

# System Administration

**Week 05, Segment 6**

**Networking I: A Network of Networks**

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<https://stevens.netmeister.org/615/>

## Networking

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**“The network is the computer.”**

John Gage, Sun Microsystems

## Networking

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“The network is the network,  
the computer is the computer  
-sorry about the confusion.”

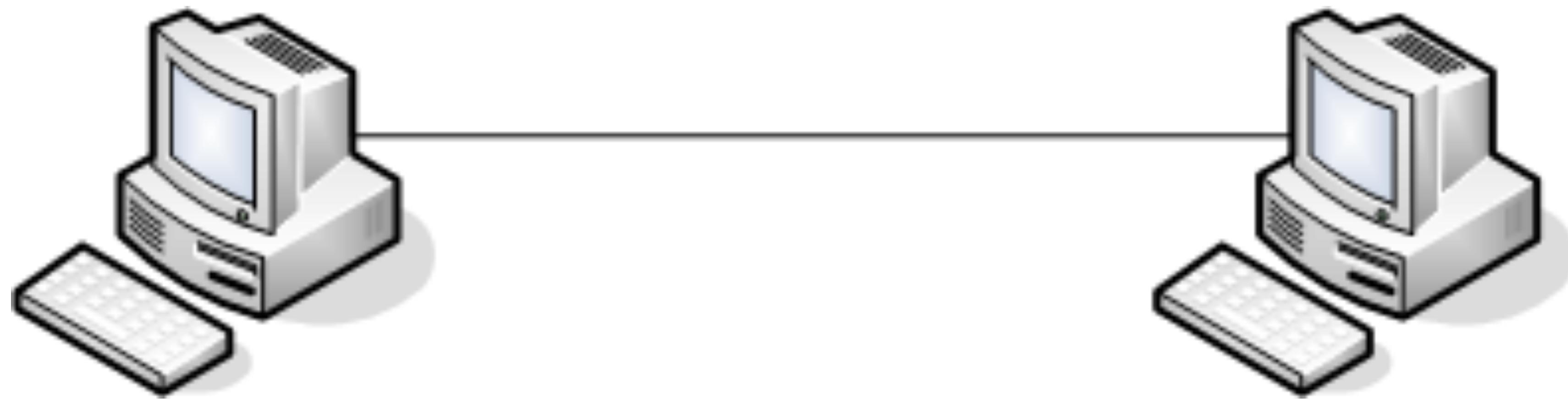
Joe on Computing  
<https://is.gd/mBkNPm>

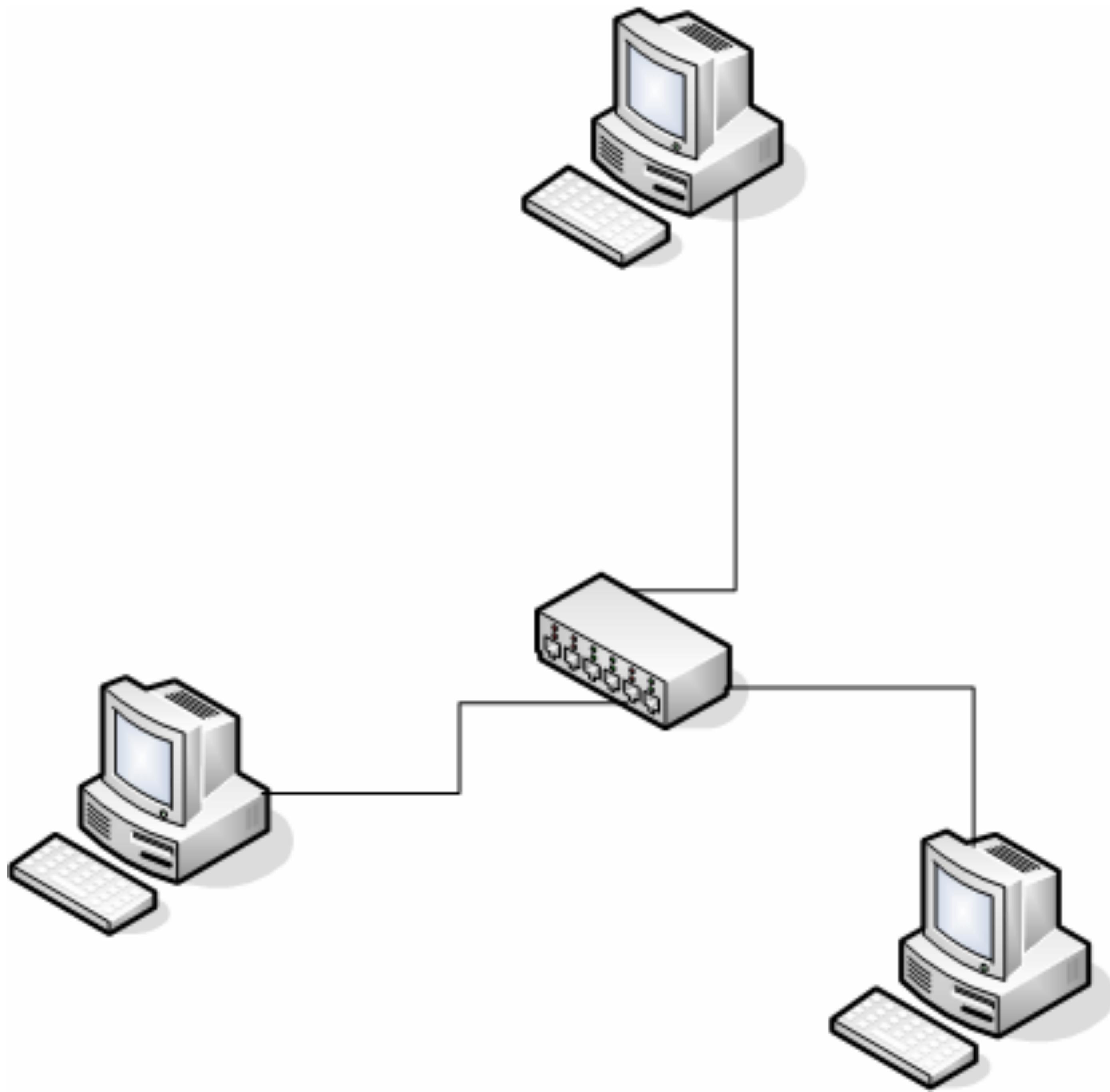
# Networking

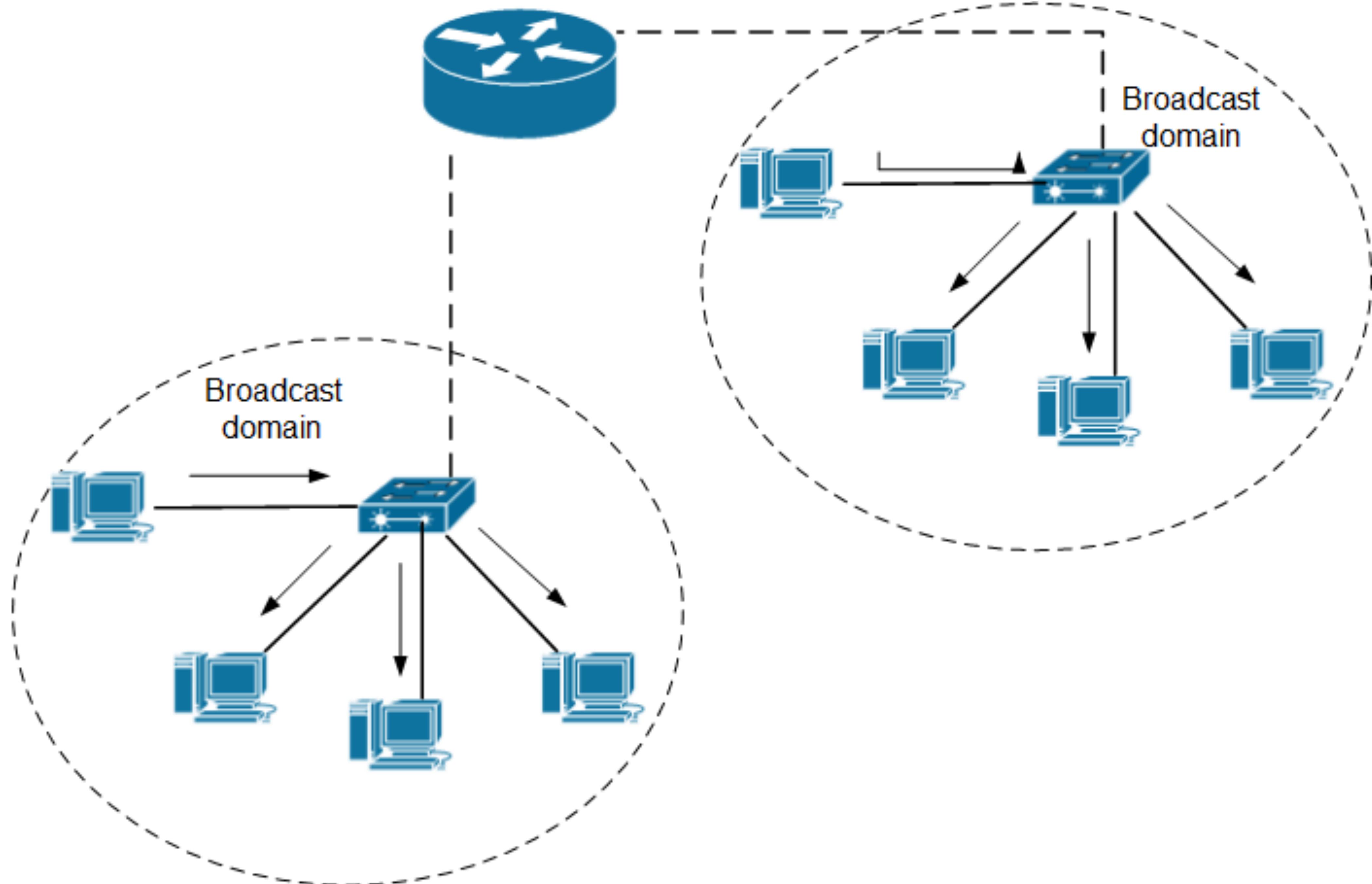
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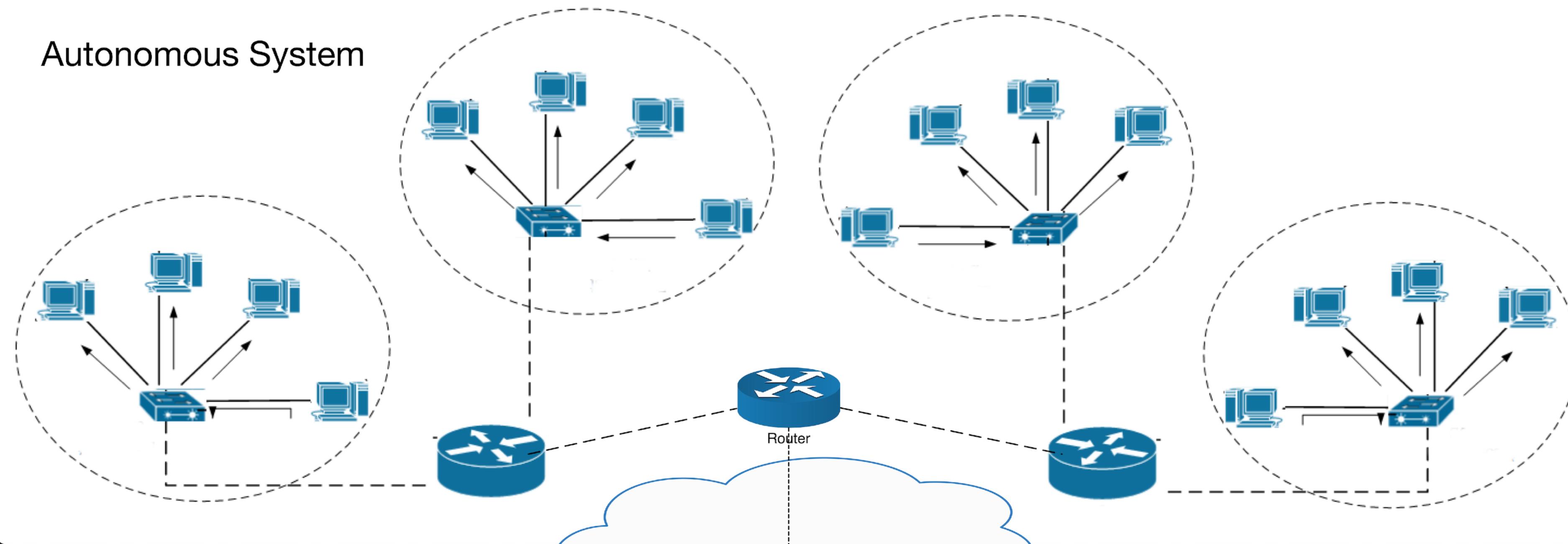
There is no cloud, only other people's computers.



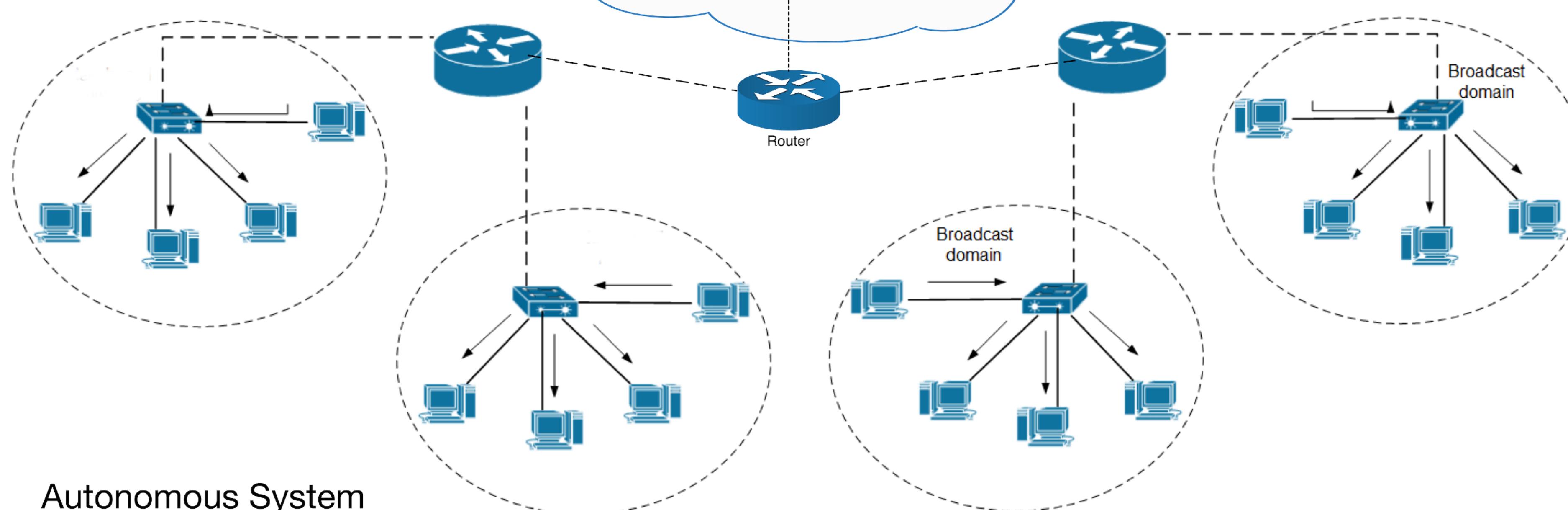


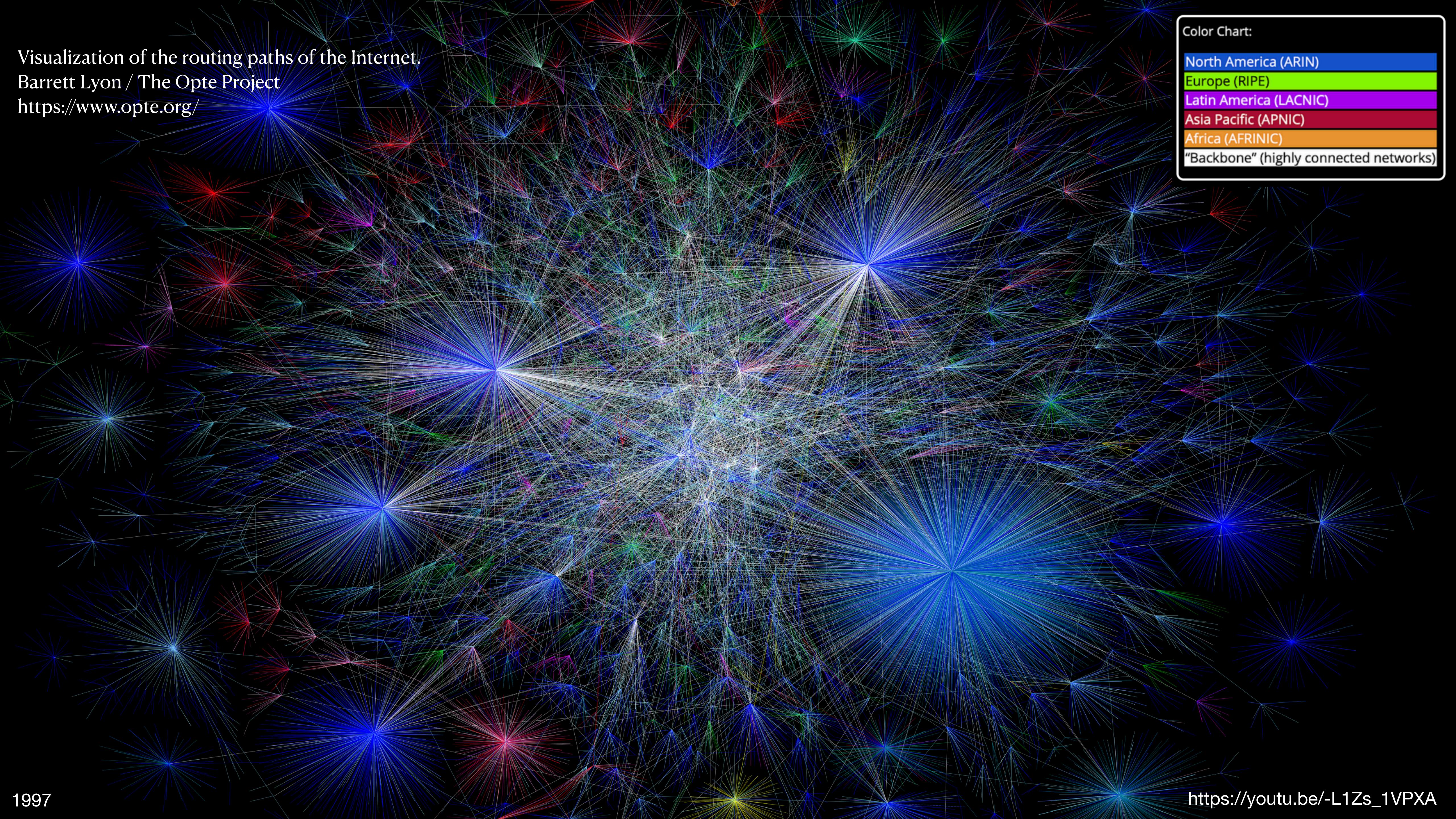


## Autonomous System



## Autonomous System

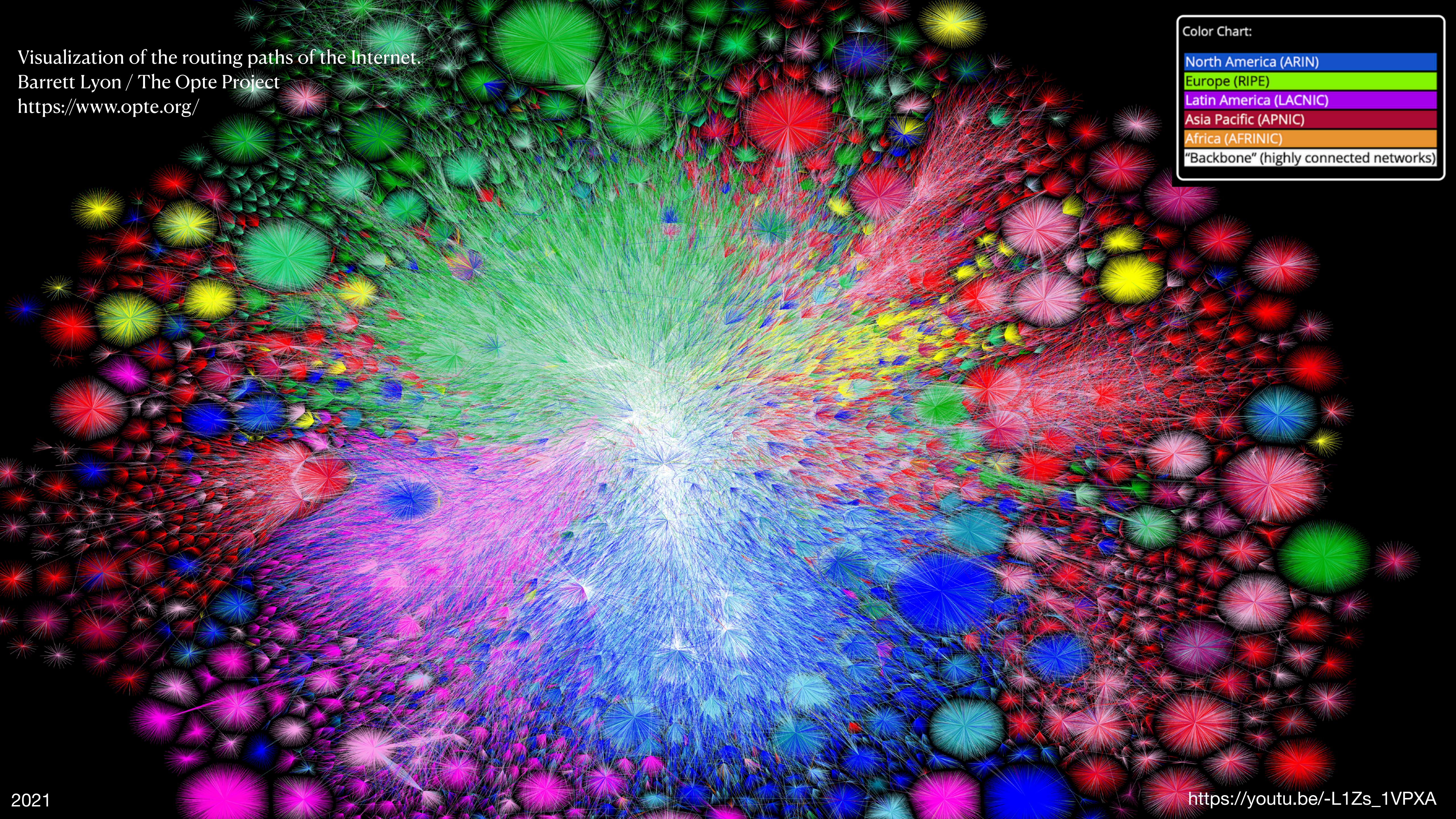




Visualization of the routing paths of the Internet.

Barrett Lyon / The Opte Project

<https://www.opte.org/>



## WHOIS IANA

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<https://www.iana.org/>

**The Internet Assigned Numbers Authority (IANA)  
oversees global IP address/AS *number allocation*, root  
zone management etc.**



WHOIS(1)

BSD General Commands Manual

WHOIS(1)

**NAME**

**whois** -- Internet domain name and network number directory service

**SYNOPSIS**

**whois** [**-aAbfgiIklmPQrRS**] [**-c TLD** | **-h host**] [**-p port**] [**--**] **name** ...

**DESCRIPTION**

The **whois** utility looks up records in the databases maintained by several Network Information Centers (NICs).

By default **whois** starts by querying the Internet Assigned Numbers Authority (IANA) whois server, and follows referrals to whois servers that have more specific details about the query **name**. The IANA whois server knows about IP address and AS numbers as well as domain names.

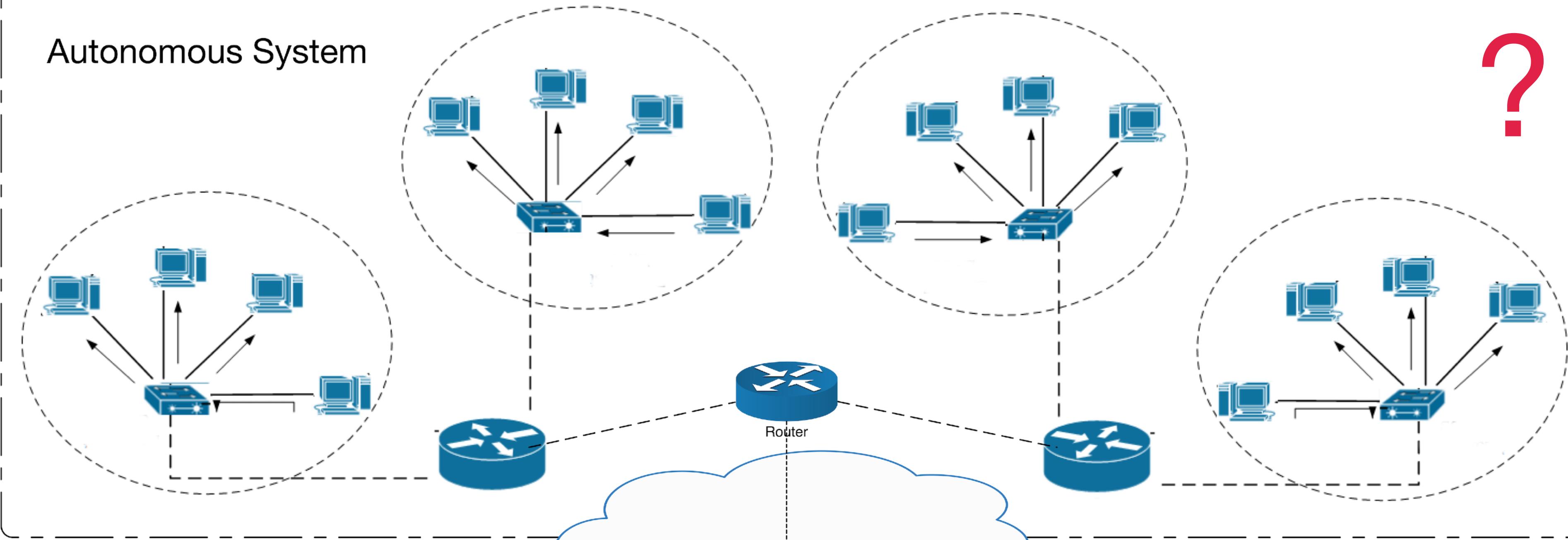
There are a few special cases where referrals do not work, so **whois** goes directly to the appropriate server. These include point-of-contact handles for ARIN, **nic.at**, NORID, and RIPE, and domain names under **ac.uk**.

The options are as follows:



```
"cidr0_cidrs" : [ {
    "v4prefix" : "192.12.216.0",
    "length" : 24
} ],
"arin_originas0_originautnums" : [ ]
} ],
"port43" : "whois.arin.net",
"objectClassName" : "entity"
}
[laptop$ curl -s https://rdap.arin.net/registry/entity/SIT | jq '.autnums[0].handle'
"AS16889"
[laptop$ curl -s https://rdap.arin.net/registry/entity/SIT |
> jq -M '{ "AS" : .autnums[0].handle, "Netblocks": [ .networks[] | "\\.startAddr"
ess) - \(.endAddress)"]}'
{
    "AS": "AS16889",
    "Netblocks": [
        "2620:10f:: - 2620:10f:f:ffff:ffff:ffff:ffff:ffff",
        "155.246.0.0 - 155.246.255.255",
        "192.12.216.0 - 192.12.216.255"
    ]
}
```

## Autonomous System



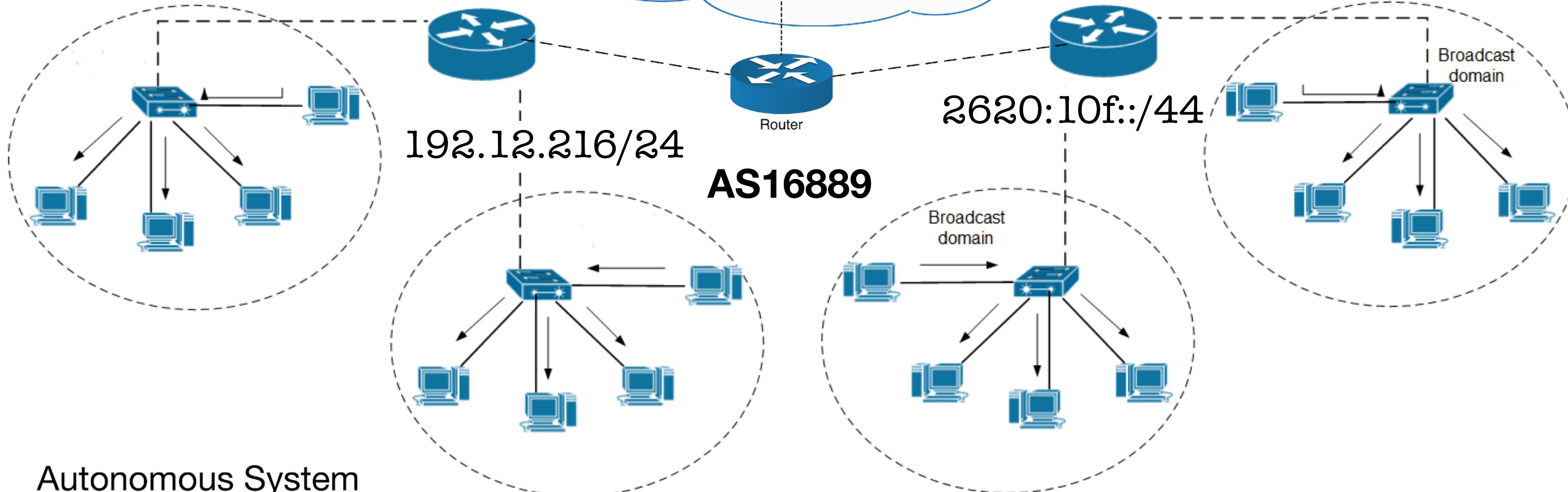
155.246/16



192.12.216/24

**AS16889**

2620:10f::/44

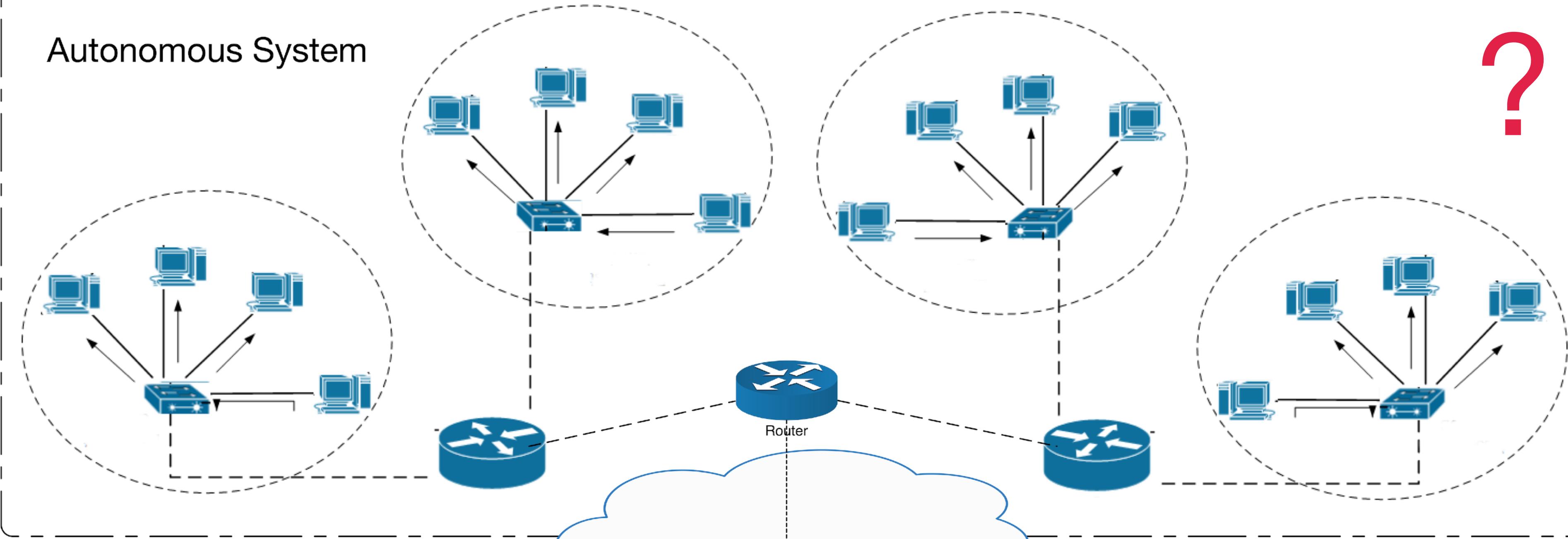


## Autonomous System



```
traceroute to www.yahoo.com (74.6.143.25), 30 hops max, 60 byte packets
 1  155.246.89.2 (155.246.89.2) [AS16889]  1.008 ms  1.270 ms  1.631 ms
 2  10.255.8.171 (10.255.8.171) [*]  0.652 ms  0.650 ms  0.620 ms
 3  155.246.151.33 (155.246.151.33) [AS16889]  3.981 ms  3.959 ms  3.941 ms
 4  130.156.251.105 (130.156.251.105) [AS21976]  1.791 ms  1.851 ms  1.904 ms
 5  130.156.251.25 (130.156.251.25) [AS21976]  1.648 ms  1.632 ms  1.613 ms
 6  nyiix.bas1-m.nyc.yahoo.com (198.32.160.121) [AS4637]  1.573 ms  1.601 ms  1.
605 ms
 7  ae-1.pat1.bfw.yahoo.com (209.191.64.163) [AS10310]  10.364 ms  14.906 ms  10
.394 ms
 8  et-0-1-1.msr2.bf2.yahoo.com (74.6.227.61) [AS10310]  11.770 ms et-0-1-1.msr1
.bf2.yahoo.com (74.6.227.67) [AS10310]  11.781 ms et-1-0-0.msr2.bf1.yahoo.com (7
4.6.227.45) [AS10310]  10.324 ms
 9  et-1-1-0.clr1-a-gdc.bf2.yahoo.com (74.6.122.53) [AS26101]  10.404 ms et-19-0
-0.clr1-a-gdc.bf2.yahoo.com (74.6.122.41) [AS26101]  11.803 ms et-0-1-0.clr2-a-g
dc.bf2.yahoo.com (74.6.122.25) [AS26101]  13.364 ms
10  lo0.fab7-1-gdc.bf2.yahoo.com (74.6.123.238) [AS26101]  11.772 ms lo0.fab6-1-
gdc.bf2.yahoo.com (74.6.123.239) [AS26101]  10.274 ms lo0.fab2-1-gdc.bf2.yahoo.c
om (74.6.123.243) [AS26101]  11.750 ms
11  usw1-1-lbb.bf2.yahoo.com (74.6.98.138) [AS26101]  11.732 ms  13.141 ms usw2-
1-lbb.bf2.yahoo.com (74.6.98.139) [AS26101]  11.707 ms
12  media-router-fp73.prod.media.vip.bf1.yahoo.com (74.6.143.25) [AS26101]  13.0
25 ms  11.602 ms  11.624 ms
shell$
```

## Autonomous System



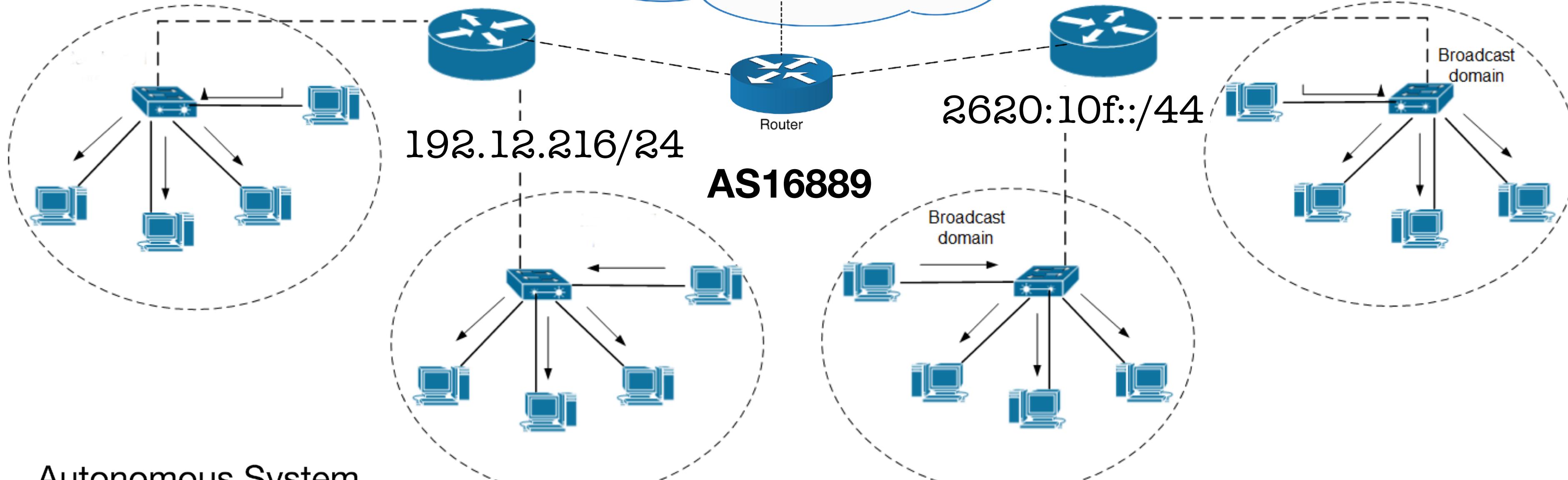
155.246/16



192.12.216/24

**AS16889**

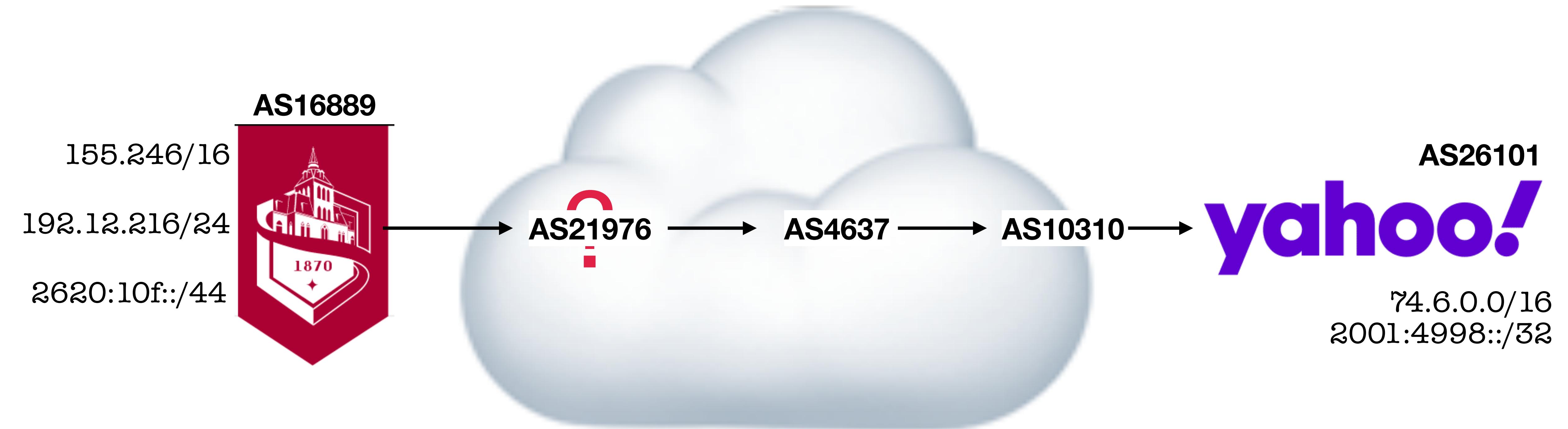
2620:10f::/44



## Autonomous System

## Peering

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## Exchanges (0)

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you agree to adhere to

[2.25.1 - Privacy Policy](#)



```
Terminal — 80x24
traceroute to www.yahoo.com (74.6.143.25), 30 hops max, 60 byte packets
 1  155.246.89.2 (155.246.89.2) [AS16889]  1.008 ms  1.270 ms  1.631 ms
 2  10.255.8.171 (10.255.8.171) [*]  0.652 ms  0.650 ms  0.620 ms
 3  155.246.151.33 (155.246.151.33) [AS16889]  3.981 ms  3.959 ms  3.941 ms
 4  130.156.251.105 (130.156.251.105) [AS21976]  1.791 ms  1.851 ms  1.904 ms
 5  130.156.251.25 (130.156.251.25) [AS21976]  1.648 ms  1.632 ms  1.613 ms
 6  nyiix.bas1-m.nyc.yahoo.com (198.32.160.121) [AS4637]  1.573 ms  1.601 ms  1.
605 ms
 7  ae-1.pat1.bfw.yahoo.com (209.191.64.163) [AS10310]  10.364 ms  14.906 ms  10
.394 ms
 8  et-0-1-1.msr2.bf2.yahoo.com (74.6.227.61) [AS10310]  11.770 ms et-0-1-1.msr1
.bf2.yahoo.com (74.6.227.67) [AS10310]  11.781 ms et-1-0-0.msr2.bf1.yahoo.com (7
4.6.227.45) [AS10310]  10.324 ms
 9  et-1-1-0.clr1-a-gdc.bf2.yahoo.com (74.6.122.53) [AS26101]  10.404 ms et-19-0
-0.clr1-a-gdc.bf2.yahoo.com (74.6.122.41) [AS26101]  11.803 ms et-0-1-0.clr2-a-g
dc.bf2.yahoo.com (74.6.122.25) [AS26101]  13.364 ms
10  lo0.fab7-1-gdc.bf2.yahoo.com (74.6.123.238) [AS26101]  11.772 ms lo0.fab6-1-
gdc.bf2.yahoo.com (74.6.123.239) [AS26101]  10.274 ms lo0.fab2-1-gdc.bf2.yahoo.c
om (74.6.123.243) [AS26101]  11.750 ms
11  usw1-1-lbb.bf2.yahoo.com (74.6.98.138) [AS26101]  11.732 ms  13.141 ms usw2-
1-lbb.bf2.yahoo.com (74.6.98.139) [AS26101]  11.707 ms
12  media-router-fp73.prod.media.vip.bf1.yahoo.com (74.6.143.25) [AS26101]  13.0
25 ms  11.602 ms  11.624 ms
shell$
```

# Daily stats

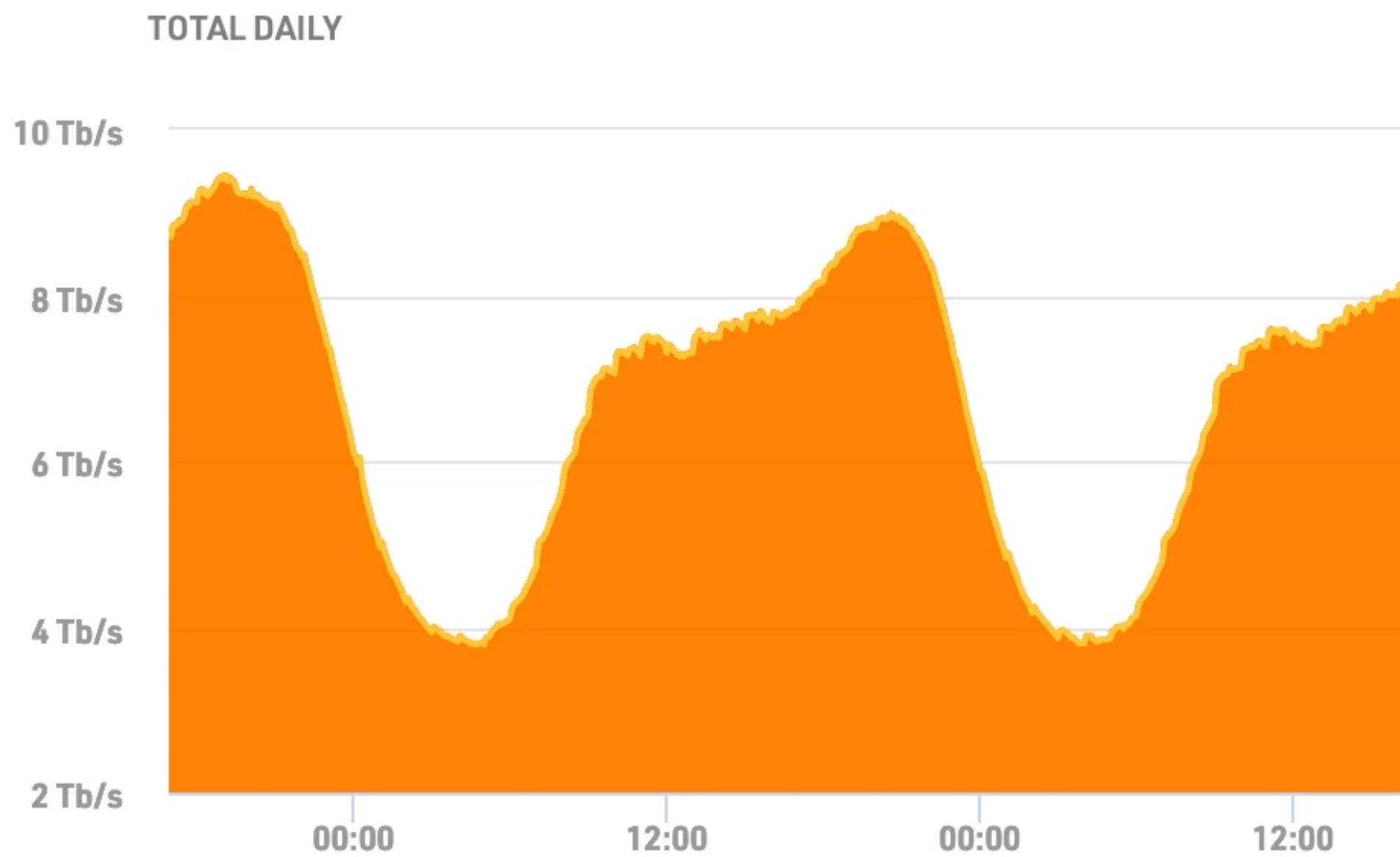
Daily traffic statistics, all colocations combined.

Total statistics

Daily stats

Monthly stats

Yearly stats



PEAK IN  
**9.454** Tb/s

PEAK OUT  
**9.448** Tb/s

AVERAGE IN  
**6.71** Tb/s

AVERAGE OUT  
**6.709** Tb/s

CURRENT IN  
**8.131** Tb/s

CURRENT OUT  
**8.131** Tb/s

## Summary and Questions

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- Identify AS numbers of other organizations and companies and find out where they peer.
- Research and review some of publicly known cases of “depeering” between ISPs and how this could lead to degraded network performance for their respective customers.
- Review the list of largest internet exchange points and compare their throughput and facilities; try to find out more information about e.g., the “NAP of the Americas”.
- Consider joining the NANOG mailing list at: <https://nanog.org>

Coming up: tracing packets and applications

## Links

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- <https://www.opte.org/>
- [https://en.wikipedia.org/wiki/Autonomous\\_system\\_\(Internet\)](https://en.wikipedia.org/wiki/Autonomous_system_(Internet))
- <https://www.iana.org/assignments/as-numbers/as-numbers.xhtml>
- `whois(1)`
- <https://en.wikipedia.org/wiki/Peering>
- [https://en.wikipedia.org/wiki/List\\_of\\_Internet\\_exchange\\_points\\_by\\_size](https://en.wikipedia.org/wiki/List_of_Internet_exchange_points_by_size)
- <https://peeringdb.com/>
- <https://nanog.org>