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Mark Scheme (Results)

Summer 2013

Applied ICT (6959)
Unit 9: Communications and Networks

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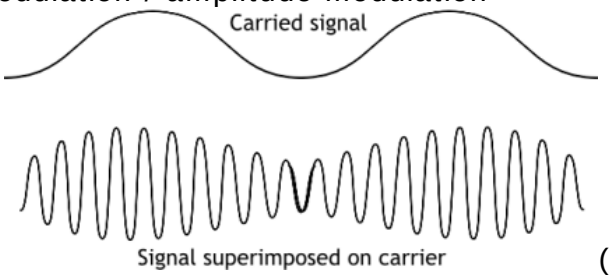
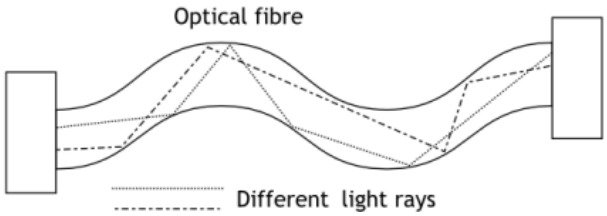
General Marking Guidance

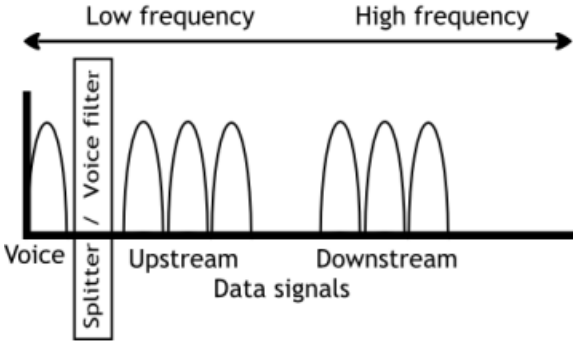
- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

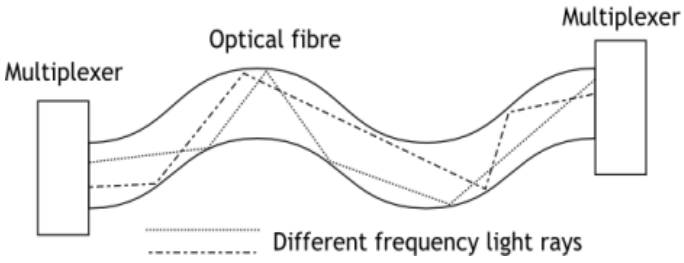
Activity 1 — Network management

A briefing document for Viro about Wan technology, NOT paragraphs from Wikipedia or similar website.

Question Number	Answer	Mark
1 (a)	**Describes devices needed to connect the LANs to the WAN.** Max 3 marks for telephone. Max 3 for fibre optics. Max 4 marks total. No marks for simply naming devices, marks are for functions. Telephone line: • *Modem. Modulator – demodulator* converts digital signal / data into analogue (1) uses / sends (analogue) via a carrier signal (1) access control/encryption(1) • *Router / router with switch* on LAN side of modem (1) forwards packets / data to and from PCs (1) allows multiple PCs to use modem (1) access control/encryption(1) Modem and router may be considered as single, combination device Fibre optic cable. As telephone line, plus: • *Transceiver. Transmitter – receiver* converts optical - electrical (and reverse) (1) (transmitter) uses (semiconductor) laser. (Not LED, old technology) (1) (receiver) uses (semiconductor) photodiode / photo detector (1)	**(4)**

Question Number	Answer	Mark
1(b)	**Explains, with the aid of diagrams, how data signals are passed along a telephone wire and a fibre optic cable.** Award 1 mark for each relevant diagram and 1 mark for a correct explanation (may be on the diagram). Telephone line diagrams may include: • modulation / amplitude modulation  (1) Change in amplitude / signal strength carries the information (1) frequency splitting / signal separation (1) Fibre optic cable diagrams may include: • modulation / amplitude modulation as for telephone line multiplexing / multiple light beams  (1) The rays are bounced down the fibre because of total internal reflection (1) Multiplexer changes / detects light frequency / wavelength / colour (1) Each frequency carries one / different data stream (1)	**(4)**

Question Number	Answer	Mark
1(c)	**Explains how a single telephone wire can handle data signals and telephone messages at the same time.** Telephone line: • each message/data stream travels on a carrier signal (1) • carrier signals can be distinguished by / have different frequencies (1) • data frequency above 3.4 kHz / voice limit / too high to hear (1) • filters / splitters used to separate signals / frequencies (1)  Give credit for information shown on a diagram. Max 2.	**(2)**

Question Number	Answer	Mark
1(d)	**Explains how a single fibre optic cable can handle data signals and telephone messages at the same time.** Fibre optic cable: • each message / data stream travels on a carrier signal (1) • each message / data stream / carrier signal travels at a different frequency / wavelength / colour of light (1) • uses multiplexer to generate / read frequency / wavelength / colour of light (1) • Splitter keeps voice away from data • Data streams separated into frequency bands  (1) Give credit for information shown on a diagram. Max 2.	**(2)**

Total for Question 1 = 12 marks

Activity 2 – Connectivity and Network management

<table>
<tr><th colspan="2">Question Number</th><th>Indicative Content</th></tr>
<tr><td colspan="2">2(a)</td><td>Explanation of bandwidth
• rate of data transmission
• maximum number of bits per second that can be carried by the wire
Explanation of contention
• may be 16 - 20 stations using one telephone wire
• each station using fraction of bandwidth
• fractions may add to more than one
Possible problems (in context)
• data collisions / dropped packets / data errors
• leading to loss or corruption of data
• resend requirements adding to amount of data sent
• reduction in speed / reliability
• reference to services e.g. bookings
Strategy to reduce bandwidth and / or contention problem by
• increasing number of telephone wires
• using repeaters
• using regenerators
• using data compression, hardware and / or software
• time schedules for routine tasks from stations
• monitoring (software) to identify bandwidth hogs
• utilizing / switching some of the telephone line data to the fibre optic cable
• utilising / switching to existing Internet connection for some tasks eg.
o for heavy usage such as OS service packs
o at (identified) peak traffic times</td></tr>
<tr><th>Level</th><th>Mark</th><th>Descriptor</th></tr>
<tr><td></td><td>0</td><td>No rewardable material</td></tr>
<tr><td>1</td><td>1-4</td><td>An explanation of bandwidth or contention with some consideration of a problem. Some attempt to solve the perceived problem. The explanations do not need to be in context.
The candidate uses everyday language and the response lacks clarity and organisation. Spelling, punctuation and the rules of grammar are used with limited accuracy.</td></tr>
<tr><td>2</td><td>5-8</td><td>An explanation of bandwidth and contention with a relevant identified problem. An explanation of a solution to that problem. Explanations must be in context.
The candidate uses some terms and shows some focus and organisation. Spelling, punctuation and the rules of grammar are used with some accuracy.</td></tr>
<tr><td>3</td><td>9-12</td><td>A detailed explanation of bandwidth and contention with more than one relevant identified problem. Explanations of workable solutions to those problems. Problems and explanations of solutions must be in context.
The candidate uses a range of appropriate terms and shows good focus and organisation. Spelling, punctuation and the rules of</td></tr>
</table>

	grammar are used with considerable accuracy.	
Question Number	Answer	Mark
2(b)	**Required evidence for 2b: advice on implementing central management.** Allow one mark for each relevant statement to a maximum of 9 marks. 2 marks for each section, 1 additional mark can be awarded in any **one** section. Answers may include: **Backup** • detail of an appropriate backup system (1) • scheduling system for backups to be sent from stations(1) • detail of alternate method of sending backup in case of failure. e.g. physical transport, use of Internet(1) • detail of new time slot / rejoin queue in event of failure(1) **Security** • detail on network OS security facilities, e.g. group policies(1) • detail on remote login over a WAN / via VPN(1) • detail on security of WAN(1) • detail on security of local LAN, in Precipaurbo Central(1) **Administration** • detail on 'push' administration, e.g. updates, installing SW(1) • detail on 'pull' administration, e.g. reading remote logs, (1)collecting system information(1) • detail on synchronising over the WAN, e.g. using common database / spreadsheet(1) **User support** • detail on support method, e.g. VoIP, remote desktop, video conferencing. Including a use. (1) • detail on second support method, e.g. VoIP, remote desktop, video conferencing. Including a use. (1)	**(9)**

Total for Question 2 = 21 marks

Activity 3 - Network components

<table>
<tr><th>Question Number</th><th>Answer</th><th>Mark</th></tr>
<tr><td>3(a)</td><td>
A table identifying the hardware and cabling components for the system, with reasons

1 mark per component, with sensible reason. To a maximum of 14 marks
<table>
<tr><th>Component</th><th>Qty</th><th>Reason (needs to be in context)</th><th>Notes</th></tr>
<tr><td>Basic business PCs</td><td>13+</td><td>For administrative staff, ticket office, remote assistance</td><td>Must have spec Suitable to run office SW.
Assume monitors, keyboards, etc. are included.</td></tr>
<tr><td>Good business PCs</td><td>6</td><td>6 offices identified in the management block.</td><td>Must have spec Need to be better than the basic PCs
Assume monitors, keyboards, etc. are included.</td></tr>
<tr><td>Black and white printer</td><td>6</td><td>For offices</td><td>Must have spec Ink-jet or mono laser, no network requirement.
May be 8 if the two specified B&W lasers are included.</td></tr>
<tr><td>Black and white laser printer</td><td>2</td><td>Admin staff and ticket office</td><td>Must have spec Allow mark here if printers are specifically included in previous item</td></tr>
<tr><td>Colour laser printer</td><td>1</td><td>Admin staff</td><td>Must have spec</td></tr>
<tr><td>Server</td><td>1</td><td>For network management area</td><td>Needs to be a dedicated server, not a PC running server software.</td></tr>
<tr><td>Backup server / device</td><td>1</td><td>Backup is essential for a business setting</td><td>Needs to be a dedicated server / system, not a PC running DVD burner</td></tr>
</table>
</td><td></td></tr>
</table>

			etc.
Main Switch	1	Cable connections required by scenario for most areas	Minimum 8 port if subsidiary switches are used in each main area. 32 if everything runs from one switch.
Subsidiary switches / switch-routers	3+	Used to reduce cable runs from main switch, give more flexibility in each area.	8 ports would do ticket office. 24 in management block
Router-modem copper cable	2	Internet connection and WAN connection	May be combined devices
Router-modem, fibre optic	1	WAN connection	May be combined device
Web server	1	For the railway web site / web booking service	
WAP / Wifi router	2+	Management and passenger access	Number depends on location of devices
Cable	305m box	Cable connections for most areas	Could be given as individual lengths. amount depends on use of switches.
RJ 45 ends	50+	to connect to data points to PCs etc.	Needs 25 + leads. Accept any plausible number over 50. Accept included as made patch leads
Data sockets	30+	To connect PCs etc to network	Minimum of 26 needed for required connections. Probably more, depending on how the network management area is set up
Other sensible device		With reason	May include: UPS, patch panels, cabinets, PC for managing servers, PCs for remote assistance.

(14)

				Accept up to **3** devices, which can include cables, ends and sockets without quantities for 1 mark each.	

Question Number	Answer	Mark
3(b)	A table identifying the **software** components for the system, with reasons **1 mark per component (must be specific – see notes), with sensible reason. To a maximum of 5 marks**	**(5)**

Component	Reason (needs to be in context)	Notes
Network server operating system	for LAN and WAN	Any sensible. Windows Server 2011, Linux Ubuntu
PC operating systems	for office etc PCs	Any sensible. Windows 7, Linux
Web server	For web site / web booking	Any sensible. MS Internet Information Services (IIS), Apache.
Backup	Server / DB / system backups	Any sensible, may use OS built in.
Database	for web booking / ticketing	Not Access.(it is not suitable for system this size) Any sensible multi- access database. Oracle, various SQL based.
Remote assistance local	For user support on LAN	Any sensible. Probably OS based, MS remote desktop, Linux remote desktop
Remote assistance distant	For user support to stations	Bonus mark for candidates who consider the problem. Should be WAN based. Must not require a third party Internet based server to make the connection. eg LogMeIn

		Anti-malware software	System protection for LAN and WAN	Any sensible network based software		

Total for Question 3 = 19 marks

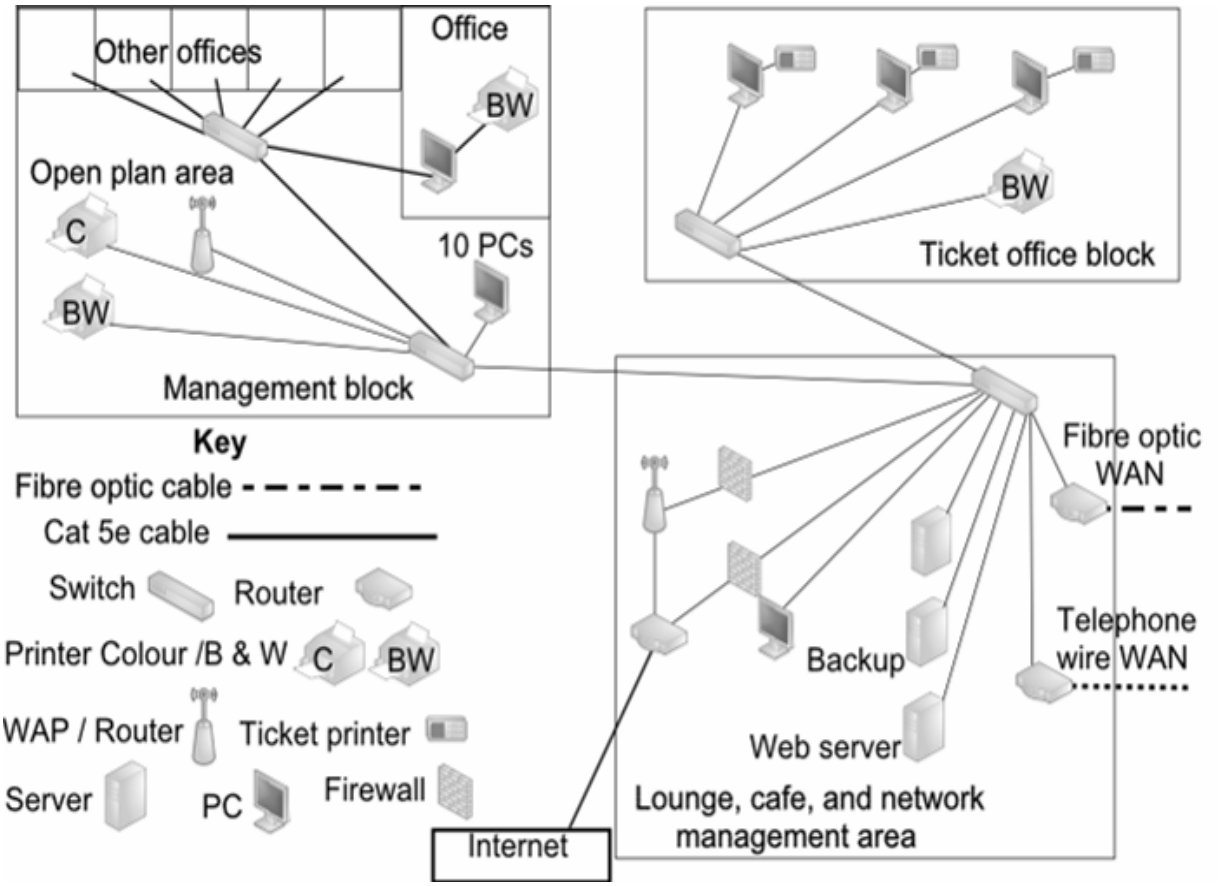
Activity 4 — Network Design

Question Number	Answer	Mark
4(a)	**Required evidence for 4a: a network design for the complete project.** Example network diagram on next page. a) diagram shows links to: three blocks/ offices and admin area, passenger lounge with network management area, ticket office. b) cable types shown c) management block, one office with PC and attached printer d) management block, 5 other offices shown as connection and label e) management block, 10 PCs f) management block, networked B&W laser printer and colour laser printer g) management block, networked WiFi connection h) ticket office, 3 PCs with ticket printers i) ticket office, networked B&W laser printer j) waiting room, networked WiFi connection k) network management area, server l) network management area, backup server / device m) network management area, web server / database server n) network management area, switch o) network management area, PC p) network management area, router for copper cable q) network management area, router for fibre optic r) sensible, short route from server(s) to router s) Internet connection t) WAN connection, fibre optic or telephone u) second WAN connection v) firewall separating the passenger WiFi from the network Max 18 marks	**(18)**

Example Network Diagram

NOTE: This diagram:

- is **not** the only answer
- is probably not the best answer
- is drawn to illustrate all of the marking points



Question Number	Answer	Mark
4(b)	**Required evidence for 4b: notes justifying each major decision made with regard to the network design.** There are no marks for descriptions of what is on the diagram. 1 mark per explanation which justifies a decision, to a maximum of 6. e.g. I have used a switch in the management block = 0 I have used a switch in management block to reduce the amount of cable needed by using a single link from the main switch rather than one for each device. = 1 Answers may include justifications of: • backup system position • type of backup system • router position • network protection, e.g. cabinets, position WAP out of reach • number of switches • switch position • wifi provision and / or coverage • provision for expansion	**(6)**

Total for Question 4 = 24 marks

Activity 5 – Network protocols

Question Number	Answer	Mark
5(a)	**Required evidence for 5a: An explanation of security measures.** 1 mark for each relevant factual statement about a usable security measure. To a maximum of 4 marks. 1 mark for an expansion that explains the measure. Answers may include: • have passengers on a separate domain/ router(1), so that they cannot see / log on to the main LAN (1) • have passengers use a 'guest' setting / account with limited access rights(1), so that they only have access to the Internet / railway web portal(1) • enforce WPA / WPA2 on the management WAP, (1) to prevent people linking to it without having a password/key(1) • ensure Transport Ministry laptops have encryption / password protection,(1) to prevent staff connecting / reading data(1) • have Transport Ministry staff log on to a different subnet / sub-domain from the admin staff(1), so a one way trust / link can be used(1) • use access rights / security privileges(1), to restrict what admin staff can do on the network / specified restriction.(1)	**(6)**

Question Number	Answer	Mark
5(b)	**Required evidence for 5b: A description of laptop settings** 1 mark for each relevant factual statement to a maximum of 2 marks. Answers may include: • network adapter / card / dongle set to DHCP client / get IP address from DHCP • be running a zero configuration service to detect and link to WiFi e.g. Wireless zero configuration (MS), DNS based service discovery (Apple / Linux), zeroconf (Linux) • have a WiFi network discovery application running/ensure WiFi application is enabled • not using a proxy Do not accept physical plugging in devices/switching on devices.	**(2)**

Question Number	Answer	Mark
5(c)	**Required evidence for 5c: An explanation of server configuration.** 1 mark for each relevant factual statement to a maximum of 3 marks. 1 mark for an expansion that explains the measure. Answers may include: • configure / set up / authorise a DHCP server(1), to allocate IP addresses(1) • establish a scope(1), a range of IP addresses that can allocated(1) • ensure lease lengths are short(1), to prevent IP addresses being tied up / running out(1) • allow 'guest' accounts(1), so no log in / password is needed(1)	**(4)**

Total for Question 5 = 24 marks

Standard ways of working. 2 Marks

All printouts must have a header and a footer. The header must contain the activity number. The footer must contain your name, candidate number and centre number.
Minimum font size of 10 should be used for all word processed documents.
Submitted work must meet the page limitations given in each activity.

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