WHITE PAPER
Intel Embedded and Communications Group
Service Provider Enablement

Endless Possibilities for the Future of Communications

Standards-based Intel® Architecture Lays the Foundation for Service Provider Innovation

As the shifting business landscape brings new challenges and opportunities to communications service providers, the strategic application of technology becomes even more crucial to success. Intel's continuing commitment to innovation in areas such as standards-based architecture, virtualization, and energy-efficient performance helps service providers meet emerging challenges head-on.

OVERVIEW AND EXECUTIVE SUMMARY

The telecommunications industry is on the cusp of another period of explosive growth. Over the next decade, billions of new devices will connect to the global internetwork, and data volumes will expand geometrically. A host of players—from traditional telecommunications service providers to video and web service vendors—are both driving this growth and seeking to benefit from it.

In this environment, service providers have an unprecedented opportunity to expand operations with new scalable services. But to do so, they must build flexible infrastructures for a broad array of content and data services aimed at smarter end-user devices. Intel's scalable, dependable, and coherent architecture helps service providers quickly and cost-effectively support service offerings that counter competitive threats and meet changing marketplace demands with low TCO.

This paper provides an overview of how Intel® technologies can help service providers increase average revenue per user (ARPU) and address network capacity issues, while managing costs.

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Maximizing Competitive Advantage in the Communications Industry

An exciting new world of connectivity is here. Video and other data-intensive applications are pushing the limits of current bandwidth, while trends such as voice over IP (VoIP), flat-rate pricing, and market entry by strong non-telco brands (for example; Apple*, Google*, and Microsoft*) are pushing service providers to develop new ways of driving competitive advantage. At the same time, customer expectations have evolved to include personalized experiences that are consistent across multiple devices. In this environment of rapid, unpredictable change, service providers are finding that their traditional mechanisms for growth, such as multi-year investments and multi-billion dollar build-outs, are unsustainable.

To remain competitive, service providers must embrace new revenue models while increasing the efficiency of existing ones. As voice and data services become more and more commoditized, service providers must seek out innovative ways to increase ARPU, cost-efficiently increase bandwidth, and minimize costs.

Opportunities for New Revenue

Traditionally, voice services have accounted for the majority of service provider revenues. However, these services are experiencing a slowdown in growth, while data usage is rapidly increasing. 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.

Connected Devices

A single target platform is the basis for everything from smartphones to intelligent signage

Core Infrastructure, Network Computing, and Cloud

- Outstanding cost-performance and the robust x86 ecosystem support high ARPU and deliver rapid ROI
- General-purpose servers deliver superior cost and flexibility compared to specialized hardware

Worldwide Ecosystem

Deep relationships and collaboration help optimize building block interoperation and performance

Figure 1. Standards-based Intel® architecture enables opportunities for service providers across solution areas.

To take advantage of these opportunities and drive competitive advantage, service providers need an infrastructure that enables them to not only quickly and efficiently add new kinds of services, but also be able to monetize them. An investment in standards-based architecture will support service provider growth and innovation now and into the future.

Opportunities to Better Utilize Resources to Meet Bandwidth Demands

As the mobile market matures, 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 devices.

In today's environment of rapid change, service providers can no longer wait for—or count on—return on large investments, such as new towers. To remain sustainable, service providers must better utilize existing resources to support as many customers and as much content as possible.

Opportunities to Manage Operating Expenses and Capital Expenditures

As competition increases and the field of telecommunications players expands, the ability to invest in new technologies will be a crucial indicator of success. 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 set them apart.

Intel Provides Agile Solutions for Service Providers

Intel is a premier provider of open-architecture technology building blocks that can be provisioned for a broad range of communications workloads and applications. This standards-based approach to system design provides fast time-to-market and a consistent and flexible architecture that can be deployed across the wireless infrastructure network in everything from client devices to core network elements (Figure 1).

The combination of standards-based architecture with energy-efficient performance makes Intel® processor-based platforms and devices the logical choice for service providers seeking to enhance revenues and manage costs.

A Flexible Platform Is Key to Increasing ARPU

The rapidly increasing availability of broadband—in particular, mobile broadband—and the proliferation of smart, connected devices are generating endless possibilities for new revenue streams, from monetizing services to monetizing the level of service. To take advantage of these opportunities, service providers need the agility to build new services on demand, test them quickly, and then deploy them widely.

Service providers can achieve this agility by moving to standards-based Intel® architecture and a software configuration model. They must also position applications and usage models for the cloud, drawing on ecosystem best practices to maximize future agility and provide capacity on demand.

General-Purpose Intel® Processor-based Hardware Maximizes Scalability

Today's telecommunications environments tend to be complex, heterogeneous collections of special-purpose hardware and legacy systems, which are costly and difficult to maintain and expensive to upgrade. Moreover these systems lack the flexibility necessary to respond to the rapidly changing demands of today's customers. By replacing special-purpose equipment with general-purpose Intel® processor-based hardware, service providers can create and deploy new services more quickly and cost effectively.

Platforms based on Intel architecture give service providers the means to ensure top performance, including the ability to:

- **Move quickly with new offerings**. With high-performance, general-purpose hardware, service providers can deploy new services without having to build dedicated infrastructure.
- **Attain interoperability**. By using standards-based Intel architecture, service providers can use a variety of suppliers from the large Intel ecosystem to more easily acquire and deploy solutions.
- **Reap the benefits of flexibility**. General-purpose Intel processor-based servers can easily be re-provisioned for new implementations, allowing ongoing savings in both capital expense and operating costs.

Software-based Services Minimize Development Costs and Timelines

Most telecommunications networks today have been built from specific, complex hardware and software elements, each designed for the workloads and capabilities required. Each new network standard increases the complexity of the system, along with the costs to develop and maintain it.

Intel is working with innovators in the industry to deploy these network functions in software. This transition can be thought of as a transformation from "telco to softco," where all network functionality is encapsulated in modular software components that can be deployed flexibly as needed (Figure 2). The adoption of standards-based hardware is an essential first step toward making this switch.The softco model is particularly well suited to cloud computing, where capacity can be metered on a utility-like basis from an internally managed private cloud, leased space on a public cloud, or a combination of both.

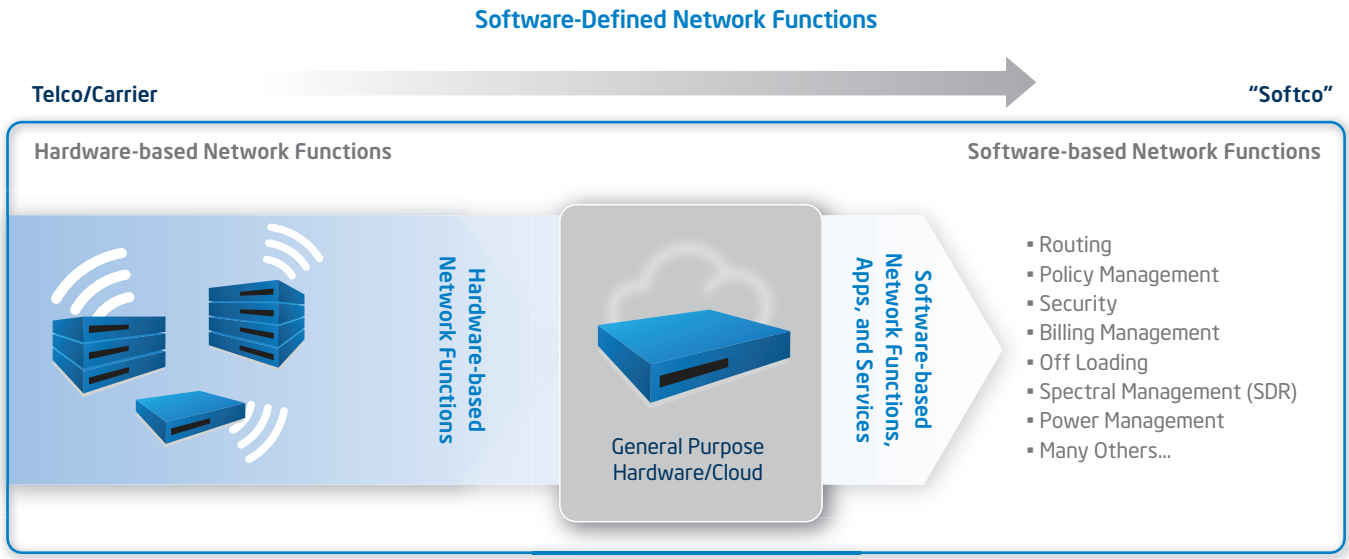

Figure 2. The transition to software-based services positions service providers for greater flexibility and agility.

The benefits of software-based services include:

- **Lower capital expenses**. Service providers can build out new product offerings without risky purchases of dedicated equipment, achieving a cost savings of 30 percent or higher.[1]
- **Scalability**. Because all Intel processors use the same code base, service providers can design software once and cost-effectively scale it across multiple systems.
- **Faster time to revenue**. Software services are significantly faster to develop, test, and deploy—so service providers can enjoy a return on investment sooner.
- **Preparation for increased cloud adoption**. Because software-based services are easier to develop and deploy, service providers can focus more resources on architecting applications to operate in the cloud, with a particular eye toward mobile computing applications.
- **Future-proofing**. Because Intel processor-based hardware is based on standards, software written for it can be migrated to the hardware and devices of tomorrow.

Flexible, Scalable Architecture Lays the Foundation for New Revenue Opportunities

The adoption of general-purpose Intel processor-based hardware and a software configuration model gives service providers the flexibility and freedom to pursue new opportunities for revenue and improve customer satisfaction.

Here are just some of the exciting revenue opportunities this model makes available to service providers:

- **M2M services**. The world of M2M communications is still largely untapped and offers service providers numerous opportunities to add value beyond bandwidth. Service providers can monetize services related to managing energy and security in the home, remote management of intelligent digital signage, the connected car, and more.
- **Premium offerings**. Rich media-based communications, such as video telephony, benefit from guaranteed levels of service quality, latency, and throughput. By defining and managing end-to-end service delivery, service providers can monetize service quality. For instance, a service provider could offer enterprise customers guaranteed throughput and latencies, for a price.
- **Network intelligence**. Service providers have a lot of information about subscribers, from their current locations to their usage habits. This intelligence can be rendered anonymous and then sold to interested parties. For example, a service provider could use network hand-over information to determine the speed of travel on roads and highways, and then provide this data, in real-time, to a navigation company.

Virtualization Can Address Network Capacity Issues

The pursuit of new services carries with it the specter of increased network traffic. Intel® platforms feature Intel® Virtualization Technology (Intel® VT), which uses unique hardware-assist features to offload the amount of processing that must be done in software, driving up consolidation ratios and throughput. As a result, service providers can support larger workloads with less equipment, for a better overall cost-benefit profile. Intel VT also helps enable service providers to repurpose equipment rather than have to make new capital purchases.

Virtualization offers service providers a number of opportunities to meet increased bandwidth demands:

- **Target resources to capacity**. New towers cannot be built quickly or cheaply enough to address new usage patterns. At the same time, existing towers continue to be dramatically underutilized during non-peak hours. Intel VT allows service providers to centralize processing and then deploy it on-demand in a targeted way.
- **Exploit existing assets to provide more flexible access**. Legacy OSs and applications are used across the telecommunications industry. These systems have an extensive repository of code that cannot be replaced or easily rewritten for today's newer high-performance platforms. Intel processor-based servers with Intel VT can emulate the legacy environment, enabling consolidation of OSs and applications onto newer platforms while improving system performance.
- **Manage traffic through edge caching**. With the popularity of social networking, the amount of duplicate content is staggering. The use of Intel processor-based servers with Intel VT gives service providers the raw processing power needed for processor-intensive solutions, such as edge caching. As an additional benefit, using virtualization is more cost efficient than adding hardware, helping free up the budget to move more processing to the edge of the network and give customers faster and higher-quality service.

ALCATEL-LUCENT* SEES PERFORMANCE JUMP WITH INTEL® TECHNOLOGY

Alcatel-Lucent* obtained a 15x performance boost over their previous single-core platforms using new servers based on the Intel® Xeon® processor 5600 series.[2]

Intel Leadership Drives High Quality and Manageable Costs

Intel's consistent technology leadership and its commitment to standards, interoperability, and energy-efficient performance enable service providers to reduce capital expenditures and lower day-to-day costs. Moreover, the software tools, extensive ecosystem, and predictable performance improvement from generation to generation of Intel technology gives service providers a reliable framework on which to build and evolve their operations.

Intel® Technologies Are Engineered for Maximum Lifetime Value

The use of Intel VT not only helps reduce the number of towers service providers must provision, but it also helps reduce the number of devices providers must support and the footprint of those devices, resulting in day-to-day cost savings. In addition, with Intel® Active Management Technology (Intel® AMT), service providers can perform more management tasks remotely, reducing support costs and increasing the value of their offerings. For example, service providers can perform remote administration of devices, even if they are powered down or have a missing OS.

Intel Technologies Deliver Significant Power Savings

The latest Intel platforms feature Intel® Intelligent Power Technology, which enables systems to deliver high performance per watt and adjust power consumption through load-based dynamic performance allocation, a major benefit to base stations where the cell site itself contributes the bulk of the power load. In addition, general-purpose Intel processor-based hardware with Intel VT uses less floor space than legacy systems, resulting in less power being dissipated. As a result, service providers can create the right balance of performance and power dissipation for them.

A Worldwide Ecosystem Gives Service Providers More Choices

Intel is aligned with hundreds of hardware makers, software developers, and system integrators worldwide in an ecosystem that stretches across the technology industry, as illustrated in Figure 3.

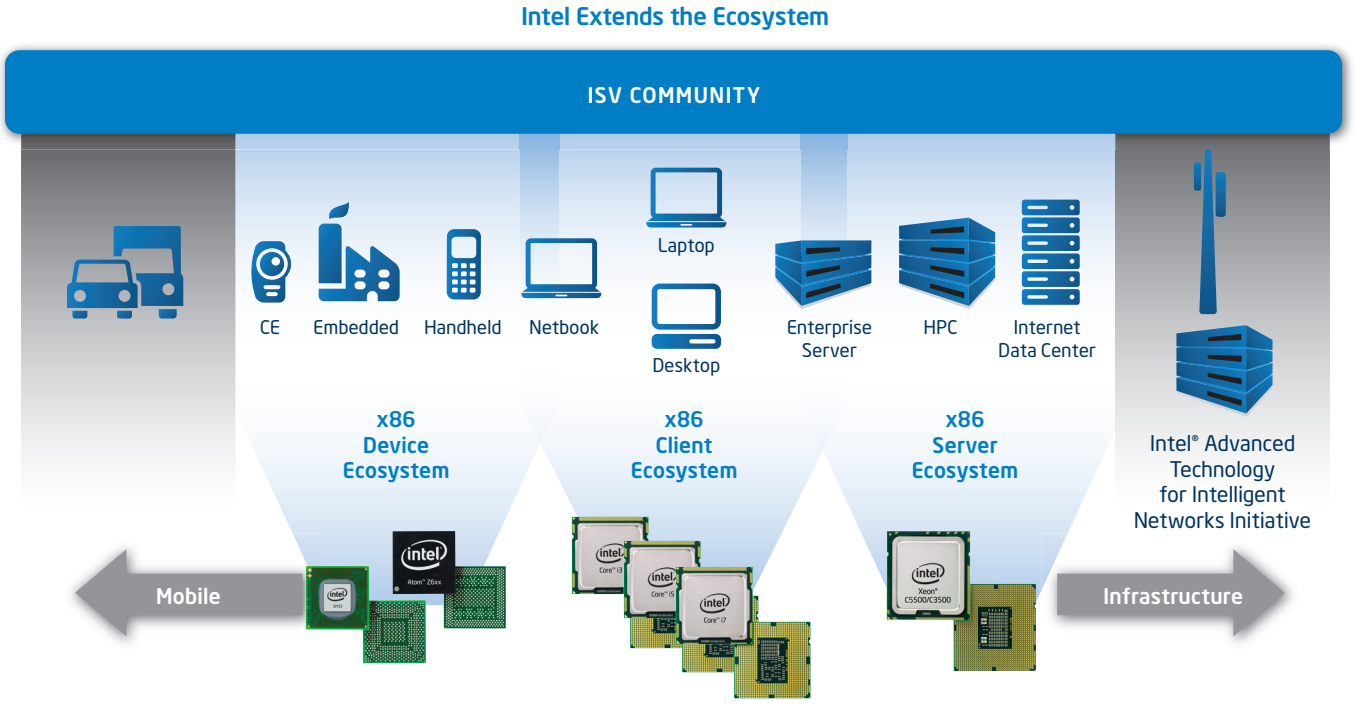

Figure 3. Intel's work with thought leaders enables an extensive ecosystem of optimized hardware and building block.

This ecosystem offers service providers a number of benefits, including:

- **Collaborative enablement**. Ongoing engineering relationships between Intel and other companies help ensure high performance and interoperability among communications building blocks.
- **A world of choice**. Because Intel architecture is standards-based, service providers can choose hardware and software building blocks from a large number of suppliers.
- **Leading-edge solutions**. Intel partners get early access to roadmaps, test platforms, and design support. This helps them innovate with the latest technologies to give service providers first-in-market solutions they can use to stay ahead of the competition.

ERICSSON* SIGNIFICANTLY REDUCES RESOURCE REQUIREMENTS USING INTEL® TECHNOLOGY

Ericsson* achieved approximately a 90 percent reduction in footprint and power requirements for its Mobile Switching Center Server (MSC-S), which provides high-capacity switching control in mobile circuit core networks, using servers based on the Intel® Xeon® processor 5600 series.[2]

Conclusion

The telecommunications industry is at an inflection point. The age of complex, multi-architectural equipment design is over. The road ahead is filled with exciting possibilities, but only the most agile and innovative players will succeed. By moving to standards-based Intel architecture and a software configuration model, service providers will gain the flexibility and scalability to quickly and efficiently develop new revenue streams, such as M2M services and network intelligence. More importantly, this move gives service providers the tools to address the rapid changes in customer behavior and expectations that are now the norm.

Learn more about the Intel Embedded and Communications Group:

www.intel.com/embedded

[1] Based on Intel benchmarks taken in mid-2010 in Arizona.

[2] Mats Karlsson, the vice president of Ericsson's Corporate Technology Office, publicly talked about standardizing on Intel® architecture for telecom for both reliability and maximum performance/watt/inch (Intel Developer Forum, Beijing , 2010, on-stage with Dadi Perlmutter). For example, using the Intel® Xeon® processor 5600, Ericsson saw a 90-percent reduction in footprint and power over its previous architecture, in applications such as its Mobile Switching Center Server. Similarly, Alcatel Lucent used the Intel Xeon processor 5600 and saw a 15x performance increase over its previous single-core architecture.

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