

Money saving advantage Analysis of Datacenter Consolidation Using Global Virtual Datacenter Online Calculator and VMware ROI TCO Calculator

Aditya Jain¹, Shubham Taneja¹

¹VIT University, Vellore



ABSTRACT: Datacenter consolidation decreases expenses and offers convenient, unrivaled administrations by minimizing interests in IT framework and structures and lessening power utilization. This contextual investigation offers a money saving advantage examination of the most well-known consolidation approach—virtualization—utilizing two online adding machines. Datacenter consolidation through virtualization has the potential for both high cost speculation supports and minimized game plan and downtime for disaster recovery. To successfully fulfill this present, it's central for a relationship to lead a basic study on strength, weakness, opportunities, and threat (SWOT) examination. Various fiscal, operational, specific, and security-related issues expect a basic part in figuring frameworks for datacenter consolidation and recoverability. Likewise, picking which datacenter consolidation contrasting option to pick is comparably fundamental in controlling a relationship toward accomplishment. Building a business case allows you to survey the union system to make sense of if the attempts meet the fancied goal. Hardening depends on upon the vital aptitudes to keep up the establishment, and what's more on systematization. Understanding the present resources is vital to recognize the best contender for union. The Configuration Management Database can give you a complete point of view of what exists and how it is outlined. Besides, advantage resource masterminding courses of action can help you fathom the full extensiveness of your datacenter assets. When you perceive what exists in the datacenter, it is definitely not hard to pick the best parts to converge to get the greatest benefit for union.

KEYWORDS: Datacenter consolidation, Recoverability, Systemization, Benefits.

1. INTRODUCTION

Datacenter Consolidation is a noteworthy research territory for creating innovation to diminish IT framework's expenses and many-sided quality. Consolidation all in all minimizes equipment costs by moving or wiping out underutilized or unused equipment resources. As per the 451 Research Group, the Data Center Infrastructure Management (DCIM) arrangement business sector is likely to achieve US\$1.2 billion by 2015. To improve IT assets effectiveness and execution to meet these expanding requests, associations are exponentially expanding their utilization of virtualization innovation in datacenter plan. Cloud administration suppliers are putting forth effective DCIM arrangements as programming as an administration, which can be sent with negligible venture and hold up time, bringing about tremendous cost reserve funds and upgraded execution.

As indicated by the World Information Technology Report 2010–2011, yearly worldwide datacenter IP movement will achieve 4.8 Zettabytes by the end of 2015. Furthermore, worldwide datacenter IP activity in 2015 is liable to achieve 402 Exabytes every month. From 2010–2015, worldwide datacenter IP activity is relied upon to increment fourfold at a compound yearly development rate of 33 percent. The Universal Data Corporation gauges that computerized substance will

reach 35 ZBytes by 2020.

The UK government is thinking about proposition for lessening the quantity of datacenters to an ideal number of secure, proficient, and versatile administrations by 2020.⁷ Such proposition have the potential to decrease costs by up to £300 million every year by 2020.⁸ The Australian Government Data Center Strategy 2010–2025 additionally portrays methodologies for sparing US\$1 billion in datacenter costs utilizing virtualization, combination, and advanced hardware, as well as by killing unmoving hardware. Efficient use of assets and vitality through datacenter combination spared Microsoft \$23.2 million—a 40 percent slice in pre-combination spending.

Here, we offer a money saving advantage examination of datacenter combination utilizing virtualization. We begin by looking into how datacenter combination expects to decrease costs while looking after execution, inspecting specifically how union and virtualization can enhance vitality protection and debacle recuperation endeavors. At that point we utilize two online adding machines to decide the arrival on speculation for solidification endeavors.

Table 1. Results of datacenter consolidation for three large companies.

Organization	No. of datacenters before consolidation	No. of datacenters after consolidation	Savings
Hewlett Packard	85	6 (with 3 mirrored for disaster)	\$1 billion annually
IBM	3,900	30 virtualized Linux mainframes	Reducing datacenter floor space by 8 million square feet resulted to 80 percent reduction in energy use
Williams-Sonoma	100	5 IBM Regatta Unix servers	Eliminated the need to add 50 more stand-alone servers to handle an anticipated increase in processing demands

2. DATACENTER CONSOLIDATION GOALS

Union, which decreases the quantity of frameworks, brings together information administration by accommodating gadgets clashing components furthermore, monitoring data in one spot.

Datacenter union includes the accompanying:

1. Uniting endeavor datacenter administrations
2. Upgrading the utilization of versatile and secure servers
3. Incorporating server support for infrastructure as a service (IaaS), and
4. Enhancing power use.

Basically, Consolidation uses institutionalization to improve the base, which at last can lessen costs.

2.1. MINIMIZING COSTS

The datacenter union arrangement incorporates the taking after cost lessening approaches:

1. Solidify datacenters utilizing virtualization, which decreases the quantity of server machines and cuts vitality utilization (particularly for cooling)
2. Bring together bookkeeping strategies to decide the genuine expense of administrations;
3. Streamline operations
4. Migrate datacenters relinquishing cost urban land for less costly, low-temperature areas.

2.2. MAINTAINING PERFORMANCE

Virtualization addresses server solidification for diminishing center IT frameworks—particularly equipment—prompting

decreased capital uses).

Be that as it may, associations are still attempting to diminish operational consumptions, since framework directors are confronted with the manual and asset concentrated everyday errands of dealing with whatever is left of the datacenter assets, for example, systems administration, stockpiling, and client administration.

Along these lines, to fundamental the present framework, combination should likewise include:

1. Distinguishing existing assets
2. Deciding the best possibility for combination, furthermore
3. Reconfiguring IT assets and assessing

Be that as it may, compelling datacenter union is more than diminishing the quantity of datacenters, since trimming down equipment frequently comes about in debased execution. This, thusly, could in the end result in impromptu consumptions to advance the datacenter base.

Another essential part of datacenter union is dependability. On the off chance that a datacenter's unwavering quality is 99 percent, two datacenters are prone to give 99.99 percent dependability and three datacenters might give 99.9999 percent in the best-case situation; no limited number of datacenters will ever give 100 percent dependability. A greatly solid design can give high unwavering quality with a couple datacenters.

Since the force is the significant cost part in datacenter operation, a force proficient datacenter is the prime element in datacenter solidification.

Next, we examine procedures for diminishing the force utilization in a datacenter.

3. DIMINISHING POWER CONSUMPTION

As indicated by a McKinsey report, the aggregate assessed vitality bill for datacenters in 2010 is US\$11.5 billion, and vitality costs in an ordinary datacenter twofold every five years. Electricity speaks to around 25–40 percent of the operational uses for a run of the mill datacenter. Gartner gauges that, by and large, 40–60 percent of server rack space is underutilized or squandered, and up to 30 percent of accessible force is stranded, which can prompt associations exceeding datacenters rashly.

3.1. ENHANCING POWER EFFICIENCY

The biggest and most wasteful datacenter power purchaser is PC room aerating and cooling (CRAC) frameworks; more than 50 percent of datacenter power goes to cooling. The weight component of aerating and cooling (the proportion between creation power and cooling power) by and large ranges from 1.8 to 2.5.¹⁷ If a server requires 100 watts of delivering force, a CRAC unit would require somewhere around 180 and 250 watts of force to cool the server. The elements that contribute to a CRAC unit's weight element are fundamentally the unit's operational effectiveness and air appropriation plan—that is, the manner by which effectively the air can reach the objective server.

A force effective configuration for datacenter framework would be to utilize less attachments, in light of the fact that the less the attachments, the less the transformation misfortune. Power misfortune dependably happens as far as warming for furnishing the datacenter with a continuous power supply, whether it's through a Switch Mode Power Supply or an expansive uninterruptible power supply (UPS) framework. For instance, at Cisco, an expansive exchanging stage working at 90 percent power proficiency and requiring 1,000 watts of force will lose roughly 100 watts of force through warmth era amid its working hours.

Taking after are some best practices embraced by mammoth datacenters for diminishing force use and sparing expenses:

- Hitachi Data Systems Corporation works a 10,000 square meter Green Data Center in Yokohama, Japan, that utilizes green datacenter innovation to accomplish a force utilization adequacy (on the other hand load component) of 1.6.
- The San Diego Supercomputing Center is a 19,000 square foot atmosphere controlled, secure datacenter. It's operational with 13 Megawatts of force and multi-10-gigabit system availability.
- In San Antonio, Texas, Microsoft's datacenter utilizes around 8 million gallons of reused water from the city's waste framework per month amid crest hours for cooling.

Utilizing an exponential model of effectiveness change, we can see that if a present piece of best in class hardware has limit C_0 what's more, power utilization P_0 , then, in t years, a practically identical bit of best in class gear will have a vitality utilization $EQ(t)$ as takes after:

$$EQ(t) = PQ/CQ = P_0/C_0(1 - a)^t,$$

where PQ is the force utilization in t years, CQ is the limit in t years, and a is the state-of-the-art innovation's yearly change rate. The units for limit C_0 and CQ rely on upon the piece of gear being viewed as; the velocity of directing is measured in bits every second (bps). The limit of substance servers (a systems administration gadget) is measured regarding transmission rate (bps), also, calculation server limit is measured in terms of handling limit. My prior work demonstrates that server vitality effectiveness is multiplying by each two to four years and execution for each Watt in servers is multiplying at regular intervals, which compares to $a = 0.21$. Other exploration demonstrates that expanded stockpiling thickness in hard circle drive (HDD) platters has accomplished exponential diminishments in vitality consumption. My prior work likewise demonstrates that, while including a 30 percent per annum rate of vitality effectiveness change away, $a = 0.3$.

At last, different studies demonstrate that greatest server and capacity usage ranges from just 20 to 40 percent, which results in poor cost-viability as far as an operation's energy utilization. Associations can enhance asset use in numerous courses, for example, by making the most operations procedure arranged utilizing propelled system innovation, which has a significant correlative impact.

3.2. LEVERAGING VIRTUALIZATION

The virtualization of servers and capacity has helped numerous associations facilitate the troubles of not having devoted IT foundation for business exercises and fiasco recovery. Without virtualization, one and only application can keep running on one server—for instance, email keeps running on a mail server, record capacity on a record server, etc. In this situation, the servers and applications regularly are utilized for a constrained time and are generally sit. Notwithstanding, the power costs, cooling costs, space necessities, and different necessities proceed, which demonstrates extremely exorbitant for associations and abuses the idea of "becoming environmentally viable." With virtualization, numerous applications can keep running on one server, guaranteeing that the server is ideally used. Table 2 demonstrates the effect of different vitality sparing technologies. Server combination has a few benefits, counting

- a more than 50 percent decrease in equipment what's more, working expenses;
- 80 percent cut in vitality bills;
- Investment funds of \$3,000 every year for each virtualized server;
- 70 percent diminishment in new-server provisioning time because of diminished downtime, upgraded unwavering quality, and implicit calamity recuperation; and
- On-interest conveyance of IT administrations free of equipment, OS, programming, or administration supplier.

Table 2. Energy-saving datacenter technologies.

Technology	Savings (%)
Server virtualization	40
Power efficient server	20
Efficient facilities infrastructure (computer room AC and power distribution unit)	7
Efficient storage system	6
Efficient network equipment	5
Data storage management technique	5
Server/PC power management software	4
Alternative/renewable energy	4
Tiered storage	4
Other	5

4. DATACENTER VIRTUALIZATION FOR DISASTER RECOVERY

Table 3. Cost per month based on virtual private server (VPS), storage, and RAM usage.

No. of VPS nodes	Storage (G bytes)	Cost in US\$*
1	10	32.12
2	35	52.20
3	60	72.27
4	85	92.35
5	110	112.43
6	135	132.50
7	160	152.58
8	185	172.65
9	210	192.73
10	235	212.81
11	260	232.88
12	285	252.96
13	310	273.03
14	335	293.11
15	360	313.19
16	385	333.26

The unified calamity recuperation methodology's sole reason for existing is to offer a reinforcement office for proceeded operations amid disastrous occasions. Indeed in spite of the fact that IT foundation recuperation destinations have a lot of consistency, 100 percent cover is inconceivable to accomplish. The more extensive the arrangement contrast between the essential and recuperation destinations, the higher the recuperation site's IT foundation costs. At the point when arrangements are broadly assorted, datacenters that came about because of the merger would recreate the IT framework at the reinforcement site, making the whole practice purposeless. Blending datacenters is another procedure for reproducing a datacenter's substance on another indistinguishable datacenter for calamity recuperation reason. A perfect datacenters blending licenses improved fiasco recuperation in a financially savvy way with for all intents and purposes no downtime. Through datacenter blending, it's too conceivable to complete incessant information replication, redesigns, furthermore, upkeep, which expands in general uptime and reductions upkeep downtime.

5. MONEY SAVING ADVANTAGE EXAMINATION

The standard way of thinking for purchasing more than you at present need to ensure your speculation prompts fast out of date quality because of innovation headway. Moore's Law expresses that the quantity of transistors on incorporated circuits copies roughly like clockwork. In any case, the period is regularly cited as "18 months," because Intel official David House anticipated year and a half as the period for a multiplying of IC chip performance. The life of servers and capacity clusters are typically two to seven years, while vast switches and switches are revived each five to seven years. Since datacenters are frequently intended for a 10-to 15-year life cycle, the pace of cutting edge innovation organization in datacenters is similarly moderate. Nonetheless, amid their life cycle, datacenters require no less than three to four overhauls; subsequently, the dynamic life time of datacenter equipment is roughly three years.

Besides, different offices ascertain that the devaluation rate of electronic hardware is in the scope of 20 to 80 percent for each annum. As indicated by the Canada Revenue Agency, IT gear's deterioration rate is 30 percent. Eventually, the hardware's life range is around three years. Consequently, the best alternative is to purchase for current needs and afterward add more ability to meet the necessities of utilizing low-control double attachment servers to expand vitality productivity.

For the money saving advantage investigation of datacenter combination utilizing virtualization, two online adding machines were utilized: Global Virtual Datacenter online calculator and VMware ROI TCO.

5.1. GLOBAL VIRTUAL DATACENTER ONLINE CALCULATOR

Table 4 demonstrates the Virtual Internet's Virtual Data Centre. In this choice, the committed CPU pace was 0.6 GHz, with 376 MB of RAM and 1 Terabyte of transfer speed. As Table 3 appears, the expense relentlessly increments as more storage room is used.

In Table 4, stockpiling was bit by bit expanded by 25 GBytes, keeping the CPU rate, RAM, and data transmission consistent. The quantity of virtual private server (VPS) hubs was settled at one. Table 4 demonstrates the outcomes when the quantity of VPS hubs progressively increments from 1 to 16.

At the point when RAM was expanded by 256, the charges additionally expanded by £9.50.28 .The permit cost per CPU for Windows Server 2008 DC release is around \$2,999. The Software Assurance permit charge is \$750 every year.

Table 4. Costs per VPS with varying CPU, RAM, and storage.

No. of VPS nodes	Dedicated CPU (GHz)	RAM (Mbytes)	Storage (Gbytes)	Bandwidth (Tbytes)	Cost in US\$*
1	0	1,40	1	1	93.15
2	1	1,77	2	2	114.03
3	1	2,15	3	3	131.70
4	2	2,52	4	4	149.37
5	3	2,90	5	5	165.43
6	3	3,28	6	6	186.31
7	4	3,65	7	7	204.37
8	4	4,03	8	8	224.85
9	5	4,40	9	9	245.33
10	6	4,78	1	1	265.81
11	6	5,16	1	1	286.28
12	7	5,53	1	1	306.76
13	7	5,91	1	1	327.24
14	8	6,28	1	1	347.72
15	9	6,66	1	1	350.13
16	9	7,04	1	1	369.40

5.2. VMWARE ROI TCO CALCULATOR

The scope of info variables for the VMware ROI TCO calculator is as per the following:. Years of civil war, coups d'état and unstable political situation left a community of almost illiterate and impoverished people. National roads, telecommunication services and border control in the affected region are weak and unsafe.

- Number of years: 1–10;
- CPUs/servers: 1, 2, 4, or 8;
- Centers/CPUs: 1, 2, 4, 6, 8, 10, or 12;
- Number of workloads: clients must enter this (with at least 1 workload); and
- Number of servers: clients must enter this (according to prerequisites).

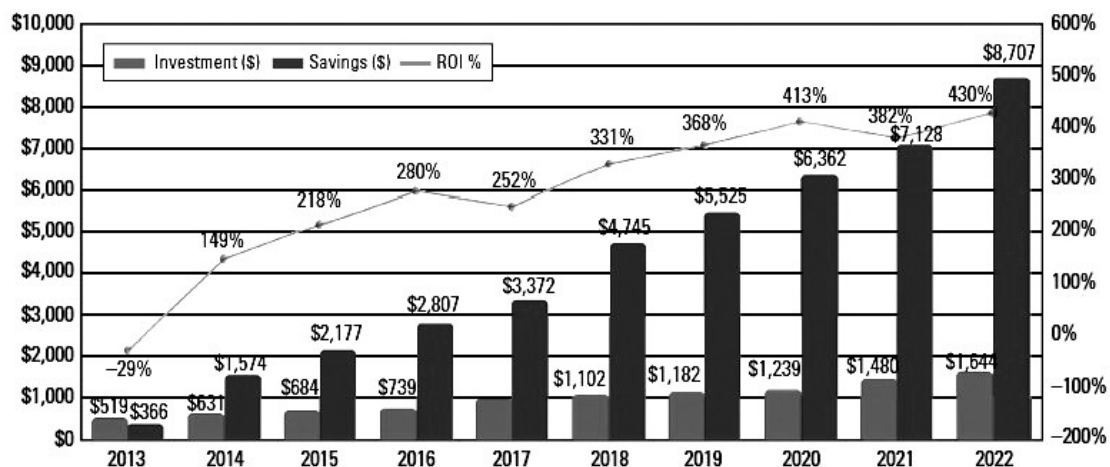


Fig. 1. Cumulative investment, savings, and return-on-investment over a 10-year period. The investment of \$1,644,248 investment yielded a total savings of \$8,707,030, for an ROI of 430 percent.

For the minimum input value for the CPUs/servers, cores/CPU, number of workloads, and number of servers, the ROI TCO calculates the average price per server at \$1,226. When input to these four variables changes, the charges are recalculated. Table 5 shows details of calculations for a test case for one year.

For the parameters shown, all host servers are new buys, and existing servers are completely devalued as foundation moves. The estimations depend on the accompanying:

- Number of VMs and host servers: 150;
- Current union proportion (workloads/server):12:1;
- Normal VMs per physical center: 1.5;
- Yearly development in workloads: 5 percent;
- Valuable existence of non-virtualized servers: 4 years;
- Normal period of existing servers: 3 years; and
- Valuable existence of new host servers: 4 years.

Utilizing the same estimation for a 10-year investigation period (2013–2022) with a venture of \$1,644,248, I found the accompanying:

- Capital cost: \$1,546,711;
- Working cost: \$3,949,284;
- Other: \$3,211,035;
- Complete reserve funds: \$8,707,030;
- ROI: 430 percent; and
- Payback period: 2.1 years.

Figure 1 outlines the discoveries.

6. ANALYSIS

The datacenter solidification venture requires ready route to accomplish the expected advantages.

6.1. SUPPORTING THE EFFORT

The essential test in combining a datacenter is adjusting your assets among operations, upkeep, and union. The accompanying five stages can bolster datacenter combination:

- construct a business case;
- comprehend the current framework;
- recognize the best contender for union;
- repurpose and reconfigure IT assets; and
- keep up what you have accomplished.

Building a business case gives you a chance to assess the union procedure to figure out if the endeavors meet the fancied objective. Solidification relies on upon the essential aptitudes to keep up the foundation, and in addition on institutionalization. Understanding the current assets is important to distinguish the best contender for union. The Configuration Management Database can give you a complete perspective of what exists and how it is designed. Furthermore, benefit asset arranging arrangements can help you comprehend the full expansiveness of your datacenter resources. When you recognize what exists in the datacenter, it is anything but difficult to pick the best components to merge to pick up the most extreme profit for union.

6.2. CHALLENGES

Virtualizing the current datacenters includes numerous issues. On the off chance that physical designs are not perfect, you should remunerate by purchasing equipment to improve your ability. The more servers you solidify, the more specialized bolster you will require. Now and again, in spite of solidifying servers in a sharp edge environment, the equipment is not virtualized. Some of the time, a solitary virtual machine keeps running on a solitary cutting edge server, while the equipment

can run different virtual machines. Henceforth, ideal use is required to accomplish higher accessibility of both the server equipment (sharp edge thickness) and the VMs.

Table 5. Cost-benefit analysis for a one-year period and 158 workloads using the VMware ROI TCO calculator. The return on investment is 34 percent, for a total savings of \$331,066.

		Physical Server	Virtualized Server	Reduction %
Capital expenditures	Client hardware (HW) + Microsoft Virtual Desktop access	—	—	—
	Server HW	\$20,310	\$82,803	(308)
	Storage HW	\$4,800	\$106,875	(2,127)
	networking and security HW	\$8,000	—	100
	VMware software + social networking software	—	\$128,569	—
Operating expenses	Infrastructure admin	\$294,553	\$161,964	45
	Power and cooling	\$103,177	\$10,360	90
	Rack space and office Space	\$50,400	\$8,400	83
	Services and training	—	\$162,955	—
Other	Planned downtime	\$94,800	—	100
	Unplanned downtime	\$3,200	\$3,120	2
	Business downtime	\$278,471	\$153,122	45
	Other + tax	\$1,656	\$24,060	(1,353)
	total	\$859,366	\$842,229	2

Aside from servers, other layer segments, for example, switches, intermediary servers, store, and SSL resources, are similarly imperative. These layers represent up to 33% of the expense and many-sided quality that datacenter groups must oversee. Virtualizing these parts is similarly basic. Consider the instance of utilizing virtualization to combine three physical servers to one physical server. For this situation, you would introduce Hypervisor on the staying two physical servers. You would then make and reproduce their elements and qualities, which would now exist as virtual servers on the single physical server. This change is, actually, an arrangement administration. Administration mechanization arrangements help reconfigure IT assets. Arrangement creators must guarantee that datacenter consolidation endeavors are having the sought impact in meeting the predefined objectives and targets, without affecting ordinary working.

Datacenter consolidation through virtualization has the potential for both high cost investment funds and minimized arrangement and downtime for calamity recuperation. To effectively accomplish this current, it's fundamental for an association to lead an underlying study on strength, weakness, opportunities, and threat (SWOT) examination. Numerous monetary, operational, specialized, and security-related issues assume an imperative part in figuring systems for datacenter consolidation and recoverability. Also, choosing which datacenter consolidation alternative to pick is similarly essential in controlling an association toward achievement.

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