Universal Imaging: Revolutionizing Desktop Support

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ABSTRACT
Lehigh University has recently implemented a new PC deployment model which is built around the Universal Imaging Utility, a product of Big Bang, LLC. This model has allowed Lehigh to provide a consistent configuration on all desktops while reducing computer setup time significantly. The increased efficiency not only benefits the Lehigh IT staff, but also reduces downtime for end-users.

The Universal Imaging Utility allows Lehigh to create a single image that can be deployed to any PC regardless of make, model, or configuration. Not only has Lehigh been able to reduce new PC setup time by fifty percent, they have also reduced operating system reinstall time by seventy-five percent. Lehigh has managed to save considerable amounts of time by using the Universal Imaging Utility and is excited to share their insight with other higher education institutions.

Categories and Subject Descriptors
C.5.3 [Computer System Implementation]: Microcomputers – personal computers, portable devices.

General Terms

Keywords
Deployment, Imaging, Spyware, Viruses, Desktop Support, Drivers, Ghost.

1. INTRODUCTION
1.1 Lehigh University Overview
Lehigh University is located in Bethlehem, PA and boasts an enrollment of over 4,500 undergraduates, 2,000 graduate students, 560 faculty members, and nearly 900 support staff. Both library and computer services are combined in one integrated organizational unit known as Library and Technology Services (LTS). LTS owns and maintains over 600 classroom and lab PCs while also supporting nearly 2,000 departmental PCs.

1.2 Changes in Desktop Computing Support
Lehigh University's LTS Client Services teams for desktop computing support have been challenged with a growing number of PCs that require reformatting. This increase is a result of desktop security requirements and the onslaught of viruses and spyware.

To ensure that all confidential data is removed from relocated computers, the university security policy requires that the hard drives be overwritten and the system be reloaded for the next user. In addition, removing viruses and spyware from PCs is time intensive and often results in residual problems with functionality and reoccurring infections.

Although reformatting ensures that secure data is removed and eliminates virus and spyware problems, it requires hours of consultants' time. As a result, we considered the feasibility of using imaging to support departmental computers.

1.3 Imaging Defined
Webopedia defines imaging as a process where the contents of a hard drive (including settings, configurations, and applications) are converted into a single image file. When the contents are needed again the process is reversed. Imaging allows IT professionals to rapidly clone PCs and has long been the industry choice when deploying large quantities of new systems[6].

1.4 Imaging in the Lab Environment
For many years, LTS has used imaging technologies to efficiently deploy and maintain classroom and lab PCs. These PCs are on a three-year lifecycle. Hence, at any given time there are three models of PCs in service. Upon initial deployment, all PCs are imaged using Symantec Ghost[5]. After deployment, should a user experience a problem with a lab or classroom PC, he or she may initiate a “refresh.” A refresh is an automated procedure that will cause the computer to reload itself from the respective Ghost image.

Imaging has worked very well in the lab environment. When compared with the notion of setting up and maintaining PCs on an individual basis it is clear as to why imaging is a superior method of managing lab PCs. The caveat of imaging has always been how an image is specific to a particular hardware configuration. One image is required for each model lab PC. Still, the work of
maintaining three separate images is well worth the efficiency realized via imaging technology.

1.5 Departmental PCs
Departmental PCs have always been a different case, however. Departments purchase PCs throughout the year and those purchases are rarely identical. Occasionally, when a department purchased a large quantity of identical PCs, LTS would configure one and then image the others. Unfortunately, the image quickly became outdated and saving it for future refreshes was impractical and of very little value. The majority of the time, LTS consultants setup departmental PCs individually.

This has all changed recently now that Lehigh has decided to use the Universal Imaging Utility (UIU), a product of Big Bang, LLC [1]. Simply put, the UIU allows LTS to make a single image that can be used on nearly any PC, regardless of make or model.

2. UNIVERSAL IMAGING MECHANICS

2.1 Process Overview
The concept of universal imaging is quite simple. Utilizing the UIU allows IT professionals to create one image that can be deployed to nearly any PC. The process is very simple. You begin by configuring a “master PC” to your liking. This includes installing Windows XP and any other software desired. Once configured, the UIU can be applied to your master PC. The UIU installs an extensive driver database on the PC to ensure that your image will work on nearly any computer.

2.2 UIU Driver Library
The UIU’s driver database does not take up as much disk space as one would imagine. According to a Big Bang, LLC FAQ, the drivers amount to approximately 200 MB. At this point one may wonder how a world of drivers can be condensed into such a small size. The engineers at Big Bang, LLC incorporate “white box” drivers in their database. Often, manufacturers have multiple versions of the same driver. For example, ATI may have a Dell branded driver, a Gateway branded driver, and a HP branded driver all for the exact same video card. Additionally, ATI makes “white box” drivers available for people who purchase their video card separate from a PC (and often in a white box). The use of white box drivers in the UIU is how the small size is achieved[1]. After the driver database is installed the UIU invokes Microsoft Sysprep. Upon Sysprep’s completion, the PC is then shut down and is ready to be imaged with Symantec Ghost.

2.3 Disk Imaging Software
It is important to understand that the UIU does not replace imaging software such as Symantec Ghost. Rather, the UIU transforms a “master PC” into a state where it can be imaged with Ghost or other imaging software of your choice; the image captured can then be loaded onto nearly any PC.

2.4 Deploying the Universal Image
The Windows XP mini-setup will run on the first boot of an imaged PC. Setup will detect hardware and install appropriate drivers using the UIU’s driver database. This process only takes about ten minutes on a typical PC and requires no user interaction. Once complete, the client PC is configured just like the master PC.

3. PRODUCT EVALUATION
Utilizing a trial version, Lehigh tested the UIU beginning in fall 2004. Satisfied with our initial testing, we then ordered a small quantity of licenses to test in the field on actual client PCs. This testing confirmed our initial assessment of the UIU; it did exactly what it said it would.

3.1 Time Saved Over Manual Processes
We found that the average setup of a brand new PC (with a preinstalled OS) took LTS consultants approximately one hour. This would include installing and configuring all software programs and desktop settings. Using the UIU, we were able to do the same work in about half the time. We also found that the average time of a reformat/reinstall took consultants more than two hours. Again, the UIU could do the same operation in thirty minutes. These time savings are significant for both LTS staff and our clients.

3.2 Feedback from Staff
Below is commentary from LTS staff members regarding their initial experience with universal imaging:

“I really liked the test we did with UIU. I had need for it today matter of fact. I had an older machine with 98 and needed to take it to XP. The fact that each team (Eng, Admin, etc.) can have their own flavor of an install is very nice. The time it saves vs. a standard install is great. As you know we have quite a few system images in ME, fluids, CAD1, CAD2 and the ME21 and ME121 systems. It would be nice to have a non hardware specific image for faculty and staff.” – Fred Welheden, Computing Consultant

“What a timesaver! Easy to use. Makes short work of a new system setup. (sorry it sounds like advertisement, but it's all true!) Yes, I believe that all computer consultants would use UIU just for the time factor.” – Sandra J. Edmiston, Computing Consultant

"Although I was initially skeptical that the concept of a "universal" image could work, I'm becoming convinced that this approach not only works from a technical standpoint, but if standardized across campus, has the potential to provide tremendous benefit both to LTS and to our clients. Computing consultants will save time setting up new PCs, with approximately a 75% reduction (30 minutes versus 2 hours.) Increasingly severe spyware infections, and a corresponding decrease in our ability to clean them with certainty, leaves reformat/reinstall as the only option in many cases. Availability of the UIU would mean a quick, reliable resolution, rather than sinking unpredictable hours into attempts to clean a system (with no guarantees), or taking several hours to install Windows from scratch and reinstall applications and drivers, etc. Clients get the benefit of faster setup of new PCs and faster turnaround in emergencies. The time that consultants are not spending on mundane tasks like waiting for Windows to install, can be spent on more complex client problems where we provide more added value.” – Brad Price, Computing Consultant

3.3 Image Storage and Movement
Several methods of storing and moving the image were evaluated. These avenues included the campus LAN, CD/DVD disks, and portable USB hard drives.

We first evaluated placing our image on a server in the same manner we do for the lab PCs. Immediately, we became aware of speed issues. Unlike our labs, many buildings on campus still use category three wiring. The result is an image load time of
approximately forty-five minutes. Uploading and storing new images also took longer than desired.

The use of CD and DVD disks was examined, but their reliability was questioned. All too often we noticed read errors on this media type. Storage of the image is also a problem. Because the average size of an image is approximately 3 gigabytes, using CDs as the media would require the image to be spanned over a number of disks. Not only would this be a problem when preparing the image, but during the imaging process, someone would have to load the disks when prompted. Additionally, each time the image is updated, a new set of disks for each consultant would have to be burned. Although the image would fit on a DVD disk, there are issues of compatibility and some of our older computers are not equipped with DVD drives.

We have found that using portable USB hard drives is the most convenient and efficient method of storing and transporting the image. Prior to the Universal Imaging project, each consultant had been provided with a USB hard drive for storing backups of the clients' data when reformattting and refreshing PCs. Therefore, the USB hard drives were already at our disposal for deploying images. We recommend purchasing lightweight drives with both USB 2.0 and Firewire capability. While most newer systems are equipped with USB 2.0, older PCs still have conventional USB. These older systems can take nearly one hour to load. To save time, we have found it prudent to carry a PCI USB 2.0 card along with our USB hard drives. In the event we need to refresh an older PC we install the USB 2.0 card temporarily. For older laptops that do not have USB 2.0, we purchased PCMCIA USB 2.0 cards. Using these cards was successful only with a USB hard drive that could be powered with an AC adapter or through a USB port on another PC; otherwise the external drive was not recognized.

3.4 Consultation with UIU Customers
Other schools reported to be using the UIU include Bucknell, Colgate, Syracuse, and Wesleyan. We took the time to speak with current UIU customers who each gave an overall positive review.

4. FULL-SCALE ADOPTION
In April 2005, Lehigh University licensed 2,000 copies of both the UIU and Symantec Ghost at a cost of approximately $25,000.

4.1 Staff Training
The first major step in full-scale adoption of the UIU was training our computing consultant staff. Some consultants were Ghost gurus, some had only occasionally used Ghost, while others confessed not even knowing how the program worked. Not only did staff need to be taught how to use Symantec Ghost, but they also needed to learn the entire universal image creation process.

4.2 Specialized Images
Rather than using a single image for every campus PC, it was determined that each area would use its own image. This meant that the consultants responsible for supporting the engineering college created their own image, the arts college consultants made their own image, etc. This gave each team a sense of ownership in their image and allowed them to incorporate their own determination of ideal set up standards. For example, the universal image for the engineering college includes engineering software, whereas the universal image for the business college may include stock-analysis software, etc.

4.3 Configuring the PC for Imaging
The PCs that we deploy use Windows XP Professional in an Active Directory (AD) network environment. With a goal of creating an image that requires minimal setup time on the cloned PCs, we recommend using a procedure that ensures that all settings are included in the new profile that is created the first time a user logs onto the computer with his or her AD user name and password.

When preparing the master PC for imaging, it is added to the AD domain and configured. Once the PC has the ideal configuration, the PC is restarted and the consultant logs in as the local Administrator. The profile created during configuration is copied to the Default User profile, and becomes the template for creating new profiles on the PC. Once the profile has been copied, it is deleted from the Documents and Settings folder and the computer is removed from AD. A Microsoft default user hotfix must be applied next to correct a problem with the sysprep tool that uses the Administrator account instead of the Default User account from which to build the profile when a new user logs on (see Microsoft KB887816)[4].

4.4 Completing the Setup after Imaging
After the PC is cloned, it is renamed and added to AD. The client then logs onto the computer and his profile is created in Documents and Settings. The consultant completes the setup by configuring user-specific software such as email and Palm Desktop and copying the user's data from the backup.

5. BENEFITS REALIZED
5.1 Consistency
The UIU adoption has been valuable in providing consistency in desktop configuration. In addition to full-time staffers, LTS employs student helpers who setup computers. Using an image ensures that the computers are setup in a uniform and consistent manner. Prior to imaging, a seven-page checklist listed all installations and configurations we imposed on new PCs. Not surprisingly, items were sometimes forgotten and a follow-up visit would be necessary. Lehigh's use of imaging dramatically reduces the opportunity for human error and thus saves many man-hours.

5.2 Ability to Combat Spyware and Viruses
With the proliferation of spyware and viruses, we have found ourselves frequently having to reformat PCs. This is where the UIU has really paid off – we finally have an easy answer to "my PC is running slowly." When our clients call reporting this condition we offer to refresh their PCs via the UIU. This process begins with the LTS consultant backing up the user's data to a USB hard drive. The image is then loaded, configured, and the user's data is moved back over. Post-refresh, a client's PC is up to date with all the latest versions of campus software, security patches, and OS enhancements. And of course all this is done in about thirty minutes.

5.3 Speed and Efficiency
Knowing that PCs can be refreshed in such a short period of time, LTS consultants now have a cap figure on their troubleshooting work. Rather than spending hours trying to diagnose a problem, we often stop after forty-five minutes or so. It typically does not make economic sense to spend a whole day trying to diagnose a problem when it can be resolved with a half-hour refresh.
Refreshing also helps in identifying hardware defects. Prior to imaging, LTS hardware repair technicians would often question whether a suspected hardware problem was in fact hardware related. With imaging now in place, LTS computing consultants can more quickly and more confidently identify hardware defects.

In addition, LTS also finds the UIU useful in complying with our own security policies:

“...To ensure that all confidential data has been removed from a computer system and cannot be restored using data restoration tools, as well as to ensure that the computer is in compliance with all software licensing issues, all information on the hard drive should not only be deleted but also overwritten (also known as zeroing out the drive). This applies not only to computers being sold, donated, or otherwise disposed of, but also to ones going to another individual at Lehigh as that individual is unlikely to have the same access rights to confidential information as the original user of the system.”[3]

Without question, the UIU has reduced both initial PC setup time and subsequent troubleshooting time.

6. BUMPS IN THE ROAD

6.1 Driver Bangs

With Dell, IBM, and Gateway systems, we rarely have a problem. Binary Research International, a distributor of the UIU, states:

“To ensure correct compatibility with most business-class desktops and laptops, Big Bang LLC have compiled software drivers for over 25,000 hardware components from brands such as Dell, HP, Compaq, IBM, Sony, Toshiba, Panasonic, as well as hardware component manufacturers Intel, 3Com, VIA, nVidia, ATI, SoundMax, and many more.”[2]

Occasionally, a driver may not be present in the UIU’s database. However, this is not a major problem because drivers are usually available online. A recent example of a “driver bang” (the term Big Bang assigns to the inability of the UIU to detect a piece of hardware) would be a new sound card in a recent Gateway purchase. Downloading the driver from Gateway was not a big inconvenience in the grand scheme of things. Also, when informed of such an occurrence, Big Bang will update the UIU driver library. Each time you create an image the UIU automatically connects to Big Bang servers to ensure it has the most up-to-date drivers.

6.2 Non Site-Licensed Software

The most bothersome issue surrounding our implementation of the UIU relates to CD/DVD authoring software (such as Roxio) and DVD playback software (such as WinDVD). Lehigh has a site license for Windows XP, Microsoft Office, Symantec Anti-Virus, and all the other programs we include in our image. We do not have a site license for CD/DVD authoring software and DVD playback software. This is a major inconvenience because it means that we can not include these titles on our image.

Subsequent to an initial image load (or refresh) we must reinstall these software titles from the OEM media that shipped with the PC. There has been a recent trend to not send restore CDs with new PCs, so we must specifically ask our vendors to do this. Also, we must ensure that our clients do not lose the CDs since they may be needed a year later should their PC require a refresh.

All-in-all these problems are addressable; and, when compared with the time savings of universal imaging, they are by no means showstoppers.

7. FUTURE CONSIDERATIONS

7.1 Student PC Imaging

Lehigh is now examining the possibility of using the UIU on student-owned PCs. LTS provides support for student PCs and in many cases encounters systems so severely infected with spyware that a reformat is the only solution. Cost considerations arise because, unlike Lehigh-owned PCs, we would have to purchase a license for every student PC we image. A one-time purchase of 2,000 licenses is sufficient for campus use because at any given time there are no more than 2,000 departmental PCs operating. As old PCs are decommissioned, the Ghost and UIU licenses are freed up to be used on newly purchased PCs. This is not the case for student PCs since students will graduate and literally walk off campus with our license for Ghost and UIU.

7.2 Ghost as a Backup Solution

Symantec Ghost, a required component in facilitating the UIU implementation, is also being examined as a campus backup solution. Advantages include Ghost’s legendary robustness and reliability. The disadvantage of Ghost is that it needs to be run from DOS as an independent process. LTS worries that a backup solution that requires a reboot into DOS will be an inconvenience for our users and discourage backups. We continue to evaluate the possibilities of Ghost as a campus backup solution.

8. CONCLUSION

Universal imaging works. Implementing the UIU has resulted in significant time savings for both LTS staff and our clients. Despite the fact that the UIU is not bulletproof, it provides a significant efficiency improvement over prior practices.

Lehigh University cordially invites any interested IT professional to contact us with any questions he or she may have regarding this paper or universal imaging in general.

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10. REFERENCES