Data Center Consolidation

Financial Analysis
&
High-level Technical Recommendation

for NewCo
by Metagyre, Inc.
February 23, 2009
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Executive Power Point Presentation

See following slides
Current data center allocations

- Data Center 1 accounts for 61% of total data center costs
- Data Center 2 accounts for 15%
- Data Center 5 accounts for 13%
- Remaining data centers 11%
Operational comparison

Looking at the rent, power and bandwidth costs between Data Center 1 and Data Center 8 in Portland:

- September breaks even after paying overlapping rent and early termination penalties for moving in April 2010
- Q4 2010 returns $434,450 in cost avoidance
Break even in 5 quarters

- If the project starts in Q1, 2020 it breaks even in Q2, 2021
- 63% return on investment at the end of the third year with an accumulated net present value of $2MM
Facility requirements

Current use:
- 50 cabinets of servers and networking
- 20 cabinets of storage
- 6 cabinets of tape library
- 162kW power draw

Projected need:
- 90 cabinets for existing and consolidating other sites
- Start with 220kW and grow 20% year-over-year to 407kW
Executive Summary

NewCo currently manages computer resources across eight data centers globally at an approximate annual cost of $5,129,000. The data centers are located in Portland, New York, Hong Kong, Phoenix, Cleveland and Billings. Most of the data centers have been added to the organization through corporate acquisitions. This organic growth has left room for significant savings to be realized through data center consolidation and improved contract rates. This strategy recommends consolidating NewCo's current eight data centers into two regional data centers (RDC). One RDC in Portland utilizing Data Center 8's collocation facilities and the other in Billings utilizing Data Center 7's facilities. When completed, this consolidation represents an estimated annual savings of $2,760,000. The annual spend at the end of the project for the two RDCs is estimated to be $3,620,000.

In order to achieve these savings, this strategy proposes an initial capital investment of approximately $2,151,000. This investment includes overlapping data center rent, early contract penalties, seed equipment, cabling, network equipment, storage data transfer, and equipment move for Portland. This initial investment will allow NewCo to migrate from the current Data Center 1 location into the new lower-cost Data Center 8 facility followed by a Hong Kong move in June. An overlap of data center costs for three (3) months is expected in order to minimize system down time. Once the Portland move is complete, NewCo is projected to save $1,180,000 annually. Additionally, $650,000 will be saved annually by consolidating Hong Kong into the new Portland data center. The final $930,000 in annual savings may be realized by consolidating the New York, Phoenix, and Cleveland data centers functionality into the new Portland space. In addition to the tangible savings, NewCo should anticipate a lower total cost of ownership (TCO) as a result of reducing the number of data centers it currently manages.

The two locations Portland and Billings were chosen to maximize NewCo's current investment and take advantage of existing staff. The distance between the two sites is approximately 600 miles which allows for geo-diversity while remaining close enough for low latency network communication.

Based on the information available to the team, NewCo requires approximately 90 cabinets to provide adequate room for existing equipment and to begin consolidation of other sites into Portland. Over time, the number of cabinets can be reduced as equipment density increases allowing room for additional resources. Starting with the initial estimate of 220kW of power used and growing 20% year over year, NewCo's power requirement will grow to approximately 407kW at the end of 2022.

Using the current requirements and a projected growth rate of 20% year over year, the analysis recommends negotiating for collocation space with a starting capacity of 230kW and 80 cabinets with a contractual guarantee of an end state with greater than 400kW and floor space to accommodate approximately 100 cabinets.
Audience

This document is intended for internal NewCo staff only.

Assumptions

Assumptions can represent a significant risk if all stakeholders do not agree with the assumptions. In order to predict needs and associated budget costs over the next three years several, assumptions have been made. In recommending the data center consolidation strategy the following assumptions have been used as inputs into the process:

- To manage financial exposure, the analysis planning term is for a three year solution
- NewCo has determined that Data Center 8 is a prime candidate for their collocation needs
- Most equipment currently housed in Data Center 1 will be migrated over to new location
- Additional return on investment is available by consolidating other sites into the space in later phases
- Data center growth budgeting at 20% year over year increase in power is appropriate
- NewCo has working policies in place to consolidate functions into denser form factors (virtual machines, blades, 1U servers)
- Data Center 1’s high cost not poor service initiated the search for alternative data center facilities
- The Portland data center is the major operations hub
- Billings will migrate out of the Data Center 9 location into Data Center 8 and Data Center 7
- The Data Center 6 facility will be decommissioned between March and July of 2020
- Planned outages must be minimized during relocation
- Other projects purchase of new equipment is available to support migration
- Data Center 8's security model meets NewCo requirements
- This is a high-level go/no go plan; there are still many details to flush out
- All contracts fall to month-to-month on expiry
- The sampling of invoices taken are representative for those sites
- There is no technical/application reason the consolidation can't happen
- Systems from diverse sites can be consolidated into the same location
- NewCo staff resources are available as needed
- Vendor support is available for moving their equipment
- Equipment leasing is an option and will be cheaper than purchasing new
- TCO will be lower due to less facilities to manage
- Data Center 1 facility will be the first site to migrate
- Portland's move will cover the up front costs of other moves
- New acquisitions/data centers will be factored separately
- Requirements will change over the course of the project
- Detailed site requirements remain to be defined
- Data Center 7 will maintain its low cost and have sufficient resources to handle NewCo's needs as the second data center
- The Portland migration can occur within a 3 month time frame to contain costs
Current Situation

NewCo is currently managing computer resources across eight data centers globally at an approximate annual cost of $5,129,000. The data centers are located in Portland, New York, Hong Kong, Phoenix, Cleveland and Billings. Most of the data centers have been added to the infrastructure through company acquisitions.

As a result of this organic growth each data center has different contract terms, termination dates, levels of support and network connectivity. A review of their invoices shows significant savings may be realized through data center consolidation and improved contract rates.

The “Current Monthly Cost by Data Center” graph illustrates the average cost per month of each data center. The cost difference between the various data centers is relative to the space and equipment running at each facility along with the amount of network bandwidth consumed.

While the analysis for this strategy reviewed all the data centers to establish a baseline, the focus was placed on Data Center 1's Portland facility which represents the largest expense with potential for cost reductions in power and network costs.

The Portland data center supports approximately 50 cabinets of servers and networking equipment, 20 cabinets of data storage and six (6) cabinets of tape backup. On average the Portland data center costs $260,000 per month or $3,125,000 annually. From a total spend perspective, the Portland data center
currently accounts for 61% of the total NewCo data center spend.

In addition to the current equipment inventory, NewCo is planning to add an additional 10 cabinets of storage and seven (7) cabinets of servers in 2020 to the Portland data center.

Data center management is the continual balance between three factors. Those factors are space, power and cooling (HVAC). It is not unusual to look into a data center that is at capacity and see several rows of empty space. Physical space is only one leg of the triangle. Available power and the ability to cool the equipment using that power are more often the gating factors. NewCo's Data Center 1 facility is broken into two areas – the main area and a small space down stairs. The main area is at 94% capacity based on available power; the small down stairs space has some capacity, but overall the site is at 88% power capacity.

In the Portland area the cost of Data Center 1 is approximately double the current cost of comparable data center facilities. Additionally, Data Center 1 has changed its strategic direction and no longer considers collocation services core to its business.

Although migrating the Portland data center from Data Center 1's facility into a lower cost facility will reduce the monthly spend, there is a financial impact to the timing of this move. The Portland data center facility has expanded organically over time resulting in numerous contracted work orders which are not coterminous. Specifically there are 38 contract work orders which terminate throughout 2020 and 2021. The penalty for early termination of a work order is 50% of the remaining duration multiplied by the monthly cost. The other data center facilities carry similar penalties for early termination.

**Recommendation**

**Summary**

Based on cost analysis and engineering review of the initial data, NewCo has the potential to realize significant cost savings by acquiring space in a new lower cost data center facility such as Data Center 8 and consolidating several high cost data centers into one.

To meet the current equipment load and provide for 20% year over year growth through 2022 the new data center should support a 410 kW total draw from 90 cabinets. To see further savings NewCo should continue its application consolidation effort, moving applications from legacy equipment to its new data center standards. This consolidation will improve space and power utilization.

From a return on investment (ROI) perspective, moving from Data Center 1 to Data Center 8 in 2020 is projected to break even in the second quarter of 2021 - less than six (6) quarters. Following the break even point, NewCo will continue to see a benefit of $420,000 per month in reduced monthly data center costs. The three year return on investment is 45% or approximately an accumulated net present value of $2,000,000

**Financial Analysis**

In order to understand the cost savings available through a data center consolidation several financial
models were built to perform “what if” scenarios. The first model determines the most cost effective time to leave Data Center 1. This model balances the financial penalties against the monthly savings. The model also incorporates the overlap in rent while the new Data Center 8 data center is built out and the move takes place. Based on experience, a three month overlap was set in order to minimize application down time. Following several runs of the model April was found to be the most advantageous month to complete the Data Center 1 data center move.

The “Proposed SG&A Cost Avoidance by Month” graph shows the savings month over month that will occur once the move is complete. The spike in the first few months shows the cost of overlapping data centers for three months along with the early termination penalties. The “Monthly SG&A Cost Avoidance” in green highlights the month over month savings available from this project.
The "DC 1 and DC 8 SG&A Cost Model" shows the accumulated cost of both data centers' rent, power and Internet connectivity. It compares the cost of staying with Data Center 1 (doing nothing) against moving to Data Center 8. The graph shows September breaking even and the remaining three months returning budget that would have been spent on the Data Center 1 data center.

Both graphs above show there is considerable savings available from Data Center 8's lower rent, power, and Internet charges. However, the models that produced those graphs do not incorporate the costs associated with moving equipment and other one time capital costs.

To further quantify the costs and build a complete ROI picture the team developed a model based on the following data:

<table>
<thead>
<tr>
<th>Amount</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$260,000</td>
<td>One month rent, power and Internet at Data Center 1 (based on an average bill)</td>
</tr>
<tr>
<td>$120,000</td>
<td>Estimated cost for one month rent, power and Internet at Data Center 8 (based on preliminary discussions with data center)</td>
</tr>
<tr>
<td>$327,000</td>
<td>Early termination penalties for leaving Data Center 1 April 30, 2020 (50% of the remaining contract)</td>
</tr>
<tr>
<td>$54,000</td>
<td>Estimated cost for one month rent, power, and Internet at Data Center 5.</td>
</tr>
<tr>
<td>$215,000</td>
<td>Early termination penalties for leaving Data Center 5, June 30, 2020 (50% of the remaining contract which ends February 28, 2021)</td>
</tr>
<tr>
<td>$1,068,000</td>
<td>Seed equipment and initial investment to include:</td>
</tr>
<tr>
<td></td>
<td>Category</td>
</tr>
<tr>
<td>Storage equipment</td>
<td>0</td>
</tr>
<tr>
<td>Storage move</td>
<td>105,000</td>
</tr>
<tr>
<td>Servers</td>
<td>100,000</td>
</tr>
<tr>
<td>Edge router</td>
<td>117,000</td>
</tr>
<tr>
<td>Load Balancer</td>
<td>112,000</td>
</tr>
<tr>
<td>Firewall</td>
<td>94,000</td>
</tr>
<tr>
<td>Distribution network</td>
<td>54,000</td>
</tr>
<tr>
<td>Amount</td>
<td>Description</td>
</tr>
<tr>
<td>----------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Core network layer</td>
<td>116,000 Pair for redundancy</td>
</tr>
<tr>
<td>Dark fiber</td>
<td>57,000 3 pairs for 12 month lease</td>
</tr>
<tr>
<td>DWDM</td>
<td>50,000 Modulator for dark fiber use</td>
</tr>
<tr>
<td>IBM Cabinet</td>
<td>30,000 20 new cabinets &amp; reuse the 5 empty ones currently available</td>
</tr>
<tr>
<td>PDUs</td>
<td>30,000 50 Power distributions units for 25 seed cabinets</td>
</tr>
<tr>
<td>Network cable plant</td>
<td>83,000 Cabling for initial 70 cabinet setup</td>
</tr>
<tr>
<td>Site Prep</td>
<td>50,000 Facility cost for setting up cage and overheads</td>
</tr>
<tr>
<td>Power Installation</td>
<td>80,000 Run all circuits but only turn on the ones required</td>
</tr>
<tr>
<td>$170,000</td>
<td>Contingency fund of 5% of the quarterly project costs for the first 5 quarters</td>
</tr>
<tr>
<td>5%</td>
<td>Cost of money for calculating net present value</td>
</tr>
</tbody>
</table>

Using the input, above the model calculated out ROI, Break Even and Net Present Value. The cost savings between Data Center 8 and Data Center 1 is represented as a positive benefit in the model's calculations. The model also closes Data Center 5 before the end of June 2020 and adds the savings in rent power and Internet bandwidth to the benefits. As a result the model shows the lower cost of Data Center 8 will completely fund the purchase and move in just over five (5) quarters. If the project begins Q1, 2020 break even is achieved in Q2 2021. The model also shows a 63% return on investment at the end of the third year with an accumulated net present value of approximately $2,115,000.
Graphically the data shows continued positive cash flow resulting from the lower cost Data Center 8 data center. In the “Summary Financial Analysis” graph below each of the key financial measurements can be seen over the 17 quarter life of the model.
For a pure cost verses benefit view, the following graph shows the difference between the total project spend and the benefit.

![Project Costs vs. Total Benefits](image)

Based on the current costs of the other facilities and industry best practices the team recommends a two data center model at the end of the consolidation project. The two regional data centers (RDC) should provide NewCo with cost effective data center space and set the foundation for disaster recover (DR) and business continuity plans (BCP) in the future.

In an ideal setting the two RDCs should be:

- geographically diverse to ensure a disaster at one location does not extend to the other location
- networked together with the least amount of latency possible to ensure data movement or application communications between the two locations is not negatively impacted
- close to knowledgeable resources that can provide technical and business support if a fail-over scenario is initiated.

Comparing the other data centers against the requirements above, Billings' Data Center 7 facility performs well and has low costs similar to Data Center 8. Moving forward, Portland and Billings are recommended as the data centers to consolidate the others into. Consolidating into Portland and Billings should maximize NewCo's current investment and take advantage of existing staff. The distance between the two sites is approximately 600 miles which allows for geo-diversity while
remaining close enough for low latency\(^1\) network communication.

While out of the scope for this phase of the project, each data center should plan to provide backup for the other. A high level approach is to consolidate systems and data in either Portland or Billings RDC with the other RDC to provide backup support for the consolidated system. In other words, a back up copy of Portland data can reside in Billings while Billings' data and back up systems reside in Portland. The level of system and data redundancy in place for disaster recovery (DR) and business continuity (BCP) will depend on the amount of risk the business is willing to accept.

**Technical Analysis**

**What is known**

- Currently have 76 cabinets of equipment in Portland, averaging 0.1kW/RU or 4kW per rack
- Budgeted growth for 2020 are 4 cabinets of high-speed storage and 8 cabinets of tier 2 storage, plus some amount of servers. The number of servers has not been budgeted at this this time but has seen a historical growth rate of 22% 
- Planned for near term migration are approximately one and a half racks of servers and support gear from Billings
- Compressed into racks without any spaces or cable management, all equipment (all data centers) would require 53 standard cabinets
- At 75% rack usage to allow room for less than ideal placement and patch panels, the current equipment (all data centers) would occupy 72 cabinets
- Cost effective dark fiber is available on the Data Center 1 campus that can be utilized for the move

**What is projected**

With the initial information available to the team, NewCo will need approximately 90 cabinets to provide adequate room for existing equipment and begin consolidation of other sites into Portland. Over time, the number of cabinets can be reduced as equipment density increases to allow room for additional resources. Starting with the initial estimate of 220kW of power used and growing 20% year over year, NewCo's needs will grow to approximately 407kW of power at the end of 2022.

**Space and Power Recommendations**

Based on the current requirements and a projected growth rate of 20% year over year, the analysis recommends negotiating for collocation space with a starting capacity of 230kW and 80 cabinets with a contractual guarantee of an end state with greater than 400kW and floor space to accommodate approximately 100 cabinets.

\(^1\) Estimated 25 milliseconds round trip
Data Center 8 Data Center

In Portland there are a number of vendors providing data center facilities. These vendors include: AT&T, Verizon, Savvis, Internap, Qwest and others. Each vendor provides facilities with different levels of hardness and supporting services. Data Center 8 is often a cost effective solution compared to other data centers in their market. Data Center 8 maintains its competitive pricing by acquiring its space at a very low cost and not requiring a bundled set of services to be purchased with collocation space. In addition Data Center 8 is carrier neutral for Internet connectivity allowing NewCo to see additional savings on its bandwidth usage costs.

Data Center 8 recently acquired additional space in the same campus as NewCo's Data Center 1 facility. This new space will come on-line over the next month, providing NewCo the opportunity to select the space within Data Center 8 that meets its needs most effectively. The floor diagram shows the different configurations available shaded in red. In addition custom work can be performed to move walls, add ramps, increase cooling capacity or other structural change in order to have a space match NewCo current and planned requirements. Undertaking the custom work at this stage is significantly less expensive than retrofitting it in after NewCo has established it operations in the space. The price of custom work has not been established with Data Center 8 and should be a part of the overall contract negotiation.

Having the two facilities only a short distance away can also assist with the migration process. The two centers can be networked to appear as one allowing equipment to be shared across the two sites and minimizing the need for significant down time as servers and data are migrated.
Consolidation Approach

What

Inventory current equipment
In order to plan a data center relocation, identification of the physical assets is the first step. A complete inventory includes a hardware manifest, label names, vertical size in rack units, and current location by site, row, rack, and rack unit\(^2\). A recent rack power audit obtained from the collocation provider will give a power density for the site. An inventory for Portland has been completed; data for the other sites remains to be collected.

Identify application to hardware dependencies
This activity requires NewCo resources to complete. While services and software options exist such as EMC's Smarts Application Discovery Manager and IBM's Tivoli Application Dependency Discovery Manager, both are costly and still require various inputs from the inquiring organization. Alternatively this output can also be generated manually with resources from the networking, storage, systems administration, database, and development/quality assurance groups. Most organizations already have the needed data requiring only collation and analysis rather than a full investigation. The final combined deliverable is a map from the networking and storage layers up through the application tiers to the end user. This map of resources is then used to identify dependency branches in the infrastructure, identify critical core components, and assist in planning the phases of the move.

Identify server farms
In many cases, application resources are deployed in multiples for load tolerance and redundancy. This design provides benefit that can be used during the move to mitigate downtime. The steps are to identify excess resources that during slack usage periods can be physically relocated from one hardware pool into another in the new location. The new pool is then brought on-line with network connectivity redirecting traffic appropriately.

Identify gear slated for decommissioning
On occasion, other project time lines can be accelerated to allow for gear to be decommissioned in time to eliminate the need for relocation. This equipment may also be re-purposed for use in the relocation as a temporary measure.

Identify gear slated for upgrade
On other occasions, upgrades can be delayed to allow the service to be deployed directly into the new facility.

\(^2\) The term “rack unit” denotes equipment position as measured from the bottom of the rack in 1\(\frac{3}{4}\)” increments
Identify other project resources

Large budgeted purchases such as storage, networking, or new server deployments can be allocated as resources to provide needed temporary services while equipment is being moved. In these cases budget is already earmarked and the move simply accelerates the acquisition for use during the relocation before being deployed to its final state. This acceleration can bridge some costly gaps and requires a review of next year's approved projects' hardware purchase plans.

Identify equipment gaps requiring procurement

After other options are exhausted there are occasionally still resource shortfalls. These gaps have to be bridged with external resources. Costly equipment that is only used during the migration is a prime candidate for lease or rent. Networking and storage gear is often in this category. Depending on the vendor relationships some equipment may be available for use on a very short time frame.

How

Vendor selection and site design

Data centers are typically defined by a resource triangle whose points are defined as available power, available space, and the inverse of the overall cost. A very inexpensive collocation site is useless if it lacks either adequate power or space. A successful site will suit our strategic needs in all three areas now and over a strategically defined period.

Cabinet layout design

Standardization of resources increases manageability and reduces total cost of ownership. A standard cabinet footprint with uniform features assists in effective space planning and improves deployment efficiencies.

Power plant design

Power and how it is deployed into the environment is one of the larger engineering activities facing a data center manager. Around the need to optimize space and cooling constraints lay the restrictions imposed by the facility on power draw. Balancing all this to give suitable options for standard and high density cabinets can require compromises around equipment placement and choice. Also to consider are methods for effective power management and supporting tools such are remote monitoring and switching. Certification standards for acceptance from vendors yield consistency in labeling, source redundancy, and capacity verification.

Cable plant design

Robust access layer strategies, labeling/coloring standards partnered with defined copper and fiber standards for panels, connectors and patch management allow for clean and auditable network infrastructure. This in turn reduces total cost of ownership and unplanned outages.
Network migration planning

The location currently under review has dark fiber capacity between buildings which can facilitate a migration if the fiber and it's requisite support gear are financially viable. New equipment locations need to be mapped out and accounted for. Acceptance testing methodology must be drawn up and reviewed to ensure any network extensions perform as expected prior to being promoted to production.

SAN planning

Migrating storage tends to be a laborious task in detailing the dependencies for all the equipment involved. It requires migrating those elements over to new storage, relocating the physical disk, and then migrating data back to the original configuration in the new location. Additionally, the fact that the servers may not migrate to the new location at the same time the data storage moves will require a method to bridge across the two sites.

When

In the initial planning stages, we use modeling tools to research financially ideal time tables for relocating. As the project progresses, we allocate equipment into move cycles based on dependencies and production impact:

- Production issues such as release cycles, corporate initiatives, high market times, etc.
- Allocate to minimize the number of high risk relocations per phase. In the case of an issue, this allows more resources to focus on the single problem.
- Plan move cycles to mitigate impact by scheduling during times of least use.
- Within the external limitations from vendors such as network, power, and the site build out.

For high-risk/high-impact moves, the process is broken down into a short interval schedule for review and practice, complete with rollback procedures to minimize risk.

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3 Short interval schedule (SIS) is a defined step by step process paired with appropriate roll back strategies for high profile actions. Each step has a defined action, duration and assigned resource. There are defined management go/no go decision points defined along the way. The SIS will allow peer review, trial runs and management approval in advance of the actual execution.
Appendix

Data Center 1 Power Calculation Summary

This area shows the current state of “As is” plus some estimations based on this information:

- Current Power Draw (main space+new space estimate): 162,871 W
- Power additions: 56,000 W
- Space additions: 598 RU
- Current Seattle Rack Unit Total: 1,694 RU
- Least Possible Total Cabinets: 72 racks
- 75% Utilization of All Cabinets: 72 racks

Known Power Requirement

<table>
<thead>
<tr>
<th>RU</th>
<th>kW</th>
<th>AVG kW/RU</th>
<th>Avg kW/Rack – 100% util</th>
</tr>
</thead>
<tbody>
<tr>
<td>2252</td>
<td>219</td>
<td>0.10</td>
<td>4.98</td>
</tr>
</tbody>
</table>

This area calculates how many RU at the current AVG kW/RU rate

- KW Capacity
- HVAC
- Max RU by available power: 4187
- Capacity Increase: 86%

Calculates how many standard 1U servers at moderate use could be supported:

<table>
<thead>
<tr>
<th>Total &quot;Servers&quot;</th>
<th>Cabinets</th>
<th>Servers per Rack</th>
<th>A at 208V</th>
<th>Usable W</th>
<th>Allocated W</th>
</tr>
</thead>
<tbody>
<tr>
<td>1424</td>
<td>89</td>
<td>16</td>
<td>1.4</td>
<td>4560</td>
<td>5700</td>
</tr>
</tbody>
</table>

Cooling Calcs

<table>
<thead>
<tr>
<th>Unit</th>
<th>BTU</th>
<th>W</th>
<th>kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12000</td>
<td>3515.97</td>
<td>3.52</td>
</tr>
</tbody>
</table>

Forward needs projection based on year over year increase in power:

- Power Growth: 20%
- Annual % increase: 20%

<table>
<thead>
<tr>
<th>Year</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>kW</td>
<td>407</td>
<td>115.76</td>
<td>4187</td>
<td>86%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Add known items coming in early next year here:

- Power additions: 566 kW

<table>
<thead>
<tr>
<th>Portland servers</th>
<th>54</th>
<th>8000</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 DB Storage Units</td>
<td>168</td>
<td>20400</td>
</tr>
<tr>
<td>8 Data Storage Units</td>
<td>336</td>
<td>29600</td>
</tr>
</tbody>
</table>

Rack count

- 19' x 31' = 312 RU
- 23' x 29' = 66 RU

Racks Total: 6 RU
# Portland Data Center 1 Collocation Power Report

## Power Report

**10 July 2016**

<table>
<thead>
<tr>
<th>Pri. Gen.</th>
<th>UPS</th>
<th>PWR</th>
<th>120V</th>
<th>120</th>
<th>120V</th>
<th>240V</th>
<th>240</th>
<th>Wattage</th>
<th>Cabinet</th>
<th>42U</th>
<th>Total Sq. Ft.</th>
<th>White Per Sq. Ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>D1</td>
<td>120</td>
<td>15-20</td>
<td>6.7</td>
<td>8.6</td>
<td>824.0</td>
<td>A1</td>
<td>R</td>
<td>1472.0</td>
<td>1512.0</td>
<td>3024.0</td>
<td>1010.0</td>
</tr>
<tr>
<td>D</td>
<td>D1</td>
<td>120</td>
<td>15-20</td>
<td>8.1</td>
<td>8.8</td>
<td>1035.0</td>
<td>A1</td>
<td>R</td>
<td>2148.0</td>
<td>2148.0</td>
<td>4296.0</td>
<td>1428.0</td>
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<tr>
<td>F</td>
<td>F2</td>
<td>120</td>
<td>15-20</td>
<td>3.0</td>
<td>10.0</td>
<td>1320.0</td>
<td>A1</td>
<td>R</td>
<td>3275.0</td>
<td>3275.0</td>
<td>6550.0</td>
<td>2185.0</td>
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<tr>
<td>D</td>
<td>D1</td>
<td>120</td>
<td>15-20</td>
<td>8.7</td>
<td>8.8</td>
<td>1024.0</td>
<td>A1</td>
<td>R</td>
<td>2244.0</td>
<td>2244.0</td>
<td>4488.0</td>
<td>1496.0</td>
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<tr>
<td>F</td>
<td>F2</td>
<td>120</td>
<td>15-20</td>
<td>8.5</td>
<td>7.9</td>
<td>912.0</td>
<td>A1</td>
<td>R</td>
<td>1820.0</td>
<td>1820.0</td>
<td>3640.0</td>
<td>1213.3</td>
</tr>
</tbody>
</table>

## Data Center Consolidation Financial Analysis & High-level Technical Recommendation

**NewCo**

- **Used Qty:**
  - G1
  - D1
  - E2
  - F2
  - D1
  - G1

- **Data Center Consolidation Financial Analysis & High-level Technical Recommendation:**
  - **Used Qty:**
    - G1
    - D1
    - E2
    - F2
    - D1
    - G1

- **Total Square Footage:**
  - **Used Qty:**
    - G1
    - D1
    - E2
    - F2
    - D1
    - G1

- **White Per Square Foot:**
  - **Used Qty:**
    - G1
    - D1
    - E2
    - F2
    - D1
    - G1

## Confidential

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February 23, 2009
# Rack Cost Model

## Rack Utilization

<table>
<thead>
<tr>
<th>Type of device</th>
<th># of devices</th>
<th>RU.s / device</th>
<th># of devices</th>
<th>RU.s / device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access Layer Switches</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Servers</td>
<td>26</td>
<td>1</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

## Item Counts and Prices

<table>
<thead>
<tr>
<th>Item Counts and Prices</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desired rack density in RU.s</td>
<td>42</td>
</tr>
<tr>
<td>Applications, services, or JVMs per server</td>
<td>0</td>
</tr>
<tr>
<td>Co-location Racks space available</td>
<td>50</td>
</tr>
<tr>
<td>Applications, services and JVMs required</td>
<td>0</td>
</tr>
<tr>
<td>Web tier servers required</td>
<td>20</td>
</tr>
</tbody>
</table>

## Install Cost per Server Rack (NRC)

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switch cost</td>
<td>$19,200</td>
</tr>
<tr>
<td>server cost</td>
<td>$185,000</td>
</tr>
<tr>
<td>Circuit cost</td>
<td>$1,200</td>
</tr>
<tr>
<td>PDU cost</td>
<td>$1,600</td>
</tr>
<tr>
<td>Rack cost</td>
<td>$2,000</td>
</tr>
<tr>
<td>Cabling cost</td>
<td>$576</td>
</tr>
<tr>
<td>total</td>
<td>$219,576</td>
</tr>
</tbody>
</table>

## Rack Cost for Storage (NRC)

<table>
<thead>
<tr>
<th>Cost for Storage (NRC)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Install Cost for Storage (NRC)</td>
<td>$1,200,000</td>
</tr>
</tbody>
</table>

## Install Cost Network Services (NRC)

<table>
<thead>
<tr>
<th>Install Cost Network Services (NRC)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost per Rack (MRC)</td>
<td>$1,700,000</td>
</tr>
</tbody>
</table>

## Cost per Rack (MRC)

<table>
<thead>
<tr>
<th>Cost per Rack (MRC)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floor cost</td>
<td>$1,500</td>
</tr>
<tr>
<td>Power cost</td>
<td>$1,500</td>
</tr>
<tr>
<td>total</td>
<td>$3,000</td>
</tr>
</tbody>
</table>

## Required Nbr of Racks

<table>
<thead>
<tr>
<th>Required Nbr of Racks</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server Racks required</td>
<td>1</td>
</tr>
<tr>
<td>Storage Rack required</td>
<td>4</td>
</tr>
<tr>
<td>Network Racks required</td>
<td>2</td>
</tr>
<tr>
<td>total</td>
<td>7</td>
</tr>
</tbody>
</table>

## Accumulated Costs

<table>
<thead>
<tr>
<th>Accumulated Costs</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly Recurring</td>
<td>$85,500</td>
</tr>
<tr>
<td>Annual Recurring</td>
<td>$1,026,000</td>
</tr>
<tr>
<td>Initial Capex</td>
<td>$3,169,576</td>
</tr>
<tr>
<td>First Year</td>
<td>$4,195,576</td>
</tr>
</tbody>
</table>