

# Securing IoT Networks through Moving Target Defence

CSCS25

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# Outline

Introduction

Technical Primer

Proposed Architecture

Results & Insights

# Introduction

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- Explosion of IoT devices in smart homes, healthcare, critical infrastructure
- Resource constraints & lack of built-in security
- IoT as attractive targets for large-scale DDoS attacks

# Research Objectives

- Evaluate Moving Target Defence (MTD) for IoT security
- Integrate MTD with Software-Defined Networking (SDN)
- Evaluate the solution in a public network

# Technical Primer

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# Moving Target Defense (MTD)

- Dynamically alters attack surface
- Examples: ASLR, ISR, honeypots/honeynets
- Increases attacker uncertainty and cost

# Software-Defined Networking (SDN)

- Separation of control plane (controller) and data planes (switches)
- Northbound API: apps → controller
- Southbound API: controller → forwarding devices



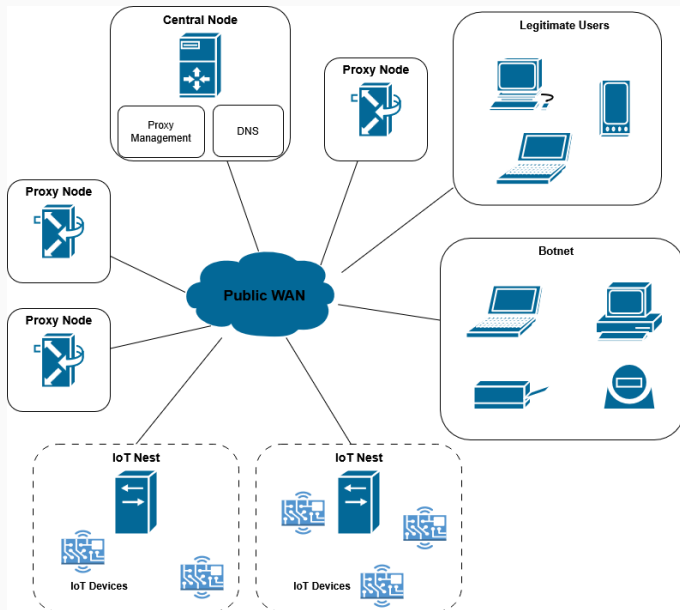
- **Mutable Networks (MUTE)** – crypto-shuffled IP/port mapping
- **Random Host Mutation (RHM)** – edge IP shuffling
- **OF-RHM (OpenFlow)** – SDN-based randomization

# Proposed Architecture

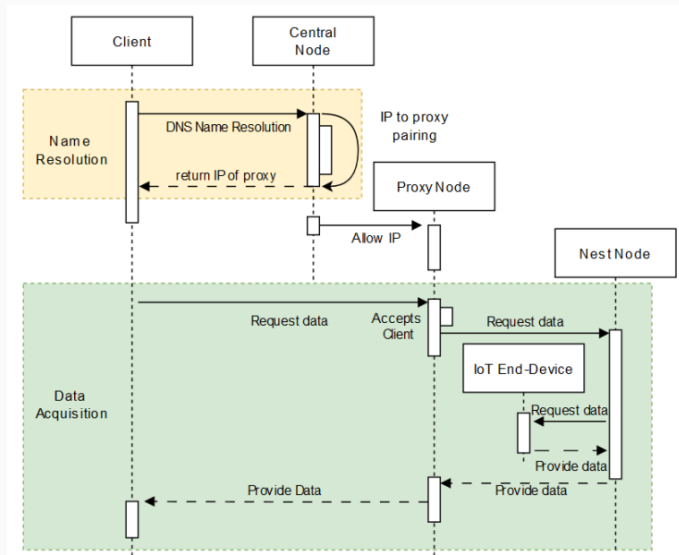
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- Botnet-driven volumetric DDoS (SYN/UDP flooding)
- Target: resource-constrained IoT devices (no IDS/ACL)
- Reconnaissance & Exploitation threat vectors also considered

# System Architecture



# Defence Workflow



## Case I - Botnet is not connected

1. Recon is done to find the IP address of the proxy
2. Botnet floods directly to the IP
3. Botnet is blocked by the proxy

## Case II - Botnet is connected

1. Bots flood the IPs of the proxies assigned to them
2. Proxy will detect the flood and flag the IPs
3. Master Node will renew the IP address of the proxies from the ISP's DHCP server
4. Legitimate users will be able to connect again to the DNS

## Results & Insights

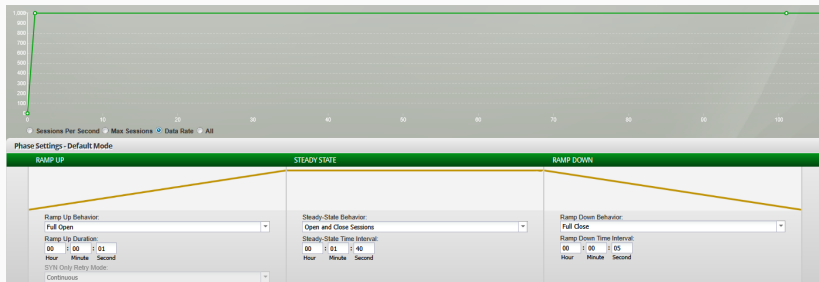
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- Simulated Internet inside VMs and Docker
- ESP8266 microcontroller HTTP service
- Locust framework & Ixia Breakingpoint for traffic generation
- Power usage measurement using a lab bench power supply
- Scenarios: baseline, nominal load, volumetric DDoS

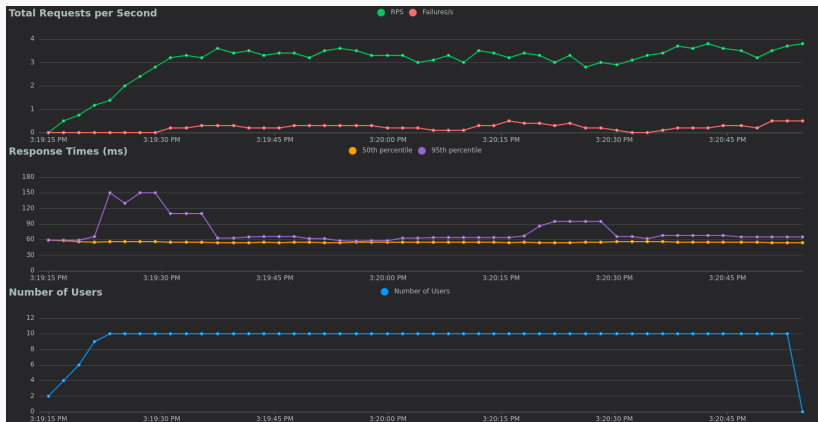
# Simulation Environment

## Ixia Breakingpoint Data Rate Curve

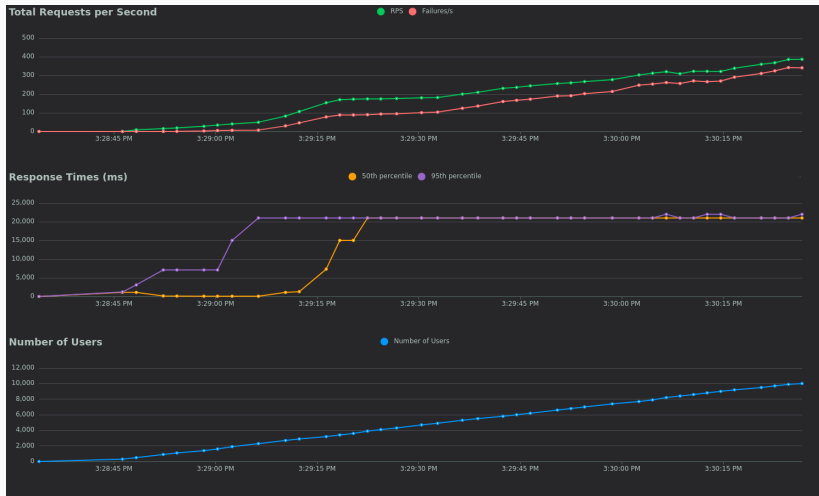


- Latency
- Failure Rate
- Power Usage

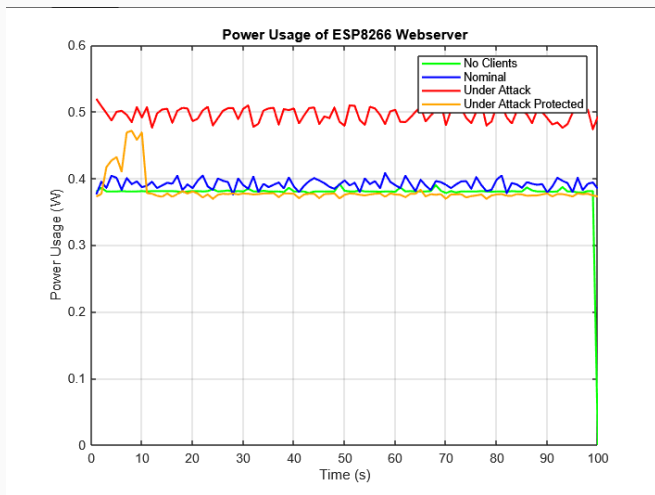
## Nominal Usage



## Unprotected Attack



## Power Draw



# The Good, the Bad & the Lag

- **Advantages:**

- Cheap-ish
- Increases attacker cost
- Easy to implement in public WAN networks
- Modular, device agnostic approach

- **Limitations:**

- Overhead from ISP IP changes is a wildcard
- Needs complementary security measures
- Will need to be fine tuned for different services

Thank you!

Any questions?