Demystifying IT:

A Framework for Shared Understanding between Archivists and IT Professionals

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OCLC

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FOREWORD

In 2012, OCLC Research published the first report in our Demystifying Born Digital series, *You've Got to Walk Before You Can Run: First Steps for Managing Born Digital Content Received on Physical Media*,[*] which proved influential across the archival community as a very brief approach to preparing for an institutional program to manage born-digital archival materials. From the feedback we received, we learned that our instinct to provide some basic guidance in this complex area was greatly valued by our professional community. We then published several other reports to help archivists move ahead with born-digital management.

In the years since that report was published, digital archivists have expressed a need for guidance in many other areas, one of which is to gain a better understanding of how to work successfully with colleagues in information technology. The two professions have a deep need for collaboration but have different work cultures and take different approaches to work tasks such as project management.

Most recently, *The Archival Advantage: Integrating Archival Expertise into Management of Born-digital Library Materials* (2015),[†] explicated ten areas of archival expertise as they pertain to the digital realm. Its intended audience was library staff—including information technologists—who are responsible for digital library systems and content, and who might find value in base-level understanding of archivists' core skills and knowledge.

This present report is intended as its reciprocal: a brief introduction to IT, intended to help digital archivists understand the priorities, techniques and culture of information technology so that they can be the most effective collaborators possible.

We hope readers will find it useful.

Jackie Dooley
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[*] Demystifying Born Digital series: http://www.oclc.org/research/publications/library/born-digital-reports.html. Erway, Ricky. 2012. *You've Got to Walk Before You Can Run: First Steps for Managing Born-Digital Content Received on Physical Media*. Dublin, Ohio: OCLC Research. http://www.oclc.org/research/publications /library/2012/2012-06.pdf.

[†] Dooley, Jackie. 2015. *The Archival Advantage: Integrating Archival Expertise into Management of Born-digital Library Materials*. Dublin, Ohio: OCLC Research. http://www.oclc.org/content/dam/research/publications /2015/oclcresearch-archival-advantage-2015.pdf.

ACKNOWLEDGMENTS

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EXECUTIVE SUMMARY

Today's digital archivist needs tools and platforms to ingest, manage and provide access to electronic records and digital content of all types. The complexity of digital systems makes the participation of information technology (IT) professionals essential. Archivists have sophisticated domain knowledge, while IT staff have advanced technology skills. As in other areas of human endeavor, working together effectively requires a desire to understand each other's expertise, priorities and constraints. It requires developing a *culture of collaboration*.

This report describes types of IT providers and the services they typically offer, offers insights on the software development process, provides guidance toward building partnerships and emphasizes the centrality of resource constraints. Many of the issues described are relevant to librarians and archivists who work with IT colleagues on issues other than born-digital management.

Key takeaways, some of which may seem obvious, but which nevertheless can stop effective collaboration in its tracks if clients do not take them to heart:

- Regardless of the number of IT staff, they must always prioritize core functions (e.g., workstation and server maintenance, internet connectivity, email) that serve the entire organization over specialized services and projects.

- IT resources are never limitless. You will always have rivals for time and attention. Be prepared to negotiate rather than demand.

- IT staff must equate time with money, which often means utilizing formalized approaches to project management to develop timelines and guard against "scope creep."

- All parties should clarify terminology and intended meaning to guard against misunderstanding and be prepared to explain themselves clearly.

- Clients are more likely to be respected and valued by IT colleagues if they follow designated procedures (such as use of a ticketing system) and utilize documentation before seeking help.

- The ability of IT units to acquire new hardware, software or storage space for their clients on short notice is often constrained by an annual budget cycle.

- IT must always be involved from the outset when acquisition of any product or service from an external provider—including open-source software—is under consideration. They will be asked to support it in future.

This report is a companion to *The Archival Advantage: Integrating Archival Expertise into Management of Born-digital Library Materials*, which describes ten core areas of archival expertise to help library directors, managers, IT professionals and other colleagues become aware of the benefits of incorporating archival knowledge into many aspects of digital library development and implementation.[*]

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[*] Dooley, Jackie. 2015. *The Archival Advantage: Integrating Archival Expertise into Management of Born-digital Library Materials*. Dublin, Ohio: OCLC Research. http://www.oclc.org/research/publications/2015/oclcresearch -archival-advantage-2015.html.

INTRODUCTION

Today's archivists need sophisticated tools and platforms to ingest, manage and provide access to born-digital archival materials and digital content of all types. They have used digital technologies for decades (such as the MARC format in the early 1980s), yet have not necessarily required assistance from information technology (IT) professionals. But the ground has shifted dramatically in recent years: archives exist within a complex technological infrastructure that is increasingly dependent on distinctive IT skills such as managing hardware, developing software, contracting with external vendors, supporting open-source software and implementing security measures.

Archivists already have substantial familiarity with archives-related technologies; gaining familiarity with the work culture of IT professionals would take this understanding to a deeper level. Further, understanding the range and depth of expertise held by IT experts is key to making the best use of their services. The digital imperative calls for building a culture of collaboration.[1]

This report's objective is to help archivists work effectively with IT professionals by describing types of providers and their typical services; providing insights on the resource constraints under which they work; articulating the software development process; and offering guidance for effective collaboration. We were motivated to write it after conversations with fellow archivists suggested that a primer about the culture of IT professionals would be helpful.

> Archivists should see their IT colleagues as essential consultants and service providers and learn how to articulate the archives' needs clearly and effectively.

Faced with navigating differences in organizational culture and practice, some archivists may wonder whether going it alone would be easier—a course that we contend would be misguided. Archivists should see their IT colleagues as essential consultants and service providers and learn how to articulate the archives' needs clearly and effectively. Learning to work together effectively requires effort on both sides, as well as a shared interest in understanding each other's sophisticated milieus.

Understanding goes both ways, of course. Archivists may find the culture of IT unusual, but archival methods and theory may seem just as mysterious to IT professionals. Collaboration is an opportunity for both IT and archives to learn one another's ways to their mutual benefit.[2]

An archivist's collaboration with IT professionals can take many forms:

- Implementing and maintaining digital workstations and servers

- Supporting systems, tools and services

- Creating or enhancing new features for existing applications

- Developing new software in-house and/or adopting external open-source software

- Contracting with external service providers

- Building a digital preservation environment

- Setting in place data security and disaster recovery policies and procedures

This report is organized in the following four sections.

IT Service Provider Models describes three common organizational structures:

  i. *Small shops*, in which IT responsibilities fall to a single individual or a small group
  ii. *Departments*, in which a management structure coordinates staff who support IT functions
  iii. *External service providers*, who sell products and services that organizations either cannot or choose not to provide internally

The section describes each model, the services usually provided and how staff maintains quality of service.

Building Partnerships describes three project roles:

  i. Client (you, the archivist)
  ii. IT professionals
  iii. Project manager

The section looks at how these roles intersect and how their interaction can lead to common understanding and good working relationships.

Resource Management describes the limits that both archivists and IT professionals face for funding, infrastructure and staffing, and how finding the right balance within those limits may offer the best chance of achieving an optimal technology solution. This section also considers short-term funding options and the total cost of IT services.

Development and Support describes widely used models of software development (waterfall, agile and lean), the process of negotiating project requirements and good practices for archivists to help developers fix software problems.

IT Service Provider Models

Every organization's IT functions require a variety of skills and different levels of support. Although many functions are consistent across organizational types, each institution has its own needs and resource levels, and the mission of a parent organization determines the size and structure of its IT support. For example, a very small organization may have to rely on outside support even for core services.

This report divides IT organizational structures into three generic types: small shops, departments and external service providers.

SMALL SHOPS

Structure and Staffing

A small shop is characterized by a single individual or a small group providing support for all IT functions. Managing a wide variety of technologies and keeping everything running effectively requires a broad skill set. Success for a one-person shop depends on flexibility and a willingness to learn at least the basics of multiple systems and tools. If the small shop includes more than one person, each member may have separate areas of responsibility, but usually will be familiar enough with colleagues' responsibilities to perform minor tasks when necessary.

Consortial agreements and communities of support, such as the Online Archive of California,[3] can be an especially important resource for a small shop (including their "lone arranger" counterparts in archives). An active community of professional peers may be able to expand a small shop's potential by providing expertise and experience that its staff may not have the time or resources to develop on their own.

Development and Support

Many processes may be managed informally in a small shop, and this affects many aspects of client interaction. In addition, staff are inherently responsible for multiple systems and services; rarely can they be experts in every one of these.

As in any organizational structure, the burden is on you to convince IT professionals (and your managers) that your need is important, because they will be responsible for ongoing maintenance of any service. Maintenance costs—especially staff time—are an important consideration for any IT shop, but the relative impact of every added demand is greater in small shops. When existing core systems need attention, IT staff must give them top priority, and new projects may be the first to be put on hold.

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New services often require a learning curve for IT staff; even experienced professionals may need to expand their skills or master entirely new areas of technology, such as a programming language or a complicated application. A small IT staff may not be able to justify the time and effort required unless the new service would be truly central to the mission of the broader institution, not just the archives. Moreover, if only one IT person can acquire the new proficiency, the archives may no longer be able to provide the service if that person leaves.

Be open to compromise. An appropriate technology may be available that provides most of what you need and is already familiar to your IT staff. A few well-chosen concessions may make the difference in enabling your vision.

Documentation and Help

Small shops often rely on oral tradition and memory, by necessity, because they lack the capacity to create detailed documentation without compromising their principal responsibilities. If documentation exists, it may primarily follow the preferred style of those who write it. Limited resources necessitate that documentation supports the needs of the IT staff, including the technical information they need. This can make it challenging for clients to use.

Quality of Service

When small shops interact with clients, the quality of service may depend on the strength of personal relationships. Friendly relations among colleagues are always desirable, but here they are critical. Small shops feel every request acutely because fewer staff are available to handle the workload. Past interactions, both professional and personal, are likely to influence their responsiveness. Making an effort to establish good relationships will work to your advantage.

THE DEPARTMENTS

Structure and Staffing

A department is a formal organizational unit, and organizational needs determine the range of responsibilities of the IT professionals. Departments prefer to hire specialists rather than generalists for tasks such as systems administration, networking, application support and software development. The degree of redundancy within a role (i.e., how many IT staff have the same or similar responsibilities) depends on how much demand there is for that function across the organization. When new expertise is needed, a new hire may be made if financial resources permit. Frequently, however, the task will be assigned to the staff member with the closest matching skill set. In larger institutions, a department may also have the option of reaching out to colleagues in an IT department elsewhere in the organization. Some institutions have an IT Account Manager who acts as a liaison between IT and other units.

Development and Support

Many services are similar to those offered by a small shop, but departments usually have the resources to provide more consistent support. A wider range of options in hardware, software applications and storage for digital content may also be possible. For example, while a small shop may only be able to provide full support for the Microsoft Windows operating system, a department may be able to support OS X or Linux as well. Departments may also be able to assign staff to teach clients how to use supported software as effectively as possible.

IT support inherently includes maintenance for office workstations, core infrastructure (such as internet connectivity and file storage) and enterprise systems such as email. Maintaining these basic services always has the highest priority, and even the largest IT department must prioritize requests for implementation of new software or services. Some departments may not be able to support software development at all, though most will try to find a way to fulfill a clearly expressed need.

When approaching your IT department in such a situation, their response is likely to follow a relatively formal process. While small shops may be more informal, a larger group must rely on more formal policies and procedures to ensure consistent service over time. Requests for assistance are usually directed to staff who are charged with setting priorities. One staff member may act as a primary

contact, working with you to clarify details and develop a formal plan before the work is assigned to the most appropriate person. The degree to which you will be integrated into (or insulated from) that plan will vary based on the culture of the department and its parent organization.

Many departments use a ticketing (or issue tracking) system that allows clients to submit requests via email or an online form. Soliciting the same pieces of information for every request helps ensure that each client interaction is documented consistently despite inevitable staff turnover. The ticketing system may automatically route a request to the person best suited for dealing with your problem, or it may be added to a central queue so the next available member of the support team can respond as quickly as possible. Some ticketing systems can consolidate a complete record of a service request, including email correspondence, screen shots and other relevant documentation. If the issue recurs, this record serves as a resource and can lead to quick resolution.

Documentation and Help

Despite having more staff than a small shop, some departments have limited time for creating formal documentation. As units within larger organizations, however, they have added incentives to provide it, being subject to institutional standards.

When it exists, help documentation can be used to address the most common problems and questions without requiring IT staff to intervene, thereby preserving valuable staff time for more complex tasks.

Quality of Service

Quality of service is another area influenced more by organizational culture than by individual interactions, although strong individual relationships can sometimes cut through red tape.

All parties should clarify expectations at the outset to ensure mutual accountability and to set a baseline for the work. This is sometimes done via a Service Level Agreement (SLA), especially if the service is new. An SLA usually includes a description of the service, the appropriate channels to use for communication, the expected service uptime (i.e., the minimum number of hours per week/month/year a service is guaranteed to be available), and the expected response time when issues surface.

Quality of service is another area influenced more by organizational culture than by individual interactions, although strong individual relationships can sometimes cut through red tape.

Staff time is expensive—especially after normal working hours—and every department must control this cost carefully. Determine which of your archival services are truly critical to your mission; if you anticipate requesting 24-7 support, this can strengthen your case—or you may realize that it is not actually warranted.

Most IT departments have a structure in place for mediating conflicts, and you may want to familiarize yourself with the process at the outset. Doing so will ensure you understand how and when to request mediation. It may give you some insight into what the IT department needs and expects from its clients. The process may be time consuming, and achieving a desired result may not be easy, but reaching a mutually acceptable outcome is essential.

THE EXTERNAL SERVICE PROVIDERS

Structure and Staffing

Some organizations outsource IT functions to external service providers who have the infrastructure and staff expertise necessary to support a specified set of functions that cannot be provided in-house. Their services may include specialized archival systems, web hosting, systems administration, software development, desktop support and more. Providers typically charge fees based on developer time, service usage and the length of the contract.

When shopping for a service provider, be very specific about the services needed to ensure they match those offered. For example, do you need a hosted application, or would less costly support for running it on your in-house server be adequate? In some cases, an external contract or license with a software vendor may be required before an application can be used via a third-party provider.[4]

The decision to consider using an external provider cannot lie with you alone. Your organization's IT professionals must have a part in any agreement so they can confirm that the service cannot be provided in-house. They must also ensure that any agreement observes established practices and that it clearly defines areas of responsibility between the provider and in-house staff.

Development and Support

Many commercial providers offer tiers of service that are based on a client's volume of demand, the services desired or a combination of both. External providers typically require a formal contract before providing services. Developing a new feature for an existing service usually requires a supplemental contract. Some providers take the initiative to conduct customer surveys to identify opportunities for additional products or services.

When collaboration with an external provider has been especially successful, a client institution may opt to share ideas for future service needs. This gives the provider an overall picture of what the institution is planning, which may suggest opportunities for cost savings or sharing services across multiple units.

A provider is free to offer any service developed for a particular client to its other clients. You should not assume that you have exclusive access to a new feature, even if your institution paid to develop it.

Documentation and Help

Most external providers document their systems thoroughly and have good client resources. They may also have more robust help options than in-house IT groups can offer. These may include discussion forums, text-based "chat" or real-time webinars in addition to email and telephone.

Self-help documentation and tutorials generally are provided at no cost, as are asynchronous means of communicating with the provider's support team. Discussion forums allow users to post questions and receive guidance. Some forums allow the user to attach supporting materials such as screen captures or text files to help explain the situation. Responses may come from the provider or from experienced community members. A major advantage of discussion forums is the possibility that a question may have already been asked and answered by other contributors. A search of the discussion board may result in an immediate solution.

Some providers host a wiki to give clients all the benefits of a discussion forum while being easier to navigate for solutions to common problems. Members of the user community can edit and update the wiki to keep it current with the latest features and upgrades. The wiki may include illustrated guides and video tutorials that walk the user through common tasks and provide examples of features and tips.

Synchronous communication options may include a phone line or online webinars. Face-to-face training is no longer the norm: online technologies that provide live instruction to multiple clients simultaneously have become common. For individual support, a videoconference session may allow the trainer to see your desktop ("share the screen") while you perform various functions, allowing her to provide direct guidance.

Response time can vary depending on your contractual agreement and the provider's volume of competing requests. Live forms of communication enable the quickest response but can be quite expensive, especially outside normal business hours. Give serious thought to your actual support needs; this may save significant costs.

Quality of Service

A provider's quality of service is heavily dependent on its corporate culture. Many emphasize customer support above all else, but some do not. Evaluate the customer support services, perhaps by talking to other clients, before signing any agreement.

Building Partnerships

A strong and lasting partnership between archivists and IT professionals should begin from the first interaction, and good preparation will get things off on the right footing. It helps to have some understanding of what IT professionals typically expect from their clients and to be aware of pitfalls that can hinder working relationships. Based on experience, your colleagues in IT may assume that clients will not be adequately prepared. Taking the time to plan is enormously advantageous.

In any case, the more your IT needs are aligned with the overall goals and priorities of your parent institution, the easier it will be for your colleagues to move the archives toward the front of their work queue.

Effective collaboration begins with people who are committed to working well together. Familiarity helps, and one way to get an early start on that is to learn about projects your new colleagues have worked on before. This may give you insight into their work practices and offer additional insights toward viewing them as fellow professionals with an interest in making your collaboration a success. The sooner a team's members interact in a spirit of ease and confidence, the sooner they will be able to put that positive attitude to work on the problem at hand. There is much to be said for building genuine rapport.

IT resources always have limits, and priorities are often set at the institutional level. The archives will have many rivals for IT resources, and even if you make every effort to become your IT colleagues' favorite client, you cannot expect your priorities always to come first. Much will also depend on where IT staff are located administratively. For example, those responsible for an entire large organization are not likely to be as responsive as a group serving only the needs of the library and/or archives. IT staff responsible to an entire university community may have to adopt practices more like those of an external service provider than an in-house department. In any case, the more your IT needs are aligned with the overall goals and priorities of your parent institution, the easier it will be for your colleagues to move the archives toward the front of their work queue.

ROLES AND RESPONSIBILITIES

Successful collaboration depends on each party having a clear understanding of roles and specific responsibilities. The roles appropriate for a given IT service vary, but for significant projects they

include the client (you), an IT professional and, in some cases, a software developer and a project manager. Defining these roles and their specific responsibilities should be one of the first things you discuss and agree on.

The *client* (you, the archivist) is the caretaker of the vision. You will be called on to judge whether a service and its support are acceptable or whether a project has successfully achieved its objectives. (Note that this does not guarantee you the authority to change anything if you are dissatisfied.) Only you can determine if the chosen solutions conform to archival standards and practices. Articulate as clear a vision as possible at the outset, and define the requirements for a successful outcome as concisely and measurably as possible. In the end, you must be able to confirm that you understand how to use the new service or tool, that the documentation provided for it is clear, and that the demands it places on you will be reasonable over time.

IT professionals are experts in the technologies they support, but the standards and practices of the archival profession are likely to be outside their experience. You may need to help your colleagues acquire at least a basic understanding of archival methods and terminology.

The *IT professional* provides expertise and when presented with a problem, offers possible solutions, including an assessment of relative merits and drawbacks. Their goal is to find an effective and efficient solution—preferably one with reasonable implementation and long-term maintenance costs. IT professionals who are part of an in-house department are likely to have a good understanding of the institution's infrastructure and how the new technology will fit within it. Some projects may demand that IT staff spend time researching new standards or practices before they can identify milestones that will indicate success. Legal or regulatory restrictions may apply if sensitive data or intellectual property is involved, and your IT colleague may depend on you to help find ways to comply with relevant local, state or federal regulations. Give special consideration to accessibility and privacy concerns.

The *software developer* is an IT professional who takes on a role that is part architect and part builder for projects that involve creating a new tool or feature. Just as a traditional architect needs a clear vision and an understanding of the limits of building materials to design a structure, a good software developer presses for concrete design objectives and use of the most appropriate development tools for meeting those objectives. Decisions about the best programming languages and development methods to fit your project's needs should be the developer's responsibility. The developer then writes the code and debugs it (i.e., identifies and remedies errors in the code).

The *project manager* tracks progress, ensures that resources are used effectively, and keeps the project on budget and on schedule. This includes maintaining project documentation, timelines and task lists. The manager should help IT staff members set project milestones and identify potential setbacks as early as possible. If circumstances surrounding a project change, the manager will make any necessary

changes to the project's timeline, resources or objectives. A project team may not include someone with the title project manager, but the responsibilities of this role are crucial to success. They may be split between the team members, or you may be tapped to take them on yourself.

Each of these roles does not necessarily belong to a single individual. One role may be shared by many people (especially in a large IT department or development team), or multiple roles may converge in one individual who relies on colleagues to compensate for any gaps in expertise. The size and organization of the team varies according to the complexity of the service or project. Bigger is not always better, and a small team with minimal management overhead can produce excellent results.

REACHING A COMMON UNDERSTANDING

Establishing a successful working relationship requires some self-education. You don't need to be a programmer or developer to master the basic concepts of the technology relevant to your project. Your goal should be to gain a general understanding.

This begins by sharing terminology. Do not pretend to be familiar with a term or concept when it is new or unclear: ask for clarification. Experienced IT professionals understand that progression along a learning curve takes time, and you will gain credibility by making a sincere effort. Establishing a solid working relationship in this way will help you to communicate the archives' business needs.

Creating a project glossary is an excellent way to master new terms and concepts. Keep a short and simple list of unfamiliar terms as you review background materials and look up definitions and descriptions. Wikipedia can be a useful starting point. Take time after every meeting with IT colleagues to add new words to your glossary or to revise existing definitions.

Share your glossary so your IT colleagues can offer helpful corrections and explain concepts with which you may be struggling. Do not be surprised if your glossary becomes a reference for everyone on the team. Reciprocally, IT staff may be struggling to understand archival vocabulary and practices. Be prepared to provide explanations, and encourage your colleagues to ask for clarification when they encounter an unfamiliar archival term. It may sometimes be useful to direct them to specific terms in the *Glossary of Archival and Records Terminology* so that all can use the same definitions.[5] Sharing a common language will help you communicate the archives' needs.

Consider offering a tour of the archives so your colleagues will have a sense of its physical space, become familiar with existing digital tools and gain a basic understanding of your daily activities. In turn, they may offer you a tour of their offices and the data center where your digital resources are maintained.

Neutral Terminology

Some terms have multiple meanings, including "archive" (in both its verb and noun forms), which means very different things to archivists and IT professionals. *The Open Archival Information System: A Reference Model* (OAIS) intentionally uses neutral terminology, and this makes it a powerful tool for establishing a common understanding when managing digital assets.[6] OAIS defines terminology for the functional areas of a repository (ingest, data management, archival storage, access and management), the tasks associated with these areas and three stakeholder groups (producers, management and consumers—collectively referred to as agents). Using OAIS terminology to explain your business needs, and encouraging IT colleagues to do the same, helps speed mutual understanding. In contrast, use of ambiguous terminology can derail a project by making it appear that consensus has been reached when, in fact, you and the IT professional understand a situation differently. Agreement in word usage is not the same as shared understanding of meaning. Differences in perspective may not surface until they begin to cause friction during the design phase, or worse, during implementation. All parties must try to provide clear and concise explanations of terms throughout.

Initial confusion can be an opportunity in disguise. For example, archivists and IT professionals are likely to have a different understanding of what constitutes "records management," yet the need to manage, preserve and dispose of records in at least some capacity is a concept that most recognize. Rather than making the initial difference a matter of debate, treat it as a helpful starting point for reaching shared understanding.

Describing the Request

Try to use terms your IT colleagues understand when you request new or expanded services and tools. The better you express yourself using IT concepts, the easier it will be for them to offer potential solutions. Your sincere effort will also encourage them to listen closely and clarify their own meanings.

Define your need as clearly and specifically as possible. You may be able to find examples of how other archivists have described similar needs. Are there relevant case studies in blog posts or conference presentations? If so, how did the authors deal with their situations? What technology options did they explore? If your IT staff has a preferred system for managing projects, try to frame your request to match it. You may not have permission to access their ticketing system directly, but ask whether descriptions of previous requests are available and use them as a model for explaining your own.

Be prepared to explain the archival rationale behind a requirement so that the IT professional understands why it is not arbitrary or frivolous, especially if the requirement runs against existing IT practice. Good IT professionals ask clarifying questions and restate concepts in their own terms to make sure they understand. You can do the same by rephrasing technical explanations that are not clear. "This is what I heard. Is that what you mean?"

Visuals often help. Many IT professionals sketch out system components or workflows to understand better how various pieces work together. Keep a record of all substantive discussions. A whiteboard is handy when brainstorming, and taking a photograph of it after brainstorming can preserve valuable ideas.

Resource Management

As always, being budget conscious is important when balancing your needs and expectations with available resources.

Resources for IT support break down into three categories: money, infrastructure (i.e., software, hardware and network capacity) and staff time.[7] The availability of each varies by institution. An archives might have adequate funding but only limited access to IT staff time. In that case, outsourcing a service may make the most sense because it leverages an available resource (money) while compensating for one that is lacking (staff time). Even if all three are available, one resource may be more important than the others. For example, an IT team may be well-supplied with all three but still prefer to outsource a need if it does not fit well with their other supported services and if an acceptable cost-effective alternative is available elsewhere.

A common saying in project management is that only two of the three basic needs can be met: good (meets every need), fast (can be completed quickly) and cheap (requires few resources).

This is especially true when developing or purchasing new systems. A common saying in project management is that only two of the three basic needs can be met: good (meets every need), fast (can be completed quickly) and cheap (requires few resources).[8] An expensive project that meets all requirements will probably require many hours of work. A project accomplished quickly and cheaply

will probably not meet all requirements or reach an appropriate level of quality. A project done well and quickly may require outsourcing or licensing of system components, which can become expensive. These options must be balanced carefully within the context of your organization.

Budgeting for IT projects can be an enormous challenge, and you may need to find new sources of funding to undertake a major project. Long-term funding is likely to require institutional support. It may be possible to "walk on" ongoing costs to the operations budget by making successively larger allocations from the usual budget request cycle until the full cost is covered. If you can avoid asking for a large initial allocation of funds and rely instead on incremental increases, your project may be much easier to approve.

Institutional support is not always feasible, however, and external sources of one-time or short-term funding must be identified. Options may include special-purpose endowments, donations and grants (usually for especially significant or innovative projects). Depending on the funder, grants may sometimes may be used for acquisition of external products.

BUY, ADOPT OR BUILD?

Three general options exist for obtaining a new service or tool:

- Buy a commercial product, either off the shelf or with slight modifications

- Adopt an open-source solution

- Build, either in-house or through an external provider

Some institutions are tempted to move directly to the third option, especially if they are fortunate enough to have a software developer available. You should consider each option carefully, however, before selecting a strategy. An excellent off-the-shelf commercial solution from an external provider may already exist, or an existing open-source framework might provide a powerful foundation to build on. For example, Drupal or Fedora can provide a generic repository platform and allow institutions to take advantage of development work being done elsewhere to tailor it to archival needs. Combining options in this way may enable resource limitations to be overcome.

IT staff should be involved in the decision-making process. Even if the archives pays for the initial cost of a commercial solution, support and maintenance will likely become a responsibility, and therefore a cost, for IT staff. Such long-term maintenance may include time-consuming tasks such as debugging code, installing software updates, purchasing hardware and responding to security threats. Your IT colleagues may also be able to find cost-saving options, such as re-using software that is already being licensed for other projects.

Buy

Using commercial software might be compared with dining at a restaurant: either the meal is already prepared, or it can be made to order efficiently. The option to buy a readymade product is especially attractive for an archives with limited IT support. A commercial product can provide a wide range of existing features, substantial technical support, and have gone through revisions and debugging that make it reliable.

Commercial solutions can, however, be expensive. The initial direct cost is acquisition, but this is not always a one-time purchase. Some software must be licensed on a time-limited basis—annually, quarterly or monthly—a recurring expense that your institution must maintain for as long as the application is used. A widely-used example is Archive-It,[9] a subscription service from the Internet Archive for capturing and providing access to web content. In addition to an annual fee, ongoing support costs may also be necessary for some software or for tailored services.

Just like dining out, from fast-food to five-star restaurants, quality and service vary widely among commercial providers. You will play a lead role in determining whether the software is appropriate for the archives. Be sure that the provider is one that will be responsive to your needs and that the product meets archival requirements. Any existing data must be fully exportable so that the archives can extract its data without alteration for the inevitable migration to successive software environments.

Even if a commercial application meets your technical requirements, the company offering it may not meet sustainability thresholds. Your IT colleagues can help you navigate questions such as these: Is the software widely used? Does it conform to best practices for the software industry? Is user documentation sufficient and easy to use? Is the company reputable and unlikely to have financial difficulties that might take the software off the market in the foreseeable future? What are the contract exit conditions and costs? Is the service-level agreement appropriate to your needs? Are customers satisfied?

Taking all the above into account, commercial software can have a strong cost/benefit ratio.

Adopt

A wide variety of high-quality open-source applications are available to perform essential archival functions, including managing born-digital materials;[10] several prominent examples include BitCurator,[11] Archivematica[12] and ArchivesSpace.[13] Open-source software can be examined, modified and used without incurring up-front licensing costs or signing contracts, while still offering some of the same time-saving benefits as commercial software. This makes open-source software appealing, but caveats apply. Significant staff time and expertise generally are required for installation and set-up, training and long-term maintenance. The open-source community sometimes works together to overcome shortcomings or missing features, but not always. Your in-house IT staff may have to build tools to compensate for missing functionalities and to adapt the software to your institution's IT infrastructure. Poor documentation can also be an issue. In theory, IT staff can make up for inadequate documentation by studying the open-source code, but in practice this is often a time-consuming task.

Some IT departments have a policy of not allowing open-source software to be installed on production hardware to avoid a variety of potential risks. In such cases, it may be possible to have resources set aside to provide a limited amount of IT support for internal development or experimentation.[14]

Build

Sometimes building an application from scratch truly is the best option if you have a specific functional need that cannot be met elsewhere. A custom application offers the *promise* of providing exactly what you need—though it could possibly fall short of your vision—and gives you the opportunity to meet archival needs from the outset.

However, a customized solution also carries risks. First, it is only as good as its developer. Second, development can take a long time and require many iterations. Third, even if you are fortunate enough to have access to an exceptional developer, when that person leaves your institution, it will take time and effort for a successor to be hired, master the application, and learn to provide support. You should do all you can to ensure that the initial developer creates excellent documentation, both user-oriented and technical.

If your application proves successful, you might consider sharing it with the broader archival community as open-source software. If it enjoys widespread acceptance, this could distribute the

burden of support, maintenance and ongoing development. Libraries and archives have embraced open-source tools precisely for this reason. A tool that becomes widely adopted and supported can have a long life.[15]

TOTAL COST OF OWNERSHIP

The cost of a digital product or service does not end with initial implementation. Ongoing costs are necessary to maintain the application, so think carefully about each tool or feature that you implement: will its long-term benefit warrant the cost of maintaining it? For example, a good software developer will try to find the most cost-effective way to implement each feature, but anticipating the total costs tends to be challenging. An IT professional usually makes a rough calculation based on known variables and prior experience. If your application is breaking new ground, however, comparison products may not exist.

Be particularly wary of systems that would require major investment in new hardware, including workstations, storage and network capacity. Higher levels of system usage impose new costs if the existing infrastructure is already near capacity. Adding hardware may require high up-front costs and lead time. Many institutions budget hardware for replacement on a periodic basis and off-cycle requests may be difficult to fulfill. Hardware maintenance costs can easily be higher than those for software, so it is especially important to determine real costs before making a final commitment.

One alternative to purchasing new hardware is to use a hosted solution in which an application resides on servers maintained and kept up-to-date by the software company that owns the application. This moves the cost of support to an external provider and may significantly reduce your costs in the short to medium term. It sometimes proves more expensive in the long term, however, depending on the hosting fees, which are likely to increase over time. There may also be a prohibitive cost for extracting your data when you inevitably want to migrate to a different system. This concern sometimes leads IT professionals to take the default position that a hosted solution is always costlier. A full assessment of development and ongoing maintenance costs may prove, however, that a hosted solution would be more cost-effective, especially if the host can leverage efficiency of operations, economies of scale and expertise to provide services less expensively than your institution can provide in-house.[16]

Archivists' desire to be good stewards of their collections sometimes provokes anxiety or frustration when sufficient resources are not available and compromises must be made. Do not let this prevent a project from moving forward. Compromise is a natural part of the IT world and should not be a reason for a needed service or project to be shelved or abandoned. Carefully analyze your requirements: Would a downsized version of the service still fulfill your needs while reducing costs? Might it be possible to begin by building a less fully featured tool and adding components over time? Such flexibility allows you to make the most of limited resources. Start with the most fundamental requirements and build capabilities as resources permit.[17]

Development and Support

Developing and supporting information technology takes a great deal of time and effort and thus requires careful planning. Planning is much easier when you negotiate priorities, understand the development process your IT professionals use and report back when challenges arise. Doing so makes projects more efficient, and all participants will be more satisfied with the experience than otherwise.

STARTING THE PROCESS

Like anyone juggling numerous responsibilities, IT professionals must prioritize assignments carefully to ensure that the organization's critical systems run smoothly and that multiple clients' needs are

fairly addressed. This can be frustrating when your project is deferred because another assignment has higher priority at that moment, but familiarity with IT practices can help you understand how and why they set priorities. This will help you both to become a more effective collaborator and to make the best use of your own time and energy.

Once your proposal arrives at the front of the priority list, you may find that working with IT colleagues seems like a game of tennis. You describe your need and vision; they respond with suggestions for how to achieve it; you ask which option they think might be best; and they respond; and so it goes, back and forth. Volleying ideas helps both parties better understand the project as you clarify, refine and improve your initial vision before software writing begins. Ideally, a trust-based relationship emerges that facilitates collaborative decision-making. This process may continue throughout the life of a project.

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To avoid possible misunderstandings, work together to prepare a complete set of specifications before actual development gets underway. This is a critical stage in the process during which your understanding of your own need will be analyzed in detail, giving you the opportunity to explain archival processes to your IT colleagues. Which features are mandatory? Which are only desirable? You and the developer should agree on the answers and develop a method for evaluating additional priorities. Adopt a ranking system that uses words (such as required, important and desirable), numbered values (such as 1 for low to 5 for high) or a similar approach.

Once software development has begun, you may be tempted to request new features. Exercise restraint! "Scope creep" can create hidden costs and may strain working relationships. A new feature may significantly improve the outcome, but usually at the expense of exhausting more resources. Consider whether a new feature helps to fulfill the original vision, complements the other features and follows good archival practices. If the new feature cannot meet these criteria, then the benefits are probably not worth the added costs.

THE WATERFALL, AGILE AND LEAN DEVELOPMENT PROCESSES

IT professionals commonly use iterative approaches to software development. If you are new to this area of activity, it is helpful to have a basic understanding of the most common methods.

Software developers have traditionally used the *waterfall* method, which uses a linear approach in which each step is completed before moving on to the next. A complete set of design requirements and specifications must be created before moving on to the design stage, the design must be complete before moving on to an acquisition phase, and so on. If any significant changes need to be made to the design goals or functionality, they must wait until a future development cycle after the current phase has been completed. One of the potential implications of this model is that clients are heavily involved in the initial planning stages but barely involved during active development other than for testing and implementation.

More recently, development teams have shifted to more responsive models, particularly *agile* software development. Agile includes the same stages as the traditional waterfall method (specification, design, implementation, etc.), but in much smaller iterations so that many cycles are

performed over the course of a project. This allows features to be tested immediately after the code has been written. If a feature is not working as intended, it is much easier to fix while the process is still underway. The mantra of "release early and often" can seem counterintuitive at first, and some administrators may balk at this approach out of concern that an early version could be perceived as substandard. Others, however, may be persuaded by the agile development model's potential for identifying a problem in time to correct it without a significant loss of effort and resources. This does come at a cost, however: agile development may require you, the client, to invest more time and effort in the process.

A third process, *lean*, emerged out of agile development. The main difference between the agile and lean approaches lies in the opportunities available to provide feedback about each release. In agile development, the developers share each iteration only with the client. With lean development, on the other hand, the team makes each iteration more widely available to solicit a wider audience for reactions and suggestions. The archival community's inclination toward openness and sharing may make lean development a desirable option.

The choice of development model is heavily dependent on your organization's internal IT culture. As a client, you'll need to adapt to the model that IT staff prefer. The descriptions provided above are intentionally brief, and many variations of these methods are in use. Ask the developers to describe their preferred development strategy so you will know what to expect.

REPORTING PROBLEMS AND GETTING HELP

Knowing how to report problems effectively is essential during the development of a new service or tool, but it is just as important for addressing problems that arise in your everyday use of IT resources. As noted earlier, your IT staff may provide multiple channels for reporting problems, and the advice below will make it easier for your colleagues to help you.

Before reporting a problem, check the available help documentation to determine whether your issue has already been addressed. IT staff are not always able to provide comprehensive help documentation, but they may have documented the most common problems. The solutions provided might be brief (often under the banner of an FAQ (frequently asked questions)) or lengthy.

Some users skip this step and move directly to consulting colleagues or experimenting on their own, but this is inefficient, puts an undue burden on IT staff time and fails to show appreciation of their efforts. Show the IT staff that you tried to find a solution using the tools they have provided; this will help build a positive relationship and may also allow them to get a head start on diagnosing the problem.

You can play a valuable part in the problem-solving process by providing as detailed and accurate a report as possible:

- Provide a complete description of the problem. Developers cannot respond effectively based on a vague statement such as "login is broken" or "pages are not loading correctly" or "the display looks strange." Details and context matter. Try to provide both.

- Report the *full text* of any error messages, including any numbers or codes. The more obscure a string of numbers and letters may seem, the more important it probably is.

- Some other details to include:

    o When did the problem first occur? Specify the date or even the exact hour if you possibly can.

- o Precisely what were you doing when the problem occurred? Does it occur every time a feature is used? Are you able to replicate it? Can you detect a pattern or a common factor?

- o Does the problem affect every feature of the application or only selected ones?

- o Include details about your workstation, such as the operating system (e.g., Windows 10 or OS X), which browser you were using (e.g., Firefox or Chrome) and the version of the software.

- o When possible, provide a screen shot from the moment when the problem occurred to demonstrate what happened.

- o If you have reported this problem before, try to find the tracking number from that incident and include it in your report.

Why is so much detail necessary? Debugging software can be a complex process, and the cause of a problem may not be immediately apparent. A bug may be a consequence of an entirely hidden problem buried somewhere else in the application. The developer may need to consult system logs and work back through the code to determine the origin of the problem.

Always submit problem reports using established procedures. If you and the developer have been corresponding directly, a simple email message may be appropriate. If, however, an issue tracking or ticketing system exists, use it. Such a system can build a complete record of client reports and steps taken in response, from the first occurrence of a problem to its eventual solution. This may help IT staff save time by determining whether the problem has been addressed earlier. Tracking systems can also help ensure that all relevant IT staff are aware of the issue as soon as possible.

Follow the rules of civil human behavior: never lose your temper or become impatient. IT staff probably did not cause the problem, and they will be intent on solving it. Technical problems are inherently frustrating, and your IT colleagues understand this better than most people. Despite the inconvenience, use the problem-solving process as an opportunity to build on your working relationship. Once they have found a solution, go out of your way to say thank you.

CONCLUSION

The use of information technology is key to the success of today's archives. Archivists have been mastering technology to support aspects of management, discovery and access to our materials for decades, but both archival management systems and born-digital materials require more intensive applications of technology throughout all phases, from appraisal through processing, and from preservation to end-user access.

Archivists' technical expertise continues to grow, but if we are to address challenges effectively and efficiently, we must embrace the enormous advantages of collaboration with our information technology colleagues. To achieve this, we should make the effort to understand their professional environment, become conversant with their terminology and methods (while helping them to become familiar with ours), and learn to be valued clients with whom they will welcome working again and again.

NOTES

1. Two earlier articles address some aspects of this need: Conrad, Mark, Jean M. Deken, Bob Horton, Richard Marciano, Glen McAninch, Reagan Moore, Shawn Rounds, Pari Swift and Caryn Wojcik. 2005. "PAT Project Lessons Learned: Archivists' Perspectives." *Archival Outlook* Nov/Dec 2005: 10-11, 23. http://files.archivists.org/periodicals/Archival-Outlook/Back-Issues/2005-6-AO.pdf; Lawrimore, Erin. 2013. "Collaboration for a 21st Century Archives: Connecting University Archives with the Library's Information Technology Professionals." *Collaborative Librarianship.* 5 (3): 189-196. https://libres.uncg.edu/ir/uncg/f/E_Lawrimore_Collaboration_2013.pdf.

2. The following report explicates ten areas of archival expertise to assist archivists in communicating their needs to internal colleagues, including IT staff: Dooley, Jackie. 2015. *The Archival Advantage: Integrating Archival Expertise into Management of Born-digital Library Materials.* Dublin, Ohio: OCLC Research. http://www.oclc.org/research/publications/2015/oclcresearch-archival-advantage-2015.html.

3. Online Archive of California: http://www.oac.cdlib.org/.

4. The Society of American Archivists offers a workshop on developing contract specifications and RFPs that is offered periodically. See, "Developing Specifications and RFPs." In Course Catalog. Accessed 9 March 2017. http://www2.archivists.org/prof-education/course-catalog/developing -specifications-and-rfps.

5. Pearce-Moses, Richard. 2005. *A Glossary of Archival and Records Terminology.* Chicago: Society of American Archivists. http://files.archivists.org/pubs/free/SAA-Glossary-2005.pdf.

6. For two introductions to the model and its use, see, Ockerbloom, John Mark. 2008. "What Repositories Do: The OAIS Model." *Everybody's Libraries* (blog). Posted 13 October. https://everybodyslibraries.com/2008/10/13/what-repositories-do-the-oais-model; Lavoie, Brian F. 2014. *The Open Archival Information System Reference Model: Introductory Guide, (2nd edition).* DPC Technology Watch Series. [Heslington, York, United Kingdom]: Digital Preservation Coalition. doi:10.7207/twr14-02.

7. An experienced IT professional is likely to be efficient, which makes her work hours more productive and valuable than those of a less experienced colleague. Hence, the amount of available staff time depends in part on the level of expertise.

8. Wikipedia. s.v. "Project Management Triangle." Last modified 25 December 2016. https://en.wikipedia.org/wiki/Project_management_triangle.

9. Archive-It. Accessed 9 March 2017. https://archive-it.org.

10. Many such tools that may not be familiar to your IT colleagues are described in Barrera-Gomez, Julianna and Ricky Erway. 2013. *Walk This Way: Detailed Steps for Transferring Born-Digital Content from Media You Can Read In-house.* Dublin, Ohio: OCLC Research. http://www.oclc.org/research/publications/library/2012/2012-06.pdf.

11. Bitcurator. Accessed 10 March 2017. http://www.bitcurator.net.

12. Archivematica. Accessed 10 March 2017. http://www.archivematica.org.

13. ArchivesSpace. Accessed 10 March 2017. http://www.archivesspace.org.

14. Owens, Trevor. 2013. "When Is Open Source Software the Right Choice for Cultural Heritage Organizations? An Interview with Peter Murray." *The Signal* (blog). Posted 18 January. http://blogs.loc.gov/digitalpreservation/2013/01/when-is-open-source-software-the-right-choice-for-cultural-heritage-organizations-an-interview-with-peter-murray.

15. An example is the File Identification Toolset (FITS) from Harvard University, accessed 9 March 2017, http://fitstool.org.

16. A somewhat related option is to use the "cloud," which typically refers to using third-party servers for file storage only.

17. Two useful resources for planning projects to manage born-digital materials: NDSA (National Digital Stewardship Alliance). "Levels of Digital Preservation." Accessed 10 March, 2017. http://ndsa.org/activities/levels-of-digital-preservation/; Dollar, Charles and Lori Ashley. 2014. *Assessing Digital Preservation Capability Using a Maturity Model Process Improvement Approach.* White paper. https://static1.squarespace.com/static/52ebbb45e4b06f07f8bb62bd/t/53559340e4b058b6b2212d98/1398117184845/DPCMM+White+Paper_Revised+April+2014.pdf.