



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

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

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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
Cabinet (Fan-Cooled, Indoor)	< 2.2kW	<ul style="list-style-type: none"> • Lowest cost • Wide range of cabinet styles (see Edge-Series Cabinets) • Wall mounted or stored in compact areas
Single-Rack (Integrated Cooling, Indoor)	2.5 – 5.5	<ul style="list-style-type: none"> • Stored in open areas or on manufacturing floors • Lower installation costs and no external cooling unit • Easy deployment
Single-Rack (Split Cooling, Indoor)	3.5 – 5.5	<ul style="list-style-type: none"> • Low-noise operation • Low-heat dissipation • Greater equipment RMU capacity
Single-Rack (In-Row Cooling, Indoor)	5 – 7.6	<ul style="list-style-type: none"> • High density power and cooling • Low-noise operation • Low-heat dissipation
Multi-Rack (Aisle Cooling, Indoor)	10 - 40	<ul style="list-style-type: none"> • High-capacity power and cooling • Use existing floorplan (no raised floors or room-cooling required) • Scalable for the future
Single & Double-Rack (Split Cooling, Outdoor)	3.5 – 7.6	<ul style="list-style-type: none"> • Suitable for harsh environments • Easy deployment • High density power and cooling
Container (Wall Cooling, Outdoor)	40 - 100	<ul style="list-style-type: none"> • Suitable for harsh environments • Easy deployment • High-capacity power and cooling

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 manageable 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 overhead or underfloor cabling systems and changing the cooling system. Several application examples 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)
Creating or modifying 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
Adding room-level fire suppression	\$2k	\$0
MDC or server rack system (incl. power and monitoring)	\$6k	\$10k
Rack system installation costs	\$3k	\$3k
Total	\$27 - \$37K	\$15k

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



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.

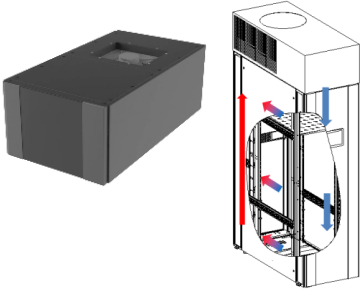
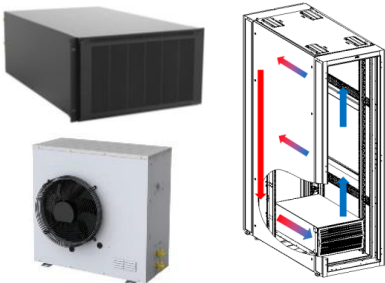
Micro Data Centers Can Minimize the OPEX Costs to Store On-Premise Edge-Servers

The power consumption 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.

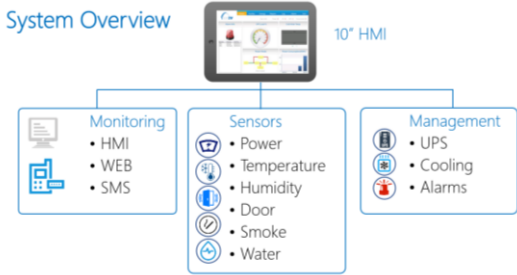

Cooling Type		Benefits
Integrated Cooling System (Top-Mount) 	Split Cooling System (Internal Blower) 	<ul style="list-style-type: none"> • Higher A/C efficiency • Minimal room cooling required • Lower utility costs • Greater IT equipment performance and reliability

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.


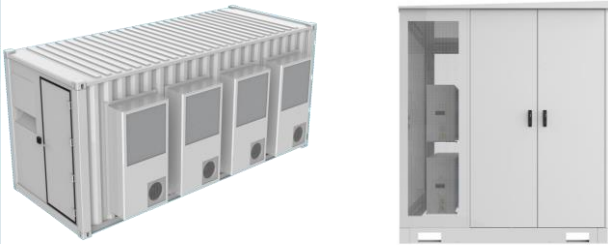
Remote Management Function	Benefits
Micro Data Center 	<ul style="list-style-type: none"> • Power, environment and cooling alarms • Real-time monitoring of critical systems • Security monitoring
Managed PDU (Optional) 	<ul style="list-style-type: none"> • Power consumption alarms • Real-time power monitoring • 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.


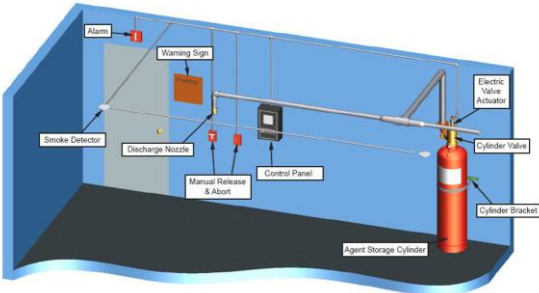
Ruggedized Cabinets can Operate in Harsh External Conditions

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
<p>Indoor Systems</p> 	<ul style="list-style-type: none"> • 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
<p>Outdoor Systems</p> 	<ul style="list-style-type: none"> • IP6X rated for outdoor environments • Can be located remotely in extreme weather conditions • 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
<p>3U Rackmount Suppression</p> 	<ul style="list-style-type: none"> • Self-detecting suppression system • Environmentally friendly (R410A) • Safe for the equipment • Rack-mount (1 and 3U options) • Sends alarm via MDC controller
<p>Container Fire Suppression System</p> 	<ul style="list-style-type: none"> • 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.

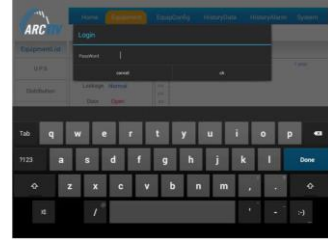
Access Control

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 breathe 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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