
# AI-Driven Autonomous Network Management for Private 5G with Oceus Intelligent Controller

**AT A GLANCE**

**CHALLENGES**

- Cellular technology adds complexities to planning, deploying and managing networks
- Demand for mobile connectivity continues to accelerate at unprecedented pace
- Organizations have increasingly large demands on network connectivity

**OUTCOMES**

- Complexity is mitigated and network downtime is prevented
- Operational costs are reduced
- The availability of private 5G networks is expanded

With the mass proliferation of mobile-centric use cases across industries, private 5G is advancing to create the connectivity foundation for mobile-reliant technology innovations. But cellular technology is very different from existing wired and wireless solutions adding complexities across acquiring spectrum, planning, deployment, device provisioning, interference detection and mitigation, optimization, operating and maintaining performance. The Oceus Intelligent Controller (OIC) is an end-to-end virtual network orchestration and management solution that mitigates the complexity of designing, deploying and managing private 5G networks. With decades of expertise deploying private cellular networks in challenging and highly secure environments for military and public sector use cases, Oceus has leveraged its patented innovations and years of field experience to develop a solution that makes private 5G networking a viable and cost-effective option for military, public sector, and commercial enterprise installations.

This solution brief describes drivers that are accelerating the adoption of private 5G networks to solve real-world, real-time connectivity challenges by enterprises, the challenges of deploying cellular technology, and how Oceus simplifies the complexity to intelligently automate installation, provisioning, security, and performance through advancements in artificial intelligence and machine learning.

## Drivers for Intelligent Network Management: The Data & Connectivity Explosion

The demand for mobile connectivity continues to accelerate at unprecedented pace, enabling an always-connected world with people and businesses increasingly dependent on reliable communications. Demand for mobile connectivity is driven by three trends:

- Improved device capabilities, from smartphones being used for critical business and personal always-connected applications, to massive Internet of Things (IoT) deployments, where sensors enable machines and devices with connectivity;
- Increases in data-intensive content, including high bandwidth real-time applications such as video, and massive data being gathered from IoT devices;
- Rapid growth in data consumption that will nearly triple in 4 years, growing from 133 exabytes per month in 2023 to 370E by 2027.

The fifth generation of cellular technology, 5G, was developed to not only manage but also accelerate the adoption of high-speed, highly reliable, always-on connectivity for individuals and for industry, enterprise, and machines. 5G has coexisted with 4G since being introduced in 2018, predicted to overtake 4G within 2023, and includes critical features that enable advanced technologies such as artificial intelligence (AI) and machine learning (ML), IoT, augmented and virtual reality (AR/VR), and robotics:

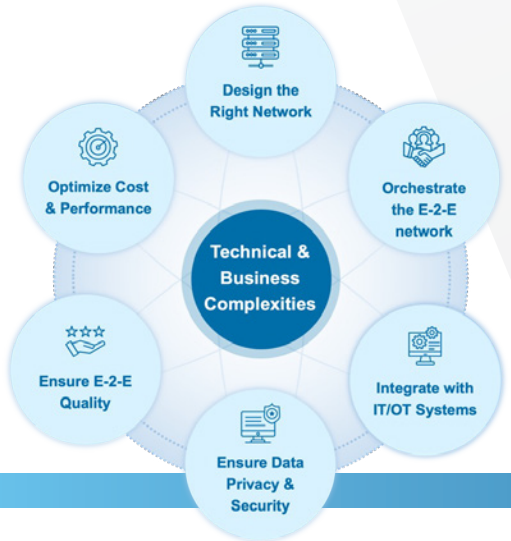
- Bandwidth up to 1 Gbps, with an average rate of 100Mbps;
- Ultra reliable low latency communications (uRLLC) with latency under 5 milliseconds;
- High device density with support of up to 1 million devices within a square kilometer;
- Enhanced native encryption and authentication protocols;
- Virtualization of network functions with cloud-native architectures and edge networking that enable improved security and ultra-low latency.

Another critical advancement was the availability of unlicensed and shared spectrum, allowing the private use of 5G cellular technology separate from public networks. In the US, Citizen Band Radio Service (CBRS) is spectrum from the 3.5 GHz to 3.7 GHz range dedicated for private use. This has enabled military, public safety organizations, and businesses to create highly secure, highly reliable private 5G networks that bring IoT, AI, AR/VR, and robotic applications to life.

## Complexities of Planning, Deploying, and Managing Private 5G Networks

Cellular technology is, by its very nature, complex. Deploying private 5G networks requires specific expertise in both cellular technology as well as networking infrastructure to cohesively integrate them with existing Ethernet and Wi-Fi networks.

Aligning networks with business drivers is critical but challenging in an ever more complex technology landscape where mobility and always connected is paramount to most business and field operations applications. Network downtime can be disastrous - costing some businesses over $1MM an hour. Poor network planning is the primary culprit.
[ITIC 2020 Global Server Reliability Report]




From planning and design to deployment and orchestration, cellular technology has unique challenges, different from other wired and wireless technologies. Compounding these challenges is the vast number of network management systems, IT systems, configuration options, and massive device proliferation. It is not uncommon for organizations to have thousands of users, devices, and gateways that rely on high mobility and reliable connectivity, using services from a variety of public mobile network operators (MNOs), and who require internet and enterprise connectivity, as well as indoor and outdoor mobility and roaming. Organizations must also choose from wireless and wired connectivity, transport, and backhaul technologies, and determine if on-premise, edge, cloud, or hybrid solutions are optimal for their requirements.

Normally, these combined objectives and challenges required hundreds of hours to manually complete and many hours more to verify and troubleshoot. Based on its experience with hundreds of deployments, **Oceus set out to apply the latest developments in artificial intelligence and machine learning to create an Intelligent Private 5G controller that reduces the time to get a private 5G network up and running, in a matter of days, not weeks or months**.

# The **OIC Vision**: Make the Complex Simple

*Oceus has developed the Oceus Intelligent Controller (OIC),* ***a ground-breaking, end-to-end network orchestration and management solution that turns days into minutes by automating planning, deployment and network management for critical, always-on connectivity. OIC leverages advanced AI to always ensure network availability*** *and simplify the complexities of cellular network design, deployment, and management to unleash the promise of private 5G networks.*


*OIC: Managing complex end-to-end network and application systems and environments*

OIC provides intelligent network control over the entire end-to-end lifecycle of building and managing a private 5G network, including design and planning, provisioning and orchestration, management and monitoring, and automation and adaptation.

## OIC Saves Time & Money and Reduces Errors

- Common toolset to Design, Deploy, Operate, and Support the network.
- Saves thousands in costs of buying multiple tools
- Saves 75% in planning and deployment time and SME labor
- Predictive and Generative AI for anomaly detection, automation and resources optimization.
- Network and system failure prediction reduces downtime by 80%
- Anomaly detection reduces network debugging time by 90%
- Redeploy networks with ease using unique version-controlled Network and System baselines.
- Reduces integration and deployment time by 85%
- Reduces initial troubleshooting by 75%
- Reduces initial customer acceptance by 95%

# **AI-Driven 5G:** End-to-End Network Orchestration

OIC utilizes artificial intelligence to adapt systems to provide scale, resilience, robustness, and security. The autonomous functions of OIC reduce human error by automating or simplifying redundant tasks, processes, and workflows that involve many steps across multiple disparate systems, such as generate and deploy user and network certs, perform security audits, and provision and revoke users.

Self-Optimizing Network Performance with AI-Powered Assurance
OIC orchestrates the entire end-to-end deployment and management lifecycle, improving RF planning and network design accuracy and efficiency, reducing time to deployment and provisioning, and monitoring the health of the entire system by autonomously regulating performance, identifying anomalies, and detecting interference and security threats in real-time. Through the AI-driven intelligence of OIC, the network continually learns, adapts, and self-heals so the network's performance and reliability autonomously improves.

*The network learns, adapts, and self-heals, continually improving performance and reliability.*

- **Optimized Performance** - Adapts systems to provide scale, resilience, robustness, and security.
- **Failsafe** - Autonomous functions predict failures, regulate performance, and identify anomalies.
- **Resource Efficiencies** - Automates tasks across multiple disparate systems to save time and reduce human error

# **Cloud-to-Edge:** End-to-End Network Visibility and Control

Oceus OIC delivers end-to-end visibility and control of all network components, through the entire lifecycle from a single pane of glass, from the design and planning stages all the way through automation and adaptation. The OIC's user configured dashboard utilizes drag and drop widgets to easily customize how users want to design and manage their networks. OIC manages RAN, core, network components, and 5G features such as network slices. It also handles alarms, logs, and KPIs of all network elements, and also provides visibility to elements adjacent to the network, such as Wi-Fi networks, backhaul, and legacy networks.

## ANY-NETWORK ORCHESTRATION AND ANY-G CONNECTIVITY

OIC is network agnostic and delivers robust orchestration for 4G, 5G, and NextG networks, CBRS, and cloud-based network systems. OIC powerfully integrates legacy networking systems into a comprehensive network architecture and its flexibility is future-proof when next generation technologies emerge. OIC seamlessly integrates with existing and legacy systems for a comprehensive network view.

*Single Pane of Glass Orchestration through the full E2E lifecycle*

- **Network Agnostic & Future Proof** - Public & Private Any-G: 4G, 5G, NextG, CBRS.
- **Centralized and Distributed Control** - Seamless integration with existing networks and comprehensive visibility to adjacent networks, including Wi-Fi and backhaul.
- **Inclusive Network Management** - Complete hardware and software management, inventory, tracking all software, licenses, and certificates for each network element.

# **Intelligent Provisioning** with Zero-Touch Automation

The viral adoption of IoT, AI/ML, AR/VR, and robotics, the proliferation of connected device types and their ever-expanding volume, necessitates the automation of deployment, configuration, activation, and deactivation to reduce set-up time and keep pace with forward-facing demands. OIC intelligently provisions network elements within hours (versus days or weeks) by providing a snapshot of the entire system, including physical inventory, cables, servers, and software, and autonomously provisions and pushes software to activate devices.

## REDEPLOY NETWORKS WITH EASE USING UNIQUE NETWORK AND SYSTEM BASELINES

OIC's templated network and system baselines introduce configuration management and version control across the entire network, reducing integration and deployment time by 85%, initial troubleshooting by 75%, and initial acceptance by the customer by 95%. OIC gives visibility to the design and implementation, and highlights errors as granular as a cable and port on a switch.

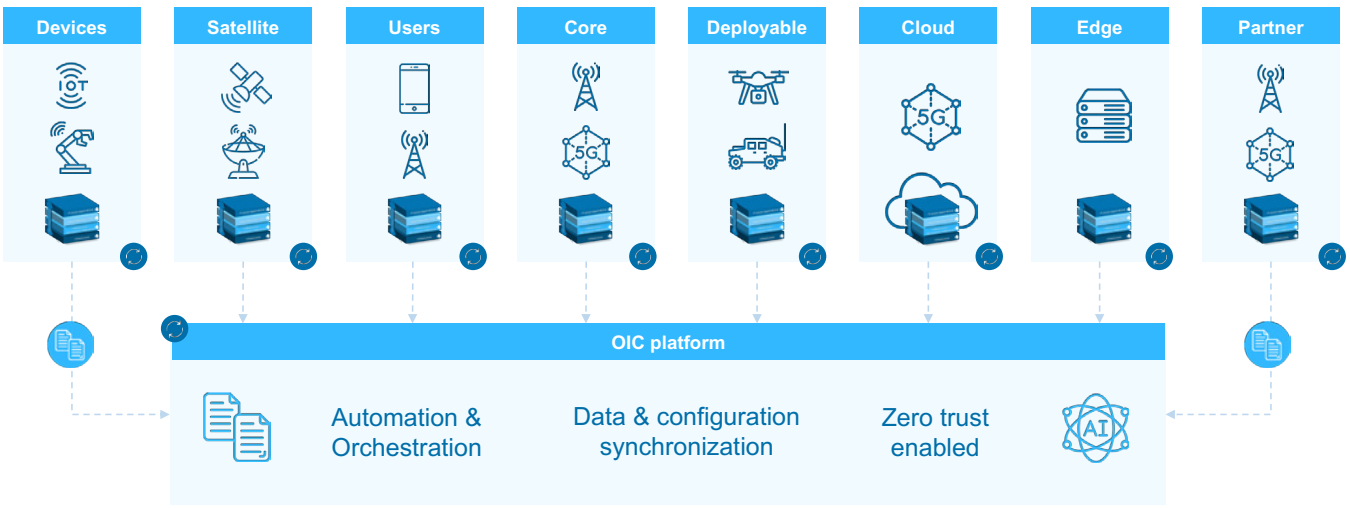
*Automation of configuration, onboarding, and activation to keep pace with forward-facing demands.*

- **No Added Cost** - Integrated RF planning tool for 4G/5G (licensed & CBRS) & Wi-Fi.
- **Customized Design** - Drag & drop network and system level architecture and planning with baseline snapshot.
- **Deploy within Hours** - zero-touch provision and validation of design: RAN, core, MEC, Devices, GWs, switches, routers.
- **Easy to Redeploy** using baseline network and system configuration snapshot.
- **Automated Network Mesh Identification** track all software, licenses, and certs, and identifies which elements are connected to other elements

## User and Endpoint Device Management

The OIC device management dashboard enables zero-touch provisioning, permissions, status, and decommissioning of all network elements, users, and devices on the network including:

- RAN and antennas
- Network core
- Mobile Edge Compute (MEC)
- SIM and eSIM provisioning
- Subscriber profiles
- User connection status
- Smart phones
- P25 land mobile radio (LMR)
- ONComm Push-to-talk
- Tough mobile device (TMD) 5G
- Mobile ad-hoc network (MANET)
- AR/VR headsets
- IoT sensors (Any-G and LoRaWAN)
- Multi-Operator Core Network (MOCN) gateway
- Switches, Routers and gateways
- Other Any-G devices



## **Autonomous Cybersecurity** with Real-Time Threat Detection and Mitigation

The OIC Security Operations Console establishes and enforces zero-trust security policies and certs for identification, remediation, and allocation of resources. OIC includes Integrated Security Information and Event Management (SIEM) to model potential threats and vulnerabilities, informing AI learning ≠engines so the network can autonomously and continuously respond to threats and attacks.

*Zero-trust security enforcement integrated with enterprise security systems.*

- **Autonomous** - Threat detection, identification, remediation, and allocation of resources
- **Real-Time** - Detects interference and security threats in real-time.
- **Centralized** - Centralized end-to-end network, device, and user security policy enforcement.

## **Predictive Analytics** for Resource Allocation and Dynamic Capacity Management

The OIC incorporates an intelligent data lake that collects, stores, and analyzes the vast amounts of structured and unstructured data sets collected from components in the private 5G network. Utilizing its AI engine, OIC processes data from RAN, core, user credentials, devices, and other ingress points. OIC informs automated processes and human-in-the-loop managers of anomalies, failures, and improvement areas to make decisions that improve the network's intelligent ability to respond in real-time to security threats and performance gaps through self-healing. Digital twin synchronization (cloud and on-premise) and APIs to integrate with data from 3rd party systems expands OIC's predictive capabilities for efficient resource scaling and utilization.

*Observe, learn, heal, alarm on network events quickly.*

- **AI Behavior Profiling** - Determines normal and abnormal states, learns, and self-heals.
- **Failsafe** - Autonomous functions predict failures, regulate performance, and identify anomalies.
- **Massive Data Analysis** - Intelligently utilizes structure and unstructured data sets from large numbers of devices to optimize network quality and application experience.

# Solving Private 5G Network Challenges

OCEUS OIC IS AN INTELLIGENT AI-DRIVEN END-TO-END NETWORK CONTROLLER SOLUTION THAT SIMPLIFIES THE ENTIRE PROCESS TO DESIGN, DEPLOY, OPERATE, AND SUPPORT PRIVATE 5G NETWORKS. WITH ITS DEEP BENCH OF EXPERTS AND HUNDREDS OF DEPLOYMENTS, OCEUS HAS BUILT OIC TO SOLVE USERS' MOST CRITICAL CHALLENGES THROUGH INTELLIGENT TECHNOLOGY INNOVATIONS.

## Design

### PROBLEM:

The planning and design phase of a private 5G network is a critical time to consider all use case requirements, including access, performance, business outcomes, and ROI. This requires collaboration and alignment across various stakeholders who likely have differing views and priorities.

### SOLUTION:

OIC allows users to design the solution and document the implementation details in a singular place. The assets determined during the planning stages become the assets provisioned during deployment. Via APIs, OIC integrates with your existing investment in tools such as ServiceNOw and Sharepoint.

### OUTCOMES:

- **Clarity of deployment** - Full visibility into all the elements that have been deployed
- **Traceability** - Once in production, all changes are tracked and reflected back as compared to planned deployment.
- **Scalability** - Saves time to deployment and labor costs, as well as customizable, with enhanced privacy and security.

## Deploy

### PROBLEM:

Deployment should reflect what has been planned, but undocumented changes can happen that lead to questions and slow down progress. The deployment team needs ready access to planned items, which can be in differing formats and interpreted differently than intended.

### SOLUTION:

OIC's intelligent provisioning automates deployment, taking the input parameters from the design and plans. Variations in deployment get reflected back into the plan and updated as a changed item.

### OUTCOMES:

- **Speed to Delivery** – AI validates the deployment to the plan as the team deploys the end-to-end solution eliminating human errors and reducing deployment time.
- **Traceability** - Once in production, all changes are tracked and reflected back as compared to planned deployment.
- **Collaboration** - Deployment teams work in the same toolset as the design and planning team.

## Operate

### PROBLEM:

Achieving a holistic view of a deployed ecosystem is challenging. Switching from operating view to management view may require switching applications. Changes aren't reflected back in the deployment scheme and planned design. As a result, performance fluctuates and time to resolve is excessive.

### SOLUTION:

OIC allows users to operate and manage their entire ecosystem from a singular system. Designed with user experience as its topmost requirements, OIC offers customizable views and switches from operational view to management view within the platform, minimizing errors and delays resulting from user context switching. The OIC network learns, adapts, and self-heals, continually and intelligently improving performance and reliability.

### OUTCOMES:

- **User Satisfaction** - Easy to understand and use, designed by industry experts who understand user problem domains, with reliable connectivity and excellent performance.
- **Scalable** - Expands and grows as your ecosystem requirements evolve.
- **Integration** - Integrates via APIs to enable specialized applications and integration into existing IT investments.
- **Failure Prediction** – AI examines KPIs from the entire end-to-end network and provides predictive failure indications before they happen reducing down-time.
- **Behavior Profiling** – AI understands what normal is and notifies if it detects abnormal behaviors, including the application layer.

## Support

PROBLEM:

Things may have changed from what was originally in the plan, problems are not easily traced, and upgrades may be challenging. Coordination across people, processes, and technology realms is time-consuming. Network threats are a continuous challenge.

SOLUTION:

OIC supports the entire end-to-end ecosystem from a singular point. With its predictive analytics, potential issues are identified before they happen. AI-driven cybersecurity identifies threats and autonomously protects against attacks. With all information within the same platform for customer, support, designers, and procurement groups, mean-time to resolution is reduced.

OUTCOMES:

- **Customer Satisfaction** - With its self-optimizing network performance, end users experience fewer issues, and support staff have to engage with fewer problems.
- **Quick Resolution** - Traceability and change management allows users to determine where the problem may be and go back to a known working solution, dramatically reducing network downtime.

## Conclusion

The Oceus Intelligent Controller is an AI-driven end-to-end solution that intelligently provisions network resources, from cloud-to-edge, with predictive analytics and autonomous cybersecurity for self-optimizing network performance. Designed to intelligently automate as many controller functions as possible, OIC dramatically reduces costs, errors, and time to deployment. **With its highly customizable configuration, and AI-driven intelligence, OIC and Oceus Private 5G network solutions are the right choice for any operation where highly resilient, always-on, high-speed mobile connectivity is needed to achieve critical outcomes.**

OCEUS

## About **Oceus**

Oceus empowers government and commercial enterprise with intelligent private 5G communications for uninterrupted critical operations in challenging environments where deterministic delivery of data in a wireless environment is critical: in-building, campus-wide, and on-the-move.

Oceus delivers advanced wireless network infrastructure with the mobility, security, and performance needed for seamless connectivity. Our edge computing capabilities provide low latency, ultra-high reliability, and enhanced security for wireless IoT devices and applications. The Oceus Intelligent Controller provides software-defined network orchestration using AI/ML to automate the management of 5G enterprise systems and applications for military operations, border security, disaster response, smart cities, logistics, transportation, manufacturing, healthcare, education, utilities, and energy.

Oceus is headquartered in Herndon, VA, with Oceus Technologies, our R&D lab, and our Integration and Operations Center both located in The Colony, TX.

**To learn more about how Oceus Private 5G network solutions and industries served, visit us at Oceus.io.**