2024-2025
DIRECTOR'S REPORT
Center for the Advancement of Cybersecurity

Do you see a person skilled in his work?
He will stand in the presence of kings.
He will not stand in the presence of the unknown.

Proverbs 22:29

DIRECTOR'S REMARKS

We stood up the Cyber Center in 2018 with a $50K gift from a generous Cedarville family. That was enough funding to keep us going for five years according to our original budget planning. Our goal was to become financially independent before the funds ran out. Thanks to God's incredible provision, since that time we have received over $6.5M in federal, state, and private grants, exceeding our wildest expectations! Almost all of these funds have gone directly to students in the form of scholarships and stipends. The rest have gone to initiatives that enhance the educational experiences of our students and grow our programs. At Cedarville, *the reason it all exists* is for the outstanding and godly young men and women the Lord brings us from all over the country every year. This year, moving into the Scharnberg Business and Communication Center was another huge step forward for us. We now have our own dedicated space, including a cyber lab, research rooms, an office suite, and a student lounge. As you read this report of our activities over the past year, please rejoice with me in what the Lord has done at Cedarville. He is blessing us no doubt so that our students can advance His kingdom for His glory in this strategic field.

Seth Hamman, PhD | CISSP | GPEN | CEH-M | GLEG
Director, Center for the Advancement of Cybersecurity &
Professor of Cyber Operations and Computer Science
School of Engineering and Computer Science
Cedarville University

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ABOUT THE CENTER

History

The Center for the Advancement of Cybersecurity at Cedarville University was established in 2018 by Cedarville faculty who recognized the need to equip young men and women for Christ-centered cybersecurity service marked by excellence while also enhancing the emerging field of cyber education in the academy. On campus, the Center advances cybersecurity by providing students, faculty, and staff with cybersecurity expertise. Off campus, the Center serves society by promoting cybersecurity best practices.

Ultimately, the Center exists to advance Christ's Kingdom by equipping His ambassadors for influence in the increasingly vital domain of cyberspace. From its humble origins in the basement of the Engineering and Science building to its current home in the Scharn-berg Business & Communication Center, the Cyber Center, as it is affectionately known on campus, is uniquely positioned not only to address the problems of the ever-evolving field of cybersecurity but also to provide leadership in its growth.

Mission

The Center for the Advancement of Cybersecurity at Cedarville University will advance cybersecurity in our nation by developing tomorrow's cyber leaders in the classroom, shaping cyber education in the academy, and promoting cyber awareness in society.

Vision

The Center for the Advancement of Cybersecurity at Cedarville University, with the clarity, conviction, and character that arise from our Christian faith and values, will advance cybersecurity to the benefit of society.

Meet the Director

Dr. Seth Hamman joined the faculty at Cedarville in 2012, transitioning to academia from his job as a tech consultant in Chicago. Today, he directs Cedarville's Cyber Center where he led the creation of Ohio's first Cyber Operations Bachelor of Science degree program. In addition to teaching his Introduction to Cybersecurity and Cyber Defense courses, he heads the Knowledge Units criterion for the National Security Agency's National Centers of Academic Excellence designations, co-leads the Cyber Operations Community of Practice, and is a member of the National Cyber Curriculum Taskforce. Dr. Hamman is passionate about shaping the growing discipline of cybersecurity education, developing the next generation of cyber leaders, and integrating the Christian faith into his teaching.

Cyber Faculty

David Gallagher, Ph.D., Lt. Col., USAF, Ret.
Head of Program for Computer Science and Cyber Operations
Senior Professor of Computer Science

Seth Hamman, Ph.D
Cyber Center Director
Professor of Cyber Operations & Computer Science

Nick Parry, M.S.
Cyber Center Deputy Director
Professor of Cyber Operations & Computer Science
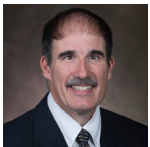
Keith Shomper, Ph.D., Lt. Col., USAF, Ret.
Cyber Center Faculty Fellow
Senior Professor of Computer Science & Cyber Operations

Patrick Dudenhofer, M.S.
Cyber Center Faculty Fellow
Associate Professor of Computer Science & Cyber Operations

George Landon, Ph.D.
Professor of Computer Science

Eric Knoerr, B.S.
Instructor of Computer Science

Accolades

NSA National Center of Academic Excellence in Cyber Operations
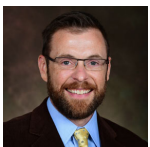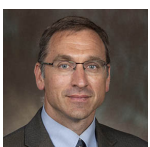1 of 22 in the USA *06/06/2018*
NSA National Center of Academic Excellence in Cyber Defense
1 of 350 in the USA *10/21/2021*

ABET Cybersecurity Accreditation
1 of 7 first cyber programs to receive this accreditation *09/17/2019*

1 of 2 undergraduate programs in the USA to hold both NSA & ABET accreditations *10/21/2021*

Ranked #1 Accredited Cybersecurity Degree Program by Intelligent.
9/17/2024

Ranked #1 Cybersecurity Bachelor's Program by Cybersecurity Guide.
12/14/2023

Chief Information Officers Institute Top 16 Cyber Education Program
10/06/2021

Regional Programming Center of the Ohio Cyber Range Institute
11/02/2020

Facilities/Scharnberg Opening

Our cyber program was blessed by the opening of the new Scharnberg Business and Communication Center (SBCC) this past August, which houses the Berry Center for Free Enterprise and our new Cyber Center. As America continues to experience the onslaught of intellectual property theft from foreign actors, our Cyber Center stands ready to protect the entrepreneurial endeavors of our students. These new facilities highlight the University's commitment to ensuring a strong cyber capability for our community and nation.

The new Cyber Center includes the Cyber Lounge, faculty offices, a student fellow office, secure research rooms, a conference room, and the Cyber Operations Lab.

Above: The Cyber Ops Lab by day

Below: The Cyber Ops Lab by night
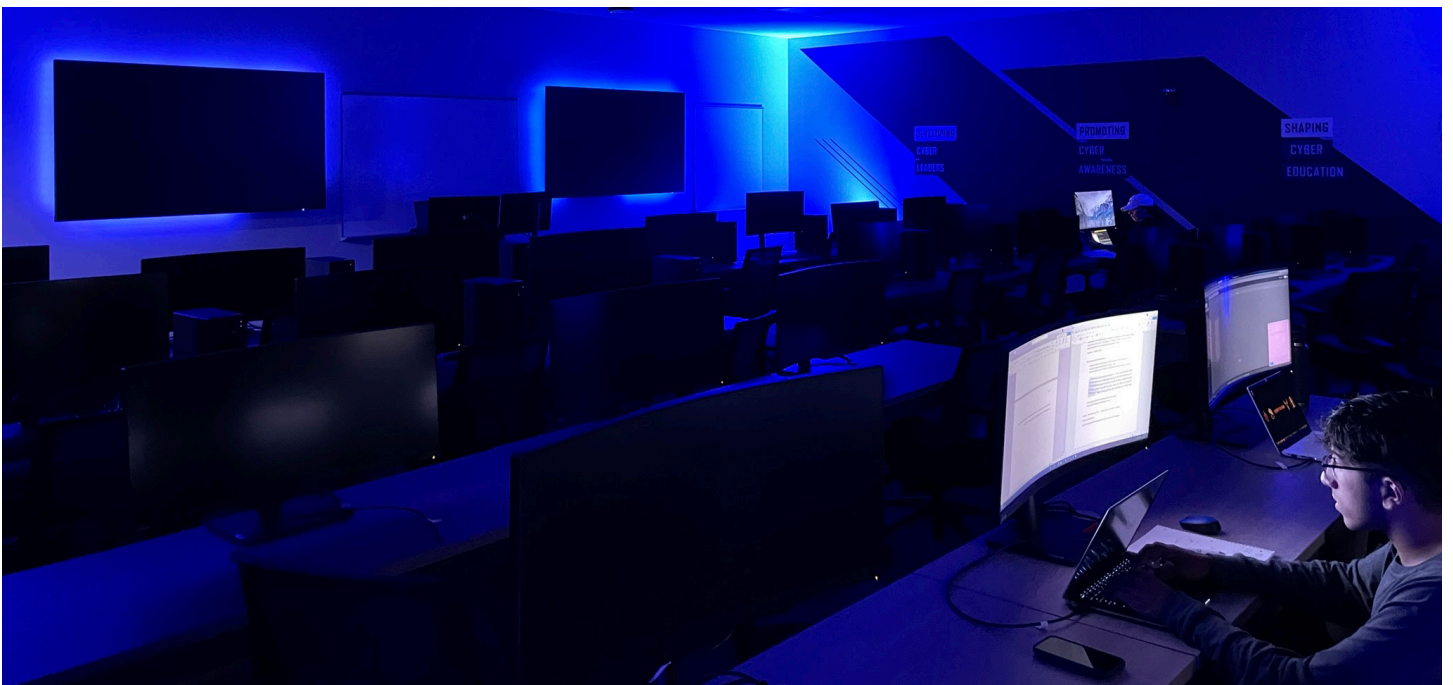
CYBER EVENTS IN REVIEW

Our rigorous academics are only one component of developing world class cyber operators. We also hail the top talent from industry and government to stay current with the emerging trends in cyberspace. And, we have fun events too.
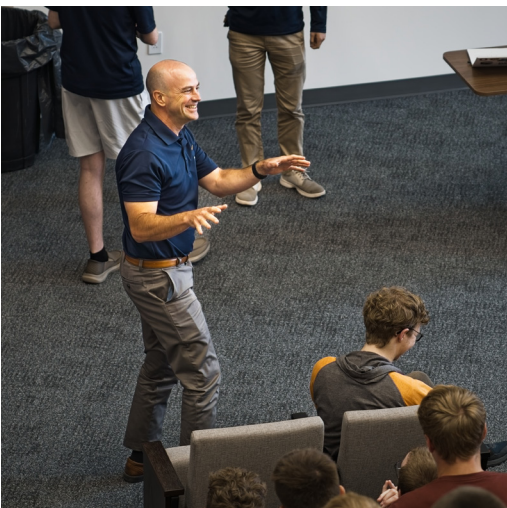
Annual Cyber Briefing

The yearly kickoff meeting drew quite a crowd in the new building. See for yourself!

Challenge Coins

The Cyber Center Challenge Coin is awarded by the Director or a Fellow with the Director's approval to an individual who has performed a distinguished service or accomplished a noteworthy achievement for the cyber program. Distinguished visitors often receive this coin as well.

The Director's Challenge Coin is awarded solely by the Director to personally recognize those who have performed exemplary service in advancing the University's cybersecurity program.

The Cyber Graduation Coins are presented only to graduates in our Cyber Operations major. The coins are individually numbered and zero-indexed. They show the cyber stinger breaking out of the hive to symbolize our grads going forth from CU to advance God's kingdom.

Challenge Tokens

This year in addition to our challenge coins we started the tradition of awarding challenge tokens to recognize individual participation in cyber-related events. Tokens have the advantage of being inexpensive and are able to be personalized to specific years and events. We made eight different tokens this year covering our CTF competitions, our scavenger hunt, and our new Red Team Trade-craft group. We expect that students will collect several as they progress through the cyber program, and that these tokens will give them an extra incentive to stretch themselves and get more involved. We also have a generic challenge token that we give out to prospective students during their visits to campus.

Cyber Speaker Series: Dan Wilkins

Mr. Dan Wilkins is a Cedarville alum who visited campus during National Cybersecurity Awareness Month to share about his story and career in cybersecurity, including his experience in cyber incident response and the stressors of the field.

Lockheed Martin Tech Talk

Every year, Lockheed Martin sends an engineer from their Advanced Technology Laboratory to speak on a technical subject. This time it was Mr. Chris Blackburn and a Cedarville alum, Adam Marvin, who spoke on the complicated intricacies of software security sandboxes.

Majors Assembly Chapel

This Spring's major's assembly featured Mr. David Reid speaking on cyber operations and the Bible as well as other announcements. There were also plenty of donuts too!

FBI Visit

This Spring semester, we were honored to host the Federal Bureau of Investigation on campus. Students had a valuable opportunity to network with a FBI representative and gain insight into the agency's work in cybersecurity and law enforcement. This visit provided an inside look at opportunities for those interested in serving the U.S. government.

Ohio Digital Academy

The Ohio Digital Academy visited campus to provide students with the opportunity to explore careers in cybersecurity for the State of Ohio.

Witness in the Workplace

Our annual event dedicated to helping students understand how best to represent Christ in the work force was a major highlight for students and faculty members alike. This year featured four panelists, Dr. Miller, Dr. Ayers, Prof Parry, and Prof Long.

Guest Speakers

This year we had the privilege of hearing from some outstanding leaders in the field of cybersecurity. Jonathan Elchison ('06), Founder of Cryptic Vector, and TJ O'Connor, Ph.D., LTC (Ret.), former head coach of the United States Cyber Games team, both shared wisdom with our students. We are grateful for them coming to our campus.

Annual Cyber Debrief

We begin every school year with our Cyber Briefing to welcome back students and introduce the freshmen to our cyber program. At the end of the school year we hold our annual Cyber Debrief to present awards, reflect on what the Lord has done and His blessings to us, and, of course, to enjoy pizza! This year we recognized our senior leaders for their outstanding service to our cyber program, and in particular, David Reid, who received a resounding standing ovation from his peers for his devoted service to our cyber program.

DEVELOPING TOMORROW'S CYBER LEADERS

Proverbs 29:18a states "Where there is no vision, the people perish." Biblical leadership is needed more than ever today, and it is our students who are stepping forward to meet that need by serving God in their spheres of influence. This year's senior class contributed heavily to advancing the cyber program. While they will be most missed, the next batch of leaders is rising right behind.
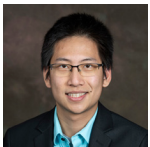
Student Fellows

Student Fellows are hand selected cyber student leaders employed to assist the Director in the day-to-day operations of the Center. They serve in their fellowships at the Director's discretion, typically fulfilling their roles to graduation.

David Reid, '25 CS/CY
Chief Cyber Student Fellow

Kaicheng Ye, '25 CS/CY
Cyber Student Fellow for Cyber Exercises
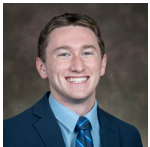
Stephen Reid, '27 CS/CY
Cyber Student Fellow for Cyber Maneuvers

Clara Reeder, '27 CS/CY
Cyber Student Fellow for Public Affairs

Cyber Scholars for Service

As a Center of Academic Excellence, our cyber operators are eligible for the Department of Defense Cyber Service Academy (DoD CSA). DoD CSA is a scholarship-for-service program paying all education-related expenses plus a $29,000 living stipend. Since 2020, 21 students have been selected for this elite scholarship. This year, 10 new students were selected with 2 returning for a total of 12 currently in the program.

Cyber Leader Development Program

"...but the people that do know their God shall be strong, and do exploits."
Daniel 11:32 KJV

The Cyber Leader Development Program (CLDP) is designed to cultivate leaders in the cyber domain who are equipped with both technical expertise and strategic leadership skills. As the cybersecurity arena continues to expand, there is a fundamental need for professionals who not only possess technical capability but can also effectively lead a team to accomplish the tasks before them. This program seeks to equip students with an immersive and comprehensive understanding of cyber leadership, emphasizing practical, hands-on learning experiences.

2025 marked the inaugural year of the Cyber Leader Development Program. This new initiative provides a formal way for our most dedicated students to receive advanced training in not only advanced technical subjects but also strategic leadership concepts.

Find more information at cedarville.edu/cldp.

Stephen Reid led the development and implementation of the CLDP, including the monthly meetings, strategic vision, and the planning of the program.

Students engage in a team leadership problem designed to simulate a stressful environment where leaders must make decisions with limited information.

Seal of the CLDP

In the seal's center is a shield representing the protection that cybersecurity provides from malicious threats. The shield has three elements: a chess knight, a leadership torch, and a cryptographic key. The knight embodies the strategy, creativity, and versatility that all outstanding cyber leaders possess. The torch signifies a leader's ability to persist and innovate. The key characterizes cryptography, an essential when securely maneuvering in cyberspace against the adversary. The blue and red denote our leaders' expertise in both defensive and offensive cyberspace operations while the white symbolizes our pure and moral pursuit of such actions. Flanking the shield are wheat stalks reflective of the humble cornfields of Ohio and the seal of the Center for the Advancement of Cybersecurity. Along the edge of the shield are twelve binary octets encoding the program's verse Daniel 11:32.

Cyber Maneuvers

As a part of the Cyber Leader Development Program, students currently take two student led courses: Basic Cyber Maneuvers (BCM) and Advanced Cyber Maneuvers (ACM). This was the second year these courses have been offered and both BCM and ACM had roughly 30 students in attendance, comprised predominantly of underclassmen. These courses are taken in addition to undergraduate curriculum and are designed to be supplemental one-hour seminars teaching hands-on, practical skills. BCM focuses on Linux, Windows, and networking fundamentals through TryHackMe labs. ACM focuses on the cyber kill chain and teaching fundamental hacking techniques that culminates in students completing an in-house simulated cyber operation known as CEDAR FLAG.

EPAs with NSA and USCYBERCOM

In the past year Cedarville signed Educational Partnership Agreements (EPAs) with the NSA and United States Cyber Command—the two most elite cyber organizations in the world. These agreements allow the sharing of resources in both directions, and they open up pathways and opportunities for Cedarville students and faculty. We are excited to see how we can use these new agreements to continue developing cyber leaders at Cedarville and to enhance the educational experience of our undergrads.

Cedarville Cyber Team

Cyber competitions like capture-the-flags (CTFs) provide an unrivaled environment where cyber operators not only acquire technical skills but also practice tactical leadership. Our cyber teams consistently score high, a testament to the caliber of our program and our unwavering pursuit of excellence. This year 110 Cedarville students competed in 11 different CTFs as part of the Cedarville Cyber Team. Read below for more information about our competitions

- **Hivestorm:** The collegiate CyberPatriot competition.
- **Cyber Games:** The beginner cyber competition for NCAE schools.
- **VIVID:** The cyber competition for NCAE schools.
- **Collegiate Cyber Defense Competition:** The national cyber defense competition.
- **National Cyber League:** The cyber competition for all individuals at all levels of education.
- **NSA Codebreaker Challenge:** NSA's cyber competition for individuals.
- **Collegiate Penetration Testing Competition:** The national cyber offense competition.

Competition	Rank	# of Participants
Hivestorm	22nd	24
CPTC Qualifier	Unknown	8
NCL Individual Fall	41st	36
LU Cyber Summit	1st	7
GoCyber Collective CTF Morning	2nd	10
GoCyber Collective CTF AFternoon	1st	10
NCL Team Fall	31st	6
NCL Power Ranking Fall	24th	N/A
NCAE VIVID Nationals	3rd	5
CCDC Qualifier	2nd	12
NCAE Cyber Games Qualifier	1st	30
CCDC Qualifier Wildcard	1st	12
CCDC Regionals	4th	12
NCL Individual Spring	24th	57
NCAE Cyber Games National	7th	10
OCRI CTF	1st	10
NCL Team Spring	7th	8
NCL Power Ranking Spring	7th	N/A

Collegiate Cyber Defense Competition (CCDC)

The CCDC team has recently enjoyed continued success in the nation's most prestigious cyber defense exercise. After falling short to Baldwin Wallace in the State Qualifier, the team rebounded at the Wildcard match to earn a spot at Regionals. Both junior varsity and varsity units won first in the CCDC invitationals.

Collegiate Penetration Testing Competition (CPTC)
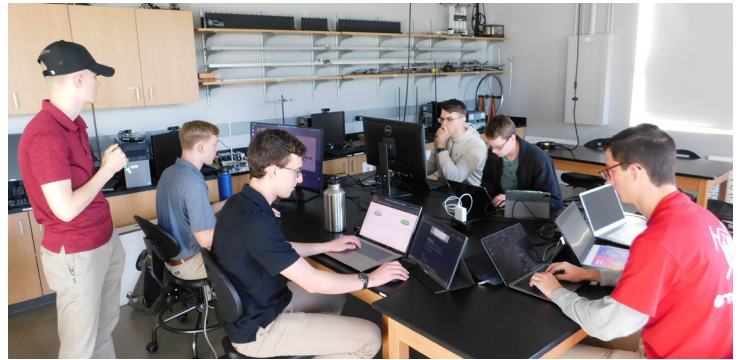
This was Cedarville's second year competing in the Collegiate Penetration Testing Competition (CPTC), specifically the Great Lakes Region hosted by Baldwin Wallace University. CPTC is a competition where mock penetration tests are performed on an enterprise environment, providing students with a glimpse of what it is like to work as a penetration tester. One unique aspect of the event is that all in-person interactions must be in-character meaning that the teams are supposed to act as if they are meeting with an actual client. This year's theme was based on social media. We scored much higher this year than our first, and we are already honing our skill for next year's competition.

Hivestorm

Hivestorm is a beginner-friendly defense competition where competitors are given Linux and Windows machines to secure. Participants need to patch vulnerabilities on the systems while solving forensics questions specific to each machine. Cedarville had 24 students compete virtually from within our new cyber lab with one team placing 32nd in the national rankings.

National Cyber League (NCL)

The National Cyber League (NCL) is a virtual capture-the-flag competition held by Cyber Skyline. NCL has two seasons of competition: spring and fall. Each season features an individual game and a team game, that occur on different weekends. This year, we had a record number of students (28) who earned a Cyber Center Challenge coin, which means they scored over 1500 points in the individual game. The highest scoring individual took 24th place nationally, and the highest scoring team placed 7th nationally. We placed 7th in the national Cyber Power Rankings.
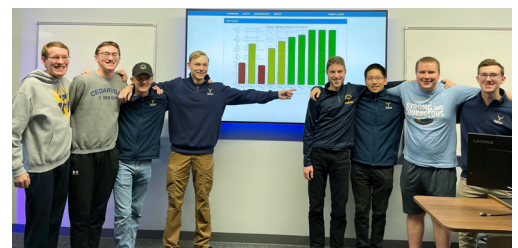
NCAE Cyber Games

The Cyber Games teams achieved outstanding success this year, with one winning their regional qualifier to travel to Florida for the championship. Despite coming up short, the accomplishment marks a big advancement for Cedarville in the Cyber Games competition.

Liberty CTF

Liberty University hosted a Christian CTF this year where our cyber team won first. To celebrate the win, the team went out to dinner and spent part of the $3,000 prize on an arcade console. The system has 6,000 pre-installed games on a Raspberry Pi.

VIVID

On November 13-14, 2024, five operators from the Cedarville Cyber Team battled top schools from around the country in Augusta, Georgia, home of the U.S. Army Cyber Command. The exercise was dubbed VIVID, which the team qualified for in March. VIVID is the highest competition for all schools designated as a National Center of Academic Excellence in Cybersecurity by the National Security Agency. It is comprised of 4 four-hour events: jeopardy capture the flag (CTF), red team CTF (offensive in nature), blue team CTF (defensive in nature), and king of the hill. Cedarville finished third behind the University of South Florida and Embry-Riddle Aeronautical University.

OCRI CTF

The Ohio Cyber Range Institute (OCRI) put on the first ever statewide CTF where we just happened to win first again! Battling against top competitors from schools such as The Ohio State University and University of Cincinnati, one Cedarville team, Byte Defender, placed first and another placed fourth.
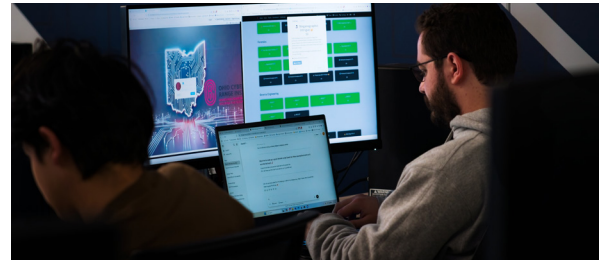
OHIO CYBER RANGE INSTITUTE
UNLOCKING POTENTIAL,
SECURING THE FUTURE
POWERED BY
UNIVERSITY OF CINCINNATI

Congratulations to our CTF winners:

First Place:
CU_ByteDefender (Cedarville University)

Second Place:
Cyber@UC (University of Cincinnati)

Third Place:
99PLabs (Miami University and The Ohio State University)

Capture The Flag WINNERS

Cedarville

University of Cincinnati

OSU+Miami

Women in Cybersecurity Chapter

In 2021, female student leaders in our cyber program stood up Cedarville's chapter of Women in Cybersecurity (WiCyS). Our local chapter has flourished from the beginning, meeting a real need for creating connections and mentorship opportunities for the female students in our Computer Science and Cyber Operations majors. This school year the ladies organized several successful events.

WiCyS leadership

Gabi Mallack, '25 CS/CY
WiCyS President

Esther Solokha, '27 CS
WiCyS Secretary

Lydia Bingamon, '26 CS
WiCyS Vice President

Isabel Luke, '26 CS
WiCyS Treasurer

Mentorship

Throughout the year, the organization implemented a Mentorship Program designed to pair freshmen with returning students. This initiative aimed to foster relationships, provide guidance, and support new members as they transition into the university environment.

Events

- **Involvment fair:** The organization participated in the Involvement Fair, effectively promoting its mission and engaging with prospective members.
- **Meet and Greet Coffee Date:** Sponsored by WiCyS, this event was held at Beans n Cream, providing an opportunity for members to meet new students and fostering connections.
- **Cookie Night:** Hosted by Dr. and Mrs. Gallagher, this annual event promoted fellowship among women in computer science and cybersecurity through a time of decorating and enjoying cookies.
- **Dr. Tsai Speaking Event:** Dr. Phoebe Tsai, an ITM professor at Cedarville, led a discussion on career development in technology, sharing her insights and experiences, as well as those of prominent women in the field, to guide graduating members.
- **Snack and Study:** The WiCyS team organized a casual gathering in the Computer Science Lounge, offering donuts and music, inviting members to enjoy refreshments while studying together.
- **Ice Skating:** An afternoon ice skating activity was organized at the NTPRD Chiller, aimed at promoting fellowship and fun among the members.
- **Galentine's Day:** This event featured snacks, drinks, bracelet-making, a photo booth, and a movie, creating a fun atmosphere for the members to connect with one another.
- **Tea Party:** Hosted at the Hamman residence, this event included tea and snacks provided by Mrs. Hamman, along with activities such as painting notebooks and bracelet-making, encouraging members to connect and build memories with one another.

SHAPING CYBER EDUCATION IN THE ACADEMY

Cedarville's Contributions to Cyber Higher Ed

This winter Dr. Hamman created helpful videos to walk schools through the CAE in Cyber Operations application process. These resources are hosted on ncyte.net.
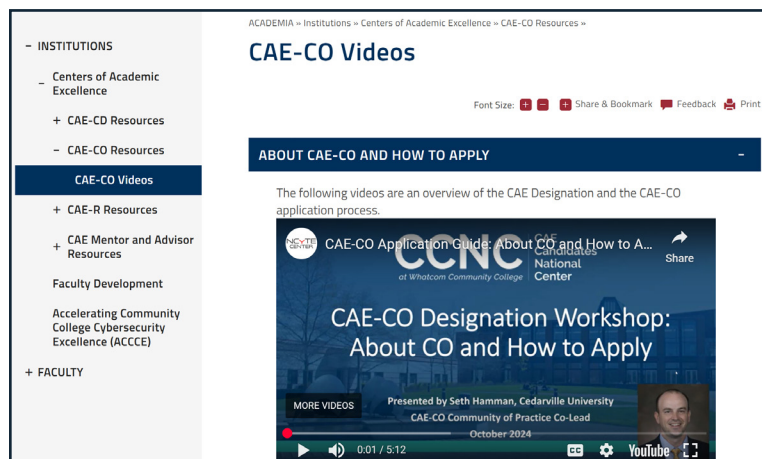
Cedarville was originally designated as an NSA Center of Academic Excellence in Cyber Operations in 2018 for a period of five years. In 2023-2024 we had to go through the entire application process again to retain our designation status. Fortunately, our cyber program has only grown and improved every year since 2018. In that time we turned our Cyber Operations Specialization into a stand-alone Cyber Operations major and grew our extracurricular program substantially. So the application process, while rigorous and time consuming, was straightforward, and we were redesignated. Praise the Lord! We received our new CAE-CO certificate at the designation ceremony at the CAE Symposium in Charleston, SC, in April. We are now designated as a Center of Academic Excellence in Cyber Operations through 2029! In 2018 we were one of the first 20 schools in the nation designated and today there are 23 schools currently designated. The list of schools can be found on the CAE Community website.

Cedarville on the Road
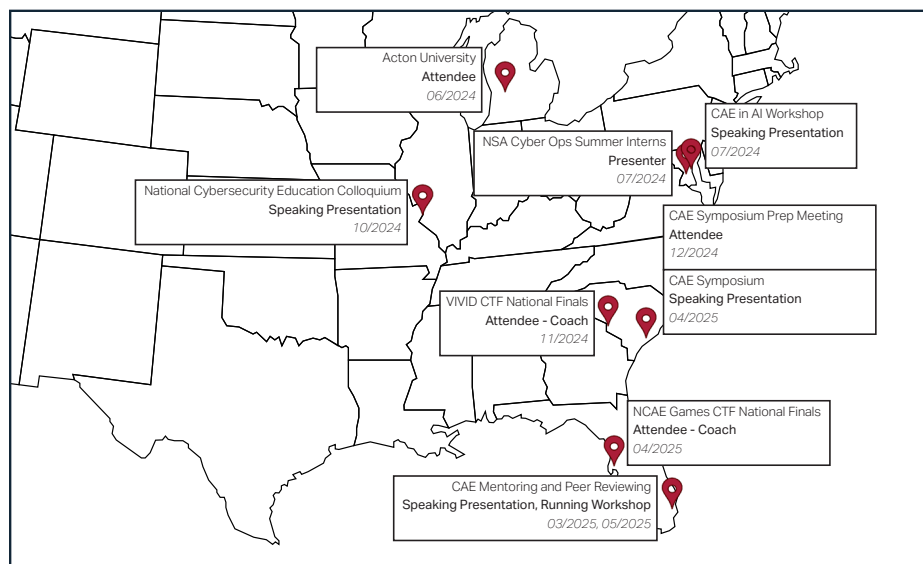
Dr. Hamman went on the road this school year helping to spread the word about Cedarville. He spoke at conferences and taught summer interns at the NSA. He and several students also traveled to national capture-the-flag competitions.

Cyber Operations Research
Lockheed Martin Research

For the past several years Cedarville has been blessed to work with Lockheed Martin Advanced Technology Labs in Arlington, Virginia, on cyber-related research projects. This provides valuable experience to our students and faculty, helping to keep us on the forefront of technology. This year Lockheed wrote us the following commendation:
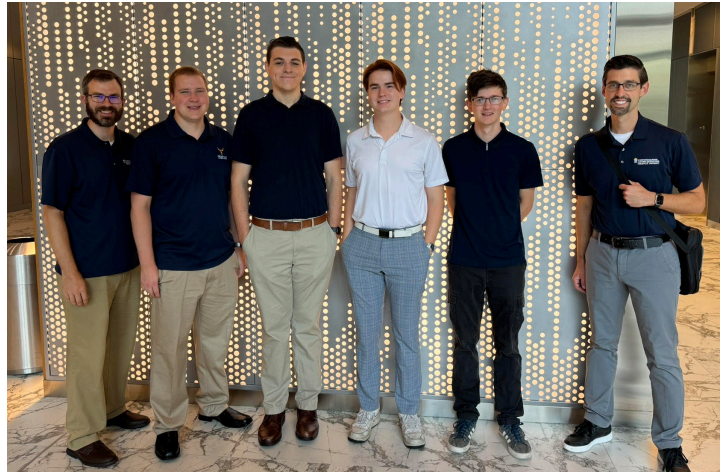
> *Cedarville University has once again impressed us with their robust research and development skills. The faculty and students are knowledgeable, and they understand both the technical challenges we present them with and how important the research they do is to Lockheed Martin ATL. With the closing of a two-year long research effort, they have yet again provided us with thorough and thoughtful approaches to state-of-the-art technologies. We are thankful to continue our partnership with Cedarville as we together seek to perform novel research and development.*
>
> Lockheed Martin Advanced Technology Laboratories

Senior Design Projects

More than anything else in the undergraduate experience, our year-long senior design capstone projects prepare students for their future careers. Structured similarly to an internship, students work in teams for a client under the guidance of a faculty advisor. Students are stretched to extend what they have learned the previous three years and to demonstrate the ability to teach themselves new skills. They also develop professional skills as they collaborate with one another and work with a client. By the end of the year the students develop the confidence to know that they can tackle and solve difficult challenges. It is a perfect segue as they graduate and begin their professional careers. This year the teams created a pilot cyber business called CyberWeb to meet the cybersecurity needs of churches and Christian schools, they developed a cyber physical city called Jericho to practice critical infrastructure hacking and see the effects, they used large language models and generative AI to create a tool called MAESTRO to aid cyber operators in conducting cyber operations, and they built a technology called Speculo to safely and efficiently mirror Internet resources for software development use inside SCIFs.

CYBERWEB: A MANAGED SECURITY SERVICE PROVIDER FOR CHURCHES | ETHAN HUNTER, ANNA KAUFFMANN, STEPHEN PEARSON, ARIELLA VANDERLAAN

ABSTRACT

In the modern era of technology, churches interact with the internet in many ways. They may utilize desktops for their full-time staff, public WiFi for members and guests, online giving, a website for their church, or other ways. All of these have the potential to be taken advantage of by cybercriminals looking to cause harm.

Many churches are either not equipped with the technical skills to defend against these criminals or do not want to spend all their budget on enterprise cybersecurity solutions. CyberWeb provides a solution: fractional cybersecurity services for organizations with limited resources, allowing clients to focus on their mission without being burdened by securing their digital assets.

CyberWeb offers three main services. Network protection, content filtering, and security awareness training foster a healthy online environment that more closely aligns with the values of an organization. By addressing a client's unique cybersecurity needs, CyberWeb empowers them to focus on their core purpose. An organization's online presence does not have to be a mystery; they can have security unlocked.
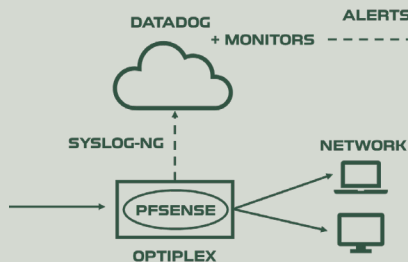
DESIGN

There are four main design components to CyberWeb.
1. **Client Network**
   a. The collection of devices underneath an organization.
2. **Hardware**
   a. Optiplex.
3. **Software**
   a. pfSense is the firewall platform running on the Optiplex.
4. **Cloud**
   a. Datadog is a cloud-based infrastructure monitoring and analyzing platform. It collects information about the client network.
   b. Logs are sent from pfSense to Datadog using syslog-ng.
   c. Monitors on Datadog check these logs to track various statistics, such as network latency or how many blocked pages are trying to be accessed by devices on the client network.

SERVICES

CyberWeb currently provides three main services:
1. **Network Protection**
   i. Network protection detects and blocks bad traffic. If a computer is compromised, CyberWeb can block the exfiltration of sensitive data, preventing unauthorized network use.
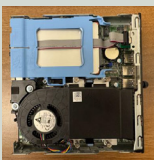2. **Content Filtering**
   i. Content filtering allows the organization to control what is being accessed on their network. CyberWeb will block bad websites in several categories, including advertisements, pornography, or other websites specified by the organization. In addition, it can enable SafeSearch on platforms such as Google, DuckDuckGo, Bing, and YouTube.
3. **Security Awareness Training**
   i. Security awareness training equips individual members of an organization. People are the last line of defense against cybercrime and must be equipped. CyberWeb seeks to teach clients the importance of good security practices and encourage them to take proper action.

Network protection and **content filtering** are facilitated through pfSense running on Optiplex (see the design section). CyberWeb monitors the firewall to ensure it is up-to-date and able to address any cyber threats. **Security awareness training** equips individual members of an organization. CyberWeb seeks to teach clients the importance of good security practices and encourage them to take proper action.

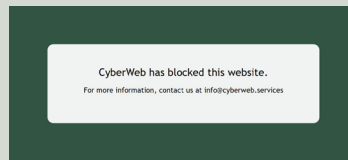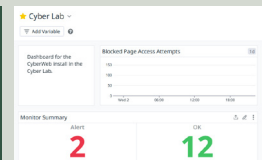| THE INSIDE OF THE OPTIPLEX DEVICE | ONE OF THE CYBERWEB OPTIPLEX DEVICES, INSTALLED IN THE CYBER LAB | THE CYBERWEB TEAM INSTALLING AT A CLIENT LOCATION | THE WEBSITE SHOWN WHEN A USER ON THE NETWORK ATTEMPTS TO ACCESS A WEBSITE ON THE CYBERWEB BLOCKLIST | AN EXAMPLE DATADOG DASHBOARD, SHOWING MONITOR STATUSES |

JERICHO
A Cyber City for Enhancing Cyber Operations Education

David Reid, Jacob Grady, Logan Miller, Kaicheng Ye, Dr. Seth Hamman

School of ENGINEERING and COMPUTER SCIENCE — CEDARVILLE UNIVERSITY

CENTER FOR THE ADVANCEMENT OF CYBERSECURITY — CEDARVILLE UNIVERSITY

Research & Scholarship SYMPOSIUM

CRITICAL INFRASTRUCTURE HACKING

Sector	Feature	Action	Physical Component
Chemical	Gas Pipeline	Control gas flow light strip	LED strip
Commercial Facilities	Ferris Wheel	Stop/start at will	Motor
Communications	Satellite	Access camera live feed	Camera
Critical Manufacturing	Factory	Alter conveyor belt function	Motor
Dams	Lock & Dam	Open lock releasing water	Motor
Defense Industrial Base	Laser	Toggle laser beam	Laser
Emergency Services	Fire Station	Play audio over siren	Audio
Energy	Substation	Toggle city streetlamps	Lights
Financial Services	Bank	Vandalize digital billboard	LED
Food and Agriculture	Restaurant	Turn power off	LED Display
Government Services	Airport	Halt radar spinning	Rotate
Healthcare	Hospital	Adjust HVAC operation	Fan
Information Technology	Data Center	Alter temperature	LED
Nuclear Sector	Nuclear Plant	Toggle smoke	Fog
Transportation Systems	Traffic Lights	Toggle lights	Light
Water	Water Plant	Toggle clarifier arms	Spins

ORIGIN OF JERICHO

The biblical Jericho symbolized a seemingly impenetrable stronghold until it was overcome through faith and strategy. It reminds us that no system is invincible, and with the right approach, even the strongest defenses can be breached.

ABSTRACT

Cyber operations create effects in physical space as well as cyberspace, but most cybersecurity education exercises are confined to cyberspace. Jericho helps drive home the real impact of cyber operations and cyber-insecurity by incorporating physical space effects into cyber operations education. Jericho is a physical table-top cyber city that incorporates critical infrastructure elements. It blends a traditional cyber range experience with a physical range. Existing cyber physical ranges are rare and prohibitively expensive. Jericho is a model for how ranges can be constructed inexpensively. It is constructed using an extensible crate model using off-the-shelf electromechanical components like motors, speakers, and LEDs wired to a microprocessor such as Raspberry Pi Zeros. It models how missions can be created on the range by placing students in the role of cyber operators charged with the attack or defense of critical infrastructure. Students gain access to the cyber city's network over a VPN and begin their mission in a sandboxed virtual machine environment similar to many cyber education exercises. In one mission, students find and exploit vulnerabilities as they pivot through a mock city's cyberspace infrastructure with the goal of commandeering the city's traffic lights. The mission is accomplished when the physical traffic lights in the miniature city change at the will of the students.

MODULAR & EXTENSIBLE CRATES

Size: 18"x24"x20" and < 10 lbs.
Setup: Plug-in, connect to internet, and start
Portability: Stand-alone exercises on each crate
Modular: Use crates in combination or separately
Cost: <$150/crate
Microprocessor: Raspberry Pi Zero
Structures: 3D Printed & Off-the-Shelf

CYBER SCENARIOS

Students receive an intelligence report before starting a scenario.

(U) OPERATION MOLASSES MAZE (OMM)

(U) Narrative
(U) LOCAL has for many years conducted successful clandestine operations within the city limits of JERICHO. However, as JERICHO's counter-intelligence capabilities have grown increasingly adept at detection and disruption, LOCAL must now secure additional safeguards for its operatives within the area. To address this, LOCAL has sanctioned an offensive cyberspace operation to assess the potential for kinetic impacts on a specific target network. Codenamed MOLASSES MAZE, this operation has been entrusted to LOCAL leadership, who are granted tactical discretion to execute the mission.

(U) Target
(U) The mission target is ADVCORP, a government contractor under JERICHO's public works sector.

(U) Objective
(U) Traffic control infrastructure is built and maintained by ADVCORP. Infrastructure control is centralized for ease of management, meaning it is possible to manipulate all city traffic lights from one location. LOCAL CYBER is to access the traffic light controls and demonstrate such capability by causing severe traffic jams for the JERICHO populace at large. This will serve to demonstrate to LOCAL COMMAND that operatives inside the city may use this to their advantage during infil to and exfil from their operations.

(U) Strategy
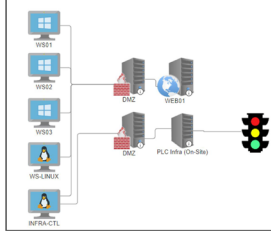(U) Penetrate the ADVCORP network via external public services. Pivot and escalate privileges inside the network to gain access to traffic control infrastructure by whatever means possible and practical. Use your access to manipulate the traffic control infrastructure to cause as much chaos as possible.

(U) Intelligence
(U) External enumeration of ADVCORP's attack surface revealed a promising endpoint which will be relayed once the operation is underway. Full compromise of the contractor environment may or may not be necessary to affect traffic flow, but to maintain persistence inside the network, it is highly advised to elevate your privileges as highly as practical. Visible effect on target should only be attempted once persistence is established.

//SIGNED//
HEC7WE*XERQE
LOCAL COMMAND

CYBER RANGE

Each scenario possesses its own virtual network which students access via a VPN connection.

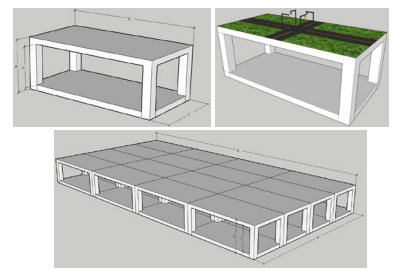WS01, WS02, WS03, WS-LINUX, INFRA-CTL, DMZ, WEB01, DMZ, PLC Infra (On-Site)

PROXMOX HYPERVISOR
Lenovo BLADE SERVER

Some networks are sophisticated while others are quite simple.

THREE CRATES ASSEMBLED

AND WiFi OR

WATER TREATMENT PLANT & TRAFFIC LIGHTS | DATA CENTER | NUCLEAR POWER PLANT

School of
ENGINEERING and
COMPUTER SCIENCE
CEDARVILLE UNIVERSITY

MAESTRO
Faculty Advisor: *Professor Parry*
Mentor: Matt Clark
Students: *Adrianna Holst, Elliot Viaud-Murat, Gabriela Mallack, Carson Levenson, Asher Antrim, Blake Mead*

Research & Scholarship
SYMPOSIUM

Definitions

MAESTRO:
Multi-Agent AI Enhancing Security, Threat Response, and Orchestration

LLM:
A specific type of AI focused on understanding, processing, and generating human language.

Multi-Agent System (MAS):
A system composed of multiple interacting agents designed to solve complex problems that are difficult or impossible for a monolithic system to handle.

Knowledge-Augmented Generation (KAG):
A framework that incorporates logical reasoning and structured knowledge graphs alongside the LLM's natural language processing capabilities.

Abstract

In the cybersecurity field, a significant skills gap exists between senior-level operators and novice operators. The goal of this project is to develop an Artificial Intelligence Offensive Cyber Assistant that enables novice cyber operators to perform at the level of an expert. This assistant is called Multi-Agent AI Enhancing Security, Threat Response, and Orchestration (MAESTRO). Through our research and development, we built a program integrating local or cloud-based state-of-the-art Large Language Models (LLMs) that will give accurate responses to assist a cyber operator in developing tactics. We utilize a Multi-Agent System (MAS) and Knowledge-Augmented Generation (KAG), as well as rigorous user testing, to increase confidence in our system. This research addresses ways to improve accuracy and consistency in LLM responses to confidently use artificial intelligence to scale operators in the cyber operation sector.

User Testing

User testing provided valuable insight that guided developers to create an assistant that was helpful for users of all skill levels. The user ran through the TryHackMe RootMe room using MAESTRO.

Results: Tests found the Maestro to be similar and preferred over Google. Users found MAESTRO useful for guiding in Reconnaissance. Users desired an improved GUI. 66% of people found MAESTRO to be the same or better compared to surfing the web. 17% found MAESTRO to be more efficient than the internet.

Reflection: Developers adjusted the GUI, creating a more user-friendly interface with reduced clutter. Additionally, databases were incorporated to better assist users..

LLM Findings and Testing

LLM Test Considerations:
- Security analysis
- Maximum context length
- Token count
- Cloud-based vs. locally hosted LLMs

☀ Claude

Findings:
- Implements strong data handling policies and encryption, suitable for secure enterprise use.
- Claude Sonnet 3.5 supports a maximum content length of 200k tokens, making it ideal for long queries and back-and-forth conversations. This put it above most of the other models
- Of the 10 models tested, Claude's high token count was the most notable consideration in improving the consistency and reliability of MAESTRO.
- Claude's cloud-based model enables scalable access, regular updates, and reduced local hardware requirements.

Information Retrieval

Information retrieval helps build confidence and consistency in MAESTRO.
- Improves quality of the response from the LLM
- Responses are verified through trusted databases
- Trusted datasets help guide MAESTRO to respond with trustworthy information

Databases used:
- National Vulnerability Database (NVD) CVE
- Collegiate Red Team Competition Team
- Tools, Techniques, and Procedures (TTPs)
- Cyber Kill Chain

Benefits:
- Useful, relevant information
- Verified and trusted information
- New databases can be added or replaced based on users needs

Architecture Design

Speculo: Internet Resource Replicator

Joshua Curry, Micah Vranyes, Gable Levenson, Alex Steele
Sponsor: Cryptic Vector | *Client/Advisor:* Jordan Bellanti

Abstract

Speculo is a tool designed to aid the development of software in an air gapped environment. The tool consists of two main parts: the first to pull the required data on an internet accessible network and the second to distribute the obtained data to endpoints on the air gapped network. The transfer of data between the two networks depends on the specific deployment environment of the tool and is accomplished by the administrator. Speculo can then host these files in an s3 bucket or locally, distributing them to the end user upon request (HTTP request and/or Pip install). The project is sponsored by Cryptic Vector in collaboration with Cedarville University.

Deployment

Container Deployment
- Pre-built multi-architecture Docker containers hosted in Gitlab image repository
- Automated container build in CI/CD pipeline with Ko Builder
- Foundation for both standalone use and Kubernetes cluster deployment

Deployment Methods
- Direct command-line execution from container for simple implementations
- Kubernetes orchestration from scalability and high availability
- Custom Helm charts for streamlined cluster deployment
- Integrated Certificate Manager for automated TLS security

Core Commands

Internet-Connected Network

Request:
This command allows the user to add a request for a new resource, checking the Cache-Control header for conflicts.

Sync:
This command (1) downloads the resources on the internet-side, (2) stores them locally, and (3) automatically pushes them to the S3 server. It includes constraints to prevent redundant uploads.

Zip:
This command takes the locally downloaded resources and zips them up for manual transfer.

Disconnected Network

DNS:
This command starts a DNS server that will point clients to the Speculo server for files.

Serve:
This command starts servers to serve the synced resources.

New Functionality

PyPi:
Speculo can now store and serve PyPi packages, further enabling developers. Developers can run a simple pip install and never know that their package was served from Speculo and not the internet.

S3:
Speculo can now store in and pull from S3 buckets, enabling it to integrate well with S3 compatible cloud solutions and deployments.
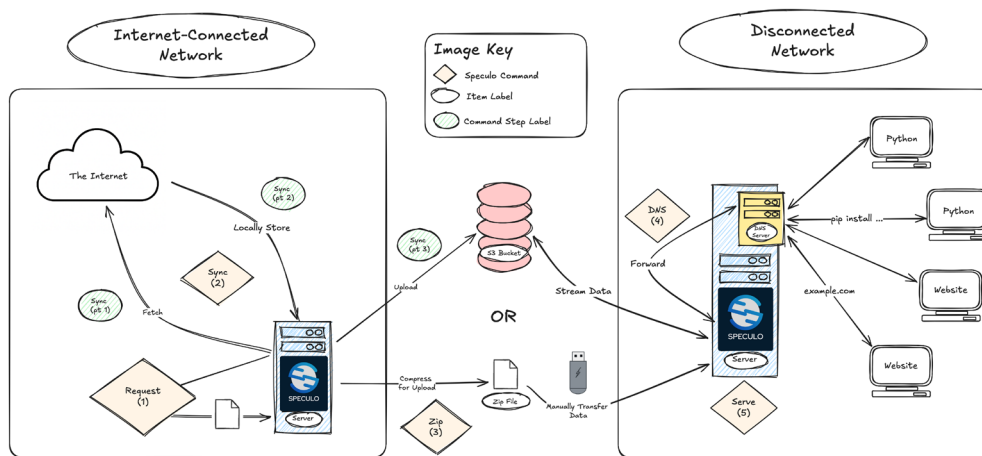
DNS:
The new internal Speculo DNS server can take incoming requests for resources and direct the traffic to Speculo.

Deployment Options:
Speculo can now be deployed on a Kubernetes cluster or using the Docker containers.

Speculo Infrastructure

PROMOTING CYBER AWARENESS IN SOCIETY

The Center strives to strengthen society's cybersecurity, often accomplishing this person by person. Throughout the year, we have engaged in numerous events to promote cybersecurity and spread awareness of the best cybersecurity practices.

Dr. Hamman had the privilege again this spring semester of speaking to all the senior Cedarville nursing students about the importance of cybersecurity in the medical field as part of their senior seminar. The students watched his TEDx talk ahead of time and took a short quiz. They had a great conversation that was steered by the nursing students' questions. He started the conversation by asking them *to tell him* why cybersecurity was important and what best practices they should follow. In the five years he has been doing this lecture, the nursing seniors have clearly grown in their understanding of the importance of cybersecurity. The medical field is a prime target for hackers, especially ransomware, as seen in the attack on Kettering Health in May.

Dr. Hamman was also honored to be the breakfast speaker for the month of May at GoCyber Collective, a new organization in the Miami Valley that promotes cyber awareness and conducts cybersecurity training. John Siebel, former WDTN anchor, is the director and visited Cedarville's campus in the winter to learn more about Cedarville's cyber program. Dr. Hamman spoke about the importance of cybersecurity education, what students are learning in the classroom, and covered the national cybersecurity education landscape.

Great Lesson by the Professor!

In a presentation fit for the silver screen, two big thumbs up for Dr. Seth Hamman!

Drawing on some classic movies, Dr. Hamman's plot line was in bright lights: don't just float on the surface of cybersecurity, go deep.

Dr. Hamman pioneered the first Cyber Ops B.S. degree in Ohio and continues to shape the future safety of the state and country by teaching, developing and encouraging Cedarville University students as the Director of the Center for the Advancement of Cybersecurity.

It was an honor to host Dr. Hamman as our Keynote Speaker!

Cyber Outreach

Mars Hill Christian Academy

In January Dr. Hamman was invited to kick-off Mars Hill's annual Worldview Summit at their campus in Mason, Ohio, before they traveled to Washington, D.C. He spoke on A Christian Perspective on Technology and shared the Accept, Reject, and Redeem paradigm of Christian integration with the students.

"Dr. Hamman, your talk to us was truly the best opening presentation for our summit. Your insights and three principles for how Christian's should look at technology have penetrated our classroom conversations and set a foundation for the presentations this week. At Mars Hill, we value having the Bible at the foundation of every topic. With your deep integration of the Bible, you set the tone for comparing technology and its use to scripture. Thank you for spending the time with us and kicking off our event! We are truly grateful for the time that you graciously dedicated to giving us solid insights and wisdom for our view of technology" - MHA Student Thank You Note

Cedar Cliff High School

The Cyber Center had the opportunity to host high school students from Cedar Cliff High School for a lesson on the basics of cyber competitions. After a short lecture, the high schoolers competed in a mini-CTF prepared by the Cyber Center that covered many common topics in cyber competitions, then they had lunch in Cedarville's dining hall. Volunteers from the Cyber Operations major helped run the event by helping the visitors with tough CTF challenges and engaging them in conversation during lunch.

National Cybersecurity Awareness Month

This October we conducted our second annual cyber scavenger hunt. The hunt consists of beginner cyber challenges leading participants around Cedarville's campus. Finishers are awarded a commemorative token for their accomplishment. Special thanks to Nick Sheldon for spray-painting the rock to lead to the first clue of the scavenger hunt this year.

What is Cyber?

In recognition of National Cybersecurity Awareness Month, the Cyber Center produced a video titled "What is Cyber?" This initiative, targeted at the Cedarville college campus community, aimed to provide a deeper understanding of what cybersecurity is and its importance in today's digital landscape. The video can be found here.

Cyber Movie Night

We saw over a hundred students from across the campus join us to watch the movie *Bridge of Spies* starring Tom Hanks. A great patriot film based on a true story about spycraft and international relations

ASCII Art Competition

February saw our second annual ASCII art contest with the theme of patriotism. This campus-wide event provided a fun and creative outlet for students to showcase their artistic talents using only text characters. The winners this year were Mr. John Clevenger and Mr. Allen Ropp. View the submissions here.

In the News

Cedarville was ranked by Intelligent.com as having the best accredited cybersecurity program in the country. Read about it here.

Cedarville Cyber On-Air

Our Chief Cyber Student Fellow, Mr. David Reid, got plenty of airtime this year. He was interviewed on air for multiple broadcasts including The National News Desk out of Washington D.C. We are proud of him for representing the program well and for his courage to speak. Click any of the below links to hear him.

- The TikTok Ban here.
- Cyber Team Success in Competitions here.
- Security Concerns with Spy Cameras here.
- A Failing Security Grade: DeepSeek here.
- Adapted from above for WTAQ-AM Radio in Green Bay, WI here.
- Upcoming 2025 GenCyber Summer Camps here.

Cedarville Stories Podcast

Former Cyber Student Fellow David Reid and Emily Wollschlager did an outstanding job representing the senior class on the Cedarville Stories podcast with Mark Weinstein. S:12 E:18 | "From the Heartland to High Places: How Two Cedarville Graduates Are Launching Their Dreams"

Cedarville Press Releases

Cedarville Senior Recognized for NSA Codebreaker Achievement

Kaicheng Ye cracked the code and now the Greene County Commissioners are going to honor him for this national accomplishment

Bridging the Gap: New Cyber Endeavor Cultivates Leaders

As the demand for cybersecurity professionals soars, Cedarville University is launching a new student-led initiative to equip future cyber experts with technical and leadership skills.

GenCyber Camp Returns to Cedarville

Cedarville University has been awarded a grant from the National Security Agency (NSA) to host the GenCyber cybersecurity camp this summer, June 23-27. Designed for rising high school seniors, the camp aims to ignite and sustain interest in cybersecurity, a field critical to national security and economic stability. Applications are open until March 1.

Cedarville University's Key Player in Cyber Operations

Cedarville University's cyber operations program continues to earn national recognition for its educational excellence and high-level partnerships. Now, one of its leaders is helping to pioneer cyber operations education across the country.

Cedarville's Cyber Team Dominates National Contests

Cedarville University's cyber operations program, the highest-ranked program in the nation according to Intelligent.com, proved its worth by winning Liberty University's Cyber Summit Capture the Flag competition in November and finishing third at the prestigious VIVID Coalition event in Augusta, Georgia.

Cedarville University Among Top Three Evangelical Universities in WSJ National College Rankings

Cedarville University has been placed among the top three evangelical universities in The Wall Street Journal's 2025 Best Colleges in the US national rankings.

Cedarville Pioneering Cyber Operations Program Earns NSA Distinction

The National Centers of Academic Excellence in Cybersecurity, managed by the National Security Administration, provides a designation in Cyber Operations that is held by only 22 universities in the United States. Cedarville University, a private Christian university in Ohio, stands among the many prestigious institutions on that list.

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Cedarville-Air Force Materiel Command Partnership Benefits Students, Region

Cedarville University and the Air Force Materiel Command Engineering and Technical Management Directorate at Wright-Patterson Air Force Base (WPAFB) have formalized their long-standing relationship through a new Education Partnership Agreement (EPA).

New Scharnberg Business and Communication Center Open

Nearly two years after breaking ground, Cedarville University dedicated the $40 million Scharnberg Business and Communication Center today before a standing-room-only crowd along the new Stinger Plaza between the Stevens Student Center and the new facility.

NSA Partnership Expands Cedarville Opportunities

Insecurity in cyberspace is an international problem that has created mistrust in society and led to a growing need for security professionals who can provide online safety. Cedarville University is at the forefront of preparing future cyber-security professionals through its partnership with the National Security Agency (NSA).

National Excellence in Cybersecurity

Cedarville University's commitment to providing a premier education in cybersecurity, anchored in biblical principles, has been recognized with top honors in Cybersecurity Guide's 2024 rankings. The program secured the No. 1 ranking for Best Overall cybersecurity program, while also being ranked No. 3 for Most Afford-able nationwide.


Student Dominates NSA Code-breaker Challenge

Not many people can say they have won a national championship. Kaic-heng Ye, however, can claim winning the 2022 National Security Agency's Codebreaker Challenge.

Empowering Cybersecurity with New Certifications

The SANS Institute is recognized as being one of the most prestigious and trusted training and certification programs for cybersecurity profes-sionals. Certifications from this insti-tute gives credibility to cybersecurity teachers and practitioners.
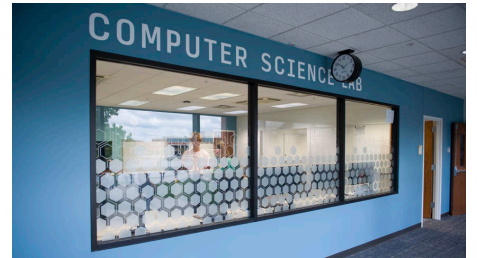
Computer Science Lab Renova-tions Meeting Student Needs

A leader among computer science and cyber operations programs, Cedarville University has updated its computer science labs to meet the needs of the growing department.

Student Testimonials

The first part of the Cyber Center's mission is to develop tomorrow's cyber leaders in the classroom. The Center strives to bless its creative and diligent cyber students that attend Cedarville, molding them into seasoned cyber operators. Included here are testimonials from a few of the many students the Center has made an impact on.

Gabriela Mallack

I am amazed at how far my classmates and I have come. I have learned so much, gained confidence in my skills, and received invaluable wisdom from our faculty in this department. Over these years, I have had the opportunity to participate in several cyber competitions, be part of our Women in Cyber Security organization, and hear from incredible speakers, all of which have helped me become a well-rounded cyber student. Our program has helped me build confidence not only as an academic but also as a Christian entering this field. So many doors have been opened, and I can confidently say this is the career path I want to continue pursuing. The Lord has been faithful and gracious to me, blessing me with supportive, knowledgeable, and caring faculty members, as well as wonderful classmates who have guided me throughout my journey. As I head into graduation, I am excited to apply my skills and to see how Cedarville's Cyber Department continues to make an impact for Christ—not only on our students but also on the world we are stepping into after graduation.

Alexander Taylor

When I started as a cyber student in the fall of 2022, I never imagined how much I would enjoy working with my peers and professors in Cedarville's cyber program. Whether it be a simple interaction with a fellow student in the hall, or a professor sitting down to help me understand a complex topic, I have consistently been blessed to interact with the men and women seeking to serve the Lord through cyber. The Cyber Center offers a wealth of opportunities for new cyber operators to learn valuable skills as well as more experienced operators to build an immense set of skills that I would not have imagined coming in as a freshman. As I head into my senior year, I am looking forward to learning from and helping my peers to be better cyber operators who seek to glorify God first and foremost.

David Lamoreaux

The Cyber Program at Cedarville has been instrumental to my growth during my sophomore year. My peers have continually challenged and encouraged me, strengthening my confidence to make a meaningful impact on those around me. With so many opportunities for development, I'm excited to contribute in the years ahead and to support the classes that follow. I'm deeply thankful for the high-quality education I receive at Cedarville, and I'm confident it will prepare me well for the cybersecurity industry. Most of all, I look forward to seeing how God uses this program and its students to make a lasting gospel impact in the world.

THE REASON IT ALL EXISTS

We know that the Lord is blessing Cedarville's cyber program so that our students will go from here to advance His purposes in cyberspace. This year 47 godly young men and women graduate from our computer science and cyber operations program, and we know that the Lord has big plans for them. We are so grateful that He brought them to study with us for 1,000 days at Cedarville. This group was truly an outstanding class that is leaving behind a legacy that will bless future students.

Anna Kauffmann received the Cyber Operations Daniel Award

Gabriela Mallack received the Outstanding Cyber Operations Team Leader Award

David Reid received the Outstanding Cyber Operations Senior in Design Award

Kaicheng Ye received the Outstanding Cyber Operations Graduate Award

Not pictured: Kaiden Delsing received the Outstanding Cyber Operations Innovation Award.

CONNECTION OPPORTUNITIES

Are you interested in partnering with us to develop tomorrow's cyber leaders in the classroom while advancing cybersecurity in our nation? If so, here's how:

- Support our Cyber Teams as they compete in cyber exercises around the U.S.

- Share your industry insights with us via a speaking engagement.

- Sponsor an engineering senior design project.

- Tour Cedarville's cyber facilities to better understand our mission.

- Invest financially to create enhanced learning opportunities for our students.

Contact us via email cybercenter@cedarville.edu or Instagram @cucybercenter.

More information
- Cyber Center website: cedarville.edu/cybercenter.
- Cyber Operations Major website: cedarville.edu/cyberops.
- Cyber Team website: cyber.cedarville.edu.

Partners