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infrastructure for a connected world

PANDUIT'S CONVERGED DATA CENTER INFRASTRUCTURE SOLUTION

Athens, Layer One Event, 6th 2017

Sander Kaempfer
EMEA Business Development Manager Data Center

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Agenda

- Converged Infrastructure Solution for Data Centers
- Market Trends & Standards Update
- Signature Core™ Fiber
- Latency Legislation Law - MiFID II
- Case Study Financial Customer - Latency Equalization
- Launch 5th Generation Rack PDU's
- Data Center Infrastructure Management
- Summary

Our Strategy

Converged Infrastructure Solution for Data Centers

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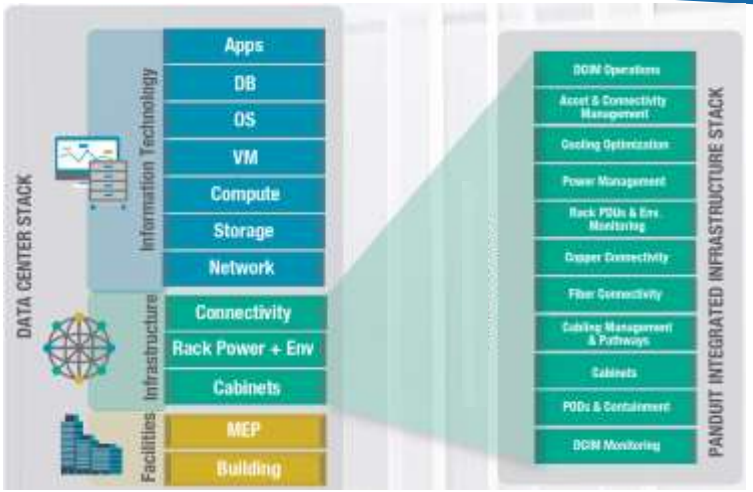
~~DATA~~ CENTER VALUE PROPOSITION

Transforming the Data Center

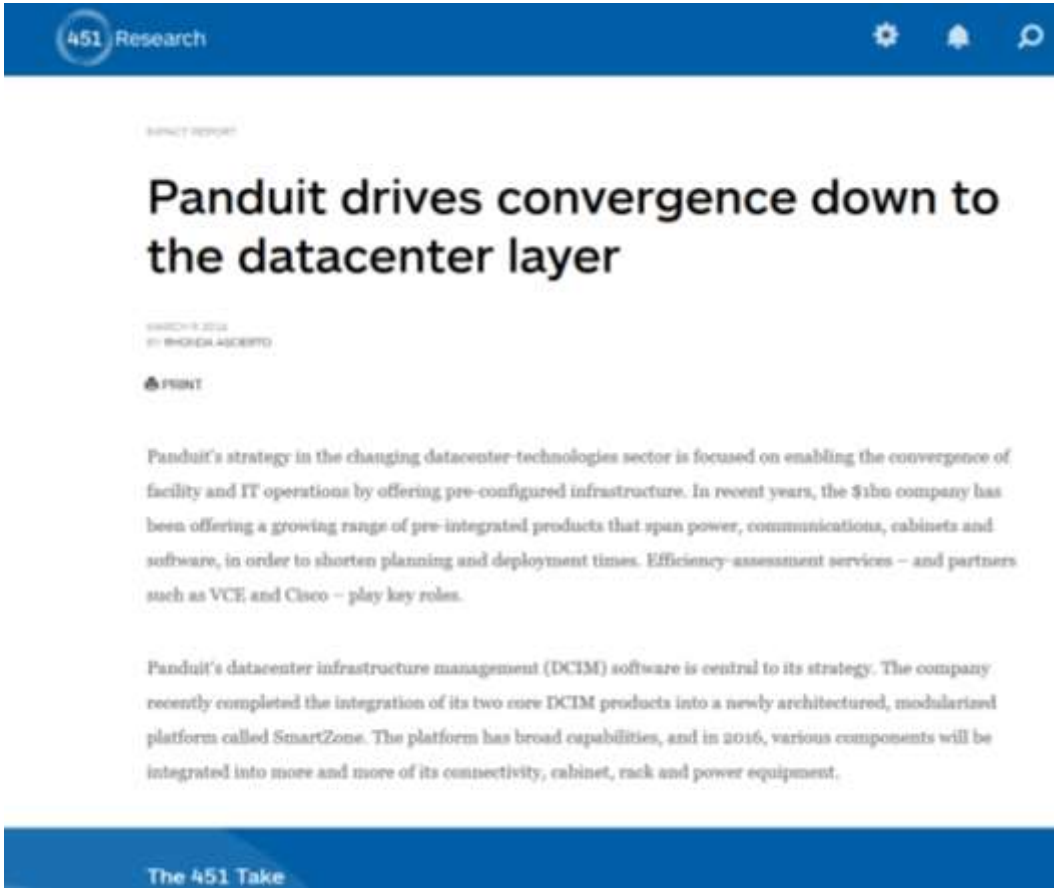
Converged Infrastructure solutions enable data centers to be ***agile*** and ***scalable*** with the ***operational efficiency*** to adapt as the business evolves

VALUE PROP:

- Accelerate & simplify the data center design
- Reduce the deployment cycle
- Optimize operations
- Improve total cost of ownership (TCO)



What do analysts say?



451 Research

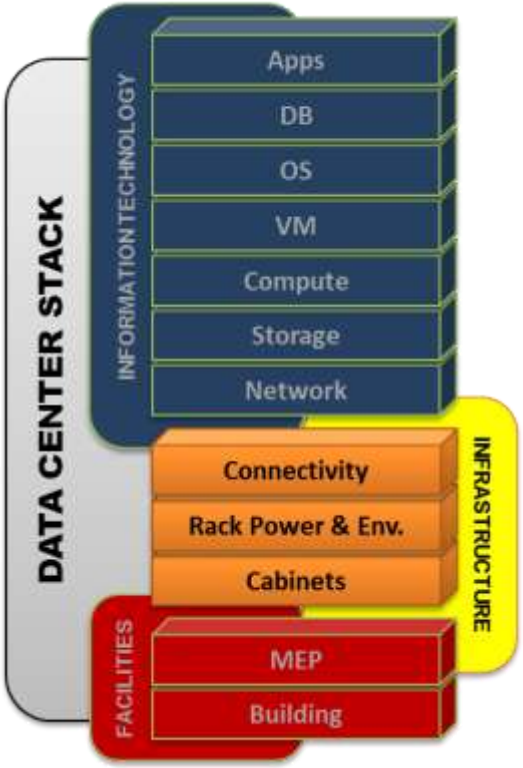
Panduit drives convergence down to the datacenter layer

Panduit's strategy in the changing datacenter-technologies sector is focused on enabling the convergence of facility and IT operations by offering pre-configured infrastructure. In recent years, the $1bn company has been offering a growing range of pre-integrated products that span power, communications, cabinets and software, in order to shorten planning and deployment times. Efficiency-assessment services – and partners such as VCE and Cisco – play key roles.

Panduit's datacenter infrastructure management (DCIM) software is central to its strategy. The company recently completed the integration of its two core DCIM products into a newly architectured, modularized platform called SmartZone. The platform has broad capabilities, and in 2016, various components will be integrated into more and more of its connectivity, cabinet, rack and power equipment.

The 451 Take

Our offering



← Implementation and Support


DCIM Cooling Optimization


DCIM Power Management


DCIM Asset & Connectivity


Professional Services


Copper Connectivity


Fiber Connectivity


Cabling Mgmt. & Pathways


Physical Accessories


Network and Server Cabinets


Pre-Configured Cabinets


Thermal Containment


Rack Power Distribution

Design and Optimization →

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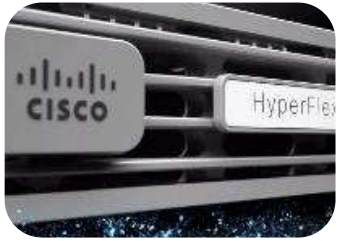
Convergence - Reference Architecture Designs



Cisco Architectures
- Hyperflex
- ACI
- UCS/Nexus

Emerging Architectures
- PureStorage
- Simplivity/HPE
- Nutanix

Customer Experience
- Accelerated time to live
- Reduced Risk
- Lowered TCO

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Converged Data Center Solution

Use Case:

Global Software company

Adaptable for Colo and Multi-Tenant Application

Global consistent design for standards based design

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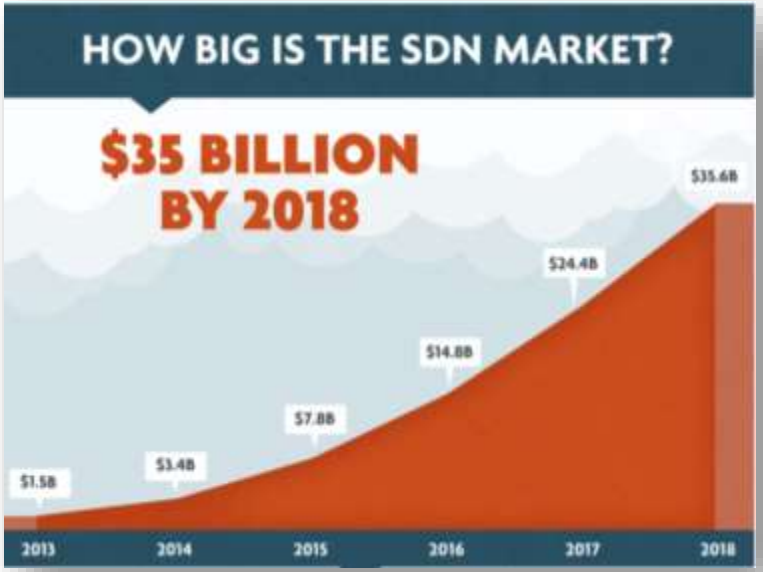
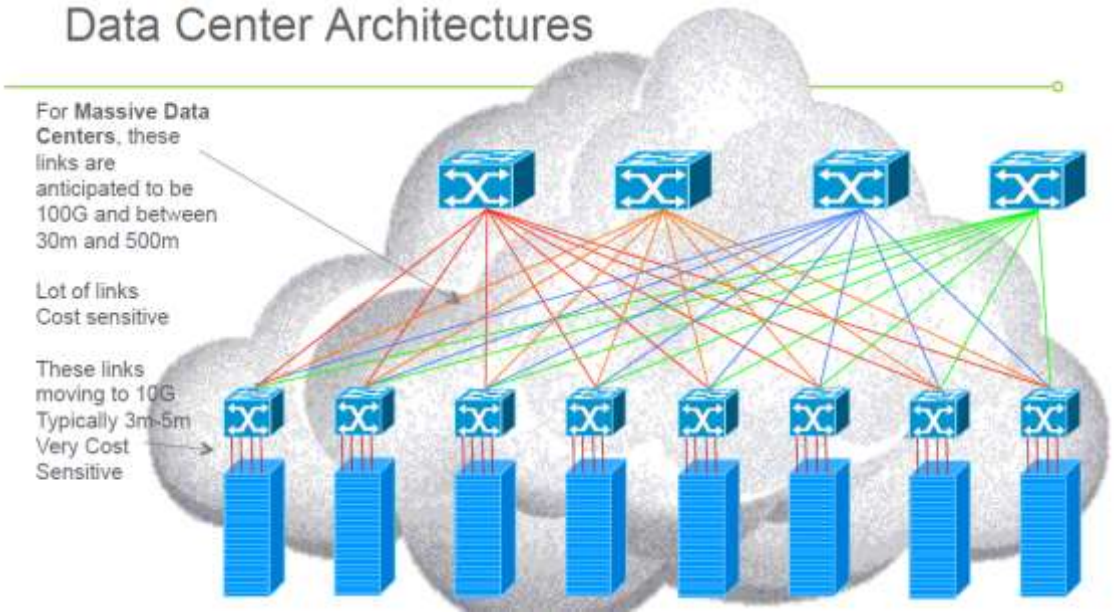
Software Defined Data Center

- Software Defined Networks (SDN) is projected to grow substantially over the next years
- Cisco's SDN offering is called Application Centric Infrastructure (ACI)
- Panduit is the leading infrastructure partner in Cisco's ACI Ecosystem



Data Center Physical Infrastructure Trends

- Higher interest in DCIM
- Movement towards flat architectures, requires longer point-to-point optical connections
- Agility to migrate to higher data rate speeds
- Need to reduce latency
- Desire for fully integrated data center solutions
- Movement toward edge computing
- Higher focus on energy & power utilization efficiency



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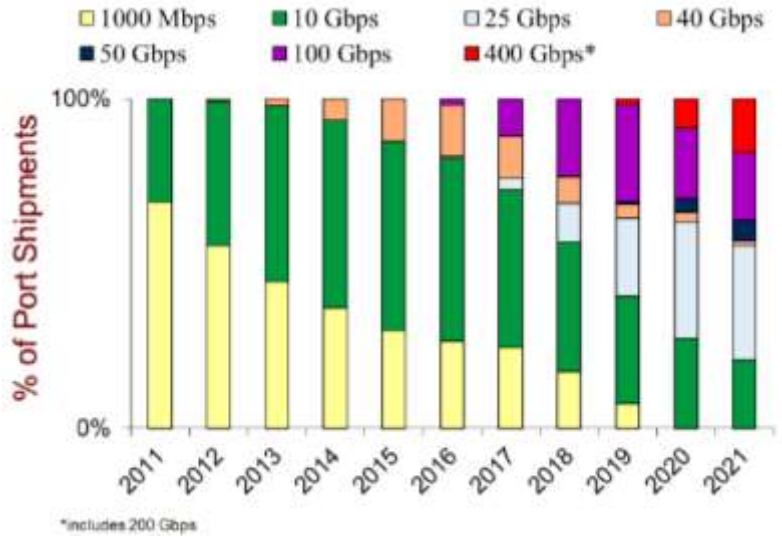
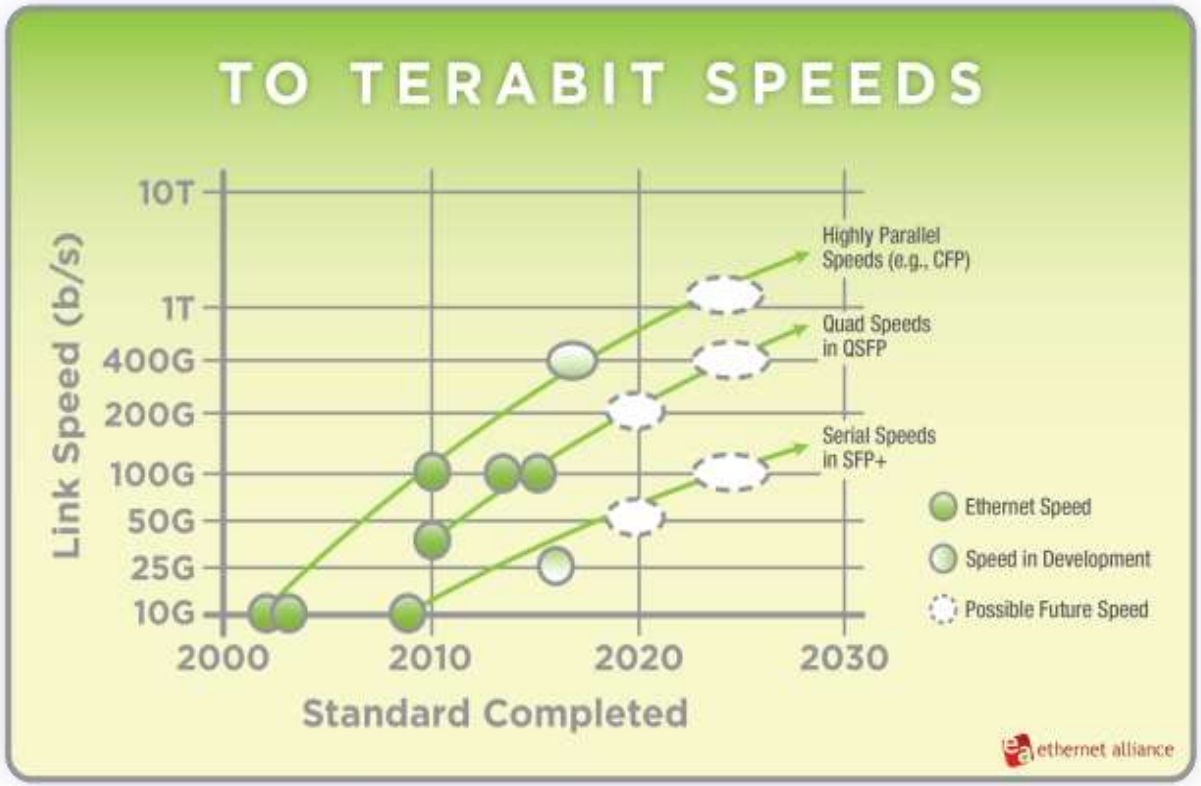
Need for Speed - Server Port Forecast

- **100G** to represent **50%** of **DC** optical transceivers - by 2019 Infonetics forecast
- DC customers are provisioning for 400G **now**
  - 400G predicted to appear 2018



Source - Dell'oro
All port shipment forecast

Standards – How to future proof your data center?




CFP


QSFP


SFP+

Source: http://www.ethernetalliance.org/roadmap/

These Figures Do Not Include Fibre Channel Applications

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Multimode Application Standards

Application	10GBASE-SR	25GBASE-SR	40GBASE-SR4	40G BiDi	50GBASE-SR	100GBASE-SR10	100GBASE-SR4	100GBASE-SR2	100G BiDi	200GBASE-SR4	400GBASE-SR16
Data Rate	10 Gbps	25 Gbps	40 Gbps	40 Gbps	50 Gbps	100 Gbps	100 Gbps	100 Gbps	100 Gbps	200 Gbps	400 Gbps
Standard	IEEE 802.3ae	IEEE 802.3by	IEEE 802.3ba	Cisco	IEEE 802.3cd	IEEE 802.3ba	IEEE 802.3bm	IEEE 802.3cd	Cisco	IEEE 802.3cd	IEEE 802.3bs
Released	2002	201	20	20	s 2018	010	201	s 201	Unkno n	st. 2018	est. 2017
Form Factor	SFP		QS	QSF	QSF	, CXP	QSFP, CFP4			CFP4	
Fiber Type	OM3 / OM4	OM3 / OM4	OM3 / OM4	OM3 / OM4	OM4	OM3 / OM4	OM3 / OM4	OM4	OM3 / OM4	OM3 / OM4	OM3 / OM4
Reach	300m / 400m	70m / 100m	100m / 150m	100m / 135m	100m	0m / 150m	70m / 100m	100m	TBD	70m / 100m	70m / 100m
# Fibers	2	2	8	2	2	20	8	4	2	8	32
P te	10 Gbps	25 Gbps	10 Gbps	Gbps	2 Gbps		25 Gbps	2 Gbps	TBD	2 Gbps	25 Gbps
# w en hs	(85 m)	(8 m	(850nm,	(85 + 900	1 (850nm	(850nm)	1 (85 m)	1 (85 nm	BD	1 (85 m)	(85
Modulation	NRZ	NRZ	NRZ	NRZ	PAM-4	NRZ	NRZ	PAM-4	TBD	PAM-4	NRZ
Connectors	Duplex LC	Duplex LC	12f MPO	Duplex LC	Duplex LC	24f MPO	12f MPO	12f MPO	Duplex LC	12f MPO	32f MPO
Schematic											

120GBASE-SR12
120 Gbps
Arista
QSFP
OM3 / OM4
100m / 150m
24
24F MPO
10 Gbps

NO IEEE SWDM STANDARDS & SWDM DOES NOT SUPPORT 'BREAKOUT MODE'

- 'BASE' 2F, 4F, 8F, 20F, 24F… 32F

MPO
PanMPO™
MTP

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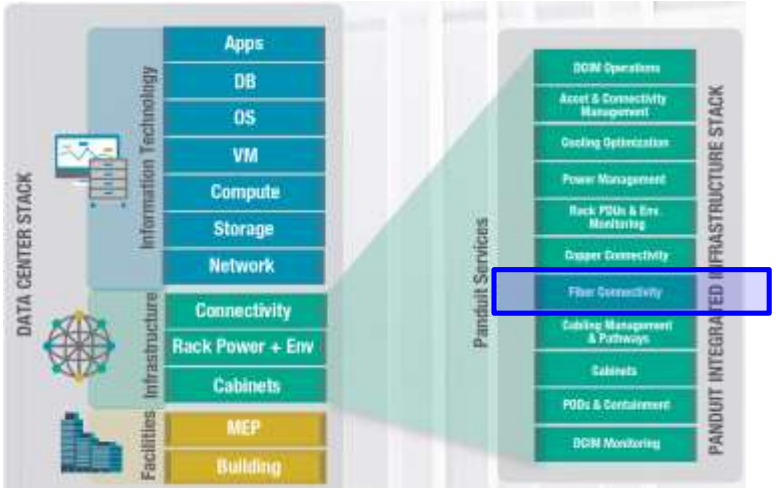
Signature Core™ Fiber

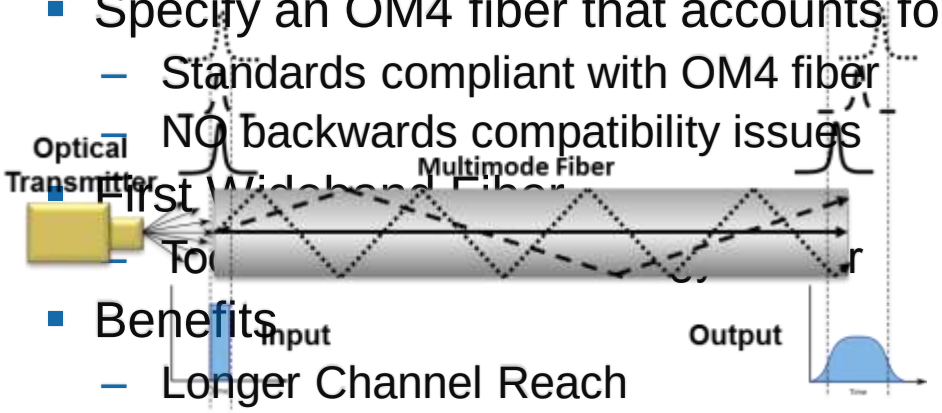
Transforming the Data Center

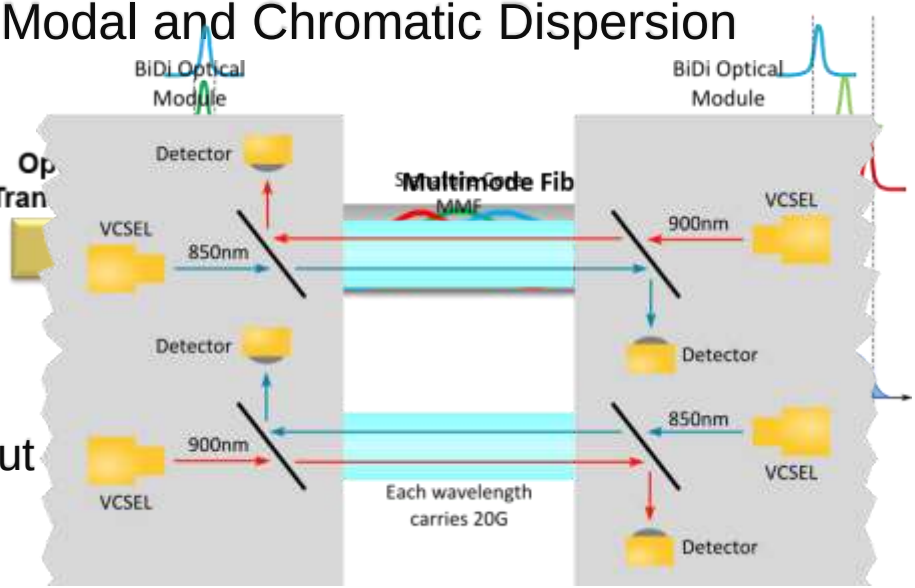


Panduit Signature Core™

OM4 SIGNATURE CORE™

- Panduit Researchers discover effect of Chromatic Dispersion
  - At data rates >10Gbps Inter-Symbol Interference (ISI) significant
  - OM3/OM4 only account for Modal Dispersion
- Specify an OM4 fiber that accounts for Modal and Chromatic Dispersion
  - Standards compliant with OM4 fiber
  - NO backwards compatibility issues
  - First Wideband Fiber
  - To
- Benefits
  - Longer Channel Reach
  - Reduces Bit Errors – improves throughput
  - Increased Margin Headroom





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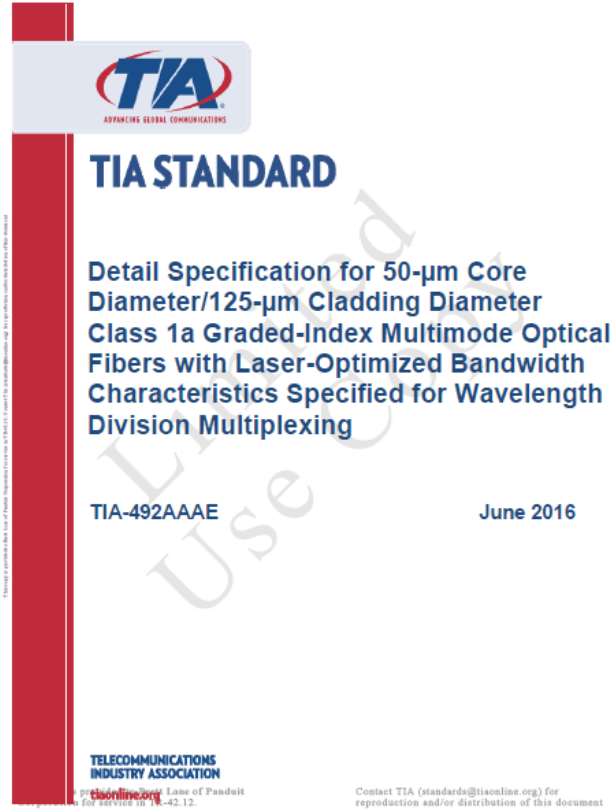
WB MMF – OM5 - Standard ANSI/TIA-492AAAE

- Chaired by Panduit
- Fully Backwards Compatible
  - OM3 < OM4 < WB MMF = OM5
    - Technical: geometry, modal bandwidth, chromatic dispersion, tighter test requirements
- Global Standards Harmonization:
  - Fiber: IEC 60793-2-10 Ed 6
    - Type A1a.4
  - Cabling: TIA 568.3-D
    - Cable jacket color Lime Green
  - Cabling: ISO 11801 Ed 3
    - OM5



Multimode Fiber Reach Table - 1.5dB Connectivity

	Fiber Type				
	OM3	OM4	OM4 SC	OM5	OM5 SC
Application*	Maximum Channel Length (m)				
10GBASE-SR	300	400	550	400	465
25GBASE-SR	100	125	165	125	145
40GBASE-SR4	100	125	165	125	145
100GBASE-SR10	100	125	165	125	145
100GBASE-SR4	70	100	125	100	115
4GFC	380	400	500	400	445
8GFC	150	190	250	190	215
16GFC	100	125	200	125	160
32G Fibre Channel	70	100	125	100	115
128G Fibre Channel	60	85	95	85	90
Cisco 40G BiDi	100	135	200	150	175
Cisco 100G BiDi	70	100	135	110	125
40G SWDM4	240	350	420	440	485
100G SWDM4	75	100	150	150	185

SC = Signature Core™

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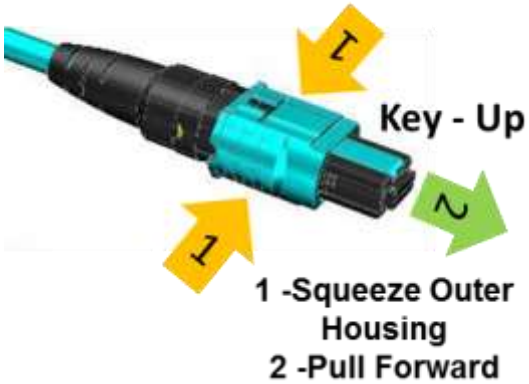
Stay Flexible

- Consider ease of migration and scale
  - Port Density
  - Ease of Moves, Adds and Changes
  - Deploy and scale quickly
  - Simple cable management
- Avoid options that are rigid
  - PanMPO™
  - Solution that accepts multiple width cassettes – HD Flex™
  - Field convertible



Latency Legislation

“You can buy your way out of bandwidth problems. But latency is divine.”

Intel Technical Computing Group CTO Mark Seager

Legislation

- **MiFID** stands for "**M**arkets **i**n **F**inancial **I**nstruments **D**irective".
  - This directive is European Union law since 2007
    - Aims to create a single, more competitive market in financial services across EU

- MiFID**II** becomes EU law – Jan 3rd 2018
  - New category of trading venue
  - Greater traceability & visibility
  - Further ‘leveling of the playing field’
  - Co-location trading venues shall;
    - *‘publish policy on their websites, including cable length’.*
    - *‘provide users network access under equivalent conditions including cable length’*

High Frequency Trading (HFT) - Speed

Time (Latency) SI Unit	Power 10^n	Example
Second (**s**)		Human reaction time is **0.3** seconds
Millisecond (**ms**)	10^{-3}	Human reaction time is **300** milliseconds
Microsecond (**µs**)	10^{-6}	One µs is a millionth of a second
Nanosecond (**ns**)	10^{-9}	One ns is billionth of a second

- 1**ms** advantage can be worth $100 million p.a.
  - to major brokerage firms
- Over 100,000 orders per second, <40µs average latency
  - http://business.nasdaq.com/market-tech/marketplaces/trading
- 1ns cycle time for a 1 GHz processor.
- Ultra low latency switches 20ns – 250ns

Nasdaq

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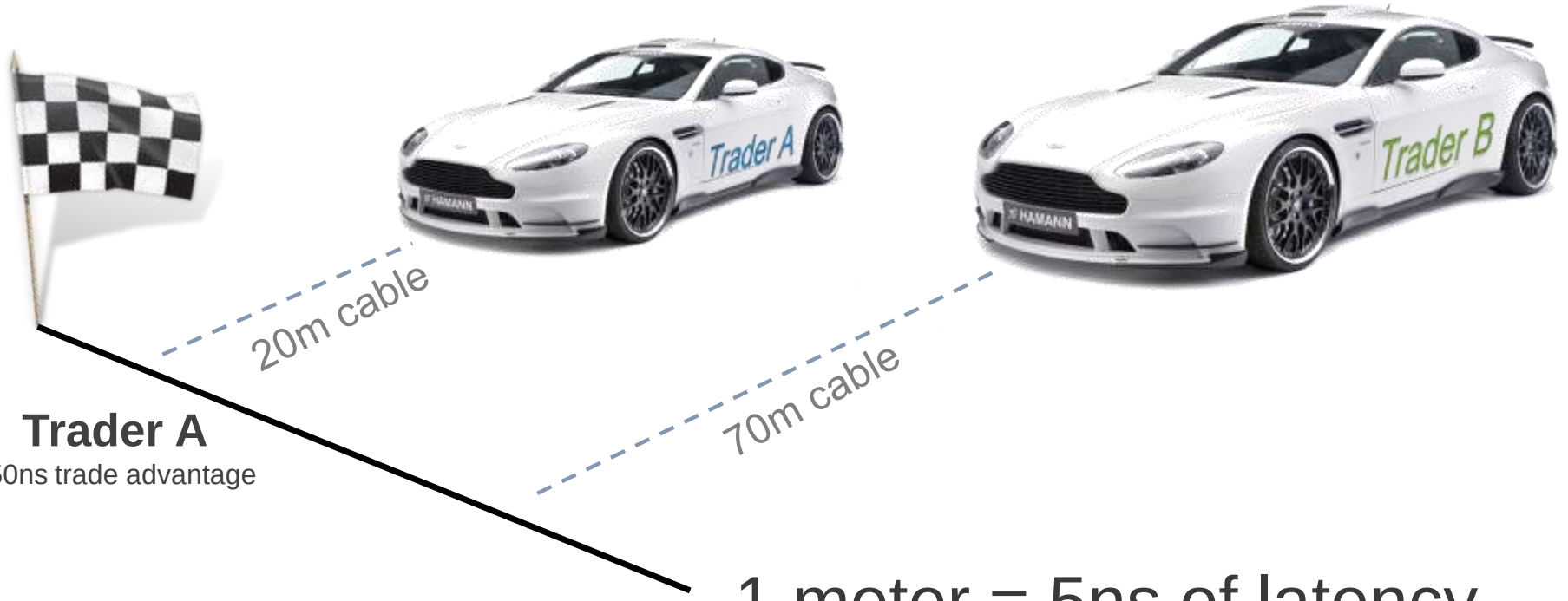
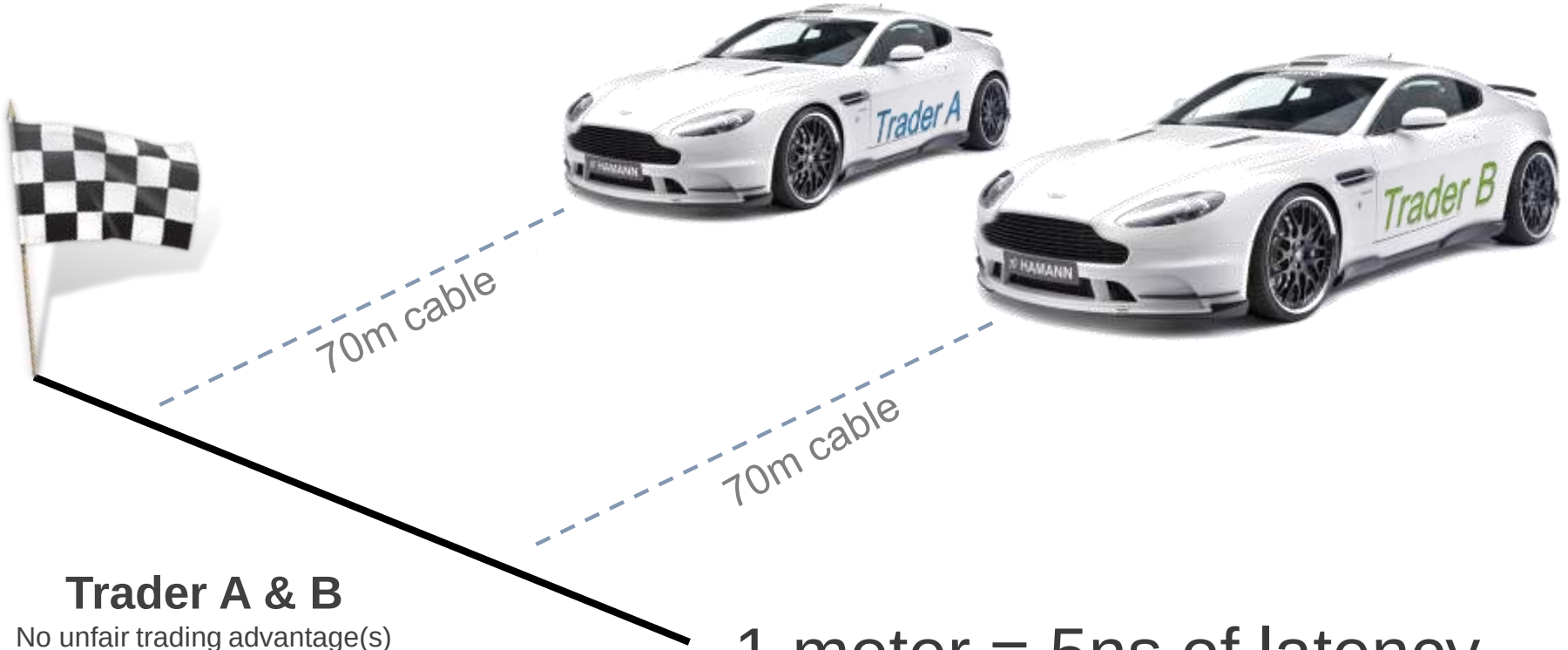
Un-equal fibre cable lengths



Latency (length) Equalisation



Trader A & B

No unfair trading advantage(s)

1 meter = 5ns of latency

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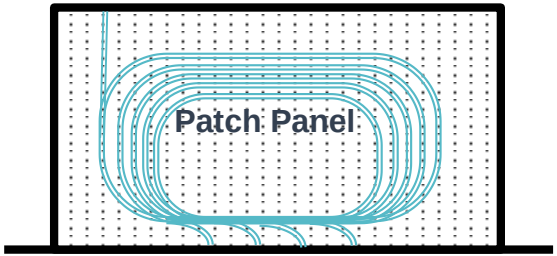
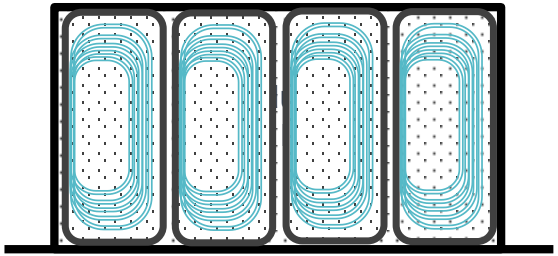
Cable Length Equalisation – Examples ONLY

Method A



- No loss of valuable ($) RU space
- Remove congestion in cable management/ pathway
  - reduce cooling baffles.
- LC-LC or MPO-LC

Method B



- Modular version of Method [A]

Method C

- Small diameter cabling
- Where cable pathway space permits
- Enables use of Panduit's standard patch panel range

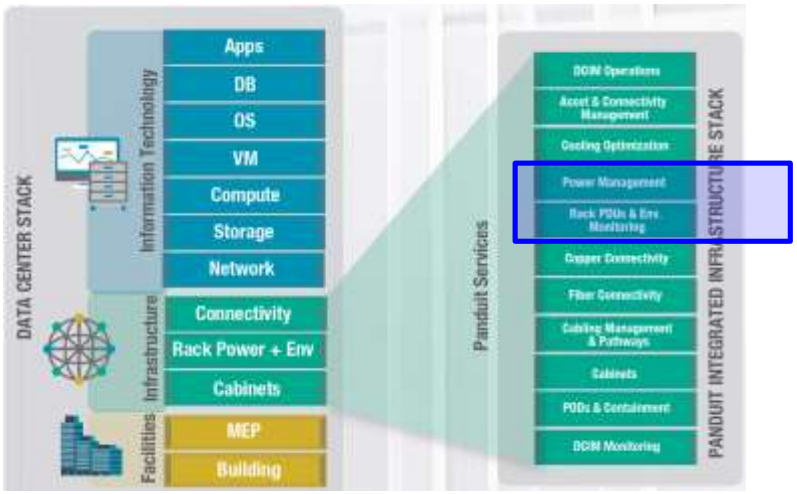
Case Study - Financial Customer

- Customer: Large Stock Exchange/HFT Co-location
- Requirements:
  - Minimize risk of bit errors (latency)
  - Hosted client **latency/cable length equalization**
    - Solving cable management challenges/containment
  - High reliability
  - High density
  - Support a future expansion to 100G on two MMF

- Solution
  - OM4 **Signature Core™** small diameter pre-terminated cabling
    - Custom tight length tolerance ±250mm up to 60m
  - HD Flex™
  - PanMPO™

Smart Power & Capacity Management

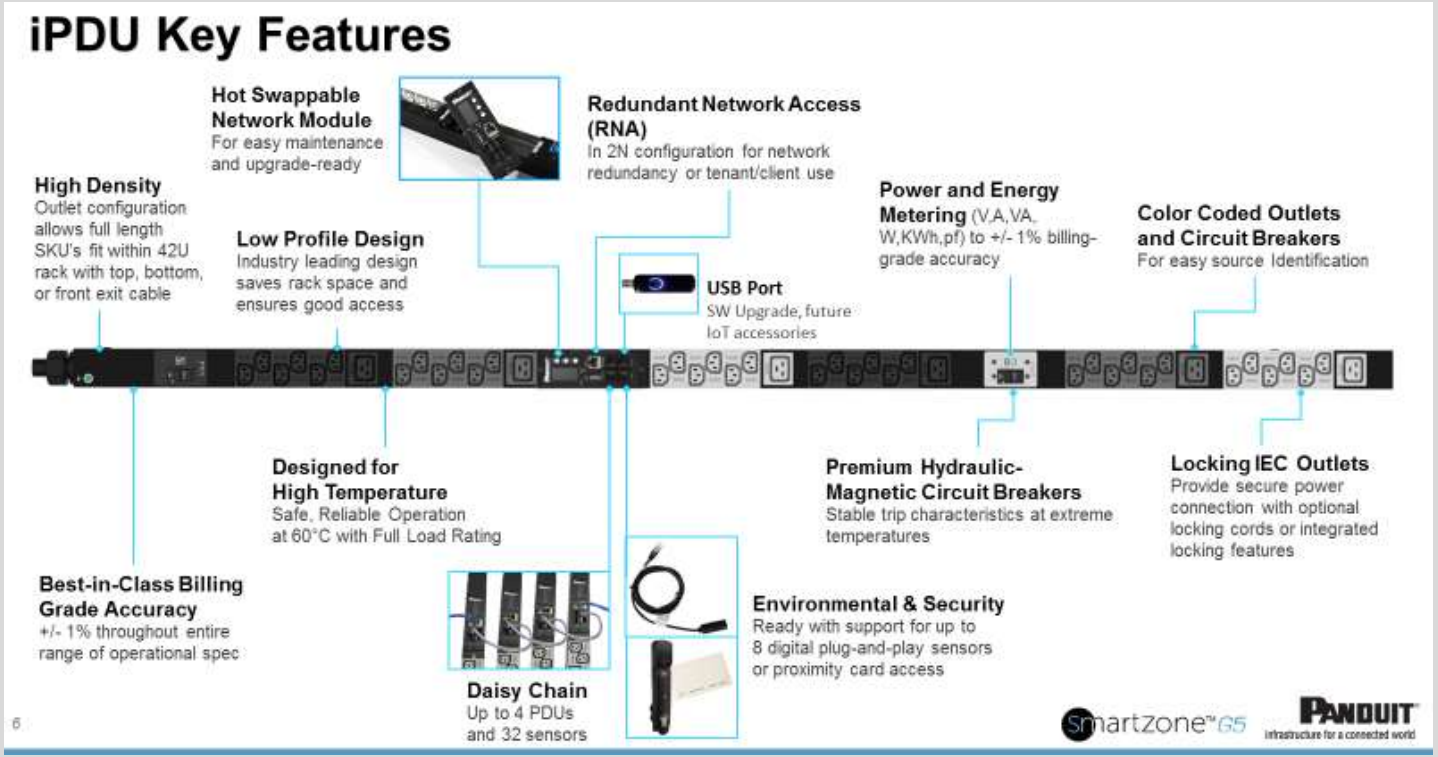
Transforming the Data Center



Smart Power Technologies

smartzone™ G5

Higher Power Density, monitoring driving innovation



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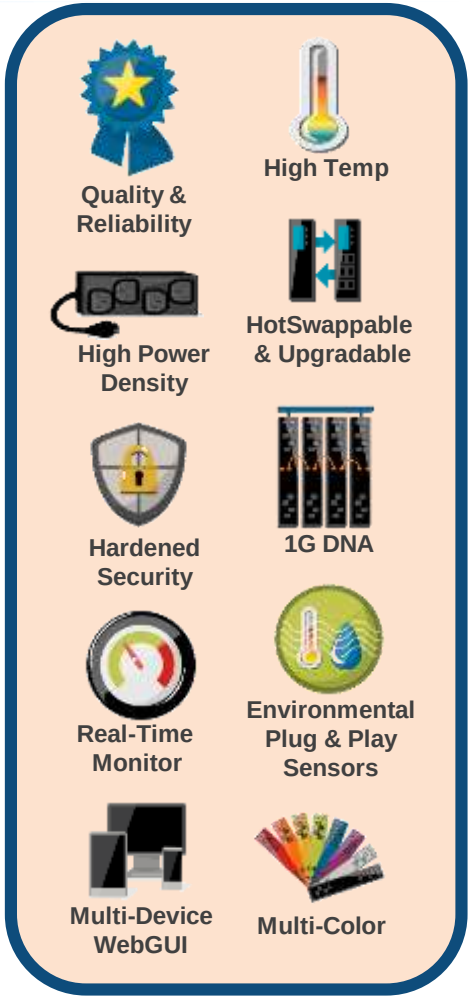
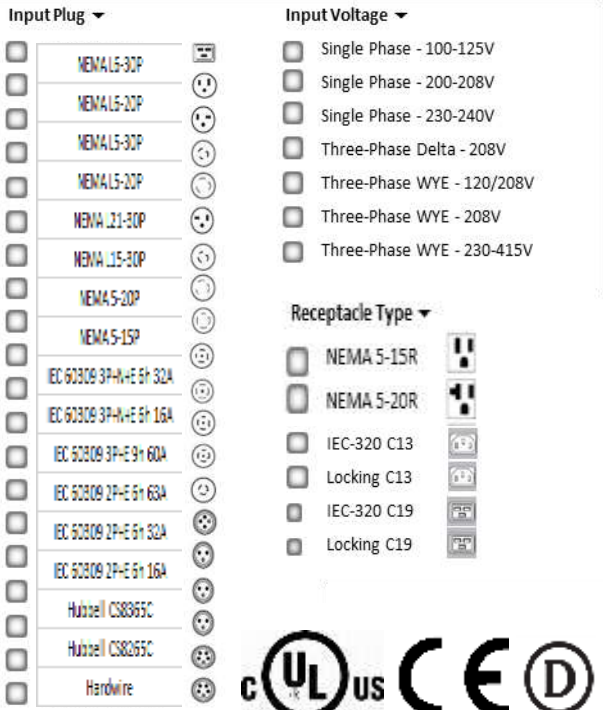
Our Value Proposition



- Built with high-temperature grade premium components to withstand 60°C high temperature at full load for extended period to provide high quality and reliability. 3-Year standard & 5-Year extended warranty.
- Unique outlets design for high power density & compact form-factors minimizing cabinet space.
- Hot-Swappable Controller with large OLED display and high contrast ratio.
- Real-time monitoring with high Networking speed (1G) and with Dual Network Access (DNA) for connectivity redundancy or for allowing separate Colo/Tenant Network connectivity.
- Enhanced security w/ (SNMPv3 & RESTful/TLS) with certificate-based advanced asymmetric encryption, validated and hardened with multiple security scanning tools.
- Variety of Plug-n-Play Environment & Access Security accessories thru U-Ports.
- Enhanced User-Experience w/ BYOD WebGUI & colored PDU, cords & cable ties
- Designed to fit into industry standard cabinets and 100% of Panduit Cabinets
- **One-Stop-Shop** – Fully Interoperable Cabinet, PDUs, Accessories & DCIM Solution

Multiple PDU Intelligence Level & Variations of Configurations

- **Families**
  - ***Basic***
  - ***Monitored Input***
  - ***Monitored Switched***
  - ***Monitored per Outlet***
  - ***Monitored & Switched per Outlet***
- Orientations, Form-factors & Sizes
- Voltages & Currents
- Plug Types
- Receptacle Types
- Number of Receptacles
- Global Compliance



smartzone™G5 PANDUIT®

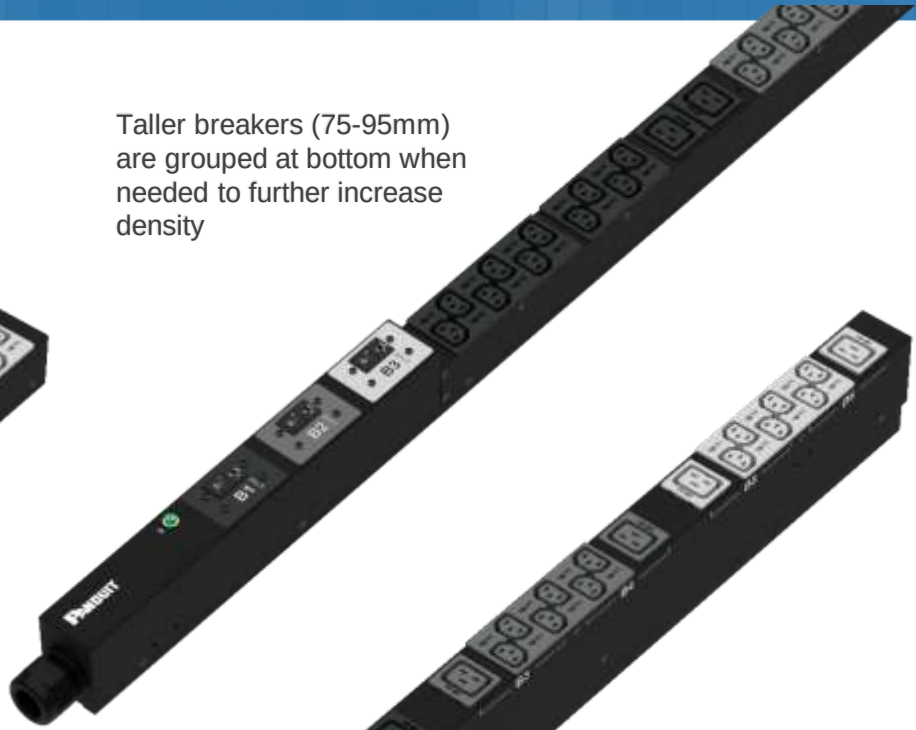
Form Factors

Breakers grouped with outlets when feasible

Low Profile Breakers (52mm)

Breakers grouped at bottom when needed to increase density

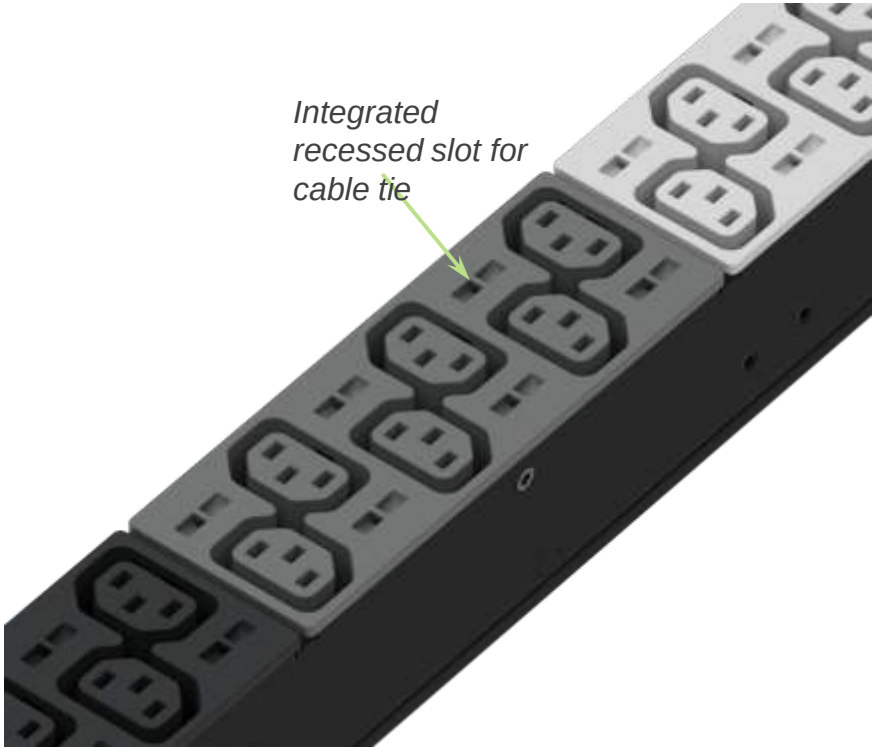
Taller breakers (75-95mm) are grouped at bottom when needed to further increase density



Double Sided form factor for maximum density. Breakers on opposite side of outlets

Locking Outlets and Cables

- Locking outlets compatible to V and W power cords
- W power cords provide locking at both end (PDU and equipment)
- Variety of power cords lengths and colors available
- Cable ties supported for locking



iPDU

High Visibility OLED

Reset

USB port for firmware update, configuration upload, etc

PDU Out for Daisy Chain

Sensor Port

Menu Selector Buttons

Status LED
Green = OK
Yellow Solid = Warning
Yellow Blinking = Firmware update
Red = Error

1Gb Ethernet Port for Network Connection

PDU In for Daisy Chain Serial for command line Interface

Sensor Port

ePDU

Lower cost

No Display

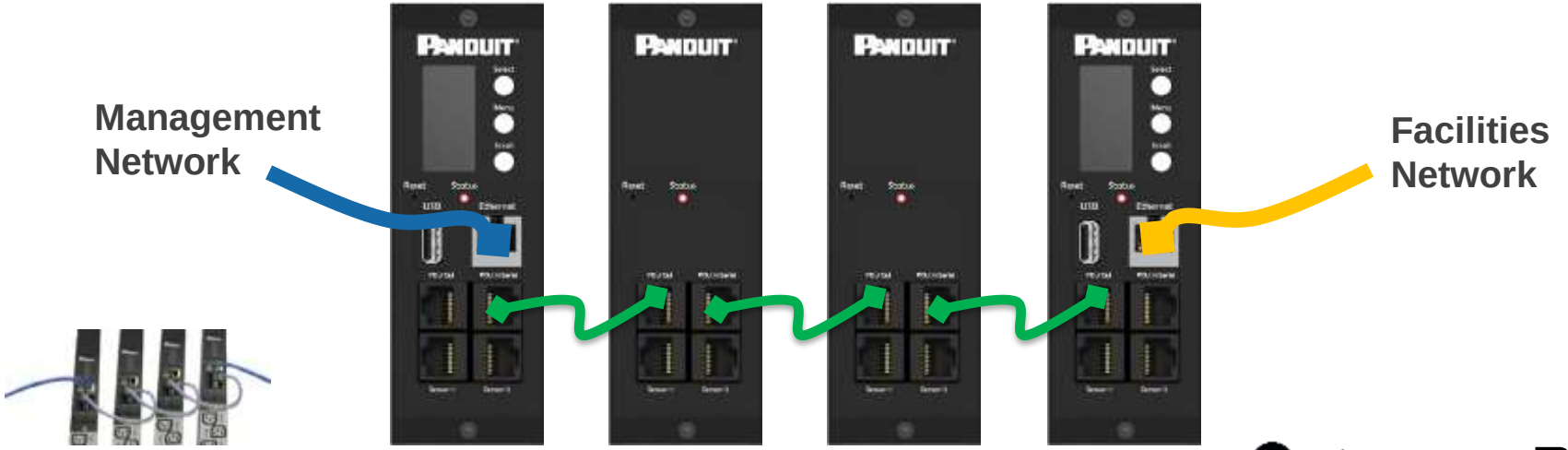
No Network Connection

No USB

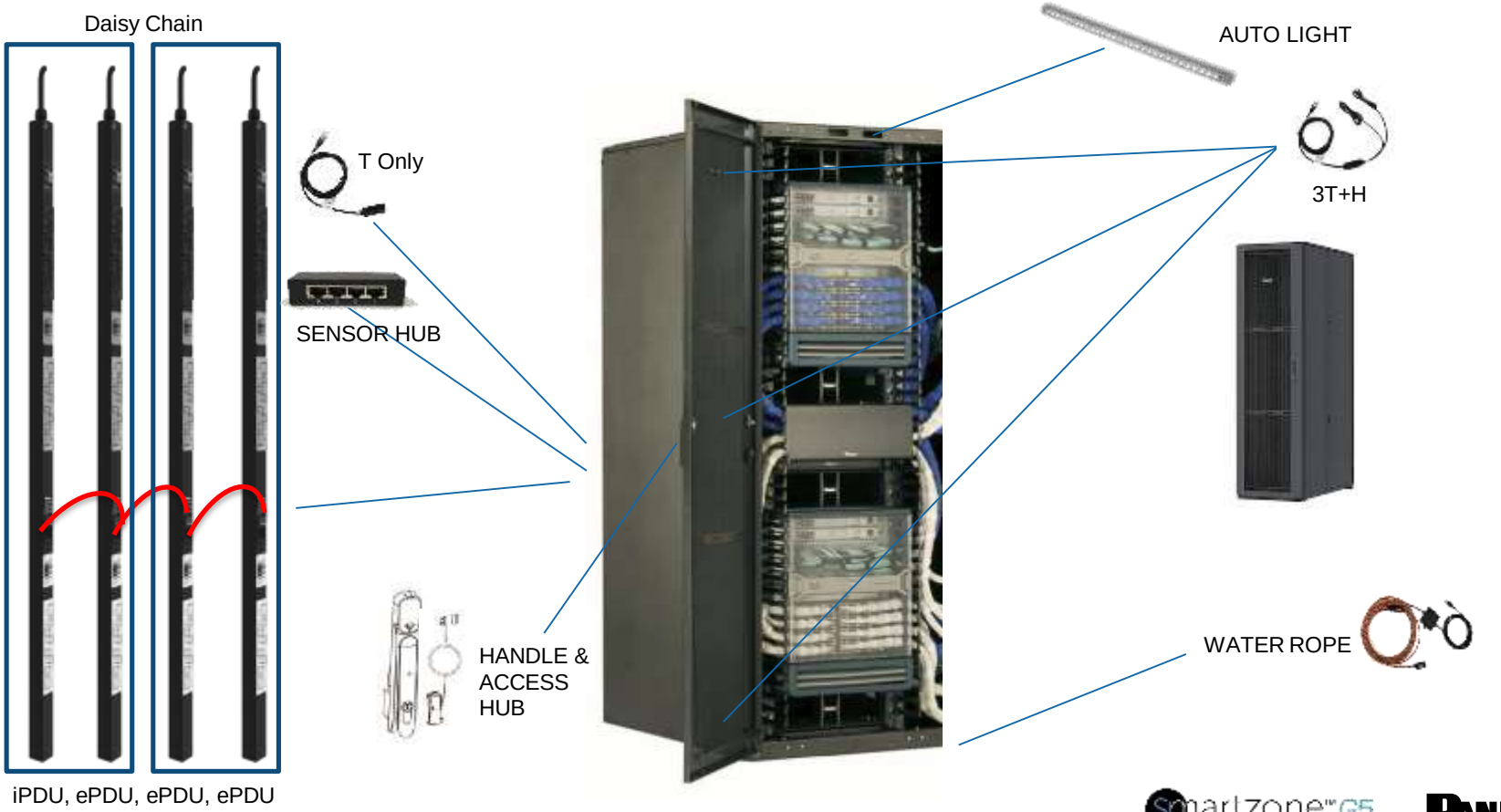
Keeps remaining PDU and Sensor function

Dual Access Network

- Allows two separate network connections to Daisy Chained PDU's
  - Facilities for monitored power usage and tracking data
  - Management network for PDU control
- Support for two iPDUs, two iPDUs and one ePDU, or two iPDU's and two ePDUs



Panduit SmartZone *G5* Connected Multi-Cabinet



Data Center Infrastructure Management

Transforming the Data Center

POWER › ENVIRO › CAPACITY MGMT

Software

Power management

Thermal management

Cooling optimization

Asset and connectivity management

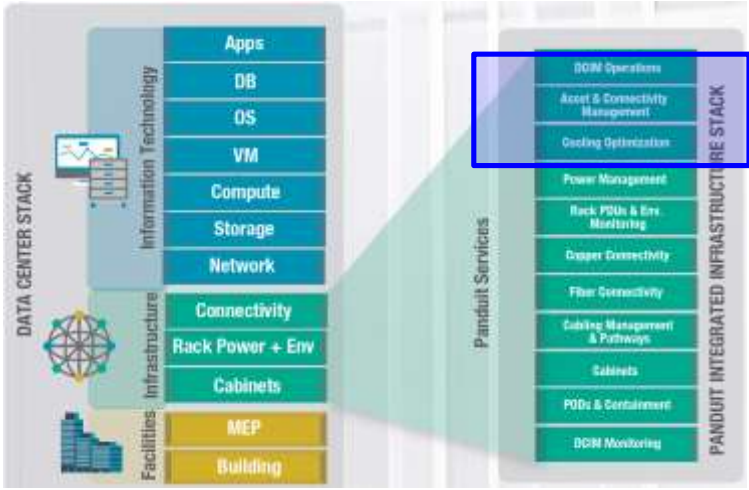
Pre-Config / Intelligent Hardware

Monitored rack PDU's to manage outlet level

Environmental Monitoring

Intelligent patch panels

Security and remote operations



DCIM Solution

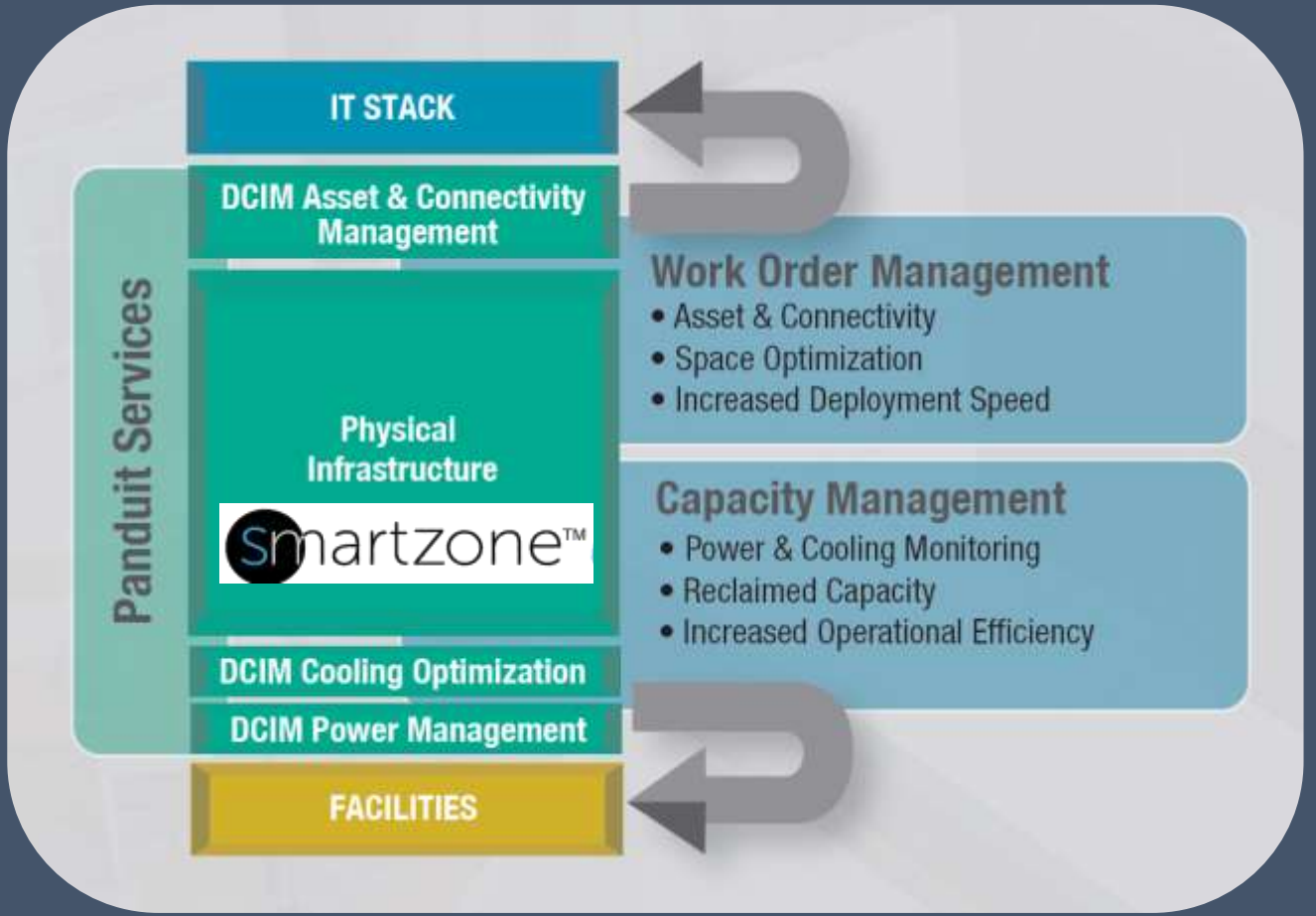
smartzone™

Bridge to Facilities Stack

- Monitors operational power and cooling usage
- Drive efficiencies
- Improve capacity management

Bridge to IT Stack

- Visibility into asset connectivity
- Protect operational uptime
- Accelerate work order management



Designed to work cohesively

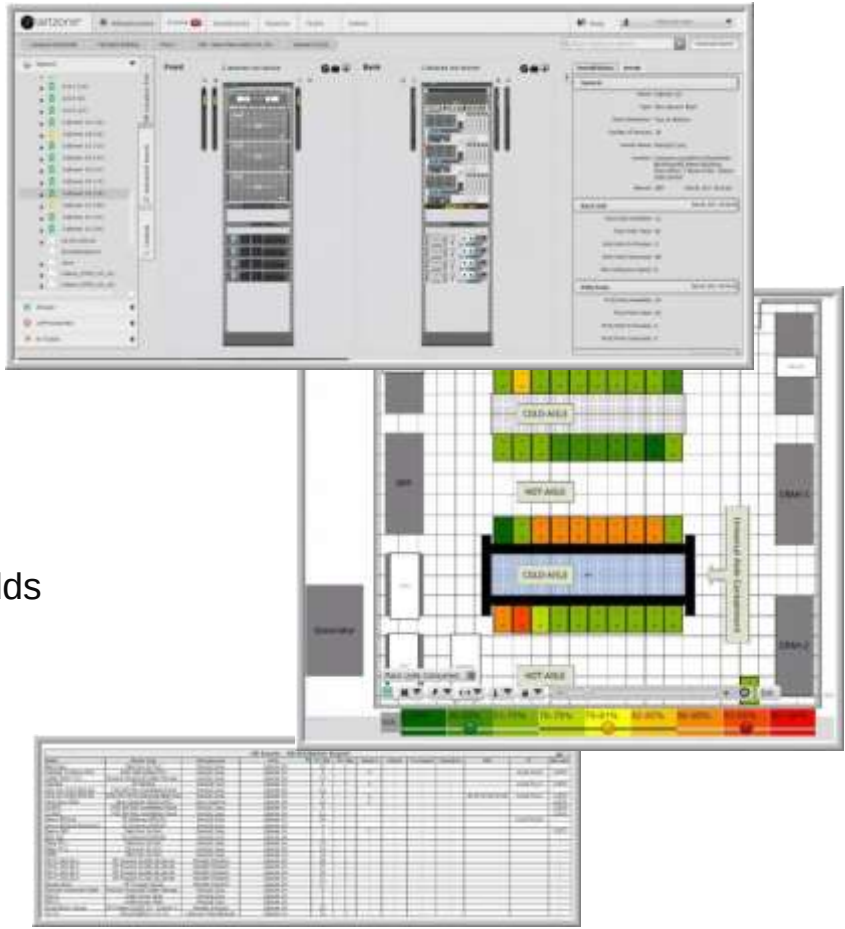
Asset

Feature set provides the following:

- Physical to Logical model of infrastructure
- Search and Locate Assets
- Physical Space Capacity and Floorplan Views
- Standardized Workflow and Deployment Processes
- ITSM Integrations using API's

Value:

- Accurate modeling provides the ability for faster Move, Adds and Changes
- Central Repository for Managing Data
- Provides Asset Inventory and Tracking
- Robust Reporting including standard and custom Asset Attributes



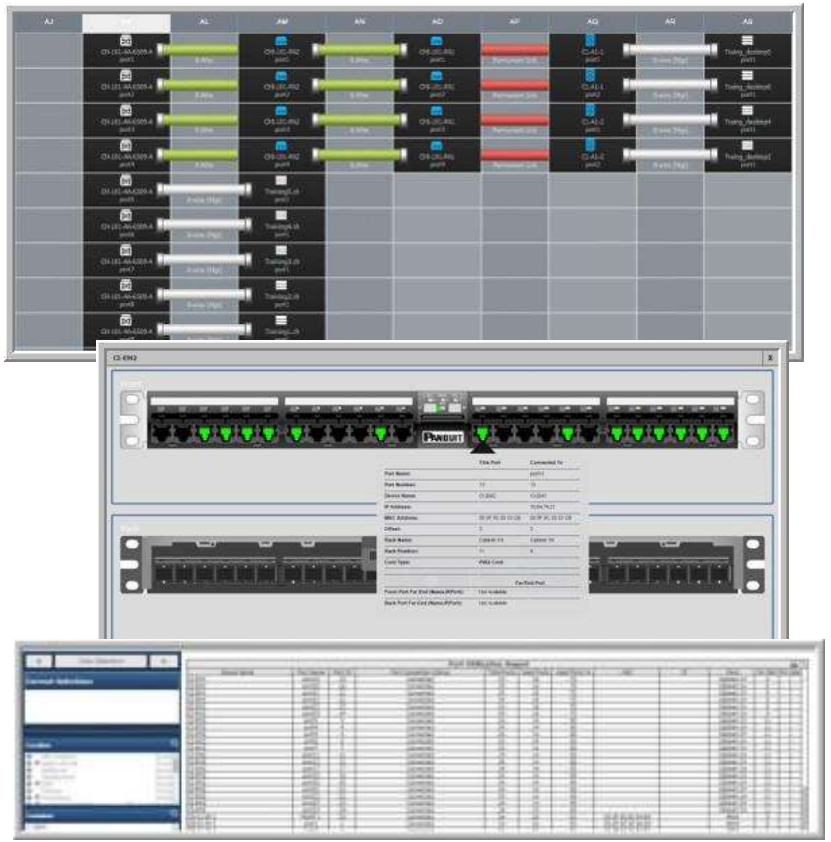
Connectivity

Feature set provides the following:

- Management of End-to-End Network Connectivity
- Cabling Capacity
- Auto-Notification of Link Status
- Auto-Reconcile Devices

Value:

- Shortens connectivity troubleshooting time
- Provides cabling capacity for faster asset deployment
- On/Off-Line Device Notifications
- Notification of Devices that need to be Reconciled



Power

Feature set provides the following:

- Monitor Racks Provides alerts/alarms on breached user-defined power/environmental thresholds.
- Monitors, documents, and displays vital data and analysis of operational parameters
- Rack PDU historical power trends
- Rack power availability and used capacity

Value:

- Reduce downtime risk and cost
- Analyze trends for potential issues
- Find underutilized rack power for deployment of new equipment or consolidating existing equipment.
- Reduce over provisioning cost
- Enhance MAC and Service agility
- Enhance equipment efficiency and life

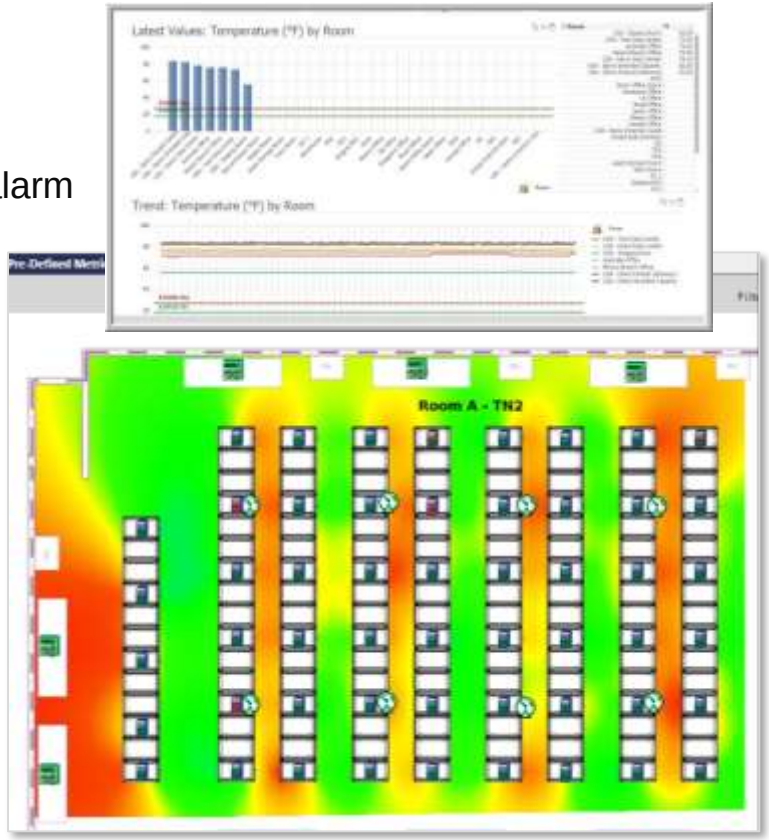
Environmental

Feature set provides the following:

- Monitor whitespace environmental condition and set basic alarm thresholds and alerts
- Rack inlet temperature warning and critical alerts
- Rack inlet humidity warning and critical alerts

Value:

- Reduce downtime risk and cost
- Analyze trends for potential issues
- Enhance equipment efficiency and life



Summary

- Converged Data Center Infrastructure Solution adds value
- Panduit is recognized by the 451 Group as the innovator for Converged Unified Physical Infrastructure
- Signature Core Fiber provides lowest latency, highest performance & maximizes reliability
- Latency Legislation per Jan 3rd 2018 for European countries
- G5 Rack PDU Solution increase efficiency and monitoring capabilities
- SmartZone DCIM gives data center owners insight - in usage of space, power, cooling, assets and connectivity - and will help to do future capacity planning

Thank You!

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