WHITE PAPER

How to Choose the Best IT Cabinet Configuration for your Edge-Computing Application

ArcTiv Technologies, LLC
30 N Gould St Ste R.,
Sheridan, WY 82801
email: sales@arctiv-tech.com
www.arctiv-tech.com

Daniel S. James II, MSEE, MBA
President
ArcTiv Technologies, LLC
daniel.james@arctiv-tech.com

Abstract

As companies move their data storage off-site to cloud or fog computing, IT managers are commonly utilizing hybrid cloud & edge-computing deployments for on-premise management of critical equipment. This trend addresses the latency and security issues commonly faced with cloud computing while still leveraging the cost advantage of the cloud. The expansion of IoT devices being distributed into the LAN has also added another layer of complexity to maintain local servers and powered networking switches. As a result, there is an ongoing struggle to minimize OPEX costs while delivering optimal system performance and data security. The benefits of edge-computing include:

- Low-latency data analysis
- Greater data security
- Lower operating costs
- Reduced network traffic
- Improved application performance

Examples of edge-computing devices include servers, powered switches, firewalls, routers, modems, rack-mount UPS's, PDU's and IoT devices, amongst others. Typical markets for these applications include:

- SMB's, corporate branch offices & high-rise buildings
- Banks
- Retail & Restaurants
- Hospitals
- Hotels
- Education
- Manufacturing & logistics

Hybrid edge/cloud deployments have dramatically reduced the overall on-premise equipment, resulting in a significant reduction of racks, total system power capacity and support infrastructure. As a result, companies can often reduce or eliminate their server room or network closet and instead use smaller enclosures which can be located in open office areas, conference rooms, private offices or back rooms.

When selecting the cabinet configuration, it is important to consider the following factors to manage the edge-computing application:

- Securing IT equipment in open areas
- Managing high-power equipment in small cabinets
- Storing rack-mount UPS's in small cabinets
- Mitigating noise in office environments
- Securing IoT devices and small equipment
- Installing and servicing the equipment

ArcTiv Technologies Edge-Series Cabinets offer specialized, high-density solutions which minimizes the total system investment. A wide-range of configurations and accessories are available to create the ideal solution for each application.

ArcTiv Technologies, LLC is a USA-based technology and consulting company specializing in high-performance network and security solutions. Find out more about our products and services at www.arctiv-tech.com.

EDGE-SERIES CABINETS

The ArcTiv Edge-Series Cabinets help to eliminate the IT network closet by providing high-density storage solutions which support critical, on-premise edge-computing devices. The cabinets can be placed in offices or manufacturing environments and support large IT equipment such as UPS's, servers, and high-powered network switches.

The Edge-Series cabinets are offered in multiple configurations and can be customized to each application with a wide-range of accessories. Standard cabinet styles include:

- Floor Standing Cabinets
- Swing-Gate Wall Mount Cabinets
- Fixed Wall Mount Cabinets
- Side-Mount Wall Mount Cabinets
- Vertical Wall Mount Cabinets
- Sound Proof Cabinets
- USB Charging Cabinets

These innovative cabinet designs allow the user to select the best solution based on the following factors:

- Security Features
- Load Capacity
- Equipment Depth
- Mounting Configuration
- Access for Equipment Service
- Aesthetics
- Cable Management
- Airflow
- System Noise Rating
- Ability to Support Non-EIA Devices

The Impact of Edge-Computing on Network Closets and Server Rooms

The recent adoption of Cloud / Fog / Edge computing topologies has fundamentally changed the role of the network closets in most companies. Their primary data storage is now being transferred to the cloud or 'fog' and the remaining on-premise devices are used to help manage the LAN along with a few servers which are kept on-site for data security or latency reasons.

This trend is allowing many IT and facility managers to reduce or eliminate the network closet and replace it with smaller, specialized cabinets which can support these edge-computing devices.
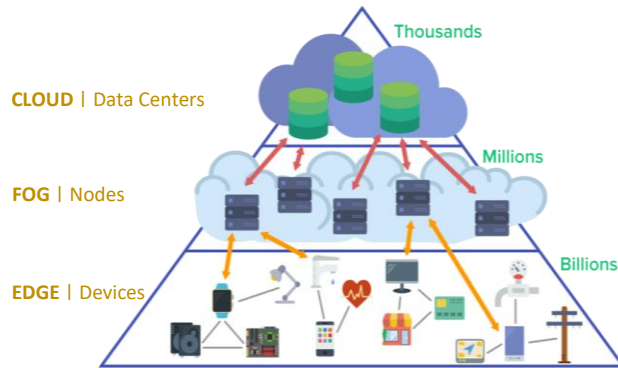

Figure 1. Cloud, Fog & Edge Computing Deployments

Networking cabinets were traditionally used for managing patch panels, switches and small equipment which could be housed in a light-duty, fixed wall-mount configuration and stored in the back room. With the adoption of both edge-computing and higher powered PoE applications such as IP cameras, VoIP phones and media systems, these applications now require larger switches, higher-power cabling, servers and rack-mount UPS's. Examples of these devices are shown in **Figure 2**.

As a result, IT managers are requiring solutions which provide the support for the larger, heavy equipment, but can still be managed in open-offices area to help reduce the OPEX costs. Factors considered in these new applications include:

- Managing equipment security in open areas
- The impact of higher-powered equipment on the cabinet
- Managing rack-mount UPS's
- Office friendly appearance and noise levels
- Installing and servicing the equipment

Figure 2. Common Edge-Computing Devices

Most office environments will use similar specifications for the cabinets as they have common devices, security and environmental conditions. However, industries such as retail, manufacturing and logistics may require a unique approach to housing their IT devices. **Table 1** lists some of the factors by vertical.

Table 1. Considerations in Storing Edge-Computing Equipment, by Vertical

Market Vertical	Major Equipment	Considerations
Branch offices High-rise buildings Banks Hospitals Hotel Education	Servers & Storage Managed PoE Switch UPS & Battery Security Camera's Networking Equipment Intelligent PDU	– Cabinet with increased capacity and load rating to store large equipment – Cabinet access restricted to only IT or branch manager – High cable capacity to manage PoE devices (VoIP phones, Security Camera's) – Greater airflow to support 1 to 5kVA rackmount UPS – Remote monitoring of UPS, PDU, cabinet environmental sensors
Retail	PoS & Networking Equipment Security Camera's & Switch UPS & Battery Intelligent PDU	– Low-profile cabinet which fits in the back store room or owner's office – Cabinet access restricted to only IT or branch manager – Remote monitoring of UPS, PDU, cabinet environmental sensors – Mounting of non-EIA equipment
Manufacturing Logistics	Server & storage Security Camera's & Switch UPS & Battery Intelligent PDU	– Servers should be located close to the equipment for lowest latency. – IP rating to operate in manufacturing areas (temperature / humidity / dust) – Remote monitoring of UPS, PDU, cabinet environmental sensors

Securing IT Equipment in Office Areas

By eliminating the dedicated server room or network closet, the edge-computing cabinet will typically need to be placed in either a private office, conference room or open office area. These smaller cabinets will need to be fully-locking as they can be accessed by the general public. **Table 2** shows a comparison of the two applications.

Table 2. A Comparison of Network Closets and Server Rooms vs. Edge-Computing Cabinets

Application	Network Closet or Server Room	Edge-Computing Cabinet
System		
Room Requirements	− Dedicated IT room with locking door − Room-level environmental management (temperature, humidity, dust) − Access to network cables − Minimal noise requirement	− Office area (open or locked) − Room-level environmental management (temperature, humidity, dust) − Access to network cables − 55 dB max noise rating for offices (EHS)
Cabinet Style	Network or Open-Frame Racks	Floor, Desktop or Wall Mount Cabinets
Max Cabinet Height	42U	24U
Environmental Security	Room-level	Building-level
Cabinet Security	Open access	Fully locking cabinet
Access Rights	IT or Facility Manager (room lock)	IT or Facility Manager (cabinet lock)

Arctiv Edge-Series Cabinets are offered in different styles, security and mounting options and the application requirements need to be considered, as shown in **Table 3**. The primary factors required in selecting the best cabinet include:

- Equipment size and weight
- RMU capacity
- Location and mounting style (wall mount, castors or mounting feet)

Table 3. A Comparison of Edge-Series Cabinet Security Features

	Floor Standing	Swing Gate	Fixed	Side-Mount	Vertical	Sound Proof	USB Charging
Style							
Mounting Options	Castors, Feet	Wall, Castors, Feet	Wall, Castors, Feet	Wall, Castors, Feet	Wall	Castors	Wall, Feet
Security	Locking Doors & Side Panels Easily move to secure office	Locking door, Side Panels & Back Gate Secure wall mounting	Locking doors & Side Panels Secure wall mounting	Locking doors & Side Panels Secure wall mounting	Locking door & Access Panel Secure wall mounting	Locking Doors & Side Panels Easily move to secure office	Locking doors & Side Panels Secure wall mounting

Managing High-Power Equipment in Small Cabinets

Traditionally, small office cabinets were designed to support network switches, patch panels, routers and networking equipment while larger servers, storage, high-power switches and UPS's were installed in the server or network rack in a dedicated IT room.   Now that these systems are moving to the office environment, the cabinet needs to be selected to handle greater load, cable and air-flow density. **Table 4** addresses the key issues affecting these applications.

Table 4. Key Factors Impacting Cabinet Specifications for High-Power IT Equipment

Factor	Description
Higher load ratings	− Higher power systems will require greater power conditioning and back-up power. Rackmount UPS's can commonly range from 1 – 3kVA for a small network and can add from 20 to 60 kg's of added weight; requiring a robust, welded cabinet design with higher-rated castors or wall mounting brackets.
Greater depth	− Greater mounting depth is required to support the equipment, accessories and cables. − Rackmount servers and UPS's require from 450 to 900mmD rail depth
High density network and power cables	− IoT devices such as VoIP phones and security cameras require at least 30W per cable. Large cable bundles from the switch will dissipate significant heat and require greater organization and airflow regulation. − Power cables need to be separated from the network cables to minimize power line noise interference.
Greater airflow	− Systems will require either passive (fan) or active (A/C) cooling. Fan capacities need to be sized based on the total KVA rating and the cabinet ventilation. − In select cases, blanking panels and solid side panels can help manage the mix of hot and cold air. − Device layout inside the rack needs to be managed for proper spacing and heat dissipation.

The Impact of Enhanced Power Over Ethernet (PoE++)

Starting in 2018, IEEE802.3bt amendment for Enhanced Power over Ethernet (PoE++) will increase from 30 watts (type 2) to 60 and 90 watts (type 3 and 4) per cable. The high-power cable ratings will allow a new tier of devices to be powered directly from the switch; eliminating the need for local A/C power converters. Once released, this will significantly impact the ratings of the cables and heat dissipation inside the cabinet. **Table 5** compares the new ratings and devices.

Table 5. A Comparison of Power over Ethernet Ratings and Devices

Per-Port Power	15.4W (PoE)	30W (PoE+)	60W (PoE++)	90W (PoE++)
Port Type	Type 1	Type 2	Type 3	Type 4
Year Established	2003	2009	2018 (pending)	2018 (pending)
IEEE Standard	IEEE802.3af	IEEE802.3at	IEEE802.3bt	IEEE802.3bt
Powered Devices	IP Camera VoIP Phone 802.11n WAP	PTZ Camera Display Phone 802.11ac WAP	Video Phones 10G WAP's 5G small cells 802.11ax WAP	LED Lighting & Signage POS systems Monitors / HDTV's Laptops

Impact on Cabling

Multiple types of cable ratings can be used to support the next-generation PoE capacities, including CAT5e, CAT 6 and CAT 6A, though enhanced cabling techniques need to be used in managing the higher heat dissipation. Recommended practices include:

- Limit cable bundle sizes based on NEC standards (best practice is less than 100 cables per bundle).
- Cable sizes are increasing to support higher power, temperature and transmission rates (from 24AWG to 22AWG), requiring greater cable management capacities.
- Power cables changing to support UPS and high-power switches, moving from local outlets to IEC-rated PDU's.

ArcTiv Edge Series Cabinets offer greater depth, load rating, cable and airflow management to support high-powered equipment in a wide range of applications. The cabinet configurations and high-density accessories can be selected based on equipment rating to manage the cabling, airflow and device mounting. Key cabinet accessories include the Revi-Rail™ vertical cable management system along with a full line of cable and airflow management.

Storing Rack-Mount UPS's in Small Cabinets

For small offices, the total power capacity will typically range between 1 to 5kVA with the leading power consumption devices driven by the server and network switch (PoE+). A back-up UPS and battery can be installed to ensure continuous operation of critical IT equipment and devices such as security camera's, VoIP phones, email & internet connection. As the size and weight of the UPS is a driving factor in the cabinet selection, the following factors need to be considered in managing the rackmount UPS:

- **Total weight of the UPS and IT system -** The UPS can be the heaviest item in the cabinet and is the key driver for the load capacity rating. Wall mount cabinet ratings are typically rated from 90 – 110kg, while industry practice is to de-rate the cabinet load rating by 50%.

- **Total depth of the UPS and power cabling -** The max depth of the UPS can vary by brand and UPS capacity. Extra cabinet space is needed to support rail positions, power cable size and bend radius.

- **Total RMU and depth of the application -** Most edge-computing applications require a UPS stored with IT equipment in a small cabinet where RMU availability is critical. 0U mounting of small devices can provide higher densities so the available RMU is maximized.

- **Ease of access to the back of the UPS -** Throughout the lifespan of the UPS, routing maintenance and servicing of the battery is recommended which requires full access to the front and rear of the UPS.

Table 6 shows a comparison of the leading UPS brands. Notice that the weight of the battery module is significantly heavier than the UPS and is a major consideration in determining the final specification of the cabinet.

Table 6. Physical Parameters for Leading Rackmount UPS Brands

		APC (Smart UPS)			Eaton (9PX)			Delta (RT Series)		
		RMU	Weight (kg)	Depth (mm)	RMU	Weight (kg)	Depth (mm)	RMU	Weight (kg)	Depth (mm)
UPS	1kVA	2	21	463	2	17	450	2	12	335
	2kVA	2	26	470	2	28	604	2	18	432
	3kVA	2	41	670	2	29	604	2	28	610
Battery	1kVA	2	30	536	2	27	450	2	15	335
	2kVA	2	34	595	2	39	604	2	27	432
	3kVA	2	41	595	2	39	604	2	44	610

The ArcTiv Edge Series Cabinets Revi-Ring™ Vertical D-Ring Managers can be field-reversed to allow the greatest equipment depth in the smallest form factor. **Tables 7 and 8** depict the cable management techniques and max equipment depth.

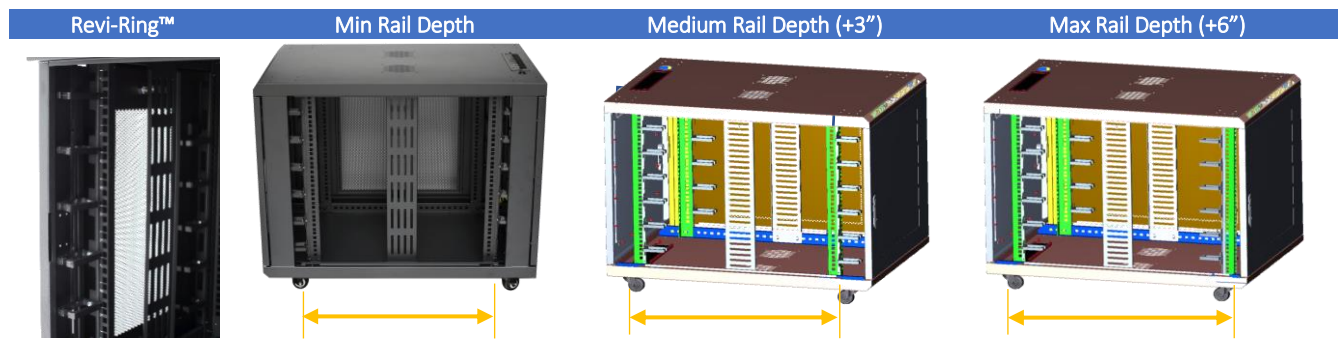**Table 7. Description of the ArcTiv Revi-Ring™ technology**

Revi-Ring™	Min Rail Depth	Medium Rail Depth (+3")	Max Rail Depth (+6")

Table 8. Edge-Series cabinet max depth, RMU and load rating by cabinet type

Cabinet Style	Floor Standing	Swing Gate	Fixed	Side-Mount	Vertical	Sound Proof	USB Charging
Max Equip. depth (mm)	750	520	500	826	930	900	400
Max RMU	24	12 + 2	12	12	5 + 2 + 2	24	16 Ports
Load Rating (kg)	110	90	90	110	68	1,000	40

Mitigating Noise in Office Environments

Edge computing applications are commonly installed in open-plan office environments and need to be configured to manage both cabinet and equipment noise levels in addition to maintaining an office-friendly appearance. According to EHS standards, the max office noise levels are 55dB though the recommended levels are 50dB or lower. Closed offices or conference rooms will often require < 45dB in a noise sensitive envrionment. Table 9 shows recommended max noise levels by application.

Table 9. Recommended Max Noise Levels by Application

Application	Max Noise Level (dB)
Open-Plan Office	55
Closed office	45
Storage Room (with Door)	75
Warehouse or Factory	75

Though the server noise levels are not often published, third-party studies have been conducted to validate the max noise rating for select server models. Table 10 shows these tested noise levels for both popular servers and UPS's, by brand.

Table 10. Tested Noise Ratings for Popular Server and UPS Models

	Dell Power Edge	Noise (dB)	HP ProLiant	Noise (dB)
Server	R610	43	DL360	40
	R710	46	DL380	42
	2950	69	DL380G5	45
	1950	71	SuperMicro	60

		Noise (dB)		
		APC	Eaton	Delta
UPS	1kVA	40	40	40
	2kVA	42	45	43
	3kVA	42	45	46

ArcTiv Edge Series Cabinets offer noise-reduction features such as sound proof cabinets and low-noise fan kits to support office environments. Applications using 1 to 2 servers and a UPS will exceed the recommended open-office noise threshold and will require noise isolation. For non-server applications, a standard cabinet with low-noise fans will usually meet the guidelines. Examples of typcial solutions are shown in Table 11.

Table 11. Examples of System Noise Levels by Applications (Estimation)

Application 1: Open Office (no Servers) SMB, Branch Office		Application 2: Open Office (with Servers) SMB, Branch Office		Application 3: PoS (Closed Office) Retail, SMB	
Equipment	Noise (dB)	Equipment	Noise (dB)	Equipment	Noise (dB)
Switch (2) UPS (2kVA) (1)	40 (x2) 45 (x1)	Server (x2) Switch (x2) UPS (3kVA)	69 (x2) 40 (x2) 46 (x1)	Switch (1) UPS (1kVA) (1)	40 (x2) 40 (x1)
Total Equipment Noise	47	Total Equipment Noise	72	Total Equipment Noise	43
Floor Standing Cabinet With Low-Noise Fan Kit (2)	40dB (x2)	Sound Proof Cabinet with 20dB net sound attenuation	20dB (reduction)	Vertical Wal Mount Cabinet (5U) with Low Noise Fan (x1)	40dB (x1)
System Noise	49	System Noise	52	System Noise	45
Max Allowable Noise Rating	55	Max Allowable Noise Rating	55	Max Allowable Noise Rating	45

Securing IoT Devices and Small Equipment

For most applications, there will be a mixture of standard EIA equipment along with non-EIA devices which need to be secured in the same enclosure. Examples of these devices include:

- PoE Injectors (1-4 port)
- Media Converters
- Routers, Modems and Wifi
- Power Strips
- USB Devices

Conventional approaches to supporting these devices include using a rack-mount shelf which can consume multiple RMU depending on the size of the mounted device.

ArcTiv Edge Series Cabinets offer unique solutions to securing small devices with a full line of specialized accessories which can be added before or after installation. The IT manager can safely and efficiently store the maximum amount of equipment in the enclosure without compromising security or performance. Table 12 highlights examples of these products and applications.

Table 12. Edge-Series Cabinet Accessories and Configurations to Support Non-EIA Mounted and IoT Devices

Item	Equipment Mounting Shelf	Vertical Lacing Brackets	USB Charging Ports
Compatibility	Vertical Wall Mount Any standard EIA cabinet.	Floor Standing Swing Gate Fixed Side Mount	USB Charging Cabinets
Description	Provides mounting provisions for vertically mounting devices.	Provides mounting provisions for non-EIA equipment.	Supports Tablets, Phones and small USB devices
Product			
Application			

Installing and Servicing the Equipment

It is important to plan for both the installation and long-term servicing of IT devices throughout the application lifespan. For servers, switches and UPS's, there can be a combination of routine maintenance along with device, battery and cable changes. To support the life-cycle service, the following items should be considered

- **Front Access** – Full visibility and access to manage cables, equipment, patch panels, etc. Proper clearance to install and remove EIA rail mount equipment as UPS batteries, managed switches and servers need to be managed from the front door. Visible glass doors and proper cable organization is required for a quick review of device status without opening the door.

- **Rear Access** – Ability to manage power cables, network cables and service the back of equipment. Cabling should be properly organized to allow for easy, open access.

- **Side Access** – Required to manage cables and IoT devices.

- **PDU Access** – 1U intelligent and basic PDU's are popular for small cabinets. It is recommended to install the PDU with the power cable inputs to the back of the cabinet in order to separate the network and power cables. When mounted on the wall, full access to the PDU outlets is required for maintenance. The PDU should not interfere with the removal and servicing of the other equipment, ensuring the system can be fully powered even during maintenance.

ArcTiv Edge-Series Cabinets provide full equipment access to help install and service equipment. **Table 13** describes the features and benefits of common configurations.

Table 13. Edge-Series Cabinets provide greater access to the equipment for easy maintenance and installation

Vertical Wall Mount	Swing Gate Wall Mount	Floor Standing, Side Mount & Sound Proof
Top Panel Access Limited access patch panel (cable entry) for checking equipment and basic service	**Full Side Access** Side panels & vertical lacing bracket for cable mgmt and IoT device mounting	**Full Side Access** Side panels & vertical lacing bracket for cable mgmt and IoT device mounting
Full Equipment Access PDU & patch panel mounting brackets allow equipment access w/o removing power	**Rear Equipment Access** Rear PDU & patch panel mounting allows equipment access w/o removing power	**Brush Strip and Rear Door** Allows sealed access to cabling while servicing equipment from back rails.

Conclusions

ArcTiv Edge-Series Cabinets offer high-density solutions to address the rapid industry transition from on-premise network closets and server rooms to cloud, fog and edge computing deployments. These high-density cabinets provide best-in-class performance while helping IT managers to eliminate or dramatically reduce the need for on-site data rooms to store and manage their equipment. The product line provides unique, cost-effective features which can support a wide range of IT applications while maintaining a professional design which is appropriate for both office and manufacturing environments.

Using the guidelines and techniques addressed in this white paper, the user can select the best cabinet style and accessories to customize a low-cost, high performance solution for edge-computing networking deployments. For more information, contact the author or visit our website at www.arctiv-tech.com.

About the Author

Daniel S. James II, MSEE, MBA – President, ArcTiv Technologies, LLC
Over 10 years of experience in international business and product development for Fortune 500 companies in the data center and industrial automation industries. MSEE in power systems engineering with extensive product development experience in power electronics and data center infrastructure.

Currently resides in both the USA and Taiwan.

Contact Info:
Email: daniel.james@arctiv-tech.com

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