Root DNSSEC Design Team

A. Bolivar
T. Okubo
VeriSign
F. Ljunggren
Kirei
R. Lamb
ICANN
J. Schlyter
Kirei
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DNSSEC Practice Statement for the Root Zone ZSK operator

Abstract

This document is the DNSSEC Practice Statement (DPS) for the Root Zone Zone Signing Key (ZSK) operator. It states the practices and provisions that are used to provide Root Zone Signing and Zone distribution services. These include, but are not limited to: issuing, managing, changing and distributing DNS keys in accordance with the specific requirements of the U.S. Department of Commerce.

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1. INTRODUCTION

This document is the Verisign DNSSEC Practice Statement (DPS) as the Root Zone (RZ) Zone Signing Key (ZSK) Operator. It states the practices and provisions that Verisign on behalf of the U.S. Department of Commerce (DoC), employs in providing Root Zone Signing and Zone distribution services that include, but are not limited to, issuing, managing, changing and distributing DNS keys in accordance with the specific requirements of the DoC.

1.1. Overview

The Domain Name System Security Extensions (DNSSEC) is a set of IETF specifications for adding origin authentication and data integrity to the Domain Name System. DNSSEC provides a way for software to validate that Domain Name System (DNS) data have not been modified during Internet transit. This is done by incorporating public key cryptography into the DNS hierarchy to form a chain of trust originating at the root zone.

The DNS was not originally designed with strong security mechanisms to provide integrity and authenticity of DNS data. Over the years, a number of vulnerabilities have been discovered that threaten the reliability and trustworthiness of the system. DNSSEC addresses these vulnerabilities by adding data origin authentication, data integrity verification and authenticated denial of existence capabilities to the DNS.

This DPS is specifically applicable to The Root Zone Maintainer and Root Zone Zone Signing Key Operator. More generally, this document will provide the governing policies and provisions as it relates to the management, security and technical specifications of DNSSEC operation at the Root. This document will be under the control and management of Verisign with guidance and direction from the DoC. Information in this document and subsequent documents will be made public as required.

The DPS is only one of a set of documents relevant to Verisign's management of the Root Zone's ZSK. Other documents include: ancillary confidential security and operational documents that supplement the DPS by providing more detailed requirements, such as: The Verisign Physical Security Policy, which sets forth security principles governing the DPS infrastructure, The Verisign Information and Physical Security Policies and Verisign Security and Audit Requirements which describes detailed requirements for Verisign concerning personnel, physical, telecommunications, logical, and cryptographic key management security, and Key Ceremony Reference Guide, which presents detailed key management operational

requirements. In many instances, the DPS refers to these ancillary documents for specific, detailed practices implementing Verisign proprietary standards where including the specifics in the DPS could compromise the security of the RZ ZSK's operation.

1.2. Document name and identification

Document title:
DNSSEC Practice Statement for the DNS Root Zone Maintainer
Version:
($Revision: 1532 $)
Date:
$Date: 2016-04-27 19:10:40 -0400 (Tue, 27 Apr 2016) $

1.3. Community and Applicability

1.3.1. IANA Functions Operator

The Internet Corporation for Assigned Names and Numbers (ICANN) acts as the Internet Assigned Numbers Authority (IANA) Functions Operator under contract to the U.S. Department of Commerce, National Telecommunications and Information Administration (DoC/NTIA). The IANA Functions Operator accepts change requests to the contents of the Root Zone from the Top Level Domain (TLD) Operators and validates those requests. After validation occurs, the IANA Functions Operator submits the requests to the DoC/NTIA for authorization and sends a copy to the Root Zone Maintainer for implementation once authorization is received.

1.3.2. Root Zone Administrator

The Root Zone Administrator is the National Telecommunications and Information Administration, which is an agency in the U.S. Department of Commerce that performs the authorization for changes to the Root Zone. This role differs from the third party auditors who conduct the compliance audit and generates the audit report.

1.3.3. Root Zone Maintainer

Verisign, per the Cooperative Agreement with the U.S. Department of Commerce, is acting as the Root Zone Maintainer. The Root Zone Maintainer is performing the function of receiving change requests to the Root Zone from the IANA Functions Operator, receiving authorization to make changes to the Root Zone from the Root Zone Administrator, implementing the changes, generating a new Root Zone File and distributing it to the Root Server Operators.

1.3.4. Root Server Operators

The Root Server Operators consists of 12 different professional engineering entities responsible for providing the root zone to the public via the 13 Root Zone Authoritative Name Servers. The Root Server Operators are not involved in the making of any policies or modification of data.

1.3.5. Root Zone Key Signing Key Operator

ICANN is the Root Zone Key Signing Key Operator (as the IANA Functions Operator) performing the function of generating the Root Zone's Key Signing Key (KSK) and signing the Root Keyset, including the Root Zone Zone Signing Key (RZ ZSK), using the KSK. The Root Zone KSK Operator is also responsible for securely generating and storing the private keys and distributing the public portion of the KSK (the Trust Anchor) to the relying parties.

The Root Zone KSK (RZ KSK) operator is responsible for:

(1) Generating and protecting the private component of the RZ KSK.
(2) Securely importing public key components from the RZ ZSK Operator.
(3) Authenticating and validating the public RZ ZSK keyset.
(4) Securely signing the RZ ZSK keyset.
(5) Securely transmitting the signed RZ ZSK key set to the RZ ZSK Operator.
(6) Securely exporting the RZ KSK public key components.
(7) Issuing an emergency key roll-over within a reasonable time if any private key component associated with the zone is lost or suspected to be compromised.

1.3.6. Root Zone Zone Signing Key Operator

The Root Zone Zone Signing Key Operator is Verisign performing the function of generating the Root Zone's Zone Signing Key (ZSK) and signing the Root Zone File using the ZSK.

The Root Zone Zone Signing Key (RZ ZSK) Operator is also responsible for securely generating and storing the private keys and distributing the public portion of the ZSK to the RZ KSK Operator for signing.

The Root Zone ZSK (RZ ZSK) operator is responsible for:

(1) Generating and protecting the private component of the RZ ZSK.
(2) Securely exporting and transmitting the public RZ ZSK component to the RZ KSK Operator.
(3) Securely importing the signed RZ ZSK keyset from the RZ KSK operator.
(4) Signing the Root Zone's resource records (optionally omitting the DNSKEY resource record).
(5) Issue emergency key roll-over within a reasonable amount of time if any private key associated with the zone is lost or suspected to be compromised.

1.3.7. Child zone manager

The child zone (TLD) manager is a trustee for the delegated domain, and as such responsible for providing registry services and operating subordinate DNS servers. If a child zone is signed using DNSSEC, the child zone manager is also responsible for:

(1) Generating the keys associated with its zone using a trustworthy method.
(2) Registering and maintaining the shorthand representations of its Key Signing Key (Delegation Signer Resource Record) in the parent zone to establish the chain of trust.
(3) Taking reasonable precautions to prevent any loss, disclosure or unauthorized use of the keys associated with its zone.
(4) Issuing emergency key roll-over within reasonable time if any private key associated with its zone is lost or suspected to be compromised.

1.3.8. Relying Party

A Relying Party is the entity relying on DNSSEC, such as security-aware validating resolvers and other applications performing validation of DNSSEC signatures.

The relying party must properly configure and update the Trust Anchor as appropriate. The automated method described in RFC 5011 [RFC5011] may be used.

Relying parties must also stay informed of any critical changes in the Root Zone operation as notified by ICANN in accordance with Root Zone Key Signing Key Operator's DPS section 2.1. [RZKSKDPS]

1.3.9. Applicability

This DPS is only applicable to the Root Zone, and more specifically the RZ ZSK Operator. Each link in the chain of trust may have entirely different requirements that can affect the end entity, and

is not governed by this DPS.

Entities must evaluate their own environments and its associated threats and vulnerabilities to determine the level of risk they are willing to accept.

1.4. Specification Administration

This DPS will be periodically reviewed and updated, as appropriate by the RZ ZSK Operator Policy Management Authority (PMA). The PMA is responsible for the management of the DPS and should be considered as the point of contact for all matters related to the DPS. The PMA notifies, and when appropriate, seeks the review and authorization from DoC prior to taking action and/or modification of the DPS.

1.4.1. Specification administration organization

VeriSign Inc
12061 Bluemont Way
Reston, VA 20190
USA

1.4.2. Contact Information

The DNSSEC Practices Manager
Verisign DNSSEC Policy Management Authority
c/o VeriSign, Inc
12061 Bluemont Way
Reston, VA 20190
USA
+1 (703) 948-3200 (voice)
+1 (703) 421-4873 (fax)
dnspractices@verisign.com

1.4.3. Specification change procedures

Amendments to this DPS are made by the Verisign DNSSEC Policy Management Authority (PMA). Amendments will either be in the form of a document containing an amended form of the DPS or an update. Amended versions or updates will be linked to the Practices Updates and Notices section of the Verisign Repository located at: http://www.verisigninc.com/en_US/repository/index.xhtml. (See section 2 for a more detailed explanation of Repositories.) Updates supersede any designated or conflicting provisions of the referenced version of the DPS.

The PMA reserves the right to amend the DPS without notification for amendments that are not material, including without limitation

corrections of typographical errors, changes to URLs, and changes to contact information. The PMA's decision to designate amendments as material or non-material is within the PMA's sole discretion. Proposed amendments to the DPS will appear in the Practices Updates and Notices section of the Verisign Repository, which is located at: http://www.verisigninc.com/en_US/repository/index.xhtml. The PMA solicits proposed amendments to the DPS from the community. If the PMA considers such an amendment desirable and proposes to implement the amendment, the PMA will provide public notice of such amendment in accordance with this section. Notwithstanding anything in the DPS to the contrary, if the PMA believes that material amendments to the DPS are necessary immediately to stop or prevent a breach of the security of any portion of it, the PMA is entitled to make such amendments by publication in the Verisign Repository. Such amendments will be effective immediately upon publication.

2. PUBLICATION AND REPOSITORIES

2.1. Repositories

Verisign, as the ZSK Operator, publishes the DPS in the Verisign repository section of Verisign's web site at http://www.verisigninc.com/en_US/repository/index.xhtml. Public access to this repository will include the option of using an HTTPS-authenticated channel.

2.2. Publication of key signing keys

Refer to the Root Zone Key Signing Key Operator's DPS for details [RZKSKDPS].

2.3. Access controls on repositories

Information published in the repository portion of the Verisign web site is publicly-accessible information. Read only access to such information is unrestricted. Verisign has implemented logical and physical security measures to prevent unauthorized persons from adding, deleting, or modifying repository entries.

3. OPERATIONAL REQUIREMENTS

3.1. Meaning of domain names

Refer to the Root Zone Key Signing Key Operator's DPS for details [RZKSKDPS].

3.2. Activation of DNSSEC for child zone

Refer to the Root Zone Key Signing Key Operator's DPS for details [RZKSKDPS].

3.3. Identification and authentication of child zone manager

Refer to the Root Zone Key Signing Key Operator's DPS for details [RZKSKDPS].

3.4. Registration of delegation signer (DS) records

Verisign, as the Root Zone Maintainer, applies changes to the Root Zone file based on requests from the IANA Functions Operator and authorized by the Root Zone Administrator.

3.5. Method to prove possession of private key

Refer to the Root Zone Key Signing Key Operator's DPS for details [RZKSKDPS].

3.6. Removal of DS resource records

3.6.1. Who can request removal

Refer to the Root Zone Key Signing Key Operator's DPS for details [RZKSKDPS].

3.6.2. Procedure for removal request

Refer to the Root Zone Key Signing Key Operator's DPS for details [RZKSKDPS].

3.6.3. Emergency removal request

Refer to the Root Zone Key Signing Key Operator's DPS for details [RZKSKDPS].

4. FACILITY, MANAGEMENT AND OPERATIONAL CONTROLS

4.1. Physical Controls

As the RZ ZSK Operator, Verisign has implemented the Verisign Physical Security Policy, which supports the security requirements of this DPS. Compliance with these policies is included in Verisign's independent audit requirements described in section 7. Verisign Physical Security Policy contains sensitive security information and

is only available upon agreement with Verisign. An overview of the requirements is described below.

4.1.1. Site location and construction

Verisign DNSSEC operations are conducted within a physically protected environment that deters, prevents, and detects unauthorized use of, access to, or disclosure of sensitive information and systems whether covert or overt. Verisign also maintains disaster recovery facilities for its DNSSEC operations. Verisign's disaster recovery facilities are protected by multiple tiers of physical security comparable to those of Verisign's primary facility.

4.1.2. Physical access

Verisign DNSSEC systems are protected by a minimum of four tiers of physical security, with access to the lower tier required before gaining access to the higher tier. Progressively restrictive physical access privileges control access to each tier. Sensitive DNSSEC operational activity and any activity related to the lifecycle of the RZ ZSK occur within very restrictive physical tiers. Access to each tier requires the use of a proximity card employee badge.

Physical access is automatically logged and video recorded. Additional tiers enforce individual access control through the use of two factor authentication including biometrics. Unescorted personnel, including visitors or employees without specific authorization, are not allowed into such secured areas. The physical security system includes additional tiers for key management security which serves to protect both online and offline storage of Hardware Security Modules (HSM) and keying material.

Areas used to create and store cryptographic material enforce dual control, each through the use of two factor authentication including biometrics. Online HSMs are protected through the use of locked cabinets. Offline HSMs are protected through the use of tamper-evident bags, locked safes, cabinets and containers. Access to HSMs and keying material is restricted in accordance with Verisign's segregation of duties requirements. The opening and closing of cabinets or containers in these tiers is logged for audit purposes.

4.1.3. Power and air conditioning

Verisign's secure facilities are equipped with primary and backup power systems to ensure continuous, uninterrupted access to electric power and heating/ventilation/air conditioning systems to control temperature and relative humidity.

4.1.4. Water exposures

Verisign has taken reasonable precautions to minimize the impact of water exposure to Verisign systems.

4.1.5. Fire prevention and protection

Verisign has taken reasonable precautions to prevent and extinguish fires or other damaging exposure to flame or smoke. Verisign's fire prevention and protection measures have been designed to comply with local fire safety regulations.

4.1.6. Media storage

All media containing production software and data, audit, archive, or backup information is stored within Verisign facilities or in a secure off-site storage facility with appropriate physical and logical access controls designed to limit access to authorized personnel and protect such media from accidental damage (e.g., water, fire, and electromagnetic).

4.1.7. Waste disposal

Sensitive documents and materials are shredded before disposal. Media used to collect or transmit sensitive information are rendered unreadable before disposal. Cryptographic devices are physically destroyed or zeroized in accordance with the manufacturers' guidance prior to disposal. Other waste is disposed of in accordance with Verisign's normal waste disposal requirements.

4.1.8. Off-site backup

Verisign performs routine backups of critical system data, audit log data, and other sensitive information. Off-site backup media are stored in a physically secure manner using a bonded third party storage facility and Verisign's East Coast disaster recovery facility.

4.2. Procedural Controls

4.2.1. Trusted roles

Verisign considers the categories of personnel identified in this section as Trusted Persons having a Trusted Position. Persons seeking to become Trusted Persons by obtaining a Trusted Position must successfully complete the screening requirements set out in this DPS.

Trusted Persons include all employees, contractors, and consultants that have access to or control operations that may materially affect:

- Generation and protection of the private component of the Root Zone Zone Signing Key;
- Secure export or import of any public components; and
- Generation and signing Zone File data.

Trusted roles include, but are not limited to:

- Naming resolution operations personnel;
- Cryptographic business operations personnel;
- Security personnel;
- System administration personnel;
- Designated engineering personnel; and
- Executives that are designated to manage infrastructural trustworthiness.

4.2.2. Number of persons required per task

Verisign has established, maintains, and enforces rigorous control procedures to ensure the segregation of duties based on job responsibility and to ensure that multiple Trusted Persons are required to perform sensitive tasks. Policy and control procedures are in place to ensure segregation of duties based on job responsibilities.

The most sensitive tasks, such as access to and management of cryptographic hardware (HSM) and associated key material require multiple Trusted Persons. These internal control procedures are designed to ensure that at a minimum, two trusted personnel are required to have either physical or logical access to the device.

Access to cryptographic hardware is strictly enforced by multiple Trusted Persons throughout its lifecycle, from incoming receipt and inspection to final logical and/or physical destruction. Once a module is activated with operational keys, further access controls are invoked to maintain split control over physical access to the device. Persons with physical access to modules do not hold "Secret Shares" and vice versa.

Other manual operations such as the signing of Zone File Data, require the participation of at least 2 Trusted Persons, or a combination of at least one trusted person and an automated process.

4.2.3. Identification and authentication for each role

For all personnel seeking to become Trusted Persons, verification of identity is performed through the personal (physical) presence of such personnel before Trusted Persons performing Verisign Human Resources or security functions and a check of well-recognized forms of identification (e.g., passports and driver's licenses). Identity is further confirmed through the background checking procedures in DPS section 4.3. Verisign ensures that personnel have achieved Trusted Status and departmental approval has been given before such personnel are:

- issued access devices and granted access to the required facilities,
- issued electronic credentials to access and perform specific functions on Verisign IT systems.

4.2.4. Tasks requiring separation of duties

Tasks requiring separation of duties include but are not limited to the generation, implementation or destruction of Root Zone DNSSEC key material.

Personnel holding a role in the multi-party access to the RZ KSK do not hold a role in the multi-party access to the RZ ZSK, or vice versa. Designated audit personnel may not participate in the multi-person control for the RZ ZSK or KSK.

4.3. Personnel Controls

4.3.1. Qualifications, experience, and clearance requirements

Verisign requires that personnel seeking to become Trusted Persons present proof of the requisite background, qualifications, and experience needed to perform their prospective job responsibilities competently and satisfactorily, as well as proof of any government clearances, if any, necessary to perform operations under government contracts.

4.3.2. Background check procedures

All personnel with access to any cryptographic component used with the Root Zone Signing process are required to pass a background check extending back at least three years.

Prior to commencement of employment in a Trusted Role, Verisign conducts background checks which include the following:

- Confirmation of previous employment
- Check of professional references
- Confirmation of the highest or most relevant educational degree obtained
- Check of credit/financial records to the extent allowed by national laws for the individual's country of residence
- Search of criminal records (local, state or provincial, and national)
- Search of driver's license records
- Search of Social Security Administration records

To the extent that any of the requirements imposed by this section cannot be met due to a prohibition or limitation in local law or other circumstances, Verisign will utilize a substitute investigative technique permitted by law that provides substantially similar information, including but not limited to obtaining a background check performed by the applicable governmental agency.

The factors revealed in a background check that may be considered grounds for rejecting candidates for Trusted Positions or for taking action against an existing Trusted Person generally include (but are not limited to) the following:

- Misrepresentations made by the candidate or Trusted Person,
- Highly unfavorable or unreliable professional references,
- Indications of a lack of financial responsibility.
- Certain criminal convictions

Reports containing such information are evaluated by Verisign human resources and security personnel, who determine the appropriate course of action in light of the type, magnitude, and frequency of the behavior uncovered by the background check.

Such actions may include measures up to and including the cancellation of offers of employment made to candidates for Trusted Positions or the termination of existing Trusted Persons. The use of information revealed in a background check to take such actions is subject to the applicable federal, state, and local laws.

4.3.3. Training requirements

Verisign provides its personnel with training upon hire as well as the requisite on-the-job training needed for them to perform their job responsibilities competently and satisfactorily. Verisign periodically reviews and enhances its training programs as necessary.

Verisign's training programs are tailored to the individuals responsibilities and include the following as relevant:

- Basic DNS/DNSSEC concepts
- Job responsibilities
- Use and operation of deployed hardware and software
- Security and operational policies and procedures
- Incident and compromise reporting and handling
- Disaster recovery and business continuity procedures

4.3.4. Retraining frequency and requirements

Verisign provides refresher training and updates to their personnel to the extent and frequency required to ensure that such personnel maintain the required level of proficiency to perform their job responsibilities competently and satisfactorily.

4.3.5. Job rotation frequency and sequence

Positions are rotated and replaced as needed.

4.3.6. Sanctions for unauthorized actions

Appropriate disciplinary actions are taken for unauthorized actions with respect to this DPS and/or other violations of Verisign policies and procedures. Disciplinary actions may include measures up to and including termination and are commensurate with the frequency and severity of the unauthorized actions.

4.3.7. Contracting personnel requirements

In limited circumstances, independent contractors or consultants may be used to fill Trusted Positions. Any such contractor or consultant is held to the same functional and security criteria that apply to a Verisign employees in a comparable position. Independent contractors and consultants who have not completed or passed the background check procedures specified in DPS section 4.3 are permitted access to Verisign's secure facilities only to the extent they are escorted and directly supervised by Trusted Persons at all times.

4.3.8. Documentation supplied to personnel

Verisign provides its employees the requisite training and other documentation needed to perform their job responsibilities competently and satisfactorily.

4.4. Audit Logging Procedures

4.4.1. Types of events recorded

Verisign manually or automatically logs the following significant events:

RZ ZSK key life cycle management events, including:

- Key generation, backup, storage, recovery, archival, and destruction
- Exporting of public key components
- Cryptographic device life cycle management events

RZ ZSK signing and management events, including:

- Key activation
- Receipt and validation of signed public key material (from the KSK operator)
- Successful or unsuccessful signing requests
- Key rollover events

Security-related events, including:

- Successful and unsuccessful system access attempts
- Key and security system actions performed by trusted personnel
- Security sensitive files or records read, written or deleted
- Security profile changes
- System crashes, hardware failures and other anomalies
- Firewall and router activity
- Facility visitor entry/exit
- System changes and maintenance/system updates
- Incident response handling

Log entries include the following elements:

- Date and time of the entry,
- Identity of the entity making the journal entry,
- Serial or sequence number of entry, for automatic journal entries,
- Kind of entry.

Other events as appropriate.

All types of audit information will contain correct time and date information.

4.4.2. Frequency of processing log

Audit logs are examined on at least a weekly basis for significant security and operational events. In addition, Verisign reviews its

audit logs for suspicious or unusual activity in response to alerts generated based on irregularities and incidents within the Verisign Zone Signing systems. Audit log processing consists of a review of the audit logs and documentation for all significant events in an audit log summary. Audit log reviews include a verification that the log has not been tampered with and an investigation of any alerts or irregularities in the logs. Actions taken based on audit log reviews are also documented.

4.4.3. Retention period for audit log

All audit data collected in terms of section 4.4.1 is retained on-site for at least one (1) year after creation and is thereafter archived for at least 10 years.

The media holding the audit data and the applications required to process the information will be maintained to ensure that the archive data can be accessed for the time period set forth in this DPS.

4.4.4. Protection of audit log

Audit logs are protected with an electronic audit log system that includes mechanisms to protect the log files from unauthorized viewing, modification, deletion, or other tampering.

Only authorized Trusted Personnel are able to obtain direct access to the audit information. The integrity of the audit log information will be verified by validating the digital signatures before handing the information over to the designated auditor.

4.4.5. Audit log backup procedures

Verisign incrementally backs up electronic archives of its Root ZSK information on a daily basis and performs full backups on a weekly basis. Copies of paper-based records will be maintained in an off-site secure facility.

4.4.6. Audit collection system

Automated audit data is generated and recorded at the application, network and operating system level. Manually generated audit data is recorded by Verisign personnel.

Electronic information is incrementally backed up and copies of paper-based records are made as new records are entered in the archive. These backups are maintained in an off-site secure facility.

4.4.7. Notification to event-causing subject

Where an event is logged by the audit collection system, no notice is required to be given to the individual, organization, device, or application that caused the event.

4.4.8. Vulnerability assessments

Events in the audit process are logged, in part, to monitor system vulnerabilities. Security vulnerability assessments ("SVAs") are performed, reviewed, and revised following an examination of these monitored events. SVAs are based on automated logging data and are performed on a ad-hoc, daily, monthly, and annual basis. An annual SVA will be an input into an entity's annual Compliance Audit.

4.5. Compromise and Disaster Recovery

4.5.1. Incident and compromise handling procedures

Backups of audit data and database records are kept in off-site storage and made are available in the event of a Compromise or disaster.

Back-ups of private keys will be generated and maintained in accordance with the DPS section 5.2.4. All incidents will be communicated to NTIA in a reasonable timeframe.

4.5.2. Corrupted computing resources, software, and/or data

In the event of the corruption of computing resources, software, and/or data, such an occurrence is reported to Verisign Information Security and Verisign's incident handling procedures are implemented. Such procedures require appropriate escalation, incident investigation, and incident response. If necessary, Verisign's key compromise or disaster recovery procedures will be implemented.

4.5.3. Entity private key compromise procedures

4.5.3.1. Key Signing Key compromise

Verisign will support Root Zone Key Signing Key emergency rollover in the case of RZ KSK compromise while following ICANN's procedural direction, as outlined in Root Zone KSK Signing Key Operator's DPS [RZKSKDPS].

4.5.3.2. Zone Signing Key compromise

Procedures are in place for unscheduled rollovers. In addition, plans and procedures are in place for key compromise situations.

Upon the suspected or known Compromise of the Root Zone ZSK, Verisign's Key Compromise Response procedures are enacted by the Verisign Security Incident Response Team (VSIRT). This team, which includes Information Security, Cryptographic Business Operations, Production Services personnel, and other Verisign management representatives, assess the situation, develop an appropriate action plan in accordance with Verisign's information security policy and implement the action plan with approval from Verisign executive management and PMA.

4.5.4. Business Continuity and IT Disaster Recovery Capabilities

Verisign has implemented a disaster recovery site that is physically and geographically separate from Verisign's principal secure facilities for signing operations. Verisign has developed, implemented and tested business continuity and IT disaster recovery plan to mitigate the effects of natural, man-made, or technological disasters. These plans are regularly tested, validated, and updated to be operational in the event of any incident or disaster. Detailed business continuity and IT disaster recovery plans are in place to address the restoration of information systems services and key business functions.

Verisign has in place a formal Incident Response Team which is supported by a formal Corporate Incident Management Team (CIMT) and business unit Business Continuity Teams to respond to and manage any incident or disaster that impacts Verisign employees, operations, environments, and facilities. Verisign's IT disaster recovery site has implemented the physical security protections and operational controls required by Verisign Physical Security Policies, the Verisign Cryptographic Key Mangagement Guide, and the Versign Key Ceremony Guide, to provide for a secure and sound backup operational environment. In the event of a natural, man-made, or technological incident or disaster that requires temporary or permanent cessation of operations from Verisign's primary facility, Verisign's business continuity and IT disaster recovery process is initiated by the Verisign Incident Response Team (IRT) and Corporate Incident Management Team (CIMT). Because root zone signing operations on a validated zone file are performed actively, independently and redundantly in both facilities, manual intervention is not required in order for the following functions to proceed following a disaster at either site:

- o Signing a Zone File
- o Distributing the Signed Zone File

Verisign's disaster recovery environment is protected by physical security protections comparable to the physical security tiers specified in DPS section 4.1.2. Verisign tests its environment at its primary site to support all functions to include DNSSEC functions. Results of such tests are reviewed and kept for audit and planning purposes. Verisign maintains redundant hardware and backups of its infrastructure system software at its IT disaster recovery facility. In addition, private keys are backed up and maintained for disaster recovery purposes in accordance with DPS section 5.2.4.

4.6. Entity termination

Verisign has implemented a DNSSEC termination plan in the event that the roles and responsibilities of the Root Zone ZSK Operator must transition to other entities. Verisign will co-ordinate with the IANA Functions Operator, Root Zone KSK Operator and DoC in order to execute the transition in a secure and transparent manner.

The DNSSEC termination plan also includes procedures in the case of IANA Functions Operator and/or Root Zone KSK Operator termination.

5. TECHNICAL SECURITY CONTROLS

5.1. Key Pair Generation and Installation

5.1.1. Key pair generation

Root Zone (RZ) Zone Signing Key (ZSK) key pair generation is performed by multiple pre-selected, trained and trusted individuals using Trustworthy Systems and processes that provide for the security and required cryptographic strength for the generated keys.The cryptographic modules used for RZ ZSK key generation meet the requirements of FIPS 140-2 level 4.

All ZSK key pairs are generated in pre-planned Key Generation Ceremonies in accordance with the requirements of the Key Ceremony Reference Guide and other applicable policies. The activities performed in each key generation ceremony are recorded, dated and signed by all individuals involved. These records are kept for audit and tracking purposes as required in section 4.4.3.

5.1.2. Public key delivery

Refer to the Root Zone Key Signing Key Operator's DPS for details [RZKSKDPS].

5.1.3. Public key parameters generation and quality checking

For the current key size, primality testing of RSA parameters (p and q) will be performed to ensure with the probability of less than 2^-100 that the numbers are not composite.

Quality checking will also include validating the size of the public exponent to be both resource-efficient and secure.

5.1.4. Key usage purposes

Any root zone ZSK private key will only be used for signing the relevant root zones RRset or self-signing with the same scheme to provide proof of possession of the private key.

Any resulting RRSIG record will have a validity period that is no longer than 15 days, and will not extend more than 15 days in to the future.

5.2. Private key protection and Cryptographic Module Engineering Controls

All cryptographic functions involving the private component of the ZSK are performed within the HSM; that is, the private component will not be exported from the HSM except in encrypted form for purposes of key backup.

5.2.1. Cryptographic module standards and controls

For RZ ZSK key pair generation and RZ ZSK private key storage, Verisign uses HSMs that are certified at FIPS 140-2 Level 4.

5.2.2. Private key (m-of-n) multi-person control

Verisign has implemented technical and procedural mechanisms that require the participation of multiple trusted individuals to perform sensitive cryptographic operations. Verisign uses "Secret Sharing" to split the activation data needed to make use of a RZ ZSK private key into separate parts called "Secret Shares" which are held by trained and trusted individuals called "Shareholders." A threshold number of Secret Shares (m) out of the total number of Secret Shares created and distributed for a particular HSM (n) is required to activate a RZ ZSK private key stored on the module. The threshold

number of shares needed to sign a root Zone File is 3. It should be noted that the number of shares distributed for disaster recovery tokens may be less than the number distributed for operational HSMs, while the threshold number of required shares remains the same. Secret Shares are protected in accordance with this DPS.

5.2.3. Private key escrow

Private components of Root Zone ZSKs are not escrowed.

5.2.4. Private key backup

Verisign creates backup copies of RZ ZSK private keys for routine recovery and disaster recovery purposes. Such keys are stored in encrypted form within hardware cryptographic modules and associated key storage devices. Cryptographic modules used for private key storage meet the requirements of this DPS. Private keys are copied to backup hardware cryptographic modules in accordance with this DPS. Modules containing on-site backup copies of RZ ZSK private keys are subject to the requirements of this DPS. Modules containing disaster recovery copies of RZ ZSK private keys are subject to the requirements of this DPS.

5.2.5. Private key storage on cryptographic module

Private keys held on hardware cryptographic modules are stored in encrypted form.

5.2.6. Private key archival

RZ ZSK key pairs do not expire. Superseded key pairs will be securely retained within HSMs that meet the requirements of this DPS. These key pairs will not be used for any signing events after their supersession.

5.2.7. Private key transfer into or from a cryptographic module

Verisign generates RZ ZSK key pairs on the HSMs in which the keys will be used. In addition, Verisign makes copies of such key pairs for routine recovery and disaster recovery purposes. Where key pairs are backed up to another HSM, such key pairs are transported between modules in encrypted form.

5.2.8. Method of activating private key

The RZ ZSK private key will be activated using a minimum of 3 MofN Secret Shares.

5.2.9. Method of deactivating private key

Verisign RZ ZSK private keys are deactivated upon system shutdown.

5.2.10. Method of destroying private key

Where required, Verisign destroys RZ ZSK private keys in a manner that reasonably ensures that there are no residual remains of the keys that could lead to the reconstruction of the keys. Verisign utilizes the zeroization function of its HSMs and other appropriate means to ensure the complete destruction of RZ ZSK private keys. When performed, private key destruction activities are logged.

5.3. Other Aspects of Key Pair Management

5.3.1. Public key archival

RZ ZSK public keys are backed up and archived.

5.3.2. Key usage periods

The Operational Period of a RZ ZSK ends upon its supersession. The superseded RZ ZSK will never be reused to sign a resource record while in retention.

5.4. Activation data

5.4.1. Activation data generation and installation

Activation data (Secret Shares) used to protect HSMs containing RZ ZSK private keys is generated in accordance with the requirements of DPS section 5.1. The creation and distribution of Secret Shares is logged.

When required, activation data for the RZ ZSK private keys is transmitted directly from the Host IS platform to the HSM. This transmission occurs on Verisign's secure infrastructure.

5.4.2. Activation data protection

Shareholders are required to safeguard their Secret Shares and sign an agreement acknowledging their Shareholder responsibilities.

Activation data for RZ ZSK private keys will be decommissioned using methods that protect against the loss, theft, modification, unauthorized disclosure, or unauthorized use of the private keys protected by such activation data. After the record retention periods in section 5.2.6 lapse, Verisign will decommission activation

data by overwriting and/or physical destruction.

5.4.3. Other aspects of activation data

Not applicable

5.5. Computer Security Controls

Verisign ensures that the systems maintaining key software and data files are Trustworthy Systems secure from unauthorized access. In addition, Verisign limits access to production servers to those individuals with a valid business reason for such access. General application users do not have accounts on production servers.

Verisign requires the use of passwords that have a minimum character length and a combination of alphanumeric and special characters. Verisign requires that passwords be changed on a periodic basis.

5.6. Network Security Controls

Verisign performs all its online signing functions using networks secured in accordance with the Verisign Information and Physical Security Policies to prevent unauthorized access and other malicious activity. Verisign protects its communications of sensitive information through the use of encryption and digital signatures.

Verisign's production network is logically separated from other components. This separation prevents network access except through defined application processes. Verisign uses firewalls to protect the production network from internal and external intrusion and limit the nature and source of network activities that may access production systems that are related to key signing activities.

5.7. Timestamping

Time derived from the procedure will be used for timestamping of

- electronic and paper based audit log records
- DNSSEC signatures expiration and inception times

Asserted times are required to be reasonably accurate.

5.8. Life Cycle Technical Controls

5.8.1. System development controls

Applications are developed and implemented by Verisign in accordance with Verisign systems development and change management standards.

All Verisign software deployed on production systems can be traced to version control repositories.

5.8.2. Security management controls

Verisign has mechanisms and/or policies in place to control and monitor the configuration of its systems. Verisign creates a hash of all software packages installed on production systems. This hash is used to verify the integrity of such software.

5.8.3. Life cycle security controls

The signer system is designed to require a minimum of maintenance. Updates critical to the security and operations of the signer system will be applied after formal testing and approval. The origin of all software and firmware will be securely authenticated by available means.

Critical hardware components of the signer system (HSM) will be procured directly from the manufacturer and transported in tamper-evident bags to their destination in the secure facility. Any hardware will be decommissioned well in time before the specified life time expectancy.

6. ZONE SIGNING

The IANA Functions Operator (ICANN) provides the Root Zone Maintainer (VRSN) with signed and valid DNSSEC RRset for the Root Zone ZSK operator's current keys and the KSKs.

The Root Zone Maintainer includes this keyset into the Root Zone file, adds the Next Secure resource records (NSEC) and creates signatures for all relevant records. The Root Zone is then distributed to the Root Server Operators.

The daily Root Zone signing will be conducted semi-automatically by the system. It is not fully automatic since the interface with the IANA Functions Operator is currently manual.

6.1. Key lengths and algorithms

Key pairs are required to be of sufficient length to prevent others from determining the key pair's private key using crypto-analysis during the period of expected utilization of such key pairs.

The current RZ ZSK key pair(s) is an RSA key pair, with a modulus size of at least 1024 bits.

6.2. Authenticated denial of existence

Authenticated denial of existence will be provided through the use of NSEC resource records as specified in RFC 4034 [RFC4034].

6.3. Signature format

The cryptographic hash function used in conjunction with the signing algorithm is required to be sufficiently resistant to preimage attacks during the time of which the signature is valid.

The RZ ZSK signatures will be generated by encrypting SHA-256 hashes using RSA [RFC5702].

6.4. Zone signing key roll-over

RZ ZSK rollover is carried out quarterly automatically by the system. ZSK key signing is conducted manually every three months. The necessary ZSKs to be used in between these gatherings are pre-generated and signed at the same occasion with the projected signature inception- and expiration time.

6.5. Key signing key roll-over

Refer to the Root Zone Key Signing Key Operator's DPS for details [RZKSKDPS].

6.6. Signature life-time and re-signing frequency

The signing practice of the Root Zone is divided into quarterly continuous time cycles of approximately 90 days. Time cycles begins at the following dates each year:

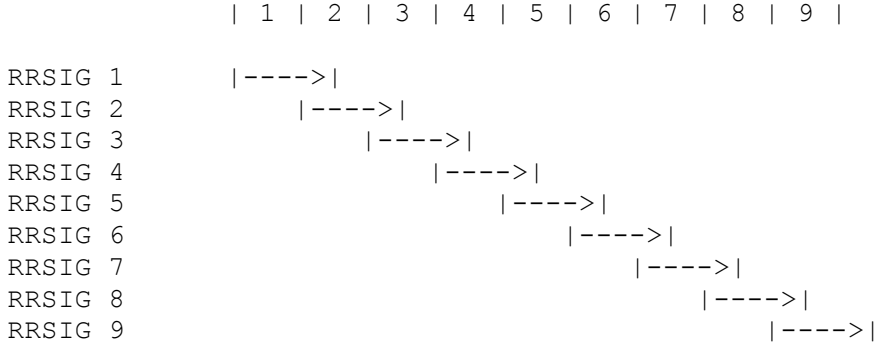
January 1st
April 1st
July 1st
October 1st

For each of these time cycles there is a key ceremony scheduled approximately 60 days, but no later than 33 days before the time cycle commences. At this key ceremony, all of the necessary RZ KSK operations are performed to enable the Root Zone Maintainer to operate and publish the zone independently throughout period.

To facilitate automatic updates of resolvers Trust Anchors as described in RFC 5011 [RFC5011], while minimizing the number of keys in the key set, each of the ~90 days time cycle is divided into 10 day slots (9 slots).

The time cycle will never be less than 90 days. If the time cycle is more than 90 days, the last slot in the cycle will be expanded to fill the period.

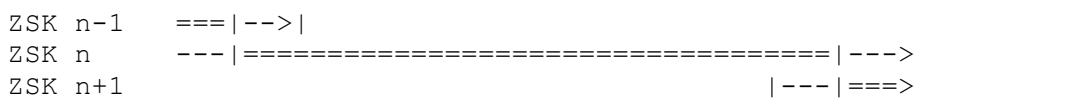
For each of these slots there is a pre-generated DNSKEY key set which is signed at the key ceremony with at least 15 days validity time to allow for up to 50% overlap. The Root Zone Maintainer is responsible for selecting the current key set and publishing it with the corresponding valid signature.



DNSKEY RRSIG's validity period within the cycle

Figure 1

The Root Zone Maintainer may use slots at the edge of every time cycle for pre- and post-publishing at RZ ZSK roll-overs.



(-) post- or pre-publish
(=) used for signing

90 day cycle with ZSK roll-over

Figure 2

In the event of a RZ ZSK roll-over, time slots are used for pre-publish and post-publish in the following order;

```
Slot 1:
      publish ZSK (n) + ZSK (n-1) + KSKs, sign zone with ZSK (n)
Slot 2-8:
      publish ZSK (n) + KSKs, sign zone with ZSK (n)
Slot 9:
      publish ZSK (n) + ZSK (n+1) + KSKs, sign zone with ZSK (n)
```

The Root Zone is then published. At each publication the Root Zone Maintainer selects and includes the current DNSKEY RRset and corresponding signature(s), and then signs all other authoritative records within the root zone using the current RZ ZSK with a validity period set to at least 10 days.

The Root Zone Maintainer may post-publish a ZSK for more than one slot in extraordinary circumstances, such as when increasing key lengths or changing algorithms. In such circumstances, the details shall be clearly communicated to the parties identified in section 1.3.

6.7. Verification of zone signing key set

Each key set within the Key Signing Request (KSR) is self-signed with the active key to provide proof of possession of the corresponding private key. The signer system will automatically validate this signature and perform checking of available parameters before accepting the KSR for signing.

The RZ KSK Operator will verify the authenticity of the KSR document by performing an out-of-band verification (verbally over the phone, by fax, or any other available method) of the hash of the KSR, before entering the KSR into the signer system. The resulting Signed Key Response (SKR) is transferred back using the same TLS client-side authenticated connection used to receive the KSR from the Root Zone Maintainer.

In case a key rollover requires special attention due to a significant change (e.g. key length, algorithm) and a fallback mechanism is needed, there may be instances when two KSRs are generated and submitted to the RZ KSK Operator for signing.

6.8. Verification of resource records

The signature verification will be performed using the published RZ TA on the Extractor/Validator system, which holds both the signed data and the unsigned data prior to the zone distribution in order to carry out the verification. Prior to signing, the integrity of the unsigned Root Zone is validated by a different system. The integrity of the non-signed contents will also be performed as part of this

validation process.

6.9. Resource records time-to-live

RRtype	TTL
DNSKEY	48 hours
Delegation Signer (DS)	24 hours
RRSIG	same as the covered RR (varies)

7. COMPLIANCE AUDIT

An annual compliance audit for DNSSEC operations examination is performed for Verisign's data center operations and key management operations supporting Verisign's Root Zone Zone Signing services including the RZ ZSK management.

7.1. Frequency of entity compliance audit

Compliance Audits are conducted at least annually at the sole expense of the audited entity.

7.2. Identity/qualifications of auditor

Verisign's compliance audits are performed by a public accounting firm that: Demonstrates proficiency in DNSSEC public key infrastructure technology, information security tools and techniques, security auditing, and the third-party attestation function, and is accredited by the American Institute of Certified Public Accountants (AICPA), which requires the possession of certain skill sets, quality assurance measures such as peer review, competency testing, standards with respect to proper assignment of staff to engagements, and requirements for continuing professional education.

7.3. Auditor's relationship to audited party

Compliance audits of Verisign's operations are performed by a public accounting firm that is independent of Verisign. Third party auditors do not participate in the multi-person control for the RZ ZSK.

7.4. Topics covered by audit

The scope of Verisign's annual compliance audit includes all DNSSEC operations such as key environmental controls, key management

operations, Infrastructure/Administrative controls, RZ ZSK and signature life cycle management and practices disclosure.

7.5. Actions taken as a result of deficiency

With respect to compliance audits of Verisign's operations, significant exceptions or deficiencies identified during the Compliance Audit will result in a determination of actions to be taken. This determination is made by Verisign management with input from the auditor and DoC. Verisign management is responsible for developing and implementing a corrective action plan. If Verisign or the DoC determines that such exceptions or deficiencies pose an immediate threat to the security or integrity of the RZ ZSK, a corrective action plan will be developed within 30 days and implemented within a commercially reasonable period of time. For less serious exceptions or deficiencies, Verisign Management will evaluate the significance of such issues and determine the appropriate course of action with DoC authorization.

7.6. Communication of results

A copy of Management's Assertion letter can be found at http://www.verisigninc.com/en_US/repository/index.xhtml

8. LEGAL MATTERS

8.1. Fees

Not applicable

8.2. Financial responsibility

Not applicable

8.3. Confidentiality of business information

8.3.1. Scope of confidential information

The following records shall, be kept confidential and private (Confidential/Private Information):

- Private keys and information needed to recover such Private Keys
- Transactional records (both full records and the audit trail of transactions)
- Audit trail records created or retained by Verisign

- Audit reports created by Verisign (to the extent such reports are maintained), or their respective auditors (whether internal or public)
- Contingency planning and disaster recovery plans
- Security measures controlling the operations of Verisign hardware and software and the administration of DNS Keys

8.3.2. Information not within the scope of confidential information

All information pertaining to the database of top level domains is public information. Public Keys, Key Revocation, and other status information, Verisign repositories and information contained within them are not considered Confidential/Private Information.

8.3.3. Responsibility to protect confidential information

Verisign secures confidential information from compromise and disclosure to third parties.

8.4. Privacy of personal information

8.4.1. Information treated as private

To the extent, Verisign receives or processes, personally identifiable information in the course of providing root services, such PII is treated as private in accordance with Verisign's Privacy Policy as set forth at http://www.verisigninc.com/en_US/privacy/index.xhtml.

8.4.2. Information not deemed private

Subject to applicable laws, all information required to be published as part of a root zone file is deemed not private.

8.4.3. Responsibility to protect private information

In providing Root services, Verisign acts as a data processor and not as a data controller, and any obligations that Verisign may have with respect to any personally identifiable information is governed, subject to applicable law, by the applicable customer agreement and to the extent not governed by any applicable customer agreement, by Verisign's Privacy Policy set forth at http://www.verisigninc.com/en_US/privacy/index.xhtml.

8.4.4. Disclosure Pursuant to Judicial or Administrative Process

Verisign shall be entitled to disclose Confidential/Private Information if, in good faith, Verisign believes that disclosure is

necessary in response to judicial, administrative, or other legal process during the discovery process in a civil or administrative action, such as subpoenas, interrogatories, requests for admission, and requests for production of documents.

8.5. Limitations of liability

Verisign shall not be liable for any financial loss, or loss arising from incidental damage or impairment, resulting from its performance of its obligations hereunder or the IANA Functions Operator or the Root Zone KSK Operator's performance of their respective obligations under DNSSEC Practice Statement for the Root Zone KSK operator. No other liability, implicit or explicit, is accepted.

8.6. Term and termination

8.6.1. Term

The DPS becomes effective upon publication in the Verisign repository. Amendments to this DPS become effective upon publication in the Verisign repository.

8.6.2. Termination

This DPS is amended from time to time and will remain in force until it is replaced by a new version.

8.6.3. Dispute resolution provisions

Disputes among DNSSEC participants shall be resolved pursuant to provisions in the applicable agreements among the parties. Disputes involving Verisign require an initial negotiation period of sixty (60) days followed by litigation in the federal or state court encompassing Fairfax County, Virginia, in the case of claimants who are U.S. residents, or, in the case of all other claimants, arbitration administered by the International Chamber of Commerce ("ICC") in accordance with the ICC Rules of Conciliation and Arbitration, unless otherwise approved by Verisign.

8.6.4. Governing law

This DPS shall be governed by the laws of the Commonwealth of Virginia.

9. References

9.1. Normative References

[RFC4034] Arends, R., Austein, R., Larson, M., Massey, D., and S. Rose, "Resource Records for the DNS Security Extensions", RFC 4034, DOI 10.17487/RFC4034, March 2005, <http://www.rfc-editor.org/info/rfc4034>.

[RFC5011] StJohns, M., "Automated Updates of DNS Security (DNSSEC) Trust Anchors", STD 74, RFC 5011, DOI 10.17487/RFC5011, September 2007, <http://www.rfc-editor.org/info/rfc5011>.

[RFC5702] Jansen, J., "Use of SHA-2 Algorithms with RSA in DNSKEY and RRSIG Resource Records for DNSSEC", RFC 5702, DOI 10.17487/RFC5702, October 2009, <http://www.rfc-editor.org/info/rfc5702>.

9.2. Informative References

[RZKSKDPS] Ljunggren, F., Okubo, T., Lamb, R., and J. Schlyter, "DNSSEC Practice Statement for the Root Zone KSK Operator", May 2010.

Appendix A. Table of acronyms and definitions

A.1. Acronyms

Term	Definition
AD	Authenticated Data Flag
AICPA	American Institute of Certified Public Accountants
BIND	Berkley Internet Name Domain
CC	Common Criteria
CD	Checking Disabled
DNS	Domain Name System
DNSKEY	Domain Name System Key
DNSSEC	Domain Name System Security Extensions
DO	DNSSEC OK
DoC	Department of Commerce
DPS	DNSSEC Policy and Practices Statement
DS	Delegation Signer
EAL	Evaluation Assurance Level (pursuant to the Common Criteria)
FIPS	Federal Information Processing Standards
FISMA	Federal Information Security Management Act
HSM	Hardware Security Module
IANA	Internet Assigned Numbers Authority
ICANN	Internet Corporation for Assigned Names and Numbers
ISO	International Organization for Standardization
NIST	National Institute of Standards and Technology
NS	Name Server
NSEC	NextSecure
NSEC3	NextSecure3
NTIA	National Telecommunications and Information Administration of the U.S. Department of Commerce.
PKI	Public Key Infrastructure
PMA	Policy Management Authority
RFC	Request for Comments
RZ	Root Zone
KSKO	Key Signing Key Operator
RRSIG	Resource Record Signature
RZMS	Root Zone Management System
SEP	Secure Entry Point
SHA	Secure Hash Algorithm
SOA	Start of Authority
SP	NIST Special Publication
TA	Trust Anchor
TLD	Top Level Domain
TSIG	Transaction Signature
TTL	Time To Live
VERT	Verisign Emergency Response Team
VSIRT	Verisign Security Incident Response Team
ZSKO	Zone Signing Key Operator

A.2. Definitions

Term	Definition
Chain of Trust	DNS keys, signatures and delegation signer records linked together forming a chain of signed data.
Compromise	A violation (or suspected violation) of a security policy, in which an unauthorized disclosure of, or loss of control over, sensitive information may have occurred. With respect to private keys, a Compromise is a loss, theft, disclosure, modification, unauthorized use, or other modification, unauthorized use, or other compromise of the security of such private key.
Compliance Audit	A periodic audit that a Processing Center, Service Center, Managed PKI Customer, or Gateway Customer undergoes to determine its conformance with standards that apply to it.
Confidential/Private Information	Information required to be kept confidential and private.
Delegation Signer (DS)	Delegation Signer is one of the resource (DS) records in the indicating that the delegated zone is digitally signed. It also assures that the parent zone recognizes the indicated key for the delegated zone.
Hardware Security Module (HSM)	A type of secure crypto-processor aimed at managing cryptographic keys and cryptographic operations while providing physical protection of the private keying material through tamper protecting mechanisms.
Intellectual Property Rights (IPR)	Rights under one or more of the following: any copyright, patent, trade secret, trademark, and any other intellectual property rights.
Island of Security	A signed zone that does not have a chain of trust from the parent zone.
Key Generation Ceremony	A procedure whereby a key pair is generated, its private key is transferred into a cryptographic module, its private key is backed up, and/or key sets are signed.

Key Signing Key (KSK)	A key that signs the key set.
Management Review	Compliance Audit of the entity or as part of the overall risk management process in the ordinary course of business.
Offline HSM	HSMs that are maintained offline for security reasons in order to protect them from possible attacks by intruders by way of the network. These HSMs do not directly sign the zone file.
Online HSM	HSMs that sign the Zone file under the Zone Signing Key are maintained online so as to provide continuous signing services.
Parent Zone	The zone which is one level higher.
Policy Management Authority (PMA)	The organization within Verisign responsible for managing the DPS.
Public Key Infrastructure	The architecture, organization, techniques, practices, and procedures that collectively support the implementation and operation of a public key cryptographic system.
Regulated Financial Institution	A financial institution that is regulated, supervised, and examined by governmental, national, state or provincial, or local authorities having regulatory authority over such financial institution based on the governmental, national, state or provincial, or local laws under which such financial institution was organized and/or licensed.
Resource Record Signature (RRSIG)	Signature data in the zone file.
RSA	A public key cryptographic system invented by Rivest, Shamir and Adelman.
Root Zone Management System (RZMS)	A system used to automate the Root Zone update process requested by the IANA Functions Operator.
Secret Share	A portion of a private key or a portion of the activation data needed to operate a private key under a Secret Sharing arrangement.
Supersedence	A key is superseded when it stops being published in its respective zone.

SysTrust Assurance	SysTrust is an assurance service developed by American Institute of Certified Public Accountants (AICPA) and the Canadian Institute of Chartered Accountants (CICA). SysTrust is designed primarily to build trust and confidence among businesses depending on systems, addressing areas such as: security, availability, confidentiality, and processing integrity.
Supplemental Risk	A review of an entity by Verisign following incomplete or exceptional findings in a Compliance Audit of the entity or as part of the overall risk management process in the ordinary course of business.
Trusted Anchor	A trust anchor is an authoritative entity represented via a public key. It is used in the context of public key infrastructures, X.509 digital certificates and DNSSEC.
Trusted Role	The roles within the DNSSEC operations that must be held by a Trusted Person.
Trusted Person	Personnel assigned to a Trusted Role who have successfully completed a a comprehensive background investigation as defined in Section 4.3.2, which indicates their ability to maintain the level of trust necessary for critical DNSSEC operations.
Verisign	Means, with respect to each pertinent portion of this, VeriSign, Inc. and/or any wholly owned Verisign subsidiary responsible for the specific operations at issue.
Repository	DNSSEC-related information made accessible online.
Zone	A boundary of responsibility for each domain.
Zone Signing Key (ZSK)	A key that signs the Root Zone

Appendix B. History of changes

Section	Description
Cover Page	Changed "T.Okubo ICANN" to "T.Okubo VeriSign"
	Updated the date and copyright year
Table of Contents	Updated page numbers
Entire Document	Updated the date
	Added "Verisign Public" to footer
1.2	Updated the version
1.4.2	Changed "The DPS Practices Manager" to "The DNSSEC Practices Manager"
4.5.4	Changed "by Verisign Physical Security Policies" and Verisign Security and Audit Requirements to provide" to "by Verisign Physical Security Policies, the Verisign Cryptographic Key Management Guide, and the Verisign Key Ceremony Guide, to provide"
5.1.4	Changed "Any resulting RRSIG record will have a validity period that is no longer than 10 days, and will not extend more than 10 days in to the future." to "Any resulting RRSIG record will have a validity period that is no longer than 15 days, and will not extend more than 15 days in to the future."
6.1	Changed "of 1024 bits." to "of at least 1024 bits."
6.6	Changed "with 15 days validity time" to "with at least 15 days validity time"
	Changed "set to 7 days." to "set to at least 10 days."
	Added "The Root Zone Maintainer may post- publish a ZSK for more than one slot in extraordinary circumstances, such as when increasing key lengths or changing algorithms. In such circumstances, the details shall be clearly communicated to the parties identified in section 1.3."
6.7	Added "In case a key rollover requires special attention due to a significant change (e.g. key length, algorithm) and a fallback mechanism is needed, there may be instances when two KSRs are generated and submitted to the RZ KSK Operator for signing."
8.6.2	Changed "as amended" to "is amended"
A.2	Added definition of supersedence

Author's Address	Changed "Tomofumi Okubo Internet Corporation for Assigned Names and Numbers 4676 Admiralty Way, Suite 330 Marina del Ray, CA 90292 USA Email: tomofumi.okubo@icann.org" to "Tomofumi Okubo VeriSign, Inc. 12061 Bluemont Way Reston, VA 20190-5684 USA Email: tomokubo@verisign.com"

Authors' Addresses

Alejandro Bolivar
VeriSign Inc.
12061 Bluemont Way
Reston, VA 20190-5684
USA

Email: abolivar@verisign.com

Tomofumi Okubo
VeriSign Inc.
12061 Bluemont Way
Reston, VA 20190-5684
USA

Email: tomokubo@verisign.com

Fredrik Ljunggren
Kirei AB
P.O. Box 53204
Goteborg SE-400 16
Sweden

Email: fredrik@kirei.se

Richard Lamb
Internet Corporation For Assigned Names and Numbers
4676 Admiralty Way, Suite 330
Marina del Ray, CA 90292
USA

Email: richard.lamb@icann.org

Jakob Schlyter
Kirei AB
P.O. Box 53204
Goteborg SE-400 16
Sweden

Email: jakob@kirei.se