

Distributed Data Centers

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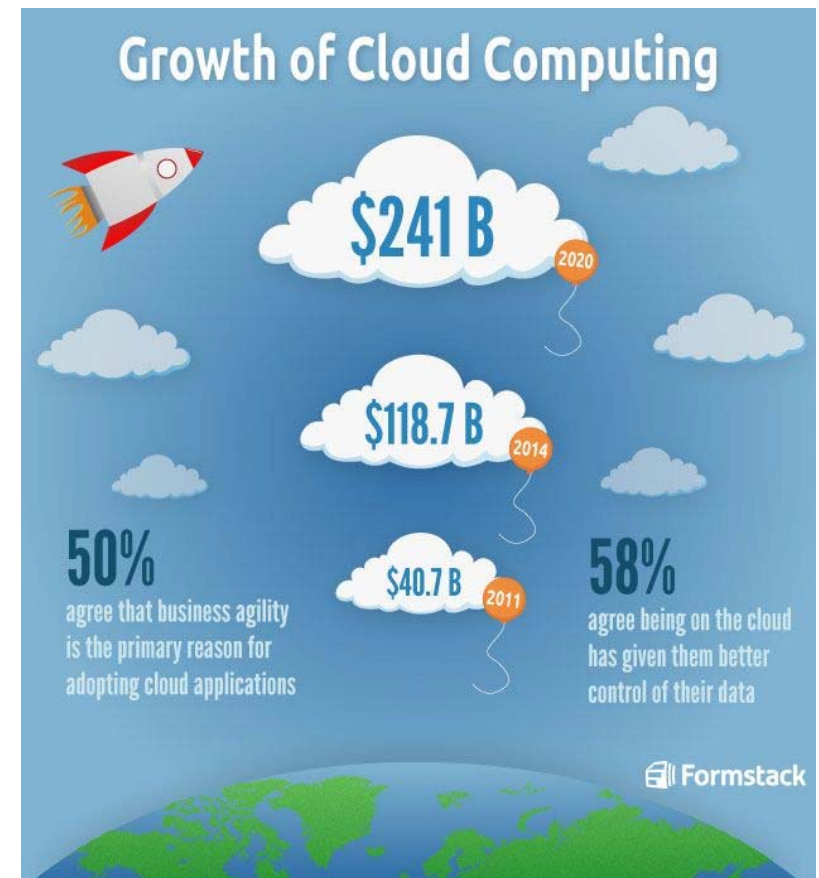
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Agenda

- Cloud Computing Overview
 - Overview
 - Pros & Cons
- Edge Computing/Distributed Cloud Computing
 - Overview
 - Advantages
- Modular Distributed Data Centers
 - Opportunity/Need
 - Modular Data Centers
 - Product Features/Benefits
- Q & A

Cloud Computing Market

- Cloud Computing –
 - All data is gathered & processed in a centralized location (data center)
 - Ideal for traditional client/server networks
- Will continue to expand due to growth of
 - Streaming & gaming
 - Access to data
 - Apps
 - Use/growth of the IoT (Internet of Things)



Cloud Computing

- “The Cloud” is essentially a “remote mainframe”
 - Data is stored off-site in massive shared storage facilities and accessed via the Internet
 - Instantly scalable
 - Maintains redundancies (back-up copies) and security/firewalls to protect data
 - Depending on where a company conducts business (how many locations) redundant data may be stored in multiple data hubs in different regions of a country or globally



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Advantages of a Centralized Cloud

- Provides access to data from “anywhere” via the Internet
 - Improves efficiencies – people can access data remotely and are not tied to a desk that is tied to an on-site server
 - Reduces risks from server crashes or not enough storage
 - Increases speed because all software and data are stored elsewhere enabling the user to gain more power from his/her own computer
 - Reduces costs for on-site utilities, hardware & infrastructure to maintain on-site facilities



Advantages of a Centralized Cloud

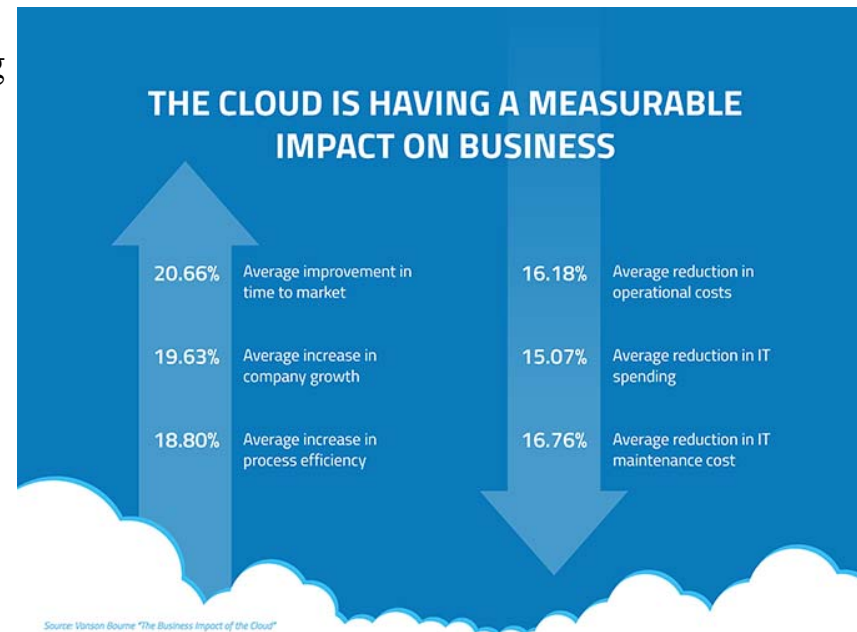
- Data is more secure
 - Cloud storage providers include a baseline of security features and functions
 - Encryption
 - Authentication
 - Control of access
 - Cloud storage providers also have more advanced security services that can coexist with any additional measures provided by the “tenant”



Advantages of a Centralized Cloud

- Scalability

- Cloud storage can grow with you in real time
 - Seasonal peaks and valleys
 - Adding storage space or expanding to additional regions can be virtually instantaneous
 - No need to spend on internal infrastructure



Advantages of a Centralized Cloud

- Mobility

- Cloud storage enables access to corporate data via smart devices
- Resources can be stored, retrieved, recovered or processed easily
- Remote/traveling employees have access to the same data as when they are in the office – all via the Internet
- Saves time and costs for maintaining internal systems
- Reduces IT workload as all upgrades are done automatically by off-site service providers



Advantages of a Centralized Cloud

- Disaster Recovery

- Dramatically reduces the risk of lost or damaged data from physical issues such as

- Server crashes
- Damage to PC's or laptops
- Natural disasters
- Power outages



- Protects data from malware & viruses that can more easily attack a PC
- Reduces the risk of losing data to human error

Advantages of a Centralized Cloud

- Control
 - Storing data on the Cloud enables complete visibility and control over data
 - Limit which users have access to which data
 - Streamlines workflow
- Using “virtual documents” enable multiple users to populate the document without having to keep several copies of half-finished versions in circulation



Advantages of a Centralized Cloud

- Competitive edge
 - Data is
 - More easily accessed & shared by those who need it, from more locations & devices than ever before
 - Better protected from loss or corruption
 - Cloud computing saves money, space, resources and time when scaling up or down based on trends



Drawbacks of Centralized Cloud

- Downtime –
 - Interruptions of Internet service can cause delays, lost sales and poor customer service levels
 - Possible service dropout if the customer doesn't replicate their services across multiple zones if their particular zone has downtime or a failure for any reason
 - Must plan “Best Practices” for downtime including:
 - Disaster recovery contingencies
 - Multi-regional zones for storage redundancies with automated switching
 - Dedicated connectivity options such as AWS Direct Connect, Azure ExpressRoute or Google Cloud’s Dedicated Interconnect or Partner Interconnect



Drawbacks of Centralized Cloud

- Security and Privacy –
 - Although cloud service providers have the best security standards in place, anyone can still be hacked



- Internal employees can cause issues
 - Intentional
 - Accidental

Drawbacks of Centralized Cloud

- Vulnerability to Attack –

- It only requires a credit card to start using the Cloud
- Many users don't understand “best practices” for Cloud security
- Smaller companies often don't classify information and limit access/control of data
- Make security a core aspect of all IT operations
- Many don't invest in cloud services such as AWS Inspector, CloudWatch, CloudTrail and Config to automate compliance controls
- Many don't run regular audits to ensure that their data is still there and intact



Drawbacks of Centralized Cloud

- Limited control & flexibility –
 - Cloud infrastructure is entirely owned, managed and monitored by the service provider
 - Customer has minimal control over function and execution of services within a cloud-hosted infrastructure
 - Customers do retain control of apps, data and services but it's limited on their backend infrastructure



Drawbacks of Centralized Cloud

- Vendor Lock-in –
 - Hard to move from one cloud service to another
 - There are differences between vendor platforms
 - Gaps or compromises could occur during migration
 - Additional vulnerability do data security and privacy vulnerabilities
 - Nontechnical issues, such as the availability of real estate, power, and bandwidth for a large “mega data center” near enough to your particular business network which leads to...



Drawbacks of Centralized Cloud

- Latency –
 - The further away one is from the data, the more latency (delay) there will be in retrieving it



- As we evolve into the new world of 5G, with AI (artificial intelligence) VR (virtual reality), AR (augmented reality) and streaming as a part of our everyday lives, it becomes VITAL to have instantaneous access to data
- 5G signal doesn't travel as far as 4G, therefore an intricate, sizeable network of decentralized, distributed cloud data centers must be implemented to ensure that this “data super highway” never slows down

Distributed Cloud & Edge Computing

- With Billions of users & devices accessing data, the “information super-highway” is slowing down (latency)
 - Allied Market Research predicts that by 2020 the IoT will include over 21 Billion devices
 - Over 800 ZB of data in the Cloud (a Zettabyte = 1 sextillion bytes) – 85 ZB devoted to IoT
- IoT, AI, AR, VR, gaming, streaming all require a more efficient way of storing, transmitting and accessing data



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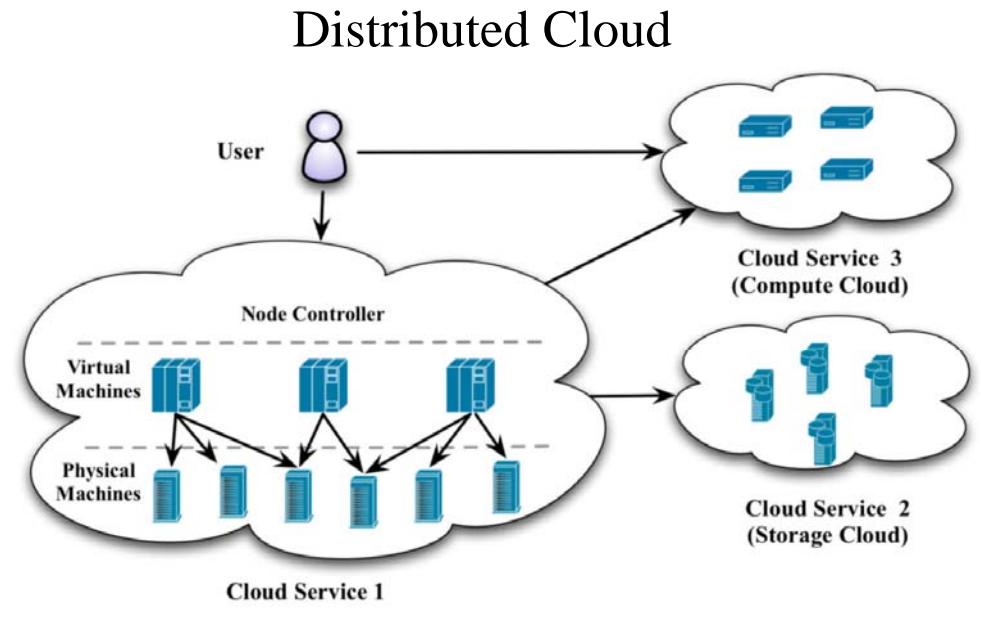
References: <https://www.vxchnge.com/blog/edge-computing-vs-cloud-computing>
<https://www.huawei.com/minisite/gsf2015/service-driven-distributed-data-center-drives-carriers-business-success.html>

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Distributed Cloud

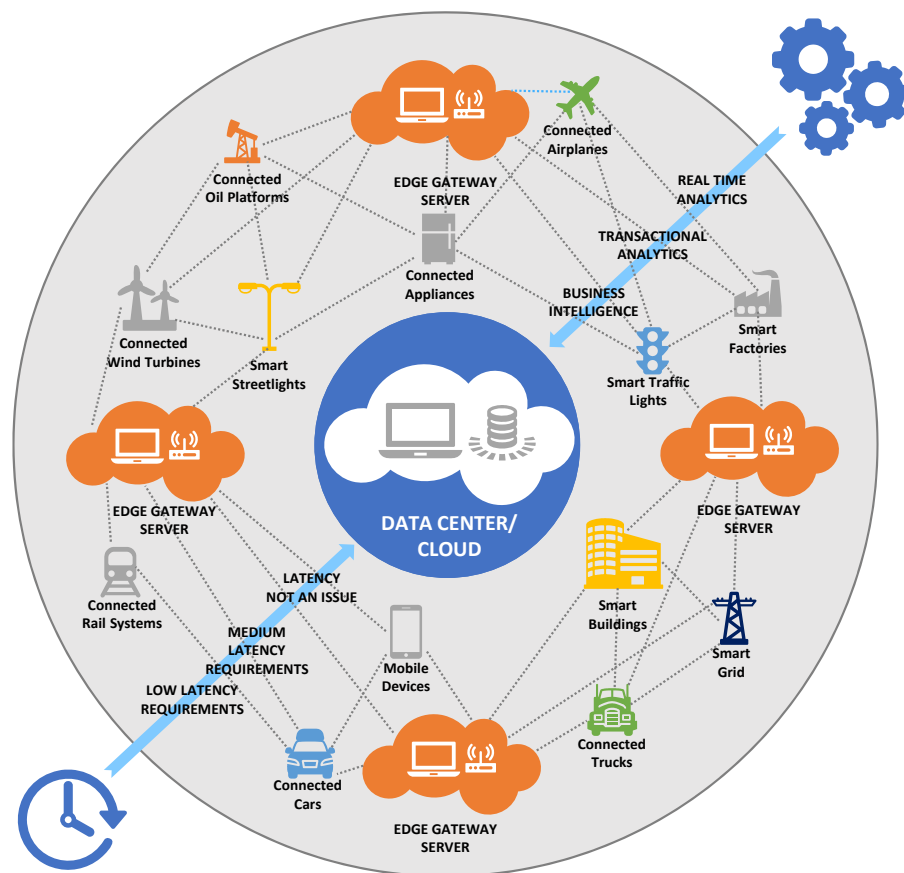
- A Distributed Cloud is a micro-cloud located outside the centralized cloud
- It performs computation, storage, and networking functions
- A Distributed Cloud puts computing closer to the end user
 - Decreases latency
 - Provides opportunities for increased security



Resources: https://www.ericsson.com/en/digital-services/trending/distributed-cloud?gclid=CjwKCAjwscDpBRBnEiwAnQ0HQGpKfkASR23T79DMTYNOi0WKEIzGB2PIBQDy24cYrPMi6sEkafvd0hoCRZYQAvD_BwE
<https://www.sdxcentral.com/edge/definitions/whats-the-difference-between-mec-and-distributed-cloud/>

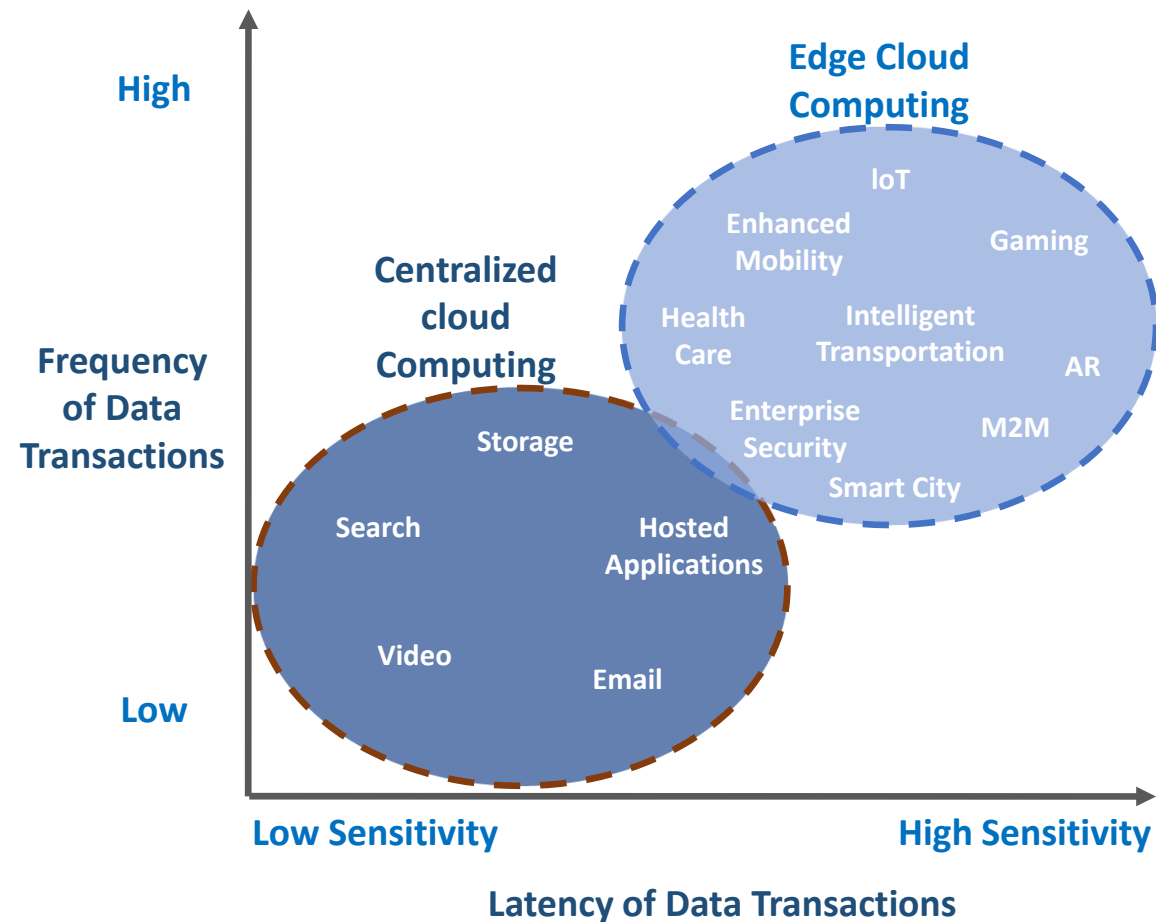
Distributed Cloud & Edge Computing

- Edge Computing is the primary solution to addressing latency
- Complimentary to Cloud Computing
- Solves the issues caused by latency for streaming and IoT devices
 - Relocates crucial data processing to the “edge” of the network instead of having data travel to a central server
 - Requires Edge Data Centers in order to process and store vital data application needs in a localized environment



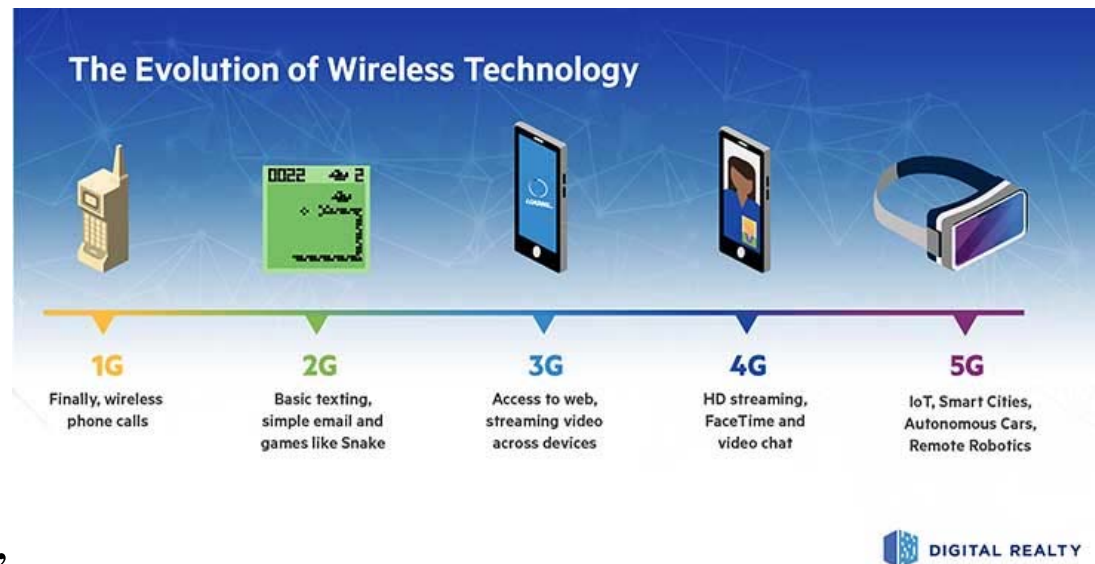
Welcome Distributed Cloud & Edge Computing

- Utilizing a Distributed Cloud and Edge Computing brings the data closer to the users
 - Reduces latency
 - Improves the quality of related technologies such as:
 - Streaming & Gaming
 - Smart Homes & Devices (IoT)
 - Smart Cities & Transportation
 - Health Care



5G & Edge Computing

- 5G is essentially 5th Generation Wi-Fi transmission of data, providing:
 - High-bandwidth mobile broadband of 100 Mbps or better
 - Support for massive machine-to-machine (M2M) communications, with density of up to 100,000 connections per square kilometer.
 - Ultra low-latency communications, enabling sub-10 millisecond latency for mission-critical apps.



5G & Edge Computing

- Roll-out of infrastructure in the USA started in late 2018
- Providers anticipate 5G to be providing a “digital tsunami” of data by 2022
 - The average smartphone will generate 11Gb of mobile traffic per month in 2022, compared to 2GB per month in 2017.
- Requires a new transmission infrastructure
 - Thousands of cell towers and tens of thousands of antenna – known as small cells and DAS (Distributed Antenna Systems)
 - Deployed on utility poles and other urban infrastructure
 - Estimate of 400x more cell towers to service 5G



PRIME® References: <https://datacenterfrontier.com/what-5g-will-mean-to-the-data-center-industry/>
<https://www.zdnet.com/article/what-is-5g-everything-you-need-to-know/>

5G & Edge Computing

- “5G will deliver
 - Enhanced power efficiency
 - Cost optimization
 - Massive IoT connection density
 - Dynamic allocation of resources based on awareness of content, user, and location
- 5G will be able to concurrently support both
 - Low-end IoT applications (such as sensors and meters) as well as
 - High-end IoT applications (such as autonomous driving cars and tactile Internet experiences).” Thomas Barnett Jr., Cisco’s Director of Service Provider Thought Leadership

Advantages of Distributed Cloud

- Higher Data Transmission Speed (up to 1000x faster)
 - Having data centers closer to where the data is needed improves speed
 - Stock trading
 - International office locations
 - E-commerce –
 - 40% of visitors leave if a website takes more than 3 seconds to load Akamai analysts
 - Walmart states it has only 1/4 second to retain a visitor
 - Amazon states a 1 second delay results in a 1% loss in sales



Advantages of Distributed Cloud

- Safer Storing Data

- Storing Data in one centralized location is too risky
 - Power outages
 - Natural disasters
 - Interruptions to access between cities, countries and continents
 - Industrial espionage
 - Internal sabotage or “operator error”



- Easier Compliance With New 'Digital' Regulations

- Many countries and some states have laws regarding storing citizens' personal data abroad
- Several countries have laws that state if you do business there you must store the data there or risk being blocked (LinkedIn in Russia for example)

Vital Need for Distributed Data Centers

- “Tens of Thousands” of Distributed Data Centers must be implemented to support the Distributed Cloud and Edge Computing
- “Distributed Data Centers will be key components of the 5G/Edge Computing infrastructure to make all this happen
 - In order to successfully create a network that wirelessly connects all devices and interactions with those devices, data will need to be
 - Transferred, stored, and processed at rapid speeds
 - Consistent and highly reliable
 - On the back-end, certain data will need to live on a dedicated network away from congestion from other applications”
- Primary beneficiaries of 5G data growth will be Data Centers with a focus on interconnection

Nadia Tuffaha, Senior Content Manager at [Digital Realty](#)

References: <https://datacenterfrontier.com/what-5g-will-mean-to-the-data-center-industry/>
<https://www.digitalrealty.com/blog/5g-how-we-got-here-and-its-impact-on-data-center-infrastructure>

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The NEW Distributed Data Centers

- Key stakeholders/service providers in the growth and implementation include:
 - Mobile Operators
 - Verizon, AT&T, T-Mobile, etc.
 - Application Developers
 - Virtual Reality, Augmented Reality Apps
 - Over the Top (OTT) Players
 - Providers who's services go over the internet
 - Outside of specific networks such as voice & messaging services
 - Independent Software Vendors
 - Work closely with OTT's to provide software to mobile operators, app developers, etc.

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References: <https://www.zdnet.com/article/have-hyperscale-will-travel-how-the-next-data-center-revolution-starts-in-a-toolshed/>

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The NEW Distributed Data Centers

- Key stakeholders/service providers in the growth and implementation include:
 - Telcom Equipment Vendors
 - Nokia, Huawei, Ericsson, etc.
 - IT Platform Vendors
 - AWS, Salesforce, Microsoft Azure
 - System Integrators
 - Hardware, software & networking solution providers
 - Technology Providers
 - Marketing, healthcare, finance, etc.

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References: <https://www.zdnet.com/article/have-hyperscale-will-travel-how-the-next-data-center-revolution-starts-in-a-toolshed/>

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The NEW Distributed Data Centers

- Initially Amazon, Microsoft, and Google built out their cloud service centers from servers assembled in shipping containers
- For the Distributed Cloud/Edge Computing model, Micro Data Centers (μ DC) are the next generation of the Data Center
 - Smaller
 - More commercial grade
 - Energy Efficient
 - Smarter

Original Data Center



NEW Modular Data Center

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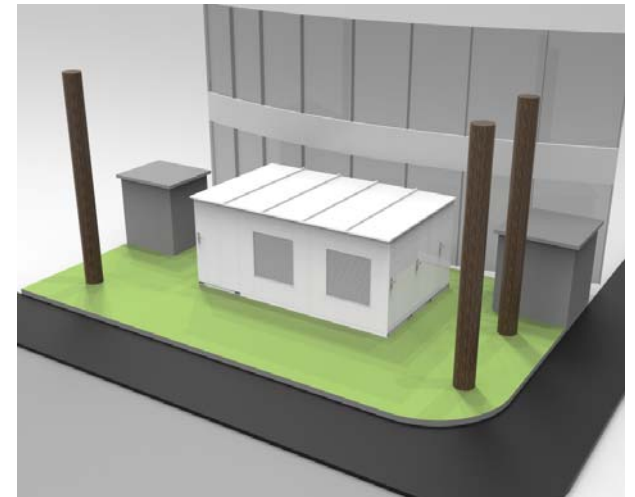
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New Distributed Data Centers

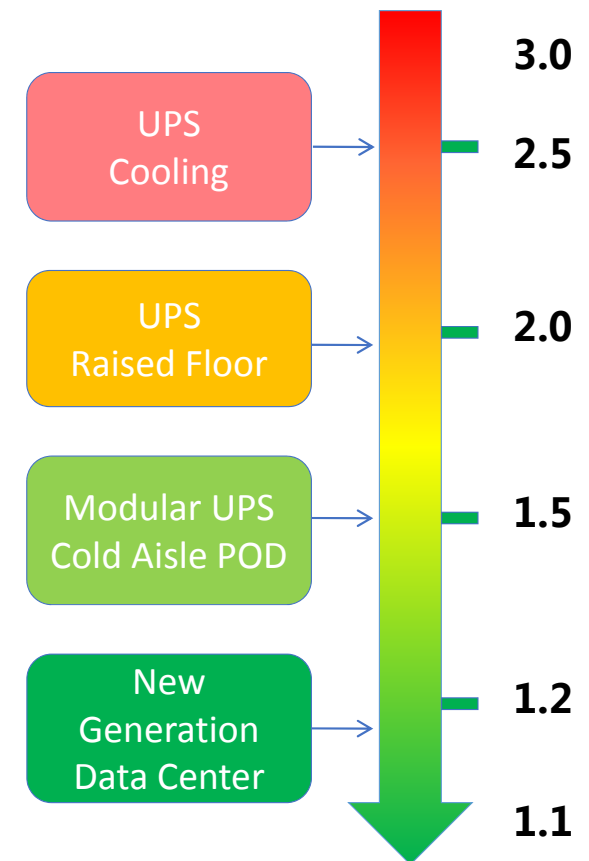
- New Distributed Data Centers must be:
 - Modular, agile, and adaptable
 - Traditional data centers are used in a controlled environment
 - Distributed data centers are exposed to local conditions and must be able to perform in any environment including outdoor use
 - Look for pre-fabricated, pre-tested units as they will cost much less than data centers built from scratch



New Distributed Data Centers

PUE

- New Distributed Data Centers must be:
 - Energy efficient
 - China Mobile's 2013 study showed 46% of the energy consumption for their base stations was from air conditioning
 - Smarter cooling systems with low energy consumption
 - Use outside air & evaporated cooling system
 - PUE (Power Usage Effectiveness) 1.1 vs. >1.5 for traditional data center cooling systems



New Distributed Data Centers

- New Distributed Data Centers must be:
 - Smart/Low maintenance
 - Remote maintenance capabilities
 - PLC (Programmable Logic Controls)
 - PDU's with switches and/or meters to monitor and adjust power consumption



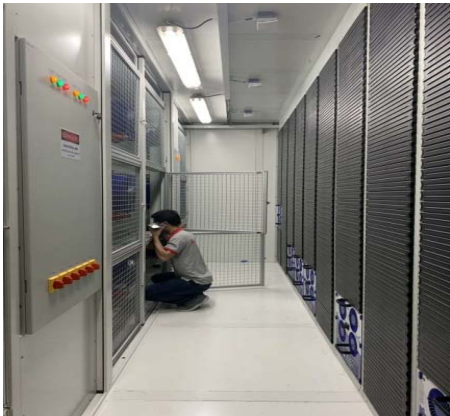
New Distributed Data Centers

- New Distributed Data Centers must be:
 - Secure
 - Indoor and Outdoor use
 - Electronic locks
 - Surveillance equipment



New Distributed Data Centers

- Key Advantages/features to Modular Data Centers
 - Pre-built
 - Professionally designed and tested
 - Consistent quality
 - Save time on assembly and installation



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New Distributed Data Centers

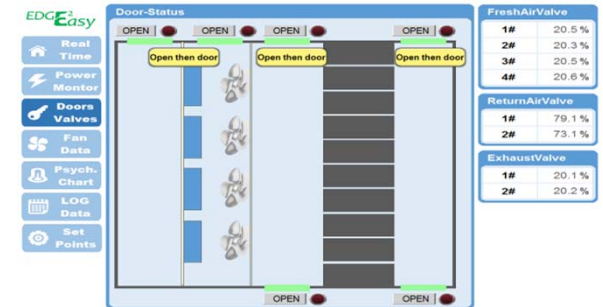
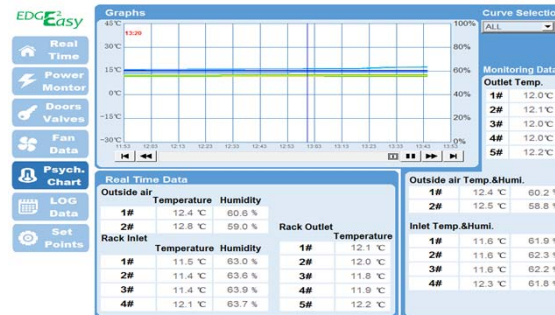
- Key Advantages/features to Modular Data Centers
 - Scalability
 - Small to large
 - Modularized
 - Traditional Data Centers are custom built with no ability to scale up when demand increases



New Distributed Data Centers

- Key Advantages to Modular Data Centers

- Automation
 - PLC Control
 - Remote Maintenance

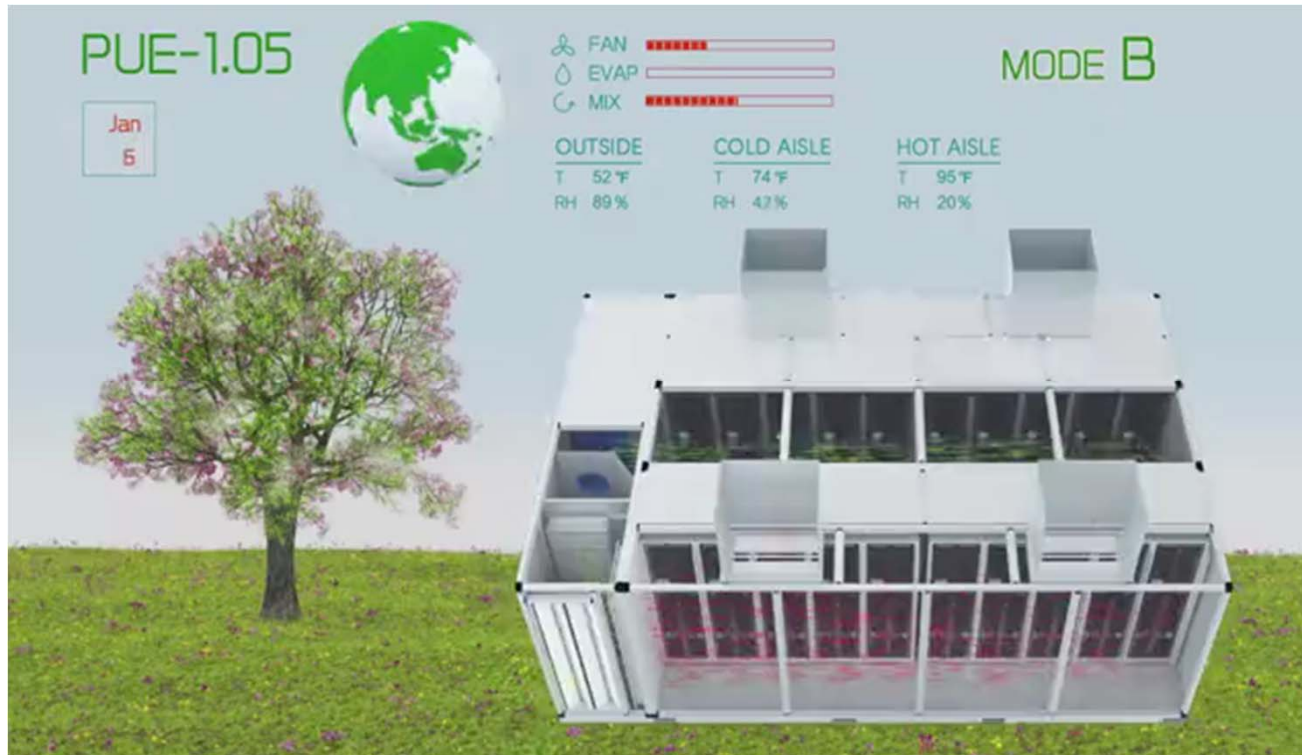


New Distributed Data Centers

- Key Advantages to Modular Data Centers
 - Cost Efficient
 - Save on construction costs
 - Shorter delivery & installation time
 - Save on water consumption
 - Lower electricity/energy costs



New Distributed Data Centers



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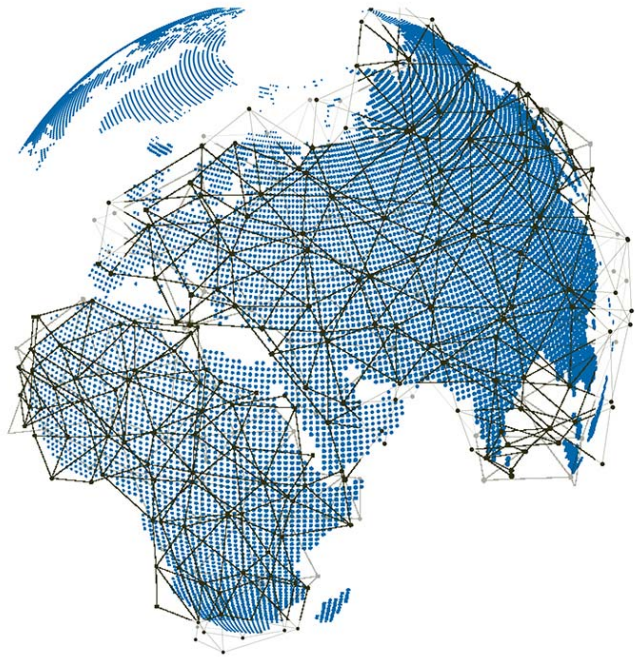
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Recapping

- Distributed Data Centers are a vital component of Distributed Cloud & Edge Computing
 - Must be agile/adaptable
 - Scalable to meet today's and tomorrow's needs
 - Work in any environment (indoor/outdoor)
 - Must be intelligent
 - Energy efficient
 - Cooling system
 - Overall electricity draw
 - Secure
 - Locks and monitoring systems
 - Self-sufficient
 - Intelligent PDU's
 - Programmable Logic Controls
 - Ability to monitor all equipment and react to a variety of circumstances

Recapping

- Prefabricated construction is superior and more cost effective to custom-built
 - Performance-tested prior to installation
 - Everything fits the first time – virtually eliminating on-site guessing or workarounds
 - Easier and faster to install
 - Modular – expandable
 - Given the ever-increasing amount of data that must be accessible, not being able to easily expand will be very costly as future demand and data-transmission technology requires more servers, memory, power, control, flexibility, etc.
 - Components are matched to the structure
 - Cooling system
 - Racks
 - Security
 - Cost Effective
 - Saves time & money on the installation
 - Saves time, energy & money in-use



Thank You for Your Time!

Distributed Data Centers

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