



Solution Guide

# R&S<sup>®</sup> PROBE OBSERVER

Ready-to-use network analytics suite for  
high-performance network monitoring

**ROHDE & SCHWARZ**

Make ideas real



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# 1 INTRODUCTION

Communication service providers (CSPs) are struggling to remain competitive in today's fast-changing environment. To successfully face future challenges such as Big Data, 5G and IoT, CSPs need to:

- ▶ Be able to handle increasingly large data volumes and a growing number of connected endpoints.
- ▶ Keep a lid on costs by avoiding classical price-per-throughput models, which are too costly to optimize and plan networks effectively.
- ▶ Be able to connect their existing analytics tools to multiple systems without being limited to only one type of analytics solution.
- ▶ Reduce cost pressure by reducing operational expenditure (OpEx) and capital expenditure (CapEx) as well as generating new revenue streams and finding ways to keep customers satisfied.

## The following factors are essential for choosing the right traffic analytics solution:

- ▶ Flexibility and scalability: Accelerate performance and be prepared for changing conditions without having to replace existing systems.
- ▶ Real-time IP network monitoring and subscriber analytics: Increase customer satisfaction and decrease customer churn.
- ▶ Holistic analytics approach for maximum business efficiency: Avoid silo mentality and drive business with cross-departmental data usage.

## 1.1 Key benefits

### Revenue generation

Connecting R&S®Probe Observer to Big Data analytics systems creates new opportunities for CSPs to monetize additional services based on objective data from the network, for example subscriber segmentation and NB-IoT analytics.

### OpEx savings

R&S®Probe Observer enables real-time monitoring of the core network reducing monitoring efforts at the edge and optimizing RAN network troubleshooting.

### CapEx savings

Reduce capital expenditure (CapEx) through inherent modularity and scalability. Easily integrate, fully virtualize, and scale on demand, optimizing your infrastructure investment.

### Future-proof solution

The various deployment scenarios of R&S®Probe Observer and the use of open standards such as Apache Kafka and IPFIX as a connector to any type of analytics solution make the whole system future-proof. R&S®Probe Observer allows decoding of control plane data providing new insights into RAN, such as RSRP, RSRQ, SINR measurements, cell congestion, re-selection events etc., and NB-IoT patterns, such as PSM and eDRX activities, coverage enhancement, device communication intervals etc., enabling deeper network optimization and dynamic slicing.

### Customer retention

Real-time traffic analytics deliver advanced and efficient troubleshooting capabilities, directly improving quality of experience (QoE) and quality of service (QoS).

## 1.2 Key features

- ▶ Customizable virtualized or bare-metal system with high scalability, scaling up to the Tbps mark
- ▶ Deepest insights based on real network usage, application performance and subscriber experience
- ▶ High statistics resolution with a configurable reporting rate down to 1 second
- ▶ Easy-to-use drill-down dashboards to get insights about overall network, subnetwork, individual subscriber
- ▶ Data export for Big Data systems makes it a holistic analytics platform

R&S®Probe Observer excels in modularity and processing speed, offering optimal support to CSPs facing future challenges and technologies.

# 2 SOLUTION ARCHITECTURE

R&S<sup>®</sup>Probe Observer is a traffic analytics solution that extracts data from a passive copy of the production traffic, in real time. Its flexibility and adaptability to different deployment situations and customer requirements make it easy for CSPs to extract all the insights they need, even when dealing with highly specific implementations.

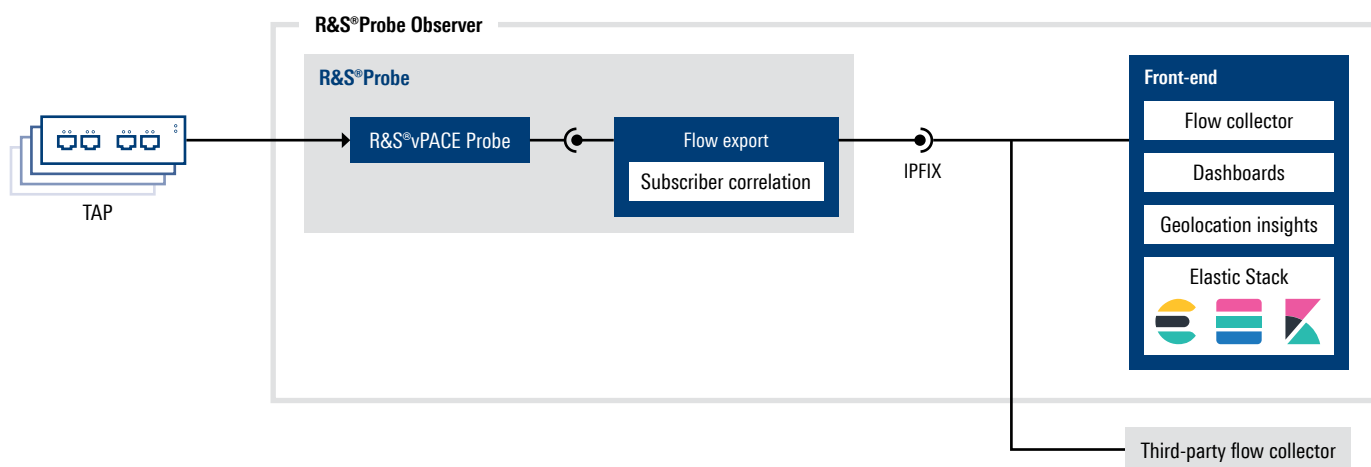
Featuring the technologically leading deep packet inspection (DPI) engine R&S<sup>®</sup>vPACE and advanced real-time packet processing, R&S<sup>®</sup>Probe Observer offers high-quality real-time information about network traffic, subscriber sessions and network metadata.

## 2.1 Components

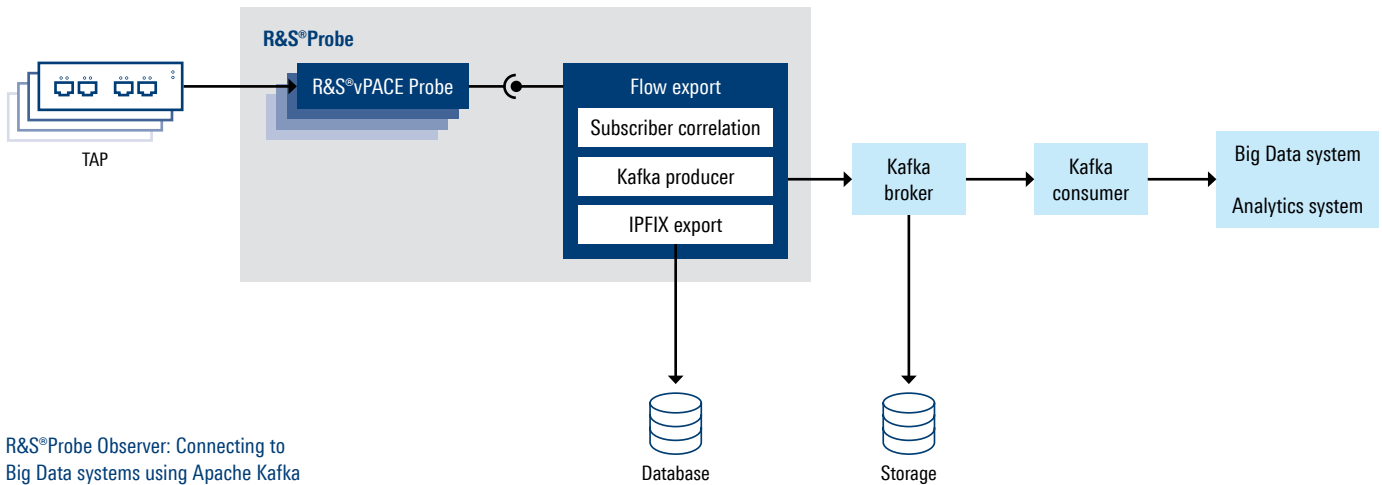
R&S<sup>®</sup>Probe Observer can handle several Tbps of real-time traffic. It consists of an analytics platform and multiple instances of R&S<sup>®</sup>Probe, which are powered by the DPI engine R&S<sup>®</sup>vPACE.

- ▶ R&S<sup>®</sup>Probe is a technically advanced, intelligent IP probe that allows CSPs to extract meaningful network traffic and subscriber behavior data, and to identify statistical trends in mobile and fixed networks. R&S<sup>®</sup>Probe is powered by R&S<sup>®</sup>vPACE.

- ▶ R&S<sup>®</sup>vPACE is a powerful DPI engine for highly reliable real-time classification of IP traffic, covering thousands of protocols and applications. It extracts rich data such as usage time, type of content, identification of different types of services, and the top applications. R&S<sup>®</sup>vPACE is deployed worldwide and known for its fast performance and efficient memory usage.
- ▶ Front-end: R&S<sup>®</sup>Probe Observer includes a data analysis and high-performance network monitoring front-end that automatically aggregates and stores all relevant information extracted from IP packets and flows. Open REST APIs of the Elastic Stack provide direct access to the underlying analytics database. An easy-to-use, intuitive and customizable user interface provides a wide variety of views, displaying detailed insights into all kind of network traffic flows.



R&S<sup>®</sup>Probe Observer components



## 2.2 Deployment scenarios

R&S<sup>®</sup>Probe Observer offers a variety of deployment scenarios, depending on the specific use cases and customer needs.

### 2.2.1 All-in-one analytics system

R&S<sup>®</sup>Probe Observer can be deployed as a stand-alone main traffic analytics system. This scenario is especially suitable for CSPs that need an end-to-end analytics system to process traffic and present relevant reports for strategic decision-making, network planning, and subscriber analytics.

- ▶ Reads real-time data records from a pool of R&S<sup>®</sup>Probe instances
- ▶ Connects to external systems to enrich its database with additional information, including CRM, TAC, etc.
- ▶ Performs subscriber correlation and data correlation, and generates reports
- ▶ Provides customizable dashboards via its graphical web interface

### 2.2.2 Supplement to Big Data systems

The front-end of R&S<sup>®</sup>Probe Observer provides an aggregation function for traffic and subscriber information to correlate data with additional sources, creating a Big Data pool.

- ▶ Reads real-time data records from a pool of R&S<sup>®</sup>Probe instances
- ▶ Provides aggregated information on network traffic, subscribers, services and applications to Big Data systems
- ▶ Integrates the analytics capabilities of Elastic Stack
- ▶ Ready to integrate into analytics system landscapes via Apache Kafka and IPFIX

### 2.2.3 Combined set-up

R&S<sup>®</sup>Probe Observer can be deployed as both an independent traffic analytics system that provides insights and dashboards, and as an aggregator for Big Data and third-party analytics.

## Benefits

- ▶ Developing a Big Data system containing knowledge based on aggregated data from multiple sources offering a solution which provides valuable data for several internal departments with differing demands
- ▶ Avoiding proprietary data extraction systems with vendor lock-in as well as specific analytics for narrow and inflexible use cases
- ▶ Very short time-to-market through use of existing systems
- ▶ Future-proof analytics architecture that supports further extensions, virtualization and an agile approach to changing requirements

## 2.3 Connecting to Big Data solutions

The true value of collected data emerges when data is extracted from all the CSP's business units and then analyzed as a whole. To connect an analytics system effortlessly to any Big Data system, flexible interfaces are crucial.

R&S<sup>®</sup>Probe Observer can be easily deployed in any network to enrich existing Big Data systems, as well as external analytics tools, with real-time data from the network. The Apache Kafka interface ensures optimized and reliable real-time data delivery between R&S<sup>®</sup>Probe Observer and third-party data analytics systems. This synergy of multiple analytics systems ensures an optimal use of data and brings value to several use cases and departments.

For example, the data rates of each individual application (e.g. Netflix on mobile) regarding radio sector and radio technology can be coupled with network layout maps to extrapolate potential optimization approaches, ensuring a consistent QoE for Netflix users across access technologies and locations. The same data can be analyzed in parallel and combined with subscriber analytics and CRM systems to identify potential strategies for monetizing over-the-top (OTT) services, such as flat rates, premium packages, partnering with OTT providers, etc.

Apache Kafka is an open-source streaming platform used for building real-time data pipelines. Systems and applications can publish (producers) or subscribe (consumers) to a stream of data (records). In the example below, R&S<sup>®</sup>Probe Observer is acting as a Kafka producer, while the customer's Big Data system is the Kafka consumer. Information about communication flows as well as subscriber sessions are reported in real-time by R&S<sup>®</sup>Probe Observer and are temporarily stored in the Kafka broker. Depending on the use case and implementation, customer Big Data systems can subscribe to specific data on demand and read data at their own tempo.

R&S<sup>®</sup>Probe Observer leverages Elastic Stack with industry-grade data analytics capabilities to efficiently index, filter, and visualize the insights that are required for the task.

With data exchange grounded in the widely adopted industry standard IPFIX and enhanced with our year-long experience in the domain, we ensure interoperability, stability and tailored insights for every use case.

Other real-time data feed platforms are available if required.



"This holistic use of data represents a significant shift in how we can extract value from our network, use data in a more agile way and accelerate time to action."

**Product Manager, European Tier 1 CSP**

# 3 BUSINESS CASES

The following business cases are a selection of scenarios and do not intend to cover all potential use cases.

## 3.1 Solving Open RAN observability for mobile network operators (MNO)

### 3.1.1 Initial situation

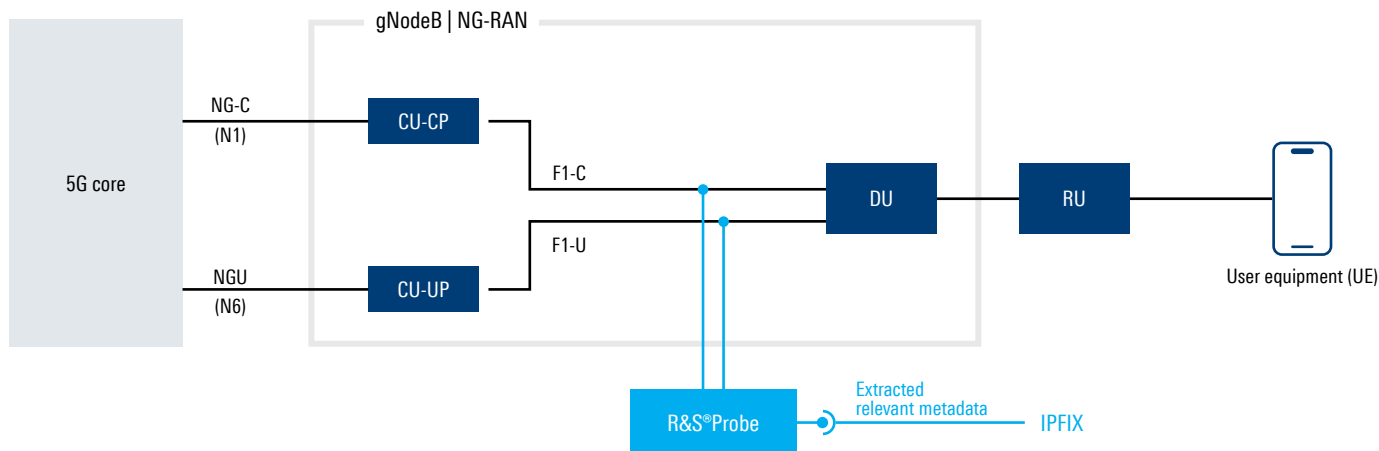
The advent of next-gen wireless technologies such as 5G, 5.5G, and 6G, combined with emerging data applications such as AR/VR gaming and V2X communications, is driving mobile network operators (MNO) to revamp their network architectures and operational models. This has led to the rise of Open RAN, a revolutionary approach that promotes openness, virtualization, disaggregation, cloudification, multi-vendor solutions, and interoperability. By enabling different RAN hardware, control platforms, and network functions to co-exist, Open RAN enhances network agility, adaptability, and performance, while fostering innovation and expanding market opportunities. The implementation of Open RAN relies on advanced analytics, including real-time traffic intelligence and cutting-edge technologies such as deep packet inspection (DPI), which provides granular visibility into the network, supports intelligent decision-making, and enables MNOs to introduce innovative features that meet customer needs and experiences.

To manage this complexity, the telecom industry is adopting observability practices honed in the cloud-native domain, typically analyzing metrics, events, logs, and traces (MELT). While standard, cloud-native tools work well within controlled application boundaries, observing the critical interactions across multi-vendor, standardized interfaces require deeper network insights. This includes analyzing the network traffic flowing over these interfaces, for example by inferring performance from transport-layer behavior (using TCP/TLS handshake times, retransmissions, etc.), or, more powerfully, inspecting the traffic itself to understand the relationship between protocols and applications and the impact on performance.

### 3.1.2 Solution: Bridging the inter-module observability gap

Powered by DPI, R&S®Probe Observer enhances Open RAN observability, particularly for inter-module interactions.

- ▶ **Application & service context:** Accurately identify applications (e.g. distinguishing VoNR calls from Teams video calls or IoT data) traversing interfaces such as F1 or flowing into the UPF. This context is vital for RIC-based optimization (via xApps/rApps) needing to apply policies based on application type or slice requirements. xApps managing slice QoE, for instance, can use DPI data to differentiate high-priority URLLC traffic from best-effort flows sharing the same logical slice resources.



Using R&S®Probe on F1-U between CU-UP and DU to extract deeper insights and metadata that can be streamed to IPFIX collectors for comprehensive analysis

- ▶ **True network performance:** By analyzing application-layer transactions within the traffic crossing interfaces, DPI can derive granular performance indicators (e.g. application-specific latency, video/voice quality metrics such as jitter affecting MOS, retransmission rates impacting throughput) that reflect actual user experience more accurately than infrastructure counters alone. This helps pinpoint whether latency issues originate in the transport network, the radio interface, or within a specific RAN function's processing.
- ▶ **Rich metadata for correlation:** Extract relevant metadata (subscriber identifiers, device types, application transaction details, etc.) and export it (for example via IPFIX) to enrich logs and traces from other systems. This allows operators to correlate network-level events (such as a latency spike on the F1 interface) with specific application flows or subscriber groups, drastically speeding up root cause analysis.
- ▶ **Security context & encrypted traffic insights:** Identify protocols and application behavior, aiding security tools in detecting anomalies or policy violations crossing inter-module boundaries. Crucially, advanced DPI techniques incorporating machine learning can classify and analyze encrypted traffic patterns (such as those using TLS 1.3 or QUIC), providing vital security and performance context even when payload visibility is limited – essential for ZTNA and threat detection across distributed architectures.

### 3.1.3 Main business results

#### Cost reduction

- ▶ Reduce and optimize development costs by outsourcing DPI and IP probing
- ▶ Streamline operations with our ready-to-use solution, enabling informed decisions and enhanced efficiency
- ▶ Save resources by deploying a small-footprint DPI in multiple network locations to achieve comprehensive, end-to-end visibility with a disaggregated architecture
- ▶ Get a handle on virtualized network functions (CNF, VNF) through a high-performance, cloud-native software probe
- ▶ Maintain accurate traffic recognition with dynamic updates at runtime, ensuring seamless operation
- ▶ Minimize costly downtime and security breaches with observability, accelerating threat detection and response
- ▶ COTS hardware (no vendor lock-in)
- ▶ Reduced need for traditional field testing such as drive tests and handheld measurements, so that more engineering and expert resources can focus on solving significant problems

- ▶ Reuse collected data for various insights and future use cases through standard and vendor-independent data exports, for example via IPFIX

#### Competitive advantages

- ▶ Fastest software probe on the market
- ▶ Understand complex Open RAN setups in real time
- ▶ Bridge the visibility gap across disaggregated components, assuring performance and enhancing security
- ▶ Zero-trust network access (ZTNA)

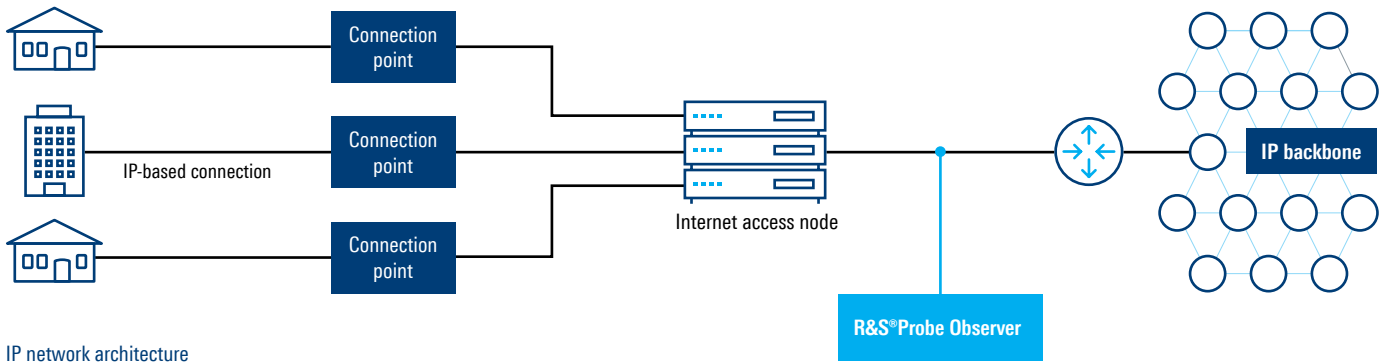
#### Capital investment savings

- ▶ Savings in hardware and resource demands through low-footprint software components
- ▶ Improved network planning and forecasting from deeper insights into complex networks and enhanced observability
- ▶ Higher flexibility thanks to hardware-agnostic and platform-agnostic solutions

#### Higher business profitability

- ▶ Make informed strategic decisions and respond quickly to evolving traffic and subscriber trends
- ▶ Advanced network optimization capabilities thanks to better subscriber-based planning with data from the core and the edge
- ▶ Resolve network issues faster and improve QoE/QoS with real-time traffic analytics and AI-driven automated responses
- ▶ Minimized churn rate by improving network performance and enhancing customer loyalty
- ▶ Integrate in existing systems, using REST, IPFIX and Elastic Stack





IP network architecture

### 3.2 Large-scale CSP increases business profitability through sampling approach

#### 3.2.1 Initial customer situation

A large-scale fixed-line CSP is facing huge volumes of daily and peak traffic. Their amount of traffic, especially for landline connections, is constantly increasing and even light users' internet consumption is steadily growing. To correctly forecast the evolution of customer needs and increase marketing and product management efficiency, objective insights from the network are needed. Installing a fully-fledged analytics system that covers the whole network traffic as well as all subscribers would be a considerable financial and organizational burden. This is why they are opting for a sampling approach to analytics.

Customer's requirements:

- ▶ Very high traffic volumes and multi-million subscriber base
- ▶ Network planning, finance and marketing departments need detailed information about traffic volumes, peak traffic, application and protocol distribution, acceptance and usage of offered products and services of the provider

#### 3.2.2 Solution: deployment scenario

For this implementation, a representative sample of 3% of all subscriber lines has been selected based on a balanced distribution in terms of geographical location and line rate (used data packages).

- ▶ Several locations country-wide to monitor landline traffic and extrapolate the acquired data
- ▶ Flexible connectivity to accommodate different BNG lines (10 GbE, 40 GbE, 100GbE)
- ▶ Customized subscriber correlation in the context of L2TP tunnel tracking, for example via RADIUS

- ▶ Advanced decapsulation and tracking for asymmetric network stack structure (several layers of VLAN, MPLS)
- ▶ Data export from R&S Probe Observer to feed into customer's specific analytics system
- ▶ Anonymization of attributes that would identify specific customers, GDPR compliance

#### 3.2.3 Main business results

##### Capital investment savings

- ▶ Dramatic savings in hardware, licenses and power thanks to a representative sampling approach
- ▶ Excellent network planning and forecasting based on extrapolated data and averages
- ▶ Computing optimal investment for the next years based on network data and available technologies

##### Higher business profitability

- ▶ Optimize agreements with virtual network operators (VNO) by leveraging detailed insights into subscriber usage, peak times, and overall network demand
- ▶ Create, monitor, and evaluate new offerings based on representative data analysis across products and subscriber types
- ▶ Manage products effectively and gain early feedback on the usage of products and packages
- ▶ Better strategic decisions and agility to answer traffic- and subscriber-related questions at any time when they appear

##### Cost reduction

- ▶ Improve efficiency with a sampling approach that requires less hardware, power, and cooling
- ▶ Pay-as-you-grow model, no large upfront investment
- ▶ COTS hardware (no vendor lock-in)

### 3.3 Mobile CSP optimizes network quality with edge and core data

#### 3.3.1 Initial customer situation

A European tier 1 mobile service provider wants to reduce customer churn and improve monitoring of network quality and subscriber QoE. How can the CSP come up with a solution that helps them achieve a 360-degree view of their subscriber base and network? Together with Rohde&Schwarz, the CSP sets up a holistic analytics system to gather and analyze data from both the edge and the core. This solution provides them with the statistics needed to optimize QoE and create innovative solutions for 5G networks. This way, they can improve customer experience while simultaneously generating new revenue streams.

Customer's requirements:

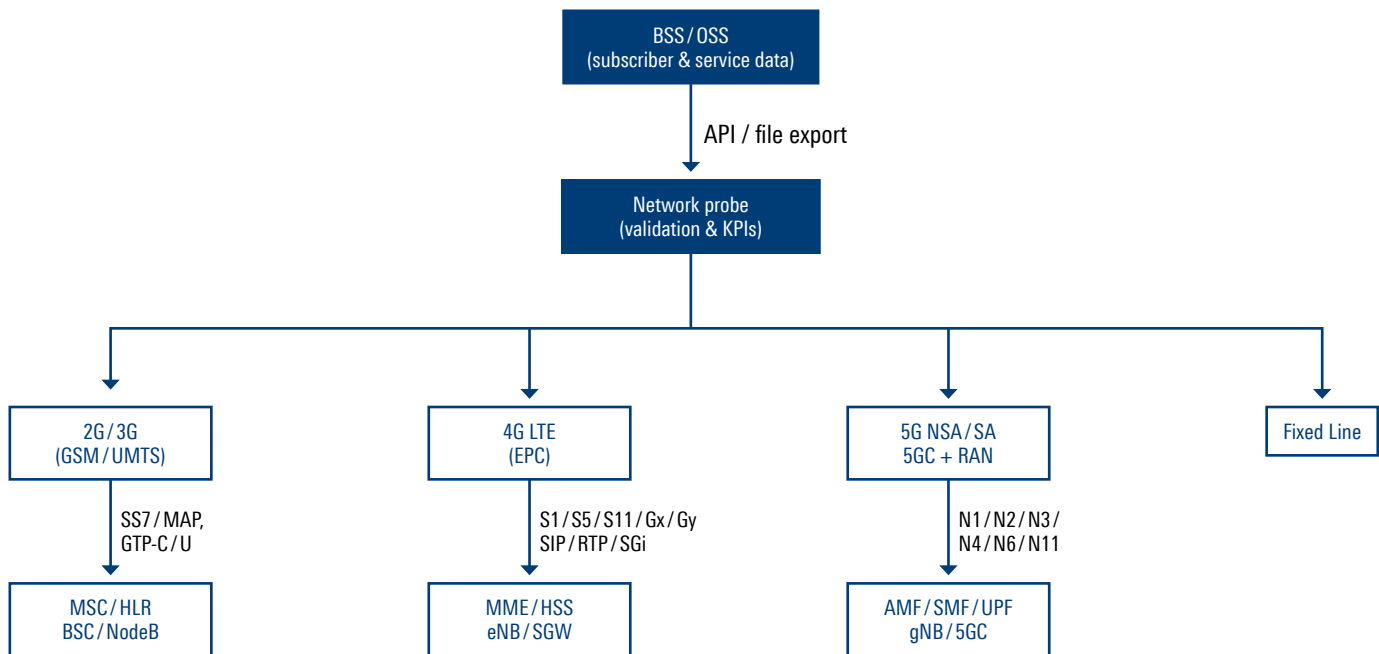
- ▶ CSP wants to use their own Big Data system to bring together data from various sources
- ▶ CSP wants to create an infrastructure which will ultimately help them move towards a self-organizing network (SON) technology
- ▶ The network optimization and planning team wants to dynamically tailor the extracted data based on their project needs

#### 3.3.2 Deployment scenario adapted to the customer's challenges

In response to the challenges faced by modern CSPs, Rohde&Schwarz provides a series of products from within the mobile network testing (MNT) division. When applied in a complimentary way, these products provide the required streams of analytical data needed to build a complete 360-degree view of the network, ranging from the core and the radio access network (RAN) all the way to the end user device.

There are many advantages to these products that can be individually harnessed to assist modern CSPs with their ongoing or one-off network optimization projects. Combining these best-of-breed components within either an existing or a new Big Data solution allows the CSP to create a singular solution to optimize their network and move towards a self-organizing network (SON).

In the case of the CSP's major network optimization project, R&S®Probe Observer was deployed to serve as the main data input source for the planning department. The IP statistics (TCP KPIs and RAN statistics in combination with layer 7 awareness) obtained from R&S®Probe Observer provide the optimization and planning team with the critical information they need to review the impact of IP data on the existing networks. This will help them increase performance and save costs.



360 degree view of the network: from RAN to core

The extracted data can be tailored based on the project needs. For this customer's project, the aim was to:

- ▶ Combine the data from RAN testing with information about subscriber connections and communication KPIs to gain complete awareness of the network state from the end device to the CSP core and all the way to the used service
- ▶ Report RAN parameters and attributes directly from the control plane of the traffic, ensuring an additional perspective about the access network state and performance
- ▶ Be aware of daily network peaks and troughs to assure maximum performance and efficiency of delivered services
- ▶ Customize advanced subscriber correlation to get full visibility of communications in the context of multiple default bearers, roaming traffic, LTE-2G/3G handover, etc.
- ▶ Ensure high system scalability and sustainability by using modular architecture and intelligent subscriber-aware load balancing
- ▶ Control and validate new technologies and services introduced by the CSP by using the application visibility capabilities
- ▶ Comprehend data from fixed-line to 5G networks to increase network performance and optimize network planning

The solution combines IP traffic insights from the core with detailed RAN analytics provided by other Rohde&Schwarz tools such as the ROMES drive test software, QualiPoc Android, a smartphone-based tool for voice and data service quality troubleshooting, the postprocessing and reporting software platform SmartAnalytics, and several diversity optimizer tools by Rohde&Schwarz. This combination of technologies ensures faster root cause analysis and situation awareness, along with a better understanding of what is truly happening in the network.

The RF as well as IP data are harnessed and included in the CSP's global Big Data solution. This solution provides the CSP with a detailed picture of the network's strengths and, even more important, the areas that need further optimization.

When these tools are combined as part of an ongoing optimization program, they can be used to manage both CapEx and OpEx. Moreover, the operational teams can manage near real-time user data to plan regular or non-regular external optimization tasks.

### 3.3.3 Main business results

#### Higher business profitability

- ▶ Advanced network optimization capabilities thanks to better subscriber-based planning with data from the core and the edge
- ▶ Improved QoE/QoS through more efficient troubleshooting thanks to real-time traffic analytics
- ▶ Minimized churn rate by improving network performance and enhancing customer loyalty
- ▶ Monetization of new services by identifying and evaluating frequently-used applications, top-tier subscribers and OTT

#### Capital investment savings

- ▶ Better network planning and optimization by evaluating network performance and coverage as perceived by the subscriber
- ▶ Better forecasting of future demand for network capacity based on real network usage and application performance

#### Cost reduction

- ▶ Reduced edge network monitoring costs (e.g. for extensive drive tests) by complementing core network monitoring with edge network monitoring
- ▶ Reduced need for traditional field testing such as drive tests and handheld measurements, so that more engineering and expert resources can focus on solving significant problems
- ▶ Re-usage of collected data for various insights and even for future use cases thanks to the standard and vendor-independent Big Data export

„One of the reasons for choosing Rohde & Schwarz was the immense flexibility of R&S®Probe Observer. Now, we can tailor the solution to our needs. Furthermore, R&S®Probe Observer scales up to a reporting resolution of 1 TBps which addresses our growing demand for fast data rates to gain a far deeper understanding of our network in real time.“

**Business Development Manager, European Tier 1 MNO**

# 4 TECHNICAL FEATURES

Technical functionalities of the analytics solution R&S®Probe Observer are threefold. This ensures optimal data input and processing, traffic analytics and reporting:

## Traffic input

- ▶ Real-time line speed data
- ▶ Passive analytics on a copy of traffic
- ▶ Subscriber-aware load balancing and scalability up to several Tbps
- ▶ Content processing for IPv4, IPv6, dual stack (e.g. Teredo), L2TP, GRE, GTPv1, GTPv2, etc.
- ▶ User plane and control plane traffic
- ▶ up to 400 G connectivity
- ▶ Support for asymmetric traffic stack structure for uplink and downlink
- ▶ Traffic pre-filtering based on address range, MPLS, VLAN

## Traffic processing

- ▶ In-house DPI engine R&S®vPACE with 2,800+ classification signatures and 95% classification coverage with virtually no false positives
- ▶ Subscriber correlation and tracking over multiple IPs and default bearers
- ▶ Geolocation insights: mapping network traffic to geographic locations
- ▶ Control plane extraction and analytics: DNS, DHCP, RADIUS, GTPv1/2
- ▶ Subscriber correlation: linking subscribers to user traffic by processing both GTP control (GTP-C) and user (GTP-U) traffic
- ▶ Subscriber analytics (radio access technology, Cell ID, etc.)
- ▶ Traffic reporting granularity: down to 1 second
- ▶ Support for virtualization

## Reporting

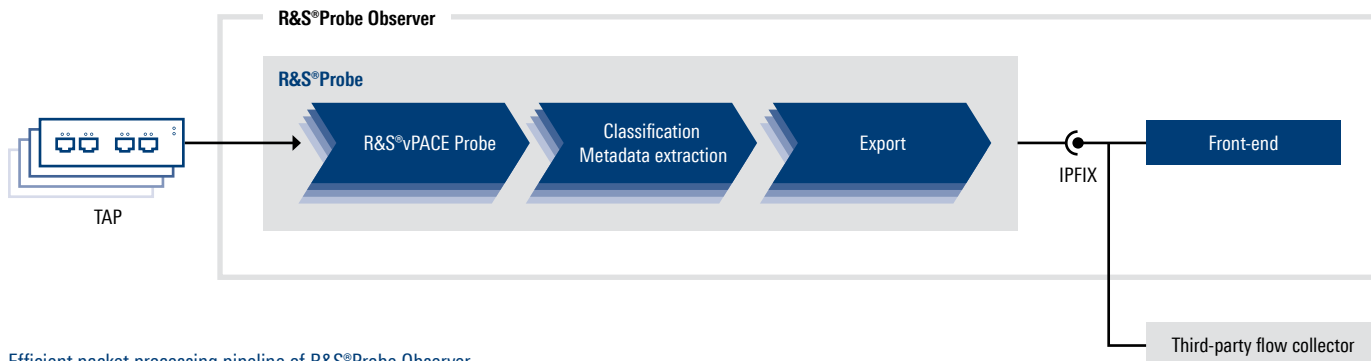
- ▶ Intuitive graphical web interface
- ▶ Insights into:
  - Data rate values, with flexible granularity (total, per application and protocol, per subscriber, per flow)
  - Consistent reporting for services, applications, protocols and configurable application groups
  - Subscriber insights (data consumption rates, distribution of used applications and protocols, radio attributes)
  - Network information (statistics aggregated per radio access technology, location, cell, etc.) and KPIs (TCP retransmission counter, TCP round trip time)
  - Content delivery networks, etc.
- ▶ Optional export to Big Data systems, for example via Apache Kafka or the Elastic Stack
- ▶ Open standards for connecting to third-party analytics platforms: REST API using IPFIX, CSV
- ▶ Customizing data granularity to meet customer use cases with minimal footprint and cost

### 4.1 Traffic input and processing by R&S®Probe

R&S®Probe is a passive network probe that analyzes traffic in real time and extracts the KPIs, along with classification details (i.e. protocol, application, etc.) and statistics (e.g. number of packets and bytes transferred both upstream and downstream). The probes are designed to detect and report both user plane data and control plane data for subscriber correlation.

Technical advantages:

- ▶ A decoupled two-stage architecture for traffic preprocessing and detailed DPI handling ensures both vertical and horizontal scalability of the system, as well as an efficient packet-processing pipeline
- ▶ Stage 1 prepares traffic for inspection and performs pre-processing and decapsulation of traffic
- ▶ Stage 2 performs flow tracking, DPI classification and control plane extraction



Efficient packet processing pipeline of R&S®Probe Observer

- ▶ Absolute scalability is achieved through efficient load balancing between stages
- ▶ Up to 10 decapsulation levels allow analytics of traffic within tunnels or with labeling even when using multiple headers/labels
- ▶ 5-tuple flow tracking plus optional tunnel tracking ensure precise traffic detection as well as flexible subscriber correlation and statistics
- ▶ The process of extracting selected control plane messages (e.g. GTPv1/v2, DNS, RADIUS, etc.) and forwarding them towards analytics lays the foundation for an optimized and flexible analysis

#### 4.1.1 Traffic classification by R&S®vPACE

The DPI engine R&S®vPACE constitutes the core of R&S®Probe. It inspects and analyzes network data in real-time, reliably detects the most popular applications and extracts metadata and application attributes from the network traffic. It analyzes IP packets using different technologies such as deep packet inspection and behavioral, heuristic and statistical analyses to determine the protocol, application and other application-based attributes of the traffic.

Using an in-house DPI offers several benefits:

- ▶ Seamless integration into R&S®Probe, taking full advantage of the DPI
- ▶ Short time to market for new features
- ▶ Control over product roadmap
- ▶ Faster and more efficient support

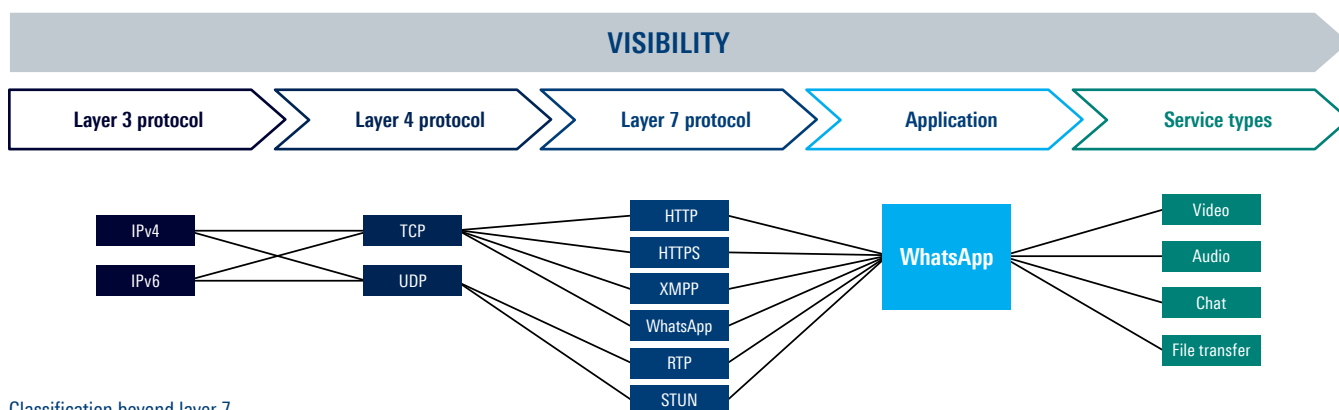
#### 4.1.2 Handling encryption

As encrypted traffic constitutes approximately 70% of all communications data and is steadily growing, CSPs need to be able to identify which of their services and resources are being accessed.

Today, encryption is just another transport layer that is used to access streaming, browsing, messaging and corporate applications. R&S®vPACE features a variety of detection techniques such as network flow tracking, byte pattern matching and behavioral analysis. Using this technology, R&S®Probe can correctly identify a large number of applications that use encryption.

Here are some examples for encrypted applications:

- ▶ IPv4-TCP-TLS-Youtube
- ▶ IPv4-TCP-TLS-Facebook
- ▶ IPv4-TCP-TLS-WhatsApp



Classification beyond layer 7

## 4.2 R&S®Probe Observer front-end

R&S®Probe Observer features analytics capabilities based on information about network flows, the corresponding counters and classification stack and other metadata. The following input data is used by the front-end to extract insights and create reports:

- ▶ Traffic forwarding (control plane payload)
- ▶ Reporting on classification results
- ▶ Reporting on flow counters
- ▶ Reporting on network stack structures

Optimized for real-time reporting, R&S®Probe extracts and reports on the traffic parameters to ensure short reaction time when needed as well as fine-grained data (down to 1 second reporting resolution). This is why R&S®Probe Observer covers a vast variety of use cases, ranging from real-time detailed network monitoring to strategic statistical data analytics.

### 4.2.1 Faster subscriber correlation

When it comes to customer care and service optimization, the analytics platform R&S®Probe Observer delivers data to aid fast problem identification and improve QoS for subscribers. This is achieved by using fine-grained data to associate data rates and communication KPIs to individual endpoints. R&S®Probe Observer enhances its ability to understand network performance by connecting subscriber activity with detailed network data, using protocols such as RADIUS and GTP. RADIUS provides essential information about each subscriber, such as how they access the network (e.g. line ID, IP address), while GTP helps link that subscriber to the actual data traffic they are generating. This combined visibility allows for a clearer understanding of what is happening on the network and a faster resolution of service issues. For use cases limited to trend and application analytics, R&S®Probe Observer performs subscriber anonymization to protect personal data. Subscriber information is linked to network flows and can be exported via IPFIX.

### 4.2.2 DNS lookup

DNS reverse lookup aggregates flows with domain names, allowing for analysis based on hostnames rather than IP addresses. This provides enhanced visibility into the endpoints of monitored traffic.

### 4.2.3 Geolocation insights

Geolocation enhances network visibility by mapping network traffic to geographic locations. This capability supports critical fault detection, enables GeoIP-based security measures, and provides valuable insights for performance monitoring. By visualizing traffic patterns geographically, operators can quickly detect and address problems impacting service quality.



### 4.2.4 Standard reports and insights

The following reports are available with R&S®Probe Observer:

#### Standard reports

- ▶ Network
- ▶ Subscribers
- ▶ Attributes (related to subscribers)
- ▶ Applications
- ▶ Protocols
- ▶ DNS servers
- ▶ Domains

#### Insights for specific use cases

- ▶ Content delivery networks (CDN)
- ▶ Media streaming
- ▶ Domain details
- ▶ Domain relations

### 4.2.5 Reporting & measurement interval

When it comes to providing good customer care and real-time monitoring, high data granularity is essential to spot irregularities, bad customer experiences or network issues. For marketing purposes, on the other hand, a powerful application recognition engine is much more important than

granularity. R&S®Probe Observer is highly adaptable to the customer's specific requirements. It provides flexible and configurable reporting and aggregation intervals for all different kinds of use cases.

R&S®Probe continuously performs measurements and traffic analysis to extract information from every single communication stream with an aggregated value interval of only 1 second. The derived information is periodically sent to the front-end of R&S®Probe Observer for aggregation and presentation.

### 4.3 Visual presentation

Multiple reports are available in the intuitive web interface of the R&S®Probe Observer front-end.

#### 4.3.1 Overview of general traffic data

##### Application consumption insights

CSPs can gain valuable insights into subscriber behavior by analyzing the data volume of specific applications, their usage patterns over time, and their popularity within the subscriber base. An aggregated view of this data reveals weekly and monthly trends, as well as fine-grained activity at a 5-minute granularity. This detailed understanding empowers CSPs to offer targeted marketing plans and generate additional revenue. Additionally, the solution provides a comprehensive view of network traffic, allowing CSPs to monitor daily fluctuations in downstream and upstream usage. They can see an overview of a week's traffic and zoom in to proactively plan network capacity based on observed data consumption patterns.

Complementing this network-level analysis, CSPs also have access to detailed insights into media streaming usage. The solution provides an overview of the volume used per streaming type (audio & video), enabling comparison of paid versus free content and a deeper understanding of subscriber preferences for paid subscriptions. These insights allow CSPs to refine their marketing strategies and make informed strategic decisions regarding partnerships with entertainment and streaming platforms.

#### 4.3.2 Insights on specific issues

##### Traffic mix of one specific subscriber

CSPs can analyze a one-day snapshot of an individual subscriber's traffic, providing detailed visibility into application, protocol, transport, and network layer characteristics. This allows them to understand upload and download volumes, identify data peaks, and troubleshoot network performance issues. The data resolution is configurable, offering granularity down to 5-minute intervals.

#### Detection of encrypted traffic

The solution provides detailed analysis of encrypted traffic volumes within the network. A one-day sample, comprising approximately 7.7 Gigabytes, with 3 Gigabytes encrypted, enables efficient identification of encrypted communication patterns.

#### Overview of CSPs' own as well as roaming subscribers

R&S®Probe Observer generates detailed statistics on roaming subscriber activity, including aggregated data consumption rates per country of origin (mobile country code/MCC) and a breakdown of application usage. These insights empower operators to develop optimized roaming packages tailored to data rates and subscriber behavior, maximizing revenue opportunities.

#### Overview of mobile access technology

The solution provides detailed insights into data rates and subscriber statistics segmented by mobile access technology (UTRAN, EUTRAN, GERAN), along with correlated application distribution. This visibility allows operators to understand how applications utilize network resources and verify that protocols requiring higher data rates are leveraging appropriate technologies.

#### Insights of content delivery networks

Detailed analysis reveals which content delivery networks (CDN) are most used, based on data volume, number of subscribers that access them, and domain usage. Detailed visibility into server locations (country distribution) and throughput peaks allows operators to optimize peering arrangements and enhance connectivity to frequently accessed CDNs.



## **ipoque**

ipoque, a Rohde&Schwarz company, is a global leader in the world of network analytics software. We leverage our deep domain expertise to create customized software solutions that empower our customers to transform data into intelligence. As a subsidiary of Rohde&Schwarz, we take advantage of potential synergies.

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