WATERLOO
INFORMATION SYSTEMS
& TECHNOLOGY

Project Closure Report

Digital Signage and Kiosk Technologies

Stephen Carr
Last Update: July 31, 2014

Project Summary

This section should include a brief summary of the project that is being closed. This summary should capture the scope of the project and should contain enough detail to provide a full understanding of the project (high level objectives and purpose of the project).

This project was campus-wide in scope and achieved direct participation from IST, Retail Services, Federation of Students, and Plant Operations, and all academic faculties (except Science, whose input was collected by the project leader). Project objectives were as follows (from the project charter):

1. Determine the current and expected future use of digital signage and kiosk technologies on campus.
2. Review how other universities are deploying digital signage and kiosk technologies.
3. Enumerate the various commercial and home-grown systems in current use on campus and review what each provides.
4. Generate a list of technical requirements for such systems and specify performance targets. This list will include network security, information accessibility and public safety requirements (e.g. for emergency broadcasts), as well as other requirements to be determined as the project unfolds, for example availability and maintainability targets, ability to share content, physical security of the installations, etc.
5. Produce documentation that summarizes the current technologies used, existing campus license agreements, and applicable university policies and procedures, thereby providing guidance for groups who want to implement digital signage and kiosks on campus.
6. Determine if it makes sense to provide a centralized service and/or select a preferred vendor for this service.

Chico Silvestri and Melissa Keith from Plant Operations were significant additions to the project team in November 2013, after bringing to Steve Carr's attention deficiencies in the current Guidelines for Internal Building Signage. These Plant Ops guidelines originally controlled the installation of traditional building signage, but had been last amended in 2008 by Deans' Council to include digital signage installations. The Internal Building Signage guidelines specify restrictions in the size, number and location of digital signage installations. These guidelines are no longer appropriate for current needs and available equipment (screen sizes). Since almost all digital signage systems now fall outside the scope of the Internal Signage guidelines, they must be approved by both the senior administrator of the building space and the VP, Administration and Finance. This has resulted in a bottle neck in the approval process and a large backlog of pending installations.

Once Plant Ops had joined the project team, it was agreed that a new set of guidelines to specifically govern digital signage installations was needed, and that these guidelines would be an important deliverable from the project. Since digital signage systems require on-going operation and maintenance, and their information content is dynamic, it made sense to the project team to include general operational guidelines along with the installation guidelines.

Project meetings took place over one year from March 2013 to March 2014. The project group remained open to all interested parties throughout this period. Initially, the meetings were a venue for sharing of information, and demonstrations of technologies, among the various IT groups on campus (Retail Services, faculty IT groups, IST through projects in Food Services, Co-op Ed.). The project team used a collaborative Web environment on collaborate.uwaterloo.ca to conduct project business and share the findings from the team's research and discussions.

Project Team

Name	Representing	Title
Stephen Carr (Project Leader)	IST-Client Services / Engineering	Engineering Account Rep.
Chico Silvestri	Plant Ops	Manager, Client Services
Melissa Keith	Plant Ops	Facilities Technologist
Mike Gaspic	IST	Enterprise Systems – Campus Apps
Brad Krane	FEDS	IT Manager
Randy Dauphin	Retail Services	Operations Administrator – New Media Services
Colin McIntyre	Environment Computing	Web Designer/Administrator
Chris Roth	MFCF	Data Centre Supervisor CS Tech
Amy Aldous	Math	Director Communications and Research Alliances

Lawrence Folland	School of Computer S	Technical Manager, Research Support
Keith McGowan	Arts Computing Office	UNIX System Administrator
Jodi Szimanski	IQC	Senior Communications Manager

Project Outcome

This section should outline the outcome of the project by comparing it to the objectives stated in the charter (or the approved changed objectives documented in the Project Management Plan). It should analyze the end result against key success factors that were identified in the project management plan and/or charter. It should analyze its performance against plans and tolerances and baselines (cost, schedule, quality, scope, risk, communication, etc). Budgeted vs actual costs should be included, as well as how the project measured against the planned timeline/milestones. Relevant statistics could also be included (eg. Stats on change requests received).

This section should also list planned vs actual product and project deliverables. This section should also include any final quality or cost measurements that were identified in the project management plan.

The following are outcomes from each of the project's objectives:

1. It has been clear since the outset of this project that demand for digital signage installations is high on campus. The many new buildings on campus are using digital signage installations as showcase features. Digital signage services have already been offered for several years by Retail Services, Engineering Computing, Environment Computing and Arts Computing. Other faculties are seeing high demand and many new installations are planned. Indeed this project was conducted primarily to compare notes on what is currently being done.

2. It is often difficult to determine whether a university has a centralized system or not. Searches often find a service being offered, but it is not clear if that service is mandated. Various locations or buildings often have deployed different systems, much like we see here at Waterloo. We looked at a few representative Canadian universities by searching their Web spaces.

   Commercial vendors are often focused on just content management systems, and perhaps "player" software for the driving computer, rather than complete systems. A few vendors supply the driving computers as well. Here is what a few universities use:

University	Centralized	Web Site	Vendor's Web Site
UBC	Yes	http://digitalsignage.ubc.ca/	http://www.haivision.com/
Carelton	Yes	http://carleton.ca/dss/	http://www.visix.com/
McMaster	No		
Wilfrid Laurier	No		

3. Several IT groups on campus have been involved in deploying digital signage on campus. Their descriptions of what they currently do are attached as Appendix A.

4. The project team outlined some general "technical considerations and best practices" for digital signage based on their experiences. No quantitative targets were determined. These considerations and best practices are presented in Appendix B.

5. Several commercial technologies and open source technologies are being used on campus to provide digital signage solutions. The following table shows the technologies reported by various campus groups as of the spring term of 2014. Note that during the course of the project, several faculty groups began experimenting with Visibull as the content system, and recently (July 2014) the Chromebox has been found to be an excellent hardware platform for driving the screens. Science, Environment, Arts and Engineering are testing the Chromebox platform now.

Department / Faculty	Content Technology	Display Computer Technology	Licensed Product
Retail Services	LAN-based. Creation Station and Network Manager (on Windows server)	Windows-based player application downloads and displays content from the Windows server	Infocaster
Food Services	Web-based. Remotely hosted.	Web browser	Screenscape (for signage) Wireless Ronin Technologies (for menu displays)

Environment	Web-based content design server. Remotely hosted.	Platform-independent browser (run on Mac Mini or Chromebox)	Visibull
Engineering	Locally-hosted Web content	Platform-independent browser (run on secure custom Debian Linux)	Open Source
Arts	Locally-hosted Web content	Platform-independent browser (run on Ubuntu Linux)	Open Source
AHS	Stand-alone	PowerPoint	
Science	Locally hosted (InfoBeamer)	Media player app on Raspberry Pi	Open Source

6. The project team discussed whether a centralized solution makes sense for the campus at this time. The project team does not recommend the implementation of a centralized system for digital signage, at this time, for the following reasons:

    a. There is significant investment in various digital signage systems on campus, including many systems already purchased and waiting to be installed. Several different commercial products are licensed and in use already and local experience and expertise has been developed.

    b. The pace of change in technologies used in all aspects of digital signage applications introduces significant risk that a single commercial vendor chosen today may not keep up with changing customer expectations, or may not survive in the very competitive market.

    c. Campus IT groups have long-term (as much as a decade) expertise in developing, operating and specifying digital signage applications. So there is existing capability on campus to provide various services ranging from managed/turn-key systems offered by Retail Services, to specialized/custom home-grown systems offered by faculty IT groups, and specialized commercial-grade systems, as have been selected by IST for, e.g., Food Services.

    d. Needs and requirements for digital signage systems are not uniform across campus. For example, faculty IT groups may want to display real-time data about service availability, e.g. lab workstations. Others may only want to display a relatively static slide show. And

others are focused on user interactivity, etc. We currently have different systems on campus that can cater to all of these various needs.

e. The project team has demonstrated that there is interest in co-operating and sharing information in this rapidly changing IT sector. This spirit of co-operation is continuing, e.g. with an info session this summer to demo the Chomebox as a signage computing platform.

f. The proposed new Guidelines for Campus Digital Signage Systems should provide sufficient controls to ensure responsible operation of digital signage systems (see Appendix C below).

g. Emergency broadcast capability is not something offered by commercial vendors, but is an important campus requirement. The locally-developed Emerge system has clients that run under PC, Macintosh and Linux operating systems, and Emerge is currently in use on all Retail Services signage systems and on those operated by Engineering Computing. It should be possible to implement Emerge on most other signage systems with minimal effort. Additional development is possible to enable Emerge on new computing platforms as they come into use, e.g. Android, etc. It is likely that local development will continue to be required to implement emergency broadcast capabilities.

The project team drafted "Guidelines for Campus Digital Signage" designed to control both installation and operation of digital signage on campus. These guidelines specify the approval process for installation of digital signage, as well as propose requirements for, and authorities over, their operation. The guidelines document is attached as Appendix C.

After the Guidelines for Campus Digital Signage document was prepared, and just before it was presented to UCIST and CTSC to address the current installation bottleneck, the VP, Administration and Finance decided that the Plant Ops' (installation) Guidelines for Internal Building Signage should continue to control installation of digital signage, in an updated form, and be kept separate from any operations guidelines. The combined Guidelines for Campus Digital Signage document was presented to UCIST and CTSC along with the major findings from the project (summarized below). Resolution of questions about how operation of digital signage should be governed in a federated management environment was left with UCIST and CTSC.

Lessons Learned Summary

This section should only contain a high level summary of lessons learned for the project, with a referral to where the complete lessons learned are documented. This high level summary should highlight the top 3-5 successes and issues that should be kept in mind for future projects.

1. Through the course of this project, it has become clear that the line between passively viewed digital signs and interactive kiosks is now blurred to the extent that we think it is no longer useful to distinguish between the two. Large touch-screen displays are now available, and other interactive technologies, such as viewer proximity detection and interaction with mobile devices are now starting to appear. Privacy of user data is our main concern when designing interactive digital signs, and this has been added to the Guidelines for Campus Digital Signage document.

Transition to Operations

Describe the transition of the project to operations upon completion. Reference any documents (such as the Maintenance Plan) created for this transition. Outline any difficulties or challenges faced during this transition, as well as highlight what went right during transition.

[Insert Transition to Operations]

Recommendations

List any recommendations for future projects.

1. We recommend the adoption of the new Guidelines for Campus Digital Signage Systems by Deans' Council or appropriate governing body and revision of the current Guidelines for Internal Building Signage to remove references to digital signage systems. Or, we recommend revision of the Guidelines for Internal Signage to address digital signage as a separate type of signage with different installation rules, as outlined in this project's proposed Guidelines for Campus Digital Signage Systems, and establishment of a separate Guidelines for Operation of Campus Digital Signage document.
2. Create a collaborative digital signage Web space in the WCMS or elsewhere on the campus Web that will allow campus IT groups to house, share and update current information on recommended hardware and software, including details on product licenses. This will be the main source of technical information for IT groups who want to install new signage systems. It should also link back to the more general Guidelines document(s).
3. Details about the digital signage services offered on campus should be collected and made available from a new, publicly-accessible page in the campus Web space (WCMS). This page

should link to the governing Guidelines documents and also to the internal collaborative Web space.

4. We recommend that the UW Emerge system and/or client be modified to include an "all clear" mechanism that can signal any digital signage systems (which may not have any means of user interaction) when to resume normal operation.
5. We need Emerge clients that work on all signage computer platforms (we currently have this for Windows, Mac and Linux), but the need to expand this list may arise, e.g. Android, Chromebox. The Emerge system will require a service owner who can respond to such requests.
6. Plant Operations has sufficient control over installation of digital signage through Policy 22. However, we need an auditing mechanism to ensure that signage systems also adhere to the operational guidelines. We recommend that the senior administrator in charge of a building be responsible for overseeing the operation of digital signage in that building.
7. Content harvested from Internet feeds must be moderated or monitored to ensure that it is appropriate. The collaborative Web site for digital signage will give details of best practices for various types of Internet media feeds.
8. With increasing viewer/user interactivity with digital signage, we recommend that appropriate measures be taken to protect privacy of viewer/user data.
9. We are not aware of a campus policy or guidelines document on advertising as it applies to Web pages and digital signage. This is a "gap" area in the operation of digital signage systems and we recommend that it be addressed.
10. We do not recommend at this time that a single centralized service be provided for campus digital signage installations. There is already significant investment in digital signage on campus, including systems that are waiting to be installed, pending approval to do so. We have prepared the Guidelines for Campus Digital Signage document which we believe to provide sufficient clarity about installation and operation of such systems. Our proposed collaborative web pages will provide information on which campus groups are providing services, current best practices for operation, and equipment recommendations.

Post Project or Outstanding Tasks and Issues

List any post project or outstanding tasks/issues that still remain, who is responsible and how they will be managed to ensure completion.

1. The project team has questions about appropriate governance of “federated” (as opposed to centralized) IT services, such as digital signage. How should authority and oversight be established for federated services? Are Guidelines documents sufficient? At UCIST it was questioned whether the Plant Ops “Guidelines for Internal Building Signage” should apply at all to digital signage (Policy 22 continues to govern installation of equipment attached to building structures). Of particular concern was the restriction on the numbers of digital signage displays

imposed by the Guidelines for Internal Building Signage. UCIST and CTSC will need to resolve these issues.

2. Installation and operations guidelines for digital signage remain to be established and adopted. Again, UCIST and CTSC will need to implement these.
3. A public Web page in the WCMS that describes current campus resources for digital signage deployment, with link(s) to the Guidelines document(s) needs to be established. IST will need to assign this task and determine where it fits into the WCMS site design as a federated service.
4. An access-controlled collaborative Web space for campus IT groups to share current local technical expertise on digital signage deployment needs to be developed. IST is best equipped to host this site. The project's site on collaborate.uwaterloo.ca could be a starting point for this.
5. A clear campus policy on advertising on digital media is needed.
6. Addition of an "all clear" signal in the Emerge system is required so that overriding emergency messages can be removed in a timely manner.
7. Some level of local development will be required to enable the emergency broadcast system. A service owner should be designated for the Emerge system so that development requests can be addressed.

Contract Closure

Summarize project contract closure activities for procurement during the project.

This project had no budget or mandate for procurement.

Project Closure Approval

Approved by: [insert who has reviewed and approved this project's closure]

Approval Date: [insert date the closure is approved]

This closure report was discussed by [insert where this closure was discussed] and documented at [insert where documentation for closure resides]. The above listed individuals agree to the closure of this project.

Appendix A: Report of Campus Digital Signage Installations

The following is a snapshot of digital signage installations on camps, reported by project team members as of the April 2014. More systems have been installed since that time, and some technologies have already changed.

It should be noted that there has been a recent boom in the digital signage marketplace, mostly in cloud content providers. Visibull is a local company that offers a cloud service for digital signage content development, operated by Collin McIntyre of Environment Computing. Collin has offered free accounts on Visibull to campus IT groups for a limited time. There has also been a recent boom in miniature, inexpensive computing platforms ranging from low-end Raspberry Pi-type ARM-based devices to the more recent Intel-based Chromeboxes. Depending on graphics needs, most of these can be deployed to drive signage displays. Engineering, Science and Environment faculties have been experimenting with many of these devices.

Retail Services

Over ten years ago Retail Services used to operate a display in the window of the Book Store. It was nothing more than a plasma TV attached to a laptop running a power point. Seven years ago Retail Services and Food Services purchased software called Infocaster. The product is owned and distributed by Harris Broadcast, whose digital signage headquarters is here in Waterloo. This is the same product that is being used by CECA as a messaging system for student interviews.

Retail Services has partnered with and helps to manage screens in The Library, Registrars, Student Success, St Jeromes, Arts, Science, Housing, Health Services, The Turn Key Desk and the School of Accountancy. RS accepts, creates and distributes content from students, faculty and staff across campus. All of the digitals signs maintained and updated by RS are part of the campus emergency system.

The software components of the system are comprised of a Creation Station, Network Manager and Player software. The Creation Station software is responsible for the look displayed on the screen and content scheduling. The network manager software distributes content updates to the digital signs. The

The hardware of the system is as follows. Creation Station software runs on a windows PC with a beefed up graphics card. The Network Manager runs on a Windows PC running apache server software. Player software runs on a windows PC with similar specs as the Creation Station. Player PC's are attached to industrial grade monitors that are secured and hung various ways across campus.

Retail Services has partnered with various departments across campus: DP Library, DC Library, SCH Book Store, SCH Student Success, B1, PAS, HH, NH, PHY, C2, SLC CampusTech, SLC Great Hall, St Jeromes ,

Food Services

Food Services is currently deploying two different solutions, one for digital signage and one for digital menu boards. The digital signage platform is a web based, hosted solution provided by ScreenScape Networks Inc. (http://screenscape.com/). This software only requires a PC with internet access to launch a specific URL (via IE or Firefox) in kiosk mode. Administrators responsible for the content use an online CMS tool which can accept text, images, and video, schedule content and share published items with others using ScreenScape (optional). The CMS tool limits content to either one screen with three pre-defined regions, or one full screen option containing either an image or video. This solution is currently deployed in: REV (REVelation), DP (Browser's Cafe), HH (LA's Cafe), and EV3 (Williams Cafe).

The digital menu provider is Wireless Ronin Technologies (http://www.wirelessronin.com/) which is also a hosted solution. WRT's Ronincast CMS tool is also access through a web portal and offers a more selection of features and functionality over ScreenScape which is better suited to the digital menu requirements. The hardware requirements are minimal which include a low powered PC, running windows embedded OS, internet connection and digital video outputs. Currently this solution is being used in: ML (ML's Cafe) and V1 (Mudie's).

Applied Health Sciences

AHS currently has one digital display located in the main hallway on the first floor of BMH. This is a Dell Vostro desktop PC located in a TR looping a PowerPoint presentation. A script runs each day that checks a directory on a network drive for an updated PowerPoint file. The PowerPoint file is updated regularly with new content by the Student Services Coordinator in the Dean’s office of AHS. The video output from the PC runs through a Video/Audio Extender. The Extender outputs over standard VGA to a monitor in the TR and also over Ethernet through the patch panel in the TR to the flat panel display in the hall. The total cost of this system was about $1500.

Arts

Arts Computing uses a Ubuntu LTSP (Linux Terminal Server Project, http://www.ltsp.org/) server to provide the kiosks with a boot image and file system. Based on the client configuration defined on the server, the kiosks boot to run in different modes:

- A full screen web browser session used for print job release monitors and signage.

- A Remote Desktop client to connect to a Windows Terminal Service: Use for the Arts Lecture public thin client machines.

Engineering and Architecture

Engineering Computing has been deploying some form of digital signage dating back to the early days of the Web in the 1990s. Recent implementations, going under the name Enginfo, use an on-site Web server to deliver content and have screens powered by small, fanless, single-board computers running a customized and hardened Debian Linux. Signage content is written in HTML 5, and some content is dynamic, e.g. displaying the number of available workstations in the public computer labs. The Enginfo signage computers and touch-screen information kiosks boot up and run the Chromium browser in full-screen mode from an unprivileged user account. Enginfo signage and kiosk systems are locked to Engineering Computing's web site. Interactive kiosks are located in some of Engineering Computing's public labs. These display the regular Enginfo content until the screen is touched, then display a navigation system for retrieving information about computing accounts, labs and printing in Engineering. Hardening of the Linux OS involves running the browser without privileges, setting up a firewall, and not running any unnecessary services.

The latest generation of Enginfo systems is powered by the Cubieboard2, a fanless single-board computer that costs approximately US$65. This board is not suitable for heavy graphics animation or video. Customization of the Debian Linux OS on the Cubieboard is more complicated than for the UWIK kiosks described below.

Engineering Computing used the same hardened Linux to produce general purpose Internet kiosk computers, including the University of Waterloo Internet Kiosks (UWIK) that have been operating continuously in the Student Life Centre since 2004. UWIK kiosks allow unrestricted access to the Internet using the Google Chrome browser and have a standard keyboard and mouse. The Debian operating systems is build and customized using the Debian Live framework. In addition to the hardening employed in Enginfo systems, user data accumulated during a UWIK browser session is purged when the browser is closed or after an inactivity time-out. Users are prevented from running a shell or doing anything other than using or closing the browser. The new generation of UWIK machines are powered by the GizmoBoard, a fanless, single-board computer with an AMD G-Series APU that enables smooth video playback. It uses 12W of power at full load and on average 8W. The board boots from on-board flash, or can network-boot via iPXE. The board costs approximately ~US$200. Engineering Computing continues to investigate new hardware as it becomes available.

All of Engineering Computing's signage and kiosk systems are capable of running the Emerge emergency broadcast client, which takes over the browser.

More Enginfo-type digital signage is being deployed for the Engineering Student Society (EngSoc). These will use the Chromebox as the driving computer.

Architecture is planning to deploy some digital signage in the near future.

Environment

The Faculty of Environment currently has 6 displays, 3 of which are run internally by Environment Computing and the communications team. Signage deployed by Environment Computing is using the commercial Visibull remote-hosted content system and is powered by Mac Mini computers. The Chromebox is being tested as a replacement for the Mac Minis. An example system:

EV3 Atrium 1
Birth date: May 2012
Display: Sony 52" LCD commercial (~ $3000) Player: 2012 Mac Mini
Connection: Mounted to back of display, security tab
Content Software: Visibull

Mathematics and Computer Science

There is no Faculty-wide digital signage currently in place. High-traffic areas that will be priority locations include:

- MC 3rd floor, outside the student lounge and coffee shop
- Bruce White Atrium in the M3
- Great Hall in DC

Visibull is being tested as the content management system for the faculty, starting with a screen that will be placed behind an MFCF server room window at the end of a busy hallway. Once the bugs are worked out, we will investigate hardware options for additional locations.

Content to include:

- @WaterlooMath and @mathsocTwitter feeds
- uwaterloo.ca/math and MathSoc news and events
- upcoming research seminars

Computer Science now has two displays setup using the Visibull content management system.

- in the CS Main Office: http://cscf.uw-math.visibull.tv/
- the CSCF Help Desk window: http://cscfhelp.uw-math.visibull.tv/

A large 8-screen system is being planned to replace a defunct kiosk in the DC atrium, that will be interactive and may use the Visbull content system.

Science

Science computing has tested several open-source signage systems. These have recently been converted to Chromebox computers in undocumented kiosk mode, and the Visibull content management system.

Federation of Students

FEDS looked at the following systems about a year ago before deciding to partner with Retail Services and use their existing solution:

- Xibo - Open source, Python client app for Windows and Ubuntu Linux.
- Concerto - Open source, Debian Linux web based.
- Navori - Commercial software.

We ruled out the above options mainly because of a lack of the features we wanted, ease of maintaining content and how it could be displayed and time shared with many different campaigns, stability and in the case of Navori, price. The other reasons why we decided to use Retail Services system is that they already had it setup, configured, tested and integrated with the uWaterloo emergency broadcast message network.

For hardware we will likely use fanless mini-PCs that we will build or buy if we can find what we need off the shelf. The screens we will be using are commercial grade MD46B. The plan is to have at least one in almost every building in high traffic areas.

Appendix B: Best Practices / Technical Considerations

The project team discussed best practices and technical considerations for digital signage deployment based on experiences. These were split into display and content subsystems.

Content Subsystem

The content subsystem includes the server-side infrastructure that hosts and deploys content to signage/kiosk displays and the software tools used to create content. The most important technical considerations for the content subsystem proposed by the project team are:

1. Ease of generating content (intuitive user interface) and incorporating data feeds
2. Ease of scheduling content display
3. Ability to modify look and feel for emphasis of special events
4. Ability to delegate and control permissions for content creation and vetting

5. Ability to share content among different groups if desired for branding, message content consistency
6. Logging of content displayed
7. Ability to broadcast emergency notifications (generated by an on-site service, e.g. Emerge client running on display computer)
8. Security of content (e.g. local versus off-site storage, protection against tampering, etc.). Local content is preferred, but cloud content services are now ubiquitous.
9. Data format. W3C standards preferred. Moving target.
10. Cost

Display Subsystem

The display subsystem includes the digital display itself and the computer (and peripherals, if used) that drive and interact with the displayed content. Kiosks allow user interaction to control the displayed content, possibly via a touch-sensitive screen, or standard keyboard/mouse. The line between signage and kiosks is becoming blurred as touch screens become more available. Also, passive interaction, e.g. proximity detection of viewers, is beginning to become available. The most important technological considerations for the display subsystem are:

1. Security of the computing platform against tampering (physical security); separation of computer from display e.g. with signal booster (computer in secure, controlled location). Physical access controlled. Computer with no keyboard, etc.
2. Security of software / OS / network: firewalled, hardened OS; Controlled boot image location.
3. Reliability of hardware (display, computer, peripherals). Fanless computers are preferred . Commercial grade displays should be considered for some locations.
4. Display burn-in; plasma vs. LED durability; temperature variations; outdoor conditions; vibration and movement (relocation
5. Computers: graphics capabilities should be adequate for type of content, e.g. video
6. Ability to monitor the state of the display subsystem; remote reboot
7. Maintainability of OS and software (e.g. ease of updating software); automation of building systems
8. Ease of deployment and scalability. Instructions available; a group of people with expertise to deploy and improve.
9. Cost
10. Ease of installation
11. Location for traffic, sun glare, etc.: ergonomics

Some of these general considerations have been incorporated into the proposed Guidelines for Campus Digital Signage. Specific technical details regarding building and maintaining current systems are recommended to be shared on campus through a restricted-access collaborative Web space.

Appendix C: Draft Guidelines for Campus Digital Signage

Note that this document was prepared under the assumption that both installation and operation guidelines could be combined into a single document. If this proves not to be the case, they can be separated. The guidelines have been kept general so that they need not be updated frequently. The specifics of current practices are recommended to be kept elsewhere on the campus Web so that they can be kept up to date more easily. These guidelines were presented to UCIST and CTSC in May 2014 for review. The questions raised at those meetings have been incorporated into the Outstanding Tasks and Issues section of this report. Point 3 in the Operations section of the Guidelines has been amended here to include "The privacy of users of interactive signage systems must be protected. Any accumulated data generated by an interactive session shall be cleared when the session is completed (e.g. on a "kiosk" installation)." The Draft Guidelines for Campus Digital Signage prepared by the project team:

Definitions and Scope

These guidelines govern the installation and operation of wall/door/ceiling/floor/window-mounted electronic information systems located in interior public spaces (hallways, foyers and atria) within academic and administrative buildings. These guidelines are intended to streamline the installation process for typical digital signage systems, and also provide some basic standards for their operation.

In this document we use the generic term "digital signage" to describe a variety of possible configurations. A typical digital signage system comprises a visual display screen (possibly consisting of multiple panels), a computer that drives it, and a remote system for generating and providing content over the campus network. Interactivity, if implemented, may be achieved through a touch screen display or some other technologies. Note that "information kiosks", which are primarily user-interactive installations, also fall under this definition of digital signage.

Some campus buildings are exempted from the governing guidelines for installation due to their specialized uses: SLC, Fed Hall, PAC, CIF, Grad House, and SCH. For the same reason, computing lab spaces are also exempted. All digital signage installations remain subject to applicable University policies (e.g. Policy 22, regarding installation) and to the guidelines for operation described below.

The rapidly changing technologies used to provide digital signage systems, and the greater variety of possible uses of dynamic, interactive information displays, separates them significantly from traditional static building signage. Guidelines for internal building (static) signage are described in a separate document, "Guidelines for Internal Building Signage".

Approval Process and Authorities

Digital signage systems which adhere to the guidelines stated below may be installed routinely through a work request submitted to Plant Operations. Digital signage systems which are attached to building

structures fall under Policy 22, which requires that Plant Operations carry out the installation in compliance with governing building and fire codes. At the time of the request, Plant Operations must be informed of any extraordinary power or structural requirements, and intended use of any equipment that is not commercially available (e.g. custom-designed, or not CSA approved).

The authority over on-going operation of, and information displayed on, a digital signage installation is the senior administrator (e.g., Dean, Associate Provost, CIO) responsible for the building or location. The senior administrator may delegate responsibility for routine operation and adherence to these guidelines to an appropriate senior technical official (Associate Dean for Computing, or Director of an IT group).

Proposed digital signage systems which fall outside the scope of these guidelines must have the signed approval of the senior administrator responsible for the building or location, and the Vice President, Administration and Finance.

Governing Guidelines for Installation of Digital Signage

1. The **size, height and orientation of displays** should be reasonable for the location and intended use. Ergonomic principles should be considered when selecting the size, height and orientation of the display. For example, displays in atria would typically be higher and larger than those in hallways. Relation to existing lights and windows should also be considered to optimize visibility and reduce glare. User interactivity with the display will also affect its location and orientation. Location should also optimize proximity to the intended audience.

2. **Unnecessary proliferation** of digital signage in public spaces is discouraged. Digital signage should be limited to two installations per departmental office location, to be mounted in reception/waiting areas, and public entrances/foyers. Installations in public atria should be limited to the number of main public entrances to the space. Digital signage installations should share content from various interested parties whenever possible. Digital signage cannot be installed in locations (such as in a window or door) where it is intended to attract the attention of persons located outside the building.

3. **Computing systems that support digital signage must be secured against tampering**, which requires that they be located inside controlled-access rooms, or within secured enclosures. Displays should be secured against theft and protected from damage where significant risks exist.

Governing Guidelines for Operation of Digital Signage

1. **Other legitimate uses of public spaces must be respected.** For example, silent operation of digital signage is generally desirable, and it may be necessary to shut off visual displays during

special events in the space. The senior administrative official responsible for a public area must be informed of which campus unit is operating each signage system in that area. If possible, installations should also be labelled with the contact information of the operator, or otherwise identify the operator.

2. **On-going operation and maintenance** of digital signage systems is the responsibility of the requester, not the installer (Plant Operations). Retail Services, Information Systems and Technology, and faculty computing departments are some on-campus units that have expertise to specify equipment, operate, and generate content for digital signage systems. There may be additional on-going costs to the requester for maintenance, operation and content development. Energy efficiency of equipment should also be considered in terms of on-going cost of operation and environmental impact.

3. **Information content** for digital signage installations is subject to the authority of the senior administrative official responsible for the public space. Content "look and feel" and limits on commercial advertising are subject to university guidelines or policies (under development at the time of this writing). Policy 8 on information security applies to protection of confidential information. Policies 21 and 29 define rules around promotion of consumption of alcohol and smoking, respectively. Policy 33 describes ethical behaviour including inclusiveness and accessibility.
   The privacy of users of interactive signage systems must be protected. Any accumulated data generated by an interactive session shall be cleared when the session is completed (e.g. on a "kiosk" installation).

4. **Computing systems that support digital signage must be secured against remote tampering** through the network.

5. **Emergency broadcast capability** is covered by Policy 60. Digital signage installations must have the capability of displaying notifications originating from the University emergency broadcast system.

More Information

More information about campus service organizations that support digital signage installations, services offered, best practices, and equipment recommendations, is available on the campus Web space.