# NREN and Campus
# IP Addressing

WACREN Webinar:

Research and Education Networks:
Architecture, Routing and Peering

01/12/2020

# Who Needs Public IP Space?

- **Every campus must have Public IP address space – Where do you get it?**

- NREN needs to get IP address space

- If NREN becomes ISP, it must have address space for its "customers"

- Any University can get their own IP address space.

# Provider Independent IP Addresses

- What are provider independent IP addresses?
  - Public IP addresses that are not allocated to you by your Internet Service Provider.
- Can move between service providers without changing IP addresses
- If NREN gets space, then addresses provided by NREN is not provider independent

# NAT is a reality

- NAT is common technique to reduce number of public IP addresses required

- NAT makes some things hard.

  - NAT breaks things like SIP (standard-based VoIP), which you have to work around
  - NAT translation device needs to know about applications. Stifles innovation.
  - Makes it harder to track down viruses and hackers
  - Don't do it if you don't have to

# Who Needs Public IP and ASN?

- NREN
  - Must have both ASN and Public IP

- Campus Network
  - All campuses must have Public IP
  - Only need ASN if campus is multi-homed
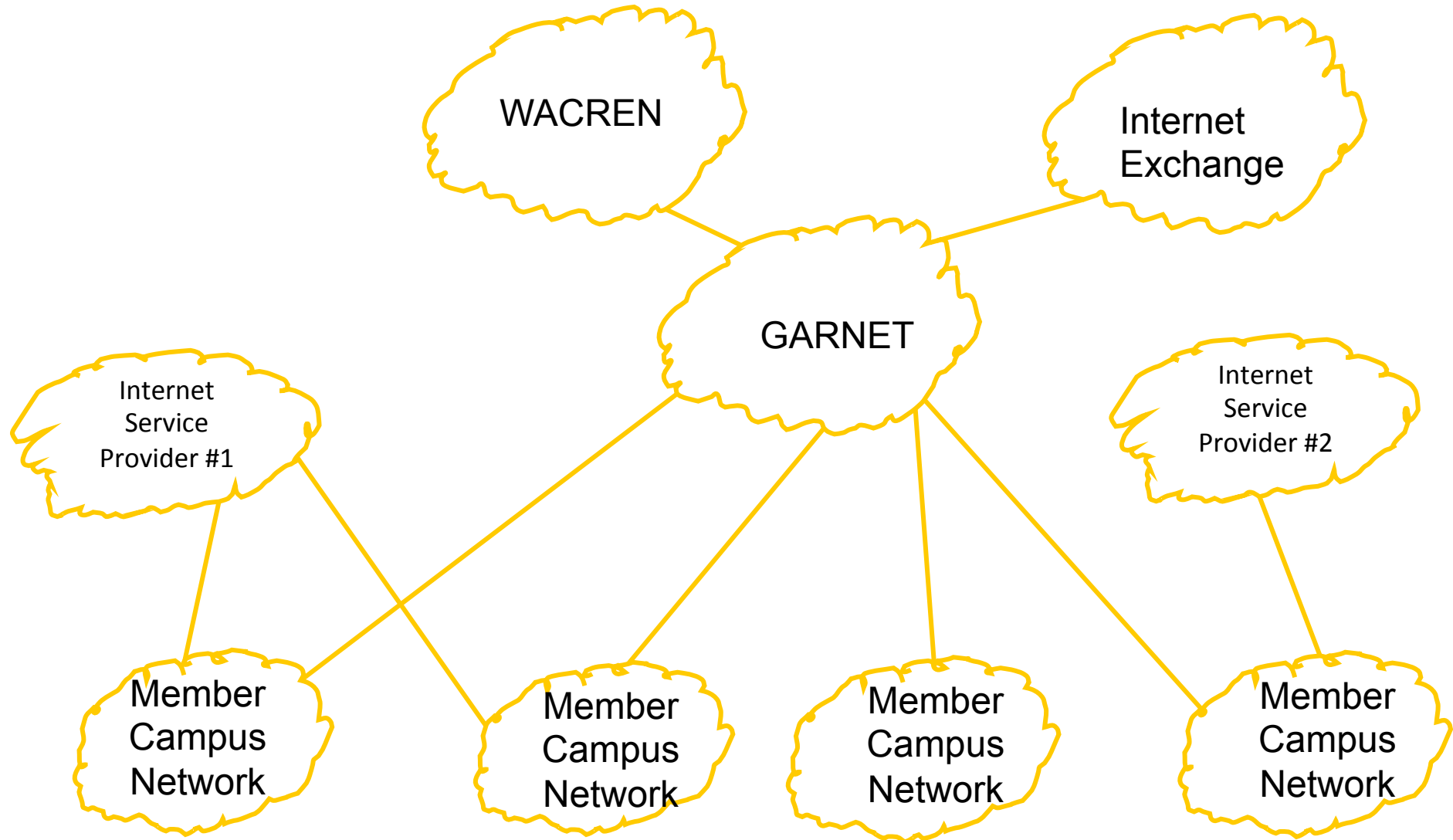
- How much IP address space?

# General Notes on IP Addressing

- IP version 4 addresses are 32 bits long

- IP address blocks allocated in powers of 2
  - Blocks of addresses: 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096, etc.

- CIDR notation: Address blocks are described with a notation of /number.  /32 = 1 address, /31 = 2, /30 = 4, ….  /24 = 256
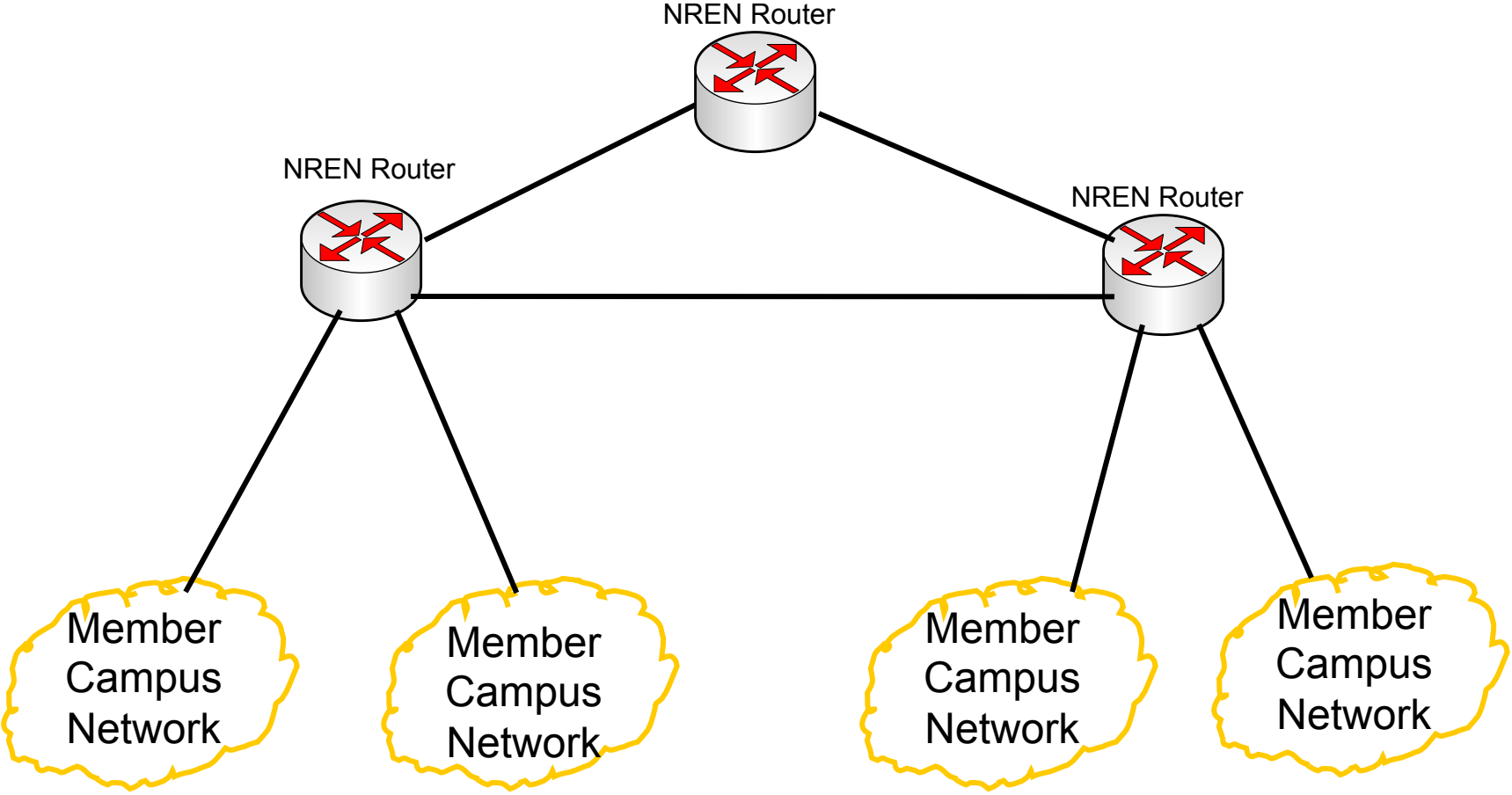
# Logical Network
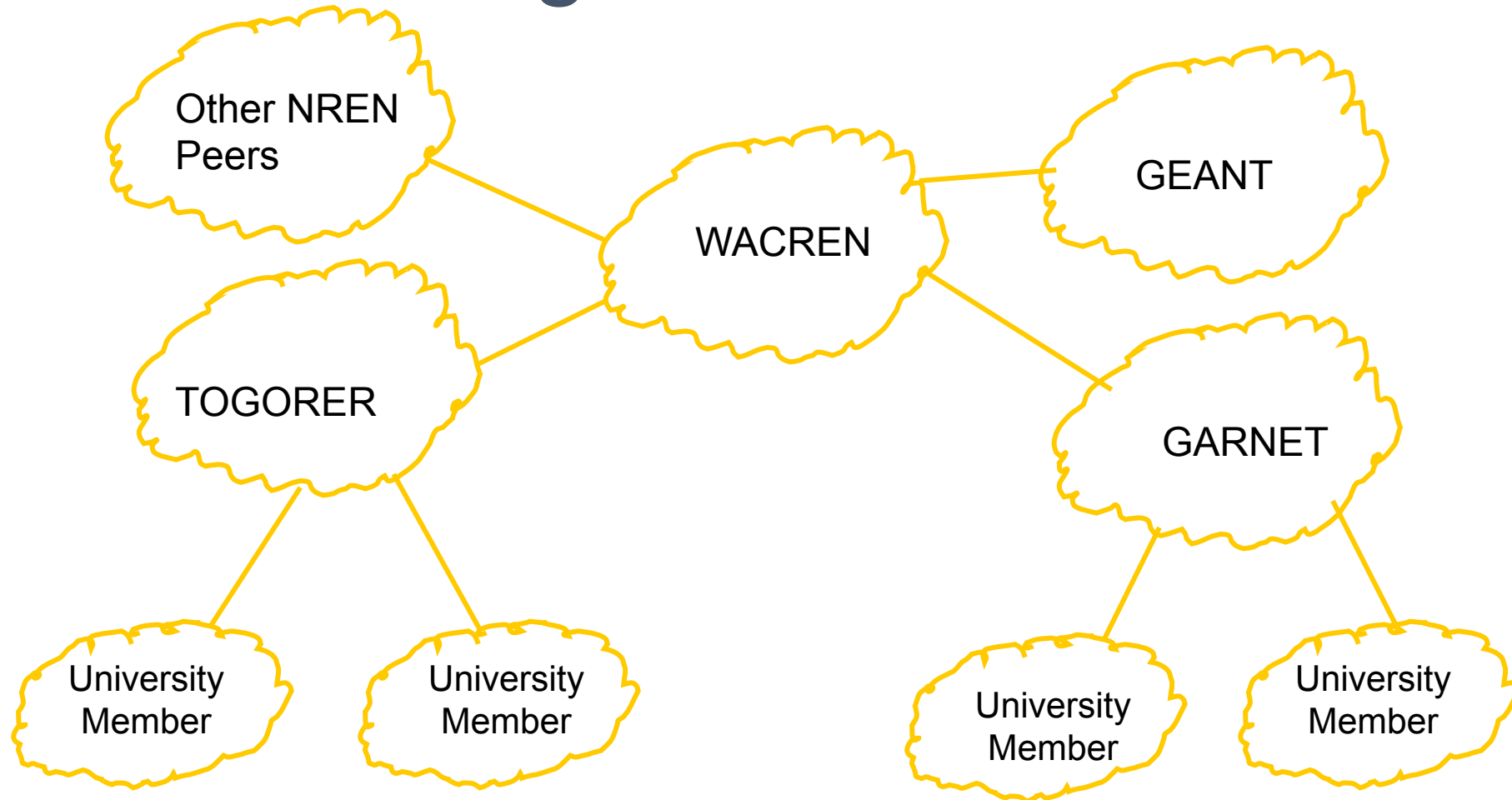
# Examining The NREN

# NREN IP Addressing

- Every member connected with a point to point link
  - Every point to point link requires at least a /30 (4 addresses) – A /31 also work
- NREN will address space for
  - Network management equipment
  - Services such as web, video conferencing
- Build a spreadsheet that details all the above

# A Simple (Small) REN Example

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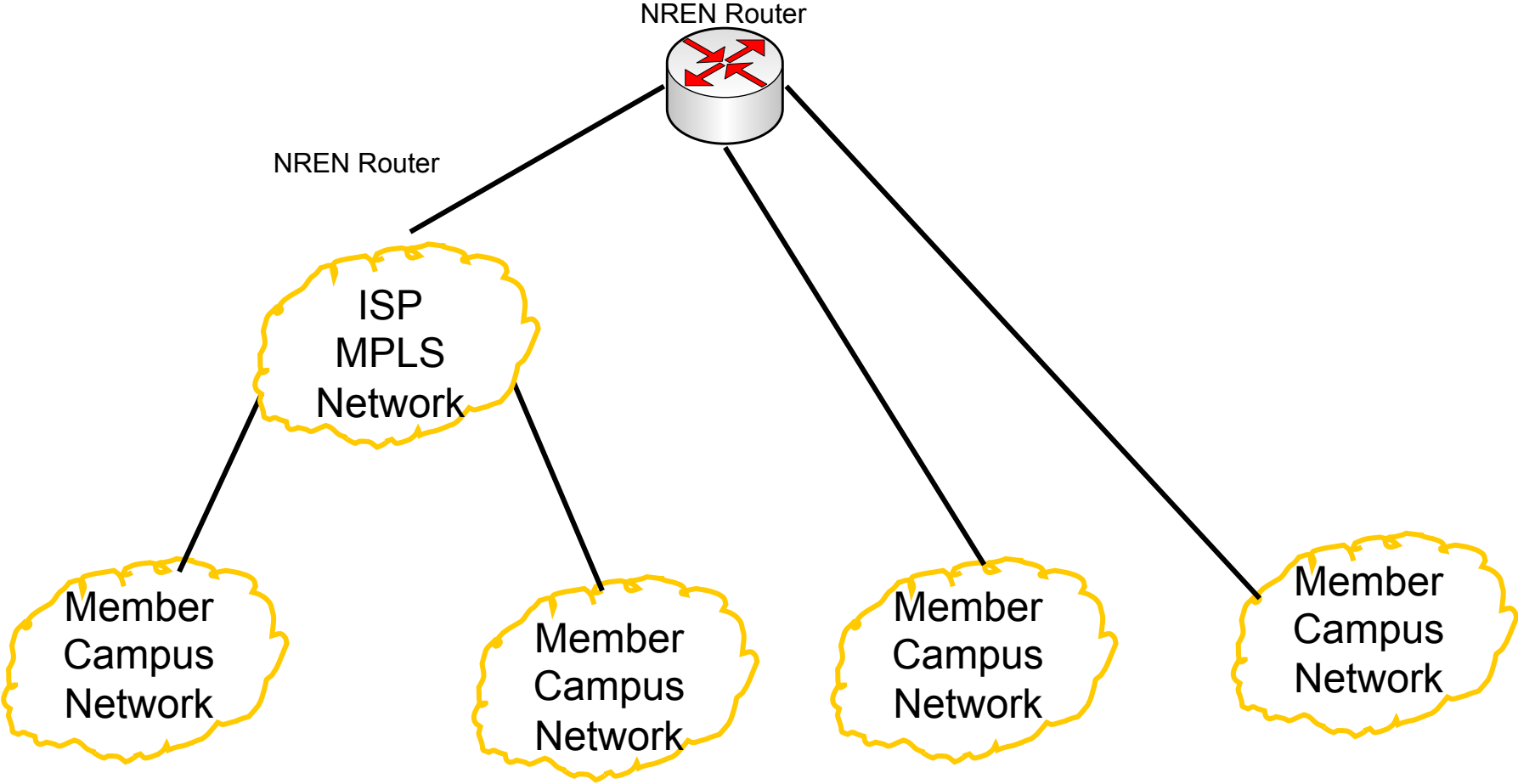
# Simple (Small) REN Example

| Network | Hosts | CIDR block | Size | Qty | Total |
|---|---|---|---|---|---|
| Point to point links | 2 | /30 | 4 | 7 | 28 |
| Server network for network Mgmt | 40 | /26 | 64 | 1 | 64 |
| Server network for Services | 40 | /26 | 64 | 1 | 64 |
| Future network for services | 40 | /26 | 64 | 1 | 64 |
| Future customer links | 2 | /30 | 4 | 4 | 16 |
| Total | | | | | 236 |

You can't get a CIDR block of 236 addresses - rounding up, you get 256 or a /24

# That isn't all for the REN

- If the REN is going to act as an ISP
  - REN needs IP address space to allocate to customers.
  - If customers NAT, don't need as much, but still need space.
  - In application to AFRINIC ([www.afrinic.net](www.afrinic.net)), you will want to apply for space for your customers.

# Campus Network IP Addressing

- Build a spreadsheet
  - One row for every building on your campus
  - Write down how many computers will be in each building
  - Round up to the nearest power of 2
  - Add a row for servers
  - Add a row for wireless

# A Simple Campus Example

Core Router
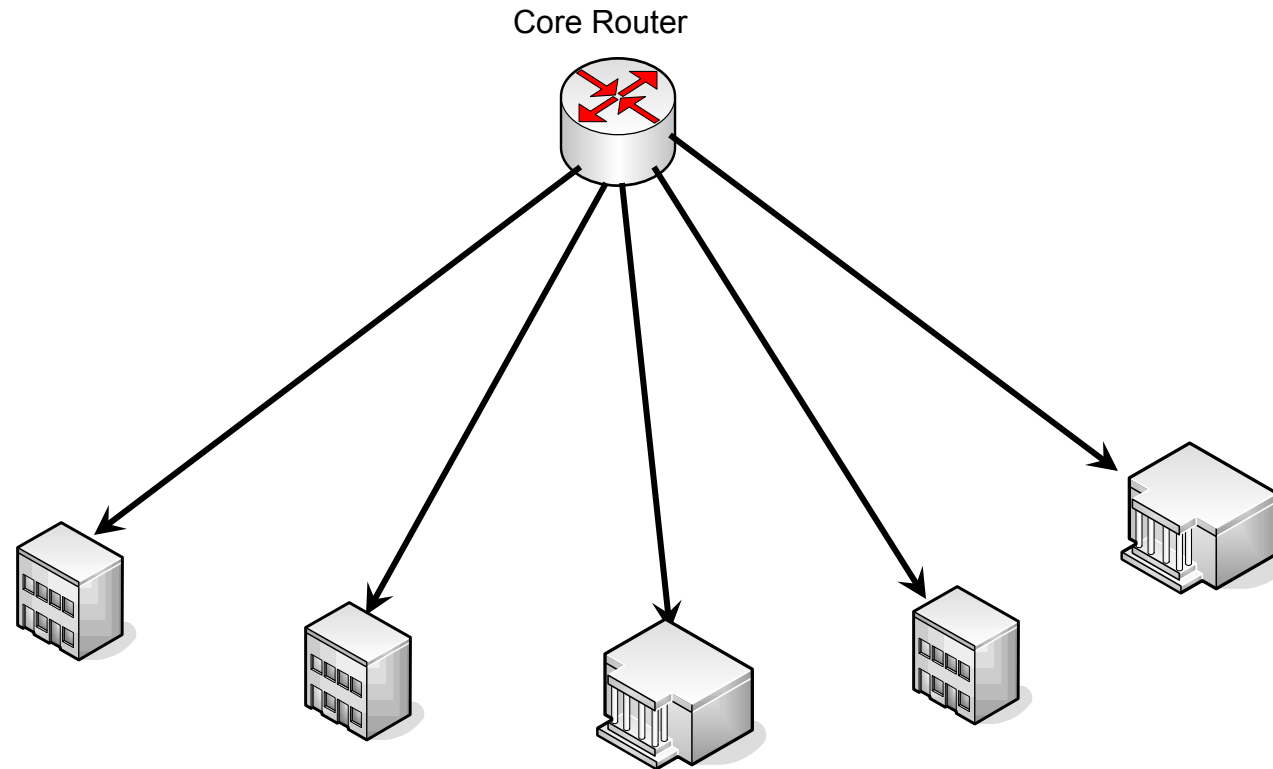
# A Simple Campus Example

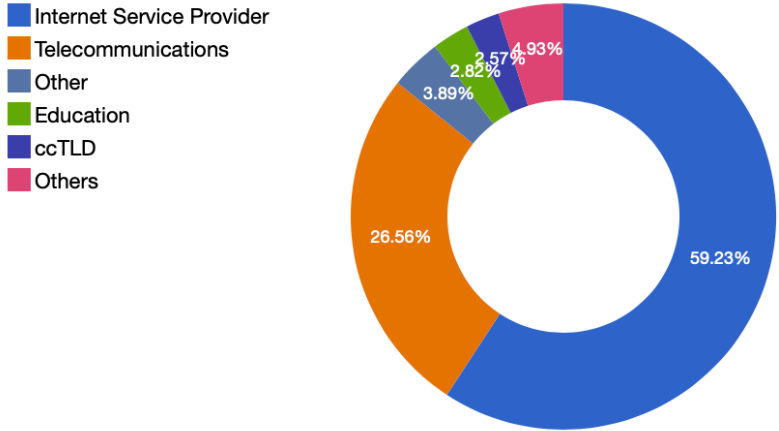| Building | Hosts | CIDR Block | Size | Qty | Total |
|----------|-------|------------|------|-----|-------|
| Administration Building | 68 | /25 | 128 | 1 | 128 |
| Physics Building | 220 | /24 | 256 | 1 | 256 |
| Chemistry  Building | 120 | /24 | 256 | 1 | 256 |
| Computer Science | 200 | /24 | 256 | 1 | 256 |
| Literature Building | 44 | /26 | 64 | 1 | 64 |
| Server Network | 20 | /27 | 32 | 2 | 64 |
| Additional Buildings Medium | 100 | /25 | 128 | 3 | 384 |
| Additional Buildings Large | 200 | /24 | 256 | 2 | 512 |
| Wireless Network | 500 | /23 | 512 | 1 | 512 |
| Total | | | | | 2432 |

Round 2432 up to the next CIDR block gives you 4096 or a /20
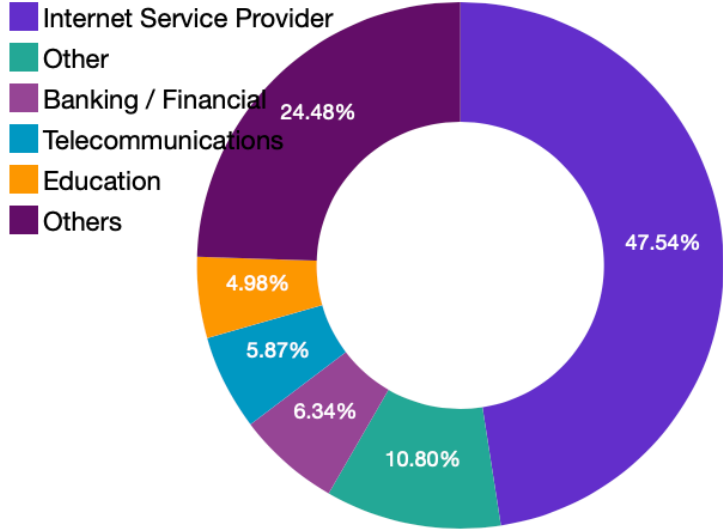
# Applications to AfriNIC

- AAU has negotiated a 50% discount on fees with AFRINIC
- There is no barrier to getting space
- When you apply for V4 address space, also apply for V6 space

# AFRINIC STATS
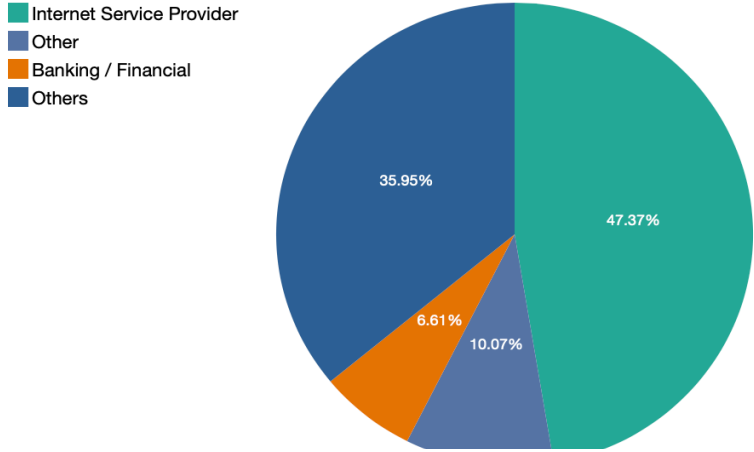


Percentage of IPv4 (/24s) issued grouped by member in...

- Internet Service Provider
- Telecommunications
- Other
- Education
- ccTLD
- Others

59.23%
26.56%
3.89%
2.82%
2.57%
4.93%

ASN Allocations by Members Industry

- Internet Service Provider
- Other
- Banking / Financial
- Telecommunications
- Education
- Others

47.54%
24.48%
10.80%
6.34%
5.87%
4.98%

# AFRINIC STATS



Members by Industry
- Internet Service Provider
- Other
- Banking / Financial
- Others

47.37%
35.95%
10.07%
6.61%

IPv6 issued by Members Industry(/32)
- Internet Service Provider
- Telecommunications
- Other
- Internet Hosting Provider
- Others

49.53%
48.23%

# Questions?