CSCI 101
Connecting with Computer Science
Lecture 2: Introduction to WWW III

Jetic Gū

2023 Fall Semester (S3)

Overview

- Focus: Internet
- Architecture: von Neumann
- Readings: 1
- Core Ideas:
  1. Basic Communications in the Internet
  2. HTML Tutorial

Basic Communications in the Internet

Review

- Computers are accessed by IP addresses
  - Domain/URL resolution through DNS -> DNS servers provide IP addresses like a yellow phone book
- Data are transmitted as packets
  - Webpages: HTML (hypertext markup language)
  - Protocols (ways of transmitting): e.g. HTTP, HTTPS (encrypted secure-HTTP)

P1
Communications

But wait, there are more problems!

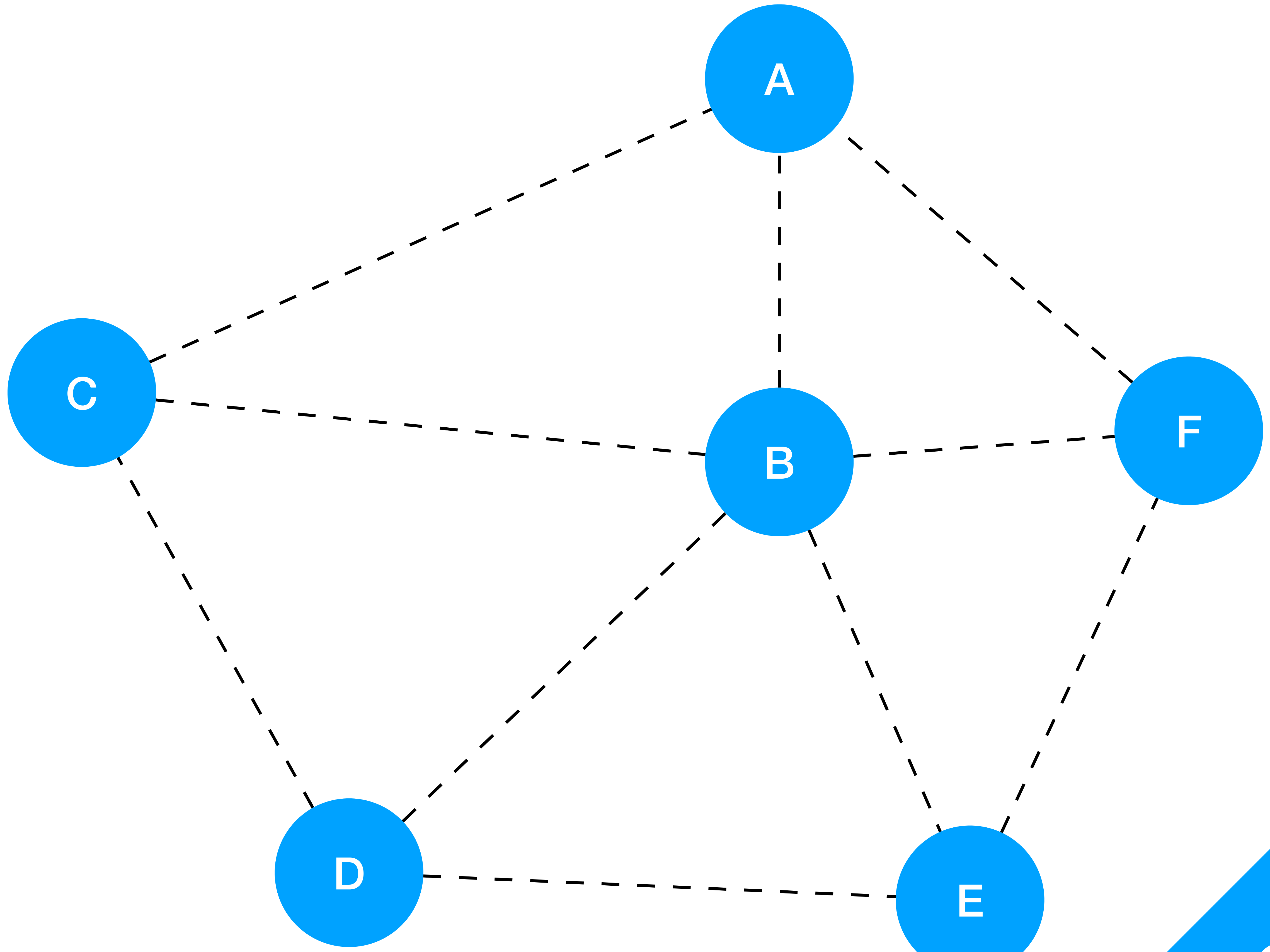
- Q: How do computers find a remote server using its IP address?
  - A: Through **internet routing** (routing problem)
- Q: Are IP addresses unique?
  - A: for any network, the IP addresses for directly connected devices **are unique**
- Q: How do packets reach my computer in a local area network, which doesn't have a public IP address?
  - A: Through Gateways. e.g., your router will help sorting out packets to your phone, your tablet, your TV, and your laptops

Concept

P1
Communications

Routing Problem

- How to send a packet from C to F?
  - C **knows** which nodes it is connected to (**neighbours**)
  - using A, B, or D and E as **hops**
- Multiple algorithms and protocols exist for different types of networks
  - Static
  - Routing Information Protocol (RIP)
  - Open Shortest Path First (OSPF); etc.



Technical

P1
Communications

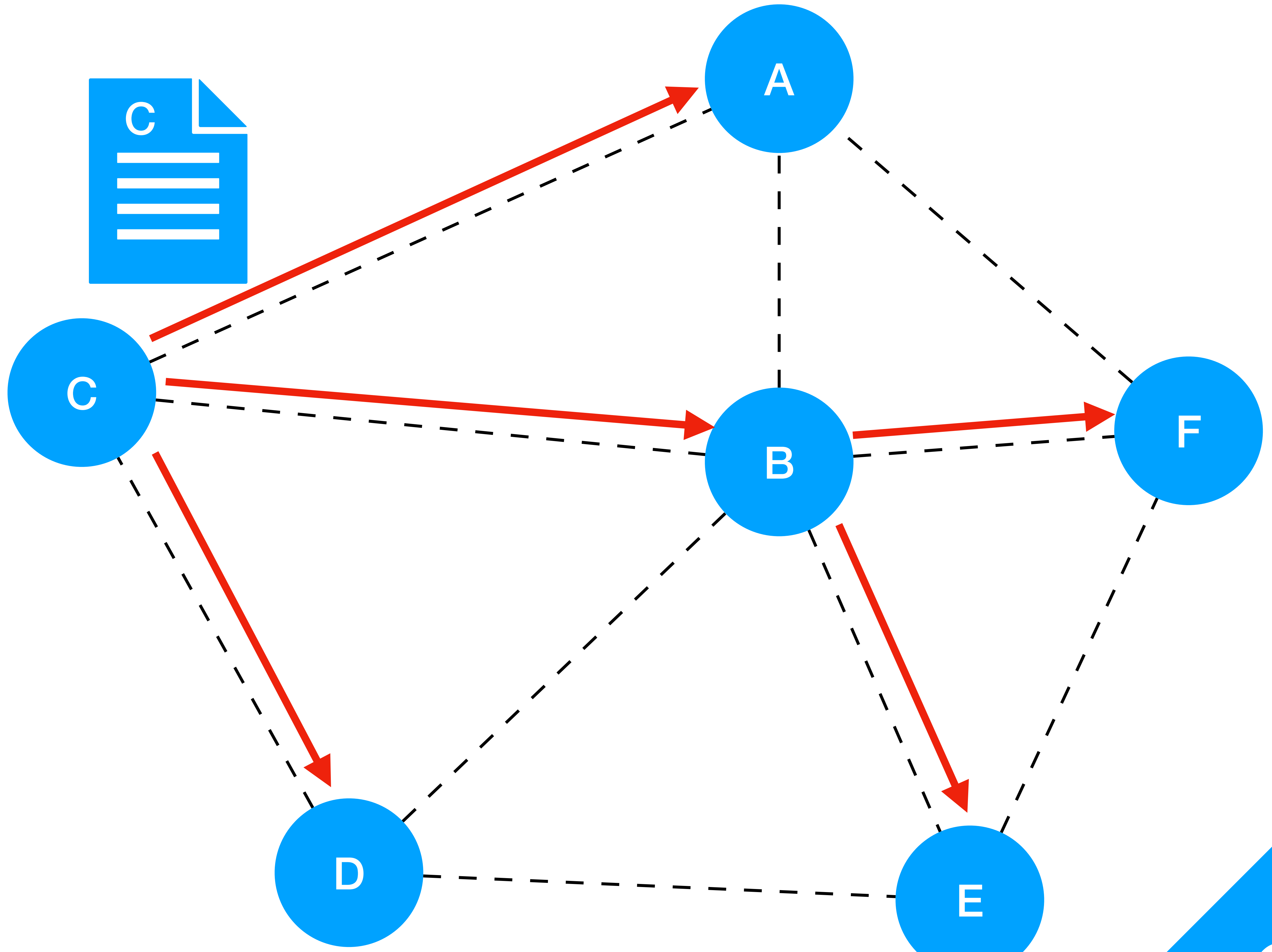
Routing Problem

- Uses **routing table**

- This is a **possible** routing table for **C**
  Dest A: -> A
  Dest B: -> B
  Dest D: -> D
  Dest F: -> B -> F
  Dest E: -> B -> E

- Static
  Routing table is static (not updated)

  - Secure, but not flexible

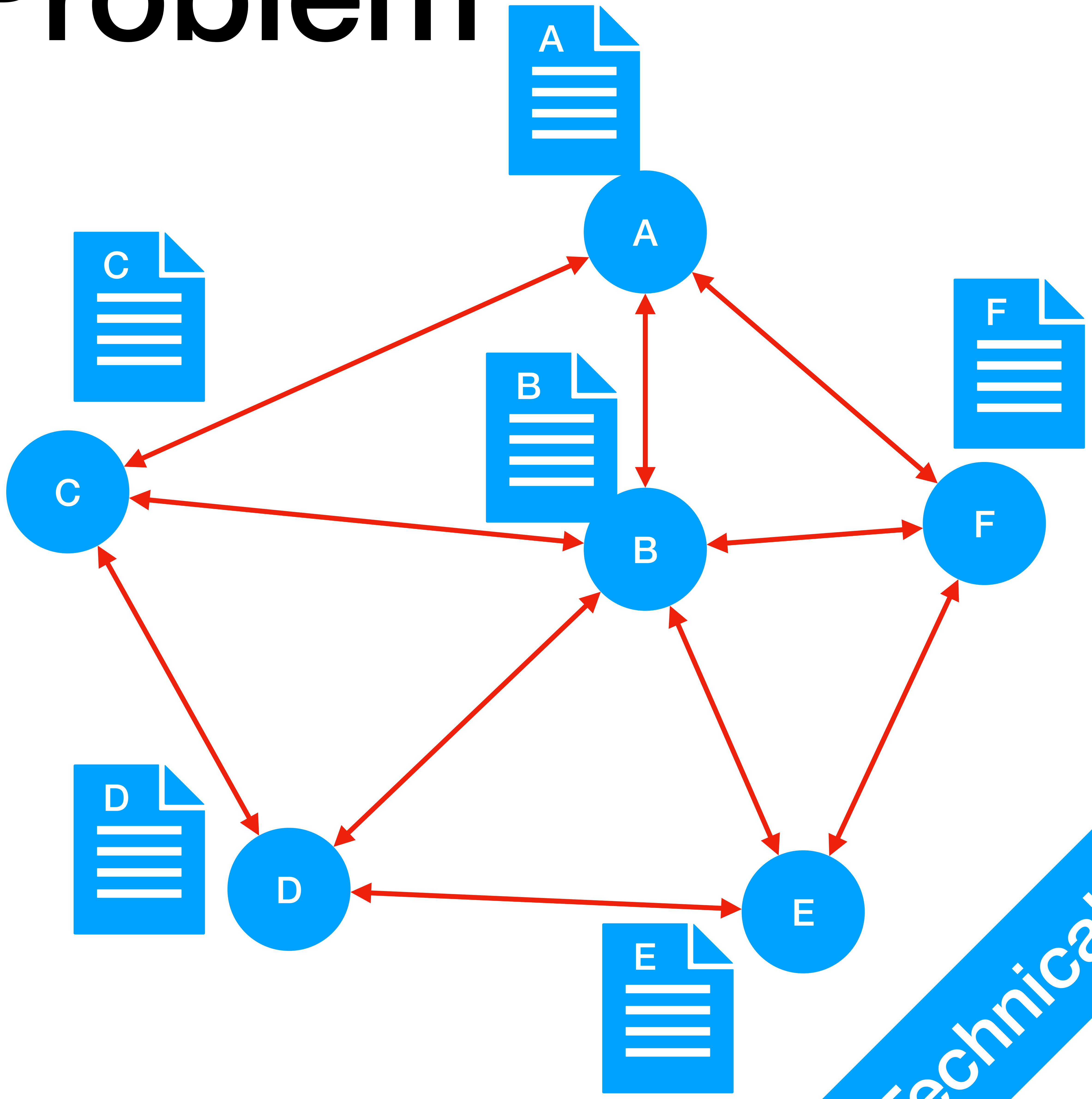


Technical

P1
Communications

Routing Problem

- **Routing Information Protocol** (RIP)
  Entire routing tables are shared between all devices periodically
  - Slow, sometimes insecure
- **Open Shortest Path First** (OSPF)
  Most **efficient** route is calculated **every time** based on available routing tables. Routing tables exchanged on request.
  - Large overhead



Technical

P1
Communications

IP addresses

- Internet Protocol (IP) address
  - numerical label assigned to each device connected to a network that uses the TCP/IP protocol for communication
  - versions
    - IPv4 (most common), 32 bits long,
      e.g. `192.168.0.1`
    - IPv6 (gradually expanding), 128 **bits** long,
      e.g. `FE80:CD00:0000:0CDE:1257:0000:211E:729C`

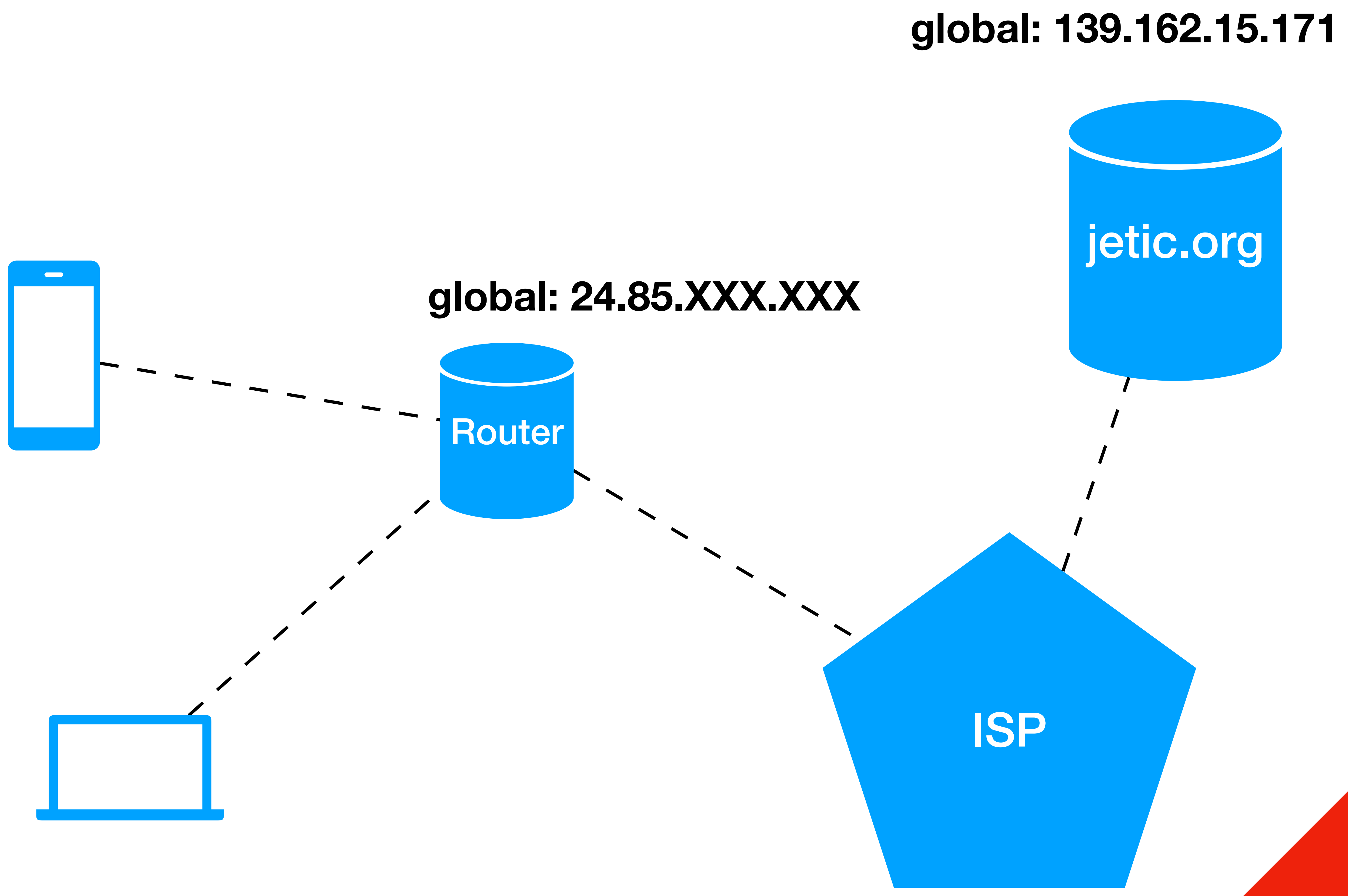
Concept

IP addresses

- How to acquire an IP address
  - Static: you know your IP address, e.g. you bought it from an ISP
  - Using DHCP service
    - e.g. your router will use DHCP to assign you a **local IP**

local & global IP addresses

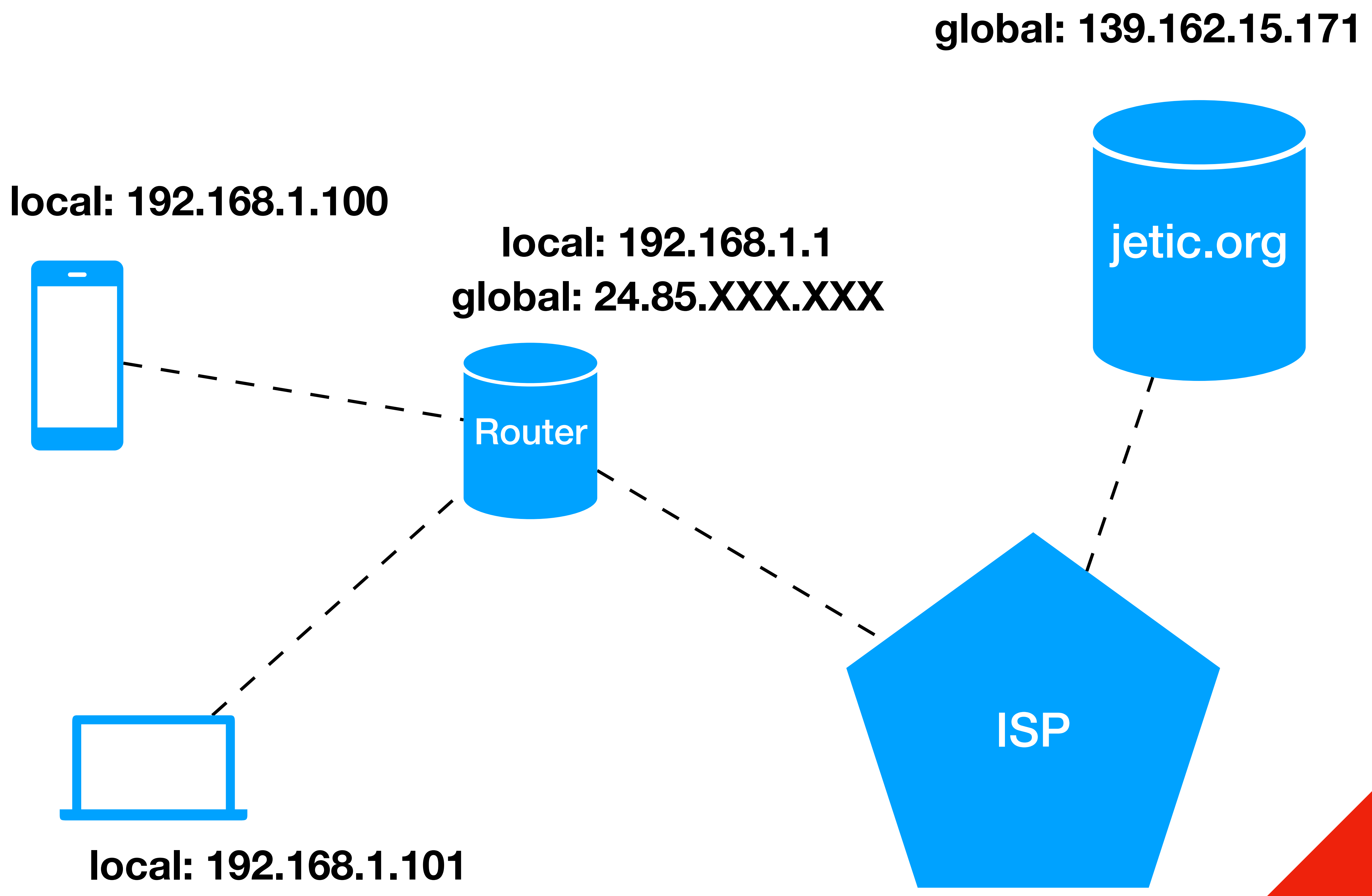
- ISP typically assigns global IP using DHCP
  - Static IP: I bought mine, so for `jetic.org` it is static



P1 Communications

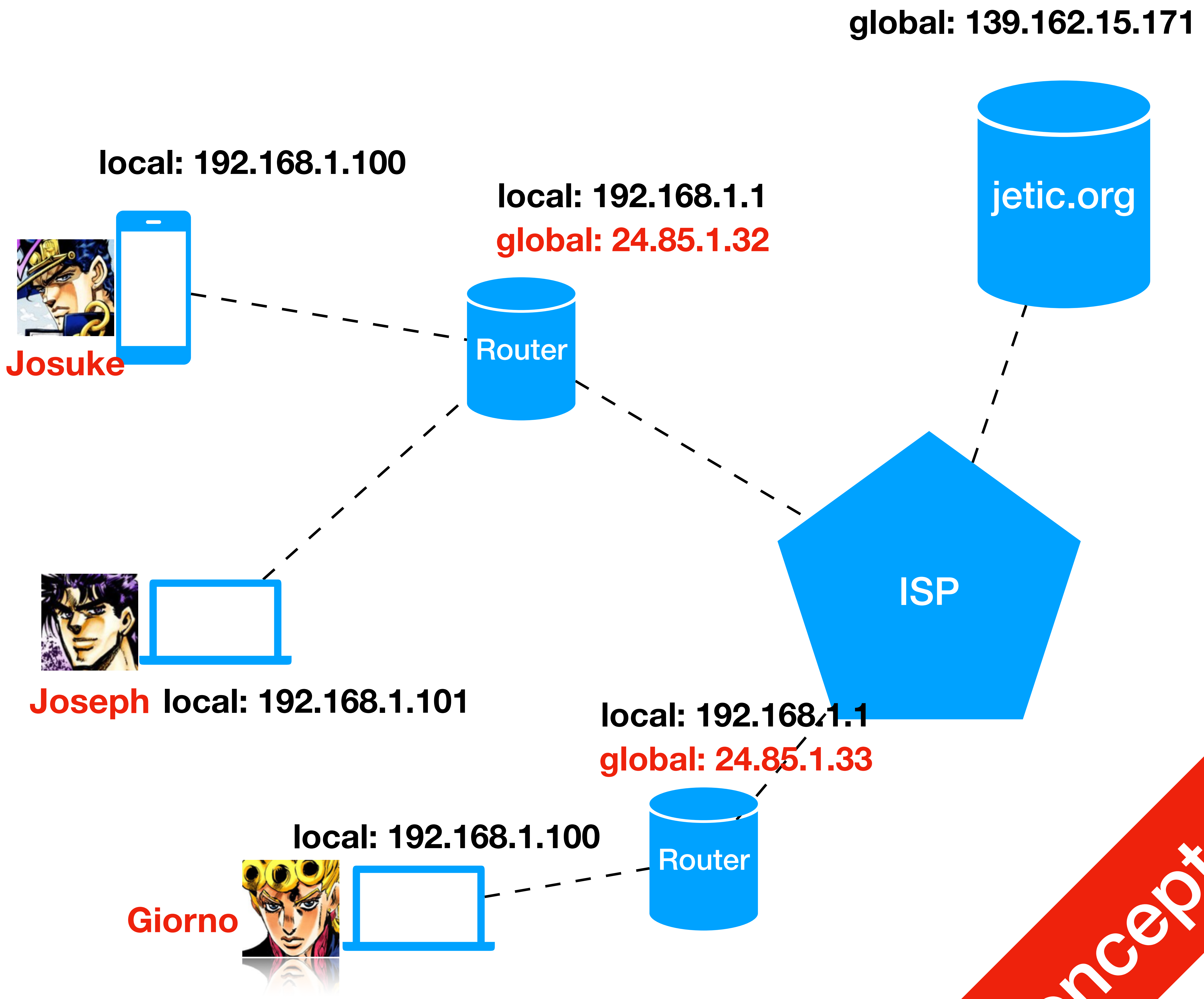
local & global IP addresses

- Your router creates a **local area network**, for which it is the DHCP server
  - e.g., it has the local IP 192.168.1.1
  - It assigns local IP addresses to your devices, e.g. your phone and laptop



Concept

- All devices in this network have unique IP addresses
- Josuke **CAN** reach jetic.org using its global IP
  - In fact anyone with internet access can do so
- jetic.org **CANNOT** reach Josuke through your local IP
  - Only Joseph can, even Giorno can't.
- So how do Josuke receive packets from jetic.org?
  - Through **Gateways**
    e.g. your router can be your gateway
- So how do Josuke receive packets from Giorno?
  - Nope, we are not talking about it.[1]



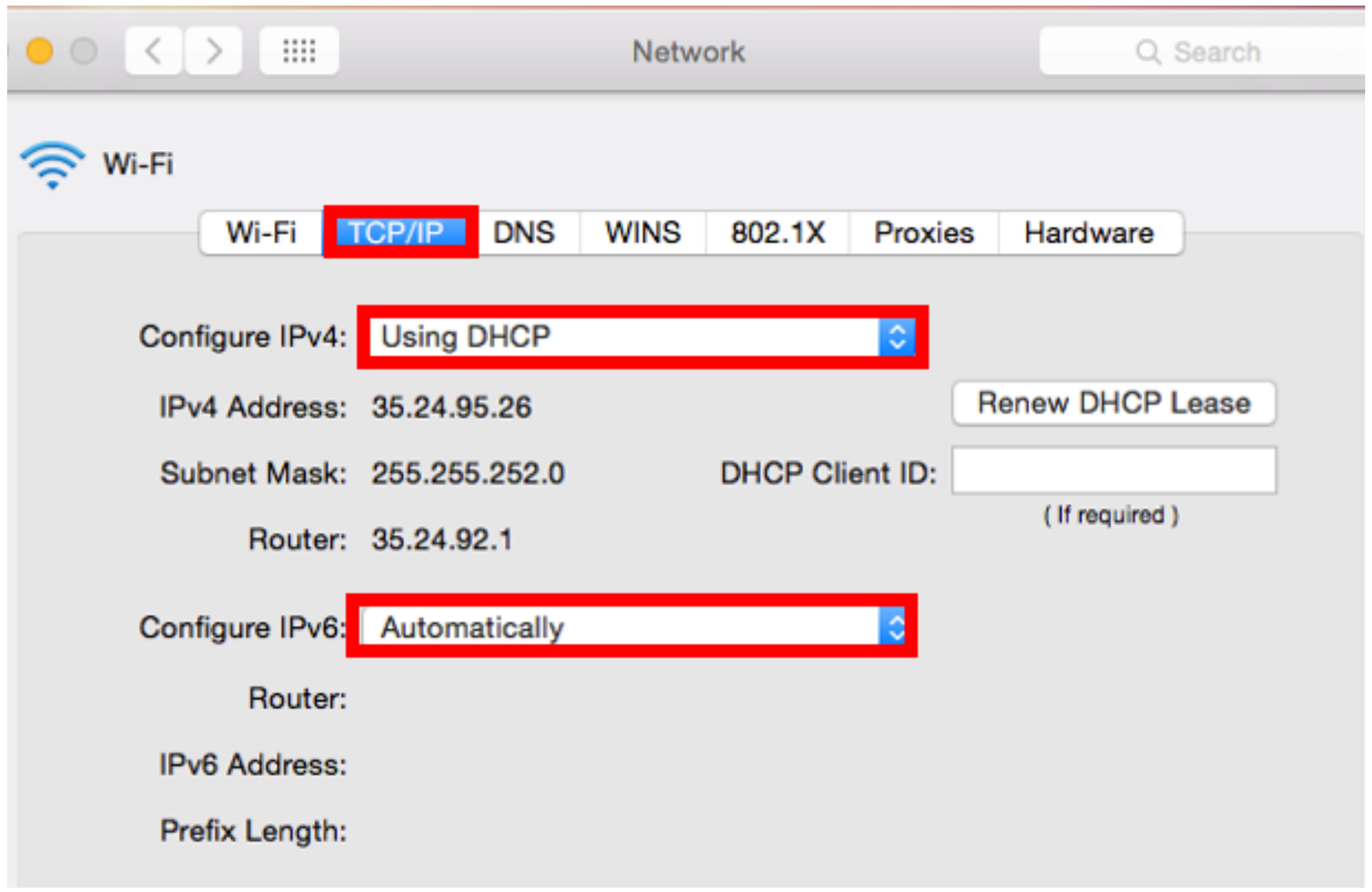
1. It's complicated

Concept

P1 Communications

local & global IP addresses

- This is an example
  - **Subnet Mask** (Binary)[1]
    tells you the range of IP address that belongs to this local network
  - DHCP assigned IP address needs to be **renewed periodically**
    This can be set on your router



Configure IPv4: Using DHCP
IPv4 Address: 35.24.95.26
Subnet Mask: 255.255.252.0
Router: 35.24.92.1
Configure IPv6: Automatically
Router:
IPv6 Address:
Prefix Length:

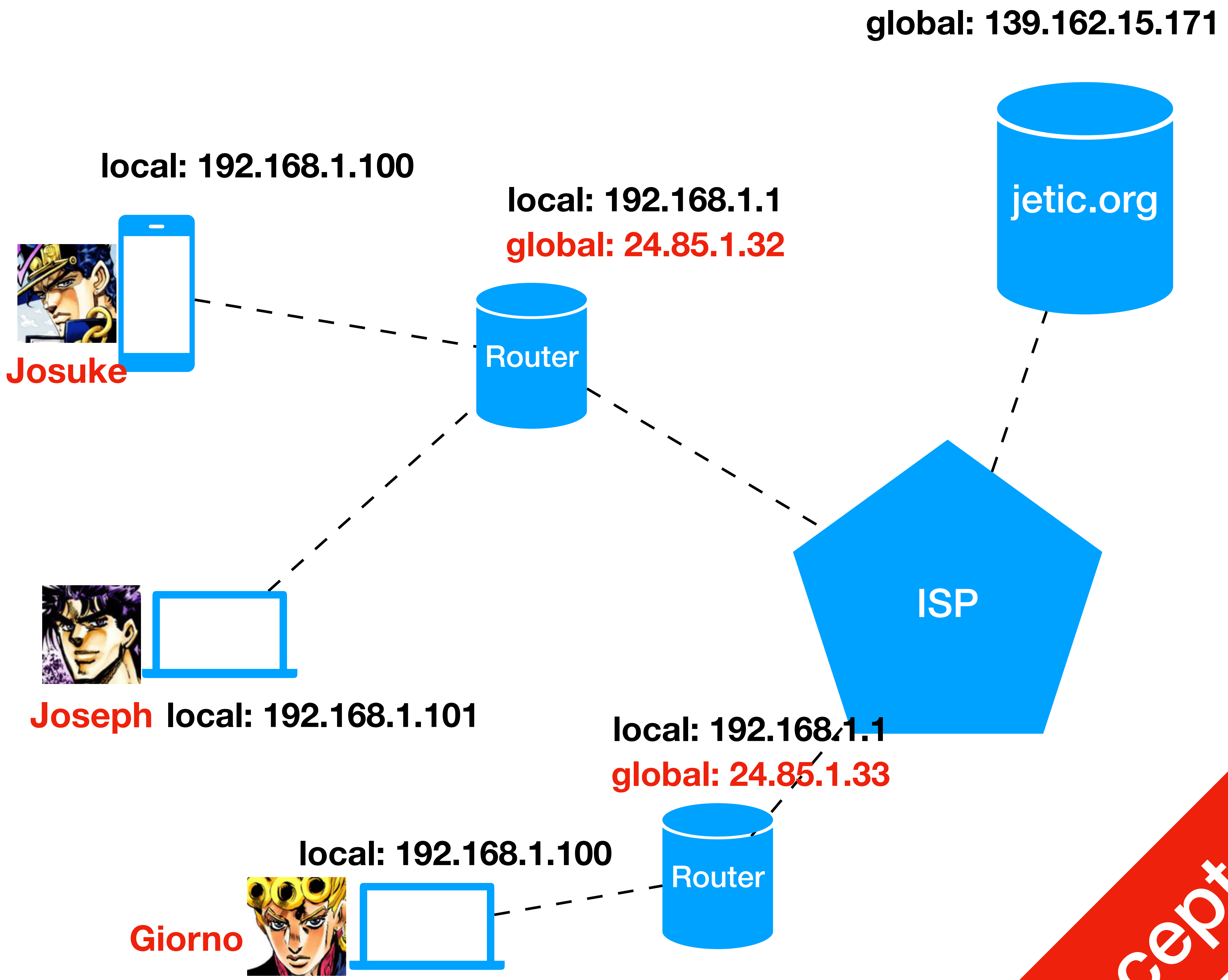
1. Not required for this course

Concept

P1
Communications

Gateway (Simplified)

- So how do **Josuke** receive packets from jetic.org?
  - Through **Gateways (e.g. router)**
  - The Gateway devices will figure out which packet is for whom
    - e.g. distinguish between packets **to** **Joseph** and **Josuke**



Concept

Basic Webpage

Summary

P2
HTML

What is HTML?

- HyperText Markup Language (frontend)
- When you access any webpage, a request is sent to the server, and the server returns in HTML, the webpage
- Descriptive Language: HTML describes the webpage
- Styling: Usually through the use of CSS
- Interactive Webpage: Javascript + Backend

Technical

P2
HTML

Create A Static HTML Page

- Create a file named `index.html` default page by a lot of servers
- Type the content on the right
- HTML uses Tags, enclosed in `<>`
    - Most tags come in pairs, but some tags like `<img>` and `<br>` don't

```
<!DOCTYPE html>
<html>
<head>
    <title>Page Title</title>
</head>

<body>
    <h1>Heading</h1>
    <p>This is a paragraph.</p>
</body>

</html>
```

Tutorial

Create A Static HTML Page

- Create a file named `index.html` default page by a lot of servers
- Type the content on the right
- HTML uses Tags, enclosed in `<>`
  - Most tags come in pairs, but some tags like `<img>` and `<br>` don't

```
<!DOCTYPE html>                          Document Type
<html>
<head>
    <title>Page Title</title>
</head>

<body>
    <h1>Heading</h1>
    <p>This is a paragraph.</p>
</body>

</html>
```

Tutorial

P2
HTML

Create A Static HTML Page

- Main HTML section
- Usually contains Head and Body
  - Head: Title information, loads scripts, loads styling css files
  - Body: Main content

```
<!DOCTYPE html>
<html>
<head>
    <title>Page Title</title>
</head>

<body>
    <h1>Heading</h1>
    <p>This is a paragraph.</p>
</body>

</html>
```

HTML Section

Tutorial

P2
HTML

Create A Static HTML Page

- Headings
  - h1: largest heading
  - h2: second largest
  - h3: third largest
  - …

```
<!DOCTYPE html>
<html>
<head>
    <title>Page Title</title>
</head>

<body>
    <h1>Heading</h1>
    <p>This is a paragraph.</p>
</body>

</html>
```

Heading

Tutorial

P2
HTML

Create A Static HTML Page

- Paragraphs
  - there's just paragraphs
  - Line break: `<br>`

```
<!DOCTYPE html>
<html>
<head>
    <title>Page Title</title>
</head>

<body>
    <h1>Heading</h1>
    <p>This is a paragraph.</p>
</body>

</html>
```

Tutorial

P2
HTML

Wanna Learn Webpage Design?

- WWW School: https://www.w3schools.com/html/
- Start with HTML, then CSS, then Javascript
  These are **Front-End**

Technical