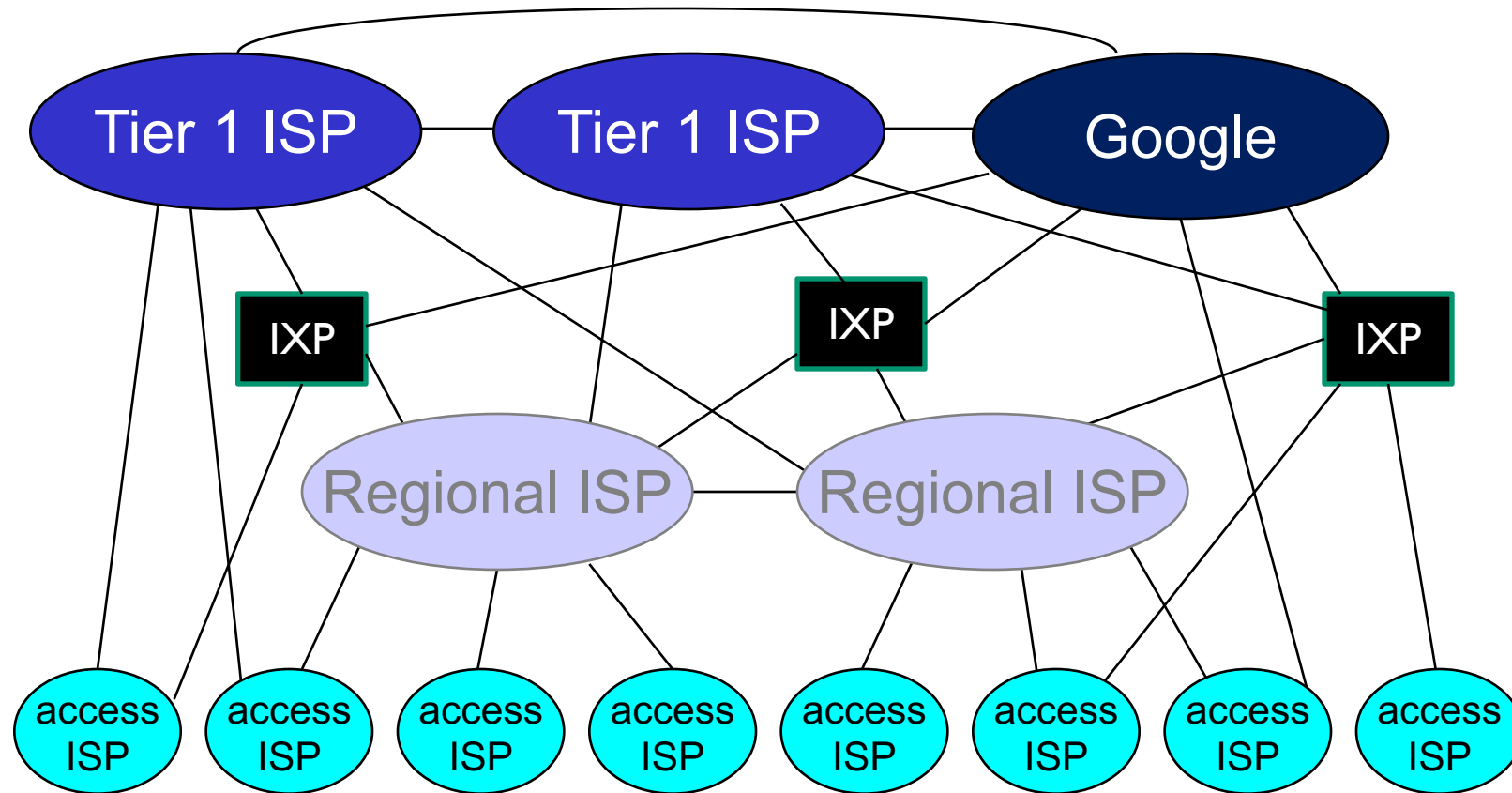


# Introduction Review

What is a protocol?

**What is bandwidth?**

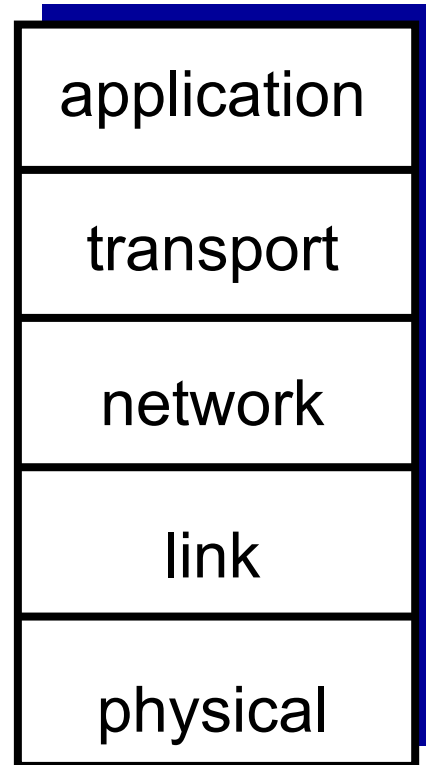
# Internet structure: network of networks



- at center: small # of well-connected large networks
  - “**tier-1**” **commercial ISPs** (e.g., Level 3, Sprint, AT&T, NTT), national & international coverage
  - **content provider network** (e.g., Google): private network that connects its data centers to Internet, often bypassing tier-1, regional ISPs

What are the 4 components of networking delay?

# What's the service model for each layer?



# Internet protocol stack

- *application*: supporting network applications
  - FTP, SMTP, HTTP
- *transport*: process-process data transfer
  - TCP, UDP
- *network*: routing of datagrams from source to destination
  - IP, routing protocols
- *link*: data transfer between neighboring network elements
  - Ethernet, 802.11 (WiFi), PPP
- *physical*: bits “on the wire”

