The Enterprise as the Experiential Design Platform

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Abstract. Individuals are autonomously designing, creating, and operating their own complex, idiosyncratic information systems. These systems are designed in an experiential and emergent way. This growing individual technological autonomy creates dynamic bindpoints where formerly there were relatively static user endpoint interfaces across an air gap. This enables the organization to adjust the location of its enterprise system bindpoints in relation to the individual system endpoints.

1 Introduction

In the past there were few who would question that the rightful ownership of an organization's information system would be organization itself. However the increasing availability of information technologies to the individual is providing powerful individually designed information systems that are increasingly available to interact with organizational information systems. When workers incorporate their own complex information systems into their daily work processes, their organizations begin to shift from a platform that was entirely owned by the organization to a platform that is partly owned by the organization and partly owned by the individual. Processing on such shared systems is not a new idea for many organizations today. Shared computing platforms across supply chains have meant that an organization's information system is sometimes shared with other organizations. The reliance on cloud computing and software-as-a-service has also increased the sharing of computing between organizations (Fingar, 2009).

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The arrival of a worker supplied information resources is also not new. Although there have been nagging security problems, workers have frequently brought their own devices for use in their organizational work life (Kennedy, 2013).

Increasingly these worker supplied information resources are growing into complex multi-device, multi-software architectures in their own right. The result is a set of information resources shared between the organization and its workers. Importantly there is a potential collision between the architecture of the organization's information system and the architecture of the individual worker.

The arrival of complex individual information systems is new. Of particular novelty is the manner in which these systems are designed and developed. The architectures of these systems are not developed by trained system professionals for a persistent, effective and reliable information platform. Rather, they emerge through a process of design-experience-redesign that places the organization into a dynamic architectural setting.

In this paper we explore the interaction between individual information systems and organizational/enterprise information systems. This interaction is increasingly important because it is increasingly difficult to prevent workers from creating the interaction between the organization’s systems and their own individual systems (Luftman et al., 2012). This interaction is also important because it offers organizations powerful new information resources developed and made available as part of their employment of smart, technologically adept workers.

2 Individual Information Systems

Individual Information Systems (IIS) are, in the first place, information systems. We distinguish these from the more common notion of organizational/enterprise information systems (OEIS). In this paper we will take the view that information systems are complex social technical phenomena (Bostrom & Heinen, 1977; Mumford & Weir, 1979). These systems arise in a human computer system. It is information and communications technology in a human context. Information systems are not just an accumulation of technology, information, and human factors. Information systems are a synergetic whole that results in a symbiosis of information and communication technology with information and human factors that produce more than just the sum of the parts.

Stephen Alter (2008) inventories more than 20 important definitions of information systems. While many are similar, this suggests that there are many differences in the way experts define information systems. Of the 20 definitions, most include references to computer or technology. Most of these definitions also refer to organizations in some way. Some of these definitions mention society or social aspects, and most would exclude an individually owned information system. The proposal in this paper, that individuals have now become so empowered by technology that they are operating an information system as an individual rather than as an organization.

Since we are obliged to have a working definition of information systems for our purpose in this paper, we can adapt Alter's (2008) definition for our purposes: an information system is a type of system, "in which human participants and/or machines perform work (processes and activities) using information, technology, and other resources to produce informational products and/or services for internal or external customers".

We have specifically adopted the term *IIS* rather than *personal information systems* because the term *personal information system* is already present in the literature with a much narrower scope of meaning. Information science has defined personal information systems from a database or bibliographic perspective (Burton, 1981, p. 440) for the support of personal "collections and personal indexes" (Moon, 1988, p. 265). Personal information systems are defined as,

A "personal information system [is one that] provides information tailored to an individual and delivered directly to that individual via a portable, personal information device (PID) such as a personal digital assistant, handheld PC, or a laptop." (Silberschatz & Zdonik, 1996, p. 770)

Personal information systems are regarded as individuals with a particular technology being serviced in their needs for data or information. The prevailing definition does not allow recognition of complex multi-technology information systems under the control of an individual.

However there is one important aspect of the work in personal information systems that is relevant to any definition of IIS. This is the idiosyncratic nature of personal information systems that also will inhabit IIS (Burton, 1981). This is because IIS, like personal information systems, correspond to unique individuals.

By integrating these two somewhat contradictory streams, namely, information systems, and personal information systems, we can derive a working definition of an IIS:

> An IIS is a system in which individual persons, according to idiosyncratic needs and preferences, perform processes and activities using information, technology, and other resources to produce informational products and/or services for themselves or others.

3 Example: Sam Spade

Many readers will have experience with their own IIS, and may find it surprising to argue that their own personal computer (PC) or laptop should be elevated to the lofty conceptual level of an IS. Before discussing how this form of IS has evolved, we should examine a case of this phenomenon (reported in 2011a; Baskerville, 2011b). Keep in mind that IIS follow idiosyncratic needs and preferences, so no immediate case can be considered typical.

Sam Spade (a pseudonym) is a professional employee in a large government division. Spade has three computers to his personal use: two desktop machines and one laptop. His employer has located one desktop in Spade's office on the employer's premises. Spade owns the other desktop, which is in his home office. Spade's employer also provides a laptop for his personal use. Spade also owns two other laptops he shares with his family. At home, Spade also owns and uses a smart phone, and a combination printer, scanner, and fax machine. All of the devices in his home are networked into a local area network (LAN) that includes a DSL modem, a firewall, an Ethernet router, and a wireless access point. He uses three Internet providers: the DSL connection in his home via a telephone provider, an Internet link to the smart phone via his mobile phone provider, and the connection to his office using his employer's LAN.

Spade has installed more than 50 separate software packages on these computers. His main activities involve only a few of these. The mainstay of his work life is the productivity software package with its spreadsheet, presentations, and especially the word processing tool. He uses this package to generate documents in all facets of his profession. In connection with this tool, he uses accessory writing packages like dictionaries. He also depends on an email package as his main communications medium, and uses a diary/calendar application for planning and record-keeping. He uses a VOIP package for low cost teleconferencing across the Internet. The data related to these major packages are synchronized between PCs, laptops, and his smart phone.

Spade accesses services related to his profession from a cloud provided by his employer. The term cloud is used here in its loose, IS perspective because, in terms of access to services, the cloud is evolving. This notion is broader than cloud computing and extends to cloud-based processes and information systems. This evolution represents the increasing availability of cloud-based business processes as well as low-level data services (Fingar, 2009).

This cloud permits access to many reference resources, such as publications and regulations, much of which is contracted by his employer. The employer-provided cloud also provides online access to customer and vendor data, online professional tools, and virtual meeting resources. The employer's personnel unit allows Spade online access his personnel and compensation records. Spade also uses a few additional professional services from outside his employer's cloud, including writing aids, discussion groups, meeting planning, and shared file folder drop sites.

In terms of his personal business, a growing cloud of personal finance services is supported by the retail banking, insurance, and financial services industry for individual customers. Spade uses a personal finance package to harvest services from this cloud, and to manage banking accounts and credit cards. He downloads and synchronizes transactions from his accounts for reconciliation with his records. He uses a portfolio package to manage a shares/stock investment portfolio that spans several brokerage and insurance investment accounts. In addition, he uses income tax software to prepare annual tax reports. The tax and personal finance software synchronizes automatically, drawing information from the various clouds. Results are filed directly with the tax authorities across the Internet.

Spade's personal and professional lives overlap where his employee financial transactions touch his personal accounts, as in the case of compensation and expense reimbursement. The overlap extends to travel expenses because Spade does most of his travel planning through airline and hotel booking web sites via the Internet. He often shops online, and while most of his online purchases are personal, he sometimes purchases business related items and claims reimbursement. Such professional expenses go through Spade's personal books further extending the overlap between his employer's IS and his own individual IS.

Spade makes the parts of his IIS that he owns available to his family. Family members share the home LAN for email communications and social networking services. The family also has access to Internet-based films, videos, and television programs that form part of the subscription service from the local cable television provider.

Figure 1 details this IIS architecture. The architecture in this case demonstrates how this individual's usage of ICT has evolved beyond the boundaries of personal computing or ICT alone. These are simply the bottom two layers that provide the foundation for the information architecture. Here we find work and activity flows, business and personal information processes, and social technical design decisions. These elements form IS problems that are similar to those of large businesses or SMEs. The PC has grown into an IIS that is a genuine IS. Because such IIS architectures are idiosyncratic, other examples would be more complex, and yet others simpler.

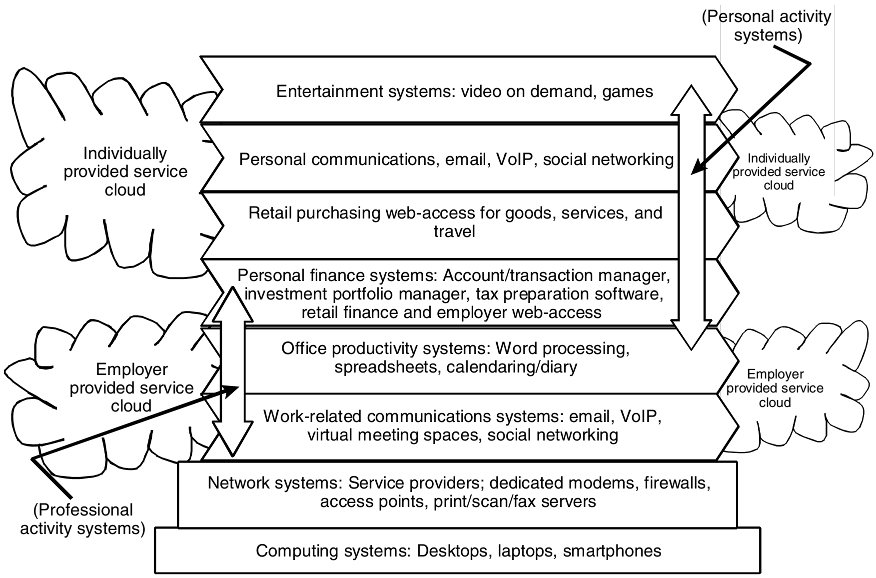

Fig. 1 Spade's IIS architecture (adapted from Baskerville, 2011b)

There are two vertical arrows that denote two overlapping activity systems that form subsystems within this IS architecture. The professional activity system corresponds to Spade's information processing activities in his role as an employee. The personal activity system spans Spade's information processing activities outside of his role as an employee. The arrows cut across architectural elements denoting how the distinction between the elements can blur, such as in cases where the employer provides individuals with personal Internet access. The figure also represents how Spade is consuming information services and producing information that arise from, and sinks into, two clouds that do not necessarily overlap. One cloud is generally provided by his employer for use in his professional activities. The other cloud is constructed of services (such as retail financial services) for which Spade contracts individually.

4 Individual Technological Autonomy

Technological autonomy is more often considered as a characteristic of a nation state or culture (McOmber, 1999). For our purposes, we are more interested in technological autonomy as a characteristic of an individual refers to the degree of independence with which workers within an organization command the architecture of their own IIS. Many organizations are contending with the presence of workers' own devices in the workplace; often referred to as *bring your own device* (Kennedy, 2013). This viewpoint suggests that the OEIS must now be configured in order to interact with a particular device provided by the individual workers. It is a simplistic notion that the worker will simply provide the organization with their preferred device. It fails to recognize that such devices might better be acknowledged as portals to the individual's information system. In other words, such a device is an interface between the OEIS and the IIS. This may be a more realistic representation of the situation as *bring your own system.*

A worker-provided interface to their own IIS is rather a more complex proposition than merely providing the organization with a device. The organization is acquiring an interface to a system with a great degree of individuality and autonomy. We cannot assume that people are simply organizational system nodes. People have idiosyncratic reasons for using the OEIS. These reasons involve idiosyncratic adoption patterns, such as which feature subset will be operationally adopted. Idiosyncratic adoption patterns have created issues in the study of adoption because it is difficult to measure adoption in settings where each individual adopts a system differently. As a result a great deal of information systems research into adoption uses measures of intention to adopt rather than adoption itself. Such measures are chosen because the intention to adopt is a simpler and more easily measured construct. There are also issues of individuality in end user development where each individual does more or less in the development of the system. And there are also issues with task technology fit that substitutes a suite of task performances for the individual.

The research into personal information systems brought recognition that when people use their own systems to interact with libraries they begin storing and processing library and database information in idiosyncratic ways. Their usage of library systems was clearly subjective in both its scope and in its methods or processes for approaching the information. In order to accommodate this idiosyncrasy, OEISs encountered new overhead, for example, accounting for complexity in query and database schemas. This complexity has also been noticed in research into executive information systems that extend their reach into highly diverse information sources for strategy setting.

5 Experiential Design

While IIS may offer the same profile as a complex architected OEIS, these are rarely designed with the same kind of rational design process. IIS have a highly variable scope, idiosyncratic processes, and often weird configurations of information technology. It might be tempting to attribute unusual designs to an uneducated designer and user. However, this design process operates in a different context than the design process of a professionally architected OEIS. IIS have unlimited system availability to their user. As we have seen from the research into personal information systems, IIS have richer information attributes than many OEISs. The design goals for IIS are also different. These design goals often include not only utilitarian goals, but hedonistic goals and desires for particular social outcomes. The design goals may also include value, enjoyment, and even status enhancement. The latter can occur when an IIS is outfitted with a particular technology in order to reflect the desired social status. Research has already shown that Internet usage patterns often reflect high social and community purposes.

IIS are also bounded both socially and geographically to particular sets of information and communication technology. The individual designer is operating within a confined sociotechnical context. Purchase decisions are highly influenced by the individual designer's social and professional networks. Family, neighbors, and coworkers all influence component selection through their own past choices and their advice to the designer about their future choices. The design components are chosen from mass-market devices usually at very low cost. These devices are consequently highly standardized and reconfigured for the most general individual use. Yet the designer is aiming to achieve a very peculiar system by using these standard parts. This puts the architecture into a tension setting. There is a tension between the idiosyncrasy of the designer and the design process and the standardized, preconfigured components available from which to construct the IIS. As a result such systems often have complicated and inefficient workarounds to make the various components work together to achieve the rather peculiar goals and aims of the designer.

This context creates a setting for a design process that involves an explorative patchwork approach to designing an IIS architecture. It is a situation in which the designer is both designing and experiencing the design results at the same time (Baskerville, 2011a). This process of experiential design is important in accommodating interactions with organizational systems because of its idiosyncratic results and continuous adaptation. Experiential design is necessarily explorative because system components are continuously being disconnected and reconnected in different ways. It is a trial and error process that sometimes involves acquiring temporary components such as trial software or returnable devices in order to experiment with different designs. The design process interacts with the artifact being designed. There is a hodgepodge of components that are progressively acquired for integration into the IIS. This hodgepodge is worsened because these components are acquired piecemeal and often without a long-term plan. Because components cannot be easily discarded and replaced, the component hodgepodge places a more severe constraint on the redesign of the IIS. This makes for its matching more difficult because the existing hodgepodge system provides the basis for determining new components. This determination arises with any goal elaboration and drives a search for a feasible elaboration of the existing system in order to achieve the goal elaboration. These are highly emergent systems often with very short term planning and operating horizons.

6 Enterprise Individual Bindpoints

Enterprise individual bindpoints are distinct from OEIS end points. They represent dynamic intersections between different information systems. By their nature they shift the system air gap deeper into the IIS. In this section we will deal with each of these concepts: enterprise end points, dynamic intersections, system bindpoints, and air gaps.

An *air gap* is an information security concept that refers to the lack of an electronic connection between two elements of a system (Lindqvist & Jonsson, 1998). Any information to be conveyed from one element to the other element requires some physical intervention, such as keying information into a system terminal. For many OEISs, the air gap occurs at the end user interface. At this point the user interface often involves a video screen, a keyboard, and a mouse. Information is sent to the user on a video screen, and retrieved from the user via the keyboard. Of course the user may also introduce pluggable devices such as a flash memory stick where allowed. In security terms, there is an air gap between the user and the OEIS resources.

A user air gap often represents one end point of an OEIS. An *endpoint* is the mark of a terminus or completion that generates or terminates an information stream. It can involve remote devices such as laptops or other wireless and mobile devices that connect to an enterprise system. Many current enterprise architectures assume that a user endpoint will involve a device and an air gap, such as a laptop connected to a server. It is a fundamental assumption underlying bring-your-own-device (BYOD) thinking.

This notion of an air gapped end point is quite different from a *bindpoint* that represents the new (changed) context created when a new or altered IIS connects with an OEIS. The bindpoint occurs when the enterprise system connects to an IIS. Distinctive to the notion of a bindpoint is the dynamic and changing character of an IIS. As we learned above, an IIS is emergent and idiosyncratic. But the bindpoint does not simply represent the connection between two systems. Owing to the nature of experiential design, the connection will change the architecture of the IIS, and affect the emergent goals, affordances, and constraints that inhabit the system. Upon connection, the designer will redesign the IIS in an experiential way. The IIS becomes a changed and reconfigured system. Because of the connection, the IIS is moved to a new place (a new context) and becomes a new platform for experiential design. Because the connection is a system to system connection, we cannot assume that the OEIS is unaffected by this dynamic connection. Replacing an endpoint with a bindpoint elaborates the enterprise system in a way that users are experientially designing. The enterprise system also moves to a new place (a new context). The result is similar to the notion of a bindpoint in a computer game. When a character in a game encounters or uses an object, both the character and the object may be taken to a new place in the game. The new place is the bindpoint (Griffiths et al., 2003). Importantly bindpoints may be too innumerable to predict every permutation of the elements, but they must be computable.

The connection of an OEIS to an IIS creates a form of cross road or intersection between multiple systems. This intersection is no longer a simple connection of an endpoint that provides a terminus for the enterprise system. It is not merely the entry or exit point for service or process. As a bindpoint it becomes the condition of an IIS after binding to the enterprise system. Concomitantly, it also becomes the condition of the OEIS after binding to the IIS. In settings where many IIS are bound to an OEIS, bindpoints are frequent and diverse. This can mean that the OEIS is subject to constant redesign in the presence of the constant experiential design arising in the constellation of associated bindpoints.

The bindpoint is a new context, not a simple connection. It can affect a diverse array of inputs and outputs for both the OEIS and the IIS. Because the bindpoint changes the context of both the individual system and the enterprise system, it may develop a web of connections between the two architectures. The exact shape of this web is ephemeral to the degree engaged by the dynamics of experiential design (see Figure 2).

Unlike an end point, a bindpoint will usually shift the air gap further away from the OEIS and deeper into the IIS. It can be an important feature of the new context for the enterprise system. The enterprise system’s interactions with its user are mediated by experientially designed elements. As the air gap becomes more remote, more governance must be exercised to take best advantage of the more sophisticated input and output processing afforded by the IIS. The functional advantage stands at tension with the security disadvantage.

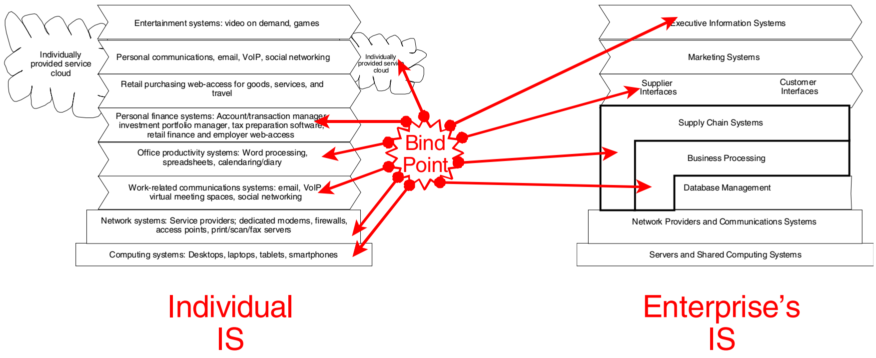

Fig. 2 Bindpoint as a web between individual and enterprise information systems

7 Example: Virtualizing a Digital Forensics Laboratory

In this simple example, we consider the laboratory work of information systems students who are studying digital forensics in a university executive program. The traditional digital laboratory set up would provide one desktop computer for each student in the room and an instructor's desktop computer with a projection screen. A network would connect the computers. Each computer would have the licensed forensics software installed. Students would attend classes in this laboratory, and would perform their homework exercises in the same lab. The student workstations would represent endpoints in this information system architecture, and the air gap would be present at each workstation. In this sense the air gap is always present in the laboratory.

In the executive program all students are provided with a tablet computer and required to provide their own laptop computer to support their studies. All students in the program were self-equipped with smartphones. In this setting the traditional digital laboratory largely duplicated the IIS provided by the students. Further the traditional laboratory constrained the students to complete their work while physically in the lab. An alternative organizational architecture created a lab using virtual machines available for access via remote desktop from student laptop computers. The virtual machines provided the licensed forensics software. For some instances forensics tools had to run in native mode on student laptop computers for purposes such as media imaging that required direct hardware access. Instruction manuals and lab protocols were delivered to student tablets.

The resulting bindpoint created a new context for both the OEIS and the IIS. The organization had to provide ideal wireless connectivity for classrooms in which laboratory exercises would be conducted during class. This was needed to support the remote desktop bandwidth and large file downloading bandwidth for many laptops. The organization also provided a substantial virtual machine server to support the necessary virtual machines simultaneously active during class. Students had to configure or reconfigure their systems to support the course. This meant installing (where required) and configuring the remote desktop software, along with other forensic tools (such as imaging and hashing tools) as required. These tools had to be determined by the students according to the configuration of their own laptop computers and information systems. Because these student systems were idiosyncratic, new demands were placed on the university staff to consult on a wide variety of possible forensic computer configurations. The laboratory protocols had to be substantially revised to provide useful direction for individuals using substantially idiosyncratic system configurations. The air gap moved away from university computers and disappeared somewhere into the IIS.

While this is a simple example, it provides insight into the changing situation when an endpoint is replaced with a bindpoint. In the original laboratory, the university owned and controlled the information system all the way to the air gap. In the revised executive laboratory, the university did not own or control the complete information system. It was partly owned and partly controlled by the university, and partly owned and partly controlled by the student. In the original laboratory, the architecture was persistent to a great extent. The laboratory design was intended to last three years. This meant that there was three years of exploitation from its design. In the revised executive laboratory, the design is intended to last one term (at best). The design and configuration of student IIS evolved in some cases during the course. With each successive term, some students will arrive with the most recently available devices, while others will arrive with devices older than those seen previously. Each idiosyncratic student IIS dictates a new bindpoint for the overall information system shared between students and university. Further, reconfiguration of virtual machines is more easily done from term to term. Rather than lasting three years, the virtual machines are themselves less persistent. It is not only the student IIS that is changing the bindpoints, it is also the OEIS undergoing more frequent change.

8 Discussion

For more than a generation, a steady increase of the proportion of contingent workers in the labor force. This increase is driven by the need for flexibility and the demand for cost competitiveness, but may also arise from the technological independence of workers. Workers, in possession of their own information systems may no longer be dependent on organizations to provide the basic technical resources needed to accomplish their tasks. There are indications that the growth in new positions for contingent workers is outpacing the growth in new positions for standard employees. In 2005 there were more than 2.5 million temporary and contingent workers employed by 90% of large U.S. companies drawing from a market of more than 10 million Americans (Yang, 2012).

Since organizations often regard these trends from a perspective of the benefits to the organization, it is easy to overlook the shifting job security to the worker. Rather than drawing security from a single employer, contingent workers draw their job security from multiple employers. Working with a portfolio of employers can lower the career risk of a contingent worker in comparison to a worker fully employed by a single organization. It is a sense of not having the entire employment benefits in a single basket. Replacing the job-for-life with a career portfolio also satisfies the current shift in worker attitudes toward an emphasis on choice, autonomy, and flexibility (Jorgensen & Taylor, 2008). The ability for knowledge workers to develop multiple employer relationships depends on the IIS because of the necessary technology. However, it also means the worker is engaging multiple bindpoints in their IIS. The web of bindpoints between organizations and knowledge workers is an increasingly complex many-to-many relationship.

Insights into the nature of experiential design in the IIS can also reveal its features in the design of OEIS. Prototyping and agile development adopt experiential design principles to a degree, but in many cases formal resource commitments limit the extent to which experiential design unfolds. Experiential design probably has a higher degree of presence in more independent funded *skunkworks* or unfunded *hobbyshopping* developments, where innovation runs in a management-hands-off setting. End user development within OEIS can also unfold in an experiential design manner. Security event response and disaster recovery often invokes experiential design in early stages, owing to the intense need to restore essential information services to the organization.

The search must begin for practical solutions to the management of this increasing web of highly emergent OEIS bindpoints. Experiential design is probably foremost opportunity for quickly tuning OEIS bindpoints to a moving constellation of IIS. Using this design approach, OEIS developers will have to find ways to manipulate architecturally safe portals into the OEIS. Such bindpoint affordances will themselves have to be marshaled carefully to keep them attuned to diverse IIS bindpoints, and still protect the integrity and security of the OEIS.

9 Conclusion

An IIS is a system in which individual persons, according to idiosyncratic needs and preferences, perform processes and activities using information, technology, and other resources to produce informational products and/or services for themselves or others. These systems are complex, idiosyncratic information systems. Individuals autonomously design, create, and operate these information systems. A number of factors are increasing the organization's need to interact productively with these systems. Factors include the changing technological sophistication of the knowledge worker, and changing trends in worker career and employment options.

Interaction with an array of individual information systems poses a complex problem for organizations with complex information architectures of their own. These individual systems are designed in an experiential and emergent way. They are autonomous and fast-changing. These idiosyncratic features create dynamic system-to-system bindpoints where formerly there were relatively static user endpoint interfaces across an air gap. This change recasts the organizational information endpoint problem. The organization now needs to adjust the location of its enterprise system bindpoints in relation to the endpoints that have moved deep within the individual information system.

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