Best practices in fiber broadband operations

Use case

Introduction

To keep up with exploding demand for bandwidth, broadband operators are spending significant amounts of money on upgrading their networks with Gigabit fiber services. Additionally, the rapid rise of cloud, software defined networking (SDN), network functions virtualization (NFV), big data, artificial intelligence, and Internet of Things (IoT) technologies is driving fixed service providers to support larger and more diverse ecosystems with high levels of service performance. Service providers need to keep pace with these rapid changes, but their reactive approach to support creates challenges that make it difficult to resolve network problems. These difficulties result in higher costs, lost revenue, and end-customer dissatisfaction.

The challenges with reactive network operations

Traditional reactive support services often do not identify network issues until they cause the network to cross a performance threshold and trigger an alert or create a service-affecting condition. These services typically send an alert to a support engineer, who must then try to determine what caused the alert and how to resolve it.

Determining the root cause of an issue can be a challenge. The engineer must often capture and analyze log files after the fact to find out what happened. The next step is to consult information systems such as knowledge bases, operations guides, and vendor-specific manuals to find a solution to the problem. This takes time, and it may be difficult for the engineer to reproduce the issue. Solving an issue typically requires manual actions. If the problem is complex or unknown, it takes more time to analyze and resolve it.

Service providers that lack visibility of issues until they impact services or have challenges in identifying, prioritizing, and resolving issues face revenue loss and end-customer dissatisfaction. These providers must develop a means to rapidly identify and isolate network problems to avoid extended service degradation and an eroding end-user experience.

Start with an impartial view of the network health

The solution to the problem is the evolution from reactive to a pro-active network operations. But how do you close the gap? Where do you invest (first) to increase network performance or reduce network OPEX?

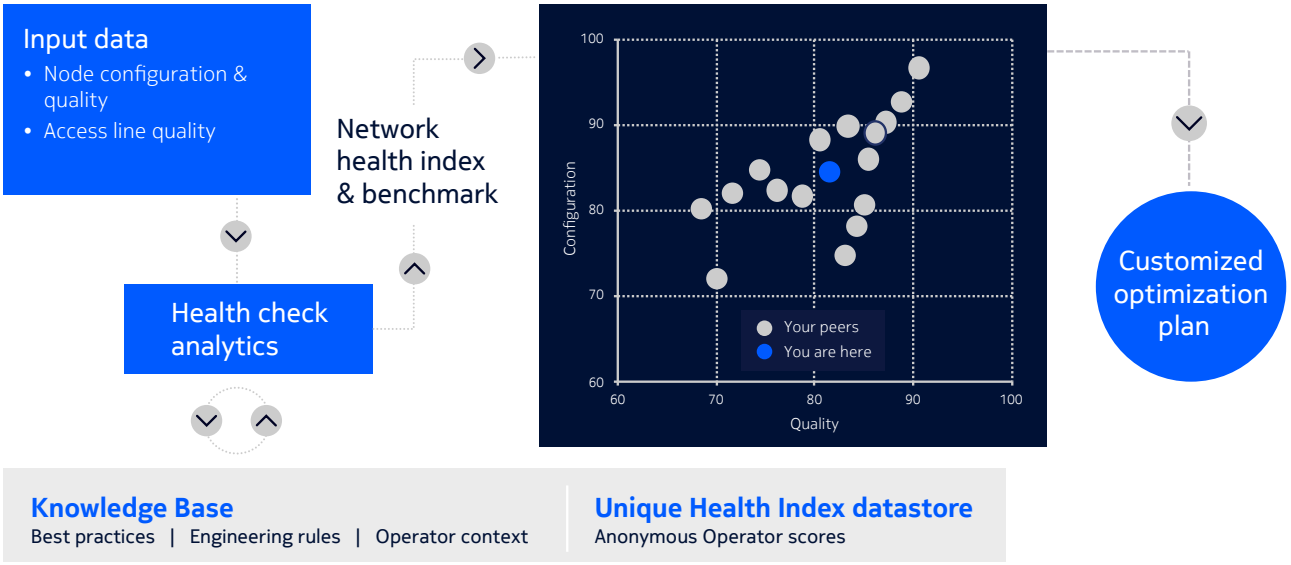
The start of the journey would be baselining the network health. But it’s hard to know which of the hundreds of network KPIs are the critical ones telling you if the network is maximizing its potential or frustrating customers. A good health check service should do that for you and give you a clear impartial view of network quality and design compliance. It will also give you a benchmark against other network operators, so you know if you’re off the pace or out in front.

But it's not as simple as capacity: the network must be engineered with multiple factors in mind to sustain quality services. And over time, of course, those factors change. New technology is introduced, services change, and customers' demands change. This has been especially pronounced in the last few years. Gigabit services for homes and businesses have arrived. 5G mobile transport across FTTH networks is on the rise. And the COVID pandemic has had a seismic effect on usage patterns: daytime traffic, upstream video, latency sensitive app usage, to name just a few. Networks must adapt accordingly, so health checks are never a one-off exercise.

From tactical fix to operational efficiency

The outcome of a network health check immediately helps to identify and fix the most critical and individual issues and kick off full-scale optimization programs.

Figure 1. Network health check & benchmarking



Optimization activities are phased, starting with ensuring that nodes are configured as expected and that line quality (copper or fiber) is not impaired. The next phases depend on your business objectives, competitive landscape, and network observations and provide a continuous cycle of plan/do/check/act to reach the desired outcomes. The health check indicators keep you focused on what matters most. That's why it's so important to be able to run health checks on a regular basis.

Processes will usually be a focus area for optimization, ensuring those that are creating network inefficiencies are fixed, kept under control, and remain efficient when scaling. This requires operational discipline, advanced analytics, and automation.

Predictive analytics are foundational to pro-active network operations

Pro-active network operations apply analytics, automation, and expert support to proactively address problem indications and prevent outages. The foundation is predictive analytics which can identify problems before they happen. Predictive analytics systems can collect and process huge amounts of data from network management systems and elements in real time and use symptoms to proactively identify network conditions that could cause future network problems. Machine learning enables these systems to recognize the increase in potential network problems early in the process and trigger preventive actions before symptoms escalate into real, service-impacting problems. It also helps them identify new symptoms and determine how to solve them through continuous learning. Triggered actions can allow the system to proactively collect specific performance and log data at the network element level. This information would be lost in a reactive support model, where troubleshooting happens after problems occur.

Predictive analytics systems typically monitor multiple service provider networks. Therefore, they collect a wealth of network diagnostic data to build an extensive “known issues” library that can be used to predict future degradation and automate issues resolution. The known issues library growth will increase the collective intelligence available in the system to make problem prediction and resolution more accurate.

Automation drives faster problem resolution

The combination of predictive analytics and augmented intelligence accelerates problem solving by enriching symptom-level alerts with actionable insights and context-specific information such as log files and symptom data. It speeds up problem analysis and resolution by enabling service providers to avoid having to perform swivel-chair operations or search multiple information systems after a problem occurs. This is particularly helpful with complex or unknown symptoms.

Automated troubleshooting workflows can accelerate the resolution of known symptoms. Predictive analytics can accurately identify the right workflow to use. For example, a known symptom could trigger a series of automated actions that execute specific tests. The test results could initiate new actions, some of which may require manual intervention or acknowledgement if they are intrusive to the network element that is being investigated. The outcome of an automated workflow triggered by predictive analytics is a more effective resolution or recommended action.

Where it makes sense, the analytics outcome may trigger the automated optimization of the network to prevent a problem from occurring or anticipate the need for additional capacity. Digital assistants powered by analytics, collective intelligence, and automation enable natural-language interaction to speed up problem analysis and resolution and support more efficient preventive actions.

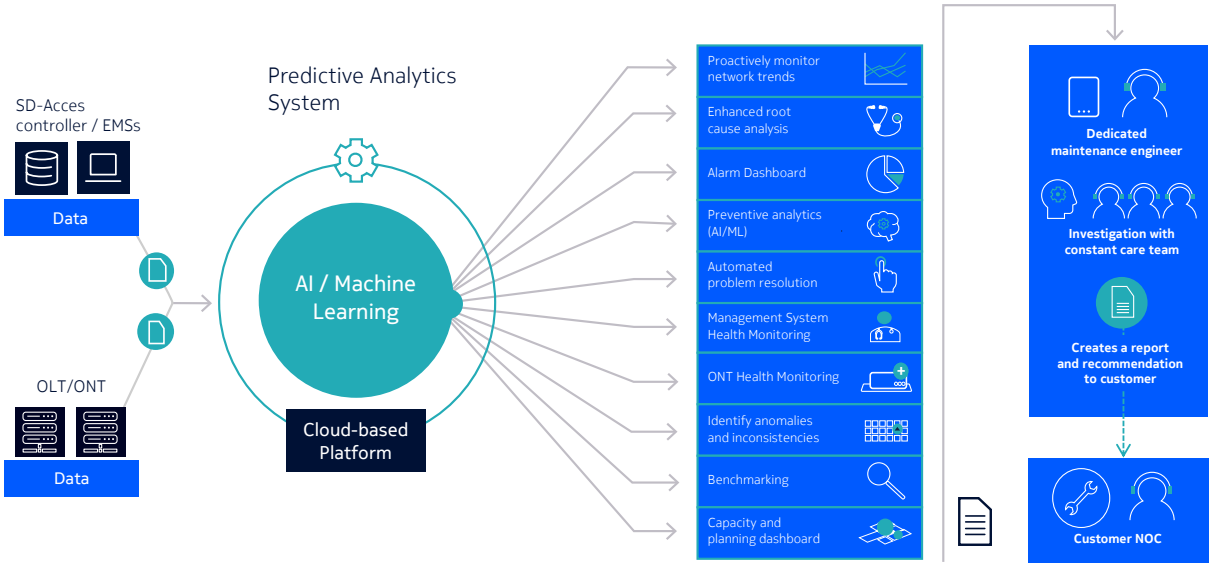
Expert care team provides context and resolution

To keep problems from occurring, augmented intelligence triggers automated actions or provides actionable insights to an expert care team. The expert care team looks for relevant information in these insights, puts them into a customer-specific context, and recommends specific resolution steps. It focuses on helping the service provider resolve complex problems.

The expert team has a deep domain knowledge and an in-depth understanding of the service provider's network, so it is ideally positioned to evaluate automated recommendations relative to the service provider's specific network conditions. For example, expert evaluation could be part of an automated workflow that includes decision-making steps that are specific to the service provider's network.

The starting point for expert analysis is typically the result of an automated pre-analysis or the collection of context-specific alert information relating to an unknown or complex symptom.

Figure 2. Predictive analytics system



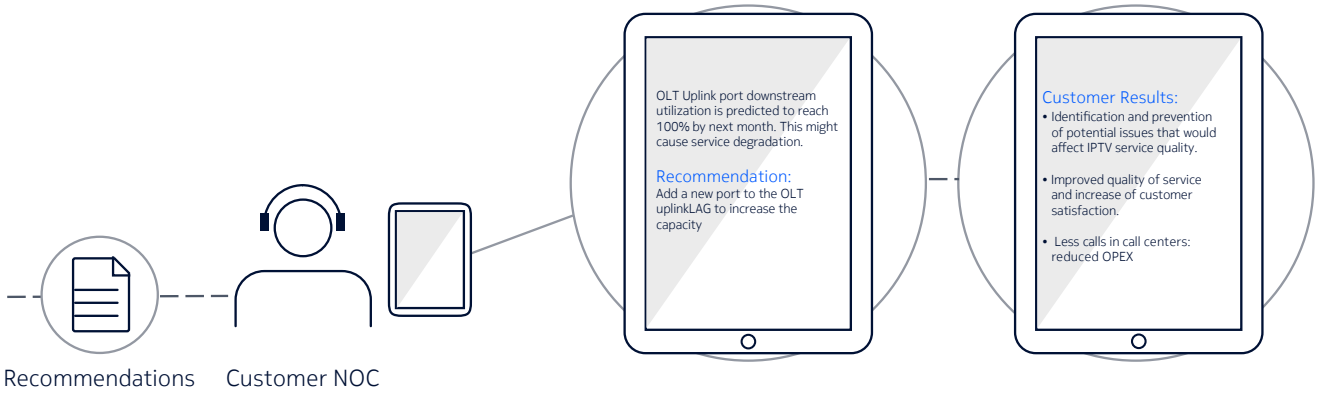
Predictive analytics in action

This example illustrates a use case of predictive analytics and automated problem solving in action.

Traffic utilization monitoring

A traffic utilization app from the Predictive Analytics System monitors the traffic on the fiber network. Its task is to spot future bottlenecks via machine learning algorithms to avoid service degradation. Therefore, it monitors OLT traffic utilization at different levels, for example at OLT uplink, PON port, backplane communication, etc. Machine learning supervised regression methods are used for predicting maximum expected utilization for OLT uplink and PON ports with a specific level of accuracy. When the predicted utilization becomes critical, for example within the next 30 days, the system will automatically send a notification to the customer operations team to recommend a capacity upgrade. Pro-actively upgrading the network will result in the prevention of potential issues and an impact on customers.

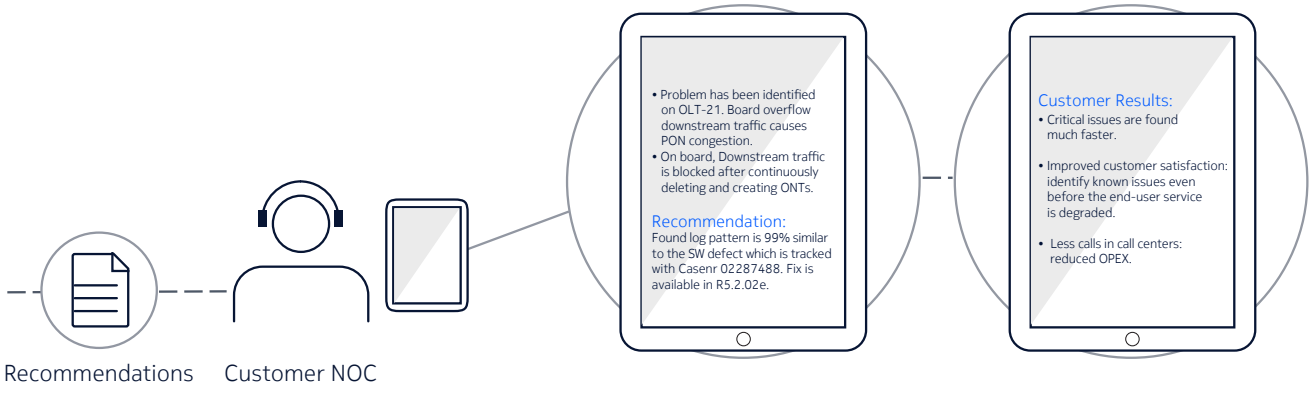
Figure 3. Proactively monitor network trends



Automated root cause analysis

The Predictive Analytics System continuously monitors the network for network symptoms to avoid service degradation. A problem with an OLT has been identified. Moreover, the symptom has been identified with high certainty as already existing in the known issues datastore. Therefore, the predictive care system sends a notification to the customer operations team to make recommendations to resolve the problem based on the resolution of a problem which has a 99% similar symptom match. The automated root cause analysis accelerates solving problems thereby increasing network operations efficiency and improving customer service experience.

Figure 4. Enhanced root cause analysis



Benefits

The benefits of a Predictive Analytics System and services are multiple. They improve return on investment and end-customer satisfaction by providing capabilities that enable service providers to:

- Reduce OPEX and improve staff efficiency.
  - Shift from reactive to pro-active network care.
  - Shorten resolution times for network problems.
  - Reduce firefighting and improve maintenance planning.
  - Increase the speed and accuracy of issue detection, root cause analysis, and resolution.
  - Improve the efficiency, utilization, and work quality of operations and management teams.
- Deliver a consistent quality of service and high network availability.
- Simplify network management by gaining visibility of vital network health data.
- Ensure that networks are ready to handle interventions, upgrades, special events, and new launches.
- Improve KPIs and increase network utilization.
- Boost network uptime and prevent outages.
- Increase network stability and reliability.
- Improve end-customer service quality and availability.

Conclusion

Fiber rollouts are accelerating and broadband access networks have become mission critical. Degradation of network performance hinders the end-customer experience, impedes revenue growth, and negatively impacts return on investment.

Coping with this growth and complexity requires network operations that can scale without increasing network operations cost. Continuous network optimization and pro-active network operations are the answer. They keep your fiber services running at the highest performance, keep customers satisfied, and your fiber investment safe.

The best practices in pro-active fiber broadband operations are:

- Network optimization tools and services combining advanced analytics to analyze network data with best practices to provide the insights you need to continuously improve your fiber network performance.
- Predictive analytics and services combining powerful artificial intelligence and machine learning algorithms to your network data, unique knowledge databases, and expert support to identify and solve network problems before they impact your customers.

Find out more about Nokia's network optimization services here and predictive analytics services here.

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Document code: (February) CID212617