The migration from IPv4 to IPv6

The Armstrong IPv6 Project

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The project title?

- **We thought we get rid of the usual three-letter project acronym ...**
- **„One small step for IP, but a giant leap for mankind“**

Agenda

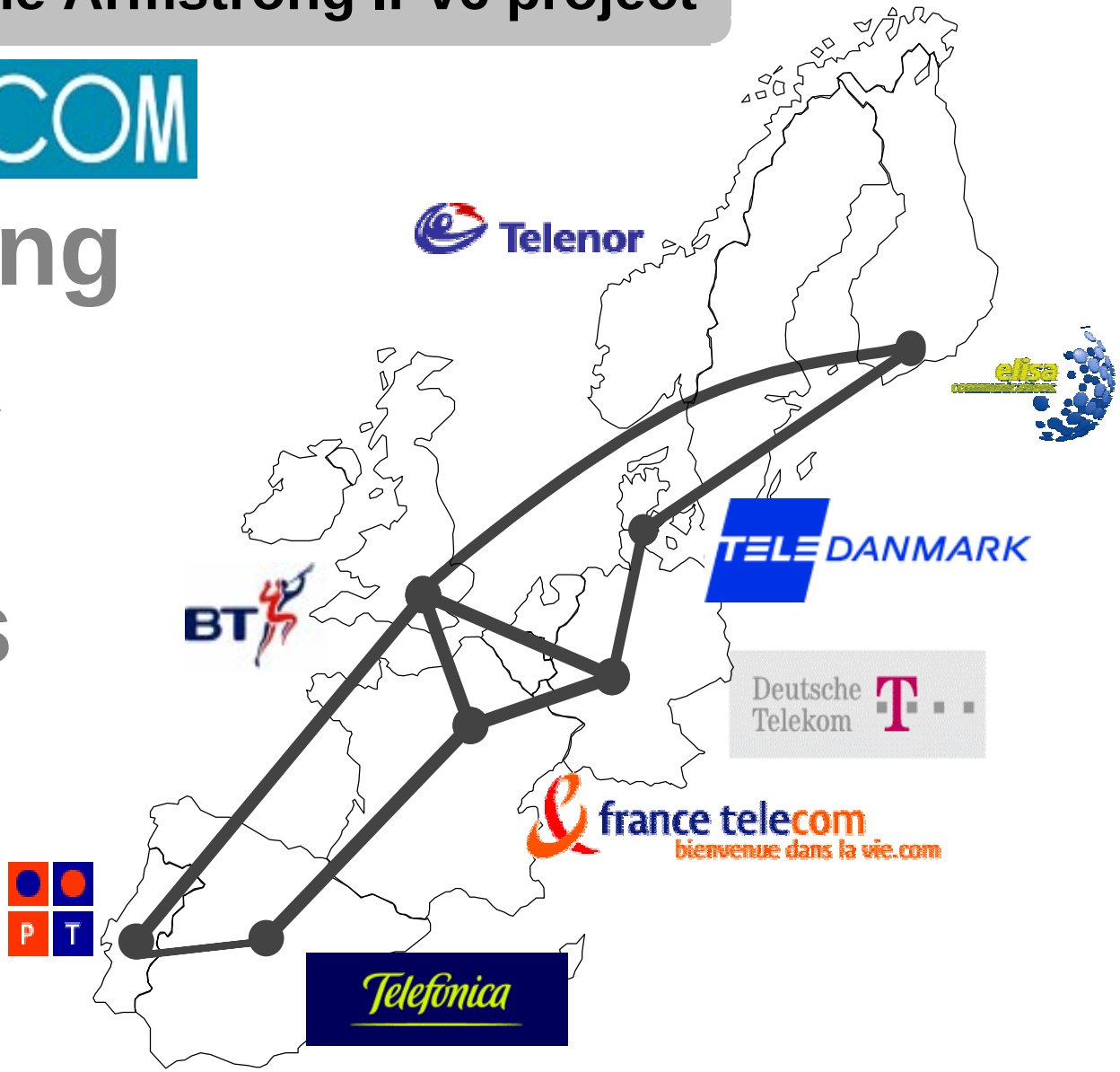
- Quick overview: The Armstrong project
- The migration tools: transition mechanisms
- Things to do as an IPv6 ISP
- Which transition mechanism to use?
- Conclusion from this presentation

The Armstrong project

What is EURESCOM?

- Performs collaborative R&D projects for new telecommunications and Internet scenarios, network solutions and advanced services.
- European Institute for Research and Strategic Studies in Telecommunications
- Founded in 1991 and located in Heidelberg, Germany.
- 20 Shareholders from 19 European countries

The EURESCOM Armstrong Network PoPs & Partners



Rationale for the Armstrong project

- Operational experience needs to be gained by the Internet community with the deployment of the IPv6 protocol suite
- Appropriate transition mechanisms and strategies for various scenarios are needed
- This project can be seen as an IPv6 deployment trial with a European provider testbed.

Main Project Results

- **“Transition strategies IPv4 to IPv6”**
  - **January 2001**
- “Inter-provider Routing and Peering in IPv6“
  - March 2001
- “IPv6 in Always On and Mobile Scenarios (e.g. UMTS)”
  - April 2001

Transition strategies IPv4 to IPv6

- Which are the possible transition strategies for an incremental transition from IPv4 to IPv6?
- Which advantages and disadvantages do these transition mechanisms offer for ISPs
- What should “legacy” (IPv4) ISPs do (what could “greenfield” ISPs do)?

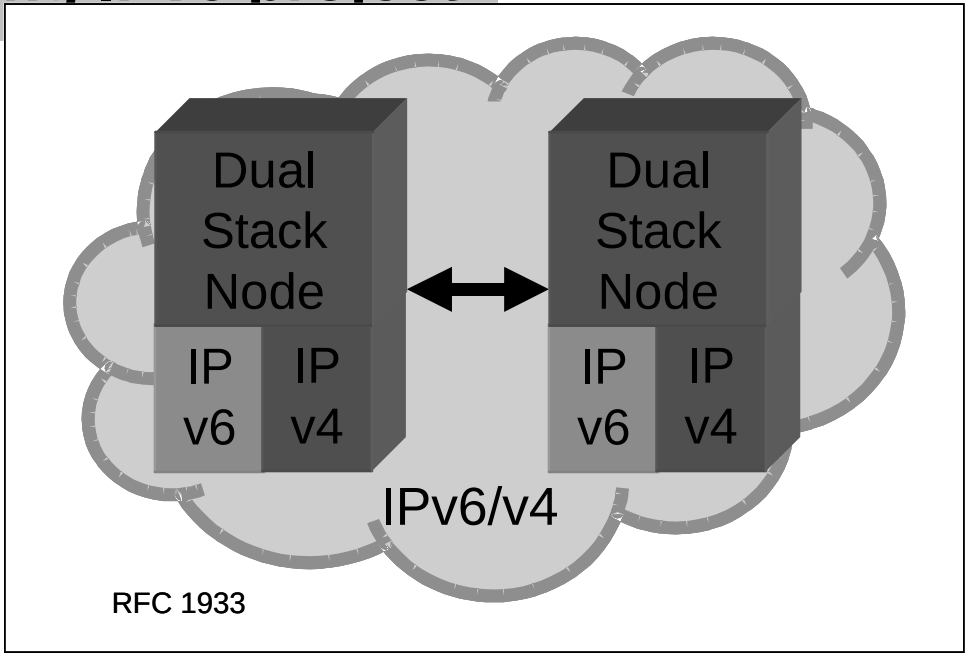
The migration from IPv4 to IPv6

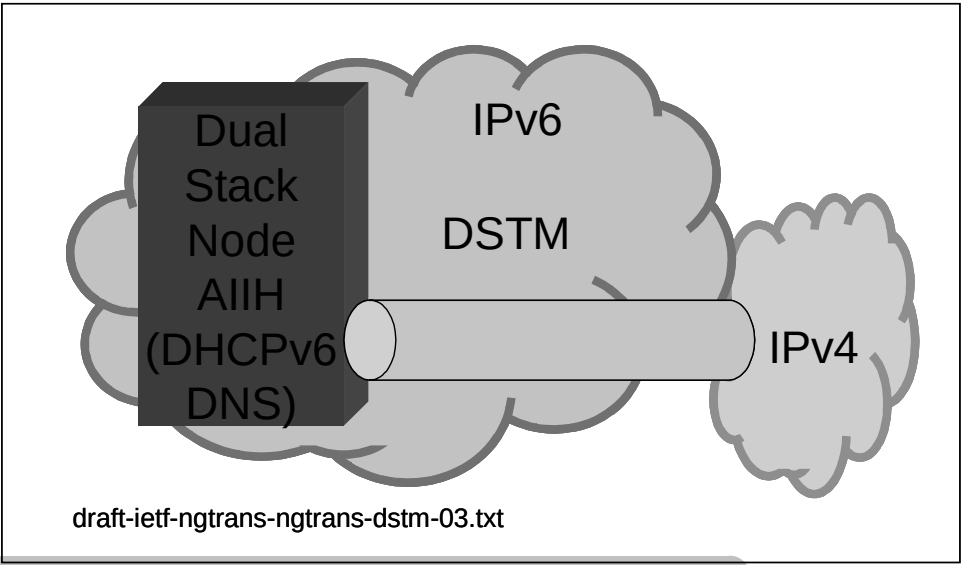
- Migration is a complex problem
- Transition will take a long time
- Transition requires an analysis of the network environment
- A „flag day“ is not acceptable
- The good news: the IETF had all this in mind, when designing IPv6

The migration tools: transition mechanisms

3 types of mechanisms

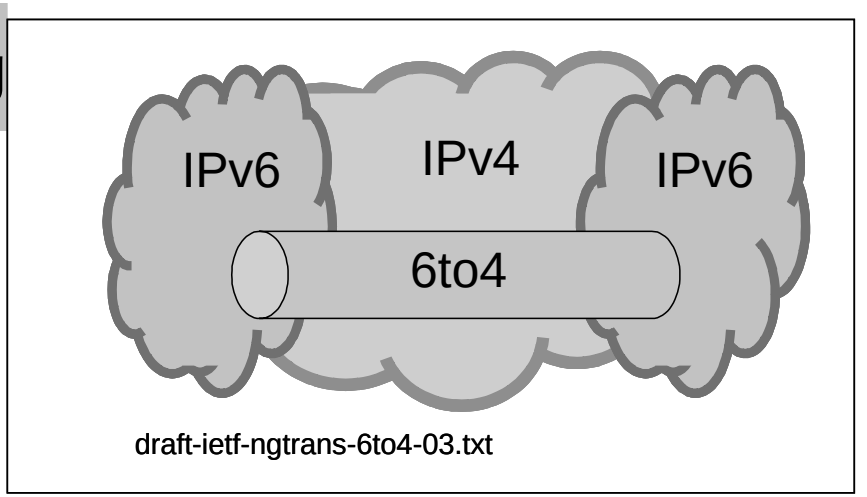
- **Dual Stack** mechanisms allow for the parallel usage of IPv4 and IPv6 in one machine or network

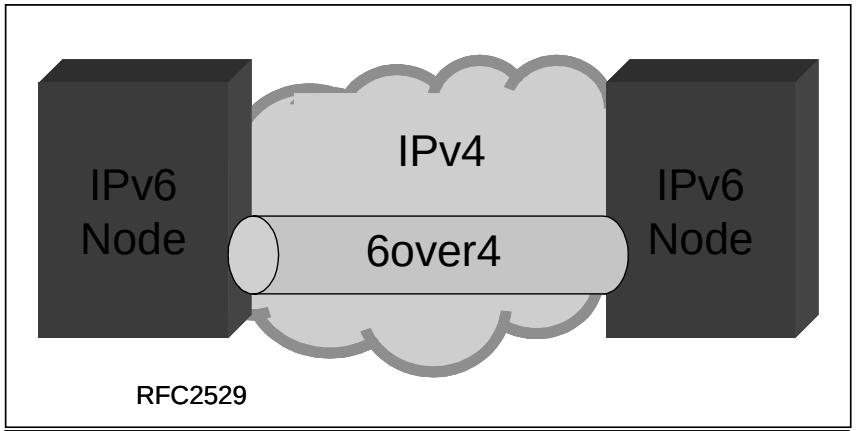


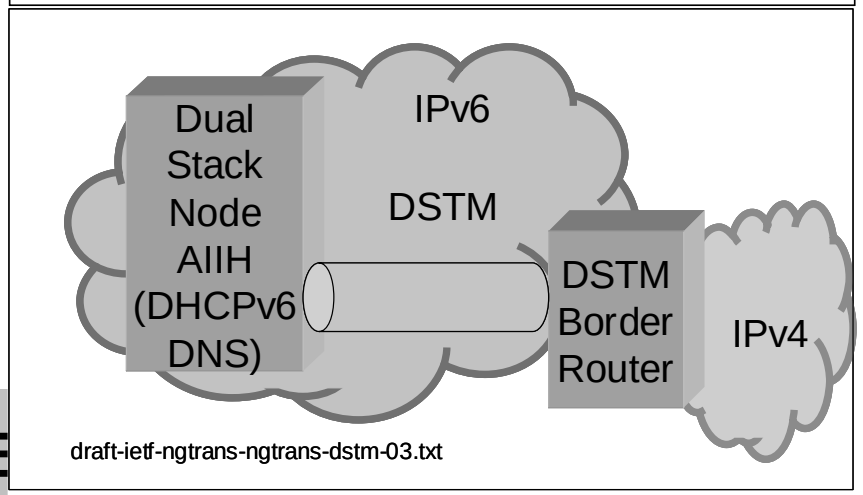


3 types of mechanisms

- **Tunneling** mechanisms allow for the usage of IPv6 services over IPv4

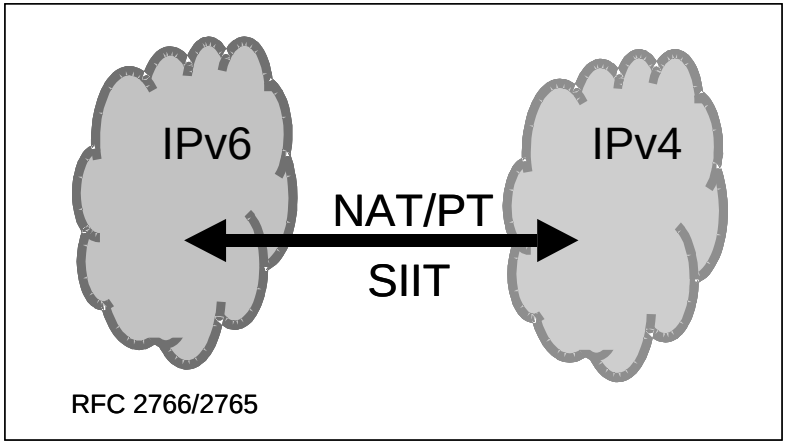


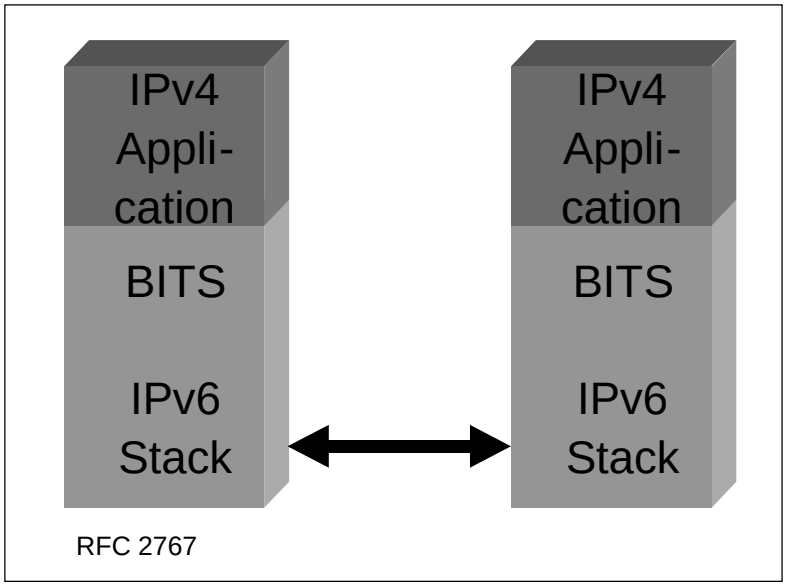


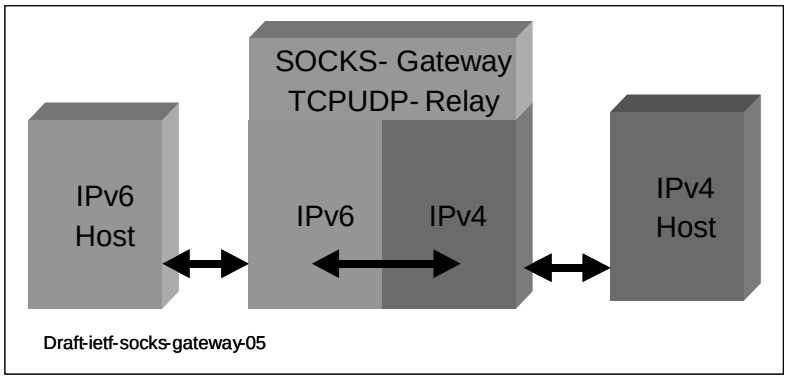


3 types of mechanisms

- **Translator** mechanisms allow for a smooth transition from IPv4 to IPv6

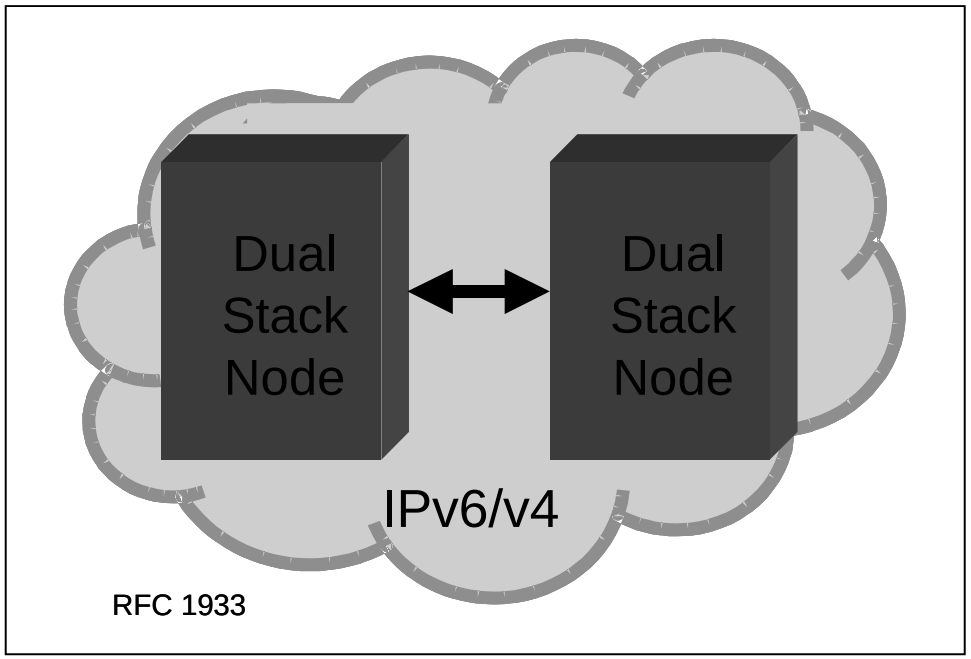




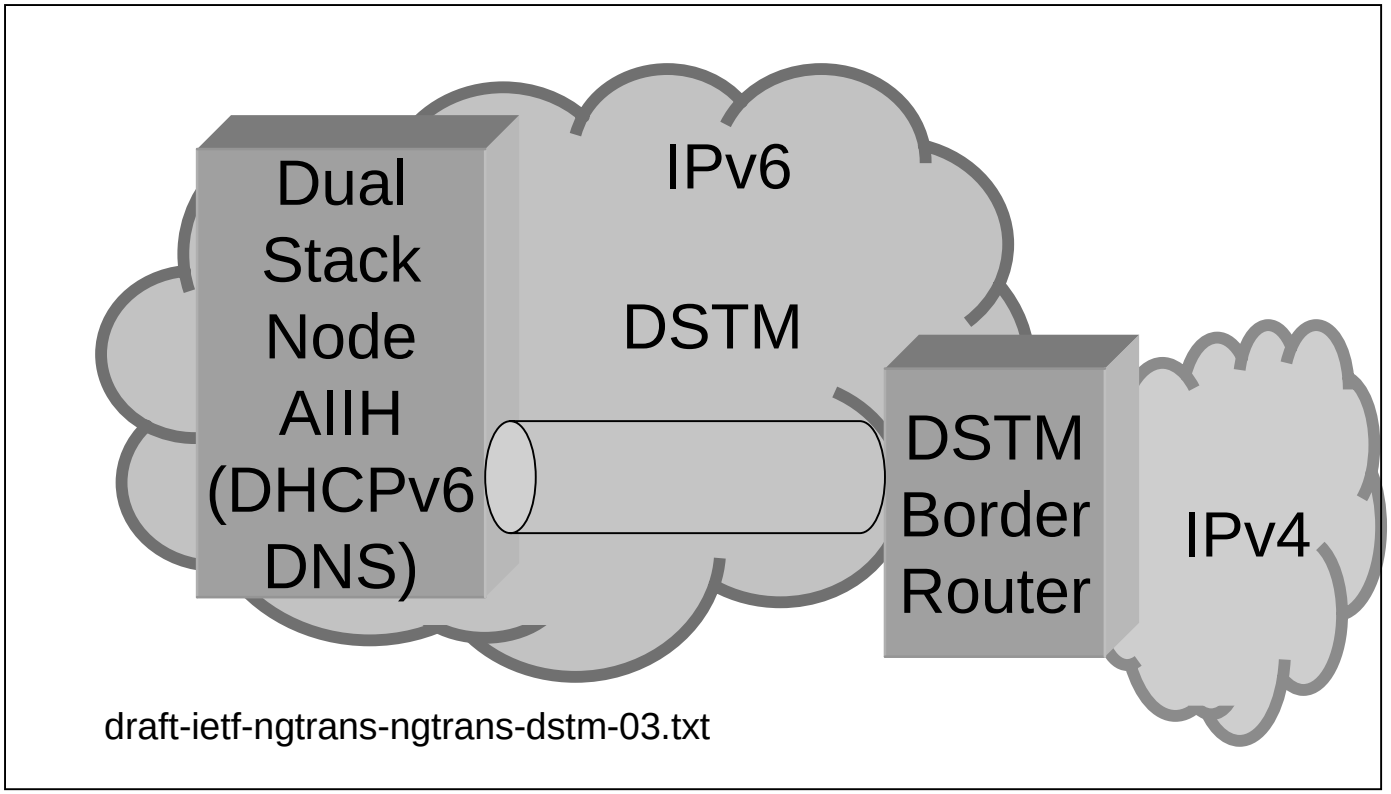


Realistic Scenario: Dual Stack systems

- Routers and hosts support IPv4 and IPv6
- E.g. if the Domain Name System (DNS) returns an IPv6 address, IPv6 will be used.
- Problem: 1 IPv4 address / host

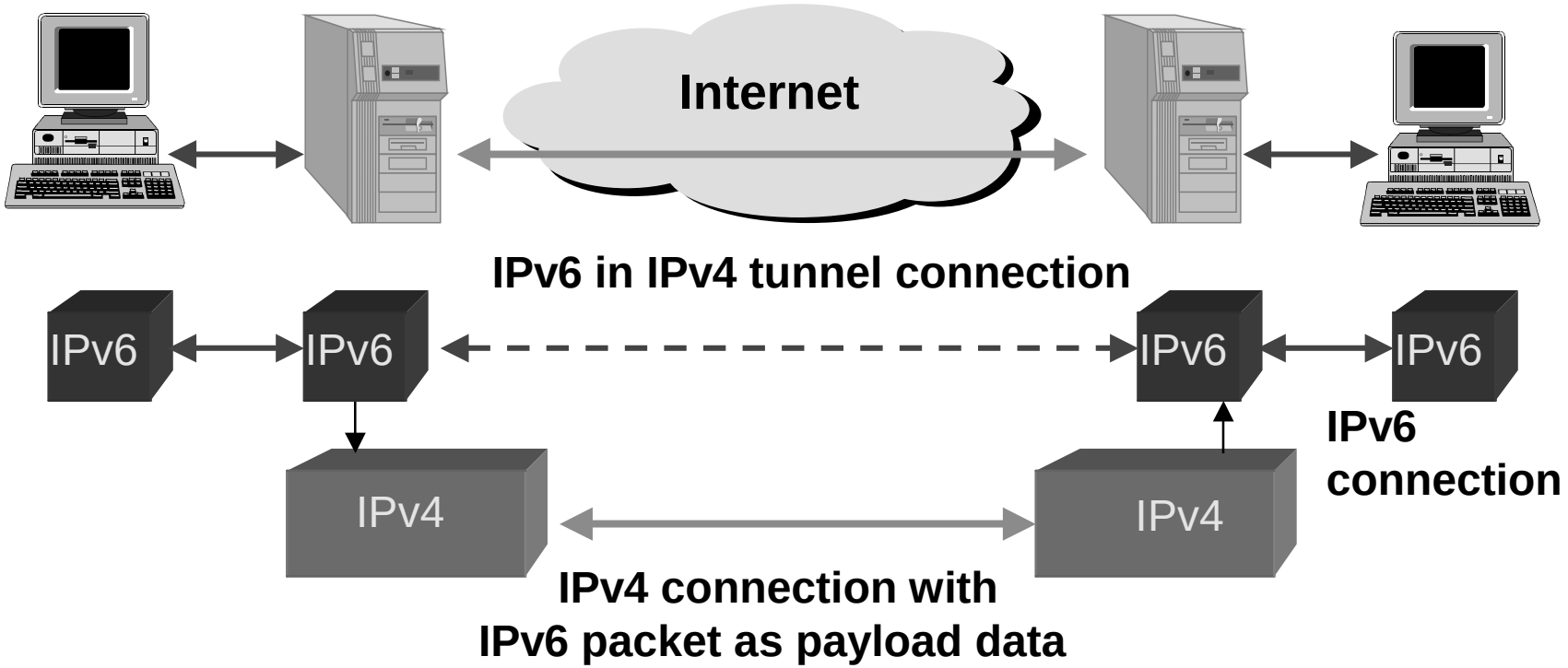


Dual-stack: Dual Stack Transition Mechanism (DSTM)

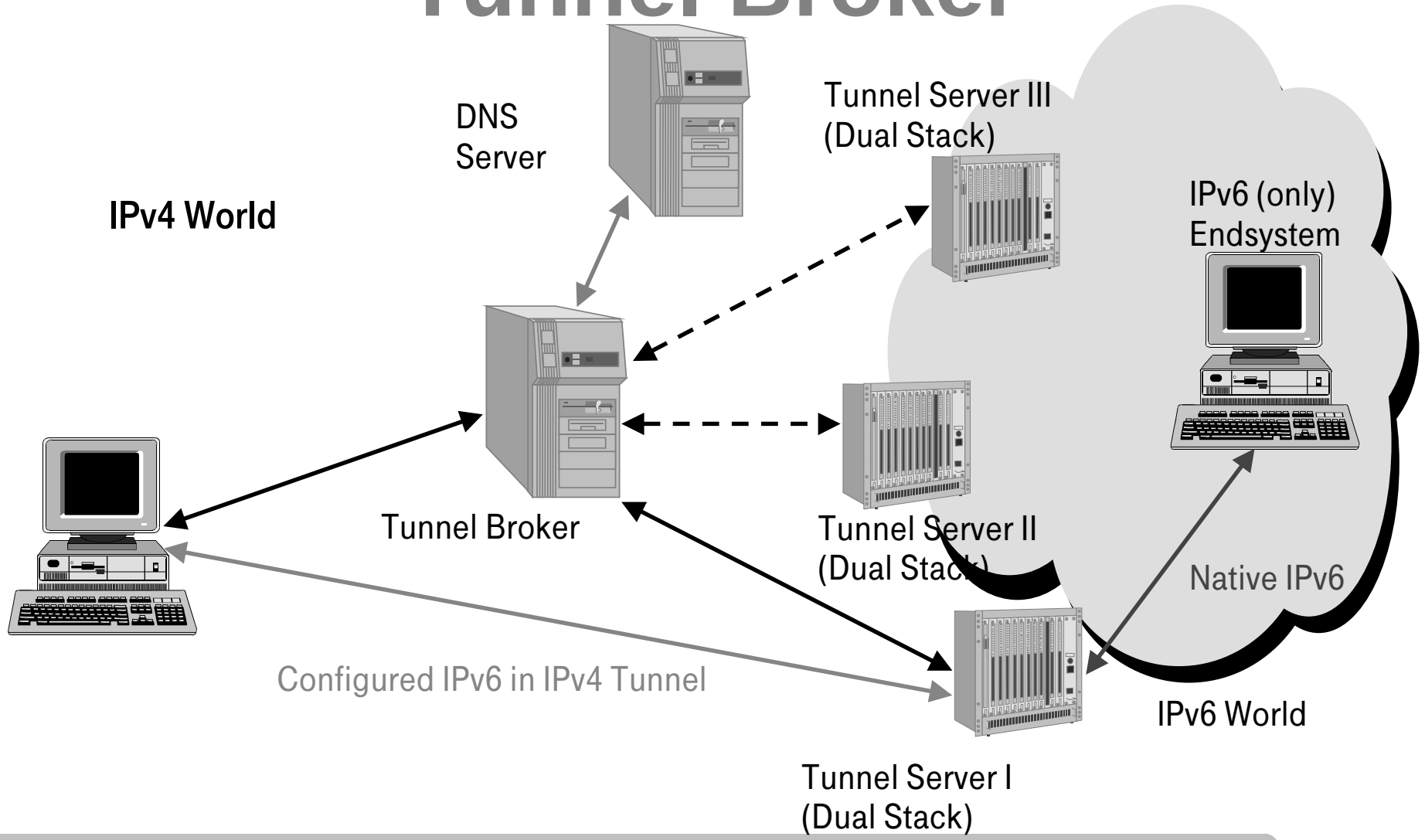


Realistic Scenario: IPv6 in IPv4 Tunneling

- static or automatic tunneling (e.g.6to4)

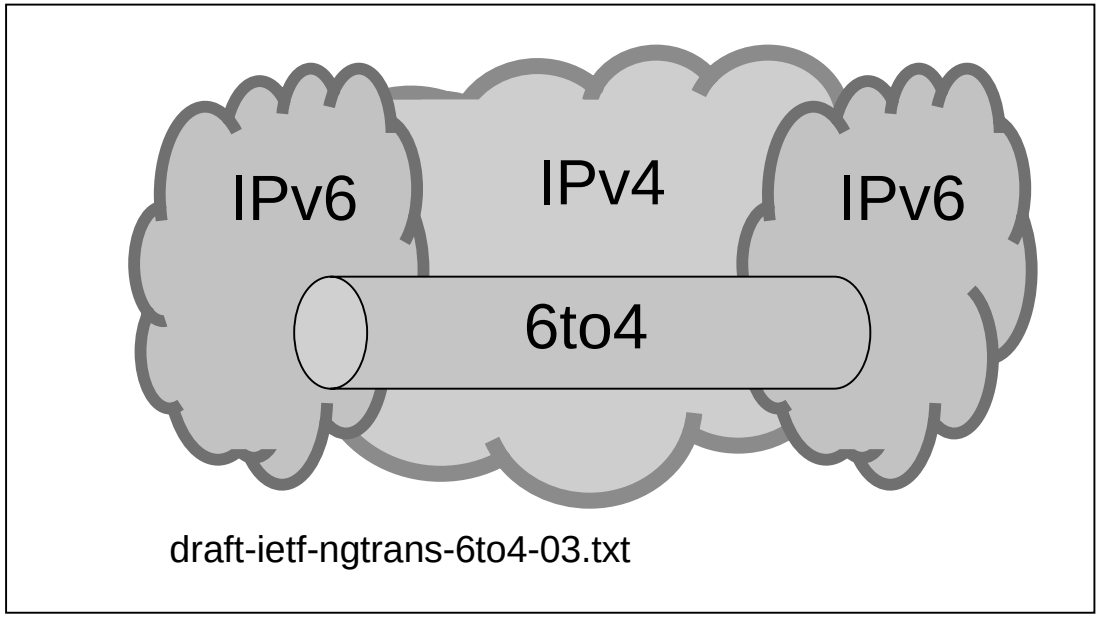


Tunnel Broker



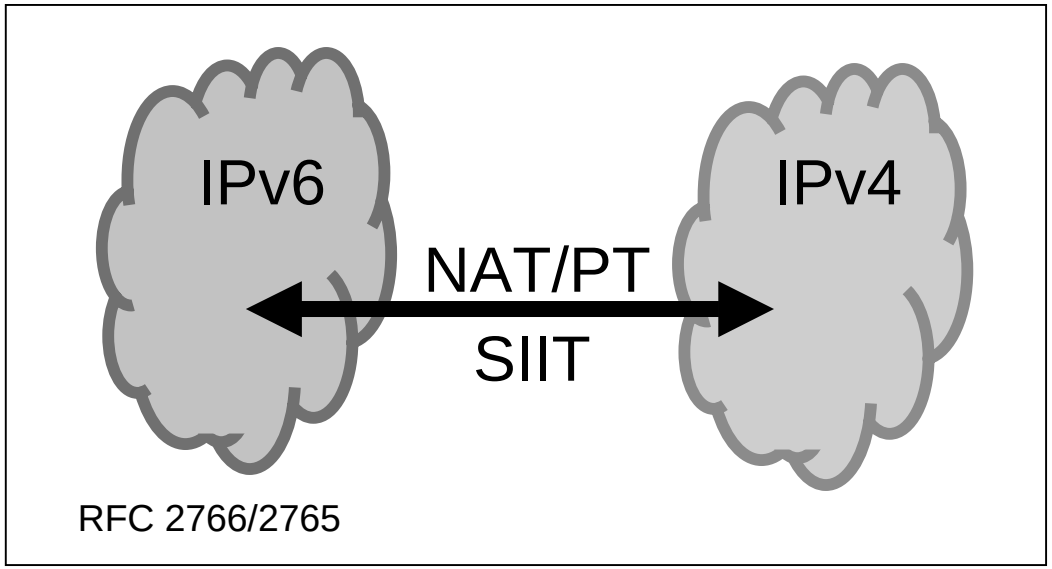
Realistic Scenario: 6to4

- To interconnect IPv6 islands in IPv4 sea
- Egress router creates tunnel to other domain
- Prefix formed from special TLA (2002::/16) and IPv4 address of egress router



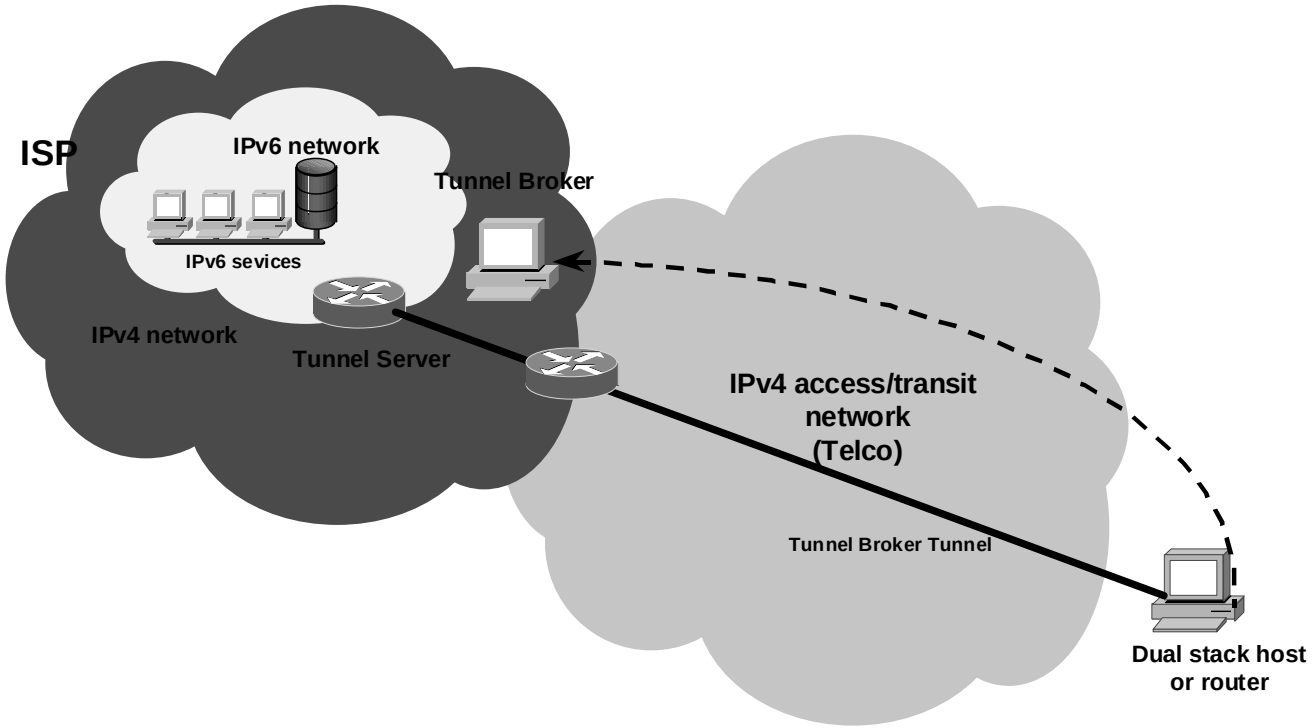
Protocol Translation

- Sort of cross between proxy server and NAT

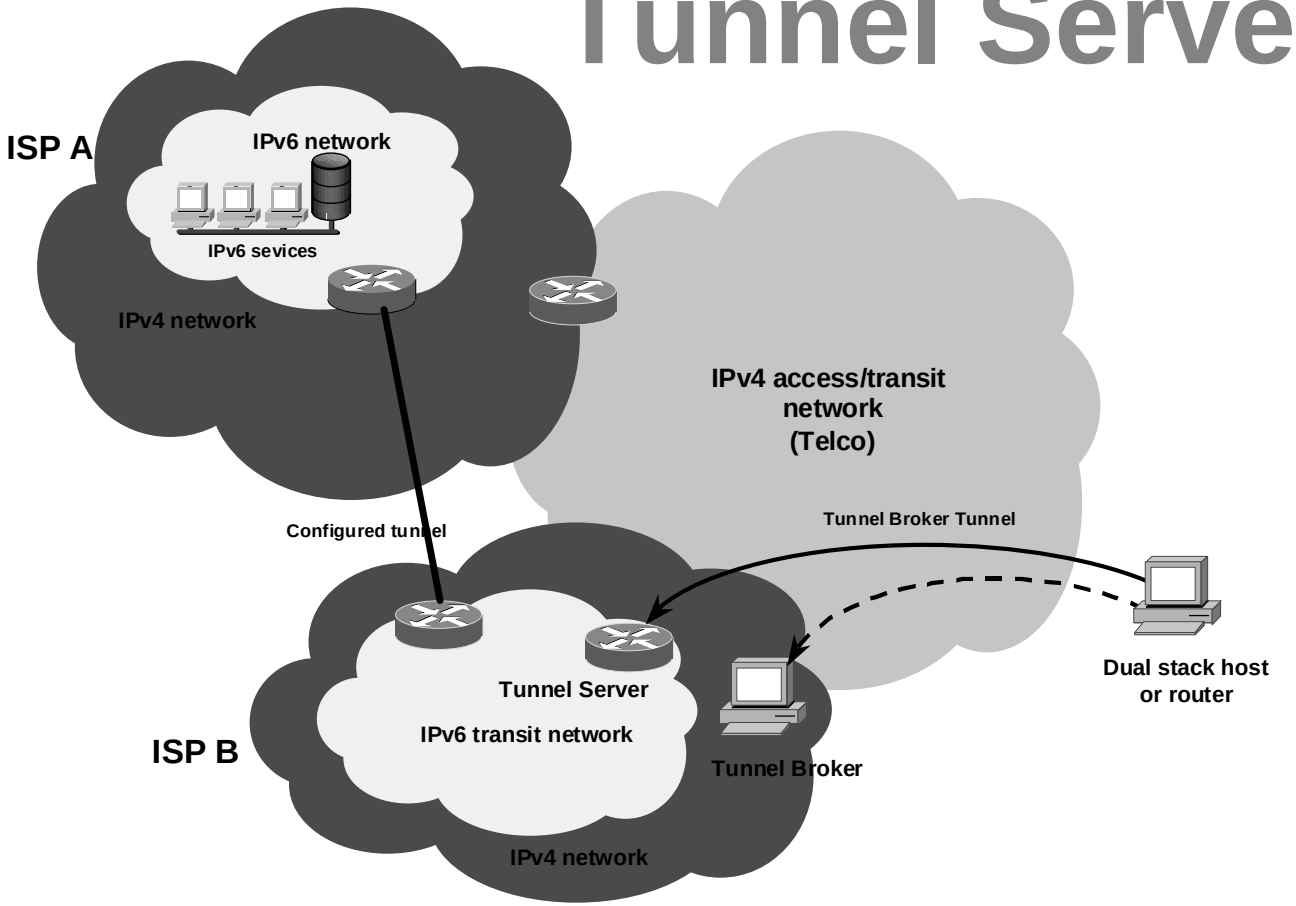


Things to do as an IPv6 ISP

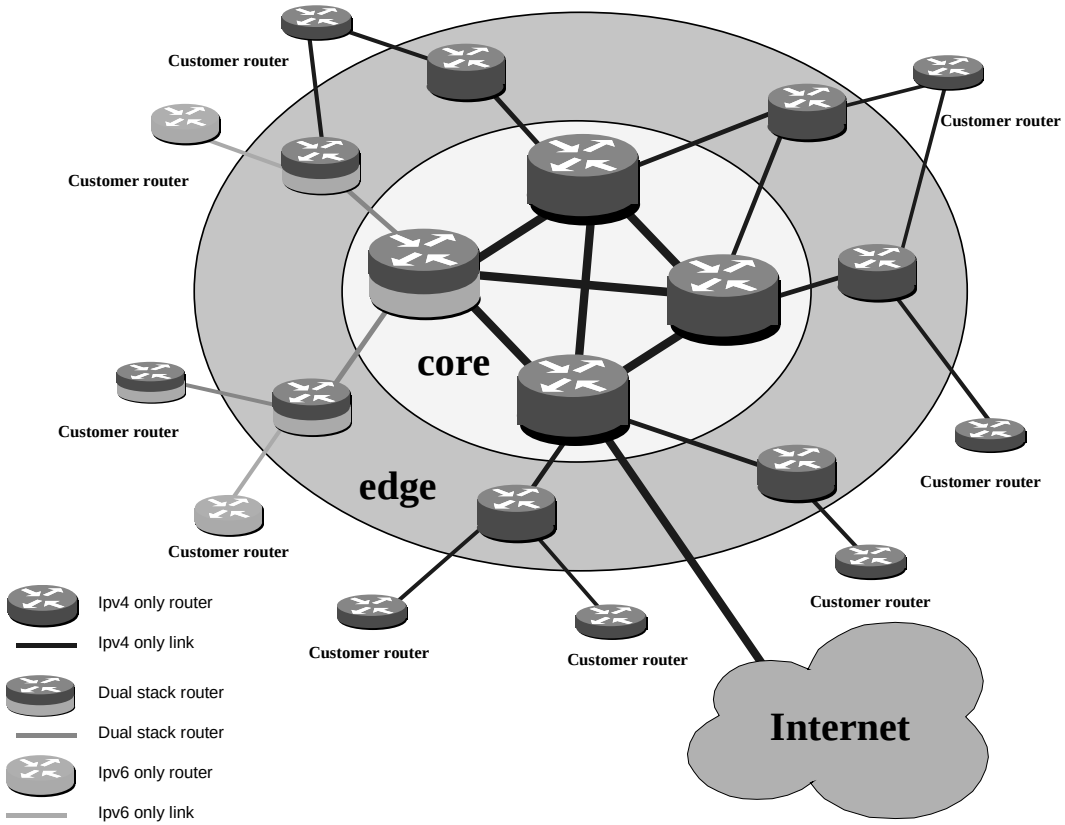
Do nothing / Let users use external Tunnel Broker



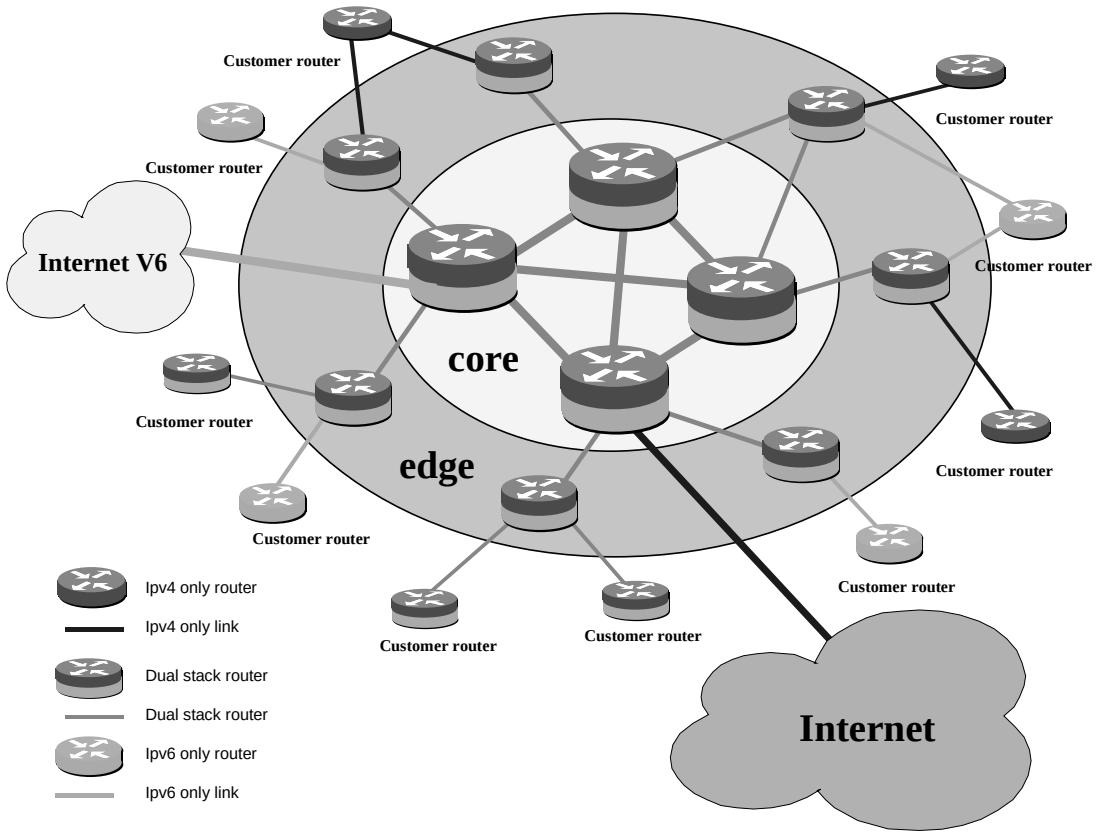
Offer Tunnel Broker and Tunnel Server



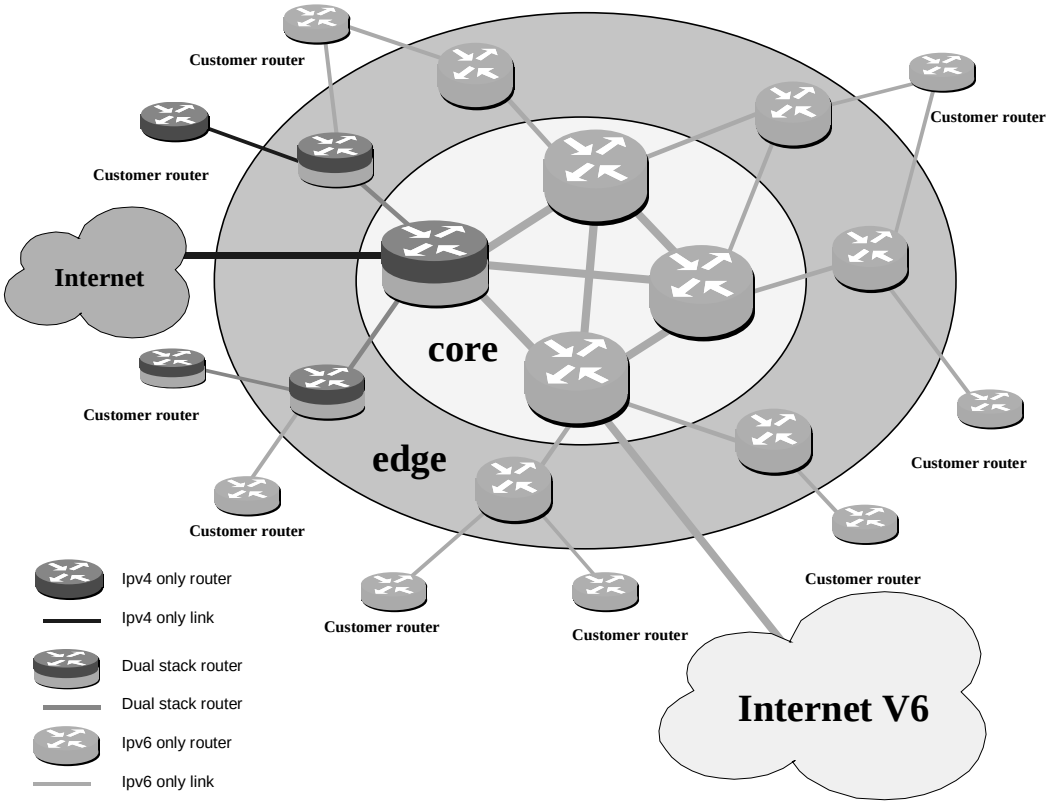
Offer Dual Stack Network (early stage)



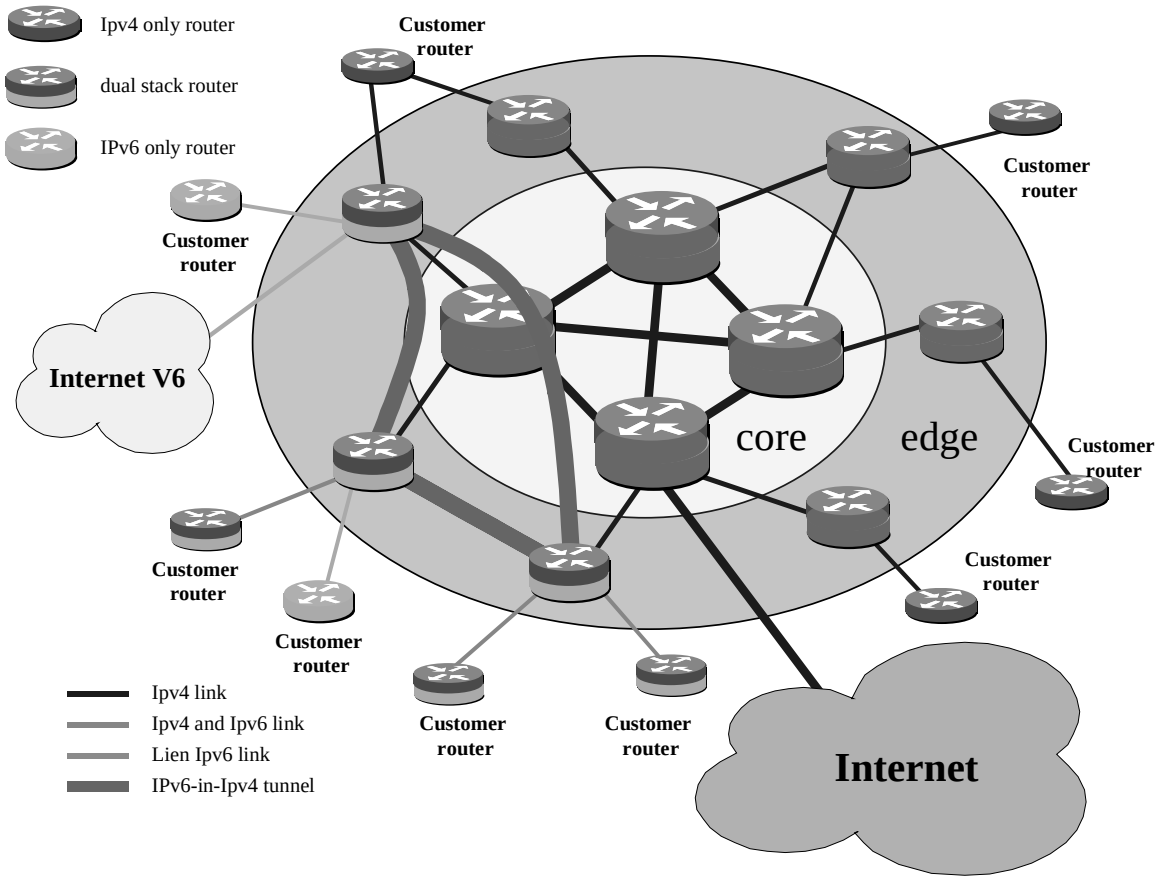
Offer Dual Stack network (intermediate stage)



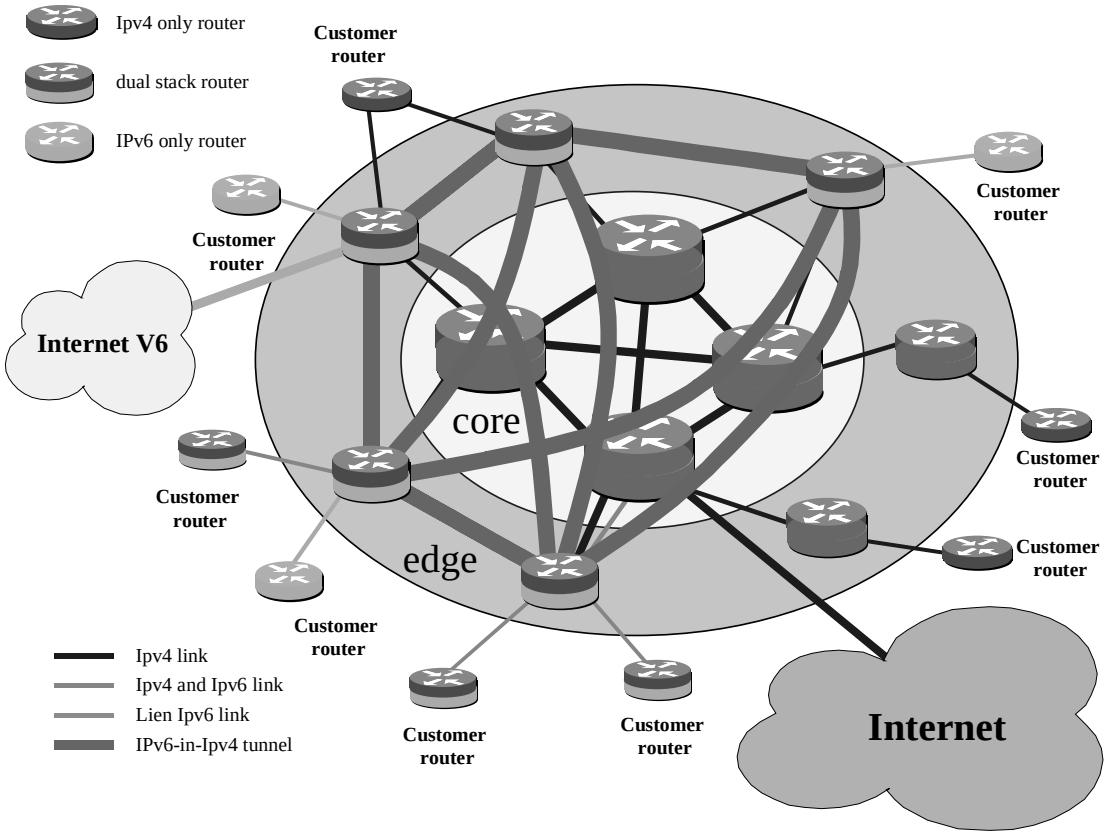
Offer Dual Stack Network (late/final stage)



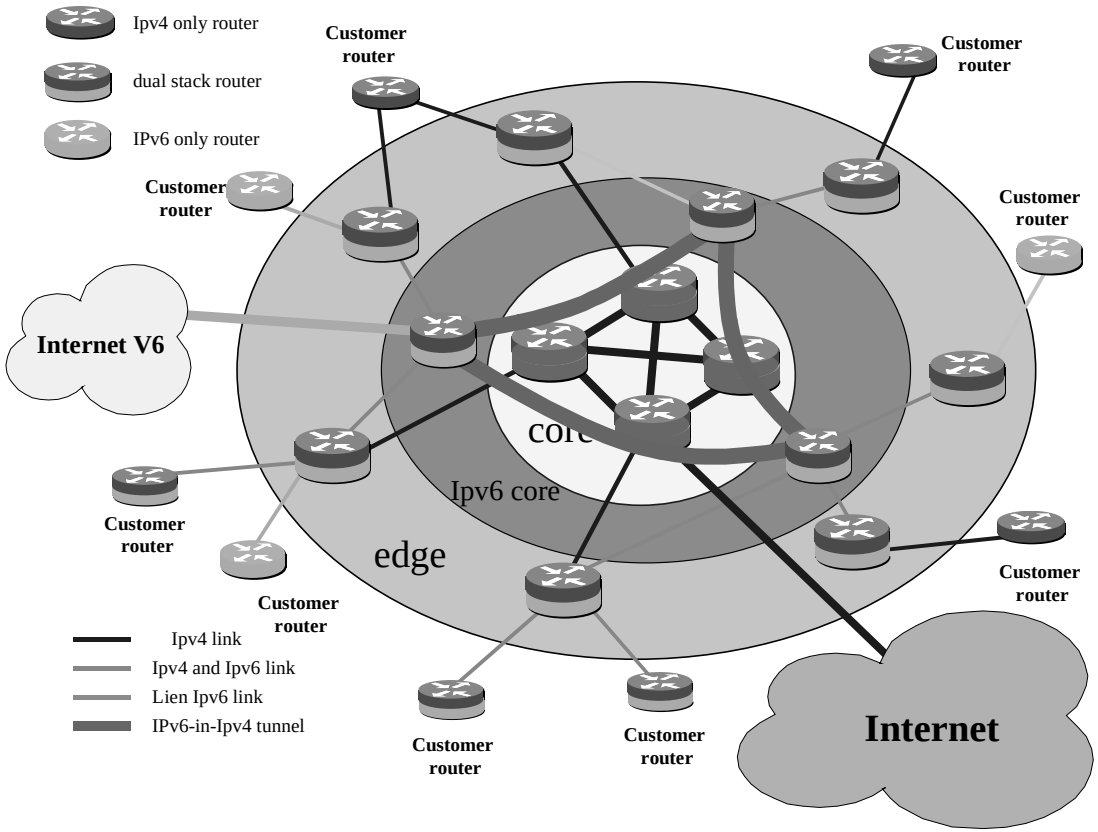
Alternative path: Offer edge only IPv6 networks (first)



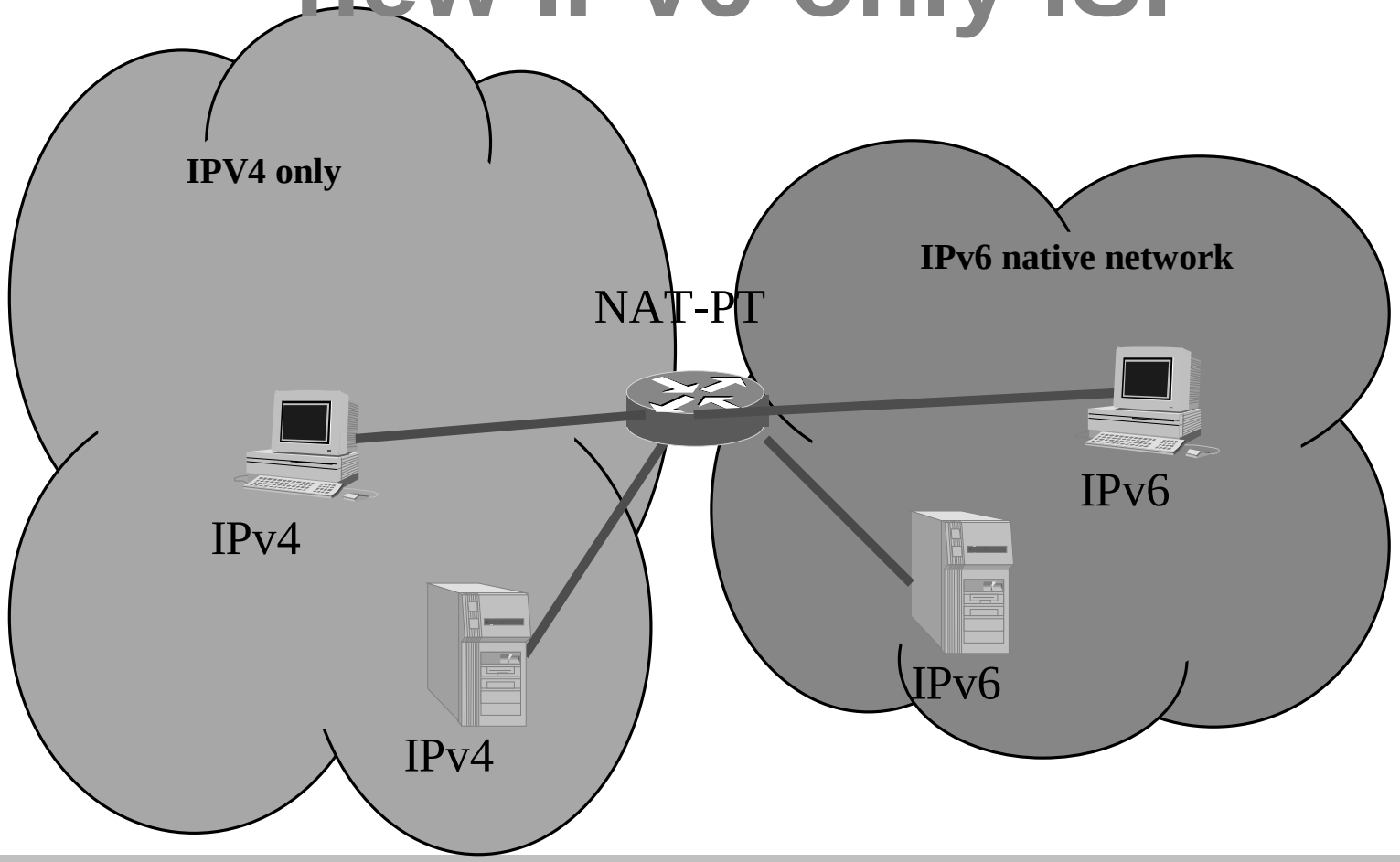
Alternative path: Offer edge only IPv6 network (intermed.)



Alternative path: Offer edge only IPv6 network (late/fin.)

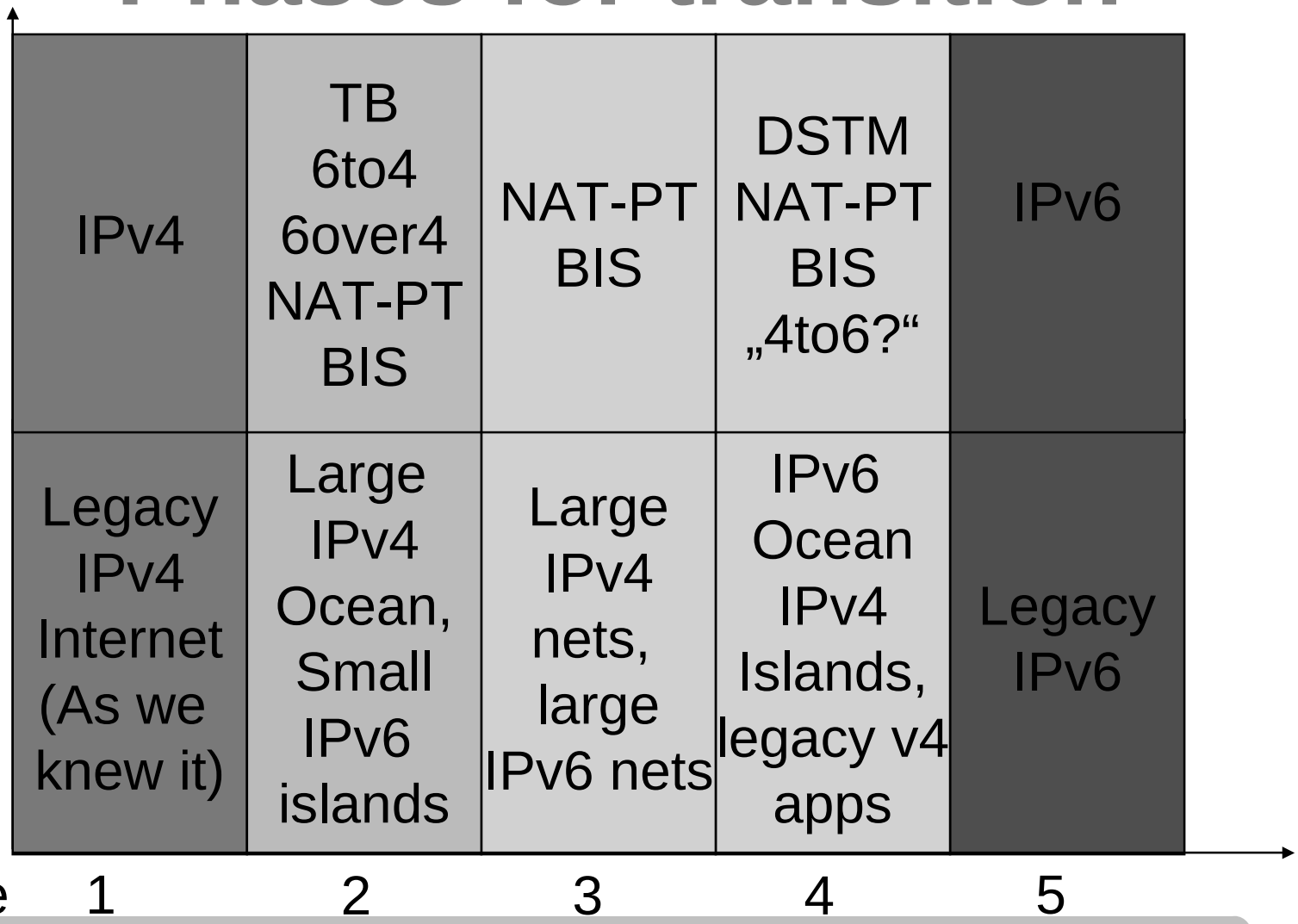


Things one could do as a new IPv6-only ISP



Which transition mechanism to use?

Phases for transition



Prelim. Interoperability table

<draft-krampell-v6transition-interaction-00.txt>

Src \ Dest	6to4	Tunnel Br	DSTM	SOCKS	NAT-PT	BIS	6over4
6to4	x	A(1)	N/A	N/A	A(2)	A(1)	A(1)
Tunnel Br	A(1)	x	N/A	N/A	N/A	A(2)	A(1)
DSTM	N/A	N/A	x	A(3)	A(1)	N/A	N/A
SOCKS	A(2)	N/A	A(1)	x	A(1)	N/A	N/A
NAT-PT	A(2)	N/A	A(2)	N/A	x	A(1)	N/A
BIS	A(1)	A(1)	N/A	N/A	A(1)	x	A(1)
6over4	A(1)	A(1)	N/A	N/A	N/A	A(1)	x

A(1) = applicable, will work
A(2) = applicable, with special limitation, see comment
A(3) = Applicable, one mechanism has a limitation
N/A = Not applicable, because mechanisms have a different goal
x = no interaction of transition mechanisms

Conclusion from this presentation

- The IETF has developped a plethora of transition mechanisms
- This is good, since no single mechanism applies to all situations
- The philosophy is to offer a toolbox with special tools for special cases
- Some guidelines must be applied, to easily choose the right tool for a specific case

Outlook


津波
The Tsunami IPv6 Project
The Tidal Wave of IPv6 is going to hit the coast soon

For more information ...

- http://www.eurescom.de/public/projects/P1000-series/p1009/P1009.htm
- Email andre.zehl@telekom.de

Thank you for your attention!