Dell Blueprints

Deploying business-critical email on-premises or in the cloud

A practical guide for decision-makers

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July 2015 | Rev 1.2

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Tools for email decision-makers at a crossroads

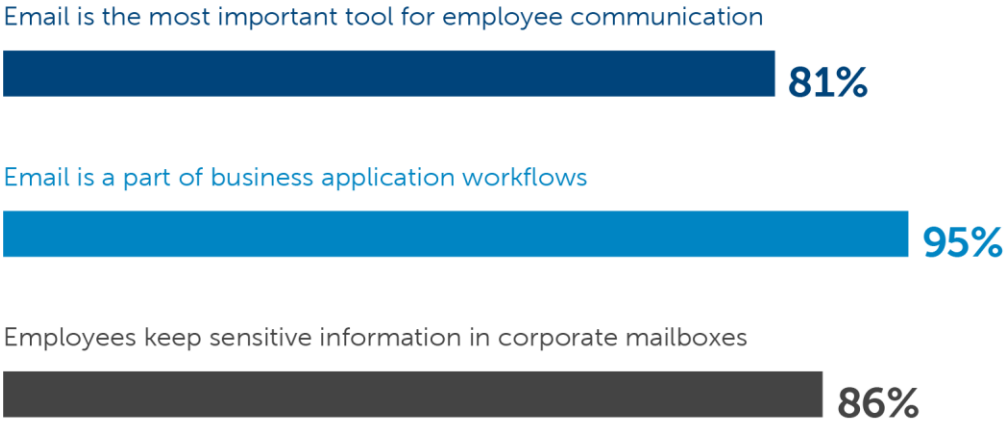
Many IT decision-makers are considering whether to deliver messaging services on-premises, in the cloud or in a hybrid environment. This is a complex decision that impacts their entire organization, as well as their customers and suppliers. If you, too, are at this crossroads, this guide is for you. We have two goals in this paper: 1) To help you prepare for a conversation with your internal stakeholders about the tradeoffs involved in on-premises and hosted Microsoft Exchange and 2) to provide you a methodology to weigh the relative four-year costs of these two models.

Comparisons between on-premises and hosted Exchange deployments are complex and nuanced. These factors include organization size, level and skills of internal IT staffing, data handling requirements and ongoing enhancements to Exchange Online service offerings. What may seem unimportant in one organization is a heavily weighted factor in another, so your requirements and costs will likely differ from the example we use in our TCO analysis. For these reasons, our solution consultants also have interactive tools to help you customize your analysis with their assistance.

The state of corporate email

In a Dell-sponsored study,[1] IT professionals involved in email decisions characterized their messaging environments and reinforced the continuing importance of email. While 44% of these respondents deployed email on-premises, 42% said they used both cloud and on-premises models. Almost half of those deploying only on-premises planned to keep their email on-premises for the foreseeable future, while 43% of the on-premises-only respondents were still evaluating options. At the forefront of this decision is the question of how to balance requirements and priorities across the organization.

Following are some highlights from this study, made of up respondents from companies with more than 1,000 users:



These results underscore the emphatic need to set and deliver a sound strategy that considers the embedded nature of email in many organizations, and the ever-present concerns about protecting data and reputation, regardless of environment.

Enterprise-class email via Microsoft Exchange

Microsoft Exchange and the Outlook client have been the leading email and calendar engine for enterprises for many years. Signs indicate that this trend will continue, with Exchange market share projected to grow from 64 percent in 2014 to 76 percent by 2018.[2]

Microsoft Exchange has evolved significantly over the years to provide companies with industry-leading capabilities for email retention, email content protection and security, e-Discovery and legal holds, compliance enforcement and auditability of email messages. Microsoft Outlook 2013 enhances the server side with Data Loss Protection (DLP) and tight integration with other Microsoft collaboration tools such as SharePoint and Skype for Business (Lync) for improved functionality and user and IT efficiency.

Changes "under the covers" in Exchange Server 2010 and 2013 set the stage for dramatically lowering costs per mailbox. For example, to provide enterprise-class application availability, performance and business continuity, older versions of Exchange, such as Exchange 2003 and 2007, were typically deployed on-premises using physical clustered servers and relatively expensive storage-area-networks (SANs) vs. today's alternatives.

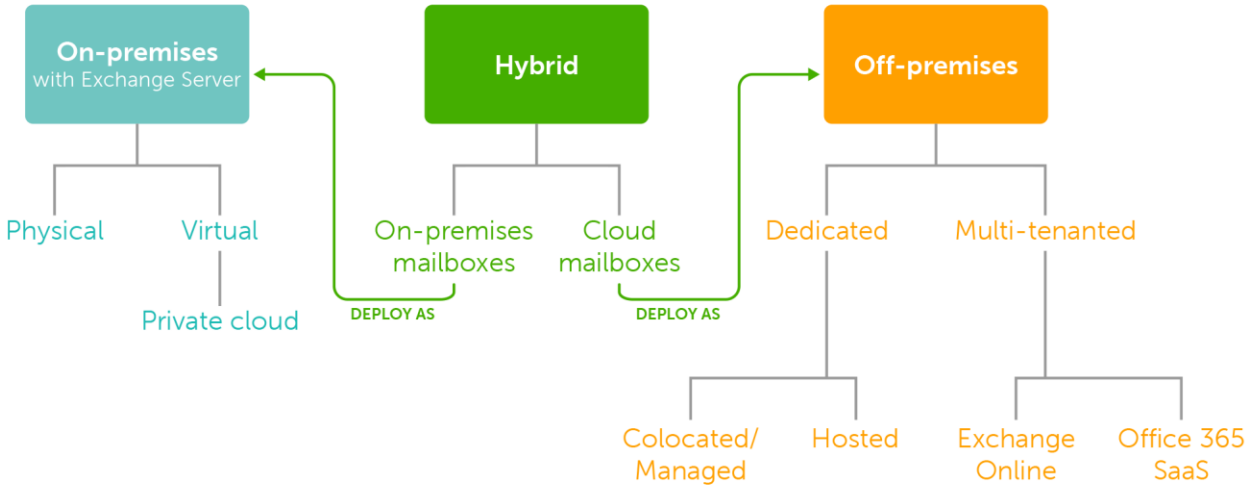
With Exchange Server 2010 and 2013, Microsoft massively reduced disk input/output (I/O) requirements. This efficient design enables Exchange mailboxes to be deployed on low-cost, very large-capacity drives. As a result, IT teams can deliver bigger mailboxes in a high-density server/storage footprint at a significantly lower cost per mailbox than with previous generations of Exchange.

Also introduced with Exchange 2010 and carried into Exchange 2013, Database Availability Groups (DAGs) increase Exchange mailbox availability by replacing traditional clustering with multiple local and remote copies of databases; failure of these databases is managed directly by Exchange.

A third significant enhancement in recent versions of Exchange is support for virtual deployment, which provides more flexibility for infrastructure design, scale and consolidation.

Options for deploying Microsoft Exchange

These generational enhancements have spurred a growing array of deployment models for Exchange. Today, Exchange can be deployed **on-premises** at your own data center or **off-premises** through a hosted service provider or at a colocation facility. Hosted service providers may deliver single-tenant (dedicated) and/or multi-tenant (public cloud) deployments of Exchange. Exchange can also be delivered **in a hybrid mode** with some mailboxes on-premises (in physical, virtual or private cloud environments), and others in dedicated or multi-tenant public cloud. The options continue to expand, but the following graphic portrays the most common.



On-premises deployments

Microsoft Exchange mailboxes are primarily delivered on-premises using a capital expense (capex) financial model with hardware depreciated over three to five years. Internal IT staff acquire infrastructure and either internally manage or outsource tasks ranging from deployment to migration and ongoing management.

An emerging alternative to "do it yourself," managed on-premises Exchange messaging appeals to organizations that prefer to keep their messaging environment on-premises, but want to shift primary operating responsibility to a service provider, typically in an operating expense (opex) model. Most of these service providers offer a menu of services, including design, deployment, migration, monitoring, maintenance and support for their end customer.

Off-premises deployments

In recent years, off-premises Exchange deployments have become increasingly common, and include the following:

- Microsoft Exchange is an option with Microsoft Office 365, a popular dedicated or multi-tenant cloud solution available through Microsoft or syndication partners such as Dell, who provide value-added services for a fixed monthly fee.
- Alternatively, Exchange Online is available through Microsoft and other hosted service providers, in dedicated- and multi-tenant models.
- Exchange Server also can be deployed on a co-located or managed hosted server at a third-party data center.

Hybrid deployments

Exchange mailboxes can be implemented in a hybrid configuration, with some of the mailboxes on-premises and others hosted. This is a technically challenging deployment and management model. In this use case, mailbox location decisions are typically based on strategic or operational considerations, such as security issues, sensitivity of information stored in emails, geographic dependencies and the need for some email boxes to integrate and interact with on-premises applications.

Evaluating needs by deployment model

Each of these Exchange delivery models has unique considerations. Following are some highlights:

- **IT expertise.** Whether physical, virtualize or in a private cloud, an on-premises deployment requires a mature IT staff with knowledge about the hardware and software platforms used and technical expertise in Exchange Server deployment, tuning, management and troubleshooting. This same level of skills and competencies will be needed for off-premises colocation, and an even higher degree of expertise is required for hybrid deployments. This expertise may reside in the internal IT team or be outsourced to an IT consulting provider such as Dell or a Dell partner.
- **Financial considerations**
  - **Exchange on-premises. The "pros":** This model enables predictable, long-term financial control because you own the versioning and features and are in complete control of your data. Migration across local area networks decreases costs, time and complexity vs. a hosted model. **The "cons":** Significant capital expense and effort are required to refresh infrastructure, on average every four years. Ongoing operating expense must cover resources to manage and monitor infrastructure and the application environment. Establishing disaster recovery processes and mechanisms can be complex if you do not already have these in place.
  - **Hosted Exchange. The "pros":** You receive access to new features as they are made available by your service provider. Your service level agreement provides an availability guarantee with an outage penalty clause. Other services, such as disaster recovery and data protection, are often included for an additional fee. **The "cons":** Bandwidth and networking-related investments are commonly the largest unforeseen costs. Further, you are no longer in control of your data, which could present problems if there a security breach with legal repercussions. This shifting of control can also be a problem if you later want to change providers or migrate email on-premises from the hosted environment. Migration to and from a cloud solution will be more costly and complex than continuing with your current deployment model.
- **Stakeholder requirements.** Stakeholder requirements include specific features and functions, and include factors such as security, scalability, availability, business continuity, compliance (for highly regulated industries), data protection, data loss prevention, data sovereignty and geographic alignment.

Depending on the characteristics of your organization, you may need to take into account other business process aspects. For example, if messaging must be integrated into corporate applications or business process workflows, you may achieve greater value by leveraging Exchange infrastructure on-premises, in the same environment with your other applications and internal corporate communication networks. Similarly, legal compliance may be an overarching key decision factor—for example, the need to adhere to Sarbanes-Oxley (SOX) and Health Insurance Portability and Accountability Act (HIPAA) regulations, where your email must comply with stringent policy and process controls.

Comparing options

The following table summarizes key differences between an on-premises solution based on Exchange Server 2013, and a multi-tenant cloud solution using Microsoft Exchange Online Plan 2.[3] Exchange Online Plan 2 has limitations vs. Exchange Server on-premises,[4] but offers additional features beyond the base Exchange Online solution in the areas of security, compliance and business continuity. These added features make it more comparable to the on-premises solution. Even so, the two options have differences which will be more important to some organizations than others, and you should compare these differences carefully with the help of an expert.

Comparison of on-premises Exchange and online Exchange

Key factors	On-premises	Exchange Online Plan 2
Features, versions & limits	Organization maintains complete control over your version, features, limits, policies and tools. Little to no impact to existing third-party spam filtering tools.	Provider controls version, features, limits and tools. Ability to lock down features, control over limits and changing from third-party spam filtering deserve review.
Performance & accessibility	Campus users on local area network (LAN); messaging for local users continue to function in event of wide area network (WAN) outage.	All access is via the WAN and Internet. Organizations such as retail and hospitality, with a large geographically disbursed user base, can benefit from offloading messaging traffic to a provider.

Comparison of on-premises Exchange and online Exchange		
Key factors	**On-premises**	**Exchange Online Plan 2**
Availability	Highest level of control over resiliency and maintenance windows. Organizations with limited staff and expertise may use a third-party offering for disaster recovery and archive.	Service-Level Agreement (SLA)-backed offering includes site-resiliency, which is designed and operated with the highest level of IT maturity. No control over maintenance window,
Data loss prevention and business continuity	Complete control of organizational data, policies and processes	Defined by service provider. Data Loss Prevention (DLP) capabilities deserve review.
Security	Data resides on IT-governed servers, behind the firewall. Can use preferred third-party tools and services.	Service provider has control over security.
Governance	Policies, digital rights management (DRM), role-based access control available with Exchange Server.	Typically cannot control geographic location of data; multi-national locations of backend data may affect data-sovereignty law compliance. Loss of control over deployment schedule and extent of updates. Changes to service are determined by service provider.
Migration	The simplest model, with mailboxes migrated over LAN to minimize bottlenecks. Least amount of change needed to surrounding services and applications.	Migration from on-premises to public cloud can be complex and take considerable time. Common hurdles: Domain integration issues, underestimating bandwidth needs, and transitioning off third-party archive platforms.
Ease of integration with applications/ workflows	Easiest, because the Exchange deployment is close to the IT infrastructure and application environment.	Hosted model may require significant efforts and investment to address large distribution group messaging needs, public folders and custom workflows.
Support model	Corporate support, using local system administrators or managed services.	Defined by service provider, subject to service level agreement.
Cost model	Capex financial model with average four-year refresh. Offering like Dell Financial Services can be leveraged to spread cost out over time.	Operating expense financial model. Common unplanned costs: underestimating migration efforts, additional WAN bandwidth, Active Directory (AD) services, large file handling capabilities, mass-email distribution.

Customer use case

To illustrate a cost comparison, we use the scenario of a company in a highly regulated industry. This company has 8,000 Exchange mailboxes and is deciding whether to move its current on-premises physical deployment to a multi-tenant cloud using Microsoft Exchange Online. We assume that the company:

- Has an experienced IT organization with deep data center and Exchange Server expertise
- Has stringent requirements for email retention, e-discovery, legal hold, data loss prevention, disaster recovery and role-based access control
- Requires significant auditable security and compliance mechanisms to satisfy business and legal constraints.

Earlier, we highlighted some key considerations for the two models which generally apply across use case scenarios. For this use case, the mailbox size difference between the two solutions merits deeper consideration. The Exchange Online Plan 2 solution allows you to grow your mailbox to 50 GB, with restrictions on message size, number of messages and distribution size, but no cap on archival storage. For the use case we've described, the company would likely limit mailbox size because of the added burden of analyzing immense volumes of email for compliance or regulatory reasons, difficulty in tracking problems in an email store and so on. Many companies reduce these burdens by requiring users to actively control their mailbox volume, using measures such as offloading document attachments from mailboxes to desktop or server storage and cleaning up redundant email conversations. We frequently see companies planning for 3GB to 5GB mailboxes on average across user tiers. This specific on-premises comparison is for 3GB mailboxes. Flexible configurations are available to customize your solution to meet your mailbox profile needs and numbers.

Configuration details

Exchange on-premises deployment: Validated Dell PowerEdge R730xd Exchange solution

The on-premises Exchange deployment, is a server-storage solution architecture[5] validated by Dell using Microsoft's Exchange Solution Reviewed Program (ESRP), which provides a common storage testing framework for technology suppliers. This solution incorporates Dell PowerEdge R730xd servers with internal RAID-1 paired drives to provide a balance of low cost and additional resiliency in a small footprint. The PowerEdge R730xd server is a dual-processor socket, 2U rack server for data-intensive applications, with an Intel Xeon E5-2600 processor and internal RAID storage controller with an optional caching feature.

Following are the configuration details for Dell PowerEdge R730xd servers.

Configuration details for PowerEdge R730xd servers	
Processor	2 x Intel Xeon E5-2660 v3
Memory capacity	12 x 16GB RDIMM
RAID controller	PERC H730P RAID controller
Hard drives	2 x 1.2TB 10K RPM SAS 6Gbps 2.5-inch flex bay hard drive

Configuration details for PowerEdge R730xd servers	
Hard drives	12 x 4TB 7.2K RPM NLSAS 6Gbps 3.5-inch hot-plug hard drive
Hard drives	4 x 4TB 7.2K RPM NLSAS 6Gbps 3.5-inch internal bay hard drive
Network daughter card	Broadcom 5720 QP 1Gb network daughter card
For cost analysis, we added the following features not specified in the ESRP document:	
Power supply	Dual, hot-plug redundant power supply (1+1), 750W
Power cords	2 x NEMA 5-15P to C13 wall plug, 125 Volt, 15 AMP, 10 feet (3m), power cord, North America

The solution design includes Database Availability Group (DAG), a high-availability mechanism in Exchange 2013 that supports up to 16 copies of an Exchange database. The DAG is active-passive, which means that only one copy is accessible to email clients at any given time. The active copy is synchronized to passive copies, including copies at remote sites in the form of transaction logs, to provide for disaster recovery. Active and passive copies do not share storage. Dell has tested this environment with up to 8,000 users with 3GB mailboxes and 150 messages per day (i.e., 0.121 IOPS per user including 20 percent input/out (I/O) headroom). The design can scale modularly to accommodate larger mailboxes and more users.

Exchange Online Plan 2 multi-tenant solution

Microsoft Exchange Online Plan 2 is deployed on globally redundant servers with a feature set similar to Exchange Server 2013. Exchange Online Plan 2 is billed as a software-as-a-service (SaaS) application on a per-mailbox monthly fee of $8 per mailbox per month.[6]

Configuration comparison

The following table shows the on-premises and multi-tenant cloud configurations.

Configurations		
	Microsoft Exchange on-premises configuration[7]	**Microsoft Exchange Online Plan 2[8]**
User count	The tested environment simulates up to 8,000 users including 20% headroom	8,000
Mailbox size	Mailbox profile of 3GB and 150 messages per day, or 0.121 IOPS for every user	50 GB of storage in each user's primary mailbox
Archiving	The archive fits within the 3GB mailbox profile tested.	Unlimited storage in the user's In-Place Archive
Mailbox resiliency	Three-copy DAG with two local copies and one remote copy of each database	Guaranteed 99.9% uptime, financially backed service level agreement

Total cost of ownership (TCO) analysis

The following table illustrates a methodology for a four-year TCO analysis. The cost basis for these calculations is included in the notes at the end of this document. License and hardware costs are based on retail prices at the time of this writing. While actual costs for a given customer solution will vary by line item and may include additional line items, this methodology provides a starting point for you to estimate your own costs and do your own comparisons.

TCO comparison		
On-premises cost category[9]	**On-premises cost**	**Multi-tenant cloud cost**
User licenses and subscriptions[10]		
Microsoft Windows Server Client Access Licenses (CAL) (SA only)[11]	$288,000.00	$288,000.00
Microsoft Exchange Standard CAL (SA only)[12]	$640,000.00	$0.00
Microsoft Exchange Enterprise CAL with Services (SA only)[13]	$992,000.00	$0.00
Microsoft Exchange Online Plan 2[14]		$3,072,000.00
Server costs		
Dell PowerEdge R730xd servers with Dell ProSupport Plus[15]	$216,400.00	$0.00
Microsoft Windows Server 2012 R2 Datacenter edition (factory install)[16]	$26,323.150	$0.00
Microsoft Windows Server 2012 R2 Datacenter edition (SA)[17]	$26,323.140	$0.00
Microsoft Exchange Server Enterprise 2013 (license + SA)[18]	$48,798.00	$0.00
Data center operating costs		
Energy costs for power and cooling[19]	$19,584.00	$0.00
Switch costs[20]	$20,077.51	$0.00
Data center space costs[21]	$4,800.00	$0.00
Transition costs[22]		
Design costs[23]	$4,078.40	$8,156.80
Validation costs[24]	$4,078.40	$8,156.80
Deployment costs[25]	$8,156.80	$1,019.60
Migration costs[26]	$8,156.80	$12,235.20
Exchange administration training costs[27]	$0.00	$2,529.92
WAN bandwidth costs		
Mailbox migration WAN bandwidth costs[28]	$0.00	$8,000.00
On-going WAN bandwidth costs [29]	$0.00	$58,422.49

TCO comparison		
On-premises cost category	**On-premises cost**	**Multi-tenant cloud cost**
Administration costs		
Server and platform administration costs[30]	$63,618.00	N/A
Exchange administration day-to-day mailbox administration costs[31]	$218,080.00	$163,560.00
Exchange administration break-fix and patch management costs[32]	$462,329.60	$346,747.20
Other costs		
Estimated cost for Active Directory Federation Services server for single sign on[33]	$0	$82,000
Total	$3,061,160.65	$4,050,828.01
Savings with on-premises	$989,667.36	
Percentage savings with on-premises	24%	

Conclusions

As this cost analysis illustrates, the on-premises solution would cost approximately 24 percent less than the on-premises solution over a four-year period using today's retail pricing and our operating cost estimates. Of course, the value of each solution to your organization depends on your use case and vantage point, and the right answer may be a hybrid approach. Given the pace of change in both on-premises and cloud-based email capabilities and costs, a thorough analysis of both is essential to help you to deliver the right solution for your organization.

Regardless of which Microsoft Exchange deployment model you choose, Dell has the solution portfolio and expertise to help you navigate the entire lifecycle, from planning and design to implementation, deployment and management.[34] If an on-premises solution is the best choice for you, but you want to spread expenses, Dell Financial Services can help.

In addition to expert IT consulting services from Dell and our partners, we offer a broad portfolio of server, storage and networking solutions and end-user devices. Our IT management tools streamline infrastructure deployment, email migration, infrastructure and application management and performance monitoring and enhance data protection. We also provide applications, appliances and online services to enhance email security.[35]

For more information and assistance with a customized analysis or with designing your on-premises, hosted or hybrid Microsoft Exchange solution, contact your Dell representative or Dell channel partner.

Notes

[1] Dimensional Research. *The State of Corporate Email*. Dell-sponsored study of IT email decision-makers in corporations with more than 1,000 employees.

[2] The Radicati Group, Inc. *Microsoft Office 365, Exchange Server and Outlook Market Analysis, 2014-2018.*

[3] See *Compare Exchange Online Plans.*

[4] See *Exchange Online Limits.*

[5] See *Dell PowerEdge R730xd 8,000 Mailbox Resiliency Exchange 2013 Storage Solution*

[6] Pricing as of this writing. See *Compare Exchange Online Plans*.

[7] See *Dell PowerEdge R730xd 8,000 Mailbox Resiliency Exchange 2013 Storage Solution*.

[8] See *Compare Exchange Online Plans*.

[9] Four-year cost summary. The on-premises ESRP R730xd-based cost model is based on a configuration defined in a highly resilient Microsoft Exchange 2013 storage solution for up to 8,000 mailboxes using Dell PowerEdge R730xd: *Dell PowerEdge R730xd 8,000 Mailbox Resiliency Exchange 2013 Storage Solution*. It includes the following four-year costs:

- Server hardware and software costs, which are based on publically available software costs from Microsoft, and hardware and factory-installed OS costs from Dell. The purchase cost of factory installation of Windows Server 2012 R2 the ESRP servers is included, as well as the purchase cost for Exchange Server 2013 Enterprise for each server, including four-year Software Assurance (SA). Leveraging any existing Exchange Server license may further lower this expense. We assume a Microsoft Enterprise Agreement (EA) is in place but report undiscounted prices from the Microsoft Open Value Program, No Level for software that is not factory installed and for software assurance.
- Software Assurance costs for each user's Windows Server Client Access License (CAL), Microsoft Exchange Standard User CAL, and Microsoft Exchange Enterprise User CAL. This assumes users already have the licenses, and the cost model includes software assurance only.
- Transition costs, including deployment and migration costs
- Estimated data center operating costs, such as power and administration for the servers
- Exchange administration costs

The cloud model includes the following costs:

- Microsoft Exchange Online Plan 2 subscription costs
- Costs for Active Directory Federation Service servers and Windows Server CAL SA costs for users to access it, based on the assumption that the organization uses Active Directory (AD) and wants to use Single Sign-On (SSO) in Exchange Online.
- Transition costs, including deployment costs, migration costs, and Exchange administrator training costs
- Exchange administration costs

[10] User licenses and subscriptions -- CAL cost estimates use Microsoft Open Value Program, No Level software prices from the *Microsoft License Advisor tool*. Four-year SA costs are estimated based on three-year costs. For all CALs, the assumption is that each user is already licensed with the CAL, so the

cost model includes Software Assurance costs only. The cloud solution includes Exchange Online Plan 2 subscription for each user in the cloud solution.

[11] Microsoft Windows Server CAL (SA only) — Includes four-year Microsoft Windows Server User CAL SA costs for each user at $36 per user. Costs include Windows Server CAL costs for the cloud solution because the Active Directory Federation Services (ADFS) servers included in the solution require these CALs. Adjust percentage users needing ADFS access on Cost Details tab (default = 100 percent).

[12] Microsoft Exchange Standard CAL (Software Assurance (SA) only) — Includes four-year Microsoft Exchange Standard User CAL SA costs for each user at $80 per user for the on-premises solution.

[13] Microsoft Exchange Enterprise CAL with Services (Software Assurance (SA) only) — Includes four-year Microsoft Exchange Enterprise User CAL SA costs for each user at $124 per user for the on-premises solution.

[14] Microsoft Exchange Online Plan 2 -- Includes $384 per user over four years for subscription to Exchange Online Plan 2 at $8 per user per month. See *Compare Exchange Online Plans.*

[15] Price for the Dell servers described in *Dell PowerEdge R730xd 8,000 Mailbox Resiliency Exchange 2013 Storage Solution*. Each server includes 2x Intel Xeon processor E5-2660 v3, 12x 16GB RDIMM, PERC H750P RAID controller, 2x 1.2 TB 10K RPM SAS drives, 16x4tB 7.2 RPM NLSAS drives, Broadcom 572- 1Gb Network daughter card, and redundant 750W power supply. Dell ProSupport Plus is included to provide mission-critical support and iDRAC8, Enterprise with OpenManage Essentials is added to enhance manageability. The PowerEdge R730xd server cost is list price on 2/23/15 from the *Dell Online Store.*

[16] Microsoft Windows Server 2012 R2 Datacenter edition (factory install) — Software for each server includes Microsoft Windows Server 2012 R2 Datacenter Edition factory install license priced in the Dell Online Store at $4,614.57.

[17] Microsoft Windows Server 2012 R2 Datacenter edition (SA) — Software for each server includes Windows Server SA at $6,180.00, priced using the Microsoft License Advisor.

[18] Microsoft Exchange Server Enterprise 2013 (license + SA) — Software for each server includes Microsoft Exchange Server Enterprise 2013 (license + SA) at $8,133.00

[19] Energy costs — The *Dell Energy Smart Solution Advisor* is used to estimate the power utilization at 509W for the servers at 60 percent utilization in a transactional workload. Power costs estimates use the average US commercial rate of 0.1075 cents per kWH reported for 2014 in "*Electric Power Monthly with Data for January 2015*," published by the U.S. Energy Information Administration, for year-round usage. Cooling costs are estimated based on a data center PUE of 1.7. PUE estimated using 2013 survey results reported here.

[20] Switch costs — Switch cost estimates use the average cost per port of a Dell Networking S4810 Switch priced at $40,155.02n the Dell Online Store, including four-year Pro Support and cables. Estimate assumes each server uses a total of four ports across redundant switches for a one-time per-server switch cost of $3,346.25.

[21] Data center space costs — Data center space costs are estimated at $100 per U per year, or $800 over four years for each of these 2U servers.

[22] Transition costs – This field estimates costs for design, validation, deployment, migration, and training for each solution using a cost per hour of $50.98 based on $106,030 total compensation (salary + benefits) of a System Administrator II reported at Salary.com divided by the hours in 52-40 hour weeks.

[23] Design costs — Cost are based on estimate of 40 hours of System Administrator II-level staff time per 4,000 users to plan for the upgrade for the on-premises solution and 80 hours per 4,000 users to plan for the cloud migration for the hosted solution.

[24] Validation costs — System Administrator II-level staff time is estimated at 40 hours per 4,000 users to validate the upgrade for the on-premises solution and 80 hours per 4,000 users to validate the cloud migration for the hosted solution.

[25] Deployment costs — System Administrator II-level staff time is estimated at 80 hours per 4,000 users to deploy the on-premises solution and 10 hours per 4,000 users to deploy the cloud solution.

[26] Migration costs — System Administrator II-level staff time is estimated at 80 per 4,000 users to migrate workloads for the on-premises solution and 120 hours per 4,000 users to deploy the hosted solution.

[27] Exchange administration training costs — No additional training costs are assumed for the on-premises solution, which is a server-upgrade from a similar configuration. User training is estimated at 32 hours per 4,000 users for System Administrator I-level staff who administer the hosted solution. Staff training cost is estimated at $40 an hour based on System Administrator I total compensation of $82,228.00 as reported at Salary.com.

[28] Mailbox migration bandwidth costs — Based on estimate of $1 bandwidth costs to migrate each mailbox to the cloud.

[29] Based on estimates of $.50 per GB bandwidth cost, initial count of 150 messages sent or received per day per user, average message size of 75KB, and 15 percent growth year-to-year in message traffic.

[30] Server and platform administration costs — One full-time equivalent (FTE) System Administrator I-level staff is estimated to administer an average of 40 Windows servers at a four-year cost of $10,603.00 per server.

[31] Exchange administration day-to-day mailbox administration costs —For the on-premises solution, 500 hours per year is estimated for FTE Mail Server Administrator-level staff per 4,000 users to manage the on-premises Exchange. Cost per hour is $54.52 based on $113,405.00 total compensation (salary + benefits) of a Mail Server Administrator reported at Salary.com. For the hosted solution, costs are estimated at 25 percent lower.

[32] Exchange administration break-fix and patch management —For the on-premises solution, 1,060 hours per year per 4,000 users is estimated for FTE Mail Server Administrator-level staff to manage the on-premises Exchange. For the hosted solution, costs are estimated at 25 percent lower.

[33] Estimated cost for Active Directory Federation Services servers for single sign-on — The hosted solution is assumed to require two servers for up to 20,000 users at a cost of $41,000 per server for hardware, support, Windows Server software license and Software Assurance, administration, and data center operating costs. Larger solutions would require five servers at an average four-year cost of $42,600 per server, which includes costs to maintain a SQL Server backend. These servers are in addition to those the enterprise is already using with their existing Exchange. The on-premises solution requires no additional servers for this purpose.

[34] See *Dell Unified Communication and Collaboration Services.*

[35] See *Dell Windows Server management.*