The simple route to the perfect Data Centre

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Product Manager - IT Infrastructure Solutions

Rittal – The System.
Faster – better – worldwide

Bicsi
Holistic Data Center Concept – The System.

UPS systems
1-18 kVA, 1-phase
10 – 960 kW, 3-phase

DC software
Manages and monitors the entire data centre

Room, raised floor, rack cooling
Individual cooling concepts

Server racks
A large range with comprehensive accessories

Network enclosures
Network enclosures, IT wall-mounted enclosures

Sensor network monitoring
Optimum availability & transparency

Power distribution
Fully wired and contact hazard proof

IT recooling systems
Holistic solutions for IT cooling

Pipework
Optimum design

Security rooms
Protection against a large number of physical hazards

IT wall-mounted enclosures

Network enclosures

Bicsi

RITTAL
The simple route to the perfect Data Center

3 Key Steps

- Reduce your DC footprint
- Minimize Energy Consumption
- Deploy modular DC Infrastructure
The simple route to the perfect Data Center

Step 1

Reduce your DC footprint

Minimize Energy Consumption

Deploy modular DC Infrastructure
Reduce footprint drastically
Understanding Cooling Limitations

Up to 6kW per rack

Low Density

6-12kW per rack

Mid Density

12 – 60kW Per rack

High Density
Reduce footprint drastically
Understanding Cooling Limitations

- Basic solutions
- CRAC-system
  - With Cold Aisle Containment
- Rear Door Heat Exchangers up to 30 kW
- Inline Cooling up to 35 kW
  - With Cold Aisle Containment
- Closed Loop Rack Based Cooling 20, 35 kW

Heat Load in the Server racks
Reduce footprint drastically
Generation Blue e – Rack Based HD Cooling

Facts and features:
+ Cooling output up to 60 kW per rack
+ CW and DX systems
+ High availability for enclosures with high loads
+ Access-protected because cooling and rack are separated

Saves time by ...
- Less time required for service and maintenance

Saves cost by ...
- Using energy-efficient EC fan technology
- Being energy-efficient due to the high water inlet temperature
- Providing the option of high-density cooling without raised floor

Innovation 2011:
Up to 60kW per rack!
Reduce footprint drastically
Bring cooling closer to the heatsource
Reduce Footprint drastically
Footprint comparison Raised Floor vs. Rack based cooling

150kW N+1...
• Cooling units
• Chiller ✓

Tier 2

Raised-Floor Cooling

Rack-Based Cooling

- Base plate cold aisle
- Base plate warm aisle
- Racks
- CRAC units
- Free floor space

- Racks
- LCP
- Free floor space
- Floor space for expansion
Reduce footprint drastically
Investment Comparison Raised Floor vs. Rack based cooling

**Initial Investment**

<table>
<thead>
<tr>
<th>150kW n+1</th>
<th>Raised-Floor (5kW / Rack)</th>
<th>Rack-Based (25kW / Rack)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling Units</td>
<td>3.2 Mio INR</td>
<td>6.5 Mio INR</td>
</tr>
<tr>
<td>Chiller</td>
<td>7.1 Mio INR</td>
<td>7.1 Mio INR</td>
</tr>
<tr>
<td>Racks</td>
<td>2.2 Mio INR</td>
<td>0.5 Mio INR</td>
</tr>
<tr>
<td>Piping</td>
<td>1.9 Mio INR</td>
<td>2.2 Mio INR</td>
</tr>
<tr>
<td>Sum</td>
<td>14.4 Mio INR</td>
<td>16.3 Mio INR</td>
</tr>
</tbody>
</table>

Cost Savings due to unneeded Footprint

- Raised-Floor: 0 INR
- Rack-Based: 5.0 Mio INR

Sum with Footprint Savings

- Raised-Floor: 14.4 Mio INR
- Rack-Based: 11.3 Mio INR

**65% less space needed**

### Raised-Floor Cooling

- Space needed: 1100 sqft
- Space free: 0 sqft
- Cost savings (20 INR/sqft): 0

### Rack-Based Cooling

- Space needed: 300 sqft
- Space free: 800 sqft
- Cost savings (20 INR/sqft): 5.0 Mio INR
Reduce footprint drastically
Investment Comparison Raised Floor vs. Rack based cooling

**Rental Costs**

<table>
<thead>
<tr>
<th></th>
<th>Raised-Floor</th>
<th>Rack-Based</th>
</tr>
</thead>
<tbody>
<tr>
<td>150kW n+1</td>
<td>(1100sqft)</td>
<td>(300sqft)</td>
</tr>
<tr>
<td>Rental p.a.</td>
<td>1.5 Mio INR</td>
<td>0.4 Mio INR</td>
</tr>
</tbody>
</table>

→ Annual Saving 1.1 Mio INR

**Operating Expenditures**

- Being energy efficient due to high water inlet temperatures (15°C+)
- Using energy efficient EC fans for intelligent fan control
- Intelligent water control saves chiller water pump energy
- Easy Maintenance and Service

→ Up to 13% less compared to room based cooling
Reduce footprint drastically
Reference IUAC – 80 Teraflops HD Cooling

Key Facts
- High Performance Computing
- 50m² / 600 Servers / 80 Teraflops
- Fastest DC in Government Sector in India

Technology
- **Racks & Accessories**
  - 16x HPC racks @ 20kW Load
- **Cooling**
  - 16x LCP Standard
  - Chiller + Pump Panel + Piping Installation
- **Power**
  - LV Distribution
  - PMC 200 (2x 250kVA)
  - 32x PDUs
- **Security**
  - Fire Detection + Fire Extinguishing
  - Access Control + Environmental Monitoring
The simple route to the perfect Data Center

Step 2

Reduce your DC footprint

Minimize Energy Consumption

Deploy modular DC Infrastructure
Minimize Energy Consumption

Where most money can be saved

- 3% light et cetera
- 10% power distribution and backup
- 50% server
- 37% cooling
Minimize Energy Consumption
Step 2

$ COOLING

$ MONITORING AND INTELLIGENT CONTROL

$ POWER DISTRIBUTION & BACKUP
# Minimize Energy Consumption

Savings by optimizing the complete COOLING Infrastructure

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
</table>
| Rack-based cooling | • High-performance cooling with up to 30 kW / rack  
                   | • High energy efficiency                                                     |
| Suite-based cooling | • Cooling system integrated into the enclosure suite  
                      | • Efficiency can be increased with optional aisle containment systems  
                       | • Raised floor not required                                                  |
| Room-based cooling | • Cooling output up to 118 kW  
                    | • Efficiency can be increased with optional aisle containment systems  
                      | • Optimised energy and room efficiency                                       |
| IT chiller & Piping systems | • Cooling output from 8.5 to 462 kW  
                         | • Redundant pump design                                                     |
|                 | • Optimised COP value                                                       |
|                 | • Inexpensive plastic pipework                                              |

![Image of cooling systems](image_url)
Minimize Energy Consumption
Aisle Containment – Separate Cold from Warm

• **Cold Aisle Containment with raised-floor cooling:**
  - Use of conventional CRAC system
  - Reduced heights between enclosure and ceiling, maximized raised-floor height possible
  - Homogenous temperature distribution in the cold aisle
  - Extended life-cycle of raised-floor cooling systems

• **Cold Aisle Containment with row-based cooling:**
  - Reduced heights between enclosure and ceiling possible
  - Homogenous temperature distribution in the cold aisle
  - Easy pipe work in the plinth components

• **Hot Aisle Containment with row-based cooling:**
  - No heat dissipation to an existing data center
  - Only works with LCP Inline
  - More capacity for every cooling unit available
Minimize Energy Consumption
Cold Aisle Containment – Where do the savings come from?

**Energy Savings:**

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fans</td>
<td>19 MWh/a</td>
</tr>
<tr>
<td>Pumps</td>
<td>6 MWh/a</td>
</tr>
<tr>
<td>Chilled water</td>
<td>65 MWh/a</td>
</tr>
<tr>
<td>Total</td>
<td>90 MWh/a</td>
</tr>
</tbody>
</table>

**Cost Savings with Cold Aisle Containment:** Up to 36%

<table>
<thead>
<tr>
<th>Metric</th>
<th>Before Containment</th>
<th>After Containment</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Q_{\text{net}} (Q_{\text{sens.}})$</td>
<td>80kW (80kW)</td>
<td>80kW (80kW)</td>
</tr>
<tr>
<td>$T_{\text{air;return}} (\text{rel. hum.})$</td>
<td>26°C (45%)</td>
<td>36°C (25%)</td>
</tr>
<tr>
<td>$T_{\text{air;supply}} (\text{rel. hum.})$</td>
<td>15°C (89%)</td>
<td>21.3°C (54.2%)</td>
</tr>
<tr>
<td>$V_{\text{air}} (\text{ext. press.})$</td>
<td>22000m³/h (80Pa)</td>
<td>17000m³/h (20Pa)</td>
</tr>
<tr>
<td>$T_{\text{water;in}}$</td>
<td>10°C</td>
<td>15°C</td>
</tr>
<tr>
<td>$T_{\text{water;out}}$</td>
<td>15°C</td>
<td>23.5°C</td>
</tr>
<tr>
<td>$V_{\text{water}} (P_{\text{electr.}})$</td>
<td>13.8m³/h (3kW)</td>
<td>8.09m³/h (2.3kW)</td>
</tr>
<tr>
<td>$P_{\text{electr. for CRAC fans}}$</td>
<td>3.6kW</td>
<td>1.5kW</td>
</tr>
<tr>
<td>$P_{\text{electr. for chilled water}}$</td>
<td>190MWh/a</td>
<td>125MWh/a</td>
</tr>
<tr>
<td>$P_{\text{electr. total}}$</td>
<td>248MWh/a</td>
<td>158MWh/a</td>
</tr>
</tbody>
</table>
Minimize Energy Consumption
Cold Aisle Containment – Where do the savings come from?

Cost Savings for a cell of 80KW:
570,000 INR per year*

ROI for the CAC in 1.5 years!
Minimize Energy Consumption
Cold Aisle Containment – Reference

30 % less energy consumed by means simple optimising

- Host Europe – 3rd largest provider of hosting solutions
- 2 separated data centres with about 24,000 servers; one of them used to be a warehouse that had to be converted to fulfil data centre standards

Initial situation:

Data centre in a former warehouse with 500 racks and raised floor cooling based on CRAC systems

Effect: Cold and warm air was mixed in front of the servers. Air inlet temperature has to be a couple of °C below the temperature required to cool the servers

Solution:

Aisle containment system installed and server front transferred to the separated area (cold aisle)

Effect: This prevents cold and warm air from mixing up, and helps to increase inlet temperature. After free cooling was added,

30% less energy was consumed
Minimize Energy Consumption
Savings through revolutionary MONITORING AND CONTROL

DC Management Software
• is the data centre management software from Rittal
• permits the administration of the complete physical infrastructure of a data centre

MKD
• Compact design, 1 U only
• Various keyboard layouts
• VGA input
• Optional KVM switch (SSC view) for 8 or 32 servers may be integrated

KVM
• The right KVM solution for any KVM solution
• KVM-over-IP and multi-user environments with up to 2,048 servers
• May be extended at any time

Dynamic Rack Control
• Asset management based on RFID
• Exact overview of unused U slots inside the rack
• Information is saved on tags as specified by ISO standards
Minimize Energy Consumption
With DC Management Software.

Facts and features:
+ Infrastructure management software
+ Monitors and controls:
  + Intelligent power supply, distribution and back-up
  + Cooling generation and distribution
  + Enclosure security
  + Room security
  + Efficiency and energy consumption

$ Saves cost by ...
- Increasing security and reliability of the data centre
- Saving energy consumption with monitoring and control functions
- Offering a modular, scalable license model to suit the customer's requirements
Minimize Energy Consumption

Interfaces

- UPS systems
- Sensor network monitoring
- Power distribution
- Cooling

Innovation 2011: 3rd PARTY EQUIPMENT INTEGRATION!*

* BacNet and other GLT protocols via partners

- UPS Monitoring
- PDU Cooling
- BACnet LV Power
- Dynamic Rack Control
- Chiller

- LV Power
- Dynamic Rack Control
- IT chiller
Minimize Energy Consumption
Holistic Control Algorithm – cool only what you need!

▸ Monitors permanently the complete cooling chain:
  - cooling (chillers, free coolers)
  - cooling transportation (pumps, valves)
  - cooling distribution (cooling, CRAC)

▸ Once all parameters are known the software creates a control algorithm to keep the server air inlet temperature constant

**The Result:**
The automatic adjustments of the operating points of each component results in an optimum in energy efficiency of the overall system
Minimize Energy Consumption
IT Power Distribution & Backup

Low-voltage main distributor with Ri4Power
- Busbar systems up to 5,500 A for individual configurations
- Integrates measuring systems for different works

Power back-up with the UPS system
- Rack-mounted, modular design
- Scalable up to 960 kW
- Highly efficient, with 95% energy conversion efficiency in the partial load range already

Power sub-distribution with PDR and PDM
- Modular construction; can be extended with the system operational
- Phase current up to 250 A at the input; VDE-certified
- Shock-hazard protected

Power distribution inside the rack with Rack PDU
- Plug and play power supply
- Modules with different sockets
- Manageable modules with current measuring and switching functions
Minimize Energy Consumption
Modular & Scalable UPS Solutions from 1kW – 960kW

• Compact, 1-phase UPS
• Scalable autonomy
  Up to 55 min. at 100% load
• Optional monitoring via web browser

1 – 18 kVA

10 – 40 kW
• Rack-independent, 3-phase UPS
• Redundant system for maximum availability
• Mixed population e.g. with servers in the same rack also supported

8 – 800 kW
• High level of efficiency: 95%
• Flexible, almost unlimited scalability and redundancy.
• Less capital tie-up, may be expanded thanks to its modularity

64 – 960 kW
• Maximum availability and performance in a modular design
• Service-friendly because modules are divided into a power and a control module

🔍 Saves time by ... Making maintenance work easier and quicker whilst the system is operational due to a rack-mounted, modular system

💰 Saves cost by ... High-level efficiency and scalability in line with requirements
Minimize Energy Consumption
Low loads + high efficiency

Pure energy saving:
Excellent efficiency even at low loads.

Grow with your demand – Stop wasting money and energy!
## Minimize Energy Consumption

2% Efficiency makes a major difference

<table>
<thead>
<tr>
<th></th>
<th>UPS A</th>
<th>XY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency of consumers in kW</td>
<td>160</td>
<td>160</td>
</tr>
<tr>
<td>UPS efficiency in % (with partial load)</td>
<td>95.0%</td>
<td>93.0%</td>
</tr>
<tr>
<td>Input in kW</td>
<td>168.4</td>
<td>172.0</td>
</tr>
<tr>
<td>UPS heat loss in kW</td>
<td>8.4</td>
<td>12.0</td>
</tr>
<tr>
<td>kW/h per Jahr</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity costs in INR per kW/h</td>
<td>7.00</td>
<td>7</td>
</tr>
<tr>
<td>Additional costs owing to heat loss per year (without cooling)</td>
<td>516,379</td>
<td>738,477</td>
</tr>
<tr>
<td>kW/h per year with cooling</td>
<td>103,276</td>
<td>147,695</td>
</tr>
<tr>
<td>Cooling required for heat loss, factor</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>Additional cost per year including cooling</td>
<td>722,931</td>
<td>1,033,868</td>
</tr>
</tbody>
</table>

### During 5 years

<table>
<thead>
<tr>
<th></th>
<th>UPS A</th>
<th>XY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3,614,653</td>
<td>5,169,342</td>
</tr>
</tbody>
</table>

### More than 10 years

<table>
<thead>
<tr>
<th></th>
<th>UPS A</th>
<th>XY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7,229,305</td>
<td>10,338,684</td>
</tr>
</tbody>
</table>

Additional cost compared with PMC 200 UPS during 10 years

### CO2 emissions per year

1 Kilowatt hour (kWh) of electr. = 0.6 kg CO2

<table>
<thead>
<tr>
<th></th>
<th>UPS A</th>
<th>XY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difference in CO2 per year</td>
<td>26,652</td>
<td>114,869</td>
</tr>
</tbody>
</table>

Equals an annual car mileage with a car fromt the Golf range of:

**Difference in CO2 throughout 10 years of operation**

266,518 kg
The simple route to the perfect Data Center

Step 3

Reduce your DC footprint

Minimize Energy Consumption

Deploy modular DC Infrastructure
Deploy Modular Scalable DC Infrastructure

Modular IT-Infrastructure Solutions...

Pay as you grow!

- A total scalable solution that contains 5 elements:
  - Rack
  - Power
  - Cooling
  - Security
  - Remote Mgmt & Monitoring
Deploy Modular DC Infrastructure
Physical IT Security

Internal requirements
- Data loss / replacement cost
- EDP failure / economic loss
- Economic espionage / loss of know-how
- Accidents / fire / arson
- Theft / sabotage / manipulation

Legislation / directives
- Federal Data Protection Act
- EU legislation / Product liability law
- Quality assurance systems: ISO 9001 /
  ISO 27001
- Expert guidelines (VdS in Germany)
- Basel II, Solvency II and Sarbanes-Oxley Act

Micro data centre
- The smallest security solution: 15 U, turn-key, including physical security
- Incl. climate control concept

Mini data centre
- Energy-efficient climate control
- Monitoring and extinguisher system
- Modular UPS and power distribution
- Physical protection against threats like fire, water, smoke gases and burglary

Data Centre Container
- Temporary outdoor data centre during conversions, extension or relocations
- Energy efficiency through direct free cooling (PUE less than 1.2)
- Provides space for 329 U

Data centre
- Physical security: From high availability to basic protection
- Requirement-oriented package with energy-efficient infrastructure

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Deploy Modular DC Infrastructure
Physical IT Security – Against all hazards!
Deploy Modular DC Infrastructure
Physical IT Security – Micro Data Centre

Example:

**Rack part:**
- Basic Rack with maximum protection
- UPS, cooling
- Monitoring, Fire protection
- Active managed Socket
- Management Software
- Microsoft SCOM MP

**Server & Software part:**
- Application server with
- 120 virtual servers
- 10 TB memory
- SAN server / reliability
- Microsoft Hyper-V

![Synchronous mirroring](image)
Deploy Modular DC Infrastructure
Physical IT Security – Mini Data Centre

Facts and features:
+ Individualised climate control concept with up to 30 KW cooling output
+ Future-oriented thanks to extension options
  – Scalable growth in line with IT
+ Can be applied economically
  – Scalable product range

っていましたな なに？
・Reducing delivery and installation times

助けたな なに？
・Reducing operating cost with energy-efficient climate control systems
  • Improving write-off conditions because of its mobile property status
Deploy Modular DC Infrastructure
Physical IT Security – Security Rooms

Facts and features:
+ Building-independent IT data centre
+ Modular, flexible and tailor-made to meet current requirements
+ System-tested safety guaranteed for all functional components
+ Short implementation period: Planning → Commissioning
+ Multi-functional protection based on European standards

☆ Saves time by ...
  • Reducing implementation: Planning → Commissioning
  • Installing whilst the IT system is operational

$ Saves cost by ...
  • Delivering a energy-efficiency
  • Increasing investment security with its modularity and expansion options
Deploy Modular DC Infrastructure
Physical IT Security – Data Centre in a Container

Facts and features:

+ Can be used as a substitute data centre temporarily when the IT department is relocated or converted
+ Up to 329 U (7 racks) and 6kW/rack maximum
+ Compatible with alternative power generators – Perfect power independence with CHP unit
+ Simple planning – fixed price for the data centre

🔥 Saves time by ...
  - Predefined standard versions available
  - Deliver – connect up (data and power) – ready to use

💰 Saves cost by ...
  - Uses direct free cooling, which helps to cut down cost and operates with energy-efficient rack climate control and UPS (PUE ≥ 1.2)
The simple route to the perfect Data Centre
Efficiency up – costs down!

Thank you!