

The Thin Client Operational Cost Advantage

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Abstract: What is the power and resource footprint of your IT infrastructure?
Labor costs, Power Costs and Environmental Costs?

The Problem

As the world today continues to embrace technology, constantly finding new and beneficial ways in which to leverage it, the footprint that this technology creates also continues to grow. This footprint can be looked at in a number of different ways and from different perspectives. The perspectives that are the focus of this analysis are the hard costs associated with operating the technology; that is labor, and electricity. Other white papers¹ from CANDIS discuss the soft costs associated with different design and management decisions and won't be covered herein.

The problem at the heart of this constant drive to adopt technology is that it not only costs money to design and build, moreover the major cost of any system in perpetuity will be the ongoing operational and maintenance costs. And unlike other cost centers in businesses and life, the dependence on these systems operating, smoothly or otherwise, does not leave much room for speculative use or abandonment of systems as their ownership costs rise. We are dependant on them now.

What follows is a discussion based on a real world deployment by CANDIS for a company in China in 2008. The approaches below show the real world values, as measured by CANDIS and DELL for the system deployed. A system that was designed to lower operational costs and also the company's carbon footprint. To compare with this actual deployment is a model that is based on the average costs and operating needs of CANDIS clients with legacy systems built with a different design and operational philosophy in mind. The operating costs of each system will be compared and contrasted and discussed.

¹ See www.candisgroup.com for more white papers

The Case Study

CANDIS was approached to provide the complete infrastructure for a multi national company that was establishing their new head office and operations centre in China. The managing director expressed a clear and deliberate desire to see their company run and be enhanced through the aggressive adoption of technology, yet also to do so in the most efficient and green fashion as possible.

While a complete infrastructure roll out encompasses many activities and services, we will limit the focus of this discussion to the actual operating costs of the system as a collection of physical machines and office work environment. Sundry systems like CRM², ERP³, SCADA⁴ and the like will not be addressed here, as their values are the same across both deployment models being discussed.

The requirements were to provide the foundation office IT platform for 100 employees. This platform had to provide each worker with a desktop, personal file space, email, productivity applications and access to a corporate file share and knowledge base. While this is indeed a very vanilla and common request for IT systems implementers, the goal of CANDIS through it's design and consulting phase was to make this as easy a system to manage as possible, while still enforcing all security protocols, audit logs and disaster recovery mechanisms. It just so happened that the approach that CANDIS investigated also addressed the company's goal for green computing as well as the goal to stop the system from "decaying" and becoming, unwieldy, insecure and ever more expensive to operate.

When CANDIS finished deploying the system, all goals were met with a Service Level Agreement backed contract, that had a *fixed* cost per user per month for a guaranteed set of deliverables. This was a very attractive operational setup for the client as there were no unexpected costs and the technology had a forecast friendly cost structure for their internal planning as they dealt with expansion.

In the final breakdown a Thin Client system was deployed for them, using a mini onsite "Cloud" approach to the server technology, using VMWARE, iSCSI SAN's with multi site data backup and replication for disaster recovery purposes. The benefits of such a system in general would entail a whole white paper in itself to discuss the practical ways in which things are improved and flexibility is afforded the company. Though as stressed before, we shall be focusing this discussion and analysis on the physical operational costs only.

² Customer Relationship Management

³ Enterprise Resource Management

⁴ System Control And Data Acquisition

The server cluster consisted of switched and metered Power Distribution Units that help measure and control power draw, environmental monitoring devices that ensure system health and also alert to air conditioning or other environment changes that may be indicative of failure or malfunction. While there were also switches, routers and backup libraries, these items are all common between both deployment models analyzed, so their power usage and draw is not considered.

As deployed for a Thin Client setup, the server cluster with VMWARE used consisted of:

- 4 x Dell PowerEdge R805 Servers

Each server was outfitted with 2 x Quad Core AMD Opteron 2350 CPUs, 16GB of Single Rank Memory, Two 15K SAS 2.5 Inch Hard Drives in RAID10 Arrays, Redundant Power Supplies and Remote Management Cards

- 1 x Dell PowerEdge 2950 III Server

Server was outfitted with 1 x Quad Core INTEL 5335 CPU, 2GB of Single Rank Memory, 6 7.2K SAS 3.5 Inch Hard Drives in RAID 10 Array. Redundant Power Supplies and Remote Management Card

- 1 x Dell MD3000i iSCSI SAN

Array was outfitted with 4 x 15K 146GB SAS 3.5 Inch Hard Drives, 8 x 10K 300GB SAS 3.5 Inch Hard Drives, 4 x 7.2K 750GB SAS 3.5 Inch Hard Drives, Redundant Power Supplies and Redundant Controllers

The power draws for each server device, as reported by Dell Capacity Planner⁵ and confirmed with CANDIS' measurements from the APC Power Units with active connections and work loads were:

	Median Power Draw (W)	Median Power Draw Year (KWH)
2U SMP Server + 6 Drives ⁶	351.9	3,082.64
2U SMP Server + 2 Drives ⁷	382.6	3,351.58
SAN TRAY + 15 Drives	411.8	3,607.37

Median Power Draw, is measured in WATTS

Median Power Draw Year, is measured in Kilo Watt Hours; (((WATTS/1000)*24)*365)

⁵ www.dell.com

⁶ PowerEdge 2950 III Config

⁷ PowerEdge R805 Config

As deployed for a Thin Client setup, the desktop/thin client component consisted of:

- 100 x HP T5750 Thin Client Boxes

Each Thin Client was equipped with 1GB of Memory, Fast Ethernet, 4 USB Ports, 1GHZ CPU and a standard 17 Inch Dell LCD Monitor

The power draw for each Thin Client and LCD screen, as reported by Dell Capacity Planner⁸ and confirmed with CANDIS measurements from an inline AmMeter with a live current and active work loads and network connections were:

	Median Power Draw (W)	Median Power Draw Year (KWH)
THIN CLIENT + 17 LCD	61.4	537.86

As deployed for a Thin Client setup, the total operational maintenance (labor) consisted of:

- 5 x Tier 3 (Top Engineer) Hours Per Application Cluster, Per Month

⁸ www.dell.com

The Final Solution : : Thin Client

Putting the system together (servers + thin clients) below shows the full breakdown and what the aggregate power usage and operational costs were:

Power

Desktops Needed	0	0.00
Servers Needed	5 ⁹	16,757.88
TC Needed	100	53,786.40
SAN Needed	1	3,607.37
		74,151.65

Operational Management

Tier 3 Engineer Hours Needed	5
Tier 2 Engineer Hours Needed	0
Tier 1 Engineer Hours Needed	0

In China average rates for a Tier 3 Level Engineer are approx 800 RMB per hour at retail¹⁰.

Commercial Power on average is approx 1 RMB per KWH¹¹.

Metric	Total	Rate	Total Cost
Power Total KWH/Year	74,151.65	1	74,151.65
Operational Management Year	5 H x 12 Months	800	48000
			122,151.65

From the above breakdown the final operational cost of running the basic productivity system for 100 employees is **122,151.65 RMB** per year. Including all power and labor. Using a per employee/workstation metric this is **1,221.5 RMB** per worker per year. With guaranteed uptime, no viruses, full security, full compliance, data protection and no extra hours or costs.

For an organization that grows, this rate per user/workstation will reduce as the servers can consolidate and handle more users without significant increases in Power or Operational Management needs.

⁹ 4 x Application Servers (1 Cluster) and 1 x Backup Server

¹⁰ Average Retail Market Rate in Beijing for Bilingual certified engineer

¹¹ Commercial Rates are higher than residential rates and vary according to building, overheads for heating and cooling and energy restrictions in place

The Traditional Approach

In a Traditional Client/Server setup, the software and uses of the system are the same. Certain technologies like VMWARE can still be deployed to help with server consolidation and management, this is the case in this model as well. The only difference is that the workers are working on local PC's and not Thin Clients. The cost of desktops and other factors are not considered in this model – though are in themselves another solid topic for discussion¹².

As per the outline statement of this paper, the analysis is being limited to the Operational Costs of the system; power and labor. Our results are based on real world support data collated by CANDIS from over 200 organizations across China and thousands of desktops.

As deployed for a Traditional Client/Server setup, the server cluster with VMWARE used consisted of:

- 2 x Dell PowerEdge R805 Servers

Each server was outfitted with 2 x Quad Core AMD Opteron 2350 CPUs, 16GB of Single Rank Memory, Two 15K SAS 2.5 Inch Hard Drives in RAID10 Arrays, Redundant Power Supplies and Remote Management Cards

- 1 x Dell PowerEdge 2950 III Server

Server was outfitted with 1 x Quad Core INTEL 5335 CPU, 2GB of Single Rank Memory, 6 7.2K SAS 3.5 Inch Hard Drives in RAID 10 Array. Redundant Power Supplies and Remote Management Card

- 1 x Dell MD3000i iSCSI SAN

Array was outfitted with 4 x 15K 146GB SAS 3.5 Inch Hard Drives, 8 x 10K 300GB SAS 3.5 Inch Hard Drives, 4 x 7.2K 750GB SAS 3.5 Inch Hard Drives, Redundant Power Supplies and Redundant Controllers

¹² See www.candisgroup.com for more white papers

The power draw for each server device, as reported by Dell Capacity Planner¹³ and confirmed with CANDIS' measurements from the APC Power Units with active connections and work loads were:

	Median Power Draw (W)	Median Power Draw Year (KWH)
2U SMP Server + 6 Drives ¹⁴	351.9	3,082.64
2U SMP Server + 2 Drives ¹⁵	382.6	3,351.58
SAN TRAY + 15 Drives	411.8	3,607.37

Median Power Draw, is measured in WATTS

Median Power Draw Year, is measured in Kilo Watt Hours; (((WATTS/1000)*24)*365)

As deployed for a Traditional Client/Server setup, the desktop component consisted of:

- 100 x SFF DELL Optiplex 760, 235W PSU @ 88%

Each PC was equipped with 2GB of Memory, Fast Ethernet, 4 USB Ports, 2GHZ CPU and a standard 17 Inch Dell LCD Monitor

The power draw for each Desktop PC and LCD screen, as reported by Dell Capacity Planner with a workload set at 4 hours per day of compute intensive tasks, 4 hours per day of normal tasks and all power saving features enabled in both the BIOS and Operating System were:

	Median Power Draw (W)	Median Power Draw Year (KWH)
Desktop PC + 17 LCD	302	2,645.52

As deployed for a Traditional Client/Server setup, the total operational maintenance (labor) consisted of:

- 4 x Tier 2 (Middle Engineer) Hours Per Server, Per Month
- 0.5 x Tier 1 (Basic Engineer) Hours Per Desktop, Per Month

¹³ www.dell.com

¹⁴ PowerEdge 2950 III Config

¹⁵ PowerEdge R805 Config

The Final Solution : : Traditional Client/Server Setup

Putting the system together (servers + desktops) below shows the full breakdown and what the aggregate power usage and operational costs were:

Power

Desktops Needed	100	264,552.00
Servers Needed	3 ¹⁶	1,147.80
TC Needed	0	0
SAN Needed	1	3,607.37
		269,306.37

Operational Management

Tier 3 Engineer Hours Needed	0
Tier 2 Engineer Hours Needed	8
Tier 1 Engineer Hours Needed	50

In China average rates for a Tier 2 Level Engineer are approx 600 RMB per hour at retail¹⁷ and the average rates for a Tier 1 Level Engineer are approx 400 RMB per hour at retail¹⁸.

Commercial Power on average is approx 1 RMB per KWH¹⁹.

Metric	Total	Rate	Total Cost
Power Total KWH/Year	74,151.65	1	269,306.37
Operational Management Tier 2	8 H x 12 Months	600	57,600
Operational Management Tier 1	50 H x 12 Months	400	240,000
			566,906.37

From the above breakdown the final operational cost of running the basic productivity system for 100 employees is **566,906.37 RMB** per year. Including all power and labor. Using a per employee/workstation metric this is **5,669 RMB** per worker per year. However due to the complex nature and large foot print of such systems, putting a line underneath any labor time and expense needed is much harder to predict, guarantee and enforce.

¹⁶ 2 x Domain and File Servers, 1 x Backup Server

¹⁷ Average Retail Market Rate in Beijing for Bilingual certified engineer

¹⁸ Average Retail Market Rate in Beijing for basic, partially bilingual engineer

¹⁹ Commercial Rates are higher than residential rates and vary according to building, overheads for heating and cooling and energy restrictions in place

Discussion

CANDIS fully understands that some of the cost estimates in this discussion are based on straight-line average rates. Of course in actual business practice, discounts are offered and some economies of scale kick in.

What is important to note though, is that the power usage measurements are empirical and verified from two sources; DELL and CANDIS. So from an environmental and electricity usage perspective the differences and contrasts are absolute.

When dealing with labor charges, what is important to remember is that the same methodology was used for both systems were compared and support values assigned. Any business deals or discounts that may be levied against one system, can be equally levied against the other. As such, what is of most note is not what the actual values are, moreover what the ratio between them is.

It can be seen that from the figures above, that a Thin Client system delivers a 4 X efficiency gain over a traditional Client/Server system. Even with a very generous margin of error, any system that is 3 X or even 2 X more efficient is something that any technology adopting business would want to take notice of.

The conclusion therefore reached by CANDIS from this empirical results is that a Thin Client system will lead to a much lower carbon foot print than a traditional system and from a labor management perspective, however the support contract is negotiated, will also deliver huge efficiency gains there as well.