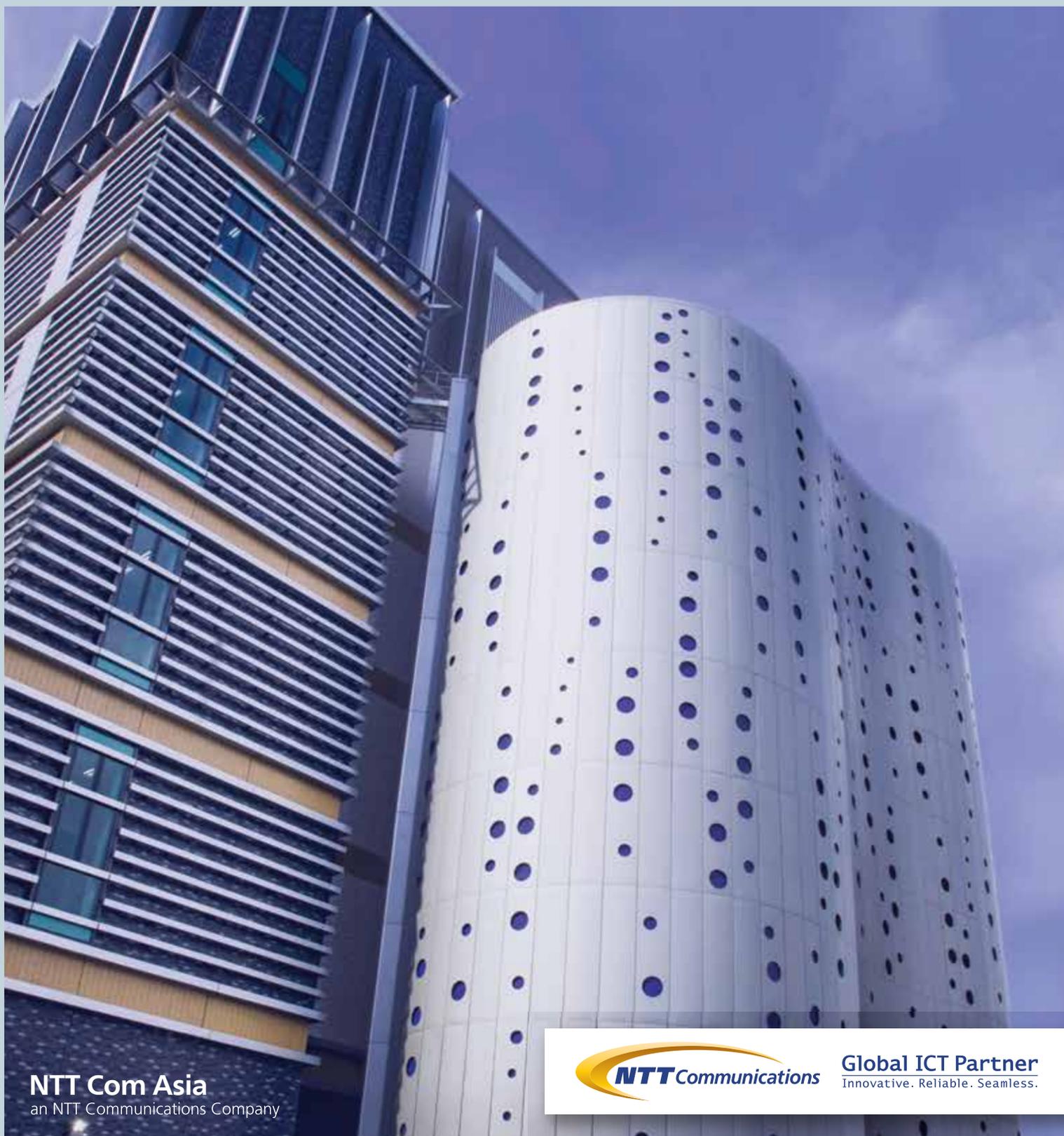


Hong Kong Financial Data Center



Racing into the Future of Digitalization





NTT Communications Global Data Centers

Nexcenter — The Global Data Center Vision

NTT Communications is one of the largest data center service providers in the world, offering services at over 140 locations* worldwide under the brand name “Nexcenter”. With an international footprint and business presence, our data center services are designed to meet the needs of global enterprises. We realize our Nexcenter promise through high-quality facilities, industry-leading SLAs, innovative

technologies and robust security that are designed to keep our customers always a step ahead of the market. We also understand that it is important to grow with your business, and are committed to offering the same professional service levels and consistent practice no matter where you are located. This assurance has seen many global enterprises choosing our data centers to house their data and applications.

* As of Sep 2015

High Evaluations and Prestigious Awards





bps
e Express

Nexcenter

Data Centers in Hong Kong

NTT Communications currently operates three data centers in Hong Kong, each offering tailored services that best match our customers' diverse business needs.

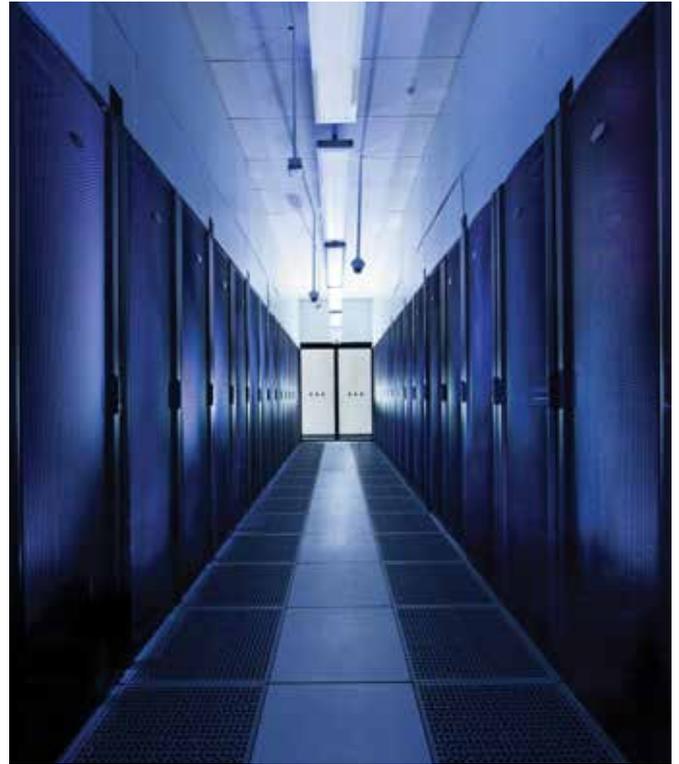
- I. Hong Kong Financial Data Center (FDC™) in Tseung Kwan O: FDC1 and FDC2
- II. Hong Kong Data Center in Tai Po
- III. HKNet Data Center in Kwai Chung



The FDC™ Promise

The role of data centers has evolved. Businesses today are becoming increasingly data driven and digitalized. Modern data centers need to go beyond reliable and secure data storage; they need to be future-proofed with innovative and advanced energy-efficient technologies that cater for better business performance.

The FDC™ is the largest data center¹ in Hong Kong, with industry-leading space, power and cooling capacity. Located on a parcel of 30,000 m² company-owned land in Tseung Kwan O, it is a purpose-built complex with two data center towers (FDC1 and FDC2) and one command and control tower. Its Tier IV ready infrastructure features a vast array of leading-edge technology and new innovations designed for customers who demand the very best on their digitalization journey.



FDC™-at-a-Glance

- Tier IV ready infrastructure
 - 100% uptime service level
 - Fault tolerant design with no single point of failure
 - Continuous cooling
 - Continuous rating generator
 - Infrastructure compartmentalization
 - Dual utility power
- Capacity
 - 70,000 m²+ gross floor area
 - 7,000+ racks of server space
 - 200MVA power capacity
- Modular design for hybrid tiering
- 8 layers of physical security
- On-premise ASE cable landing station and NTT Communications Global Network node
- Green infrastructure design with LEED Gold certification and market leading PUE

FDC1

FDC1 is the first phase of the complex launched in 2013. Engineered with one objective in mind — always on, always available — it has achieved great success in transforming the hosting landscape for mission-critical data center in Asia.

With over 3,000 racks of server space, FDC1's Tier IV ready infrastructure offers a sophisticated fault tolerant design that features continuous cooling and infrastructure compartmentalization. It is the first data center in Hong Kong with Tier 4 design certified by Uptime Institute, and the first data center in the region to adopt a modular design that allows customized tier level in different ICT halls (hybrid tiering), giving customers total flexibility for choosing when they want to upgrade from Tier III to the most stringent Tier IV standard.

¹ Offered by data center service providers. As of Dec 2015.

INNOVATIVE DATA CENTER TECHNOLOGIES TO DRIVE BUSINESS PERFORMANCE

FDC2



Cooling Battery - Thermal Energy Storage System

As digital transformation, big data, cloud and virtualization generate new demands on IT infrastructure, customers are looking for data centers to drive their transformation journeys. They need the right facilities that offer the agility to grow and leap ahead, while driving innovation and opening doors to new revenue streams.

Launched in 2015, the second phase of the data center complex (FDC2) builds on the success of FDC1 to integrate the latest innovative technologies, with the vision to enhance customers' business performance and optimize Total Cost of Ownership (TCO). With over 4,000 racks of server space, FDC2 is designed with ultra-high power density, ultra-tall rack, innovative energy-efficient cooling and data visualization technologies to create new values and enhance business performance for enterprise customers. It underscores our value as a technology strategy partner for next-generation data centers offering the best-in-class technologies.

FDC2 Key Differentiations

- Ultra-high power density up to 24kVA per rack
- Ultra-tall rack up to 54U
- Cooling Battery - the largest thermal energy storage system in Hong Kong for uninterrupted cooling
- Water-side economization
- Cooling Wall - front-flow cooling with hot aisle containment improve energy efficiency by 20%
- Smart lighting for actionable intelligence
- Virtual Data Center for performance visibility

Extreme Level of Rack Power Density

Increase in digitalization and data consumption has seen the demand for more data storage equipment and space grows rapidly. The onset of virtualization and cloud also calls for high density computing applications and equipment that consume more power and emit excessive heat. This makes effective cooling systems critical in order to avoid heat-related failures, as the burden on TCO increases and forms a major obstacle for any digital transformation journey.

FDC2 offers a more sustainable data center solution that enables customers to maximize the utilization of IT equipment and flexibility for future expansion to reduce TCO in the long run. Our extreme level* rack power density of up to 24kVA per rack ensures that high power equipment is housed in an optimal environment. It also supports the use of ultra-tall racks of 54U, which is ideal for top-of-rack cabling topology that maximizes the utilization of servers and network equipment within the same rack.

* AFCOM Data Center Institute categorized Rack Power Density into four levels in 2014:

RACK POWER	DENSITY LEVEL POWER RANGE (kW)
Low	0-4
Moderate	5-8
High	9-15
Extreme	16 and above



Cooling Wall - Front-flow Cooling with Hot Aisle Containment

Energy-Efficient Technologies

A complete suite of innovative energy-efficient technologies and cooling infrastructure design enable extreme level of rack power density, high reliability and lower TCO. Together, they offer a strong value proposition for customers who want a data center solution that grows with their operational demands, while streamlining their TCO in the long term. Key innovations include:

Cooling Battery

Designed to address the continuous cooling requirement for a Tier IV data center, FDC2's unique thermal energy storage system is equipped with a total of 3,600,000 liters of chilled water, and are by far the largest stratified thermal energy storage system in Hong Kong. It can override 6 cycles of chiller restart without re-charging, and provides 42 minutes of uninterrupted cooling to ensure that the cooling systems remain operational to maintain stable temperature and humidity inside the ICT hall in the case of a power interruption.

Cooling Wall

FDC2's pioneer front-flow cooling design with hot aisle containment, supports ultra-high power density per rack and improves energy efficiency of the cooling system by more than 20%, compared to the traditional down-flow cooling with cold aisle containment.

Water-side Economization

By elevating the chilled water temperature to 14°C, FDC2 enables water-side economization of 24 days in a year. When wet-bulb temperature is lower than 10.5°C, the chillers will be shut down and the cooling system uses the cooling towers for direct cooling. Together with the Cooling Wall, FDC2 can achieve a market-leading annualized PUE of below 1.5 at full load condition.

Smart Lighting

This Power-Over-Ethernet LED lighting system transforms data of FDC2 into actionable intelligence to help reduce energy costs, enhance security and user safety. Integrated with the access control system, the motion sensor embedded will add an extra layer of security to the data center. It can also be leveraged to direct users during emergency evacuation when needed.

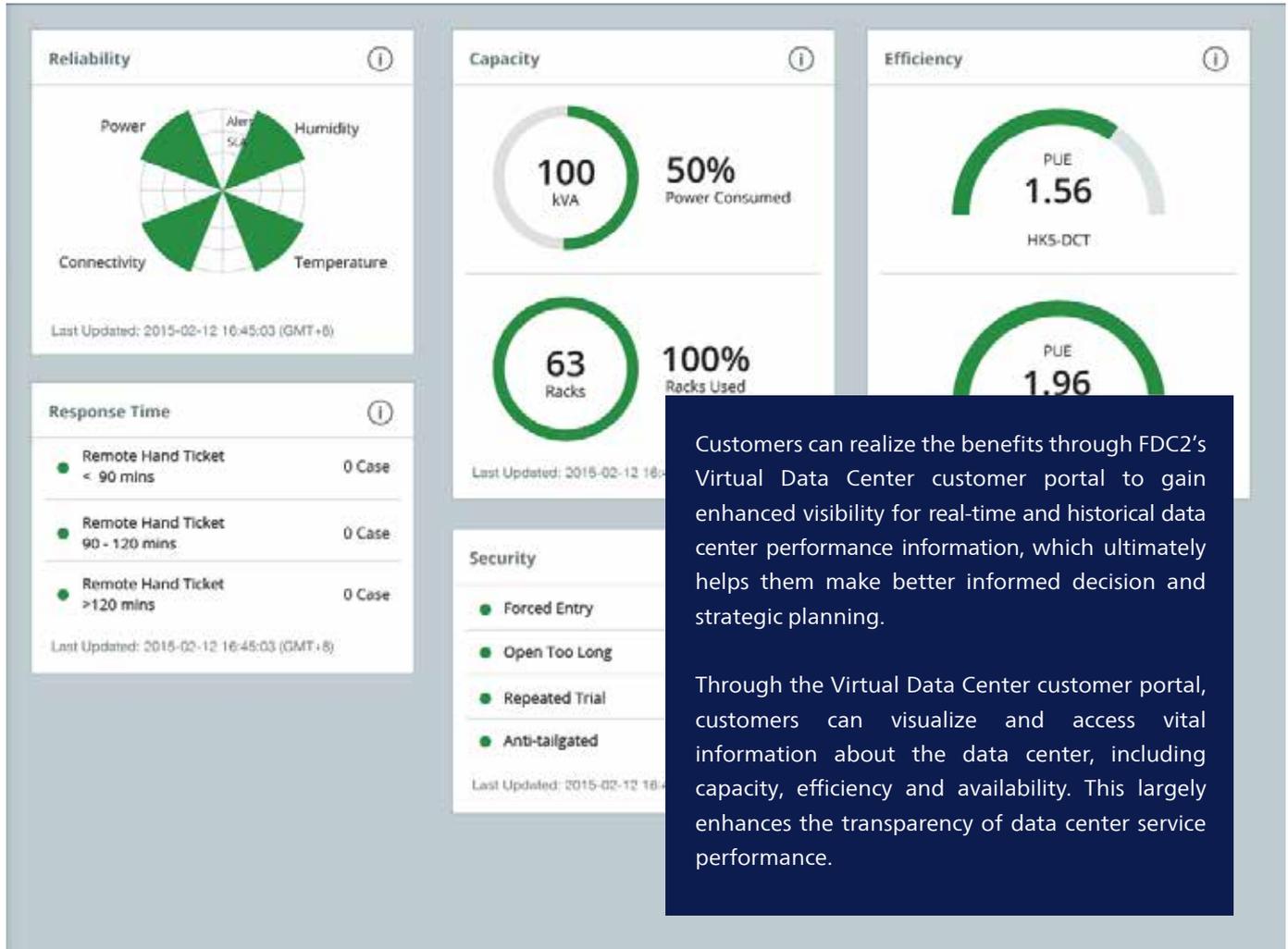


54U Rack and
Smart Lighting

Enhanced Service Visibility

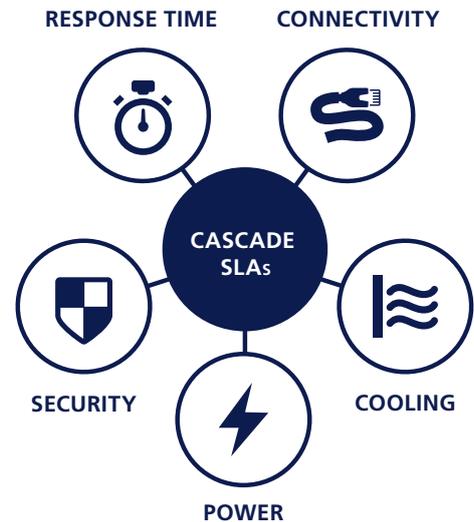
FDC2 features a digitalization and big data analysis approach for end-to-end data center lifecycle management. Being a pioneer to adopt Building Information Modeling (BIM), FDC2 takes the concept further by integrating information and data with in-house Data Center Management System (DCMS) to offer a comprehensive solution for lifecycle management of all critical facilities. The integrated automation could provide insights on planning, design, construction, commissioning, and operation of FDC2.

Virtual Data Center



Cascade SLAs for Better Service Guarantee

Along with the new service transparency given by real time data from the Virtual Data Center customer portal, FDC2 is introducing a brand new SLA model that promises better guarantee and transparency. It goes beyond traditional SLAs on power and cooling, and extends to cover connectivity, security and response time. It redefines the industry standards, and offers a brand new approach for always-on assurance and performance visibility that digitalization needs.



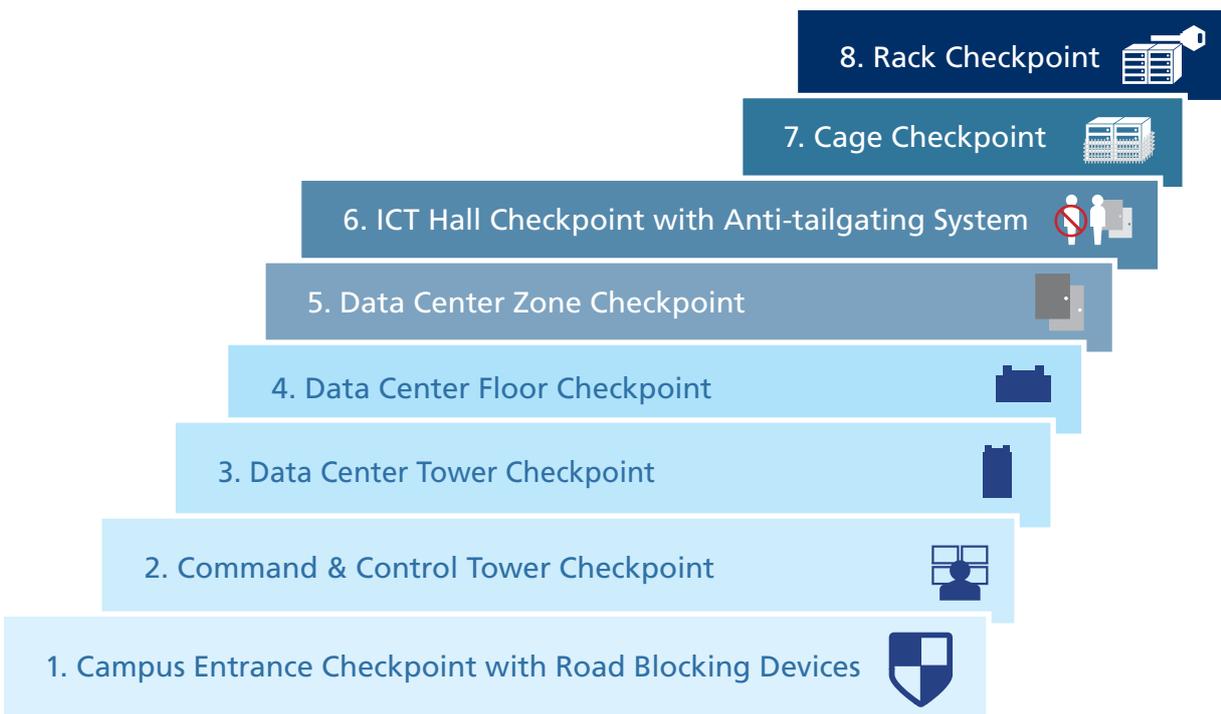


Robust Physical Security

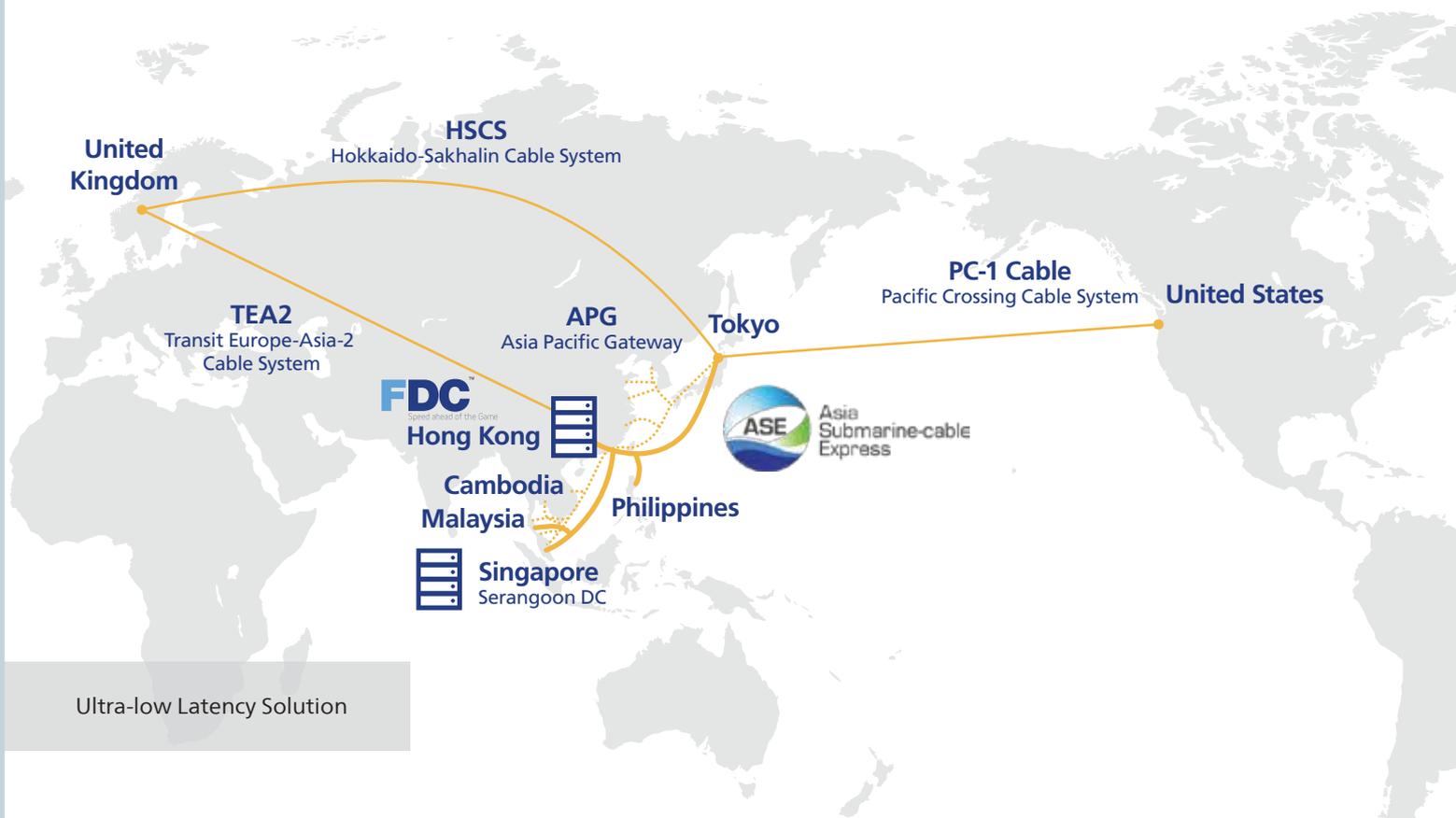
Eight layers of physical security measures with digital sign-in through FDC's Access Management System (AMS) ensure that our customers' mission-critical assets are in safe hands. Physical security controls at the site, building and lobby

entrances, in the lifts, at the floor and ICT hall mantraps right down to the cages and cabins ensure only the right approved personnel can access your servers.

8 Layers of Physical Security at FDC™



Faster Business Communication



Ultra-low Latency Solution

With NTT Communications' Tier 1 network infrastructure and Asia Submarine-cable Express (ASE) connected directly with the FDC™, customers can enjoy exceptional ultra-low latency and

reliable global connectivity to meet their needs for "frictionless" business communications in today's fast-changing world.

Data Center Value-Added Services



Business Resumption Center



Managed Data Center Operation Services

- Green Disposal Service
- Tape Backup Management



Infrastructure Hosting Services

- Hosted Storage
- Enterprise Backup
- Dedicated Server and Equipment Hosting



Professional Services

- Data Center Customization and Migration
- Smart Hand Services



Connectivity

- Arcstar Universal One
- Global Leased Line Service
- IPv6 and IPv4 Transit
- HKNet SecureNet Managed Network
- HKNet vIP-Net Premium Internet

Specifications

NTT Communications Hong Kong Financial Data Center (FDC™)		FDC1	FDC2
 Location	Tseung Kwan O		
 Building	Dedicated purpose-built data center premises owned by NTT Communications		
 Rack	Rack Capacity	7,000+	
	Rack Space Option	Open Area, Caged Area, Private Suite	
	Power Density	Max 18 kVA/rack	Max 24 kVA/rack
 Power	Utility Power	Dual power substations through diversified paths	
	Generator	N+1, continuous rating	N + Catcher, continuous rating
	UPS	2N	N + Catcher
	UPS Power Distribution	2N Active with STS	
	Fuel Distribution	2N, PLC control	
	Fuel Storage	36 hours at full load	24 hours at full load
 Cooling	CRAC	N+1, down flow	N+1, front flow, UPS powered
	Chiller	N+1 Water Cooled (Upgradable to 2N, Water Cooled + Air Cooled)	N+1, Water Cooled, PLC control (Upgradable to 2N, Water Cooled)
	Makeup Water Storage	36 hours at full load	24 hours at full load
	Chilled Water Distribution	2N, UPS powered	2N, UPS powered, PLC control
	Continuous Cooling	10 minutes continuous cooling at full load	42 minutes continuous cooling at full load, PLC control
 Security	7x24 security operation center and security patrol, CCTV surveillance camera		
	8 layers of physical access security checkpoints with anti-tailgating mantrap		
	Multiple-factors authentication access control		
	Impact resistant fence wall with intrusion detection & road blocking device		
 Fire Protection	VESDA System (Very Early Smoke Detection Apparatus), FM200 Gas Suppression System and Double Interlock Type Pre-Action Sprinkler System		
 Network	Carrier Neutral		
	Multiple Local Carrier Entry from diversified paths		
	Dual Entrance Room, Local Carrier Room & Meet-me Room		
	NTT Communications Network Node		
 Service Support	Dedicated in-house 7x24 facility management and service operation support team		
	In-house 7x24 customer service support team with 7x24 service hotline		
	In-house expertise on facility, network, system, security and project management		
 Certificate/Compliance	ISO/IEC 27001, ISO 9001, ISAE3402, PCI-DSS, LEED Gold Design, Uptime Tier IV Design	ISO/IEC 27001, ISO 9001, ISAE3402, PCI-DSS, LEED Gold Design	

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