

The Rise of Collaborative Tools

For the last several years, a number of colleges and universities have been steadily at work on a pair of coordinated initiatives: (1) building consistent campus middleware infrastructures to serve campus applications; and (2) developing interinstitutional tools that can leverage this consistency for a wide array of new collaborative services. The first initiative has resulted in the emergence of numerous key pieces of a campus middleware infrastructure, including directories, campus-wide authentication systems, and identity-management services. (This infrastructure supports efficient and scalable institutional applications as diverse as Web services, course management systems, legacy applications, and calendaring.) Because these campus deployments have used consensus standards and consistent architectures, they have laid a foundation for intercampus-use tools and applications, and the second initiative has begun to bear fruit. Important new possibilities for campuses to collaborate both academically and administratively are now emerging.

These interinstitutional developments have resulted from a shift in the model being used to design middleware. Higher education has changed its perspective from seeing users as free-range creatures, carrying and maintaining their own electronic credentials and attributes independently, to viewing users as people associated with enterprises, such as universities, which then broker information on behalf of their employees, greatly easing the burdens on both enterprises and users. Related enterprises in turn come together into federations, exchanging

attributes about their users and resources to control access. This "federated administration" permits lightweight mechanisms to develop in support of collaborations. Federations are being seen as new and catalytic in the corporate sector, but they have been part of the *modus operandi* of higher education for years.

This shift in perspective, coupled with the emergence of technologies such as XML, has created a number of accelerating initiatives in what has been termed the "federated identity space." All the efforts aim to deliver interrealm services, which allow users to access content at other organizations, convey personal attributes from one domain to another, and connect multiple instances of their electronic selves. Several efforts in this space are noteworthy. Microsoft, through .NET and Passport, has tried to leverage its desktop dominance into identity services. The Liberty Alliance Project (<http://www.projectliberty.org>) is a growing consortium of major corporations—in technology, banking, transportation, and other areas—promoting an open standard for interorganizational exchanges of individual identities and attributes.

Within higher education, a three-year effort by leading institutions, with coordination and support from Inter-

net2, has resulted in a system called Shibboleth. Shibboleth represents two interleaved efforts: (1) the development of a set of Web services (implemented as open-source software) for interinstitutional sharing of authentication and authorization information; and (2) the ongoing creation of a larger framework and architecture for general interrealm services. The set of Web services that Shibboleth provides is part of what can be called the middleware "plywood," not only for its layered approach but also for its potential to be used as subflooring for a number of surfaces, each of which will draw far more attention.

The collaborative potential is immediate. Institutions should be able to transparently share course Web sites, secured from the outside world but available to appropriately enrolled students at the participating colleges and universities. Campus researchers can work with their national peers to share Web-based work sites, using their existing local campus identities and log-ins. National associations can share information, with new forms of controls on who can access what. Libraries can offer access to campus users regardless of their location and can refine licensing mechanisms to save funds.

Another area of impact lies in digital rights management

(DRM). The requirements for managing digital rights in higher education are quite complex, with issues of privacy, fair use, and copyright combining with needs for such academic controls as "annotate." Moreover, higher education is both a leading provider and a leading consumer of digital content, and it needs models that offer both roles. For this area, with its great consequence for the academic community, Shibboleth and associated directory infrastructures provide an immediate infrastructure for DRM to scaffold on a superstructure.

Federated tools such as Shibboleth can also be leveraged within the curriculum itself. Spreadsheets can be built between institutions, with data provided by each campus using its local system but moved securely and privately in interrealm exchanges. Even the K-12 curriculum could be served. If an elementary school's mascot is a cougar, students could frame questions such as: Do more schools in the West have cougars as their mascot than in other regions? Does the mascot apply more often to rural schools than urban? Do more elementary schools than middle or high schools have a cougar as their mascot? Can we see other schools' cougar mascots? Each of these queries could be answered with simple network-based information tools that can harvest data from other schools. The opportunity to train students on how to perform complex searches across networked spaces seems useful.

Virtual organizations, such as many of the planned computing grids and the National Virtual Observatory, can significantly reduce their difficulties in implementation by leveraging the federated services model. Researchers can use their local institutional credentials and information in the virtual organizational context. Local resources being provided by a

researcher can integrate both campus and organization rules for use. Collaborative tools, such as Web authoring systems and list processors, can be made to operate within national organizations as they work within the campus organization.

It should be noted that such a future can present real challenges. For example, can we rethink our "workflow" to take advantage of such tools? How difficult will it be for users to manage privacy? The design targets have been systems that permit

video has often been cited as the next "killer app," but it has suffered from a variety of real-world deployment challenges, most notably the lack of plumbed middleware. We want desktop clients that have point-and-click initiation. We want clients that announce and control incoming video calls. We want clients that allow institutions to authorize how much bandwidth a user is permitted to consume. Elements of the Shibboleth architecture can be repositioned to be used to enable such capacities.

Peer-to-peer applications are another application model that might leverage this emergent architecture. Peer-to-peer is an extremely powerful approach for information sharing, but on the open Internet it has proven hard to manage. However, some pioneering campuses have "tamed" P2P, using their enterprise authentication and authorization systems. The results in shared file systems, calendaring, and other collaborative services are impressive. Extending these results to interrealm environments using collaborative tools such as Shibboleth presents interesting new opportunities for role-based access controls.

We are building interinstitutional transports for moving containers of different sizes and shapes from one domain to another, securely and with user-controlled privacy. We have created consensus standards on some of the cargo that can go in those containers. We now face the question of how best to collaborate in using these interinstitutional transportation tools to conduct the business of higher education and, in the process, to transform both ourselves and our society.

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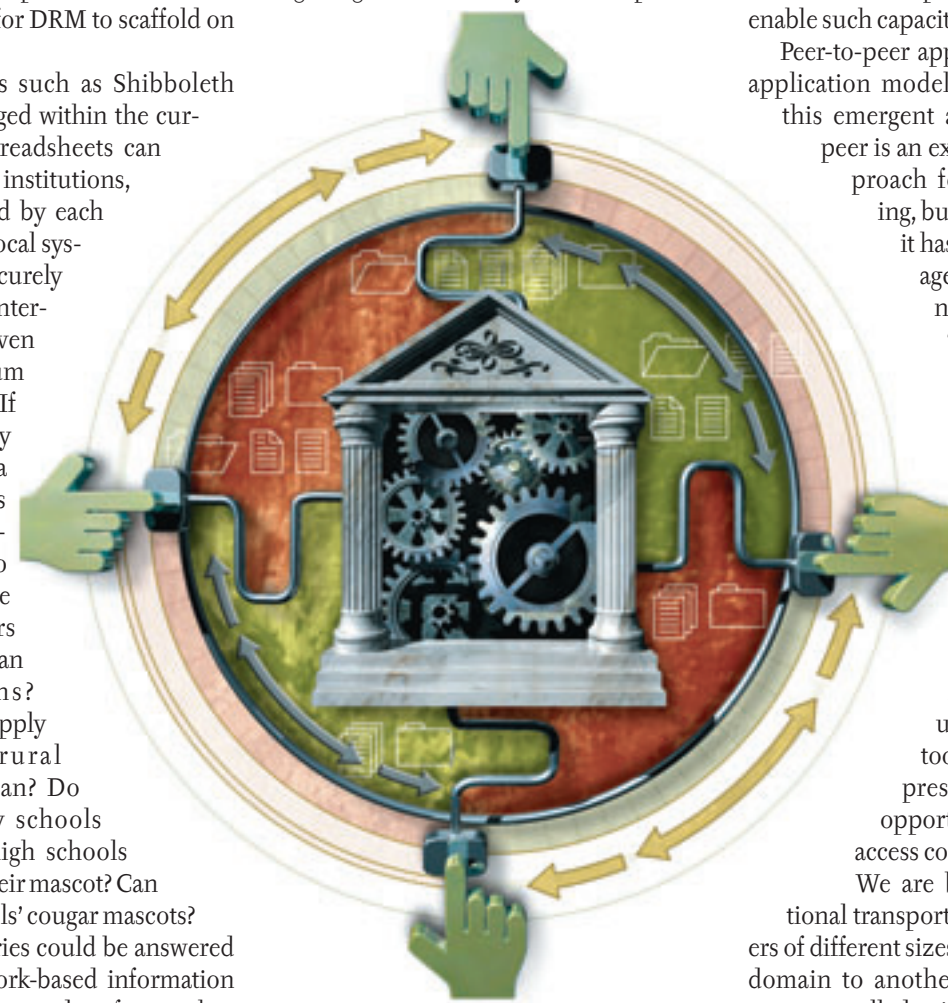


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