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USA 2015

MOBILE POINT OF SCAM: ATTACKING THE SQUARE READER

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WHO ARE WE?

AGENDA

- Mobile P.O.S.
- Square Reader
- Software Vulnerabilities
- Hardware Vulnerabilities
- Countermeasures
- Disclosures

MOBILE P.O.S.

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A NEW P.O.S.

- 3 C’s: compact, cheap, compatible
  - Yet still sophisticated
- Food trucks, coffee shops, salons, taxis…
- Square, PayPal, Intuit, Groupon, Amazon…

WHY DO I CARE?

New software & hardware,

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New software & hardware,
from lots of providers,

WHY DO I CARE?

New software & hardware,
from lots of providers,
with rapid adoption...

WHY DO I CARE?

New software & hardware,
from lots of providers,
with rapid adoption...
handling sensitive info!

> "We protect your data like our business depends on it—because it does." [1]

Square, Inc.

SQUARE READER

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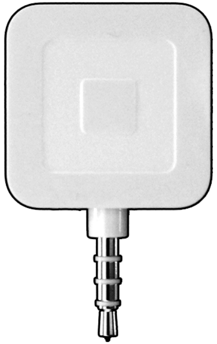
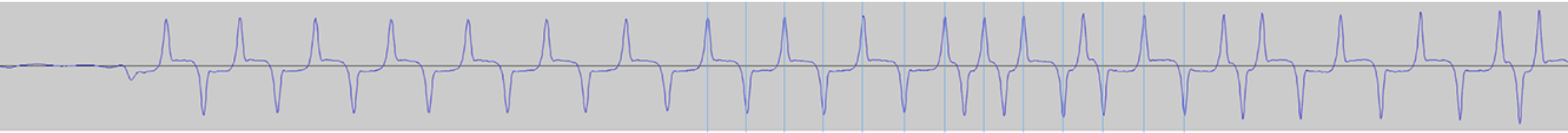
SQUARE, INC.

- $20b in transactions in 2013 [2]
- $30b in 2014 (estimated) [2]
- $100m in single day [3]
- $50m → $5b valuation in 5 years (100x) [4]
- >1 billion transactions [5]

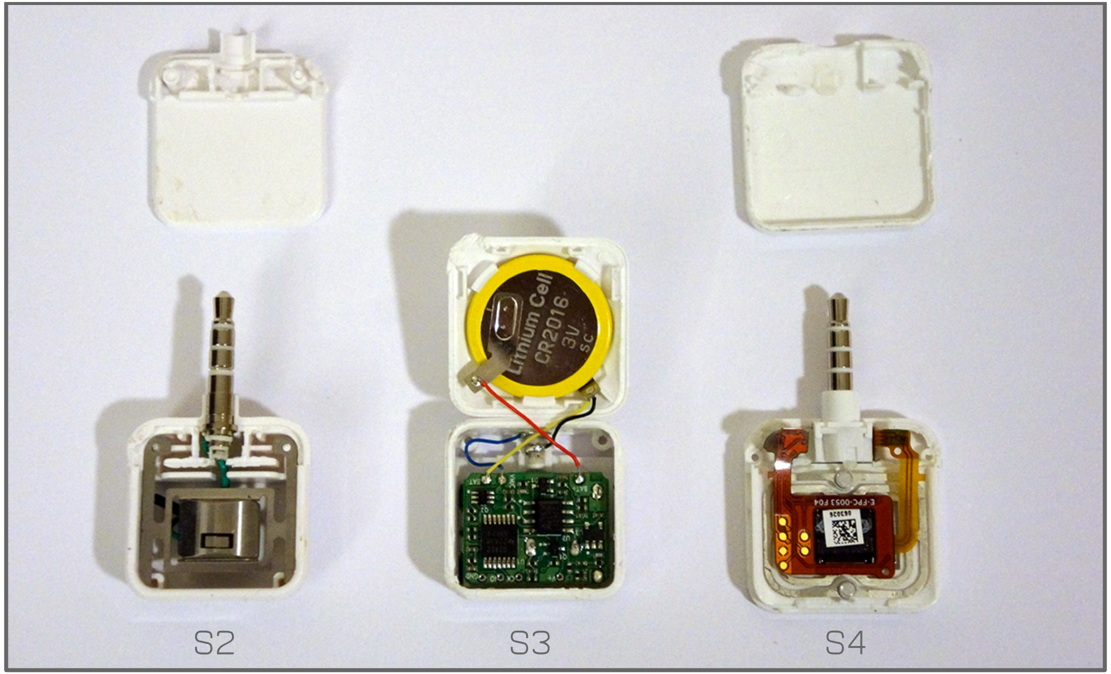
HOW IT WORKS

- Magnetic head moves over stripe
- Varying voltage is decoded to bits
- Earlier models are passive
- Later models encrypt and amplify





THE SQUARE READER - MODELS



SOFTWARE VULNS

INCOMPLETE DEPRECATION

- June ‘14: S3 “no longer supported,” but…
- June ‘15: all Readers still successfully complete transactions
  - Including unencrypted ones!

> “All previous readers continue to be secure for daily use.” [6]

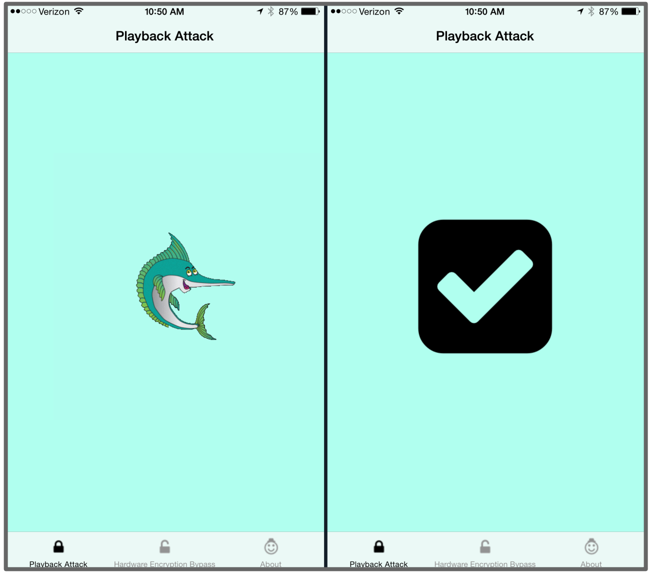
Square, Inc.

PLAYBACK ATTACK

- Replay attacks not possible for S3 and S4
  - Protected by transaction counter
- But playback of swipes is possible
  - Monotonically increasing count not enforced
- Stockpile swipes
  - Initiate delayed transactions
  - Use social engineering as necessary

SWORDPHISH

- Proof of concept iOS/web app assists with attack
  - Records extra swipes
  - Transmits to server
  - Server provides interface for playback

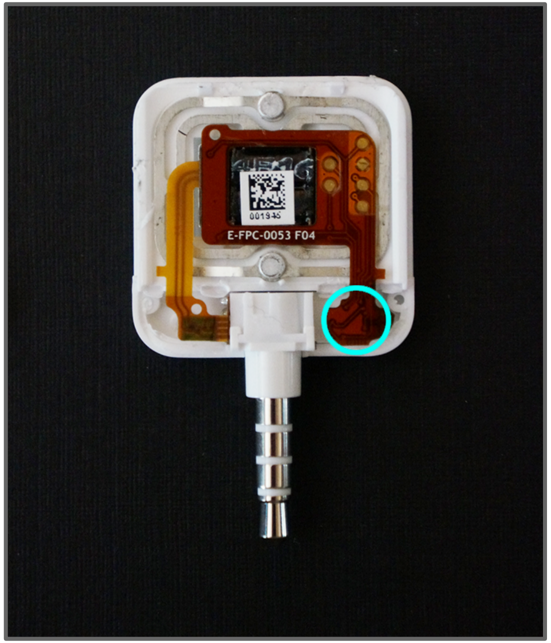


DEMO

HARDWARE VULNS

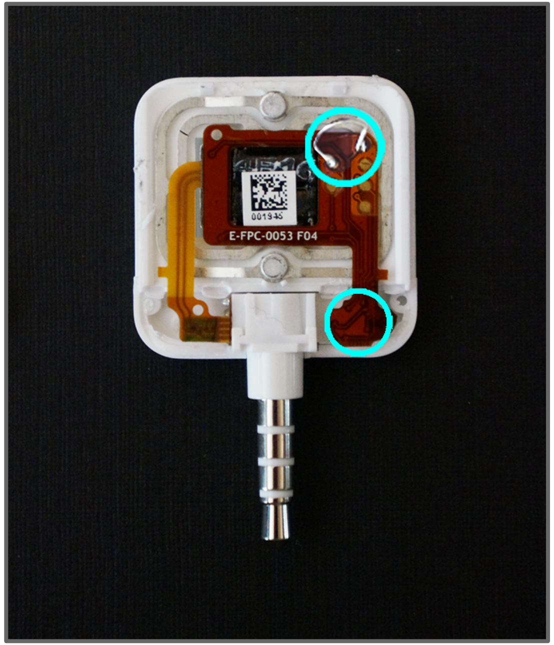
HARDWARE ENCRYPTION

- Ribbon cable connections
- Chip not located for point-of-swipe encryption

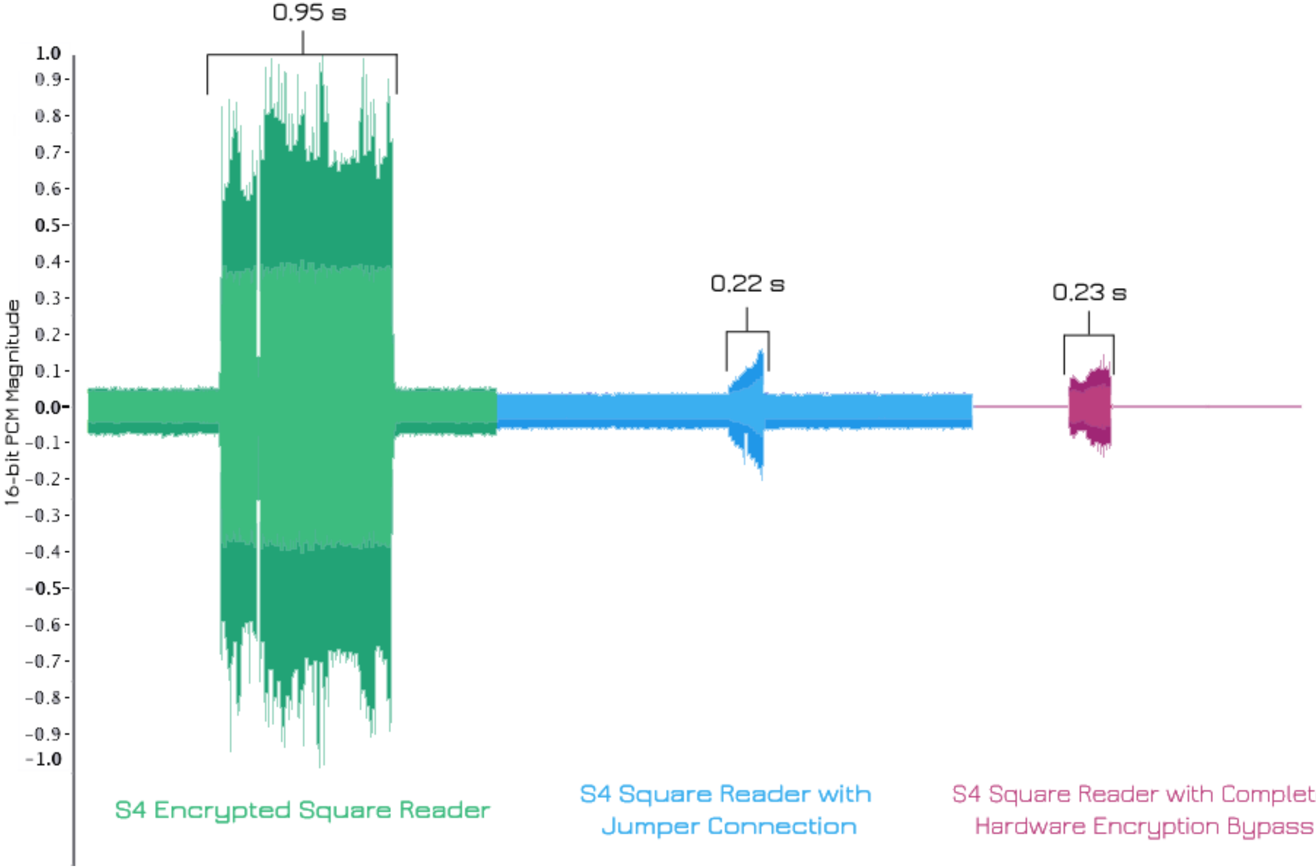


HARDWARE ENCRYPTION BYPASS

- Tamper-resistant casing
- Jumper connection
- Crush encryption chip OR disable encryption chip connections



HARDWARE ENCRYPTION BYPASS



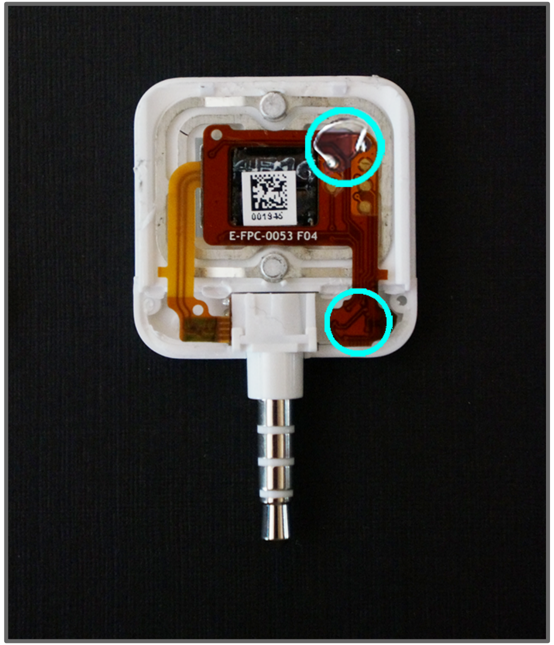
S4 Encrypted Square Reader

S4 Square Reader with Jumper Connection

S4 Square Reader with Complete Hardware Encryption Bypass

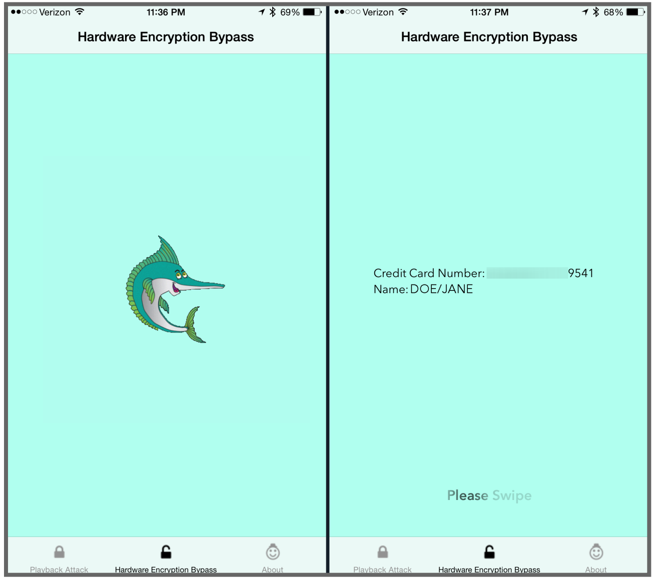
HARDWARE ATTACK VECTOR

- Malicious merchants
- Credit card skimmer
  - □ Cheap
  - □ Small
  - □ Easy



SWORDPHISH

- Proof of concept
  - Records swipe
  - Transmits audio to our external server
  - Server decodes audio and stores info



Hardware Encryption Bypass

Hardware Encryption Bypass

Credit Card Number: [redacted]9541
Name: DOE/JANE

Please Swipe

DEMO

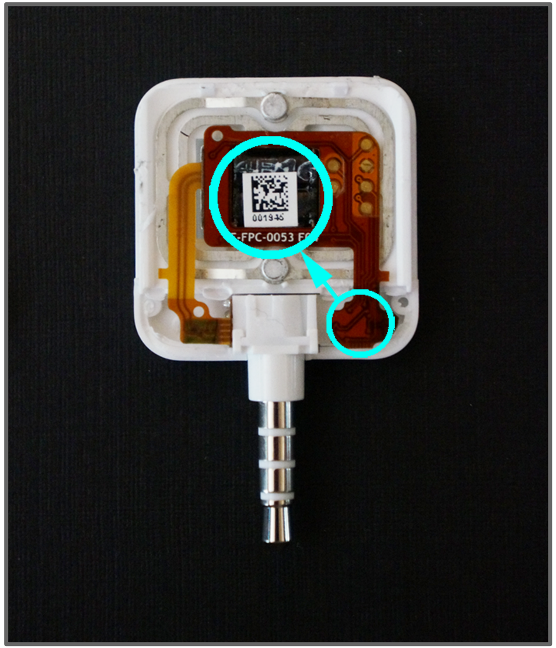
COUNTERMEASURES

SOFTWARE

- Remove claims of old models' security
- Enforce deprecation of old models
- Implement risk signals as appropriate
- Decline stale swipes based on counter

HARDWARE

- Enforce deprecation
- Move chip directly to magnetic head for point-of-swipe encryption



DISCLOSURES

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SOFTWARE

- Reported playback attack in December '14
- Square triages issue in January '15
- Deployment of fix proves troublesome
  - Database synchronization
  - Offline transactions
- Marked as resolved in May '15

SOFTWARE (cont.)

✓ Remove claims of old models' security
✓ Enforce deprecation of old models
✓ Implement risk signals
✗ Decline stale swipes based on counter

HARDWARE

“We’re already aware
of the possibility that someone might tamper
with our readers in this way.”

Square, Inc.

SOUND BYTES

- Square Readers are susceptible to SW and HW attacks that leave users vulnerable.
- The growing mobile P.O.S. market faces unique challenges.
- It is worth exploring (and securing) this relatively new attack surface!

Thank you!

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Please complete the speaker feedback surveys!

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CITATIONS

1. https://squareup.com/security/
2. http://techcrunch.com/2014/10/05/square-closes-150-round-at-6-billion-valuation/
3. https://squareup.com/townsquare/100m-day/
4. http://techcrunch.com/2014/01/13/putting-squares-5b-valuation-into-context/
5. https://venturebeat.com/2014/11/05/jack-dorsey-square-has-processed-1-billion-payments-to-date/
6. https://squareup.com/help/us/en/article/5202-square-reader-options/