Safely Sharing Data Between CSIRTs:
The SCRUB* Security Anonymization Tool Infrastructure

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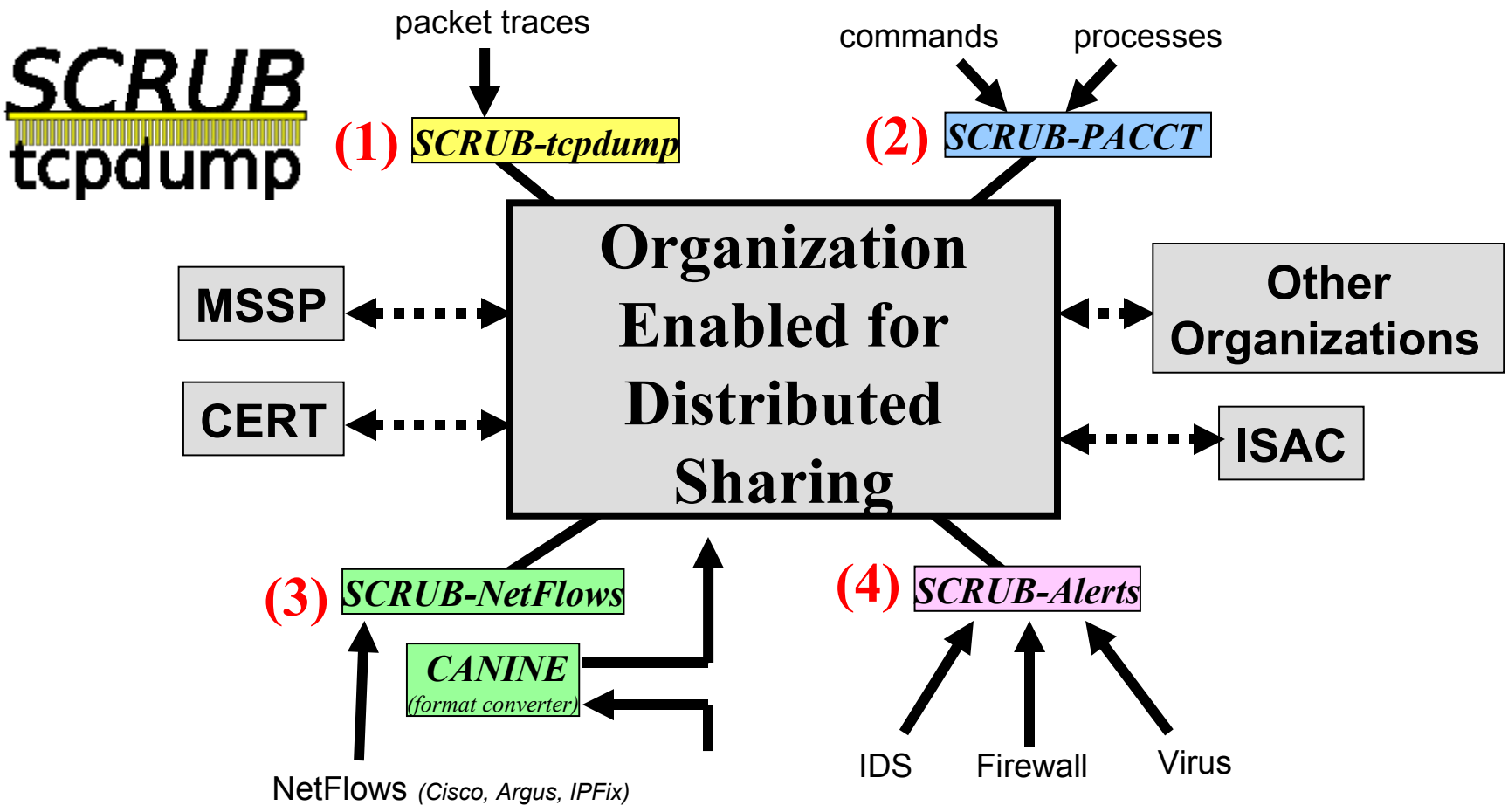
The SCRUB* Architecture



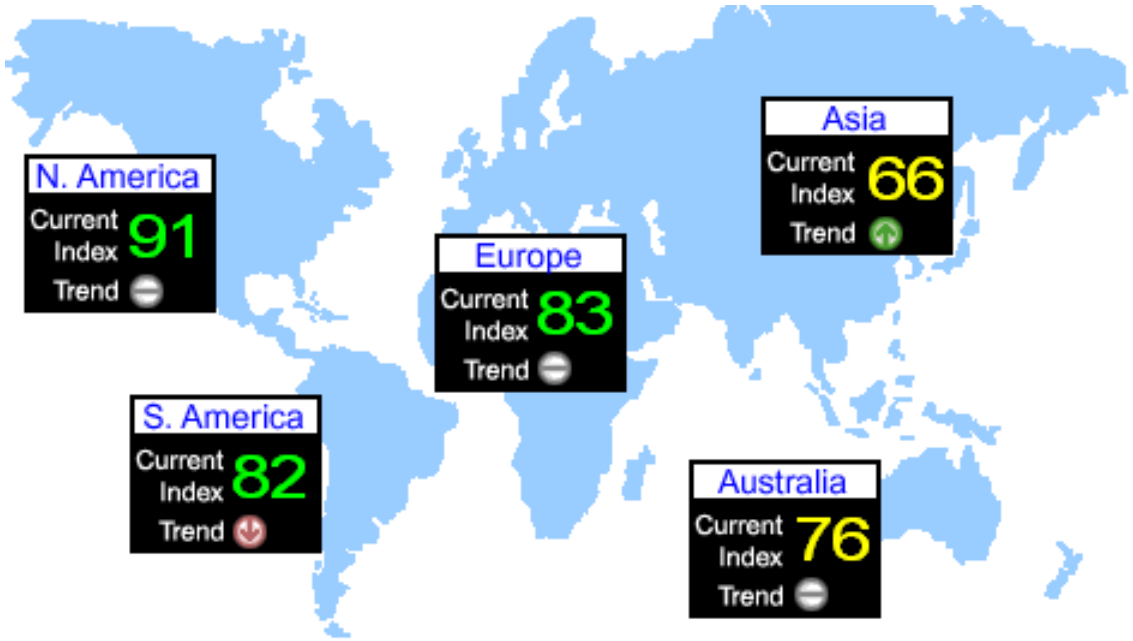
*SCRUB** Motivation
Why Should We Share Security Data?

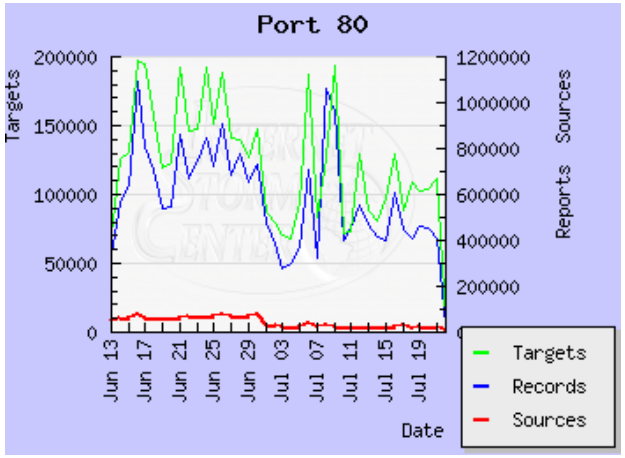
- **Event correlation across administrative domains is needed based on shared data**
  - **We cannot continue to stop attacks at organizational borders, we need to cooperate with law enforcement and each other.**
  - **Chasing attackers away to other organizations does not improve security**
- **Need to share security data between organizations in order to**
  - **Detect attacks**
  - **Blacklist attackers and attacker techniques**
  - **Distinguishing normal versus suspicious network traffic patterns**

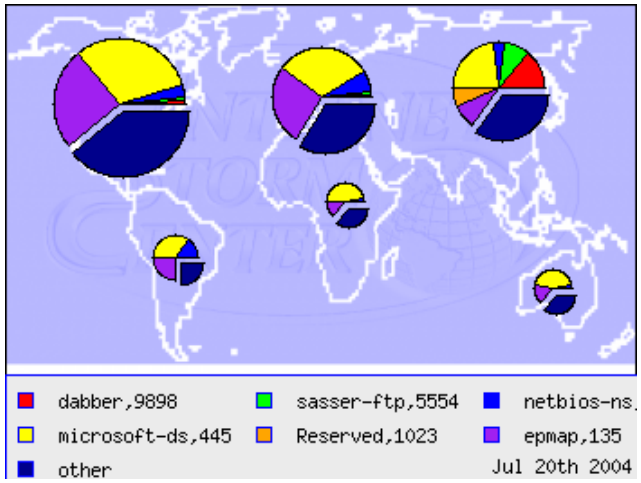
SANS

INTERNET TRAFFIC REPORT

Last update (MST):
7/21/2004 20:20
Global Index 85
Trend







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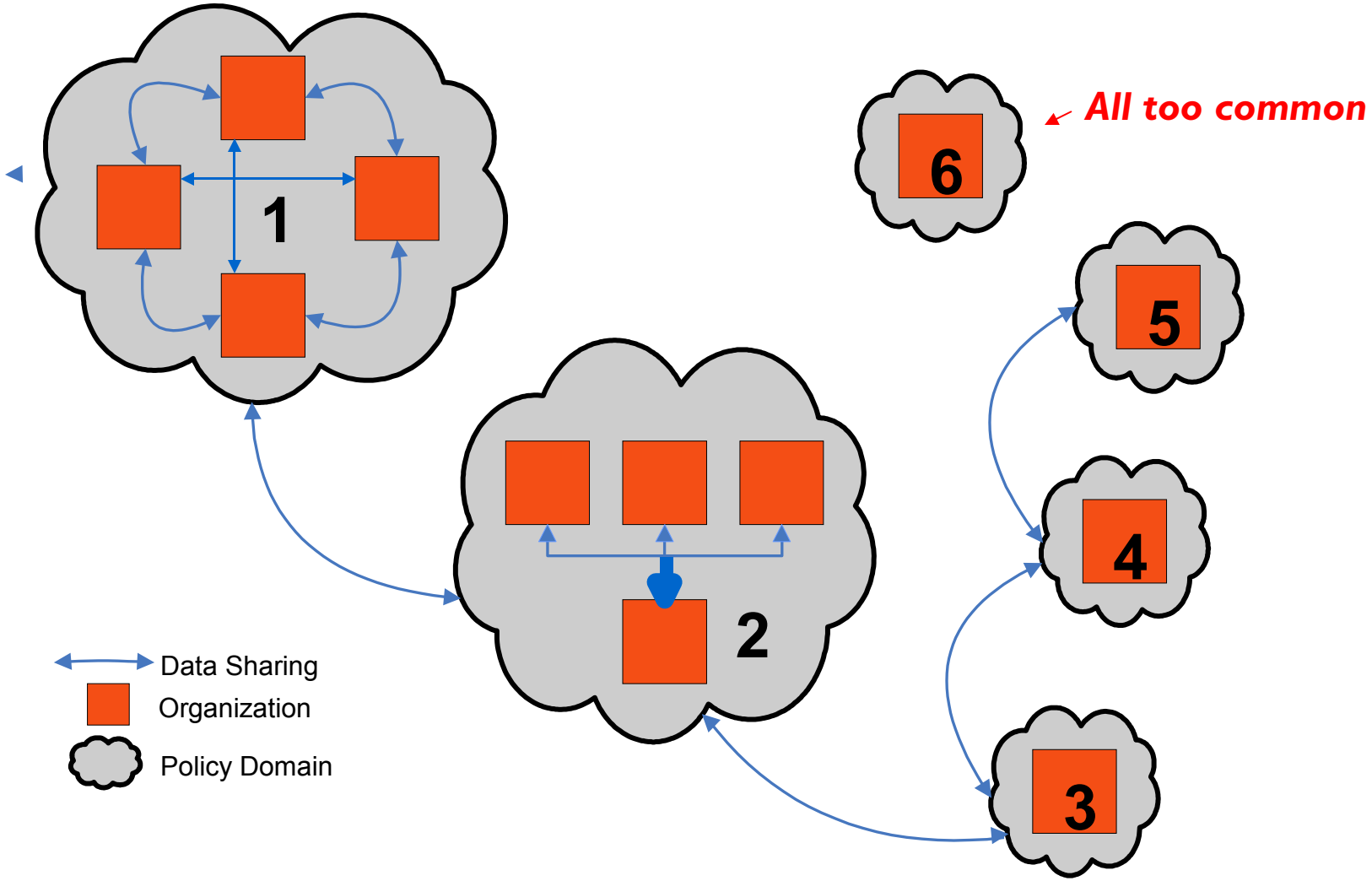
State-of-the-Art in Security Data Sharing



For Safe Data Sharing: Two Types of Data To Protect

- **Private Data**
  - User-identifiable information
    - user content (Email messages, URLs)
    - user behavior (access patterns, application usage)
  - Machine/Interface addresses
    - IP and MAC addresses
- **Sensitive Data**
  - System configurations (services, topology, routing)
  - Traffic patterns (connections, mix, volume)
  - Security defenses (firewalls, IDS, routers)
  - Attack impacts

*SCRUB** TOOL 1:

- Anonymizes packet traces
  - packet traces can contain the most private/sensitive data
  - packet traces are the authoritative raw security source
- Leverage a popular existing tool – *tcpdump*
- Anonymizes any/all packet fields (12)
- Each field has multiple anonymization options
  - none/low/medium/high levels of protection for protecting the same data field

*SCRUB** TOOL 2: *SCRUB-PACCT*

- Anonymizes proccess accounting logs
  - process accounting records contain user IDs and user command behavior
  - process accounting records contain precise timing information for event correlation between systems
- Anonymizes any/all process accounting fields (16)
- Each field has multiple anonymization options
  - none/low/medium/high levels of protection for protecting the same data field

*SCRUB** TOOL 3: *SCRUB-NetFlows*

- Anonymizes NetFlow logs
  - NetFlows logs efficiently aggregate packet traffic by connections
  - Most commonly shared security data
- Anonymizes any/all NetFlow fields (5)
- Each field has multiple anonymization options
    - none/low/medium/high levels of protection for protecting the same data field

*SCRUB** Fields of Interest Between Data Sources

1. **Transport Protocol Number**
   - data sources: packet, NetFlows, alerts
2. **IP Address**
   - data sources: packet, NetFlows, alerts
3. **Ports**
   - data sources: packet, NetFlows, alerts
4. **Payload**
   - data sources: packet, alerts
5. **Timestamp**
   - data sources: packet, process accounting, NetFlows, alerts

Multi-Level Anonymization Options

- Black Marker (filtering/deletion)
- Pure Randomization (replacement)
- Keyed Randomization (replacement)
- Annihilation/Truncation (time, accuracy reduction)
- Prefix-Preserving Pseudonymization (IP address)
- Grouping (accuracy reduction)
  - Bilateral Classification
- Enumeration (time, adding noise)
- Time Shift (time, adding noise)

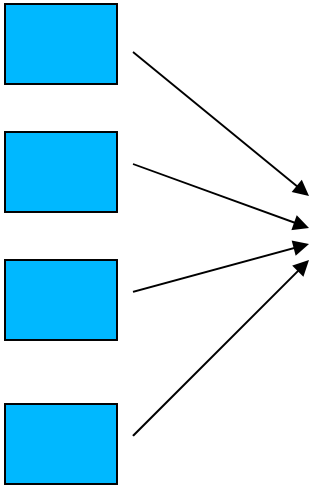
A Problem with Anonymization for Sharing: Privacy vs. Analysis Tradeoffs

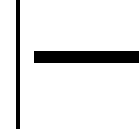
while anonymization protects against information leakage it also destroys data needed for security analysis

- Zero-Sum? (more privacy <> less analysis & vice versa)
- to date, no quantitative measurements of how useful anonymized data is for security analysis

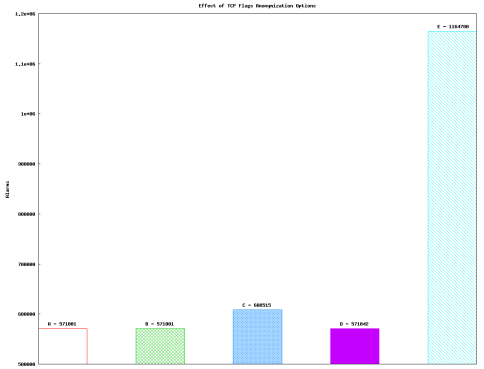
Empirically Measuring Anonymization Privacy/Analysis Tradeoffs

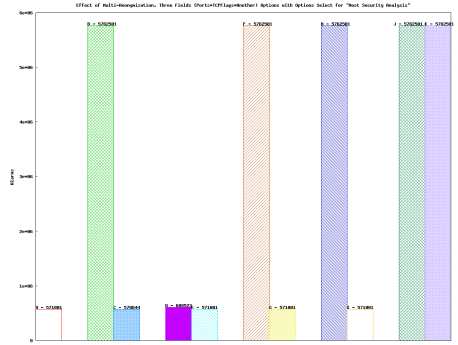
- Series of experiments to test effects of different anonymizations options
- Use snort IDS alarms as a metric for security analysis





alarms





Data Set

Summary

- There is a critical need for security data sharing between organizations
- Anonymization can provide safe data sharing
  - Multi-Field: prevent information leakage
  - Multi-Level: no one-size-fits-all anonymization solution
- A practical data sharing infrastructure is needed which supports multiple data sources
  - *SCRUB** tool suite for packet traces, process accounting, NetFlows, alerts
- Privacy/analysis anonymization tradeoffs can be characterized
  - Zero-Sum tradeoff? (not always, more complex than this)
  - Multi-Level anonymization options can/should be tailored to requirements of sharing parties to optimize tradeoffs
  - More tradeoff measurements are in progress

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