

Protocol acceleration for high capacity and performance in 3G and 4G networks, IoT and M2M

Introduction

GTP (GPRS Tunneling Protocol) is a UDP/IP based tunnelling protocol used within the core radio control network of 2.5G (UMTS), 3G (GPRS) and 4G (LTE) cellular networks. GTP consists of two separate protocols: GTP-U which is the data plane protocol which tunnels data packets within the core network and GTP-C which is the control plane protocol, responsible for setup and teardown of GTP-U tunnels.

As network capacity increases so does the need for performance, security and reliability. Adax GTP software, and its sister product, SCTP/T (see separate datasheet), are designed to meet the exploding capacity demands of both 3G and 4G networks, especially from IoT and M2M. This impacts both the GTP-C and GTP-U and the encapsulation and de-encapsulation of packets, PDP context requests and responses, and packet header insertion and enhancement.

Accelerating GTP tunnels and offloading GTP data traffic is a critical requirement in the performance of 3G and 4G networks, especially for traffic management and load balancing in the core network. Removing bottlenecks in the network increases performance and supporting Differentiated Services improves Quality of Experience.

GTP Usage in the Mobile Core Network

GTP is used at various places within the core network. In 4G networks GTP is used on the S1-U interface between the eNodeB and SGW, the S5 and S8 interfaces between the SGW and PGW and the S11 interface between the MME and SGW. The acceleration of the GTP traffic between these points prevents bottlenecks and increases capacity and performance – Figures 1 and 2 show both the Control and User Plane protocols. In 3G networks it is typically used between the GGSN and SGSN and SGSN and RNC -Figure 3 below shows the User Plane protocols used in A/Gb mode.

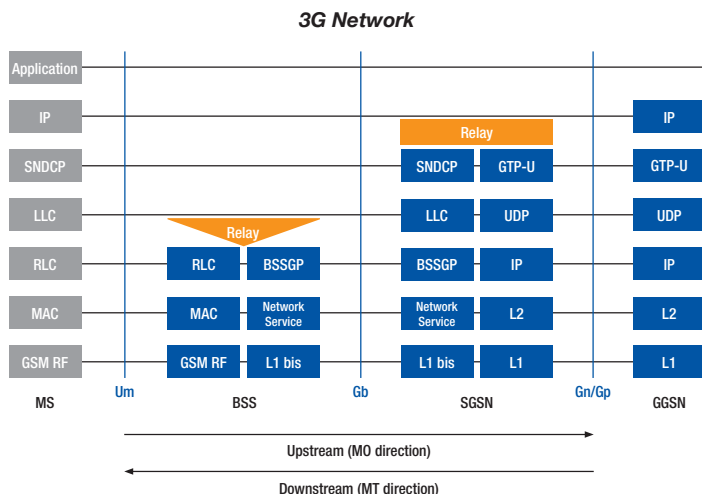


Figure 3 – User Plane for A/Gb mode and for Gn/Gp

GTP Protocol Software Features

- Interworking between IP and GTP-U (GTP Tunnel termination)
- Termination and Relay per PDP context for Mobile Data Offload (GTP Bypass)
- Interworking between two separate GTP tunnels (GTP Relay)
- GTP-U Echo Requests/Responses can be terminated to the host, relayed to another GTP tunnel, processed automatically, or discarded
- Supports over 250,000 GTP PDP contexts per module
- Full QoS support, including DHCP copying and/or remarking; token bucket policing for ingress and egress packets
- Supports a loosely coupled (message based RPC) interface to the GTP-U data plane, allowing the dataplane to be run on a separate machine from the GTP-C control plane
- IPsec to GTP interworking
- Compliant to 3GPP release 12
- Supports Adax Pkt2 boards for protocol acceleration to meet high-capacity requirements

4G User Plane

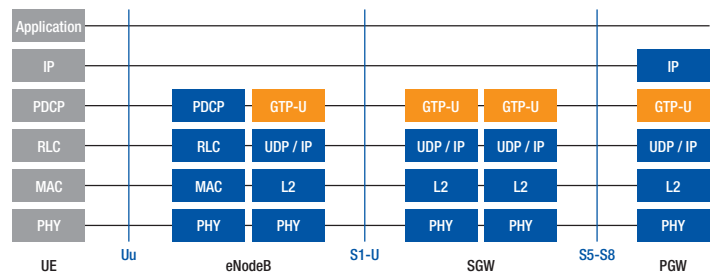


Figure 1 – Control Plane for S1-U and S5-S8

4G Control Plane

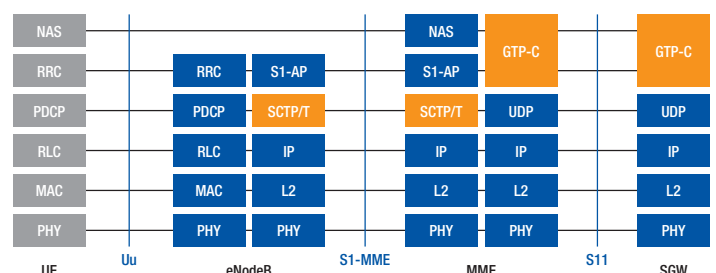


Figure 2 – Control Plane for S1-MME and S11



High-Capacity GTP-U Acceleration

For ultra-high capacity requirements, Adax GTP software can be combined with the Adax Packet2 boards (see separate datasheet) delivering unrivalled performance of GTP-U user plane traffic critical to these applications. Supporting over 250,000 GTP PDP contexts per board, offloading the GTP-U data traffic to the Adax boards greatly increases traffic capacity by accelerating the data paths and freeing up the host system processor to handle control plane applications. With the Adax PacketRunner2 and PacketRunner2i ATCA carrier boards, up to 4 Packet2AMC boards can be installed in a single 1U slot, allowing for easy, incremental upgrades as capacity needs increase without requiring additional rack space.

Accelerating GTP tunnels is a critical requirement in the performance of 3G and 4G networks especially with regard to traffic management between the SGW and PGW. Removing these bottlenecks in network performance improves Quality of Experience, supporting Differentiated Services (DiffServ) and associated billing for improved carrier revenues.

GTP and SCTP Capacity and Reliability for Massive M2M and IoT Connections

Machine to Machine (M2M) communications represent a significant growth opportunity for the 3GPP ecosystem. Millions of low speed, low data volume, M2M devices will be deployed on a mass scale to create the Internet of Things (IoT) and they will all need to be connected to the core mobile network. This massive increase in the number of devices connecting to the core network over the S1 and Gb interfaces will require highly efficient, high capacity data and control plane protocol implementations such as Adax GTP and SCTP/T.

Adax GTP and SCTP/T protocol products deliver the capabilities and performance to handle this massive number of connected devices securely and reliably without impacting overall network performance and Quality of Service, thus improving the user experience.

GTP – IPsec Interworking

Adax GTP is integrated with the Adax IPsec package allowing interworking between IPsec and GTP-U tunnels in applications such

as ePDGs which provide access to the mobile network for untrusted WiFi gateways. GTP-C traffic can also be encapsulated into IPsec tunnels to secure the control plane signaling, allowing untrusted networks to be used for networking signaling traffic. As the Adax software terminates the IPsec and then encapsulates the GTP-U in one operation it can remove the need for a separate IPsec gateway.

Application Areas

- Core Network Performance Acceleration
 - 4G PGW, SGW and MME enhancement
 - 3G SGSN and GGSN enhancement
 - Load Balancing, Backhaul & Aggregation
 - QoS and Traffic Management
 - Monitoring, Test and Measurement
- M2M and IoT including:
 - Car telematics including the 'connected car'
 - Industrial automation, monitoring and control
 - Intelligent transport systems
 - Smart homes and buildings
 - Healthcare
 - Retail
 - Utilities

3GPP and Narrow Band IoT

3GPP is moving ahead with the standardization of NB-IOT. 3GPP TR 45.820, 'Cellular system support for ultra-low complexity and low throughput Internet of Things (CIoT)', defines a new narrowband radio technology to address the requirements of the IoT. The new technology will provide improved indoor coverage, support a massive number of low throughput devices, low delay sensitivity, ultra-low device cost, low device power consumption and optimised network architecture. As well as enhancements to the S1 interface to the core network the NB-IOT standard includes the option for the large number of connected devices to use the Gb interface to the base station on a new Cooperative Ultra Narrow Band (C-UNB) and then be interworked in an SGSN to GTP.

SCTP/T Acceleration *(see separate datasheet)*

Adax SCTP for Telecom (SCTP/T) was designed specifically to meet the demands of LTE and IMS networks, IoT and M2M. Authentication chunks designated in RFC 4895 secure SCTP-based Associations from packet injection, hijacking or accidental disconnection. Thus securing the millions of simultaneous associations required by today's networks. SCTP/T also supports an accelerated version of Authentication Chunks for SCTP (RFC 4895) using the SHA hardware engines on the Cavium and an optimized version for Intel using the specialized AVX2, SSSE3, or NI instruction sets on processors where they are available.

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Adax is an industry leader in high performance packet processing, security and network infrastructure for Legacy to LTE networks. Modular, scalable and flexible, the Adax LTE-EPC solutions, SIGTRAN and SS7 Signaling platforms, as well as the DPI, IPsec Security, and GTP acceleration products enable customers to build the solutions they need, creating a smarter network infrastructure for all.



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