Using DNS for Mapping Host Identifiers to Locators

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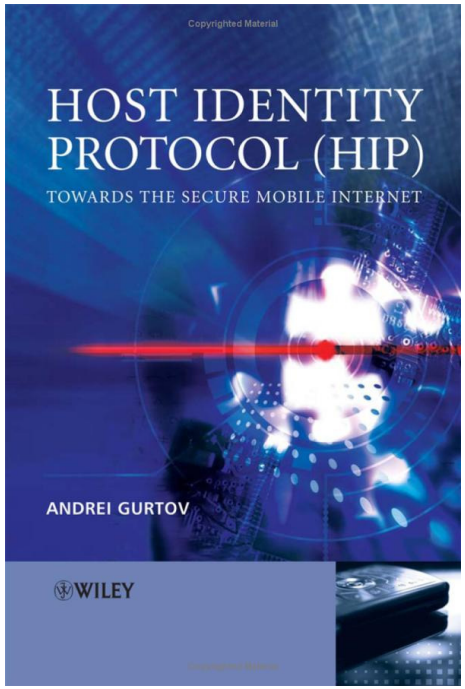
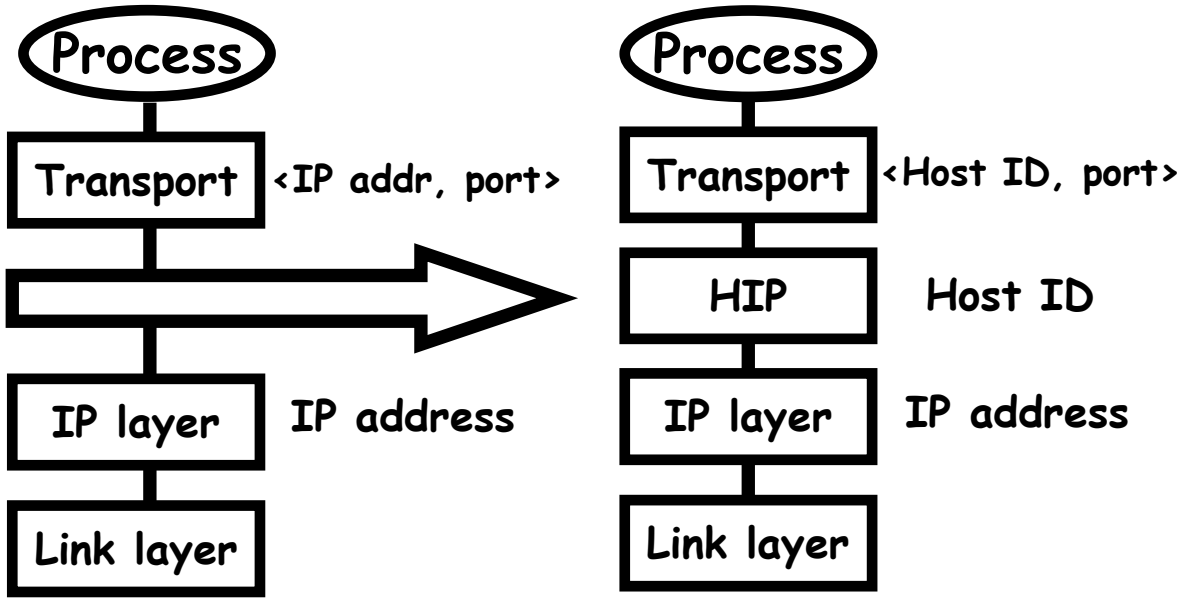
OUTLINE

- Current situation
- Storage conventions
- Usage

HOST IDENTITY PROTOCOL

New layer between the internetworking and transport layers





RFC 4423, 5201-5206 5338

ORCHID prefix 2001:10::/28 for HITs

HIT 2001:11:4cf1:6fd5:3787:581:1104:b980

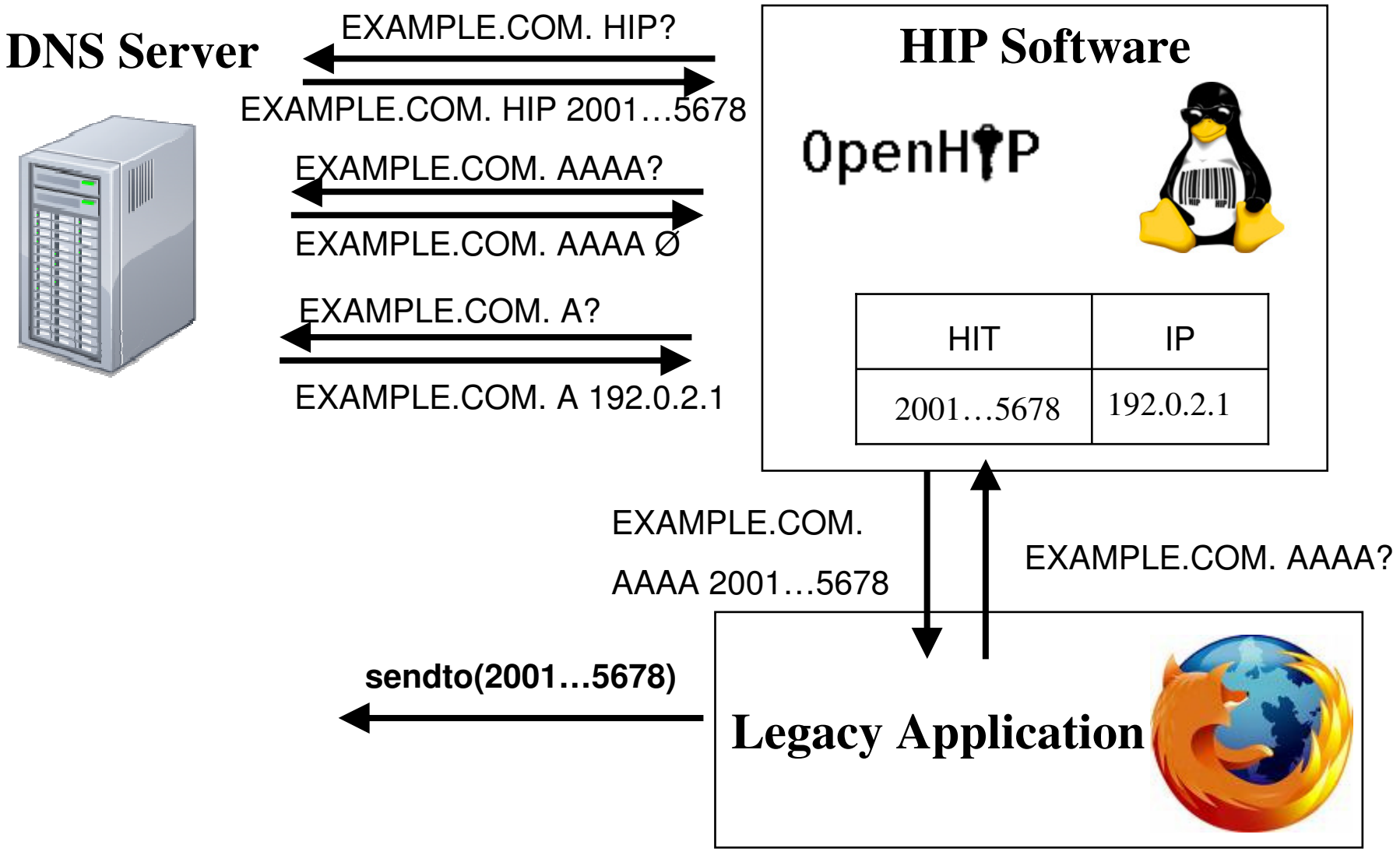
LSI 1.7.8.9

HIP RR

- **RFC5205: HIP RR Storage Format**

IN HIP (pk-algorithm
base16-encoded-hit
base64-encoded-public-key
rendezvous-server[1]
...
rendezvous-server[n])

NOW


DNS Server
EXAMPLE.COM. HIP?
EXAMPLE.COM. HIP 2001…5678
EXAMPLE.COM. AAAA?
EXAMPLE.COM. AAAA Ø
EXAMPLE.COM. A?
EXAMPLE.COM. A 192.0.2.1
HIP Software
OpenHIP
HIT
IP
2001…5678
192.0.2.1
EXAMPLE.COM.
AAAA 2001…5678
EXAMPLE.COM. AAAA?
sendto(2001…5678)
Legacy Application

OK, BUT

- IN HIP {HIT} {IP1; IP2; IP3} – all in one query
- What if the application does not use DNS?
- What if the application stores IP addresses internally?
- HIT to IP global mapping database?
- OpenDHT: 16 packets, 2132 bytes – **SLOW!**

draft-ponomarev-hip-hit2ip-03

- 8.7.6.5.4.3.2.1.0.F.E.D.C.B.A.9.8.7.6.5.4.3.2.1.0.
  1.0.0.1.0.0.2.HIT-TO-IP.EXAMPLE.

A/AAAA	IP ADDRESS(ES)
PTR	HOSTNAME(S)
CNAME	LINK TO ANOTHER DOMAIN
HIP	COMPLETE HOST IDENTITY

- DNS is just an access interface
- Much experience, re-use existing resolvers

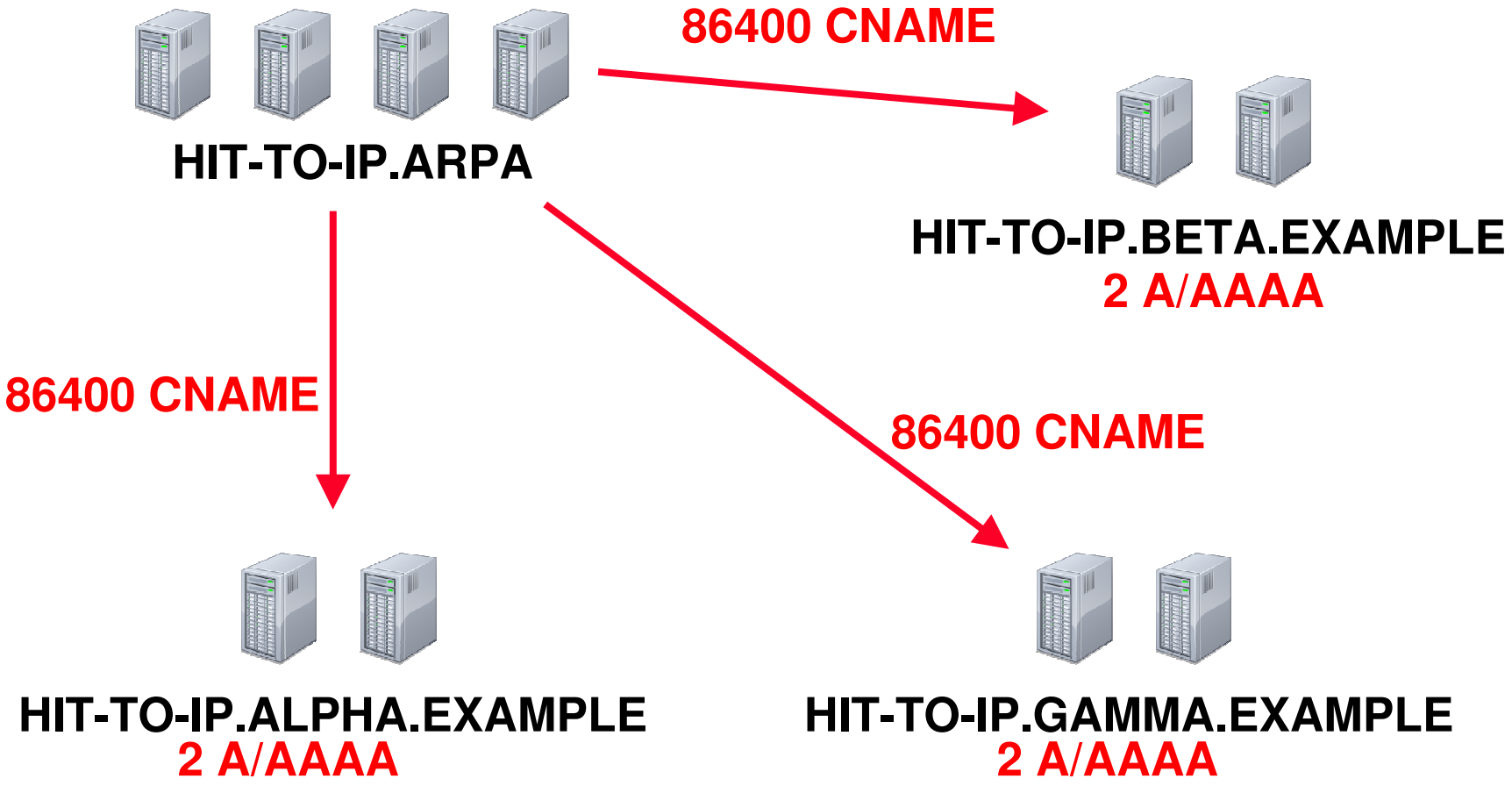
UPDATES

- DNS UPDATE authenticated by HIP, only *2001:10:1234:5678:9ABC:DEF0:1234:5678* may change *8.7.6.5.4.3.2.1.0.F.E.D.C.B.A.9.8.7.6.5.4.3.2.1.0.1.0.0.1.0.0.2.HIT-TO-IP.*
- Validate A/AAAA?
- Delete A/AAAA records from those IPs?

INITIAL DEPLOYMENT

- BIND9 – 100.000 replies / second
- HIPL – 100 base exchanges / second
- Enough for 100.000 active clients, assuming 15 minute update interval
- OK in local scale

TWO LEVELS


86400 CNAME
HIT-TO-IP.ARPA
HIT-TO-IP.BETA.EXAMPLE
2 A/AAAA
86400 CNAME
86400 CNAME
HIT-TO-IP.ALPHA.EXAMPLE
2 A/AAAA
HIT-TO-IP.GAMMA.EXAMPLE
2 A/AAAA

SOME NUMBERS

- Root level: 100 bit (HIT) + 28 bit (index) = 16 bytes
- 32GB RAM ($1500 server) – two billion identifiers
- 40 servers (40U) – 40 billion identifiers (redundantly)
- Indirection for HIT-TO-IP.ARPA
- The same second level index for 1.0.0.1.0.0.2.IP6.ARPA

SUMMARY

- Deployment is important
- Legacy applications must work
- Global mapping can be done
- Do we need it?
- Comments

BACKUP: TWO LEVELS

8.7.6.5.4.3.2.1.0.F.E.D.C.B.A.9.8.7.6.5.4.3.2.1.0.1.0.0.1.0.0.2.HIT-TO-IP.ARPA.

86400 CNAME 8.7.6.5.4.3.2.1.0.F.E.D.C.B.A.9.8.7.6.5.4.3.2.1.0.1.0.0.1.0.0.2.HIT-TO-IP.EXAMPLE.NET.

8.7.6.5.4.3.2.1.0.F.E.D.C.B.A.9.8.7.6.5.4.3.2.1.0.1.0.0.1.0.0.2.HIT-TO-IP.EXAMPLE.NET.

2 A 192.0.2.1

2 AAAA 2001:DB8::1

BACKUP: LOCAL USAGE

- Application: EXAMPLE.COM. AAAA?
- EXAMPLE.COM. HIP {2001…5678}
  A 192.0.2.1

- Local DNS server: EXAMPLE.COM. AAAA 2001…5678
- Add 8.7.6.5…1.0.0.2.HIT-TO-IP.EXAMPLE.NET.
  CNAME EXAMPLE.COM.

BACKUP: CNAME HIT-TO-IP

- EXAMPLE.COM. CNAME
  8.7.6.5…1.0.0.2.HIT-TO-IP.EXAMPLE.

- 8.7.6.5…1.0.0.2.HIT-TO-IP.EXAMPLE.
  HIP {2001…5678}
  A 192.0.2.1

BACKUP: LSI

- Application: EXAMPLE.COM. A?
- EXAMPLE.COM. HIP {2001…5678}
  A 192.0.2.1

- Local DNS server: EXAMPLE.COM. A 1.7.8.9
- Add 9.8.7.1.LSI-TO-IP.EXAMPLE.NET.
  CNAME EXAMPLE.COM.

BACKUP: IP6.ARPA

1.0.0.1.0.0.2.IP6.ARPA.

86400 NS A.HIP-SERVERS.NET.

86400 NS B.HIP-SERVERS.NET.

86400 NS C.HIP-SERVERS.NET.

8.7.6.5.4.3.2.1.0.F.E.D.C.B.A.9.8.7.6.5.4.3.2.1.0.1.0.0.1.0.0.2.IP6.ARPA.

86400 CNAME

8.7.6.5.4.3.2.1.0.F.E.D.C.B.A.9.8.7.6.5.4.3.2.1.0.1.0.0.1.0.0.2.HIT-TO-HOST.EXAMPLE.NET

8.7.6.5.4.3.2.1.0.F.E.D.C.B.A.9.8.7.6.5.4.3.2.1.0.1.0.0.1.0.0.2.HIT-TO-HOST.EXAMPLE.NET.

86400 PTR EXAMPLE.COM.

BACKUP: OpenDHT vs DNS

15:14:51.138879 IP 137.226.59.118.46496 > 137.226.12.31.domain: 61489+ AAAA? opendht.nyuld.net. (35)
15:14:51.139144 IP 137.226.12.31.domain > 137.226.59.118.46496: 61489 1/1/0 CNAME[|domain]
15:14:51.139254 IP 137.226.59.118.46496 > 137.226.12.31.domain: 7881+ A? opendht.nyuld.net. (35)
15:14:51.139469 IP 137.226.12.31.domain > 137.226.59.118.46496: 7881 2/0/0 CNAME[|domain]
15:14:51.139648 IP 137.226.59.118.33646 > 130.104.72.201.5851: S 2902443105:2902443105(0) win 5840 <mss 1460,sackOK,timestamp 110486255 0,nop,wscale 6>
15:14:51.160524 IP 130.104.72.201.5851 > 137.226.59.118.33646: S 1423455886:1423455886(0) ack 2902443106 win 5792 <mss 1460,sackOK,timestamp 3564656007 110486255>
15:14:51.160576 IP 137.226.59.118.33646 > 130.104.72.201.5851: . ack 1 win 5840 <nop,nop,timestamp 110486260 3564656007>
15:14:51.160651 IP 137.226.59.118.33646 > 130.104.72.201.5851: P 1:151(150) ack 1 win 5840 <nop,nop,timestamp 110486260 3564656007>
15:14:51.189501 IP 130.104.72.201.5851 > 137.226.59.118.33646: . ack 151 win 5792 <nop,nop,timestamp 3564656034 110486260>
15:14:51.189557 IP 137.226.59.118.33646 > 130.104.72.201.5851: P 151:481(330) ack 1 win 5840 <nop,nop,timestamp 110486267 3564656034>
15:14:51.222324 IP 130.104.72.201.5851 > 137.226.59.118.33646: . ack 481 win 6432 <nop,nop,timestamp 3564656062 110486267>
15:14:51.364380 IP 130.104.72.201.5851 > 137.226.59.118.33646: P 1:400(399) ack 481 win 6432 <nop,nop,timestamp 3564656208 110486267>
15:14:51.364433 IP 137.226.59.118.33646 > 130.104.72.201.5851: . ack 400 win 6432 <nop,nop,timestamp 110486311 3564656208>
15:14:51.364459 IP 130.104.72.201.5851 > 137.226.59.118.33646: F 400:400(0) ack 481 win 6432 <nop,nop,timestamp 3564656208 110486267>
15:14:51.366094 IP 137.226.59.118.33646 > 130.104.72.201.5851: F 481:481(0) ack 401 win 6432 <nop,nop,timestamp 110486312 3564656208>
15:14:51.392833 IP 130.104.72.201.5851 > 137.226.59.118.33646: . ack 482 win 6432 <nop,nop,timestamp 3564656238 110486312>

↑16 packets, 2132 bytes ↓ 2 packets, 542 bytes

16:46:00.396623 IP 137.226.59.118.46613 > 137.226.12.31.domain: 36570+ A? 0.8.9.b.4.0.1.1.1.8.5.0.7.8.7.3.5.d.f.6.1.f.c.4.1.1.0.0.1.0.0.2..hit-to-ip.net. (49)
16:46:00.396749 IP 137.226.12.31.domain > 137.226.59.118.46613: 36570 1/0/0 (65)