Smart Infrastructure around MTCA Crates

14th MicroTCA Workshop for Industry and Research

at DESY, Hamburg

Udo Weiss

December 03, 2025

nVent SCHROFF

60 YEARS

Presenter:

Udo Weiss

Business Development Manager

nVent SCHROFF

Connect on LinkedIn

with nVent Schroff	since 1994
Mechanical Design Engineer	1994-2000
Project Manager	2001-2010
Field Application Engineer	2011-2017
Business Development Manager Systems	since 2018

CAPABILITIES AND EXPERIENCE:

- Mechanical Engineering
- Cooling solutions
- High Availability Systems
- High Speed Backplanes and Systems
- Telecom and NEBS compliant systems
- Enclosures and Crates for Advanced Physics Applications

Fast Facts
About nVent

- Powered by more than **11,000+ employees** working together to ensure a more secure world
- $3,0 B in Revenue in 2024

- More than **100 years of innovation**
- **Leading brands** in connection and protection
- **Mission critical** solutions provider

- Continuous history of **innovation**
- Deep **product and application expertise**
- **Global footprint and product offering** with more than 8,000 distribution points

Premier brands recognized for **innovation, quality and reliability**

Systems Protection

nVent HOFFMAN

nVent SCHROFF

Electrical Connections

nVent CADDY

nVent ERICO

nVent ILSCO

Resiliency and Protection:
Our solutions add resiliency to critical systems by helping keep them safe from natural and manmade disruptions.

ESG at nVent:
2024 Report

People Products Planet

Schroff at a Glimpse

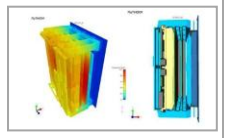
CABINETS & COOLING

EMBEDDED SYSTEMS

SUBRACKS, CASES AND ACCESSORIES

Integration

Services



- **High-quality protection solutions**
  for a wide variety of electronic applications
- **Large selection of standard 19” products,**
  plus the broadest array of modification options and customization capabilities
- **World-Leading**
  Electronic Packaging and Cooling Solutions
- **Components and System-Solutions**
  within 19” and beyond
- **Worldwide presence and support**
- **Production sites in Europe, USA and Asia**

Everything from one supplier

- Mechanics, Backplane, PSU: development and production in-house

Superior expertise in

- Air cooled, Conduction cooled and Liquid cooled solutions
- Highspeed Backplane design
- EMC Shielding
- Experience in tests according to NEBS, MIL 901, IEC, …

Proven processes
for Configurations, Modifications and Custom Specific designs

Environmental Conditions

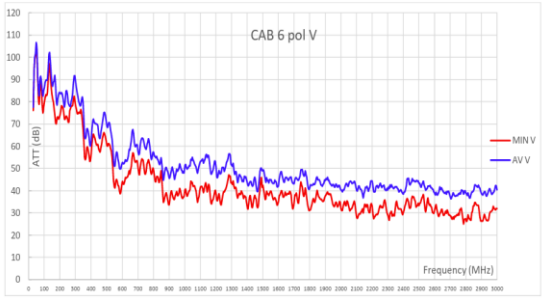
Are you aware of the conditions and environment your Crate has to operate in ?

- Operating Temperature (environmental)?
- Air conditioning in room available?
- Specific Temperature stability required for proper operation of your blades?
- Crate is installed into an Open Cabinet / closed cabinet?
- How are the power and Signal wires fed towards your installation?
- Access control or protection necessary?
- External radiation / EMI Protection?
- Other: dust , water leakage or dripping water from room infrastructure?

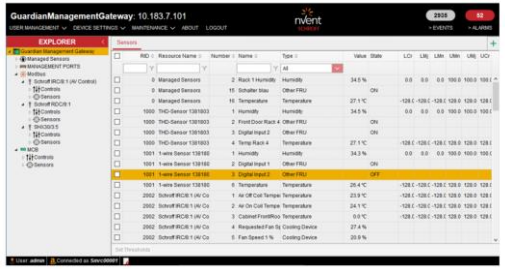
Consider what is around your Crate

Infrastructure Securing Operation Stability

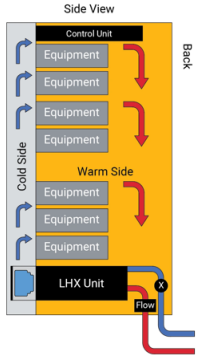
EMI protected cabinets



Control & Monitoring on Cabinet Level



Cooling Options

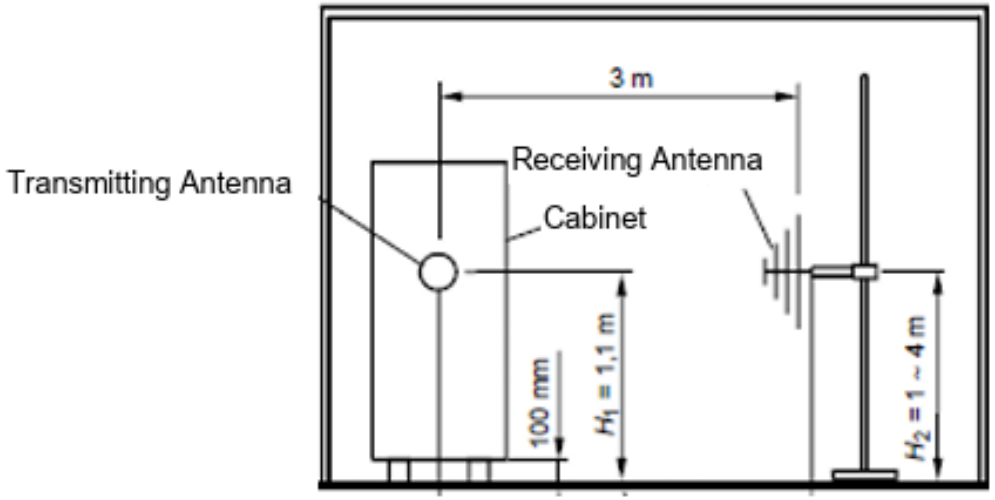


Intelligent Power Distribution Units

Four Key-Areas for hassle-free Operation

EMI Protected cabinets

How to keep immunity high



Cabinets with EMI Protection

Considerations:

- Do you need EMI protection,
  and which Frequencies could be critical for your application?
- Which openings are technically required
  (air inlet / exhaust, wires for power or signaling) ?

Frequency	Wave length (λ)	Admissible slot length (λ / 10)
30 MHz	10.00 m	1.000 mm
100 MHz	3.00 m	300 mm
300 MHz	1.00 m	100 mm
1 GHz	0.30 m	30 mm
10 GHz	0.03 m	3 mm

Cooling with perforated HF door with high air throughput (78 % open area)

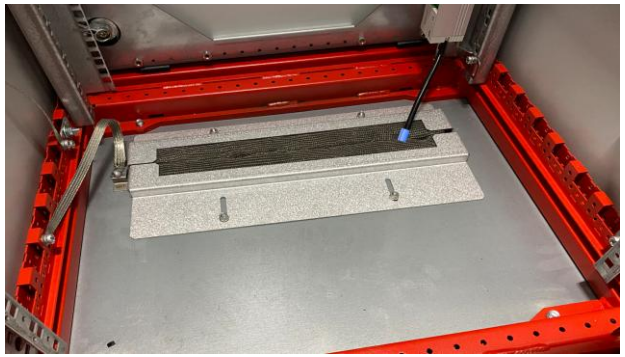
EMI Protection - Nice to have or a Must?

Cabinets with EMI Protection

An Ideal cabinet would be completely closed

EMC gasket

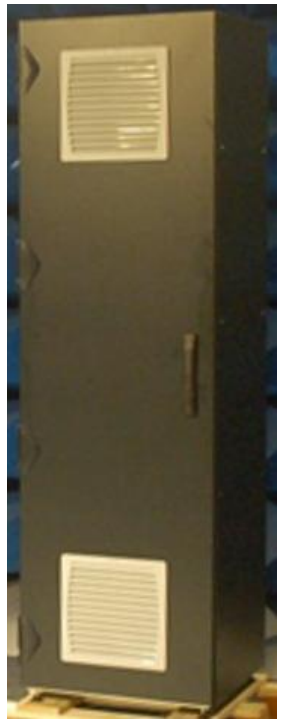
Paint-free
(Conductive) Area

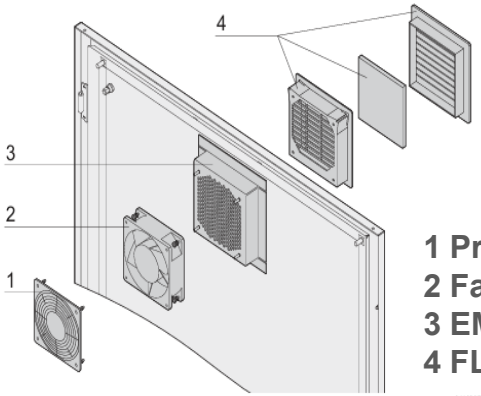


Cable Entry Solutions to keep immunity high

EMI Protection - Openings for Power and Signals

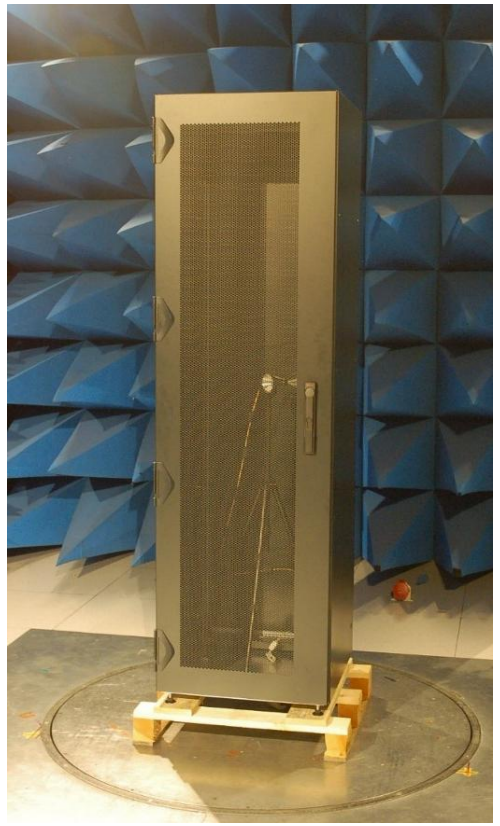
Cabinets with EMI Protection





1 Protective grille
2 Fan
3 EMC hood
4 FLA inlet filter

Air Entry with Dust Filter and EMC Hood



Door with EMI perforation

Cabinet with Elevated roof for Air exhaust

Cooling with EMI fan top cover and 9 fans

EMI Protection - Openings for Cooling and Airflow

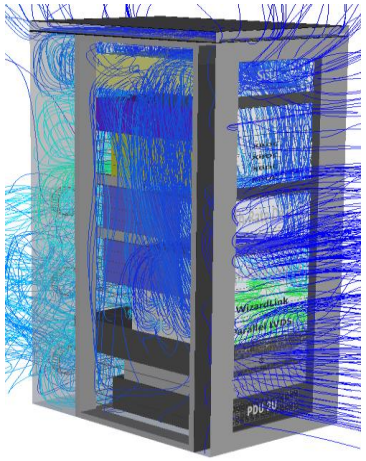
Cooling

Concepts and technologies
for open and closed cabinets

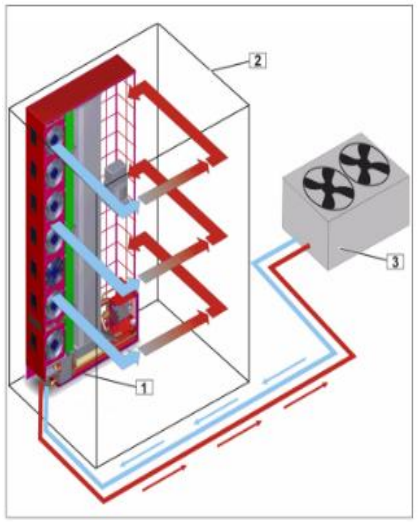
Cabinets Cooling

Considerations:

- What is the total amount of power installed in the cabinet?
- What is your equipment's comfort temperature?
- Do your electronics require temperature stability?
- Are there Multiple Airflow directions within the cabinet?
- Infrastructure in the building (Water, available) ?
- Control & Monitoring necessary?
- Optical components – Are Vibrations critical ?

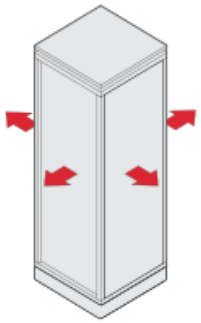


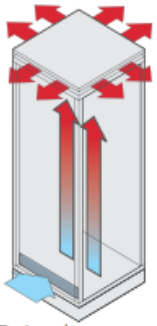
$$\dot{V} = \frac{P}{\rho \cdot c_p \cdot \Delta T}$$

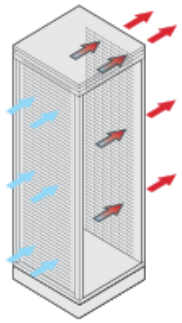


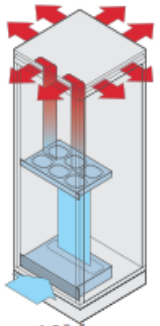
Have a closer look into Airflow Directions and Power of the Equipment installed into your Cabinet

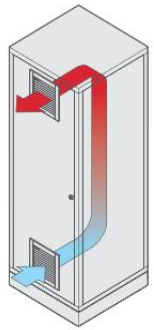
Cabinet Cooling Concepts

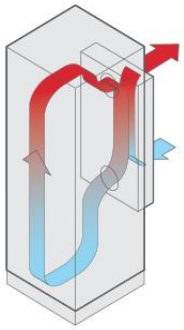

Closed cabinet

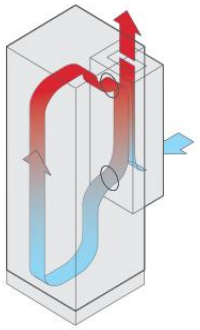

Raised cover, ventilation slots

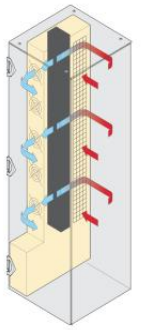

Perforated doors


19" fans, top-cover fans


Air filtered fans


Air/air heat exchanger


Air conditioners


Air/water heat exchanger (LHX)

Description	Natural convection via thermal radiation	Free convection through top-cover opening	Free convection through openings in the doors/rear panels	Forced cooling with air	Forced cooling with air	Forced cooling with air	Cooling with coolant	Cooling with water
Type of protection	≤ IP 55	≤ IP 20	≤ IP 20	≤ IP 20	≤ IP 54	≤ IP 54	≤ IP 54	≤ IP 55
Noise level approx.	0	0	55 ... 65 dB (A)	34 ... 67 dB (A)	39 ... 71 dB (A)	55 ... 75 dB (A)	50 ... 81 dB (A)	50 ... 60 dB (A)
Ambient conditions	$T_i > T_u$	$T_i > T_u$	$T_i > T_u$	$T_i > T_u$	$T_i > T_u$	$T_i > T_u$	$T_u \leq 55$ °C	$T_u \leq 70$ °C
Cooling capacity approx.[1)]	< 500 W	< 500 W ... 800 W	< 500 W ... 6000 W[2)]	< 2000 W	< 1500 W	< 2000 W	< 6000 W	< 40000 W

1) depending on cabinet size, electronic components, location and room cooling concept
2) > 800 W are only possible with own, active cooling through components like server etc.
T_i = cabinet inner temperature T_a = cabinet ambient temperature

Enclosure cooling options range from 500W to 45kW+

Air and Liquid Cooling Solutions

Rack w/Integrated LX Cooling

5-10 kW

In Row Cooling – LX

30-45 kW

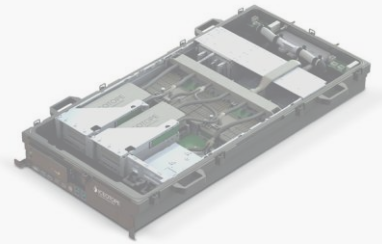
Rear Door Cooling (Passive/Active)

25-55 kW

Row and Rack Coolant Distribution Unit (CDU) & Rack Manifolds

40-800 kW

Chassis Level Immersion Cooling



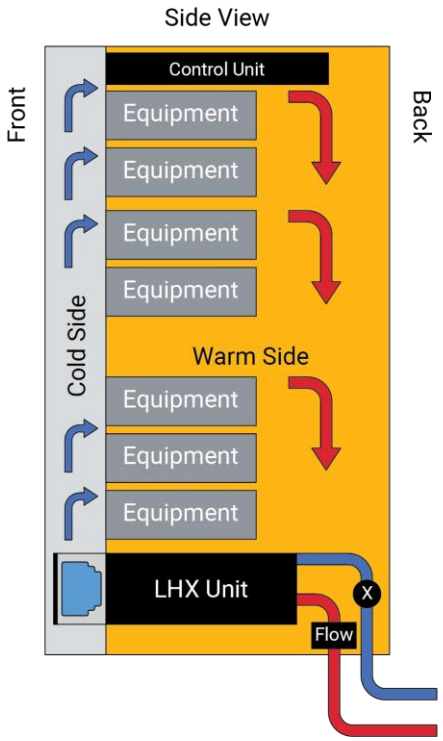
3.2 kW per chassis

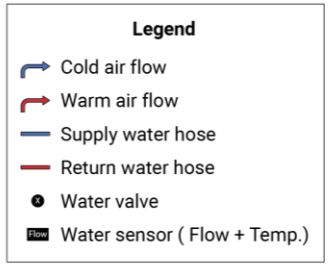
Cooling Solutions For Demanding Requirements

Retrofittable Air to Liquid HEX

Rack-mounted Air-to-Water heat exchanger

- Cooling up to 10kW
- Retrofittable into existing 19” racks
- Requires cold water input
- Cooling capacity dependent on temperature of water input
- Can integrate sensors, monitoring, and remote management as required
- Maintains IP and EMC ratings of existing enclosure



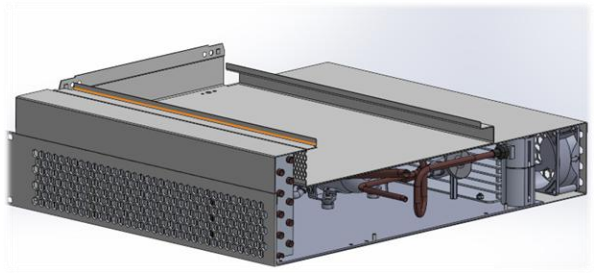


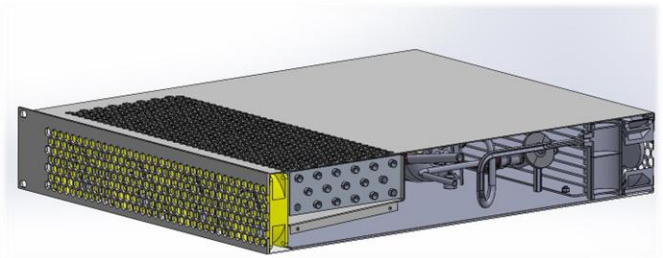
19” retrofittable Air to Liquid Heatexchanger

19” Rack Mount Air-Conditioner

Liquid Cooling on Chassis level (Air to Air Heat Exchanger)

- Air-Conditioner for Devices in an Open Rack
- 2U or 3U Height
- Retrofittable
- Enhancing the ΔT of the target device
- Cooling Capacity > 1000 W
- Different versions (passive air flow, active air flow, front to back)





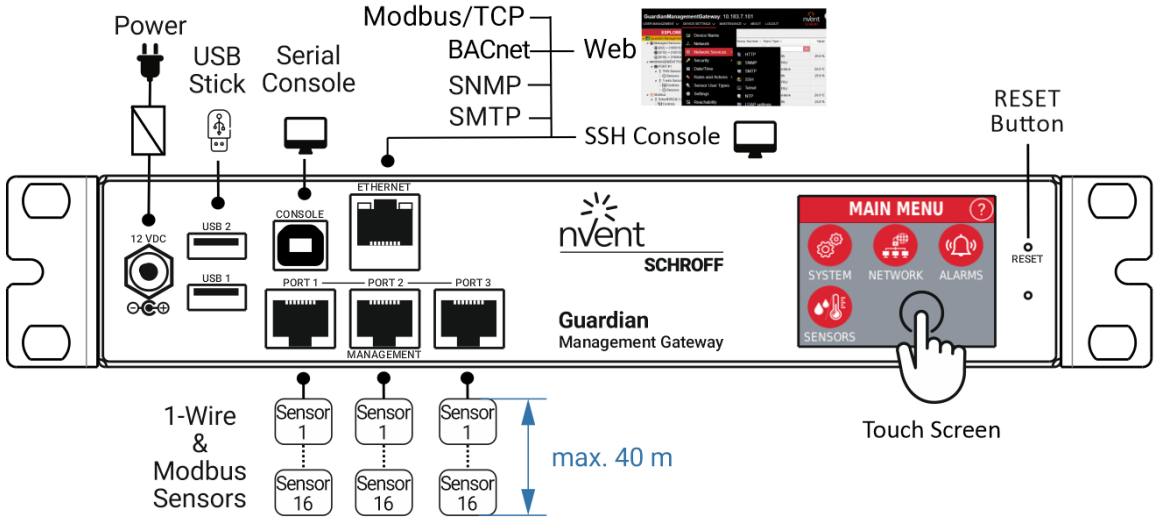
19” retrofittable Air Conditioner

Monitoring

What happens around your Crate

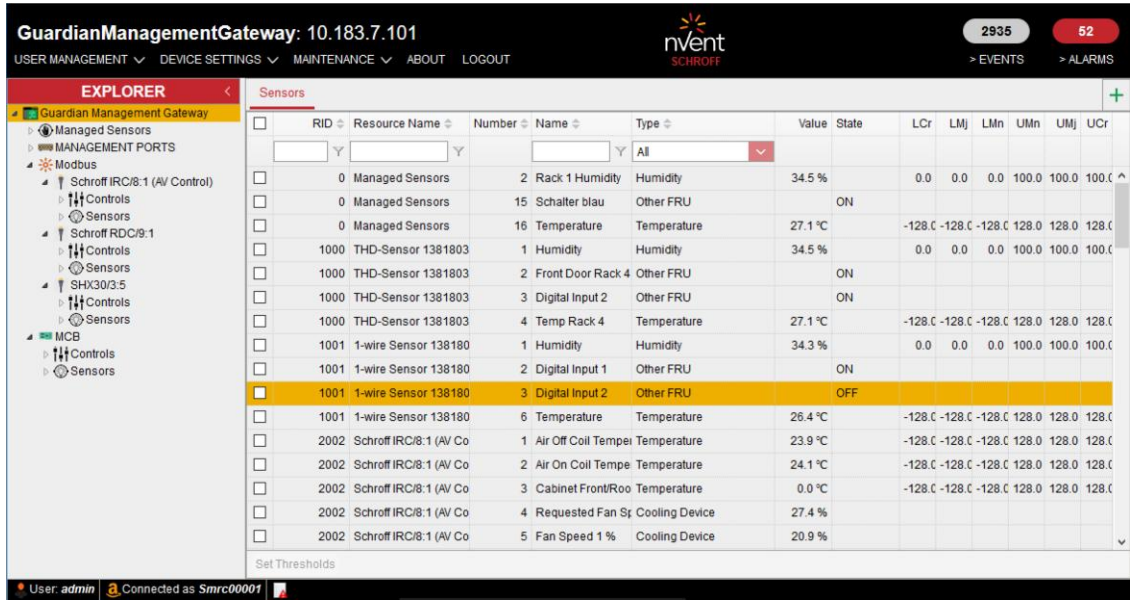
Management Gateways

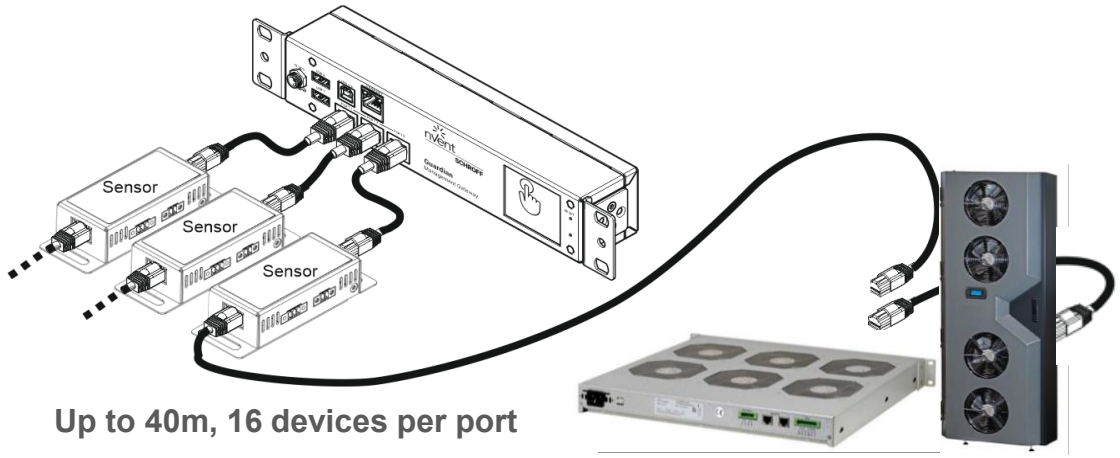
- Management Gateways can be used to monitor and control the environmental and operational parameters in a cabinet.
- Typical environmental sensors are, e.g. Temperature, Humidity, Door Sensors, Smoke Detector, Leak Detector, etc.
- The Guardian Management Gateway also supports monitoring and control of nVent cooling devices (LHX+, Rear Door Cooler, Intelligent Fantrays)
- A Web interface is provided as well as specific data building-management software (BACnet/SNMP, etc.) supported
- In addition, there is the option of a cloud integration via Azure/AWS.



Guardian Management Gateway

- Cascading allows up to 16 devices per port
- Integration of e.g. Smoke, Shock or Motion Sensor through Digital Input / Output Devices
- Monitor and Control Flow rates, Fan-RPM and cabinet access





Up to 40m, 16 devices per port

Modbus Devices i-Fan-Tray/ RDC

Temperature, Humidity, Digital Contact Sensor for Guardian
Catalog#: 21070-120

Digital Contact Sensor (Output) for Guardian Management Gateway
Catalog#: 21070-124

Digital Contact Sensor (Input) with 12V supply for Guardian Management Gateway
Catalog#: 21070-125

Smoke Sensor

Shock Sensor

Motion Sensor

Mechatronic swivel handle

Intelligent Power Distribution Units

Including Environment- and Access-Management

Intelligent Power Distribution Units

Typical Feature Sets

- Web Interface / Remote Control
- Meter Power on Branch and Circuit Breaker Level
- Options to Power Cycle equipment
- Switched Outputs and option to define Power Sequence
- Intelligent Locking Systems for Access Control
- Options to include Environmental Sensors
- Detect Anomalies (Deviation vs. Nominal Value)
- Event-logs and Alarms

Example: Enlogic Advantage Series

Intelligent Power, Environment and Access Management Solutions

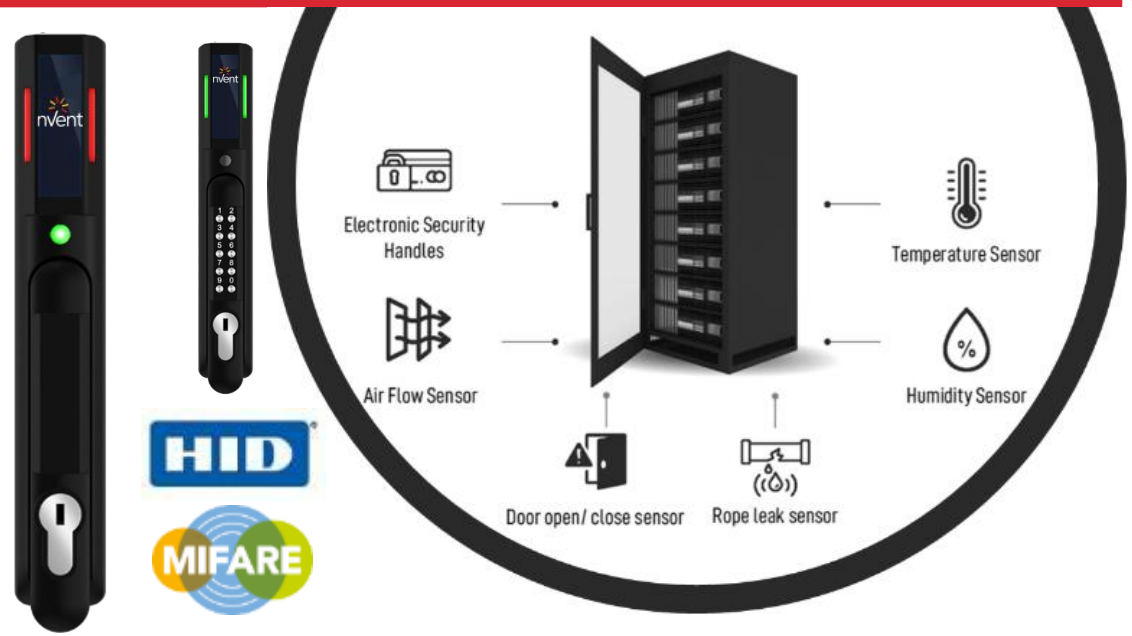
- Ensure Uptime
- Automate Your Infrastructure Management
- Leading security

Metered and switched solutions:

Available in **single and three** phase versions

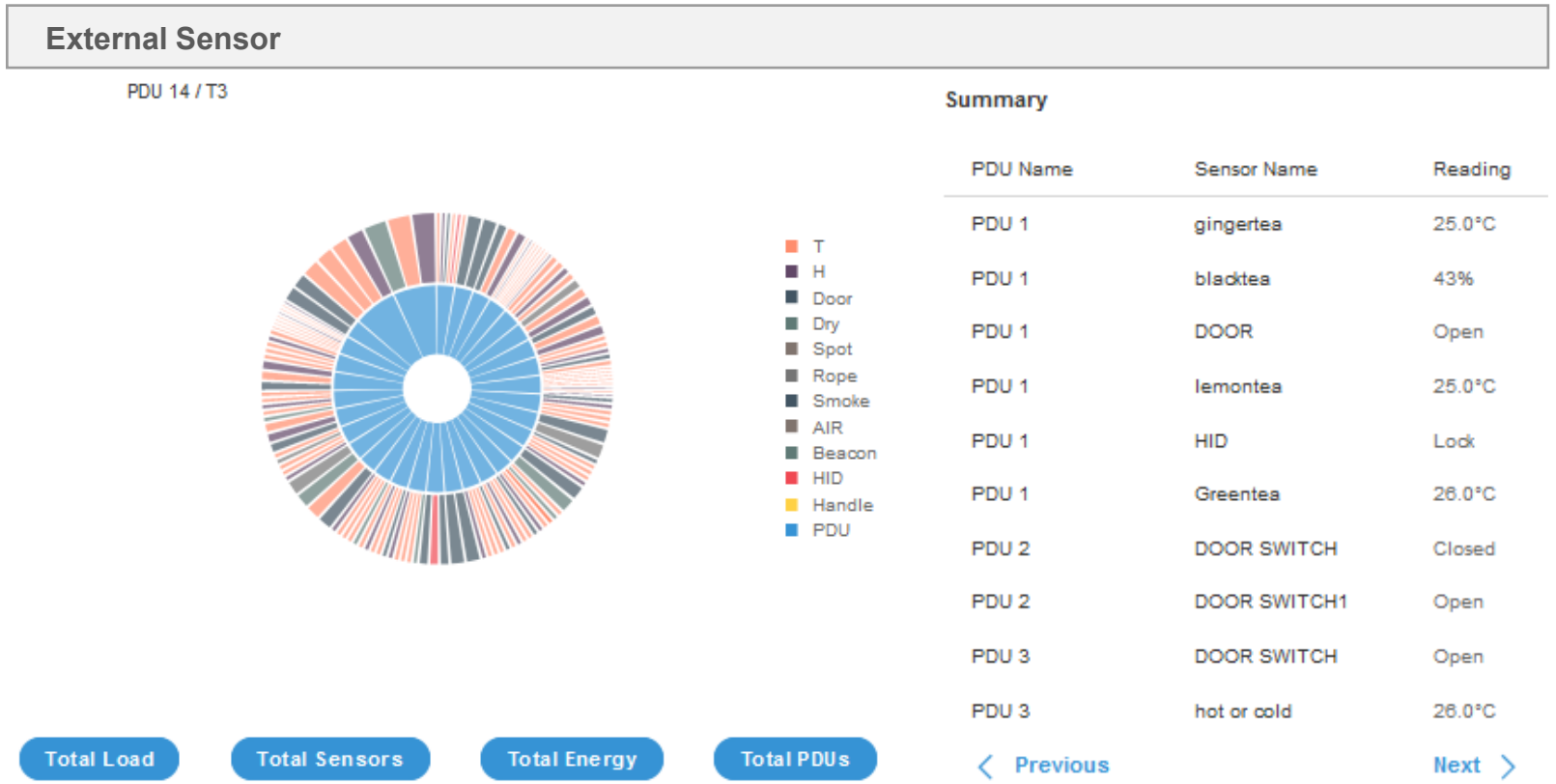
- **Input metered PDU:** input phase and CB metering and alarms
- **Switched PDU:** *Input metered function, plus, r*emote ON/OFF outlet switching
  Control & Manage - On / Off Delay, State on Startup, Recycle.
- **Outlet Metered** *All features of Input metered, plus* Individual outlet level metering and alarms
- **Outlet Metered & Switched** *All features of Switched, plus* Individual outlet level metering and alarms

Security Access Control and Environmental Management



Locking Power Cables

Graphical User Interface and Ressources



Communication Protocols

IPv4, IPv6, {JSON}, DMTF Redfish, SNMP V1, V2c, V3, CLI, SSH, LDAP, TLS 1.2, HTTPS, RADIUS

Microprocessor

Cortex A5. 528MHz 128MB RAM, 256MB FLASH

Operating System

Linux

Web UI Framework

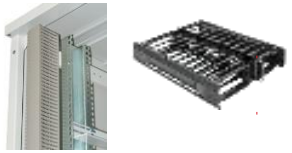
React

nVent

Conclusion

- Open or Closed (EMC) Cabinets

SMART



- Cable Management

- Cable Support & Pathways

- Grounding, Bonding & Protection

- Power Distribution & Management

- Cooling

- Leak Detection

- Fixing & Fastening

- Monitoring & Access Control

Many Aspects to consider and ensure reliable Operation

Thank You

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