Zonemaster

A new DNS testing tool

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DNSCheck

DNSCheck is a program that was designed to help people check, measure and hopefully also understand the workings of the Domain Name System, DNS.

Background

- DNSCheck does not give truly deterministic results
- ZoneCheck written in Ruby, old legacy code
- AFNIC and .SE needed better tools for DNS measurements
- Decision to create a joint “reference” tool

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The Collaboration

- Based on DNSCheck and ZoneCheck
  - Joint requirements and specifications
- Collaboration between AFNIC and .SE
- A new tool with a great name

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Requirements

- For version 1.0:
  - All test cases from DNSCheck and ZoneCheck
  - All functionality from DNSCheck and ZoneCheck
  - Modular code
  - Faster, and lower impact on network!

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Report on Requirements to Test Case mapping

Req	Requirement desription	Level	Test Case ID	Test Description
R01	UDP connectivity	Connectivity-TP	CONNECTIVITY01	UDP connectivity
R02	TCP connectivity	Connectivity-TP	CONNECTIVITY02	TCP connectivity
R03	address in a private network	Address-TP	ADDRESS01	Name server address must be globally routable
R04	address should not be part of a bogon prefix	Address-TP	ADDRESS04	IPv6 address not part of bogon prefix
R05	illegal symbols in domain name	Syntax-TP	SYNTAX01	No illegal characters in the domain name
R06	dash ('-') at start or beginning of domain name	Syntax-TP	SYNTAX02	No hyphen ('-') at the start or end of the domain name
R07	double dash in domain name	Syntax-TP	SYNTAX03	There must be no double hyphen ('--') in position 3 and 4 of the domain name

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CONNECTIVITY01: UDP connectivity

Test case identifier

CONNECTIVITY01: UDP connectivity

Objective

DNS queries are sent using UDP on port 53, as described in section 4.2.1 of RFC 1035.

The objective for this test is that all the authoritative name servers for the domain are accessible over UDP on port 53

Inputs

The domain to be tested.

Ordered description of steps to be taken to execute the test case

1. Obtains the IP address of the name servers from Method4 and Method5
2. A SOA query is sent over UDP to distinct IP addresses of each name server found in step 1.
3. If all queries in step 2 receive a DNS answer (bogus responses are not checked here) then the test case succeed.

Outcome(s)

If there is any name server that fails to answer queries over port 53 using UDP, this test case fails

Special procedural requirements

If either IPv4 or IPv6 transport is disabled, ignore the evaluation of the result of any test using this transport protocol. Log a message reporting on the ignored result.

Intercase dependencies

None

Implementation

- Written in Perl…
  - Engine
  - CLI
  - Backend
  - GUI (Javascript + Perl)

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Zonemaster Engine

- A Perl library (`Zonemaster::*`)
- That implements
  - All functionality for testing
  - All the test cases
  - Functionality for logging results
  - Its own resolver
    - That uses `Net::LDNS` (built on ldns) instead of `Net::DNS`

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Zonemaster CLI

- Takes its input from a user
- Executes a test
- Publishes a log
  - Log as text, raw text - or JSON

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Zonemaster Backend

- JSON-RPC-interface to the Engine
- Used by the GUI to execute tests
- Can also be used by other applications for batch testing

Zonemaster GUI

- The UI to run tests
- … and present the result
- Is available at zonemaster.net

ZONEMASTER
by .se and afnic

en | fr | sv

Domain check | Pre-delegated domain | FAQ

Non-Javascript Interface

Domain name

iis.se

Advanced options

Test # 8828

Executed at 2015-04-27T10:25+0200

Link

http://zonemaster.net/test/8828

Basic | Advanced | Export | History

- ✔ SYSTEM
- ✔ BASIC
- ✔ ADDRESS
- ✔ CONNECTIVITY
- ✔ CONSISTENCY
- ✔ DNSSEC
- ✔ DELEGATION
- ✔ NAMESERVER
- ✔ SYNTAX
- ✔ ZONE

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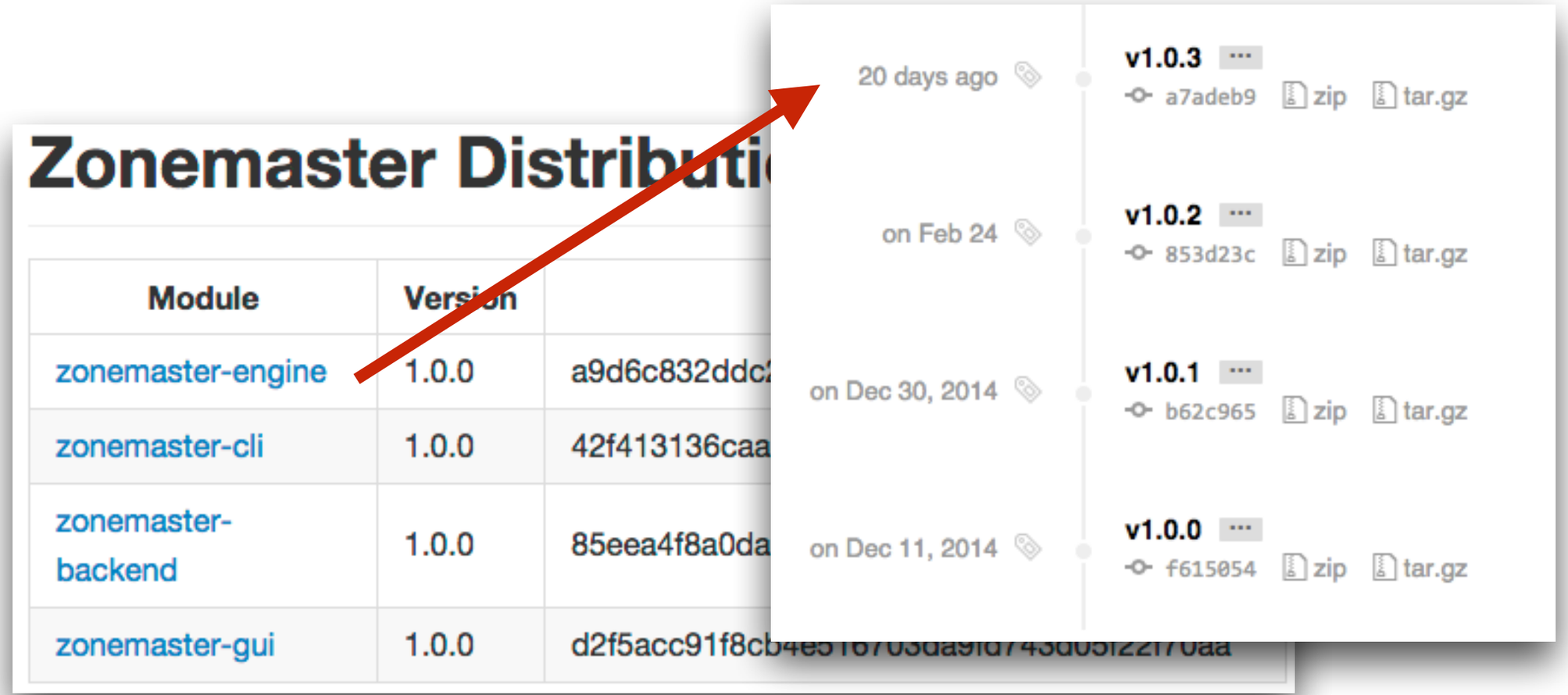
Releases

- The four components can be released independently
- “Zonemaster Distribution” releases



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Installation

sudo apt-get install build-essential libfile-slurp-perl libjson-perl liblist-moreutils-perl libio-socket-inet6-perl libmodule-find-perl libmoose-perl libfile-sharedir-perl libhash-merge-perl libreadonly-perl libmail-rfc822-address-perl libintl-xs-perl libssl-dev libdevel-checklib-perl libtest-fatal-perl libtie-simple-perl libio-capture-perl libgeography-countries-perl libidn11-dev

sudo cpan -i Zonemaster

sudo apt-get install libmoosex-getopt-perl libtext-reflow-perl libmodule-install-perl

sudo cpan -i Zonemaster::CLI

How to run a test?

```
$> zonemaster-cli blipp.com
Seconds Level     Message
======= ========= =======
   8.25 NOTICE    Nameserver boa.blipp.com has an IP address
(2001:1b40:5600:900:4321:1234:9b92:4bc0) with mismatched PTR result (snake.blipp.com.).
   8.25 NOTICE    Nameserver boa.blipp.com has an IP address (95.154.217.14) with
mismatched PTR result (snake.blipp.com.).
   8.25 NOTICE    Nameserver vic20.blipp.com has an IP address (2001:16d8:ff00:2a9::2)
with mismatched PTR result (cl-682.sto-01.se.sixxs.net.).
  33.47 NOTICE    Nameserver boa.blipp.com/2001:1b40:5600:900:4321:1234:9b92:4bc0 allow
zone transfer using AXFR.
  33.57 NOTICE    Nameserver boa.blipp.com/95.154.217.14 allow zone transfer using AXFR.
  34.40 NOTICE    Nameserver vic20.blipp.com/192.195.142.21 allow zone transfer using
AXFR.
  34.42 NOTICE    Nameserver vic20.blipp.com/2001:16d8:ff00:2a9::2 allow zone transfer
using AXFR.
```

```
usage: zonemaster-cli [-?h] [long options...]
       -h -? --usage --help  Prints this usage information.
       --version             Print version information and exit.
       --level               The minimum severity level to display. Must be
                             one of CRITICAL, ERROR, WARNING, NOTICE, INFO or
                             DEBUG.
       --locale              The locale to use for messages translation.
       --json                Flag indicating if output should be in JSON or
                             not.
       --raw                 Flag indicating if output should be translated
                             to human language or dumped raw.
       --time                Print timestamp on entries.
       --show_level          Print level on entries.
       --show_module         Print the name of the module on entries.
       --ns                  A name/ip string giving a nameserver for
                             undelegated tests. Can be given multiple times.
       --save                Name of a file to save DNS data to after running
                             tests.
       --restore             Name of a file to restore DNS data from before
                             running test.
       --ipv4                Flag to permit or deny queries being sent via
                             IPv4. --ipv4 permits IPv4 traffic, --no-ipv4
                             forbids it.
       --ipv6                Flag to permit or deny queries being sent via
                             IPv6. --ipv6 permits IPv6 traffic, --no-ipv6
                             forbids it.
       --list_tests          Instead of running a test, list all available
                             tests.
       --test                Specify test to run. Should be either the name
                             of a module, or the name of a module and the
                             name of a method in that module separated by a
                             "/" character (Example: "Basic/basic1"). The
                             method specified must be one that takes a zone
                             object as its single argument. This switch can
                             be repeated.
       --stop_level          As soon as a message at this level or higher is
                             logged, execution will stop. Must be one of
                             CRITICAL, ERROR, WARNING, NOTICE, INFO or DEBUG.
       --config              Name of configuration file to load.
       --policy              Name of policy file to load.
       --ds                  Strings with DS data on the form
                             "keytag,algorithm,type,digest"
       --count               Print a count of the number of messages at each
                             level
       --progress            Boolean flag for activity indicator. Defaults to
                             on if STDOUT is a tty, off if it is not.
       --encoding            Name of the character encoding used for command
                             line arguments
       --nstimes             At the end of a run, print a summary of the
                             times the zone's name servers took to answer.
       --dump_config         Print the effective configuration used in JSON
                             format, then exit.
       --dump_policy         Print the effective policy used in JSON format,
                             then exit.
```

CLI Features

- Pre-delegation tests
- Record a dump of queries+answers
- Use answers from a recorded dump
- Stop execution at specific log level
- Use different policy evaluating the results
- Record name server response times
- Human readable output in Swedish and French ;)

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Log levels

- DEBUG 1, 2, 3
- INFO
- NOTICE
- WARNING
- ERROR
- CRITICAL

Configured by policy

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Policy

```
$> zonemaster-cli --dump_policy
{
   "ADDRESS" : {
      "NAMESERVERS_IP_WITH_REVERSE" : "INFO",
      "NAMESERVER_IP_PRIVATE_NETWORK" : "ERROR",
      "NAMESERVER_IP_PTR_MATCH" : "INFO",
      "NAMESERVER_IP_PTR_MISMATCH" : "NOTICE",
      "NAMESERVER_IP_WITHOUT_REVERSE" : "WARNING",
      "NO_IP_PRIVATE_NETWORK" : "INFO",
      "NO_RESPONSE_PTR_QUERY" : "WARNING"
   },

. . .
```

Log - Human readable

```
$> zonemaster-cli blipp.com
Seconds Level     Message
======= ========= =======
   8.25 NOTICE    Nameserver boa.blipp.com has an IP address
(2001:1b40:5600:900:4321:1234:9b92:4bc0) with mismatched PTR result (snake.blipp.com.).
   8.25 NOTICE    Nameserver boa.blipp.com has an IP address (95.154.217.14) with
mismatched PTR result (snake.blipp.com.).
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with mismatched PTR result (cl-682.sto-01.se.sixxs.net.).
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zone transfer using AXFR.
  33.57 NOTICE    Nameserver boa.blipp.com/95.154.217.14 allow zone transfer using AXFR.
  34.40 NOTICE    Nameserver vic20.blipp.com/192.195.142.21 allow zone transfer using
AXFR.
  34.42 NOTICE    Nameserver vic20.blipp.com/2001:16d8:ff00:2a9::2 allow zone transfer
using AXFR.
```

Log - Raw

```
$> zonemaster-cli --raw blipp.com
   8.13 NOTICE    ADDRESS:NAMESERVER_IP_PTR_MISMATCH
address=2001:1b40:5600:900:4321:1234:9b92:4bc0, names=snake.blipp.com., ns=boa.blipp.com
   8.13 NOTICE    ADDRESS:NAMESERVER_IP_PTR_MISMATCH address=95.154.217.14,
names=snake.blipp.com., ns=boa.blipp.com
   8.13 NOTICE    ADDRESS:NAMESERVER_IP_PTR_MISMATCH address=2001:16d8:ff00:2a9::2,
names=cl-682.sto-01.se.sixxs.net., ns=vic20.blipp.com
  33.60 NOTICE    NAMESERVER:AXFR_AVAILABLE
address=2001:1b40:5600:900:4321:1234:9b92:4bc0, ns=boa.blipp.com
  33.74 NOTICE    NAMESERVER:AXFR_AVAILABLE address=95.154.217.14, ns=boa.blipp.com
  34.57 NOTICE    NAMESERVER:AXFR_AVAILABLE address=192.195.142.21, ns=vic20.blipp.com
  34.59 NOTICE    NAMESERVER:AXFR_AVAILABLE address=2001:16d8:ff00:2a9::2,
ns=vic20.blipp.com
```

Log - JSON

$> zonemaster-cli --json blipp.com


```
[{"args":
{"address":"2001:1b40:5600:900:4321:1234:9b92:4bc0","names":"snake.blipp.com.","ns":"boa
.blipp.com"},"level":"NOTICE","module":"ADDRESS","tag":"NAMESERVER_IP_PTR_MISMATCH","tim
estamp":8.25753903388977},{"args":
{"address":"95.154.217.14","names":"snake.blipp.com.","ns":"boa.blipp.com"},"level":"NOT
ICE","module":"ADDRESS","tag":"NAMESERVER_IP_PTR_MISMATCH","timestamp":
8.25794792175293},{"args":
{"address":"2001:16d8:ff00:2a9::2","names":"cl-682.sto-01.se.sixxs.net.","ns":"vic20.bli
pp.com"},"level":"NOTICE","module":"ADDRESS","tag":"NAMESERVER_IP_PTR_MISMATCH","timesta
mp":8.26008701324463},{"args":
{"address":"2001:1b40:5600:900:4321:1234:9b92:4bc0","ns":"boa.blipp.com"},"level":"NOTIC
E","module":"NAMESERVER","tag":"AXFR_AVAILABLE","timestamp":33.5192708969116},{"args":
{"address":"95.154.217.14","ns":"boa.blipp.com"},"level":"NOTICE","module":"NAMESERVER",
"tag":"AXFR_AVAILABLE","timestamp":33.6047399044037},{"args":
{"address":"192.195.142.21","ns":"vic20.blipp.com"},"level":"NOTICE","module":"NAMESERVE
R","tag":"AXFR_AVAILABLE","timestamp":34.4463429450989},{"args":
{"address":"2001:16d8:ff00:2a9::2","ns":"vic20.blipp.com"},"level":"NOTICE","module":"NA
MESERVER","tag":"AXFR_AVAILABLE","timestamp":34.4668040275574}]
```


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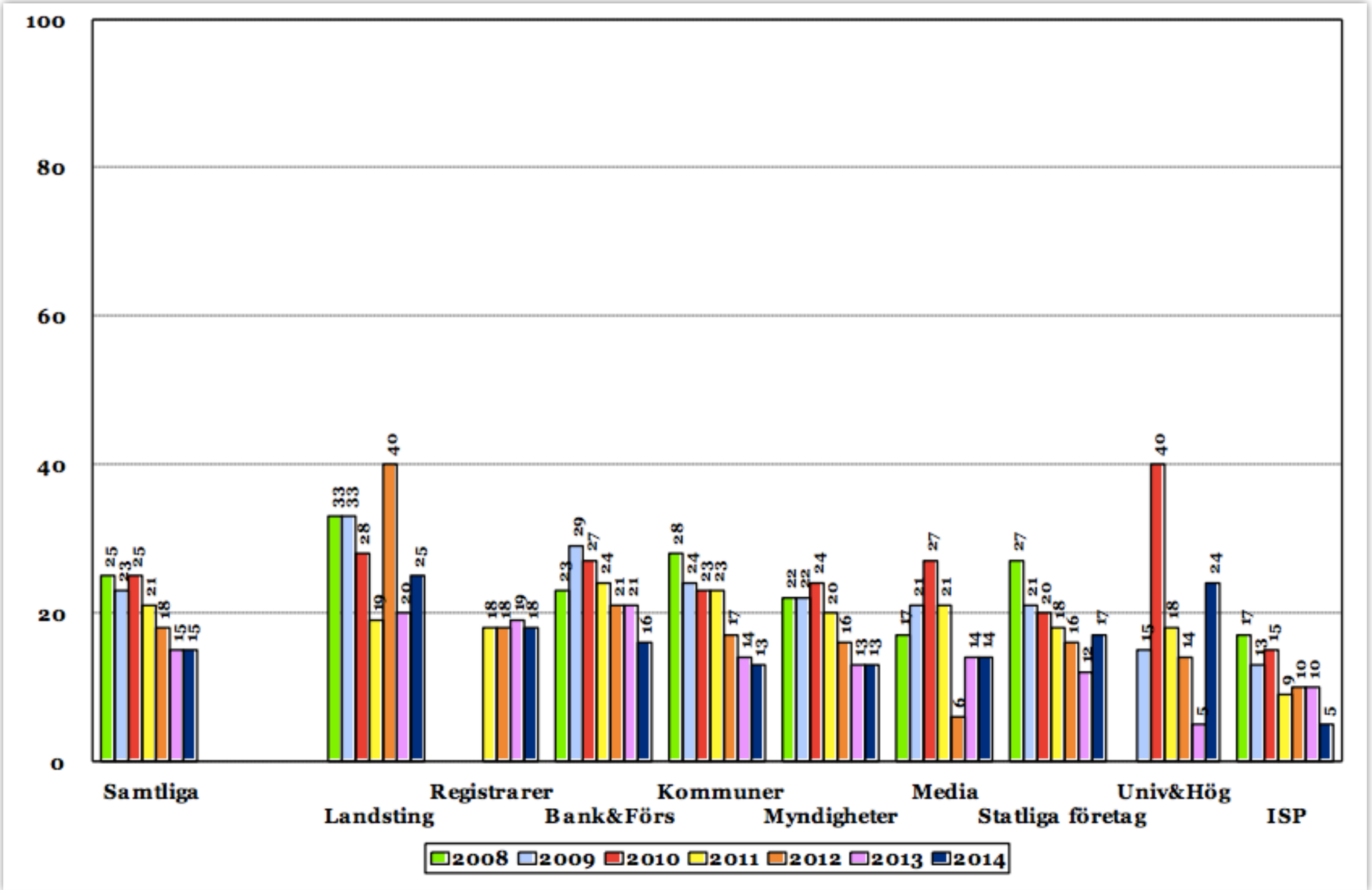
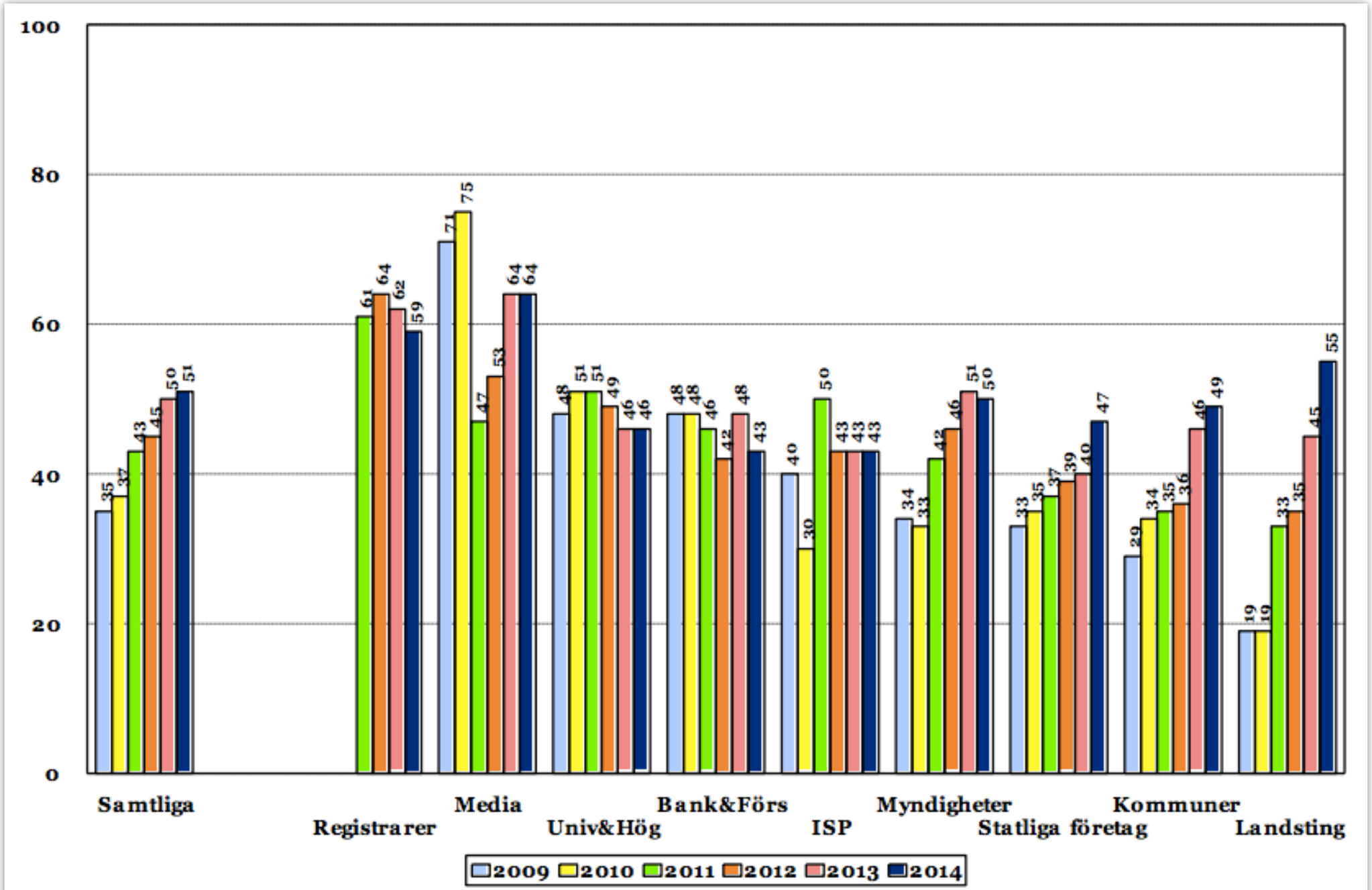
The .SE Healthcheck



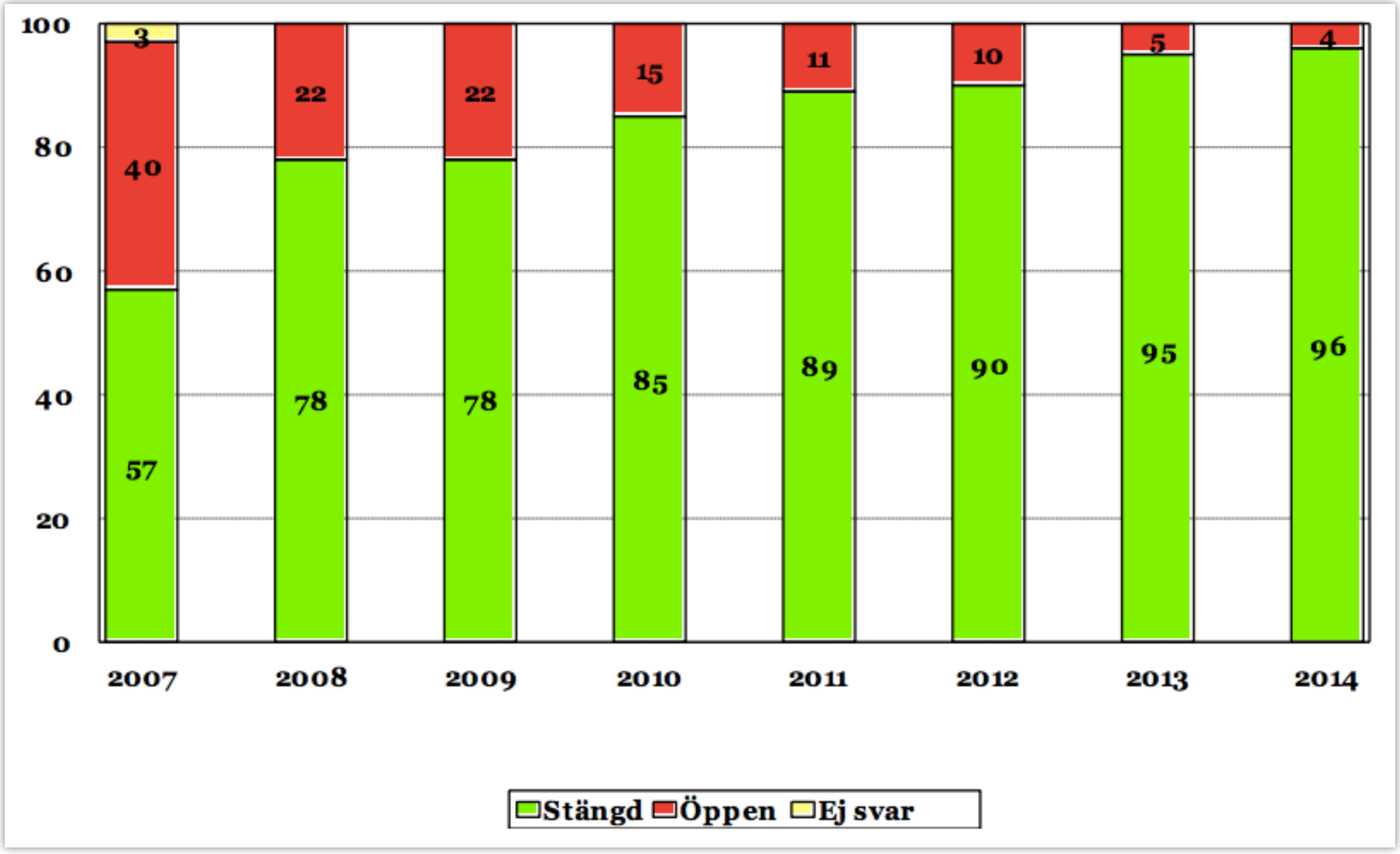
Healthcheck Categories

- 57 State owned companies
- 81 Banks, financial institutes and insurance companies
- 21 Internet Service Providers (ISPs)
- 290 Municipalities
- 20 Counties
- 36 Media companies
- 229 Government agencies
- 37 Universities and higher education
- 151 Registrars

Number of ASNs



Open recursors



Build your own applications

```
use Zonemaster;

# execute a test
my @log = Zonemaster->test_zone( ‘blipp.com’);
my $json = Zonemaster->logger->json( ‘NOTICE’ );

# get name servers for a zone
my $zone = Zonemaster->zone( ‘another-zone.com’ );
my $nameservers = join ( ' ', @{ $zone->ns_names } );
```

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“zonemaster-collector”

- My own tool for mass collection
- Multi-threaded use of Zonemaster
- Storage in MongoDB
- Easy to query a lot of test data
- https://github.com/pawal/zonemaster-collector
  - Examples in the“howtomongo” document

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Mass collection

```
$ collect.pl -f 10000.txt --mongo --db results --collection foo --threads 35
```

Query example 1

```
# results in a list of open resolvers

db.domains.aggregate(
  { $match: { "result.tag": "IS_A_RECURSOR" } },
  { $unwind: "$result" },
  { $match: { "result.tag": "IS_A_RECURSOR" } },
  { $project: { "name":1, "result.args": 1, "_id": 0 } }
);

{
   "result" : {
        "args" : {
             "ns" : “ns2.example.com",
             "address" : “12.34.56.78”,
             "dname" : "xx--domain-cannot-exist.xx--illegal-syntax-tld"
        }
   },
   "name" : "example.com"
}, …
```

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Query example 2

```
db.domains.aggregate(
  { $match: { "result.level": "ERROR" } },
  { $unwind: "$result" },
  { $match: { "result.level": "ERROR" } },
  { $match: { "result.args.ns": { $exists: true } } },
  { $project: { "name":1, "result": 1, "_id": 0 } },
  { $group: { _id: "$result.args.ns", nscount: { $sum: 1 } } },
  { $sort: { nscount: -1 } },
  { $limit: 25 }
);
```

```
{
    "result" : [
          {
                "_id" : “ns1.example.com”,
                "nscount" : 233
          },
          {
                "_id" : “ns2.example.com”,
                "nscount" : 232
          },
…
```

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Future improvements

- Fix all the log imperfection
- Implement new test requirements
- “IANA test profile” - different test profiles/policies
- HTML export of results

TRTF

- The test specifications will be further refined by a new CENTR task force, the TRTF
- The goal is to have a best practices document
- Published as an informational RFC

Test it yourself!

- https://github.com/dotse/zonemaster
- http://lists.iis.se/cgi-bin/mailman/admin/zonemaster-users
- http://lists.iis.se/cgi-bin/mailman/admin/zonemaster-devel

  The Healthcheck report (in Swedish):

- https://www.iis.se/docs/Halsolaget-i-se-2014.pdf

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