

Implementation of Fee-Based Printing in Student Computing Sites

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ABSTRACT

After years of providing no-cost printing in its computing sites, the University of Delaware (UD) decided to move to a fee-based printing scheme for its student computing sites. This paper discusses the development, testing and implementation of this system, as well as campus reaction to the prospect of paying for something for which they had not previously been charged.

In 2001, printing costs rose more than 25%. Professors post class notes, syllabi, homework and exam solutions, and even entire textbooks on their course websites. Despite the high level of computer and printer ownership among UD students, approximately two-thirds reported using sites primarily to print. Moreover, a lot of paper was being wasted. More than six million pages were printed during academic year 2002. These factors lead to the decision to implement fee-based printing.

Since all students have a flexible spending (Flex) account associated with their student ID which can be used for campus services, it was decided to charge these accounts for printing. After extensive research, we chose VendPrint printing software. The vendor was willing to customize the software to meet our needs, including developing an interface to the Blackboard Transaction System.

Initial testing began during the summer of 2002. By the beginning of fall 2002, the application was implemented in all Information Technologies (IT) student computing sites. At each of eleven sites, students claim their jobs from a central release station before it is sent to the printers. Over winter break, the Blackboard interface was implemented, requiring students to swipe their ID to release print jobs, although their "Flex" accounts were not charged. This system is currently in place and data is being gathered and analyzed on a monthly basis. So far, the process has gone smoothly with little resistance. Beginning in the fall 2003 semester, students will be charged for printing.

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1. HISTORICAL PERSPECTIVE

The IT/User Services unit runs eleven public and departmental computing sites on campus with approximately 435 systems, 310 of which are Windows-based, 75 X-Terminals and 50 Apple based systems. Printing in these sites has always been free of charge with the exception of color printing, which is not addressed in this paper. As shown in figure 1, printing had a fairly stable growth rate of 2-4% representing 4-4.5 million sheets since 1996 through the 2000-2001 school year. However in 2001-2002, we experienced a 25% increase in printing to 6.2 million sheets. This has been attributed mainly to the increase in use of electronic resources, particularly for instruction with faculty posting class notes, syllabi, homework and exam solutions, and even entire textbooks on their course websites.

Despite the high level of computer and printer ownership among UD students, in Fall 2002 approximately two-thirds reported using sites primarily to print. For a variety of reasons, students print drafts or send print jobs mistakenly or multiple times, and a large number of print jobs are printed but never picked up. While the bulk of printing is necessary, an examination of the most heavily used computing site indicated that approximately one-quarter of all pages printed end up directly in the recycling bins.

In the Spring of 2002, IT-User Services started a campaign called *PrintLess* to educate students on how to reduce the amount they print by being more cognizant of what they are printing. Suggestions included: proofreading a paper to eliminate needing to reprint because of a few typographical errors; previewing a document to ensure the format is correct; printing only one page of a ten page document or only the first page of a multi-page web site if that is all that is needed or the first page of a multi-page web site, only print that one page, and printing posted class slide-show notes six to a page. Duplex (double-sided) printing was made the default selection in all IT-User Services student computing sites and posters were displayed with slogans such as

“Cover Your Back Side” to encourage paper usage reduction. In addition, student printer purchases are being actively encouraged.

Because of the dramatic increase in printing in 2001-2002, a remedy needed to be found which would effect a reduction in total printing. Implementation of a quota system and/or fee-based system seemed the most viable solution. While on the surface the objective of a fee-based system would seem to be cost recovery, quite the contrary, the goal is print reduction. A very simple assumption was made which turns out to be true. If the user has to either account for, or better yet pay for their waste, waste will be reduced.

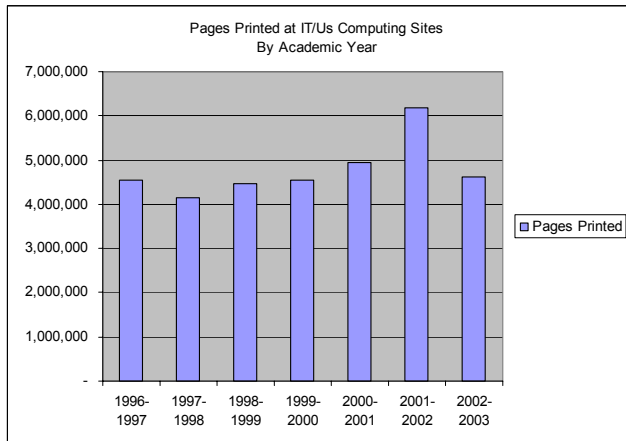


Figure 1. Pages Printed by Academic Year.

2. EVALUATION AND TESTING

In addition to educating students to help reduce printing in computing sites, an evaluation team for investigating print management software was formed. The team’s goal was to recommend a hardware or software implementation for use on campus that would control the run-away printing costs and could, in the long term, be used to charge students for printing. The committee started by creating a matrix of options desired in a print management software package and evaluating solutions from that standpoint. It became clear that the two main criteria which were most crucial would be that the solution allows users to use a generic login in our computing sites while still enabling the University to charge users for printing via the Student ID/Flex cards already in use on campus. The team then narrowed the search down to four packages and did extensive research and testing on those in the late spring/early summer of 2002. The final decision was based on cost, ability to work directly with the developer of the product and the developer’s eagerness to customize their print management solution to our needs. The clear choice was VendPrint, a package still in development.

Testing occurred in selected sites throughout the summer of 2002 and the vendor was able to make rapid changes to the product, to fix bugs. By Fall semester the product was ready for the first stage of implementation.

3. HOW VENDPRINT WORKS

The general description of the printing process is as follows. Before VendPrint was implemented, print queues were hosted on

Windows 2000 based servers in each computing site. A student sends a print job from a workstation to the queue associated with a particular printer or pool of printers, and that queue sends jobs to the desired printer for pickup by the student. VendPrint inserts a print release station and second (output) queue between the previously existing (input) queue and the printer. Security is introduced on the output queue so that only certain stations (release and/or bypass stations) or users (Administrators) can place jobs and manages that queue. The print release station is a dedicated workstation centrally located, usually near the printer(s) which allows the user to “release” a print job from the input to the output queue for printing.

The user selects their job from a list of pending jobs, is told the total cost of the job and number of pages, authorizes it, and then it is printed. Authorization can involve simply selecting and approving a job, swiping an ID/Flex card, or swiping an ID/Flex card and having their Flex account actually debited for the cost of the job. Users also have the ability to cancel unwanted or duplicate jobs. Jobs which sit in the input queue for a specified length of time (30 minutes) expire and are deleted. The software can distinguish between simplex (single sided) and duplex jobs and assign differential costs, and can limit the number of copies of a document.

The hardware requirements for the release station are fairly modest, and decommissioned computers left over from computing site upgrades were used. Queues can be hosted either on the release station or on a server so only minimal storage is required. The current systems in use are Pentium III computers with 256MB memory and 20GB of hard drive storage.

If card swiping is in use, the release station has a card reader installed which is attached through the keyboard port. The release station communicates with a centralized clearing house server that interfaces with Blackboard to deduct funds from the user’s Flex account. Multiple accounts can be used per user. In this way, a separate print account can be set up with a specified allocation of free printing funds each semester. When these funds are gone, the system will begin charging the Flex account.

4. IMPLEMENTATION

The implementation of VendPrint on campus is being done as a three-stage process. In the fall of 2002, monitoring print jobs began but users were not required to swipe IDs. VendPrint allowed IT/US to buy their product at a reduced rate and put into operation print release stations which required students to claim their print job before it actually prints. The user can determine which job is their job based on either the job title or the station they sent it from. In the initial stage, there was no user authentication and therefore no card swipe or Blackboard interface.

The second stage, implemented at the beginning of spring semester 2003, involved adding the interface to our Flex card system, which is run on Blackboard. Any student, faculty or staff member who has a valid University of Delaware ID has a FLEX flexible spending account. FLEX is a declining balance account that can be used in place of cash all around campus for food, to do laundry, make purchases at the bookstore and now to print in IT-User Services computing sites. In this second stage, the user is required to swipe their University ID in order to release a print job at a VendPrint print release station. Via contact with the

Blackboard interface, VendPrint determines if the ID is a valid University ID, and, if so, releases the job for printing. Users are not being charged for their print jobs during this stage. Instead, a “virtual” print account that has been assigned to every FLEX account is being debited. This has allowed us to test the Blackboard interface, assess its performance, evaluate how it handled offline transactions, gather statistics on usage, determine what types of jobs are being printed and make educated decisions on how to implement the final charging stage.

In stage three, slated for implementation fall semester 2003, charging will be activated. Every student will be given an initial balance in their print account that will in essence give them free printing equal to a predetermined dollar amount. If they choose to print duplex instead of simplex, the student will get more sides of printing free as duplex will be charged at a lesser rate per side than simplex. Currently under consideration is a charge of five cents per simplex page and four cents for each side of a duplex page. Once the user has used up their free allotment, they will be charged for printing in sites by drawing on funds in their FLEX account when they swipe their ID card at a print release station. If the Blackboard system is offline, the student’s print jobs will be processed, VendPrint will hold on to the transaction until Blackboard comes online again and then the student’s account will be debited accordingly. Other departments on campus have expressed interest in using print release stations in their sites. To date, only two have actually done so. However, with the advent of charging, we anticipate more departments will come on board since students wishing to escape being charged for output may migrate to sites which have not implemented charging.

5. DATA ANALYSIS AND IMPLICATIONS

In addition to interfacing with the Blackboard system, VendPrint generates a log file which can be kept either locally or on a server. This file contains a variety of information on both printed and cancelled/time-out jobs including time and date, number of pages, document name, and total cost of each job in a comma-delimited format. With some assistance from the vendor and a bit of programming, the data can be imported into Microsoft Access for analysis. A variety of reports were generated including number of pages per job, simplex vs. duplex etc. Some interesting information was brought to light from the Spring 2003 data:

- A. 1.7 million pages were printed on 1.25 million sheets of paper. This equates to an annualized paper usage of just under 3 million sheets.
- B. Most (62%) of all pages were printed duplex
- C. Just over half (51%) of all print jobs submitted were cancelled or timed out. Of these the vast majority timed out.
- D. Almost all (95%) of all print jobs were single copies.

- E. 28% of all jobs were single pages with 70% of all jobs being 5 pages or less. This accounted for only 5% and 28% of all output. This means that 72% of all printing is on documents of more than 6 pages
- F. Pages printed were comprised of 47% web documents, 31% Microsoft Word and 10% Microsoft PowerPoint.

It is apparent that there has been a dramatic reduction in the number of pages printed over 2001-2002 levels and we feel this can be attributed mainly to the implementation of VendPrint. Waste has been noticeably reduced. In the past, all jobs were printed when they were sent to the queue. The fact that over half of all print jobs were not printed, and of these 95% simply timed out would lead one to believe these savings account for the bulk of the printing reduction.

Historically, approximately 36% of annual printing occurred in the fall semester and 43% in the spring semester. This year those numbers look to be reversed, mainly due to the reduction in printing which occurred once VendPrint was implemented with card swiping, and without charging. Assuming levels of printing consistent with summers past, printing will be down 25% back to 2000-2001 levels.

6. STUDENT REACTION

Initial student reaction to the prospect of being charged for printing was decidedly negative, though in actual fact the implementation went very smoothly. After the first week or so of the fall and spring semesters, students became acclimated to the print release stations and went about their business. Students were used to using their flex cards for paying for all sorts of campus purchases, so this was not an issue. The only problem area was that many graduate students and faculty did not have cards handy and were not used to using them. This problem, however, was easily addressed. It remains to be seen how students will react once their accounts are actually debited for printing.

7. CONCLUSIONS

The implementation of the VendPrint system, even without charging students, has resulted in a dramatic decrease in printing output. It is apparent from the number of submitted versus printed jobs that a large portion of this reduction is obtained by reducing waste in the form of unclaimed or duplicate jobs. Another interesting fact is that pages printed prior to Spring 2002 were almost exclusively single-sided. This means that paper usage is actually down 33% below 1999-2001 levels. There have been occasional glitches in the Blackboard system interface, however by and large, the operation has been trouble free.