

SYSTEM AND METHOD FOR MODULAR DATA CENTER

CROSS-REFERENCE TO RELATED APPLICATIONS

5 **[0001]** This application claims priority to U.S. Utility Application No. 14/504,081, filed on October 1, 2014 and also claims the benefit of U.S. Provisional Application No. 61/886,402, filed on October 3, 2013. The entire disclosures of the above applications are incorporated herein by reference.

10 FIELD

[0002] The present disclosure relates to data center systems and methods for constructing data centers, and more particularly to a modular, pre-fabricated data center structure that is able to be configured in a highly space efficient manner for shipping purposes and then easily deployed at a destination site to form a data center, and further which is readily modularly expandable to meet changing data center needs at the destination site.

BACKGROUND

[0003] The statements in this section merely provide background
20 information related to the present disclosure and may not constitute prior art.

[0004] As data center needs increase world-wide, there has been increasing interest in finding more cost effective ways to set up and construct data centers. Additional concerns are consistent quality of the data center components and the time required to construct the data center. These concerns are especially relevant when constructing data centers in countries other than the United States. Traditionally data centers have been constructed in “stick building” fashion completely at the selected data center site. This involves bringing all the raw materials out to the data center site, using large numbers of construction workers such as electrical contractors, welders, building construction workers and other skilled tradesmen to construct the data center structure from the raw materials shipped to the site. As will be appreciated, this construction approach can be quite costly. Maintaining quality of the finished

data center structure can sometimes be challenging, typically requiring numerous inspections by various individuals as the construction process is on-going. Construction delays may be encountered when specific subcomponents or raw materials being used to construct the data center are not received at the building site according to the planned construction timetable. The need to separately ship independent building components (steel, cable trays, wall panels, etc.) to the site can also contribute significantly to the overall high cost of constructing a data center. Seasonal weather changes and delays brought on by inclement weather can also result in a lengthy and costly construction timeline for a data center structure.

[0005] Additional concerns with data centers are the ability to easily and cost-effectively expand the data center as needs grow. With conventional data center structures that have been constructed using the "stick build" approach, expansion can sometimes be expensive and particularly time consuming.

[0006] Accordingly, there is strong interest in reducing the cost of a data center structure as well as the time needed for its construction. Significantly reducing the overall construction cost of a data center structure and the time required to get a new data center up and running may make it feasible to set up data centers in various parts of the world where the cost of constructing a data center with the conventional "stick build" approach would make the endeavor cost prohibitive.

SUMMARY

[0007] In one aspect the present disclosure relates to a modular data center. The modular data center may comprise a plurality of unit structures arranged generally parallel to one another. A plurality of supports may be used for supporting the unit structures elevationally above a floor, and wherein adjacent ones of the unit structures form hot aisles therebetween through which hot air generated from data center components may be channeled. Each unit structure may form an elongated structure having a frame structure, a roof panel supported by the frame structure, and a ceiling panel. The ceiling panel may be

spaced apart from the roof panel to define a volume through which the hot air from one of the hot aisles may be received and channeled. The roof panel helps to form a cold aisle between adjacent rows of data center components disposed below the unit structure. The cold aisle may be configured for channeling cold air between the data center components.

5 [0008] In another aspect the present disclosure relates to a method for forming a modular data center. The method may include providing a plurality of unit structures each having a frame, with each unit structure operating to help form a cold aisle through which cold air may be circulated, as well as a hot aisle through which hot air may be circulated. The unit structures may be supported above a floor to allow data center components to be positioned under each of the unit structures in two rows facing each other to help form the cold aisle. One row of each of the two rows of data center components from adjacent ones of the unit structures may be used to help form the hot aisle therebetween. The method may further include configuring each of the unit structures to form a volume, defined at least in part by a ceiling panel and at least in part by a roof panel, through which the hot air from one of the hot aisles may be received and channeled. The method may further include using the roof panel to help form the cold aisle between adjacent rows of data center components disposed below the unit structure, with the cold aisle being configured for channeling cold air between the data center components.

15 [0009] In still another aspect the present disclosure relates to a modular unit structure configured to help form a modular data center. The modular unit structure may include a frame forming an elongated structure, at least one roof panel supported by the frame, a plurality of supports for supporting the frame above a floor, and at least one ceiling panel supported by the frame in spaced apart relation to the roof panel to form a volume between the ceiling panel and the roof panel. The volume may operate as a channel for channeling hot air originating from data center components positioned below the unit structure, where the data center components are positioned in two rows facing one another. The unit structure may further operate to help form a cold aisle between the two rows of data center components, through which cold air is

circulated; and wherein additional ones of the unit structures may be disposed adjacent one another in a plurality of rows to form a modularly expandable data center.

5 BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The drawings described herein are for illustration purposes only and are not intended to limit the scope of the present disclosure in any way. In the drawings:

10 **[0011]** Figure 1 is a perspective illustration of a plurality of modular, collapsible data center unit structures disposed adjacent one another to help form a data center, in accordance with one embodiment of the present disclosure;

15 **[0012]** Figure 2 is an enlarged perspective view of a portion of one of the data center unit structures of the present disclosure even more fully illustrating a plurality of foldable cable tray supports, along with one cable tray, that each unit structure incorporates;

[0013] Figure 2a is a perspective view of a portion of one form of pivoting mechanism that may be used to support the hangers, which involves the use of an elongated tubular support member which is able to rotate;

20 **[0014]** Figure 2b is an enlarged perspective view of the saddle-like strap shown in Figure 2a which may be used to help enable rotational movement of the elongated tubular support member shown in Figure 2a;

25 **[0015]** Figure 3 is a perspective view of one of the data center unit structures shown in Figure 1 but with the unit structure in its collapsed configuration for shipping;

[0016] Figure 4 is a perspective view of two data center unit structures in their collapsed configurations and positioned back-to-back, which forms a highly compact package suitable for placement in a standard shipping container;

30 **[0017]** Figure 5 is a high level side view of a portion of a data center in which two of the data center unit structures are shown forming an elongated row, and further illustrating a modular penthouse exhaust structure that resides above the data center unit structures to facilitate the exhaust of hot air from hot air isles

formed between rows of equipment racks positioned underneath the unit structures;

[0018] Figure 6 is an enlarged view of just circled portion 6 in Figure 5;

5 **[0019]** Figure 6a is a perspective view of a portion of one end of the data center illustrating how hot air from a hot air isle may be exhausted through the modular penthouse exhaust structure;

[0020] Figure 7 is a perspective view of modular cooling unit that may be used with the data center unit structures to help form a modular data center;

10 **[0021]** Figure 8 shows a perspective view of one of the modular cooling units arranged adjacent the ends of a plurality of the data center unit structures;

[0022] Figure 9 is a high level top view illustrating the components of the modular cooling unit shown in Figure 7;

15 **[0023]** Figure 10 is a high level front view of the modular cooling unit of Figure 9;

[0024] Figure 11 is a high level side view of the cooling unit of Figure 9 in accordance with arrow 11 in Figure 10;

[0025] Figure 12 is a high level perspective view of just a filter unit of the modular cooling unit;

20 **[0026]** Figure 13 is a high level perspective view of just a fan unit of the modular cooling unit;

[0027] Figure 14 is a high level perspective view of just a cooling module media unit of the modular cooling unit;

25 **[0028]** Figure 15 is another high level perspective view of the modular cooling unit but with its outer wall structure removed, and further with the wall structure surrounding one of the fan units removed;

[0029] Figure 16 further illustrates components that may be included within each of the modular cooling units;

30 **[0030]** Figure 17 is a perspective view of one modular cooling unit located adjacent to a plurality of the data center unit structures illustrating how hot exhaust (i.e., return) air from one of the hot isles may be returned to the modular cooling unit;

[0031] Figure 18 is a high level overhead view of a portion of a data center illustrating a plurality of modular sections that together form a “power hall” for a data center, and which are located adjacent to a plurality of the data center unit structures;

5 **[0032]** Figure 19 illustrates a modular power supply unit for constructing the power hall shown in Figure 18;

[0033] Figure 20 illustrates a modular power cabinet unit for use in constructing the power hall shown in Figure 18;

10 **[0034]** Figure 21 shows a modular UPS unit for use in constructing the power hall shown in Figure 18;

[0035] Figure 22 shows a modular PDU unit for use in constructing the power hall shown in Figure 18;

15 **[0036]** Figure 23 is an overhead view of one exemplary layout for a data center that makes use of two halls separated by a modular office/storage area and a modular water treatment unit;

[0037] Figure 24 is a perspective view of another embodiment of the unit structure; and

[0038] Figure 25 is a perspective view of a portion of the unit structure of Figure 24 illustrating a centrally located cable tray.

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DETAILED DESCRIPTION

[0039] The following description is merely exemplary in nature and is not intended to limit the present disclosure, application, or uses. It should be understood that throughout the drawings, corresponding reference numerals indicate like or corresponding parts and features.

25 **[0040]** Referring to Figure 1 there is shown a portion of a modular data center facility 10 incorporating a plurality of modular, collapsible data center unit structures 12 (hereinafter simply “unit structures 12”) for forming a rapidly deployable data center. Each of the unit structures 12 forms an elongated structure which may be used to channel both cold air from one or more air conditioning systems through a cold aisle 15 which separates parallel rows of equipment racks 14, as well to help channel hot air from a hot aisle. Each unit

structure 12 is adapted to be supported by structural support columns 16 at a predetermined height above a floor 18 of the data center facility 10. Figure 1 illustrates a plurality of the unit structures 12 positioned in side-by-side fashion. Adjacent ones of the unit structures 12 are further spaced apart a predetermined distance. This spacing forms hot aisles 17 between adjacent ones of the unit structures 12.

[0041] With further reference to Figure 1, the modular data center facility 10 may also include one or more modular penthouse exhaust structures 20 for receiving hot air from the hot aisles 17 and exhausting the hot air from the modular data center facility 10. The modular penthouse exhaust structures 20 receive the hot air flow from the hot aisles 17 through openings 24 in ceiling panels 26 of the unit structures 12. This feature will be explained in greater detail in the following paragraphs. A plurality of bridging ceiling panels 26a are also used to bridge the spacing between adjacent ones of the unit structures 12, and thus ensure that hot air being drawn out from the hot aisles 17 is exhausted through the openings 24.

[0042] Referring to Figure 2, one of the unit structures 12 is shown in greater detail. In addition to the ceiling panel 26, each unit structure 12 has a frame structure 28 that supports a plurality of the ceiling panels 26 to form a roof-like structure. A perimeter frame structure 30 may be coupled to the structural support columns 16. The perimeter frame structure 30 may be used to support collapsible (i.e., foldable) panels 32 to help maintain cold air from air conditioning systems within the cold aisles 15 between adjacent rows of equipment racks 14. The perimeter frame structure 30 also may include a plurality of pivotally secured hangers 34 and 36 that are supported from the frame structure 30. Hangers 34 in this example are supported from separate cross members 33 and are able to pivot into the orientation shown in Figure 2 for use. Hangers 34 may have a plurality of cable trays 38 secured thereto and hangers 36 may likewise have a plurality of cable trays 40 secured thereto. Cable trays 38 and 40 may be used to support a variety of different types of cables such as network cables, power cables, etc., that need to be routed through the data center facility 10 to equipment components mounted in the rows of equipment racks 14. A roof

panel 42 may also be secured to the perimeter frame structure 30. Roof panel 42 forms a partition which further helps to channel cold air from one or more air conditioning systems through the cold aisle 15 formed between adjacent rows of equipment racks 14.

5 **[0043]** With brief reference to Figure 2a, a portion of one of the hangers 36 is shown. The hanger 36 may be representative of, or identical, to the construction used for the hangers 34. The ability of the hanger 36 to pivot is achieved, in one example, by using a round, rigid, tubular, elongated support member 36a, which may be supported for rotational movement at its opposing
10 ends by a saddle-like bracket 36b, where the saddle-like bracket 36b is fixedly secured to a portion of the perimeter frame structure 30 by suitable fasteners (not shown). The saddle like bracket 36b is also shown in Figure 2b. Of course any other suitable hinge or hinge-like structures could be implemented to enable pivoting motion of the hanger 36.

15 **[0044]** Figure 2a also shows that the hanger 36 may include a plurality of depending structural members 36c which may support the cable trays 40. The depending structural members 36c may be fixedly secured to the elongated support member 36a so as to be able to rotate with the elongated support member 36a, and thus be able to present the trays 40 in an operative position
20 below the perimeter frame structure 30 or in a stowed orientation. One or more braces 36d may be used to brace the hanger 36 in its operative position. The braces 36d may each be secured at one end to the perimeter frame structure 30 by suitable brackets 36e that enable pivoting motion thereof, and at their opposite ends to the depending structural members 36c. This enables the
25 braces 36d to be pivoted upwardly into stowed configurations once detached from the structural members 36c. Still, the braces 36d are able to be quickly and easily secured to the structural members 36c of the hanger 36, to brace the hanger 36 once the hanger 36 is lowered into its operative position. It will also be appreciated that the hangers 36, as well as the hangers 34, may be
30 constructed from suitable structural supports and brackets to permit their easy removal from the perimeter frame structure 30, instead of a folding motion. Depending on how many cable trays 38 and 40 are employed, and the overall

dimensions of the unit structure 12, it may be helpful or necessary to have the hangers 34 and or 36 supported by structure that is removable completely from the perimeter frame structure 30 when the unit structure is prepared for shipping.

[0045] With reference to Figures 5, 6 and 6a, one of the modular penthouse exhaust structures 20 is shown from one end thereof. It will be appreciated that, in practice, a plurality of the modular penthouse exhaust structures 20 will be used to form an elongated channel 46 into which hot air 17a from the hot aisles 17 may be drawn into with the assistance of a plurality of opposing exhaust fans 44. In one embodiment each modular penthouse exhaust structure 20 may include a total of six exhaust fans 44 arranged as two opposing rows of three fans. With further reference to Figure 1, the openings 24 in the ceiling panels 26 may also have positioned therein modulated louver assemblies 48 that may be electronically modulated to tailor the flow of hot air from the hot aisles 17 that may be drawn into the penthouse exhaust structures 20. Suitable air flow and/or temperature control monitoring systems (not shown) may be provided for this purpose.

[0046] Referring to Figure 3, one of the unit structures 12 is shown in its collapsed configuration. The unit structure 12 has the hangers 34 and 36 pivoted into a stowed position where they are held such that they do not protrude below panel portions 32a of panels 32. Panels 32 are also pivoted such that they extend parallel to the ceiling panels 26. In the collapsed configuration the unit structure 12 forms an elongated, relatively narrow configuration with the hangers 34 and 36, as well as the cable trays 38 and 40, tucked up between the panel portions 32a. This configuration also forms a highly space efficient configuration from a shipping and packaging standpoint. Any suitable locking structure may be used in connection with the panels 32 to hold the panels 32 in their collapsed configuration, such as elongated structural beams (not shown) that may be physically connected to select portions of the panels 32 and the perimeter frame structure 30. Figure 4 illustrates a pair of the unit structures 12 in their collapsed configurations positioned back-to-back. Each of the unit structures 12, when in its collapsed configuration, may have dimensions of approximately 12192mm (40.0 feet) in overall length by 3658mm (12.0 feet) in

width and 2848mm (5 feet and 5.22 inches) in height. The back-to-back positioned pair of unit structures 12 in Figure 4 may have overall dimensions of about 12192mm (40 feet) in length, 3658mm (12 feet) in width and 2848mm (9 feet and 4.13 inches) in overall height. The collapsed configuration enables a pair of the unit structures 12 to be efficiently packaged for shipping.

[0047] Figure 7 illustrates a modular cooling unit 50 that may be used to help form the modular data center facility 10 of Figure 1. It will be noted that the modular cooling 50 may have dimensions of about 13761mm (45 feet) in length, about 7315mm (24 feet) in width and about 3500mm (11 feet and 5.8 inches) in overall height. As such, the cooling module unit 50 is very similar in overall dimensions to the back-to-back pair of unit structures 12 shown in Figure 4, which again facilitates shipping in a standardized shipping container.

[0048] In Figure 8 one modular cooling unit 50 can be seen arranged so that its major length extends perpendicular to the major length of the unit structures 12, and such that it is positioned adjacent one of the ends of the unit structures 12. This enables the modular cooling unit 50 to supply cold air to the cold aisles 15 formed by a plurality of the unit structures 12.

[0049] With reference to Figures 9-11, each modular cooling unit 50, in one embodiment, may form an evaporative (i.e., adiabatic) cooling unit that includes a filter unit 52, a media unit 54, a fan unit 56, and may draw on the order of 900kW. Figures 12-14 further illustrate these components. Each fan unit 56 may include a plurality of fans 56a, and in one embodiment a total of twelve such fans 56a configured in three separate cabinets 56b as shown in Figure 15. Figure 15 further illustrates that the cabinets 56b each may have an isolated access through a door 56c.

[0050] Figure 16 illustrates that the media unit 54 may include three independent evaporative cooling modules 54a-54c having four cooling stages each. A DX coil and dampers 60 may optionally be included. The filter unit 52 may include a plurality of filters 52a, an electronically actuated return air damper 52b for controlling a return air flow into the modular cooling unit 50, and an electronically actuated outside air louver and damper 52c for controlling the flow of outside (ambient air) drawn into the cooling unit 50. Figure 17 illustrates how

hot air 17a in the hot air isles 17 may be returned within an area 64 formed between the ceiling panels 26, the bridging ceiling panels 26a, and the roof panels 42 of the unit structures 12 as “return” air through the return air dampers 52b to the modular cooling unit 50. Cool air 62 is supplied into each of the cold aisles 15 by the modular cooling units 50, which are able to draw in outside air 63.

[0051] Figure 18 illustrates one embodiment of a modular “power hall” 70 that may be used in connection with the unit structures 12 to form the modular data center facility 10. With additional reference to Figures 19-22, the modular power hall 70 may be made up of one or more modular power supply units 72 (Figure 19), one or more modular power cabinet units 74 (Figure 20), one or more modular UPS (uninterruptible power supply) units 76 and one or more modular PDU (power distribution unit) units 78, as well as any other type of power component or subsystem. Figure 18 also shows a plurality of electrical bus bars 80 that may be used to connect the various components in each of the modular units 72-78 as needed to distribute power.

[0052] The modular power supply units 72 may each include a main bus, for example a 5000A main bus for supplying 100kA at 480V. A plurality of main breakers and distributed breakers may also be included along with a suitable power control system and a power quality meter.

[0053] The modular power cabinet units 74 may each include a 1600A bus main bus for delivering 65kA at 480V. Power breakers and distribution breakers may be configured as needed for specific applications.

[0054] The modular UPS units 76 may each include parallel 400kVA/400kW modules to provide 750kW of backup power. However, it will be appreciated that the UPS units 76 may be configured as needed to suit a specific application.

[0055] Each of the modular PDU units 78 may be configured to provide 300kVA 480/208/120V, or a different selected electrical output. Load distribution breakers may also be mounted in cabinets (not shown) that are in turn mounted to the sides of a frame of each PDU contained in the modular PDU unit 78.

[0056] Each of the modular units 72-78 may have similar or identical dimensions. In one embodiment the dimensions of the modular units 72-78 are identical with a length of 12192mm (40 feet), a width of 3658mm (12 feet) and a height of 3500mm (11 feet and 5.8 inches). Obviously these dimensions may be varied slightly if needed. In this example, the modular units 72-78 may have length and width dimensions that are the same as the unit structures 12. These dimensions enable shipping of the modular units 72-78 in conventional shipping containers.

[0057] With brief reference to Figure 21, each of the modular units 72-78 may include a frame structure 73 having one or more of components secured thereto such as a floor 73a and one or more wall portions 73b. The modular units 72-78 are also rapidly deployable when they are received at the destination site. The modular configuration of the units 72-78 allows for easily expanding the power supply capabilities of the power hall 70 as data center needs grow.

[0058] Figure 23 shows an overhead view of one example of an implementation of the modular data center facility 10. The unit structures 12 are grouped into two halls, "Hall A" and "Hall B", separated by a modular office/storage section area 80. A modular water treatment section 82 may include water treatment equipment. Rows 84 of modular cooling units 50 may be arranged adjacent the rows of unit structures 12. A row of modular penthouse exhaust structures 20 (not shown in Figure 23) may extend over a hallway area 86, perpendicularly to the unit structures 12, to interface with the hot aisles 17 adjacent the unit structures 12. A modular room 86 may be included for other data center or office equipment.

[0059] Referring to Figure 24, a unit structure 100 is shown in accordance with another embodiment of the present disclosure. The unit structure 100 in this example also has additional structural columns 102 that may be used to help form a hot aisle with one or more doors at opposing ends of the unit structure 100.

[0060] The unit structure 100 can also be seen in Figure 25 to include a central, elongated tray 104 that runs a substantial portion of a full length of the unit structure 100. The central, elongated tray 104 may include a pair of curving

tray portions 106 that enable cables to be fed out from the central, elongated tray 104. The central, elongated tray 104 and the curving tray portions 106 may each include a plurality of posts 108 to help retain cables within the trays 104 and 106.

5 **[0061]** It will be appreciated that the various embodiments of the present disclosure may incorporate built in lighting fixtures, as well as one or more lengths of built in conduit for the delivery of water or a different fire suppression agent. The cable trays 38, 40 and 104 may be used to divide and route specific types of cabling (i.e., optical, power, network, etc.) depending on user requirements or preferences.

10 **[0062]** The various embodiments of the modular data center facility 10 enable the various modular components that are used to form the data center to be easily shipped to a destination site and constructed in a desired configuration. The modular components the data center facility 10 can be rapidly deployed so that a fully functioning data center can be constructed much more quickly than a
15 conventional "stick built" data center structure.

[0063] While various embodiments have been described, those skilled in the art will recognize modifications or variations which might be made without departing from the present disclosure. Any dimensions given on the drawings hereof are intended to be merely examples of suitable dimensions, and such
20 may be modified as needed to meet the needs of specific applications. The examples illustrate the various embodiments and are not intended to limit the present disclosure. Therefore, the description and claims should be interpreted liberally with only such limitation as is necessary in view of the pertinent prior art.

CLAIMS

What is claimed is:

1. A modular data center comprising:

a plurality of unit structures arranged generally parallel to one another;

5 a plurality of supports for supporting the unit structures elevationally above a floor, and wherein adjacent ones of the unit structures form hot aisles therebetween through which hot air generated from data center components may be channeled;

each said unit structure forming an elongated structure having:

10 a frame structure;

a roof panel supported by the frame structure; and

a ceiling panel spaced apart from the roof panel for defining a volume through which the hot air from one of the hot aisles may be received and channeled; and

15 the roof panel helping to form a cold aisle between two adjacent rows of data center components disposed below the unit structure, the cold aisle being configured for channeling cold air between the data center components

and using one said row of each of the two rows of data center components from adjacent ones of the unit structures to help form the hot aisle
20 there between;

the modular data center further comprising a plurality bridging ceiling panels disposed between adjacent ceiling panels of adjacently positioned ones of the unit structures, to assist in forming the hot aisles.

25 2. The modular data center of claim 1, wherein the unit structures each include a plurality of foldable panels configured to be suspended below the unit structures to help contain cold air within the cold aisle.

30 3. The modular data center of claim 2, wherein the foldable panels of each said unit structure are foldable into a space efficient configuration disposed closely adjacent the roof panel to facilitate shipping and packaging.

4. The modular data center of claim 1, further comprising at least one penthouse exhaust structure configured to be supported above a given one of the hot aisles between two adjacently positioned ones of the unit structures, the penthouse exhaust structure including at least one fan for exhausting at least a portion of the hot air from the hot aisle to an ambient environment.

5. The modular data center of claim 4, wherein each said penthouse exhaust structure includes a plurality of exhaust fans arranged in opposing fashion.

6. The modular data center of claim 1, further comprising a plurality of the penthouse exhaust structures arranged to extend generally perpendicular to the unit structures, and to communicate with a plurality of the hot aisles formed between associated pairs of the unit structures.

7. The modular data center of claim 1, further comprising a plurality bridging ceiling panels disposed between adjacent ceiling panels of adjacently positioned ones of the unit structures, to assist in forming the hot aisles.

8. The modular data center of claim 1, wherein the unit structures each comprise at least one cable tray supported from the frame structure so as to be suspended from the unit structure.

9. The modular data center of claim 8, wherein the cable tray is supported by a hanger, the hanger in turn being coupled to the frame structure.

10. The modular data center of claim 9, wherein the hanger is pivotally supported from the frame structure such that the hanger and cable tray are pivotable between a deployed position and a stowed positioned.

11. The modular data center of claim 1, further comprising a modular cooling unit adapted to be positioned adjacent to the unit structures so as to provide a cooling airflow into the cold aisle of at least one of the unit structures.

5 12. The modular data center of claim 1, further comprising a plurality of modular cooling units adapted to be disposed generally perpendicular to common ends of the cold aisles of the unit structures, to generate a plurality of cooling airflows that are directed into the cold aisles of the unit structures.

10 13. The modular data center of claim 1, further comprising at least one of:
a modular power supply unit;
a modular power cabinet unit;
a modular uninterruptible power supply (UPS) unit; and
a modular power distribution unit (PDU).

15 14. The modular data center of claim 1, further comprising:
a modular power supply unit;
a modular power cabinet unit;
a modular uninterruptible power supply (UPS) unit; and
20 a modular power distribution unit (PDU); and

wherein the modular power supply unit, the modular power cabinet unit, the modular uninterruptible power supply (UPS) unit and the modular power distribution unit (PDU) each have approximately a common length, width and height.

25 15. The modular data center of claim 14, wherein the length and the width are the same as a length and width of the unit structure.

30 16. The modular data center of claim 1, wherein the unit structures are configured to form two halls for the modular data center, and further comprising a modular office storage section separating the two halls.

17. A method for forming a modular data center comprising:

providing a plurality of unit structures each having a frame, each said unit structure operating to help form a cold aisle through which cold air is circulated, and a hot aisle through which hot air is circulated;

5 supporting the unit structures above a floor to allow data center components to be positioned under each of the unit structures in two rows facing each other to help form the cold aisle;

using one said row of each of the two rows of data center components from adjacent ones of the unit structures to help form the hot aisle therebetween;

10 further configuring each of the unit structures to form a volume, defined at least in part by a ceiling panel and at least in part by a roof panel, through which the hot air from one of the hot aisles may be received and channeled; and

further using the roof panel to help form the cold aisle between adjacent rows of data center components disposed below the unit structure, the cold aisle
15 being configured for channeling cold air between the data center components.

18. The method of claim 17, further comprising using at least one of:

a penthouse exhaust structure configured to be supported above a given one of the hot aisles between two adjacently positioned ones of the unit
20 structures, to assist in exhausting at least a portion of the hot air from the hot aisle to an ambient environment; or

a plurality of foldable panels operably associated with each of the unit structures to help form the cold aisle associated with each said unit structure.

19. The method of claim 17, further comprising using at least one of:
- a modular cooling unit to generate cold air to be circulated into the cold aisle;
 - a modular power supply unit;
 - 5 a modular power cabinet unit to supply power to the data center components disposed adjacent the cold aisles;
 - a modular uninterruptible power supply (UPS) unit to supply power to the data center components; and
 - a modular power distribution unit (PDU) for distributing power to the data
 - 10 center components.