Telecommunications Design Guidelines

University of Alberta Cabling Standards (version 3.2)
Revised: 2021

Introduction:

The information in this document should be useful in making design-related decisions that will not only satisfy the University of Alberta (U of A) Information Services and Technology (IST) requirements but also meet the needs of the building and its future occupants with respect to voice, video and data communications. The intention of this document is to provide stakeholders, at early stages of projects, sufficient information relevant to the design of telecommunications pathways and spaces.

The Telecommunications Design Guidelines are for all planned building projects, either new builds or renovations to existing builds, on the U of A campus.

Stakeholders such as Facilities Management, the PMO, architects and engineers that design physical pathways for the telecommunications cables will benefit by following these guidelines. All new cabling installations and wiring retrofits to existing cable requirements at the University of Alberta should follow the current EIA/TIA and CSA cabling standards. The following points are to be strictly adhered to for all wiring jobs and are to be considered an integral part of the University cabling infrastructure.

Any inquiries about this document should be directed to the Cabling and Edge Network team within the University of Alberta, Information Services & Technology department. To contact, please call 780-492-9400 or email ist@ualberta.ca**.**

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1. General Specification Guidelines

IST bases its requirements on CAN/CSA standards and ANSI/EIA/TIA standards such as:

- 568-B -- Commercial Building Telecommunications Cabling Standard
  ANSI/TIA/EIA-568-C.3.
- Optical Fiber Cabling Components Standard 569-C Commercial Building Standards for Telecommunications Pathways and Spaces 606-C.
- Administration Standard for the Telecommunications Infrastructure of Commercial Buildings 607-.
- Commercial Building Grounding and Bonding Requirements for Telecommunications.
- BICSI Telecommunications Distribution Methods Manual (TDMM) Part 1, C22.1 Canadian Electric Code (NFPA 70).

Requirements dictated by Canadian Electric Code (CEC) shall be adhered to completely. Adjustments to any of the requirements stated in this document, that are not CEC based, will be evaluated on a case by case basis and must be coordinated with IST and Facilities Management Electrical Projects Office.

Canadian Standards Association (CSA)

CSA produces several documents and standards that affect telecommunications. Among the most important are:

- CAN/CSA-B72-M87, Installation Code for Lightning Protection Systems.
- CSAC22.1, Canadian Electrical Code (CEC), Part I, Safety Standard for Electrical Installations.
- CSAC22.3 No. 1-15, Overhead Systems.
- CSAC22.3 No. 5.1-93, Recommended Practices for Electrical Protection–Electric Contact Between Overhead Supply and Communication Lines.
- CSAC22.3 No. 7-15, Underground Systems.
- CSA Z195.1-16, Guideline for Selection, Care, and Use of Protective Footwear.
- CSA Z195-14, Protective Footwear.
- CSA Z462, Workplace Electrical Safety.

2. Entrance Conduits

New buildings must be connected to the U of A telecommunications Service Corridors and cabling tray or conduit system within. IST will give design advice as to where the point of connection should be, and recommend a pathway for the new conduit or tray.

In some circumstances, new conduit may need to be installed, as existing conduit may be full. At minimum one 110mm (4”) and one 63mm (2”) conduit will be installed in a new building. The 63mm conduits are to be routed to the fire alarm panel, Remote Control Monitoring System (RCMS) panel etc. and not to the telecommunications room (TR). A minimum 10mm pull rope with 90kg tensile strength must be provided in each conduit, NO pull strings will be permitted. All conduits must be cleaned utilizing a mandrel to eliminate sharp edges after installation.

Note that it is important that the general contractor obtains substructure locations for all existing utilities prior to starting excavation work. The contractor should use both Facilities Management and campus sources for the proper permits.

Minimum Bend Radius

During installation, cables are bent or flexed in various environmental conditions. Cables are often bent around a curve in conduits or underground ducts. Cables are also bent when pulling a cable around a sheave, which is a pulley set up in a manhole to help ease a cable around a curve. Cables are composed of different components that may become compromised if bent too far and stress is placed on the cable.

For example, while bending a medium-voltage cable consisting of a copper tape shield, the cable may form cracks in the outer jacket. To prevent cable damage, cable standards such as The National Electrical Code (NEC) and the Insulated Cable Engineers Association (ICEA) formed requirements for minimum bend radius.

The minimum bend radius is the smallest allowed radius the cable is allowed to be bent around.

3. Requirements for Telecommunications Room

A. Location

There must be at least one telecommunications room (TR) in a single-story building. For multi-story buildings there must be one TR on the first floor (or basement). TR placement must be discussed and approved by IST before issuance of final design drawings. TRs must be placed to make sure the cabling for all telecommunications outlets (TO) are no longer than

90m. In the case where this is not possible on a single floor, then multiple TRs may be required on a floor.

It is ideal to locate the TR(s) near the building's core. The TRs should be aligned or stacked as vertically as possible. TRs must be accessible from a public space (IE: building exterior or hallway). Areas such as offices, classrooms and auditoriums are not considered public spaces.

B. Contents

Where possible a TR should be dedicated solely to telecommunications. A TR should not contain electrical and mechanical equipment, fire alarm panels (permissible on a case by case basis), sinks or other sources of water, equipment not related to the TR's function (such as piping, duct work, building column and distribution of building power).

C. Size

The size of the telecommunications spaces depends on the function and total area served. (Please refer to the sizing method for each specific type of telecommunications space in items K and L.)

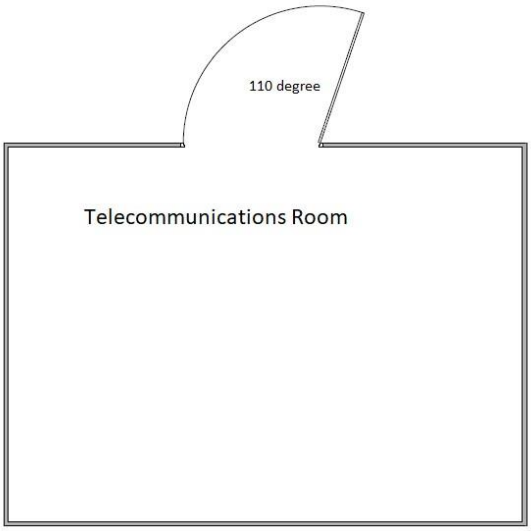
D. Clearances

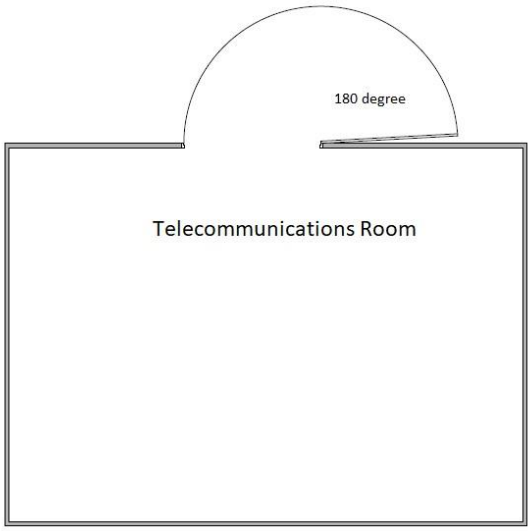
The following clearances should be provided for equipment and cross-connect fields in telecommunications spaces:

- Minimum 1m clearance free from obstruction in front and back of all equipment.
- Minimum 300mm clearance free from obstruction on each side of all equipment.
- If the 1m clearance is not possible due to cabling mounted below access floors or above ceilings, provide as much unobstructed space as possible. 1m clearance must always be maintained in front.
- In some cases the depth of equipment exceeds the depth of the rack or cabinet. In these cases the working clearance shall take into account the depth of rack-mounted equipment that exceeds the rack or cabinet.
    - NOTE: In some cases, equipment and connecting hardware may extend beyond racks, cabinets, enclosures, and backboards. It is important that the clearance is measured from the outermost surface of these devices rather than from the mounting surface of the rack, cabinet, enclosure, or backboard.
- The designer should always consider adequate clear space in the area of cabling terminations and equipment connections for safety considerations.

E. Doors/Entryways

All doors to a TR must open 180 degrees outward unless restricted by building code. They must be a minimum of 2032mm x 910mm wide with no door sills or windows. Locks must be keyed to the University of Alberta standard. There should only be one entrance, with the exception of loading doors where needed. If double doors are used it is prefered to not have a mullion. If a mullion is needed, it must be removable.





F.Floors

Carpeting shall not be permitted in any TR. Flooring should be treated and sealed to eliminate dust. Static-controlled vinyl tiles are the preferred floor cover. The floor load rating in a TR shall be no less than 490kg/m2. The static loading shall be no less than 900kg in areas that will support telecommunications equipment.

G. Walls

All walls must be lined with 19mm plywood. The plywood must be fire retardant or treated with at least two coats of fire retardant paint on all sides. There shall be nothing run across or mounted to the plywood that is not related to the telecommunications equipment. This includes, but is not limited to, conduits and junction boxes or any other equipment.

In some older situations where the proper 19mm fire retardant wall material was not used, all wall anchors must be lead or metal or approved drywall anchors and NO plastic or fiber to be used. As is the case for fire/building safety codes, all wall penetrations within a TR must be fire stopped with proper rating.

There shall be no windows in a TR, walls should be treated and sealed to eliminate dust.

Proper lighting is addressed in the lighting section, however the use of light colored paint is recommended to aid with lighting in the rooms.

H. Ceiling

There shall not be a drop or suspended ceiling in any TR. The minimum acceptable ceiling height is 8.5' or 259 cm. It should be unobstructed to provide space over the equipment racks for suspended cable trays or horizontal ladder racks. Sprinkler heads must be provided with cages to prevent accidental operations.

Ceilings should be treated and sealed to eliminate dust.

I. Electrical Power for Telecommunications Rooms and Entrance Facilities

A minimum of two dedicated non-switched 3-wire 120 volt AC quad outlets are required for equipment power; each one on a separate branch circuit. Branch circuits for equipment power shall be protected and wired for 20A capacity.

For information regarding VoIP installations. The outlets should be mounted 305mm above the finished floor (AFF). Separate duplex convenience outlets shall be installed at a 1830mm interval around the room.

Both building power and emergency power must be utilized whenever possible for Building Aggregation Switches within Entrance Facilities where Uninterrupted Power Supplies (UPS) devices are used. Uninterrupted Power Supplies (UPS) devices are used in Building Aggregation network rooms.

Requirements:

Emergency power: L6-20R (twist locking 208V, 20A Receptacle) **Note**: please install the receptacle close to the rack in the Entrance Facility so equipment within the rack can be connected efficiently.

Building power: Standard NEMA 20A. **Note**: please install the receptacle close to the rack in the Entrance Facility so equipment within the rack can be connected efficiently.

Due to the universal access to cell phones, IST's standards for Telecommunication rooms do not require UPS for VoIP.

FMNet power requirements:

The switches FMNet use are spec'd and supplied through IST and have the same requirements.

J.Lighting

Due to the nature and sensitivity of working on network equipment, it is imperative to be able to see when working in a Telecommunications Room. Lighting must have a uniform intensity of 1500 lumens which is approximately equivalent to four 60 watt bulbs.

Indirect lighting is not permitted. Lighting fixtures must be on separate electrical circuits separate from the circuit that feeds the electrical outlets in the room. Do not place light fixtures above equipment racks, cabinets, frames or other freestanding equipment to avoid blocking of light.

K. Environmental Control

The temperature inside telecommunications rooms must be maintained between 17.7 degrees Celsius to 23.8 degrees Celsius and relative humidity between 30%-55%. Ideally, there must be at least one air exchange per hour in the rooms to maintain positive pressure inside the rooms.

L.Grounding

Proper bonding and grounding (earthing) helps to reduce the effects of Electrical Magnetic Interference (EMI). This section contains several important considerations.

The bonding and grounding (earthing) of buildings, electrical systems, and cabling infrastructure are as varied and dynamic as the equipment and cabling served within or by them. Important items of consideration when designing a cabling system for Electrical Magnetic Compatibility (EMC) are:

- Availability of structural steel within the building.
- Bonding infrastructure for EFs and TRs.
- AC grounding (earthing) electrode system design.
- AC equipment grounding (earthing) system design.
- Use of surge protection.

- Use of shielded cable.
- Existing or possible sources of EMI.

Per Canadian Electrical Code (CEC) and ANSI/EIA/TIA- 607 requirements, the telecommunications grounding and bonding infrastructure shall be designed and routed through each telecommunications space. Each telecommunications room shall be equipped with a Telecommunications Grounding Busbar (TGB) bonded directly to the Telecommunications Bonding Backbone (TBB). The busbars shall be a minimum of 6" or 152 mm in length, 2" or 51 mm in width and 6mm thick. They shall be drilled and tapped to accommodate standard NEMA compliant grounding hardware. The TBB shall be a minimum of #6 AWG stranded copper grounding conductor and should be in conduits. All TBBs must be tied to the telecommunications main grounding busbar (TMGB) located in the equipment room (or main telecommunications room). The TMGB must be bonded to the building system ground with a minimum of 3/0 AWG stranded copper bonding conductor (BC). The ohmic resistance to ground from any point in the telecommunications grounding system must not be more than 3 ohms.

M. Fiber cabling

In every project, renovation or new build, when there is existing legacy fiber (50 or 62.5 micron) it needs to be replaced with Single Mode Fiber (SMF) which is IST's standard for fiber cabling. It may not be clearly evident as to what type the existing fiber is, please contact IST for confirmation to ensure clear understanding prior to project design.

4. Entrance Facilities (EFs)

An Entrance Facility (EF) is an entrance to a building for both public and private network service media, including wireless. This includes the Entrance Point (EP) at the building wall or floor, the conduit or pathway, and continuing on to the entrance room (ER) or space. The Entrance Facility (EF) can be located within a separate room or within the Entrance Room (ER). If the Entrance Facility (EF) is within the Entrance Room (ER), additional space shall be designed within the Entrance Room (ER). Telecommunications Entrance Facilities (EF) shall be located in an area or areas of a building that are best suited to serve the occupants of a building.

This service entrance includes the:

- Path that these facilities follow on private or public property.
- Single or multiple Entrance Points (EPs) to the building. ● Termination point or Distribution Point (DP).

The type and location of the entrance depend upon the:

- Type of facility being used.
- Path the facility follows.
- Building architecture.
- Aesthetics.

5. Backbone Distribution System

A backbone distribution system is the part of a premises distribution system that provides connection between telecommunications spaces.

A backbone distribution system typically provides:

- Building connections between floors in multi-story buildings. ● Campus connections in multi-building environments.

A backbone distribution system may consist of any or all of the following:

- Cable pathways (i.e., inside and outside plant).
- Entrance Facility (EF) that may contain Horizontal cross-connect (HC).
- Floor distributor (FDs).
- Intermediate cross-connect (building distributor) ICs (BDs).
- Main cross-connect (campus distributor) MCs (CDs). ● TRs that typically contain HCs (FDs).

An EF:

- Transmission media (i.e. cables and connecting hardware). ● Miscellaneous support facilities.

Component	Description
Transmission media	The actual medium, which may be: • Optical fiber. • Balanced twisted-pair. • Coaxial. • Wireless. Connecting hardware, which may be: • Connecting blocks. • Patch panels. • Patch cords and jumpers. • Interconnections. • Cross-connections. NOTE: Backbone cabling also can be a combination of media, wireless, and free space optics equipment.
Miscellaneous support	Materials needed for the proper termination and facilities installation of the backbone cables. These include: • Cable support hardware. • Firestop • Bonding hardware [Earthing]). • Protection and security.
HC (FD)	A group of connectors (e.g., patch panel, punch-down block) that allow equipment and backbone cabling to be cross-connected or interconnected with patch cords or jumpers to horizontal cabling. Floor distributor is the international equivalent term for horizontal cross-connect.
IC (BD)	The connection point between a backbone cable that extends from the MC (CD [first level backbone]) and the backbone cable from the HC (FD [second level backbone]). Building distributor is the international equivalent term for intermediate cross-connect.
MC (CD)	The cross-connect normally located in the (main) equipment room for cross-connection and interconnection of entrance cables, first level backbone cables, and equipment cables. Campus distributor is the international equivalent term for main cross-connect.

HC (FD) = Horizontal cross-connect (floor distributor)
IC (BD) = Intermediate cross-connect (building distributor)
MC (CD) = Main cross-connect (campus distributor)
TIA = Telecommunications Industry Association

6. Telecommunications Rooms (TRs)

IST shall determine telecommunications room locations for new build projects. With regards to renovation or technology renewal projects IST will determine which telecommunication room will be used.

Telecommunications cables should be separated from possible sources of Electromagnetic Interference (EMI) and from possible Radio Frequency Interference (RFI). For safety purposes, power cables shall be separated from telecommunications cables.

A telecommunications room (TR) will contain telecommunications equipment, much of it mounted on 19" racks. Cables will be spliced and terminated on the walls. It is important that the entrance conduits stub up in the TR as close to a corner as possible.

Typical TR dimensions are 12' x 12-1/2' (minimum) or 3657mm X 3810mm for a building serving fewer than 200 work areas -- a typical work area (WA) is 10'x10' or 3048mm X 3048mm. A larger building will require a larger TR.

TR's Must include horizontal cable trays mounted a minimum of 610mm from both the ceiling and rack to provide 2 meters of a service loop for cabling before it is run into the rack. No service coils are permitted to be located in the rack.

TRs differ from EFs in that they are generally considered to be floor-serving or tenant-serving (e.g., as opposed to building or campus-serving) that provide a connection point between backbone and horizontal infrastructure spaces

TR design should consider incorporation of other building information systems in addition to traditional voice and data needs (e.g., CATV, wireless networks, alarms, security, audio, other building signaling systems).

TRs provide an environmentally suitable and secure area for installing:

- Cables.
- Cross-connects.
- Connecting hardware.
- Telecommunications equipment.

The design of TRs depends on the:

- Size of the building.
- Floor space served.
- Occupant needs.
- Telecommunications service used.
- Future requirements.
- Number and type of cables being served from the space.

Heat Load (Typical TR)

Assume we use 2x power supply per 48-port switch, and each power supply would have 1000W or 3412 BTU/hr so 2x 48-port switches would be 2x 3412 BTU/hr

Example: if a Comm Room has 158 lines, this will require 4x 48-port switches = 4x 6824 = 27296 BTU/hr.

Note: this assuming value is the maximum fully loaded power of the switch.

Drawings

IST requires floor layouts showing data ports / data port counts to ensure appropriate amount of switchgear equipment is ordered and labeling written on the drawings after terminations are completed.

7. Service Corridors

The University of Alberta's Service Corridor is not considered as an outdoor environment therefore a minimum flame test rating of FT6 (CSA) or CMG (NEC) for communications cabling is required. All new installations must be reviewed by Utilities and IST in order to follow the University of Alberta's standard on no splice canisters installed into or mounted on to the tray system. Indoor/outdoor fiber cables are required when running cables through the service corridor.

8. Horizontal Pathways

The Horizontal Pathway System is the pathway through which cables are pulled from the TR or TR to the outlets on that floor. Outlets must be connected to the closest TR as specified by IST.

9.Tie Wraps or Zip ties

The cable jacket shall not be deformed when dressing cables. Tie wraps/Zip ties are **not acceptable**. Velcro shall be used to support CAT 6 cabling.

10. Riser Conduits

In new buildings, a minimum of four 102mm vertical riser conduits are required between TRs. In the case of non-existent conduits such as renovations of existing buildings or addition of TRs, adding additional conduit will be allowed as required or physically able to fit.

11. Raceway Systems

Perimeter Raceways

In a perimeter raceway, power and telecommunications cables must be in separate compartments and must comply with applicable electric codes. When a metallic barrier is provided, it must be bonded to ground. The barrier must run continuously throughout the length of the raceway. Radius bend fittings must be used in “LB” fittings, or any other raceways. Junction boxes to have a 7” or 178 mm radius bend. A pull box must be installed every 30 metres or every 90 degree bend radius. Open ceiling and mechanical rooms must have conduit or approved cable tray. No free air or supported by existing conduit is allowed.

Raceways Inside Rooms

- Wiremold 700 or equivalent can only be used on single vertical surface installations down a wall with a maximum of two (2) CAT 6 cables and minimum box of Wiremold 5748 or equivalent.
- Suggested minimum raceways or equivalent: Non-metallic uniduct 2900 1-1⁄2” (38mm) x 3⁄4” (19mm) with radiused elbows.
- Existing hollow walls with a low voltage bracket can be used as a raceway. CAT 6 cable must be protected entering through metal studs or metal plates.
- Hubbell PL1 non-metallic Raceway - single channel with radius elbow fittings or equivalent.
- Hubbell PW2 - two channel raceway with radius elbow fittings or equivalent.
- Wiremold 5400 series - two channel raceway with radius elbow fittings or equivalent. Suggested for larger installations.

12. Cable Trays

Cable trays to be installed according to electrical code. Telecommunication Outlets (TOs) can also be connected to the TR via a combination of cable tray and conduit. U of A has standardized on using basket or ventilated solid type cable trays. Ladder tray is not recommended. TOs should be connected to the cable tray with home run 1-1/4" conduits. Cable trays should be a minimum of 18" x 4" (45.72 cm X 10.16 cm. 457 mm X 101 mm.).

Waterfall should be provided for transition from overhead cable tray to racking.

It is important that the path for the cable tray is clear of obstructions, such as HVAC ducts, large pipes and structural beams within the building. Where fire or smoke barriers are penetrated by the cable tray, they shall be fire stopped to maintain the rating of the barrier. Alternatively, conduit sleeves may be used through the penetrations. They must be fire stopped as well. The number of sleeves required depends on the number of cables and size of tray. Use a 40% fill ratio to

determine the number of sleeves. Two additional spare sleeves should be installed to accommodate future cable placement with fire seal or capped off.

Place cable trays above drop ceilings in corridors. Do not place them above offices or inaccessible spaces. There must be at least 102mm of vertical space between the suspended ceiling tile and the bottom of the cable tray; 305mm of vertical clearance from the top of the cable tray to the true ceiling; and 2' (50.8mm) total side clearance (meaning, if the cable tray is wall mounted and there is no clearance on one side, then minimum clearance on the other side should be 2' (50.8mm)).

It is desirable that the cable tray originates from the TR. If it does not originate from the TR then 4" or 102mm conduits may be used to connect the TR to the cable tray. The number of 4" or 102mm conduits required depends on the number of cables and size of tray. Use a 40% fill ratio to determine the number of 4" or 102mm conduits. Two additional spare conduits should be installed to accommodate future cable placement.

Access ceiling panels must be installed at a 1525mm interval if the cable tray is passing through a hard-lid ceiling. The panels should be within 610mm from the cable tray. They shall not be mounted directly underneath the cable tray.

All metallic cable trays must be bonded but should not be used as grounding conductor for equipment.

It is recommended for installations over 25 lines that a cable tray be used. The cables must be properly radiused or waterfalled when leaving the cable tray in the TR with a physical radius part, no tie wraps or Velcro substitutes.

13. Homerun Conduits

Telecommunications outlets (TOs) should be connected to the TR with a home run. 1-1/4” or 32mm conduit sleeve/stub required in wall space, with a maximum of four CAT 6 cables. Longer runs of 3⁄4” or 19mm conduit shall have a maximum of three (3) CAT 6 cables. “LB” fittings to be used only with radius bend of 7” or 178mm. Junction boxes to be 4”x4” or 102mm X 102mm deep straight through - 3 - conductor 3⁄4” or 19mm conduit. For straight through 1” or 25mm conduit, there shall be a maximum of six (6) CAT 6 cables. A 7” or 178mm radius bend on CAT 6 cable must be kept even when using larger junction boxes for 90 degree turns.

14. Flexible Conduits

Flexible conduits such as metallic flexible conduit are not desirable pathways for telecommunications cables because they tend to "creep" and "shift" and cause sheath damage to the cables. Therefore, the use of flexible conduits as pathways for telecommunications cables must be avoided as much as possible. Conduits should be grommeted.

15. J-Hooks

J-Hooks are to be used only in existing ceilings or small renovations where cable tray or conduit cannot be installed. J-hooks on T-bar wire support a maximum of five (5) CAT 6 cables on single wire. There shall be one (1) J-hook maximum per T-bar wire, and be at every 1220mm. J-Hooks with six (6) or more CAT 6 cables shall be supported by independent rods
every metre or every 915mm. J-hooks shall be installed to nearest tray or conduit

New constructions or renovations shall be cable tray and conduit. No J-hooks are allowed.

16. Telecommunications Outlets (TO)

A. Standard Wall Outlets

Hubbell universal keystone standard U of A telecommunications outlet (TO) is used for voice, data and sometimes video communications. It requires a 4” or 102mm square electrical double gang box, 3 5/8" or 92mm deep with a single gang mud ring. It is mounted flush in the wall at the same height as the convenience electrical outlet -- 12" or 305mm AFF. The 1104 electrical outlet boxes will not be acceptable. Wall outlets shall have a maximum of four (4) CAT 6 per gang box according to electrical code.

Telecommunication Outlets mounted behind furniture must be accessible. If the structure of a desk, such as a privacy skirt or a modesty screen, is restricting access to the TO, the TO must be brought upwards to an appropriate height for accessibility.

If possible, please consider furniture designs when determining outlet placement. Wall ports must remain accessible for terminations, testing, and future troubleshooting. Hubble angled style faceplates are best practice to reduce damage caused by furniture.

Indicate TO locations on the prints with half-shaded triangles. Use appropriate symbols to differentiate TOs that have an additional interface such as video or that support special devices like a wireless access point.

A TO for a wireless access point should be no more than 915mm away from the specified wireless access point location. IST is responsible for wireless design and wireless access point placement. The TO must be designated with appropriate subscript on the drawings. IST installs the wireless access points after the building construction is complete.

B. Jacks, Faceplates and Panels

An angle type faceplate is recommended to be when terminating cable. Acceptable Material:

- Hubbell:
    - Voice/data jacks must be purple. ○ UWS jacks must be yellow.

Part Number	Description
Hubbell NSPJ24	Hubbell Patch Panel
LBP - 4a	MidAtlantic Square Lacing Bars
Hubbell HXJ6P (for room ends)	XCELERATOR™ Jacks, Category 6, Purple
Hubbell HXJ6Y (for UWS wireless ends)	XCELERATOR™ Jacks, Category 6, Yellow
Hubbell	iSTATION™ Modular Plate Frame, Single-Gang, Office White
IMF1OW	
Hubbell IM2KA15OW	AV Unloaded Module, Keystone, 2-port, Angled, 1.5 Unit, Office White
Hubbell IM1KA15OW	AV Unloaded Module, Keystone, 1-port, Angled, 1.5 Unit, Office White
Hubbell IMB15OW	AV Module, Blank, 1 Unit, Office White
Hubbell	AV Connector, Blank Module, Office White

C. Floor-mounted Outlets

Enclosures for floor mounted TOs must have 1-1/4" or 32mm knock-outs to accept the station conduits and must accommodate Hubbell universal keystone standard TO faceplates.

D. Pack Poles

The pack pole must have a physical divider between the power and data as per CSA standard. This pack pole must have grommets on entry and exit points.

E. Service Loops

The cable installation contractor will leave a 1m minimum of extra CAT 6 cable on the room end, and should have a 1m service loop in the ceiling space before being installed down the wall. The cable installation contractor will create a minimum 2m service loop in the TR space leaving no more than 3m of extra cable past the service loop. Moreover, a 3m service loop should be left on the cable tray in the TR.

F. Modular Furniture

Modular furniture must accommodate Hubbell universal keystone standard TO faceplates and can be provided by IST Cabling Services for an added cost.

17. Miscellaneous

A. Audio-visual, Intercom and Paging Systems

Audio-visual (AV) systems, intercoms and similar in-house paging devices are the responsibility of the project manager or architect.

The associated equipment to support Audio Visual services may not be located in any network TR. Contact IST Repair and Deployment for further information in designing, supporting or maintaining these systems. To contact the IST Repair and Deployment team, call the helpdesk at 780-492-9400.

B. Legacy Phone Line

Special cabling requirements may be needed in case of PBX service. Phone line information and PBX questions are handled by IST Telecommunications Team. Their responsibilities include University Switchboard; University telephone systems - PBX, Cisco VoIP, Cisco Uniity Voicemail,

Cellular Services; Audio conferencing support, Campus directory, TELUS directory; wired phones; liaising with TELUS Technician and other vendors. To contact the IST Telecommunications Team, call the helpdesk at 780-492-9400.

C. Elevator Phones

Elevator phones are covered under the Elevator Specification Guideline as designed by U of A Planning & Infrastructure, Electrical Maintenance is responsible for service to these phones. There must be at least one TO in the elevator equipment room that is cabled to the elevator controllers to allow for the actual connection of the phone in the elevator cab. There must be an adequate number of jacks on the TO to accommodate all elevators in the building.

18. Reroutes

For many new buildings, the site work means that existing telecommunications cables in the area need to be rerouted. The architect is responsible for designing the conduit, cable tray etc. necessary for the reroute. IST will provide design advice and information. The general contractor will install the new underground conduit and Service Corridor conduit.

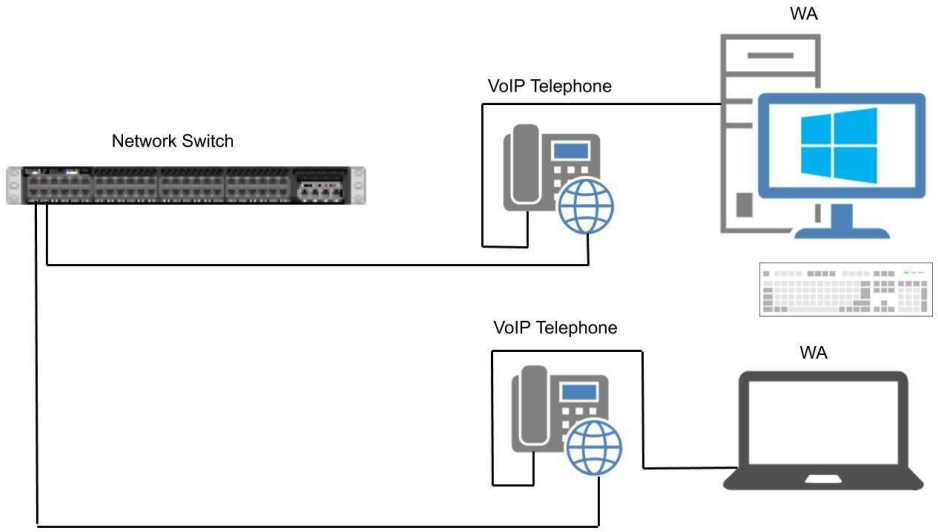
IST will engineer the reroute of the cables through the new conduit. Cable reroutes are not done by the general contractor. No existing telecommunications cables can be damaged or demolished until the reroute is complete. This needs to be made clear in the general bid documents. IST will advise the Project Management Office (PMO) during the design stage how much time must be allowed in the construction schedule for the cable reroute.

19. Additional Cabling Specifications

* All cable and/or connectivity hardware can be obtained directly from IST*

- Our standard is to reduce unused ports campus wide. Therefore our standard is to deploy one network line to be used for each person within a specific room for VoIP and the PC.
- Additional lines could be required, such as for printers or faxes (including ATA services) and shared devices. An analog telephone adapter (ATA) is a device for connecting traditional analog fax machines.
- Also Additional lines could be required, such as for printers or faxes (including ATA devices) and shared devices.

The following diagram lays out an example of one workstation area:



VoIP = Voice over Internet Protocol
WA = Work Area

Installation permits for data and telecommunication cables requirements:

- **Fiber Requirements - as per EIA/TIA and CSA standards:**
  - Singlemode to be SMF28e or equivalent.
  - Multimode(MM) 50µm OM4 minimum (Legacy support, **NO** new Multimode installations).
  - Indoor use FT-6 rated, tight buffered.
  - Outdoor use is moisture protected, tight buffered, and may need UV protection.
  - Can share conduit space with copper lines.
  - Termination to be LC connectors.
  - Multimode fiber to be directly terminated or fusion spliced (Preferably by IST, legacy support).
  - Singlemode(SM) fiber to be fusion spliced (Preferably by IST).
  - Fiber patch panels to be used at all locations, IST to determine type/brand of enclosure to suit the location (i.e. Siemon depending on location and proper adapter strips depending on terminations).
  - Fiber optic cable should have a 10m loop at each end of installations.
  - For consistency the following orientation for Adapter Strips (may be referred to as “Bulkheads”) indicates upright orientation

- IST's standard Adapter Strips standard manufacturer is Siemon. IST understands there are 2 colours of adapter strips (Blue and Beige). There is no difference in core size support between the 2 colours, ei: SMF or MMF. For consistency, IST's preference is beige.

NOTE: Per applicable standards (e.g., ISO/IEC 11801-1 and TIA 568.3) OM1 (62.5/125) and OM2 (standard 50/125) are legacy. These MMF cables are not used for new installations but are used for upgrading pre-existing cabling systems.

In every project, renovation or new build, when there is existing legacy fiber (50 or 62.5 micron) it needs to be replaced with Single Mode Fiber (SMF) which is IST's standard for fiber cabling. It may not be clearly evident as to what type the existing fiber is, please contact IST for confirmation to ensure clear understanding prior to project design.

- **Copper Cable Supported - as per EIA/TIA and CSA standards:**
  - Minimum CAT6 certification.
  - **No lines to exceed 90 metres / 300 feet. If this cannot be avoided, please contact IST as soon as possible.**
  - **For all Unshielded Twisted Pair (UTP) installations data and voice the minimum requirement will be Category 6.**
  - Current primary: minimum GenSpeed 6000, Hubbell.
  - Secondary: Mohawk/CDT Advancenet or approved equivalent.
  - Cable color is only to be Yellow for CAT 6 (Data).
  - Cable color is only to be White for CAT 6 (PBX Voice), and only to be used where VoIP infrastructure is not available
    - General Cable GenSPEED 6000 Enhanced CAT 6 Cable, CMP, U/UTP, Yellow.
      (Part # 7131902)

        - Hubbell NEXTSPEED®Link 6 UTP Cable Plenum Rated. (Part # C6RPEY)
    - All terminations to be done using T-568B code.

- **Connectivity Hardware – minimum CAT 6 certified:**
    - Data Jacks: Hubbell (violet/purple in color).
    - PBX Voice Jacks: Hubbell (white in color).
    - Unloaded patch panel ends - discrete jacks must be used for all lines.
    - All above must conform to the Hubbell universal keystone standard.

- **Testing and labeling requirements:**
    - printed test, minimum link (90m) level 3 certification for Category 6.
    - labeling as per ANSI/EIA/TIA 606 standard or minimum IST standard (i.e. C001 TR245).
    - Room End (i.e. C001 RM231) Telecommunication Room.
    - Cable certification summary and wiring diagrams to be supplied on completion of all cabling installations.
    - Copy to be sent to IST and to the PMO on capital projects. ○ Must be a machine-created label (eg. Brother/DYNO).

* IST reserves the right to check and verify all certification results performed by non-IST personnel. In case of failure to meet certification standards, reinstallation of any non-compliant cabling will be expected at installer's expense.*

Note:

- All projects must take into consideration removing legacy cables (fiber or copper)
    - Please consult with IST prior to removing legacy cabling, as it may be in production. Removal will have to be planned out to ensure new cabling is installed.
    - Removal of legacy cabling - both in tunnels and hallways to their respective sources.
- If a horizontal voice interconnect trunk is needed between two electrical closets it can be cabled using a standard 25 pair or higher Category 3 UTP trunk cable.
- All new voice lines shall be cabled to the nearest active telecommunications closet.
- All wall penetrations must be fire stopped with proper rating.

20. Additional Cabling Requirements

The manufacturer for the preferred “Premise Wiring Systems” is Hubbell. Facilities and Operations or the contractor will provide the primary supported cable, connectivity hardware. Fiber cabling can be obtained through IST on request. All other non-specified CAT 6 cable and hardware must be approved by IST prior to installation. For renovations and any cabling projects where IST is supplying the cable, the cable can be obtained only through the PMO or requesting university department. IST is not authorized to re-sell any cable to outside contractors or vendors.

** Important Note for Capital Renovations Projects:

Minimum Category 6 (CAT 6) as of July 2003. Discrete jacks on Telecommunications Room end and Hubbell universal keystone standard are expected and any changes to this standard must be approved by IST. All other standards for hardware and electrical requirements as per this document.

A. Voice over Internet Protocol (VoIP)

IP telephony makes it critical to ensure an uninterrupted transmission and high QoS on the data network. Structured cabling systems must be carefully controlled to ensure a minimum category 6/class E or higher for optimum IP telephony performance. As a critical need for any telephone system is the ability to function at any time, especially during a power outage, uninterrupted power in IP telephony is provided by using PoE. The implementation of structured cabling for IP telephony also must consider both present and future application requirements.

The following Voice over Internet Protocol (VoIP) items are required to be implemented for this type of network infrastructure:

1. The power should be mounted on the wall close enough so that no extension cord is required.
2. Minimum of one 4 post relay rack.
3. This VoIP TR shall be considered an IST secured room.
4. In every instance only (1) Category 6 (CAT 6) line to each WA / Phone unless otherwise
5. specified.

For further assistance in the requirements for a VoIP telecommunications room contact IST networking team. Contact number is 780-492-9400.

For all Unshielded Twisted Pair (UTP) installations data and voice the minimum requirement will be Category 6.

21. References

Telecommunications Distribution Method Manual (TDMM) 13th and 14th Edition by Building Industry Consulting Services Incorporated (BICSI) ANSI/EIA/TIA 568-B-- Commercial Building Telecommunications Cabling Standard ANSI/EIA/TIA 569-- Commercial Building Standards for Telecommunications Pathways and Spaces ANSI/EIA/TIA 606-Administration Standard for the Telecommunications Infrastructure of Commercial Buildings ANSI/EIA/TIA 607-Commercial Building Grounding and Bonding Requirements for Telecommunications CEC (Part 1, C22.1)—Canadian Electric Code (CEC)

22. Appendixes

A. IST Cabling Termination/Testing Requirements for Contractors

Introduction

This document outlines requirements when a third-party performs Cat 6 copper data cabling terminations and testing.

All inquiries and contact should be directed to the Information Services and Technology (IST) Cabling / Edge Networking group at the University of Alberta:

Email: ist@ualberta.ca
Phone: 780-492-9400

Acceptance of work is dependent on the below criteria.

General

Review and adhere to the latest version of the Cabling Standards document.

All installations are expected to adhere to proper industry codes (eg. Alberta Building Code, CAN/CSA standards and ANSI/EIA/TIA standards).

New deployments shall support VoIP and avoid the use of PBX telephone lines.
Both voice and data are supported over a single Cat6 copper cable for VoIP installations.

Contractor is expected to provide test results and correct any deficiencies found before acceptance.

Contractor/project is welcome to contact IST directly for ANY clarifications or verification.

Contractor is expected to keep regular communication with IST contact person when the work is in progress.

Telecommunications Room (TR) Location

IST shall determine which telecommunications room (TR) data cabling runs to.

Drawings

IST requires floor layouts showing data ports / data port counts to ensure appropriate amount of switchgear equipment is ordered and available.

IST requires floor layouts showing data ports / data port counts and labeling written on the drawings after terminations are completed.

Parts

Cat 6 Copper Data Cabling

No lines to exceed 90 metres / 300 feet. If this cannot be avoided, please contact IST as soon as possible.

In-building cabling to be yellow for data and must be FT6/Plenum Rated.

Acceptable Material:

- General Cable GenSPEED 6000 Enhanced Cat 6 Cable, CMP, U/UTP, Yellow (Part # 7131902)
- Hubbell NEXTSPEED®Link 6 UTP Cable Plenum Rated
  (Part # C6RPEY)

Service loop (2 metres on TR end, 1 metre on room end) to be included, placed on cable tray above racks.

Waterfall should be provided for transition from overhead cable tray to racking.

Please clarify room and tray layouts with IST when performing terminations.

Jacks and Faceplates

Acceptable Material:

- Hubbell
    - Voice/data jacks must be purple
    - UWS jacks must be yellow
    - Analog/PBX voice phone jack must be white

Part Number	Description
Hubbell HXJ6P (for room ends)	XCELERATOR™ Jacks, Category 6, Purple
Hubbell HXJ6Y (for UWS wireless ends)	XCELERATOR™ Jacks, Category 6, Yellow
Hubbell HXJ6W (for analog/PBX voice phone ends)	XCELERATOR™ Jacks, Category 6, Yellow
Hubbell IMF1OW	iSTATION™ Modular Plate Frame, Single-Gang, Office White
Hubbell IM2KA15OW	AV Unloaded Module, Keystone, 2-port, Angled, 1.5 Unit, Office White
Hubbell IM1KA15OW	AV Unloaded Module, Keystone, 1-port, Angled, 1.5 Unit, Office White
Hubbell IMB15OW	AV Module, Blank, 1 Unit, Office White
Hubbell SFB10	AV Connector, Blank Module, Office White

Racking

IST to supply racking. A typical telecommunication room (TR) will have one 4-post rack for electronic equipment, one 2-post rack for the cabling, and a vertical manager in-between. Racks must have square holes for mounting.

Contractor to electrically ground and bolt down racking to floor.

Acceptable Material:

- Hammond Manufacturing

Middle Atlantic lacing bars to be used on both front and rear of rack

Part Number	Description
Hammond Manufacturing SR1504215	SR1504215 44U 2POST RACK CAGE NUT FRONT/BACK
Hammond Manufacturing RRCM844UD	RRCM844UD 82” VERTICAL MANAGER 8” X 6” D
Hammond Manufacturing GKIT	GKIT CABINET GANGING KIT
Hammond Manufacturing 1421CNC100	12-24 CAGE NUT
Hammond Manufacturing H1224S100	12-24 X 5/8 SCREWS
Hammond Manufacturing DC4R4448	DC4R4448 4POST CAGE NUT RELAY RACK 84”77”USEABLE
Hubbell NSPJ24	Hubbell netSELECT 24-port patch panel Unloaded, Rack Mount, 24-Port, 1U, Black
Middle Atlantic LBP-4A	Middle Atlantic lacing bar Lace Bar, 4" Offset, L-Shaped

Fibre Panels

IST to determine fibre optic cabling endpoints. Separate fibre cabling from copper cabling.

Part Number	Description

Siemon FCP3-DWR	6- to 72-port Fiber Connect Panel with sliding tray. Includes mounting brackets, housing/tray, fiber managers, grommets, label holders, and labels, black
Siemon RIC-F-LC24-01C	6 Quad LC Adapters (24 Fibers)
Siemon RIC-F-BLNK-01	Blank Adapter Plate

Patch Cables

IST to supply patch cables for the telecommunications room.

Terminations

All terminations to be done to T-568B code.

Group cabling by similar floor/location.

Labelling

Must follow the labelling scheme in the latest Cabling Standards document.

Must be a machine-created label (eg. Brother / DYNO)

Cables must be lablelled C0xx with room numbers

Cables must start at C001 with the lowest room number and continue incrementally
Note: Each TR should start again at C001

Testing

Must be performed using a tester such as Fluke Networks DSX-5000 and permanent link must be used.

Copper cabling must meet Category 6 specification.

No lines to exceed 90 metres / 300 feet. If this cannot be avoided, please contact IST as soon as possible.

Test results (eg. Cat 6 certification) must be supplied to IST as soon as testing is completed.

Data lines will not be used until test results are provided.

Contractor is responsible for resolving any discovered discrepancies

Contractor should provide warranty for their work per specifications

Site Visits

Contractor is encouraged to view an existing telecommunications room with an IST staff member before terminations begin.

When termination work begins in the telecommunications room, IST should be notified. Site visits will be performed by IST to verify that University standards are followed.

A contact person from the third-party shall be provided so that IST may schedule and perform follow up site visits.

B. Requirements for Copper and Fiber Installations

i. Racks

Depending on the services that we are designing either one or two racks are used. If the service requires a UPS then both a four post rack and a two post rack is required with a vertical manager separating the two racks. The two post rack will contain all the cabling infrastructure and the four post rack will contain all the electronics. If space is constrained, please contact IST Cabling and Edge for recommendations. To contact IST Cabling and Edge, please call the helpdesk at 780-492-9400. See below for examples of racks.

ii. Terminations and Cable Management

All fiber will be terminated in a 1U rack-mounted fiber panel installed on the second U from the top of the two post rack. Leave a 1U below it as well. All splicing will be done using a fusion splicer. The splices will be managed in a splice tray.

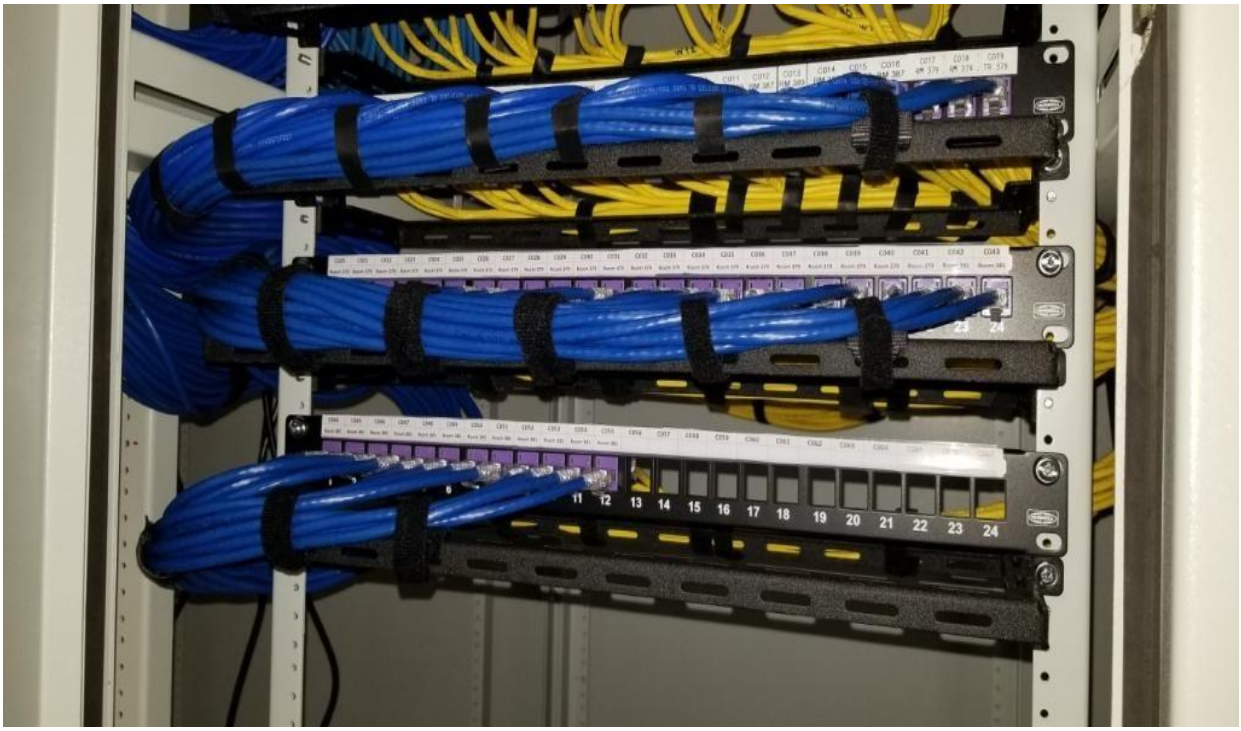
For Fiber cabling, there will be a 10m service loop at each termination location using a snowshoe or cable tray to create the service loop.

All copper terminations will be code T-568B using Hubbell CAT6 jacks, installed in a 24 port Hubbell netselect patch panel, use of 48 port patch panels is not permitted. Middle Atlantic Square Lacing Bars will be used to manage the cables (tie straps are not permitted to secure lacing bars). There will be a 1U space between each patch panel. The jack color will depend on the purpose of the connection:

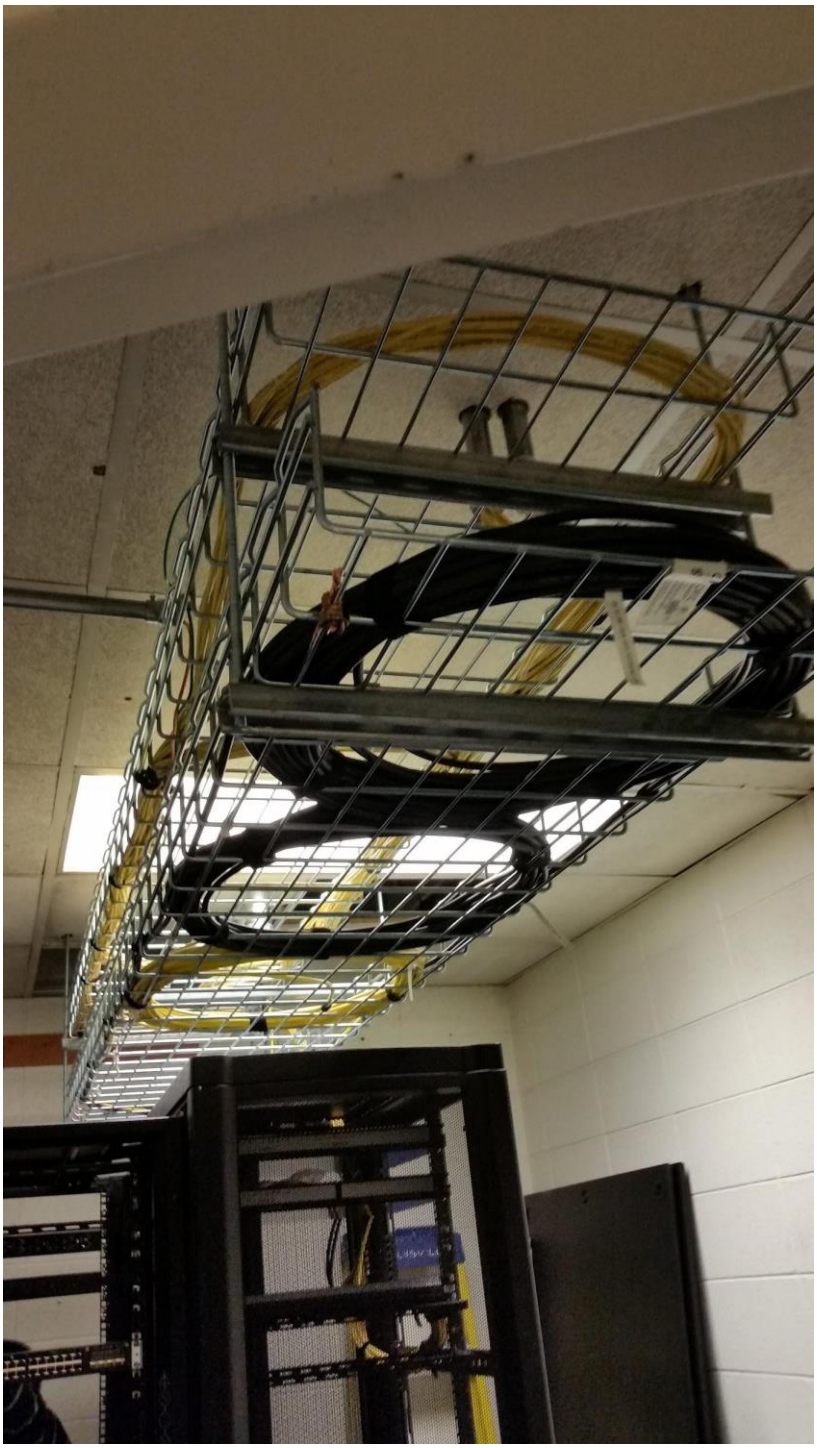
- Purple Jacks are for Data/Voice.
- Yellow Jacks are for University Wireless Service (UWS).
- White Jacks are for PBX telephones (Room ends only).
- Purple Jacks and Green Jacks are for A/V (Green jacks are allowed for cable runs inside rooms, Purple jacks to be used in TRs).

The data connections should be installed on the first available patch panels and the UWS should be on the very last patch panel on the end to leave room for expansion. Lacing bars should be used for sides of the Hubbell patch block.

The following images (front and back of patch panel) are examples of what IST expects for copper cable management.



The following image is an example of what IST expects for a fiber tray.



iii. Labeling

Must be a machine-created label (eg. Brother / DYNO). Contractors are encouraged to view an existing telecommunications room with an IST staff member before terminations and labeling begin.

Cables must be labeled C0xx (Cable and number eg. C001 or C045 up to C999) with room numbers. Cables must start at C001 with the lowest room number and continue incrementally. **Note: Each TR should start again at C001.** First cable will be started from C001, then 2nd cable C002 and so on allowing for growth up to 999 cables. If there are existing cables on the patch panel, then the number will be continued from the last existing number.

Labeling in the Telecommunication room (TR) for data/voice connections will be as follows:
C001 C002 C003 C004 C005
Rm# Rm# Rm# Rm# Rm#

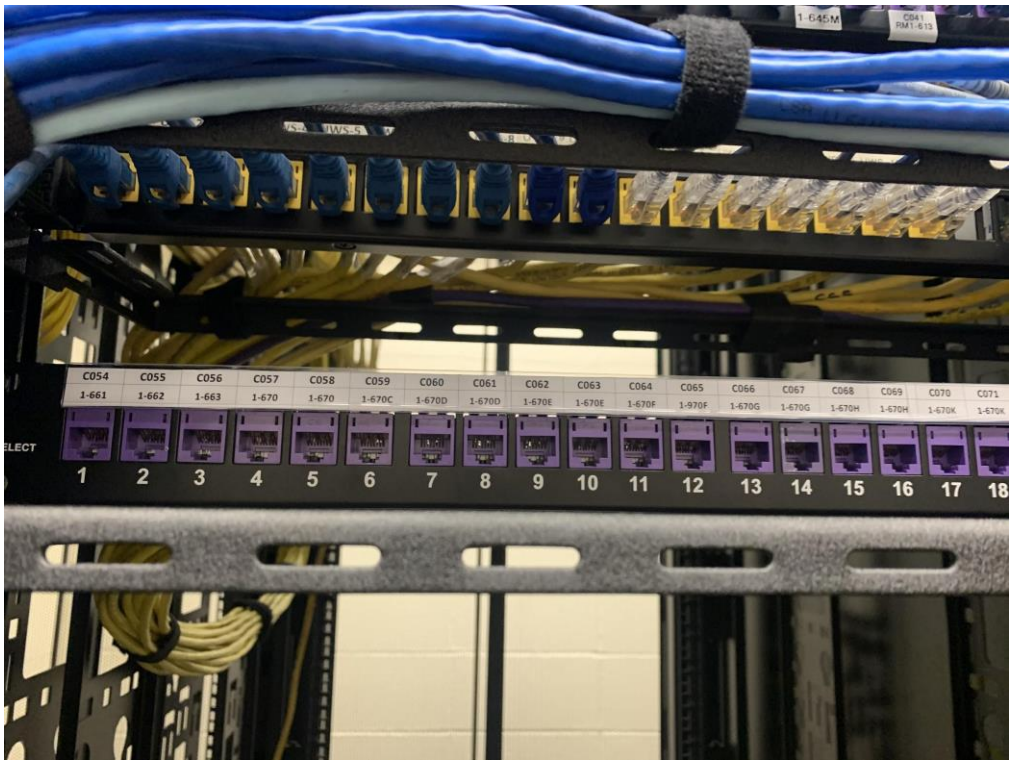
Labeling in TR for wireless access point (AP) locations will be as follows:
UWS1 | UWS2 | UWS3 | UWS4 |
Rm201 | Rm202 | Rm203 | Rm204|

If AP is outside a room then use the closest room number to the AP. All labels will be computer generated and no handwritten labels will be acceptable. IST can provide an editable spreadsheet for easily making the required labels for the Communications rooms.

Labeling for the users end will be as follows:
C###
TR Rm#
Examples:

Labeling for the AP locations will be as follows :
UWS#
TR Rm#
For Example:

The following is an example of what is expected for labelling within a Telecommunications Room.



C. Access Points (APs)

The role of an AP is to serve as a central point for communications and management on a WLAN. APs can communicate with stations, other APs, and cabled networks. Since APs are the initial destination for all messages sent by stations, the APs can be configured to centrally provide various network services to all stations on the WLAN.

Such services include:

- Security, which encrypts all messages and prevents access by unauthorized wireless stations.
- Configuration, which provides addressing identifiers to authorized stations.
- Roaming, which enables stations to move between coverage zones controlled by different APs.
- Management, which provides status information and enables remote maintenance (e.g., firmware upgrades) over the organizational network or the Internet.

i. AP Power

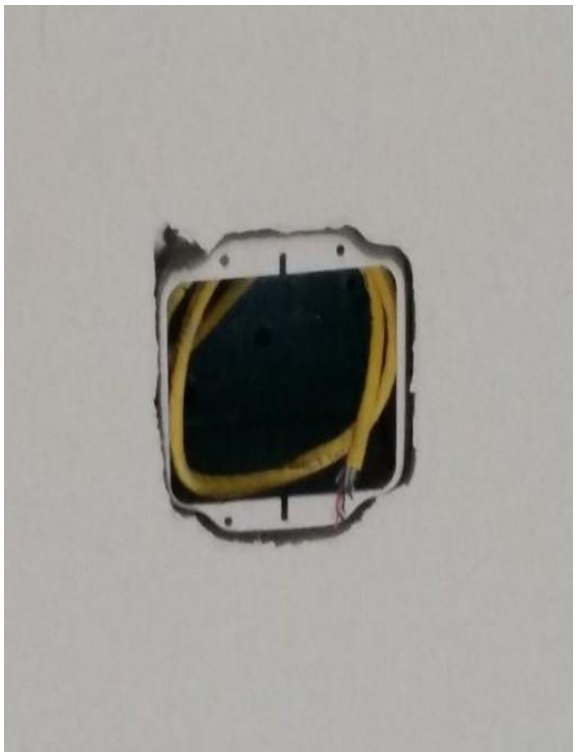
An AP can be supplied with electrical power and connected to a cabled network using a single Ethernet cable. This feature, commonly referred to as PoE, provides additional flexibility to WLAN ICT distribution designers and administrators. 10/100 Mb/s Ethernet signaling uses two pairs in a 4-pair balanced twisted-pair cabling channel, making it possible to provide dc voltage

to an AP over the unused pairs, which is called Mode B. 1000 Mb/s (Gigabit) Ethernet uses all four pairs of the cabling and requires PoE Mode A (Phantom Power). Some APs that use dual or tri-band radios, multiple spatial streams, and multiple input, multiple output architecture require more power than the 802.3af PoE standard (12.95 W) can provide. These WAPs require the PoE+ 802.3at standard that can deliver up to 25.5 W over balanced twisted-pair cabling.

The NICs and APs used in WLAN environments are equipped with built-in antennas that are used to transmit signals from the device and detect incoming signals sent to the device. In some cases, external antennas can be used in place of the built-in units.

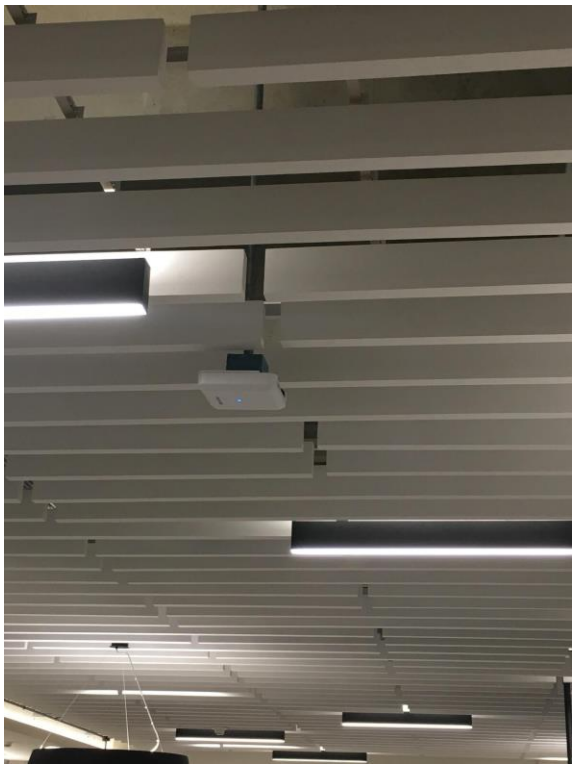
ii. AP Installation

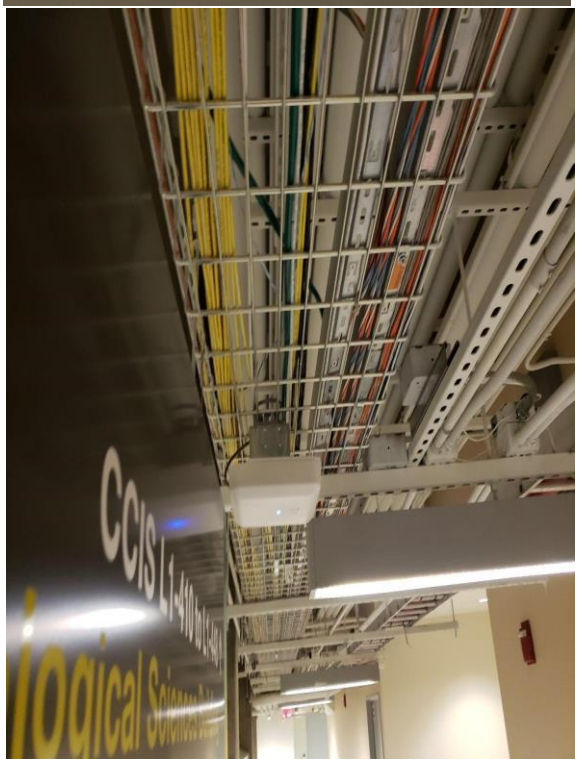
- Power over Ethernet (PoE) devices such as wireless access points (APs) must have a home run to the telecommunication room (TR) that contains the PoE network switch. Patching between floors or between different TRs is not acceptable.
- A map will be provided as to the location where the access points will be installed. A 10m service coil will be provided at each of the locations to give flexibility to move the access point. A yellow jack will be used for terminations and a short 1m patch cable will be used to connect to the access point.
- Access points will either be mounted to T-Bar on drop down ceilings or a double gang electrical box using a 4” or 102mm plaster ring on the hard surface such as concrete or drywall.
    - Contractors will provide the plaster ring as part of the installation as per the images below



- All applicable information such as each access point's MAC address, UofA asset tag, Access Point Location of deployment and serial numbers will be recorded.
- This information needs to be provided to IST so the access points can be added to the correct controllers and put on monitoring.
- The 3 ft or 1m patch cable needs to be plugged into the port labeled Ethernet and the other end to the jack. The cable needs to be routed so not to be seen.
- After each floor is complete the installer needs to insure that they are able to connect their device to each access point.
- APs must be installed facing downward, and free of obstructions. Free of obstructions means preference of 12 inches or 30cm from any structure.
- For a T-bar suspended ceiling, gang boxes are not required
- When gang boxes are required, such as when installed on a solid surface or ceiling, the best size of gang box for which the AP will be installed is a 4in X 4in or 102mm X 102mm with a minimum of 1 foot or 30cm clearance around all sides
- IST's preferred height restriction when installing APs is 10 feet or 305 cm. The reason for this constrained height is to allow servicing the AP as required in the future. IST understands that the 10 foot or 305 cm restriction is not always achievable, in these situations please contact IST Cabling and Edge. IST Cabling and Edge would propose installing a conduit between gang box to gang box in order to lower to the preferred height.
- **Signal attenuation:**
    - AP signal attenuation occurs with structural interference.
    - All AP installation must be mounted below any structure that may impede the AP signal.
    - Clearance surrounding the AP is very important to reduce signal impedance.
    - Access Points (APs) or Wireless Access Points (WAPs) must be installed below all structures. It may require the installation of a conduit to extend from the double gang box that is installed on the ceiling to be brought down to another double gang box, below all structures. A plaster ring then is provided by and installed by the contractor on the lower double gang box in order for the AP or WAP to be installed on the plaster ring.
    - A good rule of thumb is "line of sight". If you can see the AP (nothing in the way) the signal coverage should be adequate
    - In situations where ceilings are over 4 meters, such as a gymnasium the signal from the Access Point will be compromised to some extent. If the project allows, IST's recommendation is to use wall mounted APs
    - In situations where ceilings are over 4 meters, such as a gymnasium the AP will be difficult to service. If the project allows, IST's recommendation is to use wall mounted APs

The following images show AP installation on T-bar and with extension conduit to bring the AP underneath structural material that may impede the signal.





D. Testing

All test results need to be signed off by IST before the job is complete.

i. Copper Media

All tests are to be Certified for CAT 6 using a **permanent link** with a Fluke cable certifier. Testing will include attenuation, PS Next, PSELFEXT, ACR, Return Loss, PP Next, PS ELFEXT, PSACR.

** All results must be provided and accepted by IST before project handover. **

ii. Fiber Optic Media

All fiber strands need to be tested using a SM fiber loss kit. An example of a loss kit is a Fluke OptiFiber Pro Quad OTDR Module

- OTDR captures information regarding every splice and connector. It generates a readout of the information, indicating pass or failure.
- **IST requires these results prior to project sign off**

iii. Wireless Access Point (WAP) or Access Point (AP)

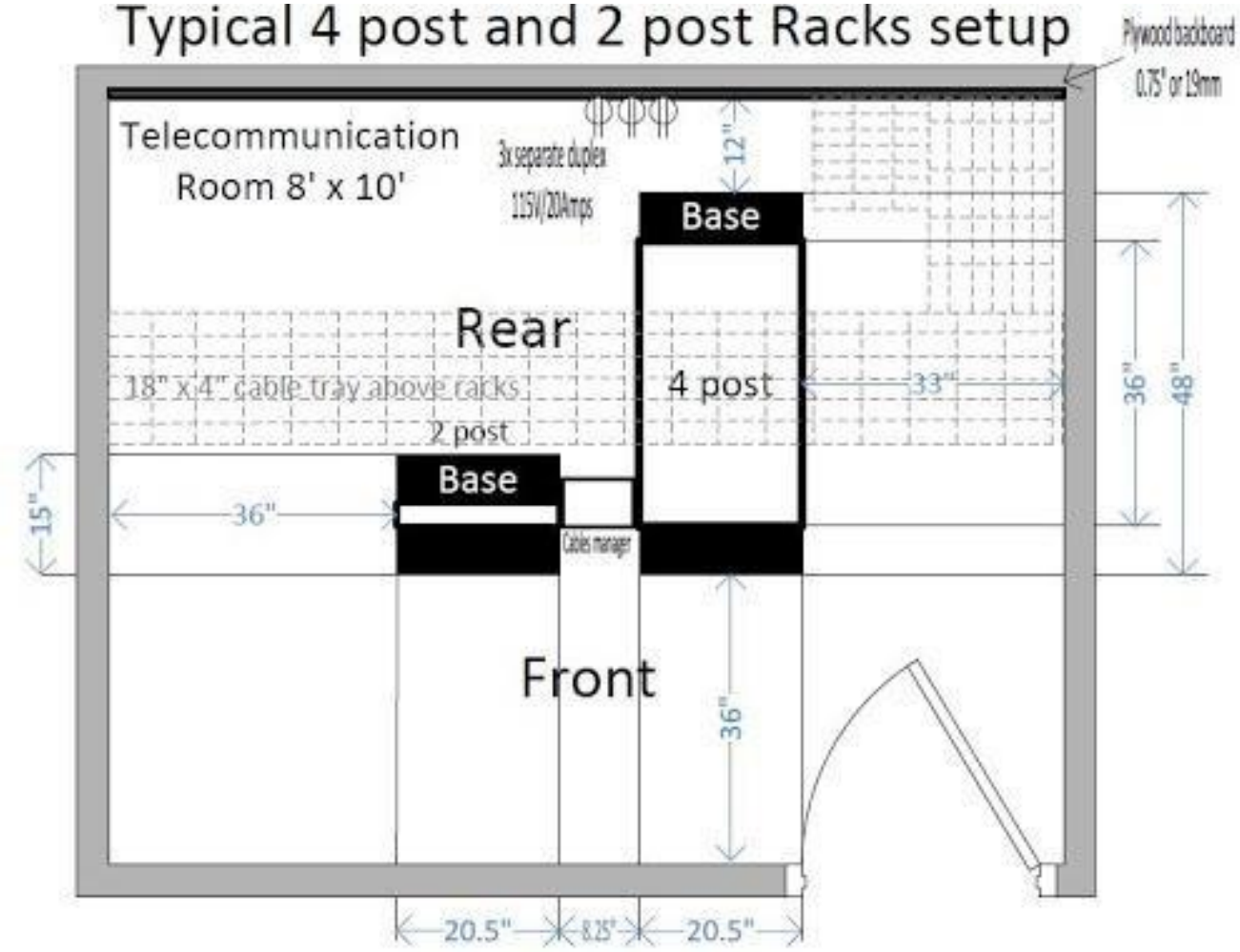
All wireless access points installed need to be verified by IST that they are working correctly in addition to the copper testing and the light indicators on the access point.

E. CAD Drawings

For any new renovations where the layout of the room changes a new CAD drawing of the floor shall be required for the purpose of mapping the new access points. This will insure correct placement of access points and monitoring of APs going forward

Typical Telecommunications Room Layout

** Electrical code must be adhered to for all finalized designs. **



Conceptual drawing/picture is not to scale. IST will assist with telecommunication room design layout. *The provided examples are 2 post and 4 post racks, with a cable manager in between:*