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Executive Briefing

COMBINING PRIVATE 5G & EDGE COMPUTING: THE REVENUE OPPORTUNITY

As edge and 5G investments accelerate, operators search for the business case for these new technologies. In this report, we highlight the enterprise opportunity for operators in combining private 5G and edge, to deliver innovative and holistic solutions to enterprise customers.



Executive summary

- Operators are looking for **new services** they can deliver to their enterprise customers. If it can be done beyond the borders of their country of operation, then even better.
- A solution that combines **private 5G** connectivity with **edge computing** is one example of a new service that fits this criterion.
- By offering these technologies as part of a **bundled solution** for the enterprise, operators can ensure **operational simplicity** while delivering a **quality of performance** that cannot be achieved with existing technologies. This can both optimise existing digital use cases and unlock new ones.
- While private 5G and edge computing can be used to deliver a multitude of use cases, we focus on **five use cases within three verticals** – healthcare, ACE (architecture, construction and engineering) and retail. These use cases are good candidates as early **anchor applications** that will drive the adoption of private 5G and edge computing solutions.
- A private 5G and edge computing offering also provides an opportunity for **operators to work with partners** to provide more than just the connectivity. In taking on roles like systems integration and reselling applications, operators can become more **strategic partners** for enterprises and derive more revenues.
- We explore **three potential business models** and their associated benefits in the paper below. We also explore an **early example of this solution** in practice, developed by South Korea Telecom in conjunction with their partners Dell Technologies and VMware.

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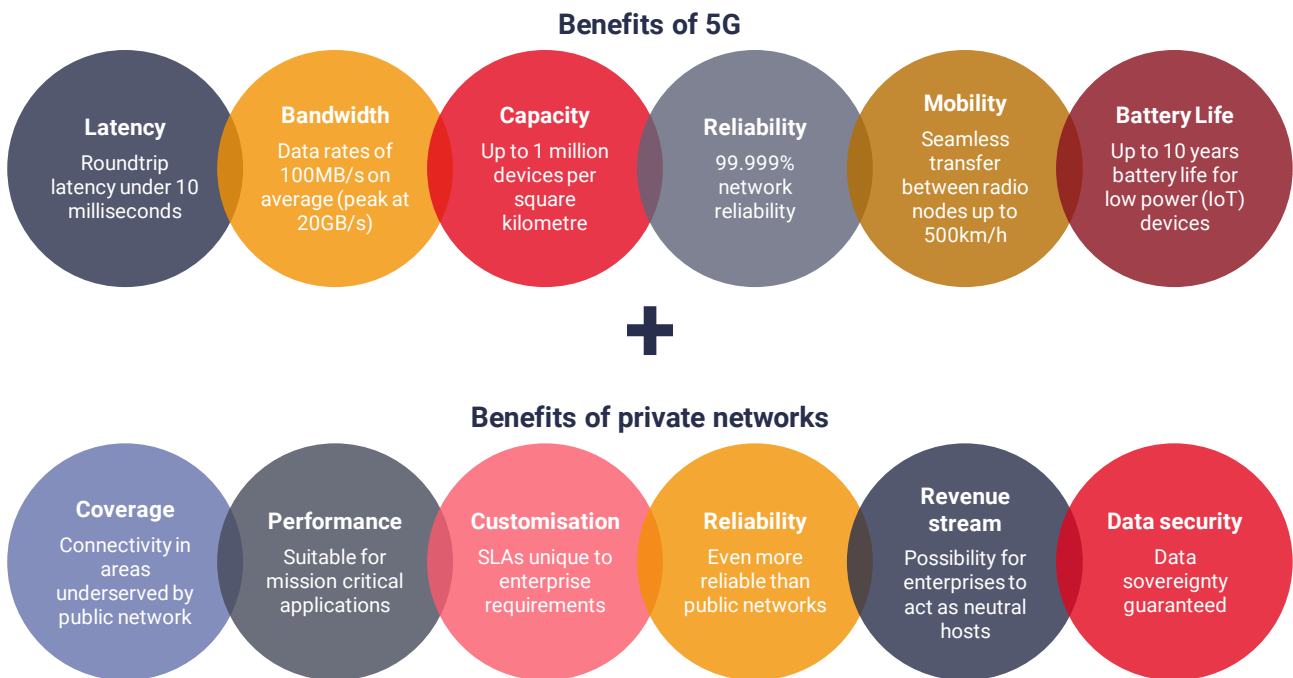
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Identifying the opportunity: proven demand for private 5G and edge computing

For most mobile operators, 5G rollout is front and centre of their strategies for 2020 and beyond. They are investing not only in infrastructure but also in the software and skills needed to build and run next-generation cloud-native networks and services. These capabilities present revenue opportunities, particularly within the enterprise space. These opportunities include:

Private cellular networking: An enterprise is provided with 3GPP connectivity for a closed-user group, which is either application-specific or for general networking. Figure 1 highlights the benefits of such a service for an enterprise, focusing on the combined proposition of private networks and 5G technology.

Figure 1: The enterprise proposition for private 5G networks is compelling



Source: STL Partners

On-premise edge computing:¹ Compute and storage to run enterprise applications is installed at the customer premises. The infrastructure and applications can be managed on behalf of the enterprise by a third party and will often involve integration into the centralised cloud. Figure 2 indicates where edge computing can provide additional value – this can be both in improving the customer experience of existing applications and enabling new applications that today cannot be delivered satisfactorily.

¹ Throughout the rest of this paper, on-premise edge computing may also be referred to as “MEC” or “MEC in a box”.

Figure 2: The value proposition of edge computing is about more than just latency

Local compute-like provides benefits like:	Cloud compute-like provides benefits like:
<ul style="list-style-type: none"> • Low latency and reliability • Reduced backhaul • Data sovereignty, security and privacy 	<ul style="list-style-type: none"> • Scalability • Light end-device • Mobility • Resilience

Source: STL Partners

Demand for edge computing and 5G private networks: addressing industry pain points

Use cases for these new capabilities can be widespread. However, it is important to evaluate these use cases in terms of the real value they can bring to enterprises, to avoid pushing technology for technology’s sake. To do this, we evaluated opportunities based on the pain points they could solve for an enterprise and validated this with a survey of more than 750 technology decision-makers.

Figure 3: Promising use cases likely to drive enterprise adoption of private 5G and edge computing were identified across three key verticals

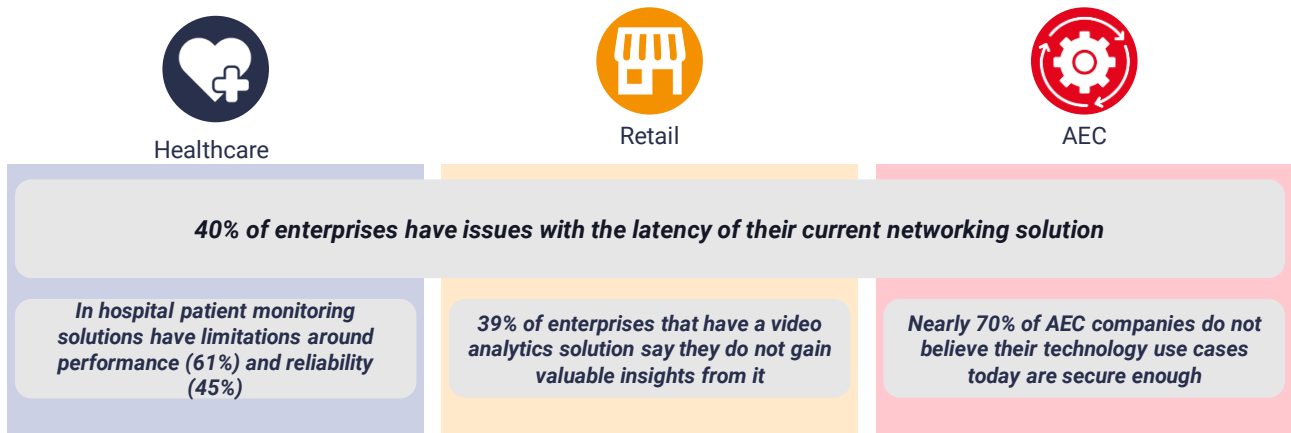


Source: STL Partners

Figure 3 indicates, from this process, which use cases presented the most promising short-term opportunity. This is not to say that only these industries and use cases can benefit from edge computing and private 5G connectivity or that 5G and edge computing will always be the best way to deliver this solution. But, we do expect the use cases above to be among the key ones, acting as anchor applications for enterprises and driving adoption of these technologies.

Private 5G and edge computing can help to improve the performance of these applications, make them deployable in new circumstances and provide a competitive total lifecycle cost of ownership for these solutions. Some of the core drivers for adopting a private 5G and edge enabled solution in replacement of how these use cases are delivered today are outlined in Figure 4.

Figure 4: The enterprise survey highlighted where there is real demand for private 5G and edge computing enabled solutions



Source: Survey with 750 industry experts, August 2020, STL Partners analysis

To illustrate the benefits edge computing and private 5G can bring, take the example of a retail store looking to derive customer insights using video cameras. Today, an enterprise may invest in several smart cameras they install throughout their shop, capable of performing some analysis of the video feeds they are capturing. Each camera is expensive and when software updates need to be provided this has to happen for each camera individually.

To get an aggregated picture of how customers move throughout the whole store, data from the cameras also need to be aggregated. One possibility would be to connect all the cameras to the cloud. This would result in the retail stores' connectivity costs being high and there are added concerns about identifiable customer data being stored in the public cloud.

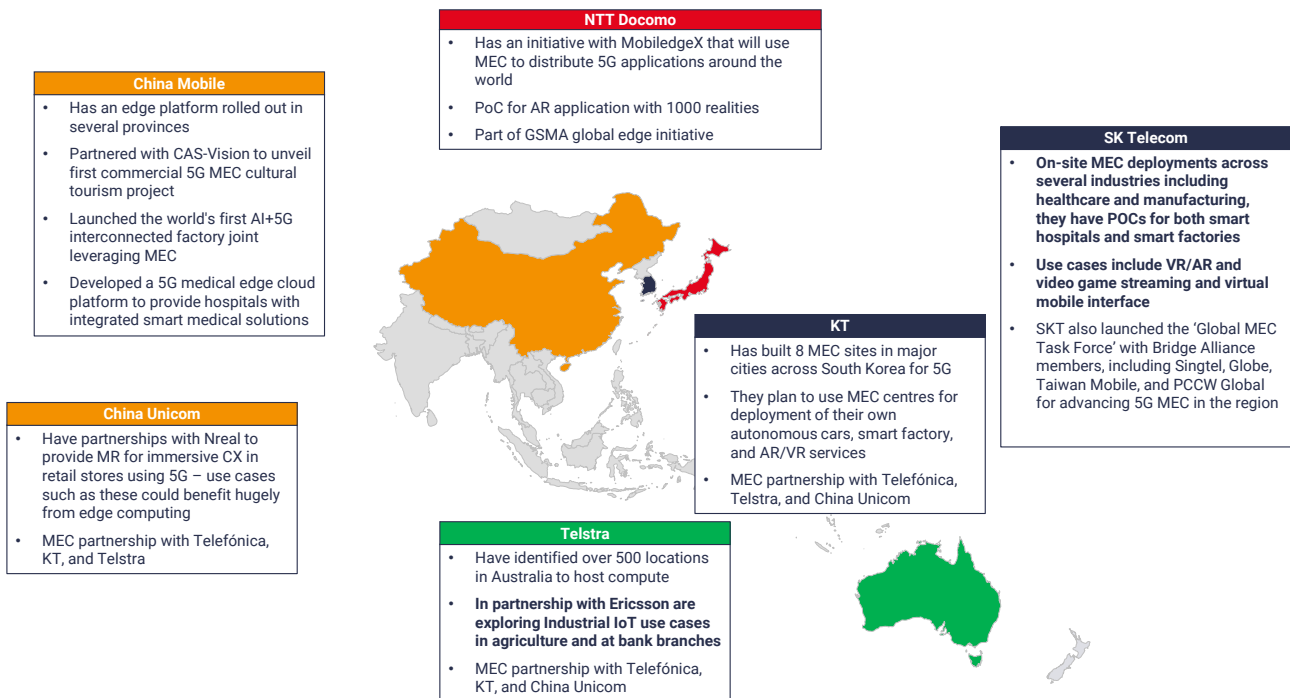
With a private 5G and edge enabled solution, very little compute needs to occur on the video camera, making them cheaper and reducing the replacement cycle. Instead, analysis of the video is streamed (via a reliable and high-performance 5G connection) to a server on the retail premises, which can aggregate the video feeds and perform the analysis.

Less data needs to be streamed to the centralised cloud (e.g. just for longer term trend analysis and storage) and all identifiable footage of customers always remains on (or very near) the retail store premises. Since the connection is a private cellular network with a dedicated spectrum, the connection can be reliable, should not suffer from congestion with other (unlicensed spectrum) networks and all security concerns can be allayed.

MEC in a box: driving simplicity and performance

The commercialisation of 5G and edge computing is here. Early movers (see Figure 5 for examples within the APJ region) report more than 2 million 5G subscribers and edge computing trials are gathering pace. On-premise edge computing (indicated in bold text in Figure 5), in particular, is maturing rapidly. Rather than deploying these technologies separately, there is an opportunity to do both at the same time; we'll explore how one operator, South Korea Telecom, are approaching this.

Figure 5: The APJ region has been aggressive in both its 5G rollout and in early examples of edge computing trials and deployments



Source: STL Partners

To address this opportunity, SK Telecom has developed a prototype MEC in a box solution for enterprises, currently undergoing proof of concept trials. In addition to providing edge computing functionality, the MEC in a box solution will also support private 5G network functions using the same hardware. A solution that combines edge computing and private networks can deliver both operational simplicity and infrastructure benefits in terms of the cost and space of the solution. These benefits are summarised in Figure 6.

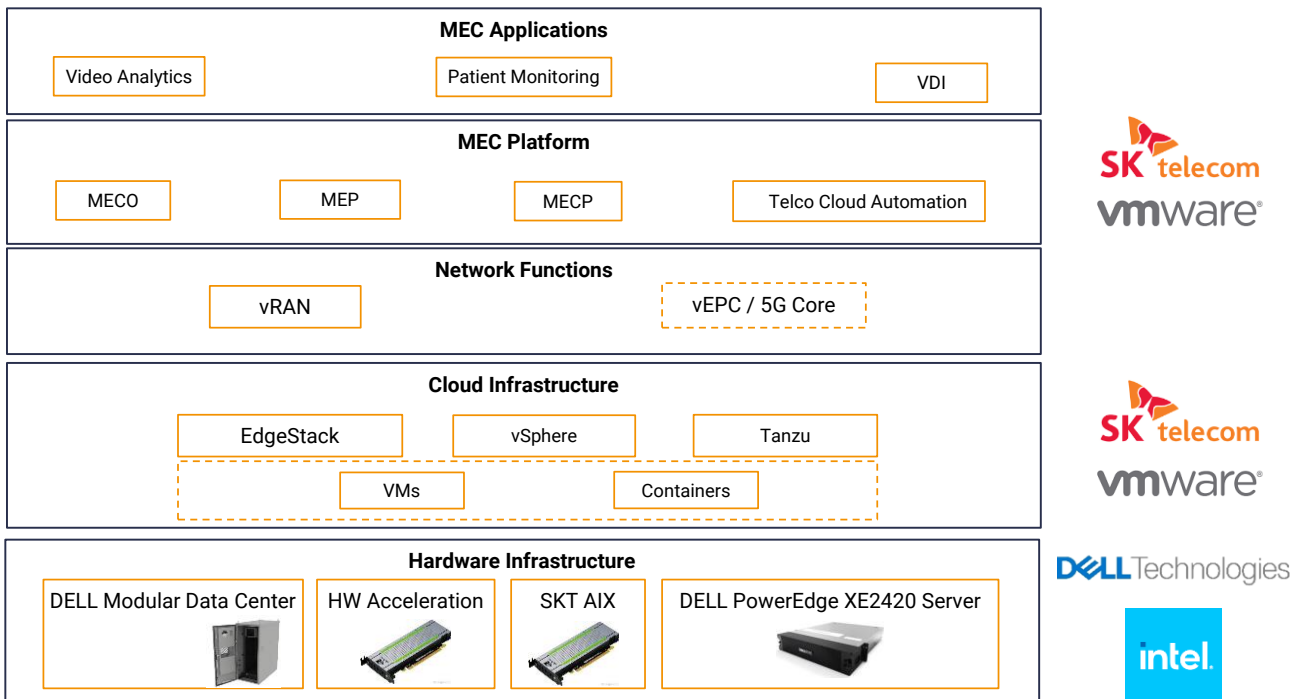
Figure 6: The “MEC in a box” solution will provide several benefits above and beyond other 5G and edge computing offerings

Simplicity benefits	Infrastructure benefits
Single supplier accountability	Improved TCO (hardware, power, cooling)
Low support needs (no enterprise IT team on-site required)	Reduced space
One standard interface	No need for data centre environment
One integration partner (plug and play)	Colocation of network and apps for performance
Easier to scale / add applications	Suitable for temporary deployments
Convergence (of bill, mgmt., customer journey)	Pre-integration of mobile connectivity

Source: STL Partners

SK Telecom has developed some of the components itself, and are working with partners Dell Technologies, VMware, and Intel. VMware’s Telco Cloud Platform will enable the solution to include both virtualised network functions and cloud native applications. Telco Cloud Automation will provide onboarding, life cycle management, and zero touch provisioning of both the MEC infrastructure and applications/services. Dell Technologies is working with SK Telecom to design and integrate the system, identify market potential and bring the solution to market. Figure 7 summarises the solution architecture.

Figure 7: SK Telecom is working with partners to develop a “MEC in a box” solution for enterprises



Source: Dell Technologies

TCO comparison: MEC in a box to reduce costs for enterprises

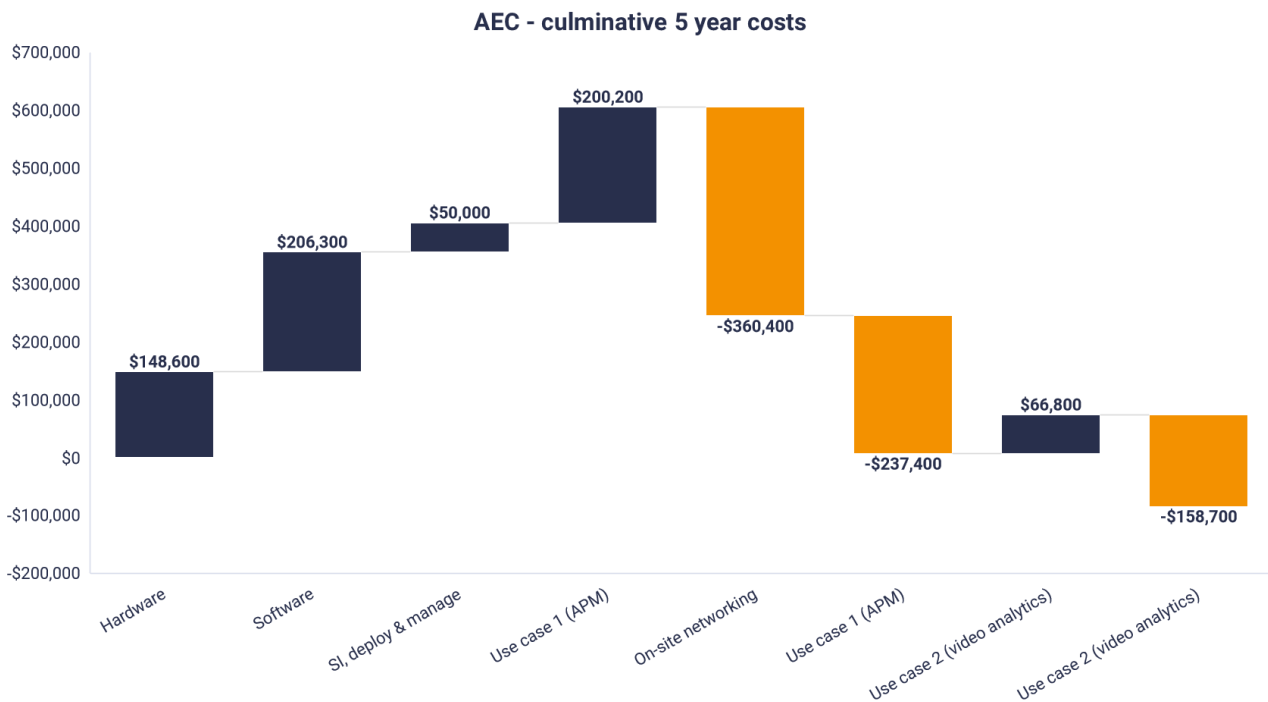
For many enterprises, the cost of the solution is critical. For example, 55% of those surveyed indicated they would be very interested in purchasing a solution for in hospital patient monitoring, but a further 37% would be interested should it prove to be more cost-effective than their existing solution. Thanks to the use of shared infrastructure, the MEC in a box solution can provide high performing applications at a competitive lifecycle cost, particularly when additional use cases are considered (see Figure 8).

The blue blocks represent the estimated cost of a MEC in a box solution, which, initially, has one use case running on it and then, in the second year, a second use case is added. The orange blocks represent what enterprises reported they spend today on their on-site networking and the same digital use cases. These orange blocks make clear there is already significant investment in these use cases. This makes them attractive for operators to look to deliver with MEC in a box technology since the business case for them does not have to be made from scratch.

By enabling the aggregation of several use cases on one platform, the enterprise customer avoids paying for bespoke point solutions for each application. This means that the benefits of leveraging the same MEC in a box infrastructure is compounded as more use cases are added.

For more information on our methodology, see: **Methodology: cost of ownership model**.

Figure 8: A MEC in box enabled solution will be cheaper for the average construction site to deploy than their traditional networking investments²



Source: STL Partners

Access technology: why use private 5G?

The above modelling compares an edge computing solution delivered with private 5G with what enterprises are spending today. It is possible to deliver an on-premise edge computing solution with other access technologies such as LTE or Wi-Fi. However, as noted in Figure 1, there are unique benefits of private 5G compared to these technologies and the industries and use cases we have selected provide a sweet spot for operators. This is primarily because of four key reasons:

1. **Private 5G technology can provide performance benefits.** Private 5G technology can provide multiple applications with their own dedicated resources and quality of service in a more flexible way than Wi-Fi, fibre or LTE technology. It can also ensure data sovereignty and security, important for industries such as healthcare where sensitive patient data must be stored and shared securely.
2. **These industries typically either don't use Wi-Fi or Wi-Fi has not been effective for them in the past.** It's difficult to make the business case to remove it in favour of a private 5G connection where Wi-Fi connectivity is effective. The case for private 5G is much stronger where Wi-Fi does not perform effectively, or it does not exist. Within ACE, for example, a new construction site will

² TCO analysed based on the following scenario: A branch of a construction site for a project lasting 36 months decides to adopt MIAB with an anchor application (use case 1). The construction company pays for the hardware up front as a one-off capex investment and then are charged on an ongoing basis for software licenses and managed services. In Y2 the site adopts a second use case.

not have pre-existing Wi-Fi or fibre infrastructure, and therefore private 5G is an attractive alternative option.

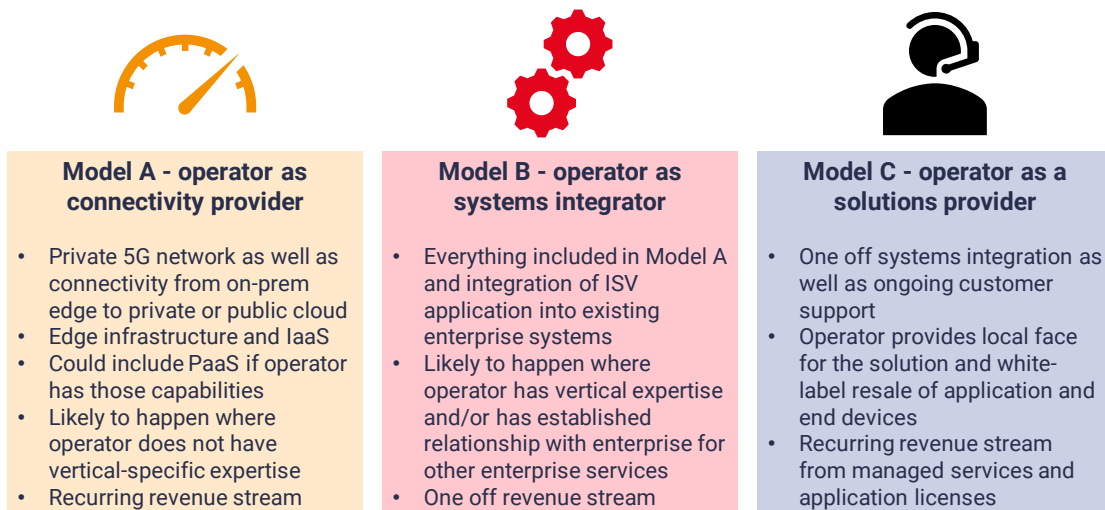
3. **Using private 5G ensures a future-proofed solution.** For enterprises concerned with cost and in an environment where no connectivity means the business cannot run, ripping out their on-site networking solution is a major issue. By choosing a private 5G solution, enterprises can feel secure that it will support future digital use cases without replacement, such as telesurgery within healthcare or autonomous guided vehicles within construction.
4. **There is a revenue opportunity for enterprises in providing a neutral host.** Enterprises who deploy private 5G may be able to offer a neutral host that can provide a revenue stream for them. For example, a hospital can deploy private 5G for use cases such as VDI or in-hospital patient monitoring and then charge an operator to leverage the same infrastructure to also provide patients within the hospital with public 5G coverage as well.

Taking the solution to market: a new revenue opportunity for operators

There are several roles that an operator can play in delivering a MEC in a box solution (see Figure 9). At a minimum, operators can provide the infrastructure for edge computing and private network software. Where operators, such as SK Telecom, have MEC platform capabilities, they can also support the management and orchestration of the edge computing applications.

Where operators have the appetite to play higher up the value chain, they may also consider offering systems integration, ongoing managed service support to the enterprise, or even reselling the application. While the MEC in a box solution does not require sophisticated systems integration for customer deployment, there may be existing enterprise systems (such as an ERP or CRM system) that would need access to data from the MEC in a box enabled applications. Operators can do this both in a one-off exercise when installing the solution, and on an ongoing basis as part of customer support and managed services role.

Figure 9: Operators can take a lead role in delivering MEC in a box to existing and new enterprise customers



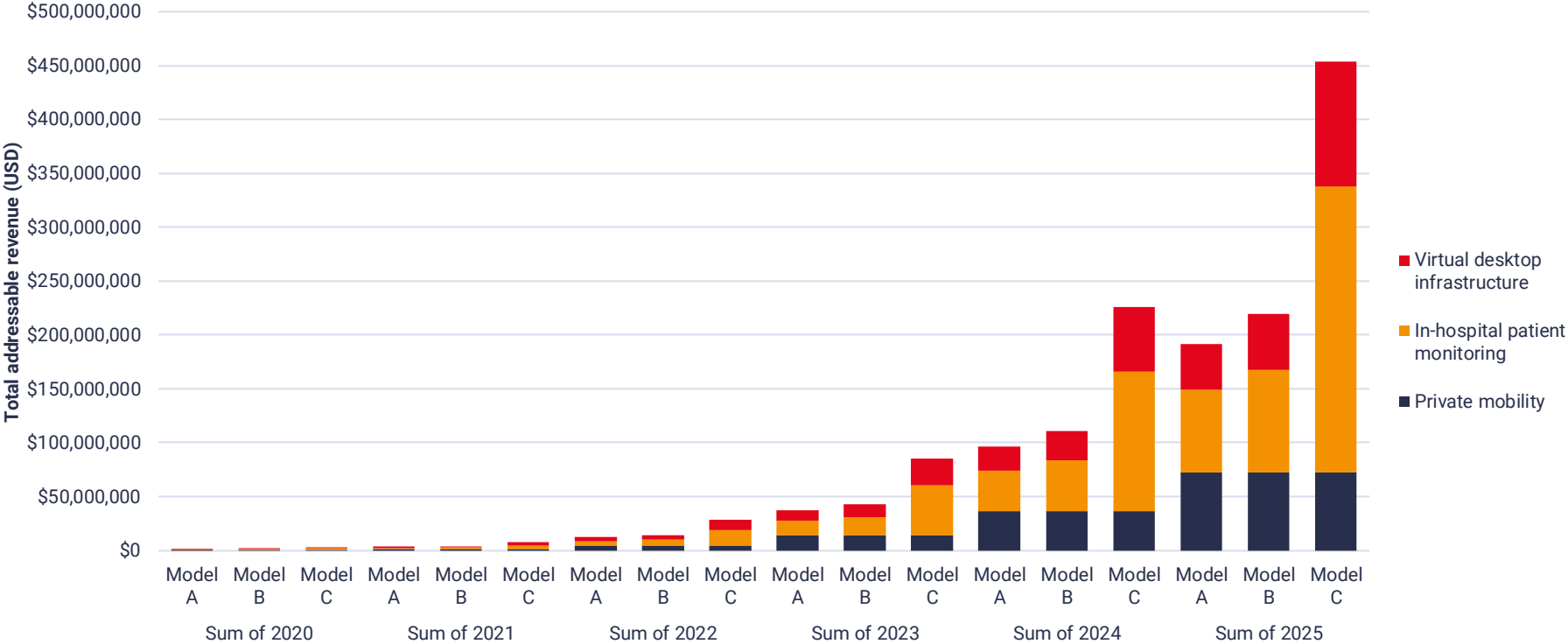
Source: STL Partners

These three models offer operators different revenue opportunities. As an example, we forecast below the total addressable revenue opportunity, for an operator delivering two healthcare use cases (in-hospital patient monitoring³ and virtual desktop infrastructure⁴) via MEC in a box infrastructure in the Japanese market.

³ This use case enables data from monitoring devices (e.g. glucose monitors) to be compiled and analysed on the hospital premises with cloud-like flexibility. Right-time notifications can be sent to practitioners of unusual changes in patient conditions.

⁴ This use case enables compute and graphics intensive processing to be moved from the PC or desktop to hosting the compute at the on-premise edge. Within healthcare, this means that staff can access applications like medical simulations or diagnostic quality image processing on tablets or small, portable laptops rather than expensive, high-end computers fixed at specific workstations.

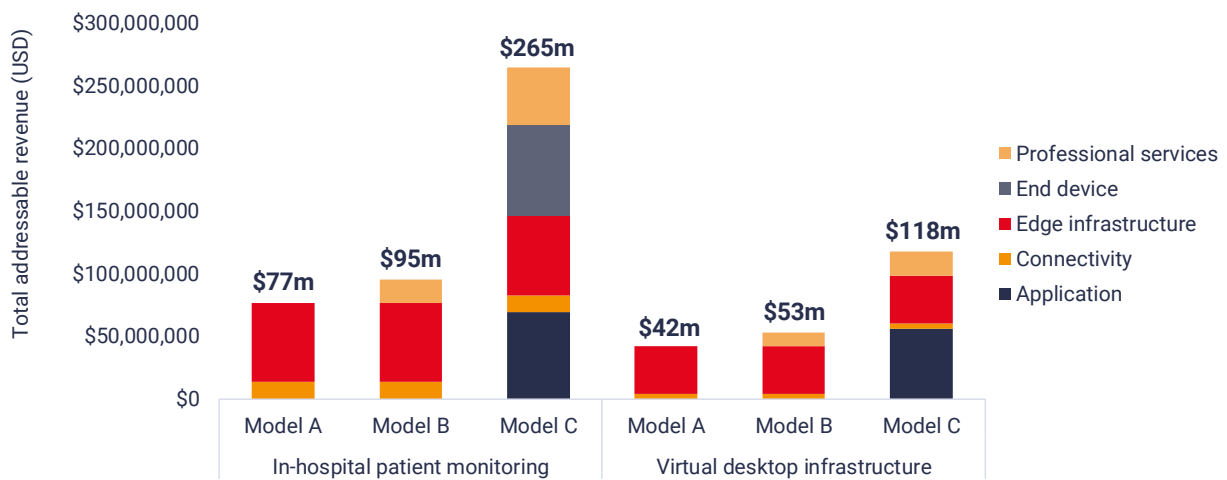
Figure 10: The estimated addressable revenue opportunity for operators in 2025 in the Japanese market is between \$191.8 and \$455.2 million USD



Source: STL Partners

The significant increase in revenues between models A and B, and model C, is driven by revenues derived from application and device resale, as well as increasing revenues from ongoing professional / managed services for the solution (see Figure 11). For example, in 2025, we estimate potential application revenues for in-hospital patient monitoring and virtual desktop infrastructure of \$69m and \$56m USD respectively.

Figure 11: Operators can derive significant revenues from application and device resale, and professional services revenues



Source: STL Partners

For operators, delivering a MEC in a box solution does not only focus on their geographical footprint. Assuming operators can partner with local operators to gain spectrum, there is no reason that operators could not serve enterprises across several markets and geographies with a private 5G and edge computing solution. This widens the addressable market that operators should consider.

While we have focused on the opportunity within one specific vertical, building the skills to deliver a private 5G and edge computing enabled solution, operators will create horizontal capabilities. For example, operators could first deliver VDI for healthcare companies and then offer this solution to construction companies doing on-site 3D CAD modelling to widen their addressable market further and increase the revenue opportunities.

Next steps for operators to capitalise on this opportunity

For operators to move forward in addressing the opportunities that edge computing and private 5G networks offers, they should:

1. **Evaluate key enterprise customers and applications that will drive the adoption of private 5G and edge computing.** In this paper, we have discussed five use cases that we believe will be key anchor applications within three verticals. Operators should evaluate the industries and use

cases within their own markets to ensure they have the best chance of disrupting existing ecosystems. Operators need to assemble a strong vision for where the best hunting ground will be. Private 5G and edge can offer unique capabilities – for example, campus environments with high data residency, coverage and performance requirements.

- 2. Establish relationships with solution providers and build the ecosystem.** Operators are unlikely to develop applications themselves, e.g., for advanced predictive maintenance. Instead, they will need to partner with solution providers who will run their applications enabled by the MEC in a box capabilities. Operators will require partners to test the solution with and may want to offer certain capabilities pre-installed and optimised for enterprises as anchor applications.
- 3. Reskill and retool sales teams to enable more solution selling.** To engage with enterprises, operators need to have a clear and informed picture of the unique challenges and opportunities within a specific vertical. Within healthcare, for example, operators will need to understand the different key players within a national healthcare system. To do this, operators will need to invest in equipping more specialised sales teams with industry knowledge.
- 4. Explore partnership opportunities to deliver private 5G networks outside of typical national footprints.** Operators should consider viable markets outside of their usual footprint where they could deliver services. This may mean establishing a relationship with a local operator or third party from whom they could lease spectrum to deliver a private network offering.
- 5. Consider the commercial models they should adopt.** A private 5G and edge computing solution will need to compete with existing solutions such as solutions that run in the cloud or solutions that rely on Wi-Fi connectivity. To compete, operators will need to ensure they can demonstrate strong performance improvements and a competitive price to push enterprises to switch.

Appendix

Methodology: prioritising use cases

Within this paper, we focused on five use cases in the Japanese, Malaysian and Singaporean markets (see Figure 3). These are not the only use cases that an operator could deliver using private 5G and edge computing technology but are some of the strongest candidates. To prioritise them, we went through the following process:

To begin, we evaluated opportunities at an industry level, ranking industries by:

- **Size of the industry:** how significant is the industry in terms of GDP contribution⁵?
- **Digitisation of the industry:** how digitised is the industry today and how aggressively is it looking to adopt new technologies?
- **Use case factor:** how many viable 5G and edge computing use cases are there within the industry?

From this we identified three key promising industries for a 5G and edge computing enabled solution: healthcare, retail, and architecture, engineering and construction (AEC).

Then we evaluated more than 40 applications at a use case level within the three prioritised verticals, using the following criteria:

- **Value to industries:** does the use case benefit industry customers and is there evidence they will invest significantly?
- **Edge factor:** to what extent is on-premise edge computing key to enabling the use case?
- **Private 5G factor:** to what extent is private 5G technology key to enabling this use case?
- **Barriers/dependencies:** are there any (technical/regulatory) barriers that will prevent the adoption of the use case?

Strongest scoring use cases across all these criteria were prioritised.

Methodology: cost of ownership model

The aim of the cost of ownership model was to establish a benchmark for what enterprises are currently spending on enterprise connectivity and digital use cases today. This was done with a top-down methodology by attaining benchmarks from 750 enterprises as to their existing IT, technology and networking spend. We have compared this with a bottom-up modelling of the cost for an

⁵ With a focus on large markets within the Asia Pacific and Japan region (APJ)

enterprise of the components needed to deliver a MEC in a box solution to support the same digital use cases. This has been done in conjunction with the partners working with SK Telecom to develop the solution, though the pricing of each element is indicative and still liable to change.

Methodology: revenue model

The revenue model was built to illustrate the overall size of the revenue opportunity for an operator in delivering a MEC in a box solution alongside some anchor digital use cases. The model outputs total addressable revenues. A single operator will take a proportion of these revenues, dependant on their market position and the competitive landscape.

The model has been built bottom-up, looking at the elements of a solution that an operator can deliver themselves and elements that they can work with partners to resell through their channels. The addressable market for the solutions has been developed using the following methodology:

- The estimated overall addressable market for enterprises who would use the use cases
- Estimated sub-section of this addressable market that would adopt an edge-enabled solution – this multiplied by the pricing assumptions for the solution gives total use case revenues
- Estimated sub-section of this addressable market that would also use private networks to deliver their edge-enabled solution – this indicates revenues derived from private mobility

The model indicates the revenues for the whole solution and does not break down the revenue share agreements or indicative costs that a telco will need to have with their partners.

Assumptions were derived from a survey to 750 enterprises in the Japanese, Malaysian and Singaporean markets, as well as an interview programme with solutions providers delivering the prioritised use cases.

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