New Internet Infrastructure Features on HP-UX

William Gilliam
Network Architect
&
Muthukumar Lakshmanan
Engineer
Hewlett Packard SNSL

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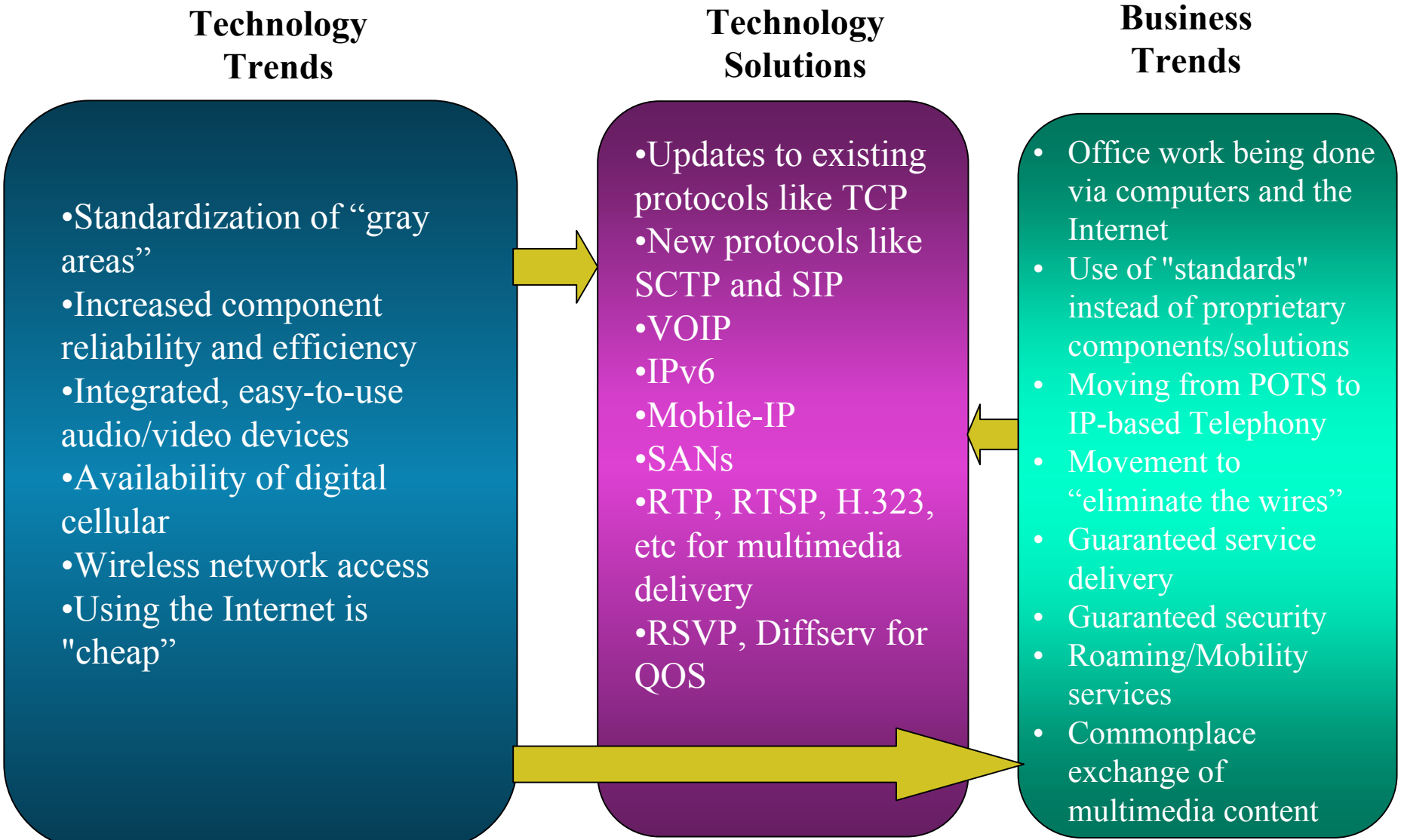
Agenda

- HP-UX Internet Infrastructure – A business perspective
- HP-UX Enabling Network Technologies
  - IPv6 for the Wireless and Mobile Internet
  - Mobile IPv6
  - IPv6 Routing
  - IPv6 over PPP
  - PPP over Ethernet
- Q & A

HP-UX Internet Infrastructure – A business perspective



HP-UX Enabling Network Technologies

- HP-UX Mobility Enablers - To facilitate roaming without losing connectivity (i.e. “Always-On”)
  - Mobile IPv6
  - Router Advertisement Daemon
  - Multicast Listener Discovery
  - Mobile IPv4
  - AAA Support in HA/FA Mobility Agents
  - IPSec for IPv6

HP-UX Enabling Network Technologies

- HP-UX Wireless Enablers - To facilitate use of the various services from anywhere
  - "Wireless TCP", including TCP Limited Transmit
  - DNS performance improvements
  - EAP authentication using a Radius AAA server

HP-UX Enabling Network Technologies

- HP-UX Routing Enablers - To insure that packets get from Point-A to Point-B
  - RIPng
  - BGP4+
  - IS-ISv6
- HP-UX Internet Connectivity Enablers – Via dial-up or dedicated lines, to provide connections to end-users or local network domains
  - PPP over IPv6
  - PPP over Ethernet

IPv6 for the Wireless and Mobile Internet

- Why IPv6
- Benefits of IPv6
- Advantages of IPv6
- IPv6 Product Features
- IPv6 Deployment
- HP-UX Roadmap for IPv6
- IPv6 Strategy

Why IPv6

IPv4

- Uses a 32-bit address
- Running out of internet addresses
- Security was an add-on
- System management is complex and slow
- Incredibly successful
- 20 + years old

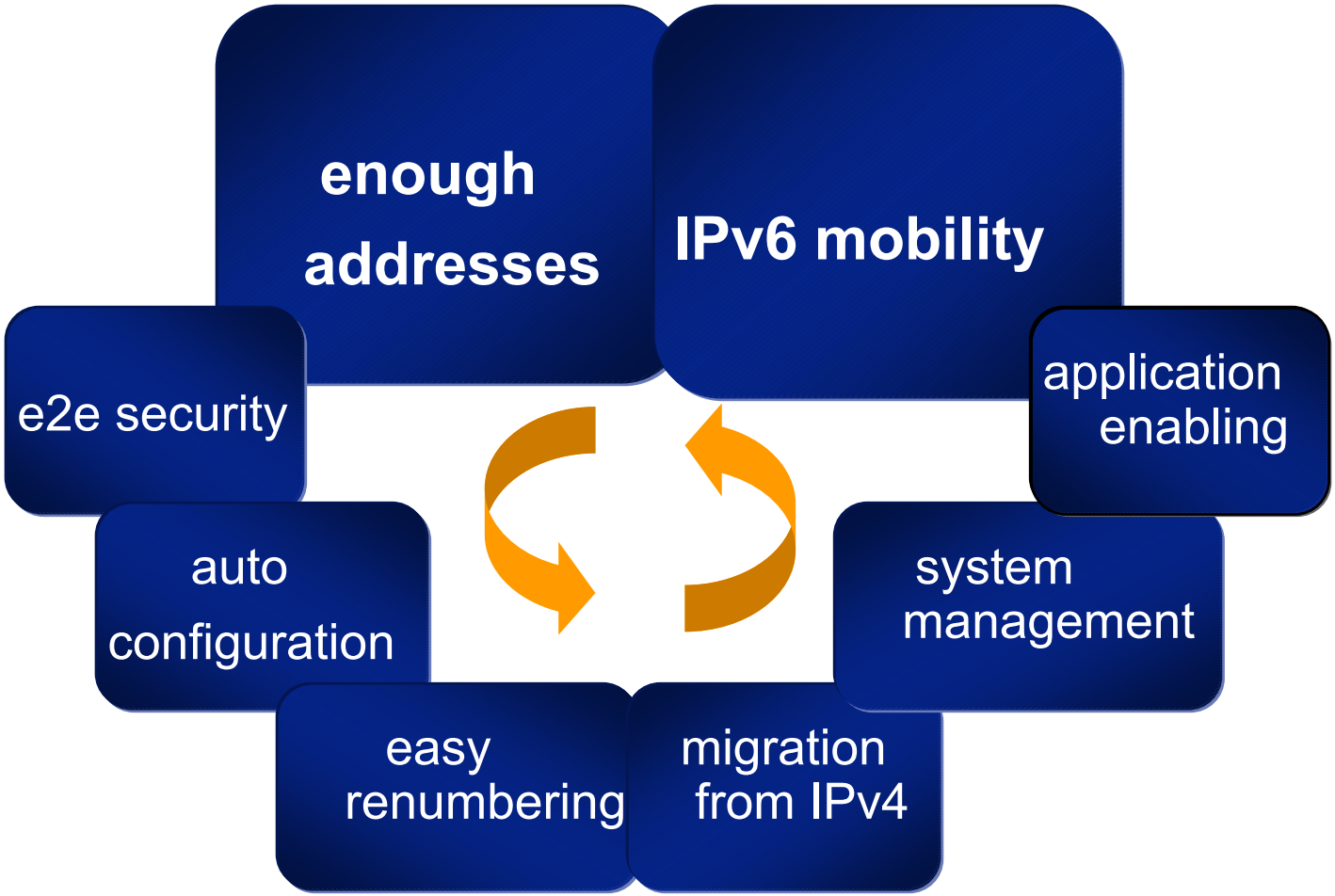
IPv6

- Uses 128-bit addressing
- Enough address space to give every human on the planet a unique IP address
- Mandatory and effective IP security
- Less Infrastructure Maintenance and complexity required
- More efficient Mobile IP = seamless service availability
- Architecture of the future = Next Generation internet protocol

Benefits of IPv6

- Increased Address Space - 2^128 is a really big number
  - Enough unique addresses for all devices
- Reduce common-case processing cost of pkt handling
- Efficient and Extensible IP datagram
  - Fixed Size IPv6 Header, Fewer fields in basic header
- Efficient option processing
  - Processing of most options limited performed only at destination
- Performance Wins Processing
  - Remove checksum from Network Layer
  - No fragmentation in the network
- Efficient Route Computation and Aggregation

Advantages of IPv6



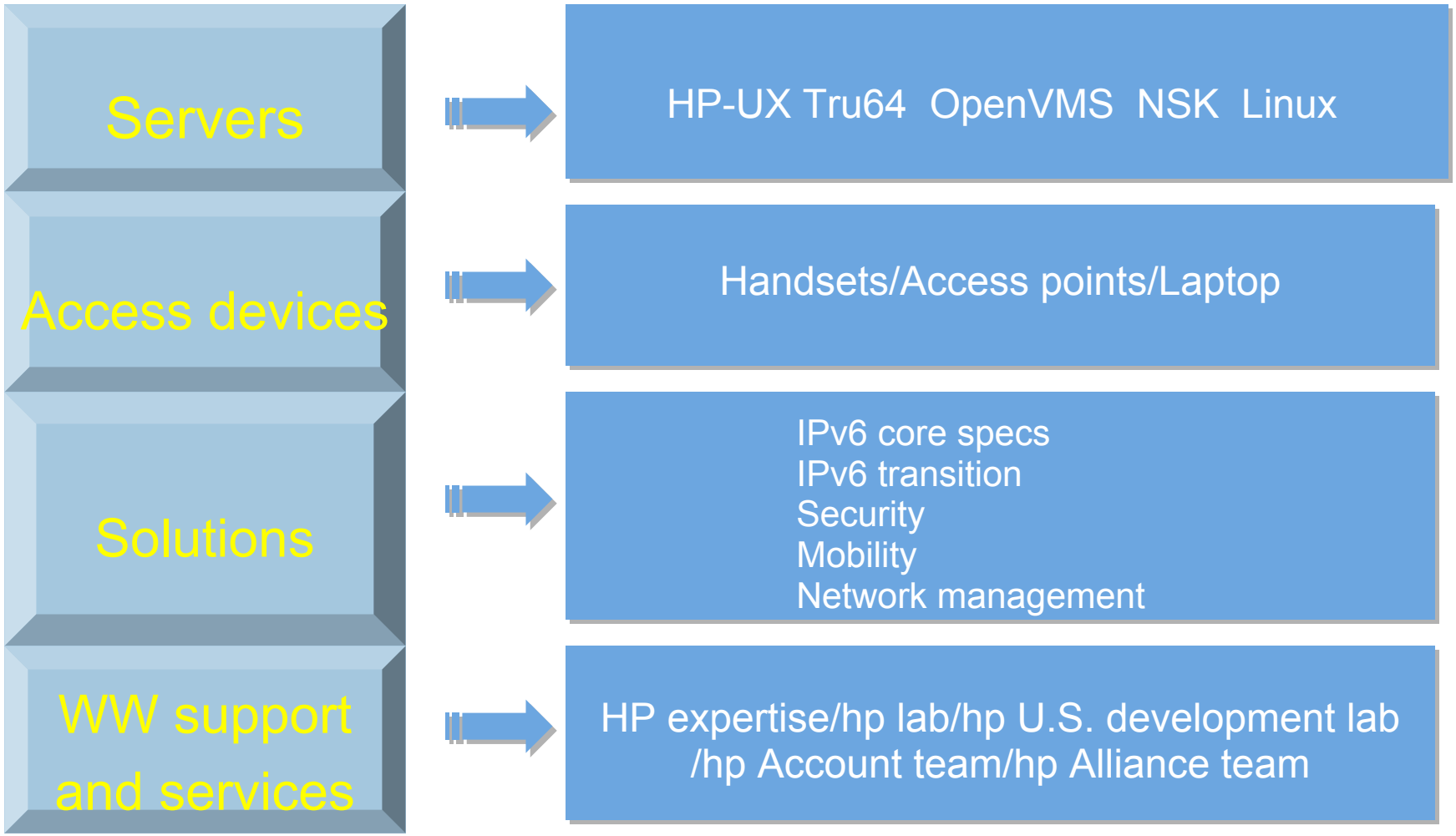
IPv6 Product Features

- Large address support
  - 128-bit addresses
- Natural Mobility support
  - Autoconfiguration
  - Routing Headers
  - Built-in security
  - Integrated support for QoS (Traffic class & Flow label)
- IPv4/IPv6 Dual Stack support
- Internet solutions such as BIND9, DHCPv6, ftp, telnet, inetd, sendmail, and nslookup have been integrated with HP-UX IPv6

IPv6 Product Features

- Provide complete IPv6 Internet solution
- Having IPv6 enabled services are key to the success of IPv6. For example, the following HP-UX products will be integrated with HP-UX IPv6 seamlessly:
  - Mobile IPv6
  - IPSec
  - OpenView
  - HA / ServiceGuard
  - SAM
  - NFS
  - Apache Web Server
  - FDDI, PPP, ATM
  - Java Virtual Machine (JVM)

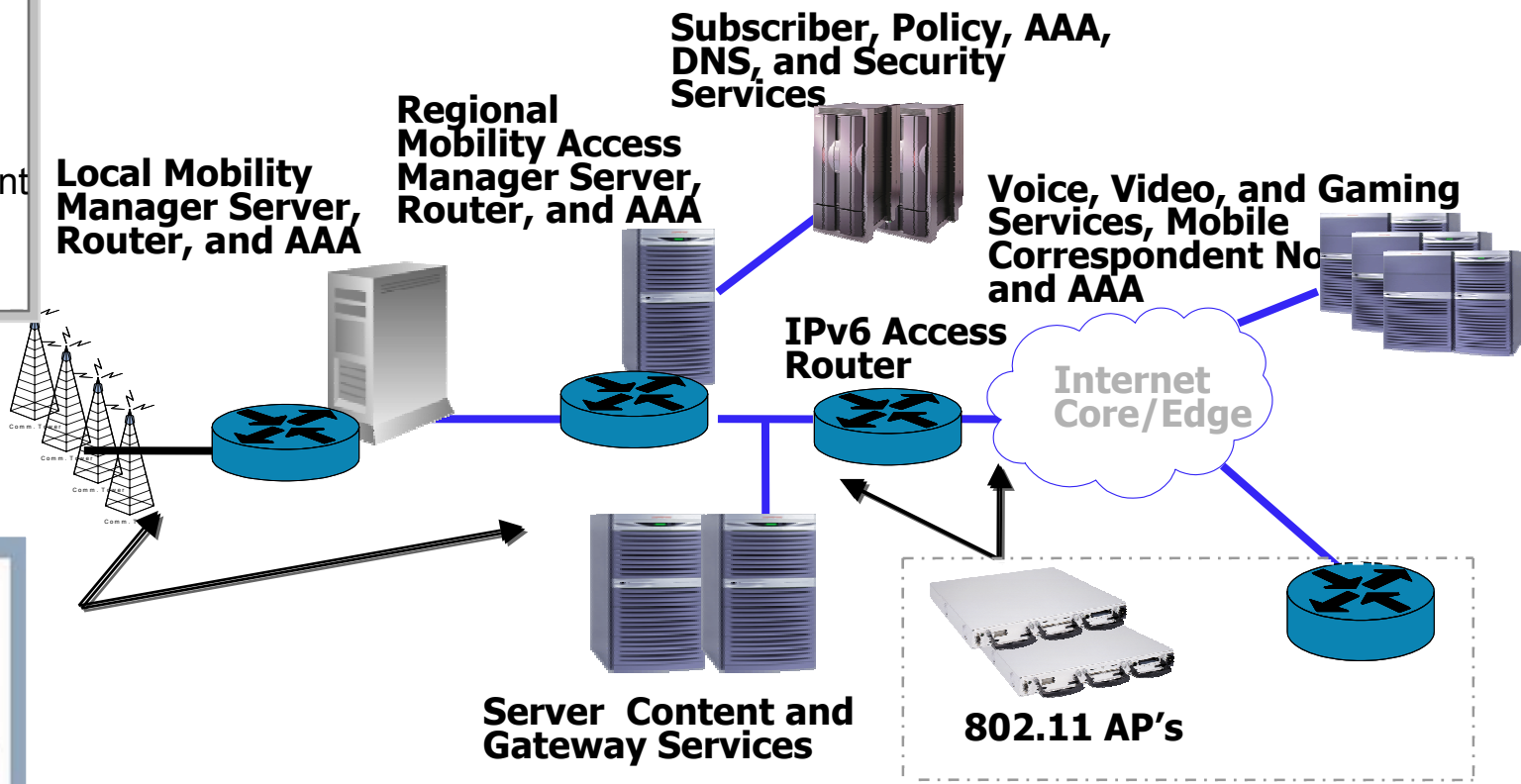
IPv6 Deployment



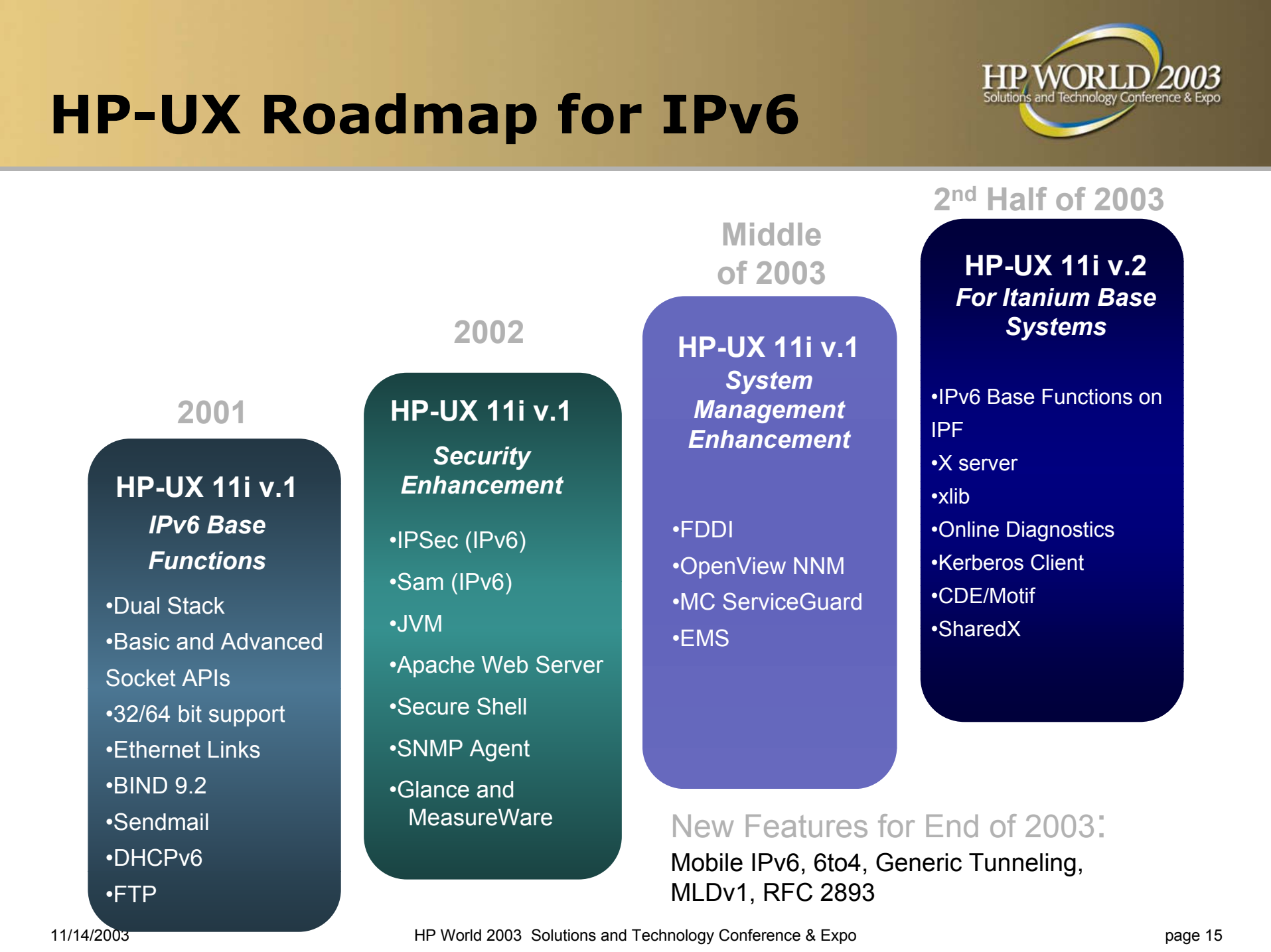
IPv6 Deployment

Example: End-2-End IPv6 Mobile Wireless Services

HP products
- Server
- Handsets
- Access points
- Laptop
- Network management stations
- Emerging platform



HP-UX Roadmap for IPv6



New Features for End of 2003:

Mobile IPv6, 6to4, Generic Tunneling, MLDv1, RFC 2893

IPv6 Strategy

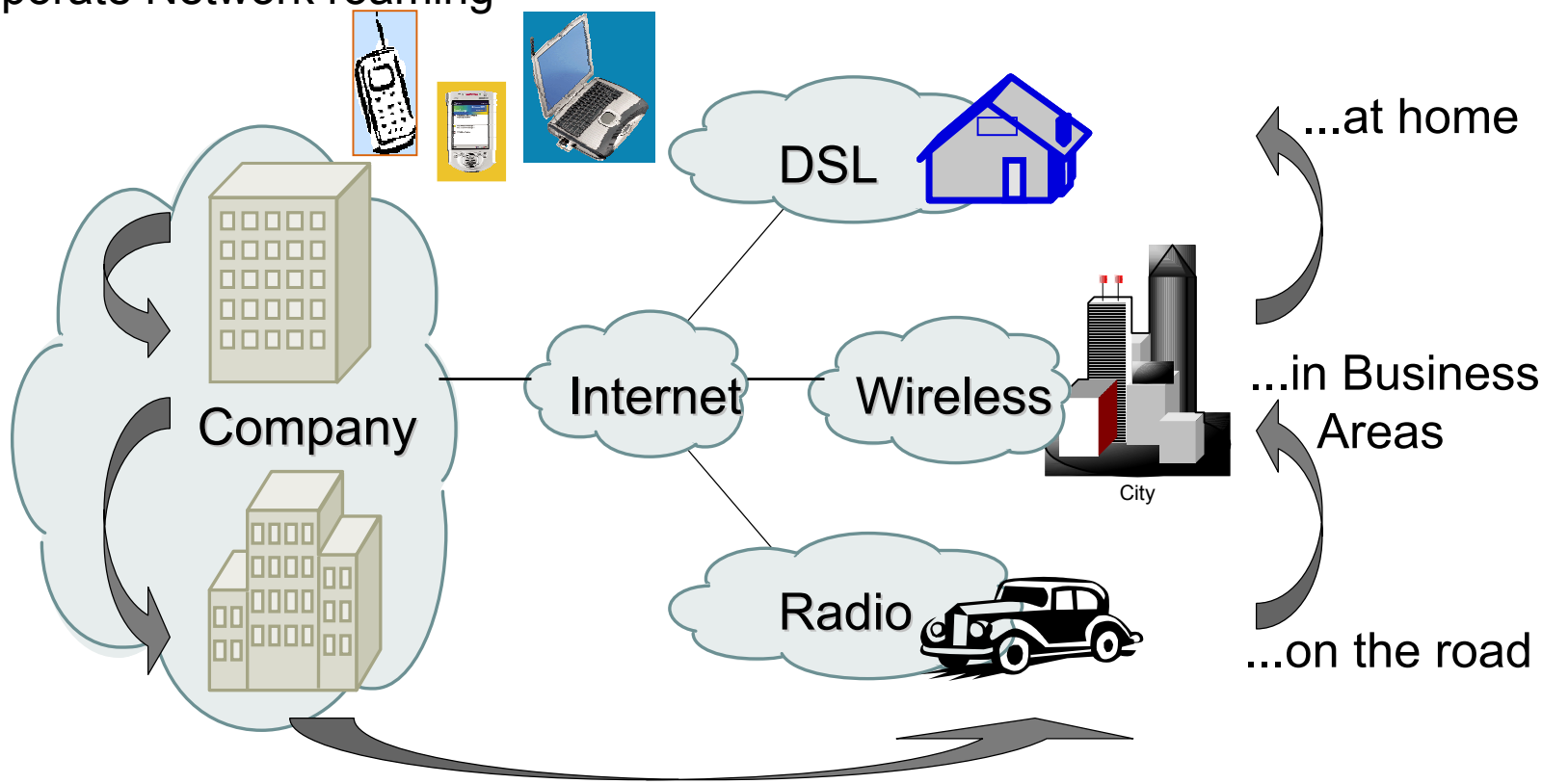
- Will provide an Internet evolution to support connectivity of devices and people worldwide
  - At a scale that is beyond the dreams of the Internet when it was created, or as it exists now, where devices are pervasive and ubiquitous and people are mobile
  - Advanced Industry adoption of IPv6
    - Services
    - Solutions
    - Platforms
    - Secure Infrastructure
    - Network Management infrastructure
    - Research and Development
      - (e.g. Multimedia, Grid Computing, Sensor Devices)

Mobile IPv6

- Benefits of Mobile IPv6
- Advantages of Mobile IPv6
- Mobile IPv6 Product Features
- Architecture of “Mobile IP Agent Platform”
- Mobile IPv6 Deployment
- Mobile IPv4 Deployment with AAA
- HP-UX Roadmap for Mobile IP

Benefits of Mobile IPv6

- To enable telecom customers to provide secure continuous connectivity anytime anywhere
- Mobile users, workers, travelers
- Corporate Network roaming



Advantages of Mobile IPv6

- Tightly-Coupled with IPv6 Protocol
  - Large Address space (no NATing is needed)
  - Stateless and Statefull Address Autoconfiguration for Care-of-Address
  - Leverages AH and ESP IPv6 headers for security
  - New IPv6 Extension header (Mobility Header) for MIPv6 control messages
  - Modified IPv6 Routing header for better performance and less overhead

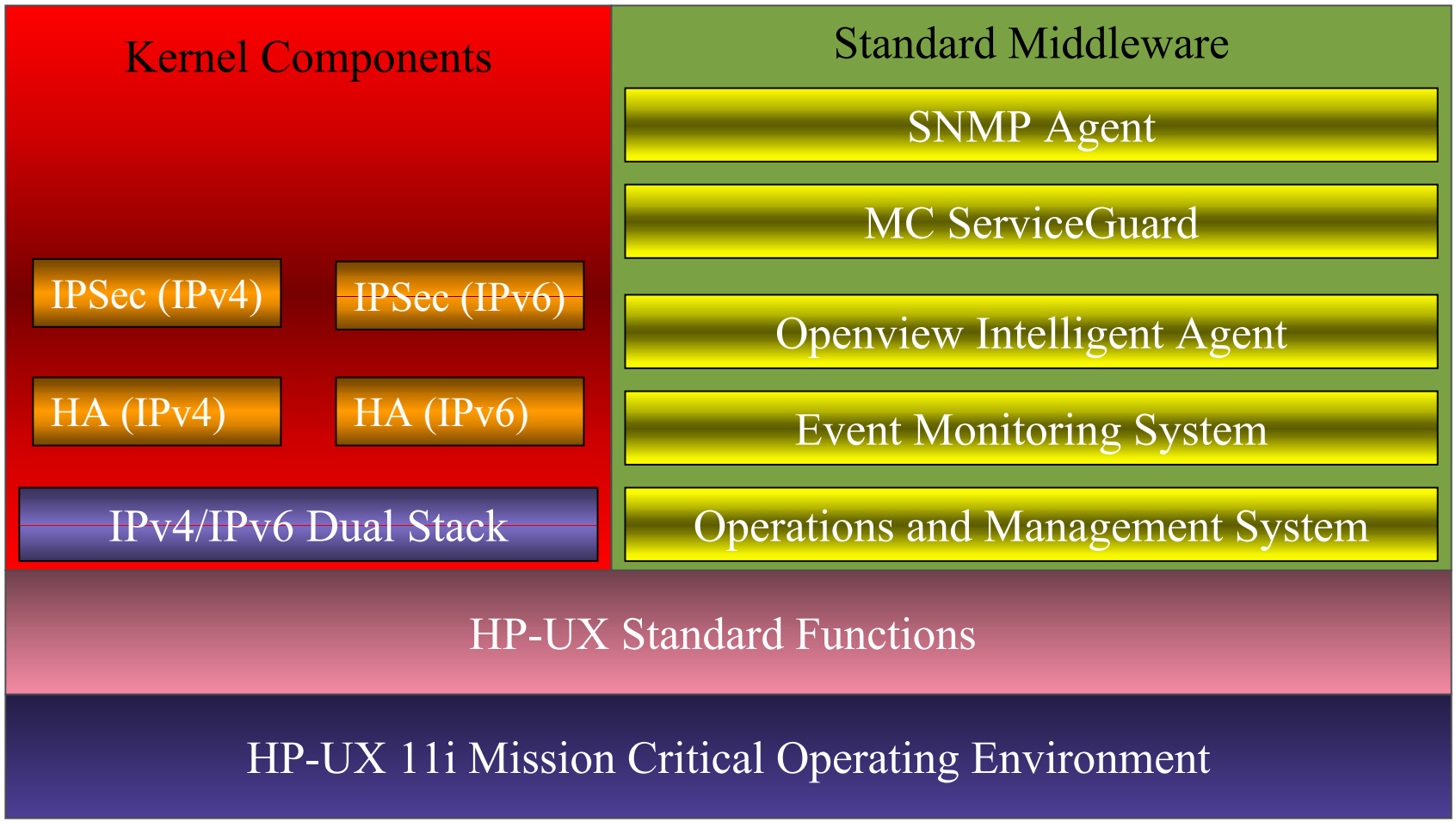
Mobile IPv6 Product Features

- Standards Features (Draft 23)
  - Home Agent support
  - Correspondent Node support
  - Route Optimization support
  - Reverse Tunnel support
  - IPSec (MN-HA)
  - MN-CN authentication (Return Routability)
  - Dynamic Home Agent Address Discovery

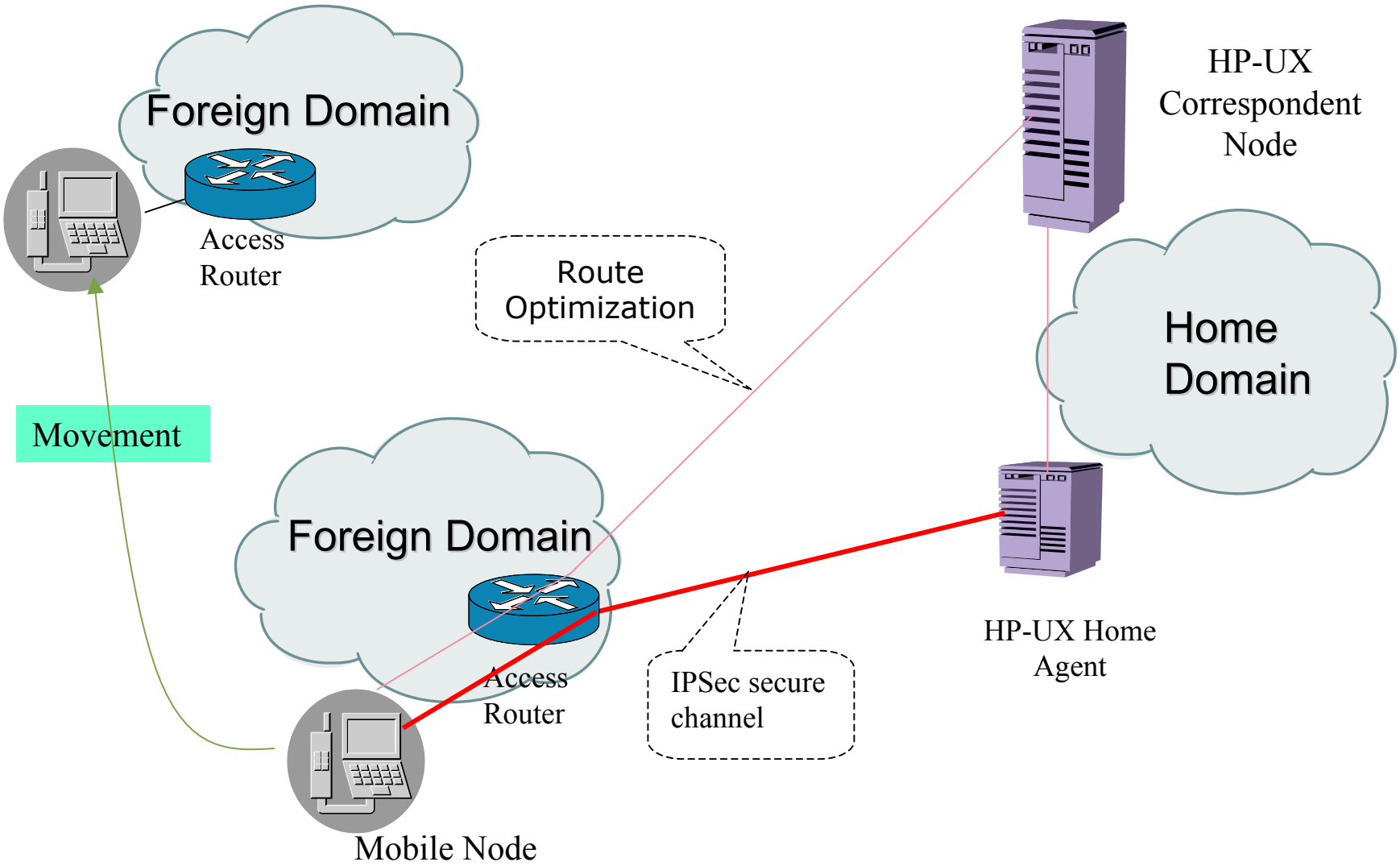
Mobile IPv6 Product Features

- Product Deployment Features
  - Automatically Disabling/Enabling IPSec based upon location
  - Dynamic Configuration
  - High Availability for HAs
  - Load Balancing among HAs
  - Mobile IPv6 MIB
  - Event Monitoring
  - AAA (MN authentication and authorization)
  - AAA (MN accounting statistics)
  - AAA (Key generation and distribution)

Architecture of "Mobile IP Agent Platform"

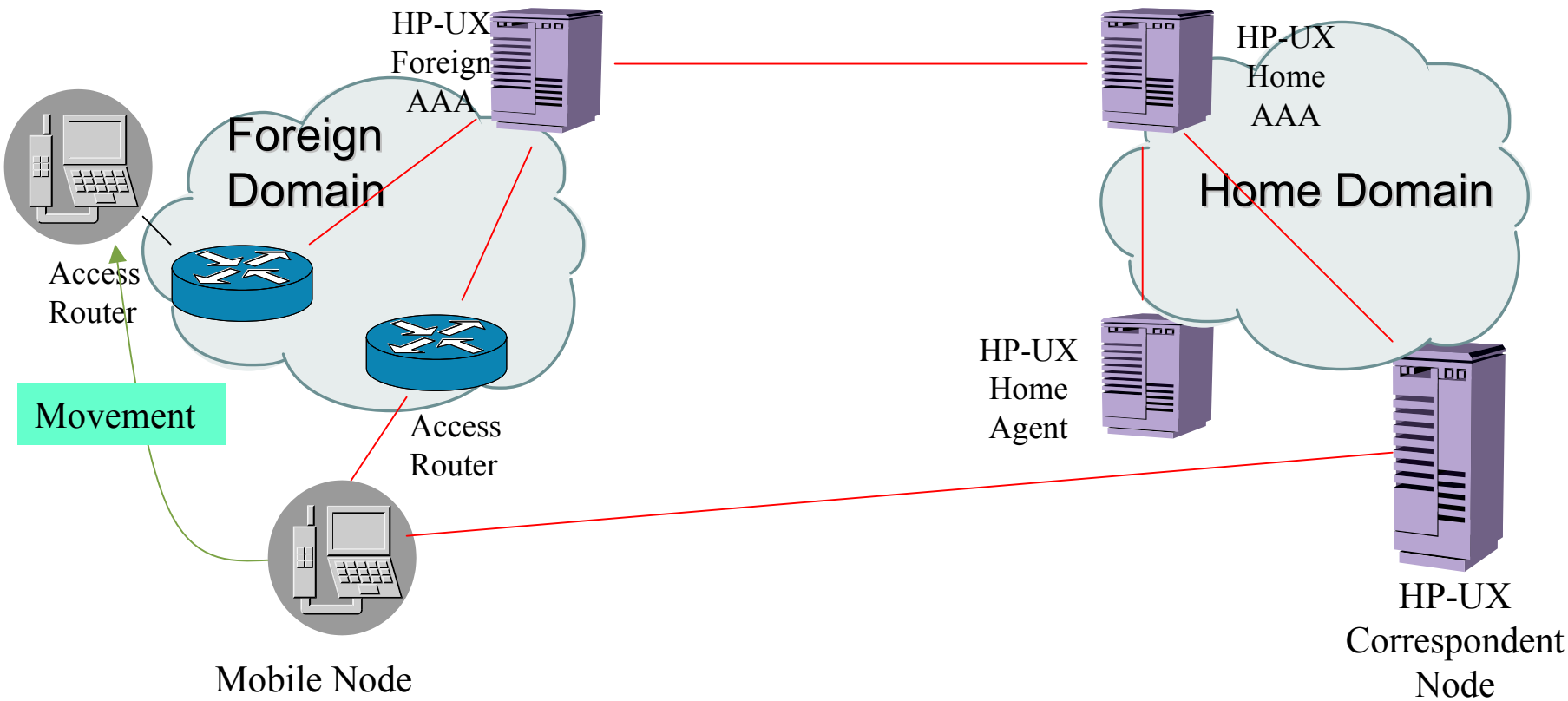


Mobile IPv6 Deployment



Mobile IPv4 Deployment with HP-UX AAA Server

- AAA provides mobile node authentication and authorization while visiting foreign networks
- Scalable key generation and distribution feature



HP-UX Roadmap for Mobile IP

- MIPv6 Prototype product (draft 15) demonstrated at
  - HP World (Los Angeles, CA)
  - Network+Interop (Tokyo, Japan)
  - IPv6 Forum (Washington D.C.)
- MIPv6 Prototype product (draft 20) successfully tested at Connectathon 2003 – March 2003
- MIPv6 Product Release (RFC) – Q1/2004
  - HP-UX 11.11 (PA)
  - HP-UX 11.23 (IPF)
- MIPv4 Product Release with AAA support – April 2003
  - HP-UX 11.11 (PA)

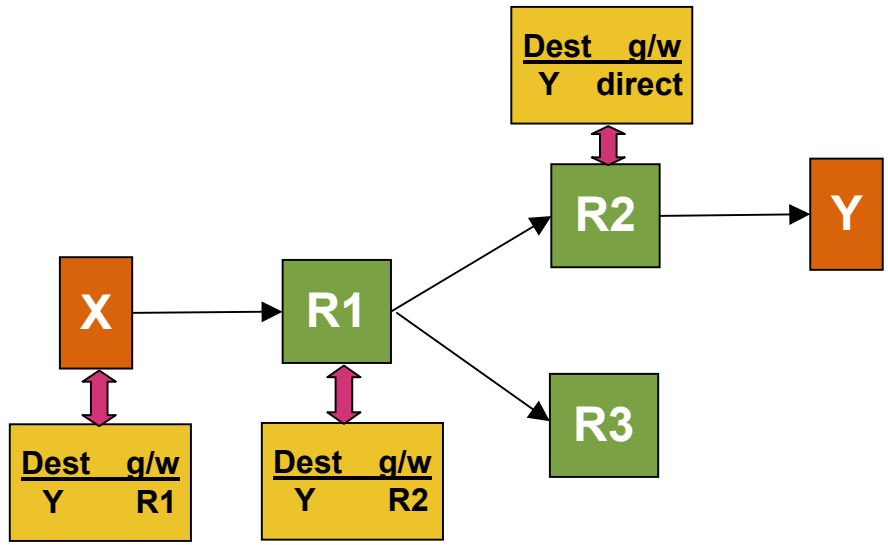
IPv6 Routing

- Routing basics
- IPv6 routing concepts
- Static routing Vs Dynamic routing
- RIPng protocol
- IPv6 routing infrastructure on HP-UX
- HP-UX roadmap for IPv6 routing

Routing Basics

What is Routing?

- Moving packets from a source to a destination on the internet
- Each host/router on the internet uses its routing table to make a decision on the path the packet should traverse
- Routing table is part of the network layer.



Routing Basics

IPv6 Routing Table

A sample IPv6 Routing table is as follows:

Destination/Prefix	Gateway	Flags	Refs	Interface	Pmtu
::1/128	::1	UH	0	lo0	4136
fe80::210:83ff:fe18:886f/128	fe80::210:83ff:fe18:886f	UH	0	lan0	4136
fe80::/10	fe80::210:83ff:fe18:886f	U	2	lan0	1500
default	fe80:: 210:83ff:fe18:886f	UG	0	lan0	1500

Forwarding Algorithm

- Longest prefix match
  - Transmitted on the local link if the destination is also on the same link.
  - Transmitted to the router if the destination is on a different link.

IPv6 routing concepts

Problems with IPv4 Routing

- No relationship between addresses and topology
- Need for core routers to maintain a route table entry for every network

IPv6 Routing Solution

- Provider-based addressing
- Hierarchical addressing aids in route aggregation
- Need for core routers to maintain a single route table entry per provider

Static Routing Vs Dynamic Routing

Static Routing

- Manual addition of routes by the administrator
- Inability to handle outages or down connections
- Difficult to configure on large networks

Dynamic Routing

- Dynamic discovery of routes by routing protocols
- Optimal routes
- Automatic handling of outages and down connections

RIPng

- IGP – Interior Gateway Protocol
- Belongs to the distance vector class
- Same design of RIPv2
- Important requirement for immediate deployment of IPv6
- Next-hop limit of 15
- Uses UDP port 521 and the multicast address ff02::9
- New feature: Next-hop RTE

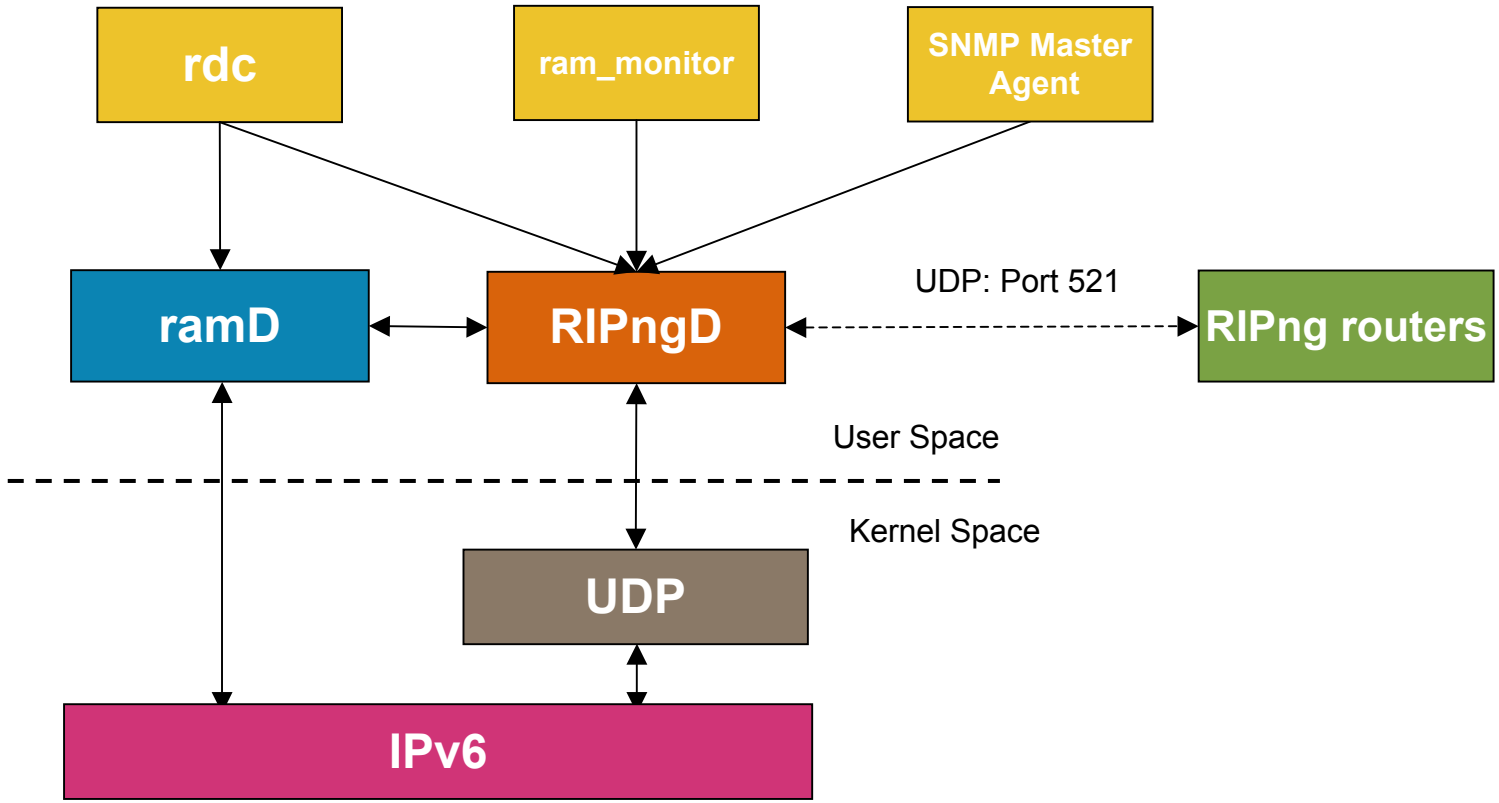
IPv6 Routing Infrastructure on HP-UX

ramD (Route Administration Manager Daemon)

- Role of ramD
  - Reads the /etc/ramd.conf file and initializes the configured routing protocols.
  - Maintains a routing table in the user space and synchronizes it with the kernel forwarding table.
  - Notifies the routing protocol daemons of changes in the kernel forwarding table and the interface table.
  - Redistributes routes between the various routing protocol daemons.

IPv6 Routing Infrastructure on HP-UX

ramD & RIPngD Architecture



IPv6 Routing Infrastructure on HP-UX

The rdc Utility

The RDC utility can be used to:

- Restart and reconfigure ramD & RIPngD.
- Produce status dumps and core dumps.
- Retrieve kernel interface table information.

The ram_monitor Utility

- Establishes a connection with ripngd.
- Retrieves forwarding table or interface table information from the kernel.
- Enables or disables ripngd tracing.

IPv6 Routing Infrastructure on HP-UX

Sample ramD Configuration File

```
preference ripng 100;
preference static 20;
preference direct 10;

ripng on {
    admin up;
    cliport 15000;
    maxroutes 30000;
};

kernel {
   scaninterval 40;
   routepoll on interval 50;
   remnantholdtime 1;
   traceoptions "/var/tmp/ramd/ramd.trace" size 2m files 3 all except nostamp;
};
```

HP-UX Roadmap for IPv6 Routing

- RIPng – Q3/2003
  - HP-UX 11.11 (PA)
- BGP4+ and IS-IS (IPv6) – Q4/2003
  - HP-UX 11.11 (PA)

IPv6 over PPP

Point-to-Point Protocol

- Need for PPP
  - Transmission of packets over serial links
- Components of PPP
  - Encapsulation of datagrams over serial links
  - A Link Control Protocol for establishing, configuring and testing the data link
  - Network Control Protocols for establishing and configuring different network layer protocols

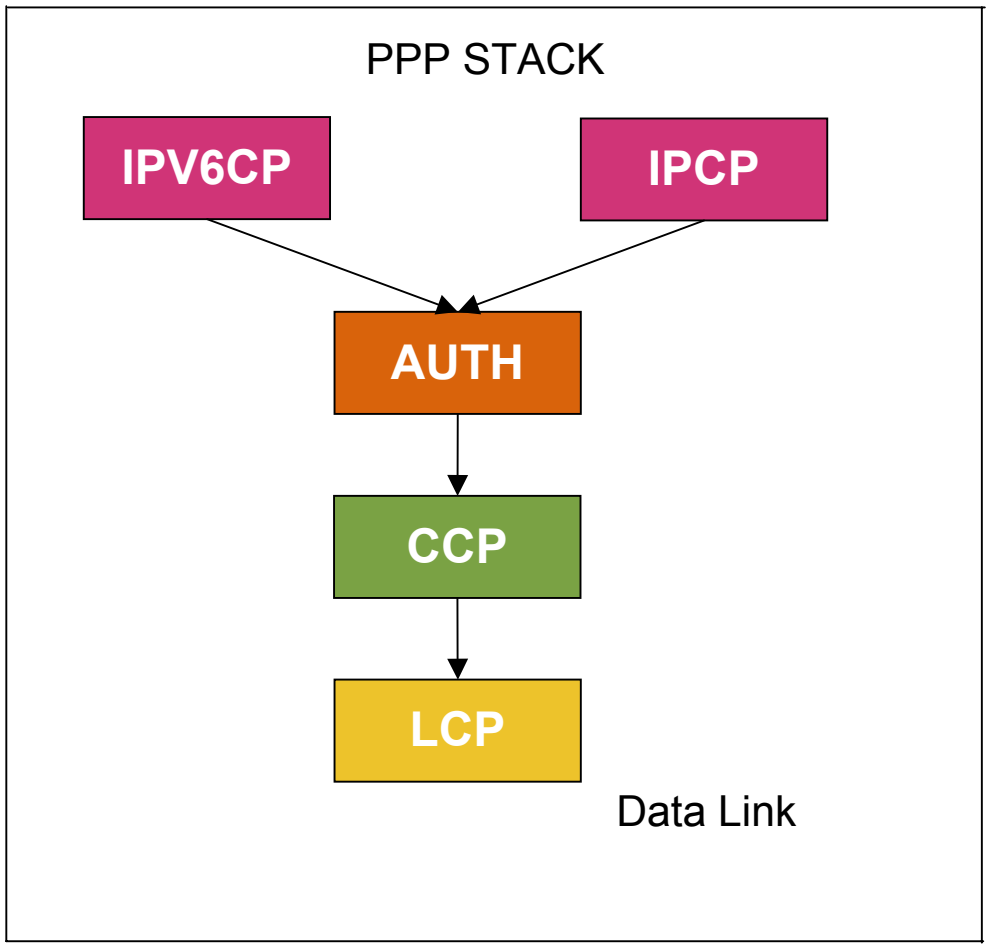
IPv6 over PPP

IPV6CP - IPV6 Control Protocol

- Network Control Protocol for IPv6 over PPP
- Configure IPv6 modules on either end of the PPP link
- Negotiate IPv6 parameters for the PPP session
  - IPv6 Interface-Identifier
  - IPv6-Compression-Protocol
- fe80:: is appended with the negotiated interface-identifier to generate the link local address
- No need for Duplicate Address Detection(DAD)

IPv6 over PPP

How IPV6CP Fits in PPP



IPv6 over PPP

Configuring IPv6 over PPP

- Same as that of existing pppd
- New command-line options added to pppd for supporting IPv6
  - exec6
  - ipv6 local-ifid, remote-ifid
  - noipv4
  - need-ip6-ifid

Point-to-Point Protocol over Ethernet

PPPoE overview

- Connects users on Ethernet to the Internet using broadband access device.
- Based on the cost-effective LAN technology, such as Ethernet.
- Provides administrative controls of PPP.
- No permanent connections.
- Specifications in RFC 2516

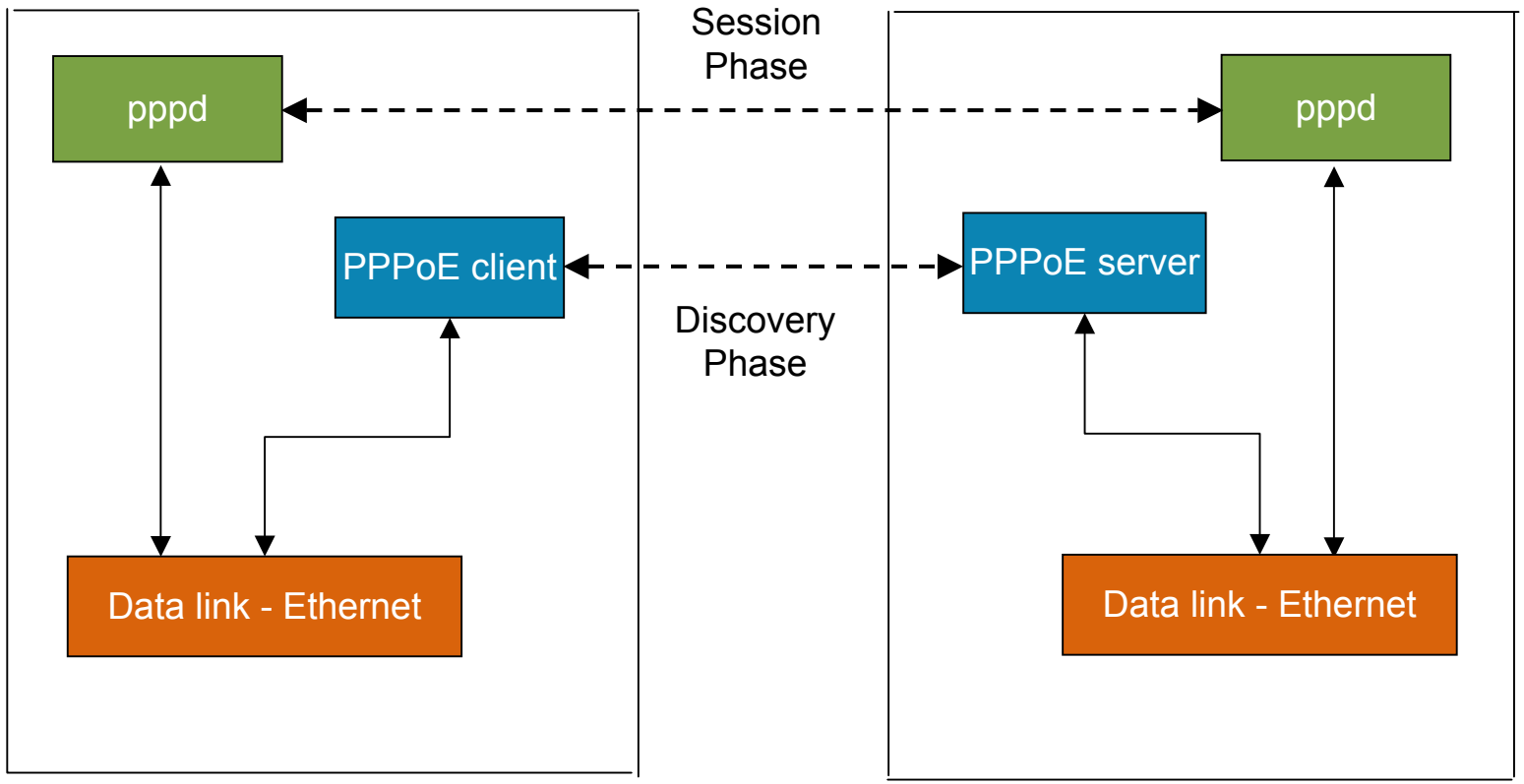
Point-to-Point Protocol over Ethernet

PPPoE Protocol Overview

- Discovery phase
  - The PPPoE client identifies Access concentrator that is able to provide the required services.
  - The PPPoE client and the server allocate the necessary resources for the PPPoE session.
- Session phase
  - Actual PPP session.
  - PPP data is encapsulated in PPPoE header and transmitted over Ethernet.

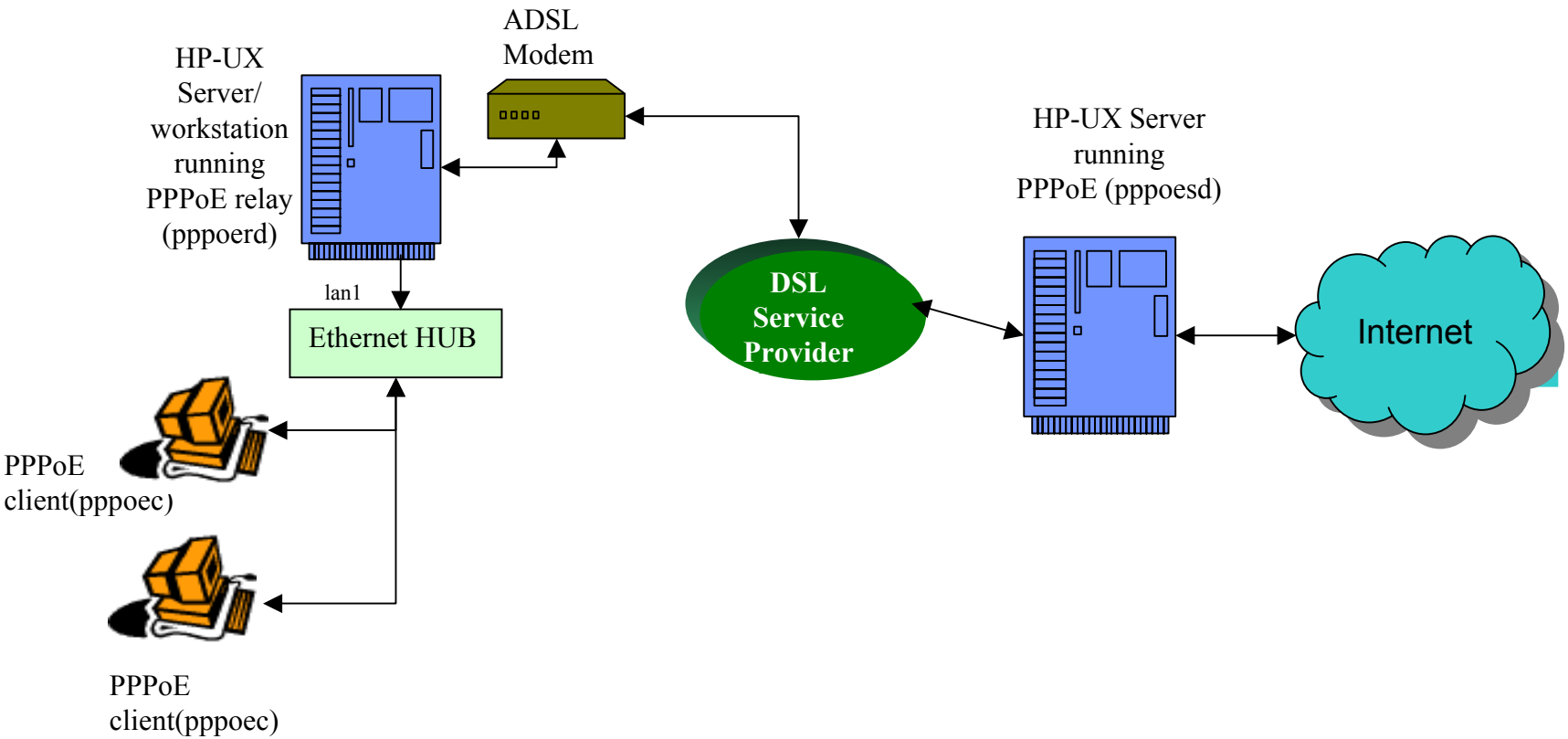
Point-to-Point Protocol over Ethernet

How PPPoE Works



Point-to-Point Protocol over Ethernet

PPPoE - Typical Deployment Scenario



Point-to-Point Protocol over Ethernet

Configuring PPPoE

- Configuration files in /etc/ppp/

```
# PPPoE client configuration file
[ lan0 ]
service=isp
acname=gatt3
host_unique=0
timeout=120
retry-number=4
pppd-options=debug 11  log /tmp/pppoec.log
enable_ipv6=1
```

```
# PPPoE server configuration file
[ lan1 ]
service=isp
acname=gatt3
ac_cookie=2
timeout=120
local-ipv4-address=9.2.3.4
ipv4-address-pool=2.6.7.8 - 2.6.7.20
local-ipv6-identifier=::9
ipv6-identifier-pool=::10 - ::15
pppd-options=debug 11 log /tmp/pppoesd.log
```

Questions and Answers

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