Evolved Packet Core (EPC) for a flat 'all-IP' architecture

to address increasing traffic volumes in Mobile operator's networks

EPC architecture is an evolution of the 3GPP mobile network architecture for LTE (Long Term Evolution), providing the connectivity between LTE radio networks and content/service capabilities. The Nokia Siemens Networks EPC solution addresses increased traffic and smartphone signalling demand, while lowering the operator's Total Cost of Ownership (TCO)

Evolving mobile networks

Mobile broadband growth is being driven by the dramatic evolution of terminals, rapid growth of laptop data cards and widespread deployment of high speed networking technologies. Mobile networks have experienced a transformation from circuit switched to packet switched technology, changing the operator business model from a pure service provider to a service and connectivity provider. Internet access continues to revolutionize this business model, where the operator provides connectivity and data transport.

New methods are needed to manage the growing volumes of data traffic. Mobile operators can support this growth cost-effectively by deploying more efficient radio network technologies, smart backhauling, efficient all-IP network architecture (e.g. EPC) and tools to control how network resources are used.

Standards

The 3rd Generation Partnership Project Release 8 (3GPP R8) introduces major advances in mobile networks (e.g. higher access rates, lower latency), with LTE radio technology providing lower cost per transmitted bit due to more efficient use of radio network resources. Advances in the core network include improved service quality and networking efficiency, leading to a better end user experience. 3GPP R8 architecture is an 'all-IP' network where services are provided over IP-based connections, with interoperability with current circuit switched networks and existing packet switched networks also specified, allowing subscribers to move easily between different types of access networks. Traffic flows are separated in the core network by user plane and control plane, allowing a more flexible network architecture. The user plane data is carried from the Radio Network directly to the Serving/Packet Gateways (S/P-GW, similar to Direct Tunnel and Interenet-High Speed Packet Access (I-HSPA) in 3GPP R7 networks based on 3G). To handle control plane traffic, EPC introduces a Mobility Management Entity (MME) that takes the role of the Serving GPRS Support Node (SGSN) in 2G/3G networks as a dedicated control plane element, handling session and mobility management. MME connects to Home Subscriber Server (HSS), which is the main database for subscription & authentication/authorisation of user access to EPC. The S-GW and P-GW together take the role of the Gateway GPRS Support Node (GGSN) in 2G/3G networks. S-GW acts as a user plane anchor for mobility between the 2G/3G access system and the LTE access system. P-GW acts as mobility anchor for all accesses and as a gateway towards the Packet Data Network (PDN).

Mobile network unification

EPC along with other evolving mobile technologies form a unified evolutionary step for all existing mobile networks. EPC is the evolution of packet core for all existing 3GPP mobile networks (e.g. GPRS/EDGE (2G), WCDMA (3G), HSPA/HSPA+ and I-HSPA), as well as non-3GPP networks (e.g. WiFi and fixed network access). EPC provides interworking between all these types of access, with its key components MME and S/P-GW having an essential role in supporting next-generation mobile broadband using LTE, maximizing operator's return on investment from 3G infrastructure when upgrading to LTE. Simultaneous operation with existing 2G/3G networks can be introduced without any hardware upgrades to the existing system. The EPC solution supports a smooth migration of existing packet core network elements simply by a software upgrade. The eventual target is a 3GPP R8 common core network where all accesses are served by a common gateway.

Access agnostic

EPC is designed to support any mobile access technology and as such serves as a common anchor point for subscribers moving between the different access networks. EPC's ability to support both LTE as well as current access technologies gives operators a smooth migration path towards next generation mobile. EPC also acts as the policy and charging enforcement point. The mobile gateway is a central point through which all traffic must travel, making it the natural place to enforce policy and online charging control to identify subscribers and to perform real-time traffic reporting. This centralized control allows the operator to implement their preferred business models and stay in control of how network resources are used.

4D Scaling

Highly efficient 4D scaling makes the Nokia Siemens Networks EPC solution the most powerful in the market. Signalling capacity is extremely important, having to adapt to smartphones saving battery power by switching on and off their connections, thereby generating huge signalling load. Furthermore, LTE is optimized to be 'always on' for data usage and since network architectures are becoming flat, all subscriber movements are directly visible to the mobile gateway, which has a huge impact on signalling load.

New radio access technologies like HSPA/HSPA+ and I-HSPA, together with advanced terminals, mobile data dongles for laptops and smartphones have caused a data 'tornado'. Flat mobile data tariffs are encouraging subscribers to consider mobile broadband as a viable alternative to fixed broadband, calling for an EPC to meet increasing bandwidth requirements.

Session density is increasing along with higher data usage. Operators are faced with more simultaneous sessions than ever before. Coupled with LTE being 'always on', each active terminal will have at least one bearer towards the network.

All three previous aspects are complemented by service intelligence, which is needed for operators to remain in control of their network resource usage, enforce fair usage policies and to collect statistics on subscriber behaviour. Our leading service intelligence hardware ensures user experience and customer loyalty, while optimizing utilisation of network resources. Deep Packet Inspection (DPI) is a business critical aspect of our solution, allowing service and subscriber differentiation for added value in a highly competitive market.

Dimension 1 - Signalling capacity

Flexi NG S/P-GW is highly and linearly scalable, with a fully equipped platform with 3 ATCA shelves able to handle 108k transactions per second, while a 3-shelf ATCA-based Flexi NS MME (Multi Media Entity) supports 22k transactions per second.

Dimension 2 - Throughput

The Flexi NG S/P-GW has the best throughput capacity for mobile data in the market. With a fully equipped rack, it can provide 360Gbps throughput capacity.

Dimension 3 - Session density

A Flexi NG S/P-GW rack with 3 ATCA shelves is able to handle 21.6 million sessions, a 3 shelf ATCA-based Flexi NS MME can support 6M subscribers connected to 60k LTE basestations (eNodeB's).

Dimension 4 - Service intelligence

The Flexi NG S/P-GW design is flexible and scalable, allowing the service intelligence functionality to be transparent. DPI software can be updated and ran without any interruption of the gateway functionality. Its dedicated hardware blades allow the identification of more than 300 different protocols (e.g. P2P traffic), which is the vast majority of applications and Internet protocols used today.

Driving down the cost per transmitted bit

One business challenge is the decoupling of the association between traffic volume and revenues. Since operator revenues are not following the huge increase of data traffic growth and the related cost to maintain the network, retaining profitability is to lower the cost per transmitted bit. Cost-efficient, scalable and flexible solutions are required to implement subscriber connectivity to Internet, operator services and corporate networks. This can be achieved with EPC as an optimized core network that deploys 'all-IP' interfaces towards the radio network and the data services domain. Mobile operators are currently forced to maintain parallel networks for voice and data services and considerable savings are realised when all services can be offered over a single, IP based network technology

The Nokia Siemens Networks value

EPC is a highly efficient network based on the right solution, consisting of flat architecture, efficient gateways, high signalling capacity and data policy enforcement, requiring the best products: Flexi NG (Network Gateway) as S/P-GW and Flexi NS (Network Server) as MME from the market leader – Nokia Siemens Networks. We deliver packet core solutions to more than 280 customers in over 110 countries, serving 650 million mobile broadband subscribers worldwide. The world first EPC/LTE trial was already announced in late 2008 and since its introduction at Mobile World Congress in February 2009, numerous EPC trials have been conducted with leading operators on all continents