# The IBM Data Center Family® -

## IBMs answer on today's increasing challenges on energy efficiency, modularity, scalability and cost effectiveness

Maite Frey, Business Development Leader CEE

Advanced Micro Devices, Inc., Pensando Systems, Inc. - Ex. 1014, Page 000001
IPR2025-00223 (Advanced Micro Devices, Inc., Pensando Systems, Inc. v. Concurrent Ventures, LLC, XtreamEdge, Inc.)

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# agenda

| | |
|---|---|
| *1* | Today's challenges –<br>The data center tipping point |
| *2* | The IBM Data Center Family ®<br>Scalable Modular Data Center – Enterprise Modular Data Center – Portable Modular Data Center – High Density Zone |
| *3* | Reference of a Data Center Family Solution:<br>KIKA Leiner SMDC |

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# Key messages

- Energy efficiency is a global issue with impact today – and will have a greater impact in the future
- Energy efficiency is a key metric to optimize IT operational efficiency
- Simple actions can yield significant cost savings
- We are deploying solutions with clients and within IBM
- We can help you determine how to get started

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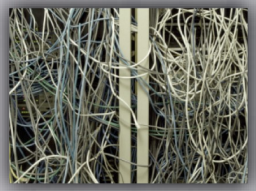
# Facing new pressures: data centers are at a tipping point

**According to Gartner, "50 percent of current data centers will have insufficient power and cooling capacity to meet the demands of high-density equipment."[1]**

**Increased computing demand**

**Changing cost dynamics**



**Data center lifecycle mismatch**

*Energy usage is a common theme impacting IT capability.*

1. Gartner, *Data Center Power and Cooling Challenge*, Gartner 25th Annual Data Center Conference presentation, Michael A. Bell, December 2006.

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# Increased computing demand—its impact on energy usage

**According to Gartner, "The underlying consumption of energy in large data centers to power and cool hardware infrastructure is likely to increase steadily during the next ten years."[2]**

**Increased computing demand**

Low-cost, scalable technologies drive opportunity for new applications—server installed base is expected to increase.

**Changing cost dynamics**

Regulatory actions drive the need for resiliency with the Sarbanes-Oxley Act, the Health Insurance Portability and Accountability Act (HIPAA) and Basel II.

**Data center lifecycle mismatch**

In the next decade, server shipments will multiply by 6, while storage will multiply by 69.

—IBM/consultant studies

2. Gartner, *Data Center Power and Cooling Scenario Through 2015*, Rakesh Kumar, March 2007.

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# Changing cost dynamics—the impact of rising energy usage

**"... If current trends continue till 2012, best-case estimates show that powering and cooling a server will cost three times as much as purchasing the hardware."[3]**

Increased computing demand

**Changing cost dynamics**

Data center lifecycle mismatch

Per square meter, data center energy costs are 10 to 30 times those of typical office buildings.[4]

Reducing enterprise costs is now the #2 CIO priority in 2009.

Global electricity prices are increasing 10-25% per year.

Data center operating costs are 3-5 times the capital costs over 20 years.

3. Munir Kotadia and Ella Morton, "Moore's Law can't stand the heat," *ZDNetAustralia,* April 26, 2007, http://www.zdnet.com.au/insight/hardware/soa/Moore-s-Law-can-t-stand-the-heat/0,139023759,339275034,00.htm; The Uptime Institute, *Data Center Energy Efficiency and Productivity*, Kenneth Brill, January 2007.
4. William Tshudi, Evan Mills, Steve Greenberg, Lawrence Berkeley National Laboratory and Peter Rumsey, "Measuring and Managing Data Center Energy Use: Findings—and resulting best practices—from a study of energy use in 22 data centers," *HPAC Engineering*, March 2006.
5. Gartner, Meeting the Challenge: the 2009 CIO agenda, December 2008
6. Energy Information Administration, 2001-2008; IBM analysis

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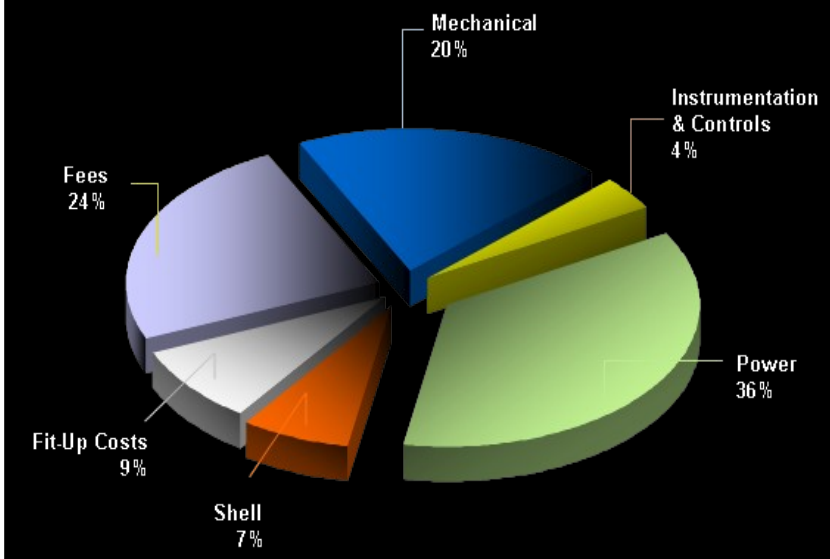
# Data Center Challenges (COST) – Design new infrastructure to be responsive to change

## Data Center capital costs

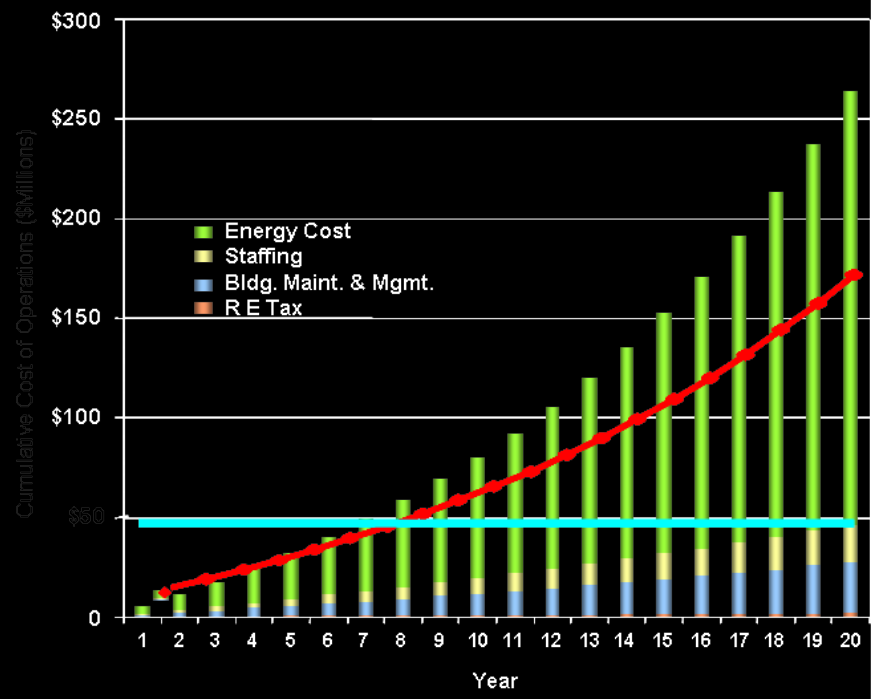
*60% costs from energy related components*




*Source: IBM Estimates*

## Data Center operating costs

*75% costs from energy use*




*Source: IBM Estimates, $50 Million DC*

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# Lifecycle mismatch—the impact of rising energy usage

**Eighty-seven percent of data centers were built before 2001.[7]**

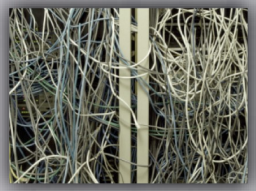
**Increased computing demand**

New, low-cost technologies such as blades consume 20 to 30 kilowatts (kW) of power per rack, when the average data center is designed to support 2 to 3 kW per rack.[8]

**Changing cost dynamics**

Twenty-nine percent of organizations surveyed said power and cooling issues have affected server purchases.[9]

Clients identify power or cooling as the most significant problem they face.[10]



**Data center lifecycle mismatch**

Fifty-seven percent of organizations surveyed indicated they planned data center consolidations in the next 12 months; 49 percent planned to build new data centers in the next 18 months.[11]

7. Nemertes Research, *Architecting and Managing the 21st Century Data Center*, Johna Till Johnson, president and senior founding partner at the IT: Roadmap, Boston conference in 2006.
8. Based on IBM experience.
9. Ziff Davis Media, *Power Consumption and Cooling in the Data Center: A Survey*, November 2005.
10. Based on IBM experience.
11. Nemertes Research, *Architecting and Managing the 21st Century Data Center*.

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# Data centers are at a tipping point and energy costs and usage are the drivers

### *Increased IT Demand*

- Server growth 6X, Storage growth 69X this decade[1]
- Average power consumption per server quadrupled from 2001-2006[2]
- By 2011, blades will represent 26% of all server shipments[3]

### *Changing cost pressure*

- Data centers energy use doubling every 5 years[3]
- New data center construction costs are increasing - $30 to $50 Million for a 2K square meter data center
- Operating costs = 3x capital costs over 20 years

### *Data center lifecycle mismatch*

- 78% of data centers are > 7 years old[4]
- Technology densities are growing 20x this decade[5]
- 33% of managers expect data centers to last 30 years[6]

***Meet Business & IT Growth***

***Align capital and operating costs to provide flexibility as capacity is needed***

***Reduce risk by providing more available and predictable data center operations***

1. IBM and Consultant Studies
- 2. Gartner, The Data Center Power and Cooling Challenge, David Cappuccio, November 2007.
3. IDC Worldwide Blade Server 2008-2011 Forecast, February 2008, IDC #210229
3. Koomey, February 2007
4. Gartner Survey Suggests Extensive Data center Expansion plans on the Horizon, G00154962, mike Chuba, February 200
5. ASHRAE (find source)
6. IDC The datacenter evolution: Technologies, Designs, People and Green, Michele Bailey, 2008

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# Data center actions can significantly improve costs, resiliency, and flexibility to meet changing requirements

**Extend** the life of an existing Data Center infrastructure

- 23% average energy savings from audits
- Up to 35% less cost to adopt new technology
- 30-70% TCO savings from virtualization
- Over 30% savings from energy efficient technology

**Rationalize** the Data Center infrastructure across the company

- Up to 50% reduction in operational costs

Design new infrastructure to be **responsive** to change

- Defer 40-50% capital and operational costs with a modular Data Center approach
- Save up to 50% operational costs from energy efficient design

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# IBM has the solution to address your data center concerns

## IBM can help provide:

- An energy-efficient data center solution
- A data center solution with a design/build cost approximately 15 percent lower than that of a traditional raised-floor data center solution
- Reduced daily operating costs
- Rapid data center deployment: design/build in approximately 8 to 12 weeks
- Power and cooling capacities designed for the load
- A flexible solution that can grow as your needs grow
- A secure server environment

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# IBM offers a comprehensive portfolio of services to help you optimize your IT facilities around the world

## IBM Data Center and Facilities Strategy Services

Helping you identify your requirements, capabilities and capacities, and define your optimal "green" and high-resiliency options

### IBM IT Facilities Assessment, Design and Construction Services

Providing capabilities to design and build new data centers or improve existing ones

### IBM IT Facilities Consolidation and Relocation Services

Helping you take advantage of savings and redundancy through consolidation and relocation, leveraging IBM's local presence around the globe to help minimize risk

### IBM Specialized Facilities Services

Providing leadership on design and construction requirements for state-of-the-art clean rooms, intelligent/green buildings and trading floors

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# Design for flexibility with modular data centers

***IBM's Data Center Family® solutions align to your business and cost objectives***

Scalable modular data center

- Turnkey data center for 50-250 dynamic 12 weeks
- Standardized design
- Rad 500 450

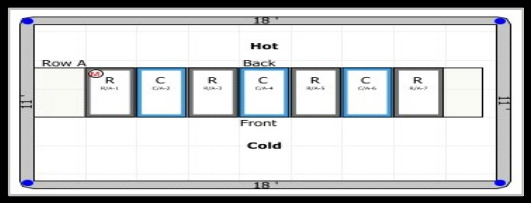
Enterprise modular data center

- 20% less cost than traditional data center, multi-centers
- Designed for high availability
- Leadership energy efficiency — 66% less vertical infrastructure to support high density deployment than

Portable modular data center

- Delivered to high availability
- Vendor support
- 15-30% improved efficiency
- "Plug and play" temporary and 25% data deployment

High density zone




- Rapid efficiency
- 25% data

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# Scalable Modular Data Center

The scalable modular data center is designed to provide conditioned power, cooling, equipment racking, security and monitoring in one comprehensive package.

APC Infrastructure and IBM Services offer a turn-key solution for small to medium environments which is fully deployed providing a highly secure and resilient Data Center infrastructure. No raised floor required.

Most of the infrastructure is within the rows of racks, helping to increase efficiency and save floor space.

**SMDC Elements**

Equipment Racks
- Racks for server, storage and other IT equipment
- Width: 600 mm and 750mm
- Height: 1070 mm and 1200 mm
- 19” (RoHS)
- 42 and 48 units (height)

UPS and Battery Solution
- Modular design, scalable in 10kW or 16kW steps
- Scalable during operation
- More than 90% efficiency
- Easy, fast maintenance

Cooling
- Chilled water and air cooling
- Short air flow ways
- High equipment density
- Intelligent cooling (up to 70 Kw per Rack)
- Hot aisle configuration

| Benefits | | |
|---|---|---|
| **Cost efficiency** | • Reduced costs for design and construction<br>• Reduced operational costs<br>• Highest scalability and flexibility<br>• Up to 40 % savings in energy consumption<br>• Helps enable rapid, cost-effective deployment in virtually any working environment | |
| **Energy efficiency** | • Designed for maximum energy efficiency, including hot aisle/cold aisle configuration<br>• Supports heat and power loads of high-density computing technologies<br>• Optimized cooling<br>• Holistic energy and cooling concept | |
| **Space efficiency** | • Installation in almost any surrounding<br>• No raised floor or ceiling construction<br>• Space saving high density architecture<br>• Easy and fast change of location | |
| **Time efficiency** | • Ready to use in 8 to 12 weeks<br>• Instantly deployable<br>• Easy and fast scalability<br>• Trouble-free change of location | |

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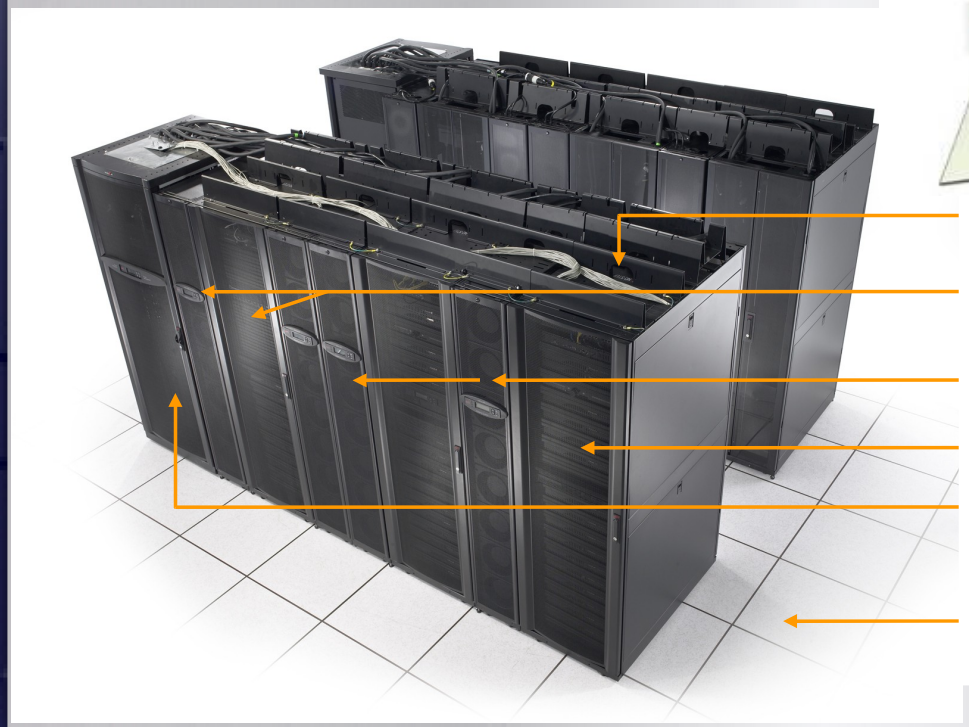
# With the scalable modular data center, most of the infrastructure is within the rows of racks, helping to increase efficiency and save floor space



- **Cabling**
- **Uninterruptible power supply (UPS)/batteries**
- **In-row cooling**
- **Equipment racks**
- **UPS power distribution/bypass**
- **Non-raised-floor environment**

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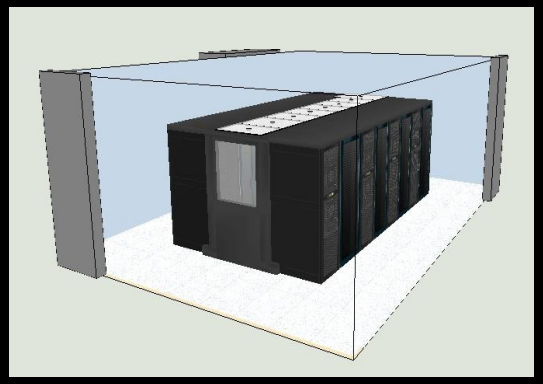
SMDC is a highly secure and resilient Container Solution



A hot aisle containment option can be utilized to prevent hot exhaust air from mixing with the cooled supply air and thereby increasing cooling capacity and efficiency.

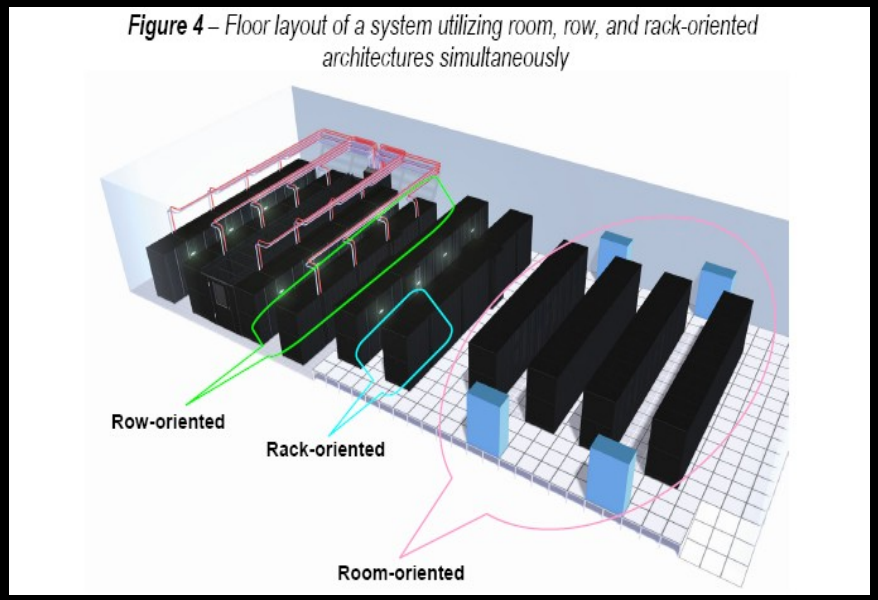
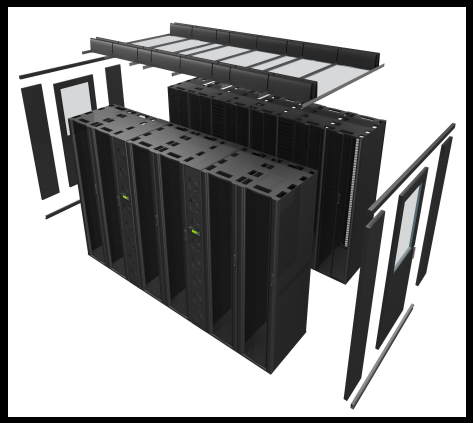



*Figure 4 – Floor layout of a system utilizing room, row, and rack-oriented architectures simultaneously*



- Multiple cooling methods can be mixed in one SMDC solution
- Cooling methods are rapidly and individually deployable
  - Row-oriented
  - Rack-oriented
  - Room-oriented

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# Enterprise Modular Data Center

The Enterprise Modular Data Center (EMDC) is well suited for organizations who need to design and build an efficient enterprise data center that can accommodate future expansion with minimal disruption to operations, reduce capital and operational costs and ensure high availability.

IBM provides a proven, reliable and standardized data center design that allows capacity increases on demand, capital and operational cost deferral, reduction in design through build time while helping to eliminate unpredictable operations.

| Benefits | | |
|---|---|---|
| **Cost Efficiency** | • Defer capital investment and operational costs until capacity is required<br>• Building out in a scalable modular methodology helps lower operational expenses by up to 50 percent<br>• Building out in a modular fashion helps lower capital costs by up to 40 percent | |
| **Energy Efficiency** | • Allows 12 times or greater power and cooling capacity growth within a data center<br>• Operating at an attractive energy efficiency data center infrastructure efficiency (DCiE) of 66 percent or better.<br>• Reduce energy consumption by “right sizing.” | |
| **Space Efficiency** | • Expansion without downtime to operations<br>• Standardized, independent modular design ensures high data availability<br>• Deployment of additional modules if required | |
| **Time Efficiency** | • 25% faster deployment than custom approach | |

- Helps enable rapid, cost-effective deployment for data center expansion and new build
- Readily scales to meet changing requirements from 500m² up to 2000m²
- Provides a modular solution for chilled water, CRAC’s or air handlers depending on raised floor space, modular UPS, environmental monitoring and overhead cabling
- Designed for maximum energy efficiency, PUE of 1.5-1.8
- Designed for IBM availability level 3
- The service produce reduces the time from design to commissioning by 25%

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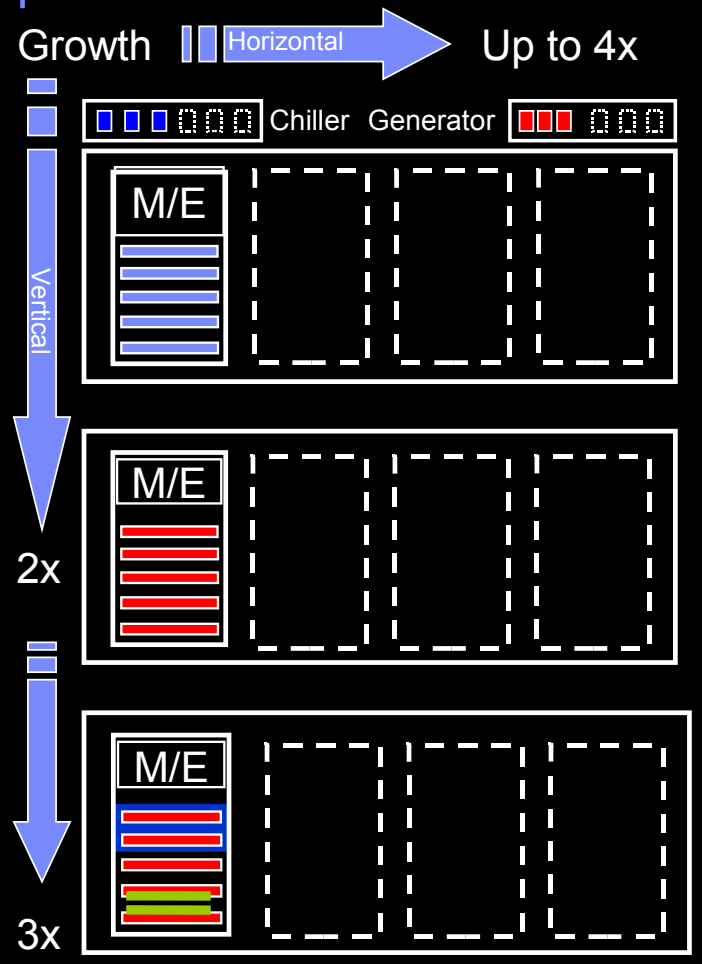
# Enterprise Modular Data Center allows for flexibility in capital and operational costs to address unpredictable IT requirements




***Meet unpredictable business and I T growth***

- Enable 3x density growth at one-third the cost to retrofit
- Up to 12x power and cooling capacity growth

***Align capital and operational cost to I T needs***

- Defer up to 40% capital costs until capacity required
- Defer up to 50% operational costs as capacity is required
- 50% energy savings compared to existing data center

***Provide available and predictable operations***

- Provide expansion without downtime to operations
- Improve facilities management through standardized operating environment

***Design to an "open architecture"***

- Integrated leading vendor's technology capabilities
- Opportunities for OEM innovation and enhancements

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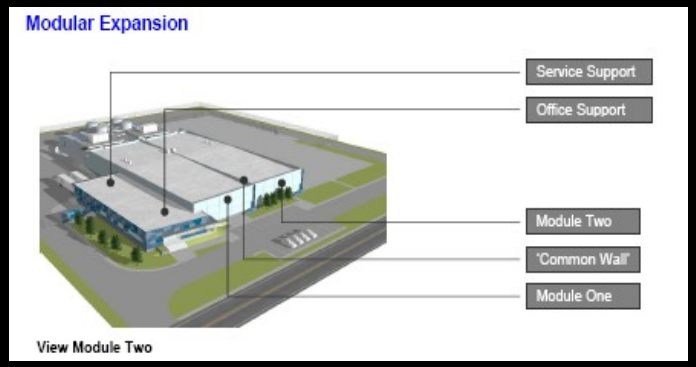
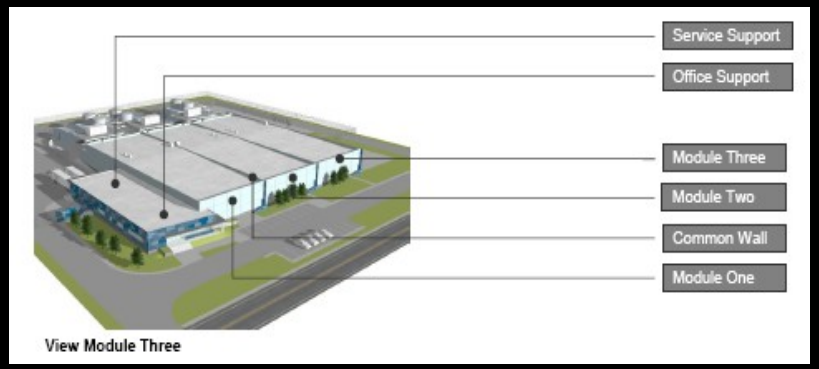
# The modular expansion capabilities of the Enterprise Modular Data Center



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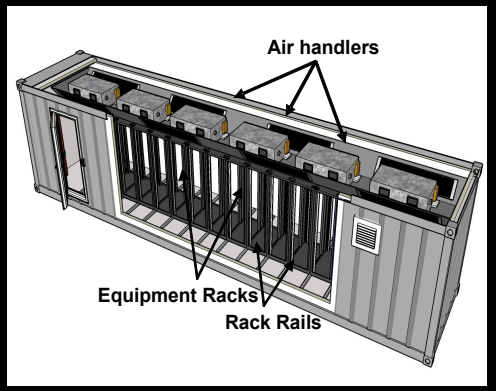
# Portable Modular Data Center

***Rapid deployment of a standardized, repeatable data center environment for installation in any location around the world***

**Solution**

- Complete turn key, fully-functioning "plug and play" data center including UPS and cooling capacity
- The data center in a container-like environment is available in 20, 40, and double-wide 40 feet containers.
- Designed, built and drop-shipped in as short as 12-14 weeks
- Portable - temporary and remote data centers
- Designed for high availability, Level 3 design
- Leadership energy efficiency target of 66-77%
- Secure operational environment
- Open architecture – multi-vendor support




| Benefits | | |
|---|---|---|
| **Cost efficiency** | • Approximately 35% cheaper than trying to retrofit existing floor space<br>• Lower TCO than new data center build | |
| **Energy efficiency** | • Modular and scalable for easy growth<br>• Designed dor high density environments<br>• Leadership energy efficiency: 77% DCiE | |
| **Space efficiency** | • Up to 50% less space required<br>• Focused on portability, remote locations<br>• Install data center where you want and need it | |
| **Time efficiency** | • Rapid deployment in 12-14 weeks from plan to start-up<br>• Turn-key data center | |

Electrical Room

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# Features of the Portable Modular Data Center

| Solution | Features | Uses |
|---|---|---|
| **Portable modular data center** | **Complete**, fully functional, stand-alone data center | **Remote data center** |
| | **Flexible** infrastructure designs, not a "one-size-fits-all" approach | |
| | **Quick** to deploy, turnkey data center | **Cloud and Web 2.0** |
| | **Locate** in nonstandard locations(cities, suburbs, deserts, mountains, arctic regions, etc.) | |
| | **Lower TCO** than new data center build | **Temporary data center** |
| | Designed for high-density technology and **open architecture** for multivendor support | |
| | **Standard data center design capabilities**, including high availability and energy efficiency | **Mobile data center** |

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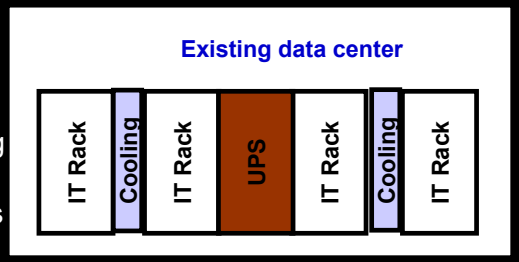
# High Density Zone

## *Solution to address your high density IT equipment needs in your existing data centers*

IBM's High Density Zone allows clients to support higher density servers in their existing data center while quickly implement an integrated, energy efficient solution. It provides a "plug and play", modular racking architecture which incorporates a self-contained cooling and power infrastructure solution.

High Density Zones increase the ability to meet IT growth – helping to keep the business running in the existing data center space.




- Leverages best practices in data center design with hot aisle/cold aisle configuration for improved energy efficiency
- Provides a modular solution with standard 19" racking, close-coupled cooling, and can include power and monitoring capabilities
- Targeted to support 5 to 25 kW/rack (and greater) capacities to extend your ability to support new high density technology in existing facilities
- Close-coupled cooling provides "right-sized" cooling, directly at the heat source, to meet the real time demands of the IT hardware
- Allows for rapid implementation of high density zone solution in existing data center using existing chilled water capacity

| Benefits | | |
|---|---|---|
| **Cost efficiency** | • Approximately 35% cheaper than trying to retrofit existing floor space | |
| **Energy efficiency** | • Potential to extend the life of the existing data center by supporting high heat loads in traditionally designed data centers<br>• A flexible solution that can grow as your high density IT equipment needs grow and provide for energy efficiency (from a single rack to hundreds) | |
| **Space efficiency** | • Readily scales to meet changing requirements by adding additional cabinets/cooling units/zones (from one to hundreds of cabinets) | |
| **Time efficiency** | • Rapid deployment in 8 to 12 weeks<br>• Non-disruptive implementation at the existing site for the physical infrastructure installation | |

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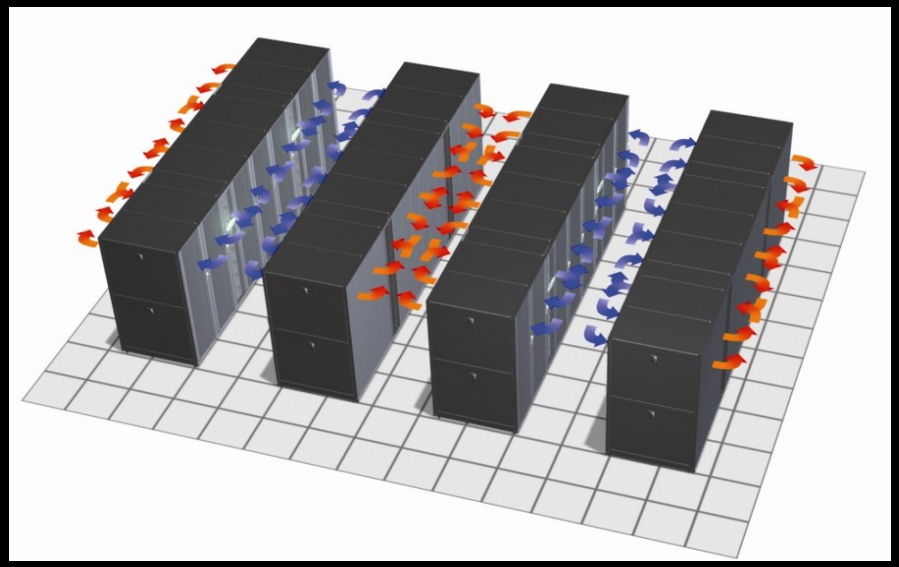
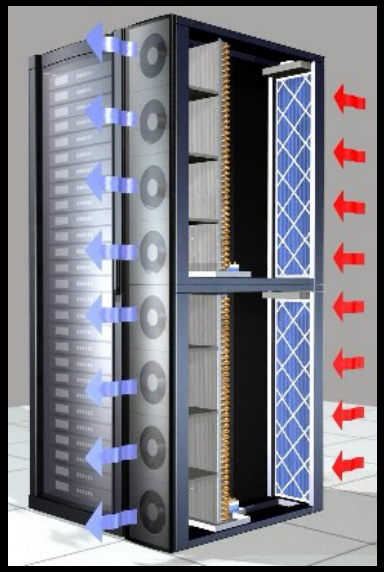


High Density Approach



Close-coupled cooling module

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# Benefits of IBM's Data Center Family

| | from | | to |
|---|---|---|---|
| ***Financial*** | Large upfront capital costs | → | Align capital and operational costs to IT needs |
| | Squeeze on IT budgets | → | Operational cost savings from more efficient data center design |
| | Constraints on IT growth | → | Meet unpredictable business and IT growth |
| ***Operational*** | Highly dense server systems | → | Non-disruptive implementation in existing centers |
| | Need to plan for capacity upgrades | → | Provide expansion without downtime to operations |
| | Aging data centers | → | Extend the life of existing data centers |
| ***Environmental*** | Corporate social responsibility | → | Energy conservation from inital design to on-going operations |
| | Limited „green" public image | → | Improved „green" public image |
| | Improve employee moral | → | Link CSR and personal value |

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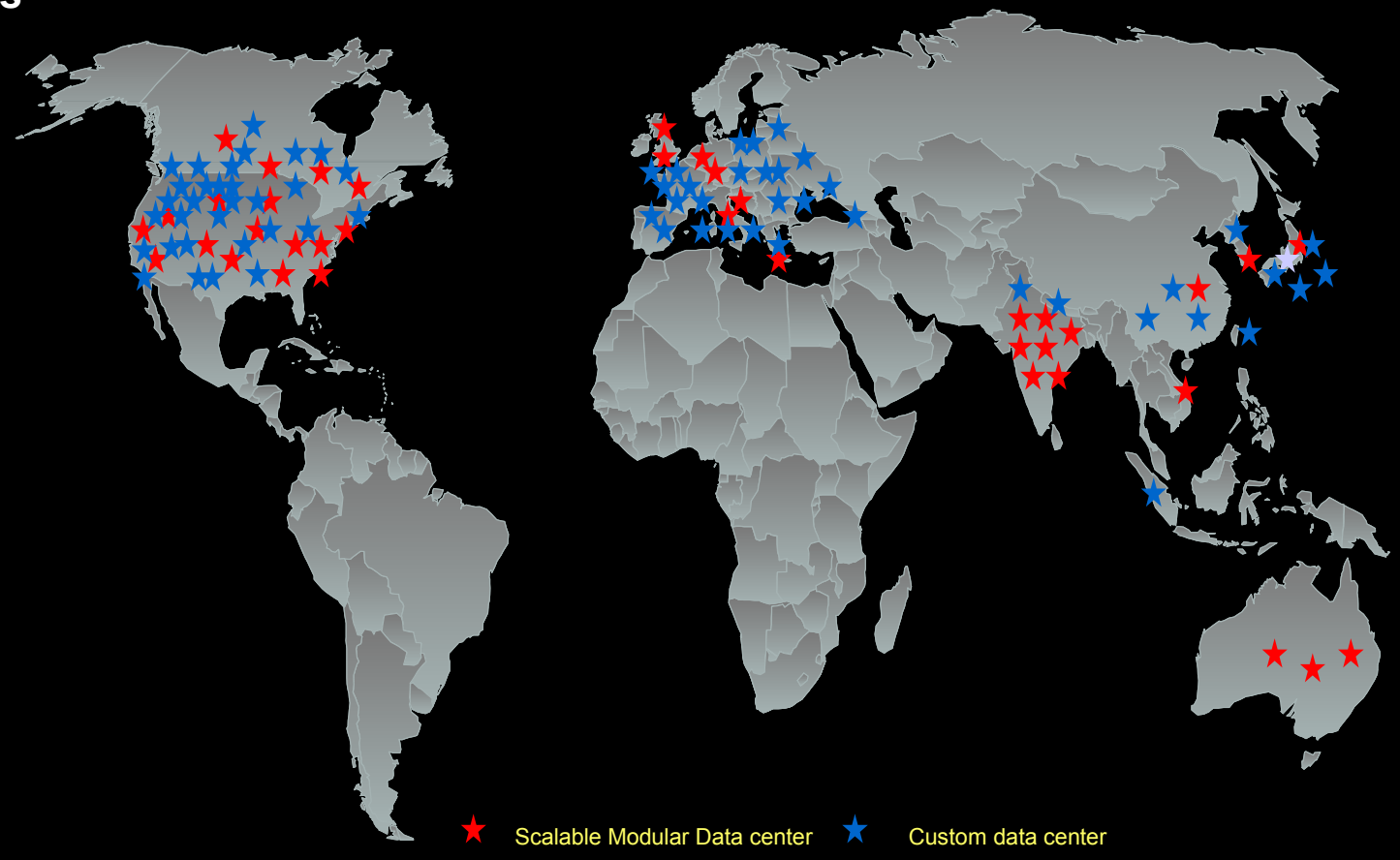
# IBM's global experience in data center design

***Over 100 implementations of custom and standardized design in the past 2-3 years***

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# Design for flexibility for small and mid-size data centers

***One of Europe's businesses goes "green" with scalable modular data center***

## *Client requirements*

- Expansion across Europe and Middle East
- Aging data center threatens growth
- Need rapidly deployable and green data center

## *Solution*

- IBM Scalable Modular Data Center solution with InfraStruXure® architecture from APC
- Standardized on IBM BladeCenter®
- Uses "green" design concepts

## *Benefits*

- Supports corporate sustainability ("Green Line")
- Up to 40% reduce electric power consumption
- 24% less energy from new servers

*""In IBM we have an IT partner who meets our ideal expectations for sustainable business"*

*- Dr. Herbert Koch, manager of the kika/Leiner group*

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# Critical questions about your IT environment

- **Are you using or planning to move to blade server technologies? If yes, are they or will they be installed in a secure, monitored, conditioned environment? Is this or will this environment be designed specifically to support the high heat densities and power requirements of the blade servers?**
- **Are you installing servers and blade servers in a data center designed for mainframe technologies? How inefficient is your existing data center and how much energy cost is being wasted?**
- **Will your IT requirements grow within the next year, two years, three years and beyond? Does your current IT environment allow for data center infrastructure growth (scalability) as your needs grow?**
- **Does your current data center or IT environment allow for quick, easy maintenance of the data center infrastructure through a modular design?**
- **Do you need to quickly design and build a data center environment?**

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# Leverage IBM's experience to help

**Maite Frey**

Business Development Leader
Site & Facilities Services, Central- and Eastern Europe

**E-Mail:**

**frey@ch.ibm.com**

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