I·C·S
The Institute for Cyber Security

C·SPECC
Center for Security and Privacy Enhanced Cloud Computing

Institute for Cyber Security Overview

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October 2019

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World-Leading Research with Real-World Impact!

UTSA Computer Science

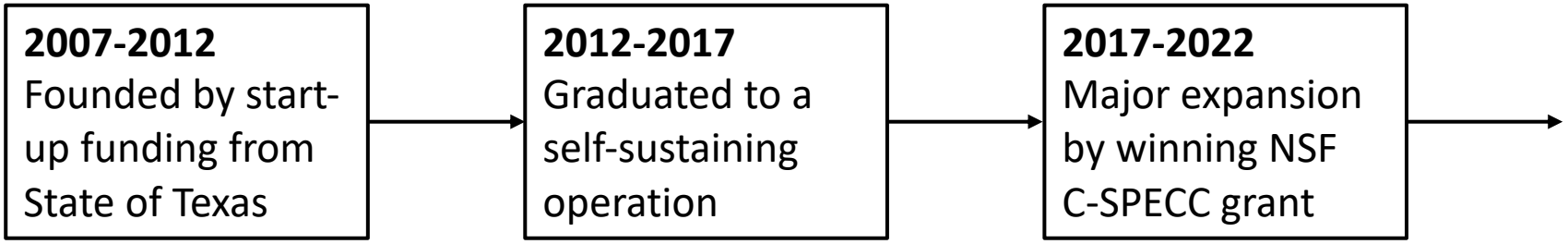
ICS Mission and History

I·C·S The Institute for Cyber Security

C·SPECC Center for Security and Privacy Enhanced Cloud Computing

MISSION

Excellence in graduate-level sponsored research



- **FlexCloud & FlexFarm**
  World class research laboratories
- Sustained production of PhD graduates and sponsored research

In collaboration with:
College of Engineering
College of Business
College of Education
Open Cloud Institute
Cyber Center for Security & Analytics

Partnership with 4 NISD High Schools:
Harlan, Woodson, Taft, Business Careers

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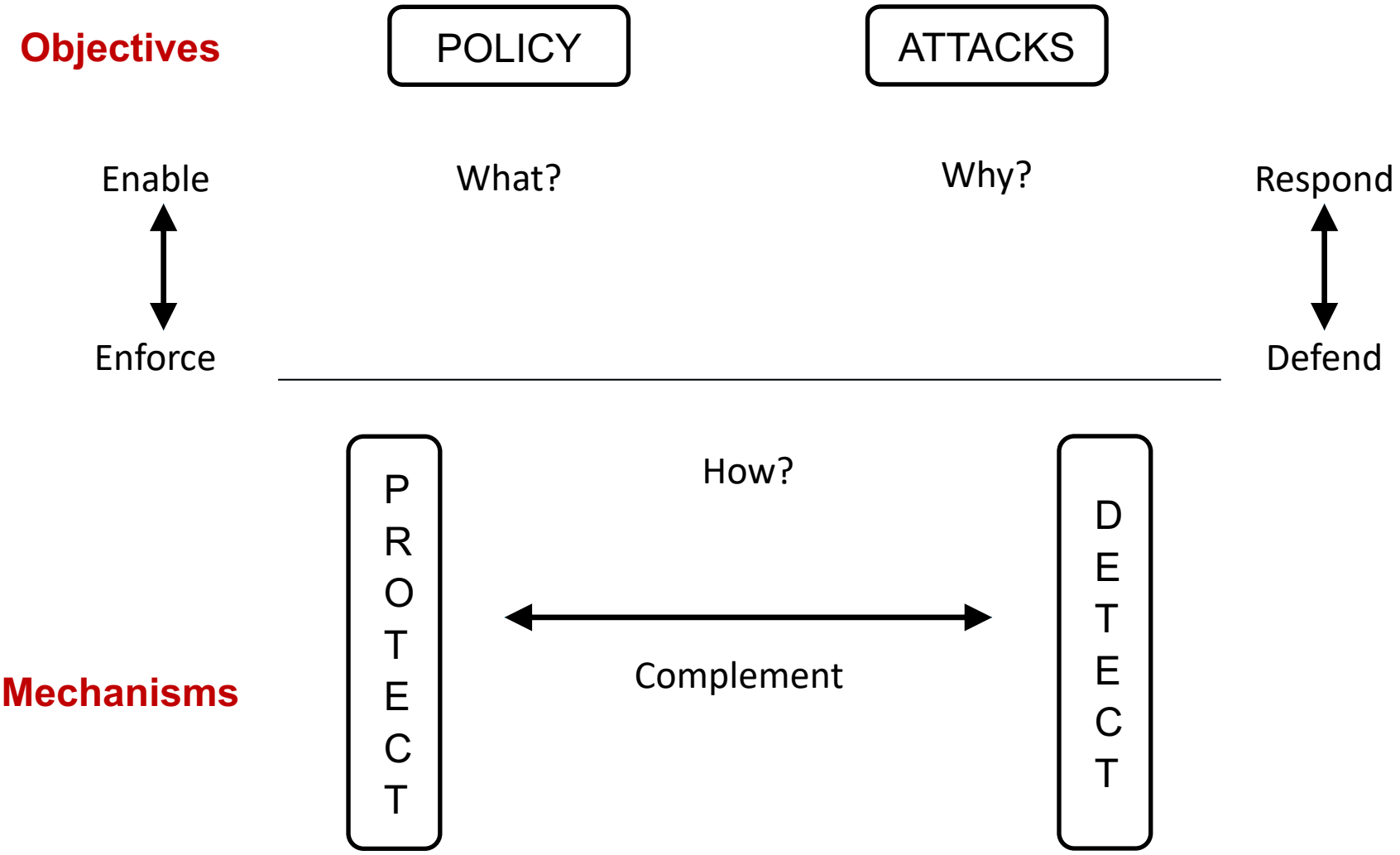
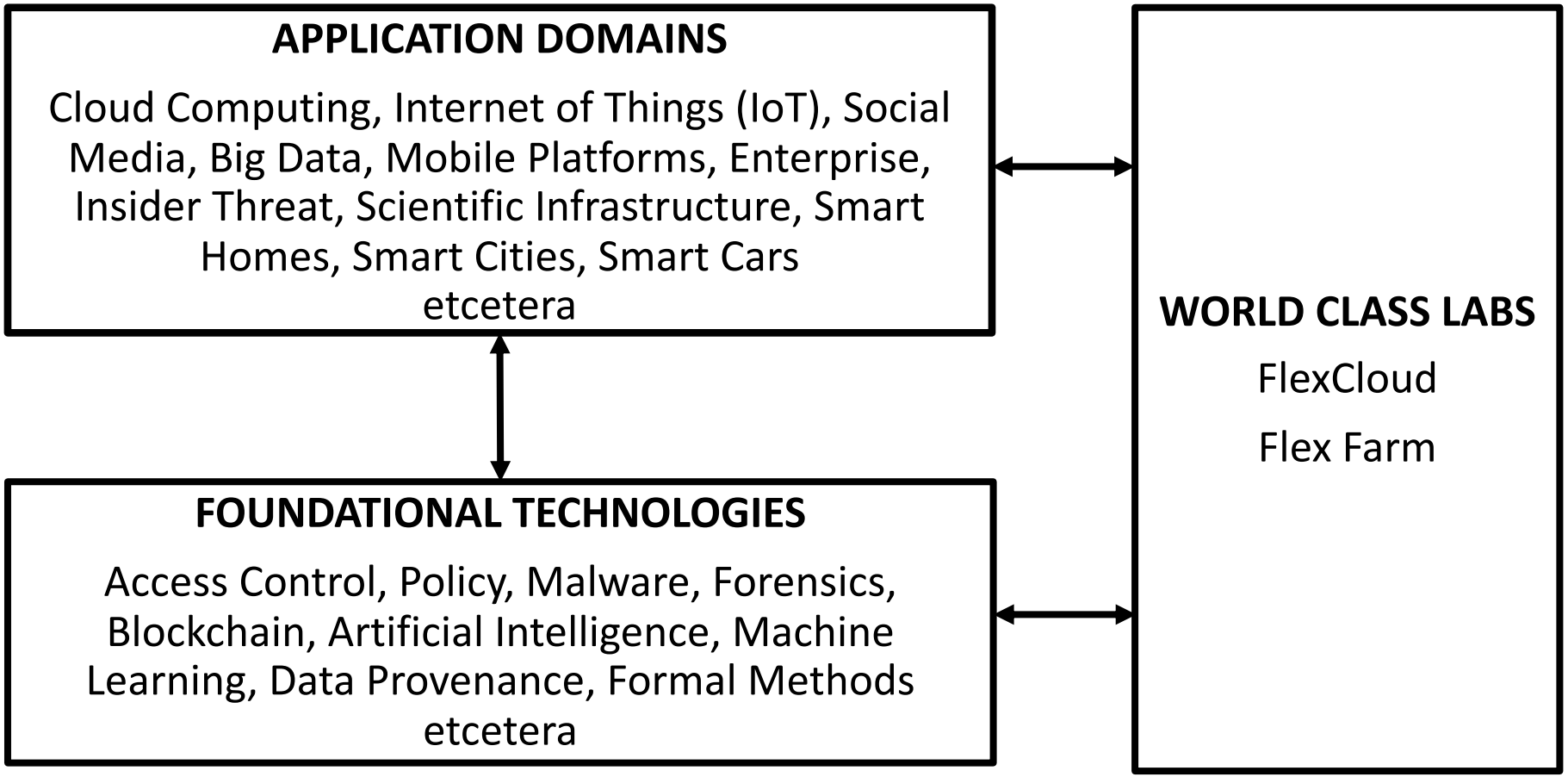
UTSA Computer Science

Holistic Cyber Security Research



Holistic Cyber Security Research

ICS Major Research Thrusts



Goal: Broaden and Deepen

Facts and Figures

PAST SYNOPSIS

- PhDs graduated: 27
- External funding raised: $22M

CURRENT STATUS

- Faculty affiliates: 22
  - College of Sciences: 8
    College of Engineering: 7
    College of Business: 6
    College of Education: 1
- Current PhD students: 29
  - College of Sciences: 19
    College of Engineering: 7
    College of Business: 2
    College of Education: 1
  - Domestic vs Foreign: roughly 50-50

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Institute for Cyber Security: Galahad Project

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https://gitlab.com/utsa-ics/galahad

ICS Data Center

- Research Data Center (RDC) was opened in the summer of 2012.
- Total square footage for servers is 1,632 sq. ft.
- The entire MS RDC is 3,558 sq. ft.

- Our equipment consists of over:
  - 1,300 threads,
  - 10TB of RAM,
  - 370TB of storage, and a
  - 10GB backbone.

Galahad 10,000 Foot

- Galahad was Star Lab's solution for IARPA VirtUE program - Virtuous User Environment (VirtUE).

- 4 Original Contenders:
  - Star Labs;
  - Raytheon BBN;
  - Siege Technologies;
  - and Next Century

- **Galahad is unique** in that it was transitioned from Star Labs to ICS; We have open-sourced it. To create a turn-key opensource deployment tool to share it with others.

Goals and Motivation

- Objective: Detection and mitigation of threats attempting to exploit, collect, and/or effect user computing environments (UCE) within public clouds

- Cloud service providers have not offered any “game changing” security solutions
  - Adversaries can leverage an arsenal of capabilities used to succeed
  - Providers cannot necessarily be trusted

- Current end-point security solutions and analytical approaches are not tuned for cloud environments

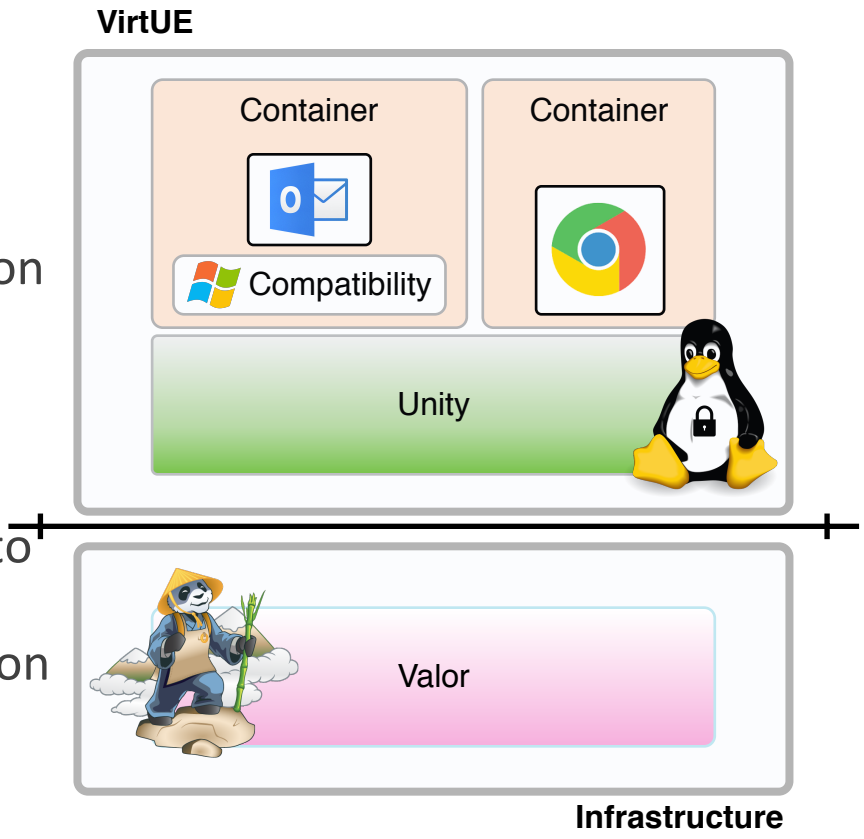
Galahad Approach

- To combat threats in a public cloud, isolate, protect what is controlled, and maneuver
  - Do not attempt to establish trust
  - Do not require special cloud services, e.g., dedicated servers
  - Impede the ability of adversaries to operate within AWS by making it more difficult to co-locate
  - Force adversaries to consume more resources thereby increasing the accuracy, rate, and speed with which threats maybe detected
  - Facilitate the creation of role-enabled security models
  - Reduce attack surface area, hardened kernel, real-time sensing, limit resources.

Galahad VirtUE

Containers for easy packaging and security configuration

A nested hypervisor to facilitate regular, recurring live migration of Unity VMs inside AWS

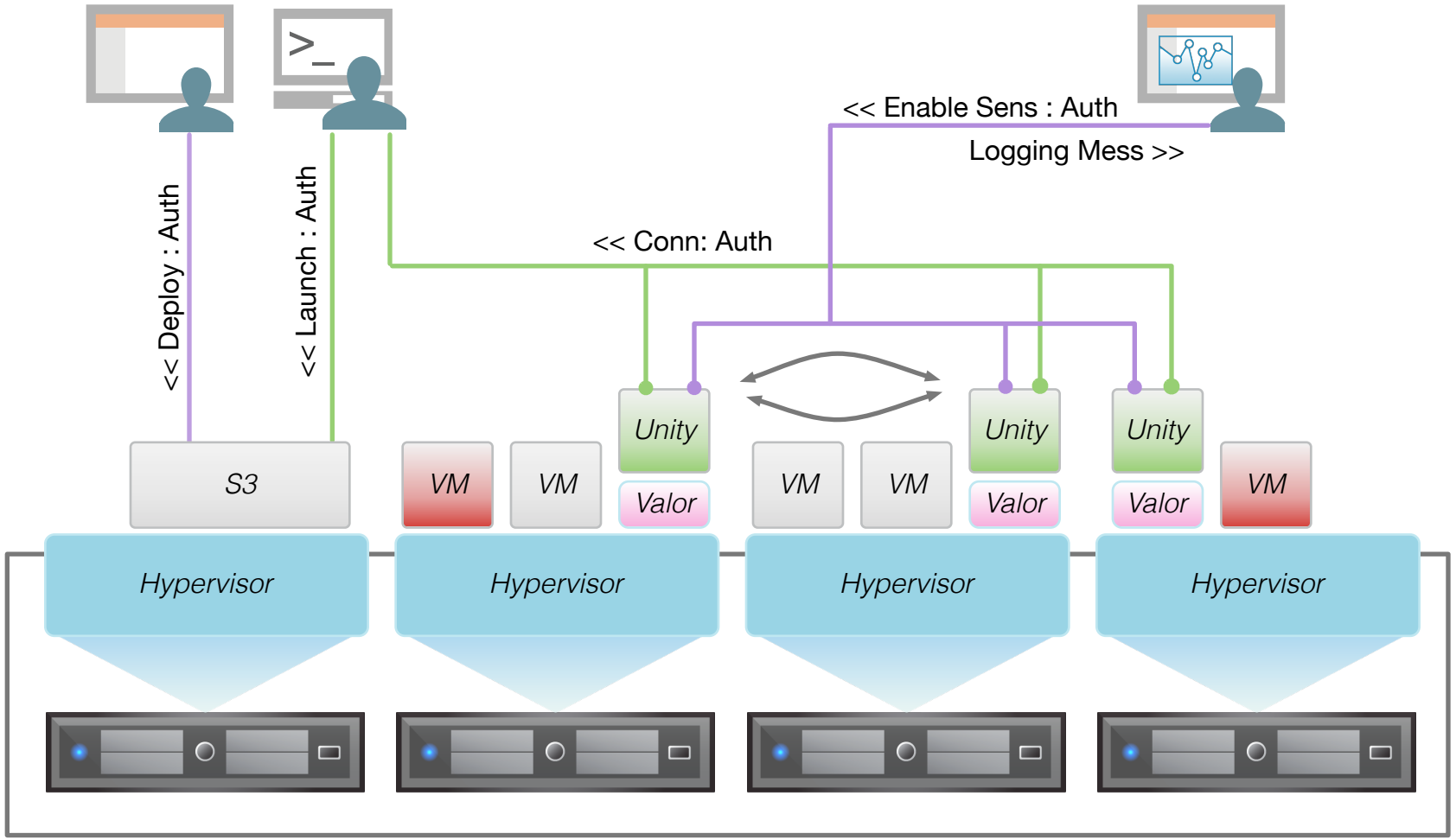


A small, hardened, de-privileged Linux OS VM

Sensing/control Capabilities

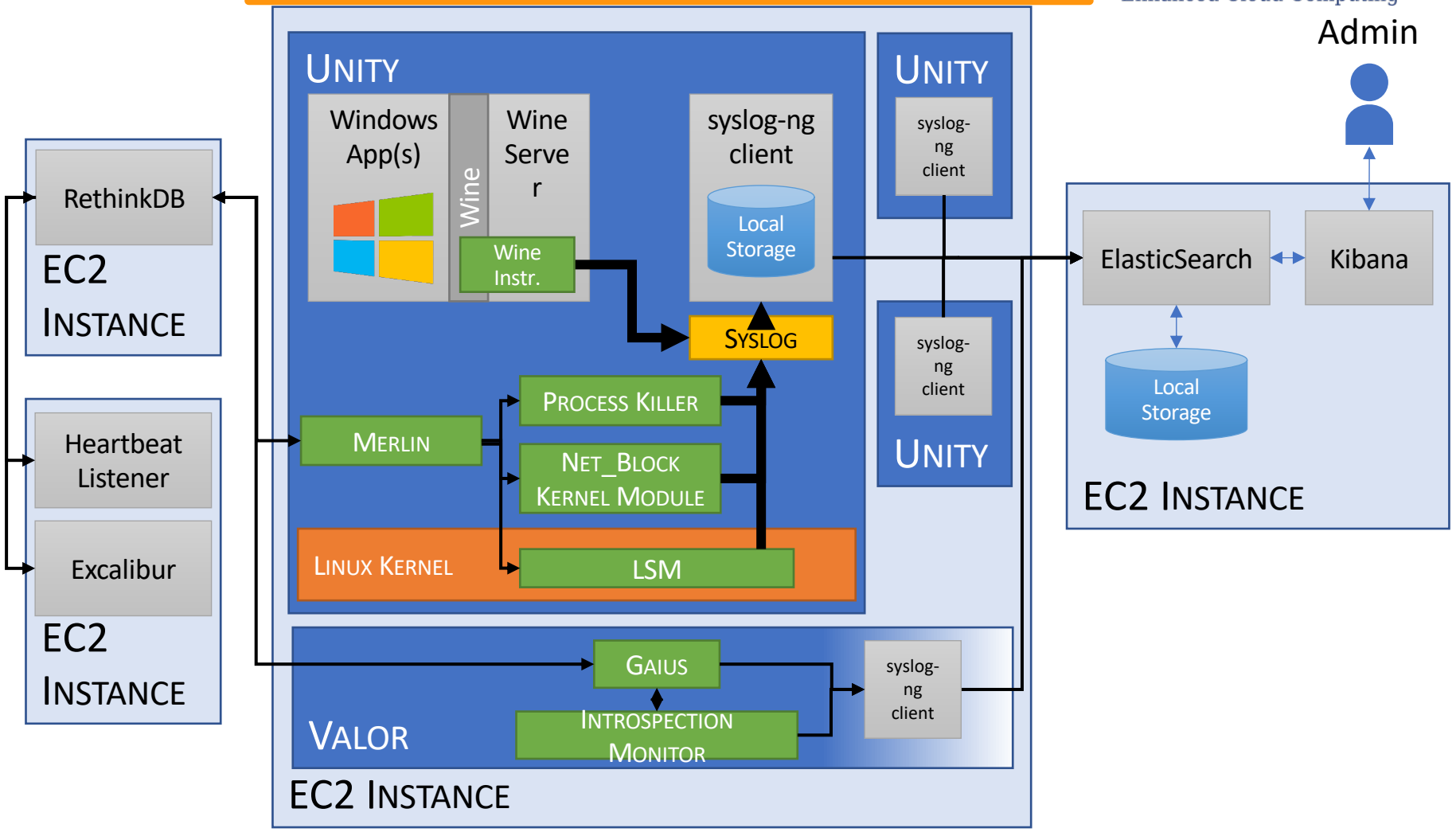
- Valor:
  - Network communications,
  - Virtual memory remapping,
  - Physical device access
- Unity/VirtUE:
  - Process creation,
  - Storage usage,
  - Network access
  - Libraries loaded by Win processes
  - Attempted access to privileged resources
- Docker:
  - Start/Stop services
  - Enable/disable ports

Galahad Use Case

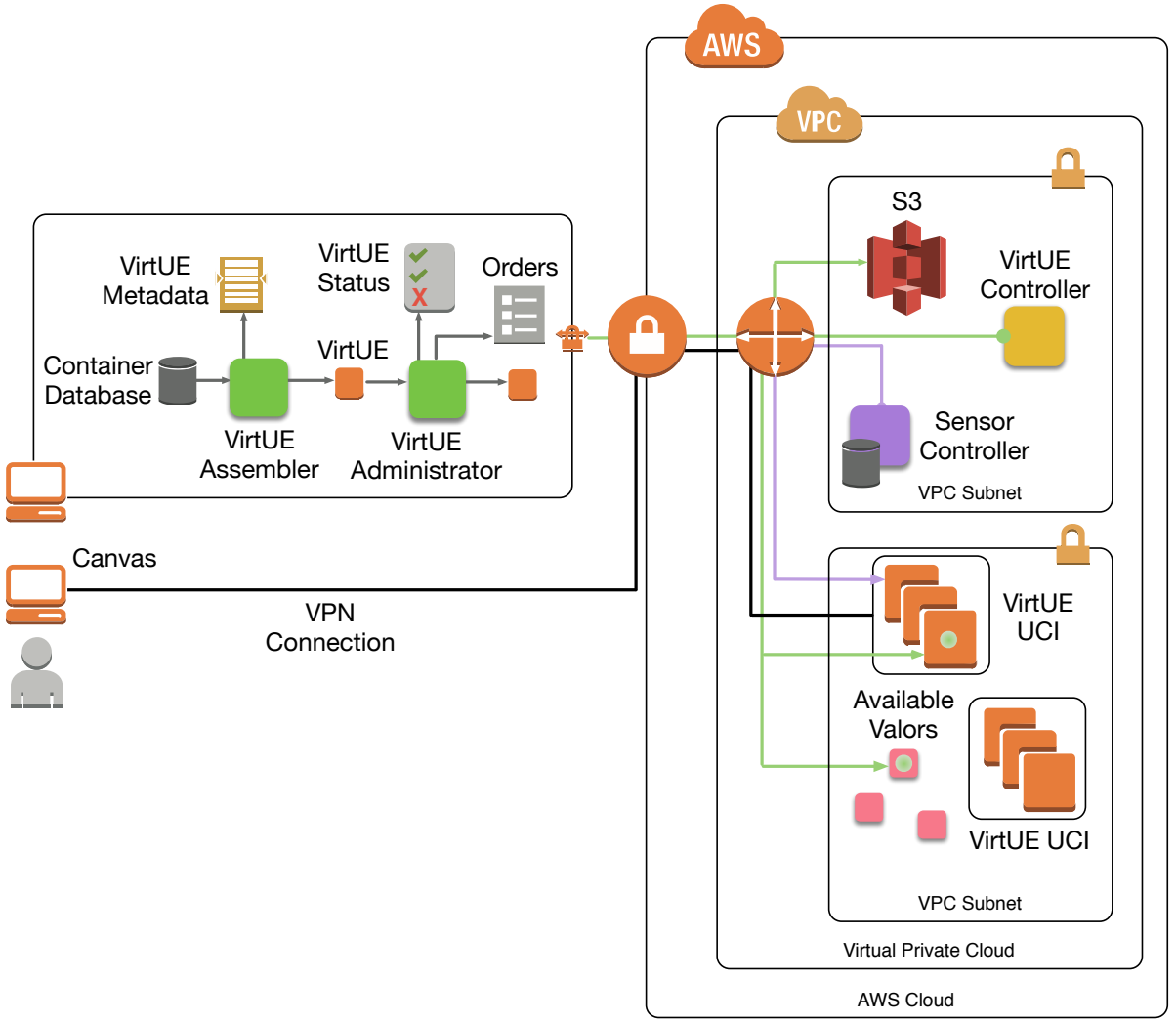


AWS Immutable Infrastructure

Galahad Components



Galahad Architecture



Questions?