

## DNSSEC Policy Statement – Version 1.2.1

This DNSSEC Practice Statement (DPS) conforms to the template included in RFC 6841.

### 1. Introduction

The approach described here is modelled closely on the corresponding DPS procedures published for .SE by the "Stiftelsen för Internetinfrastruktur" (.SE The Internet Infrastructure Foundation)<sup>1</sup> and the DPS procedures published for the .CA by the Canadian Internet Registration Authority (CIRA)<sup>2</sup>.

#### 1.1. Overview

DNSSEC is an extension to the DNS that allows data retrieved from the DNS to be authenticated. DNSSEC is specified in RFC 4033, RFC 4034, RFC 4035, RFC 5155 and RFC 5702. DS Resource Record updates to the root zone for TLDs will conform to the process as described by IANA.

#### 1.2. Document Name and Identification

Document Name: CentralNic Registry DPS Statement

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#### 1.3. Community and Applicability

##### 1.3.1. Registry

CentralNic operates a registry system for various ccTLDs, gTLDs and ccSLDs. CentralNic is responsible for the management of the registry, and consequently for the registration of domain names under various top-level domains. CentralNic is responsible for all DNSSEC operations of these zones.

##### 1.3.2. Registrars

A registrar is a party responsible for requesting changes in the registry on behalf of registrants. Each registrar is responsible for the secure identification of the registrant of a domain name under its sponsorship. Registrars are responsible for adding, removing or

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<sup>1</sup> <https://www.iis.se/docs/se-dnssec-dps-eng.pdf>

<sup>2</sup> <http://cira.ca/knowledge-centre/technology/dnssec/practice-statement/>

updating Delegation Signer (DS) records for each domain at the request of the domain's registrant.

### **1.3.3. Registrants**

Registrants are responsible for generating and protecting their own keys and registering and maintaining corresponding DS records through a registrar.

### **1.3.4. DNS Operators**

The registrant may outsource their technical responsibility to a third-party DNS Operator which may also be the sponsoring registrar of the domain.

### **1.3.5. Relying Party**

The relying party is the entity that makes use of DNSSEC signatures, such as DNSSEC validators and other applications. Relying parties should make use of the root zone trust anchor to obtain the trust anchors for the various zones via publication of the DS record.

### **1.3.6. Applicability**

This DPS applies to all zones operated by CentralNic.

## **1.4. Specification Administration**

This DPS is updated as appropriate with best practices in the industry.

### **1.4.1. Specification Administration Organisation**

CentralNic Ltd, 35-39 Moorgate, London, EC2R 6AR, United Kingdom.

### **1.4.2. Contact Information**

Operations Team, CentralNic Ltd, 35-39 Moorgate, London, EC2R 6AR, United Kingdom.

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### **1.4.3. Specification Change Procedures**

The current version of this document is available at:

<https://centralnicregistry.com/support/policies/dps>

CentralNic may amend the DPS without notification for changes but will provide reasonable notice of significant changes to registrars and registry operators. All changes to this DPS will be effective immediately upon publication.

## 2. Publication and Repositories

Notifications relevant to DNSSEC at CentralNic will be distributed by e-mail to CentralNic registrars and registry operator clients.

### 2.1. Repositories

Apart from this document, no further information about CentralNic's DNSSEC operations is published online but may be provided to third parties from time to time. A number of external resources (such as DNSViz.net) may be used to obtain information about DNSSEC information and configuration for zones managed by CentralNic.

### 2.2. Publication of public keys

CentralNic publishes digests of Key Signing Keys (KSKs) for its zones as DS records in the root (or parent) zone. No other trust anchors or repositories are used.

## 3. Operational Requirements

### 3.1. Meaning of Domain Names

For the purposes of this document, a domain name is a name registered under a top-level domain (ccTLD such as .FM, gTLD such as .WIKI) or second-level domain (ccSLD such as .UK.COM) and corresponds to a delegation from the parent zone to name servers operated for the domain name's registrant.

### 3.2. Identification and Authentication of Child Zone Manager

Identification and authentication of each child zone manager is the responsibility of the sponsoring registrar for the domain name.

### 3.3. Registration of delegation signer (DS) resource records

The registry accepts DS records through an RFC 5910 EPP interface and via the Registrar Console<sup>3</sup>. The registry will accept any syntactically valid DS record, and no checks will be performed as to the accuracy of the trust anchor with respect to the child zone's KSK to allow pre-publishing of DS records.

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<sup>3</sup> <https://registrar-console.centralnic.com>

### **3.4. Method to Prove Possession of Private Key**

The sponsoring registrar for a domain name is responsible for authenticating the registrant as the manager of the domain name in control of the private key.

### **3.5. Removal of Delegation Signer Record**

DS records are removed from the registry using an EPP interface according to RFC 5910 or manually via the CentralNic Registry web interface.

#### **3.5.1. Who can request removal**

The registrant has the authority to request removal of a DS record, subject to identical authentication as required for modifications of NS records.

#### **3.5.2. Procedure for removal request**

The registrant of a domain name requests the domain's sponsoring registrar to remove the DS record. The registrar transmits this request to the registry using EPP or the Registrar Console. Once the transaction has been successfully received and processed by the registry, the DS record will be removed from the zone when the following revision of the zone is distributed (no later than 60 minutes after). The sponsoring registrar must comply with requests from the registrant, regardless of the standing between the two parties.

#### **3.5.3. Emergency removal request**

There is no provision for emergency removal requests.

## **4. Facility, Management and Operational Controls**

### **4.1. Physical Controls**

CentralNic has implemented a Security Policy, which supports the security requirements of this DPS.

#### **4.1.1. Site Location and Construction**

CentralNic has established two fully operational and geographically dispersed operation centres. Both sites are protected by multiple tiers of physical security that deter, prevent and detect unauthorized access attempts. Each site contains a full set of equipment necessary to sign and validate all zones. All signing components are placed within locked

cabinets at all sites. An additional site is used to store off-line HSM key cards and associated portable media, within a secure container.

#### **4.1.2. Physical Access**

Physical access to operation centres is restricted to authorized personnel. Access is controlled using RFID photo cards and visual confirmation of identity by security personnel. Technical areas are further controlled by PIN entry locks on doors. Access to locked cabinets is further restricted to personnel with trusted roles. The physical security system includes additional tiers of key management security and segregation of duties to protect both online and offline storage of HSMs and keying material.

Offline HSMs are protected through the use of locked cabinets.

#### **4.1.3. Power and Air Conditioning**

Operation centres are equipped with redundant power sources and air conditioning systems to ensure a consistent, stable operating environment.

#### **4.1.4. Water Exposure**

Both operation centres implement flood protection and detection mechanisms.

#### **4.1.5. Fire Prevention and Protection**

Operation centres are equipped with fire detection and extinguishing systems.

#### **4.1.6. Media Storage**

All media containing production software and data, audit, archive, or backup information is stored securely within the operation centres.

#### **4.1.7. Waste Disposal**

Sensitive media and other material that may contain sensitive information are destroyed in a secure manner, either by CentralNic or by a contracted party.

#### **4.1.8. Off-Site Backup**

CentralNic performs regular backups of critical data, audit logging data and other sensitive information. An off-site facility is leveraged for storage of backup media. Physical access to the storage facility is limited to authorized personnel.

## 4.2. Procedural Controls

### 4.2.1. Trusted Roles

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

Trusted Persons include; but are not limited to:

- DNS operations personnel
- Security personnel
- System administration personnel
- Executives that are designated to manage infrastructure

Trusted positions are assigned to CentralNic staff personnel. The trusted roles are:

- "SA" - System Administrator
- "SO" - Security Officer

There must be at least two different individuals assigned to each position.

### 4.2.2. Number of Persons Required per Task

- HSM Activation and Deactivation: 2 out of 5 authorised persons (1 SA + 1 SO)
- Key Generation: 2 out of 5 authorised persons (1 SA + 1 SO)
- Distribution of encrypted Key Archives to: 2 persons ( 1 SA or SO, 1 WI)

### 4.2.3. Identification and Authentication for Each Role

Only CentralNic staff members who have signed a CentralNic employment agreement may hold a trusted person role of SO or SA. The role of WI can be filled with any person of good standing. Valid identification must be provided.

### 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 DNSSEC key material. No two trusted roles may be held by a single individual.

Systems Administrators have exclusive physical access to DNSSEC operational equipment. Security Officers have no access but hold credentials for HSM activation. Systems Administrators hold no such credentials.

### **4.3. Personnel Controls**

#### **4.3.1. Qualifications, Experience and Clearance Requirements**

Candidates for any trusted role must demonstrate appropriate background knowledge and qualifications.

#### **4.3.2. Background Check Procedures**

Background checks for candidates for SA and SO roles are carried out by the Human Resources department at CentralNic follow normal procedures for background checks on new hires.

#### **4.3.3. Training Requirements**

CentralNic provides its personnel with training upon hire as well as on-going training as needed to perform their job responsibilities competently and satisfactorily.

#### **4.3.4. Job rotation frequency and sequence**

SA and SO roles are kept as stable and with the least amount of rotation possible by assignment to senior staff members where possible

#### **4.3.5. Sanctions for unauthorized actions**

Any unauthorized action taken by a staff member will result in disciplinary action and possible criminal prosecution.

#### **4.3.6. Contracting personnel requirements**

Personnel hired by CentralNic as contractors are subject to background checks and confidentiality agreements. Contractors must demonstrate appropriate qualifications.

#### **4.3.7. Documentation supplied to personnel**

Personnel will be supplied with documentation required for their trusted role, including this DPS policy, audits performed in the past, plus all system administration documentation relevant to the DNSSEC signing solution.

### **4.4. Audit Logging Procedures**

CentralNic implements automatic log collection from CentralNic computer systems. Paper documentation relating to the execution of procedures is also collected for the purposes of auditing performance of those procedures.

#### **4.4.1. Types of Events Recorded**

CentralNic manually or automatically logs critical events related to KSK and ZSK management.

CentralNic manually or automatically logs critical events related to system security and management.

Log entries include the following elements:

- Date and time of the entry based on NTP
- Identity of the entity making the journal entry
- Serial or sequence number of entry, for automatic journal entries
- Entry type and log level

#### **4.4.2. Frequency of Processing Log Information**

Logs are continuously analysed through automatic and manual controls.

#### **4.4.3. Retention Period for Audit Log Information**

Electronic logs are retained online for at least one year. All log information collected is archived for at least three years.

#### **4.4.4. Protection of Audit Log**

All audit log information is stored securely to protect against unauthorized viewing and manipulation.

#### **4.4.5. Audit log backup procedures**

All audit log information is stored securely at multiple physically separate locations

#### **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 CentralNic personnel and stored using current methods for physical and fire protection.

#### **4.4.7. Vulnerability Assessments**

All anomalies in the collected log information are investigated to analyse potential vulnerabilities.



## **4.5. Compromise and Disaster Recovery**

### **4.5.1. Incident and Compromise Handling Procedures**

All actual and suspected events relating to security are defined as incidents. All incidents are handled according to CentralNic's standard procedures.

### **4.5.2. Corrupted Computing Resources, Software and/or Data**

Any defect which would result in the generation of inaccurate data will be caught before publication by the deployment of multiple, independent signing implementations that trigger an incident at any inconsistency.

### **4.5.3. Entity Private Key Compromise Procedures**

A suspected or actual ZSK compromise will be addressed by immediately removing the compromised ZSK from service, replacing it with a newly-generated or pre-generated replacement key. A suspected or actual KSK compromise will be addressed by immediately executing a controlled KSK rollover.

### **4.5.4. Business Continuity and IT Disaster Recovery Capabilities**

CentralNic's organisation-wide business continuity and IT disaster recovery plans include measures to ensure continuity of operation for registry and zone distribution systems including all DNSSEC signing components.

## **4.6. Entity Termination**

If operation of the registry is transferred to another party, CentralNic will participate in the transition so as to make it as smooth as possible according to the same rules and conditions as defined for registrant transfer and cooperation of DNSSEC operations.

# **5. Technical Security Controls**

## **5.1. Key Pair Generation and Installation**

### **5.1.1. Key Pair Generation**

Key generation takes place in a Hardware Security Module (HSM) that is managed by trained and specifically authorized personnel in trusted roles. The cryptographic modules are used for the Storage Master Key (SMK), Operation Key (OK), KSK, and ZSK meet the requirements for FIPS-140-2 Level 3 and Common Criteria EAL4+. The SMK, KSK, and ZSK are generated by procedures implemented in the OpenDNSSEC software.

### **5.1.2. Public Key Delivery**

SOs are responsible for publishing the public part of each generated KSK pair. Publication is in the form of the addition of a DS record corresponding to the new KSK in the root (or parent) zone.

### **5.1.3. Public Key Parameters Generation and Quality Checking**

Key parameters, including the key length and the algorithm type, are verified by SAs and SOs prior to the submission of the parent zone update.

### **5.1.4. Key Usage Purposes**

Keys generated for DNSSEC are never used for any other purpose or outside the signing systems.

## **5.2. Private Key Protection and Cryptographic Module Engineering Controls**

All cryptographic operations are performed within FIPS-140 certified HSMs and no private keys are ever available in unprotected form outside an HSM.

### **5.2.1. Cryptographic Module Standards and Controls**

For KSK and ZSK key pair generation and signing, CentralNic uses hardware modules that are certified to FIPS 140-2 level 3 and Common Criteria EAL4+.

### **5.2.2. Private Key (M of N) Multi-Person Control**

CentralNic has implemented technical and procedural mechanisms that require participation of a minimum of two out of five trusted individuals to perform sensitive cryptographic operations.

### **5.2.3. Private Key Escrow**

Private components of zone KSK and ZSK are not escrowed.

### **5.2.4. Private Key Backup**

The key archive is encrypted with an Operation Key (OK) which is encrypted by a Storage Master Key (SMK).

The SMK is stored on five key cards where at least two is needed to perform sensitive cryptographic operations, it is split with a quorum of (two out of five). The SMK key cards

are distributed between authorized SOs, SAs and a TL-30 rated safe, which is only accessible to SOs.

The OK is stored on four key cards where at least one is needed to be slotted inside each HSM to perform ZSK and KSK keys generation and encryption. It is split with a quorum of (one out of four).

The OK cards are distributed between the HSMs and a TL-30 rated safe which is only accessible to SOs.

#### **5.2.5. Private Key Storage on Cryptographic Module**

Private keys do not leave the tamper-proof cryptographic module without first being encrypted with the OK. The OK is encrypted with the SMK which is stored inside the tamper-proof cryptographic module.

#### **5.2.6. Private Key Archival**

KSK and ZSK key pairs do not expire but are retired when superseded.

#### **5.2.7. Private Key Transfer into or from a Cryptographic Module**

During the installation of each signing system a shared SMK is transferred via portable media to each HSM. Keys are transferred between HSM's in encrypted key archives stored on portable media.

#### **5.2.8. Method of Activating Private Key**

Private keys are activated by putting an HSM online. Access to the HSM is provided by an SA; credentials for putting an HSM online are held by a SO.

#### **5.2.9. Method of Deactivating Private Key**

Private keys are deactivated by taking an HSM off-line, either by manipulation of the device by and SO or due to a power failure or tamper attempt.

#### **5.2.10. Method of Destroying Private Key**

Private keys are not destroyed. After their useful life, keys are removed from the signing system. Tampering with an HSM destroys its contents. If there is any operational issue with an HSM, a controlled tamper will be performed before returning the HSM to the vendor.

### **5.3. Other Aspects of Key Pair Management**

Superseded KSK and ZSK will be never be reused to sign a resource record.

## 5.4. Activation Data

The activation data are the credentials held by the SO to activate the HSM.

### 5.4.1. Activation Data Generation and Installation

Each SO is responsible for specifying a PIN, which is used in conjunction with a physical token. The PIN is known only to the SO that specified it. Physical tokens are stored with the HSM they are intended to be used with.

### 5.4.2. Activation Data Protection

Each SO is responsible for protecting their PIN in a secure fashion. If there is suspicion that a PIN has been compromised, the SO concerned must immediately change it.

### 5.4.3. Other aspects of activation data

There are no other aspects of activation data.

## 5.5. Computer Security Controls

All production computer systems are housed in secure facilities. Physical access to computer systems is limited to authorized personnel. Remote (network) access to signing systems is only possible via an authenticated VPN connection by an SA. All attempts to access computer systems, successful and unsuccessful, are logged.

## 5.6. Network Security Controls

CentralNic's DNSSEC signing infrastructure is logically separated from other components. This separation prevents network access except through defined application processes. CentralNic uses firewalls to protect the DNSSEC signing network from both internal and external intrusion. The network that connects signing systems to HSMs is wholly contained within a locked cabinet that houses the signing systems and HSMs.

All data transfers between signing systems and distribution and validation systems are initiated by the signing system. It is not possible to transfer data to or from a signing system using a transaction initiated from a remote host. Additionally, firewalls are deployed.

## 5.7. Timestamping

All DNSSEC components are time-synchronised to diverse, reputable time servers using authenticated NTP.

## 5.8. Life Cycle Technical Controls

All software deployed on production systems can be traced to change management tickets.

The signer system is designed to require a minimum of maintenance. Updates critical to the security and operations of the signer system from the vendors will be applied after formal testing and approval.

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

## 6. Zone Signing

### 6.1. Key Lengths and Algorithms

Legacy deployments (prior to 2019):

- KSK Algorithm: RSASHA256
- KSK Length: 2048 bits
- ZSK Algorithm: RSASHA256
- ZSK Length: 1024 bits

New deployments from 2019:

- KSK Algorithm: ECDSA Curve P-256 with SHA-256
- KSK Length: 256 bits
- ZSK Algorithm: RSASHA256
- ZSK Length: 128 bits

Zones migrated to CentralNic from other operators may temporarily use parameters which differ from the above.

### 6.2. Authenticated Denial of Existence

Authenticated denial of existence will be provided through the use of NSEC3 records with OPT-OUT.

### 6.3. Signature Format

Zone KSK and ZSK signatures are generated using RSA over SHA256 (RSASHA256) or ECDSA Curve P-256 with SHA-256.

### 6.4. Key Roll-over

ZSK rollovers are carried out for all zones every 30 days. ZSKs are pre-published and post-published for at least 7 days.

If a ZSK is believed to be compromised, the ZSK will be published for at most 2 days after the emergency rollover.

KSK rollovers will not be automatically rolled for all zones: instead, CentralNic operates a continuous process where one zone goes through a KSK rollover every 2 years to ensure operational procedures are tested regularly.

KSKs are pre-published and post-published for at least 14 days.

If a KSK is believed to be compromised, an emergency rollover of the KSK will result in the old key still being published with the new one for 7 days.

## 6.5. Signature Lifetime and Re-Signing Frequency

Resource Record sets (RRSets) are signed with ZSKs with a validity period of 30 days using jittered signature lifetime periods, and are re-signed when the validity period would become less than 3 days.

## 6.6. Verification of Resource Records

Each signed zone is validated before being distributed to name servers using cryptographic software from at least two independent implementations.

Orphaned glue records are removed from the zone prior to signing.

## 6.7. Resource Records Time-to-Live

Time-to-live parameters will vary, but typical values will be as follows:

- SOA: 3600 seconds (one hour)
- DNSKEY: 3600 seconds (one hour)
- NS (apex, plus associated A/AAAA glue records): 172800 seconds (two days)
- RRSIG: inherited from signed RRSet
- Delegation NS: 3600 seconds (one hour)
- DS: 3600 seconds (one hour)
- NSEC3: 3600 seconds (one hour)

## 7. Compliance audit

Audits are conducted using stored audit information to ensure system integrity and procedural compliance of all procedures related to the DNSSEC signing system.

### 7.1. Frequency of entity compliance audit

CentralNic conducts internal audits at least annually and will conduct more frequent audits in the event of system changes, outages, anomalies or significant staff changes.

## **7.2. Identity and qualifications of auditor**

CentralNic compliance audits are performed by CentralNic personnel (or appointed contractors) with proficiency in security and DNSSEC.

## **7.3. Auditor's relationship to audited party**

CentralNic will appoint an internal auditor who is responsible for the audit's implementation.

## **7.4. Topics covered by audit**

Each audit will include a review of events which occurred during a specified audit period. The auditor will ensure that CentralNic is informed and prepared prior to the audit.

## **7.5. Actions taken as a result of deficiency**

CentralNic will take immediately action to resolve deficiencies found by an audit.

## **7.6. Communication of results**

Results of each audit will be produced in a written report no later than 14 days following the completion of the audit.

## **8. Legal matters**

No fees are charged for any function related to DNSSEC. CentralNic accepts no financial responsibility for security incidents or outages based on its DNSSEC deployments.

Disputes among DNSSEC participants shall be resolved pursuant to provisions in the applicable agreements among the parties. Parties must cooperate by removing or adding DS records as requested by the registrant, regardless of standing of the registrant.

This DPS shall be governed by the laws of England and Wales.