

# Design Guide Part 11: General requirements for ICT & telephone systems

RIBA Stages 3 – 7

2018 V1.0 Grey Cover

Phillip Hunt (EST) [Phillip.hunt@uea.ac.uk](mailto:Phillip.hunt@uea.ac.uk)  
Estates & Facilities Division, University of East Anglia, Norwich Research Park, Norwich NR4 7TJ

## Contents

1	Introduction .....	4
1.0	Prior Reading.....	4
1.1	Purpose of the UEA Design Guide.....	4
1.2	Purpose and Structure of this Part of the Design Guide .....	4
1.3	Interpretation.....	5
1.4	Structure of this Part of the Design Guide .....	5
1.5	Version control and updates .....	6
2	Requirements for Data and Telephone Systems - Overview .....	7
2.0	Introduction .....	7
2.1	Key Principles and Requirements .....	7
2.2	Building Load Assessment.....	8
2.2.1	Introduction.....	8
2.2.2	Key principles and requirements.....	8
2.2.3	Preferred materials, technology and solutions.....	9
2.2.4	Suggested schematics.....	9
2.2.5	Applicable standards and best practice guides .....	9
2.3	Operational Procedures .....	9
2.4	Testing, Commissioning and Documentation .....	10
2.4.1	Testing and Commissioning.....	10
2.4.2	Documentation.....	10
3	Telephones.....	11
3.0	Introduction .....	11
3.1	Key Principles and Requirements .....	11
3.2	Preferred materials, technology and solutions.....	11
3.2.1	1308 Copper Pair Cable .....	11
3.2.2	Supports & fixings.....	12
3.2.3	Containment system .....	12
3.2.4	System design .....	12
3.2.5	Analogue equipment.....	12
3.2.6	VoIP Equipment.....	13
3.3	Connection Procedure .....	13
3.4	Applicable Standards and Best Practice Guides for Telephone Systems.....	13
4	Data.....	14
4.0	Introduction .....	14
4.1	Key Principles and Requirements .....	14
4.2	Preferred Materials, Technology and Solutions.....	14
4.2.1	UTP copper cabling .....	14

4.2.2	Single mode fibre .....	15
4.2.3	Multimode fibre .....	15
4.2.4	Cabinets and racking .....	15
4.2.5	UTP outlets.....	16
4.2.6	Cable ties.....	17
4.2.7	Comms rack patch panels (UTP and fibre) .....	17
4.2.8	UTP copper cabling containment .....	17
4.2.9	Cabinet layout.....	18
4.2.10	Network routers .....	19
4.2.11	Network switches.....	19
4.2.12	Wireless networking.....	20
4.2.13	SFP/SFP+ specifications .....	20
4.2.14	Media convertors .....	20
4.3	Applicable Standards and Best Practice Guides for Data Cabling.....	21
5	Appendix.....	21
5.0	Topography diagram.....	21

# 1 Introduction

## 1.0 Prior Reading

It is imperative for readers of this document to first refer to the introductory Part entitled:

*'Design Guide Part 1 – Principles and overview'*.

Part 1 gives vital information and context that apply to all projects.

## 1.1 Purpose of the UEA Design Guide

The Design Guide (as a whole) is written for employees of the UEA, architects and external consultants and contractors. The purpose of the Guide is to act as a briefing document to give designers an overview of the design requirements, constraints and challenges presented by the UEA's specialist needs. It applies to all new-build and refurbishment projects controlling quality in the production of designs, specifications and the subsequent performance of buildings.

The Design Guide aims to discuss strategic matters and does not provide an exhaustive treatment of statutory or best practice design and compliance requirements; its primary purpose is to establish a starting point for design *briefs*. It is the responsibility of readers/duty holders to ensure subsequent designs are complete, compliant and able to meet the final approved brief when measured in use.

## 1.2 Purpose and Structure of this Part of the Design Guide

This Part of the Design Guide is written for designers and specifiers of communications systems (telephones and data) from the Developed Design Stage (RIBA Stage 3) to when the building is in use (RIBA Stage 7).

The following systems are *not* in the scope of this document:

- Building Management System (BMS)
- CCTV
- Access control
- Intruder alarm
- Fire alarm
- Disabled refuge
- Disabled toilet communication
- Intercom
- Induction loop

Details on these systems can be found in Part 8 of the Design Guide - Access, alarms and specialist communication systems except for BMS information which can be found in Part 5.

### 1.3 Interpretation

Any part of the Design Guide may be referenced in project contractual documentation in order for the UEA to control quality. The following interpretations apply:

**Enforced requirements;** the use of the word(s) 'shall', 'are required', 'is required' 'must' or 'will be' denotes a requirement that is non-negotiable and shall be used as the basis for designs, technical submissions and/or activities. If such a statement conflicts with a statutory obligation then a report to the Head of Engineering and Infrastructure shall be produced highlighting the conflict, for his or her final decision regarding compliance.

**Requirements needing confirmation;** the use of the word 'may' denotes a negotiable requirement or indication of a solution, where innovation and further calculation, design and discussion may be required to arrive at an optimised solution.

**Quality;** the Design Guide aims to arrive at the UEA's highest design aspirations and standards. It may be that, at the UEA's sole discretion, solutions are value engineered during subsequent design iterations. Designers are encouraged to consider where value engineering may result in an improved financial performance should funding constraints occur.

**Currency of third party documents;** where superseded standards and regulatory documents are referred to in the text, the reader shall apply current versions and disregard superseded versions.

**Proof;** where the word 'proof' is used e.g. 'proof is required', a written report or installation certificate must be produced for approval depending on context.

**Approval and proof;** all designs shall be approved by the UEA. Approval shall be interpreted as meaning written approval from either the UEA's appointed approving authority or by the Head of Engineering and Infrastructure where no other approving authority is appointed. Approvals shall be sought prior to design decision points or installation activities (depending on context) and shall be made in writing. Where approvals are sought, a written technical submission shall accompany the request setting out, with proof (e.g. calculations, drawings), the case for the approval. The purpose of the approval process is to ensure designs meet the strategic requirements of the UEA.

The obligations owed by external architects, consultants and contractors to UEA and their liabilities to UEA is not in any way diminished or otherwise reduced by the approval process. UEA is not taking over the roles and duties of the external architects; consultants and contractors who will remain fully and totally responsible for the design and/or works carried out by them or on their behalf by their staff; agents; sub-consultants or sub-contractors.

### 1.4 Structure of this Part of the Design Guide

The separate sections are as follows:

**Section 1: Introduction;** prior reading, purpose and interpretation

**Section 2: Requirements for data and telephone systems – overview;** applies to all sections in this document including general principles, details of equipment to

be used, deployment topologies and linkages back to the existing infrastructure.

**Section 3: Telephone;** requirements for the phone system to allow integration with the rest of the campus

**Section 4: Data;** configuration and topology information regarding the deployment of active equipment, cabling and wireless access points.

Each Section includes the following sub-headings:

- Introduction
- Key principles and requirements
- Preferred material, technology and solutions; this section describes how the key principles and requirements will be met
- Applicable standards and best practice guides

## 1.5 Version control and updates

Any new or amended content is highlighted in **yellow** so readers can easily identify changes from previous versions. Where no **yellow** highlights exist the document either remains unchanged or it is the first version to be published.

## 2 Requirements for Data and Telephone Systems - Overview

### 2.0 Introduction

The principles and requirements detailed below are of strategic importance and apply to all data and telephone systems, mainly with regard to scalability and reliability.

### 2.1 Key Principles and Requirements

- The IT & Computing Services (ITCS) department of the university is responsible for data and telephone systems
- Across the campus - the data network is designed like a "wagon wheel" with buildings having a direct "spoke" link back to one of the two data centres, as well as a "rim" connection to the two nearest academic or residential buildings (depending on whether the project is academic or residential). Cabling in these cases is always single mode fibre terminated on LC panels. All buildings must be provisioned with at least two disparate points of egress from the building to minimise the risk of an incident affecting all cross-campus cables.
- Within the building – the data network typically comprises one communication (hereafter 'comms') room per floor, which house floor-standing 800 x 800mm cabinets, which may be bayed into banks, with access all around. These cabinets should contain at least 25% spare capacity at installation to allow for expansion. One of these comms rooms is designated as "hub central" and CAT5e cabling is then starred-out from this cabinet to link up to all the other comms rooms (the quantity is defined to exceed the initial amount of equipment on each floor – each edge switch will have its own uplink). "Hub central" is the designated location for the building router and is where all the cross-campus fibres (outlined above) are terminated.
- Within each floor of the building - the cabinets in the comms rooms shall contain the CAT5e structured cabling on 24-way patch panels and a maximum fixed link length of 90 meters (from patch panel to wall outlet). These are laid out in the rack to allow space for network switches to be interspersed to minimise patch lead length and allow for on-going maintenance.
- Regarding heat dissipation, locations of three or more switches must include active air-flow (venting and fans) and locations of more than five switches must include active cooling.
- With respect to power, cabinets must be provided with pairs of separately tripped power feeds presented on front-mounted power distribution units (PDUs) where a maximum of four switches are connected to each supply. The breaker in the fuse-board should be of at least type B20 (where B indicates it will trip if it passes between 3 and 5 times the rated full current load, C between 5 and 10 times)

- An allowance for 1308 telephony pair cabling must be included via underground ducting back to the old PBX room in the Estates Building (25/1.17) for alarm, BT, lift and emergency phones. The use of catenary wires is not permitted.
- The internal telephone system on site is run, resiliently, from the two data centres and uses the vendor's handsets, or agreed alternatives, for which the university has a procurement arrangement.
- Structured cabling must be installed to the manufacturers' standard to include a 20 year warranty, be loosely bundled and comply with the standard of "low smoke, zero halogen" (LS0H). Each point must be uniquely labelled with the floor number, room number and outlet number in that room – starting to the left of the main entrance door. Additional points must then follow on from that sequence.
- Containment shall be left accessible for future installations and must not be more than 50% full at first install, 75% on a revisit.
- Comms rooms must not share their function with any other operation of the building and should be fitted with a standard university barrel lock. They shall also be located so as to be accessible from the publically accessible space such as a corridor or externally in order to prevent disturbing office or teaching space during routine maintenance.
- The wireless service is an extension of the existing solution. A desktop survey of the building, including factoring in likely occupancy density, shall be undertaken by ITCS to inform the wireless deployment with preference for installation to circulation space rather than in offices or labs.
- Wireless equipment is available through a university procurement arrangement.
- Active networking equipment (switches and routers) are available under a university procurement arrangement.
- Telephone equipment is available under a university procurement arrangement.

## 2.2 Building Load Assessment

### 2.2.1 Introduction

Where there is little or no design metric to work with the following rule of thumb can be employed: a typical building should assume to have three floors and around 100 dual outlets per floor. During a conventional project however, a plan showing the location of all outlets and cable runs shall be developed and presented to the Head of Networking, or their nominated representative, for their written approval.

### 2.2.2 Key principles and requirements

Where a building spans a considerable horizontal distance or the design restricts/informs cabling routes, it may be necessary to have two comms locations per floor to maintain the maximum fixed link length of 90m. Inversely, where the dimensions are smaller – it may be

more efficient to have comms rooms only on some floors and cable the other floors up or down to the nearest cabinet – the consequence of this is that it increases the probability of the need for passive or active cooling to be installed. The latter option will also increase the ducting capacity required to the comms locations and the capacity for cabling between floors.

### 2.2.3 Preferred materials, technology and solutions

Wireless equipment must be provided from Juniper, active equipment (switches and routers) from Brocade and cabling must adhere to the standards of either KRONE or Excel – completed with a 20 year warranty. Other cabling vendors may be acceptable assuming they can assert the same level of reliability. If considering an alternative cabling manufacturer, the specification must be approved in writing by the Head of Networking, or their nominated representative.

### 2.2.4 Suggested schematics

Topologically there must be a telephony 1308 copper pair cable run to the old PBX room in the Estates Building (25/1.17). The capacity of the pair cabling will depend on projected use/demand from as little as 20 pairs for a small development to a more typical 50 to 100 pairs for a significant building depending on size. In addition there must be a single mode fibre run to one of the data centres (as defined by the ITCS network team) but also to neighbouring buildings via diverse routes out of the building.

Within the building one of the comms rooms shall be designated as "hub central" where the cross-campus cables are terminated (and the router is installed) with all other comms rooms fed from this location in a star layout (no stacking of switches creating co-dependencies). All switches and routers shall be provided with second, redundant power supplies for resilience. Wireless must allow for complete internal coverage and make efforts to cope with known/expected device density (such as in lecture theatres).

### 2.2.5 Applicable standards and best practice guides

Cabling must be installed to the manufacturers' standards to comply with warranty, typically this will be to EN 50174. Active equipment (switches, routers and access points) must be presented to the ITCS network team for configuration 20 working days ahead of installation.

## 2.3 Operational Procedures

The UEA has evolved a set of operating procedures that ensure safety, efficiency and continuity of business. Key principles of the operating procedures include:

- Cross-campus cabling shall be diverse from the point that it leaves the building
- Equipment shall be installed in purpose-built racking with access all around for installation and maintenance
- Racking shall always be installed to allow access whilst floor standing – no high-level wall racks to be used

## 2.4 Testing, Commissioning and Documentation

### 2.4.1 Testing and Commissioning

The UEA recognises that the design aspirations for any development work can be realised or lost at the testing and commissioning stage. Testing and commissioning often takes place during the final stages of a project when time pressures are greatest, potentially resulting in systems that perform poorly when in use.

The testing, commissioning and certification of any installation is Quality Assured (QA) by the UEA networking staff in conjunction with the contractors installing and terminating the cables. This process involves the provision of all test results electronically. The audit process is either through witness testing (cable testing whilst an ITCS network team representative is present) or follow-up random set of tests using the in-house calibrated test device to confirm the submitted results. Contact [itcs.netteam@uea.ac.uk](mailto:itcs.netteam@uea.ac.uk) to arrange a site visit.

### 2.4.2 Documentation

The UEA requires as built CAD drawings to be provided in dwg format. The location of each installed point along with details of the cable route will be included on the electronic plans held within the Estates and Buildings Division. Estates naming convention for the layers must be observed; 655T for text and 655G for graphics. The standard colour coding will be used, which is as follows:

- Blue            Fibre Optic Cabling
- Black          Telephony Cabling
- Red            Copper Cabling

## 3 Telephones

### 3.0 Introduction

The university has moved all of its office desk phones to a VoIP (Voice over Internet Protocol) solution and all desk handsets must be provided using this solution. For fax machines or accessibility handsets an analogue convertor is available.

The exception to the IP-based solution is the provision of BT lines. These star out from the old PBX room on the first floor in the Estates Building (25/1.17) and route across campus through a number of high-capacity copper pair cables in the ground going to regional DPs (distribution points) which are then jumpered onto structured cabling and use an outlet converter to provide the necessary BT-style connection.

Note – the UEA data network is not PCI (Payment Card Industries) compliant and so any credit card machine or phone line taking card payments needs to be undertaken using a BT line (see the final paragraph in section 3.2.6 for more details regarding credit card payment options).

Details for refuge alarms, lift phones, disabled toilet alarms and emergency phones are dealt with in Part 8 of the Design Guide.

All part numbers detailed below are KRONE part numbers unless otherwise stated. Deviation from these specifications must be authorised in writing by the Head of Networking, or their nominated representative.

### 3.1 Key Principles and Requirements

The basic approach is that the majority of phone users will be operating computerised VoIP handsets which they will connect to the data network to provide their service. These handsets provide a second socket on the back for connecting the computer – so the number of outlets and network switches does not need to be doubled.

For those with specialist receiver requirements or fax machines then an analogue convertor is available to provide the link between the traditional phone line socket on the device and the computer network.

Each new build or refurbishment project must make an allowance for BT connectivity by providing some 1308 copper pair cabling back to the old PBX room in the Estates Building (25/1.17). The number of pairs to be installed must be authorised in writing by the Head of Networking, or their nominated representative.

### 3.2 Preferred materials, technology and solutions

#### 3.2.1 1308 Copper Pair Cable

The cable for linking from the old PBX room in the Estates Building (25/1.17) to the remote distribution point is:

General Cable GelCat (Internal/External) CW1308B

For analogue and VoIP lines – distribution from the comms cabinets to the desk are as per the UTP flood wiring detailed in *Section 4: Data*, of this document.

### 3.2.2 Supports & fixings

The frames located in the main exchange room shall be:

- Single Vertical Frame 108A 6420/1/050/00
- Distribution Frame 108A 6420/1/013/00

Whereas outside the exchange room the telephony cabinets shall be:

- Connection Box 301A (up to 100 pairs) 6530/1/017/00
- Connection Box 510 (up to 340 pairs) 6532/2/009/00
- Connection Box 520 (up to 680 pairs) 6532/2/010/00
- Connection Box 530 (up to 1020 pairs) 6532/2/011/00
- Connection Box 540 (up to 1360 pairs) 6532/2/012/00

Where it is necessary to link, externally, copper telephony cabling:

- Austin Taylor high security cabinet Austin Taylor 9CAB216455

### 3.2.3 Containment system

The cables shall be routed via the existing ducting where available – and installed in such a way as to minimise the friction impact to existing cables. Advice on cross-campus routes is available from [itcs.netteam@uea.ac.uk](mailto:itcs.netteam@uea.ac.uk)

### 3.2.4 System design

The distribution points used are the same as those defined for data networking – i.e. co-located with data cabinets. See *Section 4: Data* of this document.

### 3.2.5 Analogue equipment

The outlet converter for adapting RJ-45 structured cabling to BT-style socket for analogue connections shall be:

- Flying Lead 258A PABX Master 6536/1/720/10

The patch panel for terminating telephony pair cabling shall be:

- 50-way telephony patch panel Austin Taylor 9PAN204871

### 3.2.6 VoIP Equipment

The telephone solution shall use Unify OpenStage handsets in lava colour. Wall mounting brackets and snap-on keys modules are also available.

Basic handset (open listening, 2 line display):

- OpenStage 15G p/n L30250-F600-C175 (Lava)

Advanced handset (speakerphone, 6 line display, headset socket, optical call alert, 6-programmable keys built-in, display backlight):

- OpenStage 40G p/n L30250-F600-C101 (Lava)

Bulk procurement of Unify equipment is possible under the university main contract at preferential rates – contact [itcs.netteam@uea.ac.uk](mailto:itcs.netteam@uea.ac.uk) for details. Licences for the phones for use with our exchange are not required since the exchange has been heavily licensed centrally.

A Mediatrix analogue adapter is available (to convert from VoIP to BT-style connection) for those requiring a specialist receiver. Specialist receivers typically comprise: accessibility handsets, DECT phones or fax machines. For conference phones a Polycom Soundstation 6000 conference handset shall be used.

Note that the university phone system is NOT rated for taking card transactions, be that orally or through the use of a card machine with an analogue phone line. In both these cases a BT line should be obtained for this purpose. Card machines which are on the PCI (Payment Card Industries) Security Standards Council list as being validated P2PE (Point-to-Point Encryption) solutions ARE permitted on the data network for university business. For non-university members on the university network – a disclaimer will need to be signed with ITCS indemnifying the university against any claim for loss.

### 3.3 Connection Procedure

All requests for new phone lines or migrations from elsewhere on campus, be they analogue or VoIP, shall be made according to the timescales below to the [telephony@uea.ac.uk](mailto:telephony@uea.ac.uk) Email address.

Telephone extensions	lead time
1 – 3 lines	1 week
4 – 10 lines	4 weeks
11 – 100 lines	6 weeks

NOTE that any analogue line patching from the telephony patch panel to the UTP flood wiring on the floor should be undertaken with RED straight-through CAT5e patch leads and made to connect to the ‘odd’ numbered outlets in the remote locations.

### 3.4 Applicable Standards and Best Practice Guides for Telephone Systems

This section is intentionally left blank.

## 4 Data

### 4.0 Introduction

Across the campus the data network is designed like a "wagon wheel" with buildings having a direct "spoke" link back to one of the two data centres, as well as a "rim" connection to the two nearest academic or residential buildings (depending on whether the project is academic or residential) for resilience.

Within the building the data network comprises a primary comms rooms ("hub central") which services the rooms around it along with links starring out to satellite comms rooms which service the rest of the building. The active equipment (switches and routers) in the cabinets must match the university standard. These comms locations must not have their function shared with any other function of the building and must be secured with a university standard barrel lock opening on to a publically accessible space (such as a corridor or via an external door).

### 4.1 Key Principles and Requirements

Cross-campus cabling is via single mode fibre and internal cabling is via CAT5e cables which are "low smoke, zero halogen" – unless an alternative performance cable has been agreed with the Head of Networking or their representative. The building must be provisioned with at least two disparate points of egress from the building to minimise the risk of an incident affecting all cross-campus cables.

The comms rooms should provide two independent, separately protected, power supplies for the networking equipment. The breaker in the fuse-board should be of at least type B20 (where B indicates it will trip if it passes between 3 and 5 times the rated full current load, C between 5 and 10 times). A separate pair of feeds should be supplied for each bank of four network switches; which are presented on front-facing power distribution units (PDUs).

For installations of up to two switches in a room then ambient cooling is sufficient. For installations of three or more must be provided with active air-flow (venting and fans), whilst locations of more than five must include active cooling.

### 4.2 Preferred Materials, Technology and Solutions

#### 4.2.1 UTP copper cabling

The model in use at the university is to have a single cable permanent link between wall socket and patch panel. Note that, in certain circumstances, HiBand consolidation points are acceptable where the certification of the cable isn't affected.

Generally, copper cabling is not used between buildings or run externally. Where this is necessary then the cabling should be rated for external use (such as certain CAT6 cabling) and a lightning protector should be fitted. The use of copper cabling externally must be authorised by the Head of Networking or their nominated representative, in writing, ahead of installation.



Advanced patching frame 42U

6420/1/500/00

Cabinets in a machine room are subject to the machine room specification as far as external requirements (such as floor attachment) allow. These must, however, be 19" standard racks and meet our minimum depth requirement for active equipment of 660 mm.

At installation, all cabinets should provide at least 25% spare U capacity at install to allow for future expansion and be at least 660 mm deep.

Wall Cabinet 21U  
Cabinet

Prism 600 series  
Cooper B-Line Access

As far as possible, floor standing cabinets should be used with adequate access all around. Floor standing cabinets can be bayed together into racks.

#### 4.2.5 UTP outlets

These are the wall outlet sockets, RJ-45, into which computer and telephony cabling is attached.

Back boxes for installations, as far as they should provide adequate bend radius for cables – can be provided as to be suitable and compatible with the available containment and surface construction materials.

White 50x50 surround (single gang) face plate	6540/1/806/00
CL 45 degree Adapter	6540/1/802/00
CL UTP, white shutter, 568A/B	6540/1/200/01

The labelling of such sockets will be of the format:

University standard floor number . Room number <sup>1</sup>. two digit increment

i.e. the third port in room 07 on floor 01 of a building will read 01.07.03

This naming convention shall be the same at both ends of the cable, with numbering starting to the left of the main entrance door to the room and go round in a clockwise direction. Subsequent installs will follow the same pattern for their installation taking the next available port number.

Note that the physical alteration of a building or area does not, necessarily, require the labelling to be updated as long as each cable and outlet can still be uniquely identified (i.e. no room number changes have taken place further up the corridor so as to cause room number duplication).

Patch leads should be of the same standard as the fixed link of the structured cabling. Typically comms room data patching is done in 0.5m cabling – telephony patching may be shorter. The following colour code should be used for all UTP cabling:

- Yellow            Edge device (straight through UTP)
- Green            Uplink (cross-over UTP)

---

<sup>1</sup> UEA floor and room numbering system can be found in Part 2 of the Design Guide – Architecture and development context.



- Cable separation for 400V (three phase) cables should be three times the distances stated above
- The minimum distance from neon, incandescent and high intensity discharge lighting is 130mm

Tray and bundle size for CAT5e (Note that CAT6a will mean fewer cables):

- 150mm tray will take a maximum of 3 x 48 cable bundles (approximately 150 cables)
- 100 x 100 box containment will take a maximum of 144 cables
- 50 x 50 box containment will take a maximum of 24 cables
- MT2 will take a maximum of 6 cables
- 25mm conduit will take a maximum of 8 cables
- 20mm conduit will take a maximum of 4 cables

Containment should only be 50% full on a new installation and 75% full on a revisit. If an installation will take the capacity in use above these figures then new containment is to be installed as part of the installation.

#### 4.2.9 Cabinet layout

Campus Distribution including Brocade ICX6610 Router: 7U

Spare	1U
Fibre – Incoming from DC	1U
Fibre – From next building	1U
Fibre – From next building	1U
Brocade ICX6610 router	1U
Building Interlinks	1U
Spare	1U

Building Distribution including Brocade FCX648S-HPoE Switches: 6U per single switch formation

Brocade FCX648S-HPoE	1U
24 Port Data Panel	1U
24 Port Data Panel	1U
50 Port Voice Panel	1U
24 Port Data Panel	1U
24 Port Data Panel	1U
Brocade FCX648S-HPoE	1U
24 Port Data Panel	1U
24 Port Data Panel	1U
50 Port Voice Panel	1U
24 Port Data Panel	1U
24 Port Data Panel	1U

UTP patching should be done from the switch down to the patch panel for data, and both up and down from the voice panel where appropriate. This allows for replacement of equipment without impediment.

#### 4.2.10 Network routers

**For the main campus** (teaching/learning/office spaces) - Brocade ICX6610-48P-P (PSU: RPS16, 10 Gb licence: ICX6610-10G-LIC-POD, fan: ICX6610-FAN) are used, which are 48-port gigabit routers with a further 8 SFP/SFP+ ports for long distance (external to building) connection across campus or to remote locations. This is used for consolidating the input from switches located around each department into a single feed suitable for linking directly back to the core of the network or via a neighbouring building.

Note that these units do not have secondary management modules but should be specified with a second redundant power supply, redundant second fan assembly, the premium licence (included in the unit code above) and one 4-port 10 Gb licence for cross campus links – shown above.

- Power Rating 3122 BTU/hour or 1605 watts per device (max)

**For the student residences** – Brocade ICX7450-48F (plus 2 x RPS15-E power supplies, 2 x ICX-FAN10-E fans and ICX7450-PREM-LIC software licence) are used, which are 48-port gigabit routers with 48 mini-GBIC ports for long distance (external to building) connection across campus or to remote locations. This is used for consolidating the input from switches located around each residence into a single feed suitable for linking directly back to the core of the network or via a neighbouring building.

Note that these units are not sold with any power supplies or fans and do not have secondary management modules but should be specified with two power supplies, two sets of fans and the premium licence (shown above).

- Power Rating 420 BTU/hour or 123 watts per device (max)

Bulk procurement of Brocade equipment is possible under the university contract at preferential rates – contact [itsc.netteam@uea.ac.uk](mailto:itsc.netteam@uea.ac.uk) for details.

NOTE that router port-counts should not be used to offset edge device connectivity. Edge devices shall connect to a switch and then the switches connect to the routers unless the building comprises less than 24 client ports.

All active equipment, including switches, wireless access points and routers, are to be configured by the Networking Team – please allow 20 working days.

#### 4.2.11 Network switches

Brocade ICX7450-48P (plus 2 x RPS16-E power supplies, 2 x ICX-FAN10-E fans) is a 48-port 10/100/1000 switch with 4 gigabit uplinks (via UTP or SFP optic) with the ability to provide Power over Ethernet (PoE) for running wireless access points, VoIP phones etc via the UTP ports.

These devices shall be specified with redundant power supplies and fans.

- Power Rating 386 BTU/hour or 935 watts per device (max – inc PoE load)

Bulk procurement of Brocade equipment is possible under the university contract at preferential rates – contact [itsc.netteam@uea.ac.uk](mailto:itsc.netteam@uea.ac.uk) for details.

All active equipment, including switches, wireless access points and routers, are to be configured by the ITCS Networking Team – please allow 20 working days.

#### 4.2.12 Wireless networking

The edge equipment used is a Juniper WLA532-WW 802.11a,b,g,n 3x3 MIMO access point which must be specified with a suitable bracket (by default the box contains bracket for false ceiling tile frame – surface mount boxes available separately).

The requirement is only that the edge equipment is needed – and suitable CAD diagram surveys need to be undertaken to identify suitable ceiling locations for installation. Access points shall be located, wherever possible, in public areas such as corridors to aid in installation and maintenance.

Bulk procurement of Juniper equipment is possible under the university contract at preferential rates; contact [itsc.netteam@uea.ac.uk](mailto:itsc.netteam@uea.ac.uk) for details. Depending on the scope of the project, software licences for the access points to connect to the centralised controllers may not be necessary.

All active equipment, including switches, wireless access points and routers, are to be configured by the ITCS Networking Team – please allow 20 working days.

#### 4.2.13 SFP/SFP+ specifications

All the equipment uses 1Gb SFP (Small Form Pluggable) mini-GBICs from Brocade (obtainable with the edge switches and routers), or SFP+ 10Gb optics. Typically port 1 on a router is used to connect back to one of the Data Centres – whilst ports 2 and 3 are used to connect to neighbouring buildings. These all require some form of laser optic:

##### 1Gb optics:

1000Base - LX Single-mode @ 1310nm is 10km

Multi-mode @ 1310nm is 550m for either 62.5 or 50micron fibre

##### 10Gb optics:

10GbaseLR @ 1310nm is 10km

10GbaseSR @ 850nm is 300m

SX optics (850nm) are typically only used within the Data Centres to connect to high performance servers where no UTP connectivity is available. In certain instances TX SFPs are required (e.g. some residence locations) although this is rare given the profusion of UTP connectivity on the Brocade range of devices.

#### 4.2.14 Media convertors

If it is necessary to convert between fibre optic and UTP connectivity, and the fourth port on the router has already been used, then an Allied Telesyn 10/100/1000 to SFP module

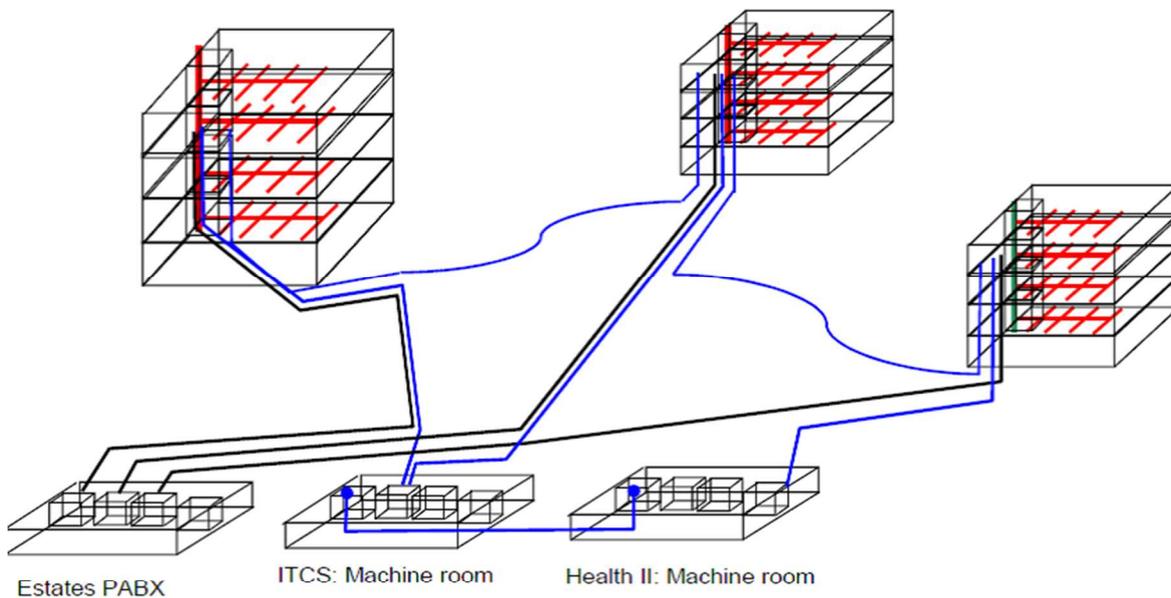
should be used (Part Number: AT-GS2002/SP). Note that, where a number of media convertors are used in the same location, the UEA has a stock of AT-MCR12 dual-powered chassis' for the above media convertor - to aid in physical and electrical installation.

### 4.3 Applicable Standards and Best Practice Guides for Data Cabling

This section is intentionally left blank.

## 5 Appendix

### 5.0 Topography diagram



- Horizontal distribution: Cat5e permanent link (*up to 90 metres*)
- Building distribution: Cat5e or M/M 50 micron LC Fibre optic
- Campus distribution: up to 3 KM SM 9 micron SC 24 core Fibre optic
- Telephony: Copper multi core CW1308B Intext