A Seamless Educational Organization of University Wi-Fi Network: A Case Study
Dr. H. B. Bhadka
Dean
Faculty of Computer Science, C. U. Shah University, Wadhwan, Gujarat (India)

Abstract—Wireless networks play an important role in education. New educational models and wireless architectures have been proposed to enhance collaborative training. Wireless networks can provide a dynamic educational environment. Many educational organizations recognize the merit to promote public access to wireless broadband, and make efforts to achieve the goal of being the digital educational organization. This paper explores the Wi-Fi network features and analyzes its uniqueness from the perspective of delivering educational contents to the students. It also applies the concept of the eco-system to analyze the symbiotic to engender network effects. This case study expectedly provides other educational organization with some guidelines to develop the Wi-Fi network and its services. This paper examines the ways wireless technology work and the required prerequisites to integrate it into the educational area. It also describes educational opportunities and challenges of teaching in a real time wireless classroom environment.

Key words: Wireless LAN, Issues in Education, Access Point, Coverage

I. INTRODUCTION
The term wireless broadband is widely cited for the next-generation of human lives, or at least, to be a critical component of human communication and behaviours [1]. The most obvious difference between wireless and wired networks is that the latter uses some form of cable to connect computers together. A wireless network does not need cable to form a physical connection between computers. Wireless networks can be configured to provide the same network functionality as wired networks, ranging from simple peer-to-peer configurations to large-scale infrastructures accommodating hundreds of users. [2]. For an educational institution, right from filing admission by prospective students to administering exams more and more colleges are going the e-way. Campus wide internet availability and Wi-Fi (Wireless Fidelity) enabled classrooms are ubiquitous in today's academic institutions. Educational Institutions rank at the top when it comes to harnessing the latest in technology. Especially technologies that seek to eliminate the constraints of time and distance and make learning possible from anywhere are well received. The backbone of this capability is internet. Often researchers at universities use the internet as a principal form of communicating their research findings - including means such as tele-conferencing and webinar based streaming videos. This session are often attended by researchers from other premier institutions and laboratories. In such events even the slightest glitch in the network reflects badly on the faculty member and the academic institution [3]. Wireless technology has expanded rapidly over the past ten years and is now being used by an increasing number of users to access information and network resources. The use of wireless technology in higher education is gaining momentum as the Internet and electronic learning materials becomes a necessary part of the learning process. Students are now in a mobile society where they can be contacted at anytime and where information is freely accessible and wireless technology enables this mobility to occur on campus [4, 7].

The time and expense previously required to manage any University’s important events such as registration and graduation have been dramatically reduced, and students and faculty will now benefiting from reliable, convenient wireless access.

II. IMPLEMENTATION OF WI-FI NETWORK
Wireless LAN implementation in educational institutions started almost a decade ago.

A. Wi-Fi: Around the Barriers [5]
A new situation has recently emerged that may overcome the technological and regulatory barriers. It was created through the continuing evolution in IP technology. It’s a new wireless-based technology called Wi-Fi. Wi-Fi technology operates in an unregulated band of radio spectrum designated 802.11. This is an unlicensed band of spectrum that is shared and available for use by anyone. Up to now it was most commonly used for personal appliances, such as a microwave oven or a cordless home phone, and for specialized purposes.

B. Purpose and Objectives
Colleges are among the most aggressive adopters of Wi-Fi technology. The trend toward more collaborative and open learning environments, fuelled by the explosive adoption of mobile devices among students and faculty, makes higher education campuses fertile ground for wireless LANs. The Initiative adopts the Wi-Fi technology as the default standard to build the network.

C. Coverage
While more and more education institutions are making the case for pervasive Wi-Fi coverage on campus, providing such coverage presents several technical challenges that are costly, difficult, or impossible to overcome with traditional WLAN system designs created to support small or hotspot deployments.

D. Access Points
To increase the coverage area of wireless at the institutions, access points play a major role. It is the device, which is used to increase the coverage of wireless so that more people are able to access the wireless.

E. Wireless Services
Wireless LAN System is the only Wi-Fi solution built from the ground up to serve high densities of users and provide
high quality of service for today’s robust applications such as voice. In a nutshell wireless networking is important because it is convenient. Students are increasingly mobile in their communication styles and activities, and to extend a campus network without wires allows for new cultures of learning too form. Once the network is everywhere, learning will be untethered about the campus. Wireless networking also gives universities a cost effective way to extend the campus network to previously unwirable locations, or quickly provide a network in a space that has none. Higher education Institutions are not immune by today’s economic challenges. WLAN’s give Institutions a means of progressing their IT infrastructure to support the mission of teaching and learning in a fairly inexpensive way. Wireless delivers value for network users and the institution in general as well as network administrators. For students and faculty—a particularly mobile set of technology enthusiasts—wireless networking delivers productivity and convenience [8].

IP-based applications for education are dramatically enhanced when deployed over Wi-Fi broadband networks.

Wi-Fi networks are basically local-loop networks providing last-mile connectivity. Local-loop networks are where individuals, schools, businesses, hospitals, libraries and governments connect to the Internet. In essence, they are community networks; they both serve and operate within the local community. Education applications can reside on the local network and empower a community like never before. The community becomes capable to direct and determine its own requirements and processes, maintain and strengthen local standards, enhance collaboration between individuals and institutions, and develop an economy capable to compete with other communities [5].

A wireless network can provide the flexibility to converge many applications without sacrificing quality or reliability of each service. Fig. 1 shows various services provided through the Wi-Fi network at UNIVERSITY.

![Fig. 1: Various Services of Applications, etc.](image)

**F. Wireless Benefits**

- Centralized control and management of entire campus-wide WLAN
- Ability to easily extend the WLAN with Smart Mesh Networking
- Three-fold performance increase
- Support of existing 802.11g clients as well as emerging 802.11n clients
- Adaptable Wi-Fi signals allow reliable coverage within hostile RF environment
- Flexibility: With anytime, anywhere in campus access to resources, students can conduct schoolwork in unconventional settings—the campus quad, cafeteria, student center, library and many other places around the campus. Similarly, wireless enables instructors to deliver lessons outside of the classroom, such as lab exercises in outdoor settings.
- E-learning: Instructors can complement classroom instruction with on-line activities to create an integrated learning experience.
- Communication: By providing easy access to communications tools such as e-mail and on-line group discussion boards, wireless facilitates team building across multiple disciplines.
- Revenue: Wi-Fi presents potential revenue-generating opportunities. For example, universities could charge visitors for wireless Internet access.
- Competitiveness: Today’s students are more technologically savvy than ever. Wireless access throughout campus and student living areas helps academic institutions compete for students and faculty.
- Innovation: By fostering a more collaborative and creative learning environment.

### III. NETWORK DESIGNING

An access point was situated high on the back wall as close to the fibre termination point as possible. The access points used power over Ethernet injectors to power the devices, and the 802.11a radio to be used for AP-to-AP (Access Point) communication. This minimized new wiring, keeping costs low and speeding installation. The Base Station Unit used non-penetrating rooftop mounts on top of the dormitory building. This served as the central point for the outdoor wireless system, connecting to the campus’ existing fiber network. Ease mounts were used for each Omni Unit located on top of each building. Fig. 2 shows design of Wi-Fi Network in UNIVERSITY campus.
A Seamless Educational Organization of University Wi-Fi Network: A Case Study

**A. Requirements**
- Higher speed 802.11n Wi-Fi services
- Seamless integration with existing network and authentication infrastructure
- Ubiquitous Wi-Fi coverage
- Centralized WLAN management
- Secure mobile access for different user groups
- Ability to support simple guest access
- Easy administration and management
- Future-proofed expansion

**IV. ISSUES AND CHALLENGES**
The Wi-Fi broadband “cloud” is far more powerful than what cellular service providers offer, and transmits data at a speed of 11 Mbps, which is sufficient for all types of multimedia. It is accessible 24-hours a day. Anyone can join or connect to the network, even install a Wi-Fi antenna inside a structure for indoor access [5].

Although wireless services have already begun to appear on college campuses, their appearance is not without issues, both positive and negative. Before wireless services can become truly ubiquitous, campus IT must establish solid processes and procedures when deploying campus-wide mobile solutions [6].

**A. Security**
Perhaps security is the biggest challenge and one that has received the most publicity. WLAN’s specifications are based on the assumption that all who access the WLAN’s are trusted users. The WLAN specifications need to include security in order to make it an enterprise service. Malicious intruders can penetrate several kinds of attacks in a WLAN (Sniffing, Spoofing, Jamming, Denial of Service attacks).
Anyone of these attacks could turn out to be a major catastrophe for Institutions, both on teaching and learning and bad publicity. The fact that there is “no wire” to be tapped leads us to two primary security issues. The first is that all transmissions may be monitored by anyone in reception range, these are the attacks listed above. The second is that of access. Assume that one would like to grant access to the network to only certain individuals. The challenge is how to accomplish this for a user that is not physically attached to a switched point on the network, but rather on a shared bus that is roaming around campus [8]. Requiring users to connect to the wireless LAN via a VPN is recommended. Once authenticated, authorized users communicate using an encrypted tunnel between the connecting device and the LAN, reducing the risk that a transmission will be captured.

B. Less Limited Roaming
The second challenge, but less limited is roaming. Roaming issues are present in some 802.11 wireless networks. The roaming is a problem for some of today’s wireless networks, due to vendor interoperability issues. Even with a homogeneous deployment of equipment from one manufacturer, roaming will only work when there is a single IP subnet for a given wireless network. This is primarily due to the fact that all IP connections depend on a given host keeping the same address for the duration of a connection. If a wireless client roams, and obtains a new IP address in the process, connections will be dropped [8].

C. Cost
Wi-Fi network not only has a much greater bandwidth capacity, but is also far less expensive. And as Wi-Fi technology rapidly advances, costs are being reduced regularly.

D. Financial and Staff Resource Restraints
College staff is stretched thin with daily tasks of planning, managing, and upgrading networks. It is being asked to do more with less. Schools are frantically looking for ways to push their campus network beyond the current stagnant locations. Campus needs alternative technologies to lighten their work load, save money, and provide a positive experience to campus stakeholders [5].

E. Behavior of Radio Signals
Another challenge is the behavior of radio signals on you campus and the potential interferers of those signals. Wireless LANs use radio as the communications medium and in fact use unlicensed radio spectrum that they cohabitiate with many devices. Some devices like 2.4GHz cordless phones can cause major problems with Wi-Fi devices in the area. Bluetooth devices are becoming more pervasive and these too can interfere with 802.11b and g Wi-Fi networks. Also in this area, the reflection or absorption of radio signals by the materials used in the construction of a building can cause problems or anomalies in coverage. As a rule of thumb, if a material absorbs sound waves for acoustic insulation of a space, it will likely absorb radio waves as well.

F. Cultural and Social issues
While the network is generally viewed as a tool in the educational community, it can also be a distraction to some students. The technological problem presented by this is how to allow faculty in a given classroom control over what students may do on the wireless network. Immediately we think about students cheating, making social plans after class, or just not paying attention because there to busy surfing the net.

G. Too Many Devices to Deploy and Manage
Traditional Wi-Fi vendors try to resolve issues with dense deployments and limited bandwidth by increasing the number of infrastructure devices (switches, access points, security monitors, software, etc). This increases the complexity, deployment, management, and overall cost of the network, while adversely decreasing the network’s capacity and performance due to continued co-channel interference and the ability to efficiently use all non-overlapping channels. Throwing more devices at the problem increases the burden and cost to IT– this is not a solution [7-8].

V. Conclusion
Wi-Fi is simply very easy, and costs very little to deploy. Wireless technology is increasingly been used at higher education around the world. Wireless networks are changing the way students and staff access information. The Internet was the most common service with every institution providing internet access. This has made the process of accessing information easier for students and staff. With new devices coming on board greater demand will be placed on access to wireless networks. The initial wireless network installation at UNIVERSITY has been such a success that the college is planning a significant network expansion by adding new wireless access points to its existing network.

REFERENCES