

**SAC 046**

**Report of the Security and Stability Advisory  
Committee on Root Scaling**



A Report from the ICANN  
Security and Stability  
Advisory Committee  
(SSAC)  
06 December 2010

## **Preface**

This is a Report of the Security and Stability Advisory Committee (SSAC) that provides recommendations following the SSAC assessment of the report of the Root Scaling Study Team.

The SSAC advises the ICANN community and Board on matters relating to the security and integrity of the Internet's naming and address allocation systems. This includes operational matters (e.g., matters pertaining to the correct and reliable operation of the root name system), administrative matters (e.g., matters pertaining to address allocation and Internet number assignment), and registration matters (e.g., matters pertaining to registry and registrar services such as WHOIS). SSAC engages in ongoing threat assessment and risk analysis of the Internet naming and address allocation services to assess where the principal threats to stability and security lie, and advises the ICANN community accordingly. The SSAC has no official authority to regulate, enforce or adjudicate. Those functions belong to others, and the advice offered here should be evaluated on its merits.

The contributors to this report, reference to the committee members' biographies and statements of interest, and committee members' objections to the findings or recommendations in this report, are at end of this report.

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## 1. Introduction

ICANN Board of Directors' Resolution 2009-02-03-04,<sup>1</sup> dated 3 February 2009, asked the Root Server System Advisory Committee (RSSAC), the Security and Stability Advisory Committee (SSAC), and ICANN staff to study the potential impact on the stability of the root level of the Domain Name System (DNS) when IPv6 address records, IDN (Internationalized Domain Name) top level domains (TLD), other new TLDs, and new resource records to support DNS security (DNSSEC) are added to the root zone. The Board resolution asked that the study consider both the technical and operational issues related to expanding the root zone. From the study, the Board sought to better understand the impact of each new addition separately and in aggregate.

In response to the Board resolution, RSSAC, SSAC, and ICANN staff formed a Root Scaling Steering Group to define the parameters and deliverables for a focused study. These are described in a Terms of Reference published 5 May 2009 (the "ToR").<sup>2</sup> The Steering Group identified a team of experts to conduct the study. This Root Scaling Study Team (RSST) issued a report on 31 August 2009 entitled, *Scaling the Root: Report on the Impact on the DNS Root System of Increasing the Size and Volatility of the Root Zone*.<sup>3</sup> An accompanying report, *Root Scaling Study: Description of the DNS Root Scaling Model* released on 1 October 2009 (the "TNO report") provides a quantitative modeling of the root zone to simulate scenarios relevant to the root scaling study.<sup>4</sup>

Although the RSST delivered a report that embodied its best judgment in response to a broad set of questions, it did not accomplish the research specified in the ToR. The SSAC critiqued the RSST report in "SSAC Comment on the Root Scaling Study Team Report and the TNO Report, although the SSAC also acknowledges that the allocated time, resources, and available data access was demonstrably inadequate to accomplish the requested work."<sup>5</sup>

Following that effort, the RSSAC and SSAC also failed to converge on a common position and began to pursue separate responses to the Board. This Report is the SSAC's response to the Board's request.

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<sup>1</sup> "Draft Minutes of the Special Board Meeting," ICANN Board of Directors, <<http://www.icann.org/en/minutes/minutes-03feb09.htm>>.

<sup>2</sup> "Root Scaling Study Terms of Reference," ICANN Root Scaling Steering Group (RSSG), 05 May 2009, <<http://www.icann.org/en/committees/dns-root/root-scaling-study-tor-05may09-en.htm>>.

<sup>3</sup> "Scaling the Root - Report on the Impact on the DNS Root System of Increasing the Size and Volatility of the Root Zone," ICANN Root Scaling Study Team (RSST), 31 August 2009, <<http://www.icann.org/en/committees/dns-root/root-scaling-study-report-31aug09-en.pdf>>.

<sup>4</sup> "Root Scaling Study: Description of the DNS Root Scaling Model," TNO Information and Communication Technology, 29 September 2009, <<http://www.icann.org/en/committees/dns-root/root-scaling-model-description-29sep09-en.pdf>>.

<sup>5</sup> "SSAC Comment on the Root Scaling Study Team Report and the TNO Report (SSAC publication No. 042)," ICANN Security and Stability Advisory Committee (SSAC), 2009, <<http://www.icann.org/en/committees/security/sac042.pdf>>

## 2. Discussion

Despite the lack of accepted research results regarding the impact of a potentially disruptive set of changes to the root zone, some innovations have successfully occurred over the last year. Most notably, the root zone is now DNSSEC-signed, and root-level DS records have been accepted and published. Distributed observation of the DNSSEC transition occurred and several presentations are archived.<sup>6</sup> The DNS Operations, Analysis, and Research Center (OARC) also presented statistics at its October 2010 meeting showing an expected increase in transmission control protocol (TCP)-based queries as each root server converted to a signed (but unvalidatable) zone, and an expected increase in average response size, but "no known reports of significant outages."<sup>7</sup> In addition, as of 03 December 2010, 291 IPv6 address records and 15 new IDN TLDs (representing 12 countries/territories) have been added to the root zone, bringing the total number of TLDs to 294.<sup>8</sup>

In 2010 ICANN also commissioned a study by KPMG to inform their gTLD scenario planning, and published some theoretical scenarios derived from their study.<sup>9</sup> The main conclusion of these and all previous studies thus far is that root zone growth is currently limited by scaling human factors. ICANN estimates that staff or external consulting resources will be able to review up to 1000 applications per year without detracting from the integrity of the review process. In October 2010 the ICANN Board of Directors issued a resolution to this effect, stating "an initial survey of root server operators' ability to support this rate of growth has been conducted successfully."<sup>10</sup> ICANN also has stated that as they and others gain experience with the application process these numbers are likely to increase.

The inability to rigorously model root zone operations as they are today, much less in the face of the proposed changes, rendered it impossible to answer the original questions posed in February 2009. The RSSAC and SSAC were unable come to a timely resolution on the issue. ICANN's commissioned study of gTLD theoretical growth scenarios enabled the ICANN Board of Directors to simplify the original research questions to the following:

1. Can the root system sustain a maximum growth of 1000 new gTLDs per year for the first round of new gTLD applications?

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<sup>6</sup> See <<http://www.root-dnssec.org/presentations/>>.

<sup>7</sup> Geoff Sisson, "DURZ Analysis," DNS-OARC Meeting, 14 October 2010, <[https://www.dns-oarc.net/files/workshop-201010/OARC\\_DURZ\\_Sisson.pdf](https://www.dns-oarc.net/files/workshop-201010/OARC_DURZ_Sisson.pdf)>.

<sup>8</sup> Based information received from Tina Dam, Leo Vegoda, and Kim Davies of ICANN on 03 December 2010.

<sup>9</sup> "Delegation Rate Scenarios For New gTLDs," Internet Corporation for Assigned Names and Numbers (ICANN), 06 October 2010, <<http://www.icann.org/en/topics/newgtlds/delegation-rate-scenarios-new-gtlds-06oct10-en.pdf>>.

<sup>10</sup> "Adopted Board Resolutions. Trondheim, Norway." ICANN Board of Directors, 25 September 2010, <<http://www.icann.org/en/minutes/resolutions-25sep10-en.htm#2.3>>.

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2. If ICANN subsequently increases its capacity to approve more applications, what should the process be to handle this increase?

In the next section the SSAC provides recommendations relating to these two questions.

### 3. Recommendations

The SSAC believes that RSSAC is in a better position to respond to the first question, and defers to its judgment. Regarding the second question, the SSAC recommends the following steps be taken before launching additional gTLDs, in parallel with continued deployment of IDNs and IPv6.

**Recommendation (1):** Formalize and publicly document the interactions between ICANN and the root server operators with respect to root zone scaling. ICANN and the root server operators may choose to utilize RSSAC to facilitate this interaction.

**Recommendation (2):** ICANN, National Telecommunications and Information Administration (NTIA), and VeriSign should publish statements, or a joint statement, that they are materially prepared for the proposed changes.

**Recommendation (3):** ICANN should publish estimates of expected and maximum growth rates of TLDs, including IDNs and their variants, and solicit public feedback on these estimates, with the end goal of being as transparent as possible about the justification for these estimates.

**Recommendation (4):** ICANN should update its "Plan for Enhancing Internet Security, Stability, and Resiliency," to include actual measurement, monitoring, and data-sharing capability of root zone performance, in cooperation with RSSAC and other root zone management participants to define the specific measurements, monitoring, and data sharing framework.<sup>11</sup>

**Recommendation (5):** ICANN should commission and incent interdisciplinary studies of security and stability implications from expanding the root zone more than an order of magnitude, particularly for enterprises and other user communities who may implement strong assumptions about the number of TLDs or use local TLDs that may conflict with future allocations.

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<sup>11</sup> See "Plan for Enhancing Internet Security, Stability, and Resiliency," <<http://www.icann.org/en/topics/ssr/ssr-plan-fy11-redline-23nov10-en.pdf>>.

## **4. Acknowledgments, Statements of Interests, and Objections, and Withdrawals**

In the interest of greater transparency, these sections provide the reader information on three aspects of our process. The Acknowledgments section lists the members who contributed to this particular document. The Biographies and Statements of Interest section points to the biographies of the Committee members and any conflicts of interest, real, apparent or potential, that may bear on the material in this document. The Objections and Withdrawals section provides a place for individual members to disagree with the content of this document or the process for preparing it.

### **4.1 Acknowledgments**

The committee wishes to thank the following SSAC members and invited guests for their time, contributions, and review in producing this Report.

Alain Aina  
Jeff Bedser  
KC Claffy  
David Conrad  
Steve Crocker  
James Galvin  
Jeremy Hitchcock  
Warren Kumari  
Matt Larson  
Xiaodong Lee  
Ram Mohan  
Danny McPherson  
Russ Mundy  
Barbara Roseman  
John Schnizlein  
Bruce Tonkin  
Paul Vixie  
Rick Wilhelm  
Suzanne Woolf

### **4.2 Statements of Interest**

SSAC member biographical information and Statements of Interest are available at:  
<http://www.icann.org/en/committees/security/biographies-07jul10-en.htm>.

### **4.3 Objections and Withdrawals**

The following are objections. There were no withdrawals.

**Statement from David Conrad**

David Conrad feels that the reason the original questions posed in 2009 went unanswered was due to an inability to obtain sufficient information to perform the modeling, not because it was impossible to rigorously model the root zone. He also believes the appropriate entities to respond to questions like “[c]an the root system sustain a maximum growth of 1000 new gTLDs per year for the first round of new gTLD applications?” are the root management partners (ICANN, VeriSign, and NTIA) and the root server operators individually, not RSSAC.

**Statement from John Schnizlein**

John Schnizlein concurs with the statement from David Conrad.

**Statement from KC Claffy and Paul Vixie**

While we agree with what the SSAC report says, we also think it doesn't go far enough. Our view, which did not achieve consensus, is that the lack of satisfying research has a simple explanation: The current models of data collection and sharing among stakeholders failed to yield enough information to allow useful realistic modeling of root zone dynamics or evolution. As such, we have no way to show that adding many thousands of TLDs would have positive rather than negative effects on the security, stability, or economics of the domain name (now critical) infrastructure and related industries. Nonetheless, ICANN is asking for a go-ahead to move forward because there is no data to show that a few thousand TLDs will seriously break anything, there are (for some, definitely for ICANN) strong political and economic incentives to move forward, and it will yield some data and some capital from which to develop better policy. Yet, both the public and private sectors should be aware of the risks of moving forward in light of all the unanswered questions: the lack of data on expected demand; the lack of metrics or models or visibility to determine whether something has gone wrong; the lack of any transparent process to back out changes if something does go wrong; and the political difficulty in denying future TLDs when some observable limit has been reached, since there will be tremendous pressure to invest our way out of any limiting factors. In this risk-seeking posture, ICANN should take seriously its responsibility to present a deep understanding of the ramifications of possibly disruptive policies in advance of launching them.