DNSwitness: A Generic Platform For DNS-based Measurements

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Overview

- **Motivation**
- **Principles & Requirements**
- **Architecture**
- **Past & Current Uses**
- **Some results**
- **Conclusion & Prospective work**

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Motivation

- ✓ DNS registry is seated on a “gold mine” of DNS data
- ✓ What does DNS tell us?
  - ✓ There is precious information to extract and use
  - ✓ Our marketing team, technical team, management ask various questions we may have the answer for:
    - ✓ “How many of our domains are used for e-mail only?
    - ✓ What has the penetration rate of IPv6, DNSSEC or *phenomenon X* evolved over the last N years?
    - ✓ Could you assess the technical quality of a given portfolio of DNS zones?
- ✓ We focus on things that we can obtain by starting with the DNS
  - ✓ Either from the DNS itself
  - ✓ Or by further exploring

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Principles & Requirements

- ✓ Generic
  - ✓ Can do many different surveys
  - ✓ Most known tools deal only with one survey
- ✓ Automatic
  - ✓ Works unattended (from cron, for instance), for periodic runs,
- ✓ Store raw results
  - ✓ Not just aggregates
  - ✓ For long-term analysis
- ✓ Free Software
- ✓ Usable by small and medium actors
  - ✓ ***Run it yourself***, and keep your own data, share aggregated & anonymized results
  - ✓ No data to be sent to a centralized analysis fabric

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Global Architecture

- ✓ DNSwitness Platform: **2 main** (free) software **components**
  - ✓ **DNSdelve, for active measurement**
    - ✓ What we send out : active DNS queries sent to domains
    - ✓ *“Go on a fishing trip!”*
    - ✓ Typically: **sampling** in a zone TLD file vs **comprehensive walk**
  - ✓ **DNSmezzo, for passive measurement**
    - ✓ What comes in: DNS queries sent name servers, passively monitored
    - ✓ *“Who’s knocking at our door?”*
    - ✓ Sampling by default (might take all the traffic for a given window of time)

- ✓ **A database** to store results
  - ✓ To allow **long-term** surveys and study the **evolution**
  - ✓ To do **benchmark** with other partners based on **uniform indicators/metrics**

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Architecture: Active Measurements Component (DNSdelve)

- ✓ A framework
  - ✓ To gather information from the DNS zones delegated by a registry
  - ✓ To get start points to explore the Internet for further information

- ✓ Composed of
  - ✓ A generic basis:
    - ✓ Handles zone file parsing and parallel querying of the zones
  - ✓ Modules dedicated for targeted surveys:
    - ✓ Perform the actual queries: ask explicit questions to the DNS
    - ✓ Examples: IPv6, DNSSEC, SPF modules already available

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Architecture: Passive Measurements Component (DNSmezzo)

- ✓ Capture DNS traffic, analyze content and store in a Database
  - ✓ By sniffing the DNS traffic on a server (port mirroring, tcpdump…)
  - ✓ Storing structured info (what we have learnt) in a rDBMS

- ✓ Do measurements/statistics by querying the DB
  - ✓ Periodically, unattended or on-demand runs
  - ✓ Examples:
    - ✓ Top N domains queried for (and more specifically those which yield a NXDOMAIN answer)
    - ✓ Percentage of queries targeting AAAA (wrt A) records
    - ✓ Percentage of traffic transported on IPv6 (wrt IPv4)
    - ✓ How many queries use EDNS0 and for which sizes?
    - ✓ Percentage of recursive name servers patched against Kaminsky attack (SPR)

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Similar Work (DNS-based)

- ✓ Active measurements
  - ✓ “The Health of the Internet in Sweden” (annual reports): https://www.iis.se/en/internet-for-alla/halsolaget

- ✓ Passive Measurements:
  - ✓ IIS.se dns2db http://opensource.iis.se/trac/dns2db
  - ✓ ISC SIE https://sie.isc.org/
  - ✓ DSC http://dns.measurement-factory.com/tools/dsc/

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Past & Current DNSwitness Uses

- ✓ Feeding the French Annual DNS Industry Report with IPv6 figures
  - ✓ http://www.afnic.fr/fr/ressources/publications/observatoire-du-marche-des-noms-de-domaine-en-france-3.html
- ✓ Contribution to the OECD Report on IPv6 Deployment Measurements in the world
  - ✓ http://www.oecd.org/dataoecd/48/51/44953210.pdf
- ✓ As a platform for Internet Resilience measurements in France
  - ✓ "Observatoire de la Résilience de l'Internet en France"
  - ✓ Jointly with ANSSI (the French Network and Information Security Agency)
  - ✓ AFNIC's contribution: from the DNS perspective
  - ✓ Results unveiled at the DNS-OARC meeting (while waiting for the 1st edition of the report to be published): https://www.dns-oarc.net/files/workshop-201203/OARC-London-2012.pdf
- ✓ Surveys on demand (AFNIC or third parties)

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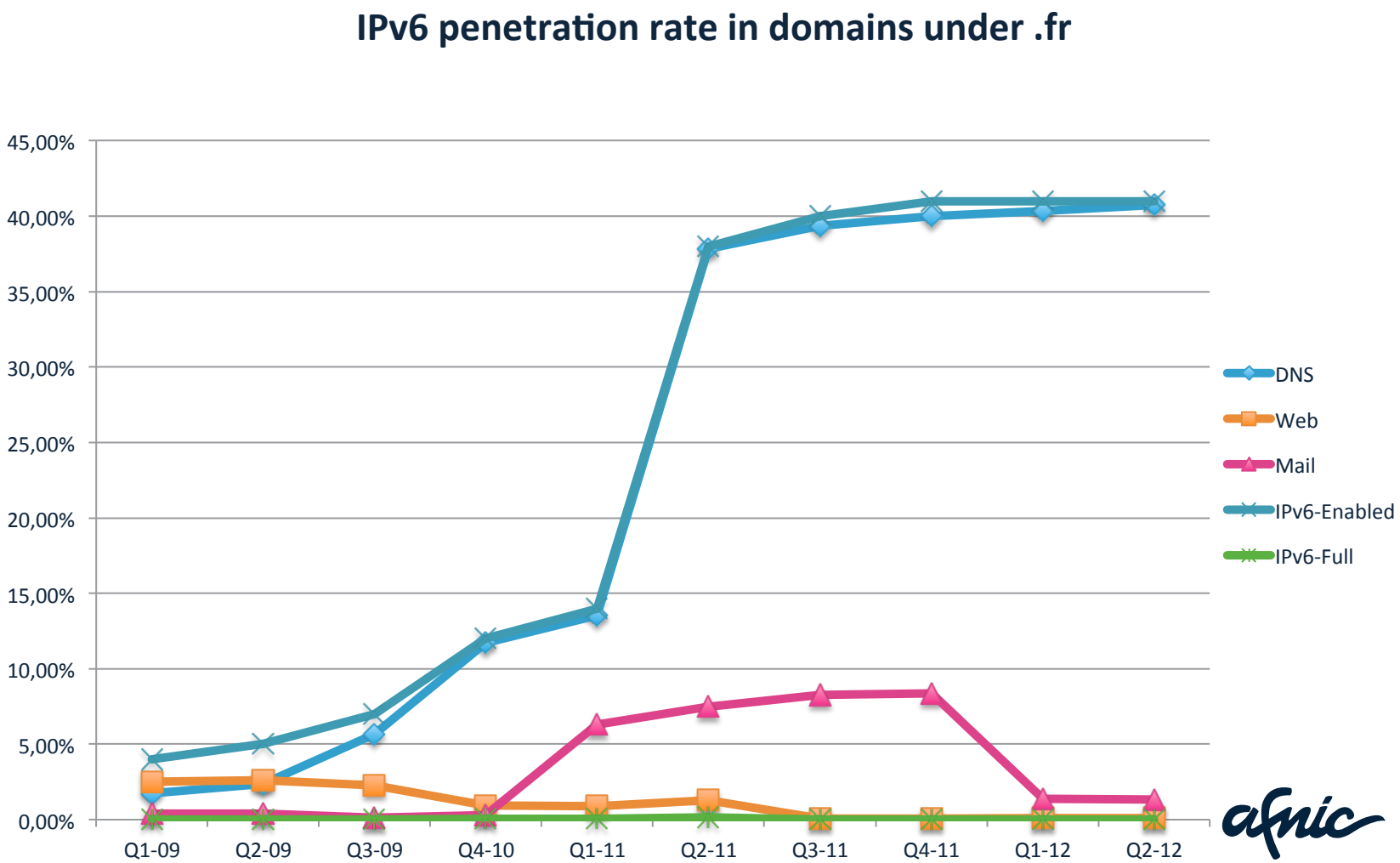
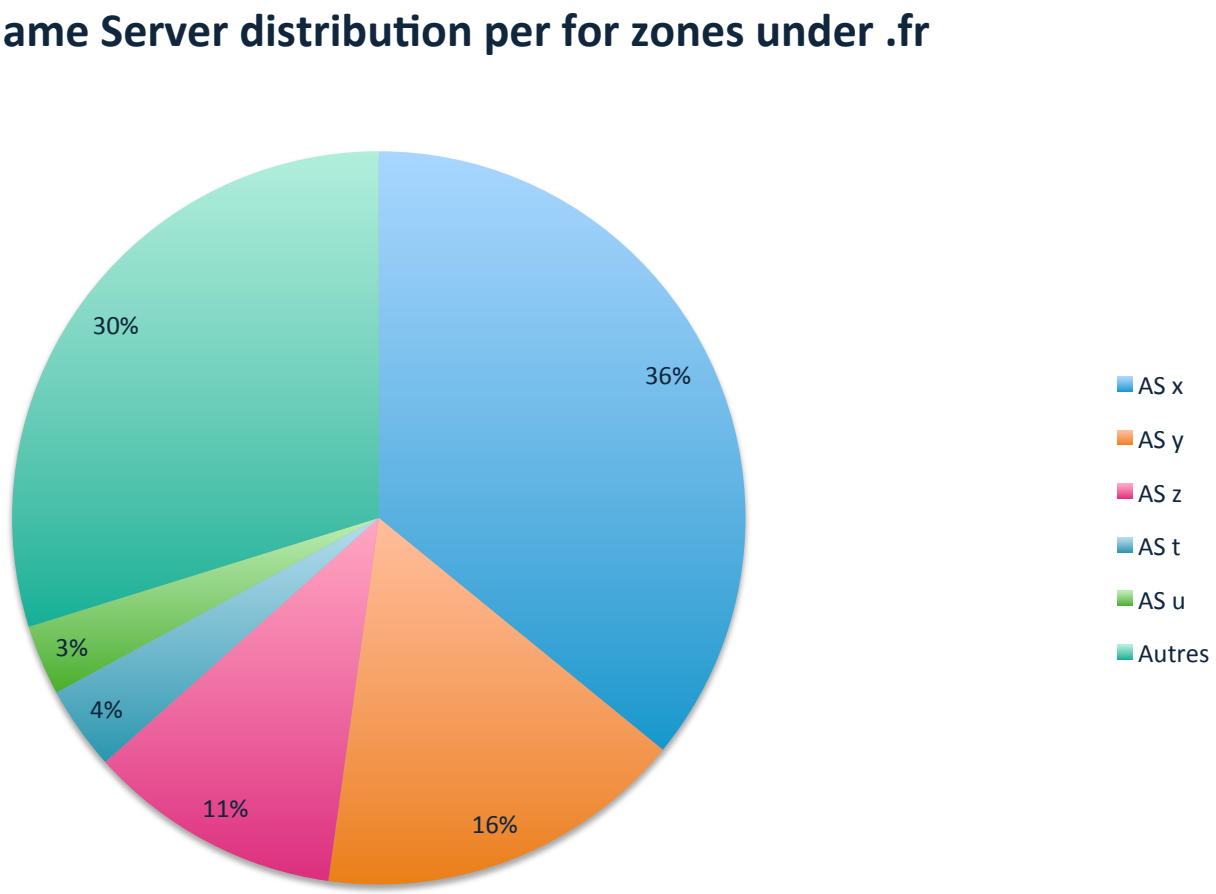
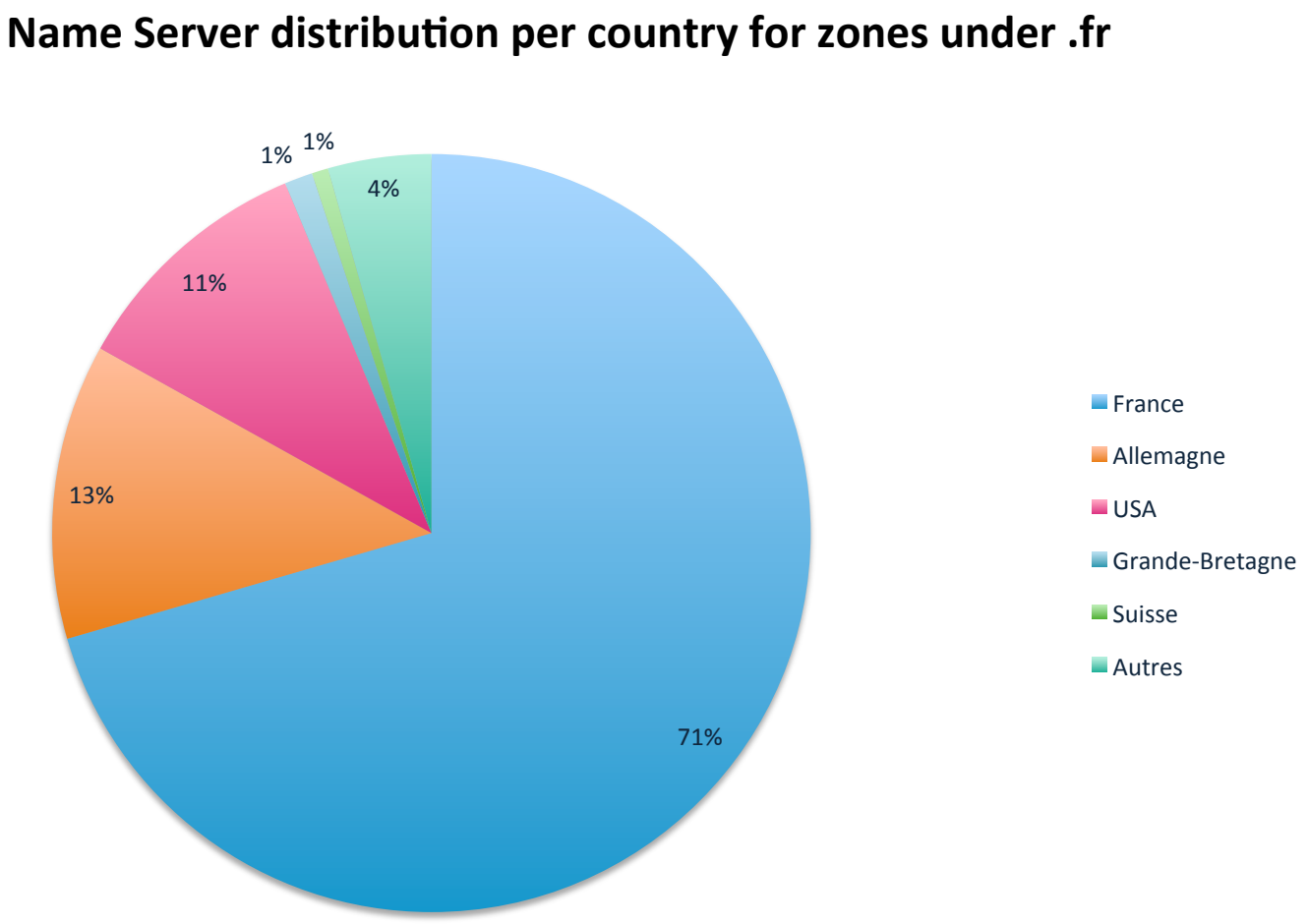
Active measurements results



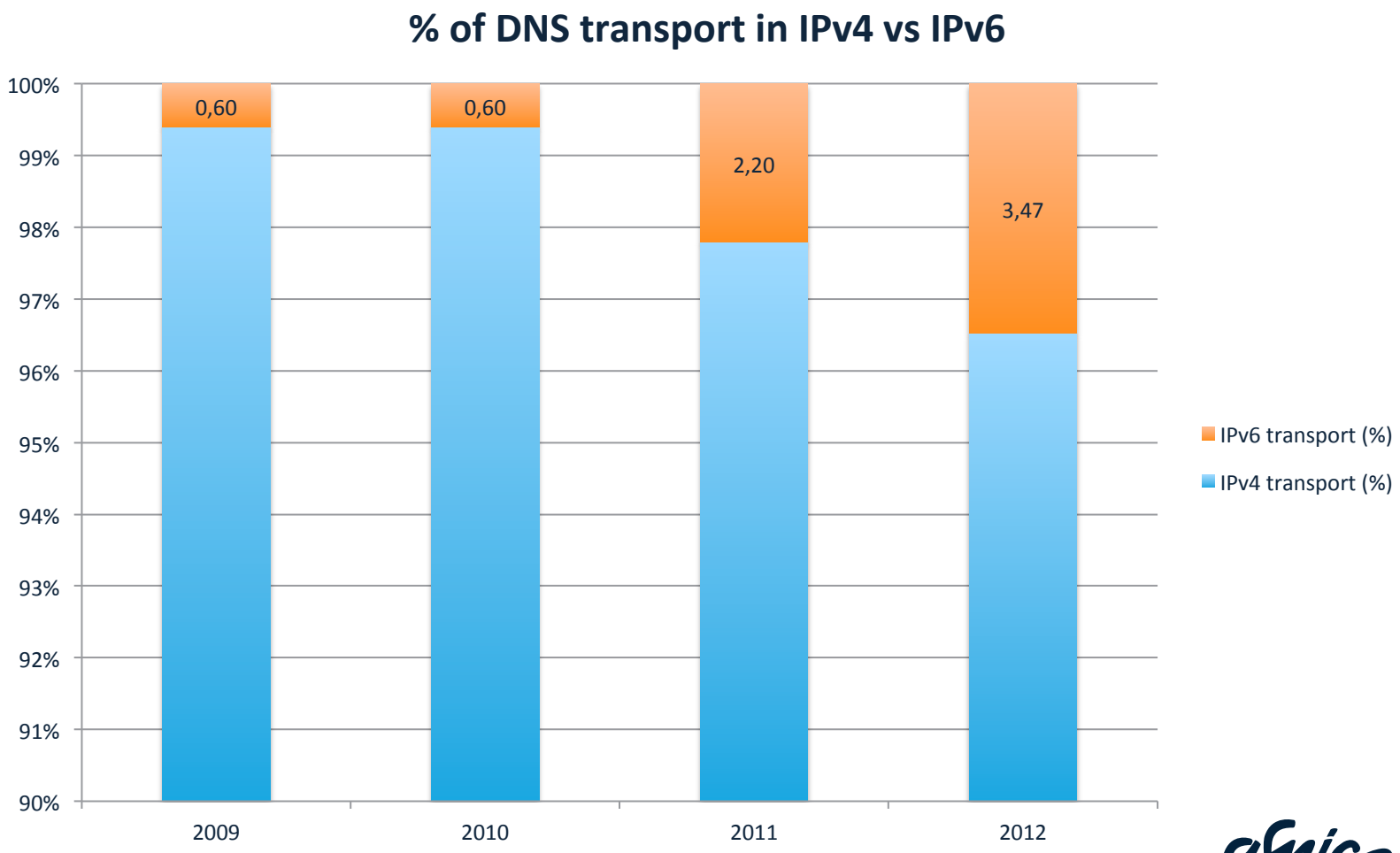
Active measurements results (2)



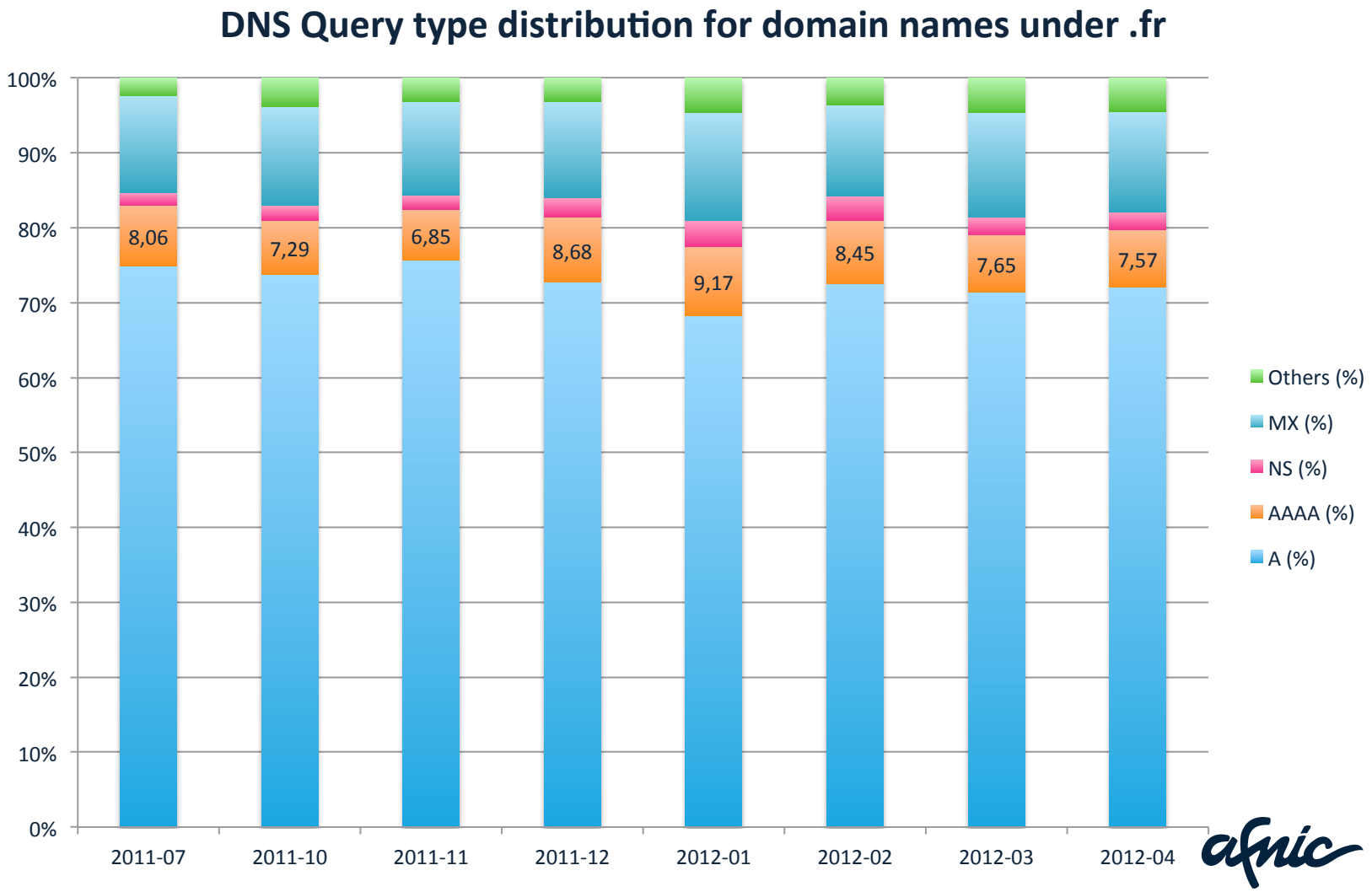
Active measurements results (3)



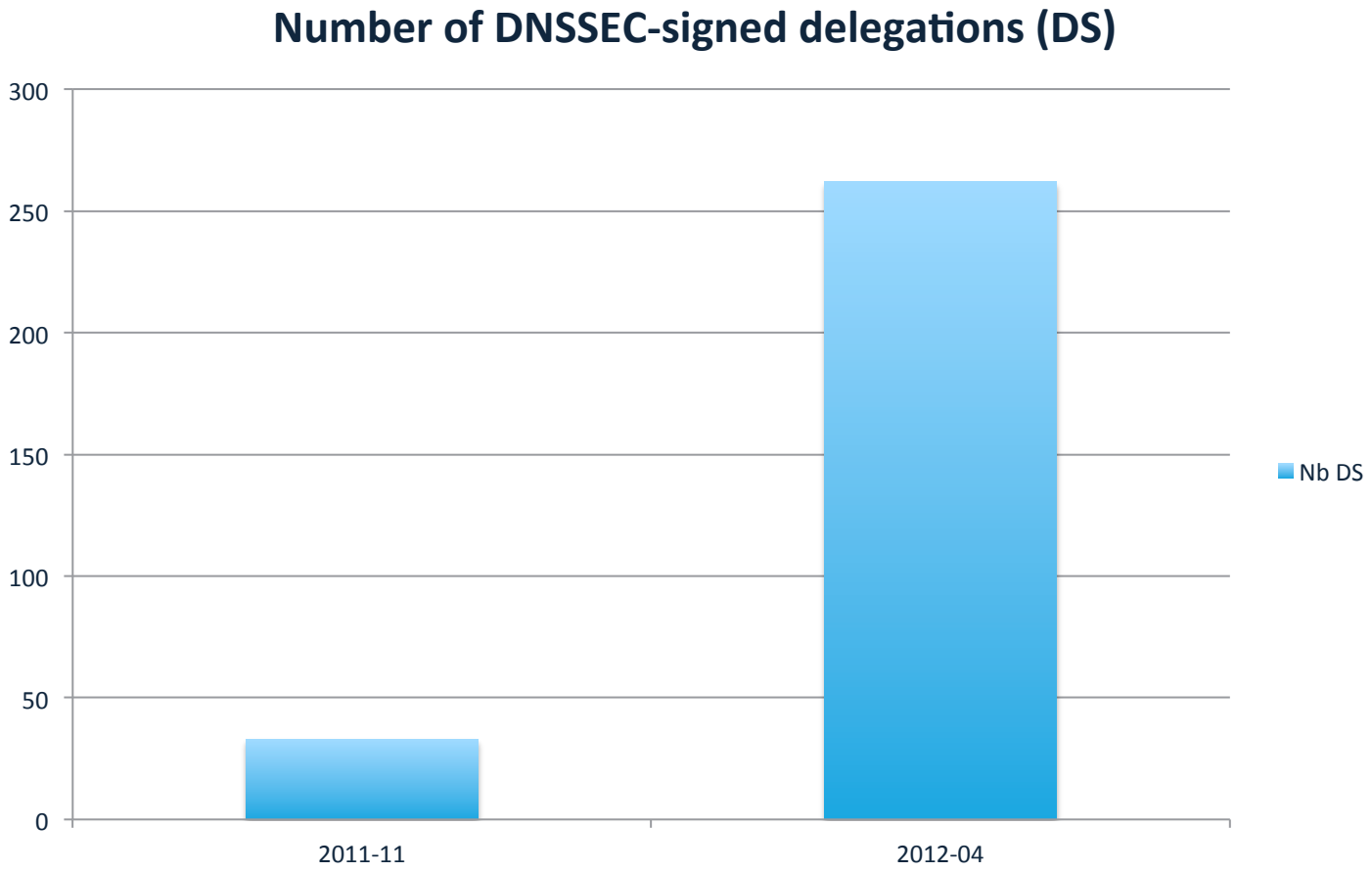
Passive measurements results



Passive measurements results (2)



Passive measurements results (3)



Conclusion & Prospective Work

- ✓ DNSwitness is a generic measurements platform used in different contexts for different needs
  - ✓ It has served multiple purposes so far
  - ✓ The platform is running in production at AFNIC premises

- ✓ Will evolve continuously in order to answer new needs
  - ✓ Collaboration with researchers
    - ✓ Define metrics and get periodic measurements
    - ✓ Put together results and get a joint analysis activity for a complete and long-term view
  - ✓ New developments for:
    - ✓ Additional resilience indicators measurements
    - ✓ Additional services penetration rate measurements
    - ✓ Added-value services for AFNIC and third parties

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Merci !

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