Nokia Siemens Networks Flexi Network Gateway

4D Scaling

Executive Summary

With unique 4-dimensional scalability, Nokia Siemens Networks' Packet Core is the most powerful in the market allowing our customers to make maximum use of their investment.

Executive Summary

How can networks cope with the dramatic increase in data traffic?

A mobile broadband data boom has been sparked with HSPA networks, flat rate tariff offerings and mobile data dongles for laptops. Smartphones have significantly contributed to this increasing data throughput.

Smartphones and extending battery runtime have also highlighted a second important dimensioning parameter for gateways in addition to pure throughput. Signaling capacity is becoming extremely important to fulfill requirements of next generation flat all-IP networks (direct tunnel, I-HSPA, and LTE).

Further, the popularity of mobile broadband services with high data usage results in more and multiple sessions per subscriber/terminal than operators see today.

And, to sustainably control the network resources in an efficient way, to enforce fair usage limits for best end user experience or to collect statistics about subscriber behavior to optimize customer care, an increasing number of operators is asking for service intelligence.

At the end, there are four dimensions a mobile broadband gateway has to scale:

1. Throughput
2. Signaling Capacity
3. Session Density
4. Service Intelligence

= 4D Scaling

We explain how Nokia Siemens Networks is addressing those issues with Flexi NG (Flexi Network Gateway) product, which is our mobile broadband gateway for 2G/3G, HSPA, and LTE mobile broadband networks.

Flexi NG can be initially deployed as high capacity GGSN for 2G/3G networks and can be upgraded by software to serve as a Serving and Packet Data Network Gateway (S/P-GW) for LTE. It is also possible to introduce Flexi NG as an S/P-GW as an overlay gateway deployment for LTE. Later on, the same node can also serve 2G/3G networks as a GGSN.

Mobile operators are facing an increasing pressure created by the proliferation of smart phones and mobile broadband. This fact combined with the strategic move towards LTE with always-on data connectivity are placing unprecedented demands for signaling capacity, throughput, session density, and service intelligence on mobile networks forcing operators to upgrade their packet core networks.

Its unique four-dimensional scalability makes Flexi NG the most powerful gateway solution in the market to ensure operators can solve this challenge by enabling differentiated end user experience and leading to new revenue opportunities in order to retain their business case.

1. Dimension Data Throughput

The long awaited data tornado is now taking effect. In 2010, data traffic exceeded voice traffic for the first time on global level. This evolution has been enabled by new radio access technologies (e.g. HSPA, HSPA+, and I-HSPA) together with advanced terminals, mobile data dongles for laptops, and smartphones. Flat mobile data tariffs are encouraging subscribers to consider mobile broadband as a viable alternative for fixed broadband.

Smartphone mobile broadband is the next trend increasing bandwidth requirements in the networks. In particular, this development calls for more efficient radio and access networks. LTE technology with Evolved Packet Core will be needed to accommodate this throughput and traffic growth.

… and how Nokia Siemens Networks provides increased traffic growth?

The Flexi NG has the best throughput capacity in the market. In a fully equipped rack, which includes three 16-slot ATCA shelves, it can provide 360 Gbps throughput capacity. On the other hand, Flexi NG also supports even the smallest configuration with 10 Gbps throughput and can flexibly scale up the maximum configuration in steps of 10 Gbps.

Example: The entire Internet traffic of Finland at peak hour is around 20-25 Gbps.

2. Dimension Signaling Capacity

The importance of signaling capacity has already been seen in live customer networks, with smartphones saving battery power by switching on and off their connections to the network, which in some cases has crashed operator networks by generating huge signaling load.

The LTE radio interface is optimized to be ‘always on’ for data usage, but as network architectures are flat, all subscriber movements are directly visible to the mobile gateway, which has an impact on the overall signaling load.

… and how Nokia Siemens Networks addresses increased signaling load?

The Flexi NG is highly and linearly scalable, and a fully equipped platform with 3 ATCA shelves is able to handle 108 thousand transactions per second.

Analyst Quotation:

Heavy Reading (Vol 7, No 11, November 2009) confirms importance of signaling capacity for Evolved Packet Core:

"Taking these three factors together – flatter architecture, mobility-load, and application-load – and the fact that signaling events tend to require EPC nodes to interact ("transact") with surrounding network elements (e.g. between MME and S-GW or SGSN), the result is that EPC product platforms will need to scale control-plane capability and that the "**transaction rate" of the platform will be the key to system performance**. This requirement to support transaction rate scalability is expected or substantially more important than the increases in raw throughput."

Example: 25 million attached 3G subscribers with 33% smartphones and a typical traffic profile assumed will generate approximately 60 thousand transactions per second, which results in about 8 million smartphones. AT&T has activated around 15 million iPhones in 2010.

3. Dimension Session Density

The session density is increasing along with the popularity of mobile broadband services. With high data usage, operators are facing a scenario with more simultaneous sessions per subscriber/terminal than seen today.

LTE, with its always on approach, is increasing session density due to the fact that each terminal that is powered on will have at least one active bearer towards the network.

… and how Nokia Siemens Networks enables increased active bearer sessions?

A fully equipped Flexi NG rack with 3 ATCA shelves is able to handle 21.6 million sessions.

The reliability aspect is also taken into account in the Flexi NG design, with the implementation of multiple redundancy scenarios, from simple redundancy inside a shelf and also providing upgrade towards geographical (inter-chassis) redundancy that would allow session continuity during switchover.

4. Dimension Service Intelligence

The three key scalability aspects signaling capacity, throughput, and session density are complemented by the fourth dimension service intelligence.

Service intelligence is used to differentiate applications and service subscription to ensure best end user experience (e.g. fair usage limits). It also helps mobile operators to optimize usage of network resources to maximize revenues and to enable new business models. And, with collection of statistics and usage reporting, it also enables them to provide better customer care and to avoid customer churn.

Service intelligence is optimally implemented in the gateway element that offers direct interfaces to policy control, online and offline charging, and to network management.

Deep Packet Inspection (DPI) is able to identify the majority of user traffic and protocols used by subscribers. Because of frequent changes in applications and Internet protocols (e.g. very dynamic behavior of P2P) we need to update DPI functionality independently and separately to Flexi NG software.

… and how Nokia Siemens Networks ensures service intelligence?

Service intelligence is a business critical aspect of our solution, allowing service and subscriber differentiation for added value in a highly competitive market.

As service intelligence is a computing-intensive function, it is typically implemented on dedicated hardware blades in the Flexi NG. This flexible and scalable design makes the service intelligence functionality transparent to the gateway functionality. Further, the software on the so-called Service Aware Blade (SAB) running service intelligence functionality can be updated without any interruption of the gateway functionality.

The Flexi NG service intelligence functionality allows more than 600 protocols to be identified. A large number of other traffic attributes, such as the URL, can also be tracked. Updates of DPI software are done on quarterly basis and are independent of Flexi NG software.

Charging information is generated according to the operator's charging configuration. Flexi NG interacts with OSS/BSS systems to perform policy enforcement and to provide online and offline charging information, according to 3GPP specifications.

Flexi NG is already deployed in multiple operator LTE trials and is just to be introduced as a high capacity GGSN in live operator networks.

To summarize, all the maximum values stated for capacity, session density, signaling capacity and service intelligence are simultaneously valid in Flexi NG. None of the four dimensions need to be compromised.

Acronyms & Abbreviations

2G	2nd Generation of Mobile Telephone Systems (GSM)
3G	3rd Generation of Mobile Telephone Systems (UMTS)
3GPP	Third Generation Partnership Project
4D	4-dimensional
ATCA	Advanced Telecommunications Computing Architecture
AT&T	American Telephone & Telegraph Corporation
CDx	Change Delivery number x
DPI	Deep Packet Inspection
EPC	Evolved Packet Core
Flexi NG	Flexi Network Gateway
Gbps	Gigabit per Second
GGSN	Gateway GPRS Support Node
GPRS	General Packet Radio System / Service
HSPA	High Speed Packet Access
HSPA+	Evolved High Speed Packet Access
I-HSPA	Internet - High Speed Packet Access
IP	Internet Protocol
LTE	Long Term Evolution
MME	Mobility Management Entity
OSS/BSS	Operations Support System / Business Support Systems
P2P	Peer to Peer
SAB	Service Aware Blade
SGSN	Serving GPRS Support Node
S-GW	Serving Gateway
S/P-GW	Serving Gateway / Packet Data Network Gateway
URL	Uniform Resource Locator