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Software as a Service and Cloud Based Applications

Report of a CNI Executive Roundtable
Held March 31, 2014; Published December 4, 2014

Landscape and Synthesis

Many universities have moved a variety of institution wide systems such as email (possibly only for students), office applications (word processing, spreadsheets, etc.), learning management systems (LMS), and even enterprise resource planning (ERP) platforms to network-hosted services. There are many other niche network-based applications widely used by the higher education community for scheduling, sharing documents, administering surveys, etc. (examples would include Doodle, Survey Monkey, and Dropbox); often these have simply been adopted on a grass roots basis with little policy consideration. As more libraries and computing centers plan for research data management storage requirements, cloud storage is a prominent option.

In the past two years, we have seen a major shift in how some of the largest companies in the software industry are offering their products to the higher education community (and more broadly). Specifically, a number of companies have moved aggressively to encourage customers to shift away from software locally installed on the desktop to network-based software offerings (Microsoft, with Office 365, for example); in other instances, they are providing no choice other than licensing their network-based software, often referred to as "software as a service" (Adobe is a leading example here). While the availability of software as a service via the network is not new, the vendor pressure is becoming intense in some sectors, as are, perhaps, economic incentives to convert to network-hosted software. We are also seeing network-hosted offerings of both commercial and community source LMSs (to cite just one example) being more widely adopted.

These developments bring up numerous institutional concerns, including losing the ability to control back compatibility, software stability and release validation and management, data preservation and continuity of access over time, as well as risk assessment and disaster and recovery planning. Many of these issues are not new, but they take on new dimensions in a transition to network-based services. Vendor lock-in

and the ability to migrate from one service to another, or to return to locally hosted systems in an orderly fashion, are particular concerns, as is sudden failure of a vendor (contractual terms alone cannot guarantee customer service continuity or smooth transitions to alternative arrangements in the face of an abrupt corporate shutdown).

If services provided in this environment are essential, how do institutions deal with questions about stability and reliability? What will be (or should be) the locus of decision-making at the institutional level about adoption of such services? Such changes need wide institutional consultation among a variety of players, who may include legal counsel, audit and risk management, information technology (IT) and library professionals, and faculty researchers. "Cloud" and network based solutions have become very fashionable to the point that they are accepted uncritically be many in leadership positions as the only way forward: university presidents and trustees may believe that their institution is backwards if it does not move quickly in adopting network and cloud based offerings since they see them as a way to save money and achieve efficiencies. While availability of these services is a godsend for startup organizations trying to get running very quickly, tightly focus effort, and to minimize capital outlays, the longer-term perspective of universities as large, mature service providers and as institutions bearing important long term stewardship responsibilities suggests a more cautious and nuanced adoption strategy.

It is often overlooked but libraries, in fact, were in this game very early: by the mid-1990s virtually all research libraries in the US and Canada were licensing journals on content providers' platforms, what we might now think of as content combined with supporting services via the network. It took roughly a decade for librarians, publishers, IT, legal counsel and other interested parties to work through license and service provisions for privacy, usage reporting, and preservation, and to create a reasonably mature marketplace for such content delivery services. And even for libraries, this was only one part of the landscape: only now are they considering migrating other key operational software from local hosting such as catalogs, circulation, or discovery systems to network-based services. Sorting through all of the implications of moving services to network or cloud environments is a lengthy process that is currently playing out for a range of applications areas.

A discussion on this dynamic and evolving landscape took place at the Coalition for Networked Information (CNI) Executive Roundtable in St. Louis, Missouri on the morning of March 31, 2014. This roundtable on *Software as a Service and Cloud-Based Applications* included CNI representatives from a variety of institutions, including higher education, content intermediaries, service providers, and consortia. Individuals from the US, Canada, Germany, and the UK described their experiences, concerns,

strategies, and future plans for software as a service and cloud-based services. Roundtable participants shared their perspectives on network-based services, the policies and procedures they have put into place, and the opportunities and risks that they perceive in this environment.

It was clear during the roundtable, and again in writing this summary, that there are serious terminology problems, and that we had failed to frame the roundtable as precisely as we might have, though there was very strong convergence on the actual issues in question when the participants gathered. Mostly, what is at issue here is *not* commodity cloud services such as bit storage or computational cycles (packaged as virtual machines of various sorts), where one does not know exactly how or where these services are provisioned (Amazon compute or storage clouds, Microsoft Azure, etc.). These cloud services are important in research computing contexts, for example, or perhaps as infrastructure to support digital preservation services. Cost tradeoffs of commercial clouds, private clouds of various kinds, and local institutional resources are very complex and depend both on data flows and usage patterns. Cloud services also play an important role in some disaster recovery strategies. While we touched on such cloud services, they were not the primary focus of discussion.

Rather, the core issue for this roundtable was the transition from software functions that were hosted in local computer centers, or sometimes local desktops, or both (everything from email, document processing and calendaring, to enterprise human resources, accounts payable, class registration, and LMSs) to services based on software hosted somewhere on the network by a vendor. The software-as-service vendor, in turn, may well use one or more of the commercial compute clouds to host its software, but the underlying cloud is hidden from user institutions to a greater or lesser degree. Hidden does not mean irrelevant, and sometimes underlying cloud infrastructure constraints do surface back to the user institution. For example, a document management vendor may be unable to guarantee that data will only be held on servers physically within the US, because the vendor's cloud provider does not offer such guarantees, and this may limit the contexts in which the network-based document management service can be used because of privacy or International Traffic in Arms Regulations (ITAR) issues.

So, for the purposes of the conversation summarized here, clouds are a very secondary issue. The central focus is on the transition from locally hosted software to services delivered across the network, whether these services are being hosted at vendor provided data centers or on third-party cloud services.

Finally, the reader should be mindful that much has happened since the March 2014 conversation summarized here; some of these subsequent developments were very

specific to the research and higher education community and might have reshaped the conversation. To name a few: the restructuring of the Kuali community source project to incorporate revenue streams from hosted Kuali software components and a for-profit organization; the launch of Unizin; and the roll-out at scale of the OLE system.

Institutional Perspectives
Some key perspectives from participants' institutions included:

- Many participants underscored the importance of good, comprehensive, and thoughtful contractual provisions addressing a very wide range of issues, including exit strategies, service levels, and guarantees necessary to ensure that universities can meet regulatory and funder requirements. At the same time, participants noted that some of the potential network-based service providers were very reluctant to move past standardized contract offerings or to provide much visibility into their own operations, reliability and other practices (there are obvious scaling considerations here for the vendors; it's very expensive to do a complex, custom contract with every higher education institution, hence the interest in frameworks like Internet2 NET+).

- Many of the higher education participants have moved undergraduate student email to the cloud; often faculty and perhaps graduate student email remains as a local service due to security, privacy or records management related concerns. Health sciences units may have different policies from those of the host institution due to the tight privacy, confidentiality and compliance constraints that they face under the Health Insurance Portability and Accountability Act (HIPAA) and other regulatory and legal frameworks.

- Several institutions mentioned that they had moved some services back to the local level after trying them in the network; reasons included concerns about exporting data and security.

- Some institutions shared very frustrating experiences where, after migrating services such as email to external vendors, they found it very difficult to get quick, responsive, high level technical support and priority problem resolution. Being one (rather small) account with a very large vendor is a very different experience than controlling and running local services directly.

- Software maintenance and release management, particularly in a very hostile environment where security patches are issued frequently and security flaws are rapidly exploited, has become a very difficult and expensive headache for many

local implementations of commercial software. One great advantage of moving to network based services is that all of this can be moved back to the software vendor, who presumably has much deeper expertise to do such maintenance.

- A number of higher institutions have developed guidelines or principles for contracts for network-based services. One provider of network services noted that his company had to dramatically rethink contract terms for customers in this environment, an important reminder that the disruptions caused by network-based services impact all participants in the marketplace, not just customers.

- Many academic libraries represented at the roundtable are using search software as a service provided through vendors. Vendors usually have APIs available for the platform, but some libraries may not have staff with adequate skills to take advantage of that. One provider invested in a team of field engineers who go onsite to custom build applications for libraries. While APIs provide opportunities for customization, integration, and extension of services, exploiting these opportunities can be challenging (and sometimes resource intensive).

- Several institutions expressed concerns that individual campus units are making their own, separate, arrangements for network-based services and are not adequately taking into account concerns such as Family Educational Rights and Privacy Act (FERPA) compliance. Some researchers are very comfortable with using the commercial cloud for their research data but may not be fully aware of the policies and procedures they should follow regarding security and privacy. Another issue arises when an employee leaves the institution and has some institutionally owned data stored in personal accounts in the cloud (for example, a service like Google Disk); this can create significant problems for the institution.

- Some institutions have done data security audits of services before signing contracts. The NET+ group at Internet2 may develop a consortial audit model so that each institution does not have to do this separately; in general, the group is trying to simplify contracting with various network-based services.

- The Canadian and European institutions represented at the roundtable noted that since the Snowden revelations about US government collection of private data, there is much more concern about using US-based cloud storage and compute services. Indeed, some nations are looking at laws or regulations that require data belonging to their citizens to be stored on servers within their own national territory (or perhaps territory of another nation with consistent privacy

policies). Network-based service providers are also continuing to consider where they will need to place or obtain hosting servers to meet customer needs; this is now moving beyond a simple engineering analysis.

- Several institutions mentioned that they have had to develop strategies for network and cloud services for their global campuses; for example, there can be problems with using some systems in China due to restrictions by that government. Network latency is also a concern in these global environments, and one participant in a US state with a low, dispersed population, mentioned that it also applied in his region. Researchers in the field may also encounter latency issues.

- The move to cloud-based services is changing the skill sets needed by IT staff. Several institutions stated that one motivation for moving to cloud services is to focus in-house staff on innovative services while moving commodity services outside of the institution. However, there are management issues in moving staff to new roles. In addition, one participant mentioned the difficulty of attracting staff with the appropriate skill set to library positions and mentioned working with library schools to help ensure that some students emerge from those programs with the ability to work in the cloud environment.

- Institutions realize that they may need to get their data out of a cloud service at some point, for example to migrate to a different service, or as part of a disaster recovery plan, and that it is essential to have provisions for data export and migration in their contracts. Having an institution's data in a consortial database creates particular problems because the data may have been changed in order for its format to be compatible with the consortial format.

- One institution described that its contract for e-portfolio software will include provisions that the student-generated content will remain available to the student after he or she leaves the institution. In general, the challenges of transition and ongoing access to content in part or entirely owned by students after those students graduate or otherwise leave the institution is a long-standing, underestimated problem that often gets much more complex in the network or cloud environment.

- One provider of cloud-based services noted that developing the reliability of their service infrastructure was more expensive than they had anticipated. Another noted that they must convey details about their infrastructure in

negotiation with customers in order for those customers to do risk assessment and disaster planning.

- Cost-savings in moving to cloud services or software as a service was discussed in several ways. Some institutions noted specific cost savings (in some cases well into six figures annually) in the transition of undergraduate student email. Others discussed the shift in expense categories, which can be difficult to explain to higher level administrators in budget hearings, especially the shift from the typical large, up-front implementation costs of a new local system to larger, ongoing expenses in cloud or software as a service situations (the shift from capital expenses to operating expenses). None of the participants quantified the amount of staff time involved in contract negotiation and related procurement activities, although clearly many institutions are devoting a lot of resources to this activity.

- While some expressed concern about disaster recovery capabilities of network-based systems, others noted that they believe that such systems offer the institution protection for access to systems during difficult weather or other crises.

Concluding Thoughts

Higher education institutions are clearly making cloud based services a part of their repertoire of solutions for managing and accessing digital information of all types as well as for providing a wide range of services. Most institutions are moving cautiously and deliberately; contract negotiations, vendor selection, and transition (including adjustments to business continuity planning) all take considerable time and investment. Despite occasional overheated rhetoric, it appears that the transition will be measured and selective, and that very few institutions will move entirely to network and cloud based services in the near future. Those that move very aggressively may be able to argue that they have reduced expenditures and doubtless will brag about their role as innovators, but they likely will have accepted greater risk and lower quality and robustness of service (on a number of dimensions). Some of these compromises may take a long time to become visible.

Network and cloud services have the potential to disrupt the ways in which institutions are able to manage their information and the information of their community. There are questions about records management, especially regarding discovery (for legal or other purposes), confidentiality, and archiving. When institutions trust the curation of their records to a cloud service, what guarantees do they have that those records will persist,

or that the records can be read when multiple new versions of software have been implemented? Will some unit on campus, such as the library or IT organization, need to maintain a software archive in order to read records that have been archived on old versions of software? Another set of questions arises when the institution decides to stop paying licensing fees for a particular software suite; in that case, has the institution made realistic provision to export its records in a usable format? If a student has added materials to an e-portfolio that is maintained in and requires a licensed network-based software environment, does he or she lose access to his or her work after graduation? These are important procedural and policy questions that must be aired in addition to the financial and control discussions that usually take place when moving operations to the cloud.

It may be too early to determine the payoff of the shift to cloud services. While many institutions appear happy with the decisions they have made, it is possible that future developments will make them question some decisions and rethink what terms need to be included in vendor contracts. As we gain more experience, we will find out what happens when you have to make transitions in this world: faculty moving to another institution, or students graduating and losing access (to an e-portfolio, for example, or to documents he or she has written or contributed to).

Another potential payoff that many institutions hope to realize is to transition staff resources from routine management of commodity systems to focusing on innovations. Whether this outcome will be realized remains to be seen. There's another long-term challenge in this as well: routine management of commodity systems and services is not simple, but in fact requires highly skilled and trained staff. Today there is an internal pool of staff expertise that can be applied to selecting and managing transitions to network based replacement services replacing the internal commodity systems. Over time, this internal pool of expertise will atrophy, and institutions will become more dependent on the external service suppliers and perhaps a few consultants.

One participant encouraged the group to think about network-based solutions as potentially more than institution/vendor offerings; there are opportunities for higher education to "own" such services, which are developing in projects like HathiTrust, the Academic Preservation Trust (APTrust), the Digital Preservation Network (DPN) or Unizin. We will need to be as rigorous with policies and procedures for these systems (though this will often be re-framed as consortial governance issues, perhaps) as we are with arrangements with commercial vendors.

It is also interesting to reflect on issues we did *not* hear about much at the roundtable, though we might have expected to. Participants were eager to talk about transitions

from software to network service for things that were acquired institutionally (such as an LMS, an ERP, or a calendaring system) and to some extent things that were site licensed on behalf of the local community (email, document processing, etc.), with the latter class being viewed very much from the perspective of a service provider rather than that of an end user. Much of what goes on in universities has both an institutional and a personal aspect: students want to take their work with them when they leave the institution; faculty want to have personal control over their writing and other research outputs, and to be able to move this easily from institution to institution, or even system to system. They want this work to remain accessible and useable over long periods of time and are justifiably wary of forced obsolescence, vendor lock-in, and, particularly, reliance on services and software that they can only obtain by being part of a specific institutional community, and cannot reasonably acquire as an individual unaffiliated consumer, if it comes to that.

The complex comingling of very rapidly developing consumer and institutional offerings (think of Google's suite, which is widely used by people both personally and in institutional contexts) is another related challenge we need to better define and understand. We had hoped to explore these issues more deeply, but participants were not eager to talk about (or perhaps had not much considered, or had not yet gained much experience with) how these issues related to developments such as Adobe's new software marketing strategy, or the adoption of the Google applications suite or Microsoft Office 365. The loss of the ability to manage updates and version control implicit in many of these offerings (and indeed, becoming pervasive in the IT industry, especially the consumer segments – think about the behavior of Apple in recent years with regard to version management in both iOS and OS X), for example, has massive implications: stability (and, in particular, surprise appearances of new versions with new bugs at critical moments); elimination of backwards compatibility without warning at any moment; the undocumented introduction and perhaps later correction of software errors, perhaps leading to irreproducible results or errors; unexpected removal of features; forced obsolescence. Some of these are of particular concern in the context of the long-term stability and quality of the scholarly record. Hopefully we can revisit these issues, perhaps with a somewhat different framing, in the not too distant future, as they are essential to the long-term health of the digital environment.

CNI Executive Roundtables, held at CNI's semi-annual membership meetings, bring together a group of campus partners, usually senior library and information technology leaders, to discuss a key digital information topic and its strategic implications. The roundtables build on the theme of collaboration that is at the foundation of the

Coalition; they serve as a forum for frank, unattributed intra and inter-institutional dialogue on digital information issues and their organizational and strategic implications. In addition, CNI uses roundtable discussions to inform our ongoing program planning process.

The Coalition for Networked Information (CNI) is a joint program of the Association of Research Libraries (ARL) and EDUCAUSE that promotes the use of information technology to advance scholarship and education. Some 230 institutions representing higher education, publishing, information technology, scholarly and professional organizations, foundations, and libraries and library organizations, make up CNI's members. Learn more at www.cni.org.

Addendum I

CNI Executive Roundtable
Calls for Expressions of Interest
The Ritz-Carlton, St. Louis, Missouri
Monday, March 31, 2014
8:30 – 11:00 AM

Software as a Service and Cloud-Based Applications
Spring Meeting
Deadline: February 7

At the Spring CNI meeting in St. Louis, Missouri, we will have another in our series of Executive Roundtables. The topic for this Roundtable will be **Software as a Service and Cloud-Based Applications.** In the past year, we have seen a major shift in how some of the largest companies in the software industry are offerng their products to the higher education community. Specifically, a number of companies are encouraging institutions to license their software in the cloud and in other instances, they are providing no choice other than licensing their software in the cloud. While the availability of software in the cloud is not new, the pressure to access software from a provider's cloud service, rather than from a locally hosted service, is becoming intense. In addition to standard desktop applications software, many universities have moved enterprise level systems – email or even learning management systems -- to third-party, cloud-hosted services. And, there are a host of other network-based applications widely used for scheduling, administering surveys, etc.

While on the surface, this change may appear to be merely one of efficiency, the move to cloud services has the potential to disrupt the ways in which institutions are able to manage their information and the information of their community. There are questions about records management, especially regarding discovery (for legal or other purposes), confidentiality, and archiving. When institutions trust the curation of their records to a cloud service, what guarantees do they have that those records will persist, or that the records can be read when multiple new versions of software have been implemented? Will some unit on campus, such as the library or IT organization, need to maintain a software archive in order to read records that have been archived on old versions of software? Another set of questions arises when the institution decides to stop paying licensing fees for a particular software suite; in that case, has the institution made

provision to export its records in a usable format? If a student has added materials to an e-portfolio that is maintained in a licensed cloud software environment, does he or she lose access to his or her work after graduation? These are important procedural and policy questions that must be aired in addition to the financial and control discussions that usually take place when moving operations to the cloud. We will encourage conversations among Roundtable participants on their experiences with cloud services, the policies and procedures they have put into place, and the opportunities and risks that they perceive in this environment.

We will hold the Executive Roundtable on Monday, March 31, the morning of the first day of the spring membership meeting. **At this Roundtable, institutions may be represented either by one individual or a pair of individuals who have different roles, e.g. a library director or CIO. All sectors of the CNI membership are invited to express interest in attending this Roundtable.** We particularly want to encourage discussions between library and information technology executives around these issues. If you wish to propose a team of more than two people, please contact Joan Lippincott.

Cliff Lynch will moderate this session and provide some framing remarks, and then participants will have an opportunity to discuss issues with peers from other institutions. The Roundtables build on the theme of collaboration that is at the foundation of the Coalition. We want to promote institutional dialogue and inter- and intra-institutional information exchange on digital information issues. We see these Roundtables as one means of bringing together stakeholders.

CNI uses Roundtable discussions to inform our program planning process. We will disseminate a summary of the issues that emerge from the Roundtable, but in order to encourage frank discussion, there will be no individual or institutional attribution of statements without prior permission from the relevant party. Reports from recent Executive Roundtables are here http://www.cni.org/executive-roundtable-reports/

The meeting will be held at The Ritz-Carlton on Monday, March 31, 2014 from 8:30 AM – 11 AM. The broad topic for this Executive Roundtable is **Software as a Service and Cloud-Based Applications.** Participants will share strategies, policies, experiences, and perspectives on institutional, consortial, or commercial initiatives in this area.

Potential topics to be explored – time permitting – could include:

- What pressures are higher education institutions receiving to move to cloud services? In what cases are there no options other than the cloud?

- How have institutions been addressing policy issues such as privacy and access when they license cloud software and services?
- What units of higher education institutions have been involved in policy decisions?
- How are reliability and continuity of service questions addressed?
- How are institutions and companies handling problems related to software versioning and potential forced obsolescence of software?
- Do higher education institutions feel the need for a set of principles when they license software or services in the cloud? Have institutions or consortia developed such policies?
- What are future directions for the industry and for higher education?

To express interest in participating, please send a message by end of day Friday, February 7 to Joan Lippincott joan@cni.org with the name(s), title(s), and e-mail address(es) of the **one or two individuals** from your institution who would like to attend. We will choose approximately 20 individuals, using the criteria of position, experience, and balance of institutions (type, geographic area, etc.) to determine who will attend. **We will notify you by Friday, February 14 as to whether you have been accepted or whether you will be on a waiting list for participation.** If you have any questions about the Roundtable, please contact Joan Lippincott at joan@cni.org.