

LIS-5411

The Internet

What makes “the Internet” unique?

# What makes “the Internet” unique?

We had:

- The written word
- The PRINTED word
- The Telegraph
- Radio
- TV
- Telephone (which is pretty close, actually?)

# What makes “the Internet” unique?

*(Why didn't, e.g. the American Telegraph and Telephone company invent the Internet?)*

# Good Ol' AT&T

They had the physical network?

Which worked like the following:

# Smart Network (circuit switching)

direct “single-wire” connections



# Smart Network (circuit switching)

direct “single-wire” connections

A remarkable, complex system...as opposed to...

Well, let's try it...

# Our L'il Internet

- 1) Pass this note to the person waving their hand.
- 2) If you can't, then pass it to someone who is closer to them. than you are.



# Our L'il Internet

C

D

B

(1/4)

# Our L'il Internet

**A**

**E**

**E**

(2/4)

# Our L'il Internet

**E**

**D**

**F**

(4/4)

Okay, so how did THAT work?

# Dumb Network (packet switching)

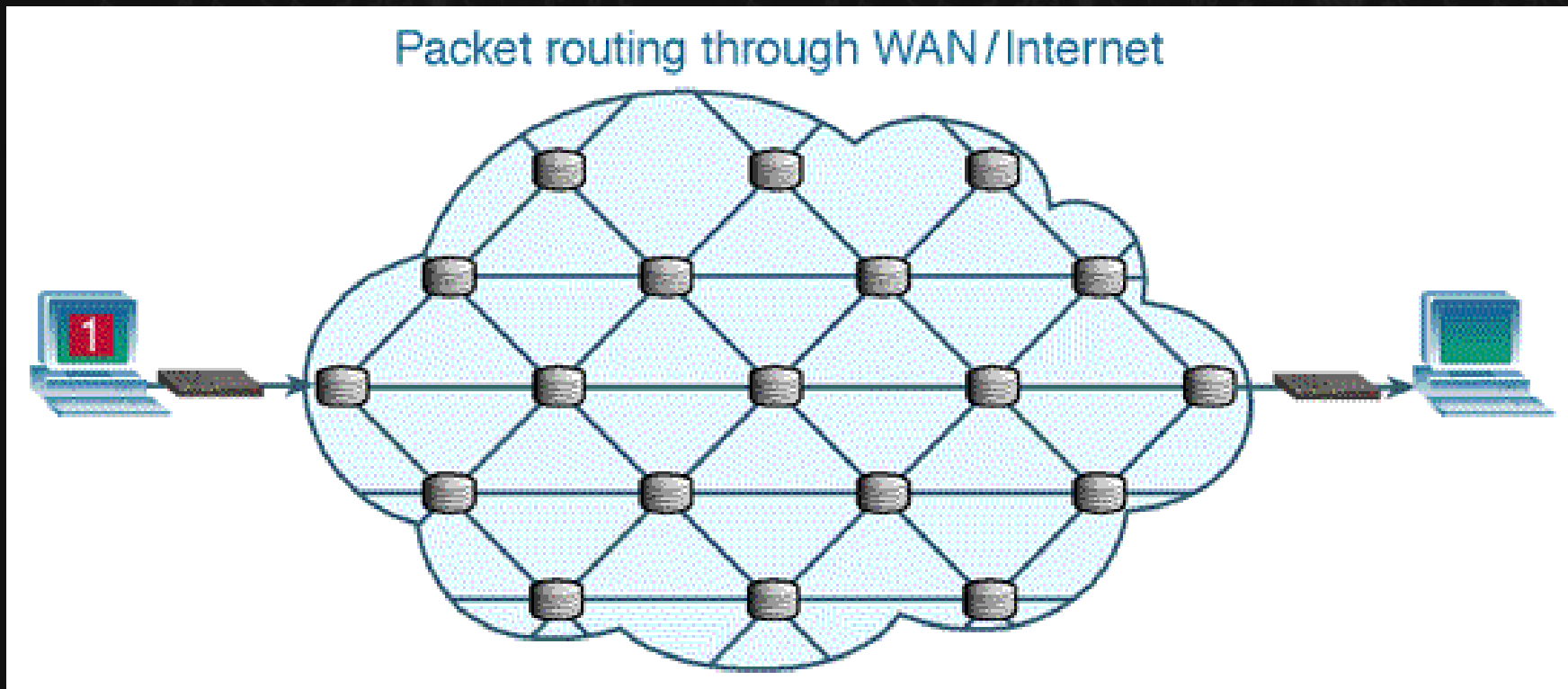
indirect, node based “post-office” connections

Consider how “resilient” this system is  
(simple instructions, etc) vs.

The complexity and brittleness of a “smart” network  
(E.g. Susie → John → Fred → Singh → Joe  
and then what if a node is absent or moved, etc.

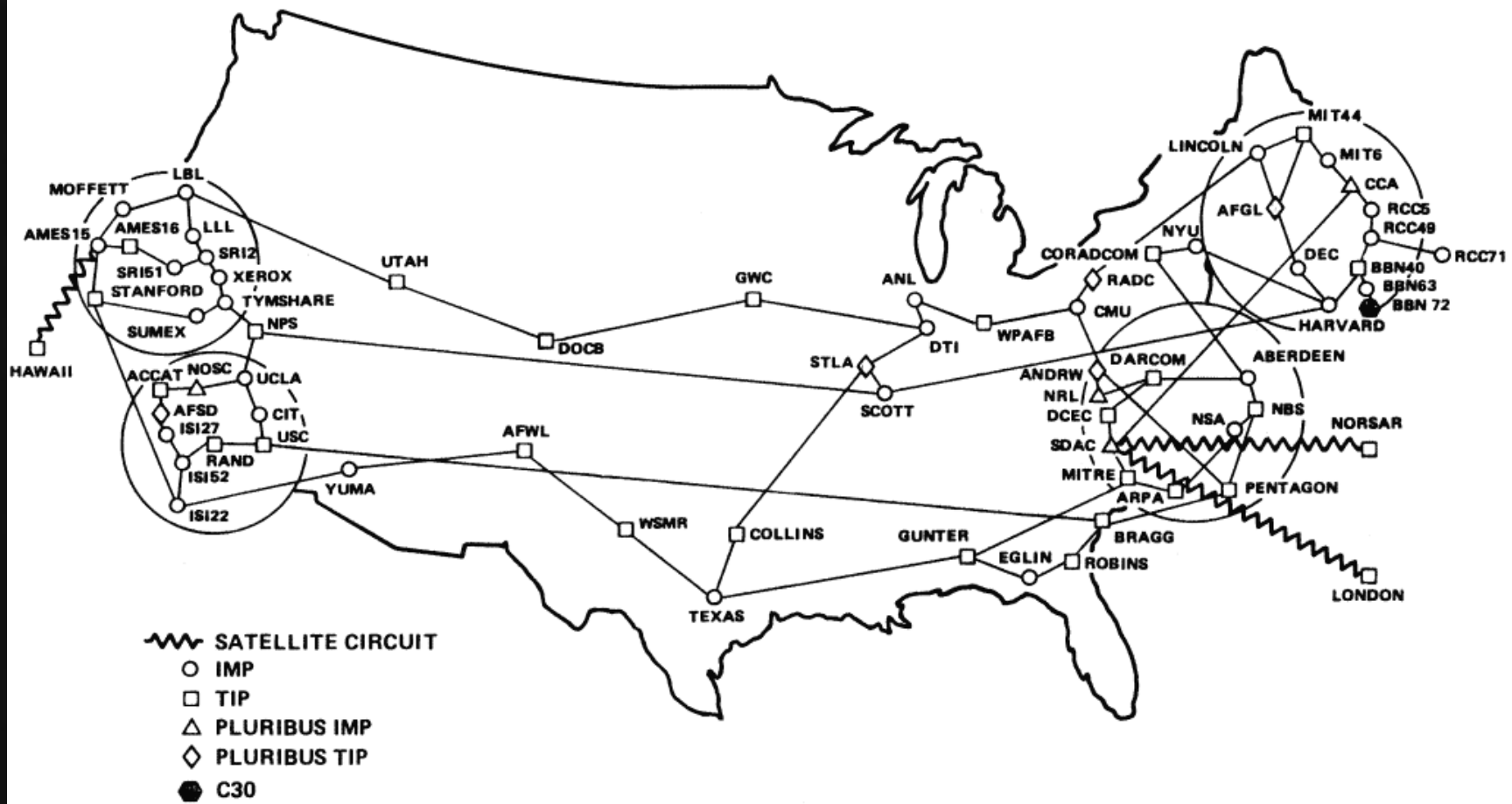
# Dumb Network (packet switching)

indirect, node based “post-office” connections



# ARPANET

ARPANET GEOGRAPHIC MAP, OCTOBER 1980



(NOTE: THIS MAP DOES NOT SHOW ARPA'S EXPERIMENTAL SATELLITE CONNECTIONS)  
NAMES SHOWN ARE IMP NAMES, NOT (NECESSARILY) HOST NAMES

# Top 3 things about the net:

## 3) PACKET SWITCHING

Use of a “Dumb” Network:

”Pipes” and “switches”



# NOW - **What** was sent?

A huge number

- (technically, this is DEFINITELY a right answer)

Hex: CDBAEEFAEEDF =

226,202,757,033,695

# What was sent?

- MAC Address?
- Perhaps a computer was identifying itself.

CD:BA:EE:FA:EE:DF

# What was sent?

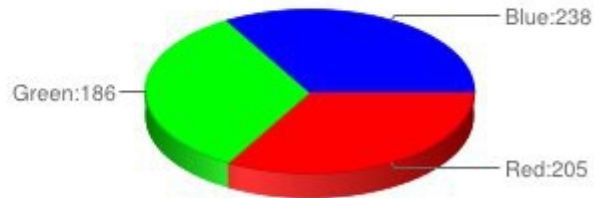
Perhaps, a lovely color scheme...

## #cdbaee color hex

#cdbaee hex color information.

RGB value of **#cdbaee** is (205,186,238)

[Change page background color to #cdbaee](#) | [Reset](#)

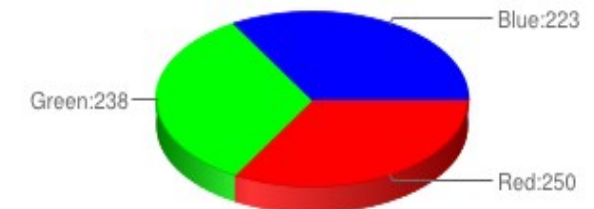


## #faeedf color hex

#faeedf hex color information.

RGB value of **#faeedf** is (250,238,223)

[Change page background color to #faeedf](#) | [Reset](#)





# What was sent?

## Something else?

- 1100110110111010111011101111010111011101101111

What was sent?

Wait – maybe encrypted?

(badly)

Tricky...

C	A	F	E
D	E	A	D
B	E	E	F

Obviously, a restaurant recommendation. (Or not.)

# Cafe Dead Beef





# Top 3 things about the net:

3) packet switching

2) DIGITIZATION

(literally, turning any “data” into a number)

# Top 3 things about the net:

## 3) DIGITIZATION

(literally, turning any “data” into a number)

NOTE, as demonstrated:

The nodes need not **know** or **care** what the data “is”

(Later, we learn that ,in fact, **encryption** can prevent them from knowing)

But: Phones and other older tech  
(sort of) had this:

- telegraph?
- Fax Machines (documents)
- Party Lines (group chat)
- Info Hotlines (websites)

But: Phones (sort of) had this:

:



...until they didn't?

# This brings us to a good question: Who owns the network?



Models for Hand-set Phone



Models for  
Pedestal Phone

## **A Telephone Silencer – the HUSH-A-PHONE**

*A solution of three phone problems of subscribers*

*Safeguarding Privacy: So others cannot hear confidential matters*

*Eliminating Phone Talk Annoyance: Quieting the office for personal efficiency*

*Improving Hearing in Noisy Places: By keeping surrounding noises out of the transmitter*

*Write for Booklet T-E.*

**Hush-A-Phone Corporation, 43 W. 16th St., N. Y. City**

# Who owns your telephone and what does that mean?

# Who owns your telephone and what does that mean?



# Top 3 things about the net:

## 3) PACKET SWITCHING

Use of a “Dumb” Network:

## 2) DIGITIZATION

(literally, turning any “data” into a number)



# Top 3 things about the net:

## 3) PACKET SWITCHING

Use of a “Dumb” Network:

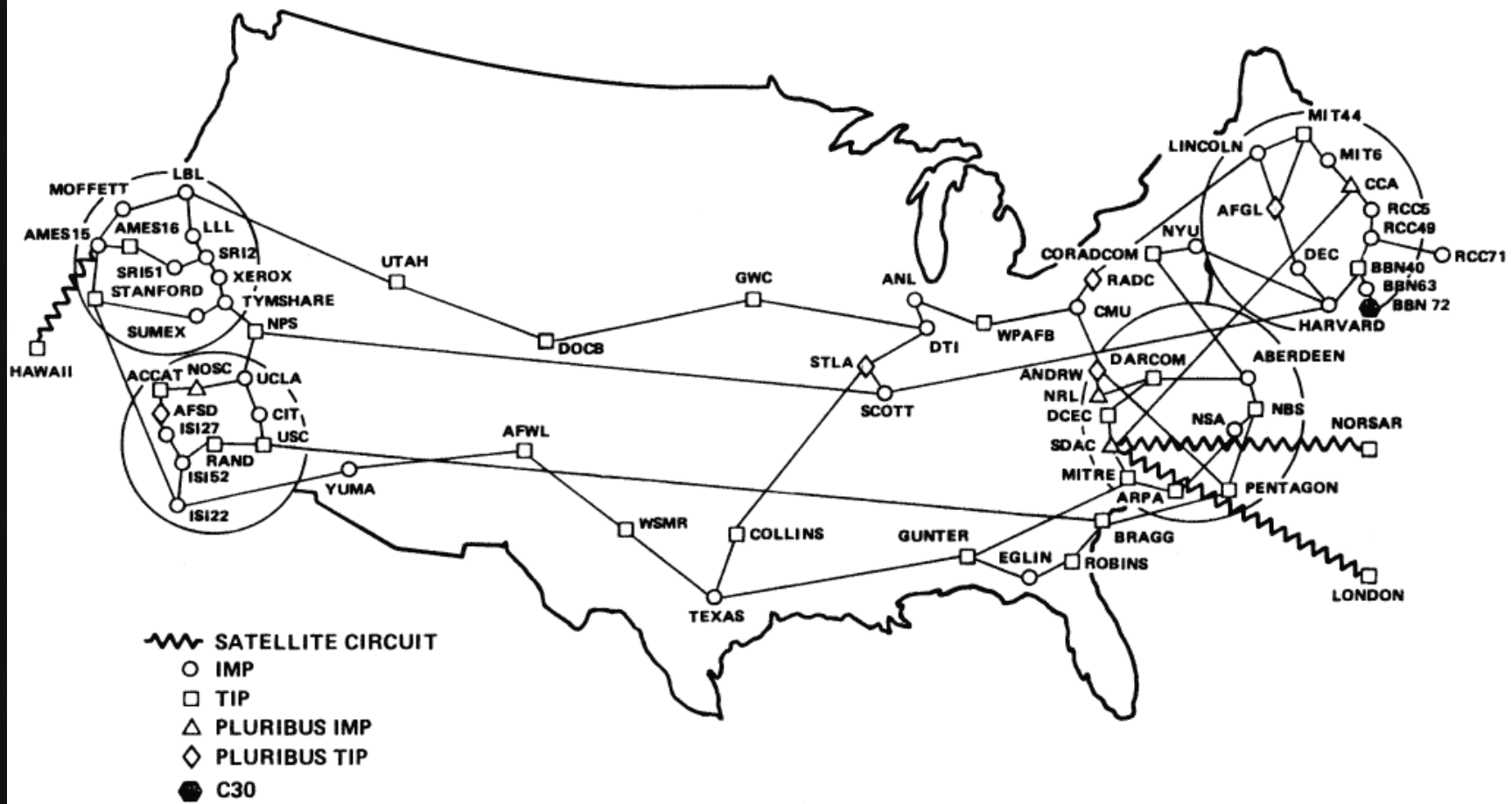
## 2) DIGITIZATION

(literally, turning any “data” into a number)

1).... who owns the internet?

# ARPANET

ARPANET GEOGRAPHIC MAP, OCTOBER 1980



(NOTE: THIS MAP DOES NOT SHOW ARPA'S EXPERIMENTAL SATELLITE CONNECTIONS)  
NAMES SHOWN ARE IMP NAMES, NOT (NECESSARILY) HOST NAMES

# 3 things about the 'net...

DIGITIZATION

+

PACKET SWITCHING

+

PUBLICLY CREATED UTILITY

# (somewhat controversial) thoughts on innovation

The public sector (schools, defense, NASA, government) etc. is as inventive and as innovative as private companies...

perhaps, probably more.

(the internet, GPS, touchscreens, digital photography, water filters, invisible braces etc.)

Why didn't the American Telegraph and Telephone company invent the Internet?



Nobody owns the Internet.

Nobody owns the Internet.  
(technically)

It's a “protocol” or  
”technical agreement”

Nobody owns the Internet.

Consider: “Cable” v. “Telephones”  
etc., vs.  
“The Internet”



Side Question:

Who gives you the fastest  
Internet?

Of course: Who were the “ISPs” in the beginning?

Earthlink, America Online

Juno, “Freenet”

Schools. Libraries. Community centers

Of course: Who were the “ISPs” in the beginning?

Earthlink, America Online

Juno, “Freenet”

Schools. Libraries. Community centers

What about now?

Comcast, AT&T, Verizon, etc..

# 3 things about the 'net...

DIGITIZATION

+

PACKET SWITCHING

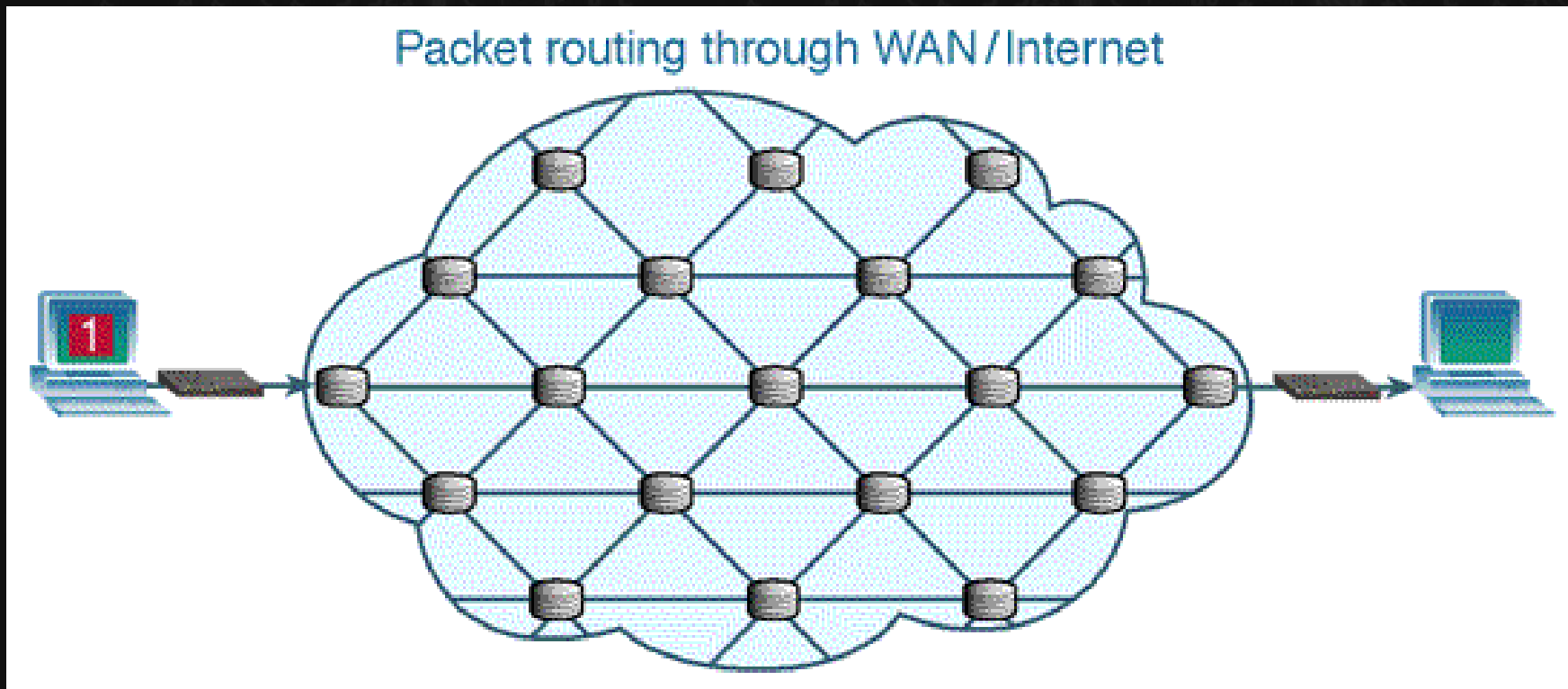
+

PUBLICLY CREATED UTILITY

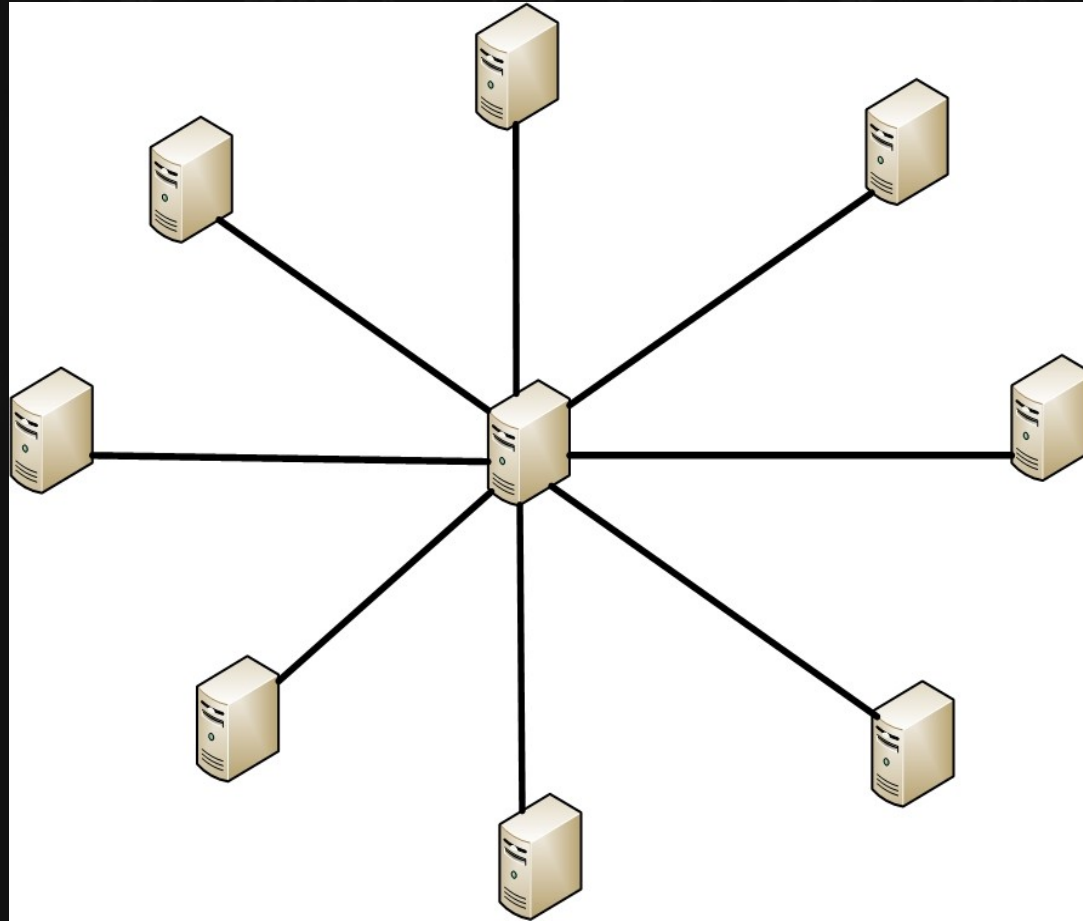
=

Peer to peer node based network

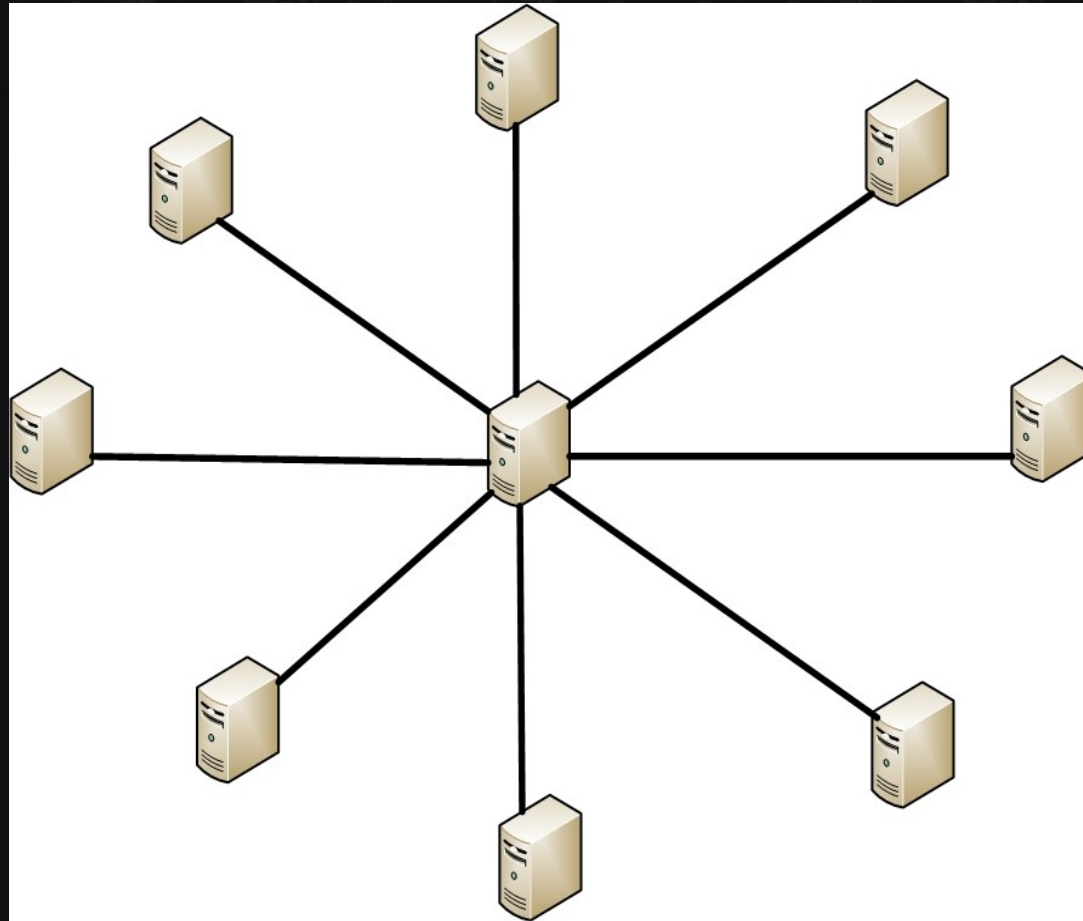
# What services/protocols ACTUALLY look like this?



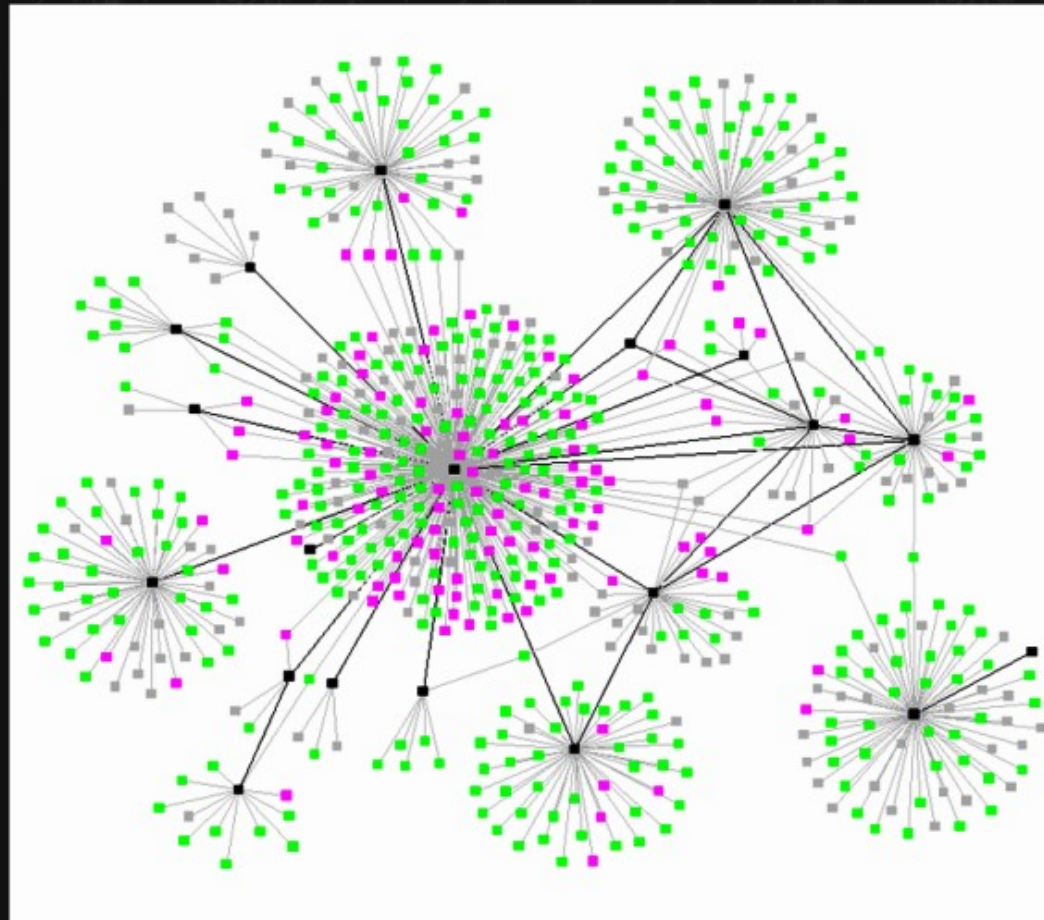
vs. this?



# “Hub and Spoke”



...ish





# Diversity of layers (OSI)

- Application (HTTP, telnet, etc)
- Presentation (framework MIME)
- Session (pipe,SOCKS)
- Transport (reliable packet delivery, TCP)
- Network (nodes and address, IP)
- Data (PPP)
- Physical (wires, radio, USB)

# Diversity of layers...unofficial

*Platform? Ecosystem? Use?*

(e.g. Wordpress, Facebook? Apple?

dreams love? Instagram?

Twitter? Black Twitter?

Fortnite? selfies Discord? Hopes Slack?

Mastodon? Etc. etc. etc.)

---

- Application (HTTP, telnet, “email”)

- Presentation (frameworks, MIME)

# Diversity of transmission media:

- telephone lines (modem/DSL)
- - tv cable
- - wireless (802.11)
- - satellites
- - radio
- - lasers (pointless, but true)
- - fiber

# The “Usual Path”

- Your computer
- Your router
- ISP “station”
- Bigger ISP Station/Backbone
- .... etc.

# But wait, what does internet?

- Laptops
- Tablets
- Phones
- Routers
- Cars
- Ovens?

wardrive, and find out yourself – :)

# Lampposts?



# All running you know what...

```
[root@treasure ~]# iptables -L -n
Chain FORWARD (policy ACCEPT)
target     prot opt source                destination
MAC-STOP   all  --  0.0.0.0/0             0.0.0.0/0
RH-Firewall-1-INPUT  all  --  0.0.0.0/0             0.0.0.0/0

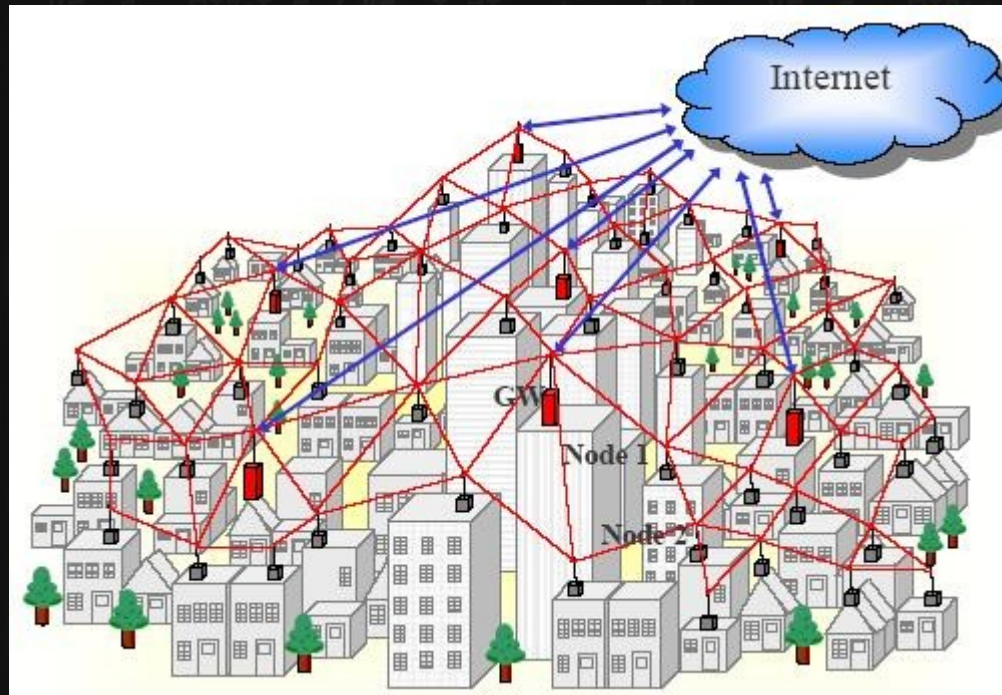
Chain INPUT (policy ACCEPT)
target     prot opt source                destination
MAC-STOP   all  --  0.0.0.0/0             0.0.0.0/0
RH-Firewall-1-INPUT  all  --  0.0.0.0/0             0.0.0.0/0

Chain MAC-STOP (2 references)
target     prot opt source                destination
RETURN     all  --  0.0.0.0/0             0.0.0.0/0

Chain OUTPUT (policy ACCEPT)
target     prot opt source                destination

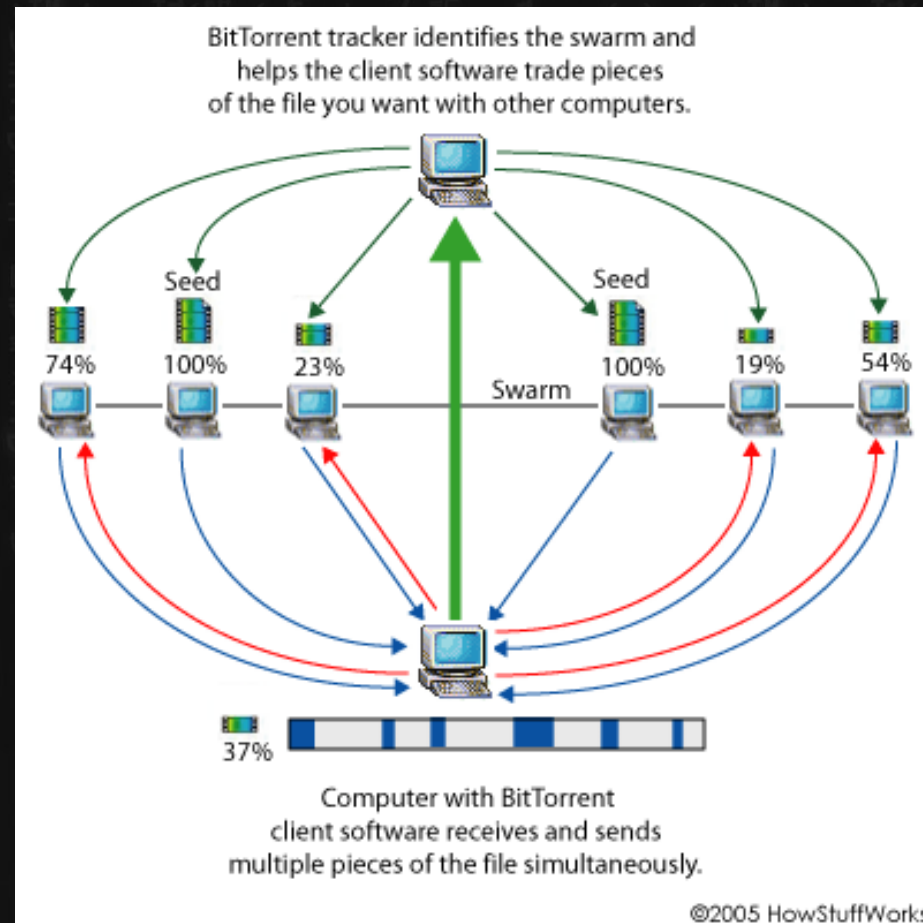
Chain RH-Firewall-1-INPUT (2 references)
target     prot opt source                destination
ACCEPT     all  --  0.0.0.0/0             0.0.0.0/0
ACCEPT     icmp --  0.0.0.0/0             0.0.0.0/0             icmp type 255
ACCEPT     all  --  0.0.0.0/0             0.0.0.0/0             state RELATED,ESTABLISHED
ACCEPT     tcp  --  0.0.0.0/0             0.0.0.0/0             state NEW tcp dpt:928
ACCEPT     tcp  --  0.0.0.0/0             0.0.0.0/0             state NEW tcp dpt:139
ACCEPT     tcp  --  0.0.0.0/0             0.0.0.0/0             state NEW tcp dpt:22
ACCEPT     tcp  --  0.0.0.0/0             0.0.0.0/0             state NEW tcp dpt:80
ACCEPT     tcp  --  0.0.0.0/0             0.0.0.0/0             state NEW tcp dpt:21
REJECT     all  --  0.0.0.0/0             0.0.0.0/0             reject-with icmp-host-prohibited
[root@treasure ~]#
```

# Mesh Networking





# Look familiar?



# No Cell or Wi-Fi....

