brillio

Next-gen Customer Network Experience Software System:
A Data-Driven Approach

Dealing with Network Experience Issues

In the past, it could take days, if not weeks, to pinpoint the cause of a poor network connectivity experience (wired or wireless) for customers. The network troubleshooting team had to scourge through data from various network devices in different formats to find the root cause of the issue. Poor connectivity could be due to several reasons – transmission and reception of weak radio signals, issues with a particular type of mobile device, changes in nearby geography of radio towers (e.g., the blocking of radio signals due to a newly raised building, growth of trees, etc.), misconfigured networks, network congestion, etc. Managing customer complaints for poor connectivity conventionally has required the setup of an extensive customer care team to handle incoming customer calls, address incident tickets and perform analysis of reported issues. A significant portion of the OPEX budget is allocated for this activity by Tier-1 operators.

Humans and businesses are increasingly dependent on reliable data and voice connectivity, which has been further accelerated after the onset of Covid. With stress on digital transformation in practically every facet of business transaction or human interaction, there is a need for software tools and solutions that can quickly point to the real cause of network issues affecting the customer network experience. These software tools need to process vast volumes of telemetry data that networks generate and be able to derive insights in near real-time by correlating data from various sources. Functionally, a software system that provides insights into customer connectivity experience is developed with the following principles in mind:

- Provide a snapshot of the network at a particular time instance in terms of network throughput, radio interference, network congestion, state of network devices, and nature of data traffic flow.

- Have real-time access to customers' experience with regard to data, voice, HD content, and type of mobile device.

- Provide proactive updates to customers for any predictive outage in network service.

- Provide automated remediation to solve network issues using AI/ML techniques.

Network experience software systems are helping operators reduce their operational overheads by reducing the following:

- Number of incoming calls to customer care
- Average time to handle a customer call
- Incident resolution and network troubleshooting time

Tier-1 operators having nationwide deployments deal with a massive customer base, and even a fraction of savings leads to a huge advantage and significantly improved customer satisfaction. In this whitepaper, we provide an overview of a modern customer network experience software solution and its functional aspects when dealing with large volumes of network data

Evolution of Network Experience Software

Before delving into modern trends of network experience software solutions, let us first understand the evolution of these systems.

Manual → Software Based System → Intelligent Software System → Self-healing Software System

Where in the past, we would require manual inspection of logs, traps, and KPIs, the present-day systems are software-based, showing consolidated data on graphical dashboards and widgets and providing advanced reporting capabilities. These systems are now migrating towards using data analytics and AI/ML techniques, making them more automated by correlating data from various sources and using predictive AI techniques. In the future, we will come across systems that will perform self-healing actions by taking the required configuration actions on the network to auto-resolve the issues.

High-level Software Architecture of Data-driven

The diagram below represents the functional working and architecture of a modern Telco network experience software system that harnesses massive amounts of data in real-time and, with the help of AI/ML and data analytics, derives intelligence on network performance and customers' experience of the network.

Figure 1: Functional Architecture of Customer Experience Solution
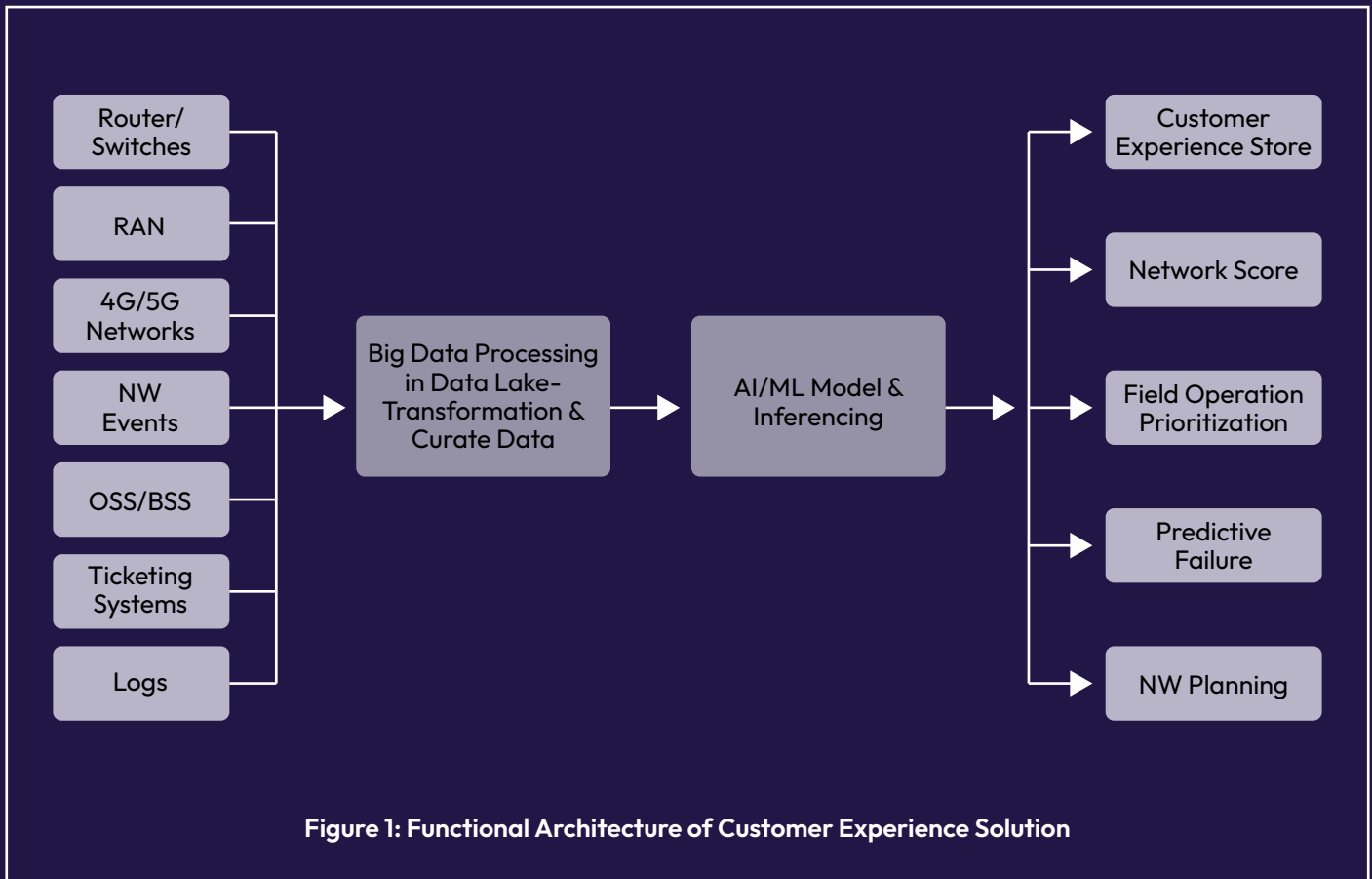
The data lake consumes streaming data from various network devices and other software systems to perform ETL (Extract, Transform & Load) operations. Given below are some of the sources that send data to the data lake:

- Network devices (routers, switched, APs, and CPEs)

- RAN devices

- Core networks

- OSS/BSS

- Ticketing systems

- Network planning and optimization software systems

The data lake is capable of ingesting data streams at high velocity due to its sheer capacity of computing, storage, and network resources. Data arriving in different formats such as SNMP, Syslog, KPIs, CSV, Netconf, text, binary, and proprietary formats are curated and then further utilized to build inference models using artificial intelligence and machine learning techniques. These inference models help in deriving the following aspects related to the customer's network experience:

- Customer experience score

- Network score

- Prioritization of field operation

- Predictive failures

- Network planning

High-capacity Data Processing Pipeline

In this section, we dig deeper into the data processing pipeline that the data lake performs, dealing with vast volumes of data for real-time processing to determine customer network experience and network scores.

Figure 2: Data pipeline stages for finding customer experience score

Data Ingestion: Terabytes of data related to millions of subscribers covering billions of events daily are ingested in this stage in batches and micro-batches.

Data Aggregation: Ingested data from multi-vendor network equipment and OSS/BSS systems are validated and aggregated based on customer data. It is normalized in a standard format to aid further processing.

Customer Experience Scoring: Customer experience related to data, HD access, voice, and device QoE are calculated in this stage based on specific industry standard KPIs.

Root Cause Analysis: Based on the available data, automated RCA for issues related to call drops, poor data speed, and inability to make calls or connect to the network are figured out wherever possible.

Data Correlation: The correlation of various aspects of data, such as customer experience score, network score, and KPIs.

High-Performance DB Storage: Results generated from the previous stage are stored in a high-performance database, which can be further leveraged for different purposes.

Access with APIs and over Message Bus: Access to data stored in the above phase is made available with the help of APIs and messaging bus to other associated software components such as UI dashboards, admin consoles, NOC displays, etc. Customer care personnel and network technicians also use this inference data with the help of APIs or messaging bus.

Calculating Customer Experience Scores

Customer experience related to network reliability, data quality, and voice quality is calculated using data obtained from enodeb, gnodeb, network device KPIs, and tools for network planning and optimization. Each operator has its

Figure 3: Calculating customer experience score

proprietary way of calculating customer scores, typically using statistics and data analytics techniques. Some examples of KPIs that can be used in calculating customer experience scores are: attach failures, setup failures in RAN, service request failures, failed connection attempts, and dropped connections.

A Walkthrough of using Network Experience Software

Network experience systems can be leveraged by customer care personnel or network technicians. The system has the capability to plot various parameters associated with customer experience. It has access to customer data generated as early as 15-20 minutes in the past, thus making it a near real-time system. The following aspects of a given customer can be analyzed to determine the cause of poor connectivity:

- Various scores related to data, voice, device, high-definition content, and overall network experience are plotted over a given time duration for a mobile device number.

- The comparison of scores of other customers in the same region having the same device type during the given time frame.

- Plot of movement of a customer on the map during a given time frame.

- Details of radio signal parameters associated with the customer (SINR, RSRP, RSSI, RSRQ).

- The location of different radio access terminals on the map (eNodeBs, gNodeBs, Nodeb, etc.) based on customer location. Provide coverage of signals for each radio access terminal on the map.

- Provide strength of indoor and outdoor radio signals.

- Graphically denote network congestion associated with a specific eNodeB for a particular class of traffic (e.g. Volte, streaming, high-definition, etc.).

- Overlay different boundaries on the map so technicians can analyze the customer problem along with boundaries data (PSAP, 911, time zone, state boundaries).

In addition to the above, a connectivity experience is also used to notify customers of the following:

- Report improved network experience to affected customers upon upgrades to the network (e.g. improvement in connectivity on the construction of a new cell site in a region).

- Report anticipated network downtime or dip in network performance. This is usually achieved with the help of AI/ML techniques.

Brillio Expertise in Building Customer

Brillio is a product engineering organization with roots in digital transformation. The company has stellar credentials in developing operations management and network transformation software systems for tier-1 operators and large network OEMs in North America and supports complete product and business lifecycle, including product architecture, software design & development, tech consulting, and driving GTM & sales strategy.

Brillio has significant experience developing cutting-edge customer experience software systems leveraging AI/ML and data analytics techniques. These systems ingest massive amounts of data from various sources, applying correlation and AI/ML algorithms to derive insights on customer experience to resolve network issues. The outcomes of this effort for operators have been manifold - better connectivity experience for customers, reduced customer care calls, auto-resolution of issues, a quicker resolution to tickets, and faster turnaround time by network technicians to fix network problems.

ABOUT BRILLIO

At Brillio, our customers are at the heart of everything we do. We were founded on the philosophy that to be great at something, you need to be unreasonably focused. That's why we are relentless about delivering the technology-enabled solutions our customers need to thrive in today's digital economy. Simply put, we help our customers accelerate what matters to their business by leveraging our expertise in agile engineering to bring human-centric products to market at warp speed. Born in the digital age, we embrace the four superpowers of technology, enabling our customers to not only improve their current performance but to rethink their business in entirely new ways. Headquartered in Silicon Valley, Brillio has exceptional employees worldwide and is trusted by hundreds of Fortune 2000 organizations across the globe.

https://www.brillio.com/
Contact Us: info@brillio.com