

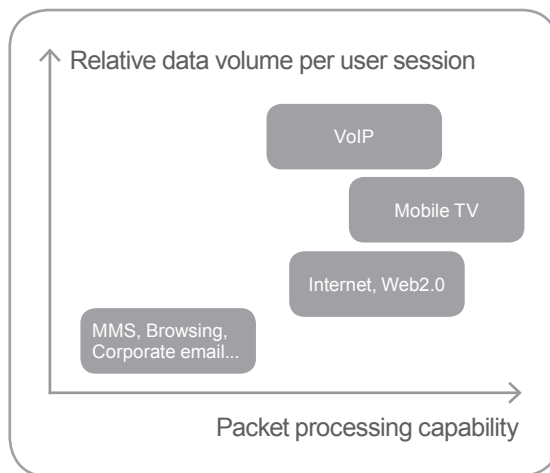
Direct tunnel – the flat architecture of LTE becomes a reality

Nokia Siemens
Networks



Mobile networks are becoming better, faster and cheaper as services and patterns of usage shift to packet data and the Internet becomes a major source of services. This evolution is enabled by the simplified network architecture and packet data efficiency of Long Term Evolution (LTE), which is a development of GSM/ EDGE/ WCDMA technologies.

The growing volume of Internet and VoIP traffic in mobile networks places increasing demands on the packet processing capabilities of networks.



Nokia Siemens Networks Internet-HSPA with Direct Tunnel is the first step towards LTE

Our Internet-HSPA is a fully 3GPP standards-based solution for cost-effective broadband wireless access. The solution combines the most feasible innovations of the LTE/ SAE simplified network architecture, which is evolving from 3G. With improved latency and fast handovers it introduces the throughput and packet processing capabilities required by services such as streaming and VoIP.

Our Internet-HSPA architecture optimizes the HSPA radio system architecture for data applications. It does so by implementing a subset of RNC functionality into base stations, while the SGSN offers the ability to create a tunnel from Internet-HSPA or the RNC to the GGSN. In other words, it creates a direct tunnel. The Direct Tunnel solution also works in existing 3G networks and in multivendor environments.

In direct tunnel architecture, the SGSN controls mobility, authentication and control plane accounting to decide whether one or two tunnels are needed. When only one tunnel is created, the user plane traffic bypasses the SGSN.

When a PDP context is created in a current network, two GTP-U tunnels are created for user data. One runs between the RNC and SGSN, while the second runs between the SGSN and GGSN. The direct tunnel solution instead requires only one tunnel, which runs between the RNC and GGSN.

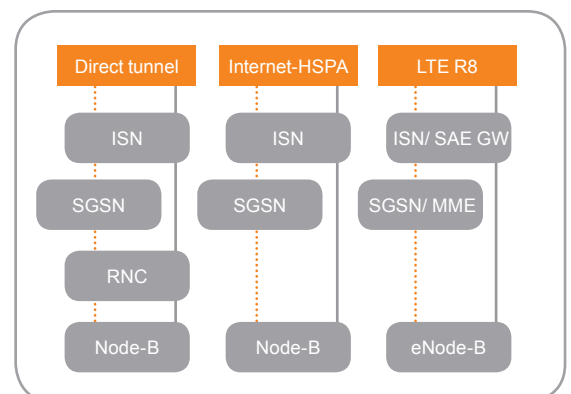
The SGSN decides on a context-by-context basis how many tunnels are created.

- It creates one when the SGSN and GGSN belong to the same PLMN.
- It creates two tunnels when the SGSN and GGSN belong to different PLMNs.

In the following situations, two tunnels are typically required and the SGSN will establish them automatically.

- During roaming, the visited operator checks the data volume exchanged.
- Lawful interception is activated in the SGSN.
- CAMEL pre-paid services may operate in the SGSN.
- An old GGSN may support only GTPv0.

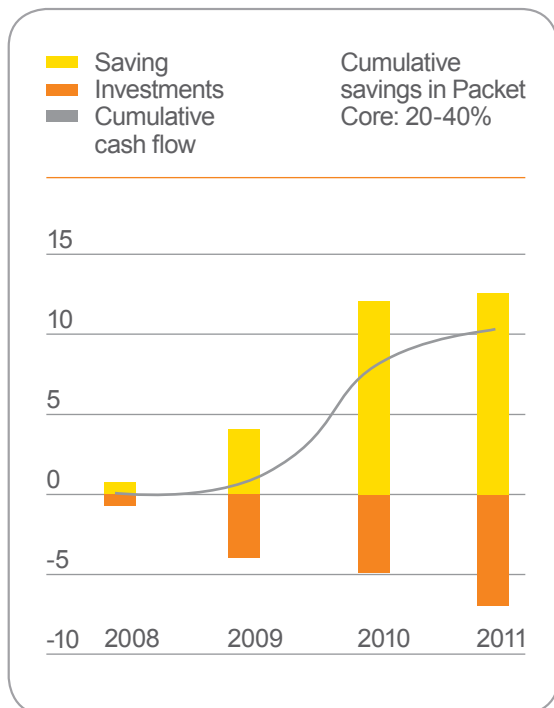
In the case of a single-tunnel solution, the RNC and GGSN perceive that a GTP-U tunnel is established to the normal SGSN tunnelling unit, but most of the user data actually bypasses the SGSN.



Direct tunnel functionality in the Nokia Siemens Networks SGSN is implemented according to 3GPP Release 7 specifications.

Flat architecture results in cost savings

The direct tunnel approach facilitates the handling of user plane throughput in the core network. User plane processing requires a lot of processing capacity in the SGSN, but the solution enables the operator to transfer user plane traffic beyond the SGSN using the IP backbone. Creating the user plane tunnel directly between the RAN and the GGSN optimizes the operator's costs, since most of the throughput capacity can be carried by standard IP routers and switches. This simplifies user plane dimensioning and operators no longer need to over-dimension SGSNs to carry user plane data safely. Direct tunnel functionality can also be used in the ATM network.



In a reference network of one million active users with close-to-saturated capacity in 2008, a direct tunnel investment will break even after one year when the throughput exceeds approximately 1Gbps.

Traffic mix and throughput define the right time to implement

The right timing for direct tunnel implementation depends mainly on the traffic load in the network and the existing invested capacity.

According to the latest estimates, the packet processing capacity savings become significant when network traffic reaches 1Gbps.

At this point it is usually advisable to invest in direct tunnel functionality.

Standards compliancy guarantees no-risk implementation

Nokia Siemens Networks Direct Tunnel is available today in our SGSN for Internet-HSPA systems. The implementation was originally based on Nokia Siemens Networks' innovative "one GTP tunnel" approach. It uses existing 3GPP standards to guarantee its performance in multivendor environments, as well as in the CS core. The Direct Tunnel also complies with the 3GPP Rel7 specification for direct tunnel functionality.

No hardware discontinuities

Nokia Siemens Networks Direct Tunnel is implemented with software on top of the SG6.0, or combi SGSN. The functionality can be used both in IP transport and in ATM networks, giving operators more flexibility to plan their strategy for network evolution.

Functionality highlights

The Nokia Siemens Networks SGSN offers more than 100 advanced features and functions.

The majority of these are value-added features over basic 3GPP standardized connectivity. The latest functions and capacities include:

- 2G, 3G and Internet-HSPA are supported in a single SGSN element
- Iu over IP and ATM
- Gb over IP and Frame Relay
- Multipoint Iu and Gb
- HSDPA and HSUPA support
- 1.2 M attached users
- 960k PDP contexts
- 500Mbps/ 1Gbps (2G/ 3G) throughput



Nokia Siemens Networks Corporation

P.O. Box 1

FI-02022 NOKIA SIEMENS NETWORKS

Finland

Visiting address:

Karaportti 3, ESPOO, Finland

Switchboard +358 71 400 4000 (Finland)

Switchboard +49 89 5159 01 (Germany)