VIRTUAL LEARNING ENVIRONMENT
NATIONAL CENTER OF ACADEMIC EXCELLENCE - CYBER OPERATIONS

UNIVERSITY OF ARIZONA
JASON DENNO
2018
OVERVIEW

- Purpose built Cyber Virtual Learning Environment specifically designed to support an NSA CAE-CO degree program -

2016

Created in 2016 to support the Bachelor of Applied Science degree in Cyber Operations

850+

Web-based access with multi-factor authentication and encrypted communications to ensure security, accounting, and auditability.

Over 850 students enrolled covering 20 different locations including US, South/Central America, Europe, Africa, Asia, and Afghanistan.

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Why we built and use our VLE

- Consistently deliver all 26 courses across the Cyber Operations program
- Focus all course time on achieving the learning objectives – not fighting their systems
- Avoid distributing USB drives or requiring students to download and install 100s of security tools and files
- Simplify and minimize student environment maintenance & support requirements
- Create an environment to deliver Offensive Cyber Operations (OCO) education – Not on the open Internet!
- No weaponization of students

How we achieve this

- Provide a hybrid cloud-based solution that includes student desktops
- Baseline all students and prevent installation, versioning, and configuration management issues
- Preconfigure and test all desktops, tools, data, and networking
- Centrally manage all updates, data distribution, software versioning and patching, etc.
15,000 Detailed Virtual Residents
- 100+ Highly Detail Virtual Persona
- Underground Hacker Community
- Organized Crime Element
- Entity & Data Relational Linkages
- Patterns of Life
- Web Browsing, Emailing, Social Media Posts

Web and Network Infrastructure
- City Infrastructure with IRC Servers
- Water Company
- Power Company
- 2 Online News Agencies
- Bank
- Hospital
- Shipping Company
- Large Retailer
- 20 Small Retailers/Service Providers

Social Media Sites
- Social Park
- ChirpyHub
VIRTUAL PERSONAS

- Reverse Engineered to Support Learning Objectives
- Relationships & Patterns of Life
  - Web Surfing, Email, Social Media, Purchasing, Shipping, Work & School
- Functional CyberApolis Accounts
  - Bank, Credit Cards, Customer Accounts, Digital Health Records
- Metadata Embedded in Documents & Pictures
- Proteus AI Driven and/or Manually Crafted Activities
- Organizational Structured Tied to Website & Network
- 136 Detailed Employees (Future Scenario Growth)
- Corporate Data & Metadata to Support Scenarios
- Security Vulnerabilities Built Into Website & Networks
- Full Network Architecture Implemented in the Cloud
- Students Segmented in Separate Security Groups
VLE ARCHITECTURE
VLE MAIN PORTAL

- Main Entry Point to VLE
- Access All Areas of VLE
- NOC Portal
- Faculty Portal
- Student Portal
- User Management Portal
- People Portal
- CTF Portal
- Development Portal
- System Test Portal
- CellSim Portal
- Rules-Based Access Control
- Status of VLE Servers
- Online Users & Locations
- Total Enrollment
- Active Sessions
- Active VMs
- Bandwidth Usage
FACULTY PORTAL

- Central Faculty Dashboard
- Search, Schedule and Launch Existing Courses
- Dynamically Create New Cyber Courses & Training
- Enroll & Monitor Students
- Record Learning Sessions
- Add, Delete, & Update Course Content
- Reset Student & Environment Resources
- Monitor Course Interactions & Record Statistics
FACULTY PORTAL – COURSE MANAGEMENT

- Central Course Dashboard
- Enroll/Drop Students
- Launch Learning Sessions
- Visualize Course Resources
- Visualize Student Interactions & Resource Status
- Centrally Manage Student & VM Files
- Reset Student Resources
STUDENT PORTAL

- Central Student Dashboard
- View Course Details
- Access Enrolled Courses
- ~320kbs Bandwidth <200ms
- Access Virtual Desktops
- View VLE Alerts & Messages
STUDENT PORTAL – COURSE ACCESS

- Start, Stop, Reset, and Fix Assigned Compute Resources
- View Assigned Account Details
  - IP Address
  - User Name
  - Reset Password
- View and Access Assigned Courses Material and VM Files
STUDENT PORTAL – HELP PAGES

- Central Help Dashboard
- Access Download Links
- Video Demonstrations with Voice & Closed Caption Narration
- Step by Step Instructions
  - VPN Install & Launch
  - Virtual Desktops
  - CLI Servers
- All Platforms
  - Windows
  - Mac OS
  - Linux
STUDENT DESKTOPS

WINDOWS

LINUX

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TRAINING & STAFFING REQUIREMENTS

<table>
<thead>
<tr>
<th>Time</th>
<th>Skill</th>
<th>New Student</th>
<th>New Faculty</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1 Hour</td>
<td>Use a Web browser</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 2 Hours</td>
<td>Use a Web browser</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OUR SYSTEM IS MAINTAINED BY

1 Developer
1 Cloud Engineer
1 Product Manager
SYSTEM MAINTENANCE TOOLS

Fix Button
Course administrators are presented with a Fix button when one of their students' VMs fails a status check. e.g. If the VM's file system is corrupted or there are hardware issues on the physical host.

Self Healing
This is a job that runs nightly to ensure that each student’s environment is in a good state. It automatically fixes impaired VMs, reassigns missing VMs, and sends a summary of any fixes performed to the development team.
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VIRTUAL LEARNING ENVIRONMENT

THANK YOU