WHITE PAPER

Micro Data Centers Can Reduce Your CAPEX and OPEX for Edge-Computing Applications

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Abstract

Common edge-computing strategies for small & medium sized businesses (SMB's) and corporate branch offices include a hybrid edge/cloud server deployment where critical, low-latency data is managed on-site and low-priority data is sent to the cloud or corporate data center. Traditionally, the on-premise servers are stored in a network closet with room-level cooling and security.

With recent advances in rack cooling technologies, Micro Data Centers (MDC's) have quickly replaced the network closet with an all-in-one solution comprising of power, cooling and environmental management. The MDC's can easily be configured to fit within the existing building infrastructure, requiring minimal investment while also providing flexibility to expand capacity in the future.

The contained, in-rack cooling system is proven to be more efficient and stable than the room-level cooling which often mixes hot and cold air while not precision regulating temperature, humidity and dust for highly sensitive equipment.

In summary, the advantages of the Micro Data Center include:

- Minimal CAPEX and room investment required
- Lower operating costs
- Greater environmental stability for edge-servers
- Eliminate the need for room level security

Key markets and applications are shown below:

Offices


High-Rise Buildings


Conference Rooms


Healthcare

Retail


Convenience Stores


Grocery Stores / Big Box


Restaurants

Manufacturing


Factory Automation


Logistics


Airports

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.

MICRO DATA CENTERS

The ArcTiv Micro Data Centers offer high-performance products which can reliably and efficiently store edge-computing and on-premise networking equipment. The MDC's are customizable and offered in a range of configurations including:

Indoor Solutions

- Single-Rack (Fan Cooled)
- Single-Rack (Integrated Cooling)
- Single-Rack (Split Cooling)
- Single-Rack (In-Row Cooling)
- Multi-Rack (Aisle Cooling)

Outdoor Solutions

- Single & Double Rack (Split Cooling)
- Container

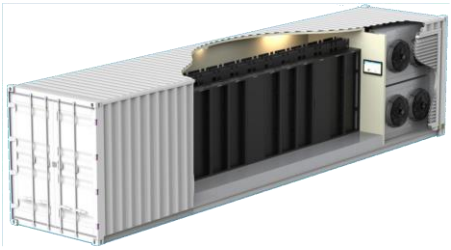
These innovative cabinet designs allow the user to select the best product for the application based on the following factors:

- Power and Airflow Capacity
- Security Features
- Cable Management
- Noise Rating
- Remote Management
- External Environment
- Latency and Cable Power Loss
- System and Installation Costs
- Future Expansion

Micro Data Centers Are Offered in Multiple Configurations To Meet Your Application Needs

The Micro Data Center (MDC) product family is designed to cover a wide range of power and cooling ratings to support your on-premise edge-computing requirements. The table below shows the standard configurations and the unique benefits of each.

Table 1. Comparison of Micro Data Centers by Product Type

MDC Configuration		Power (kW)	Benefits
Rack Rackmount, Integrated Cooling Unit		3.5	• Stored in open areas or on manufacturing floors • Lower installation costs and no external cooling unit • Easy deployment
Rack Rackmount Blower, Split Cooling		3.5 – 7	• Low-noise operation • Low-heat dissipation • Greater available RMU
Rack In-Row Cooling Unit		5 – 10	• High capacity power and cooling • Low-noise operation • Low-heat dissipation
Row In-Row Cooling Unit with Cold-Aisle Channel		10 - 40	• High-capacity power and cooling with N+1 redundancy • Use existing floorplan (no raised floors or room-cooling required) • Scalable for the future
Container In-Row Cooling with Hot-Aisle Isolation		40 - 100	• High-capacity power and cooling with N+1 redundancy • Suitable for outdoor environments • Easy deployment

Micro Data Centers Can Minimize the Total CAPEX Costs to Store On-Premise Edge-Servers

Many businesses lease office space where changing the cooling system or retrofitting a network closet or server room may be prohibitive. The Micro Data Center allows the IT manager to store the edge-servers in the most managable area for the current floorplan without modifying the building or compromising security.

No Dedicated IT Room or Cooling System

The total costs of the MDC should be compared not only to the standard open-frame or server racks, but also to the total costs of modifying the room, re-routing overhear or underfloor cabling systems and changing the cooling system. Several application example have shown that the total CAPEX investment of the network closet may be 2 to 3 times the costs of a MDC. Below is a side-by-side comparison of building out a network closet versus a single-rack MDC with integrated cooling (3.5kW).

Table 2. Total investment cost comparison of a dedicated network closet versus a Micro Data Center

Cost ($USD)	Network Closet (3.5kW room cooling)	Micro Data Center (Integrated Cooling, 3.5kW)
Building out a dedicated IT room	$5 – 15k	$0
Routing overhead cable management tray and hangers	$5k	$2k
Upgrading the room security	$1k	$0
Upgrading the room cooling system	$5k	$0
MDC or server rack system (incl. power and monitoring)	$6k	$10k
Rack system installation costs	$3k	$3k
Total	**$25 - $35K**	**$15k**

The figure below illustrates the decentralized deployment of the MDC and edge-cabinets into an open office environment.

Office Application	Benefits
	• Minimal costs to modifying the office area or building a dedicated IT room • Reduce cabling costs • No additional room cooling requirements • Minimal cable power loss (PoE applications) • Lowest latency (vs. offsite or cloud)

Pay-As-You-Grow

Micro Data Centers are scalable and can be increased or added as the business needs grow. This should be compared to building out the capacity a server room for the next 5 to 10 years when the business may only utilize a small portion during the deployment. For applications such as high-rise buildings, the costs of leasing this unused space should be factored into both the CAPEX and OPEX estimations. The MDC provides the IT manager with the flexibility to invest for the exact requirements of today while easily expanding for the future.

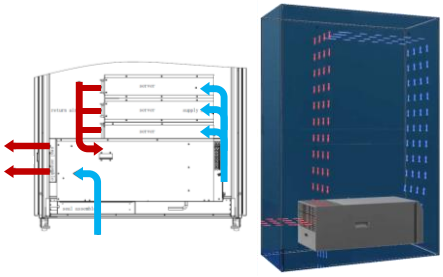
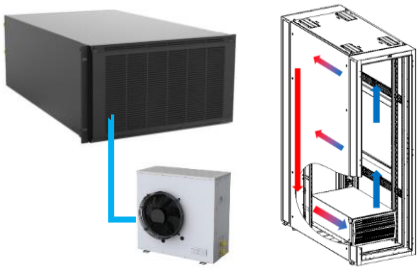
Micro Data Centers Can Minimize the OPEX Costs to Store On-Premise Edge-Servers

The power consumptions costs of the network closet or server room are often hidden within the total utility bill, but can be a major contributor to the total power consumption of a business, especially as the system needs to run continuously, 24/7, even during after business hours. Consolidating the server room to a self-contained Micro Data Center can have a dramatic improvement on the total power consumption.

Efficient Cooling Isolates the Hot and Cold Air

A typical network closet or server room will not have a cooling containment system, but usually combines open frame, network racks and server racks in a tight back-office area. The room cooling will use the current building CRAC or a dedicated room unit which mixes the hot air generated by the servers.

A more efficient design is to isolate and recirculate the hot and cold air through a dedicated A/C unit. The figure below shows how the Micro Data Center can internally isolate the hot and cold air for optimal performance.

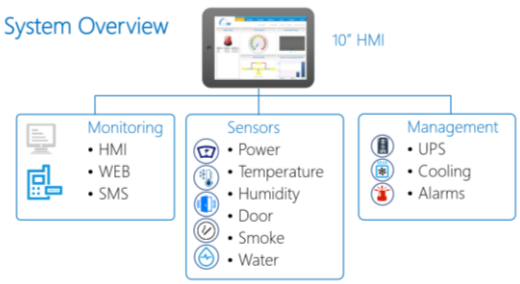
Cooling Type		Benefits
Integrated Cooling System (Rack-Mount)	Split Cooling System (Internal Blower)	• Higher A/C efficiency • Minimal room cooling required • Lower utility costs • Greater IT equipment performance and reliability
		

Turn Off the Building Cooling During Off-Work Hours

In many hot and humid regions around the world, it is often customary to turn off the building A/C during off work hours (nights and weekends). The servers may be exposed to out of range temperatures or need to be located in an isolated room with a cooling unit which can run continuously. The Micro Data Center can be located in open-office areas and run continuously, 24/7, without the need for additional room cooling so the facility A/C can be shut off during non-business hours.

Remote Management Eliminates the Need for Localized IT Managers

The MDC remote management function allows a single IT manager to access all the critical functions of the system. For businesses with many locations, this can reduce or eliminate the need for branch offices to have on-site IT managers and more efficiently operate the system from headquarters. The MDC is configured with alarms and user-defined set-points to continuously monitor and manage the power, environment and cooling system.

Remote Management Function	Benefits
Micro Data Center 	• Power, environment and cooling alarms • Real-time monitoring of critical systems • Security monitoring
Intelligent PDU (Optional) 	• Power consumption alarms • Real-time power monitoring • Remote outlet switching for device reboot

Micro Data Centers Create a Stable Environment for Edge-Servers

In hot, humid and dusty environments, edge-servers and IT equipment will require environmental management to operate within their specified ratings. The Micro Data Center provides a controlled cooling and power conditioning system to support the most sensitive IT devices. Many edge-computing applications include IP5X (indoor) and IP6X (outdoor) where a fully contained cabinet system is required.

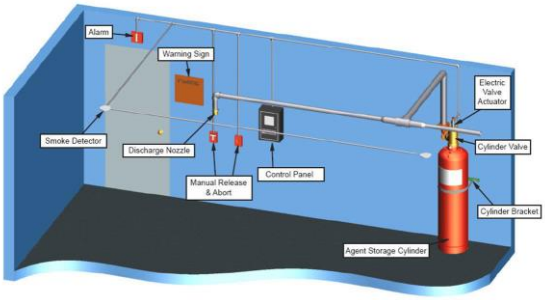
Ruggedized Cabinets can Operate in Harsh External Conditions

Micro Data Centers are designed to handle harsh conditions in both indoor and outdoor environments along with unstable power conditions. The user should consider the right MDC configuration and system options to protect the equipment as shown below.

Micro Data Center Style	Benefits
Indoor Systems 	• IP5X rated for indoor environments • Protects against dust • Adjustable internal temperature set-point • Double-pane glass for high-humidity (95% non-condensing) • Automatic overtemperature door release • Internal rackmount fire suppression • Surge suppression • Power conditioning UPS • N+1 redundant power and cooling options (Row Options)
Outdoor Systems 	• IP6X rated for outdoor environments • Can be located remotely • Adjustable internal temperature set-point • Internal fire suppression system • Surge suppression • Power conditioning UPS • N+1 redundant power and cooling options

Integrated Fire Suppression to Protect Your Equipment

The fire suppression system is available for all MDC's and is offered in a rackmount (1U or 3U) or containerized system. The rackmount fire suppression can auto-sense and release inside the MDC before it is spreads to the room and could potentially trigger the building sprinkler system. The table below highlights the configurations and features for each option.

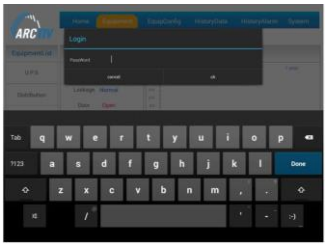
Fire Suppression	Benefits
3U Rackmount Suppression 	• Self-detecting suppression system • Environmentally friendly (R410A) • Safe for the equipment • Rack-mount (1 and 3U options) • Sends alarm via MDC controller
Container Fire Suppression System 	• Self-detecting suppression system • Environmentally friendly (R410A) • Safe for the equipment • Sends alarm via MDC controller

Micro Data Centers Eliminate the Need for Room-Level Security

An advantage of a network closet or server room is the added layer of room security to restrict access to critical IT devices. Micro Data Centers can combine the security access control of an IT room with the on-premise flexibility of a cabinet or enclosure.

Access Control

The Micro Data Center includes a 3-in-1 access control system which combines fingerprint, passcode and RFID card options. When the doors are released, the IT manager will be remotely alerted via an internal door sensor. The doors are made of tempered glass so the equipment is visible but are not accessible. In addition, both the on-screen HMI and remote login are password protected.

3-In-1 Access Control	HMI & Remote Login Password Protection
	

Automatic Door Operation

The MDC doors are controlled through an electronic locking system which can be auto-released during an internal fire or over-temperature. In this event, the front door will release to allow the open room air to feed the servers until the system can be maintained.

Double-Frame Front Door (Optional)	Description
	The MDC can be upgraded to include a unique double-framed front door which combines a tempered glass inlet with a vented base door. In the event of an internal overtemperature, the glass inlet door will auto-release while the vented door will remain locked and allow the equipment to breath the room air while restricting access.

In-Rack Video Monitoring System

As the MDC's are often located in remote offices, room and rack-level video surveillance can provide full security to ensure the system is only accessible to qualified personnel. Each MDC can be equipped with video monitoring and NVR storage.

In-Rack Monitoring	Description
	Top of rack or internal video cameras can be installed along with a NVR system to be remotely accessed by the IT manager.

Conclusions

ArcTiv Micro Data Centers offer an all-in-one power, cooling and environmental management system which can be customized to meet the requirements of on-premise, edge-computing applications. By eliminating the need for a dedicated room, raised floors or modifying the building cooling system, the total CAPEX investment is significantly reduced and allows for scalable expansion in the future. The wide-range of Micro Data Centers, including indoor, outdoor and container systems, provide a turnkey infrastructure solution which is easily deployed to get your network running quickly with the lowest installation costs.

Using the recommendations addressed in this white paper, the user can select the best solution based on the building and equipment requirements. For more information, contact your local sales rep or visit our website at www.arctiv-tech.com.

About the Author

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Over 15 years of experience in international business and product development for Fortune 500 companies in the data center, industrial automation and defense industries. MSEE in power systems engineering with extensive product development experience in power electronics and data center infrastructure.

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