

Loughborough University Specifications for Networking Standards

Part 3 – Wireless Networking

1. Introduction

This document is intended to act as guidance for the installation of a Wireless Networking equipment required to support the network infrastructure for Loughborough University.

Adherence to this document should ensure potential problems are minimised and handovers completed in a straightforward and timely fashion.

Deviations from this document will only be allowed by written permission from Loughborough University IT Services Network and Communications Team Manager, IT Services Director, or their nominee.

This document is one of several covering different aspects of the IT infrastructure:

- Part 1 Structured Data & Fibre Optic Cabling
- Part 2 Communication Rooms
- Part 3 Wireless Networking

This document is issued by Loughborough University IT Services.

1.1 IT Services Contacts

The following IT Services staff can be contacted for further information:

| | | | |
|-----------------|-------------------------------|--|--------------|
| Anthony Tunley | Network & Comms Team Manager | a.tunley@lboro.ac.uk | 01509 226043 |
| Jonathan Oakden | Senior IT Services Specialist | j.p.oakden@lboro.ac.uk | 01509 226070 |
| Pranay Pancholi | IT Services Specialist | p.m.pancholi@lboro.ac.uk | 01509 226067 |

1.2 Document Control

| Date | Version | Author | Comments |
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1.3 Abbreviations

LU – Loughborough University
IT – IT Services
CR – Communications Room
AP – Wireless Access Point
UTP – Unshielded Twisted Pair
OTDR – Optical Time Domain Reflectometer
IP – IP Protocol

1.4 Review

To be reviewed every 12 Months

Author: Pranay Pancholi, IT Services Specialist

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2. Standards

All cabling work for the University must be undertaken to the most recent version of the following standards:

| Standard | Description |
|-----------------------------|--|
| BS 7671:2018 - 18th Edition | Requirements for Electrical Installations. IET Wiring Regulations |
| BS 6701:2016 +A1:2017 | Telecommunications equipment and telecommunications cabling. Specification for installation, operation and maintenance |
| BS 8492:2016 | Telecommunications equipment and telecommunications cabling – Code of practice for fire performance and protection |

2.1

British and International Standards

2.2 European (CENELEC) Standards

| Standard | Description |
|-----------------------------|--|
| BS EN 50173-1:2018 | Information technology. Generic cabling systems. General requirements |
| BS EN 50173-2:2018 | Information technology. Generic cabling systems. Office Spaces |
| BS EN 50173-3:2018 | Information technology. Generic cabling systems. Part 3: Industrial Spaces |
| BS EN 50173-4:2018 | Information technology. Generic cabling systems. Homes |
| BS EN 50173-5:2018 | Information technology. Generic cabling systems. Data Centre Spaces |
| BS EN 50173-6:2018 | Information technology. Generic cabling systems. Distributed building services |
| BS EN 50174-1:2018 | Information technology. Cabling installation. Installation specification and quality assurance |
| BS EN 50174-2:2018 | Information technology. Cabling installation. Installation planning and practices inside buildings |
| BS EN 50174-3:2013 +A1:2017 | Information technology. Cabling installation. Installation planning and practices outside buildings |
| BS EN 50310:2016 | Application of equipotential bonding and earthing in buildings with information technology equipment |
| BS EN 50346:2002+A2 2009 | Information technology. Cabling installation. Testing of installed cabling |

2.3 Other Standards

| | |
|---------------|--|
| EIA/TIA 598 | Optical fibre cable colour coding standard |
| EIA/TIA T568B | pin/pair assignments for eight-conductor 100-ohm balanced twisted pair cabling |

3. Project Management

It is important to establish an early and clear dialogue with IT Services on projects that have any sort of IT impact. Failure to do so may result in delays to the project or incorrect installation which will not be accepted.

3.1 Communication

All large scale projects should contact the following:

| | | | |
|-----------------|-----------------------------------|--|--------------|
| Anthony Tunley | Networks & Communications Manager | a.tunley@lboro.ac.uk | 01509 226043 |
| Jonathan Oakden | Senior IT Services Specialist | j.p.oakden@lboro.ac.uk | 01509 226070 |
| Pranay Pancholi | IT Services Specialist | p.m.pancholi@lboro.ac.uk | 01509 226067 |

Any miscellaneous projects should contact the University IT Services Service desk to ensure your request is directed to the correct person.

Email: IT.Services@lboro.ac.uk

Phone: 01509 222333

3.2 Documentation

Where suitable IT Services should be issued with the following documentation:

- Floor layout plans in Autocad format and PDF
- Communication room locations and layouts
- Cable containment route plans
- Number of data outlets terminated at each comms room
- List of building network connected services (e.g. BMS, Door Access Control, Intruder Alarms etc)

3.3 Costs and Budgets

The project is responsible for funding all IT costs.

This includes but is not limited to:

- Construction work to connect into the data duct system, including contingency to address collapsed or blocked existing duct work.
- Installation of specified fibre optic cables as a single piece of unjointed cable between locations
- Installation of internal building fibre and copper cabling
- Purchase and installation of data cabinets
- Purchase and installation of power distribution units within each rack
- Purchase of active networking equipment (switches, wifi and optics)
- Purchase of patch cabling
- Purchase of network installation equipment

4. Design

IT Services are the design authority for all IT infrastructure within all University buildings and must be included in the design stage of any installation on major building or refurbishment. IT Services will design the wireless networking for LU to meet the needs of the client and proposed building occupants, taking into account the use of connecting services such as telephony, CCTV and IoT.

It is important for IT Services to be able to work with FM colleagues and those involved in the design and build process to understand any constraints for wireless installation both internally and externally on the façade of the building.

What about including statements about enterprise 802.1X like we did in the procurement document?

4.1 General Design Principles

- Full Coverage – Wi-Fi will be designed and installed for full coverage in all occupied buildings.
- Capacity – Wi-Fi coverage to support full occupancy of buildings.
- Mobility – Ability for devices to roam between Wi-Fi APs within a building to maintain connection.

4.2 Internal Wi-Fi

All LU occupied buildings will be provisioned with Wi-Fi. Staircases, W/C rooms and lifts will not be specifically covered but will factor this into the design plan to have these areas covered with Wi-Fi.

The installation location of Wi-Fi access points must not deviate by more than 3m in a horizontal plane from the location specified by IT Services. If a significant deviation is required IT Services should be consulted, this includes any proposal to deviate from mounting on a horizontal plane (ceiling). The placement must consider ease of access to both the access point, associated data socket, and security padlock for maintenance purposes (e.g. not normally installed above a 8 rung ladder height, behind access panels, or in risers etc.)

4.3 External Wi-Fi

For any external Wi-Fi coverage demands the nominated IT Services contact must be consulted to create a bespoke external Wi-Fi design together with FM colleagues to ensure the design is aesthetically sympathetic within the built environment. The recommended solution will comprise of multiple components which need to be included in the project costs: external grade access points, external antenna, cabling and mounting hardware.

4.4 Coverage Requirements

IT Services will design the new wireless network with the following coverage requirement parameters:

- Signal Strength -65dBm
- Signal-to-noise Ration 30 dB
- Data Rate 24 Mbps
- Number of Access Points 2 at min. -67 dBm
- Channel Interference 2 at min. -70dBm
- Round Trip Time 200 ms
- Packet Loss 2%

5. Site Surveys

New Wi-Fi installation must adhere to a detailed wireless design which will be completed by LU IT Services using industry standard software known as Ekahau Site Survey Pro. There is no additional financial cost for the use of this software or the development of the survey.

5.1 Pre-install Survey

To complete a Wi-Fi design plan a pre-installation plan must be completed. The two methods are known as active or predictive surveys.

Active Surveys

An active survey will provide the most comprehensive design plan as physical APs will be used on site to survey. This type of survey will capture all RF measurements of the environment. However, given the typical construction schedules and lack of access, these surveys may not be feasible for new builds. Although for small refurbishment projects this method of surveying may be preferred.

Predictive Surveys

A predictive survey can be completed remotely using Ekahau Site Survey Pro planning feature based on a scaled floor plan and construction of building materials. For new build designs this will be the default survey method.

5.2 Post-install Site Survey

A post-install site survey should be conducted by LU IT Services to validate the installed design to prove the installation meets the design specification as part of benefits realisation and to inform future project learning points. Should the post-install survey fail to meet the original design plan IT Services will recommend any changes that will need to take place. This may involve in moving of APs, installation of additional APs and removal of APs.

Should there be a change of use once the design plan has been created then a new plan will be required to determine if any further changes are required.

6. Installation

6.1 Pre-Requisites

Prior to any successful Wi-Fi installation, the following requirements should be met:

- Infrastructure – structured cabling installation as per LU – Part 1 Data Cabling Specification.
- Dual CAT 6A data sockets must be used for every installed AP.
- Internal APs should be installed at a maximum height of 4 meters in an horizontal plane. If this is not achievable, please discuss with the nominated IT Services contact.
- APs must not be hidden and should be installed within clear line of sight.

6.2 IT Services Responsibilities

The technical Wi-Fi design in major and refurbishment projects will be created by LU IT Services who will:

- Annotate floor plans to show required positions for twin CAT 6A data points to be installed which will be used to connect APs to.
- Decide which model of Wi-Fi AP is deployed.
- Determine the orientation and positioning of the APs.
- Undertake procurement exercise to source Wi-Fi hardware, licensing and maintenance. Please note the procurement will need to be included in the capital project budget.
- Conduct a pre and post wireless survey using Ekahau Site Survey.
- Configure the APs upon successful installation by the project.

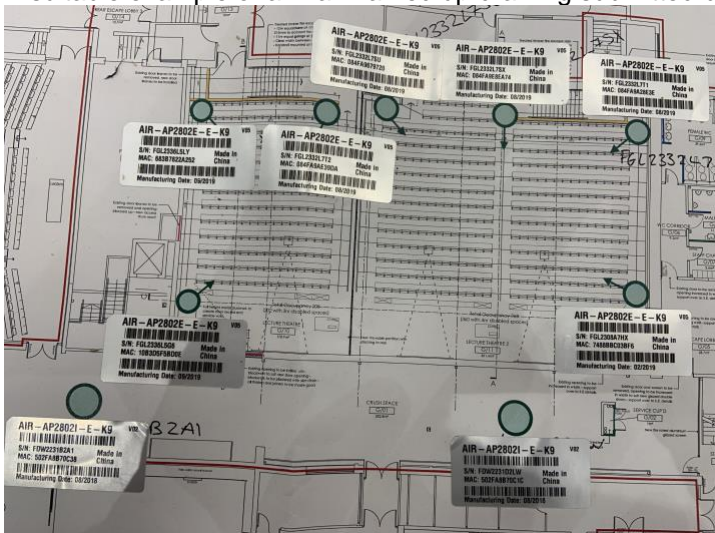
6.3 Access Point Installation

All contractors must work from an approved Wi-Fi design plan submitted by IT Services which will indicate the location and quantity of the APs. All APs must be ceiling mounted unless specifically stated otherwise. In any case where an AP cannot be installed ceiling mounted or installed at the correct location, the IT Services project representative must be consulted.

IT Services will provide the APs and mounting brackets.

The contractor will be required to mark up with Wi-Fi design plan, the MAC address of the AP against its position and the data point number. The completed Wi-Fi drawing will be required to be handed back to IT Services upon completion.

A suitable example of a final marked up drawing submitted back to IT Services can be seen below:



7. AP Models

7.1 Internal Access Points

The standard model of APs that are currently used at LU is Cisco 2802I series model for the majority internal areas.

Areas of high density (libraries, lecture theatres, exhibition spaces) will have a mixture of 2802I and 2802E with ANT2566D4M antennas.

The models are subject to change to support existing hardware compatibility and infrastructure.

Samples:

Cisco AIR-2802I-E ceiling mounted access point.



Dimensions: 8.7 x 8.7 x 2.11 in. (22.1 x 22.1 x 5.4 cm) (without mounting bracket).

Cisco AIR-2802E-E ceiling mounted access point.



Dimensions: 8.7 x 8.7 x 2.11 in. (22.1 x 22.1 x 5.4 cm) (without mounting bracket).

Cisco AIR-ANT2566D4M-R Antenna



7.1.1 Sample Illustration



7.2 External Access Points

The standard model of APs that are currently used at LU is Cisco 1560 series model for the majority of external areas. This model comes in 3 types 1562I (internal omni-directional antenna), 1562D (internal directional antenna), 1562E (allows for external antenna to be installed).

The models are subject to change to support existing hardware compatibility and infrastructure.

Sample:

Cisco 1562I and 1562D



Dimensions: 9 x 7 x 4 in. (23 x 17 x 10 cm)

Cisco 1562E



Dimensions: 9 x 7 x 4 in. (23 x 17 x 10 cm)

7.2.1 Sample Illustration



