

WHAT IS CLAIMED IS:

1. A computing module, comprising:

a chassis configured to be installed on a shelf in a rack;

one or more circuit board assemblies in a primarily vertical orientation coupled to the chassis; and

one or more hard disk drives in a primarily vertical orientation coupled to the chassis,

wherein at least one of the hard disk drives in a primarily vertical orientation is coupled such that the hard disk drive can be removed from the computing module without removing any other components from the computing module.

2. The computing module of claim 1, wherein the chassis comprises one or more guides for at least one of the hard disk drives, wherein the at least one hard disk drive is configured to slide on at least one of the guides to remove the hard disk drive from the chassis.

3. The computing module of claim 1, wherein the one or more circuit board assemblies comprise a left circuit board assembly coupled to the chassis and a right circuit board assembly coupled to the chassis; and

wherein the chassis comprises a left chassis member and a right chassis member coupled to one another, wherein the left circuit board assembly is coupled to the left chassis member and the right circuit board assembly is coupled to the right chassis member.

4. The computing module of claim 3, further comprising:

a first set of one or more hard disk drives coupled to the left chassis member and operably coupled to the left circuit board assembly; and

a second set of one or more hard disk drives coupled to the right chassis member and operably coupled to the right circuit board assembly.

5. The computing module of claim 3, further comprising a power supply unit coupled to the chassis, wherein the power supply unit is configured to supply electrical power to the left circuit board assembly and the right circuit board assembly.

6. The computing module of claim 1, wherein the computing module comprises a left computing unit configured to perform computing operations and a right computing unit configured to perform computing operations independent of the left computing unit.

5 7. The computing module of claim 1, further comprising two or more rows of two or more hard disk drives and an air passage between at least two adjacent rows.

8. The computing module of claim 1, further comprising one or more hard disk drives coupled to the chassis in a primarily horizontal orientation.

10 9. The computing module of claim 8, wherein the chassis is configured to allow at least one of the horizontally oriented hard disk drives to slide in and out the side of the chassis.

15 10. The computing module of claim 8, further comprising an air passage commonly adjoining at least one of the vertically oriented hard disk drives and at least one of the horizontally oriented hard disk drives, wherein the air passage is configured to allow air to flow from the front of the air passage to the rear of the air passage such that the air removes heat from the at least one vertically oriented hard disk drive and at least one horizontally oriented hard disk drives.

20 11. The computing module of claim 1, wherein the hard disk drives are located rearward in the chassis from the one or more circuit board assemblies.

25 12. The computing module of claim 1, further comprising a faceplate, wherein the chassis comprises one or more chassis members configured to carry at least one of the circuit board assemblies, wherein at least one of the chassis members comprises at least one handle configured to extend through the faceplate.

30 13. A method of providing computing capacity, comprising:
providing a shelf module comprising and shelf and two or more computing modules coupled to the shelf, each of at least one of computing modules comprising one or more circuit board assemblies in a primarily vertical orientation and one or more hard disk drives in a primarily vertical orientation; and
performing computing operations with at least one of the computing modules.

14. The method of claim 13, further comprising removing and replacing at least one primarily vertically oriented hard disk drive from one of the computing modules by sliding the hard disk drive out through the top of the computing module and sliding another hard disk drive in through the top of the computing module.

5

15. The method of claim 13, further comprising removing and replacing at least one primarily horizontally oriented hard disk drive from one of the computing modules by sliding the hard disk drive out through a side of the computing module and sliding another hard disk drive in through the side of the computing module.

10

AMENDED CLAIMS

received by the International Bureau on 13 September 2012 (13.09.12)

WHAT IS CLAIMED IS:

1. A computing module, comprising:

a chassis configured to be installed in an opening in a shelf in a rack;
one or more circuit board assemblies in a primarily vertical orientation coupled to the chassis, wherein the installed height of each of the one or more circuit board assemblies in the primarily vertical orientation is greater than its width as measured across the opening in the shelf, and

one or more hard disk drives in a primarily vertical orientation coupled to the chassis, wherein the installed height of each of the one or more hard disk drives in the primarily vertical orientation is greater than its width as measured across the opening in the shelf,

wherein at least one of the hard disk drives in a primarily vertical orientation is coupled such that the hard disk drive can be removed from the computing module without removing any other components from the computing module.

2. The computing module of claim 1, wherein the chassis comprises one or more guides for at least one of the hard disk drives, wherein the at least one hard disk drive is configured to slide on at least one of the guides to remove the hard disk drive from the chassis.

3. The computing module of claim 1, wherein the one or more circuit board assemblies comprise a left circuit board assembly coupled to the chassis and a right circuit board assembly coupled to the chassis; and

wherein the chassis comprises a left chassis member and a right chassis member coupled to one another, wherein the left circuit board assembly is coupled to the left chassis member and the right circuit board assembly is coupled to the right chassis member.

4. The computing module of claim 3, further comprising:

a first set of one or more hard disk drives coupled to the left chassis member and operably coupled to the left circuit board assembly; and

a second set of one or more hard disk drives coupled to the right chassis member and operably coupled to the right circuit board assembly.

5. The computing module of claim 3, further comprising a power supply unit coupled to the chassis, wherein the power supply unit is configured to supply electrical power to the left circuit board assembly and the right circuit board assembly.
6. The computing module of claim 1, wherein the computing module comprises a left computing unit configured to perform computing operations and a right computing unit configured to perform computing operations independent of the left computing unit.
7. The computing module of claim 1, further comprising two or more rows of two or more hard disk drives and an air passage between at least two adjacent rows.
8. The computing module of claim 1, further comprising one or more hard disk drives coupled to the chassis in a primarily horizontal orientation.
9. The computing module of claim 8, wherein the chassis is configured to allow at least one of the horizontally oriented hard disk drives to slide in and out the side of the chassis.
10. The computing module of claim 8, further comprising an air passage commonly adjoining at least one of the vertically oriented hard disk drives and at least one of the horizontally oriented hard disk drives, wherein the air passage is configured to allow air to flow from the front of the air passage to the rear of the air passage such that the air removes heat from the at least one vertically oriented hard disk drive and at least one horizontally oriented hard disk drives.
11. The computing module of claim 1, wherein the hard disk drives are located rearward in the chassis from the one or more circuit board assemblies.
12. The computing module of claim 1, further comprising a faceplate, wherein the chassis comprises one or more chassis members configured to carry at least one of the circuit board assemblies, wherein at least one of the chassis members comprises at least one handle configured to extend through the faceplate.
13. A method of providing computing capacity, comprising:
providing a shelf module comprising a shelf and two or more computing modules installed in an opening in the shelf, each of at least one of the computing modules comprising one or more circuit board

assemblies in a primarily vertical orientation and one or more hard disk drives in a primarily vertical orientation, wherein the installed height of each of the one or more circuit board assemblies in the primarily vertical orientation is greater than its width as measured across the opening in the shelf, and wherein the installed height of each of the one or more hard disk drives in the primarily vertical orientation is greater than its width as measured across the opening in the shelf; and

performing computing operations with at least one of the computing modules.

14. The method of claim 13, further comprising removing and replacing at least one primarily vertically oriented hard disk drive from one of the computing modules by sliding the hard disk drive out through the top of the computing module and sliding another hard disk drive in through the top of the computing module.

15. The method of claim 13, further comprising removing and replacing at least one primarily horizontally oriented hard disk drive from one of the computing modules by sliding the hard disk drive out through a side of the computing module and sliding another hard disk drive in through the side of the computing module.

WHAT IS CLAIMED IS:

1. A computing module, comprising:
 - a chassis configured to be installed in an opening in a shelf in a rack;
 - one or more circuit board assemblies in a primarily vertical orientation coupled to the chassis, wherein the installed height of each of the one or more circuit board assemblies in the primarily vertical orientation is greater than its width as measured across the opening in the shelf,
 - one or more hard disk drives in a primarily vertical orientation coupled to the chassis, wherein the installed height of each of the one or more hard disk drives in the primarily vertical orientation is greater than its width as measured across the opening in the shelf, and
 - one or more hard disk drives coupled to the chassis in a primarily horizontal orientation,
 - wherein at least one of the hard disk drives in a primarily vertical orientation is coupled such that the hard disk drive can be removed from the computing module without removing any other components from the computing module.
2. The computing module of claim 1, wherein the chassis comprises one or more guides for at least one of the hard disk drives, wherein the at least one hard disk drive is configured to slide on at least one of the guides to remove the hard disk drive from the chassis.
3. The computing module of claim 1, wherein the one or more circuit board assemblies comprise a left circuit board assembly coupled to the chassis and a right circuit board assembly coupled to the chassis; and
 - wherein the chassis comprises a left chassis member and a right chassis member coupled to one another, wherein the left circuit board assembly is coupled to the left chassis member and the right circuit board assembly is coupled to the right chassis member.
4. The computing module of claim 3, further comprising:
 - a first set of one or more hard disk drives coupled to the left chassis member and operably coupled to the left circuit board assembly; and

a second set of one or more hard disk drives coupled to the right chassis member and operably coupled to the right circuit board assembly.

5. The computing module of claim 3, further comprising a power supply unit coupled to the chassis, wherein the power supply unit is configured to supply electrical power to the left circuit board assembly and the right circuit board assembly.

6. The computing module of claim 1, wherein the computing module comprises a left computing unit configured to perform computing operations and a right computing unit configured to perform computing operations independent of the left computing unit.

7. The computing module of claim 1, further comprising two or more rows of two or more hard disk drives and an air passage between at least two adjacent rows.

8. The computing module of claim 1, wherein the chassis is configured to allow at least one of the horizontally oriented hard disk drives to slide in and out the side of the chassis.

9. The computing module of claim 1, further comprising an air passage commonly adjoining at least one of the vertically oriented hard disk drives and at least one of the horizontally oriented hard disk drives, wherein the air passage is configured to allow air to flow from the front of the air passage to the rear of the air passage such that the air removes heat from the at least one vertically oriented hard disk drive and at least one horizontally oriented hard disk drives.

10. The computing module of claim 1, wherein the hard disk drives are located rearward in the chassis from the one or more circuit board assemblies.

11. The computing module of claim 1, further comprising a faceplate, wherein the chassis comprises one or more chassis members configured to carry at least one of the circuit board assemblies, wherein at least one of the chassis members comprises at least one handle configured to extend through the faceplate.

12. A method of providing computing capacity, comprising:

providing a shelf module comprising a shelf and two or more computing modules installed in an opening in the shelf, each of at least one of the computing modules comprising one or more circuit board assemblies in a primarily vertical orientation and one or more hard disk drives in a primarily vertical orientation and one or more hard disk drives in a primarily horizontal orientation, wherein the installed height of each of the one or more circuit board assemblies in the primarily vertical orientation is greater than its width as measured across the opening in the shelf, and wherein the installed height of each of the one or more hard disk drives in the primarily vertical orientation is greater than its width as measured across the opening in the shelf; and

performing computing operations with at least one of the computing modules.

13. The method of claim 12, further comprising removing and replacing at least one primarily vertically oriented hard disk drive from one of the computing modules by sliding the hard disk drive out through the top of the computing module and sliding another hard disk drive in through the top of the computing module.

14. The method of claim 12, further comprising removing and replacing at least one primarily horizontally oriented hard disk drive from one of the computing modules by sliding the hard disk drive out through a side of the computing module and sliding another hard disk drive in through the side of the computing module.