TCP/IP What's It All About?

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TCP/IP: What's It All About?

Abstract:

This tutorial is designed for the "non-network savvy professional" who wants to understand what TCP/IP is all about. This talk will NOT get you to the point of designing TCP/IP networks, but it will show you how the basic elements of a TCP/IP network work--addressing, network definition, routing, and the basic universal services. Discussion will start with a historical perspective, including the design principles of IP (the Internet Protocol) and where and when the work was done. Then the session will address the structure and definition of an IP network, with a look at the services that are typically implemented. It will close with a look at IP Version Six--its extensions and challenges.

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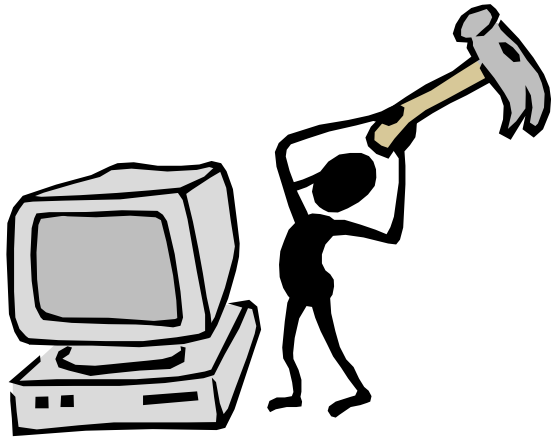
Biography:

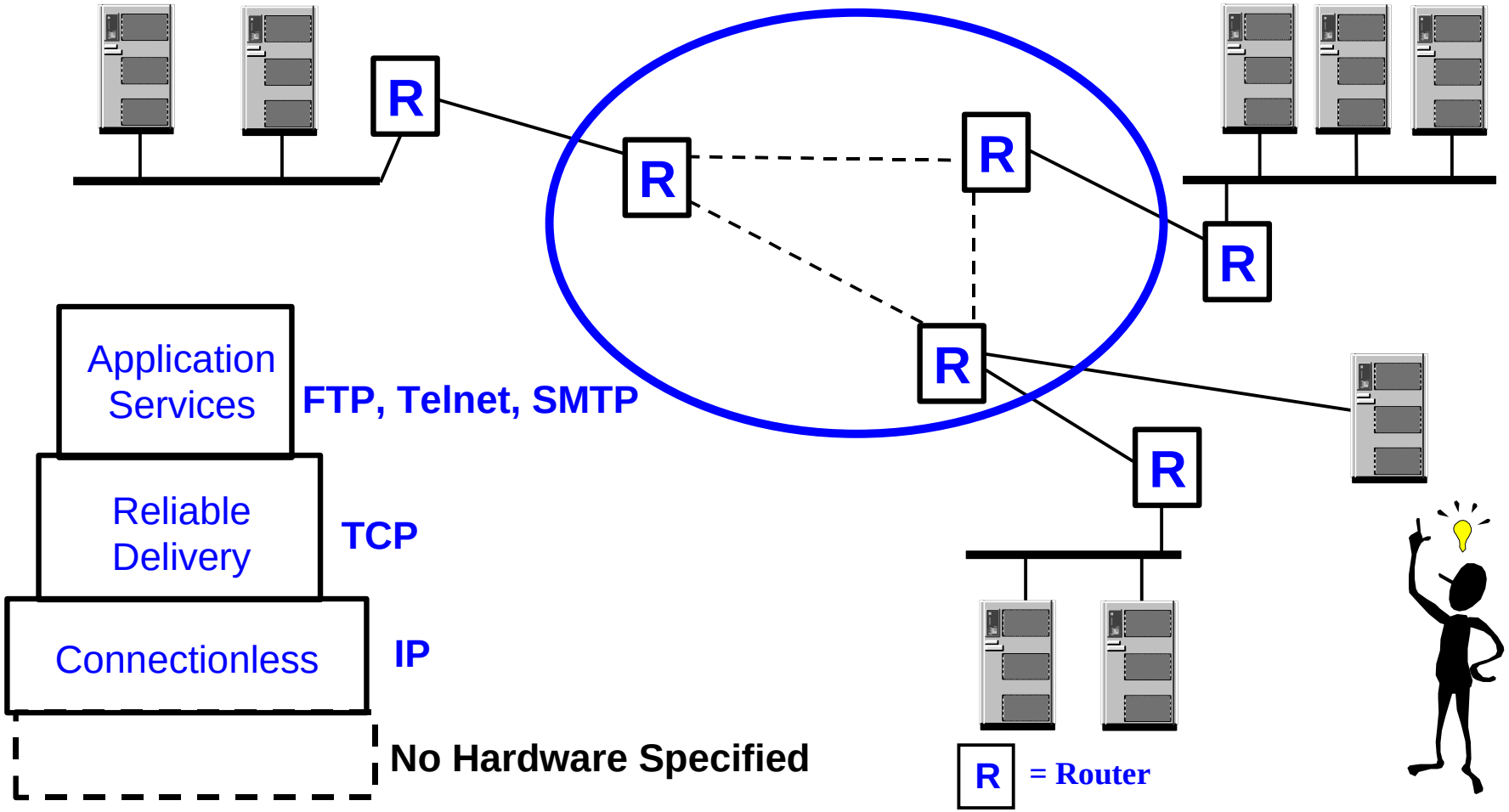
Robert Davia works in Hewlett-Packard's Enterprise Account Services organization in Piscataway, N.J. His current assignment is supporting the Center of Excellence at AT&T. He holds a B.S. in computer science and an M.S. in telecommunications management and has worked in the areas of network design, systems troubleshooting, and network and systems management. When not working, he can be found playing with his thirteen year old son, participating in a rousing square dance, or tinkering with his 100 year old house.

Agenda

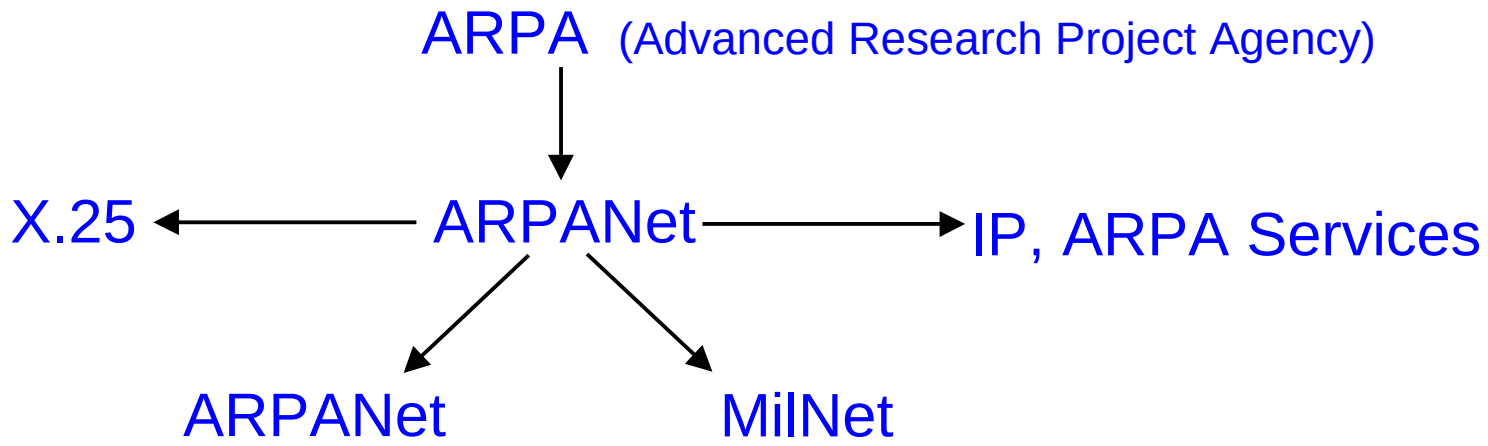
- Design Objectives
- The InterNet
- The Details
  - Addressing
  - A Few Choice Protocols
  - Routing
  - Universal Services & Management
- IPng (aka IP v6)
  - A New Address Format
  - Expanded Services



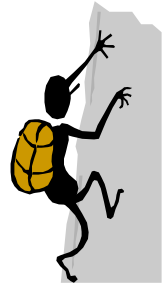
An Overview of TCP/IP Networking



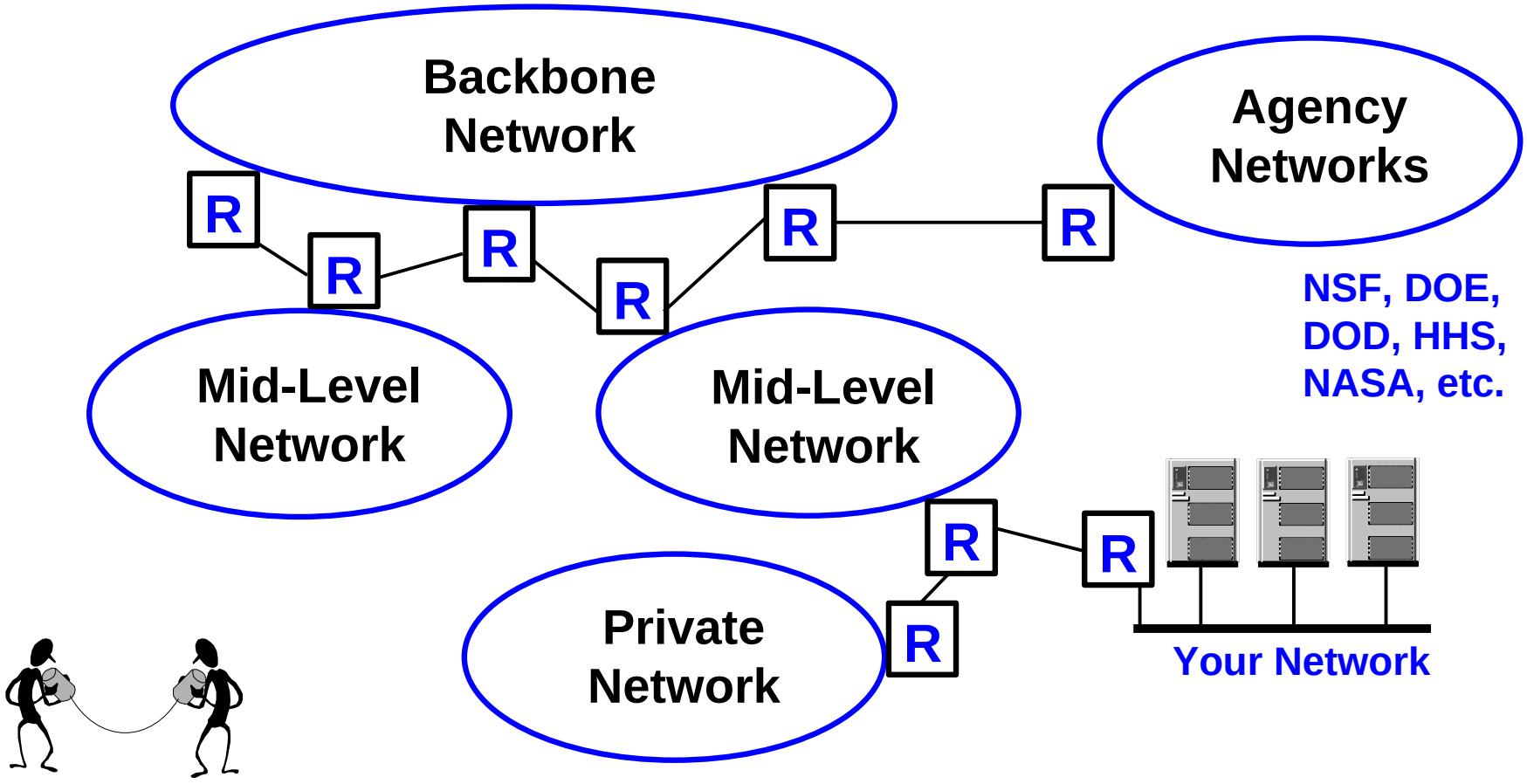
A Brief History of the Internet



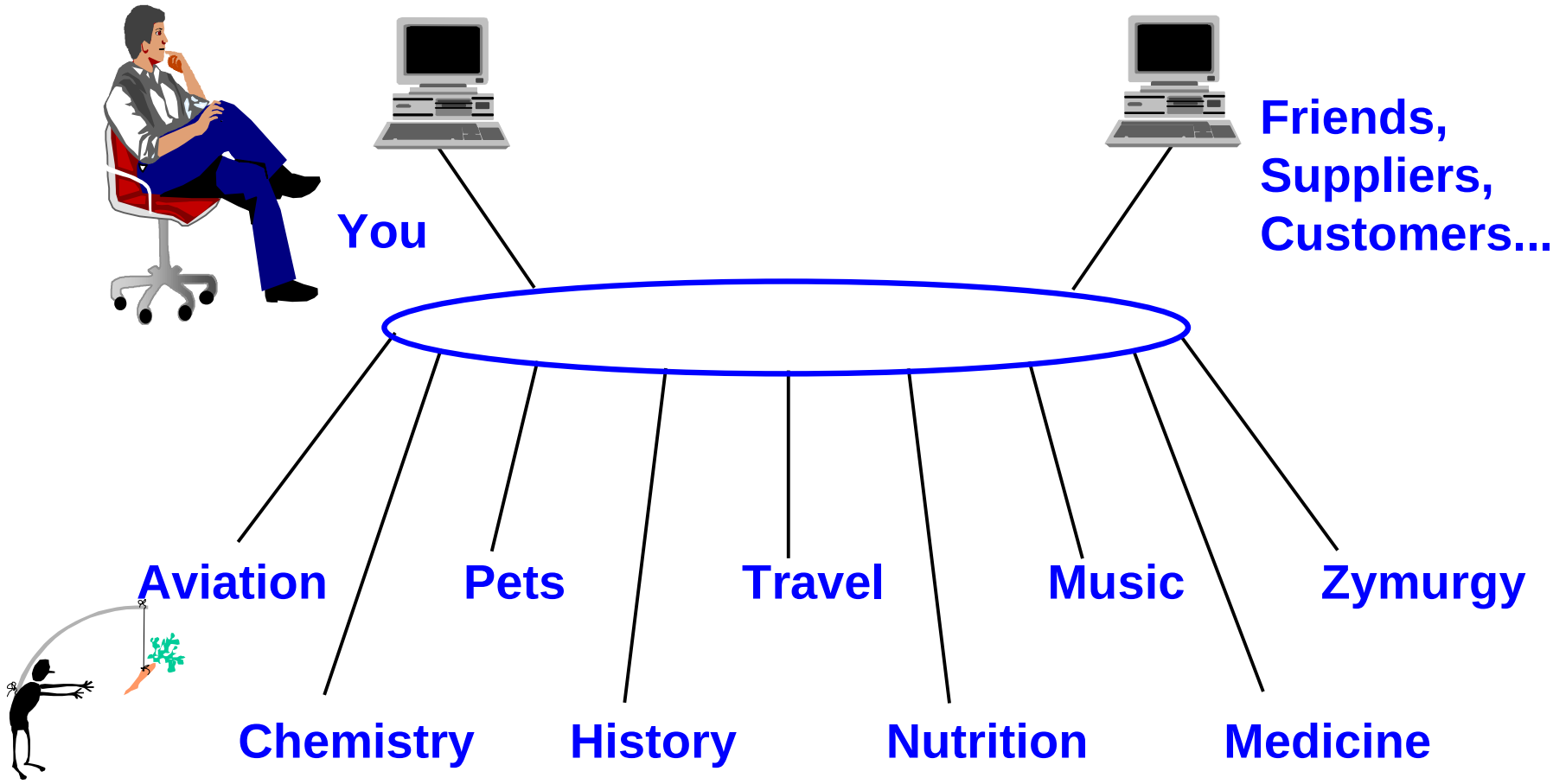
Mid - '70's	**Packet switch R&D**
'77 - '79	**Protocols stable**
'80	**The InterNet begins**
'83	**All DOD computers get IP**
'85	**NSF links 6 R&D sites**
'86	**NSF network re-built**
'87	**NSF adopts "backbone"**
'88	**New NSF backbone**
'90's	**Growth accelerates**
'95	**Internet goes private**



The Internet: A Hierarchy of Networks



Why Bother With the Internet?



The IP Address Format

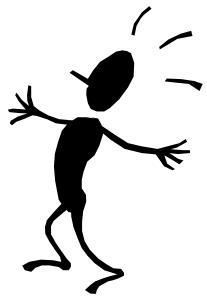
"8 bits . 8 bits . 8 bits . 8 bits" = "network + host-id"

For example:

15. 32.167. 7

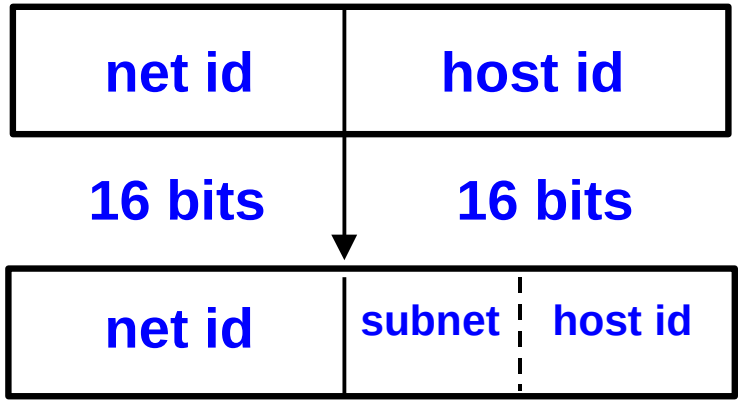
192. 202. 1. 60

41. 352. 41. 12 **WRONG**



	8 bits	8 bits	8 bits	8 bits		
A	0- - - - - - -				few networks	many nodes
B	10- - - - - -					
C	110- - - - -				many networks	few nodes

OK, I Got a Class B Address -- How Do I Administer 65,000 Nodes?



flexible division of IP address determined by the network mask;
1=use this bit as part of the network id
0=this bit is part of host id

11111111.11111111.11111111.00000000

255 . 255 . 255 . 0

255.255.0.0	no subnet : 65k hosts
255.255.224.0	3 bits of host id : 8 nets@8k hosts
255.255.255.0	8 bits of host id : 256 nets@256 hosts
255.255.255.240	12 bits of host id : 4096 nets@16 hosts

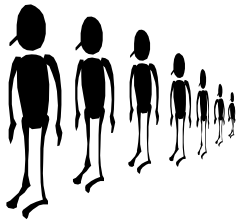
Some Related Protocols

I just got a new computer -- what IP Address should I use?

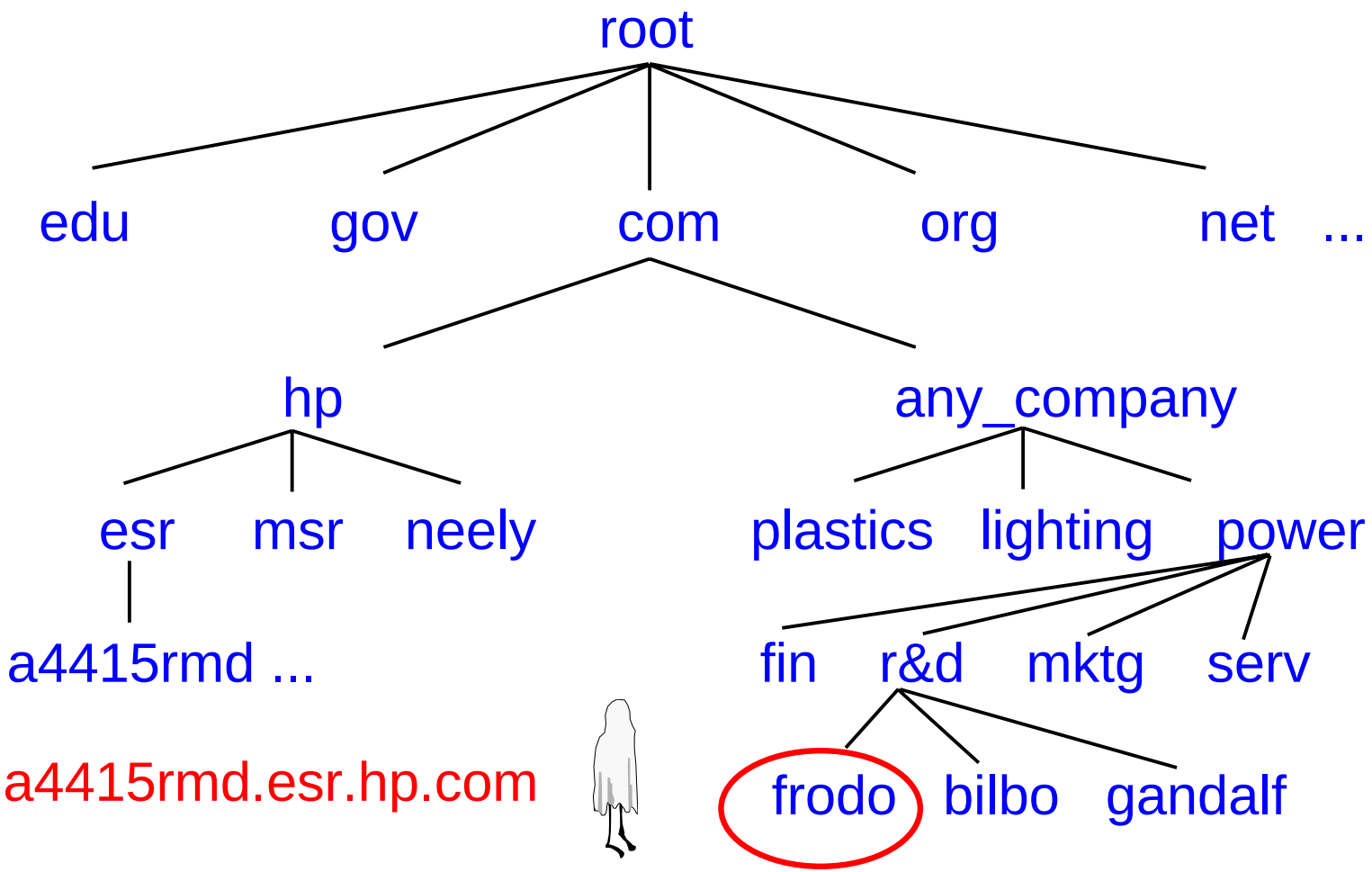
Dynamic Host Configuration Protocol (DHCP)

Copy this file to the node called FRED --
I don't remember its IP address.

1) /etc/hosts
2) Domain Name Service (DNS)

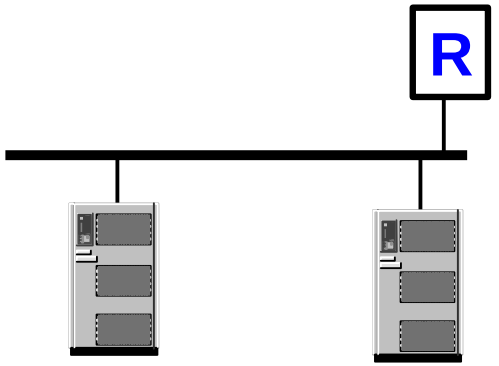


An Example of DNS



Simplifying Email Addresses

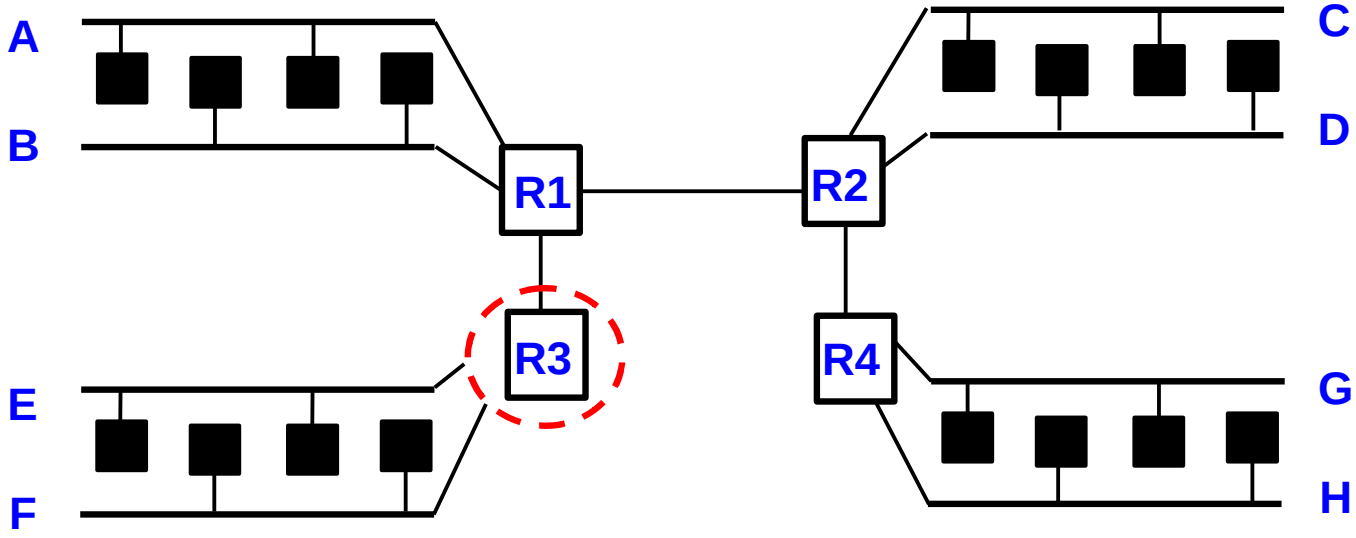
- My actual work Email address is: robert@om1335.atl3.hp.com
- My alias Email address is: robert_davia@hp.com
- The Email Alias server does the translation!
- Hides IT organization; simplifies external communications



Email engine
Routes mail

Address server
Translates External Addresses to Internal Addresses

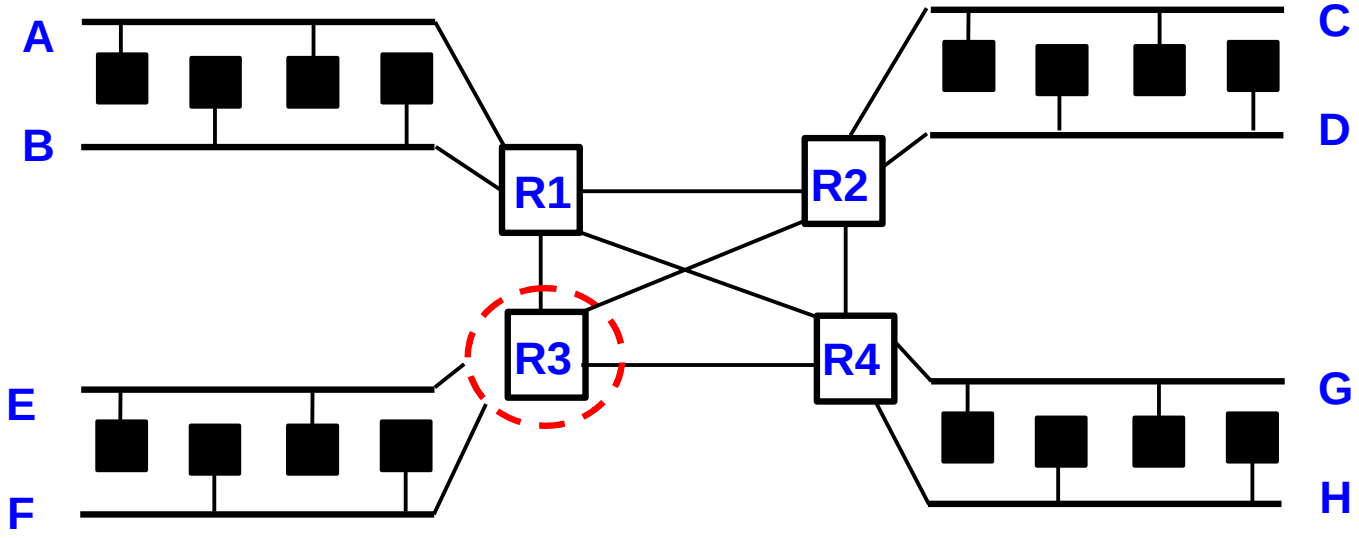
How Do IP Packets Get Delivered?



Dest	Via
A,B	R1
C,D	R1
E,F	local port
G,H	R1

But isn't IP supposed to be robust, with alternate routing?

How Do IP Packets Get Delivered?



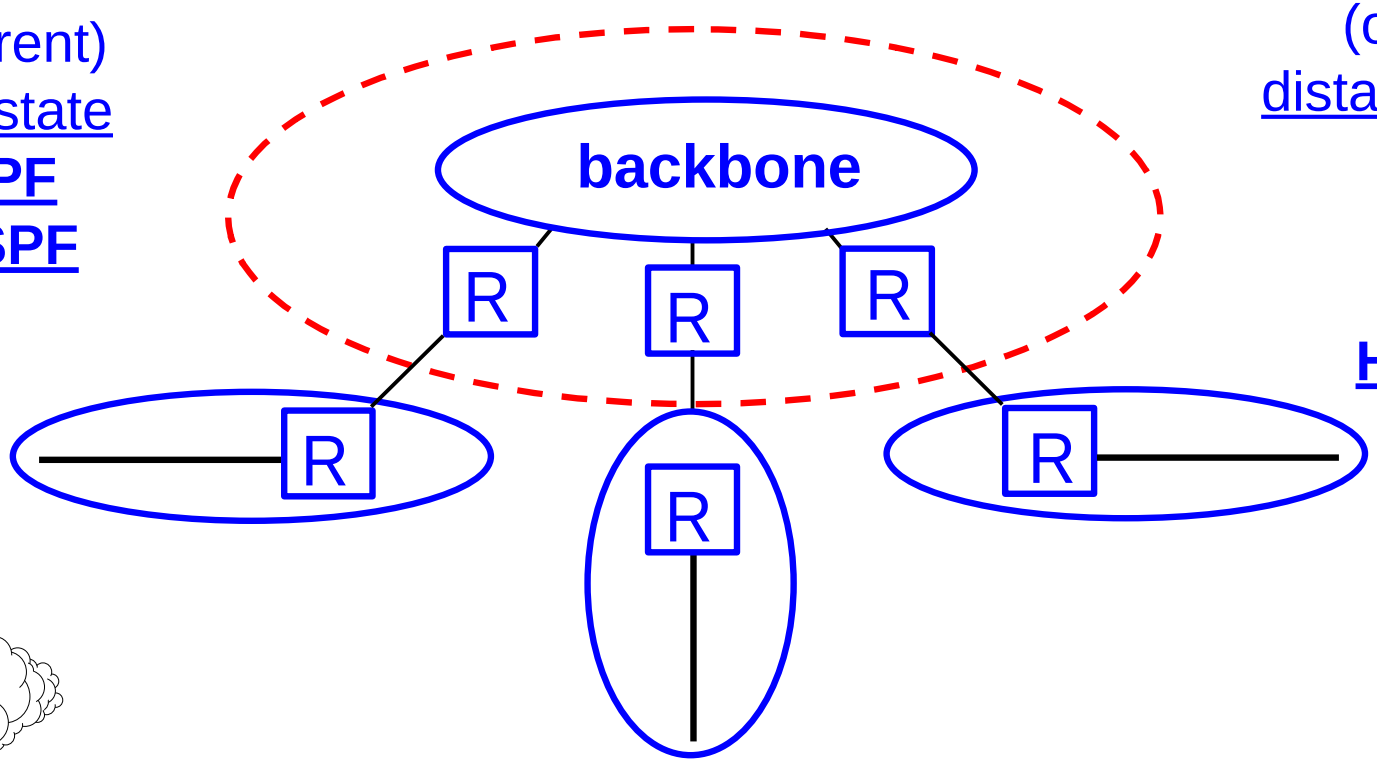
Dest	Via
A,B	R1-1, R2-2, R4-2
C,D	R2-1, R1-2, R4-2
E,F	local port
G,H	R4-1, R1-2, R2-2

IP Alternate Routing creates robust networks, but adds complexity

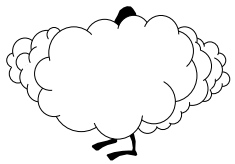
What is the Best Route?

What metric is used? How is it updated?

(current)
link state
SPF
OSPF



(original)
distance-vector
GGP
EGP
RIP
HELLO

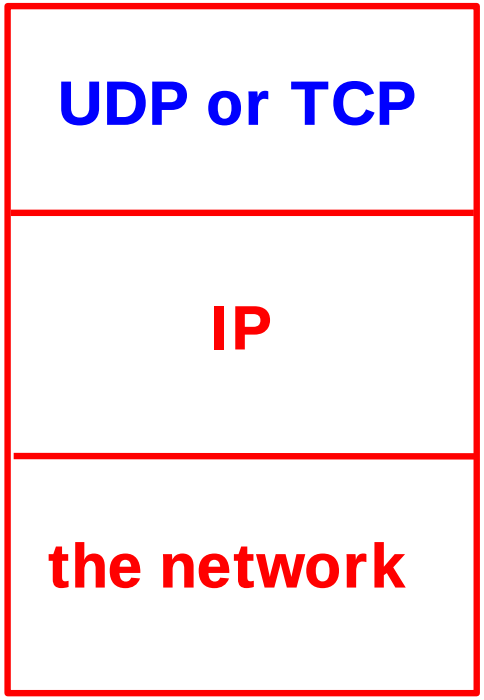


Pick Your Level of Service

User Datagram Protocol
(delivery not guaranteed)

* brief dialog
* minimal content
* repeatable

-- in the same room
-- headline news
-- pings



Transmission Control Protocol
(delivery guaranteed)

* extended conversation
* long messages
* difficult to re-create

-- my payroll check
-- a customer order
-- data base uploads

But What Can I Do With It?

The Tried & True:

Sockets	**API (UDP, TCP)**
FTP	**File Transfer (TCP)**
SMTP	**E-mail (TCP)**
Telnet	**Virtual Terminal (TCP)**

But What Can I Do With It?

The New & Exciting:

HTTP **Information Publishing (a.k.a. web browsing)**

Transactions (a.k.a. shopping, banking...)

Collaboration (group work environments)

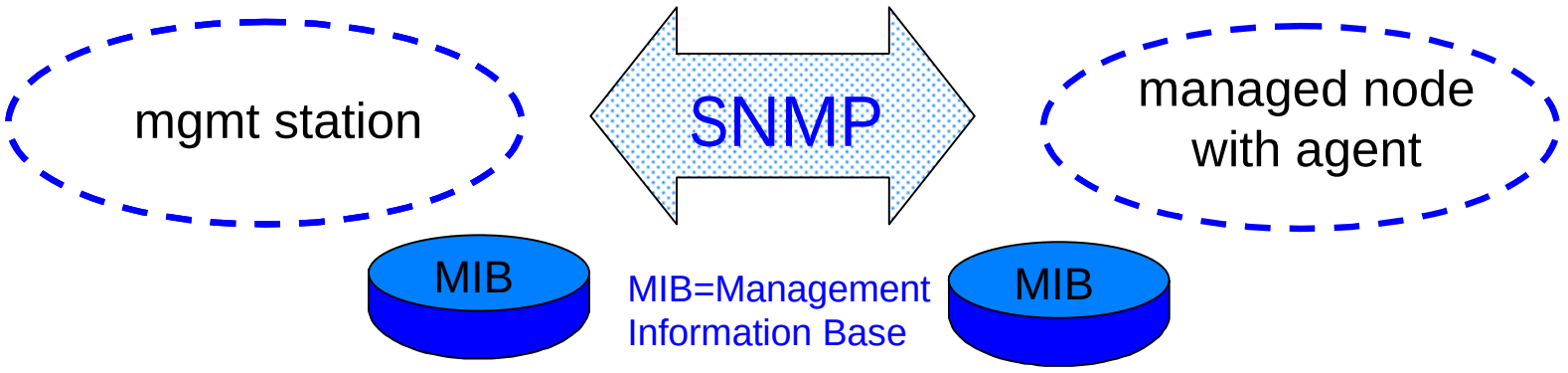
How Do I Manage It?

1. ICMP (Internet Control Message Protocol)

Connectivity
Routing Trace

Flow Control
Routing Redirection

2. SNMP (Simple Network Management Protocol)



IP Version 6 (aka IPng)

- Extended Addressing
- Extended Services & Functionality
- “Extended” Transition Time

IPv6 New Address Space

How many IP addresses are enough?

128 bit addressing means 340,282,366,920,938,463,463,374,607,431,768,211,456 addresses, or 1/3 of a duodecillion.

That is 665,570,793,348,866,943,898,599 addresses per square meter of the earth's surface, … or

3,911,873,538,269,506,102 addresses/sq meter of the earth's surface, allowing for allocation inefficiencies.

IPv6 New Address Format

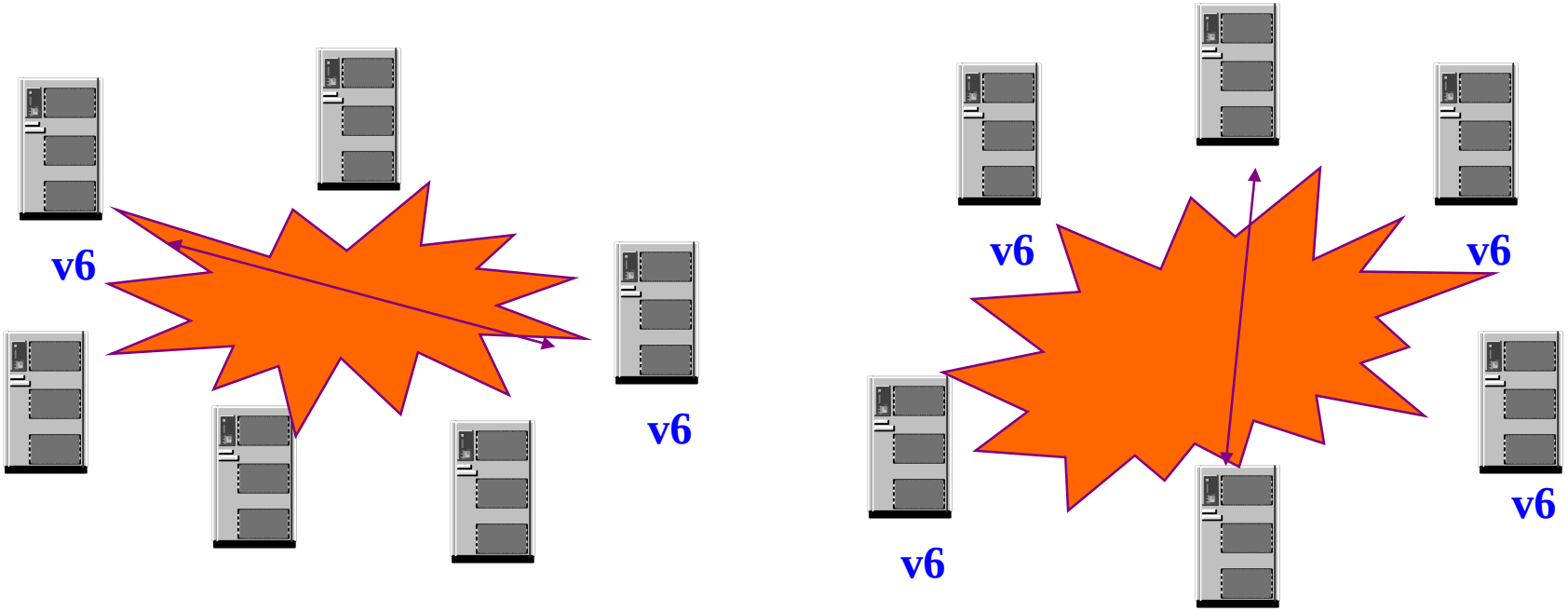
- Moving from 4 octets to 16 octets.
- Leaving the last 4 octets the same implies “tunneling”.
- Increases portability, reduces cost to adopt.
- Same concept of “network & host” but very hierarchical.

Flag : Registry ID : Provider ID : Subscriber ID : Subnet ID : Interface ID

IPv6 Services & Functionality

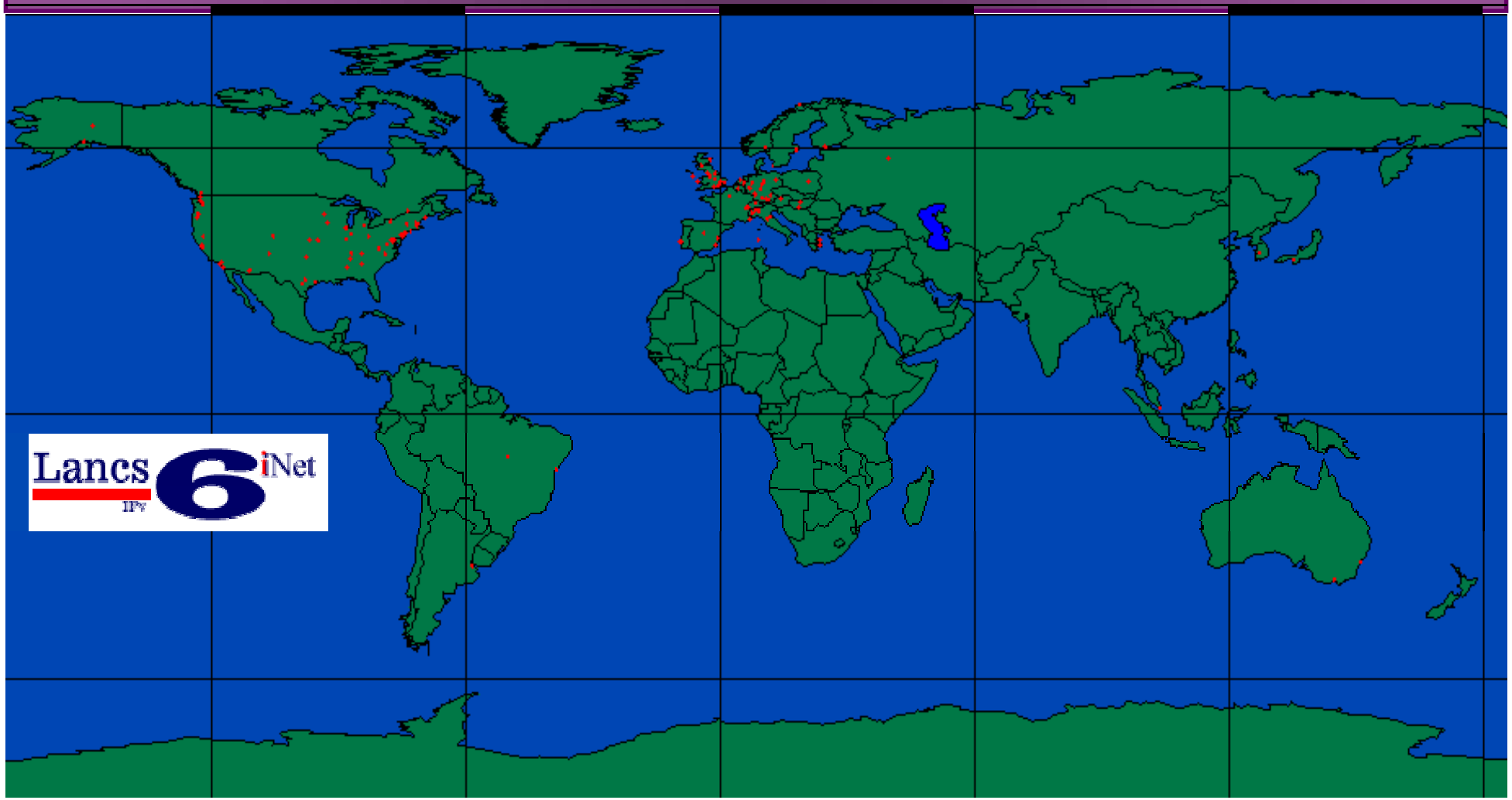
- Adding Priority – realtime versus batch
- Adding security – Authentication and Privacy/Encryption
- Better Mobility Support
- Improved Autoconfiguration

Transition from IPv4 to IPv6



- Need v6 in limited locations – tunnel through v4 links.
- Upgrade routers to be bilingual – less tunneling.
- V6 is predominant – tunnel traffic to laggard sites.

IPv6 Current Deployment Sites



In Conclusion....

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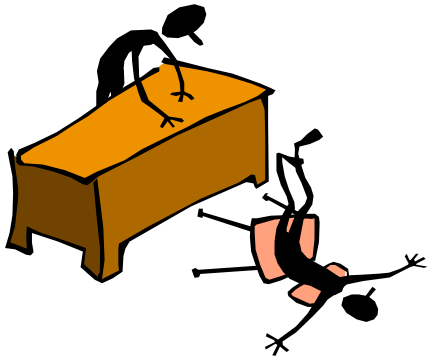
  - A Few Choice Protocols
  - Routing
  - Universal Services
  - Management
- IP Version 6



QUESTIONS