ITPP Solution Development – Printing Service

**Template Inputs:** High Level Requirements, NewSOFT, & Use Cases

# Solution Overview

## Solution Description

Describe the general purpose, overall usage, or goal to accomplish with this solution.

### General Purpose

The University of Illinois at Urbana-Champaign IT Power Plant Printing Service is a campus-wide effort to provide a consistent and reliable printing experience for identified user groups. The printing experience for all students at the Urbana-Champaign campus should be improved to increase user satisfaction and functionality, and reduce overall cost in the service. The printing service will increase availability, reduce complexity, and simplify pricing and support.

### Goal

The primary goal of the IT Power Plant Printing service is to provide users and groups the ability to easily and reliably produce print (and copy) jobs submitted through a variety of inputs, managed through a few processes, and completed via several possible methods. This new service will ensure that users will have the ability to print from most devices to any supported printer. Included with this service is the ability to send a print job from a device, walk to an affiliated printer elsewhere on campus, and release/receive the print. The focus for this solution is commodity printing (8.5”x11”, monochrome/color laser, simplex/ duplex) for graduate and undergraduate students at the Urbana-Champaign campus.

## Target Group for Solution

Identify the customers, users, and stakeholders that will be impacted by this solution, and how they will be impacted.

### Target groups

The Printing Solution Development team considers graduate and undergraduate students in the Urbana-Champaign campus as primary users of the recommended solution. Colleges, units and departments providing services for student printing are stakeholders consulted in the development of the solution and partners in the proposed solution. Printing service managers are IT professionals and business office staff responsible for system operation and integration with campus identity and financial systems. Printing service owners include the proposed printing service steering team as well as IT Power Plan coordination team.

### Impact on identified groups

* + Students
		- Printing services will be available to students where they live, work, and learn.
		- Student experience and satisfaction will be improved by printing services that are widely available, supported, consistent, usable, and reliable.
	+ Colleges, units, and departments
		- Stakeholders will achieve improvements in student experience and satisfaction by adopting the printing services solution
		- Additionally, stakeholders will have capacity to control costs, protect revenue (if any), and receive printing system support/training
	+ Printing service managers
		- Printing service managers will develop, implement and maintain printing services that offers improvements in flexibility, compatibility, manageability, and supportability.
	+ Printing service owners
		- * Increased efficiencies in printing service delivery
			* Improvements in service cost effectiveness
			* Improved user experience and satisfaction

# Existing Solutions & Use Case Gap Analysis

Identify and describe existing related solutions and the unit that is responsible for those solutions. Identify the gaps between existing solutions and the use cases identified that are related to this solution. Document any new Use Cases discovered during this review.

## Gaps for All Existing Solutions

Currently, the Urbana-Champaign campus offers at least 5 disparate printing solutions for students, including deployments in the College of Engineering, Technology Services, College of Business, University Library, and a shared print service. Existing printing solutions have evolved to meet user needs in the college, unit, or department over time, and several of the solutions successfully manage thousands of users and several million printed pages per year. Despite the relative success of individual printing system deployments, all solutions share a common shortfall- students currently lack a simple, reliable and (most importantly) cohesive printing solution spanning across campus. Current printing systems divergence in printing pricing, quota management, process, and support culminate in a confusing and often disappointing user experience for students on campus.

## Existing Solution A: College of Engineering

### Summary of service/solution

The College of Engineering currently provides student printing of 8.5 x 11 in both color and black and white. Students receive a quota of black and white pages based on their status: Freshmen and sophomores get 300 pages, juniors get 400 pages, and seniors and graduate students get 500 pages. Duplexed pages are only charged as a single page. Each color page is charged as 4 black and white pages. These quotas are treated as a declining balance and once a student’s balance reaches zero they must purchase additional pages. Students can purchase additional pages in 100 page increments for $8.00. Recovery costs for the initial quotas are taken from the Engineering Student Fee. Printing is currently tracked with Print Manager Plus.

### Use Cases

Undergraduate and graduate student printing.

### Scope of current usage

Black and white student printing is offered in ~20 EWS labs with color printing available in 4 EWS labs.

### Current limitations and identified gaps

Engineering students can only use their Engineering print quota in EWS labs. They cannot carry this balance to other areas of campus.

## Existing Solution B: Technology Services; Tech Services + Housing

### Summary of service/solution

Technology Services Printing is a multiple department, PaperCut based solution that uses the Technology Services Business Office for billing/charging and the Help Desk for Tier 1 support. It integrates with the UOFI Active Directory and uses Shibboleth for authentication to the PaperCut user portal. A separate web application was built to simplify some of the administration of PaperCut, exporting of logs, and a web based release system that accept authentication from different sources.

Departments using this solution generally own their own printers and purchase consumables. Technology Services can provide the print server component through Novel iPrint, a print server solution that provides common Windows, OS X, and Linux management of drivers, profiles, authentication, and authorization. The department can also choose to manage their own print server.

### Use Cases

* + - Standard printing for students, staff, and faculty
		- Guest printing restricted to specific locations
		- Billed or tracking only
		- CFOP charging, using Shared Accounts
		- User credits restricted to specific departments, using individual Shared Accounts
		- Web print provided by PaperCut
		- Discount rates for users, specified by AD group
		- AirPrint
		- Local OS X and Windows queues on BYOD
		- Multiple department billing handled centrally
		- Refund processing handled centrally
		- Heartland integration (launching Spring 2016)

### Scope of current usage

Housing has approximately 20 locations with 35 printers using Papercut. ICS supports 6 central labs on campus, along with services for Uni High, McKinley (1 printer), Education, Labor and Employment Relations, and the Bruce Nesbit African American Cultural House. ICS also has a poster printer that bills through PaperCut. These locations provide 8.5”x11” B&W and color printing.

* + - * Billing
				+ ICS student employees get $80/semester, Housing student employees $50/semester for printing.
				+ Some ICS and Housing full time staff receive free printing on their printers.
				+ Other students, staff, and faculty are charged through Banner.
			* Infrastructure
				+ All workstations are supported with iPrint on OS X and Windows. iOS and Web Print are also offered.
				+ Domain joined workstations print to unauthenticated queues; remote users print to authenticated queues.
				+ Printer pooling is used at high volume locations.
				+ Custom release station software that provides a queue list on a web page where users can select their jobs and authenticate.

### Current limitations and identified gaps

PaperCut Web Print has scaling limitations with rendering large file-size documents. Limited finishing options (lack of size, duplex, manual feed, etc.) when using web print.

## Existing Solution C: College of Business

### Summary of service/solution

The college of Business uses [Wepa](http://www.wepanow.com) print kiosks to provide 8.5X11 printing of B/W and color – single sided or duplex printing. Students can print via USB, email, Cloud Drives (Google Drive, iCloud, Box, MS One Drive, Dropbox), mobile apps, standard print drivers or web upload. Print jobs go to the external cloud. A student can then go to any Wepa kiosk, swipe their card, select what they want to print and the jobs will print out immediately and funds with deduct from their payment choice. Wepa supplies the kiosks, paper and supplies free of charge and mails them to us. College of Business IT staff receive an email when supplies are low and complete the needed changes. Students pay .09 for B/W, .17 for B/W duplex, .20 for color and .38 for color duplex. The kiosk needs a network connection and has been customized with University branding.

### Use Cases

All undergraduate and graduate student printing (8.5”x11” format)

### Scope of current usage

Currently 2 kiosks are supported in the Business Instructional Facility

### Current limitations and identified gaps

Business students can only use their print quota in Business Wepa Kiosk locations. They cannot carry this balance to other areas of campus.

## Existing Solution D: University Library

### Summary of service/solution

Library Printing is a PaperCut based solution that leverages existing campus financial processes for billing/charging and Library IT staff for Tier 1 support. It integrates with the UOFI Active Directory and uses Shibboleth for authentication to the PaperCut user portal. All Library Units use this solution and have printers purchased by Library IT. All service and support comes from Library IT.

### Use Cases

* + - Standard printing for undergraduate and graduate
		- Guest printing restricted to specific locations
		- Billed or tracking only
		- CFOP charging, using Shared Accounts
		- User credits restricted to specific departments, using individual Shared Accounts
		- Web print provided by PaperCut
		- Local OS X and Windows queues on web print only
		- Papercut does have the ability to provide printing for mobile and BYOD, iOS printing, email to print, and Google / Cloud printing. Papercut also provides the ability to track and bill Scanning and Copying on papercut controlled MFP printers. These features are available via Papercut MFP license but not yet enabled.

### Scope of current usage

The Library has approximately 30 locations with 47 printers using Papercut. One location, the Undergraduate Library, has large format (11x17 color) printing and the ability for patrons to use a pay cash printer.

### Current limitations and identified gaps

PaperCut Web Print has scaling limitations with rendering large file-size documents. Limited finishing options (lack of size, duplex, manual feed, etc.) when using web print.

## Existing Solution E: Shared services printing (LAS/FAA/ACES/Media)

### Summary of service/solution

The PaperCut Shared Service is a collaborative service involving several units on the UIUC campus. Units that have adopted the service are ACES ACF, FAA, LAS, and Media. Library and Tech Services at Illinois also participated in discussions around the service. ATLAS provides the infrastructure for the test and production PaperCut Primary Servers and external databases. The PaperCut Primary Server applications are run by Site Admins from various units. ATLAS also provides billing tools for charging students. Representatives from each unit participate in a multi-tiered shared governance/operations system. Unit Admins and other persons from the participating units administer the remainder of the printing service for their units, including:

* + - * purchase and maintain their own printers and consumables;
			* administer their own printers, print queues, and print servers (PaperCut Secondary Servers);
			* configure their printers in PaperCut;
			* set prices to support their printers, consumables, and business models;
			* transact refunds for their users;
			* execute monthly student billing procedures;
			* (if applicable) manage their own additional, non-billing personal accounts;
			* create and manage their own shared accounts;
			* provide additional user support for their printers and users

### Use Cases

* + - Lab printing and office printing
			* office printing tends to be fairly basic but does also include some higher-quality, large-format color printing (e.g., Xerox Phaser models) and MFPs
			* lab printing ranges from basic to more exotic – e.g., high-end solid ink color printers, plotters, large photo printers, jobs sent through EFI Fiery XF servers
		- MFP usage includes:
			* office: scan to email, scan to server (rare), scan to computer (rare, bypassing print server), copying (sometimes tracked by things like Xerox Standard Accounting), some fax
			* lab: scan to email, copying (one device charges via PaperCut)
		- Multiple personal accounts:
			* billing personal account used for charges students via Banner
			* non-billing/departmental personal accounts that can involve real money (prepaid or pay later, via CFOP, check, etc.) or gifted money/quotas (i.e., absorbed by the unit)
		- Shared accounts that generally involve real money (prepaid or pay later)
		- Some charging, some quotas, some just tracking, some combinations - examples (incomplete, but fairly representative):
			* faculty/staff print for free (but are tracked); students are charged but receive $X of free prints per month
			* students are billed, guests automatically charge to shared accounts (sometimes bypassing hold/release)
			* staff print for free (but are tracked) or charge to shared accounts, faculty charge to shared accounts or a departmental non-billing personal account, students charge to billing personal account
			* lab managers print for free, lab assistants get $10/week free, students charge to shared accounts or billing personal account, faculty/staff charge to departmental non-billing personal account or shared accounts
			* tracking only for everyone
			* some printers are simply ignored in PaperCut (but they exist on a print-queue server aka PaperCut Secondary Server)
		- Charging is not always just per page:
			* charging based on page size
			* discounts for grayscale
			* discounts for duplex
			* charging based on area (linear foot and square foot)
		- Refunds - each unit transacts refunds for their own printers, deciding when refunds are valid or not - we're currently not using the "refund request" feature built into PaperCut but the service has the ability to allow/hide this feature per print server (via some a web code override provided by PaperCut Support)
		- Hold/release is usually set for all printers that limit or charge - release stations and/or web release
		- Much of the staff printing comes from computers without the PaperCut Client
		- Printing from Windows SMB, Mac SMB, and Mac LPD (username = AD account name, not using "unauthenticated printer" settings in general)
		- Some load balancing via virtual queues
		- Group restrictions and other filters (spool size, page number, etc.)
		- Printer scripting, including limiting usage of foreign shared accounts and personal accounts, custom charging behavior per group/user, restrict printing during certain hours
		- PaperCut Client used in some cases but not all
		- No user-level configuration changes outside of "standard account selection", except for departmental-owned non-person users

### Scope of current usage

* Currently, four colleges participate in the PaperCut Shared Service: ACES, FAA, LAS, and Media.
* PaperCut shows over 400 printers/MFPs, although not all print queues are being watched by PaperCut and not all printers have print queues (some are networked and being accessed directly, others are not networked). Most lab/student printers are in PaperCut but there are also lots of faculty/staff printers (particular from LAS, also FAA).
* More than 2 million pages were printed according to PaperCut, although those pages vary from 8.5X11 to huge plots. This statistic is incomplete from the perspective of LAS as they only joined the service over the summer.
* There were $236,473.28 of charges on printers in PaperCut in the past year. Most of that is probably real money, but a small portion would reflect quota money or other free credit.
* About 12.5% of the printing tracked was in color.
* Plots and large photo prints are particular important in FAA: this includes 32,841 jobs, which represents 8.3% of all pages printed in FAA labs and, more significantly, 2/3 of the charges for printing in FAA labs.

### Current limitations and identified gaps

* + - Web printing – cannot fully implement because PaperCut is limited to one Web Print Server
		- Cannot prevent admin from Unit X from transacting a refund for printing done on printers owned by Unit Y - don't think it's been a problem, but... [may be able to do this with code overrides similar to what we've done with the "refund request" button]
		- Cannot refund print jobs charged to the student billing account more than 10 days after printing (can provide credit to an alternate account or post a reversal in Banner) - essentially, after student printing charges have been billed to Banner, our system cannot touch them
		- Students can charge to their billing account in any college BUT there is no to support money flowing from one unit to another if foreign non-billing personal accounts / shared accounts are used on a printer (e.g., a Media shared account used in FAA)
		- Can restrict which personal accounts and shared account are usable when printing but not when scanning/copying
		- Cannot allow admins to release jobs for other users because they would be able to do it for all users / all printers
		- Application-level clustering - possible but not yet implemented
		- No built-in reports that break out charges by each personal account (ATLAS had to design an external report)
		- Not enough staff time devoted to central administration
		- Cannot restrict administration of select personal accounts to the department that owns them (or to application and billing processes only in the case of the billing personal account)
		- Support for non-AD users - discussed but not explored in detail
		- Automatically bill a CFOP (e.g., attached to a shared account)

# Non-Functional Requirements

## Technical Requirements

Describe the technical requirement expectations such as capacity, scalability, availability, reliability, performance, network, data management (data types, databases, data classification, etc.), capacity, reuse, recovery, system, hardware, portability, standards…

### Capacity

* Campus units print 15 to 20 million pages per year in student printing, and a significant amount of staff and faculty printing. The printing solution must have the capacity to store jobs as they’re being processed, a detailed history of jobs, and track accounting details between users and departments.

### Scalability

* The printing solution should be able to quickly and easily add printers to new locations, adjust the number of printers based on relevant statistics, and provide suitably sized printers based on location and usage. Additionally, the printing solution should accommodate evolving campus strategies and mechanisms for billing and charging.

### Availability

* Campus members print and access the system from a wide variety of locations. The solution must be available anywhere people live, work, and learn.
	+ University Housing: printing must be available from computer lab and study locations.
	+ Off-Campus Living: campus members should be able to print from their off-campus location and collect their document when they come to campus.
	+ Departments/classrooms
	+ Study Locations: students must have access to printing from the many campus computers labs and study lounges.
* The printing solution must support the most commonly used platforms, including:
	+ Bring your own device (BYOD)
	+ Web and cloud
	+ Print system clients
	+ Multifunction devices (scan)

### Reliability

* The printing solution must be highly available at all layers. Components should be made fault tolerant or configured to be fault resilient.
	+ Database: an enterprise database system in a hot standby configuration.
	+ Application: hot standby configuration with fault resilient behavior if the application or database is unavailable.
	+ Workstations/Kiosks: locations across campus available to all users, using a common system.
	+ Printing hardware: in high traffic areas, redundant hardware pooled together to service jobs. In less trafficked areas, users should have the option to print to a nearby printer instead. Consumables are supplied based on the tier selected and will be replaced at the unit level.
	+ Solution Support: timely questions and issue resolution from the vendor, and from the central team to local department contacts. When provided by the solution, timely monitoring and replacement of device consumables and maintenance.
	+ Customer Support: responsive answers to questions and issues, and providing self-help documentation for the solution from either the Customer Support Help Desk or the Distributed IT.

### Performance

* Due to the physical nature of printing, there is sometimes considerable time spent printing the job. The printing solution software should not add any significant overhead in processing time. From the time the user hits “Print” to when it appears on a release station should be measured in seconds. When jobs are released they should spool an available printer immediately, or if no printers are available then placed in a queue immediately.
* Locations that receive a high volume of pages should receive faster printers. Locations that receive a large number of big jobs should receive printers with more memory.

### Network

* Printers on the campus network must be firewalled from external connections. Only ports essential to the service should be allowed through the firewall. All mobile client solutions must work without Bonjour/Zeroconf/multicast DNS.
* Access to the printing system should be available through wired and wireless campus networks.
* Off campus networks, though not able to directly access printers, should have access to the print system via ports: 80, 443, 8080 & 8443

### Data Management

* A printing solution handles data in the areas of user authentication/authorization, job processing, job tracking, and job billing.
	+ Banner Accounts: importing CFOPs with associated group permissions for the advanced billing of accounts.
	+ Authentication/Authorization: Users and groups must synchronize from the UOFI Active Directory. Authorization of jobs must allow for the use of existing Active Directory groups.
	+ Job Processing: Complete information about a job includes a rendered document and metadata, and might include the original document itself. The solution can choose to keep the rendered and original documents during processing.
	+ Job Tracking: Metadata about the job and how it was processed must be retained for a minimum of 3 years.
	+ Job Billing: Data about how the job was charged and how it moved through the billing system should be retained for 3 years.

### Reuse

* Many units on campus have a considerable investment in printing hardware and consumables. Where possible, the printing solution should make use of this investment.
* Several campus units have invested in PaperCut licenses. Reuse and consolidation of these licenses is desirable.
* Develop a suggested list of pre-vetted and preferred hardware, consumables, etc. available for units and departments to choose from.

### System

* The printing solution must support the most commonly used operating systems on campus which are still supported by their vendors.
	+ Windows
	+ OS X
	+ iOS
	+ Android
	+ Linux
* The printing solution must work with existing end point management systems on campus for the deployment of printers: IBM Endpoint Management (IEM/BigFix); Microsoft System Center Configuration Manager (SCCM); and Munki.
* Where the printing solution interacts with print servers, it must support Windows Server 2008 and 2012, OS X, and Novell iPrint.

### Hardware

* The database layer should leverage existing database infrastructure
* The application layer should be able to run on virtualized hardware.
* The university has a large variety of printer hardware. The printing solution must work with at least the top four manufacturers: Hewlett-Packard; Dell; Xerox; and Lexmark. All of these manufacturers provide Postscript and PCL drivers.
* It should also integrate with devices that support “off-the-glass” copying/printing. Embedded software that provides alternate billing and tracking is a desirable feature.

### Standards

* Protocols for clients to submit jobs to the solution:
	+ SMB
	+ IPP
	+ LPR
	+ AirPrint
	+ Google CloudPrint
* Common document formats that the solution must minimally support, but is not limited to:
	+ Microsoft Office (Word, PowerPoint, Excel)
	+ PDF
	+ JPEG
	+ TIFF
	+ PNG
	+ BMP
	+ GIF

### Portability

* Other user groups on the Urbana campus, including faculty, staff and researchers, should be easily integrated to the printing system in subsequent phases (2-4).
* The printing service at the Urbana Campus should have capacity to port to the other University of Illinois campuses, including Chicago and Springfield.

### Recovery

* Backup
	+ The printing system will be backed up according to with industry standards and align with Urbana campus production services backup policy
* Disaster Recovery & Business Continuity
	+ The printing system will align with Urbana campus best practices for disaster recovery and business continuity for production systems

## Legal Requirements

RFP, FERPA, HIPAA, Audit

* FERPA data: system must comply with campus FERPA related data management requirements
* HIPAA data: printing system should comply with campus HIPPA data requirements
* If using a cloud based printing solution: the user must be notified in some manner that cloud servers might be located outside the United States.
* All printing-related functions must strive to meet accessibility guidelines
* All printing services should use SSL to encrypt student data
* Must comply with the University Web Privacy Notice: <http://www.vpaa.uillinois.edu/policies/web_privacy.cfm>
* Audit Compliance— service must comply with university and campus audit offices efforts to evaluate the effectiveness of risk management, internal control, and governance processes.
* Information about printing should be limited to users and those that need access to operate the service.

## Accessibility Requirements

Reference to “Minimum Functional Accessibility Requirements for Software Candidates” (Attached)

An Accessibility Checklist and Accessibility Requirements help is available from Technology Services (Keith Hays - khays@illinois.edu )

* All printing service software must comply with accessibility requirements as described in the document titled “Minimum Functional Accessibility Requirements for Software Candidates” published by Keith Hays (khays@illinois.edu) from Technology Services.
* The solution must provide the University with the functionality and tools to meet the specifications outlined in the WCAG 2.0, lever A and AA.

## Usability Requirements

* A single user interface for students: review print history, check (and possibly add to) account balances, etc.
* Unified user experience for printing to the student printers across campus.
	+ The service must design and implement a unified UIPrint system brand and marketing strategy
* Ability to print from university owned machines as well as bring your own device (BYOD).

## Security Requirements

FERPA, HIPAA, Social Security Numbers, Privacy

Security Requirements help is available from Technology Services (Chuck Geigner - geigner@illinois.edu )

* FERPA data: system must comply with campus FERPA related data management requirements
* HIPAA data: printing system should comply with campus HIPPA data requirements
* If using a cloud based printing solution: the user must be notified in some manner that cloud servers might be located outside the United States.
* All printing services should use SSL to encrypt student data
* Must comply with the University Web Privacy Notice: <http://www.vpaa.uillinois.edu/policies/web_privacy.cfm>

## Financial Requirements

* Requirements for billing/charging system(s) used
	+ The system must interface with existing financial, billing, and charging processes and systems, including Banner and Heartland
	+ The system must be able to accommodate declining balances, direct charging, and quota management (individual users and department level).
	+ The system must be able to generate usage reports.
* Cost Recovery
	+ The system must provide the capacity for participating units to efficiently recover costs incurred, including bulk and per page recovery
* Funds management (expenses, revenues, reconciliation)
	+ The system must interface directly or indirectly with University funds management processes, as specified by OBFS
	+ The process will require rate establishment and updating, reconciliations and distributions, refund processing and other administrative tasks that will require FTE’s.
* Compliance (business processes)
	+ The system must comply with campus business practices in regards to student accounts, accounting, cashiering (anything covered by OBFS).

## Other Non-Functional Requirements

Administrative management, communication, quality

### Administration

* The printing service will:
	+ Provide notification of supply level, trouble issues, and maintenance
	+ Provide process for ordering supplies, distribution of supplies, and installation of supplies and maintenance items.
	+ Establish procurement process and property accounting process based on tier level of service
	+ Develop appropriate troubleshooting protocol for helpdesk
	+ Establish reporting procedures – ad hoc and periodical for system, cost, and lifecycle management.

### Communication

* The solution must provide a customer focused website that integrates with the campus knowledgebase and help desk solution. Features of the website: mobile friendly; printer location and availability map; links to additional services; updates and service changes.
* Service documentation will be hosted on the campus knowledge base solution (answers.uillinois.edu).
* The service will provide website, Help Desk number to call, and unique identifier labeled on all endpoint devices

### Quality

* Procurement and output should be suitable for academic and professional use.
* The solution should build and implement a Dual Service Level Agreement (SLA):
	+ Definition:
		- Requirements for the printing service managers to the stakeholders, Distributed IT and users.
		- Requirements for the distributed IT to the printing service users
	+ Components:
		- Uptime
		- Central and local resolution of issues
		- Central and local supply
		- Contact availability

# Recommended Solution

The recommended solution could include modifications to an existing solution, a solution that is under development, or a new solution not yet created. More than one proposed solution for a set of Use Cases is acceptable, but should be documented in separate templates. “Cloud first” should be part of the consideration of the solution review. An outsourced solution should be one of the solutions considered and documented.

## Overview of Solution

Provide a brief solution narrative describing the recommended solution. What was compelling about this recommended solution? What are the tradeoffs of choosing this solution over alternative solutions?

### Summary

The printing solution development team collected and analyzed information from a variety of sources while investigating possible printing solutions, including:

* Information gathered on existing student print systems implemented on the Urbana-Champaign campus
* Input solicited from users (students) via survey linked from several campus websites, and received 300 responses in approximately one week
* Feedback collected via survey from IT professionals across colleges, units and departments offering printing services to graduate and undergraduate student and solicited
* External environmental scan, including contact with several peer institutions, CIC, and review of Educause CIO mailing list resources
* Information gathered from meetings with several University of Illinois groups, including UI Procurement Services and the Illini Union Document Services

After analysis of use cases, user needs, and existing printing solutions on campus, the solution development team recommends a single printing solution with several components. This solution is designed to reduce service duplication, improve user experience, streamline administration, and ultimately reduce costs. Key components include common branding, pricing, billing/charging processes, user/group identity management, print queue and quota management, reporting, documentation, and user support. The service will leverage two printing solutions currently implemented on the Urbana-Champaign campus- PaperCut and Wepa. Users will be able to submit print and copy jobs through a variety of methods, and jobs can be released and collected at any branded location across campus, including labs, print release stations, and kiosks. The solution will use existing billing mechanisms as well as the recently implemented declining balance mechanism via Heartland.

The user experience begins when a graduate or undergraduate student decides to print to the UIPrint system. First, the user decides if their print job will be standard (8.5”x11”, color or monochrome laser), or alternative format. Assuming this job will be a standard format Microsoft Word Document, the user then leverages one of several inputs (web, print system client, mobile device) to select the appropriate virtual print queue. Details of the queue are to be refined by the implementation team, but current queue options include UIPrint Kiosk, UIPrint Black&White, and UIPrint Color. Note: additional virtual queues can be added as needed, including UIPrint LargeFormat, UIPrint Poster, etc. The user submits the print job to the virtual queue and proceeds to a UIPrint location compatible with the queue selected. For example, if UIPrint Kiosk is selected, the user can proceed to any campus UIPrint branded print kiosk station to release and receive the print job. If the UIPrint Black&White or UIPrint Color queues are selected, the user proceeds to any campus UIPrint branded PaperCut release station. In both kiosk and print release station experiences, the user is asked to confirm the job and approve associated costs before completing the print process. Once accepted, the user account is either debited (via iCard/Heartland) or billed and the document prints. Users will have a website to review printing activity, contact support, review how-to’s and other documentation, request refunds, and find UIPrint locations.

Participating colleges, units, and departments can select from one of two tiers of service when opting to participate in the printing solution. Tier 1 (light) offers the capacity for stakeholders to leverage common print system components while managing print hardware acquisition, placement, and maintenance. Tier 1 service provides cost recovery capacity for pages printed to unit owned equipment (less a service fee TBD). Selecting tier 2 (full) extends the printing service to include service-provided hardware, placement, and maintenance. Tier 2 is offered at no charge to participating units, but cost recovery is not available. For both service tiers, the unit is responsible for replacing commodity supplies, including paper, toner, and basic maintenance kits.

In many ways, the recommended solution is the first step to making qualified decisions after establishing a better understanding of the printing footprint on the Urbana-Champaign Campus. Once implemented, the solution will enable printing service managers, IT professionals, and business office staff to identify and report on printing locations, equipment, costs, revenue, and system usage (pages, jobs, etc). Additionally, stakeholder selection of tier of service will provide guidance for future resource allocation. For example, if stakeholder uptake for tier 1 service is high, more resources may be directed towards further developing the PaperCut component of the solution. Alternatively, stakeholder selection may focus on tier 2 kiosks, which in turn help reassess hardware and support decisions.

Many application, infrastructure, and support components of the recommended solution can be re-used for use with subsequent phases, including staff and instructional faculty printing as well as guest/non-affiliated user printing. As phases are implemented, the campus will benefit from a more developed understanding of its printing profile, and can use this information as direction when considering scope and scale of an RFI/RFP for printing support on the Urbana-Champaign campus and possibly the Chicago and Springfield campuses as well.

### Future state

* + - Solution Components
			* Print from: BYOD, web, print system clients
			* Print to: computer labs, print release stations, kiosks
			* Functions: 8.5x11”, laser, color/monochrome, simplex or duplex
			* Experience:
				+ Financial: continuity in experience related to cost and billing/charging methods
				+ Appearance: single brand that students can identify as their printing system
				+ Support: centralized and convenient services for questions, documentation, and troubleshooting
* Use cases
	+ Computer lab
	+ Print release station
	+ Kiosk
* Core technologies
	+ Print management solutions:
		- [PaperCut MF](http://www.papercut.com/products/mf/)
		- [WEPA](https://www.wepanow.com/)
* Considerations
	+ Printing is a mature product and these solutions focus on delivering better user experiences and efficiencies.
	+ Papercut and WEPA already have successful implementations on the Urbana-Champaign campus.
* Opportunities
	+ Additional phases
		- Unaffiliated and guest printing should be possible through the use of Wepa Kiosk printing, which should serve public located needs well.
		- Development of solution for instructional faculty and staff based on the proposed solution should be possible with minimal additional funding and personnel.
	+ Efficiencies
		- Achieve economies of scale as more units sign on to use the system. Maintenance, consumables and purchasing improvements should be possible through economies of scale as the service matures.
		- Inventory opportunities will exist to allow University administration to view costs of printing in hardware, consumables, software and FTE across campus to redesign global printing cost structures as needed.
	+ Design learning initiative support
		- As edge cases in printing (3D, posters, CNC, etc.) move into main stream mature printing for students, the infrastructure of the shared printing service will provide opportunities to support student printing needs in an agile manner.
	+ Partnerships
		- Through the course of meeting with University groups, an intriguing opportunity arose to partner with Document Services in opening a student-focused printing retail space in the Illini Union. This space will give students the opportunity to print 3D, large and other alternatively formatted documents while leveraging printing service common components.

### Printing service high level goals

* + - User groups identified:
			* Students – graduate and undergraduate
			* Staff and instruction faculty
			* Researchers and research faculty
			* Unaffiliated users – public, community, guests
		- Phases:
			1. Design and build printing solution to improve quality of experience and service provided to undergraduate and graduate students **(primary focus of this document)**
			2. Design and implement improvements to staff and instruction faculty printing, borrowing relevant infrastructure and processes from student printing solution
			3. Leverage printing solution components to (at least in part) accommodate use cases for unaffiliated users and possibly researchers
			4. Investigate improvements to printing-related procurement processes for the University of Illinois
		- Timing
			* Student printing solution: Fall 2016 launch
			* Staff and instruction faculty printing: TBD
				+ investigate feasibility and implementation following the student printing solution rollout
			* Unaffiliated user/guest printing: TBD
				+ investigate feasibility and implementation following the student printing solution rollout
			* Researcher and research faculty printing: TBD
			* Procurement improvements: TBD

### Practical needs

* + - Users : undergraduate and graduate students on the UIUC campus
			* Core components requested by students for their printing experience:
				+ Available
				+ Supported
				+ Consistent
				+ Usable
				+ Reliable
		- Stakeholders: colleges, units and departments offering printing services to users
			* Core components of stakeholder printing experience:
				+ Similar to users: usable, available, consistent, reliable, supported
				+ Also: control costs, protect revenue (if any), provide training

### Top level needs

* + - Printing service managers
			* Flexible
			* Robust
			* Compatible
			* Manageable
			* Supported
		- Printing service owners
			* Efficient
				+ Reduce duplication
				+ Achieve economies of scale
			* Cost effective
				+ (mostly or completely) self- supporting system
				+ System optimized to accommodate equipment selection and placement based on use
			* Delights customers
				+ Responsive to user needs
				+ Reduce confusion
				+ Appropriately addresses user concerns

### Tiers of Service

* **Summary**

Colleges, units and departments adopting the printing service will be able to choose between two tiers of service. Tier 1 (light) offers units with large deployments the opportunity to take advantage of common print service components (branding, pricing, billing/charging processes, user/group identity management, print queue and quota management, reporting, documentation, and user support) while providing capability to acquire, deploy and maintain printing hardware. Tier 1 provides cost recovery capacity for the unit. Tier 2 (full) extends service support beyond common printing service components and offers hardware acquisition, placement, and maintenance. Tier 2 service does not offer cost recovery capacity, but enables units the ability to opt into the printing service without incurring significant one time or recurring costs. Both Tiers of service offer an identical, reliable, and consistent printing experience to students.

* + - **Tier 1: light**
			* Local colleges, units and departments use the service for tier I problem resolution, documentation, refunds and billing, branding, backend application support and analytics, cost recovery, PaperCut users and groups, best practices for drivers and device recommendations, and quota management.
			* Cost Recovery: Tier I adopters recover all revenue generated from their printer less the administrative service fee (to be determined by the implementation team and proportional to costs)
		- **Tier 2: full**
			* Tier I functions plus hardware (maintenance, procurement, and lifecycle management), consumables (procurement, storage/delivery, and installation/replacement), level 2 problem resolution, and printer and print queue management.
			* Cost Recovery: Tier II adopters do not incur costs for the service (for service approved hardware and locations) and receive no revenue in return.
			* Printing service managers coordinate with Tier II adopters to optimize printer selection and location (applies to existing and new equipment and locations)
		- **NOTE:** for additional information and details related to services, please see **Tiers of Service spreadsheet** located in ***Appendix A -- References***

## High Level Diagram

Provide a high-level model or diagram of the recommended solution.

* **NOTE:** please see high level printing services diagram located in ***Appendix A – References***

## Technology

Identify all hardware, infrastructure, or software technologies required for the solution. Describe the probable platform or general architecture of the recommended solution.

### Summary

The recommended print solution requires connections to billing/charging and identity management functions on campus. Additionally, the solution requires endpoint protection and inventory software for printing hardware. The recommended solution leverages two print management applications – PaperCut MF and Wepa. Wepa is a cloud-based printing solution and currently does not require hardware or software infrastructure on the Urbana-Champaign campus. The Wepa hardware deployed on campus as part of the printing solution is a kiosk, which consists of a print station with integrated display, computer, card reader and printer connected to the campus network. The Wepa service will work with service managers to brand, locate and deploy printing kiosks for Tier 2 service adopters. PaperCut MF is an application installed and administered locally on the Urbana-Champaign campus. Infrastructure requirements include virtual servers for the PaperCut application, print queues, web front end and web printing. Additional resource requirements include a database server (or connection to a production database instance/farm) and redundancy servers as identified by the implementation team. Beyond server infrastructure requirements, the PaperCut application will require printers (or multi-function printers), print release station hardware, and licenses for print release stations.

### Hardware

* Infrastructure
	+ Leverage IT power plant virtualization service for printing service virtual servers where feasible
* Printing equipment & print release stations
	+ Tier 1: responsibility of the distributed IT unit
		- Recommend that future device procurement comply with recommended hardware list developed and updated by printing service managers
	+ Tier 2: responsibility of the printing service
		- Procure and configure devices from recommended hardware list
* Printing-related furniture & associated power/data
	+ Tier 1: responsibility of distributed IT units
		- distributed IT units will provide printing-related furniture & associated power and data connections
	+ Tier 2: responsibility of the printing service
		- printing service managers will coordinate furniture procurement and placement
		- distributed IT will provide associated power and data connections
* Kiosks
	+ Specifications created and maintained by printing service managers

### Infrastructure

* Application server (primary)
* Print servers (secondary)
	+ Centrally hosted
	+ Distributed IT hosted
* Web server(s):
	+ Web front end for single sign on and additional hosted components
	+ print to web
* Database server
* Redundancy servers as required – hot spares for primary application server, database server, etc.

### Software & Licensing

* Revised terms/agreement with WEPA to reflect broader implementation
* Current version of PaperCut MF
	+ PaperCut MF licensed correctly for # of users
	+ Heartland module licensing
		- Note: Heartland is a financial system recently vetted by Housing and adopted for use on the Urbana-Champaign campus, which adds declining balance functionality to ICards used by students, faculty and staff
	+ Application & license for PaperCut print release station client
	+ Application for PaperCut client
	+ MFP device license(s)
	+ Web printing
		- Separate application or built-in PaperCut function as tested and decided by implementation team
* Database
	+ Latest version MSSQL or Oracle -- to be determined by implementation team
* External service connector
	+ Heartland module
	+ Banner
	+ User/group import
* Threat analysis & protection software for endpoints
* Printing device single source registration software

### Probable platform or general architecture

* + - Primary PaperCut MF application server will run on latest supported version of Microsoft Windows Server
		- For Apple printing, the IT Power Plant printing service will follow guidance provided by virtualization service team

## Scalability

Describe how the solution is scalable. Describe the attributes and characteristics that makes the solution a scalable model and able to accommodate future growth.

* Application scaling – the print service is designed as an enterprise solution capable of supporting a large and growing number of students and devices on the Urbana campus
* User group scaling – the print service is designed to accommodate the functionality needed with the addition of future user groups, including staff, faculty, and researchers. Print service FTE and resources are independent of the need for additional users on the system

## Staffing

### Summary

The recommended solution identifies allocation of several FTE to form a centralized printing service management team. The FTE totals reflect the amount of work required and roughly estimates the number of staff required to ensure printing service success. The recommended solution advocates cross training among members of the team to ensure redundancy in skills and improved staff availability in the event of an upgrade, outage, or escalated issue. It is expected that printing service implementation will bring additional staffing requirements as infrastructure, software, hardware, financial processes, documentation, branding, and support are organized and deployed. Staffing requirements will be lower once the printing service is mostly online and running in production capacity. It is estimated that 9 FTE are required for service implementation, and 7 FTE are required for ongoing support.

Staffing requirements are divided into four primary zones of responsibility, including user support, service administration, finance, and hardware and consumables. Staffing needs for each zone are enumerated below.

### Implementation & Ongoing FTE

Estimate the FTE number of staff needed to implement and provide ongoing support for this solution.

### Key

* DIT = Distributed IT – colleges, units, departments
* SM = Service Managers for the Shared Printing Service
* ITP = IT Professionals
* UIPrint = placeholder for printing shared service name

### User Support

* Problem resolution (tier I helpdesk) and routing to SM, refund and billing support, DIT or hardware and consumable support
* Documentation, including setup and maintenance of a website, maps, links to other printing services, help desk support, FAQ, instructions, and knowledge base (answers.uillinois.edu)
* User service support defined
	+ Hours
		- End User Helpdesk Calls – *ITPP tier 1 helpdesk hours*
		- Second Level Support Calls (SMs*) – standard business hours*
* Marketing and brand management
	+ Campaign to build branding for UIPrint – website, devices, etc. (~1 month)
	+ Ongoing support for UIPrint – onboarding participating units, updates, etc.

### Administration

* Users and groups management
	+ Solutions must support Shibboleth or AD and Heartland, where existing users and groups are available and used for authorization and billing
* Federated control & management
	+ Support federated management capacity to be developed by service managers as time and resources allow
* Application administration
* Printer and print queue management
	+ Print drivers & queues – best practices & drivers recommendations
	+ Virtual queues and print drivers managed by SM
	+ Physical queue and print driver management:
		- Tier 1: Distributed IT
		- Tier 2: SM
* Reporting and analytics
	+ Set up and manage reporting and analytics for use by SM and DIT
* Business process improvement
	+ Identify usage, cost, revenue, billing, and scale improvements with printing system (service managers)

### Finance

* Financial manager
	+ Oversees all financial aspects of services
	+ Leads financial team
	+ Reports to governance
	+ Billing and charging
		- Establish standards for:
			* printed page cost
			* billing/charging mechanisms: GAR, declining balance, etc.
* Financial team
	+ Set up fund transfers to DIT
	+ Quota management
	+ Tier 1 budgeting, including hardware
	+ Tier 2 budgeting, including consumables, FTEs, licensing, servers
	+ Cost recovery budgeting
	+ Expense and revenue management
	+ Reconciliation & auditing
	+ Duties as assigned for financial methodologies (Heartland, etc.)

### Hardware and Consumables

* Procurement
	+ Tier 1
		- DIT responsible for: consumables & hardware
	+ Tier 2
		- consumables shipped directly to DIT
		- hardware shipped to SM for configuration, then sent to location
* Maintenance and Service – Hardware (printers, scanners, physical device security)
	+ Tier 1 – Responsibility of DIT
	+ Tier 2 – Responsibility of SM or service contract (decided by implementation team)
* Placement and Lifecycle management
	+ Components and responsibilities:
		- Tier 1:
			* Lifespan determination – DIT
			* Logistics (single source registration service)
				+ coordination: SM
				+ implementation is DIT
			* Tagging and naming conventions – SM
			* Threat analysis and protection – SM
			* Accessibility –
				+ compliance best practices documented and distributed: SM
				+ implementation: DIT
		- Tier 2
			* All handled by SM
* **NOTE:** for more information, please see **FTE Staffing Needs** spreadsheet located in ***Appendix A -- References***

## Costs

Identify potential costs or saving opportunities, especially at the campus level. This does not necessarily need to be actual costs.

### Summary

The design of the recommended printing solution affords the opportunity for IT Power Plant to implement without additional substantial financial commitment. Both PaperCut and Wepa print management solutions are implemented on campus, so efforts will focus on restructuring licenses to accommodate campus-wide deployment. Some printers, copiers and multi-function devices can be repurposed for the printing solution, and some new printing hardware will be required. Appropriate power and data resources for many printing locations are already in place. Some implementation costs will focus on acquiring and locating printing hardware of stakeholders selecting Tier 2 services without kiosks. Once the printing services is online and functioning in production capacity, it is expected to be largely if not completely self-supporting.

### Implementation Costs

Identify initial or one-time costs associated with build-out, implementation, transition, and migration of the solution.

* Hardware
	+ Printing service can re-use many if not most campus resources already allocated for student printing
* Software
	+ Printing service can consolidate existing licenses purchased for PaperCut; WEPA costs TBD based on quantity and volume
* Branding
	+ Costs TBD associated with printing location map development, marketing materials and design, etc.
* FTE and part-time staffing
	+ Resource costs may be necessary to reallocate staff to implement recommended solution
* Service
	+ Costs may be incurred as printing hardware service and maintenance agreements are investigated and possibly selected
* Savings opportunities
	+ Funds currently allocated to licensing different print system products will be eliminated
	+ Service/maintenance contract costs in composite can be lower

### Ongoing Support Costs

Identify costs associated with staff support, service support plans, monthly/yearly service costs, lease costs, or other recurring costs.

* Hardware
	+ Replacement of hardware (printers, release stations, etc.) that has reached end of lifecycle.
* Software
	+ Licensing renewals and possible additional cost due to growth of student population. All contracts are subject to changes based on vendor preference and service uptake.
* Branding
	+ Changes due to modifications of UIprint brand and ongoing commitments to onboarding new units. As well as website design and maintenance.
* FTE/part time staffing
	+ As the printing system grows, the ITPP Printing Service may see growth in staffing requirements.
* Service
	+ Possible growth in service commitment costs as volume of service varies across devices.
* Savings opportunities
	+ Bulk purchasing of hardware and consumables.
	+ Service/maintenance contract costs in composite can be lower.

### Refresh or Enhancement Costs

Identify potential costs associated with the solution to maintain or enhance the system, such as hardware and software upgrades, and the frequency of those costs.

* + As printing is a mature commodity service, most of the printing service should not require large (new) refresh or enhancement costs.
	+ Most refresh costs are accounted in the ongoing costs.
	+ Enhancements to printing service will be determined and considered for implementation as needed.

## Solution Benefits

Identify the benefits of this solution, especially in consideration to other potential solutions. Describe why this is the recommended solution.

### Overall benefits

The recommend printing solution provides a large range of benefits. The campus will reduce (and eventually eliminate) duplication of printing service efforts at the college, unit, and department level. Also, common components of the centralized printing solution reduce unit-level printing support staffing requirements for IT professionals and business office staff. A centralized printing solution provides opportunities to achieve economies of scale, as well as analyze and optimize equipment, supplies, and maintenance agreement selection. If the recommended print solution is adopted, the greatest benefit may be the ability to pursue new opportunities, including support for the campus design learning initiative and forming partnerships to support non-traditional printing– including 3D, large and alternative formats.

### User benefits

* If the printing services solution is implemented effectively, the following student needs will be addressed:
	+ Available- print service locations distributed strategically and effectively across Urbana Campus
	+ Supported- convenient paths for users to access appropriate support channels
	+ Consistent- established prices & billing/charging methods, quality of equipment and print output
	+ Usable- intuitive to use and quick, continuity in users experience across locations
	+ Reliable- services, equipment & output regularly behave as expected.

## Solution Risks

Identify risks and possible mitigation strategies specific to this solution.

* If the print solution is not widely/completely adopted across campus, this could undermine consistency for students and ability to deliver at scale cost reductions for the campus and university.
	+ Possible mitigation: providing incentives such as subsidized printing
* Increased licensing or contracts costs
	+ Possible mitigation: the solution contains more than one support product and more than one venue for service and maintenance so costs are not singularly dependent on a single licensed product
* A single source of knowledge and support
	+ Possible mitigation: FTE responsibilities structuring designed to avoid single source knowledge and support issues
* Negative impact on students who currently receive lower print rates who also lack the need for a unified printing solution.
	+ Possible mitigation: Providing incentives such as subsidized printing
* Inherited equipment may not fit within the best practices (determined by implementation team) and may affect the ability to find a single vendor for consumables or maintenance.
	+ Possible mitigation:
		- Non-supported equipment will eventually rotate out of service via equipment lifecycle
		- The best practices and recommended equipment list supplied by Service Managers should help prevent non-compliant hardware issues in the future

## Solution Assumptions and Constraints

### Assumptions

* Leveraging other IT power plants:
	+ The IT Power Plant Tier 1 Helpdesk solution will be implemented and will provide tier 1 support for the printing service
	+ The IT Power Plant Virtualization solution will be implemented to support the printing service infrastructure needs.
* There will be financial and staffing resource assistance with the implementation of the printing service.
* There will be enough college, unit and department buy in across campus to support the ongoing cost and maintenance of the service.

### Constraints

* The printing service solution is subject to ongoing financial duress at the State of Illinois and Urbana Campus levels.
* The printing service rollout timing will be impacted by the timelines and subsequent changes resulting from other IT Power Plant solutions
* In order to achieve buy-in, a solution has to be financially viable for distributed IT units.
* Departments will continue to be responsible for the costs of providing power and data for printing locations.

## Milestones: Implementation

Identify key milestones required for solution implementation, including dependencies and potential timeline.

* Build out printing service infrastructure – servers, network, etc.
* Create and test standards for printing hardware and print queues (physical and virtual)
* Coordinate billing and charging process development with OBFS
* Compile support protocol and documentation
* Create and implement printing service governance
* Solicit and identify college, unit and department tier of service selections
* Adoption of service

## Compare and Contrast

Provide a brief narrative on why this solution was chosen over the alternative solutions. Use the table to compare and contrast the recommended solution to other solutions considered (and documented in Appendix B.)

### Summary

The recommended solution was chosen over alternative solutions A and B after evaluating several key factors. The recommended solution allows stakeholders to select from multiple tiers of service, and this flexibility increases likelihood of buy-in from both large and smaller colleges, units, and departments with variety of existing deployments and financial conditions. The recommended solution also minimizes potential contract fulfillment issues if a single vendor fails to meet expectations. This assures continuity in service for users who are asking for a reliable and consistent printing experience. Additionally, the recommend solution provides the capacity to scale the printing service to fit the Urbana-Champaign campus as it grows in adoption and user population served.

### Alternate Solution A: PaperCut only

#### Strengths of a PaperCut-only solution

* Lots of experience and knowledge at UIUC
* Local accountability for operation of the service
* Existing printing workflows and processes
* Flexibility for expanding and meeting various unique customer requests
* Already integrates with existing campus billing processes
* Leverages existing hardware on campus
* Heartland support

#### Weaknesses of a PaperCut-only solution

* More work involved with implementing kiosk solutions
* More involved process for guest and cash transactions
* Web Print: scalability and options for processing (color/monochrome, duplex, multiple pages/sheet, etc.)

### Alternate Solution B: Wepa only

#### Strengths of a Wepa solution

* Entirely vendor supported and implemented
* Richer options for web print processing (color/monochrome, duplex, multiple pages/sheet, etc.)
* No cost to University entities

#### Weaknesses of a Wepa solution

* Vendor accountability for operation of the service
* Limited flexibility and control – vendor hosted, cloud based solution
* Inability to handle all of the use cases. Example: handling zero cost, track only printing; accounting to different funding sources (CFOP)
* Does not integrate well with existing hardware or business procedures
* To take advantage of cost recovery benefits, the service would price it out of an acceptable range

| Items\Solutions | Recommended Solution | Solution A:  | Solution B:  |
| --- | --- | --- | --- |
| Technology | Hybrid – PaperCut/Wepa | Papercut only | Wepa only |
| Scalability | Minimal challenges | Some challenges | Some challenges |
| Staffing: Implementation FTE (est) | 9 | 11 | 11 |
| Staffing: Ongoing Support FTE (est) | 7 | 9 | 5 |
| Costs: Implementation Costs | Low | Low | Minimal |
| Costs: Ongoing Support Costs | Mid | Mid | Minimal  |
| Costs: Refresh or Enhancement Costs | -- | -- | -- |
|  |  |  |  |
| Meets defined use cases | All | Most  | Some |
| Cost recovery options | Yes | Yes | No |
| Integration with existing hardware and business processes | Yes | Yes | No |
| Kiosk printing | Yes | Some challenges | Yes |
| Tier of service selection | Yes | Yes | No |
| Single vendor dependence | No | Yes | Yes |

# Transition Planning

The intent of this section is to understand the potential complexity, timeline, and challenges of moving forward with this recommended solution, especially in consideration to other solutions. Consider that a solution may be chosen to more quickly fill a shorter-term gap, or to realize a more immediate cost savings and reduction in the duplication of work, while follow-on solutions may move towards a longer-term strategy. This section should communicate the potential timeline of a solution so that strategic decisions can be made regarding these factors.

## High-Level Transition Plan

If a migration from current systems to the recommended solution is needed, provide a description of the high-level transition plans. Describe what systems and data will need to be migrated.

### Summary

One of the benefits of the recommended solution is that several key components are already deployed on the Urbana-Champaign campus, including large PaperCut implementations in Technology Services, University Library, and shared services. Wepa is already vetted and implemented at the College of Business. Expertise in print management application and system administration is also readily available through IT professionals and business office staff in several colleges and units across campus.

Transitioning to the recommended solution requires coordinated efforts related to staffing and governance, finance processes (billing/charging/reconciliation), hardware and infrastructure, support and documentation, branding, and migration planning. More information on each topic is included below.

### Staffing and governance

* Allocation of duties
* Assignment of responsibilities (service managers vs. distributed IT)
* Governance team

### Financial processes

* Acquire required Banner codes and CFOPs
* Student accounts
* Discussion with departmental business offices on new billing processes
* Cost analysis for rate development that supports the solution

### Hardware and infrastructure

* Security audit. Adjusting firewalls for new server IPs.
* Monitoring of the application and hardware, with notifications about up/down state, consumables status, and maintenance warnings.
* Physical placement and access. The information will be needed for development of the printing map.
* Inventory, labeling, and signage (branding)
* Ownership and access of networks in ContactDB. Where possible, the solution team should have at least read access to all networks printers are on.

### Support and Documentation

* Processes and policies for customer support
* Processes and policies for departmental support and cooperation
* Customer documentation on using the service
* PR and advertisement of the new service and changes
* Creation of website that contains and references this information

### Branding

* Creation of UIPrint service brand
* Generate materials – web, signs, labels

### Migration from Existing Solutions

* Printing Transactions
	+ Credits need to be migrated and available to users in the solution when it goes live. The solution must have the ability to process refunds for jobs transacted in the previous systems. The detailed user transaction history from previous systems must be available for both the user to review and for historical reports of overall printing activity.
* Unique Server and Queue Naming
	+ Enforce a standard naming convention for print servers and queues on the solution, and coordinate with departments on technical procedures for remapping their existing names.
* Integration of Existing Queues/Drivers/Access
	+ Copy and verify existing settings
	+ Copy and verify that existing drivers are compatible with the solution
	+ Copy and review the access controls on queues
* Triage Implementation
	+ Existing PaperCut. Easiest users to migrate.
	+ Other Solutions. Discuss benefits and limitations of the printing solution and how existing use cases map.

## Milestones: Transition

Identify key milestones required for solution transition, including estimated durations and dependencies.

* Establish implementation team: less than 1 month
* Establish budget: less than 2 months
* Identify and begin building key infrastructure components: less than 3 months
* Documentation of the core solution and common components: less than 2 months
* Adoption: Major completion by 1st week of August, 2016 -- approximately 1 month per stakeholder
	+ Order of operations:
		- Existing PaperCut system users
		- Existing WEPA system users
		- Print Manager Plus system users
		- Other Campus Printing system users
* Charge steering and governance team/create service governance: occurs simultaneous with adoption
* Finish up infrastructure and documentation: occurs simultaneous with adoption
* Investigate opportunities for future phases of the printing service (staff and instruction faculty, unaffiliated users, researchers)

# Appendix A: References

Provide information about white papers, documents, or other materials used as a reference or that support the recommended solution. This can include links to materials with a short description of the material purpose or content.

## Solution Development Template: Appendix A: References

Last update: 01/06/16

### In-document references:

* Tiers of Service Spreadsheet ([link](https://uofi.box.com/s/n3mx3n2x8h8pn26ke760kzx3bski62a6))
* ITPP Printing Service high level diagram ([link](https://uofi.box.com/s/cmgr7y63u0uobmkldnovm75z0xbysi34))
* FTE staffing needs spreadsheet ([link](https://uofi.box.com/s/phsqwgzzmkhjd12o9wcnynmd7ynqt64d))
* Student Survey summary document ([link](https://uofi.box.com/s/3vjyswr69bbcsd0eoertu1crjf98v0av))

### Research group:

* Gartner Hype Cycle for imaging and printing – 2014 ([link](https://uofi.box.com/s/ku4f2vkxvrgvh8si01mcsb266yn6kaqs)) and 2015 ([link](https://uofi.box.com/s/8a6c67p88id98fheed601gb2crnf6uc3))
* Meeting notes: UI Procurement Services (Duane Elmore) ([link](https://uofi.box.com/s/ya158x8rxfnyl6rn6fya9ykcvebx3pni))
* Meeting notes: UIUC Document Services ([link](https://uofi.box.com/s/62x2htp2nlivayb5b1snz30bvgw5ww21))
* Yale University printing services ([link](http://ypps.yale.edu/blueprint-programs))

### Communications group:

* UIUC Campus IT Pro Survey executive summary ([link](https://uofi.box.com/s/ounbymsjho8bikcgtmhkh73j7m23se7v))
* ITPP Printing Services Governance draft ([link](https://uofi.box.com/s/204ouqgb4k793pow44iaslj8nqyjb7xi))

### Use Cases group:

* Solution development feature matrix ([link](https://uofi.box.com/s/ta970lo7gzwt7z63pg2mmmjyx76ilntt))
* IT Power Plant Accessibility Requirements document – Keith Hays ([link](https://uofi.box.com/s/9wi5lz6g54x7zr2i1h85i7njro3s5rn0))
* Accessibility Requirements for Procured Software ([link](https://uofi.box.com/s/8w95ybmyroamy8sxvvlqcc89n98hst7u))

### Logistics group:

* Solution development team – logistics survey ([link](https://uofi.box.com/s/gm8xioctiq79f1yxhnvtkujjeg5ece6j))
* Tech Services Print Job workflow ([link](https://uofi.box.com/s/jilnf0mjskltgm36crro8sgz8qigrhke))
* Library Print Job workflow ([link](https://uofi.box.com/s/scg150ngiueyrzjb3qaudj7ssq12n5ys))
* Geospatial map of Library printing locations ([link](https://uofi.box.com/s/brtu1fmgspy4ede2mmw7mrjze5hnojqj))
* Partial list of printers deployed on Urbana-Champaign campus ([link](https://uofi.box.com/s/ehpzxlywr813euyxm7itcjskn2okpbsx))

### Working documents:

* Solution detail notes (from whiteboard session 12/09/15 – [link](https://uofi.box.com/s/iy6ntc3kwbkiis4du90p90ca5qrd4n15))
* User experience spreadsheet ([link](https://uofi.box.com/s/zz8xc8j92718ce7hz52rufxhcqiuxvuk))
* ITPP Printing Service Summary -- October 2015 ([link](https://uofi.box.com/s/3eoun2jql6nqfc9xw2pactk16li8vhdg))

# Appendix B: Alternative Solutions

Describe the alternative solutions reviewed, but were not the recommended solution. Alternative solutions could include modifications of existing solutions or new solutions not yet created.

## Solution Alternative A: PaperCut only

### Overview of Solution

Provide a brief solution narrative describing this solution.

* A PaperCut only solution consists of the entire printing service handled solely by the PaperCut print management system software. Solution features include:
	+ Print from: BYOD, web, print system clients
	+ Print to: computer labs, print release stations, kiosks (self-developed)
	+ Functions: 8.5x11”, laser, color/monochrome, simplex or duplex
	+ Core technologies: PaperCut MF
	+ Use cases
		- Computer lab
		- Print release station
		- Kiosk (self-developed)
	+ Accounting: shared accounts for different billing scenarios, along with multiple personal accounts tied into campus AD

### Solution Benefits

Identify the benefits of this solution, especially in consideration to other potential solutions.

* Lots of experience and knowledge with PaperCut at UIUC, as well as many other institutions.
* Local accountability for operation of the service
* Existing printing workflows and processes
* Flexibility for expanding and meeting various unique customer requests
* Already integrates with existing campus billing processes
* Leverages existing hardware on campus
* Heartland support

### Solution Limitations

Identify risks and limits related to this solution.

* More work involved with implementing kiosk solutions
* More work involved in building customized departmental solutions
* More involved process for guest and cash transactions
* Web Print: scalability and options for processing (color/monochrome, duplex, multiple pages/sheet, etc.)

### Comparison to Recommended Solution

Describe why this solution was not chosen as the recommended solution.

* Benefits and limitations are also included in the recommended solution, as PaperCut is part of the solution. A PaperCut-only solution does not contain the WEPA component to offset the limitations.

## Solution Alternative B: Wepa only

### Overview of Solution

Provide a brief solution narrative describing this solution.

* A Wepa-only solution consists of kiosk-based printers that print black and white, black and white duplex, color, and color duplex at a fixed price per page. The money generated from that fixed price goes to WEPAnow.com in exchange for the kiosk based printers and supplies. Supplies are shipped to kiosk locations and replaced by local staff as outages occur. Printing is available from web, mobile, print drivers, cloud, and e-mail. It can be integrated into the Heartland system and deduct from I-cards or similar structures. Printers are located across campus in locations that meet both need and volume requirements as dictated in a contract. A contract would exist for a length of time (TBD) with a one year contract being a current example.

### Solution Benefits

Identify the benefits of this solution, especially in consideration to other potential solutions.

* Entirely vendor supported and implemented
* Richer options for web print processing (color/monochrome, duplex, multiple pages/sheet, etc.)
* No cost

### Solution Limitations

Identify risks and limits related to this solution.

* Vendor accountability for operation of the service
	+ Possible issues with vendor executing SLA and subsequent contract enforcement
* Limited flexibility and control
	+ Determines number and locations of kiosks, services offered and support parameters
* Inability to handle all of the use cases
	+ Example: handling zero cost, track only printing; accounting to different funding sources (CFOP)
* Does not integrate well with existing hardware or business procedures
* To take advantage of cost recovery benefits, the service would price it out of an acceptable range

### Comparison to Recommended Solution

Describe why this solution was not chosen as the recommended solution.

* Solution would require less implementation and infrastructure costs, staffing requirements would be minimal, and the cost to the university would be minimal as well
* Solution would be dependent on the vendor living up to SLA. The vendor would have final say in virtually all matters of printing solution
* Solution would require significant changes to existing printing structures currently in use across the majority of campus
* While solution would be more consistent in branding and image it would lack the scalability to meet all needed circumstances across campus

# Appendix C: Other Solutions Considered

Other potential solutions may have been discussed, but were not considered, possibly due to known issues or reasons that make the solution not be viable. Describe the solutions discussed and the reason why they are not viable.

## Other Solution Considered A: Pharos

### Overview

* Consideration of a Pharos solution was based on previous presentations given by the University of Illinois at Chicago. Pharos provides multi-vendor secure pull printing, job accounting and charge back, rules-based policies, mobile printing, pay for print/copy/scan, reporting options, and intelligent toner reduction. It uses a Windows-centric printing infrastructure.

### Reasons for non-consideration

* Licensing costs: purchasing all-new Pharos licenses when the campus already owns several PaperCut licenses.
* Complexity: the UIC implementation of Pharos involved many custom applications to enable basic operations. The Pharos system is not as rich and flexible as PaperCut.
* Platform: requirements for the solution included support for OS X and Linux printing and Pharos does not have as much flexibility in this area.

## Other Solution Considered B: Vendor print managed solution

### Overview

* Contracting with a single local vendor and manufacturer (Xerox, Ricoh, Canon) to purchase consistent printing equipment to service student printing and provide maintenance for said printing equipment

### Reasons for non-consideration

* The cost of replacing all existing hardware on campus with additional hardware purchase from a vended solution is not feasible given the fiscal climate on campus and in the state of Illinois
* The large size and diversity of our campus precludes any one service provider (i.e. Xerox) ability to meet campus needs
* University entities lose all cost recovery options from student printing.

# Appendix D: Use Case Mapping

List the use cases that address or support the recommended solution.

* User groups identified:
	+ Students – graduate and undergraduate (focus of this solution)
	+ Future phases
		- Staff and instruction faculty
		- Researchers and research faculty
		- Unaffiliated users – public, community, guests
* Use cases
	+ Computer lab
	+ Print release station
	+ Kiosk
	+ BYOD -- Laptops, tablets, smart phones
* User group practical needs
	+ Who: undergraduate and graduate students on the UIUC campus
	+ Core components of student printing experience:
		- Available
		- Supported
		- Consistent
		- Usable
		- Reliable
* **NOTE:** for more information, please see Student Survey summary document located in ***Appendix A -- References***