

ITSC Colocation Data Center User Policies

Information Technology Services Center (ITSC)

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ITSC Colocation Data Center

In October 2020, a New Data Center called Colocation Data Center has been established by ITSC that is intended to provide a high level of reliability and availability environment for housing Departmental servers and related equipment. The Colocation Data Center has approximately 157 square meter of raised floor space with 60 equipment rack capacity managed by the ITSC. It will adopt the energy-efficient design, in conjunction with leading-edge In-row Cooling and Hot Aisle Containment technologies. In aligned with the sustainability goal of the University by reducing the overall power utilization and carbon footprint in Data Centers.

The total present power and cooling capacity of the co-location space is 180 kVA with 3 kVA being the maximum capacity of any one rack. The facility is equipped with an Uninterruptible Power Supply (UPS) and an Emergency Backup Generator for reliability purposes.

The Colocation Data Center is a new ITSC service that allows departments and researchers to house and operate their computing hardware inside professionally maintained Data Center on the HKUST Campus. Leveraging the central facilities in Colocation Data Center rather than operating independent server rooms, the overall energy consumption and expenses of the University would be reduced. Departments would be relieved of the responsibility and expense to maintain their own server room and reclaim the space for other purposes.

1. Data Center Specifications

- 157 square meter of Data Center space.
- Three UPS systems in 2N+1 configuration with a total IT Load Capacity of 180 kVA and diesel generator backup.
- The space can physically house a maximum of 60 600mm x 1200mm 42U equipment rack drawing a maximum of 3 kVA per rack as illustrated in Appendix C.
- Each rack will be provided with 2 vertical Power Distribution Units (PDU) in A-B redundant power configurations and per outlet intelligent power monitoring. Each PDU will provide 30 C13 and 12 C19 power outlets.
- In-row Cooling and Hot Aisle Containment systems are installed to provide high cooling capacity and efficiency gains.
- Novec 1230 Fire Detection and Suppression system is installed.
- 1G/10G campus network connectivity.
- Actively monitored video surveillance.
- Physical security and restricted access.

2. Features

The ITSC Colocation Data Center offers several features to ensure a high degree of availability, security, and reliability:

- **Managed Rack Services** – ITSC offers managed rack services when physical colocation of Department's computing equipment is required. This service provides dedicated rack space in an industry-standard enclosure and top-of-rack managed network services. Access to racks is controlled by the ITSC to maintain the highest level of security for each campus member.
- **Monitoring** – Data Center infrastructure Management (DCIM) tools is installed to monitor and control the environmental and energy consumption of Data Center facility infrastructure components (such as PDUs, UPS and Cooling Systems); and protected against fire, power surges, overheating, and water leakage. Alarms are automatically relayed to ITSC Operation Support on call 365 days a year.
- **Security** – ITSC uses Data Center management standards and industry-recommended practices to ensure the safety and security of the Department's computing equipment:
 - **Authenticated Facility Access** – Smart Card Based door access and control system are installed at Data Center entrances and each equipment rack door.
 - **Surveillance Cameras** - Video security surveillance IP cameras monitor all activity in Data Center.
 - **Visitor Access** - An ID badging kiosk provides a highly secure method for visitors to sign in and out of the Data Center facility during normal business hours.
- **Sustainability** - Designed to maximize the use of efficient energy solutions while minimizing the impact on environment.
 - **Hot Aisle Containment** - To ensure optimal performance, IT equipment are housed within sustainable hot aisle containment units. The heat generated from the IT equipment will capture and neutralize by the In-Row Cooling systems before mixing with room temperature air.
 - **Energy Saving Lighting** - Low-energy lighting systems are equipped with motion sensors to reduce energy consumption by turning off automatically when areas of the building are unoccupied.
- **Unmanned Data Center** – The Colocation Data Center will be operated in 24x7 and unmanned mode. All installed facilities can be managed remotely, no operator intervention will be required. An authorised user can give 24 X 7 entrance into the facility without escorted by ITSC Operation Support.
- **Installation and Recurring Costs** - There are no installation and recurring costs associated with use of the facility in Colocation Data Center including electrical power, cooling or networking services etc.

3. Unmanned Colocation Data Center

ITSC Colocation Data Center is a secure and monitored facility with redundant power, cooling and a variety of network connectivity for hosting Departmental computing equipment. The Colocation Data Center is planned to operate in 24x7 unmanned mode with minimum operator intervention. All facilities will be monitored and managed remotely with the help of Data Center Infrastructure Management (DCIM) Software. The operations of Unmanned Data Center are different from traditional Data Center in following areas:

- Door access control system are installed at entrance of Colocation Data Center and Front/Rear Door of Equipment Rack. An authorised user with ITSC Colocation Data Center Access Card can give 24 X 7 entrance into the Colocation Data Center. Each Department will be assigned specific racks for hosting their computing equipment and only designate individuals are authorized to access the equipment.
- Escorted access is available upon request to ccops@ust.hk between 9 a.m. and 5:30 p.m., Monday through Friday, excluding public holidays. Special access arrangements can be made outside these hours with advanced notice.
- Video security surveillance IP cameras monitor all activity in Colocation Data Center.
- Automated monitoring of physical access and environmental control systems. ITSC is notified and responds to environmental and security alerts, escalating to appropriate facilities or vendor resources.
- Automatic light sensors that turn on lights only when an area is occupied helps lower energy consumption and reduces heat generation.
- Each rack offers dual power connections with intelligent power monitoring outlets and enables the measurement of power consumption for each plugin computing equipment.
- No installation and management services are offered in Colocation Data Center, users are responsible for the installation and management of their own equipment into the facility.
- Data Center Operation Support must be consulted for any equipment to be installed/removed in the Data Center. It is advisable to consult with the Operation Support as early as possible to confirm the necessary space, power and cooling will be available upon arrival for the equipment.

4. User Policies

This document establishes guidelines for access and physical security related to the Colocation Data Center. The procedures and policies described in this document have been developed to help maintain a stable and secure Data Center environment; and must be followed by all users who are working in or visiting the Data Center.

4.1. Data Center Access Requirements

- For accessing the Colocation Data Center Entrances as illustrated in Appendix D, users are required to be affiliated with the University and possess a HKUST Staff Card.
- For accessing the Rack Door in Colocation Data Center as illustrated in Appendix E, users are required to be affiliated with the University and possess an ITSC Colocation Data Center Card.
- Authorization applies only to the named individual, is not transferable, and does not permit that individual to extend access to any other person.
- Third party vendors providing support for IT systems are permitted in the facility only with a Data Center customer escort.
- Data Center entrance doors and rack doors will always remain locked.
- Extreme caution should be exercised to ensure that unauthorized persons do not gain access to the facility by “tailgating”.
- **Access violations:** ITSC reserves the right to terminate unescorted access by staff who have made inappropriate use of the Data Center access rights granted to them.
- **Orientation:** Before access is granted to Colocation Data Center, the Department requesting Colocation services must complete a Data Center safety training and orientation for which the requestor is requesting access. All tours of the Data Center must be scheduled in advance.
- **Rack Access:** Users will be assigned specific racks and specific locations within their racks in the Colocation Data Center and will only have access to their racks. Users may only open and work in rack space specifically assigned to them. Instructions for using access control system will be given during training and orientation session.
- **Appropriate Use of Access:** Unescorted access is provided to staff for access to rack space assigned to their respective locations only. Colocation Data Center access must not be used to interfere with Data Center systems or equipment belonging to other groups

4.2. Equipment Installation Workflow

- For any equipment to be installed/removed in the Colocation Data Center, the Data Center Operation Support must be consulted as early as possible to confirm the necessary space, power and cooling will be available upon arrival for the equipment.
- For new equipment installation, user is required to provide for the following information for asset management and keeping track of equipment life cycle .

Department	Server Name	Contact Person	Rack Mount Server (No. of Rack Unit)	Tower Case Server (Dimension : WxHxD mm)	No. of 1G port	No. of 10G port	Manufacture Year	Power Consumption (KW)	Remark

4.3. Equipment Guidelines

- **Equipment Allowed:** All equipment will be mounted in a standard 19"-wide equipment cabinet
- **Equipment Power Requirements:** Power: All equipment must be able to accept single-phase 220V power. All power cords must utilize C13 or C19 outlets. Two rack-mounted power distribution units (PDUs) fed by different power sources will be supplied in each rack
- **Equipment Installation:**
 - All equipment must be installed in assigned rack units
 - For rack mountable equipment should be utilized a front to rear cooling configuration. Shelving can be supported for non-rack mountable equipment and will be discussed at time of occupancy.
 - It is the responsibility of the user to move the equipment into the assigned rack in the Data Center.
 - All equipment racks are provided by ITSC. No proprietary racks are allowed in the Data Center
 - No rack-mounted uninterruptable power supplies (UPSs) will be allowed in the Data Center
 - Adjacent equipment should be mounted contiguously without gaps so space is used efficiently
 - All equipment shall be labelled with host names.
 - Equipment must be oriented to vent from a cold aisle to a hot aisle, if applicable. Contact ITSC Operation Support with questions if it is unclear how to do this.
 - All Data Center Racks are set up with rails with square holes. Some equipment hardware is adapted to snap into these rails with no screws. Other hardware requires

that cage nuts and screws be used. If cage nuts are required, please contact ITSC Operation Support if this size cage nuts are needed and not otherwise available.

- **Equipment cabling**

- All power and data network cables will be provided by ITSC unless otherwise specified by users and approved by ITSC
- All network cables will be labelled by ITSC at both ends.
- Cabling between racks by customers is NOT allowed.
- Unsecured cabling across aisles or on the floor is prohibited. All devices must be installed in racks or cabinets
- Cabling must not obstruct airflow / ventilation /AC (perforated tiles) or access to power strips

4.3. Liabilities

ITSC is not liable for equipment damage related to the facility infrastructure or any actions beyond the control of ITSC personnel.

4.4 Use of ITSC Managed Space within the Facility

A temporary staging area outside Collocation Center will be offer for housing the hardware until such time as it is ready to be racked, powered up and connected to the network. Due to the space constraint, the arrangement of staging area will be reviewed on a case by case basis.

Boxes, cardboard and all transport materials and tools are required to remove from the staging area once the hardware is racked. General cleanliness and courtesy to fellow occupants is expected.

4.5. Security and Acceptable Use of the Facility and Equipment Housed in the Facility

Access is provided upon request for those individuals responsible for the management of equipment in the facility. Requests must be submitted to ITSC in writing. Since the collocation space is shared amongst all groups, it is the responsibility of each group to ensure that their personnel do not interfere with the operation of other equipment. ITSC must be immediately notified of individuals who no longer require access. ITSC reserves the right to revoke or refuse access privileges to any individuals at any time. Use of the facility and equipment housed within are subject to the University Policy on the Acceptable Use of Information Technology Resources.

4.6. General Work Rules

- Users must carry proper HKUST identification with them at all times within the Data Center. Falsifying or withholding one's identity or refusing to cooperate with Data Center personnel is a violation of these rules.
- Escorted vendors are required to have proper state and/or company issued identification at all times when performing work within the Data Center.
- Data Center Operation Support reserves the right to exclude any individual from the facility. Anyone requested to leave the Data Center must do so peacefully and immediately.
- Customers and Visitors are solely responsible for their personal belongings and property while on the premises.
- Touching, inspecting, documenting, photographing or any form of tampering with other user equipment is strictly prohibited. Persons seen engaging in such activity will be reported and may be subject to expulsion from the facility.
- All unpacking activities must occur outside the Data Center in designated staging areas. Absolutely no cardboard, plastic, packing peanuts, paper wrap, wood or other such materials are allowed in the Data Center.
- Smoking, drinking, and eating are strictly prohibited within the Data Center.
- Sharing Data Center Proprietary information (like architecture, design, facilities information and services) without the express written permission is strictly prohibited.
- All refuse materials (which include, but are not limited to boxes, crates, corrugated paper, plastic, foam packing materials, and any other materials which are non-essential to the operation of equipment) must be removed. Materials must be placed in designated disposal
- "Un-racked", operating equipment outside of cabinets/racks is strictly prohibited.

4.7. Safety

Data Centers can be hazardous due to the presence of high voltage electricity and trip hazards. In order to minimize the risk of personal injury, the following rules will be observed:

- Avoid safety cones, barricades, caution tape, or other safety equipment that has been installed to guide you around hazardous areas including open floor tiles.
- The Data Center & staging area must be kept as clean as possible. All individuals in the Data Center are expected to maintain a clean working environment and clean up after activities as required. Boxes and trash should be disposed of properly.

- Closed-toe footwear will be worn at all times while in the Data Center. Extreme caution should be used when wearing high heel shoes; this footwear may pose a risk while walking across certain perforated floor tiles.
- No network cables or power cord should be strung along the floor creating a trip hazard.

4.8. Emergencies

- Any emergency Data Center incidents should be reported to the Operation Colleagues at Rm.2029 during office hours and Support Colleagues listed on the Emergency Contact list during non-office hours.
- In the event of fire, the fire suppression system will be activated automatically. Evacuation of the facility immediately and do not stop to collect personal belongings after hearing the fire alarm.

Appendix A – Guidelines for improving the Energy Efficient of Computing Equipment in Colocation Data Center

The main goals of ITSC Colocation Data are to provide a central facility for housing departmental computing equipment and reduce the energy consumption by optimising the data centre's performance, efficiency and space.

ITSC will use the metric Power Usage Effectiveness (PUE) to measure the efficiency of the Colocation Data Center. PUE is an industry-preferred metric for measuring infrastructure energy efficiency for Data Centers proposed by the Green Grid that is the ratio of total amount of energy used by Data Center Facility (i.e. cooling, lighting, UPS, power distribution units (PDUs), batteries and any other overhead energy) to the energy delivered to computing equipment.

$$\text{PUE} = \text{Total Facility Power} / \text{Computing Equipment Power}$$

The lower the PUE value indicates the higher the efficiency of the Data Center as more energy is used by computing equipment.

<u>PUE</u>	<u>Levels of Efficiency</u>
3.0	Very Inefficient
2.5	Inefficient
2.0	Average
1.5	Efficient
1.2	Very Efficient

ITSC has a target to achieve the PUE 1.6 to fulfil the sustainability goal of the University by reducing the power utilization and carbon footprint in Colocation Data Center. Besides the adoption of high efficient power and cooling systems, one of the most impactful way is to use the more energy-efficient computing equipment in Colocation Data Center. Almost half of the total energy consumption is dominated by computing equipment as reported in related research on University Data Center.

• Data Center Facilities (Lightings, PDU, UPS etc.)	10%
• Cooling	30 %
• Computing Equipment (Desktop, Servers, Storage etc.)	60%

Departmental Technical Supporting Colleagues are recommended to follow the below guidelines for improving the energy efficient of computing equipment in Colocation Data:

- Use Energy Star certified computing equipment, the energy efficient could improve by 30% than standard equipment on average. Replacing a conventional server with an Energy Star server could save up to 1000 kWh annually.

ENERGY STAR is a U.S. Environmental Protection Agency voluntary program that certified computer product criteria require that computers operate efficiently in multiple modes of operation, utilize efficient power management features and utilize energy efficient power supplies. For detail, please refer to <https://www.energystar.gov/products?s=mega>.

- Use virtualization to consolidate multiple servers to a single physical host server or leverage on ITSC Private Cloud Service, thus reducing the number of physical servers needed and decreasing

electricity consumption and waste heat. With virtualization, each machine can run at high utilization rate and enable the repurposing and decommissioning of some existing servers.

- Use Rack mountable server with a front to rear cooling configuration could provide better cooling and space efficiency.
- Identify aged computing equipment with no use still running, the decommissioning of unused computing equipment could decrease electricity consumption and waste heat.
- Recommend to set the maximum lifecycle of computing equipment for a period of 8 years. The Performance per watt of computing equipment will be depreciated over time and lead to inefficiencies and raising the total cost of ownership (TCO). Performance per watt metric is a measure of the energy efficiency of a computer hardware. Literally, it measures the rate of computation that can be delivered by a computer for every watt of power consumed.
- The Power Distribution Units (PDU) in each equipment rack can provide active metering of individual outlets and enable the measurement of power consumption for each plugin computing equipment. The power usage reports for each department will be provided by ITSC for optimization and capacity planning including the total rack power consumption and individual computing equipment power consumption of Department.

Appendix B - FAQs for ITSC Colocation Data Centre Service

1. What are the features of ITSC Colocation Data Center Service?

Users of this service can expect the following from ITSC:

- **Coordination** - ITSC Operation Support will coordinate with users in planning the move and installation of computing equipment, assistance in infrastructure resource assignments, power, rack and cable management without installation services offered.
- **Physical monitoring** - ITSC will monitor the Data Center to make sure only approved personnel enter the facility.
- **Facilities monitoring** - ITSC will monitor the Data Center facilities, network and other support services to ensure they are available and operating as expected.
- **Safety Checking** - ITSC reserves the right to inspect user's equipment rack as necessary to ensure power, networking and other standards are being correctly followed. ITSC may also take immediate steps to remedy any safety and operational issues (e.g. power off any equipment in the Data Center if the equipment represents a security risk, a risk to other tenants. Reasonable attempts will be made to contact the client before taking such action.)
- **Network Connectivity** – ITSC will provide Campus network connectivity and internet access to the computing equipment installed in Colocation Data Center. Depend on the user requirements, 1G/10G connectivity will be provided including the UTP patch cables.

2. What do users have to do?

As users of this service, they are responsible for the following:

- Provide and ensure system and security contact information is kept up-to-date and notify ITSC for any changes (e.g. new services, upgrades, changes, outages) by mail to ccops@ust.hk.
- Designate individuals authorized to access their equipment. ITSC will challenge any individuals not authorized.
- All equipment must have out-of-band and remote management capability, if applicable. (e.g. iDRAC, iLO, IPMI etc.)
- Users must not lease rack space to others.
- Users are responsible for all external costs associated with vendor for computing equipment hardware and software maintenance.
- Ensure proper delivery of equipment to the Data Center and coordinate with ITSC before placing any new or relocating existing equipment.
- Users must identify at least two people that shall have physical access to the Data Center and computing equipment. Users must let ITSC know in a timely fashion when changes to access are necessary, for example, when someone on the list leaves your department.
- When the current ITSC Data Center equipment reaches end-of-life, users will be responsible for removal and disposal.

- Users are responsible for the operation of computing equipment including managing hardware upgrades and maintenance, installations, removals, and software upgrades.
- Users are responsible to make sure your data assets are backed up to support your recovery needs. Users are also responsible to perform any system recoveries.

3. Security

Users are responsible for following University guidelines and general best practices for securing the computing equipment. This includes registering and patching servers, using appropriate malware avoidance software and maintaining access control lists. If for some reason the computing equipment is compromised, and it becomes a threat to the University (e.g. it is being used as a host to attack other services), ITSC reserves the right to remove the equipment from the network or block its traffic. If this occurs, ITSC will notify the user immediately.

4. What type of equipment can be hosted?

Any server, storage or computing equipment can be hosted by the Colocation Data Centre. The Rack mountable equipment with a front to rear cooling configuration is highly recommended in providing better cooling and space efficiency. Shelving can be supported for non-rack mountable equipment and will be discussed at time of occupancy

5. Is the facility secure and how do user get access?

The Colocation Data Centre incorporates the HKUST Card for access control. All entry records are logged and the facility has monitored cameras throughout. For rack door access, users are required to possess an ITSC Colocation Data Center Card.

The Colocation Data Center will be operated in unmanned mode, an authorised user can give 24 X 7 entrance into the facility without escorted by ITSC Operation Support.

6. How to apply ITSC Colocation Data Center Card?

The ITSC Colocation Data Center Card for rack door access is required to apply through the Technical Supporting Staff of each Department who is responsible for the administration of departmental servers hosting in Colocation Data Center



7. Can the ITSC staff help with installation?

ITSC Operation Support will provide assistance in infrastructure resource assignments. No installation and management services are offered in Colocation Data Center, users are responsible for the installation and management of their own equipment into the facility.

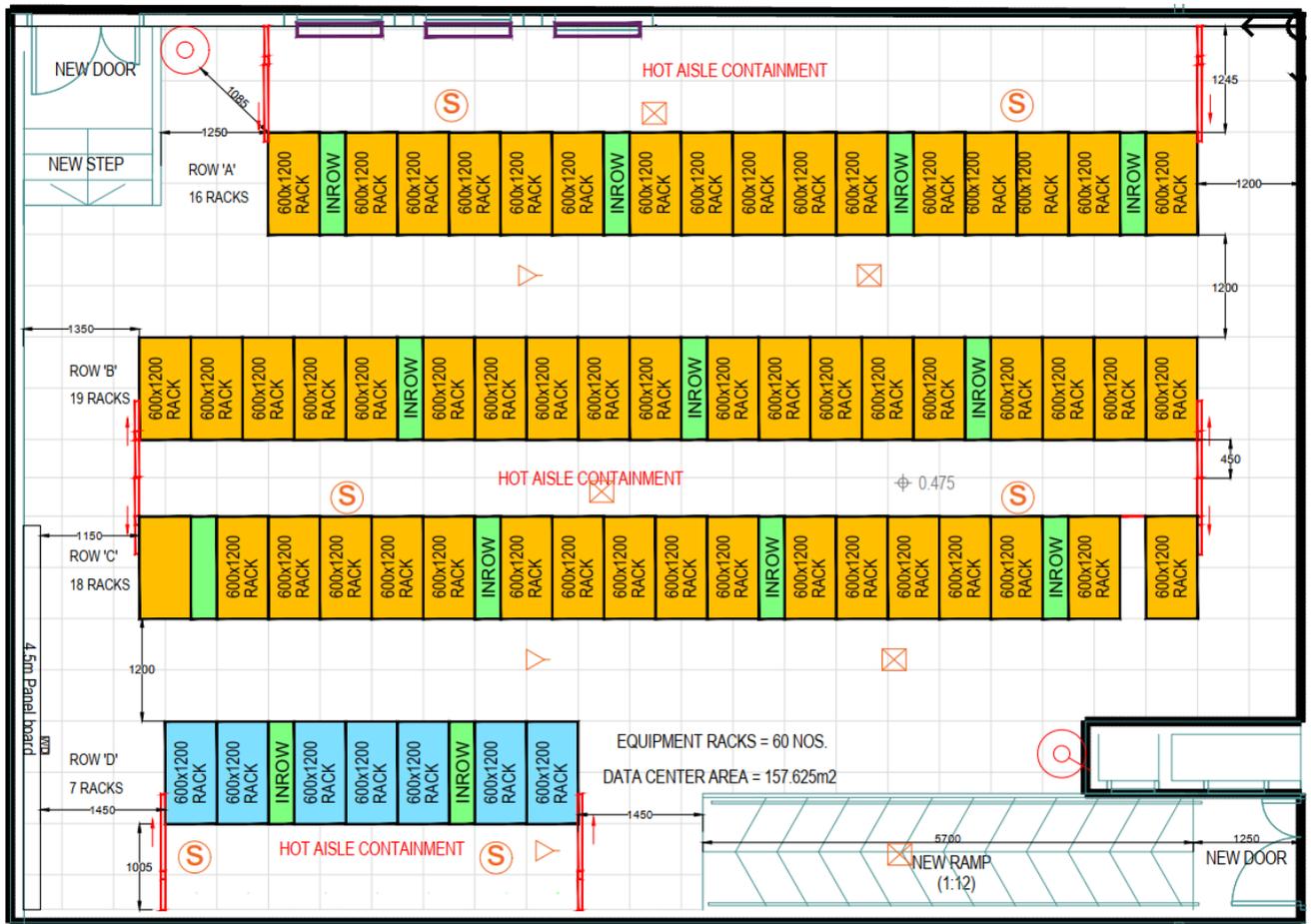
8. Will users get charged for Rack Space, Power and Cooling costs?

No fees will be charged.

9. How long can computing equipment stay?

A maximum lifecycle for the computing equipment is set at 8 years. When the equipment has reached end of life that will need to retire and remove from Data Center.

Appendix C - Colocation Data Center Rack Layout



Appendix E – Rack Door Access

