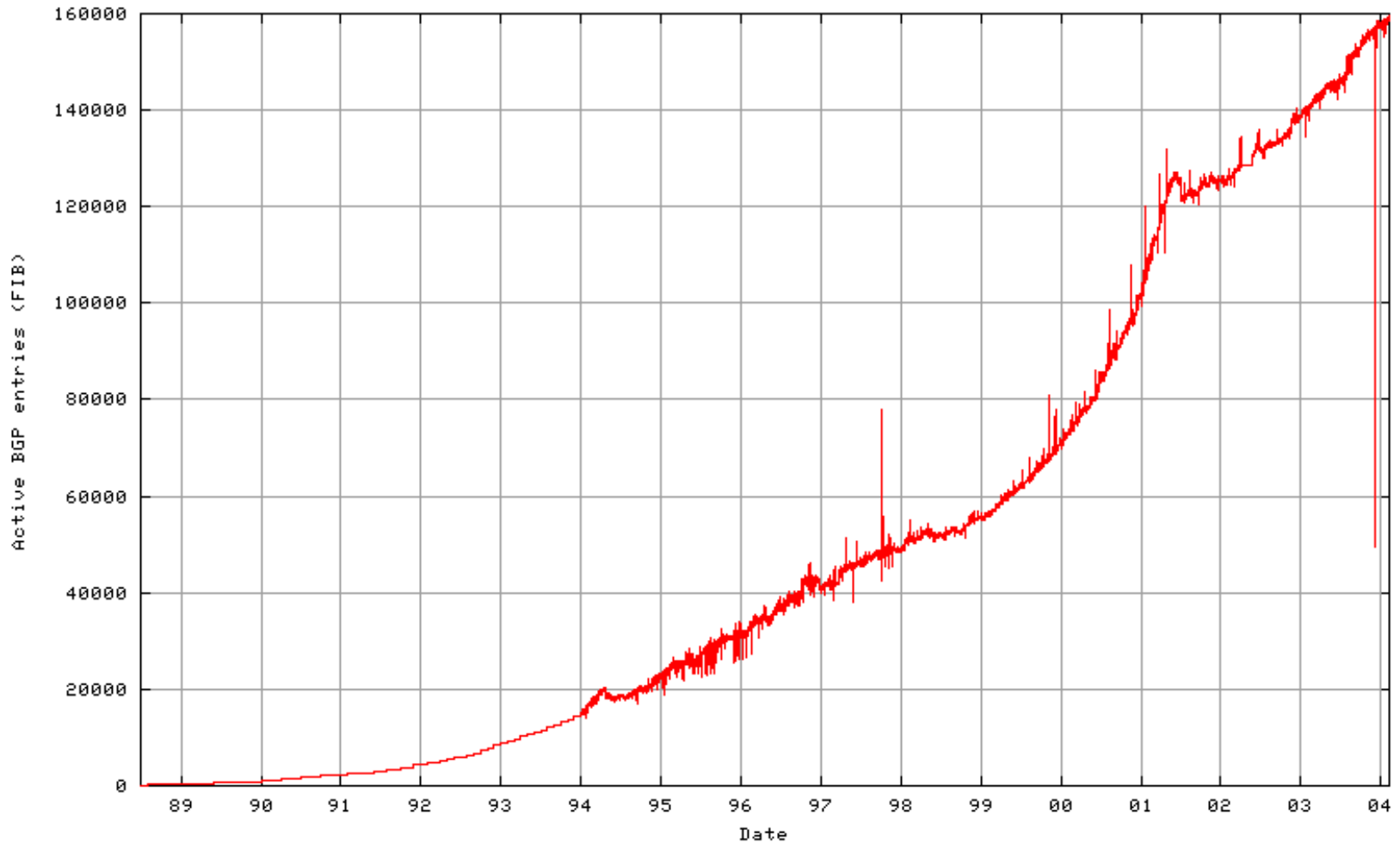


# **2 Decades of the Internet**

## **1988 to 2004**

NANOG 30  
Retro Talks

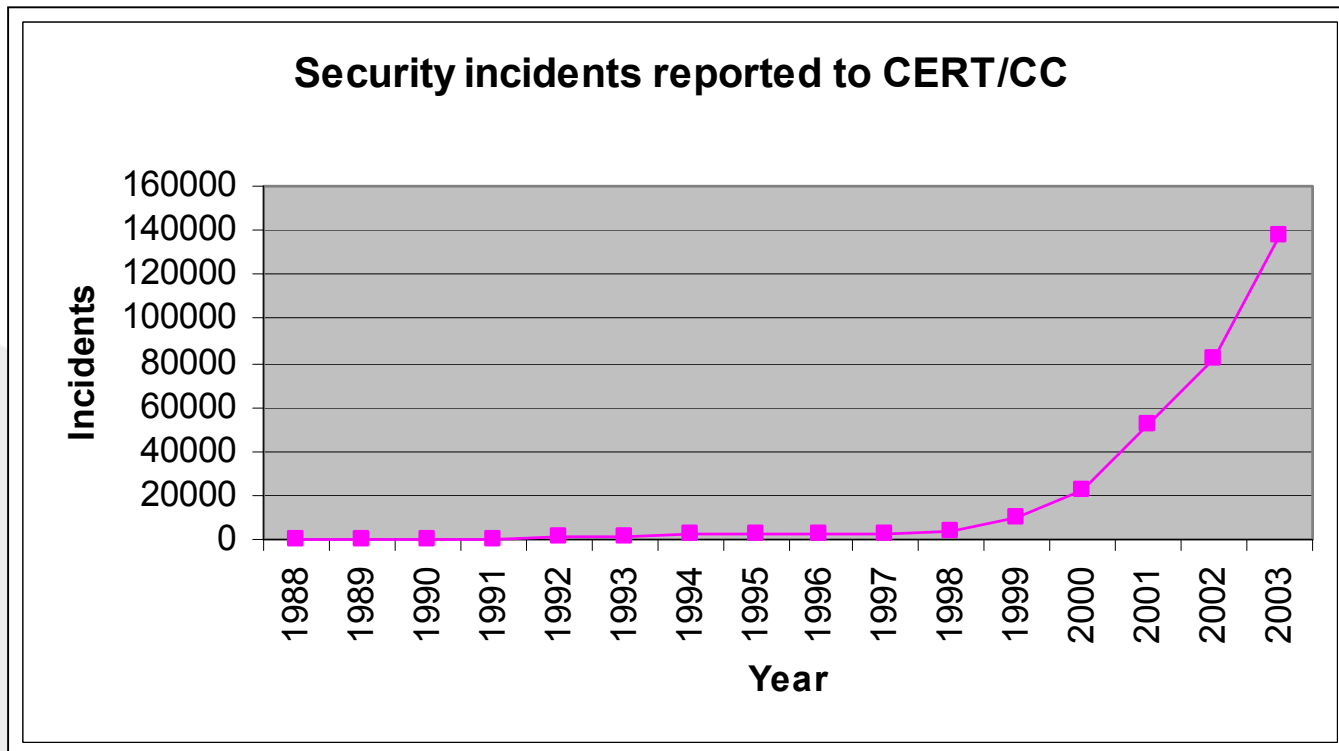
# 15 years of Growth



Sue Hares  
Retro Introduction

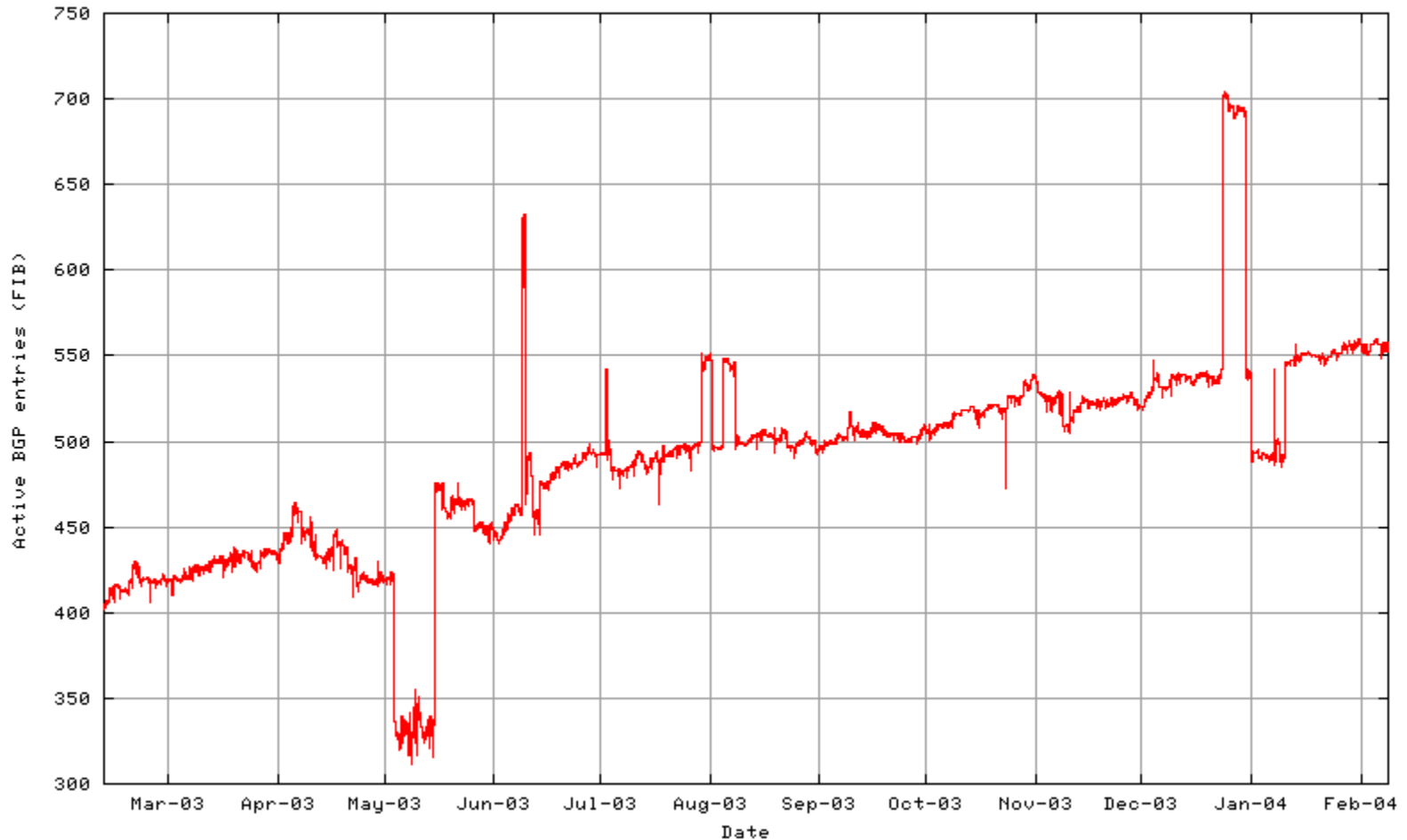
# 2002 Internet = Critical Infrastructure

- IP - how to get there
- DNS - Name to How to get there
- BGP – Policy + Routes between networks



Sue Hares  
Retro Introduction

# For 2004-2024? (BGPv6 stats AS 1221)

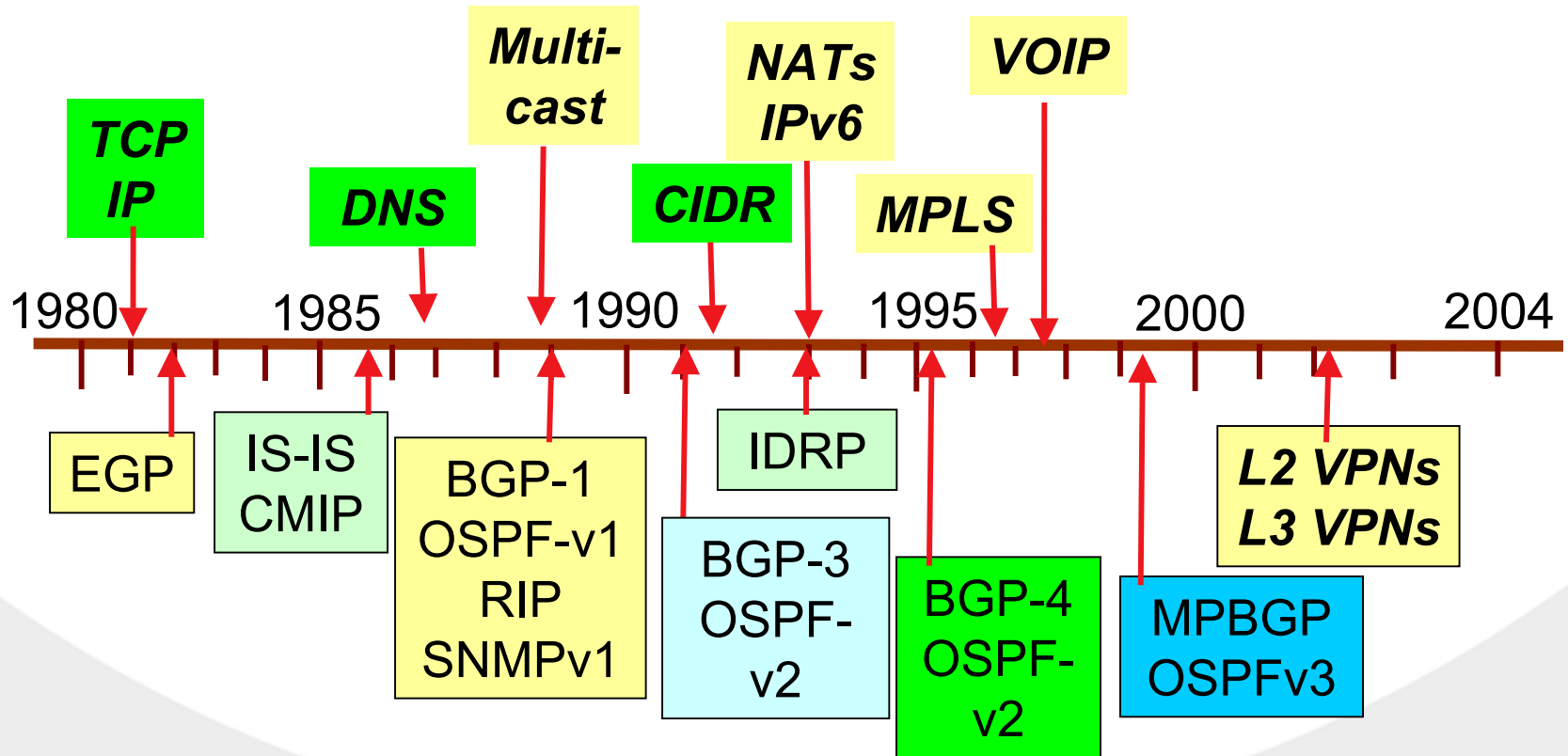


# What's New? (1988 vs. 2004)

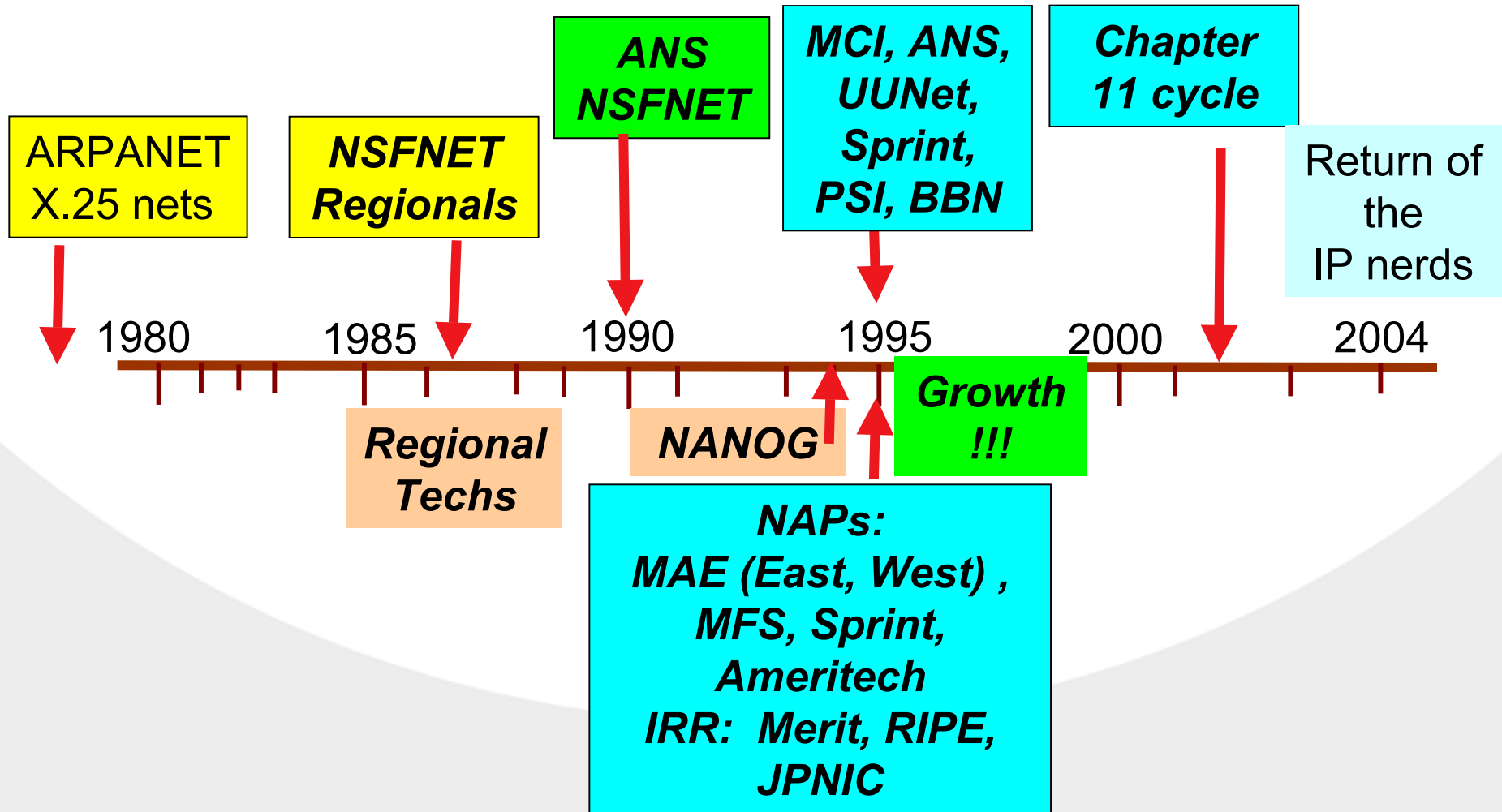
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- **Commercial Internet is Critical Infrastructure**
  - Fierce Competition for revenue, little sharing
  - Security attacks occur regularly
- **Multihoming, NATs, VPNs**
  - Shortage of IP address space (official rationale)
  - Enterprise-friendly demarcation (unofficial driver)
- **Policy is complex**
  - Multiple independent policies frustrate convergence
  - VPNs create better and more complex router configurations
  - It is critical that SLAs turn into the appropriate router configurations

# 2 Decades of Internet Technology



# 2 Decades of ISPs and Carriers



# Today's retro focus

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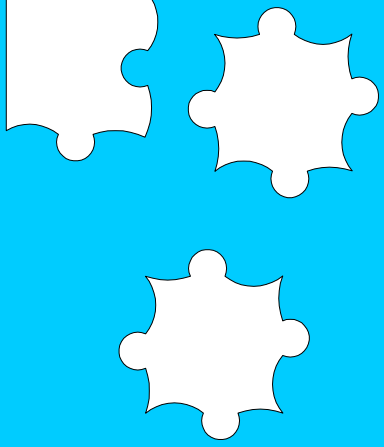
- Technologies
  - IP (Scott Bradner)
  - IPv6 and NAT (Paul Francis)
  - ETE & issues (Phil Karn)
  - IGP routing (Dino Farinacci)
  - BGP routing (Sue Hares)
  - Security (Steve Bellovin)
- Networks – policies and People
  - 10 years of Corporate Change in NANOG & IP backbone (John Curran)
  - History of Exchange Points

**"The people who started this Internet were unique. They shared information, they publicized information, they were teachers, they were evangelists, and there's been five other network technologies that could have come forth and blossomed but they've all been killed by exclusivism before they expanded . "**

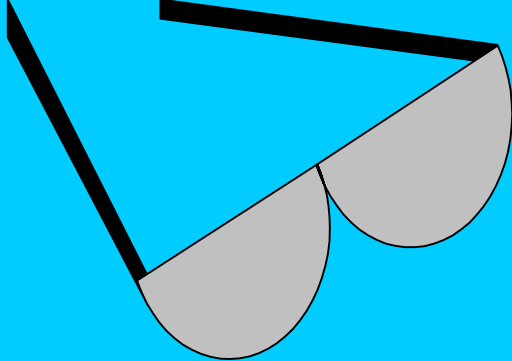
-Susan Hares, 2004




# IP: When you are in the swamp...

Technology	Problem we tried to solve	Technologies input	Lessons
IP	Not the Phone company Network handling Circuits and LANs	7 virtues of IP	<p>Oh... you want To know what We learned?</p> 
End-to-End	End-to-End, Spam and DOS	host just sends and gets end-to-end connection	
IPv6	IP v4 address Exhaustion	1) The gang: TUBA, PIP, IPAE, SIP 2) NAT (the despised) 3) No new routing, security, QOS	
Security	Attacks are increasing in number and quality	1) IP & IP sec 2) Routing: MD5 3) Firewalls & NDS	

# Routing: ...and the alligators are biting

Technology	Problem we tried to solve	Technologies input	Lessons
Routing	Find routes within a network	<ul style="list-style-type: none"> <li>1) layer 2 or layer 3</li> <li>2) datagrams or Connections</li> <li>3) Network Stack</li> <li>4) IGP or EGP</li> </ul>	<p style="text-align: center;">Well.. I guess you'll just Have to watch The talks...</p> 
IGP routing	<ul style="list-style-type: none"> <li>1) layer 2 or Layer 3</li> <li>2) Datagrams or Connections</li> <li>3) Network Layer,</li> </ul>	<ul style="list-style-type: none"> <li>1) convergence can be sub-second</li> <li>2) SPF improved over time</li> </ul>	
Policy Routing	"No Route Storms", limit by policy	<ul style="list-style-type: none"> <li>1) BGP, EGP</li> <li>2) IRR, RPSL</li> </ul>	
Multicast	No Problem, just an opportunity to match "broadcast" functionality	<ul style="list-style-type: none"> <li>1) IGMP, PIMs, MSDP</li> <li>2) MOSPF</li> <li>3) Application Multicast</li> </ul>	

# Carriers & IXP: ...it's hard to recall.. You're trying to drain the swamp

Technology	Problem we tried to solve	Technologies input	Lessons
IP Regional and National Networks	No IP Network - Building Infrastructure in 3 years	1) Let 20 regional networks bloom (Eric Aupperle) 2) NSFNet Regional Techs meeting 3) AUP policy (Scott)	Cause the speakers will throw darts At me If I tell.. 
Exchange points	Commercial ISP meet to exchange routes	1) NAP Layer 2 technologies (ATM, FDDI, Xgig-E) 2) Peering Arrangements	

# Technologies we are not covering

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<b>Technology</b>	<b>Problem we tried to solve</b>
<b>VOIP</b>	<b>I need to reduce my cost: 1 network for phone and voice</b>
<b>Wireless LANS</b>	<b>"Don't tether me, Let me go to the bar"</b>
<b>Mobile IP</b>	<b>"Salesman in the car needs IP"</b>
<b>Adhoc</b>	<b>"Airport connectivity on the run"</b>

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