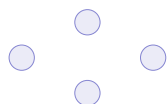


Computer Systems & Networks

AP Computer Science Principles ■ Unit 4

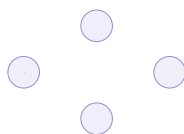
AP Computer Science Principles



Computer Systems & Networks

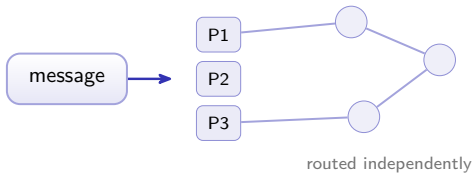
What we will cover

- 1 The Internet
- 2 Fault tolerance
- 3 Parallel & distributed computing

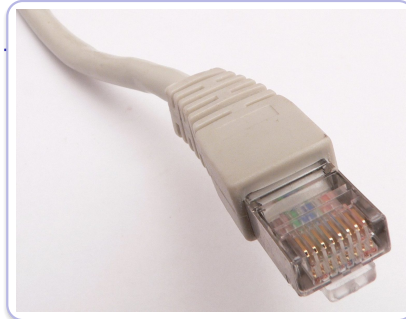


1 The Internet

Data travels as packets



The **Internet** 互联网 is a network of networks cooperating through shared **protocols** 协议. Data splits into **packets** 数据包, each addressed by an **IP address** 网际协议地址 and reassembled in order. The **World Wide Web** 万维网 is one service on top.



Packets carry data across networks

2 Fault tolerance

Fault tolerance

Fault tolerant 容错的
redundancy 冗余: extra paths/copies, a backup takes over

The Internet is fault tolerant because many routes mean a broken link is bypassed. Redundancy costs money, so designers weigh it against reliability.

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Routers forward packets toward their destination

3 Parallel & distributed

Parallel & distributed computing

Sequential 顺序计算
one step at a time

Parallel 并行计算
several **proces-**
sors 处理器,
one machine

Distributed 分布式计算
many sepa-
rate machines



Distributed systems run across many machines

Speedup 加速比 = $\frac{\text{one-processor time}}{\text{many-processor time}}$. The **sequen-**
tial part caps it – a 100 s task with 20 s sequential can never beat 5×.

Key points

The **Internet** routes indepen-
dent **packets** via protocols

Redundancy makes a
system **fault tolerant**

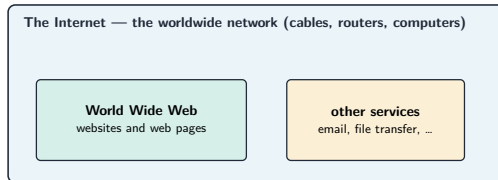
Parallel = one machine;
distributed = many

The **sequential part**
caps parallel speedup

The Internet is not the Web

The **Internet** 互联网 is the **network of networks** – the wires, routers and protocols. The **World Wide Web** 万维网 is **one service running on top of it**.

Email, video calls and games also ride the Internet **without** touching the Web.



one is the road, the other is one kind of traffic

Worked example – the limit of parallelism

A 40 s sequential part + a 60 s parallelizable part

On one processor: $40 + 60 = 100$ s. Spread the parallel part over 3 processors: $\frac{60}{3} = 20$ s, so the total is $40 + 20 = 60$ s and the speedup is $\frac{100}{60} \approx 1.67$.

The 40 s sequential part is a **floor**: even with **infinitely many** processors the task can **never** finish in under 40 s.

Check yourself

- 1 Is the Web the same thing as the Internet?
- 2 A 40 s sequential part: can 1000 processors beat 40 s?
- 3 Why does packet switching make the Internet fault tolerant?
- 4 What is redundancy in a network?



Answers 1. no – the Web is one service on the Internet 2. no – it is a floor 3. packets reroute around a failure 4. more than one path between two points