

The Modern Datacentre – Energy Efficient, Modular, Scalable, Secure

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The Modern Datacentre

- **The planning, construction and operation of IT infrastructure for mission-critical applications in reliable Datacentres represents a real challenge.**
- **It is not only choosing the right IT equipment to satisfy an individual company's requirements which is of the greatest importance.**
- **There are other factors which also need to be considered: those involving building design and size, electric cabling, waste heat, ventilation equipment, availability as well as acquisition and operating costs.**



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- The ongoing development and integration of information technology in all areas of business means that today, no company can afford this technology to fail.
- A Datacentre failure can lead to a full collective business incapacity.

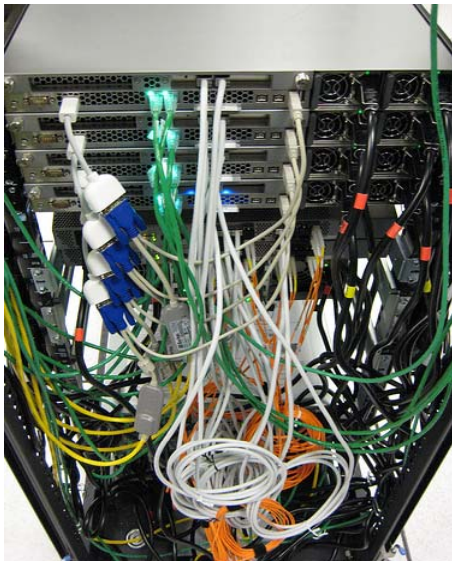


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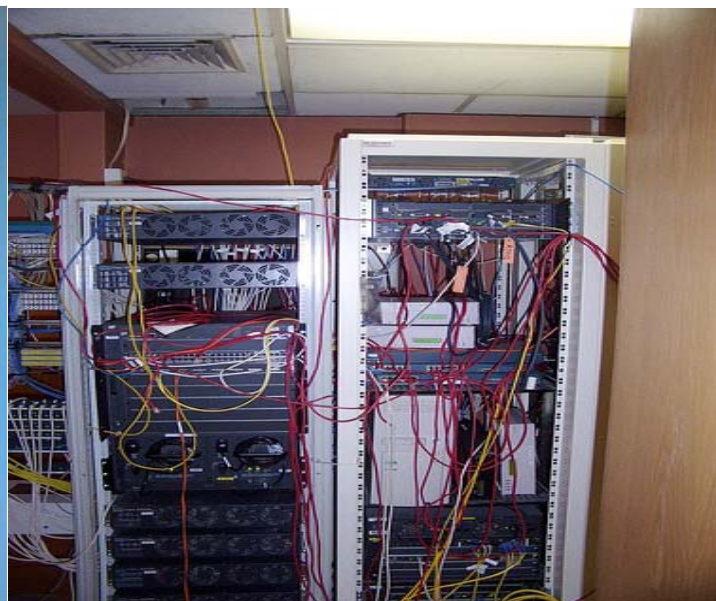
- As a result of growing availability demands on IT infrastructure, it is not only the demands on the IT systems themselves which are increasing, but above all the need for fault-tolerant environmental conditions and services.
- Redundant climate control and power supply configurations, dual power feeds and concurrent systems maintenance have become the established standards for high-availability IT facilities.



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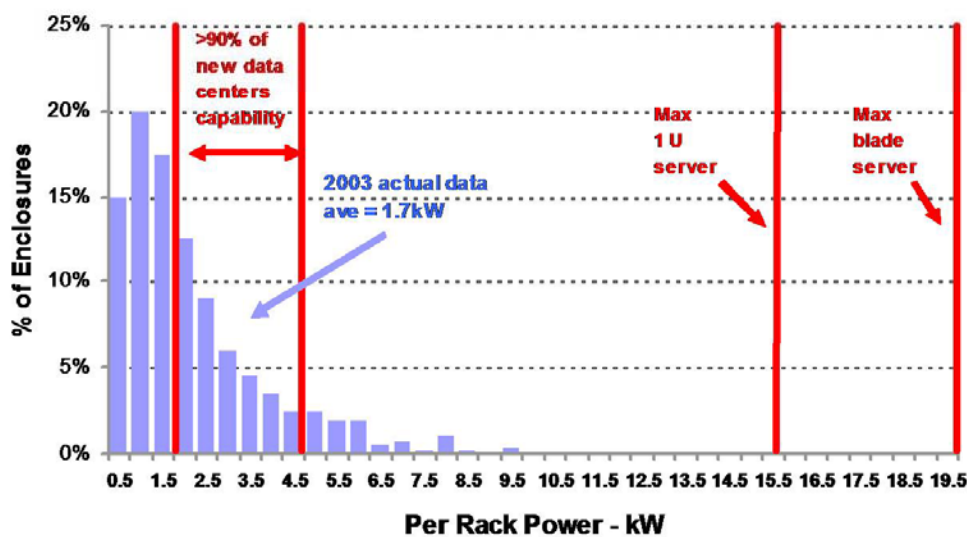


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- Technology compaction is the major trend impacting rack systems
 - Escalating heat densities of rack-mounted equipment
 - Increasing number of required power receptacles with redundancy
 - Large amounts of power and data cables
 - Increasing rack-mounted equipment weight loads
- Technology convergence driving a mix of rack-mounted equipment
 - More equipment requiring 3-phase input @ Rack level



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- **Metrics and standards**

- PUE

- Power Utilisation Equivalence

- At the simple level, PUE is computed by dividing total facility power by IT equipment power.
 - “Playing the PUE Game”
 - The areas in which further refinements to PUE are required and underway include the following:



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- Geographic location: Better PUE numbers are more easily achieved in temperate areas than in areas with an extreme hot or cold climate.
- Distinctions between facility and IT equipment: From internal server fans to cooling elements (such as pumps, refrigeration, blowers, and heat exchangers within the IT equipment itself), it is not yet clear how we can distinguish between IT equipment and cooling equipment. In addition, the categorization of certain components, such as facility equipment versus IT equipment, skews the PUE calculation.
- Dynamic nature: Simply dividing the total power by the IT power would produce a result, but there is no formal definition for measurement frequency or for averaging requirements. If measurements are taken on a day of extreme hot weather and low IT equipment usage, the results would be far different than if the measurements were taken on a day of temperate weather and high equipment use. In reality, PUE is not constant. Rather, it is always changing and computations should be adjusted to reflect this.
- Compute cycles: Present calculations do not account for the number of compute cycles or the actual work produced by energy that is expended.



The Modern Datacentre

- **Energy Efficiency**

- Power and Cooling

- Power Generation
- UPS Systems
- Cooling
- Physical Datacentre security and threat reduction



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- **Energy Efficiency**

- Power Generation

- Gas Micro Turbines
- 180KW Power
- 400KW Cooling



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- **Energy Efficiency**
 - Power Generation
 - Diesel Generators
 - Fuel Cells
 - Geothermal



The Modern Datacentre

- Comfort Cooling Problems
 - Designed to run during summer days, up to an expected maximum of 1200 hours per year
 - Neither the controls nor the refrigeration system is designed for zero downtime
 - Low airflow (Designed to be quiet)
 - No Humidity control



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- ASHRAE's "Thermal Guidelines for Data Processing Environments" recommends a temperature range of 20–25 °C (68–75 °F) and humidity range of 40–55% with a maximum dew point of 17°C as optimal for Datacentre conditions.

– American Society of Heating, Refrigeration and Air-conditioning Engineers

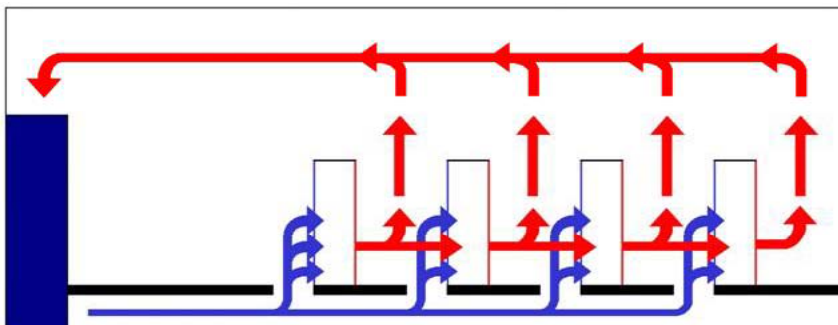


Common Cooling Issues

Racks facing same direction

Most rack-mounted servers draw air in the front and exhaust at the back

Exhaust air mixes with cold air with no aisle separation



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- **Energy Efficiency**

- Cooling

- Separation of Hot and Cold Air
 - Hot Aisle vs Cold Aisle
 - Close coupled Cooling
 - “Free Cooling”



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- **Free Cooling**
- **Free cooling is an economic method of using low external air temperatures to assist in chilling water, which can then be used for industrial process, or air-conditioning systems in datacentres.**
- **When the ambient air temperature drops to a set temperature, a modulating valve allows all or part of the chilled water to by-pass an existing chiller and run through the Free Cooling system, which uses less power and uses the lower ambient air temperature to cool the water in the system.**
- **This can be achieved by installing an air blast cooler with any existing chiller or on its own. During low ambients a processor can by-pass an existing chiller giving energy savings of up to 75%, without compromising cooling requirements.**



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- **Energy Efficiency**
 - Cooling
 - High chilled water inlet temperature
 - Variable Speed EC Fans
 - Dual Coil for redundancy
 - Dual Power for redundancy



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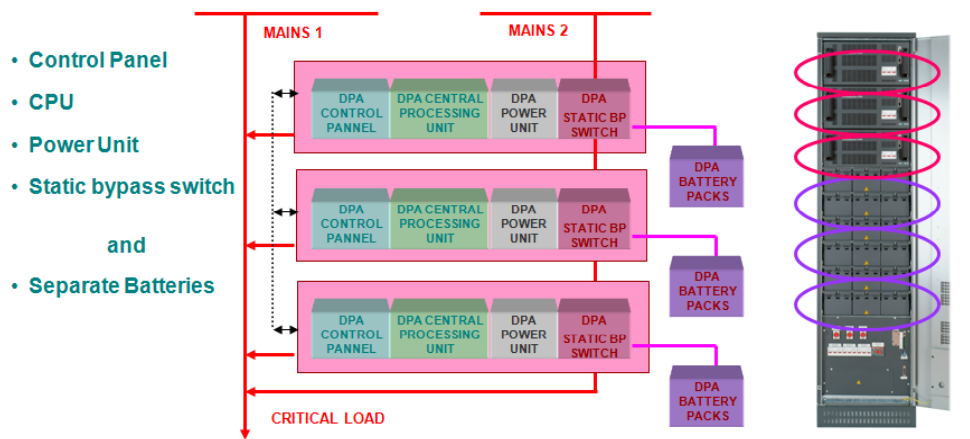
- **Energy Efficiency**
 - UPS Systems
 - Modular Units
 - High Efficiency
 - De-centralised Parallel Architecture
 - No single points of failure



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Decentralized Parallel Architecture (DPA)TM

Decentralized Parallel Architecture (DPA)TM was designed to distribute virtually the entire UPS Hardware and Software into modules in order to reduce the Single Points of Failures (SPOF). DPA includes distributed



POWERFIRM

Ensuring data and IT systems are available and secure

Physical Threats

- Fire



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Ensuring data and IT systems are available and secure

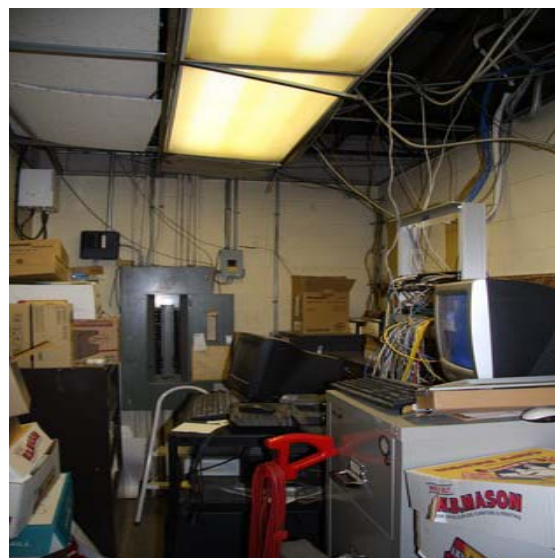
Physical Threats

- Smoke



Physical Threats

- Water



Physical Threats

- Water



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- Gas



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- **Explosion, Collapse, Debris**



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- **Recent disasters made public (only ones you hear about 😊)**
- **2006 Holmesglen TAFE – Fire**
- **2006 Peerless Jal - Fire**
- **2006 Livingstone International - Electrical Damage**
- **2006 Baker Institute - Water Ingress**
- **2006 Primus Telecoms - Water Ingress**
- **2006 Agriquality - Construction Damage**
- **2005 Peter Stevens Motorcycles - Fire**
- **2005 NuFarm - Fire**
- **2005 Cypress Semiconductors - Fire**
- **2005 Tasmanian Supreme Court - Construction Damage**
- **2004 VPAC - Electrical Damage**
- **2004 Alfred Hospital - Electrical Damage**
- **2004 Roving Enterprises (Rove Live)**
- **2004 CPM Australia - Water Ingress**



The Modern Datacentre

- **Summary**
 - **Room**
 - **Fire Proof**
 - **Water Proof**
 - **Gas Tight**
 - **Modular/Scalable**



The Modern Datacentre

- **Summary**
 - **Power Generation**
 - Back-up only, co or Tri-generation
 - Carbon footprint concerns
 - Modularity/Scalability
 - Redundancy



The Modern Datacentre

- **Summary**

- Cooling

- Separation of Hot and Cold Air
 - Energy Efficiency (inlet water temp/Fans etc)
 - Closed coupled or Traditional
 - DX or chilled water solutions
 - Modularity/Scalability
 - Redundancy



The Modern Datacentre

- **Summary**

- UPS

- Modularity/Scalability (Parallel-able)
 - No Single Points of Failure
 - Energy Efficiency
 - Redundancy



The Modern Datacentre

- **Summary**

- Monitoring

- Monitor from the Source to the equipment Power Supplies
- Capacity management & Planning



The Modern Datacentre

- **Measure attributes at the rack level:**

- Temperature
- Humidity
- Airflow
- Particulates
- Smoke
- Water
- Surveillance



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Ensuring data and IT systems are available and secure

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- Questions
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