On Beyond Z: Building a Directory Service

Deborah Keyek-Franssen
Marin Stanek
Paula J. Vaughan
University of Colorado at Boulder
Boulder, Colorado

The University of Colorado at Boulder recently implemented an Enterprise Directory. During the early stages of this project, we realized that the effort would involve much more than just the cobbled together of an LDAP directory. The success of our Enterprise Directory would depend upon us forging On Beyond Z: beyond the silos of application-specific directories, disconnected business processes, and strong independent entities (departments, governing bodies, organizations, systems and individuals). This paper describes how we created our Enterprise Directory by building a cohesive foundation of solid technology woven together with departmental expertise, cross-campus collaboration, and a culture of increased trust.
In the places I go, there are things that I see
That I never could spell if I stopped with the Z.
I’m telling you this ’cause you’re one of my friends.
My alphabet starts where your alphabet ends!

Dr. Seuss
On Beyond Zebra

Introduction

In the fall of 2001, the University of Colorado at Boulder implemented an Enterprise Directory.

And that statement doesn’t come close to doing justice to the technical, political, and cultural realities that form the foundation of that implementation.

Early in the development of the Enterprise Directory, it became clear that success would be elusive unless we turned our attention to more than just the cobbling together of an LDAP directory. That’s not to say that the technical A-Zs of a directory project aren’t important—they are. But the success of our directory implementation depended on our forging into the seldom-explored and rocky terrain beyond technical A-Zs.

Integrating data silos is the goal of any Enterprise Directory. To do so effectively, the business practices that underlie the silos must be addressed: the combination of data and business practices found within and between silos will form the basis for subsequent decisions regarding processes and rules for adding, reconciling and managing data in the directory.

We ventured beyond the business practices and functions, and into the world of departmental and institutional politics, policies, and processes. Although this required mapping new terrain, we knew that an understanding of this land beyond Z was critical to the long-term success of our Enterprise Directory.

To get the necessary buy-in, to establish a robust process of ongoing directory management, and to ensure successful authentication and authorization functions, we needed to build a cohesive enterprise foundation of technology, expertise, and culture, woven together with the expertise and culture found within individual silos. To accomplish this, we began building the letters beyond Z: an always surprising and enlightening, a sometimes frightening and frustrating, and, for the optimists, a magical endeavor that included:

• collaboration across institutional and political boundaries,
• establishing a cultural fit between the directory, departments, and technology, and
• opening boundaries between processes.
As with many higher education institutions, it was time for the University of Colorado at Boulder to implement an Enterprise Directory. The campus had a plethora of application-specific information silos that were discrete, non-communicative, and often repetitive sources of information. Taken as a whole, the campus’ processes for collecting and using information were inefficient, ineffective, and without a means for ensuring integrity or consistency of information from one silo to another.

Again, as at many higher education institutions, CU-Boulder’s employee, student, and financial information is stored in three discrete, highly independent systems: a Human Resources system (recently converted to PeopleSoft), a Student Information System (SIS), and a General Ledger system (also recently converted to PeopleSoft). Each of these systems represents a distinct data silo.

And, like many higher education institutions, CU-Boulder has had (and, until the full implementation and acceptance of the Enterprise Directory is complete, will continue to have) myriad departmental applications that often duplicate information from HR or SIS. The student health center billing system, the BuffOne ID card system, the recreation center membership system, and Mailing Services’ E-Memo system, are just a few examples of the siloed application landscape at CU-Boulder.

Not surprisingly, the data contained in these silos is not only walled off from the rest of the university, but is often disparate. That is, mismatches between systems abound. During the project, discrepancies between systems became evident in name misspellings, date of birth differences, social security number mismatches, and gender discrepancies. Disconnects between systems were highlighted: name, telephone number and address changes for students, faculty, or staff need to be updated in every one of the silos in which a person appears, but are often found to have been updated in only one system. The very idea of data reconciliation between each discrete unit of the constellation of systems was mind-boggling.

Additionally, until the Enterprise Directory, there was no one definitive data source or set of business rules or policies that could be referenced in the case of disparate data. For example, there was no agreement about the criteria to use to determine a person’s primary affiliation if that person had multiple roles with the University. There was no shared understanding of what data differences were acceptable (e.g., nickname vs. formal name) or indicative of errors (e.g., name spelling differences).

But the real evidence of the timeliness of an Enterprise Directory services project was the lack of an authoritative source for access control. The existence of many independent system administrators meant numerous (and inconsistent) criteria for granting access to electronic information, network resources, and services. While silo-based guidelines existed, there was no documented campus-wide policy for access control.

It was, in short, a wild, hairy nightmare of scattered information and lack of access control that was only going to get worse in the absence of an Enterprise Directory.
An internal audit of the campus’ telecommunications and network infrastructure pointed to an immediate need for better access control. Furthermore, savvy departments had an understanding of the need for better information and more controlled access and authorization. New applications being considered for implementation required an Enterprise Directory, and the departments interested in those applications were queuing up at the doorstep, in some cases begging for a directory. Portals, calendaring, electronic voting, computer based training, library resource validation, and security mechanisms were all pending applications that required the authentication services, affiliation checking, and attribute information that an Enterprise Directory could provide and support.

The time was, shall we say, overripe for an Enterprise Directory.

**Enterprise Directory Service Project Goals**

A robust Enterprise Directory was a good technical solution to the problems noted above. But the goals for our directory services project included considerations beyond a technical implementation, beyond the Z, to address the roots of our problems and to build a strong foundation for the institution’s most effective use of the Enterprise Directory.

Early on, the project team recognized the importance of cultural issues to the success of the Enterprise Directory: the project’s commissioning statement emphasized the need to deploy and maintain the directory within the context of the University-wide environment; and the project’s goals also stretched beyond LDAP technology:

- **The directory will be a trusted, authoritative source of data.**
  “Trusted” and “authoritative” imply political, cultural, and human elements. Any Enterprise Directory can strive to provide accurate data, but being a trusted, authoritative source of data means that there is not just integration of data from different sources, but that there is buy-in from those sources, and from directory users: buy-in into (and an underlying understanding of) the processes of integration and reconciliation. Without excellent communication with and involvement of data sources and directory users, the directory can never be a truly trusted and authoritative source of data.

- **The project will develop a process for identity, data, and relationship management.**
  Again, it is impossible to overestimate the importance of cross-departmental communication and cooperation to achieve the processes necessary for universal identity management. Although the directory manager may be the lynchpin of identity management, data sources and users must have a shared understanding of the processes and data used to create and manage complete identities for the elements of the directory. Without it, adequate (and, again, trusted) standards for authentication and authorization can never be achieved.

- **The directory will be a general-purpose service usable by a variety of applications and services.**
The technical foundation of the Enterprise Directory met this goal by building a standards-based but extensible directory structure. Our cultural component of this goal is being met through ongoing cross-campus communication and cooperation, and with a thorough understanding and adept handling of the political realities of our campus. This goal is further supported by campus-wide policy ensuring that all new systems requiring authorization, authentication, or enterprise attribute access are LDAP-enabled. The policy, in part an enforcing mechanism, also provides much-needed targets and guidelines for departments who want to play the LDAP game.

- **The directory will support the campus’ central authentication mechanism.** The key word for the Beyond Z challenges of the Enterprise Directory project is “central.” Establishing a central authentication mechanism providing definitive affiliation checking, as well as a structure for supporting centralized account management, meant navigating the terrain of decentralized departments to the end of buy-in and cross-campus cooperation. These navigation challenges were eased to some degree because of the widely recognized attractiveness of the goal.

**The Original Alphabet**

Although we contend that our forging Beyond Z was the element most crucial to the long-term and broad success of our Enterprise Directory, we also understand fully that an Enterprise Directory cannot be successful on the most basic level without significant attention to the A-Z of directory technology and the A-Z of the campus’ technical infrastructure. The campus and university infrastructure played a large role in the design of the Enterprise Directory, and continue to have an impact on its implementation. The following bullets give a brief overview of the campus’ demographics and pertinent structure:

- The University of Colorado comprises four campuses and a central administration. This means that the University has four distinct campuses, and four distinct cultures, all of which need to be taken into consideration during the course of the directory project, and throughout the life of the directory itself. Although the initial implementation serves only the Boulder campus, there are plans for all four campuses and the System Office to join the Enterprise Directory. In addition, the System Office manages the two major source systems that contribute data to the directory (Human Resources for employee information, and SIS for student information).
- The Boulder campus serves approximately 29,000 students. The campus employs about 2,400 faculty, instructors, and researchers, and another 2,600 staff. Each of these community members has a directory entry, as do retirees, the Board of Regents, and a variety of other affiliates.
- CU-Boulder’s Information Technology Services (ITS) is the campus’ primary technology provider. It provides the campus backbone and an extensive array of computing, telecommunications, and media services and is strengthening its role in standards setting and technological innovation. However, several large “alliance networks” and an array of decentralized IT professional campus units create a mix between central and departmental technology support across the campus. CU-Boulder’s IT Council supports the work of the entire campus by facilitating cross-
campus communication and policy development. Nonetheless, department-specific IT shops continue to build independent IT silos by pursuing their own technologies, systems, and protocols, presenting a challenge to the development of an Enterprise Directory that is fully integrated into centrally and departmentally supported areas alike.

**Multi-Level Project Structure**

Our campus environment of independent information systems, processes, and technologies necessitated a venture into the cultures and languages Beyond Z. The project team structure is both a microcosm and a foreshadowing of the structures and relationships that guarantee the long-term success of the directory.

Our Project Champion played a leading role in our project structure. The existence of an *active* project champion was crucial to the successful implementation of the CU-Boulder Enterprise Directory. This person—in our case, the Executive Director of ITS—acted as a political conduit to the very top ranks of the administration and, via policy and an active role on the campus’ IT Council, to departments and system administrators. Our Project Champion kept the momentum going by reinforcing the importance of the directory initiative to those impacted directly by the project and to those doing the hands-on project work. He also championed the project to all of CU’s campuses, setting the groundwork for University-wide commitment to the Enterprise Directory Services.

Our Core Team was at the heart of the project. Core Team members, chosen for their technical and functional expertise, were drawn from various areas of ITS and from major campus departments (e.g., Libraries, Housing, Computer Science, Registrar) as well as from the System Office. In twice-monthly meetings throughout the life of the project, this team dealt with the details of the project: implementation issues, design decisions, and specific task assignments ranging from technical exercises (experimenting with indexes, replication design, creating database links to source systems, etc.) to documentation. Core Team discussions culminated in recommendations that were sent to the Steering Team for their review, comments, and, in most cases, approval.

The Big “Team” (the word “team” in quotes because this group never actually met)—comprising system administrators and departmental representatives from around campus—gave the project structure the language needed to perform effectively in the terrain Beyond Z. The Big Team functioned differently than the other teams in the project: in lieu of team meetings, Big Team members were interviewed individually and extensively at the beginning of the project, and were subsequently called upon whenever their individual expertise was needed. It was those early interviews and discussions with the Big Team members that provided the basic vocabulary that set the stage for the entire project. These interviews provided critical information about the campus’ respective data, systems, business functions, and culture. The analysis of this information was then used for designing the directory and for creating the project’s implementation strategy.
The Steering Team was the smallest of the project teams, but it carried the most authority. This team brought together key decision-makers representing the primary constituencies of the campus: faculty, staff, and students. Because it was critical that this group have the authority to approve process change and institute policy, representatives on this team were all at levels of senior manager, director, or above. In addition to their decision-making role, the Steering Team members acted as communication conduits to their constituencies and superiors, reinforcing the Project Champion’s messages. Monthly meetings established a culture of communication and understanding among and between these constituencies and with the technical side of the Enterprise Directory project.

Our Technical Team tackled the nuts and bolts project tasks. This workhorse team shouldered the responsibility for all of the development, testing and integration of the technical components of the Enterprise Directory. The Technical Team included the Project Manager, the IT Architect, the Directory Administrator, system administrators, analysts, programmers and web designers. Of these, only the Project Manager was devoted full time to the project.

This wide representation throughout the project layers encouraged participation, established channels of cross-campus communication and buy-in, and helped define the political and cultural structures to be negotiated. The multi-layered project structure established a process and a culture for the Enterprise Directory project, and for the directory: both would be intimately concerned with silo-based functional expertise, and both were committed to a collaborative, inclusive process that attended to the cultural and political nuances of individual fiefdoms.

An Iterative Process

With the early Big Team interviews, the directory project initiated an iterative process of technical, cultural, and political negotiation that is the hallmark of the CU-Boulder Enterprise Directory project (and of the directory itself). The technical design and development work was carried out in large part by the Technical Team, but constant communication and collaboration between the technical side of the project and the Core, Steering, and Big Teams set in motion an iterative process that has served the project and the directory equally well.

Original interviews with the Big Team set the direction for the original design proposals. The Core Team worked through these proposals, sending recommendations to the Steering Team for review, approval and comment. Steering Team comments returned to the Core Team for refinement, and so on. These iterations evolved into the specifications, stamped with institution-wide authorship, from which the Technical Team began their work. The result of the Technical Team’s work went back to the Core Team, then to the Steering Team, then to the campus. Each step generated comments, ideas, and issues that percolated throughout the project layers.

But this integration of players within the Directory Project has not abolished silo fiefdoms on campus. Indeed, it hasn’t needed to. Instead, the project has drawn such fiefdoms, which dot the lands Beyond Z, into the process, while concurrently respecting cultural boundaries and functional expertise. It’s not just that lines of communication have been open throughout the project, but that communication is facilitated, and opportunities abound to increase
understanding of departmental business practices, as well as the politics and culture that underlie them.

There have been significant rewards for departmental participation in the project, rewards that will continue throughout the life of the Enterprise Directory. First, there is the satisfaction of being involved with a successful, campus-wide project. Historically at the University of Colorado, the decentralization of technological systems and administration has been coupled with a perception that departments were on their own, and that their concerns were neither heard nor taken into consideration. In the past several years, steps have been taken to change that perception. The directory project built upon this trend. Integrating departments into the project and processes of the directory serves both to change the technological landscape on campus, and to provide the intrinsic reward of being an active participant in and contributor to a successful endeavor.

Building Trust

Because of the continual percolation of ideas, design and issue resolution through the project layers, departments that have participated in the project, and those that continue to collaborate in the implementation and operation of the Enterprise Directory, are able to influence both its design and its ultimate use. Most importantly, these participants and collaborators witness firsthand the results of their influence both on the Directory Project itself and on the campus’ project process as it moves Beyond Z.

Although the Beyond Z realm is enjoyable on its own merits (it really is exciting to chart new terrain, learn new cultures, visit exotic places!), there are also campus-wide benefits for approaching a directory project with the Beyond Z in mind. Silo and campus buy-in, trust, and collaboration have all contributed to a comfort level and a level of engagement that encourages adoption of directory-enabled applications, and even a measure of risk-taking concerning those applications. It has increased knowledge about security, access, authorization, and authentication; fostered a better understanding across functional units; and promoted efforts to establish consistencies among data-dependent processes.

Build for Strength and Potential

The project team, in addition to extending the horizon beyond cultural, political, and functional boundaries, extended the horizon out to the future. It was crucial to build a strong foundation for the directory in order to maximize its potential: the stronger the foundation, the more effective the directory will ultimately be at supporting current and future needs of Boulder campus users, as well as potential University-wide and inter-University users. The following table correlates the directory’s strengths with the potentials they enable:
**Strength**

- Adhere to LDAP standards (the project’s fundamental strength)
- Incorporate Internet2 standards for Higher Education
- Common standard for CU data
- Established standard for handling campus-specific objects within the overall directory structure
- Establish a standard for directory governance

**Potential**

- Maximize the ability to extend the directory for application use
- Enhance the ability to participate in inter-institutional initiatives
- Common platform for university-wide use
- Enable campus-specific uses of the Enterprise Directory without compromising the basic CU directory structure
- Continue collaborative policy making

Except for the final strength listed, these elements constitute a solid technical layer of schema, logic, data, and security that provides the underpinnings of the project and directory structure. That layer is, in turn, nested under a communication layer of education and commitment that moves the directory and the project Beyond Z.

The Beyond Z influence of project participants creates a layer of process, policy, and design that overarches the entire project. To maximize its potential, this strength must include a thorough understanding of cultural and political complexities, diplomatically acquired and enhanced through collaboration.

**Measures of Success**

There are different ways to measure the success of an Enterprise Directory. Basic existence is one: just getting an Enterprise Directory up and running can be viewed as a significant accomplishment. Error-free data is another: we could quantify a frequency of errors, and the directory would be successful if it came in under this level or was instrumental in reducing the pre-directory error level.

But there are equally significant, though less easily quantifiable, measures of success—measures that correlate with the processes put into place by our directory project, and which continue past its implementation:

- We knew the directory was successful when community members—such as the technical and administrative citizens of the silo fiefdoms—were engaged in the process, and not threatened by it.
- We knew the directory was successful when community members—from network managers to deans—asked to learn more about the directory project, and about the details of the post-implementation directory.
- We knew the directory was successful when community members were asking to be involved, and asking to serve on teams and committees associated with the directory and the directory project.
- We knew that the directory was successful when community members wanted to use the directory, and had lists of directory-enabled applications that they wanted to implement.
We knew that the directory was successful when praise was heard on the campus grapevine. Official buy-in was fostered through the cross-campus structure of the teams, and encouraged by policy. But voluntary buy-in is always more elusive, and therefore that much more significant, when evidence that it abounds starts rolling in.

Lessons Learned and What We’d Do if We Had to Do it All Over Again.

Not that we’d want to do it again, but if we had to, we’d do it pretty much the same way, but with the following adjustments:

- We would staff higher, earlier and with more dedicated FTE to compress the time of the earlier project stages, and to accelerate the momentum of the project.
- We would absolutely build upon the same project structure—with one adjustment: we would bring a dedicated Directory Manager into the project at its earliest stages.
- We would consider having one or two actual “Big Team” meetings with the group as a whole to build a common energy among those players.
- We would collaborate with Legal Counsel early on in the process to streamline policy development and approval.
- We would be better prepared to capitalize on the success of the project, staffing to handle new directory-based initiatives while putting the final touches on the original implementation initiatives.

Conclusion

The Enterprise Directory project gave us the opportunity to blend together the talents of our highly skilled IT professionals, the functional expertise of our departments, the political savvy of our administrators, and the wisdom of Doctor Seuss. The technical underpinnings of the project were well-grounded in the established landscape of higher education’s fiefdoms and LDAP’s technical architecture. The success of the project, however, was dependent upon our willingness to venture out of our familiar environment and into the Land Beyond Z:

- to the trials, tribulations and ultimate successes of the intermingling of data, processes, politics, and cultures;
- to the creation of a robust and sustainable project culture; and
- to the forging into the future with the directory governance framework built upon communication, understanding, and collaboration.

Adopting this iterative and open multi-layered project model has helped to create an environment of increased trust which, in turn, is building a campus culture of collaboration, commitment and even risk-taking—a culture that further enhances the potential successes of the next IT projects that choose to venture Beyond Z.