



I C A N N
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How It Works

101: Naming, Addressing, Routing

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Agenda

1

Networking
by
Numbers

2

Naming

3

Addressing

4

Routing

Networking by Numbers

Layer 0 to 9 of the 7-Layer OSI Model

Layer 0: Physical Realm

Wired
Copper
Fiber



VS

Wireless
Antennas



Layer 1 Example: Lambda on a fiber

- ◎ Wave length on a fiber pair

- ◎ Point-to-point



Layer 2 Example: WAN Fiber Path

- How to get fiber connectivity from A to B?
 - Can't always use a single, dedicated fiber
 - Interconnect multiple Layer 1 to create a fiber path from A to B
- Speed:
 - GE, 10GE, 25GE, 40GE, 100GE,...
 - Multiples of the above

Layer 3: Networking

- The world is NOT flat
- L2 domain == broadcast domain
- Need for topology isolation
- L3 interconnects L2 domains

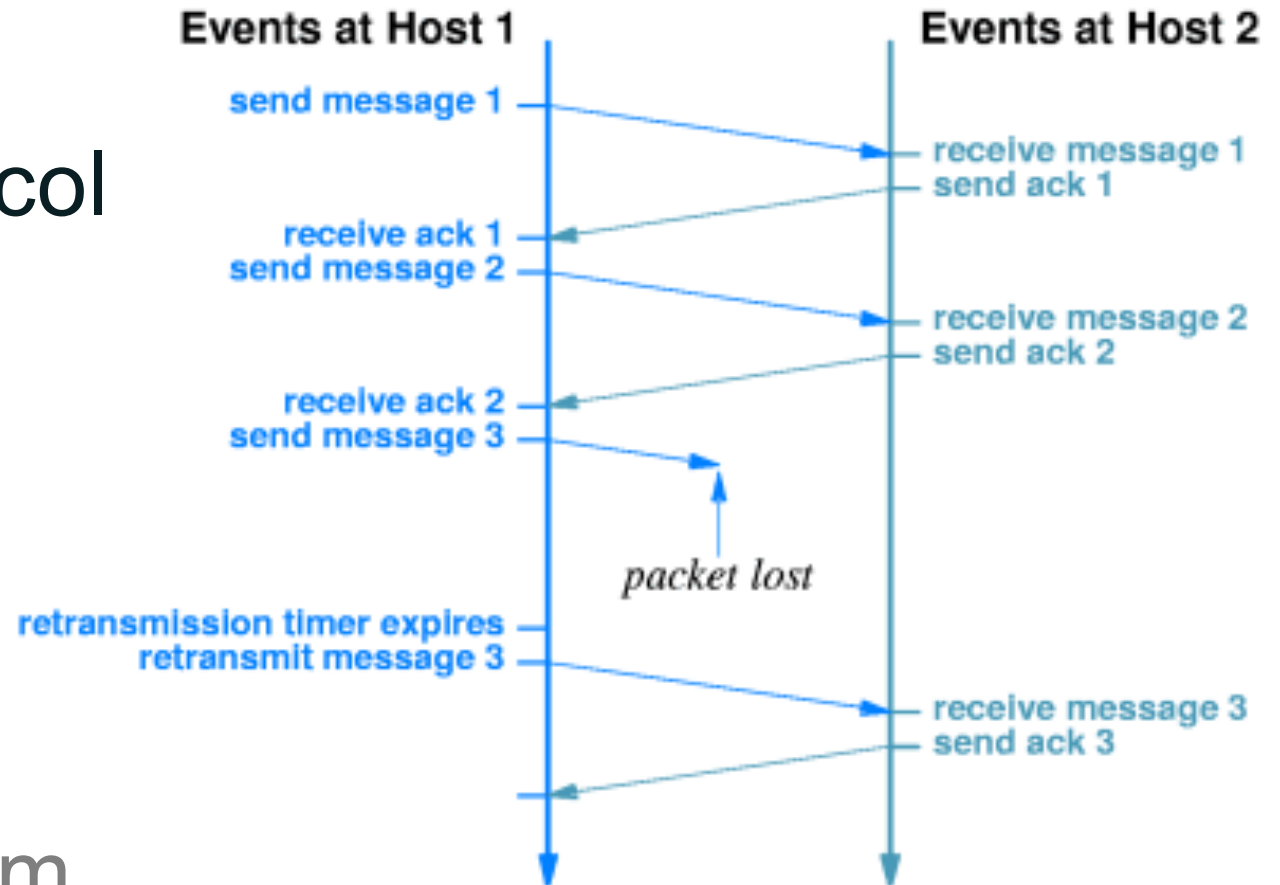
Layer 3 == IP



IP:
Internet
Protocol

Layer 4: Transport

- Transmission Control Protocol (TCP)



- User Datagram Protocol (UDP)

Layer 5: Session

- Real Time Streaming Protocol (RTSP)



Layer 6: Presentation

- In reverse chronological order:
 - JSON
 - XML
 - ASN.1
 - "fixed width"
 - "anything goes"

```
{"menu": {  
  "id": "file",  
  "value": "File",  
  "popup": { "menuitem": [  
    {"value": "New", "onclick":  
      "CreateNewDoc()"},  
    {"value": "Open", "onclick":  
      "OpenDoc()"},  
    {"value": "Close", "onclick":  
      "CloseDoc()"} ] } } }
```

L7: Applications

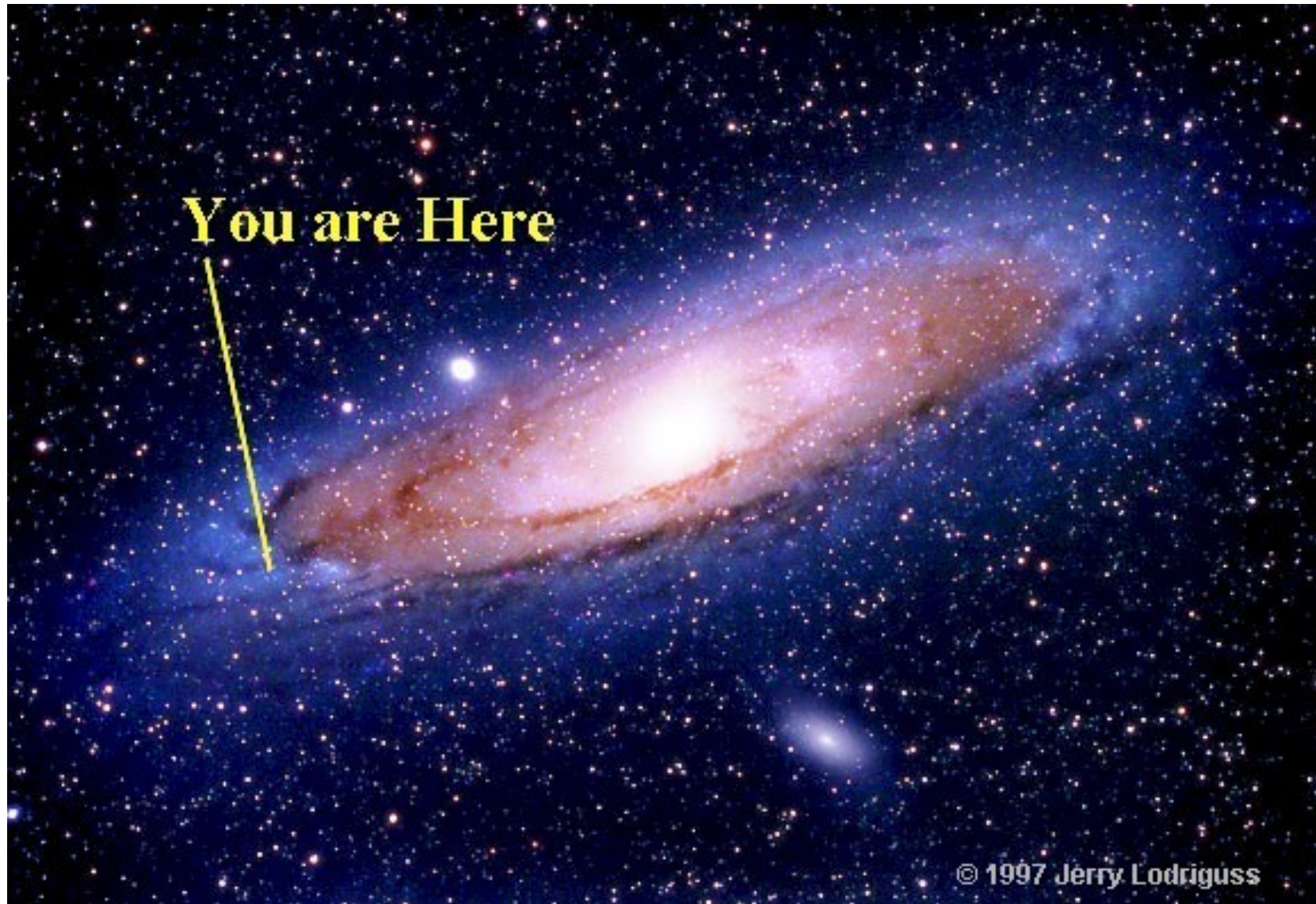


- Hypertext Transfer Protocol (HTTP)
- HTTP Secure (HTTPS)

Layer 8: Financial



Layer 9: Political



Naming

“Who is your dentist?”

What is a Name?

- Name [nām]

- Noun

- 1: A word or set of words by which a person, animal, place, or thing is known, addressed, or referred to: my name is Parsons, John Parsons | Köln is the German name for Cologne.
- 2: A famous person: as usual, the big race will lure the top names.
[in sing.] a reputation, especially a good one: he set up a school that gained a name for excellence.

→ If I know your name,
I know 'who' you are

Name as a Handle

- “A word or set of words by which a person, animal, place, or thing is known...”
 - Having a name is only meaningful when other people know about it.
 - Knowing a name enables us to relate to it
 - We can talk –to– someone, or we can talk –about– someone.
 - Names can be passed from one party to another as a referral.

Here is the name of my dentist:



Names have Scopes

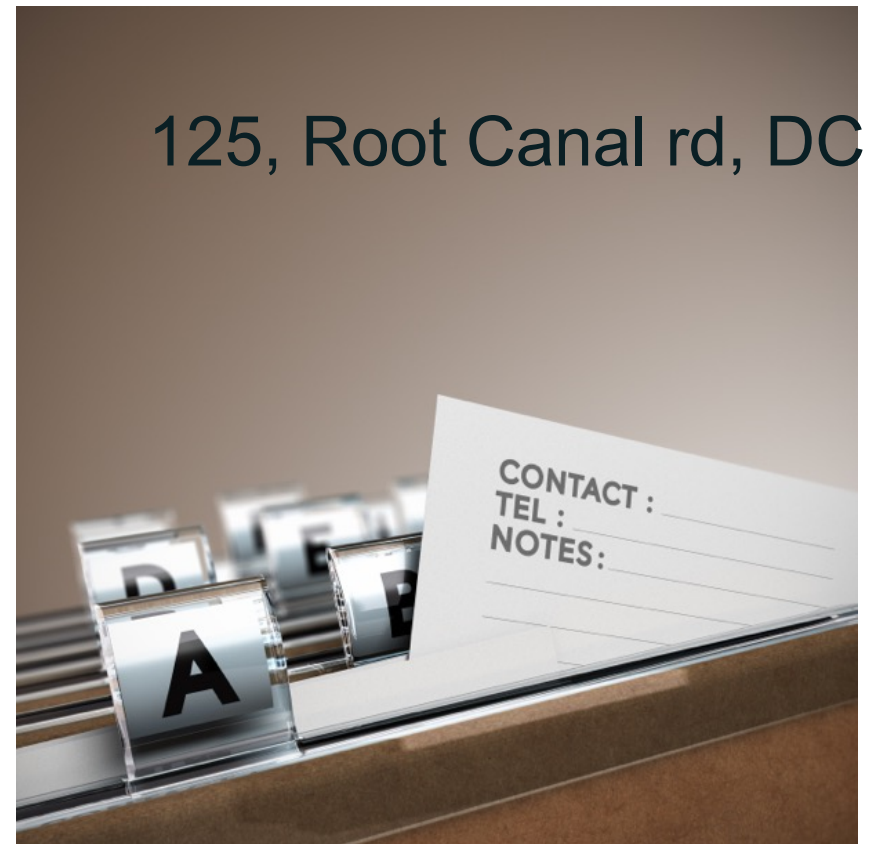
- Names need to be unique within a scope to avoid ambiguity
 - I'm the only Alain in my family
 - There were several Alains in my elementary classes, so teachers had to use a combination of first name/last name.

A name is Not Enough to Communicate

- Ok, I have your dentist name, but what is his address?

➔ Names must be mapped to a lower level identifier that will enable communication.

This process is called name resolution.



Addressing

“Where is your dentist?”

What is an Address?

- Address |ə'dres, 'a,dres|
 - Noun
 - The particulars of the place where someone lives or an organization is situated: they exchanged addresses and agreed to keep in touch
- If I know your address,
I know 'where' you are.

Address Structures

- A little detour: **most famous address in DC**:
1600 Pennsylvania Avenue NW, Washington,
D.C. 20500-0003, USA
- Hierarchical structure:
 - USA
 - DC
 - NW
 - » Pennsylvania Avenue
 - 1600
- Not always geographically organized
 - 1-800 (toll free) telephone numbers
 - Cell phone numbers
 - **IP addresses**



Addresses Have Scopes

- If you live in DC, all I need to tell you is:
 - 1600 Pennsylvania Avenue NW



- If you live in Europe, you know that Paris is most probably in France. If you live in the US, you have 29 cities to choose from...

Address as a Handle

- Similar to names:
 - Addresses can be used directly
 - E.g., to send a postcard
 - Passed on to someone else as a reference

Here is the address of my dentist:
125, Root Canal rd, DC



An Address is Not Enough to Communicate

- You can send a postcard to
1600 Pennsylvania Avenue
NW, Washington D.C.
20500 USA from anywhere
in the world
- It would only arrive there
because there is a postal
system that will “route” the
postcards through a
number of mail hubs
- Now, How do I go to
125, Root Canal rd, DC?



Routing

“How do I go to your dentist?”

What is a Route?

- route |root, rout|
 - Noun
 - A way or course taken in getting from a starting point to a destination: the most direct route is via Los Angeles
- If I have a route for you,
I know where to go.

Building Routes Before the Traffic Flows

Route announcements flow in the reverse direction from the future traffic:



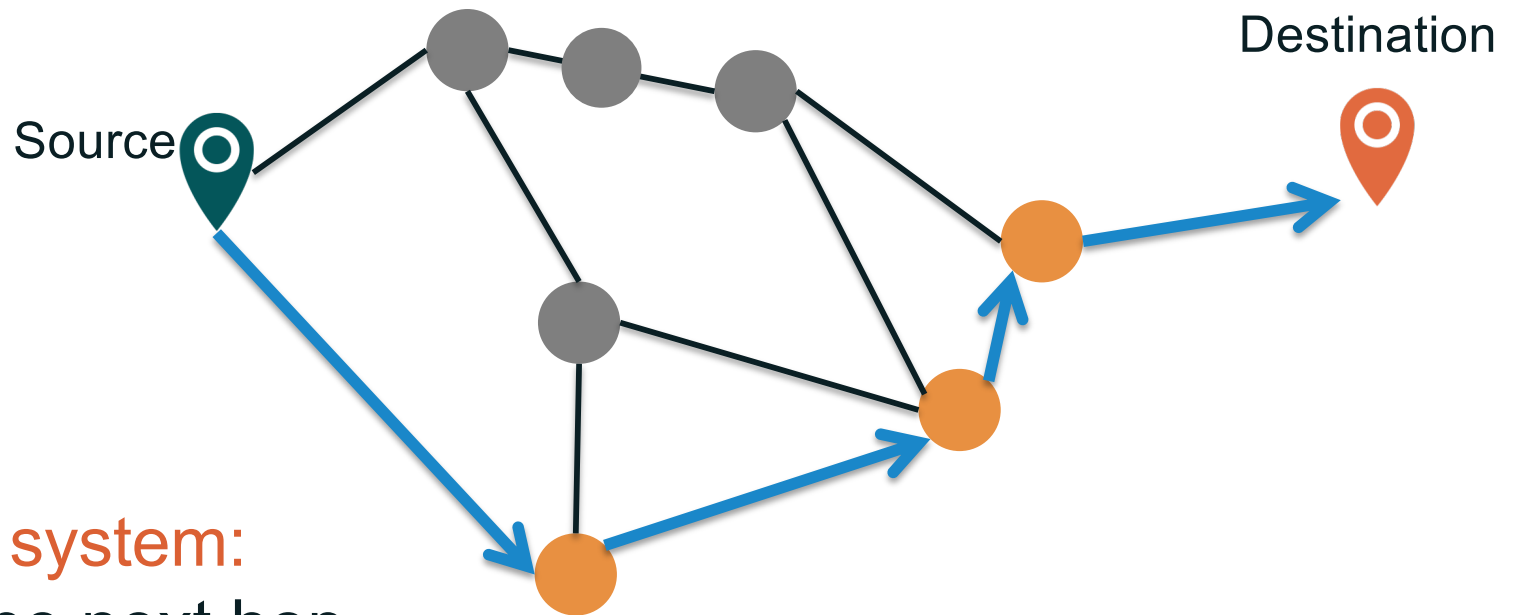
Cooperative system:

Previous hops re-announce routes

Sending Traffic Hop-by-Hop

Forwarding traffic happens hop-by-hop

→ If I have a route for your destination, I know the “next hop” to which I can deliver the packet.



Cooperative system:
We rely on the next hop
to do the “right thing”

Conclusion

“You have arrived...”

You Have Arrived!



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