Overview of Shared Address Solution Space

NOKIA

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A Core Technology with Extensions

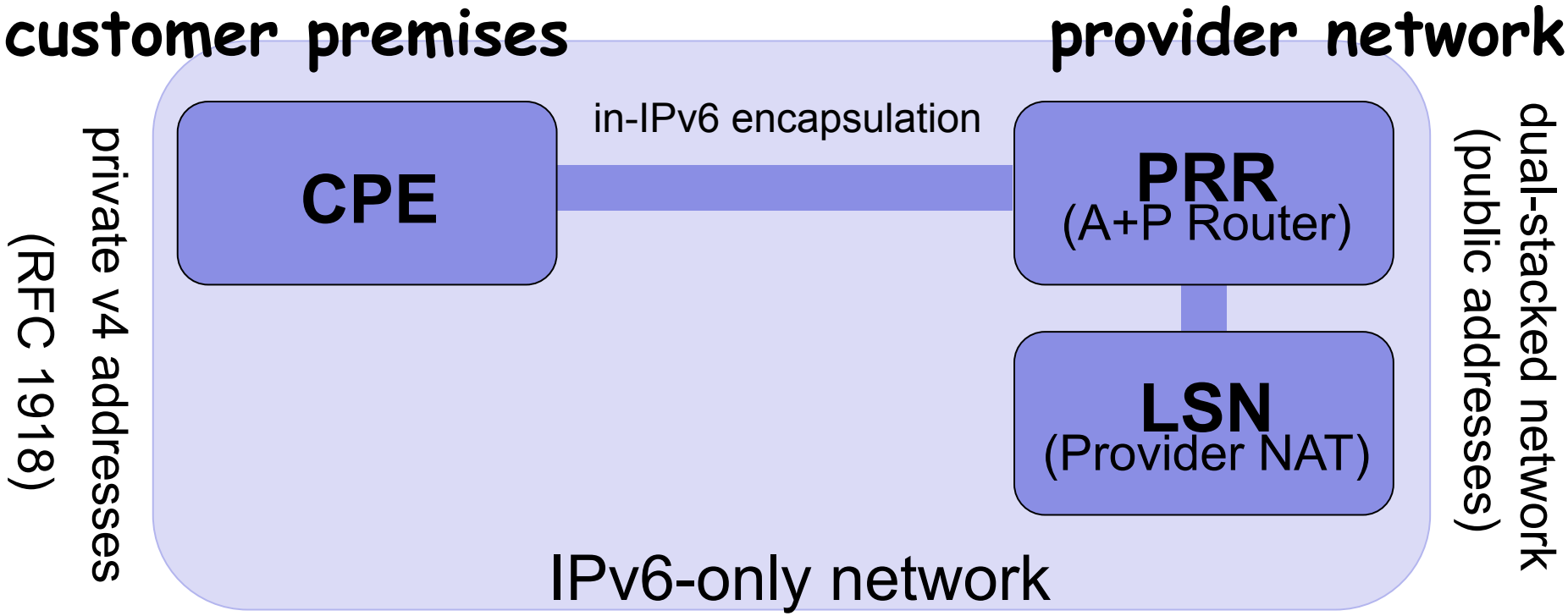
- Single core technology to form the basis
- Suite of extensions for tuning the core technology to suit different deployment models
- Set of signaling mechanisms for communicating required parameters
- Deployment Scenarios

A+P (aka PRR) Core Technology

- Provides **Encapsulation**
- Provides **Port Reduction**
  - PRR for port based forwarding
  - Fallback to CGN for NAT

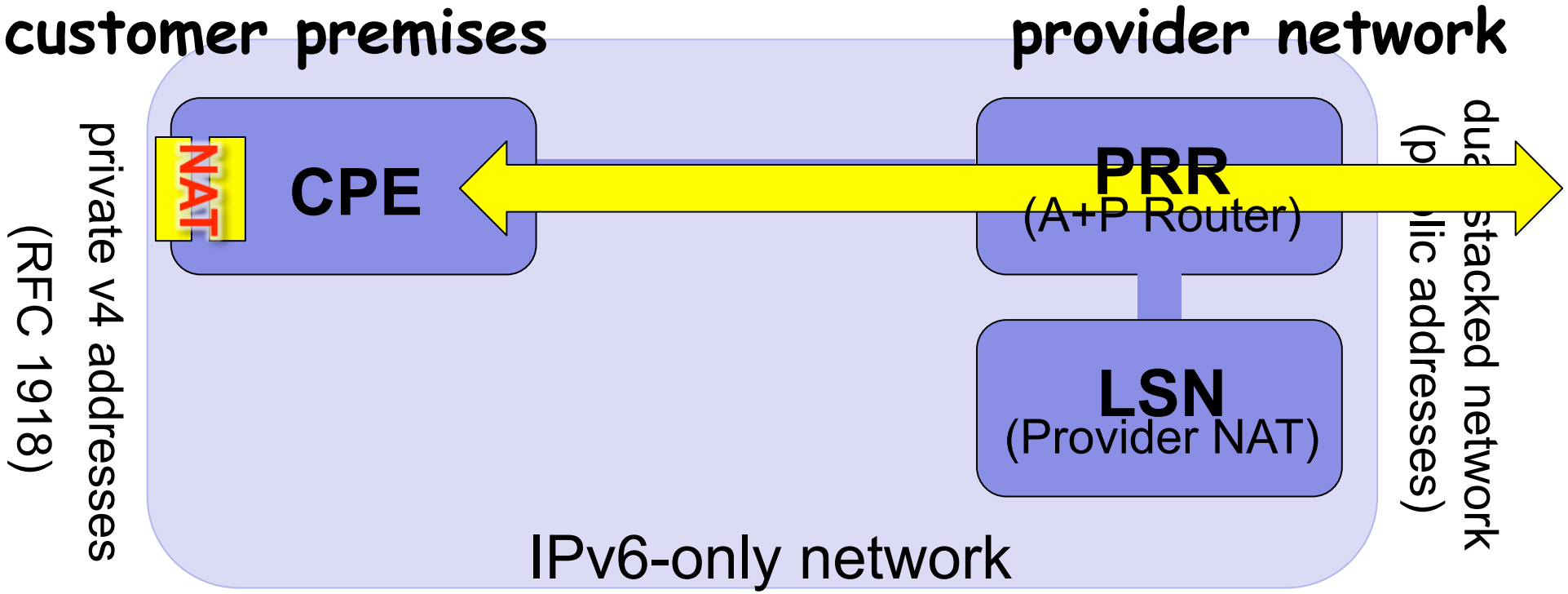
- DS-Lite - a technology for deployment, particularly as a transition mechanism when you can not immediately change CPE (very much)

A+P Example



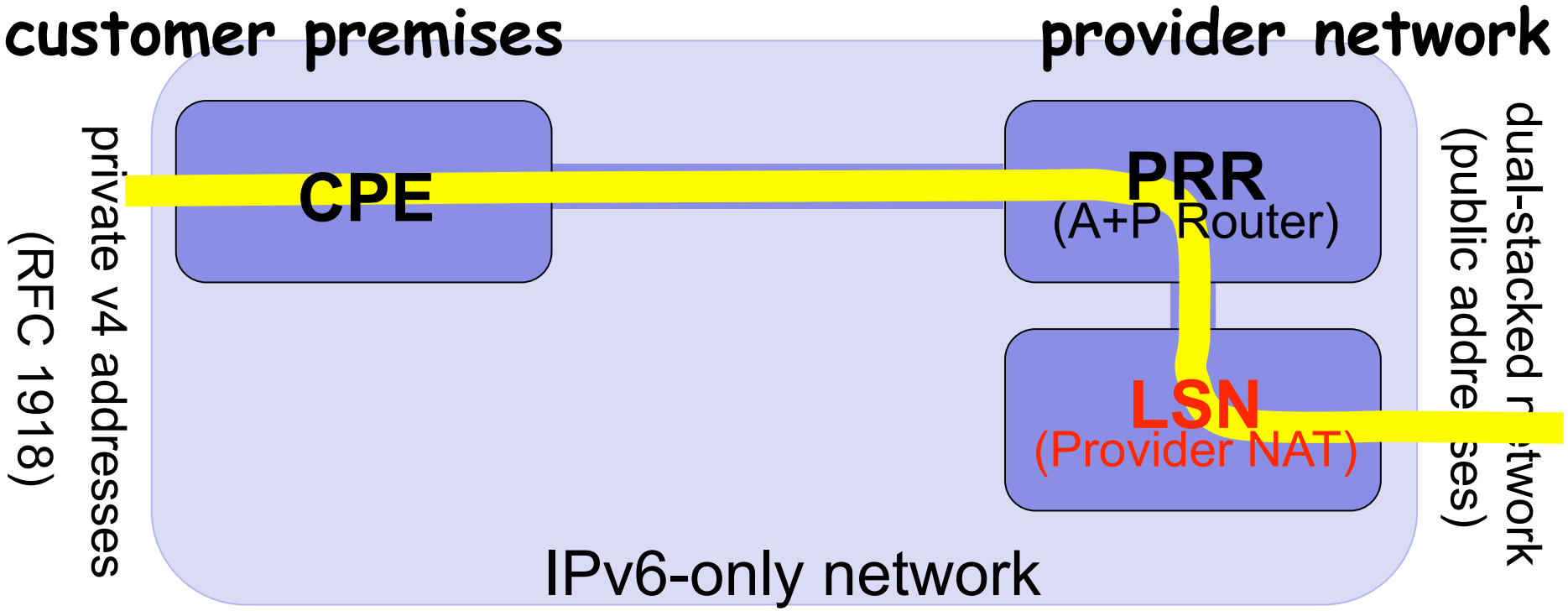
- "A+P pkts" are encapsulated in IPv6

A+P-NAT at CPE



- Untranslated end-to-end to CPE
- CPE nats to connect legacy hosts.
- APR encap/decaps only (LSN bypassed) !

Out-of-port-range pkts



- NAT could also be done at LSN
- However, customer has choice where NATing shall be done!

Adapting to Different Deployment Models

1. Desired IP address compression ratio (1/5, 1/100, 1/1000)
2. IP compression techniques & side effects (Static vs dynamic, port randomization, port usage logging,…)
3. Encapsulation mechanism (IPv6, GRE,…)
4. Signaling mechanism (DHCP, UPnP/NAT-PMP, web page,…)

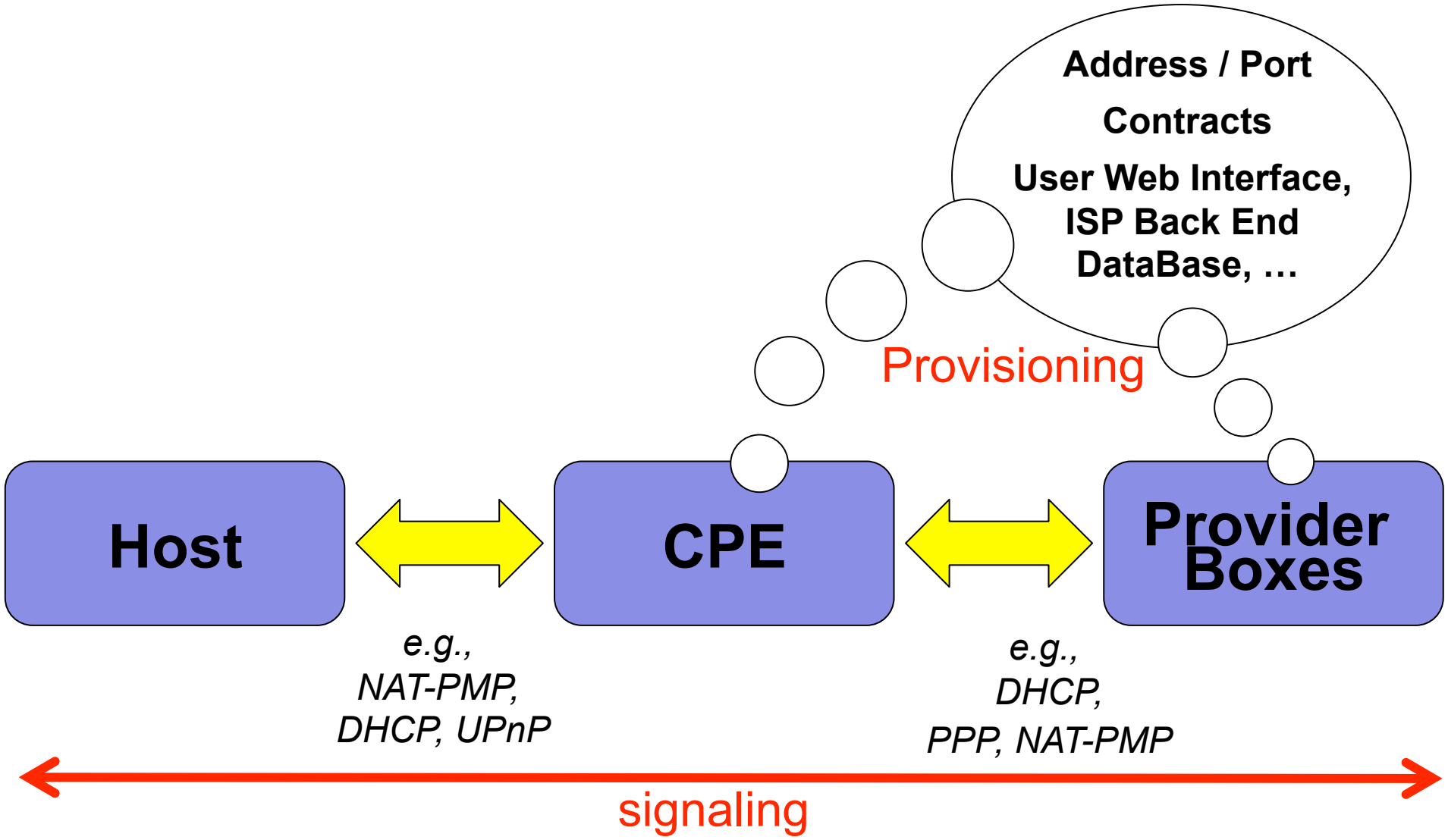
IP Address Compression Ratio

- The desired IP address compression ratio has an impact on how the core technology is tuned for deployment
- For maximum compression ratio:
  - only use highly dynamic port assignment
- Minimum port compression ratio:
  - use large static port assignment
- Somewhere in between:
  - use a hybrid environment

Encapsulation Mechanisms

- Layer 2, for example PPP-link (or similar, like 3GPP EPS bearer)
- Layer 3, for example any IPv4-in-IPv4, IPv4-in-IPv6, GRE…
  - Note: To avoid problems with ARP on a shared medium, shared IPv4 addresses must be used with an encapsulation

Signaling vs. Provisioning



Signaling

- Signaling between *and/or*
  - **Provisioning to CGN/PRR from ISP and/or web page**
    - **Maybe XML**
  - **CGN/PRR & CPE or Host Stack or home router stack**
    - **DHCP, PPP options, …**
  - **CGN/PRR & Application**
    - **NAT-PMP/UPnP**
  - **User & ISP provisioning system**
    - **Web interface**
- Pre-assignment vs just-in-time signaling
- One port at a time or block of ports

Documents

- Architecture
  - A+P - draft-ymbk-aplusp
- Address/Port Allocation& Signaling
  - draft-bajko-pripaddrassign
  - draft-boucadair-port-range
  - draft-boucadair-behave-ipv6-portrange
  - draft-boucadair-pppext-portrange-option
- Deployment / Application
  - DS-Lite - draft-ietf-softwire-dual-stack-lite

Work In Progress

Advantages/Disadvantages (i)

	CPE-NAT	IPv6 only	v4/v6 dual-stack	A+P	LSN
Works with current IPv4 Internet	partially	no	yes	yes	partially
Additional customers with v4 access can be added after exhaustion	no	n/a	no	yes	yes
Requires protocol translation to access v4 content (ALG)	no	yes	no	no	no
Costly to implement	no	no	no	yes	yes

Advantages/Disadvantages (ii)

	CPE-NAT	IPv6 only	v4/v6 dual-stack	A+P	LSN
Req. gateway devices	yes	no	no	yes	yes
Complex deployment	no	yes	no	yes	yes
Req. changes to host	no	yes	no	no	no
end2end connectivity	no	yes	yes	yes	no
extends v4 life	no	no	no	yes	yes
encourage v6 deployment	no	yes	yes	yes	maybe
is scalable	partially	yes	yes	yes	no

Advantages/Disadvantages (iii)

	CPE-NAT	IPv6 only	v4/v6 dual-stack	A+P	LSN
Customer controls translation	yes	n/a	n/a	yes	no
Customer may get incoming WKP	yes	yes	yes	yes	no
Works with IPsec	no	yes	yes	no	no
port randomization	yes	yes	yes	partially	yes
ICMP echo	**outgoing only**	no	no	**outgoing only**	**outgoing only**
ICMP (other types)	?	yes	yes	?	?