

MobileStack

5G Visibility Intelligence Tailored for the Mobile Carrier Evolved Packet Core

Network Challenges

As mobile networks transition from 4G NSA to 5G SA, the amount of traffic to monitor is rapidly increasing, driven by subscriber demands for new services, applications, and devices. The rise in subscriber-driven bandwidth and service demands has led to an exponential increase in user plane traffic, adding to the already overwhelming amount of network traffic that needs to be monitored and managed. Without visibility into this traffic, it's difficult for network operators to identify and address potential issues, optimize network performance, and ensure the security of the network.

The sheer volume of user plane data, combined with new approaches to providing subscribers access to lower latency applications through Control and User Plane Separation (CUPS) and the implementation of Multi-access Edge Computing (MEC), present significant challenges for service provider operations teams. Probes are difficult to scale as they all require data and developing methods for each probe to receive data separately can be tedious and difficult to achieve. As a result, service providers need a comprehensive solution that can efficiently manage network traffic, including the ability to aggregate, process, and forward traffic to probes at scale and within budget constraints.

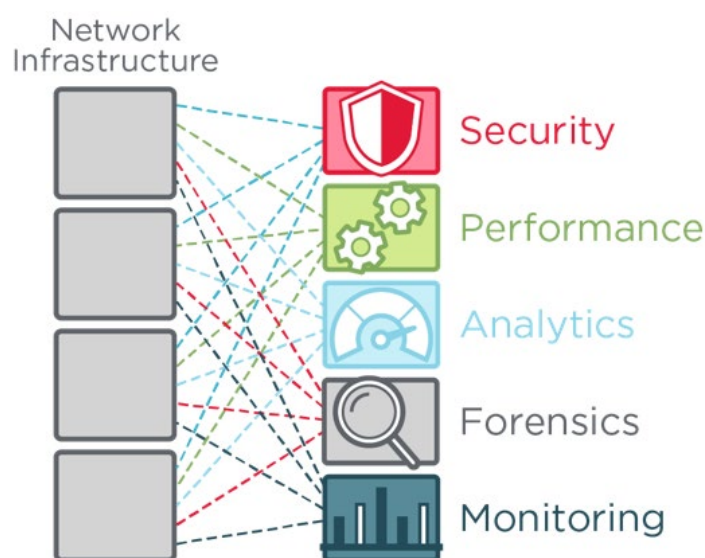


Figure 1. Monitoring platforms without a visibility layer can be very complex

Solution

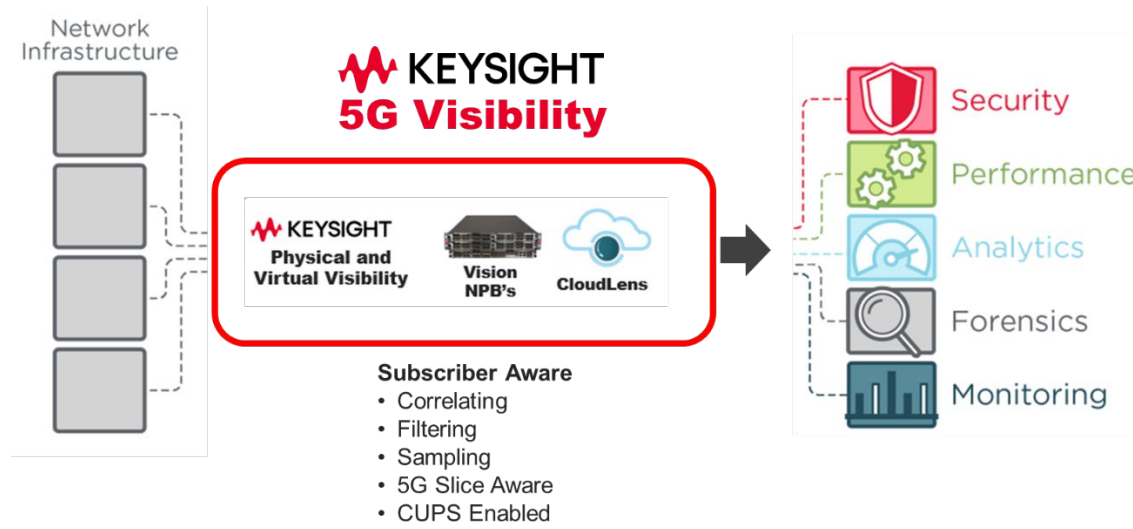


Figure 2. A visibility layer provides easier management of probes and tools at a lower cost

Keysight's MobileStack solutions provide a comprehensive end-to-end visibility solution for service providers, from data access to data processing to generating subscriber-aware metadata. With centralized control through Keysight Vision Orchestrator, MobileStack enables complete 5G visibility control and can integrate with higher-level orchestration layers to meet the dynamic needs of 5G. By leveraging correlation and subscriber sampling, MobileStack significantly lowers probe costs and provides the flexibility to filter and load balance subscriber traffic flows.

The Mobile Core visibility solution offers operational benefits such as reduced complexity, simplified network architecture, and enhanced troubleshooting capabilities. With improved packet filtering and capture options, network traffic can be more efficiently monitored, leading to more targeted troubleshooting and ultimately improved performance. Moreover, MobileStack supports various methods for accessing 5G data, including encrypted traffic, and provides advanced processing capabilities. By offloading processing from probes to the visibility layer, MobileStack enhances network performance and efficiency.

5G Network Visibility Architecture

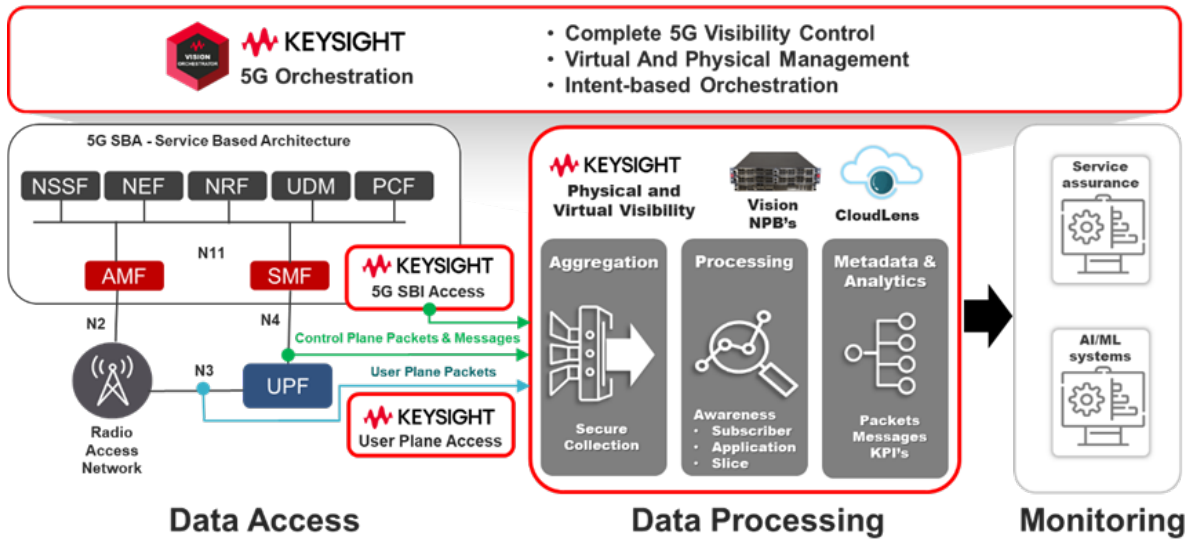


Figure 3. Keysight MobileStack visibility solution comprises components for data access, processing, and management

Vision X

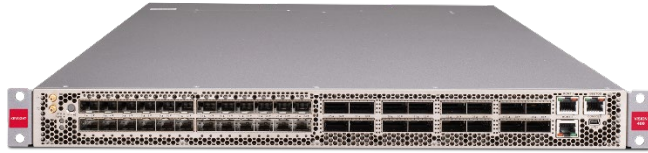


Vision X is a 3RU network packet broker purpose-built for large-scale 5G visibility. It delivers up to **1.6 Tbps of user-plane correlation** and supports **512 million subscriber sessions**, making it suited for the most demanding network environments. Its modular design allows operators to choose between application-centric processing modules or FPGA-accelerated modules depending on the specific performance and feature requirements.

Vision X supports both 5G user-plane and control-plane data access. The platform can terminate **5G SBI interfaces** from network-function vendors while simultaneously correlating, processing, and distributing traffic to monitoring tools. This reduces probe load and significantly lowers visibility infrastructure costs. After correlation, Vision X can generate subscriber- and application-aware metadata and forward it efficiently into analytics, observability, or big-data systems.

Designed for flexibility at both the edge and core, Vision X adapts to deployments requiring heavy control-plane inspection, large-scale user-plane correlation, or a combination of the two. Its performance, scale, and processing depth help service providers achieve true end-to-end visibility across 5G networks.

Vision 400XT



The Vision 400XT is a high-density 1U visibility platform engineered for large 4G/5G deployments. It supports **up to 12 million subscriber sessions** and delivers **400G of user-plane correlation** within a compact footprint. By integrating CPU, FPGA, and switch-fabric processing in a single chassis, the platform enables operators to map each visibility function to the optimal processing engine.

This architecture provides full flexibility across edge and core deployments, including distributed GTP correlation and native 400G port-speed operation. The result is a scalable, efficient visibility platform that fits easily into both centralized and highly distributed 5G architectures.

MobileStack Product Portfolio

	Vision X with GTP Correlation	Vision X with GTP Flow Distribution (ELB)	Vision 400XT	GSC 7433	Vision ONE
GTP correlation	✓		✓	✓	
GTP load balancing	✓	✓	✓	✓	
SIP/RTP correlation					✓
MobileStack PLUS	✓			✓	✓
Packetstack PLUS			✓		
Subscriber filtering	✓			✓	✓
Whitelisting	✓			✓	✓
Sampling	✓			✓	
Packet core filtering	✓			✓	✓ (SIP only)
Fragmentation	✓			✓	
Backup and restore	✓	✓	✓	✓	
GRE origination	✓	✓	✓		
GRE termination	✓	✓	✓	✓	✓
S1/S11	✓	✓	✓	✓	
Gn					
S6a					
S1MME	✓	✓	✓	✓	✓
S5	✓	✓	✓	✓	✓
S8	✓		✓	✓	
S2b	✓			✓	
5G PFCP support (N3, N4)	✓	✓	✓	✓	
5G N11 support (N11)	✓				

Figure 4. Keysight MobileStack feature table

5G Data Access

Accessing packet data in 5G networks can be challenging due to the encryption and the dynamic nature of the Service-Based Interface (SBI). Keysight offers multiple 5G data access options, including integration with Network Function vendor virtual TAPs (NF-vTAP) and a Keysight data access method that works without specific network equipment. The NF-vTAP option provides penetration of the encrypted traffic and Keysight has developed additional methods for encrypted packet access. By adding a Keysight visibility layer, service providers can ensure network performance and deliver a superior user experience.

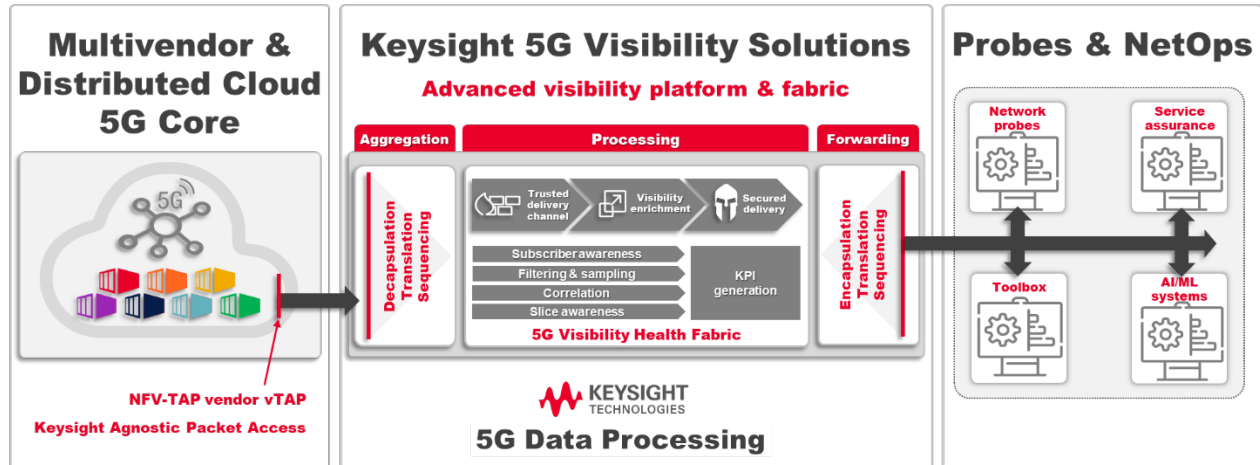


Figure 5. Keysight 5G data access solutions integrate with network equipment manufacturers' virtual taps or agnostic solutions that work with any network core

The solution provides easier configuration, an abstraction layer for updated software and traffic translation, and improved security and performance. Keysight's solution also removes duplicate packets between SBI functions and relocates timestamps to the trailer to enhance probe efficiency. With packet capture capabilities, the visibility layer aids in troubleshooting and debugging situations between network equipment manufacturers and probe vendors.

5G Orchestration

Keysight's 5G visibility solution, Vision Orchestrator, provides a centralized management system for visibility that includes whitelist management for SUPI/IMSI/MSISDN, inventory management, and both physical and virtual visibility management. It reacts to changes within the 5G environment, ensuring that as services are deployed or scaled, the platform is able to automatically and reliably receive new data streams without manual reconfigurations or loss of data. With a common API and intent-based solution, Vision Orchestrator is easy to configure and maintain, and features a self-healing data plane. Operator-friendly and highly maintainable, Vision Orchestrator ensures visibility and reliability in a constantly changing 5G environment.

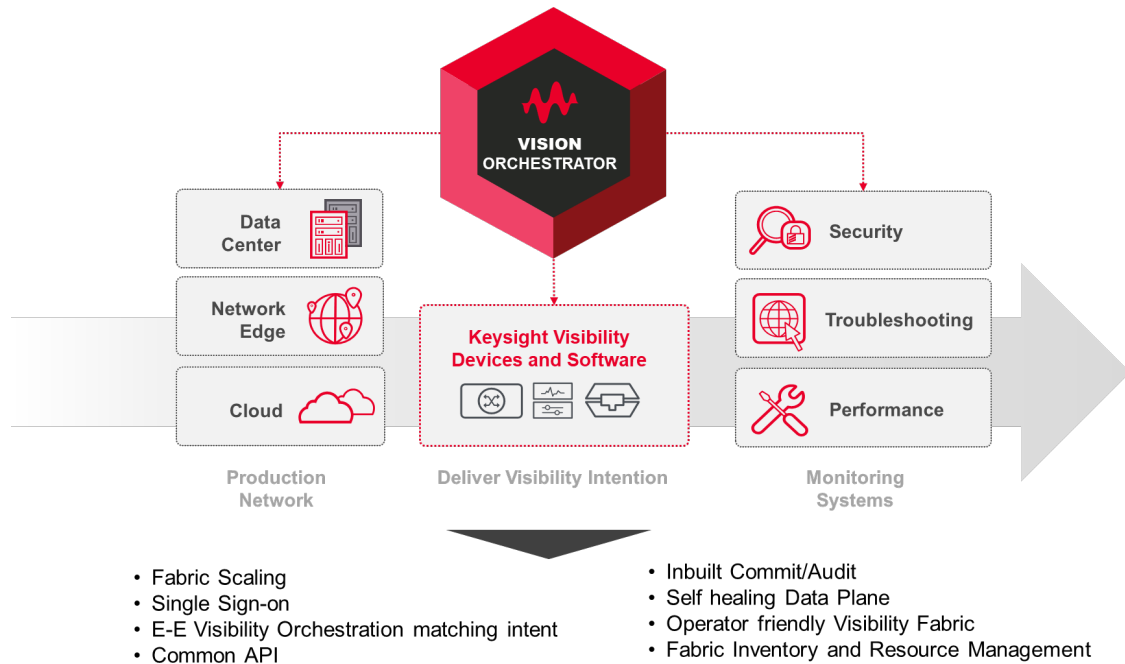


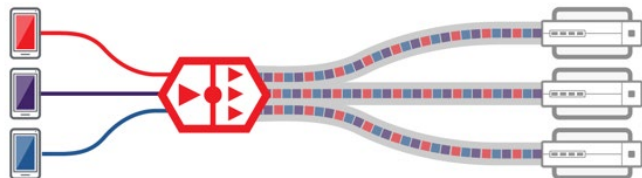
Figure 6. Keysight Vision Orchestrator automates network service provisioning, monitoring, and troubleshooting for efficient operation of dynamic 5G networks

GTP/SIP Session Correlation

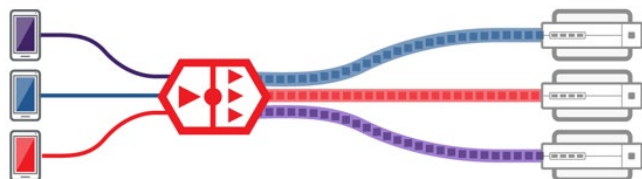
GTP correlation is a critical aspect of network visibility for service providers as it efficiently processes and manages the large volumes of data generated by 5G networks. Mobilestack offers GTP correlation, a method that provides subscriber session correlation across the network, enabling the reconstruction of data flows and the analysis of traffic patterns. GTP correlation offers several advantages over traditional GTP flow distribution, such as the ability to perform efficient and effective 5G data access and analysis using techniques like sampling and whitelisting. Additionally, GTP correlation reduces probe and tool costs while maintaining subscriber quality of experience (QOE) using subscriber correlation, sampling, and filtering.

GTP correlation also provides multiple session filters to increase flexibility and ease of use, including filters for SUPI, IMSI, MSISDN, GPSI, IMEI, PEI, DNN, APN, QFI, QCI, NSI, NSSAI, and RAN ID. Finally, GTP correlation features integrated session table backup, allowing session table persistence between reboots and upgrades, as well as multiple allow listing capacity to maintain visibility into important subscribers while sampling.

WITHOUT SESSION CORRELATION

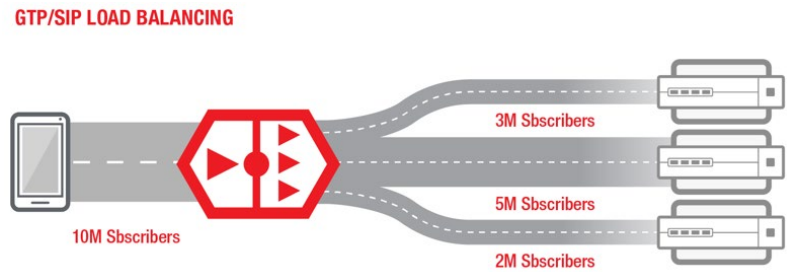


WITH SESSION CORRELATION



GTP/SIP Load Balancing

Load balancing helps to scale a monitoring infrastructure to ensure network probes receive distributed traffic or sessions. Distribution ensures multiple probes can split the monitoring quality of service (QoS) load without exceeding a probe's capacity.



- MobileStack provides load balancing GTP/SIP data plane traffic based on probe throughput capacity
- MobileStack's enhanced GTP/SIP session correlation function assures that traffic for one subscriber's control and data sessions always reach the same monitoring probe.

Coupled with GTP/SIP correlation functionality, load balancing applies to throughput, the number of supported subscribers per probe, or by the supported packets per second (pps).

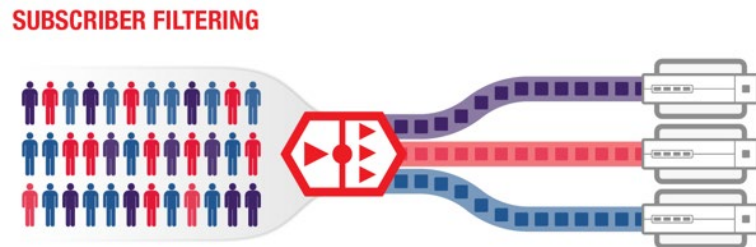
Subscriber Filtering

Subscriber-aware filtering is a critical component of 5G network visibility, enabling operators to selectively filter and analyze data from individual devices on the network.

This filtering provides a wide range of filter options, including

Subscription Permanent Identifier

(SUPI) filtering, International Mobile Subscriber Identity (IMSI) filtering, Mobile Station International Subscriber Directory Number (MSISDN) filtering, International Mobile Equipment Identity (IMEI) filtering, and slice filtering NSI/NSSAI and Radio Access Technology (RAT) like UTRAN, location identifiers like ULI, quality identifiers like QFI, QCI and 5QI, and domain identifiers like APN or DNN (see above section regarding Subscriber Filtering for all filter options).



Subscriber filtering enables a variety of use cases for operators, including:

- Selective filtering and analysis of data from users who are activating new features, for debugging and troubleshooting purposes
- Always-on monitoring of high-value subscribers, with the flexibility to ensure visibility of user experience by different subscriber segments, when combined with subscriber sampling
- Cost-effective infrastructure, reducing the need for additional probes and allowing operators to provide different Service Level Agreements (SLAs) to customers

In addition to these benefits, subscriber filtering can also be used to direct different flows of subscriber data to specific tools. For example, operators can filter all 4G traffic and send it to a different set of probes than 5G traffic, or they can direct different 5G network slice data to different probes, allowing slices with

different SLAs to go to different types of probes. Subscriber filtering provides this flexibility, maximizing probe utilization and reducing costs.

Subscriber filtering is also useful for tracking and managing individual devices on the network. By using IMSI and SUPI filters, network administrators can detect rogue or unauthorized devices on the network, identify devices that may be causing network issues, track devices that may have been involved in security breaches, and implement policies and controls based on specific devices for more detailed network management.

Overall, subscriber filtering plays a critical role in ensuring the security, reliability, and performance of 5G networks. By providing a more granular and detailed view of network traffic and behavior, operators can quickly identify and address potential issues, improve network performance, and ensure the security of the network.

The complete list of Keysight Subscriber Filtering options is listed in the table below:

Filter Type	Filter Parameter
Subscriber parameters	<ul style="list-style-type: none"> Subscription Permanent Identifier (SUPI) International Mobile Security Identity (IMSI) International Mobile Equipment Identity (IMEI) Mobile Station International Subscriber Directory Number (MSISDN) Generic Public Subscriber Identifier (GPSI) Permanent Equipment Identifier (PEI)
Slice filtering	<ul style="list-style-type: none"> Network Slice Instance (NSI) Network Slice Selection Assistance Information (NSSAI)
Radio access technology	<ul style="list-style-type: none"> UMTS Terrestrial Radio Access Network (UTRAN) GSM EDGE Radio Access Network (GERAN) Wireless LAN (WLAN) Generic Access Network (GAN) High-Speed Packet Access (HSPA) Evolved Universal Mobile Telecommunications System (EUTRAN) Virtual
Location identifiers	<ul style="list-style-type: none"> User Location Identifier (ULI) 5G NR Cell Global Identity (NCGI) Location Area Identity (LAI) E-UTRAN Cell Global Identifier (ECGI) Cell Global Identity (CGI) Service Area Identifier (SAI) Routing Area Identifier (RAI)
Quality identifiers	<ul style="list-style-type: none"> 5G QoS Identifier (5QI) QoS Flow Identifier (QFI) Bearer QoS Class Identifier (QCI)
Domain	<ul style="list-style-type: none"> Data Network Name (DNN) Access Point Name (APN)

Figure 7. A list of subscriber, slice, RAT, and location-based filter options that can be applied to visibility flows in a 4G/5G correlation workflow. These filters make it easy to direct different subscriber groups to specific probes or probe groups, with complex rules easily configured in the Keysight 4G/5G interface.

Network Slicing

In 5G, network slicing is not only important for creating virtual networks, but also for filtering traffic in the visibility layer. By leveraging NSI and NSSAI filter variables, operators can combine them with subscriber, radio access technology, location identifiers, quality identifiers, and domain (see above section regarding subscriber filtering for all filter options) to create flows of traffic to probes. This approach enables administrators to have a clear view of the performance and behavior of each network slice, which is crucial in 5G where multiple use cases demand different network requirements. Without network slice awareness, tools may not be able to distinguish traffic between network slices, leading to visibility blind spots and potential performance issues. By incorporating network slicing into their visibility solutions, mobile operators can ensure that they have end-to-end visibility across all slices of the network, and can quickly identify and address any potential issues, ensuring a smooth and efficient network operation.

Keysight visibility with slice awareness provides:

- The ability to monitor and control multiple slices simultaneously
- Real-time visibility and analytics capabilities
- The ability to detect and respond to security threats
- The ability to support virtualization and automation
- Scalability to handle large amounts of data and many network slices
- Integration with other network management and security tools.

Overall, network slicing in 5G and a superior visibility platform are critical for ensuring the reliability, scalability, and security of 5G networks.

Subscriber Sampling

Subscriber sampling is a key feature in reducing the overall cost of probe deployment, allowing mobile operators to send only a certain percentage of the subscriber traffic, or a sample, to the monitoring infrastructure. By selecting a representative sample of data, the variation in Probe KPIs (e.g. percentage of dropped calls over a given period) is not statistically significant, resulting in improved throughput and reduced load on tools. This, in turn, allows mobile operators to better manage QoS and monitor QoE, while keeping costs in check. Moreover, the ability to turn up or down the sampling rates as needed allows operators to efficiently manage the capacity of existing probes, reducing the need for costly hardware upgrades.

The combination of subscriber sampling and subscriber aware filtering also provides allowlist capabilities for high-value customers who always appear in the sample. This ensures that these customers receive the necessary quality of service and helps maintain their satisfaction with the service, which can have a positive impact on customer retention. Additionally, by utilizing sampling and filtering techniques, mobile operators can avoid oversubscribing their probes and overloading their monitoring infrastructure, which can lead to lost data and reduced accuracy in analysis.

SUBSCRIBER SAMPLING



Subscriber Allowlisting

In addition to subscriber sampling, allowlisting is an important feature that can be used to ensure that a specific cohort of users are always forwarded to probes, even when traffic is being sampled. This is particularly important for high-value customers who require a certain level of service and whose activity is closely monitored. This feature provides greater granularity and control over the sampled traffic and ensures that high-value customer visibility is maintained even when the overall traffic volume is high.

SUBSCRIBER ALLOWLIST



The allowlist feature in MobileStack has a capacity of up to 8 million customers on the Vision X platform and is based on Subscriber Permanent Identifier (SUPI), International Mobile Subscriber Identity (IMSI), Mobile Station International Subscriber Directory Number (MSISDN), or International Mobile Equipment Identity (IMEI). This flexibility allows operators to specify the criteria for including customers in the allowlist and ensures that the feature can be tailored to meet the specific needs of the network. With MobileStack's allowlist, operators can provide a high level of service to their most important customers and maintain visibility and control over their activities, even in high-traffic scenarios.

Control and User Plane Separation (CUPS)

5G networks use the Control and User Plane Separation (CUPS) technique to separate the control and user plane data, enabling greater flexibility, scalability, and security. The control plane manages the network resources, maintains the network state, and provides signaling between the devices. In contrast, the user plane is responsible for the transportation of user data.

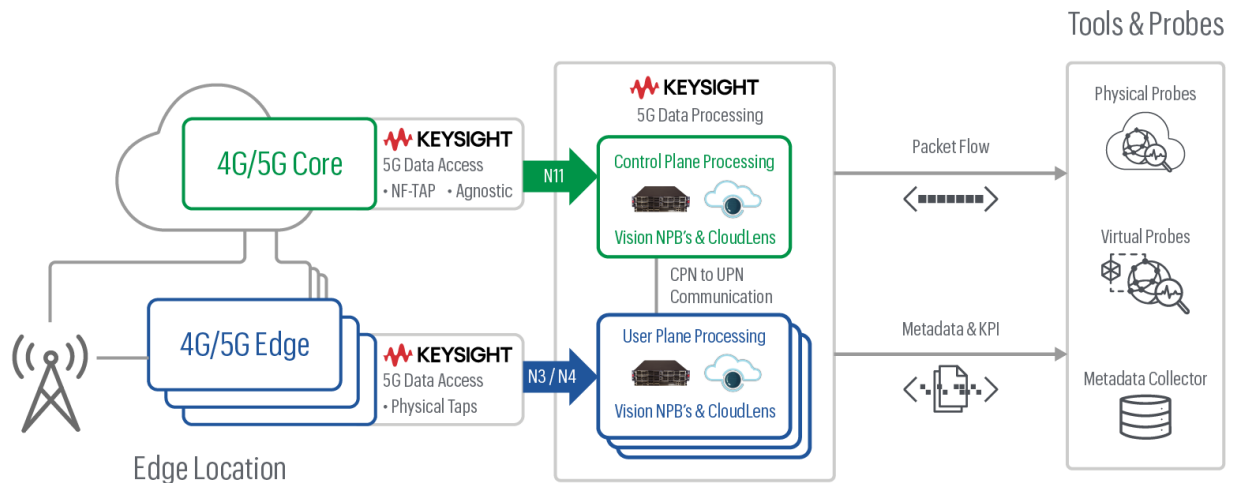


Figure 8. Keysight's 5G visibility, with CUPS support, brings user plane traffic closer to the edge, enhancing network performance and reliability.

By separating these two planes, CUPS enables independent management of the control plane from the user plane which enables better visibility into the network. With CUPS, the control plane can be virtualized and run on a separate infrastructure, which is a more efficient allocation of network resources. It also provides better control over network traffic and the ability to scale the network more easily. The separation of control and user plane data also enables the implementation of more granular security measures, improving the network's overall security.

Keysight 5G Visibility Platform Provides:

- Monitor and control multiple slices of the control plane simultaneously
- Application of real-time visibility and analytics on control plane traffic
- Control plane virtualization and automation using Keysight Vision Orchestrator
- Scalability to handle large amounts of control plane data and many network slices
- Integration with other network management and security tools.
- The use of CUPS and a superior visibility platform in 5G networks are critical for ensuring the reliability, scalability, and security of 5G networks.

MobileStack PLUS

Unlike traditional visibility, which requires complex processing operations to loopback through the same device, Keysight's MobileStack on Vision X network packet broker has the horsepower to process not only GTP correlation in the same visibility flow but also in combination with deduplication, QUIC/HTTPs trimming and timestamping. This provides service provider operations teams with a more efficient visibility layer by processing.

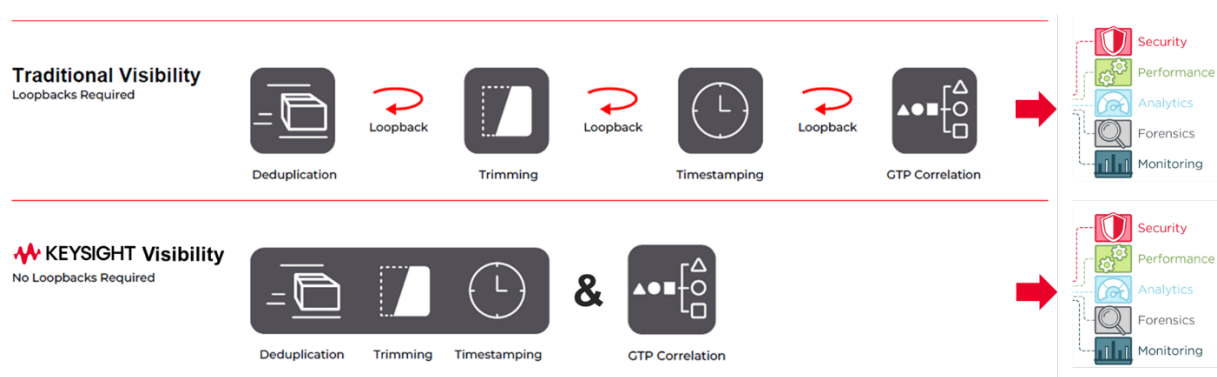


Figure 9. Mobilestack PLUS simplifies network design, reducing costs by enabling simultaneous processing of multiple operations like deduplication and GTP correlation, without loopbacks

PacketStack+

PacketStack+ delivers line-rate advanced packet processing through a P4-programmable pipeline built on Tofino switch silicon. The architecture enables all advanced functions to run simultaneously across all ports and speeds without performance loss. Capabilities include protocol header stripping, deduplication, packet trimming (slicing), timestamping, data masking, native tunnel termination, and L2GRE/VXLAN tunnel origination.

[Learn more about PacketStack+ features.](#)

Subscriber Aware Metadata

Our solution offers subscriber-aware metadata which allows for KPIs with mobility parameters such as SUPI, IMSI, IMEI, RAN ID, and per-flow transport KPIs like connection setup time, application response time, and aggregated KPIs including uplink and downlink throughput, and peak and average data rates. This metadata can be forwarded to a distributed event streaming platform or via IPFIX and NetFlow. By combining packet-based visibility with metadata, organizations can get a complete view of all customers via metadata and only investigate specific problems via packet-based visibility when they occur. This approach helps manage the high costs associated with buying more probes to handle the surge in user plane traffic.

Subscriber aware Metadata generation

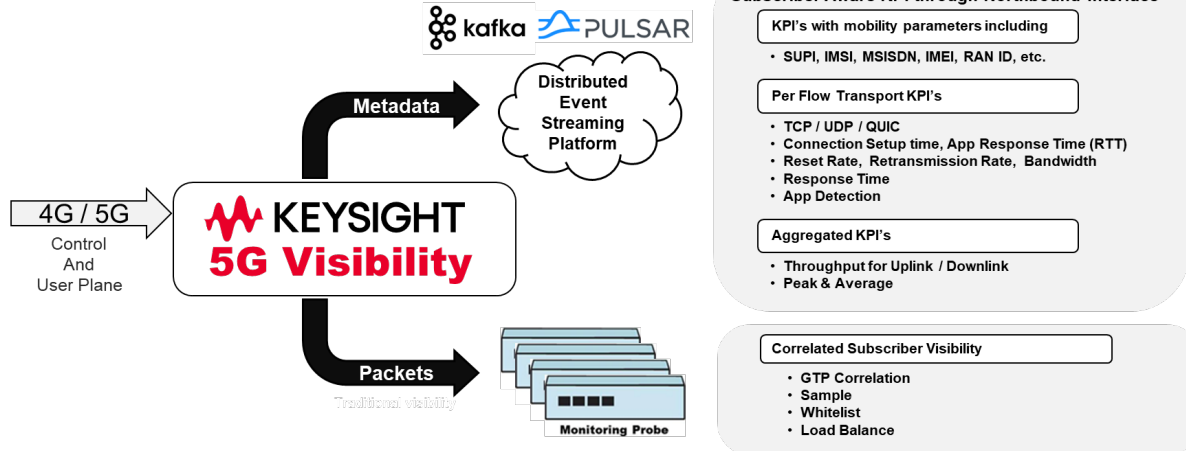


Figure 10. Metadata generation enhances service assurance platforms beyond packets with cost-effective insights for big data and machine learning

GTP Flow Distribution (ELB)

Certain probe types require a complete view of all GTP-C traffic, and for these situations, MobileStack provides GTP flow distribution that broadcasts control plane traffic to all probes and load-balances all user plane traffic.

GTP Flow Distribution Solution - Available on the Vision X Platform

- Utilize Elastic Load Balancer (ELB) to load balance GTP traffic using GTP Flow Distribution
- Delivers smooth GTP-U IP flow distribution across multiple tool ports
- Broadcasts GTP-C packets to one or multiple tool ports
- Handles up to 2TB of GTP traffic per Vision X chassis within dedicated hardware acceleration architecture for high performance

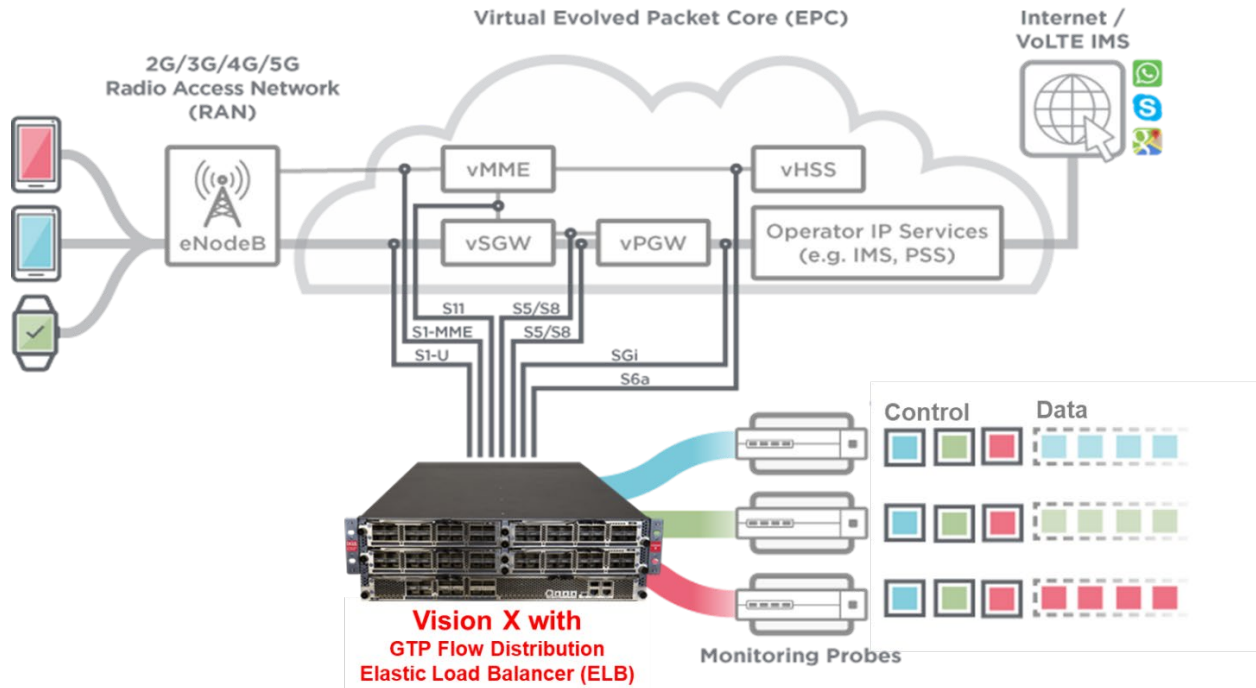


Figure 11. GTP Flow Distribution, also known as Elastic Load Balancer (ELB), broadcasts control plane and load balances user plane traffic

Voice Over LTE (VoLTE) Technology and MobileStack

VoLTE carries voice over the same high-bandwidth links used for services like HD video, which makes voice quality highly noticeable when problems occur. Today, operators often monitor all voice traffic to maintain quality — but doing so requires a large number of costly probes.

MobileStack’s VoIP application reduces the amount of voice traffic sent to probes while still preserving subscriber QoS. It enables operators to get key KPIs — such as average MOS — without needing full visibility into every call. MobileStack groups packets for each call, tracks calls across multiple sites, and uses intelligent sampling to detect issues efficiently. VIP subscribers can also be fully included through allowlisting.

The solution correlates VoLTE calls across EPC and IMS interfaces using SIP signaling. It supports load balancing through port weighting, caller/callee allowlisting, and multi-site sampling. Available statistics include active and peak call counts, new calls per second, timeouts, and SIP/RTP packets per second.

MobileStack Ordering Information

Vision X with GTP Correlation

LIC-VX-MS2C	IXIA Vision X, MobileStack perpetual feature; GTP Correlation, GTP-U for up to 200G on MVX-PS-R or MVX-PS8PC Module; Max (2) per module
LIC-VX-GTP	IXIA Vision X, MobileStack perpetual feature; GTP Correlation, GTP-C for up to 64M subscriber sessions per CPU on MVX-AM4PC module; Max (2) per module
LIC-VX-GTP5GC	IXIA Vision X, MobileStack perpetual feature; GTP Correlation, 5G correlation, load balancing and CUPS support on MVX-AM4PC module. Requires one LIC-VX-GTP license; Max (2) per module (993-0193)

Vision ONE SIP/RTP

MV1-MS-SRC	IXIA Visibility Application Module bundled with MobileStack; Includes SIP/RTP for VoLTE license; Requires previous or adjunct purchase of Vision ONE system. One license per system
LIC-V1-MS-SRC	IXIA MobileStack SIP/RTP for VoLTE license.

Vision X with GTP Flow Distribution

LIC-VX-GTPFD2C	IXIA Vision X, 200G MobileStack GTP Flow Distribution (ELB), Per Module; licensed per PacketStack module
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Vision X MobileStack Plus Features

LIC-VX-PS-MS-DDUP	Keysight Vision X deduplication feature perpetual license. MUST run in conjunction with MobileStack GTP correlation, requires LIC-VX-MS2C. Max (1) per chassis (993-0346)
LIC-VX-PS-MS-TRIM	Keysight Vision X packet trimming feature perpetual license. MUST run in conjunction with MobileStack GTP correlation, requires LIC-VX-MS2C. Max (1) per chassis (993-0347)
LIC-VX-PS-MS-TMSP	Keysight Vision X timestamping feature perpetual license. MUST run in conjunction with MobileStack GTP correlation, requires LIC-VX-MS2C. Max (1) per chassis (993-0348)
LIC-VX-PS-MS-TRAL	IXIA Vision X add trailer with original packet length feature perpetual license. MUST run in conjunction with MobileStack GTP correlation, requires LIC-VX-MS2C. Max (1) per chassis (993-0349)

Vision X 5G Data Access

LIC-VX-5GT	Keysight Vision X, MobileStack third-party virtual tap termination perpetual feature; Licensed for one (1) CPU on MVX-AM4PC module; Max (2) per module
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Vision X with Subscriber Aware Metadata

LIC-VX-MSMD	Keysight Vision X, MobileStack Metadata Generation support per chassis on MVX-AM4PC modules; Max 1 per chassis
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Vision 400XT Correlation

LIC-V400-GTP5GC	Keysight Vision 400, Floating (worldwide) perpetual license - MobileStack 4G/5G GTP control plane correlation. Max 1 per Vision 400. Supported on Vision 400XT Only (993-0367)
LIC-V400-MS2C	Keysight Vision 400, Floating (worldwide) perpetual license - MobileStack 4G/5G GTP user plane correlation, 200G of GTP-U. Max (2) per Vision 400 (993-0368)

Keysight enables innovators to push the boundaries of engineering by quickly solving design, emulation, and test challenges to create the best product experiences. Start your innovation journey at www.keysight.com.



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