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Drivers for the study

- ★ Deploying a new technology requires investment
 - ★ Hardware
 - ★ Software
 - ★ Human Resources
 - ★ Bandwidth
- ★ For DNSSEC these costs are not well defined
 - ★ Uncertainty can hinder its deployment

Why ENISA?

- ★ “Improving Resilience in European e-Communication Networks”, 2008-2010
 - ★ DNS is a critical service for IP Based Networks
 - ★ Not designed to be secure
 - “Intentional omissions include security”, Dr. Paul Mockapetris
 - ★ Its improved stability and security will improve networks resilience
 - ★ DNSSEC greatly enhances networks resilience. Policies and guidelines are needed



Objectives & Scope

★ Objectives

- ★ Study the costs (CAPEX/OPEX) of DNSSEC deployment
- ★ Assess the required changes on resources of the different roles and operations

★ Scope

- ★ Registries, Registrars, Zone Operators and Recursive Resolver Operators.

★ Means

- ## ★ Stocktaking, questionnaires and interviews

★ Side effects

- ★ Analyse adoption
- ★ Analyse business benefits

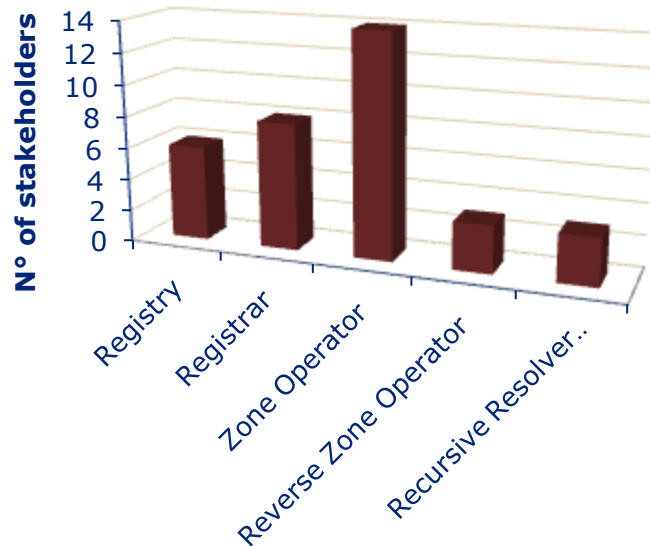
★ Hurdles

- ★ Not detailed answers

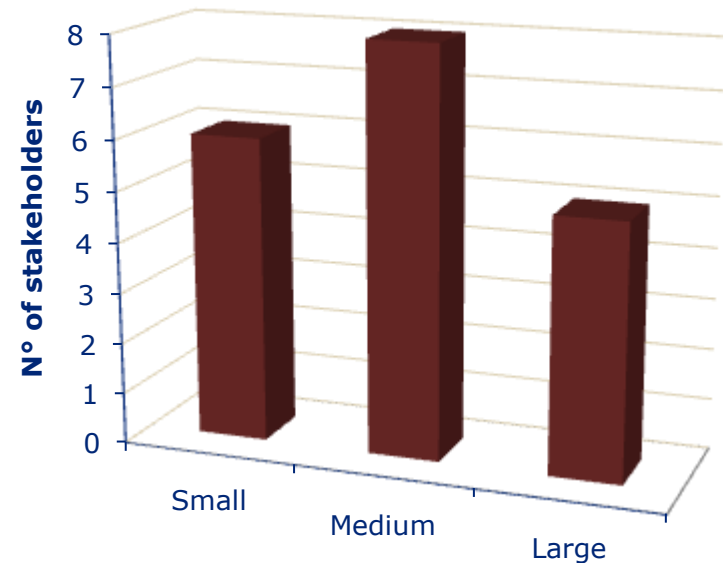
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Stakeholders involved

Roles Surveyed



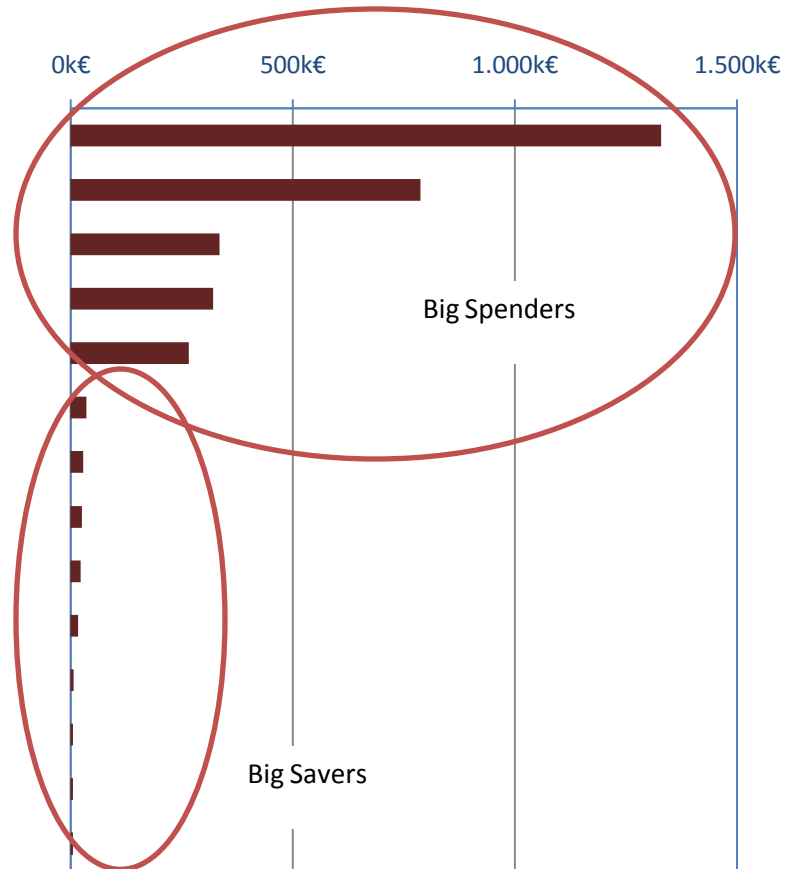
Stakeholder size in Terms of Zones



- ★ Selection Criteria
 - ★ Considered, implemented or abandoned a DNSSEC implementation
- ★ Voluntary participation

Overall Investment Cost

- ★ Clear distinction between “*big savers*” and “*big spenders*”
 - ★ “big savers” invest on average 27.000€
 - ★ “big spenders” invest on average 608.000€
- ★ Pure play registrars
 - ★ Investment cost below 5.000€



Big Spenders vs. Big Savers

Infrastructure costs

- ★ Significant investments
 - ★ 17% to 48% of total investment cost
- ★ Use existing infrastructure
 - ★ <10,000 €

Strategic Positioning

- ★ Frontline of deployment
- ★ Emphasis in governance
 - ★ Key management
 - ★ Operational processes
- ★ Use existing open source software
- ★ Limit themselves to customisations
 - ★ 90% of cost

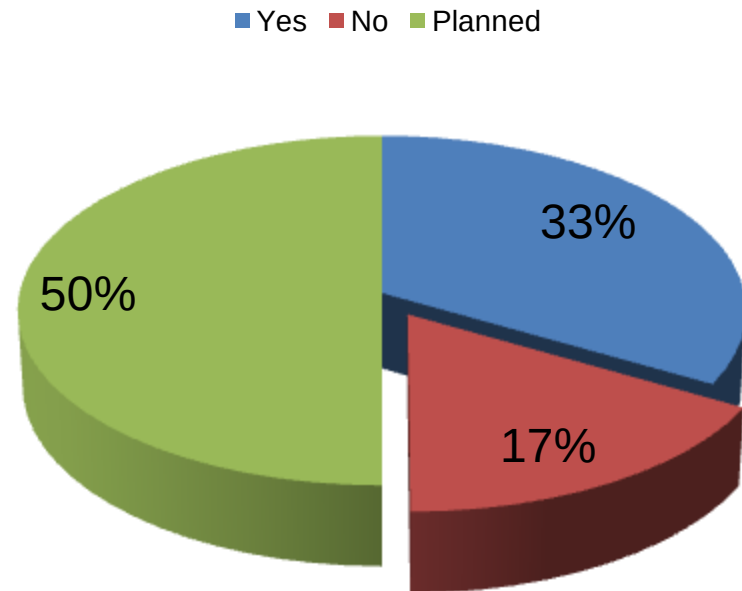
Software Cost

- ★ Almost none of the correspondents have bought a commercial-of-the-shelf product
 - ★ 83% use opensource
- ★ Software costs come from:
 - ★ in-house development
 - ★ customization of open source solutions
- ★ Early adaptors (before 2008) were obliged to invest significantly in in-house development
- ★ Development cost for future DNSSEC deployments can significantly be reduced
 - ★ “Leaders pay the bill, followers can limit their investments.”

Key Management Costs

- ★ Only a limited number of stakeholders adopt hardware security modules (HSM's)
 - ★ Poor support of HSM within open source software is one of the reasons
 - ★ Size of the organisation does not influence the choice to implement HSM or not
- ★ Costs vary between 500€ and 25.000€

HSM use for registries



Other Costs

- ★ Deployment of specific features
 - ★ NSEC3, Dynamic Updates, DLV
- ★ Training
- ★ Legal support
 - ★ Legal value of a signed DNS record

Operational Expense

- ★ Increasing bandwidth is the only operational cost item
 - ★ Increase in zone size
 - ★ Obligated to use new methods for the transfer of zones

# ID	Role	Daily DNSSEC Queries	Daily Regular Queries	% of queries with DNSSEC	% in bandwidth increase
# 13	RY; ZO	1.250.000.000	2.500.000.000	33%	15 %
# 16	ZO	3.024.000.000	6.048.000.000	33%	50 %
# 15	RY	311.040.000	518.400.000	37%	50 %
# 14	RY	345.600.000	864.000.000	29%	100 %

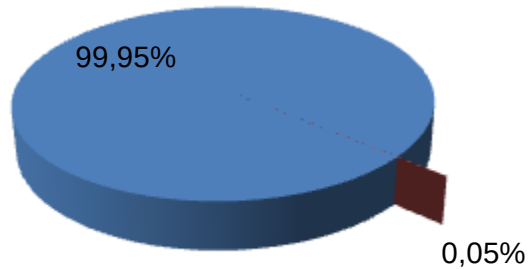


Cost Evolution

- ★ Costs for newer deployments will decrease
 - ★ As adoption grows and technology and procedures related to DNSSEC become more standardized
 - ★ Out-of-the-box solutions will reduce the capital expense costs
- ★ Additional costs in a one and three year period will be minimal
 - ★ Costs of new features or adaption to new procedures (e.g. Signed Root)

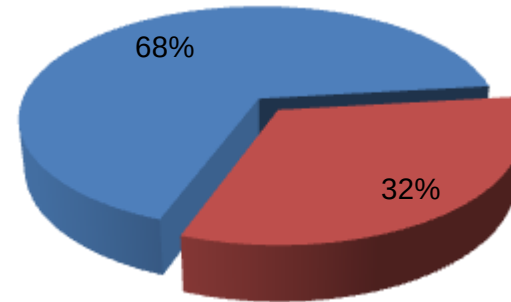
Adaption of DNSSEC

Signed Zones



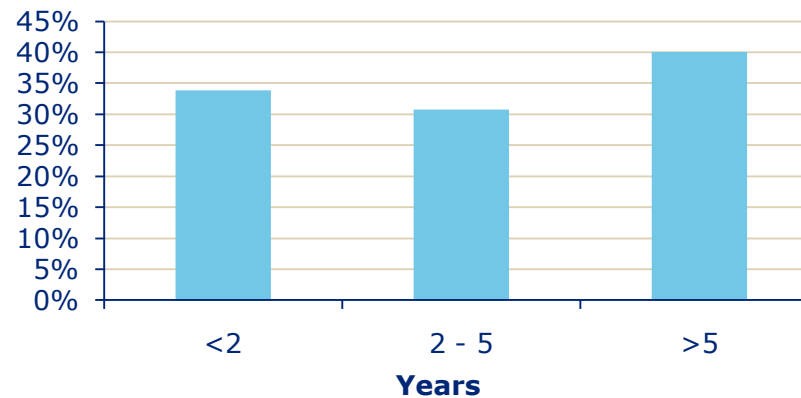
■ Non-DNSSEC zones ■ DNSSEC zones

Resolver Queries



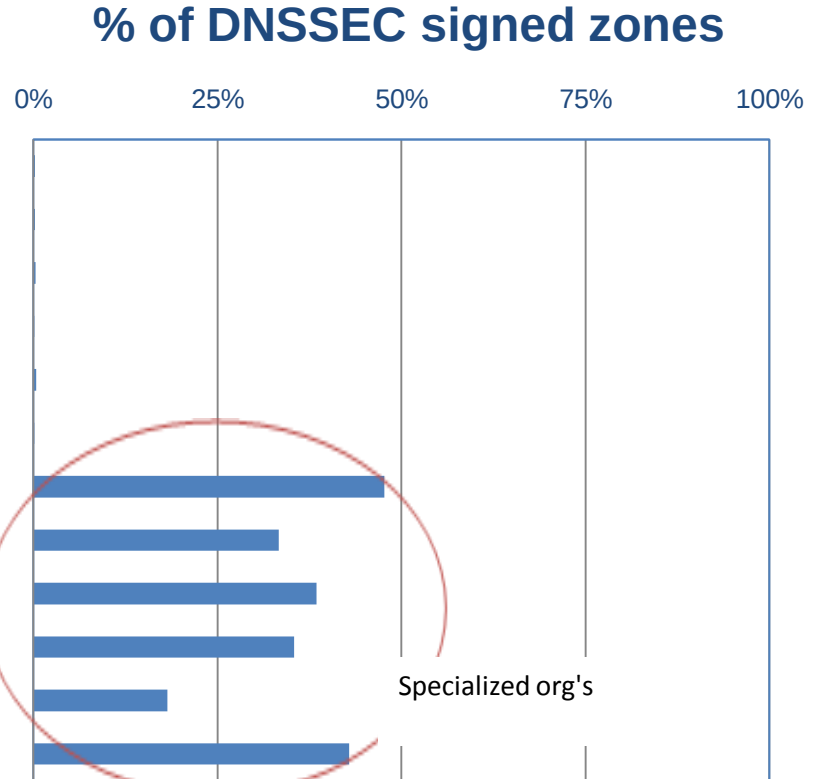
■ Non-DNSSEC queries ■ DNSSEC queries

% DNSSEC capable queries per deployment adoption timeframe



Specialization on DNSSEC

- ★ Zone operators that deployed DNSSEC have an average of 30% of zones signed
- ★ Host less than 600 zones
- ★ Succeed to attract, convince or oblige domain owners to enable DNSSEC



Business Benefits and Motivation

★ Registry

- ★ Become a reliable Trust Anchor
- ★ Lead by example and stimulate parties further down in the chain to adopt DNSSEC
- ★ Earn recognition in the DNS community

★ Zone operator

- ★ Provide assurance to clients that domain name services are reliable and trustworthy
- ★ Look forward to increasing adoption rate when revenue is an important driver. Deploying DNSSEC can be profitable

★ Registrar

- ★ Differentiator and competitive advantage versus others

★ Recursive Resolver Operator

- ★ Assure end-users on DNS reliability and trustworthiness
- ★ Offering differentiator and competitive advantage



Online resources

★ The report

- <http://www.enisa.europa.eu/act/res/technologies/tech/costs-of-dnssec-deployment>

★ Technologies for resilience

- <https://www.enisa.europa.eu/act/res/technologies>

