Joint Whitepaper

Mobile Broadband at Virginia Tech

Benefits to student body, faculty, Support staff, and public safety
Advantages of Mobile Broadband Access Across Virginia Tech University

About Virginia Tech
Virginia Polytechnic Institute and State University, popularly known as Virginia Tech, is located in Blacksburg VA. Home to over 25,000 students and 1500 faculty members, Virginia Tech is the largest university in the state of Virginia. The main campus is set on 2600 acres, and consists of 100 buildings and an airport.

About Citizens
Citizens is a well-known service provider that offers voice, broadband data, cable television and video throughout southwest Virginia. They are headquartered in Floyd, VA.

About Flarion Technologies
Flarion Technologies is mobilizing broadband communications with its innovative cellular network technology. Flarion's FLASH-OFDM® enables mobile operators to profitably offer mobile broadband communication IP services. Flarion's RadioRouter® base station product may be overlaid onto an operator's existing network and radio spectrum, and provides a seamless routing interface to the operator's existing IP network. Flarion Technologies is based in Bedminster, New Jersey.
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What is Mobile Broadband?

Mobile broadband is defined as broadband access (e.g. cable and DSL) in the cellular environment. The term is synonymous with FLASH-OFDM, a 3G alternative system developed and marketed by Flarion Technologies.

Just as the cellular phone revolutionized voice telephony by freeing the user from wires and stationary constraints, mobile broadband is doing the same for high-speed data. Users are no longer confined to desks, no longer tethered to wires, no longer restricted to a stationary environment.

Mobile broadband is a step up from local wireless data applications like WiFi (and eventually WiMax), which gets rid of the wire, but not the confinement. Users still must be stationary and in a certain area (mostly inside) when using such technologies. One can think of WiFi as the data equivalent of the cordless phone, whereas mobile broadband is analogous to the cell phone, enabling everywhere access to high speed data – at any range of motion.

Flarion mobile broadband performs like DSL and cable, with typical user speeds of 1 to 1.5 Megabits per second (Mbps) and latency (network delay) below 50 milliseconds. This is 20 times faster than wired dial up service and twice as fast as any other mobile data technology in existence.

Flarion FLASH-OFDM mobile broadband technology provides wide area coverage and works in mobile and fixed environments (the latter as a replacement for DSL and cable). This makes it ideal for the nuances of a campus environment. Students, faculty, and other campus employees are constantly moving across a wide area. Therefore, it’s not just in-building coverage they require, but everywhere and always on access (outside, in-dorm, in bus, in-library, etc) to exchange information, research and create.

How does it work?
The Flarion mobile broadband network works like a typical cellular network. The campus is divided into cells, allowing for frequency reuse so that many subscribers can access the network simultaneously. Each cell contains an antenna tower and a base station, which handles all incoming and outgoing data traffic. The cells together make up a wireless access network, which will enable users in that coverage area (Blacksburg, Virginia in this instance) with fully mobile broadband connectivity.

Users would subscribe to the service through Citizens, a prominent service provider in southwest Virginia. They would also need to purchase a PC card or desktop modem, which will be plugged into the laptop for plug and play mobile broadband access.

Mobile Broadband Business Case for University

The business cases for mobile broadband in the enterprise and government sectors are well chronicled. With business, mobile broadband will dramatically improve productivity, operating efficiencies, and generate new revenue. With government, mobile broadband will improve prevention (public safety/homeland security) and
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emergency response through better communication, faster exchange of information, improved surveillance, and productivity increases.

However, the business case for mobile broadband networks at universities is not as publicized. While certain campuses are turning to wireless access, they are not doing so with mobile technologies. Instead the equipment being deployed consists of scores of local area network (WLAN) hotspots that unwire classrooms and libraries, but never come close to achieving everywhere broadband access.

Mobile broadband is required to blanket the entire campus and outlying areas with cellular broadband coverage, covering courtyards, dorm rooms, on and off-campus apartments, lounges, classrooms, cafeterias, research facilities, faculty offices, on the bus, in the stadium and everywhere in between. Confined wireless access like WiFi does not do a whole lot, except remove the need for wires. The real breakthrough comes in the form of a wide area technology for everywhere and always on access, one that tightly integrates the student to the teacher, the teacher to the researcher, and the whole campus population to the public safety official.

Flarion mobile broadband also interoperates with WiFi technology, which would create one expansive network for in-building and out.

The following areas in and around campus can benefit from mobile broadband service:

- public safety (campus and town police, fire, rescue)
- student/university healthcare
- Veterinary Medicine-animal healthcare
- agriculture-farms
- sports
- instructional technology (classroom, campus, town, home)
- utilities--power, buildings, grounds, maintenance
- hotel
- building level housekeeping
- industrial park-corporate research park
- warehouses
- airport
- replacement for student dorm phones--comes with room
- replacement for student data connections--comes with room
- VT bundled services both on and off campus, including students/faculty/staff at home
- ways to leverage campus Wi-Fi/Cisco network and Citizens Flarion (roaming between)
- replacing PBX with all wireless for voice, data, video
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Virginia Tech, located on 2600 acres in Blacksburg, Virginia, is home to over 25,000 students, 3,000 faculty and research associates, and 4,000 support staff. FLASH-OFDM will benefit them all.

Benefits to Student Body

With 25,000 students roaming around 4 square miles of campus and throughout the larger Blacksburg vicinity, Virginia Tech is the ideal location for a mobile broadband network. College students are always in motion, always communicating, and always in need of real time broadband access for research, presentation, and delivery.

The possibilities of mobile broadband on campus are limitless. Everywhere students sit or ride is a potential work area or classroom. They can flip open their laptops and immediately connect to the network – anywhere, anytime. They can connect to electronic library resources, course intranet sites such as Blackboard®, and other research portals. They can communicate via email or video mail, transfer large files like Powerpoint® presentations and work more efficiently in an increasingly online environment.

Productivity gains of mobile data and broadband access are well known in the enterprise and public safety spaces. The following shows the gains from each one separately. Imagine if they are combined as in the case of FLASH-OFDM mobile broadband:

• **Mobile** email saves an estimated 53 minutes a day in downtime for business professionals.
• **Broadband** is approximately 25 times more efficient than narrowband (dial-up) access, saving users time and money

Additionally, colleges across the country are making laptops mandatory for students, or providing them as part of the curriculum. All users would need is a FLASH-OFDM PC Card, which plugs into the PCMCIA slot on laptops, or a desktop modem similar in scope to a DSL/Cable modem (the latter can be used for desktop PCs as well).

Benefits to Faculty

Teachers continue to rely on Internet access to lecture, monitor and research. But that is confined to the classroom or at home. For 3,000 professors and research associates, mobile broadband brings the network to them, regardless of location or range of motion. Like corporate users, Virginia Tech faculty can now reduce dead time, communicate more effectively, and have real time access for research and planning. They can avoid the enormous time spent in the library, as mobile

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1 Ipsos-Reid Research Study (Analyzing ROI of Blackberry Deployment)
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broadband allows users to access library resources such as journals, periodicals, research reports, and textbooks. Other critical applications enabled by mobile broadband:

- Email w/large file attachments
- Video conferencing
- Online course management software and grading
- Online video (for course presentations)
- Online audio
- Instant Messaging

Benefits to Support Staff

Virginia Tech is home to a support staff of 4,000, including those in administration, housing and dining, health and wellness, transportation, maintenance and custodial staff. Mobile broadband integrates these workers together into a more cohesive team. Housing and dining can communicate more effectively with the custodial staff; the same goes for the exchange between transportation and maintenance staff.

Additionally, certain campus employees (administration) once confined to the office can now work remotely, creating a more flexible environment. Finally, mobile employees like transportation workers, recruiters, maintenance, etc. are now connected no matter where they work.

Mobile broadband will enable new custom applications in all support staff areas. For instance, housing and dining employees can carry around PDAs that record student offenses, which they can then transfer to public safety officials. Transportation workers can eliminate the heavy paper work (and down time) of counting passengers, miles, and gas by utilizing a PDA and transferring the information back to administration.

In short, with mobile broadband, Virginia Tech will resemble an efficient corporation of accountability, horizontal management, empowerment and productivity.

Benefits to Public Safety and Emergency Response

The benefits of mobile broadband to public safety are currently being showcased in Washington DC. The District of Columbia is deploying a FLASH-OFDM network that will integrate public safety with emergency response for detection, prevention and response.

The same benefits can be made available to Virginia Tech campus security and emergency response. With mobile broadband, police can now communicate with fire officials in real time, utilizing data as well as voice. Emails can be sent with still or video images attached. Wireless surveillance can be situated anywhere without the need for wires. In addition, all public safety and emergency response officials
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are considered mobile, and require a technology that supports wide area mobility. Other applications supported:

- Fast transfer of medical information for emergencies
- Global Positioning Services (GPS)
- Instant Voice and Data
- Electronic Paperwork
- Video, Photo and Audio Upload
- Database Access
- Email

Mobile Broadband vs. WLANs

Currently, the only wireless access being deployed on campus is WiFi, a radio technology used for wireless local area networks (WLANs). WiFi is used primarily in classrooms because of its restrictions to stationary usage. In short, it is broadband access without the need for wires. One can think of it as the cordless phone equivalent for data.

The disadvantages of the WiFi technology are as follows:

- **No mobility or wide area coverage:** WiFi does not truly represent a wireless experience. Users must be able to access wireless data with the range and ubiquity of cellular phones. WiFi, on the other hand, represents the cordless phone in that they are still confined indoors and to one location. Additionally, most dorms and other campus living spaces do not offer WiFi access because of the cost involved of deploying access points. Therefore, WiFi doesn’t really act as an upgrade over wired LANs.

- **No productivity enhancements for university employees/ public safety:** the campus support staff and public safety community cannot make use of WiFi because of the number of hotspots required to provide all-around coverage. Only students and professors can benefit with in-class access. A wide area, fully mobile solution is required to achieve this.

- **Security concerns:** Because WiFi operates in unlicensed spectrum (the same spectrum as microwaves and cordless phones), there are major security concerns. Hackers can intercept data that is being transferred over the air, including financial information.

- **Interference will drastically limit performance:** again, because WiFi operates in unlicensed spectrum, it is prone to interference from microwaves, cordless phones, and other WiFi users (many WiFi users in a classroom will negatively impact each other) In a public safety situation, the negative impact may be accentuated by the volume of attempted users alone.

Mobile broadband addresses these concerns. It allows for fully mobile (at vehicular speeds), wide area coverage, which means everywhere/ anytime broadband access. In this instance, students and professors aren’t the only group to benefit off from wireless access; everyone in the campus community does.
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Security is better maintained because FLASH-OFDM operates in licensed spectrum, meaning that it shares its spectrum with no other technologies or devices. Interference is also avoided because of this licensed spectrum attribute, which equates to better overall performance. In public safety situations, FLASH-OFDM controls access to allow priority to officials in charge of the situation such as fire fighters, police, etc.

Conclusion

FLASH-OFDM is the ideal network for Virginia Tech University. All segments of the campus population can benefit from everywhere broadband access at full mobility; students, faculty, support staff and public safety.

FLASH-OFDM mirrors the performance of cable and DSL, but extends it all over campus and across town. Students and employees can work on the bus, in the courtyard, cafeteria, dorm room, and everywhere in between.

FLASH-OFDM is the most advanced technology in the wireless space, with faster speeds than other mobile technologies, and larger, more flexible coverage than WiFi.

CITZENS is completing engineering design and licensing applications for deployment of the FLASH-OFDM system in Blacksburg, Christiansburg and Radford. 2005 will provide the opportunity for Virginia Tech to partner with Citizens to provide the University population the services discussed in this white paper.