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Mavenir maximizes network energy efficiency with 4ᵗʰ Gen Intel® Xeon® scalable processors for 5G core UPF deployments

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Mavenir and Intel recently collaborated to take a step forward in enhancing network energy efficiency and sustainability for CSPs. By integrating the Intel® Infrastructure Power Manager for 5G Core with the 4th Gen Intel® Xeon® Scalable processors, this partnership promises to significantly reduce energy costs and carbon emissions, while upholding essential telco performance metrics.

Mavenir has furthered the advantage by optimizing the UPF performance using SmartNIC offload technology. This addition not only complements Intel's processor advancements but also improves the overall network power efficiency. Through this collaborative effort, Mavenir and Intel are delivering a solution that combines improved processor power savings with the added benefits of hardware offloading, offering CSPs a network that is both power-efficient and high-performing.

As a global leader, Intel® pushes the boundaries of what's possible with infrastructure power management optimized for 5G core networks. With dynamic power management, CSPs can aggressively cut power usage without compromising performance.

Since the UPF is in the path of processing all network data, it plays a vital role in the 5G network and the ability to realize the ambitious vision of supporting low latency and high throughput requirements. Mavenir's fully containerized and converged User Plane Function (UPF) is cloud-native, employs a low hardware footprint, features a highly optimized packet processing design and supports 2G, 3G, 4G and 5G technologies. With these remarkable abilities, it promises enhanced performance, higher efficiency, and superior scalability for CSPs.

Intel has long invested in technologies and practices that deliver breakthrough performance while leading the industry in energy efficiency and environmental stewardship, with some examples shown in Figure 1.

	Intel uses 90% renewable electricity for a lower carbon footprint.		Architecture and built-in accelerators increased perf/watt on workloads that matter
	Integrated AI for 4x perf/watt boost4 for AI inference workloads - TensorFlow		10x increase in energy efficiency by 2030 for client and server CPUs3
	Built-in telemetry and power management control per-core frequency and power consumption		Built with circular economy strategies for waste; 5% of total waste to landfill

Figure 1 Intel® Xeon® processors: Innovation for performance and sustainability [1]

Intel's 4th Generation Intel Xeon Scalable processors are specifically engineered to boost 5G UPF deployments with their advanced power efficiency by including an array of built-in acceleration that makes the processors more energy efficient. These network-optimized processors support more data per clock cycle and deliver highly granular control over power states and frequency (and therefore power consumption) at the per-core level. The platform introduces two new light sleep power states that improve the potential responsiveness of power-management software by enabling cores to recover full power more quickly. That reduced exit latency helps avoid delays in the packet processing execution pipeline that could otherwise manifest as dropped packets or other negative impacts on service quality.

Packet rate is strongly correlated with how the core is utilized to process that packet flow. Intel Infrastructure Power Manager for 5G Core tracks UPF worker core utilization at millisecond granularity, a level of detail enabling significant power reduction without impacting performance KPIs. Per core frequency can therefore be modulated in accordance with core utilization. Mavenir further incorporated hardware SmartNIC offload, presenting substantial fast path power-saving by decreasing the number of utilized cores. Mavenir has made significant investments in enhancing and refining SmartNIC offload to reach Full Flow Offloading, a critical feature for optimizing user plane performance. This technology utilizes capabilities of latest generation of NICs to offload the workload from processors to NICs. Mavenir can offload Receive Side Scaling (RSS), GTP encapsulation and decapsulation, QoS Enforcement Rules, Usage Recording Rules, Flow Aging tasks.

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[1] https://www.intel.com/content/www/us/en/wireless-network/core-network/infrastructure-power-manager-solution-brief.html

The testing setup is used for simulating a realistic Fixed Wireless Access (FWA) scenario to reach 100Gbps throughput by utilizing RAN simulators and Traffic Generators. Diagram (Figure 2) illustrating the test environment used, providing a visual overview of the setup, key components involved, and traffic model used in the testing process.
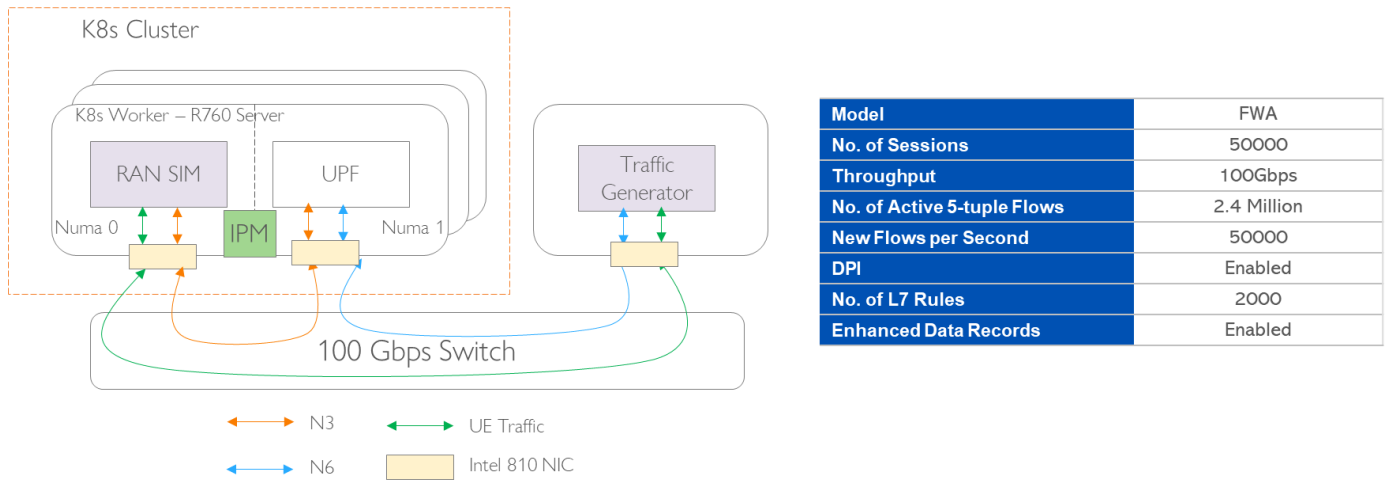

Model	FWA
No. of Sessions	50000
Throughput	100Gbps
No. of Active 5-tuple Flows	2.4 Million
New Flows per Second	50000
DPI	Enabled
No. of L7 Rules	2000
Enhanced Data Records	Enabled

Figure 2: Test setup configuration

The power-saving ratio is anticipated to vary according to the workload. Performance is assessed across three main scenarios: full load (100%), moderate load (50%), and idle load (5%) where load is presented as UPF capacity that is utilized. Power saving is measured by monitoring power consumption of fast path cores that are in use.

Mavenir has showcased that its UPF achieves a significant 40% power savings, even under the most demanding conditions, such as 100% traffic load. This achievement is largely attributed to Mavenir's utilization of Full Flow Offloading technology, which plays a pivotal role in power conservation during full-load scenarios. Additionally, Mavenir UPF leverages Intel Power Management functionality to further enhance power savings during 50% and idle load scenarios to reach up to 62%.

Mavenir and Intel continuously strive to bring together an ecosystem of expertise to ensure our customers get the most advanced and unbeatable technology.
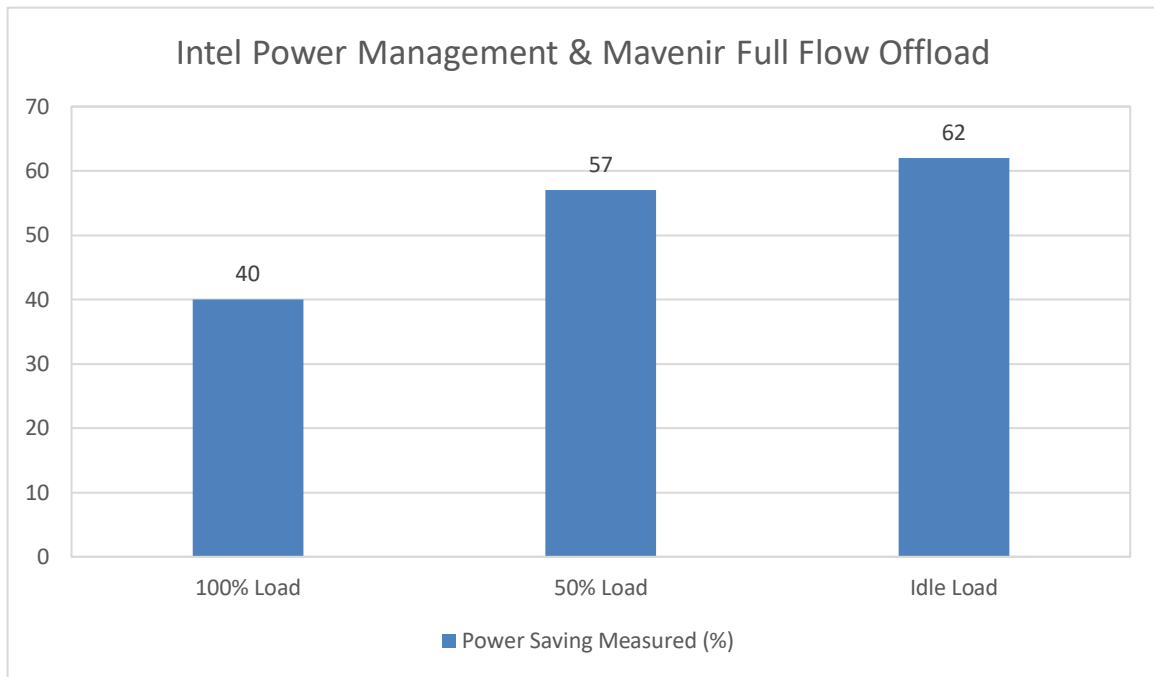
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Figure 1 : Mavenir UPF and 4th Gen Intel Xeon processor testing results

*Mavenir has achieved a significant milestone by integrating high-performance Intel processors optimized for 5G core networks and leveraging NIC offload technology for packet processing. This strategic combination of hardware enhancements and processor capabilities has led to a substantial **40% power savings** at full load.*

Conclusion

Mavenir and Intel are disrupting network efficiency and sustainability with their ultra-advanced User Plane Function (UPF) and 4th Gen Intel® Xeon® Scalable processors (Saphire Rapids).

By capitalizing on Intel's latest processors and integrating SmartNIC offload capabilities, Mavenir not only achieves significant power savings but also sets a new benchmark for UPF performance in 5G core network infrastructure. Mavenir's UPF is ingeniously designed to be hardware-agnostic. This foresight enables Mavenir to effortlessly embrace future advancements in NIC cards, processors, and other cutting-edge technologies.

By keeping up with technological advancements, especially with Intel's ongoing improvements in processor technology, Mavenir is well-positioned to stay ahead in the competition, ensuring high performance and efficiency in the fast-changing telecommunications sector.

About Mavenir

Mavenir is building the future of networks and pioneering advanced technology, focusing on the vision of a single, software-based automated network that runs on any cloud. As the industry's only end-to-end, cloud-native network software provider, Mavenir is transforming the way the world connects, accelerating software network transformation for 300+ Communications Service Providers in over 120 countries, which serve more than 50% of the world's subscribers.