Information and Communication Technology

Network Cabling Infrastructure Standard

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Information and Communication Technology (ICT)

Network Cabling Infrastructure Standard

This standard was endorsed and issued by the Manager of Communication Services, Office of Information Technology Services (ITS) in December 2005.

ITS reserves the right to modify this standard as required.

Changes between versions

The key changes between this version and previous versions of this document are:

- Addition of Section 5.6 *Administration and Documentation*

- Telecommunication Room width specification changed to a minimum of no less than 2000mm

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Network Cabling Infrastructure Standard

1.0   Purpose

This standard provides the minimum installation and operational requirements for Murdoch University cabling systems.

This standard applies to all ICT cabling (voice, data, audio and visual cabling), in horizontal cabling, backbone cabling, and inter-building cabling. The standard is to be applied to all copper and fibre optical cabling within all Murdoch University campuses and buildings, regardless of their intended use.

2.0   Scope

The principles of the standard must be applied when conducting cabling projects for:

- The construction of new buildings;
- Fit outs of existing buildings;
- Upgrades to existing cabling infrastructure;
- Implementation of cabling infrastructure to interconnect new or existing buildings.

Refer to appendices for more details.

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3.0   Accountability and Management

Ensure effective and consistent management of cabling throughout all Murdoch University campuses and buildings.

Must ensure that:

- All cabling work conducted is consistent with regulatory and legislative obligations including relevant Australian and Western Australian Standards;
- All relevant stakeholders are consulted prior to commencing cabling projects;
- Comprehensive audits are conducted on completion of cabling projects;
- Only cabling systems offering appropriate warranties are used;
- Warranty documentation for cabling infrastructure is kept up to date and that copies are provided to the Office of IT Services.

Any conflicting information should be clarified with ITS. Any conflicting information should be governed by reference to the following documents:

- Relevant Australian Standard;
- Relevant International Standards;
- This reticulation standard;
- Internal Instructions by ITS.

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4.0 Requesting and Purchasing ICT Cabling Products and Services

Ensure requests and purchases comply with Australian and Murdoch University standards.

Must ensure that:

- Where cabling is purchased as part of a major building project contracts between Murdoch University and the contractor/vendor are formed in compliance with AS4000 or AS2124;
- This standard is referenced as requirements in tender and contract documentation;
- Tenders and contracts for ICT cabling are issued separately from any other electrical or building works;
- All ICT Installers must be registered by one of the Australian Communications Authority (ACA) approved registrars;
- All ICT installers have been inducted by the Office of Commercial Services (OCS).
- All ICT installers must be selected in consultation with ITS

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5.0   Installation and Performance Specifications

Ensure that all installations meet the following specifications:

- Adhere to a single certified system throughout a new building installation;
- Undergo certification tests prior to acceptance of work completed;
- Provide copies of certification tests to the Office of IT Services;
- Comply with the installation specifications detailed in this standard.

5.1 General Installation Notes

- Data connection to all major buildings is via optical fibre cable
- External single-mode fibre shall be used for all distribution fibre, except where IT Services specifies multimode fibre.
- The required performance level for horizontal cabling is Class E permanent link, or channel, utilising Category 6 cable and connecting hardware. This is the general recommendation unless compelling reasons exist to use a lower performing category of cable and connecting hardware.
- Compliance testing for Class E installations requires a Level III tester as defined by the Standards Australia AS/NZS 3087.

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5.2 Horizontal Cabling Installation Requirements

The required performance level for horizontal cabling is Class E permanent link, or channel, utilising Category 6 cable and connecting hardware. This is the general requirement unless compelling reasons exist to use a lower performing category of cable and connecting hardware

- Compliance testing for Class E installations requires a Level III tester as defined by the Standards Australia AS/NZS 3087.
- All certification documents must be lodged with ITS before outlets can be officially approved for operation.
- Warranty provisions shall include on-site repair for a period of at least 1 year following completion of commissioning with a minimum defects liability of 15 years.
- A defects liability period of 20 years is preferred.

All outlets radiate from a data enclosure associated with that building, or building wing

- The cable pathway shall not exceed an overall length of 90 metres.
- Cable terminations will be made at Cat6 compliant High Density (32 port) patch panels, fitted in a rack of appropriate size for the building.
- A cable management panel shall be fitted between each patch panel.
- All conduits and ducts for building wiring shall be installed so that cabling is not exposed to moisture.
- Where multiple outlets are installed in a single room the minimum conduit size is 25mm per 6 x CAT6 outlets.
- Where ceiling spaces will not be available to provide future cable installations, spare conduits shall be installed. 1 x 25mm spare conduit shall be installed for every 2 offices.

Floor chases may be used where required.

- Minimum installation is 2 x 25mm conduits.
- 1 x 25mm conduit shall be installed for every 6 x CAT6 cables required.

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- For each floor chase installed an additional spare conduit with pull cord shall be installed for future expansion.
- Audio/visual and data/phone cables should be installed in their own conduit

Each outlet should be clearly marked at each end with a unique outlet number.

- The wall plug numbering scheme is defined, managed and assigned by ITS.
- The contractor shall obtain the above information from ITS at the time of installation.
- Unless otherwise specified by ITS, new outlets will be installed at a convenient point, adjacent to telephone and power services.

Some specialist applications may benefit from having fibre optic cable installed as the horizontal cable.

- Support for such applications will be handled on an individual basis with direct consultation with ITS.

5.3 Backbone Cabling Installation Requirements

Backbone cabling shall be considered as any cabling that interconnects campus building ICT services together.

- All backbone cabling for all data services shall be comprised of fibre optic cabling.
- Copper cabling may be used in special circumstances. Earthing and surge protection shall be used for these circumstances.
- Subject to application, cabling for Telephone services may either be multi-core copper cabling, or optical fibre cabling, as advised by ITS.
- Communication pits should be established at locations no greater than 70 metres apart or at any point where there is a change in direction.
- Wherever possible communications pits must be aligned so that they are easily located
- Communication pits should be located such that they remain permanently unobstructed (by landscaping, flowerbeds etc).

- All backbone pathways shall be connected by 3 x 50mm conduits.
- All major backbone pathways shall be connected by 3 x 100mm conduits.

5.3.1 Entrance Pathways

This is pathway between the backbone's entrance point into the building and the entrance room.

Appropriate external conduits must be provided so that the proposed building can be connected back to the to the existing campus network infrastructure.

- The building entrance rooms should be connected to the external data pit via 3 x 50 mm conduits (minimum requirement).
- External data pits shall be inter-connected by 3 x 50 mm conduits
- Bends on conduits entering the building from the cabling pit should have a bend radius of no less than 150 mm.
- Each building shall have 2 entrance points and pathways to the entrance room. These entrance points should enter from different sides of the building to provide redundant paths.
- These facilities shall be used for ICT services only.

5.4 Fibre Optic Distribution

5.4.1 External Fibre Installation Requirements

Where computer conduits cross open ground, approved external grade single mode or multimode fibre shall be used.

- To minimise the possibility of damage due to mechanical stress on the cable, wherever possible fibres shall be reticulated in their own conduit and not with other building services.
- Each fibre shall be tagged at each terminating fibre patch panel, and at every communications pit along the way.
- Tags shall be made of durable material to resist weathering.
- The use of blow tubes is the recommendation for connecting all major buildings.

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- 12-core Single-mode fibre cable is the minimum recommended fibre capacity to all major buildings.

5.4.2 Internal Fibre Installation Requirements

Where conduits do not traverse open ground and therefore moisture is not a problem

- Suitable loose sheath single mode multi-core fibre of the "external light duty loose tube riser fibre" will be used.
- Where internal fibre is used to inter-connect groups of data enclosures, the fibre must be housed in physically continuous conduit.

5.4.3 Fibre Installation - General Requirements

Each fibre shall be clearly tagged with a unique identification number

- The fibre numbering scheme is managed by ITS.
- A unique fibre number can be obtained from ITS at the time of installation.
- All fibre pairs are to be clearly identified at each terminating patch panel.

Fitted off fibres should comply with the following mechanical requirements:

- Epoxy bonded SC connectors to be used for all single mode fibre terminations and ST connectors to be used for all multimode fibre terminations.
- Each fibre termination is to be adequately reinforced, and supported with the appropriate zero force sleeving.

The fibre termination panel or enclosure should be fitted with strain relief bars, to support fibre patch cables.

- Where approved enclosures are used to house the fibre and termination, panels on the enclosure should be such that they are easily removed for inspection and maintenance of the fibre.
- All fibre patch panels shall be enclosed in a sliding tray or removed front panel, such that fibre outlets are not visible.

Fibre loss and fibre transmission characteristics should conform to the appropriate Australian standards.

New fibres will not be put into operation until the appropriate certification documentation has been lodged and approved by ITS.

5.5 Building Telecommunication Spaces

As specified in standard AS/NZS 3084:2003. Refer to this standard for additional details and definitions as required.

5.5.1 Work Area

- A work area is an office or area where staff will work.
- For building areas where it is difficult to add additional telecommunication outlets at a later date (for example private offices), a minimum of 2 separate outlet locations should be provided in the initial design of the area.
- They shall be located to offer maximum flexibility for change within the work area. (For example on opposing walls in private office space.)
- Telecommunication outlet locations should be co-coordinated with the furniture layout.
- A minimum of 1 power outlet should be installed near each telecommunications outlet.

5.5.2 Telecommunication Room

The telecommunication room (also called a riser or distribution closet) shall be able to contain:

- Telecommunication equipment
- Horizontal and vertical cable terminations.
- Associated cross-connect cables.

A telecommunication room shall be provided on each building level.

- Additional rooms (one for each area up to 1000m^2) should be provided when the area to be served exceeds 1000m^2 or when the horizontal pathway distance to any work area exceeds 90m.
- The telecommunication room shall be located as close as practicable to the centre of the area served.

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- Horizontal pathways should terminate in the telecommunication room located on the same floor as the area being served.

- For security reasons telecommunication rooms shall only be used for ICT services.

- Each telecommunication room shall have
    - minimum total door opening width of 1600 mm
    - depth of no less than 1000 mm
    - width of no less than 2000 mm
    - the enclosure should be fully secured by 2 full height doors.

- The floor level in the enclosure should be the same as the outer access area, so that equipment racks and equipment can be easily installed and maintained.

- The proposed telecommunication room must be fully accessible from public areas.

- All telecommunication rooms should be vented (or air-conditioned) such that internal temperatures do not exceed 30 degrees Celsius.

- Concrete walls shall be treated to minimise dust. Finishes shall be light in colour to enhance room lighting.

In multilevel buildings the risers shall be vertically aligned.

- Appropriate sleeves or slots to be provided between each riser in a multilevel building. The requirement is 2 x 100 mm conduit.

- Where the sleeves or slots penetrate shall not be left open except during cable installation and shall be properly fire-stopped as per the BCA.

Power and lighting requirements include:

- Adequate artificial lighting should be provided in each telecommunication room.

- Two double general power outlets (GPO) should be provided in each telecommunication room.

- The GPO should be on its own separate circuit breaker.

- Power interruptions to these GPO should be kept to a minimum, when it is necessary to interrupt power, adequate warning must be provided.

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- A technical earth will be provided in each telecommunication room.
- The earth must conform to the relevant Australian building codes.
- UPS power shall be provided to all telecommunication room. Minimum recommended UPS rating of VA2000.

5.5.3 Building Entrance Room Requirements

An entrance room is a space that includes terminations for backbone cabling into the building. It may also serve as a telecommunications room.

- The entrance room has the same requirements as the communications room.
- Each entrance room should have 2 entrance pathways connecting to different entrance points.

5.5.4 Equipment Room Requirements

An equipment room is a centralised space for the telecommunication equipment (e.g. network, AV and security devices) which serves users of the building, Any or all the functions of a telecommunication room or building entrance facility may be provided by an equipment room.

- The room should be of appropriate size to accommodate the required equipment. Minimum internal area of $8m^2$.

5.5.5 Building MDF (Main Distribution Frame) room Requirements.

An MDF (main Distribution frame) room is included as a requirement in a building process when one or more of the following design criteria need to be met:

- Is the proposed location likely to be a major distribution point for multiple buildings?
- Is the proposed location likely to be a primary distribution point for multiple campuses?
- Is the space being regularly accessed by external suppliers for the maintenance of ICT equipment?
- Will the space potentially be used to house third party ICT equipment.

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An MDF room may serve as telecommunications room and/or entrance room.

Requirements:

1. Ease of access between internal and external connecting services and distribution equipment located in the MDF.

   a. Adequate floor and ceiling access.

      i. Raised floor where necessary.

      ii. Removable ceilings

      iii. Adequate cable conduits between equipment racks within the room

2. Allow for 100% expansion capacity within conduits to cater for future growth

3. Emergency power to satisfy critical system requirements

4. Controlled access to ensure that only authorised personnel gain entry

5. Easily accessible at all hours during emergencies.

6. Air conditioned to a maximum 21 C degrees under all environmental conditions.

7. Adequately protected from the elements.

8. Minimum room size $10m^2$.

5.5.6 Server Room requirements

It is envisaged that the server room will be used to house sensitive equipment and servers associated with a range of varied applications:

- Data
- Voice
- A/V
- Security
- Other specialized applications

A server room should be included in a building project when one or more of the following design criteria need to be met:

- Do the servers carry out a critical University function
- Do the servers/workstations require special environmental and security conditions?

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5.6 Administration and Documentation

5.6.1 General

All documentation is to be delivered in both hard and electronic formats to:

Communications Administrator

Office of IT Services

comshelp@murdoch.edu.au

5.6.2 New Constructions

At the completion of new constructions, the following information is to be provided:

- Schematic diagrams indicating the location of cable routes, pit locations and enclosure locations
- Documentation correlating outlet identification numbers to room numbers
- Test and certification information for all fibre and copper cabling
- Warranty Documentation

5.6.3 New Backbone Cabling

At the completion of new backbone cabling installations, the following information is to be provided:

- Schematic diagrams indicating the location of cable routes and pit locations.
- Test and certification information for all fibre and copper cabling
- Warranty Documentation

5.6.4 New Outlets

Test and certification information is to be provided upon the request of Murdoch University

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Appendix A.   New Buildings, prior to commencement

A.1   Prior to commencement of any new building projects, ITS will be provided with:

- Details of the relevant OCS project officer responsible for project;
- A relevant University project account code to which agreed costs can be debited.

A.2   For all new buildings and extensions that do not currently have data telephone and other communication services, the current University regulations allow the installation of premises cabling and communications infrastructure to be included in the building contract provided that the following requirements are met:

- The building contract specifications must ensure that all relevant requirements as defined in this standard are met.
- ITS must be given timely notice of any pending works which may involve the installation of communication services within the above category
- ITS must have input throughout the planning, design and construction process to ensure that published Murdoch network reticulation standards are met, and to ensure compatibility with existing services.

A.3   The building contract for above category may include:

- Premises cabling;
- Premises communications infrastructure;
- Enclosures;
- Equipment racks;
- Conduits to rooms;
- Ducted skirting;
- End to end terminated cabling;
- The physical interconnection of the new building to the existing physical communications infrastructure, i.e.
  - Inter-building conduits;

- Associated service pits;

A.4 The building contract for above category **shall not** include:
- The provision and installation of network equipment;
- The provision and installation of telephones handsets and related phone extension;
- The provision and installation of inter-building cabling and optical fibres;
- The provision and installation of communications cabling and optical fibre to connect the new building to the existing University infrastructure;
- The relocation of data and telephone services from existing locations to the new location.

A.5 The Above Items in the building works shall be fully managed supplied and installed by ITS.
- A provisional sum shall be included as part of the building project budget to cover the cost associated with items above;
- ITS will be responsible for identifying an appropriate Budgetary provisional sum for the above items, but it is the responsibility of OCS (or its representative) to provide ITS with a clear scope of works;
- Any costs incurred as a result of variations to the agreed scope of works will be met by the building project.

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Appendix B. Existing Services and Buildings

For all other works where existing telephone, data services and other Communication services are involved, or where a project involves the shifting of telephone and data services from one location to another.

B.1 Prior to commencement of any work, ITS will be provided with:
- Details of the relevant OCS project officer responsible for project.
- A relevant University project account code to which agreed costs are to be debited.

B.2 ITS shall be given full contract responsibility for the effective completion of the work, this role shall include:
- Interaction with clients to define their telephone/data requirements.
- Cabling contractor selection and supervision.
- Installation of all telephone and data cabling equipment.
- Activation and testing of relevant services.

B.3 An agreed provisional sum shall be included in the project budget to cover the cost of above.

B.4 It is responsibility of ITS to identify the appropriate Budgetary provisional sum for the above portion of the work, but the responsibility of OFM (or the nominated representative) to provide ITS with a clear scope of works.

B.5 Any costs incurred as a result of variations to that above agreed scope of works will be met by the building project.

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Appendix C.   Communications Infrastructure

C.1   In instances where Communications infrastructure is being accessed or utilized, and where we believe there is a high risk of damage or disturbance to existing infrastructure, ITS reserves the right to be granted full management and contract responsibility for any proposed cabling work.

- Prior to commencement of any work, ITS will be provided with:
- Details of the relevant OCS project officer responsible for work;
- A University project account code to which agreed costs are to be debited.

C.2   ITS is responsible for ensuring that network, telephony and other communication services have minimal downtime, the communications infrastructure plays a vital role in this, therefore to prevent damage or service outages:

- ITS must be given timely notice of any groundwork being carried out in the vicinity of existing communication pits and easements, so that contractors can be appropriately briefed;
- ITS must be given notice of any power outages that may affect communication services;
- ITS must be given timely notice of any work being carried out in the vicinity of existing broadcast equipment (radio aerials, microwave towers) etc, so that contractors can be appropriately briefed;
- ITS must be given timely notice of any work where the communications infrastructure is to be disturbed, accessed or utilized;
- No work is to commence until scope of works has been agreed to by ITS;
- No existing ITS managed copper, optical fibre cabling or related cabling hardware is to be used unless agreed to by ITS.

Appendix D.   ITS Scope of Responsibility

D.1   Communication Services for which ITS has full (f) or partial

(p)interest/responsibility: All telephone services, including mobile services (f)

- Data services connected to the Murdoch network and beyond (f)
- Emergency call points, maintenance& provision of hardware (f)
- Radio based emergency services, maintenance& provision of hardware (f)
- Campus paging services and associated equipment (f)
- Radio based (wireless) LANs (f)

D.2   Communication Services infrastructure for which ITS has full(f) or partial(p)

interest/responsibility:

- The University's telephone PABX (f)
- The University's network switching and routing equipment (f)
- All building data and telephone enclosures/risers (p)
- Inter-building data and telephone conduits and easements (p)
- Telephone cabling and associated plant (f)
- Optical fibre cabling and associated plant (f)
- Microwave linkages to AARnet (f)
- Microwave links to Rockingham and Mandurah (f)
- Physical platforms, towers, masts and other plant related to above (p)
- Paging system infrastructure and plant (f)
- Emergency radio (TARA) provision of maintenance& hardware (f)

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Appendix E.   Check list at building completion

E.1   At building completion check:

E.2   Size of communication spaces?

E.3   Adequate ventilation?

E.4   Adequate lighting?

E.5   Has appropriate power been provided?

E.6   Are there adequate shelving and/or equipment racks in risers?

E.7   Are internal risers appropriately linked?

E.8   If it is a building extension have risers in the old building been appropriately linked?

E.9   Is there a satisfactory entry point to the riser from external computer conduits?

E.10 Do external conduits adequately service the building?

E.11 Are risers secure and correctly keyed and will door be accessible at all times to technical staff?

E.12 Has the contractor tested all UTP cables, and have certification docs been received?

E.13 Has the ports database been updated?

E.14 Has the contractor tested all optical fibres, and have certification docs been received?

E.15 Has the fibre documentation been updated?

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Appendix F.   What happens when a telephone service is requested?

F.1   A request is received for new telephone service either by online order form or email.

F.2   A profile of client's requirements is established, and client is contacted to discuss details of available options and related costs.

F.3   Once client has agreed on requirements:

- Initiate new extension via extension management database;
- Arrange for technician to establish necessary cabling within the client's building;
- Provide technician with extension information so that appropriate service can be activated at the central location, and at various cable junction points between the central location and the building;
- Install, program and test handset as per user specifications.

F.4   Activate other associated services as requested by the client:

- Extension service accessibility characteristics (i.e. local, interstate, international access etc);
- Pin number assignment (if requested);
- Voice mail functionality;
- Rotary group functionality;
- Any other characteristics for special applications.

F.5   Update new or modified client information in all relevant databases:

- Outlet location database;
- Extension Manager database;
- Directory Management database;
- Other related traffic and billing databases.

F.6   Upgrade inter-building cabling capacity database, and flag possible cabling shortages.

F.7   Upgrade equipment inventory database, and flag possible handset and extension card shortages.

Note:

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- Outlet location database is linked to the OCS space allocation database; outlet locations will not be accurate if the OCS database is not up to date.
- Directory management database is also linked to the HR database to reflect accurate information relating to staff name and position.

Appendix G.   What happens when a network port is requested?

G.1   A request is received for new data service either by telephone, service desk incident or email.

G.2   A profile of client's requirements is established.

G.3   Requirements are approved by client

G.4   Account code for work is provided before installation.

G.5   A certified technician installs the new outlet.

- Unique outlet numbering information is provided to the contractor so that outlet can be labelled

G.6   ITS staff will verify that outlet has been tested to comply with appropriate standards.

G.7   The network equipment is configured to the appropriate network vlan.

G.8   A connection is established from the network switching equipment to the wall outlet.

G.9   The outlet location database is updated.

G.10 The accounts database is updated.

G.11 Flag network/equipment capacity issues.

G.12 Client is informed of completion of work

Note:

- Outlet location database is linked to the OCS space allocation database; outlet locations will not be accurate if the OCS database is not up to date.
- Directory management database is also linked to the HR database to reflect accurate information relating to staff name and position.