Technology Article

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ATCA Blade Solutions Provide Seamless Migration to LTE

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Network operators worldwide are gearing up to provide 100 Mbps downlink and 50 Mbps uplink speed to mobile users with Long Term Evolution (LTE) technology. With LTE, users can expect to experience bandwidth that is three to four times the current downlink levels for High Speed Downlink Packet Access (HSDPA) and two to three times the current High Speed Uplink Packet Access (HSUPA) levels. Having gone through evolutions from GSM, EDGE, GPRS, and 3G in the last 15 to 20 years, one thing that the telecommunications industry has learned time and again is that the traditional approach of migrating a core network to a new technology is similar to undergoing a painful surgery.

New networks have been rolled out in a green field manner, thus making the transition capital intensive, time consuming, and often prone to errors. Delays encountered during the rollout due to interoperability issues, difficulties with new platforms, and so on have cost both network operators and equipment manufacturers significant revenue. Network operators end up being consumed in focusing almost exclusively on the "working rollout," and they have missed the opportunities to add value differentiation during the upgrade to new technologies.

Fortunately, wireless operators' core network migration from 3G to LTE will not be nearly as painful as earlier transitions. Thanks to ATCA standards-based LTE solution blades offering Deep Packet Inspection (DPI) features, combined with simplified LTE network architecture, operators will be able to capture the value differentiation offered by Commercial Off The Shelf (COTS) solution blades specifically designed for LTE.

3GPP's LTE network consists of the Evolved Packet Core (EPC) and Evolved UMTS Terrestrial Radio Access (E-UTRA). LTE's promise at the EPC is a simplified and flat "All IP" core network which consists of the Mobility Management Entity (MME), Serving Gateway (SGW), and Packet Data Network Gateway (PGW). On E-UTRA, LTE offers less complexity by supporting flexible carrier bandwidths. Figure 1 compares 3G and LTE networks. In LTE, the combination of the EPC and Evolved UMTS is called the Evolved Packet System (EPS).

MME provides the control node functionality, which was enabled by the SGSN in 3G networks. The MME's main functions are bearer set-up and release, initial User Equipment (UE) context setup, NAS node selection, and intra-LTE handover. The SGW enables the data plane functionality, which is provided by the GGSN in 3G networks. The SGW's main functions are routing and forwarding user data packets, mobility anchoring, policy enforcement, aggregation, and Quality of Service (QoS) management. The PGW provides connectivity to from the UE to external packet data networks. The PGW's main functions are packet filtering and mobility anchoring between 3GPP and non-3GPP technologies like WiMAX and CDMA2000.

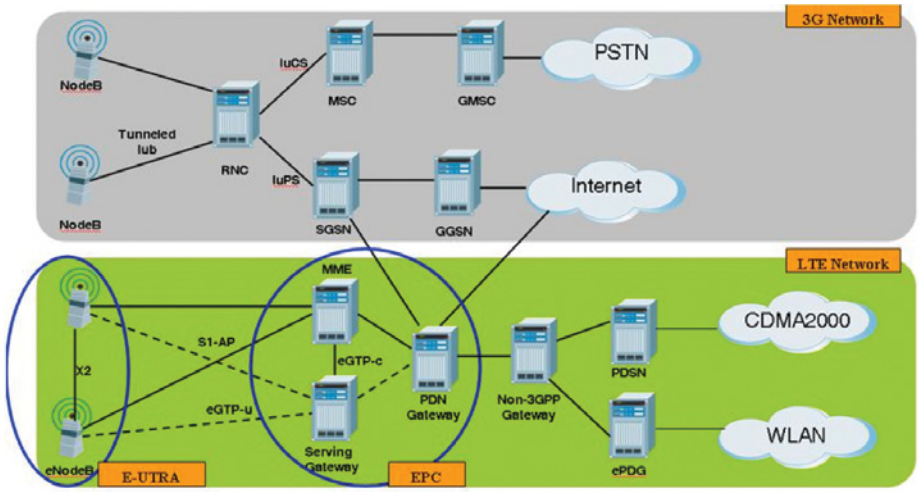

Figure 1. *3G and LTE Networks*

Faster LTE migration

Experts will debate who has the competitive edge during technology evolution – operators with custom intertwined proprietary solutions, or operators with standards-compliant platforms such as ATCA. There are mainly two approaches in which 3G core network elements like SGSN and GGSN will be upgraded to support LTE MME, SGW, and PGW functionalities.

The first approach is a software upgrade on the existing platform. While this approach brings LTE EPC functionality into 3G elements like SGSN and GGSN, it does not leverage the window of opportunity for network operators to introduce additional revenue-generating features and capacities in the system. The second approach is to use pre-integrated standards-compliant ATCA bladed solutions for MME, SGW, and PGW functionalities which will seamlessly plug into existing ATCA-based SGSN and GGSN elements. ATCA-based systems have a competitive advantage over proprietary systems in that they leverage the ecosystem's ability to offer products that incorporate rapid advances in computing power to deliver increased capacity in the form of new application-ready blades as well as big improvements in technologies such as DPI to offer guaranteed QoS by filtering bandwidth-intensive applications such as Peer-to-Peer (P2P) file sharing.

The mobile industry is constantly looking to increase Average Revenue per User (ARPU), and incremental revenue will come in the form of tiered service offerings. A pre-integrated ATCA-based DPI module in the LTE EPC is the way to achieve such additional revenues. The DPI module will have capabilities to utilize the network efficiently by managing heavy users – those producing P2P and YouTube-like video traffic and using Multimedia Messaging Services (MMS) – and providing traffic shaping under load conditions in accordance with Service Level Agreements (SLA). Lawful intercept under the Communications Assistance for Law Enforcement Act (CALEA) and other features will be key differentiators for DPI module deployment at the LTE core. Such functionality opens up a host of opportunities for additional revenue-generating capabilities in operators' networks.

Mobile data usage is growing at over 25 percent annually, outstripping fixed broadband revenues and growth. This presents both challenges and opportunities for LTE service providers, because the "All-IP" network architecture is prone to heavy P2P traffic and Distributed-Denial-of-Service (DDoS) attacks, which can result in degradation of services, unsatisfied users, and potential

loss in revenue. Operators will need the ability to perform line-rate DPI at Layers 4 through 7 to analyze complex patterns for threat signatures. Over time, these complex patterns will also likely evolve, and the only way to combat these threats will be through combining hardware- and software-based DPI at line rates to not only block DDoS attacks but also quarantine and block the latest worms and viruses at the core of the LTE network. The ideal solution is to combine a high-speed packet-processing blade with traffic-engineering capabilities on an ATCA-based platform.

Heavy data usage also brings the opportunity to insert time-sensitive and content-relevant advertisements. With advanced DPI ATCA-bladed solutions, operators will be able to offer both demographic-specific and variable-length advertising based on users' content preferences. This functionality will be implemented using content-insertion software based on DPI functionality provided by ATCA DPI-bladed solutions embedded in the LTE core.

Last but not least, service providers will need to use DPI to determine what content is flowing across their IP network; they can then leverage that information to modify their delivery strategy and potentially create new revenue streams from P2P traffic. The SGW in LTE networks needs to have highly flexible and scalable storage capabilities to address changing mobile user tastes and fluctuations in content popularity.

ATCA LTE blade solutions, as shown in Figure 2, offer pre-integration all the way up to the application layer as shown in Figure 3. The pre-integrated ATCA solution from Radisys supports low-level platform management in the form of Layer 2 High Availability (L2HA), carrier-grade operating system, remote system management, system-wide diagnostics, Service Availability Forum

PP50 10G Packet Processing *XE50 Dual Quad-Core*

Figure 2. *ATCA LTE Compute and Packet Processing Blade Solutions*

(SAF)-compliant middleware, and SAF AIS application API for applications redundancy support. Trillium LTE protocols integrated on top of the ATCA LTE platform solution offer seamless migration to the LTE core on 3G SGSN and GGSN elements.

In addition, MME control plane multithreaded protocols like S1-Application Protocol (S1AP), Diameter, and eGTP-c can be optimized to exploit platform performance gains. At the MME, S1AP supports the S1 interface toward evolved Node Bs (eNodeBs), Diameter supports the S6a interface toward the Home Subscriber Server (HSS), and eGTP-c supports the S4, S5, S10, and S11 interfaces toward the SGSN, PDN, MME, and SGW. At the SGW, protocols like SCTP and eGTP-u are optimized to leverage the network processor architecture for higher performance. Figure 4 shows MME and SGW protocol stacks and various interfaces. A strong professional services team with expertise in both Wireless and DPI capabilities can tune such as system to deliver precisely the throughput and capabilities needed by a network equipment provider or mobile operator.

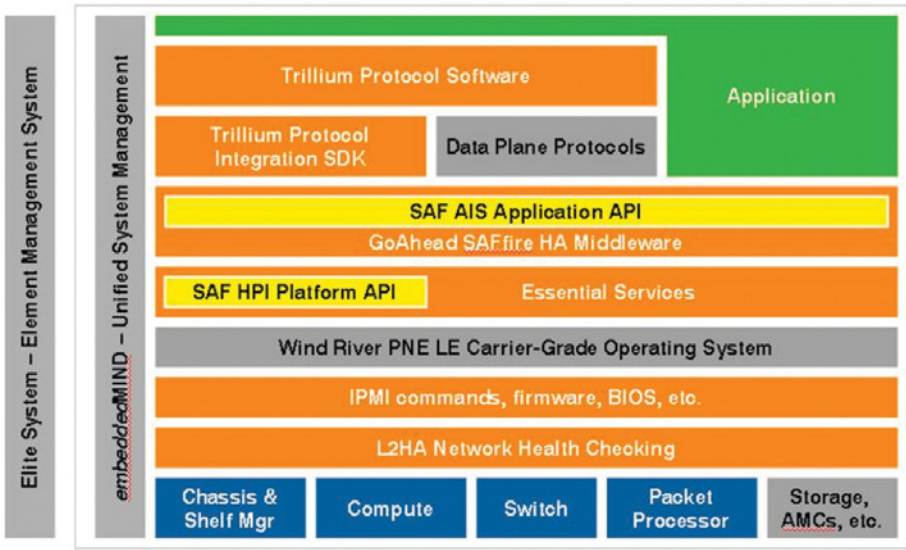

Figure 3. *LTE MME and SGW Solution Diagram*

Conclusion

A smooth, fast, and cost-effective migration from 3G to LTE is crucial for network operators. Pre-integrated, fully tested, and application-ready ATCA LTE solutions offer Wireless and DPI functionality at either the component or pre-integrated platform level for the MME, SGW, and PGW functionalities. A pre-integrated ATCA solution is one of the most efficient ways for a network operator to deliver high-speed data services with differentiated services such as tiered SLA, and it is also a future-proofed investment as ATCA processor blades will continue to leverage innovations and improved architectures in the silicon world. The technology simplification offered by LTE at the network level is complemented very nicely by ATCA-based pre-integrated solutions to yield the fastest migration approach, ultimately offering quicker time to revenue for network operators and improved quality of service for end users.

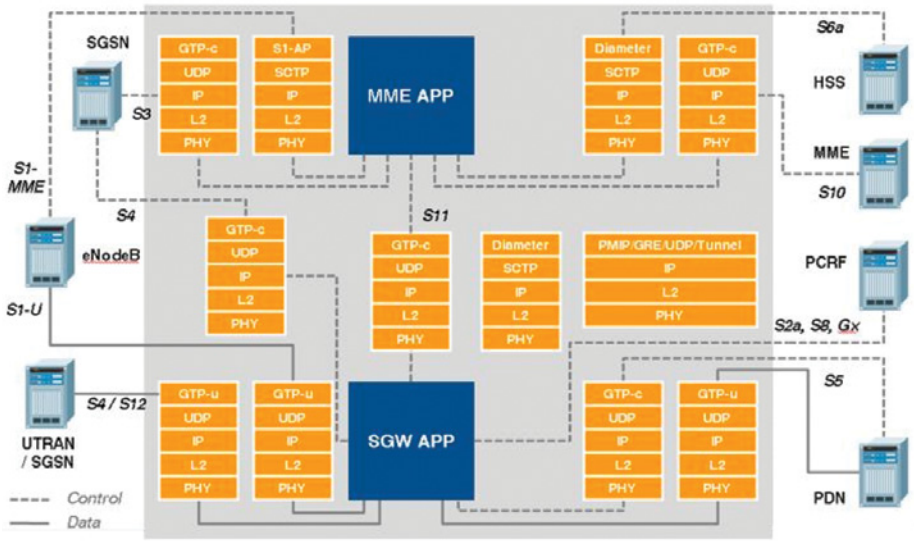

Figure 4. *LTE MME and SGW Protocol Software Architecture*

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