2018 U.S. Information Technology Collegiate Conference Network Design Competition

**Do not put your name(s) or your school's name on anything that you submit.
Doing so will result in disqualification of your team.
The only identifying information you should use is your team number.**

Wassamatta University has acquired Online With U College (OWUC) – an online college that has 11,100 students and faculty all over the planet. OWUC uses a public cloud to do file transfers for students, faculty and school administration. OWUC has no other physical facility than their headquarters that contains all of their infrastructure. Wassamatta U currently has 12,570 students they would like to move to a private cloud that has better security and more automation so that issues that need to be monitored 24/7 by humans are greatly reduced. This is especially import for the call center duties they want to bring in house with a more intelligent AI that can direct people to the appropriate representative automatically rather than having them select a myriad of options prior to getting to talk to a person. The 100% perfect goal would be to have a system that can be given a set of answers to inquiries that are predetermined, but can also learn how to perceive answers and inflections to better tailor the UI experience. This solution needs to be secure and safe because of Personally Identifiable Information (PII) data that will transmitted over it.

Since Wassamatta U has only Ethernet and mesh wireless network and no cloud infrastructure in place, it will be necessary to implement even the most basic of services and associate their current DNS, email, and enterprise database solution, etc. Wassamatta U has no requirements for which type of operating system the project team uses and has no brand loyalty. The project team is free to use any vendor for any solution if it is documented, and justified. Wassamatta U currently has an outsourced web site and will be bringing it in-house and will need the architecture to provide service to both students and staff 24-7. Wassamatta U is concerned that with all the technology that they are adding there will be a need to "sign-on" many times and would like a solution to help alleviate this.

Because Wassamatta U deals with student PII data, they are required to meet very stringent security standards. You are to ensure that all technologies and services used are secure. All traffic that is sent across the Wassamatta U network is required to be encrypted. As an added level of security all traffic should be segregated on the local area network as well as be encrypted. Wassamatta U wants to have a network monitoring system in place to control network administration and access. Wassamatta U, because of security concerns would like to have a multi-tiered DMZ in place so that services such as the Wassamatta U web site, email system, HR Site and Financial Site can be contained in their own network. There are certain resources, both physical and logical, that should be controlled in a manner that would prevent critical information from getting into the wrong hands, and Wassamatta U would like to have a process in place that covers that. There are three main groups—faculty, staff, and students—that should

each have access to only their network and should not be allowed to enter the other networks without the proper permissions.

Wassamatta U would like to have a centralized datacenter model which will have the primary datacenter at the Lee's Summit, MO location where OWUC is headquartered. Wassamatta U is headquartered in Kansas City, KS and wants to move the existing IT department to the Lee's Summit facility. There is more than enough room for the IT group and, since the move is towards cloud the technology, most of the equipment currently on site is too old to handle that kind of workload so there is no need to move most of what is at HQ to OWUC's facility. OWUC is within 100 meters of a major Internet node and that neighborhood offers fiber to the curb at speeds up to 10gbs. All traffic between Wassamatta U's HQ and OWUC will be encrypted and securely sent to the primary datacenter in Lee's Summit which will house the primary security features of Wassamatta U's network. Redundancy should be used when possible and a plan should be in place in the event of a disaster. One important requirement in this design is to have as close to 100% up time as possible.

Wassamatta U also hopes to utilize some of the newly purchased IT infrastructure to reduce cost and increase efficiency. One of the areas of greatest cost is the monthly cost of people manning the communications and call centers for Wassamatta U. To reduce cost Wassamatta U hopes to use the network at HQ to connect to any device to communicate in real time regardless of operating system with the entire staff as well as area partners. They want a far more efficient process, and will ultimately allow Wassamatta U to help more students in a day. Wassamatta U wants to be a connected campus no matter where the students are connecting from. Wassamatta U would like for the infrastructure to be planned to help reduce cost while maintaining a good level service. To further reduce cost Wassamatta U would like to have an IP video solution in place so that they can multicast training videos to both students and staff and at the same time host IP video teleconferences thus reducing travel related expenses.

Wassamatta U would also like to have the IT staff be able to operate in the most efficient manner so that any future issues can be solved quickly and without interruption. To do so Wassamatta U would like to have a network management solution that covers all aspects of the FCAPS (Fault, Configuration, Accounting, Performance, and Security) model. All services implemented should be done in such a manner that they can be managed centrally or securely through a remote connection. Wassamatta U also want to reduce the need to buy new hardware and software on a regular basis while staying with current versioning and that needs to be part of the solution.

Because of the amount of traffic that will be sent over the Internet there needs to be a high amount of bandwidth available always. Wassamatta U knows that there are a lot of ISP's and different WAN technologies available. The IT project team will need to provide the specifics as to what speeds are necessary as well as what technologies are used. If more than one ISP is used, the IT project team will need to document why more than one is used.

Wassamatta U expects a complete explanation of all service and protocols used throughout the design including the routing protocols which will be used both locally and in the WAN. Wassamatta U would like to have a solution in place that utilizes some of the best available practices in reducing traffic such as quality of service, spam/email filters, and network cache

proxies that will reduce the amount of unnecessary traffic that leaves the network. Some of the images and information that will be traveling over the network are very large and require not only a large amount of bandwidth but a great deal of storage as well. A storage solution should be implemented that is distributed, redundant, and be capable of handling large amounts of data as well as keep it available over the network 100% of the time.

Company Breakdown:

The project team should create a "template" for all locations. The cost for all locations should be accounted for.

The office space in Lee's Summit is only about 15,000 square feet in size. Most of this is for the NOC. The Wassamatta U HQ is a 400,000 square foot 5-story building that houses teachers' offices, classrooms, auditoriums, administrative offices, and the data center.

The stated HQ location square footage doesn't include the full basement where the datacenter and IT group is housed. The basement space is not utilized as efficiently as it could be because over time hardware has gotten smaller.

Number of devices at Wassamatta U identified at last audit of HQ:
5 – High capacity/high resolution, color laser printers per floor
17,000 – Tablet PC's for students, faculty and staff to use
2,200 – Workstations
7,500 – Phones
10 – Video Conference Rooms
15 – Fax Machines
2 – Wireless Access Points per floor

Most of the battery back-ups and the necessary network equipment connected to the datacenter are more than 10 years old and need to be replaced with new solution. The goal is to reduce consumption of energy of network related resources from 45% of total energy consumption to 18% to 20% or less. The project teams are free to add equipment that may be necessary. Every item included will need to be documented and justified. The IT project team will be responsible for what is included in each data center.

Wassamatta U has recently purchased the IP address space of 64.233.167.128/25. Use this address space as well as RFC-1918 address space processes.

Deliverables:

The IT project team should submit a proposal style document with supporting diagrams of all network components to be used in your network design. As is often the case when gathering requirements, many details are not included in the provided description and you must make reasonable assumptions about how they should be implemented. The solution should contain justification for expenditure, and choice of technology and services. The solution should also be

cost-effective, scalable, efficient, and secure. You need to complete an IP chart that will be implemented in your new network for the entire enterprise broken down by department and function with minimum wasted IP addresses. Be as detailed as possible in your description of the network. Include a list of all the protocols you will support for normal network use and any protocols used for specific uses with an explanation of why you are going to support them. Create a **detailed** budget that supports the decisions made for the network. All diagrams should be embedded in the document in the format of either a .jpg, .png, or .gif as bitmap pictures are often too large and not all computers can open Visio drawings. In your solution show all estimated costs in the documentation that you provide and show network address scheme.

This exercise is meant to challenge not only your network design skills, but also time and project management. Being able to quickly identify the technology required and being able to "put the pieces" together will ultimately identify the best teams. Use your time wisely, and if you find yourself struggling, do not waste your time–skip it and move on.

Good Luck!