ENIGMA

Pre-authentication messages as a common root cause of cell network attacks

Yomna Nasser
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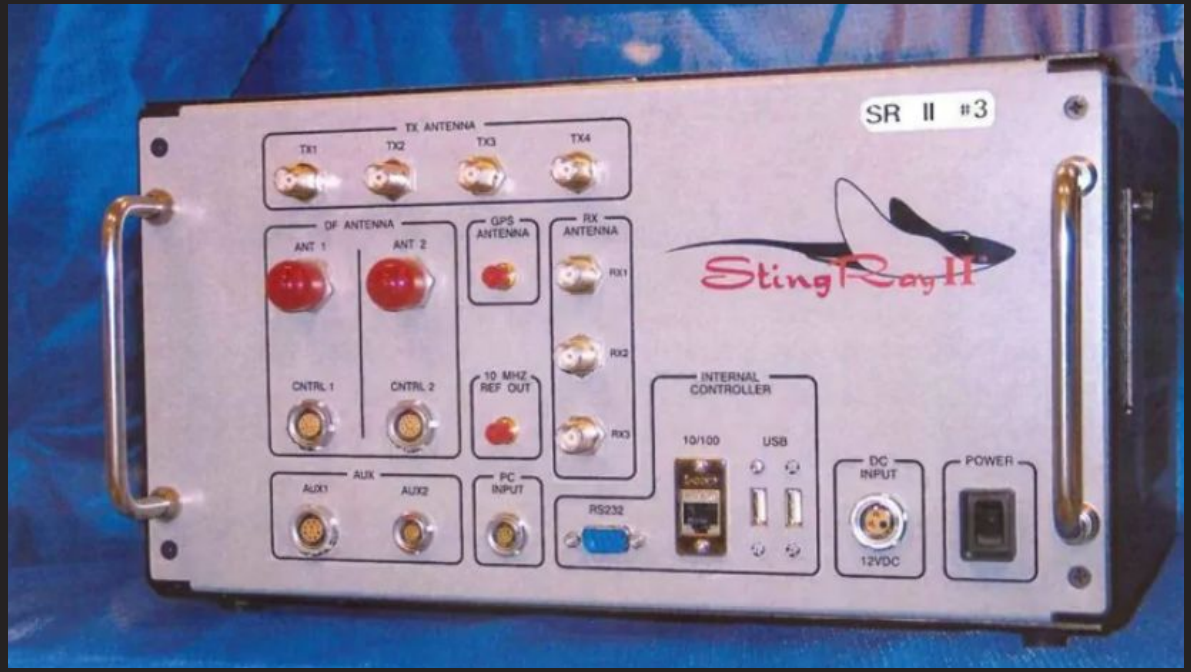
What is an IMSI-catcher?



SPY VS. SPY —

Feds: There are hostile stingrays in DC, but we don't know how to find them

There's also "anomalous activity"—probably stingrays—in other US cities, too.

CYRUS FARIVAR - 4/3/2018, 12:27 PM

ACLU sues Homeland Security over ‘stingray’ cell phone surveillance

Zack Whittaker @zackwhittaker / 8:00 am PST • December 11, 2019

Feds use anti-terror tool to hunt the undocumented

Robert Snell, The Detroit News Published 10:49 p.m. ET May 18, 2017 | **Updated 6:18 p.m. ET May 19, 2017**

(Photo: Facebook)

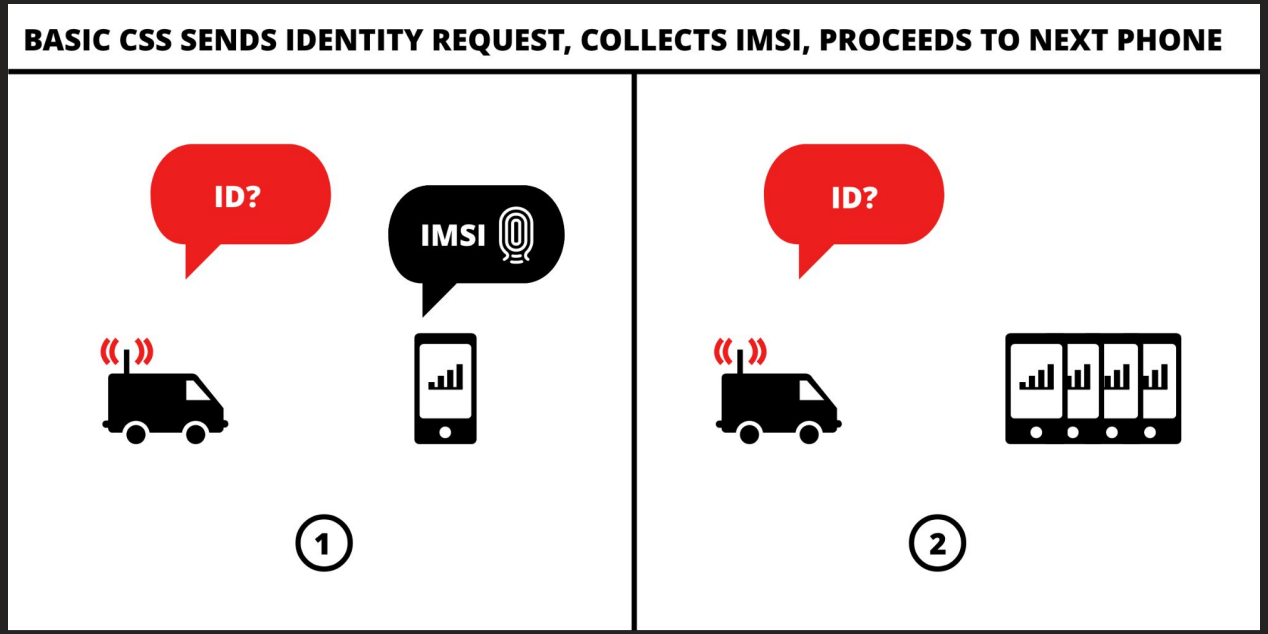
Detroit — Federal investigators are using a cellphone snooping device designed for counter-terrorism to hunt undocumented immigrants amid President Donald Trump’s immigration crackdown, according to federal court records obtained by The Detroit News.

An unsealed **federal search warrant affidavit** obtained by The News is the first public acknowledgment that agents are using secret devices that masquerade as a cell tower to find people who entered the U.S. illegally, privacy and

Terminology

- Base station
- GSM (2G)
- LTE (4G)
- 5G

The original (GSM) IMSI-catcher



General attack types (from research)

Communication interception/
Eavesdropping (GSM)

Location tracking

Service denial

Downgrading

Same root cause:

Pre-authentication messages

Spoofing Presidential Alerts

This is Your President Speaking: Spoofing Alerts in 4G LTE Networks

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Spoofing Presidential Alerts

SIB-10	ETWS (Earthquake and Tsunami Warning System) information (Primary notification)
SIB-11	ETWS (Earthquake and Tsunami Warning System) information (Secondary notification)
SIB-12	Commercial Mobile Alert Service (CMAS) information.

What about digital certificates?

Insecure Connection Bootstrapping in Cellular Networks: The Root of All Evil

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What about digital certificates?

- Backwards compatibility
  - Radio packet size issues

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- Revocation challenges
- Replay attacks

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Challenges in cell network security research

- Closed source implementations

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Challenges in cell network security research

- Closed source implementations
- $$$
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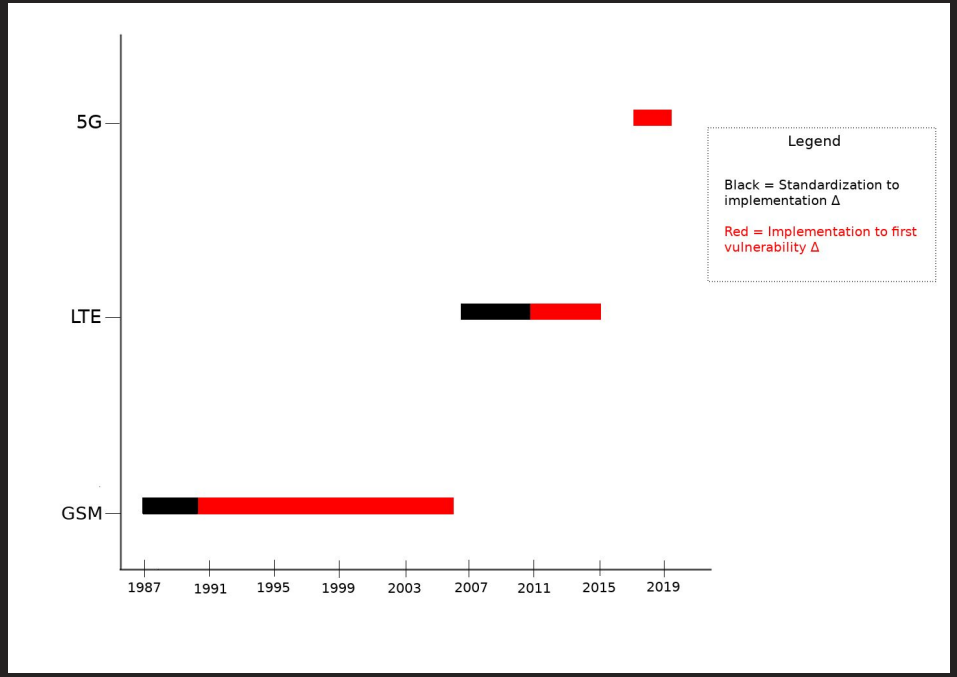
- Sprawling specs
- Huge variance across carriers

Cell network security research historically



MobiSys '19, June 17–21, 2019, Seoul, Korea

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Conclusion + next steps

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- More press & pressuring carriers

Questions?