# AE IT Data Center Aggregation Work Team Project Agenda / Draft Business Case

**Date / Time:**
Tuesday, May 1, 2012
10:00 am – 12:00 pm

**Location:**
Memorial Library, Room 362

**Attendees:**
Ed Van Gemert, Steve Krogull, Phil Barak, Kevin Cherek, Nancy McDermott, Melissa Amos-Landgraf, Rick Konopacki, Terry Bradshaw, Chris Slatter

--- **AGENDA** ---

<table>
<thead>
<tr>
<th>TOPIC</th>
<th>WHO</th>
<th>TIME</th>
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<tbody>
<tr>
<td>Review 4-24-12 meeting notes</td>
<td>All</td>
<td>5 min.</td>
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<tr>
<td>Present draft sections of the Business Case for discussion and revision:</td>
<td>All</td>
<td>75 min.</td>
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<tr>
<td></td>
<td>Project Summary</td>
<td>EVG</td>
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<tr>
<td></td>
<td>Business Need or Opportunity</td>
<td>EVG</td>
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<tr>
<td></td>
<td>Alternatives Considered</td>
<td>PB</td>
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<tr>
<td></td>
<td>Proposed Solution Description</td>
<td>KC/EVG</td>
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<tr>
<td>Break</td>
<td>All</td>
<td>5 min.</td>
</tr>
<tr>
<td>Server data update</td>
<td>Steve K.</td>
<td>15 min.</td>
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<tr>
<td>Update on scan process</td>
<td>Steve K.</td>
<td>15 min.</td>
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<tr>
<td>Meeting Wrap Up/Next Steps</td>
<td>All</td>
<td>5 min.</td>
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<tr>
<td>Business Case Element</td>
<td>Assigned Team Member</td>
<td>Status</td>
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<tr>
<td>Initiative Sponsorship and Ownership</td>
<td>Ed V.G.</td>
<td>Completed 3/6/12 Revised 4/29/12</td>
</tr>
<tr>
<td><strong>Project Name:</strong></td>
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<tr>
<td>AE IT Data Center Aggregation</td>
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<tr>
<td><strong>Project Summary:</strong></td>
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<tr>
<td>Analyze and identify cost savings and efficiencies by assessing the existing infrastructure and making recommendations for future state. Areas of examination and data collection include: utility costs, labor efficiencies and effective best data center practices, space re-utilization costs, and improved risk management and security measures by greater virtualization, consolidation and co-location of servers and data centers across campus.</td>
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<td>Estimate current spend on campus server/data center costs. Provide cost estimate for alternative hosting costs.</td>
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<td>Identify and describe a plan for service models that will invite greater consolidation, co-location, virtualization and platform sharing.</td>
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<td>Recommend phase 3 implementation teams and areas of focus.</td>
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<td><strong>Business Unit(s):</strong></td>
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<tr>
<td>Vice Chancellor for Administration and Budget—Administrative Excellence.</td>
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<tr>
<td><strong>Business Process Owner(s)</strong></td>
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TBD

**Primary Cost Estimate:**

To be supported by a separate financial model document.

**Proposed Go-Live Date:**

TBD—based on proposed solution milestones and timing.

**Business Need or Opportunity**

The primary driver and opportunity is to be able to recover cost savings around co-location, virtualization and shared platform services. But there are other significant drivers including the growing requirements to provide safe, secure storage for sensitive data. The current server/data center environment puts the institution at risk for data loss and there exists an increasing need to safely store sensitive data.

Currently, the server/data center service model on campus is inefficient resulting in duplication and over spending in areas including: hardware purchases, utility costs for power and cooling, labor and facilities. There is little coordination, consistency or communication in putting up a server on campus today.

**Assess existing infrastructure:** A thorough current state campus server inventory, data collection including network scans, power utilization effectiveness (PUE), focus groups, and data center survey analysis is needed in order to identify and recommend future campus server/data center needs and services. The opportunity exists today to encourage best data center practices using incentives that will result in significant cost savings for central campus, individual schools and colleges and administrative units through the reorganization and consolidation of server placements and solutions including increased virtualization, co-location and outsourcing. The mission of the University may not be to build and manage a high end data center today but rather to leverage all available options and assets in managing risk, securing sensitive data and responsibly managing costs.

This team examined how we might develop a coordinated campus-wide service providing the customer with a full range of data center service needs at a reasonable cost to the University and to the unit.

**Alternatives Considered**

*Scenarios for UW-Madison Data Center Aggregation for Admin Excel Team*

*Disclaimer: None of the following scenarios are recommendations,*
either personal or team, and certainly not plans. Some may be regarded as straw-man arguments constructed simply to be thorough in deliberations.

1. OutSource Servers and Storage (aka, the U.S. Cloud)

Case: Building and maintaining server and storage facilities in Madison, where real estate is expensive and with no local energy sources except for those imported from other regions, seems counter-intuitive. As an alternative, let other facilities attached to the fast fiber connections bid for our business. Offshoring would involve unnecessary entanglements with export restrictions for intellectual property but outsourcing to, say, Montana (coal), Tennessee (hydroelectric) or elsewhere within the US, might suit.

Migration/Transition: The servers in the least secure facilities would be the first to migrate, perhaps at little or no cost to users so as to minimize resistance to change. Similarly, old servers would be migrated instead of replaced to minimize replacement costs. Network scans would verify that new servers and server locations didn’t pop up in their place. Ultimately, all servers would be migrated off campus during a normal replacement cycle, perhaps five years. Only high throughput and high performance computing services would likely remain on campus, if individual business cases or evidence of unsuitability could be produced. Local server administrators would transition from tending the hardware to providing customer services with the applications on the remote hardware.

Contra: Investments in existing campus data centers—Dayton St, Genetics, Education, etc.—would be lost, unless power savings offset. Some of that space would not easily revert to offices or labs.

2. Single OffCampus Data Center (aka, the Wisconsin Cloud)

Case: Building and maintaining server and storage facilities on campus, where real estate is limited seems counter-intuitive. As an alternative, utilize the fast fiber connections to west Madison to permit construction of a new server and storage facility from the ground up, perhaps in Fitchburg or Verona. Consider best practices: free cooling or geothermal cooling to reduce energy costs.

Migration/Transition: The servers in the least secure facilities would be the first to migrate, perhaps at little or no cost to users so as to minimize resistance to change. Similarly, old servers would be migrated instead of replaced. Network scans would verify that new servers and server locations didn’t pop up in their place. Ultimately, all servers would be migrated off campus during a normal replacement cycle, perhaps five years. Only high throughput and high computing services would likely remain on campus, if individual business cases or evidence of unsuitability could be produced. Local
server administrators would transition from tending the hardware to providing customer services with the application on the hardware. Contra: Investments in existing campus data centers—Dayton St, Genetics, Education, etc.—would be lost, unless power savings offset. Some of that space would not easily revert to offices or labs. The new facility would be a single point of failure in the event of disaster.

3. **Single OnCampus Data Center (Campus Cloud)**

Case: None of the existing campus data centers is large enough to meet all campus needs for servers and storage. A single data center on campus would have to be properly sized for space, power and cooling.

Migration/transition: much as 2) above, but migrated on campus to new data center.

Contra: Large localized demand for power and cooling. Adequate space and utilities are unlikely to be found in existing campus building, requiring new building. Such as facility would be a single point of failure in the event of disaster. Investments in existing campus data centers—Dayton St, Genetics, Education, etc.—would be lost, unless power savings offset.

4. **Distributed OnCampus Data Centers**

Case: A number of data centers and server rooms exist on campus and demand exists for upgrading server rooms into data centers. Servers and storage can be moved from lowest quality facilities into the existing quality data centers. If existing data centers of requisite quality cannot accommodate all of campus servers and storage, then either they will be expanded/upgraded or the best of the server rooms will be upgraded into data centers. Perhaps 10-15 data centers may remain.

Migration/transition: like 3) above. Some of the data centers have lease rates per rack unit or per rack that would be best standardized and/or subsidized to reduce resistance to change.

Contra: Almost certainly the best 5-10 data centers on campus cannot contain all the campus servers and storage without serious rehab, particularly since power and cooling upgrades will be required.

5. **Augmented OnCampus Data Centers**

Case: Once the existing 5-10 best quality data centers on campus are filled with servers and storage co-located from the lowest quality space or most matching the existing data security standards, augmenting capacity with another built-from-the-ground-up data center, either on campus or off, could be used to meet the additional
requirements.

Migration/transition: like 4) above

Contra: Some of the presumed labor savings from having a single site with a small, efficient crew of server administrators may be lost with numerous sites but perhaps inefficiencies could be mitigated by remote access and surveillance of all data centers by a single crew.

**Observations:** Savings of labor and power/cooling are achieved in two different but related processes: virtualization of servers and co-location of servers.

Virtualization is basically consolidation of virtual machines on a physical host. Absolute limits are set by CPU utilization--operations that are computationally intense cannot be consolidated as densely, if at all, on a physical host as those that are less intense, such as simple web hosting. Virtualization has been underway on campus for some years, with varying degrees of completion of the process.

Many server rooms are unoptimized, as when the room is cooled instead of the racks themselves. In such cases, energy requirements for cooling, fans, and uninterruptible power supply may be as much as double the power requirements of the servers themselves. Optimized data centers can have in-rack cooling or hot&cool zones; excess heat, though of low heat differential, can be seasonally utilized for conditioning air intake for additional power efficiency. Proper data centers are also more likely to have formal data security standards that allow them to be assigned a service tier suitable for the functions served.

Proper sizing of facilities to be built or rehabbed may be difficult to guess but essential to approximate accurately. For example, co-locating a number of unvirtualized servers into a data center without virtualizing them first could lead to building a larger data center intended to receive them than if they were first virtualized. Conversely, co-locating a number of servers that were already virtualized or unable to be further virtualized because of the extent of cpu utilization could lead to under-building if overestimates were made a priori about the possible level of virtualization achievable with those servers.

**Proposed Solution Description**

Kevin C. = lead

<table>
<thead>
<tr>
<th><strong>Scope of Proposed Solution</strong></th>
<th>Kevin/Rick K.</th>
<th>Completed 4/29/12</th>
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</table>

The creation of a central service: The team recommends the creation of a central campus authority or service providing overall management and direction of server/data center service needs under the administration of the CIO. A consultation component is strongly encouraged to help match server/data center needs with available options at a reasonable price. For
example, were we to require a central registry and business process for purchasing, many servers could be virtualized. Requests for purchase could be approved or not approved depending upon prior consultation from a central service.

**Flexibility and costs:** From the data we have gathered units desire co-location facilities and services ranging from basic platform sharing and utilities to the hosting facility managing the entire server. Units desire flexibility and a range of services: from All I need is rack space for my server, you provide platform, cooling, power and some basic security. I can get in whenever I want to do whatever I want—to You figure out what I need for server needs and I sit at home and take care of my application. Security, power, OS patches, viruses, monitoring . You are my server administrator now. And I can use my person differently.

Cost savings and flexibility are key components to the success of a central service. An opportunity exists despite current budget constraints to offer a flexible service that is less expensive that what is currently offered.

Directly related to service layers from lower needs to higher server needs including virtualization. Host figures out how best to utilize the hardware. Eliminate stand alone servers. High end through put computers may be an exception.

Although a service model for a central model requires additional phase 3 implementation work, the team developed the following outline of a service structure and purpose.

**Service Goals**
1. Single Point of Contact for Services
2. Encourage use of managed platforms instead of local spaces
   a. Saves on power, cooling;
   b. Save money
   c. Reduces Risk
   d. Allow customer to focus on core business goals
3. Encourage use of virtual servers instead of physical ones
   a. Saves on power, cooling;
   b. Save money
   c. Reduces Risk
   d. Allow customer to focus on core business goals
4. Provide a foundation upon which additional services could be built, e.g. HIPAA, PCI-DSS, Any New Federal Regs, etc.

**Service Model**
The services provided fall into the following service layers (see attachment):
**Platform:**
- Basic Co-Location Services
- High Security co-location services
- Platform Locations: TBD

**Network:**
- Customers will need an IP space for their devices including a firewall;
- High-speed connection to second site for failover

**Server:**
- Hardware service offerings
  - Basic Virtual Server
  - Many Additional Options

**Storage:**
- Basic storage for system, application and data drives.
  - Tiers?

### BACKGROUND:

**WHAT WE HAVE – Key Platform Service Attributes**

**From Server Platform Survey:**

<table>
<thead>
<tr>
<th>Service</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Redundant Power</td>
<td>24 (9 unk)</td>
<td>29%</td>
</tr>
<tr>
<td>Backup Power</td>
<td>65 (3 unk)</td>
<td>78%</td>
</tr>
<tr>
<td>UPS</td>
<td>44</td>
<td>68% of sub total</td>
</tr>
<tr>
<td>Generator</td>
<td>21</td>
<td>32% of sub total</td>
</tr>
<tr>
<td>Dedicated Cooling</td>
<td>62 (1 unk)</td>
<td>75%</td>
</tr>
<tr>
<td>Backup Cooling</td>
<td>27 (4 unk)</td>
<td>33%</td>
</tr>
<tr>
<td><strong>All</strong></td>
<td>9</td>
<td>11%</td>
</tr>
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**SECURITY**

<table>
<thead>
<tr>
<th>Access Type</th>
<th>Count</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Key Access</td>
<td>71</td>
<td>86%</td>
</tr>
<tr>
<td>Card Access</td>
<td>30</td>
<td>36%</td>
</tr>
<tr>
<td>Video</td>
<td>14</td>
<td>17%</td>
</tr>
<tr>
<td>Staffed Desk</td>
<td>8</td>
<td>10%</td>
</tr>
<tr>
<td>Escort Required</td>
<td>27</td>
<td>33%</td>
</tr>
<tr>
<td>Entry Log</td>
<td>18</td>
<td>22%</td>
</tr>
<tr>
<td>Locking Racks</td>
<td>38</td>
<td>46%</td>
</tr>
<tr>
<td><strong>All</strong></td>
<td>3</td>
<td>4%</td>
</tr>
</tbody>
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(Out of 83 total)

**MONITORING/ALARMS/ALARMS – TEMPERATURE**

54/35/48 = 65%/43%/58%
OBSERVATIONS:
- Mish-mash of features of existing facilities, possibly due to responders listing features that weren’t part of the server room;
  - Eg. Visitors require escort but no log;
- Most server rooms have backup power and dedicated cooling;
- Most rooms with backup power use rack based UPS

WHAT WE NEED:
- Defined services (external facing) with required capacity in each service layer
- Facilities for providing services (internal facing)

PLATFORM LEVEL SERVICE OFFERINGS
Co-location Level 1:
Level 1 is a service where customers are provided with the ability to install devices in a center owned rack. Authorized customers can enter the facility as necessary. Provided features include:
- Network, Firewall, VPN, KVM
- Redundant Power
- Backup Power (enough to turn off systems)
- Dedicated Cooling
- Backup Cooling (enough to turn off systems)
- Card Access
- Locking Racks
- Monitoring/Alarm/Alert service
- Optional Services

Co-location Level 2:
Level 2 is a service like level 1 except substantial backup power and cooling is provided along with a full suite of security services. Customers have their own IP space and can manage a firewall protecting it and VPN service:
- Network, Firewall, VPN, KVM
- Redundant Power
- Backup Power – “Long Term”
- Dedicated Cooling
- Backup Cooling – “Long Term”
- Full Security Services
  - (Card Access + 2-factor authentication; Video; Staffed Desk; Escort; Entry Log)
- Locking Racks
- Monitoring/Alarm/Alert service
- Optional Services
Firewall, VPN?

Co-location Level 3:
Level 3 provides a near real-time failover capability to a second site…???

For Each Option Need:
1. Space Required
2. Space Available
3. Options for resolving difference if less space is available

SERVER LEVEL SERVICE OFFERINGS
Server Level 1:
Level 1 provides a basic virtual server service for customers. The health of the machine is monitored by the central unit which reports its results to the customer. The VM is automatically powered down, moved to other hardware, etc. as needed.

Virtual Server:
  OS:?
  CPU:
  Memory:
  System Volume:
  Application Volume:
  Data Volume:
  Backup: (Server Snapshot; Application; Data)
  Failover: N
  Performance Monitoring (CPU/Memory/Disk/Network)
  Optional Services:
    OS Patch Compliance, Tracking, Release
    Backup Integrity Check

Server Level 2:
Level 2 provides a physical server service for customers. The center owns and manages the servers on behalf of the customer:

Physical Server:    OS:?
  CPU:
  Memory:
  System Volume:
  Application Volume:
  Data Volume: Backup: (Server Snapshot; Application; Data)
  Failover: N   Performance Monitoring
CPU/Memory/Disk/Network)
Optional Services:    OS Patch
Compliance, Tracking, Release
    Backup Integrity Check

Server Level 3:
Facilities

The team recommends leveraging and improving upon current capacity before building new. We also encourage strong consideration of outsourcing specific higher-end, higher security services along with a move to the use of cloud services depending on costs. The team identified 7 potential on-campus candidates for additional hosting. There will be additional costs needed for upgrading some of these sites.

The team further recommends consideration given to higher end/higher security needs shifted off site with lower end needs shifted to the DoIT platform in addition to providing a campus virtualization service.

Governance of a central campus service

We recommend that a central service report through the Office of the CIO. A governance structure is needed to provide oversight and to keep the needs of the customer first. Ownership by stakeholders is also important.

Integration with the University of Wisconsin-Madison Advanced Computing Infrastructure (MACI)

MACI==points of intersection co-location type of service. Research service available to faculty, high performance specialized kind of computing, sit on a platform somewhere. Co Location – virtualize those two.

Sharing lower levels—central service gives you a portion of what you need. MACI could build off the basic services. Value add for special research needs.

Admin. Computing more predictable.

Phase 3 Implementation Recommendations:

The use of cloud services and outsourcing is a clear direction for the future and one of the reasons that the team is not recommending building a high-end campus data center. The early work being done by the Internet2 group may offer opportunities in this area.

Phase 3 Implementation Teams:
Central service organizational needs, staffing, resource needs, costs Development of service models including network and disk storage.
| **Current facility upgrades needs, capacities** |  |
| **Consideration of off site/leasing/cloud services** |  |
| **Integration with MACI** |  |
| **Network level service offerings** |  |
| **Storage level service offerings** |  |

**Reference:**

Edge Federated Leveraged Service Layers
Elevating Research Computing Cyberinfrastructure at UW Madison
Service Model

| **Proposed Milestones and Timing** | Kevin/Phil B./Dan |
| **Alignment with Strategy** | Kevin/Nancy M. |
| **Customer Readiness** | Kevin/Melissa/Dan |

Focus group data indicates many of the smaller server rooms are ready now for co-location, server virtualization and platform sharing options. Flexibility is again key to success. Frustration exists with a one size fits all approach.

**Impact**

Melissa A-L = lead

<p>| <strong>Anticipated Benefits</strong> | Melissa/Phil B./Dan |
| <strong>Stakeholders Impacted</strong> | Melissa/Nancy M. |
| <strong>Impact on Other Initiatives</strong> | Melissa/Steve K./Dan |</p>
<table>
<thead>
<tr>
<th>Section</th>
<th>Responsible Person(s)</th>
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<tbody>
<tr>
<td>Project Success Factors</td>
<td>Steve K. = lead</td>
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<tr>
<td>• Change Management Plan / Communication Plan</td>
<td>Steve/Melissa</td>
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<tr>
<td>• Dependencies or Constraints</td>
<td>Steve/Phil B./Dan</td>
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<tr>
<td>• Assumptions</td>
<td>Steve/Rick K.</td>
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<tr>
<td>• Project Risks</td>
<td>Steve/Rick K.</td>
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<tr>
<td>• Criteria for Measuring Success</td>
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<td>Supporting Materials</td>
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<td>Report on Data</td>
<td>Chris S. = Lead</td>
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<tr>
<td>• Metadata</td>
<td>Chris S. / TBD</td>
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<tr>
<td>• Data Accuracy</td>
<td>Chris S. / TBD</td>
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<tr>
<td>• Data Recommendations</td>
<td>Chris S. / TBD</td>
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<tr>
<td>Financial Model</td>
<td>Phil B./Rick K/Ed V. G./CS</td>
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