



ICANN

# 2017 DNSSEC KSK Rollover

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# Purpose of this Talk

1

To publicize the  
new Root Zone  
DNSSEC KSK

2

Provide status,  
upcoming events,  
and contact  
information

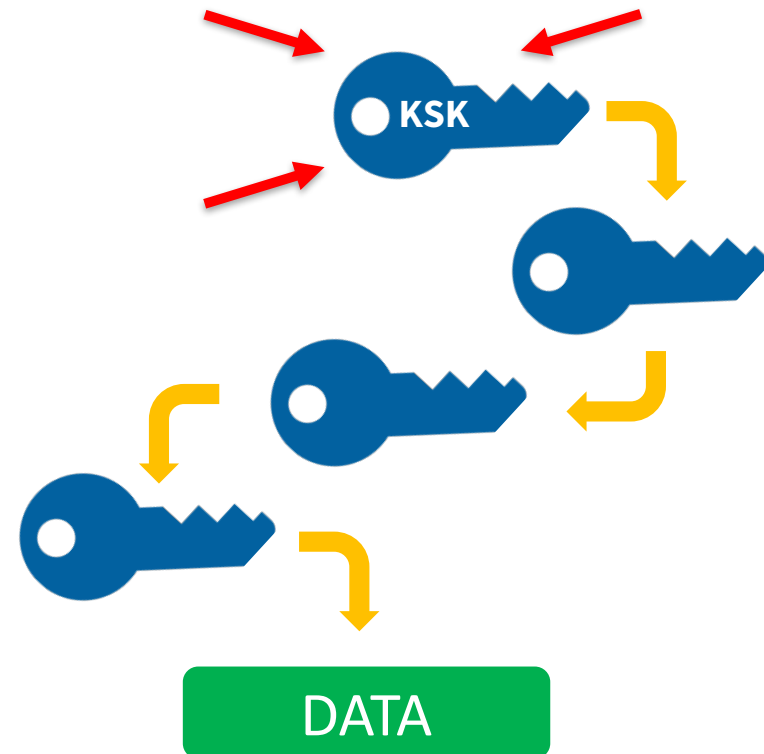
3

Provide helpful  
resources on  
the KSK roll



## The Root Zone DNSSEC KSK

- ⦿ The Root Zone DNSSEC Key Signing Key “**KSK**” is the top most cryptographic key in the DNSSEC hierarchy
- ⦿ Public portion of the KSK is configuration parameter in DNS validating revolvers



## Rollover of the Root Zone DNSSEC KSK

- ⊙ **There has been one functional, operational Root Zone DNSSEC KSK**
  - ⊙ Called "KSK-2010"
  - ⊙ Since 2010, nothing before that
- ⊙ **A new KSK will be put into production later this year**
  - ⊙ Call it "KSK-2017"
  - ⊙ An orderly succession for continued smooth operations
- ⊙ **Operators of DNSSEC recursive servers may have some work**
  - ⊙ As little as review configurations
  - ⊙ As much as install KSK-2017

## Important Milestones

Event	Date
Creation of KSK-2017	October 27, 2016
Production Qualified	February 2, 2017
Out-of-DNS-band Publication	Now, onwards
In-band ( <i>Automated Updates</i> ) Publication	July 11, 2017 and onwards
Sign (Production Use)	<b>October 11, 2017</b> and onwards
Revoke KSK-2010	January 11, 2018
Remove KSK-2010 from systems	Dates TBD, 2018

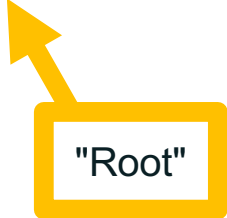
## Recognizing KSK-2017

⦿ The KSK-2017's Key Tag is

20326

⦿ The Delegation Signer (DS) Resource Record for KSK-2017 is

```
.      IN      DS      20326  8  2  
      E06D44B80B8F1D39A95C0B0D7C65D084  
      58E880409BBC683457104237C7F8EC8D
```



*Note: liberties taken with formatting for presentation purposes*

## KSK-2017 in a DNSKEY Resource Record

### © The DNSKEY resource record will be:

```
. IN DNSKEY 257 3 8  
AwEAAaz/tAm8yTn4Mfeh5eyI96WSVexTBAvkMgJzkKTOiW1vkIbzxef3  
+/4RgW0q7HrxRixHlFlExOLAJr5emLvN7SWXgnLh4+B5xQlNVz8Og8kv  
ArMtNROxVQuCaSnIDdD5LKyWbRd2n9WGe2R8PzgCmr3EgVLrjyBxWezF  
0jLHwVN8efS3rCj/EWgvIWgb9tarpVUDK/b58Da+sqqls3eNbuV7pr+e  
oZG+SrDK6nWeL3c6H5Apxz7LjVc1uTIdsIXxuOLYA4/ilBmSVIzuDWfd  
RUfhHdY6+cn8HFRm+2hM8AnXGXws9555KrUB5qihylGa8subX2Nn6UwN  
R1AkUTV74bU=
```

"Root"



*Note: liberties taken with formatting for presentation purposes*

## Why are there DS and DNSKEY forms of KSK-2017?

- ⦿ **Tools that you will use to manage DNSSEC trust anchor configurations work on either the DS form, the DNSKEY form or both**
  - ⦿ For each tool there are historical reasons
  - ⦿ The DS record contains a hash of KSK-2017
  - ⦿ The DNSKEY record contains the public key of KSK-2017
- ⦿ **Consult your tool's documentation to know which is appropriate**





## Current "State of the System"

- ⊙ **Sunny, as in “sunny day scenario”**

- ⊙ We are changing the KSK under good conditions
- ⊙ Leverage trust in KSK-2010 to distribute KSK-2017
- ⊙ Recommended course of action – rely on RFC 5011’s *Automated Updates of DNSSEC Trust Anchors* protocol

- ⊙ **Why mention this?**

- ⊙ Alternative to *Automated Updates* is bootstrapping (or establishing an initial state of trust in) a trust anchor
- ⊙ That would be necessary in stormy (emergency) conditions



## *Automated Updates of DNSSEC Trust Anchors*

- ⦿ **Defined in RFC 5011**

- ⦿ Use the current trust anchor(s) to learn new
- ⦿ To allow for unattended DNSSEC validator operations
- ⦿ Based on "time" – if a new one appears and no one complains for some specified time, it can be trusted
- ⦿ Defined "add hold" time is 30 days



## Important dates when following *Automated Updates*

July 2017						
S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

KSK-2017  
"DNSKEY RR"  
appears in  
DNS

August 2017						
S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

KSK-2017  
should be  
trusted

September 2017						
S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

October 2017						
S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

KSK-2017  
"RRSIG RR"  
appears,  
starts signing

## What if KSK-2017 isn't trusted on that day in August?

### ⦿ **Don't Panic!**

- ⦿ There are nearly two months to examine why, fix, and test before KSK-2017 "goes live"
- ⦿ Begin to investigate early but there is no need to rush a fix
- ⦿ Resources to consult are listed later in the slides

## Why is *Automatic Updates* in use?

- ⊙ **Many DNSSEC validation tools have RFC 5011 support built-in**
  - ⊙ Consult your administrator guides/documentation
- ⊙ **Under "good" conditions, safest way to transfer trust**
  - ⊙ Only trust in KSK-2010 is "needed" to trust KSK-2017
- ⊙ **For the root zone DNSSEC operator, most scalable way to reach the unknown operators using DNSSEC**
  - ⊙ Entirely standards-based method
- ⊙ **Still, establishing trust is subject to local (operator) policy**



## Establishing Trust in KSK-2017 Automatically

- ⦿ **If you are DNSSEC validating with KSK-2010**

- ⦿ You can simply follow *Automated Updates of DNSSEC Trust Anchors* by configuring your tool of choice to do so



## Establishing Trust in KSK-2017 Manually

- ⊙ **Via the official IANA trust anchor XML file at <https://data.iana.org/root-anchors/root-anchors.xml>**
  - ⊙ Contains the same information as a DS record for KSK-2017
  - ⊙ Validate root-anchors.xml with the detached signature at <https://data.iana.org/root-anchors/root-anchors.p7s>
- ⊙ **Via DNS (i.e., ask a root server for “./IN/DNSKEY”)**
  - ⊙ Validate the KSK-2017 by comparison with other trusted copies
- ⊙ **Via “Other means” ...**



## What “other means” for a manual approach?

- ⊙ **Most software/OS distributions of DNSSEC**
  - ⊙ Embed copies of the KSK (now KSK-2010, later KSK-2017)
  - ⊙ In contact with as many distributors as possible
- ⊙ **Compare with the key from these slides**
  - ⊙ Presuming you trust the contents of this presentation and the presenter :-)
- ⊙ **Obtain a copy from another operator, or other trusted source**
  - ⊙ How well do you trust "them"?





## Call to Action

- ⊙ All the work is for operators, developers and distributors of software that performs DNSSEC validation – keep reading/listening!
- ⊙ What if you're not one of them? What if you're an Internet user?
  - ⊙ Be aware that the root KSK rollover is happening on **11 October 2017**
  - ⊙ Do you know a DNS operator, software developer or software distributor?
    - ⊙ Ask them if they know about the root KSK rollover and if they're ready
    - ⊙ Direct them to ICANN's educational and information resources



## What does an operator need to do?

- ⦿ **Be aware whether DNSSEC is enabled in your servers**
- ⦿ **Be aware of how trust is evaluated in your operations**
- ⦿ **Test/verify your set ups**
- ⦿ **Inspect configuration files, are they (also) up to date?**
- ⦿ **If DNSSEC validation is enabled or planned in your system**
  - ⦿ Have a plan for participating in the KSK rollover
  - ⦿ Know the dates, know the symptoms, solutions



## DNSSEC validation-enabled tools

- ⊙ **ISC's BIND**
- ⊙ **NLnet Lab's Unbound**
- ⊙ **Microsoft Windows**
- ⊙ **Nominum Vantio**
- ⊙ **CZnic's Knot Resolver**
- ⊙ **DNSMASQ**
- ⊙ **Secure64 DNS Cache**
- ⊙ **PowerDNS Recursor**



## A Special Note About ISC's BIND

- ⦿ **Blog post from ISC**

  - <https://www.isc.org/blogs/2017-root-key-rollover-what-does-it-mean-for-bind-users/>

- ⦿ **Unique to BIND**

  - ⦿ Because of BIND's long DNSSEC history, some "named.conf" files may have to be updated despite tech-refresh of BIND versions

  - ⦿ Notably, the introduction of managed-keys in ***February 2010***, (ISC's version 9.7) an update to trusted-keys

    - ⦿ **I.e., Check pre-February 2010 configurations!**



## Notes on Microsoft Server

### ⦿ **Extensive Documentation**

⦿ *DNSSEC and Windows: Get Ready, 'Cause Here It Comes! (2010)*

<https://channel9.msdn.com/Events/TechEd/NorthAmerica/2010/WSV333>

⦿ *DNSSEC in Windows Server 2012 (updated 2014)*

<https://technet.microsoft.com/library/dn593694>



## Information About Other Tools

### ⊙ **Unbound**

[https://sched.ws/hosted\\_files/icann572016/49/Jaap-Akkerhuis-Unbound-KSK-rollover.pdf](https://sched.ws/hosted_files/icann572016/49/Jaap-Akkerhuis-Unbound-KSK-rollover.pdf)

### ⊙ **PowerDNS**

<https://doc.powerdns.com/md/recursor/dnssec/#trust-anchor-management>

### ⊙ **Knot Resolver**

<https://knot-resolver.readthedocs.io/en/latest/daemon.html#enabling-dnssec>

### ⊙ **DNSMASQ**

[http://www.thekelleys.org.uk/dnsmasq/CHANGELOG\\_\(see v2.69 notes\)](http://www.thekelleys.org.uk/dnsmasq/CHANGELOG_(see_v2.69_notes))



## Symptoms of a Problem Related to the Rollover

- ⦿ **If there are problems caused by fragmentation-related issues**
  - ⦿ DNSSEC validation fails for everything, resulting from an inability to get the Root Zone DNSKEY set with KSK-2017
  - ⦿ Look for a large number of queries leaving a recursive server "retrying" the question
- ⦿ **If there are problems caused by using the wrong trust anchor**
  - ⦿ DNSSEC validation fails for everything, resulting from an inability to build a chain of trust
  - ⦿ Look in logs for validation failures, implementation specific



## Fragmentation, IPv6 and DNS

- ⦿ **Fragmentation in IPv6**

- ⦿ Fragments created at source, reassembled at destination
- ⦿ Unlike IPv4, fragmentation not done in middle of network
- ⦿ Instead a notice is sent back to source

- ⦿ **IPv6's fragmentation feedback does not help DNS' use of UDP**

- ⦿ No recollection (memory) of what was sent, can't resend

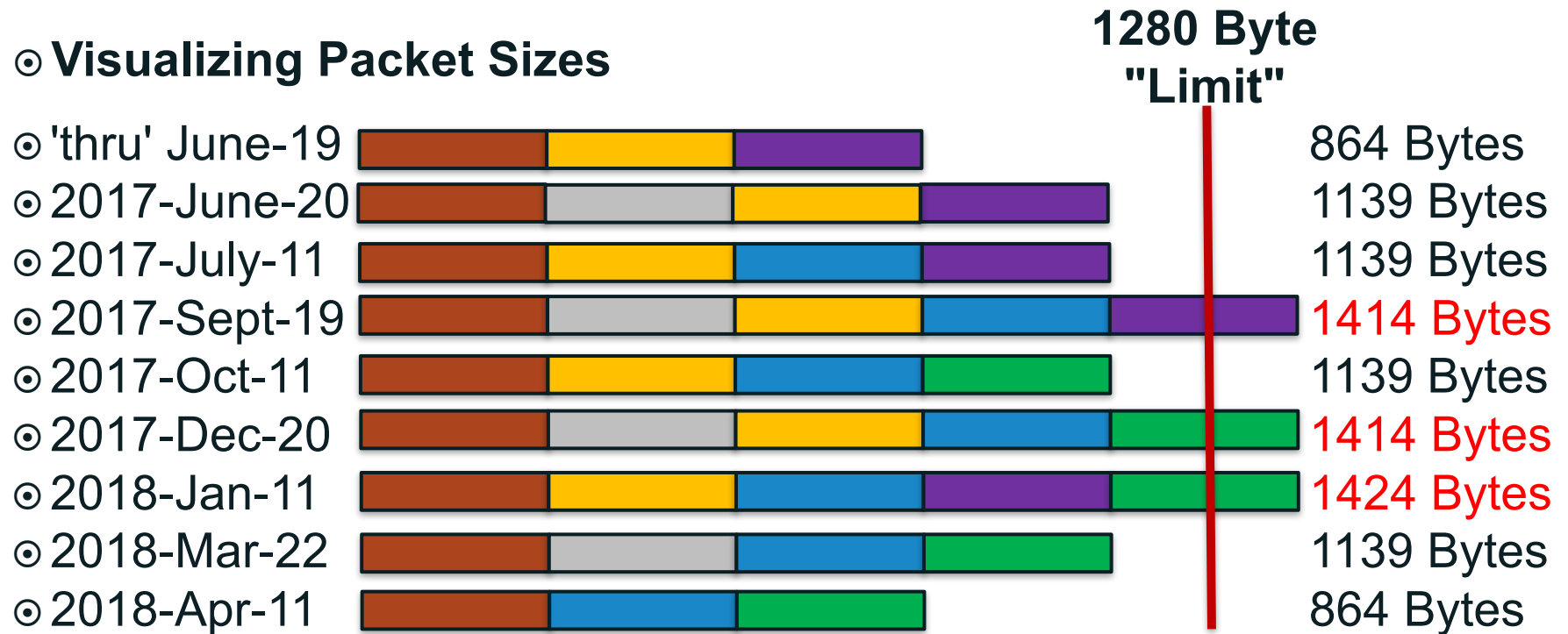
- ⦿ **At a high-level, there have been concerns about DNS responses over 1280 bytes**

- ⦿ The KSK Rollover process will peak over 1280 three times



# Impact on the KSK Rollover Process

## Visualizing Packet Sizes



## Experience with IPv6 Fragmentation and DNS

### ⦿ Quantifying Concerns

- ⦿ Examining responses from TLD zones, some with large keysets, has been helpful
  - ⦿ From one vantage point (residential cable ISP), some large DNSKEY sets were not retrieved over IPv6 in UDP
  - ⦿ From hosted virtual machines, almost no errors observed
  - ⦿ Perhaps it is just paranoia!
- ⦿ Nevertheless, TCP over IPv6, worked for all sampled zones

## Recommendation for IPv6 (and for IPv4 too)

### ⦿ **What you should do**

- ⦿ Make sure your servers can query over TCP (especially in IPv6)
- ⦿ Test and verify that you can receive large DNSKEY sets  
<http://keysize-test.verisignlabs.com/>  
<https://www.dns-oarc.net/oarc/services/replysize-test>
- ⦿ This should be a "permanent fix", not just for the KSK key rollover, TCP is an important piece of DNS operations

## Three Steps to Recovery

- 1. Stop the tickets!** It's OK to turn off DNSSEC validation while you fix (but do turn it back on!)
- 2. Debug.** If the problem is the trust anchor, find out why it isn't correct
  - ⊙ Did RFC 5011 fail? Did configuration tools fail to update the key?
  - ⊙ If the problem is fragmentation related, make sure TCP is enabled and/or make other transport adjustments
- 3. Test the recovery.** Make sure your fixes take hold



## Tools and Resources Provided by ICANN

- ⦿ **Following slides will describe these further**
- ⦿ **A python-language script to retrieve KSK-2010 and KSK-2017**
  - ⦿ `get_trust_anchor.py`
- ⦿ **An *Automated Updates* testbed for production (test) servers**
  - ⦿ <https://automated-ksk-test.research.icann.org>
- ⦿ **Documentation**
  - ⦿ <https://www.icann.org/resources/pages/ksk-rollover>

## get\_trust\_anchor.py

- ⦿ **A tool that retrieves "https://data.iana.org/root-anchors/root-anchors.xml" and validates all active root KSK records**

<https://github.com/iana-org/get-trust-anchor>

- ⦿ Contains extensive in-code comments/documentation
- ⦿ Download & run in python v2.7, v3 or newer
  - \$ python get\_trust\_anchor.py

- ⦿ Writes DS and DNSKEY records to files that can be used to configure DNSSEC validators



## ICANN's *Automatic Updates* Testbed

- ⊙ **Designed to allow operators to test whether production resolver configurations follow *Automatic Updates***
  - ⊙ The goal is to test production resolvers with live test zones executing a KSK rollover in real time
    - ⊙ A full test lasts several weeks
  - ⊙ Joining the testbed involves:
    - ⊙ Configuring a trust anchor for a test zone such as *2017-04-07.automated-ksk-test.research.icann.org*
    - ⊙ Receiving periodic emails with instructions for what to do and what to watch for
  - ⊙ ***<https://automated-ksk-test.research.icann.org>***



# Signing Up For the Testbed

The screenshot shows a web browser window with the address bar displaying `https://automated-ksk-test.research.icann.org`. The page title is "Automated Trust Anchor Update Testbed". The main content area contains the following text:

The root zone Key Signing Key (KSK) is changing, or rolling, on 11 October 2017. Operators of recursive resolvers with DNSSEC validation enabled will need to ensure that their systems are updated with the new root zone KSK configured as a trust anchor before that date. If a recursive resolver supports RFC 5011, "Automated Updates of DNS Security (DNSSEC) Trust Anchors", and this feature is properly configured, the new KSK should automatically be installed as a trust anchor and DNSSEC validation should continue without problems.

If a validating resolver's implementation or cc update protocol is incorrect for any reason, t

real KSK roll. This will help us later assist other operators who might encounter the same problems you did.

**How To Join**

To join the testbed for the current zone:

[Click Here](#)

**Questions**

The ICANN logo is visible in the bottom left corner of the slide, and the page number "32" is in the bottom right corner.



## Educational/informational Resources

- ◎ **ICANN organizes KSK rollover information here:**

<https://www.icann.org/resources/pages/ksk-rollover>

- ◎ Link to that page can be found on ICANN's main web page under "Quicklinks"
- ◎ Contains links to what's been covered in this presentation, the `get_trust_anchor.py` script and information on ICANN's live testbeds



## How can you engage with ICANN?



### Thank You and Questions

Join the [ksk-rollover@icann.org](mailto:ksk-rollover@icann.org) mailing list

Archives: <https://mm.icann.org/listinfo/ksk-rollover>

KSK-Roll Website: <https://www.icann.org/kskroll>



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