The Cybersecurity Ecosystem and the YAKSHA Platform

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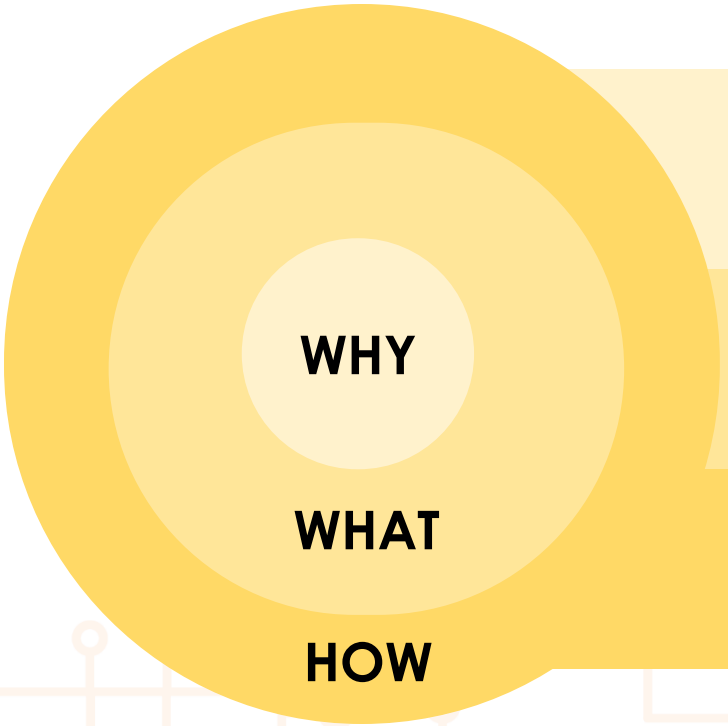
The Concept



YAKSHA Motivation

Develop and implement a software toolkit to improve Cybersecurity of organisations in the ASEAN region

YAKSHA Results

Enhance cybersecurity readiness levels for its end users, help better prevent cyber-attacks, reduce cyber risks and better govern the whole cybersecurity process.

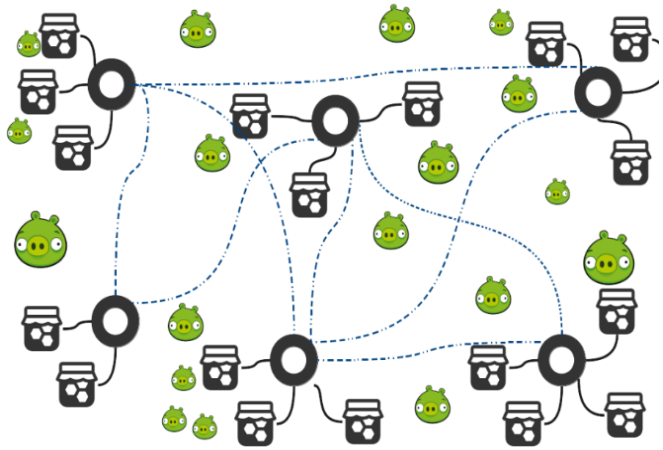
Process & Strategy

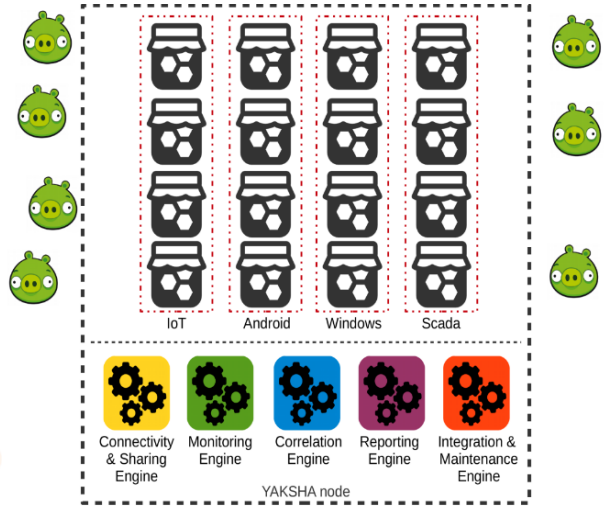
Focus on adapting & integrating other domain technologies into innovative solutions

YAKSHA Concept

YAKSHA is a platform which allows the **automated deployment of honeypots, data collection and analysis** as well as reporting and information sharing with affiliated YAKSHA installations.

YAKSHA enables organisations, companies and government agencies to **deploy custom honeypots** meeting their own **specifications, monitor attacks in real time and analyse them**.





YAKSHA

Use Case and Pilot Project

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VietjetAir.com

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UTeM

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YAKSHA offer structure

YAKSHA will be offered as a flexibly packaged cloud service for cybersecurity enhancement. The end users will be able to deploy one or more YAKSHA nodes,

The price structure of the service will be fee-based, with options for (at least) monthly and annual recurring fees. The exploitation task will explore a range of fee structures, including freemium models. Feedback from end-user workshops will be considered as input in developing the final business plan. Differentiation between free and paid services has also been discussed

YAKSHA Architecture Traits

- **Distributed**: The architecture is inherently distributed. YAKSHA makes possible to deploy easily and cost-effectively hundreds of honeypots through its interconnected nodes. The distributed nature of the YAKSHA system allows also to leverage information and knowledge gathered by nodes outside of one's organisation, improving its readiness and defensive capabilities.

- **Modular**: It allows both opportunistic and continuous sample collection, as well as selective information sharing with other entities when necessary. Users can upload custom honeypots, monitor attacks in real time and analyse them

- **Scalable**: It is easy to scale up installations by adding nodes to the network, up to national and international scale.

YAKSHA Architecture Traits

- **Systems and Tools:** YAKSHA will provide hooks for IoT devices, Android and SCADA systems, as well as regular Windows and Linux. In addition, YAKSHA provides machine learning tools and AI algorithms that can detect malware more accurately, correlate the information with other samples, and extract attack vectors and patterns.

- **Automation**: the platform allows the automated creation of nodes and honeypots deployment, data collection and analysis as well as reporting and information sharing with affiliated YAKSHA installations.

- **Policies**: since honeypots may expose stakeholder's specific vulnerabilities, each YAKSHA node has the capability of specifying policies for information sharing: the ability to limit the sharing of information outside a single organisation (if the user choses to), as well as anonymization and data protection by default.

YAKSHA

YAKSHA Prototype

YAKSHA is a Honeypots management environment

The definition

a machine deliberately designed to provide a wide attack surface and made vulnerable to lure adversaries to attack it.

Strictly monitored in order to collect all interactions made with it

YAKSHA aims to distil real (threat) intelligenze from the raw data.

YAKSHA Prototype

Two kinds of machines are hosted by the platform. The machines which are used as honeypots are machines which will be used by end-user

1 – VMs to be used as models for custom Honeypots (Windows, Linux, Android, IoT, SCADA)

2 – VMs used for analysis of binaries collected from the honeypots. Not directly accessible to users, but managed by the platform.

YAKSHA Prototype

Implemented

- configure and develop sandbox environments for malware trapping
- monitoring tools for malware actions (including monitoring mechanisms for SCADA, IoT and ICS platforms)
- automation of procedures to deploy honeypots
- development of the database which stores all the collected information
- manage users and roles for each node

Honeypots Machines

Environments: MS Windows, Linux , IoT, SCADA

Conpot for emulating SCADA and IoT

Automated management via custom vagrant scripts developed by YAKSHA.

- start / halt / suspend / delete
- customization of the model VMs to suit the use case

Management of the included the implementation of two distinct web-services, a traditional SOAP-based that uses XML, and another REST-ful API that uses JSON requests and responses. This layer automates the activities relating to single VMs and allows for scalability.

Infrastructure machines

Constituents of the backend data analysis module: extract information (features), build malware datasets and learn. Cuckoo is one of the elements chosen for this task.

The management/admin system:

User-friendly graphical web interface (Angular) that allows for a variety of workflows focused on creating, configuring, maintaining and destroying a virtual machines. Furthermore, our customized design involves operating and managing computing resources from multiple hosts (including remote or geographically dispersed hosts), while user details and quotas are managed by the YAKSHA admin users with special privileges.

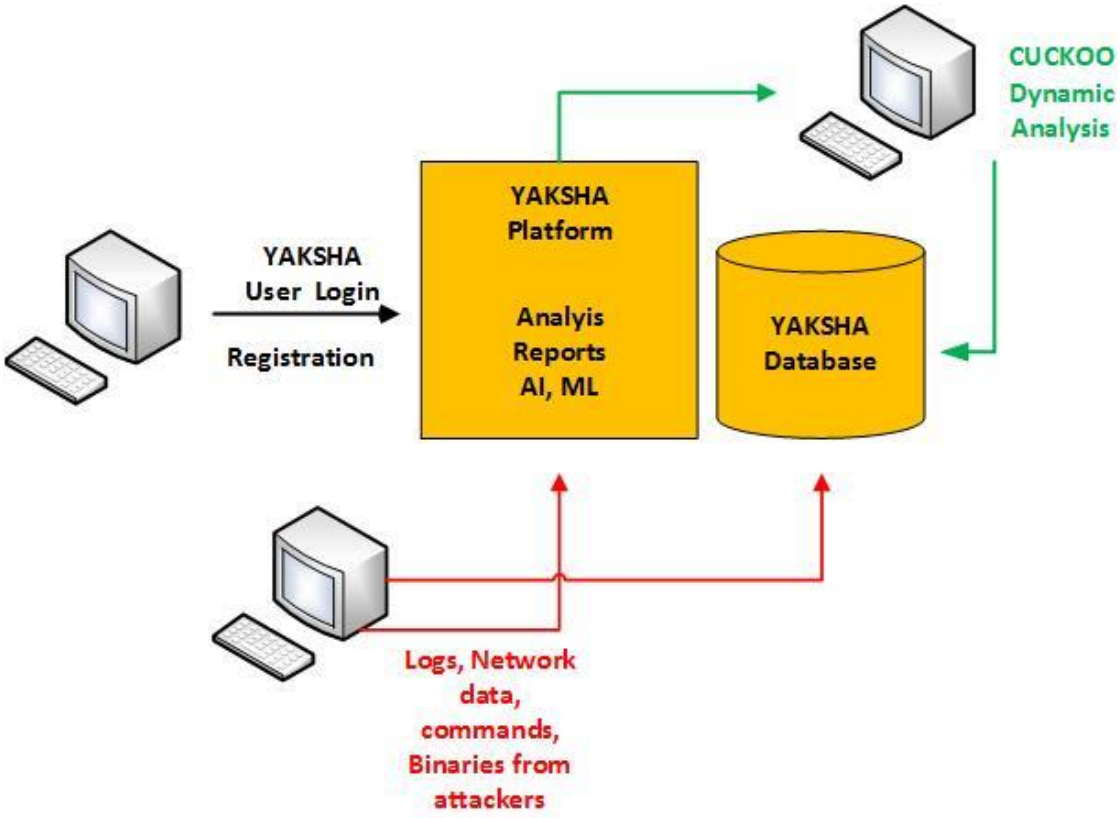
Data collected

Honeypots VMs are preconfigured to log all traffic, user commands, and filesystem changes in order to collect all the necessary evidence of an attack (forensics preparedness). This information is forwarded to the YAKSHA server and stored in the database.

The data management of YAKSHA is based on two underlying databases, one relational and one NoSQL.

- user related data, policies, reports, VM-related information etc. is stored in a relational database, while
- collected malware data is stored in a NoSQL system (MongoDB)

YAKSHA Prototype



References

FOSS Projects leveraged by YAKSHA

- UBUNTU 16.04 as the OS to host hypervisor provider
- KVM/QEMU as platform hypervisor provider (https://www.linux-kvm.org/)
- CUCKOO as sandbox (https://cuckoosandbox.org/) It was chosen based on its characteristics – it is a sandbox environment which also works on docker. Android sandbox and honeypot environments have been implemented through cuckoo.
    - Cuckoo does not support SCADA and IoT environments hence partners developed the necessary VMs for SCADA / IOT honeypots, collecting data and integration with above installations has taken place through a web service (REST API) supporting Linux, Windows and Android operating systems
- Vagrant (https://www.vagrantup.com/)
- Virtual Box as internal virtualization platform for honey pots VMs (https://www.virtualbox.org)
    - Connecting users to these virtual machines is allowed through SSH (Linux) and WinRM (Windows) and Android so that the end users can remotely install the necessary software that they want and customize their honeypot according to their needs is in progress.
- cloudstack to manage Infrastructure (https://cloudstack.apache.org)
- The YAKSHA database is developed on MongoDB and PostgreSQL is the repository for users data (roles etc) and extracted data from malware + reports generated
- OSSEC (https://www.ossec.net/)
- Fabric (http://www.fabfile.org/)
- Conpot (http://conpot.org/)
- Logstash (https://www.elastic.co/products/logstash)
- Elasticsearch (https://www.elastic.co/products/elasticsearch)
- Kibana (https://www.elastic.co/products/kibana)

Security of YAKSHA honeypots

Not surprisingly, malware authors have started designing malware to detect whether it is been executed in a VM or sandbox (anti-security and anti-forensics)

To facilitate the management and communication to VM manager (VMM), **virtualized systems leave some artifacts in guest OS**. These artifacts include among others processes, registry keys and values, loaded and exported DLLs (Win).

In order to harden the virtual machines YAKSHA hides their existence as far as possible by properly configuring the model machines.

Our virtual machines apply state-of-the art methods to prevent fingerprinting and identification from an adversary.

Automated static analysis

The system identifies the category any file belongs to, and implements the most relevant or appropriate static analysis method.

Feature extraction: the system perform this task on the collected malware in order to use them afterwards in the ML/Analysis models.

Features include **static** ones, which may include the existence of specific code snippets, packers, hardcoded strings and URLs and **dynamic** ones, such us URLs, registry changes, filesystem changes etc.

Automated static analysis

- The data collection methodology established a baseline of activities that leads to determining **what data YAKSHA collects** regarding remote interactions and malware analysis, what assumptions, limitations and **legal ground** are relevant, **what methods and tools to adopt** for data collection, and what reference architecture design is suitable for YAKSHA data collection, management and processing.

YAKSHA NETWORKING EVENT

- When: November/December 2019
- Where: Hanoi, VN
- How Long: Two days

First Day: Public Conference

- Opportunities for speaking (supported by the project)

Second Day: Ambassadors' day

- In-depth technical training and seminar
- Live, hands-on demonstration of the platform
- In the second-half of the day, open discussion with the ambassadors' community
  - Feedback on the platform / solution – Tech & features, Commercialisation
  - Future of the ambassadors' community

AMBASSADORS' DISCUSSION

- Status of the development
- Pilot projects: scheduled and volunteers
- Ambassadors' expectations from the project and from the community
  - Now
  - Long term:
    - Commercial partnerships
    - Technical partnerships
    - YAKSHA certification
    - Region-specific threat intelligence exploitation
- End user event: interest in being part of one of the panels or speak?

Thanks for Your Time

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YAKSHA

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