Site Preparation for ClearCube Installation

Rev. F

EXECUTIVE SUMMARY

Because of the centralized nature of the ClearCube architecture, installation of the system requires a certain degree of site preparation. Proper preparation will result in a rapid installation and long-term trouble-free operation. In some cases, such as installation in pre-existing data centers and/or network closets, this preparation will not require many modifications to the site. In other cases, it may be necessary to convert closets or backrooms to accommodate chassis and blades.

This paper will describe the steps required for ensuring all pre-installation activities and site preparation steps are identified. The paper details what environmental conditions need to exist (cooling, power, architectural supports, etc.) for successful installation and why they are necessary. In addition, observations from the field are documented to illustrate areas requiring particular attention during your installation.

This paper is a companion document to the ClearCube Site Prep Checklist (found on the ClearCube Support website), which must be completed and signed by the customer's Project Manager and the ClearCube (or Partner) Account Executive to verify that the customer site is ready for installation.

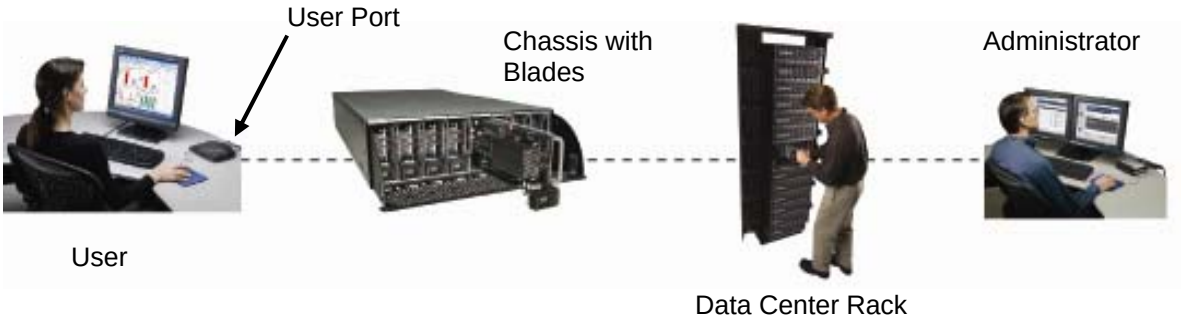
The CompleteStart™ Professional Services Program is available to help customers resolve issues at any time during pre-installation preparation as well as during the installation itself. This service will ensure that installation of the ClearCube Solution is as smooth as possible for the IT staff and transparent to the user. CompleteStart is a comprehensive program covering three vital areas: Pre-installation Readiness, Training and Installation.

INTRODUCTION

The ClearCube solution removes box PCs from the desktop and delivers true centralization of your company's computing assets. Aided by the PC small form factor and the exclusive distance capability, a company can centralize the computers of several hundred users within the secure confines of a data center or other IT space. Alternatively, PC blades can be stored in local communications closets closer to the end users. In any of these scenarios, the site must meet certain minimum requirements prior to installation of ClearCube chassis and blades. These requirements fall under the categories of clearance, load bearing capacity, power delivery and cooling capability.

Site preparation is a critical part of the ClearCube installation process. The site must provide adequate clearance for maintenance purposes in the event a blade needs to be changed out or if cabling at the rear of the chassis needs adjustment. Proper cooling and ventilation is required to prevent thermal overload of the blade and chassis electronics. Finally, the site must provide sufficient electrical power for operation of the blades and chassis. The power draw and heat output is highly concentrated and can require expansion of the electrical infrastructure as well as added cooling capacity and/or air flow for smaller data centers.

In addition, the ClearCube solution includes enterprise-level management software that unleashes the full potential of the R Series blade architecture. The software requires proper setup and installation, and the customer's Network Administrator must work with ClearCube to determine any conflicts that the software might have with site-specific server or web policies.



SPACE AND CLEARANCE REQUIREMENTS

The dense form-factor of ClearCube PC blades allows a high concentration of computing power in a relatively small space, resulting in improved hardware security and manageability than a distributed PC architecture. This concentration of blades and chassis will have an impact on your data center and/or network closet. ClearCube chassis fit into standard 19" racks and/or cabinets and are 29.8 inches deep and 3U in height. ClearCube recommends that the racks (or cabinets) that you choose incorporate cable guides (horizontal or vertical) to organize the power, network, User Port connection and management cables. A full rack of 112 blades (56 for dual slot blades) will have the following cable counts (it is important to note that the information below is a guide, as each installation may be different):

Chassis Type	**Power Cables**	**C/Port Cables** Single slot blades Dual slot blades	**Ethernet Cables**[1] Single slot blades Dual slot blades	**Management Cables** Management Administration Sparing
Direct Connect BackPack	14	112 56	112 56	14 0 0
Blade Switching BackPack	14	112 56	112 56	14 14 14
R4300 chassis with Administrator Connect Modules	28	0	112 56	14 14 0
R4300 chassis with User Connect Modules	28	112 56	112 56	14 14 14
R4300 chassis with 8x8 Connect Modules	28	112 56	112 56	14 14 14

[1] R1300, R2100 and R2200 blade models contain dual NICs. If both NICs are utilized, the number of Ethernet cables required is doubled.

Table 1: Chassis Cabling Requirements

In addition, each chassis requires proper airflow to keep the blades cool. At least five inches of space should be maintained behind the rack at all times to ensure adequate ventilation. However, ClearCube recommends maintaining eight inches at all times, giving IT staff members space for cable management and administration. The minimum physical footprint for a rack of ClearCube blades is two feet wide and three feet deep. If you are using a cabinet, the footprint will be dependent on the size of the cabinet (please refer to the cabinet manufacturers specifications for this information).

During the operational life of the chassis, it will need to be accessed for maintenance purposes from time to time. This may entail opening a cabinet door or other access point, and therefore more space than the minimum footprint is recommended. In any case, personnel must be able to access the rear of the chassis to change cable connections or replace chassis modules – this will require at least eight inches of clearance behind the chassis. From the front of the chassis, a technician must be able to open the front bezel and pull out all of the blades – this requires two feet of clearance (the length of each blade).

You will also need access to the network switch that is connected to each chassis in the event the port settings must be manually adjusted.

LOAD BEARING (WEIGHT) REQUIREMENTS

Made with strong sheet metal to protect the Blades and modules, one fully loaded chassis weighs approximately 80 pounds. A fully loaded rack of 14 chassis and 112 Blades will weigh approximately 1120 lbs, not including the weight of the rack itself. The loading on the floor will be greater than 187 lbs. per square foot. Prior to installation, the customer must verify that the floor will hold this considerable weight – raised floors may need additional support under the racks. Customers with smaller installations also must make sure that their floor, table, or other furniture can handle the weight of multiple chassis.

In addition to weight concerns, racks and chassis must be in stable positions for proper installation. If the installation site uses a 2-post rack, the chassis must be mounted on the rack at each chassis' center of gravity. ClearCube recommends using a 4-post rack or a cabinet with adjustable middle rails, which will add stability by providing support at both ends of the chassis. ClearCube offers a Chassis Rapid Mounting Kit for use with 4-post racks that can improve installations times by a factor of five. Prior to chassis installation, the rack should be secured to both the ceiling and floor to prevent tipping.

COOLING AND ENVIRONMENTAL REQUIREMENTS

Each ClearCube R Series chassis holds up to eight single processor blades or four dual processor workstation blades and their associated hard drives, memory and power supplies. This concentration of electronics generates a significant amount of heat, even when the equipment is not operating at full capacity. While the chassis can exceed 5100 BTU/Hr with all Blades operating at peak power, nominal usage will result in heat rates between 3100 and 3850 BTU/Hr. ClearCube recommends a cooling system designed to remove 3850 BTU/hr of heat. In terms of cooling capacity, every three chassis will require approximately 1.3 tons of additional cooling at the location where they are installed.

The acceptable thermal range for operating blades and chassis is from 0 to 35 °C (32 - 95 °F). Temperatures outside this range will damage the internal electronic components, regardless of whether the event is a brief spike or a sustained condition. If blade temperatures exceed the acceptable range and components fail, this will void the product warranty.

Installation Experiences:

While data centers are often well equipped to handle the heat load, other rooms such as telecommunications closets and spare backrooms may need duct work to bring in more ventilation from the central cooling system. Lacking this ventilation, temperatures above 100°F are easily reached, which can cause blades and chassis to prematurely fail. In order to prevent this, a ClearCube-certified Systems Engineer should verify that the installation site has been properly prepared to provide sufficient cooling.

Cooling capabilities of the HVAC system will be severely reduced without proper ventilation and airflow through the chassis. In an open rack, chassis require five inches of clearance at the rear of the fans to allow airflow. Care must be taken in organizing cable bundles to not disrupt this airflow, which will necessitate the use of cable ties and guides. For chassis held in cabinets or other enclosures, a fan at the top of the cabinet will be required to ensure hot air does not stagnate in the enclosure. Proper room ventilation ducting is vital to ensuring that air heated by the blades doesn't continuously circulate in the room. Regardless of the cooling system capacity installed, waste heat from the blades should be directly vented to the environment. If waste heat from the blades isn't properly vented, a closed loop circulation system could form leading to excessive room temperatures. This is true even if the installed cooling system has excess cooling capacity because heated, re-circulated air can enter the chassis intakes.

In addition to thermal considerations, the blades must be kept in a relatively clean environment. The electronic circuitry on the blades and chassis modules is not protected from airborne contamination by dust or chemicals. Therefore, the chassis must be kept away from areas with high concentrations of contaminants.

POWER REQUIREMENTS

The power draw of a fully populated rack is highly concentrated, making adequate power circuitry vital for proper operation. Each chassis, operating at full power, will draw a maximum current of 12 amps at 120 VAC (6A at 240 VAC) or 1.44 kVA. This power draw can be seen during blade boot-up and imaging, when the processors and hard drives are running at full speed. Normal blade operation will result in a current draw in the range of 7-9 amps per chassis at 120 VAC. The chassis power supply is designed to accept A/C voltages between 100 and 240 VAC. Note: there is an inverse relationship between voltage and current. Therefore, if the power system voltage is doubled from 120 VAC to 240 VAC, the current required is halved.

For detailed power requirements on various circuit voltages (100V, 120V, 208V and 240V), please refer to the Site Preparation Checklist spreadsheet available at www.clearcube.com/support/.

Installation Experiences:

Sites other than Data Centers may not have adequate pre-installed power. Customers who intend to place several chassis in telecom closets or other backrooms may need to expand the site power system so that adequate power will be delivered to the chassis.

Surge suppression at the desktop is vitally important, as C/Ports can be damaged when an electrical storm disrupts the site's power distribution system.

Consult a professional electrician before attempting ANY electrical system modifications!

After ensuring that adequate power can be supplied to the chassis, the next site concern is power protection. ClearCube recommends one 15 A (at 120 VAC) circuit breaker to be allocated for each chassis, with another appropriately sized circuit breaker protecting each rack. If a customer uses uninterruptible power supplies, sizing should be based on the requirement to supply 9 A (at 120 VAC) to each chassis for the desired duration. Customers should also make sure that the UPS will pass through enough current to the chassis even while charging. A 3 kVA UPS will, at most, support two chassis. Refer to Table 1 below for additional information for minimum UPS sizing. Finally, installation sites will require surge protection for both the chassis in the Data Center as well as the C/Ports at the desktop. Although the C/Ports do not require much power, they can sustain damage from power surges in the electrical system.

Table 2: Minimum UPS sizing required for Chassis

# of Chassis	UPS Size
2	3 kVA
3	5 kVA
5	8 kVA

Cabling Infrastructure

Each fully loaded chassis will require eight Category 5 cables with RJ-45 connectors for connecting the PC blades to the C/Ports at user's desktops and eight network cables for connecting the PC blades to the Ethernet network switch. These cables are not included with the ClearCube equipment. Short, color-coded Category 5 cables ARE provided with each chassis for sparing, administration and management daisy-chain connections.

NOTE: the ClearCube Architecture uses all four copper wire pairs for the cable connection between the PC blade and each C/Port. If your installation currently splits out wire pairs for multiple uses, you will need to ensure that a separate, full Category 5 connection is available for each PC blade to C/Port connection. Fiber optic installations require two 62.5 micron, multi-mode fibers connected in a straight-through manner.

NETWORK CONSIDERATIONS FOR I/PORT ENVIRONMENTS

Customers deploying I/Ports need to ensure their Ethernet infrastructure can support the added network demands imposed by these products. Each I/Port requires a dedicated network switch port for connectivity. This is in addition to the network switch port required for each blade. I/Ports also require sufficient network bandwidth for adequate performance. Depending upon the user's applications this can range from 50 kbps for text-based applications to 1 Mbps for graphically intensive programs. The chart below can help you determine necessary bandwidth that will be required by the users in your organization.

Application Environment	Example Applications	Typical Sustained Bandwidth Required While a User is Active
Basic, text-based	Email, notepad	15 Kbits/sec
Typical Office	Word, Excel, basic web browsing	35 Kbits/sec
Graphically intensive	Flash animation, PowerPoint	70 Kbits/sec

Table 3: I/Port Bandwidth Guidelines

Note: Every network environment is unique, so these bandwidth amounts should be used as a guideline, not absolute measures. Certain network conditions may dictate higher bandwidth requirements than those listed above.

SOFTWARE PREPARATION AND IT PERSONNEL REQUIREMENTS

The ClearCube Management Suite (CMS) is enterprise software that enables customers to realize the full potential of ClearCube's centralized PC blade architecture. The components of CMS require various TCP and UDP ports to be open for reliable communication. Please call ClearCube Technical Support or visit support.clearcube.com to obtain the most current list of network ports used by CMS. These ports cannot be blocked by firewalls or access lists when customers are deploying CMS. In some customer environments, this may require assistance from a group other than the team deploying ClearCube hardware and CMS. Arrangements should be made with the required personnel to complete this work before deploying the ClearCube software. ClearCube Professional Services can assist in customizing the software installation process to help meet customer security requirements and resolve other issues.

The ClearCube Management Suite components rely on Java, Perl and Apache Tomcat technologies as prerequisites. Some customer environments include other applications that rely on Java or Tomcat. Administrators should ensure that CMS prerequisite requirement versions do not conflict with prerequisite versions for other applications in the environment.

In addition to management software, each managed group of ClearCube chassis must have one chassis with a Remote Management Module (RMM) connected to the network. The RMM is a controller that links a chassis systems management bus to the ClearCube management software via Ethernet. The RMM enables switching functions, logging of chassis events, and permits remote control of an entire rack of chassis, allowing any administrator with Internet access to manage the client blades and chassis remotely. Depending on the RMM version, some will

require static IP addresses and some can be configured in static or DHCP mode. During installation, the network administrator must assign static IP addresses to the RMMs or ensure that a DHCP server is available for models that support DHCP. This also means each RMM will require a physical network connection.

CONCLUSION

The ClearCube solution represents a revolutionary step forward in efficient and cost-effective business computing. However, because it does reverse the trend of distributed computational power, installation can present unique challenges. Adherence to the guidelines set out in this paper and summarized in the ClearCube Site Preparation Checklist will ensure a trouble-free installation and subsequent usage. This will result in a positive experience for both the customer's IT department and end-users.

ClearCube Professional Services

ClearCube has a Professional Services group to assist customers with installation of its equipment, including pre-installation site surveys. ClearCube Professional Services will work with clients to resolve any site or software issues and ensure compliance with installation guidelines. Please contact your ClearCube Account Executive or visit the ClearCube Professional Services home page at www.clearcube.com/controller/services.php for more information.