Lecture 1

Internet as an infrastructure
From computing to communication (connecting you and me)
But connecting everyone → how many connections?

Clique: Everyone connected to everyone directly
Similar Problems in other walks of life? What's the solution?

Hierarchy
Hierarchy → Permeates natural & man-made efficiency

where is hierarchy in nature?

Any downsides to hierarchy?
Hierarchy of hierarchy → Why not keep going?
Topology Design to prevent network disconnections.

To p o l o g y Design to prevent network disconnections.

Can UIUC join the hierarchy?

UIUC network
Connect Everyone at the edge!
who is doing the “plumbing”, maintaining, managing?  
Who owns routers?

Can 1 ISP cover the whole world?

Who are the “plumbers” in airline industry?
Tier-1 ISP: e.g., Sprint

Sprint US backbone network

- Seattle
- Tacoma
- Stockton
- San Jose
- Anaheim
- Fort Worth
- Kansas City
- Chicago
- Roachdale
- Atlanta
- New York
- Pennsauken
- Relay
- Wash. DC
- Orlando
- Atlanta

Bandwidth options:
- DS3 (45 Mbps)
- OC3 (155 Mbps)
- OC12 (622 Mbps)
- OC48 (2.4 Gbps)
Tier-1 ISP: e.g., Sprint

Sprint US backbone network

POP: point-of-presence

to/from backbone

peering

to/from customers

DS3 (45 Mbps)
OC3 (155 Mbps)
OC12 (622 Mbps)
OC48 (2.4 Gbps)
Cables Laid Out in the Oceans

Optical Fiber cross-section
Cable Connections carry 95% traffic (rest?)
Tier 1, 2, 3 Service Providers
Infrastructure Ready!! Now communicate... but wait!

To whom? Which address?

IP address: ece.illinois 130.126.151.38
Advertising: Who can deliver to which address

As if Routers are gossiping to figure out who can forward to whom.
Forwarding packets based on Destination Address

Forwarding table

<table>
<thead>
<tr>
<th>Dest'n IP</th>
<th>Interface #</th>
</tr>
</thead>
<tbody>
<tr>
<td>129.105.136.48</td>
<td>northwestern.edu</td>
</tr>
<tr>
<td>128.83.120.11</td>
<td>cs.utexas.edu</td>
</tr>
<tr>
<td>130.126.151.38</td>
<td>ece.illinois.edu</td>
</tr>
</tbody>
</table>

I can deliver to Texas, Nevada

I can deliver to all of Illinois State

I can deliver to UIUC
why do links have costs?

What do they depend on?
Let's Route

![Graph diagram]
IP Address based Routing: Control plane, Data plane.
Zoom Out

CORE

EDGE
And YOU are here
Questions?
Lecture 2

Internet as a service