Qwest IPv6

Engineering & Certification

1/31/2011

Qwest BUSINESS

Government Services

Agenda

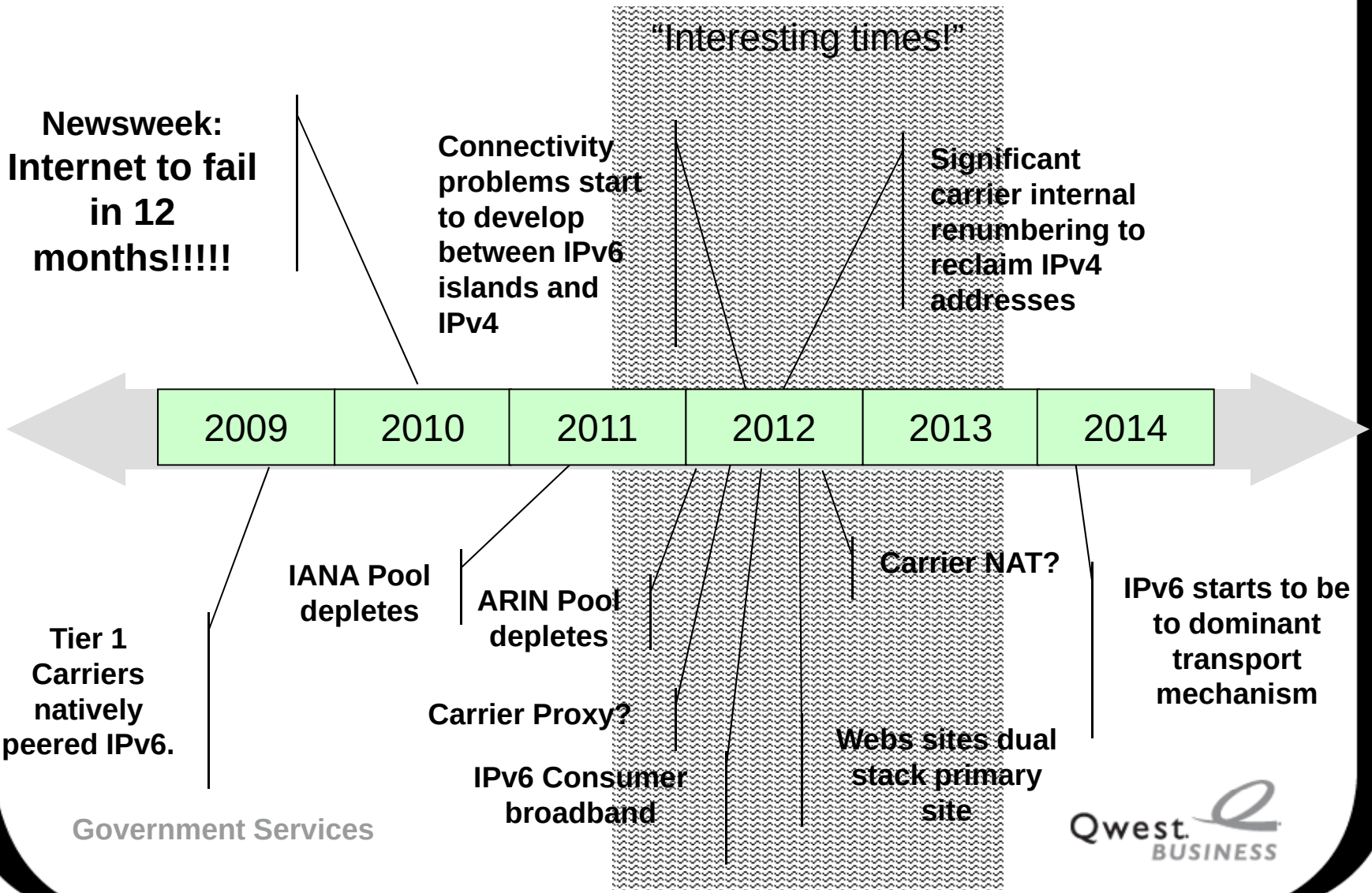
- Qwest IPv6 history
- IPv4 Depletion & Carrier Timeline
- IPv6 Service objectives
- Qwest IP Networks => IPv6 Networks?
- IPv6 Implementation: Public port (6PE)
- IPv6 Implementation: Private port (6VPE)
- IPv6 DNS
- Next steps

Qwest IPv6 history

- **Obtained 6bone Pseudo Next Level Aggregator (pNLA) from Abilene in 1999**
- **Obtained production Sub Top Level Aggregator (sTLA) 2001:428::/35 in 2000 (now /32)**
- **Built IPv6 test network in 2000**
  - Native IPv6 across OC3s and Generic Routing Encapsulation (GRE) over IPv4 OC48s
  - Alpha customers connected via GRE over existing IPv4 circuits
- **Built to gain experience with operating a native IPv6 network**
  - Gauge customer interest
  - Maintains v6 peering connectivity
- **Supported Government customers meeting June 2008 Mandate**
  - Mostly decommissioned now as production network is ready
- **Started in 2007 preparing the IP backbone for IPv6 services**

Qwest BUSINESS

IPv4 Depletion & Carrier Timeline

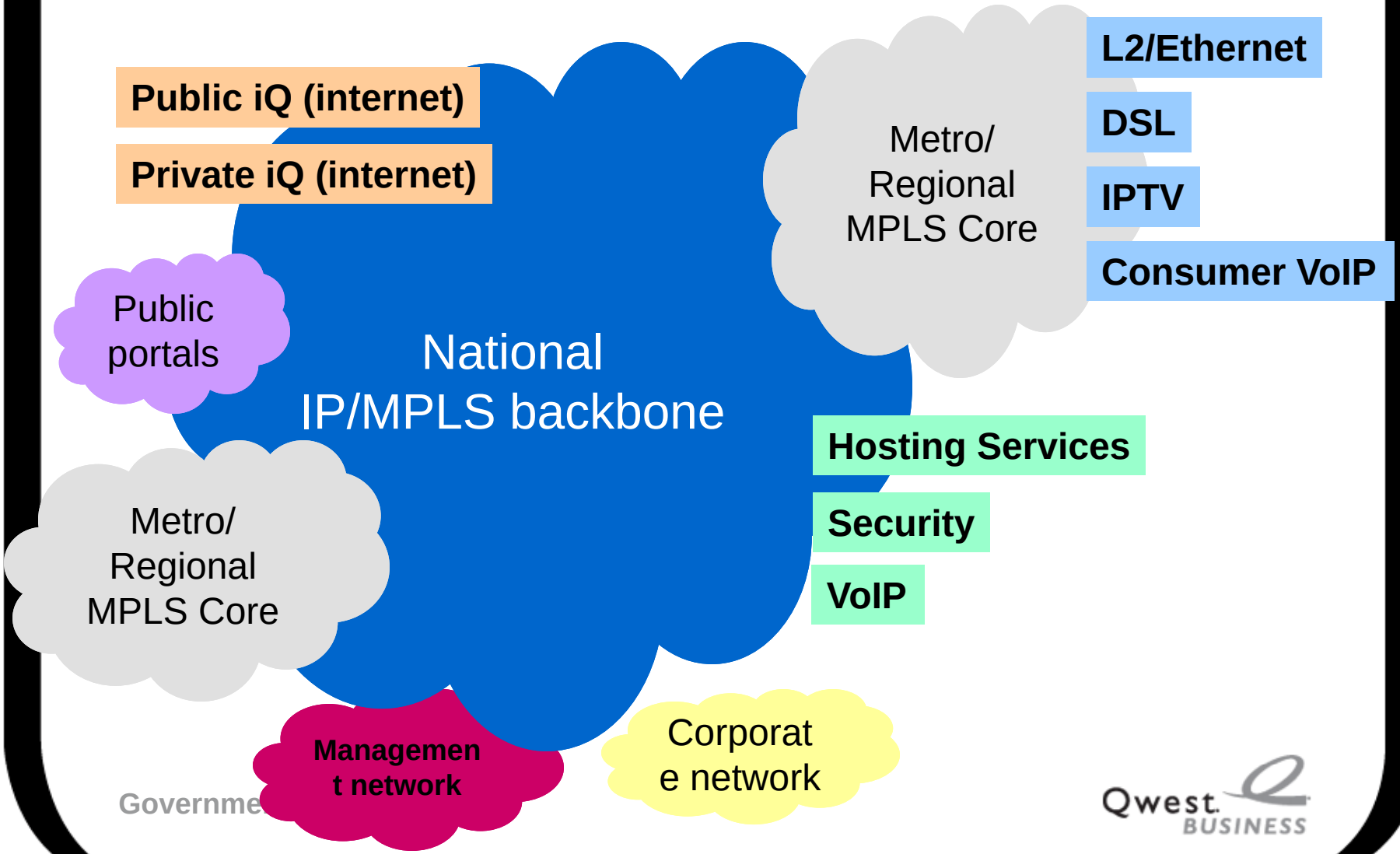


IPv6 Service objectives

- **Enable IPv6 equivalents of existing IPv4 iQ services**
  - Public port – Connect to the public internet
    - Options include customer static routes, BGP with customer, Qwest vs. customer address space
  - Private port – L3VPN product
- **Enable full mixing of IPv4 and IPv6 on the same physical port**
  - In full complexity, an enhanced port would offer public access and private L3 VPN for both v4 and v6 on a customer single Interface
  - Across all interface types (Ethernet, POS/TDM, ATM, FR)
- **Operations model:**
  - Fully integrated. No overlay. No special operations group. Same systems as IPv4.

Qwest BUSINESS

Qwest IP Networks => IPv6 Networks

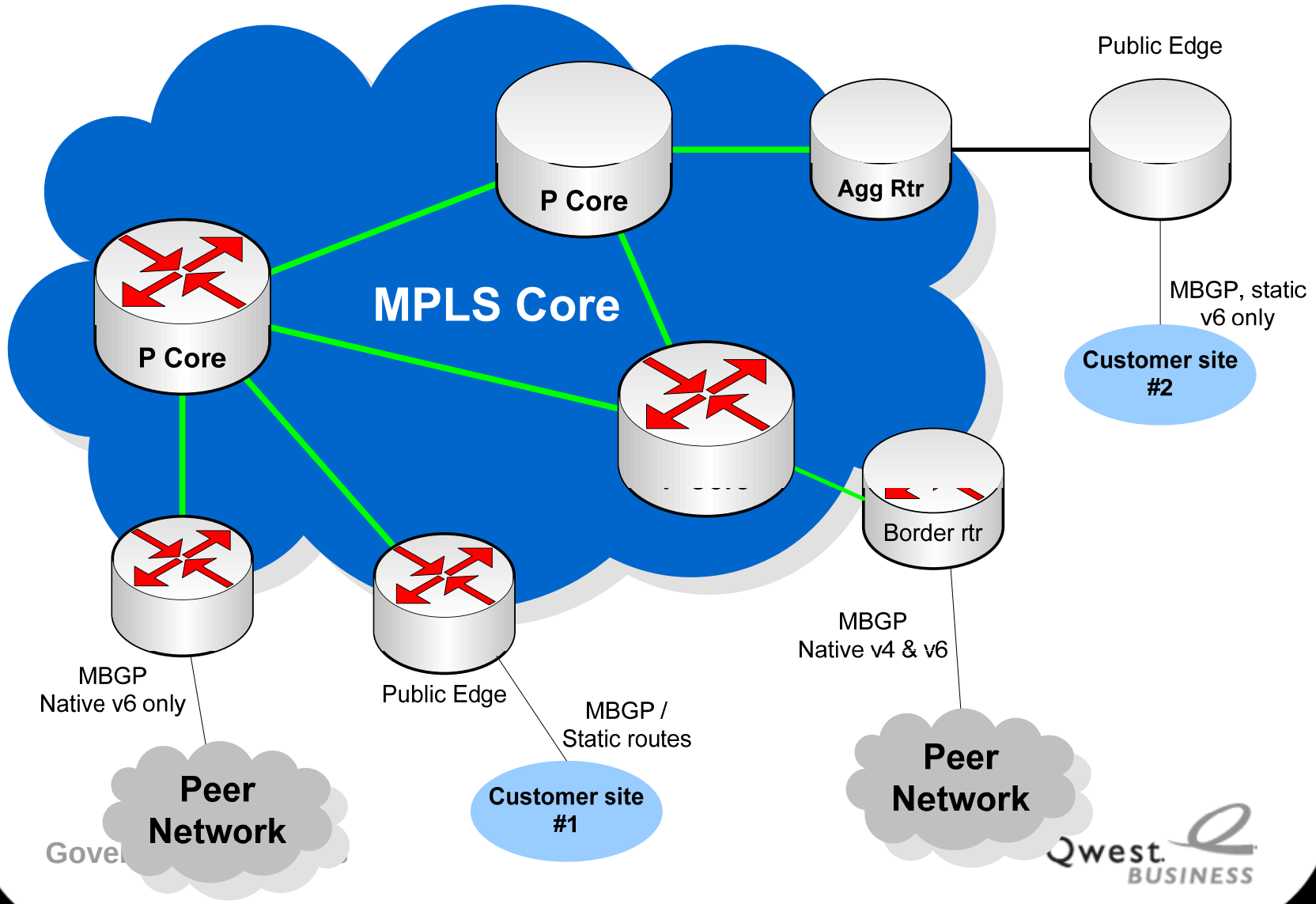


IPv6 Implementation: Public port (6PE)

- **Use a dual stack design**
  - On the border, public edge and aggregation routers
- **Same set of LSPs used for v4, v6 traffic**
  - IPv4 control protocols manage the LSP topology
- **Protocols**
  - v6 extensions for ISIS
  - v6 MP-iBGP
  - v6 MP-eBGP for peering connections
- **Peering uses existing ports/same border routers**
  - Tunneling had to be added to support peers that are not native yet
- **Status:**
  - 6PE certification complete. Operationalization complete
  - Production peering complete on 18 brdr routers
  - Certification ongoing to round out public footprint

Qwest BUSINESS

IPv6 implementation: 6PE Public port



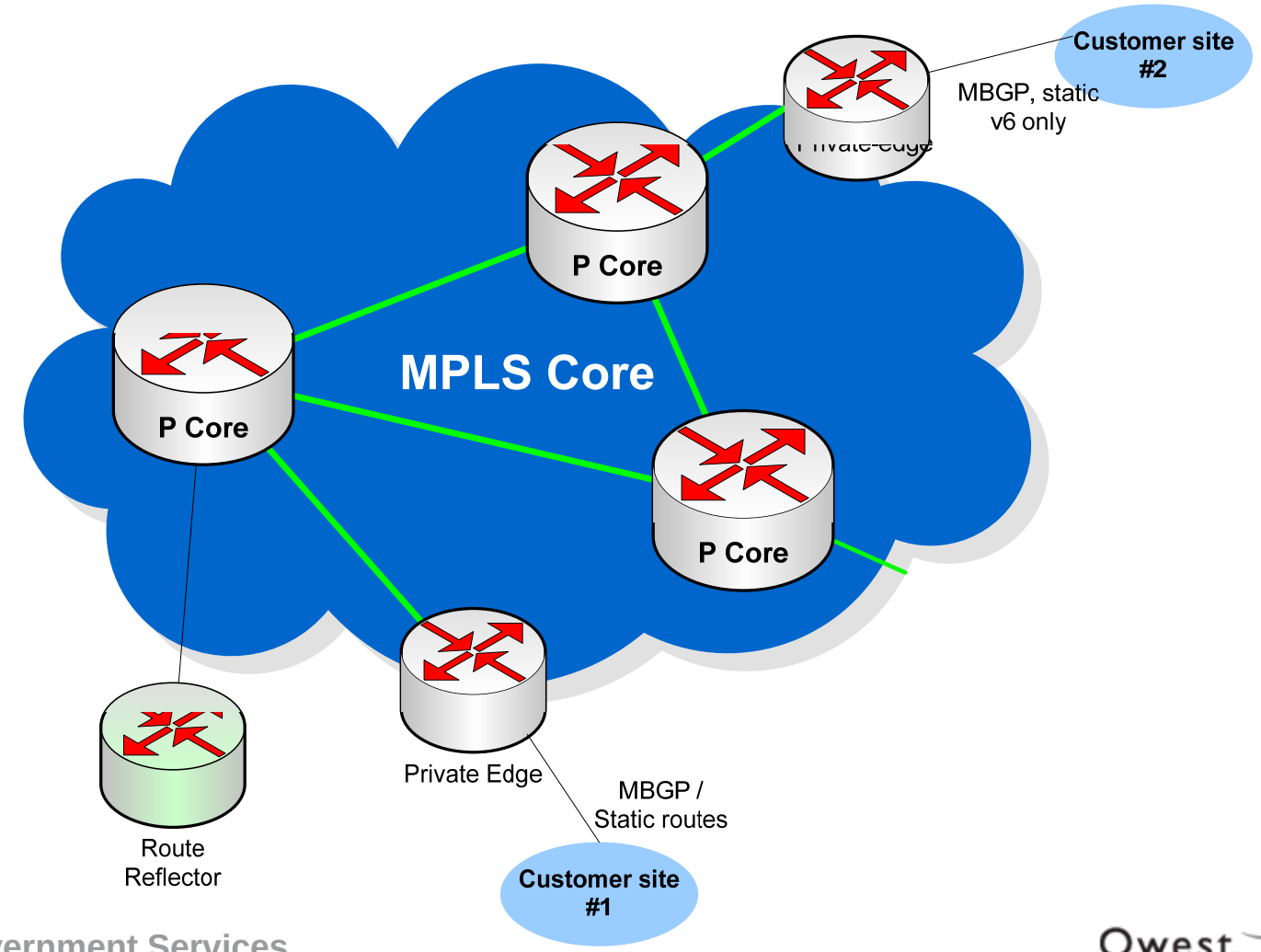
IPv6 Implementation: Private port (6VPE)

- **VPN PE routers are dual-stack enabled.**
- **Any given Closed User Group in a VPN may be IPv4 only, IPv6 only, or both IPv4 and IPv6 at the same time.**
- **Customer access will be native IPv6 on the same circuits as standard IPv4 traffic.**
- **IPv6 traffic will travel across the core IP network inside the same MPLS LSPs as the existing IPv4 traffic.**
  - Separate LSPs from public traffic
- **Support will be as similar to standard IPv4 MPLS VPN service as possible**.

- **Status:**
  - Certified and operationalized. Same footprint as IPv4. Beta customer is being provisioned.

Qwest BUSINESS

IPv6 implementation: 6VPE Private port



Government Services

Qwest BUSINESS

IPv6 DNS

- Qwest has dual stacked its DNS infrastructure
  - Now able to service IPv6 and IPv4 DNS queries for any type of record on the backbone.
  - Qwest can host IPv6 AAAA address records on our authoritative servers along with the corresponding PTR records
    - Systems have been upgraded to support this

```
# dig ipv6.google.com

; <<>> DiG 9.4.3-P1 <<>> ipv6.google.com
;; global options:  printcmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 61094
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 1, ADDITIONAL: 0
<snIP
;; Query time: 166 msec
;; SERVER: 2001:428:101:100:205:171:3:65#53(2001:428:101:100:205:171:3:65)
;; WHEN: Mon May  4 09:03:01 2009
;; MSG SIZE  rcvd: 102
```


Qwest BUSINESS

2011-2012 IPv6 Work items

- **Qwest has a committed IPv6 program**
  - Base services and systems have been done for some time
  - Seeking input as to what brings the most value to our customers
- **Service:**
  - Customer management via IPv6: “Portal”
    - Customer can unplug IPv4 and still use Qwest services
      - Customer service Web sites are IPv6 enabled
      - Customer support (email/IM) IPv6 enabled
  - Security services
    - Improving network based IPSEC/Firewall service support
      - Virus/Scanning/Filtering
    - Awaiting TIC2.0 requirements
    - Enable “enhanced port”

Qwest BUSINESS

2011-2012 IPv6 Work items –con’td

- **Certification/Regression cleanup/waiting for customers to show interest**
  - IPv6 QoS
  - IPv6 Multicast
  - CyberCenter/hosting and the residual public IPv6 ports
- **VoIP**
  - Wholesale VoIP will be first [2011]
  - Consumer VoIP second
- **Mass Market last mile access**
  - Tunneled IPv6 support for xDSL
  - Native Dual Stack support for xDSL

Qwest BUSINESS