# Worksheet 2 Packet switching and routers

**Task 1**

1. **What is network latency, and how is it measured?**

* How do you define latency in the context of computer networks?
* What tools or methods can be used to measure latency in a network?

1. **What are the main factors that contribute to network latency?**

* How do physical distances (geographical location) affect latency?
* What role do network devices (e.g., routers, switches, firewalls) play in increasing or reducing latency?
* How do network protocols (e.g., TCP vs. UDP) influence latency?

1. **How does latency affect user experience in different applications (e.g., web browsing, video streaming, online gaming)?**

* Can you identify scenarios where high latency severely impacts performance or usability?
* How does latency differ in real-time applications like VoIP or video conferencing versus non-real-time applications?

**Task 2**

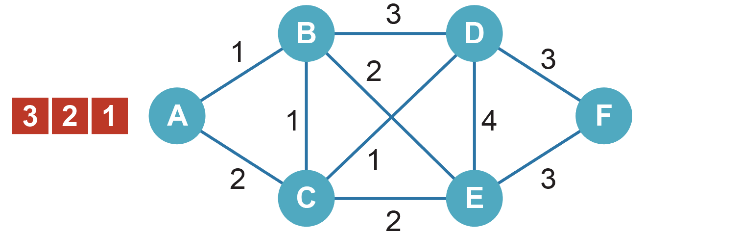
The following network shows the latency in milliseconds (ms) between routers in a network. Routers estimate the latencies from the actual progress of packets during the previous ms.

Node A is sending data to node F as three packets in the order: 1, 2 and 3, setting off at 1 ms intervals.

On the diagrams below, label where these packets will be after each millisecond if each travels by one of the quickest routes calculated from the estimated latencies. Latencies (given by numbers marked between each node) and available routes vary each millisecond depending on congestion or cable failure (indicated by dotted red line).

At the start, (0 ms elapsed time) packets 1, 2 and 3 are shown in red at A.

0 ms



|  |  |
| --- | --- |
| 1 ms | 2 ms |
| C:\Users\Rob\AppData\Roaming\PixelMetrics\CaptureWiz\Temp\114.png | C:\Users\Rob\AppData\Roaming\PixelMetrics\CaptureWiz\Temp\77.png |
| 3 ms | 4 ms |
| C:\Users\Rob\AppData\Roaming\PixelMetrics\CaptureWiz\Temp\125.png | C:\Users\Rob\AppData\Roaming\PixelMetrics\CaptureWiz\Temp\126.png |
| 5 ms | 6 ms |
| C:\Users\Rob\AppData\Roaming\PixelMetrics\CaptureWiz\Temp\127.png | C:\Users\Rob\AppData\Roaming\PixelMetrics\CaptureWiz\Temp\128.png |
| 7 ms | 8 ms |
| C:\Users\Rob\AppData\Roaming\PixelMetrics\CaptureWiz\Temp\129.png | C:\Users\Rob\AppData\Roaming\PixelMetrics\CaptureWiz\Temp\130.png |

In which order will the packets arrive:

Justify why packet payloads are usually kept to around 1500 bytes. Consider the effects of much larger payloads on transmission time, and the effects of very small payloads on the overheads within the headers and trailers.

**Task 3**

A file is being transmitted across an Ethernet network using File Transfer Protocol (FTP)   
and TCP/IP.

Label the diagram to explain what is happening at each stage of the communication process and add arrows to show the direction of travel.

|  |  |  |
| --- | --- | --- |
| **Application Layer** |  | **Application Layer** |
|  |  |  |
| **Transport Layer** |  | **Transport Layer** |
|  |  |  |
| **Internet Layer** |  | **Internet Layer** |
|  |  |  |
| **Link Layer** |  | **Link Layer** |
|  |  |  |

Explain why TCP and IP are able to work with different application protocols and different network media, (for example HTTP web pages transferred via a fibre optic connection.)

**Task 4**

Email can be accessed on a server using two different protocols, POP3 and IMAP. Compare the differences between these.

What role does SMTP play in the delivery of email?