Administrative Excellence

IT – Data Center Aggregation

WISCONSIN
UNIVERSITY OF WISCONSIN–MADISON

Campus Forum – 6/20/2012

Project Team Members

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Note: (1) – team lead

Goal Statement

Develop a new model of server and data center structure to serve the needs of the University's academic, research, and administrative communities, leveraging industry-leading practices for server administration, virtualization, and management to save costs, improve service levels, and minimize data security risks.

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Work Team Approach

Faced with no existing data on the current campus data center and server infrastructure, the AE team prioritized the planning and building of key datasets for decision-making:

	Prior State	Approach	Current State
Servers	• No data	• Network scans and surveys to locate and quantify servers	• ~5,000 servers on campus; 58% virtualized
Facilities	• No data	• Built detailed inventory of facilities • Collected power use effectiveness (PUE) data to gauge energy efficiency of selected facilities • Conducted selected site visits	• 97+ facilities on campus • ~52,000 sq. ft. of known space (23% not utilized) • Facility profiles vary widely (e.g. security, power/cooling systems)
Change Readiness	• No data	• Held listening session with data center administrators	• Expediency and service levels are paramount

The team has significantly advanced the understanding of the current state of servers and data centers, and through the process of data collection, has learned much about the institution's investment in this area.

Current State Observations – Facilities

Survey Summary

- The team identified 97 facilities utilized by campus to house servers
- Facility profiles vary widely – almost all were designed before the advent of virtual computing
  - 23% of identified space is reported as not utilized
  - 55% of identified space is used for research purposes
  - 25% of identified facilities are 500 square feet or larger; 16% are 100 square feet or smaller
  - 53% of identified facilities have lockable racks; 34% have card access systems
  - 76% of identified facilities have a dedicated cooling system; 30% have a backup cooling system
  - 8% of identified facilities are offering a paid hosting service; 18% are interested in doing so

Current State Observations

High-Level Findings

- No central campus level approach for providing data center services
- No incentives to consider a campus level facility or hosting service
- Lack of coordination and consistency between units/departments that need to add to or modify their server infrastructure
  - Duplication and overspending is occurring in areas such as hardware purchases, utility costs for power and cooling, labor, and facilities
  - Current driver for developing server room space leans towards expediency and local priorities with little emphasis on reliability, energy efficiency, or security
- Data center and server information is limited – the existing distributed infrastructure has grown with minimal visibility /oversight from a campus perspective
- Based on available data, campus spends approximately $9M per year* on its server infrastructure

The current state infrastructure limits campus' ability to apply consistent best practices and maximize efficiency. The data center aggregation team recommended a new model to best position the University to do so.

- *Includes hardware, software, labor, and utilities; excludes the cost of space and ongoing capital investment in facilities*

Recommendations

The data center aggregation team recommended that the University create a **campus shared data center service provider**:

- Proposed organization would oversee a reduction in the number of campus facilities dedicated to housing servers
  - All data centers under consideration for continued operation should have requisite minimum levels of energy efficiency, security, and projected uptime
  - Over time, inefficient, suboptimal, and/or underutilized facilities should be repurposed, with servers moving to alternative hosting locations
  - Priority should be placed on maintaining service continuity
- Manage server hosting facilities as a shared resource across campus
  - The team identified types of facilities that may be candidates for the high-efficiency data centers that the campus would seek to maintain
- Provide a one-stop shop for data center services including consultation and the virtualization and co-location of servers
- Align with the UW-Madison Advanced Computing Infrastructure (MACI) and the research community through the provision of foundational services

- Eliminate duplicative infrastructures and substandard facilities
- Match optimized, high-efficiency hosting facilities with service needs
- Provide consistent service levels across campus
- Promote and incentivize best practices, including virtualization

The creation of a shared data center service provider would facilitate campus-wide optimization of the server infrastructure. Gross savings are estimated at ~$6.8M over 5 years (~$55K in year 1).

Financial Impact of Proposed Solution

	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017
*% of Servers Virtualized**	*59%*	*62%*	*66%*	*68%*	*70%*
% of Servers in High Efficiency Data Centers	*22%*	*32%*	*43%*	*59%*	*71%*
Cost Avoidance	$250K	$975K	$1.9M	$2.6M	$3.5M
Variable Costs	$195K	$520K	$690K	$435K	$595K
GROSS SAVINGS	**$55K**	**$455K**	**$1.2M**	**$2.2M**	**$2.9M**
Upfront Costs**	TBD	TBD	TBD	TBD	TBD

Savings Components: Virtualization, co-location, and campus-wide consideration of private/cloud alternatives

Cost Avoidance: Server replacement costs, annual backup and software costs, utility costs, and labor costs

Variable Costs:

- Dependent on the degree of virtualization and co-location
- Costs include virtual machines, licensing, maintenance, additional storage, and the level of effort associated with the co-location and virtualization process

Gross Savings: Cost avoidance minus variable costs, excluding upfront costs to upgrade facilities

** Excludes compute clusters*

*** Initial capital investment to retrofit/upgrade facilities (if necessary) to be determined by implementation team*

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Steps to Estimate Upfront Costs

The AE team proposed the following steps to estimate the capital investment to support campus' future-state server infrastructure:

1. Quantify Space Required

Factors Impacting Requirements

- Future-state assumptions
  - Degree of virtualization
  - Server growth rate
- Future-state uncertainty
  - Movement to cloud based services
  - Technological advances allowing for improved density
  - Demand for computing and storage

2. Assess Space Available

Factors Impacting Assessment

- Current facilities vary widely - the potential to scale specific facilities is currently unknown
- Space available for new facilities requires evaluation

3. Evaluate Cost / Benefit of Alternative Options

Factors Impacting Evaluation

- Broad option set
- Multiple implementation approaches (e.g., pilot, staged, opt-in) each impacting and impacted by option selection
- Options have attendant risk profiles, requiring actuarial analysis to understand costs and benefits
- Little data exists about existing capital plans (i.e., capital avoidance savings unknown)
- Current OpEx to run current facilities is unknown but varies significantly

Deciding whether to invest in all or some of the options including in-situ upgrades, retrofitting, new construction, and public-private partnerships requires a degree of data collection and analysis that extends beyond the AE team's work.

Implementation Plan

The team recommended that three implementation teams are formed to: define the organization/governance of the central service, define the set of services to be offered, and identify the set of hosting facilities where these services will be provided.

Implementation Timing: Estimated at 30-45 weeks; many activities could be run concurrently

Organization/Governance Team	Services Team	Data Center Facilities Team
▪ Work closely with the CIO ▪ Develop funding model ▪ Develop operational model ▪ Develop staffing model including the provision of consultation services ▪ Develop attendant policies	▪ Interview customers to determine what services must be provided ▪ Set service level expectations ▪ Define server hosting facility attributes/requirements ▪ Define approach for virtualization services	▪ Complete campus data center inventory ▪ Identify spaces suitable for providing co-location and virtualization services ▪ Determine level of investment needed to bring existing spaces to required campus standards ▪ Identify services to be provided by off-campus hosting vendors

Projected Future State

Current State	Future State
97+ data center/server room facilities with varying degrees of energy efficiency, security, and performance	Limited number of high-efficiency data centers, held to minimum security and performance standards to be defined
Units/departments/end users are responsible for picking the best product, whether hardware or software, and obtaining value	Centralized purchasing of servers, software, and related equipment will ensure best practices/prices
Service level is dependent upon level of expertise and resources at the unit/department level	A consistent level of service is provided to all departments that is easy to use and flexible
Private service provider options are either ignored or considered on an ad-hoc, sporadic basis	Central service provider will monitor the private market, match solutions with needs, and support the negotiation of contracts
Some departments don't have the resources to effectively take advantage of virtualization technology	Virtualization will be a core service of the proposed organization; tools and process support will be provided to all units/departments at the best price to campus
Minimal collaboration between campus units/departments on data center best practices	Central service provider will provide a vehicle for collaboration and engagement across campus

Campus Readiness

The diverse nature of the IT and user community at UW-Madison was reflected in the team's stakeholder engagements.

Finding	Implication	Concern	Mitigation
8% of facilities are offering paid hosting; 18% are interested in doing so	Select facilities may already have the resources, willingness & infrastructure to meet customer needs	Administrators are thinking in terms of "their facilities"	Explore incentives for collaboration (e.g. upgrades/maintenance); transition mgmt. plan
7+ facilities were identified as candidates for high-efficiency data centers based on key characteristics	Identified facilities may be candidates for the backbone of central campus service	Facilities may require additional investment	Conduct site visits/interviews with admins. to assess readiness and determine most cost-effective approach
Server end-users exhibit varying degrees of readiness	• Some want nothing to do with physical boxes and would be early adopters • Some are virtualizing "effectively" already • Others are completely resistant and will need significant convincing	Many end users are apprehensive because of the perceived lack of customer focus, limited service tiers, and cost model associated with DoIT's current offerings	Relay differences in the new model through an effective communication plan; rely upon word of mouth via effective engagement with early adopters

Appendix

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Projected Campus Data Center Service

Summary

- Reports through the CIO
- Guided by a steering committee representing major stakeholders
- Where possible, leverage existing campus expertise to staff the unit
- Uses a service layer approach to provide data centers as a campus service
- Uses campus-based and private service providers
- Leverages portion of savings from reducing physical infrastructure to fund central service

Potential Services Provided

- Facilities management
- Server co-location services
- Virtualization services
- Consultation services
- Operational coordination
  - Policy
  - Procedure surrounding access
  - Accountability
  - Governance
  - Capacity planning

Goals

- Provide consistent, easy to use, and flexible services
- Promote and incentivize best practices
- Eliminate duplicative infrastructures
- Encourage virtualization
- Maintain an inventory of server hosting facilities
- Manage selected server facilities consistently and according to industry best practices
- Eliminate substandard server rooms
- Match hosting facilities with service needs
- Take advantage of private providers when it makes sense

Through the matching of hosting facilities with service needs, the campus data center service will support MACI and campus compliance requirements such as PCI DSS, HIPAA, and FERPA.