

6.033 Spring 2018

Lecture #13

- **New Technologies on the Internet**
 - **File-sharing (BitTorrent, DHTs)**
 - **VoIP (Skype)**
 - **Video Streaming**

Internet of Problems

How do we **route** (and address) scalably, while dealing with issues of policy and economy?



BGP

How do we **transport** data scalably, while dealing with varying application demands?



TCP,
in-network
resource management

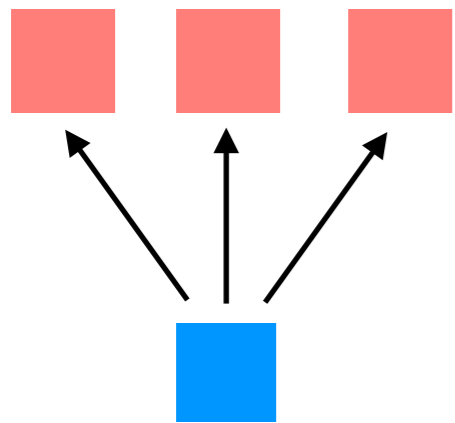
How do we **adapt** new applications and technologies to an inflexible architecture?



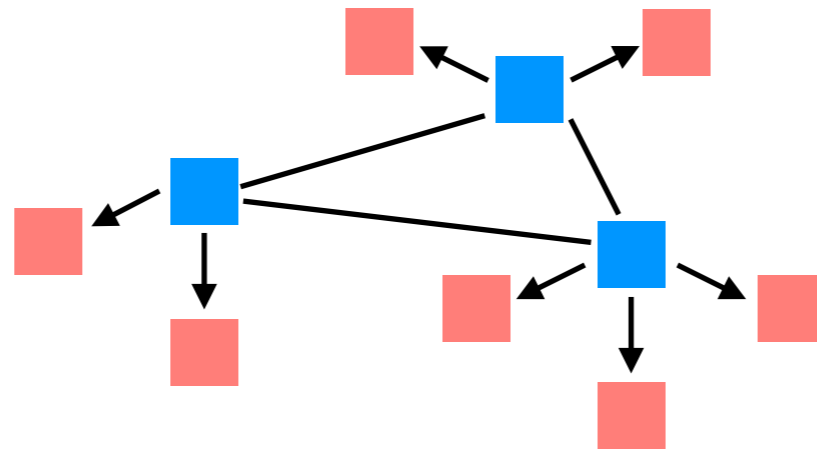
P2P Networks,
CDNs
(and more)

File-sharing Techniques

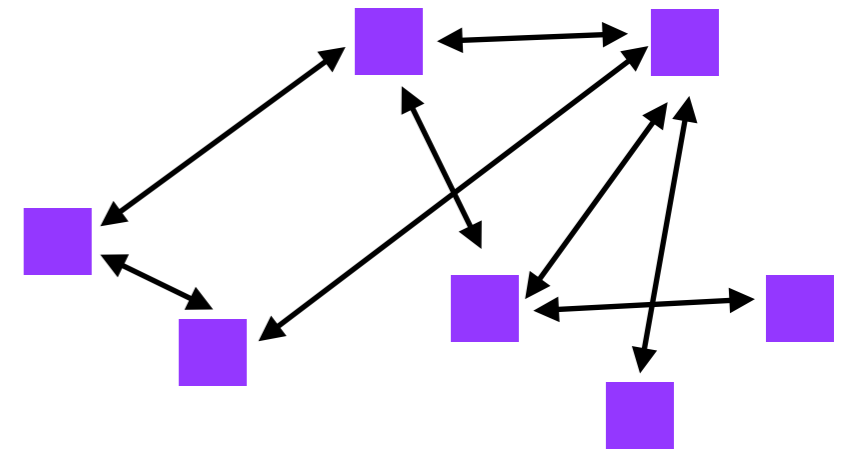
client-server



CDNs



P2P

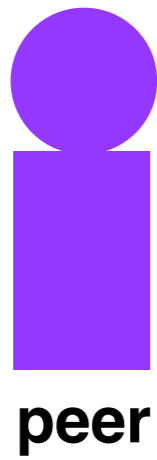


scalability increases
(in theory)

problem: how do we incentivize peers in a P2P network to upload?

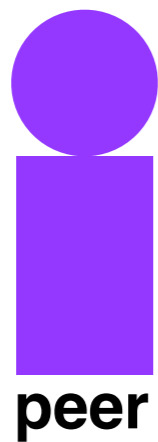
Discovering the P2P Network

(the “swarm”)

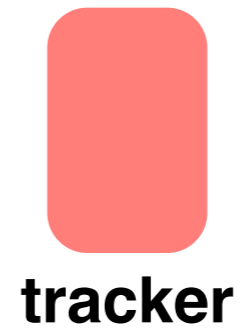


Discovering the P2P Network

(the “swarm”)

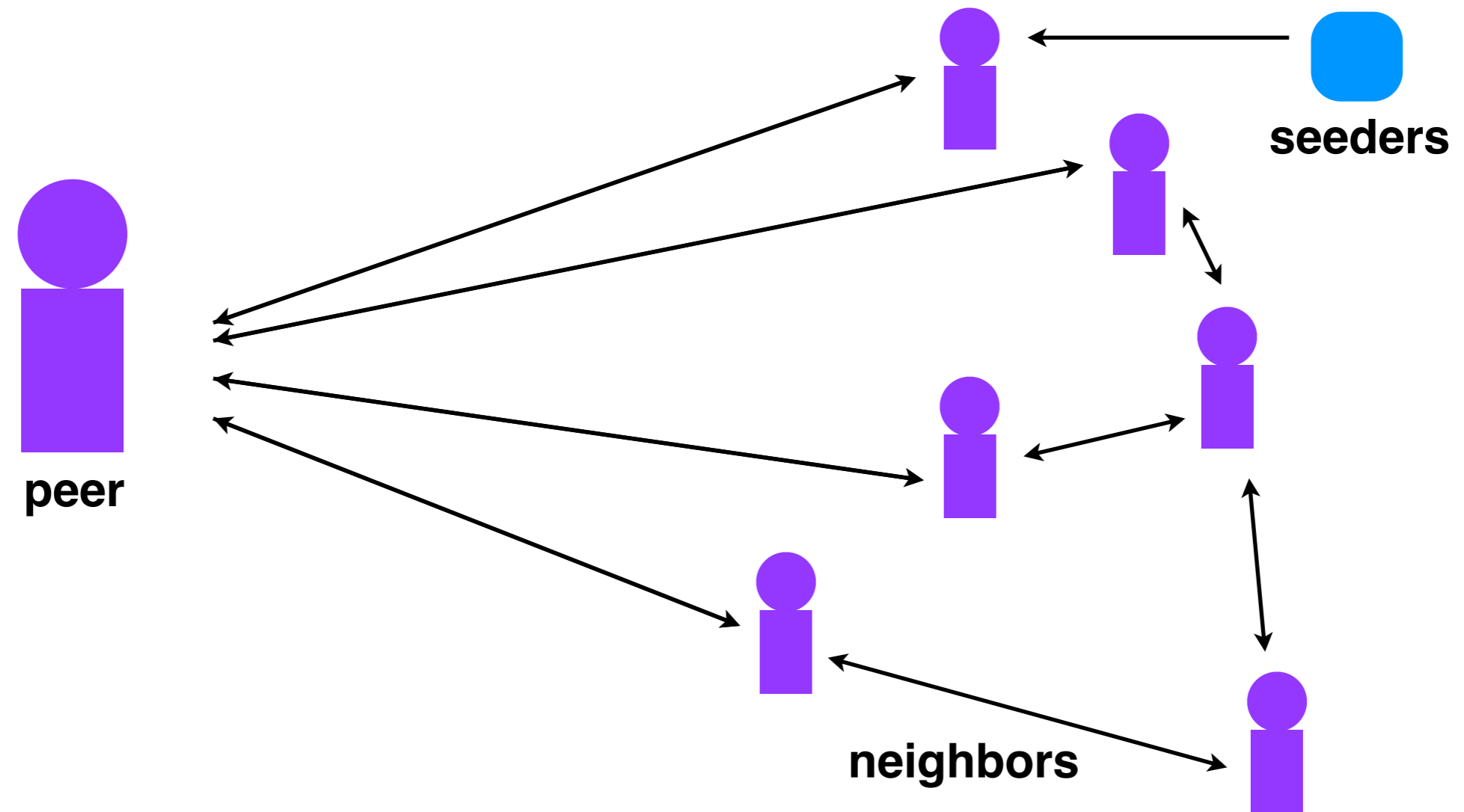


130.136.254.21
130.136.254.22
171.66.3.182
128.31.1.11
128.83.122.180
128.232.103.202
155.98.35.4
...

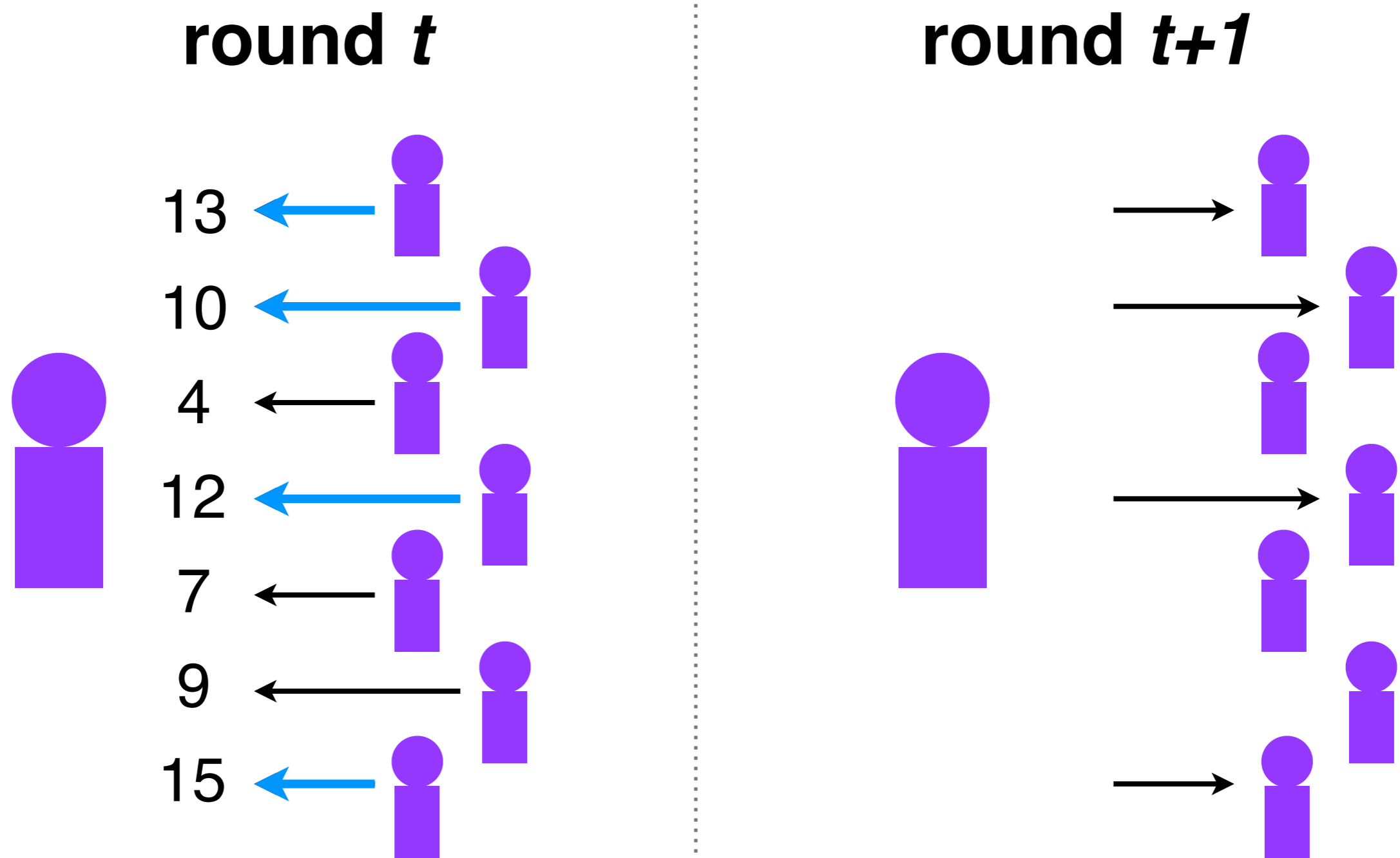


Discovering the P2P Network

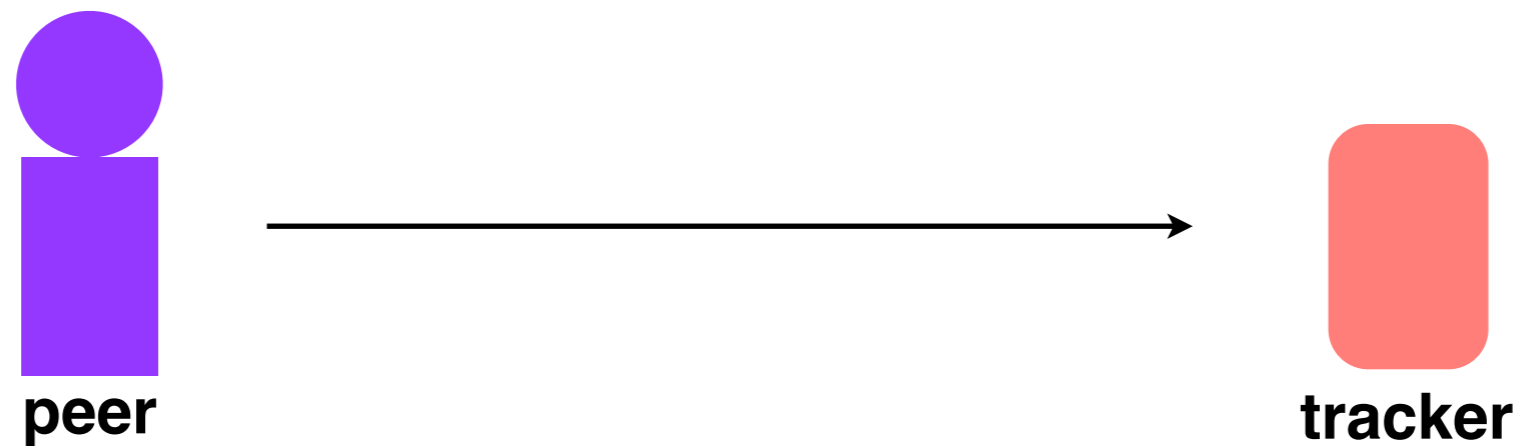
(the "swarm")



Incentivizing Peers to Upload



problem: the tracker is a central point of failure



in practice, most BitTorrent clients are **trackerless**.
The list of peers is stored (and replicated) across multiple machines in a distributed data structure

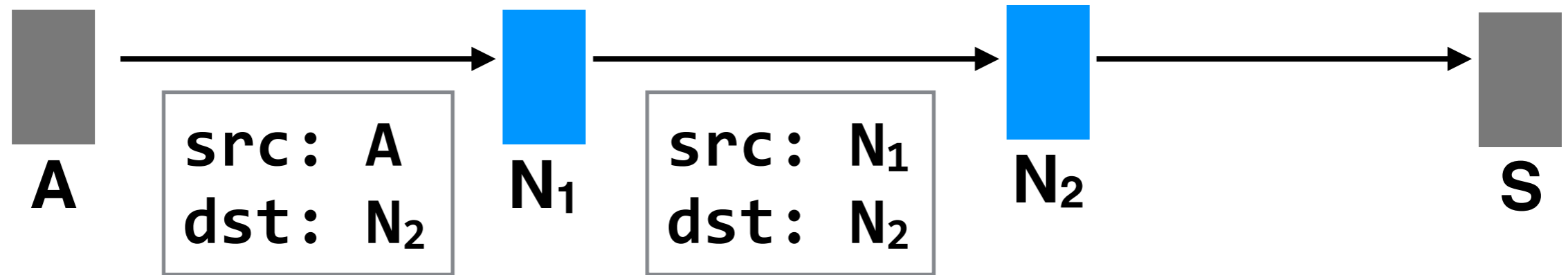
VoIP

(Voice over IP)



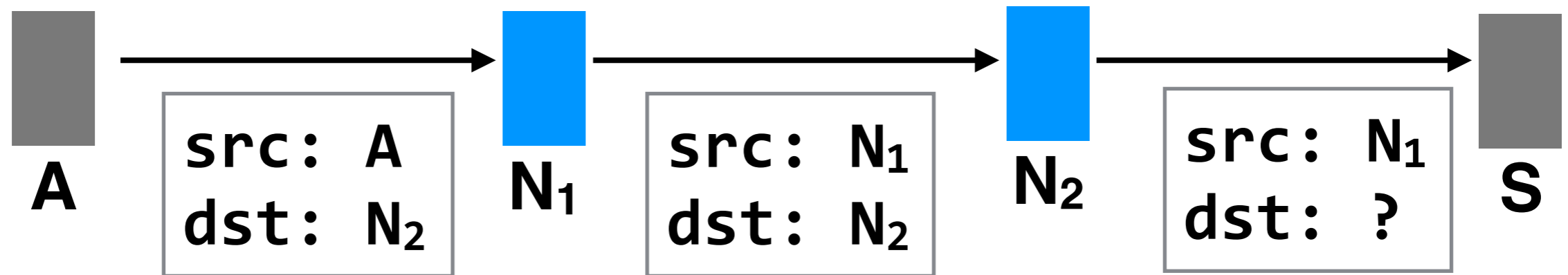
problem: S's IP is private
(can't route to it, and can't figure
out that it's "behind" N₂)

N1 will keep some state
mapping a connection
on this port back to A

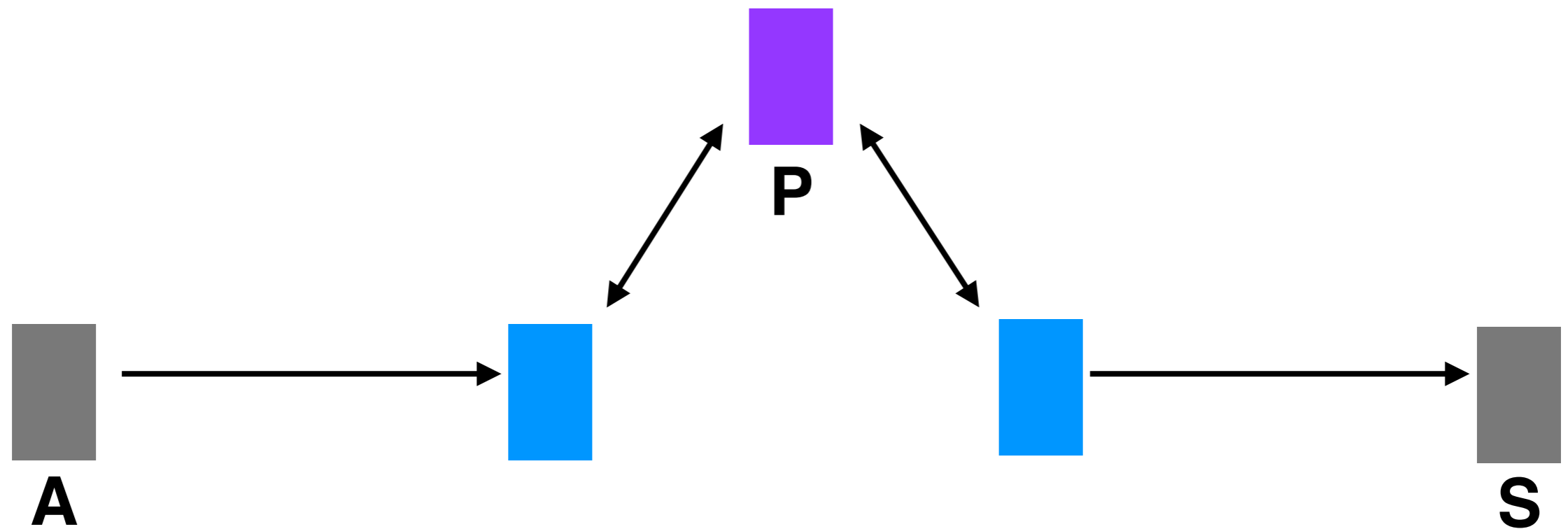


**skype provides a directory,
so assume we can get N₂'s IP**

N1 will keep some state
mapping a connection
on this port back to A



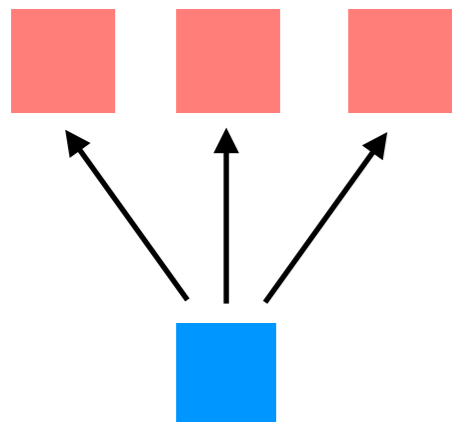
problem: N₂ has no idea who
this packet is meant for



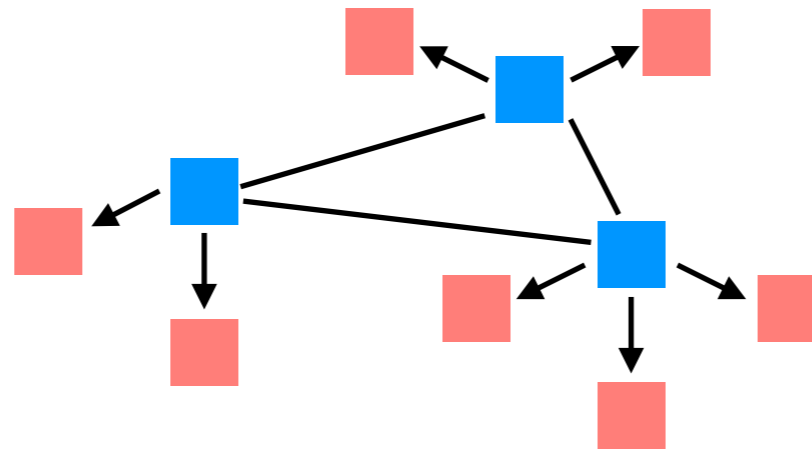
solution: A and S route their communication through P
(who has a public IP)

File-sharing Techniques

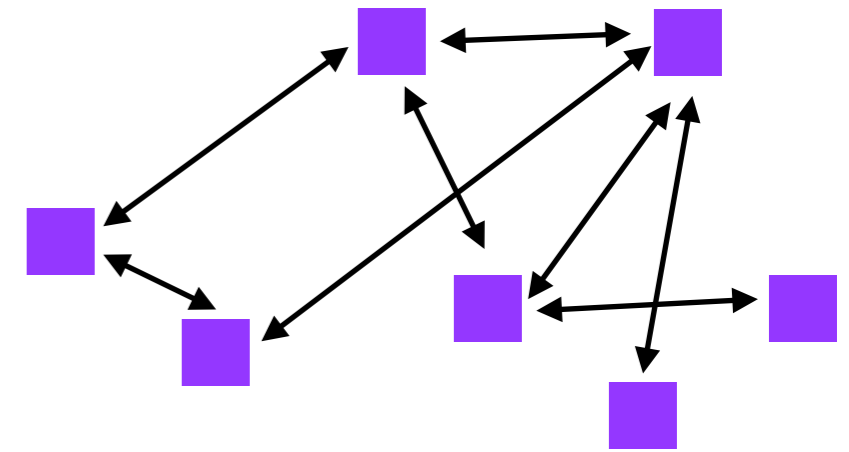
client-server



CDNs



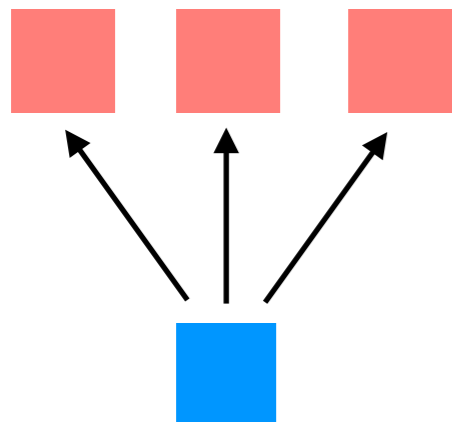
P2P



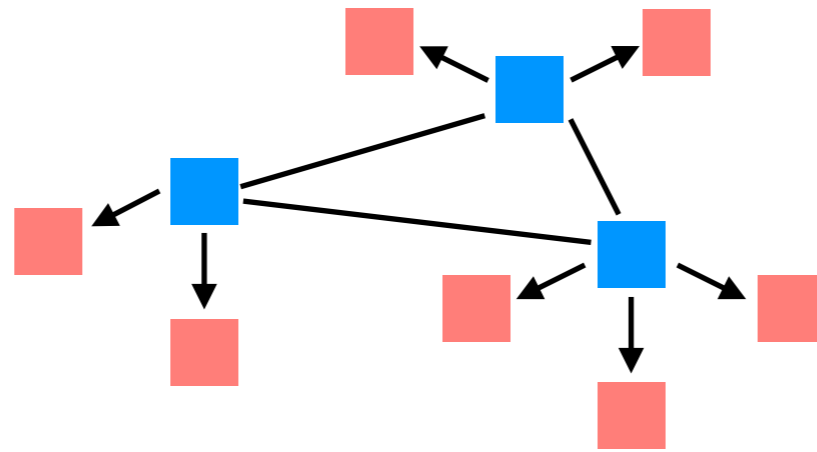
scalability increases
(in theory)

Video-streaming Techniques?

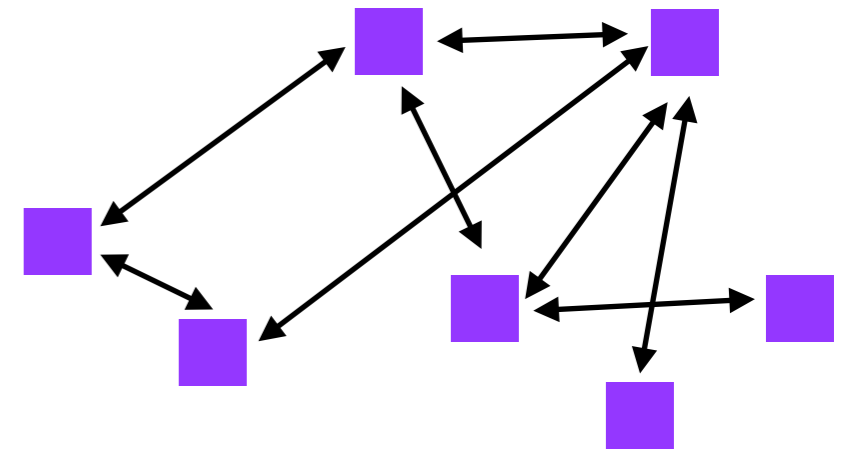
client-server



CDNs



P2P



scalability increases
(in theory)

- **P2P Networks** are, in theory, infinitely scalable. They can improve performance for some applications, and provide a way to overcome certain aspects of the Internet's architecture. **Incentivizing** peers to behave is an important problem.
- **CDNs** don't scale in the same way that P2P networks do, but are more appropriate for some applications, and provide some features that a P2P network can't (more on that in Thursday's recitation).

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6.033 Computer System Engineering
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