Retrofitting Post-Quantum Cryptography in Internet Protocols: A Case Study of DNSSEC

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DNSSEC Basics and Challenges

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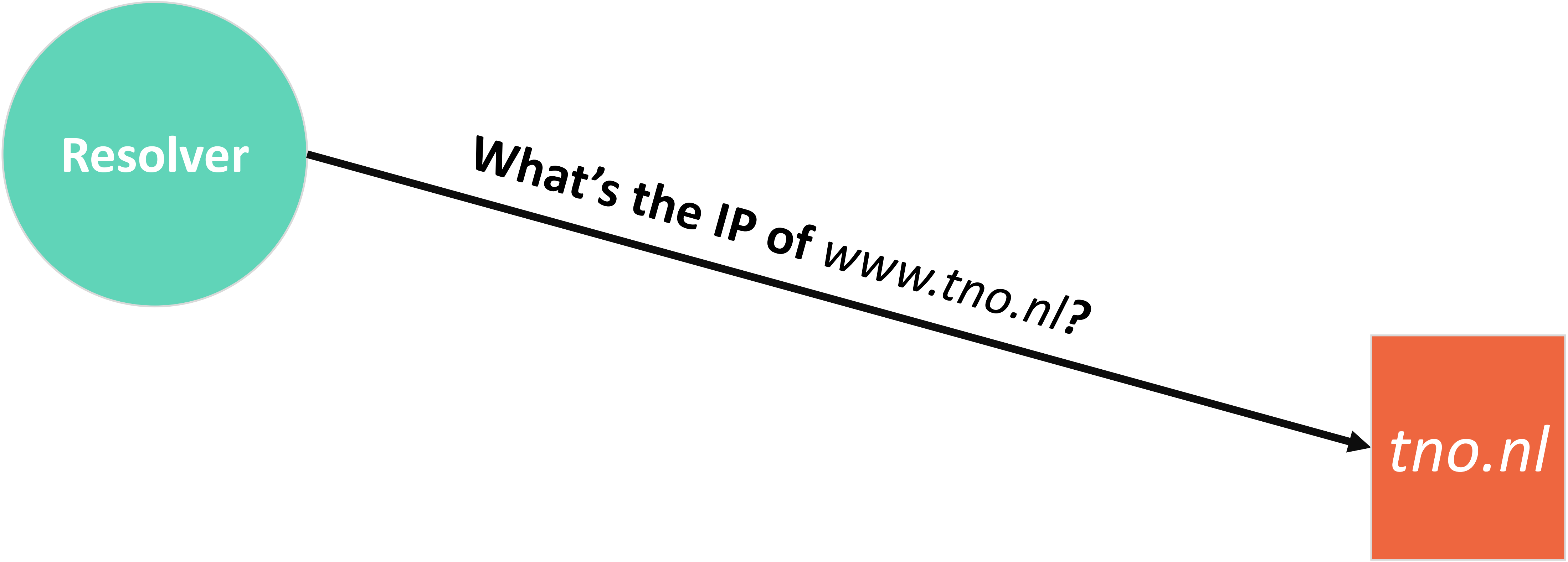
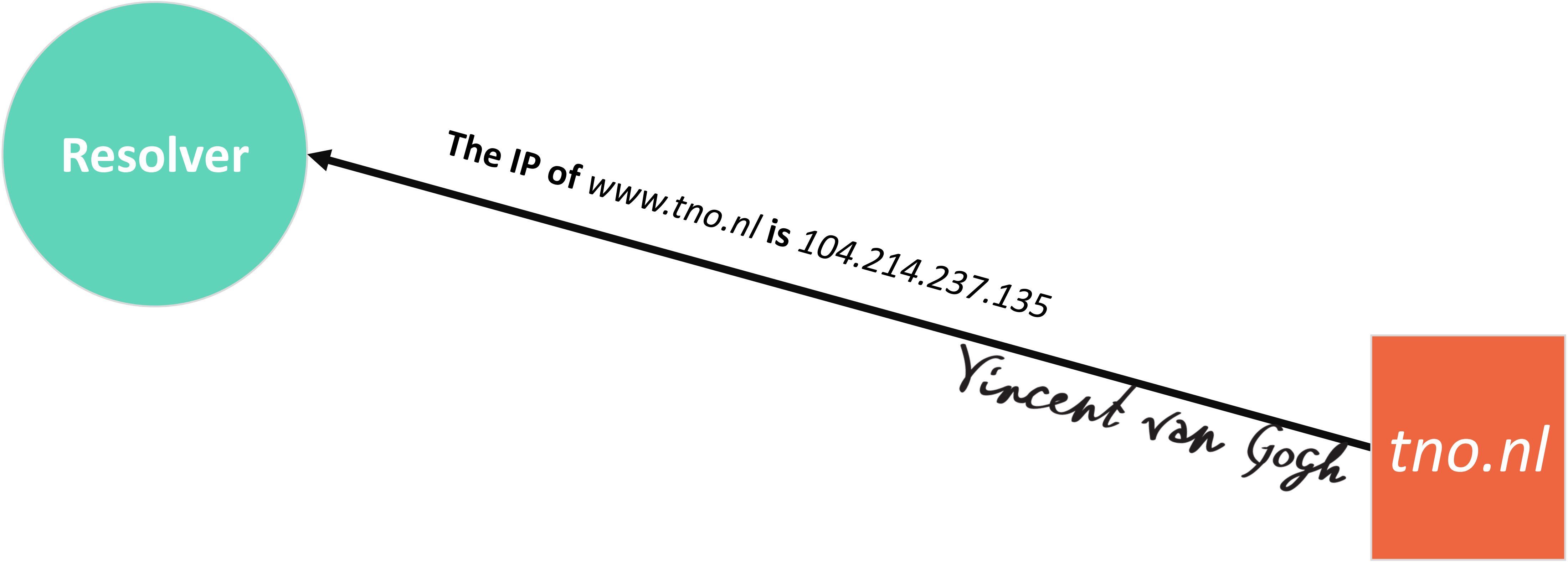
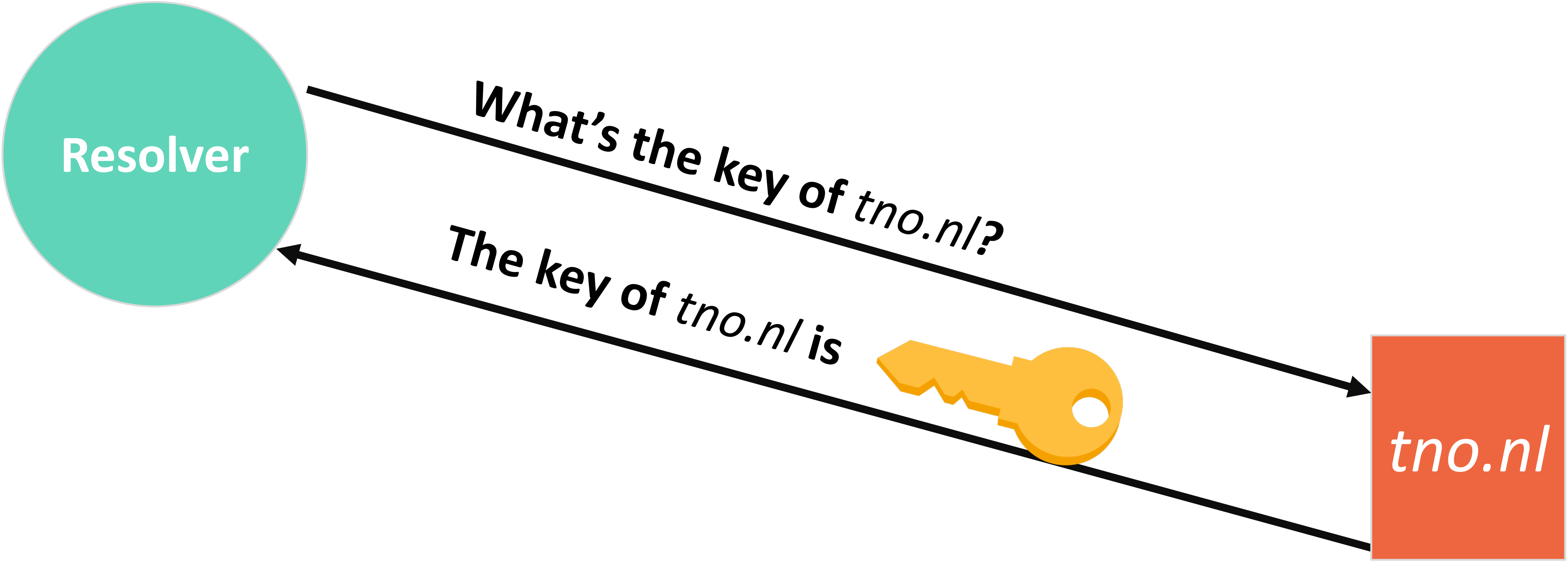


DNSSEC Basics and Challenges



DNSSEC Basics and Challenges



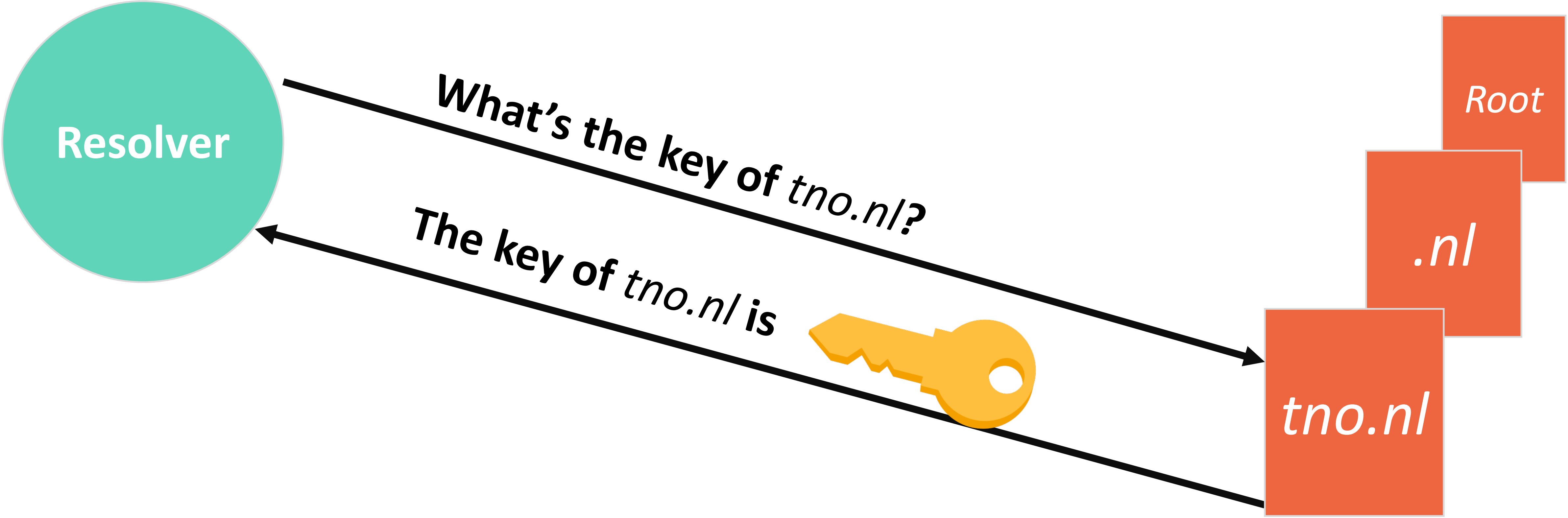
Resolver

What's the key of *tno.nl*?

The key of *tno.nl* is

tno.nl

DNSSEC Basics and Challenges



DNSSEC Basics and Challenges

- Signatures are transmitted with every response
- In some cases multiple keys and signatures in the same response
- Multiple signing algorithms are already supported
- Transport usually is UDP, with TCP fallback

Applying PQC to DNSSEC

Restrictions

- Payload > 1,232 bytes often causes fragmentation
- Resolvers validate thousands of signatures per second
- Signing in some cases on the fly

Requirements for Algorithms

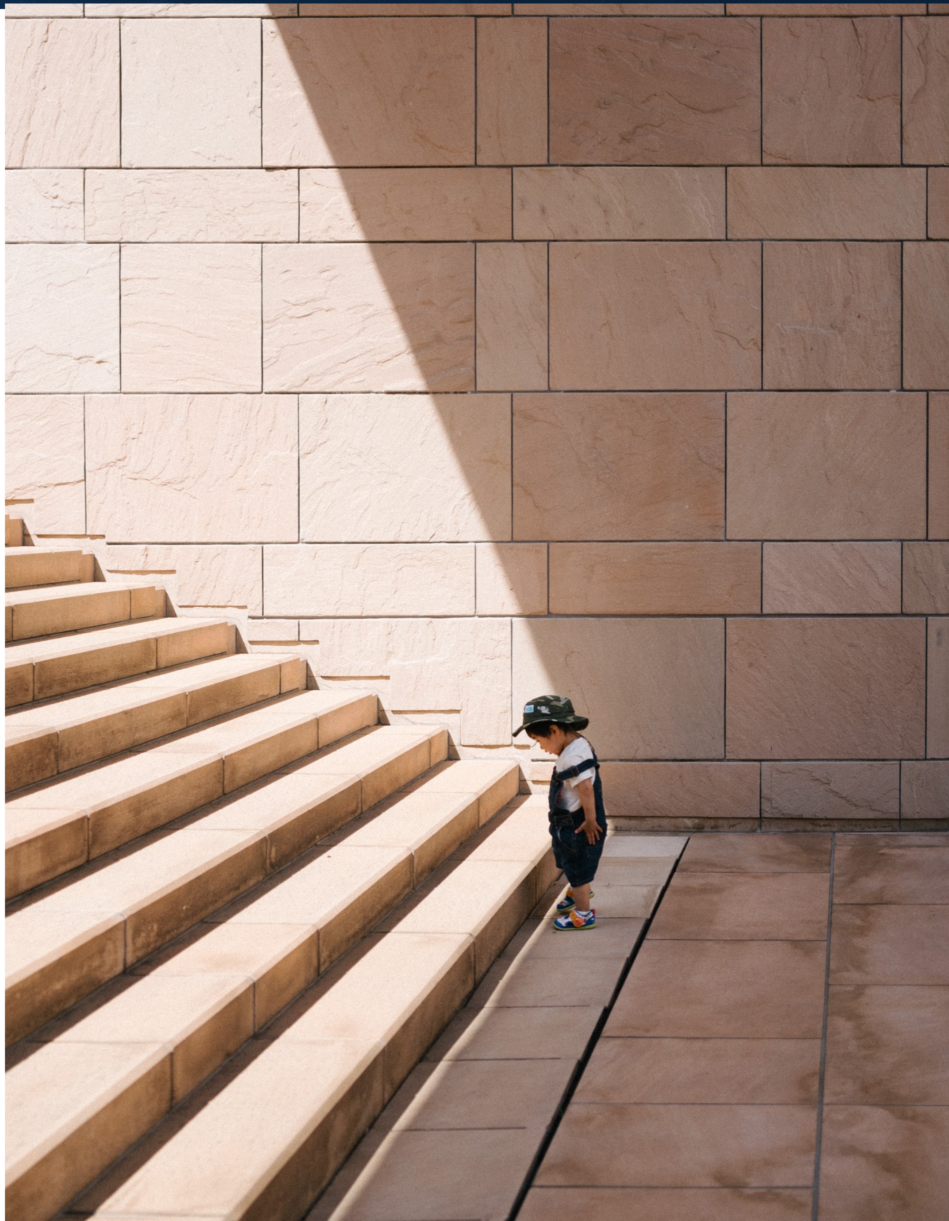
Signature Size:	≤ 1,232 bytes
Validation Performance:	≥ 1000 sig/s
Signing Performance:	≥ 100 sig/s

Finding the Right Algorithm

Algorithm	Public Key	Signature	Sign/s	Verify/s
Falcon-512	0.9kB	0.7kB	~ 3,300	~20,000
Rainbow-Ia	149kB	64B	~ 8,300	~ 11,000
RedGeMSS128	445kB	35B	~ 540	~ 10,000

Preparing DNSSEC for PQC

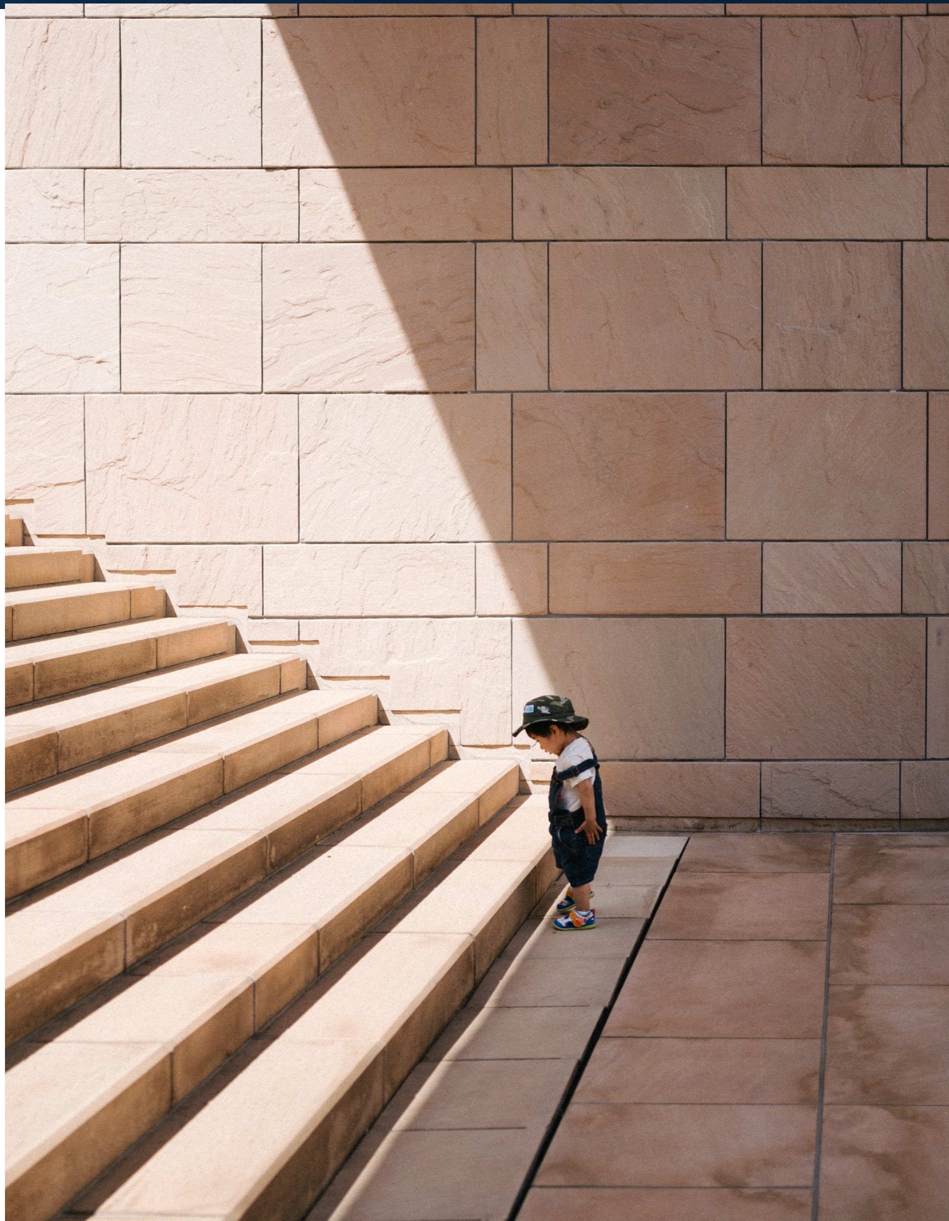
- Out of band key distribution
- Increased TCP support



Preparing DNSSEC for PQC

- Out of band key distribution
- Increased TCP support

- We are currently implementing and testing our proposals



Thank You!

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