

An IPv4 End of Life Plan A Shared Vision for IPv6

from IETF IntArea with
Mark Townsley (tunnels) & Dan Wing (nats)

NANOG / San Diego

2012.02.06

Randy Bush <randy@psg.com>

Why Has the
Transition
to IPv6
Been Sooooo Slow?

Is it the Vendors?

Is it
Lazy Operators,
as the IPv6 Idealists
Complain?

Is it Lack of
Content?

Is it That
Applications
do not Support IPv6?

Is it
CPE?

Is it the
End User Host Stack?

Is it Because
There Are Only
430 Transition
Mechanisms?

Transition Depended on
All of Those
at the Same Time!
a Recipe for
Failure

But There is
One Much Larger
Problem



IPv6 is
On the Wire
INCOMPATIBLE
with IPv4

And it had a
New Business Model
(remember TLA/NLA)
and No Feature Parity
with IPv4

It Was Not
Transition,
It Was a
Leap!

How Did This Happen?

Arrogance &
Operational Cluelessness
in the IETF

IPv6 is Incompatible
With IPv4 and
There Was No
Realistic
Transition Plan!

But it is Too Late
We Have No Alternative

We are
Out of IPv4 Space

The IPv4 Internet
Was a Simple Place
Where Packets Flowed
Freely Between Us



But We Can Easily
Destroy the
Environment in the
Next Year or Two



32 bits

CGN

128 bits

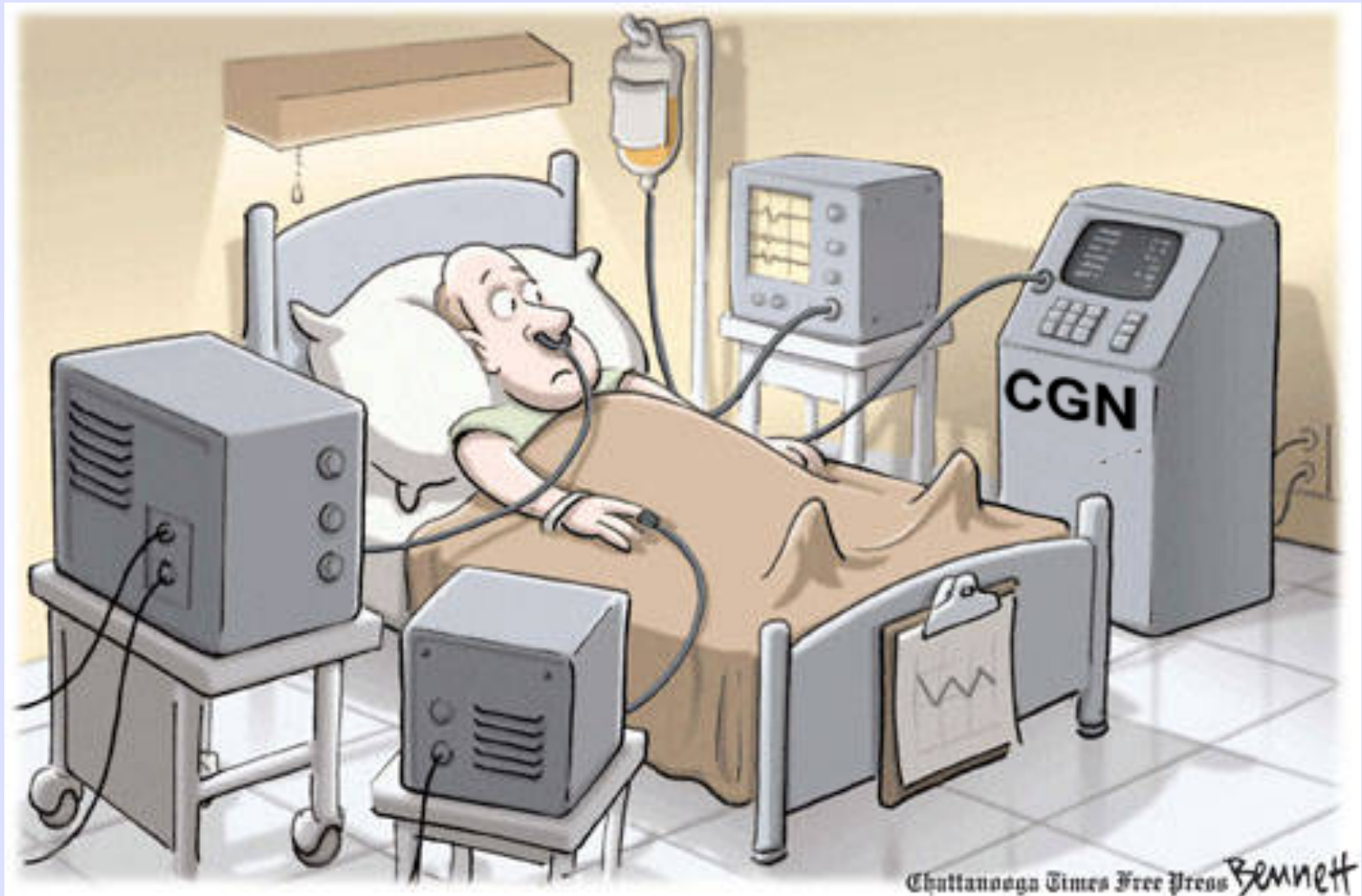
There is
One Serious
Problem
With CGNs

We are the Salmon



and When They Say
"Service Continuity"
What They Mean is
They are NOT
Transitioning to IPv6

IPv4 Life Support



And They are Not
Going to Remove the
Grand Coulee Dam

And Carriers are Not
Going to Remove the
Multi-Million Dollar NATs

End to End and the Principle of the Stupid Core and Smart Edge

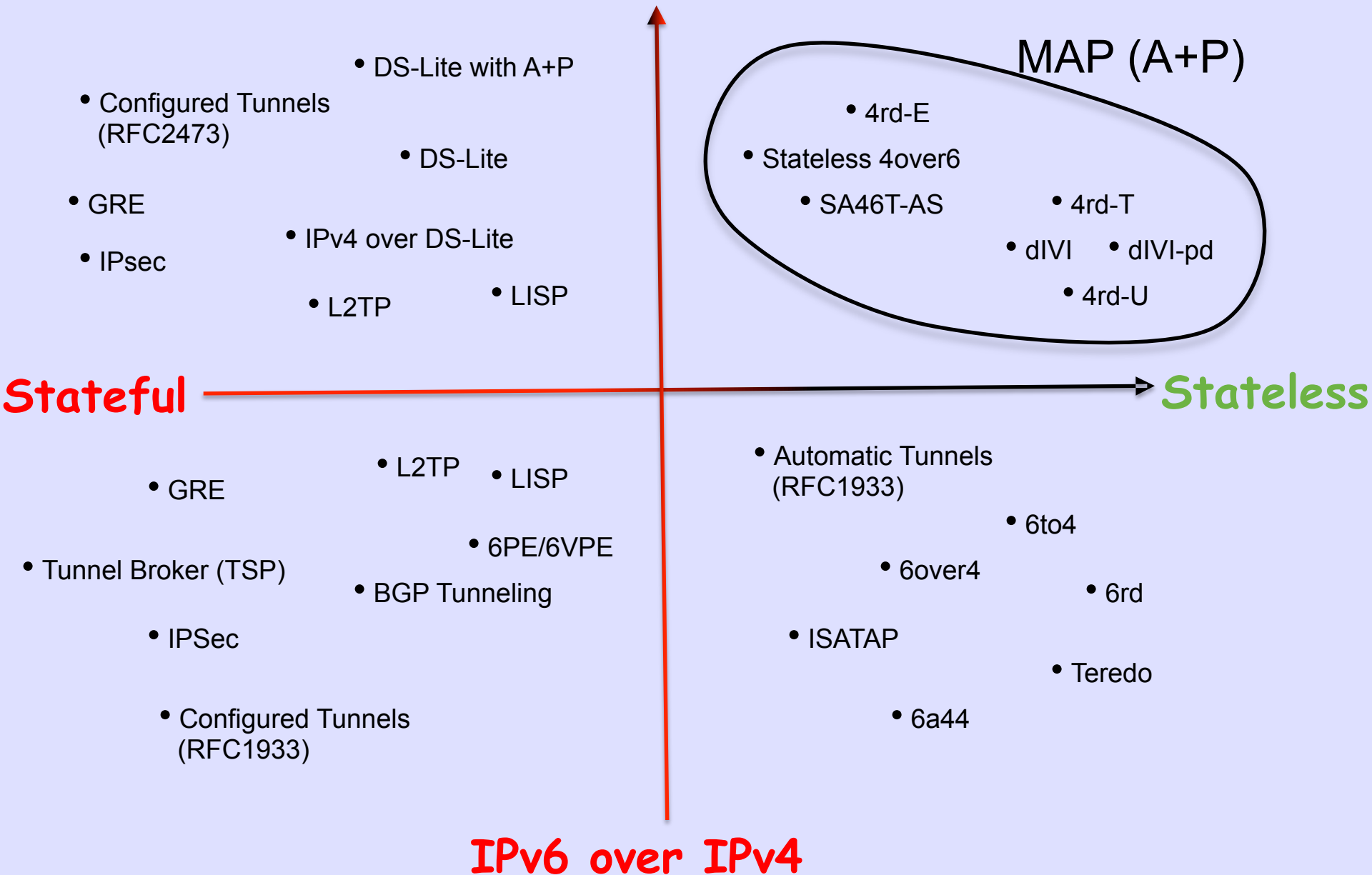
Smart Edge & Stupid Core

- Traditional Voice has stupid edge devices, phone instruments, and a very smart expensive core
- The Internet has a smart edge, computers with operating systems, applications, ..., and a simple stupid core, which just does packet forwarding
- Adding an entirely new Internet service is just a matter of distributing an application to a few consenting desktops (until NATs)
- Compare that to adding a service to Voice

Think About a World
Where You Can Not
Deploy New Protocols
(e.g. Skype)
Without AT&T's
Lawyers' Approval

But On-the-Wire
Incompatibility of IPv4
and IPv6, Transition
Leaves No Choice but
Translation and/or
Encapsulation

IPv4 over IPv6



IPv6 over IPv4

Stateful vs. Stateless Tunneling

"Stateful Tunneling" (e.g. L2TP)

Dynamic or "per-tunnel"
information must be distributed
throughout tunnel endpoints

Mapping function based on
synchronized state built and
destroyed on demand by
tunneling system

Scale is typically proportional to
the amount of traffic and
number of tunnel endpoints

Control protocol, keepalives, etc.
are needed between the
endpoints

Does more than "just tunnel"

IPv4 and IPv6 addressing remain
independent

"Stateless Tunneling" (e.g. 6rd)

A single common configuration
must be distributed to all
tunnel endpoints

Mapping function is based on an
algorithmic mapping from
existing state and common
config

Scale is proportional only to the
amount of traffic (point to
multipoint)

No control protocol needed
between endpoints (aside from
troubleshooting)

Very focused on one specific goal
IPv4 and IPv6 addressing are
coupled via algorithmic mapping

Work on Mechanisms
Which are
Actual Progress
Toward IPv6

Prefer Mechanisms
Which are
Simple, Stateless,
Use IPv6 not IPv4, ...

Keep State
at the
Edge Not the Core

Use Mechanisms Which
Preserve e2e and the
Other Basic Principles
as Much as Possible

Tunnel if you Have to NAT only if you're Desperate



WATER TUNNEL 7 - JUNE 2001 CHRISTOPH HORMANN

The Salmon are Swimming Happily Under the Water