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How MTDCs Can Help Address Today's Data Center Power Challenges

Data center operators often take different approaches to network design and platforms. However, every operator, regardless of size, has one thing in common: power—how to get it and how to conserve it.

For the first time in the history of the data center industry, the ability to deliver power to the right place and at the right price can no longer be guaranteed. In fact, the decision of where to build the data center is governed as much by these external factors as the operator's business strategy. Let's explore three primary factors that can challenge a data center's plans when it comes to power and examine the role of multi-tenant data centers (MTDCs) in addressing those challenges.

Power supply constraints

In a 2022 earnings conference call, Andy Power, president and CEO of Digital Realty—the world's largest MTDC—revealed that a primary electricity provider in northern Virginia had warned customers of a bottleneck in eastern Loudon County that could delay deliveries until 2026.[1] The issue was not reported as a power generation problem but rather a lack of transmission lines to carry the power required.

Sometimes, the forecasted demand for data center power is enough to prompt governmental action. Following alerts from energy providers, the Office of the Mayor of London (UK) published a briefing paper describing a rapid influx of requests for new electricity connections throughout West London. Most new requests were from data center operators seeking to co-locate adjacent to fiber-optic cables that pass through the region along London's M4 corridor, home to many high-tech companies and one of the largest digital tech workforces in the country.

According to the Mayor's office, "Data centers use large quantities of electricity, the equivalent of towns or small cities, to power servers and ensure resilience in service. The scale of electricity demanded by these data centers has created capacity constraints on both the distribution and transmission networks in the region, absorbing remaining electricity capacity in…(the) West London region for the remainder of the decade…major new applicants to the distribution network, including housing developments, commercial premises and industrial activities, will have to wait several years to receive new electricity connections."

Politics at hand

Recently, Ireland has become a hotbed for data center building activity. Their success is something of a double-edged sword. From 2015 to 2022, the power consumed by data centers in the Republic of Ireland (5,200 GWh) increased by 400%, representing 20% of all power generated in the country in 2022.[2] The Irish government must balance its leading position in the global data center industry with its responsibility to supply energy to its citizens and protect the environment. Politicians from multiple sides within the Irish parliament are therefore exploring what can be done and what part it should play in regulating data center builds to ensure sustainable, abundant power—including suggestions such as capturing the potential of renewable energy sources like offshore wind and implementing moratoriums that require strategic review before granting approval for and connecting new data centers.[3, 4]

Annual energy consumption per end-user category (TWh), 2016-30

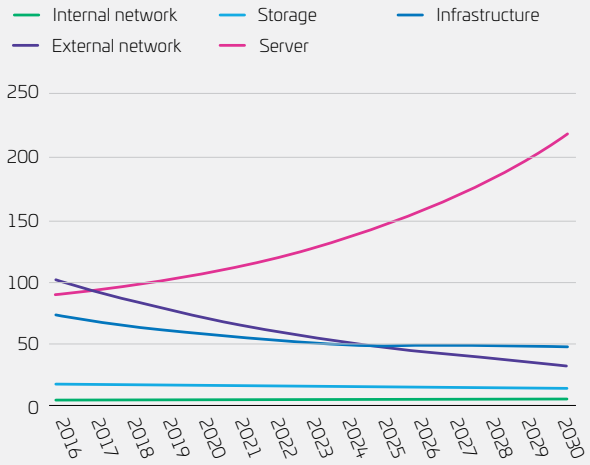

Figure 1: Annual global data center power consumption. Source: Techmonitor

Figure 1 illustrates the trajectory for data center power consumption globally, particularly server power consumption—clearly supporting the need for highly efficient data center designs as a key instrument to keeping federal regulators onside.

In Eastern Europe, the political decisions that have led to the current conflict in Ukraine have had a huge impact on the data center industry in the region. Many Eastern European countries had previously benefitted from their geographic locations at the confluence of the West, Russia and Asia. Those governments are now having to revisit their "raison d'etre" in the digital economy.

At the same time, the Russian/Ukrainian conflict has significantly disrupted the distribution and pricing of the natural gas and oil upon which much of Eastern and Western Europe has relied. Prior to Russia's invasion of Ukraine, much of Europe's demand for gas and oil was filled by Russia. Since the invasion of Ukraine, natural gas prices have increased dramatically. Before the war, Germany, which was sourcing half of its natural gas and around one-third of its oil from Russia and had some of the highest energy prices in Europe, saw energy prices rise even further. Sanctions applied by both sides have resulted in Germany looking to other methods of generation and energy supply, leading to further cost increases for homes and businesses alike.

Figure 2 shows the sudden and dramatic increase in the commercial prices of natural gas across the European Union (EU). Interestingly, the upward trend in the EU's natural gas prices pre-dates the onset of Russia's aggression against Ukraine by about a year. Since the last quarter of 2022, energy prices have stabilized due to a combination of government intervention and supply chain efficiencies.

Development of natural gas prices for non-household consumers, EU, 2008-2022 (€ per kWh)

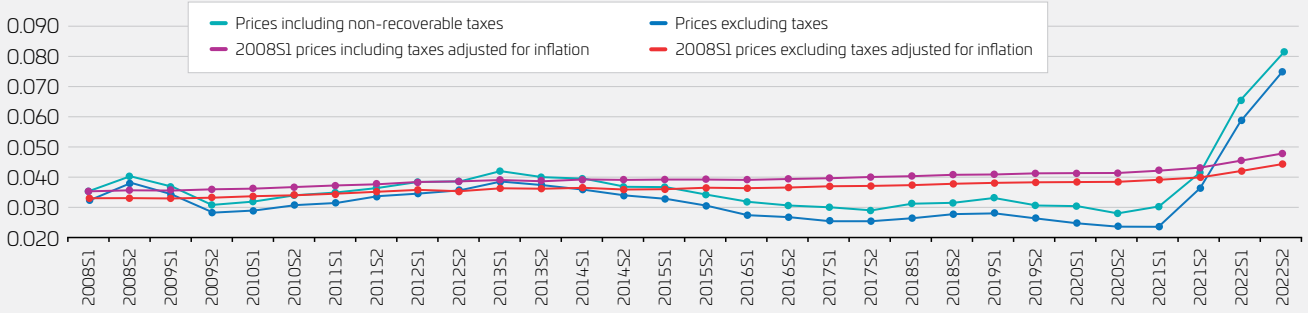

Figure 2: EU natural gas prices for non-household consumers, 2008-2022. Source: Eurostat

Social demography impacts

The third and final external lever affecting power availability and affordability for data centers is a shift in the world's population centers. With regard to choosing optimal data center locations, conventional business thinking says go after the low-hanging fruit first. For many years, that meant investing in a select number of markets in the United States and Western Europe. The U.S.— with its large middle class, high disposable income and relatively few high-density metro areas—represented the easiest pickings. It also offered data center operators the conveniences of a common language, regulatory system, supply chain routes and a history of delivering large-scale CapEx builds.

The European market was a bit more complicated but hardly impregnable. The idea was to start with Tier 1 cities, where power is readily available. The challenge was navigating the different national governments, local business practices and languages. But given that Western Europe is home to a large middle class and a multitude of well-financed international corporations, the reward was worth the effort. However, the cost of land and power in these European cities commands a high premium from data center builds. Instead of focusing on a few key high-value Tier 1 cities, data center operators have had to widen the search and settle for Tier 2 locations like Madrid, Marseille, Milan, Zurich, Berlin and Stockholm. This adds more intra-continental complexity with the need to manage operations across four additional countries and power grids, as well as three more languages.

While it is easy to intellectualize the complexities of adding a large data center to an operator's existing portfolio, it can be difficult to truly grasp the challenges awaiting hyperscale and cloud providers looking to grow their footprint. Tables 1 and 2 help put the issues in context. Table 1 shows the population and MTDC power available in the world's seven strongest economies—the G7. In these prime markets, the average MTDC power demand per million people is a whopping 48.7 megawatts (MW). This is the IT power load required to support a world-class digital economy.

Table 2 compares the same metrics for some of the fastest-growing markets in Asia, which also happens to be the fastest-growing MTDC region. Even with Singapore and Australia positively skewing the metrics for the region, the average IT load per head of population among those seven countries is less than one-tenth of that of the G7 countries.

Based on these and other findings from across the APAC region, it is clear that localized growth in data, population and 5G delivery demand is outpacing growth of data center capacity. This suggests

that aggressive build initiatives—at both the government and private levels—are needed if data center capacity is to keep pace with the population and demand for more data.

The APAC region offers an attractive upside for new data center construction from a population and cost standpoint. It is also highly challenging. As difficult as it is to move a new-build project from the U.S. to Tier 1 and Tier 2 European cities, consider how much more challenging it is to try and deploy that same capacity in a country where power generation and supply are underdeveloped and where there might not be enough water supply to support a rapidly expanding local population.

G7 Country	Population (Millions)	Data Center Market Size	Data Centre MW's/Population
USA	335	26,000	77.6
Japan	125	3,600	28.8
Germany	84	2,000	23.8
France	68	1,500	22.1
UK	67	3,000	44.8
Italy	59	500	8.5
Canada	40	1,300	32.5
Total	**778**	**37,900**	**48.7**

Table 1: Available MTDC power for G7 countries. Source: 451 Research and CommScope

APAC Country	Population (Millions)	Data Center Market Size	Data Centre MW's/Population
India	1,392	1,700	1
Indonesia	278	600	2
Philippines	111	300	3
Vietnam	100	315	3
Malaysia	33	600	18
Australia	26	1,100	42
Singapore	5	1,000	200
Total	**1,945**	**5,615**	**3**

Table 2: Available MTDC power in Asia. Source: 451 Research and CommScope

The role of the MTDC

Given the costs and uncertainties inherent in local power supplies, political instabilities and shifting demographics, data center operators are rethinking their vertical integration strategies and the wisdom of building their own facilities. This is particularly true of organizations in which the data center is a support function as opposed to the primary revenue generator (think soft-drink manufacturer versus cloud service provider). As a result, more cloud-based and hyperscale operators are opting instead to partner with MTDCs that have existing capacity around the world.

In many ways, this new partner model offers more benefits than challenges. MTDC operators are real estate savvy and are optimized to satisfy tenants' evolving demands for world-class white space and reliable and affordable power. Perhaps more importantly, MTDC facilities are located in prime metro areas—perfect for cloud-based and hyperscale operators that need to support low-latency and ultra-low latency mobile edge compute instances for 5G, Industry 4.0 and IoT applications. Best of all, these facilities already exist, enabling larger data centers to roll out services quickly and easily with a high and faster return on investment. Figure 3 below illustrates how the servers, and therefore the whole operation, can be spread across a multitude of locations in an effort to provide edge computing. MTDCs play a part in supporting this rollout.

To ensure the operations at various MTDCs fit their intended purposes and can be interconnected as needed, a structured base build must be planned at the start of the project; this is especially true when external factors dictate siting the MTDCs across a campus, city or region. Industry standards can provide valuable guidance for designing data center infrastructure during the base build process, including the North American ANSI/TIA-942 Telecommunications Infrastructure Standard for Data Centers and the European EN-50600 Standard for Information Technology - Data Centre Facilities and Infrastructures. These standards cover aspects of design, cooling systems, security and sustainability—providing a solid framework to ensure that MTDCs meet the requirements for redundancy, availability and interconnectivity. Both standards specifically deal with telecommunications cabling throughout the data center and the different key zones.

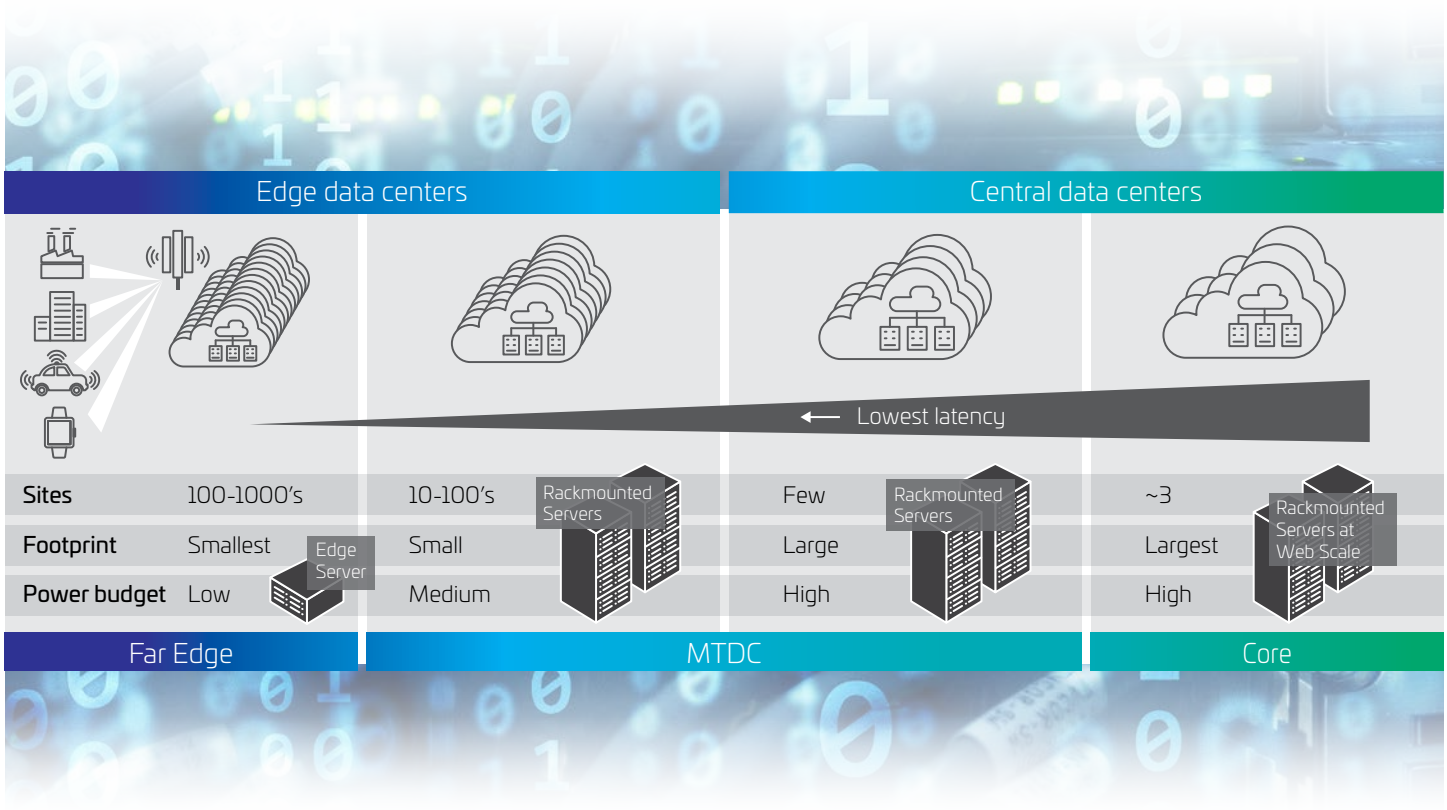

Figure 3: Server distribution to support edge computing. Source: Nokia, 2023

As shown in Figure 4 below (from left to right), the key functional areas of an MTDC are:

- **Building entrance facility (BEF)** and premises entrance facility, which serve as transition points for external fiber and copper cables entering and exiting the MTDC. Transitions from the external cable to the internal cable are made with an appropriate optical fiber.
- **Meet-me rooms (MMRs)** host the carrier equipment and cabling and distribute the cabling throughout the rest of the MTDC.
- **The floor distribution area/intermediate distribution frame (FDA/IDF)** enables local floor-level flexibility between the MTDC structured cabling and the customer's cage.
- **The main distribution area (MDA)**, also known as a "demarc" or "demarcation point," is typically the last handover from the MTDC network to the customer's cage or hall. From here to the equipment distribution area (EDA), the customer will have control of the network, and the operation will appear to be more like a typical data center operation. Note that all cabling paths are fully redundant, with A and B cabling paths.

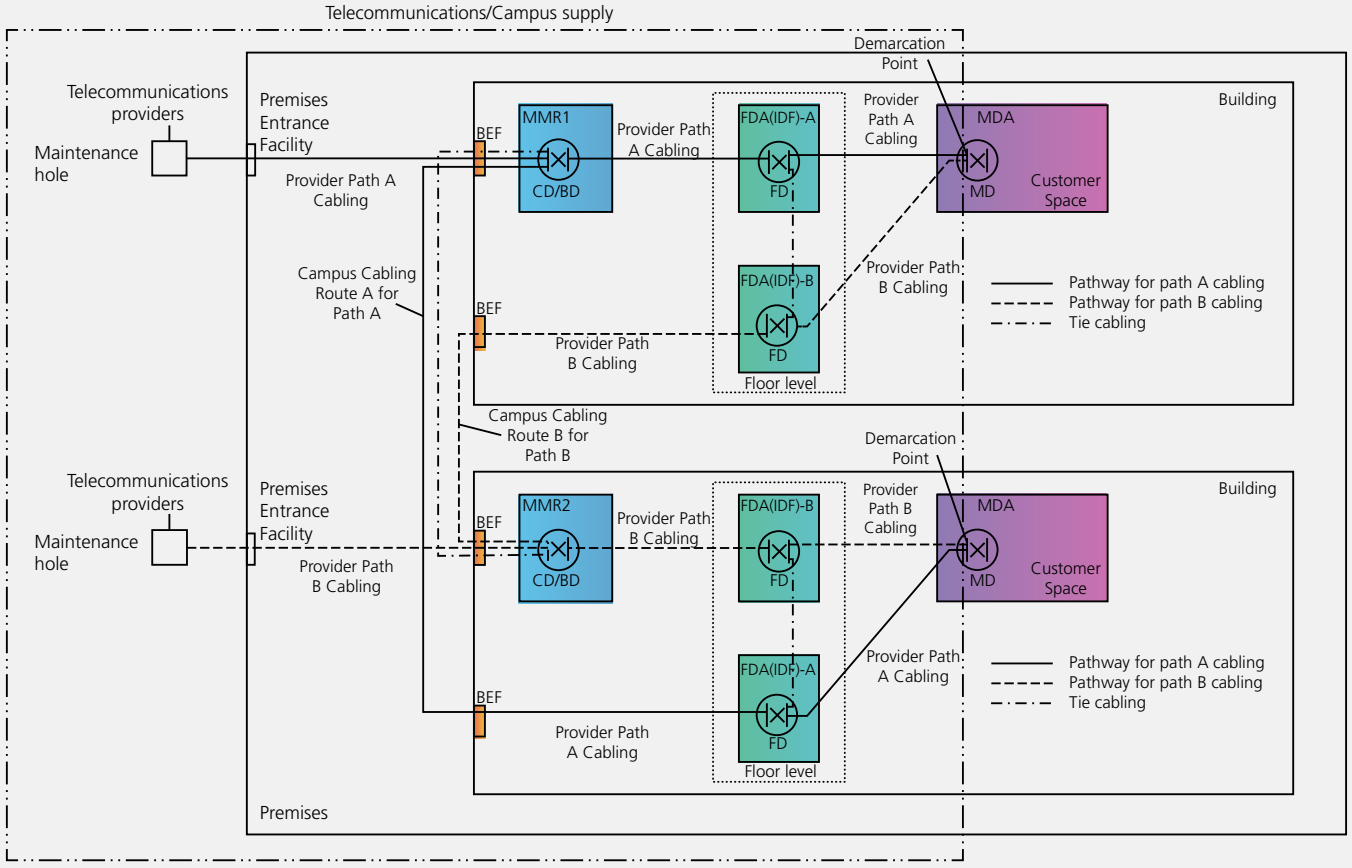

Figure 4: Key functional areas of an MTDC

Figure 5 below shows some of the core infrastructure components and where they can be found across the various functional areas of the MTDC.

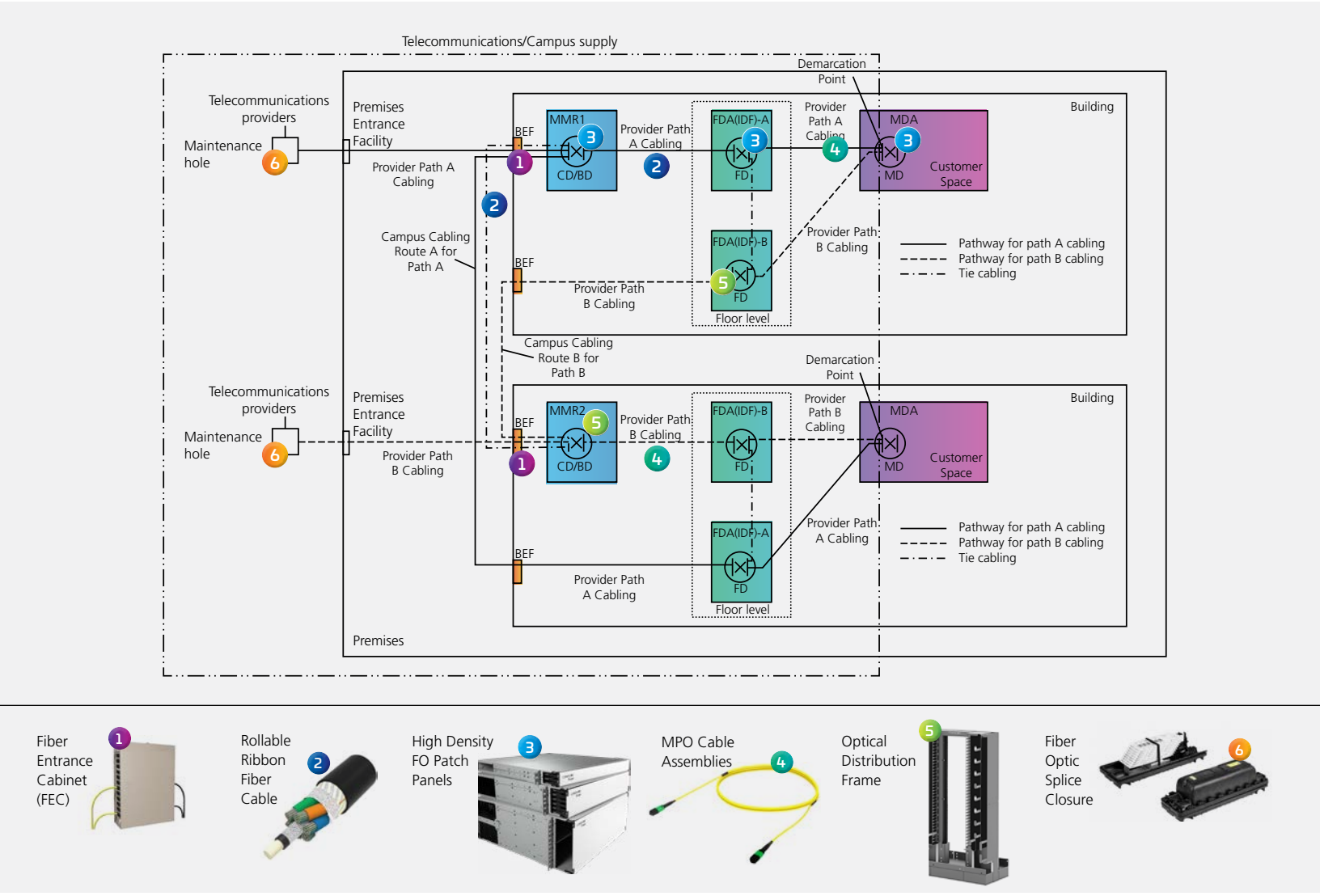

Figure 5: Core infrastructure components by MTDC functional area

Efficiency is the key

The three primary factors of power, politics and population growth lead to a few conclusions that need to be considered when building an MTDC.

- Efficient power usage: As much grid energy as possible should be used to power the IT equipment instead of being wasted by inefficient hardware.
- Efficient design: The base build should be flexible enough to be upgraded in support of new customers and data halls (wherever they are located). Look to the TIA-942 and EN50600-2-4 standards for guidance.
- Efficient supply chains: Explore how partners and supply chains can help build data centers in new locations. A holistic global approach to product selection can enable a partner to stage product sets—delivering them using a just-in-time approach to delivery. It can also simplify and speed installation in the field.

References

[1] Digital Realty Trust, Inc.; Q2 2022 Earnings Call, transcript; July 28, 2022

[2] Central Statistics Office of Ireland, 2023.

[3] Cap on data centres ruled out despite surge in energy use; Irish Times, article; June 13, 2023

[4] Cap on data centres ruled out despite surge in energy use; Irish Times, article; June 13, 2023

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CO-118686-EN (03-24)