



DATA CENTER

Frontier

SPECIAL REPORT

Transforming Your Data Center Networking:

Digital Twins and AI



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Introduction

Artificial intelligence (AI) is poised to play a transformative role in the operations and strategies of digital infrastructure providers. AI promises to enhance operational efficiency, improve customer experiences, ensure security, and drive innovation. Infrastructure providers who make use of AI technologies are primed to gain competitive advantages to meet the increasing demands of their customers, in a rapidly evolving market.

The most significant impact AI promises to deliver for digital infrastructures will be observed in areas traditionally clogged by inefficiencies when addressed with point solutions or requiring intensive human intervention.

Identifying how AI can improve your business

Organizations deploy a comprehensive array of cybersecurity tools to protect their digital assets. What AI brings to the table in this context is additional capabilities for enhanced threat detection and automated mitigation and remediation. Additionally, recent advances in AI provide digital infrastructure providers tools to cope with the increasing complexity of cyber threats often requires, the processing of increasing amounts of network traffic to detect patterns of interest and flag anomalies and predict incidents in a timely manner.

In addition to cybersecurity, enterprises routinely target routine IT operations with automation tools to increase efficiency. Use-cases around configuration management, system monitoring and network troubleshooting have typically been addressed with automation tools. AI, here as well, plays a crucial role to enhance the efficacy of available solutions, as well as going beyond a reactive approach to remediation and troubleshooting to a proactive approach powered

by AI-driven predictive analytics. These capabilities become increasingly more important when the goal is running more efficient data centers, especially when tasks such as energy-efficient network operations are essential objectives. The ability to react effectively to changing energy demands within a data center can show a significant impact on operational costs, and of course on sustainability as an increasingly important aspect of operating modern digital infrastructures.

The evolution of AI in Digital Infrastructures

The telecom industry has long looked at automation techniques to aid in maintaining and managing their networking infrastructure. Early AI applications in telecom focused on basic automation with rule-based systems, and data processing with expert systems, and over time, advancements in machine learning and big data analytics have expanded AI's role to include predictive maintenance, network optimization, and real-time decision-making using data-driven and learning systems.

With the scale of these networks and the huge number of endpoint devices, increasing the level of automation of the operations of our increasingly complex networks cannot be overstated. The progress that AI and machine learning has enjoyed in recent years, has opened new venues and made the quest of

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higher automation practical and evolutionary, where intelligent automation systems can be deployed to deliver early value and improve in operations to realize continuously increasing business value.

When we look at the ways in which AI can enhance the digital infrastructure, understanding context and how the infrastructure is used is key to effective growth. Let's first look at how AI implementations can directly affect your digital infrastructure.

Today's digital infrastructure is an exceedingly complex combination of technologies that need to be maintained, monitored, updated and managed; deploying AI/ML needs to be subsequently thought of as a composition of intelligent capabilities carefully orchestrated and introduced to operational networks to deliver specific point-values in addition to end-to-end consistency. This is easier said than done, as ensuring the compatibility and efficacy of a multitude of AI/ML models, composed together to address operational needs, is no easy task. The concept of a Network Digital Twin defines a framework to gracefully introduce today's complex networks to AI/ML capabilities. A Network Digital Twin is a replica of a physical network, designed to facilitate pre- and post-deployment capabilities. Its purpose is to evaluate intricate integration component behavior that might be challenging to observe in laboratory testing. Additionally, Digital Twin serves as an environment where identified operational behavior can be transferred for further in-depth analysis and troubleshooting.

If we take Telecommunications infrastructure as an example, a Network Digital Twin would require the ability to generate RAN and Core replicas and perform advanced and complex network testing procedures at a scale comparable to real world networks.

Combining tools such as RAN and Core emulators in addition to the ability to ingest real time traffic and execute analytics and optimization decisions are ingredients for a Network Digital Twins have

the required real-world fidelity to truly evaluate the performance and behavior of AI/ML models and composed capabilities before they affect real-world networks. Additionally, a Network Digital Twin leverages AI to create accurate and dynamic models of network environments, learned from real-world traffic and network topologies, in order to provide an accurate enough replica of the physical network.

Some examples of how the digital twin is used include:

- **Network design:** Digital twins enable precise planning and simulation of new network deployments, ensuring optimal configuration and performance.
- **Troubleshooting:** They allow for real-time monitoring and analysis of network issues, facilitating quicker resolution and minimizing service disruption.
- **What-if analysis:** network changes can be tested and evaluated without touching the live environment.
- **Security optimization:** cyber-attacks and mitigation strategies can be tested and evaluated to allow for problems to be prevented before attacks happen.

AI's Impact on Network Management, Resiliency, and Response

Properly implemented AI solutions can gather and use the immense amount of data constantly generated by network to optimize and improve the overall network operations in many ways. Network, security, and operational efficiency are key areas that AI can directly impact in positive ways.

NETWORK OPERATIONS

Improved resource allocation — By predicting network usage patterns and adjusting resources accordingly, AI tools can improve efficiency in using the existing network infrastructure. Network optimization involves dynamically adjusting resources based on real-time data, ensuring optimal performance and cost efficiency.

Dynamic traffic management — Better network performance can be achieved by using real-time demand information to dynamically adjust bandwidth, resulting in more efficient network traffic management and better network performance.

Predictive maintenance — a predictive maintenance process, where the AI algorithms can continuously analyze component data to enable failure prediction and recognize maintenance requirements proactively, can minimize downtime and reduce ongoing maintenance costs.

SECURITY IMPROVEMENTS

Response automation — AI-based event correlation and root cause analysis can enable security threats to be responded to automatically and in a targeted manner, where only areas potentially under threat are isolated, secured, and have any threats resolved, with minimal impact to other network operations.

Threat detection — makes use of the ongoing network monitoring to identify anomalies that could indicate potential security issues or, more simply, operational inefficiencies that need to be addressed, either by the automated response systems or by human intervention.

AI can also play a role in predicting and mitigating the impact of natural disasters on network connectivity, improving overall system resiliency. AI models can analyze environmental data to predict natural disasters and their potential impact on network infrastructure. Proactive measures, such as rerouting

traffic and reinforcing vulnerable points, can be implemented based on these predictions. Reliable networks are crucial for emergency services, especially during disasters when communication is vital. AI-enhanced resilience ensures that networks remain available when natural disasters occur, supporting emergency response and recovery efforts.

AI and enhancing the customer experience

When AI touches the customer experience it can result in higher levels of customer satisfaction, for several reasons. For examples, the use of chatbots and virtual assistants that understand the customer requirements and have access to information about previous customer interactions results in an improved interactive experience that can lead to greater customer satisfaction and increases in customer loyalty. Personalized and targeted services make the customer feel that they are receiving the service that best fits their business requirements. The use of AI-powered chatbots to provide first-level response to customer inquiries and basic support reduces the need for human intervention and speeds up response times.

From the company side, AI monitors the quality of service and automatically adjusts network parameters to ensure consistent and optimal customer experiences. It also analyzes user behavior to understand customer needs and preferences, enabling companies to offer targeted services and marketing campaigns that meet the customer needs. More efficient big data analytics are possible, using AI to process vast amounts of user data generated providing actionable insights for improving operations, customer service, and strategic planning.

The Transition to Open RAN and the Role of AI

Open RAN, or the Open Radio Access Network (O-RAN), offers substantial benefits to cloud service providers by reducing costs, enhancing flexibility, offering clear paths for innovation, improving network performance and scalability, and providing better integration with existing cloud infrastructure. This will enable cloud service providers capabilities to deliver more competitive, efficient, and innovative services to their customers, improving positioning for future technological advancements and market demands.

With an open standard approach to what was traditionally a vendor specific market, O-RAN will minimize vendor lock in and encourage providers to use multiple vendors to deliver best of breed components. The competition that this will foster between vendors encourages innovation in technology and competitive pricing, savings that can be passed along to customers. Both CAPEX and OPEX savings can potentially be realized, as equipment costs can be reduced using off-the-shelf components with standardized interfaces, which generally are less expensive than proprietary solutions, while ongoing operational costs are reduced by leveraging cloud-native applications and automation tools that work with open standards and allow for cost effective management.

This open ecosystem encourages innovation and gives service providers the opportunity to customize cloud native solutions to meet specific customer requirements, reducing dependency on one-size-fits-all solutions. Because the components become standardized and interoperable customer choice becomes more flexible, and service providers will have capabilities to more rapidly configure, provision, and deploy customized solutions.

Of course, this increased flexibility and requires managing increased complexity and ensuring

interoperability between components from multiple sources. And with O-RAN leveraging software defined networking (SDN) and network function virtualization (NFV) there will still be a need to evaluate and verify that all components, both hardware and software, behave as expected. This is where a partner such as Viavi becomes a critical part of your overall digital infrastructure deployment.

VIavi aids in certifying and optimizing Open RAN components and systems

VIavi Solutions provides testing and certification services to ensure that Open RAN components meet industry standards and work seamlessly together. Their AI solutions help optimize Open RAN performance by automating the integration and management of these diverse components. VIavi also offers capabilities that extend beyond the O-RAN aspects of the modern digital infrastructure.

Partnering with VIavi, a company with a broad portfolio of Network Testing, Monitoring and Optimization technologies and experience acquired in its over 100 years of existence, enables an acceleration of cutting-edge technologies into Telecommunications Networks. Their experience and innovation in test and measurement solutions have paved the way for modern methods of network management and optimization, especially in developing, deploying, and managing digital infrastructures in high stakes environments.

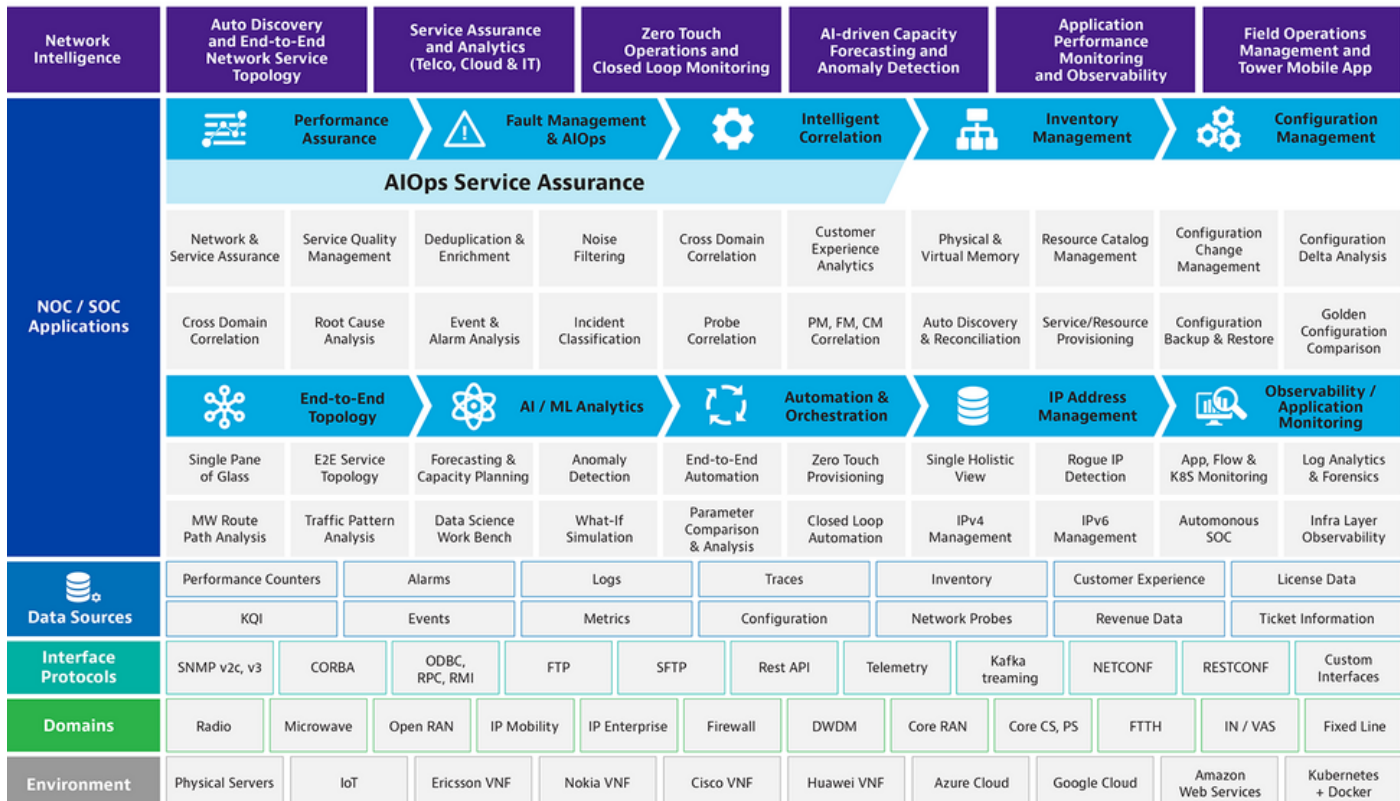
VIavi NITRO® AIOps Cloud Native Inventory, Assurance, and Analytics software provides an end-to-end view of the entire network. It is a complete suite of AI-driven tools designed to enhance various aspects of digital

infrastructure operations, from network monitoring and diagnostics to security and customer service. NITRO AIOps includes advanced analytics, automated troubleshooting, and predictive maintenance capabilities. The suite of applications allows legacy operators to evolve their existing management and maintenance platforms to meet the demands on the latest in AI-driven operations. End-to-end visibility of the digital infrastructure becomes a reality even as that infrastructure extends from beyond traditional networking infrastructures to cloud, mobile, IT/MEC, and IoT platforms.

The NITRO suite is cloud-native and includes Inventory, Service Assurance and Analytics, AI and ML driven Analysis, Customer and Service Analytics and Network Automation Solutions.

The importance of being able to work across multiple technology domains is clear; with tools that can

leverage AI/ML, and automation you can gain the benefits of AI-driven operations across your entire digital infrastructure. The migration from existing operational siloes and manual processes has been a complex and resource intensive process, that can now be automated across domains with the integration of advanced AI capabilities of AI. The process now can optimize expenditure for both OPEX and CAPEX as well as deliver better quality services to users and customers. Network operational integration of IT, telecom, and edge services, applying AIOps across all of these domains, significantly reduces operational complexity and streamlines overall operations while delivering an AI-enabled environment that can respond more flexibly and efficiently to changing network and business conditions. The automation of routine tasks, coupled with AI-optimized resource allocation results in reduced operating costs, improved efficiency, better resource management and improved service quality. The data that can be derived from the AI-driven



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processes means that business insights will have the potential to enable more effective decision-making, resulting in improvements in processes throughout the business infrastructure.

In addition, for digital twin scenarios, VIAVI TM500 and TeraVM solutions emulate base stations, core networks, and real-world traffic, with VIAVI NITRO Platform providing Real-Time Analytics and Optimization technology.

The Future of AI for Digital Infrastructures

AI Integration is widely expected to become a cornerstone of future technologies. It is predicted AI will become even more integral to digital infrastructures, and will significantly impact networking technologies in 5G/6G, IoT, Edge Computing, mobile and enterprise/cloud environments.

We can expect to see increased use of AI with a focus on the customer experience, personalization, technical/customer support, sales and marketing campaigns, and everyday user interactions. Automation will become more seamlessly integrated, and network and data security should see a significant improvement as AI-driven techniques are applied.

We also must consider that while AI offers significant benefits, it also raises concerns around security, privacy, and regulatory compliance. It will be an ongoing process to find the correct balance between enabling AI enhancements to operations and privacy and information security, especially in what data is used to train AI models as customer experience becomes increasingly AI-driven. Regulatory compliance can be a moving target as different geographic regions already have different requirements for everything from how data is stored to how it can be utilized.

Utilizing AI to enhance IT infrastructure operations, from network design to security and cloud deployment, is a promising trend for the future. We anticipate increasingly sophisticated implementations in infrastructure security, AIOps and automation.

Conclusion

Network management, security, efficiency, and customer experience is undergoing an AI-driven renaissance as its predictive capabilities and automation potential are changing expectations for the future of network operations. VIAVI Solutions is uniquely placed at this juncture to take advantage of its 100-plus year history and accumulated expertise in the industry to see what benefits AI-enabled infrastructures will bring to businesses, while leveraging a history of providing innovative solutions that address the industry's evolving needs.