Cognitive Operations: The Future of Telecom Networks is Here

Abstract

The digital era has redefined the meaning of customer experience and its significance to the telecom businesses. This has resulted in a paradigm shift for the industry, with communications services providers (CSPs) moving their focus from network or product-centric approach to a customer-centric one.

Telecom networks have undergone a massive transformation in the last few years. On one hand, rapid growth in 'smart' devices and data has placed enormous pressure on the underlying infrastructure to keep pace with this growth. Meanwhile, technological advancements relating to 5G, Internet of Things (IoT), and cloud continue to increase the complexity of telecom networks. It is no more possible for just humans to manage this rising complexity without affecting performance, service levels, and efficiency.

It is therefore no surprise that CSPs are exploring how disruptive technologies can be harnessed to orchestrate intelligent network operations.

According to a report published by market intelligence firm Tractica[1], network operations monitoring and management are likely to account for 61% of telecom AI spending in the coming years. This paper explores the possibilities of introducing cognitive abilities into telecommunications network management function.

Intelligent Network Operations: The Answer to Traditional Network Challenges

Intelligent network operations, also known as cognitive network operations center, use artificial intelligence (AI) and machine learning (ML), along with advanced analytics, to run self-optimized, self-healing and autonomous transport networks. If deployed effectively, a cognitive NOC can facilitate enhanced business agility, superior scalability, and optimized performance in telecom management, in ways not imagined so far.

Conventionally, most network operation centers work in a reactive mode, wherein a majority of network-related problems are discovered and resolved only after an issue is reported or customer complaint filed. Though many indicators and performance data are available in the form of alarms, service-level KPIs, and network transaction data, technicians are ill-equipped to handle them efficiently and quickly. Many telecom carriers also struggle to effectively use historical data to correlate and discover the root cause behind repeat incidents.

A research we conducted reveals only about 20% of alarms in an NOC are typically acted upon immediately, with the remaining ones requiring extensive investigations that involve significant time and resources. The continuous loss of knowledge arising from the departure and retirement of employees, alongside inefficient resource utilization practices do not help matters either, directly impacting many service-level KPIs.

The service impacts in the network are often linked to old events–ones that typically occurred weeks and months ago–which may have appeared as minor alarms. The root cause analysis, though, is currently done based only on the current state of alarms and events that transpired a few hours back, thus making problem resolution difficult. This means every minor event and alarm needs to be microscopically analyzed for its potential long-term impact so that service impacts can be avoided–keeping the network availability, mean time to repair (MTTR), and mean time between failure (MTBF) at healthy levels.

To address these issues, carriers tend to deploy more resources with higher skills, which in turn only add to operating costs. The inability to correlate current and past data across network events thus translates into high total cost of ownership (TCO) for carriers, beside impacting business continuity and employee productivity.

Leveraging AI and ML for Next-Gen Network Operations

CSPs must completely reimagine their telecom networks by adopting a next-gen, cognitive NOC. Being self-aware, self-healing, and self-protecting, cognitive NOCs can unearth the root cause of failures, and perform preemptive actions. In addition to monitoring and analyzing streams of network data, cognitive NOCs can automate tasks and run algorithms to identify precursors of degradations and failures, such as shifts in traffic, capacity, utilization, and parameterization, in near real-time.

Cognitive NOCs leverage AI and ML to understand network systems in their entirety. An embedded large-scale computing ability allows them to use and analyze all available network data to create a central repository of events. The self-learning intelligent algorithm continuously carries out predictive analytics on data aggregated automatically from different systems, for proactive troubleshooting. This paves the way for automation of hierarchical, complex decision making, and implementation of the same in real time. Consequently, CSPs can substantially reduce MTTR and MTBF. Human intervention is only limited to jobs that demand absolute dependency such as physical connectivity and workflow policy governance.

For cognitive NOCs to deliver on their promise, the following features are a must-have: high correlation and contextualization of incidents and alarms, predictions and prioritization of patterns, auto-remediation, and prescription of next-best actions. Resolutions will be carried out using robotic process automation (RPA) and lifecycle handling. Continuous learning and adaptation to network changes will be quick and efficient, with capacity dynamically orchestrated per demand, resulting in higher ROI and improved customer experience.

Implementing Cognitive Network Operations

To institutionalize cognitive network operations, telecom operators need to:

- **Increase inventory accuracy:** We believe inventory accuracy of roughly 90% and higher is an important step in the cognitive journey. An effective way to achieve live and precise inventory data is by deriving it from alarms and events of the network management system (NMS). This requires ML and AI techniques with a deep understanding of attributes and values of each event log.

- **Move from fixed-rule automation to lifecycle-based task automation:** Automation in telecom networks is at present based on RPA frameworks that are fixed-rule based and don't have feedback loops. A lifecycle-based approach instead will make automation frameworks self-learning and more effective. For this, task bots need to be incorporated as workforce entities whose efficiencies should get evaluated after the execution of each task, with the output being estimated correctly in each case.
- **Digitize trouble ticket entries:** Comments in trouble ticket records related to observations, resolution steps undertaken, network synced date and time entries are important to create machine usable knowledgebase. All this information will also help correlate remediation activities to alarms and event logs appearing in the network management system (NMS).
- **Archive unfiltered alarm and event data:** The NMS data is often programmed with rule based noise cancellation and a certain level of correlations to compress the alarms. Using this data for a cognitive network is less effective. Storing unfiltered alarm and event data is a healthy practice to run AI-ML use cases.
- **Introduce service and application performance analytics to network operations:** In telecom NOCs, actions are usually carried out based on alarms and events. Service impacts are not always linked to system alarms, which disrupts services and causes time delays. Analytics based on service and application performance at the micro-transaction level need to be gradually inducted into the cognitive network operations system.
- **Build a central AI and ML strategy:** All OSS data outputs need to be used in ML algorithms, uniquely based on each use case. The systems will also execute with inputs from ML algorithms.
- **Automate ground operations:** Cognitive automation in field operations is an absolute imperative to deliver enriching customer experience. By enabling real-time actions based on the right data, cognitive, automated operations boost the efficiency of the field force. The workforce is further empowered with 'uberized' applications that assist in handling the physical, logical, and virtual elements.

Critical Components of a Cognitive NOC

Telecom operators should consider designing and implementing a cognitive NOC underpinned by a three-layer framework (see Figure 1). This includes a scalable data infrastructure as the base foundation, cognitive computing engine with AI and MI abilities on the top, and several 'smart' operational apps, workflows, and dashboards.

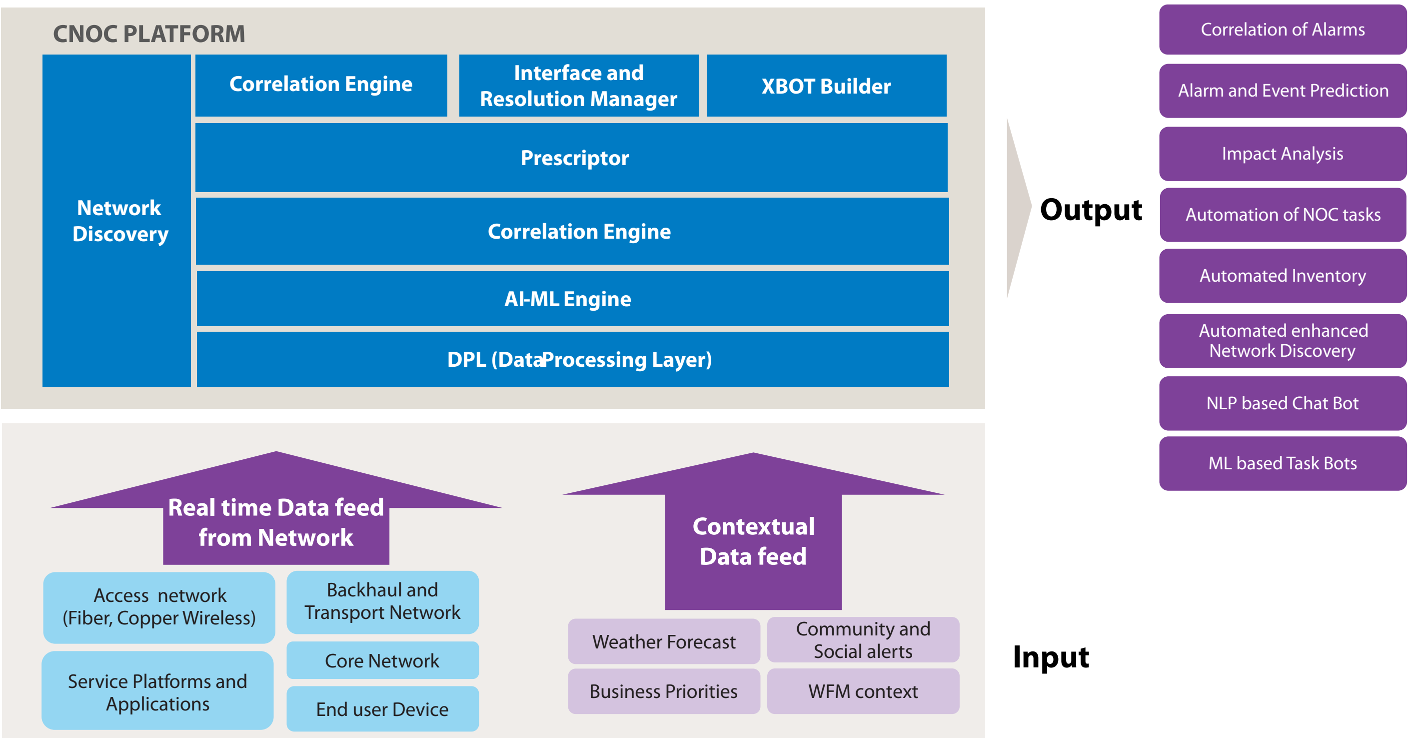

Figure 1: Three-layered framework of a cognitive NOC

These building blocks should be embedded with the following critical capabilities:

- **Data collector and parser:** An API framework is used to collect data from network elements and other reference touch points. This data is then stored in Hadoop-distributed data storage.
- **Prescriptor:** This component is used to perform event predictions, correlations, and root cause analysis. It should also be able to conduct impact and context analysis, and make next-best action predictions.
- **XBot:** This will be the automation engine that defines policies for automation, bots and the highly skilled resources needed during the training of control machines.

- **Lifecycle manager:** A cognitive NOC will also need a resolution and learning lifecycle manager that supervises virtual workforce integration.
- **Network service and application discovery:** This will form the automated inventory tracker of the physical, logical, and virtual elements in the network, by ensuring real-time identification of the same alongside services and connectivity.
- **AI and ML engine:** Finally, the AI and ML engine should be able to perform the functions of feature engineering and pattern generation, and maintain an ML algorithm library for the overall operations.

Conclusion

By going from a reactive to proactive, predictive, and cognitive mode of operations leveraging AI and ML, telecom carriers can transform their network landscape. Doing so would yield multiple business benefits, including significantly lowering operating expenditure, improving customer satisfaction, and better resource utilization. Telcos can further improve their NOCs and become a service operations center that focuses on customer experience, working on a proactive basis with enhanced service SLAs. Finally, carriers can even evolve their cognitive NOCs to move from a predictive to a prescriptive stage. As competition from non-traditional upstarts mounts, and their core offerings get commoditized rapidly, carriers will have to reimagine their network operations to deliver differentiated, value-for-money services.

Existing data transactions within a network, and service-related customer expectations, exert tremendous pressure on incumbent players to cross-sell content and platform, which might further complicate the NOC processes. However, for telcos to maximize the return on infrastructure-related investments they've made, diversifying and upgrading the NOCs from legacy to proactive, to predictive, to finally cognitive, seems the way forward.

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