Cambridgeshire County Council

Technical Principles for ICT in Primary School Building Designs

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CAMBRIDGESHIRE EDUCATION ICT service

SIMS ACCREDITED Support Team

QA naace CONSULTANCY FOR ICT DEVELOPMENT PLANNING

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1 Target Audience

The target audience for this document includes Architects, Builders, Mechanical and Electrical Engineering contractors, Fixtures Fittings and Equipment contractors involved in the implementation of ICT as part of school building projects in Cambridgeshire.

2 Purpose of Document

ICT should be at the heart of all schools being designed and built in the 21st Century.

In order to integrate ICT into a school's environment, architects and designers are required to give due consideration not only to the class rooms, teaching spaces, specialist teaching areas, sports, drama and administrative requirements but also to the supporting infrastructure necessary for the delivery of ICT in schools.

In order to deliver ICT in Primary schools, the design of the building should allow for a number of ICT specific spaces from which to deliver ICT. For example, a server room, one or more Data Cabinet rooms, a working area for ICT technicians and storage spaces for ICT hardware, software, spares and consumables.

The delivery of ICT itself is largely reliant on there being an integrated data network installation comprising of both wired and wireless networking with adequate power sources for PC and peripheral devices. The data network will support the school's curriculum, administration and general ICT requirements.

The purpose of this document is to provide a set of standards, principles and specifications to which ICT installations should be carried out in Cambridgeshire Schools that are undergoing new build or extension work. It aims to enforce good practice and ensure that the ICT infrastructure and solutions implemented provide a good return on investment and support the teaching and learning objectives outlined in the sister document 'ICT Solutions for Primary School Build Project' which is designed to aid school leadership teams in making decisions about the optional aspects of ICT provision in new school builds.

This document details what is considered the minimum ICT provision to be included in new school building projects. It also contains specifications and standards for a number of optional solutions which the school may choose to purchase at the time of new building works.

School building projects are subject to a quality assurance inspection process by the Local Authority in line with the standards detailed in this document.

3 Minimum ICT Requirements

The following section details the minimum ICT provision to be available in all new primary schools. For ease of description, different areas of the school are dealt with in turn. This section can be used to support the 'room datasheet' process.

3.1 Classrooms

Data outlets: Data outlets should be provided according to the Data Cabling Specification (See appendix 1) as follows, with power supplied in accordance the ICT Electrical Specification (See appendix 2):

a) Teacher use – 1 x double outlet to facilitate teacher device close to the IWB or teachers desk. The remaining outlet can be used as a telephone point.
b) Pupil use – 1 x double outlet facilitating two desktop computers
c) Wireless – 1 x high level single outlet to provide wireless solution for flexible deployment of resources. This outlet needs to be positioned within the room so as to provide optimal wireless coverage. Exact positioning will require either a wireless survey or the production of a wireless heat map using specialist software. (See appendix 3)
d) Additional Functionality – 1 x single outlet to facilitate a printer, cashless catering or e-registration system.

This gives a total of 6 data outlets per classroom including 1 high level outlet.

Wireless Access Points: The wireless solution (See appendix 3) should be capable of enabling up to 30 concurrent devices to access the wireless network in each classroom at any one time. There is no requirement for a wireless access point to be installed in each classroom; however as a guide it is unlikely that less than 1 wireless access point per 2 classrooms will meet this requirement.

3.2 School Offices, Head teacher's Office and other similar areas

Data outlets: Data outlets should be provided according to the Data Cabling Specification (See appendix 1) as follows, with power supplied in accordance the ICT Power Specification (See appendix 2):

a) Office use – 1 x double outlet to facilitate PC/Telephone/Fax
b) Wireless – 1 x high level single outlet to provide wireless solution for flexible deployment of resources. This outlet needs to be positioned within the room so as to provide optimal wireless coverage. Exact positioning will require either a wireless survey or the production of a wireless heat map using specialist software. (See appendix 3)

Wireless Access Points: The wireless system (See appendix 3) should be capable of enabling up to 5 concurrent devices to access the wireless network in each office space at any one time. There is no requirement for a wireless access point to be installed in each office; however producing a heat map or wireless survey should be carried out to guarantee the correct level of wireless coverage.

3.3 School Halls

Data outlets: Data outlets should be provided according to the Data Cabling Specification (See appendix 1) as follows, with power supplied in accordance the ICT Power Specification (See appendix 2):

a) Teacher use – 1 x double outlet to facilitate digital projector functionality with Internet at the front of the hall and telephone point
b) Pupil use – 1 x double outlet facilitating two desktop computers.
c) Wireless – 2 x high level single outlets in opposing corners of the room to provide wireless solution for flexible deployment of resources. These outlets need to be positioned within the room so as to provide optimal wireless coverage. Exact positioning will require either a wireless survey or the production of a wireless heat map using specialist software. (See appendix 3)
d) 1 outlet with a fused spur electrical point at the appropriate point to service and manage ceiling mounted projector

Wireless Access Points: The wireless system (See appendix 3) should be capable of enabling up to 60 concurrent devices to access the wireless network in the Hall at any one time.

3.4 Staffrooms

Data outlets: Data outlets should be provided according to the Data Cabling Specification (See appendix 1) as follows, with power supplied in accordance the ICT Power Specification (See appendix 2):

a) Staff use – 1 x double outlet providing access to teachers for individual or collaborative work within PPA and other release time
b) Wireless – 1 x high level single outlet to provide wireless solution for flexible deployment of resources. This outlet needs to be positioned within the room so as to provide optimal wireless coverage. Exact positioning will require either a wireless survey or the production of a wireless heat map using specialist software. (See appendix 3)
c) Additional Functionality – 1 x single outlet to facilitate a printer or Telephone.

Wireless Access Points: The wireless system (See appendix 3) should be capable of enabling up to 15 concurrent devices to access the wireless network in the staffroom at any one time.

3.5 Group Rooms

Data outlets: Data outlets should be provided according to the Data Cabling Specification (See appendix 1) as follows, with power supplied in accordance the ICT Power Specification (See appendix 2):

a) Staff/Student use - 1 x double outlet providing access to the network for teachers and pupils
b) Wireless – 1 x high level single outlet to provide wireless solution for flexible deployment of resources. This outlet needs to be positioned within the room so as to provide optimal wireless coverage. Exact positioning will require either a wireless survey or the production of a wireless heat map using specialist software. (See appendix 3)

Wireless Access Points: The wireless system (See appendix 3) should be capable of enabling up to 15 concurrent devices to access the wireless network in the group room at any one time.

3.6 All Other areas

Data outlets: Data outlets should be provided according to the Data Cabling Specification (See appendix 1) as follows, with power supplied in accordance the ICT Power Specification (See appendix 2):

a) 1 x double data outlet per person / pc for non-curriculum areas, with similar power supply
b) 1 x single data outlet per person / pc for curriculum areas, with similar power supply
c) Data outlets and wireless should be considered for corridors if these are to be wide enough to allow individual or small group activity

3.7 ICT Suites

Data outlets: Data outlets should be provided according to the Data Cabling Specification (See appendix 1) as follows, with power supplied in accordance the ICT Power Specification (See appendix 2):

a) Teacher use – 1 x double outlet to facilitate teacher device close to the IWB or teachers desk. The remaining outlet can be used as a telephone point.
b) 1 x single data outlet per pc with similar power supply
c) Wireless – 1 x high level single outlet to provide wireless solution for flexible deployment of resources. This outlet needs to be positioned within the room so as to provide optimal wireless coverage. Exact positioning will require either a wireless survey or the production of a wireless heat map using specialist software. (See appendix 3)
d) Additional Functionality – 1 x single outlet to facilitate a printer, cashless catering or e-registration system.

Wireless Access Points: The wireless system (See appendix 3) should be capable of enabling up to 30 concurrent devices to access the wireless network in the group room at any one time.

Recommended Space Requirements: As a general rule each desktop computer requires a desktop working area of approximately 1000mm width by 800mm depth to allow easy use of a keyboard and mouse. Please note that in many Primary schools there is a requirement for multiple pupils to share each computer which should be taken into consideration when planning seating allocation.

3.8 Main data cabinet/server room

A Server/Data Cabinet room is a designated space within a building for the management and distribution of backbone cabling and horizontal structured cabling within a floor or an entire building. When designing a new school sufficient Data Cabinet rooms should be provided to ensure the maximum data cable lengths from wall sockets to patch panels do not exceed a maximum of 90 metres. Each Data Cabinet room should contain a data cabinet (see appendix 1)

A school server/data cabinet room will house all the local ICT systems necessary to deliver ICT services to a school. It will be a secure area containing but not limited to the following equipment:

- Data/Server Racks (See appendix 1)
- File Server hardware and data storage devices
- Network switches (See appendix 1)
- Telecommunication/VoIP hardware i.e. PBX
- Internet Caching/Filtering equipment (See appendix D)

It will also be the location in which all external data and telecommunications services would be supplied and terminated by the respective supplier/(s).

When designing a new school, Architects and Designers are requested to take note of the following guidelines in the provisioning of a Server Room:

- The Server Room should be centrally located within the school premises and preferably on the ground floor of a building to enable ease of access and for the supply of external incoming telecommunication services to the school.
- In buildings that require multiple Data Cabinet rooms each Data Cabinet room will be connected back to a main Server/Data Cabinet room via a series of switches (See appendix 5) connected via diversely routed fibre optic links terminating in each data cabinet.
- There should be a minimum of one (1) Data Cabinet room per building or block. In larger buildings of three or more floors there may be a requirement to allow for additional Data Cabinet rooms.

Data outlets: Data outlets should be provided according to the Data Cabling Specification (See appendix 1) as follows, with power supplied in accordance the ICT Power Specification (See appendix 2):

a) File Server – 2 x double outlet to enable access to the network from the server and allow out of band access to the server for support providers.
b) Technician Workspace – 1 x double outlet to enable support technicians to work in this area with access to the school network.

Recommended size: The minimum space required for a cabinet/server room is 6 square meters. This allows for a data cabinet with adequate access to maintain these cabinets. (See appendix 1)

Other Considerations:

a) The data/server cabinets and equipment can produce a lot of heat. Ventilation should be provided to prevent the ambient room temperature rising above 30 degrees Celsius. As a guide, an average Primary school Server Room measuring 6 square meters with a file server and associated active network equipment is likely to require approximately 6,000 BTU per hour of cooling to maintain 30 degrees Celsius during the summer months. This figure should be checked with the ICT installation partner on each job to ensure equipment does not overheat.
b) Utilisation of the Server Room as a possible secure lockup facility for ICT laptop trolleys should be considered to make best use of the space. However careful consideration should be given to the power requirements of this room if this option is chosen to accommodate the additional power drawn by the trolleys during overnight charging.

3.9 Additional/secondary data cabinet rooms

Additional/secondary data cabinets should be located in secure rooms with adequate ventilation. It is strongly advised that these rooms do not serve a dual purpose as unobstructed access must be maintained to the cabinet at all times.

Data outlets: Data outlets should be provided according to the Data Cabling Specification (See appendix 1) as follows, with power supplied in accordance the ICT Power Specification (See appendix 2):

a) Technician Workspace – 1 x double outlet to enable support technicians to work in this area with access to the school network.

Recommended size: The minimum space required for a cabinet/server room is 2 square meters. This allows for a data cabinet size with adequate access for maintenance (See appendix 1).

Additional/secondary data cabinet rooms require mechanical ventilation to prevent excessive build-up of heat and humidity.

4 School extensions and mobiles

Data Cabling in school extensions and mobiles should be as per the specification for normal classrooms however, if data cabling cannot be installed into an existing data cabinet in a mobile then a new 21U floor mounted data cabinet must be provided (See appendix 1) and a HP ProCurve Switch E2510-24G (J9279A) should be used as per option 3 in the switch equipment section (See appendix 5)

It is becoming more and more common that schools undergoing building works or having additional mobile classrooms installed, have an existing wireless system in their school. If this solution is a non-managed wireless network it is recommend that the school investigate the installation of a managed wireless solution as specified for new builds (See appendix 3). If the school does not have the budget for this, as the extension is small or there is a single mobile classroom being installed, then it is recommend that the ad hoc network is extended into the new part of the building or mobile but the school should understand the limitations of this option.

Optional ICT Solutions

4.1 Digital Signage Specification

Digital signage is a form of electronic display that shows information, advertising and other messages. Digital signs such as LCD, LED, plasma displays can be found in public and private environments, such as retail stores, schools, hospitals and corporate buildings.

The benefits of digital signage over static signs, in situations where changing signs are preferred over static signs, are that the content can be exchanged more easily, animations can be shown, and the signs can adapt to the context and audience, even interactively.

Digital signage will require 1 x double data outlet and 1 x double power outlet to run efficiently, this would ideally be at high level.

4.2 IWB/Teacher Wall Specification

The recommend interactive whiteboard solutions (IWB) for standard classrooms are wall mounted interactive boards with wall mounted short throw or ultra-short throw projectors. These types of solution prevent the projector shining directly into the eyes of the teacher/presenter and they are cheaper to install due to there being less cabling required and no ceiling support required to which the projector would be attached with a conventional system.

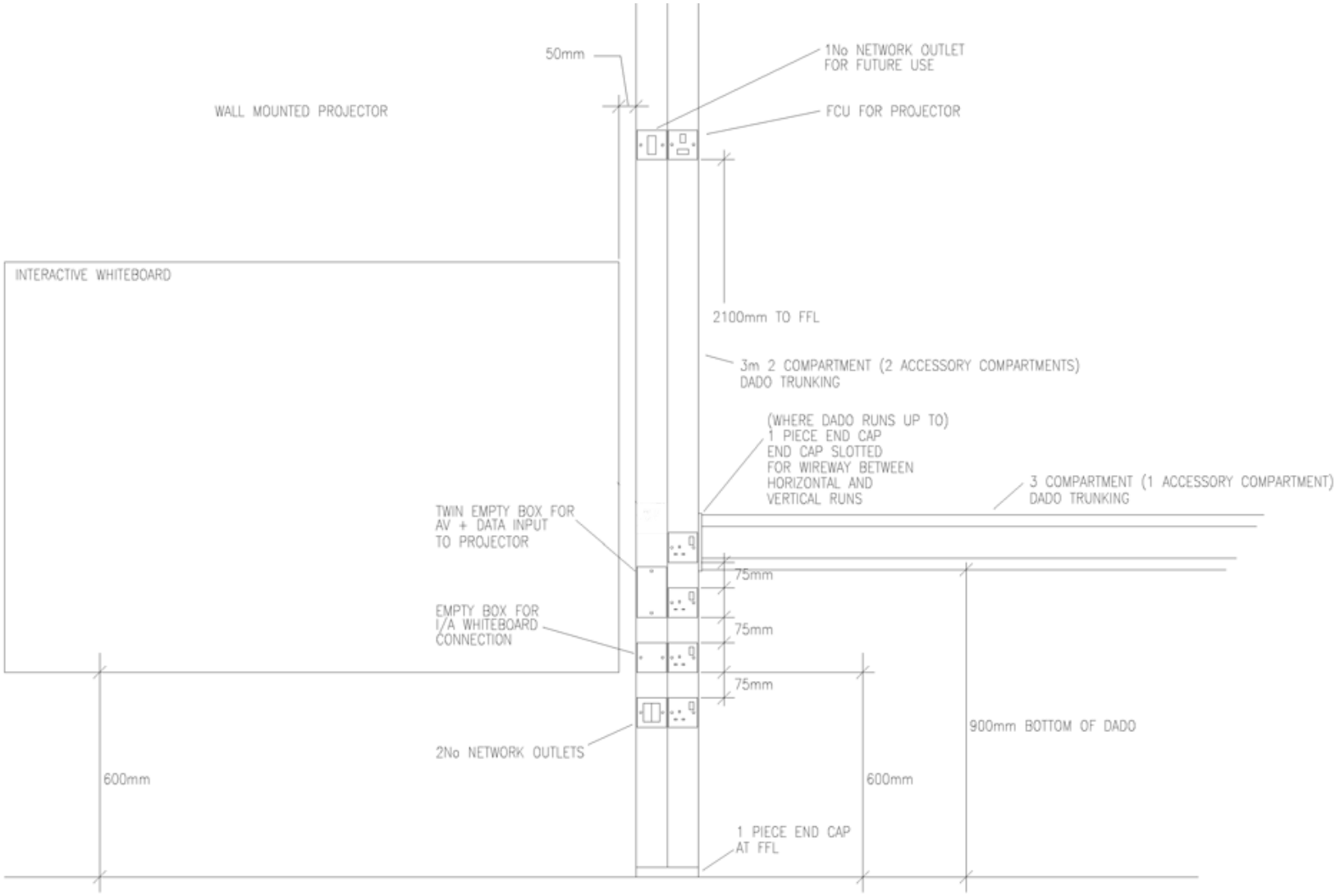
The recommended height of the bottom edge of an IWB should meet minimum requirements as below. The heights provided below are a guide based on the age of the children in each key stage. It is important to check with the school whether they have any special requirements for access to the IWB e.g. wheelchair access. This may influence the height at which the board should be mounted. It is also important to consider the height at which the short throw or ultra-short throw projector is mounted to avoid head injuries.

- Minimum height Key Stage 1 400mm (Years 1-2)
- Minimum height Key Stage 2 600mm (Years 3-6)
- Minimum height Key Stage 3 800mm (Years 7-9)

4.2.1 Example IWB elevation diagram.

The elevation diagram below (See Figure1) illustrates the recommended IWB configuration in a standard classroom including the recommended layout of trunking and the positions of required power and data points. This drawing is based on a Key Stage 2 classroom leaving 600mm between the floor and the bottom edge of the interactive whiteboard. This does not show the location of speakers or the audio visual (AV) face plate containing the VGA/USB connections. The positioning of the AV faceplate should be discussed with the school to determine a suitable location to minimise the length of the cables required between the AV faceplate and the teachers PC/Laptop. Speakers are built into some IWB however, if an amplifier and speakers are required these should be positioned either side of the IWB out of reach of the children. Any cables for these should be contained in surface mounting or recessed trunking.

4.2.2 Figure 1


50mm
1No NETWORK OUTLET
FOR FUTURE USE
WALL MOUNTED PROJECTOR
FCU FOR PROJECTOR
INTERACTIVE WHITEBOARD
2100mm TO FFL
3m 2 COMPARTMENT (2 ACCESSORY COMPARTMENTS)
DADO TRUNKING
(WHERE DADO RUNS UP TO)
1 PIECE END CAP
END CAP SLOTTED
FOR WIREWAY BETWEEN
HORIZONTAL AND
VERTICAL RUNS
3 COMPARTMENT (1 ACCESSORY COMPARTMENT)
DADO TRUNKING
TWIN EMPTY BOX FOR
AV + DATA INPUT
TO PROJECTOR
75mm
EMPTY BOX FOR
I/A WHITEBOARD
CONNECTION
75mm
75mm
900mm BOTTOM OF DADO
2No NETWORK OUTLETS
600mm
600mm
1 PIECE END CAP
AT FFL

4.3 Telephony

There are currently two main viable options for telephone systems in Primary Schools, Digital, or Voice over IP (VoIP). (It is not advisable to install out-dated analogue telephone systems anymore.)

Digital telephone systems are conventional systems which, for schools with single data cabinets, can run over existing data cabling; these need to be connected through a voice patch panel in the data cabinet. Schools with more than one data cabinet must be cabled with appropriate 50-pair voice cabling between cabinets in order for a Digital system to work in all parts of the building. The 25 pair cable should be presented on a patch panel in the data cabinet.

VoIP systems can run completely over the school data cabling infrastructure. VoIP systems can prove a slightly more expensive initial expense than a Digital system however, as VoIP does not require telephone cables to be run between data cabinets this cost can be offset. Cambridgeshire Education ICT Service standardises on Avaya VoIP systems and it is hoped that a more integrated, unified communications solution will be offered in the future. This unified communications solution should mean free calls between schools and Cambridgeshire County Council (CCC) staff. If a school wishes to be able to make use of this system when it becomes available, it should consult the Education ICT Service to ensure the system being installed is likely to be compatible.

Costs for these systems are gradually falling in line i.e. that implementation costs for comparable Digital vs VoIP systems are becoming competitive. Strategically a VoIP system will allow for more integration into other computer systems, and allow more scope for free calls to other VoIP systems, over the next 18 – 24 months.

4.4 File Servers

Every school needs a server infrastructure to manage desktop PC and laptop provision. Not having a server means the total cost of ownership of the ICT infrastructure is pushed up substantially – this is because work has to be replicated manually on each desktop device and applications/updates have to be delivered individually.

The server allows a number of important areas to be centralised in the school:

a) **Data Storage**: Servers hold all of the school's curriculum data. Schools hosting their MIS locally would also have this data stored on this system.
b) **Data Backup**: Servers will run backups automatically each night. School staff need to change tapes/backup drives each morning and check that the backup has run successfully. Education ICT Service will take care of monitoring this if the 'File Server Support' contract is taken out.
c) **Security Updates**: The server in each school will take care of delivering critical system and antivirus updates. These updates are essential to maintain endpoint security.
d) **Policy Management:** Laptops and desktops are controlled through policies set on the server in each school. Applications can be distributed through this same mechanism.

It is not possible to give precise specifications as these may change in very short timescales. The table below shows the types of system specification that was suitable for primary school servers, at the time of writing, to maximise system availability and allow for effective monitoring and management:

Organisation Type	Primary	Secondary
Server Description	Single Server	Multiple servers – virtualised where possible 2 x Domain controllers 1-2 x Application Servers 1 x SQL Database Server for local MIS provision and other database applications (if required). 1 x Suitable external storage array
Processor	Minimum Single Quad Core Xeon processor	Minimum Single Quad Core Xeon processor per server
Network connectivity	Dual network interface cards	Dual network interface cards per server
Storage	Hot swap internal drives	Centralised external drives accessible by all servers.
Backup	Enough capacity to back-up the total available storage area	Enough capacity to back-up the total available storage area
Power	Hot swappable power supplies	Multiple hot swappable power supplies
Remote Management	Suitable "lights out" remote management board	Suitable "lights out" remote management board per server

The Education ICT Service currently standardises on Dell hardware for a number of reasons:

1. Preferential pricing
2. Good management and remote monitoring capabilities
3. Excellent after sales technical support and warranty.

Appendices:

1 Data Cabling Specification

1.1 Data Cabinets

Data cabinets will be 42U high and measuring 800mm x 800mm and will require front and rear access. Each side requiring internal access will require 1200mm of clear space in front of it. Where internal access is not required, either side can be joined to an adjacent cabinet or wall.

Power will be provided to each cabinet as per the Data Cabinet Electrical Specification (See appendix 2)

Data cabinets should be located in a Data Cabinet room where possible, however it is recognised that many existing school buildings do not have Data Cabinet rooms. Therefore - when increasing the capacity of an existing data cabinet it is acceptable to replace a wall mounted data cabinet with a floor standing cabinet in its current location.

Data cabinets are used to house core ICT equipment for example:

- File servers and backup devices
- Cacheing/filtering equipment
- CCN/CPSN broadband circuit equipment
- Distribution point equipment for telecommunications
- Building Management System (BMS)

Data cabinets should have ventilation slots/holes in both top, bottom and side panels. Access doors on the cabinet should allow access from front, back and sides via lockable removable key. The cabinet door should be lockable and be made of 'see through' polycarbonate material. The cabinet should be constructed from metal and painted in a light grey colour.

Adequate cable management should be provided to enable patch leads to be tidied – this enables good airflow in the cabinet.

1.2 Data Cabling

1.2.1 Cable Separation Distances

1.2.1.1 British Standard Specification

The following table is taken from BS EN 50174-2 Information Technology – Cabling Installation Planning and Practices Inside Buildings:

Cable Type	Distance		
	Without Divider or Non-Metallic Divider	Aluminium Divider	Steel Divider
Unscreened Power & UTP	200mm	100mm	50mm
Unscreened Power & FTP	50mm	20mm	5mm
Screened Power & UTP	30mm	10mm	2mm
Screened Power & FTP	0mm	0mm	0mm

Table 1: BS EN50174-2 Separation Distances

The distance shown is the minimum separation distance between a power and data cable installed in the same containment.

- In the case of screened cabling, if the horizontal cabling length is less than 35m then no separation is required. Should the length exceed 35m then the separation distances apply to the full length excluding the last 15 metres rule.
- Separation does not apply to the last 15 metres closest to the TO.
- For backbone cables the separation distances in the above chart apply end to end.
- Fibre optic cables with metallic content could be covered by these separation guidelines.
- Safety considerations of BS7671 take precedence over the distances specified in the table and will in most cases require 50mm separation or a barrier between telecommunication cables and power cables.

1.2.1.2 EIA / TIA Specifications

EIA / TIA standards include the following guidelines. Where appropriate the worst case i.e. minimum separation distances shall be maintained.

Condition	<2kVA	2-5kVA	>5kVA
Unshielded power lines or electrical equipment in proximity to open or non-metallic pathways	127mm	305mm	610mm
Unshielded power lines or electrical equipment in proximity to a grounded metal conduit pathway	64mm	152mm	305mm
Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to a grounded metal conduit pathway.	-	76mm	152mm

Table 2: EIA / TIA Separation Distances

- In addition cables shall be located at least 300mm from adjacent runs of standard 110V or 230V AC power lines, power busbars and AC voltage transformers.
- Data transmission cables shall not run parallel to electrical cables, unless segregated.
- Proximity to other potential sources of electrical noise, e.g. lift motors, fluorescent lighting cables, etc. including radio frequency transmission devices, so as not to include electromagnetic interference coupling.
- Data transmission cables shall be run at least 120 mm from fluorescent luminaires.
- Crossovers of power and data transmission cabling shall be avoided whenever possible. Where crossovers are unavoidable, a purpose-made, steel bridging piece shall be utilised for the higher services to cross over. These steel crossovers shall be bonded to the main earthing system for the building.
- Where unavoidable crossovers occur, power and data transmission cables shall cross at 90° to each other.
- Earth connections will be in accordance with the requirements of BS 6701: 1990. The functional earth cable sheath shall be coloured Cream in accordance with BS 6746 C or Yellow/Green in accordance with BS7671.

1.2.2 Network Cable Specifications

Description	Specification
Network Connectivity between buildings	Diverse 50/125 Multimode 8-Core OM3 grade fibre
Backbone cabling (connecting Data Cabinet room and server room)	Diverse 50/125 Multimode 8-Core OM3 grade fibre
Horizontal cabling (connects network equipment to individual outlets)	UTP Category 6
Work-Area cabling (connects the ICT device to the wall outlet)	UTP Category 6
Internal Patch cabling (connects patch panels to network switches)	UTP Category 6

Table 3: Network Cable Specification

- All cables will be labelled to conform to the following methodologies, EN50174-2 (Installation planning and practices inside buildings)
- ISO 14763-2 (Planning and Installation practices) and TIA/EIA-606 (Administration Standards for the Telecommunications Infrastructure of Commercial Buildings) guidelines
- All new CAT6/Fibre-optic cabling will conform to ISO 11801 standards.

1.2.3 Applicable standards for structured cabling

European Standard(s)	EN 50310	Application of equipotential bonding and earthing in buildings with information technology equipment
	EN 50173	Information technology - generic cabling systems
	EN 50174-1	Information's technology - specification and quality assurance
	EN 50174-2	Information technology - installation planning and practices inside buildings
	EN 50174-3	Information technology - installation planning and practices outside buildings
	EN 50346	Testing of Installed Cabling
TIA/EIA Standard(s)	TIA/EIA-581.B.1	Commercial Building Telecommunications Cabling Standard
	TIA/EIA-581.B.2	100 Ohm Twisted Pair Cabling Standard
	TIA/EIA-581.B.3	Optical Fibre Standards
	TIA/EIA-569-A	Commercial Building Standard for Telecommunications Pathways and Spaces
	TIA/EIA-570-A	Residential Telecommunications Cabling Standard
	TIA/EIA-606	Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
	TIA/EIA-607	Commercial Building Grounding and Bonding Requirements for Telecommunications
ISO/IEC Standard(s)	ISO/IEC 14763-1	Administration, documentation, records
	ISO/IEC 14763-2	Planning and Installation practices
	ISO/IEC 14763-3	Testing of optical fibre cabling
	IEC 61935-1	Specification for the testing of balanced communication cabling in accordance with ISO/IEC 11801- Part 1: Installed cabling
European	CENELEC 50173	European standard for structured cabling

1.2.4 Data Cabling Warranties and Test Results

All data cabling works must be provided with a 25 year system warranty (covering both parts and labour not just product warranty). Examples of manufacturers able to offer appropriate warranties are: Molex (installed by members of the Certified Installers scheme), Panduit (Pannet range of products installed by members of the Certified Installers scheme), Seimon (installed by members of the Certified Installers scheme.)

Two sets of documentation must be provided identifying test results, cable routings (scale 1:200 minimum) and patch panel position to data outlet locations within the school.

The manufacturer's Warranty Certificate should be supplied within 20 working days of completion of the installation. (One copy should be sent to the school and one copy to the Education ICT Service, 42 West Street, Godmanchester, Cambridgeshire, PE29 2HJ).

2 ICT Electrical Specification

2.1 Data Cabinet Electrical Specification

2.1.1 Wiring Specification

The supply to all data cabinets should be taken from the nearest suitable electrical distribution board. The cabinet supply should be installed on a dedicated radial circuit, protected by a RCBO device (16Amp/30mA) and comply with BS7671:2008. Where the existing electrical distribution board is full, a separate electrical enclosure complying with British Standards should be installed, adjacent to the existing distribution board. This new electrical enclosure should house the RCBO.

2.1.2 Containment

Where cables are exposed or surface run, they should be run in suitable containment. Where surface trunking or conduit is cut to avoid obstacles or to tackle a bend the appropriate angles, tees and boxes should be used. Under no circumstances should electrical cable be visible.

2.1.3 Cables

The electric cables for the wiring should be of suitable type for the environment; the current carried capacity, and be in one continuous run from the electrical distribution board to the 13 Amp fused spur.

2.1.4 Cabinet Power Supply

At each cabinet the following should be installed:

- 13 Amp fused spur outlet, to BS7671:2008.
- Single socket outlet, to BS7671:2008. This socket outlet should be marked for 'ICT Use Only'

2.1.5 PDU (Power Distribution Unit)

A filtered 5-way rack mounted PDU should be installed in all wall data cabinets and a filtered 10-way rack mounted PDU should be installed in all floor standing data cabinets. The PDU must be mounted to the cabinet and under no circumstances should it just be left unsecured. The power cable for the supplied PDU should be cut to length as required and wired into the 13 Amp fused spur. A hole should be drilled in the side of the cabinet to allow the cable to pass out of the cabinet. Where access to the cabinet is via a two-piece rear opening door, the hole should not interfere with this access. In addition to this a screw/compression gland should be fitted for the cable to pass through.

2.1.6 Cabinet Earth Bonding

In addition to the CPC, the cabinet should be bonded via a 6mm earth cable, terminated at the electrical distribution board. This cable run should be one continuous length. This will ensure the cabinet is earthed. Where a two-piece cabinet is used then the 6mm cable from the electrical distribution board should be bonded to the rear section, a second cable should be run from the rear to front section again in 6mm cable. The cabinet door should also be bonded to the main cabinet.

2.1.7 IEE Regulations

All works should be completed to BS7671:2008, IEE Wiring Regulations 17th Edition.

2.1.8 Identification

All circuits and protective devices must be clearly identified, marked and labelled to indicate being used for ICT Data cabinet in distribution board or on separate electrical enclosure. The fused spur outlet must be clearly marked to indicate which electrical distribution board it is fed from.

2.1.9 Testing

All works must be inspected and tested based on BS7671:2008, an appropriate electrical installation works certificate, schedule of inspection and schedule of test results issued. A copy of the appropriate electrical installation works certificate, schedule of inspection and schedule of test results is submitted to Cambridgeshire County Council.

2.2 Laptop Trolleys

Laptop Trolleys should have their own dedicated power outlets for charging the devices within the laptop trolley. There should be a designated area within the school building, such as a charging station area, which can provide the dedicated power outlets.

2.2.1 Wiring Specification

The supply should be taken from the nearest suitable electrical distribution board. The supply should be installed on a dedicated radial circuit, protected by a RCBO device (16Amp/30mA) and comply to BS7671:2008. Where the existing electrical distribution board is full, a separate electrical enclosure compiling to British Standards should be installed, adjacent to the existing distribution board. This new electrical enclosure should house the RCBO.

2.2.2 Containment

Where cables are exposed or surface run, they should be run in suitable containment. Where surface trunking or conduit is cut to avoid obstacles or to tackle a bend the appropriate angles, tees and boxes should be used. Under no circumstances should electrical cable be visible.

2.2.3 Cables

The electric cables for the wiring should be of suitable type for the environment; the current carried capacity, and be in one continuous run from the electrical distribution board to the double socket outlet.

2.2.4 Laptop Trolley Supply

At each charging station the following should be installed:
A double socket outlet, conforming to BS7671:2008. This socket outlet should be marked for “Laptop Trolley Charging Only”.

2.2.5 IEE Regulations

All works should be completed to BS7671:2008, IEE Wiring Regulations 17th Edition.

2.2.6 Identification

All circuits and protective devices must be clearly identified, marked and labeled to indicate being used for ‘Charging Station’ in distribution board or on separate electrical enclosure. The electrical socket outlet should must be clearly marked to indicate which electrical distribution board it is fed from.

2.2.7 Testing

All works must be inspected and tested based on BS7671:2008, an appropriate electrical installation works certificate, schedule of inspection and schedule of test results issued. A copy of the appropriate electrical installation works certificate, schedule of inspection and schedule of test results is submitted to Cambridgeshire County Council.

3 Wireless Network Specification

It is recommended that wireless networks installed in a new building should:

- Be centrally managed to control access point load and connection/disconnections.
- Utilise 'virtual cell' technology.
- Be able to connect up to 30 devices in each area of the school.
- Be capable of supporting **IEEE 802.11b, IEEE 802.11g, IEEE 802.11n** standards.
- Be capable of supporting **WPA-PSK, WPA2-PSK** encryption.

The benefit of a managed wireless system is that it will be able to ensure that the client devices get the best connection to the network. Managed solutions are able to load balance so that the client devices are seamlessly connected and disconnected to each wireless access point as the load of each access point or the location of the wireless device changes.

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4 Cacheing and Filtering Specification

Cambridgeshire schools are on a central wide area network with a single ingress/egress point to/from the network connecting onto the national education network and the public internet. All school devices are required to be filtered to prevent access to undesirable or malicious sites.

The current solution for Cambridgeshire schools is that they all pass through centrally managed caches/filters. These devices are managed by the regional broadband consortium, E2BN.

Schools are also required to have a locally implemented cache/filter to allow for:

a) Audit logging of WWW access by each user
b) Local cacheing to make effective use of the CCN/CPSN bandwidth available to them.
c) Reporting capabilities both for audit purposes and to allow for advice to be given on effective use of available bandwidth.

The devices specified must be capable of running the E2BN Protex local filtering solution. At present - Protex is only supported on Appliansys CacheBox devices.

5 Switch Equipment

Below are 3 network switch options which can be selected to suit different school requirements and budgets. A quick reference table has been provided at the end of this section which gives comparisons between the switches to assist with determining the correct switch type for each schools circumstance.

Option 1 is recommended for most schools as this option provides the most features and greatest performance.

Cambridgeshire County Council has a support contract with the Education ICT Service for the maintenance of all managed switches on CCN/CPSN. Cambridgeshire County Council has standardised on HP networking equipment in Cambridgeshire schools. HP ProCurve switches are warranted for the lifetime of the product, each managed HP switch is remotely monitored for hardware failures by the Education ICT Service under contract with Cambridgeshire County Council. Advice should be sought from the Education ICT service when installing one of these devices into a school connected to CCN/CPSN.

5.1 Switch Equipment Options

5.1.1 Option 1

Main/first Managed Switch:
One of these switches is required in the cabinet which contains the CCN/CPSN connection to the school. This switch is directly linked to the CCN/CPSN router. This switch will be connected via optic fibre (ring or star topology) to other switches (via HP Gigabit Modules (J4858C)) on the network.

- This switch should be a managed 24 port ProCurve switch E3500-24G-PoE yl (J8692A).

(*Please note that in large Primary schools a HP ProCurve switch E5406-48G zl (J8699A) should be used – specialist advice should be sought from Education ICT Service to identify exact requirements*.)

Additional Cabinet Managed Switches:
One of these switches is required in any additional cabinets as it forms part of the optic fibre backbone connecting each cabinet back to the Main/first switch.

- These switches should be managed 24 port ProCurve switch E3500-24G-PoE yl (J8692A)

Additional Unmanaged Switches:
These switches are required to add additional switch ports to any cabinets which already contain a managed switch.

- These switches should be HP ProCurve Switch V1410-24G (J9561A), 24 port 10/100/1000 switch with twenty-two 10/100/1000 ports and two dual-personality ports for either 10/100/1000 or Mini-GBIC connectivity.

5.1.2 Option 2

Main/first Managed Switch:
One of these switches is required in the cabinet which contains the CCN/CPSN connection to the school. This switch is directly linked to the CCN/CPSN router. This switch will be connected via optic fibre (ring or star topology) to other switches (via HP Gigabit Modules (J4858C)) on the network.

- This switch should be a managed 24 port HP ProCurve Switch E2610-24-PoE (J9087A).

(*Please note that in large Primary schools a HP ProCurve switch E5406-48G zl (J8699A) should be used – specialist advice should be sought from Education ICT Service to identify exact requirements.*)

Additional Cabinet Managed Switches:
One of these switches is required in any additional cabinets as it forms part of the optic fibre backbone connecting each cabinet back to the Main/first switch.

- These switches should be a managed 24 port HP ProCurve Switch E2610-24-PoE (J9087A)

Additional Unmanaged Switches
These switches are required to add additional switch ports to any cabinets which already contain a managed switch.

- These switches should be unmanaged HP ProCurve Switch V1410-24G (J9561A), 24 port 10/100/1000 switch with twenty-two 10/100/1000 ports and two dual-personality ports for either 10/100/1000 or Mini-GBIC connectivity.

5.1.3 Option 3

Main/first Managed Switch:
One of these switches is required in the cabinet which contains the CCN/CPSN connection to the school. This switch is directly linked to the CCN/CPSN router. This switch will be connected via optic fibre (ring or star topology) to other switches (via HP Gigabit Modules (J4858C)) on the network.

- This switch should be a managed 24 port HP ProCurve Switch E2510-24G (J9279A)

(*Please note that in large Primary schools a HP ProCurve switch E5406-48G zl (J8699A) should be used – specialist advice should be sought from Education ICT Service to identify exact requirements.*)

Additional Cabinet Managed Switches:
One of these switches is required in any additional cabinets as it forms part of the optic fibre backbone connecting each cabinet back to the Main/first switch.

- These switches should be managed 24 port HP ProCurve Switch E2510-24G (J9279A)

Additional Unmanaged Switches
These switches are required to add additional switch ports to any cabinets which already contain a managed switch.

- These switches should be unmanaged HP ProCurve Switch V1410-24G (J9561A), 24 port 10/100/1000 switch with twenty-two 10/100/1000 ports and two dual-personality ports for either 10/100/1000 or Mini-GBIC connectivity.

Some schools may require all managed switches in which case the HP ProCurve Switch V1410-24G (J9561A) should be substituted for the HP ProCurve Switch E2510-24G (J9279A) This does have significant benefits in managing the complete network environment, and allows for more granular control in the event of network faults, frequently meaning school sites can minimise disruption.

5.2 Switch Equipment Specifications

5.2.1 ProCurve switch E3500-24G-PoE yl (J8692A) Specifications

Features
Quality of Service (QoS)
Power of Ethernet (PoE)
Layer 2 Switching
Layer 3 Routing

Dimensions
15.43(d) x 17.44(w) x 1.73(h) in. (39.2 x 44.3 x 4.4 cm) (1U height)

Performance

Throughput	up to 75.7 million pps (packets per second)
Routing/Switching	101.8Gbps
Switch speed	105.6Gbps
Routing Table size	10000 entries
MAC table	64000 entries

Ports
24 x autosensing 10/100/1000 ports
Or which 4 are dual-personality ports

Warranty
HP Lifetime Warranty

5.2.2 HP ProCurve Switch E2610-24-PoE (J9087A) Specifications

Features
Quality of Service (QoS)
Power of Ethernet (PoE)
Layer 2 Switching
Layer 3 Basic Routing

Dimensions
12.5(d) x 17.4(w) x 1.73(h) in. (31.75 x 44.2 x 4.39 cm) (1U height)

Performance

Throughput	up to 9.5 million pps
Routing/Switching	12.8Gbps
MAC table	8000 entries

Ports
24 x autosensing 10/100 ports
2 x autosensing 10/100/1000 ports
2 x dual-personality ports

Warranty
HP Lifetime Warranty

5.2.3 HP ProCurve Switch E2510-24G (J9279A) Specifications

Features
Quality of Service (QoS)
Layer 2 Switching

Dimensions
12.7(d) x 17.4(w) x 1.7(h) in. (32.26 x 44.2 x 4.32 cm) (1U height)

Performance

Throughput	up to 35.7 million pps
Switching	48Gbps
MAC table	8000 entries

Ports
24 x autosensing 10/100/1000 ports
Or which 4 are dual-personality ports

Warranty
HP Lifetime Warranty

5.3 Switch comparison Table

Feature	E3500-24G-PoE	E2610-24-PoE	E2510-24G
Layer 2	✓	✓	✓
Layer 3	✓	✓	X
QoS	✓	✓	✓
PoE	✓	✓	X
10Mbps	✓	✓	✓
100Mbps	✓	✓	✓
1000Mbps	✓	X	✓
Mini GBIC Ports	✓	✓	✓