CENTER FOR INFORMATION TECHNOLOGY POLICY

An Empirical Study of Wireless Carrier Authentication for SIM Swaps

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Joint work with Ben Kaiser, Jonathan Mayer, Arvind Narayanan

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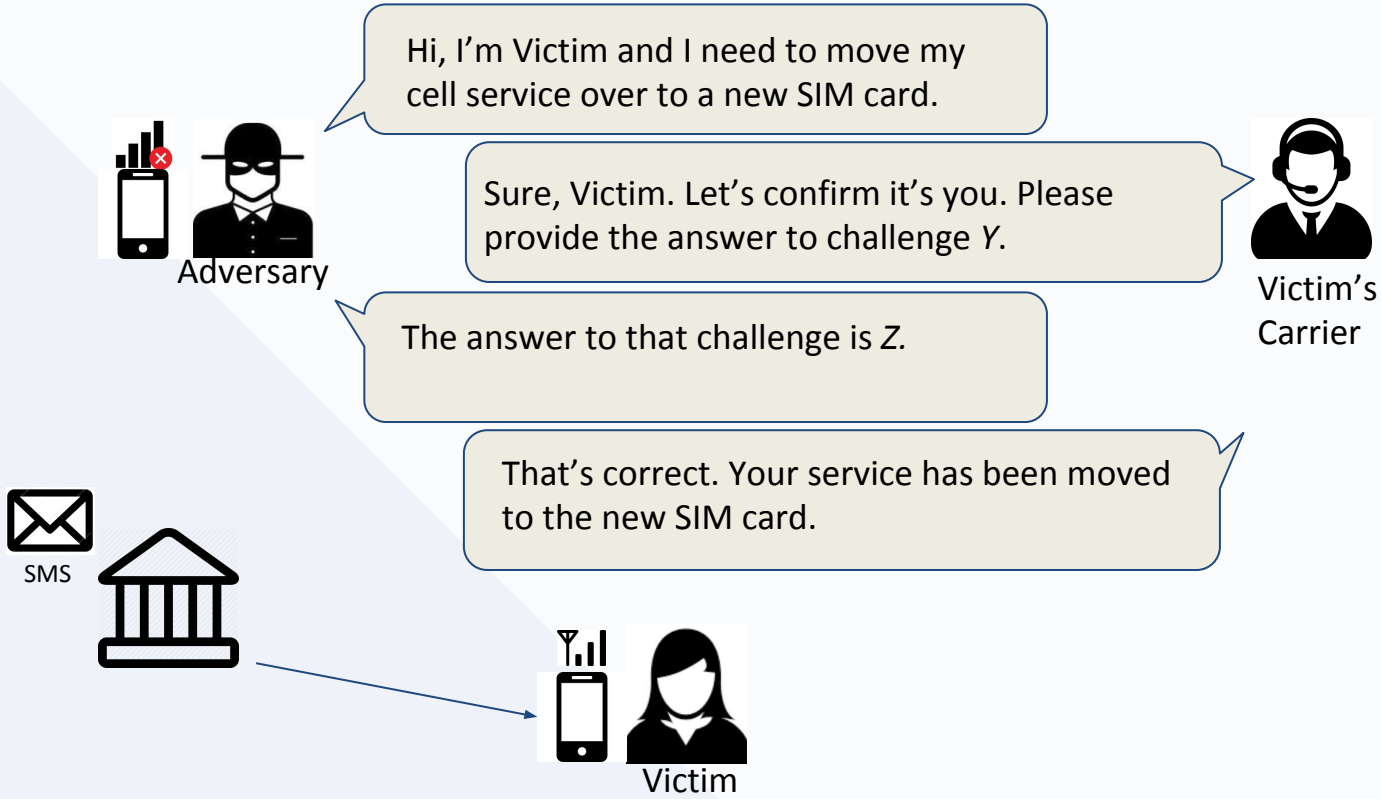
What are SIM swap attacks?



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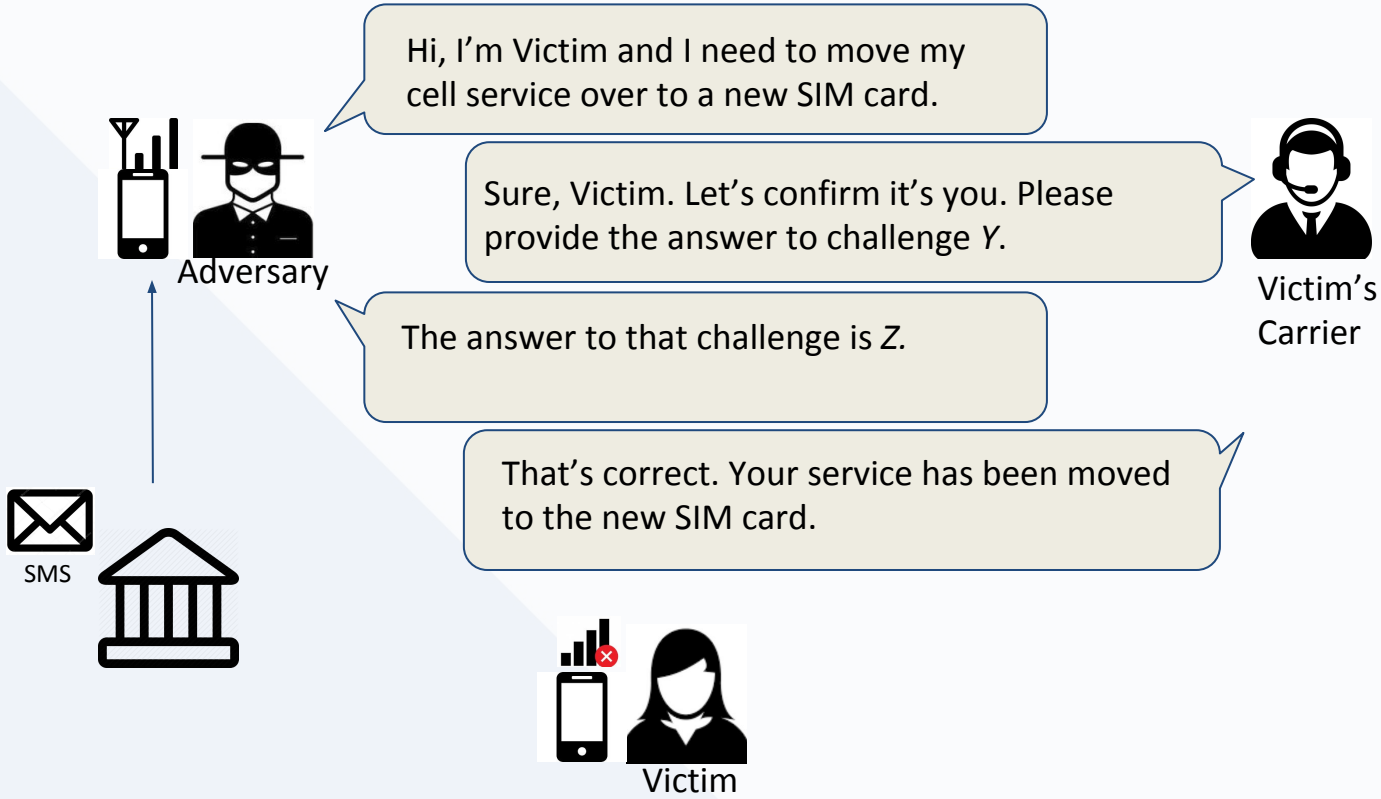
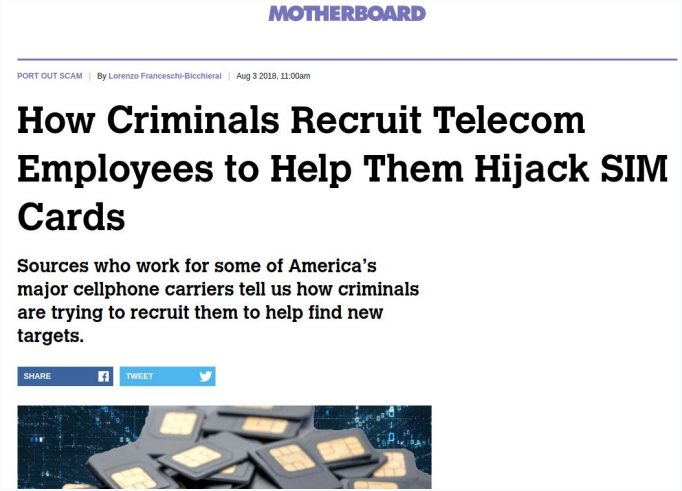


Attackers can intercept messages and calls

- Leads to financial loss, account hijacking, impersonation, and denial of service



nytimes.com

September 5, 2019

Hackers Hit Twitter C.E.O. Jack Dorsey in a 'SIM Swap.' You're at Risk, Too.

All five carriers had flawed policies

- Attack 100% successful on major carriers, 40% success on virtual carriers
- Insecure authentication challenges across all carriers

	Personal Information			Account Information			Device Information		Usage Information	Knowledge		Possession	
	Street Address	Email Address	DOB	Last 4 of CC	Activation Date	Last Payment	IMEI	ICCID	Recent Numbers	PIN or Password	Security Questions	SMS OTP*	Email OTP
AT&T					✔	✔	✔	✔	✔	✔		✔	
T-Mobile									✔	✔		✔	✔
Tracfone	✔	✔	✔				✔	✔		✔	✔	✔	
US Mobile	✔	✔		✔				✔					
Verizon						✔	✔	✔	✔	✔		✔	

Key vulnerability: Manipulable information

- Date/amount of last payment (2 carriers)
  - No authentication when making payments, so an attacker can make a payment, then use that information to authenticate
- Recently called numbers (incoming and outgoing) (3 carriers)
  - Attackers can trick victims into placing or receiving calls
- **Reponse:** After reviewing our research, T-Mobile informed us that they no longer uses call logs for customer authentication (January 2020)

Key vulnerability: Customer service reps

- Allowed SIM swaps without authentication
  - Forgot to authenticate
  - Proceeded despite failed attempts
- Disclosed information without authentication
  - Guided our guesses
  - Leaked billing address

Why does this matter?

- We reverse-engineered the authentication policies of 145 websites that support phone-based authentication.
- We examined the MFA schemes and recovery option pairs
- **Limitation: accounts were not linked to assets**

Most sites don’t stand up well to SIM swaps

- Eighty three (a majority) websites default to **insecure** configurations
- Seventeen websites allow SMS recovery allowed alongside SMS 2FA
  - We notified these vulnerable websites (January 2020)

Thank you!

Full findings, recommendations, carrier/website responses: issms2fasecure.com

Email: kvnl@cs.princeton.edu