Attacking Mobile Broadband Modems Like A Criminal Would

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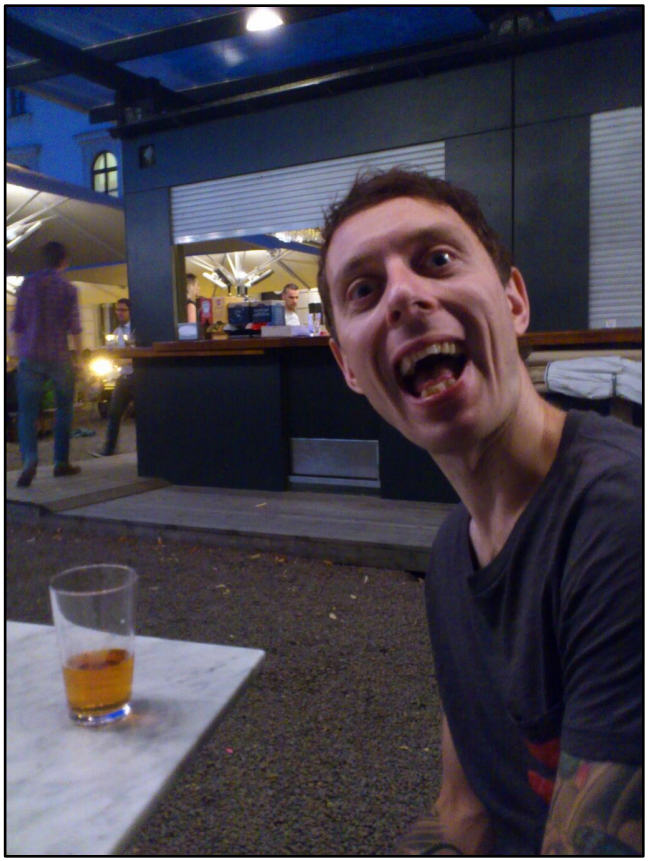
iSECURE

black hat USA 2014

whoami

- Security Analyst with I Secure Sweden
- Technical generalist
- I like web
- Not really an *expert* on anything

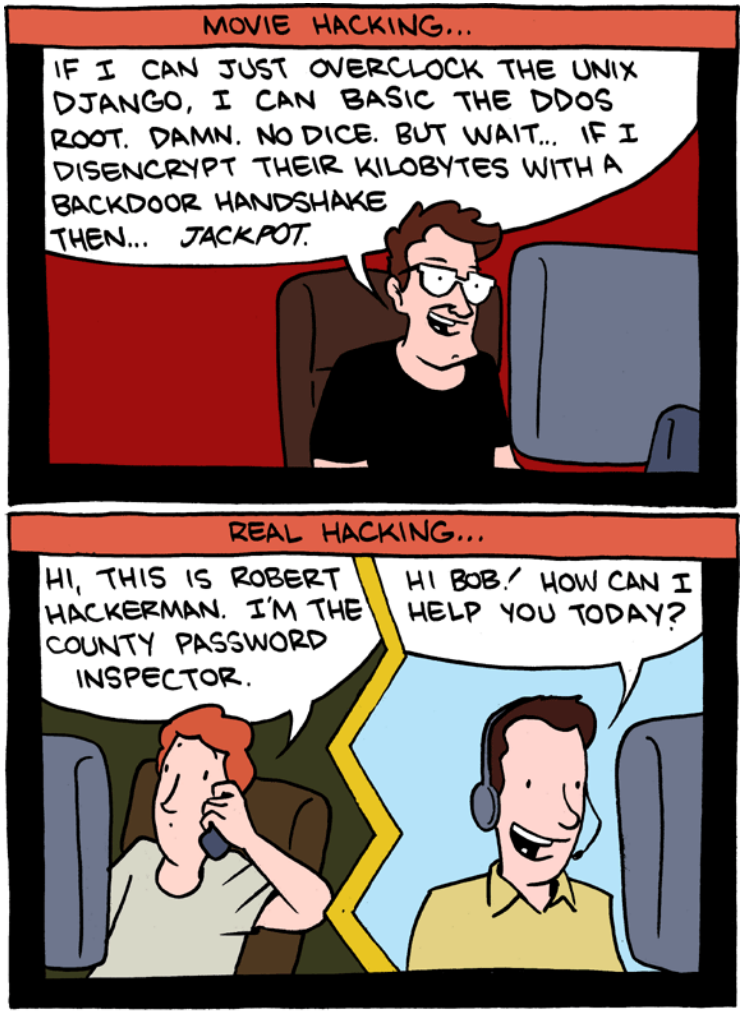


Agenda

- Introduction
- Target overview
- Attacks + demos
- Summary

Introduction

What's it about?



Source: http://www.smbc-comics.com

This is what it's about

- Practical attacks
- Likely to happen
- Easy to execute
- Great potential for paying off

Why USB modems?

- Very popular
  - ~130 million devices shipped in 2013
- Few vendors
  - Not that many models
  - Shared code between models

Target overview

Previous research

- Nikita Tarakanov & Oleg Kupreev
  - From China With Love (Black Hat EU 2013)
- Rahul Sasi
  - SMS to Meterpreter – Fuzzing USB Modems (Nullcon Goa 2013)

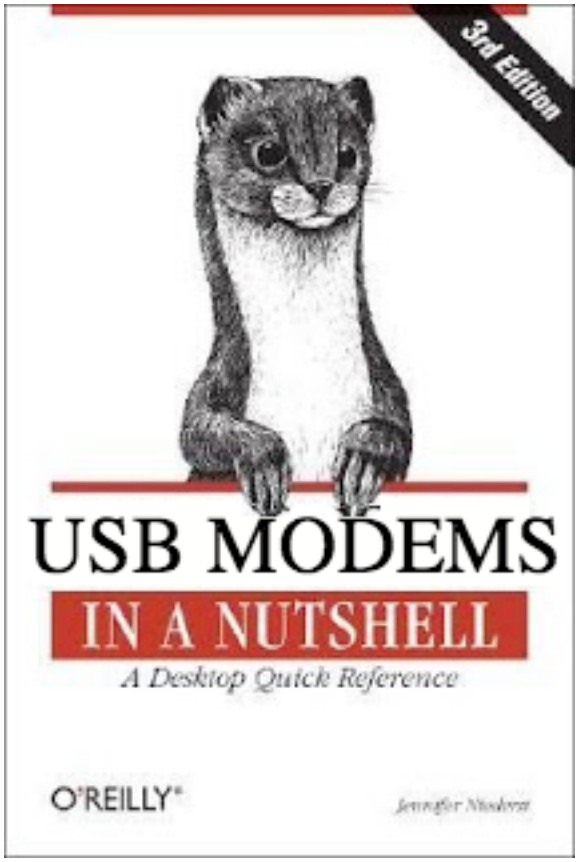
Scope

- Devices from the two biggest vendors*
  - Huawei
  - ZTE
- Focus on one device from each
  - Huawei E3276
  - ZTE MF821D
- Identify common attack surface

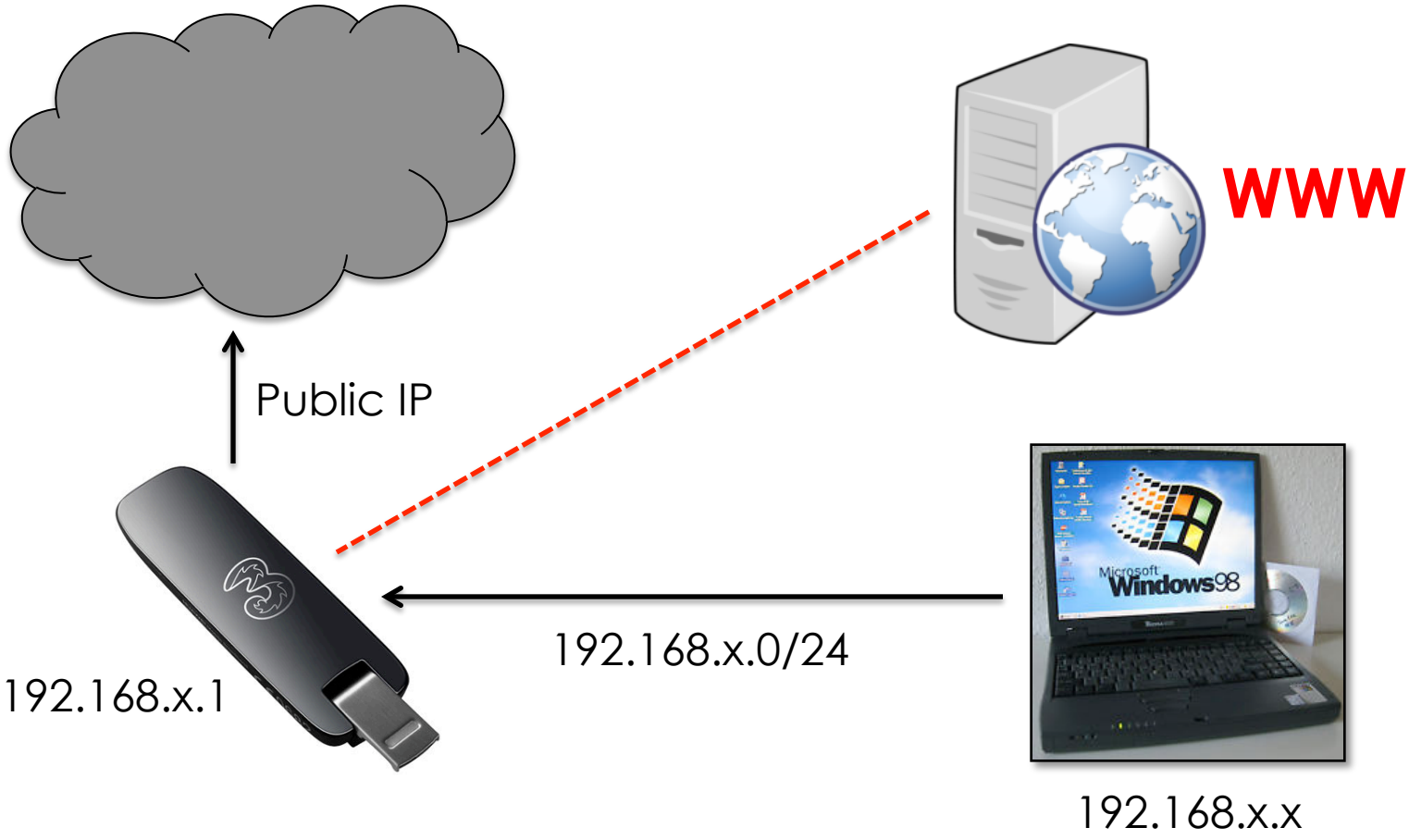
*Combined market share of more than 80% in 2011 (www.strategyanalytics.com)

In a nutshell

- Runs embedded Linux
- Mobile capabilities
  - GSM, 3G, 4G, SMS
- Web interface
  - Part of carrier branding
- No authentication
  - Single-user device



Network topology



Attacks

or

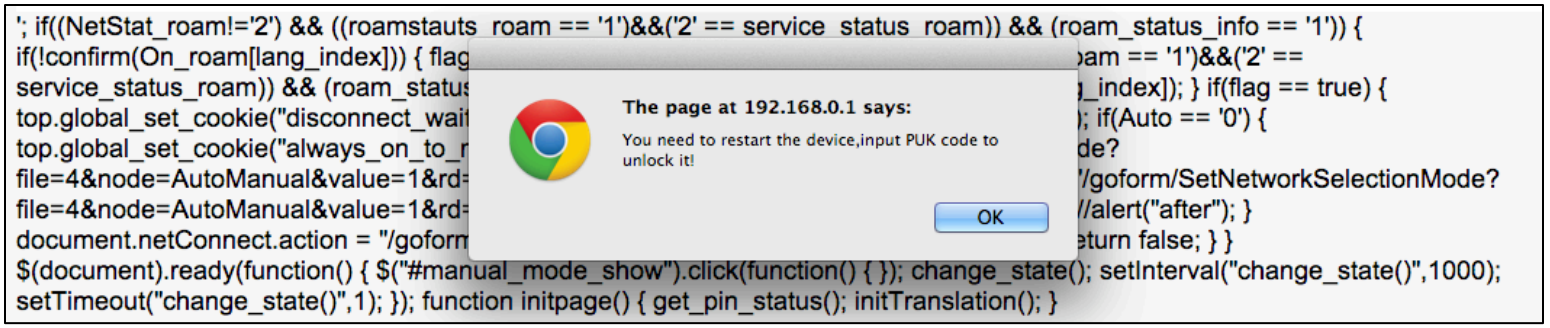
"What would Robert Hackerman do?"

Ground rules

- Objectives
  1. Make money
  2. Steal information
  3. Gain persistence
- Pre-requisites
  1. Remote attacks only
  2. See #1

Out of scope (but possible)

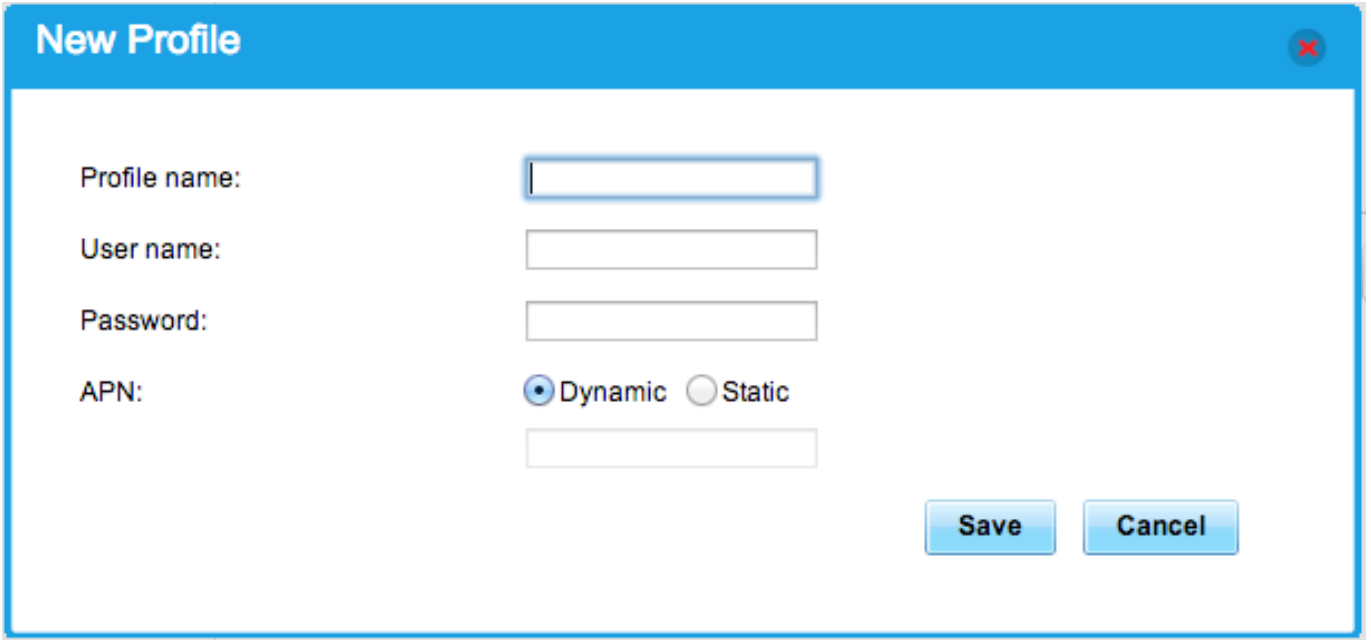
- Disconnect the device
- Lock out PIN and PUK
- Permanently break the application



- Permanently brick the device

Attacking configuration

DNS poisoning



DNS poisoning

```
<?xml version="1.0" encoding="UTF-8"?>
<request>
    <SetDefault>0</SetDefault>
    <Profile>
        <Index></Index>
        <IsValid>1</IsValid>
        <Name>malicious</Name>
        <ApnIsStatic>1</ApnIsStatic>
        <ApnName>internet.telenor.se</ApnName>
        <DialupNum>*99#</DialupNum>
        <Username></Username>
        <Password></Password>
        <AuthMode>0</AuthMode>
        <IpIsStatic></IpIsStatic>
        <DnsIsStatic></DnsIsStatic>
        <PrimaryDns></PrimaryDns>
        <SecondaryDns></SecondaryDns>
        <ReadOnly>0</ReadOnly>
    </Profile>
</request>
```

DNS poisoning

- CSRF to add a new profile
- Static DNS servers
- Read Only & Set Default
- Remove original profile
- Send user to ad-networks, malware sites, spoofed websites, etc.

DNS poisoning - bonus attack

- Trigger firmware update
- Spoof update server
  - Downloads are over HTTP
  - No code signing
- Potentially get user to install backdoored firmware...

SMS MitM


```
<?xml version="1.0" encoding="UTF-8"?>
<request>
    <SaveMode>0</SaveMode>
    <Validity>10752</Validity>
    <Sca>+46708000708</Sca>
    <UseSReport>0</UseSReport>
    <SendType>1</SendType>
    <Priority></Priority>
</request>
```

SMS MitM

- Replace the Service Center Address
- Set up rogue SMSC
- MitM all outgoing text messages

Abusing functionality

CSRF to SMS

- CSRF to make the modem send SMS
  - Send to premium rate number
- Potentially identify the user
  - Look up phone number
  - Twin cards
- Useful in targeted phishing attacks

Demo

Let's go phishing!

Getting persistent

Getting persistent

- Multiple XSS vulnerabilities
- Configuration parameters

```
data_roam_option=1';alert(1);//&submitRoam=Apply
```

```
function initTranslation2()
{
var roam_status_info = '1';alert(1);//';
```

- Configuration is persistent...

Getting persistent

- The web interface is where you go to connect to the Internet
  - Huawei Hilink opens main page automatically
  - ZTE creates a desktop shortcut
- The main page sets everything up
  - Loads an iframe for user interaction
  - It also loads the chosen language

Getting persistent

- Language is a configuration parameter loaded by the main page

```
function change_lang_cookie_before_mlang_js()
{
    var xml_lang = 'en'
    setCookie('lang', xml_lang, 60*24*20);
}
```

- It is injectable...

```
GET /goform/web_upd_xml?file=4&node=Language&string=en&rd=
```

Getting persistent

- Execute code every time the user connects to the Internet
- Interact with injected code
- Command channel
  - Poll remote server (BeEF style)
  - Out of band over SMS

Demo

SMS hooking

Summary

What to expect

- Attacks on configuration
  - Network
  - Mobile
- Abuse of functionality
  - Outbound & inbound SMS
- Injection attacks
  - Getting persistent
  - Stealing information

Getting it fixed

- ZTE is "working on it"
  - I have no details
  - ZTE does not seem to have a product security team 😐
- Huawei is fixing their entire product line
  - Nice++
  - Huawei has a product security team ☺
- Sounds pretty good though, right?

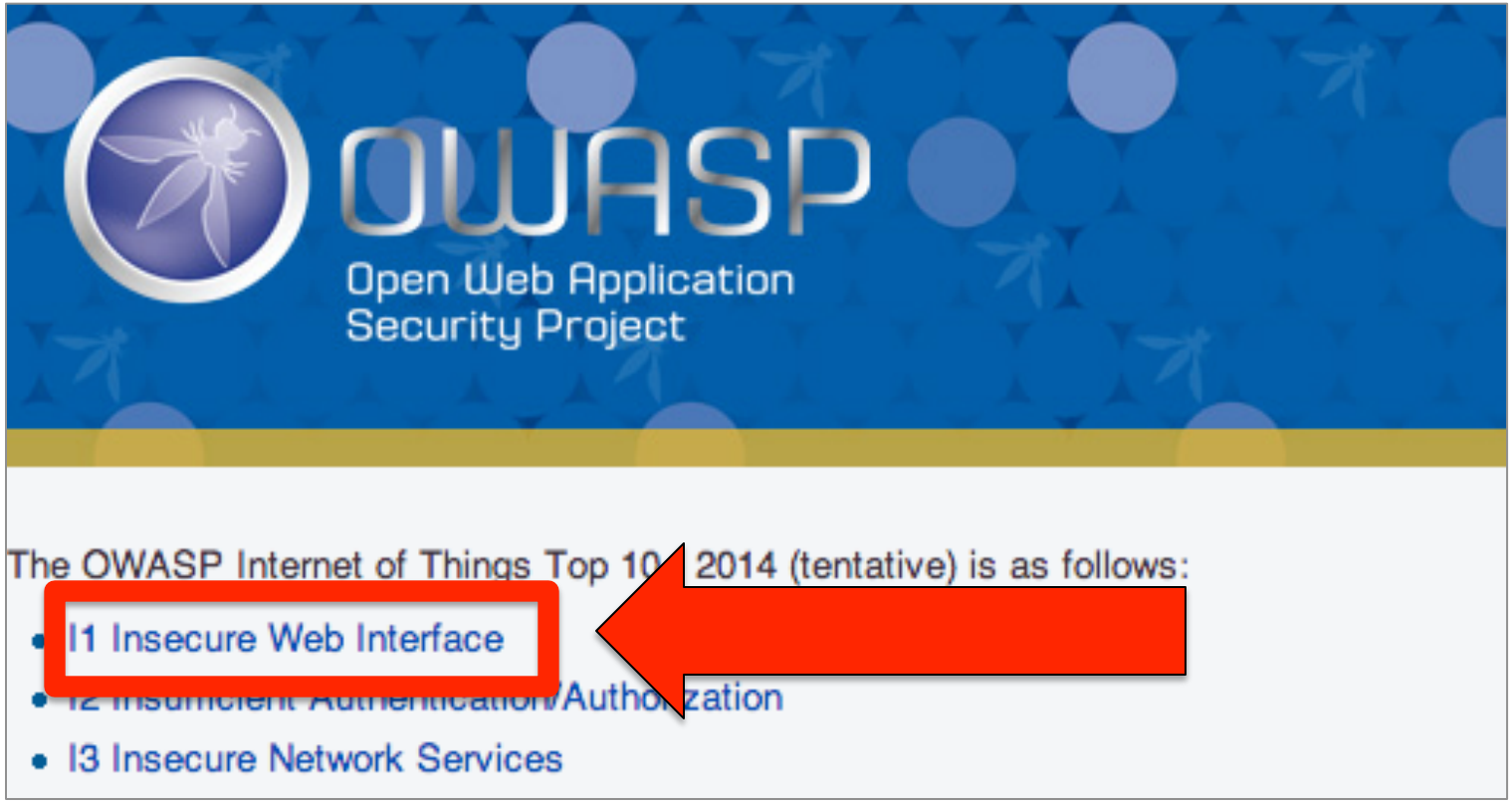
The update model is broken

- Vendors cannot push fixes directly to end-users
  - Branding complicates things
- Vendor -> Carrier -> User
  - Carriers might not make the fix available
  - Users might not install the fix
- Most existing devices will probably ***never get patched***

Summary: analysis

- Web is easy
- Web is hard!
- How about the Internet of Things?

OWASP Internet of Things top 10



Don’t forget…

Marcus J. Carey @marcusjcarey · Jun 7

Risk associated with a lot of the "trending" security research is ridiculously small. Just ignore the stuff we can fix. #nothingtoseehere

Details Reply Retweet Favorite More

Andreas Lindh @addelindh · Jun 7

@marcusjcarey 100% agree - stunt hacking sells tickets, real bad guys pick low-hanging fruit. pic.twitter.com/H8VMVNNCwC

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Thank you for listening!

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