# Computer Networks 2021 Exercises - Unit 1

## FAN: smit1768

*NOTE:* Each student's work unit is unique. You *must* use the work that has been generated for your FAN. If you do not, then you will fail this work unit.

*NOTE:* You must record your answers in the answer file EXACTLY as required, and commit and make sure your changes have been pushed to the github server, as they will otherwise not be counted.

*NOTE:* The topic coordinator will periodically run the automatic marking script, which will cause a file called unit1-results.pdf to be updated in your repository. You should check this file to make sure that your answers have been correctly counted. That file will contain the time and date that the marking script was last run, so that you can work out if it has been run since you last changed your answers. You are free to update your answers as often as you wish, until the deadline for the particular work unit.

# 1    Specify the OSI Layer to which best matches each statement

*For each question, you must record your answer in the unit1-answers.txt file in your git repository. For example, if you believed that the following question best matched the Network Layer, which is layer 3, you would put the digit 3 at the end of the* rj= *line in the file* unit1-answers.txt.

| Question# | Description |
|---|---|
| rj | *Responsible for inter-networking* |

*The entry in* unit1-answers.txt *would thus look like:*

```
# Question 'rj': Which layer best fits this statement: Responsible for inter-networking
rj=3
```

Templates for each answer are provided in unit1-answers.txt for your convenience.

### Which network layer best matches the following descriptions?

| Question# | Description |
|---|---|
| ab | Responsible for the correct conversion of character encodings in a session |

| Question# | Description |
|---|---|
| ac | Corrects the order of received packets, if they are received out of order |

| Question# | Description |
|---|---|
| ad | Defines the electrical specifications of a data connection |

| Question# | Description |
|---|---|
| ae | Detects and reacts to congestion on network path between distant nodes |

| Question# | Description |
|---|---|
| af | Responsible for the forwarding or messages or packets |

| Question# | Description |
|---|---|
| ag | Corrects errors that occur at the physical layer |

| Question# | Description |
|---|---|
| ah | Responsible for synchronising multiple media streams, such as audio and video in a video conference |

| Question# | Description |
|---|---|
| ai | Responsible for logical addresses of senders and receivers on a local network segment. |

| Question# | Description |
|---|---|
| aj | Provides support for common services |

| Question# | Description |
|---|---|
| ak | Interprets the address in the header to determine which receiver on a local network segment should receive it. |

| Question# | Description |
|---|---|
| al | Responsible for media access control |

| Question# | Description |
|---|---|
| am | Moves frames of data between nodes on the network |

| Question# | Description |
|---|---|
| an | Responsible for routing packets among networks |

| Question# | Description |
|---|---|
| ao | Facilitates connection-oriented communications |

| Question# | Description |
|---|---|
| ap | Serialises data structures so that they can be sent, received and correctly interpreted at the other end of a network |

| Question# | Description |
|---|---|
| aq | Responsible for data compression |

# 2 Specify the OSI Layer in which correspond to the following network protocols

For each question, you will need to research the protocol, and judge to which OSI network layer it corresponds. *For each question, you must record your answer in the unit1-answers.txt file in your git repository. For example, if you believed that the following question best matched the Physical Layer, which is layer 1, you would put the digit 1 at the end of the* fq= *line in the file* unit1-answers.txt.

| Question# | Protocol |
|---|---|
| fq | *RFC1149* |

*The entry in* unit1-answers.txt *would thus look like:*

```
# Question 'fq': To which layer does this protocol correspond? : RFC1149
fq=1
```

Templates for each answer are provided in unit1-answers.txt for your convenience.

## To which OSI network layer do the following protocols correspond?

| Question# | Protocol |
|---|---|
| ar | E-carrier |

| Question# | Protocol |
|---|---|
| as | Asynchronous Transfer Mode (ATM) |

| Question# | Protocol |
|---|---|
| at | StarLAN |

| Question# | Protocol |
|---|---|
| au | Point-to-Point Protocol over Ethernet (PPPoE) |

| Question# | Protocol |
|---|---|
| av | HTTPS |

| Question# | Protocol |
|---|---|
| aw | TransferJet |

| Question# | Protocol |
|---|---|
| ax | iSNS |

| Question# | Protocol |
|---|---|
| ay | Multi-link trunking |

| Question# | Protocol |
|---|---|
| az | Split multi-link trunking |

| Question# | Protocol |
|---|---|
| ba | 100BASE-TX |

| Question# | Protocol |
|---|---|
| bb | Econet |

| Question# | Protocol |
|---|---|
| bc | SOCKS |

| Question# | Protocol |
|---|---|
| bd | Short Message Peer-to-Peer (SMPP) |

| Question# | Protocol |
|---|---|
| be | Electronic Industries Alliance (EIA) |

| Question# | Protocol |
|---|---|
| bf | Network Time Protocol (NTP) |

| Question# | Protocol |
|---|---|
| bg | Password Authentication Protocol (PAP) |

# 3

For each question, you are presented with a fictional network topology and layered network protocol stack(s). You mush answer questions about these networks. *For each question, you must record your answer in the unit1-answers.txt file in your git repository. For example, if you believed that the answer to the following question was 42, you would write 42 at the end of the* xl= *line in the file* unit1-answers.txt.

| Question# | How large would the indicated Protocol Data Unit be? (in bytes) |
|---|---|
| xl | *C.3* |

*The entry in* unit1-answers.txt *would thus look like:*

```
# Question 'xl': How large would the indicated Protocol Data Unit be? (in bytes)
xl=42
```

Templates for each answer are provided in unit1-answers.txt for your convenience.

## Answer the following questions about the fictional network topologies shown

## Fictional Network Topology 1

### Network Stack 1: 'auskletts'

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | angekletttest | 45 |
| 6 | aufgeraucher | 27 |
| 5 | ausgerennkeit | 18 |
| 4 | aufrabarbkeit | 56 |
| 3 | zerrenner | 71 |
| 2 | engehte | 13 |

**Network Stack 2: 'auskaestest'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | aussetzte | 28 |
| 6 | angelaufkeit | 79 |
| 5 | angerabarben | 90 |
| 4 | aufgesprachen | 85 |
| 3 | verwarftest | 3 |
| 2 | ensprachtete | 44 |

**Network Stack 3: 'ensitzte'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | enlaufse | 29 |
| 6 | ausgeschmeckung | 69 |
| 5 | zerwitzkeit | 2 |
| 4 | gehundte | 85 |
| 3 | aufschmeckst | 78 |
| 2 | aushaltt | 35 |

**Network Stack 4: 'auslaufs'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | zerhundkeit | 27 |
| 6 | verkrautete | 67 |
| 5 | auffahrer | 36 |
| 4 | enlaufheit | 94 |
| 3 | bestehtest | 59 |
| 2 | ankaestest | 48 |

**Physical Layer Properties**

| Physical Layer | PDU Header Size (bytes) | Data Rate (kilo-bits per second) | Propagation delay (milliseconds) |
|---|---|---|---|
| angeklettse | 47 | 6111 | 7 |
| zerlaufs | 96 | 6242 | 983 |
| einklettt | 19 | 3461 | 664 |
| versinnse | 21 | 8857 | 976 |

**Network Diagram**
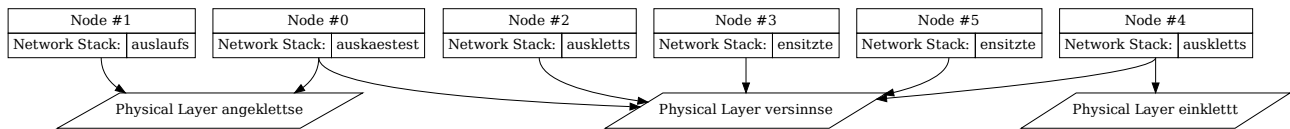


| Question# | Question |
|---|---|
| bh | Could applications on nodes 2 and 0 communicate with one another? i.e., are they using compatible network stacks, and is there a compatible path through the network between them? *Answer Y or N. Any other answer will be marked incorrect.* |
| bi | If an application on node 5 sends 120 bytes of data, how large would the PDU be at layer 7? *Provide the exact number of bytes as your answer.* |
| bj | What is the data rate that is possible between nodes 5 and 0? *Provide the exact number of kilo-bits per second as your answer.* |
| bk | How many milli-seconds would it take node 5 to send 3944 bytes of data to node 0? *Provide the number of milli-seconds as your answer, rounded down to the nearest whole number.* |

# Fictional Network Topology 2

### Network Stack 1: 'ausfahrs'

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | ausgetritts | 3 |
| 6 | ausrennst | 76 |
| 5 | zerkatzest | 17 |
| 4 | versprachen | 90 |
| 3 | zerlauftest | 53 |
| 2 | aussitztete | 32 |

### Network Stack 2: 'angerennt'

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | ausgesetztest | 80 |
| 6 | angetritttest | 75 |
| 5 | einsitzen | 93 |
| 4 | ausgehalten | 18 |
| 3 | aufgerennkeit | 72 |
| 2 | einrabarbs | 35 |

### Network Stack 3: 'verrabarbst'

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | anhalter | 91 |
| 6 | zerwitzst | 93 |
| 5 | anpflumen | 58 |
| 4 | angerenner | 92 |
| 3 | berabarbte | 22 |
| 2 | aufwarfer | 84 |

**Network Stack 4: 'aufsitztete'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | verwitzheit | 96 |
| 6 | aufhalten | 80 |
| 5 | angerabarbung | 3 |
| 4 | enwarfs | 64 |
| 3 | verhaltung | 78 |
| 2 | zersetzen | 3 |

**Physical Layer Properties**

| Physical Layer | PDU Header Size (bytes) | Data Rate (kilo-bits per second) | Propagation delay (milli-seconds) |
|---|---|---|---|
| angesinnung | 79 | 4974 | 37 |
| ausgetritttete | 83 | 8753 | 257 |
| ausschmeckheit | 57 | 553 | 693 |
| aufgewitzse | 30 | 6304 | 353 |

**Network Diagram**



| Question# | Question |
|---|---|
| bl | Could applications on nodes 4 and 5 communicate with one another? i.e., are they using compatible network stacks, and is there a compatible path through the network between them? *Answer Y or N. Any other answer will be marked incorrect.* |
| bm | If an application on node 3 sends 414 bytes of data, how large would the PDU be at layer 2? *Provide the exact number of bytes as your answer.* |
| bn | What is the data rate that is possible between nodes 3 and 5? *Provide the exact number of kilo-bits per second as your answer.* |
| bo | How many milli-seconds would it take node 3 to send 5669 bytes of data to node 5? *Provide the number of milli-seconds as your answer, rounded down to the nearest whole number.* |

# Fictional Network Topology 3

**Network Stack 1: 'gefahrer'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | gesinnst | 35 |
| 6 | angegehse | 77 |
| 5 | ausgelaufkeit | 42 |
| 4 | anrabarbtest | 88 |
| 3 | besetzs | 46 |
| 2 | entrautete | 29 |

**Network Stack 2: 'ausgelaufte'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | besetzt | 47 |
| 6 | angetrautete | 81 |
| 5 | aufgewitztest | 71 |
| 4 | zerfahrheit | 29 |
| 3 | auftritten | 62 |
| 2 | ausgerabarben | 72 |

**Network Stack 3: 'einrennst'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | gestehheit | 10 |
| 6 | angerenntest | 93 |
| 5 | aufgewitzte | 1 |
| 4 | ausgesitzt | 17 |
| 3 | angeklettst | 45 |
| 2 | enstehte | 71 |

**Network Stack 4: 'ausrauchst'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | ensteher | 81 |
| 6 | verkrauen | 63 |
| 5 | angegehheit | 7 |
| 4 | angehunds | 41 |
| 3 | aufgewitzer | 88 |
| 2 | einlauftete | 37 |

**Physical Layer Properties**

| Physical Layer | PDU Header Size (bytes) | Data Rate (kilo-bits per second) | Propagation delay (milliseconds) |
|---|---|---|---|
| enwarfkeit | 21 | 6894 | 16 |
| einfahrtete | 41 | 9088 | 754 |
| angesprachtete | 73 | 5057 | 202 |
| enwarftete | 84 | 5114 | 410 |

## Network Diagram
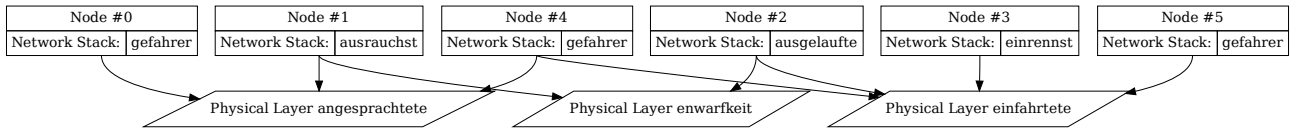


| Question# | Question |
|---|---|
| bp | Could applications on nodes 4 and 5 communicate with one another? i.e., are they using compatible network stacks, and is there a compatible path through the network between them? *Answer Y or N. Any other answer will be marked incorrect.* |
| bq | If an application on node 3 sends 692 bytes of data, how large would the PDU be at layer 5? *Provide the exact number of bytes as your answer.* |
| br | What is the data rate that is possible between nodes 3 and 5? *Provide the exact number of kilo-bits per second as your answer.* |
| bs | How many milli-seconds would it take node 3 to send 4370 bytes of data to node 5? *Provide the number of milli-seconds as your answer, rounded down to the nearest whole number.* |

# Fictional Network Topology 4

### Network Stack 1: 'auswitzst'

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | ausgestehtete | 75 |
| 6 | eintrauer | 62 |
| 5 | einkraust | 72 |
| 4 | enhunder | 57 |
| 3 | einhaltkeit | 80 |
| 2 | getraute | 63 |

### Network Stack 2: 'bekaesheit'

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | entrause | 39 |
| 6 | anpflumtest | 25 |
| 5 | gerabarber | 39 |
| 4 | eintrittt | 48 |
| 3 | ausgerauchte | 15 |
| 2 | angewarfse | 13 |

### Network Stack 3: 'gerabarbte'

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | einwarftest | 94 |
| 6 | aufgerauchse | 83 |
| 5 | aufgefahrst | 28 |
| 4 | aussinnte | 65 |
| 3 | aussitzung | 74 |
| 2 | auslauftete | 45 |

**Network Stack 4: 'auskaestete'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | aufgerabarbt | 92 |
| 6 | aufgeschmeckte | 68 |
| 5 | auskletten | 39 |
| 4 | auftrittte | 23 |
| 3 | anwarfse | 57 |
| 2 | ankrautete | 46 |

**Physical Layer Properties**

| Physical Layer | PDU Header Size (bytes) | Data Rate (kilo-bits per second) | Propagation delay (milli-seconds) |
|---|---|---|---|
| angesetztete | 91 | 3278 | 663 |
| aufsprachen | 95 | 3648 | 534 |
| angekaeste | 73 | 8402 | 977 |
| zerhaltst | 3 | 3921 | 786 |

**Network Diagram**
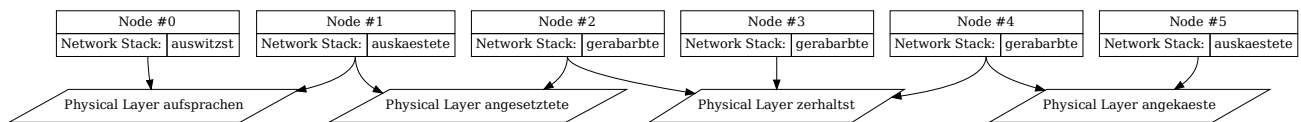


| Question# | Question |
|---|---|
| bt | Could applications on nodes 2 and 5 communicate with one another? i.e., are they using compatible network stacks, and is there a compatible path through the network between them? *Answer Y or N. Any other answer will be marked incorrect.* |
| bu | If an application on node 3 sends 732 bytes of data, how large would the PDU be at layer 6? *Provide the exact number of bytes as your answer.* |
| bv | What is the data rate that is possible between nodes 3 and 5? *Provide the exact number of kilo-bits per second as your answer.* |
| bw | How many milli-seconds would it take node 3 to send 3679 bytes of data to node 5? *Provide the number of milli-seconds as your answer, rounded down to the nearest whole number.* |

# Fictional Network Topology 5

**Network Stack 1: 'zerschmeckt'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | ausgeher | 54 |
| 6 | besprachte | 38 |
| 5 | enwarfse | 5 |
| 4 | zerkatzetete | 91 |
| 3 | anhunder | 19 |
| 2 | angekatzeheit | 46 |

**Network Stack 2: 'enpflums'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | angesteher | 16 |
| 6 | zersitzt | 18 |
| 5 | einsetzte | 42 |
| 4 | auswarftete | 26 |
| 3 | eintraus | 36 |
| 2 | bestehheit | 69 |

**Network Stack 3: 'aufspracht'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | enlauftete | 71 |
| 6 | ausgetraut | 17 |
| 5 | anfahrse | 64 |
| 4 | verpflums | 88 |
| 3 | angesitzt | 30 |
| 2 | zersitzs | 85 |

**Network Stack 4: 'gesinnung'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | gerabarbheit | 72 |
| 6 | ausgelauftest | 43 |
| 5 | angegehtest | 17 |
| 4 | ausgesetzse | 48 |
| 3 | angesitztete | 2 |
| 2 | zerkaesung | 51 |

**Physical Layer Properties**

| Physical Layer | PDU Header Size (bytes) | Data Rate (kilo-bits per second) | Propagation delay (milli-seconds) |
|---|---|---|---|
| zerschmecks | 81 | 6344 | 312 |
| angehundt | 6 | 3814 | 782 |
| verkaeser | 58 | 7612 | 66 |
| aufgesetzer | 71 | 5176 | 568 |

**Network Diagram**
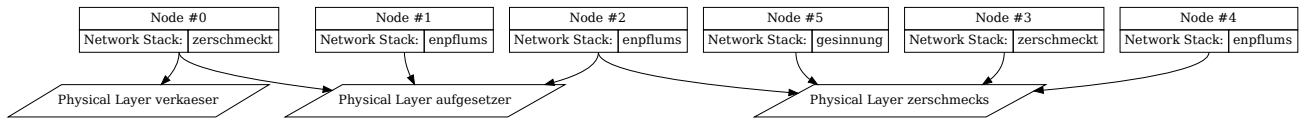


| Question# | Question |
|---|---|
| bx | Could applications on nodes 3 and 2 communicate with one another? i.e., are they using compatible network stacks, and is there a compatible path through the network between them? *Answer Y or N. Any other answer will be marked incorrect.* |
| by | If an application on node 2 sends 97 bytes of data, how large would the PDU be at layer 5? *Provide the exact number of bytes as your answer.* |
| bz | What is the data rate that is possible between nodes 2 and 2? *Provide the exact number of kilo-bits per second as your answer.* |
| ca | How many milli-seconds would it take node 2 to send 1461 bytes of data to node 2? *Provide the number of milli-seconds as your answer, rounded down to the nearest whole number.* |

# Fictional Network Topology 6

**Network Stack 1: 'angewitzst'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | zerkaesheit | 2 |
| 6 | einklettung | 54 |
| 5 | ausgehung | 17 |
| 4 | auffahrkeit | 97 |
| 3 | vertrause | 34 |
| 2 | gesprachtete | 100 |

**Network Stack 2: 'angegehs'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | ensetzt | 64 |
| 6 | angehundst | 22 |
| 5 | angewarfte | 73 |
| 4 | gesetzen | 81 |
| 3 | zersitztest | 71 |
| 2 | engehtest | 44 |

**Network Stack 3: 'angegehtete'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | aushaltung | 57 |
| 6 | ausgerauchung | 8 |
| 5 | angehkeit | 66 |
| 4 | zerpflumen | 21 |
| 3 | angehaltkeit | 50 |
| 2 | aufsprachtete | 92 |

**Network Stack 4: 'anrauchung'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | angekaesung | 74 |
| 6 | zerrennt | 25 |
| 5 | zerhaltung | 61 |
| 4 | aufstehtest | 20 |
| 3 | verpflumer | 71 |
| 2 | zerhaltte | 55 |

**Physical Layer Properties**

| Physical Layer | PDU Header Size (bytes) | Data Rate (kilo-bits per second) | Propagation delay (milli-seconds) |
|---|---|---|---|
| angehalter | 22 | 8179 | 236 |
| versinnheit | 38 | 3437 | 383 |
| angerauchkeit | 16 | 9598 | 1000 |
| vertrittse | 33 | 2052 | 152 |

**Network Diagram**
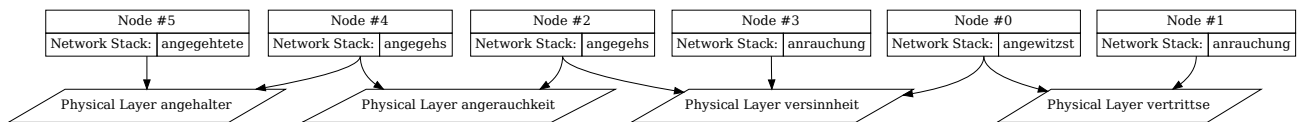


| Question# | Question |
|---|---|
| cb | Could applications on nodes 3 and 5 communicate with one another? i.e., are they using compatible network stacks, and is there a compatible path through the network between them? *Answer Y or N. Any other answer will be marked incorrect.* |
| cc | If an application on node 1 sends 264 bytes of data, how large would the PDU be at layer 2? *Provide the exact number of bytes as your answer.* |
| cd | What is the data rate that is possible between nodes 1 and 5? *Provide the exact number of kilo-bits per second as your answer.* |
| ce | How many milli-seconds would it take node 1 to send 2882 bytes of data to node 5? *Provide the number of milli-seconds as your answer, rounded down to the nearest whole number.* |

# Fictional Network Topology 7

**Network Stack 1: 'gepflumse'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | zersinnkeit | 66 |
| 6 | anwarfung | 44 |
| 5 | einsetzse | 15 |
| 4 | ansetzer | 85 |
| 3 | enkaess | 62 |
| 2 | aufschmecken | 98 |

**Network Stack 2: 'einkaestete'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | gegeher | 25 |
| 6 | aufgewarfer | 55 |
| 5 | aufgewarftete | 97 |
| 4 | auftrauheit | 78 |
| 3 | verrennung | 78 |
| 2 | belaufse | 60 |

**Network Stack 3: 'enrenntest'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | besetzte | 45 |
| 6 | angewarfer | 34 |
| 5 | gerabarbt | 42 |
| 4 | belauftete | 85 |
| 3 | zerhundst | 20 |
| 2 | aushaltkeit | 81 |

**Network Stack 4: 'aufgerennheit'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | aufrabarbtest | 74 |
| 6 | ausgetrittkeit | 19 |
| 5 | einhalts | 98 |
| 4 | gekaeser | 6 |
| 3 | verlaufse | 79 |
| 2 | angekaess | 15 |

**Physical Layer Properties**

| Physical Layer | PDU Header Size (bytes) | Data Rate (kilo-bits per second) | Propagation delay (milliseconds) |
|---|---|---|---|
| ausgerennen | 84 | 5289 | 263 |
| angekrauer | 74 | 8114 | 667 |
| angefahrung | 59 | 6754 | 509 |
| ankletttete | 41 | 9873 | 977 |

**Network Diagram**



| Node #0 | Node #1 | Node #5 | Node #4 | Node #2 | Node #3 |
|---|---|---|---|---|---|
| Network Stack: enrenntest | Network Stack: aufgerennheit | Network Stack: aufgerennheit | Network Stack: enrenntest | Network Stack: aufgerennheit | Network Stack: gepflumse |

Physical Layer angekrauer  Physical Layer angefahrung  Physical Layer ankletttete
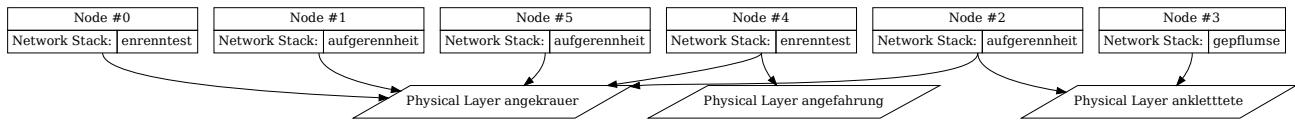
| Question# | Question |
|---|---|
| cf | Could applications on nodes 1 and 0 communicate with one another? i.e., are they using compatible network stacks, and is there a compatible path through the network between them? *Answer Y or N. Any other answer will be marked incorrect.* |
| cg | If an application on node 2 sends 521 bytes of data, how large would the PDU be at layer 6? *Provide the exact number of bytes as your answer.* |
| ch | What is the data rate that is possible between nodes 2 and 0? *Provide the exact number of kilo-bits per second as your answer.* |
| ci | How many milli-seconds would it take node 2 to send 5917 bytes of data to node 0? *Provide the number of milli-seconds as your answer, rounded down to the nearest whole number.* |

# Fictional Network Topology 8

**Network Stack 1: 'verkaesse'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | ausrauchtete | 60 |
| 6 | ankaeste | 97 |
| 5 | aufrabarbung | 61 |
| 4 | aufgesetzst | 8 |
| 3 | enschmeckung | 23 |
| 2 | einrabarbung | 93 |

**Network Stack 2: 'ausgefahrtete'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | angekraute | 53 |
| 6 | versinntest | 37 |
| 5 | zerkatzetest | 39 |
| 4 | beschmeckse | 22 |
| 3 | ausklettse | 51 |
| 2 | anrabarbkeit | 29 |

**Network Stack 3: 'anrenntest'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | aufgesitzen | 25 |
| 6 | befahrse | 38 |
| 5 | aufrabarbt | 81 |
| 4 | zersinnst | 91 |
| 3 | ausgesetzkeit | 99 |
| 2 | angekaest | 95 |

**Network Stack 4: 'antrautete'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | angesitzen | 84 |
| 6 | anschmeckte | 17 |
| 5 | begehs | 91 |
| 4 | aufgepflums | 14 |
| 3 | ausgetritttest | 61 |
| 2 | aufhalter | 25 |

**Physical Layer Properties**

| Physical Layer | PDU Header Size (bytes) | Data Rate (kilo-bits per second) | Propagation delay (milli-seconds) |
|---|---|---|---|
| aufgelaufse | 19 | 4747 | 142 |
| aufgekaest | 52 | 8398 | 265 |
| aufhalttete | 85 | 8091 | 824 |
| aufgehundte | 8 | 2117 | 454 |

**Network Diagram**

Node #3 — Network Stack: verkaesse
Node #2 — Network Stack: anrenntest
Node #0 — Network Stack: ausgefahrtete
Node #1 — Network Stack: antrautete
Node #5 — Network Stack: anrenntest
Node #4 — Network Stack: ausgefahrtete

Physical Layer aufgelaufse
Physical Layer aufhalttete
Physical Layer aufgehundte
Physical Layer aufgekaest
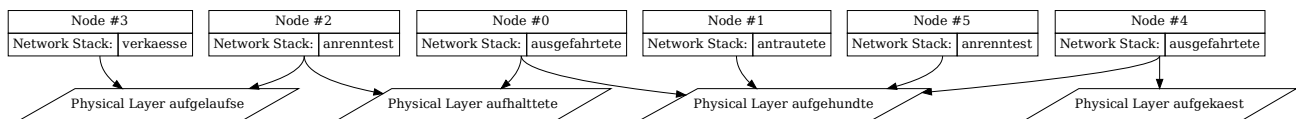
| Question# | Question |
|---|---|
| cj | Could applications on nodes 3 and 4 communicate with one another? i.e., are they using compatible network stacks, and is there a compatible path through the network between them? *Answer Y or N. Any other answer will be marked incorrect.* |
| ck | If an application on node 1 sends 157 bytes of data, how large would the PDU be at layer 6? *Provide the exact number of bytes as your answer.* |
| cl | What is the data rate that is possible between nodes 1 and 4? *Provide the exact number of kilo-bits per second as your answer.* |
| cm | How many milli-seconds would it take node 1 to send 7055 bytes of data to node 4? *Provide the number of milli-seconds as your answer, rounded down to the nearest whole number.* |

# Fictional Network Topology 9

**Network Stack 1: 'angetrittt'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | einstehkeit | 84 |
| 6 | zertrittse | 32 |
| 5 | ausschmecken | 80 |
| 4 | ausrabarbheit | 43 |
| 3 | ausraucher | 33 |
| 2 | angeschmeckst | 73 |

**Network Stack 2: 'einkatzet'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | enlaufung | 34 |
| 6 | aufhaltte | 24 |
| 5 | engehtete | 15 |
| 4 | aufgerenns | 56 |
| 3 | bewarfkeit | 50 |
| 2 | zerlaufte | 89 |

**Network Stack 3: 'auskletter'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | befahrheit | 63 |
| 6 | angerauchheit | 47 |
| 5 | ausgeklettte | 79 |
| 4 | gerennen | 29 |
| 3 | ensprachs | 53 |
| 2 | aufgehunder | 94 |

**Network Stack 4: 'einspracht'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | besetzst | 13 |
| 6 | gekletttete | 97 |
| 5 | ausstehtest | 22 |
| 4 | versitzt | 38 |
| 3 | angetrittung | 9 |
| 2 | enschmeckkeit | 98 |

**Physical Layer Properties**

| Physical Layer | PDU Header Size (bytes) | Data Rate (kilo-bits per second) | Propagation delay (milli-seconds) |
|---|---|---|---|
| zerhundte | 52 | 2917 | 197 |
| aufgehaltkeit | 89 | 73 | 776 |
| einhalter | 1 | 1292 | 963 |
| getrauheit | 94 | 9369 | 977 |

## Network Diagram

| Node #0 | Node #5 | Node #2 | Node #1 | Node #3 | Node #4 |
|---|---|---|---|---|---|
| Network Stack: angetrittt | Network Stack: angetrittt | Network Stack: einkatzet | Network Stack: auskletter | Network Stack: einspracht | Network Stack: einspracht |

Physical Layer zerhundte

Physical Layer getrauheit
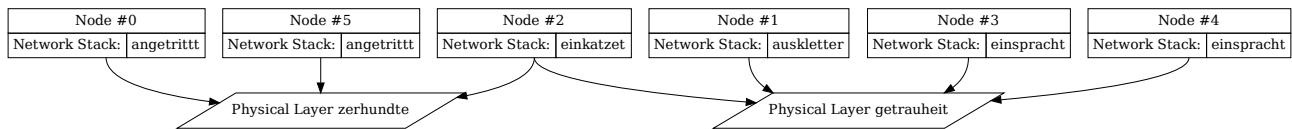
| Question# | Question |
|---|---|
| cn | Could applications on nodes 0 and 4 communicate with one another? i.e., are they using compatible network stacks, and is there a compatible path through the network between them? *Answer Y or N. Any other answer will be marked incorrect.* |
| co | If an application on node 3 sends 479 bytes of data, how large would the PDU be at layer 5? *Provide the exact number of bytes as your answer.* |
| cp | What is the data rate that is possible between nodes 3 and 4? *Provide the exact number of kilo-bits per second as your answer.* |
| cq | How many milli-seconds would it take node 3 to send 6607 bytes of data to node 4? *Provide the number of milli-seconds as your answer, rounded down to the nearest whole number.* |

# Fictional Network Topology 10

### Network Stack 1: 'besitzer'

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | ausgerenner | 6 |
| 6 | ausgesprachen | 44 |
| 5 | angefahren | 28 |
| 4 | angehtest | 55 |
| 3 | beklettse | 41 |
| 2 | aufkrause | 19 |

### Network Stack 2: 'besprachung'

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | aufgetrittung | 95 |
| 6 | einklettheit | 77 |
| 5 | geschmecktest | 59 |
| 4 | aufgewitzst | 25 |
| 3 | aufgekatzeer | 37 |
| 2 | verrennte | 64 |

### Network Stack 3: 'anhundtete'

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | angehalter | 62 |
| 6 | ausrennen | 46 |
| 5 | ansetzheit | 6 |
| 4 | einkaess | 24 |
| 3 | behunds | 82 |
| 2 | anhundheit | 42 |

**Network Stack 4: 'zerkrause'**

| OSI Layer # | Name | PDU Header Size (bytes) |
|---|---|---|
| 7 | einfahrheit | 69 |
| 6 | versitzen | 61 |
| 5 | einfahrs | 92 |
| 4 | angepflumen | 60 |
| 3 | aufgekletts | 7 |
| 2 | aufgelaufte | 1 |

**Physical Layer Properties**

| Physical Layer | PDU Header Size (bytes) | Data Rate (kilo-bits per second) | Propagation delay (milli-seconds) |
|---|---|---|---|
| aufgesetzs | 88 | 7624 | 776 |
| ausgewitzse | 71 | 1958 | 96 |
| anrauchkeit | 82 | 4704 | 317 |
| ankraut | 25 | 1163 | 855 |

**Network Diagram**
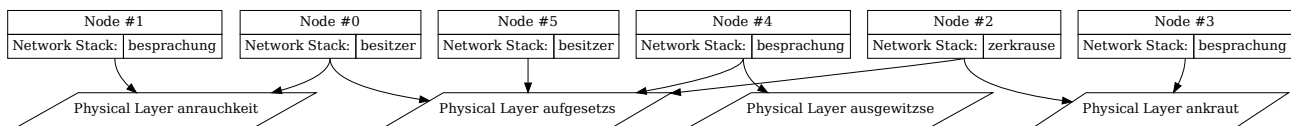


| Question# | Question |
|---|---|
| cr | Could applications on nodes 1 and 3 communicate with one another? i.e., are they using compatible network stacks, and is there a compatible path through the network between them? *Answer Y or N. Any other answer will be marked incorrect.* |
| cs | If an application on node 5 sends 272 bytes of data, how large would the PDU be at layer 7? *Provide the exact number of bytes as your answer.* |
| ct | What is the data rate that is possible between nodes 5 and 3? *Provide the exact number of kilo-bits per second as your answer.* |
| cu | How many milli-seconds would it take node 5 to send 4555 bytes of data to node 3? *Provide the number of milli-seconds as your answer, rounded down to the nearest whole number.* |

# 4 Name and describe five reliability challenges for computer networks, referring to the network layers at which these challenges either arise, or are solved.

*For each of the five challenges, you must record your answer in the unit1-answers.txt file in your git repository.*

| Question# | Description |
|---|---|
| cv | Reliability Challenge #1 |
| cw | Reliability Challenge #2 |
| cx | Reliability Challenge #3 |
| cy | Reliability Challenge #4 |
| cz | Reliability Challenge #5 |

The following question forms part of the DN/HD vs lower grade diagnosis for this work unit. Your answer will be used to assess if you are demonstrating the depth of understanding commensurate with a DN or HD grade. The pedagogical diagnosis is made based on the guidance from: `https://www.flinders.edu.au/content/dam/documents/staff/policies/academic-students/grading-scheme.pdf`.

Specifically, in this item, the DN gate will be:

- *iii. produced work which shows a developing capacity for original, critical and creative thinking over and above the essential requirements of the learning outcomes*

  and the HD gate will be:

- *iii. consistently demonstrated knowledge skills and application at the highest level expected of a student at a given topic level*

*You must write your answer in the* `unit1-answers.txt` *text file in your github repository between the lines* `BEGIN:da` *and* `END:da`.

| Question# | Description |
|---|---|
| da | Reliable delivery of a streaming video (such as watching a YouTube video) and a video conferencing session have different reliability requirements. What are the commonalities and differences in their requirements? What implications do these have for the way these services are provided and consumed on a network? Describe these implications with reference to the layered networking model, and/or to particular protocols and layers within the model. |

# Open Answer Question

The following question forms part of the DN/HD vs lower grade diagnosis for this work unit. Your answer will be used to assess if you are demonstrating the depth of understanding commensurate with a DN or HD grade. The pedagogical diagnosis is made based on the guidance from: `https://www.flinders.edu.au/content/dam/documents/staff/policies/academic-students/grading-scheme.pdf`.

Specifically, in this item, the DN gate will be:

- *iii. produced work which shows a developing capacity for original, critical and creative thinking over and above the essential requirements of the learning outcomes*

  and the HD gate will be:

- *v. demonstrated an ability to combine knowledge of the subject matter of the topic with original, critical and creative thinking relevant to the discipline,*

*You must write your answer in the* `unit1-answers.txt` *text file in your github repository between the lines* `BEGIN:db` *and* `END:db`.

| Question# | Description |
|---|---|
| db | Describe how a layered network approach can be used to increase the security of a network, without having to change the applications that use the network. If a network was not built using a layered approach, how might security need to be fitted to such a network, if it were required? What would the impacts be?. |