A testbed for evaluating post-quantum algorithms for the DNS

Caspar Schutijser | CENTR R&D (online)
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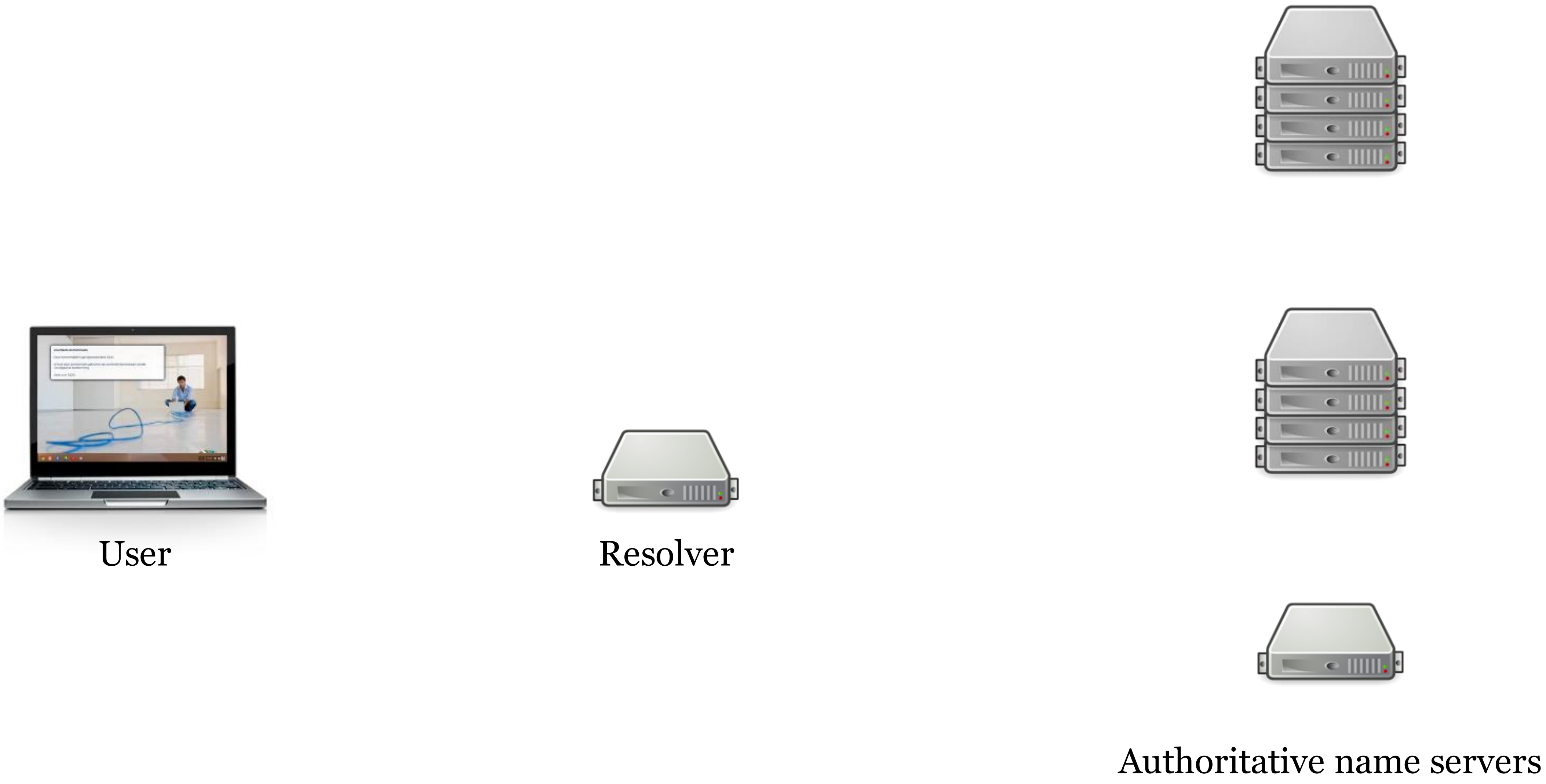

User

Resolver

Authoritative name servers

DoH, DoT, DNScrypt
https://dns4all.eu/

X25519Kyber768

DNSSEC

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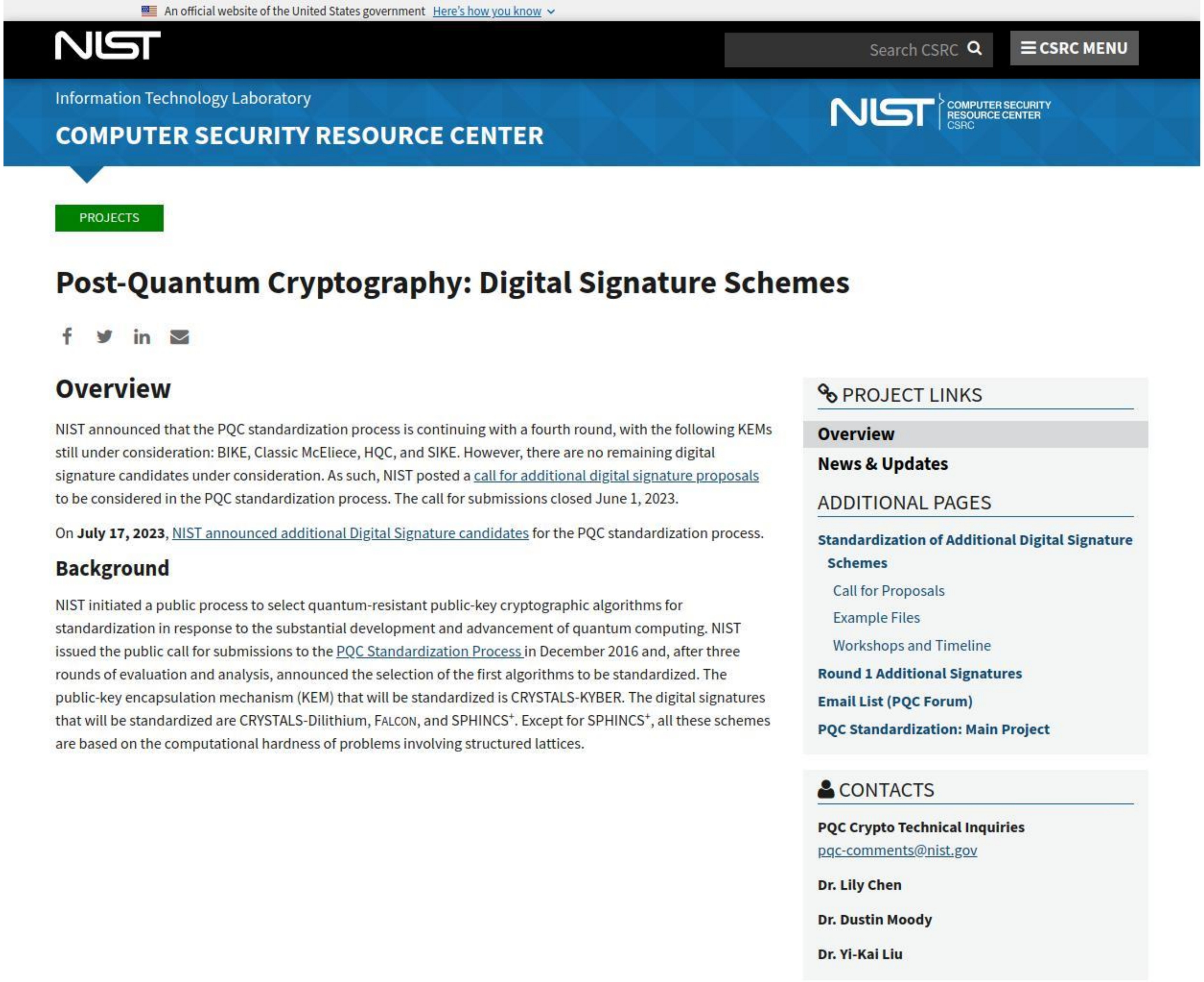
Source: https://www.flickr.com/photos/ibm_research_zurich/51248690716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PROJECTS

Post-Quantum Cryptography: Digital Signature Schemes

Overview

NIST announced that the PQC standardization process is continuing with a fourth round, with the following KEMs still under consideration: BIKE, Classic McEliece, HQC, and SIKE. However, there are no remaining digital signature candidates under consideration. As such, NIST posted a call for additional digital signature proposals to be considered in the PQC standardization process. The call for submissions closed June 1, 2023.

On **July 17, 2023**, NIST announced additional Digital Signature candidates for the PQC standardization process.

Background

NIST initiated a public process to select quantum-resistant public-key cryptographic algorithms for standardization in response to the substantial development and advancement of quantum computing. NIST issued the public call for submissions to the PQC Standardization Process in December 2016 and, after three rounds of evaluation and analysis, announced the selection of the first algorithms to be standardized. The public-key encapsulation mechanism (KEM) that will be standardized is CRYSTALS-KYBER. The digital signatures that will be standardized are CRYSTALS-Dilithium, FALCON, and SPHINCS$^+$. Except for SPHINCS$^+$, all these schemes are based on the computational hardness of problems involving structured lattices.

CONTACTS

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Dr. Dustin Moody

Dr. Yi-Kai Liu

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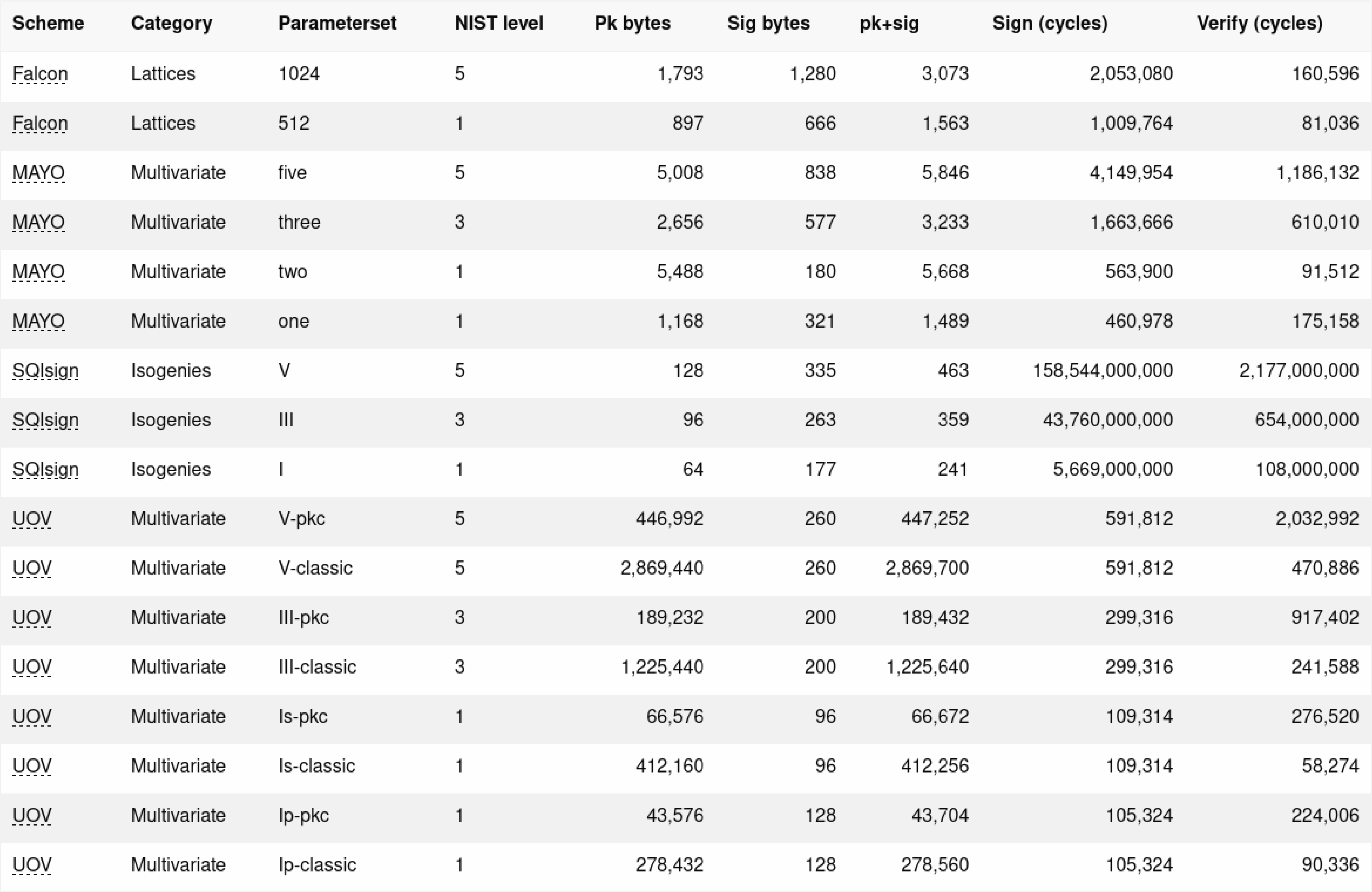

Scheme	Category	Parameterset	NIST level	Pk bytes	Sig bytes	pk+sig	Sign (cycles)	Verify (cycles)
Falcon	Lattices	1024	5	1,793	1,280	3,073	2,053,080	160,596
Falcon	Lattices	512	1	897	666	1,563	1,009,764	81,036
MAYO	Multivariate	five	5	5,008	838	5,846	4,149,954	1,186,132
MAYO	Multivariate	three	3	2,656	577	3,233	1,663,666	610,010
MAYO	Multivariate	two	1	5,488	180	5,668	563,900	91,512
MAYO	Multivariate	one	1	1,168	321	1,489	460,978	175,158
SQIsign	Isogenies	V	5	128	335	463	158,544,000,000	2,177,000,000
SQIsign	Isogenies	III	3	96	263	359	43,760,000,000	654,000,000
SQIsign	Isogenies	I	1	64	177	241	5,669,000,000	108,000,000
UOV	Multivariate	V-pkc	5	446,992	260	447,252	591,812	2,032,992
UOV	Multivariate	V-classic	5	2,869,440	260	2,869,700	591,812	470,886
UOV	Multivariate	III-pkc	3	189,232	200	189,432	299,316	917,402
UOV	Multivariate	III-classic	3	1,225,440	200	1,225,640	299,316	241,588
UOV	Multivariate	Is-pkc	1	66,576	96	66,672	109,314	276,520
UOV	Multivariate	Is-classic	1	412,160	96	412,256	109,314	58,274
UOV	Multivariate	Ip-pkc	1	43,576	128	43,704	105,324	224,006
UOV	Multivariate	Ip-classic	1	278,432	128	278,560	105,324	90,336

https://pqshield.github.io/nist-sigs-zoo/

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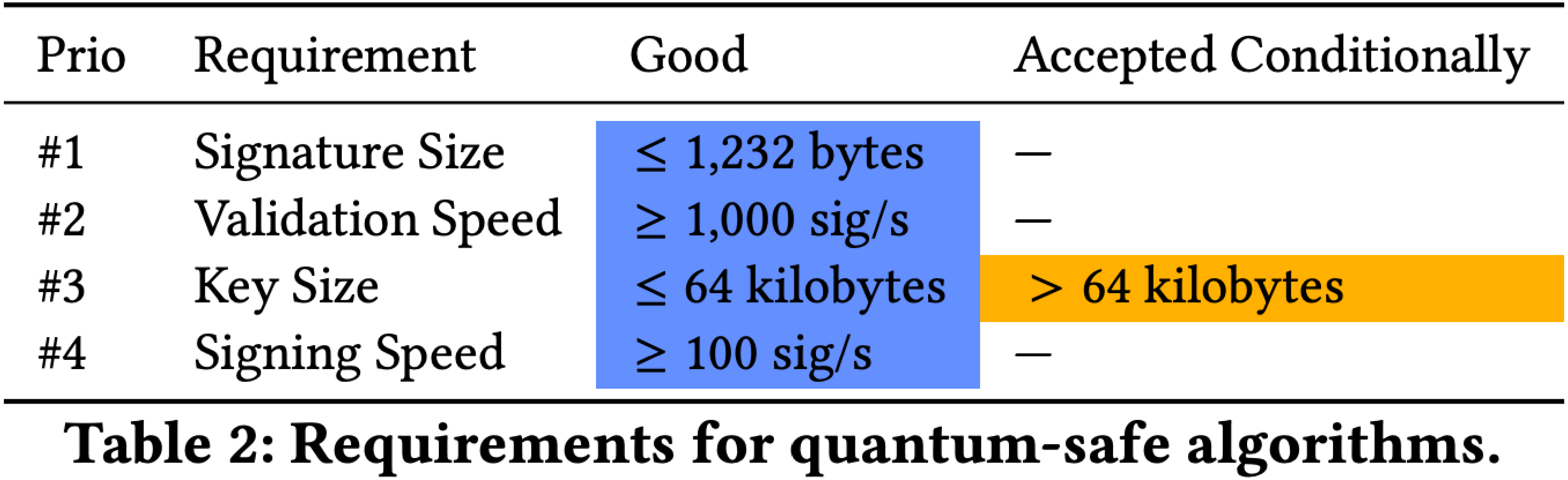
Requirements



Prio	Requirement	Good	Accepted Conditionally
#1	Signature Size	≤ 1,232 bytes	—
#2	Validation Speed	≥ 1,000 sig/s	—
#3	Key Size	≤ 64 kilobytes	> 64 kilobytes
#4	Signing Speed	≥ 100 sig/s	—

Table 2: Requirements for quantum-safe algorithms.

M. Müller et al, "Retrofitting Post-Quantum Cryptography in Internet Protocols: A Case Study of DNSSEC", ACM SIGCOMM Computer Communication Review, vol. 50, no. 4, 2020.

Jürgen Henn – 11foot8.com

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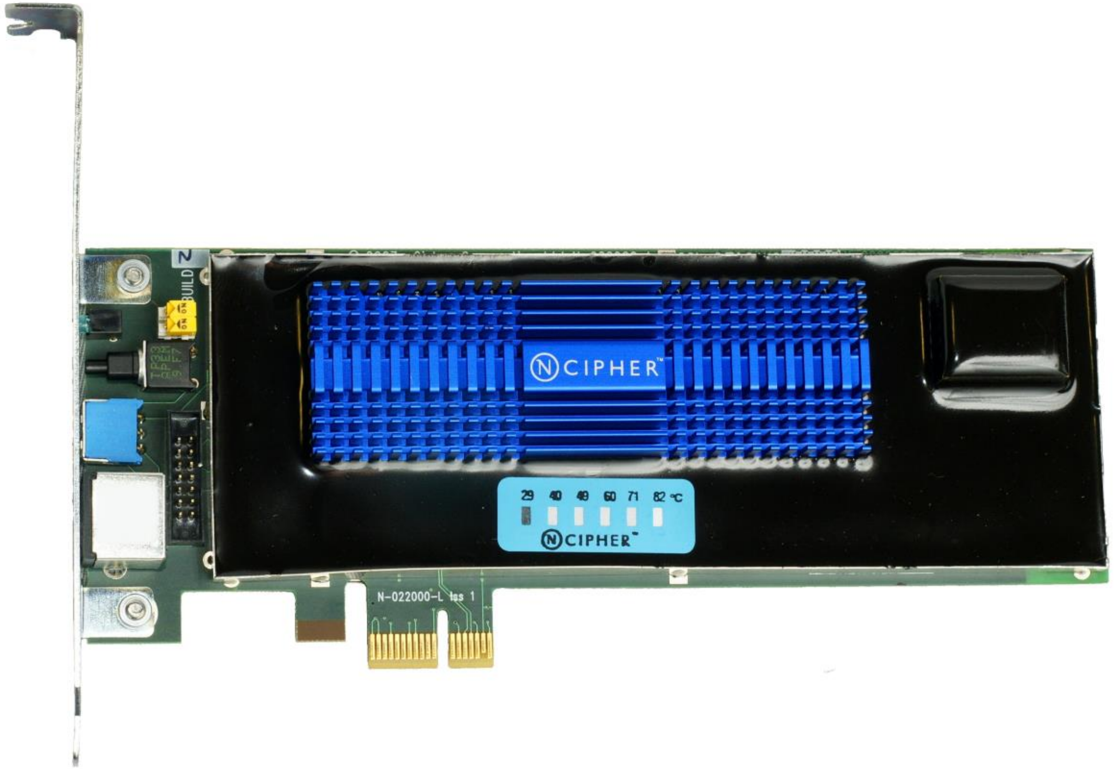
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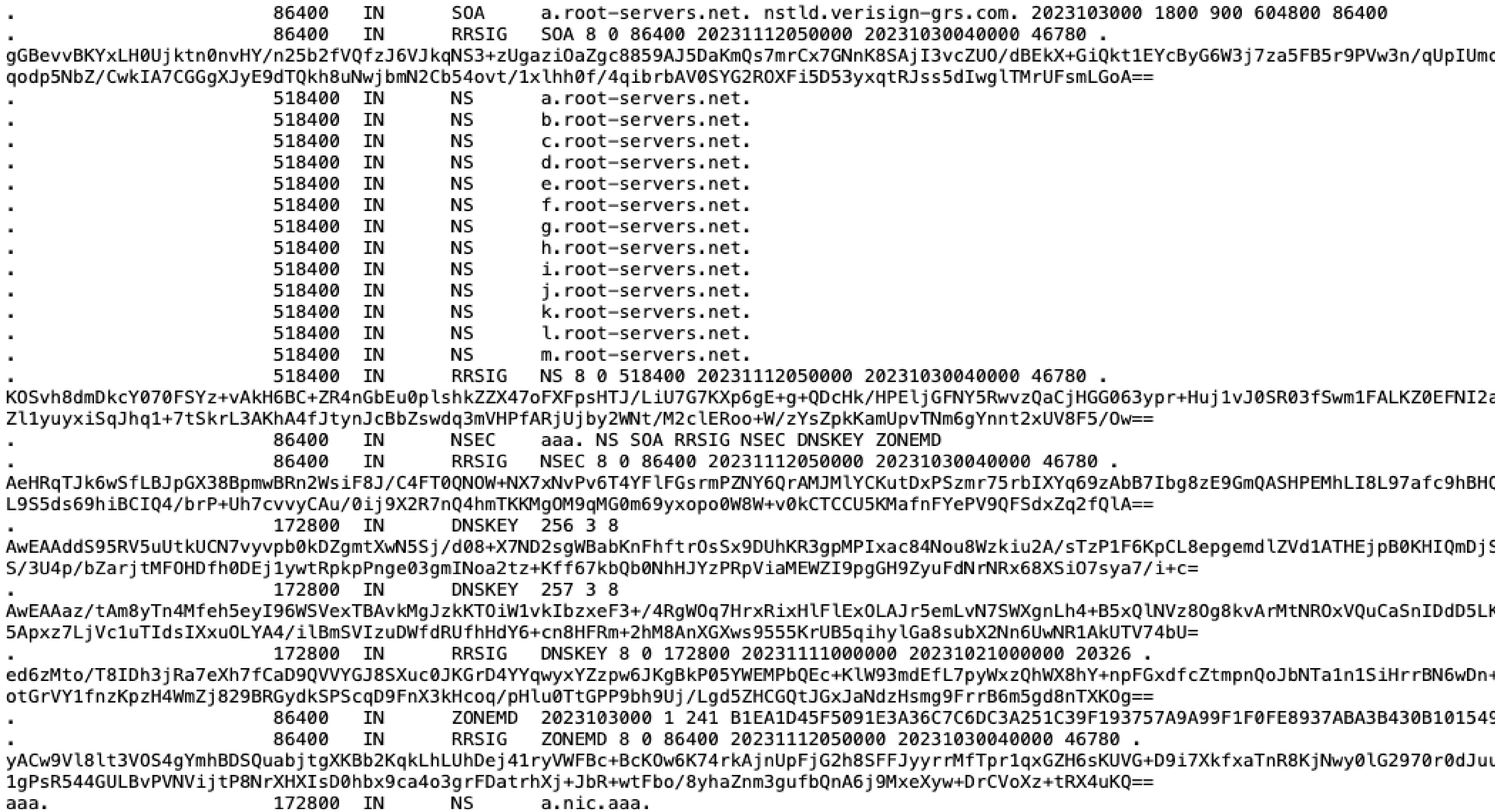

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TAKE
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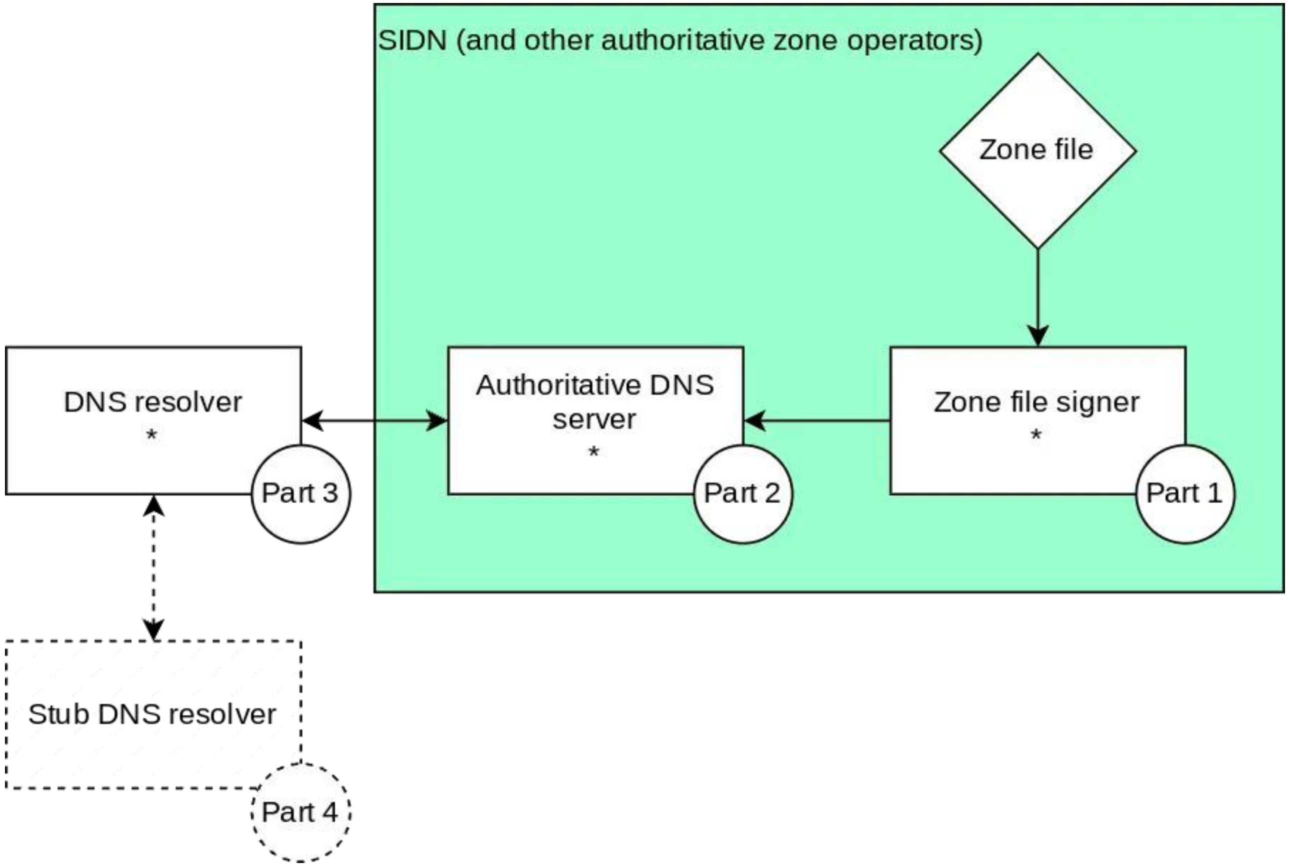

https://www.sidnlabs.nl/en/news-and-blogs/a-quantum-safe-cryptography-dnssec-testbed

What do you think it will take to deploy PQC DNSSEC in your organisation?

Thank you for your attention!

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