IPv6 Training – Case Study: IPv6 Enabling Malaysia's .my Domain

Slovenia IPv6 Summit 2010

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- Over a decade providing IPv6 services
- Worlds most comprehensive IPv6 training portfolio
- Advanced IPv6 consultancy services
- World leader in IPv6 enabled Windows-Unix/Linux integration

http://www.erion.co.uk
http://www.ipv6training.com
http://www.ipv6consultancy.com

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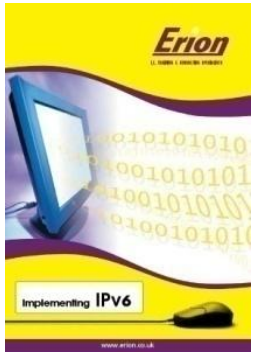
Erion IPv6 Training

- World's largest portfolio of IPv6 courses
  - Covers all aspects of IPv6
  - Different audiences (management, systems administrators, software developers etc)
  - Multiple operating systems and platforms
  - Extensive course and exercise materials
  - Over a decade of development
- Examples:
  - *Implementing IPv6* (4 days)
  - *Securing IPv6* (3 days)
  - *IPv6 for Software Developers* (4 days)

Further information at http://www.ipv6training.com



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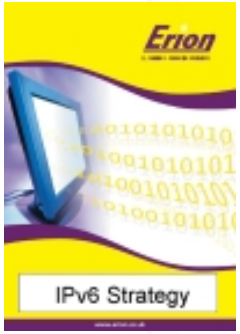
Erion IPv6 Consultancy

- Over a decade of IPv6 Consultancy provision
- Covering all aspects of IPv6:
  - IPv6 audits, strategic planning, transition projects and technical consultancy
- IPv6 Technical consultancy covering:
  - Transition and implementation
  - Host and server transition
  - Network implementation and management
  - IPv6 security
  - IPv6 software development
  - IPv6 application migration
- Erion uses best practice IPv6 and project management methodologies

Further information at http://www.ipv6consultancy.com



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Example Erion Customers

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IPv6 Enabling .my Domain

- Background to DNS and IPv6
- Case Study: MYNIC
- Domain Statistics
- Summary

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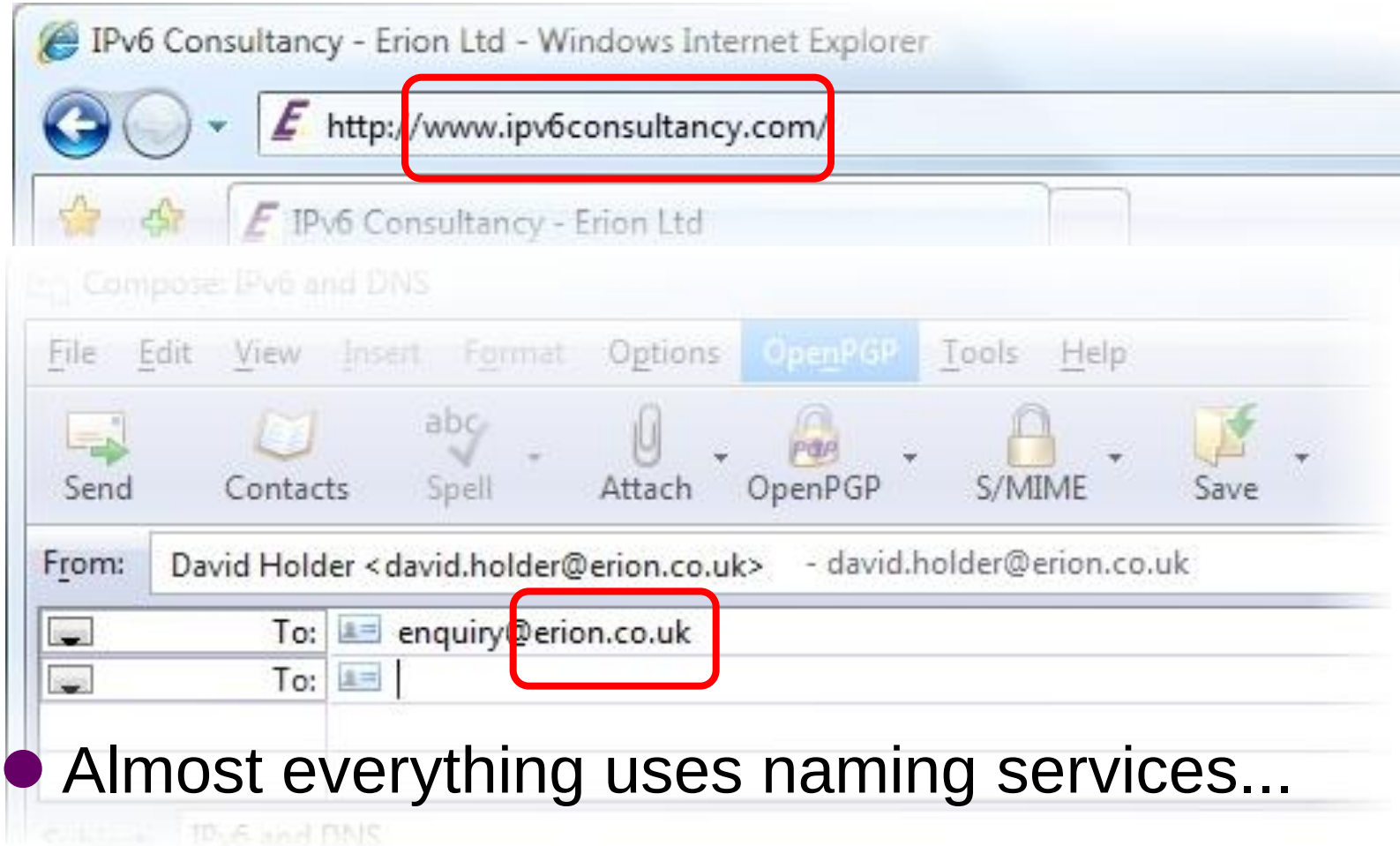
DNS is Crucial to Internet



- Almost everything uses naming services...

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DNS is Critical for Successful IPv6 Deployments

- Name resolution is critical to IPv6 deployments
- Management and users will perceive:
  - Failures in name resolution to be failures of IPv6
  - Performance problems due to name resolution to be IPv6's fault
- Crucial that you get IPv6 name resolution right!

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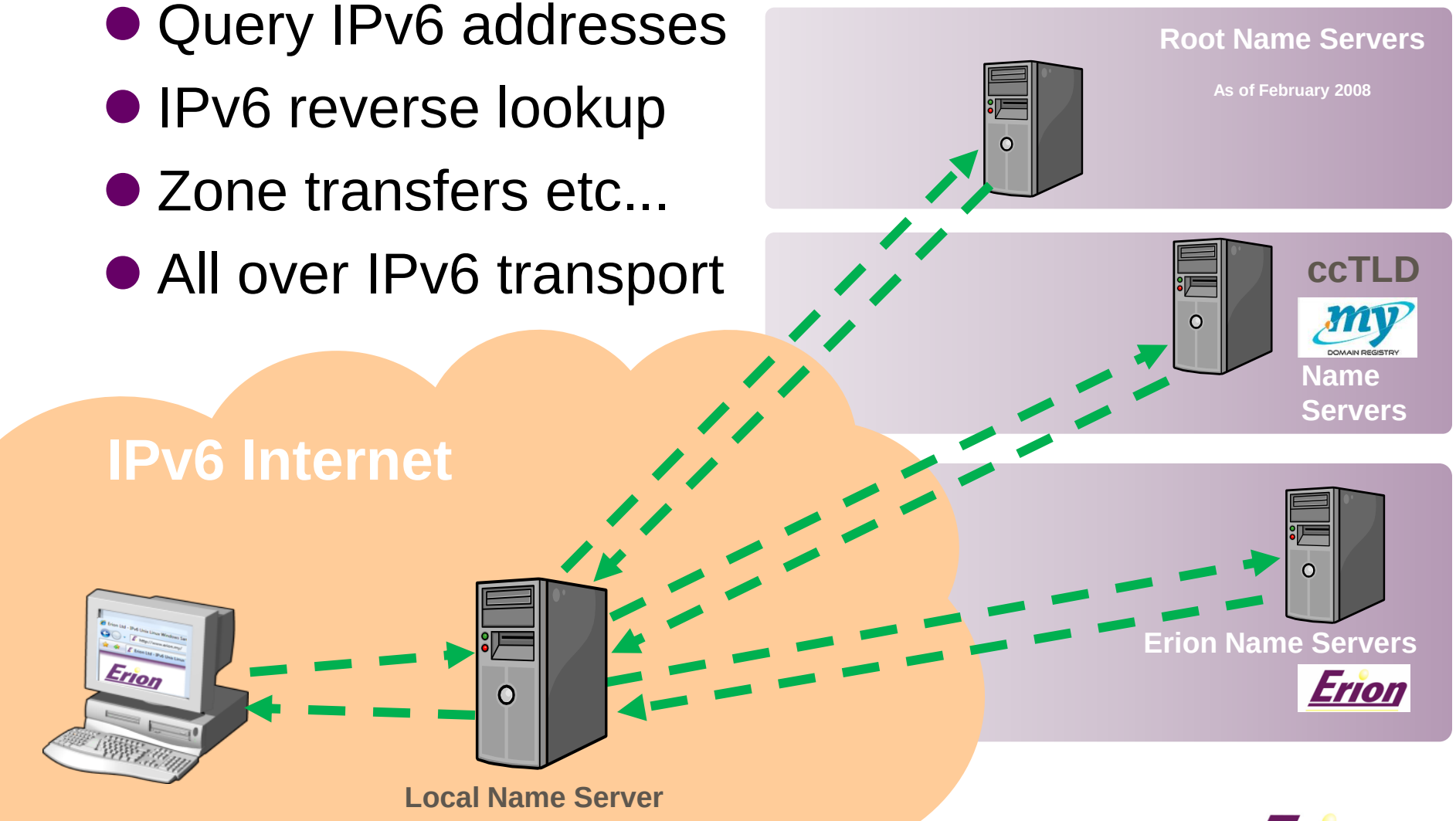
The Domain Name System

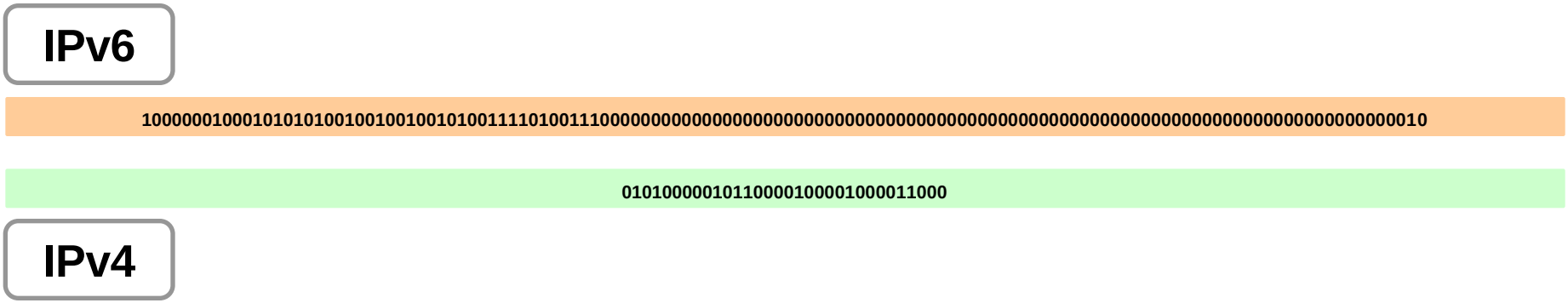
- Query IPv6 addresses
- IPv6 reverse lookup
- Zone transfers etc...
- All over IPv6 transport



IPv6 Forward Lookups

```
erion.co.uk    IN AAAA  2045:5249:4f4e::2
```

- `AAAA` data four times larger than `A` records
- `A6` records are now experimental



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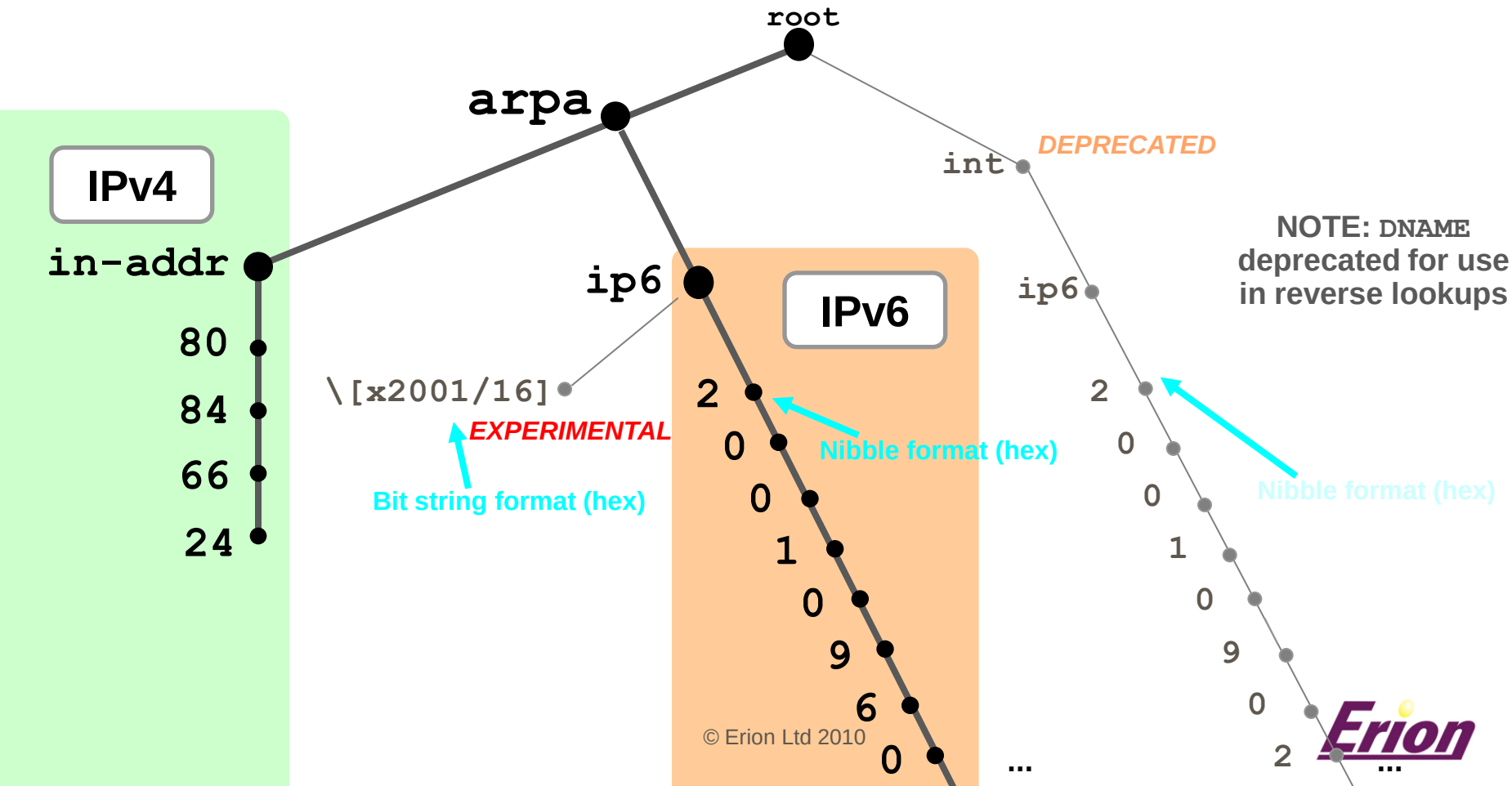
IPv6 Reverse Lookups

```
2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.5.8.5.0.2.0.0.0.0.6.9.0.1.0.0.2.ip6.arpa.
IN PTR www.erion.co.uk
```



EDNS0 (RFC 2671)

- DNS UDP datagrams explicitly limited to 512 bytes
- AAAA RRs can require more than 512 bytes
  - DNSSEC and other mechanisms can also exceed 512 byte limit
- Fall-back to TCP is inefficient

- EDNS0
  - Provides signalling extensions to DNS protocol
  - Includes provision for UDP datagrams up to 65535 bytes
  - EDNS0 is standard on modern DNS servers

- Consequences for firewalls, hosts and DNS servers

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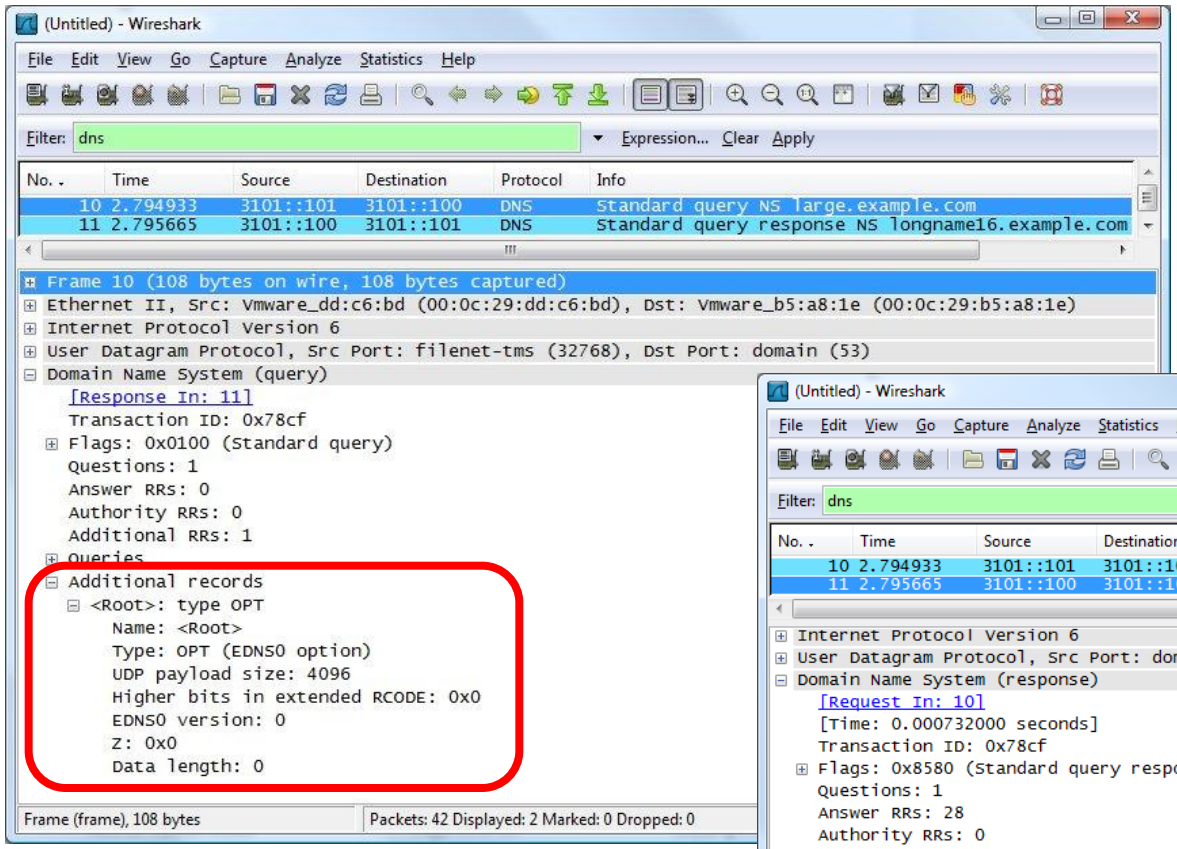
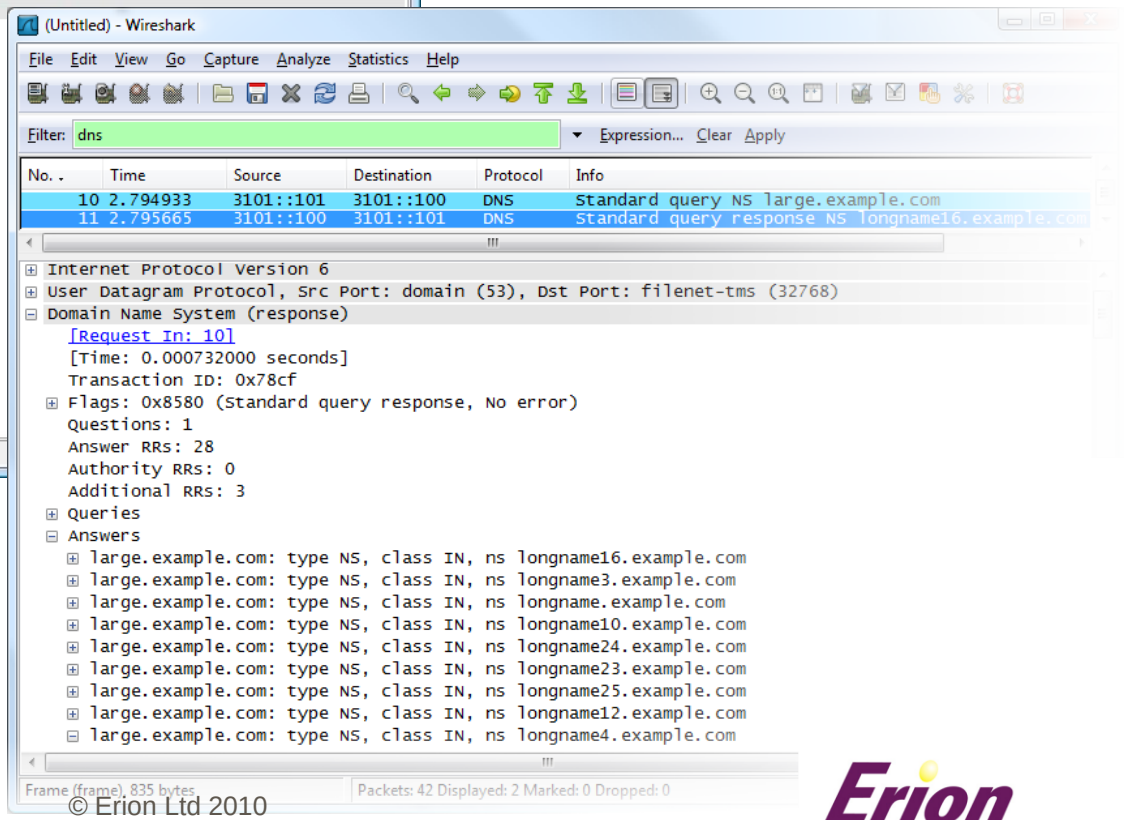
EDNS0 - Example





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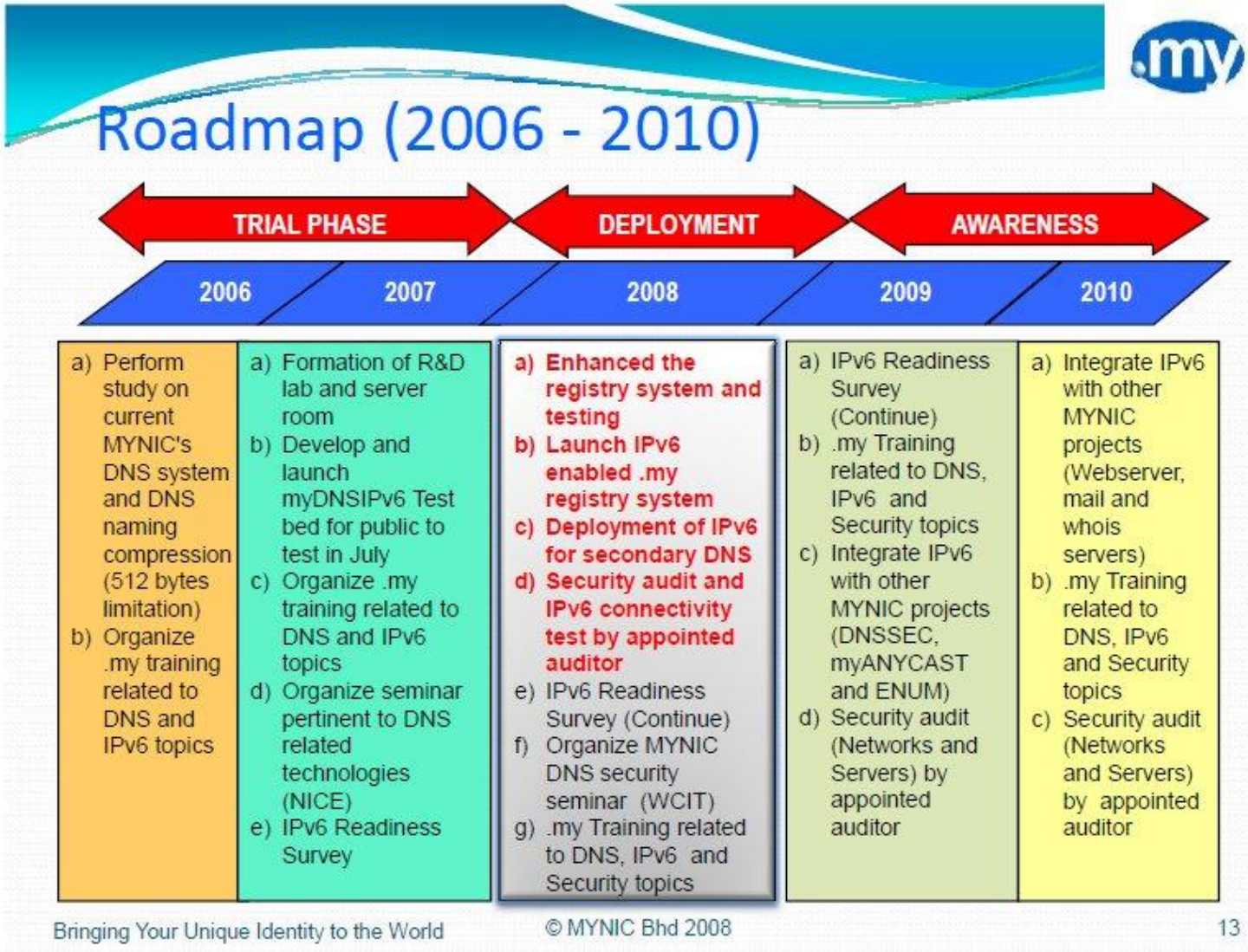
Case Study: MYNIC

- MYNIC is the domain registrar for Malaysia's .my domain

- Note: As of 23rd February 2009 MYNIC is now .my Domain Registry www.domainregistry.my

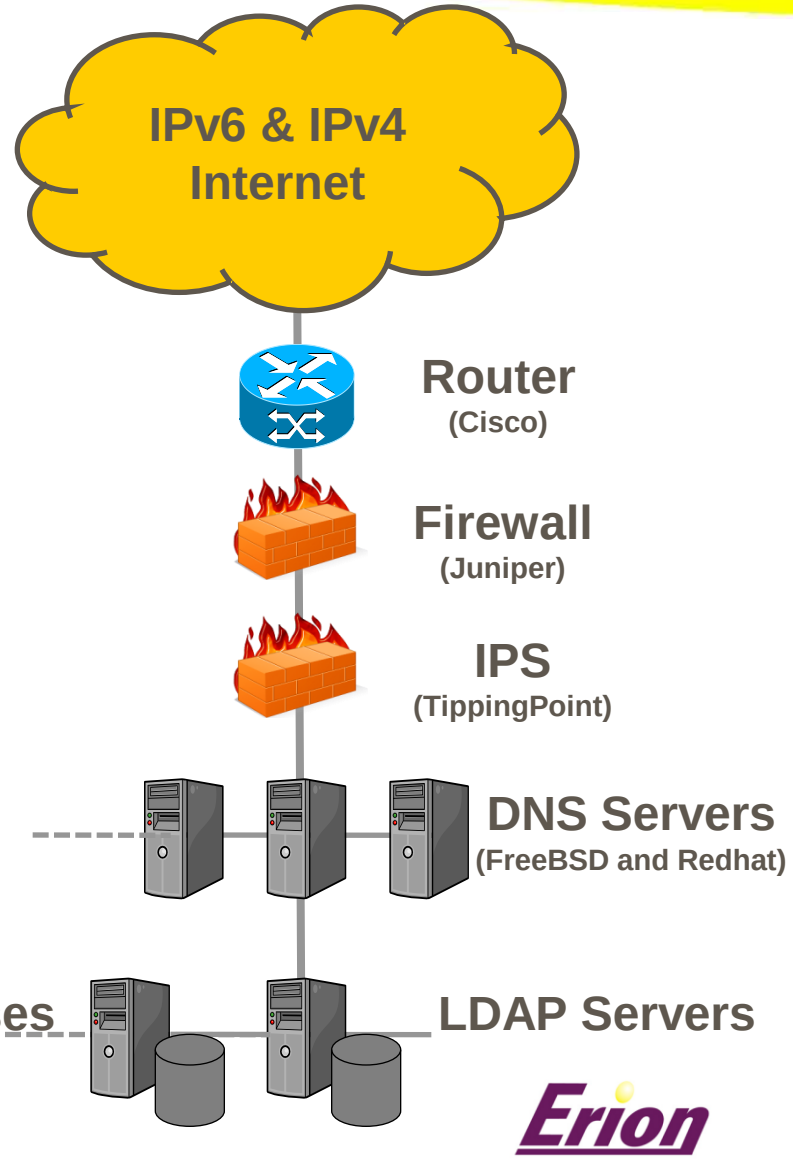
MYNIC IPv6 Roadmap



MYNIC Network

- Multiple Sites
- Multiple Servers
  - DNS
  - Database
  - LDAP
  - Web
- Multiple Network Devices

- Two main sites
- Plus test site



Changes Necessary for IPv6

- DNS Servers and Network Infrastructure
  - Servers (Redhat and FreeBSD)
  - Firewalls (Juniper SSG 550M)
  - IPS (TippingPoint 600E)
- Security
  - DNS, host operating systems, network devices
- Domain Name Database
  - Add field for IPv6 addresses
- Management Web Interface
  - Allow IPv6 as well as IPv4 addresses
- Staff skills!

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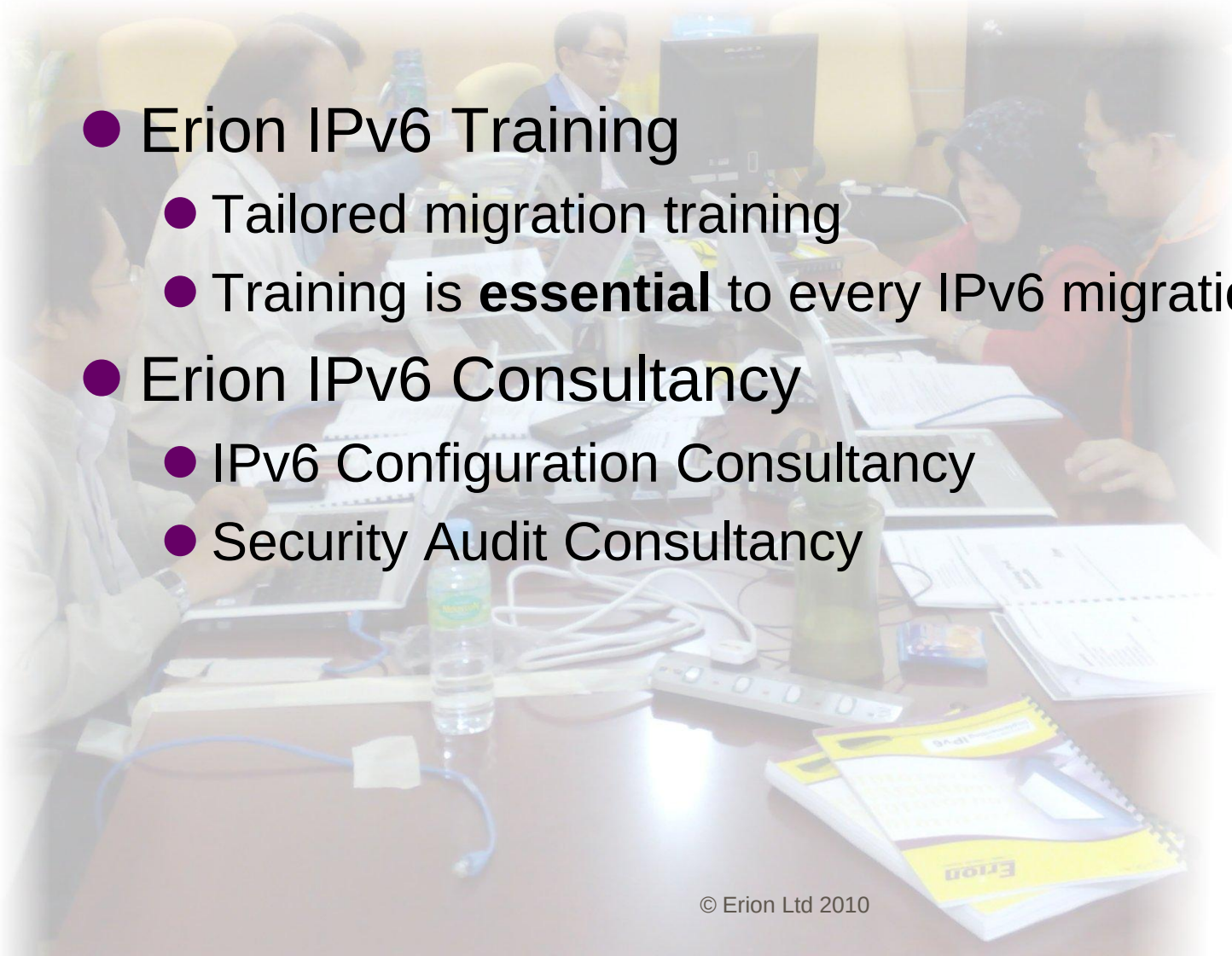
Erion and MYNIC IPv6 Deployment

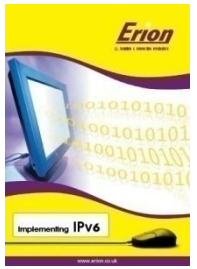


- Erion IPv6 Training
  - Tailored migration training
  - Training is **essential** to every IPv6 migration project
- Erion IPv6 Consultancy
  - IPv6 Configuration Consultancy
  - Security Audit Consultancy

IPv6 Training

- Created tailored training program
  - Using Erion's large portfolio of IPv6 courses
- Matching training aims:
  - Specific topics
  - Operating systems and platforms
  - Delegate experience and knowledge
- Based mainly on two courses:
  - *Implementing IPv6* (4 days)
  - *Securing IPv6* (3 days)

(http://www.ipv6training.com)



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IPv6 Security Audit

- Erion IPv6 security audit of MYNIC
- Consultancy to harden servers & network
- MYNIC successfully awarded IPv6 connectivity and security accreditation from national IPv6 body

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Name Server IPv6 Addresses

```
# dig @dns2.mynic.net.my. -t ns my.

; <<>> DiG 9.3.4-P1 <<>> @dns2.mynic.net.my. -t ns my.
; (1 server found)
;; global options:  printcmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 49350
;; flags: qr aa rd; QUERY: 1, ANSWER: 8, AUTHORITY: 0, ADDITIONAL: 9

;; QUESTION SECTION:
;my.                            IN      NS

;; ANSWER SECTION:
my.                     86400   IN      NS      dns.mynic.net.my.
my.                     86400   IN      NS      ns2.cuhk.edu.hk.
my.                     86400   IN      NS      ns5.jaring.my.
my.                     86400   IN      NS      ns6.jaring.my.
my.                     86400   IN      NS      dns2.mynic.net.my.
my.                     86400   IN      NS      ns20.iij.ad.jp.
my.                     86400   IN      NS      ns-my.nic.fr.
my.                     86400   IN      NS      ns.uu.net.

;; ADDITIONAL SECTION:
ns.uu.net.              2105    IN      A       137.39.1.3
dns.mynic.net.my.       86400   IN      A       192.228.180.5
dns.mynic.net.my.       86400   IN      AAAA    2001:328:1000:3::5
ns5.jaring.my.          2107    IN      A       61.6.38.139
ns6.jaring.my.          54838   IN      A       192.228.128.16
dns2.mynic.net.my.      86400   IN      A       202.75.39.36
ns20.iij.ad.jp.         54837   IN      A       202.232.2.161
ns-my.nic.fr.           141241  IN      A       192.134.0.49
ns-my.nic.fr.           141249  IN      AAAA    2001:660:3006:1::1:1
```

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Reverse Lookups

```
# dig -x 2001:328:1000:3::5

; <<>> DiG 9.3.4-P1 <<>> -x 2001:328:1000:3::5
;; global options:  printcmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 9448
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 2, ADDITIONAL: 1

;; QUESTION SECTION:
;5.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.3.0.0.0.0.0.0.1.8.2.3.0.1.0.0.2.ip6.arpa. IN PTR

;; ANSWER SECTION:
5.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.3.0.0.0.0.0.0.1.8.2.3.0.1.0.0.2.ip6.arpa. 86400IN PTR dns.mynic.net.my.

;; AUTHORITY SECTION:
3.0.0.0.0.0.0.1.8.2.3.0.1.0.0.2.ip6.arpa. 86400 IN NS dns1.mynic.net.my.
3.0.0.0.0.0.0.1.8.2.3.0.1.0.0.2.ip6.arpa. 86400 IN NS dns2.mynic.net.my.

;; ADDITIONAL SECTION:
dns2.mynic.net.my.      61058   IN      A       202.75.39.36
```

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IPv6 Glue

- Don’t forget to add IPv6 glue

```
;; AUTHORITY SECTION:
my.                     172800  IN      NS      ns.uu.net.
my.                     172800  IN      NS      dns.mynic.net.my.
my.                     172800  IN      NS      ns2.cuhk.edu.hk.
my.                     172800  IN      NS      ns5.jaring.my.
my.                     172800  IN      NS      ns6.jaring.my.
my.                     172800  IN      NS      dns2.mynic.net.my.
my.                     172800  IN      NS      ns20.iij.ad.jp.
my.                     172800  IN      NS      ns-my.nic.fr.

;; ADDITIONAL SECTION:
ns.uu.net.              172800  IN      A       137.39.1.3
dns.mynic.net.my.       172800  IN      A       192.228.180.5
ns2.cuhk.edu.hk.        172800  IN      A       137.189.6.21
ns5.jaring.my.          172800  IN      A       61.6.38.139
ns6.jaring.my.          172800  IN      A       192.228.128.16
dns2.mynic.net.my.      172800  IN      A       202.75.39.36
ns20.iij.ad.jp.         172800  IN      A       202.232.2.161
ns-my.nic.fr.           172800  IN      A       192.134.0.49
dns.mynic.net.my.       172800  IN      AAAA    2001:328:1000:3::5
ns-my.nic.fr.           172800  IN      AAAA    2001:660:3006:1::1:1
;; Query time: 267 msec
;; SERVER: 2001:500:1::803f:235#53(H.ROOT-SERVERS.NET)
;; WHEN: Mon Mar 16 14:44:09 2009
;; MSG SIZE  rcvd: 410
```

IPv6 Glue

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Example .my Domain

```
; <<>> DiG 9.3.4-P1 <<>> -t aaaa www.erion.my.
;; global options:  printcmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 23083
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 2, ADDITIONAL: 4

;; QUESTION SECTION:
;www.erion.my.                  IN      AAAA

;; ANSWER SECTION:
www.erion.my.           10800   IN      AAAA    2001:470:1f08:61d::2

;; AUTHORITY SECTION:
erion.my.               10800   IN      NS      n2.erion.my.
erion.my.               10800   IN      NS      n1.erion.my.

;; ADDITIONAL SECTION:
n1.erion.my.            10800   IN      A       78.40.241.30
n1.erion.my.            10800   IN      AAAA    2001:470:1f08:61d::2
n2.erion.my.            10800   IN      A       80.84.66.24
n2.erion.my.            10800   IN      AAAA    2001:960:2:585::2
```

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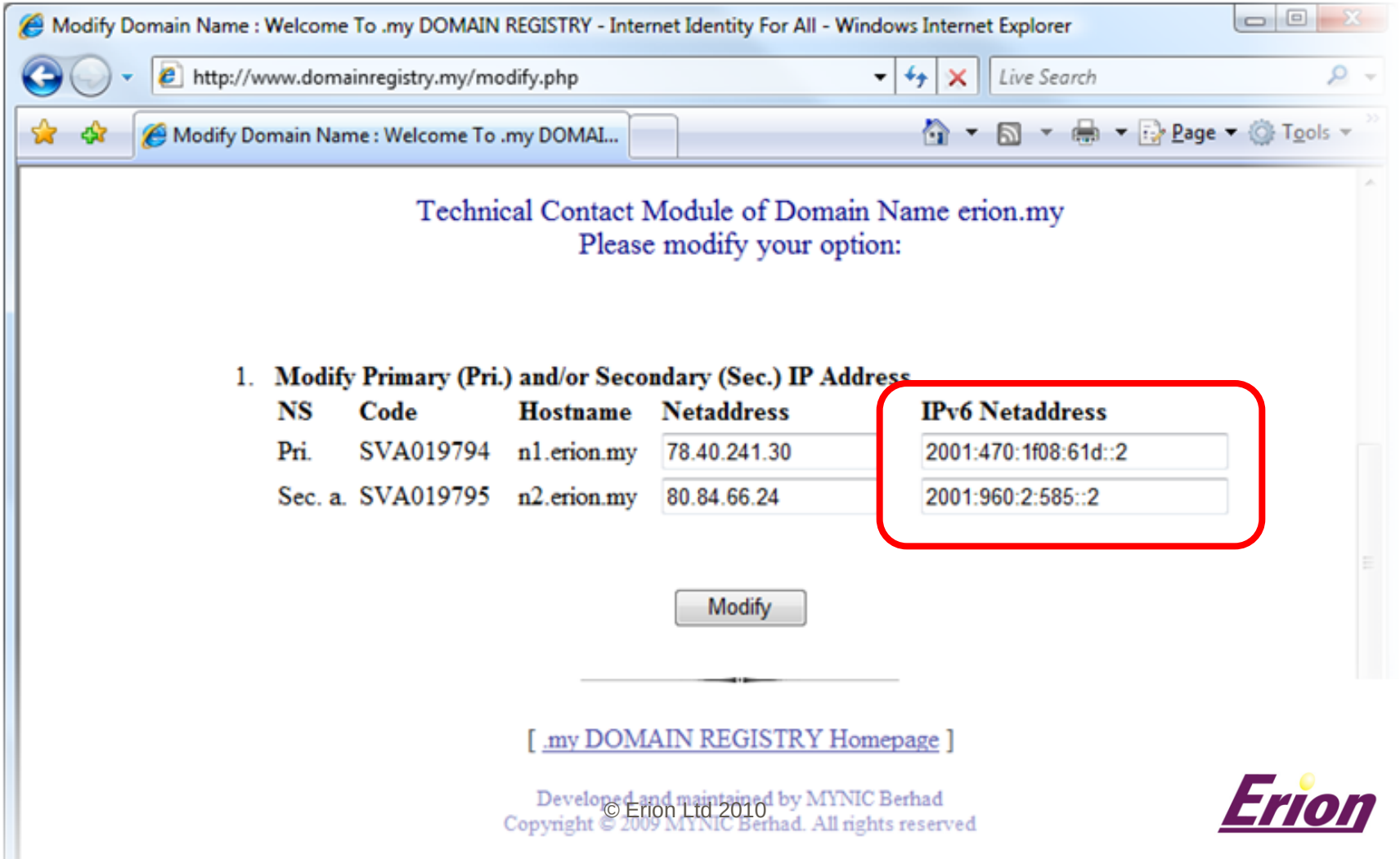
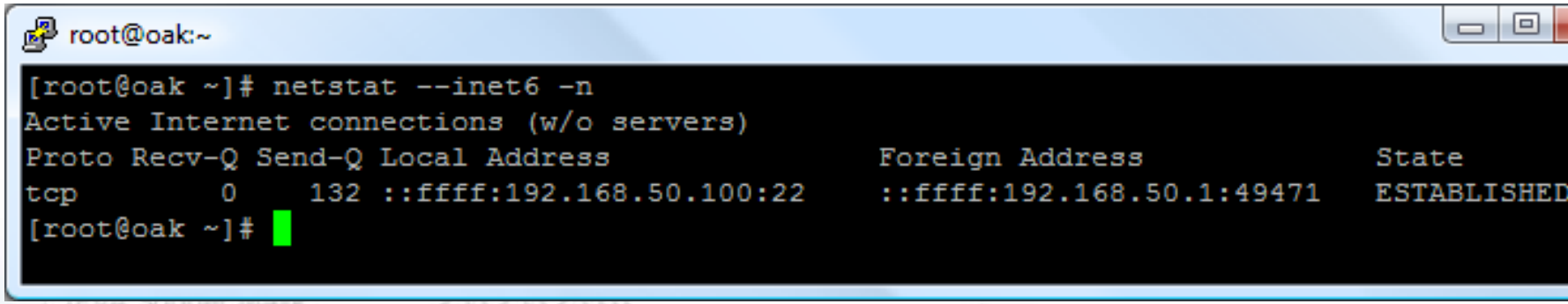
Domain Registrar Tools

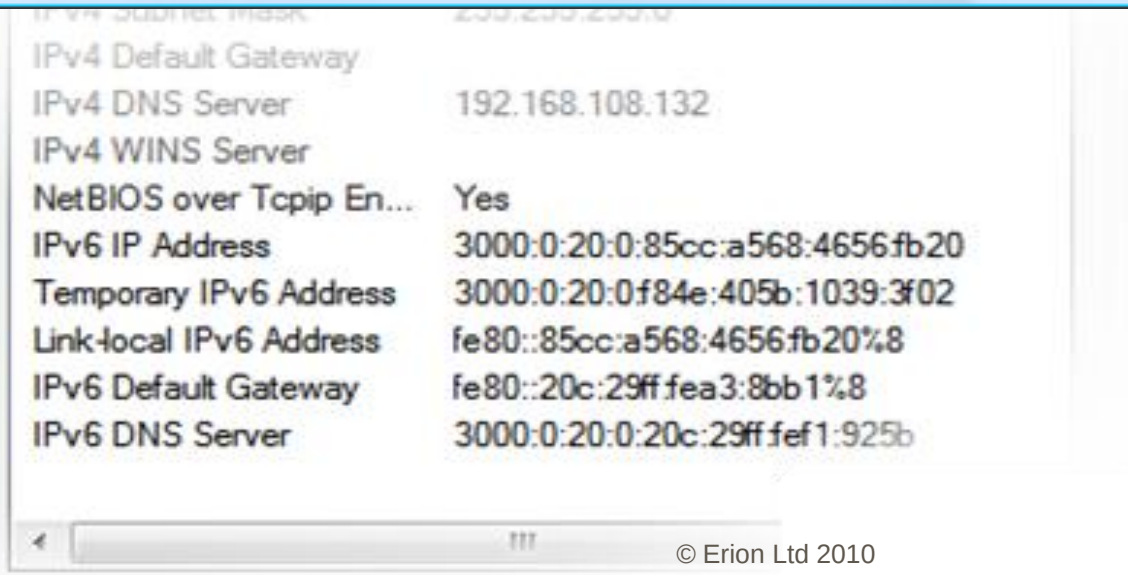
- Address validation



IPv6 Address Validation

- Important to validate addresses entered in DNS
- Certain IPv6 address are undesirable in DNS





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Domain Statistics

- 79% (73%) of ccTLDs have IPv6 name server
  - But few resellers have IPv6 name servers
  - For example 0% of .my resellers have IPv6 name servers

- Fortune 100 companies:
  - **4** have IPv6 addresses for name servers
  - **1 (2)** have IPv6 enabled web servers
- FTSE 100 companies:
  - **4** have IPv6 addresses for name servers
  - **2** have IPv6 enabled web servers

  - Values in parenthesis are from March 2009

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IPv6 Addresses – Quick Test

```
2045:5249:4f4e::2
::ffff:50.10.1.10
fe80::1
ff02::2
2001:0000:0102:0304::efff:f6ff:fffe
2002:0800:0001::1
3ffe:0302:0011:0020:0000:5EFE:0102:0304
fe80::5EFE:0102:0304
```


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Conclusions

- Training is essential to successful IPv6 deployment
- Staff are a part of the migration
- Name services are critical to IPv6 migration
- IPv6 security needs addressing even for “IPv4 only” organisations
- Training is essential to IPv6 deployment

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Questions

World-class IPv6 Training in Ljubljana

Implementing IPv6 **(4 days)**

19th-23rd July 2010

Instructor: David Holder

See sheet for further details…

Thank you for listening

Erion and IPv6 References

- IPv6 Training
  - http://www.ipv6training.com
- IPv6 Consultancy
  - http://www.ipv6consultancy.com
- IPv6 Services
  - http://www.erion.co.uk/ipv6.html
- IPv6 Blog
  - http://www.ipv6consultancy.com/ipv6blog

- Contact enquiry@erion.co.uk

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