it's about time

Kx for Telco

Service Assurance in Mobile Data Networks

Overview

Mobile networks are complex systems, and complex systems, as everyone knows, are susceptible to error. As a result, even with the most careful planning and rigorous engineering, errors and inefficiencies are not just possible, they are highly probable. And with them comes customer dissatisfaction, reputational damage and, ultimately, churn and revenue loss. Eliminating them may be difficult, but it should be a goal, and when the unexpected does occur, it should be identified, analyzed and mitigated as quickly as possible. To do so requires a combination of technology and expertise: technology to capture and process the vast amounts of data involved and expertise to analyze and interpret the results. Kx for Telco combines both in its Service Assurance offering for operators.

Kx for Telco's Service Assurance provides tools and processes that enable operators to track how their network and operations are performing and, in particular, how they are meeting their contractual obligations to customers. This document outlines how.

Kx for Telco – Service Assurance

Kx for Telco's Service Assurance gives operators the ability to monitor the quality of their normal operations and the effect of changes to ensure they stay within the levels of service they have contracted with customers.

Helping Operators to deliver on their customer commitments

The Performance Challenge

Customer demands are evolving almost as fast as the networks and processes that deliver them. Fulfilling those demands is an enormous technical challenge for operators as new technologies offer new possibilities that customers want immediately. Service differentiation is another imperative for operators in its goal to expand its customer base. As a result, the commercial offer for most operators is extensive, complex and in constant flux. Therefore, contractual obligations are equally challenging; from marketing promises to effective end-user delivery, a number of issues may arise. Failure to deliver is a breach of contract, but over delivering is a waste of resources. Both must be avoided.

This document outlines how Kx for Telco presents operators with continuous, data-driven, service assurance monitoring that provides ongoing confirmation of whether their services meet their contractual obligations and early indication if they do not. Identifying inefficiencies before they propagate in large numbers throughout the customer base can save time, money and reputation. Kx for Telco can be the basis for an automated diagnostics and root cause identification leading to the appropriate remediation.

The Mobile Data Complexity Challenge

Complexity is inherent in configurations where many different technologies, standards and protocols combine to perform a given function: there are dependencies, hand-offs, transformations and timings that need to be carefully coordinated to ensure smooth and continuous operation. Complexity is prevalent in telecommunication networks generally, and especially in mobile data networks. Among the main factors contributing to that complexity are:

- Network topology - the large number of devices and technologies needed to build up the network
- Processes - the logic and process flow required to make it all work together
- Market pressure - new and evolving devices, services demand and revenue models

It is no surprise, therefore, that as a consequence of complexity, errors and malfunctions arise in the operation of mobile data networks at unexpected times and places, and usually with unexpected results. A small error in one process can cause major malfunctions in another and lead to a swift deterioration of service across the entire network. Some of those effects will have a detrimental impact, either economically or quality-wise, or both, on the service experienced by users. The net result is that the service delivered differs from the one promised. Some effects will be easily identifiable, others won't. Some will be permanent, others intermittent or sporadic. Some will be quantifiable in economic terms like under-billing, while others may be reflected in churn ratios or customer dissatisfaction.

One thing they have in common is that they are the largely unpredictable, and sometimes unavoidable, consequences of a complex operational system and will eventually lead to operational loss. One well-known effect is revenue leakage, for which most operators have specific teams and tools in Revenue Assurance departments seeking to quantify and reconcile revenue gaps with actual service delivery. But there are many other unpredictable effects which may go unnoticed to the operator but are experienced by end-users who ultimately drop the service because this substandard service quality was never addressed. For example, the root cause may reside in the access network where the unfulfilled requests accumulate but cannot be detected and/or measured from outside the network by the operator. Irrespective of their cause, their effect is ultimately felt by the operator in terms of customer churn arising from poor quality of service experience.

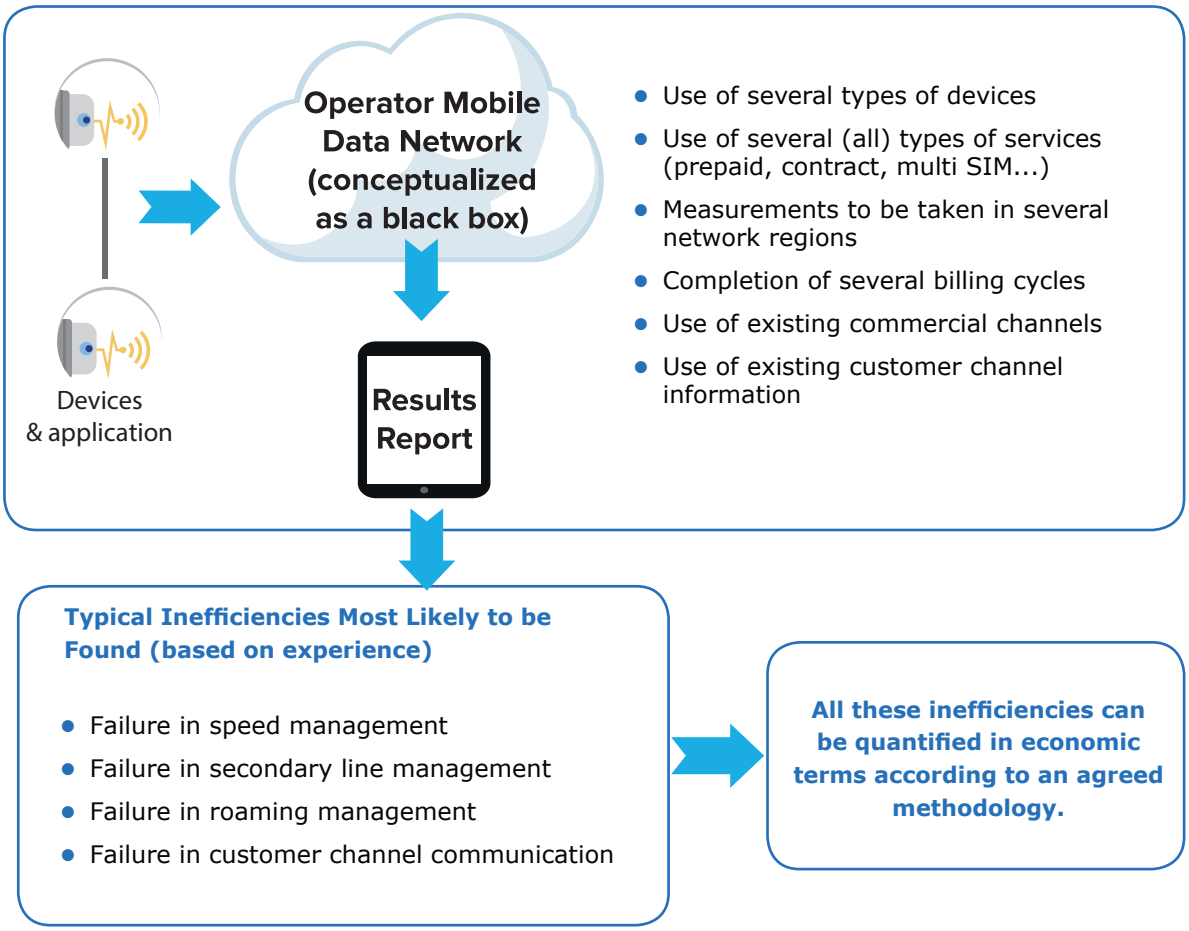
Kx for Telco’s Service Assurance monitoring will detect unfulfilled demand as well as many other unexpected problems that may remain unobserved by other operational supervision and monitoring tools - but not by customers.

Service Assurance: Going beyond Revenue Assurance

Revenue Assurance can be broadly described a set of practices whose goal is to remedy the financial impact upon the operator of certain operational issues. There is no definitive model to state where to look at in the entire operation to identify such issues, but normally Revenue Assurance services focus on the chain from delivered services to money collection. As most reports state that the highest leakage is related to the flow of CDR's/EDR's, revenue assurance services usually concentrate on analyzing these flows from the switch to the billing engines.

While there are a number of well-established approaches for Revenue Assurance for voice-based services, the same is not true for mobile data. Even within the voice domain, the services are limited: they may assess part of the network to determine why and when certain changes should apply but their scope is limited and their value resides mainly on the ability to detect and ensure correct invoicing.

Service Assurance, as delivered by Kx for Telco, goes wider and deeper. Rather than an auditing-type service operating on limited sections of the network, it provides a broader, holistic view of how efficient the operation is in delivering the services that have been contractually agreed with customers. In this way, Service Assurance is not a substitution of Revenue Assurance, but rather a tool to identify any deviation from the commercial obligation, whether it has an impact on revenue collection or not. Thus, Service Assurance is not about auditing just the information flow within the operation, but also about auditing just the information flow within the operation but about non- intrusive auditing of the entire operation as it is experienced by a user.



Kx for Telco's Service Assurance enables operators to protect revenues and reputation by closely tracking adherence to contracted service level agreements through non-intrusive monitoring of end-to-end operation as experienced by users.

Implementing Service Assurance

Kx for Telco's innovative Service Assurance is based on auditing the entire network from a user's perspective. The service consists of a client-server application running on market available devices as well as collecting all the information that the operator generates related to the services running in those devices, like SMS notifications and web-based customer information. Processing all that information, it provides comprehensive insights into the extent to which the service experienced by the user matches (or deviates from) the contracted offer and to what extent it has been correctly invoiced.

The value of this innovative approach is that the assurance service goes beyond the network alone and extends to the complete customer experience, from initial service engagement to final billing, as experienced across multiple devices and services. This contrasts with traffic generators and other lab-based test tools routinely used by operators to check services but which are limited in scope and do not fully reflect real-life experience.

Mobile data networks, because of their complexity in terms of topology, services and processes, often display erratic and unexpected behaviors in reaction to events and configuration changes. For that reason, Service Assurance is best assessed using a multivariate statistical approach based on factors across four principal dimensions:

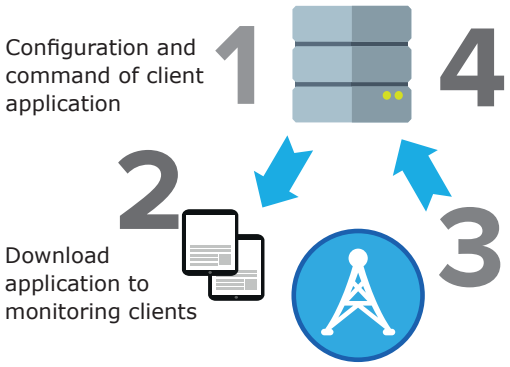
Principal Dimensions for Statistical Analysis	
Network	The locations and distribution of infrastructure equipment and devices
Time	The time and durations to analyze
Geography	The range of locations and service access points
Data Services	The type of services offered and their usage patterns

Network and time are obvious dimensions to analyze: how long and how often monitoring should be run and over what equipment to help determine what behavior is continuous and what is sporadic. Geographical analysis helps to detect if services and errors behave differently in different locations and topologies (different regions, different technologies, etc). Data services analysis helps identify where the performance and user experience change depending on the service offered (prepaid, postpaid, premium etc.). Clearly, the broader the sampling size, the greater the degree of accuracy can be attached to the results.

The frequency and timing of when analyses are performed, be it from a number of days to a number of complete invoicing periods, also warrants consideration because the duration of the analysis influences the relative accuracy of any findings. A once-off analysis can provide a snapshot view of the current service and how it measures against its target status. Repeating the analysis, in full or in part, can reveal the effect of changes made to services, configurations or simply in subscriber numbers. The greatest insight, however, comes from a regular and on-going analysis that provides the ability to identify early warning signals arising in normal operations or from unanticipated changes in behavior following network updates or new product launches.

Once the scope is decided upon, Kx for Telco's Service Assurance can be operational within days with no intrusion on normal operations or operators' resources. Regular automated reporting can be complemented by ad-hoc reports and early warnings. The initial scope can be amended at ease to cover additional locations and services.

- Client: tailored made application loaded into smartphones to produce controlled traffic, read certain parameters (i.e. speed, delays, SMS...) and send reports to the server.
- Server: tailor made program to collect clients reports and Operator notifications, process them and generate results.



1. Collect and store client data
2. Collect and store Operators customer channel information
3. Process data
4. Elaboration of results

- **Kx for Telco is a proven tool consisting of a client-server architecture for remote and unattended management of an unlimited number of smartphones running a tailor made application.**
- **Kx for Telco can be used to assess other areas that affect user experience including quality of service, fault reporting, service assurance and others.**

Kx for Telco's Service Assurance gives operators the ability to monitor the quality of their normal operations and the effect of changes to ensure they stay within the level of service they have contracted with customers.

One Step Further: Fault Diagnosis and Remediation

This paper has described Service Assurance Monitoring as a tool to identify inefficiencies in the entire process form commercial offering to invoice. That in itself is a significant output to audit operations and quantify inefficiencies so they can be converted into financial and quality ratios. But there is much more that can be derived from Service Assurance Monitoring. As an example, following error identification, the next step is to identify sources and causes and then take appropriate action to avoid its recurrence.

Service Assurance Monitoring reports can drive almost immediate remediation in instances where the source of the error is obvious; for example, in invoices consistently reflecting an error in number rounding. In most occasions, errors and malfunctions will not have such clear sources and causes. Therefore a deeper analysis, which we call Fault Diagnosis, must be performed. Due to the previously discussed complexity of the network, the source of errors can be any element or entity within its topology and process flow. Fault Diagnosis must, therefore, examine its complete span.

That means collecting information from a huge number of systems and a huge number of customers, and in the extreme, the entire operation and installed base. For that reason, it requires a technology like Kx which is capable of supporting both the massive volumes and the processing overhead. Once implemented, the trove of data coupled with Kx's analytics, and optionally augmented by its Machine Learning capabilities, forms the basis for Fault Diagnosis and Remediation Services that will be explained in further detail in a follow-up paper.

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