IP Address Management

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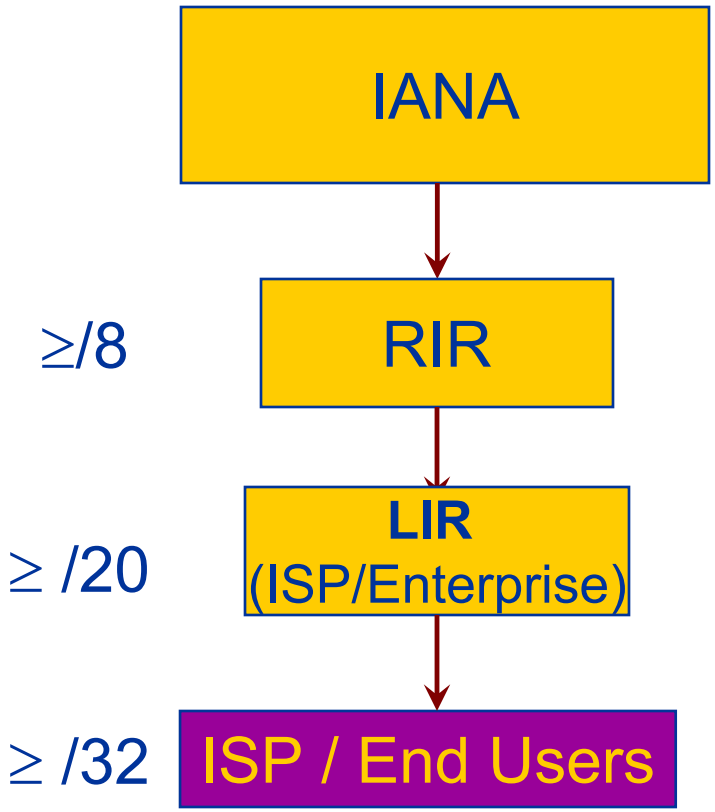
Definitions

- **Internet Registry (IR)**
  - organisation which allocates, assigns and registers Internet resources (IP addresses, ASNs)
- **Regional Internet Registry (RIR)**
  - organisation with regional responsibility for management of Internet resources
  - address registration services, co-ordination and policy development
  - *Must be neutral and consensus-based*
  - APNIC, ARIN, RIPE-NCC - AfriNIC, LACNIC in formation
- **Local Internet Registry (LIR)**
  - Usually an ISP, *assigns* address space to its customers

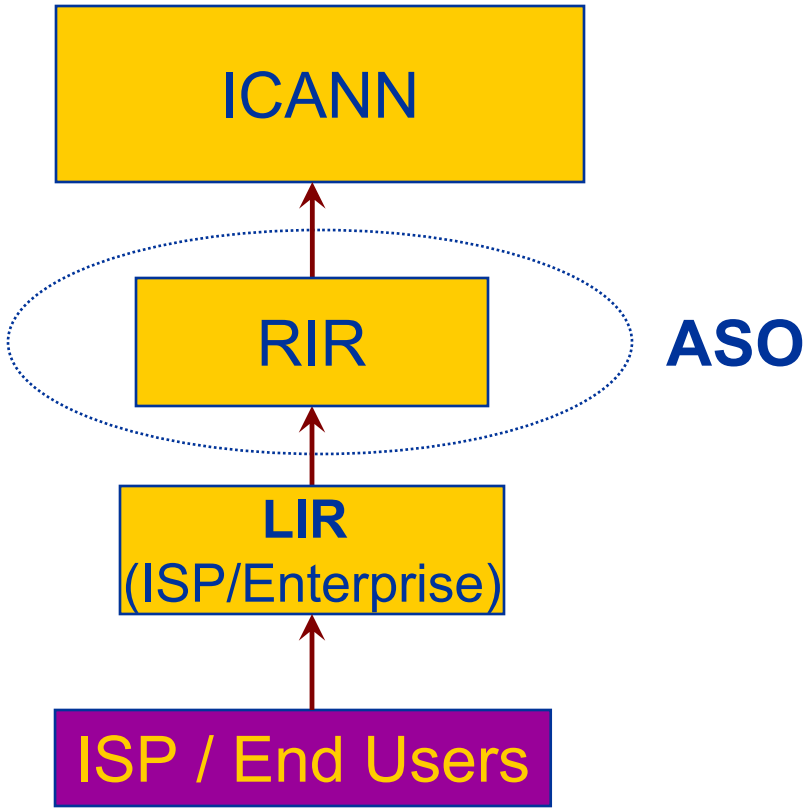
Address Distribution



Global Policy Development

- Developed in open policy forums
- Implemented by Regional Internet Registries
- Open, controlled by membership
- Co-ordinated among RIRs

Policy Development

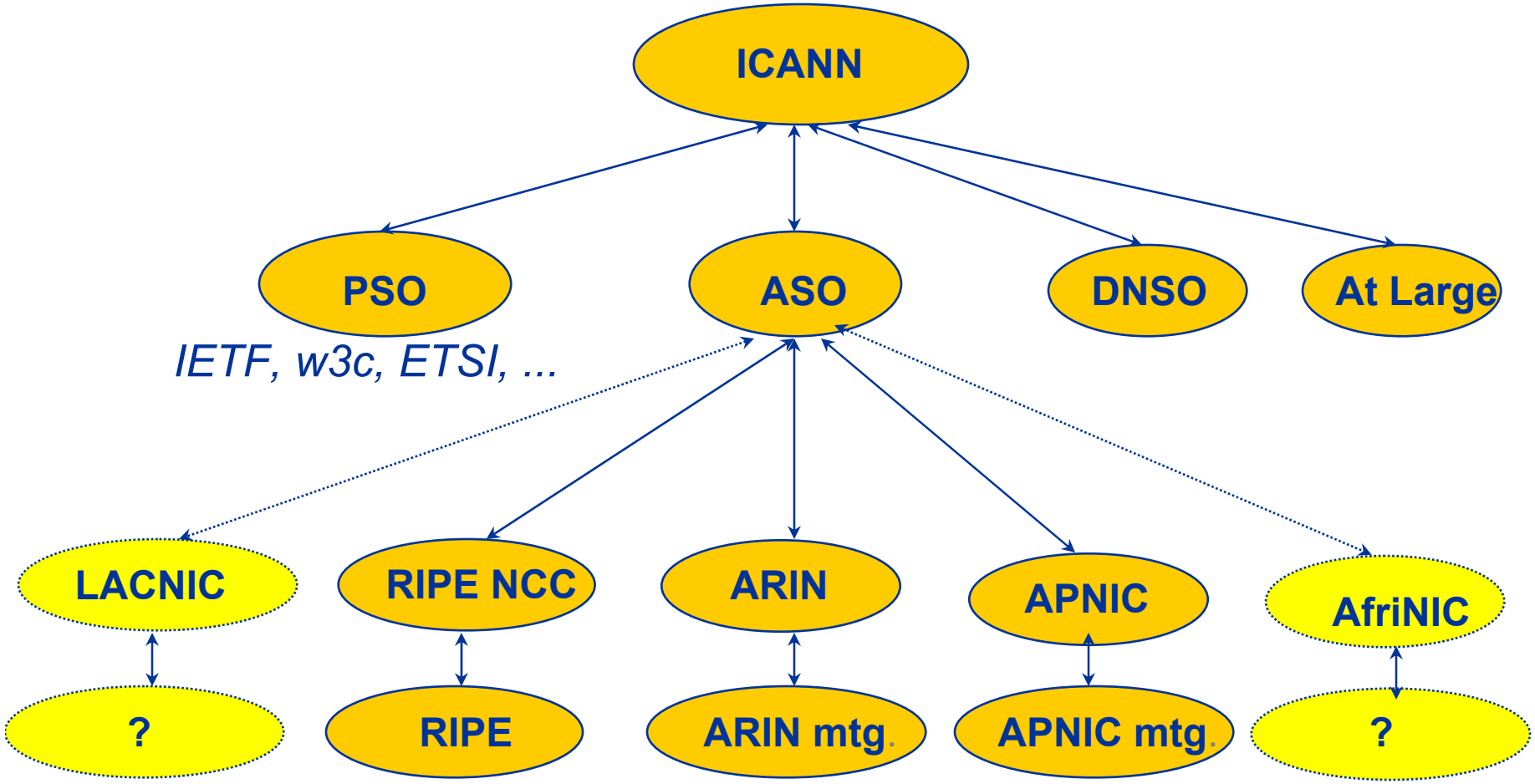


Policy Development Process

- **Policy (changes) can be suggested by**
  - RIR Members/Local IRs
  - RIR staff
  - Public at large

- **Policy must be**
  - fair to all
  - ‘good’ for the Internet
  - consistent with global policies

Global Context



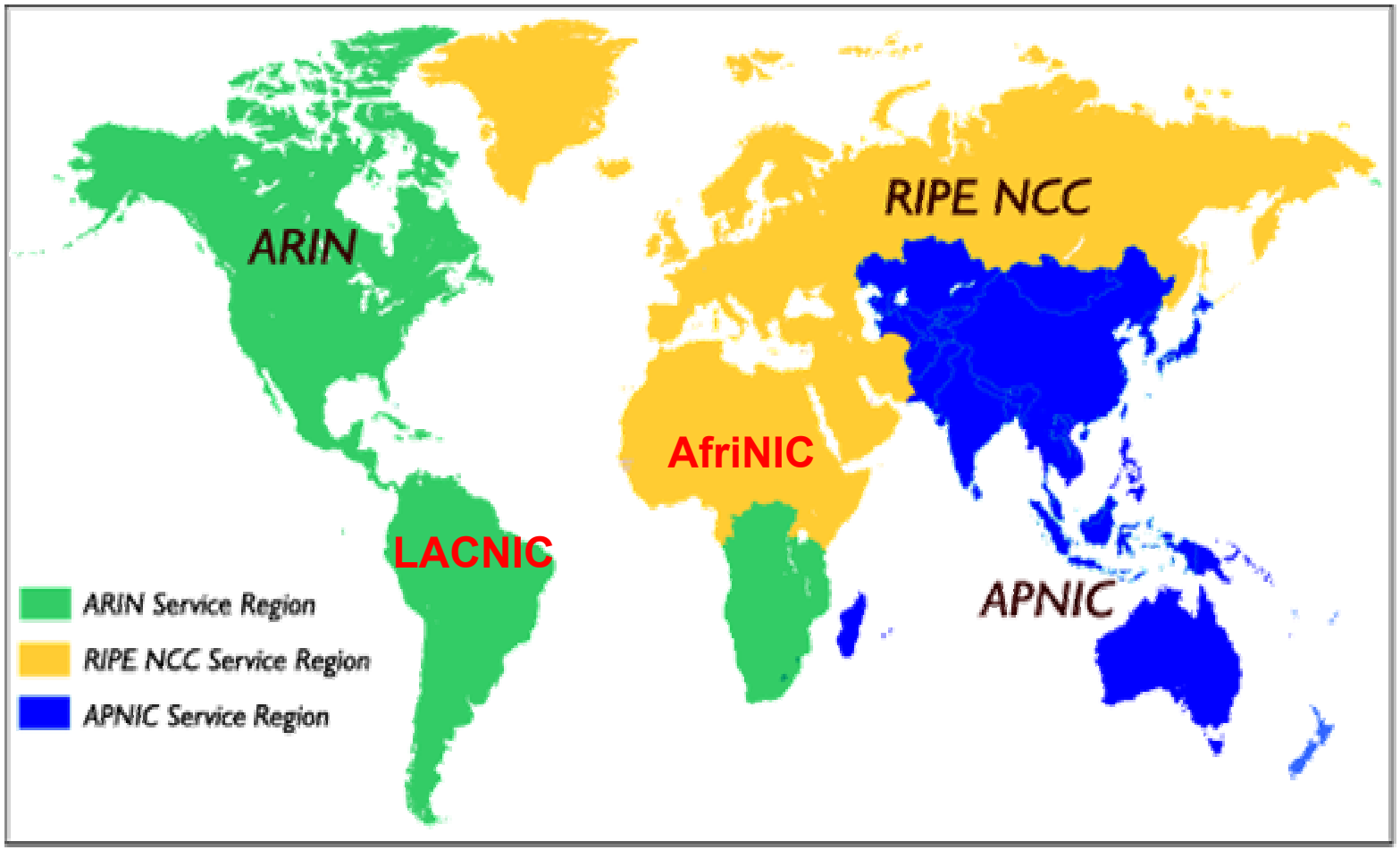
Registry System Goals

- **Conservation**
  - efficient use of resources
  - allocation based on demonstrated need
- **Aggregation**
  - Limiting growth of routing table
  - provider-based addressing policies
- **Registration**
  - Ensuring uniqueness
  - Troubleshooting
- **Fairness and Consistency**
  - In the interests of regional and global communities

RIR Model - Structure

- **Bottom up industry self-regulatory structure**
  - Open and transparent
  - Neutral and impartial
- **Not for profit membership organisation**
  - Membership open to all interested parties
  - Membership elects Executive Board
  - Membership approves activities & budget
- **Policies developed by industry at large**
  - Through open policy processes

RIR Service Regions



RIR Activities

Public Services

- **Specific online services**
  - whois database
- **Co-ordination activities**
  - Liaison with development and industry communities
    - eg IETF, IEPG, IPv6 Directorate, GSM-A
  - Public and targeted information dissemination
    - eg Governments

Beneficial for the Internet at large

RIR Activities

Member Services

- **Registration Services**
  - IPv4 address allocation and assignment
  - IPv6 address allocation and assignment
  - AS number assignment
  - Reverse domain name delegation
  - Training and Education

Note: RIRs do not register domain names

Becoming an LIR?

- **When?**
  - you have customers who need addresses
  - you need more than a /21 in 1 year
- **Advantages**
  - independent allocation from RIR
- **Disadvantages**
  - has overhead
  - costs resources
  - possible need to renumber
- **Alternative**
  - addresses from upstream ISP

Responsibilities of an LIR

- **Be familiar with latest IP policies**
- **Follow goals of Registry System**
  - conservation
  - aggregation
  - registration
- **Manage allocations responsibly**
- **Keep up to date records**
  - internally
  - whois Database

How to become an LIR

- Complete application form
- Have trained contact persons
- Read relevant policy documents
- Sign service agreement
- Pay sign-up & annual service fee

Takes resources!

Obtaining IP addresses from existing LIR

- Design and plan network
- Assess address needs
- Provide this information to ISP/LIR

Network Documentation

- **Design of the network**
  - how many physical segments will it consist of?
  - what is each segment going to be used for?
  - including equipment used
  - how many hosts are in each segment?
  - expectations of growth
  - topology map

- **Utilisation and efficiency guidelines**
  - 25% immediately, 50% in one year
  - operational needs; no reservations

Network Documentation (2)

- **Can address space be conserved by using**
  - different subnet sizes?
  - avoiding padding between subnets?
- **Any address space already in use?**
  - returning and renumbering? (encouraged)

Address Architecture - Classful

Class A: 128 networks x 16M hosts (50% of all address space)

Class B: 16K networks x 64K hosts (25%)

Class C: 2M networks x 254 hosts (12.5%)

Address Architecture - Classful

- **By end of 1992, several challenges**
  - **Internet address depletion**
    - "Generous" allocation policy
    - Many addresses allocated but unused
  - **Growing routing table**
    - Every network advertised globally
    - Routers overloaded
    - Increasing instability of routing structure

Address Architecture - Classless

- **CIDR: Classless Inter-Domain Routing**
  - Proposed as “supernetting” in 1992 (RFC1367)
  - Finalised and deployed in 1993 (RFC1519)
- **Higher utilisation through variable-length network address**
- **Higher routing efficiency through aggregation**

Classless Addressing - Examples

/10: 4M hosts

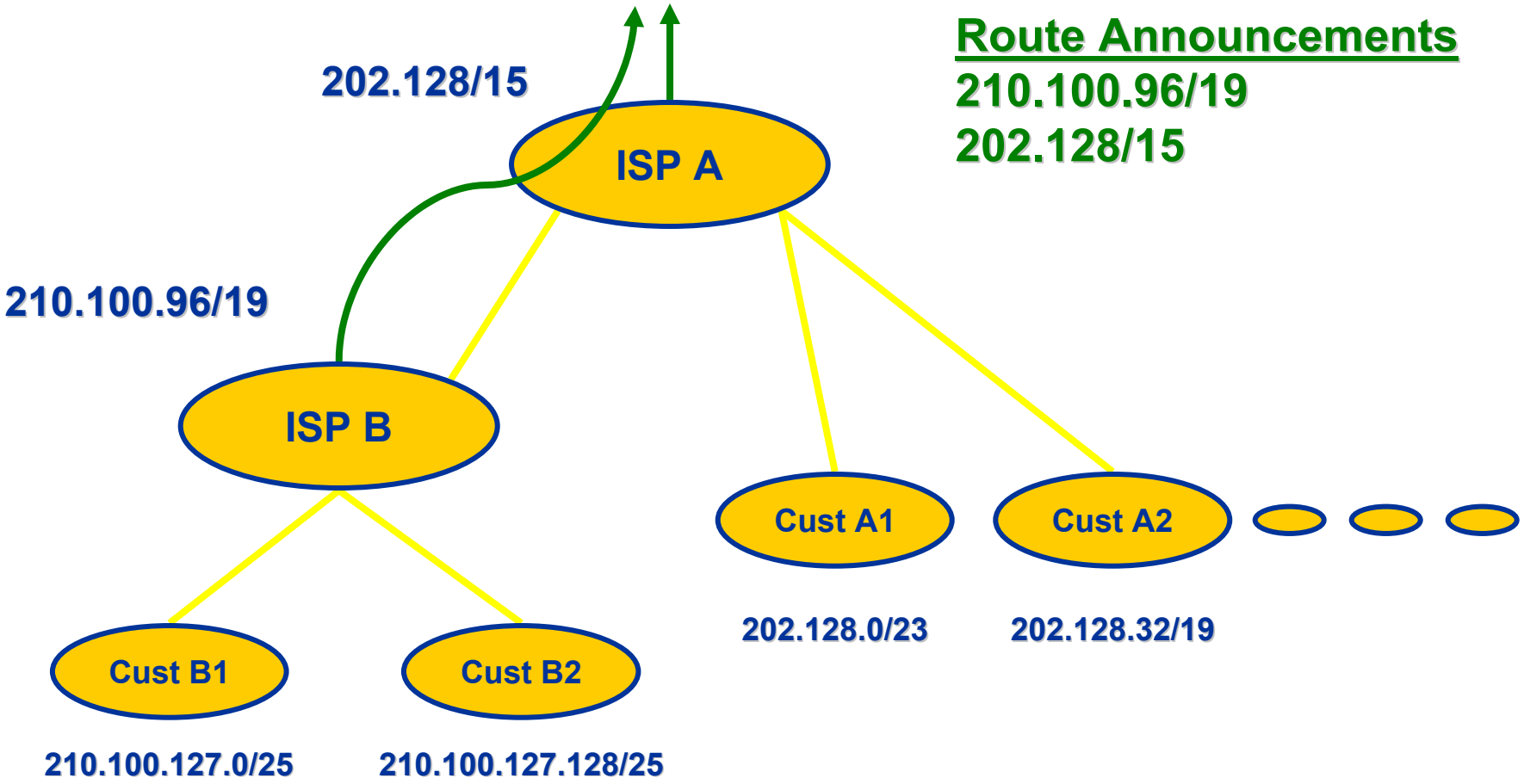
/19: 8190 hosts

/20: 4094 hosts

/24: 254 hosts

/28: 14 hosts

CIDR Aggregation



Questions

Describing your Network

An Example of how to build an Addressing Plan

Best Current Practice

- Assignments based on requirements
- Classless assignments
- RFC1918, NAT
- HTTP 1.1
- Dynamic Dial-up
- IP unnumbered

Private Address Space

- **RFC1918**
  - 10/8 10.0.0.0 - 10.255.255.255
  - 172.16/12 172.16.0.0 - 172.31.255.255
  - 192.168/16 192.168.0.0 - 192.168.255.255
- **Motivation**
  - saves public address space
  - allows for more flexibility
- **Suitable when**
  - hosts do not require access to other networks
  - hosts need limited access to outside services
    - can use application layer G / W (fire walls, NAT)

Web Hosting

- **Name based hosting**
  - single IP address assigned to physical server that hosts several virtual hosts
- **IP based hosting**
  - single unique IP address assigned to each virtual host

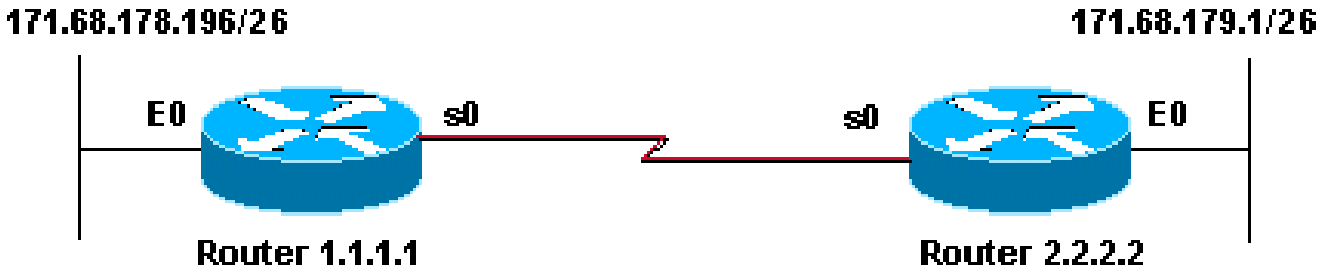
Name Based Hosting

- **Conserves Address Space**
- **Requires**
  - support of “Host:” header in HTTP requests
  - HTTP1.1 compliant browsers
- **Technical Exceptions**
  - SSL certificates
    - work ongoing at IETF to support name based hosting
  - Virtual ftp domains with anonymous login

Dial up

- **Static dial-up strongly discouraged**
  - Wastes address space
- **Dynamic dial-up recommended**
  - assigning addresses to a pool
  - serves more users

IP Unnumbered



- **R1 and R2 form a "virtual router"**
- **The serial link has no ip address**
  - All packets arriving at S0 of either router immediately go to its E0
  - All packets generated at E0 go onto serial link
- **Conserves addresses but makes management harder**

Questions