



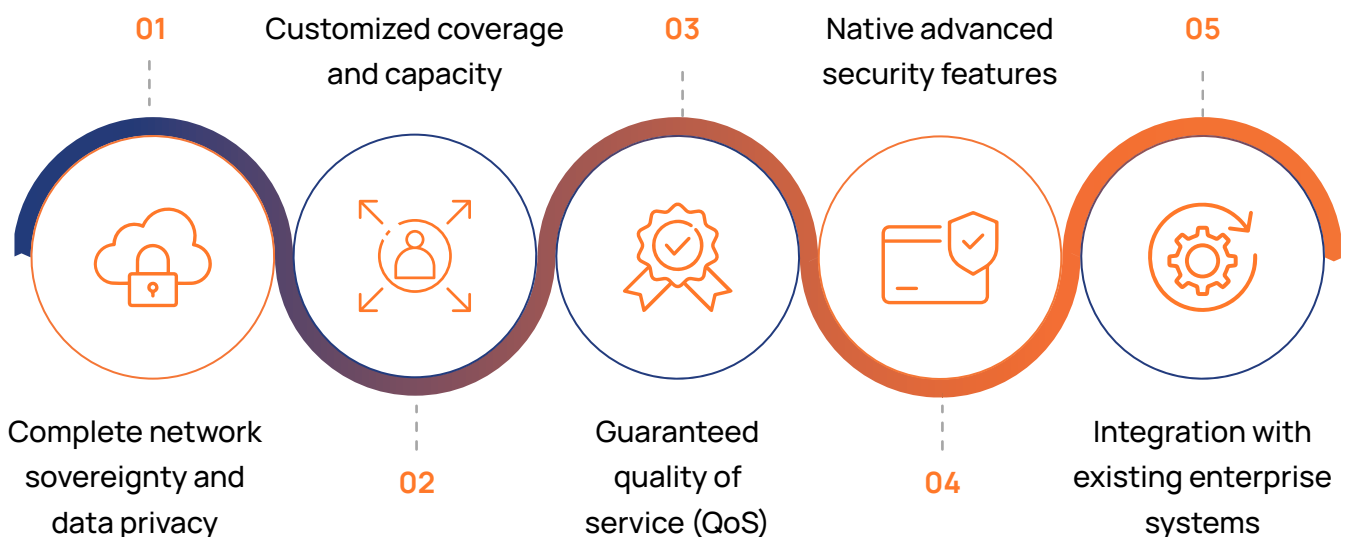
# Private Cellular Networks

## The Foundation for Business-Critical Enterprise Operations

**Private cellular networks (PCN)** are emerging as a standard for enterprises who need highly reliable, high-powered connectivity for business-critical applications. With performance, security, and ROI advantages over Wi-Fi and Ethernet, PCNs use the same powerful cellular technology as 4G/5G public networks but are deployed in compact form factors and with complete enterprise control.

### Private Cellular Network Advantages

Private cellular networks are dedicated wireless networks that use licensed, shared, or unlicensed spectrum to provide cellular connectivity within a defined area. Unlike public cellular networks, these private implementations use smaller equipment and are fully controlled by the enterprise, offering:



## Superior Performance and Reliability

Private cellular networks deliver consistent, low-latency connectivity with guaranteed bandwidth allocation. This enables:

**Very low latency (delay)  
for time-critical  
applications**

**Predictable performance  
for mission-critical  
systems**

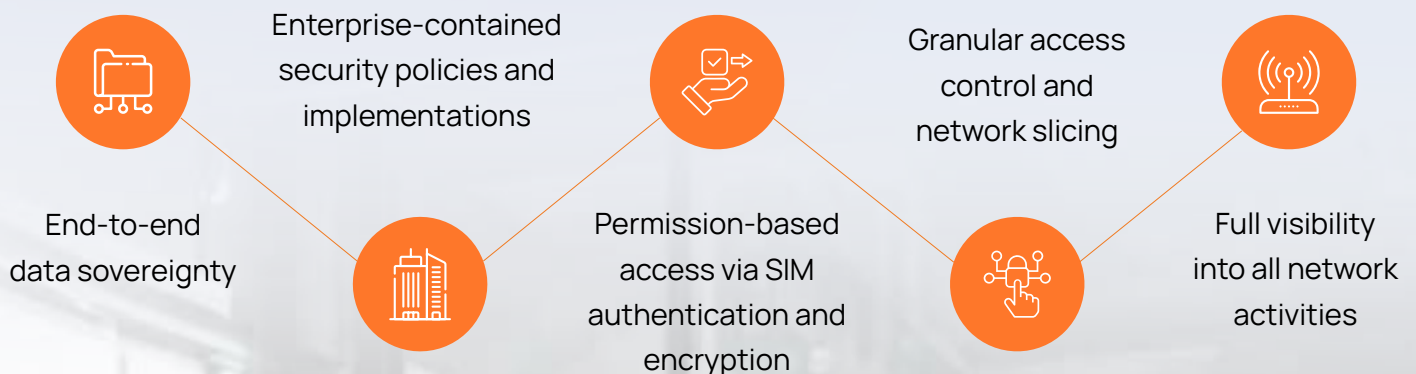
**Seamless mobility and  
handover across large  
facilities**

**Support for thousands of connected  
devices per square kilometer**

**Future-proof infrastructure that  
can support 4G/LTE and 5G devices  
simultaneously**

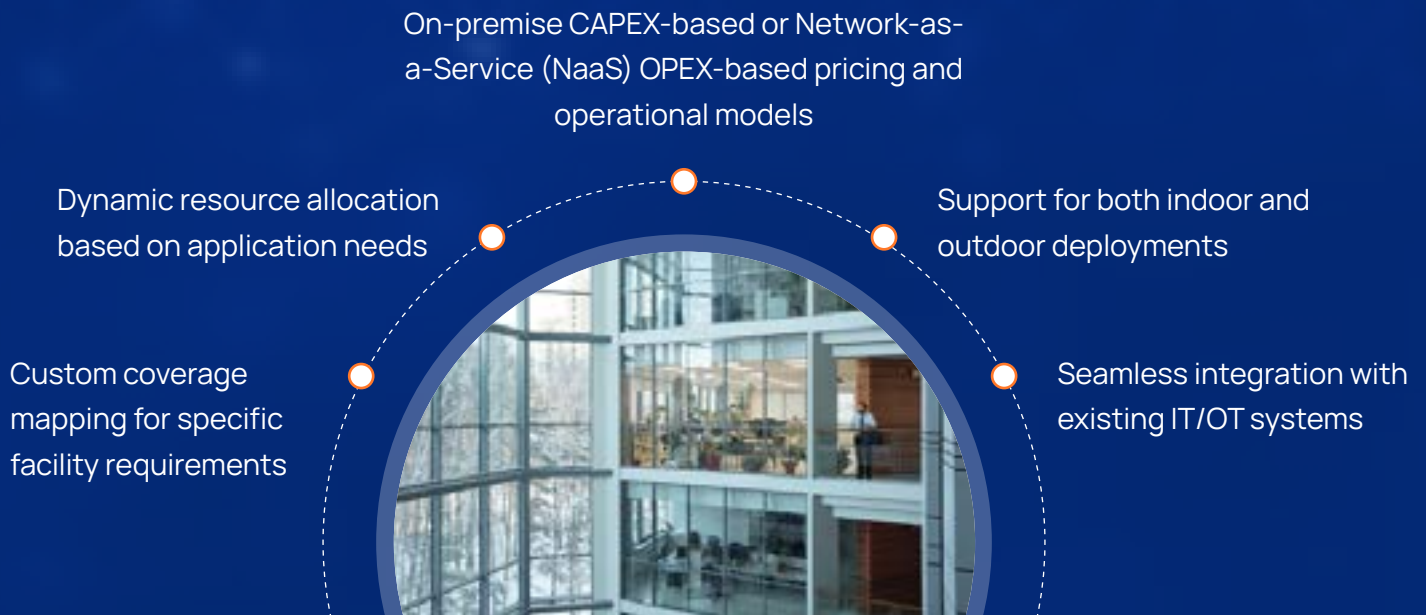
## Enhanced Security and Control

As a fully private infrastructure separate from public cellular networks, PCNs provide:



## Operational Flexibility

Private cellular networks offer unprecedented adaptability to meet diverse operational and budget requirements:



## Business-Critical Application Support

Private cellular networks deliver reliable low-latency connectivity with mobility and large capacity, critical for maximizing the effectiveness of advanced digital applications, such as:

- ✓ Automated Guided Vehicles (AGVs) and Autonomous Mobile Robots (AMRs)
- ✓ Collaborative robotic systems requiring precise control
- ✓ Automated crane and heavy machinery operations
- ✓ Real-time process control and industrial automation
- ✓ Video analytics for quality control and security monitoring
- ✓ Augmented/virtual reality for maintenance and remote expert support
- ✓ High-precision indoor positioning and asset tracking
- ✓ Automated warehouse operations and sortation systems
- ✓ Emergency communications and worker safety systems
- ✓ Mobile medical equipment and patient monitoring
- ✓ Time-sensitive networking for synchronized operations
- ✓ Automated inventory management and logistics
- ✓ Connected worker solutions with real-time data access
- ✓ Predictive maintenance with massive sensor networks

# Implementation Considerations

## Spectrum Options

Unlike Wi-Fi which operates in globally standardized unlicensed bands that are available for immediate use, private cellular networks require specific spectrum allocation to operate. This dedicated spectrum is essential because it:



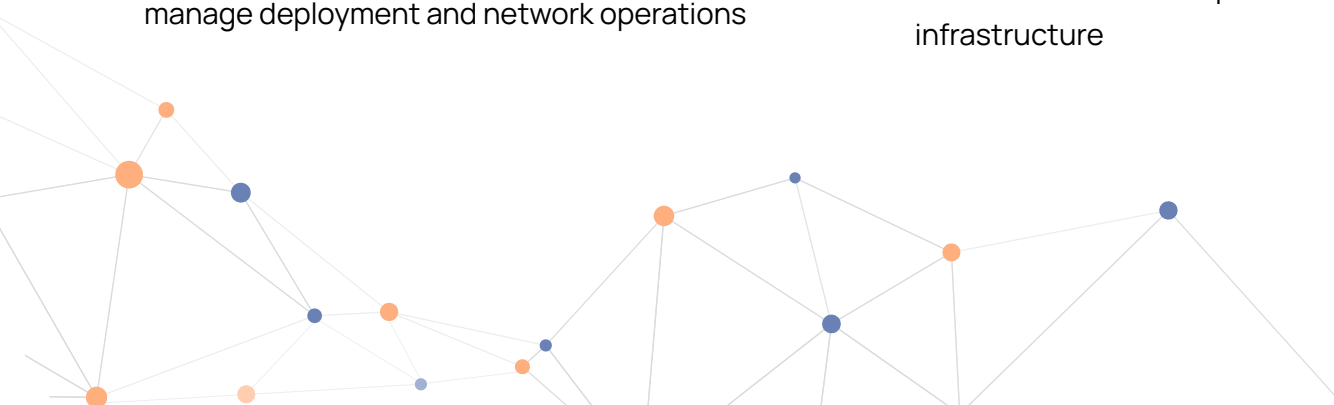
There are three main options for spectrum access, and the deployment type, location, and size will determine the best option:

- ✔ Licensed spectrum through direct purchase or carrier partnership
- ✔ Shared spectrum (CBRS in the US)
- ✔ Unlicensed spectrum for certain 5G deployments

## Infrastructure Requirements

The elements that make up a PCN are different from other IT network components. Key components include:

- Radio access network (RAN) equipment which processes radio signals
- Network core, the 'brains' of the network that controls access, policies, and performance
- Management and orchestration systems, to manage deployment and network operations
- Edge computing resources, which process time-sensitive data locally and host critical applications at the network edge
- Integration middleware, to incorporate the PCN into the enterprise network infrastructure



## Cost Considerations

### Direct Cost Savings

Because each PCN access point/cell has higher capacity, higher bandwidth, and a larger coverage area than Wi-Fi, it has a much smaller infrastructure, and therefore lower cost.

- One PCN access point/cell can replace ~10-20 Wi-Fi access points
- Dramatically reduced construction and Ethernet cabling costs
- Network-as-a-Service deployment and management options translate to lower up-front costs

### Related Cost Savings

PCNs are inherently more reliable and deliver high levels of performance, critical to transform business-critical digital and automation applications that deliver operational cost savings.

- Decreased downtime and maintenance costs
- Lower total cost of ownership for large-scale IoT deployments
- Improved operational efficiency through automation
- Enhanced worker productivity and safety

## Co-Existence

In today's enterprises, Wi-Fi and PCNs will continue to co-exist. Both 4G/LTE and 5G offer advanced network performance and services, and while 5G claims higher performance metrics, there is still a predominance of 4G-compatible devices. Many of today's PCN networks support both 4G and 5G devices and offer a future-proof investment that can adapt to changing business requirements while delivering immediate operational benefits.



	Wi-Fi 6	4G/LTE	5G
Peak Data Rates	Up to 9.6 Gbps	Up to 1 Gbps	Up to 20 Gbps
Latency (delay)	20-30 milliseconds	20-30 ms	5-10 ms ( $< 1$ ms planned)
Coverage Area	<ul style="list-style-type: none"> <li>• 30-50 meters indoors</li> <li>• Up to 100 meters outdoors</li> <li>• Signal degrades rapidly with distance</li> <li>• Highly dependent on obstacles and interference</li> </ul>	<ul style="list-style-type: none"> <li>• 2-30 kilometers (macro cell)</li> <li>• 100-200 meters (small cell)</li> <li>• Consistent signal across coverage area</li> <li>• Better penetration through walls and obstacles</li> </ul>	<ul style="list-style-type: none"> <li>• Up to 15 km (macro cell)</li> <li>• 1-3 km (small cell)</li> <li>• Consistent signal across coverage area</li> <li>• Multiple frequency options for coverage versus capacity</li> </ul>
Device Density	Up to 500 devices per access point	Up to 100,000 devices per square kilometer	Up to 1 million devices per square kilometer
Mobility Support	<ul style="list-style-type: none"> <li>• Stationary or walking speed</li> <li>• Hand-off between access points can be problematic</li> </ul>	<ul style="list-style-type: none"> <li>• Full mobility support up to 350 km/hour</li> <li>• Seamless hand-off between cells</li> </ul>	<ul style="list-style-type: none"> <li>• Full mobility support up to 500 km/hour</li> <li>• Seamless hand-off between cells</li> </ul>
Security	Optional password protection and added encryption	Native encryption, and only provisioned devices gain access	Native encryption, and only provisioned devices gain access
Ideal Implementations	<ul style="list-style-type: none"> <li>• General office use</li> <li>• Non-critical communications</li> </ul>	Critical communications and connectivity	Critical communications and connectivity

**Note:** Actual performance metrics may vary, depending on environment, equipment, and application

## Why Consider Us As Your SI Partner

Private cellular networks deliver powerful capabilities for enterprise operations, but successful deployment requires expertise in cellular technology, spectrum management, and integration with enterprise systems. We bring extensive experience in designing, deploying, and managing these complex networks and we can help you navigate spectrum options, select optimal infrastructure components, ensure seamless integration with your existing IT/OT systems, and provide ongoing network management. Whether you need full turnkey deployment and management, or targeted support for specific aspects of your private network, we can tailor our approach to match your unique requirements, resources, and operational goals. This flexibility, combined with our technical expertise and experience across multiple domains, helps ensure you realize the full potential of your private cellular network investments.

