4.2 - Bamboo Services Platform

4.2.1 Summary

The Bamboo Services Platform (Platform) will provide a common set of technologies on which services can be made available to communities of scholarship, pedagogy, and the arts. Bamboo Services will run (be deployed) on this Platform, much like web browsers and word processors run on an operating system (e.g., Microsoft Windows, Mac OS, or Linux).

Specific humanities projects and particular tools for scholarship will benefit both from software development and deployment processes that define a Bamboo Services Lifecycle, and from the availability of a growing body of shared, reusable services that can be composed to provide direct benefit to work in the arts, humanities, and interpretive social sciences. These are long-term goals, but they will be advanced in measurable stages through partnerships between Bamboo and extant projects of proven value to digital humanists; as well as partnerships with owners/custodians of valued stores of digital content, aimed at facilitating content management and advancing interoperability among key repositories and with highly valued tools and services.

Sustainability - the useful life of software - will be addressed by subjecting valued services to rigorous engineering processes and standards to broaden their applicability and capacity; while increasing value and uptake through exposure, critique, and community design evolving in the Bamboo Commons. Economic leverage will be achieved by providing a distributed, scalable means of running and managing services, decreasing cost and pressure on data centers hosted by individual institutions and organizations. An initial set of services deployed to prove the successful implementation of the Platform will include services that support and realize the Bamboo Commons.

Standardized infrastructure choices and automated procedures for realizing those choices will save money, time, and aggravation for humanists and support staff who must otherwise sink funds and effort into choosing, maintaining, and operating technology, hindering direct engagement with teaching and research.

4.2.2 Value

Bamboo will adopt software development standards and deliver technical infrastructure that permits humanities projects to transition from project-specific applications to services that are longer-lived, more broadly supported, more efficiently developed and operated, and more widely used, useful, and interoperable. This transition will enable content and technology to be easily discovered, combined, re-mixed, and shared to create new forms of digital research, teaching, and creative transformation. Through the Bamboo Commons, supported by and run atop the Bamboo Services Platform, the evolution of technology to support scholarship will be designed and directed by a rich, collaborative community of scholars, teachers, artists/performers, librarians, and technologists.

The "cloud" model of service hosting introduces more than an approach to sharing services, connectors, interfaces, and content. Deployment of a Bamboo Services Platform in the cloud will leverage investment and minimize risk to individual institutions through guarantees of service availability inherent in well-architected redundancy, drive down data center costs through economies of scale, and leverage pooled software engineering talent.

Partnering with key content and tool projects that are able and eager to externalize general aspects of their offerings will enable other digital efforts in humanities to increase the fraction of software development devoted to scholarship-specific functionality, while decreasing investment in redundant infrastructure and obviating costly, one-off solutions to content access and interoperability problems. Partners will be credited with contributing to a broader range of scholarship, a value proven by usage metrics collected for services deployed on the Platform. In turn, contributing partners who evolve their offerings to rely on contributed services deployed and maintained in a Bamboo environment will free themselves to focus on areas of specialized value and expertise.

The following perspectives have been contributed by participants in the Bamboo Planning Process and further illuminate these values in the language of a variety of scholars and technologists.

**Perspective: Sustainability Across Disciplines and Over Time**

Our goals are to revise, augment, and integrate what we already have. We need to address scale across various dimensions, including:

- **Sustainability across disciplines**: No single discipline can optimally develop and support its own infrastructure. Classicists should share as much infrastructure as possible with other students of the ancient world (e.g., cuneiform, hieroglyphics, Sanskrit) and the present (e.g., Arabic language and Middle Eastern Studies).
- **Sustainability over time**: We need to shift from services run by small, discipline specific projects to services that an emerging core of information professionals can sustain and develop over time. We will still depend upon disciplines for R&D in high value services but we need new mechanisms to convert these prototypes into services that can process very large collection, serve huge audiences, and evolve over decades.

- Gregory Crane, Professor of Classics; Winnick Family Chair of Technology and Entrepreneurship; Tufts University
### Perspective: Access and Analysis of Digital Resources Across Legacy Boundaries

As humanities scholars adopt and develop new digital methodologies, access to quality digital resources (text, image, audio, moving image and other media types) and the tools with which to work with them become increasingly important. It is at the intersection between data access and data manipulation/analysis that Project Bamboo can significantly support the digital humanities and provide services crucial to their continued growth and development.

Many institutions - universities, libraries, centers - have digitized collections of their holdings, and are eager to have them used by scholars from their own institution and elsewhere. These institutions may find it difficult to not only make their own content easily available, but are frequently unable to effectively merge their content with similar materials from other institutions.

Several factors lead to this problem. Collections will be digitized using different technologies, and will be catalogued, stored, and disseminated in different ways. Even when they are available for public use, there is no easy way to search across collections, use standard APIs to re-use information or even to discover what metadata is available for searching. Despite a genuine willingness to share digital content, institutions have experienced difficulty in selecting appropriate rights statements and expression of permissions.

Institutions need a focal point around which they can gather and agree on standards that will enable their collections to truly interoperate. Project Bamboo can be that focus by facilitating the interoperability of digital collections in several complementary ways.

- serving as a locus for discussion and as an advocate for opening collections not only on the web, but via APIs and federation
- convening institutions with large digital collections so that they can agree on exchange standards for data and metadata
- work with some flagship institutions and collections so that others can have good models for sharing and interoperating
- provide information for institutions that don't yet have repositories or digital collection programs, so they can proceed as efficiently as possible

By engaging in these activities, Project Bamboo will benefit libraries, academic institutions as well as faculty and students.

- Elli Mylonas, Associate Director, Computing and Information Services; Brown University

### Perspective: Leveraging Investments in Infrastructure

Both CIOs and library Directors face a tremendous challenge to meet the increasing needs on their campuses for access to digital resources, including both content and computational power. These needs span all disciplines but lag somewhat, for now, in the humanities. While recent trends in federal funding suggest a resurgence of support for STEM research, there are few signs of advances in support for the arts and humanities. Furthermore, directors and CIOs clearly face a time when the total sum of resources available to higher education, from private and public funds, will likely force fundamental changes in the curriculum on their campuses, and changes in how core support services are provided.

In such an environment, the digital humanities and arts will be disadvantaged, especially in those institutions without an historic investment in that field. In the aggregate, we hope that Bamboo will enable more granular sharing of scholarly resources within discipline-appropriate communities. Thus one of the attractions of Bamboo for a CIO and a library director is the opportunity to leverage investments in infrastructure. Within the Big 10 Universities, for example, we already have several initiatives underway that would enable us to deploy a shared storage facility including, most notably for the humanities, the Hathi Trust. Almost every university is facing the challenge of managing increased demand for storage and other services to support the wealth of data generated through computational research, and few of these institutions will be able to meet the needs of their communities on their own. With Bamboo, we can provide new resources specifically for the humanities without having to house or develop all of them locally. Leveraging community investments should leave our CIOs and directors with more resources to support their local faculty and graduates, and to facilitate interdisciplinary research in the humanities and across campus to computationally intensive disciplines.

- John Harwood, Associate Professor, Information Sciences and Technology; Senior Director, Teaching and Learning with Technology; Pennsylvania State University

### Perspective: Standardizing on a Reference Architecture and Platform

The Humanities Mapping Project (HMT) is an inter-institutional effort among the University of North Carolina, the Renaissance Computing Institute, North Carolina State University, and the North Carolina Humanities Council to facilitate scholarship on digital humanities collections while also engaging non-scholarly publics with these collections.

Collaboration with Bamboo would provide a reference architecture and base platform implementation for HMT, thereby saving development resources by utilizing Bamboo’s built-in scalability and other platform features. Standardizing HMT on Bamboo would also facilitate uptake and adoption of HMT's technology by other Bamboo platform users.

- Joyce Rudinsky, Associate Professor, Institute for the Arts and Humanities (IAH); University of North Carolina, Chapel Hill
Perspective: A Baseline for Common Development

This statement of endorsement is hinged to the comments made at the first Bamboo workshop, in essence, the goal of "no more one-off digital humanities projects" is a worthy endeavor. If Project Bamboo can establish the baseline common development language for components to sharing, interoperability of digital repositories, common services, communication and systems then it is a worthy effort.

This endorsement is based on the experience of having functioned as a P.I. for the AWMF funded project Imag(N)ing Shuilu’an. [...] In keeping with the core concept, "no more one-off digital humanities projects", it would be good to look again at this prototype project, and refashion the work to both expose it to other similar themed digital humanities projects as well as bring the core conceptual work as a part of an integration with other similar themed Asian art and e-culture initiatives. The obvious benefit of Project Bamboo to establish the mechanisms to not only provide systems and platforms for making this work exposable to other repositories, but in the same way that that the presentation of the Shuilu’an digital artifacts attempted to maintain their physical context, the online presentation had a method of interacting within a broader world of similar themed digital repositories for scholarly research and assessment within that context.

- Harlan Wallach, Architect for Media Technologies, NUIT Academic & Research Technology; Northwestern University

4.2.3 Description

The Bamboo Services Platform Area of Work will be realized through a set of interrelated Projects that will strongly influence each other in iterative phases. The Services Platform Projects are:

- 4.2.3.1 - Shared Services Lifecycle
- 4.2.3.2 - Services Partnerships
- 4.2.3.3 - Strategic Content Partnerships
- 4.2.3.4 - Realizing the Bamboo Services Platform and Utility Services
- 4.2.3.5 - Platform Hosting and Management

4.2.3.1 - Shared Services Lifecycle

A Shared Services Lifecycle will define qualities and processes through which software evolves as it is transformed to a services architecture, and rendered capable of running on the Bamboo Services Platform. It will include criteria for identifying candidates for inclusion in a family of shared Bamboo services based on value to scholarship, conformity with appropriate standards (software and/or data structure), and technical feasibility. Value will be identified in significant part on the basis of information harvested from the Bamboo Commons and similar repositories of critical evaluation by communities of scholarship. Similarly, the Bamboo Commons will provide a venue for community participation in service design, through iterative cycles of service evolution and critique.

Evolution through the Shared Services Lifecycle will broaden and deepen the value of software to scholars and the long-term viability of technology that may have been originally created for worthwhile but narrowly tailored purposes, whose use entails idiosyncratic technical requirements or non-standard data formats, and/or which is atypically deployed. Application of best software engineering practices, in increasingly rigorous phases, will effect this transformation - whether services are being implemented for the first time, or are being evolved (refactored) in concert with partner projects. Broadly drawn, stages of service evolution can be described as:

1. Early interest in, adoption by, or development by the Bamboo Community
2. Iterative stages of software refinement to addresses concerns like standards-compliance, reliability, and conformity to Bamboo's standard deployment models (some pre-existing services new to the Bamboo community might already address some or all of these concerns)
3. Deployment on and reliable availability from a set of distributed Bamboo Service Platform instances
4.2.3.2 - Services Partnerships

Bamboo will deploy services in direct support of scholarship on its Services Platform, partnering with existing tool and service developers to realize that goal. Initial partnerships will also provide real-world experience of obstacles to reworking siloed projects/applications within a culture of shared services, and how those obstacles might be resolved. In the course of such partnerships, software will be reengineered through the Shared Services Lifecycle (above) to become standards-compliant and conform to a common services architecture. Testing and refining the Shared Services Lifecycle in the context of partnerships actively engaged in refining services of direct benefit to scholarship will enable future and more focused successes by enabling development of a set of tested partnership processes (a partnership roadmap), independent of the initial yield of services from Year One efforts, and thus provides significant value in and of itself.

In choosing an initial set of partnership projects, Bamboo will look to the value of both deployable services of demonstrable value to scholarship, and to a partnership roadmap for future and ongoing service evolution. To the latter end, different types of projects that are critically important to humanities scholarship will be selected for partnership. Project types might include:

1. long-running, faculty-driven, discipline-centered projects (e.g., ARTFL, Perseus); and/or
2. newer, native-SOA projects (e.g., Berkeley Prosopography Services); and/or
3. enterprise-quality, consortial, community-source oriented projects (e.g., SEASR, Sakai, Fluid).

Activity across all partnerships will include contribution to the Bamboo Commons, as an integral element of Bamboo's Shared Services Lifecycle. Contribution of Bamboo Commons elements related to partnerships will enable community participation in service design and evolution, and will augment the content of the Commons itself.

4.2.3.3 - Strategic Content Partnerships
Shared technology services in support of arts and humanities scholarship necessarily orbit around objects of scholarly interest - a subset of which can be broadly categorized as "digital content." As a path to early delivery of significant value to scholars, Bamboo will actively seek partnership with one or more owner/custodian/curator of substantial stores of digital content. The goal of such partnerships will be to develop or adopt, and deliver as services accessible via the Bamboo Platform, content management and/or interoperability capabilities that will expose very large or critically important bodies of content to Bamboo's community of scholarship. These partnerships are distinguished from those of the preceding project, Services Partnerships, in that they aim for synergy with organizations or projects less likely to be Bamboo Partners, but which have deep interest in providing organized, efficient, standardized modes of access to particular, valued repositories of content for communities of scholarship.

Potential types of candidates for such partnerships might include special collections of substantial breadth or depth; significant digital corpora; and/or libraries of digitized scholarly publications (e.g., JSTOR). Materials in the HathiTrust archives are a very large collection of considerable interest, and partnership opportunities are being actively explored with this organization.

### User Scenario: Content integration and resource sharing reshape content development and digital asset management at U Arizona library

Members and partners have exposed a large and growing body of digital content through Bamboo services that facilitate access, citation, transformation to standard formats, and unified analysis across text, multimedia, and data resources owned by multiple libraries and archives. The University of Arizona has shared its unique resources under widely adopted licensing arrangements that restrict access to the degree that is required, but no more; and is able to offer faculty, researchers, and students search and discovery across its own collections and those of the many other "Bamboo friendly" institutions and archives. As scholars affiliated with other institutions access, analyze, and cite materials in Arizona’s collections, our libraries are able to document the value of the institution’s holdings to national and international scholarship. Linkage through Bamboo services to open-access journal publications permit the library to cancel some commercial subscriptions, relieving pressure on tight acquisition budgets. Mirroring agreements facilitated by services available in Bamboo greatly reduce concerns about downtime for the library’s critical repositories, as well as local staff and equipment costs. Bamboo provides clear pointers to practices addressing data curation and digital preservation issues, developed and maintained as best practices by national and international organizations. Arizona and other Bamboo institutions are incented by mutual interest in maintaining access to others' contributions as well as availability of our own.

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scenario contributed by Yan Han, Associate Librarian; University of Arizona

### 4.2.3.4 - Realizing the Bamboo Services Platform and Utility Services

A Bamboo Services Platform ("Platform") is the technology needed to run software services. Bamboo services will run (be deployed) on a Bamboo Services Platform, as web browsers and word processors run on an operating system (e.g., Microsoft Windows, Mac OS, or Linux). Services are expected to run on the Bamboo Services Platform in midrange and advanced - but perhaps not initial - stages of the Shared Services Lifecycle. Software services can, in fact, run on a wide array of platforms; but converging on a single or small number of platforms facilitates economies such as shared or distributed data center management, and evolution of a corps of programmers able to apply skills to a broad set of service development problems. The Platform is a required element of running services in a commonly managed, reliable, and fail-safe way. In technologists’ terms, the Bamboo Services Platform may include elements such as a service container; message mediation, transformation, and routing software; a rules engine; connectors to secure, distributed storage; a service orchestration engine; and logging capability to track and report usage metrics. These are elements of a Platform technology stack that will be selected (adopted), not developed by Project Bamboo.

A core set of "low level" or "utility" services are needed to realize the Bamboo Commons. These will be adapted or developed as an initial set of utility services to be run on the Bamboo Services Platform, with the expectation that they will be reused in contexts that extend well beyond the Commons itself. Additional utility services will be developed and deployed over time, driven by evolution of the Bamboo Commons and by overlapping requirements of evolving Services Partnerships.

Categories within the initial, Commons-supporting set of utility services include:

1. Usage Tracking (generic tracking of service and platform usage, with core & extensible data structures for cross-cutting & service- or application-specific reporting)
2. Notification (email, Bamboo message queues, RSS and Atom feeds, messages broadcast via social networking applications such as Twitter or Facebook, messages delivered via Open Social gadgets, etc.)
3. Authentication
4. Authorization
5. Persistence (storage)

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Add user scenario here

### 4.2.3.5 - Platform Hosting and Management

To better realize economic value from a Bamboo Services Platform, the Platform will be packaged as an "appliance" - a standardized set of technologies bundled together into an easily-replicated server. The Platform appliance will be a virtual machine, managed via a standard set of interfaces appropriate to distributed ("cloud") hosting. Hosting will be provisioned by commercial, consortial, and/or institutional partners, to best address stewardship, economic, legal, and policy considerations, in alignment with ongoing "Above the Campus" work being undertaken by the Common Solutions Group. An appliance may also contain additional technology bundles/systems/platforms (such as Fedora, Nuxeo, JCR interfaces for Plone et al., or SEASR), where the value of co-deployed functionality is judged beneficial in reasonable proportion to operational demands and complexity of the appliance.

This set of standardized infrastructure choices and automated procedures for realizing those choices will save money, time, and aggravation for humanists and support staff who must otherwise sink funds and effort into choosing, maintaining, and operating technology, hindering direct engagement with teaching and research.
4.2.4 Work Plan

Project Investment across All Areas of Work

Percentage values given in the table below represent investment of all types. These are percentages of investment Projects across both Areas of Work, the Bamboo Commons and the Bamboo Services Platform. The sum of percentages in each year is 100% across both Commons and Platform Projects; for readability, this table is reproduced in full in each area’s Workplan section.

<table>
<thead>
<tr>
<th>Area of Work</th>
<th>Project</th>
<th>Year 1 Investment</th>
<th>Year 2 Investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commons</td>
<td>Commons Core Services</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>Commons</td>
<td>Interchange and Access</td>
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<td>10%</td>
</tr>
<tr>
<td>Commons</td>
<td>Services Registry</td>
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<td>7.5%</td>
</tr>
<tr>
<td>Commons</td>
<td>Growing and Sustaining the Commons</td>
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<td>10%</td>
</tr>
<tr>
<td>Platform</td>
<td>Shared Services Lifecycle</td>
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<td>5%</td>
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<tr>
<td>Platform</td>
<td>Services Partnerships</td>
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<td>15%</td>
</tr>
<tr>
<td>Platform</td>
<td>Strategic Content Partnerships</td>
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<td>10%</td>
</tr>
<tr>
<td>Platform</td>
<td>Realizing the Bamboo Services Platform and Utility Services</td>
<td>20%</td>
<td>12.5%</td>
</tr>
<tr>
<td>Platform</td>
<td>Platform Hosting and Management</td>
<td>2.5%</td>
<td>10%</td>
</tr>
</tbody>
</table>

Bamboo Services Platform Project Deliverables

Deliverables described in the second table below are differentiated between those scheduled for Year One, those scheduled for Year Two, and those whose delivery is expected in subsequent Bamboo implementation phases. Detailed information about goals and deliverables, including quarterly goals and deliverables for the first year of Bamboo implementation, can be found in Section 8 of this proposal, “Detailed Plans of Action.”
<table>
<thead>
<tr>
<th>Project</th>
<th>Year One (Y1)</th>
<th>Year Two (Y2)</th>
<th>After Year Two</th>
</tr>
</thead>
</table>
| Shared Services Lifecycle             | 1. Identify and initially draft stages and processes of a Bamboo Shared Services Lifecycle, considering best engineering practices, and integrating description and response/evaluation cycles made feasible by features of the Bamboo Commons.  
   2. Refine stages and processes of a Bamboo Shared Services Lifecycle, testing and evolving current Lifecycle state against Commons and Partnership projects-in-process; and delivering articulated refinements in multiple iterative drafts.  
   3. Identify and formally describe criteria for identifying candidates for inclusion in a family of shared Bamboo services, based on value to scholarship, conformity with appropriate standards, and technical feasibility; and accounting for a growing body of information and evaluation in the Bamboo Commons.  
   4. Articulate and pilot the application of formal requirements/criteria that appropriately and accurately locate a service (or set of services) in the Lifecycle. | 1. Iteratively review, evolve, and apply Lifecycle descriptions and requirements on a six- to nine-month cycle of revisions.  
   2. Iteratively review, evolve, and apply criteria for identifying candidates for inclusion in a family of shared Bamboo services on a six- to nine-month cycle of revisions.  
   3. Iteratively review, evolve, and apply formal requirements/criteria used to locate services in the Lifecycle, on a six- to nine-month cycle of revisions. | Same as Y2, but on an annual cycle                                                                 |
| Services Partnership(s)               | 1. Articulate criteria for selecting partners, where initial partners are to be selected based on value to development of a partnership roadmap for future and ongoing service evolution, in addition to value to scholarship of deployable services and fit of deployable services to Service Lifecycle criteria.  
   2. Select a set of projects for the first phase of Bamboo Implementation (2010-11), identifying at a high-level the functionality that is to be (re)engineered or factored out as shared services.  
   3. Establish project partnerships that have been ratified by appropriate Bamboo governance bodies in sufficient time to invest in service modeling, design, and contract development in Q4 2010.  
   4. Publish a set of service models, designs, and contracts for refactorable services to be developed and contributed by each selected project partnership.  
   5. Integrate initial Platform utility services into each selected partnership project's system/platform/application. | 1. Refine criteria for selecting partners.  
   2. In accordance with published service models, designs, and contracts, engineer or reengineer projects to deliver shared services in direct support of scholarship, in iterative stages that correspond to (evolving) stages and processes of the Shared Services Lifecycle and meet its requirements.  
   3. In concert with the Platform-Realization and Platform Hosting & Management Projects, deploy shared services on the evolving Bamboo Services Platform.  
   4. Select and establish a set of candidate projects for post-Y2 partnerships. | 1. Iteratively refine criteria for selecting partners, on a 12 month cycle.  
   2. Repeat Partnership processes in their evolved and evolving states                                                                 |
| Strategic Content Partnership(s)      | 1. Identify, articulate, and prioritize qualities of strategic bodies of content, and strategic partners (content owners/custodians/curators).  
   2. Identify, articulate, and prioritize types and value of functionality that might be the products of strategic content partnerships.  
   3. Identify, establish relationships with, and explore partnership opportunities with candidates who align to priorities that have been articulated by this Project and appropriately ratified. | 1. Develop a partnership roadmap for candidates where mutual benefit and feasible deliverables have been identified.  
   2. Hand off successfully-mapped partnerships that have been ratified by appropriate Bamboo governance bodies to the Partnership to Derive Services for Scholarship Project. | Continue the work articulated in Y1 and Y2 deliverables.                                                                 |
| Realizing the Bamboo Services Platform and Utility Services | 1. Establish criteria for selection of standards, architectures, and technologies to be included in a Bamboo Services Platform, including platform-management technologies; and including criteria for determining what needs or circumstances might justify evolution of an alternate Bamboo Services Platform.  
   2. Select, assemble, and configure technologies that make up the Platform, supporting the initial iteration to support Commons and Utility services; automating assembly and configuration processes where possible using best practices and appropriate management tools; and documenting to a degree that insulates Bamboo from dependencies on individual participants.  
   3. In concert with Bamboo Commons and Partnership teams expected to initially consume them, model and design interfaces for; then implement, deploy, and test utility services in appropriately coordinated iterative steps.  
   4. In concert with service development teams, deploy additional Bamboo services on the Platform. | 1. Evolve the Platform to support Partnership services; as well as additional Commons and Utility services, as appropriate.  
   2. In concert with service development teams, deploy Bamboo services (including Partnership services) on the Platform.  
   3. Evolve previously-deployed utility services, as necessary and appropriate.  
   4. Identify, model and design interfaces for; then implement, deploy, and test additional utility services in appropriately coordinated iterative steps. | 1. If deemed appropriate as Bamboo matures, repeat realization processes for one or more additional platform(s).  
   2. Continue the work described in Y2 deliverables.                                                                 |
| Platform Hosting and Management       | 1. Establish criteria for selection of additional technology bundles/systems/platforms to be included in an appliance deployment of a Platform, including cluster- and distributed-cluster management technology.  
   2. Explore and address legal and policy issues inherent in distributed hosting of infrastructure and services, in concert with key higher education stakeholders (e.g., Common Solutions Group).  
   3. Articulate and explore models for Platform hosting and management, and select one or more for realization. | 1. Package the Platform and included technology as an appliance that can be deployed and managed as a virtual, "cloud"-hosted server; if an alternate Platform is developed, repeat this step for the alternate Platform.  
   2. Devise, implement, prove, and document a service request/redirection mechanism to direct service requests to multiple backing Platforms (or, ideally, clusters of Platforms) from a single point-of-request.  
   3. Realize Platform hosting and management under the selected model(s).  
   4. Gather service/platform usage and maintenance metrics.  
   5. Develop and articulate (a) candidate sustainable legal, policy, and financial model(s) for running services in the cloud for review, evaluation, and decision by the appropriate Bamboo governance bodies. | 1. If deemed appropriate as Bamboo matures, repeat operationalization processes for one or more additional platform(s).                                                                 |

For further detail, please refer to Section 8, Detailed Plans of Action