SCTE•ISBE CABLE-TEC EXPO® 2020
VIRTUAL EXPERIENCE » OCTOBER 12-15

2020 Fall Technical Forum
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In Pursuit of the Dark NOC: Driving Change With Automation & AIOps

A Technical Paper prepared for SCTE•ISBE by

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1. Introduction

Network operations have evolved radically in the wake of digital transformation – and the increasing infrastructure complexity that accompanied it. As communication service providers (CSPs) roll out and support next-generation technologies like NFV, SD-WAN, IPv6, 5G, and soon 6G, network engineers face a myriad of challenges and changes in their daily operations.

The coronavirus pandemic has presented additional challenges, such as new network traffic patterns and a shifting workforce and has put unprecedented pressure on network teams to safeguard business continuity, network security, and quality of service at all costs. Reliable and high-performing connectivity has truly never been more important, making the role of the NOC more critical than ever before.

This paper explores the future of network operations, examining where we are and what's next. Drawing on real-world experience, the paper presents a blueprint for success when it comes to modernizing network operations. It also delves into the increasing role that automation and AI for IT Operations (AIOps) play in laying the foundation for the next-generation of NetOps, as well as how they are helping CSPs address current IT challenges including those stemming from COVID-19.

Becoming an "operator of the future" will require CSPs to maximize the potential of artificial intelligence, machine learning, and automation in pursuit of the so-called "Dark NOC." There are a number of actionable steps that teams can take today to achieve both quick wins and long-term success on the road to the Dark NOC and beyond.

2. Key Challenges Facing CSPs

CSPs face extraordinary circumstances when it comes to network operations due to the immense scale of the infrastructure they manage. New technologies are aggressively ramped up to remain competitive and meet customer demands, resulting in much larger scale deployments compared to average enterprise organizations – whether it's network virtualization, software-defined infrastructure, IPv6, 5G, or the imminent 6G.

Key challenges facing CSPs include:

- Managing network infrastructure complexity, including legacy networks, while rolling out complicated and demanding new technologies
- Maintaining high levels of network connectivity and service delivery
- Contending with massive amounts of data being generated by the infrastructure and the monitoring tools that have been deployed to keep an eye on it
- Ensuring network security
- Morphing, unpredictable network traffic patterns
- Meeting tight margins, requiring continual improvements in operational efficiency
- Quickly rolling out new services and infrastructure (without increasing headcount) to remain competitive

As we battle a pandemic, CSPs must also contend with workforce fluctuations (or in some cases reductions) and tightening budgets, meaning that NOC technicians need to do more with less and workloads need to be left-shifted.

To address these challenges, CSPs must embrace new technologies and advance their use of automation, AI, and machine learning. Manual processes simply cannot keep pace with the evolution, complexity, and rapid change in modern networks.

3. The Role of AI and Automation in the Dark NOC

Automation and AI are front and center in the Dark NOC. Today, automation handles not only the mundane, repetitive tasks that most network engineers dread, it also tackles complex processes that are otherwise impossible to execute on a regular basis due to time constraints. In the future, automation will replace even more of the manual activities performed by network engineers. Humans will focus on new technologies, creative problem solving, and innovation, while automation addresses much of the day-to-day.

While the Dark NOC is the long-term goal, automation offers immediate, incremental benefits, allowing operations to run much more efficiently with fewer resources. In fact, several CSPs have consolidated their NOCs with just a modest level of automation, resulting in significant costs savings. Others are turning to automation to fill the gap as baby boomers in the NOC reach retirement age.

AIOps is another important technology powering the Dark NOC. It harnesses artificial intelligence and machine learning to ingest, aggregate, correlate, and analyze millions of data points to produce insights into the health and performance of the network infrastructure and applications running on top of it. This powerful technology dramatically reduces alarm noise by performing advanced event correlation to highlight real problems and intelligently group events to isolate the root cause of issues. AIOps also has the capacity to predict and prevent outages by identifying anomalies, conducting advanced pattern analysis, and performing intelligent, dynamic thresholding. Collectively, these capabilities improve performance and reliability, accelerate incident response, and prevent outages, all while streamlining operations.

Leading analyst firms have reported a significant rise in automation and AIOps initiatives in the last year, laying the groundwork for the future state of the NOC. Gartner research indicates that 94% of executives are investing in I&O automation or plan to start. And, while less than 20% of the Global 5000 have a centralized automation function today, that is expected to grow to 90% by 2025.

EMA Research reports that 85% of enterprises have AIOps underway or planned as a major initiative. Their data shows that AIOps in deployment correlates strongly with more progressive levels of automation, closely coupling these technologies. In fact, combining the two offers a closed loop of discovery, analysis, detection, prediction, and automation.

Together automation and AIOps offer a path to the Dark NOC as the insights from artificial intelligence fuel the automation ecosystem, with increasingly less oversight from humans and increasingly more direction from artificial intelligence. These capabilities bring us closer to the promise of self-healing networks and the desired state of the future NOC.

4. Building Culture to Embrace Automation and AI

Creating the Dark NOC requires not only great technology, but also a culture that embraces automation and AI, a framework for organizational development, and process optimization.

4.1. New Roles in the New NOC

The first and most significant step in advancing the NOC doesn't involve technology at all. It's all about people, organizational structure, and up-leveling current employees into new positions that are focused on leveraging automation and AI to solve problems and improve efficiency.

Some network engineers may worry about the impact of automation on their jobs. The reality is that networking roles are moving in an exciting direction with new opportunities to drive the business. The goal is to up-level and retrain, not to displace. AT&T set an early example in 2016 by investing $1 billion in workforce retraining specifically to pivot to a software-centric network.

Among decision makers at firms that are adopting automation, 26% told Forrester that they face challenges with culture and change management; 25% believe they have gaps in their organizational structure, alignment, and readiness; and 25% said their firm lacks an overall vision or strategy for automation. Similarly, Gartner asked clients to identify their top three organizational challenges related to automation: 53% reported a shortage of people with necessary skills; 46% cited a lack of documentation of existing processes; and 44% said cultural resistance was a concern.

Taking the time to define what your Dark NOC team looks like and crafting new roles and responsibilities is essential for success. This should be part of a broader effort beyond the NOC to create, as Forrester puts it, "an automation strike team" and Center of Excellence (CoE).

Repurposing skillsets to support the transition to a Dark NOC means shifting people to focus on more data-driven customer service and moving them up in the knowledge stack to identify candidates for automation, validate automations, build automation content, and take on responsibilities that require more human-centric skills. What have traditionally been operations-oriented roles are morphing into more critical-thinking roles to facilitate digital transformation. New skillsets require understanding data and processes and making thoughtful decisions about how to leverage that data to optimize operations, advance services, and deliver innovation.

More specifically, emerging roles in the NOC include network automation architects who focus on determining the best processes to automate and how to go about doing so, as well as network automation managers who establish governance processes, run automation teams, manage the toolsets, and collaborate with business stakeholders.

4.2. Crafting a Culture of Automation

With the right roles in place, CSPs can implement initiatives that help promote the culture of automation both within and beyond the NOC. Some real-world examples include:

- Educating the workforce on the benefits of automation and how they can be a part of it
- Identifying champions and giving them a platform to socialize the benefits of automation
- Creating an internal brand for your automation strike team

- Providing easily accessible training on automation and AI tools
- Developing an automation forum to share ideas and promote what's coming down the automation pipeline
- Publicizing how automation is contributing to strategic initiatives and how it aligns with business objectives
- Showcasing automation success and rollouts in internal newsletters, videos, town halls, internal chat channels, and employee portals
- Establishing a simple process for people to recommend processes for automation
- Incentivizing employees to participate with automation awards and cash prizes

4.3. Capturing Tribal Knowledge with Automation

All too often tribal knowledge and expertise still reside primarily with a handful of subject matter experts (SMEs), especially when it comes to complex technologies and legacy toolsets. Documenting this know-how (and best practices in general) is critical to advancing automation initiatives and should be part of any plan for long-term success.

Valuable tribal knowledge can be captured and encoded into automation workflows, preserving this expertise for the long term and making it available in such a way that it scales. SMEs can even capture knowledge with conditional logic to create interactive automations that step through best practice procedures while automation executes the tasks behind those steps. In doing so, CSPs can left-shift workloads, minimize unnecessary escalations, and keep costs down.

5. Jumpstarting & Scaling Network Automation

Forrester reports that many networking teams are still in the early stages of automation, despite advances in virtualization and programmable infrastructure. One of the key challenges to any automation initiative is determining where to start.

The use cases below provide a guide to jumpstarting and scaling network automation initiatives to support digital transformation and next generation technology rollouts, as well as to improve operational efficiency. Rolling out these use cases at scale will put CSPs well on their way to achieving the Dark NOC.

5.1. Proactive Network Testing

Automating proactive network tests can avoid costly and time-consuming truck rolls, prevent network outages, and provide real-time insights into service quality – not to mention reducing repetitive workloads on the NOC.

Automation can be leveraged to:

- Execute multi-step testing processes, like PIM testing, circuit testing, and customer turn-ups
- Capture network testing and diagnostic information for analytics, compliance, auditing, and change management purposes

- Build comprehensive reports on the health of the network, so key stakeholders and executives can always be on top of service delivery and quality

Benefits of automating network testing include:

- Identifying performance and connectivity issues before they impact users
- Speeding up network testing, while simplifying the process
- Reducing reliance on operator interpretation
- Improving efficiency by replacing manual efforts with automation
- Enforcing consistency and standardization across testing procedures

5.1.1. A Real-World Proactive Network Testing Example

Cell tower outages were causing major impacts for the customers of a large CSP, and their NOC needed a way to validate customer service complaints, perform diagnostics, and quickly implement fixes. With a daily rate of 500K alarms coming in, their Tier 1 analysts couldn't keep pace.

They also needed to automate a set of complex testing procedures on more than 57,000 cell towers. By running these procedures consistently, they could verify mobile connectivity for their millions of subscribers.

Today, an automated process polls the entire radio network every hour and compares outages it identifies to existing tickets and events. It then automatically updates these tickets and generates validated events that are sent to the NOC for follow-up. Additionally, complete coverage and outage reports are auto-generated and sent to each of the market owners, providing unprecedented and accurate visibility into real-time network health and performance.

By automating network testing procedures, the CSP saves 40,000 man hours every year while also accelerating incident resolution and improving service delivery.

5.2. Incident Resolution

Network uptime and performance are mission critical, putting incredible pressure on the NOC to resolve incidents as quickly and efficiently as possible. Automation can radically transform the entire incident resolution process and overcome common challenges – for example, avoiding unnecessary escalations or delays by encoding systems access in the automation itself, thereby enabling lower level analysts to resolve the problem on their own.

Automation can be leveraged to:

- Reduce alarm noise by automatically validating events, correlating related events, and consolidating duplicates
- Collect troubleshooting data from multiple systems across environments and locations, build timelines, and diagnose issues
- Centralize incident management to oversee all aspects of the incident resolution process from a single pane of glass
- Automatically resolve common incidents with pre-built workflows that can be triggered in a variety of ways

- Arm admins with interactive automations to address outages that require more complex resolution workflows, including step-by-step instructions, incremental automations, and decision paths
- Enable agents to safely execute remediation tasks without system access or the necessary CLI or coding skills
- Eliminate time-consuming handoffs between the ITOps and NetOps teams with centralized orchestration of the end-to-end, service-level workflows
- Auto-create and update tickets with a log of all actions and automations that were completed

5.2.1. Real-World Incident Resolution Examples

The NOC for a leading multinational CSP leverages automation to process both traditional and non-traditional alarms, such as network configuration, compliance, and inventory validations. By automating alarm handling, trouble ticketing, triage, intelligent decision-making, and dispatch operations, the organization has accelerated incident resolution time from more than 1800 minutes to less than 60 seconds.

Similarly, another North American provider also relies on automation to reduce alarm noise, enrich events, and triage resolution procedures. They have even extended automation to customer communications. When nodes are impacted by an outage, an automated process quickly cross references those nodes with their CRM system to determine which customers are impacted, and notifications are automatically sent out to keep customers informed in real time.

5.3. Network Provisioning

Automating network provisioning is significantly faster, more reliable, and more accurate than manual efforts – and automation eliminates human error. It also enables CSPs to deliver scalable new services to customers much quicker.

Automation can fast-track network provisioning by:

- Executing pre-provisioning checks to eliminate hours of manual effort
- Conducting pre-configuration checks for authorization and/or billing
- Automating post-configuration checks and any necessary remediation steps to verify connectivity and performance
- Performing network configuration tasks to enforce standard operations and secure configurations
- Auditing every process – whether human-directed or automated – for a real-time, centralized audit trail essential for troubleshooting and compliance
- Integrating and automating updates with service and change request systems

5.4. Leveraging AIOps

AIOps and automation can radically improve network reliability and reduce outages by combining predictive analytics with proactive automations.

Key applications include:

- **Sequential Pattern Analysis & Time-Series Event Correlation:** AIOps has the ability to normalize and sequence millions of events across applications and infrastructure into a time series that can be

analyzed by machine learning algorithms to identify patterns. These patterns can then be leveraged to identify potential outages and trigger intelligent automations to resolve problems proactively.

- **Dynamic Thresholding & Multi-Variate Anomaly Detection:** Anomaly detection algorithms use unsupervised machine learning to learn network environments over time, recognize expected behavior, and set dynamic thresholds across multiple performance metrics that account for seasonality. As events are analyzed in real time, they are compared to expected behavior to provide alerts and/or trigger automated actions when a sequence of events demonstrates anomalous activity.

- **Dynamic Capacity Adjustments:** AIOps leverages historical utilization trends to predict when infrastructure will become non-operational due to capacity exhaustion. These predictive capabilities ensure more capacity can be added dynamically via triggered automations (or through manual intervention) to avoid outages stemming from common capacity issues.

6. A Blueprint for Getting Started – Actionable Steps to Transform the NOC

The technology to implement a Dark NOC is rapidly maturing. Depending on where you are in the process, here are some recommended steps towards achieving self-healing networks and automation excellence.

Phase One (2-3 months):

- Document key processes and troubleshooting activities
- Improve visibility with discovery, network mapping, and identifying application flows across hybrid networks
- Identify quick wins for out-of-the-box automation use cases
- Validate integrations across the technology stack
- Identify internal champions for automation and AIOps initiatives
- Build executive support

Phase Two (3-6 months):

- Identify the next phase of automations, including more complex processes
- Optimize the processes on paper before automating them
- Leverage technologies that deliver noise reduction, event clustering, and correlation
- Engage employees in identifying processes to automate

Phase Three (6-12 months):

- Create an Automation Center of Excellence to centralize automation efforts
- Connect AIOps to automation and start with an initial set of autonomous actions
- Activate your “army of automators” to scale
- Integrate analytics and automation
- Expand usage of autonomous automations that can be triggered by AIOps insights

7. Summary – Innovation Powering New Services

Evolving NetOps means addressing operational challenges at scale. It requires a deep understanding of how the NOC will evolve, as well as how people, processes, and technology intersect. It requires leveraging automation and AIOps to manage increasing network complexity that has far surpassed the capacity of manual processes and human analysis.

By darkening the NOC, CSPs can address tactical challenges related to cost reduction, workforce fluctuations, and tight margins, but even more importantly, they can free valuable resources to focus on innovation and creative uses of technology to offer new and improved services to propel the business forward.

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