Tor61 Project

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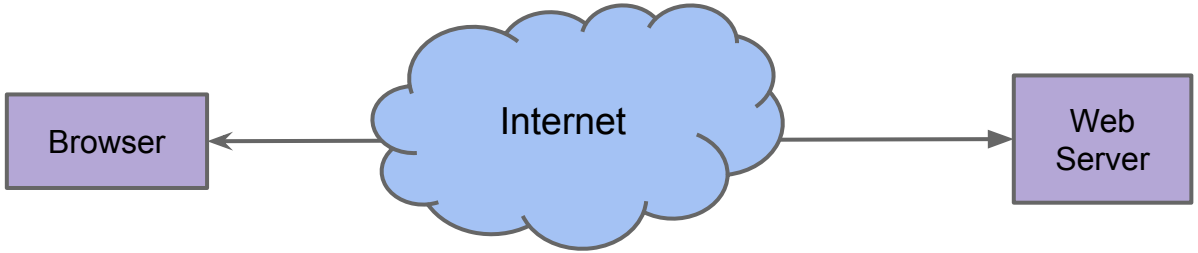
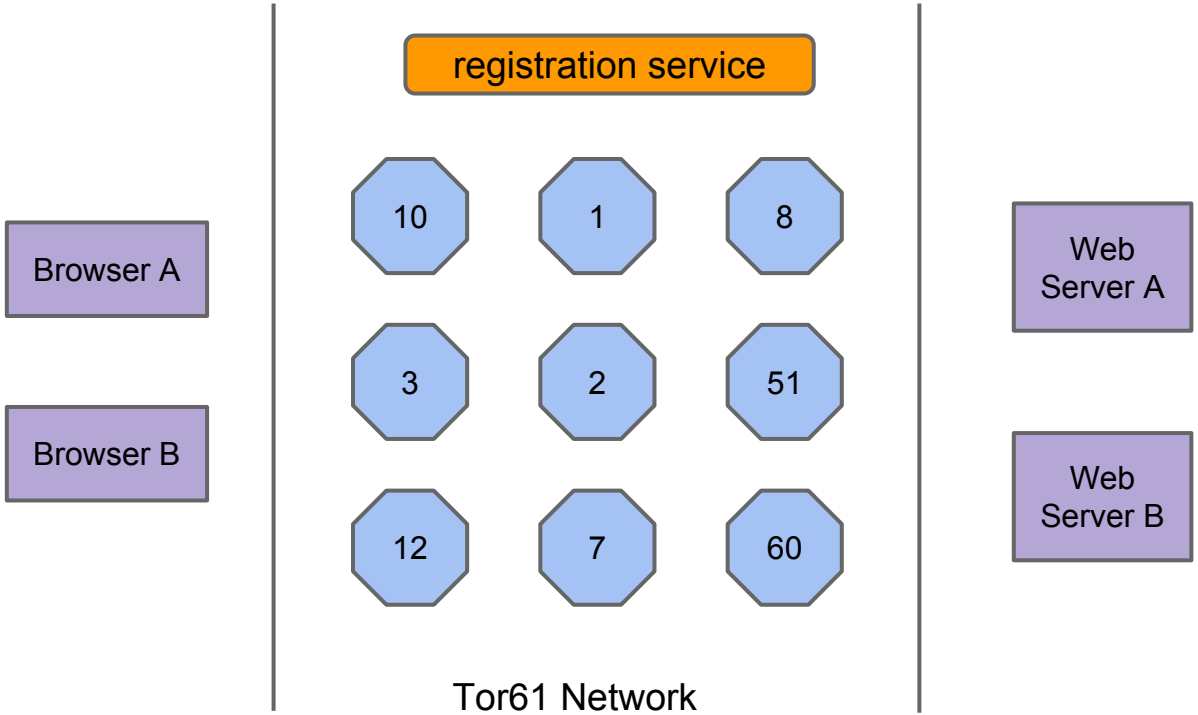
CSE 461 15sp Section 7

Why we would want Tor/Tor61?



- Packets can be sniffed -- headers reveal src/dest IP
- Encryption of packet payload is not enough!
- Tor allows you to browse the Internet anonymously
- Route your data through a random pathway so that no single node can tell the src/dst of your data
- Good: evade surveillance? Bad: Silk Road?
- Tor61 is a simplified Tor -- no encryption

Tor61 Architecture Overview



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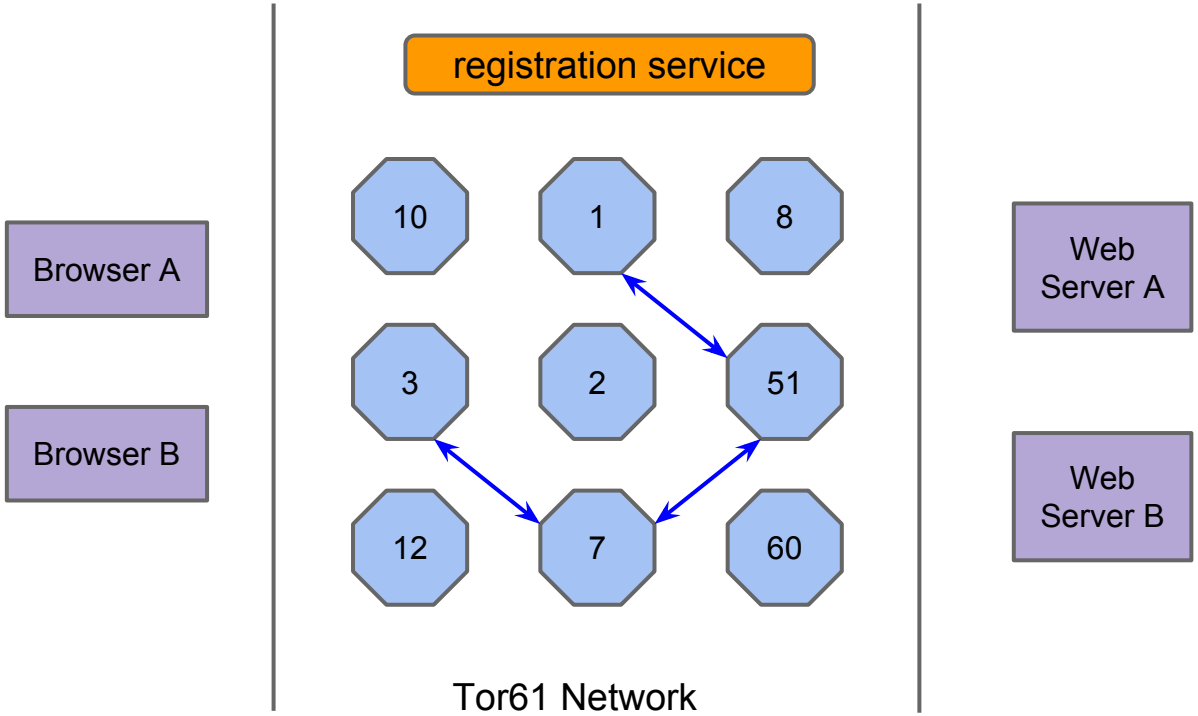

On startup, each Tor61 node establishes a single **circuit** (blue path) through the network
e.g 3-7-51-1, 10-2-3-7

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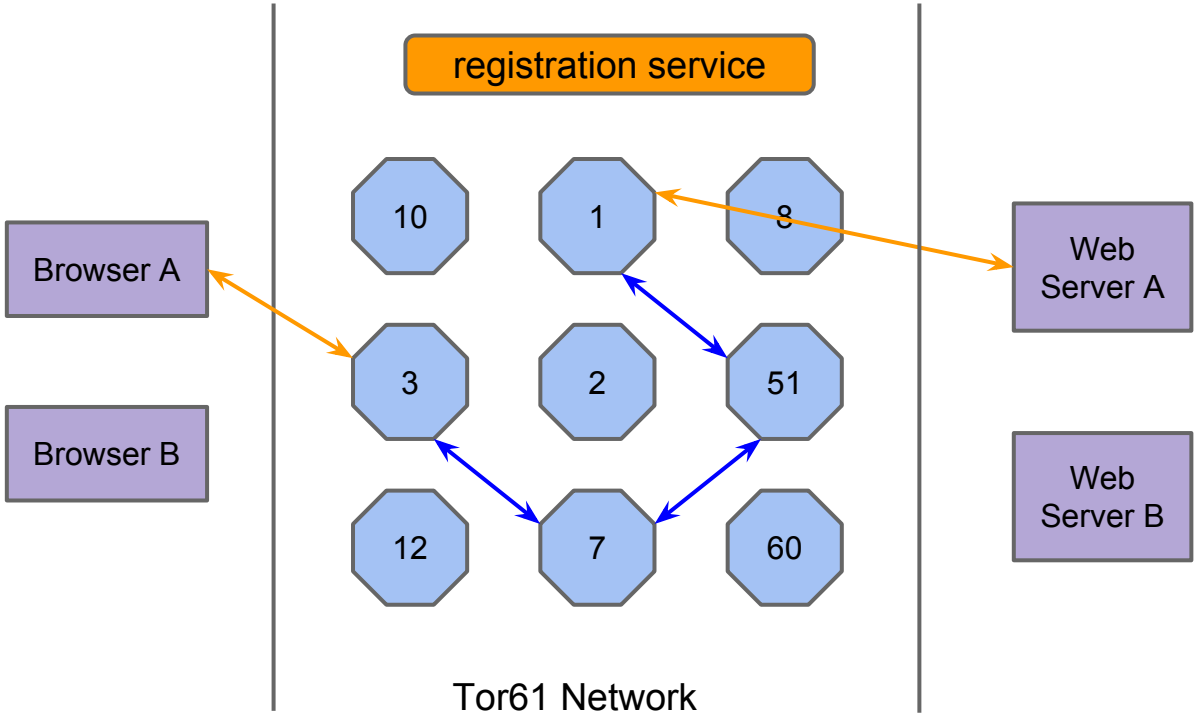

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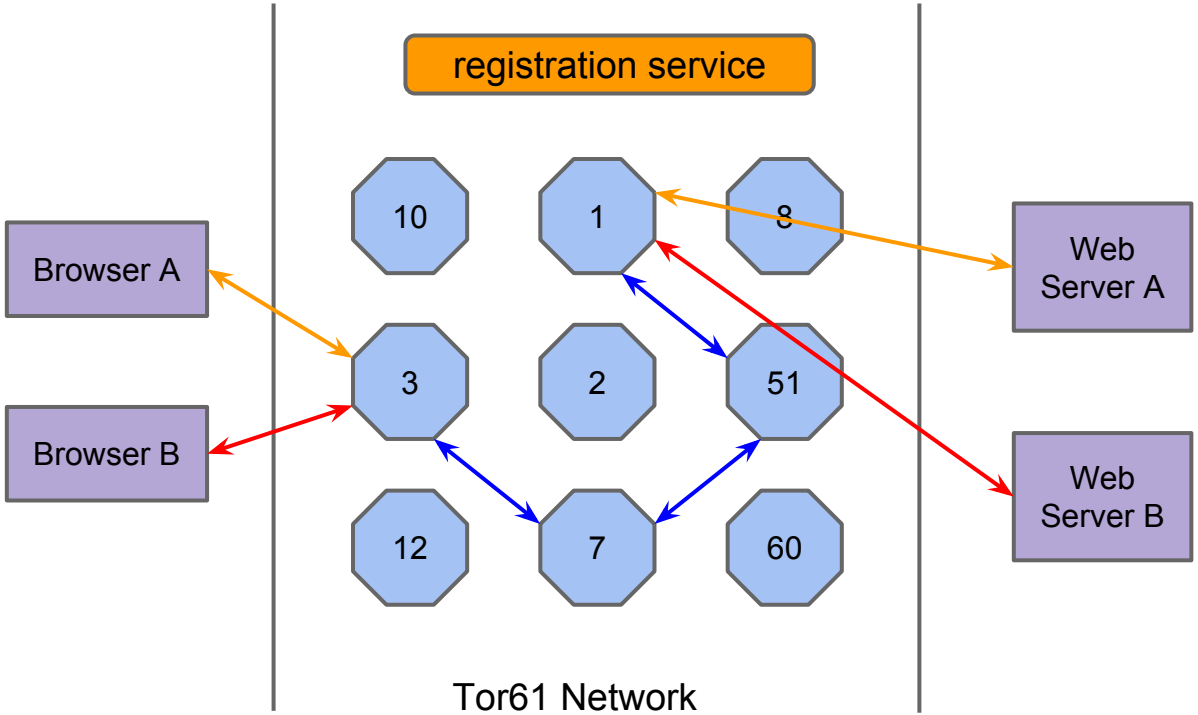

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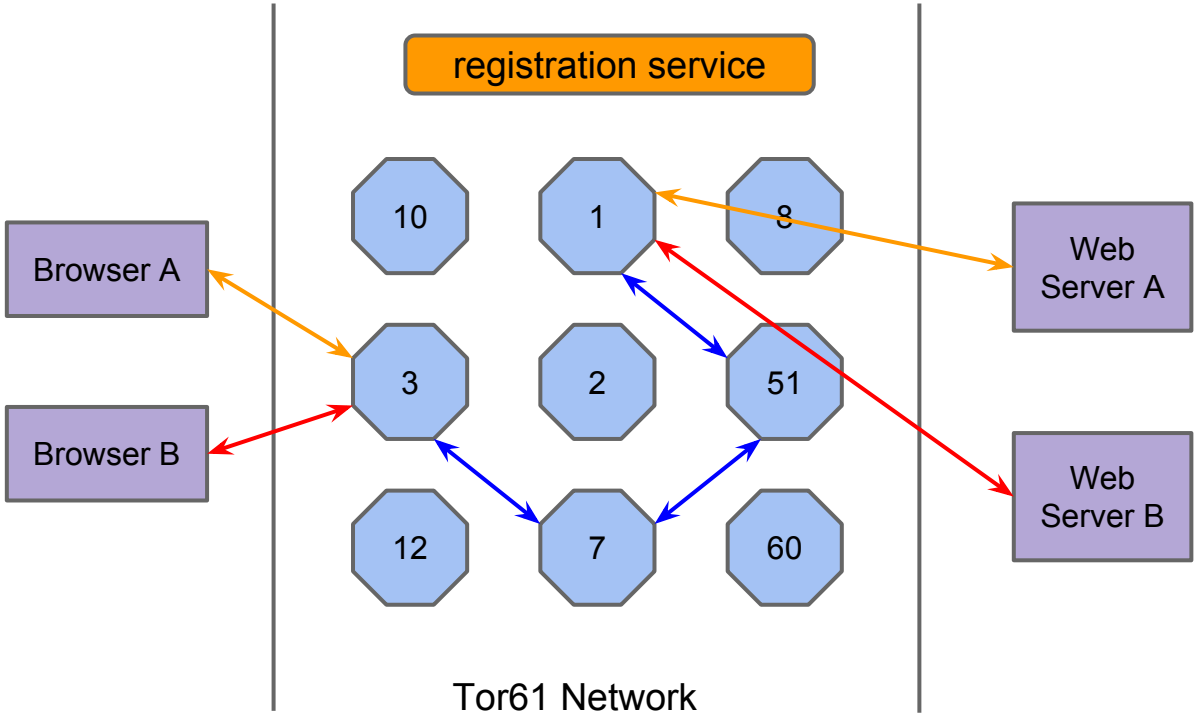

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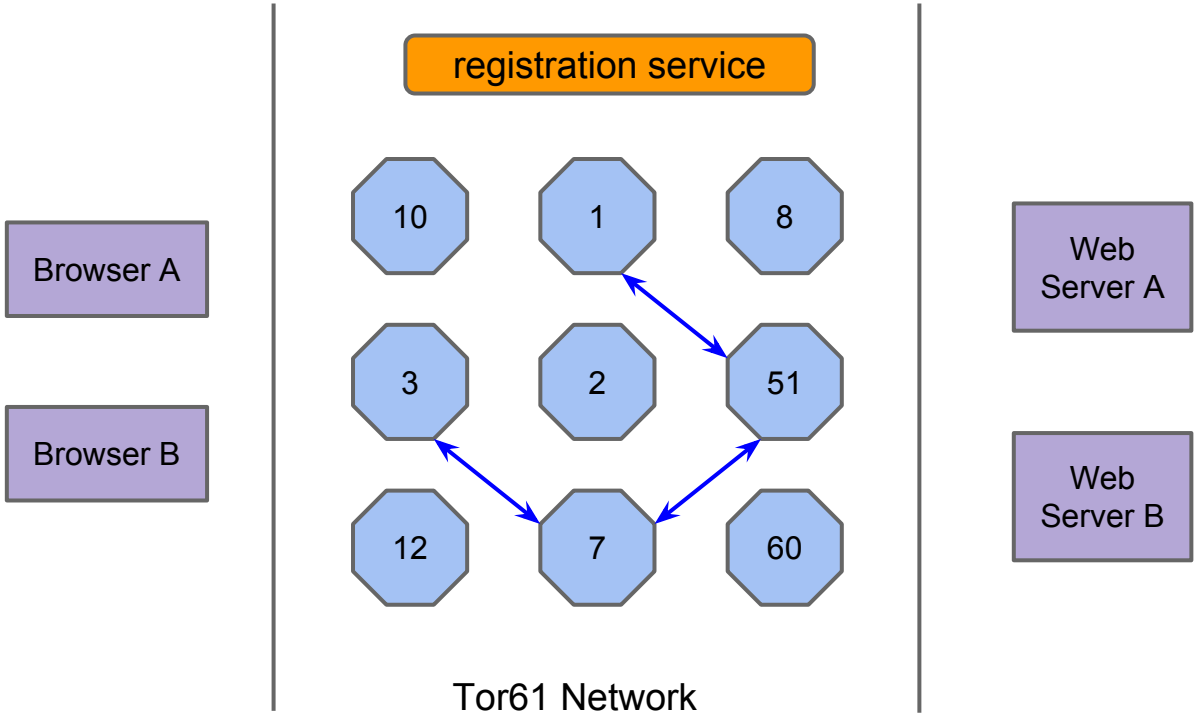

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Destroy stream and reuse circuit for other HTTP requests

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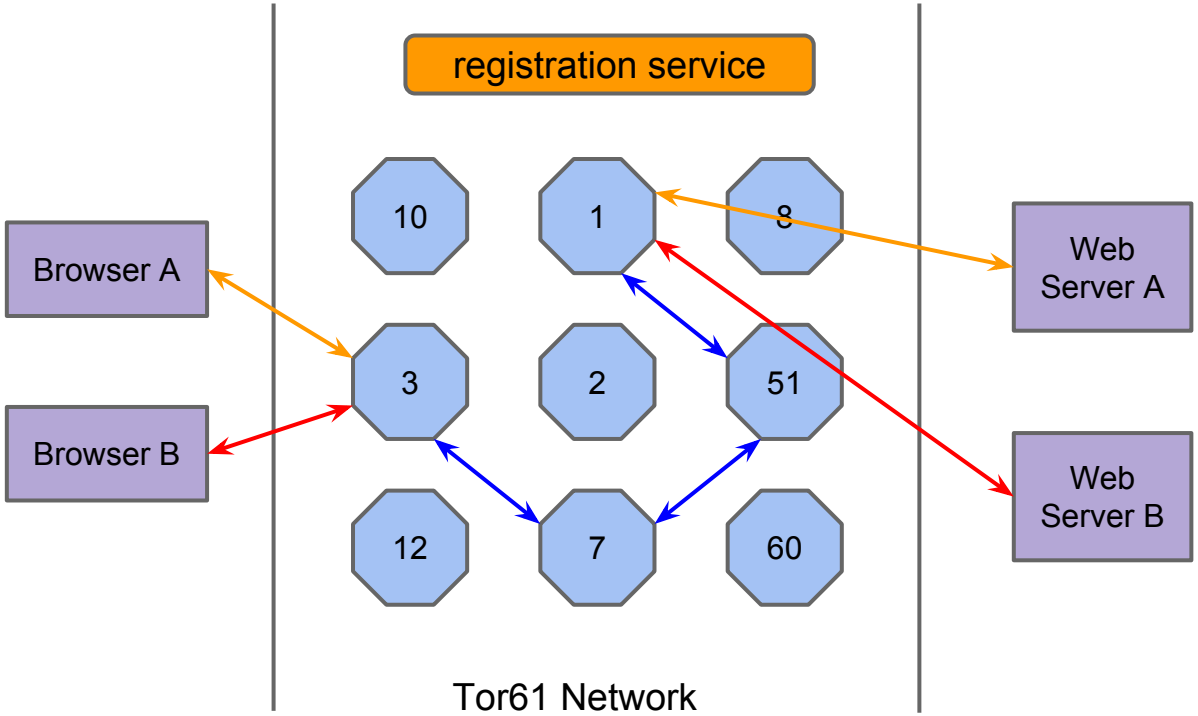
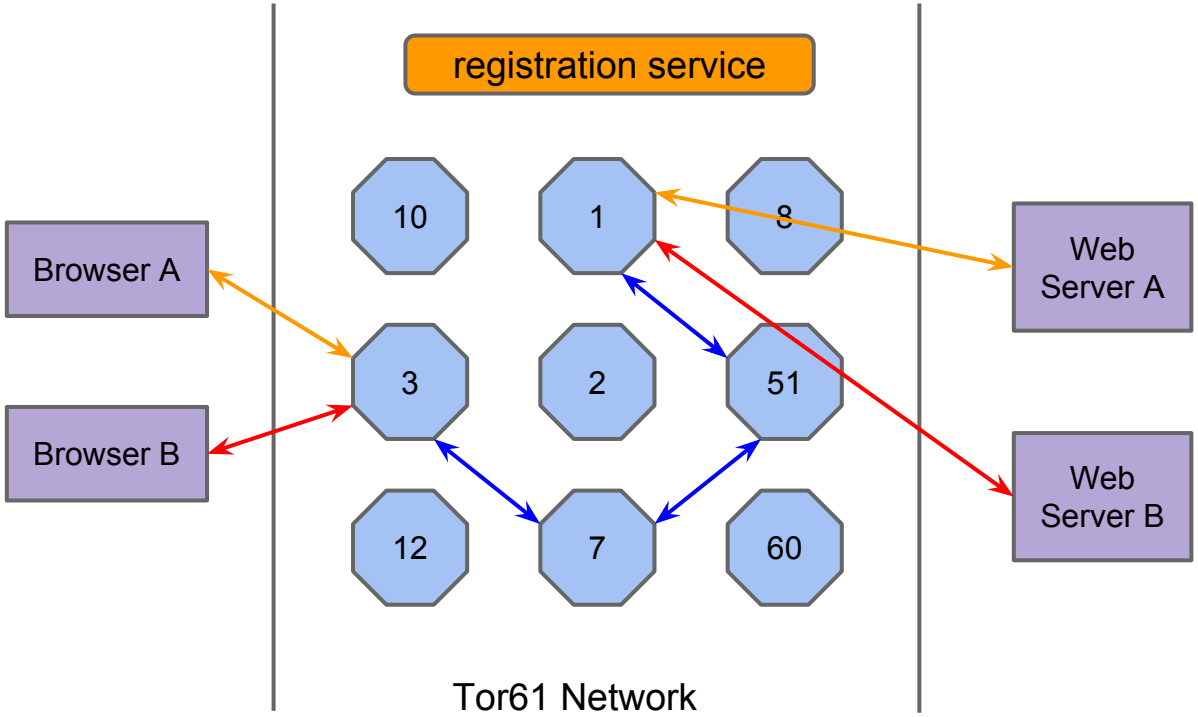


Multiplex streams on circuit
e.g. streams from A-A, B-B use the same circuit
=> need stream id

Multiplex circuits on TCP connections
e.g circuit starting at 3 (3-7-51-1) and circuit starting at 10 (10-2-3-7) share tcp connection 3-7
=> need circuit id

Why anonymous browsing now?



e.g. 3-7-51-1 and A-A request

assuming data encrypted (not for Tor61)

Using source IP, Server A thinks request is from Tor node 1 instead of Browser A

Tor node 1 only knows request is from node 51

Tor node 51 only knows request is from node 7 and sent to node 1

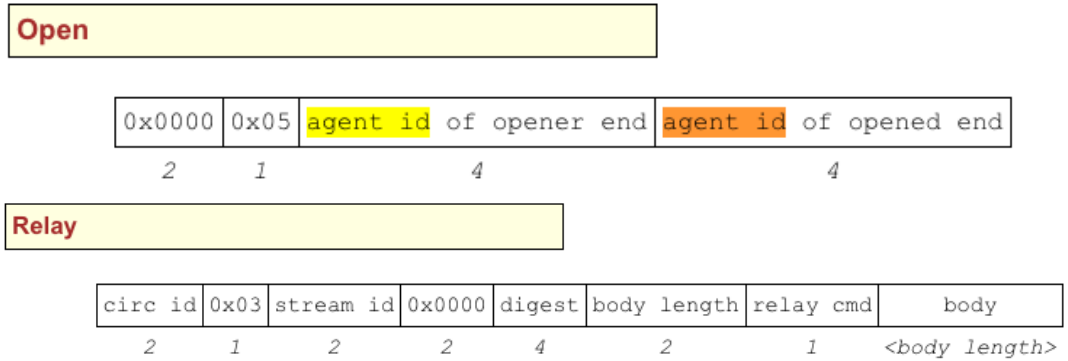
Tor node 3 knows request is from Browser A but doesn't know destination server

Tor61 Protocol and Tor61 Cells

Circuit establishment

Stream Creation

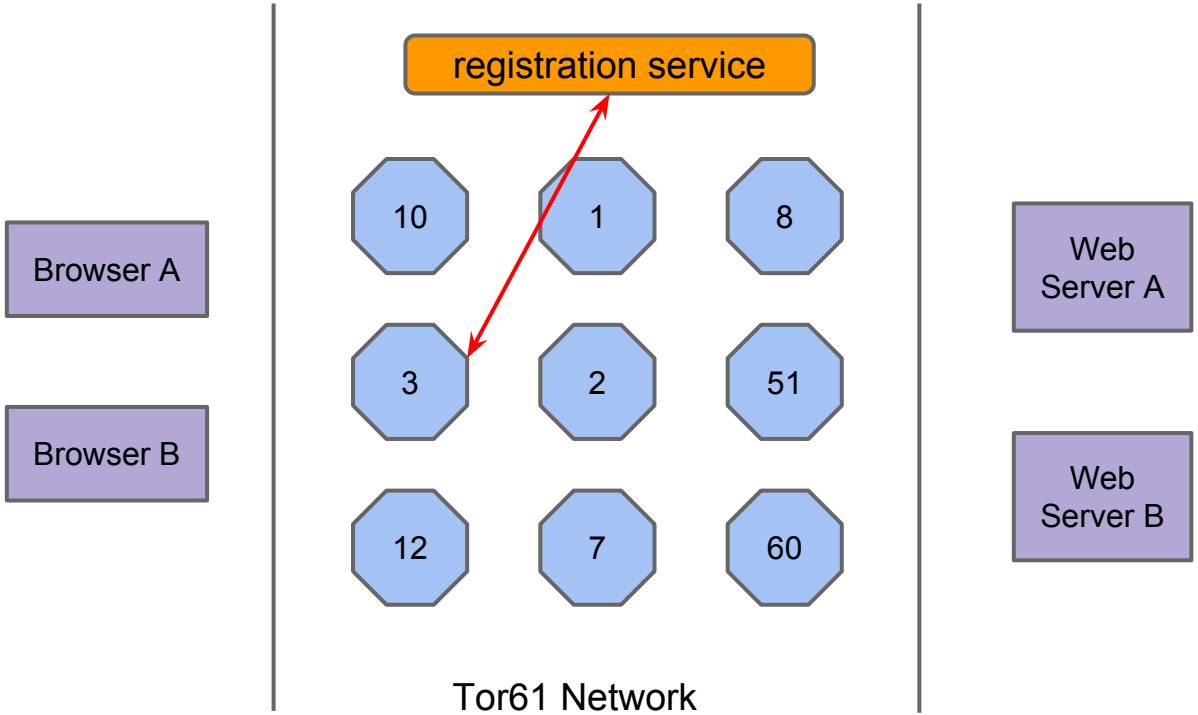
Routing data



Fixed-sized cells, padded to 512 bytes

- Control cells for next hop
  - e.g. Open, Create
- Relay cells for the last hop
  - e.g. Relay Extend, Relay Begin, Relay Data

How to create a circuit?

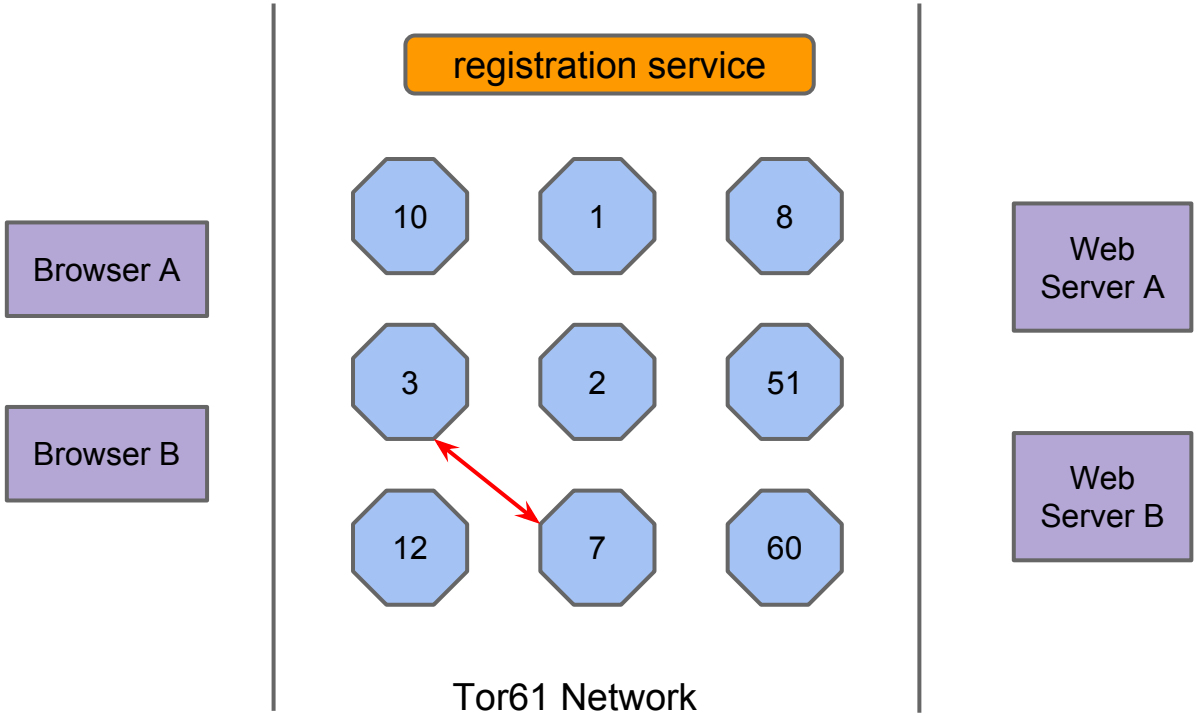


Node 3 starts up

Contacts registration service to ask which other Tor61 nodes are running

Gets a list of running Tor61 nodes, let's say all nine nodes in the figure and their IP:port information

How to create a circuit?



Node 3 picks the next router at random, let's say node 7

Opens a tcp connection to node 7 and sends Open cell

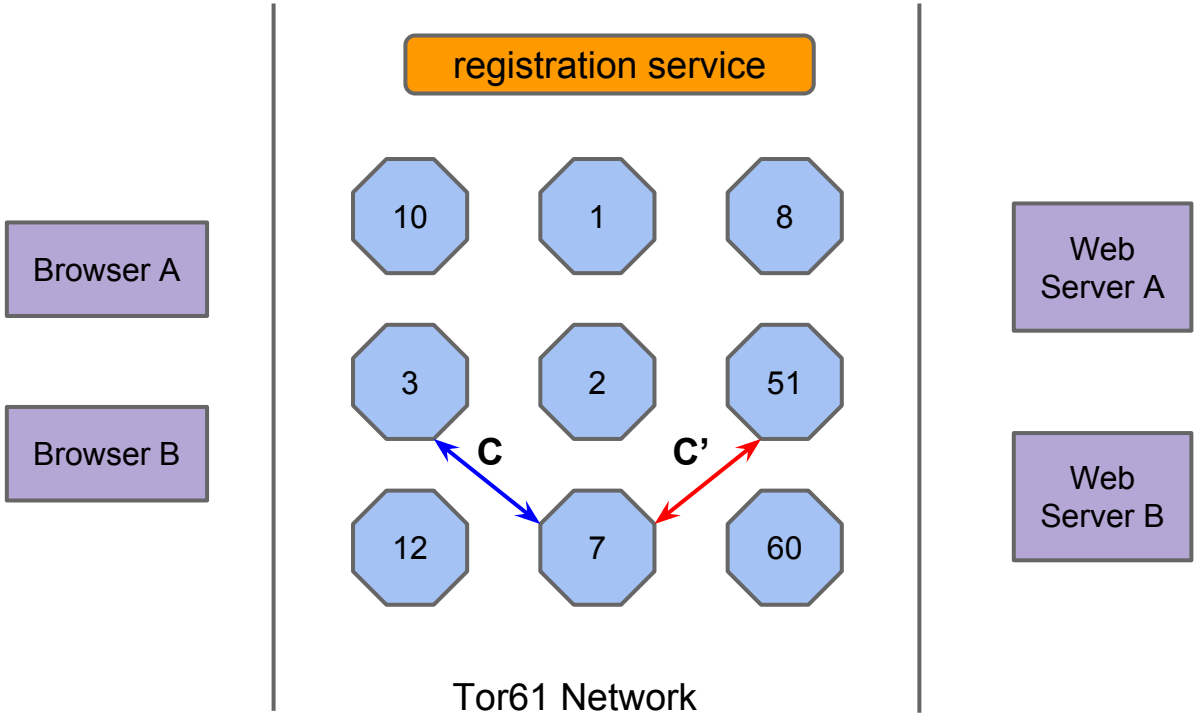
Node 7 returns Opened cell on success

Node 3 picks a circuit id, C (unique between node 3 and node 7) and sends a Create cell with circuit id C

Expect a Created cell from node 7 on success

Now we have 3-7 hop

How to create a circuit?



Node 3 picks node 51 as the next hop to extend

Node 3 sends a Relay Extend cell on circuit C. The cell contains ip: port of node 51

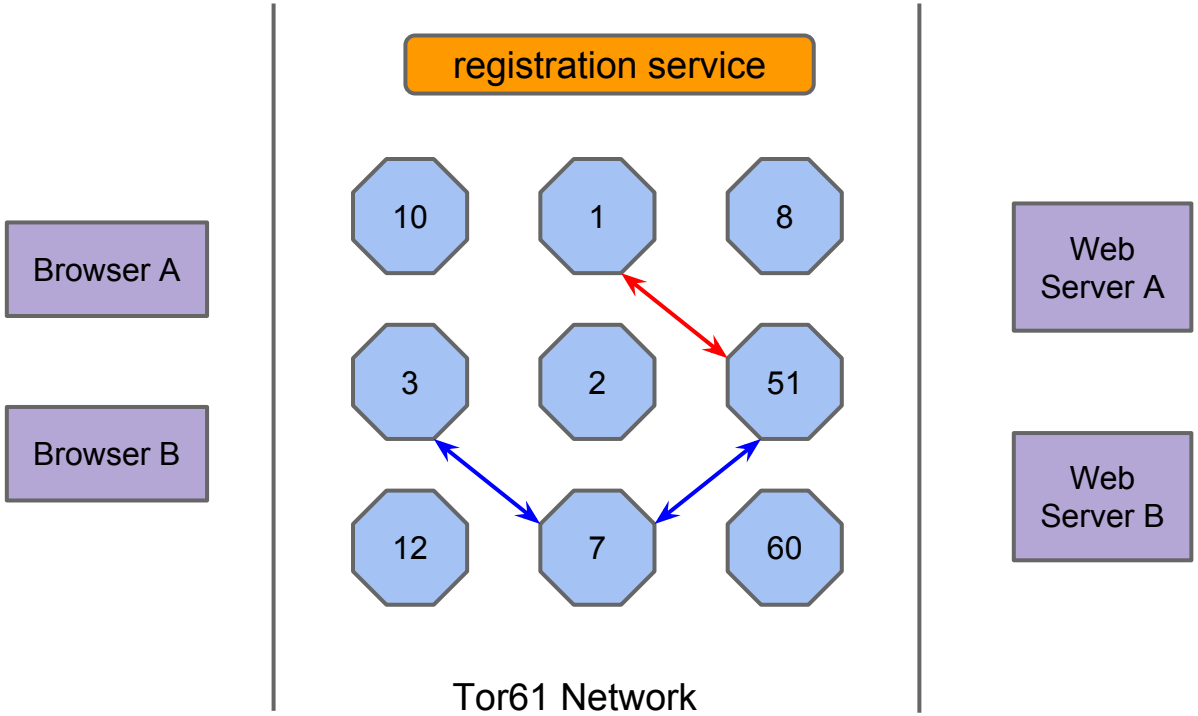
Node 7 receives Relay Extend; either uses an existing tor61 connection to node 51 or creates a new one (tcp connect+Open)

Node 7 picks a new circuit id C' (unique between 7-15), and sends node 51 a Create cell with C'

On Created, node 7 creates a new routing table entry "forward cells from circuit C to node 51 with a new circuit id C'

Node 7 sends Relay Extended back to node 3

How to create a circuit?



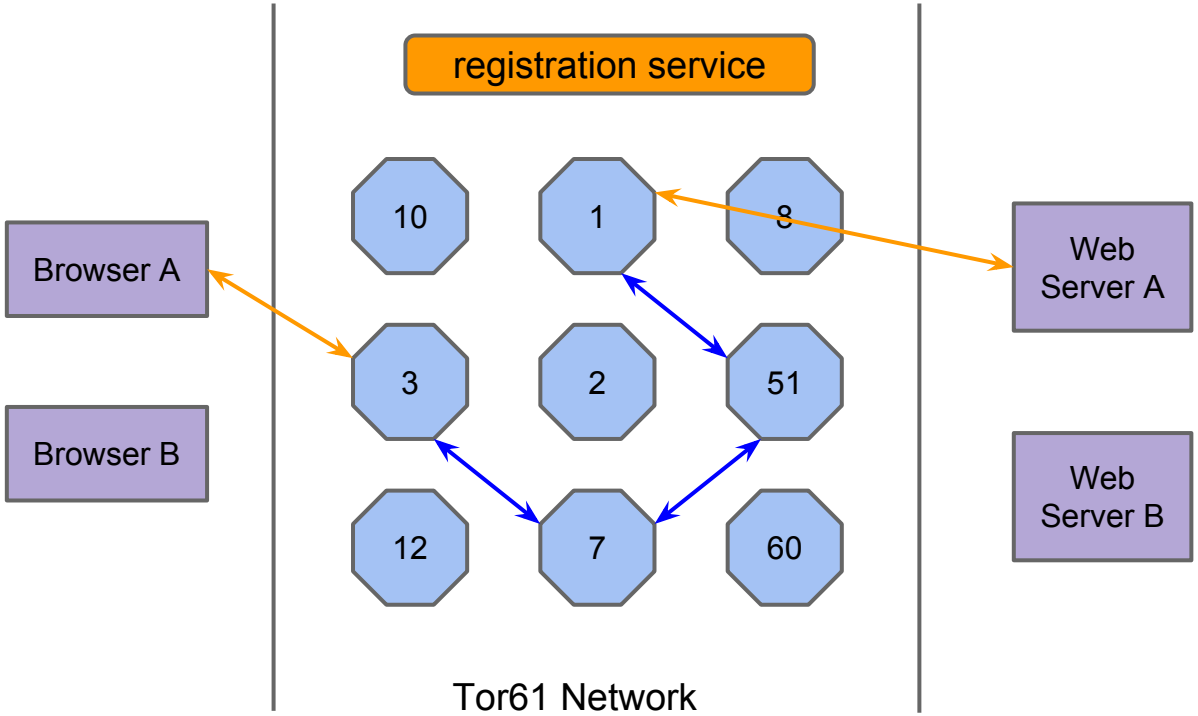
Node 3 repeats Relay Extend to extend circuit to node 1

Tor61 fix circuit length to be three, so we are done setting up circuit starting at node 3

Each node sets up its own circuit this way on startup

Each node needs a routing table to keep track of prev/next hops for different circuits through itself (check “Self Loops” more details)

How to create a stream?



Browser A wants to use circuit starting at node 3 to get a page from Server A

Each node has a HTTP proxy and a Tor61 router component; proxy part only active at circuit endpoints

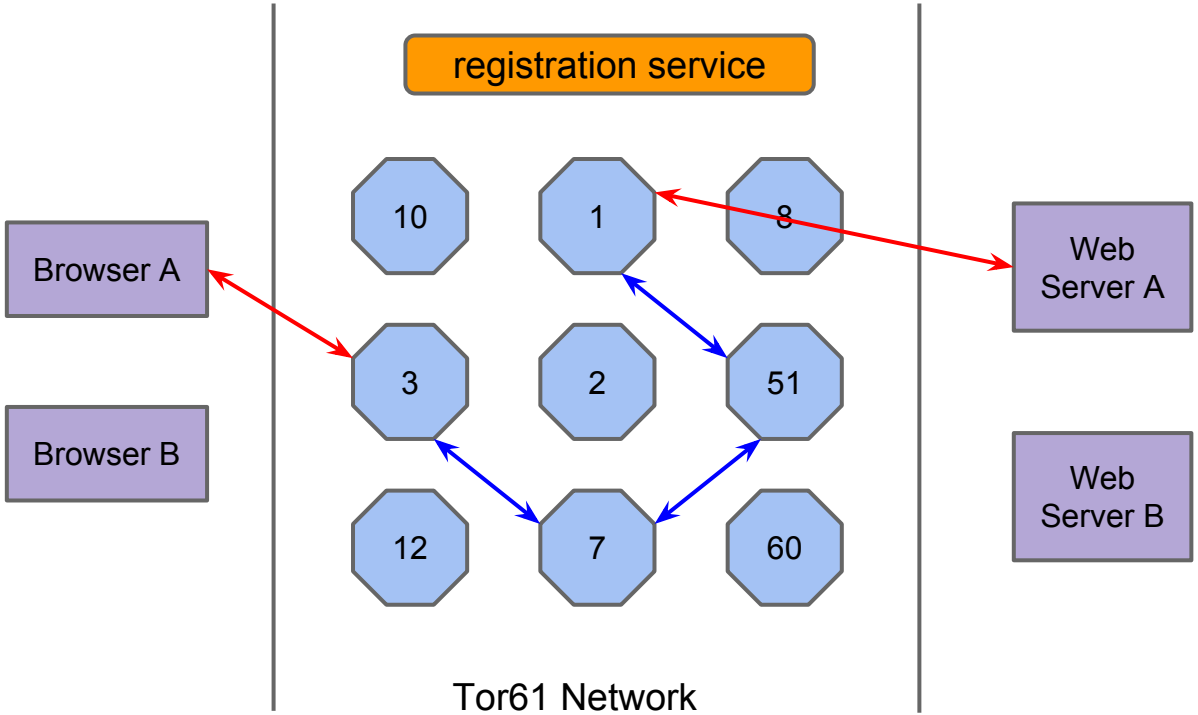
Browser A sends request to and gets response from the proxy component of node 3

Proxy part of node 3 uses the router part to create a stream and route data over the stream to node 1

Router part of node 1 gets request over stream and forwards them to the proxy part

Proxy part of node 1 finally sends request to Server A

How to create a stream?



Browser A sends GET to node 3

node 3 parses IP:port of Server A

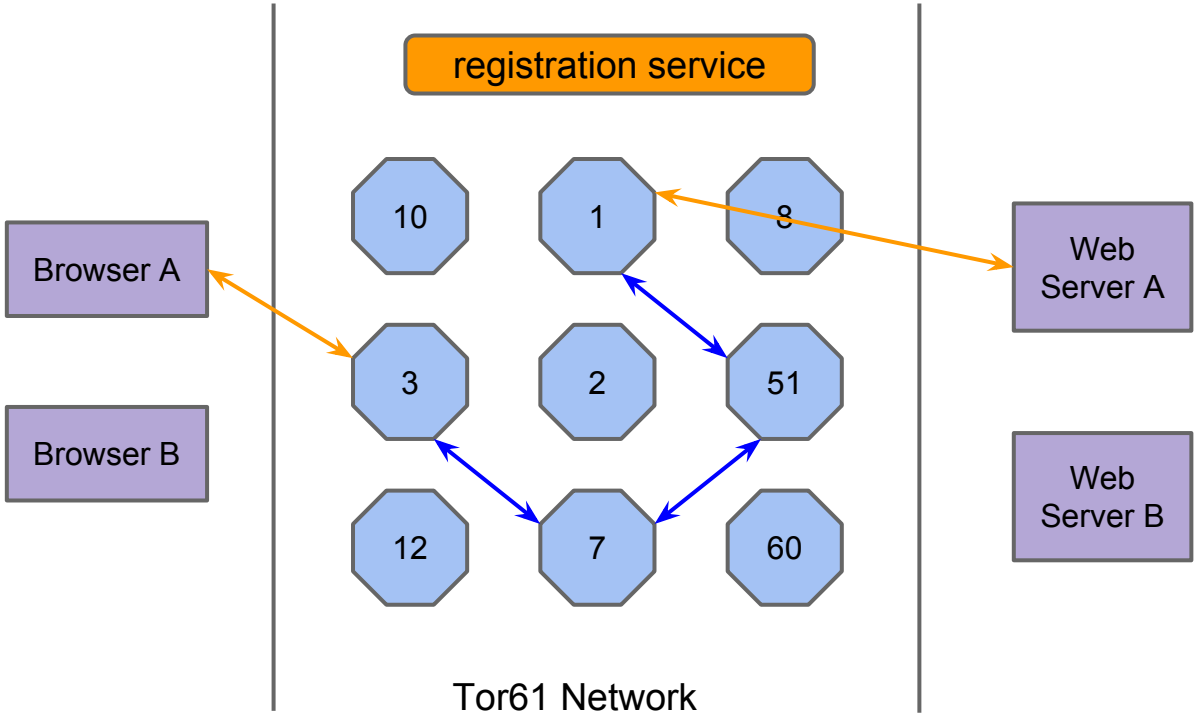
node 3 chooses a new stream number S for the circuit and sends Relay Begin cell with circuit id C and stream id S on the circuit

Relay Begin cell contains Server A ip:port as data

last node 1 gets ip:port of Server A and makes a tcp connection to Server A

On success, node 1 returns a Relay Connected cell to node 3

How to route data?



Node 3 packages request from browser into Relay Data cells and sends them on circuit C and stream S

Node 1 gets those Relay Data cells and extracts the actual request data and send them to Server A

Same process repeats for response from Server A

Registration Service

We run a service at cse461.cs.washington.edu:46101

We provide Java/Python/Node/Go utility code for you to register Tor61 nodes and fetching a list of running peers at /cse/courses/cse461/15sp/registrationUtility/

Presentation Requirements

Next Wed, Thurs and Fri signup slots

20 min presentation with TA & Arvind

Check out guidelines on project page!