Modular telecom data centers: A win-win in a rapidly evolving market

DELTA

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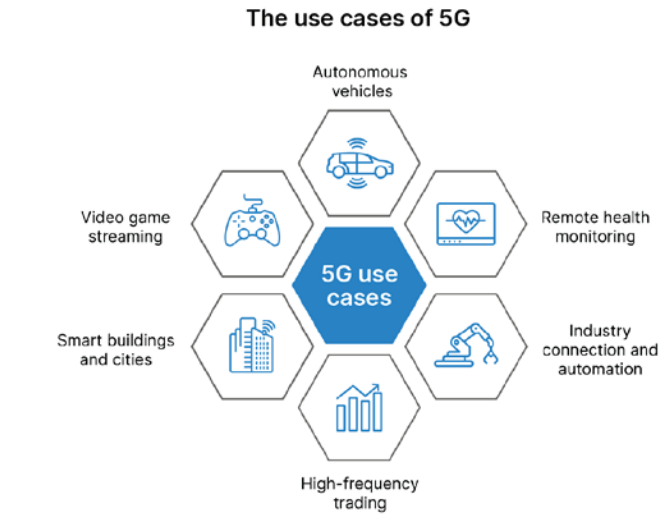
Executive summary

The telecom sector is evolving rapidly as traditional telecoms and IT networks merge and new business opportunities arise.



Used to building infrastructure that would last 30 years, the sector is now faced with fast-evolving technologies, unpredictable demand patterns and new use cases. A perennial struggle to rein in costs and a cross-industry drive toward greater sustainability and lower emissions are also adding to these challenges.

Against this backdrop, data centers (DCs) play an ever more pivotal part in enabling the content, mobile and cloud services needed for network operators to stay competitive. With increasingly complex network architectures, telecom DCs are being deployed in more diverse environments and have unique needs to fill.

The standard “brick-and-mortar” approach to DC construction can neither keep up with the pace of innovation nor offer the flexibility operators require from their infrastructure.

In this white paper, Delta discusses the benefits of prefabricated, modular DCs when building or extending network capacity, to minimize time-to-market and maximize return on investment.

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Section 1 - Introduction

A staggering 181 zettabytes of data will be created, captured, copied and consumed worldwide in 2025 - almost twice as much as in 2022.[1]

The major drivers for these skyrocketing volumes are the proliferation of internet-of-things (IoT) services and the expansion of mobile connectivity and cloud services, culminating in the rollout of 5G mobile networks.[2]

These - along with future 6G network technology[3] - will enable some of the most sophisticated applications we have ever seen, especially as high-band services in the millimeter wave spectrum come online. Providing connection speeds of 3Gbps and more, this will enable low-latency services such as self-driving cars, high-frequency trading, virtual reality and real-time streaming.

Global trends in digital and energy indicators, 2015-2022

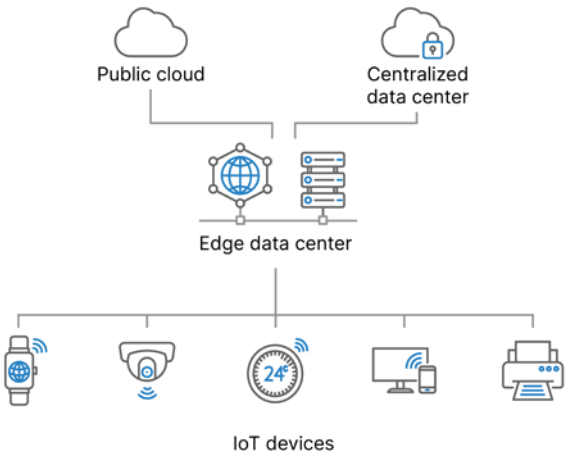
	2015	2022	Change
Internet users	3 billion	5.3 billion	+78%
Internet traffic	0.6 ZB	4.4 ZB	+600%
Data center workloads	180 million	800 million	+340%
Data center energy use (excluding crypto)	200 TWh	240-340 TWh	+20-70%
Crypto mining energy use	4 TWh	100-150 TWh	+2300-3500%
Data transmission network energy use	220 TWh	250-360 TWh	+18-64%

[1] Statista, [2] Mobile Magazine, [3] TechTarget

But as the complexity of infrastructure and services increases, data processing requirements skyrocket. This has led to telecom DCs sitting at the heart of network build-outs, handling content and service-related data as well as juggling ever-growing amounts of network resource data.

In addition to ever-expanding hyperscale DCs, smaller and micro-edge data centers (EDCs) are emerging to manage network resources and content closer to the customer. or next-generation network expansion.

Where an edge data center sits



EDCs are caching points between users and larger DCs.[4] They reduce latency by shortening the time it takes to transmit and process data compared to sending it to a larger DC further afield. By the same token, EDCs also contribute to offloading backhaul network capacity.

They must be located close to network base stations to achieve this accelerated turnaround. As 5G base stations provide higher frequencies and transmission speeds over a smaller coverage area, there will be more of them compared with previous generation networks.[5] As a result, more EDCs will be required and in more diverse locations than brick-and-mortar DCs - from city rooftops to remote tower sites.

Add to this the enduring need to scale network capacity quickly, flexibly and cost-effectively, and deploying prefabricated modular DCs (MDCs) emerges as the most efficient solution for next-generation network expansion.

[4] Delta Electronics, [5] Tech Target

Section 2 - The benefits of a modular approach

Modularity is more important than ever in the rollout of advanced fiber and mobile networks, both in conventional DCs and at the network edge.

This provides the agility and flexibility that network operators need to adapt to a rapidly changing market.

2.1. Addressing cost and competitive pressures

Telecom operators face a series of interconnected competitive challenges.

To start with, they are under pressure to expand networks at speed to accommodate traffic growth. This has always meant striking a fine balance in both financial and practical terms. However, deploying a much larger number of base stations and DCs in a wider range of locations - not all of them easily accessible - has raised the bar even further.

At the same time, network operators have to future-proof their infrastructure. The technology they select must be scalable and capable of catering to variable demand patterns depending on location, time of day and an ever-evolving range of use cases.

Further complicating matters is the perennial issue of financial constraints, a high level of economic uncertainty, continued industry consolidation and pressure to make network operations more sustainable.

Prefabricated MDCs are key to achieving the speed, flexibility and cost efficiency that network operators need under these circumstances.

2.2 What does a prefabricated telecom MDC look like?

Prefabricated DCs for telecom applications come in a range of sizes, depending on the characteristics of the cell site they are supporting.

All offer pre-integrated power systems, racks, cooling and environmental management systems, based on the operator's specific requirements. They are also fully tested before shipping, saving valuable time typically spent on testing at the installation site.

Examples include:

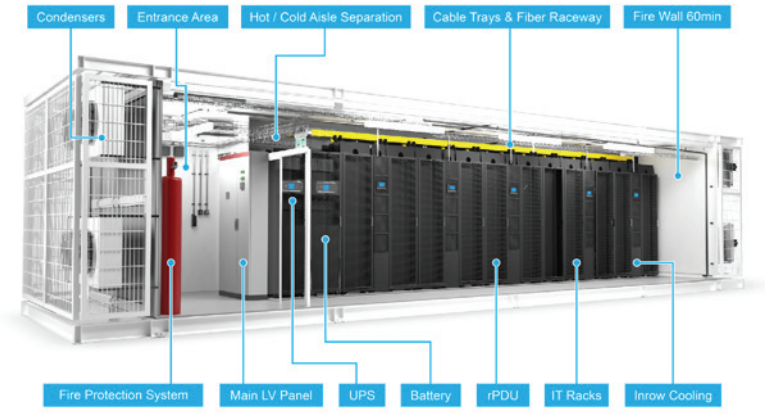
A.

Micro or single-rack DCs such as Delta's Xubus Edge solution come with fully integrated sub-systems. These include uninterruptible power supplies, cooling, power distribution, fire control, wiring, airflow management and intelligent monitoring.[6] The small footprint of these DCs enables fast deployment within a limited space.[7]

B.

Modular Data Centers

- **Single-module DCs, such as Delta's Xubus Node, are containerized, all-in-one DCs** offering an all-integrated, plug-and-play approach that can be deployed rapidly. They are ideally suited to 5G and edge applications that require installation at numerous locations, like tower sites.[8]



- **Modular data centers** enable network operators to build any size of DC by connecting individual modules to form larger DCs. Each DC is custom-designed to clients' specifications and the specific network function they are deployed to support. They are easy to scale as traffic increases at a particular cell site, as additional modules can be added as required (see Case Study Bouygues Telecom).

[6] Delta, [7] Delta, [8] Delta

Case study: Eurofiber - MDCs support flexibility for a fiber-optic network operator

Eurofiber is a leading operator of open digital infrastructure in Benelux and the North of France. Headquartered in the Netherlands, the company's fiber network is more than 70,500 kilometers long and is extended by 50 kilometers every week.[9]

To maintain optimum connection speeds throughout its network, even as it expands, Eurofiber uses inline amplifiers (ILAs) to boost signal strength. An ILA is typically placed every 75 kilometers. Among the technical solutions used in conjunction with the ILAs are Delta's Xubus Nodes.

Xubus Node is a modular data center (MDC) characterized by high performance and a high grade of mobility, which can be deployed quickly and easily in standardized containers of various sizes. This includes sites where the supporting infrastructure is not fully in place but computing power is required. Xubus Node comes in five different configurations based on the required IT workload. In addition to fiber networks, they are also frequently used in the expansion of 5G networks.

For the expansion of Eurofiber's fiber-optic "highway" between Amsterdam and Brussels,[10] Delta rolled out a custom-designed version of its Xubus Node, optimized to provide the lowest possible operating costs.

In addition to streamlined UPS modules and a highly energy-efficient ceiling cooling system, Delta integrated a rooftop solar system to enhance energy efficiency.

A smart access control system for doors and racks controlled via mobile phone created further efficiencies. It means Eurofiber can manage access to its many DC sites remotely, without the need for on-site staff.

Delta's DCIM (Data Center Information Management) system allows Eurofiber to monitor their data centers (DCs) centrally in real-time, including their power consumption and fault and fire monitoring.

The turnkey solution Delta designed and rolled out provides Eurofiber with a tailor-made ILA DC that combines high performance with great stability, reliability and flexibility as its network continues to expand at speed.[11]

[9] Eurofiber, [10] Delta Electronics EMEA, [11] Delta Electronics EMEA

Section 3 - The benefits of prefabricated modular telecom data centers

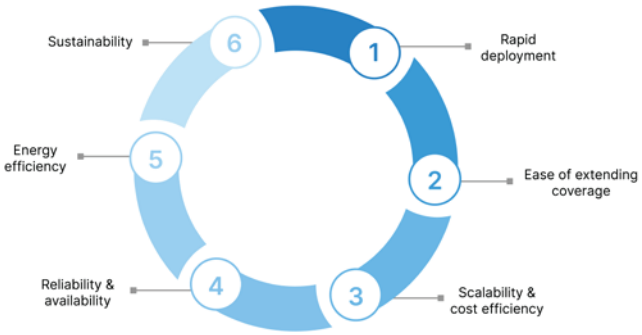
Modular DCs are designed to address variable telecom operator demands across the network in several ways.

Rapid deployment

With standardized, pre-integrated components, MDCs can be built and tested to an operator's specifications before shipping. In this way, the rollout can be sped up compared to traditional brick-and-mortar DCs. An additional advantage is that less labor and fewer contractors are required on-site as the DC arrives ready for a plug-and-play installation.

The result is faster time-to-market: while a conventional DC takes between 18 months and two years to build, prefabricated MDCs can be installed in much less time.

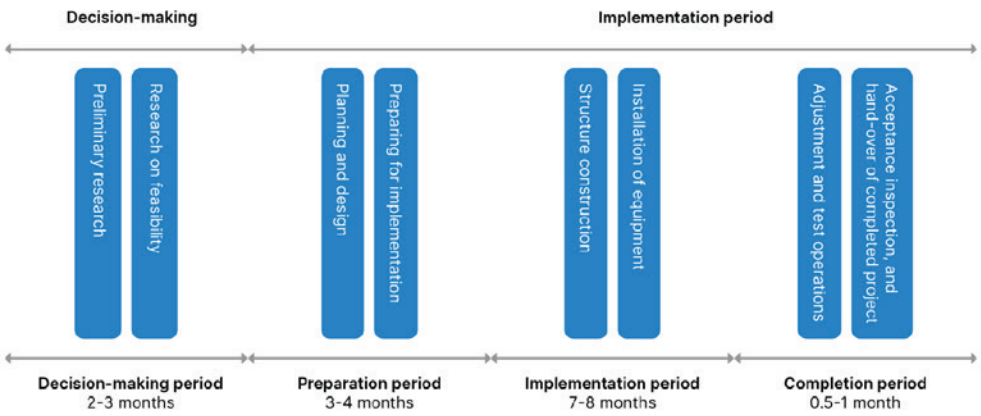
How modular DCs meet variable demands



This acceleration can amount to a huge competitive advantage, for example, by enabling operators to accommodate traffic surges more readily. To meet extra demand - such as in the wake of a marketing campaign - they can simply add more MDC units quickly and flexibly.

At the same time, operators don't have to compromise, as prefabricated MDCs still enable a high level of customization to meet the specific requirements of each cell site.

Typical construction period of data centers



Ease of expanding coverage

The speed and flexibility of rolling out a prefabricated MDC means operators can more easily deploy them in different locations where optimized network performance and reduced latency are required.

For example, a content delivery network might install MDCs close to end users around the country to deliver content more readily while reducing the load on centralized DCs.

Netflix has installed edge DCs around the world so that its customers can stream content from local servers rather than from its central servers in the US. This means less content buffering and a better viewing experience, while also saving on international bandwidth to facilitate worldwide access to US servers.[12]

Scalability and cost efficiency

For any network operator or content service provider, predicting how demand and service take-up might evolve is like looking into a crystal ball. Deploying MDCs can generate significant cost savings because they enable a pay-as-you-grow approach to network expansion.[13]

Operators can add standardized MDC building blocks as traffic increases, growing their infrastructure incrementally, in line with revenues, rather than over-provisioning at the outset. This means avoiding unnecessary costs and minimizing large capital investments while enabling operators to expand and contract capacity flexibly by adding or removing modules.

MDCs removed at one site can easily be transported and connected up at another cell site to accommodate changes in demand patterns.

[12] TS2, [13] Delta Electronics

Reliability and availability

"Five-nines" has been the expected standard in telecoms going back to the days of big, monolithic networking equipment that took up entire buildings. The term refers to 99.999% uptime,[14] typically measured over a year. This target for reliability and availability still very much applies in modern virtualized networks that run on cloud infrastructure. And it's not just an ambition, but something fixed in service-level agreements with enterprise customers.

As DCs move further out in the access network, sometimes into very remote and hard-to-reach locations, ensuring reliability becomes more important than ever. Remote locations make repair and maintenance "truck rolls" more cumbersome and costly, therefore load-balancing and shifting workloads automatically from one module to another when a fault occurs are particularly important to consider.

[14]TechTarget

Energy efficiency benefits

Like any other business, telecom network operators are under increasing regulatory pressure to improve energy efficiency and lower CO_2 emissions. Many also set themselves ambitious emission reduction targets.[15]

Today, DCs and data transmission networks are responsible for up to 1.3% of final energy demand and 1% of energy-related greenhouse gas emissions.[16]

Electricity to power and cool servers is a significant contributor to this. That said, the sector's strong efficiency improvements mean its energy needs have grown only moderately since 2010 despite rapidly rising demand for DC services.[17]

However, the advent of next-generation mobile and fiber networks and the proliferation of DCs could change this.

While 5G technology is inherently less power-hungry than previous "Gs", operators could see as much as a 140% increase in energy use because of expanding data volumes and the larger number of cell sites required.[18]

Prefabricated MDCs' cooling and power management technologies are tailored to and optimized for their intended use from the point of manufacturing, so energy savings are built into the design.

Sustainability

We will also see more and more MDCs using renewable energy and other low-carbon forms of energy to reach net-zero emissions by 2050. By their very nature, MDCs help avoid overengineering the size of a data center, ensuring that both costs and energy usage are kept low and additional capacity can be added when needed.

[15] Financial Times, [16] International Energy Agency, [17] International Energy Agency, [18] Financial Times

Case study:
France telecom fiber network expansion

Before selling its fiber network assets in France to a telecom infrastructure specialist, a French multi-service telecom operator worked with Delta to expand its edge network infrastructure for 5G deployment.

At one of the first sites, in Southern France, Delta helped the telecom giant set up a prefabricated modular data center (MDC) as a model to be replicated across the whole of France.[20]

Choosing a modular design meant it could be completed a year faster than a traditional brick-and-mortar data center (DC).

The MDC units were manufactured in Croatia, at Delta's center of expertise for modular DCs. The on-site team also pre-tested and pre-assembled most of the systems, minimizing efforts on-site in France.

Thanks to the modules being pre-integrated, Delta was able to work with local contractors in France to deploy the DC, rather than bringing in an installation team from Croatia.

Taking the pre-fabricated approach also reduced the number of suppliers Bouygues needed to work with, as very little physical construction work had to be undertaken. Along with reducing the complexity of managing the project, this approach also led to quality improvements.

[19] Cellnex.com, [20] Delta Electronics

Conclusion

Technology is only one of the challenges facing the telecom sector. With more market consolidation expected and competitive pressures unlikely to abate, making flexible infrastructure investments and decisions will continue to be vital for telecom network operators.

The high level of agility that can be achieved with modular approaches, such as those offered by prefabricated MDCs, enables operators to respond more effectively to a fast-paced market and technology environment.

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