

Most organization's data centers that were designed before 2000 were we built based on technologies did not exist or were not commonplace such as:

- > Blade Servers and 1U Low Profile**
- > Servers w/ DualQuad Core Processors**
- > VM Virtual Machines**
- > SAN & NAS Storage Arrays**
- > VOIP**

Result: Datacenters that were built only 7 years ago were not designed to support today's High-Density Hardware requirements, much less tomorrow's constantly changing standards.

The result is that these design criterion and performance metrics have radically changed, directly affecting data center design factors such as:

Computing Capability per sq ft (i.e. MPS processing power)

Storage per sq ft (Gigabytes – Terabytes)

Power & Cooling per sq ft (Watts)

Infrastructure Scalability - Designing with the ability to scale up or down with constantly changing systems and demand while maintaining energy efficiency

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Sample Data Center Power Requirements

| | Low Density 1-2 KVA | Med Density 3-5 KVA | HI Density 6-10 KVA | EXT Density 12-20 KVA+ |
|------|------------------------|------------------------|------------------------|---------------------------|
| Cabs | Total KVA | | | |
| 5 | 5-10 | 15-25 | 30-50 | 60-100+ |
| 8 | 8-16 | 24-40 | 48-80 | 100-160+ |
| 15 | 15-30 | 45-75 | 90-150 | 180-300+ |
| 25 | 25-50 | 75-125 | 150-250 | 300-500+ |

Sample Power & Cooling Requirements

High Density 1 U Servers

Information based on published specification

| 1U Servers | Each 1 U Server | | U | Rack of 40 Servers | | COOLING TONS |
|-----------------------|-----------------|-------|---|--------------------|--------|-----------------|
| | WATTS | BTUs | | WATTS | BTUs | |
| Model | | | 1 | | | |
| Dell Power Edge 850 | 345 | 1,173 | 1 | 13,800 | 46,920 | 3.9 |
| IBM eServer X306 | 350 | 1,190 | 1 | 14,000 | 47,600 | 4.0 |
| HP Proliant DL360 | 275 | 935 | 1 | 11,000 | 37,400 | 3.1 |
| Sun Fire X2100 Server | 300 | 1,020 | 1 | 12,000 | 40,800 | 3.4 |
| | | | 1 | | | |
| Dell Power Edge 1850 | 550 | 1,870 | 1 | 22,000 | 74,800 | 6.2 |
| IBM eServer X336 | 585 | 1,989 | 1 | 23,400 | 79,560 | 6.6 |
| HP Proliant DL360R4 | 535 | 1,819 | 1 | 21,400 | 72,760 | 6.1 |
| Sun Fire X4100 Server | 550 | 1,870 | 1 | 22,000 | 74,800 | 6.2 |

Challenge ... for Data Centers based on 50-100 Watts Sq Ft

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20h 21h 22h 23h 24h 01h 02h 03h 04h 05h 06h 07h 08h 09h 10h 11h 12h 13h 14h 15h 16h 17h 18h 19h

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Sample Power & Cooling Requirements

High Density Blade Servers

| Blade Servers | | | | | | COOLING |
|-------------------------------|-------------------------------|--------|----|--------|---------|---------|
| Model | WATTS | BTUs | U | WATTS | BTUs | TONS |
| Dell | Rack of 4 Chassis (40 Blades) | | | | | |
| DELL PowerEdge 1855 | 5,000 | 17,000 | 7U | 20,000 | 68,000 | 5.7 |
| IBM | Rack of 4 Chassis (56 Blades) | | | | | |
| IBM BladeCenter=H Class | 8,000 | 27,200 | 9U | 32,000 | 108,800 | 9.1 |
| HP | Rack of 5 Chassis (40 Blades) | | | | | |
| HP BladeSystem p-Class | 4,500 | 15,300 | 6U | 22,500 | 76,500 | 6.4 |
| SUN | 1 Server (72Proc) | | | | | |
| Sun Fire E25K Server | 25,000 | 85,000 | ~ | 25,000 | 85,000 | 7.1 |
| Weber Genesis Silver Barbeque | | | | 26,000 | | 2.2 |



Information based on published specification

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Challenge ... It's Very Very Hot in here

My Servers are Cooked

Heat Load Per Cabinet

**14 Servers@550W =7.5KW
=26,000 BTUs = 1 Weber Grill !!**

**28 Servers@550W =15KW
=52,000 BTUs = 2 Weber Grills !!**

**42 Servers@550W =22.5KW
=78,000 BTUs = 3 Weber Grills !!**



Information based on published specification

20h

21h

22h

23h

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01h

02h

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15h

16h

17h

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Compact Four-Way
Supremacy is Here

NOW WITH 550 WATTS OF POWER !!!



High Power Density

Watts per Rack ~

2KW-5KW-10KW~+30KW !!!!!

Watts per Sq. Foot ~

100W-150W-200W~+300W!!!!

Challenge...

Scalable UPS Power & COOLING !!

Information based on published specification

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IBM BladeCenter

H Class

9U = 14 Blades

Power=8,000VA

Heat=27,200 Btu/hr

with 4 per 42U rack

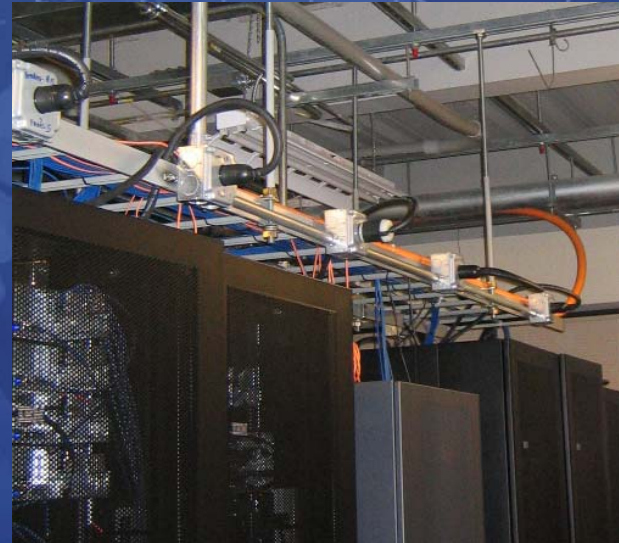
=32,000KVA Power

=105,000 Btu/hr

=9 Ton Cooling!!

Traditional-Data Center **Little/NO Flexibility**

- Fixed UPS Size
- Pre-build for Maximum Expected Loads



- Hardwire
- Electrical Power Distribution

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20h 21h 22h 23h 24h 01h 02h

03h 04h 05h 06h 07h 08h

12KW



Flexibility

- Traditional- Fixed Hardwire Electrical Distribution

+ **Modular** – Flexible Power Whips and Plug-in PDUs

= Easy Reconfiguration for Changing Loads & Equipment Types

Expandability & Growth

- Traditional- -Pre-build for Maximum (Traditional ~ Maximum Loads)
- +**Modular** = Growth On-Demand

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Sample Data Center Power Costs

| KW Hour | Day | Month | Year | 5 Years |
|---------|-----|-------|-------|---------|
| 1 | 24 | 720 | 8,760 | 43,800 |

| Cost Per KWH | Day | Month | Year | 5 Years |
|--------------|---------|----------|-----------|-------------|
| \$ 0.10 | \$ 2.40 | \$ 72.00 | \$ 876.00 | \$ 4,380.00 |

| Cost Per 100 KWH | Day | Month | Year | 5 Years |
|------------------|-----------|-------------|--------------|---------------|
| \$ 10.00 | \$ 240.00 | \$ 7,200.00 | \$ 87,600.00 | \$ 438,000.00 |

| | | | | |
|----------------|-----------------|------------------|--------------------|---------------------|
| Save 5% | \$ 12.00 | \$ 360.00 | \$ 4,380.00 | \$ 21,900.00 |
|----------------|-----------------|------------------|--------------------|---------------------|

Cooling

Traditional-Data Center **Little/NO Flexibility**

-Fixed A/C Unit Size

-Pre-build for Maximum Expected Loads



Traditional CRACs were not designed to cool High-Density Racks. They can actually cost 100-200% more to run than the server loads, and still not properly cool the racks.

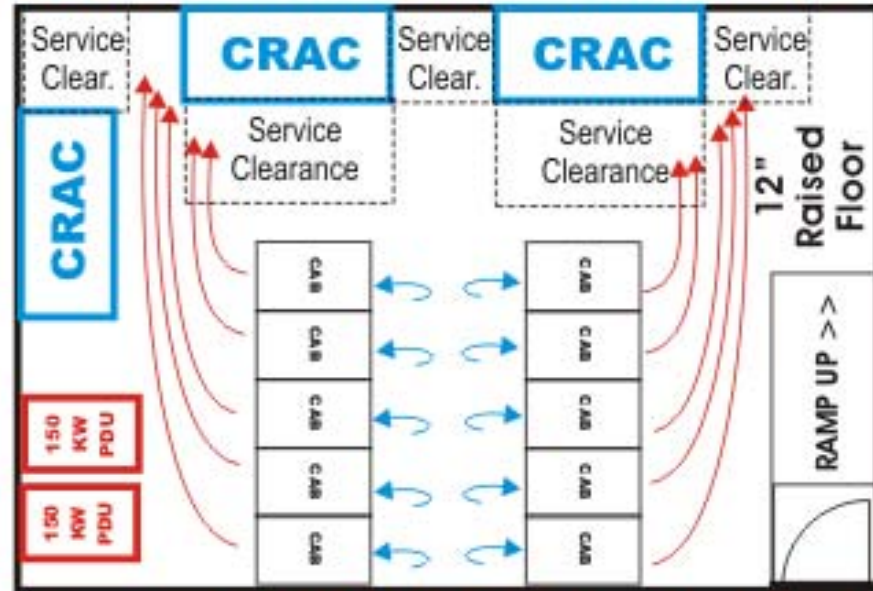
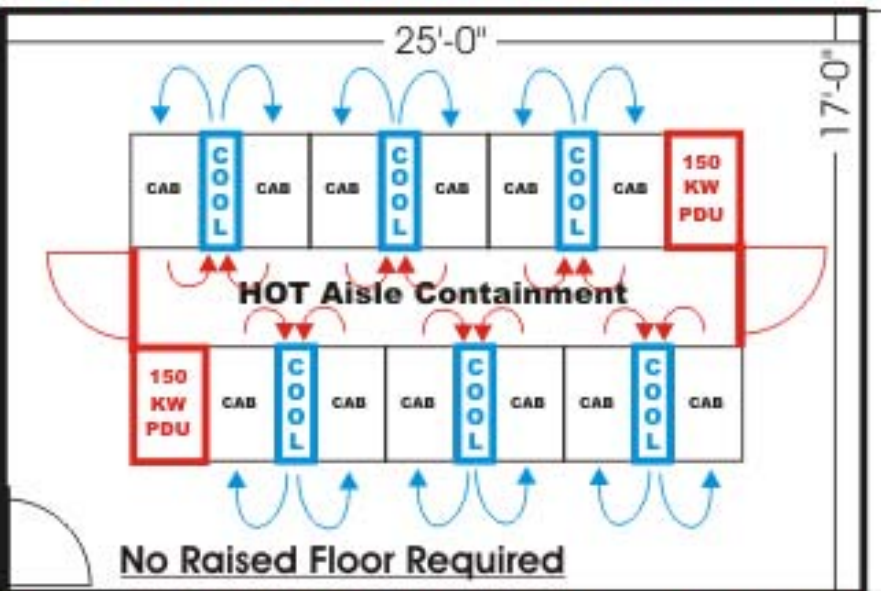
IN-ROW Cooling Technology

VS

Traditional Cooling Technology

High Density Hot-Aisle Containment

Cool Air From Perforated Floor Tiles



Power=150KW 100% Redundant (2N)
Cooling=150KW (N+1) 6 x 30KW
Payload Space=12 Cabinets=504U
Power & Cooling per Cab=12.5KW
Floorspace=17' x 25''=425 Sq. Ft.
No Raised Floor Required

Power=150KW 100% Redundant (2N)
Cooling=80KW (N+1) 3 x 40KW
Payload Space=10 Cabinets=420U
Power per Cab=15.0KW
Cooling per Cabinet Limited to 5KW*
Floorspace=17' x 25''=425 Sq. Ft.

UPS is External for both examples

**Cooling Limited by Airflow*

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Sample Data Center Cooling Power Costs

| Cost Per 100 KWH | Day | Month | Year | 5 Years |
|------------------|-----------|-------------|--------------|---------------|
| \$ 10.00 | \$ 240.00 | \$ 7,200.00 | \$ 86,400.00 | \$ 432,000.00 |

Power Cost for Cooling / percent of Electrical Load=100KW

| % of Load | KW | Month | Year | 5 Years |
|-----------|-----|--------------|---------------|-----------------|
| 50% | 50 | \$ 3,600.00 | \$ 43,200.00 | \$ 216,000.00 |
| 75% | 80 | \$ 5,400.00 | \$ 64,800.00 | \$ 324,000.00 |
| 100% | 100 | \$ 7,200.00 | \$ 86,400.00 | \$ 432,000.00 |
| 150% | 150 | \$ 10,800.00 | \$ 129,600.00 | \$ 648,000.00 |
| 200% | 200 | \$ 14,400.00 | \$ 172,800.00 | \$ 864,000.00 |
| 300% | 300 | \$ 21,600.00 | \$ 259,200.00 | \$ 1,296,000.00 |

By reviewing the design and equipment of your data center, proper support for High-Density systems can be achieved, while significant energy saving can be realized.

Please contact us to discuss your requirements

1-800-392-3299 or info@naat.com

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