Technology Consulting in the Community

Spring 2012

Just Harvest

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Final Consulting Report

**Carnegie Mellon University
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Final Report
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I. Executive Summary

Just Harvest is a Pittsburgh-based non-profit organization that "promotes economic justice and works to influence public policy and to educate, empower, and mobilize the citizens of our community toward the elimination of hunger and poverty." The organization is relatively small with 9 full-time employees running on a very limited operation budget but take advantage of a larger number of volunteers and interns. The office has a total of 15 PCs that are sharable between full-time staffs and volunteers (except for the PC used by the co-directors). They do not have any technical staff so IT is handled by non-IT staff members. The Community Partner, Ken Regal is one of the two co-director at Just Harvest and is also primary responsible for Information Technology and Finance.

The Scope of Work for this consulting engagement includes the following two projects:

1. Improving organization IT infrastructure

Just Harvest currently has a peer-to-peer network architecture which is designed for small home network and does not offer the security (including business continuity / disaster recovery) and management functionalities needed by an organization with 15 PCs and multiple users (exact number changes frequently).

An infrastructure upgrade plan was completed that outlines the steps to take as well as hardware purchase recommendations for Just Harvest to migrate from the current peer-to-peer network to a solid but also cost-efficient server - client network that adds the following technological capacities to the organization:

- Highly reliable and cost efficient backup design mitigating risk of 1) operation disruption due to hard drive failure and 2) catastrophic data loss due to unintended deletion, server failure or disaster (fire etc.)
- Centralized authentication of users through Active Directory which allows implementation of role based access control to shared documents as well as improved security through centralized security policy enforcement.
- Ability to access documents remotely from outside the office providing staff members alternative ways to work when they are able to be physically present in the office
- Centralization of documents and databases resulting in improved organization
- Eliminates a technical limitation that limits concurrent access of Access and TaxWise databases to 10 users which has been an operation bottleneck

The end result with these additional capacities is that Just Harvest can do the actual work that contributes to their mission more efficiently as well as mitigate security risks that could lead to the interruption of operation and thus Just Harvest's ability to fulfill its mission.

A key consideration for the new infrastructure is that it has to be maintainable by people without an IT background to ensure sustainability. Furthermore, the network is designed for Just Harvest to be able to implement without outside technical expertise. However, Just Harvest is also considering hiring an outside consultant. The implementation \ is planned to occur this Summer.

2. Improving document management

A number of free and paid Document Management software such as OpenDocMan, OpenKM, docStar and M-Files were evaluated. However, we concluded that using Windows' built in Explorer and search function is still the best way to access and manage documents. Based on this, Just Harvest's Administrative Assistant and the Consultant completed a File Naming convention that is about to be deployed office-wide. The convention establishes a standard folder structure used by all staff members as well as guideline on how to name documents.

The final outcome is that staff members have a better method of organizing their documents. This leads to improved ability for staff members to find someone else's document faster than before because everyone is using a common file structure. As a result, staff members are less frustrated and can work more efficiently toward the work that will actually contribute to the mission of the organization. The new convention is sustainable as it is primary designed by a full-time staff member who will have the expertise to maintain it.

Finally, two recommendations that would further improve business operation are made. Just Harvest should consider implementing them in the near future when resources are available:

1. Use the latest Windows operation system, Windows 7, on all PCs

Currently, only 11 out of the 15 PCs are running still running Windows XP, an over 10 years old operation system. Just Harvest should replace all Windows XP PCs with Windows 7 PCs within the next three years. Microsoft will discontinue support for Windows XP by 2015 which means that critical security patches will no longer be offered thus opening not only the PC but also the entire network to significant security risks that could lead to catastrophic loss of data or disruption of operation.

2. Ability to access organization e-mail remotely

All of the Just Harvest staff interviewed reported that being able to access the e-mail remotely, preferable with smartphone support, would be very helpful because staff members sometimes need to work from remote locations or access their e-mail after work hours from home. Gmail through Google Apps for Education does not only provide such ability, but also offers drastically increased e-mail storage capacity from 100MB to 25000MB and apps for Android and iPhone. In addition, it allows the current @justharvest.org e-mail addresses to be kept and is free for non-profit organization.

II. About the Organization

Organization[1]

Just Harvest works in Allegheny County, Pennsylvania to end hunger and poverty. Founded in 1986, Just Harvest is a membership-based non-profit organization that is mobilizing, advocating, and serving towards economic justice for all.

Just Harvest continues to be guided by its founding mission and principles. These guiding ideas are built on the understanding that hunger is a symptom of poverty, and poverty is a product of economic and political injustice. Public policies frame the structure of our society, and it is through changing these policies that we can best address hunger and poverty.

Working to end hunger and poverty with partner organizations, Just Harvest is:
- Advocating for change in our public policies and public institutions
- Organizing our communities through education and empowerment
- Serving clients directly to help them access the services they need

Just Harvest's Mission Statement:

"Just Harvest is a membership organization which promotes economic justice and works to influence public policy and to educate, empower, and mobilize the citizens of our community toward the elimination of hunger and poverty."

Facilities

Just Harvest has one office location located at 16 Terminal Way in Pittsburgh, PA. The office has multiple individual offices as well as one room with multiple cubic.

Programs

Just Harvest's programs are in the following areas[2]:

Advocacy: Advocates at every level of government for policies that promote economic justice and lessens hunger

Community / educational events: Educate, empower, and mobilize citizens toward the elimination of hunger and poverty

Food Stamp Assistance: help people apply for food stamp assistance

Tax Preparation: help people prepare annual tax return at no charge

With a relatively large number of programs to manage, a solid IT infrastructure is needed to support the staff to work as efficiently as possible and to eliminate frustrating technological limitations. In addition, since Just Harvest also has personal data of people it is serving, ensuring the security or confidentiality of the data is critical in order to safeguard Just Harvest's reputation. For these reasons, ensuring the availability, confidentiality and integrity of Just Harvest's data will be another major focus of this project.

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[1] Information taken from http://www.justharvest.org/index.php/about-us/mission
[2] Based on information provided on justharvest.org

Staff

Just Harvest has 9 full-time staff which includes two co-directors. In addition, it frequently recruits part-time interns and volunteers. The number of interns and volunteers can range widely depending on need but the tax season could see dozens of volunteers working in shifts 7 days a week.

Ken Regal, Co-Director is the Community Partner for this project.

All full-time staffs have an assigned PC but have also the ability to access any other PC because none of the PCs except that of the co-directors requires the user to log-in. Interns and volunteers have access to five unassigned PCs. However, if there are more volunteers than the number of unassigned PCs available, they may also use the PCs assigned to full-time staff. This frequently happens when large number of tax preparation volunteers come into the office on weekends during the tax season.

All staff members are computer literate and know how to operate the technologies available to them.

Technology Infrastructure

Just Harvest has a peer-to-peer network with 4 new Windows 7 machines and 10 older Windows XP machines linked through a switch. One PC acts as a server for the tax preparation software but otherwise there is no server infrastructure. The network also has one networked multi-purpose printer as well two printers that are connected to individual machines and shared through the network. Website and e-mail are hosted externally by Earthlink.

Peer-to-peer network may be sufficient for a small home network but is not designed for a business environment with multiple users and the need to manage 15 PCs (possible even more in the future). Major limitations include:

- lack of central management of the network which makes configuration / maintenance more complex and time consuming
- inability to centrally backup files making the backup process very time consuming and prone to errors
- lack of sophisticated access management and security controls results in significant security risk that could lead to loss of critical data, business operation interruption and potential legal liabilities

The peer-to-peer network also does not meet the need of Just Harvest's growing tax preparation program. The server side of the tax preparation software is currently hosted on a Windows XP PC. Due to connection limits with Windows non-server operating systems, only up to 10 client PCs / tax preparation stations can connect to the host PC. Windows Server operating systems do not have this limit as they are designed for large number of concurrent connections.

Furthermore, Just Harvest's current backup policy is to manually copy at regular intervals files to an external hardware for each individual PC. This is not only time consuming and intervals are bound to be missed occasionally due to the need of human intervention, but it also does not meet Just Harvest's needs. Some databases are updated with new data daily and losing even a few days worth of data can cause significant damage toward their ability to fulfill their mission.

Technical Management

While Just Harvest does not have any dedicated technical staff, multiple staffs are fairly technology savvy and have the ability to maintain and troubleshoot technical issues. In the rare case that they are not able to solve an issue, Just Harvest has the ability to call in an external contractor (if the cost warrants it).

Technology Planning

Just Harvest does not have any formal technology planning. Technology related changes are decided by the co-directors on an ad-hoc basis based on perceived need and cost. This is sufficient as the organization is fairly small in size where the co-director both has a good idea of the technology needs in the organization and is fairly technology savvy. In addition, with the highest level of authority in the organization (beside an external board), the co-directors have the ability to implement any technology changes.

Information Management

All documents including databases are stored on individual PCs and shared throughout the network through the Windows' HomeGroup feature. This allows staff members to have the ability to access the documents from other PCs. The only exception is that some of the more sensitive documents from the co-director such as financial related are not shared.

This is a major problem for the following reasons:
* Inefficient structure for finding documents
* Documents will not be accessible when the PC where the documents are stored is shutdown
* More complex backup process as you would have to run individual backup processes for each PC
* Security risk as it is impossible to control access to the shared documents

Another important requirement that need to be mentioned is that the co-director need full access to everyone's documents and also e-mails at all time. This is somewhat an issue right now because every user saves documents in a different folder and file name structure. The problem is that other staffs in particular the co-director who frequently need access to the documents have a hard time finding the document they are looking for.

III. Improving organization IT infrastructure

Motivation:

As mentioned in the "Technology Infrastructure" section above, Just Harvest's current network is a peer-to-peer architecture with documents shared across the network from individual PCs and this architecture is insufficient for the reasons mentioned. The result is that work processes are less efficient and there are security risks that could lead to operation disruption and significant monetary damage, both which would prevent the organization from fulfilling its mission.

Staff members also expressed strong interest for the ability to remotely access files on the organization's network. This is useful in that staff can occasionally work from home when needed for example when out sick or in rare cases when there is a need to access files outside of office hours. Again, the current peer-to-peer network is insufficient to do so.

While e-mail and web hosting will be cloud based due to the lack of in-house resource and expertise to manage such functions, the Consultant and client agreed to keep the IT infrastructure locally when feasible due to the following major disadvantages of cloud services:

- Monthly/yearly service fee of cloud-services in the long-term is more expensive than the one time cost of setting up own backup system.
- Reliability is questionable as a number of cases have shown that law enforcement agencies can shutdown online storage services causing significant collateral damage to legitimate users
  - Megaupload.com shutdown for hosting pirated content where many users lost critical backups even through only a minority of the content hosted are copyright infringing [3]
  - Hundreds of servers from a data center were seized putting around 50 companies out of business because one of the data center's customer is suspected of fraud [4]
- Privacy concern as you are essentially handing over your sensitive data to a third party
- Over-reliance on the internet connection which is a lot less reliable than the internal network. Not only do internet connections have a bandwidth / speed limitation but it is also a dangerous single point of failure. When the internet connection is down then business operation will be disrupted because you lose the ability to access the cloud service.

For this reason, the goal of the task is to design a solid IT infrastructure based on a server-client network architecture that will meet Just Harvest current needs as well as expected need for the next five years.

Outcome:

Due to the high risk from the lack of a proper backup process, Just Harvest and the Consultant implemented a temporary solution that provides automated backup capability. The free software SyncBack has been installed on all 15 PCs and set during the evening to automatically wake up the PCs from sleep mode and make a copy of all documents and Outlook e-mails to another PC on the network. The Consultant demonstrated how to setup the process on one PC and a staff member from Just Harvest duplicated the setup to the other 14 PCs. By doing so, the staff member has learned how to use the backup software and sustain the backup process. However, the Consultant strongly discourages long-term use of the solution as backup copies are less organized and the backup process creates a higher level of network traffic and is also less reliable. It is designed to only acts as an "emergency" solution until a new IT infrastructure is implemented.

An infrastructure upgrade plan is completed that outlines the technical detail as well as hardware purchase recommendations for Just Harvest to migrate from the current peer-to-peer network to a server - client network. In addition, a Process Consulting approach was taken which means that Just Harvest ultimately "owns" the problem. The Consultant's role was to help Just Harvest solve the problem.

Please note that implementation of the new network will not take place until June the earliest. Currently, Just Harvest is at its busiest time period of the year where activities take place 7 days a

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[3] Based on my work in the Anti-Piracy industry with extensive experience in the sharehosting area
[4] Kim Zetter, Company Caught in Texas Data Center Raid Loses Suit Against FBI, http://www.wired.com/threatlevel/2009/04/company-caught/

week due to the tax preparation program so it is not possible to make any upgrade to the IT infrastructure as doing so will lead to downtimes Just Harvest cannot afford. Budget-wise, Just Harvest estimates that they would have about $1500 to purchase the necessary software and hardware.

The plan is developed to make it possible for Just Harvest to implement the server-client network by themselves without any additional technical expertise. However, there is still a significant risk of unexpected issues arising during the implementation which Just Harvest does not have the necessary technical knowledge to resolve. To mitigate this risk, Just Harvest may hire an outside consultant they have worked in the past to do the technical side of the implementation so feasibility for implementing the plan should not be an issue. Otherwise, there should not be any other risks as the CP is part of top management of the organization and has both the funding as well as motivation to implement the project. Cost is unlikely to increase significantly either as server prices usually only decreases.

The final design plan is attached as appendix (1). After implementation, Just Harvest will gain the following major technological capacities:

- Highly reliable and cost efficient backup design mitigating risk of 1) operation disruption due to hard drive failure and 2) catastrophic data loss due to unintended deletion, server failure or disaster (fire etc.)
- Centralized authentication of users through Active Directory which allows implementation of role based access control to shared documents as well as improved security through centralized security policy enforcement.
- Ability to access documents remotely from outside the office providing staff members alternative ways to work when they are unable to be physically present in the office
- Centralization of documents and databases resulting in improved organization and document management
- Eliminates a technical limitation that limits concurrent access of Access and TaxWise databases to 10 users which has been an operation bottleneck

The end result with these additional capacities is that Just Harvest can do the actual work that contributes to their mission more efficiently as well as mitigate security risks that could lead to the interruption of operation and thus Just Harvest's ability to fulfill its mission.

Furthermore, the server-client network has been designed to be easily maintainable without the need for technical staff, as Just Harvest does not have such resources available. In exceptional case when a higher level of technical background is needed, Just Harvest has access to an outside IT consultant they have used before. This should make the new IT infrastructure sustainable even through it may seem to be more complex than what Just Harvest currently maintains.

For the server operating systems, we settled with Windows Small Business Server Essentials. Windows Small Business Server Essentials was a clear choice because its core is the latest Windows Server 2008 but it has been redesigned to target businesses that do not have any IT resources such as Just Harvest. A key feature is a dashboard that makes it straight-forward enough for anyone without prior server experience to configure and maintain the server. Furthermore, Windows Small Business Server Essentials has the ability to do everything Just Harvest is looking for with the new infrastructure without the need for third-party software. This includes the ability to remotely access documents, central storage for files and database, scheduled document backup and centralized access control.

On the hardware side, we settled on a HP ProLiant ML110 server at base configuration which is relatively low cost and specifically designed for small organizations. The base configuration alone with 2GB of memory and no hard drive is not sufficient for Just Harvest so two enterprise level hard drive (Western Digital RE4) and 8GB of memory from Kingston will be purchased separately. The reason is that PC builders such as HP and Dell significantly mark up prices for memories and hard drives usually more than twice the market price. PC builders do not make the major hardware components so what they are using is what can be purchased on sites such as Amazon.com. Installing new hard drives and memories take less than 15 minutes, and Just Harvest has done such type of work multiple times in the past so feasibility is not an issue. Not only can significant savings be archived when purchasing memories and hard drives separately, but Just Harvest can also be ensured that quality components are used.

Business continuity / Disaster Recovery has been improved significantly. The new backup capability offers redundancy that allows continued business operation after a hard drive failure and mitigates the risk of catastrophic data loss due to unintended deletion, server failure or disaster (fire etc.). Finally, backup occurs automatically with critical documents backed up daily rather than weekly through a manual process as it is right now. Automatic backup eliminates human error during the backup procedure (which has regularly occurred before) and also further minimizes loss to the organization in case of a disaster as the daily backup (as opposite to weekly backup) allows a quick recovery of more up to date data. Technically, this is done with a RAID 1 setup for the server which mirrors the full content of the hard drive to a second hard drive. If one hard drive fails, the server with all data still intact on the second hard drive can continue to operate with no interruption. In addition to mirroring the full hard drive, all documents are also synchronized every night to an Internet capable networked external hard drive located at the CP's home. This ensures that if some type of disaster such as a fire or flooding destroys the server or even the office, there is still a backup copy located at a likely unaffected location.

Additional safeguards against brownouts and blackouts have been recommended. Due to the older electricity infrastructure in the US, brownout and blackout are significant risks. A 1000VA – 1500VA Uninterrupted Power Supply for the server is recommended which costs $100 - $130. A UPS acts as an alternative power source and will prevent the server from crashing if a brownout or blackout occurs. This not only prevents data corruption but also ensures that Just Harvest can immediately restore operation as soon as the power is back up. In the case of an extended blackout where the battery of the UPS runs out, the UPS will automatically safely shut down the server. It has to be noted that a single UPS will not prevent operation interruption during a blackout. All of the desktop PCs will still crash as they do not have an alternative source of power but the most critical server where all documents are stored is protected.

Improved IT security is another component gained through the new infrastructure. Currently, all PCs are individually managed and do not have any type of password protection. All users are by default logged in as Administrator which is a very critical security risk. Through Windows Server Small Business Essentials, user accounts with extensive control over access permission and other security related policies can be established for every user. The Consultant and Just Harvest opted to use a relatively simple role-based access control model which is the standard in organizations due to the ease of implementation and management.

IV. Improving document management

Motivation:

As mentioned earlier, all staffs are required to store their work related documents in a shared folder. Right now, every staff has his/her own system to organize and name documents and folders, often with very non-descriptive folder and file names. The consequence is that the folders are very disorganized. If someone else needs to access a document, he/she will have a hard time finding the right document in particular when some people have more than 1GB of documents collected. This is a problem for the Co-Director and the Administrative Assistant as they regularly need to find documents from someone else without having to ask that person. This is again an issue that makes business operation contributing to the organization's mission less efficient.

A number of free and paid Document Management software such as OpenDocMan, OpenKM, docStar and M-Files were evaluated. However, we concluded that using Windows' built in Explorer (also known as "My Computer)" and search function is still the best way to go as explained in more detail in the next section. Instead, we have developed a File Naming convention that all staff members have to follow when they create or save a new document.

Outcome:

Just Harvest's Administrative Assistant and the Consultant completed a File Naming convention that is now ready to be deployed office-wide. The policy establishes a standard folder structure used by all staff members as shown in Appendix (2) as well as the guideline on how to name documents. In general, documents are named based on the following template:

[Date] [Document Name] [Staff name] [Version]

Example: 2012 Apr Time Sheet Heather Seiders.doc

All except "Document Name" is optional and depends on the type of the document. The convention can be easily integrated into the server-client network from the first project.

The final outcome is that staff members have a better method of organizing their documents. This leads to improved ability for staff members to find someone else's document faster than before because everyone is using a common file structure. As a result, staff members are less frustrated and can work more efficiently toward work that will actually contribute to the mission of the organization.

At the conclusion of the project, Just Harvest has not yet decided how much if any of the existing documents will be moved into the new structure. The concern is that staff members would be spending too much time sorting through old documents as some staff has more than 1GB worth of documents. Most likely, a majority of the existing documents will be moved into an archive folder instead. In either case, this is a managerial issue which Just Harvest has a lot more experience with and can be worked after the conclusion of the project (without the Consultant).

Again, a process consulting approach was used. While the consultant assisted with the process and brainstorming activities, Just Harvest's Administrative Assistant ultimately drafted the convention. Knowing the organization and how projects and other work related elements are organized is critical for drafting an effective folder structure. For this reason, the Administrative Assistant's role is critical for the success of this project. Furthermore, having a Just Harvest staff responsible for this project also ensures that the product is sustainable. If any organizational change in the future

requires the file structure to be changed, she has the expertise to be able to make the necessary adjustments.

While part of the process in developing the convention included seeking feedback from all staff members, there is nevertheless the risk that not all staff members will properly follow the convention because staff members are used to their own way of organizing documents. However training session and stressing the importance of the convention could mitigate the risk. The convention was also created to be as simple as possible and prevent people from having to spend significantly more time to be compliant.

As mentioned earlier, document management system such as OpenDocMan, OpenKM, docStar or M-Files were considered as they all claim to allow better document management and identification. Many of them do offer some advantages over Windows' Explorer but the disadvantages far outweigh the advantages. The free open source ones do not integrate into Windows Explorer which means that staff members require more extensive training to be able to use the graphic user interface of that specific document management software. Those graphic user interfaces are arguable even less user friendly than Windows' Explorer. On the other hand, some of the paid document management software does integrate into Windows' Explorer but their advantages do no outweigh the cost of the software.

More importantly in the decision to stay with Windows' Explorer is that neither of the document management software effectively mitigates the risk that staff members do not properly label the document or save in the proper folder. Furthermore, it is preferred to install as few software as possible as additional software may open up the network to more vulnerabilities that are inherited in the software and also require additional maintenance resources for that software.

V. Recommendations

Vision

To archive a high level of capacity, both in terms of technical knowledge and IT infrastructure, to be able to evaluate and implement innovative technologies such as social media, video streaming or virtual world presence that could better educate, empower, and mobilize the citizens of Pittsburgh as well as the world toward the elimination of hunger and poverty. Technological advances could greatly improve Just Harvest's ability to archive its mission but also comes with its own risks (in particular security and privacy related) that need to be carefully evaluated.

Goal

Goal 1: Use the latest Windows operation system, Windows 7, on all PCs

a. Background

While IT infrastructural improvements have been made, it is not sufficient for the next three years. One major issue is that most of the PCs are still running Windows XP which is more than 10 years old. They should be upgraded to Windows 7 as justified in the next section.

b. Justification

The mixture of Windows XP and Windows 7 is currently causing a number of compatibility issues with the communication between the PCs because of the vastly different design of the operation

system. A network with a single workstation operation system should mitigate those problems. In addition, using a single type of operation system will also decrease maintenance complexity which translates into time saving. However more importantly, Microsoft will discontinue support for Windows XP by 2015 which falls within the next three years. This means that patches including critical security patches will no longer be offered. Continued use of Windows XP would open not only the PC but also the entire organization network to significant security risks which could lead to catastrophic loss of data or disruption of operation. Finally, older PCs are more prone to hard drive failure (as the life-span of a hard drive is finite) which could result in costly downtime.

c. Strategies

Within the next 2 ½ years, Just Harvest would need to investigate on the purchase of new desktop PCs based on what's offered on the market and the budget Just Harvest has. The consultant is unable to make any recommendation on specification requirement and cost. Technologies in the PC market changes rapidly so it is difficult to forecast any purchase requirement past 3 months. However, Just Harvest has done such type of procurement multiple times before so there should not be any issues with Just Harvest doing the upgrade in-house.

d. Expected Outcomes

Replaced all older Windows XP PCs currently in use with new PCs that have Windows 7 or newer installed. In addition to increased security with the operating systems upgrade, the newer PCs are also less prone to hardware failure which would result in increased business operation efficient in addition to increased security.

e. Resources

All of the Windows XP PCs are very outdated performance-wise and thus would not be able to run Windows 7. Just Harvest would need to purchase new PCs with Windows 7 already installed. Without taking into account staff time for implementation, the cost is estimated at $300 to purchase a new PC with Windows 7 pre-installed.

The new PCs can be set up by Just Harvest staff as they have done it in the past. It's estimated to take an hour per PC but multiple factors can influence this estimate.

More information on why an organization should upgrade to Windows 7 can be found here: http://www.techsoup.org/learningcenter/software/page12222.cfm

In addition, tomshardware.com is a great website to learn more about computers: http://www.tomshardware.com

Goal 2: Ability to access organization e-mail remotely

a. Background

E-mail is currently hosted externally by Earthlink and pulled locally to individual PCs through Outlook 2003. All of the Just Harvest staff interviewed reported that being able to access the e-mail remotely after office hour, preferable with smartphone support, would be very helpful with their work. Right now, while Earthlink does offer web access to e-mail, it only supports POP3, a one-way protocol, for pulling e-mails to the local computer. This means that e-mails pulled into Outlook 2003, depending on the setting, are either removed from the cloud side (preventing remote access) or are still hosted on the web when it's deleted locally on the office computer (which is unsustainable as it eats up on the storage space). As a result of the lack of remote access, at least

two staff members are automatically forwarding e-mails to their private Gmail account which is a significant risk from a security perspective.

b. Justification

Gmail through Google Apps for Education offers not only drastically increased e-mail storage capacity from 100MB to 25000MB, but it also supports the IMAP protocol which allows 2-way synchronization of e-mails and mailbox folder structure. This means that staff members are no longer limited to accessing e-mails from the office. All e-mails including those that have been downloaded to or sent from the Outlook client at the office will still be accessible through the Gmail web interface from any computer in the world (well except China). In addition, Google also offers appropriate mobile software for iPhone and Android so staff members can access their e-mails from mobile devices too.

From an availability stand point, Google claims that they have an availability guarantee of 99.9%[5] which no other commercial e-mail provider can beat. The vast majority will not even be able to make any availability guarantees.

Finally, part of the Google Apps "package" is also Google Docs which allows users to create Documents (aka Word), Spreadsheet (aka Excel), Presentation (aka Powerpoint) and Forms stored on the cloud and edit collaboratively edit it in real time between multiple users. While Google Docs is strongly discouraged for business use in particular with sensitive documents due to security and privacy concerns[6], the advantage of the collaborative feature in some cases do outweigh the risks and could be a useful tool for Just Harvest staff to use as long as strict policy exists in regard to what type of information can be stored on Google Docs.

c. Strategies

Just Harvest would need to first open a Google account for non-profits here: https://google-for-nonprofits.appspot.com/application. Google will provide easy to follow instructions for migrating e-mail service to Gmail including the information necessary to change the MX record with the domain registrar (in Just Harvest's case it's Earthlink). The change can take up to 48 hours to complete (usually much sooner) during which service disruptions may occur so it's highly recommended to do it on a Friday afternoon to minimize operation disruption. Just Harvest then has to create the individual e-mail accounts through an easy to use web-based administrative control console. Once every staff has his/her own e-mail account, the configuration settings in Outlook also needs to be changed. It will be similar to how Just Harvest has configured Outlook for access to their current e-mails hosted on Earthlink. Google also provides detailed instruction on how to do so. Finally, Just Harvest may want to important the existing e-mails and contact information into the new system. For this, Google provides tools for mitigating existing e-mails from Outlook to the Gmail.

Like with Earthlink, Just Harvest can continue to centrally manage all e-mail accounts including the account administrator having full access to all e-mail accounts.

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[5] http://support.google.com/a/bin/answer.py?hl=en&answer=139019

[6] Google has strong relationship with the US government, in particular the US intelligence community and does from time to time share information with government agencies. In addition, the recent Megaupload case where the DoJ shut down the cloud based data storage service and all legitimate users (in addition to the illegitimate ones) have lost their data shows that there is a risk that data stored on cloud services get permanently inaccessible due to no fault of your own

d. Expected Outcomes

All organization e-mails are hosted on Gmail and staff members can access their e-mail from wherever they have internet access, including through mobile phones. This again leads to increased business efficiency and capability to do mission-related work. Security is also improved as Google claims that they have an availability guarantee of 99.9% [7] which no other commercial e-mail provider can beat. E-mail addresses are unchanged so there will be no impact on business operation. In addition, staff members can continue use Outlook to access e-mails from office PCs so staff members do not have to learn another user interface.

e. Resources

Google Apps for Education is free for non-profit organization so there is no monetary cost. However, about 2 – 3 hours of time by a Just Harvest staff is needed to implement the change. More information on Google Apps for Education can be found here: http://www.google.com/apps/intl/en/edu/

Details on how to setup Google Apps for Education can be found here: http://edutraining.googleapps.com/Training-Home/module-1

A previous Consultant, Amin Ali, has successfully helped another non-profit organization with implementing Google Apps. His final report will be supplied to Just Harvest as an additional resource.

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Just Harvest
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http://www.justharvest.org

About the Consultant
Paul Li
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Paul is a 2nd year Graduate student in Information Security Policy & Management. He will begin working as a Technology Consulting Analyst for Accenture next fall.

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[7] See http://support.google.com/a/bin/answer.py?hl=en&answer=139019

VI. Appendix

Appendix (1)

2012 Plan for upgrading Just Harvest's IT infrastructure

1. Purchase of server operating systems

Windows Small Business Server Essentials is by far the best choice for Just Harvest because its core is the latest Windows Server 2008 but has been redesigned to target businesses that do not have any IT resources such as Just Harvest. A key feature is a dashboard that makes it straight-forward enough for anyone without prior server experience to configure and maintain the server. All other server operating systems require extensive training or dedicated IT staff to configure and maintain, thus are infeasible for use at Just Harvest.

On the functionality side, Windows Small Business Server Essentials meets all of the requirements Just Harvest is looking for with the new infrastructure without the need for third-party software. This includes the ability to remotely access documents, central storage of files and database, automate document backup and centralized access control.

While some advanced features such as the ability to setup an exchange server is missing from this edition, we concluded that none of the missing features is needed by Just Harvest. Another limitation of this edition is that it only comes with 25 client licenses without the possibility to purchase additional licenses. However, Just Harvest does not expect any significant expansion and the possibility that more than 25 licenses are needed is non-existing within the life-time of the server.

Small Business Server 2011 Essentials can be purchased at techsoup.org, which offers significantly discounted software for non-profit organizations, at $29.99.

2. Purchase of necessary hardware

Since there are only 4 PCs in Just Harvest's inventory that meets the technical requirement for a server and all 4 PCs are needed for other tasks, a new PC needs to be purchased.

The below table lists important specifications for the server and includes recommendations as well as alternatives if applicable. Please note that specifications that are not important for a server such as video card or optical drive are not mentioned. If the vendor provides choices for selection, Just Harvest can go with the cheapest option.

It is also important to clarify here that hardware-wise, a server is just a PC similar to those used for workstation or at people's home. Any PC can act as a server or a workstation except that the latest generation of server operating systems requires 64-bit CPUs. Nowadays, pretty much all PCs sold are 64-bit. However, a PC used for different purposes (server, workstation, multimedia station) require different specifications to perform efficiently so selecting the right specifications for a server that meets Just Harvest's need is critical.

	Recommendation	Alternatives
CPU:		

Intel Xeon E3-12xx series	The Intel Xeon family of CPUs is specifically designed for servers and thus offers the best performance. Different models of Intel Xeon are on the market but the new E3-12xx series is recommend as it uses the Sandy Bridge microarchitecture but is not much more expensive.	Desktop-grade Intel i5 CPU is also sufficient for Just Harvest's current need for a file server. The i5 is not recommended for virtualization of multiple servers but it is unlikely that Just Harvest will need to do it within the lifespan of the server.
Memory:		
8GB ECC memory – Brand: Kingston and Crucial are often good choices but there are also other good brands	Unlike with desktop PCs, it is highly recommended to use ECC memory for server. ECC memory can detect and correct data corruption and possibly minimizes server crashes. ECC memory is usually only slightly more expensive than non-ECC memory. It is common to install memory in pairs (2x 4GB for 8GB memory) for better performance. If doing so, it is critical that both memory modules are identical brand and model. The best way is to purchase them in a kit.	
Hard Drives:		
Two 1TB Enterprise level SATA hard drives of exact model – Western Digital RE4 is an enterprise level hard drive that has been highly ranked	Two hard drives are needed for RAID 1 setup (mirroring of data on two hard drives to mitigate disruption when one hard drive fails). It is important that both are of the exact same model. Enterprise level hard drive such as the Western Digital RE4 is highly recommended because they offer higher reliability, best performance, longer warranty (usually 5 years) and most importantly include technology that prevents drive fallout in RAID setup that could lead to data corruption. In the past, Western Digital Black line of consumer hard drive also included this technology but this is no longer true in recent years. For this reason, enterprise level hard drive is strongly recommended when RAID setup is used. In general, 7200rpm (spin speed) is the	Same as under "Recommendation" except for 2TB of hard drive space. However, enterprise level 2TB hard drives are about double the price of 1TB. Furthermore, collecting more than 1TB of documents is not a good practice as it will be difficult to find documents that massive number of documents. If 1TB of hard drive space does run out, Just Harvest should archive older documents on an external hard drive.

| | minimum and the bigger the cache the better. Please note that spin speed is only one factor of overall performance so two 7200rpm drives do not have the same performance.

3Gb/s SATA is sufficient. 6Gb/s SATA which means higher transfer bandwidth is not faster because the limiting factor is the hard drive read/write speed on non-SSD hard drives.

Non hot-swappable hard drives are cheaper and sufficient for Just Harvest as it is very unlikely that Just Harvest ever need to swap the hard drive while the server is powered on. | |
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| **UPS** | | |
| 1000VA – 1200VA UPS Battery Backup (optional but recommended) | A UPS Battery Backup is like a power strip but will provide power surge protection functionality and also acts as an alternative power source for the server in the case of a blackout or brownout. The UPS will immediately switch to battery operation and prevent the server from powering off or crashing. This not only prevents data corruption but also ensures that Just Harvest can immediately restore operation as soon as the power is back up. In the case of an extended blackout where the battery of the UPS runs out, the UPS will automatically safely shut down the server which again prevents possible data corruption. A good UPC will only cost $100 - $120. | At a minimum a good power surge protector should be purchased as there is always a significant risk of a power surge caused by lightening destroying the server. This will not only cause disruption of business operation but also may lead to data loss. |

All major PC builders such as Dell or HP have dedicated server product lines. If ordered directly from manufacturer website, the buyer also has the option to customize the specification.

Purchase of rack mountable servers is strongly discouraged due to the loud noise they generate because of the low profile design which requires the use of smaller fans running at higher RPM. Mini-servers are also discouraged due to the lack of internal space for future upgrades. Tower servers are the best choice.

The Consultant recommends the HP ProLiant ML110 G7 which is an entry-level tower server. HP has the largest market share among small business or entry-level server and has a reputation for providing excellent support.

The base configuration for the HP ProLiant ML110 G7 as displayed below only comes with 2GB of memory and no hard drive.

Item	Unit cost
639259-005 HP ProLiant ML110 G7 LFF Hot-Plug Server - Smart Buy **Savings using Smart Buy - $348** HP ProLiant ML110 G7 Hot Plug Server Quad-Core Intel® Xeon® Processor E3-1220 (3.10GHz, 8MB, 80W) HP 2GB PC3-10600E 1x2GB 2Rank Memory HP Embedded 4 Port SATA Controller HP SATA DVD-RW Drive HP Embedded NC112i Gigabit Server Adapter 350W power supply Insight Control with iLO3 1-year limited warranty, parts, labor and Next Business Day on-site **This product is pre-configured.** **Additional options ship separately**	₽ $519.00

HP sells the ProLiant ML110 G7 for $519 on the their website[8] but the same server (at base configuration) is also sold by newegg.com for only $469.[9]

As discussed earlier, 8GB of memory is recommended so the 2GB the PC comes with is not sufficient. A 8GB Kingston DDR3 1333Mhz ECC-registered memory kit can be purchased at Amazon.com for $67.40 (search for B00506X8I0)[10]. Kingston memories have been tested to be compatible with the HP ProLiant ML110 and this particular kit comes with two 4GB memory sticks. Other brands of memory may be compatible too but verification with manufacturer is strongly recommended before purchasing.

Since the HP ProLiant ML110 G7 does not come with any hard drive, two 1TB Enterprise level SATA hard drives need to be purchased. The Western Digital RE4 is recommended and is sold by Amazon.com (search for B003SANWI6)[11] at a price of $134.85. As a reminder, two quantities need to be purchased for RAID 1 setup.

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[8]http://h10010.www1.hp.com/wwpc/us/en/sm/WF06b/15351-15351-241434-241646-3328424-5075942-5080828-5080829.html?dnr=1
[9] http://www.newegg.com/Product/Product.aspx?Item=N82E16859107006
[10] http://www.amazon.com/Kingston-ValueRAM-1333MHz-Desktop-Memory/dp/B00506X8I0/ref=sr_1_1?s=electronics&ie=UTF8&qid=1335032896&sr=1-1
[11] http://www.amazon.com/Western-Digital-Cache-Enterprise-Drive/dp/B003SANWI6/ref=sr_1_1?ie=UTF8&qid=1335056161&sr=8-1

Finally, the ML110 server specifically also require a HP tray bay for 3.5" SATA hard drive (HP item number 373211-001) to mount each hard drive. Amazon.com sells it for $17.97 each (search for B003FFF5RK).[12]

3. Decide on and prepare the server location

Two possible server locations have been discussed extensively with the client – the larger main office room and an individual office used by one of the staff. Neither of them is ideal but individual office is by a large margin the better choice. The main office room is frequently visited by non-staff members (e.g. people applying for food stamps) which would be too great of a security risk (e.g. some kid could accidently unplug the server).

The individual office on the other hand can be locked when he is not in the office mitigating the risk of any unauthorized physical access. Proper server cooling is a concern in particular as Just Harvest does not have any control over heating or air conditioning in the building. The server will be running 24/7 and thus will require the ambient room temperature to be kept cool enough even during non-office hour for a person to be comfortable. Based on interviews with staff member, the office will not become excessively hot but contingency plan should be made if temperature should become a problem. Perhaps the easiest way is to install a room air conditioner.

4. Backup all data

It is highly recommend before setting up the new server to run the complete backup process Just Harvest has already implemented as a safeguard against data loss caused by any unexpected issues during the implementation process.

5. Setting up the new server and migrating it into the current network

Windows Small Business Server Essentials needs to be installed and configured on the server PC. While it is designed to be easily configurable as mentioned earlier, significant time investment is nevertheless required. The consultant recommends planning at least 10 hours for installation, configuration and any trouble shooting that may be required.

It is highly recommend scheduling the installation during the weekends to avoid disrupting regular business operation.

Per discussion with the client, the client also has the ability to bring in an outside consultant the client has worked with before to implement the server.

6. Setting up users account and role-based access control

Windows Small Business Server Essentials allows through Microsoft's Active Directory system to centrally manage access control and security policy for the entire network. Under such a system, each user (which includes staff member, interns and volunteers) has their own account on the network. When using any PC on the network, he/she will need to login with his/her username and password.

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[12] http://www.amazon.com/gp/product/B003FFF5RK/ref=cm_cr_asin_lnk

However with Active Directory, the user's account is no longer tied to a computer as it is currently at Just Harvest. He/she can login from any computer in the network and the computer will then authenticate with the server and apply the respective security policy including access control policy.

In terms of access control, an important concept in information security is "least privileges":

"Every program and every user of the system should operate using the least set of privileges necessary to complete the job. Primarily, this principle limits the damage that can result from an accident or error. It also reduces the number of potential interactions among privileged programs to the minimum for correct operation, so that unintentional, unwanted, or improper uses of privilege are less likely to occur."[13]

Based on this concept, Just Harvest should divide all potential users into exactly ONE of the four groups according to their role. The exact design including appropriate security policies has been retracted from this version of the report due to security concerns.

7. Install Antivirus software

Like with all client PCs, the server would also need am antivirus software installed. Just Harvest currently uses Norton 360, Symantec's consumer level antivirus software for all PCs. Norton 360 is not compatible for the server operating systems.

Symantec Endpoint Protection Small Business Edition, an enterprise level antivirus software, is recommended for the following reasons (in addition to Symantec's long reputation as one of the top antivirus software maker):

- The small memory usage footprint compared to consumer level antivirus software
- Ability to manage the antivirus software on all PCs on the network centrally

The software can be purchased with a 1 year license at techsoup.org for $4 at non-profit pricing.

Furthermore, the Consultant strongly recommends Just Harvest to switch from the current Norton 360 to Symantec Endpoint Protection Small Business Edition for all PCs when the Norton 360 licenses expire. Not only is it $4 cheaper (at Techsoup.com pricing), but also provides the two important advantages outlined above which consumer level antivirus software do not have.

8. Implement daily backup process to a secondary location

The RAID setup only prevents data loss and disruption to business operation due to hard drive failure but it does not safeguard against the possibility of intentional or unintentional deletion, and the destruction of the entire server (e.g. fire, flooding etc.). For this reason, it is strongly recommended that Just Harvest also has a backup copy of the documents and databases at a secondary location (in case Just Harvest's office is damaged). This can be done in two ways:

Recommended:

A Network-Attached Storage (NAS) server can be placed at the Co-director's home which will be the secondary location. A NAS server is similar to an external hard drive except that it can be connected to a network (rather than directly to a PC through USB). Modern NAS servers have large number of features including the ability to be accessible through the internet. A highly rated NAS server that is

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[13] Sean Barnum, Least Privilege, https://buildsecurityin.us-cert.gov/bsi/articles/knowledge/principles/351-BSI.html

internet accessible through VPN and comes with built-in firewall (for security protection) is the Synology Disk Station DS110j. Newegg.com sells it for $149.99.[14] Some NAS already comes with a hard drive and some don't. The Synology Disk Station DS110j does not come with a hard drive but the current hard drive used by Just Harvest for manual backup process can be inserted into the NAS server.

The next step is to configure the server to automatically backup documents remotely to the NAS server. Windows Server Small Business Essentials comes with built-in backup feature that allows automated (scheduled) incremental backup similar to the short-term backup solution using SyncBack we have already implemented. Just like how it is right now, daily backup process should be scheduled outside office hour when the internet bandwidth is not used.

Alternative:

The alternative is to purchase a second external hard drive (at a cost of about $100). Toward the end of the business day, a staff member has to manually connect the external hard drive to the server and initiate the backup process. Ken Regal, the co-director then takes the hard drive home. One of the two hard drives is bought into the office for backup at alternative days so at least one hard drive or copy of the backup is always at a secondary location (Ken's home).

This is easier to implement but require human interaction which increases the risk of error in the process (e.g. not being able to keep up with backing up on a daily basis).

Online backup solution such as Mozy has been considered but not recommended due to the following reasons:

- Monthly service fee in the long-term will be more expensive than the one time cost of setting up own backup system.
- Reliability is questionable as a number of cases have shown that law enforcement agencies can shutdown online storage services causing significant collateral damage to legitimate users
  - Megaupload.com shutdown for hosting pirated content where many users lost critical backups even through only a minority of the content hosted are copyright infringing)[15]
  - Hundreds of servers from a data center were seized putting around 50 companies out of business because one of the data center's customer is suspected of fraud[16]
- Privacy concern as you are essentially handing over confidential information to a third party

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[14] http://www.newegg.com/Product/Product.aspx?Item=N82E16822108042
[15] Based on my work in the Anti-Piracy industry with extensive experience in the sharehosting area
[16] Kim Zetter, Company Caught in Texas Data Center Raid Loses Suit Against FBI, http://www.wired.com/threatlevel/2009/04/company-caught/

Appendix (2)

Please note that for security reasons, the exact folder names have been removed. Knowing where documents are located makes the organization more vulnerable to many types of attacks.