DCIM
Data Center Infrastructure Management

Part 3
Operational Management

Moves Adds and Changes

&

Electrical Infrastructure

November 5, 2013
Presented by

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Today’s Topics

• Operational Management of
  – Moves Adds and Changes (MAC)
  – Electrical Infrastructure
• Continuously Optimizing Energy Efficiency
• Long-term Benefits of DCIM
• Investment Justification for:
  – Capital, Time, and Labor
Moves, Adds and Changes (MAC)

• Data centers are a *highly fluid* environment
  • Change Control, Work Orders and Asset Tracking *are a major workload issue*
  • Each equipment change can impact the power, cooling, cabling and network requirements for the cabinet, row or zone
  • Depending on the size and scale, typical *manual processes* such as spreadsheets are *no longer practical or cost effective*, as well as a potential *source of errors*
At the Cabinet

While it may seem inconsequential in large data center, even the *improperly managed addition of a single server* can impact many other systems and IT Equipment:

- Space
- Power
- Cooling
- Network
  - Cabling

**Reliability**
**Redundancy**
**Availability**
**Resilience**
Change Control- IT MAC Planning Tool

• **DCIM** can provide the ability to determine *if* and *where* new IT equipment can be deployed

• Every piece of IT Equipment has **known requirements** for:
  
  – Space
  – Power
  – Cooling
  – Network
    • Cabling
IT Equipment

• **BladeServer**: Model XYZ-2
  - **Size**: 8 RU
  - **Power**: 5,000 Watts
    - Details PS: 6 x 2000 VA each (3 required) A – B
    - Each PS input 208-240V @ 10A – L6-20P cord
  - **Cooling**:
    - 18,500 BTU - 1,000 CFM
  - **Network**:
    - **Cabling**:
      - SAN: 4 x Fiber Channel-SPF GBIC
      - Network: 6 x 10 Gigabit Ethernet / Copper- 10 GbE
IT Equipment

- **BladeServer**: Model XYZ-2
  - Purchased: 12/24/10
  - Location: Row-15 Cabinet-5
  - Chassis SN# XYZ12345  Asset Tag: ABC123
  - Blades:
    - 1 Dual 2.8 Ghz CPU - **100 Watts**
    - 2 Quad 3.3 Ghz CPU - **180 Watts**
    - X .......
    - X .......
    - 16 Quad 3.3 Ghz CPU - 180 Watts

Blade Power Varies

Blades added over time
Power Distribution Management

- Floor PDUs and Electrical Panels
  - Modbus or TCP/IP
  - Main Feed Monitoring (Up-Stream Breaker)
  - Branch Circuit Monitoring
- Coordinate Warning Levels for A-B circuits!
Rack Power Management

- **Rack Power Strips** (unmanaged)
- **Intelligent PDUs** (TCP/IP)
- **Match Plug to Branch Circuit Receptacles**
  - Capacity & Type
  - Match Receptacle Types for **IT PS Cords**
    - Type 🌐 ○
- **Coordinate Warning levels for A-B circuits!**
Improved Availability via Optimized Power Provisioning

• Most facility based outages are related to electrical issues commonly caused by

• **2N Overloading** (A+B paths never to exceed 100%)
  – Borderline Conditions – *User Settable Warning Levels*
  • or phase Imbalances

• **AVOID Cascade A-B Failure**

• At the Branch Circuit to Rack Level PDU
  – **40%** of Branch Circuit Breaker rating (2N)

• At the Rack, Row or Area Distribution Panel
Nameplate Power Provisioning

• Nameplate data alone is not an ideal way to provision electrical circuits or do capacity planning

• Historically, various “rules of thumb” have been commonly used
  – Typically 50-70% of nameplate

• While relatively “safe” in most cases

• It still may not accurately reflect the highly dynamic power variations by modern IT hardware such as Bladeservers –

• Especially when coupled with Virtualization
Distribution Panel Surveys

• A common practice is to do regular surveys of branch circuits in distribution panels
• A manual labor intensive process that can be potential source of *errors*
• or even *Power Disruptions*
• It is a *snapshot* only valid for that moment in time!
**Real Time** Power Monitoring

- By using *Coordinated* branch circuit monitoring to develop historic data and trends, you are able to have better insight of average and **Peak Draw** (critical for A+B 2N paths) across every cabinet.

- More granular power data can be gathered using
  - Intelligent rack level PDUs
  - Direct polling of every IT device (via SNMP)

- This **improves availability** while optimizing branch circuit utilization and provisioning.
Example:

20 Amp A-B 2N Branch Circuits

A+B Above 16 A

Manual Survey 5:30 am > A=7A + B=7A = Safe?
Cooling Optimization

- Heat Load (kW/ BTU)
- Required Airflow (CFM)
  - Based on IT Device Heat Load (Presumed)
  - Based on IT Device Requirements (Info based)
- Input to CFD Model
  - Airflow Verification

Alternate Location!
Network Management

BladeServer XYZ-2 Connectivity

• **SAN Switch:**
  – 4 Ports - Fiber Channel

• **Ethernet Switch:**
  – 6 ports - 10 Gigabit Ethernet
  • **Network Switch A**
    – VLAN #
    – IP Address/Subnet
  • **Network Switch B**
    – VLAN #
    – IP Address/Subnet
Cable Management

• The accuracy and availability of ports (and their numbers) for all patch panels, cross-connects and jumpers is important to know — before designating a position in a cabinet.

• There should also be a database index about its connected network equipment ports — to avoid a tangled mass of cables.
Benefits of Managed MACs

• By having a **integrated database** of all the related information you can:
  – Avoid impacting **Availability** of IT equipment
    • *For Moved, Added and Existing systems*
  – Avoid Stranded Capacity
    • *Improve Balance of Power and Cooling load*
  – Optimized Workflow- resulting in
    • Accurate Provisioning
    • Speed of Deployment
      - Lower Labor costs
      - **Less Human Error**
Integration of Polling Data Directly from IT Equipment

Some DCIM System offer the ability to accept or poll data *directly* from **IT Systems**:

- **Power Draw (Per IT Device)**
  - Servers, Storage, Switches

- **Cooling**
  - Intake and Exhaust Temperatures - \(\Delta T - \text{CFM}\)

- **Utilization**
  - CPU, Disk Space, Bandwidth, Etc.
Continuously Optimizing Energy Efficiency

• **Cooling** is the largest use of energy in the facility

• **CFD modeling** using Temperature and Airflow information, cooling systems can be intelligently managed and optimized as IT equipment changes occur

• **Capacity Planning** based on historic trends and on existing IT equipment power and cooling data can help optimize operational and energy efficiency

• **Predictive Modeling** allows for optimal placement of new IT equipment
Long-Term Potential Benefits

Facility

• More Accurate Power Provisioning
  – Branch Circuits
  – Receptacle Types

• Cooling
  – Airflow Optimization – Match to Rack Level Heat Load
  – Less “Hot Spots”
  – Less “Overcooling”
  – Better placement of New IT Equipment
  – Improved Energy Efficiency

• Proactive Monitoring & Preventive Maintenance
  – Detect Performance Changes
Improved Operational Availability

Proactive Maintenance

- *Early detection* reduces chances of system or component level failure by of performance degradation

- *Preemptive service* rather than reactive “break-fix” or simple *scheduled* periodic intervals
Cohesive Alignment of IT and Facilities

• IT Asset Management
  – Includes Technical Requirements
    • Drives Provisioning

• Rack-Row Provisioning (MAC)
  – Space
  – Power
  – Cooling
  – Networking

• Better Facilities Resource Allocation
Improved Availability

Predictive Analysis –

IT Equipment

• Insures proper airflow under dynamic IT loading conditions
• Avoids or minimizes creating potential future “hot spots” as IT equipment is added which could reduce IT equipment reliability

• Cooling Failure Scenarios – Impact on IT equipment
  • Airflow and temperature visualization during cooling unit failure
Avoid Stranded Capacity Caused by Mismatch

• Apparent Capacity - Facility Level
  ✔ Space Total / % Available
  ✔ Power Total / % Available
  ✔ Cooling Total / % Available

• Usable Capacity - Row/Rack Level
  ✔ Space
  ✔ Power
  ❌ Cooling

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Define your Expectations!

• Be clear about your problems, and your expectations of the proposed DCIM system deliverables
• If you have a existing BMS or IT based Asset or Network Management Systems **ASK**
  – What information are they already providing
    • Ask how or if is it being used
  – What are your current systems not providing
  – What processes need improvement
• Which Group is Driving this - Facilities or IT or Both

  – **Caveat** - Ensure your DCIM vendor can integrate with existing BMS or other IT based monitoring systems
Cost Factors

• **Capital Costs**
  – DCIM Hardware and Software
  – Sensor Installation Costs (Physical)
  – Implementation Costs (System Integration)

• **In-House Staff Time and Labor**
  – Project Management
  – Supervision of Implementation and Integration
  – *Vendors require your cooperation and coordination!*
    • Understand and plan for sensor installation challenges - *(i.e. allow for some downtime)*
  – Testing
  – Training
Cost Justification

• Faster, More Accurate Provisioning (MAC)
  – Improved Workflow
  – Improved Asset Management
  – Improved Resource Allocation

• Improved Capacity Utilization and Planning
  – Simulations and Modeling
  – Higher Availability
  – Improved Energy Efficiency
The Bottom Line

• There are multiple benefits to a successful DCIM project, some are directly cost justifiable (i.e. improved energy and operational efficiency), while others are less tangible, such as improved equipment deployment and potential increase of availability.

• It begs the ROI question, how long will it take to recover the cost.

• Each organization is different, the ROI is related to how well (or poorly), disparate information and provisioning processes between IT and Facilities are coordinated.
  – Also influenced by data center size and number of devices to be monitored and managed.
No Trees *(virtual or real)* were hurt or destroyed in the preparation of this presentation.

*Thank you*

Julius Neudorfer

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Siemens provides reliable and efficient Data Centers that offer maximum uptime, are safe and secure, and meet the growing demand for data storage.
Preventative Maintenance and Testing.
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Thermography
- Most problems in an Electrical System are preceded by a change in it’s Thermal characteristics (signature).
- Primary predictive maintenance tool for electrical distribution systems.

Real Time Power Monitoring
- The ACCESS Energy Management & Control Systems from Siemens are complete enterprise solutions that help you manage your businesses energy cost and availability.
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