Improving Wireless Accessibility Subcommittee
of the Faculty Staff IT Advisory Committee

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Purpose

The Improving Wireless Accessibility subcommittee of the Faculty Staff IT Advisory Committee was assembled for collaborating to address the challenges facing wireless internet access on the campus. The subcommittee was tasked with identifying common concerns from a cross-section of stakeholders, validating concerns, researching potential solutions, and making recommendations for actionable next steps to address identified concerns.

Executive Summary

In 2009 the University entered a 5 year contract with AT&T to install the wireless infrastructure to include 3900 802.11n Wireless Access Points. The contract was deployed with a coverage design implementation, which served well at the time due to the limited wireless devices on campus. Today's wireless demands are high density and high bandwidth intensive due to the number of wireless devices per client (2.6 devices per client) and DoIT is transitioning to meet the demands and expectations of students, faculty, and staff who carry multiple devices utilizing the wireless networks. The Division of Information Technology must replace and install additional wireless infrastructure, strive to improve coverage areas, improve capacity and speed on the wireless networks, and provide appropriate security to achieve this effort.

Although the subcommittee learned there are multiple plans currently proposed to accomplish an all-encompassing wireless solution, the transitional time has presented several challenges across campus. The subcommittee has identified, researched, and made recommendations for five known challenges facing wireless accessibility.

Problem Statements

Challenges facing wireless accessibility include:

1. There are coverage holes in wireless affecting both indoor and green spaces
2. Our Fac/Staff wireless network is difficult to join and does not seem to stay connected
3. Our guest wireless network is not being used appropriately
4. There is a lack of communication and education on appropriate wireless usage
5. Lack of refresh cycles and funding for refresh cycles for wireless technology

Research and Findings

Many of the issues facing wireless coverage, accessibility and capacity stem from the original deployment of wireless technology in 2009. At that time, Technology Services partnered with AT&T as a vendor. The wireless solution in 2009 was designed for hot-spot coverage with approximately 3900 access points, with no regard for the growth, capacity, or mass coverage demands nearly ten years later. Looking back, that was the beginning of the smart phone era. The network services team shared that the average person on campus has 2.6 devices utilizing the wireless networks at times. In efforts to keep up with growth and demand, there are now over 4,100 access points on campus. Subcommittee members met with Todd McSwain, leader of DoIT's team responsible for wireless network, to gather details about the history of wireless, recent updates, pending proposals, and potential solutions to identified problems. Fortunately, he was aware of each problem the subcommittee had identified and offered detailed information for each topic.

In the past four years, $6.5 million has been spent on upgrades to the wireless network. This includes efforts to sustain coverage, replace outdated technology, upgrade switches, and provide power over ethernet (POE) capabilities in the infrastructure. Many opportunities have presented themselves through new construction and renovations. The network teams leveraged those opportunities to ensure appropriate construction materials were used that worked well with wireless infrastructure, coverage and connectivity. Attention has been given to classroom coverage, the number of controllers, internal and boarder firewall traffic, capacity, load balancing, and updating codes sets on wireless hardware for each of the wireless networks.

Guest, Student and Fac/Staff are three of the main wireless networks available. Recently, additional networks have been established for specific purposes, such as EntertaiNet which should be dedicated to gaming, streaming and other in dorm student activities. There is a proposal to continue to replace technology deployed in 2009. This proposal will install equipment that functions more effectively and efficiently. This proposal is $1.8 million.

Across campus, there are multiple challenges that impact coverage. Many of the buildings on campus are historical structures. Networking staff is limited by what can be done in these buildings, which makes adding wireless access points challenging. Other buildings have granite, plaster walls, and/or walls with metal studs all that may impact wireless signal. Many dorms and faculty/staff work spaces face inadequate coverage and capacity to meet needs. There is a solution proposed that would increase access points by 50% in academic and administrative spaces, enhance the wireless coverage throughput, and install near field access points in dorms to eliminate coverage holes. This proposal is $5.78 million.

Wireless in green spaces could be improved by installing new outdoor wireless access points and antennas. Currently, the green space technology is working, but much of the equipment has reached end of life. Mr. McSwain shared the current proposal is less than $200K for the needed upgrades in green spaces.

Mr. McSwain acknowledged that recent enhancements to the wireless network, firewalls, load balancing and traffic routing should provide marked improvement to the user experience. The recent enhancements are documented in the section below.

The subcommittee also reached out the Student Advisory Committee to better understand the perspective of our students. Michelle Foster, coordinator of the Student Advisory Committee, shared the following feedback concerning wireless coverage on campus:

1. The students want full coverage in the dorms.
2. Most students are satisfied with the coverage in the Horseshoe and Russell House.
3. The students expect improvements in large classrooms coverage.
4. Wireless coverage at Williams Brice is not a big concern for students

The subcommittee was very appreciative for the feedback from the students' perspective to help determine the recommendations for improving wireless accessibility.

Recent Enhancements to Wireless

Over the spring break holiday, the wireless network team was busy enhancing our wireless network design. In the previous wireless design, security was monitoring all traffic, but it was not designed efficiently because all information that travelled across the university network was duplicated. One set of information passed to its destination while the other set of data passed through security monitoring. This basically cut the network productivity in half while doubling the amount information that travelled across the network. See Appendix for diagram.

To alleviate the duplication and provide a more efficient design solution, optical taps were installed. In layman's terms, this acted like a "Y" in the information flow and instead of duplicating the information it simultaneously supplied the information to the original destination as well as the security monitoring unit. A total of 16 optical taps were installed on the network.

Additionally, more controllers were added to the student network and the latest code was installed on that equipment. Traffic was optimized at each controller. Additional student firewalls were also installed and upgraded to alleviate strain on the current student network.

In concert, these upgrades and improvements reduced the load on the student network by approximately 40%. This was necessary to allow the new Network Access Control solution to function properly. The Network Access Control solution will provide much needed visibility on the Guest network. Today, there is no mechanism to glean Guest credentials on the Guest network — a security requirement. Because of the recent upgrades, DoIT has laid the groundwork to implement a Captive Portal for the Guest network. In the future, DoIT can require users to provide some level of identifying information, such as an email address or phone number. The system can then provide access codes to users via text or email. The Captive Portal will allow DoIT to have contact information needed for notifying offenders of Digital Millennium Copyright Act (DMCA) once we are notified of inappropriately downloaded content.

The Fac/Staff network was recently enhanced by updating hardware to the most recent software code appropriate for the equipment. These changes coupled with the load balancing and new firewall design should allow users to experience improved connectivity and thoughput. There has

been a decrease in the number of calls to the DoIT Service Desk concerning users of the Fac/Staff network since the modifications over the spring break holiday.

Conclusions and Recommendations

The subcommittee's conclusions and recommendations for the problem statements are below:

1. **There are coverage holes in wireless affecting both indoor and green spaces.**
   The subcommittee concluded the green spaces are not as important as the dormitories, classrooms, and office buildings on campus. Green spaces, although important, are not as significant to students or faculty and staff for wireless coverage and accessibility.
   Recommendation: Prioritize office buildings, classrooms, and dormitories above green space wireless accessibility. Communicate with all incoming students the current challenges with wireless accessibility in some of the dormitories. Encourage students to bring CAT6E cables and connectors/dongles for their devices as wired connectivity to the internet is the most effective option. Work with DoIT communications team to ensure students and staff are educated on the different networks (Student, EntertaiNet, Fac/Staff, Guest) and the appropriate use of each. Setting expectations of incoming students will reduce frustrations concerning accessibility and wireless performance. Acknowledging the known challenges with wireless, such as the regulations concerning historical buildings, and transparently sharing the plans to remedy the coverage holes is important to the relationship between DoIT and the user community. Also, DoIT should set the standard for any new construction and renovation from this point forward to ensure materials and designs are compatible with the ever growing needs of IT infrastructure, especially wireless technology. This recommendation includes working with the Provost on minimum standards for wireless in classrooms. The funding for the standards will be addressed in problem five below.
2. **Our Fac/Staff wireless network is difficult to join and does not seem to stay connected.**
   The subcommittee concluded the enhancements made over spring break have improved the accessibility and continuity of connectivity to the Fac/Staff network based on feedback to the networking team and DoIT service desk. The other challenge the

subcommittee noted was users connecting to the Fac/Staff network are not clear about which network login and password to use as some departments have their own email domains.

Recommendation: DoIT should work to improve communications with students, faculty, and staff concerning enhancements and planned modifications to the wireless network. DoIT should increase communication and knowledge share concerning the network id and password to be used to access the Fac/Staff wireless network. The subcommittee feels that the creation and marketing of knowledge articles about the appropriate use of Fac/Staff, the correct login and password, as well as the process for resetting network passwords, will be very helpful to users and decrease their dependency on the DoIT service desk while encouraging connectivity to the correct wireless network.

3. **Our Guest wireless network is not being used appropriately.**

   Based on findings from the research, the subcommittee determined the guest network has become the default network for all users (students, faculty, staff and guests) when they experience accessibility issues with any other wireless network. Due to the ease of accessibility and no session expirations/time outs in place, the guest network has become very popular. This convenience has not come without complications. This is an unencrypted wireless network, meaning traffic and data is in clear text. Since there is no authentication requirement, any device can join and access the internet. When users download inappropriate content, covered by the Digital Millennium Copyright Act (DMCA), DoIT blocks the MAC address for the devices but do not normally know who the devices belong to or how to contact those individuals.

   Recommendation: The subcommittee feels that requiring authentication to the Guest networks and utilizing the functionality described by the Captive Portal is appropriate for multiple reasons. Most importantly, being able to notify users of DMCA infringements is part of DoIT's due diligence as a provider. Secondly, it will allow DoIT to better control the length of each access session to function like a true guest network.

4. **There is a lack of communication and education on appropriate wireless usage.**

   The subcommittee concluded there is a lack of information available about the wireless networks, access/connectivity, and appropriate usage expectations which leads to user frustration and increased calls to the DoIT service desk for assistance.

Recommendation: It is the recommendation of the subcommittee to increase information share with students, faculty, and staff. Options include utilizing the knowledge base available on the DoIT Self Service Portal and add articles specific to the wireless, including but not limited to, known challenges or coverage holes, tips for selecting and accessing the appropriate networks, changing passwords, and other general wireless information. In addition to knowledge articles, it is recommended to find ways to include DoIT relevant information for incoming students and new faculty and staff. DoIT should consider alternative and creative ways to interact with the user community to gain a better understanding of the challenges users face, as well as capture opportunities for improvement or information about outages/coverage holes, so DoIT can prioritize enhancements. One team member suggested having users report wireless coverage holes with latitude and longitude, so they could be geocoded to produce an outage map.

5. **Lack of refresh cycles and funding for refresh cycles for wireless technology.**
   Not unlike other systems across the university, the wireless networks are in competition for funding and have large budget asks in the near future. The information concerning the proposed upgrades along with the respective budget requests shared by Mr. McSwain were helpful once understood in context, especially considering $1.8 million of a pending budget request is to replace technology deployed in 2009. The subcommittee recognizes the rate of obsolescence with wireless technology along with the ever-changing demands of users creates an expensive proposition for the university. Wireless was once a nice to have option, but today it is a ubiquitous demand for students, faculty and staff in most settings on campus.

   Recommendation: The subcommittee recommends refresh cycles be incorporated into budgets on an annual basis to avoid large requests for new funds going forward. This will require DoIT performing accurate projections and candid conversations with stakeholders concerning planned obsolescence, growth and costs. Strategic planning for classrooms need to be done in concert with the Provost and DoIT. Solutions for funding could potentially be found by evaluating or re-allocating the Student Technology Fees and the Network Services Rate. Other ideas for new funding could be partnering with entities or sponsorship of wireless in green spaces. Ideas for sponsors or partners include

the City of Columbia, the Department of Parks, Recreation and Tourism, or local businesses.

Improving Wireless Accessibility Subcommittee Members

The chart below identifies subcommittee members and their contact information:

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Appendix

Documents provided for reference materials are attached.

1. Current wireless design diagram: