



NETWORKING 101

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In Memory of Allen Daugherty



Brenda. He enjoyed rock climbing and rappelling, tinkering with electronics, and all things sci-fi. As his family



grew to include three boys, he was dedicated to investing his time in their activities. He served as Cubmaster for Cub Scouts Pack 60, coached numerous soccer teams and was president of the Mon Youth Soccer Association. He vacationed every year at Cedar Point and the Outer Banks with his family and ever-present chocolate labs.

Allen had a long history as a key member of WVNET's staff. He was part of the original staff when WVNET started in 1977, working as a Programmer/Analyst. Through the years Allen advanced up the ranks of systems programmers, and was increasingly involved with communications technology. He eventually became Manager of Telecommunications and played a major role in designing and maintaining WVNET's statewide educational network.

On December 11, 2018, our beloved Director Allen Daugherty passed away.

Originally from New Martinsville, WV, Allen graduated from Valley High School in Pine Grove, WV. He attended West Liberty College and West Virginia University, and became involved with computer systems and programming. While at WVU, Allen volunteered as a paramedic with Monongalia County EMS, which is where he met his future wife

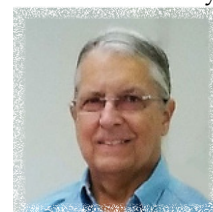
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In November 2010, WVNET got a new Director – Judge Dan O'Hanlon, who appointed Allen as Deputy Director. Dan and Allen worked to build new futures for WVNET including Distance Learning and Media Services. They transformed the statewide network into a modern fiber-optic ring that provides increased bandwidth and reliability at a lower cost to educational institutions in West Virginia.

Allen's passing is a profound loss for WVNET as well as countless people in West Virginia and elsewhere who were served by his expertise and dedication. He will be greatly missed and never forgotten. Our hearts go out to his family.



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STRATEGIC MILESTONE UPDATES

New DLES Manager



Born and raised in Western Pennsylvania, Dr. Bonnie Ordonez joins the team at WVNET as the Manager of Distance Learning and Education Services. Bonnie most recently served as the Dean of Education and Applied Social Sciences at a small university in Greensburg, PA. She has a broad background in Higher Education and K-12 Education. She has worked extensively with distance education and has taught numerous online courses over the past fifteen years. Bonnie holds a doctorate degree in Technology Education from West Virginia University and a Master's degree in Instructional Design and Technology. She is mom to two adult children. When not working you can find Bonnie reading, cooking or playing with her one-year old teddy bear puppy named Francisco.

Network Operations Center —Kim Jenkins, WVNET Operations

During the month of November 2018, the WVNET Network Operations Center logged a phenomenal 864 tickets and for December 2018, a total of 818 tickets. Please remember the WVNET Help Desk is available to serve customers 24/7. Just call 304-293-5192, or connect on the web at wvnet.edu



Blackboard is Getting an Upgrade —Harmony Garletts, WVNET Distance Learning Team Lead

WVNET is upgrading to Blackboard Learn 9.1 Q4 2018 CU 1. This is the most recent version of Blackboard and includes some new features, including Attendance Tracking, Cloud Storage Integration, create recording for feedback, and additional Grade Center enhancements. For more information on new features, check out the [Educator Release Flyer](#) and the [Q4 2018 Release Notes](#).

Institutions interested in training on the new features can contact Harmony Garletts at 304-293-5192 x240 or hgarletts@mail.wvnet.edu.



Blackboard

Mind your MANRS

—Frank Seesink, WVNET Network Specialist III



This past year has seen an unprecedented number of impactful events occur across the Internet. There was the sophisticated theft of digital currency by thieves who manipulated the routing of data intended for Amazon's Route53 DNS service. Then it was discovered that entire portions of U.S. domestic Internet traffic had been redirected through ChinaNet (an ISP with close ties to the Chinese government). The list goes on. Whether intentional in nature or through human error, these events signal a need to tighten the way the Internet functions to prevent bad actors and human fallibility from disrupting services.

It's no surprise that at this past year's Internet2 Technology Exchange (TechEX) held in mid-October 2018, that one recurring topic was Internet security. And one of the reasons for the active discussions lay around a presentation done a few weeks earlier in the security track at the North American Network Operators Group meeting (NANOG74) in Vancouver. Supposedly during that NANOG presentation, it was indicated that Google intended to begin doing something in the coming months which could seriously impact those network providers who did not conform to certain standards.

The presentation was on the Border Gateway Protocol (BGP), the protocol used between autonomous systems (ASes) on the Internet to determine how traffic gets from A to B. The presentation focused on some of the security issues around BGP. At a high level, each AS such as WVNET, WVU, Marshall, Verizon, Comcast, etc., is its own network. When one AS connects to another, they use BGP to let the other side know "Hey, if you're trying to get to these IP addresses, I have them over here." For example, WVNET would announce via BGP that anyone trying to reach an IP address in the 129.71.0.0/16 range should come to us. As each border router learns about its neighbors, they in turn relay that information along to their other peers, and much like that old shampoo commercial, "and they told two friends, and so on, and

so on." As routers "talk to each other", they eventually learn "Hey, I can get to B via C in 5 hops. But I can get to B via D in just 3 hops." Keeping in mind that the Internet is a "hop by hop" network, with that information each router then decides the best path to take to send data to its destination by sending it to the next hop (in this case, sending the packet destined for C via D).

However, it is possible for one AS to claim that they have a certain IP address range when they do not, thereby tricking others into sending traffic in their direction. A rather infamous case of this was when in February 2008, after a censorship order from the telecommunications ministry, Pakistan's state-owned telecommunications company—whether intentionally or out of ignorance—started announcing via BGP that anyone trying to get to YouTube should go to them, where they then dropped such traffic. This caused a large portion of Internet traffic destined for YouTube to be "leached" to Pakistan. From a user's perspective, YouTube was simply unreachable.

This tactic, whether by design or by accident, is known as "BGP hijacking." You announce a network that you do not own, causing traffic to potentially get redirected to you. In cases like Pakistan's censorship of YouTube, or ChinaNet's redirection of some U.S. domestic traffic via mainland China, the potential exists for nation states to intercept traffic they should not normally see. Bad actors could do the same in order to commit crimes such as the digital currency theft mentioned earlier.

There have been attempts in the past to at least have ASes be able to communicate which networks they legitimately can announce, even to those who are not directly connected peers. This information is stored in a database called an Internet Routing Registry, or IRR for short. Several exist, including Merit Network's RADb and PeeringDB. There is also what is called the Origin AS setting in the American Registry of Internet Numbers (ARIN) database, which allows owners of IP subnets to list specifically which AS can announce their address block.

Add to this that over the years, best common practices (or BCPs) have been developed to give network operators guidelines to follow in order to help prevent many of the issues going on. The most well-known of these is BCP38, officially defined here (<https://tools.ietf.org/html/bcp38>) and explained in a little more accessible manner here (<http://www.bcp38.info>). BCP38 has been around for quite some time.

Just one example of this is setting features on routers to prevent the use of "spoofed source IP addresses" in packets. This is the ability to send an Internet packet with a fake source address. Why would anyone want to do this? Notably for Denial of Service (DoS) attacks. If I can send thousands of packets of data from my computer asking a web server for information, but make it appear as if your computer is the one making the request, then all the reply traffic will be sent to your computer. Repeat

Mind Your MANRS (continued)

this process to several different web servers, and I can cause an enormous amount of traffic to fill up **YOUR** Internet connection. In human terms, imagine sending out thousands of postcards, all to different magazines, political campaigns, etc., and setting the return address to someone you don't like. Suddenly, that poor person is receiving thousands of unwanted letters in the mail, filling up their mailbox. The same principle applies.

While following BCP38 will not prevent you from being hit with a DoS attack, it will make you a good netizen so that at least your network will not be part of a DoS attack against others. I'm glad to say that WVNET has followed BCP38 for as long as I can remember.

Unfortunately, not everyone has been good about following BCP38 and/or maintaining things like IRR information. This is what led to the creation of the Mutually Agreed Norms for Routing Security, or MANRS for short (<https://www.manrs.org>). MANRS is "a global initiative, supported by the Internet Society, which provides crucial fixes to reduce the most common routing threats." (<https://www.manrs.org/about/>) It outlines four simple but concrete actions that network operators should take including filtering, anti-spoofing, coordination, and global validation. It is a voluntary initiative, where Internet Service Providers (ISPs) and Internet eXchange Points (IXPs) sign up to conform by those actions.

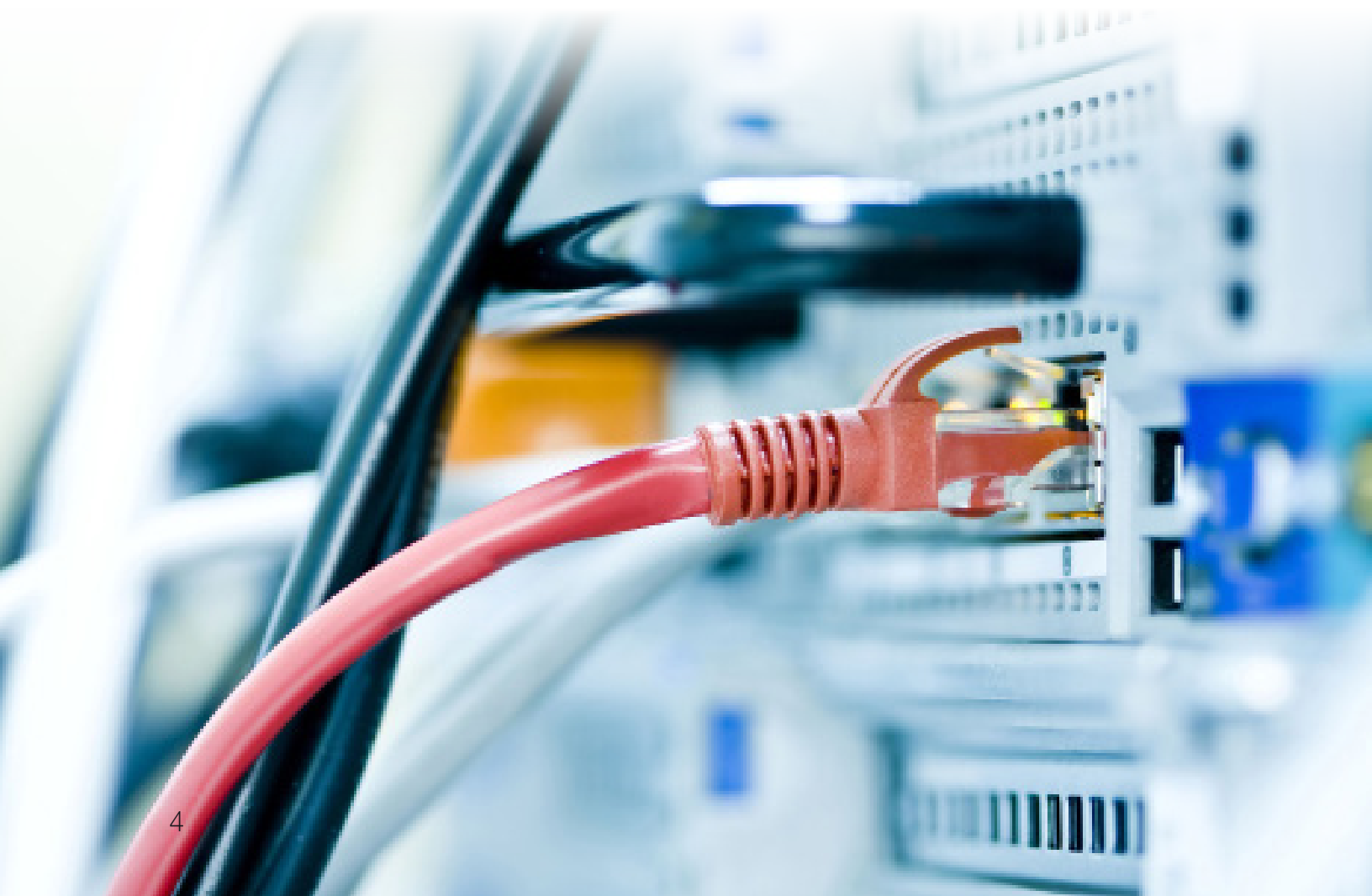
My first exposure to MANRS was at a Routing & Security Best Practices workshop at the 2016 Internet2 TechEX. But MANRS began a few years before that. Unfortunately, as it is voluntary in nature, and as the actions taken do not so much benefit you as it

does the Internet community at large, uptake of MANRS has been a little slow.

So back to that NANOG presentation. In that presentation, it was indicated that Google intended to begin monitoring BGP traffic in January 2019 and comparing the live information with that stored in IRRs. And Google would begin notifying ISPs and IXPs when they found BGP announcements which did not conform to the IRR data. But the key point was that beginning potentially in March 2019, Google would go from passively monitoring this traffic to actively filtering out any BGP announcements that did not conform. What does this mean? It means that if an ISP is announcing their network to the world, but they do not have that information in an IRR which Google is referencing, Google will not peer with them. In plain English, the customers of such ISPs will suddenly find that they can no longer reach Google assets such as Gmail, YouTube, Google Apps, etc. So to say that this caused a stir in the industry would be an understatement.

The Internet2 community, not one to be behind on supporting best practices, therefore brought this up at the recent TechEX in several sessions, encouraging everyone who had not already done so to make sure that they have their IRR data up to date, their ARIN records properly updated, and if possible, to sign up for MANRS and to commit to the actions that entails.

In this regard, WVNET, as the state's R&E network, has begun the process of verifying its IRR and ARIN information, and as we've always followed BCP38, once we validate our network, we intend to sign up as a MANRS participant. We encourage everyone with an AS to consider doing the same. Only by working together can we create the Internet we would all like to have.



Years of Service to WVNET

WVNET has an exceptional technology-savvy team with a strong customer orientation. We're happy to acknowledge the fact that these staff members have reached significant milestones in their careers with us during December 2018 and January 2019:



December 2018

Randall Long – 38 years
Chris Freeman – 20 years
Ben Mays – 13 years
Tony Masi – 4 years

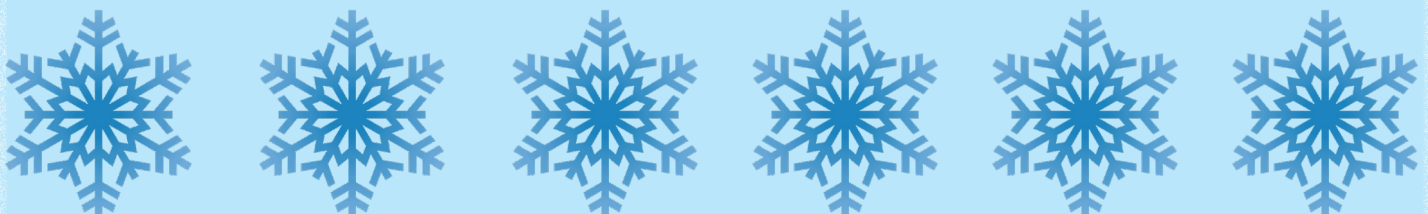
January 2019

Steven White – 6 years
Harmony Garletts – 1 year

WVNET Holiday Project December 2018



WVNET helper elves cheerfully assisted Karen Saffron and Marcie Merrill with this year's holiday project in sponsoring a family from the local community at Scotts Run Settlement House. Staff members contributed cash and gifts that included, in part, coats, blankets, dinnerware, toys and many other things. The sponsored family included both parents and four children ages 11, 9 ½, 6 ½, and 1 ½.



WVNET Significant Accomplishments – 2018

2018 was a year of serious change for WVNET. Our management from the top down was restructured, some of our staff retired or moved on to other opportunities, and we adjusted our work flow a bit to better support our customers. With all of these changes creating some chaos, we still managed to accomplish a lot. Here is our list of Significant Accomplishments from 2018:



WVNET Telecommunications played a major role in **moving nearly all 55 West Virginia county courthouses to new circuits**. The courthouses were paying a hefty price for internet access, and this change saved them many thousands of dollars. Since the circuits had to be moved before renewal of an existing contract, the time frame to complete the work was short. Our Telecommunications team worked hard to get this done on time.



WVNET worked extensively with West Virginia's County Judges, Clerks and Supreme Court Technical Staff to do arraignments, host remote lawyers, interpreters and witnesses, and other court business via **video communications**. Originally designed and implemented by Judge Dan O'Hanlon and Allen Daugherty, the video infrastructure for this service has grown and evolved for nearly two decades. WVNET provides scheduling, connecting, troubleshooting and training for the video systems.



We replaced the aging **Akamai** server and switch in our Charleston Data Center with a new one that is significantly faster and more robust. Our Akamai servers are part of a large Content Delivery Network (more than 240,000 servers world-wide) which **cache certain popular content** in multiple geographical locations. As an example of why this is important, when a

Windows Update is available there would be a lot of network congestion if every PC downloaded the update from Microsoft's servers in Silicon Valley. Instead, Akamai servers cache the update locally so that fewer computers are downloading from a more local source. The result is a significant improvement in connectivity and download speed.



WVNET deployed our first instance of **Ellucian Workflow**, a tool that automates business processes. Working with Blue Ridge Community and Technical College, we got both a test instance and a production instance running. We are now working on implementing Workflow for other institutions.



WVNET's Banner Support team achieved greater stability with the **Banner** database servers, optimizing the memory usage to prevent outages. There were semi-regular memory problems, and our DBAs worked on new memory settings that have resulted in far fewer service interruptions. Also, we worked with **Pierpont Community and Technical College** to implement their Banner system hosted at WVNET.



WVNET's custom **problem tracking system "OZ"** never stands still, as we constantly tweak and extend it by request from our customers. This year we made numerous changes to reports and invoice layouts, improved searching capabilities, and made improvements to our **Google Chromebooks management** interface.



We introduced our **Professional Learning and Development (PLAD)** system in the spring of 2018. Multiple K-12 school boards have adopted the tool for tracking their staff's professional development. Thousands of users have helped us build on the initial system

which now includes a pre-registration system for class sessions, sign-in sheet generation, and many more reporting options.



A new version of our **Public Service Training application "PSTachio"** was written by one of our software developers. The emphasis in this rewrite was bringing the software into a set of standards to improve performance and maintainability. We are now working with PST coordinators to bring this new version into production along with improvements to functionality and performance.



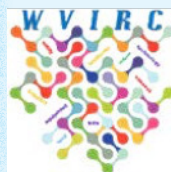
Our **Entry Log application** serves as a community monitor for WVNET staff. It helps us to know who is currently working and whether they are local or remote. New staff members can use the app to match faces with names. This year the app was completely re-written to conform to modern standards and provide a more dynamic update of staff information. We also integrated our **Emergency SMS messaging system** into the app, which is used to notify our staff of inclement weather closings and other important events. These applications were built for use at WVNET, but could work just as well for your institution. Contact us if you would like to know more!



Gatekeeper is a WVNET program that **monitors school attendance** via input from biometric devices or other sources. It is mostly used by K-12 schools to keep track of tardy and early dismissal students. This year we made improvements to the student data input code to help keep an up-to-date record of enrolled students at each school.

WV Center for Nursing (Honu) is an application that helps nursing educators schedule time at medical institutions for student experiences. In the past year many parts of the application were written to make it more

maintainable and compliant with WVNET's software development standards. Users of the application responded enthusiastically, with one saying that "This is the easiest it has ever been."



WVNET created and maintains software to help the **West Virginia Instructional Resource Center (WVIRC)**, which provides materials for the West Virginia

School for the Deaf and the Blind. The application helps teachers order free educational materials while helping the WVIRC to manage orders and inventory. This year we made many updates to the user interface, reports and help system, and improved ADA compliance in the user interface so that it will work better with screen readers.



OneTAP is our on-line **electronic bid management system** which allows an institution to post RFPs and RFQs on a web-based platform and accept vendor bids electronically. We made major improvements to the user interface and functioning of the application in the past year, and it is now available as a service to our customers.



WVNET's **home web site** was re-designed and built from scratch during 2018, with an emphasis on simplicity, easier navigation and a more modern look. See it here: <http://wvnet.edu>.



In the past year more counties began hosting their K-12 Web Sites at WVNET. We provide **free web sites for K-12**. Our support includes ready-made theme templates, training from our skilled web support staff, problem solving and software updates. We back up sites and update plug-ins on a daily basis. For sites that use

custom domain names or SSL certificates, we make sure they get renewed at the right time and continue to work correctly.



SSL (Secure Sockets Layer) is a protocol that provides security in connections to web applications and sites. An authorized certificate is required to establish an SSL connection, and this has traditionally been an on-going expense as the certificate had to be purchased/renewed from a certificate authority. There is now a product called Let's Encrypt which is free, automated and open, so there is no on-going cost. WVNET has been gradually integrating **Let's Encrypt** in our applications and sites.

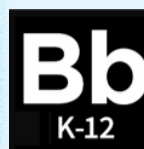


Web site accessibility is rapidly becoming an issue for schools, as the U.S. Department of Education is requiring sites to adhere to ADA compliance standards. For this reason WVNET began offering **Web Site Accessibility Remediation** services. Combining our knowledge of best practices established by the Worldwide Web Consortium (W3C) and the latest industry tools, WVNET can assist anyone wishing to craft and/or implement an Accessibility Action Plan for their institution/business, helping to provide a path to compliance. Whether building a new website or making existing web content more accessible, we are able to provide a comprehensive audit of online material, as well as the resources to remedy any issues identified. This service is offered at extremely competitive rates and helps to minimize and/or eliminate potential legal costs as more and more high-profile institutions (both government and private) are caught up in preventable litigation resulting from non-compliance. We have already worked with several customers to identify and correct accessibility issues on their sites.

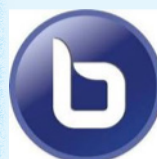


WVNET hosts and supports **Blackboard LMS** for West Virginia institutions. During the past year we upgraded the software three times to provide

the latest and greatest features and reliability. Many institutions use Ellucian Banner for student management, and WVNET created and maintains an integration between Banner and Blackboard. In 2018 we implemented this integration for more of our participating institutions. As with all of our services, we also worked with customers to train, assist, solve problems and make sure everything worked correctly.



While WVNET has hosted and supported Blackboard LMS for WV Higher Education institutions for many years, we are now offering **Blackboard for K-12**. This LMS service helps schools reduce paper costs and create reusable subject matter with powerful content management tools. The new service offers customizable content to fit a variety of lessons and delivery methods including blended/flipped classroom structures. Through the Blackboard LMS, students can access course materials and complete assignments on snow days while parents can stay informed with classroom/grade notifications for students. Plus, it is hosted right here at WVNET. The K12 Blackboard LMS also features custom integration with WVEIS, and an attendance-tracking tool. Blackboard boasts a mobile app to engage active learners where they are, as well as an instructor app to allow teachers to access their classrooms from mobile devices and a grader app that allows teachers to grade lessons on the go. WVNET offers 24/7/365 Help Desk support for teachers, students, and parents as well as a variety of technical support and on-site training for faculty and staff.



More of WVNET's customers are using **Big Blue Button** to enhance their Blackboard, WVROCKS and PEAK courses. Big Blue Button is a web-conferencing system that provides high-quality, face-to-face communications along with recording capabilities, annotations, shared desktop, document sharing, interactive whiteboard, polling, chat and more. It's an incredibly useful

tool that is surprisingly inexpensive compared with other web conferencing solutions.



WVNET redesigned its **Address Cleansing** application and began offering it to our hosted institutions at no charge. Address Cleansing is a process which checks addresses against data files of authentic deliverable locations (provided by the US Postal Service) and revises or cleanses them as needed. Approximately twenty-five percent of scanned addresses are either misspelled or have an incorrect zip code, city or state. Using this service greatly improves an institution's success in contacting students, prevents unauthorized changing of student-provided data, and enables eligibility for postal discounts.



WVNET extended its Microsoft contract for an additional year. This contract provides 19 public and private higher education institutions with all of the Microsoft products they need at the lowest possible cost through the Microsoft Campus Agreement Program.



Our Distance Learning team worked with the West Virginia Supreme Court of Appeals to deploy staff development and HR tools on our **Portal for Education and Knowledge (PEAK)**. We offer PEAK as a shared Learning Management System (LMS) for organizations who want to provide on-line training without the expense of paying for an entire LMS instance. If you have a small set of courses you want to offer to your employees, this service is worth looking into!



Some of our customers who get a lot of email rely on our **Virus and Spam Filtering** service to remove unwanted email. Email continues to be a major source of computer compromises, delivered through attached files or via embedded

links that may be clicked. WVNET uses **Defender MX** and other spam filtering tools to eliminate malicious emails and flag others that have suspicious characteristics. In the past year we updated this software numerous times to provide the best service and stay up-to-date with our ability to correctly identify and eliminate problem email.




Enrollments in the West Virginia Remote Online Collaborative Knowledge System (WVROCKS) courses continue to break records. WVROCKS provides online courses for Regents Bachelor of Arts Degree Students, Board of Governor's Degree Students, and a number of other special initiatives. Courses are offered in a compressed eight-week format and range from 1-3 credit hours for 100-400 level courses. During the 2018 calendar year, WVROCKS enrollments increased to 2317. Students from seven participating institutions of higher education enrolled in classes generating over \$600,000 in revenue for those institutions. In addition, retention statistics continue to exceed national averages in that 97% of those who enrolled, attended their classes; 96% of those students who attended, completed their courses; and 87% of the students who completed their courses earned passing grades. Spring 2019 enrollments have already surpassed Spring 2018, and two new institutions have joined the consortia of participating institutions. WVROCKS began in the Fall of 2012 with just 50 enrollments and three participating institutions. WVROCKS growth in a few short years demonstrates the sustainability of their business model and the need to extend curriculum offerings at the institutional level through a statewide portal. West Virginia Network's (WVNET's) support, both technical and administrative, is essential to the portal's success. For more information, contact Dr. Roxann Humbert (<mailto:Roxann.Humbert@wvlocks.wvnet.edu>) or Dr. Mary Stewart (<mailto:Mary.Stewart@wvlocks.wvnet.edu>).

DegreeWorks

In early 2018, WVNET's **DegreeWorks** Team, in partnership with Ellucian, launched a series of **virtual training sessions** focusing on the "scribing" course catalog process. To ensure repeated outcomes were achieved in maintaining course catalog data within DegreeWorks, instructors incorporated institution-specific curriculum and data, recommended best practices, and other scribe industry standards.

In Mid-Summer 2018, WVNET hosted our first **DegreeWorks Reporting Workshop**. During this 3-day workshop, attendees from six institutions were provided with an overview of the DegreeWorks Curriculum Planning Assistant (CPA) tables/views and report creation strategies.

Behind the scenes, the Degreeworks team made changes to ensure better data management. For example, they denoted the 2nd Tuesday of the Month for an **expanded maintenance window** for all our hosted DegreeWorks Test environments.

 WVNET worked with numerous customers to create and manage **Listserv** group email lists, **Domain Name System (DNS)** configurations that map friendly internet URLs to IP Addresses, **Domain name configurations** that allow users to have a custom URL for their web and email presence, and **Secure Socket Layer (SSL)** certificates that provide a secure internet connection. All of these services are provided at no charge to our customers, which is an example of **Value Added Benefits** you get when partnering with WVNET.



WVNET's Systems Team create and maintain the cloud in which all of our services run. WVNET's systems are complex, including a vast array of servers, operating systems, security systems, storage networks, backup systems, email and messaging, automation and monitors. The systems team keeps our services

running within the State of West Virginia to provide the best, most efficient and secure services and the most cost-effective price.



The following WVNET staff members were recognized for their Years of Service to WVNET in 2018:

Allen Daugherty (WVNET 42; State of WV 41), Jerry Burchard (WVNET 41; State of WV 39), Karen Saffron (WVNET 39; State of WV 40), Mike Karolchik (WVNET 38; State of WV 36), Randall Long (WVNET 38; State of WV 36), Roman Chuby (WVNET 38; State of WV 37), Marcie Merrill (WVNET 36; State of WV 36), Fran Barnes (WVNET 35; State of WV 40), Verne Britton (WVNET 33; State of WV 32), Barbara Long (WVNET 33; State of WV 32), Kim Jenkins (WVNET 29; State of WV 28), Jason Chastain (WVNET 27; State of WV 26), Phil Snitz (WVNET 23; State of WV 20), Dave Watson (WVNET 21; State of WV 25), Chris Freeman (WVNET 20; State of WV 19), Yvonne Howdershelt (WVNET 20; State of WV 32), Frank Seesink (WVNET 20; State of WV 19), Dianne Sisler (WVNET 20; State of WV 30), Libby Cress (WVNET 19; State of WV 25), Greg Kidder (WVNET 16; State of WV 15), Annette Dick (WVNET 19; State of WV 40), Ben Mays (WVNET 13; State of WV 12), George Tilko (WVNET 12; State of WV 46), Ron Hamilton (WVNET 7; State of WV 34), Steven White (WVNET 6 years; State of WV 6), Russell McCormack (WVNET 6; State of WV 5), Donna Meadowcroft (WVNET 6; State of WV 37), Mary Stewart (WVNET 6; State of WV 26), James DuBois (WVNET 5; State of WV 5), Cory Morrison (WVNET 5; State of WV 5), Mike McDonald (WVNET 5; State of WV 5), Scott Hofer (WVNET 5; State of WV 8), Mark Hartzell (WVNET 4; State of WV 8), Chris Seckman (WVNET 4; State of WV 3), Buffy Vehse (WVNET 4; State of WV 22), Jay Waxman (WVNET 4; State of WV 3), Tony Masi (WVNET 4; State of WV 3), Charles Stevens (WVNET 3; State of WV 3), Bob Burton (WVNET 2; State of WV 11), Eric Burgy (WVNET 1; State of WV 14), and Suma Ponnamm (1).