Panduit DC Solutions

Unified Physical Infrastructure SM

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Panduit Core Business

- Panduit is a world-class developer and provider of leading-edge solutions that help customers optimize the physical infrastructure and mitigate risk through simplification, increased agility and operational efficiency

- Independent leader since 1955

- Global presence, local focus and customization

- 4,000+ employees

- 112 countries of operation

- Solutions approach
  - Data centers
  - Enterprise networks
  - Industrial automation

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Unified Physical Infrastructure (UPI) Approach

- Flexible, end-to-end UPI-based solutions help meet business and technology challenges head on for a smarter, unified business foundation.

Unified Physical Infrastructure

- *Mitigate Risk* **– Efficient physical infrastructure management enables seamless integration to reduce risks which can occur throughout the network**
- *Lower Cost* **– Panduit physical infrastructure solutions drive financial advantages to reduce energy and occupancy costs, and help secure competitive advantage**
- *Increase Agility* **– A high level of integration within the physical infrastructure enables flexibility and improved business agility**
- *Enhance Sustainability* **– UPI-based solution offerings enable organizations to meet sustainability goals by driving resource and energy efficiencies across the physical infrastructure**

The UPI approach enables organizations to connect, manage and automate critical systems and drive operational, financial and sustainability advantages, allowing your business to minimize risk, lower cost, and heighten agility and reliability.

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Panduit Unified Physical Infrastructure[SM] *Solutions*

Data Center Physical Infrastructure Management Solutions

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The Evolving Data Center Environment

Data centers must be equipped to accommodate a broad array of rapidly changing demands:

- Maximize throughput

- Minimize latency

- Availability and flexibility

- Support diverse applications

- Server and desktop virtualization

- Quick deployment

- Space limitations

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Drivers for 10Gig

Virtualization

47%

4 socket servers with virtualization

Consolidation

15:1

Average Server Consolidation

Performance

20X

Increase in 4 socket server performance

10G simplifies the Network
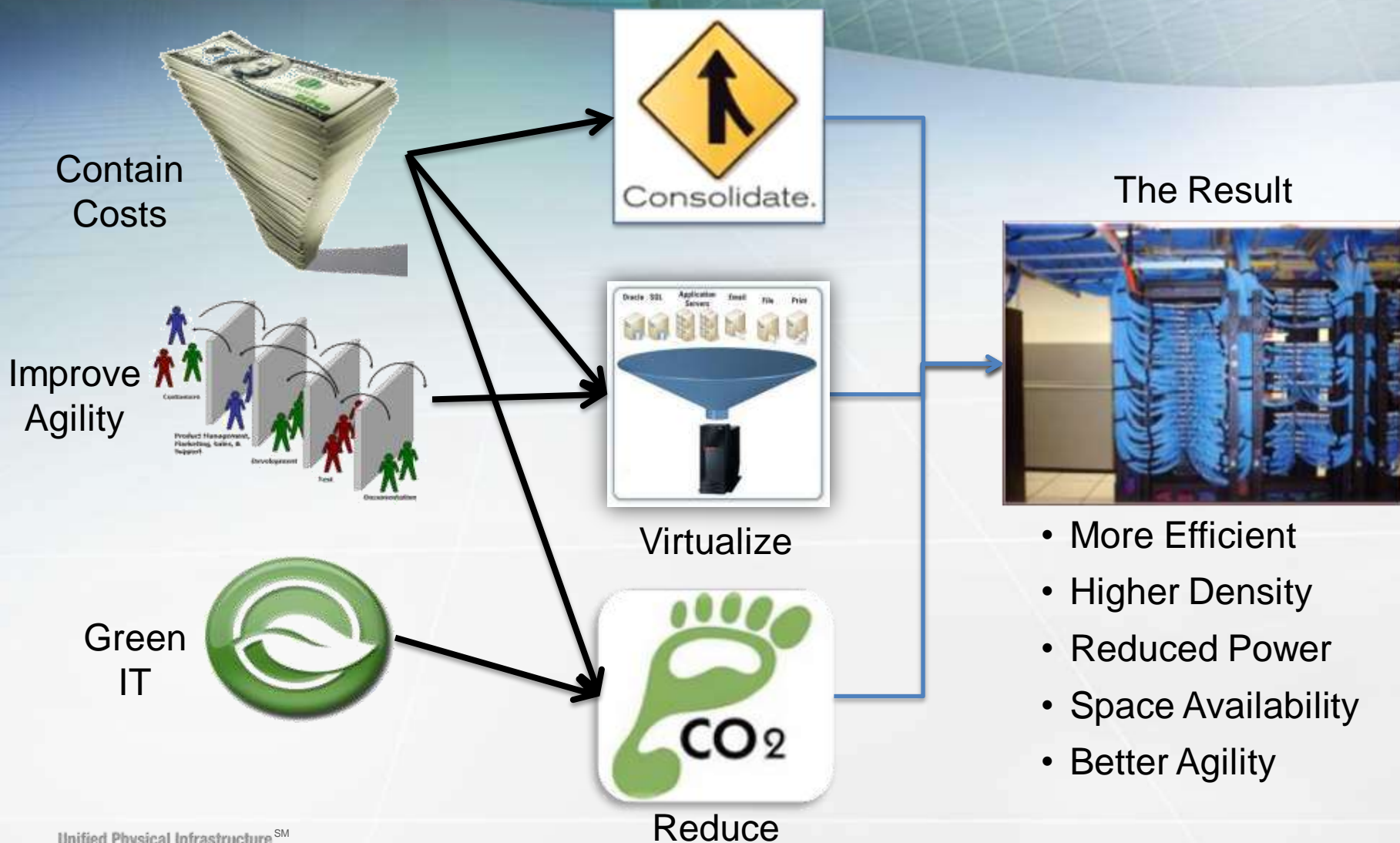Can reduce 10 ports/ cables
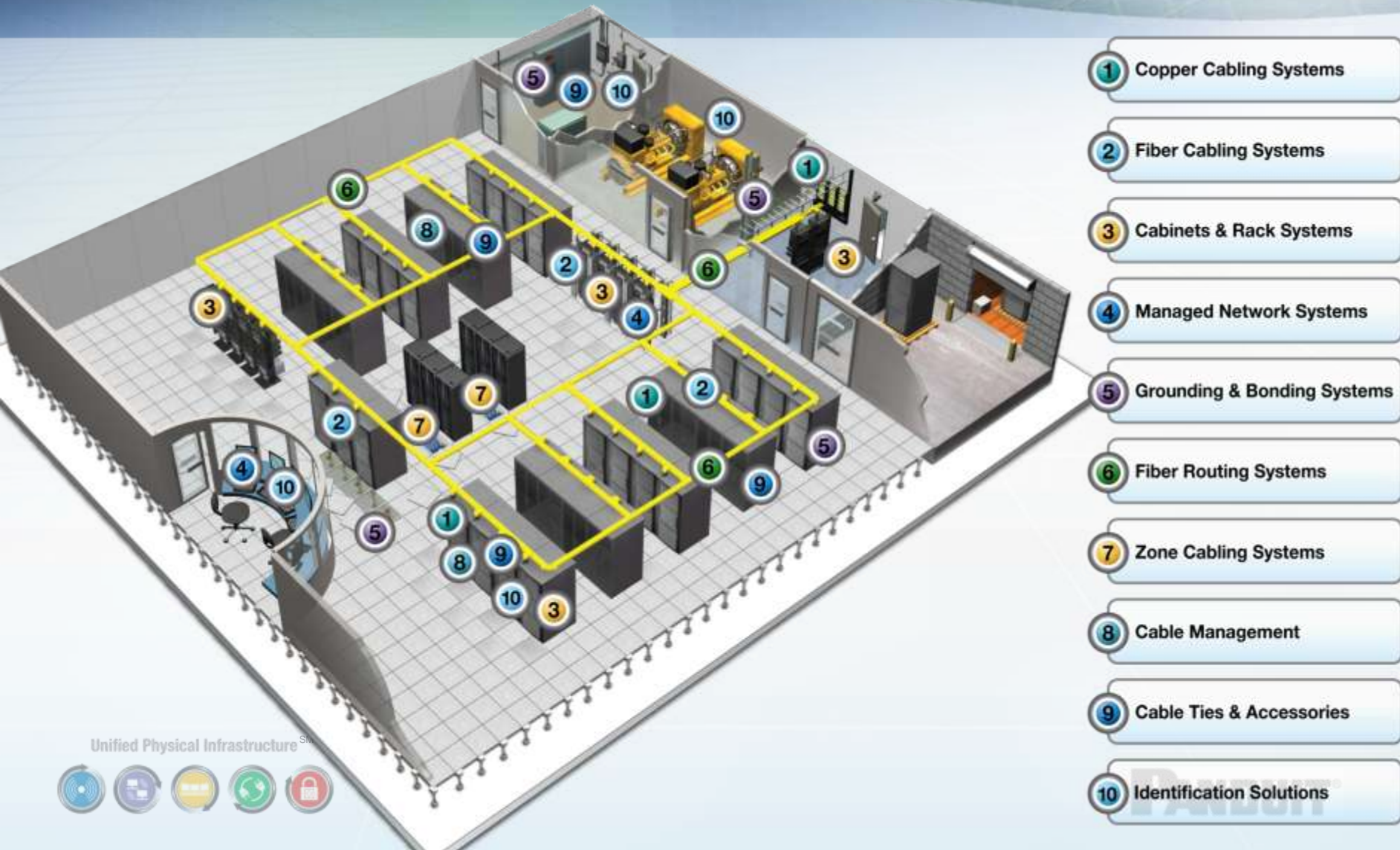Down to 2 x 10Gig per server

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Data Centre Challenges, Actions and Benefits

Contain Costs

Improve Agility

Green IT

Consolidate.

Virtualize

CO2

Reduce

The Result

- More Efficient
- Higher Density
- Reduced Power
- Space Availability
- Better Agility

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Panduit End-to-End Data Center Solution

1. Copper Cabling Systems
2. Fiber Cabling Systems
3. Cabinets & Rack Systems
4. Managed Network Systems
5. Grounding & Bonding Systems
6. Fiber Routing Systems
7. Zone Cabling Systems
8. Cable Management
9. Cable Ties & Accessories
10. Identification Solutions

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High Speed Data Transport (HSDT)

Support Comprehensive **Copper and Fiber** Cabling System Needs:

- High Performance Options
  - 10 Gigabit Ethernet
    - ➢ Small Diameter
    - ➢ FCoE
  - OM3/OM4 innovations
  - SFP+
  - InfiniBand
- Pre-Terminated Options
  - Quick Deployments
  - Integrated Copper/Fiber Optic Combinations
  - High-Density Applications
  - **Installs 75%-90% faster than field-terminated methods**

Concerns of IT Managers Over 10Gig Infrastructure

- Size and usability of cable

- Uncertainty over alien crosstalk in the field

- Uptime and reliability - assurance of future performance in light of future equipment installation

- Cable plant appearance and cable management

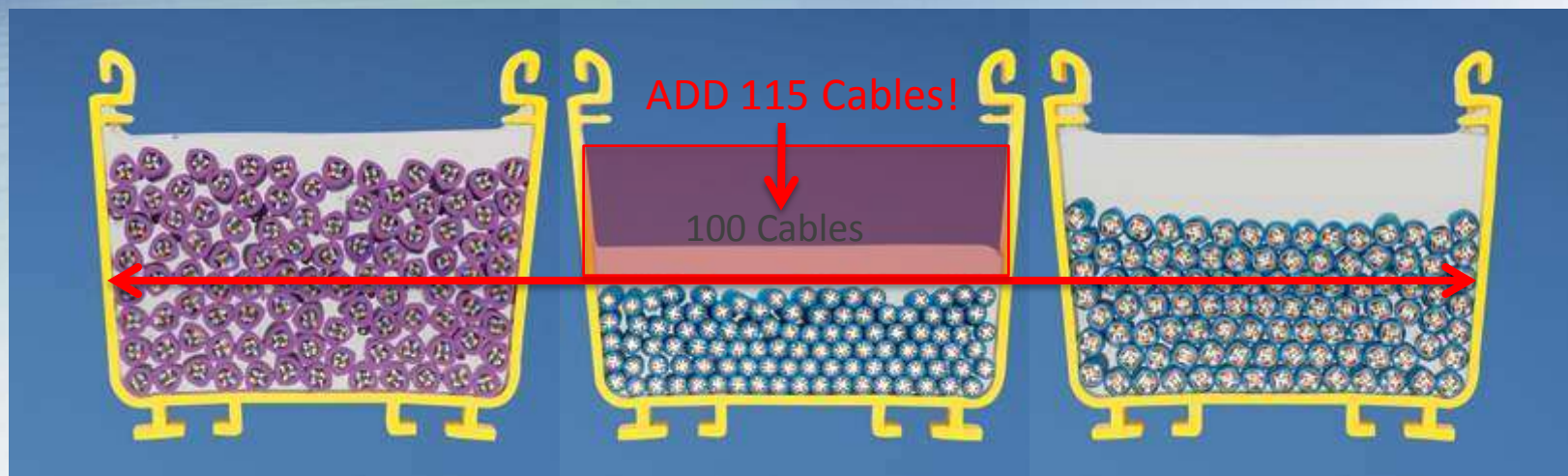**Panduit MaTriX Technology addresses and alleviates these concerns**.
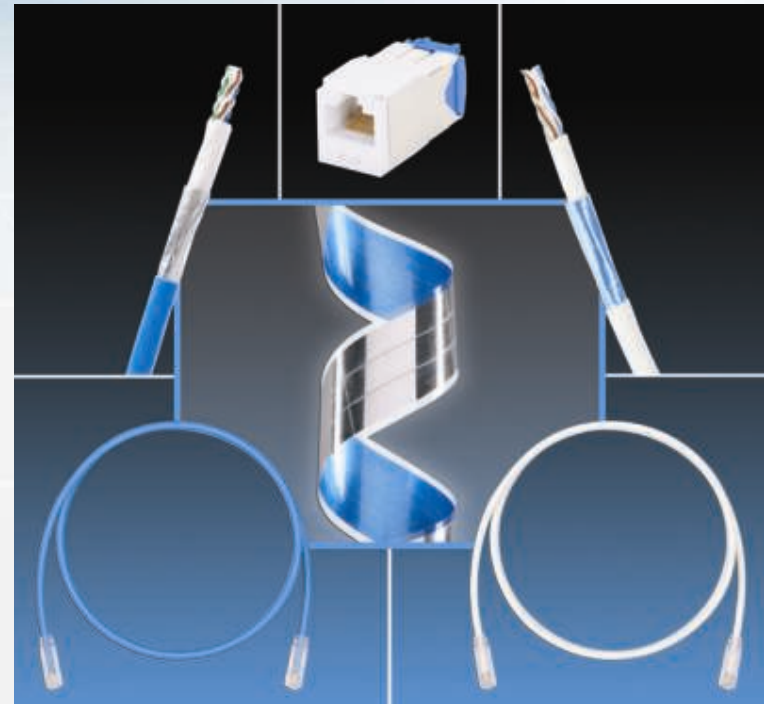
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TX6A-SD™ 10Gig™ Cable System with MaTriX Technology

ADD 115 Cables!

100 Cables

Panduit TX6A-SD MaTriX Cable

- Round cable design with actual diameter of 0.240" (6.0mm).

- World's Smallest Cat 6A UTP Cable !

- 115% increase in capacity compared to Industry Standard

- Smaller than most Category 6 cables

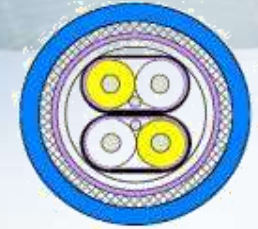Unified Physical Infrastructure ^{SM}

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Copper Twinax Transport System

- Value Proposition
  - Twinax Copper → Direct Attach
    - SFP+:   1 lane of 10G
    - QSFP+: 4 lanes of 10G
    - 10GHz Twinaxial cable
  - Ideal for server virtualization applications
  - Low power consumption
  - Low Latency
  - Up to 15 m assemblies

SFP+
Connector
(10Gig)

Cross-section
2 pair twinax

QSFP+
connector
(40Gig)
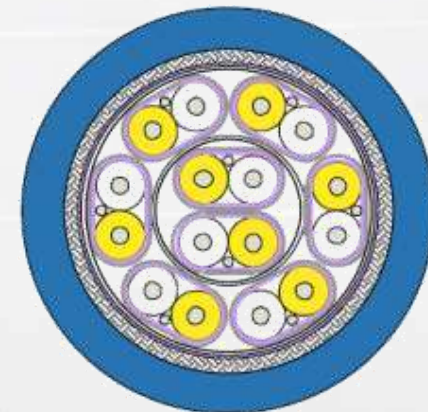
Cross-section
8 pair twinax

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Copper Twinax Transport System (cont'd)

- Trends / Considerations
  - Efficient architecture can accommodate TOR, MOR or EOR designs
  - It is not structured cabling
    - Does not use RJ45 interface
    - Possible 100G QSFP+ (4 x 25G lanes)
- Comparison vs. Fibre
  - Significantly lower cost
    - No optical transceiver needed
  - Lower power consumption
  - Limited distance

OM3 Fiber Uplinks to Aggregation

SFP+ or QSFP+ DAC
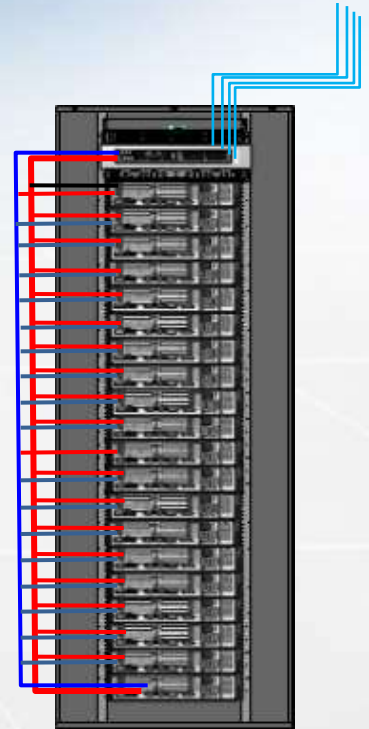
40 Panduit twinax 1-3m cables to connect 20 dual port servers

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Main Data Center 10G Cabling Options

Feature	Laser optimized Multi-mode Fiber (OM3/OM4)	Direct Attach Copper Cable Assembly	Category 6A Twisted Pair Cabling
Connector	LC	SFP+ module	RJ45
Structure	Structured or p-t-p	point to point	Structured
Reach at 10Gbps	300 m OM3 550 m OM4	7 m passive/ 15m active	100 m
Power/port (PHY + tcvr)	< 2 W	< 1 W < 1.5 W (active)	< 4 W
Energy Efficiency Modes	N/A	N/A	Short reach (2W) 802.3az EEE (< 1W)
Port latency	≈ 0.2 µs	≈ 0.2 µs	≈ 2.5 µs
Link Cost	$$$ (need optics)	$$	$

Copper QuickNet Solution

- Six cables bundled together with termination ends being cassettes, jack modules, or plugs

- Utilizes Panduit cable, jack modules, and plugs
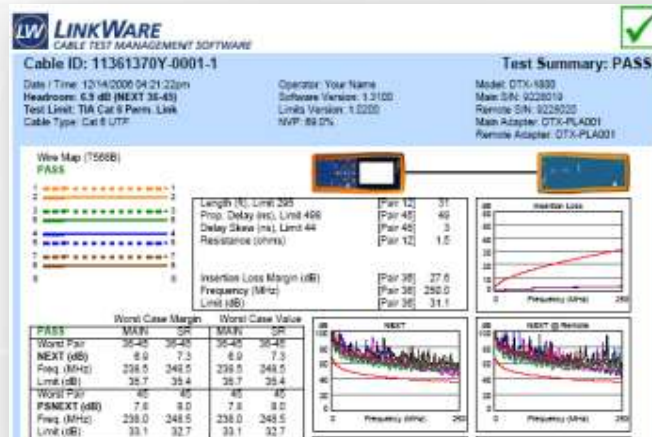
- Customizable to unique customer requirements

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Copper Pre-Terminated Solutions

- Reliable performance and assured quality

- Quick network deployment (75% less time vs. Traditional)

- No onsite rework

- Plug n go installation

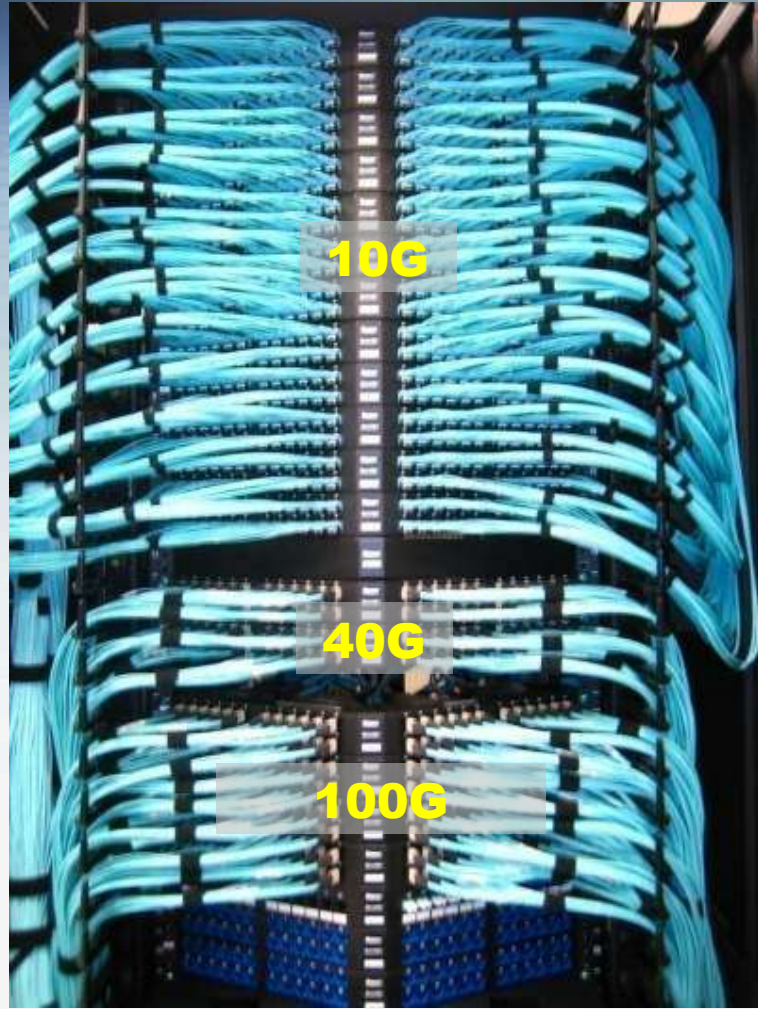- Flexible solution, can be re-deployed

- Manageability

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QuickNet Solutions for 10/40/100G Migration
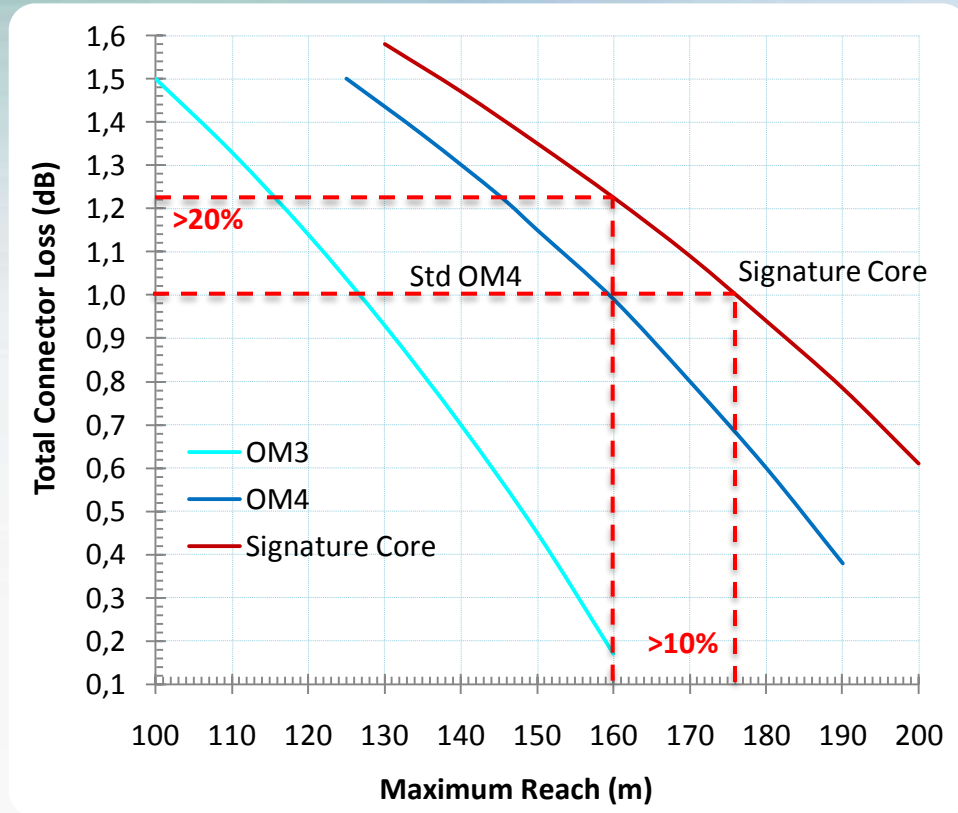

10G

40G

100G

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Signature Core™
Application to 40G/100G Ethernet
Reach Based On Modified IEEE 802.3ae Link Model

Signature Core™ Provides:
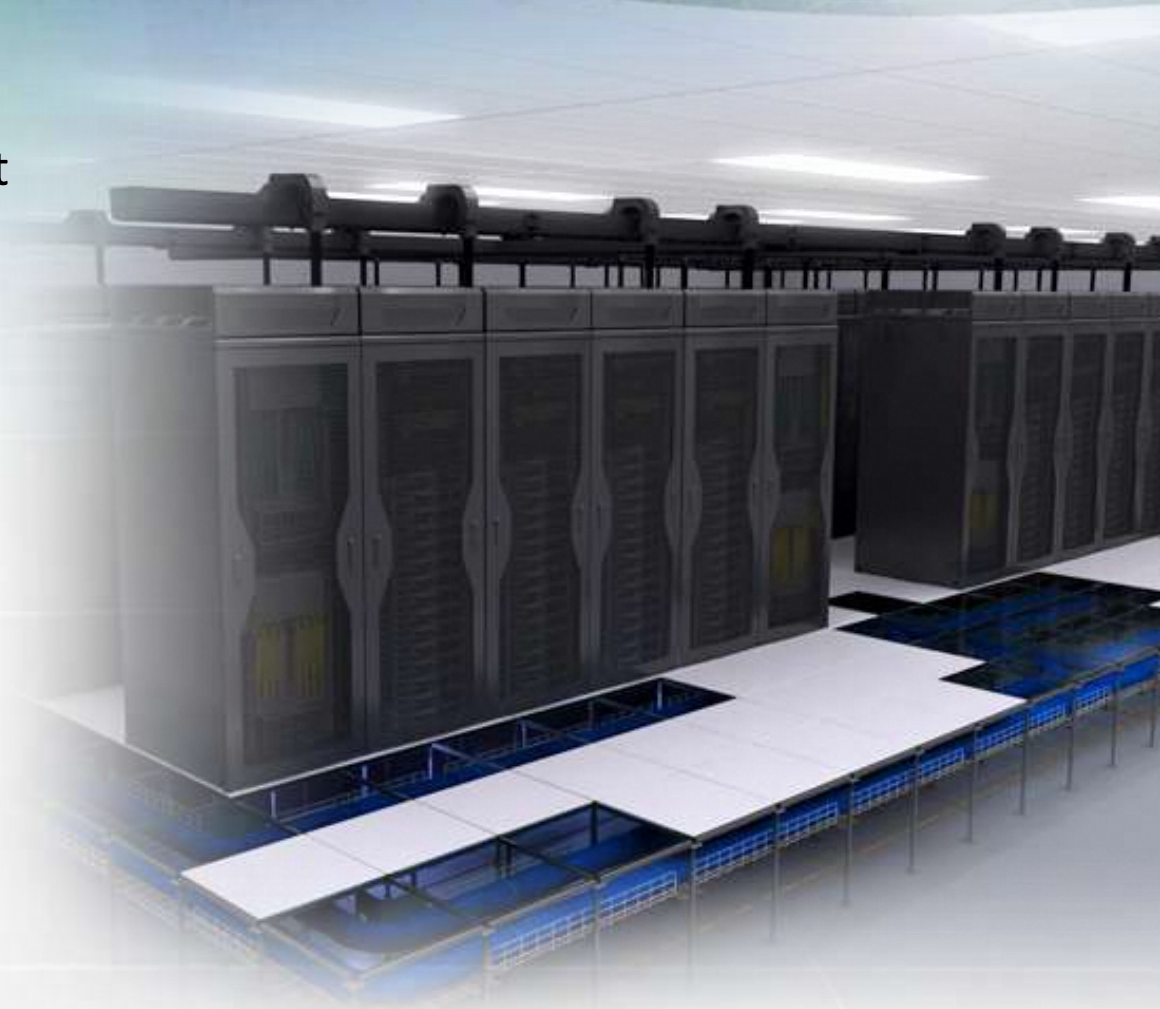**Higher reliability, more margin, or extended reach**

building a smarter, unified business foundation
Connect. Manage. Automate.

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The Rest of the Physical Infrastructure Foundation…Completing the Data Center Solution

- Racks and Cable Management
- Routing and Pathways

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Cabinets and Thermal Management Systems

Manage, Protect, and Showcase Installations:

- Full Solution
  - Switch and Server Applications
  - Multiple configurations
- Accessible Pathways
  - Improve Speed of Installations/Maintenance
- Thermal Management
  - Cold Aisle Containment
  - Cabinet System Ducting
  - Vertical Exhaust System
  - Perforated Doors
 - Raised Floor Grommet
  - Reduces operating costs up to 14%

Thermal Management – In-Cabinet Ducting

- Cabinet with ducting adapts side-to-side airflow switches to hot aisle / cold aisle data center layout

  - Cisco Compatible switch cabinet configurations for Cisco 6500, 9500, and 7000 series switches

  - Directs exhaust air to hot aisle

  - Third party lab testing confirms thermal performance of network switches in cabinet with ducting equal to open frame

  - Superior management of cables ensure proper air flow

  - Front and rear doors are perforated with 63% open design to maximize airflow

- Ventilation design optimized with input and review from Cisco thermal engineers
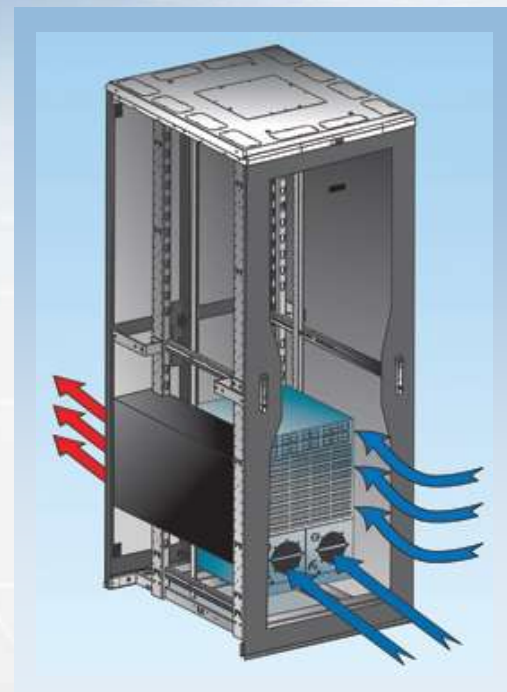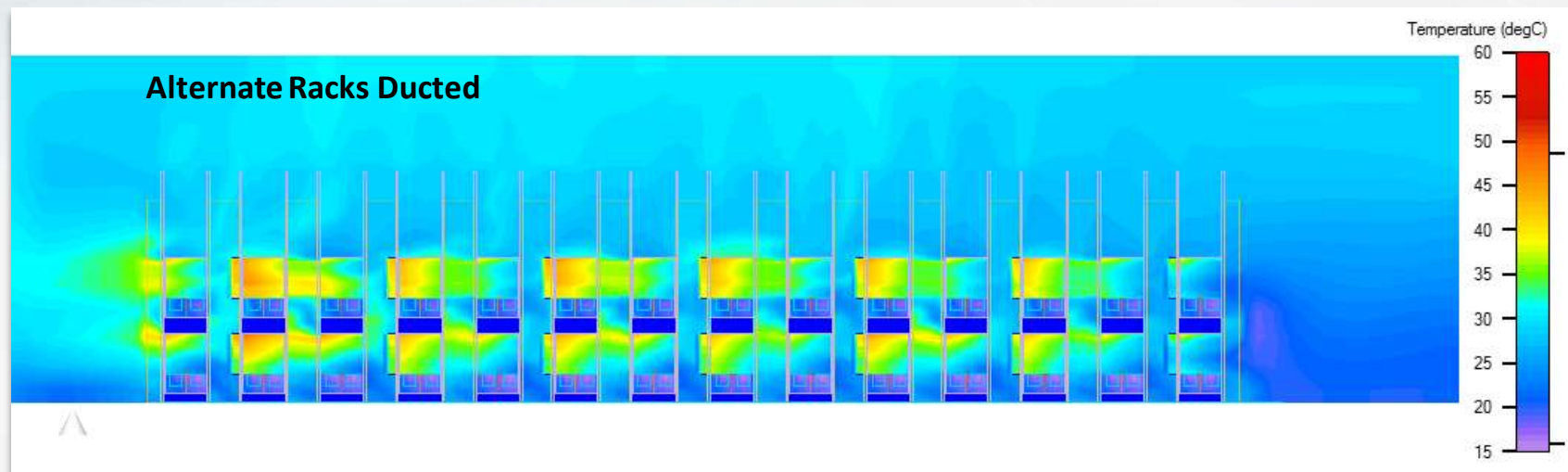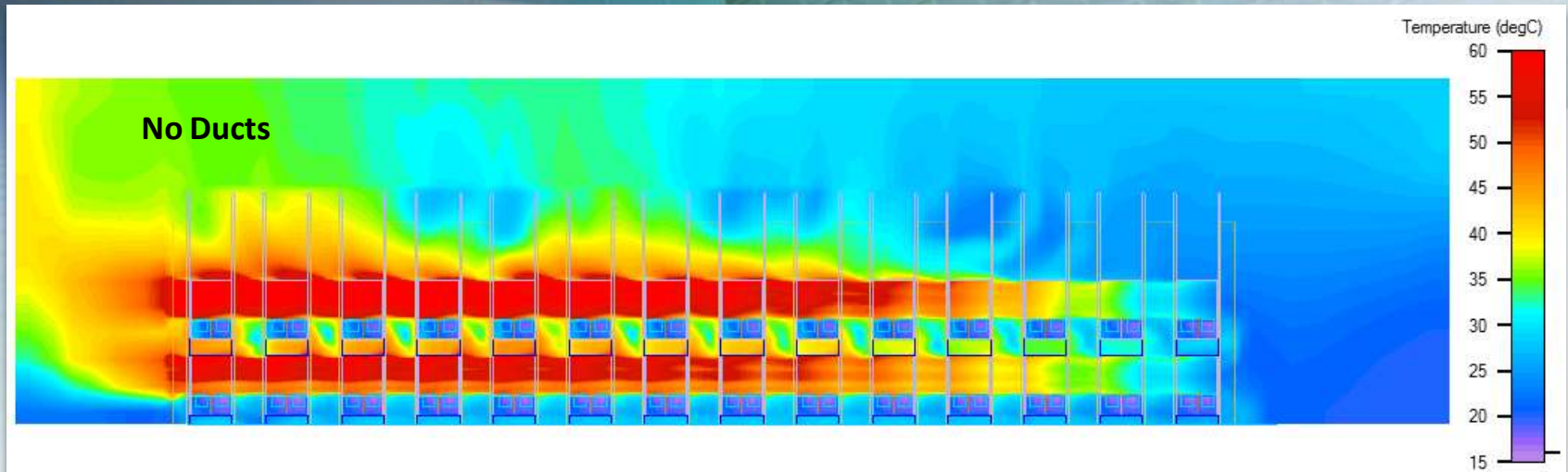

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Front View - Cut Through Centre of 6509 Switches

No Ducts

Alternate Racks Ducted

Panduit Net-Contain™ Cold Aisle Containment System

- Prevents mixing of cold and hot air streams
- Provides uniform temperature at the inlets of IT equipment
- Improves Cooling System Thermal Performance
- 25% or more Cooling Energy Savings comes from:
  - Fan Power Savings by reducing CRAH/CRAC fan speeds
  - Allows raising the supply air set point temperature
  - Chiller energy savings by raising the chiller water set point temperature
  - Pump energy savings by reducing its throughput
  - Increased hours of economizer usage
  - Use of less number of cooling units
- Allows End of Row switch and storage architectures

Net-Access
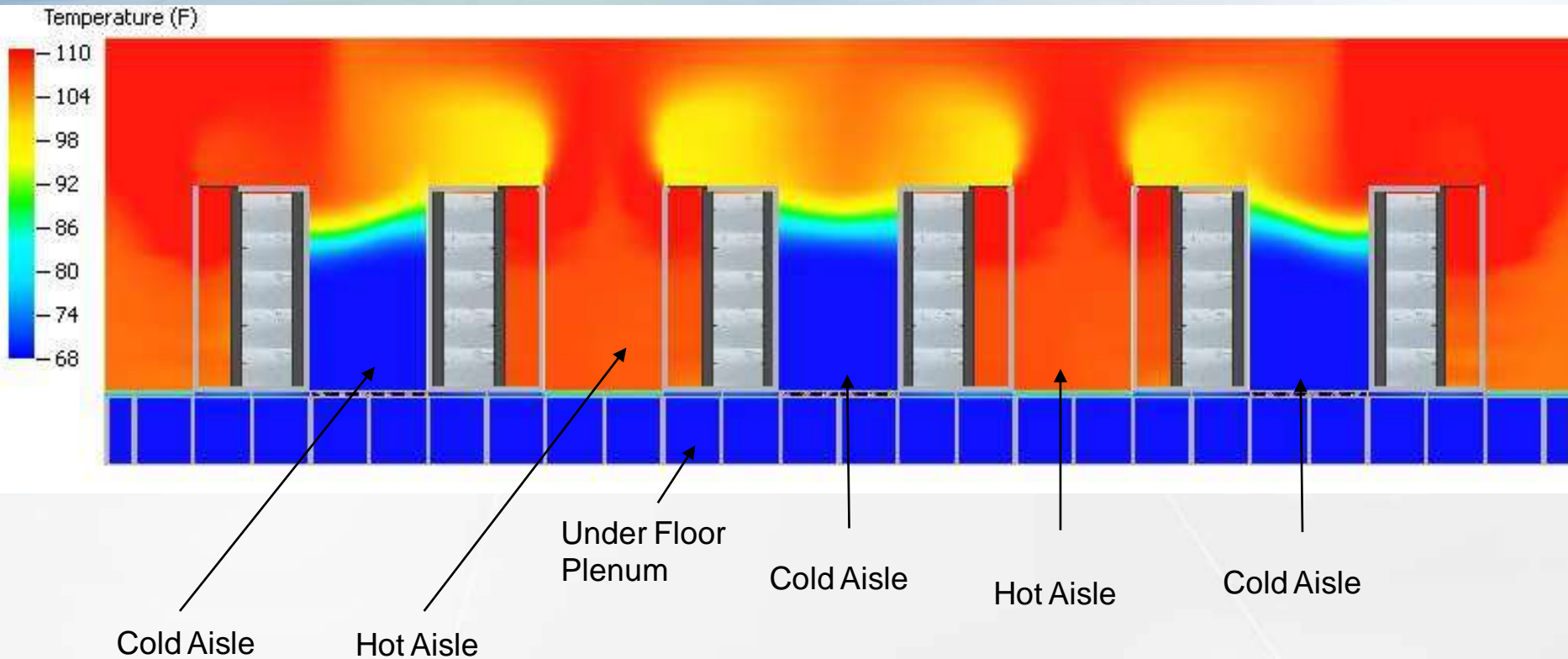
Net-SERV

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Cold Air Containment System

Cold Aisle
containment
Saving 23% on
OPEX

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Thermal Analysis Results –
Standard Cabinets without Containment

Without Containment, hot air re-circulates to the front of the cabinet heating the top 12 RU, over top of cabinets and at the end of rows to IT equipment inlets
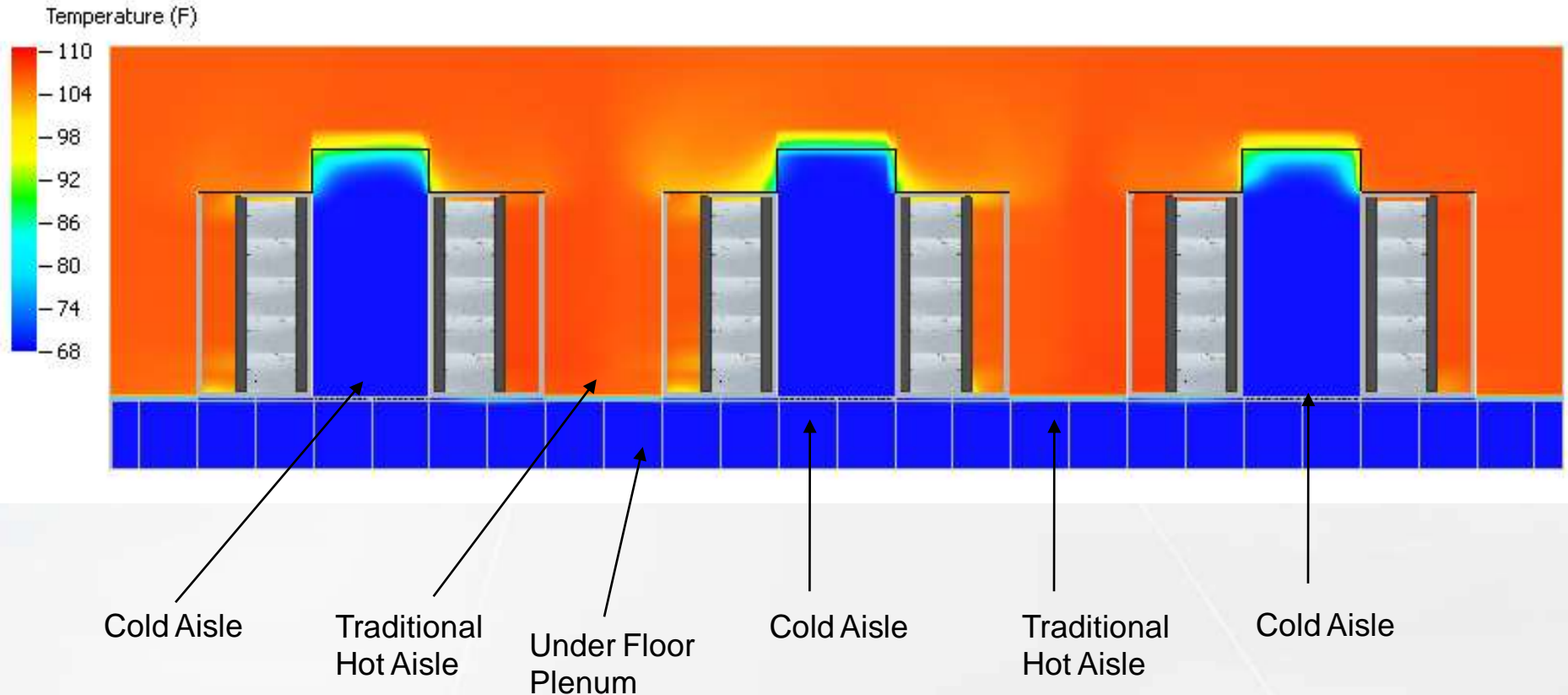

Temperature (F)
- 110
- 104
- 98
- 92
- 86
- 80
- 74
- 68

Cold Aisle

Hot Aisle

Under Floor Plenum

Cold Aisle

Hot Aisle

Cold Aisle

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Thermal Analysis Results – Cold Aisle Containment

Containment isolates cold air for uniform cold air available to server inlets.

Vertical Exhaust System For Maximum Energy Efficiency

The Vertical Exhaust System:

- Removes heated air without additional moving parts through a passive system

- Channels heat from cabinet directly to the above ceiling return plenum increasing cooling efficiency

- Enables increased server densities by preventing hot and cold air mixing and eliminating hot spots

- Dampens noise in data centre

- Can be applied as modular system at initial installation or added when required as heat densities increase
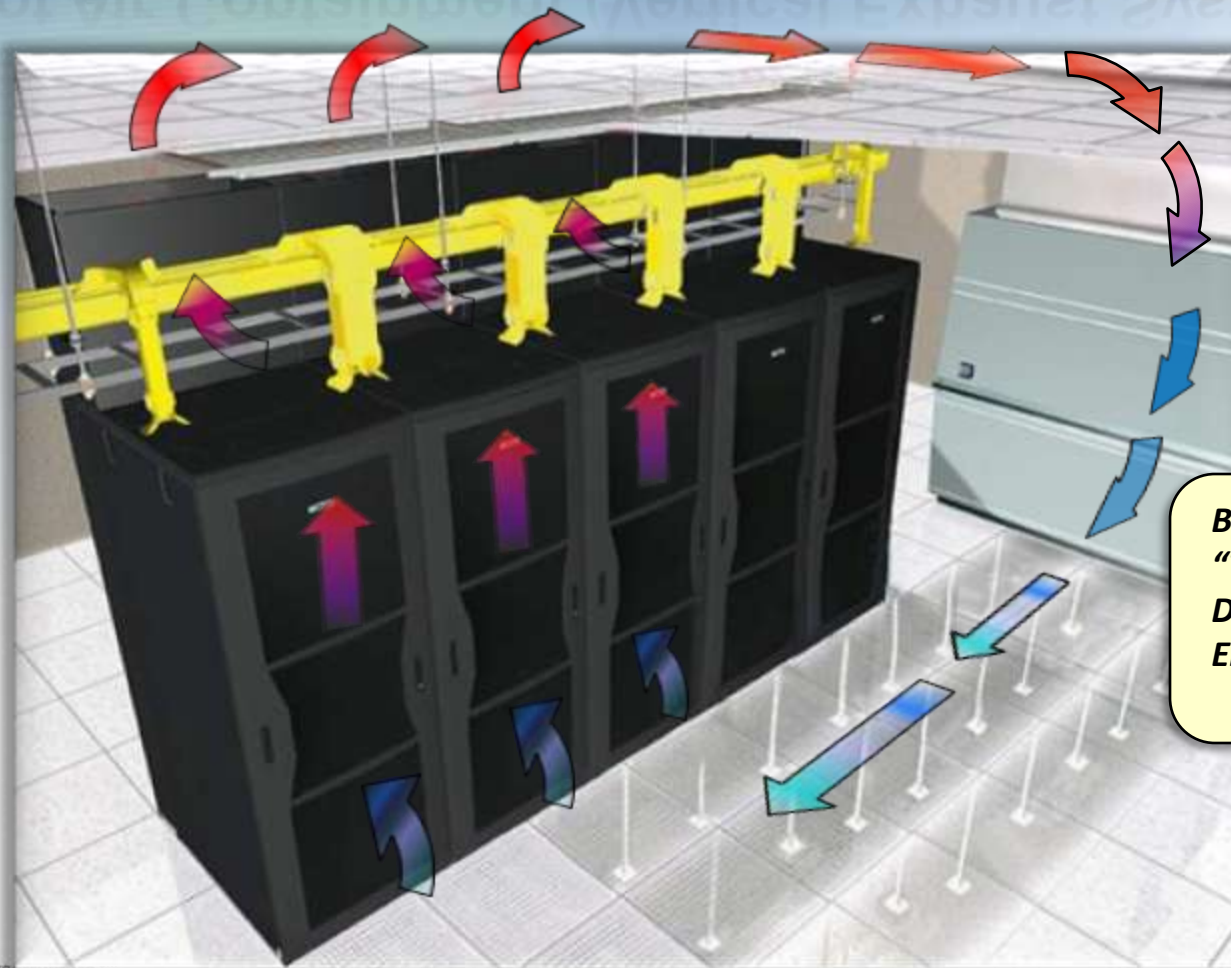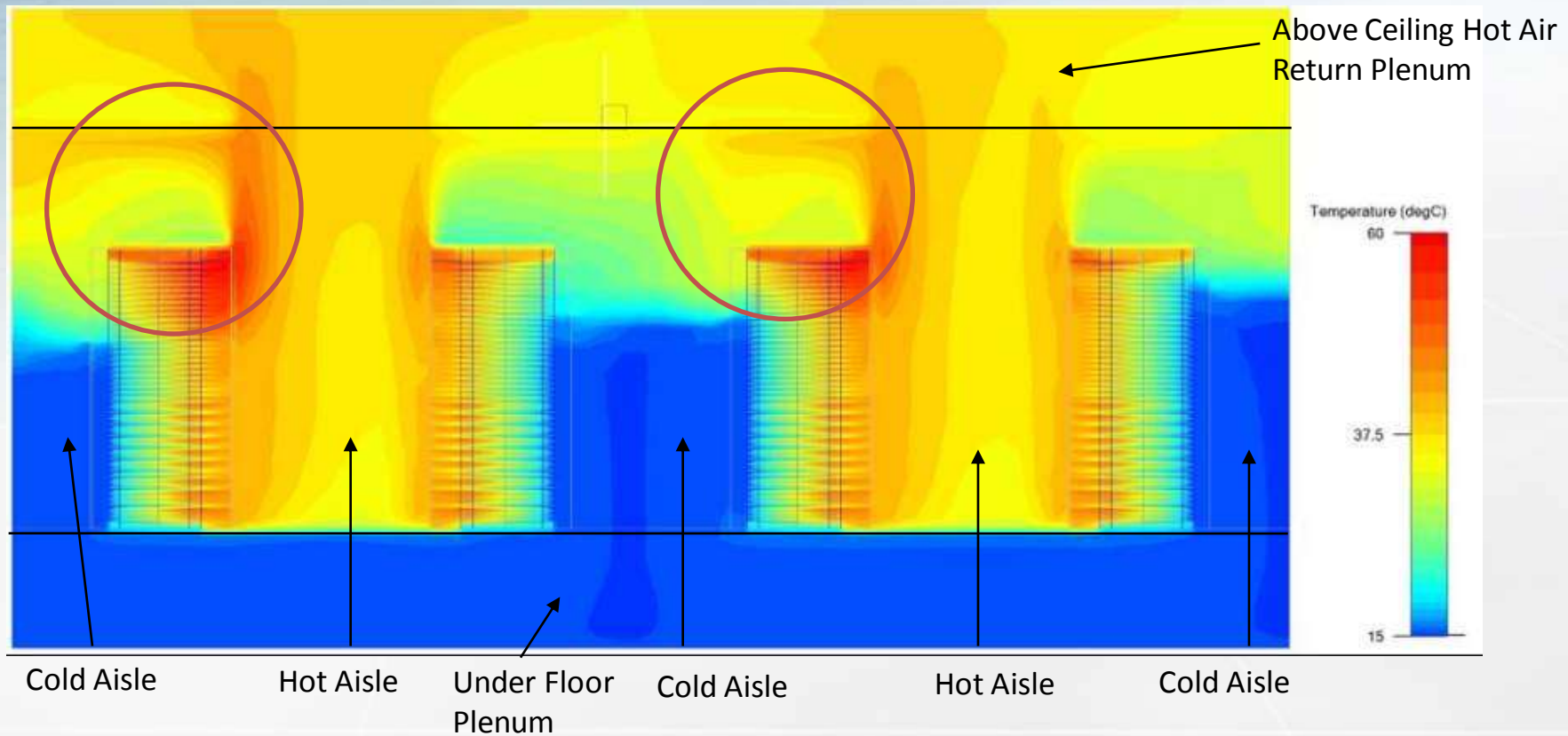

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Room Cooling Architecture – Hot Air Containment (Vertical Exhaust System)

Based on ASHRAE "Thermal Guidelines for Data Centre Processing Environments"

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Thermal Analysis Results – Standard Cabinets Without VED

Without exhaust duct, hot air re-circulates to the front of the cabinet heating the top 12 RU

Above Ceiling Hot Air Return Plenum

Temperature (degC)

Cold Aisle   Hot Aisle   Under Floor Plenum   Cold Aisle   Hot Aisle   Cold Aisle

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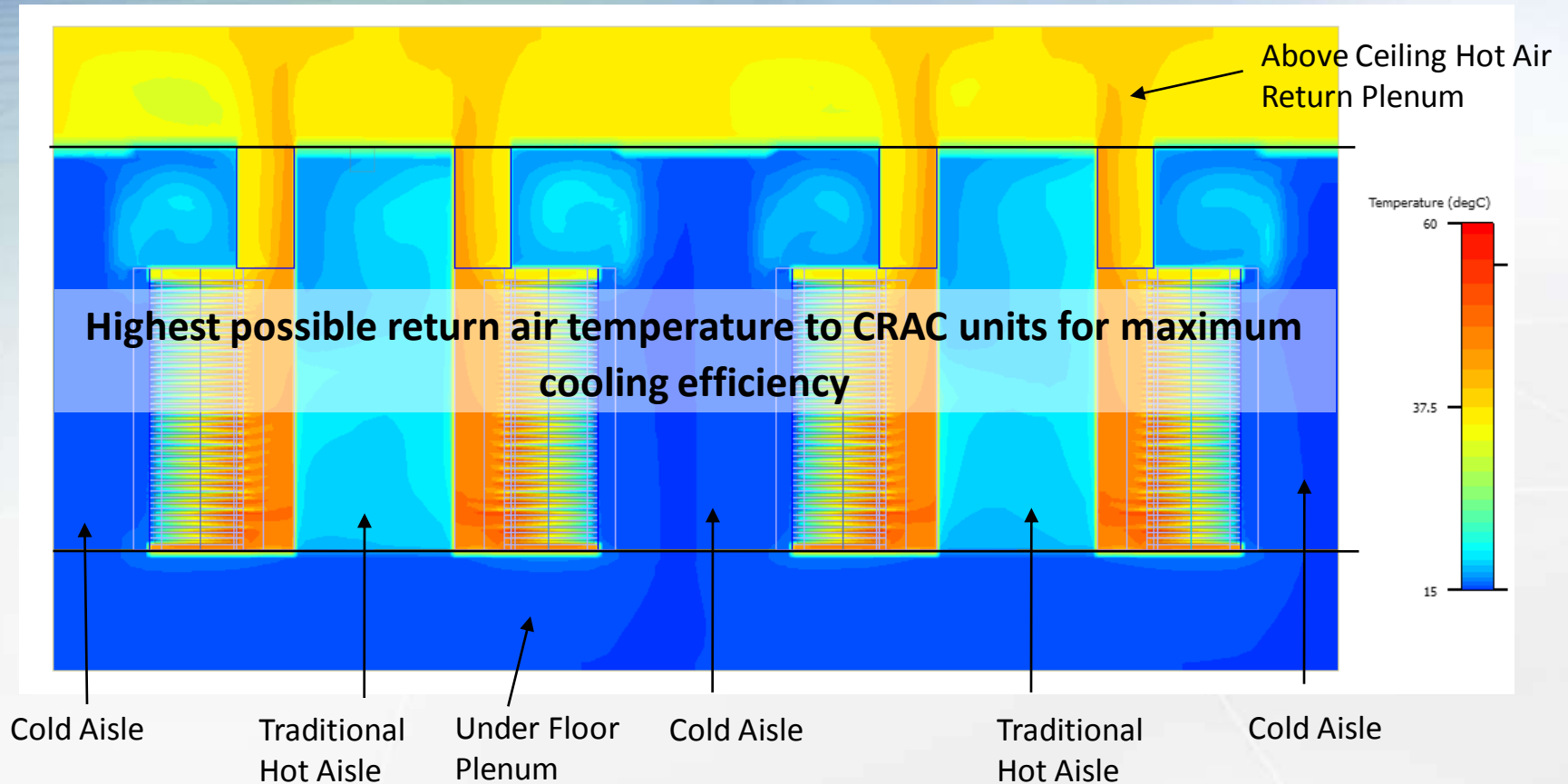
Thermal Analysis Results – Vertical Exhaust Duct

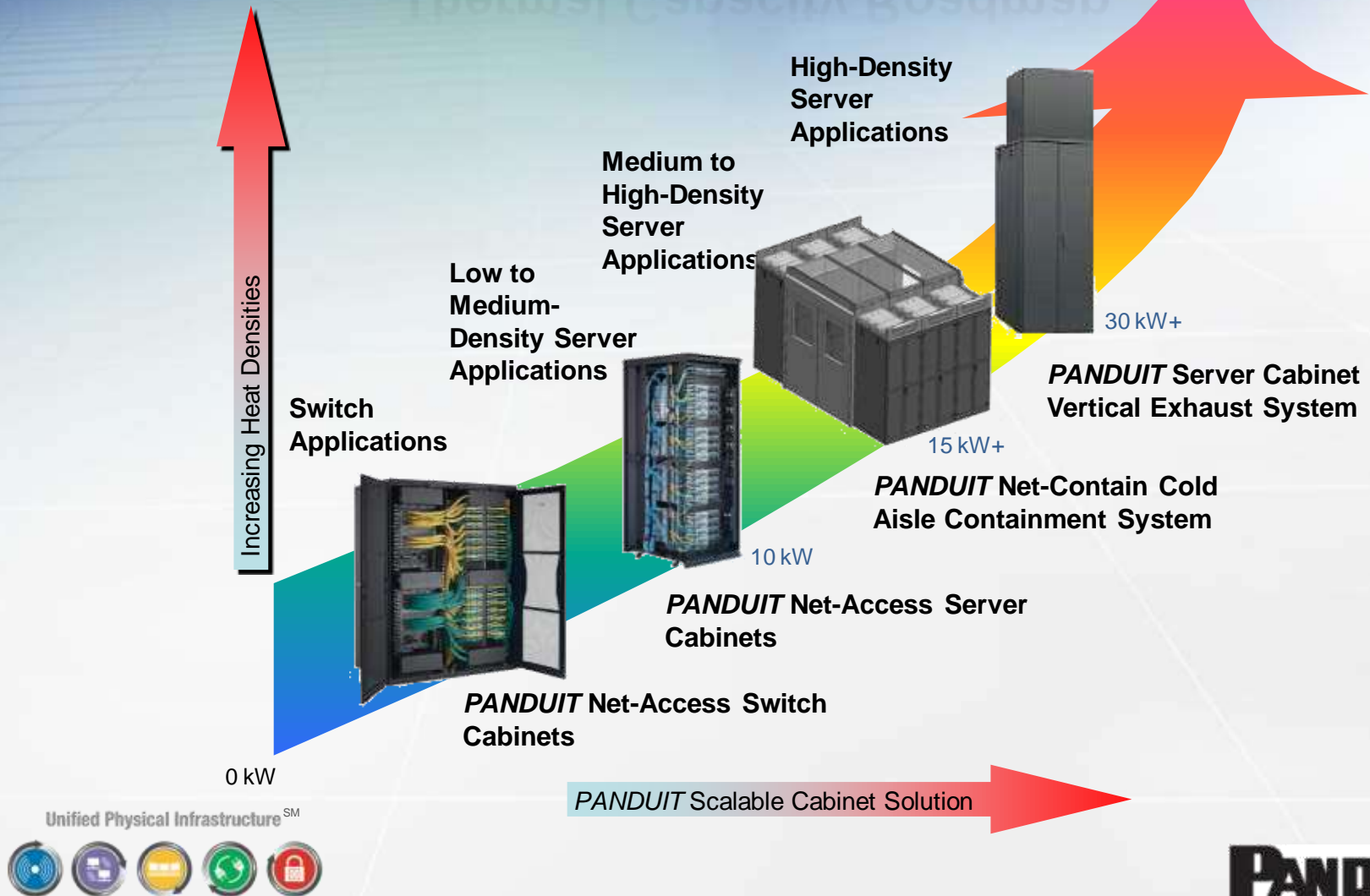Exhaust duct sends hot air to return plenum – Uniform cold air available to server inlets

Cabinet System Overview
Thermal Capacity Roadmap

Increasing Heat Densities

High-Density Server Applications

Medium to High-Density Server Applications

Low to Medium-Density Server Applications

Switch Applications

30 kW+

15 kW+

10 kW

0 kW

PANDUIT Server Cabinet Vertical Exhaust System

PANDUIT Net-Contain Cold Aisle Containment System

PANDUIT Net-Access Server Cabinets

PANDUIT Net-Access Switch Cabinets

PANDUIT Scalable Cabinet Solution

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Correcting Airflow

Air Flow

Cool Boot

Ducting

Ashrae claim **>60%** of air bypasses equipment wasting OPEX
UPTIME Institute attribute **55%** of equipment failure to Thermal failure

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Overhead Fiber Routing Pathway Solutions

Trends

- Growing use of fiber optics in data center

- Fiber optic cables are still more susceptible to physical damage

- Data center aesthetics are becoming more important

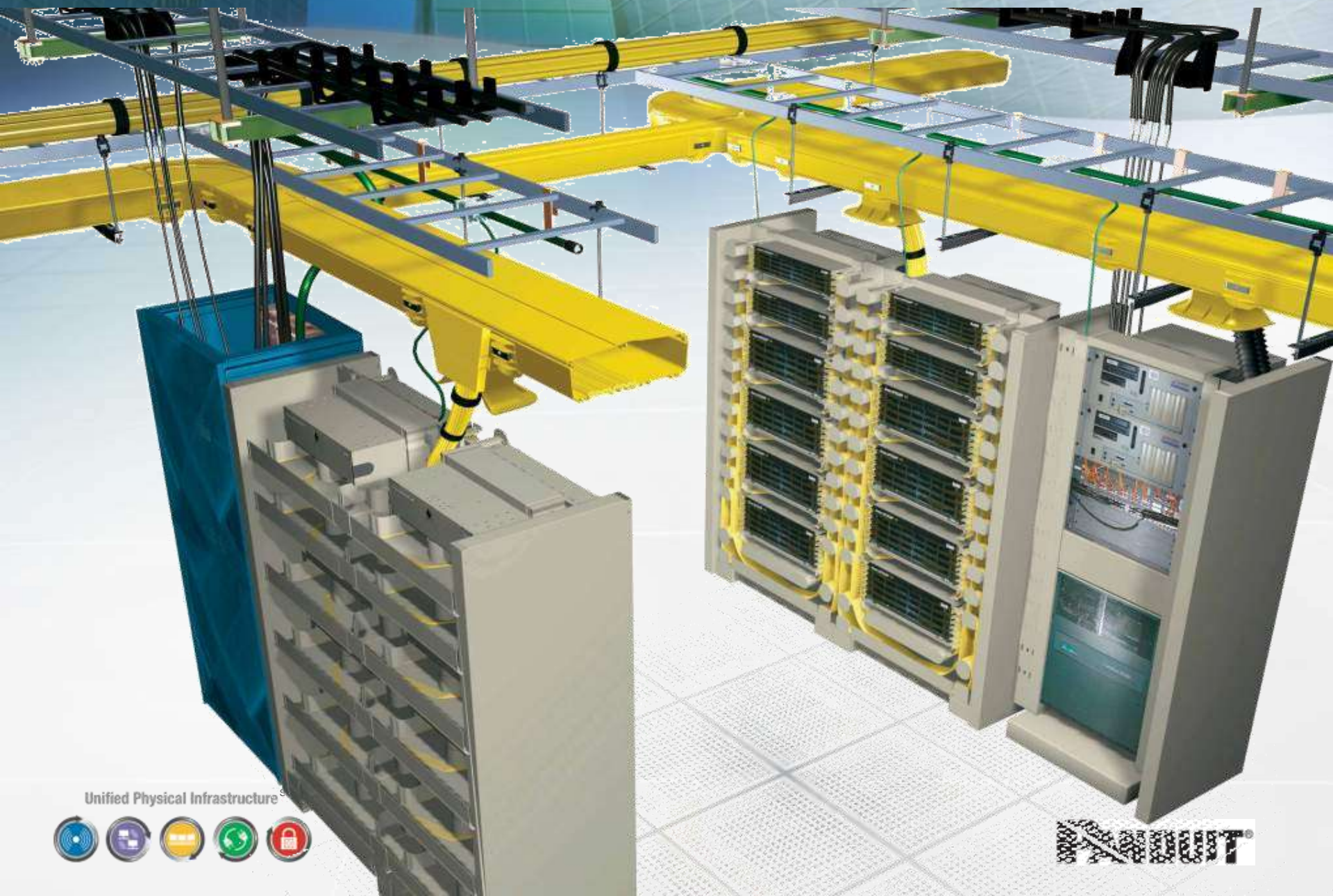- Future proofing

Top of Mind Issues:

- Improves Network Reliability

- Reduces Installation Cost and Implementation Time

- Versatile/Scalable

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Overhead Fiber Routing Pathway Solutions

Smart Data Centers Sustainable Value

Panduit Capabilities	Customer Benefits
	• **Up to 10%** more useable space • **Up to 15%** reduction in power • **Up to 40%** reduction in cooling costs • **Up to 80%** reduction in change management time • **Up to 75%** reduction in time to install

- Availability/Uptime
- Physical Security/Safety
- Agility/Responsiveness
- Energy/Sustainability
- Space/Density

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PIM™ Software Solution

- Structured modular-based offering
  - Customize module mix based on business needs
  - Enables easy deployment of additional functionality
- Available modules include:
  - Base
  - Asset
  - Power
  - Connect
  - Advanced Dashboards & Reports
- Integrations with leading:
  - Asset management systems
  - Network management systems
  - Change management systems
- Works seamlessly with Panduit PanView iQ™ system hardware and third-party networked assets
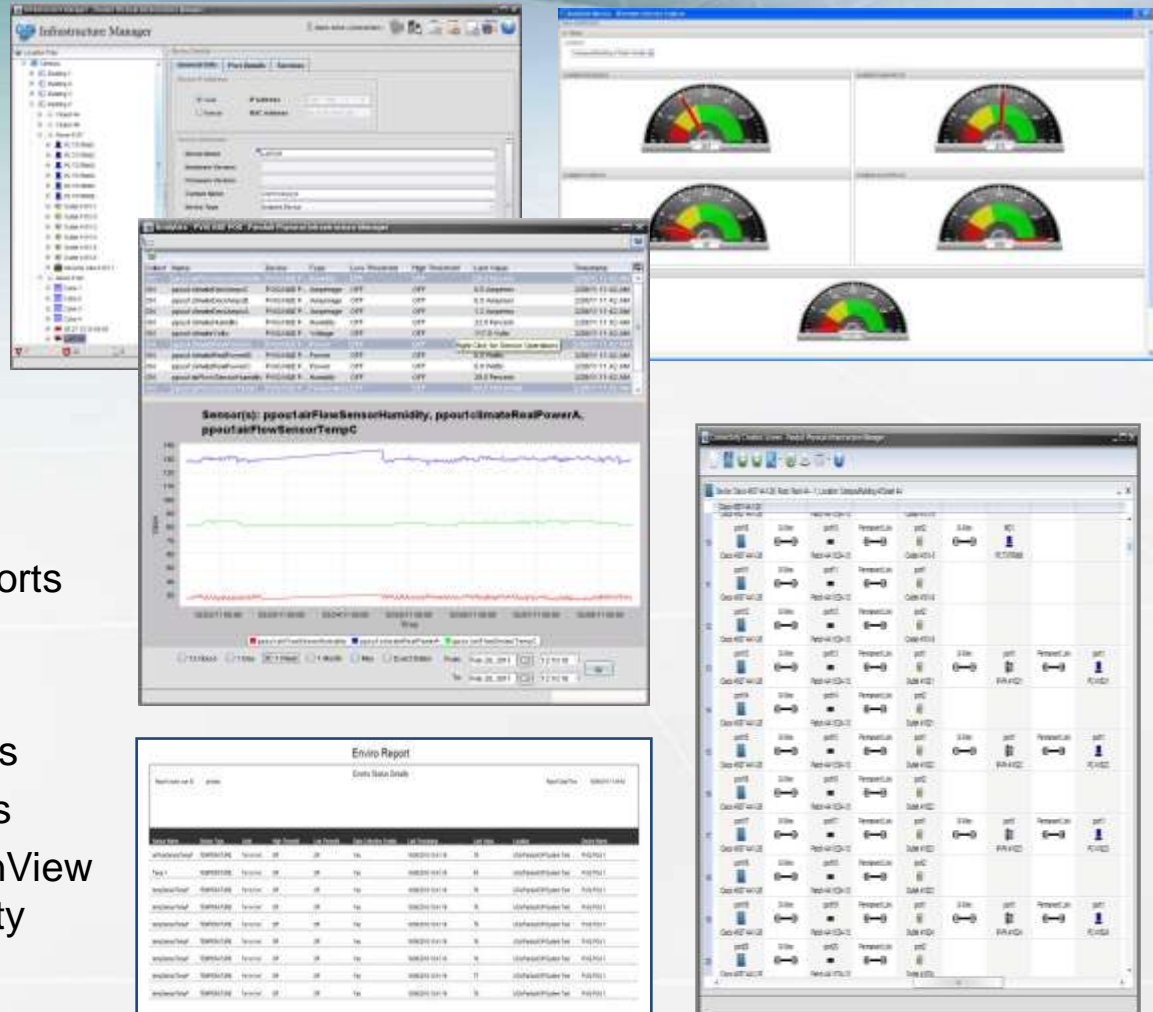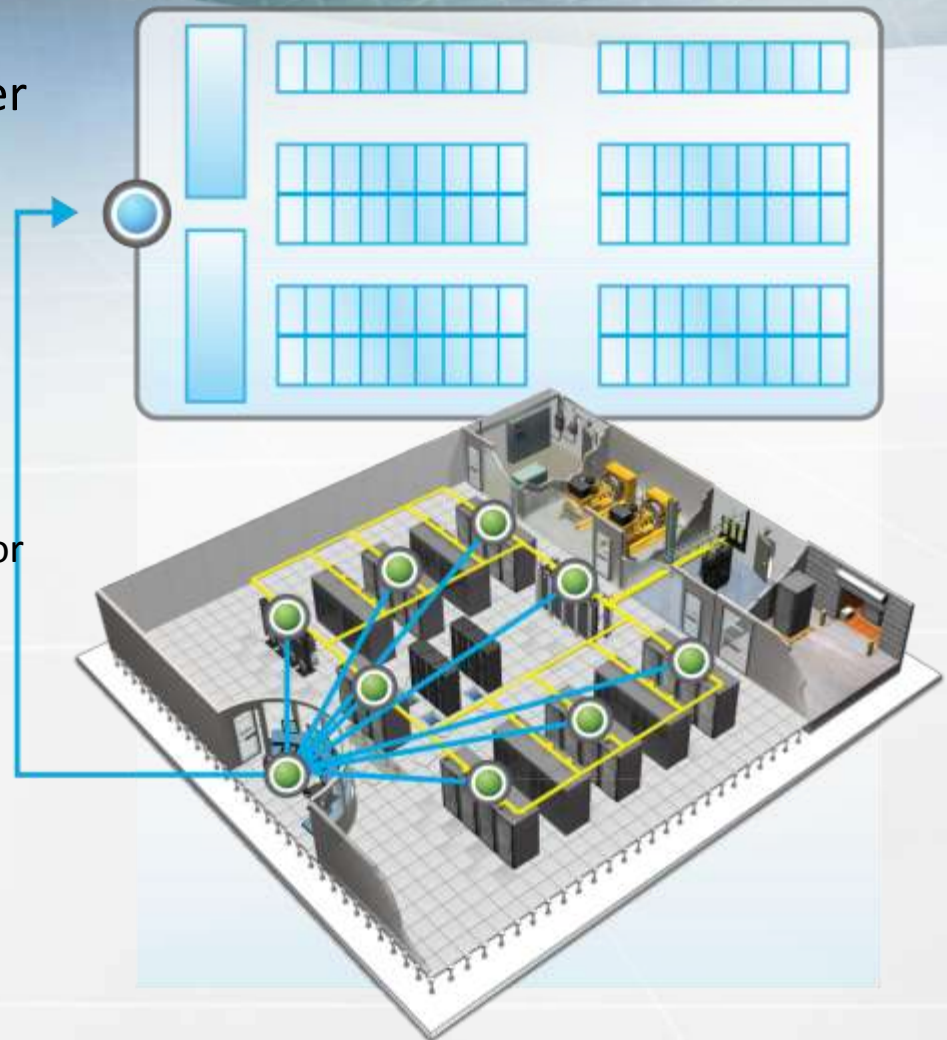
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PIM™ Capabilities Today

PIM™ Software capabilities extend beyond network connectivity into power and thermal monitoring and asset tracking and utilization information to provide visibility into:

- **Asset tracking** – expanded capabilities to include tracking of assets throughout your enterprise down to the RU level

- **Switch port capacity** — Reclaim underutilized or unutilized ports

- **Space capacity** – historical data related to power, cooling, space, and port utilization

- **Power capacity** – voltage, capacity and amperage monitoring at the cabinet

- **Thermal capacity** – temperature and humidity data sensors at the cabinet

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PIM™ Capabilities Tomorrow

PIM™ Software future capabilities will transform collected, aggregated physical layer data into actionable information that will have a direct impact on:

- **Resource utilization** – optimize use of available physical infrastructure, including space, power and cooling resources

- **Capacity planning** – modeling of past and future state physical infrastructure requirements
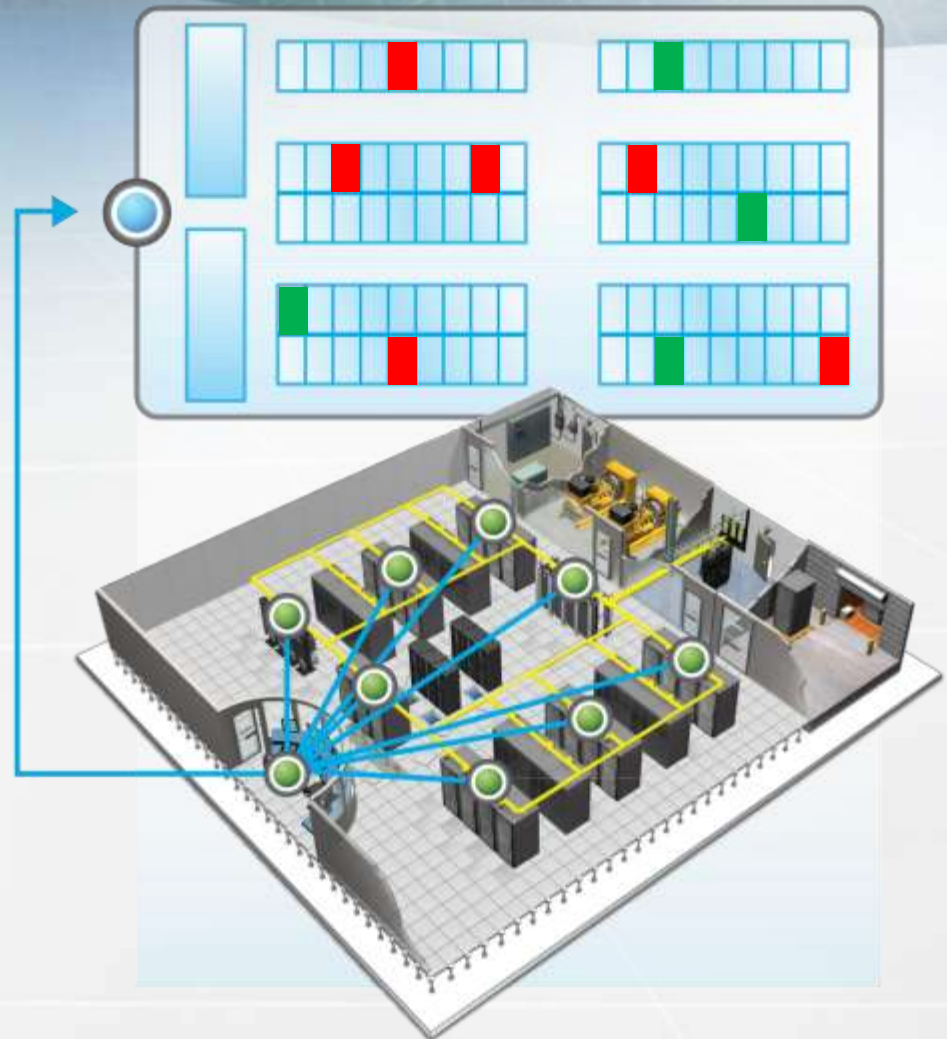
building a smarter, unified foundation