# 5G Correlation

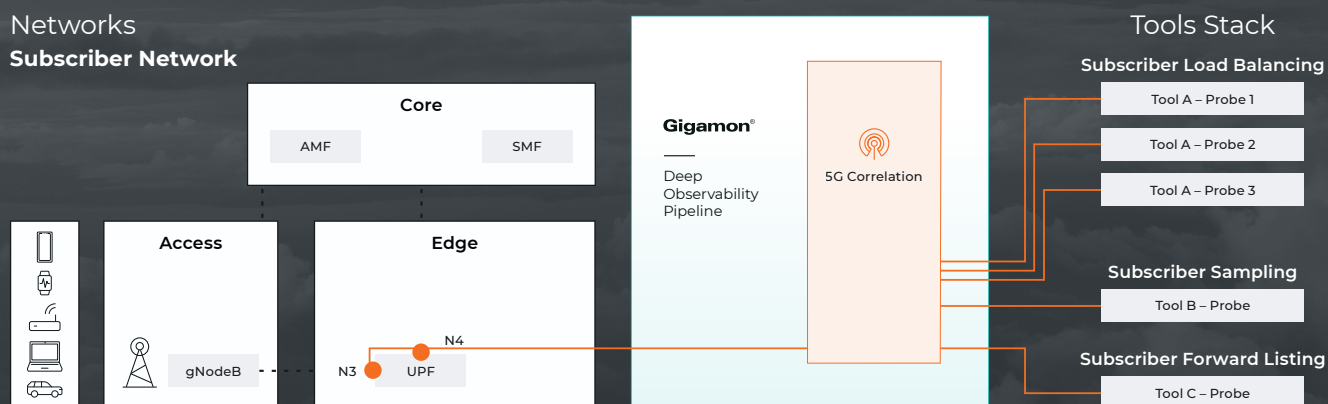## Complete Traffic Visibility within 5G and 4G LTE



Figure 1. 5G session correlation for feeding monitoring and security tools.

## 5G CORRELATION FEATURES

· Stateful correlation of user plane and control plane in 5G standalone core and 5G/4G converged core

· Stateful forward listing (also known as whitelisting) based on subscriber ID (IMSI/SUPI)

· Stateful user session sampling based on subscriber ID (IMSI/SUPI)

· Stateful load balancing based on subscriber ID (IMSI/SUPI) or user device

· Reduces key performance indicator (KPI) downtime up to 95 percent in the event of planned or unplanned outages

5G networks are poised for exponential growth in traffic and number of connected devices, and mobile carriers are searching for ways to efficiently and effectively monitor performance, quality of experience (QoE), and security for their services and subscribers, as well as identify and monetize new offerings. Furthermore, the disaggregation of the control plane and physical separation of the control and user planes (referred to as Control and User Plane Separation, or CUPS) adds additional complexity.

To ensure accurate, cost-effective analytics from their tools infrastructure, service providers are dependent on two critical components:

· Ability to correlate traffic flows on a per-subscriber basis
· Visibility across all segments of the mobile network

## 5G with CUPS

5G Correlation starts by examining two main protocols:

· GPRS Tunneling Protocol (GTP) for tunneling the user plane traffic to carry subscriber traffic from the subscriber device to the internet or subscriber services, which appears only at the user plane locations
· Packet Forwarding Control Protocol (PFCP) for communicating between the control plane and the user plane gateway functions

Visibility into a subscriber's traffic requires understanding the subscriber attributes and stateful information contained within PFCP in order to correlate subscriber-specific user sessions carried within GTP and give monitoring tools an accurate view of each subscriber's traffic on the network.

## 4G LTE with CUPS

The core of a mobile operator's 4G network that employs Control and User Plane Separation uses two main protocols:

· GTP version 1 for tunneling the user plane (GTP-U) traffic to carry subscriber traffic from the subscriber device to the internet or subscriber services, which appears only at the user plane locations
· Packet Forwarding Control Protocol (PFCP) for communicating between the control plane and the user plane gateway functions

Similar to 5G, 4G LTE with CUPS visibility requires understanding the subscriber attributes and stateful information contained within PFCP in order to correlate subscriber-specific user sessions carried within GTP-U.
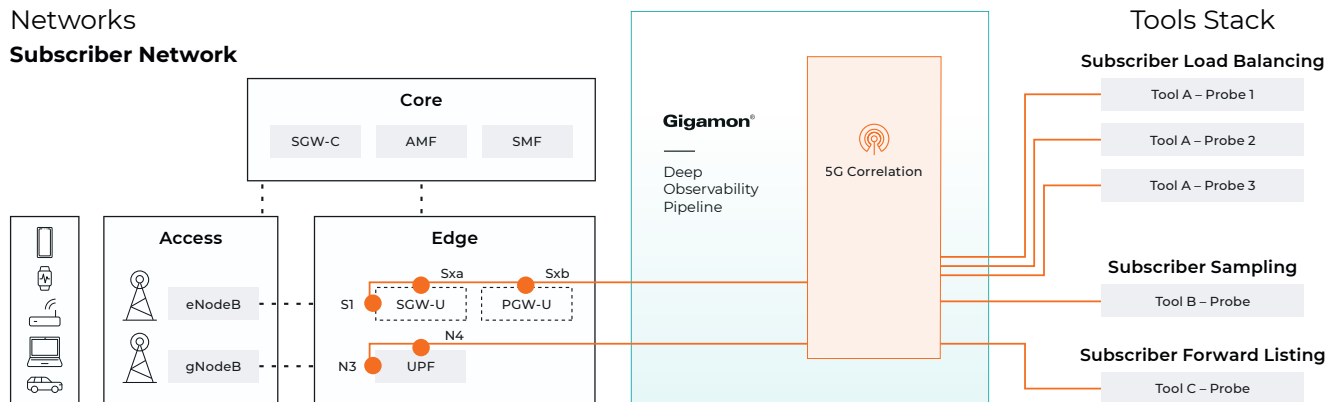


Figure 2. 5G Converged Core session correlation for both 4G and 5G traffic.

# 5G and 4G Converged Core

Gigamon also helps carriers running converged cores processing both 5G and 4G traffic simultaneously. The Gigamon 5G Correlation application can process and correlate both 5G traffic (N3, N4) as well as 4G traffic (S1-U, S11) running on the same converged core.

Further, given the rate of increase in the volume of information traversing the mobile service provider network and the expected explosion in the number of connected devices, the tools infrastructure will be challenged to scale accordingly — and proliferating tools across the network to monitor millions of subscribers will be cost prohibitive for both CapEx and OpEx.

With the Gigamon 5G Correlation application, mobile operators can install a monitoring policy within the Gigamon Deep Observability Pipeline that will intelligently deliver subscriber traffic to specific tools. It does this by correlating the subscriber-specific attributes, including the subscriber ID, also known as the international mobile subscriber identity (IMSI) or subscriber permanent identifier (SUPI). All subscriber-device user plane traffic is carried within GTP-U tunnels, which are identified by tunnel endpoint ID (TEID). Once the GTP-U TEIDs are known and correlated to the subscriber-level attributes, then subscriber traffic can be processed in a subscriber-aware manner.

With this 5G Correlation capability, the Gigamon Deep Observability Pipeline leverages a subscriber-aware monitoring policy and can optimize current tool infrastructure investments by forwarding only relevant data to the tool while increasing visibility into subscriber traffic that can help improve QoE, performance, and security.

5G Correlation enables important subscriber-aware features that optimize traffic monitoring:

1. Subscriber-aware load balancing, whereby all control and user plane sessions are load balanced to as many as 16 tool ports groups using subscriber or equipment identifier-based load-balancing criteria.

2. Gigamon FlowVUE® performs intelligent flow sampling at scale. This highly configurable capability allows tools to receive a subset of subscribers, in order to monitor performance in a statistically significant manner, without having to send every packet to a tool. FlowVUE ensures that all sessions for a percentage of subscribers can be forwarded to monitoring tools, allowing the traffic to be scaled to fit the existing tools. FlowVUE supports several sampling methods to fit your needs, including random, deterministic, and rotational methods, whereby the pool of subscribers that is sampled in will rotate every hour or day or at whatever interval you like.

3. Forward listing, which allows a defined list of high-value subscribers (up to two million) to be chosen to receive full-time monitoring, even with FlowVUE processing enabled.

5G Correlation can be combined with other GigaSMART® traffic intelligence applications, such as Application Filtering Intelligence, which enables monitoring tools to perform more efficiently by eliminating entire sessions of unwanted traffic. Armed with these subscriber-level insights, Gigamon products also help operators identify roaming subscribers across peered networks through IMSI or SUPI forward listing.

By gaining a complete activity view of high-value subscribers, carriers can look to:

- Optimize ARPU by improving operational efficiency, which allows the carrier to better compete with their in-market competitors on an expenses basis
- Ensure business continuity, security, and subscriber experience
- Identify and monetize new offerings

# Key Benefits

- Optimize the tool infrastructure
  - Optimize tools processing by accurately filtering, replicating, and forwarding monitored subscriber sessions
  - Reliably correlate subscriber sessions (control and data) to increase analytics accuracy
- Pervasive visibility into subscriber traffic
  - Extend visibility and proactively identify service issues impacting (and frustrating) subscribers
  - Facilitate drilldowns into roaming users across peer networks
- Maximize QoE and monetize services
  - Gain pervasive subscriber-level visibility and empower monitoring tools to gauge end-user QoE
  - Utilize real-time stateful visibility to enable reliable accounting, billing, and subscription management
- Make the transformation to a unified tool rail possible
  - Cost-efficiently correlate user plane traffic at the Gigamon Deep Observability Pipeline layer instead of needing attached tools to support correlation across multiple probe instances for each tool
  - Ensure that each monitoring and security tool coherently receives control and user plane traffic to help decrease MTTR and reduce ambiguities in the attached tools' results
  - Improve insights by increasing accuracy and precision
  - Distribute correlated traffic samples to reduce demand on each performance monitoring tool

# Rethinking Operator Infrastructure Monitoring with Subscriber-Aware Visibility

5G Correlation enables subscriber and data plane correlation. After correlation, both the subscriber and data plane traffic can be directly sent to the tools when the primary objective is offloading tools from the overhead of 5G Correlation. The solution goes much further than just tool optimization. It is one of the core building blocks for operators looking to build a best-in-class, modern, subscriber-aware visibility platform, as shown in Figure 1.

By combining 5G Correlation with other Gigamon traffic intelligence capabilities, operators can gain deep insights into their networks and both:

· Optimize per-subscriber monitoring cost
· Offer new services that increase the average revenue per user (ARPU)

This is done with tiered monitoring strategies that separate higher-ARPU subscribers from lower-ARPU subscribers.

Such an architecture enables operators to scale their traffic to meet their tools' processing throughput. Forward listing allows all traffic from specific subscribers to be sent to the tools, whereas sampling selects a configurable set of subscriber sessions for analysis. Both forward listing and sampling are part of the FlowVUE application in the GigaSMART suite of traffic intelligence applications and can be used by mobile operators in a variety of ways to implement highly scalable and efficient monitoring methodologies.

Some examples are:

· Prevent entire application sessions corresponding to voluminous over-the-top (OTT) traffic such as YouTube, Netflix, and other video sites from reaching the tools, eliminating expensive and unnecessary upgrades to the tool infrastructure
· Decrypt SSL traffic destined for servers hosted by the operator and feed it to a security tool for malware inspection
· Send only a sample of non-premium sessions to the monitoring tools for analysis
· Use independent tool policy to ensure every tool receives exactly what it needs, without any impact to the other tools
· Sample a set of sessions using a deterministic sampling algorithm, so that you always know whether a session was sampled in or out

To ensure this subscriber awareness is resilient and robust, especially if visibility nodes go offline due to, say, power outages or a need for maintenance, a stateful session-recovery capability is built in, which maintains session state so that KPIs recover quickly. Once the node (or nodes) comes back on line, the subscriber session tracking will continue from where it left off or based on recent updates.

# Pervasive Visibility with a Deep Observability Pipeline

In this era of big data, mobile carriers have searched for a way to efficiently and effectively monitor performance and QoE for their subscribers, as well as identify and monetize new offerings.

Gigamon allows convergence on a single deep observability pipeline that not only simplifies and automates network traffic visibility, but also provides built-in intelligence to address big data. This can shape how mobile carriers choose to monitor and manage their networks to provide better, faster connections and new services, while increasing operational efficiency and network uptime.

Legacy approaches to monitoring have offered limited traffic visibility with limited filtering capabilities, or have been difficult and costly to scale and manage, requiring change orders or network downtime in order to adapt to the evolving network.

Gigamon products provide the architecture and intelligence for mobile operators to create a monitoring infrastructure designed for the era of big data and 5G, and deliver pervasive visibility, awareness, and control from the converged edge to the cloud. Sitting between the IT infrastructure and the tools that need access to data, the Gigamon Deep Observability Pipeline provides a holistic approach to traffic visibility that includes:

- **Architecture advantages:** The Gigamon Deep Observability Pipeline offers the volume, port density, and scale needed to connect the right analytical tools to the appropriate large or bonded pipes. Tool trials are streamlined, new tools can easily be added or removed, and uptime is protected while downtime is prevented with a solution that is outside the production network and provides pervasive visibility.
- **Feature advantages:** Advanced filtering, packet manipulation, and session-aware traffic identification reduce the amount of data arriving at each tool while ensuring that the data is formatted precisely for the tool's consumption. Because each tool doesn't need to parse the incoming stream or waste processor cycles on nonrelevant data, it can be optimized and focus on the more important task of data analysis.
- **GigaSMART applications:** Traffic Intelligence, Application Intelligence, and Subscriber Intelligence (which includes 5G Correlation, GTP Correlation, and FlowVUE) provide effective monitoring of large-to-massive traffic volumes through the logical reduction of traffic, which is more suitable for connecting to existing tools with lower speed ports or limited capacity. The Gigamon 5G Correlation application enables visibility at the subscriber/session level to coherently monitor subscriber QoE and network security, and thus maximally monetize services. Through subscriber-aware flow sampling, the FlowVUE application enables intelligent management of huge traffic volumes while keeping user sessions intact.

**For more information, visit gigamon.com/solutions/service-provider.html.**