Labeled Full Packet/Flow Level Data Capture
Towards A Framework For Instrumenting Cyber Warfare Exercises
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Objective

- Design a framework that:
  - Accurately auto-labels and captures full packet / flow level data sets from different classes of cyber defense exercises
  - Produces data sets that are of value to the intrusion detection and or security community
Previous Work
DARPA IDEVAL DATA SETS

- **Pros**
  - Well-known, publicly-available data set for repeatable intrusion detection experimentation
  - Fairly rich emulation of live network traffic
  - Well-documented and well-controlled data sets

- **Cons**
  - The included threats and protocols are showing their age
  - Modest traffic rate and network size, discrete attack events
  - Statistical artifacts exploitable by anomaly detection

- **Note**
  - This work is not intended to replace the IDEVAL data sets, but to explore techniques to provide additional resources for researchers and developers
Approach

 Survey opportunity
  • What aspects of a data sets are of value to researchers

 Design framework
  • Objectives
  • Requirements

 Implement framework
  ○ USMA Internal Cadet Cyber Defense Exercise (March)
  ○ Inter-Service Academy CDX 2009 (April)

 Package and share data
 Analyze data
 Gather feedback
 Repeat
Variety of Cyber Defense/Offense Exercises

- The framework must be robust enough, and generic enough, to ensure that it can be applied to most CND/CNO exercise
  - Inter-military service Cyber Defense Exercise (Defend only)
  - DEFCON Capture The Flag (Attack Only)
  - Colligate Cyber Defense Exercise (Defend Only)
  - Intra-USMA Cadet Cyber Warfare Exercise (Mixed)
Design Framework

Objectives (What do we want out of our data captures)

- Recorded traffic from multiple sensor locations
- Attack event labeling
- Network, host and service status information
- Exercise reports
- Network and host configuration change log
- Host-base LOGS
- Exercise IDS Alert DB or logs
Design Framework

- Requirements (what do we need in order to meet our objectives)
  - Complete recordings of traffic at sensor locations
  - Accurate description, source, destination and timing of Red Cell attack events
  - Recording of network, host and service status
Abstract Network Design

- Placement of network ‘taps’ is critical when evaluating the type and amount of data captured
  - Are we only interested in the attacks?
  - Are we interested in the attacks and resulting traffic?
  - Are we interested in flow patterns without regard to type of traffic?
Limitations and Concerns

- One of the biggest concerns is to not impact the exercise/game in any way
  - Need to have the monitoring boxes and network config completely invisible to the participants
  - Limited number of monitoring boxes means that there may be data loss from unmonitored portions of the network
  - Human recording is needed to know exactly what malicious events were occurring at what times
    - We cannot guarantee that every event will be recorded
Network Design – CDX 2008 Example

- VPN
- Border Router
- Internet
- Network Data Capture Tap
- VLAN-X
  - DMZ Server
- VLAN-Y
  - DMZ Server
- VLAN-Z
  - LAN Traffic Generators (count 3)
  - End User Workstations
Software Implementation

- Network taps (capturing boxes) will be running FreeBSD 7.1
  - Will be using tcpdump with the capturing interface in promiscuous mode to dump traffic directly to 1 Gigabyte files
  - Will capture during the entire exercise
Hardware Implementation

- 4 Data Capture Nodes:
  - Dual-CPU (Intel Xeon 2.33 GHz)
  - 24 GB RAM (DDR2-667)
  - 1.5 TB RAID-5
- Will be at the listening end of a one-way Ethernet cable
- That Ethernet cable will be plugged into a spanned port on a Cisco switch to allow monitoring of all traffic in all VLANs
Future Work

 Package and share data
 Community analysis
 Gather feedback
 Adjust Framework according to feedback
 Repeat
Conclusion

- Need for revitalized IDEVAL data sets
- A number of existing opportunities to capture data
- Proposed framework to capture and label relevant Data
- Infuse into existing IDEVAL data sets