IBM’s Scalable Modular Data Center
Providing energy efficient, agile, cost effective data centers
# IBM's Scalable Modular Data Center (SMDC) offering

## Introductions

<table>
<thead>
<tr>
<th>Company</th>
<th>Name and title</th>
<th>Contact information</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBM</td>
<td>Chan Jian Wen - Infrastructure Services Consultant</td>
<td>e-mail: <a href="mailto:chanjw@my.ibm.com">chanjw@my.ibm.com</a> Phone: 019- 283 7086</td>
</tr>
</tbody>
</table>
Agenda

- Needs and challenges
- Offering overview
- Client example of benefits achieved
- How the offering addresses needs and challenges
- How Site and Facilities Services can help
- IBM’s expertise in this area
- Next steps
Executive summary

- Clients need to increase compute capacity in server rooms to meet business demand while improving availability.
- Cost-effective solutions should include decreased capital and operating costs.
- Data center design needs to change to be more flexible and responsive to meet unpredictable changes in business needs, technology and compute models.
- Modular data centers allow for quick and cost-effective implementation for increased server room capacity.
Customer’s challenges are driven by three issues

**Increased IT Demand**
- 54% growth in storage shipments due to explosion of information\(^1\)
- 85% of distributed computing capacity sits idle\(^1\)
- Data centers energy use will double from 2006-2012\(^2\)
- 51% of clients will be adding new server rooms in next 12-24 months\(^3\)

**Increasing Cost Pressures**
- 14% of CIO’s time is spent removing costs from the technology environment\(^4\)
- 75% of CIO’s anticipate a strongly centralized infrastructure in 5 years\(^4\)
- Global electricity prices are increasing 10-25% per year\(^5\)

**Responsiveness to Change**
- 64% of CIO’s expect moderate to significant change ahead\(^4\)
- 80% of every $1 is spent to maintain and manage mid-size clients existing infrastructure\(^1\)
- Technology densities are growing 20x this decade\(^6\)
- 5-60% of IT workloads may be cloud-enabled\(^7\)

---

1. IBM Dynamic Infrastructure client presentation, July 2009
3. Digital Realty Trust survey, US and Western Europe (Feb and March 2009)
4. IBM Global CIO study, September 2009
5. Energy Information Administration, 2001-2009: IBM analysis
6. ASHRAE Publication: Datacomm Equipment Power and Cooling Applications, 2009
7. IBM research, September 2009
We can help clients in three simple ways…

Extend the life of an existing data center infrastructure.

Rationalize the data center infrastructure across the company.

Design new infrastructure to be responsive to change.

Double IT capacity or reduce operational expenses by 50%.

Improve operational efficiencies while reducing operational expenses by 50%.

Pay as you grow by deferring 40-50% of capital and operational costs.
The IBM Data Center Family™— delivering a comprehensive set of capabilities to meet your data center needs

- **Enterprise Modular Data Center**
  - Standardized design for 500 up to 2,000 square meter
  - Designed for high availability
  - Leadership energy efficiency with 66 percent DCIE
  - 25 percent faster deployment than custom approach
  - Open architecture involving leading vendors

- **Scalable Modular Data Center**
  - Turnkey data center for 50 to 2,500 square meter
  - Rapid deployment in 8 to 12 weeks
  - 20 percent less cost than traditional data centers
  - 15 to 30 percent improved energy efficiency

- **Portable Modular Data Center**
  - Fully functional data center; multivendor support
  - Portable temporary and remote data centers
  - Rapidly deploy in 12 to 14 weeks
  - Designed for high availability
  - Leadership energy efficiency with 77 percent DCIE

- **High Density zone**
  - “Plug and play” infrastructure to support high density servers in existing data centers
  - Non-disruptive implementation
  - 35 percent lower cost than retrofitting existing data center
IBM Enterprise Modular Data Center

- Standardized design for 500 up to 2,000 square meter
- Designed for high availability
- Leadership energy efficiency with 66 percent DCIE
- 25 percent faster deployment than custom approach
- Open architecture involving leading vendors

Features
- High availability DC (0.5 to 1.5MW per module, 1 to 4 modules)
- Secured and weather shielded and contained at 80% land coverage
- Can accommodate Enterprise Command Center and 50 people
- Adjustable to meet the requirement 500 to 2000 sm (left sketch) using soft office spaces
- Façade to meet location architectural requirement
Data center new build
- Scalable Modular Data Center (SMDC)

- Rapid deployment: A fully functional, data center, from planning to start-up, in 8-12 weeks
- Cost 15 percent lower than traditional data center design and build
- Support for low- to high-density computing
- Reduced energy costs: energy-efficient design can deliver energy cost savings of 20% or more
- No need to acquire internal construction expertise
IBM Portable Modular Data Center (PMDC)

Server container houses:
- IT Equipment Racks (up to 17 Racks)
- Fan Coil Units
- Fire Detection / Suppression
- Remote Monitoring
- Cabling

Services container houses:
- UPS and Batteries
- Chiller
- Fan Coil Units
- Electrical Switchboard
- Fire Detection / Suppression
**Motivation for Liquid Cooling**

- Increase in heat removal performance: Superior thermal properties of liquids compared to air
- Design flexibility: Sensible heat transport to locations with available space
- Centralized secondary heat exchanger
- Efficient water-water heat exchanger

<table>
<thead>
<tr>
<th></th>
<th>Thermal conductivity [W/(m*K)]</th>
<th>Volumetric heat capacity [kJ/(m³*K)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air</td>
<td>0.0245</td>
<td>1.27</td>
</tr>
<tr>
<td>H₂O</td>
<td>0.6</td>
<td>4176</td>
</tr>
</tbody>
</table>

Disadvantage: Increased complexity

Limited heat transport due to fan efficiency

Long distance transport possible
IBM Rear Door Heat Exchanger (RDHx)  
“Cool Blue” Innovative Cooling

- Rack Cooling fitted at rack rear door
- Passive Cooling - no fan or moving parts to fail
- No fans – no power consumption
- No additional noise added
- No white space needed
- Rack neutral
- Fits existing racks - no IT downtime
- 100% heat neutralization below 20kW per rack
- Secondary CW Loop operates at low pressure (13-20 psi)
- Highest TCO saving
Removing the heat in racks BEFORE the hot air gets into the hot aisle is an energy efficient approach

- **Proven performance**
  - Engineered by IBM with 30+ years in liquid cooling computers
  - Passive operation
  - Redundancy built-in

- **Increased density**
  - Removes up to 60% of heat, or 20kW
  - Allows for high-density deployment

- **Energy efficient**
  - Lessens burden on CRAC/CRAH units
  - More efficient than fan based systems

Source: PANDUIT Corp.
Improve your availability and flexibility with a turnkey, cost-effective scalable modular data center solution from IBM

Description:

- The IBM solution is designed to enable rapid deployment of a cost-effective, high-quality 500 to 2,500 sq ft (50 to 250 sq m) data center/server room. The turnkey solution can be designed and installed in nearly any working environment in much less time than a traditional raised-floor data center.

Benefits:

- Turnkey data center design/build solution
- Designed to support the client’s specific data center availability requirements
- 15-25% lower costs than traditional data centers
  - Up to 25% less capital costs
  - Up to 15% less total operational costs
- Rapid deployment: in 8 to 12 weeks after design
- Scalable and flexible to “pay as you grow”
  - Supports increased power and cooling requirements from new technology
  - Allows for non-disruptive growth
IBM works with you to help translate business objectives into data center infrastructure requirements

<table>
<thead>
<tr>
<th>Business objectives</th>
<th>Data center requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meet business and IT growth</td>
<td>High availability¹</td>
</tr>
<tr>
<td>Balance capital and operating costs</td>
<td>Provide required capacity¹</td>
</tr>
<tr>
<td>Flexible to support new technology</td>
<td>Optimize capital costs</td>
</tr>
<tr>
<td>Faster time to deploy</td>
<td>Maximize scalability</td>
</tr>
<tr>
<td></td>
<td>Maximize flexibility for technology and computing model adoption</td>
</tr>
<tr>
<td></td>
<td>Minimize capital and operational costs</td>
</tr>
</tbody>
</table>

SMDC provides “right sized” power and cooling solutions to reduce costs 10-25% over traditional data center designs

Example: approx. 500 sq. foot (50 sq. meter) data center

Capital Costs
SMDC provides a 20-25% capital savings over traditional data center alternatives.

Operational Costs
SMDC provides up to 10-15% lower operational costs than a traditional data center

- 70% of mid-size clients are planning plan < 10 kw/rack.
- Designed at IBM Level 2, can scale to IBM Level 3.
- Mid-size clients plan on a 10-year useful life.
- Assumes energy costs increase 10% per year.

Source: IBM Estimates
SMDCs are designed with the flexibility to support existing and future technology power density changes.

**Business challenge:**
*Server power density trends*: 20x

Meet your IT kw/rack power density
*70% of midsize clients planning for < 10kw/rack*

**Solutions…**
- Create a scaleable design which allows for rack density changes over time
- Provide modular growth of cooling and backup power capacity as demands evolve over the life of the data center

- Design growth to minimize or eliminate disruption to current operations
- Modularity creates agility
SMDC provides scalability to support vertical and horizontal growth.

**Vertical scalability ...**

*supporting for more power density per rack as needed*

**Horizontal scalability ...**

*add additional racks, cooling and UPS in a non-disruptive manner*

**Cooling on demand ...**

*cooling only when the workload needs it.*
IBM’s turnkey solution approach is targeted at balancing your availability needs with the cost to achieve them through smarter design.

**Business challenge**
- Balance availability with data center budget
- Does reducing outage time from 53 minutes to 5 minutes at 25% additional capital cost make business sense?

**Solution**
- We can use smarter design to achieve same availability at less cost (Level 2+, Level 3+)
  - Generator(s)
  - Dual power feeds to critical equipment
  - N+1 UPS capacity
  - Power and cooling system concurrent maintainability

---

Note: The “+” indicates designed with concurrent maintenance
Source: IBM Estimates
Our data center specialists will translate your business, technical and financial objectives into a turnkey SMDC design/build solution.

**DETERMINE REQUIREMENTS**

**Detailed Planning / Design**

Create a design based on the requirements, defining:

- Space
- Power
- Cooling

**Turnkey Construction**

Turnkey construction:

- Architectural
- Electrical and mechanical systems
- Fire protection
- Security
- SMDC installation

**Start Up Testing / Site Turnover**

Site turnover:

- Start up / test power and cooling equipment
- IT equipment relocation and migration
- Cabling
- Commissioning and solution turnover

What are your data center requirements?

- Availability
- Capacity
- Scalability
- Security
IBM’s experienced data center project managers can help you quickly and cost effectively implement a state-of-the-art data center.

**IBM partnerships**

<table>
<thead>
<tr>
<th>Client IT Staff</th>
<th>Architects and Engineers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Contractors</td>
<td>Mechanical and Electrical Equipment Providers</td>
</tr>
</tbody>
</table>

**IBM’s value as a project manager**

- Augment your in-house resources
- Quickly and cost effectively implement data center capacity
- Coordinate specialists across IT and facilities
- Communicate project status and actions

**IBM runs the project from concept, through to construction, testing and turnover**

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Design</th>
<th>Construction</th>
<th>Turnover</th>
</tr>
</thead>
<tbody>
<tr>
<td>What are your data center requirements?</td>
<td>Create a design based on space, power and cooling.</td>
<td>Build</td>
<td>Test and turnover.</td>
</tr>
</tbody>
</table>
IBM has global experience in data center design and build
Over 300 implementations of custom and standardized design in the past 2-3 years
IBM can be your trusted data center advisor

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

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

“**With the state-of-the-art data center, we will provide total IT services for clients and strengthen our position in the Data Center market as a leading Internet Data Center service provider.**”

*Kim SeungMin, Hostway Korea, CEO*

“**We consulted several vendors and it was clear that IBM had the edge in terms of innovative ideas … the quality of the engineering work and project management from IBM was outstanding.**”

*Art Gloster, Bryant University CIO*
Why take action now?

- Yesterday’s data center power and cooling strategies are not in sync with today’s IT equipment demands
- IBM’s SMDC solutions provide you with:
  - Increased computing capacity in your server rooms
  - Improved reliability to keep up with the business demands for increased availability
  - Decreased operating costs due to lower maintenance costs and improved power/cooling energy efficiencies
  - Decreased capital costs from reduced real estate spending associated with new server room projects
  - Quick and cost effective design and installation of additional server room or data center space to support business growth
- Engineering, installation and service cost reduction is now possible

IBM will work with you to understand your data center requirements and implement the best solution to meet your needs
Thank you for your time today.
IBM Corporation 2010

- IBM, the IBM logo and ibm.com are registered trademarks, and other company, product or service names may be trademarks or service marks of International Business Machines Corporation in the United States, other countries, or both. A current list of IBM trademarks is available on the Web at “Copyright and trademark information” at www.ibm.com/legal/copytrade.shtml

- Adobe, the Adobe logo, PostScript, the PostScript logo, Cell Broadband Engine, Intel, the Intel logo, Intel Inside, the Intel Inside logo, Intel Centrino, the Intel Centrino logo, Celeron, Intel Xeon, Intel SpeedStep, Itanium, IT Infrastructure Library, ITIL, Java and all Java-based trademarks, Linux, Microsoft, Windows, Windows NT, the Windows logo, and UNIX are trademarks or service marks of others as described under “Special attributions” at: http://www.ibm.com/legal/copytrade.shtml#section-special

- Other company, product and service names may be trademarks or service marks of others.

- References in this publication to IBM products or services do not imply that IBM intends to make them available in all countries in which IBM operates.
Evaluation

Your feedback is extremely valuable to us. It is the only way we can improve our service to you.

*On a scale of 1 – 5, where 5 is “extremely well” and 1 is “not at all,”…*

- Presentation name: ____________________________________________________________
- Presenter’s name: ___________________________________________________________

[_____] **How well did this presentation answer your questions?**

- What was most helpful?
  __________________________________________________________
  __________________________________________________________
  __________________________________________________________

- What was missing or was too brief?
  __________________________________________________________
  __________________________________________________________
  __________________________________________________________

[_____] **How much will this presentation contribute to your buying decision?**

**Do you have any other suggestions for improving this presentation?**
  __________________________________________________________
Bryant University case study

Scalable Modular Data Center

- 26% reduction in capital spend
- 21% reduction in operational spend

Servers & Virtualization

- 30% time savings in operational overhead
- 12-15% improvement in service delivery

Energy Management Software

- 15% annual energy savings
Scalable Modular Data Center – Goldcorp Red Lake Gold Mine

*Gains flexible, data center in remote location in six weeks*

**Client requirements**
- Needed to consolidate two existing data centers into one
- Wanted a low-impact, scalable, easily movable site and needed it in a very short time frame
- Remote location presented an implementation challenge

**Solution**
- Implemented an IBM Scalable Modular Data Center solution with advanced InfraStruXure® architecture from IBM Alliance Partner APC
- Standardized on IBM BladeCenter®
- Built a 400-square-foot SMDC that is capable of scaling to another row of eight server racks
- Overhead air-conditioning units cool the data center

**Benefits**
- Rapid deployment - new data center in just six weeks
- Saves 15% over traditional data center cost
- Increases flexibility with a modular design
- Able to relocate data center quickly

“(the) IBM engagement with respect to this solution was exemplar of professionalism”

- Red Lakes Gold Mine ITT Superintendent
Scalable Modular Data Center – kika/Leiner

One of Europe’s top 5 furniture businesses goes Green

Client requirements

- Business expansion across Europe and Middle East
- Aging data center threatens growth
- Need for a rapidly deployable and Green data center concept on limited floor area

Solution

- Implemented an IBM Scalable Modular Data Center solution with IBM BladeCenter®
- Uses “green” design concepts such as free cooling, separate high density computing area, flexible expansion area for future growth

Benefits

- Supports corporate sustainability “Grüne Linie“ (Green Line)
- Reduce electric power consumption by up to 40%
- Uses energy efficient servers which require 24% less energy than competition
- Improved security, reliability, and TCO

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

- Dr. Herbert Koch, manager of the kika/Leiner group
Columbia County obtains a highly scalable, energy-efficient data center solution by working with IBM

**Business challenge:**
The government of Columbia County, one of the fastest growing regions in Georgia, was seeing an increase in demand for its services—many of which were available on the Internet. But the supporting IT infrastructure was struggling to keep pace with demands and had run out of space. Even worse, aging power and cooling systems threatened system availability and wasted energy, prompting the organization to pursue a new solution that would help it meet future growth, reduce costs and improve availability.

**Solution:**
Having worked with IBM in the past, the county signed a site and facilities services contract with IBM Global Technology Services. The IBM staff, after an initial assessment of the client’s infrastructure, designed and deployed a 1,200-square-foot scalable modular data center solution, featuring InfraStruXure architecture from APC and IBM BladeCenter and IBM System x servers.

**Benefits:**
- Doubles Columbia County’s IT capacity with virtually no increase in energy usage
- Anticipates operational savings of approximately US$30,000 annually due to more-energy-efficient equipment
- Gains a redundant, highly available environment, expertly designed by IBM and deployed without disrupting operations
- Monitors power and cooling efficiencies to control resource consumption

“We wanted to work with IBM staff because we thought they would have the expertise to deliver what we needed—and quickly. And we were right. IBM delivered a data center that has not only met but also exceeded our expectations.”
—Lewis Foster, CIO, Columbia County

**Solution components:**
- Site and facilities services – scalable modular data center