RSACONFERENCE2010

SECURITY DECODED

# The Key to Successful Monitoring for Detection of Insider Attacks

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# Agenda

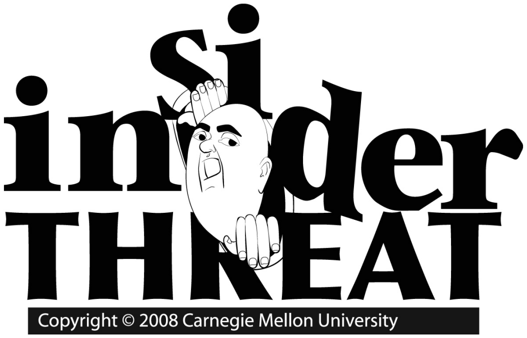
Insider Threat Center at CERT

IT Sabotage

Fraud / Theft of Information

Final Thoughts

# Insider Threat Center at CERT



# What is CERT?

- Center of Internet security expertise
- Established in 1988 by the US Department of Defense on the heels of the Morris worm that created havoc on the ARPANET, the precursor to what is the Internet today
- Located in the Software Engineering Institute (SEI)
  - Federally Funded Research & Development Center (FFRDC)
  - Operated by Carnegie Mellon University (Pittsburgh, Pennsylvania)

# CERT Insider Threat Center—Mission

Assist organizations in identifying indications and warnings of insider threat by

- performing vulnerability assessments
- assisting in the design and implementation of policies, practices, and technical solutions

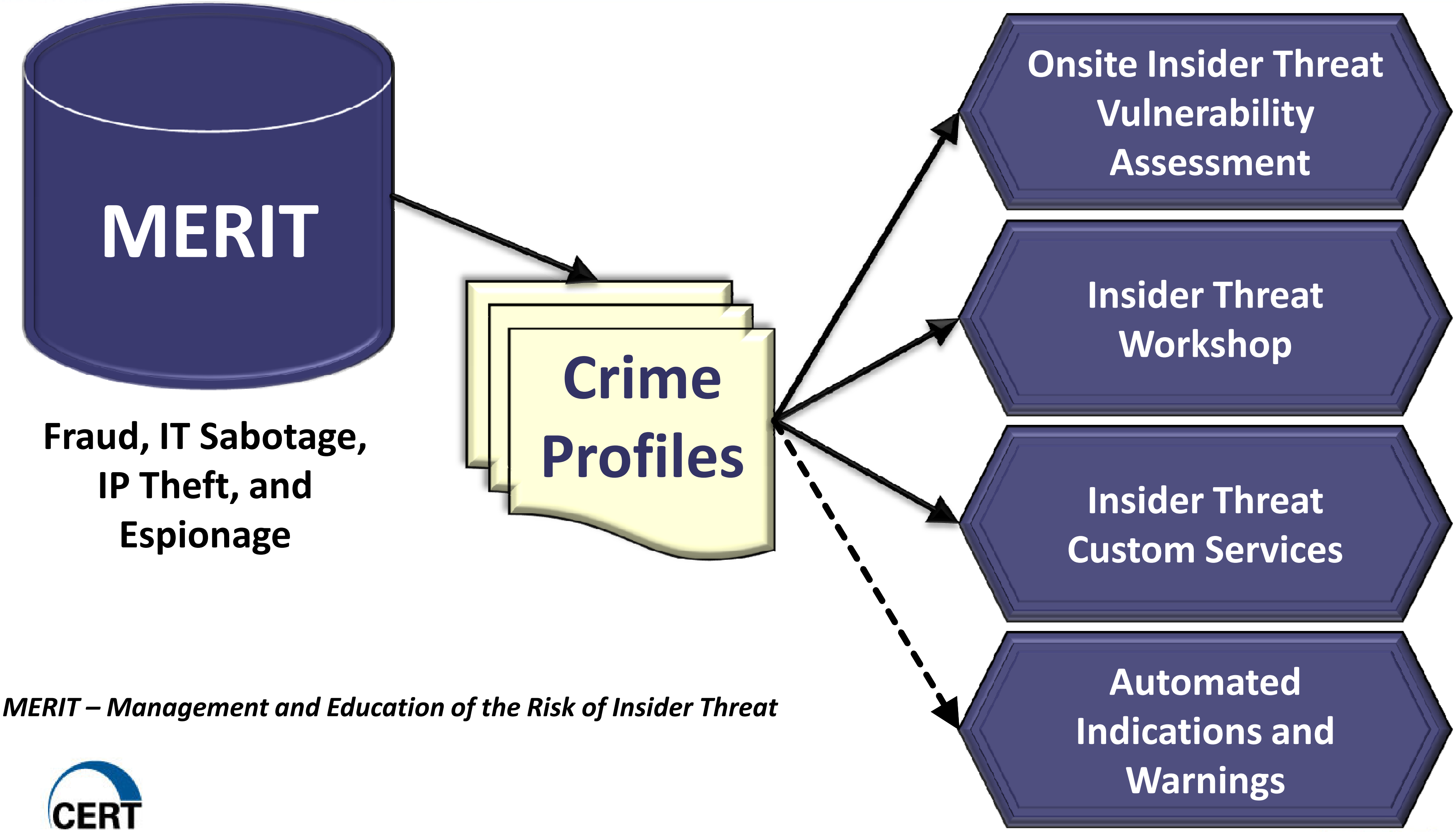
*based on our ongoing research of hundreds of actual cases of insider IT sabotage, theft of intellectual property, fraud, and espionage*

# Who is a Malicious Insider?

*Current or former employee, contractor, or other business partner who*

- *has or had authorized access to an organization’s network, system or data and*
- *intentionally exceeded or misused that access in a manner that*
- *negatively affected the confidentiality, integrity, or availability of the organization’s information or information systems.*

# Insider Threat Portfolio



MERIT

Fraud, IT Sabotage, IP Theft, and Espionage

Crime Profiles

Onsite Insider Threat Vulnerability Assessment

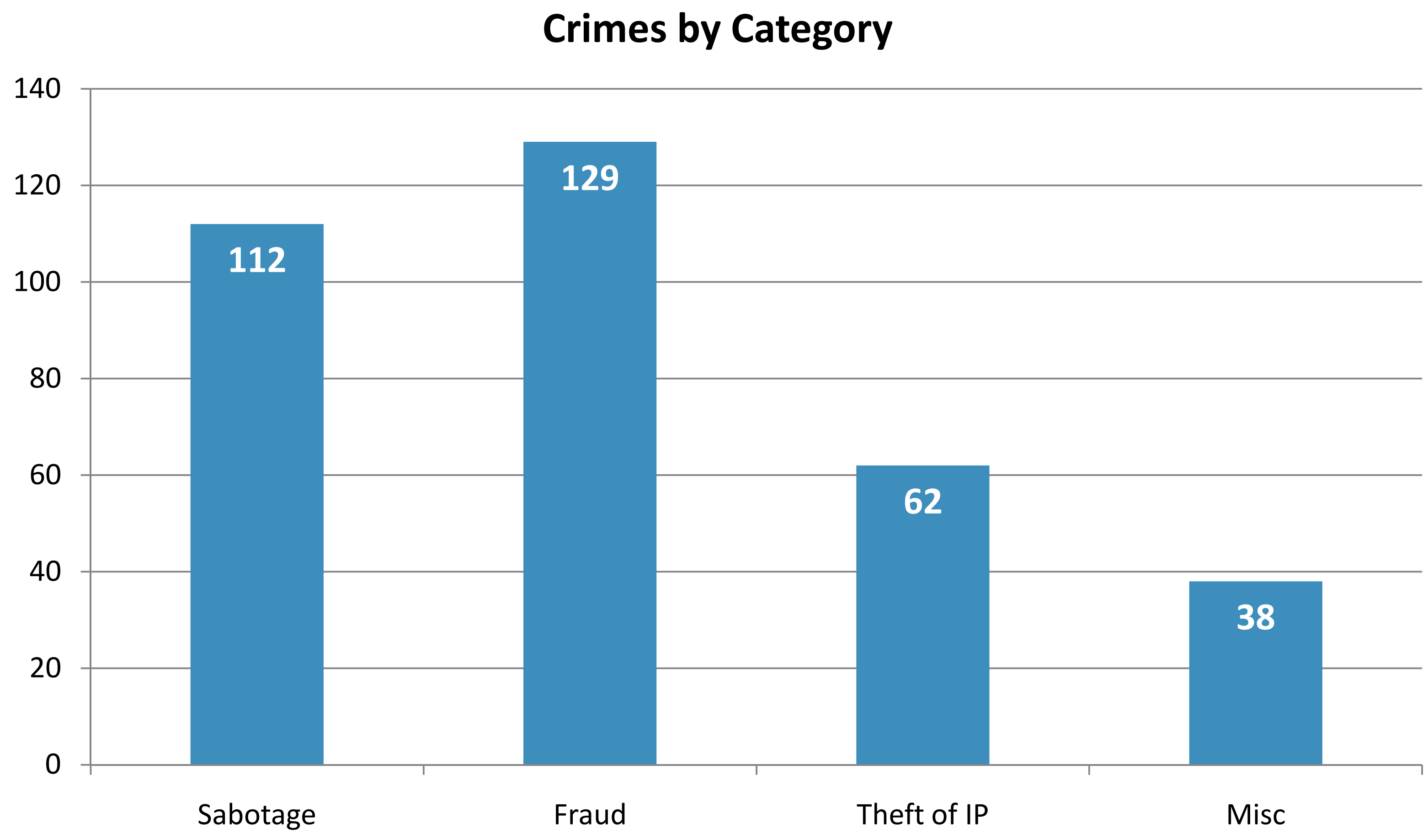
Insider Threat Workshop

Insider Threat Custom Services

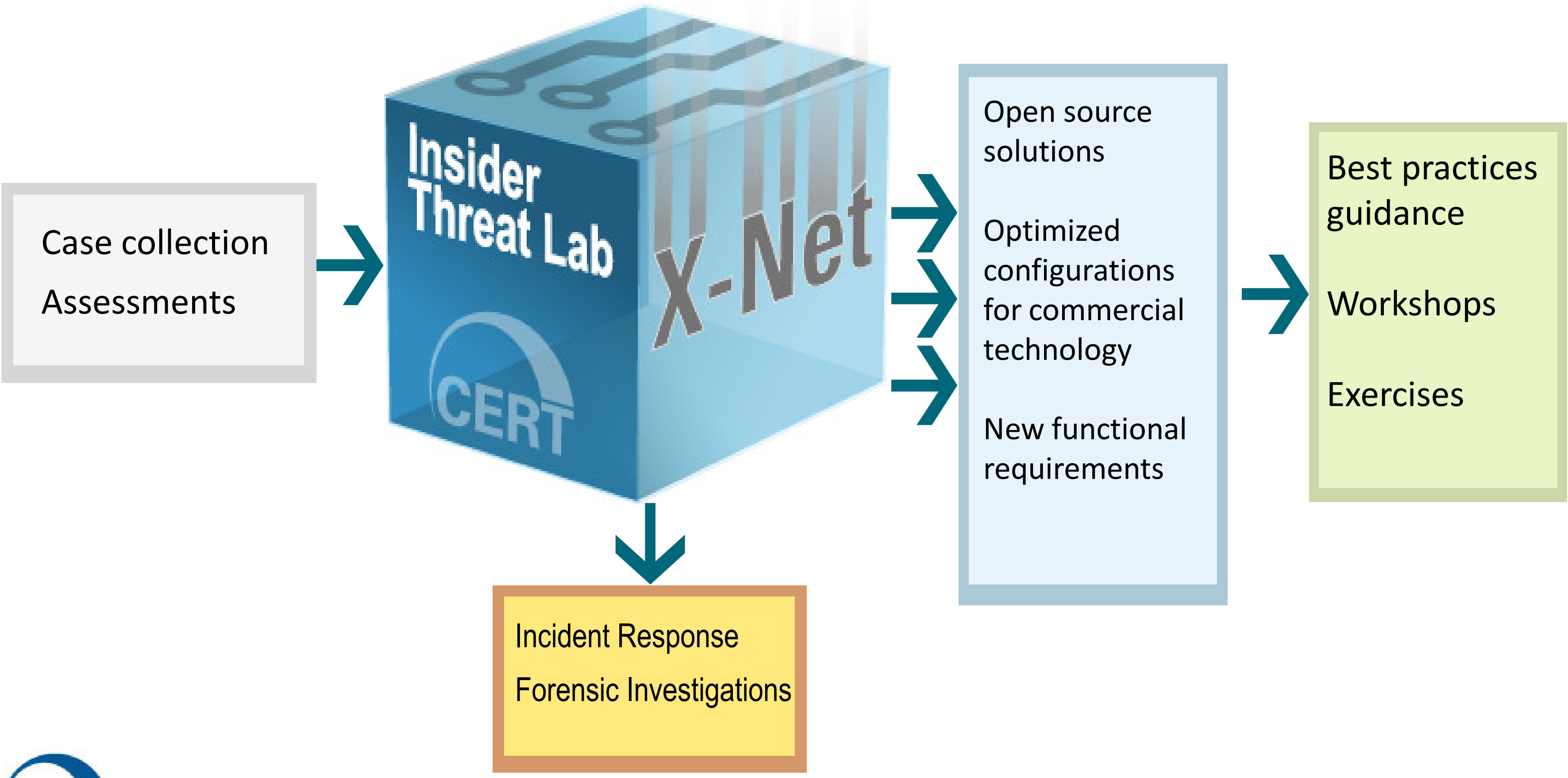
Automated Indications and Warnings

*MERIT – Management and Education of the Risk of Insider Threat*

# MERIT Insider Threat Case Breakdown



# MERIT Insider Threat Lab



Case collection

Assessments

Open source solutions

Optimized configurations for commercial technology

New functional requirements

Best practices guidance

Workshops

Exercises

Incident Response

Forensic Investigations

# Topic of this Session

- More security tools are available, so detection of illicit insider activity should be easier
- BUT: the number of insider incidents continues to grow
- WHY? Insiders have access, knowledge, and opportunity
- Our objective:
  - Present practical strategies for effectively implementing those tools to detect illicit insider activity
  - Present actual case examples and demos

# IT Sabotage

DAN
DAN
SLAM!
Attach File(s)
Do you want to attach DAN_BACKDOOR.EXE?
YES
NO

# Insider IT Sabotage

| | IT Sabotage |
|---|---|
| % of crimes in case database | 34% |
| Current or former employee? | Former |
| Type of position | Technical (e.g. sys admins or DBAs) |
| Gender | Male |

# Insider IT Sabotage - 2

| | IT Sabotage |
|---|---|
| Target | Network, systems, or data |
| Access used | Unauthorized |
| When | Outside normal working hours |
| Where | Remote access |
| Recruited by outsiders | None |
| Collusion | None |

# Unknown Access Paths Used in Actual Cases

- Planted logic bomb while still employed
- Created backdoors before termination or after being notified of termination
- Installed modem for access following termination
- Disabled anti-virus on desktop & tested virus
- Installed remote network administration tool
- Downloaded and installed malicious code and tools (e.g., password cracker or virus)

## Undetected Technical Precursors in Actual Cases

- Downloading and use of “hacker tools” such as rootkits, password sniffers, or password crackers
- Access of web sites prohibited by acceptable use policy
- Use of backdoor accounts
- Set up every new computer so he could access it remotely
- Modification of logs to conceal malicious activity

# Monitoring Strategies for Insider IT sabotage

- Detection of configuration changes
- Alerting of suspicious traffic
- Monitoring for unauthorized accounts

***We've all heard this before…. Then what's the problem???***

# Change and Configuration Control

## *Problem:*

- Privileged users
  - Can insert malicious code just about anywhere and it is not anomalous activity
  - Have the ability to override system controls without detection
- Information overload: can’t realistically monitor everything everyone does online

# Change Control

## *Solution Strategies:*

- Learn from the MERIT models and from past cases
- Implement continuous logging and centralized, secure log server
- Detect and investigate changes that should occur infrequently, e.g.
  - Changes to operating system files, scripts, and executables
  - Changes to stable production systems
  - Services killed on host
- Audit individual actions in logs for privileged accounts
  - Especially for insiders who are “on the HR radar”
- Scan workstations regularly for potentially offensive tools (scanners, crackers, fuzzers, etc.)
- Audit access to backup information and results of backup and recovery tests carefully – this is your last line of defense!

# Actual case examples

***Example#1:*** Malicious code inserted into system utility to steal employee passwords

***Example#2:*** Virus tested on employee's computer before deploying on customer installations

***Example#3:*** Modification of source code disables automated notifications to security department

# Perimeter Controls

## *Problem:*

- Privileged users have solicited assistance from the Internet Underground to commit insider IT sabotage
- Privileged users have used “hacker tools” against their organization
- Security of the physical perimeter is often taken for granted

## *Solution Strategies:*

- Configure Intrusion Detection systems and proxies to alert on suspicious outbound traffic
- Continuous logging
- Audit individual actions in logs for privileged users who are “on the HR radar”
- Audit failed physical access attempts

# Actual case examples

***Example#1:*** Download of “hacker tools” for use in IT sabotage attack

***Example#2:*** Use of IRC chat to exfiltrate credentials

***Example#3:*** Insiders were able to gain unauthorized physical access to areas to steal organization information

# Unauthorized Accounts

## ***Problem:***

- Unauthorized accounts are a common method for gaining access following termination
- Account creation is not anomalous activity for many privileged users
- Account audits are not streamlined and can be very resource intensive

## ***Solution Strategies:***

- Implement scripts to compare all accounts against current employee directory
- Alert on creation of new account and investigate or validate legitimacy of all new accounts on a frequent basis
- Control shared accounts

# Actual case examples

***Example#1:*** Use of backdoor accounts “batman” and “James Bond”

***Example#2:*** Use of VPN accounts belonging to other employees

***Example#3:*** Use of testing, training, and customer accounts

# Demo

# Fraud

Upload files?
YES
NO
GOOD LUCK!
WE'LL MISS YOU!

# Insider Fraud

| | IT Sabotage | Fraud |
|---|---|---|
| % of crimes in case database | 34% | 39% |
| Current or former employee? | Former | Current |
| Type of position | Technical (e.g. sys admins or DBAs) | Non-technical, low-level positions with access to confidential or sensitive information (e.g. data entry, customer service) |
| Gender | Male | Fairly equally split between male and female |

# Insider Fraud - 2

| | IT Sabotage | Fraud |
|---|---|---|
| **Target** | Network, systems, or data | **PII or Customer Information** |
| **Access used** | Unauthorized | **Authorized** |
| **When** | Outside normal working hours | **During normal working hours** |
| **Where** | Remote access | **At work** |
| **Recruited by outsiders** | None | **½ recruited for theft; less than 1/3 recruited for mod** |
| **Collusion** | None | **Mod: almost ½ colluded with another insider<br>Theft: 2/3 colluded with outsiders** |

# Monitoring Strategies for Insider Fraud

- Detection of unauthorized addition / modification of data in databases

# Unauthorized Data Access / Modification

## Problem:

- Authorized users have added, modified, or deleted data in databases to commit fraud against the organization
- Collusion between employees occurred in approximately 50% of the cases, possibly to overcome separation of duties

## Solution Strategies:

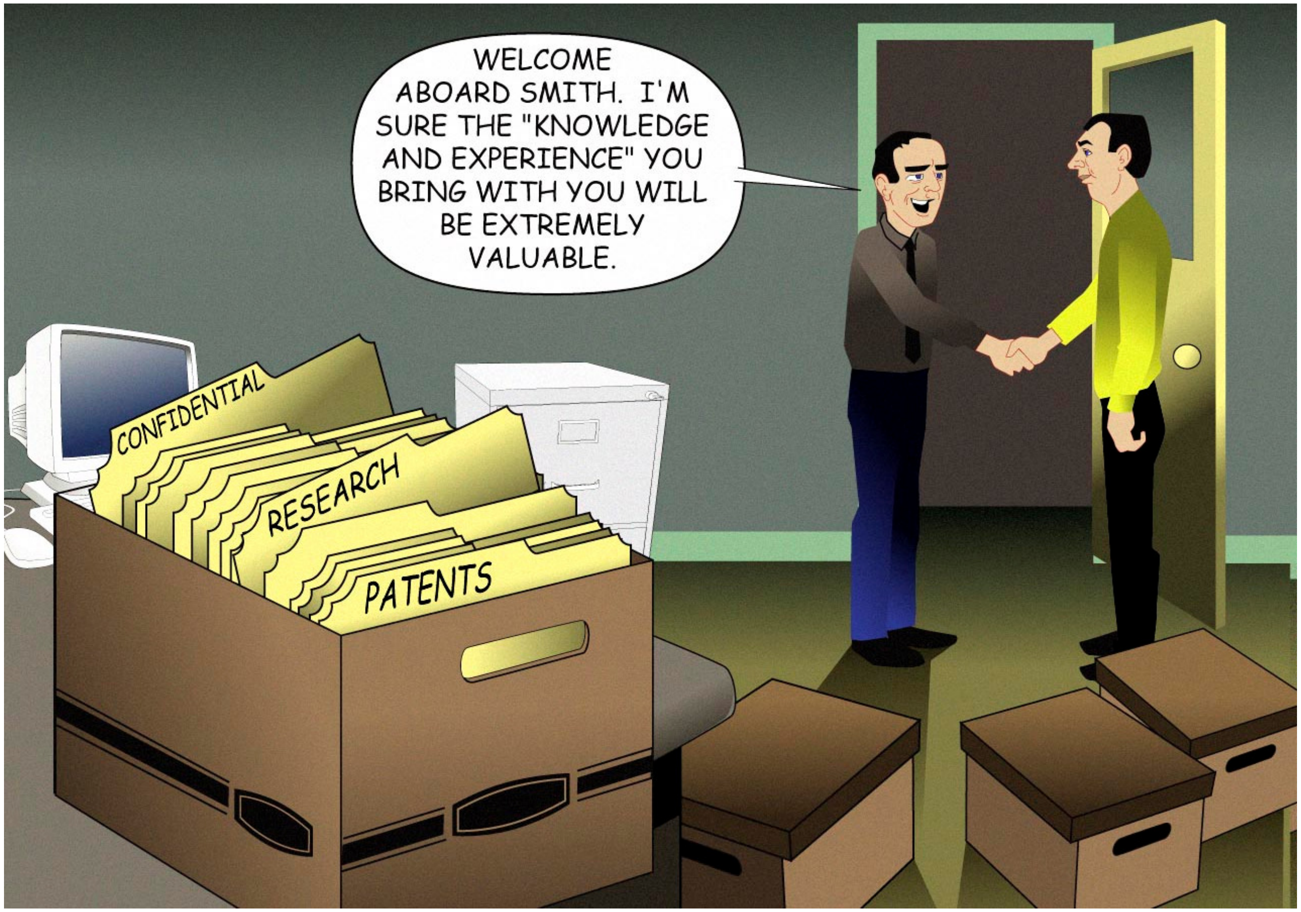
- Auditing database transactions may help detect unauthorized access and modification of data
- Auditing data changes for all tables in a database is not practical and may degrade performance
- Monitor access and data modifications on critical tables, such as tables containing PII or customer information
- Audit either successful or unsuccessful data access / modification attempts or both

# Actual case examples

***Example#1:*** Conspiracy to sell fraudulent driver’s licenses

***Example#2:*** Wiring of money from a dormant bank account into a personal account

# Theft of Intellectual Property


WELCOME ABOARD SMITH. I'M SURE THE "KNOWLEDGE AND EXPERIENCE" YOU BRING WITH YOU WILL BE EXTREMELY VALUABLE.
CONFIDENTIAL
RESEARCH
PATENTS

# Insider Theft of Intellectual Property

| | IT Sabotage | Fraud | Theft of Intellectual Property |
|---|---|---|---|
| **% of crimes in case database** | 37% | 39% | **19%** |
| **Current or former employee?** | Former | Current | **Current** |
| **Type of position** | Technical (e.g. sys admins or DBAs) | Non-tech, low-level positions with access to confidential or sensitive info (e.g. data entry, customer service) | **Technical (71%) - scientists, programmers, engineers**<br>**Sales (29%)** |
| **Gender** | Male | Fairly equally split between male and female | **Male** |

# Insider Theft of Intellectual Property - 2

| | IT Sabotage | Fraud | Theft of Intellectual Property |
|---|---|---|---|
| **Target** | Network, systems, or data | PII or Customer Information | **IP (trade secrets) – 71%**<br>**Customer Info – 33%** |
| **Access used** | Unauthorized | Authorized | **Authorized** |
| **When** | Outside normal working hours | During normal working hours | **During normal working hours** |
| **Where** | Remote access | At work | **At work** |
| **Recruited by outsiders** | None | ½ recruited for theft; less than 1/3 recruited for mod | **Less than 1/4** |
| **Collusion** | None | Mod: almost ½ colluded with another insider<br>Theft: 2/3 colluded with outsiders | **Almost ½ colluded with at least one insider; ½ acted alone** |

# Methods for Exfiltrating Information

- In order of prevalence
  - Copied/downloaded information
  - Emailed information
  - Accessed former employer’s system
  - Compromised account
  - Stole hardcopies
- Many other methods

# More Details on Exfiltration Methods

- Downloaded onto removable media at work, onto laptop from home, using ftp or telnet
- Emailed to competitor, to personal email account, to new employer, using anonymous remailer
- Created backup copy of hard drive
- Gave company laptop to competitor for copying before resignation
- Stored information on password-protected website at work
- Software and hardware keystroke loggers

# Monitoring Strategies for Insider Theft of Information

- Detection of data leakage
- Detection of unauthorized devices
- Monitoring for remote access attempts

***We've all heard this before….***

***There are lots of Data Leakage Prevention tools …***

***Then what's the problem???***

## Data Leakage

### *Problem:*

- Massive volume of data makes monitoring and alerting difficult
- Difficult to baseline normal behavior and configure tools to identify abnormal behavior
- Insiders tend to steal the same data they access in the course of the normal workday

# Data Leakage -2

## Solution Strategies:

- Learn from the MERIT models and from past cases
- Log, monitor, and audit system logs for queries, downloads, print jobs, email messages containing unusually large amounts of data, PII, and proprietary information
- Alert on emails to competitors, foreign locations, or personal email accounts
- Monitor network flow data for abnormally large file transfers, long connections, odd ports, illegal source/destination IP addresses, …
    - Then review pcap data to reconstruct content of transactions.
    - First need to measure the network baseline so “normal” baseline is defined, including who should be talking to whom

***Implement targeted monitoring of individuals who are “on the HR radar” or “on the way out the door”***

# Actual case examples

***Example#1:*** Use of FTP to exfiltrate customer credit card information

***Example#2:*** Use of email to exfiltrate trade secrets

***Example#3:*** Downloading proprietary information from a database

# Rogue Devices or Removable Media

## *Problem:*

- Organizations may not detect unauthorized devices connected to their networks
  - Peripherals, e.g. keyloggers, removable media, backup systems, modems
  - Network devices, e.g. rogue laptops, access points, mobile devices
- It can be difficult to distinguish between legitimate and illegitimate use of removable media
- Laptops are a common means of intentional data exfiltration

# Rogue Devices or Removable Media

## *Solution Strategies:*

- Audit logs for activity of resigning or terminating employees
  - Learn from the MERIT models and from past cases
  - Log all downloads to removable media
  - Alert when critical information is downloaded to removable media, e.g. intellectual property, customer information, PII
  - Log anytime a device or peripheral is attached; alert if unidentified device is attached, such as keystroke logger
  - Use monitoring tools on laptops that "phone home" when connected to the network
  - Consider prohibiting the use of personal devices for work-related activities

# Actual case examples

***Example#1:*** Proprietary source code copied to removable media

***Example#2:*** Terminating employee allows new employer to make copy of entire laptop just prior to resignation

***Example#3:*** Hardware keylogger used to steal confidential information from CEO

# Remote Access Attempts

## *Problem:*

- Privileged employees are able to create unknown access paths for access after termination
- Disabling all access paths for a terminating employee is a difficult task if constant account management practices are not followed.

## *Solution Strategies:*

- Learn from the MERIT model and from past cases
- Implement targeting monitoring of prior online activity of individuals who are “on the way out”
- Log, monitor, and audit for remote access from IP addresses from outside the U.S., from competitors’ networks, and from terminating or terminated employees

# Actual case examples

***Example#1:*** An employee was able to access a former employer's system because of a failure to detect / disable remote access software he had installed while employed.

***Example#2:*** A former employee was able to connect to the organization's network and exfiltrate information from a competitor's network (outside the U.S.)

# Application to your Organization

- Many organizations are able to log the majority of online activity

but

- Many organizations do not have the resources, including software, hardware, and people, to consistently audit and monitor all online transactions

# Application to your Organization

- The challenge to organizations is to use a combination of technical and non-technical potential indicators of malicious activity to identify individuals who may be more at risk of committing an insider crime

and then

- Apply the auditing and monitoring strategies outlined in this presentation

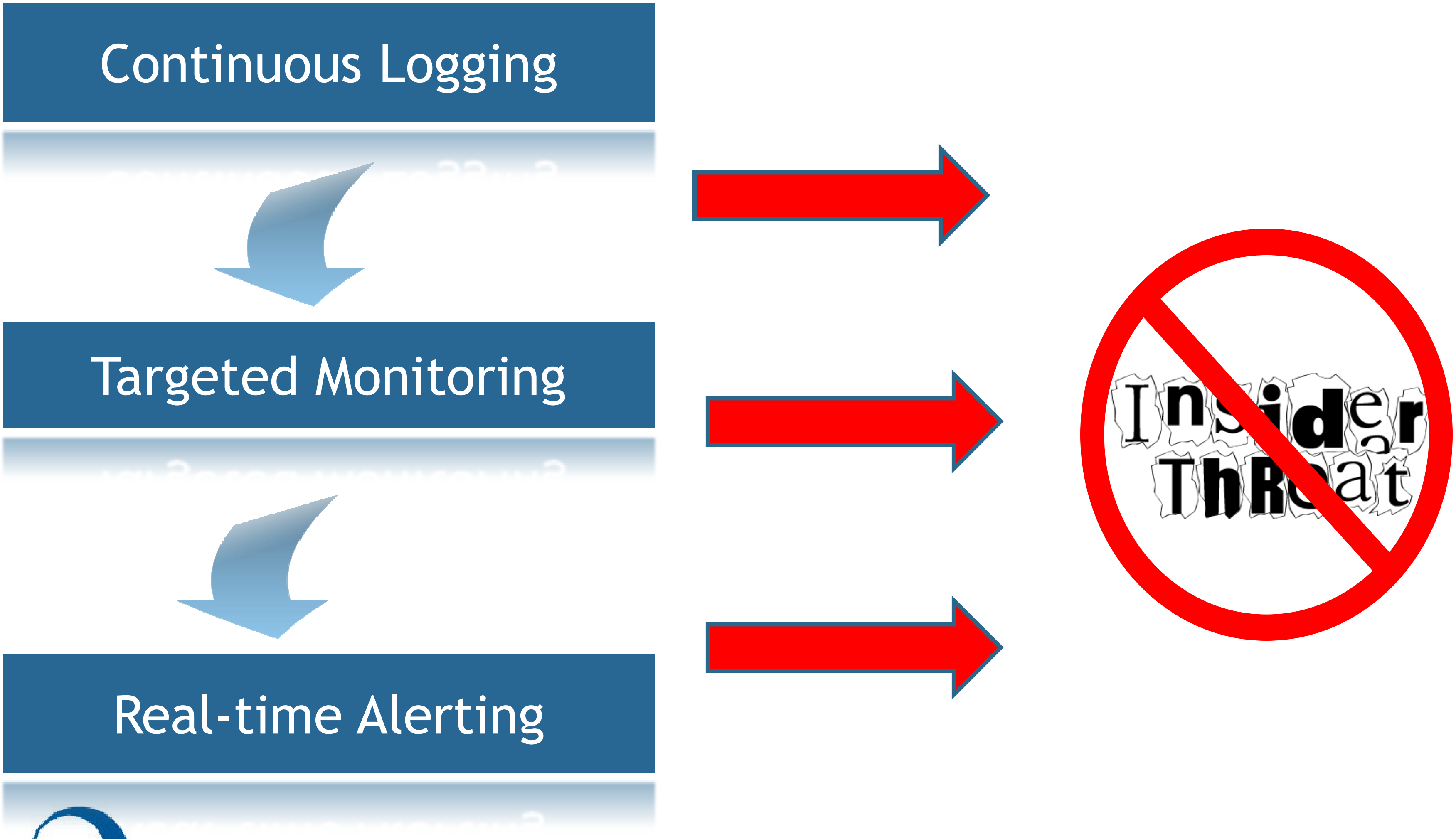
# Application to your Organization

- The good news is that most of the monitoring solutions suggested in this presentation can be implemented using existing tools, technologies, and staff
- But it does require new processes for communication between HR, IT, Information Security, Legal, Physical Security, management, … regarding employee issues
  - Employees on the HR radar
  - Employees who are about to be terminated, have resigned, have been laid off, …

# Final Thoughts

- Caveats:
  - We only have data on criminals
    - Our findings / recommendations could result in a high false positive rate
    - We would like to work with organizations that are willing to be pilot sites – please contact us!!
  - These monitoring techniques are not a guarantee
    - In the event of a missed insider attack, these methods will be tremendously beneficial for incident response and forensic analysis teams
  - Consider legal, privacy, and policy issues before implementing any employee monitoring  program
- Food for thought:
  - Which of the monitoring techniques we've presented might also be effective in detecting external intruders if they manage to gain access?
  - Could these controls be effective against both insiders and outsiders?

# Our Suggestion



Continuous Logging

Targeted Monitoring

Real-time Alerting

# Points of Contact

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http://www.cert.org/insider_threat/

Insider Threat