



IPv6 Acceptance (The Stages of Grief)

IPv6 Forum Beijing
April 15, 2008



Tony Hain

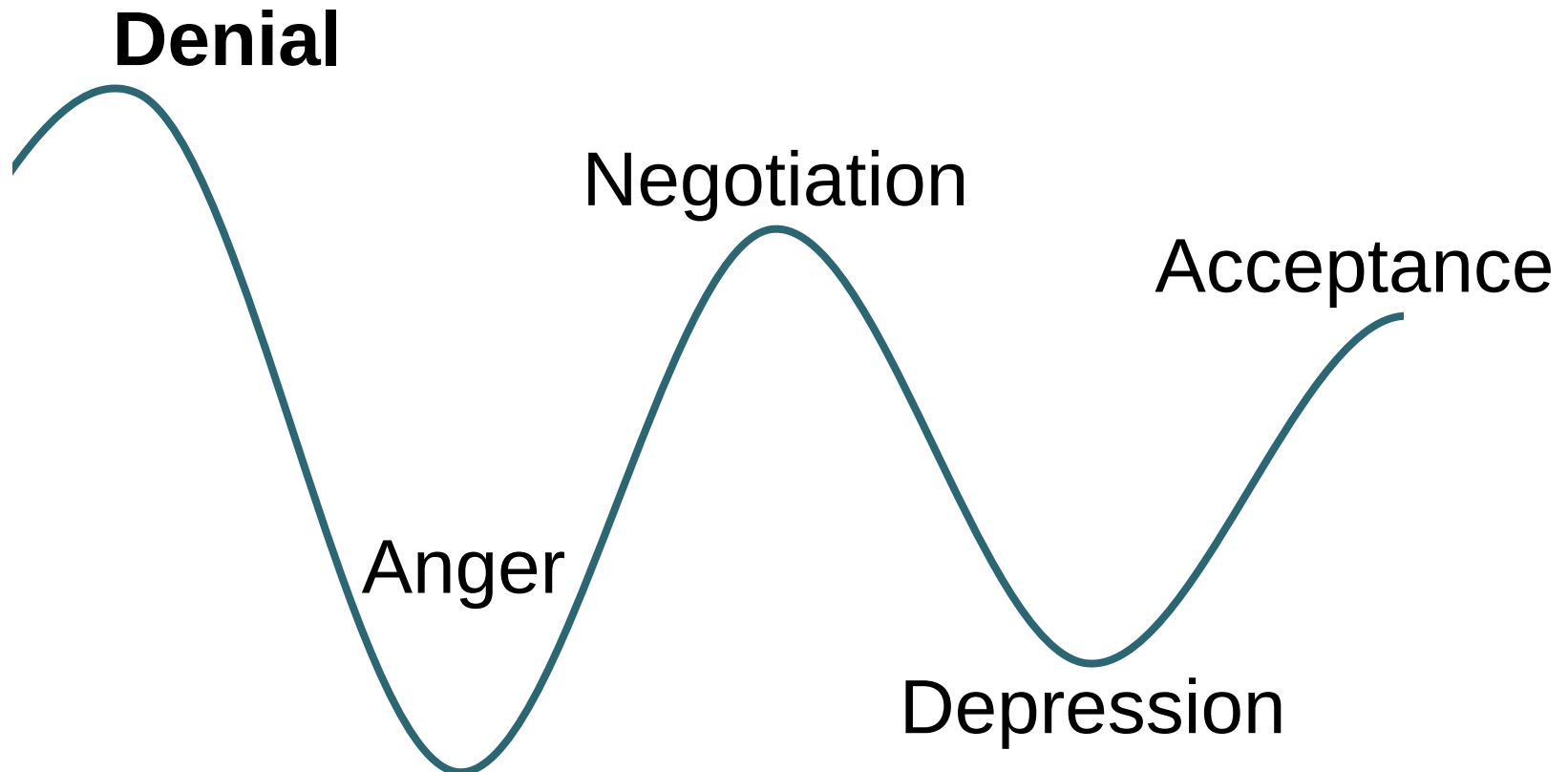
IPv6 Forum Fellow

Cisco Systems Technical Leader

ahain@cisco.com

Agenda

IPv4 to IPv6 transition and the stages of grief



- ***Most Network Managers will not ask for IPv6 until they run into a problem getting IPv4 space.*** It is simple human nature to ignore a problem until it becomes a crisis.

IPv4 Address Fractal Map Jan-2000

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004 L3	007 Reserved	008 L3	011 US DoD	030 US DoD	029 US DoD	024 Cable	025 UK Defense	230 Multicast	231 Multicast	226 Multicast	225 Multicast	244 Class E	247 Class E	248 Class E	251 Class E
005 Reserved	006 US DoD	009 IBM	010 Private	031 Reserved	028 US DoD	027 Reserved	026 US DoD	229 Multicast	228 Multicast	227 Multicast	224 Multicast	245 Class E	246 Class E	249 Class E	250 Class E
058 APnic	057 SITA	054 Merck	053 Cap Debis	032 AT&T	035 MERIT	036 Reserved	037 Reserved	218 APnic	219 APnic	220 APnic	223 Reserved	202 APnic	201 LACnic	198 Various	197 Reserved
059 APnic	056 US Postal	055 US DoD	052 El duPONT	033 US DoD	034 Haliburton	039 Reserved	038 PSI	217 RIPE	216 ARIN	221 APnic	222 APnic	203 APnic	200 LACnic	199 ARIN	196 AFRnic
060 APnic	061 APnic	050 Reserved	051 UK DSS	046 Reserved	045 Interop	040 Eli Lily	041 AFRnic	214 US DoD	215 US DoD	210 APnic	209 ARIN	204 ARIN	205 ARIN	194 RIPE	195 RIPE
063 ARIN	062 RIPE	049 Reserved	048 Prudential	047 Bell North	044 Radio	043 Inet	042 Reserved	213 RIPE	212 RIPE	211 APnic	208 ARIN	207 ARIN	206 ARIN	192 RIPE	192 Various
064 ARIN	067 ARIN	068 ARIN	069 ARIN	122 APnic	123 APnic	124 APnic	127 Loopback	128 Various	131 Various	132 Various	133 Various	186 LACnic	187 LACnic	188 Various	191 Various
065 ARIN	066 ARIN	071 ARIN	070 ARIN	121 APnic	120 APnic	125 APnic	126 APnic	129 Various	130 Various	135 Various	134 Various	185 Reserved	184 Reserved	189 LACnic	190 LACnic
078 RIPE	077 RIPE	072 ARIN	073 ARIN	118 APnic	119 APnic	114 APnic	113 Reserved	142 Various	141 Various	136 Various	137 Various	182 Reserved	183 Reserved	178 Reserved	177 Reserved
079 RIPE	076 ARIN	075 ARIN	074 ARIN	117 APnic	116 APnic	115 APnic	112 Reserved	143 Various	140 Various	139 Various	138 Various	181 Reserved	180 Reserved	179 Reserved	176 Reserved
080 RIPE	081 RIPE	094 RIPE	095 RIPE	096 ARIN	097 ARIN	110 Reserved	111 Reserved	144 Various	145 Various	158 Various	159 Various	160 Various	161 Various	174 Reserved	175 Reserved
083 RIPE	082 RIPE	093 RIPE	092 RIPE	099 ARIN	098 ARIN	109 Reserved	108 Reserved	147 Various	146 Various	157 Various	156 Various	163 Various	162 Various	173 Reserved	172 Various
084 RIPE	087 RIPE	088 RIPE	091 RIPE	100 Reserved	103 Reserved	104 Reserved	107 Reserved	148 Various	151 Various	152 Various	155 Various	164 Various	167 Various	168 Various	171 Various
085 RIPE	086 RIPE	089 RIPE	090 RIPE	101 Reserved	102 Reserved	105 Reserved	106 Reserved	149 Various	150 Various	153 Various	154 Various	165 Various	166 Various	169 Various	170 Various

Fractal map: Layout by Randall Munroe, Time Sequence by Tony Hain, Highlighted by Jeff Apcar

IPv4 Address Fractal Map Today

000 Reserved	001 Reserved	014 Reserved	015 HP	016 DEC	019 Ford	020 CsC	021 US DoD	234 Multicast	235 Multicast	236 Multicast	239 Multicast	240 Class E	241 Class E	254 Class E	255 Class E
003 GE	002 Reserved	013 Xerox	012 AT&T	017 Apple	018 MIT	023 Reserved	022 US DoD	233 Multicast	232 Multicast	237 Multicast	238 Multicast	243 Class E	242 Class E	253 Class E	252 Class E
004 L3	007 Reserved	008 L3	011 US DoD	030 US DoD	029 US DoD	024 Cable	025 UK Defense	230 Multicast	231 Multicast	226 Multicast	225 Multicast	244 Class E	247 Class E	248 Class E	251 Class E
005 Reserved	006 US DoD	009 IBM	010 Private	031 Reserved	028 US DoD	027 Reserved	026 US DoD	229 Multicast	228 Multicast	227 Multicast	224 Multicast	245 Class E	246 Class E	249 Class E	250 Class E
058 APnic	057 SITA	054 Merck	053 Cap Debis	032 AT&T	035 MERIT	036 Reserved	037 Reserved	218 APnic	219 APnic	220 APnic	223 Reserved	202 APnic	201 LACnic	198 Various	197 Reserved
059 APnic	056 US Postal	055 US DoD	052 El duPONT	033 US DoD	034 Haliburton	039 Reserved	038 PSI	217 RIPE	216 ARIN	221 APnic	222 APnic	203 APnic	200 LACnic	199 ARIN	196 AFRnic
060 APnic	061 APnic	050 Reserved	051 UK DSS	046 Reserved	045 Interop	040 Eli Lily	041 AFRnic	214 US DoD	215 US DoD	210 APnic	209 ARIN	204 ARIN	205 ARIN	194 RIPE	195 RIPE
063 ARIN	062 RIPE	049 Reserved	048 Prudential	047 Bell North	044 Radio	043 Inet	042 Reserved	213 RIPE	212 RIPE	211 APnic	208 ARIN	207 ARIN	206 ARIN	192 RIPE	192 Various
064 ARIN	067 ARIN	068 ARIN	069 ARIN	122 APnic	123 APnic	124 APnic	127 Loopback	128 Various	131 Various	132 Various	133 Various	186 LACnic	187 LACnic	188 Various	191 Various
065 ARIN	066 ARIN	071 ARIN	070 ARIN	121 APnic	120 APnic	125 APnic	126 APnic	129 Various	130 Various	135 Various	134 Various	185 Reserved	184 Reserved	189 LACnic	190 LACnic
078 RIPE	077 RIPE	072 ARIN	073 ARIN	118 APnic	119 APnic	114 APnic	113 Reserved	142 Various	141 Various	136 Various	137 Various	182 Reserved	183 Reserved	178 Reserved	177 Reserved
079 RIPE	076 ARIN	075 ARIN	074 ARIN	117 APnic	116 APnic	115 APnic	112 Reserved	143 Various	140 Various	139 Various	138 Various	181 Reserved	180 Reserved	179 Reserved	176 Reserved
080 RIPE	081 RIPE	094 RIPE	095 RIPE	096 ARIN	097 ARIN	110 Reserved	111 Reserved	144 Various	145 Various	158 Various	159 Various	160 Various	161 Various	174 Reserved	175 Reserved
083 RIPE	082 RIPE	093 RIPE	092 RIPE	099 ARIN	098 ARIN	109 Reserved	108 Reserved	147 Various	146 Various	157 Various	156 Various	163 Various	162 Various	173 Reserved	172 Various
084 RIPE	087 RIPE	088 RIPE	091 RIPE	100 Reserved	103 Reserved	104 Reserved	107 Reserved	148 Various	151 Various	152 Various	155 Various	164 Various	167 Various	168 Various	171 Various
085 RIPE	086 RIPE	089 RIPE	090 RIPE	101 Reserved	102 Reserved	105 Reserved	106 Reserved	149 Various	150 Various	153 Various	154 Various	165 Various	166 Various	169 Various	170 Various

Fractal map: Layout by Randall Munroe, Time Sequence by Tony Hain, Highlighted by Jeff Apcar

IPv4 Address Fractal Map Jan-2009

000 Reserved	001 Reserved	014 Reserved	015 HP	016 DEC	019 Ford	020 CsC	021 US DoD	234 Multicast	235 Multicast	236 Multicast	239 Multicast	240 Class E	241 Class E	254 Class E	255 Class E
003 GE	002 Reserved	013 Xerox	012 AT&T	017 Apple	018 MIT	023 Reserved	022 US DoD	233 Multicast	232 Multicast	237 Multicast	238 Multicast	243 Class E	242 Class E	253 Class E	252 Class E
004 L3	007 Reserved	008 L3	011 US DoD	030 US DoD	029 US DoD	024 Cable	025 UK Defense	230 Multicast	231 Multicast	226 Multicast	225 Multicast	244 Class E	247 Class E	248 Class E	251 Class E
005 Reserved	006 US DoD	009 IBM	010 Private	031 Reserved	028 US DoD	027 Reserved	026 US DoD	229 Multicast	228 Multicast	227 Multicast	224 Multicast	245 Class E	246 Class E	249 Class E	250 Class E
058 APnic	057 SITA	054 Merck	053 Cap Debis	032 AT&T	035 MERIT	036 Reserved	037 Reserved	218 APnic	219 APnic	220 APnic	223 Reserved	202 APnic	201 LACnic	198 Various	197 Reserved
059 APnic	056 US Postal	055 US DoD	052 El duPONT	033 US DoD	034 Haliburton	039 Reserved	038 PSI	217 RIPE	216 ARIN	221 APnic	222 APnic	203 APnic	200 LACnic	199 ARIN	196 AFRnic
060 APnic	061 APnic	050 Reserved	051 UK DSS	046 Reserved	045 Interop	040 Eli Lily	041 AFRnic	214 US DoD	215 US DoD	210 APnic	209 ARIN	204 ARIN	205 ARIN	194 RIPE	195 RIPE
063 ARIN	062 RIPE	049 Reserved	048 Prudential	047 Bell North	044 Radio	043 Inet	042 Reserved	213 RIPE	212 RIPE	211 APnic	208 ARIN	207 ARIN	206 ARIN	192 RIPE	192 Various
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065 ARIN	066 ARIN	071 ARIN	070 ARIN	121 APnic	120 APnic	125 APnic	126 APnic	129 Various	130 Various	135 Various	134 Various	185 Reserved	184 Reserved	189 LACnic	190 LACnic
078 RIPE	077 RIPE	072 ARIN	073 ARIN	118 APnic	119 APnic	114 APnic	113 Next	142 Various	141 Various	136 Various	137 Various	182 Reserved	183 Reserved	178 Next	177 Next
079 RIPE	076 ARIN	075 ARIN	074 ARIN	117 APnic	116 APnic	115 APnic	112 Next	143 Various	140 Various	139 Various	138 Various	181 Reserved	180 Reserved	179 Next	176 Next
080 RIPE	081 RIPE	094 RIPE	095 RIPE	096 ARIN	097 ARIN	110 Next	111 Next	144 Various	145 Various	158 Various	159 Various	160 Various	161 Various	174 Next	175 Next
083 RIPE	082 RIPE	093 RIPE	092 RIPE	099 ARIN	098 ARIN	109 Reserved	108 Reserved	147 Various	146 Various	157 Various	156 Various	163 Various	162 Various	173 Next	172 Various
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085 RIPE	086 RIPE	089 RIPE	090 RIPE	101 Next	102 Reserved	105 Reserved	106 Reserved	149 Various	150 Various	153 Various	154 Various	165 Various	166 Various	169 Various	170 Various

Fractal map: Layout by Randall Munroe, Time Sequence by Tony Hain, Highlighted by Jeff Apcar

IPv4 Address Fractal Map Jan-2010

000 Reserved	001 Reserved	014 Reserved	015 HP	016 DEC	019 Ford	020 CsC	021 US DoD	234 Multicast	235 Multicast	236 Multicast	239 Multicast	240 Class E	241 Class E	254 Class E	255 Class E
003 GE	002 Reserved	013 Xerox	012 AT&T	017 Apple	018 MIT	023 Reserved	022 US DoD	233 Multicast	232 Multicast	237 Multicast	238 Multicast	243 Class E	242 Class E	253 Class E	252 Class E
004 L3	007 Reserved	008 L3	011 US DoD	030 US DoD	029 US DoD	024 Cable	025 UK Defense	230 Multicast	231 Multicast	226 Multicast	225 Multicast	244 Class E	247 Class E	248 Class E	251 Class E
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059 APnic	056 US Postal	055 US DoD	052 El duPONT	033 US DoD	034 Haliburton	039 Reserved	038 PSI	217 RIPE	216 ARIN	221 APnic	222 APnic	203 APnic	200 LACnic	199 ARIN	196 AFRnic
060 APnic	061 APnic	050 Reserved	051 UK DSS	046 Reserved	045 Interop	040 Eli Lily	041 AFRnic	214 US DoD	215 US DoD	210 APnic	209 ARIN	204 ARIN	205 ARIN	194 RIPE	195 RIPE
063 ARIN	062 RIPE	049 Reserved	048 Prudential	047 Bell North	044 Radio	043 Inet	042 Reserved	213 RIPE	212 RIPE	211 APnic	208 ARIN	207 ARIN	206 ARIN	192 RIPE	192 Various
064 ARIN	067 ARIN	068 ARIN	069 ARIN	122 APnic	123 APnic	124 APnic	127 Loopback	128 Various	131 Various	132 Various	133 Various	186 LACnic	187 LACnic	188 Various	191 Various
065 ARIN	066 ARIN	071 ARIN	070 ARIN	121 APnic	120 APnic	125 APnic	126 APnic	129 Various	130 Various	135 Various	134 Various	185 Next	184 Next	189 LACnic	190 LACnic
078 RIPE	077 RIPE	072 ARIN	073 ARIN	118 APnic	119 APnic	114 APnic	113 Next	142 Various	141 Various	136 Various	137 Various	182 Next	183 Next	178 Next	177 Next
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083 RIPE	082 RIPE	093 RIPE	092 RIPE	099 ARIN	098 ARIN	109 Next	108 Next	147 Various	146 Various	157 Various	156 Various	163 Various	162 Various	173 Next	172 Various
084 RIPE	087 RIPE	088 RIPE	091 RIPE	100 Next	103 Next	104 Next	107 Next	148 Various	151 Various	152 Various	155 Various	164 Various	167 Various	168 Various	171 Various
085 RIPE	086 RIPE	089 RIPE	090 RIPE	101 Next	102 Next	105 Next	106 Next	149 Various	150 Various	153 Various	154 Various	165 Various	166 Various	169 Various	170 Various

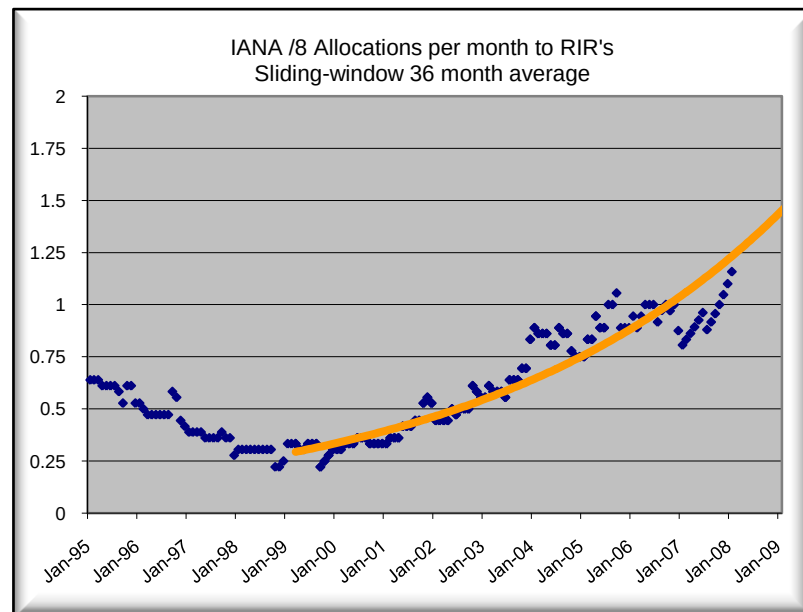
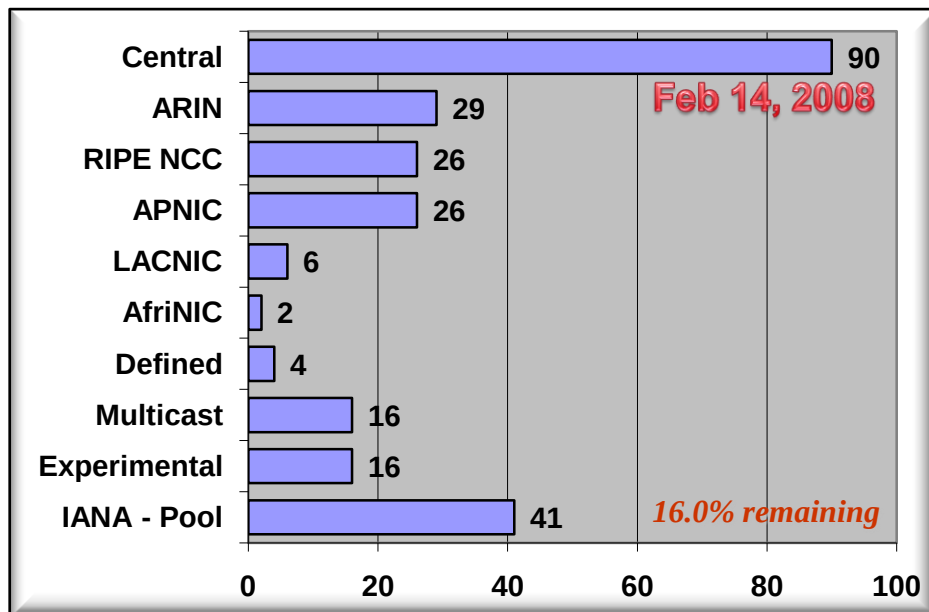
Fractal map: Layout by Randall Munroe, Time Sequence by Tony Hain, Highlighted by Jeff Apcar

IPv4 Address Fractal Map Jan-2011

000 Reserved	001 Reserved	014 Next	015 HP	016 DEC	019 Ford	020 CsC	021 US DoD	234 Multicast	235 Multicast	236 Multicast	239 Multicast	240 Class E	241 Class E	254 Class E	255 Class E
003 GE	002 Next	013 Xerox	012 AT&T	017 Apple	018 MIT	023 Next	022 US DoD	233 Multicast	232 Multicast	237 Multicast	238 Multicast	243 Class E	242 Class E	253 Class E	252 Class E
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063 ARIN	062 RIPE	049 Next	048 Prudential	047 Bell North	044 Radio	043 Inet	042 Next	213 RIPE	212 RIPE	211 APnic	208 ARIN	207 ARIN	206 ARIN	192 RIPE	192 Various
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065 ARIN	066 ARIN	071 ARIN	070 ARIN	121 APnic	120 APnic	125 APnic	126 APnic	129 Various	130 Various	135 Various	134 Various	185 Next	184 Next	189 LACnic	190 LACnic
078 RIPE	077 RIPE	072 ARIN	073 ARIN	118 APnic	119 APnic	114 APnic	113 Next	142 Various	141 Various	136 Various	137 Various	182 Next	183 Next	178 Next	177 Next
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Fractal map: Layout by Randall Munroe, Time Sequence by Tony Hain, Highlighted by Jeff Apcar

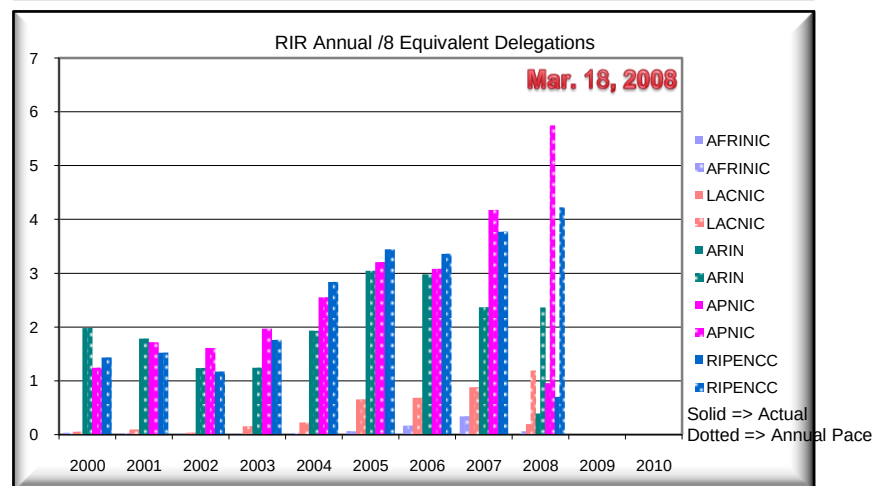
IPv4 address allocations by /8



- Consumption is accelerating despite increasingly intense conservation efforts.

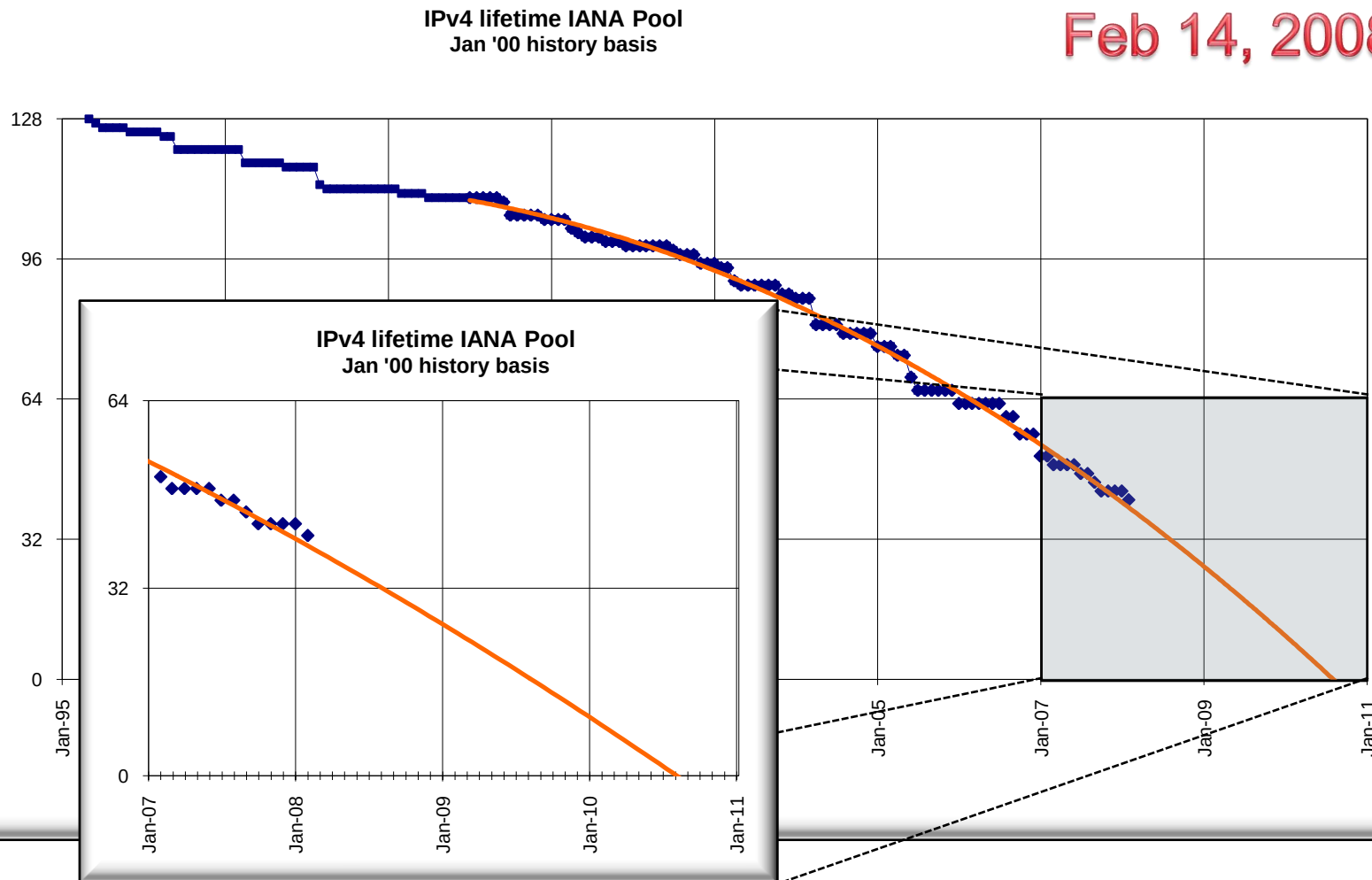
- Growth is occurring in all regions**

While many argue that North America is not affected due to historical allocations, consumption of the remaining IPv4 free pool continues globally.



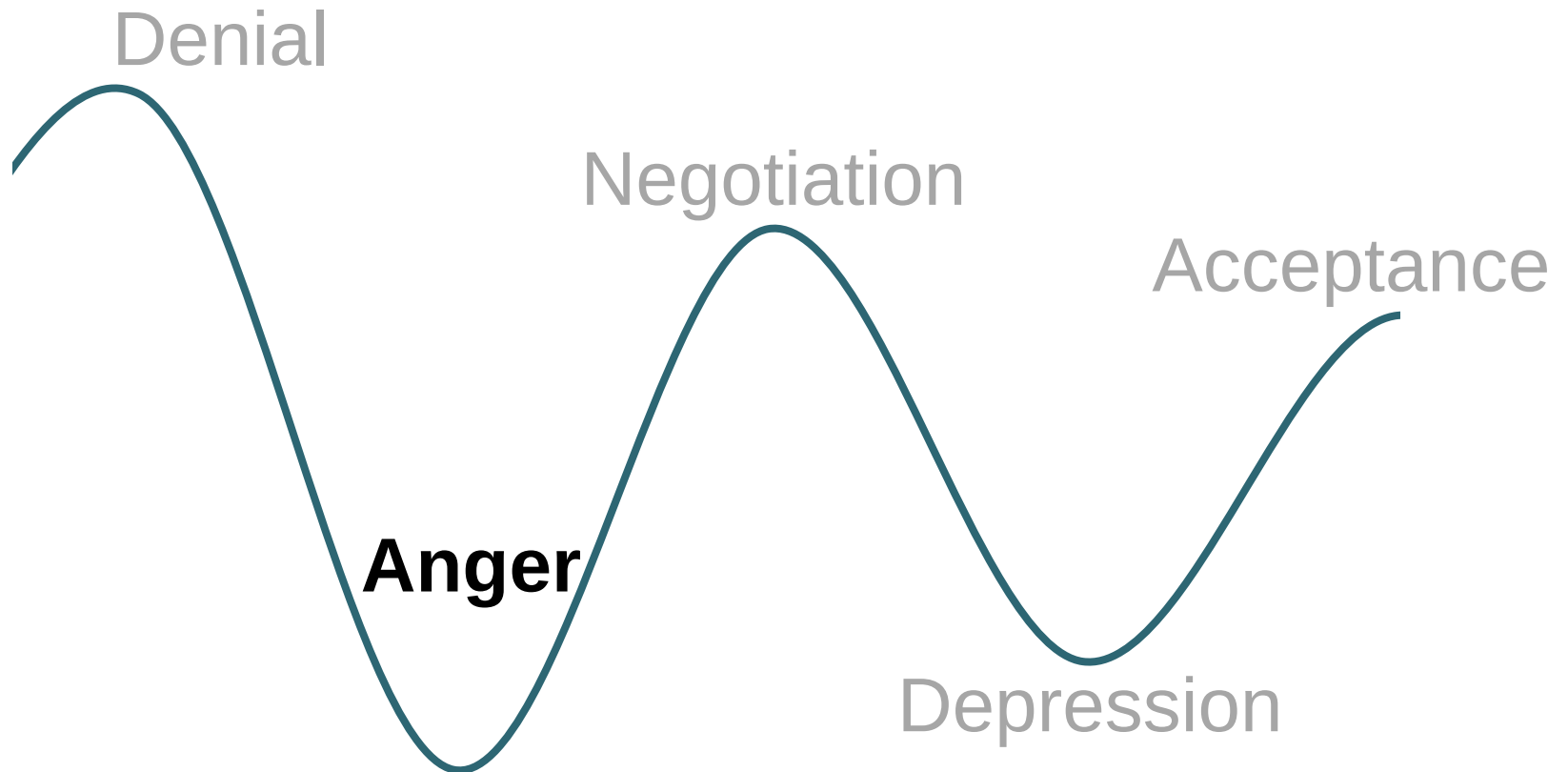
Remaining IANA IPv4 pool

Feb 14, 2008



Update to: http://www.cisco.com/web/about/ac123/ac147/archived_issues/ipj_8-3/ipj_8-3.pdf

Agenda



Impact on IPv4 Routing

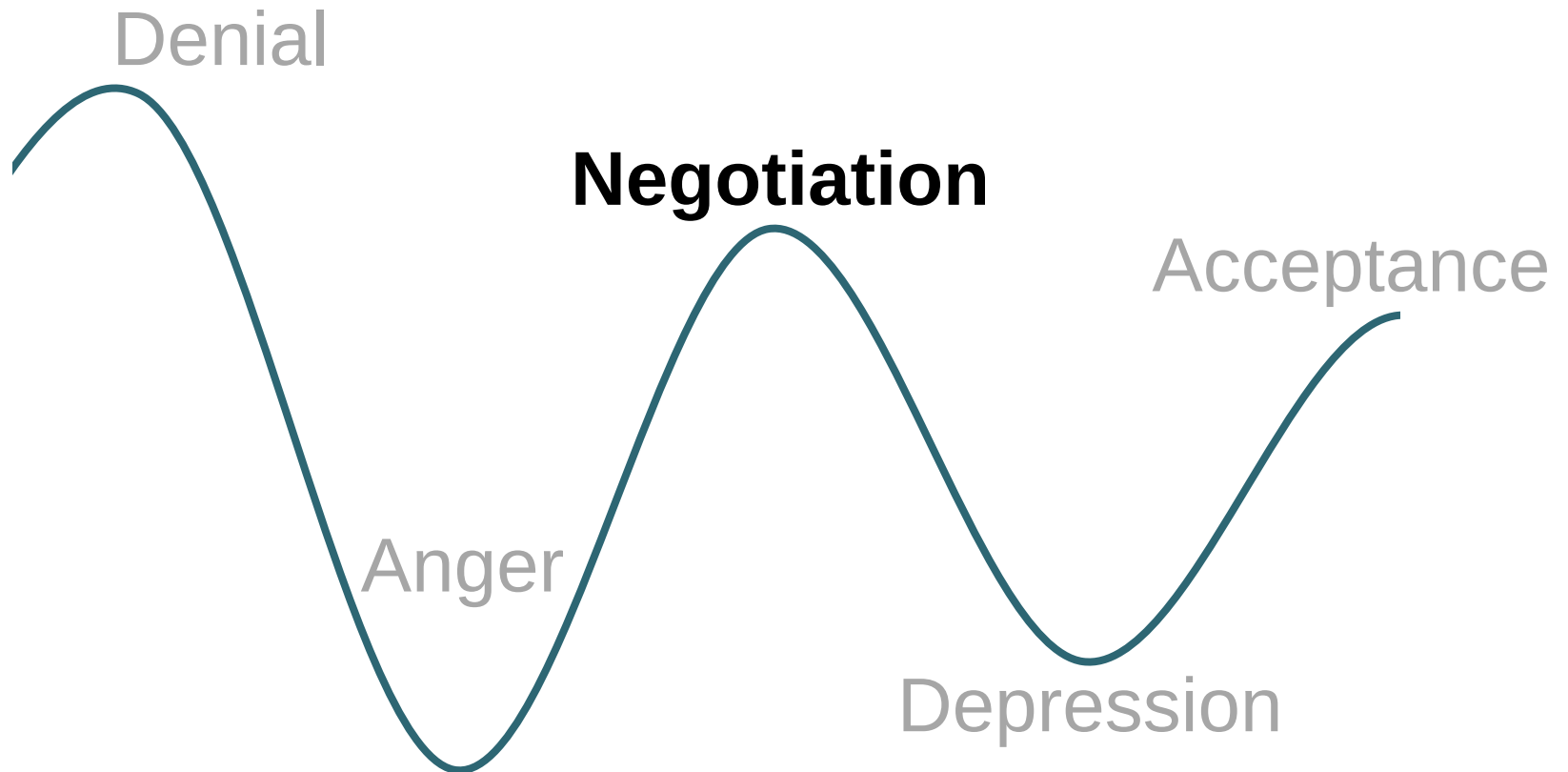
- 
- Trading smaller and smaller blocks will cause the global IPv4 routing table to explode.
 - Small blocks make it difficult for large service providers to acquire enough space to sustain the business needs.
 - The IPv4 address shortage will disproportionately harm the access providers relative to the content providers due to their imbalanced needs for additional addresses.
 - If content providers require growth beyond the availability of IPv4, they can deploy IPv6, and then wait for the access providers to connect the content customers.
 - Shortage driven IPv4 address block hijackings will become routine, which in turn will result in the routing table being politicized.

IPv6-only events



- **Distraught ‘IPv4 experts’ are having difficulties:**
 - **IPv6-only exposes IPv4 dependencies in applications and middleware.**
 - “Thunderbird and Firefox disable IPv6 dns by default”
 - **Failures when translating between versions exposes the invalid assumptions that some ISPs have been making.**
 - “Linux NAT-PT (napt) has stability issues and wedges”
 - **Provisioning model assumptions are exposed by new ways of handling addressing.**
 - “it's a real pain in the ass to get DHCPv6 working”
 - “why doesn't the RA include the DNS service”
 - **Typing ‘ : ’ instead of ‘ . ’ in a literal address exposes how resistant people are to change.**
 - “why do we have to type colon instead of dot like in a real address”

Agenda

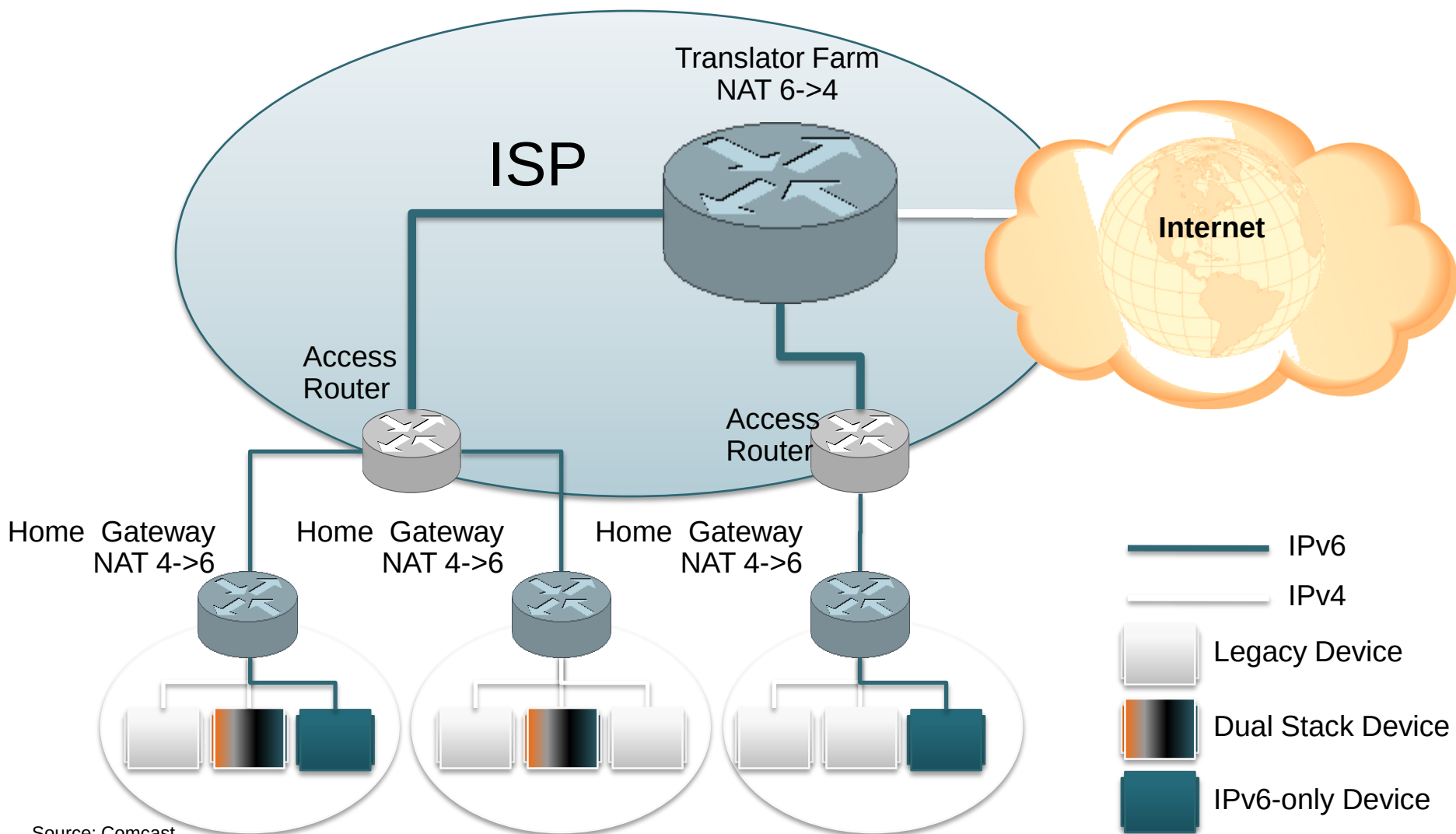


Carrier-Class IPv4/nat



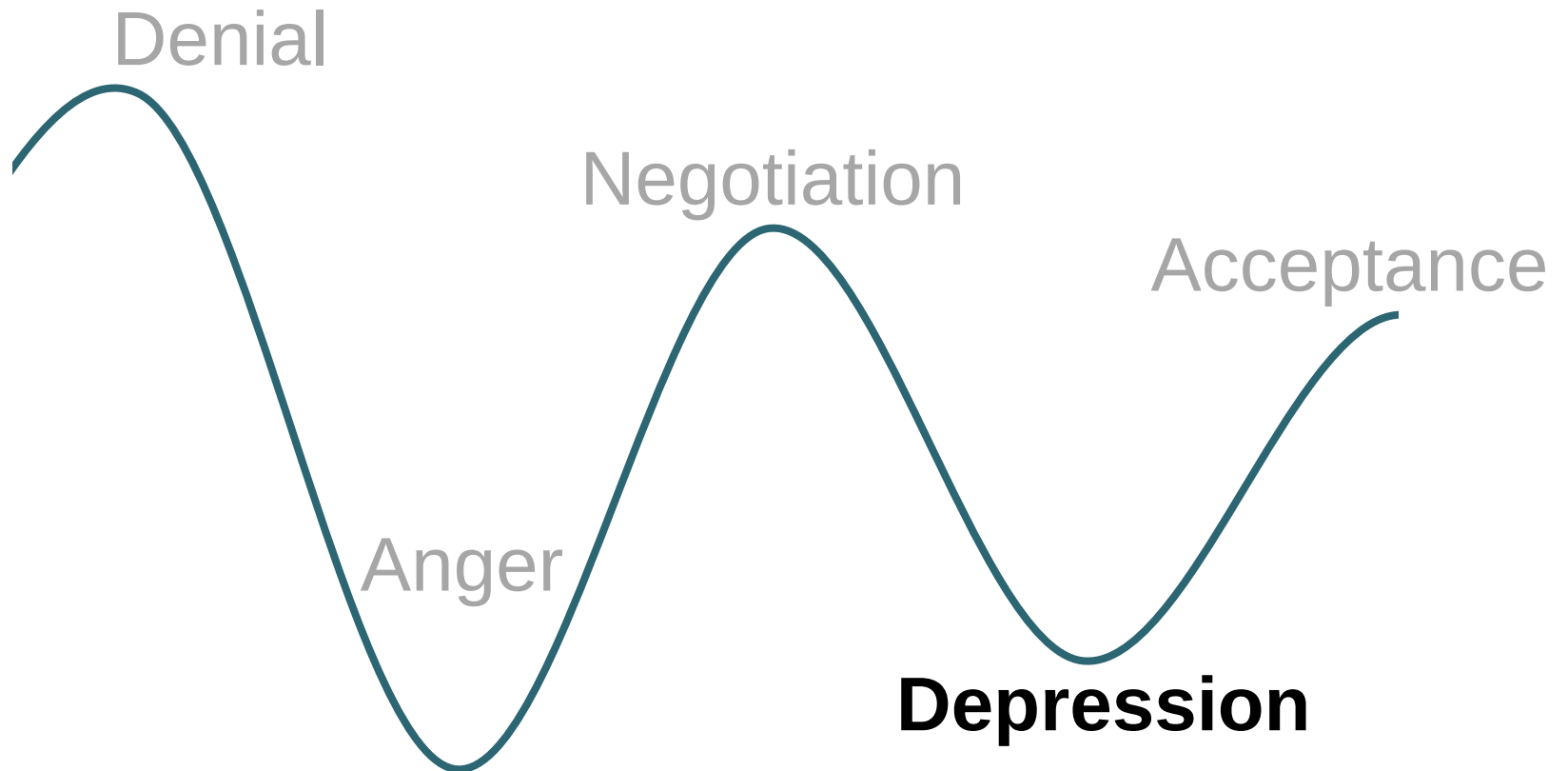
- **Several proposed approaches for carrier-class nat**
IPv4-IPv4-IPv4 IPv4-IPv6-IPv4 IPv4-tunnel-IPv4
NAT-PT NAT-PT-bis
- **These will be short term approaches for adding customers after the IPv4-free-pool is exhausted.**
- **Goal is to minimize changes to the customer routers.**
- **IPv4/nat traversal technologies like UPNP-IGD fail because they are limited to the local link for security reasons.**

Distributed NAT Deployment Model



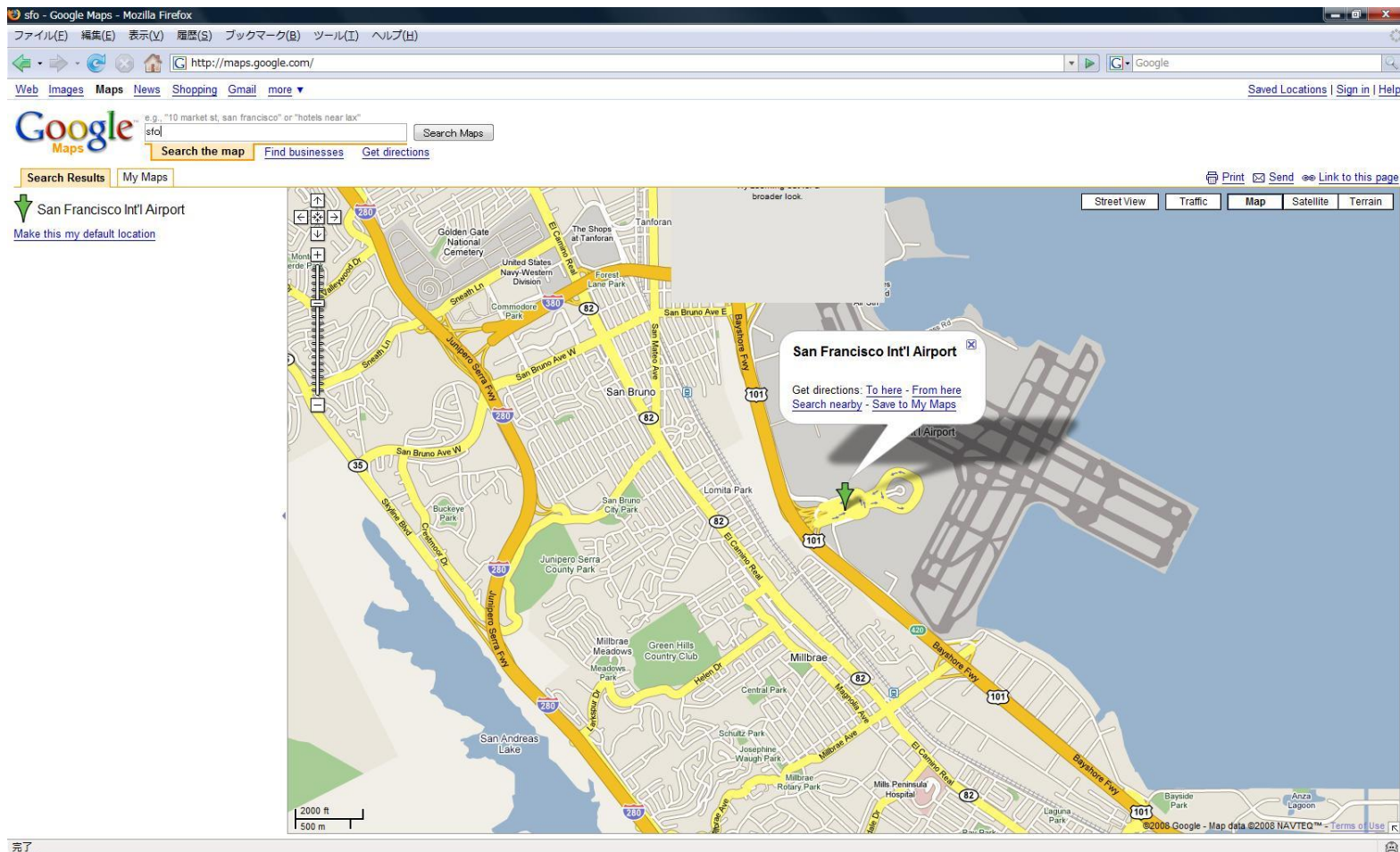
Source: Comcast

Agenda



Multiple connection applications

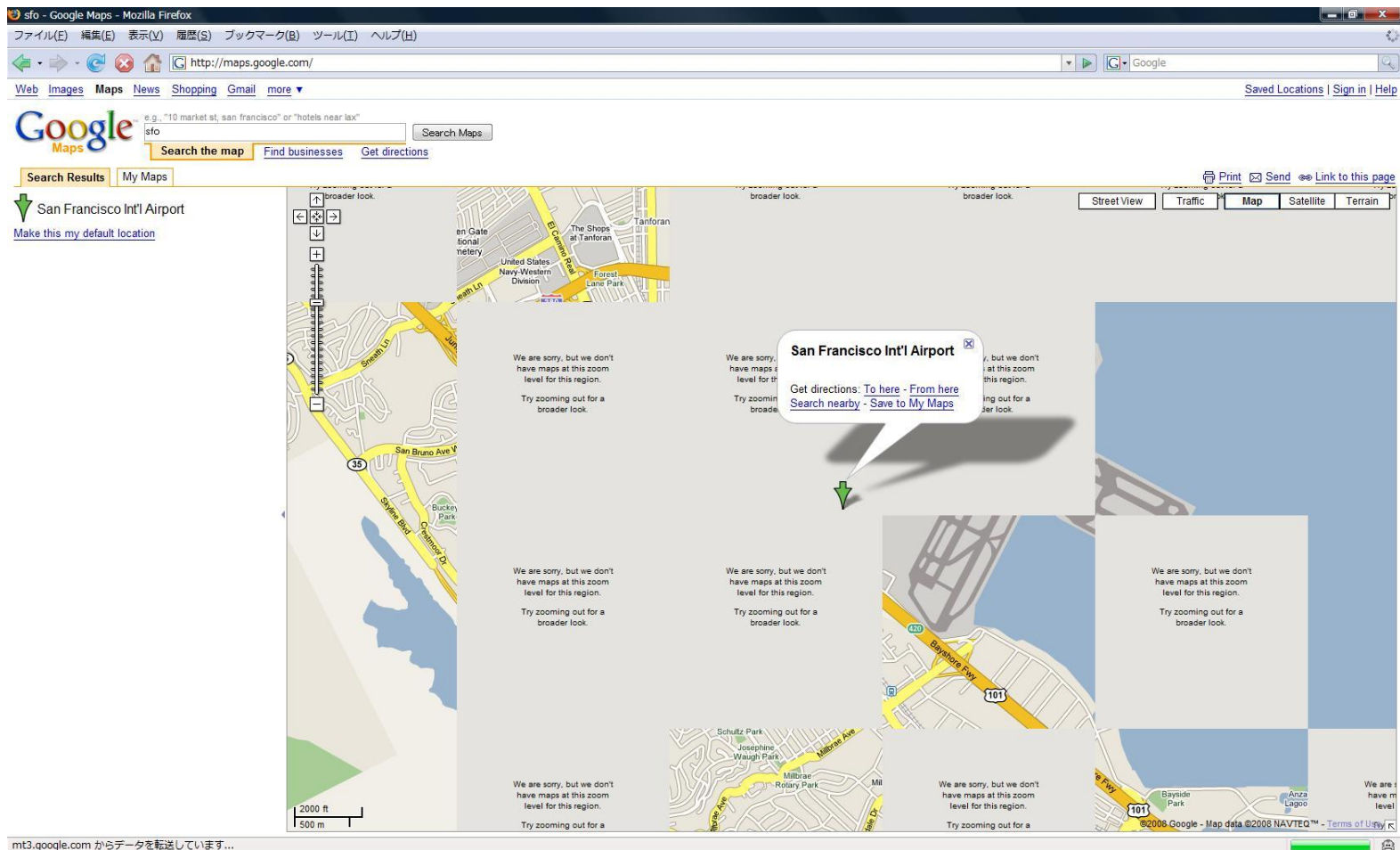
Max 20 Connections



Source: Shin Miyakawa , Ph.D. NTT Communications Corporation

Multiple connection applications

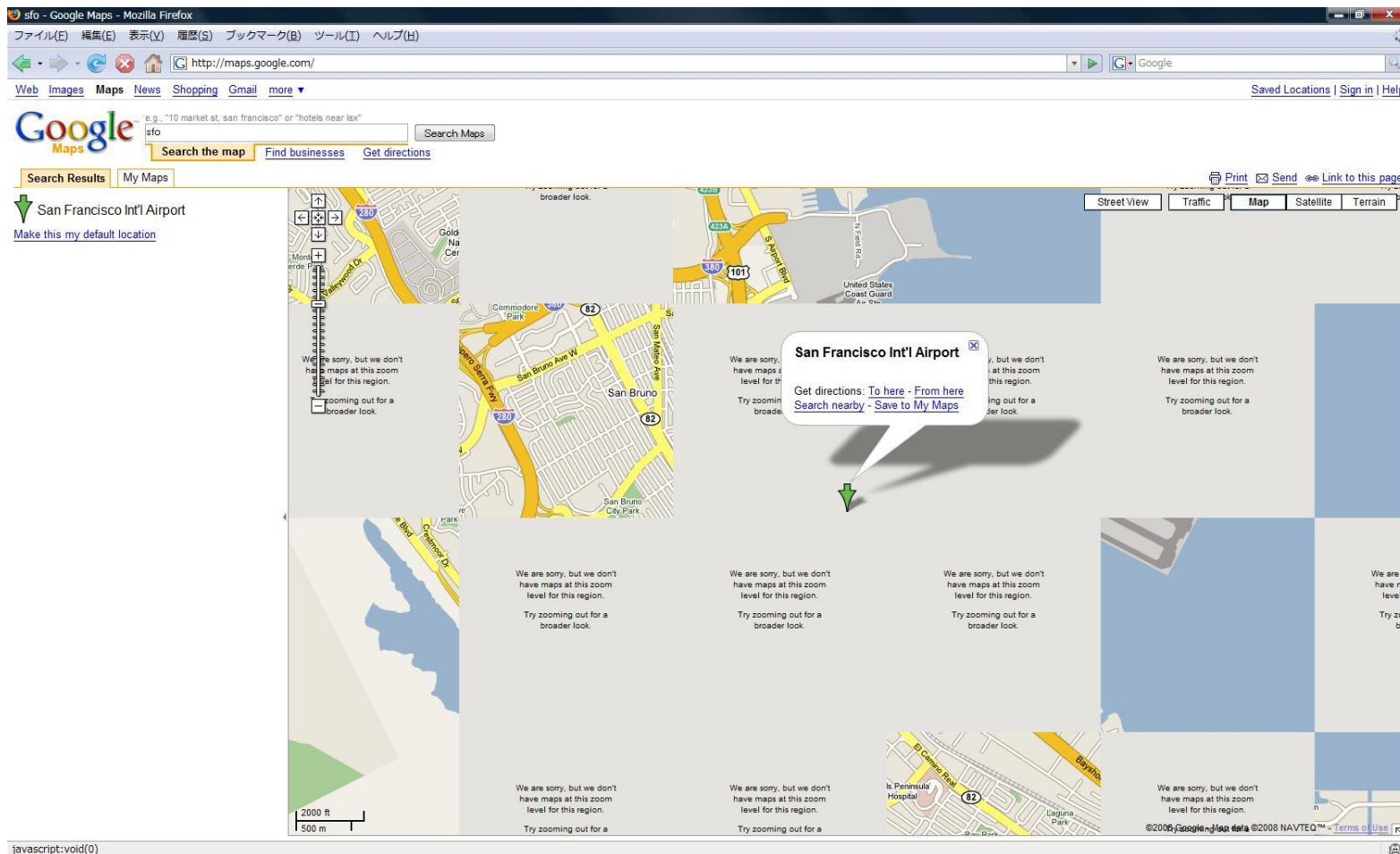
Max 15 Connections



Source: Shin Miyakawa , Ph.D. NTT Communications Corporation

Multiple connection applications

Max 10 Connections



Source: Shin Miyakawa , Ph.D. NTT Communications Corporation

Multiple connection applications

Max 5 Connections

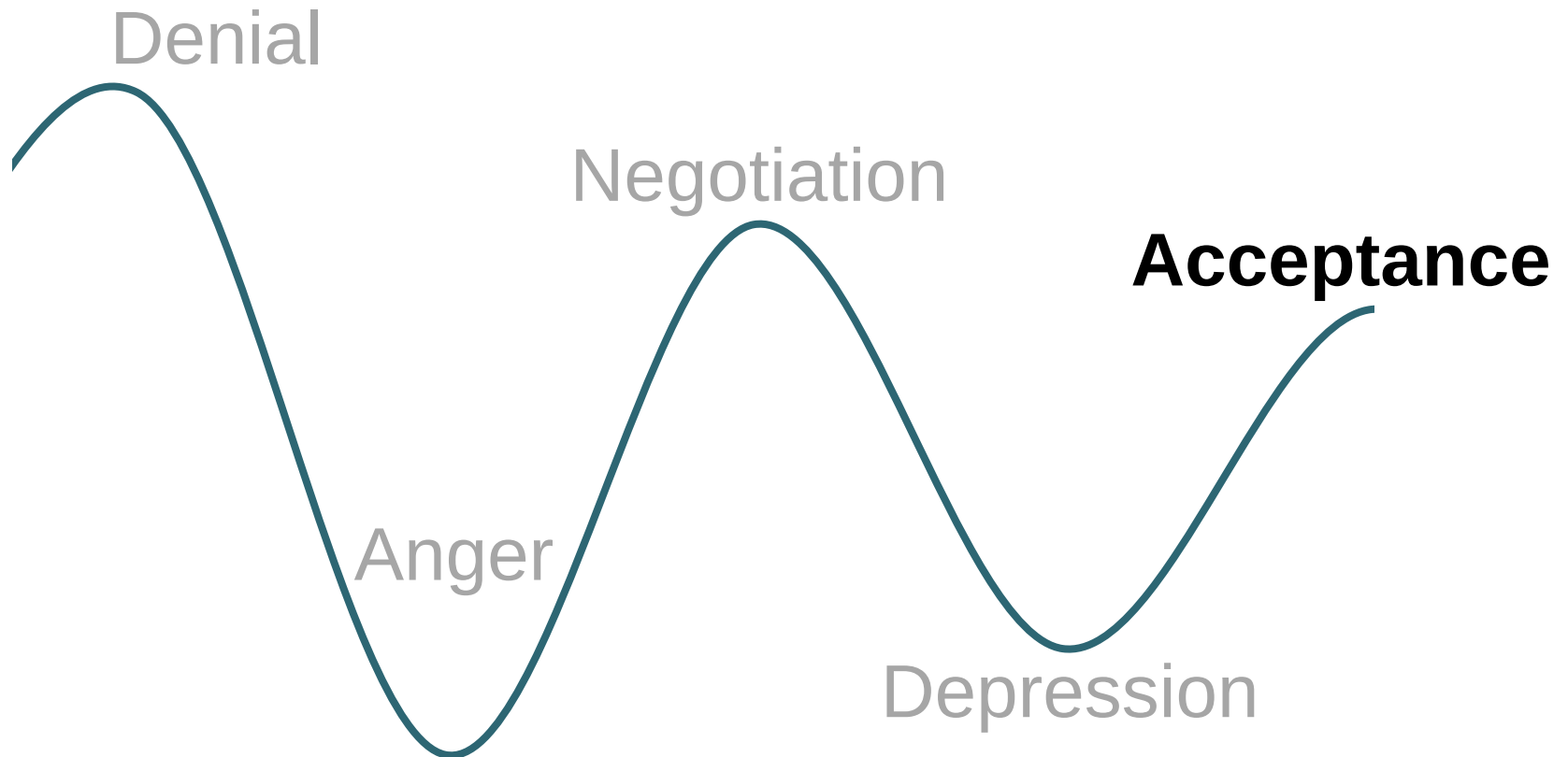


Source: Shin Miyakawa , Ph.D. NTT Communications Corporation

Multiple connection applications

- Google Maps opens ~ 70 parallel connections
- iTunes store has been shown to open as many as 300 parallel connections
- New apps that have not emerged yet ???
- IPv4/nat multiplexes multiple users through the port range, so 64k divided by 300 parallel connections results in ~200 customers per ISP based nat address (assuming each customer is only allowed to run one simultaneous instance of iTunes or similar apps).
- Services generally don't allow connections from the same host to span multiple public side addresses, so use of more ports on another address will cause the application to fail.
- Reuse of port pairs can't be guaranteed with a high rate of churn in the port pool, so the likelihood of matching src/dst port pairs to popular sites will expose the probability of TCP sequence number overlap between unrelated connections.

Agenda



Emergency Response

Solution Overview

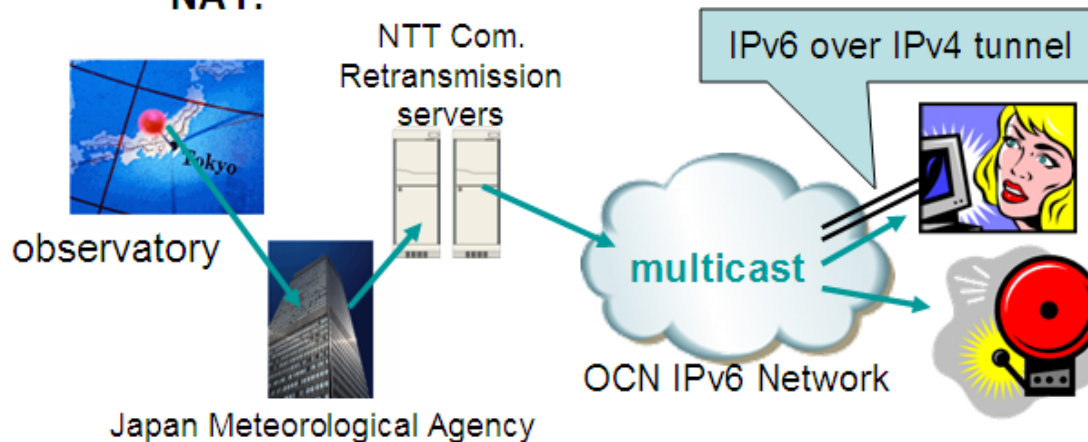
- Enhances Interoperability
- Optimizes Command & Control
- Improves Situational Awareness



NTT Com. “Earthquake alert service”

NTT Information Sharing Platform Laboratories

- **Earthquake emergency alert service**
 - On detecting P-wave, S-wave alert is delivered.
 - Dedicated terminal/software receives an alert.
 - IPv6 multicast is adopted
 - **Lower-delay delivery** is achieved.
 - IPv4 isn't suitable for such a push-type service due to NAT.



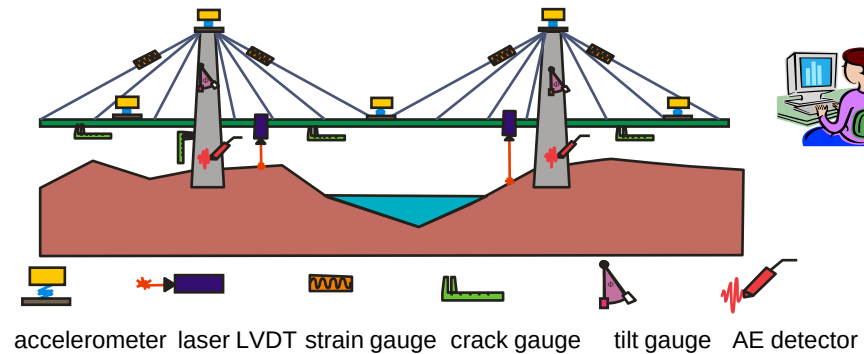
Copyright(C) NTT Information Sharing Platform Laboratories.

Sensor arrays

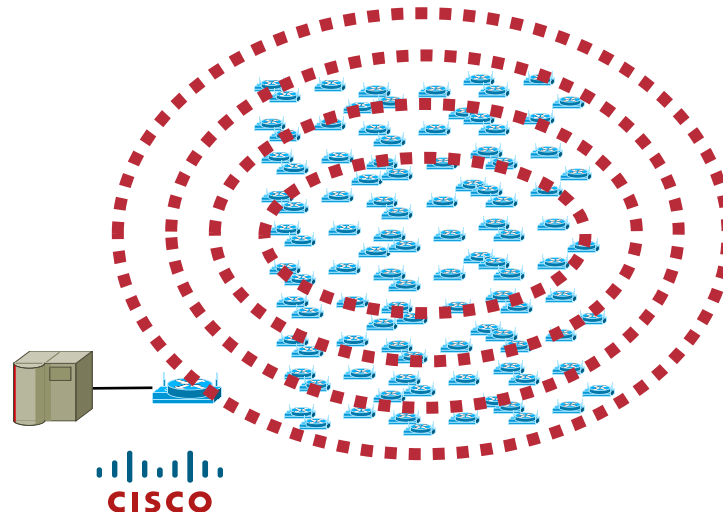
6LoWPAN (RFC 4919 & 4944) based networks

Routing Over Low power and Lossy networks <http://www.ietf.org/html.charters/roll-charter.html>

- **Sensors on aging infrastructure.**



- **Adhoc networks of fire sensors.**



Enterprise deployment Case Study - Bechtel



<http://www.cisco.com/ipv6>

Case Studies

Bechtel



Microsoft®

Bechtel Well Positioned to Serve Customers by Using Microsoft and Cisco IPv6 Solution

Overview



Country or Region

Global

Industry

Construction

Customer Profile

Headquartered in San Francisco, California, Bechtel Group is a global engineering, construction, and project management firm with more than 40,000 employees and 2006 revenues of U.S.\$20.5 billion.

"Implementing IPv6 has consumed less than 1 percent of our IT budget, and the IT budget is only a small part of the overall corporate budget. These costs are modest compared to the expected benefits."

Bechtel is a leading engineering, construction, and project management company. Always exploring opportunities for improvement, Bechtel saw the strategic value of Internet Protocol version 6 (IPv6) to support a new generation of applications and services. The company elected to upgrade its IPv4 infrastructure to develop experience and

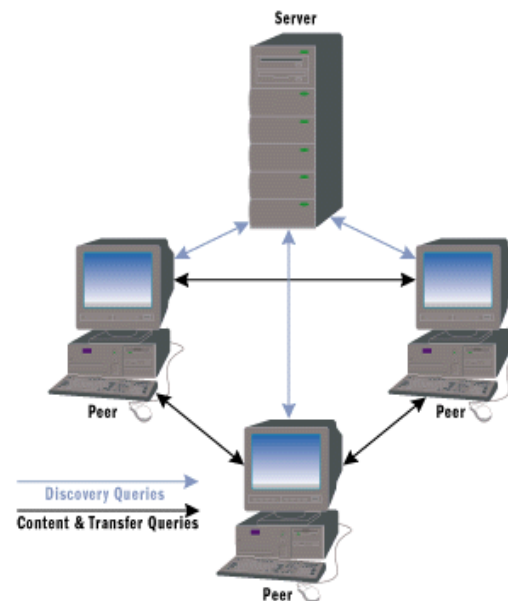
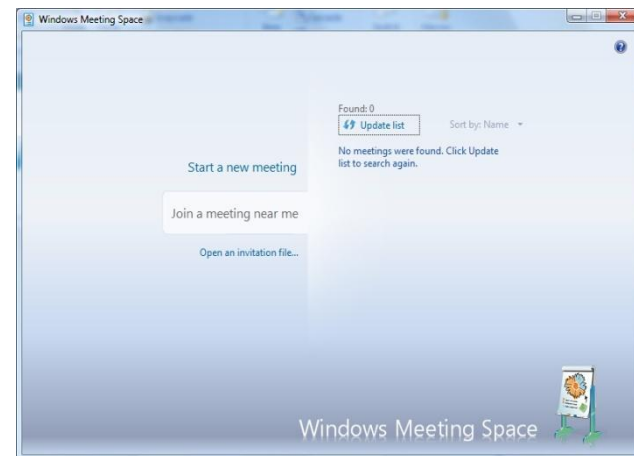
http://www.cisco.com/en/US/prod/collateral/iosswrel/ps6537/ps6553/prod_case_study0900aecd806d89d5.pdf



Microsoft P2P Framework

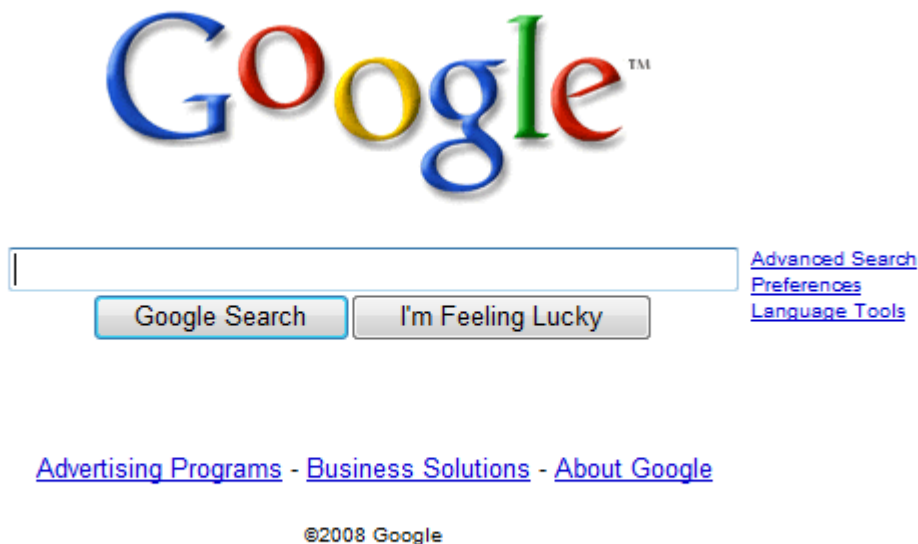
<http://blogs.msdn.com/p2p/archive/2007/03/12/writing-peer-to-peer-applications-using-net-part-1-pnrp.aspx>

- Marketed to app developers
- P2PF apps IP version agnostic
- Focus on person to person
- PNRP bypasses DNS roadblock
- Preference for IPv6 when it works
- Some new apps will be IPv6-only
- Opportunity for service providers to deploy discovery servers



Content sites are taking initial steps

ipv6.google.com - IPv6 enabled search page



Innovative Opportunity – Power consumption management

Statewide Blackouts Ordered As Heat Strains California Grid

By TODD S. PURDUM
Published: May 8, 2001

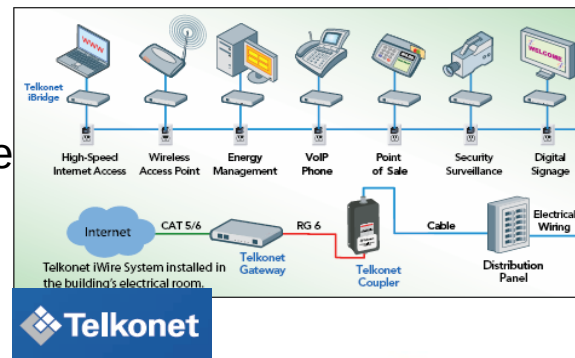
An early hot spell and a high number of power plants out of service for maintenance forced the first rolling power blackouts since March in California late today. Operators of the state's power grid suddenly ordered utilities to cut power to tens of thousands of customers at the evening rush hour, officials said.

The blackouts, imposed shortly before 5 p.m. and lasting an hour or so in most places, came just hours after power officials said they believed they had avoided blackouts by asking large commercial users to scale back their use...

Opportunity for remote management of specific high power consumption devices, rather than blacking out the entire community.

Look beyond using the power cable as a network wire replacement, to find the new applications and services that are possible for directly addressable appliances.

Power-line as local distribution



Panasonic
HD-PLC™

PLCアダプター
(高速電力線通信)



1/06 – Panasonic **HD-PLC chip** which provides 190Mbps broadband connectivity with electric outlets ... AES 128-bit encryption ...

DS2

Award winning
**200 Mbps
Powerline
Technology**



Innovative Opportunity – Agriculture

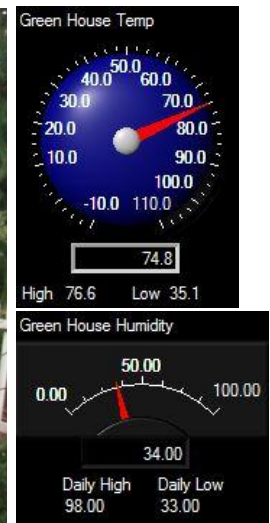
- **Wireless Sensor Network Research Group, Institute of Computing Technology, Chinese Academy of Sciences**

CNGI: IPv6 Based Sensor network Application Demonstration By cooperating with Chinese University of Sciences and Technology, we are going to develop a sensor application system by integrating wireless sensor network technology, control technology and precision agriculture technology. The applications of the integrated system are two-folded: accurate watering of farmland and water/soil pollution monitoring.

Opportunities exist beyond farming in smaller scale uses.



<http://www.sixxs.net/misc/toys/>



Innovative Opportunity – Wide access to information



- Improved crop yields through access to current farming research & weather information.
- Distribution to more markets through wide advertising at low cost.

Cisco IPv6 Solutions



- Long standing support for IPv6 by Cisco

IETF Working Group Chairs: IPv6; ngtrans; v6ops; dhcpv6; mipv6; roll; softwire

Cisco engineers originated many IETF proposals

IPv6, MP-BGP4, NAT-PT, 6PE/6VPE, DHCPv6 PD, ...

Founding member of the IPv6 Forum

Founding partner of 6Net

IPv6 Ready Logo

Mobile Networking demo – IPv6 Promotion council

“Jun Murai award”



Cisco IPv6 Solutions

High Capacity Forwarding

- **Cisco CRS-1**

OC-768, OC-48, 10GE and GE line cards



- **Cisco 12000 series**

Internet Service Engine 3 – up to 3.8Mpps per LC

Internet Service Engine 5 – Up to 16Mpps per LC



- **Cisco 10000 PRE2/PRE3/PRE4**

- **Cisco ASR 1000 series**

- **Cisco 7600 and Catalyst 6500 series**

Sup. Engine 720, 720-3BXL, 32W, 32/PISA,
RSP720 – up to 200Mpps (EANTC report)



IPv6 tunneling—Configured, Automatic, 6to4 and
ISATAP tunnels in hardware

- **Nexus 7000 series, MDS 9500 series**

- **Catalyst 4500 series**

Supervisor Engine 6E

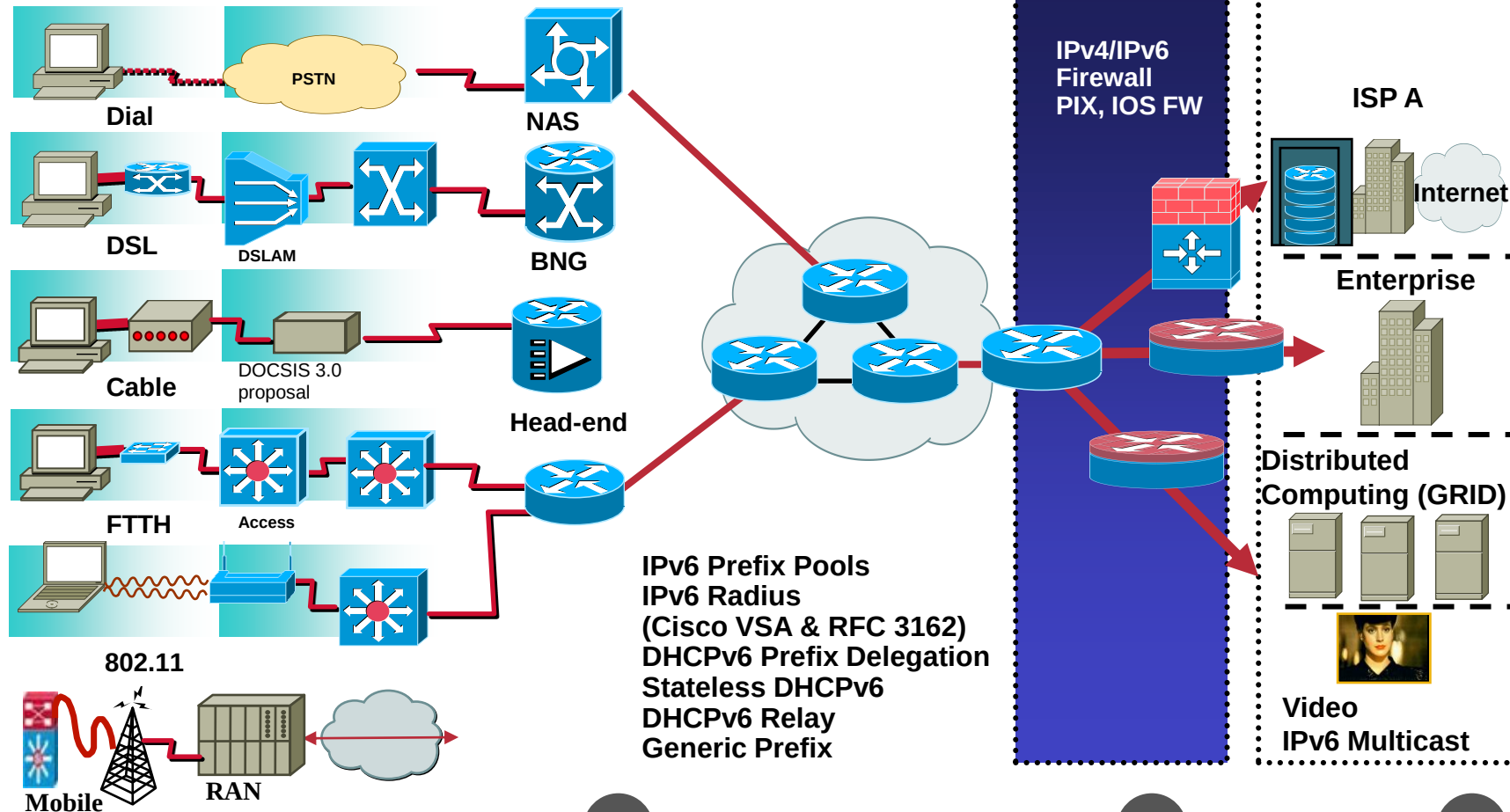
- **Catalyst 3750/3560 & 3750E/3560E series**



Cisco IPv6 Solutions

Cisco IOS IPv6 on Broadband Access

Layer 2 Encapsulation(s)



ATM RFC 1483 Routed or Bridged (RBE)
PPP, PPPoA, PPPoE, Tunnel (Cable), L2TP

Dual-Stack or
MPLS (6PE) Core

IPv4/IPv6

Cisco IPv6 Solutions

IPv6 enabled CPE routers

- The Linksys WRT600N; RVS4000; & WRVS4400 include 6to4 capability to enable IPv6 home and small business networks today, while service providers complete their deployments.
- Cisco has been instrumental in helping CableLabs define IPv6 capabilities for the next generation Docsis 3 devices.

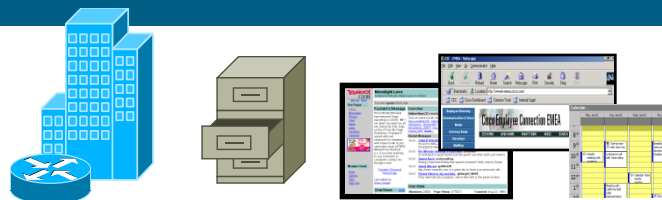


Cisco IPv6 Solutions

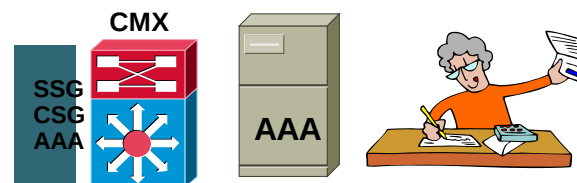
Layered Mobility Model

Content and Datacenter
Infrastructures/Services

Dual-stack services



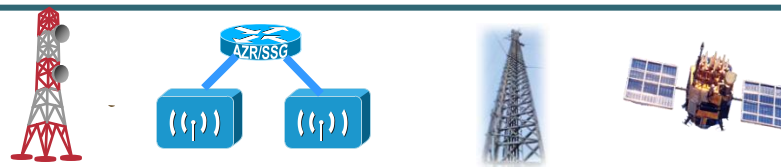
Mobile clients and Services
Service Exchange *IPv6
attributes*



Layer 3 Infrastructures + IP
Mobility Management *IPv6
+ MIPv6 Home Agent*



Layer 2 Wireless Access
Infrastructures – *must know
how to forward IPv6*



Mobile Networks

NEMO, MANEMO



Host Based Mobility devices
- *MIPv6 (IPsec or Lite
Authentication)*



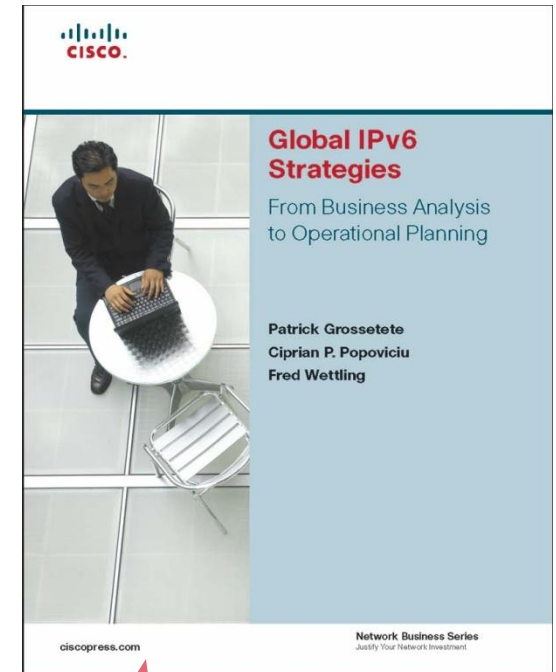
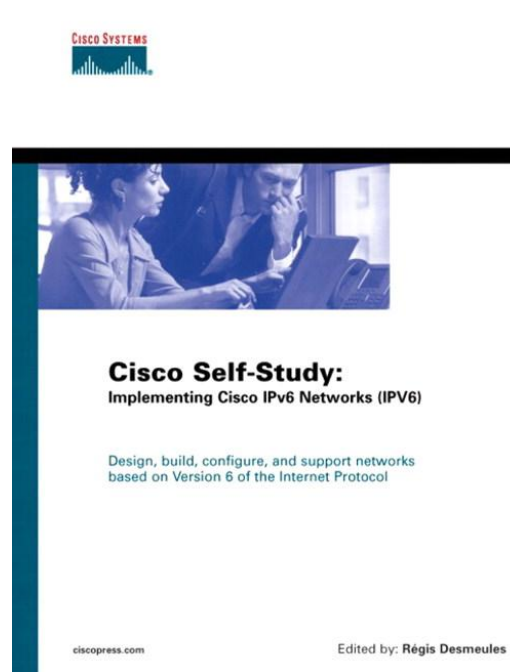
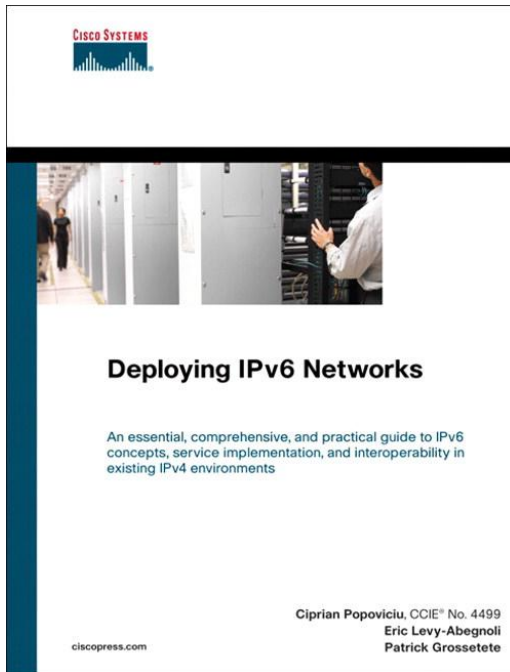
Cisco IPv6 Solutions

A Lifecycle Approach to IPv6 Services





Cisco Press Books



NEW May 2008

More Information



- CCO IPv6 - <http://www.cisco.com/ipv6>
- The ABC of IPv6
http://www.cisco.com/en/US/products/sw/iosswrel/ios_abcs_ios_the_abcs_ip_version_6_listing.html
- IPv6 Application Notes
http://www.cisco.com/warp/public/732/Tech/ipv6/ipv6_techdoc.shtml
- ICMPv6 Packet Types and Codes TechNote:
<http://www.cisco.com/warp/customer/105/icmpv6codes.html>
- Cisco IOS IPv6 Product Manager – pgrosset@cisco.com

Update to: http://www.cisco.com/web/about/ac123/ac147/archived_issues/ipj_8-3/ipj_8-3.pdf
Exhaustion of the central IANA pool - orange
Exhaustion of the collective RIR pools - magenta
Relative distribution rates between the RIRs
Time depth of collective RIR pools on pub date - white
Time depth between exhaustion events - diff between orange & magenta

Tony Hain

IPv4 Address Pool

Mar. 18, 2008

IANA Policy - RIRs Allocated Pool for 12-24 Months Distribution
Projections based on Jan 2000 to current

