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Backgrounder

Intel Powering the Global Network

The telecommunications industry is in a period of transformational change. Internet traffic is growing at a fast rate as billions of people and intelligent, connected systems come online and demand more bandwidth. The number of networked devices is expected to be double the world's population by 2015.[1] The growth in network traffic and bandwidth complexity puts a tremendous strain on the network and requires a massive change in the way the industry designs and delivers communications infrastructure solutions.

Video and other data-intensive applications are pushing the limits of such current bandwidth trends as voice over IP (VoIP), flat-rate pricing, and market entry of strong non-telco brands such as Apple*, Google* and Microsoft* are pushing service providers to develop new competitive advantages.

The demands placed on the network are significant, as are the investments required to provide the capacity growth to keep pace. With so much growth in demand, service providers today have an opportunity to expand operations with new scalable services. It is estimated to be worth more than $200 billion in incremental revenue worldwide by 2015. But their traditional mechanisms for growth, such as multi-year investments and multi-billion dollar build-outs, are unsustainable.

Opportunities and Challenges for Telecom Industry

- Data usage is outpacing voice services. The next wave of revenue will come from new services and devices, such as application storefronts, intelligent consumer electronics, and machine-to-machine (M2M) services. Service providers need an infrastructure that enables ability to quickly and efficiently add new kinds of services as well as monetize them.
- Video and other data-intensive content and applications are emerging as key demand drivers for consumer bandwidth. Service providers need to not only embrace new devices, but also find ways to support the dramatic increases in network traffic associated with those user demands.
- The field of telecommunications players is expanding. By designing networks for high-energy efficiency and low intervention, service providers can minimize the day-to-day cost of running equipment, freeing up resources to pursue exciting new opportunities that will differentiate and help set them apart.

As a result, service providers must embrace new revenue models while increasing the efficiency of existing ones. They must build flexible infrastructures for a broad array of content and data services aimed at smarter end-user devices.

Preparing the Network of the Future

As telecom service providers upgrade their networks to meet new demands, Intel is providing solutions to further streamline network operations onto one common architecture. Intel's four-to-one workload consolidation strategy will enable Intel® architecture to handle these types of workloads:

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- **Application processing** is typically done on standard servers today.
- **Control plane processing** on Intel architecture is commonplace. With routing tables becoming larger and more complex, the large caches and high performance cores of Intel® Xeon® processors converge on route table updates quickly.
- **Data plane processing** on Intel architecture is enabled using optimization techniques developed over several years at Intel. Developers can access these tools from the Intel® Dataplane Development Kit (Intel® DPDK).
- **Signal processing** on Intel architecture is enabled using the Intel® Signal Processing Development Kit (Intel® SPDK).

A software-based approach yields more benefits with Intel's four-to-one workload consolidation strategy. It creates a framework that enables an Intel-based platform to execute four workloads simultaneously on a basic networking element, such as a wireless base station. Intel® Xeon® processors can achieve this high level of consolidation through industry-leading performance, I/O throughput and performance per watt density – all on a standards-based platform.

Centralized Approach with C-RAN

Cloud Radio Access Network (C-RAN) is a possible solution to the network bandwidth problem. The C-RAN architecture combines collaborative radio and real-time cloud infrastructure with a centralized general purpose processing solution to enable the network to respond dynamically on demand. C-RANs can provide significant cost advantages in the areas of network energy consumption, construction (CAPEX) and operations (OPEX).

This network architecture moves the communications signal processing back into a centrally located, virtualized based station, referred to as the baseband (BBU) unit pool. As a result, cell-sites are only responsible for radio transmission, thus they primarily consist of remote radio heads (RRHs) and antennas. The virtualized servers perform baseband processing for high numbers of cell sites, for example thousands in a large datacenter. These cell sites are pooled resources and have the intelligence needed to support such additional services, as Content Distribution Network (CDN), Distributed Service Network (DSN), and deep packet inspection (DPI). C-RANs can provide significant cost advantages in the areas of network energy consumption, construction (CAPEX) and operations (OPEX). Intel has been working on a Cloud-RAN proof of concept with China Mobile. Together, they developed a C-RAN prototype running on Intel Xeon processor-based servers processing TD-LTE signals.

Small Cell Technology

Another solution to network bandwidth issues is Small Cell technology. Combining Intel architecture and small cell radio technology, this low-cost device can be deployed in commercial settings that work in tandem with wireless cell towers to provide improved coverage. A commercial setting such as a shopping mall with weak indoor signal or a sports arena that requires video replays to a large number of users would be ideal locations to deploy small cell technology.

To test the concept of an intelligent small cell in a live environment, Intel worked with Edge Datacomm* to deploy small cells on trains in the town of Kenilworth, England. Data was

collected over a 25-day period and trial results show that an average of 200 users accessed the network in any one day. On average users transmitted and received 22 megabytes of data per day. In this trial, the total backhaul was reduced by over 45 percent, and the operator reported a 22 percent savings in operating expenditure (OPEX).

Wireless network architectures will continue to evolve. The next phase of evolution is adding intelligence to access points in order to run applications at the network edge. These new architectures have a significant impact on service providers, total cost of ownership, and their return on investment.

Today, Intel has all the components that are necessary for service providers to transition to an intelligent access point and deliver applications at the network edge. Components include a scalable Intel architecture and host CPU to support deployments from small residential cells to large macro cells, standard interfaces and connectors to enable easy expansion of the platform, and in base-station storage for significant data content edge catching. Intel also provides extensive on-board memory for handling millions of computations, and an open platform to run value-added services and functions at the base station. Intel is working with several major service providers and other industry collaborators to implement cloud-based radio access networks.

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The worldwide trend toward ubiquitous connectivity is the primary driver in the telecom industry right now, creating the services spiral and fueling demand for more flexible, intelligent network infrastructure. Intel recognizes the challenges and opportunities facing the telecommunications industry driven by exploding growth in connections and data traffic and aims to deploy more intelligence in the network. For more information, visit the Intel Intelligent Systems at: www.intel.com/newsroom/embedded.

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[1,2] Sources: Cisco* VNI 2011, Informa Internet Traffic and Service Forecasts 2010 – 2015, IDC Wireless Bandwidth Research 2011, SMART technologies Research 2011