Breakout Session

Converged Edge:
An architectural foundation for end-to-end edge scale deployments

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David Carrera, Nearby Computing
The Momentous Shift to the Edge

Drivers for Edge Computing
- Latency
- Bandwidth
- Security
- Connectivity

IT & OT Insights

Inference Media

Network Analytics

CT Insights

IoT & Devices

On-Premise Edge

Edge Computing

Network Hub or Regional Data Center

Core Network

Cloud Data Center
Common Framework to Address Different Verticals

Edge End-to-End Edge Architectural Foundation: Inter-Operable, Open and Self Managed

End Users and Device Location
- Street users
  - Telco Edge
- Vehicles
  - Street cameras
  - Street sensors
  - ...
  - IoT Edge
- Retail shops
  - Public locations (i.e.: libraries)
  - Private enterprise
  - ...
  - Enterprise Edge

Transport Type
- INFRASTRUCTURE (5G/LTE, Wireless, Lora, Wired...)

Multi-Service (NFV & Non-NFV) Common Service Taxonomy
- NFV
- Internet of Things
- Autonomous
- AR/VR & Gaming
- Data Caching & Storage GW
- Video/Video Analytics
- FaaS
- Speech Recognition
- Medical Applications
- Enterprise

Multi-Tier Common HW Edge Taxonomy
- On-prem/Far Edge
- Far Edge
- Near Edge
- Data Center Edge
Full Edge Lifecycle Management (SW/HW)

Dashboard
- MEC Controller
- Telemetry / KPIs
- Service Chains
- Registry
  - Applications & Workloads

DC Nodes
- VNFS
- MEC
- Video Analytics
- vFW
- ...
- AR/VR

Edge Nodes

**Nearby One**
- Measures latency, validate application compute requirements, dependencies, etc.
- Deploys application and service chains to DC or other edge nodes
- Continuously monitors telemetry & KPIs (networking and compute) and moves workloads if required

Lenovo Open Cloud Automation
- Lenovo ThinkShield authenticates nodes once powered up

**LOC-A**
- Auto-discovers node
- Adds to inventory
- Updates configuration including firmware, networking, and desired OS
- Validate and mark as production ready

Platform Management
- Inventory Service
- Discovery Service
- Management Service
- Configuration Service
- Repository Service

Platform Modules
- VMware
- Red Hat
- OpenStack for NFV
- OpenShift
- Bare metal

Lenovo

NBYCOMP Nearby Computing

Telemetry / KPIs
Service Chains
Registry

Applications & Workloads

Dashboard

DC Nodes

Edge Nodes

Lenovo ThinkShield

LOC-A integration into Nearby One
(3) Control Loop:
▪ Application provides current KPI (e.g. 8 fps per stream)
▪ Orch. Identify SLO is broken
▪ TMAM or Platform telemetry to find the bottleneck
▪ Increase resource or migrate

Pull/push={fps=10; latency=100 ms; 8 cameras}

(2) Static Resource Allocation
RDT Aware Orchestrator (telemetry & profile -> MBA)
Core Affinity (CMK)
Docker* (RDT high & low priority workloads - MBA)
NDF

CaaS Components & OpenNESS u-services

(1) Select location based on latency
(2) Resource selection based on
▪ SLO
▪ Fingerprint description of the application in terms of resources needed

(0) Deploy Service with SLO X
(e.g. 10 cameras for Surveillance)

Orchestration & Management Modules

Orchestration Logic
Service Monitoring
Resource Management

Prometheus
Derived Metrics
Collectd

Service Flavors to map # resources depending on the service requirements

<table>
<thead>
<tr>
<th>Use Cases</th>
<th>SLO</th>
<th>Core Count</th>
<th>Acceleration and Core Count if Acceleration</th>
<th>Memory BW Requirements</th>
<th>LLC Trashing (Noisy Neighbor)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surveillance (1080)</td>
<td>10 fps within 100 ms</td>
<td>4 cameras / core</td>
<td>10 cameras (/ HDDL + 2cores)</td>
<td>500MB/s per camera</td>
<td>High</td>
</tr>
<tr>
<td>Safety (1080)</td>
<td>8 fps within 500 ms</td>
<td>4 cameras / core</td>
<td>14 cameras (/ HDDL + 2cores)</td>
<td>400MB/s per camera</td>
<td>Med</td>
</tr>
<tr>
<td>Retail (1080)</td>
<td>1 fps within 500 ms</td>
<td>4 cameras / core</td>
<td>8 cameras (/ HDDL + 2cores)</td>
<td>300MB/s per camera</td>
<td>Med</td>
</tr>
</tbody>
</table>
Converged Edge for Smart Cities

- An E2E smart city deployment on a virtualized network infrastructure that scaled across all locations: near, access, and on-premise edge
- Catering to multiple use cases for smart city: tourism, crowd safety/detection, need to handle multiple access points (Cameras, POS) and access technologies

### Scalable Architectural Approach

<table>
<thead>
<tr>
<th>Converged Edge architectural approach - flexible, scalable, modular</th>
<th>Intel enables two partners, Cellnex and several ISVs with deep technical engagement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platform recipes to address all edge locations from street cabinets to central office</td>
<td>Right size platforms from extensive portfolio on IA to scale up and out</td>
</tr>
<tr>
<td>Platform design to fit constrained form factors inclusive of the Green Edge servers (solar powered)</td>
<td>Orchestrate and manage</td>
</tr>
<tr>
<td>Several ISVs on OpenVINO™</td>
<td></td>
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</tbody>
</table>

### Ecosystem Pull-Through & Enabling

- **FlexRAN**
- **DPDK**
- **www.intel.com/edgesoftwarehub**
- **www.intel.com/converged-edge-insights**
Live Demo
Check out More Resources

- Converged Edge: [www.intel.com/converged-edge-insights](http://www.intel.com/converged-edge-insights)
- Intel® Edge Software Hub: [www.intel.com/edgesoftwarehub/develop](http://www.intel.com/edgesoftwarehub/develop)
- OpenNESS toolkit: [www.openness.org](http://www.openness.org)
- OpenVINO™ toolkit: [www.intel.com/openvino](http://www.intel.com/openvino)
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