TECHNOLOGY BRIEF

GPRS Tunneling Protocol (GTP) Processing

SUMMARY

Comprehensive discussion of GTP protocol and how an Accolade adapter can help with GTP deduplication

KEY POINTS

- GTP is used exclusively in mobile networks
- Accolade ANIC adapters can fully parse GTP packets and offer value added capabilities such as deduplication

GPRS Tunneling Protocol or GTP for short is a mechanism used exclusively in cellular networks to tunnel IP packets through a mobile network core. The protocol was introduced in the late 1990s when the first generation of packetized data—known as General Packet Radio Services or GPRS—was adopted. GPRS is often referred to as 2.5G because it runs over GSM (2nd Generation or 2G mobile technology). GTP has moved on from those humble beginnings and is used in an updated form in both 4G (LTE) and emerging 5G cellular networks. The main benefit of GTP is that a user's IP address can be decoupled from routing and related decisions within a mobile network core. This is what allows a cellular customer to move around from base station to base station and still maintain uninterrupted connectivity to external networks such as the Internet. It also allows for multiple services such as VoLTE (Voice over LTE) to be provisioned on the same device. In short, GTP is a crucial tunneling protocol that is indispenable in all modern mobile networks.

HOW IT WORKS

Figure 1 depicts a mobile phone (referred to as "user equipment" or "UE" in the industry) accessing an Internet web server with IP address 74.125.71.104. The phone or UE is initially connected to base station #1 (referred to as an eNodeB or "eNB" in LTE) and generates a simple IP packet to access the web server. Once the IP packet reaches the base station, and for the entire duration it is within the mobile network, the original IP packet is encapsulated within a GTP tunnel. Figure 2 shows the details of the tunnel structure. The original packet is shown in blue and simply contains the source IP (SIP) which is the phone IP and destination IP which is the Internet web server. The GTP tunnel data is shown in red and is used only within the mobile network to route the packet to its ultimate destination: the Internet. All IP addresses in the GTP packet are for mobile network elements such as the base station (eNB) and S-GW (LTE Serving Gateway).

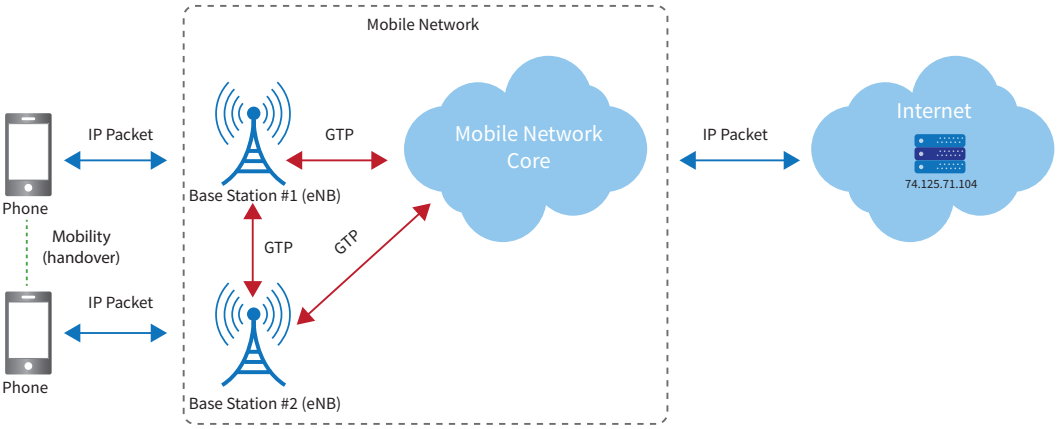

Figure 1: Mobile Network

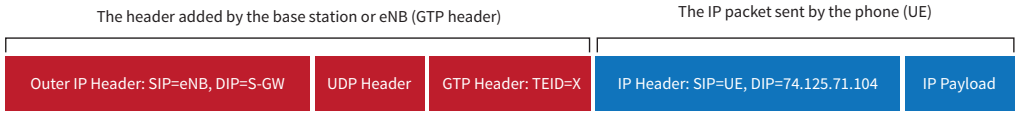

Figure 2: GTP Tunnel Structure

If the phone moves from base station #1 to #2 its IP address can remain unchanged because from the mobile network's perspective it never even looks at the phone IP address. This is clearly crucial for phone handover or mobility from one base station to another.

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GTP PARSING

An Accolade Technology ANIC adapter or SmartNIC performs a variety of packet processing functions which help offload the host CPU. As shown in Figure 3, there are a variety of feature blocks embedded in the onboard FPGA such as flow classification and filtering—which we refer to as flow shunting. Another key feature is "tunnel decapsulation" which is part of the packet header parser block. With this capability each ANIC SmartNIC intelligently identifies different tunneling protocols as they flow through the adapter. In addition to GTP, other protocols the adapter can identify and parse include VLAN, VXLAN, MPLS, GRE and others. The ANIC adapter understands each bit of the tunneling protocol and while parsing the header identifies each field for future use. For example, with GTP (see Figure 2 for header details) the parser extracts and captures the TEID (Tunnel Endpoint Identifier) which could be used later by the packet filter block to select packets with specific TEID values. Similarly most any field within the GTP tunnel can be used to enhance a subsequent operation. Some of the interactions are pre-built, but others can be developed based upon specific customer requirements. Deduplication is an example of a GTP related feature that was inspired by a specific customer request.

GTP DEDUPLICATION

Duplicate packets are very common in networks and can easily constitute 25 or 30% of the traffic in a live network. When network monitoring equipment is deployed to examine the traffic for security, network performance, lawful intercept or other reasons, having to process duplicate traffic is a large burden. In a mobile network two different GTP packets could actually be duplicates from a network monitoring perspective. The reason is because only the inner IP packet (which is sent by a phone, tablet or other end device) in a GTP tunnel is of interest for monitoring. Since the GTP encapsulation (shown in red in Figure 2) information is irrelevant for monitoring applications, even if the outer IP header is different it could still be carrying the same inner IP packet. An Accolade SmartNIC is able to extract the inner IP packet and compare it to other inner IP packets to determine if they are the same; and if they are, discard the packet before it reaches the monitoring application. This saves the monitoring application the burden of processing redundant traffic and thus makes the entire interaction more efficient.

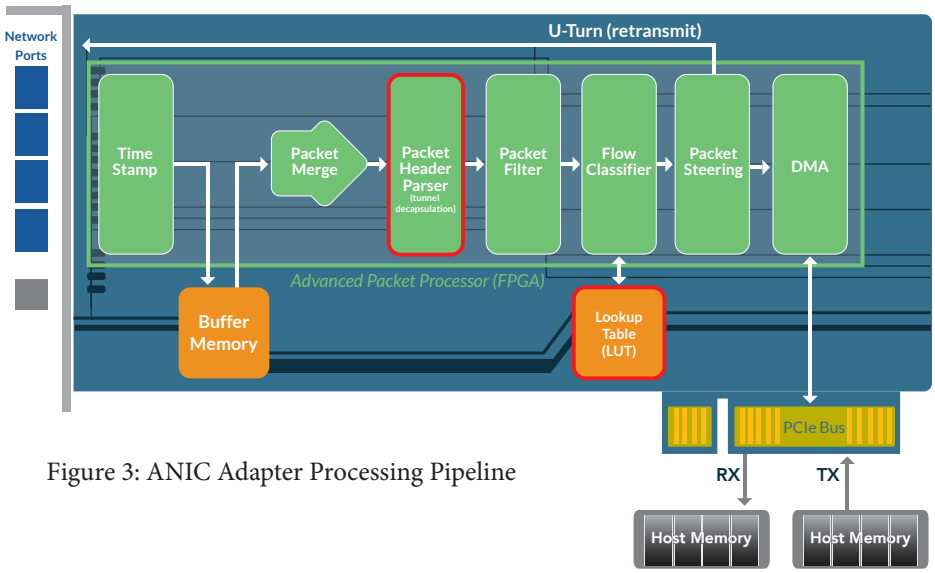

Figure 3: ANIC Adapter Processing Pipeline

ACCOLADE TECHNOLOGY PROFILE

Accolade is the technology leader in FPGA-based Host CPU Offload and 100% Packet Capture PCIe Adapter/NIC's and Scalable 1U Platforms. Accolade's line of 1-100GE products enable 100% packet capture, flow classification, deduplication, packet filtering and more. Our customers are global leaders in network monitoring & cybersecurity applications as well as in the network test and measurement, telecom and video stream monitoring markets.

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