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?

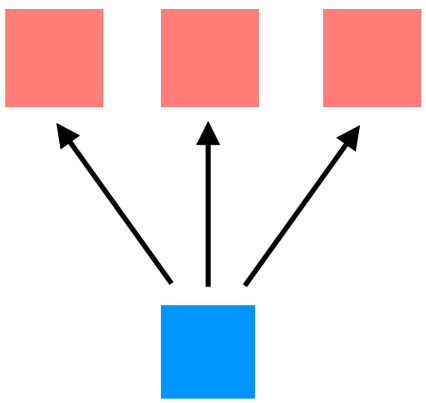
→ **TCP, in-network resource management**

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

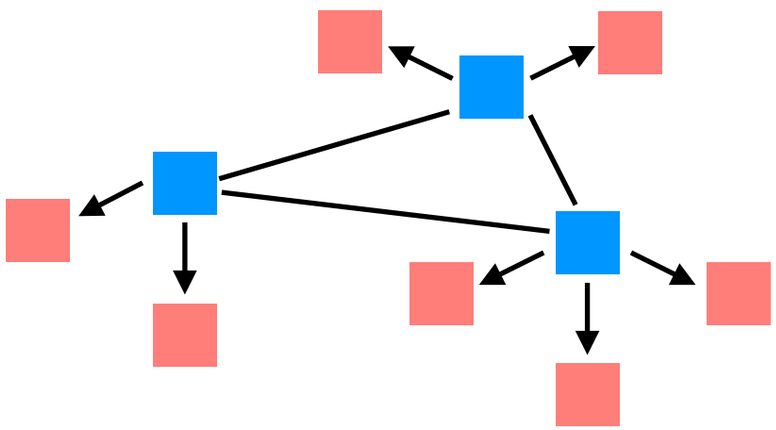
→ **P2P Networks, CDNs** (and more)

File-sharing Techniques

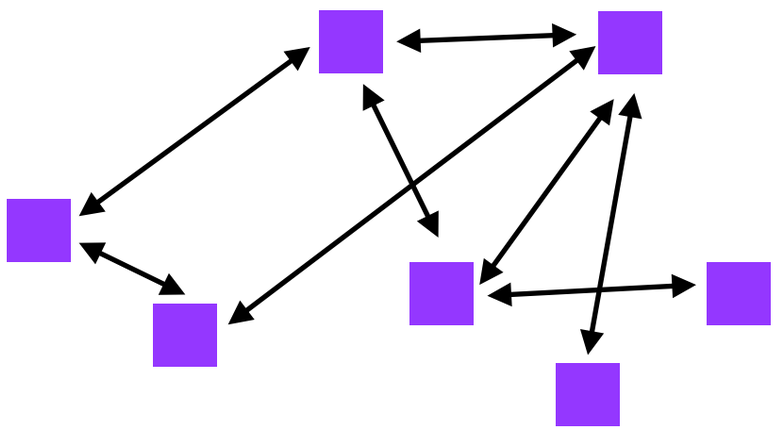
client-server



CDNs



P2P



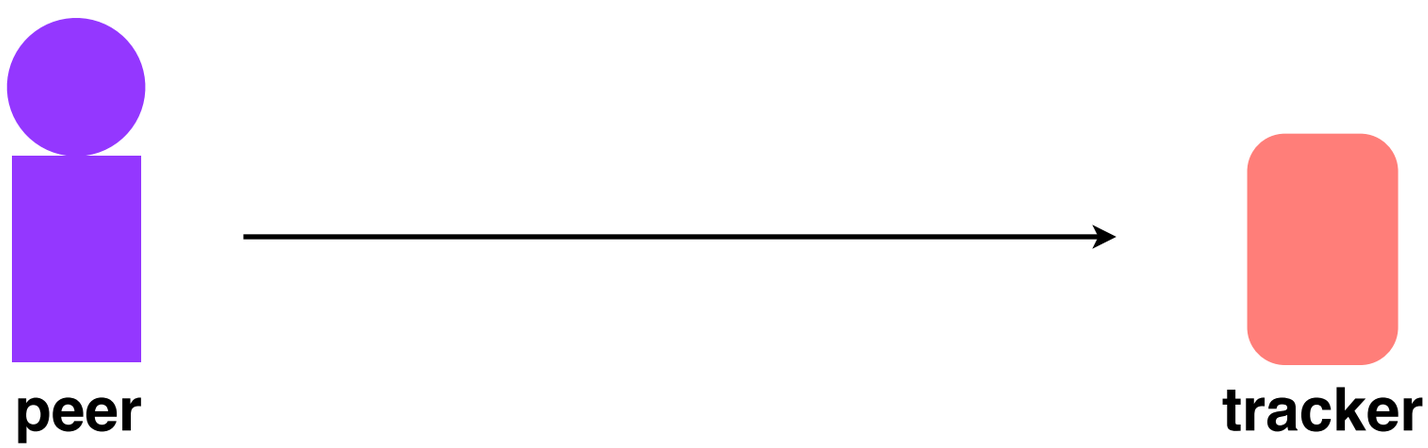
scalability increases

(in theory)

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

Discovering the P2P Network

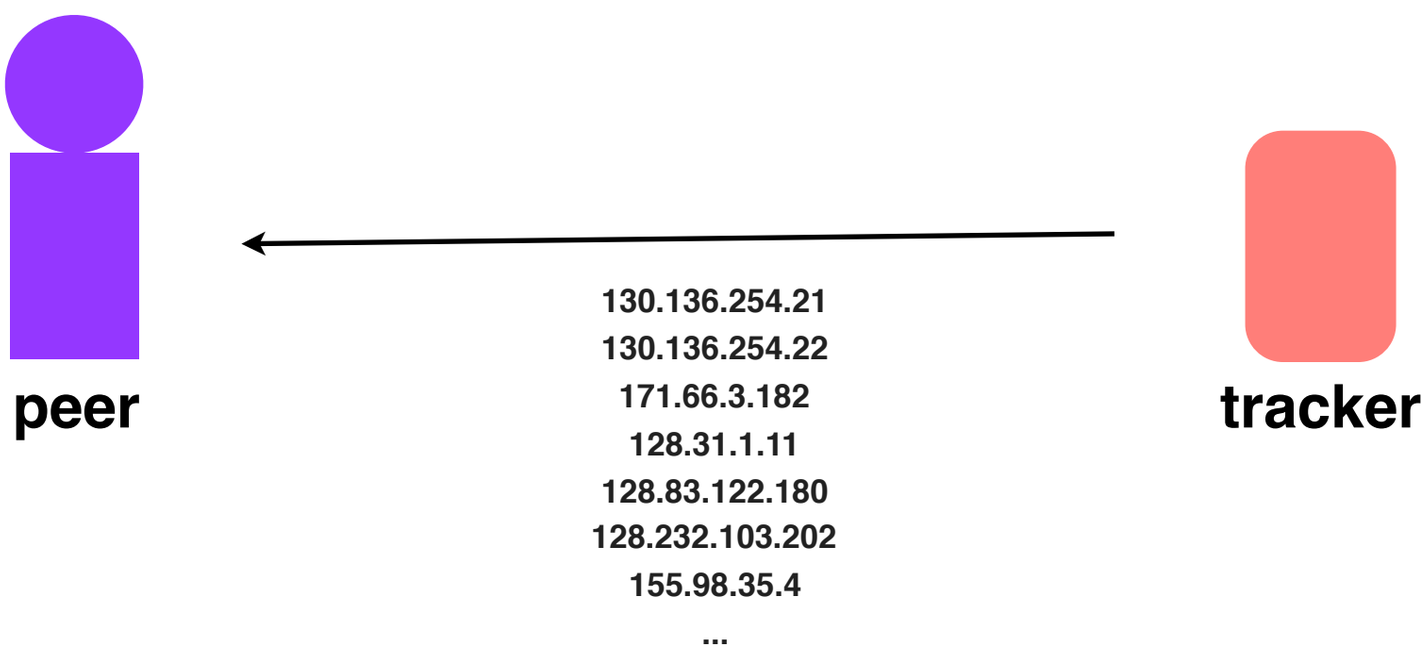
(the “swarm”)



peer **tracker**

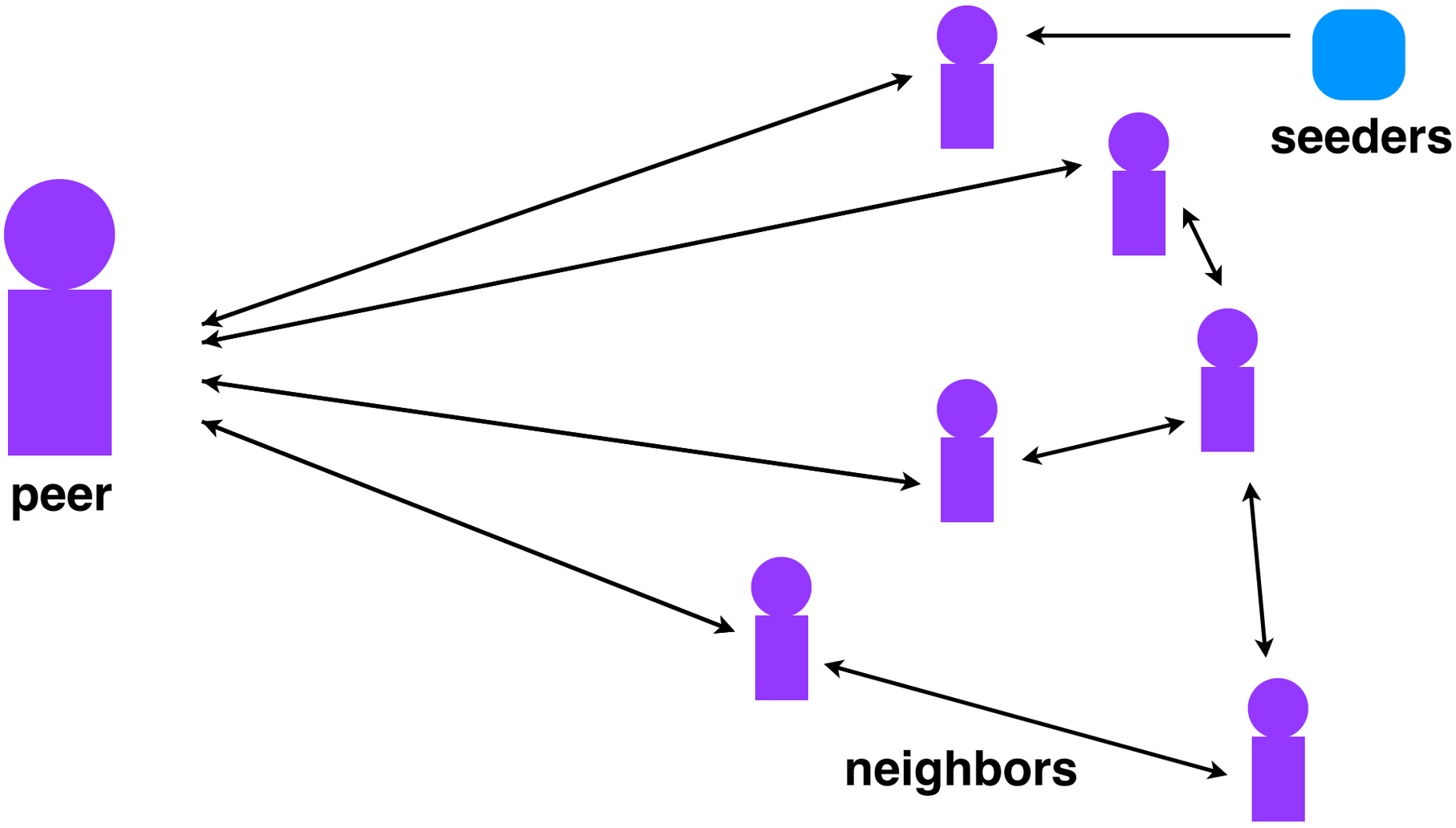
Discovering the P2P Network

(the “swarm”)



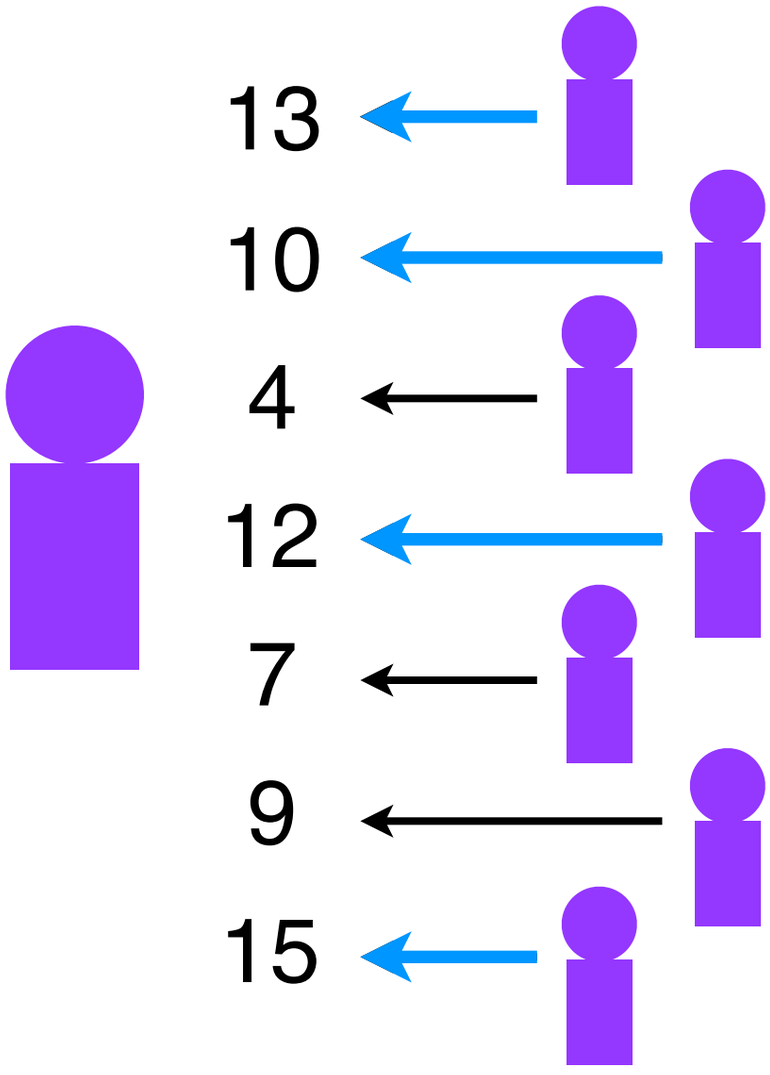
Discovering the P2P Network

(the “swarm”)

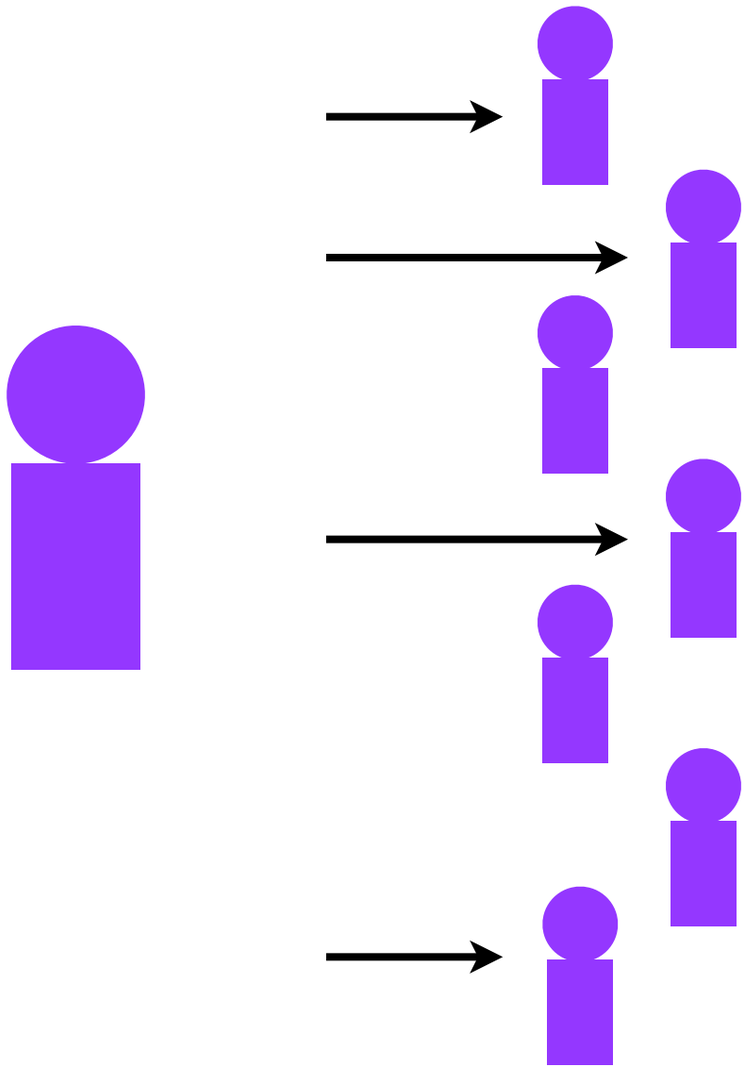


Incentivizing Peers to Upload

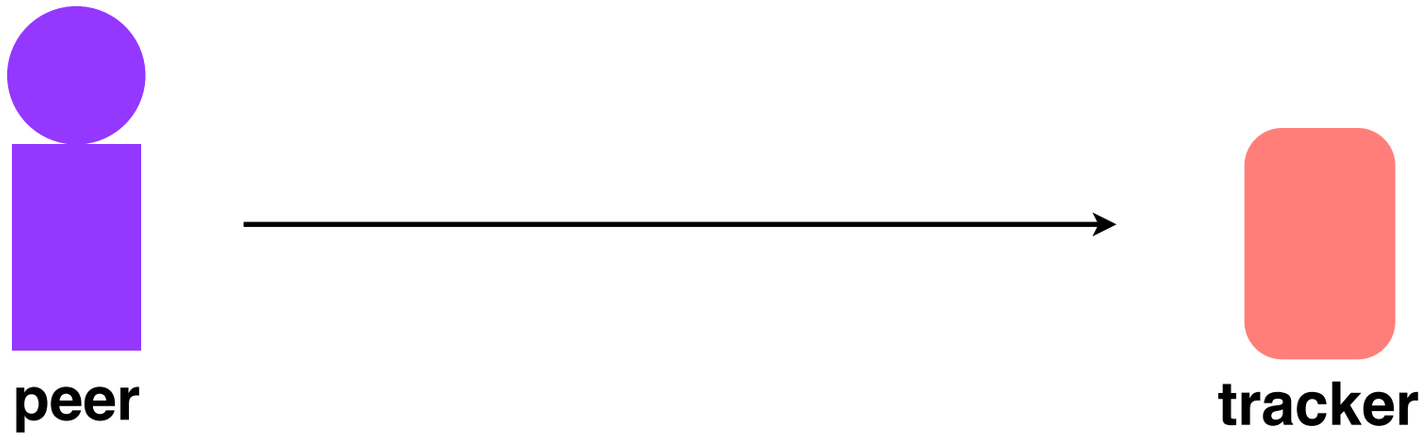
round *t*



round *t+1*



problem: the tracker is a central point of failure

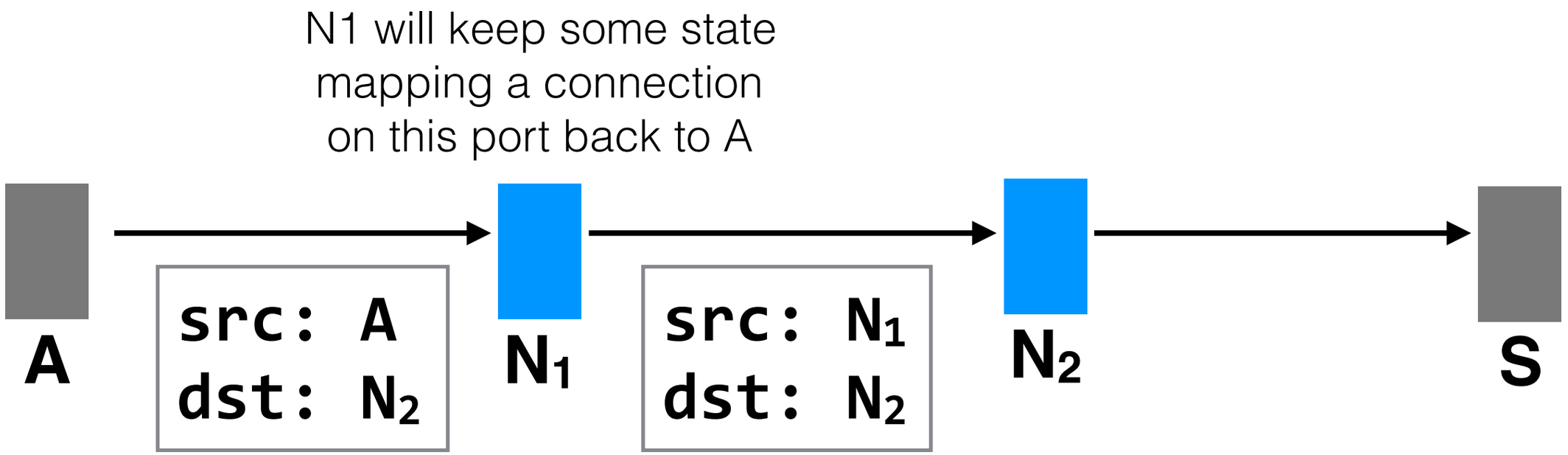


in practice, most BitTorrent clients are **trackerless**. The list of peers is stored (and replicated) across multiple machines in a distributed data structure

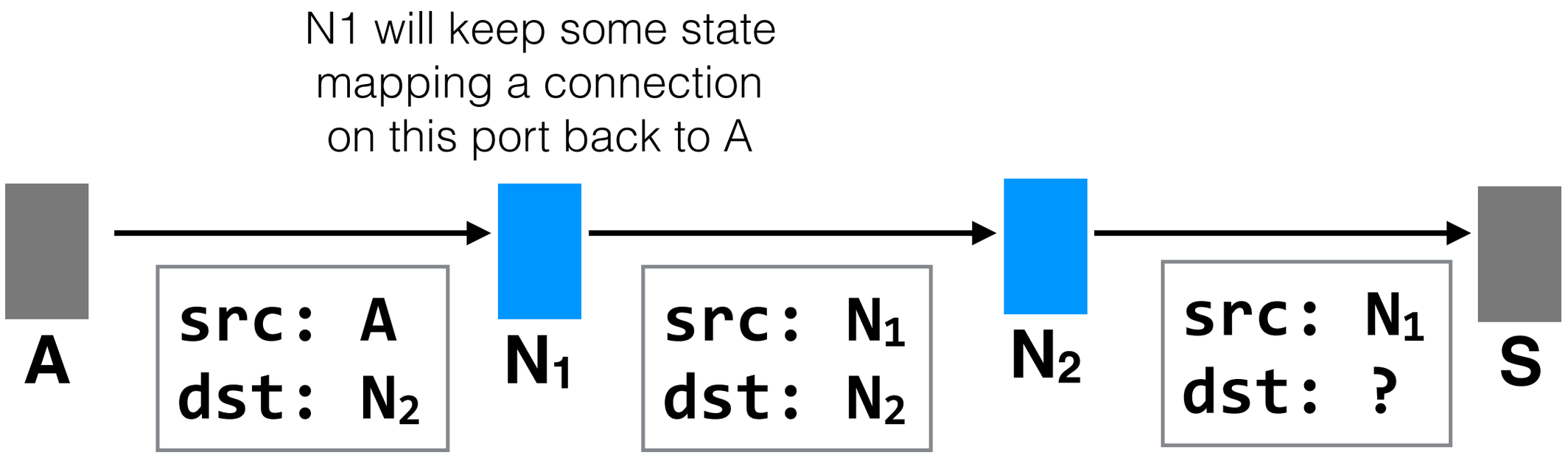
VoIP

(Voice over IP)

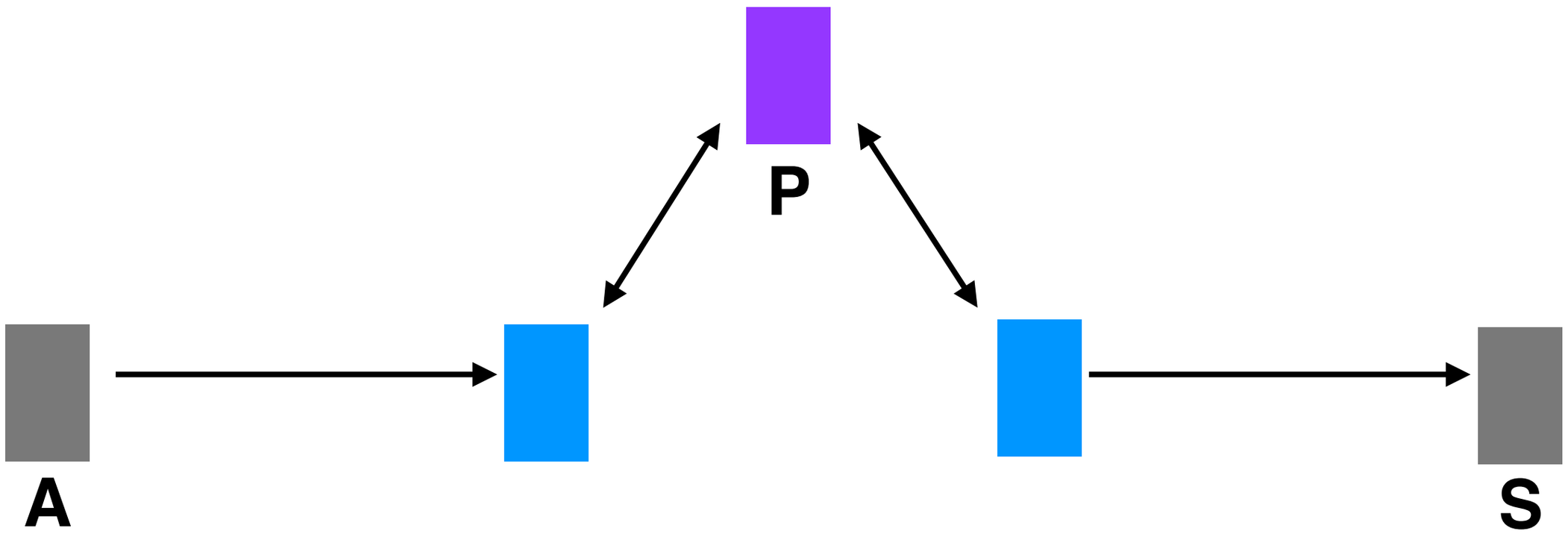
problem: S's IP is private (can't route to it, and can't figure out that it's "behind" N_2)



skype provides a directory,
so assume we can get N_2's IP



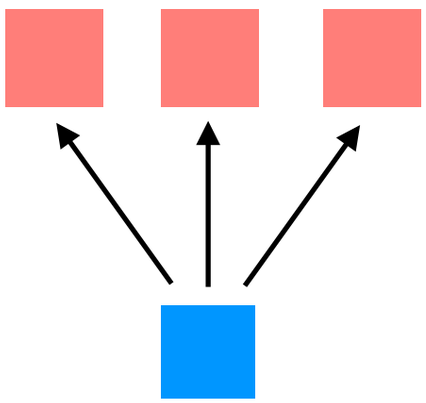
problem: N_2 has no idea who this packet is meant for



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

File-sharing Techniques

client-server



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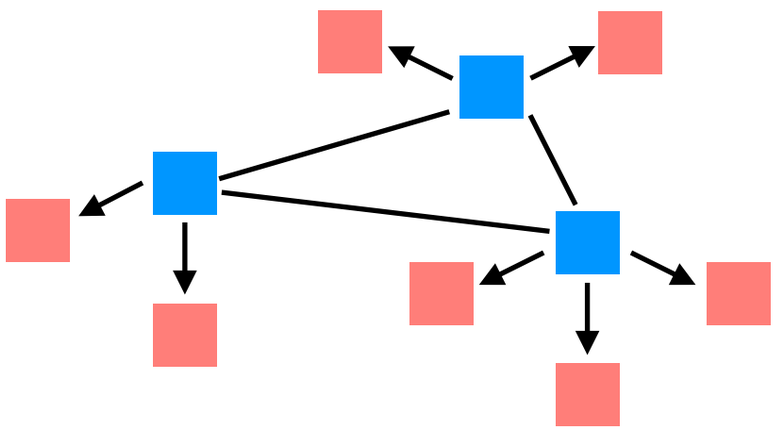
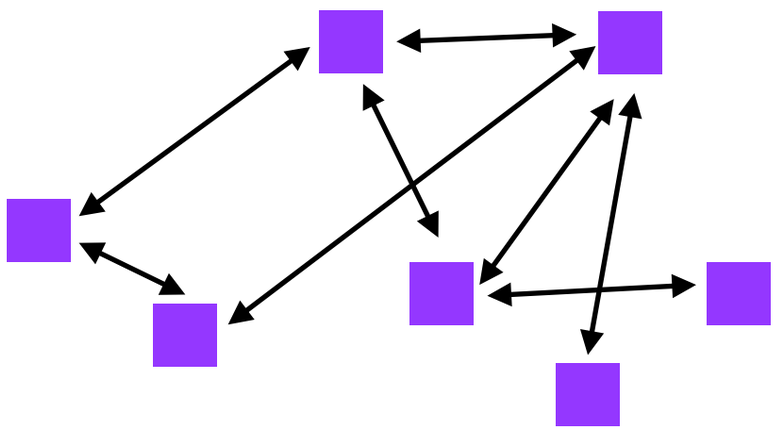


P2P

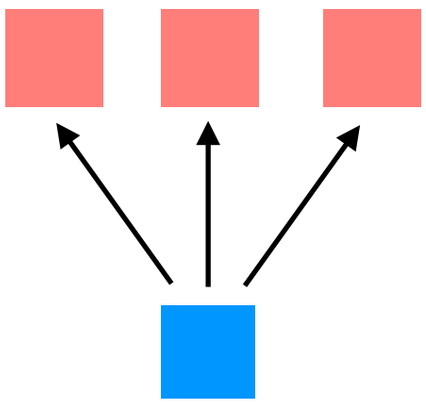


scalability increases

(in theory)

Video-streaming Techniques?

client-server



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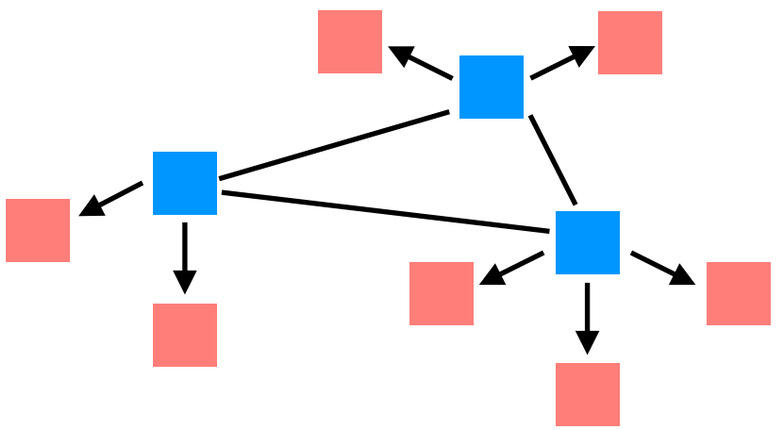

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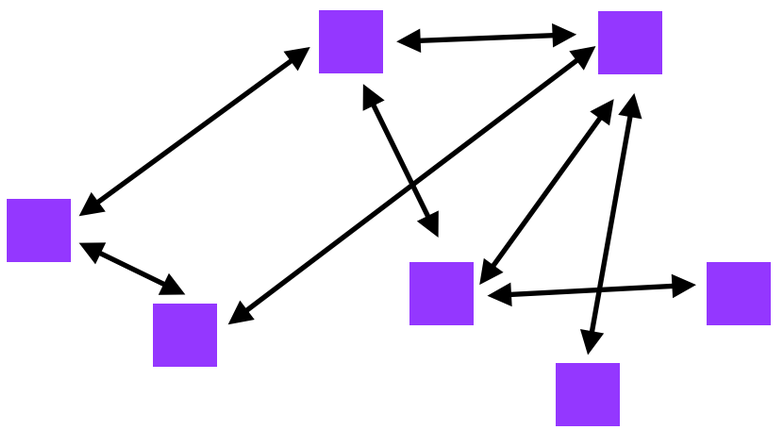

scalability increases

(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).