

Goldfish and hamsters and white mice and even
the little seed in the plastic cup -- they all die.

- Robert Fulghum

Renumbering Considered Normal

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Match the Quotes

- Brian Carpenter
- David Conrad
- Christian Huitema
- Bill Manning
- Thomas Narten
- Mike O'Dell

"Don Quixote"

"Cute, but solving the wrong problem"

Renumbering... "It was bad the first time and it was horrible the second time"

Why rock the boat ... when addresses are not that scarce?

ISPs won't stop routing

**What raised this welt
for you at this time?**

Is this a Joke? Why again?

- /64 for every LAN
- /12 for RIR
- No apparent long term planning
- Lots of work tweaking

- Prior work: PIER, RFCs 1900, 4192
- Lots of resistance

Global Good vs Local Cost

“Finite lifetimes ... [have] the potential to minimize long term structural fragmentation, [but] it’s hard to adopt measures that enhance the greater good unless they also enhance the local good at the same time.

“Perhaps we should [blacklist] ... an address block that has been deployed for more than five years.”

- Geoff Huston

Disclaimers

- Not an SSAC position
- Not an ICANN position
- Not an IAOC position
- Not related to Shinkuro, Inc

The Message

- Renumbering is good for us
 - Reduces fragmentation
 - Recovers unused space
 - Improves recordkeeping
- It need not be expensive or disruptive if
 - it's required, normal and universal and
 - good tools come into existence
- Transition will take 10 to 20 years

Basic Scheme

- Addresses have finite lifetime
- Devices have multiple addresses
 - Overlapping lifetimes
 - Not needed for DHCP devices
- Lifetime is included in address
- Enforcement: no routing of dead addresses
- Protocols need to deal with finite lifetimes
 - E.g. http://www.cs.ucla.edu/~bzhang/etcp/etcp_draft.txt

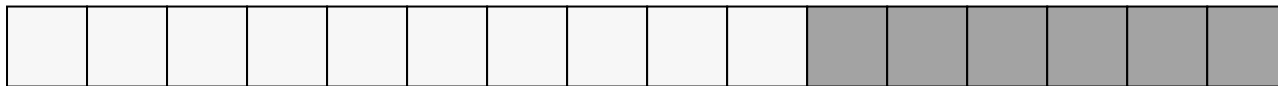
Lifetime in Addresses

(One possible scheme)



0000 Active 0...9 Dead 10...15
0001 Active 1...10 Dead 11...15, 0
0010 Active 2...11 Dead 12...15, 0...1
Etc.

Time



Asserting ownership

- Officially, addresses are not property
- User does not take ownership
- Legal disputes exist
- Limited use would clarify and emphasize their status

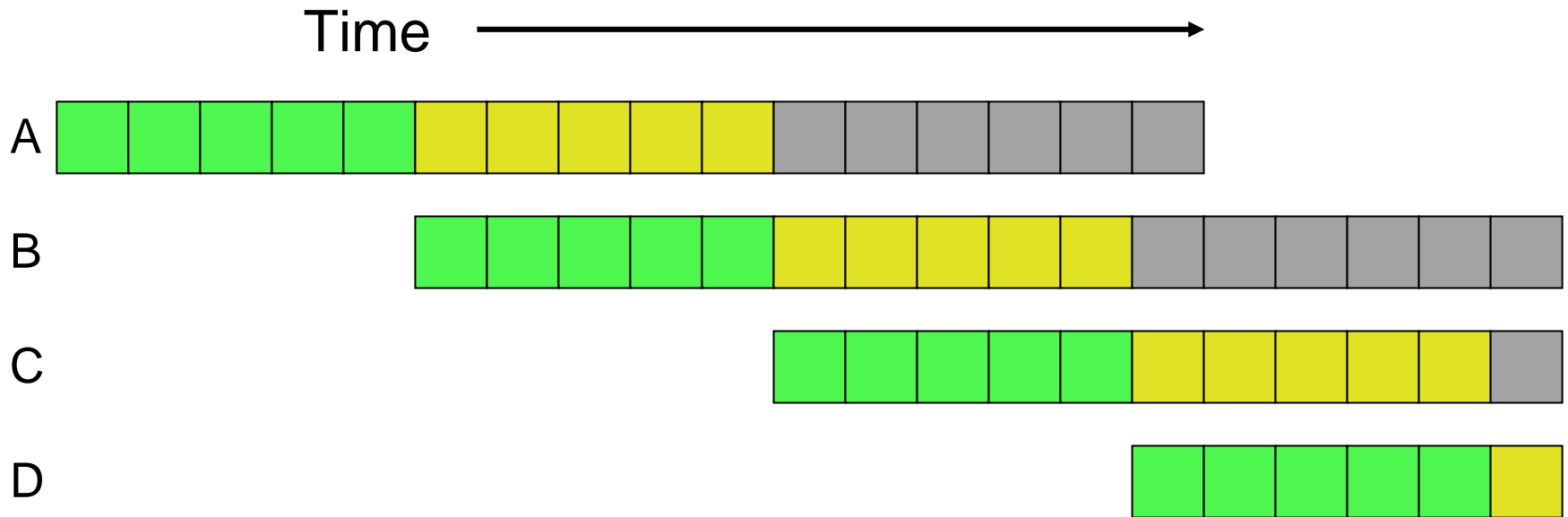
Devices

- Answer to 2 or more addresses
- Use newest address to send
- Accept assignment from Mgmt Station
 - Add Addr
 - Delete Addr

Allocation

- Allocate next block in timely fashion
IANA \Rightarrow RIR \Rightarrow ISP \Rightarrow Enterprise \Rightarrow Device
- Change AAAA records when addr is active
- Then change “send” address

Overlapping Allocation



NEW

OLD

DEAD

Merging Networks

- Mergers are common
 - Now often chaotic
 - If renumbering were normal, these would be easy
- If absorbing another entity, get a new block
- When oldest addresses expire, get new addresses for all devices

Where IP Addresses Live

- DNS A and AAAA records
- Device interfaces
- `/etc/resolv.conf`
- Other DNS root server files
- App, router access control lists
- Software licenses
- BGP peering sessions
- NTP, SNMP, etc., etc.

Division of Labor

- Research: Value vs cost; prototypes
- IETF: Protocol specs for renumbering
- RIRs, ISPs, et al: Policies

- ??? Who coordinates and drives?
- Transition plan?

What would it take?

- Where are the addresses?
- What tools are needed?

How much would it help?

- Routing fragmentation
- Address conservation
- Tighter inventory and resource control
- Address integrity (security)
- Ability to change providers, merge, etc.
- Stronger tools for managing access control
- Reduce blacklisting and growing uncertainty

Open Questions

- IPv6 only or IPv4 too?
- Cycle time
 - 16 years? 16 months? 16 days?
 - Fewer than 16 divisions?
- Testing feasibility
 - Need a design, trial software
 - Alternatives?
- Road map

Transition Ideas

- Start with a portion of the space
- Incentivize through pricing
 - Price current addresses significantly higher
 - Discount limited lifetime addresses