CS144
An Introduction to Computer Networks

Packet Switching

What is packet switching?

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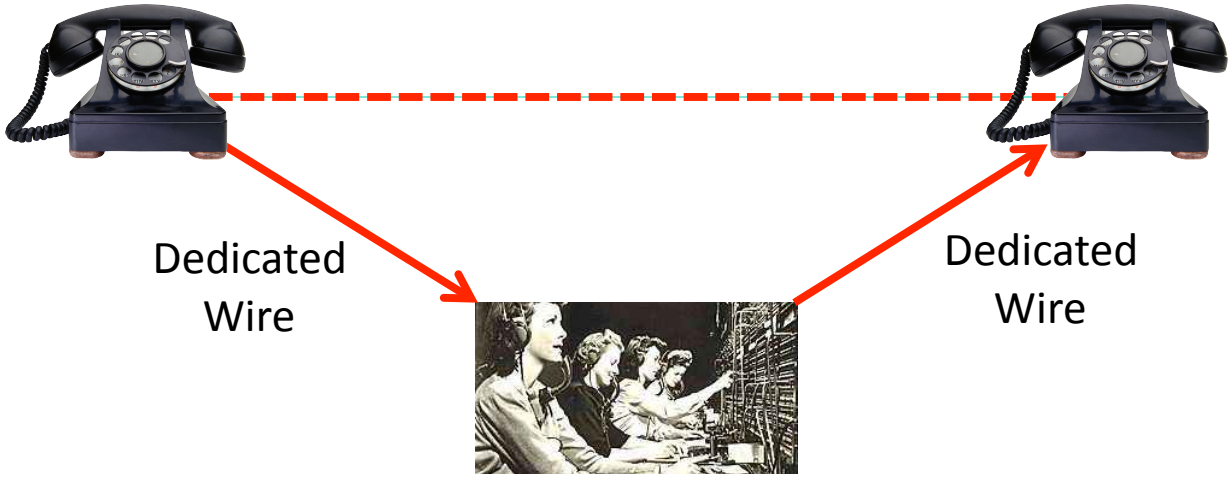
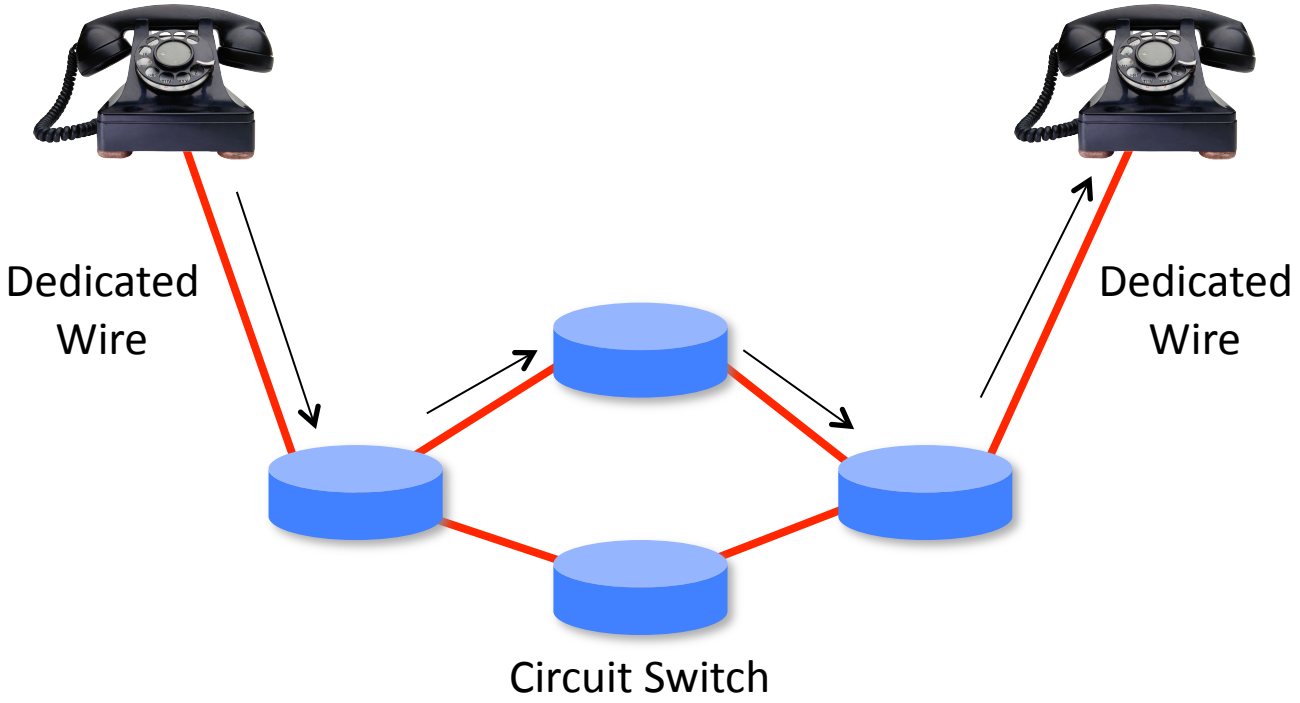
Outline

1. What is Circuit Switching?
2. What is Packet Switching?
3. Why does the Internet use Packet Switching?

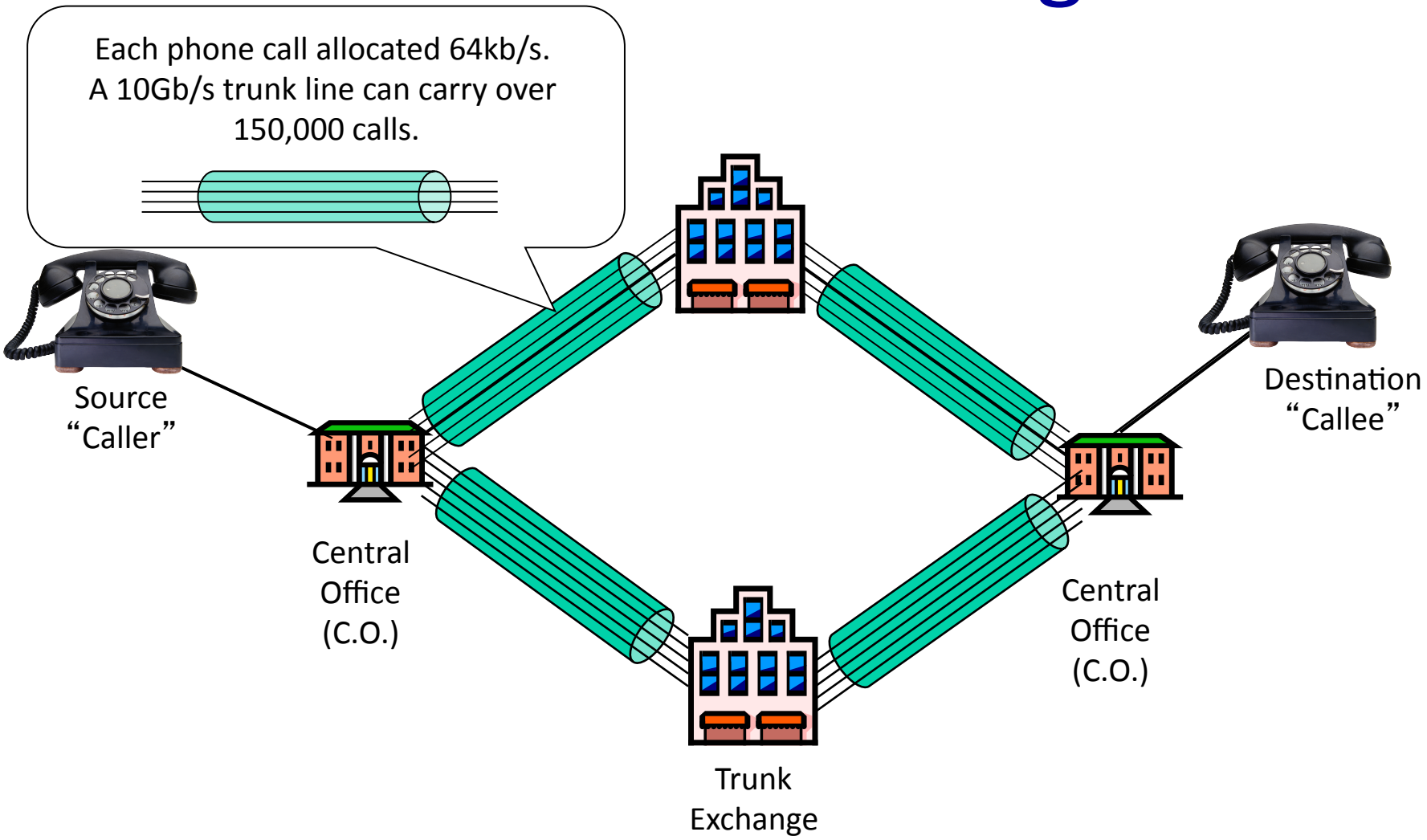
Circuit Switching



Circuit Switching



Circuit Switching



Circuit Switching

- Each call has its own private, guaranteed, isolated data rate from end-to-end.
- A call has three phases:
  1. Establish circuit from end-to-end ("dialing")
  2. Communicate
  3. Close circuit ("tear down")
- Originally, a circuit was an end-to-end physical wire.
- Nowadays, a circuit is like a virtual private wire.

Problems

1. **Inefficient**. Computer communication tends to be very bursty. *e.g*. typing over an ssh connection, or viewing a sequence of web pages. If each communication has a dedicated circuit, it will be used very inefficiently.
2. **Diverse Rates**. Computers communicate at many different rates. *e.g.* a web server streaming video at 6Mb/s, or me typing at 1 character per second. A fixed rate circuit will not be much use.
3. **State Management**. Circuit switches maintain per-communication state, which must be managed.

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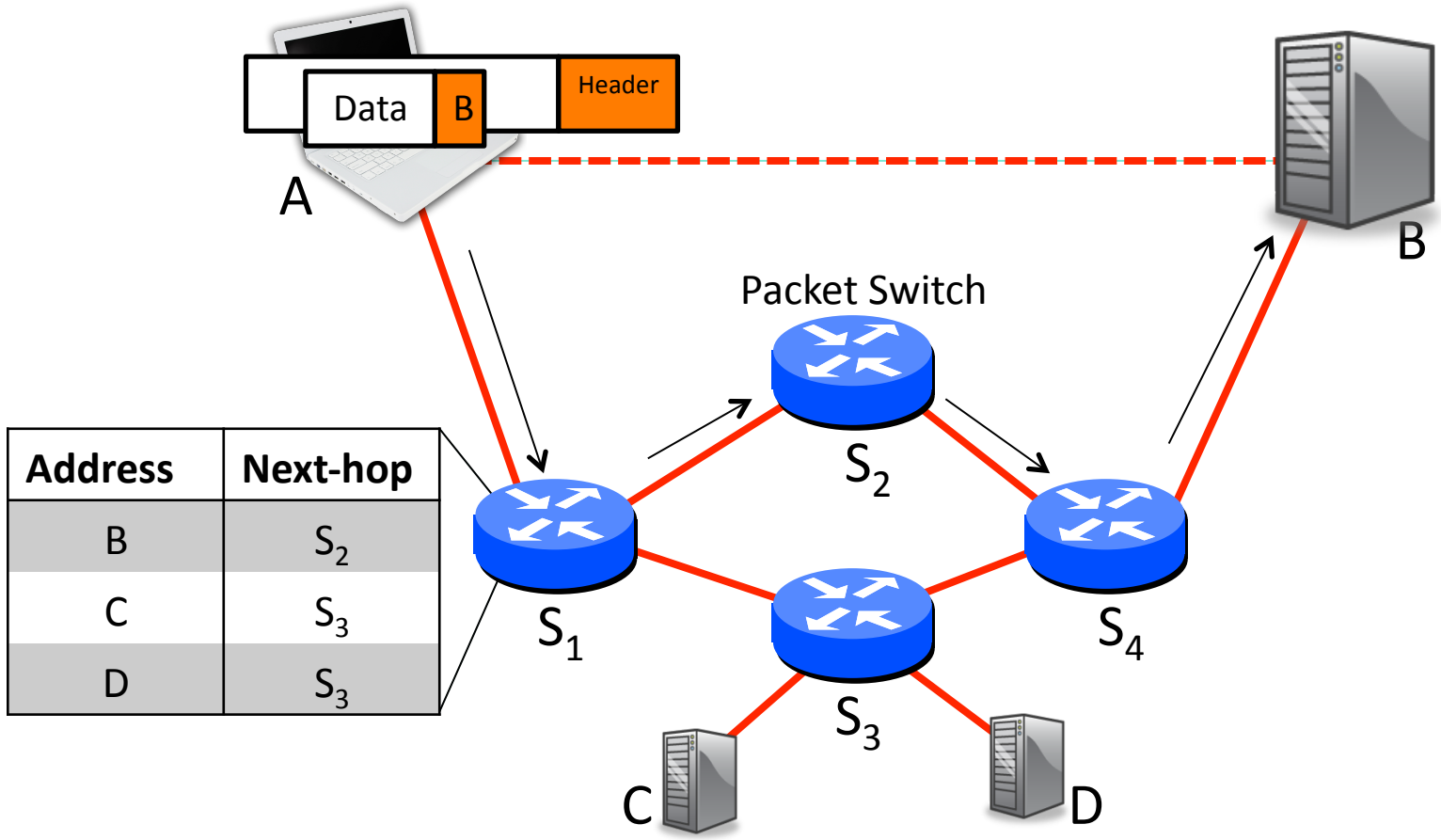
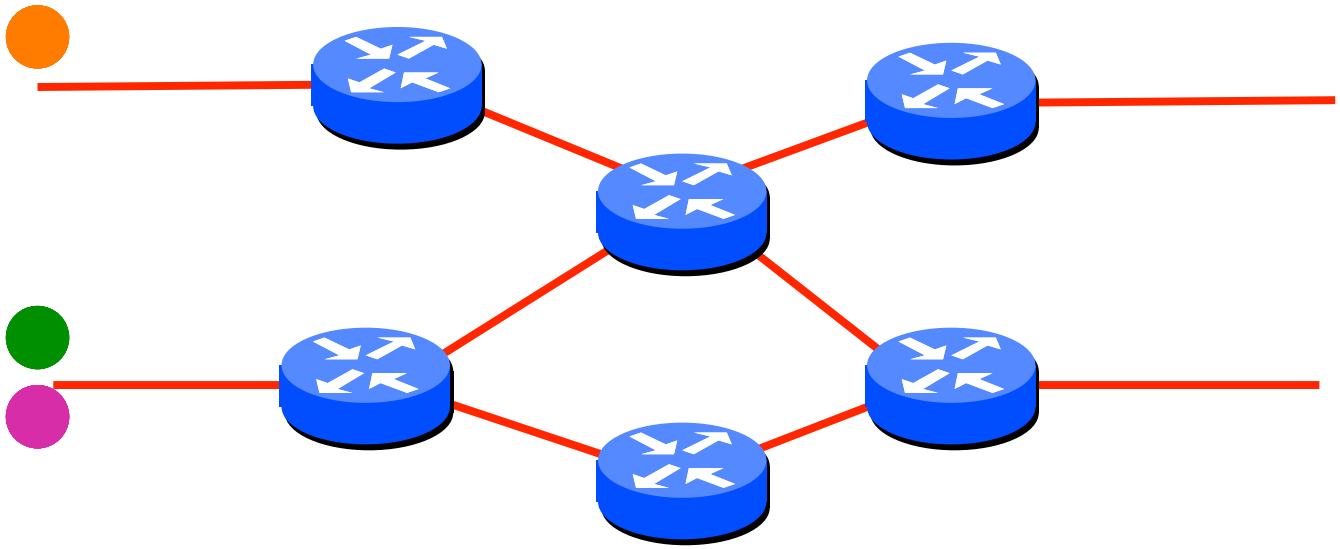
Packet Switching

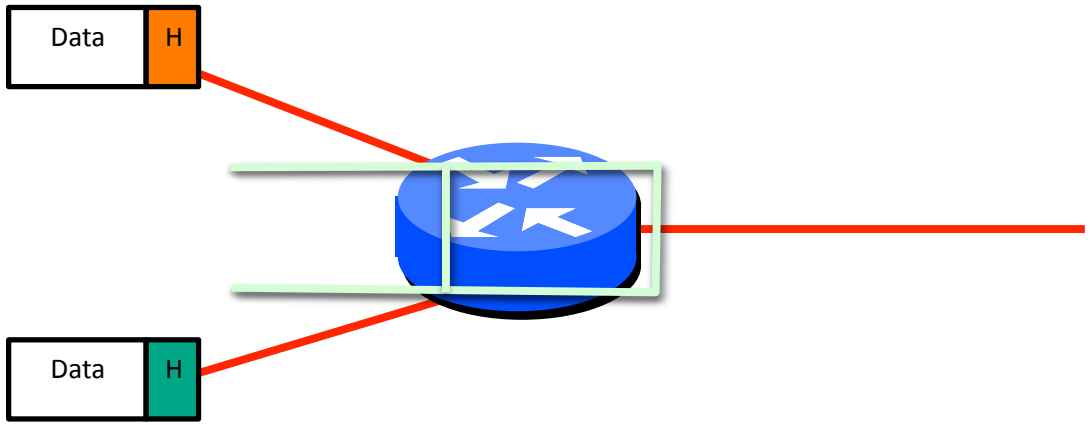


Address	Next-hop
B	S_2
C	S_3
D	S_3

Packet Switching



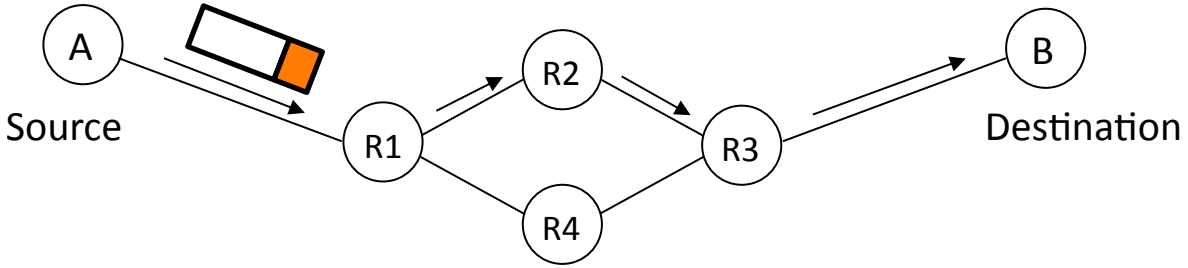
Packet switches have buffers



Buffers hold packets:

- When two or more packets arrive at the same time
- During periods of congestion

Packet Switching



- Packets are routed individually, by looking up address in router's local table.
- All packets share the full capacity of a link.
- The routers maintain no per-communication state.

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Efficient use of expensive links

- Links were assumed to be expensive and scarce.
- Packet switching allows many, bursty flows to share the same link efficiently.
- "Circuit switching is rarely used for data networks, ... because of very inefficient use of the links"
  – Bertsekas/*Gallager*

Resilience to failure of links & routers

- "For high reliability, ... [the Internet] was to be a datagram subnet, so if some lines and [routers] were destroyed, messages could be ... rerouted" - *Tanenbaum*

Summary

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