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Cybersecurity Intelligence Gathering, Sharing and Reacting

SAC-PA2

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SDAIA

ScienceDMZ Actionable Intelligence Appliance

SDAIA: NSF Award

- CICI: Secure Data Architecture: Shared Intelligence Platform for Protecting our National Cyberinfrastructure
- ACI:1547249; Principal Investigator: Alex Withers
- December 1 2015 – November 2018(estimated)
- Joint project between **NCSA**: Alex Withers(PI), Adam Slagell(Co-PI), Justin Azoff, Linh Cao, and **PSC**: Jim Marsteller(Co-PI), Shane Filus
- Development assistance from Wes Young, REN-ISAC

Project Goals - overview

- What is the SDAIA?
  - **ScienceDMZ Actionable Intelligence Appliance**
    - A virtual security appliance that will significantly enhance the security posture of open science networks.
  - Scalable, near real-time dissemination of threat intelligence.
  - Decentralized peer-to-peer model.
  - Collects and shares data, analyzes data in aggregate and creates new intelligence feeds.
  - Threats seen in multiple locations can provide sites an edge in threat detection.
  - Easy to deploy - large ROI for sites with limited security resources.

Project Goals – requirements/specifications

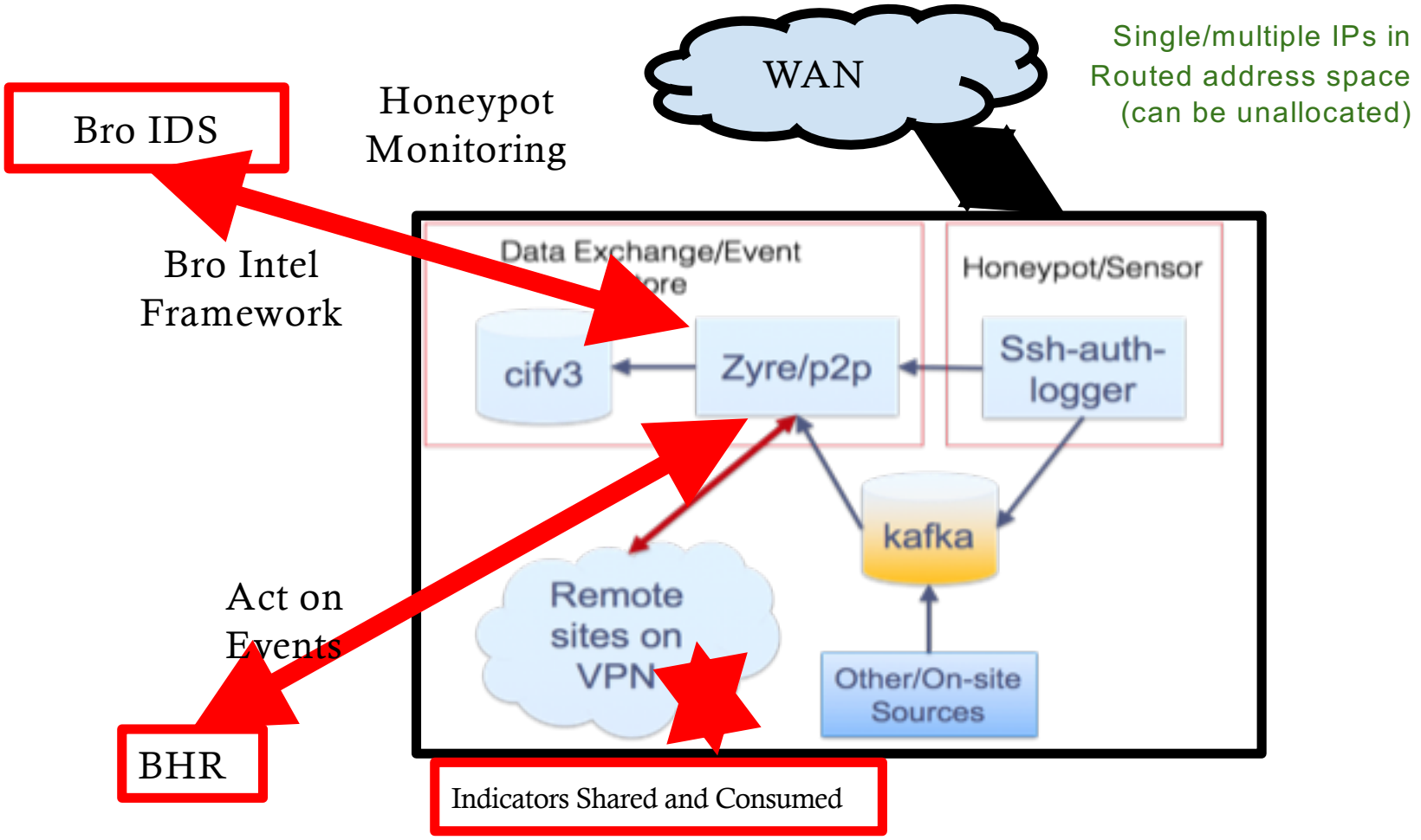
- Appliance will be easy to deploy
  - Will not require specialized networking equipment (i.e. inline taps)
  - Distributed as ansible scripts that create and setup the appliance on any routable network(VM/bare metal).
- Uses “honeypots” to attract attacks and mimic available resources like ssh, http(s), gridftp, etc
- Instrumented with sensors to collect data(i.e. bro).
- Data is securely shared with other sites - can create multiple mesh networks.
- Take active measures if desired
  - Interface with a Black Hole Router, firewall, email alerts, etc
- Share data with other sites!
  - The more data that’s collected, the better the analysis and confidence on shared indicators.
  - Confidence levels on indicators can mean more meaningful action.

Appliance Architecture

Workflow

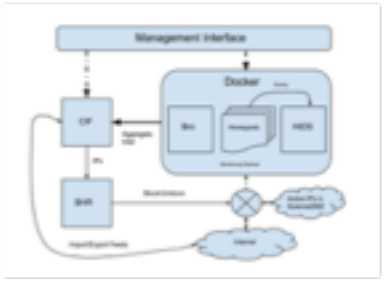
- ssh-auth-logger and Bro IDS collect indicators from SSH authentication attempts and network scans.
- Event logs are parsed and indicators are loaded into local CIF instance.
- Indicators are shared with other sites over a secure p2p network: can also be used for local policy enforcement (BHR, firewall rules, email alerts, etc).
- Indicators are also ingested from other sites: optional placement of indicators into local Bro Intel Framework or BHR.

Appliance Architecture



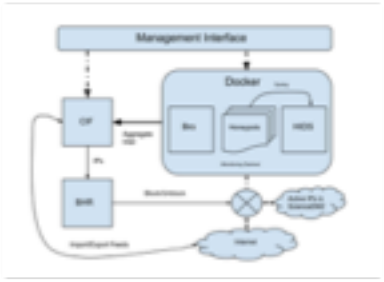
Appliance in action

SSH brute force attempt:
srcip 1.1.1.1
<login name list>



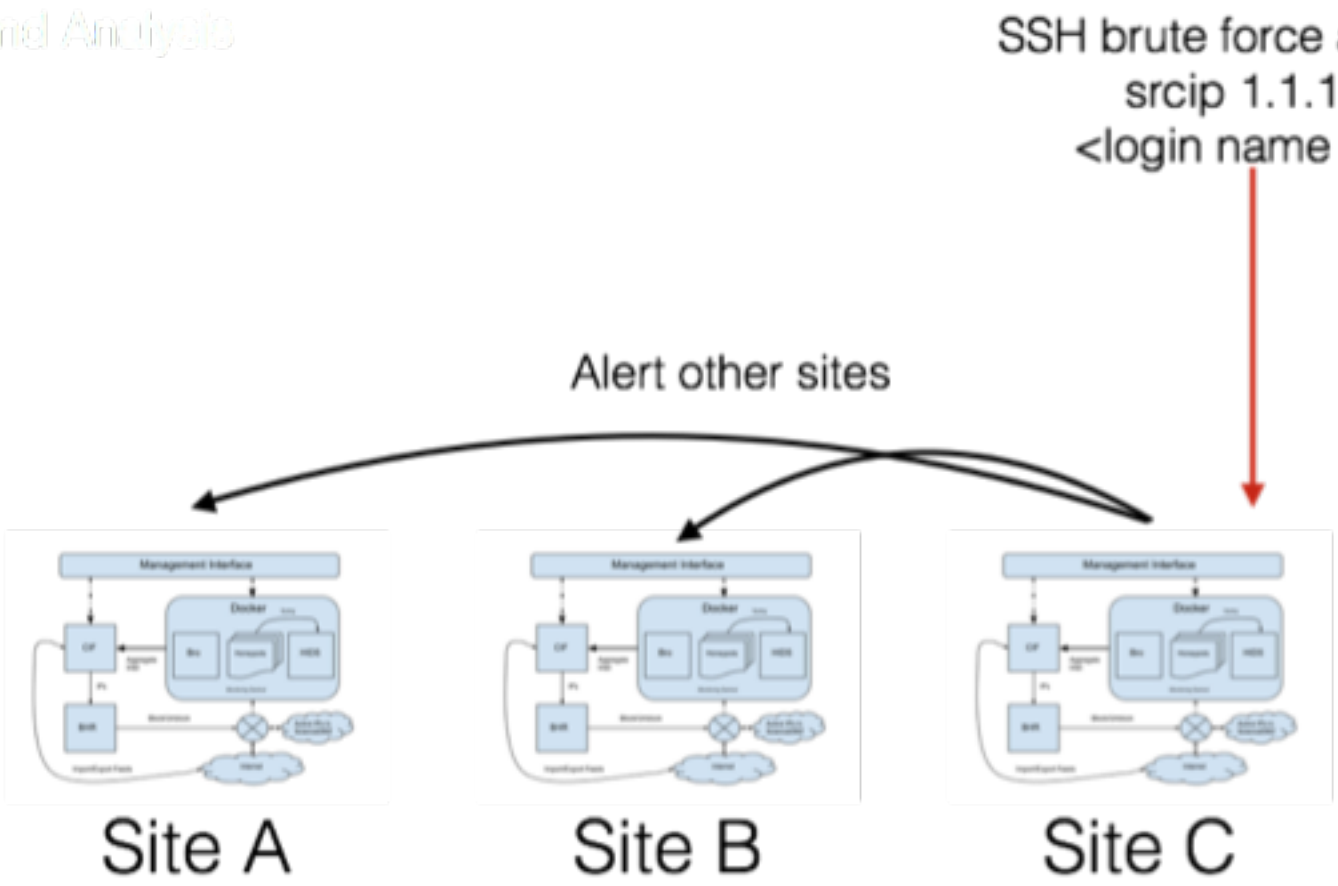
Site A

Site B



Site C

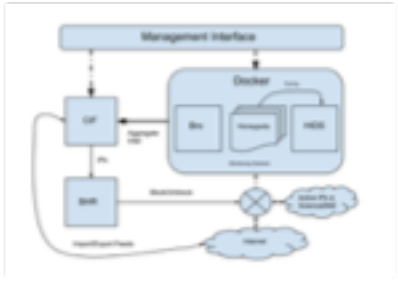
Appliance in action



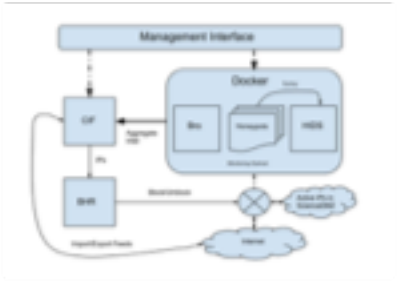
Appliance in action

SSH brute force attempt:
srcip 2.2.2.2
<login name list>

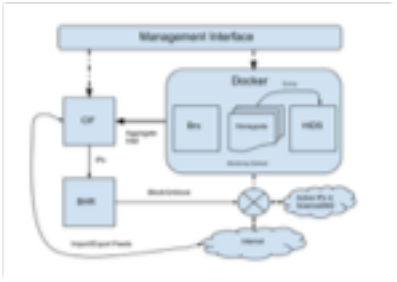
SSH brute force attempt:
srcip 1.1.1.1
<login name list>



Site A



Site B



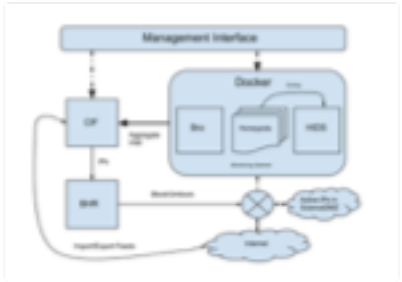
Site C

Appliance in action

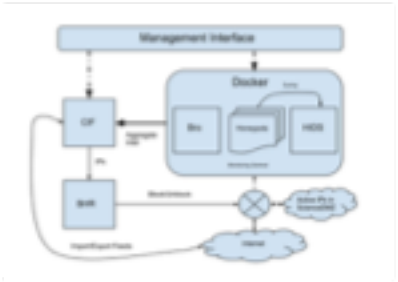
SSH brute force attempt:
srcip 2.2.2.2
<login name list>

SSH brute force attempt:
srcip 1.1.1.1
<login name list>

login name list identical



Site A



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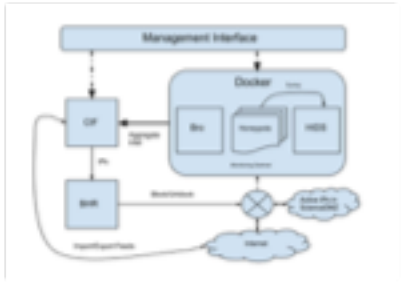
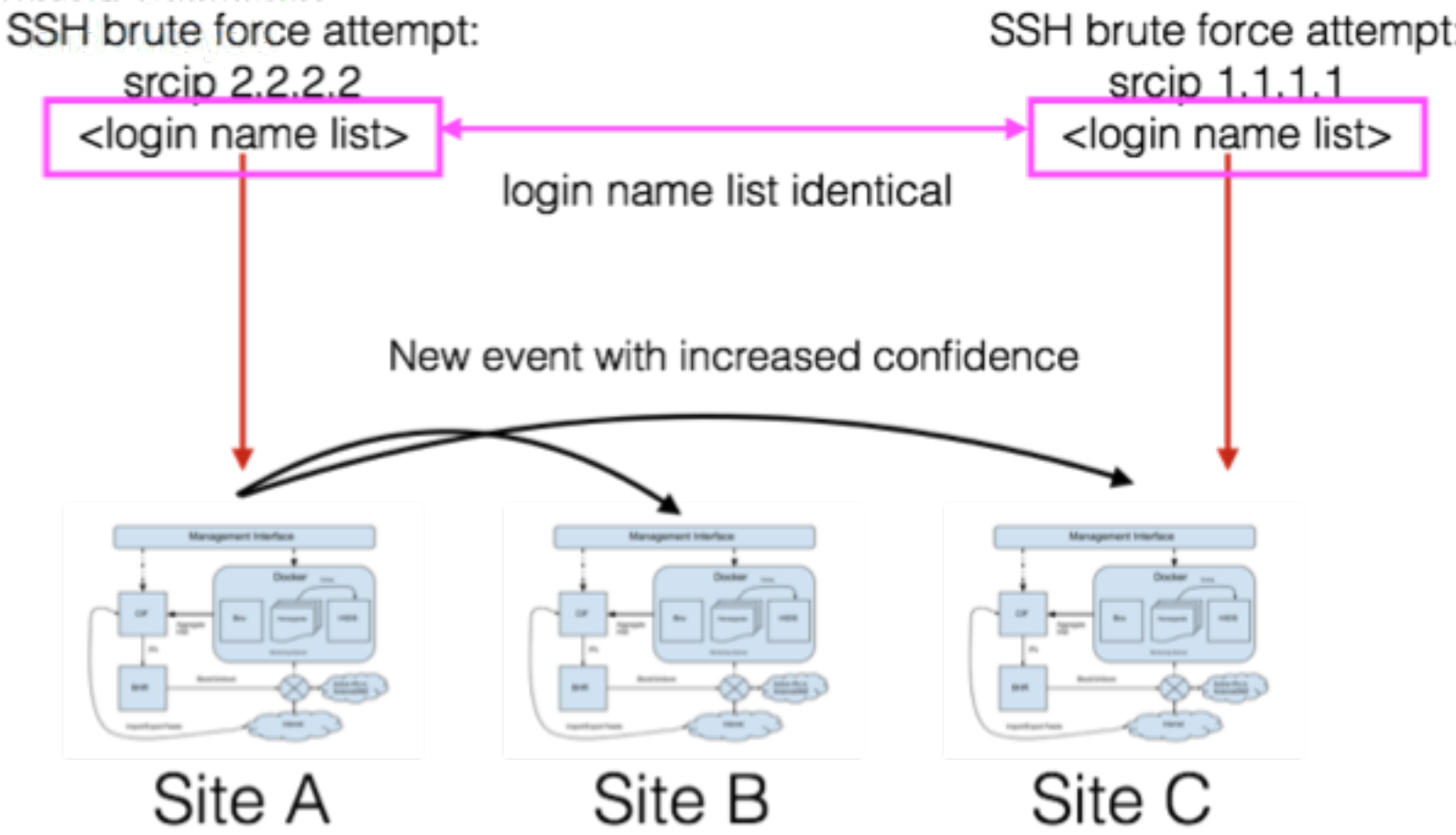


Site C

Appliance in action



Appliance Components

- ssh-auth-logger
  - Low interaction SSH honeypot written in Go.
  - Collects: src ip, username, password/pubkey, ssh version.
- Zyre (zeromq+p2p)
  - Very fast p2p 1:N message passing.
- Disco
  - Simple service discovery for key exchange and gossip
- CIFv3
  - Stores indicators/events.
- Apache Kafka
  - Message/event passing queue for extensibility.
- Bro IDS
  - Monitors network traffic going into honeypot.
  - Monitors and alerts on indicators seen at other sites.

Currently working

- Easy install
  - CentOS 7 fixes not in main distro(sdaia-xsede fork))
- SSH honeypot (ssh-auth-logger)
- p2p mesh/service discovery
  - Message passing between clients
  - Roll-your-own mesh
- Bro
  - Detects scans, uses indicators from mesh in Intel Framework
- CIFv3
  - Stores indicators seen locally and via mesh
- Simple scripts to pull indicators out of zyre/mesh
  - Create bro intel files

In Development

- Kafka
  - Brings data together from other appliance components
  - Allows sites to read out data collected into custom ingest systems (i.e. Splunk/ELK).
  - Allows sites to write out data from other sensors and systems for sharing (i.e. BHR events).
- Bro sensor
  - Create intel events from detected port/address scans, etc
- Other honeypots for commonly used/SDMZ servies
  - Web auth, smtp, ftp, gridftp
- Usability/Integration
  - Make it easy to deploy, configure, and tie into site's existing infrastructure.
  - Building tools to adapt attack correlations across sites and assign appropriate confidence levels

Where is this being tested?

- Duke U
- NCSA
- PSC
- Lehigh U (testing)
- U of Illinois Urbana-Champaign (campus network)
- XSEDE (testing/development)

Additional Information/Links

- SDAIA Main Page
  - https://wiki.ncsa.illinois.edu/display/cybersec/SDAIA
- SDAIA github page
  - https://git.ncsa.illinois.edu/awithers/sdaia
- SDAIAkeys – pubkeys/scripts
  - https://github.com/ncsa/sdaiakeys
- XSEDE SDAIA fork
  - https://github.com/filusATpsc/sdaia-xsede

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Additional Tools

Additional Tools/Resources

- Collective Intelligence Framework - https://csirtgadgets.com/collective-intelligence-framework/
  - "CIF helps you to parse, normalize, store, post process, query, share and produce data sets of threat intelligence."
- Malware Information Sharing Platform(MISP) – https://www.misp-project.org
  - "A threat intelligence platform for sharing, storing and correlating Indicators of Compromise of targeted attacks, threat intelligence, financial fraud information, vulnerability information or even counter-terrorism information."
- Critical Stack – https://intel.criticalstack.com
  - Build custom intel lists from various public feeds
- CTI-Toolkit – https://cti-toolkit.readthedocs.io/en/latest/
  - Convert between intel formats
- Ssh-auditor - https://github.com/ncsa/ssh-auditor
  - Scan for weak SSH passwords on your network
- US-CERT Announcements - https://www.us-cert.gov
  - Release IOCs for current threats
- REN-ISAC – https://www.ren-isac.net
  - SES(curtailed public and private member intel), Passive DNS, Daily Watch Report