

Softbank group's IPv6 deployment experiences

@APRICOT 2011
IPv6 Transition Conference

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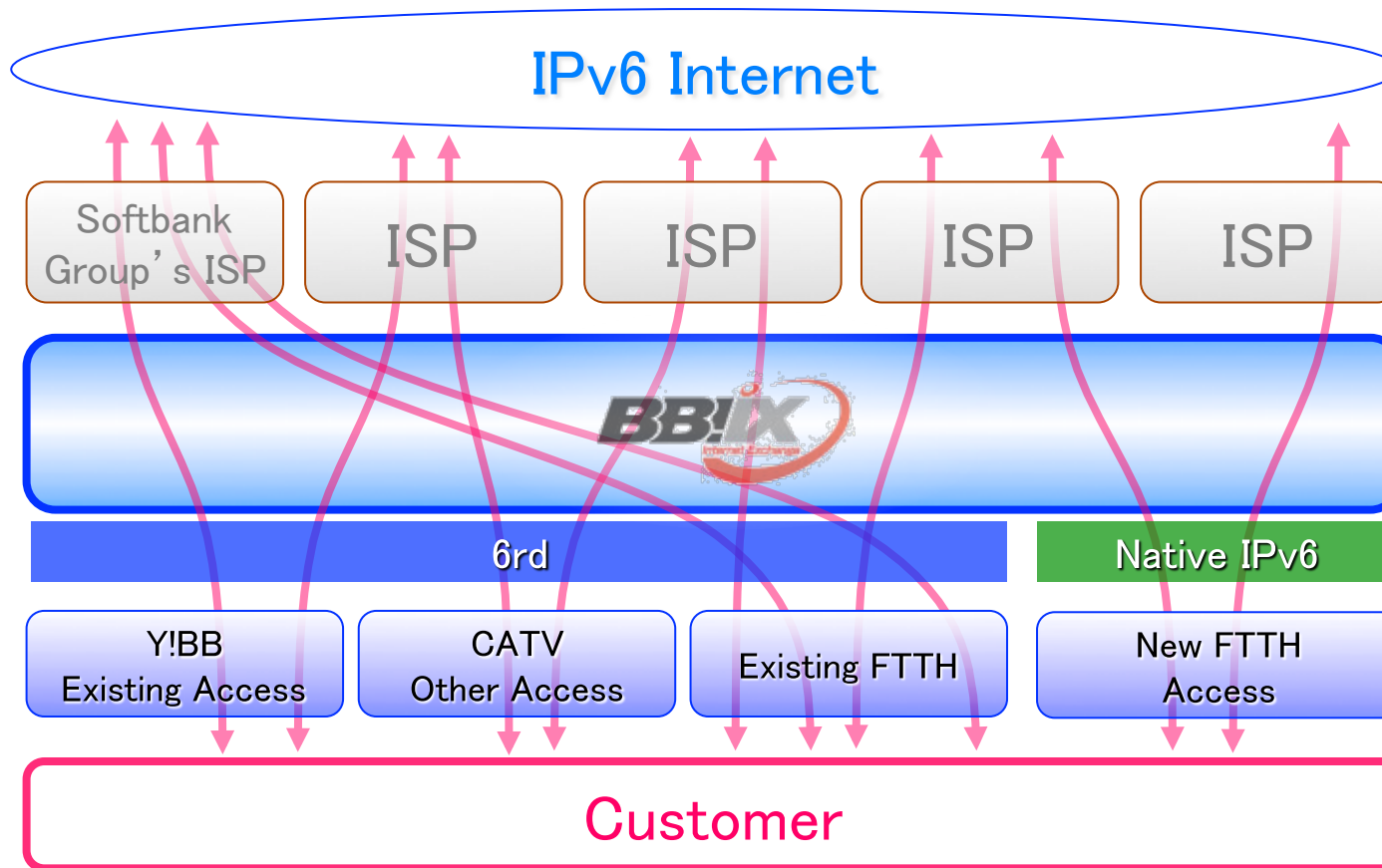


- In the transition state from IPv4 to IPv6, we should consider
 - We cannot assign new global IPv4 addresses for new subscribers
 - The network (particularly access NW) may have only IPv4 capabilities or only IPv6 capabilities
- There are many deployment solutions for such cases
 - IPv6 over IPv4, IPv4 over IPv6 and Protocol Translation, etc.,
- Requirements of each network provider are different depending on various factors, so appropriate solutions are also different
 - For existing user or new user?
 - For existing infrastructure or newly deployed infrastructure?
 - For IPv4 only network or IPv6 only network?

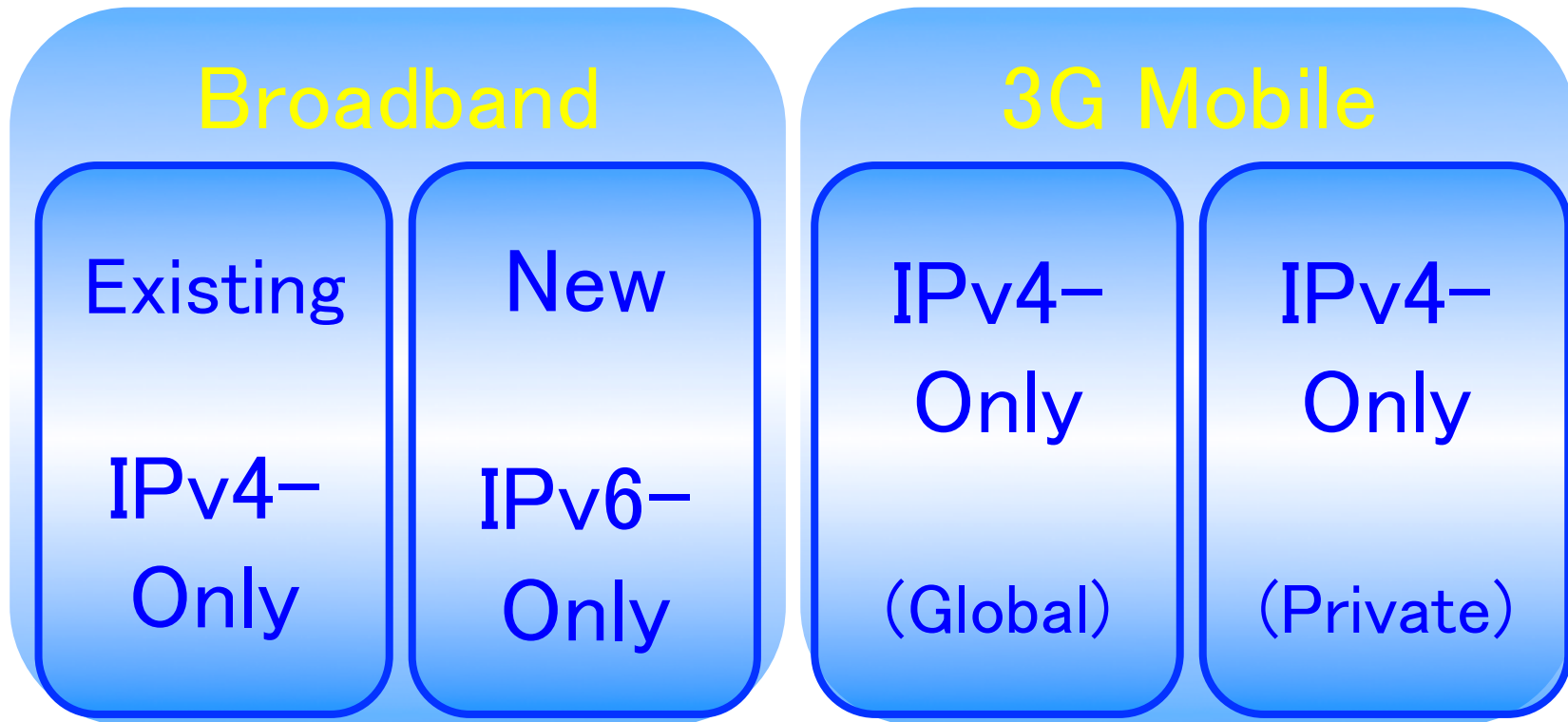
- **You will not be able to get additional IPv4 addresses anymore**
 - (Of course you have “transfer”, but it is limited and very expensive)
- **You cannot get any additional revenue by IPv6**
 - Some people may say “Yes, you can”, but it’s old (maybe obsolete) trick to promote IPv6
- **It is mandatory cost for your business continuity**
 - like replacing aged equipment

For all of broadband customer in Japan, BBIX provides 6rd and native IPv6 service to other ISPs

For Everybody!



Softbank's network portfolio for Broadband and Mobile



6rd

?

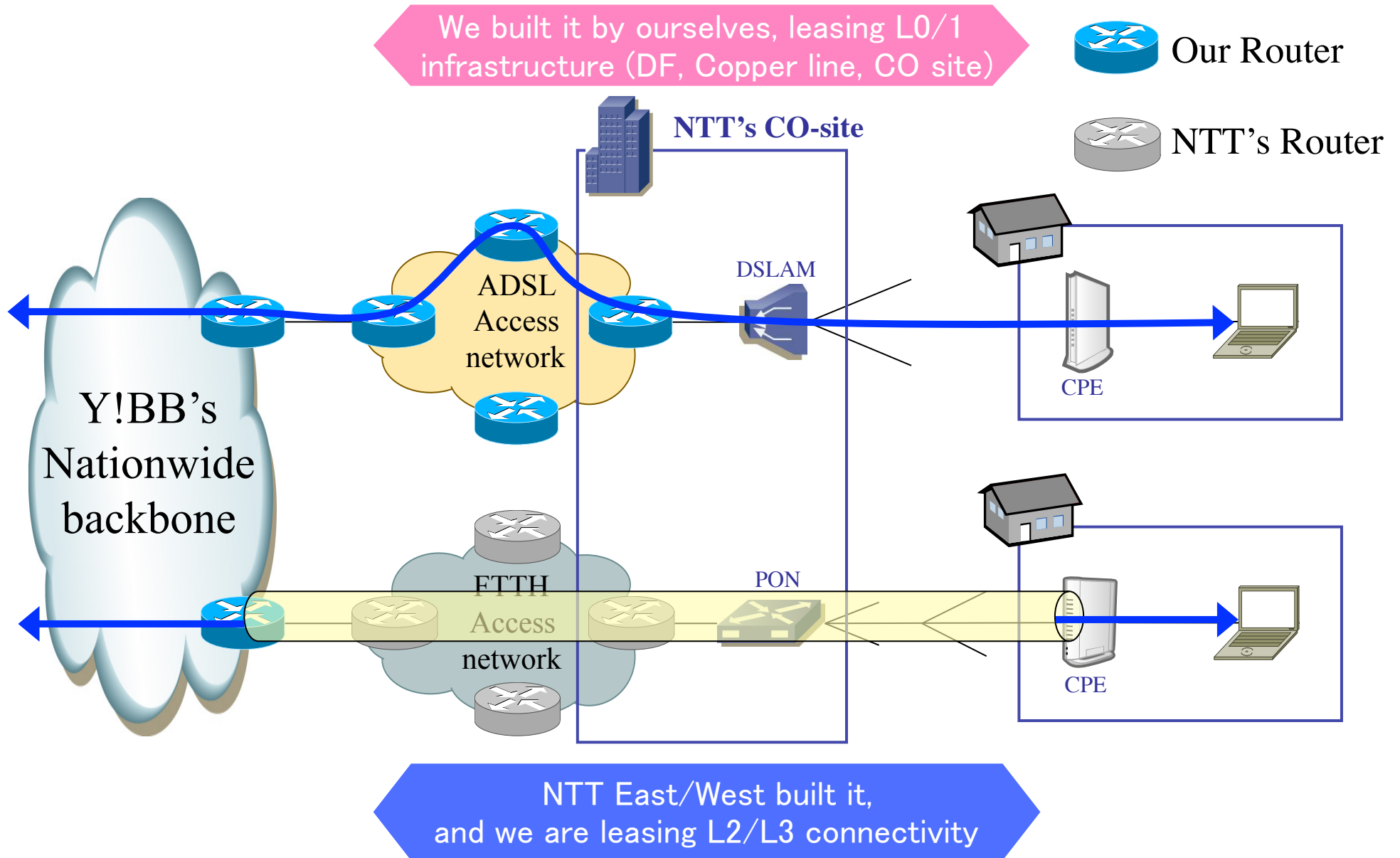
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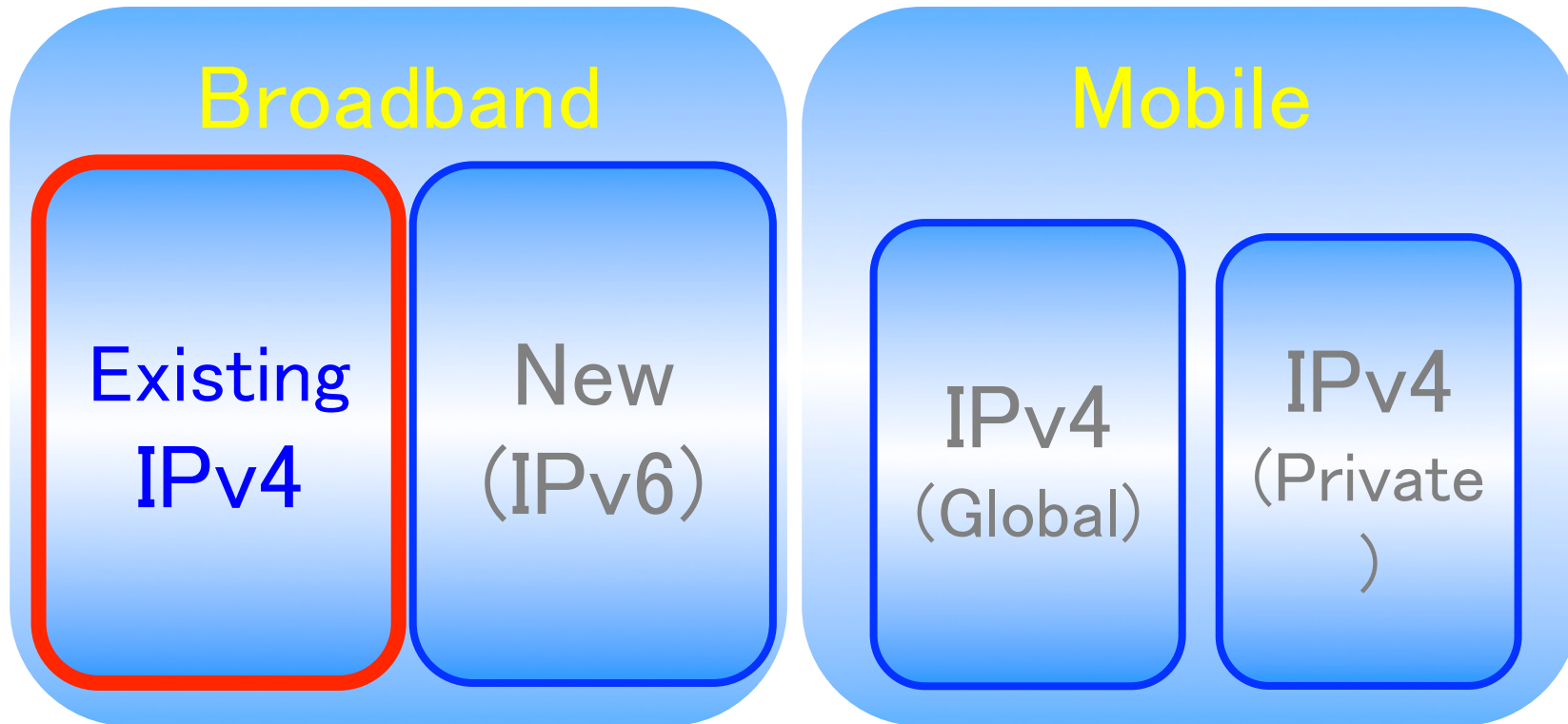
(2010)(2011)

= SoftBank

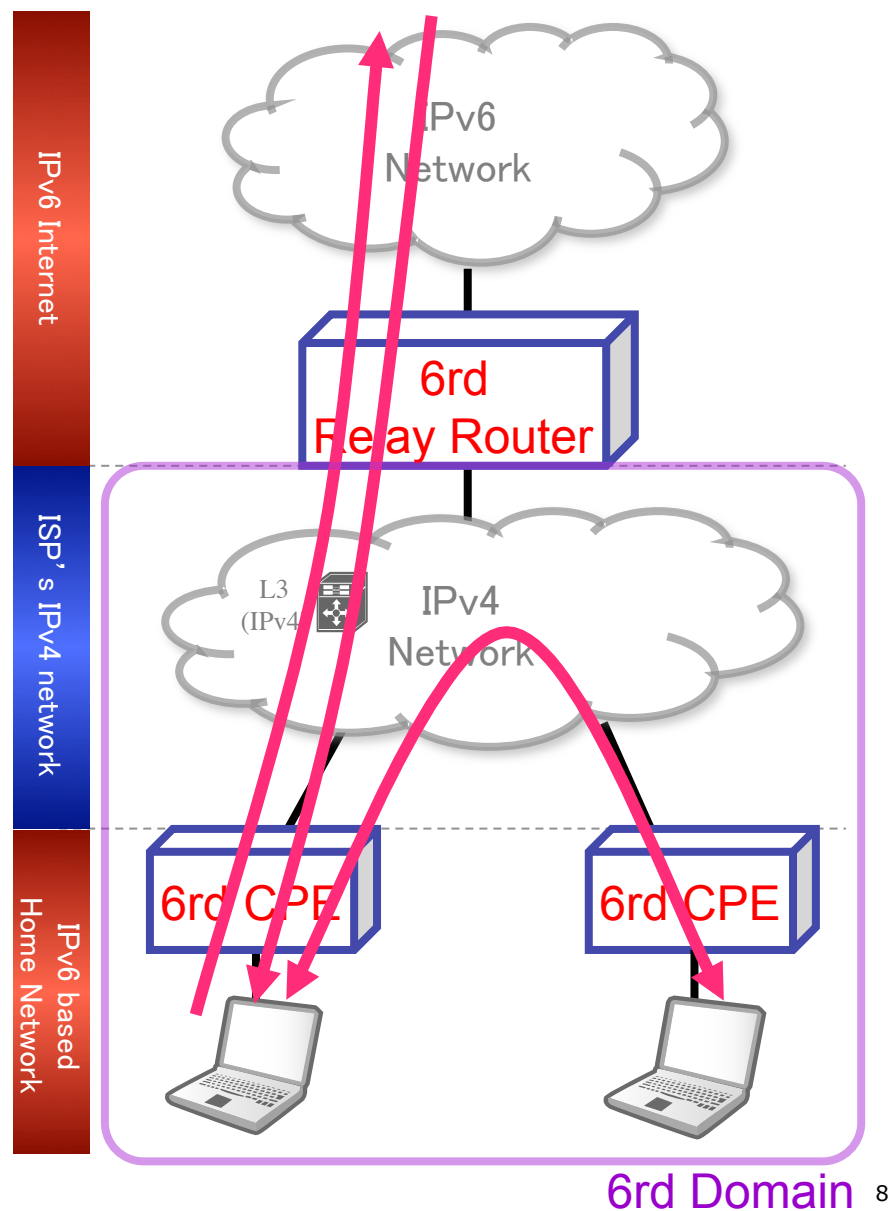
Existing vs New networks

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- Existing subscribers already have IPv4 global addresses and the # of subscribers is slightly decreasing
 - We don't need to consider how to provide IPv4 connectivity
 - Just using IPv4 global address is enough
- Existing access network is IPv4 only network
 - Replacing or upgrading all devices to enable IPv6 is not realistic
 - We will need 6 over 4 technology to provide IPv6 connectivity
- Since we are providing CPEs, we can control software in CPEs
 - On the other hand, we want to minimize configuration cost of CPEs

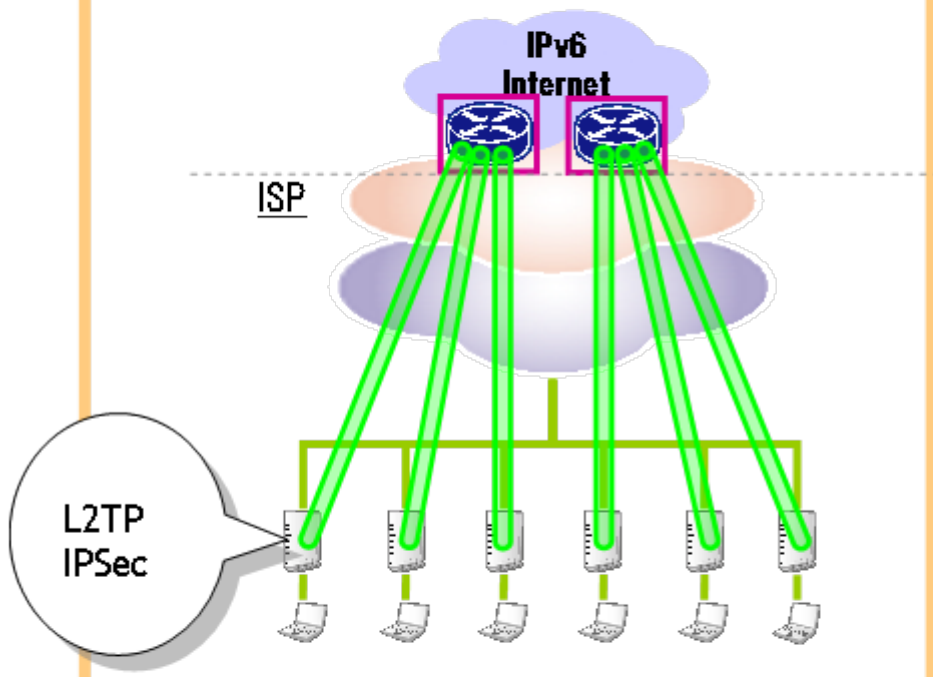


- IPv4 address is used as internal ID
- **IPv6 prefix** which is delegated for each subscriber **is derived from global IPv4 address** which is assigned for same subscriber
- **CPE can automatically configure** its delegated IPv6 prefix to home network
- For downstream packet, **6rd relay router can automatically form encaps header from dst IPv6 address** of incoming packet (without configuring a tunnel for each subs)
- For upstream packet, **CPE can figure out tunnel end point** (6rd relay router or other CPE) **from dst IPv6 address**

Why we choose 6rd? - Cost Comparison -

Other Solutions

Each customer needs tunnel state/config

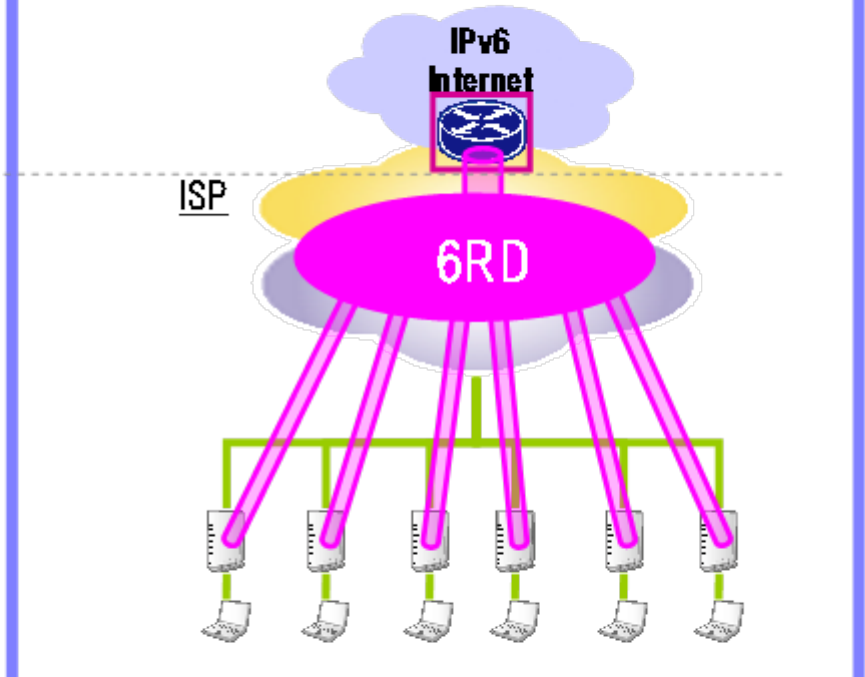


of user linearly increases cost

CAPEX/OPEX **Expensive!**

6RD

Single tunnel aggregates all customers



Eliminate cost increase with # of user

CAPEX/OPEX **Cost-Effective!**

How we evaluated 6rd efficiency?

We had to minimize transition cost, but maximize allocation of network upgrading resources. So we did following comparison.

Q: Total CAPEX and OPEX of a transition system

T: Total number of serving customers in a transition system

$$S = Q / T$$

Comparing S value between all of solutions and products



We consequently always observed following:

$$S(A) < S(B)$$

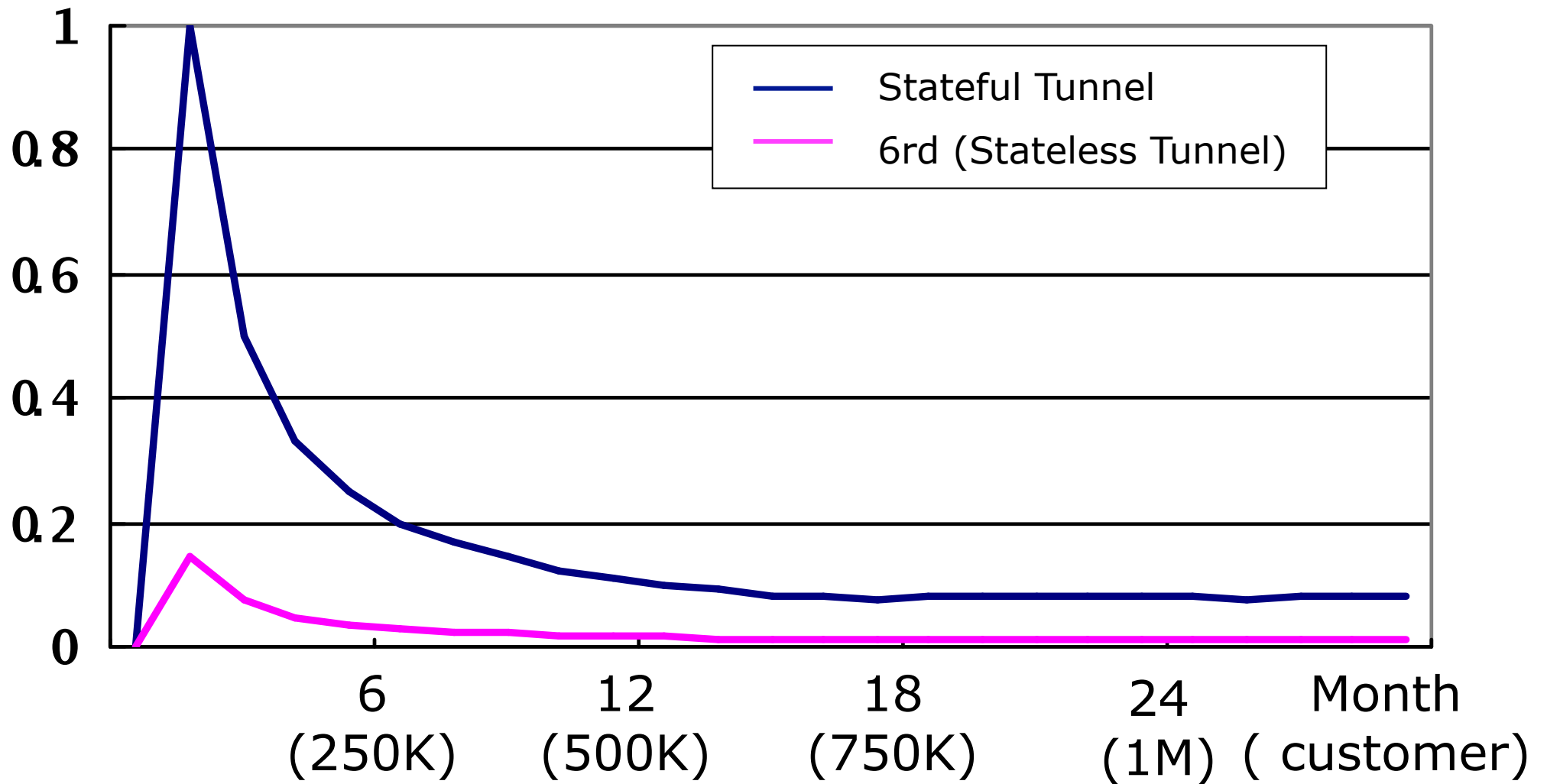
S(A): the S value of “Stateless” solution <- 6rd

S(B): the S value of “Stateful” solution

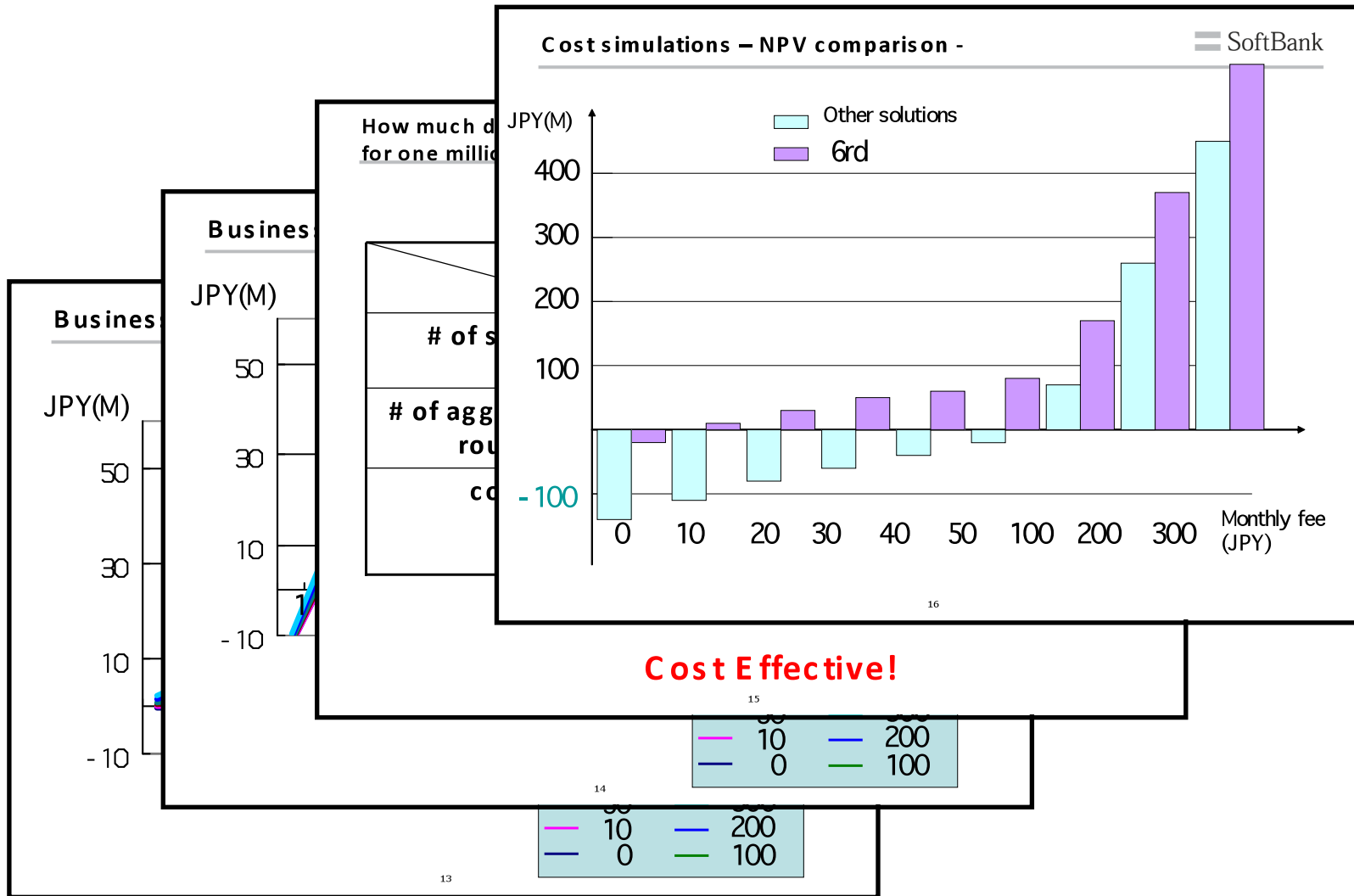
Comparison of total expense per customer transition

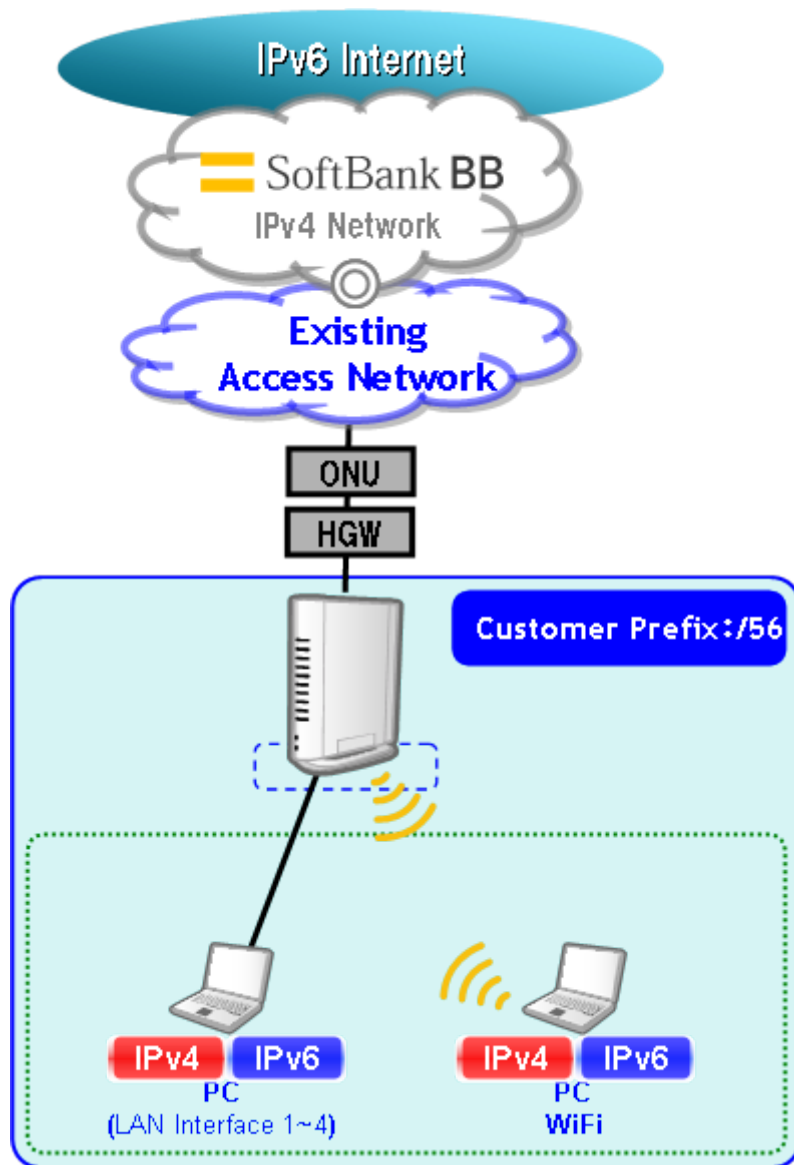
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x 100 (%)



Architecture dominates business plan

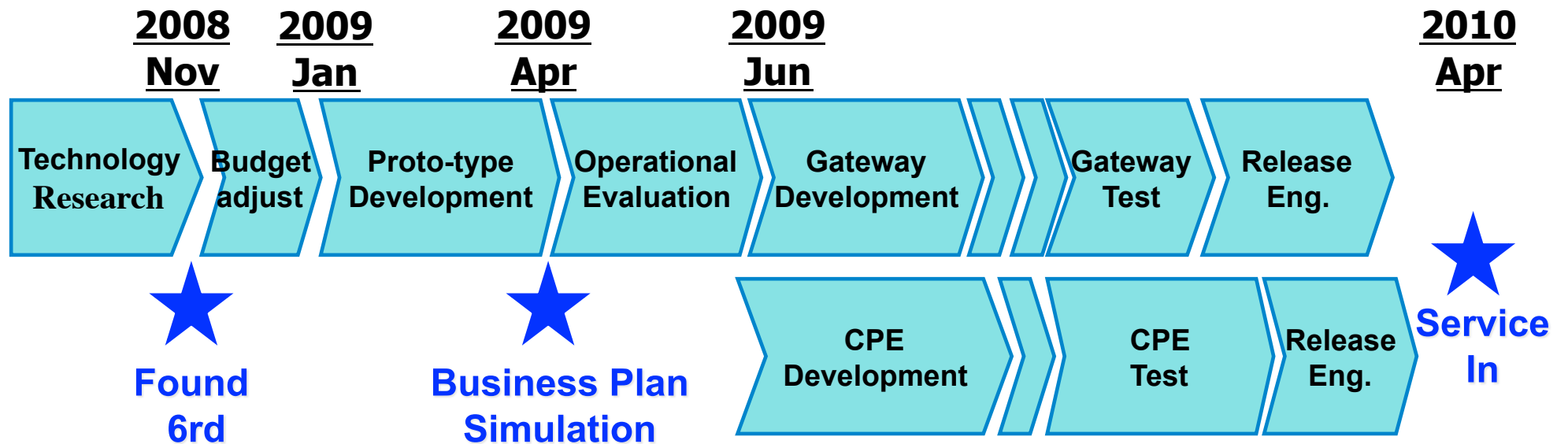




Customer IPv6 Prefix length	/56
Monthly Charge	No additional Charge!

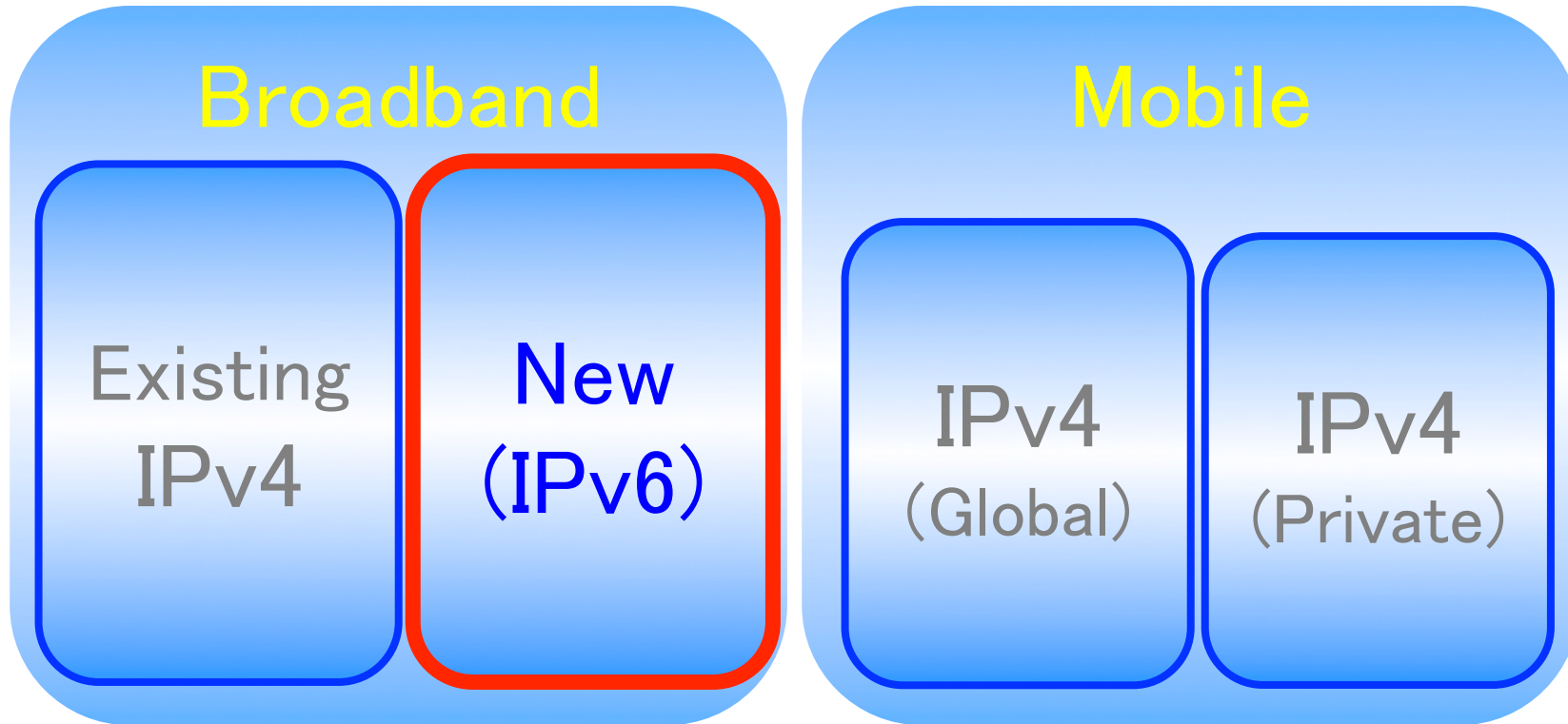
ONU=Optical Network Unit
HGW= Home GateWay

Timeline of 6rd



-
- **The transition cost is mandatory for business continuity**
 - **Architecture dominates business plan**
 - Nobody can help v4v6 transition for ISP in business
 - **Our case:**
 - A stateless address mapping might be helpful for both Softbank's broadband and mobile IPv4 to IPv6 transition
 - **Issue:**
 - No standardized Stateless solution for IPv6-Only networks/
deployment with v4 address sharing function

Backup

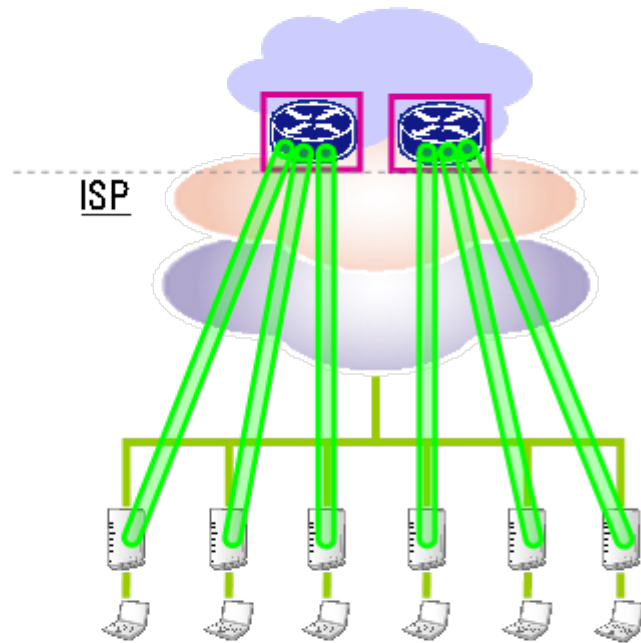


Background

- NTT East and West assign their own IPv6 address for each user, but this address is not for the internet connectivity
 - PPPoE + L2TP? It's too complicate!!
- In the middle of this year, we can inject our own prefix to NTT network, and then our customer who connected to NTT would be assigned Softbank's IPv6 prefix.
- # of customer is increasing
 - We need to provide both of IPv4 and IPv6 service over native IPv6 network
 - We should share a IPv4 global address between multiple customers
- Big Question
 - How to provide IPv4 service over native IPv6 network?
 - How to share one IPv4 address with many customers?

Remember, architecture dominates business plan

Each customer needs tunnel state/config

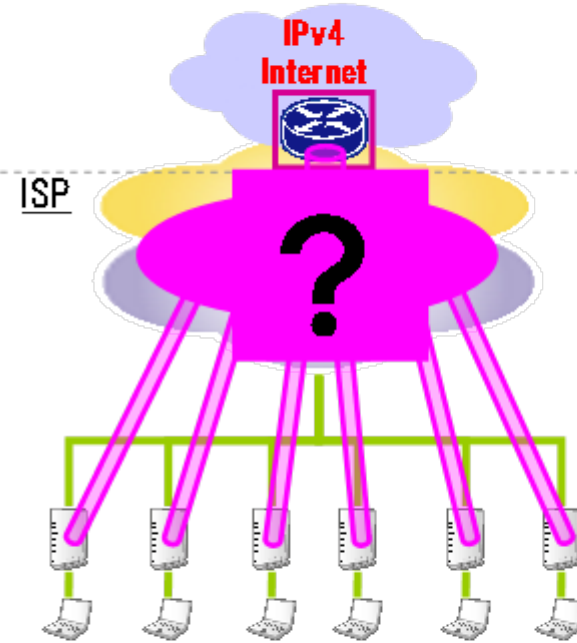


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CAPEX/
OPEX

Expensive!

Single tunnel aggregates all customers

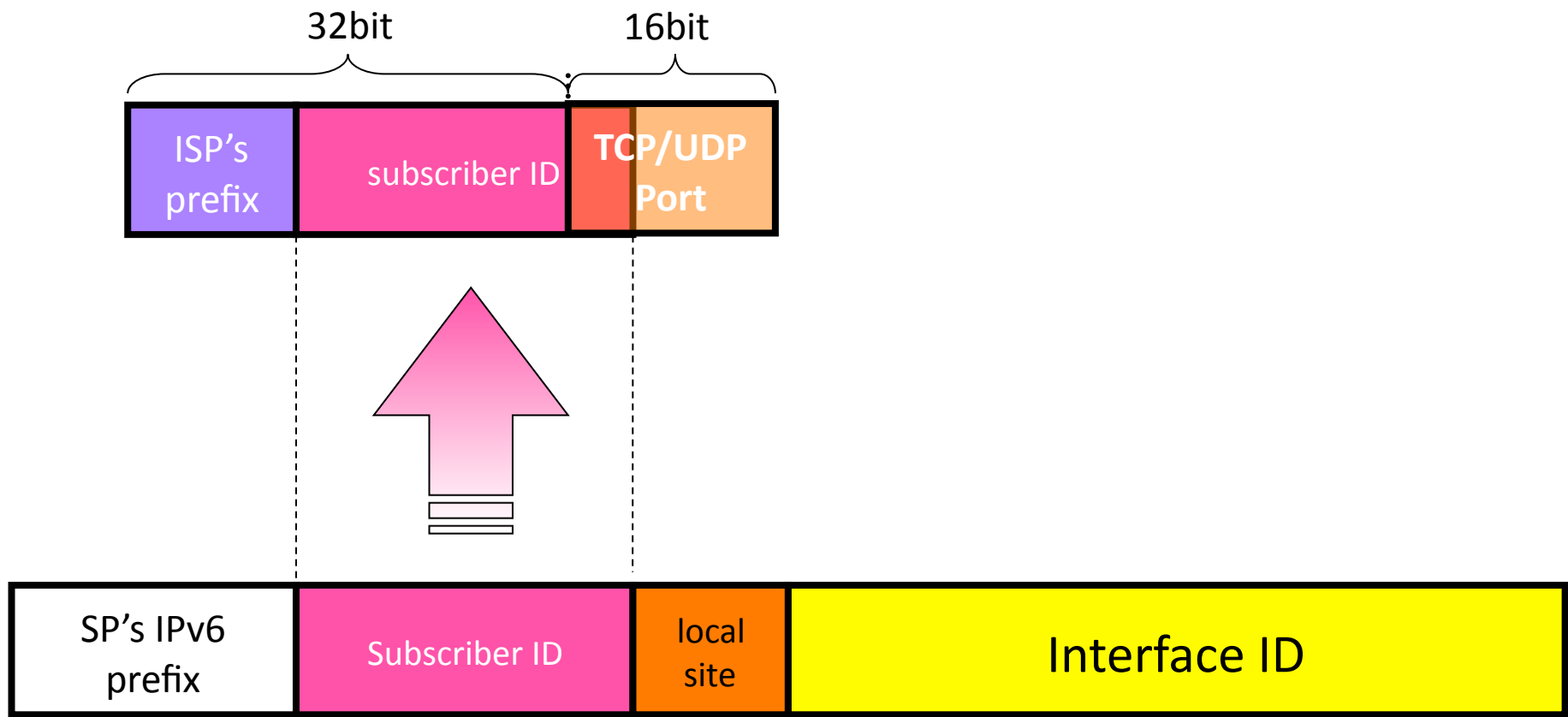


Eliminate cost increase with # of user

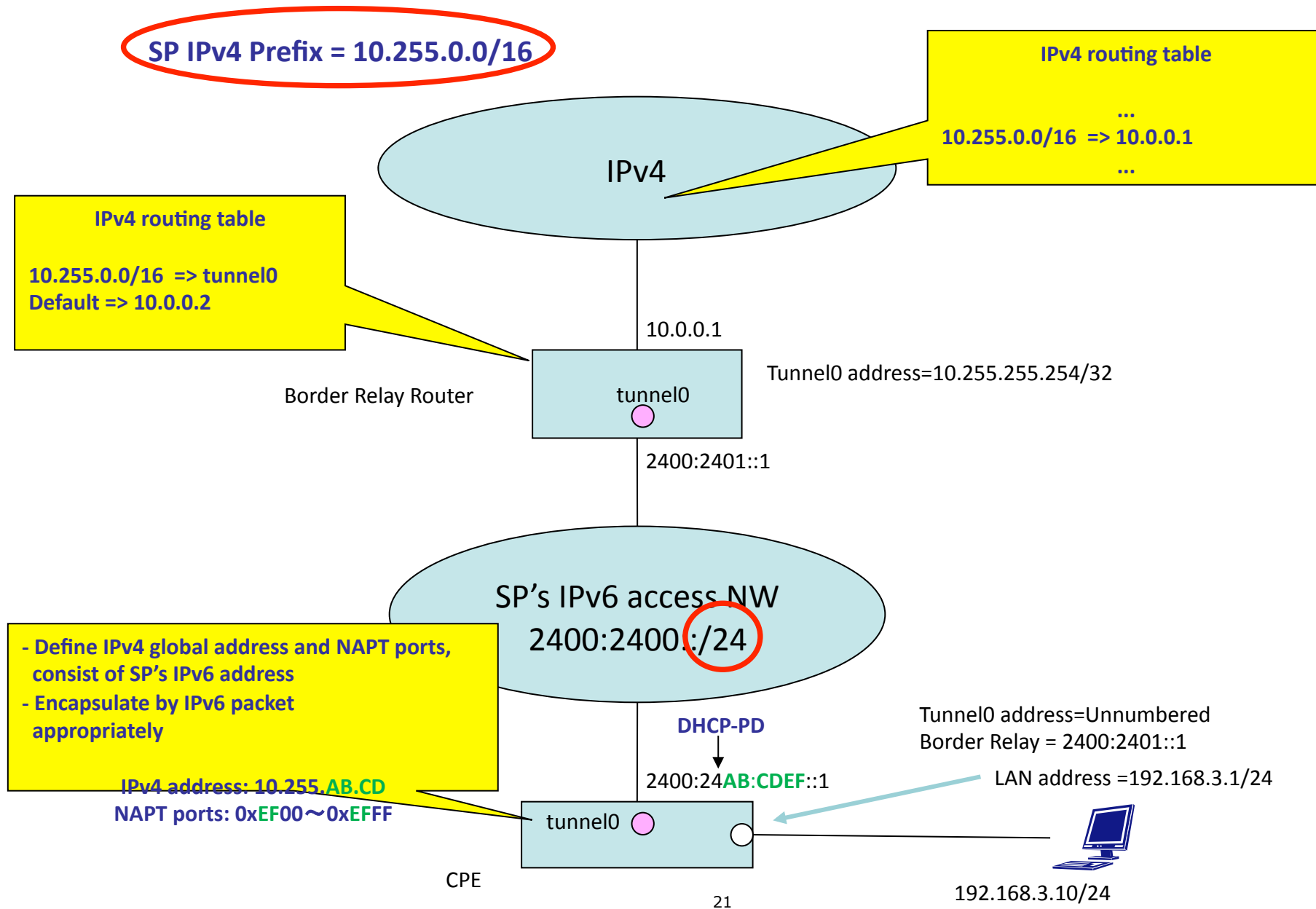
CAPEX/
OPEX

Cost-Effective!

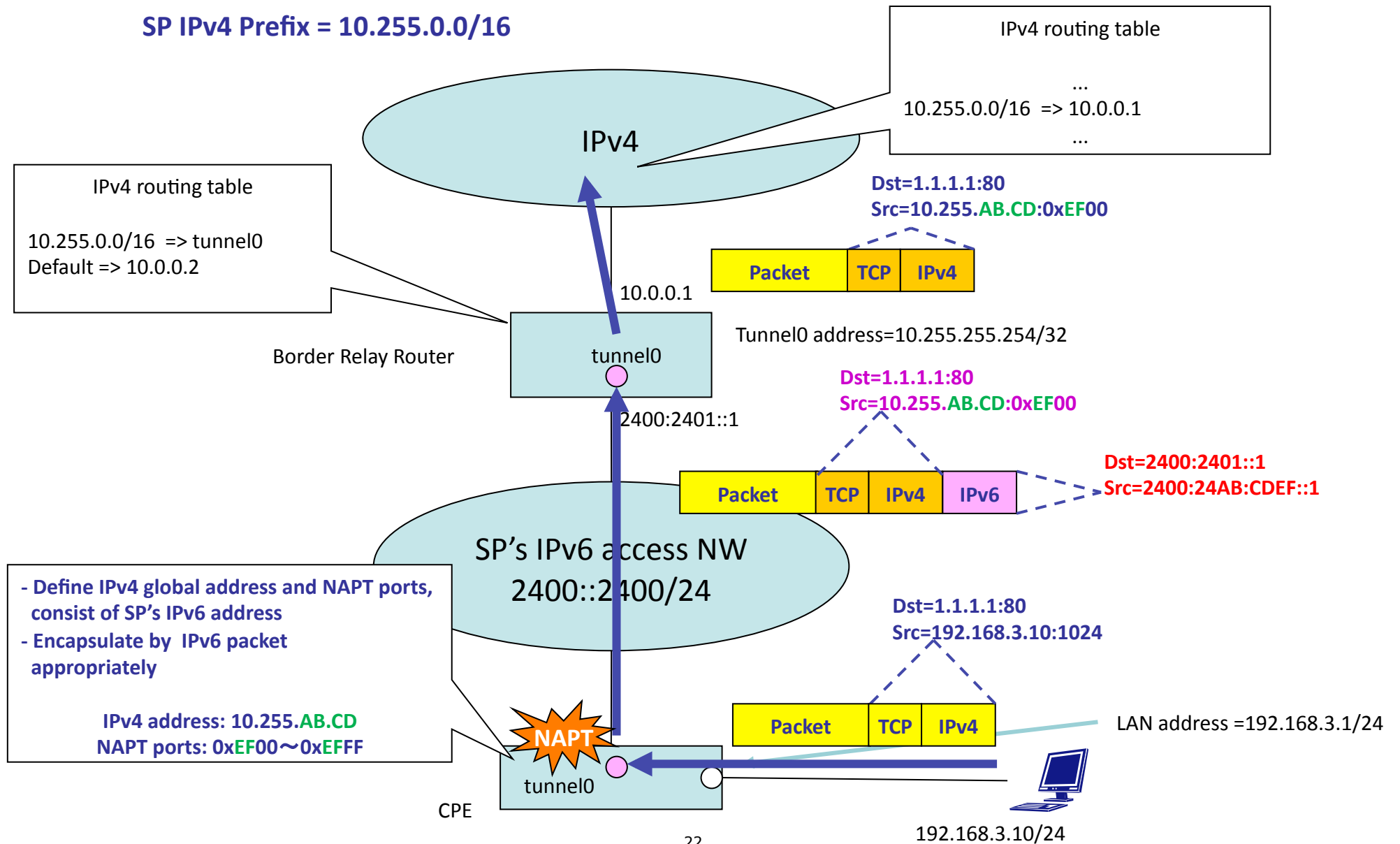
A Stateless Solution for IPv4 address sharing



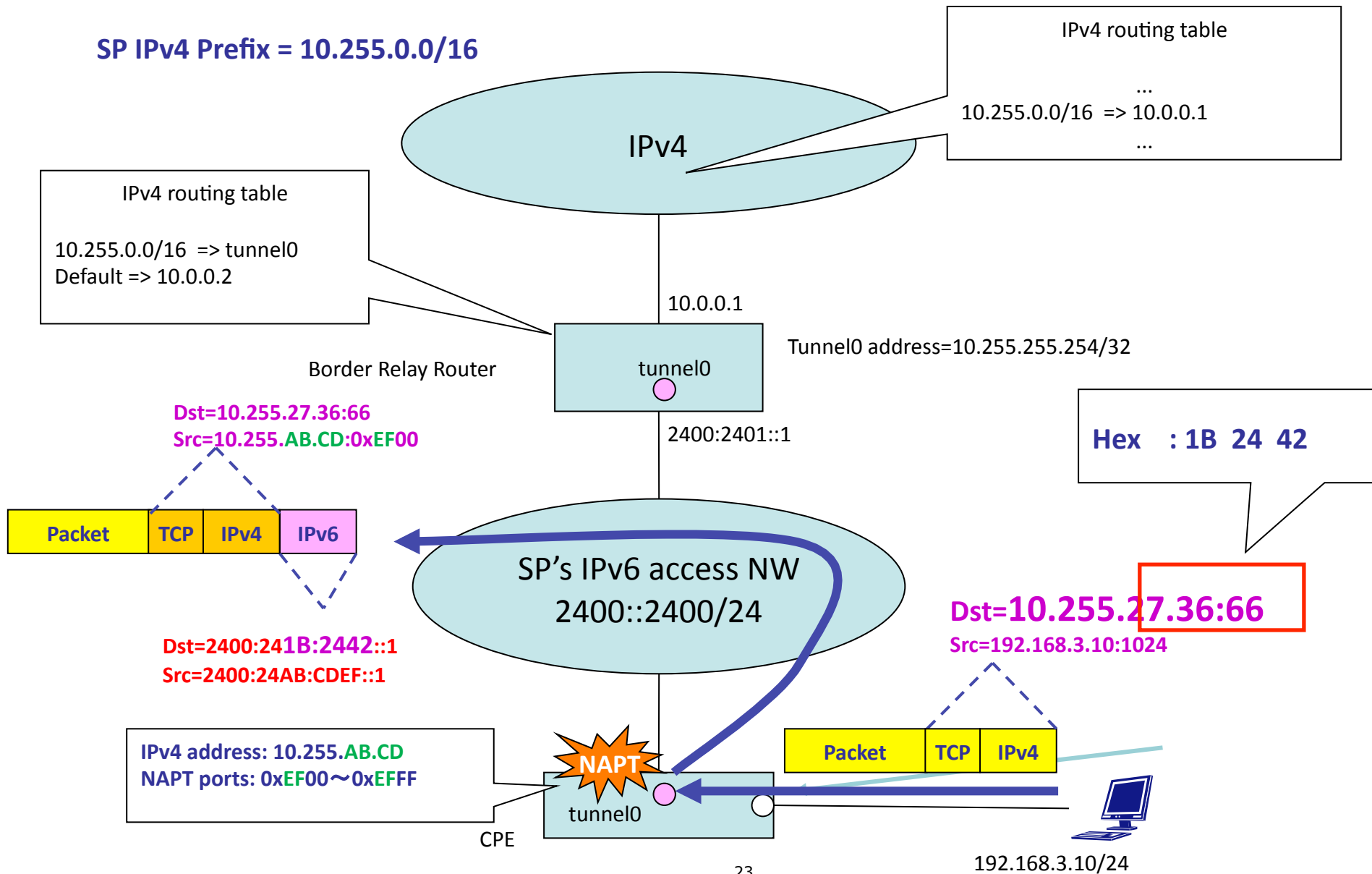
How 4rd works: a example configuration



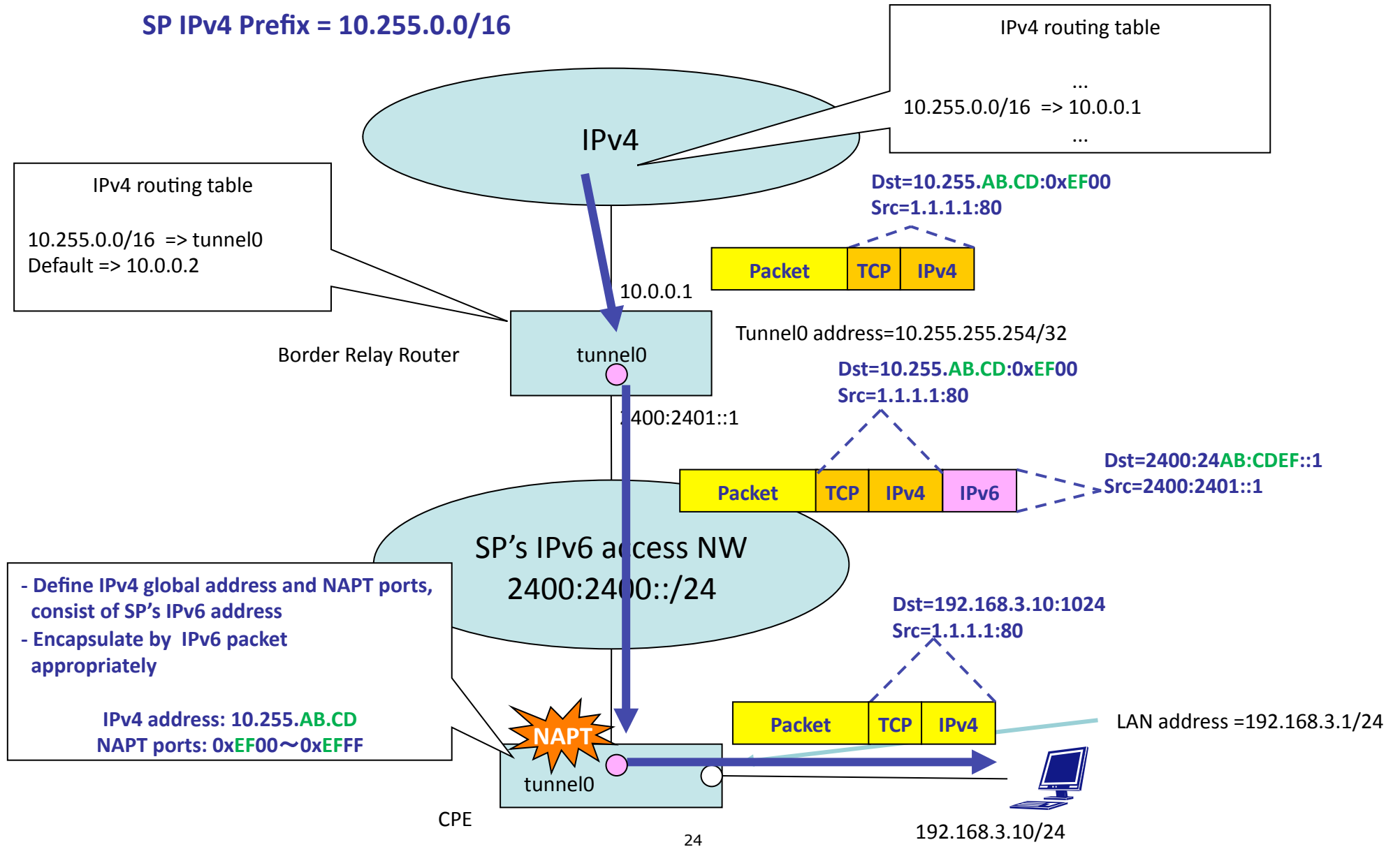
Example Behavior – Upstream



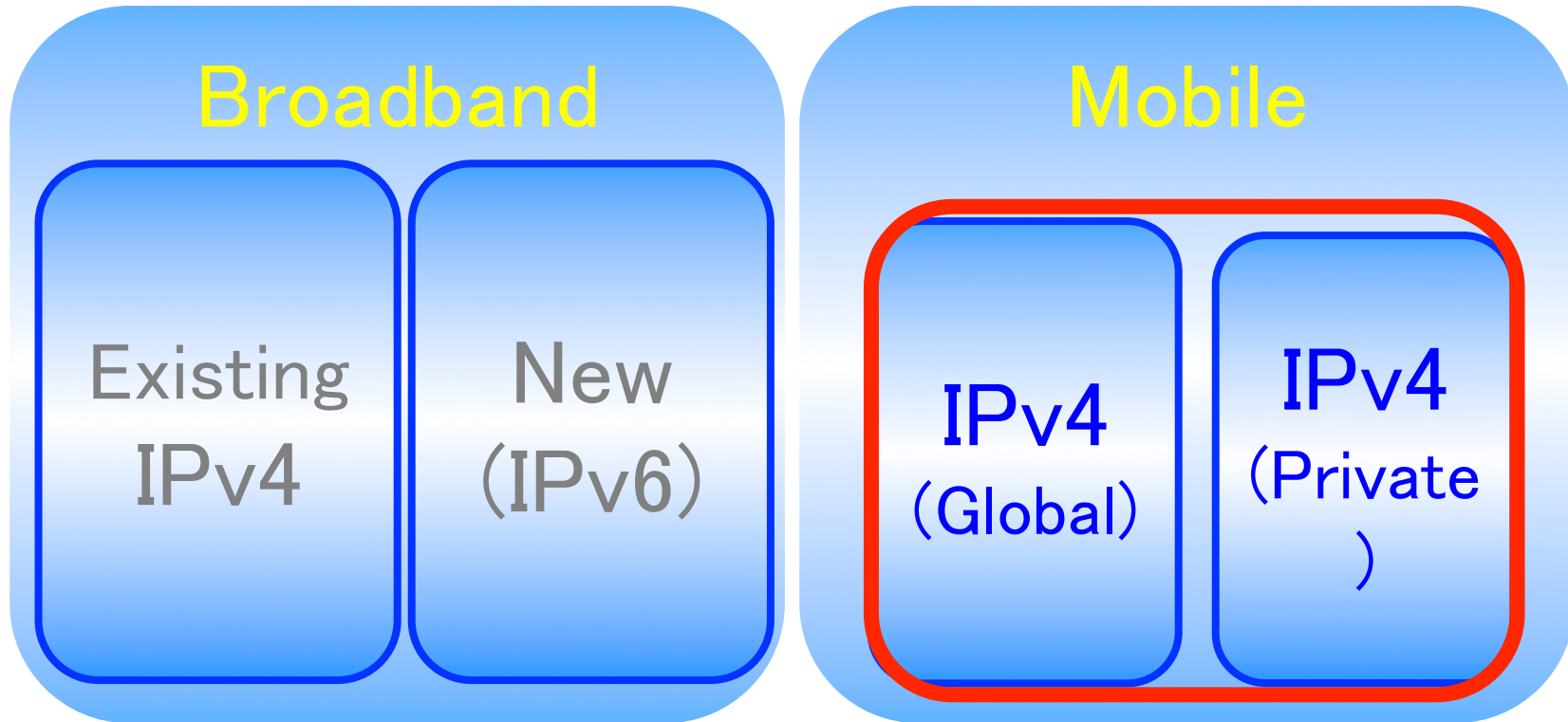
Example Behavior – Upstream (2)



Example Behavior – Downstream



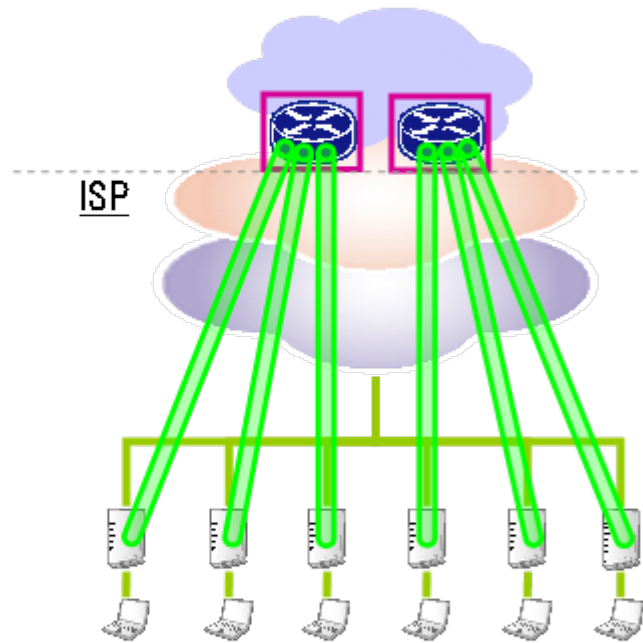
- The notion of 6rd can spread IPv4 over IPv6 with address sharing
- Overview and some use cases with specifications are described in SAM, 4rd
(draft-despres-software-sam, draft-despres-software-4rd)
- CPE (B4) can automatically configure its “shared IPv4 address” and “Port prefix” based on a delegated IPv6 prefix
- Border relay router (AFTR) can automatically form encaps header to destine to subscriber with single tunnel configuration
- NAT44 function and states only exist in the CPE



- **Softbank Mobile provides 3G data service for conventional handset and Smart-phone in Japan.**
- **We are facing a circumstance in which exhaustion of both IPv4 private and IPv4 global addresses.**
 - **Global address exhaustion by smartphones**
 - **Private address exhaustion by push application**
- **Address uniqueness in SP' network is much more important in Mobile service**
- **The question is that which scenario can be relay on most effective and reliable architecture for Softbank case.**

Remember Again, architecture dominates business plan = SoftBank

Each customer needs tunnel state/config

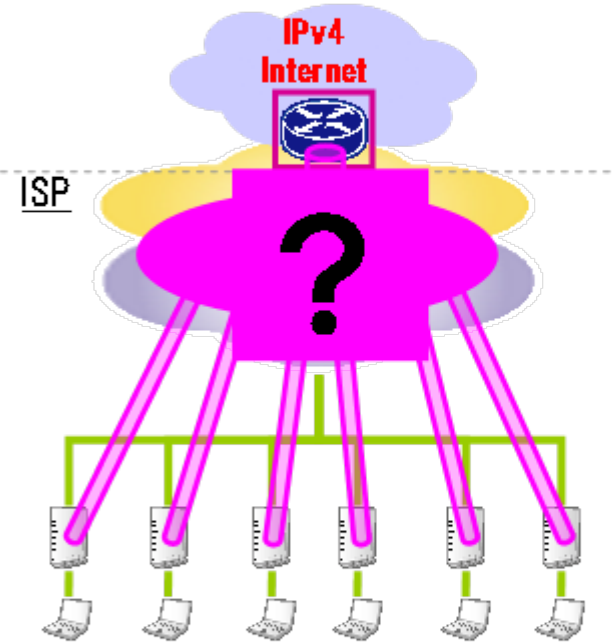


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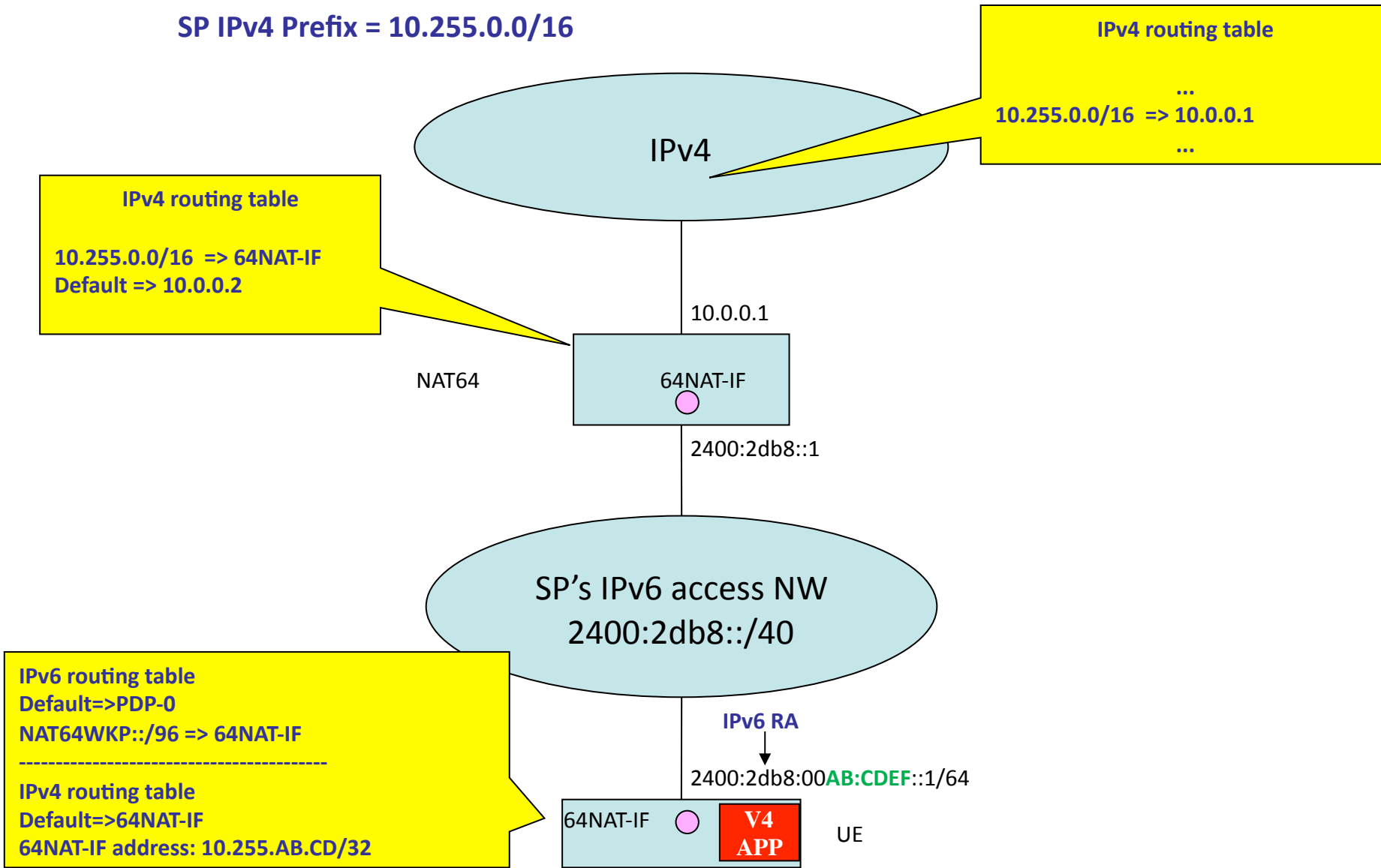


Eliminate cost increase with # of user

CAPEX/
OPEX

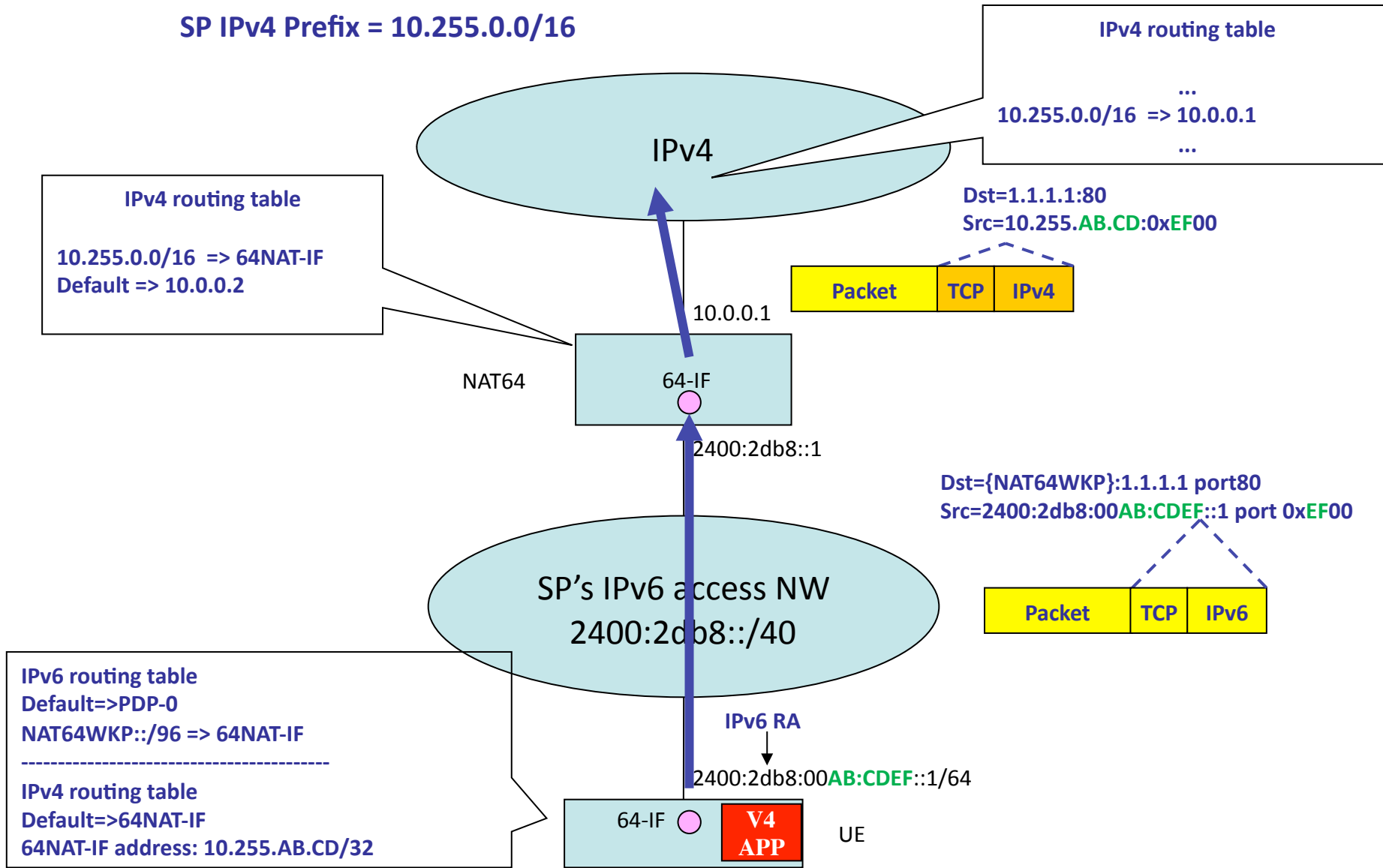
Cost-Effective!

What if stateless NAT64 work with 4rd rule as an alternative of RFC6052



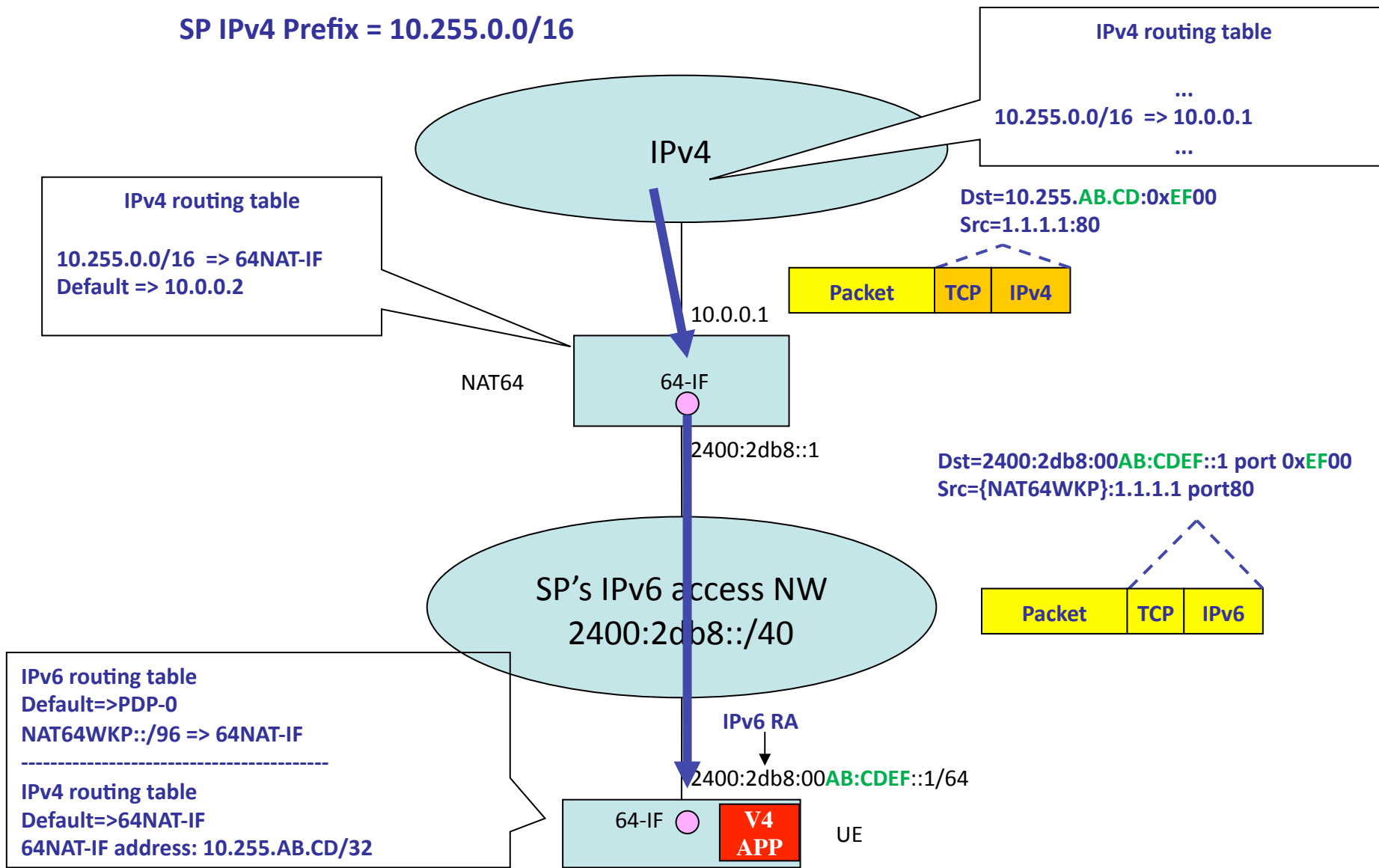
NAT64 WKP ports: 0xEF00~0xEFFF

Example behavior: Upstream



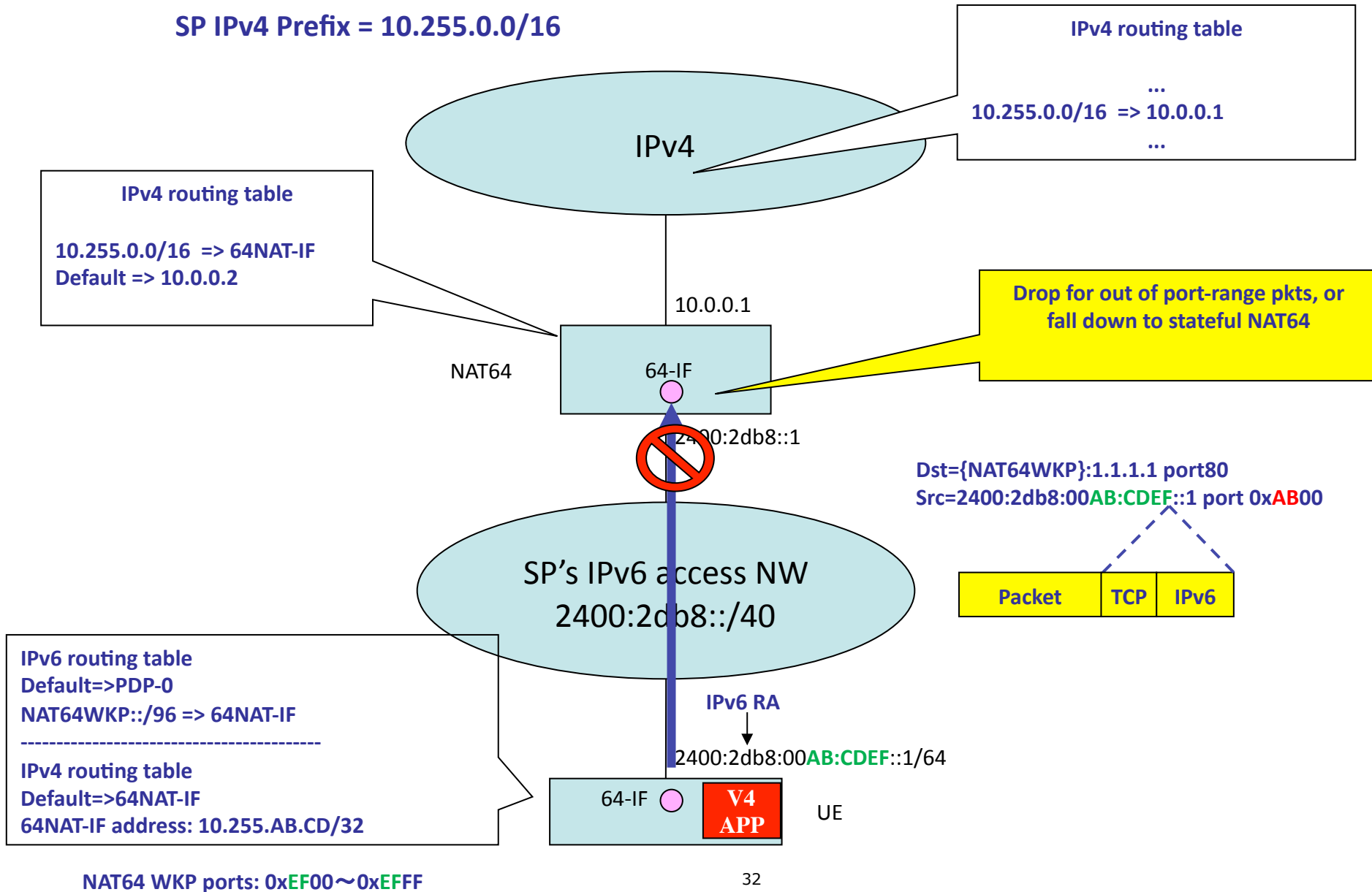
NAT64 WKP ports: 0xEF00~0xEFFF

Example Behavior: Downstream



NAT64 WKP ports: 0xEF00~0xEFFF

Example Behavior: Upstream(2)



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