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Take fixed access network care to the next level with predictive analytics

Resolve network issues proactively with intelligent analytics, automation, and expert insight

White paper

Broadband service providers are facing new challenges as consumers, businesses, and governments push for higher bit rates, comprehensive coverage, and better experiences. Their networks and services must meet the demands and expectations of the ultra-connected society and support the Internet of Things (IoT) with connectivity and near-100 percent availability for a trillion devices.

Service providers cannot deliver extremely high service availability and performance with only reactive support models. They need the ability to predict, preempt, and resolve fixed network faults before they impact services. This white paper describes how the Nokia Predictive Care service combines big data collection and storage, intelligent analytics, extreme automation, and data science expertise to enable service providers to meet new demands and reduce total cost of ownership.

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Introduction

Delivering better broadband to more people, more quickly, is more important than ever before. Broadband networks are vital for social and economic wellbeing, for the sustainability of our planet, and to unlock the promises of Industry 4.0, IoT, and future waves of innovation. The onus is on service providers to meet the demands and expectations of the ultra-connected society.

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 want 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.

Service providers need a better and more cost-effective model for supporting their evolving fixed access networks, one that can predict and preempt network events before they affect end-user services. The Nokia Predictive Care service addresses these needs with a support model that leverages cloud-based platforms, big data collection and storage, intelligent analytics, and automation. It enables service providers to deliver predictive and proactive support that enhances network performance and availability while maintaining a strong commitment to security and data privacy standards.

By using predictive services to support broadband access networks, service providers acquire a vehicle for refocusing their resources on growing new revenue streams, spending less time and effort coping with network operations and complexity, being proactive with current fixed networks technology, maximizing the data analytics benefits from technology evolution towards SDN/NFV and gaining a competitive advantage by achieving higher levels of end-user satisfaction.

Challenges associated with reactive support models

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. The drive to resolve these challenges manually may lead to increased internal resource investment or a reduced return on network investment. In a highly competitive environment, regaining the end-customer lost from a poor user experience can be a daunting challenge.

Moving to a predictive fixed access network care model

The new fixed access care model shifts the approach from reactive to predictive. It enables service providers to use intelligent analytics, automation, and expert support to proactively address problem indications and prevent outages.

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Powerful analytics identify problems before they happen

Network management systems provide insight into network performance and alert users when alarms are triggered. But they do not support real-time data gathering, data storage, or intelligent analytics. In contrast, predictive analytics systems can collect and process huge amounts of data from network management systems and elements in real time and use symptoms proactively to identify network conditions that could cause future network problems.

Predictive analytics systems base alarm thresholds on symptoms rather than on traditional network element performance statistics. 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.

As predictive analytics systems monitor more service providers networks, they will collect more symptoms to build “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 to make problem prediction and resolution more accurate.

Automation drives faster resolution

Powerful predictive analytics provide the foundation for efficiently addressing potential problems before they cause service degradation.

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 rather than on why alerts occurred.

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. In these scenarios, digital assistants can facilitate analysis and provide effective recommendations.

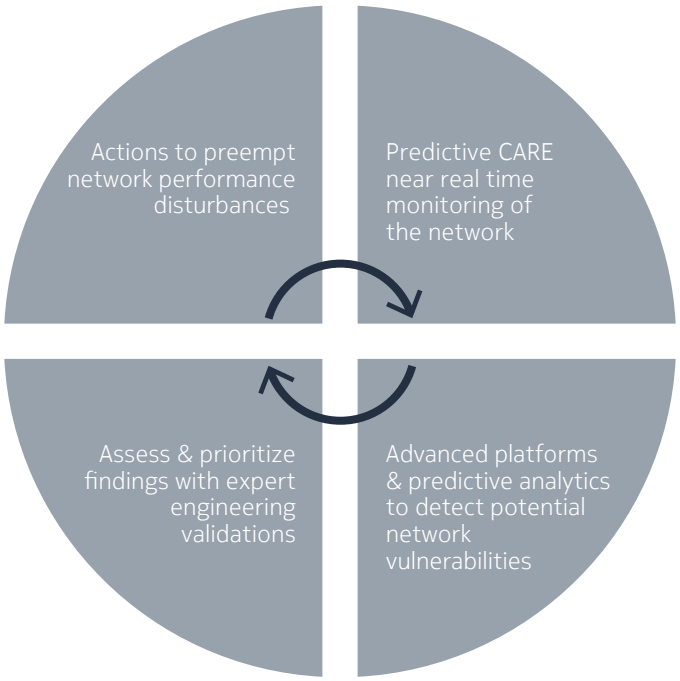
Increasing support efficiency with Nokia Predictive Care

Nokia Predictive Care for fixed access networks uses the new proactive network care model to take support to a new level of efficiency for service providers and their end users. The cloud-based Nokia Predictive Care platform powers this service. It combines big data collection and storage, virtualization, intelligent analytics, extreme automation, and advanced processes to enable service providers to move from reactive support to a proactive approach that predicts faults and resolves them rapidly. The platform's capabilities also ensure that service providers can maintain a strong commitment to security and data privacy standards.

Powerful analytics and automation

Networks change constantly as service providers upgrade software and reconfigure hardware. These changes can create problems in even the best-designed, best-managed networks. The Predictive Care service identifies potential network vulnerabilities before they impact services by combining the Nokia Predictive Care platform with proprietary data feeds, near-real-time network data collection, and engineering expertise embedded in advanced analytics algorithms.

Figure 1. Nokia Predictive Care platform proactively anticipates network issues



Based on experiences with service providers projects worldwide, Nokia continually evaluates trigger points for network symptoms to ensure the best possible network performance. As it identifies new triggers and symptoms, Nokia enhances the collective intelligence provided by the Predictive Care platform analytics. These enhancements ensure a dynamic environment that easily adapts to changes in requirements and delivers the highest possible quality of diagnostics and predictive data.

The Predictive Care service helps service providers resolve problems more efficiently by providing more than 15000 automated recommendations for known symptoms stored in the "known issues" library. When network performance crosses symptom alert thresholds, the service automatically collects relevant log, network performance, and proprietary debug information. This information would be lost in a reactive model. By collecting it proactively and automatically, the Predictive Care service can simplify root cause analysis and recommend preventive actions.

Customer care expertise

The Nokia expert care team supports the Predictive Care service by ensuring that the service provider takes the right steps to preempt outages. It utilizes best practices and dedicated resources who understand the service provider's operations, processes, network, and support staff. The team receives automated recommendations and augmented intelligence from the Predictive Care platform, in the form of network performance and availability reports. It then tailors the analysis and recommendations to address the service provider's specific needs. By acting on these recommendations, the provider can improve overall network operations and avoid issues that might impact services.

The expert care team designates engineers to individual service providers. Nokia selects engineers who combine field-leading technical capabilities with exceptional interpersonal skills. In this role, they become experts in the service provider's network, operations principles, and practices. They develop a close relationship with the service provider's operations and support staff, provide tailored analysis and recommendations, and hold regular meetings to discuss analysis and improvement opportunities. The Nokia team can provide coaching, knowledge sharing, observations, and recommendations to help the service provider improve operational efficiency and rectify potential problems in the network.

Best-in-class service-level agreement support

No service provider can avoid network disruptions. The key to avoiding loss of revenue or creating end-customer dissatisfaction is to restore services rapidly when disruptions occur. The Predictive Care service uses analytics, automation, and experts who know the service provider's operations and network to rapidly determine what caused the network disruption and facilitate rapid service restoration.

Intelligent call routing ensures that the expert care team can engage with service providers in near-real time if a critical situation occurs. The ability to engage a team of technical experts who know the service provider network and operations allows Nokia to support improved service-level agreements (SLAs). With Predictive Care, Nokia reduces the time to network restoration.

Secure remote connectivity

Data security is paramount in a world where some make it their business to disrupt and steal sensitive information. The Predictive Care service collects proactively network diagnostics data that is typically collected during any investigation in a technical support ticket without exposure to any personal or private data, Moreover, Predictive Care service is adapted to all security roles & regulations to scramble and encrypt network data to avoid by all means reverse engineering to reconstruct the network diagnostics data.

Additionally, Predictive Care service uses tools from the Predictive Care platform to allow service providers to monitor exactly what network diagnostics data passes into and out of their secure networks with full control to enable/disable the data flow any time. These tools are protected to ensure that all service provider network data remains safe.

Predictive analytics for service provider self-care

Service providers can choose to use the results of the predictive analytics for self-care rather than relying on the Nokia expert care team and SLA support capabilities. The results can enable operations and maintenance personnel to prevent service degradation and troubleshoot more efficiently.

By choosing this option, a service provider gets access to analysis and network element data that can help it understand and maintain network health. Its operations team gains visibility of critical network health data that can indicate service degradation. This visibility allows them to spend less time collecting data and more time preventing problems. The results are increased operational efficiency and improved network quality.

Predictive Care at work

Nokia Predictive Care enables service providers to address and prevent fixed network issues by supporting use cases such as proactive trend monitoring, anomaly identification, and enhanced root cause analysis.

Proactively Monitoring Network Trends

The Nokia expert care team monitors trends in the network and makes recommendations that will improve network performance over time. With an IPTV service, for example, the Predictive Care service may determine that the multicast packet discard ratio has been increasing for three consecutive reporting periods. This increase might hinder the end-user experience. After the service identifies the negative trend, the Nokia experts can analyze the problem and provide actionable advice on how to solve it. By acting on this advice, the service provider can resolve the issue quickly, without any end-user dissatisfaction or loss of revenue.

Nokia regularly collects and analyzes important performance measurements to identify potential issues and trends in the network. The Predictive Care platform provides a collection of standard measurements. In addition, Nokia can work with service providers to develop measurements and analyzers that address their specific needs or symptoms they encounter frequently in their network.

Identifying Anomalies and Inconsistencies

Anomalies with no immediately visible impact could have a significant negative impact on networks, services, and service providers over the longer term. For example:

- A database inconsistency on a network element could create a network outage by causing the loss of configuration data after a reset.
- Misconfiguration of a standard parameter on one network element could create an inconsistency that keeps the network from complying with the predefined golden configuration. Configuration issues could have a negative impact on quality of experience without creating any noticeable network issues.
- An inability to identify specific network elements or objects that generate most of the symptom alarms in the network could make it difficult for the service provider to avoid chronic network problems.

Nokia Predictive Care can identify and resolve these and other issues proactively to prevent service-affecting conditions.

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Enhanced Root Cause Analysis

Determining the root cause of a problem after the problem has occurred can be very challenging if the data required for the root cause analysis is not collected at the right time. If this valuable information is lost or unavailable, the service provider may need to attempt to replicate the exact network configuration in a lab environment. This task is challenging and time consuming. It may require the service provider to wait for the service degradation to reoccur in the real network so that it can collect the required data. If the problem is significant, waiting for it to reoccur could put end-customers relationships at risk.

Nokia Predictive Care monitors networks on a regular and symptom-triggered basis, gathering and storing data from proprietary data feeds. If a service-affecting condition occurs, the service can use this data for automated root cause analysis. The Nokia expert care team can then perform further analysis to pinpoint the cause of the problem.

This combination of automated and expert analysis accelerates service restoration and permanent correction. For example, a board reset in a network element triggers the generation of a tech-support file. The Predictive Care service automatically gathers and analyzes this tech-support file. This analysis provides valuable information that can enable the Nokia expert care team to find the root cause in a much faster way. In a reactive support model, the initial tech-support data would be lost.

Alarm Dashboard

Alarm dashboard provides a statistical view about high runner alarms per each type and object to categorize the alarm traffic in the network. The Predictive Care service detects the problematic alarm patterns that might cause service degradations or outages and provides recommendations to reduce the alarm count in the network. This help service provider's operation team to be aware of problematic alarm patterns and taking efficient actions to reduce alarm traffic in the network, that results in mitigate the problems before subscriber get affected and avoid invisible outages in the network.

Capacity and Planning Dashboard

Capacity and planning dashboard provides service provider's planning and operation team a full picture of utilized resources & traffic via a view on traffic on different levels (PON port, LT, OLT uplink), a heat-map for PON port utilization, provisioned ONTs, capacity bottleneck created by high downstream and prediction about total downstream rate impact in future.

Management System Health Monitoring

Management System Health Monitoring improves the EMS server and application health and prevent management outages causing network visibility loss by proactively monitoring management server and application KPIs. In a software-defined access network, Predictive Care frequently collects SW information from the controller and its micro applications. This information is used to track SW inventory and check if active SW is in line with the expected/supported SW matrix of the controller. Notification is provided to service provider and Nokia expert care team if any SW component is conflicting with the expected versions

Automated Problem Resolution

Automated Problem Resolution allows alarm rules to be created based on predefined specific scenarios. When these scenarios are detected in the field, the Predictive Care system provides notifications to service provider's operation team and performs additional automated mitigation actions when applicable.

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ONT Extensive Care

Besides the core network data analysis, Predictive Care service extends its insights and analytics capabilities to ONTs for on-demand monitoring and troubleshooting.

The Predictive Care system proactively monitors performance of specific ONTs (focus group or VIPs) for automated analysis. Data collected from the ONTs can vary from traffic related data, such as overall traffic and discards, bit error rates, to optical/physical values like temperature and signal level. Additionally, Predictive Care provides the infrastructure to initiate on-demand ONT troubleshooting tests. Aim is to identify ONT problems remotely and isolate home/service-related problems from ONT device problems. This capability prevents truck rolls and therefore saves on OPEX. It also improves end-customer satisfaction by timely troubleshooting and mitigation of problems. Finally, when Predictive Care system detects problematic conditions for the ONTs, it creates notifications based on analysis results.

Platinum Software Support Service

Predictive Care Service comes on top of the Access Management Solutions to take the software support service from the standard reactive care level to the highest Platinum level.

Platinum is a Service that has evolved out of a need to standardize and provide exceptional performance in SW Support embracing:

- Superior SLA and KPIs: up to 50 percent reduction of network restoration time for critical issues and 96 percent service delivery performance target
- Advanced monitoring, reporting and notification of targeted early problem indicators
- Proactive issue mitigation and outage prevention
- Dedicated senior technical care team providing a personalized support model for service providers.

Platinum Service, offered for Nokia's access network elements and management solutions, opens the door to a new level of SW Support.

Predictive Care service benefits

Service providers invest in networks to generate revenue. Degradation of network performance impedes revenue growth, hinders the end-customer experience, and negatively impacts return on investment. Nokia Predictive Care improves return on investment and end-customer satisfaction by providing capabilities that enable service providers to:

1. Reduce OPEX and improve staff efficiency
   - Shift from reactive to predictive network care
   - Shorten resolution time 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

2. 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

Software Defined Access improves Predictive Care

The Predictive Care service gathers relevant data from many points within the network, including network elements, element managers, operations support systems, and probes. It collects this data through SNMP, NETCONF/YANG and proprietary data feeds. The use of multiple sources and feeds creates issues with complexity and flexibility when network changes occur. The challenge grows in cases where service providers operate multivendor networks. For example, network configuration changes made to accommodate capacity increases or network optimization will depend on vendor-specific management systems and databases.

Software-defined access networking (SDAN) simplifies network data access, creating a more agile and flexible approach to Predictive Care service delivery. SDAN and its open interfaces and data models will provide insight on more diagnostics data more easily across systems &networks and will further improve the accuracy of predictive analytics. SDAN also provides ease of programmability that makes it possible to increase the efficiency of automated actions and find the most effective ways to optimize network performance and quality.

Conclusion

Fixed service providers want to evolve their networks to meet demand for services that connect everything. Reactive network care models that rely on traditional management and performance tools will slow this evolution by limiting their ability to identify and resolve network anomalies that could impact service performance. Service providers need a new proactive care model enabled by intelligent analytics, automation, and expert advice.

Nokia Predictive Care combines the powerful Nokia Predictive Care platform with best-in-class expert support teams to help service providers improve network performance and preempt network-affecting conditions. These improvements enable service provides to increase revenue and generate a greater overall return on their network investments.

To learn more about the Nokia Predictive Care service, visit https://www.nokia.com/networks/services/predictive-care-for-fixed-networks/.

Abbreviations

IoT	Internet of Things
IPTV	Internet Protocol television
KPI	key performance indicator
NFV	network functions virtualization
SDAN	software-defined access networking
SLA	service-level agreement
SNMP	Simple Network Management Protocol
SW	Software
3P	Third party nodes, or “access devices”

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