How to play libnice-ly with your NAT

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Summary

- What is a NAT?
  - Problems with NATs
  - How to punch holes in a NAT?
  - Types of NATs
- What is ICE?
  - What does it do ?
  - How does it work ?
- What is Libnice?
  - How to use libnice
- Future plans, links, questions?

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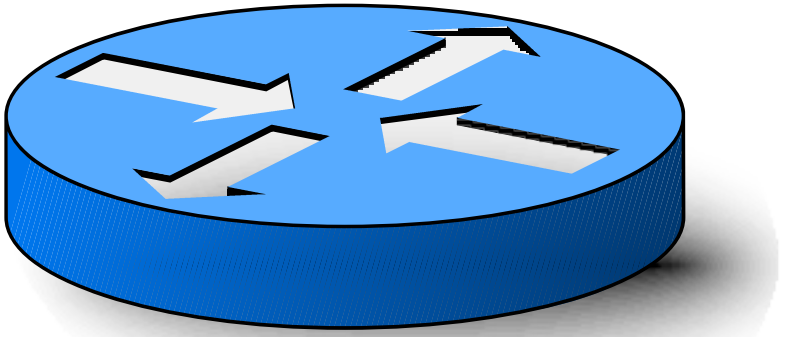

What is a NAT?

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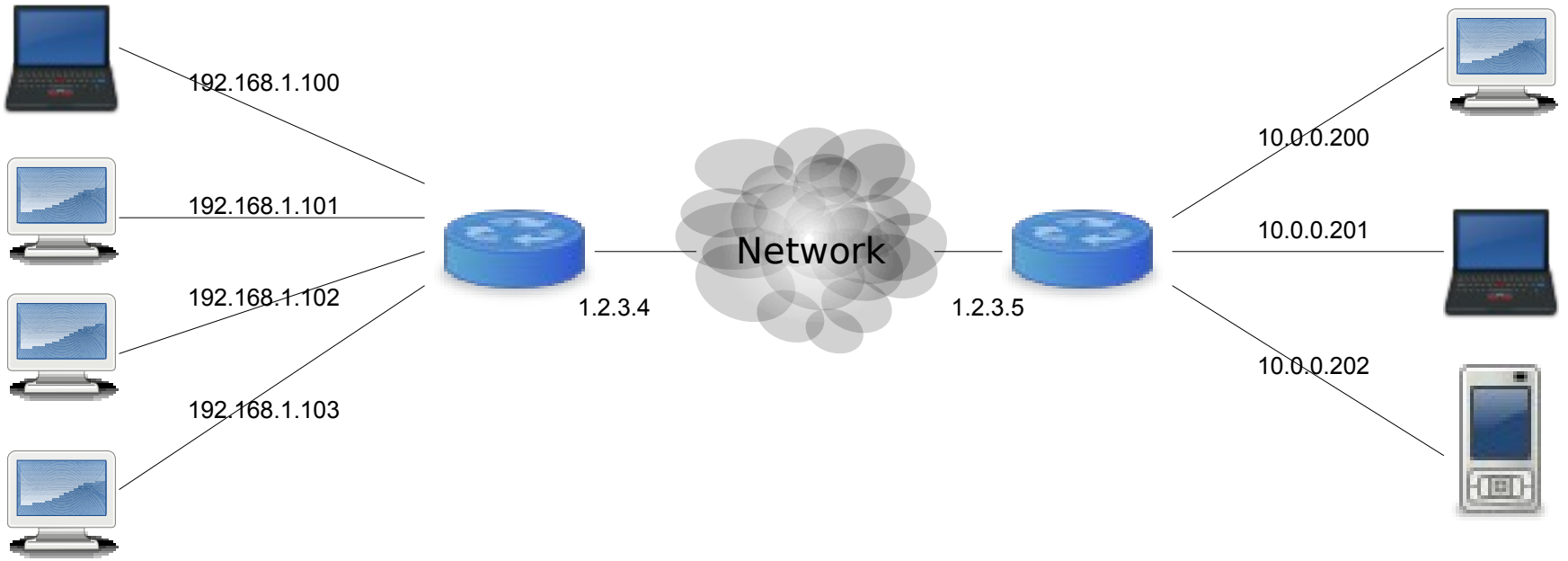
What is a NAT?

- NAT == Network Address Translation
- Allows multiple computers inside the NAT to have an IP address but share the same external IP
- Fixes the problem of the limit of IPv4 IP addresses available
- A gateway does the translation and everything is routed through it

What is a NAT ?



Example of two NATs

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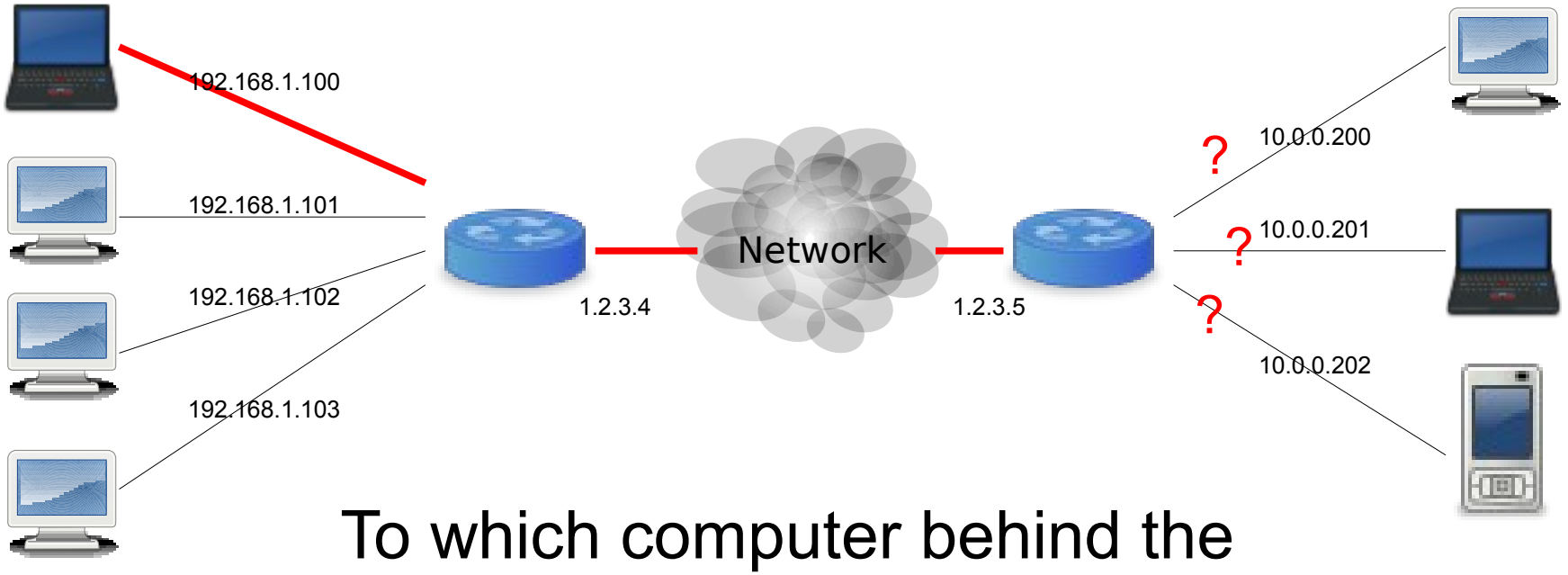
Problems with NATs



To which computer behind the NAT should the router forward data to when it receives data from the network

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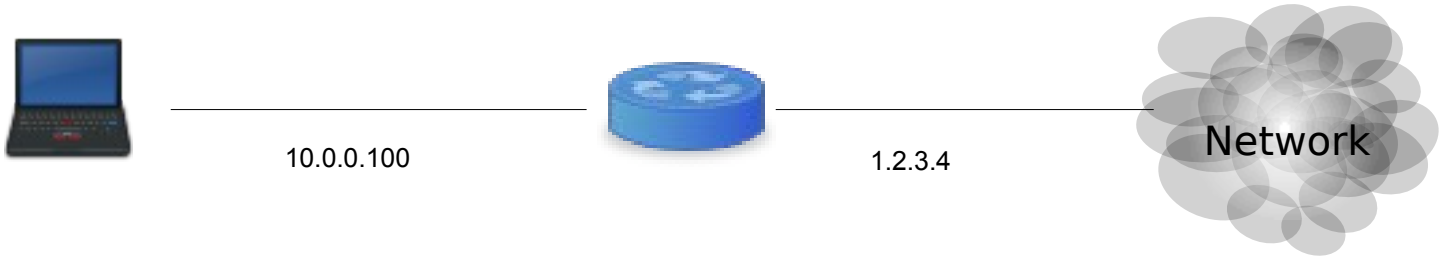
How to punch holes in a NAT?



IP : PORT	IP : PORT

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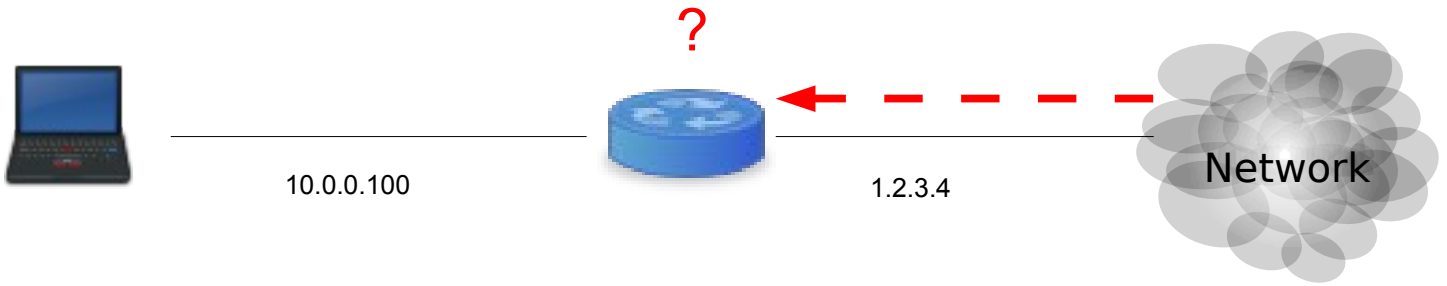
How to punch holes in a NAT?



IP : PORT	IP : PORT

Router receives a packet on port 1234 to IP 1.2.3.4.
Message is dropped by the router

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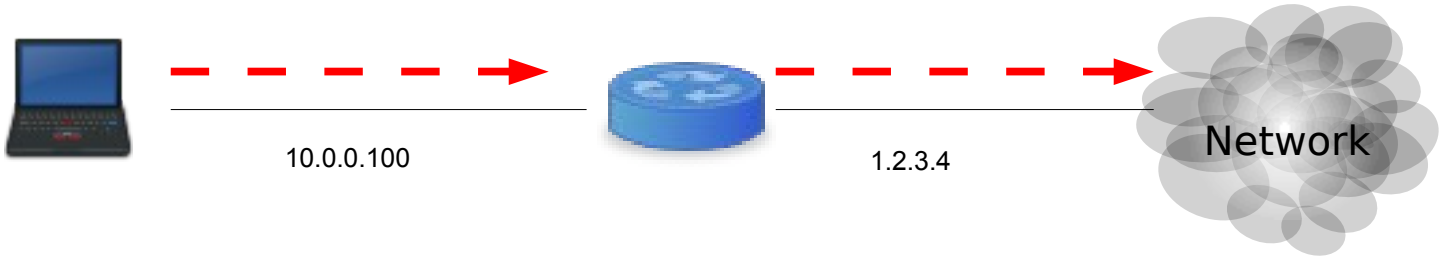
How to punch holes in a NAT?



IP : PORT	IP : PORT
10.0.0.100:1234	1.2.3.4:1234

PC 10.0.0.100 sends a packet to the network
Router creates a mapping from internal ip/port to external ip/port

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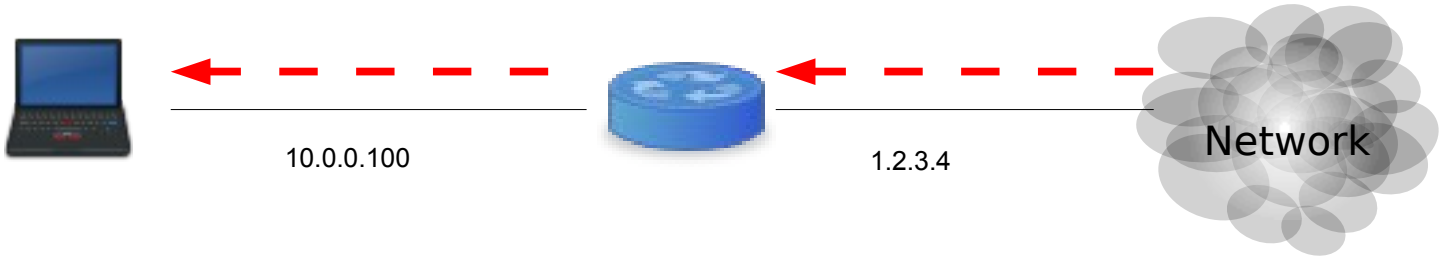
How to punch holes in a NAT?



IP : PORT	IP : PORT
10.0.0.100:1234	1.2.3.4:1234

Router receives a packet on port 1234 to IP 1.2.3.4.
Router finds the mapping and forwards the packet

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Types of NAT

* **Full cone NAT**, also known as one-to-one NAT

IP : PORT	IP : PORT
10.0.0.100:1234	1.2.3.4:1234

* **(Address) Restricted cone NAT**

IP : PORT	IP : PORT / DESTINATION
10.0.0.100:1234	1.2.3.4:1234 / 1.2.3.5
10.0.0.100:1234	1.2.3.4:1234 / 1.2.3.6

Types of NAT

* **Port-Restricted cone NAT**

IP : PORT	IP : PORT / DESTINATION : PORT
10.0.0.100:1234	1.2.3.4:1234 / 1.2.3.5:1234
10.0.0.100:1234	1.2.3.4:1234 / 1.2.3.6:4321

* **Symmetric NAT**

IP : PORT	IP : PORT / DESTINATION : PORT
10.0.0.100:1234	1.2.3.4:11111 / 1.2.3.5:1234
10.0.0.100:1234	1.2.3.4:22222 / 1.2.3.5:4321

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What is ICE?

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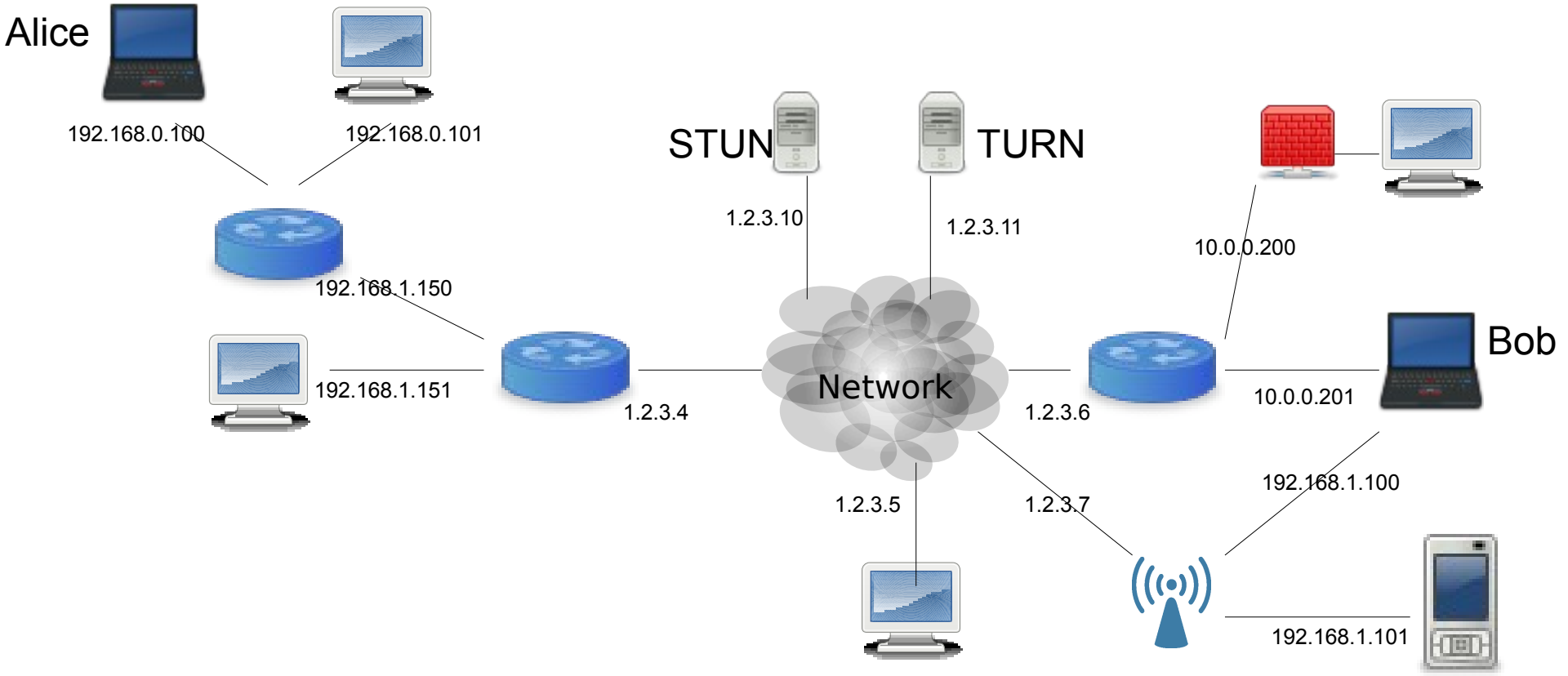
What does it do ?

- The Interactive Connectivity Establishment (ICE) is an RFC Draft (Currently Draft 19)
- It defines a methodology rather than a protocol
- It makes your life easier (when you don't have to implement it)
- It makes sure that two peers are able to connect to each other no matter which network topology they have
- Uses STUN to punch holes in the NAT

How does it work ?



Step One : Take this type of network topology

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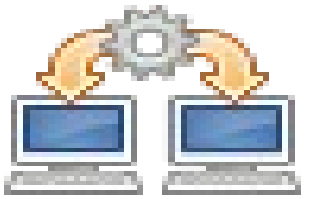
How does it work ?



Step two: Make it appear to you like this

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How does it work ?

- Gathers multiple 'candidates'
- Uses STUN for UDP hole punching
- Creates multiple candidate pairs between local and remote candidates and validates each pair's connectivity
- Elects the valid candidate pair with the highest priority to be used for peer to peer data transfer
- Uses TURN if direct connectivity is impossible

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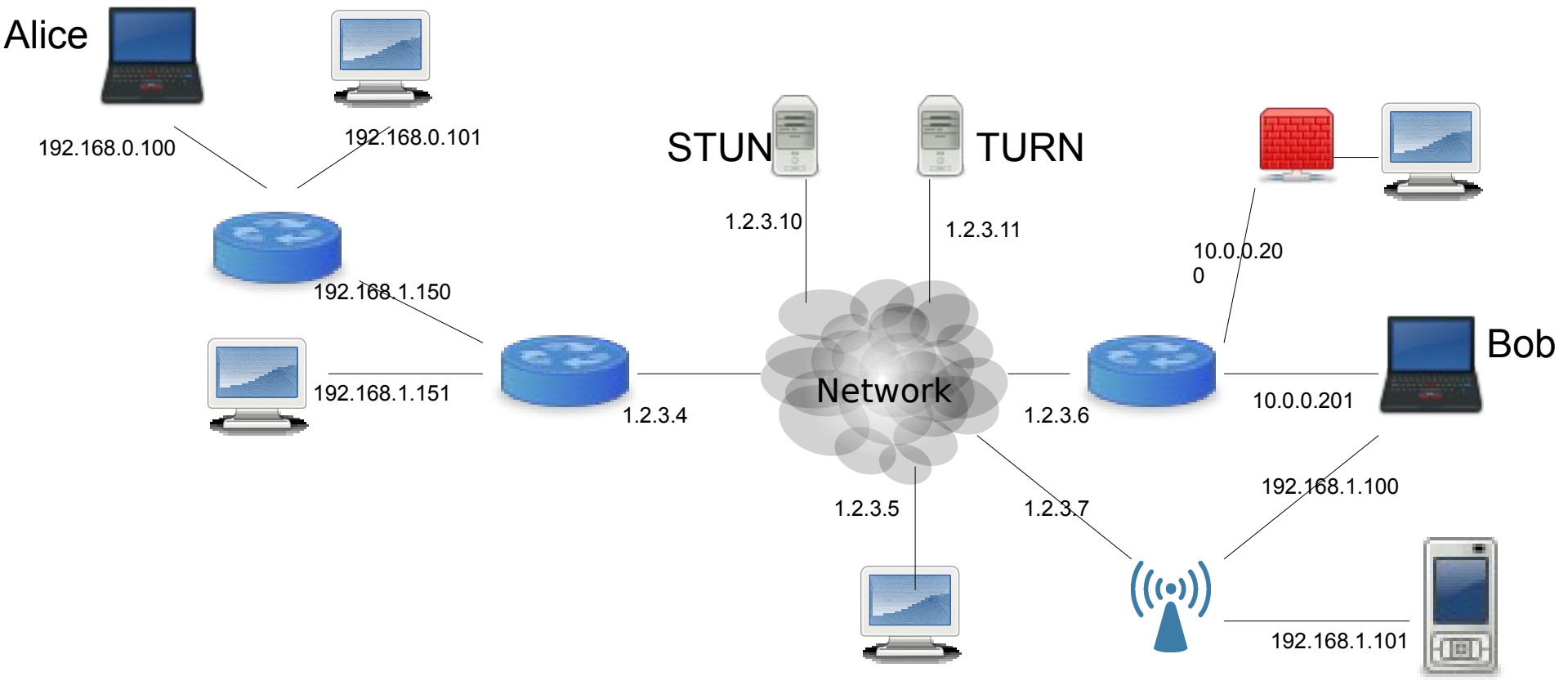
How does it work ?



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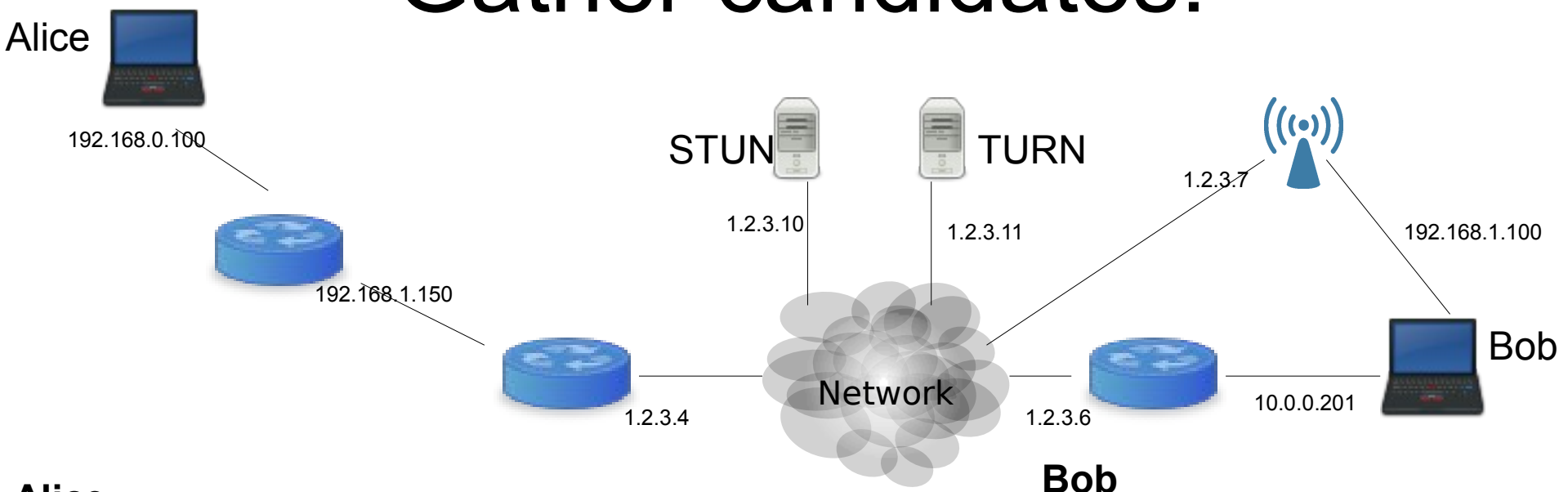
How does it work ?
Gather candidates!



Alice

Host candidates:
192.168.0.100 port 1234
Server reflexive candidates:
192.168.1.150 port 12345
1.2.3.4 port 123456
Relay reflexive candidates:
1.2.3.11 port 3478

Bob

Host candidates:
192.168.1.100 port 1234
10.0.0.201 port 12345
Server reflexive candidates:
1.2.3.6 port 12345
1.2.3.7 port 1234
Relay reflexive candidates:
1.2.3.11 port 54321
1.2.3.11 port 54322

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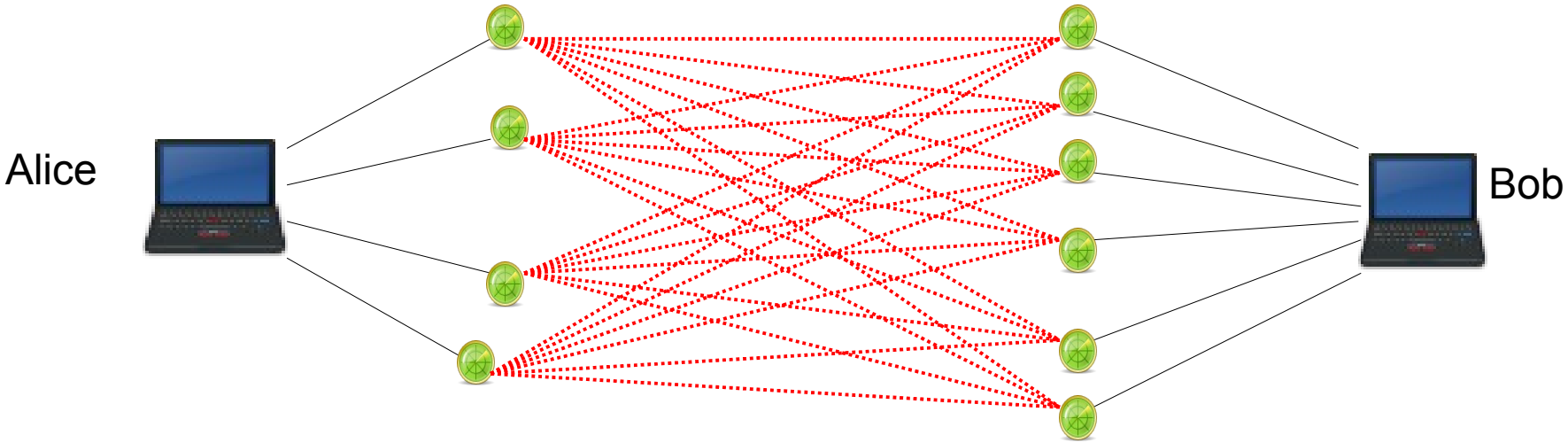
How does it work ?



Create candidate pairs and verify connectivity between each pair (STUN)

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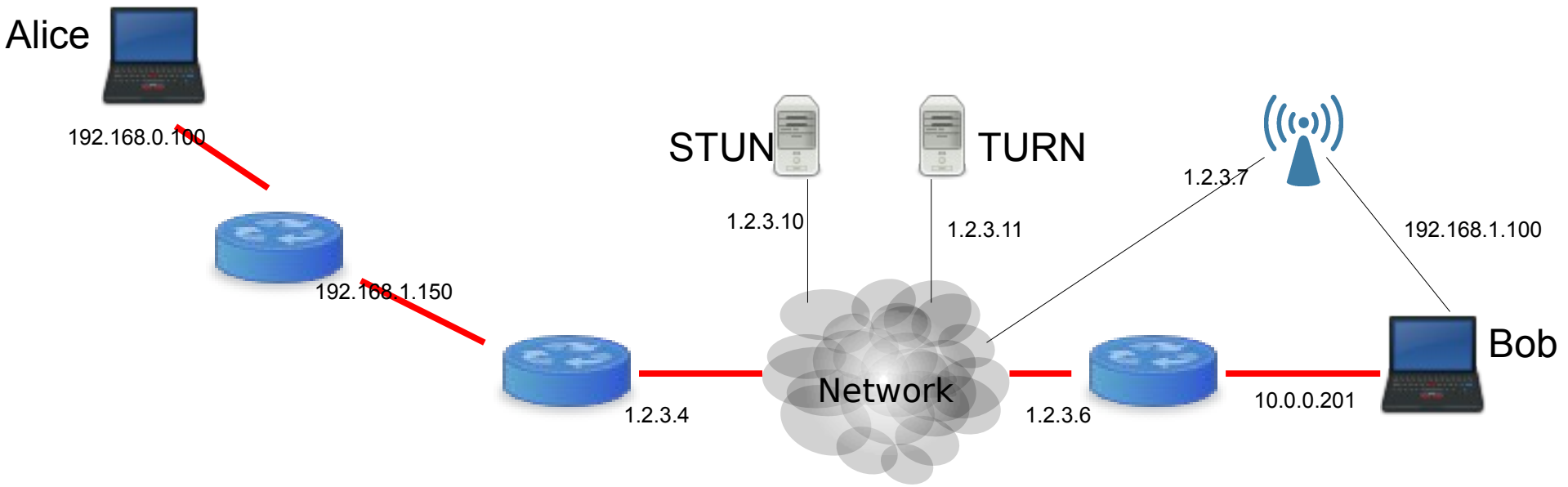
How does it work ?



Elect a valid pair and start streaming data

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What is Libnice?

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What is Libnice?

- A simple to use library implementing the ICE specifications
- Supports Draft 19, Google Talk, MSN 8.x and WLM 2009 ICE specifications
- Supports HTTP, SOCKS5 and Google's Pseudossl proxies
- Supports UDP and TCP TURN relays (TURN Draft 12, Google talk, MSN)
- Supports UPnP
- Comes with a STUN parsing and formatting library that supports STUN RFC 3489 and RFC 5389
- Gstreamer elements are available

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How to use libnice ?

```
guint stream_id;
gchar buffer[] = "hello world!";

// Create a nice agent
NiceAgent *agent = nice_agent_new (NULL, NICE_COMPATIBILITY_DRAFT19);

// Connect the signals
g_signal_connect (agent, "candidate-gathering-done",
                  cb_candidate_gathering_done, NULL);
g_signal_connect (agent, "new-selected-pair",
                    cb_new_selected_pair, NULL);

// Create a new stream with one component
stream_id = nice_agent_add_stream (agent, 1);

// Attach to the component to receive the data
nice_agent_attach_recv (agent, stream_id, 1, NULL, cb_nice_recv, NULL);
```

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How to use libnice ?

```
// Start gathering local candidates
nice_agent_gather_candidates (agent, stream_id);

// ... Wait until the signal candidate-gathering-done is fired ...
lcands = nice_agent_get_local_candidates(agent, stream_id, 1);

// ... Send local candidates to the peer and set the peer's remote candidates
nice_agent_set_remote_candidates (agent, stream_id, 1, rcands);

// ... Wait until the signal new-selected-pair is fired ...

// Send our message!
nice_agent_send (agent, stream_id, 1, sizeof(buffer), buffer);

// Anything received will be received through the cb_nice_recv callback

// Destroy the object
g_object_unref(agent);
```

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Future plans and links

- Add ICE-TCP support
- Add a reliable mode where TCP over UDP would be used
- Upgrade TURN support from Draft 12 to 15
- Add NAT-PMP support
- Integration with Telepathy D-Bus Tubes

- http://nice.freedesktop.org
- http://collabora.co.uk

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Questions ?

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