

Global Satellite Services



Navigation Message Authentication

GNSS Interferentie & Authenticatie event January 31st 2018

Daan Scheer Global BDM Satellite Services







A changing world

IoT, Autonomous vehicles, Electronic Road pricing, Driver behaviour based insurance, Always-on trackable assets & Integrity, all with location as a centerpiece

Over the coming decade processes and systems will rely more and more on **quality positioning** and equally those are exposed to more cyber attack related **risks; Position Integrity** is a clear **necessity**



Imagine NO Geolocation service or a WRONG position!

USA TODAY

GPS spoofing makes ships in Russian waters think they're on land





SAN FRANCISCO - Researchers have discovered a disturbing pattern: dozens of ships whose GPS signals tell them they're on land - at an airport no less - even when they're far out to sea.

(Photo: Sergei Ilnitsky, EPA)

An investigation released this week by the Washington D.C.-based Resilient Navigation and

Timing Foundation and Windward Ltd., a maritime data and analytics company, has found multiple instances of so-called GPS spoofing in Russian waters.

GPS Spoofing A Growing Problem for Uber



UGRO

Published: 2017/06/09 Last Updated: 2017/06/09

Mor

NEWS

are going to airports or other hot locations that **FIFO Queue** o find that there are seemingly dozens or even adv there. What many drivers don't realize is that some, or even most of those drivers are not in fact at that location, they are GPS Spoofing.

Shipping company Maersk says June cyberattack could cost it up to \$300 million



"The surprising ease with which Todd and his team were able to control a (multimillion) dollar yacht is evidence that we must invest much more in securing our transportation systems against potential





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GPS Under Attack as Crooks, Rogue Workers Wage Electronic War "We're highly dependent on (GPS) in pretty much every part of our economy and security, yet it's very easy to disrupt," said Dana Goward, president and executive director of the Resilient Navigation and Timing Foundation, which is urging the

Imagine NO Geolocation service or a WRONG position!

UGRO

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The line is First In First Out, meaning the next request will go to the Uber cab who has been waiting the longest and is in the waiting area (in blue):



(Photo: Sergei Ilnits

Timing Founda found multiple



GPS U Worke

Your location within the airport / pickup lot does not affect your position in the queue, however you will not receive dispatches unless you are in the waiting area the Resilient Ive. Foundation, which is urging the

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Self-spoofing (Uber case) or Being spoofed? & What are the Attacker's skills & What resources available?

Who is the attacker & What is objective?

Reference to Galileo Open Service Authentication: A Complete Service Design and Provision Analysis (Sept 2015)



The world of spoofing - Variables





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The world of spoofing - Use cases





High Value Assets



- Low Value Asset Tracker:
 - Tamper motivated, tracking (Insurance telematics, vehicle fleet & fishing vessel tracking)
- High Value Asset Tracking:
 - Non-tampered, externally spoofed, tracking (High value goods or vehicles / trains)

• Portable Tracker:

• Constrained on power, tamper motivated, tracking (Tagging)

High Value Positioning:

 Non-tampered, externally spoofed, positioning (Autonomous driving, dynamic positioning (rig))

GNSS Disciplined Timing:

o Power & financial transactions



The world of spoofing - Threat sources



Individual Operator:

- o Driver avoiding being tracked
- o Limited resource and little technical ability

Lone Criminal:

o Motivated by financial gain

Prestige Attacker:

- o Hacker, academic, journalism
- Motivated by publicizing their achievement
- Moderate resources but significant technical ability

• Organized Crime:

Motivated by financial gain and possess sizeable resources

Organized Attacker:

- o Terrorists or foreign intelligence services
- Motivated by the disruptive effect of the attack, potentially unlimited resources and ability.







The world of spoofing - Likelihood score





Attack likelihood:

Extreme (4), High (3), Moderate (2), Low (1), or Negligible (0)

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The world of spoofing - Spoofing scenario's







The world of spoofing - Countermeasures



Full Position Integrity

- Cryptographic source
- External-data aided position qualification
- Authentication of signal & message

GNSS Authentication is the core



GNSS Navigation Message

Ephemeris (incl. Time & Clock) Satellite health



GNSS Signal Pseudo range

GNSS Augmentation

Corrections, Satellite Health, Real time & Extended ephemeris



Fusion of systems for maximal resilience





GNSS Signal Pseudo range

GNSS Augmentation

Corrections, Satellite Health, Real time & Extended ephemeris



Navigation Message Authentication



- Ensure the GNSS messages being received & used are valid by proving:
 - Tracked signals are those the GNSS satellite transmits
 - **Cross-check** with GNSS system and from the augmentation provider
 - Encryption/Digital signature for secure distribution



Observe in Fugro's global reference network & broadcast digital signature





GNSS receivers & spoofing detection methods









Position critical processes

need reliable location services

Navigation Message Authentication provides a clear <u>yes</u> or <u>no</u> as to spoofing detection in all receiver domains and adds redundancy to the system





We are Fugro

proud to provide geo-intelligence, location services and asset integrity solutions to contribute to a liveable world

