urging a portion of the thermally conductive surface against the coolable surface of the channel is magnetic fasteners, and wherein the thermally conductive surface is located on the rail or on a side wall of the enclosure.
- 18) The rack enclosure of any one of claims 12 to 17, wherein the coolable surface is disposed such that when the rack mounted equipment is installed gravity urges a portion of the thermally conductive surface sufficient for the purpose of cooling the equipment against the coolable surface.
- 19) The rack enclosure of any one of claims 12 to 18, wherein the coolable surface can be cooled by engendering a flow of a liquid coolant within the rack enclosure.

- 20) The rack enclosure of any one of claims 12 to 19, wherein installed equipment is sufficiently supported by the rail interacting with the channel.
- 21) A method of cooling rack mounted equipment, the method comprising:
- a) enabling the transmission of heat from a heat-generating component of the rack mounted equipment to a thermally conductive surface; and
 - b) configuring the thermally conductive surface such that it can be urged against a cooled surface of a cooling apparatus by using an urging mean.
- 22) The method of claim 21, wherein the method further comprises the step of inserting the rack mounted equipment inside the cooling apparatus.
- 23) The method of claim 21, wherein the urging mean is a handle or a lever adapted to push the thermally conductive surface against the cooled surface of the cooling apparatus, the method further comprising activating the handle or lever for urging the thermally conductive surface against the cooled surface after the step of inserting the rack mounted equipment inside the cooling apparatus.
- 24) The method of claim 21, wherein the urging mean is a spring insert adapted to push the thermally conductive surface against the cooled surface of the cooling apparatus, the method further comprising inserting the spring insert for urging the thermally conductive surface against the cooled surface after the step of inserting the rack mounted equipment inside the cooling apparatus.
- 25) The method of claim 21, wherein the mean is magnetic fasteners adapted to urge the thermally conductive surface against the cooled surface of the cooling apparatus, the method further comprising fastening the thermally conductive surface to the cooled surface using the magnetic fasteners after inserting the rack mounted equipment inside the cooling apparatus, and wherein the thermally conductive surface is located on the rail or on a side wall of the enclosure.