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Zero-Touch Operations:

Telecom's Journey To
Full Network Automation

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Executive Summary



Telecommunication networks are experiencing an unprecedented transformation, driven by the rapid growth of technologies such as 5G, IoT, and edge computing. As these networks become increasingly complex, the limitations of traditional manual management methods are becoming more apparent. The need for faster, more efficient operations is clear, and telecom companies are beginning to turn to Zero-Touch Operations (ZTO) — the automation of network management to the point where human intervention is virtually eliminated.

Zero-Touch Operations represent a dramatic shift in telecom network management, where AI, machine learning, and automation are used to proactively monitor, diagnose, and resolve network issues.

This whitepaper explores the evolution of telecom operations, the technological underpinnings of ZTO, and the strategies and benefits that come with implementing this innovative approach. Real-world case studies and success stories illustrate the positive impact of ZTO on operators, while also addressing the challenges telecom providers face on the path to automation.

Introduction: The Case for Zero-Touch in Telecom

The telecommunications industry, historically built on legacy systems and manual processes, is currently facing a tipping point. Network complexity is at an all-time high, driven by the rapid deployment of 5G, the explosion of connected devices, and the increase in consumer demand for always-on, high-speed services. As operators struggle to manage increasingly dynamic environments, traditional operational models are proving to be too slow, inefficient, and costly.

Zero-Touch Operations (ZTO) represent a future where networks can self-heal, self-manage, and scale automatically without requiring human intervention. As data traffic increases exponentially and service expectations grow, telecom operators must embrace automation to stay competitive, reduce costs, and improve customer experiences.

The adoption of ZTO technologies, powered by AI and machine learning, has been shown to enhance operational efficiency, reduce error rates, and improve service reliability. The journey to ZTO is not without its challenges, but the benefits far outweigh the costs for those who take proactive steps toward automation.

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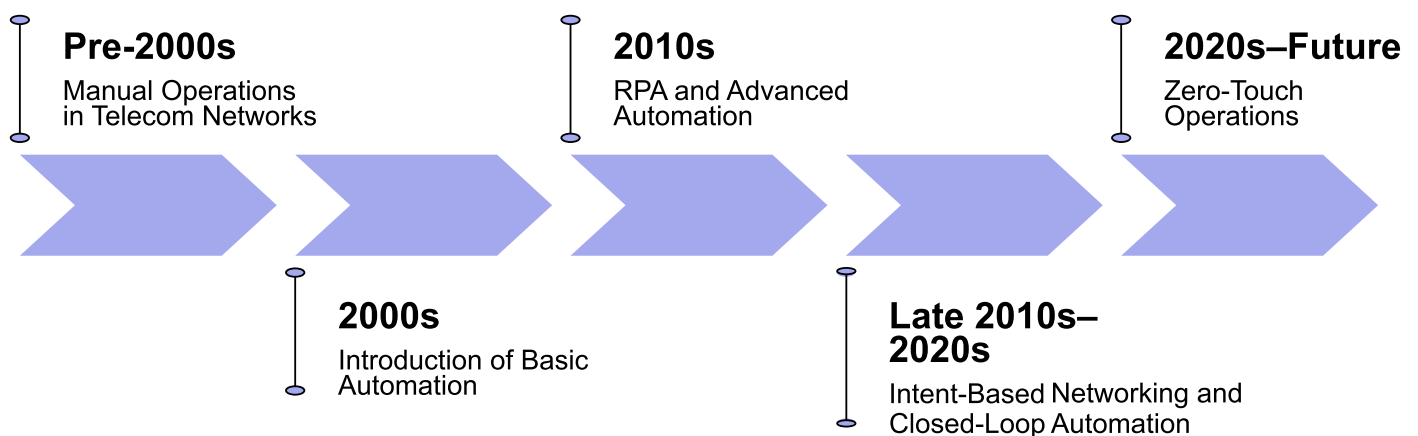
Telecom industry leader Anand Krishnan, Chief Technology Officer at AT&T -

The future of telecom is powered by automation and artificial intelligence, as networks become too complex for human oversight alone.

The Evolution of Telecom Operations

Telecom networks have progressed significantly over the years, evolving from manual, error-prone systems to automated, AI-driven solutions. Below is an overview of this progression:

Evolution of Telecom Network Management



3.1. Manual Operations (Pre-2000s)

In the early years, telecom networks were managed primarily through manual processes. Network monitoring, configuration, troubleshooting, and fault detection required human intervention, and these tasks were often time-consuming and error-prone. As telecom networks grew more complex with the introduction of new services, manual methods became insufficient to meet the growing demands for speed and reliability.

3.2. Basic Automation (2000s)

The early 2000s saw the introduction of basic automation in telecom networks. This included the use of automated scripts to perform repetitive tasks like provisioning network elements and handling basic diagnostics. While automation reduced the need for human intervention in some areas, it remained limited in scope. Operators still relied on human oversight for the bulk of network management tasks.

3.3. Robotic Process Automation (RPA) and Advanced Automation (2010s)

As data volumes and service complexity continued to rise, telecom operators began to leverage more advanced forms of automation, such as Robotic Process Automation (RPA). RPA allowed telecom companies to automate more complex workflows, including customer billing, service provisioning, and fault detection. This period also saw the introduction of software-defined networking (SDN) and network function virtualization (NFV), which enabled greater flexibility and automation in managing network resources.

3.4. Intent-Based Networking (IBN) and Closed-Loop Automation (Late 2010s–2020s)

As telecom providers sought to move beyond reactive automation, the concept of Intent-Based Networking (IBN) began to take shape. With IBN, operators define the business objectives and outcomes they wish to achieve, and the network autonomously configures itself to meet those goals. This was a major leap toward self-healing and adaptive networks. Closed-loop automation emerged as a key element of IBN, enabling networks to continuously monitor and adjust based on real-time data, ensuring optimal performance.

3.5. Zero-Touch Operations (ZTO) (2020s–Future)

Today, telecom networks are rapidly evolving towards fully autonomous, Zero-Touch Operations. ZTO systems are powered by AI, machine learning, and deep automation, allowing networks to self-diagnose, self-heal, and autonomously optimize without human intervention. By eliminating the need for human oversight, ZTO helps telecom providers scale efficiently while maintaining reliability and improving customer satisfaction.

Key Pillars of Zero-Touch Operations

To achieve Zero-Touch Operations, telecom providers must implement several foundational technologies and practices that work together to create a truly automated network. These include:

Intent-Based Networking (IBN)

Intent-Based Networking allows operators to define high-level goals and business policies — for example, prioritizing certain traffic or ensuring network resilience — without needing to configure specific network devices. With IBN, networks understand the business intent and automatically adjust their behavior to align with these objectives. This helps eliminate the need for manual configuration and reconfiguration of network elements, resulting in more efficient and agile network management.

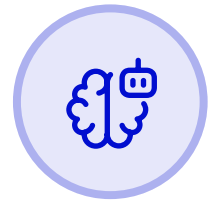


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Tim Ziemer, VP of Cloud Networking at Cisco. -

Intent-based networking is about empowering the network to make intelligent decisions on its own, based on high-level goals set by operators.

Artificial Intelligence and Machine Learning (AI/ML)



Intent-Based Networking allows operators to define high-level goals and business policies — for example, prioritizing certain traffic or ensuring network resilience — without needing to configure specific network devices. With IBN, networks understand the business intent and automatically adjust their behavior to align with these objectives. This helps eliminate the need for manual configuration and reconfiguration of network elements, resulting in more efficient and agile network management.

As mobile data traffic continues to grow at an estimated annual rate of 25% through 2027, according to Ericsson, telecom operators will rely heavily on AI-driven networks to manage this demand without requiring additional human resources.

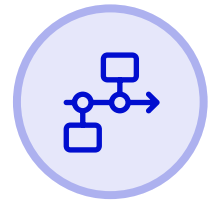
Network Function Virtualization (NFV) and SDN



NFV and SDN are key enablers of Zero-Touch Operations, as they allow network resources to be dynamically allocated and adjusted without manual intervention. NFV decouples network functions from hardware, enabling telecom providers to use software to control network behavior. Similarly, SDN provides a programmable network architecture that enables automation and orchestration of services, improving network flexibility and scalability.

Closed-Loop Automation

In a fully automated network, feedback loops continuously monitor the network, detect anomalies, and trigger corrective actions. This closed-loop automation ensures that the network can adapt and optimize itself in real-time, reducing the need for manual intervention and improving operational efficiency



Orchestration Platforms

Orchestration platforms are central to the management and automation of end-to-end telecom services. These platforms allow operators to manage network functions, data centers, and services across different domains from a single interface, enabling greater control and optimization.



Real-World Progress and Case Studies

The transition to Zero-Touch Operations (ZTO) is well underway within the telecommunications industry, with several operators around the world leading the charge by leveraging automation, AI, and machine learning to optimize their network management. Below are some of the most notable case studies that demonstrate the real-world benefits and challenges of implementing ZTO.

Telefónica: Autonomous Network Journey



Telefónica, one of the largest telecom operators in Europe, has been at the forefront of the autonomous network journey.

Strategy and Implementation:

Telefónica's primary goal was to reduce the manual intervention required to manage its network. The company implemented an AI-powered solution to handle network traffic forecasting and dynamic optimization of resources. This included leveraging machine learning models to predict network congestion and automatically adjusting the allocation of resources in real-time, preventing bottlenecks before they could affect customers.

Telefónica's approach also included the deployment of Intent-Based Networking (IBN), where operators define high-level business goals, and the network automatically adjusts to meet these goals. This allows the company to operate in a proactive rather than reactive manner.

Challenges:

One of the challenges Telefónica faced during this transition was integrating its legacy infrastructure with new automation technologies. The operator's existing network management system was not built for the level of automation required for ZTO. Thus, Telefónica had to invest heavily in updating and integrating legacy systems into the new automated framework.

Impact:

The impact of this ZTO transition has been substantial. Telefónica reported a 50% reduction in network incidents in select regions, which directly translates to fewer customer complaints and better overall service reliability. Furthermore, the automation of network operations has reduced operational costs by minimizing the need for human intervention in routine network management tasks.

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Carlos Gonzalez, Director of Digital Operations at Telefónica -

By embracing ZTO, Telefónica has moved toward a self-healing network model that adapts to changing conditions in real-time.

Rakuten Mobile: Fully Virtualized Mobile Network



Rakuten Mobile implemented the world's first fully virtualized mobile network, leveraging Zero-Touch Operations to automate every aspect of the network, from provisioning to fault management.

Strategy and Implementation:

Rakuten Mobile implemented a fully virtualized mobile network that utilizes NFV (Network Function Virtualization) and SDN to decouple network functions from hardware. This enables the operator to scale its network more easily and allocate resources dynamically based on demand. Rakuten also utilized ZTO principles to automate network management tasks, including self-configuration, fault management, and service provisioning.

One of the core components of Rakuten's ZTO strategy was its use of closed-loop automation. The network continuously monitors its performance and automatically adjusts network configurations in real-time to optimize for traffic loads, service quality, and operational efficiency. This closed-loop system ensures that the network is always functioning at its optimal capacity, without human intervention.

Challenges:

One of the primary challenges Rakuten Mobile faced was ensuring the smooth deployment of its virtualized, software-driven network across its existing infrastructure. Traditional telecom equipment was not designed to work in a fully virtualized environment, so Rakuten had to collaborate with technology partners to develop custom solutions that would allow seamless integration between hardware and software.

Additionally, implementing full automation in a greenfield network required ensuring that all automated systems could handle the scale of mobile traffic without failure, which necessitated rigorous testing and validation of the system before full deployment.

Impact:

Rakuten Mobile's fully virtualized network has delivered 40% savings in CapEx and Opex compared to traditional telecom network models. This has allowed the operator to offer competitive pricing while maintaining high network reliability and performance. Rakuten has also reported significant improvements in service deployment times, enabling it to rapidly scale its services as demand grows.

Rakuten Mobile's successful implementation of ZTO represents a paradigm shift in the way telecom networks are built and managed. The company's ability to provide high-quality services while keeping operational costs low has set a new standard for the industry.

Telenor: AI-Driven Fault Management



Telenor has embraced AI-driven fault management to automatically detect network anomalies and trigger corrective actions without human intervention.

Strategy and Implementation:

Telenor deployed a machine learning-based platform to monitor network health and predict potential failures. The platform uses AI algorithms to analyze real-time network data and identify patterns that indicate possible issues, such as service degradation or equipment failure. When an issue is detected, the system automatically triggers corrective actions, such as re-routing traffic or adjusting resource allocations, to mitigate the problem.

Additionally, Telenor integrated closed-loop automation into its AI platform, enabling it to continuously monitor the network and make adjustments as needed without human oversight. This closed-loop system ensures that network performance is optimized in real-time, minimizing downtime and improving customer experience.

Challenges:

One of the challenges Telenor faced was ensuring the accuracy of its AI models, especially when dealing with complex network environments. The company needed to ensure that the AI system could accurately predict failures and prevent false positives or unnecessary adjustments that could disrupt service.

Another challenge was ensuring that the system could scale effectively across Telenor's diverse geographical regions, each with its own unique network conditions and user behaviors. This required developing customized models and data pipelines for each region to ensure the AI system could operate optimally across different environments.

Impact:

Telenor has successfully reduced mean time to repair (MTTR) by 30%, which has had a significant impact on its customer satisfaction. Faster resolution times mean fewer service disruptions and a more reliable network for customers. Additionally, the company has seen a reduction in network operational costs due to the decreased need for manual intervention in fault resolution.

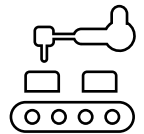
Benefits of Zero-Touch Operations

The implementation of Zero-Touch Operations offers telecom operators a wide range of benefits, which help them stay competitive in a rapidly changing market. These benefits include:

6.1. Enhanced Operational Efficiency

ZTO enables telecom providers to reduce manual intervention in network operations, leading to greater efficiency.

Automation allows telecom operators to focus on more strategic tasks, such as service innovation and business growth, rather than constantly dealing with network issues. Through automation, ZTO allows operators to handle complex network management tasks at scale, while reducing human error.



“ Sarah Thompson, Senior Network Engineer at BT Group -
Zero-Touch Operations are essential for managing the complexity of modern telecom networks.

6.2. Improved Customer Experience

With ZTO, telecom networks can resolve issues proactively, ensuring fewer disruptions and faster recovery times. This directly enhances the customer experience by reducing service outages and improving network reliability.



6.3. Cost Reduction

One of the most significant benefits of Zero-Touch Operations is the reduction in operational costs. By automating routine tasks such as provisioning and fault resolution, telecom providers can reduce the need for on-the-ground technical staff. According to IDC, telecom operators can save up to 35% of their network operating costs through automation.



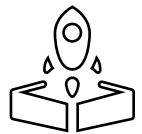
6.4. Faster Time-to-Market

Automation enables telecom operators to roll out new services more quickly and efficiently, without waiting for manual configuration or troubleshooting. ZTO allows for faster provisioning, service configuration, and network optimization, enabling telecom companies to deliver new offerings in hours instead of days or weeks.



6.5. Scalability

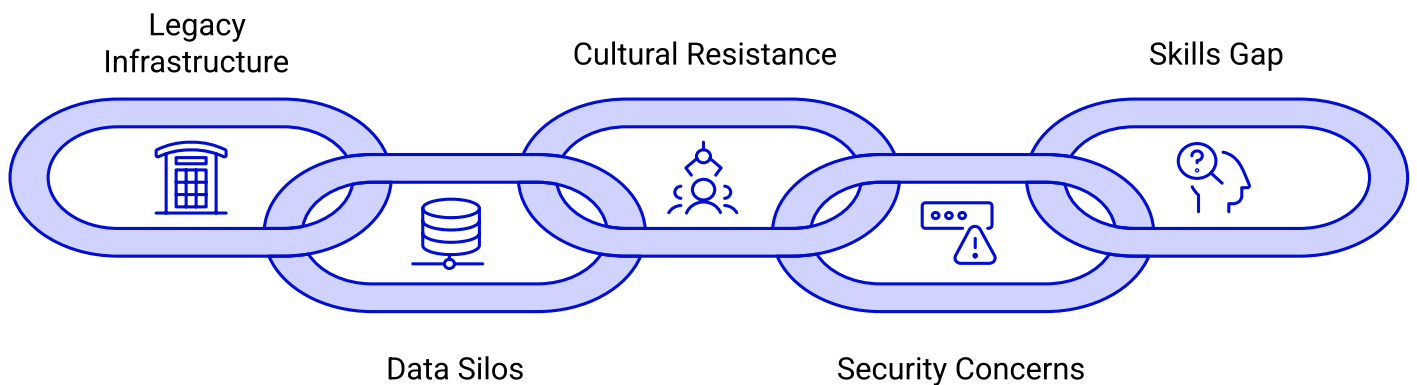
As networks grow and become more complex, ZTO provides telecom operators with the scalability to meet increasing demand without requiring proportional increases in human resources. Automated systems can easily handle larger data traffic and more complex network configurations without breaking down.



Challenges in Achieving Zero-Touch Operations

Despite the clear advantages of ZTO, implementing full automation comes with a set of challenges that telecom operators must overcome:

Challenges in Telecom Automation



7.1. Legacy Infrastructure

Many telecom operators still rely on legacy OSS/BSS systems that were not designed for automation. Integrating ZTO technologies with these outdated systems can be a complicated and costly process. In many cases, legacy systems need to be upgraded or replaced entirely to accommodate ZTO.

7.2. Data Silos

Telecom data is often stored across different systems, departments, or silos, making it difficult to access and analyze in real-time. For ZTO to function effectively, telecom providers must overcome these data silos by creating a unified data strategy that allows for seamless data integration.

7.3. Cultural Resistance

The adoption of automation can be met with resistance from employees who fear job loss or feel uncertain about new technologies. Telecom operators must manage these cultural shifts carefully, ensuring that employees are retrained and that automation complements rather than replaces human expertise.

7.4. Security Concerns

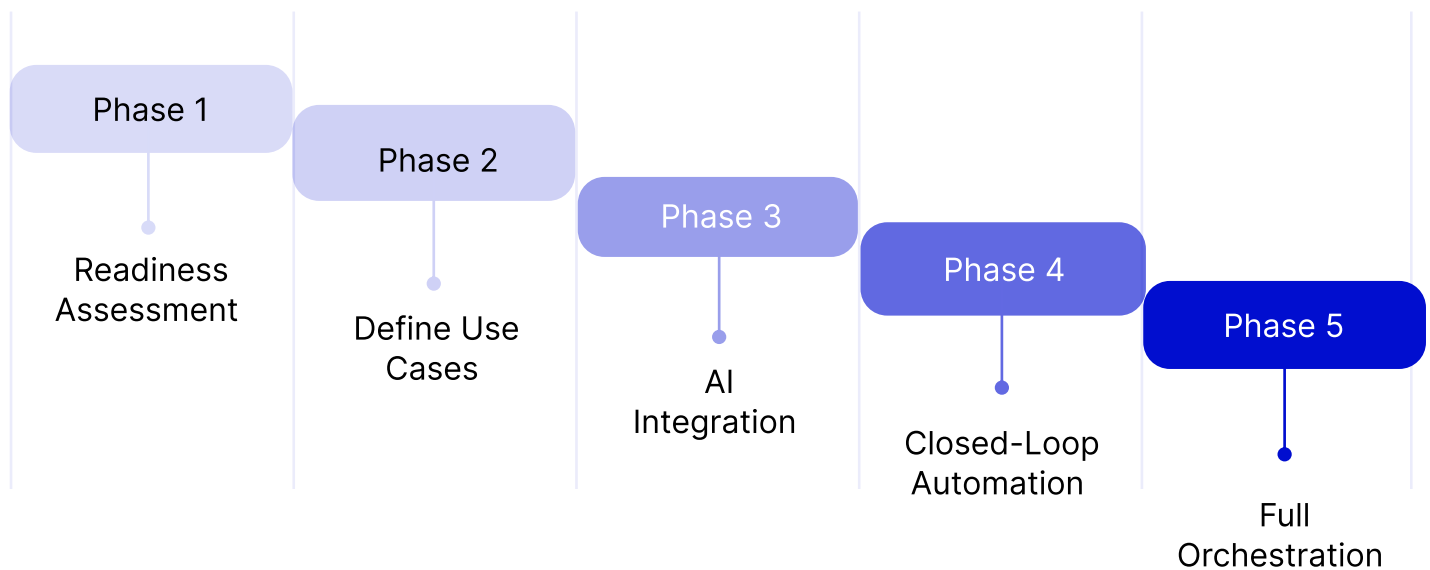
As networks become more automated, the risk of cyberattacks and security breaches increases. ZTO must be accompanied by robust cybersecurity measures to ensure that automated systems remain secure. Telecom providers need to implement security protocols that protect both the automated systems and the data they manage.

7.5. Skills Gap

There is a significant skills gap in the telecom industry, as many operators lack in-house expertise in key areas like AI, machine learning, and DevOps, all of which are crucial for ZTO implementation. To successfully implement ZTO, telecom operators must invest in building or acquiring these skills either internally or through external partnerships.

The ZTO Implementation Roadmap

Transitioning to Zero-Touch Operations is a multi-phase process that requires careful planning and execution. Telecom operators can follow a structured roadmap to achieve ZTO:



Phase 1: Readiness Assessment

Operators should start by conducting a comprehensive audit of their existing infrastructure, data systems, and operational processes to identify areas suitable for automation. This includes evaluating legacy systems, network architectures, and human workflows to determine what can be automated.

Phase 2: Define Use Cases

Identify key areas where ZTO can provide the most immediate impact. Early use cases could include auto-remediation for network faults, automated service provisioning, or AI-powered anomaly detection. By focusing on high-impact areas first, operators can quickly realize the benefits of ZTO. ...

Phase 3: AI Integration

Deploy AI-powered tools to help the network learn from historical data and make more intelligent decisions. This includes predictive maintenance algorithms, traffic forecasting, and self-healing systems that can automatically adjust to changing network conditions.

Phase 4: Closed-Loop Automation

Implement feedback loops that allow the network to self-monitor and self-correct in real time. By closing the loop between network operations and fault management, telecom providers can ensure that the network continuously optimizes itself without manual intervention.

Phase 5: Full Orchestration

Implement orchestration platforms that manage end-to-end service delivery and lifecycle management across all network domains. This ensures that network functions are automated from start to finish, allowing operators to scale quickly and efficiently.

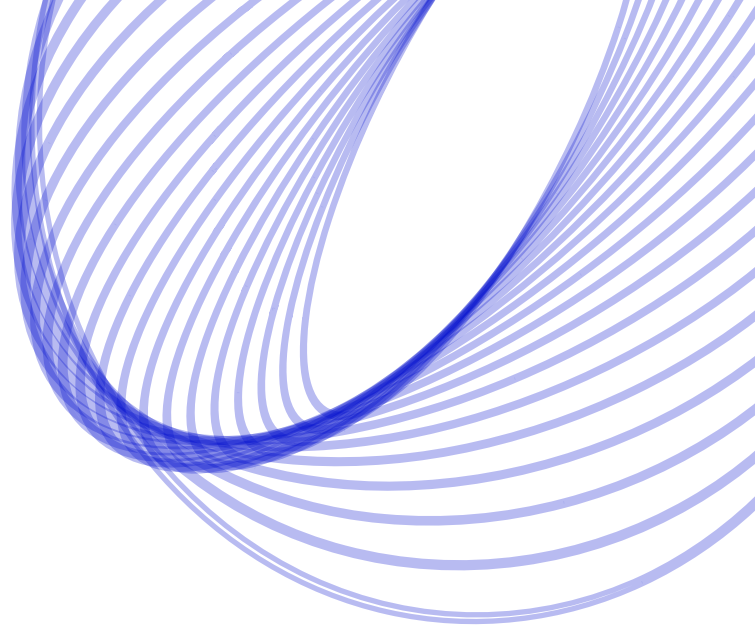
Conclusion



Zero-Touch Operations represent the future of network management in the telecom industry. By moving towards full automation, telecom providers can realize significant operational efficiencies, enhance customer experiences, and stay competitive in an increasingly complex landscape.

However, achieving ZTO requires overcoming substantial challenges, including legacy infrastructure, data silos, and cultural resistance. With the right strategy, technologies, and investment, telecom operators can position themselves at the forefront of the digital telecom transformation

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