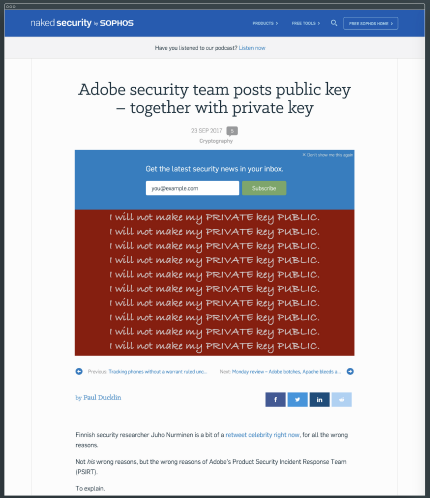
Revisiting Updatable Encryption: Controlled Forward Security, Constructions and a Puncturable Perspective

Daniel Slamanig (UniBw)* & Christoph Striecks (AIT)
Presentation given by Roman Langrehr (ETH Zurich)

TCC, November 30, 2023

*Work done while author was with AIT Austrian Institute of Technology



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Adobe security team posts public key – together with private key

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Cryptography

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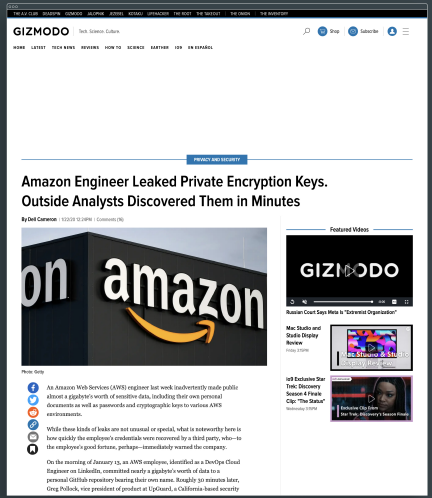
Previous: Tracking phones without a warrant ruled unc... Next: Monday review – Adobe botches, Apache bleeds a...

by Paul Ducklin

Finnish security researcher Juho Nurminen is a bit of a retweet celebrity right now, for all the wrong reasons.

Not his wrong reasons, but the wrong reasons of Adobe's Product Security Incident Response Team (PSIRT).

To explain.



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PRIVACY AND SECURITY

Amazon Engineer Leaked Private Encryption Keys. Outside Analysts Discovered Them in Minutes

By Dell Cameron | 9/23/18 12:29PM | Comments (16)

Photo: Getty

An Amazon Web Services (AWS) engineer last week inadvertently made public almost a gigabyte's worth of sensitive data, including their own personal documents as well as passwords and cryptographic keys to various AWS environments.

While these kinds of leaks are not unusual or special, what is noteworthy here is how quickly the employee's credentials were recovered by a third party, who—to the employee's good fortune, perhaps—immediately warned the company.

On the morning of January 13, an AWS employee, identified as a DevOps Cloud Engineer on LinkedIn, committed nearly a gigabyte's worth of data to a personal GitHub repository bearing their own name. Roughly 30 minutes later, Greg Pollock, vice president of product at UpGuard, a California-based security

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https://nakedsecurity.sophos.com/2017/09/23/adobe-security-team-posts-public-key-together-with-private-key; https://gizmodo.com/amazon-engineer-leaked-private-encryption-keys-outside-1841160934

Forward Security to Mitigate Key Leakage

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- Broadly considered in several cryptographic applications: e.g., key exchange [Gün90, DDG+20, BRS23, RSS23], (updatable) public-key encryption [CHK03, Gro21, DKW21], signatures [BM91, DGNW20], searchable encryption [BMO17], Cloud backup [DCM20], proxy cryptography [DKLRSS17], Tor [LGM+17], content delivery networks [DRSS21]

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Goal in this work: enhancing forward-security paradigm to updatable encryption. Not known to be achievable at all before.

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Observation: forward security cannot be achieved when all tokens leak

Starting Building Block: Symmetric Puncturable Encryption (SPE)

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Observation: coarse-grained puncturing on epochs, can we make it more fine-grained?

Contribution: Tag-Inverse Puncturable Encryption (TIPE)

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- Security: distinguish ciphertexts for a chosen epoch, even if *all* keys and tokens are available (except for trivial wins)

Application: Updatable Encryption with Expiring Ciphertexts

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- Glimpse of techniques: novel adaptation of dual system groups [CW13, GCTC16]

Takeaways

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- Tag-Inverse Puncturable Encryption (TIPE) offers a novel view on new applications areas such as updatable encryption
- Open: use TIPE for applications beyond UE?

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