July 2020

Keppel Capital watch

Data Centres

Not Just Hype

Contents

Executive Summary

The size of the global datasphere is estimated to grow fivefold from 2018 to 2025. Part of this exponential growth is driven by the increasing number of connected devices, along with the various technologies that will be facilitated by 5G, such as Augmented Reality and ultra-high definition video streaming.

The COVID-19 pandemic has resulted in behavioural changes and will lead to more online activities, whether they are individual consumers spending more on e-commerce platforms or enterprises accelerating their digitalization journeys. These activities will boost the adoption of cloud computing, and cloud service providers (CSPs) will continue to require data centre capacity to meet such ever-growing demands.

Stakeholders are naturally keen to ensure that the data centre sector can grow sustainably, given their energy-intensive nature. Some regulators have imposed temporary construction bans and require new-builds to meet strict Power Usage Effectiveness (PUE) limits. Operators often take it upon themselves to experiment and deploy sustainable data centre designs, including the use of alternative cooling methods, renewable energy and more energy-efficient hardware and software.

Considering the various demand drivers from consumers and enterprises, we see ample opportunities in Asia. China's Tier-1 cities and their satellite cities remain under-served, while Singapore, Tokyo and Sydney have always been attractive locations for CSPs due to their economic buzz and connectivity. In Europe, the FLAP markets (Frankfurt, London, Amsterdam and Paris) may be mature, but remain popular with CSPs and hyperscalers.

Data centres will likely prove to be a resilient asset class in this COVID-19 induced recession. With the right operating partners, investors still have abundant opportunities to partake in the sector's multi-year growth story. Knowing where and what kind of product is preferred by end-users such as CSPs and hyperscalers in each market will be key.

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Introduction

Since our last paper on data centres titled "Data Taking Off Into the Cloud" in July 2018, the continued boom in data generation continues to drive the growing adoption of cloud computing and related technologies, underpinning strong demand for data centres. In this paper, we take stock of the current trends and highlight potential challenges and new opportunities in the post COVID-19 world.

Datasphere into the stratosphere

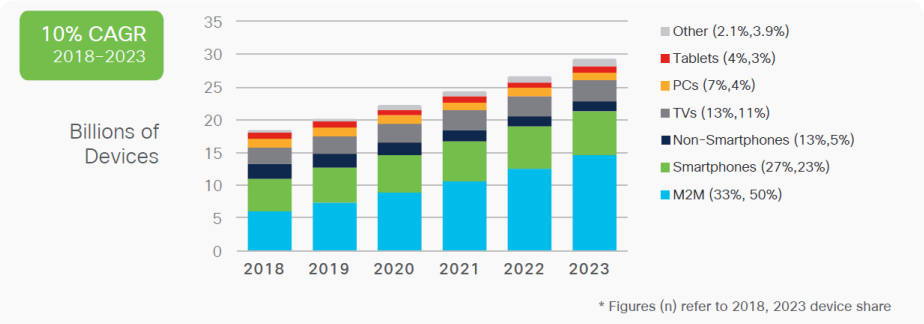
Technological advancements are increasingly allowing individuals, enterprises and policymakers to make better sense of the world by analyzing data at their fingertips. As global internet penetration deepens and the cloud continuum matures, estimates of data generation often fail to keep up with reality.

Based on the latest estimates from the International Data Corporation (IDC), the global datasphere[1] is expected to grow fivefold from 33 ZB in 2018 to 175 ZB in 2025 representing a Compound Annual Growth Rate (CAGR) of 26.9% and over 90 ZB of the data in 2025 will be created by Internet of Things (IoT) devices. To put it in perspective, the amount of data to be generated over the next three years will be more than three times that created in the past three decades.

Internet's data deluge

Despite having been around for a few decades, internet penetration continues to increase every year and is projected to grow from 51% in 2018 to 66% in 2023 globally[2]. More importantly, the number of connected devices is expected to grow at 10% CAGR between 2018 and 2023, outpacing the growth of internet users (6% CAGR) (see Figure 1).

Figure 1: Global device and connection growth



Source: Cisco Annual Internet Report, 2018-2023

The fastest growing type of connection is expected to be machine-to-machine (M2M) connections, including from applications such as smart meters, video surveillance and healthcare monitoring. The growth of M2M connections will in turn spur the growth of IoT, which allows more devices to be interconnected via the internet, vastly scaling up the data that can be exchanged, stored, processed and analysed.

[1] The Global Datasphere refers to the total amount of data created, captured and replicated in any given year across the world.
[2] Cisco Annual Internet Report (2018-2023)

Many of the connections will also be mobile. Cisco estimates that by the year 2023, the total number of mobile subscribers will total 5.7 billion, representing 71% of the global population, increasing from 66% in 2018. Telecommunication devices like smartphones and tablets will account for 54% of the global mobile connections, followed by 34% from mobile M2M connections, such as the GPS system in cars.

Widespread 5G adoption could still be a few years away as 4G deployment, which is expected to account for 46% of all connections by 2023, still reigns. When 5G technology and standards become more widely adopted, the low latency and significantly higher throughput conferred by 5G will massively scale up IoT adoption. Applications like Augmented Reality (AR), Virtual Reality (VR) and 8K ultra high-definition video streaming will become commonplace. It will not be surprising if IDC's estimate of the size of datasphere at 175 ZB by 2025 needs to be revised upwards if more applications are spawned along the way.

COVID-19 a catalyst to go digital

The stay-at-home measures in response to the COVID-19 pandemic look set to spur greater digital adoption amongst individuals and enterprises, which will be a boon to data centre demand globally.

The limitations placed on individuals to carry out normal daily activities, like going to school, watching movies in cinemas, shopping or dining in at restaurants pushed much of their activities online, such as social networking, media streaming, online shopping and online gaming. Based on a survey conducted by Comscore in the US, the average in-home device data usage grew by over 30% yoy in April and the first ten days in May 2020, led by increased usage of Smart TVs, smartphones and over-the-top (OTT) streaming boxes[3].

After COVID-19, some of these online behaviours will stick, benefitting tech names like Netflix, Amazon, Tencent and Alibaba. It is also plausible that there will be increased use of healthtech wearables to detect, prevent and control future pandemics, premised on big data analytics and AI.

The work-from-home (WFH) experiment that is occurring on a global scale has also cast the spotlight on enterprises' business continuity readiness. With the exception of essential services, most white-collar workers have had to WFH at the peak of the pandemic. Most banks are only allowing their staff to return to their offices gradually, while companies such as Google and Facebook have announced plans to allow employees to telecommute for the rest of 2020.

Enterprises therefore need to ensure adequate investments into collaboration systems like Microsoft's Office365, videoconferencing tools like Webex and Zoom, as well as step up cybersecurity and cloud data protection. What were traditionally client-facing roles will increasingly be augmented with customer-friendly online platforms (especially smartphone apps), potentially driving further growth in areas such as digital banking and

[3] www.comscore.com/Insights/Blog/How-COVID-19-is-Changing-the-Way-Americans-Engage-With-Streaming-Services

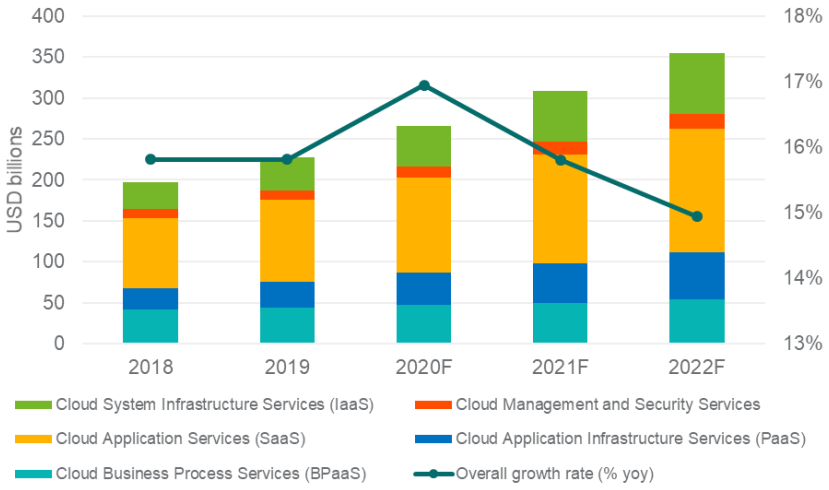
telemedicine. Most, if not all of these technologies will be cloud-native and enterprises will need to develop sound cloud strategies.

Clouds are Gathering

Enterprises are recognizing the need to digitalise their business processes to improve productivity, facilitate collaboration and make better business decisions using big data analytics and AI. Rather than undertake these processes by maintaining their own on-premise servers or enterprise data centres, it may be more cost effective to move most, if not all, the workloads into the cloud.

Based on Gartner's forecasts, global public cloud revenue is set to grow from USD228.8 billion in 2019 to USD354.6 billion in 2022 (15.9% CAGR). While the biggest segment continues to be SaaS (Software as a Service), the faster growing segments are expected to be PaaS (Platform as a Service) and IaaS (Infrastructure as a Service), due to the demands of modern applications and workloads requiring infrastructure that traditional data centres cannot meet (see Figure 2).

Figure 2: Worldwide public cloud service revenue by segment



Source: Gartner (November 2019)

The way enterprises adopt cloud computing is also shifting. Enterprises have moved from deciding between public and private cloud to hybrid cloud, which is a computing environment that connects a company's private cloud services and third-party public cloud into a single infrastructure for running the company's applications and workloads[4].

In practice, a more accurate description of how enterprises are adopting cloud technologies is "multicloud". Red Hat describes multicloud as the adoption of more than one cloud deployment of the same type (public or private), provided by different CSPs. While most corporates stumbled into adopting multiple cloud environments as different teams ended up procuring cloud services independently, there is a strong trend that multicloud is becoming a deliberate strategy. According to the recent Flexera 2020 State of the Cloud Report, 93% of the enterprises surveyed are said to have a

[4] www.ibm.com/cloud/learn/hybrid-cloud

multicloud strategy, with nearly half of them incorporating multiple public clouds and multiple private clouds.

Here are some of the benefits for adopting a multicloud strategy:

a) **Vendor flexibility**
A main benefit of multicloud is that enterprises can avoid being bound and restricted to a particular CSP's infrastructure, services and pricing. It allows enterprises to seek out and adopt the best-in-class solutions. When security and functionality are similar, enterprises can go with the vendor with the most attractive pricing.

b) **Better performance and resilience**
To minimise latency, enterprises can choose CSPs with data centres that are in close proximity to themselves and/or their customers. Enterprises with diverse workloads may also find it more optimal to work with multiple CSPs. A multicloud strategy adds resilience to the enterprise's cloud ecosystem. If an enterprise had put all its eggs in one basket, mission-critical applications may be unavailable when the CSP suffers from an outage. As a failover solution, multicloud allows enterprises to have available and scalable backup even when the primary cloud fails.

c) **Data sovereignty and localisation compliance**
Many governments have stepped up legislation concerning data sovereignty, such as the European Union's General Data Protection Regulation (GDPR). Countries like China and Germany have instituted data localisation laws, requiring companies to use, store or process data within their borders if the data originated from there, mostly for national security reasons.

Companies operating across geographies may therefore have to adopt a multicloud strategy to comply with the gamut of data-related legislations, taking into consideration where the customers are and the level of service each CSP can provide within each jurisdiction.

As more enterprises adopt multicloud strategies, CSPs regardless of size will continually seek to scale up their services to ensure they remain competitive and are able to keep up with demand across geographies to maintain or even increase market share. This bodes well for data centre demand.

Hyperscalers keep moving

Based on estimates by Synergy Research, total global spending on cloud infrastructure services reached USD29 billion in 1Q2020, nearly doubling from the USD15 billion spent in 1Q2018. The top three CSPs were the hyperscalers Amazon Web Services (AWS), Microsoft and Google, which together accounted for 58% of market share.

To keep pace with ever-growing demand and remain competitive in a multicloud world, hyperscalers continue to put in capex of around USD116

billion and USD117 billion in 2018 and 2019 respectively[5]. Much of that spending in 2019 went into building out data centres, with the number of hyperscale data centres globally increasing from 430 in 2018 to 541 as of 2Q2020. Of the 541 hyperscale data centres, the US hosts 38%, followed by Asia Pacific and Europe, led by China (9%), Japan (6%) and the UK (5%).

As building hyperscale data centres is a capital-intensive process, most hyperscalers balance between building their own facilities and leasing build-to-suit hyperscale data centres from third-party developers and operators, such as Keppel Data Centre Holdings, to meet their large-scale deployment requirements. CSPs also continue to require colocation space in multi-tenant data centres (MTDCs) with strong interconnectivity as they scale up to meet the fast-growing demand in a timely manner, especially when they expand into edge markets.

The building boom is expected to continue given the strong tailwinds. Besides the "Big Three" hyperscalers, Chinese CSPs have also announced aggressive capex plans. Tencent stated in May 2020 that it will spend CNY500 billion (~USD70 billion) over the next five years on "new infrastructure", including cloud computing, AI, blockchain, hyperscale data centres, IoT and 5G networks. Alibaba separately announced in April 2020 that it will be spending CNY200 billion (~USD28 billion) over the next three years on cloud infrastructure, servers and next-generation data centres, potentially tripling its data centres and server capacity.

Ensuring sustainable growth

While there is no lack of demand drivers and capital for data centres, CSPs, operators and regulators have to consider various factors when it comes to supply. These include land cost and availability, power supply, connectivity and geopolitical stability amongst others. Environmental sustainability has emerged as a major issue facing data centre stakeholders. While these concerns were already present before COVID-19, the global health crisis has led to renewed focus on environmental, social and governance (ESG) practices in the investment landscape.

Based on various estimates, data centres accounted for between 1 and 2% of global electricity consumption worldwide and approximately 0.3% of overall carbon emissions as of 2018. While this may not sound like a lot, it is important to bear in mind that the sizes of data centre markets vary widely across the world.

For instance, according to estimates by Cushman & Wakefield, Singapore had the highest wattage (W) per capita of data centres globally in 2018 at around 71 W per capita, far exceeding other countries with important data centre hubs such as the US, Ireland and Australia, which were at between 16 and 20 W per capita[6]. Places with higher densities of data centres are likely to face greater stresses on resources such as land and power supply.

[5] Synergy Research
[6] Cushman & Wakefield, "Data Centres in Southeast Asia Poised for Rapid Growth", August 2019

Countries which are parties to the Paris Agreement on climate change are expected to take steps to ensure that they meet their commitments under the 2015 pledge. In Singapore's case, it pledged to reduce its emissions intensity (carbon dioxide emissions per dollar of GDP) by 36% below 2005 levels by 2030 and stabilize greenhouse gas emissions with the aim of peaking around 2030. China, as one of the world's largest carbon emitters, pledged to reduce its emissions intensity by 60-65% from 2005 levels by 2030.

Measures for sustainable data centre developments

To ensure that they meet the Paris Agreement targets, many countries have instituted measures impacting data centre developments and operations. For example, cities such as Singapore and Amsterdam have imposed moratoriums against new data centre developments, while Beijing and Shanghai have imposed Power Usage Effectiveness (PUE) caps on new data centres. A summary of the measures enacted by major data centre markets is shown in Table 1.

Table 1: Summary of measures on sustainable data centre developments

Market	Description
Singapore	• Authorities have implicitly imposed a temporary moratorium on new builds expected to last through 2021 • Authorities developed a Green Mark for Data Centres Scheme - a dedicated green building rating to encourage the adoption of energy-efficient design, operation and management of data centres
Beijing	• Since 2018, citywide ban on construction or expansion of internet and information processing and storage data centres, except for cloud data centres with PUE of 1.4 or less • Within Beijing's Dongcheng, Xicheng, Chaoyang, Haidian, Fengtai, Shijingshan and Tongzhou districts, all new construction or expansion of data centres is prohibited
Shanghai	• New data centres' PUE strictly controlled to below 1.3 from 2020; redeveloped data centres to have PUE below 1.4 from 2020 • Expansion limited to 60,000 additional racks in the city between 2020 and 2023 • Strictly no new data centres within the Middle Ring Road. Those beyond the Outer Ring Road may be permitted if they meet design criteria, including each development to be kept between 3,000 and 5,000 racks, average rack density must not be below 6kW/rack and PUE strictly controlled at 1.3 and below
Shenzhen	• On 12 Apr 2019, authorities released a green data centre policy premised on "high efficiency replacing low efficiency", "large-scale replacing small-scale" and "latest technology replacing obsolete technology" to encourage redevelopment of inefficient data centres • Replacement data centres with PUE of 1.4 and less will be given policy support for additional power supply over the original usage

Amsterdam	• New data centres must have PUE of 1.2 or lower, while existing data centres must achieve a PUE of 1.3 • In July 2019, municipal authorities halted construction of new data centres in the districts of Amsterdam and Haarlemmermeer for a period of 12 months • In June 2020, municipal authorities endorsed a proposal by the Dutch Date Centre Association (DDA) identifying business parks where data centre developments will be restricted to, and allowing for moderate growth in data centres until 2030 after which there will not be any more space for data centre developments

Sources: Various

Besides these data centre-specific measures, China's National Development and Reform Commission (NDRC) also requires all large-scale fixed asset investment projects with annual power consumption of 5 GWh and above to carry out an Energy Savings Assessment (ESA) as part of the building approval process before the project can commence construction and operation. As significant consumers of power, most data centre projects will have to fulfill this requirement.

Possible mitigations by data centre operators

Even without regulatory requirements to ensure sustainable development, it is in the operators' self-interest to optimize power efficiency and reduce operating costs without impacting performance. Here are some of the ways to do so:

1) **More efficient hardware and software**

According to some reports, data centre workloads increased by more than six-fold between 2010 and 2018, but power usage only went up by 6%[7]. Much of that can be attributed to hardware efficiency gains made in this period – typical computer servers in 2018 used roughly a quarter of the energy as those in 2010 and it took one-ninth as much energy to store 1 TB of data in 2018 as it would have in 2010.

The increased AI workloads at hyperscalers such as Google and Facebook have led to the adoption of more optimized server hardware. The use of components such as graphics processing units (GPUs) and field-programmable gate arrays (FPGAs) to complement the standard central processing units (CPUs) results in higher rack densities, meaning much more computations can be performed within the same physical space.

Besides hardware improvements, virtualisation has also improved cloud data centre efficiency and scalability by running multiple operating systems and programmes on a single server.

2) **New cooling methods**

Traditionally, around 40% of a data centre's total energy consumption goes to cooling the IT equipment. Air-cooling might have been sufficient

[7] www.networkworld.com/article/3531316/data-center-power-consumption-holds-steady.html

for most data centres in the past, but with the increase in rack densities, more efficient cooling methods need to be adopted.

Liquid-cooling has become increasingly popular given that air is generally a poorer heat conductor. Google, for example, has been embracing direct-to-chip liquid cooling for its AI data centres equipped with its Tensor Processing Unit (TPU) 3.0.

Operators like Keppel Data Centres (KDC) are thinking out of the box for new ways to build data centres altogether. For instance, KDC is partnering Toll Group to explore the development of a floating data centre park (FDCP) which utilizes seawater for cooling and frees up land for other urban uses. The FDCP is also envisioned to be integrated with an adjacent Liquefied Natural Gas (LNG) and possibly hydrogen infrastructure, potentially allowing the FDCP to tap on cold energy generated from the LNG regasification process to supplement the cooling load. Keppel will also work with Mitsubishi Heavy Electric to explore the feasibility of a hydrogen-powered tri-generation plant-supported data centre that can not only tap the power generated by the plant, but also tap on the chilled water produced by the plant to cool the data centre's systems and facilities.

3) **Renewable energy**

Data centre operators are increasingly relying on renewable energy sources to minimize stressing the power grids. Google and Apple both already claim to be running on 100% green energy, while Microsoft even pledged to be carbon-negative by 2030. Smaller CSPs like Salesforce and Rackspace have also committed to 100% renewable energy by 2022 and 2026 respectively. The most common alternatives are solar and wind energy.

For example, in land-scarce Singapore, Apple, Microsoft and Facebook are already purchasing offsite solar power for their local data centres. In China, Alibaba's massive 60,000-server Zhangbei Data Centre in Hebei province is 100% powered by renewable energy, predominantly solar and wind. Nonetheless, much more can be done to increase the adoption of renewable energy, including from other sources such as hydrogen.

4) **Leveraging AI for data centre maintenance**

Data centres may be built to host AI workloads, but AI is also increasingly being used in cloud-based Data Centre Infrastructure Management (DCIM) systems in tandem with IoT sensors. For instance, in 2016, Google used its DeepMind technology to optimize cooling at its Singapore data centre to predict temperatures and suggest proactive responses. It was shown to reduce the site's cooling bill by 40% and lowered its PUE by 15%.

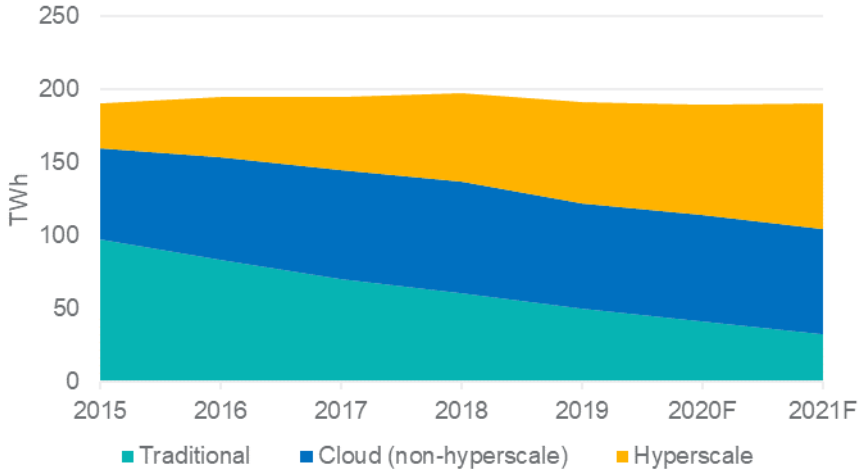
Besides managing the power and cooling systems, the combination of machine learning and big data from IoT sensors in DCIM allows for predictive maintenance and optimizing data centre workloads to improve resource utilization and reduce human error.

5) Hyperscale shift

According to the International Energy Agency (IEA), even though many workloads have gone from traditional enterprise data centres into cloud and hyperscale data centres, the overall increase in energy consumption has been limited despite robust demand (see Figure 3).

IEA attributed this to the fact that hyperscale data centres are relatively much more energy efficient and use proportionately less energy for cooling compared to smaller data centres, so the continued shift towards cloud adoption will lead to more efficient energy use in general.

Figure 3: Global data centre energy demand by data centre type



Source: IEA

Still plenty of opportunities

Despite the huge amounts of capex spent by CSPs and operators on building new data centres over the past decade, we think that there are still plenty of opportunities for investors looking for exposure in data centres.

1) China

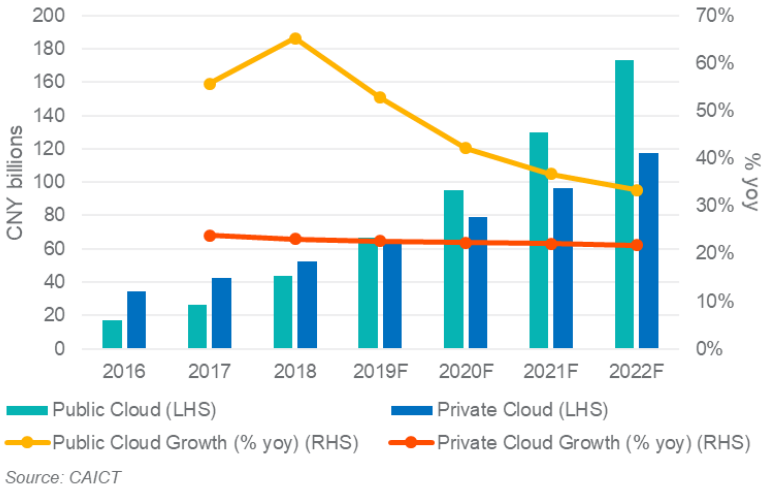
As of end-June 2019, China had 854.5 million netizens, representing an internet penetration of 61.2%, an increase of nearly 10 ppts in just three years. With 99.1% of all its netizens being mobile internet users as of June 2019, China has emerged as a truly mobile-first economy.

The most frequently used mobile apps were for instant messaging (14.5%), online video (13.4%), short video (11.5%), online music (10.7%) and online literature (9.0%)[8]. The growing number of mobile internet users has fuelled the rise of many mobile app companies, usually in the ecosystem of either Alibaba or Tencent. According to the Hurun Global Unicorn List, China is home to 206 of the world's 494 unicorns, more than the 203 found in the US. The world's three biggest unicorns are from China, namely Ant Financial, Bytedance and Didi Chuxing.

[8] CNNIC, "Statistical Report on Internet Development in China", August 2019

From a corporate perspective, spending on cloud computing continues to see robust growth in China (see Figure 4). CAICT expects China's public and private cloud markets to triple in size from CNY96.3 billion in 2018 to CNY290.3 billion in 2022[9]. Much of the growth will be driven by the public cloud market, which is expected to enjoy a CAGR of 41.1% between 2018 and 2022, mainly due to the IaaS and SaaS segments.

Figure 4: Market size of cloud computing in China



Source: CAICT

A recent report by Canalys[10] noted that China's cloud infrastructure market is the second largest in the world, rising from 10% of the global total in 1Q2019 to 12.5% in 1Q2020. The top four CSPs were Alibaba Cloud, Huawei Cloud, Tencent Cloud and Baidu AI Cloud, together accounting for 81% of the total spend in 1Q2020.

Naturally, there is robust data centre demand in China from these service providers. According to Kezhi Consulting, China's internet data centre (IDC) market is expected to double in value from CNY156.2 billion in 2019 to CNY320.1 billion in 2022[11]. Other than Alibaba and Tencent which have already announced huge capex plans, there will be ample demand from the other cloud-based companies to ensure their digital services are delivered with minimal fuss. Due to IDC licencing restrictions, foreign CSPs like AWS and Microsoft will need to partner established local operators with carrier-neutral data centres to provide their cloud services.

At a macro level, China is still underserved by data centres. Based on Cushman & Wakefield's estimates, the entire Chinese data centre market averaged under 2W per capita in 2018 vis-à-vis 71W per capita in Singapore. Data demand is higher in the more urbanised and economically vibrant city clusters along the coastal regions, especially in the Tier-1 cities of Beijing, Shanghai, Guangzhou and Shenzhen.

Based on 451 Research's data, we estimate the sizes of data centre markets in these cities to be 29.4W, 19.6W, 15.0W and 20.8 W per capita respectively as of 1Q2020, suggesting further room to grow to

[9] CAICT, "Cloud Computing Development White Paper (2019)", *in Mandarin*
[10] www.canalys.com/newsroom/canalys-china-cloud-services-adoption-Q1-2020
[11] Cushman & Wakefield, "Data Centres – Rack space to further expand in China", April 2020

keep up with demand. Satellite cities with strong fibre connectivity into these Tier-1 cities can be attractive alternatives as land is relatively more available and at lower costs.

The Chinese government has identified data centres, 5G and cloud computing to be among the sectors classified as "new infrastructure", which is a key economic growth pillar out of the current pandemic-induced slowdown through technological innovation. These developments are expected to be led by private investments, although the government will provide policy support. The actual policy details remain vague, but we expect highly-efficient data centre developments with low PUEs to be viewed more favourably.

2) **Singapore, Tokyo and Sydney**
As three of the Asia Pacific (APAC) region's Tier-1 data centre markets, Singapore, Tokyo and Sydney continue to be attractive locations for data centres. Continued cloud adoption by enterprises, the proximity to affluent urban populations and the strong connectivity (including submarine cable connections) mean that CSPs will want to strengthen their presence in these markets. Furthermore, Singapore serves as a regional hub for many CSPs looking to deploy into edge markets like Indonesia and Thailand.

Land supply for new developments, however, is limited and relatively costly in these markets. Singapore's ongoing moratorium also means that completion of new data centres may tail off between 2022 and 2024. The supply and demand mismatch in these three markets suggest continued high utilisation rates in the coming years.

3) **Frankfurt, London, Amsterdam and Paris**
Collectively known as "FLAP", these four data centre markets are the largest in Europe, which also corresponds with the fact that they are the financial capitals of their respective countries. Besides being the hubs of business and financial activity, the FLAP markets also have strong connectivity, with the Deutscher Commercial Internet Exchange (DE-CIX) in Frankfurt, the Amsterdam Internet Exchange (AMS-IX) and the London Internet Exchange (LINX) among the top five internet exchanges in the world by throughput.

These factors make these markets popular with both US and Chinese hyperscalers, which continue to deepen their presence either by leasing build-to-suit hyperscale data centres from operators or taking up colocation space in MTDCs which provide shorter time-to-market. The COVID-19 impetus to greater digitalisation also means that many of the smaller service providers will look to set up Points of Presence (PoPs) to reduce latency and ensure high levels of availability.

The supply conditions are more mixed. Even though there is ample new supply expected in the coming year in Frankfurt and London, the strong demand from hyperscalers means that less established submarkets may come into play. The moratorium in Amsterdam looks to be lifted before fall of 2020, but the moderation in supply will help tighten utilisation rates and support rental growth. Supply and demand

dynamics are well-balanced in Paris, which has the lowest vacancy rate of the FLAP markets at 12% as at 1Q2020, according to CBRE.

The world needs greater connectivity, not less

The duration and full extent of the economic slowdown resulting from the COVID-19 pandemic remain unknown. Businesses are likely to stay cautious on overall spending, but investment into cloud systems will remain robust as enterprises accelerate their digital transformations, leveraging the cloud's "as a service" model to better manage their costs. Therefore, the cloud sector is expected to outperform in this recession and by extension, data centres will likely prove to be a resilient asset class. This is further underpinned by their long leases and relatively low tenant churn.

While fundamentals appear favourable for the data centre sector, we note that it will not be totally immune from rising US-China geopolitical tensions. For instance, US officials have recently recommended that the 8,000-km Pacific Light Cable Network submarine cable system backed by Facebook and Google should bypass Hong Kong, citing national security reasons[12].

However, we believe that the advantages of regional connectivity far outweigh those of decoupling, if any. Especially in the post-COVID environment, cities which remain open and encourage innovation and tech adoption will over the medium to long term be more competitive than those which do not. These are also the cities which we believe will remain attractive to data centre end-users and operators.

We advocate that investors partner operators with established track records and strong relationships with CSPs and other enterprise users, giving them an edge in knowing where and what kind of product (e.g. build-to-suit or MTDC) is preferred by end-users.

Conclusion

As we continue to hurtle through the Digital Age, more and more aspects of our lives will lead to the creation, processing, storage and analytics of data. The COVID-19 experience has highlighted the benefits of digitalization, and technologies like cloud computing, 5G, IoT and AI will become commonplace, driving the need for greater computational powers and storage capacities in data centres.

The building of new data centres to meet ever-growing needs can be done in an environmentally sustainable manner. In this pandemic-induced recession, data centres will likely prove to be a resilient asset class. With the right operating partners, investors still have opportunities to partake in the sector's multi-year growth story. Knowing where and what kind of product is preferred by end-users such as CSPs and hyperscalers in each market will be key.

The data centre sector is not just hype - it is a fundamental infrastructure for our transition into the new digital economy.

[12] www.justice.gov/opa/pr/team-telecom-recommends-fcc-deny-pacific-light-cable-network-system-s-hong-kong-undersea

Keppel Capital is a premier asset manager in Asia. It is the asset management arm of Keppel Corporation Limited, a multinational conglomerate with key businesses in Offshore & Marine, Property, Infrastructure and Investments, providing innovative solutions for sustainable urbanisation.

With assets under management of approximately S$33 billion, Keppel Capital has a diversified portfolio that includes real estate, infrastructure and data centre properties in key global markets.

Keppel Capital aims to create value and deliver sustainable returns for institutional and retail investors through a range of products including REITs, business trusts, private funds investing in real estate and infrastructure, separate accounts and pooled investment vehicles.

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