



Structured Cabling and the Energy Efficient Data Centre



Energy Efficient Drivers



- Data Centre/Storage Growth (More Processors)
- Increased Processing Power (Increased Power Density)
- Energy Costs Increasing
- Green Initiatives
 - Green Star Rating (Green Building Council of Australia)
*New & refurb building's **green** attributes*
 - ABGR Rating (Australian Building Greenhouse Rating) now part of NABERS (National Australian Built Environmental Rating Scheme)
*Building's **green** operation after construction*
 - Energy Efficient Ethernet

Data Centre Trends



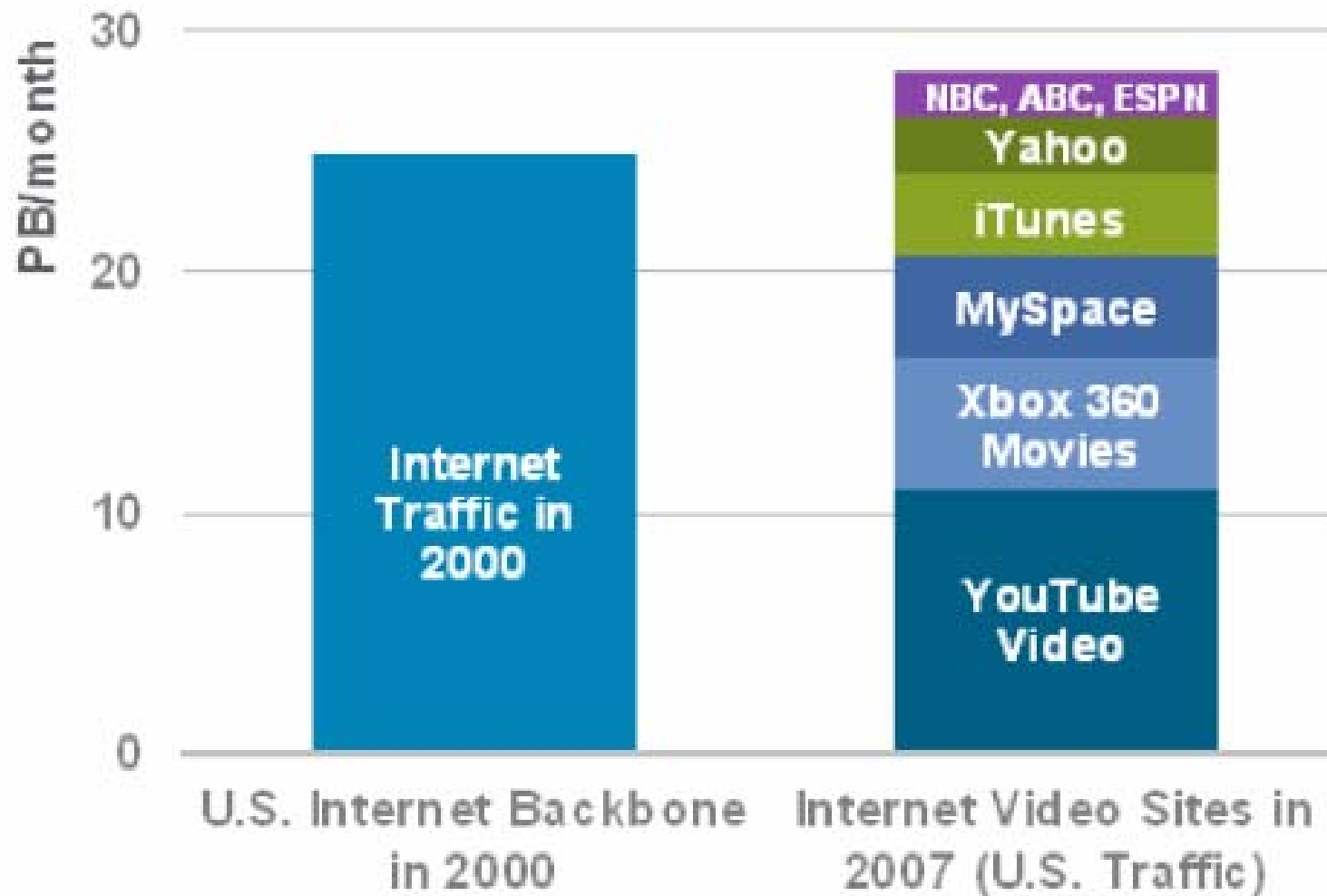
- **Consolidation:** dozens of data centres into a few central location
 - enhancing the capacity across all key areas: networking, redundancy, computing, storage and management
- **Growth:** driven by increasing traffic from an increasingly connected world.
 - Growth for servers (growing 11% per year on average)
 - Storage (growing at a median rate of 22%).
 - Rapid growth is straining data centres' capacities in environmental control, power, and space as companies struggle to find balance between sprawling low-density racks and super-hot and power-hungry high-density racks.
- **Availability:** high reliability requires redundancy: secondary and tertiary data centres hundreds of miles away from primary.
- **Operational cost:** Cooling and Powering #1 concern

Trend - Bandwidth Explosion



- New models showing traffic doubling every two years
- 2011 traffic will be 5x 2006 traffic
- In 2008 consumer traffic will surpass business traffic
- Today's bandwidth hog will be tomorrow's average user
- Driven by new connections, new users and new applications (mostly video)

Internet Growth driving Data Centre Usage



Blade Servers increase the density of cabling in the data centre



- Blade Servers (IBM shown below):
 - Increase density of cabling as there are physically more servers per cabinet
 - Increase heat generated in cabinet (Airflow becomes more important)

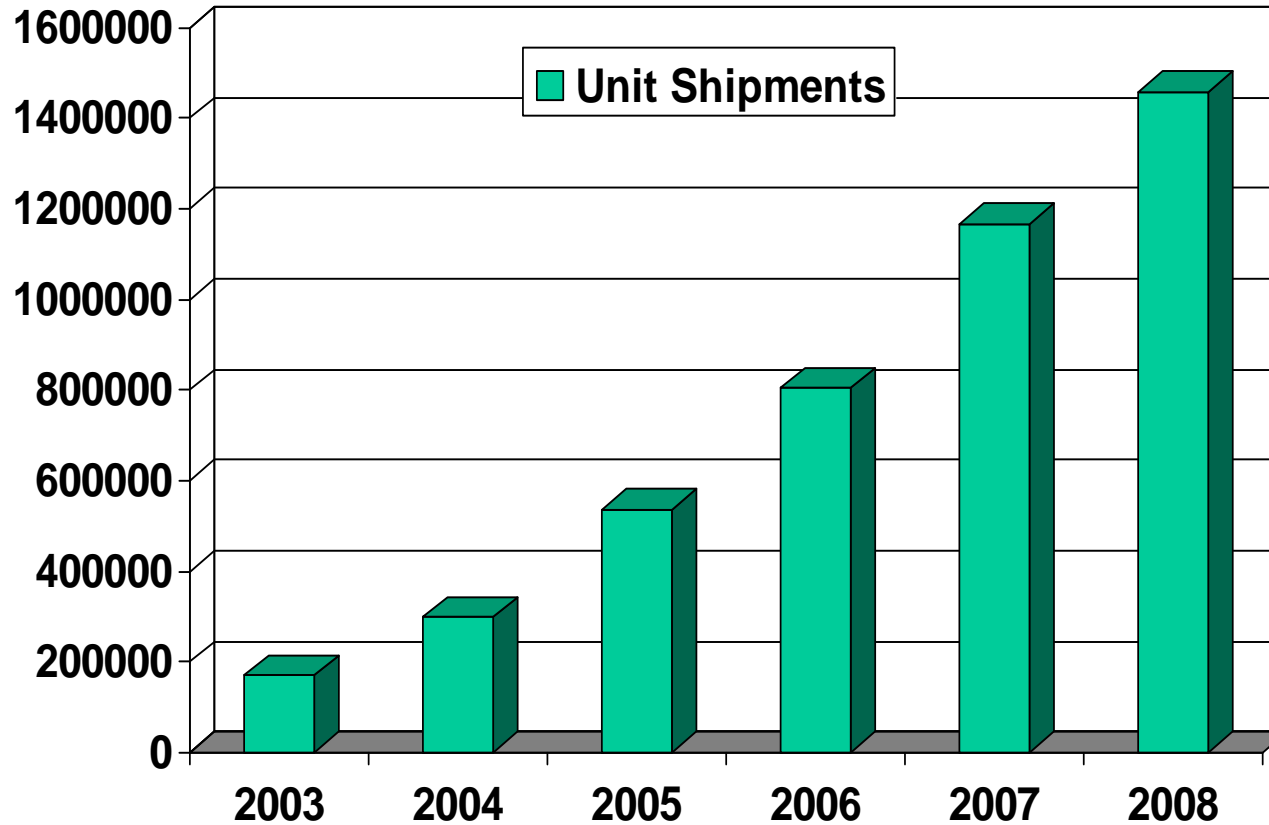
IBM BladeCenter®



ADC KRONE Confidential



Worldwide Blade Server Forecast



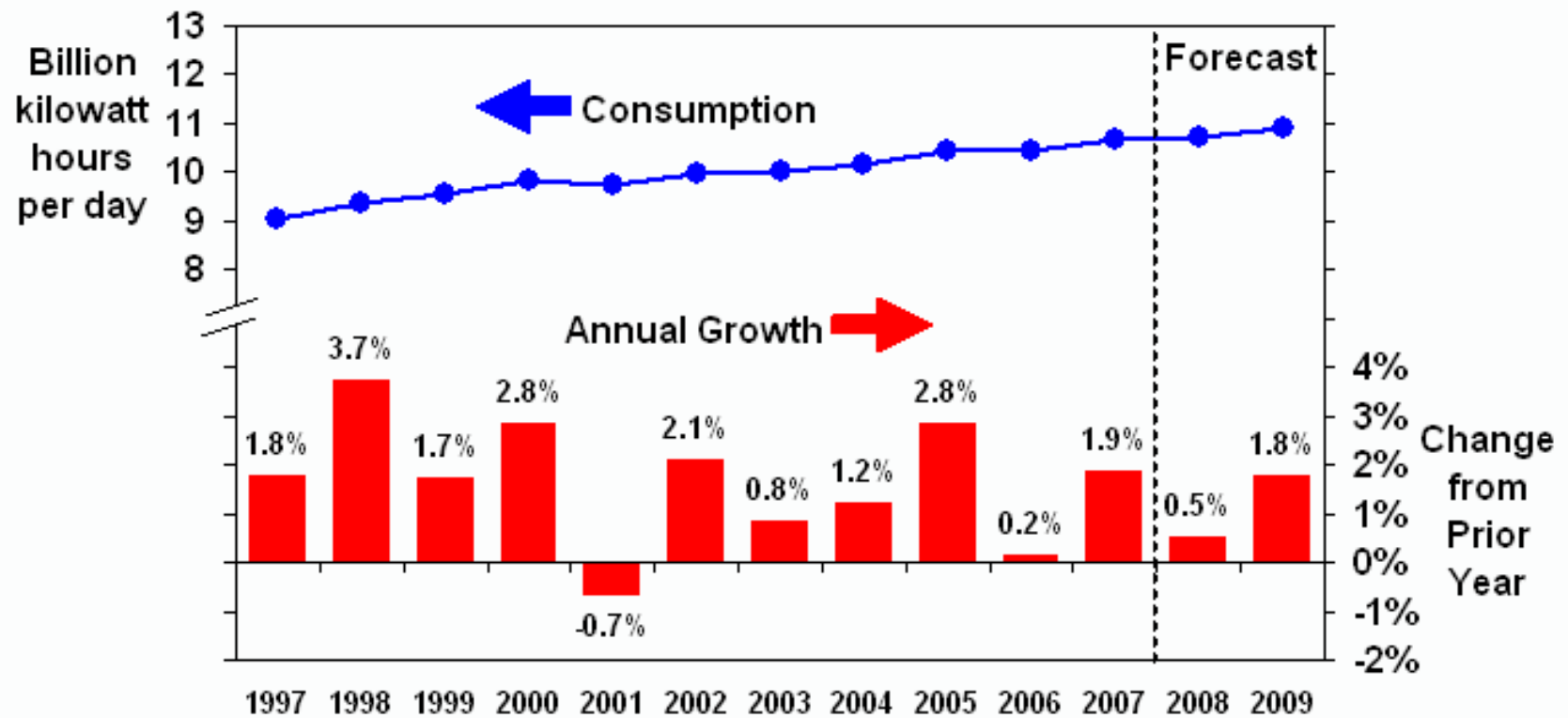
Increase from \$0.5m to \$1.5m in 3 years

Source: Gartner Group

Electricity Usage Steadily Increasing



U.S. Total Electricity Consumption



Short-Term Energy Outlook, January 2008



Not so Green Data Centres



- Data Centres consume 30 to 80 times the energy of a typical office, per square metre
- Data Centres account for 1.5% of all energy use in the US. Equivalent to 38 million metric tons of CO₂ emissions, assuming 1.55 lbs CO₂/kWhr

	Power consumption	Weight	Rack height	Capacity
HP BladeSystem p Series	26.5 kW	2,355 lbs	47U	192 Opteron 2.4 GHz
HP BladeSystem p Series	31.0 kW	2,227 lbs	47U	192 Xeon 3.06 GHz
HP Proliant DL140 1U	13.4 kW	1,200 lbs (approx)	42U (40 systems)	80 Xeon 3.6 GHz
HP Proliant DL145 1U	12.0 kW	1,200 lbs (approx)	42U (40 systems)	80 Opteron 2.4 GHz
IBM DS6800 + 12 DS6000	7.1 kW	1,620 lbs	39U (13 3U, 16-bay systems)	62.4 TB (using 300 GB drives)
Cisco Catalyst 6513	8.0 kW (approx)	560 lbs	40U (2 20U systems)	13-slot chassis, all filled

The "Green" that really matters



But it's not the CAPEX

All about OPEX (power and cooling)



- By 2009, about half the world's data centres will be functionally obsolete due to insufficient power and cooling capacity to meet the demands of high-density equipment
- New Cooling methods explored: in-server, in-rack and in-row cooling, liquid cooling
- Power costs for data centres can make up 48 percent of a business' IT budget

Source: Gartner

Data Centre Hot Buttons

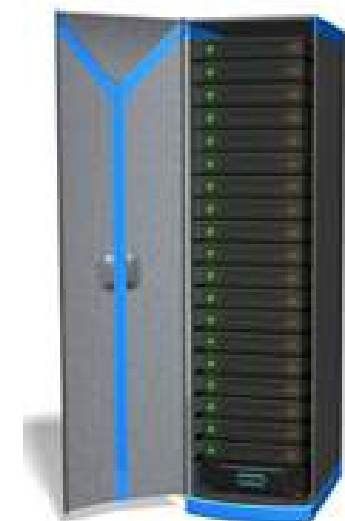


- Blade Servers
 - New Power and Cooling infrastructure will be required to accommodate this latest trend
- Storage Area Networks
 - Blade Servers have smaller hard drives
 - Ever Increasing data per user
- Utilities
 - Major providers are teaming with the likes of Sun Microsystems, VMware and ISR/Spraycool to offer rebates to offset the cost of upgrades.
- Liquid Cooling
 - Companies like APC, Liebert, ISR/SprayCool, IBM, HP, and finally Sun Microsystems are making water-cooling products.
- Site Selection
 - The price of power matters more and the geography matters less -- look for more companies to move IT operations.

NEW DATA CENTERS IN CENTRAL WASHINGTON

- 1 **Sabey Corp.:** Proposed 100,000 square-foot facility on 30 acres.
- 2 **Yahoo Confluence Technology Center:** Existing building currently being equipped by Yahoo.
- 3 **Microsoft:** Began construction in April on 74 acres.
- 4 **Yahoo:** Broke ground last week on 50-acre facility.
- 5 **Titan:** Operating data center located in a former Air Force missile-control facility.

SEATTLE P-1



Data Centre Consolidation



- Data centre consolidation is a popular strategy showing powerful economic characteristics. Major organisations are reaping the benefits of consolidation:
 - Hewlett Packard is cutting its 85 global data centres down to six--three of which will be mirrored disaster recovery sites. HP expects this move to save the company \$1 billion annually.
 - IBM is consolidating 3,900 servers into 30 virtualized mainframes running under Linux. The company anticipates an 80% reduction in energy usage while significantly shrinking its current 8 million square feet of data centre space.
 - Microsoft is well along in its data centre consolidation efforts, producing a savings of \$23.2 million--a 40% cut in its pre-consolidation spending levels.

Server Consolidation Limiting Factors

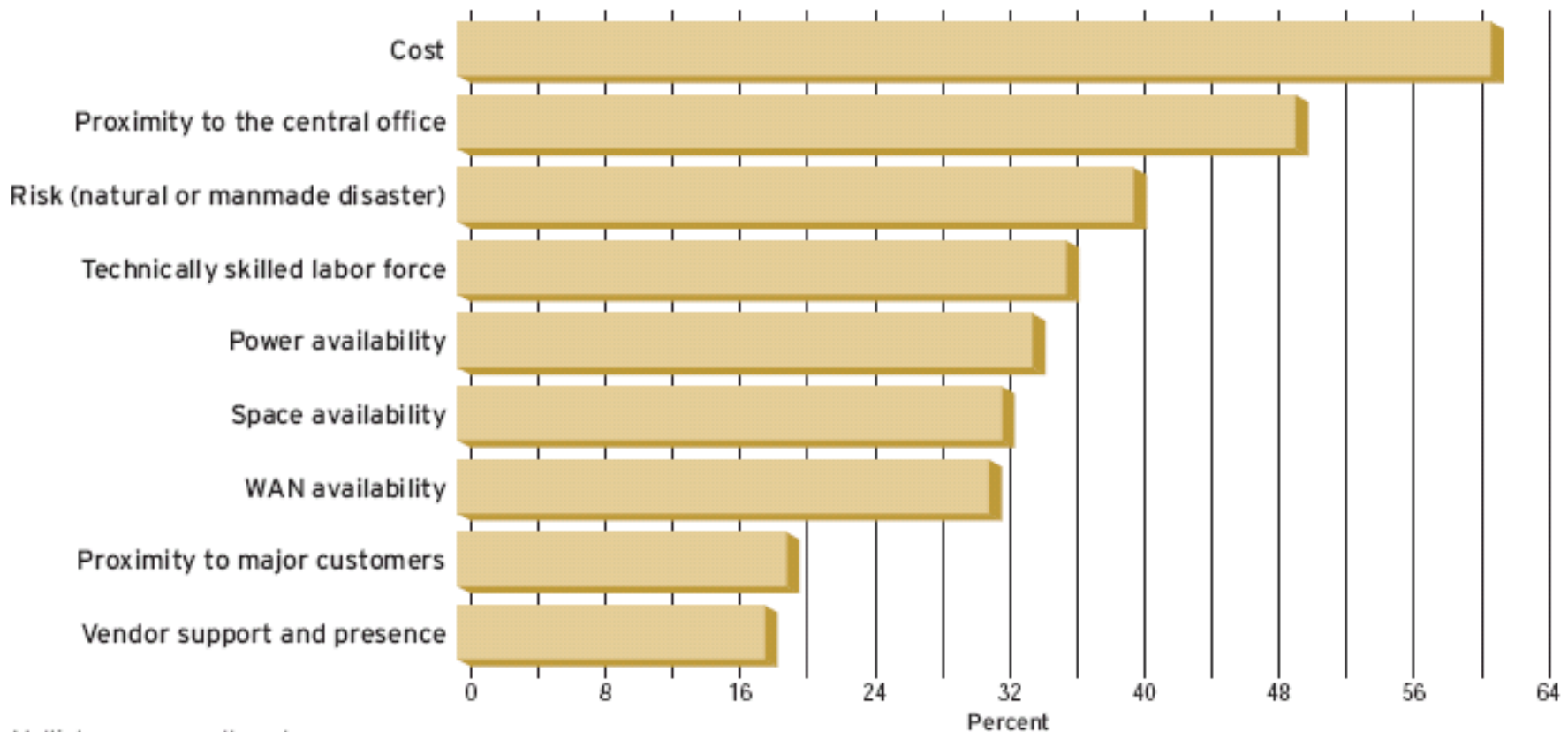


- Network Bandwidth
 - Availability of Sufficient Bandwidth
 - Service Level of Bandwidth
 - Cost of Bandwidth
- Internal Politics

Basis for Location



Which of the following do you consider most important when selecting the location(s) of your data center(s)?
(Select only four.)



Multiple responses allowed

Data Centre Hot Buttons



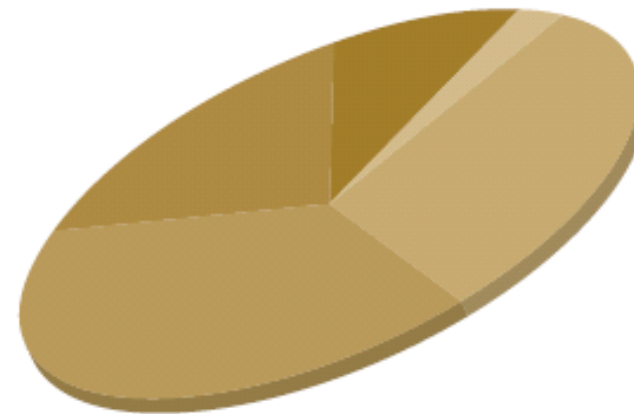
	1,500m ² raised-floor data center	5,000w/m ² usable UPS output*	Total cost
Tier I	\$3.3 million	\$75 million	\$78.3 million
Tier II	\$3.3 million	\$82.5 million	\$85.8 million
Tier III	\$3.3 million	\$150 million	\$153.3 million
Tier IV	\$3.3 million	\$165 million	\$168.3 million

*includes cooling

Source: Meta Group, The Uptime Institute

Based on processor count, what is the expected growth of your data center over the next five years?

- 0% **3.3%**
- 1% to 10% **29.4%**
- 11% to 25% **39.3%**
- 26% to 50% **17.8%**
- 51% to 100% **10.2%**



Source: NWC 2005 This Old Data Center Survey

Data Centre

Operational Costs



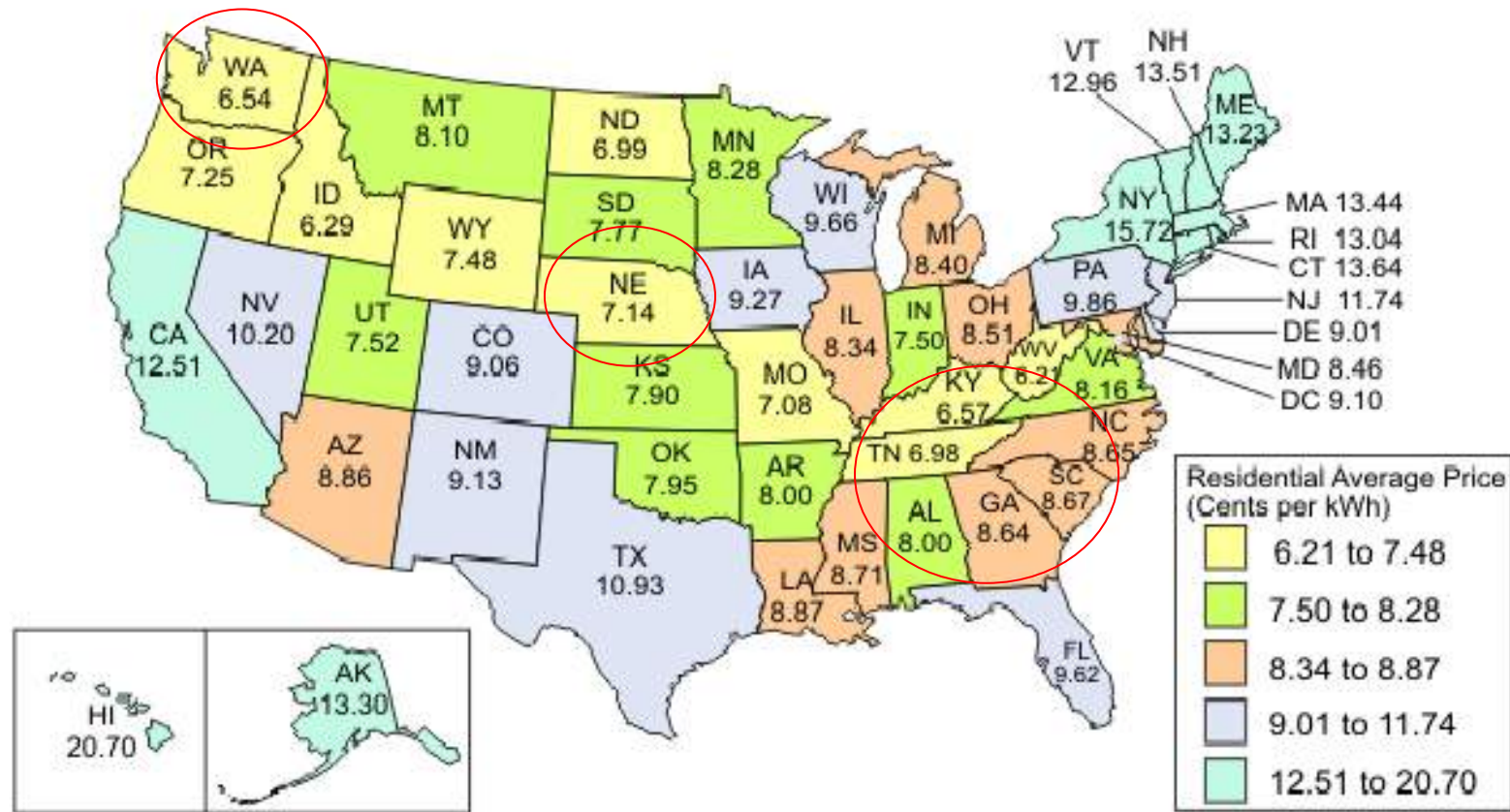
- Powering and cooling the data centre is becoming more expensive than purchasing servers and other equipment for these facilities.



Data Centre Site Selection in USA



Figure 4. U.S. Electric Industry Residential Average Retail Price of Electricity by State, 2005 (Cents per kWh)



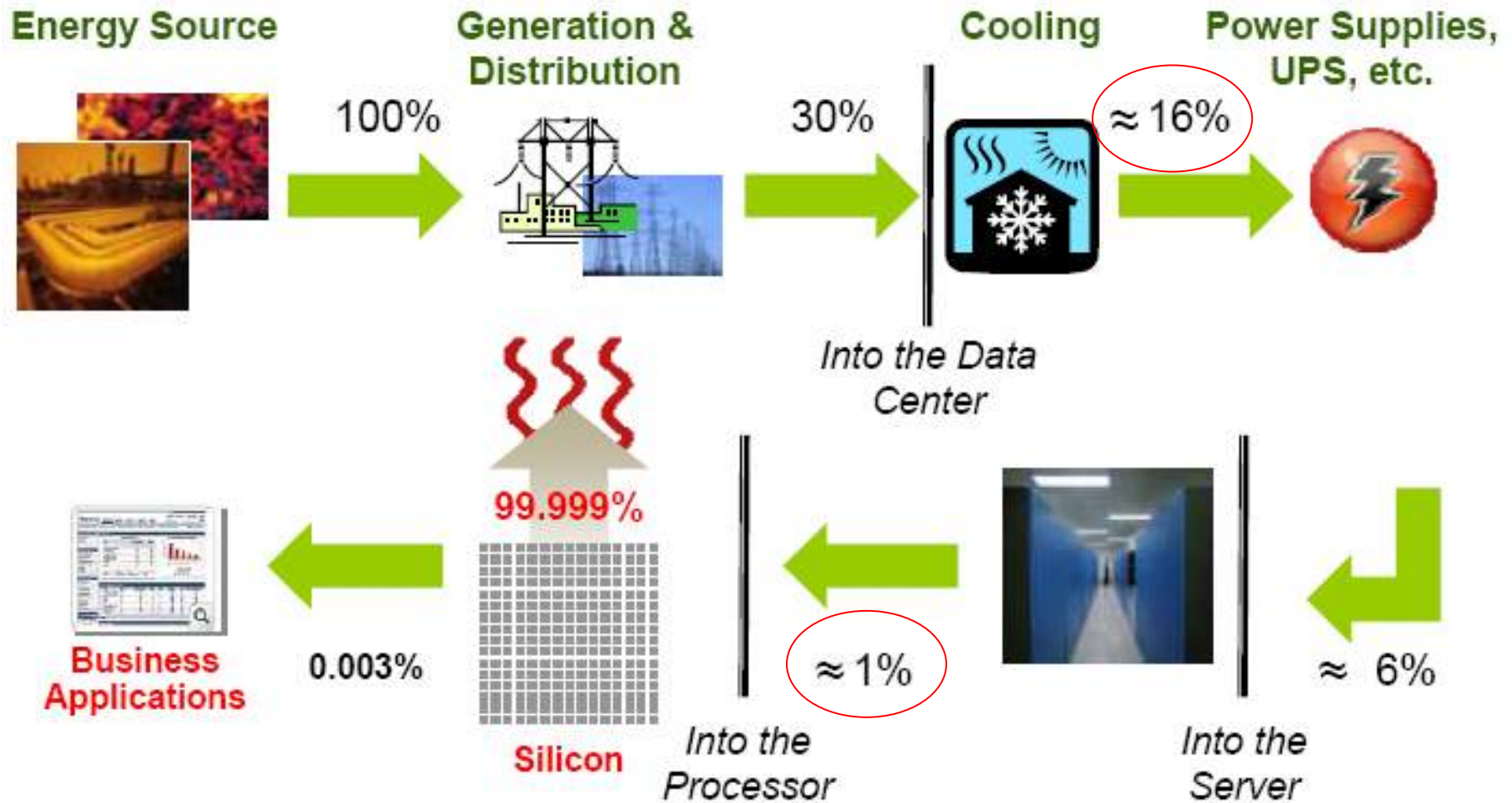
Source: Energy Information Administration, Form EIA-861, "Annual Electric Power Industry Report."

Increase Visibility of Power and Cooling



- Percentage of respondents polled by Gartner that identified Power and Cooling and the number one issue in their network
 - 2004: 46%
 - 2005: 57%
 - 2006: 68%

Where does the energy go?



Source: Gartner

Switch from AC Power to DC Power



- Energy Savings Estimates vary from 10 to 25 percent
 - AC to DC Conversion is 70 to 80% efficient in current power supplies
 - DC Power conversion from the AC grid is 90% efficient
- Conversion will require a forklift upgrade
 - Replace PDUs and UPS
 - Replace existing AC cables with larger cables to support DC
 - Conversion of system racks to support large copper bus bars to distribute power
- Fewer vendors manufacture DC powered Active Equipment
 - IBM and others improving efficiency of power supplies to 90%
 - Equipment is not available to be powered by both – must make a selection between AC or DC

Energy and Efficiency



- By 2010, for every \$1 spent on hardware, 70 cents will be spent on power and cooling
- By 2012, for every \$1 spent on hardware, \$1 will be spent on power and cooling
- 46% of data centre managers don't know how much they spend on power and cooling

Source: IDC Report



Green Star



- Green Star is an environmental rating for buildings
 - » Used by Green Building Council of Australia (GBCA)
 - » Used by Project teams and contractors
 - » Validates environmental initiatives in design of new and refurbishment of existing buildings
 - » Applies to Class 5 and above office buildings
- Applies to
 - » Voluntary rating
 - » Top 25% of building market
 - » Rates attributes of building (not operational costs)
 - » Properties of the building

Green Star



Star Rating	Score	Represents
One Star	10	Minimum Practice
Two Star	20	Average Practice
Three Star	30	Good Practice
Four Star	45	Best Practice
Five Star	60	Australian Excellence
Six Star	75	Global Leader

Green Star Assessment Tool



- Office Design Version 3
 - Office As-Built Version 3
 - PILOT – General concept tools for
 - Office interiors
 - Office existing buildings
 - Healthcare
 - Shopping Centre Design
 - Education
 - Multi-unit Residential
 - Industrial
 - Conversion
- } Combined Manual

Green Star

Assessing the Building Attributes



Key Sections

1. Management
2. Indoor Environmental Quality
3. Energy
4. Transport
5. Water
6. Materials
7. Land Use and Ecology
8. Emissions
9. Innovation

Green Star

PVC Minimisation (Section Mat-7)



- Major contributors are
 - Pipes and pipe insulation
 - Conduits, ducts, troughing and trunking
 - Flooring and carpet tile backing
 - Window frames, blinds and coverings
 - Cladding of boards and metal surfaces
 - Fixtures and fittings
 - Wires and cables
- Communications Cabling and Electrical Cabling are considered together

Green Star

What does this mean for Structured Cabling?



- Structured cabling does contribute to Green Star
- Contribution is based on:
 - Amount of money NOT spent on PVC cabling compared to original PVC cabling proposal

e.g. if PVC is 1/3 of the cable weight in original PVC cable proposal, then 1/3 of the original PVC cable proposal cost can be used in the PVC off-set calcs under the Mat-7 GBCA submission
 - Non-PVC cable must be installed (eg LSZH)
- Air flow improvement saves Energy Costs

The Green Grid

USA Industry Response to Efficiency



- Consortium of IT companies and professionals to address energy efficiency concerns in the Data Centre
- Recently completed 3 Technology Deliverables
 - Qualitative analysis of power distribution configurations for Data Centres
 - Existing Data Centre energy efficiency metrics
 - An updated version of the Data Centre Efficiency Metrics White Paper
- LEED – Leadership in Energy and Environmental Design
An American standard for developing high-performance sustainable buildings

What do these trends mean for our industry?



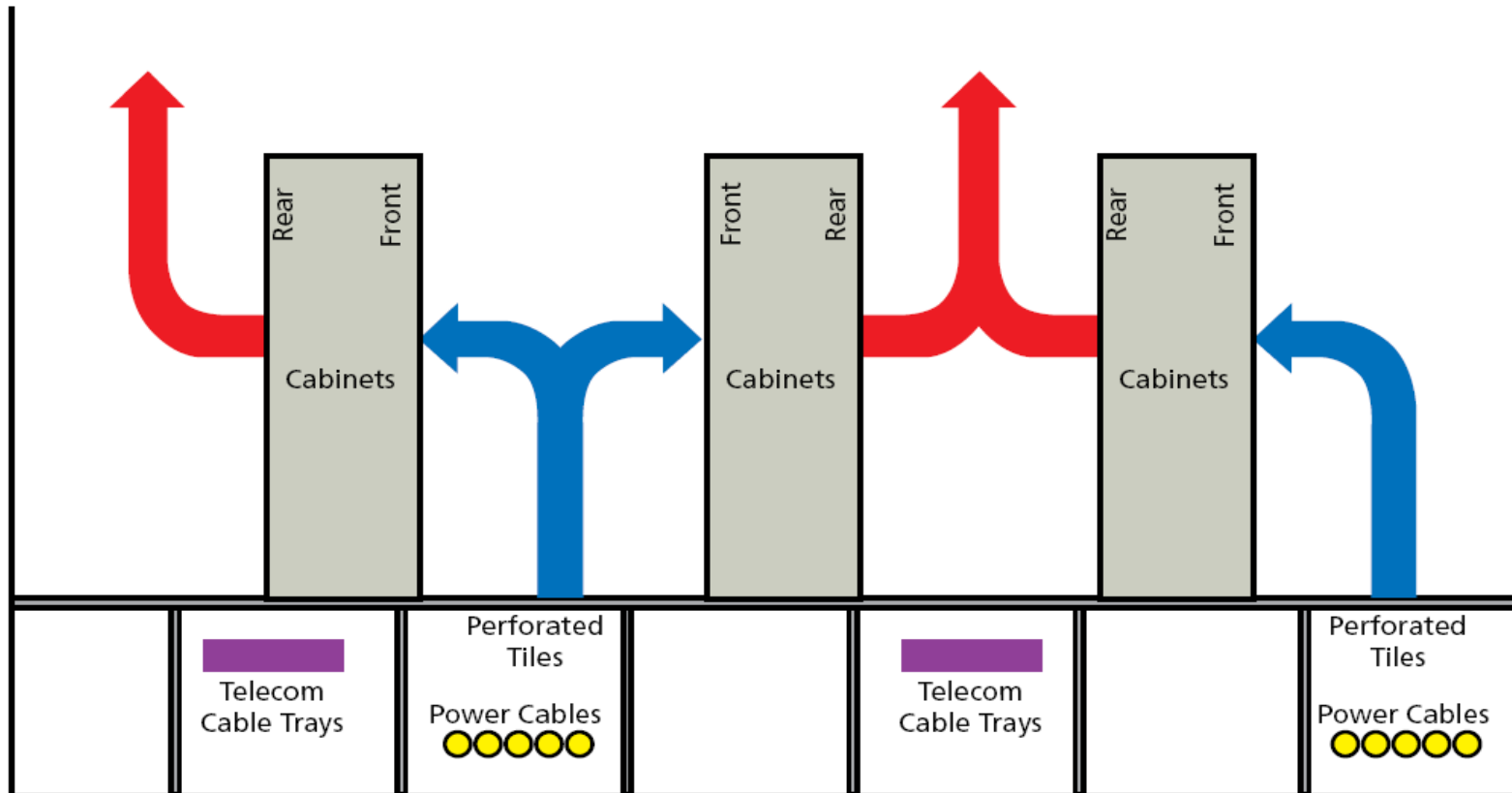
- Data Centre Consolidation, Blade Servers, and Server Virtualization will drive need for additional bandwidth within the Data Centre – **10G Technology**
- Real Estate restrictions will require higher densities within active equipment – **Managed Density Cable Management**
- Increase in Storage will require higher capacity Storage Area Networks – **Fibre Optic Infrastructure**
- Increased power density and heat generation will require more focus on efficient cooling design – **Unrestricted Airflow**

Reliability of Data Centre Equipment is Directly Tied to Proper Cooling



Proper Data Centre Design deployment of Hot Aisle/Cold Aisle Cooling

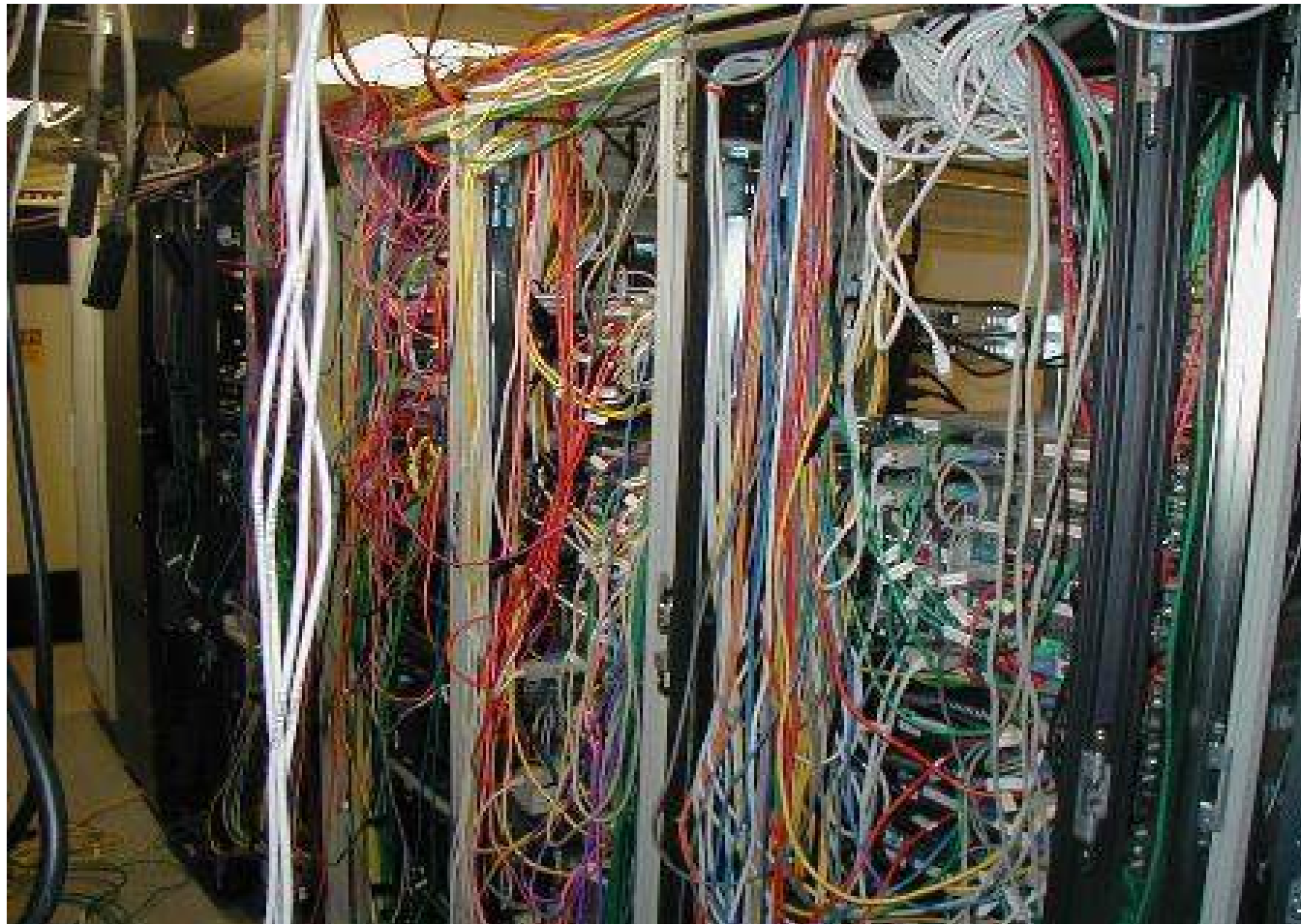
- Good Airflow/Proper Cooling = Optimal Performance of Servers and Switches



Reliability of Data Centre Equipment is Directly Tied to Proper Cooling



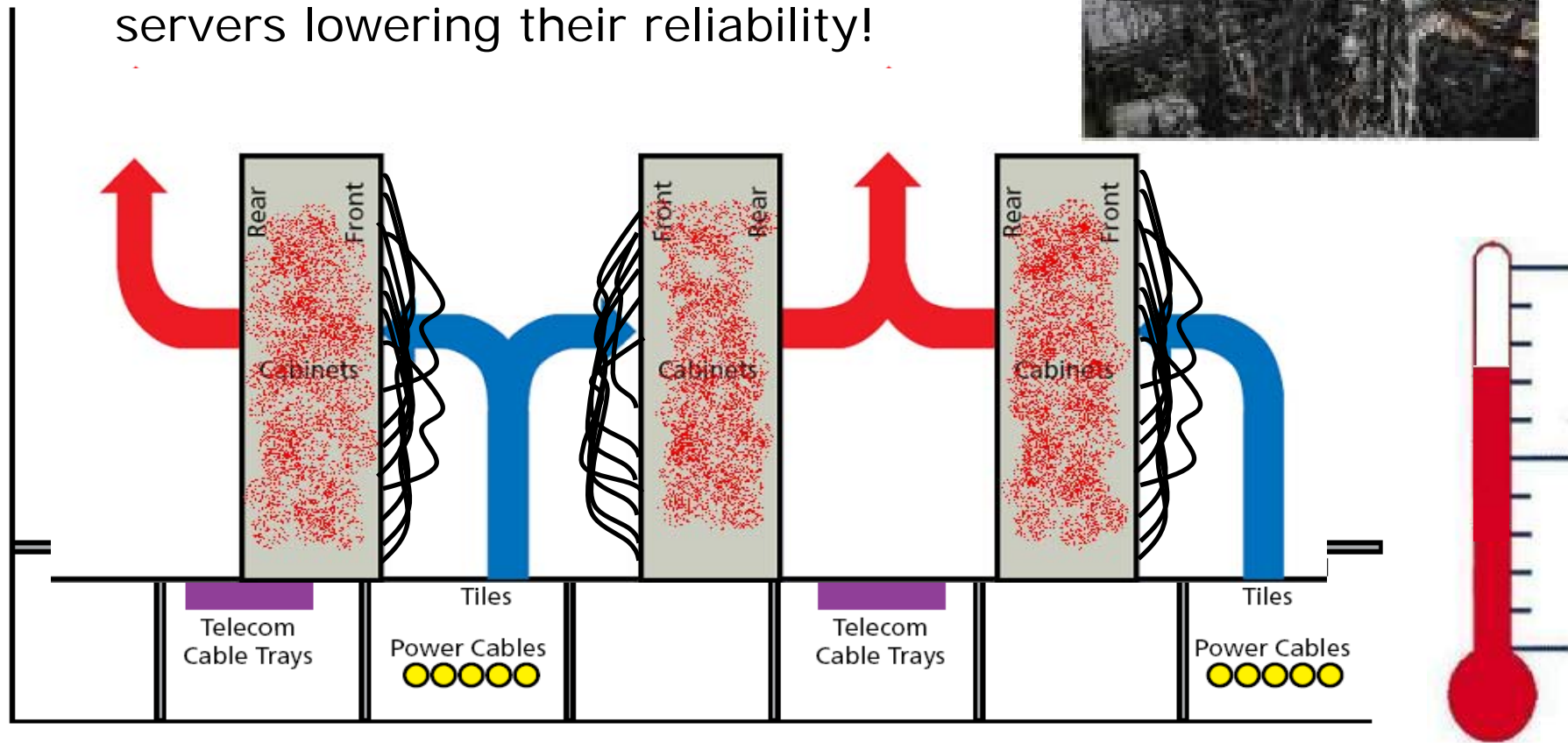
But what happens if poor cable management blocks airflow?



Reliability of Data Centre Equipment is Directly Tied to Proper Cooling



Cables blocking air inlets and exits will raise the temperature of switches and servers lowering their reliability!

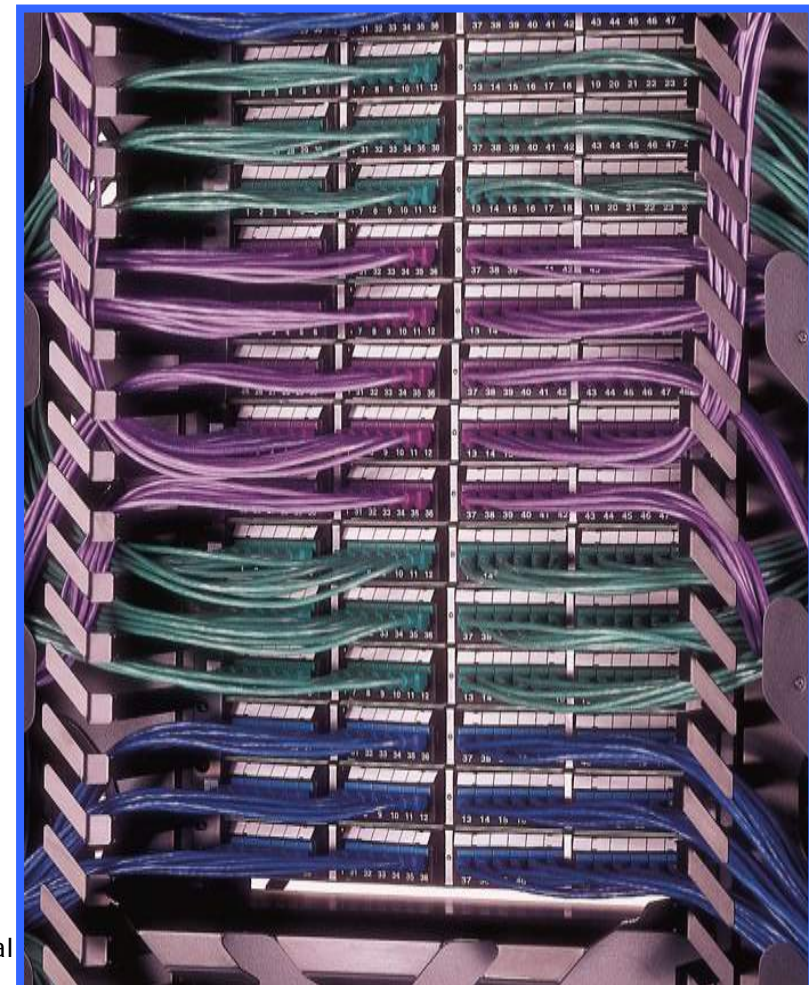


Improved Cable Management

Improves Airflow, Reduces Energy



- ADC invented the concept of Angled panels, first with our Fibre Optic Panels then with our invention of the Dynamic Angled Panel in 1998
- Dynamic Angling improves cable management and improves density when used with Glide cable management
- Low profile design ships and is installed in the flat position, making it easy to install



Improved Fibre Cable Management

Improves Density, Reduces Space

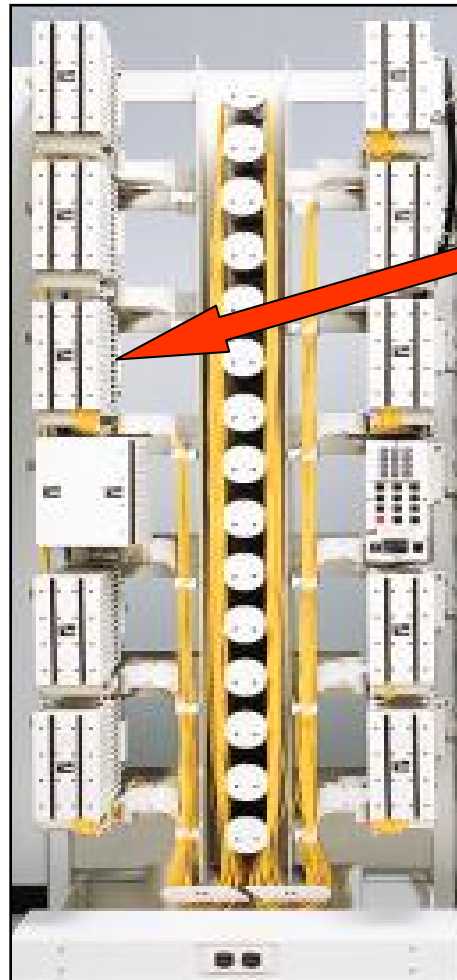


- Angle Right/Left fibre adaptor design promotes superior cable management
- Allows all termination options: Field Term, Splice, or MPO Plug and Play
- Small diameter round MPO micro-cable: 5.5 mm and 3mm diameters with 12 fibres



Fibre Cross-Connect in the NGF

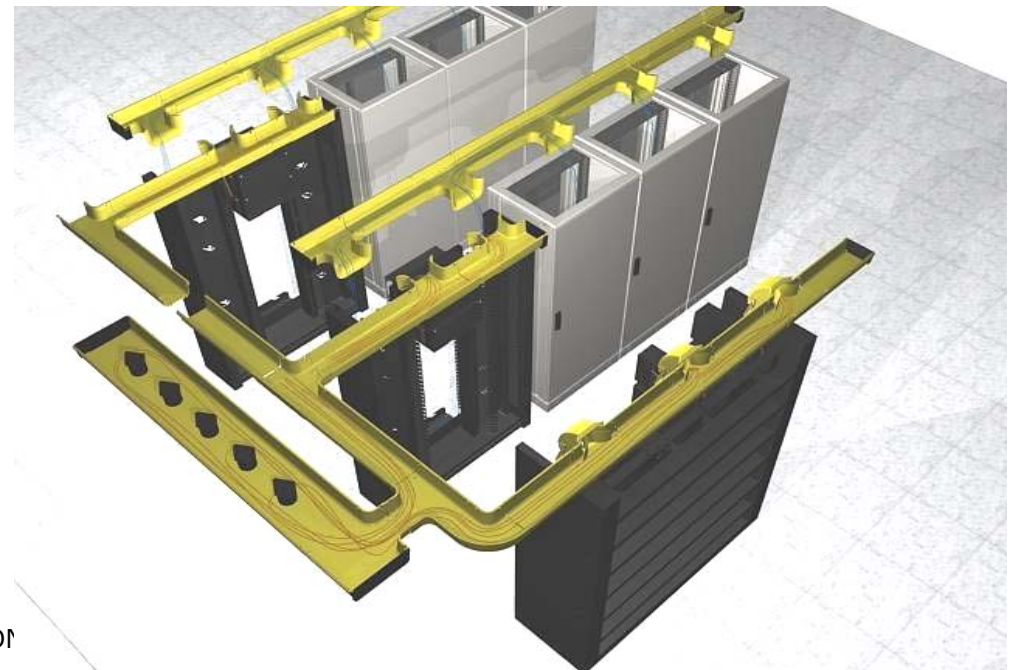
Improves Density, Reduces Space



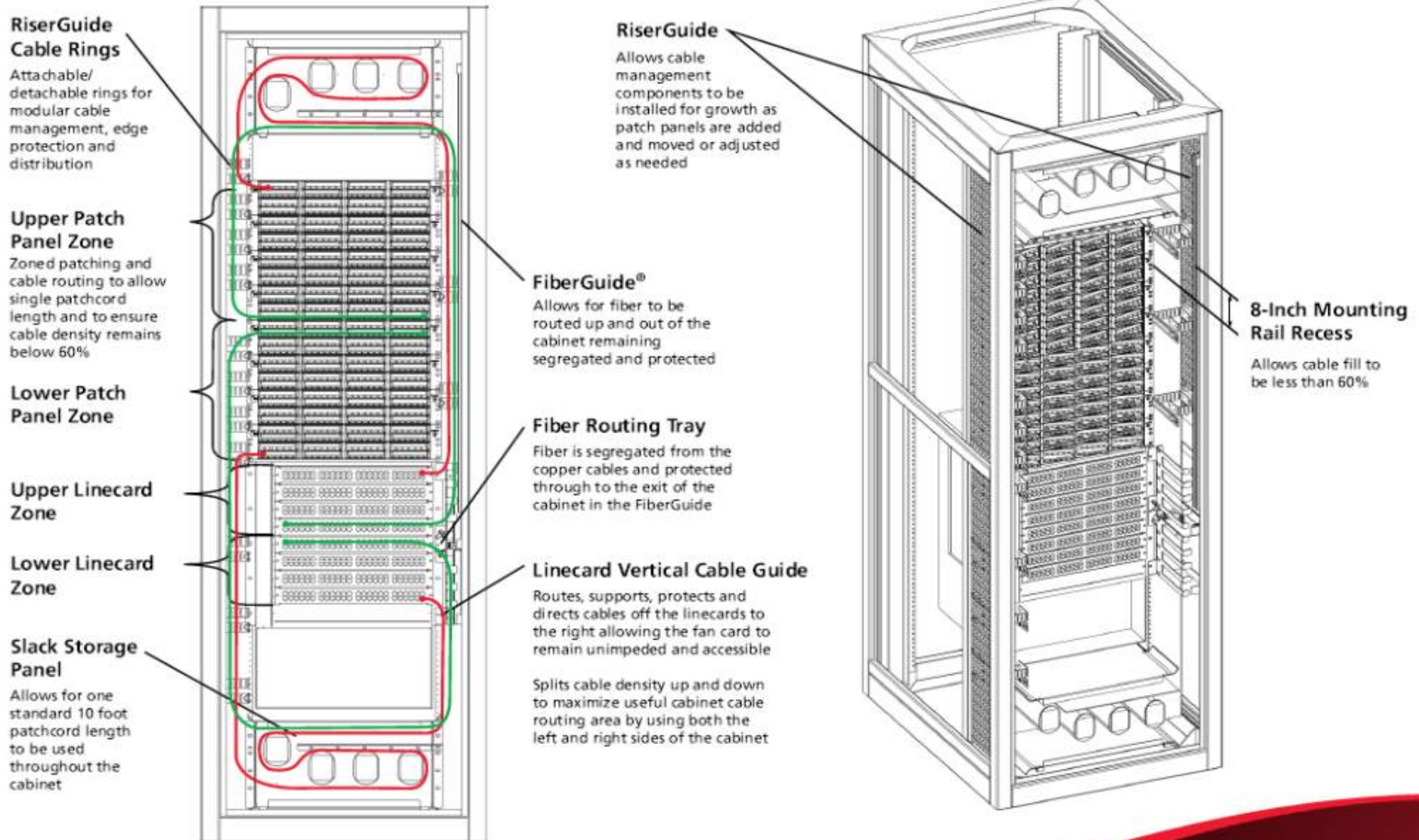
FiberGuide® Fibre Optic Raceway



- FiberGuide®
 - The key to optimising air flow in the Data Centre
 - Provides bend radius protection, physical protection, and segregation of fibre optic jumpers
 - Excels at all the key attributes of a good Fibre Raceway solution:
 - » Flexibility
 - » Speed of installation
 - » Speed of deployment
 - » Durability
 - » Fibre protection



Cisco 6509 Router Solution



Cisco Cable Management Solutions



6509 Router



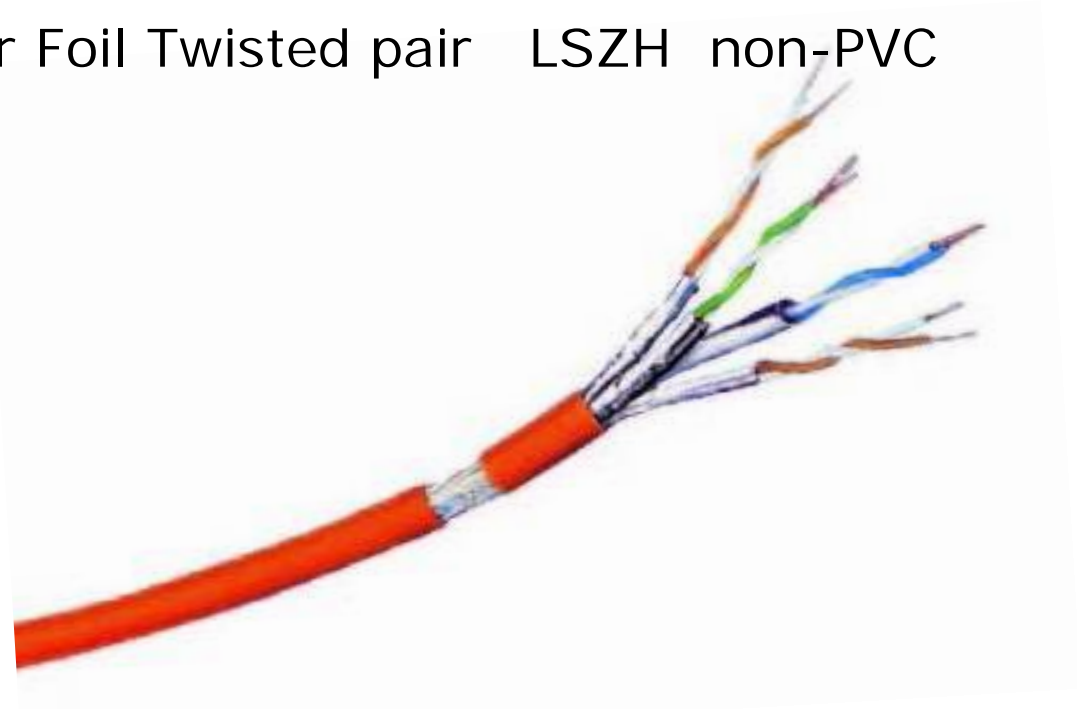
9513 SAN Switch



PVC Minimisation



- LSZH - Low Smoke Zero Halogen Cables - non-PVC
- CMP - Limited Combustible Cables (USA) - Plenum rated
- Cat 6_A - Minimum acceptable for Data Centres
- C6_A S/FTP - Shield over Foil Twisted pair LSZH non-PVC

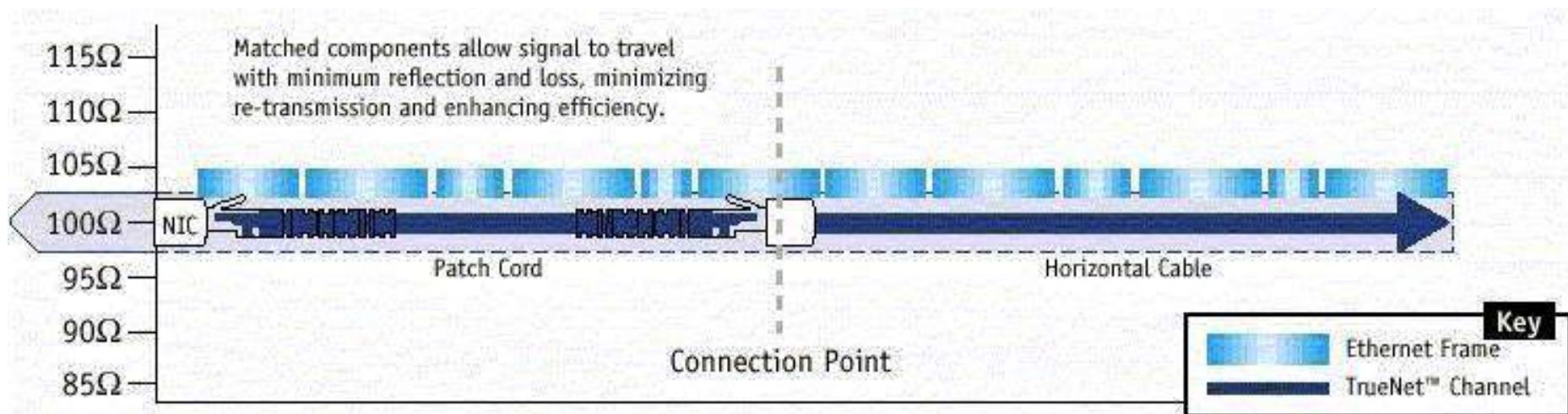


ADC TrueNet Differentiation: Impedance Matched, Tuned System



- ADC's entire CopperTen system is ADC designed and manufactured.
- As a result, we can carefully control and tune all the components and ensure compatibility and support maximum throughput.

An Impedance-Matched CopperTen Channel:



By tightly controlling the impedance of each component in the channel, the effects of Return Loss are minimised and the Bit Error Rates plummet.

The ADC Difference

Innovation



- Angled patch panels Improves Airflow, Reduces Energy
- Glide Cable Management Improves Airflow, Reduces Energy
- NGF Frames Improves Density, Reduces Space
- Pre-Term Solutions Improves Density, Reduces Space
- LSZH Cables Non-PVC Cables, Reduces Volatiles



Structured Cabling and the Energy Efficient Data Centre

Specs are available from

www.adckrone.com.au / document downloads / technical



Cisco Partner

ADC is a Cisco Technology
Developer Partner