IV. Voice Services

Current Outlook

Voice services on campus and at several off-campus sites are provided by an Aastra MD110 PBX. There are approximately 17,200 campus lines and 1,000 trunk lines. The telephone system has been growing by about 250 lines per year for the last few years. On a typical day there are 45,000 outgoing trunk calls and 75,000 incoming trunk calls.

The central switching matrix, the Group Switch, is located at Node M in the Central Utilities Building. Telephones are cabled back to a total of 77 Line Interface Modules (LIMs), located in the node rooms on and off campus. The remote node rooms are connected to Node M by fiber or occasionally by leased T1 lines. The Aastra PBX was installed in 1986, and has been upgraded many times since then. Only a few of the original components remain. The critical Group Switch is one of these original components, and while there have been no problems with it to date, we do not know if there will be future issues with this aging equipment.

ACT has several small off-campus sites utilizing Voice Over IP (VOIP) telephones connected to the Aastra PBX via the UCSD network. A major advantage of integrating Aastra’s own VOIP system with our present network is being able to move numbers from one system to the other. Also, most of the features are accessed in the same way, and the look and feel of the phones is very similar.

We are piloting an Aastra MX-one system and preparing for testing of the Aastra’s Fixed Mobile Convergence (FMC) feature, allowing enterprise users to roam between cellular networks and voice-enabled wireless LANs (WLANs), using dual-mode handsets equipped with 3G and Wi-Fi radios. With the new functionality WLANs deliver, mobile voice is now practical within the enterprise campus.

Voice mail continues to be very popular throughout the campus community. We provide voice mail services through an Interactive Intelligence voice mail system, which presently has 10,000 mailboxes and 140 ports. Voice mail usage continues to increase by approximately 200 mailboxes per year. The Telephone User Interface (TUI) was custom built by I3 during the initial installation; I3 has since built a Pulsepoint replacement TUI. Any upgrades to voice mail and/or unified messaging will need to integrate with the custom TUI.

Unified messaging is provided to over 1,000 users today and continues to increase along with campus growth.

Many campus employees use cell phones. UCSD does not have a contract for exclusive service with any one provider. Departments are free to choose whichever provider and plan is most appropriate. The providers in the San Diego area are Verizon, Cingular, AT&T, Sprint and Nextel. All providers offer a push-to-talk feature that is especially useful for departments with technicians who work around campus.
There are currently several emergency notification systems deployed at UCSD, including a Reverse 911 system, an SMS (short message service) notification system, an Emergency status toll free phone number, Emergency phone towers and the UCSD Emergency status Web page.

**Campus and Technology Changes**

UCSD continues to grow, and some major new buildings will be occupied over the next few years (as described in Section I, Infrastructure). The growth in telephone lines, however, has not matched the growth of the data and wireless networks, and we do not anticipate any capacity problems or resource issues on the voice side.

**Voice Over IP**

UCSD is also moving more staff to off-campus buildings. Whenever possible we install a LIM in these buildings so that the customers there can get the same level of service as they would on campus. It is in this type of location where Voice Over IP (VOIP) may become a more cost-effective alternative to a LIM.

For several years there has been a sense that VOIP to the desktop is the newest and best way to provide voice services. This “coolness factor” has now worn off, and VOIP is seen as a maturing technology, which in some circumstances is more cost effective than circuit switching. For VOIP to work effectively, the data network must be modern, well engineered, highly reliable and centrally controlled with strong policies. Over the last few years UCSD’s network has been making great strides toward becoming this type of network – one major addition would be Quality of Service (QoS) policies.

An increasing number of people are using their cell phones as their primary or only voice instrument. Some PDAs will be built with SIP client voice applications, allowing them to be used as a telephone when using the wireless data network. There are emerging standards of interoperability and handover, IEEE 802.21 and 3GPP. This may be of interest in some technically oriented areas such as Engineering, especially if cell phone capabilities can also be added to the same device, which would automatically connect to the cellular network if there were no 802.11 signals in the area.

Currently, we have a flat rate long distance contract with Verizon provided over Primary rate interface (PRI) circuits. VOIP trunking is a method of sending calls over an IP datastream for part or all of its route. Our current Aastra software supports this with very few technical drawbacks. The UCOP initiative for long distance services and extensions to existing contracts will have a bearing on the decisions to implement. A cost benefit analysis usually determines if it should be done or not.

Aastra has announced a migration strategy for their MD110 PBX to their MX-ONE platform. The end of new and add-on sales of our existing software, TSW, is 2012 and the end of the active support has been pushed out from 2013 to 2015. The migration to the TSE software will eliminate the group switch, which will be replaced by IP connectivity between the LIMs.

Over the next five years, changes in the work environment will center on how and where people perform their tasks and duties. This will lead to increased telecommuting and to an increased mobile work force. To accommodate this type of work force the concept of shared desks, or free seating as Aastra refers to their feature, may be introduced. This will be a culture adjustment for employees.

There is a shift towards ACT providing email service using MS Exchange for other departments across campus (see Section III, Key IP Network Services). This may result in our being able to increase the integration for unified messaging.
Cellular carriers continue to improve their wireless technology, moving toward 4G, each with higher transmission speeds. 4G cellular technology is currently being developed with the aim of providing transmission rates up to 20Mbps while accommodating QoS. The 4G applications are expected to include high-performance streaming of multimedia content. The technology is expected to appear sometime in 2010.

Femtocell technology is like having a mini cellular tower in your home or small business environment. It connects to the providers’ network via your existing broadband Internet service (such as DSL or cable), and is designed to support multiple 3G capable wireless phones in a home or small business setting. Femtocell is based on licensed spectrum and is carrier-specific. With 3G MicroCell service, users receive improved cellular signal performance for both voice calls and cellular data applications, like picture messaging and surfing the Web for up to four simultaneous users.

**Looking Ahead to 2016**

Aastra’s MD110 will continue to evolve over the next three to five years, especially in the mobile arena, with cell phone to Wi-Fi becoming more prevalent.

**Upgrade of the PBX to MX-ONE TSE prior to 2015**

MX-ONE TSE will be a significant hardware and software upgrade, but it will give us a technologically advanced voice network that will meet campus needs for the next seven to 10 years. There will be better and easier ways for users to program their own features. We should consider providing a Web interface so our customers can change their call diversions, set up speed dial buttons, access their calling records, etc.

**Voice Over IP**

We need to proactively follow developments in the VOIP market, and identify the point when it will allow us to provide the services the campus needs, and save money. It is highly unlikely that within the next five years VOIP will advance to the stage where it could replace the Aastra PBX, but there will be buildings on and off campus where it will be appropriate. SIP endpoints will be operable with the MX-ONE platform and replace the H323 instruments that are highly proprietary in their version of the H323 standards. At this time SIP endpoints are approximately twice the cost of digital instruments.

**Wireless voice**

Wireless voice is an interesting area for the coming years, and may be an area in which to focus our resources. We should investigate and test wireless voice services and how they can be integrated into our voice and data network to assess the impact of FMC on the 802.11 network. Aastra’s current mobility product is good; the dual mode concept (which requires TSE software) needs to be tested. There may come a time when all campus users are given a wireless phone rather than a desk phone, although that point is likely more than 5 years away. Those phones will probably use a combination of 802.11 and 802.21 and advanced cellular technology 3GPP, and be administered and managed through a campus operated interface. Supporting a large number of users in this environment presents challenges, but it is an interesting area and we expect to see a lot of development over the next few years.

With the degree of uncertainty regarding the best options for future voice services, it is important to have a good understanding of what our customers want. We should set up focus groups, meet with key personnel and involve campus departments in the trials that we carry out.
The cross-training of technical staff, so that the data network engineers are more familiar with the voice services and vice versa, will be important for future VOIP installations.

**Emergency notification systems**
UCSD will need to consider the following enhancements to existing emergency notification systems. The Aastra Broadcast feature, which permits the existing phone system, has the capability of broadcasting announcements over desk phones via the speakerphone feature. There is a new California Building Code where multi-story buildings must have an “Area of Refuge” or “Area of Rescue Assistance” system to provide for handicapped persons to safely exit the building without elevator access.

Establishing contract agreements (SLAs) with all of the major cellular carriers is planned so additional capacity can be deployed quickly, when necessary. AT&T, Sprint/Nextel and Verizon provide a temporary service that increases network capacity to support major public events, protracted emergencies and incidents.

**Improved cellular coverage**
Plans for voice services include encouraging public cellular providers to improve their coverage on and around the campus, especially regarding levels of service on the 3G and future 4G data networks.

**WLAN upgrades**
The establishment of granular WLAN QoS policies, tunable to a broad range of applications (notably voice and video), end-device capabilities, and other characteristics will be needed. To support an eventual migration to IP Multimedia Systems, several features will be implemented on the WLAN, including Session Initiation Protocol (SIP) based VOIP signaling and other SIP-enabled applications and services.

The ability to add WLAN capacity in cost-effective increments, and planning tools that help anticipate and proactively address problems with enterprise WLAN congestion, radio frequency (RF) coverage, and infrastructure resiliency will be needed.

**Major Milestones and Investments**

**2010 - 2011**
- Replace old telephony hardware with new hardware when possible (i.e., replace TSU, TRU MPU boards with TMU-12 boards).
- Establish service contracts with cellular providers to improve coverage during emergencies and major disasters.
- Monitor the proliferation of Femtocell technology on campus (especially in the residence halls) to ensure maximum coverage/performance is achieved without causing interference with the existing wireless network.

**2011 - 2012**
- Install quality of service standards on the voice network.

**2013**
- Upgrade to TSE software platform.

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Ongoing

- Monitor “FMC deployment and application delivery.” Experts feel the industry will mature enough by 2011-2013 with an integrated, multimedia infrastructure in place that supports multiple end devices and access technologies.

- Providers will begin creatively mixing and matching once disparate services — voice, audio conferencing, video conferencing, text-based instant messaging, e-mail, games, SIP-enabled conferencing and collaboration, broadcast video and audio — to serve an array of new applications and end-user needs.