Inventec

Inventec Data Center Solutions

K888G4 NFVi Forwarding Platform Solution -

Best NFVi and vRAN solution with optimized NFVi workload, verified by Intel® Select Solutions for NFVi Forwarding Platform

5G RAN/Core Evolving to Virtualization and openNESS with Edge Computing - NFV and Traffic Routing Matters

At the coming of 5G, the radio access network (RAN) and the core network are evolving to open infrastructures and software defined solutions. 5G communication technologies bring us the high security, ultra-wideband, ultra-low-latency, and the thrilling edge computing applications. All these solutions will be based on virtualized environments, running on plain servers, which indicates that the performance and optimization within the enclosure does matter.

All of the basic challenge of these new 5G communication technologies are based on virtualization infrastructure, aka NFVi, relating to routing and networking. It means the performance of internal routing within NFVi would be essential for optimized solutions.

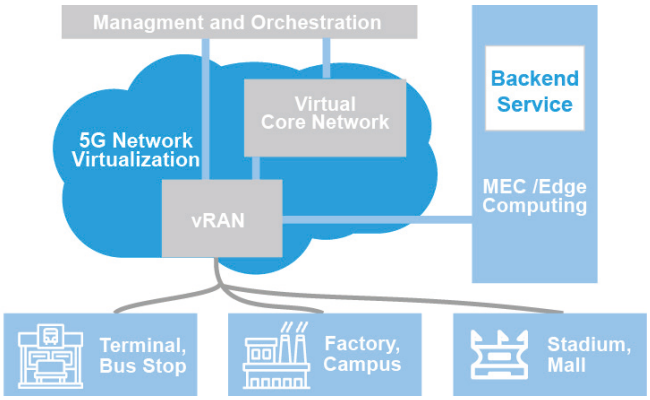

FIG1 vRAN at Open Mobile Edge Cloud

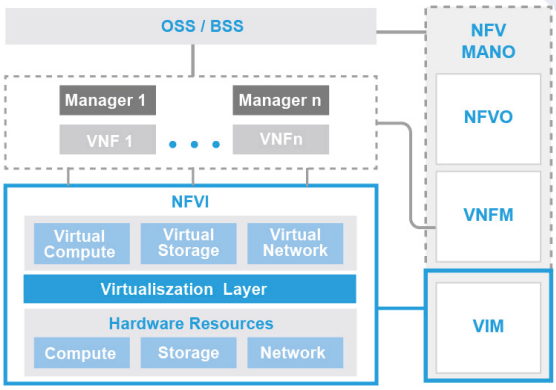

FIG 2: Example of NVFI Deployment

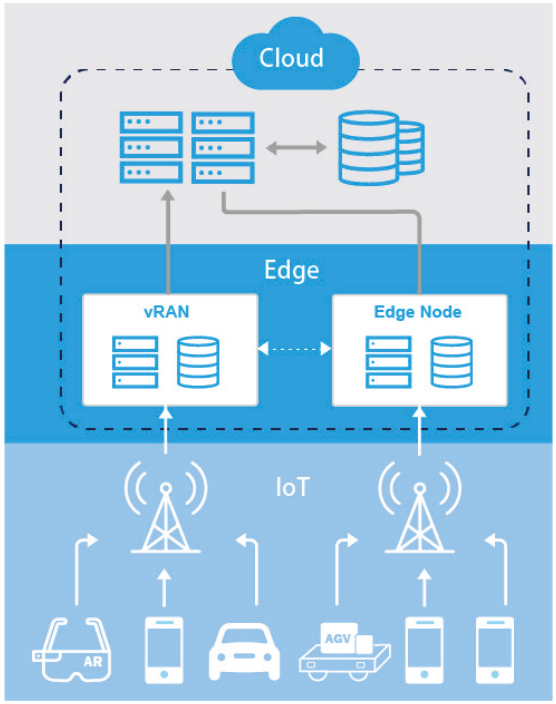

FIG 3: From Cloud, Edge, to IoT

NFVi Workload Optimized, IO Balanced, Network IO Maximized with NUMA - Intel Select Solutions For NFVi Forwarding Platform as Essence of Performance 5G Solutions

Intel® Select Solutions are a family of workload-optimized infrastructure solutions based on the Intel® Xeon® Scalable processor family, targeting today's complex workloads. Intel Select Solution NFVI FP is an enhanced NFVI solution for 4G or 5G core User Plane Functions (UPF), broadband use cases, such as virtual Broadband Network Gateway (vBNG), virtual Broadband Remote Access Server (vBRAS), Network Services such as virtual Evolved Packet Core (vEPC), IPSEC Gateway application, and cable use cases such as virtual Cable modem termination system (vCMTS) that have a great demand for high performance and throughput. Including all of the required resources to implement a software-defined multi-node infrastructure that is residing within each cloud server instance and controlled by the hypervisor, Intel Select Solutions for NFVI Forwarding Platform are defined in collaboration with Communication Service Provider and ecosystem partners to expose the value of an IO balanced architecture to maximize network IO throughput per NUMA (Non-Uniform Memory Access) node.

Inventec K888G4 NFVI FP Solution - Verified Intel® Select Solution for NFVI Forwarding Platform (FP)

Inventec Data Center Solutions (Inventec EBG), one of the key suppliers of world's leading server brands, hyper-scale data centers and server system integrators, announces its first 5G solution product based on 2U K888G4 server system, verified by Intel Select Solution for NFVi Forwarding Platform (NFVI- FP), called K888G4 NFVI Forwarding Platform Solution.

The K888G4 NFVI Forwarding Platform Solution is a Red Hat certified dual-socket 2U server system of 2nd Gen Intel Xeon Scalable Processors with optimized and balanced DDR and PCIe slots, applied with best-known-SKU (BKS) Intel components, to offer the best performance for

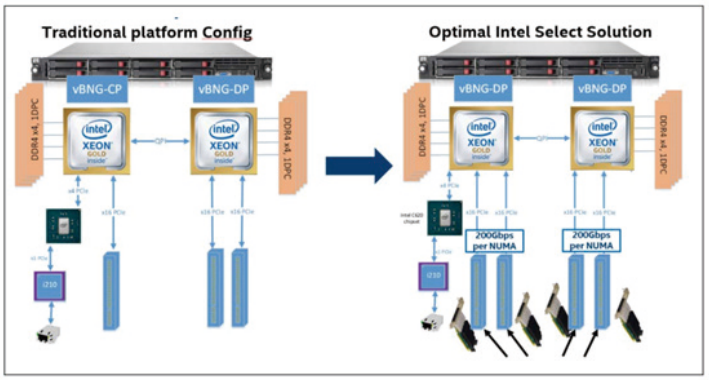

FIG 4: Traditional Platform Configurations vs. Optimal Balanced I/O Configuration (Resource: Intel)

the 5G network virtualization workloads, allowing quick and efficient deployments for Cloud and Communication Service Providers and a plenty of 5G SDN/NFV applications.

The K888G4 NFVI Forwarding Platform solutions was configured in two types, served as the controller node or cloud node(s), with provided software stacks.

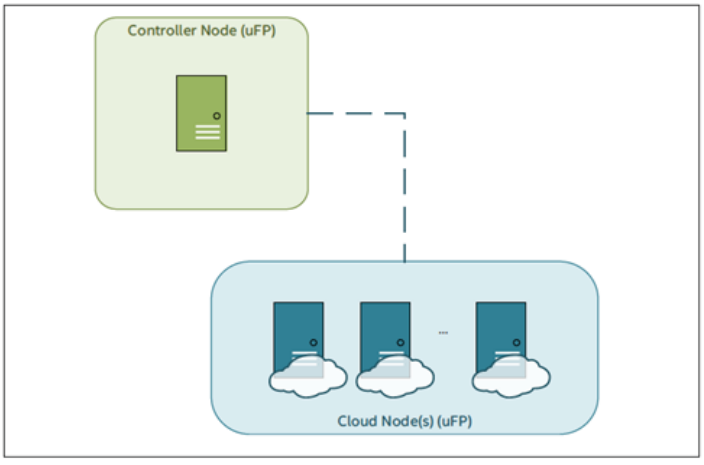

FIG 5. Intel® Select Solutions NFVI Forwarding Platform Environment (Resource: Intel)

TABLE 1 : Specification of K888G4 NFVI FP Solution

Model	K888G4 NFVI Fowarding Platform Solution	
Type	Cloud Node	Controller Node
Form Factor	2U1N rack mount with slide rail	
Processor	Dual Socket; Intel® Gen2 Xeon® Processors	
	Gold 6230	Gold 5218
Memory	12x 32GB DDR4 DIMM @2666MHz	
Chipset	Intel® C620 series (C622) Supporting 10GbE	
Network Controller	**Onboard:** Dual 10G SFP+	
	4x Intel Ethernet Network Adapter XXV710-DA2 Dual port 25 GbE	2x Intel Ethernet Network Adapter XXV710-DA2 Dual port 25 GbE
Storage	2x Intel S4510 SSD @3.8TB	2x Intel S4510 SSD @480GB
System Management	IPMI 2.0 compliant + KVM with Dedicated LAN	
Power Supply	800W (110V) Platinum 1+1 redundancy	
Fan	6x 6038 hot-swap fan 5+1 redundancy	

TABLE 2: Software and Firmware Setting of K888G4 NFVI FP Solution

	Ingredient	SW Version Details	
Firmware	BIOS MCU	SE5C620.86B. 0X.02.0040.060420190144	
	FV25 NIC FW	Release Date June 04 2019 0x5000026	
Host	OS	v6.02 or later	
	Hypervisor Libvirt	Red Hat Enterprise Linux	RHEL7.6-kernel-3.10.0-
		957.21.3.el7.x86_64	
	Docker	KVM/QEMU	2.12.0
	APPs	Libvirt	4.5.0
	Drivers	docker	Version 18.09.7, build 2d0083d
		DPDK	18.11, 19.02
Guest	APPs	I40e	2.3.2-k
	OS	NVMe	1.0
		DPDK	18.11, 19.02
		Ubuntu	18.04LTS
	Drivers	Red Hat* Enterprise Linux	7.6
		CentOS	7.6
		I40evf	3.2.2-k

Excellent Throughput and Power Consumption for Complicated 5G vRAN/NFVs Deployment - The Ultimate Result of Performance Stress on K888G4 NFVI FP Solution

In Intel Select NFVi-FP performance test, a vBNG service chain with traffic generator is set up on the K888G4 system to mimic some behaviors in a vBNG. The idea is to generate internal traffic and CPU load in the performance test while most NFVi platforms are expected to do network functions. The vBNG is deployed as below:

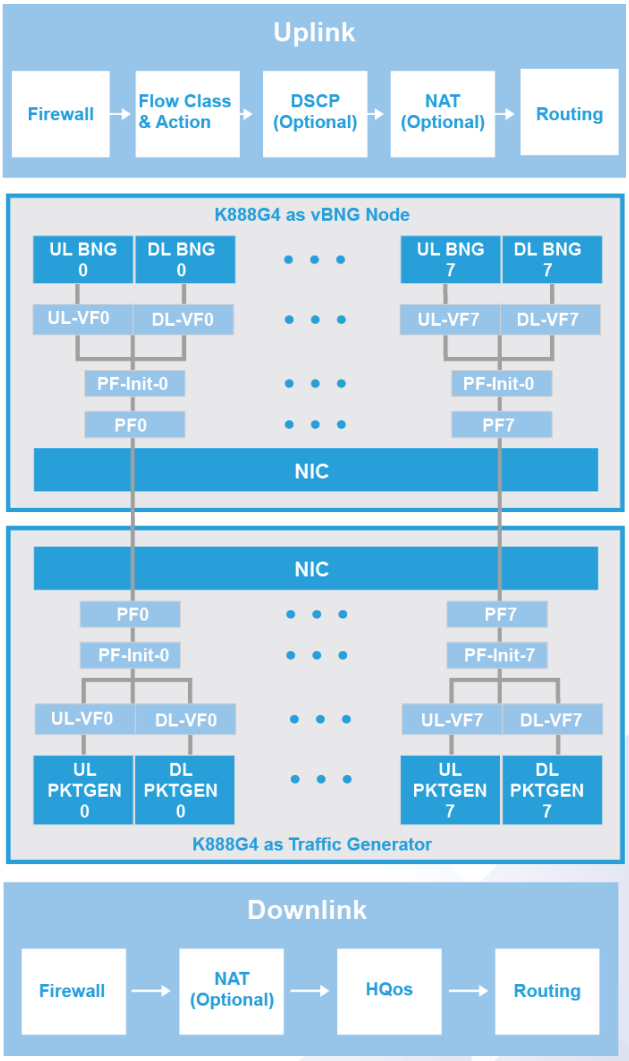

FIG 6: vBNG Testing Environment

To meet with the optimized deterministic performance requirements of Intel Select Solutions for NFVI Forwarding Platform, the following BIOS settings table provides a guidance for maximizing deterministic performance with Intel turbo mode disabled, C-State disabled, and P-State disabled.

TABLE 3: BIOS Settings of K888G4 NFVI Forwarding Platform Solution

Menu (Advanced)	Path to BIOS Setting	BIOS Setting	Settings for Deterministic Performance (Turbo Disabled)
Power Configuration	CPU P State Control	EIST PSD Function	HW_ALL
		Boot Performance Mode	Max. Performance
		Energy Efficient Turbo	Disable
		Turbo Mode	Disable
		Intel® SpeedStep® (P-States) Technology	Disable
	Hardware PM State Control	Hardware P-States	Disable
	CPU C State Control	Autonomous Core C-State	Disable
		CPU C6 Report	Disable
		Enhanced Halt State (C1E)	Disable
	Energy Perf Bias	Power Performance Tuning	BIOS Controls EPB
		ENERGY_PERF_BIAS_CFG Mode	Perf
	Package C State Control	Package C State	C0/C1 State
Intel® Ultra Path Interconnect (Intel® UPI) Configuration	Intel® UPI General Configuration	LINK L0P ENABLE	Disable
		LINK L1 ENABLE	Disable
		SNC	Disable
Memory Configuration		Enforce POR	Disable
		IMC Interleaving	2-Way Interleave
		Volatile Memory Mode	2 LM mode
Platform Configuration	Miscellaneous Configuration	Serial Debug Message Level	Minimum
	PCI Express Configuration	PCIe ASPM Support	Per Port
Uncore	Uncore Frequency Scaling		Disable

When stressing vBNG networking traffic up to 172Gbps each instance at 3 cores (an instance utilizes 1 core per UL and 2 core per DL) with total power consumption under 430W, the performance details are as below chart:

TABLE 4: Overall Throughput with Overall Server Power for NFVI-FP Base configuration when Intel® Turbo Boost Technology Disabled

Config	Number of vBNG Instance	Overall Throughput (Gbps)	Theoretical Throughput (Gbps)	Overall Server Power (W)	Overall Throughput/ Theoretical Throughput
Base – Turbo Disabled	1	24.5	25	328	98%
	2	42.8	50	320	86%
	3	65.2	75	344	87%
	4	72.8	100	344	73%
	5	97.1	125	344	78%
	6	124.9	150	352	83%
	7	151.5	175	352	87%
	8	172.8	200	360	86%

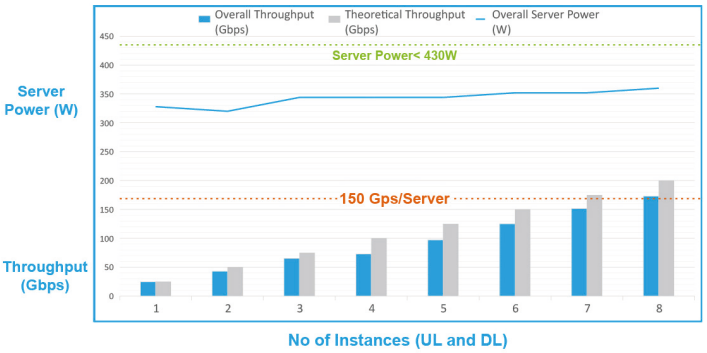

FIG 7: Overall Throughput with Overall Server Power for NFVI-FP Base configuration when Intel® Turbo Boost Technology Disabled

In the setting, eight 25Gb ports in a single K888G4 was configured to imply the theoretical 200Gbps total throughput. With the optimized configuration, the system reached over 85% line-rate with service chain on dedicated 24 cores of 8 instances in total, while power consumption was aggressively under 360W. That reflects an excellent throughput with well-balanced composition and reasonable power consumption. This also shows a good baseline of how to deploy complicated 5G vRAN/NVFs with excellent throughput and power consumption.

Inventec

Inventec Data Center Solutions

Enriched Virtualized Networking Product Portfolio, Remarking Inventec's Growing Engineering Capacity and Promising Engagements in the 5G Ecosystem

Inventec firstly revealed its plan to join Intel Select Solutions for NFVi FP at 5G World Congress 2019, held in Singapore; now the product has been thoroughly verified and brought to Cloud and Telecommunication customers in 5G world. Till recently, Inventec also adds to K888G4 series a new family member as a verified Intel Select Solution for NFVI product.

"The Intel Select Solutions for NFVI and NFVI Forwarding Platform will enrich the virtualized networking product portfolio of Inventec communications solutions. It also remarks the growing capability of Inventec in engineering complexity to provide solution-level products that reflects our passion to join the 5G Ecosystem and make contributions." said Evan Chien, Senior Director, Cloud and Communications Solution at Inventec.

Inventec will also provide customers with multiple choices for the edge computing, like GPU boxes for AI acceleration, and storages for CDN. For all products, they can be seamlessly integrated with Inventec vRAN solution. 5G ecosystem is becoming more and more open and virtualized. The vRAN and MEC edge computing will take a significant share of today's wireless communication market. 5G comes with high security, wide bandwidth, and ultra-low latency, making it the best solution in mission critical domains, like smart factories, smart stadiums, vehicle to vehicle, AR/VR extended applications, etc. Many of these applications are based on open source and requiring edge computing. Open Network Edge Services Software (OpenNESS) and virtualization will help the vRAN and edge computing ecosystem becoming more flexible and elastic.

About Inventec Data Center Solutions

Inventec Data Center solutions are delivered by Inventec Enterprise Business Group (EBG), focusing on providing the best solutions for compute intensive industries in mega data centers, including internet and telecom operators. Since its inception in 1998, the advancing server hardware design and manufacturing capabilities have been trusted by customers such as the world's leading server brands, hyperscale data centers and server hardware integrators.

Learn More

Inventec K888G4:
https://ebg.inventec.com/en/product/Server/2U/K888G4
Intel® Select Solutions:
https://builders.intel.com/intelselectsolutions
Intel® Xeon® D processor Family:
http://www.intel.com/xeond

intel select solution

Intel® Select Solutions are supported by the Intel Builders Program:
https://builders.intel.com

Inventec Corporation (TAO)
No.88, Dazhi Rd., Taoyuan Dist.,
Taoyuan City 33068, Taiwan
Tel: 886-3-390-0000
Fax: 886-3-376-2370
Email: TAOproductsupport@inventec.com
Website: EBG.Inventec.com
Linkedin: www.linkedin.com/company/inventec-data-center-solutions