SPECIAL

HIGH-END EMBEDDED COMPUTING

Carrier Grade Linux: The cornerstone of telecoms' COTS strategy

By Glenn Seiler

The telecommunications industry is in a state of profound change and is now beginning its long rebound from the burst of 2001. The industry is finally starting to see significant consumer demand for 24x7 accessibility to multimedia-based high bandwidth services. Of course consumers want these new services for less than they used to pay for standard voice service. This demand is driving the rapid growth of Next Generation Networks (NGNs) and thus provides opportunity for increased revenues and market share, if the service providers can react to the market. But this increased opportunity is also causing the emergence of new competitors to service these markets. These new competitors do not have the large inventories and cost structures that were created prior to the burst. Service providers are faced with the challenge of providing new services while continuing to reduce capital and operation expenses. These service providers must find cost-effective methods to drive down costs and get higher margins in return for their services.

Convergence and transformation

This change is having a far-reaching impact on the entire supply chain of ISVs and operating system suppliers, semiconductor and hardware component vendors, and most importantly the Network Equipment Providers (NEPs). NEPs can no longer afford to develop entire solutions in-house and must focus their resources on the development of new value-added services. A key strategy to drive down and manage costs is to develop systems for new markets using common Commercial Off-the-Shelf (COTS) components for software and hardware. These COTS components are transforming the telecommunications industry just as they did for the enterprise and IT industries in the 1990s when volume-based x86 servers running UNIX and later Linux began replacing single-vendor proprietary hardware and OS solutions.

In fact, the convergence of application services and network infrastructure applications is one of the key forces driving telecom COTS ecosystem growth. For a long time the telecom industry has been using proprietary hardware solutions with proprietary real-time carrier grade operating systems, often built in house, and in-house high availability and management solutions for their network infrastructures. At the same time they often use commercially available IT or enterprise-based solutions for application services such as BSS and OSS. But now commercially available Carrier Grade Linux-based systems offer the real-time support and high reliability the network infrastructure requires. These Carrier Grade Linux systems combined with advances in commodity processor and hardware technology are driving COTS into the previous proprietary network infrastructure. By leveraging the benefits of these COTS components many NEPs are now developing a *universal platform* comprised of COTS components that support both application services and traditional network infrastructure services in a single cost-effective platform. NEPs can now use commercially available common components to replace much of the in-house R&D development for both hardware and software, creating significant savings. This drives the creation of standardized hardware solutions such as AdvancedTCA packaged with carrier grade operating systems and third party high availability solutions. This trend is shown in Figure 1.

In particular, it is the NEPs and their customers, the service providers, who are driving this trend. They have the most to gain from a healthy ecosystem of both open source and proprietary COTS building block components. The benefits of using open source platforms such as Linux can help companies build security-rich, flexible, and scalable infrastructures, achieving levels of cost and time efficiencies crucial to accelerating development processes and speeding time to market. And the reuse of high-volume COTS components, which has long been a trend in enterprise, is now something the NEPs and service providers can leverage as more standardized COTS components designed for telecom are becoming available.

Key drivers

Let's look more closely at some of the key drivers for NEPs who are considering developing NGN solutions using COTS building blocks. What needs do these companies face that make them look for solutions that use building blocks from one or more vendors rather than build their own? The key drivers can be categorized into three distinct pressure points:

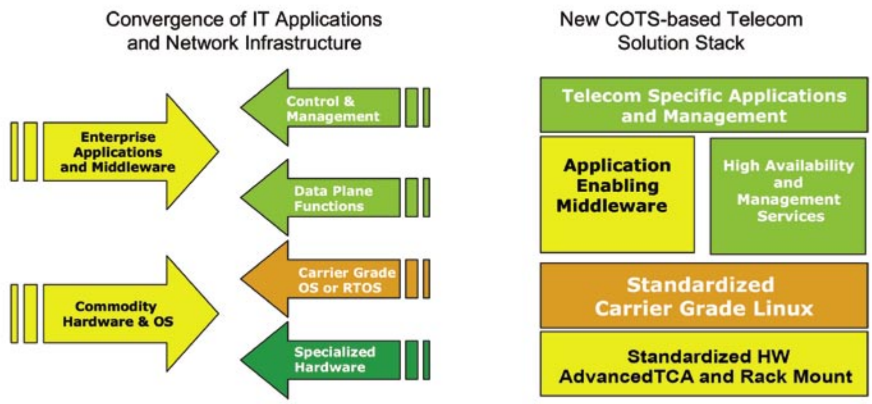

Figure 1

Consumer pressures

Service providers must simultaneously address customers' demands for increasing application complexity while delivering services at lower cost. At the same time advances in technology, especially the network, are driving demands for high bandwidth 24x7 services.

Business pressures

We still have the development cycles we inherited from the dot-com era, but not the financial exuberance. Service providers are expected to accomplish more and in less time, but for less cost than ever before. R&D budgets and operational costs are being slashed, yet at the same time providers must increase margins.

Competitive pressures

To add to the problems, in today's confusingly fast-paced business environment, product differentiation is more important than ever. The competitive field is stronger, and providers must get to market faster with better functionality than the competition.

One way that NEPs are relieving these pressures is by creating universal platforms that can be reused to build future products. This is where the use of reliable, commercial grade COTS components can provide significant cost benefits from building in-house solutions. Open source software enables leading edge technology and best-of-breed commercial solutions from ISVs and HW vendors. In addition, NEPs have access to all the functionality they need to develop state-of-the-art NGN solutions while also providing them with the control they need over their individual projects. Using these COTS-based platforms allows the NEPs to focus on their core value and still differentiate their products and services. These COTS-based universal platforms can then be reused for a multitude of NGN network elements, driving down costs and time to market.

Industry organizations driving COTS

Historically one of the challenges that NEPs face in achieving COTS solutions is the high cost and difficulty of integrating these COTS building blocks into reusable and interoperable components. In order for these COTS components to be truly reusable and interoperable, standards must be created to define the available services and the APIs that interface to those services. Many industry organizations have formed over the last few years to help grow and promote the ecosystem for COTS components being used in the telecommunications industry.

Open Source Development Labs (OSDL)

Recognized as the center of gravity for Linux, OSDL is dedicated to accelerating the use of Linux in all markets. OSDL is a key contributor to the COTS Telecom Solution Stack through sponsoring the Carrier Grade Linux Working Group. This is a group of Linux distributors, HW platform providers, and NEPs that are driving specifications for the standardization of a Carrier Grade Linux (CGL). Already in its second release, the CGL specification is the foundation of most COTS-based solution stacks being designed today.

PCI Industrial Computer Manufacturers Group (PICMG)

PICMG is a consortium of more than 450 companies who collaboratively develop open specifications for high performance telecommunications and industrial computing applications. Recently, PICMG announced the development of a new series of specifications, called AdvancedTCA, for next generation telecommunications equipment, with a new form factor, and based on switched fabric architectures. AdvancedTCA's success in the market has far exceeded initial expectations. Nearly every major NEP is planning AdvancedTCA-based NGN solutions.

Service Availability Forum (SAF)

The SAF goal is the adoption of open standards to enable the industry to build high availability network infrastructure products, systems, and services. The SAF is driving interface specifications to ensure high availability of services. As NEPs move towards a COTS model, they will need assurances that these new COTS applications will have the same level of services and availability as their legacy in-house solutions. The SAF is defining key services and the interfaces between the hardware platform, the operating system, and the High Availability (HA) middleware. The SAF is driving three key interface specifications:

- The Hardware Platform Interface Specification (HPI) defines the interfaces between the hardware and the operating system and middleware.
- The Application Interface Specification (AIS) defines interfaces for how HA middleware services communicate with each other and with the operating system. The AIS defines key services required for a complete HA system, including messaging, cluster membership, check-pointing, event monitoring, and frameworks.
- Systems Management Specification (SMS) is a complementary specification that acts as an umbrella to tie together the already existing HPI and AIS specifications. It is an SNMP and Web-based interface specification that enables the service event and error reporting by AIS and HPI.

Each of these organizations (OSDL, PICMG, and SAF) are driving standards in key areas of the COTS solution stack. Figure 2 illustrates the areas where each standards effort affects the COTS solution stack. A significant amount of synergy and cooperation exists among these industry groups, for example the OSDL Carrier Grade Linux specification even specifies the SAF HPI and AIS interfaces as requirements for a Carrier Grade Linux operating system platform. The SAF is working with PICMG to ensure that the HPI interface is mapped to AdvancedTCA. While the CGL specification is designed to be hardware neutral, SAF is considering whether to include specific support for AdvancedTCA as well.

In the lower two layers of the telecom solution stack, Carrier Grade Linux combined with AdvancedTCA is becoming the de facto solution for telecommunications platforms and substantially lowers costs for all types of NGN solutions ranging from Radio Network Controllers (RNCs) and GPRS network elements to signaling and management servers. In the upper layers of the stack, for service availability and application services, there are more choices of third-party COTS components depending on the type of solution or application. It is in these layers that the SAF APIs for AIS and HPI are so important to drive standards to ensure interoperability and consistency in the services that are required across a multitude of solutions.

The role of open source and Carrier Grade Linux

Carrier Grade Linux has a unique role in the telecom solution stack because Linux is typically the only component that is based on open source. True, commercially available middleware products above the operating system are based on open source, such as databases and HA solutions, but these products do not have a dominating position in the COTS solution stack the way that Carrier Grade Linux does. There are significant benefits for the NEPs that are driving the adoption of Carrier Grade Linux into the new COTS-based architectures:

- Lower development costs by using commercial CGL rather than developing in-house
- Faster time to market by focusing resources on value-add and using COTS components where possible
- Reliability by getting commercial grade quality with tested and mature CGL distributions
- Leading edge functionality found with Linux that is not available in more proprietary operating systems
- Control of projects and no vendor dependency; flexibility to own the source and change vendors if necessary
- Scalability and flexibility of CGL that can be reused for multiple NGN solutions
- Long-term viability and road map from a commercial vendor

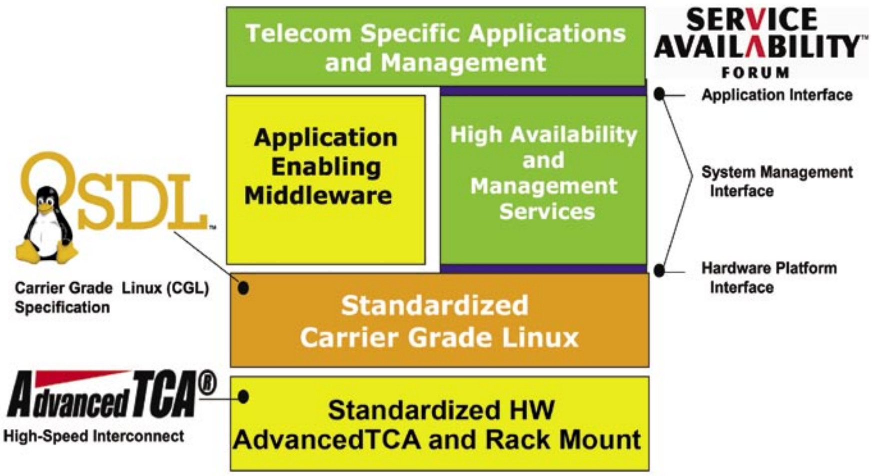

Figure 2

Because of the unique requirements of the telecom industry, Carrier Grade Linux was designed from the beginning to include functionality for the telecom industry that isn't found in typical Enterprise Linux distributions. One key example of this is the area of real-time technology. While the new Linux 2.6 kernel has made significant advances in mainstream real-time support, some CGL distributions include even stronger real-time support than what is available from mainstream Linux. Carrier Grade Linux distributions are beginning to reach the realm of RTOS and include hard real-time with such technologies as priority inheritance and user-space prioritization. But true to the nature of Open Source and Linux, these real-time enhancements are not *forks* or fragmentation, but rather formal open source projects that are optional modules or extensions to the standard Linux kernel.

Other areas of differentiation between CGL and Enterprise Linux are in service availability and high availability. For example there is activity in the open source community for both the SAF HPI and the AIS specifications. Both have launched successful open source projects, OpenHPI and OpenAIS respectively, which are gaining traction and are being adopted by Carrier Grade Linux distributors and other vendors creating open source solutions. Other examples of open source projects for high availability include such projects as redundant networking and safe disk unmounting in the case of failover. These are all examples of open source projects that can be found in some of the Carrier Grade Linux distributions available today that differentiate Carrier Grade Linux from its enterprise cousin. For the telecom solution stack, Carrier Grade Linux can now be used in both environments providing even higher levels of reuse and reduced costs. Carrier Grade Linux is robust enough to support the enterprise-based service applications and has the reliability to serve the network infrastructure.

The majority of new NGN products being designed by NEPs today are based on some form of Carrier Grade Linux. As many as five different Linux distributors claim to have a Carrier Grade Linux offering. As of this writing, three Linux distributors have already registered their products on the OSDL website. NEPs now have many choices for delivering a Carrier Grade Linux operating system. Because Linux is Open Source and the CGL specification is available to anyone, NEPs always have the choice of developing their own Carrier Grade Linux product. But remember a strong driver of COTS is reducing operational expenses, including the R&D budget. While developing their own Linux distribution may seem attractive initially, nearly every major NEP has done the analysis and determined that the cost of integrating the various technologies included in the CGL specification, maintaining this code, and upgrading the distribution over time undermines the benefits of leveraging a COTS-based solution and far outweighs the costs of purchasing software and services from a commercial Linux distributor. Using a commercial Carrier Grade Linux distribution as the cornerstone of a COTS strategy for new NGN products enables NEPs to leverage the benefits of COTS to reduce costs and speed time to market while focusing on their value-added service.

***Glenn Seiler** is Director of Product Marketing for MontaVista Software and is responsible for managing MontaVista's Carrier Grade Linux strategy. In addition to his work at MontaVista, Glenn was also responsible for managing HA Clustering solutions at SCO. Glenn has more than 15 years experience managing UNIX and Linux operating systems including previous work with Texas Instruments, SCO, BSDi, and MontaVista Software.*

For further information, contact Glenn at:

MontaVista Software
1237 East Arques Ave
Sunnyvale, CA 94085
Tel: 408-328-9200
Fax: 408-328-3875
E-mail: gseiler@mvista.com
Website: www.mvista.com

