Lenovo ThinkEdge SE455 V3
Open RAN Performance Results

Power efficiency and core performance validated by 3rd party testing proves unparalleled TCO
(Open) Radio Access Network (RAN) software vendors conducted rigorous testing on the SE455 V3 to evaluate its power savings and performance capabilities.

The testing process included comprehensive assessments conducted by verified third-party communication services providers specifically focusing on Open RAN functionality, power consumption and core performance.
Testing Setup for DU Performance and Energy Efficiency

- **Open-FrontHaul Emulation (Ue + O-RU)**
- **DU**
- **CU**
- **5G Core**
- **File Based (Performance, Energy Related Data)**
- **Service Management & Orchestration**
- **System Under Test (SUT)**
- **ThinkEdge SE455 V3**
- **Continuous Testing Platform**

Diagram:
- OFH
- F1
- N2, N3
- REST
CPU Core Placement for Performance Test

- Testing performed with 2.5GHz CPU clock frequencies on both platforms to achieve a baseline.
- Remaining system elements kept similar to avoid non-CPU related bottlenecks.

Reference System

32C

FEC
Encode + decode

Process to Core Placement

64C

FEC
Encode + decode

Process to Core Placement

CPU Core Allocation

<table>
<thead>
<tr>
<th></th>
<th>Linux OS</th>
<th>L1 PHY</th>
<th>L2 Proc</th>
<th>L3 Proc</th>
<th>Unused</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
</tr>
</tbody>
</table>
Best in Class Energy Efficiency for Telco Workloads at Edge

Deploy Multiple DUs or All User Plane Functions in a Single Server

45% Greater CPU Performance per socket for complex L1-L2 Radio Access Network (RAN) computations

89% Higher Thread Performance or every 1 watt consumed

62% Energy Efficient in power consumption per thread

52% Less Power Consumption for the same performance under busy hour load

1 Tested and benchmarked against up-to-date GPPs widely used in Telco RAN workloads
2 Further subject to software vendor dimensioning study
# Lenovo ThinkEdge SE455 V3
## Reference Architecture & Testing Results

### DU Service Layer

<table>
<thead>
<tr>
<th>Layer 3</th>
<th>RRC</th>
<th>Layer 2</th>
<th>PDCP</th>
<th>Layer 1</th>
<th>MAC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### DU Service Layer Performance Parity

<table>
<thead>
<tr>
<th>Layer</th>
<th>vDU FDD</th>
<th>vDU TDD</th>
<th>L2</th>
<th>L1 FDD</th>
<th>L1 TDD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watts</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Per/Watt</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Per/Thread</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reference System</td>
<td>Lenovo SE455 V3</td>
<td># Threads Required for Perf. Parity</td>
<td>Power Optimization</td>
<td>Power Reduction, SE455 V3/Reference</td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>------------------</td>
<td>-----------------------------------</td>
<td>--------------------</td>
<td>-----------------------------------</td>
<td></td>
</tr>
<tr>
<td>Per/Watt</td>
<td>Per/Watt vs Reference</td>
<td>Watts</td>
<td>Per/Watt</td>
<td>Watts vs Reference</td>
<td>Per/Thread</td>
</tr>
</tbody>
</table>

| Watts | 0.72 | 0.70 | 0.75 | 0.62 | 0.62 |
| Per/Watt | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Per/Thread | 0.758 | 0.734 | 0.789 | 0.653 | 0.653 |
| 
| +0.358 | +0.334 | +0.389 | +0.253 | +0.253 |

### Performance Parity

- **Reference System**: 160W / 64 Threads
- **Lenovo SE455 V3**: 75.5W / 79 Threads

- **Power Reduction**: +15 (75.5W vs 160W)
- **Power Optimization**: -84.5W
- **Power Reduction, SE455 V3/Reference**: 52%
Unparalleled Power at the Edge

Key Findings:

- Lenovo ThinkEdge SE455 V3 is capable of CPU frequency over-clocking without killing power efficiency – mainly linear increase.

- There still exists room for performance improvement with platform & compiler optimization (DPDK distributions mostly tuned for reference system).

- Lenovo ThinkEdge SE455 V3 performs even better in upper layers L3 and above, hence achieves greater potential for edge workloads as CU, UPF or other content, application services.

- Longer term, FP16/FP8 roadmap and other accelerator architecture revisions subject to even better results.

- It is further possible to co-locate multiple DUs or other services CU, UPF, content server, etc. due to great number of cores/threads per server from the Lenovo ThinkEdge SE455 V3.
Lenovo servers voted #1 9 Years in a row for reliability

thanks.