Platforms and Planning: Pennsylvania’s Transition to Enterprise Computing

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Abstract
The Commonwealth of Pennsylvania’s ongoing efforts to pursue enterprise computing are analyzed from two perspectives. First, historical changes over the course of a decade (1995-2004) are characterized as one state government shifts from an organizational to an enterprise perspective. From a strategic perspective, examples of information and communications technology (ICT) planning highlight the nature and roles of strategic alignment used to achieve the desired goals of the efforts, and to explicate expected activities and second-order effects of the enterprise from a platform perspective. Findings from this analysis mark the importance of strategic planning for providing a means to integrate across enterprise processes, operations, and standards, the need for bi-directional and continuous mapping of the enterprise, and the need for reflection and evaluation even after that the enterprise is engaged.

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In this chapter we report on the Commonwealth of Pennsylvania’s ongoing efforts to pursue enterprise computing. In doing this we make two contributions. First, we focus explicitly on the enterprise perspective of computing (Bernard, 2004). We characterize the Commonwealth of Pennsylvania’s government as an enterprise and focus on their computing changes over the past decade to provide examples of the move from organizational to enterprise perspectives (e.g., Fountain, 2001). Our second contribution is to focus explicitly on the role of information and communications technology (ICT) planning, again using Pennsylvania’s efforts as the source of examples, highlighting both strategic alignment (Henderson and Venkatraman, 1993) and platform (Ciborra, 1996) perspectives. The strategic alignment perspective helps focus on making explicit the ICT decisions that will best support achieving desired organizational goals. The platform perspective helps focus on the potential for the uses of ICT to lead to unexpected activities and second-order effects: those that were not at first imagined, but become possible only by having a particular ICT in place and used (e.g., Sproull and Keisler, 1991).

While organizations in both the public and private sector continue to seek administrative rationalization and increased operational effectiveness (albeit often using different measures to define success), we know that public sector organizations differ from private sector in their take up and uses of ICT (Boyne, 2002; Danziger, Dutton, Kling and Kraemer, 1982, Bozeman and Bretschneider, 1986; Rainey and Bozeman, 2000). In particular, the concept of enterprise computing, the arrangement of computing assets in a rationalized and strategically compliant way, and embodied in approaches such as enterprise architecture (see NASCIO, 2003; Bernard, 2004), has been taken up at the U.S. Federal and state levels to some degree (see, for example, www.feams.gov). In contrast, the take up and use of enterprise systems such as those sold be SAP, Oracle and others, and often known as enterprise resource planning or ERP systems) has been a dominant computerization activity in the global, Fortune 1000 companies over the past 15 years (and is now a focal activity of many small-to-medium enterprises).

Enterprise Computing

Enterprise computing marries the selection, development, and deployment of ICT tightly with organizational structure and operations (Bernard, 2004). This is done via semi-automating key organizational processes, aggregating data and information, standardizing operating systems, applications, and physical devices, integrating workers using common systems, and demanding a rationalized set of operational policies and procedures. This is typically depicted as a “stack” or “layered” model – known as an ‘enterprise architecture’ (Spewak, 1993). In these models, computing elements are arranged by functionality with lower levels focused on transporting data and information, and higher levels engaging issues of people and organizational needs. In the five-tiered enterprise computing model, the first layer includes the transportation media, protocols and devices as the base. Operating systems, systems software, and data structures are at the second level, above which are the devices, applications, and inter-dependencies that are demanded of software (third) followed by the fourth level, which includes work processes and procedures that are both guided by and integrated into the policies, procedures and strategies being pursued by the enterprise that are laid out in the fifth tier. In this way enterprise computing links functionally-based computer applications and strategic planning.

In contrast, an enterprise system often has a number of integrated modules that share access to a common set of data which can be accessed via coherently-designed uniform screens. These
screens are often web-based (i.e., a personal computer can gain access using a simple browser such as Netscape or Firefox). One difference between workgroup office suites and enterprise systems is scale. For example, SAP’s R/3 software (one of the most common and comprehensive enterprise systems and the one chosen by Pennsylvania) is based on 1980’s programming and innovations in creating a client-and-server architecture. The SAP R/3 system has four major elements: an integrated database, a set of development tools (ABAP), a means to encode, apply and manage business, and workflow rules that guide the operations, and the collection of business modules. These modules are typically grouped into four elements: finance, human resources, manufacturing (and logistics) and sales. Within each of these elements are a range of modules (e.g., sales can include customer relationship management and distribution modules).


We focus on the Commonwealth of Pennsylvania’s efforts in enterprise computing for three reasons. First, states are complex enterprises and serve the purpose of being a revelatory case for this exploration (Yin, 1989). The U.S. Federal government is too large to engage as a singular enterprise, while regional or county-level enterprise activities are still relatively rare. Second, Pennsylvania was one of the first states to attempt an enterprise systems implementation (engaging SAP in 1999) and did so by first engaging enterprise computing principles. Third, since 2003, Pennsylvania has been actively pursuing enterprise architecture as a means to realize the values of enterprise computing and their investment in an enterprise system.

Pennsylvania Context

In the early 1990’s Pennsylvania government was composed of approximately 152,000 employees (FTE), supporting an estimated population of 12 million citizens. State government revenues totaled approximately $36.7 billion (U.S. Census, 1992). Pennsylvania’s economy was still dependent on traditional manufacturing-based industries and Pennsylvania was ranked 47th in job growth rate. Not surprisingly, even before January 1995, when Governor Tom Ridge and his administration took office, there was a widely perceived need to move the state economy and labor force toward new forms of economic development that were less likely to focus on traditional blue-collar manufacturing jobs. Beginning in 1995, PA engaged seven strategic actions in regards to state government IT investment (IMPACCT, 1996):

- Reexamine agency policies regarding the sharing of information
- Alter personnel policies in order to improve compensation for IT managers and staff
- Move toward off-the-shelf application procurement instead of in-house development
- Create an inventory for reuse of packages already developed by the Commonwealth
- Select common software engineering tools for developing new custom applications
- Move toward the development of relational databases
- Revise procurement to meet required standards, improve competition, and reduce prices.

In early 1996, at about the same time the IMPACCT report was released, Governor Ridge created the Office for Information Technology (OIT) within Commonwealth’s Office of Administration (OA, the administrative arm of PA state government). The deputy secretary of OIT became Pennsylvania’s ‘chief information officer’ (CIO). The CIO was charged with engaging the recommendations of the IMPACCT report, as laid out in their 1997 strategic plan (Office of Administration, 1996).

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1 For more information on enterprise systems, see [www.cio.com/research/erp](http://www.cio.com/research/erp)
Enterprise computing in Pennsylvania

The OIT staff were encouraged to innovate using ICT. They worked to take on big-ideas, to learn from mistakes, and to pursue a range of projects tied to either economic development or educational excellences. The combination of clear and active issue advocacy from senior executives, the legitimization that access to both budget and senior cabinet counsel provided, the combination of innovative ideas with analytic approach to taking on ICT projects, and the willingness to take risks all reflect both the administration’s commitment to engaging ICT and the important role the OIT played in establishing both a vision for computing and standards for the Commonwealth. In doing this, OIT exemplified the enterprise computing perspective.

The OIT played a critical role in developing an enterprise perspective. Its very presence—coming from nothing to a thriving organization housed in the Office of Administration with direct access to the Governor—and willingness to engage in formal and informal actions to establish enterprise computing oversight across PA state government made it a central player. The OIT’s guiding principles were set out in a short (six page) document. These principles depicted ICT as a lever to enable economic development, reflected private-sector sophistication in developing ICT combined with public-sector ideals of service delivery and access, and laid out general principles for what ICT and the computing architecture of PA would be. This big-picture view provided a guiding frame, and not a detailed specification, for how to take on ICT. These principles helped OIT to focus on leveraging interests of constituents and emphasized negotiation and consensus. The OIT staff took an analytic orientation when engaging this work: focusing on getting evidence and using it to make their points. Their ability to develop (and provide) evidence, and their pursuit of computing tied to the guiding principles, became a potent force pushing the enterprise computing agenda.

In Table 1 we highlight seven projects undertaken by OIT to engage enterprise computing. These seven projects represent a subset of the more than 30 initiatives undertaken wholly or in part by OIT during 1995-20052. They reflect the projects that have substantial enterprise computing components and our intent in highlighting these is to make two points:

1. Technological development of PA’s enterprise computing is inseparable from the organizational and policy developed to guide and support this work.

2. Enterprise computing efforts made by PA and the OIT across ten years (1995 to 2004) represent a consistent planning focus that reflects both a platform approach and strategic alignment principles.

These seven projects include the effort to consolidate across the nearly 60,000 personal computers into a common desktop software and email standard (and, when PA did this, they became the first state to partner with Microsoft with a state-wide licensing agreement). Second, they consolidated the data centers and telecommunications. Third, they developed a streamlined ICT procurement process (ITQ). Fourth, they embarked on several government-to-business web portals (PA Open for Business) and developed a state portal providing a range of services (PA Powerport). Fifth, many of these projects were funded in part by an innovative technology investment program (TIP) that allowed the CIO to fund initiatives that embodied or enabled economic development or educational excellence. The money from TIP and the leadership by OIT staff made this (new) office a central node in e-government. Sixth, beginning in the Ridge

2 We do not include the public safety radio initiative and Justice Network (JNET) system development. While these are enterprise wide, they are also focused in the specific areas of public safety and criminal justice/homeland security. The nine projects we highlight engage the entire Commonwealth of PA government.
administration and continuing into the Rendell administration, PA pursued an enterprise systems implementation effort, focusing on SAP R/3 as a state-wide administrative operational platform. Seventh, early in the Rendell administration, OIT engaged in three related efforts to consolidate IT decision-making for the PA Commonwealth. First, they opened a state-wide office to support enterprise architecture. Second, OIT was able to gain authority to both review and approve the other state agency’s IT planning and funding requests. And, the deputy secretary of OIT was given some input on hiring for the 43 agency CIO positions, providing formal oversight to a process that had relied on informal interaction for the first 10 years of the OIT work.

Table 1: Pennsylvania’s Enterprise Computing Projects Timeline (1995-2004)

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<th>Year</th>
<th>Selected Pertinent Events</th>
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| 1995 | • January -- Tom Ridge (R) sworn in as Governor of PA  
      • October -- PA is 48th state in US to have a web site. |
| 1996 | • Spring -- IMPACCT report published |
| 1997 | • July -- Data PowerHouse Project (data center consolidation) announced  
      • August -- Commonwealth Connect (desktop/office and email standardization) discussions begun |
| 1998 | • Summer -- Technology Incentive Plan (TIP) fund created  
      • June -- Contract with Microsoft finalized for Commonwealth Connect |
| 1999 | • Spring -- Began processes to select vendors for ERP and systems integrators for Imagine PA (the enterprise system effort)  
      • December -- Lt. Gov. Mark Schweiker becomes PA Governor (Tom Ridge becomes first secretary of Homeland Security) |
| 2000 | • June -- Contract with SAP finalized for Imagine PA software vendor  
      • August -- Continuous enrollment begins in Invitation to Qualify (ITQ: a procurement and vendor registration program)  
      • October -- PA Open for Business portal site launched |
| 2001 | • Early - Imagine PA project team created  
      • March -- Contract with KPMG Consulting (with IBM as partner) finalized as system integrator for Imagine PA (SAP implementation)  
      • July -- All Pennsylvania agencies' PCs (40,000 total) standardized on Commonwealth Connect desktop software  
      • December -- Lt. Gov. Mark Schweiker becomes PA Governor (Tom Ridge becomes first secretary of Homeland Security) |
| 2002 | • July -- Beginning of implementation of Imagine PA software (SAP)  
      • November -- Ed Rendell (D) elected to be Governor of PA.  
      • End of year -- The majority of all agencies’ PCs (60,000 +) standardized on Commonwealth Connect desktop software and e-mail network |
| 2003 | • January -- Most of migration to mySAP to be complete for Imagine PA project  
      • August -- OIT creates office of Enterprise Integration  
      • September -- OIT gets oversight to agency IT budget/planning and input on hiring agency-level CIOs |
| 2004 | • July -- SAP (ERP) software to be fully implemented for Enterprise Integration (a/ka/ Imagine PA) project |

Planning and Pennsylvania Enterprise’s Computing Activities

Across ten tumultuous years, the Commonwealth of Pennsylvania’s political and IT leadership made a series of decisions that showcase a pattern of enterprise thinking around the value and uses of computing. These decisions transcend three governors, two administrations,
four CIOs, the rapid rise and bursting of the ‘dot.com’ boom, terrorist attacks, and a host of less visible but significant events. The evidence is compelling: PA has made substantial progress.

This ten year trajectory provides evidence of an enterprise computing perspective. As we laid out at the beginning, enterprise computing is the most recent and most visible effort to engage the symbiotic relationships among an institution’s structures and functions and the ensemble of computing and communications technologies (Bernard, 2004). We also reflect on this ten year effort from platform and strategic alignment perspectives. These represent fundamentally different approaches to planning: platform perspectives highlight bottom-up and strategic alignment focuses on top-down engagement (Saaksjarvi, 1997; Ciborra, 1997).

Planning: An Enterprise Computing Perspective

The literature suggests that public sector organizations engage in computing differently than do private sector organizations (Bozeman and Bretschneider, 1986; Heintze and Bretschneider, 2000; Boyne, 2002). The level of red-tape, purposes for use, and funding models make it more difficult for public sector organizations to realize the value of computing. Evidence suggests that managing public-sector IT efforts is also different from private sector in that it is even more difficult to engage in process re-engineering (Cats-Baril and Thompson, 1995; Shalala, 1998).

More recently, enterprise computing has become a focal point in the practice of public-sector IT (NASCIO, 2003; Fountain, 2001). Enterprise computing provides a layered and integrated view, and focuses on ordering the strategic and operational elements of an organization with the applications, data, and infrastructure to support them.

Seen in this light, the combination of policy decisions to establish IT oversight with OIT, the rationalization of the telecommunications, desktop and data centers, and the move toward an enterprise system reflects steady progress in pursuit of a coherent enterprise computing architecture. The more recent efforts by the OIT Office of Enterprise Architecture to establish standards for development environments, middleware applications, and information sharing indicate that the efforts are cohering.

Planning: A Platform Perspective

Empirical evidence on the take-up and uses of computing in organizations indicate that many new systems do not lead to the effects intended, and often lead to unintended consequences (Leonard-Barton, 1988; Sproull and Kiesler, 1991; Sproull and Goodman, 1989). Ciborra (1996, 2000) builds on this, arguing that new IT serves as a platform for innovation. This innovating and learning can only happen once the system is in place, which leads to a bottom-up view of planning: planning for IT can only take the organization to a certain point, then bricolage (learning and doing) takes over. This results in an indeterminate IT planning approach that requires extensive coordination and communication to engage.

The evidence from Pennsylvania’s efforts over the past 10 years to more effectively engage computing can also support the bricolage argument. There have been many changed directions: the Microsoft licensing deal was not renewed, the vendor providing telecommunications has nearly failed, the ERP effort took two years longer than expected, and many of the intended benefits have yet to be realized. One limitation of the bricolage view of bottom-up learning is that, over time, organizations can learn – they adapt (Leonard-Barton, 1988) and the tumult of days and weeks in transition can give way to subsequent years of viable operations.

For those who advocate for bottom-up planning, the evidence from Pennsylvania suggests that organizations that pay attention to constituents (i.e., by creating forums and vehicles to
engage people) can learn. OIT set a model example of how to engage in their seeking to innovate, focusing on gathering data and building a business case, and providing both financial support and internal expertise in project management and contracts.

Planning: A Strategic Alignment Perspective

The strategic alignment model posits that there is a complex relationship among the components of business strategy, functional operations, and the deployment and uses of computing (Henderson and Venkatraman, 1993; Grant, 2003; Avison, et. al., 2004). Strategic alignment is a dynamic, top-down approach, where organizational leaders seek to match strategic intent with the proper development and deployment of an IT infrastructure and processes. Critics point to its complexity and see it as a static or notional view (Ciborra, 1997), though current evidence suggests that strategic alignment is situated and always ongoing (Grant, 2003).

The nominal position in the strategic alignment model is that an organization’s strategic vision should align with its strategic vision for computing and this should drive the selection and deployment of the computing infrastructure. If decisions about the computing infrastructure drive strategic decisions, there may be alignment. This leads to where tactical decisions are forcing strategic choices: reactive planning. A third approach to strategic alignment is that operational pressures of the organization could lead to making operational choices in computing. That is, operational decisions presuppose any strategic decisions. In practice, this resembles the strategic drift Ciborra (1996; 2000) argues occurs too often in contemporary organizations.

The evidence from ten years of work by Pennsylvania and its OIT suggests that they have been able to move from operationally-led decision-making toward a strategic-alignment model. The ability to see through projects, such as telecommunications infrastructure rationalization, common desktop standards, streamlined IT procurement, the TIP (to support strategic initiatives), and the recent oversight controls for agency CIO and IT planning, suggests steady progress toward increased alignment between the Commonwealth’s strategic vision and the ability of its computing investments to support these visions.

The lengthy and difficult implementation of the SAP ERP suggests that process-level changes across the Commonwealth government are slow to realize. This is not all that different from the findings from the private sector (e.g., Grant, 2003; Avison, et. al, 2004). Given the differences in how computing is engaged in public sector organizations, and some of the differences between private and public sector organizations, it may be that process changes will be the most difficult to realize (Rainey and Bozeman, 2000; Boyne, 2002).

The ten years of evidence shows that Pennsylvania’s state-level government has been able to engage in strategic alignment. The effort is not without its struggles, and the timescale suggests that alignment change is neither quick nor direct. The evidence does suggest that an enterprises’ strategic intent can be mapped to the development, deployment and uses of computing assets. Furthermore, this alignment can be carried on across substantial organizational and environmental change. The scale and scope of Pennsylvania’s government helps to make clear that organizational size, while a considerable influence, is not a barrier to such change.

What is also clear at this time is that infrastructural alignment is easier than process alignment. However, this is a relative comparison: the efforts to align the telecommunications, desktop standards, and procurement and funding approaches to computing are complex, difficult and expensive. As Pennsylvania’s state government embarks on efforts to leverage their substantial investment in an ERP, the focus will be on business process change. From both the strategic alignment and enterprise perspectives, this focus is also the link between strategy and
infrastructure. Given the steady progress made to develop a coherent enterprise computing architecture and to engage in strategic alignment, Pennsylvania is well-positioned to engage this next stage in computing.

For those who seek examples and evidence for how to engage enterprise computing and pursue strategic alignment, Pennsylvania’s efforts from 1995 to 2004 provide both a viable template and practical lessons. For those who seek to characterize the take-up and uses of computing as bricolage and drift, or to focus on the role of platforms for post-implementation innovation, there is extensive evidence from Pennsylvania’s efforts to engage computing.

References


