EDGE DATACENTER SOLUTION – THE NEED AND THE PROMISE

Antti Romppanen / Head of Product Management, Datacenter / Nokia
New applications redefine network requirements

Similar to speed, latency becomes a point of differentiation

Low latency drivers
- Virtualized cloud access
- Interactively-intense AR/VR applications
  - virtual remote control
  - real-time cloud rendering
  - haptic interaction
- Critical control systems
  - industrial/utility
  - vehicular automation

Similar to speed, latency becomes a point of differentiation
Pushing the limits to reach the next level
Addressing capacity demand while driving down latency
The business opportunity from transforming towards the Edge Cloud

RAN Cloudification & Evolution to 5G

Fixed Access Network Transformation

Platform for latency, bandwidth, and security critical use cases (IoT, MEC)

Distributed Edge Data Centers

Cloud computing

NFV

SDN

Public/Private Cloud and open ecosystem for innovation moving to Edge

IP network transformation
- Distribution of BNG
- Virtualization IP Edge/VAS

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Managing the lowest latency/cost trade off with a layered architecture
Datacenter portfolio for all deployments from Far Edge to HyperScale

<table>
<thead>
<tr>
<th>Sites</th>
<th>100-1000’s</th>
<th>10-100’s</th>
<th>&lt;10</th>
<th>2-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Footprint</td>
<td>Smallest</td>
<td>Small</td>
<td>Large</td>
<td>Large</td>
</tr>
<tr>
<td>Power budget</td>
<td>Low</td>
<td>Medium</td>
<td>Medium - High</td>
<td>High</td>
</tr>
</tbody>
</table>

Far edge          Aggregated edge          Regional            Central

Lowest latency / high throughput

Signaling driven

Open Edge   Compact OpenRack or 19” Rack-mount or Open Edge

Full size/compact OpenRack or 19” Rack-mount

Full size OpenRack or 19” Rack-mount

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Challenges in bringing the data center to the edge
Managing the trade offs

Efficient capacity
CENTRALIZED DATA CENTERS

Cost efficiency
New business potentials
Low latency & efficient transport
EDGE DATA CENTERS

Challenges in addressing new opportunities today

Radio sites
... no space for traditional data center HW

Classical data center HW
... not designed for edge use
Managing the lowest latency/cost trade off with a layered architecture
First data center solution designed for the edge

Edge data centers
- Sites: 100-1000’s
- Footprint: Smallest
- Power budget: Low
- Content stays close to the end user: Enables lowest latency

Central data centers
- Sites: 10-100’s
- Footprint: Small
- Power budget: Medium
- No need to send the data towards the core network: Saves backhaul NW resources

AirFrame Open Edge Server

Managing the lowest latency/cost trade off with a layered architecture
First data center solution designed for the edge
A compact data center with a base station form factor
No need for additional radio sites for edge data center HW
Hardware acceleration secures performance under space and power constraints

Cloud RAN
- 4G/5G L1/L2 real-time acceleration
- 100% better performance

Machine Learning/Artificial Intelligence
- Video analytics
- Image recognition
- 10x faster

Content acceleration
- Encoding, enriching, transcoding
- 30x faster

More data center capacity per m²
Automation of data center deployment and management is required with 1000’s of distributed clouds

Open data center management solution

1. Vendor-agnostic hardware management
2. Open south-bound and north-bound APIs (Redfish, IPMI, RESTful etc.)

Customer trial in Europe: OpenRack automated deployment with AirFrame Data center Management

- Single view and operation over data centers
- Real-time data for automated operations
- Increase utilization of servers and improve power efficiency
- Analytics for smart capacity planning for future workloads
- Automated datacenter deployment using Ansible

- With parallelism, in less than 30 minutes, rack is ready for cloud installation
- Mostly automated, few manual steps, less errors
- Manual deployment would easily be a full-day task
Edge use case: Cloud RAN
Cloud RAN is part of Nokia's next generation AirScale Radio Access. Scales for the future.

AirScale Radio Access – common software

AirScale Base Station | AirScale Cloud RAN | AirScale Antennas | AirScale Wi-Fi

Capacity | User experience | New revenues | Architecture evolution | Total cost of ownership
Network topology evolution - cloud optimized architecture

Locate functions depending on application and latency needs

Services with varying requirements - low latency, high bit rate, ultra reliable critical communication

- Spectral and cell site efficiency drive centralization of radio functionality and simplification of cell site
- Cloud RAN, Distributed RAN and Centralized RAN answer to capacity requirements
- Low latency and high bit rates as drivers for distribution of functionalities
- Virtualization when optimal
- Radio and some core functions are migrating to the edge cloud
Edge use case: vEPC
5G system architecture evolution
Cloud Native with Control and User Plane Separation

- **Low latency**
  - UPF
  - uRLLC
  - Hybrid Access

- **User Plane Functions**
  - UPF

- **High latency**
  - UPF
  - eMBB
  - eMBB, IoT

- **Compute and caching**
- **Control Plane Functions**

- **HL fronthaul**
- **Backhaul**
- **Edge Cloud**
- **Regional DC**
- **Central DC**

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eMBB = enhanced Mobile Broadband
uRLLC = Ultra Reliable Low Latency Communications
5G system architecture evolution
Network Function Optimization

- Independent scaling of control and user plane
- Multiple VNF/PNF deployment options
- Standardized interfaces between the Control Plane and the User Plane nodes: Sx(4G) and N4(5G)
Open Edge Datacenter Solution

A fundamental step towards 5G
The edge cloud will play an essential role in the 5G architecture, enabling Cloud RAN and new vertical use cases

Full data center solution for the edge cloud
Compact size HW and real-time/low latency optimized infrastructure SW

Performance boost for demanding applications
Pluggable acceleration modules to secure performance within tight power and space constraints

Key enabler for AI and machine learning
Low latency and acceleration capabilities optimize the performance of machine learning and AI workloads
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