Remote Intrusion Detection (RID)

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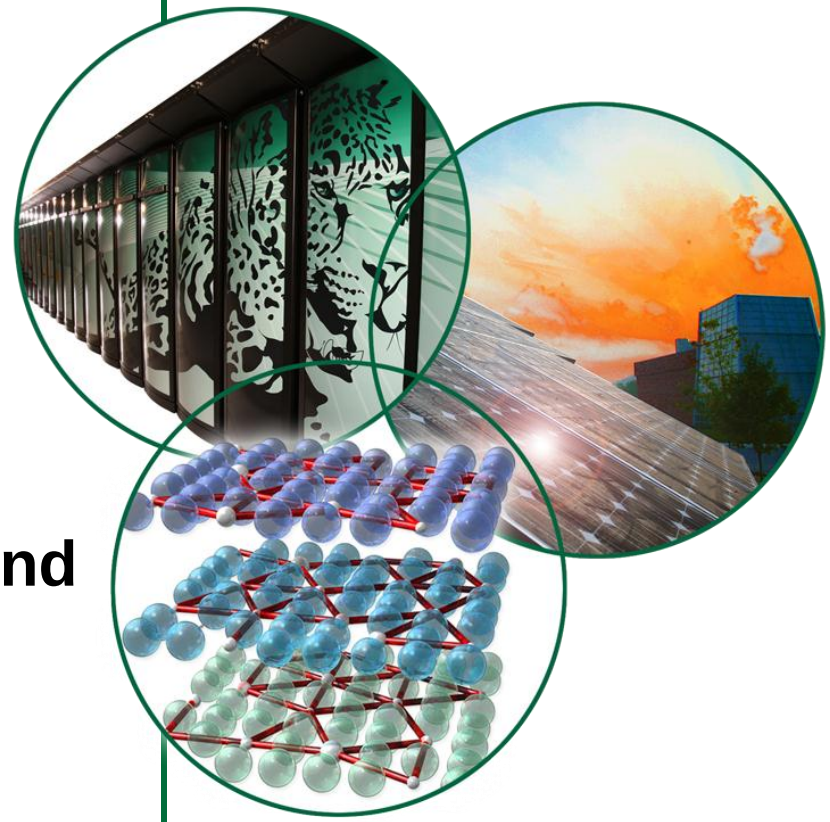

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Outline

- Introduction
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- Process
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Introduction

Securing U. S. cyber infrastructure is critical

- Attacks occur daily
- Maintaining secure cyber infrastructure is important
  - Institutions
    - Private
    - Public
  - Individual / personal use
- Attackers improve infiltration methods daily
- Difficulty of maintaining secure infrastructure increases
- Remote Intrusion Detection is proposed solution
  - Cannot keep out attackers entirely
  - Thwart efforts before any serious damage occurs

Intrusion detection

- Act of discovering occurring unauthorized activity
- Intrusion detection systems (IDS)
  - Host-based IDS
  - Network-based IDS
  - Behavioral network analysis
  - Wireless-based IDS
- All possess strengths and weaknesses
- Most effective use of intrusion detection thus far:
  - Includes multiple IDS
  - Simultaneous operation

Rootkits

- Software “kits”
- Used to gain and maintain unauthorized root / admin privileges
- Types
  - Kernel
    - Most used
    - Very harmful
    - Difficult detection
  - User-land (user mode)
  - Hardware-based
  - Hypervisor-based
  - Boot-loader
- Known and mostly used for stealth

Multilin D400

- Substation gateway created by General Electric (GE)
- Very advanced tool
  - Collection system
  - Filtration system
- Very useful for RID pursuit
- Functions
  - Advanced gateway
  - Fault logging
  - Secure access
  - Advanced automation

About RID - What makes it so special?

- Current IDS techniques are good, but have problems
- Need multiple devices for good results
  - Most are designed to work independently
  - High maintenence
- Not completely accurate
- Only warns of intrusion
- High human dependence

About RID - What makes it so special?

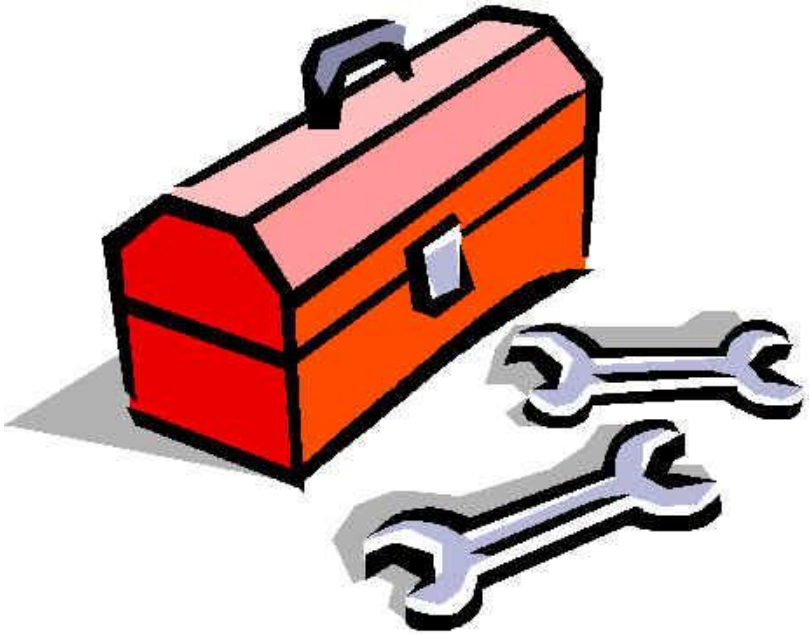
- RID would possibly
  - Perform more efficently than current methods
    - Reduce human dependance
    - Reduce security costs
    - Increase detection accuracy
  - Provide detection for multiple locations
    - Supervisory control and data acquisition (SCADA) systems
  - Alert of intrusion
  - Stop its occurrence
    - Decides solution

Objectives

- Understand and implement D400
- Modify program code by inserting detours
  - Small amounts of code
  - Intercepts function calls
- Gather precise execution time information
  - Study data
  - Establish clean machine baseline
- Infect machine with rootkit
- Gather data once more
  - Compare clean and infected machine data
  - Establish conclusions

Resources

- D400 Fedora Virtual Machine
- Oracle Virtualbox VM software
- Intel Pentium 4 HT processor



Process

- Literature search
  - Intrusion detection
  - Rootkits
  - D400
- All new material
- Increased for research
  - Familiarity
  - Proficiency

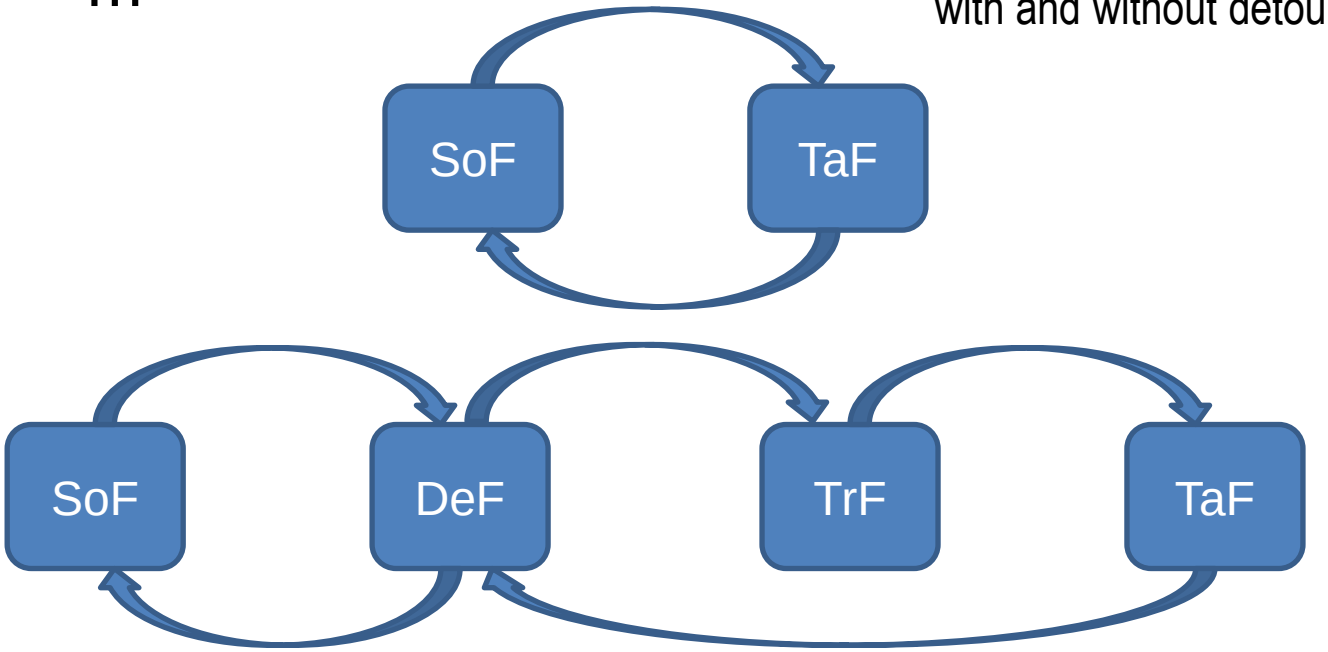
Process

- Install D400 Fedora Core 11 Virtual Machine
  - Run D400 build
  - Configure D400 virtual software
  - Observe D400 operation
- D400 build failed to work properly
  - Lengthy repair process
  - Implementation placed on hold
- Used local machine and Fedora VM instead

Process

- Modify program code for data collection
  - Observe trampolines and detours
    - Program interception
    - Collects and stores data
    - …

Figure 1. Function invocation with and without detours



Results

- Created execution time collection code
- Performed initial timing tests
- Identified Linux rootkits relavant to D400 device
- Identified system calls targeted most by Linux rootkits

```
Time: 0 secs 523 ns Clock ticks: 1251
Time: 0 secs 523 ns Clock ticks: 1251
Time: 0 secs 526 ns Clock ticks: 1260
Time: 0 secs 526 ns Clock ticks: 1260
Time: 0 secs 519 ns Clock ticks: 1242
Time: 0 secs 519 ns Clock ticks: 1242
Time: 0 secs 523 ns Clock ticks: 1251
Time: 0 secs 515 ns Clock ticks: 1242
```

Figure 2. Screenshot of time execution data

Conclusions and Future Work

- Successfully conducted initial timing tests on clean machine
- Baseline execution time can be established
- Gathered data can be used for later comparisons against compromised machines

- Continuing research needed
  - D400 VM implementation
  - Compromised machine testing
  - Real time testing
  - Real time implementation

Summary

- Securing cyber infrastructure very important
  - Rootkits used for stealth
  - Current IDS help
    - Not accurate enough though
    - Difficult implementation
- Remote intrusion detection could be solution
  - More accurate detection possible
  - More cost friendly
  - SCADA systems and D400
    - Better info collection
    - Better info filtration
    - Enhanced security features

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Questions