Incentivizing the adoption of (new) standards

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Problem

"Slow adoption of IPv6 risks harming Dutch innovation climate"  

Goal

• Promote adoption of IPv6 and other standards that help increase online security

• This proved successful for DNSSEC, the .nl-zone has largest number of DNSSEC secured domain names.
How?

- Financial incentives for domain name registrars
  - Per qualifying domain name (1 year period, wholesale price 3.40 euro)
    - IPv6 20 cent
    - DMARC 16 cent
    - STARTTLS 4 cent

- Total discount (1.7 million euro projected for 2019)
  - Up to 0.40 euro for IPv6 and Secure email (11.8%)
  - Up to 0.60 euro combined with other incentives (17.6%)
Incentives

- IPv6 responsiveness
  - DNS
    - >= 1 authoritative NS responding within 7 secs
  - SMTP
    - >= 1 mail server responding within 7 secs
  - HTTP
    - >= 1 web server responding within 7 secs
Incentives

• Secure Mail
  • **STARTTLS**
    • >= 1 MX IP responding (< 35 sec, spambot defenses) all responding IPs must support STARTTLS
  • **DMARC**
    • _dmarc RR found in DNS with valid syntax AND combination with DKIM/SPF must satisfy RSC requirements
  • **DKIM**
    • <random>_domainkey RR found in DNS (checking for white lies)
Incentives

- Secure Mail
  - SPF
    - SPF TXT record (v=spf) found with valid syntax
    - Validation requires <= 10 DNS queries (1% fail)
    - SPF result must be FAIL, SOFTFAIL or NEUTRAL
Measurement

- Developed multiprotocol crawler for HTTP, TLS, DNS and SMTP
- Scan entire .nl-zone once very month
- Duration, 10 days on modest VM
  - Retry failed checks (max 3 times)
  - Shallow web crawl (limit # of pages)
  - Low impact on hosts
Results IPv6

IPv6 deployment .nl-zone (%)

![IPv6 deployment chart]
Results DKIM

DKIM deployment .nl-zone (%)

[Graph showing the percentage of DKIM deployment over time from 2016 to 2018]
Results DMARC

DMARC deployment .nl-zone (%)
Results STARTTLS

STARTTLS deployment .nl-zone (%)
Conclusion

• Signed up 370 registrars (86% of .nl-zone domains)
• Incentives help to increase adoption, in first 6 months;
  • STARTTLS increased from 3.2 to 3.6 million domain names
  • DMARC increased from 36k to 460k domain names
  • DKIM increased from 365k to 1.1 million domain names
  • SPF increased from 400k to 2.6 million domain names
Future work

• Include DANE in our program
  • Get TLSA records both Mail and Web service
  • Validate service TLS certificate using TLSA record

Q&A

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