Structured Peer-to-Peer Overlays for Mobile Networks

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Research Goal

- Feasibility of extending P2P in mobile networks
- Experimentation the performance of various P2P overlays under high churn and bandwidth consumption
- To make sure that every node can participate in a P2P network whether it is behind a Network Address Translation (NAT) or not, we must solve the NAT traversal problem
- A general approach of NAT traversal for ring based overlays without the use of a single server
- An adaptable routing protocol that utilises both recursive and iterative routing in terms of the level of node churn and NAT connectivity

P2P in Mobile

- P2P networks are highly popular among users that have stationary computers with high-bandwidth Internet connections
- The use of mobile devices on cellular networks has dramatically changed over the last few years and moved strongly towards smarter and more powerful devices
- Providing P2P services in mobile networks will allow a user to harness the potential of P2P service while on the move
- Individual users as well as (mobile) operators and service providers

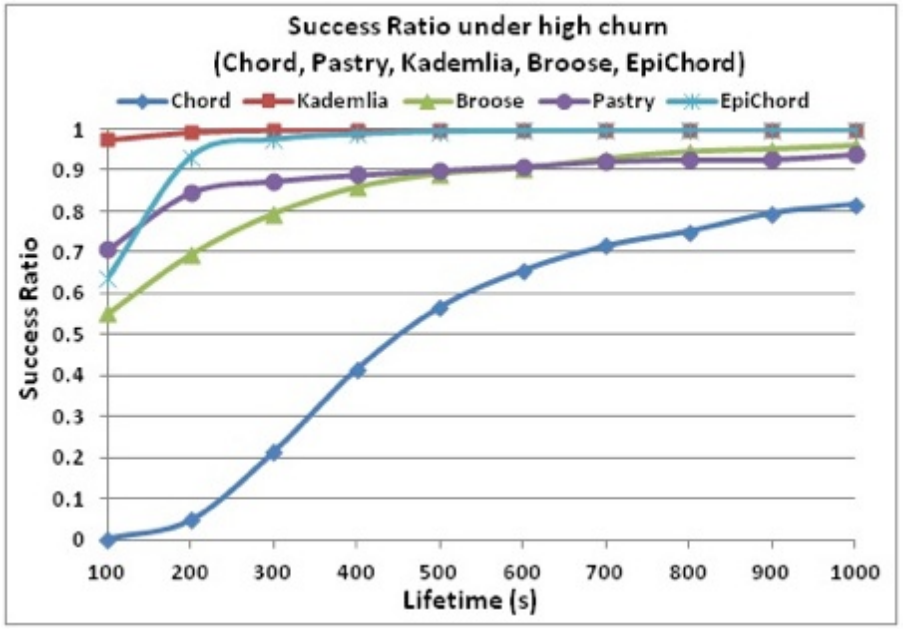
Major Challenges

- Energy Consumption
- High Churn Rate
- NAT and Firewall Traversal

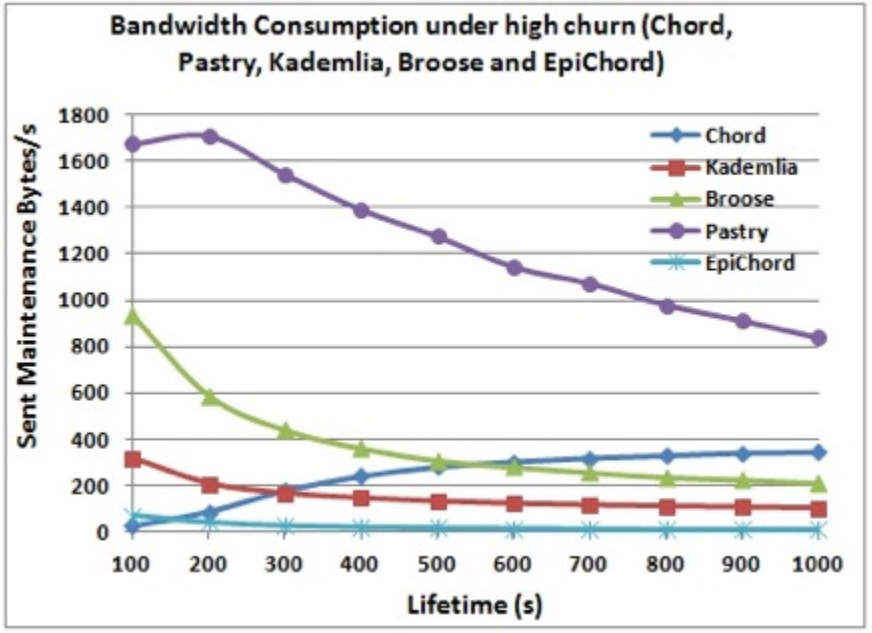
Experimentations

- Distributed Hash Table (DHT) based Structured P2P overlays
- Identify features which are suitable for use on cellular networks
- The performance of various P2P overlays

Experimentations



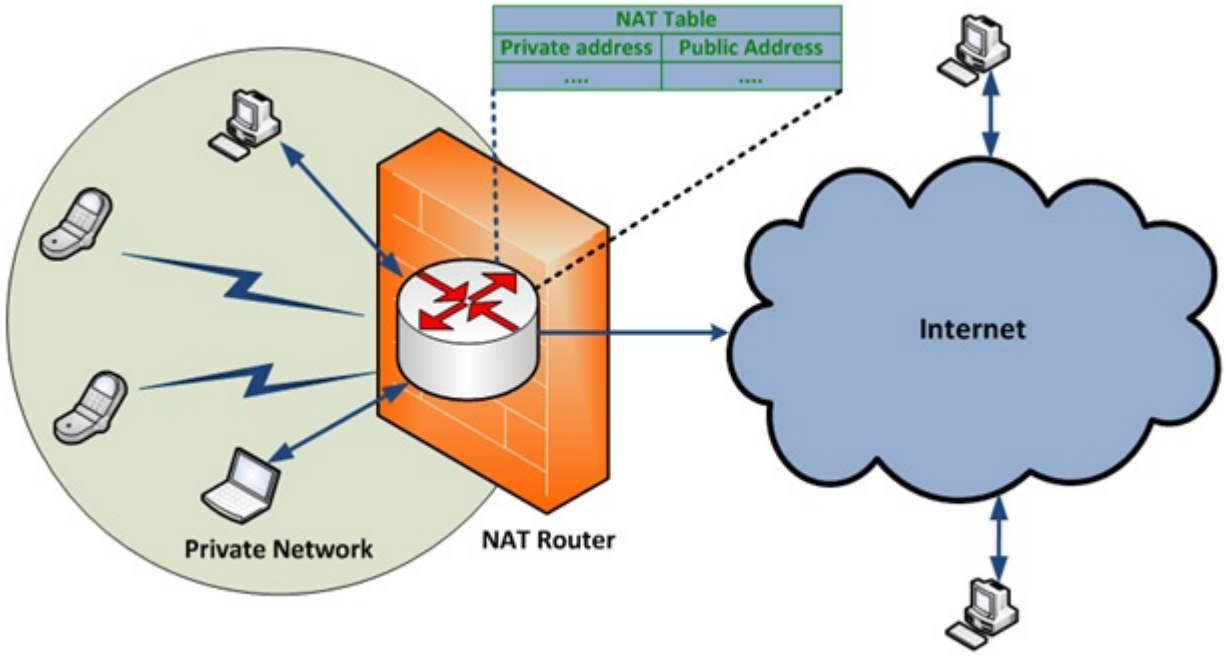
Lookup Success Ratio under a very high churn environment



Bandwidth Consumption under a very high churn environment

NAT Traversal

- NAT is used to share a single public IP address among several end systems on a private network thereby allowing many computers in the network to access the Internet using the single IP



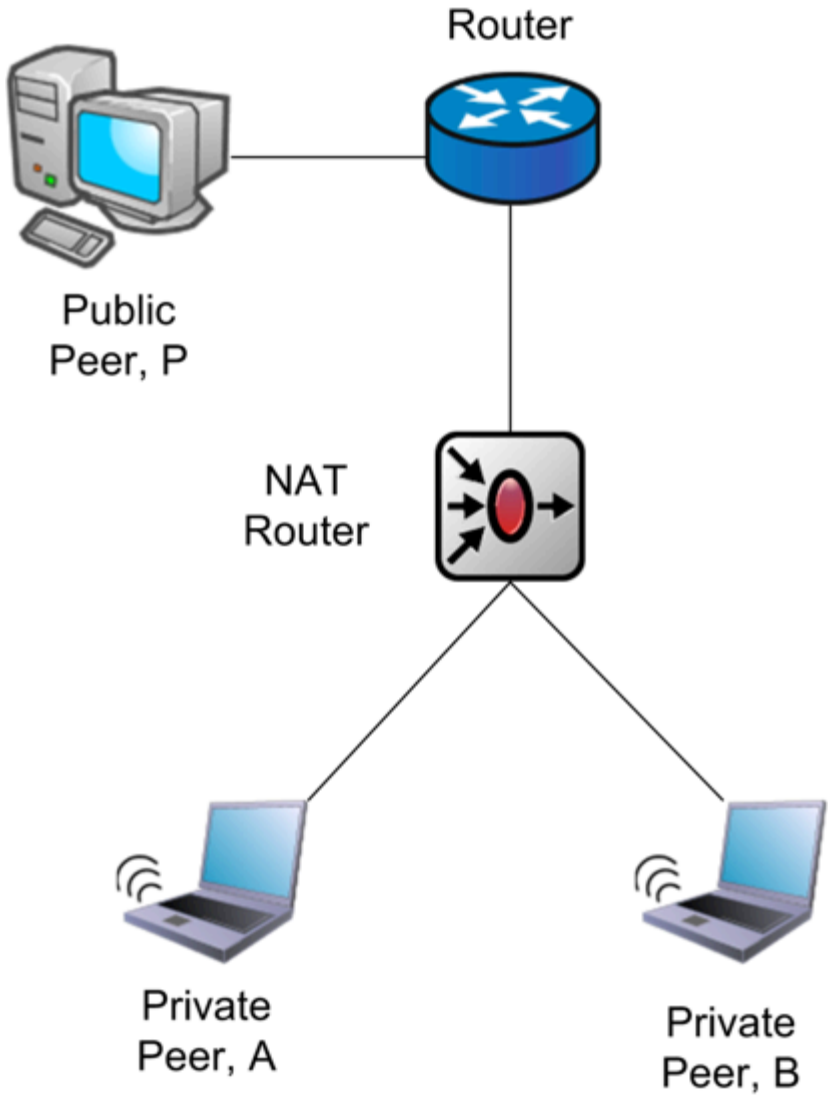
NAT Traversal in OverSim

- NAT traversal is a huge issue for any P2P
- Increasingly problematic with router manufacturers
- Integrated a NAT traversal approach in the working P2P simulator – OverSim
- Proposed a NAT traversing approach without the use of single server components

UDP Hole Punching without a Server

- A relatively straightforward procedure
- A third party peer with a public IP address, assisting the peers with private IP addresses about to connect by informing them of each others' public addresses
- When the peers are aware of the addresses they begin sending UDP packets to one another
- This causes mappings to be formed in the intermediate NATs
- Once outbound packets have passed the NATs, inbound packets are translated using these mappings

Case 1: Peers behind a common NAT



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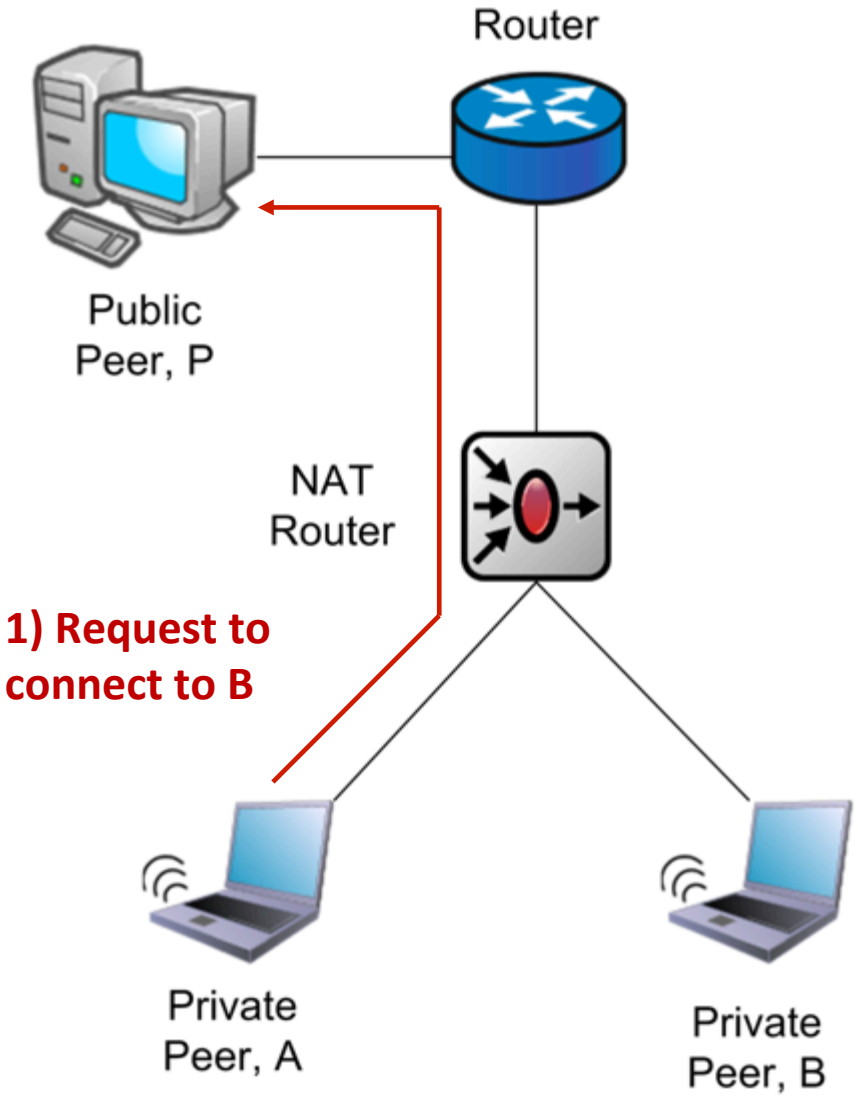

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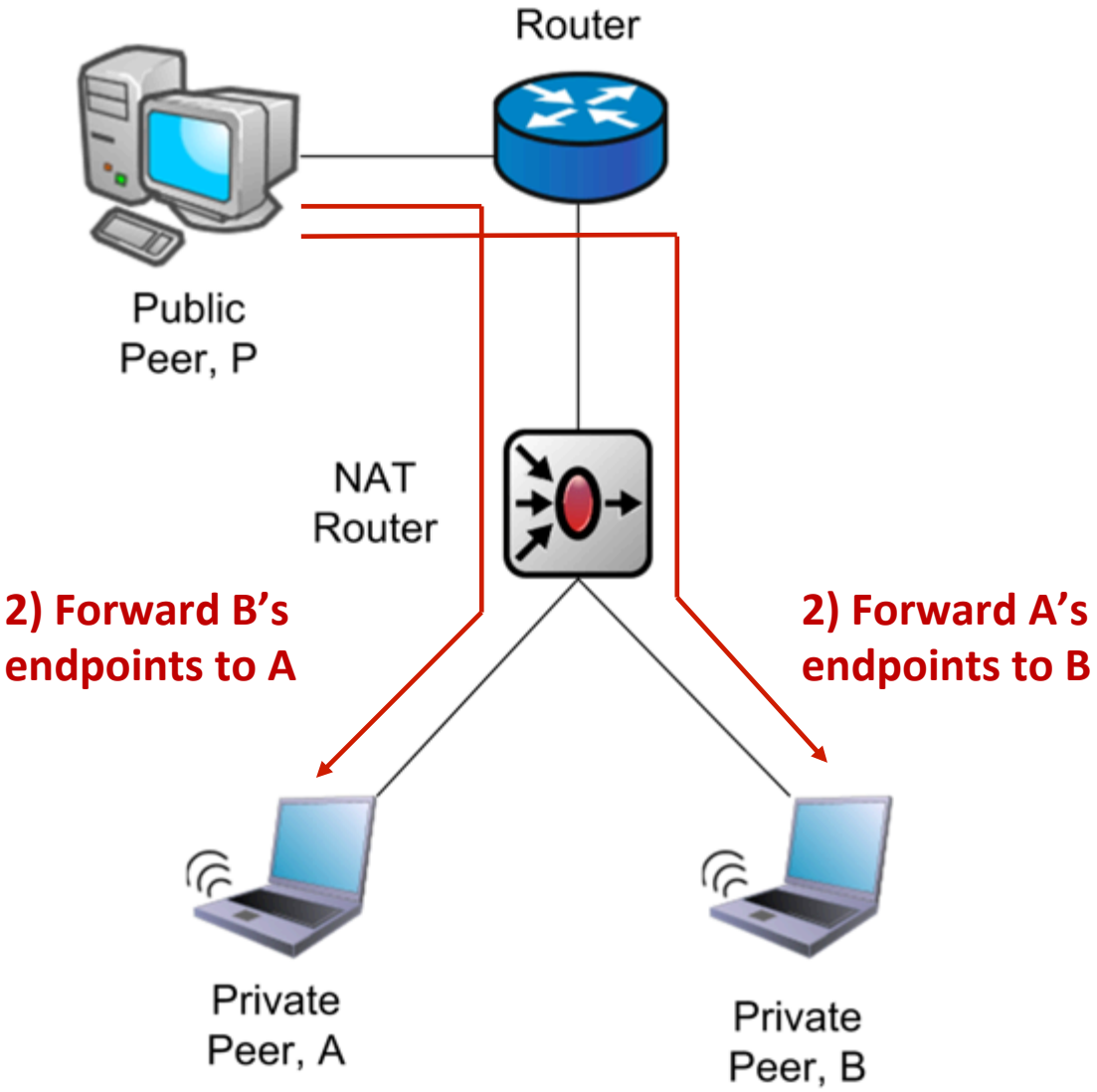

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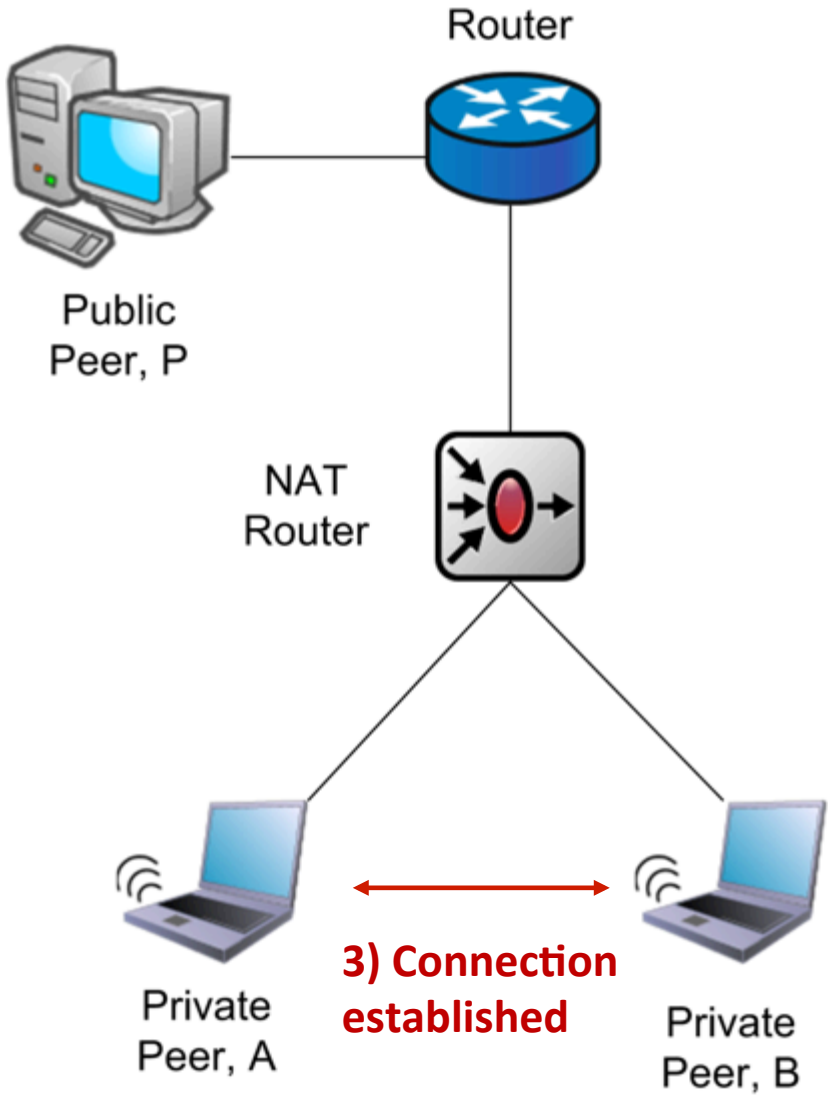
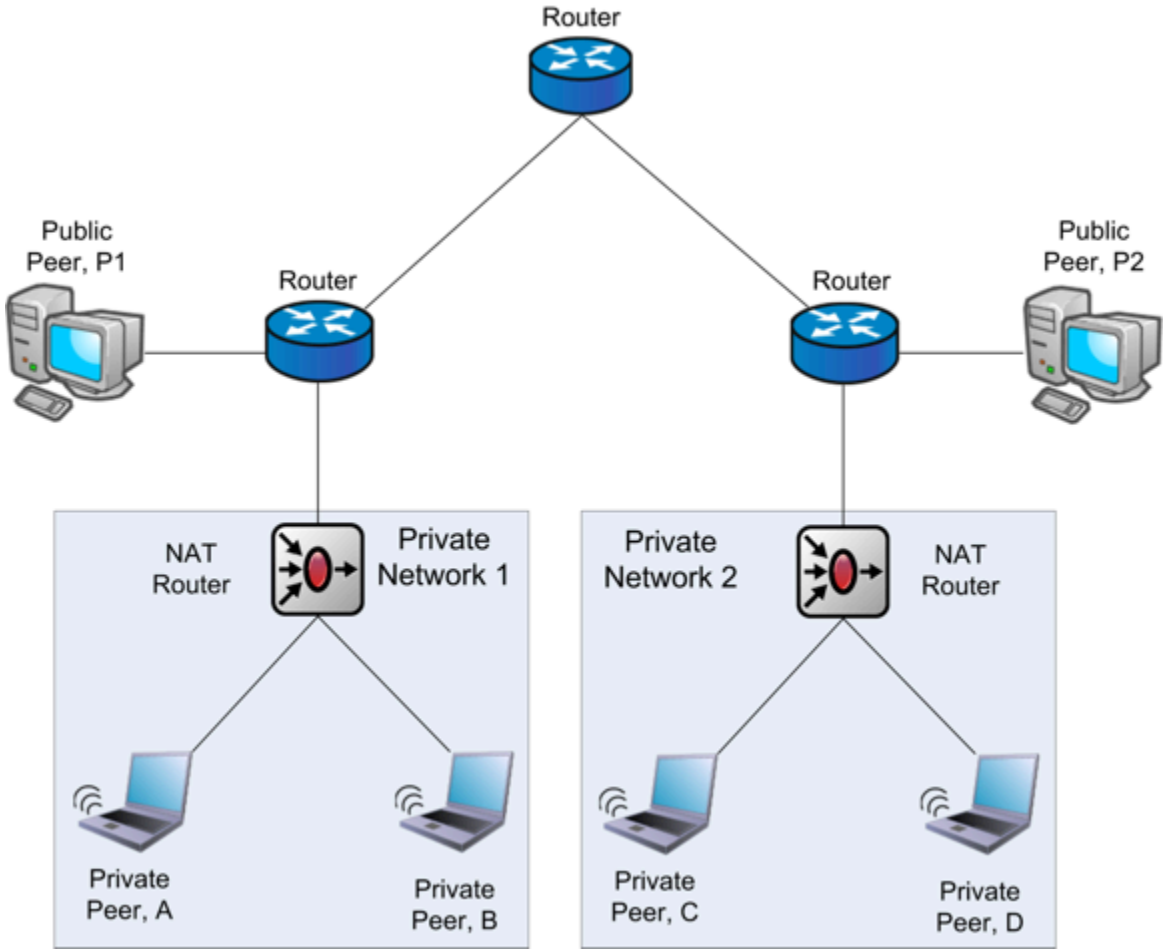


Case 2: Peers behind different NATs



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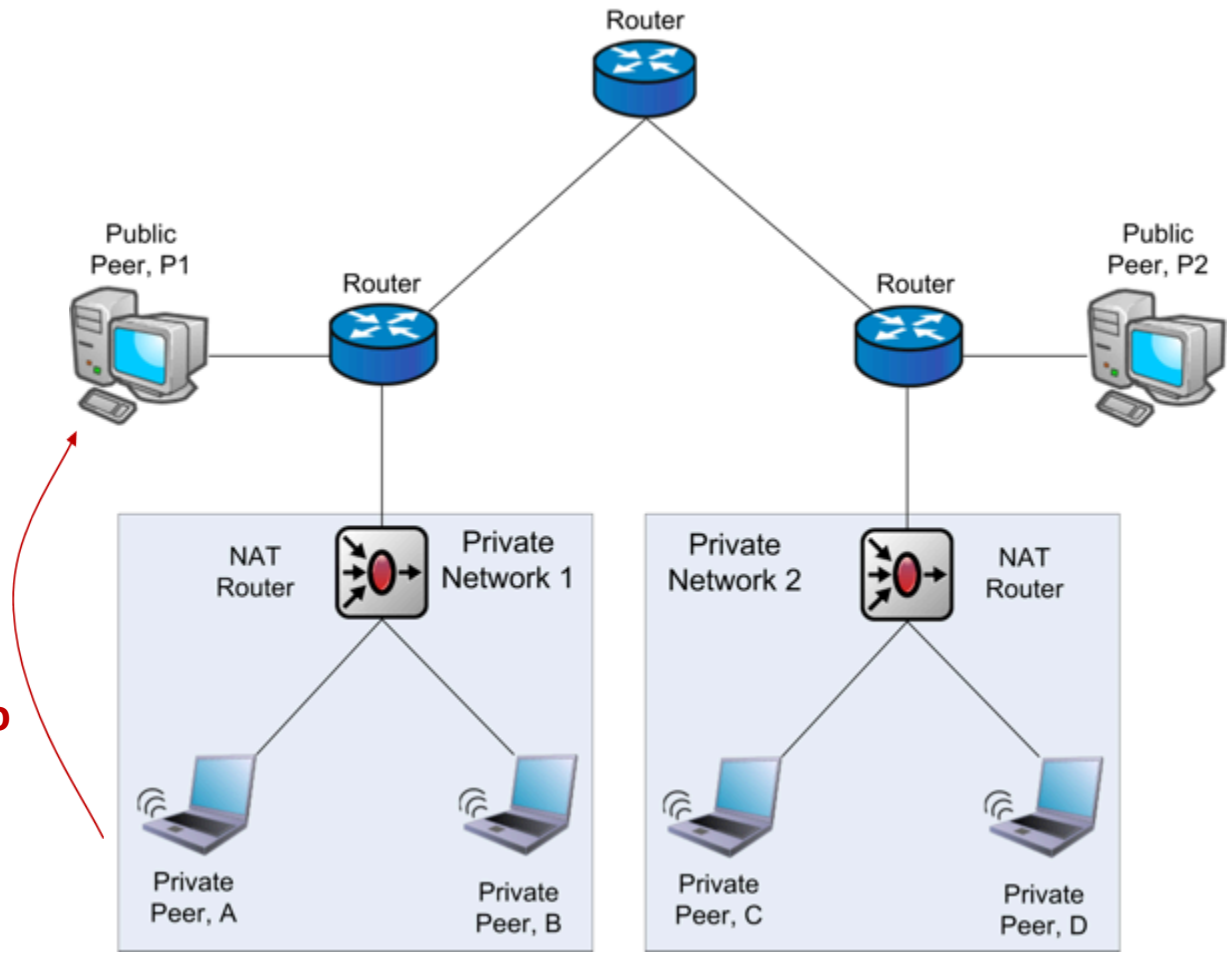
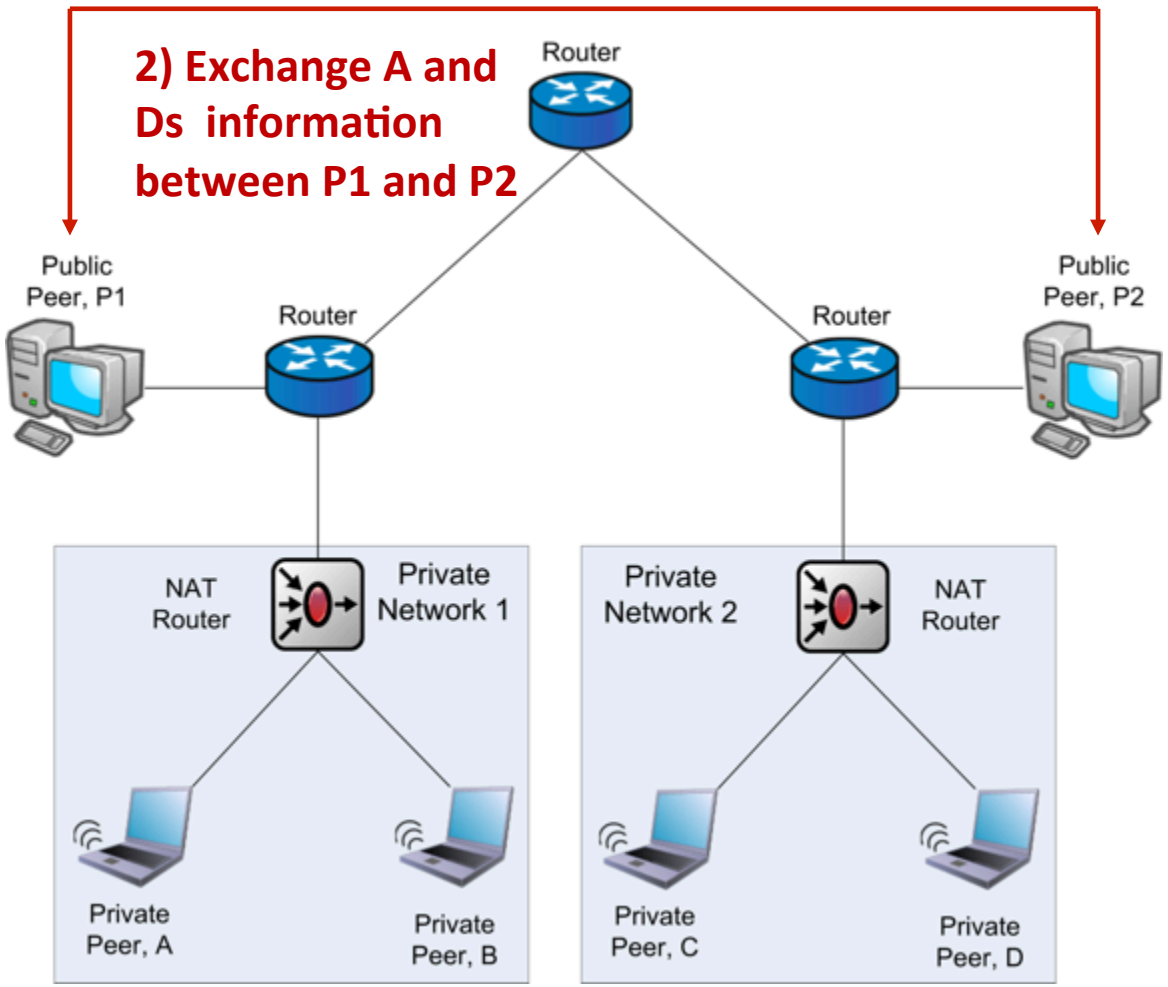


1) Request to connect to D

Case 2: Peers behind different NATs



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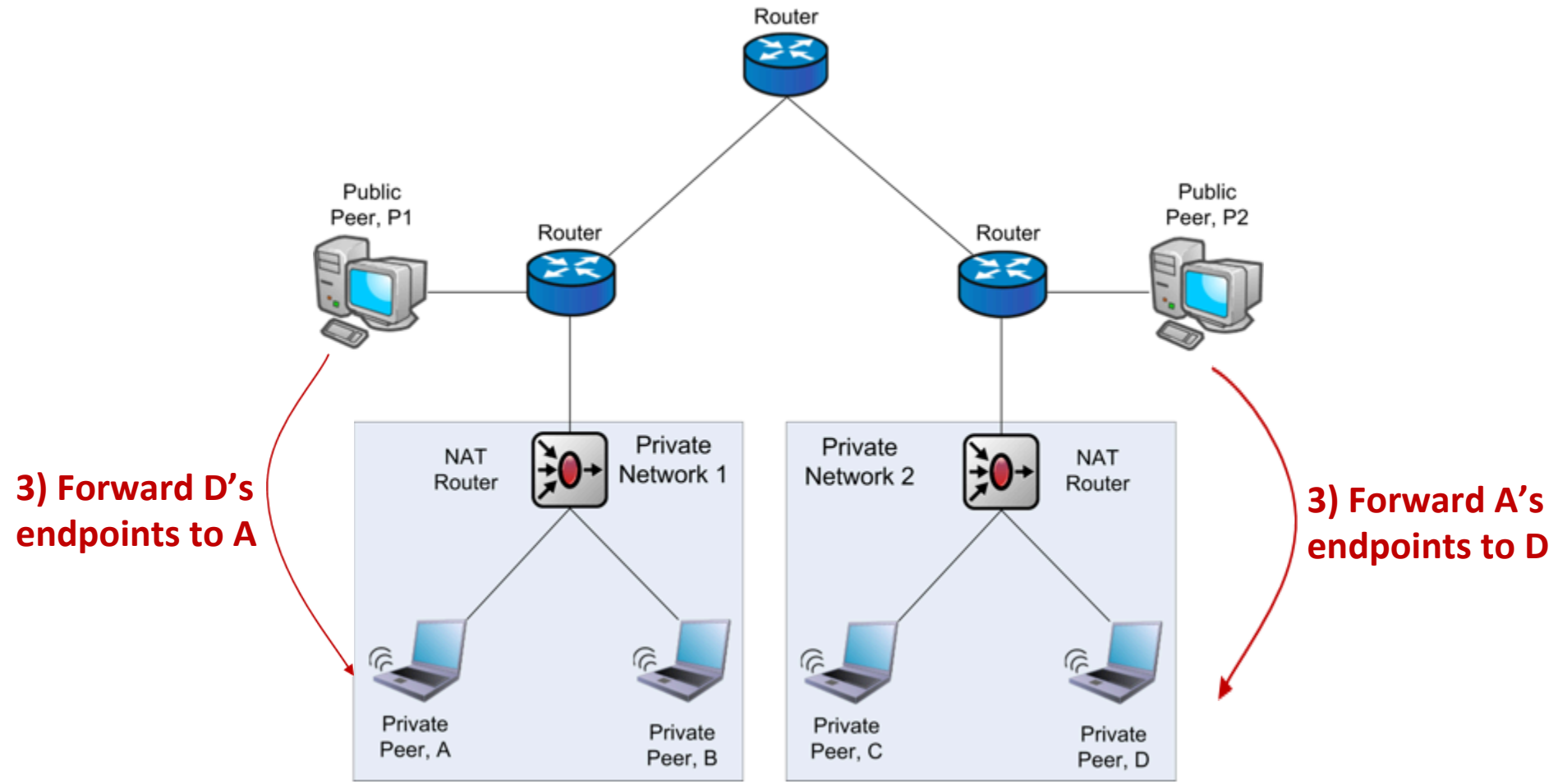

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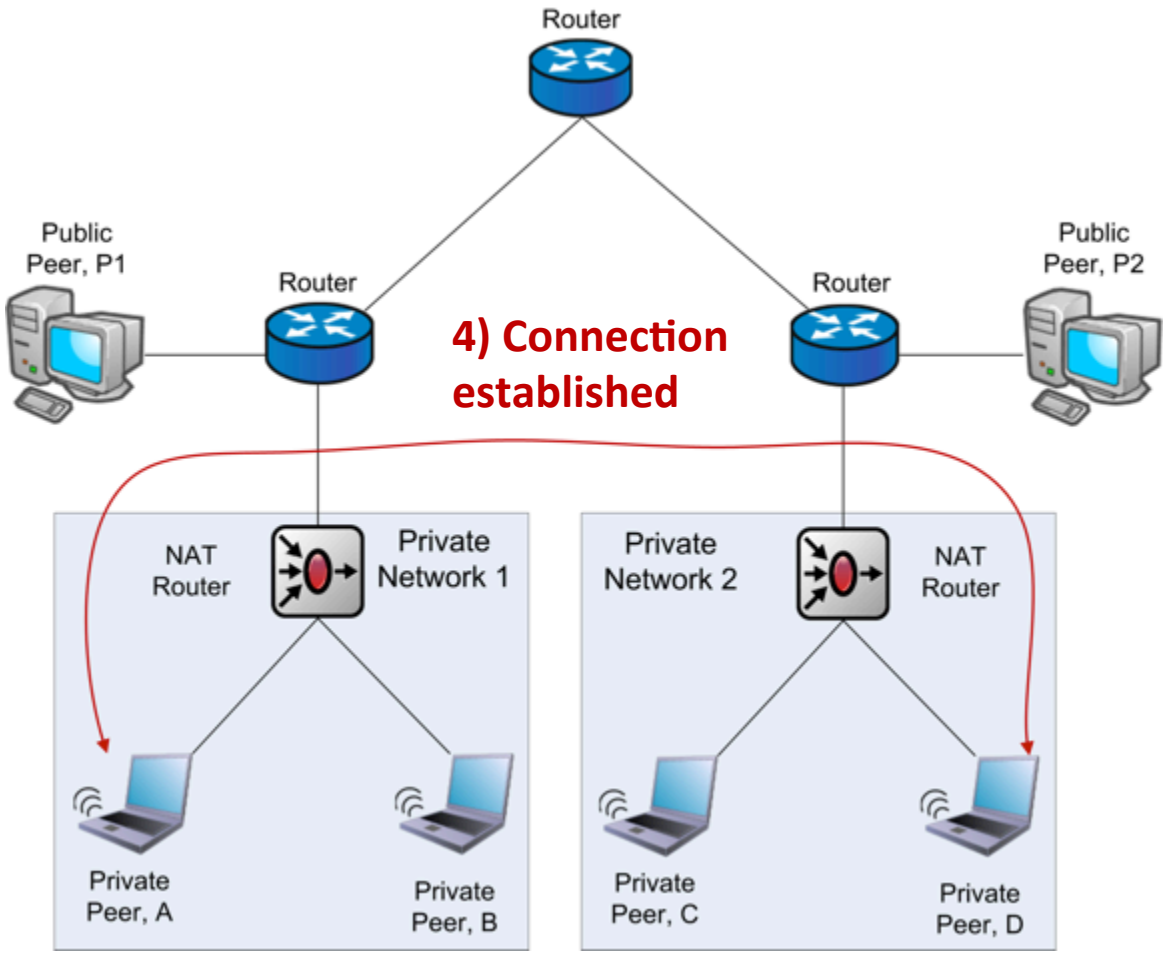

Work in Progress

- Churn and NAT aware Routing Protocol
- NATed nodes will initially utilise the recursive routing. In cases when these nodes sense high churn in the environment, they will use the iterative routing scheme
- Non-NATed nodes will utilise the iterative routing first. If they sense moderate/low level of churn they will switch to recursive routing
- Started writing my thesis