



Private
Networks

Private Networks

Improved Reliability,
Better Coverage
and Increased Security
for Businesses



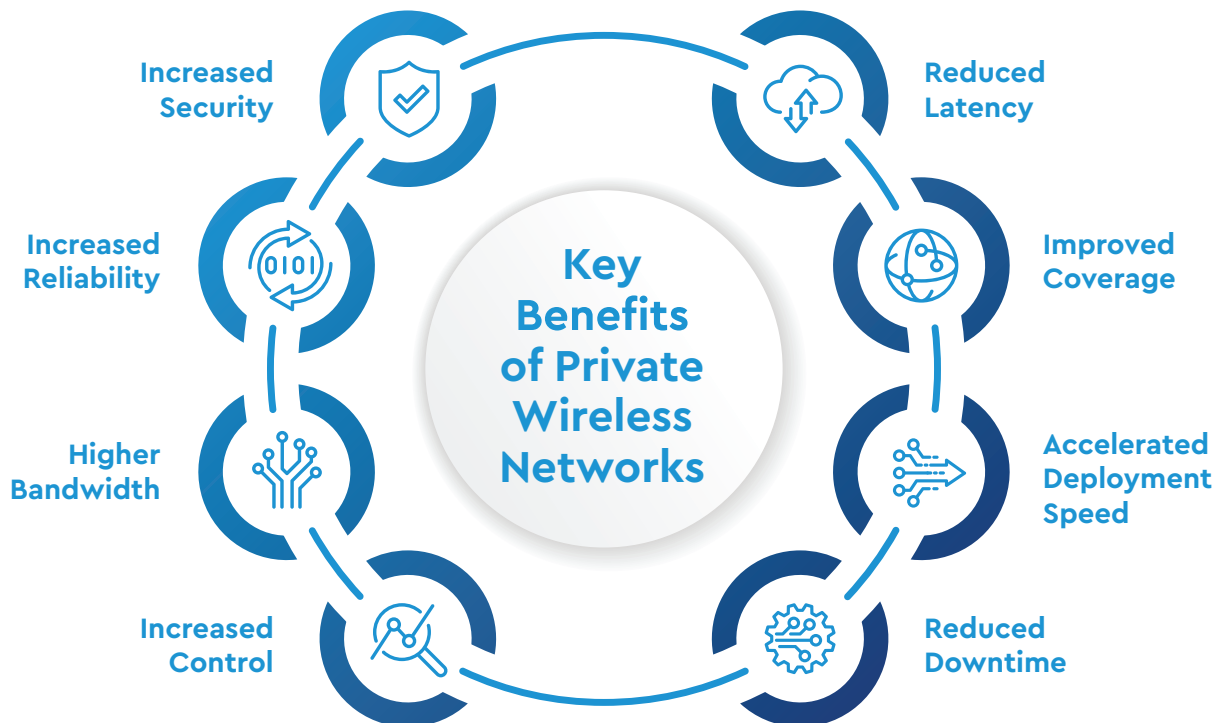
Private wireless networks are a key part of future connectivity solutions for businesses. They are a cornerstone for businesses to enable digital transformation, providing broader coverage, greater reliability & the most secure network access.

Executive Summary

Private wireless networks are expected to be an integral part of future connectivity solutions for businesses. There is a growing awareness among businesses that private networks are a technology they need to at least consider for their current and future operations. These networks promise to bring enhanced capabilities including security, reliability, coverage, latency, network configurability and accelerated deployment speed over their existing connectivity solutions. Whilst Wi-Fi, ethernet and fiber currently dominate the business connectivity landscape, there are a number of challenges associated with these solutions. These issues revolve around mobility, security, reliability, network coverage/availability and the difficulty in managing multiple connectivity solutions. The benefits unlocked by private networks will help to mitigate these challenges whilst also enabling new use cases.

However, deploying private wireless networks is not without challenges. Businesses must navigate complex regulatory requirements, ensure interoperability with their existing infrastructure and have the relevant technical expertise. Businesses need to ensure they are choosing a connectivity provider that can help solve these challenges and provide a full end-to-end connectivity solution.

Despite these challenges, the benefits of private wireless networks are significant, and their adoption is likely to accelerate in the coming years. Businesses that successfully deploy these networks will be able to maximize their network security, boost their network performance and improve their network coverage.



Key takeaways from this report

1. **Security and reliability are the key benefits that businesses are hoping to gain from private wireless networks**

Businesses are concerned with the security and reliability of their networks. These tend to be the key drivers for considering the adoption of private networking solutions alongside network coverage, control and the need for low latency.

2. **There are multiple use case drivers for private wireless networks, but real-time applications are the most popular**

There are a plethora of use cases that support the deployment of a private network. Real-time data analysis/monitoring is the most popular use case alongside real-time collaboration, increasing use of AR/VR and wider area network coverage.

3. **Technical challenges are viewed as the main challenge for businesses adopting private wireless networks**

Businesses are aware of the potential challenges of upgrading their connectivity solutions. From our research, one of the main perceived challenges for enterprises was around the complexity of integrating and managing a hybrid connectivity environment. This highlights the importance of selecting and working with a trusted partner that can provide a holistic service approach and work alongside an organization throughout their digital transformation.

4. **Businesses trust Communication Service Providers (CSPs) to provide private networks**

When it comes to selecting partners for deploying private network solutions, businesses are clear in selecting hyperscalers and CSPs as their preferred, trusted suppliers. This preference holds regardless of industry or business size.

5. **Businesses are looking for a provider who can handle end-to-end deployment**

Businesses are primarily seeking to find a single provider that can deliver an end-to-end connectivity solution to reduce the (perceived) burden associated with upgrading their connectivity landscape.

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Preface

This document has been written by independent research firm STL Partners and is commissioned by Spectrum Private Networks. It is based on STL Partners' continuous research into the telecommunications space with a specific focus on emerging technologies such as private networks.

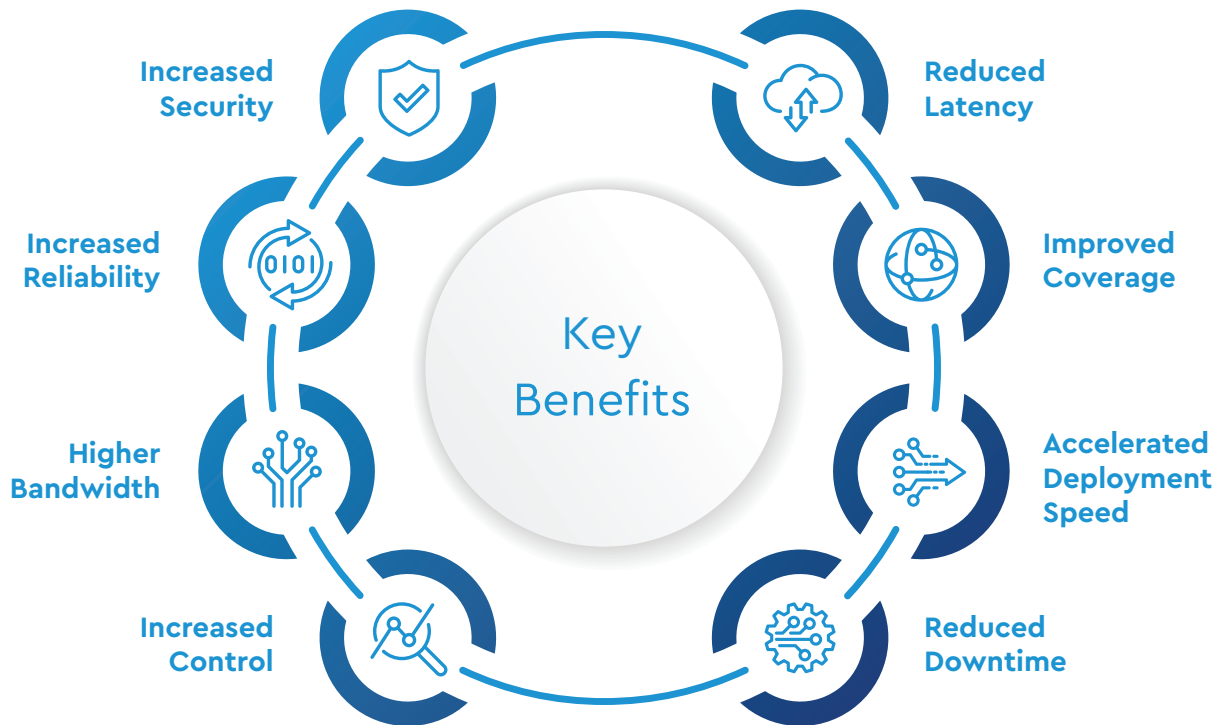
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Introduction

Private networks enable businesses' digital transformation strategies

Private wireless networks, whether LTE or 5G, are an emerging technology solution that hold the promise of enabling US businesses to digitally transform and solve some of their current key connectivity challenges. Private wireless networks offer key benefits such as increased security and high reliability whilst also helping reduce the complexity of managing multiple connectivity solutions. There is an opportunity for businesses to exploit the enhanced capabilities that private wireless networks bring as they can be configured specifically to meet a businesses' requirements.

Figure 1: Key benefits of private wireless



Source: STL Partners

This report is based on findings and analysis from a survey of 250+ businesses, including small, medium and large enterprises across different industries, and an in-depth interview programme with businesses, telecoms operators and solution providers, all of which are based in the US. Interviewees and survey respondents are aligned to the following industries:

- Education
- Healthcare
- Hospitality
- Manufacturing
- Real Estate
- Public Sector
- Retail

What do we mean by a private wireless network?

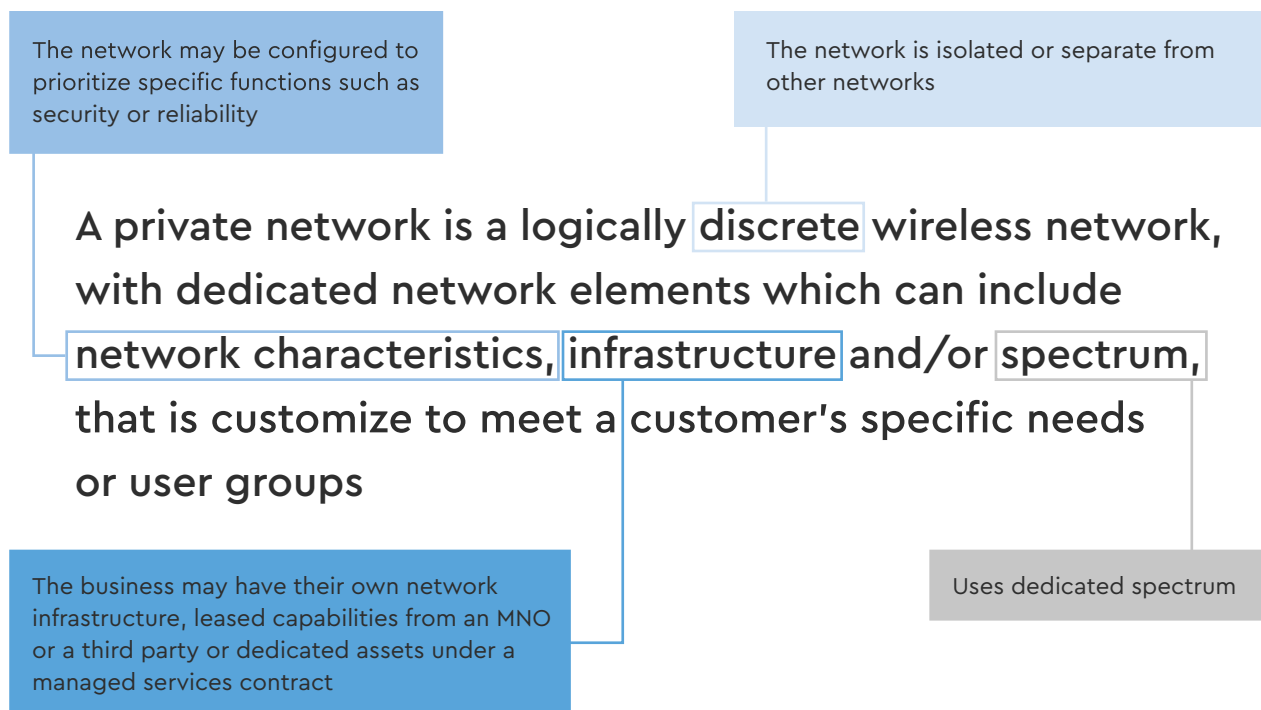
While private wireless networks have existed for over a decade, there has been increased interest by businesses looking to deploy them over the last few years. High profile developments such as the CBRS spectrum auction and 5G investments in the US have enabled the advancement of private wireless network deployments.

To take full advantage of the opportunity, it is important for businesses to establish clarity around what constitutes a private wireless network and how it can help enhance their current connectivity solutions.

Despite the renewed interest in recent years, there is still confusion among businesses about what exactly constitutes a private wireless network. Part of this stems from a lack of understanding of the technology which is also intensified by the wide range of services that are offered by providers under the umbrella term 'private networks'.

Private wireless networks use wireless technology, either on unlicensed or licensed spectrum. Unlike with WiFi where users are constrained to the coverage of the router, private wireless networks can connect to nationwide cellular networks. A private wireless network must have certain characteristics including dedicated resources and user groups/SIMs to run the network for a specific business, as well as customize requirements (KPIs). It is defined as the following:

Figure 2: Private wireless network definition



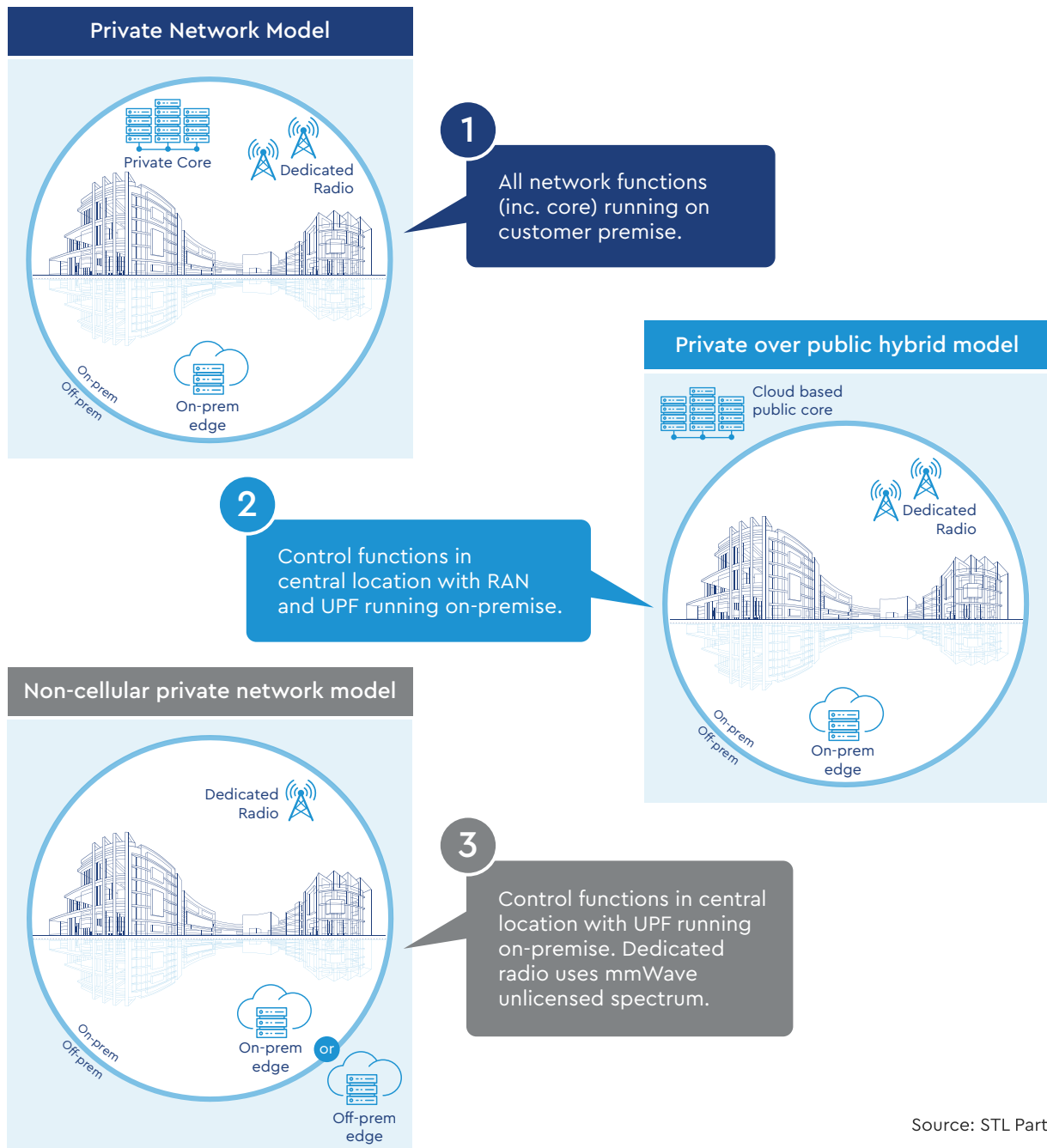
Source: STL Partners

What are the main deployment models of private networks?

Businesses need to understand the potential different deployment methods for private wireless networks. There are three main models:

1. Private network model
2. Private over public hybrid model
3. Non-cellular private network model

Figure 3: Three key private network deployment models



Source: STL Partners

What is the current connectivity landscape for US businesses?

Wi-Fi, ethernet and fiber are the most prominent connectivity solutions today

Wi-Fi, ethernet and fiber currently dominate the business connectivity landscape as the most common network forms across the businesses surveyed. Each form of connectivity still has its place and, in many cases, can satisfy current connectivity requirements.

In sectors such as manufacturing, industrial ethernet has always been used to support mission-critical stationary assets, e.g. large industrial computer numerical control (CNC) machines, whilst WiFi is used as broad-based IT connectivity across most businesses. However, while these solutions may be sufficient for current requirements, if businesses want to enable new use cases and leverage connectivity as a way to modernize their IT (Information Technology) and OT (Operational Technology) landscape, exploring next generation connectivity solutions can help them in this journey.

"We currently use industrial WiFi solutions across most of our manufacturing plants and use ethernet for machinery given mission critical situations"

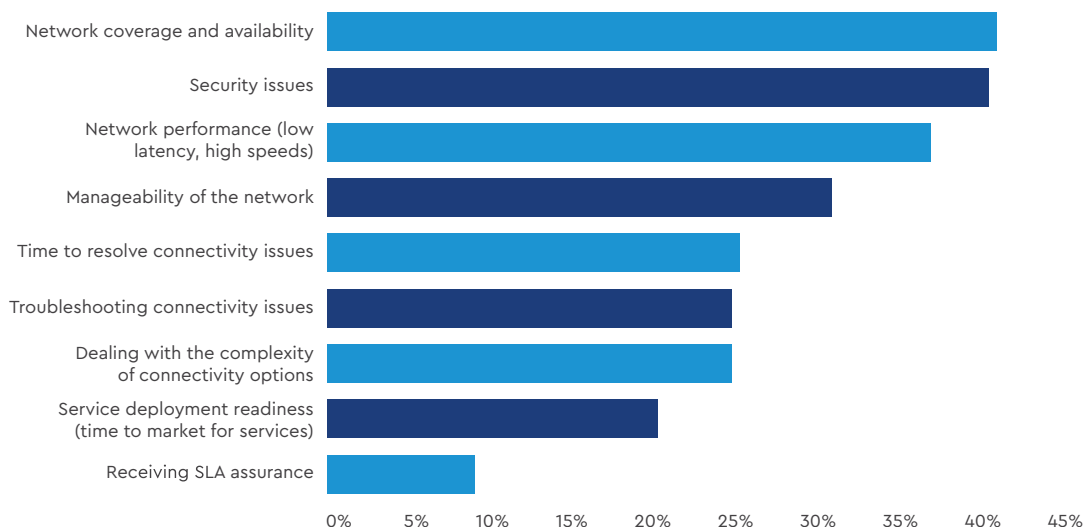
– Vice President Information Technology, Manufacturing Enterprise

Current connectivity challenges revolve around network coverage and security

According to the primary research, businesses are facing several issues with their current connectivity solutions, most notably around network coverage and availability.

Figure 4: Network coverage/availability is the biggest challenge facing businesses

Q: What are the main challenges with your current connectivity solutions?
Please select up to three options



Source: STL Partners survey (Feb 2023), n=270

Traditional connectivity solutions, such as WiFi, can be susceptible to interference from other devices. In rural/remote regions, the infrastructure is not consistently available to support these solutions.

Another key challenge that businesses are facing relates to security, as many businesses reported network security as their most pressing issue. They are concerned with ensuring their network security measures meet stringent government regulations and protect confidential data and IP.

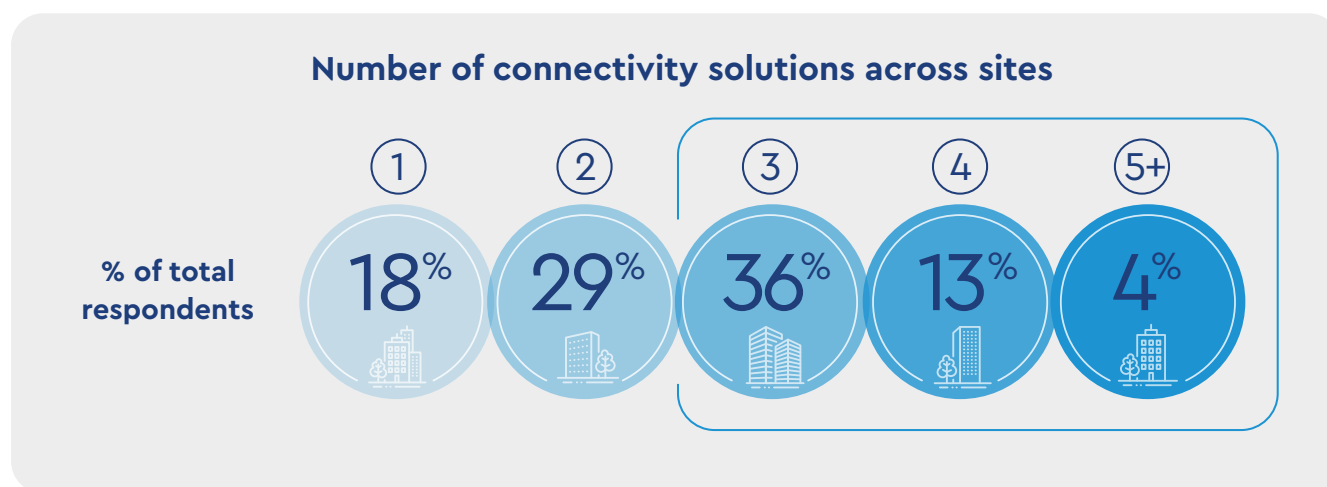
Businesses are also seeing issues with their traditional connectivity solutions – such as poor network performance, difficulty in managing their network solutions and extended time windows to resolve connectivity issues – and are looking towards new connectivity solutions to mitigate against these issues. Next generation private networks can help to resolve these challenges by offering higher speeds, lower latency and improved network configurability.

Over 80% of businesses have more than one connectivity solution

Most businesses have multiple networks and systems in operation across their sites. Over 80% of the businesses surveyed are using more than one connectivity solution across their operations with over half using three or more.

Figure 5: Over 50% of businesses are using three or more connectivity solutions

Q: How many connectivity solutions do you currently leverage in your business?



Source: STL Partners survey (Feb 2023), n=270

Often, each additional connectivity solution is linked to a specific business application or use case, which results in fragmentation, an increased overall total cost of ownership (TCO) and a higher attack surface for potential security breaches. These security issues are identified by survey respondents as being the greatest challenge for managing several connectivity solutions. Each solution may have its own security requirements and protocols, making it difficult to maintain a consistent connectivity level across the entire network.

Manageability of dealing with these multiple connectivity solutions and varied network performance needs (low latency, high speeds) are also highlighted by survey respondents as key obstacles. In theory, private networks can help to mitigate against these concerns. Although it is often not realistic with traditional forms of business connectivity solutions to have one network serving every single use case and application, private wireless networks can support multiple use cases and therefore provide businesses with an opportunity for greater network consolidation. This can help to lower TCO as network management becomes streamlined. Adopting private wireless networks can also provide further advantages including reduced latency and increased reliability.

What next-gen technologies are businesses exploring?

5G is the leading next generation technology that businesses are considering implementing

To mitigate against the challenges associated with their current connectivity solutions, businesses are turning towards next-generation infrastructure technologies such as WiFi 6/7, edge computing, private networks and 5G. The majority of businesses surveyed are in very early considerations or exploration/trial phase for adopting next generation technology

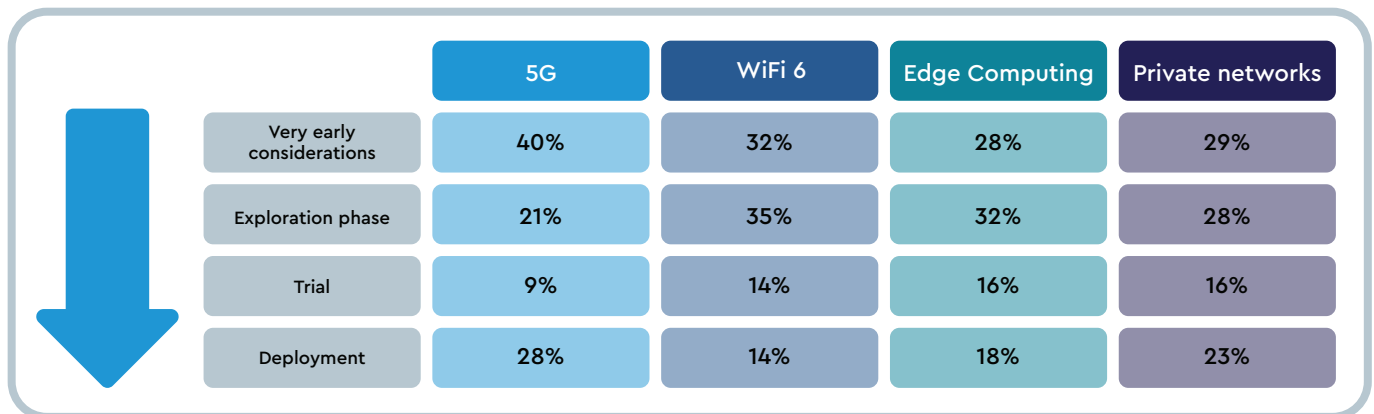
solutions. They are awaiting further proof points from other businesses within their industry and will look to find a trusted partner to advise them on their digital transformation strategy before deploying next-gen technologies. Smaller businesses surveyed are more likely to deploy WiFi 6 and 5G, while larger businesses are more likely to deploy more complex solutions catered to their needs, such as private networks.

"We see many enterprises looking to consider deploying a private wireless network as the next step on their journey to adapting their connectivity solutions"

– Global cloud provider

Figure 6: Figure 6: 5G and private networks are the most mature of the emerging next-gen technologies

Q: What stage is your business at considering deploying the following next-generation technologies?



Source: STL Partners survey (Feb 2023), n=270

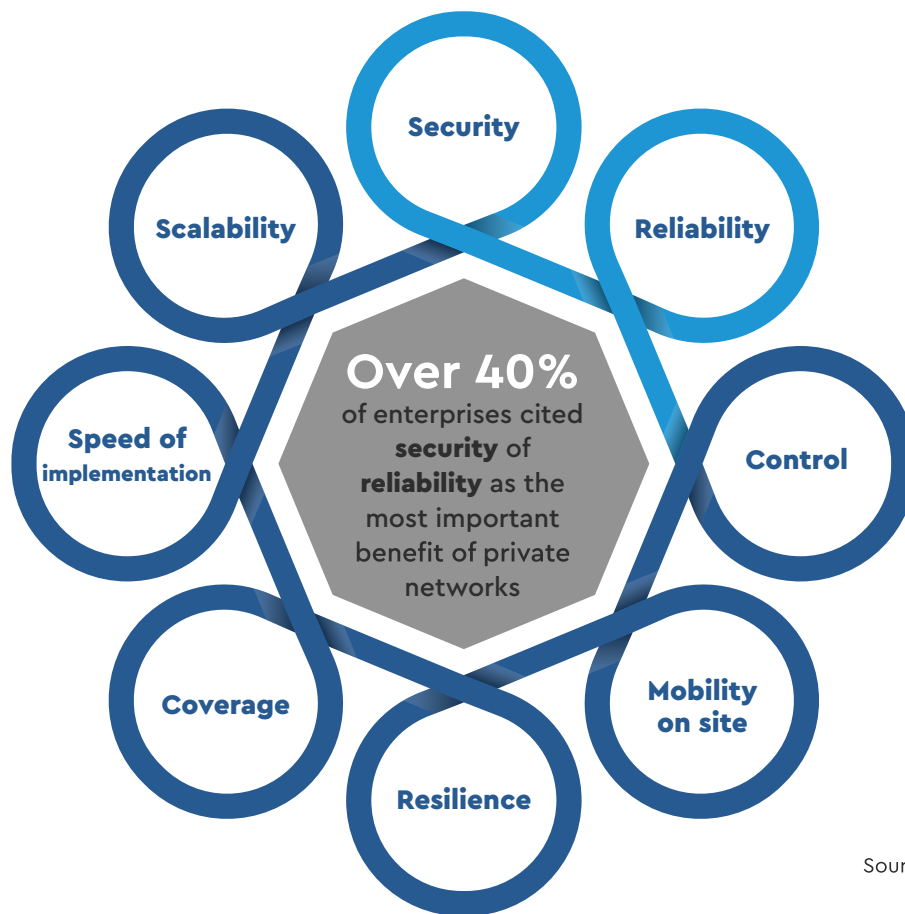
Of these new technologies 5G is seen to be the most popular, with carriers across the US having invested billions of dollars in 5G infrastructure. Public 5G refers to the 5G networks that are built and operated by telecommunications companies whilst Private 5G refers to networks that are built and operated by organizations for their own use. Many of the businesses we interviewed pointed out the "great hype and buzz" around 5G; businesses are pushing for it even when 4G or Wi-Fi 6 would likely be sufficient. Nonetheless, Private 5G networks do offer an improved networking solution for many businesses with increased security, higher mobility and lower latency. Given the potential benefits offered by private wireless, nearly 40% of those surveyed are in the deployment or trial phase with this new technology.

What are the business drivers for private networks?

Private networks offer security, latency and reliability benefits

Businesses are starting to consider adopting private wireless networks as they offer advantages over traditional connectivity solutions. Besides dedicated coverage and capacity, private networks can be customized in other aspects to deliver security, reliability, lower latency and tighter integration with current internal systems to meet business-specific requirements in ways that best-efforts public cellular or other traditional networking solutions cannot.

Figure 7: Security and reliability are key drivers for private networks



Source: STL Partners

Businesses noted enhanced security as a primary driver for deploying private networks giving them the ability to control the network. Often, businesses are vulnerable to cyberattacks which can result in data breaches and theft of sensitive information which can have serious ramifications for their business. For example, the Vice President of Information Technology at a manufacturing organization pointed this out during an interview noting that "security is essential, and we need to know that our systems are secure to meet stringent government and ITAR [International Traffic in Arms Regulations] regulations".

A private network can be customized to meet specific security environments and limit access to authorized users which reduces the risk of cyberattack by hackers or other malicious parties, giving businesses network control.

"Control of data and security concerns closely followed by latency are the key drivers to adopt private networks"

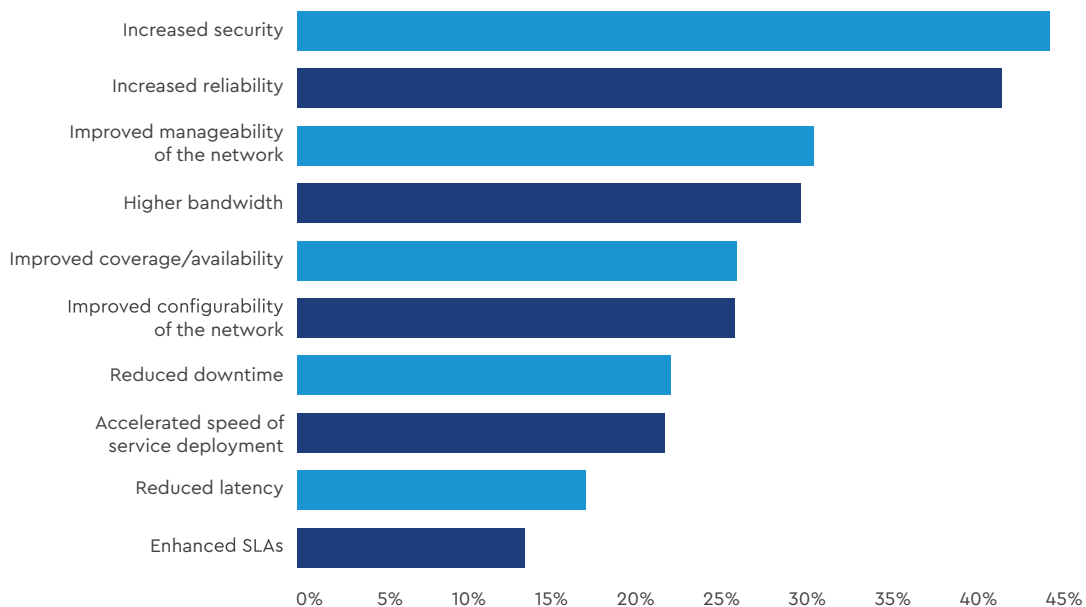
– Senior Director, Technical Solutions Private Network Specialist

"Security is first of all our consideration for deploying a private network and is crucial to our organization"

– Director, Technology Services & Infrastructure Healthcare Enterprise

Figure 8: Security is ranked as the most important benefit of private networks

Q: What are the main potential benefits that you are seeking to derive from private wireless networks? Please select up to three options



Source: STL Partners survey (Feb 2023), n=270

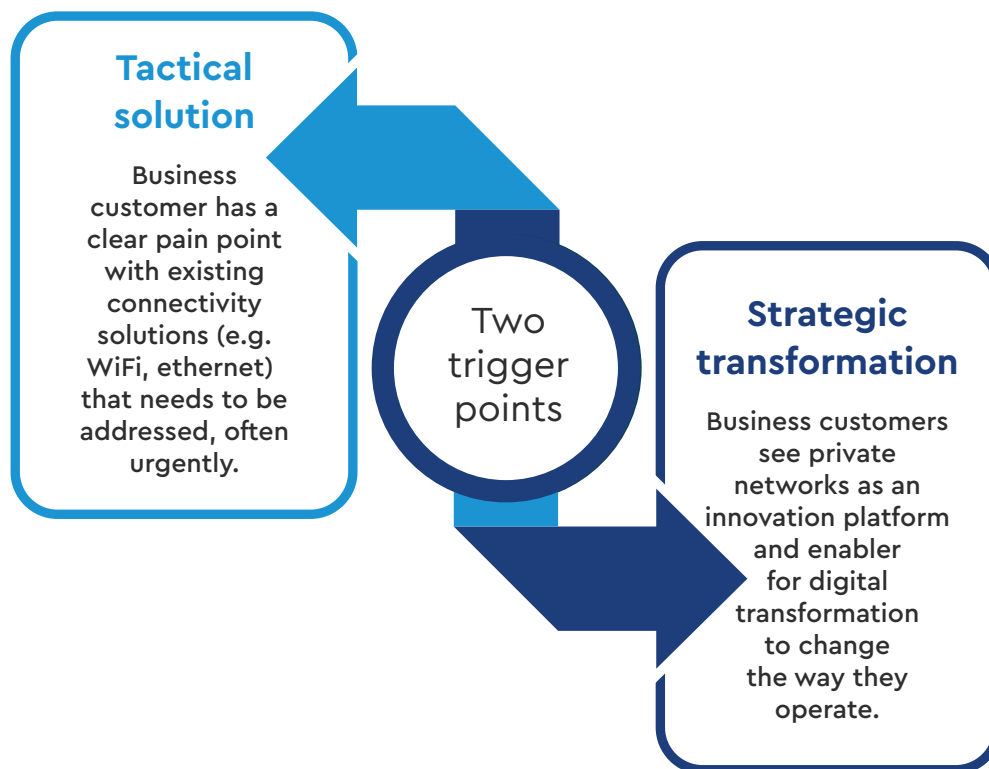
Other key drivers include improved reliability and reduced latency which result in faster data transmission and processing to help tackle current connectivity challenges. Reducing latency is also key for enabling real time applications where small delays can have a significant impact on performance and user experience.

Private network adoption will also help alleviate concerns around poor network coverage and availability which was also noted as a key challenge by businesses. Over 25% of businesses see this a key benefit of adopting private network which will help overcome current connectivity gaps.

What are the trigger points for deploying private networks?

We have broadly seen two pathways emerge behind the rationale for deploying private networks. They firstly can be seen as a 'tactical solution', which is primarily a technology-led decision to help address a businesses' current challenges with their connectivity solutions. The second major pathway for deployment is around strategic transformation where businesses see private networks as an innovation platform and enabler to allow for broader digital transformation.

Figure 9: There are two 'trigger points' for deploying private networks



Source: STL Partners

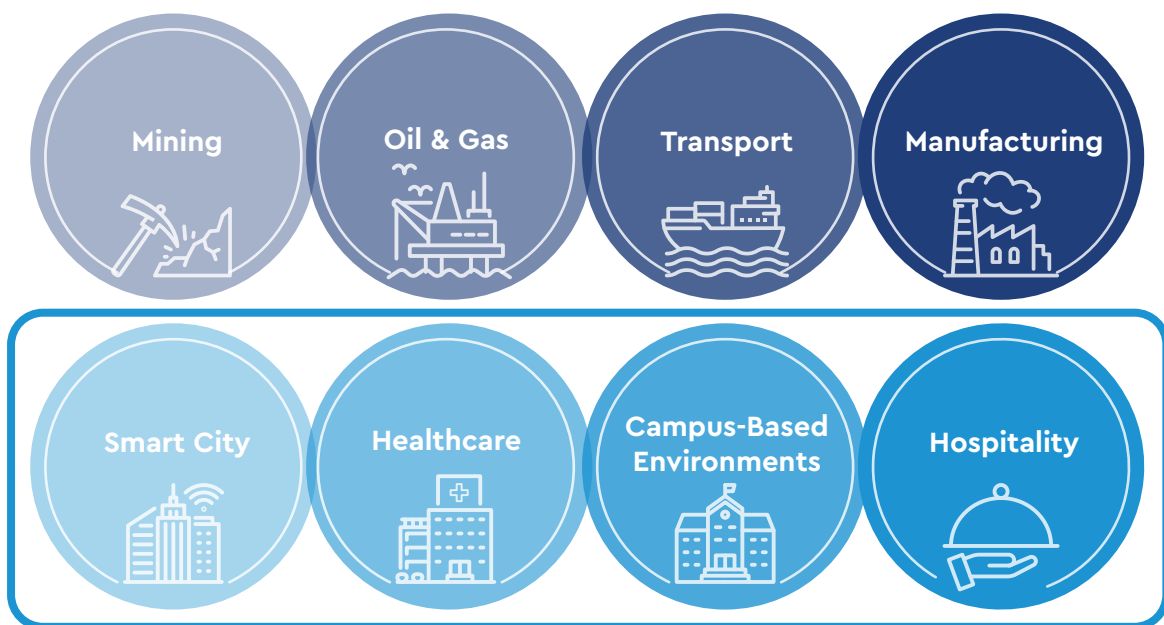
Where are we seeing private network deployments?

Deployments have historically focused in specific verticals

Private network deployments have historically been found in the mining, oil and gas, transport and manufacturing industries¹. These businesses are often in remote and mobile locations where traditional communication infrastructure may not be available and/or reliable.

However, we are now seeing an increasing number of deployments emerge across a broader set of verticals. In addition to the healthcare and hospitality industries, we are also seeing activity in Smart City and campus-based environments (property, public sector, retail). A private network specialist we interviewed mentioned that there is a huge opportunity in the healthcare sector as the majority of hospitals currently run on standard WiFi networks. Private networks offer increased reliability and security to transfer critical, confidential patient information between staff instantly, to help track the real-time status of patients.

Figure 10: New wave of deployments in healthcare, hospitality, smart city and campus-based environments



Source: STL Partners Private Networks Insight Tool

Use cases are driven by many reasons, including demand for real-time applications

While use cases for private networks are varied, enabling real-time applications is cited as one of the most important drivers. These use cases require a high degree of network reliability and low latency as they require immediate data processing and responses. 62% of businesses are focusing on adopting use cases that enable real time data analysis/monitoring and collaboration, making it the type of use case that businesses are most interested in exploring. We are also seeing interest in other types of use cases like real time collaboration (39%), AR/VR training (32%) and remote operated equipment/operations (34%).

¹ Data from the STL Partners Private Networks Insight Tool

Figure 11: Real time data analysis/monitoring is ranked as the leading use case



Which types of use cases do you plan to implement with private wireless networks?
Please select up to three options



Source: STL Partners survey (Feb 2023), n=270

Private networks are especially important for mission-critical use cases as any downtime or network issues can result in significant consequences. For example, one stakeholder from a healthcare business mentioned that they have deployed a private network in hospitals to enable real-time data analysis for lifetime monitoring systems to ensure timely medical interventions.

Other use cases enabled by private networks can help mitigate against businesses' physical security concerns. Video analytics can be used to detect intruders, track individuals or objects and alert personnel to potential security breaches. Private networks provide the high levels of bandwidth and low latency to ensure that the network can handle the connectivity which is crucial for real-time video analysis for security.

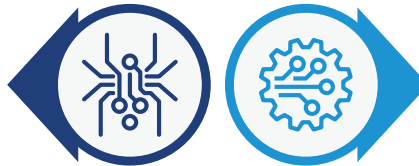
What are the main challenges with adopting private networks?

Technical issues are the greatest barrier of entry for businesses

There is a greater technical complexity for businesses when adopting and managing private networks than with traditional connectivity solutions. Private networks are designed to be highly reliable and secure, with a dedicated infrastructure and advanced network technologies that require specialized knowledge to implement. Nearly a third of businesses surveyed highlighted the complexity of integrating and managing a hybrid connectivity environment as the greatest technical challenge of deploying private networks.

Figure 12: Integration and management complexities of deployment

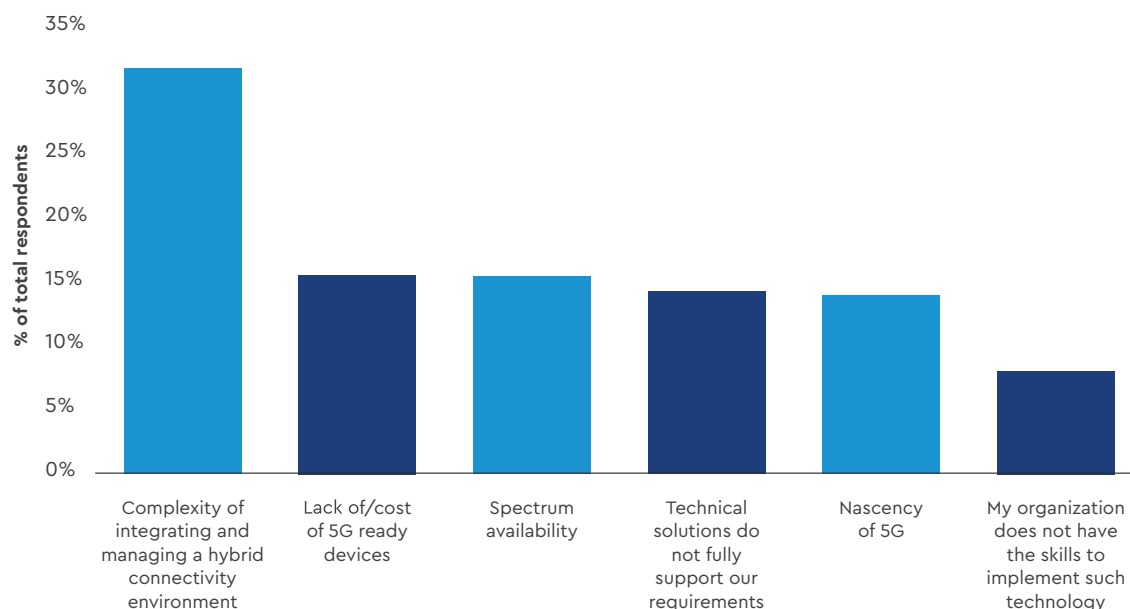
Integration complexities
Integrating a private network with existing enterprise systems can be complex, requiring integration with enterprise's current applications and databases



Maintenance and management
Maintaining a private network requires identification and addressing of network issues, applying security updates and upgrading hardware and software as required

Figure 13: Key technical challenges to consider when launching private networks

Q: What is your primary potential technical challenge when selecting and deploying private wireless networks?



Source: STL Partners survey (Feb 2023), n=270

Other technical issues that businesses anticipated relate to device readiness and compatibility. In some cases, devices that are compatible with a private network may not be readily available, leading to delays in deployment, especially with 5G-ready devices. One private network specialist firm mentioned the challenge to insert eSIMs into consumer devices to give them access to private wireless networks as there is a lack of technical expertise required. When looking to choose a particular solution provider, businesses should therefore look for one that possesses the technical expertise they require, especially around network integration and management.

General concerns for businesses revolve around security, cost and expertise

Alongside the more technical challenges associated with deploying private networks, the businesses surveyed are mostly concerned with perceived security risks and costs of deployment compared to traditional connectivity solutions as well as their lack of knowledge/education around these new network solutions.

Figure 14: General concerns associated with deploying private networks



Source: STL Partners

Among the interviewees from service providers, they emphasised that there is still a huge lack of clarity and education around what constitutes a private network and the packaging of different propositions. For example, we interviewed one hospitality business that believed they had deployed a private wireless network when in reality they were using a standard LAN network. Businesses are also hesitant to adopt a technology that is not widely deployed for fear of 'first-mover disadvantage' and desire to learn from others in a similar industry first. This lack of knowledge highlights the need for clarity around private networks. Better education for businesses around the architectures and benefits of private networking solutions will ensure providers/customers can extract the maximum benefits.

"Cost is the main challenge of deployment and also there is a lack of skills as we don't have a major subject expert who can help us with private network deployments"

– Vice President Information Technology, Manufacturing enterprise

"The main customer barriers that spring to mind are having the skills for deployment and knowledge about private networks and secondly points around cost"

– Head of Global Strategy and Digital Partnerships, Enterprise Global cloud provider

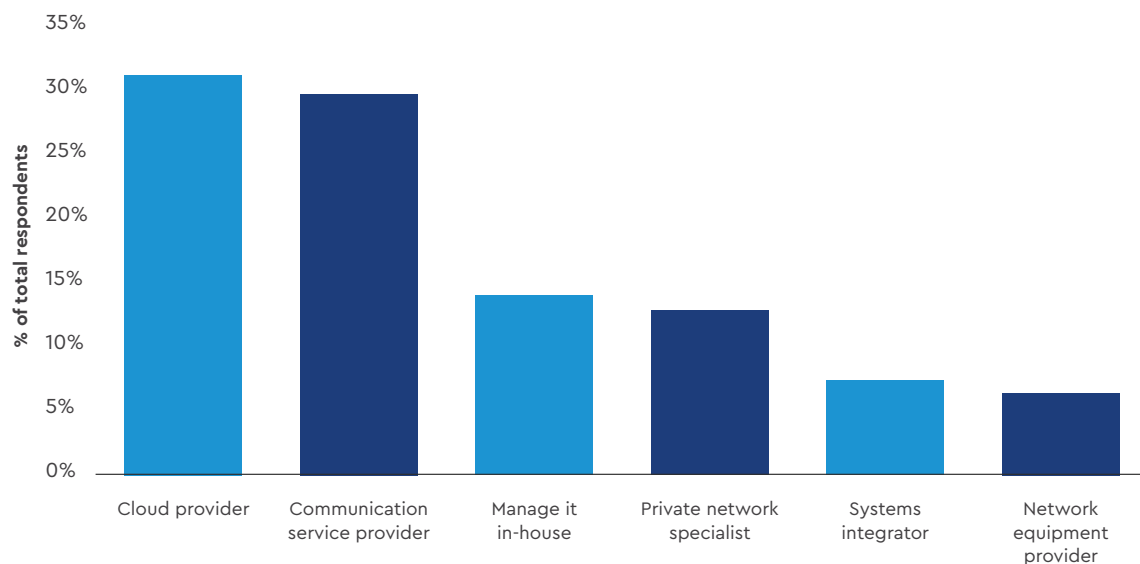
Who are the leading players in the market?

Communication Service Providers (CSPs) and Cloud providers seen as leading solution providers

There are a number of potential partners for businesses when looking to deploy a private network solution. It is not yet clear which player will be the main provider although CSPs, cloud providers, private network specialists and system integrators were all noted as potential major players for this solution type. CSPs are also referred to as Mobile Network Operators (MNO), Multiple System Operators (MSO) or Telecommunications Service Provider (TSP). Based on our survey results, CSPs and cloud providers emerged as the clear preference in terms of lead partner for provisioning private networks regardless of industry and business size. However, it is worth noting that nearly 40% of respondents selected other preferred partners which included network equipment providers, system integrators or private network specialists.

Figure 15: Cloud providers and CSPs are the preferred partners

Q: Who would be the primary GTM partner you would be likely to consider to work with on a day-to-day basis for a private wireless networking solution?



Source: STL Partners survey (Feb 2023), n=270

Businesses are generally looking for just one connectivity provider

The reality is that businesses are primarily looking for one provider for all their connectivity solutions and the decision for their chosen solution partner is influenced by the ability of a provider to deliver a full end-to-end connectivity solution. Over 60% of businesses surveyed are looking for one connectivity provider for all their future

solutions, including private networks. Having one connectivity partner offers several advantages for businesses:

- Improved integration:** one connectivity provider can simplify the integration of devices and applications, as organizations can ensure that all devices are using the same connectivity protocols and network infrastructure.
- Enhanced security:** businesses can have a better overview of their security posture and implement consistent security policies across all connectivity solutions with one provider.
- Simplified management:** one provider for all connectivity solutions simplifies network management, reduces the number of contracts and eliminates the need for coordinating with multiple vendors.
- Cost savings:** consolidating connectivity solutions with one provider can result in cost savings by negotiating better rates with their supplier and reducing administrative overhead.
- Improved Service Level Agreements (SLAs):** a single provider can offer comprehensive SLAs that cover all connectivity solutions, making it easier to hold the provider accountable for any issues.

"Our choice of go-to-market partner is influenced by which vendor can provide the full complete end-to-end portfolio for our connectivity solutions, with strong distribution channels"

– Vice President Information Technology, Manufacturing Enterprise

"We are looking for a one stop shop that can provide us with a full suite of connectivity solutions, can manage all our network operations and troubleshoot cybersecurity issues"

– Director, Technology services & Infrastructure Healthcare Enterprise

Source: STL Partners

Integration and security expertise are key when selecting a solution provider

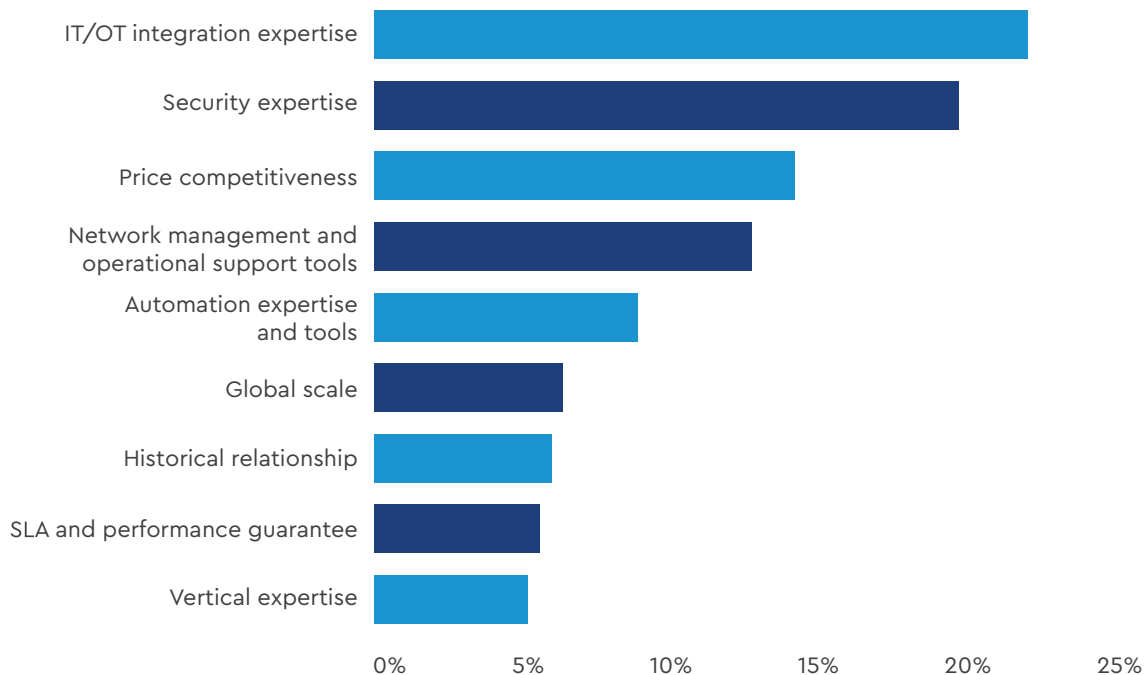
Businesses noted IT/OT integration expertise as the key selection criteria for selecting a partner for their private networking solution. This is integral to ensure that the network is seamlessly integrated with their current connectivity solutions whilst minimizing disruption and improving efficiency. As security issues are the driving factor behind private network deployments, businesses are also looking for providers who have expertise in this field.

Specific vertical expertise from their connectivity partner is particularly advantageous to businesses to help provide tailored solutions that will meet the specific requirements of the industry and understand regulatory compliance requirements. A hospitality business mentioned specific industry knowledge e.g., an understanding of the specific compliance standards for casino gaming would drive them towards partnering with a particular solution provider.

The market is still nascent for private network service providers and they have yet to define standard Service Level Agreements (defining the level of service expected from a vendor – e.g., reduced latency of 15 m/s). As there is a lack of education amongst businesses around what exactly constitutes a private network, they are unsure of the specific benefits/SLAs to require from their solution providers. As such, only 5% of businesses saw SLA/performance guarantee as a driving factor when selecting a partner for private network deployments.

Figure 16: Integration expertise is key when selecting a partner for private networks

Q: Which is the most important attribute when choosing a partner?



Source: STL Partners survey (Feb 2023), n=270

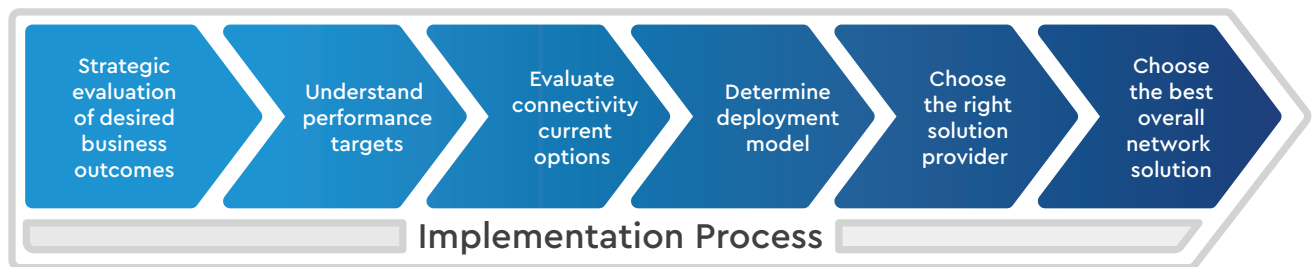
Businesses are looking for providers that offer hybrid solutions

Given that hybrid networking solutions (the combination of different wireline and wireless connectivity solutions) will continue to exist for the foreseeable future, businesses are focusing on connectivity providers who offer full end-to-end connectivity solutions and can help mitigate against the current complexity resulting from multiple networks. Businesses are looking for a provider that can help define their wider connectivity strategy and can help them undertake a Proof of Concept (PoC) or live trial to determine whether a new solution will enhance their current connectivity strategy. To the extent possible, businesses want to reduce the complexity of their current scenario by consolidating and integrating their connectivity options into smaller number of networks.

Recommendations for businesses

A business's need for enhanced capabilities offered by private networking ultimately depends on their immediate and future use cases, applications and connectivity requirements. When looking to evaluate the opportunity offered by deploying private networks, we identify some key guiding principles for businesses to follow:

Figure 17: Businesses should adopt a multistage process to evaluate connectivity needs and relevant solutions



Source: STL Partners Private Networks Insight Tool

1. Strategic evaluation of desired business outcomes

First, businesses should undergo an analysis of their overarching business goals with representation from all internal stakeholders. This includes decisions around which use cases and applications that they want to implement alongside the operational and technical KPIs that they want to achieve.

2. Understand performance targets

Once the business has identified its key requirements and use cases, the next step is to understand the associated applications and how to best support these through connectivity solutions. For new use cases, businesses must identify key performance targets and investigate whether current connectivity solutions are sufficient to meet them.

3. Evaluate current connectivity options

Businesses may have a clear pain point with their existing connectivity solutions that may need to be addressed or see new technologies as innovation platforms and enablers for digital transformation. Businesses should justify whether the enhanced capabilities (security, latency, reliability) associated with private networks justify the costs.

4. Determine deployment model

The next step in the process is to determine which is the most appropriate private network deployment model based on financial constraints, the level of required IT/OT expertise and use cases the business wants to implement. This decision can be aided by consulting their trusted connectivity partners (e.g. CSPs, systems integrators, digital transformation advisors, etc.).

5. Choose the right solution provider

Given the need to integrate these private network connectivity solutions into their existing infrastructure, businesses should look for connectivity providers who offer hybrid or full end-to-end solutions rather than those that are focused on only selling private networks. Their partner should help formulate their private networks connectivity vision with as much detail, clarity, and precision as possible, which includes specific milestones and expected timeframes. Alongside vertical expertise, businesses should also look for a partner that possesses the following technical expertise:

- **End-to-end solution delivery:** full capabilities across the full connectivity solution including cloud, edge, fiber, wireless, Wi-Fi and business solutions.
- **Turnkey managed service:** resources required to enable a fully managed network solution.
- **Wireless and wireline network visibility:** end-to-end visibility of the network for seamless management experience.

6. Choose an overall networking solution that reduces complexity and enhances security

To the extent possible, businesses should consider deploying a private network solution that can consolidate and integrate their connectivity options into a single network that can be adapted to suit different needs. Given that security issues are a key challenge faced by businesses today, they should ensure that deploying a private network will mitigate against these issues, giving them network control. Businesses should also explore available managed service options, as this will help to mitigate some of the perceived complexity barriers for adopting private networking solutions.

Conclusion

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Networks

Private networks offer businesses the opportunity to adopt an enhanced connectivity solution configured specifically to meet their needs. Private networks offer a number of key connectivity benefits such as low latency and high reliability whilst also helping alleviate security concerns and reducing the complexity of managing multiple connectivity solutions. Whilst our research indicates that WiFi and ethernet are still the most prevalent connectivity solutions today, private networks offer the capabilities to address the challenges traditionally associated with these solutions and help enable businesses in their digital transformations.

The key task that businesses should focus on is to look at private networks as enablers for achieving wider business objectives, while reducing the complexity they are currently experiencing with managing multiple connectivity solutions. Businesses should look towards a solution provider that can help them deploy a private network that will consolidate and integrate their connectivity options into a network solution that can be adapted to suit different needs. Once businesses understand how private networks should and can be deployed, this technology can play an integral role in businesses' wider digital transformation strategies.