Wireless Sensors’ Power Consumption and IoT Security

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Overview

IoT is growing **FAST**...

**IT meets OT**

Data Integrity verification and validation is very **important**
IoT monitoring architecture

Things
- Data creation from sensor nodes

Remote Edge Site
- Filter, stream analytics, comparing power profiles with actual data generated

Communications Transport
- Send and receive

Data Center
- Transform, analyze, process workflow, monitor
- Threat detection
- Historical, streaming and simulation analysis

Human/Machine Interaction
- Data visualization & monitoring

Data flow
- Systems of record
- Systems of transaction
- Maintenance history

Secure environment
IoT Security & Challenges

✓ IoT security is still “greenfield”
✓ Security is the fastest growing priority for IoT 93% by 2019
✓ Worldwide IoT Security Spending to Reach $547 Million in 2018
✓ By 2020, More than 25% of Identified Attacks in Enterprises Will Involve IoT

- Spending for IoT security (MM)

<table>
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<th>2015</th>
<th>2016</th>
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Source: Gartner (April 2016)
Challenges in IoT

IoT devices communications are growing in size and speed. Should it be a source of concern?

- Non Upgradeable Devices
- No Power Baseline for Analytics
- Small form factor devices

- UV
- Light
- Humidity
- PM$_{2.5}$
- PM$_{10}$
- Air Quality
- Temp
IoT Security, previously ignored, has now become an issue of high concern.

- 5 Billion Connected People
- 20 - 50 Billion Connected "Things"
- $1.46 Trillion Market
- 120 Million Cars Online
- Data: 44 Zettabytes
High-level IoT Security Threat/Challenges

- **Device Management**
  - Secure Device Access
  - Secure Onboarding & Device Monitoring

- **Gateway Management**
  - Gateway Management
  - Communication Management
  - Platform/Network Management
  - Secure Resource Access
  - Enterprise Data Center

- **Communication Management**
  - Communication Management
  - Platform/Network Management
  - Identity & Access Management

- **Platform/Network Management**
  - Platform/Network Management
  - Identity & Access Management

- **Identity & Access Management**
  - Identity and Access Management

**Threat/Challenges**

- **Sensors, Devices & Equipment**
  - Fake sensor
  - Fake Data
  - Malicious Command

- **Gateways**
  - Malware & APTs
  - Data Exposure & Integrity

- **Enterprise Data Center**
  - Malware & APTs
  - Data Exposure & Integrity
  - Unauthorized Access, Data Exposure & Provenance

**Analytics**

- Device Behavior Analytics
- Network Visibility, Analysis, Action
Power Consumption in IoT Ecosystem

- With the wireless nature of the connected edge devices, power consumption is one of the key research topics.
- We believe in a strong correlation between power consumption and security threats.
Solution Approach

- Proactive monitoring of power usage at the edge
- Use of AI techniques to detect abnormal behavior and react to it
Sensor Behavior Algorithm

- **Normal Behavior**
  - Same Power Consumed
    - No Analysis Needed
      - Pass Data
  - Normal behavior

- **Suspected Behavior**
  - Excessive Power Consumed
    - Alert to Admin / Mark sensor for security Analysis
    - Analysis Performed
  - Block Sensor extra security check to be performed
  - Abnormal behavior

- No Analysis Needed
  - Normal behavior
  - Pass Data
Power Behavioral Profiling

Data collection from the sensors

Power behavioral profiling

Big data and deep learning Algorithms

Pass Data

Block Data

End
Trust scoring and authentication leveling based on power consumption

Authenticated Sensor node
Authenticated Flagged Sensor node
New Sensor node

Regular authentication
1st time authentication

Security Guard (SW)
Sensor profiles
Trust scores
Power consumption, behavior profile Engine

Trust Score
Trust Score
Trust Score
Power profiling with ACPI integration System

- Automates profiling.
- Correlates results.
- Apply machine learning.

Security Guard
Next generation **Data Centers (DC)** will be fully connected and serve mostly IoT-related activities. Power consumption information needs to be included in the DC **vulnerability** assessment and risk mitigation.

The implementation of this solution can be integrated into edge management tools such as VMware Enterprise mobility management product suite.

This approach is designed for the ‘**higher orders**’ of IoT where processors can be instrumented to gather the necessary telemetry data.

Leverage IOT Gateways such as Dell GWs for deployments.

With the use of **Machine Learning** and **Deep Learning**, this solution may also be implemented at the core/DC level or as a service in the Cloud.
Related links


- [https://twitter.com/DellOEM/status/831630102312140803](https://twitter.com/DellOEM/status/831630102312140803)
More Resources

- **Performance Improvement and Power Consumption Reduction of an Embedded RISC Core**
  Author: Jung Hongkyun, Jin Xianzhe, Ryoo Kwangki

- **Wireless sensor network for aircraft health monitoring**
  Haowei Bai; M. Atiquzzaman; D. Lilja
  First International Conference on Broadband Networks
  - http://www.gartner.com/newsroom/id/3291817
Thank you

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