INDUSTRIJSKI TRENDOVI U 2021.
Podatkovni centri, edge računarstvo i tehnologija

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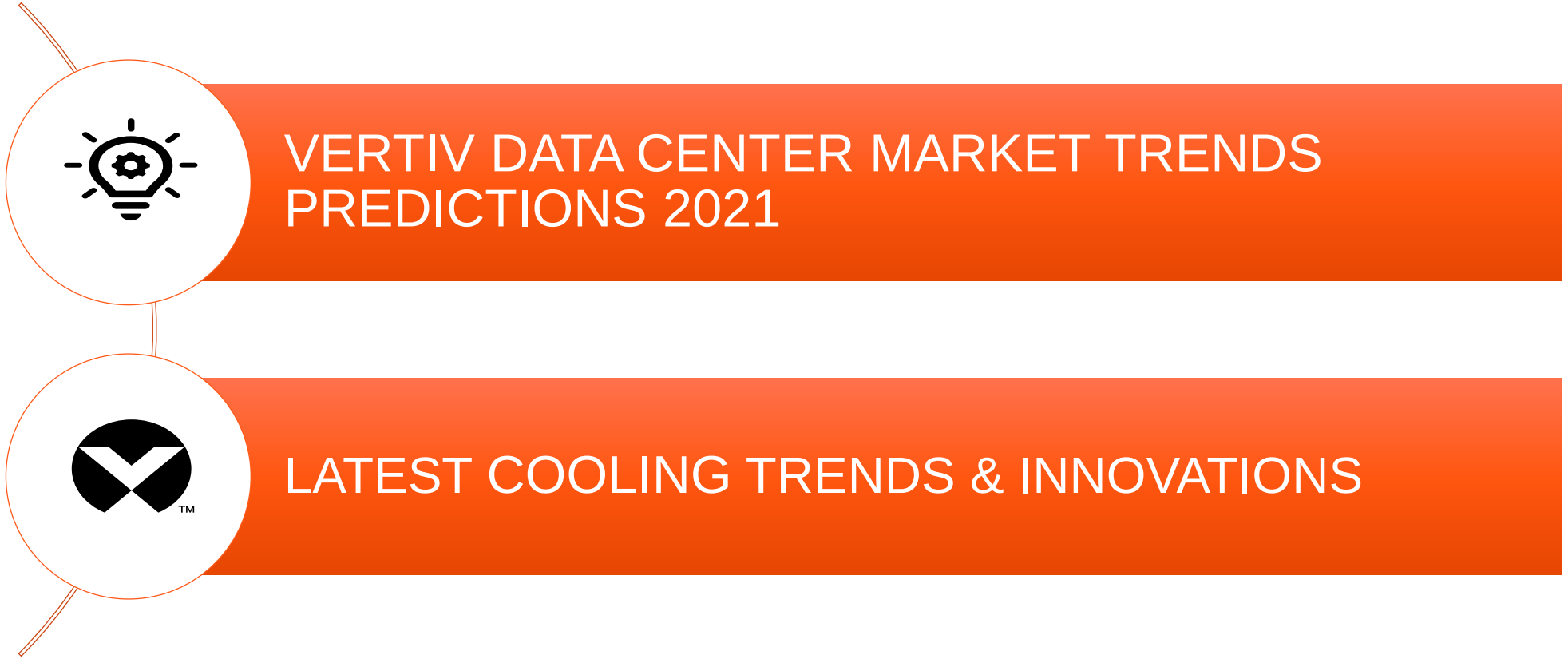
Agenda



Vertiv Data Center Trends Predictions 2021

Digitalization on Fast Forward

- COVID-19 will have a lasting effect on the workforce and the IT ecosystem supporting the new work-from-home model.

Vertiv experts expect the COVID-motivated investment in IT infrastructure to continue and expand, enabling more secure, reliable and efficient remote work capabilities. Remote visibility and management will become paramount to the success of these work-from-home models.

Bringing Large Data Center Capabilities to Small Spaces and the Edge

- Today's edge is more critical and more complex, functionally an extension of the data center rather than the glorified IT closet of the past. Cost and complexity have prevented implementation of data center best practices in these spaces, but that is changing. Vertiv's experts anticipate a continued focus on bringing hyperscale and enterprise-level capabilities to these edge sites.

5G Focus Shifts to Energy Consumption and Efficiency

- In these early days of 5G network deployment, discussion largely has been focused on the ultimate benefits of the technology – increased bandwidth and reduced latency – and the applications it will enable. The coming year will see increased focus on the corresponding increase in energy consumption, which will be significant. Looking at it more holistically, we should expect 5G applications to present opportunities for efficiency gains across multiple industries, perhaps offsetting the global impact of increased telco energy consumption.

Sustainability Comes to the Forefront

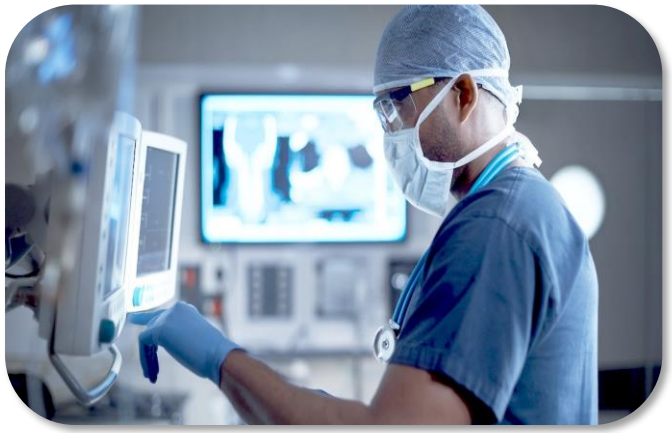
- As the proliferation of data centers continues and even accelerates, especially in the hyperscale space, those cloud and colocation providers are facing increased scrutiny for their energy and water usage. The amplification of the climate change conversation and shifting political winds in the U.S. and globally will only add to the focus on the data center industry, which accounts for approximately 1% of global energy consumption. The coming year will see a wave of innovation focused on energy efficiency across the data center.

Digitalisation

Datacenters as the foundation for a digital infrastructure ecosystem

Media & Entertainment

Manufacture



Healthcare

Agriculture

Smart Cities

Education

Vertiv capabilities

IT and Edge Infrastructure

Support for Edge applications that require moving processing and storage closer to the customer.

Use Cases

Data Intensive

- Restricted Connectivity
- Smart Cities / Factories / Home and Building
- HD Content Distribution
- High-Performance Computing
- Virtual Reality

Human-Latency Sensitive

- Web Site Optimization
- Augmented Reality
- Smart Retail
- Natural Language Processing

Machine to Machine

- Smart Security
- Smart Grid
- Low-Latency Content Dist.
- Arbitrage Market
- Real-time Analytics
- Defense Force Simulation

Life Critical

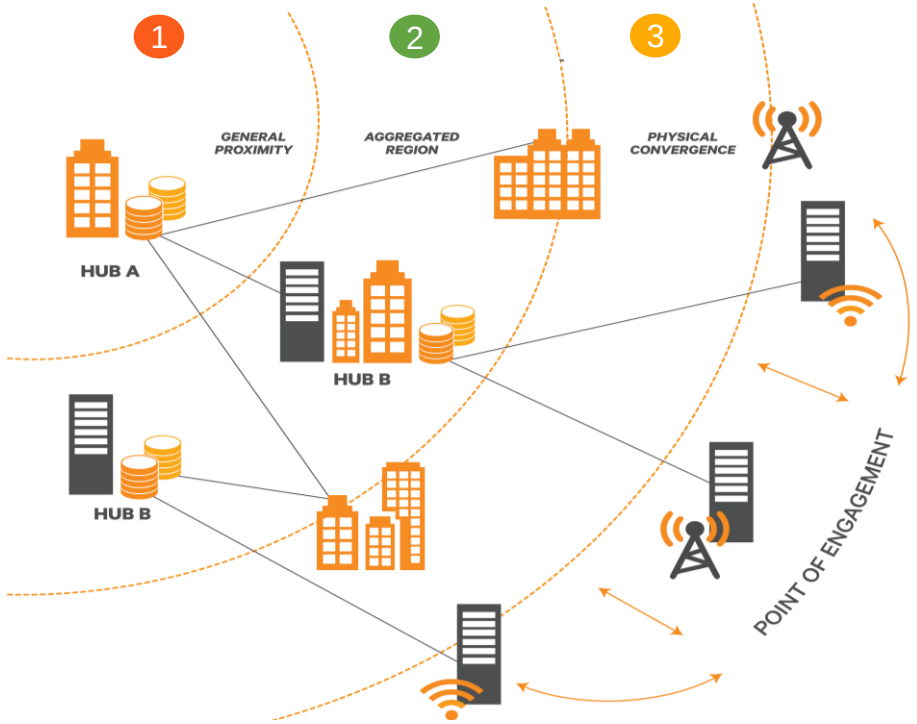
- Digital Health
- Connected/Autonomous Cars
- Drones
- Smart Transportation
- Autonomous Robots

Architecture

1 **Traditional**
- Cloud / Data center

2 **Local**
- Aggregation sites
- Metro data centers

3 **Edge**
- Rooms / Building

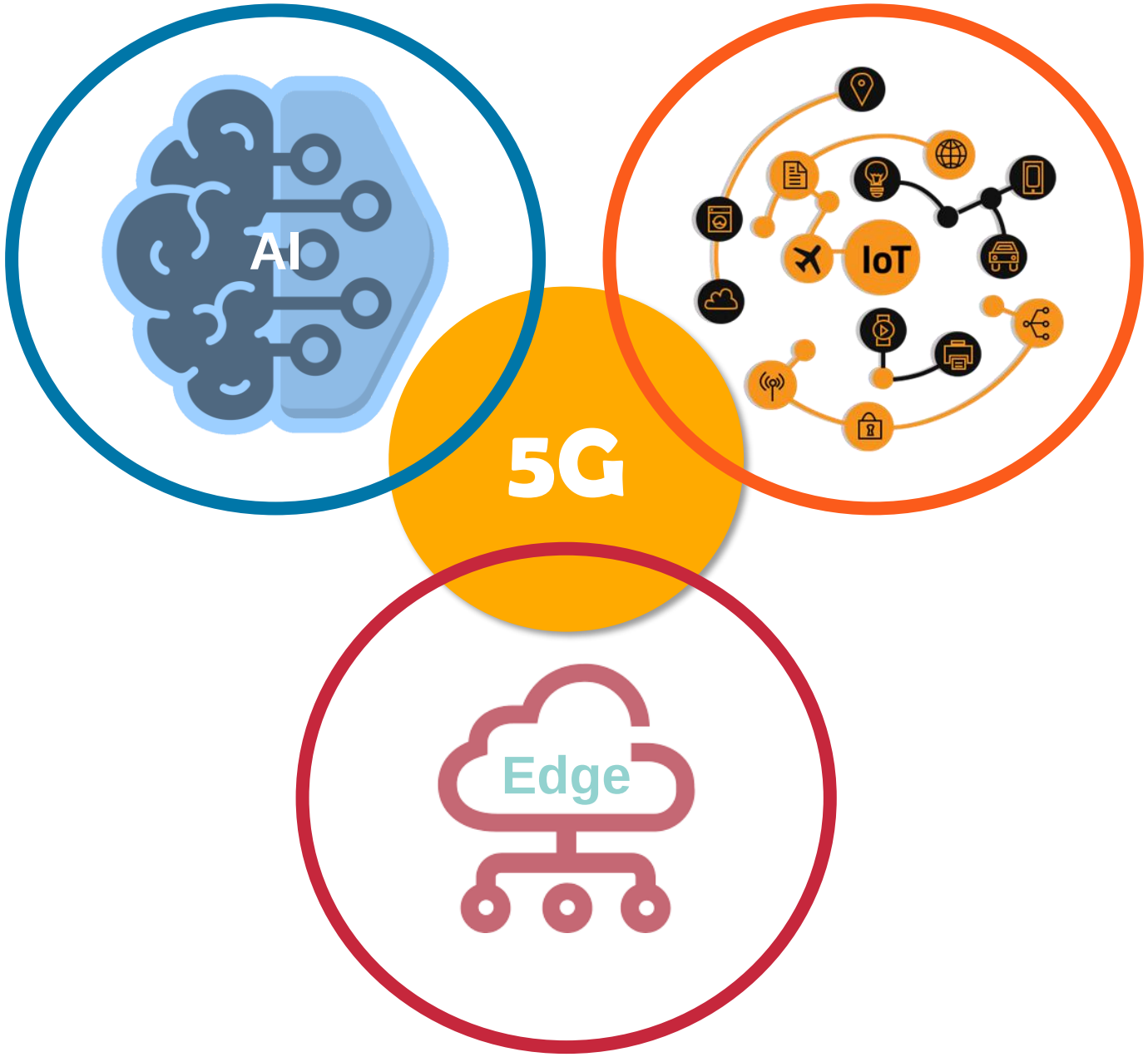


The 5G Era

Internet of Things
- 50bn sensory connections est by 2022
- Manufacture, Healthcare, Automotive, Agriculture Smart Cities & Smart Home

Artificial Intelligence
- Analysis of sensory data and behaviours
- Machine Learning and Automation of tasks

Edge
- Processing tasks closer to the End User
- Provisioning Functions and Compute through the Distributed Cloud



Sustainability Trends for the Future

Achieving Zero – Losses, Waste, Carbon and Water

Comes down to Thermal System Efficiency, Control and Peak Power

Efficiency – PUE as low as 1.10

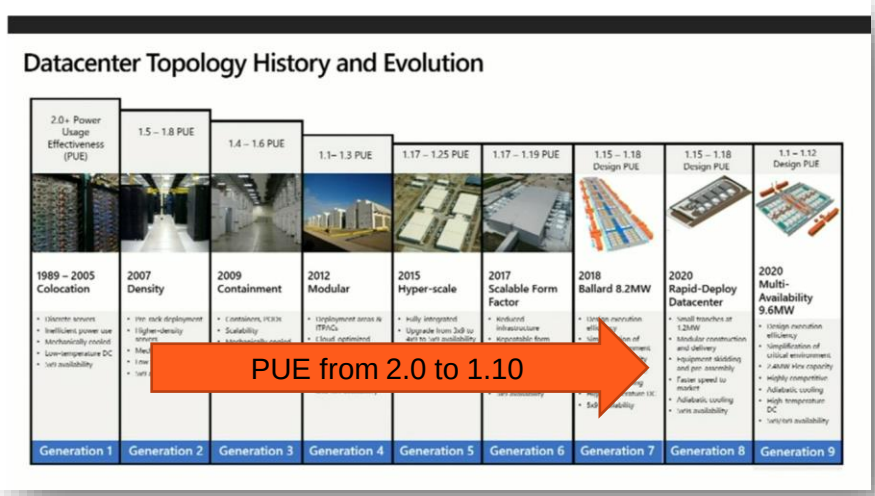
- More hours of economization mode / non mechanical refrigeration
- Achieved with:
  - High Operating Temperatures
  - Econophase Technology
  - Direct to Chip
  - Reduce the losses (fan power, etc)

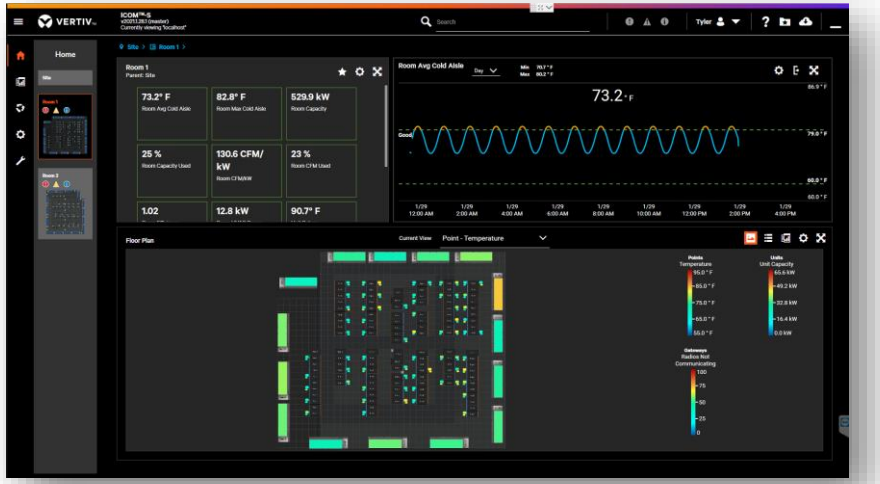
Control

- Operate to the Design Intent
- AI / Intelligent tuning of the Thermal system to the load
- Achieved with:
  - iCOM / iCOM-S
  - Chiller controls / Sequencers
  - Auto Tuning
  - Predictive

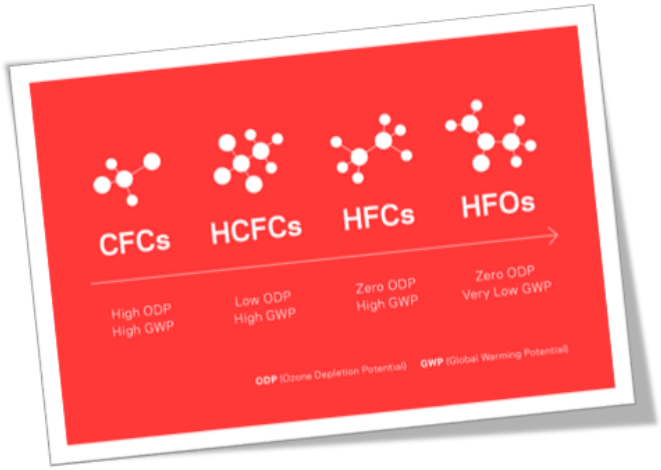
Peak Power / Peak PUE

- Minimized the power draw at the peak ambient conditions to drive down the load
- Size Thermal power to Electrical Capacity Block
- Achieved with:
  - iCOM load shedding
  - Evaporator solutions using less water





Thermal Trends and Innovations – Floor-mount DX

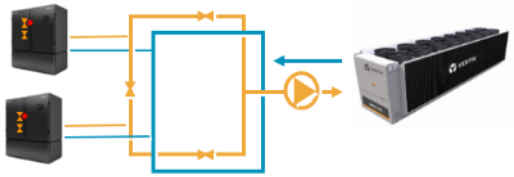


variable speed

energy efficiency

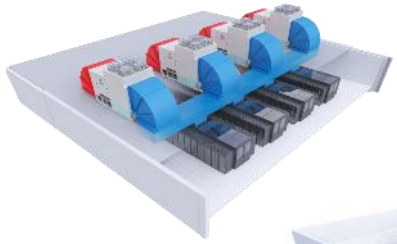
- **2021 F-Gas regulation might affect R410A price** (even if in Q1 2021 we still don't see a major increase. R410A is still widely used in most European countries in the data-center market thanks to the availability of a consistent share of the F-GAS quota, due to the comfort market already moving to alternative refrigerants).
- Acceptance of R410A **alternative refrigerants** (like R32,R454B) in data center market is **still a question mark**. EU normative about this topic (EN 378 and EN60335-2-40) is under revision; this will give a clearer picture on requirements for unit design.
- Use of **variable speed compressor technology** will become more and more widespread to maximize the part load and annual energy efficiency and reduce total cost of ownership.
- Use of **freecooling technologies will increase** (EconoPhase for air-cooled models and indirect freecooling through CW coil on water-cooled models) to exploit the opportunities provided by new data center technology trends allowing higher server working temperatures.

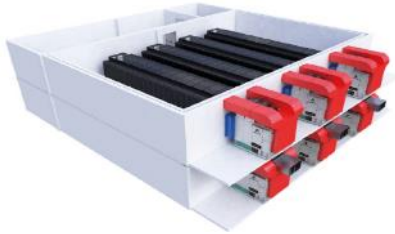
Thermal Trends and Innovations – Floor-mount CW



- **Increased Water Temperatures and DT** following new data center technology trends allowing higher server working temperatures where the increase of water T and even water ΔT maximize system energy efficiency and freecooling hours.
- **Frontal Air Delivery** configurations allow to avoid the raise floor costs, maximizing cooling density and increasing unit efficiency.
- **Pressure Independent Control Valve** combines control and hydraulic balancing functionalities in One Valve, granting always the correct amount of water to the unit.
- **Environmentally Friendly Refrigerant for chillers** to reduce the amount of greenhouse gases. The latest trend see chillers that use HFO refrigerants such as R1234ze that have practically zero GWP values.
- **System advanced control** allows the control and the communication between indoor (CRAH) and outdoor units (CHILLER). The control system allows the unit to work in harmony to maximize system efficiency. Moreover, the control system identifies and reports any malfunctions or problems and allows the units to work independently to ensure the best possible operation until the problem is resolved. Increasing the reliability and ensuring proper supply air temperature in front of the server at any condition.

Thermal Trends and Innovations – Outdoor Package Units





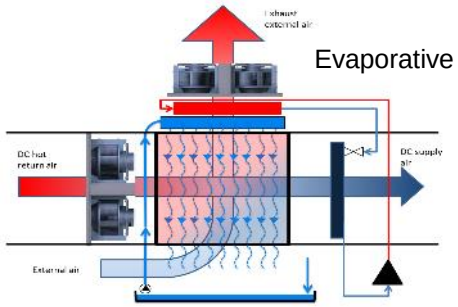
- **Data Center average size increase.** Already facing a significant expansion of outdoor package market – more is yet to come

Liebert® EFC
Evaporative Free Cooling Unit

Liebert® DSE
Pump Ref. Free Cooling Unit

Space optimized layouts: no white space occupation for cooling density maximization All required equipment is in unique package positioned outside so there is no white space occupation and outdoor space is optimized

Evaporative – EFC units

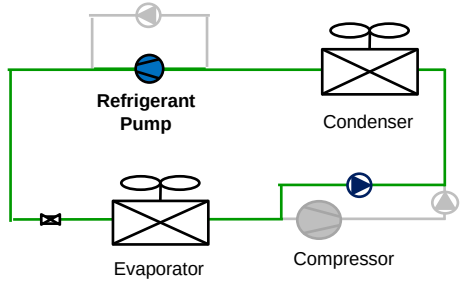


- **No raised floor –** Alternative solutions like hot or cold containments configurations grant highly efficient layouts without requiring a more expensive space consuming raised floor

- **High Efficiency – Freecooling configurations**.
  - Leverage on Evaporative technology in case of available water for extremely high efficiency
  - Or the Pumped Refrigerant Economizer alternatively

- **Increased Return and Supply air temperatures** to maximize the efficiency of the free-cooling modes of thermal equipment.

Integrated PRE (DSE units)



- **Quick time to deploy –** No or limited installation activities and costs.

- **Scalability**
  - easy redundancy handling (simply adding the redundant unit)
  - investment according to DC load increase (additional units can be added according to the request)

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VERTIV DATA CENTER APPLICATIONS

DC power systems

Batteries

Condensers

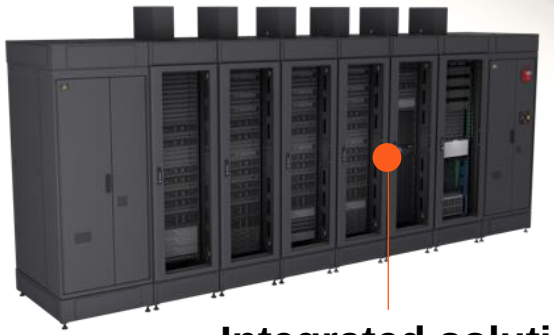
UPS systems

Thermal management

Air handlers & chillers

Racks & containment

Power distribution



Integrated solutions

Project services

Monitoring control & management

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