Data Centres - A Proactive Approach to Highly Reliable Systems

Presented by: Sanjeet Sandhu, Vice President, Data Centre, Centre of Excellence
Big Data is driving volatility into the Critical Environment…

8.6 Zettabytes of IP Traffic
that’s
8,600,000,000,000,000,000,000,000 bytes
…by 2018 The world will spend more money on energy
in the next 40 years than it has in the
previous 400.

Impacts of Big Data on Critical Environments

- Cloud Computing
- Social Media
- BYOD and Mobile devices
- On Demand Applications
- Information explosion
- Data Analysis and trending
- Security
- Compute requirements
- Network requirements
- Storage requirements
- Dynamic planning
- Dynamic Provisioning
- Increasing KW per SqM
- Power and Cooling

Big Data is driving volatility resulting in increased risks & costs

Is my infrastructure costing more than it should?
How does our data centre rate?
My PUE - what is it?
Is our data centre at risk of overheating?
Is our data centre growing beyond its limits?

8.6 Zettabytes of IP Traffic
that’s
8,600,000,000,000,000,000,000,000 bytes
…by 2018 The world will spend more money on energy
in the next 40 years than it has in the
previous 400.
Localized data centers are positioned at the network edge, placing computing power in close proximity to data and users.

- Gather massive information from “local things”
- Provide significant local computational power
- Store and deliver high bandwidth content to users

< 100ms Latency
People with the skills needed in today’s world demand UPTIME certifications.

The skills shortage

“One challenge pertains to the training of an indigenous workforce to meet the demands of the vibrant data center market.... HR is a huge component of running these [data centers],” IDC

UPTIME certifications
ATD
Global ~1000

ATS
~850

OUTCOMES OF SKILLS SHORTAGE
A lack of specific resources means wage rises – will there be enough experts to run the facilities?

2 Billion Internet users
21 Billion network devices
1.3 Million video views per min
500GB created / flight

Life Is On | Schneider Electric
### DC Regional Application Centre Global Resources

<table>
<thead>
<tr>
<th>Technical Specialization</th>
<th>COE</th>
<th>EMEAS</th>
<th>NCEE</th>
<th>APJ</th>
<th>NAM</th>
<th>CHINA</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accredited Tier Designer (ATD)</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>8</td>
<td>10</td>
<td>6</td>
<td>50</td>
</tr>
<tr>
<td>Accredited Tier Specialist (ATS)</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>Project Management Professional</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>5</td>
<td>30</td>
</tr>
</tbody>
</table>

Technical Specializations highlighted include: COE (Central Office of Excellence), EMEAS (Europe, Middle East, and Africa), NCEE (North China and Europe), APJ (Asia Pacific), NAM (North America), CHINA (China), and TOTAL (Total Resources).
Services Bureau

- 24/7 Real Time Event Monitoring
- Subject Matter Experts
- Alarm Management and Event Reporting
- Customized Web Portal
- Critical Environment Assessment, Baseline and Benchmarking
- Advanced Data Analytics and Data Science
- Energy Management
- Environmental Safety Management
- Capacity Planning
- Critical Facility Operations (CFO & FM)

Mission: To deliver world-class Operational Efficiency and Legendary Reliability in Critical Environments

EXPERTISE       TECHNOLOGY        DATA-SCIENCE
Implementation & Approach Methodology

1. Establish PROJECT PARAMETERS
   - Design Criteria
   - Business Model (CAPEX/OPEX/Charge Out Rate/Market Force)
   - Load Growth

2. Develop SYSTEM CONCEPT
   - Infrastructure Requirements / Size of Land
   - Determine Land Size Criteria
   - GBI & LEEDS, TIA-942, Uptime

3. Selection SITE SELECTION
   - Selection Criteria
   - Land size, Risk, Availability

4. Incorporate USER PREFERENCES AND CONSTRAINTS
   - Strategy, Efficiency and PUE
   - Modularity To Meet Project Parameters
   - GBI & LEEDS, TIA-942, Uptime

5. The combined outputs are the design requirements for input for the DESIGN phase

6. Verification of Design

AREA of FOCUS
Data Center Lifecycle
Develop Design

Preferences and Constraints:
Land Size Offers Different Design Topologies
## Tier Requirements Summary

<table>
<thead>
<tr>
<th></th>
<th>Tier I</th>
<th>Tier II</th>
<th>Tier III</th>
<th>Tier IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Capacity Components to support the IT Load</td>
<td>N</td>
<td>N+1</td>
<td>N+1</td>
<td>N After any Failure</td>
</tr>
<tr>
<td>Distribution Paths</td>
<td>1</td>
<td>1</td>
<td>1 Active and 1 Alternate</td>
<td>2 Simultaneously Active</td>
</tr>
<tr>
<td>Concurrently Maintainable</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Fault Tolerance</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Compartmentalization</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Continuous Cooling</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Note: Extracted from The Uptime Institute

We may need it for Operational Sustainability
User Preference and Constraints – STEP 4
Loss of Chilled Water – Temperature Rise in the Data Centre

1. Establish PROJECT PARAMETERS
2. Develop SYSTEM CONCEPT
3. Selection SITE SELECTION
4. Incorporate USER PREFERENCES AND CONSTRAINTS

- The Table below illustrates the time taken for servers of various capacities to shut down after the loss of cooling.

<table>
<thead>
<tr>
<th>Watts per Cabinet</th>
<th>1500W</th>
<th>3000W</th>
<th>5000W</th>
<th>8000W</th>
<th>10000W</th>
<th>15000W</th>
<th>20000W</th>
<th>30000W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seconds</td>
<td>30</td>
<td>60</td>
<td>120</td>
<td>240</td>
<td>360</td>
<td>480</td>
<td>600</td>
<td>900</td>
</tr>
<tr>
<td>1500W</td>
<td>21.1</td>
<td>22.2</td>
<td>24.4</td>
<td>28.9</td>
<td>31.1</td>
<td>33.3</td>
<td>35.6</td>
<td>37.7</td>
</tr>
<tr>
<td>3000W</td>
<td>23.4</td>
<td>26.7</td>
<td>33.4</td>
<td>46.9</td>
<td>53.6</td>
<td>60.3</td>
<td>67.0</td>
<td>Shutdown Command</td>
</tr>
<tr>
<td>5000W</td>
<td>26.4</td>
<td>32.7</td>
<td>45.5</td>
<td>70.8</td>
<td>Shutdown Command</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8000W</td>
<td>30.9</td>
<td>41.7</td>
<td>63.4</td>
<td>Shutdown Command</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10000W</td>
<td>33.9</td>
<td>47.7</td>
<td>75.4</td>
<td>Shutdown Command</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15000W</td>
<td>41.4</td>
<td>62.7</td>
<td>Shutdown Command</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20000W</td>
<td>48.9</td>
<td>Shutdown Command</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30000W</td>
<td>Shutdown Command</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- The Matrix represents the temperature increase over time (seconds) as it relates to the density per cabinet (Watts per Cabinet) in the event of cooling loss. It is assumed the base temperature is 20 °C.

L | Temperature Increase Over Time vs Density per Cabinet

- Loss of Cooling and the rate of rise of temperature
User Preference and Constraints – STEP 4
Schematic Development – Design for Thermal Ride Through

1. Establish PROJECT PARAMETERS
2. Develop SYSTEM CONCEPT
3. Selection SITE SELECTION
4. Incorporate USER PREFERENCES AND CONSTRAINTS
Diesel Rotary UPS vs Static UPS with Thermal Storage for Cooling Load Application

Design Parameters
- 3MW IT load, 500 racks at 6kW/rack
- Calculated cooling load – 945RT
- Water cooled chilled water system in N+1
- 8 – 15°C CHW temperature
- Canopy type of generator
- Canopy type of DRUPS
- Comparison and TCO calculation focus only on the electrical plant equipment supporting the cooling infrastructure only – “variable”
- M&E plant supporting IT load, lighting, general purpose power and other main equipment, e.g. IT UPS, etc. are excluded from the case study for simplicity – “constant”

2N Electrical Topology for Cooling – supported by Static UPS

2N Electrical Topology for Cooling – supported by DRUPS

WP-222 – To Be Launched
Diesel Rotary UPS vs Static UPS with Thermal Storage for Cooling Load Application

Approx. 360m²

Diesel Rotary UPS vs Static UPS for IT and Cooling Load Application

Approx. 448m²

### Diesel Rotary UPS vs Static UPS with Thermal Storage for Cooling Load Application

<table>
<thead>
<tr>
<th>Results</th>
<th>Cooling on DRUPS</th>
<th>Cooling on Static UPS</th>
<th>Static UPS % Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall UPS System Energy Loss</td>
<td>111 kW</td>
<td>15 kW</td>
<td>86.5%</td>
</tr>
<tr>
<td>Plant space</td>
<td>448 m²</td>
<td>360 m²</td>
<td></td>
</tr>
<tr>
<td>a) CapEx</td>
<td>$2,369,105</td>
<td>$1,516,330</td>
<td>36.0%</td>
</tr>
<tr>
<td>b) Maintenance &amp; Cylindrical Replacement for 10 years*</td>
<td>$1,097,212</td>
<td>$606,131</td>
<td>44.8%</td>
</tr>
<tr>
<td>c) Electricity Cost for 10 years</td>
<td>$19,230,432</td>
<td>$17,821,814</td>
<td>7.3%</td>
</tr>
<tr>
<td>TCO for 10 years (a+b+c)</td>
<td>$22,696,749</td>
<td>$19,944,275</td>
<td>12.1%</td>
</tr>
</tbody>
</table>

### Diesel Rotary UPS vs Static UPS for IT and Cooling Load Application

<table>
<thead>
<tr>
<th>Results</th>
<th>Full DRUPS</th>
<th>Static UPS with Buffer Tanks</th>
<th>Static UPS % Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall UPS System Energy Loss</td>
<td>341 kW</td>
<td>108 kW</td>
<td>69.3%</td>
</tr>
<tr>
<td>Plant space</td>
<td>1128 m²</td>
<td>1176 m²</td>
<td></td>
</tr>
<tr>
<td>a) CapEx</td>
<td>$8,374,978</td>
<td>$6,047,104</td>
<td>27.0%</td>
</tr>
<tr>
<td>b) Maintenance &amp; Cylindrical Replacement for 10 years*</td>
<td>$3,320,600</td>
<td>$2,484,262</td>
<td>25.2%</td>
</tr>
<tr>
<td>c) Electricity Cost for 10 years</td>
<td>$70,306,263</td>
<td>$67,578,380</td>
<td>3.9%</td>
</tr>
<tr>
<td>TCO for 10 years (a+b+c)</td>
<td>$82,001,841</td>
<td>$76,109,746</td>
<td>7.2%</td>
</tr>
</tbody>
</table>

*Li-Ion Batteries
An integrated suite of DCIM applications, enable businesses to prosper by managing their data centers across multiple domains, providing actionable intelligence for an ideal balance of high availability and peak efficiency throughout the Entire data center life cycle.
User Preference and Constraints – STEP 4

Security System

1. Establish PROJECT PARAMETERS
2. Develop SYSTEM CONCEPT
3. Selection SITE SELECTION
4. Incorporate USER PREFERENCES AND CONSTRAINTS

> Security Zone Definition

- Restricted perimeter
- Admin building
- Main entrance
- Security guard house
- Visitor car park
- Logistic & technical entrance
- Logistic area
- Public perimeter
- Technical zone
- IT & Telecom Rooms
- Secondary entrance
- Employee car park

- TRANSFO LODGES
- LOW VOLTAGE CONTROL ROOMS
- Condensing units
- Goods lift
- Loading bay
- Green wall
- ROOF PLAN  POD 2
- FIRST FLOOR   POD 2
- FIRST FLOOR   POD 3
- ROOF PLAN  POD 3
- FIRST FLOOR   POD 1
- ROOF PLAN  POD 1
- minimum height : 5500
- GENSET PLANT
- FUEL TANKS 4 x 120m³
- Fuel service bay
- Gensets plant Roof terrace
- MV ROOM
- MV ROOMS
- BATTERY ROOMS
- BATTERY ROOMS
- minimum height : 10m
- minimum height : 3500
- h = 9m
- usable roof terrace
- UPS ROOM DRY COOLER UNITS
- Ground floor plan
- ECOBREEZE
- SECURITY FENCE
- TELECOM / ENTRANCE ROOM
- LOADING BAY
- WATER TANK FOR FIRE
- SPRINKLER SYSTEM
- 60m²
- h = 7.8m
- 7%
- roof terrace
- SECONDARY EXIT
- SECURITY GATE
- SECURITY FENCE
User Preference and Constraints – STEP 4

Security System

1. Establish PROJECT PARAMETERS
2. Develop SYSTEM CONCEPT
3. Selection SITE SELECTION
4. Incorporate USER PREFERENCES AND CONSTRAINTS

> Security Zone Definition – Technical Zone

- Telecom entrance & backbone Room
- Or
- Backbone Area (no separation)
- IT Room
- Outdoor secured ecobreeze zones
- DC « Electrical » zone
- 2 Levels
Speed to Delivery – Prefabricated Building Blocks

IT Room Modules
- 90kW All-in-One (40ft Enclosure, 10 Racks, UPS, PDU, In-Row CW Cooling, DCIM)
- 110kW Single Module (40ft Enclosure, 10 racks, PDU, In-Row CW cooling, DCIM)
- 205kW Single Module (53ft Enclosure, 14 racks, PDU, In-Row CW cooling, DCIM)
- 240kW Dual Module (20x 45ft Enclosure, 22 Racks, PDU In-Row CW cooling, DCIM)
- 240kW Dual Module (20x 45ft Enclosure, 22 Racks, PDU 3 Perimeter CRACs CW cooling, DCIM)

Power Modules
- 90kW All-in-One (40ft Enclosure, 10 Racks, UPS, PDU, In-Row CW Cooling, DCIM)
- 110kW Single Module (40ft Enclosure, 10 racks, PDU, In-Row CW cooling, DCIM)
- 205kW Single Module (53ft Enclosure, 14 racks, PDU, In-Row CW cooling, DCIM)
- 240kW Dual Module (20x 45ft Enclosure, 22 Racks, PDU In-Row CW cooling, DCIM)
- 250kW 20ft Enclosure with UPS, Switchgear, cooling, DCIM
- 300kW 40ft Enclosure with UPS, Switchgear, cooling, DCIM
- 1.2 MW Skid mounted, UPS, Switchgear, DCIM

Cooling Modules
- 250kW 20ft Enclosure with UPS, Switchgear, cooling, DCIM
- 300kW 40ft Enclosure with UPS, Switchgear, cooling, DCIM
- 1.2 MW Skid mounted, UPS, Switchgear, DCIM
- 500kW 40ft Enclosure with UPS, Switchgear, cooling, DCIM
- 1200kW Hydronics Modules (Pumps, VFDs, DCIM and controls, connections for 3-600kW Chillers)
- 500kW Hydronics Modules (Pumps, VFDs, DCIM and controls, connections for 3-250kW Chillers)
- Ecobreeze ISO frame 50kW increments up to 400kW of total cooling capacity (DCIM)
Data Center Reference Design

SPEED TO DELIVERY

Verification of Design – STEP 6
Integrated System Verification Test and Close Out

> Why ISVT?

Has the systems been installed correctly?

Are the systems at higher risk during maintenance?

Are the systems functionally integrated?

Will the systems perform under all load conditions?

We created a Test Process to simulate different failure mode on all components so as to ensure that the systems interact and response according to the design intent.

Have you got value for money?

The facility is finished - but was system reliability proven?

Will the systems operate in a crisis?

Will the systems communicate when faults occur?

Establish PROJECT PARAMETERS

Develop SYSTEM CONCEPT

Selection SITE SELECTION

Incorporate USER PREFERENCES AND CONSTRAINTS

Design DESIGN PHASE

Verification VERIFICATION OF DESIGN
Verification of Design – STEP 6
Integrated System Verification Test and Close Out

1. Establish PROJECT PARAMETERS
2. Develop SYSTEM CONCEPT
3. Selection SITE SELECTION
4. Incorporate USER PREFERENCES AND CONSTRAINTS
5. Design DESIGN PHASE
6. Verification VERIFICATION OF DESIGN

> ISVT script sample
Project References
List of design & build projects

Elitery
(First Uptime Tier 3 Certification in S.E. Asia)

Bank Audi Lebanon
(Uptime Tier IV certified)

160kW All-In-One,
(Prefab module)

Snaps – FT Mumbai
(With thermal ride through system)

Bank Audi
Audi Saradar Group

Fax Lite Data Center
(Full facility, fully tested with iSVT)

Manufacturing Plant in Indonesia
(2 Data Centres)
(customer do not want to publish in Uptime)

Automotive Manufacturer in Indonesia

Prada s.p.a
Prada - CED Valvigna
20 August 2014

UPTIME INSTITUTE CERTIFIED

Life Is On | Schneider Electric
Data Center Lifecycle Services Bureau - Offers and Certifications

1. Asset Connect
   - **ASSET Monitor**
     - 24x7 Monitoring of Critical Environment, Alarm Management, and Notification
     - Customizable Reporting (Alarm performance)
     - Customer Web portal
   - **ASSET Predict**
     - Incident Management & Resolution, Enhanced Customer Web portal
     - Asset & Incident Management
     - Failure Prediction using Data Analytics
   - **ASSET Commit**
     - Critical Environment assessment & Benchmarking, Customized Advanced Data Analytics, Continual Improvement Process (CIP)
   - **ASSET Operate**
     - Critical Facility O&M Program, Maintenance Scheduling, Multi-Vendor Management (Scheduled/Unscheduled)
     - Onsite Operations, Fulltime Facility Operations & Management, Continual Improvement Process (CIP)

2. Remote Assess
   - Assessment Services Back End
     - “Remote Assessments”

3. RMS Operations
   - 24X7 monitoring of RMS connections

4. Operate Services
   - • Customer specific analytics and reporting
   - • Remote SXW for DC Operations
   - • Remote CMMS & DCIM Operations

5. SXW Offline Analytics
   - StruxureWare Offline Analytics

5. SXW Connected Analytics
   - StruxureWare+ + +

Facility Certifications
- ISO 9001
- ISO 27001
- ISO 20000

People Certifications
- ITIL
- Certified Data Center Professional
- Uptime Accredited Tier Specialist
- Aligning IT services with needs of business
- Service desk framework and the ITIL best practices
Schneider Electric Data Center Solutions

Consulting & Solution Design
- DC Design & Engineering
- Ref Design & Standards
- Project Reviews
- Country Enablement

StruxureWare for Data Center
- Power Monitoring Expert
- SmartStruxure / SBO
- Data Center Ops / Portal
- Data Center Expert
- NetBotz
- Software Services

DCLS & Service Bureau
- Digitization
- Analytics
- Data Science
- Assessment
- CFO / Vendor Mgmt

Project Management & Execution
- Project Exec Enablement
- Risk Management
- Cost & Time
- Closeout

Legend:
- ITB
- ENERGY
- Partner/Eco Blg
QUESTIONS