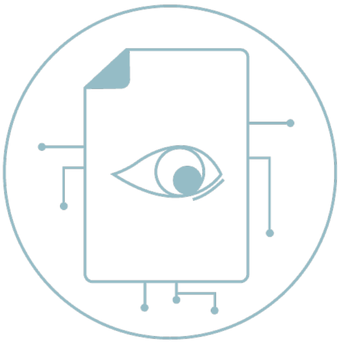
OMNIA MA

Enhancing Customer Experience through Network Bandwidth Optimization

SOLUTION BRIEF

JANUARY 2024



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Introduction

The success of digital experiences, encompassing data transfer speed, application responsiveness, video streaming quality, large file downloads, e-commerce performance, cloud-based services, and remote work productivity, relies on robust network bandwidth.

Network Bandwidth is a fundamental factor in shaping the digital customer experience. Therefore, it is vital for businesses and service providers to invest in high-capacity networks to meet customer demands for fast, reliable, and responsive online interactions.

Impact of Delay on TCP/IP Performance

Most of the communication is based on the TCP/IP protocol. The impact of delay on TCP/IP performance is significant, and it can affect various aspects of communication between devices on a network. TCP is a reliable, connection-oriented protocol, and it has mechanisms in place to deal with delays and ensure data integrity. Delay can lead to throughput reduction and increased round-trip time (RTT), impacting the user's Quality of Experience.

Throughput Reduction

Throughput is the amount of data that can be transmitted over the network in a given amount of time. High delays, especially when combined with other factors like congestion, can lead to lower throughput.

Increased RTT

RTT plays a critical role in evaluating network latency and its importance for ISPs in understanding security and performance. Specific issues such as BGP routing security, IP spoofing detection, SLA adherence, and QoE assessment are addressed, showcasing the multifaceted relevance of RTT measurements.

Delay increases the RTT, which is the time it takes for a packet to travel from the source to the destination and back. TCP uses the RTT to dynamically adjust its transmission parameters, such as the congestion window. Longer RTTs can result in slower adaptation to changing network conditions.

Round-Trip Time (RTT) stands out as a critical metric for evaluating network latency. An increasing RTT not only impacts the user's Quality of Experience but also signals potential performance or security issues in the network, such as congestion or routing changes. While RTT statistics are usually available at end hosts, Internet Service Providers (ISPs) – whether they offer consumer broadband or operate enterprise networks – lack direct visibility into the latency experienced by their customers.

Even in a data center, continually monitoring RTTs at all hosts proves to be costly. Nonetheless, continuous RTT monitoring would empower an ISP to gain a more profound understanding of both the security and performance of its network traffic.

BGP Routing Security

In the event of an attacker employing BGP routing attacks to redirect and intercept traffic, the affected traffic is likely to undergo higher-than-normal RTT. Consequently, unexpected fluctuations in RTT to a remote host may indicate a rare route change stemming from either equipment failure or a routing attack. Continuous monitoring of RTT proves valuable for the ISP in identifying potential reroutes, even when the rerouting occurs further downstream.

Detecting IP Spoofing

Since a spoofed IP address displays inconsistent RTT values compared to legitimate traffic originating from the same address, RTT can be employed to enhance the accuracy of IP spoofing detection.

Service-Level Agreement (SLA)

Typically, an ISP establishes RTT requirements within its SLA with customers. For instance, Verizon commits to setting maximum RTT limits of 45ms for intra-North America traffic and 30ms for intra-Europe traffic. Real-time monitoring of RTT enables the ISP or its customers to confirm that the RTT stays within the specified limits or receive notifications about any potential SLA breaches.

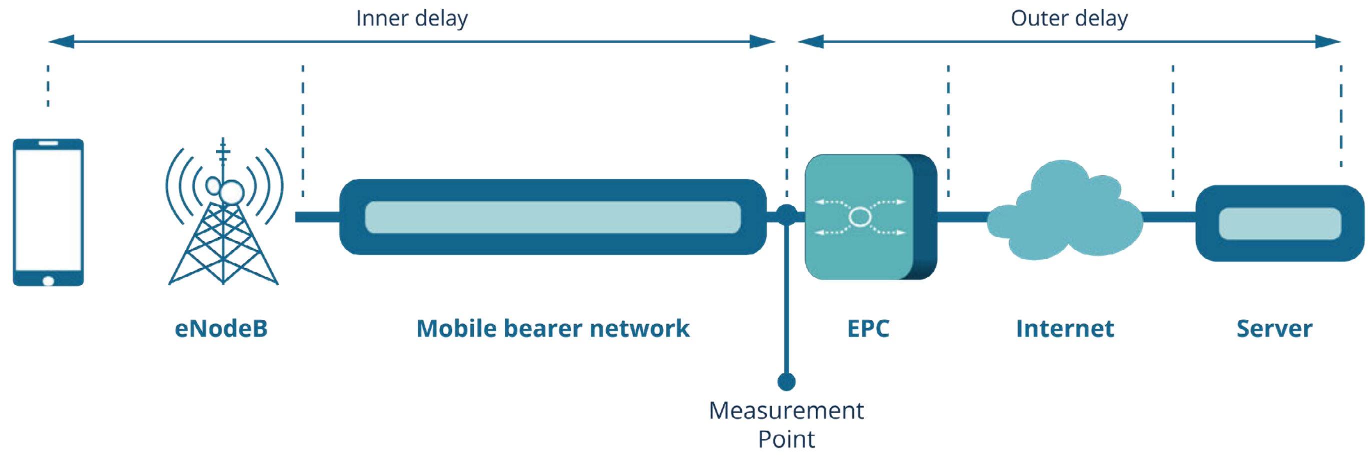
Quality of Experience (QoE)

An ISP might seek to assess the QoE for customers across various applications. Certain applications, such as video live-streaming, are particularly responsive to high latency and jitter [4], aspects that can be captured through RTT measurements. A rise in RTT may indicate ongoing congestion and queuing on peering links, providing valuable insights for the ISP to consider equipment upgrades on those links to enhance its capacity and better meet customer demands.

Measuring RTT in the data plane

Typically, this measurement is done through the SYN — SYN/ACK handshake of the TCP communication. However, the challenge lies in the fact that this method provides the total delay.

Inner delay: Mobile device to the gateway (GW)
Outer delay: GW — Internet — Datacenter — Server



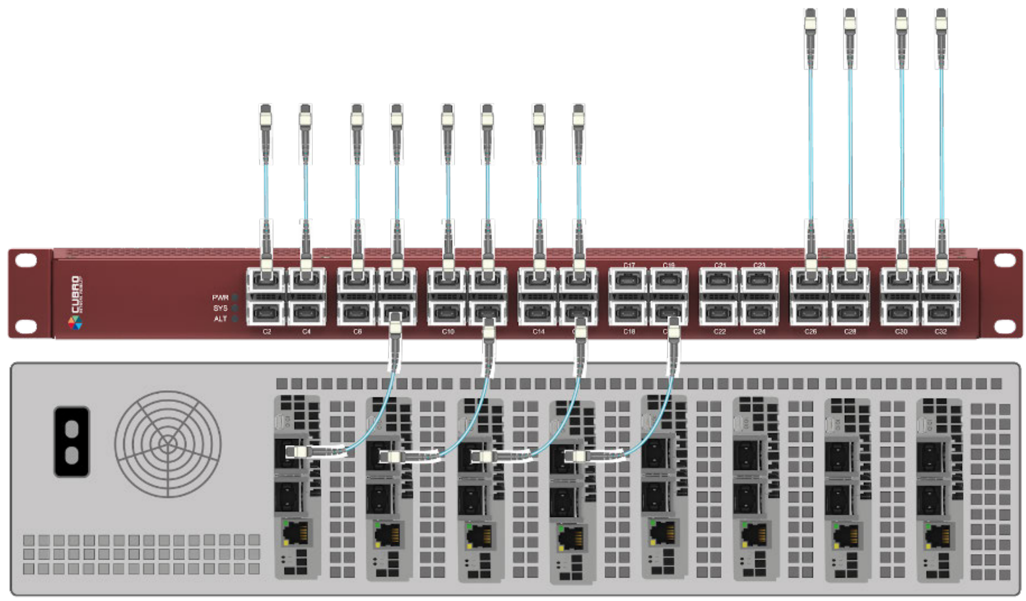
The issue is that the outer delay has an inherent packet, but it cannot be improved by the service provider (SP). This essentially means that only the inner delay is useful, but is more challenging to measure.

The second challenge involves the quantity of TCP sessions in a large network, requiring substantial processing resources since every packet must be observed.

The third concern pertains to the substantial amount of Call Detail Records (CDRs) or metadata that such a solution would generate, resulting in a large data lake environment.

Finally, such a solution typically involves full user plane monitoring, often utilizing Deep Packet Inspection (DPI). However, in some countries, DPI is not permitted by the regulator, and the associated costs could be prohibitively high.

Cubro Solution — Advanced Network Packet Broker (NPB) Functionality for Precise Analytics



Our cutting-edge NPB functionality goes beyond the ordinary by intelligently filtering only the essential packets for analytics. Unlike conventional Layer 4 (L4) filters, our approach relies on transport layer message types. This unique capability is achievable only with a programmable silicon-based NPB, instead of switch silicon-based alternatives.

The filtered traffic is then seamlessly load-balanced and directed to Omnic Smart Network Processing Interface (NPI) cards. These cards excel in efficiently calculating delays. Each card can handle up to 3.2 million packets per second, equating to a million customer sessions per Network Interface Card (NIC).


```
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    } ],
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    "imei" : "123456789101112",
    "imsi" : "121110987654321",
    "msisdn" : "431234115533",
    "rat" : "eutran",
    "lactac" : "10235"
    }
  }
```


The NIC card feeds data into the Kafka cluster, where correlation occurs based on traffic type. For instance, mobile broadband traffic undergoes correlation with mobile signalling traffic to generate the Call Detail Record (CDR).

The CDR encapsulates crucial measurements, customer information, Radio Access Technology (RAT) type, and Cell data. This comprehensive information serves as the foundation for numerous impactful use cases, ultimately enhancing network performance and delivering an improved customer experience.

Key Use Cases:

Live Inner Delay Monitoring: Gain insights into the delay experienced by every subscriber in the network. The delay serves as a valuable indicator of network performance and customer experience.

Base Station Delay Analysis: Detect issues promptly by monitoring delay variations at individual base stations. An unusual or rapidly changing delay can signify underlying problems requiring attention.

Air Delay Analysis: In combination with an active measurement solution, it would be possible to measure the air delay. This is the part which has the most value for optimizing a mobile network. Because it is the moving target in this metric and has the biggest impact on the delay figure.

The delay (RTT) is a combination of several delays.

RTT = TRadio + TBackhaul + TCore + TTransport

- TRadio is the packet transmission time between eNB and UEs and is mainly due to physical layer communication.
- TBackhaul is the time for building connections between eNB and the core network (i.e., EPC). Generally, the core network and eNB are connected by copper wires or microwave or optical fibers.

- TCore is the processing time taken by the core network.
- TTransport is the delay to data communication between the core network and the Internet/cloud.

The Cubro solution provides a metrics that is **TRadio + TBackhaul + TCore. TCore** is usually a stable figure around 1 ms. **TBackhaul** can be measured using an active solution, and this value can be subtracted from the Cubro metrics.

This means **TRadio + TBackhaul + TCore - active Backhaul measurement = TRadio + TCore.**

The **TCore** value doesn't affect this measurement much because it is consistently small compared to the **TRadio**. The result is **TRadio** correlated to each subscriber in near real-time.

Without Cubro, you can obtain this metric from the Base Station, but it involves an expensive service charge to the network vendor. Dealing with multiple vendors makes it more challenging.

However, this output needs further preprocessing as it's not directly correlated with the subscriber.

Value of Cubro's Innovative Solution

1. GDPR Compliance: Safeguarding User Data Integrity

A paramount feature of our solution lies in its strict adherence to GDPR compliance. In an era where data privacy is non-negotiable, Cubro ensures that user data remains inviolate. By adopting a hands-off approach, we guarantee that sensitive user information is left untouched, affirming our commitment to the highest standards of data protection.

2. Cost-Efficiency and Minimal Footprint for Large Networks

The cost and footprint are critical factors in networks that can make or break an infrastructure. Cubro's solution stands out by providing an exceptionally slim profile even on expansive networks. With the ability to scale seamlessly to accommodate up to a million subscribers, our solution optimizes both cost and space, offering a strategic advantage for networks of all sizes.

3. Near Real-Time Performance: CDR Generation in Less Than a Minute

Time is of the essence in the fast-paced world of networking. Cubro's solution introduces a paradigm shift with near real-time performance, ensuring that Call Detail Record (CDR) generation delay is minimized to less than one minute for every subscriber. This swift response time enhances operational efficiency and responsiveness, setting our solution apart as a leader in the industry.

4. Active Delay Measurements for Enriched Data

Leveraging the Cubro data lake, our CDR can be enriched with active delay measurements, providing a wealth of relevant information. For instance, in a mobile network scenario, our solution enables the generation of air delay figures. While not as precise as those from base stations, our approach is significantly more efficient and cost-effective.