Discovering Provisioning Domain Names and Data

draft-ietf-intarea-provisioning-domains-01

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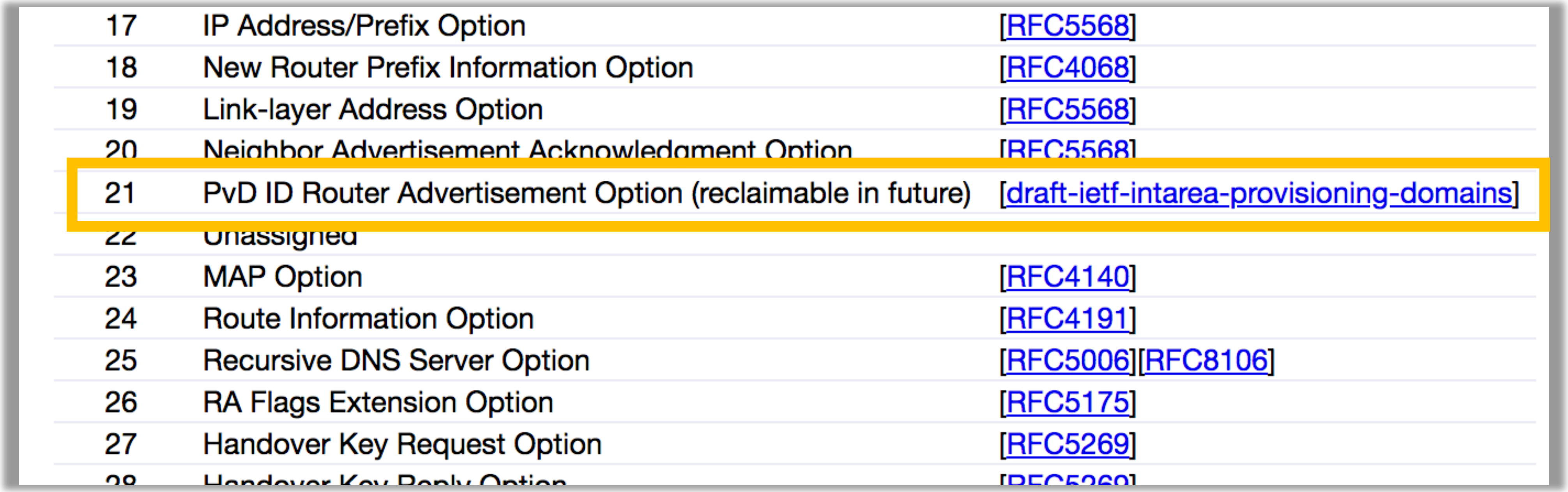
Big News from IANA



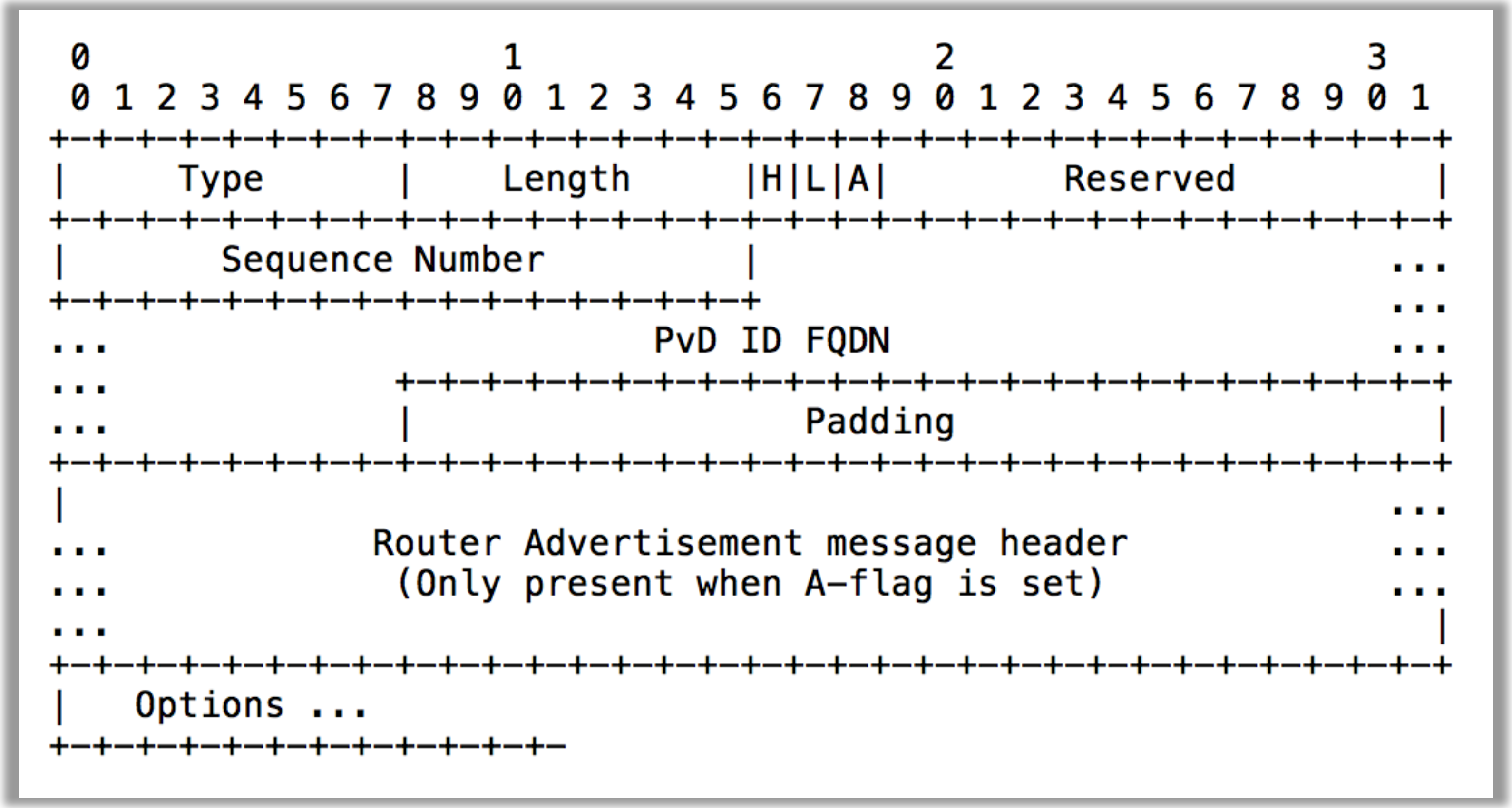
17	IP Address/Prefix Option	[RFC5568]
18	New Router Prefix Information Option	[RFC4068]
19	Link-layer Address Option	[RFC5568]
20	Neighbor Advertisement Acknowledgment Option	[RFC5568]
21	PvD ID Router Advertisement Option (reclaimable in future)	[draft-ietf-intarea-provisioning-domains]
22	Unassigned	
23	MAP Option	[RFC4140]
24	Route Information Option	[RFC4191]
25	Recursive DNS Server Option	[RFC5006][RFC8106]
26	RA Flags Extension Option	[RFC5175]
27	Handover Key Request Option	[RFC5269]
28	Handover Key Reply Option	[RFC5269]

-02 will include this number. Hackathon was done with this NDP Option Type

Changes in -01

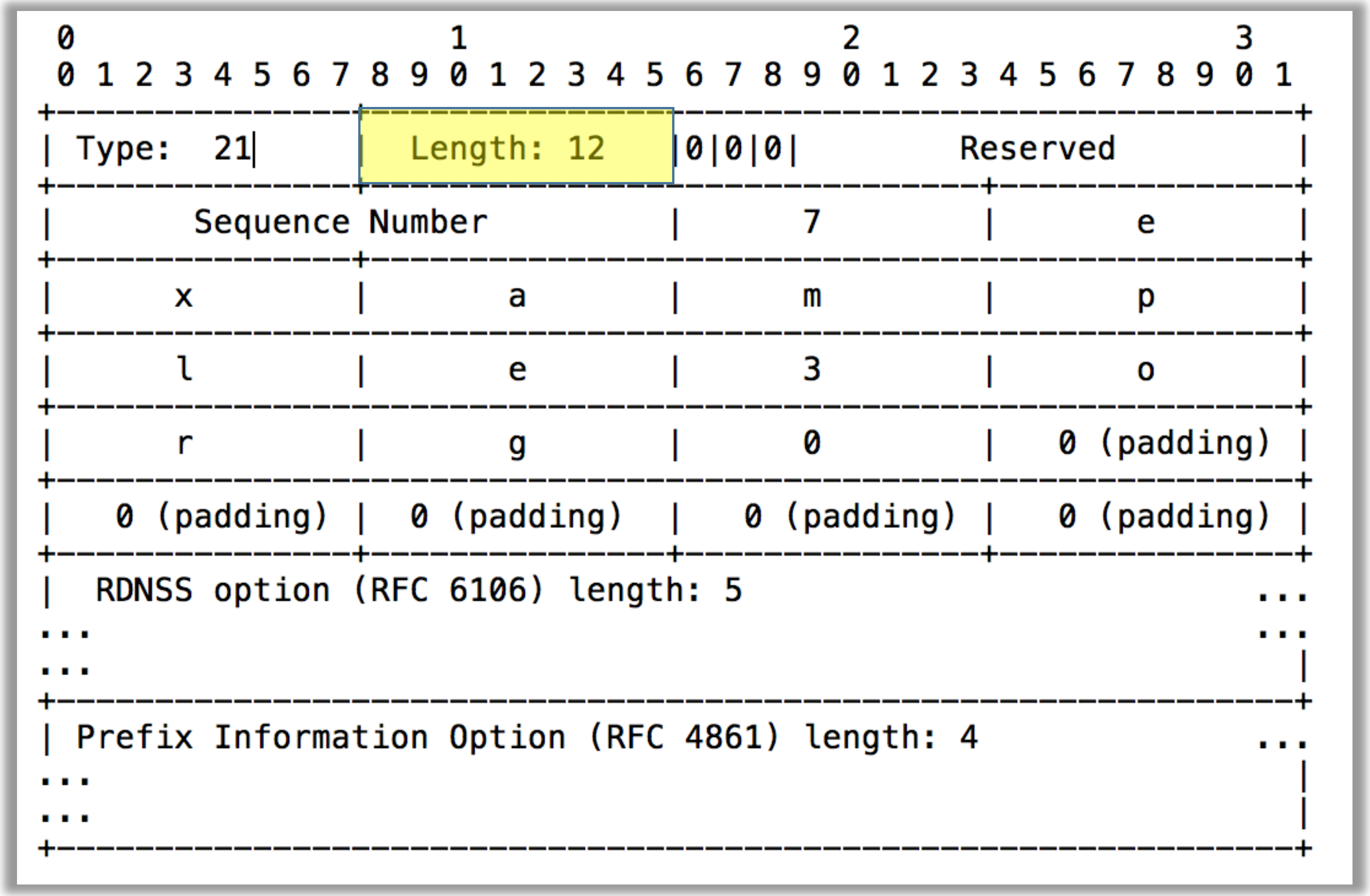
- Remove all information about ‘metered’, ‘characteristics’
  - Still relevant but in another document?
- Clarify that PvD additional information is NOT to modify host stack behavior but only for applications
- Improve security & privacy sections
- Padding now to the 64-bit boundary
- Container approach to address a mix of PvD-aware and non PvD-aware hosts (see next slide)

PvD ID Option Format



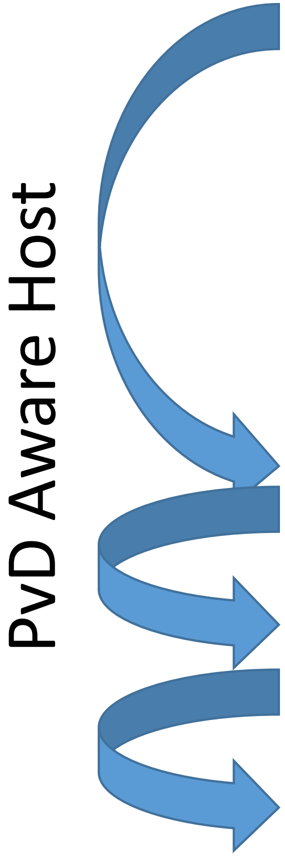
```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     Type      |    Length     |H|L|A|        Reserved         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|       Sequence Number         |                             ...
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+                             ...
...                         PvD ID FQDN                       ...
...             +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
...             |                  Padding                      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                                                             ...
...            Router Advertisement message header            ...
...             (Only present when A-flag is set)             ...
...                                                             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   Options ...
+-+-+-+-+-+-+-+-+-+-+-+-
```

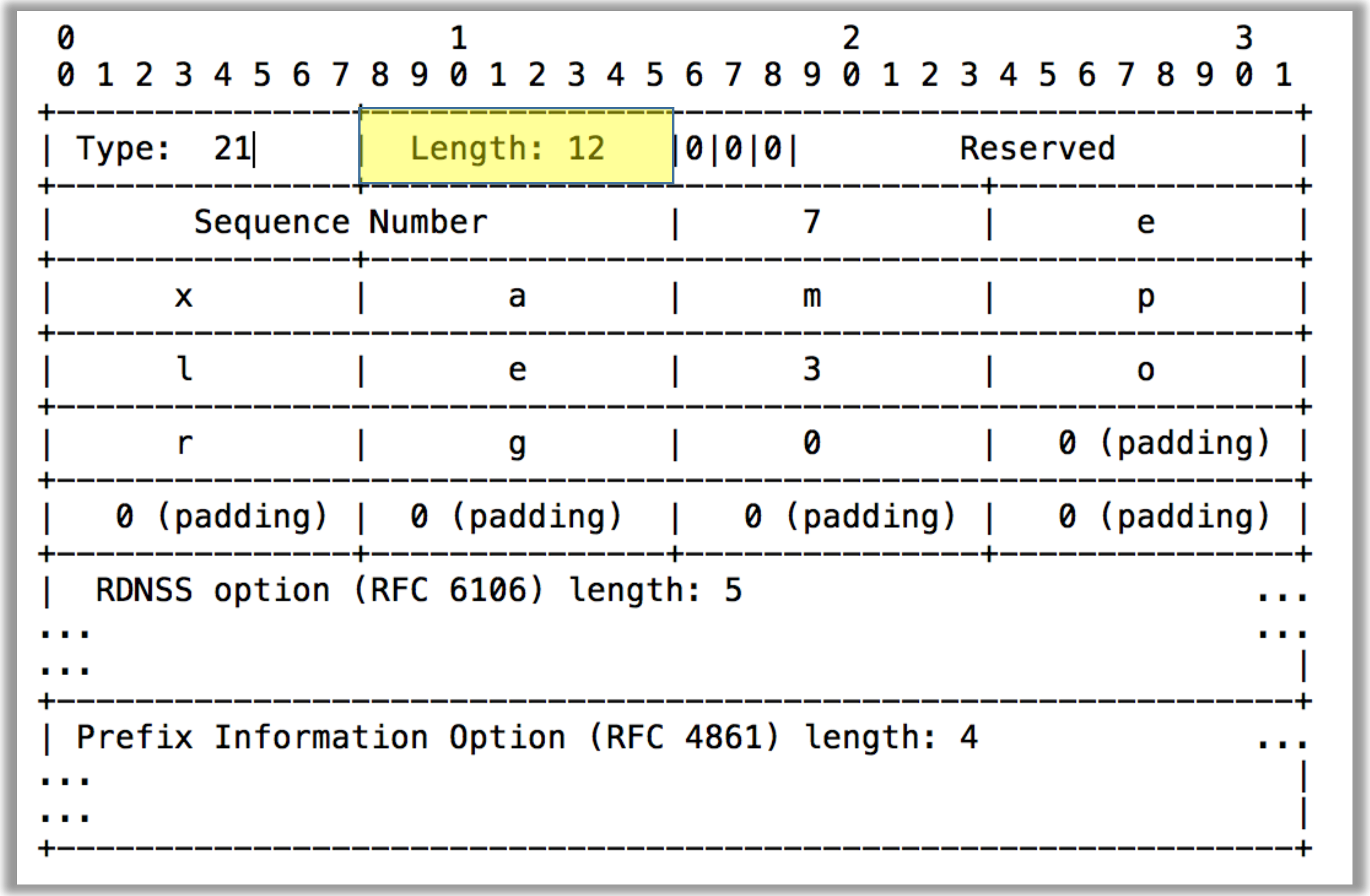
PvD ID Example



```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+---------------+-----------------------------------------------+
| Type:  21|    |  Length: 12   |0|0|0|        Reserved         |
+---------------+-------------------------------+---------------+
|       Sequence Number         |       7       |       e       |
+---------------+-----------------------------------------------+
|       x       |       a       |       m       |       p       |
+---------------------------------------------------------------+
|       l       |       e       |       3       |       o       |
+---------------------------------------------------------------+
|       r       |       g       |       0       |  0 (padding)  |
+---------------------------------------------------------------+
|  0 (padding)  |  0 (padding)  |  0 (padding)  |  0 (padding)  |
+---------------+---------------+---------------+---------------+
|  RDNSS option (RFC 6106) length: 5                          ...
...                                                           ...
...                                                             |
+---------------------------------------------------------------+
| Prefix Information Option (RFC 4861) length: 4              ...
...                                                             |
...                                                             |
+---------------------------------------------------------------+
```

PvD ID Example

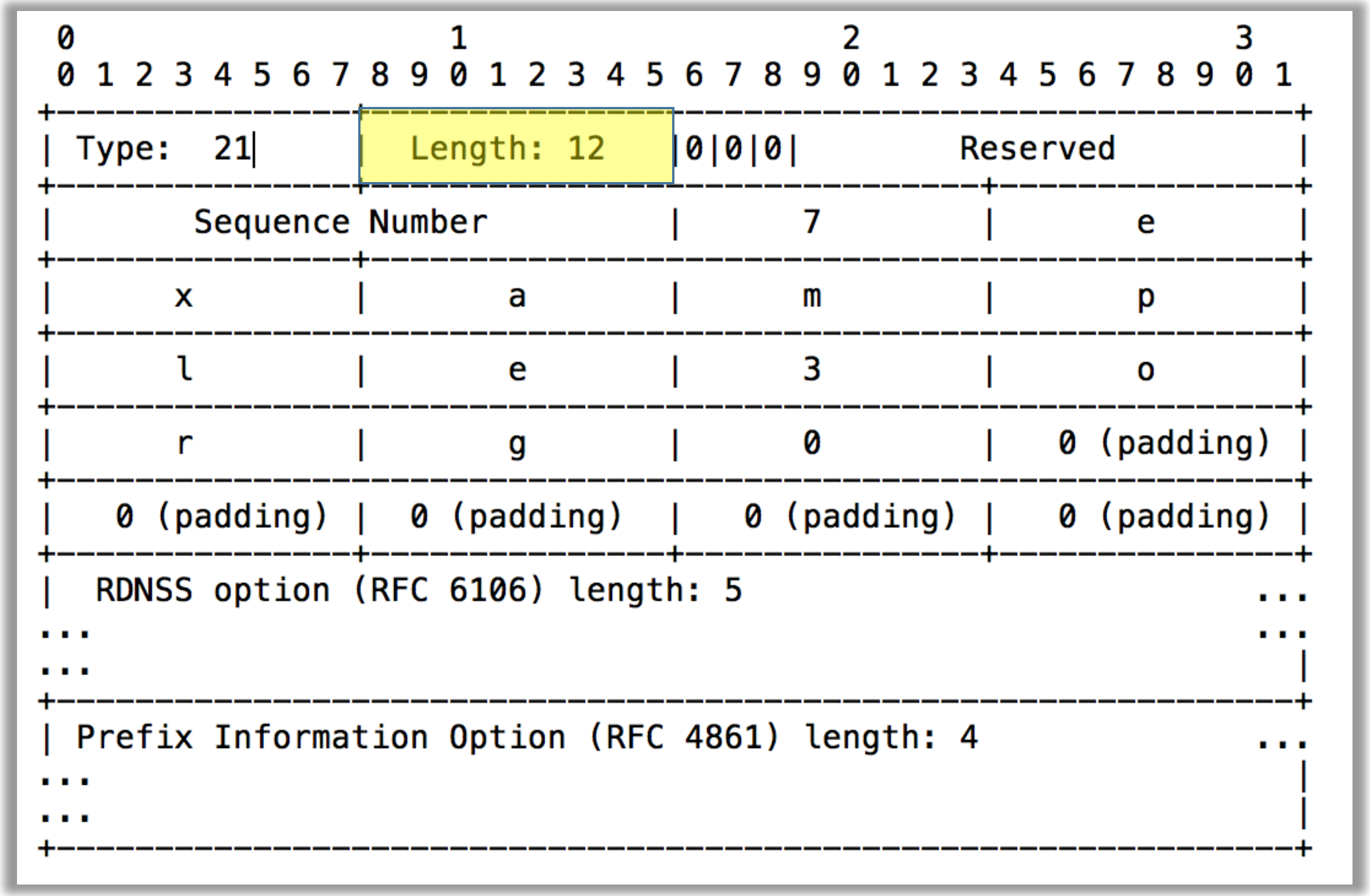




```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+---------------+-----------------------------------------------+
| Type:  21|    |  Length: 12   |0|0|0|        Reserved         |
+---------------+-------------------------------+---------------+
|       Sequence Number         |      7        |       e       |
+---------------+-----------------------------------------------+
|      x        |       a       |      m        |       p       |
+---------------------------------------------------------------+
|      l        |       e       |      3        |       o       |
+---------------------------------------------------------------+
|      r        |       g       |      0        |   0 (padding) |
+---------------------------------------------------------------+
|   0 (padding) |  0 (padding)  |   0 (padding) |   0 (padding) |
+---------------+---------------+---------------+---------------+
|  RDNSS option (RFC 6106) length: 5                          ...
...                                                           ...
...                                                             |
+---------------------------------------------------------------+
| Prefix Information Option (RFC 4861) length: 4              ...
...                                                             |
...                                                             |
+---------------------------------------------------------------+
```

PvD ID Example

PvD Aware Host



```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+---------------+---------------+---------------------------------+
| Type:  21|    |  Length: 12   |0|0|0|        Reserved           |
+---------------+---------------+---------------+-----------------+
|        Sequence Number        |       7       |        e        |
+---------------+---------------+---------------+-----------------+
|       x       |       a       |       m       |        p        |
+---------------+---------------+---------------+-----------------+
|       l       |       e       |       3       |        o        |
+---------------+---------------+---------------+-----------------+
|       r       |       g       |       0       |   0 (padding)   |
+---------------+---------------+---------------+-----------------+
|  0 (padding)  |  0 (padding)  |  0 (padding)  |   0 (padding)   |
+---------------+---------------+---------------+-----------------+
|  RDNSS option (RFC 6106) length: 5                           ...
...                                                            ...
...                                                              |
+-----------------------------------------------------------------+
| Prefix Information Option (RFC 4861) length: 4               ...
...                                                              |
...                                                              |
+-----------------------------------------------------------------+
```

Non PvD-Aware Host

Implementation status

Linux - https://github.com/IPv6-mPvD

- pvdd: A Daemon to manage PvD IDs and Additional Data
- Linux Kernel patch for RA processing
- iproute tool patch to display PvD IDs
- Wireshark dissector
- RADVD and ODHCPD sending PvD ID

Implemented in one commercial vendor router

IPv6 mPvD + NEAT + SADR + Capport

=

AWESOME

Hack & Interrop

Tom Jones

UNIVERSITY OF ABERDEEN

Pierre Pfister

Eric Vyncke

cisco

Wenqin Shao

TELECOM ParisTech

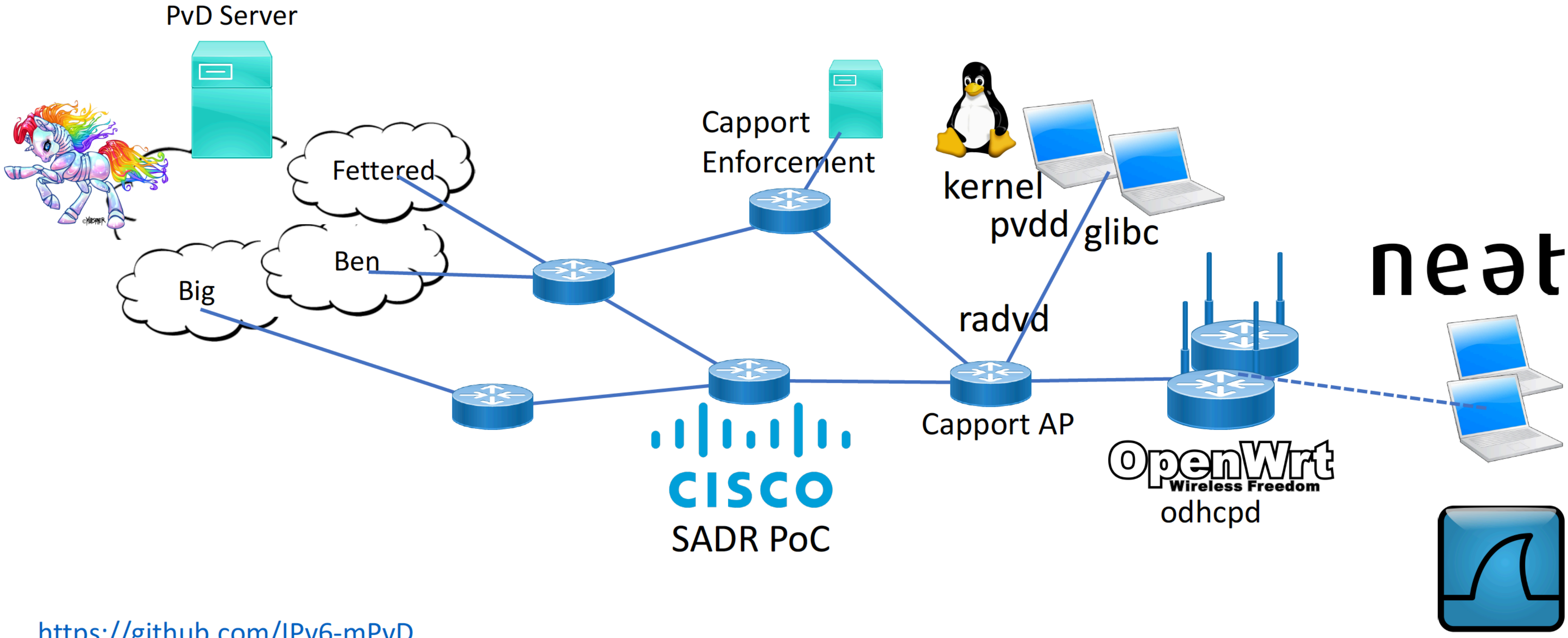
Kyle Larose

SANDVINE

Michael Di Bartolomeo

LIÈGE université

This Hackathon: Complete test topology and interop.



https://github.com/IPv6-mPvD

Next steps

- Review is required
- Present the I-D to 6MAN & V6OPS WG

What about Security & Privacy

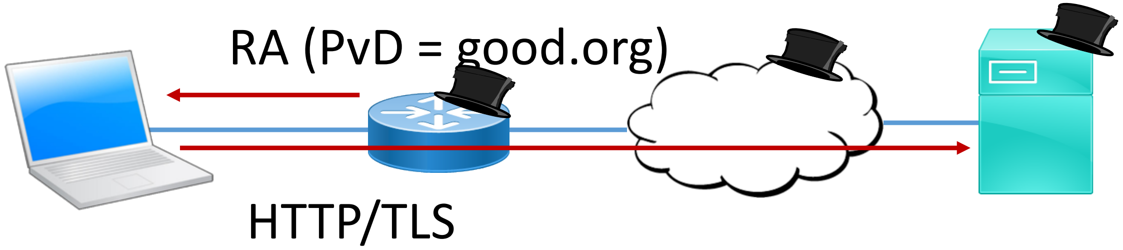
Confidentiality of PvD Additional Information

- The well-known URL https://pvd-name.example.org/.well-known/pvd could contain some sensitive data (bandwidth, recursive DNS servers, ...)
- This well-known URL is guessable ;-)
- How to provide confidentiality ?

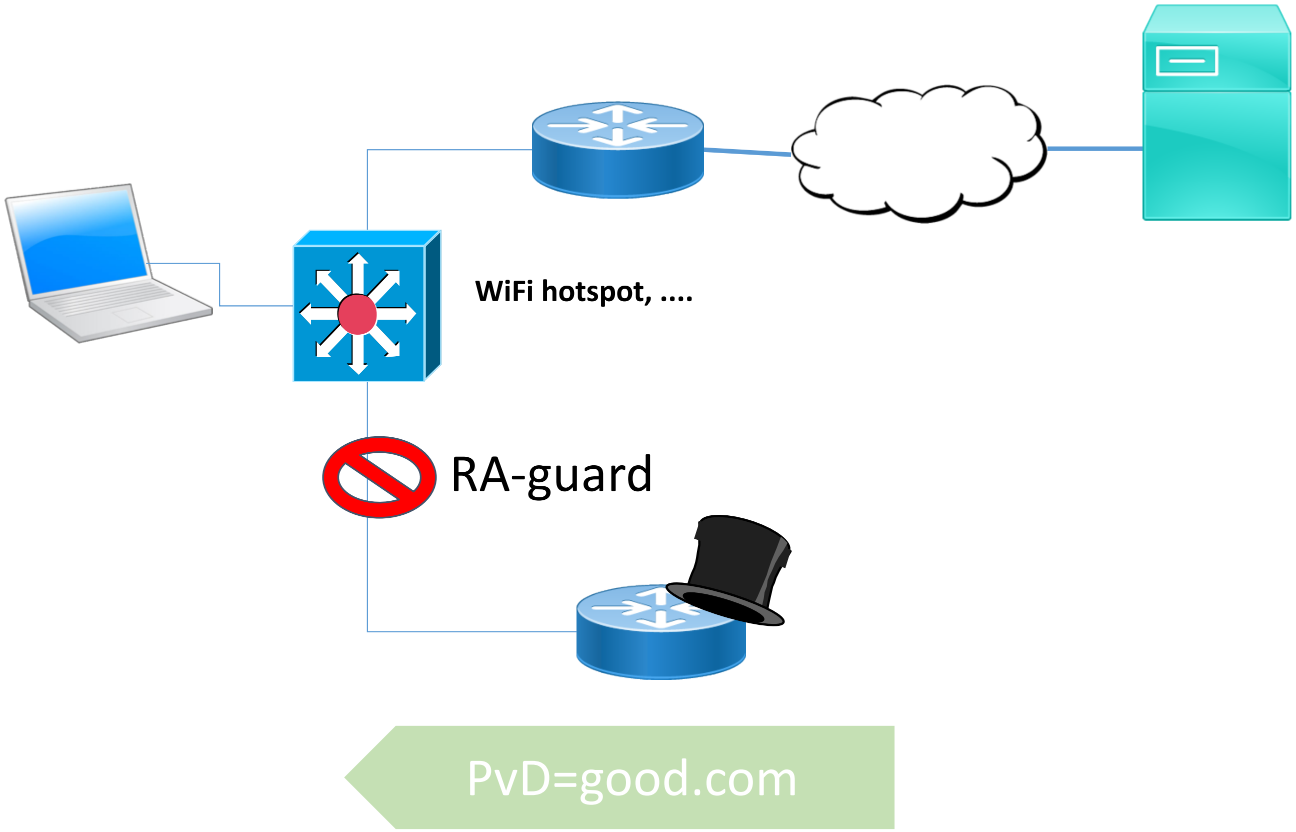
- 1) do not put anything which is really confidential
- 2) the HTTPS server should reject connections originated from prefixes not belonging to example.org

Spoofing the PvD ID

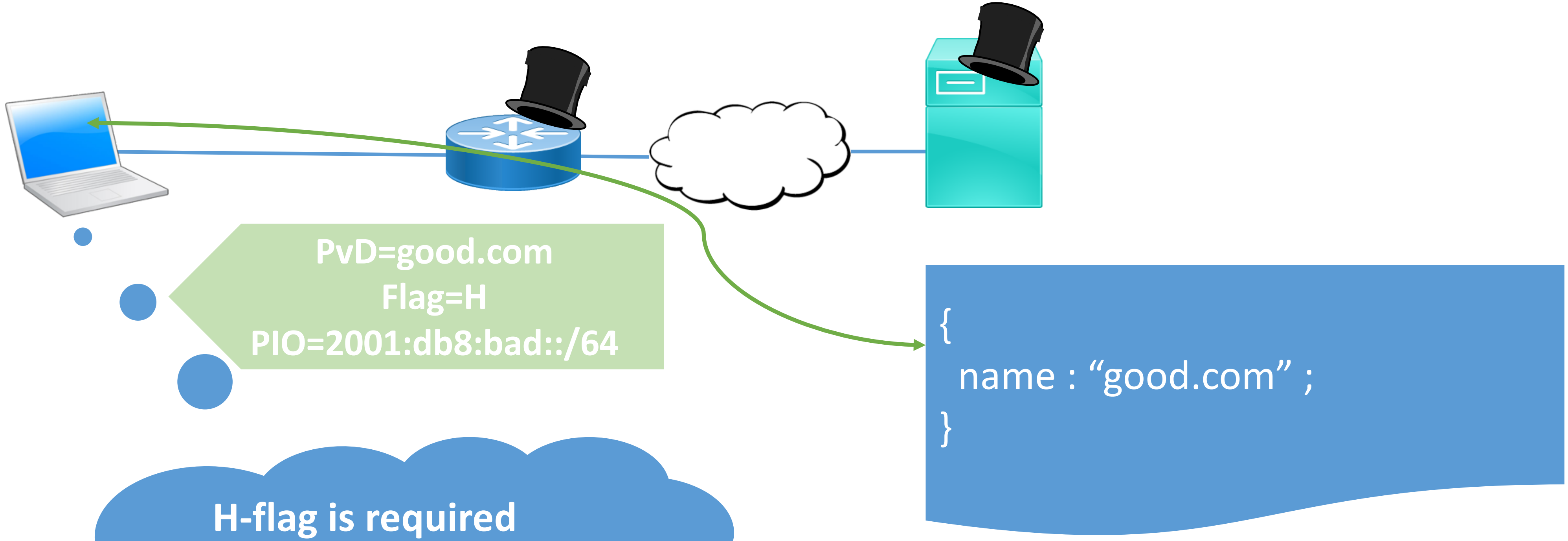
- Can an hostile party send rogue PvD, pretending to be example.org while they are hacker.org ?
- No signature in the RA option (SeND not used)



Layer-2 Adjacent Attacker



Attackers are First Hop Router and PvD ”Server”

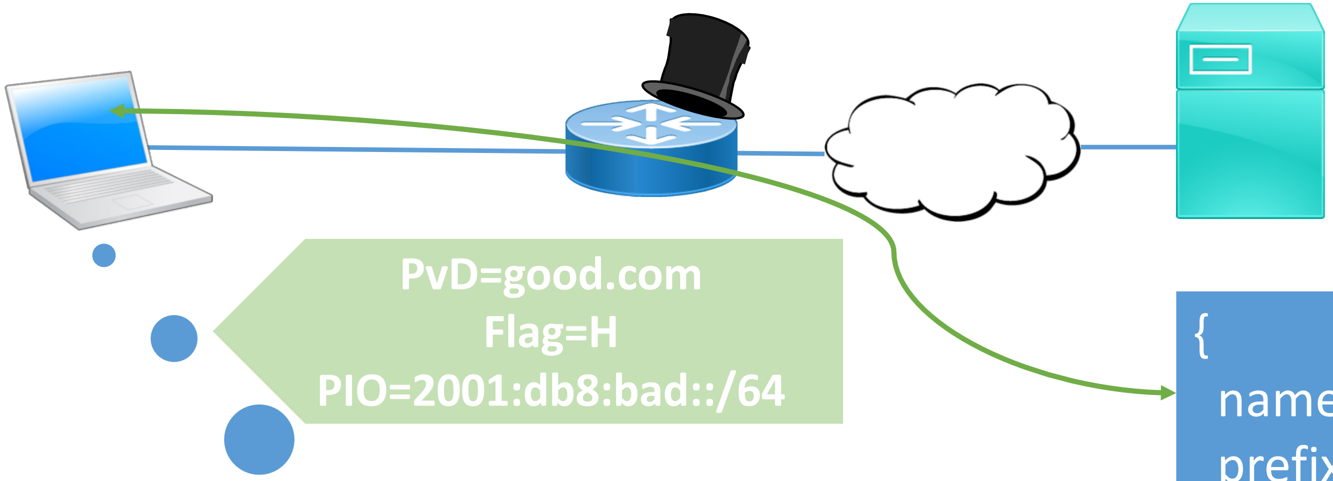


PvD=good.com
Flag=H
PIO=2001:db8:bad::/64

```
{
  name : “good.com” ;
}
```

H-flag is required
X.509 certificate is wrong
=> Do not trust

Attacker is the First Hop Router

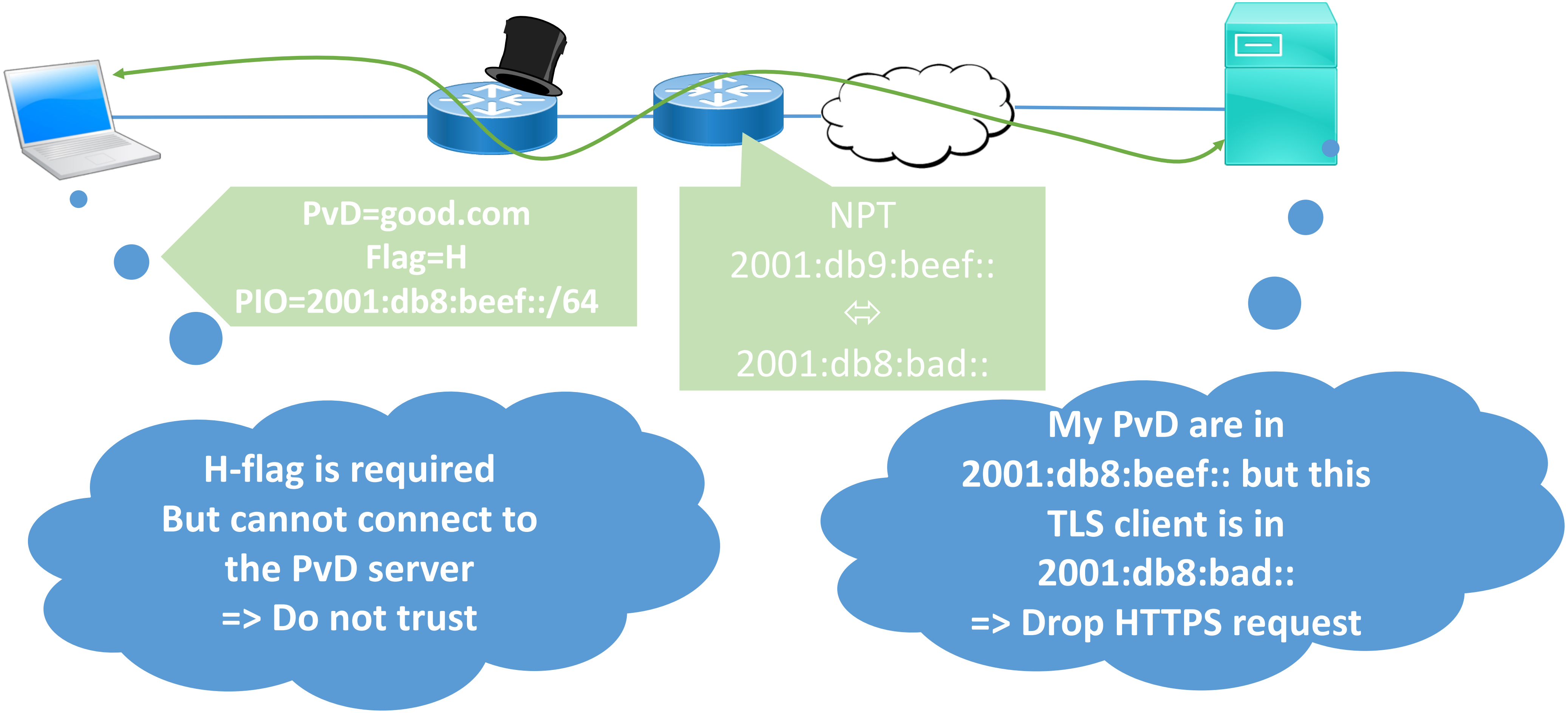


PvD=good.com
Flag=H
PIO=2001:db8:bad::/64

```
{
  name : “good.com” ;
  prefixes: [”2001:db8:beef::”];
}
```

H-flag is required
PIO not covered by ”Prefixes”
=> Do not trust

Attacker is the First Hop Router with NPTv6



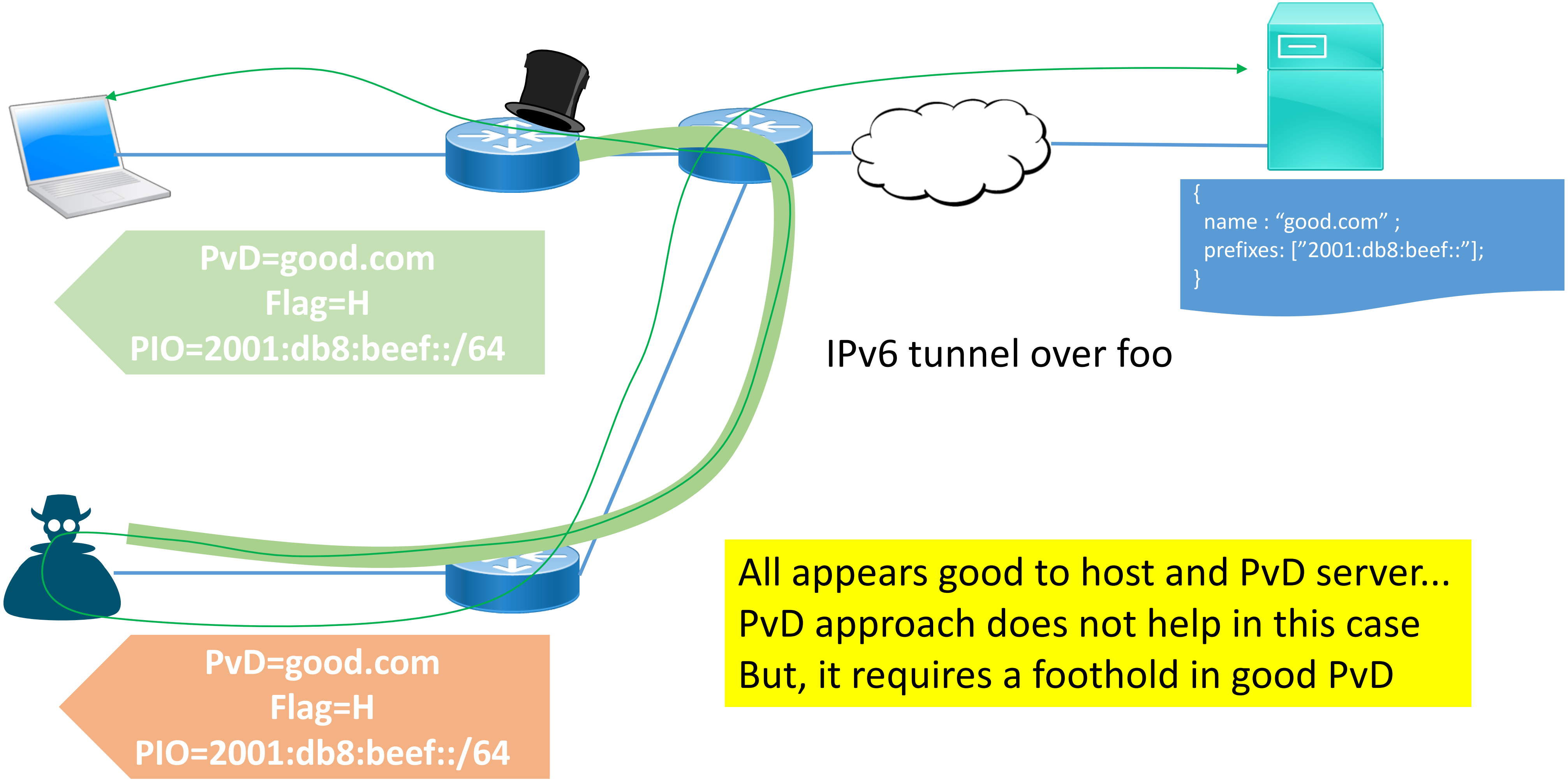
PvD=good.com
Flag=H
PIO=2001:db8:beef::/64

NPT
2001:db9:beef::
⇔
2001:db8:bad::

H-flag is required
But cannot connect to
the PvD server
=> Do not trust

My PvD are in
2001:db8:beef:: but this
TLS client is in
2001:db8:bad::
=> Drop HTTPS request

Attacker Has a Foothold in ”Good” PvD



PvD=good.com
Flag=H
PIO=2001:db8:beef::/64

PvD=good.com
Flag=H
PIO=2001:db8:beef::/64

```
{
  name : “good.com” ;
  prefixes: [”2001:db8:beef::”];
}
```

IPv6 tunnel over foo

All appears good to host and PvD server...
PvD approach does not help in this case
But, it requires a foothold in good PvD

Host Privacy with Additional Information

- Each host will fetch the additional information on connection
- The HTTPS server will know the IP address of all clients and that the client is connecting...
  - Some privacy issues esp. if using EUI-64 or stable address

- Host can change to another IP address after fetching the file
- HTTPS belongs to the network operator (same as RADIUS, DHCP, ...)
- Anyway, it has more privacy than http://captive.example.com/hotspot-detect.html which belongs to another global operator