IN-SERVICE CUSTOMER EXPERIENCE MANAGEMENT
Improving Customer Experience Through Selective Tracing and Real-Time Network Analytics

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Due to the commoditization of networks and growth in competition from OTT players, CSPs are shifting their focus from a traditional network and technology-centric approach to a customer-centric approach. As a result, the strategic importance of customer experience management has skyrocketed. Traditionally customer experience data has been captured through passive probes placed in strategic locations in the network. This approach works well for capturing transactional data. However, most available solutions track customer experience passively, after an incident has occurred. This paper explores strategies to improve customer experience through real time probing of customer transactions on the network and troubleshooting. It also considers the importance of a customer experience management maturity model that can form the foundation of a continuous customer experience tracking and improvement program.

Introduction

The rise of the Digital World, combined with macro-economic uncertainty has sent seismic changes through the telecommunications industry. A set of new opportunities and challenges has emerged for Communication Service Providers (CSPs) due to technology advancements, growth in device diversity and evolving consumer needs. Concurrently, a global credit crisis has slowed capital flow and investments. This has left CSPs particularly exposed because the nature of their business requires significant capital expenditures to meet customer requirements and keep pace with competition.

The advent of new technologies such as 4G-LTE and consumer demand for greater speed necessitates network upgrades, but a reduction in margins and capital flows is presenting tremendous challenges for CSPs. Further complicating the industry is the launch of new smart devices with bandwidth-hungry applications. As evident from Figure 1, mobile data traffic is expected to explode in the next few years requiring fresh network investments.

Although, this surge in data traffic creates new revenue-generating opportunities for CSPs, it also presents new customer experience and network performance challenges. In the subsequent sections we explore these challenges in detail. We also explain how CSPs can mitigate these challenges by focusing on network quality of service and consider how analytics can help generate critical insights to improve customer experience.

Figure 1: Global Mobile Traffic Growth Projection, Source: Cisco VNI Global Forcast, 2011-2016
Understanding the Customer Experience Management Paradigm

Customer Experience Management (CEM) aims to bridge the gap between CSP’s and customer’s views of service quality. CEM applies tools and techniques to gain insights into the service experience from a customer’s point of view and identify the pain points to improve the overall experience.

Most standardized network and service monitoring solutions focus on Quality-of-Service (QoS) measured from the network. This often forms the basis for a CSP’s perception of service quality. In order to determine the service quality in an aggregate manner CSPs rely on key performance indicators (KPIs) which are computed aggregations of multiple network performance counters and timers. For example in a mobile data service network, the service accessibility is determined through the data session setup success rates. This KPI measures the ability of the mobile subscriber to access the packet switched service successfully.

In practical scenarios KPIs and QoS indicators are important parameters to evaluate the quality of network operations, but often these indicators may not provide a holistic view of the actual experience customers face. Figure 2 depicts a real life packet switch call scenario observed in a CSP network in North America, where a mobile user was trying to download a ringtone of his choice. In this case, the waiting time to access the service was more than 4 seconds, which is far beyond the desired service accessibility threshold for customers.

An investigation determined that the latency was due to multiple Hyper Text Transport Protocol (HTTP) request redirections from one server to another caused by server maintenance or possibly the addition of new application servers with specific functionality assigned. Traditional network side QoS measurements and KPIs may not take into account redirections at the application layer such as HTTP 302 and its impact on quality of experience. As a result, these types of incidents can go unnoticed. However, the longer waiting time would result in poor experience for the customer.

In another case, a customer is trying to access rich media content such as a photo album. The user experience could be poor if CSPs do not have a content adaptation or acceleration mechanism to compress the data and render the content appropriately based on handset capability.

In scenarios where content adaptation and acceleration are implemented in the CSP service environment, there may be cases where normal KPI-based performance measurements do not provide a true reflection of the experience. For instance, as shown in Figure 3, it’s a common practice to setup multiple Transport Control Protocol (TCP) connections between user equipment and the content server to accelerate content downloads. Although this technique has many advantages, if not applied for a handset with sufficient processing capacity, the results may be poor. This is due to the fact that handsets with low processing capacity may not have the capability to handle multiple TCP connections simultaneously. The result will be slow content download speeds and delayed content rendering on the device.

In the cases mentioned above, traditional quality measurement techniques fail to record and measure these incidents and do not show any anomalies or performance issues. However, from the end user’s perspective, there is a considerable lag in content download speeds and the service quality is far below expectation. Such incidents lead to customer dissatisfaction and eventually to churn.
**Challenges in Customer Experience Management**

CEM is challenging not only due to the complexities of shifting to a new method of measuring customer experience, but also due to the lack of available techniques to quantify human perception in a standardized manner. In the section, we consider some of the key challenges that CSPs face when deploying a CEM solution.

**Scattered information across different systems**

Customer service session information is scattered across multiple systems and logs such as call detail record (CDR), the Operating Support System (OSS) and protocol-probe data. To analyze the actual customer experience of a service session it is essential to identify the individual transactions carried out by the customer, and then determine the QoS based on the performance statistics for these transactions. However, mobile networks are complex heterogeneous systems made up of many protocol interfaces, IT platforms and network sub-systems. Owing to this, the customer transaction related information also gets distributed across different systems. Although, the traditional Element Management Systems (EMS) and Network Management Systems (NMS) provide the aggregate performance statistics at a network element level, these fail to provide information on individual transactions. Without customer transaction details at the individual transaction level, customer experience measurement systems lack depth in the way in which service experience can be measured and tracked.

**Lack of proactive service quality detection systems**

Most CEM systems available today monitor service quality using the transaction records generated at the end of every service transaction. For example, the transaction record is generated immediately after terminating a voice call which will contain all the statistics associated with the call, such as the caller and called party number, unique device number, network equipments accessed and performance statistics in terms of the quality and signaling errors encountered. These transaction records then undergo data conversion before they can be updated and used by the CEM improvement systems. Since, the whole process is time consuming it is currently impossible to detect the service quality issues in a near real time basis. Consequently, customer experience suffers due to the delay between problem occurrence and detection by the CEM system.

**Complex service delivery value chain**

The service delivery value chain in a CSP environment is quite complex due to the multiple layers such as the network layer, IT and application layers as well as the end user device diversity. In a typical CEM system the network KPIs are measured using interface probes such as Iu, Gb, Gn, Gi – 3GPP defined standard interfaces in the wireless network. But in most traditional CEM systems the application related KPIs and end-user-device KPIs are not taken into consideration for estimating end-user experience. For instance, in a mobile video streaming service multiple points of failure could exist such as the network, application servers, firewalls, domain name resolution systems (DNS), policy control systems, load balancers, billing systems other end user device. The streaming quality, time and customer experience can be influenced by any of these systems in the service delivery chain. For instance, the DNS query time can influence the actual session setup time, or the time taken to query the billing system for sufficient balance before a session is initiated can slow service accessibility.

The presence of multiple points of failure makes the troubleshooting and root cause analysis process more complex and time consuming. This combined with the lack of capability to get down to the individual transaction level can complicate the troubleshooting process.

**Key Enablers for Customer Experience Management**

Due to the challenges discussed above, CEM solutions that can yield significant improvements are extremely difficult to implement.

A robust CEM solution requires a dedicated effort and tight synergy across various departments in the CSP organization. However, it is also critical that the CEM solution delivers a quick ROI for the CSP. Hence, it is important for a CEM solution to leverage existing tools in the CSP environment when feasible; additional investment in tools and systems must deliver faster ROI than what the existing environment is capable of. Another important factor that guides the success of a CEM implementation is the strength of the framework in bringing harmony between multi-vendor tools and network elements.

There are three key enablers that can help guarantee the success of a CEM solution – process consolidation, network tools consolidation and the inclusion of a data correlation mechanism (see figure 4).

![Figure 4: CEM Enablers, Source: Wipro Technologies](image-url)
Process consolidation

Process consolidation is a key enabler that can be leveraged to drive cultural change in a CSP and foster customer centricity in day to day transactions. For example, consider how trouble tickets are managed by CSPs today. Typically, whenever a service affecting issue is identified, a trouble ticket is created. The ticket is then routed to the appropriate owner based on the nature of the issue, an established process flow rule or solely on the experience of the customer support engineer. To optimize the customer experience, business processes that support trouble ticket resolution must be consolidated and aligned to the customer experience objectives so that internal workflows are also customer focused.

Tools consolidation

Tools consolidation is required to avoid the information overload that is common in a multi-vendor CSP environment. CSPs may not have an immediate solution to overcome this issue, but it is necessary to eliminate cost associated with storing redundant performance data from multiple tools. It can also help reduce revenue loss incurred while doing a deep dive into performance data collected from multiple monitoring tools. One approach to achieve the objectives of tools consolidation is to introduce event based data filtering capability. For instance, a CSP could trigger a data capture event when a quality of experience indicator crosses a certain threshold.

Data model consolidation

To effectively manage customer experience an efficient data model is required. The model must be able to categorize and analyze information. The model will help aggregate network parameters as performance indicators and monitor such indicators to quickly identify issues.

A related aspect is the amount of information a particular tool can provide to a CSP. In a typical use case, the network operations team may need to refer to output from multiple tools to understand a customer impacting issue. For example, network monitoring tools may be extremely process intensive to conduct activities such as trace handset type based statistics on a continuous basis. But, this data may be readily available from the call details records. To summarize, to gain customer insight it is necessary to correlate data from multiple elements including the corporate customer profile database, the enterprise data warehouse, OSS, the IMEI code mapping database and supply chain data – an efficient data model is key to achieving this.

All three enablers listed above converge on one important requirement which is lacking in most of the CSP environments currently - a collaboration layer that transcends the tools and information sources. The collaboration layer must aggregate real time performance data to accurately measure customer experience.

Recommended Approaches for Proactive CEM Measurement and Improvement

One of the key challenges CSPs face when implementing a CEM solution is the lack of a reference architecture to identify the integration points that derive customer data. For practical CEM deployments, it is essential to understand how a customer perceives service experience, how a CSP system responds to a customer request and the outcome or quality of the resulting transactions. Though this looks simple from customer point of view, in reality one transaction may constitute multiple sub-transactions that are hidden within CSP networks and IT systems. All these sub-transactions ultimately influence the customer experience.

In addition, the situation becomes more complex if the customer experience has to be measured for each customer in real time due to data management challenges. To solve this problem two approaches can be incorporated which are detailed below:

- Rule based selective tracing
- Smart analytics.

Figure 5 gives a high level view of Wipro’s recommended CEM solution architecture.

Rule based selective tracing

The selective tracing component helps filter and manage customer transaction related data and automate customer experience troubleshooting. One of the key components of this solution is a rules engine with support for complex event processing. The selective tracing solution monitors events and transactions from the connected data sources and dynamically processes the events against predefined rules. The rules can be simple “condition check” or can be built upon complex calculations followed by a comparison with a predefined threshold. Once the rules engine processes the events and transactions, the results can be streamed to a notification system or used to analyze the root cause. Additionally, the results can be routed to capture sufficient details from underlying systems. The platform gives flexibility to program the rules based on the requirement and can be activated at run time. This approach is also useful while troubleshooting customer experience issues because the operations engineer can program the rules and execute them to capture specific information pertaining to the customer.

With the selective tracing framework, a new layer of intelligence can be built on top of the existing tools deployed in the CSP network. Thus, rule based selective tracing helps CSPs manage customer experience data, automate customer experience measurement and map the analysis logic into tangible and reusable assets. Another advantage is that CSP can focus and prioritize on issues that are revenue and brand impacting, rather than on issues which are less critical.
Smart analytics

Analytics is another approach to control the information overload problem related to CEM. Operations generate tremendous amounts of data such as billing and location information, mobile transactions, online behavior and network conditions – and the sheer volume of data makes it unwieldy. A tier-one operator might have millions of subscribers which yield billions of transactions per day – close to a Petabyte of data. It is difficult to manage this data and derive meaningful customer insights. A robust analytical framework will enable CSPs to correlate the data from different sources and produce statistics useful for different business units in the service provider organization. An analytics framework would also help CSPs drill down and analyze multiple dimensions of customer experience through a user friendly interface. This will quickly identify patterns and expedite the troubleshooting process. The analytics framework will also improve flexibility for the operations team allowing them to build custom rules for data correlation or aggregation at run time to identify patterns.

These solutions will not only enable proactive measurement of customer experience by processing discrete network events in near real time, it will also help conduct root cause analysis and generate automated recommendations to avoid customer impacting issues before they occur.

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Next Steps for Telcos

CEM is a journey that requires continuous measurement and improvement. It is easy to appreciate this fact considering the speed at which customer preferences and network technologies are evolving. As a result, CEM is an activity that should be carried out incrementally as the CSP networks and services evolve. To enable this, CSPs must adopt the two approaches detailed below.

Adopt a standard CEM implementation methodology

Both for standardization and continuity, CEM initiatives require reference methodology and processes. With this in hand, these initiatives can be adopted across the organization. Figure 5 depicts a methodology that can be adopted for effectively implementing CEM solutions in a CSP organization.

As illustrated in figure 6, the key stages in the implementation process are:

1) Identify: The CSP ‘as is’ environment is studied and audited to understand the existing setup and the maturity level of existing customer experience implementations.

2) Recommend: Gaps are identified between the current state and known best practices to identify key recommendations. This stage also recommends the tools and process to be implemented to bridge the gaps.

3) Implement: Recommended tools and processes are implemented with the help of the respective vendors.

4) Monitor: The end to end customer experience is monitored and the entire CSP environment is optimized to deliver the best customer experience. In parallel, the same time systems are modeled to leverage business benefits from customer experience improvements realized.
To assess the internal systems for CEM readiness a maturity model for CEM can be developed as depicted in figure 7 below. This will help CSPs determine the current state of their CEM operations and how they can scale up to meet evolving customer experience requirements.

These tools will provide CSPs with a methodological approach to continuously monitor and institutionalize CEM improvement initiatives.

**Conclusion**

A variety of market challenges are forcing CSPs to pursue cost reduction and revenue enhancement initiatives. CSPs will always attempt to add new subscribers, but customer retention has become even more important in developed countries with high penetration rates. CEM initiatives can help CSPs achieve their strategic priorities in two ways. First, CEM helps optimize the utilization of resources by prioritizing consumption based upon customer impact. Second, CEM helps CSPs improve customer confidence and loyalty. To deliver an optimal customer experience, CSPs must invest in three areas:

- Measurement of customer experience and identification of customer issues in near real time
- Intelligence to analyze the measured values and minimize manual effort in troubleshooting or resolving issues that breach agreed service levels
- Proactive troubleshooting to address issues before the customer is impacted

In conclusion, customer experience improvement is a continuous journey which requires measurement, analysis and improvement of KPIs; as well as definition of a new set of KPIs on an ongoing basis.
About the Authors

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