Date: April 21, 2011

To: Mercer's College of Continuing and Professional Education (CCPE)

From: RDC Technical Consulting

Subject: Proposal for Thin Client Computing Solution

RDC has completed a proposal for replacing the current outdated computers and software at CCPE's four locations here in Georgia. This proposal takes a cost efficient technically compatible approach to replacing these computers. The purpose of this proposal is to develop and implement a new system using Thin Client technology to replace the outdated computers. The updated lab will be compatible with CCPE's current network and be able to access licenses for Microsoft office, SPSS, Adobe web Premium, and virtualization software.. The thin client will allow for a low-cost connection device that cuts down on initial installation costs and will eventually pay for itself by avoiding future maintenance costs and reducing energy consumption.

Thin Client Solution

College of Continuing and Professional Education (CCPE)

Date: April 21, 2011

Executive Summary

The purpose of this proposal is to inform and recommend a thin client computing solution for the College of Continuing and Professional Education (CCPE). The current labs are equipped with outdated computers and software. CCPE has four different locations in Georgia that have combined 200 outdated computers that need replacing. It is important for CCPE to keep their facilities up-to-date with today's technology to give their students a competitive advantage. However, replacing all of the current computers with new PC desktops will have a high initial installation cost along with high maintenance cost and energy consumption. The thin client solution offers an answer to all these problems, making for an affordable, energy efficient computing network that will save CCPE money.

Several different thin clients and servers were picked to be analyzed by a merit criteria system to find the best fit for the thin client solution. We picked a range of different performance level and price level machines. RDC technical consulting picked thin clients and servers from several well known brands such as HP, Dell, and WYSE to analyze. A detailed energy analysis of the thin client and equivalent PC is included in this proposal to display how much energy the thin client solution saves compared to a regular desktop. The thin client network will save CCPE on average around 2700 $ per year based on energy savings alone. Along with the thin client and server, we have also included a hardware recommendation for a monitor, keyboard, and mouse for each of the 200 thin clients.

A detailed budget was put together in order to estimate total costs for the thin client solution. With four servers and 200 thin client computers with monitors, keyboards and mice, the total comes out to be 65,074 $. These expenses are from online quotes of these goods. Because of low maintenance and low energy costs, thin client replacements are a good investment.

RDC Technical Consulting will collaborate with the tech support of CCPE to accomplish this thin client solution in the best way possible. With an experienced team, RDC is ready to explain their reasoning for the thin client system recommendation. The thin client system is 14,000% more energy efficient than an equivalent networked group of PCs due to their smaller more efficient design. Replacing their PCs with thin clients will save CCPE money in the long term not only because of the low energy consumption, but also in maintenance costs and initial instillation cost. Please contact us using the information provided in our letter of transmittal.

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1-Introduction

The CCPE has a number of centers around Georgia devoted to adult education in the evening. The current labs are equipped with outdated computers and software. It is important to keep their facilities up-to-date with today's technology to give their students a competitive advantage. However, replacing all of the current computers with new PC desktops will have a high initial installation cost along with high maintenance cost and energy consumption. CCPE needs a less expensive more reliable and sustainable replacement for these outdated computers. The updated lab needs to be compatible with CCPE's current network and be able to access licenses for Microsoft Office, SPSS, Adobe web Premium, and virtualization software such as VMware or Citrix Desktop. The purpose of this proposal is to develop and implement a thin client system to replace the outdated computers. The thin client will allow for a low-cost connection device that cuts down on initial installation costs and will eventually pay for itself by avoiding future maintenance costs and reducing energy consumption.

Our goal is to find the most cost effective thin client system that will not only save the client money in installation cost, but will also save money in energy use. There are many thin clients and servers available from multiple different companies. Our technical criteria analysis shows which thin client and server computer are the best fit for CCPE at all of their different locations.

The thin client system is a network of computers that use a server or mainframe to fulfill traditional computational roles, therefore eliminating the need for a full desktop PC at every station. Thin clients are less expensive than PCs and they require less maintenance and run silently. Thin clients also require less energy and they have no internal moving parts and therefore they last longer.

The project consultant team at RDC is qualified to find the best choice for a thin client solution for CCPE. The project manager, Student A, has taken several classes in electrical systems as an engineer. He has also taken multiple business classes as to keep the project organized and on track. The energy consumption technician, Student B, is well versed in energy saving technologies. As an environmental engineer he has taken

Figure 1.Network Diagram. A thin client PC network has one main server that does most of the computations for each thin client station.

many classes involving electrical systems and energy consumption. As a computer technician, John has a vast knowledge on information systems. He has taken many business classes and is well acquainted with the business world.

RDC technical consulting compared normal PCs to thin clients by doing energy consumption analysis. After our analysis, we predict that using thin clients will have a significant reduction in annual energy consumption. The outdated computers need to be replaced. Replacing the old computers with PC's will have high installation costs, high maintenance costs, and high energy consumption. The alternative thin client will be much less expensive in all aspects and will consume much less energy.

This proposal includes a criteria analysis of several different thin client options, a criteria analysis of different server options, and an energy consumption analysis of thin clients verses PCs. A hardware recommendation and an overall budget for purchasing a 200 thin client computer network are also discussed in this proposal. The criteria analysis uses performance and price based merit to find the most suitable thin client and server solution. The energy consumption analysis will determine how much less energy the thin client computers will use and how much money CCPE will save in the process. All of the hardware including keyboards and mice will be included in the final budget sheet.

2-Technical Approach

Several different technical approaches were made to ensure that the best possible thin client solution was chosen for CCPE. This includes a criteria analysis, energy consumption analyses, and hardware recommendations. The first two approaches are both criteria analyses. The first is the thin client technical approach. This technical approach uses performance and price scores to qualify the most suitable thin client for the solution. The next criteria analysis is the server computer analysis. Much like the thin client the server technical approach uses performance and price scores to qualify the most ideal server computer for the solution. The energy analysis determines the difference in energy consumption between a 200 computer thin client network and an equivalent amount of PCs. The final step of the technical approach is a hardware recommendation for monitors, mice, and keyboards.

2.1 Thin Clients

The requirements for replacing the out dated PCs were as follows: be able to access CCPE's current network, access and run Microsoft Office, Adobe Web Premium, and other virtualization software. We used these requirements to come up with a range of specifications for possible thin client and server solutions. Thin Clients will be compared by the following merit criteria to find the best possible thin client solution.

- Price

- Amount of RAM

- CPU speed

2.1.1 Devon IT Tc5Dc

The sleek black Devon IT Tc5Dc is a mid range thin client that is moderately priced at $324 per unit. It meets all the basic requirements. The thin client has a 1.6 GHZ processor and 1 GB of RAM. During our merit analysis, this product scored the following based on our performance and price merit system: 4.52 out of 10 for price, 7.6 out of 10 for processor speed, 3.73 out of 10 for RAM, and placed 6th.

Figure 2.1.1 Devon IT TcsDc. This thin client has a 1.6 GHZ processor, 1 GB of Ram, and costs $324.

2.1.2 WYSE S50

The gray WYSE S50 is a less expensive thin client that is priced at $200 per unit. The WYSE S50 meets all the basic requirements. The thin client has a 1.6 GHZ processor and 256 MB of RAM. During our merit analysis, this product scored the following based on our performance and price merit system: 7 out of 10 for price, 7.6 out of 10 for processor speed, 1.4 out of 10 for RAM, and placed 1st.

Figure 2.1.2 Wyse S50. This thin client has a1.6 GHZ processor, 256 MB of RAM, and costs $200.

2.1.3. HP T5740

The thin HP T5740 is a more powerful thin client that is priced at $353. The HP T5740 meets all the basic requirements. The thin client has a 1.66 GHZ processor and 2 GB of RAM. During our merit analysis, this product scored the following based on our performance and price merit system: 3.94 out of 10 for price, 7.96 out of 10 for processor speed, 6.87 out of 10 for RAM, and placed 2nd overall.

2.1.4. HP T5565

The HP 5565 is a less expensive HP thin client that is priced at $213. The HP 5565 meets all the basic requirements. The thin client has a 1 GHZ processor and 1 GB of RAM. During our merit analysis, this product scored the following based on our performance and price merit system: 6.74 out of 10 for price, 4 out of 10 for processor speed, 3.73 out of 10 for RAM, and placed 4th overall.

Figure 2.1.3 HP T5740. This thin client has a 1.66 GHZ processor, 2 GB of RAM, and costs $353.

Figure 2.1.4 HP T5565. This thin client has a 1 GHZ processor, 1 GB of RAM, and costs $213.

2.1.5 HP T5325

The simple HP T5325 is a basic thin client that is the most inexpensive of all its competitors; the HP T5325 is priced at $176. This thin client meets all the basic requirements. The thin client has a 1.2 GHZ processor and 512 MB of RAM. During our merit analysis, this product scored the following on our performance and price merit system: 7.48 out of 10 for price, 5.2 out of 10 for processor speed, 2.2 out of 10 for RAM, and placed 3rd overall.

Figure 2.1.5 HP T5325. This Thin client has a 1.2 GHZ processor, 512 MB of RAM, and costs $176

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2.1.6 WYSE C00le Zero

The black WYSE C00le Zero is a mid range thin client that is moderately priced at $230. This thin client meets all the basic requirements. The thin client has a 1 GHZ processor and 1 GB of RAM. During our merit analysis, this product scored the following based on our performance and price merit system: 6.4 out of 10 for price, 4 out of 10 for processor speed, 3.73out of 10 for RAM, and placed 5th overall.

Figure 2.1.6 WYSE C00le Zero. This thin Client has a 1GHZ processor, 1 GB of RAM, and costs $230.

2.1.7 Thin Client analysis

The requirements for replacing the out dated PCs were used to select and analyze which thin client was the best choice. To comply with the requirements the thin client needs a CPU processing speed of no less than 500 MHz with a maximum around 2 GHz. Thin clients having a 500 MHz CPU will receive a merit value of 1 and a CPU speed of 2 GHz will receive a 10. The processing speed merit criterion was weighted 25% based on its importance. The basic requirements for RAM range from 128 MB to up to 3 GB. A thin client with 128 MB of RAM will receive a merit value of 1 and 3 GB

RAM will receive a 10. The RAM merit criterion was also weighted 25% based on its importance. The price of the thin client received the highest weight at 50%. Thin clients costing $50 will receive a score of 10, and thin clients costing more than $500 will receive a 1.

Table 2.1.1 Thin Client Specifications

THIN CLIENT	Devon IT Tc5Dc	WYSE S50	HP T5740	HP T5565	HP T5325	Wyse C00le Zero
RAM (25%)	1 GB	256 MB	2 GB	1 GB	512 MB	1 GB
CPU Speed (25%)	1.6 GHz	1.6 GHz	1.66 GHz	1 GHz	1.2 GHz	1 GHz
Price 50%)	$ 324	$ 200	$ 353	$ 213	$ 176	$ 230

Table 2.1.1 the technical specifications and price for each of the six thin clients that we analyzed. We chose a wide variety of thin clients to find the best fit for CCPE's thin client solution.

Table 2.1.2 Thin Client Performance Analysis

THIN CLIENT	Devon IT Tc5Dc	WYSE S50	HP T5740	HP T5565	HP T5325	Wyse C00le Zero
RAM (25%)	3.73	1.4	6.87	3.73	2.2	3.73
CPU Speed (25%)	7.6	7.6	7.96	4	5.2	4
Price 50%)	4.52	7	3.94	6.74	7.48	6.4
TOTAL	5.093	5.75	5.678	5.303	5.59	5.13

In Table 2.1.2 we calculated each thin client's merit score by first interpolating between the required design specifications and then applying the weighted average. From our analysis we determined that the Wyse S50 was the best thin client to use. This server is low in cost and has a high processing speed although the RAM is the lowest this is still a good choice. The thin client itself does not require a large amount of RAM to work efficiently because it relies on the server for the majority of its computation.

2.2 Servers

The basic server requirements were determined using the same requirements for replacing the current PCs. We used these requirements to come up with a range of specifications for possible server solutions. The servers were compared by the following merit criteria to find the best possible server for the thin client solution.

- Price

- Amount of RAM

- CPU speed

- Hard drive Space

2.2.1 IBM System X3200 M3

The sleek black IBM System X3200 M3 is a powerful server tower priced at $1100. It has a powerful 2.93 GHZ processor. This server meets all the basic requirements. This server tower has 2 GB of RAM. The hard drive holds 2 TB of memory. During our merit analysis, this product scored the following based on our performance and price merit system: 6.4 out of 10 for price, 7.44 out of 10 for processor speed, 2.8 out of 10 for RAM, 4.86 out of 10 for hard drive space, and placed 2nd overall.

Figure 2.2.1 **IBM system X3200 M3 This server tower has a 2.93 GHZ processor, 2 GB of RAM, Holds 2 TB of data, and costs $1100.**

2.2.2 Dell Power Edge T610

The Dell Power Edge Series computers are very powerful and moderately priced. This model is priced at $1250. It meets all basic requirements. The processor runs at 2.13 GHZ. It has 4 GB of RAM, and has a 1 TB hard drive. During our merit analysis, this product scored the following based on our performance and price merit system: 5.5 out of 10 for price, 3.83 out of 10 for processor speed, 6.4 out of 10 for RAM, 2.29 out of 10 for hard drive space, and placed 3rd overall.

Figure 2.2.2 Dell Power Edge T610. This Dell server has a 2.13 GHZ processor, 4 GB of RAM, a 1 TB hard drive, and it costs $1250

2.2.3. HP Media Smart Sever EX495

The third candidate for the server is the HP Media Smart Sever EX495. This server is the cheapest of the competitors priced at $650. It meets all the basic requirements. The thin client has a 2.5 GHZ processor, 2 GB of RAM, and has a 1 TB hard drive. During our merit analysis, this product scored the following based on our performance and price merit system: 9.1 out of 10 for price, 5.5 out of 10 for processor speed, 2.8 out of 10 for RAM, 3.57 out of 10 for hard drive space, and placed 1st overall.

Figure 2.2.3 HP T5740. This tower server has a 2.5 GHZ processor, 2GB of RAM, 1.5 TB of hard drive space, and it only costs $650.

2.2.4 Server Analysis

The requirements for replacing the out dated PCs were used to select and analyze which server was the best choice. To comply with design requirements the server needs a processing speed of no less than 1.5 GHz with a maximum of around 3.5 GHz. Servers having a 1.5 GHz processing speed will receive a merit value of 1 and a processing speed of 3.5 GHz will receive a 10. The processing speed merit criterion was weighted 20% based on its importance. The basic requirements for RAM range from 1 GB to up to 6 GB. A server with 1 GB of RAM will receive a merit value of 1 and 6 GB RAM will receive a 10. The RAM merit criterion was also weighted 20% based on its importance. The basic requirements for hard drive space range from 500 GB to up to 4 TB. A server with 500 G of hard drive space will receive a merit value of 1 and 4 TB hard drive will receive a 10. The hard drive space merit criterion was also weighted 20% based on its importance. The Price of the server received the highest weight at 40%. A server costing $500 will receive a score of 10 and servers costing more than $2000 will receive a 1.

Table 2.2.1 Server Specifications

SERVER Model	IBM System X3200 M3	Dell Power Edge T610	HP Media Smart Sever EX495
PRICE (40%)	$ 1100	$ 1250	$ 650
PROCESSING SPEED (20%)	2.93 GHz	2.13 GHz	2.5 GHz
RAM (20%)	2 GB	4 GB	2 GB
HARD DRIVE SPACE (20%)	2 TB	1 TB	1.5 TB

Table 2.2.1 shows the technical specifications and price for each of the three servers that we analyzed. We chose a variety of severs to find the best fit for CCPE's thin client solution.

Table 2.2.2 Server Performance Analysis

SERVER MODEL	IBM System X3200 M3	Dell Power Edge T610	HP Media Smart Sever EX495
PRICE (40%)	6.4	5.5	9.1
PROCESSING SPEED (20%)	7.44	3.83	5.5
RAM (20%)	2.8	6.4	2.8
HARD DRIVE SPACE (20%)	4.86	2.29	3.57
TOTAL	5.58	4.7	6.01

In Table 2.2.2 we calculated each server's merit score by first interpolating between the required design specifications and then applying the weighted average. From our analysis we determined that the HP Media Smart Server EX495 was the best server to use. This server is at a very reasonable price with good operating specifications.

2.3 Hardware Recommendations

The current labs are equipped with outdated computers and software. The monitors, keyboards, and mice are also outdated and need to be replaced. The IT Department has requested that we also replace the monitors, keyboards, and mice. We have chosen two monitor and two keyboard and mouse combos in which we believe are cost effective and energy efficient. We gave our recommendation on which ones we believe will best fit CCPE needs. We would also like to add that we would not recommend wireless mice because they require batteries, they can get mixed up between computers, and they are easily stolen.

2.3.1 Samsung Sync Master

The Samsung Sync Master is a 17" monitor which offers high performance and it has a high dynamic contrast ratio. The monitor has a fast response time and it ensures vividly clear images and motion graphics. It also comes with exclusive magic technologies which enhance productivity. Magic Return saves dual-monitors users time by shifting content from one screen to the other when one's turned off. Magic Eco reduces energy

Figure 2.3.1 Samsung Sync Master. This monitor can adjust energy consumption by auto adjusting brightness.

consumption by auto-adjusting brightness and Magic Angle delivers crisp, bold images from

every angle. The Samsung's magic technologies give the monitor an upper hand on performance. The price is listed at $125 and can be bought online at Best Buy tax free.

2.3.2 Acer V173

The Acer V173 17" Monitor offers one of the highest dynamic contrast ratios. Acer has earned the EPEAT (Electronic Product Environmental Assessment Tool) Silver rating which means that it has strived to be more aware of energy and its affect on the environment. The Acer V173 has a 5ms response time which is one of the highest among any type of monitor. It also comes with a 36 month warranty. The price is listed at $94.99 and can be bought from TigerDirect.com.

Figure 2.3.2 Acer V173. This monitor has won an EPEAT Silver rating for energy efficiency.

2.3.3 Recommendation

We recommend that the Acer V173 be chosen because it is the best price and comes with a 3 year warranty. Acer is a well-known brand and along with the three year warranty this product is a good choice.

2.3.4 V7 Desktop Combo Standard Keyboard and Mouse

The V7 Standard Keyboard and Mouse combo has a sleek design that helps you optimize your space. The keyboard contains a curve-key input designed for easy use and mouse that is highly durable. There is no installation required just a simple connection. The V7 offers a 1 year warranty. The price is listed $13.24 and can be bought from buy.com.

Figure 2.3.4 V7 Desktop Combo Std. Keyboard and Mouse. This keyboard and mouse combo costs $13.24 on Buy.com

2.3.5 Logitech Desktop MK120 Mouse and keyboard Combo

The Logitech Mouse and Keyboard combo has low profile keys that barely make a sound. This keyboard offers a spill-resistant design. The Logitech keyboard is also very durable withstanding up to 10 million keystrokes. Logitech offers a 3 year warranty for this product. The price is listed at $17.37 and can be bought at Amazon.com.

Figure 2.3.5 Logitech Desktop NK120 Mouse and Keyboard Combo. This keyboard and mouse combo costs $17.37 on TigerDirect.com

2.3.6 Recommendation

We recommend that the Logitech Mouse and Keyboard combo be chosen over the V7 Standard Keyboard and Mouse combo because the Logitech keyboard is a well known brand and it appears to be more durable and lasts longer. Even though the Logitech Mouse and Keyboard combo is more expensive than the V7 Standard Keyboard and Mouse combo, but it offers a longer warranty. A longer warranty adds for a better piece of mind and more confidence in the product.

3- Operations Plan

Thin client technology gives you an energy efficient and productive computer desktop without the complexity of a PC. Thin clients are very compact and contain all the dynamic user experiences of a PC. These clients have no moving parts that will wear out. Their service life is extended well past those of comparable PCs and they require much less maintenance than a PC. They are quiet and give off much less heat.

The major attraction to thin client computing is their energy efficiency. They can operate at a fraction of the energy consumption of an average PC. Replacing CCPE's out dated PCs with thin clients will save them money on energy consumption as well as installation cost. During this Proposal we analyzed many different options for a thin client computing system based on their performance specifications. The thin client that we have chosen, Wyse S50, we believe will best fit CCPE's needs. The server that we have proposed the HP Media Smart Sever EX495 is the best priced server and it will exceed CCPE's thin

client needs. This server will allow for future expansion of up to 400% of CCPE's current number of computers.

3.1 Budgeting Analysis

After we constructed an analysis on the different thin clients and servers, we then constructed a budget for 200 thin clients at four different locations with four central servers. The total budget for the thin client solution is $65,074. The budget for thin clients is much less expensive than a budget for 200 PCs. We took into account hardware on the budget sheet as well, including monitors, keyboards, and mice.

Table 3.1.1 Budget Analysis

Device Purchased	Number Of Units	Individual Price	Total Cost
Thin Client Wyse S50	200	$ 200	$ 40,000
HP Media Smart Sever EX495	4	$ 650	$ 2,600
Acer V173 Monitor	200	$ 95	$ 19,000
Logitech Mouse and Keyboard	200	$ 17.37	$ 3474
Total			$ 65,074

Table 3.1.1 shows the total estimated budget for purchasing our proposed thin client solution. Compared to replacing the outdated PCs with new advanced PCs, this thin client solution will be much more cost effective.

Along with initial savings the thin client solution will provide for additional savings in energy consumption and maintenance. The Wyse S50 uses an average of 6.6 watts when in use, while the average medium performance PC uses around 100 watts.

Table 3.1.2 Energy Consumption

Device	In Use Energy Consumption	Standby/Idle Energy Consumption
Thin Client Wyse S50	6.6 Watts	.06 Watts
Medium Performance PC	100 Watts	10 Watts

Table 3.1.2 compares the in use and standby energy consumption of a PC vs. the Wyse S50 thin client. As you can see the PC uses over 12 times as much power during usage and over 60 times more energy during standby. With a total of 200 thin clients this can make a big difference.

Table 3.1.3 Yearly Energy Consumption

Device	In Use Energy Consumption	Standby/Idle Energy Consumption	Hours of Use Per Day	Total Energy Consumption Per year
Thin Client Wyse S50	6.6 Watts	.06 Watts	8 hr	1kWh
Medium Performance PC	100 Watts	10 Watts	8 hr	140 kWh

The table above shows the energy consumption for both a PC and a thin client operating 8 hours a day for one year. When this is multiplied by the 200 clients needed we can see the significance of this energy savings. At a 10 cent per kWh rate this amounts to $2780 in savings per year in energy cost alone.

Table 3.1.4 Yearly Energy Cost

Device	In Use Energy Consumption Cost Per Client	Number of Clients	Total Energy Cost Per year
Thin Client Wyse S50	$ 0.10/yr	200	$ 20.00
Medium Performance PC	$ 14.00/yr	200	$ 2800

3.2 Implementation

The total estimated time that it will take to have the new thin client desktops in place is 12 business days. This includes ordering, shipment, and teardown of old computers, assembly and setup. The only task that is not on the critical path is removing the old computers because it only takes 2 days, it will take at least 7 business days to ship the thin clients, servers, and hardware. In less than 3 business weeks, the thin client solution for CCPE can be completed.

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Order Thin Clients	■						
Order Servers	■						
Order Hardware	■						
Remove Old Computers		■	■				
Shipping		■	■	■	■	■	■
Installation							
Setup							

	Day 8	Day 9	Day 10	Day 11	Day 12
Order Thin Clients					
Order Servers					
Order Hardware					
Remove Old Computers					
Shipping	■				
Installation		■	■		
Setup				■	■

Figure 3.2.1 Ghant Chart of Thin Client Solution

4- Conclusions and recommendations

In conclusion, we found that our merit analysis was particularly useful in finding the best suitable thin client network for CCPE. We recommend using HP Media Smart Sever EX495 for the server at each of the four different locations. This server is very affordable and is powerful enough to run 200 thin clients at one time.

We recommend using the Wyse S50 for the thin client solution because it offers an affordable price and a fast processor. The amount of RAM in the Wyse is the smallest

between the competitors but the thin client does not heavily rely on RAM because of the server.

We recommend using Acer V173 monitors for the thin client solution because they are a great price for a quality screen that is a decent size. Along with the Acer monitor we recommend the Logitech Desktop MK120 keyboard and mouse package because it is a very good price for a quality brand name product. These products we recommend will save CCPE $2780 a year in energy costs and will also require less maintenance and have a long life span than equivalent PCs. We suggest that CCPE consider this thin client solution for updating the current labs.

Appendix

Wyse S50 Technical Specifications

Processor: AMD Geode GX 366MHz

Memory: 128MB Flash/256MB RAM

I/O peripheral support: VGA-type video output
Enhanced USB keyboard with PS/2 mouse port and Windows keys
PS/2 mouse included
One serial port
Four USB 2.0 ports (2 on front, 2 on back)

Networking: 10/100 Base-T Fast Ethernet twisted pair (RJ-45)

Display: 16 bpp / 64K colors: up to 1280x1024@100Hz up to 1600x1200@90Hz
24 bpp / 16.7M colors: up to 1280x1024@85Hz

Audio: Output: 1/8-inch mini jack, full 16 bit stereo, 48KHz sample rate
Input: 1/8-inch mini jack, 8 bit microphone

Physical characteristics: Height: 1.38" (34mm)
Width: 6.94" (177mm)
Depth: 4.75" (121mm)
Shipping Weight: 6 lbs. (2.7kg)

Mountings: Horizontal feet (optional vertical stand)
Optional VESA mounting bracket
Built-in Kensington security slot (cable sold separately)

Power: Worldwide auto-sensing 100-240 VAC, 50/60 Hz
Average power usage with device connected to 1 keyboard with 1 PS/2 mouse and 1 monitor: 6.6 Watts

Temperature Range: Horizontal and Vertical positions: 50° to 104° F (10° to 40° C)
Humidity 20% to 80% noncondensing

Safety Certifications: German EKI-ITB 2000, ISO 9241-3/-8
cULus 60950, TÜV-GS, EN 60950
FCC Class B, CE, VCCI, C-Tick
WEEE, RoHS Compliant

Warranty: Three-year limited warranty