2 Decades of the Internet

1988 to 2004

NANOG 30

Discussion Time

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Retro-Speakers

- Are here to answer questions
- Just a quick review on the lessons learned

Today's retro focus

- 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 (Steve Feldman)

The people concerned with Internet routing avoided the bicameral divisions that frustrated the co-evolution of other internetworking technologies, and today the Internet is the beneficiary of a "non-ideological" routing architecture that works remarkably well.“

Lyman Chapin, 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	No Security, QOS, Efficiency - we need to add them back
End-to-End	End-to-End, Spam and DOS	host just sends and gets end-to-end connection	1) ETE is good for apps 2) SPAM and DOS are attacks that impact us all
IPv6	IP v4 address Exhaustion	1) The gang: TUBA, PIP, IPAE, SIP 2) NAT (the despised) 3) No new routing, security, QOS	1) NAT was not just about addresses, it's about boundaries to Enterprise 2) IPv6 didn't add enough 3) NAT and IPv6 merge in Teredo
Security	Attacks are increasing in number and quality	1) IP & IP sec 2) Routing: MD5 3) Firewalls & NDS	1) Not building it in from the beginning makes it hard to add 2) Attacks will happen

Routing: …and the alligators are biting

Technology	Problem we tried to solve	Technologies input	Lessons
Routing	Find routes within a network	1) layer 2 or layer 3 2) datagrams or Connections 3) Network Stack 4) IGP or EGP	1) layer 2/3 - MPLS/IP 2) Datagrams (IP), Virtual Connections (VC) 3) network stack (IP) 4) ISIS, OSPF -
IGP routing	1) layer 2 or Layer 3 2) Datagrams or Connections 3) Network Layer,	1) convergence can be sub-second 2) SPF improved over time	4.5 on a scale of 5
Policy Routing	"No Route Storms", limit by policy	1) BGP, EGP 2) IRR, RPSL	1) Policy Routing can limit storms 2) BGP is TLV carrier 3) Convergence matters 4) IBGP full mesh hurts
Multicast	No Problem, just an opportunity to match "broadcast" funcationality	1) IGMP, PIMs, MSDP 2) MOSPF 3) Application Multicast	1) Problems are better than opportunities 2) Policy = business

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)	1) good technical ideas win in the end 2) Finite number of good people, so you'll see the bright ones again 3) Customers are more creative than you think
Exchange points	Commercial ISP meet to exchange routes	1) NAP Layer 2 technologies (ATM, FDDI, Xgig-E) 2) Peering Arrangements	1) Layer 2 is NOT easy 2) Never enough bandwidth 3) Peering - is a new social & business realm

It’s Open Mike time

Sue Hares

Retro Introduction

If you like this format …
Ask for any of the next topics on the survey

If you didn’t, That’s ok..

Just tell us!

Technologies we are not covering

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

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