University of California at Berkeley
Dept of Electrical Engineering and Computer Sciences
Instructional Support Group

EECS Instructional Computing Review and Plans

June 2012

Contents

Summary

Loss of funding and staff since 2008 have reduced our ability to update the computing equipment and services for EECS classes as often as is needed. In consultation with the CNIL and EECS faculty, we will define future goals and seek the means to fund them.

This report:

- reviews the current instructional budget and staffing
- reviews the age and use of our computers and labs
- highlights the equipment and services that are becoming obsolete
- suggests future service models that
  1) take advantage of the laptops that many students have
  2) provide services for virtual computers

Action items include:

1) Determine the ratio of laptops vs. thin clients vs. workstations that should be deployed in our labs, based on the laptop ownership of the students in lab classes. Wired AirBears connections for laptop users have been added in 2 of our labs (277 Soda, 199 Cory) since this the first version of this report in March 2012.

2) Determine which classes would benefit from VM services, what features and how much capacity would be required.

3) Ask instructors what features they need in course WEB site services, and support those features if possible.

4) Seek the funding needed to provide these resources.

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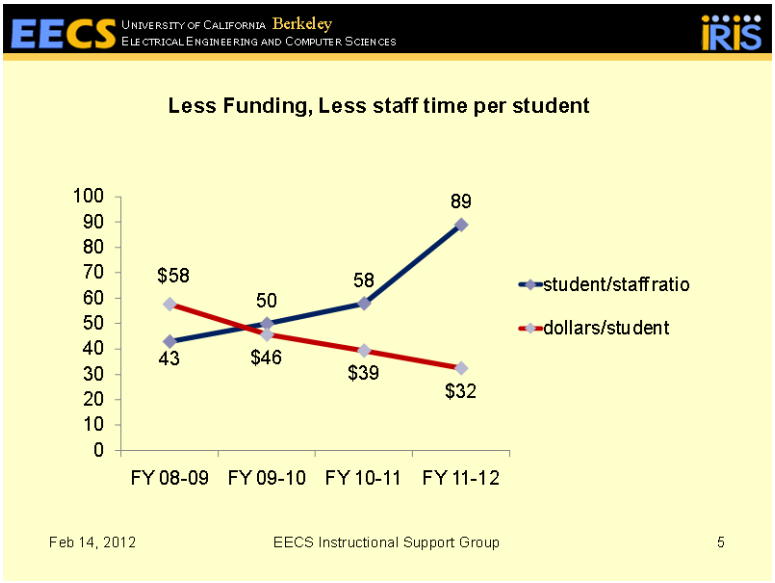
I. Budget and Staffing

Since 2008, our state-funded budget for salaries and equipment has decreased by 18% ($101K) while our course enrollments have increased by 31% (1520 students).



In 2008, ISG consisted of 1 SAM4, 1 SA4, 3 SA3 and 1 SA2 positions. Because of the budget cuts, we laid off one SA3 employee and eliminated the position. A second SA3 staff member resigned in August 2010, and we did not refill that position. Instead, we distributed some of its salary to the remaining staff as well-deserved equity increases. We also reclassified our SA2 staff member to an SA3. The remaining $50K was added to the budget for equipment, which will be spent on critical upgrades. However, it is also a loss of 22% (50 hours/week) of staff time since 2008.

Appendix 1 has a history of the budget, donations, staffing and enrollment.

The instructional staff aspires to provide custom IT solutions to serve the needs of EECS instructors. However, much of our time is spend doing necessary background services such as software patching, hardware maintenance and account management. It is ideal when we can provide services that are a direct benefit to instructors and students, such as

- porting customized software for classes
- providing specific software development environments quickly
- enabling new mobile devices for labs and projects
- providing administrative services for course WEB sites

To free up time for these services, we need to decrease the time we spend doing traditional systems administration on our servers and workstations. We must seek ways to consolidate and outsource those tasks. Here are some ways that we have done that recently:

File server	– Retired instructional NetApps; moved home directories to the IDSG SAN server; raised disk quotas x 4
Tape archiving	– Retired a tape jukebox: homedirs are now dumped via IDSG or UCBackup.
Cardkey access	– We now enable students' cardkeys automatically in a batch; were previously entered manually.
Virtual servers	– Virtualized several Solaris servers using Solaris zones; they are assigned to classes dynamically.

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II. Equipment Inventory and Use

Appendix 2 lists our Newest and Oldest Computers.
Appendix 3 has an inventory of Instructional computers.

Here are our major user communities. The upgrade needs are discussed in Section III.

Users of…	Labs & Computers	Classes (Software)	Upgrade needs
SunRay labs	271, 273 Soda (66 SunRays) Nova, Star (Solaris SPARC)	CS61A (Python) CS61B (Java)	Replace SunRays with Linux PCs and login servers.
	277 Soda (18 SunRays) Novus, Stella (Linux, Solaris X86)	CS61AS (Scheme) CS160 (User Interfaces)	Replace SunRays with students' laptops and Linux login servers. 13 new PCs have been purchased for CS160 using Kinects.
Solaris servers	Quasar, Pulsar (SPARC) Torus, Cube, Rhombus, etc (X86)	CS161 (Wireshark, Bro) CS162 (SQL, C, Java) CS164 (Python, Java) CS169 (Ruby, Java, SQL) CS170 (Lpsolve, Stp)\ CS172 (Sim) CS184 (C++, OpenGL) CS186 (Postgres) CS188 (Python) CS263 (Mathematica) CS267 (MPI, UPC) CS9*, CS47* (selfpaced) EE130 (TCAD) EE240 (Cadence) EE241 (Cadence, Synopsys) EE290C (Cadence)	CS184 uses Linux, Win, Mac on their own computers. CS186 also uses 330 Soda. These classes need real or virtual login servers (Linux).
Linux (Centos)	125 Cory (12 t7400*) 125 Cory (35 p380*) Icom1	CS152 (Simics, Riscv) CS261 (Bro, Meca) EE141 (Cadence)	
Linux (Ubuntu)	330 Soda (28 hive*; w/gpu cards)	CS161 (Wireshark, Bro) CS186 (Postgres) CS188 (Python) CS261 CS61C (C, C++, Mars) CS9E (Matlab)	
Linux (Debian)	Icuster (26-server cluster)	CS250 (Synopsys) CS294-1 (Mark Logic) CS61A (Hadoop)	

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Windows	105 Cory (30 PCs) 199 Cory (12 PCs) 125 Cory (13 PCs) Iserver{1..4}, Kramnik	CS150 (Xilinx) CS252 (ModelSim) CS285 (Quickslice) CS39P (camera) EE20N (LabView) EE120 (Matlab) EE122 (Opnet, DNS server) EE232 (Rsoft) EE245 (Coventorware) EE247 (Matlab, Cadence) EE290T (Matlab) EE225E (Terranova)	Need replacements for 4 Windows servers, RDC licenses.
EE labs	111 Cory, 119 Cory, 125 Cory, 140 Cory, 204 Cory, 218 Cory, 353 Cory Windows PCs and FPGA, scopes, sensors, wireless devices, etc 120 Hesse	CS160 (Win7, Kinect) CS260 (Win7, Kinect) EE105 (Ltspice) EE149 (Xilinx, Microblaze) EE100/EE42/EE43 EE40 (Multisim, Ultiboard) EE143 (Metrics) EE117 (Multisim, LTSpice) EE134 (MyDAQ, LabVIEW) EE140 (Hspice) EE192 (Solidworks, Eagle) EE198 (VS C#, GHI)	12 new PCs have been purchased for 353 Cory in Fall 2012. 25 new PCs will be purchased for 140 Cory in Spring 2013. Need replacements for 105 Cory. Need Metrics upgrade. Metrics in 218 Cory and 353 Cory prevents upgrade; can't run on Win7. Because of the addition of an EE149 lab in Fall 2012, we will need new computers for a new lab in 120 Hesse Hall (for EE128).
Macs	330 SDH	CS10 (Scratch) DeCal classes (Xcode, iOS) EE225E (Renderman)	

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VMs	CS161 distributed VMs to students. CS188 used the EC2 for autograding. CS169 distributed VMs to students. CS61C used the EC2 for VMs.	CS161 CS169 (Fox) CS188 (Klein) CS61C (Fox)	ISG should provide support for VMs on a cloud service.
SVN	http://isvn.eecs/	CS162 CS164 CS170 CS70	
Non-EECS course WEB sites	http://piazza.com/	CS164 CS170 CS184	
	https://sites.google.com/	CS164 CS169 CS186	
	http://bspace.berkeley.edu/	(incomplete)	
	http://calcentral.berkeley.edu/	(incomplete)	
	http://wordpress.com	EE140 (Nguyen)	
Webcast	http://netshow01.eecs	(incomplete)	This server needs to be upgraded.
	http://media.berkeley.edu	(incomplete)	
	http://youtube.com	(incomplete)	

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III. Problems and Solutions

1) Problem: Our SunRay xterminal labs and the Solaris SPARC servers are becoming obsolete. The servers for a lab of 15-30 SunRays must be powerful, such as the SUN T5220 SPARC server ($20K). We have found that Linux servers are not viable; they are not powerful enough, and the SunRay management software for Linux is flawed.

   Several classes (CS186, CS61C, CS9A, CS250, CS160, CS260) have recently migrated off of the Solaris servers to Linux servers and workstations. This has caused competition for the Linux computers in 330 Soda and for the Icluster.

   The lack of affordable support for SUN products from Oracle is a final sign that we should plan to retire the SPARC servers. We could repurpose the X86 servers as Linux servers.

   Solution: Verify that all classes assigned to the former Solaris systems are able to run on Linux. Replace 80 of the SunRays in 271, 273 and 277 Soda with Linux (Centos) workstations ($800 ea) and 4 Linux login servers ($12000 ea).

   Estimated cost: $112K for computers

2) Problem: Student-owned laptops could reduce the use of our workstations, but they don't get the same services.

   Solution: Leave several seats in each lab available for laptop users (with electrical and wired network connections). Provide wired AirBears ports in the labs for gigabit network speeds. Enable access to our printers and software license servers from computers that are authenticated via the campus VPN. Provide licensed course software for laptops when the license agreement allows it. Wired AirBears connections for laptop users have been added in 2 of our labs (277 Soda, 199 Cory) since this the first version of this report in March 2012.

   Estimated cost: several hrs/wk of IT staff for development and support

3) Problem: Our current service model lacks agility. The number and configuration of our computers is static: implementing changes to the operating systems or memory on our computers can take months. We do not have a safe way to give students administrator rights on our computers. When students try to duplicate the lab environment on their own computers, there are inconsistencies.

   Solution: Support VMs for the students. Some classes have already done this. Our servers would have space to store VMs that students could run on our servers, on our workstations, on their laptops and on commercial sites such as the EC2 or the VMWare Student Cloud. Wired gigabit AirBears connections would allow for the quick transfer of large VM image files.

   Estimated cost: unknown hardware/software costs; several hrs/wk of IT staff

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4) Problem: Instructors are adapting off-campus services for course WEB sites because the on-campus resources are not sufficient. This makes work for the instructors, who must create the sites and set up access for the students. The IT support staff should be able to administer these services and to archive the content, but the off-campus sites are not accessible to them.

   Solution: The IT staff should determine what features the instructors want. We would consider updating our WEB services to provide these features, or support a third-party site that satisfies the majority of instructors. Google Sites seems like a likely candidate. We would also encourage the next generation of bSpace (called CalCentral) to adapt these features.

   Estimated cost: several hrs/wk of IT staff for development and support

5) Problem: We lack the funding for all of these needs:

   - Replace the SUN servers. (#1 above)
   - Install VM hosting servers. (#3 above)
   - Replace 4 Windows Remote Desktop hosts, buy RDC licenses. ($$25K)
   - Replace 30 PCs in 105 Cory. ($30K)
   - Upgrade Metrics for EE143 to Win7 version. ($76K)
   - Purchase 7 computers + network for 120 Hesse Hall (for EE128 in Fall 2012). ($10K)
   - Replace Netshow01 video streaming server with new computer and software. ($12K)

   Solution: Possible sources of funding for large equipment purchases are:

   - Apply for an educational grant: define a project such as the VM hosting service and seek funding from NSF CRI, Sloan, Mellon or MacArthur.
   - Ask the College for more funds, based on the increased enrollments. Their 19900 allocation to us is based on 2-year old enrollment data.
   - Share costs with research or other departments for services such as a VM server.

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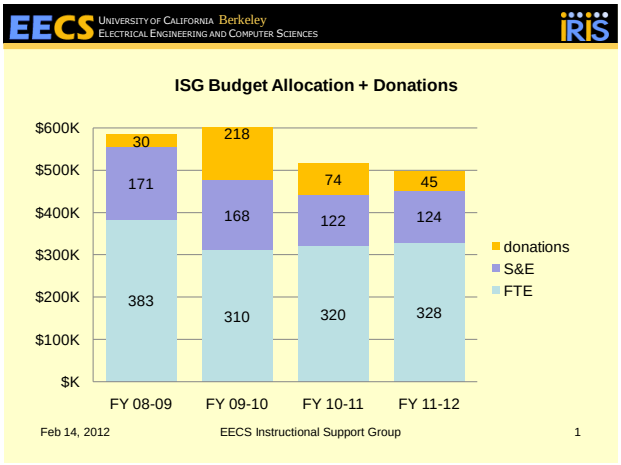
Appendix 1: Funding, Donations, Staff, Enrollment

18% ($101K) cut since 2009
We paid $50K for salaries from S&E last year.

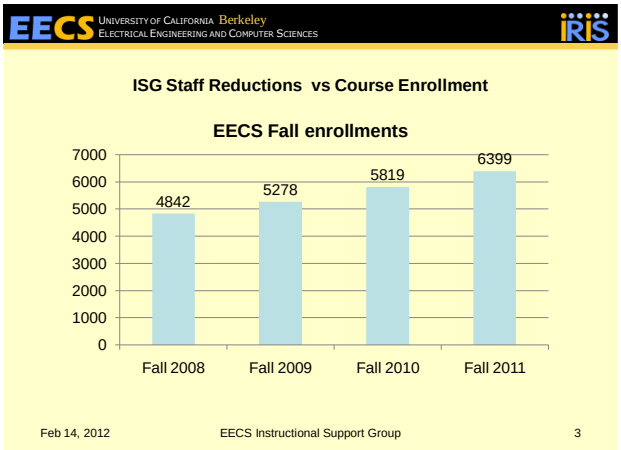
Donations:

FY 97-98	28 workstations and server ($292K, HP)
FY 08-09	125 Cory: 16 PCs for EE141 ($30K, Intel)
FY 09-10	200 SDH: Macs ($135K, Apple)
	2 SUN SPARC servers ($42K, SUN)
	2 SUN X86 servers ($23K, SUN)
	LCD displays ($18K, UC energy initiative)
FY 10-11	330 Soda ($74K, Intel)
FY 11-12	353 Cory ($30K Intel); Icluster ($15K Intel)

It was not uncommon to receive $30K-$100K in computers from SUN, Intel and HP in previous years.



Here is a contrast between the increasing enrollment in EECS classes…



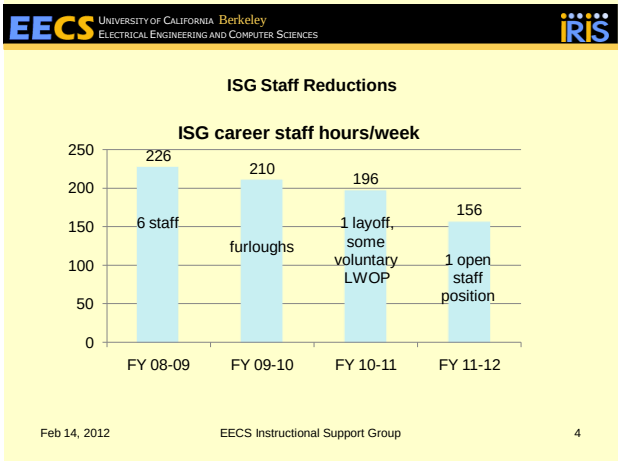
…and decreasing staff hours.

Staff were on required furloughs in FY 09-10.
1 career staff (SAIII) was laid off in July 2010.
1 career staff (SAIII) took another job in August 2011.

We have deferred rehiring to accrue cash for replacement of computers in Cory labs.

We are now, temporarily, 4 career staff.

@ 5 staff, salaries are about 80% of budget
@ 4 staff, salaries are about 66% of budget



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Appendix 2: Newest, Oldest Computers

Here are the newest computers and how they were funded:

140 Cory: EE40, EE42, EE100; TI grant (Prof Lee)

353 Cory, 277 Soda: EE105, EE140; Intel grant (Prof Spanos)

Icluster: CS61A, CS294-1, CS250; Intel/ Google (Prof Yelick)

330 Soda: CS194-15, CS61C, CS186; Intel grant (Prof Yelick)

200 SDH: CS10, CS198, CS61a; Apple grant (Prof Garcia)

SUN servers:
Solaris SPARC: 8-core UltraSPARC, 32-GB RAM; SUN grant
Solaris X86: 8-core Opteron 885, 32-GB RAM; SUN grant

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Computers – new…

140 Cory:	35 i7 PCs; TI grant (2012) ……	$40K
353 Cory:	24 i7 PCs; Intel grant (2012) ……	$30K
Icluster:	26 servers; Intel & Google grants (2007, 2012)	$105K
330 Soda:	30 dual-quad Xeon, Tesla; Intel grant (2010) ……	$90K
200 SDH:	30 MacsPros; Apple grant (2009) ……	$135K
Sun servers:	2 SPARC T5220s; SUN AEG grant (2009) ……	$42K
	2 Opteron X4600; SUN AEG grant (2009) ……	$23K

Total value of Instructional computers: $1M

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Here are the oldest computers:

SunRays: CS61A, CS61B, CS16*, CS188, EE122, etc.

Solaris servers: Cadence, Synopsys, C199, Quasar, Pulsar

Mamba: used for Samba and /home/tmp (c. 2001)

Linux servers: too old for VT; no virtualization

Windows servers: too old for Win2008 or Win7

Video Steaming: old hardware; Windows *.avi, *.wmv only;

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..and old

SunRays:	271, 273, 277 Soda, 199 Cory (2000) …	$50K
Renovate 105 Cory:	new PCs, furniture, wiring, etc (2002) …	$50K
Linux servers:	old Broadcom systems (2003) ……	$ 30K
Windows servers:	Iserver[123] for RDC (2003) ……	$30K
Video streaming:	Netshow01 - Windows only (2003) ……	$10K
Solaris servers:	Cory, Pulsar, Quasar (2004) ……	$90K

For a 5-year replacement cycle: $1MK/5 = $200K per year

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Appendix 3: Inventory of Instructional computers

Lab computers

Location	Year	Computers	How acquired	Classes	Estimated value ($)
105 Cory	2002	30 Dell 340	Intel donation	EE2ON, EE12O	45000
111/117 Cory	2003	15 DELL Precision 650	Intel donation	EE100, EE117, EE128, EE142, EE145L	14000
119 Cory	2005	9 DELL Precision 380	Intel donation	CS152, EE290	14000
125 Cory	2005	67 DELL Precision 380	Intel donation	CS15O	80000
140 Cory 14OAB Cory	????	24 HP XW8200	HP & NI	EE4O, EE43, EECS12OL, EEl, EE42, EE12O	30000
199 Cory	2002 2005	4 SunRay1 (c199.eecs) 16 DELL Precision 670	SUN match grant, Intel donation	CS39*, C6294, EE100, EE117, EE122, EE126, EE13O, EE14O, EE141, E225A,EE24, EE243	20000
204 Cory	2007	19 DELL Precision 670	Intel donation	EEl13, EE12S, EE128, EE192	26000
218 Cory	2002	8 DELL Precision 340	Intel donation	EE249 (microfab lab)	6300
353 Cory	2001 2008	25 DELL Precision 330 12 DELL Precision 670	Intel donation	EE1O5, EE141, EE199	36000
271 Soda	2000	35 SunRayl	SUN donation	CS61C	17500
273 Soda	2000	31 SunRayl	SUN donation	CS7O, CS162, C5170, CS172, CS174	15000
275 Soda	2009	30 DELL PCs	Intel donation	CS61B	16000
277 Soda	2002	18 SunRayl	SUN match grant	C5182, CS186, CS252, CS258, CS260, CS286, CS276	9000
330 Soda	2009	30 DELL Xeon	Intel purchase	CS16O, CS164, C5169	74000
349 Soda	2005	4 Workstation WllOOz	SUN match grant		3600
200 SDH	Apple	30 MacPro (2009)	Apple donation	CS61C,CS39N, CS16O ,DEcal	135000
					$541,400.00

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Servers

Hostname	year	Model	Cpu & memory	How acquired	Operating system	Estimated value ($)
UNIX:						
nova star	2009	SUN T5220	8-core 1.2GHz U1traSPARC, 32-GB RAM	SUN AEG grant	Solaris	46000
Scalar Vector Zones: (torus, rhombus, pentagon, sphere)	2009	Opteron X4600	(8) AMD Opteron 885, 32-GB RAM	SUN AEG grant	Solaris	24000
Icluster	2007	Intel/DELL 1950 (26 computers)	(2) 4-core 2.33GHz Xeon, 16 or 32-GB RAM	Intel/Google grant	Linux	105000
quasar pulsar	2004	Sun E440	(4) l.l-GHz USIII 8GB RAM	SUN match grant	Solaris	46000
c199	2002	Sun E4280R	(2) 450-MHz 2.0-GB RAM	SUN match grant	Solaris	12000
stella	2002	Sun E4280R	(2) 450-MHz 2.0-GB RAM	SUN match grant	Solaris	12000
cory	2000	Sun E450	(4) 400-MHz 3.5-GB RAM	SUN match grant	Solaris	12000
icoml		Broadcom			Linux	3000
ilinux1..4	2003	Intel/DELL 2650	(2)2. 8—GHz/Xeon 1GB 266-Mhz	Intel donation	Linux	12000
archive	2002	Intel/DELL 1650	(2)l.3-GHz/400 P4 2-GB RAM	Intel donation	tape libraries	3000
imail	2002	Intel/DELL 1650	(2)l.3-GHz/400 P4 2-GB RAM	Intel donation	IMAP server	3000
inst	2002	Intel/DELL 1650	(2)l.3-GHz/400 P4 2-GB RAM	Intel donation	WEB server	3000
ildapl	2002	Intel/DELL 1650	(2)1.3-GHz/400 P4 2-GB RAM	Intel donation	NIS+ server	3000
ildap2	2002	Intel/DELL 1650	(2)1.3-GHz/400 P4 2-GB RAM	Intel donation	NIS÷ server	3000
mamba	2001	Intel/DELL 2550	(l)l-GHz/133 P3 1-GB RAM	Intel donation	UNIX NFS server	3000
Windows:						
iserver1..4	2003	Intel/DELL 1750	(2)2 .4-GHz/Xeon 4GB 266-Mhz	Intel donation	RDC Server	12000
kramnik	????	Intel/DELL		???	RDC Server	1500
fileservice	2005	SunFire V2OZ	w/AMD		CIFS server	12000
salov	2003	DELL Precision 650	(2) 2.4GHZ 1.0-GB RAM	(by Ferenc)	tape library	1500
license-srv	2002	Intel/DELL 1650	(2)1.3-GHz/400 P4 2-GB RAM	Intel donation	licenses	1500
scotland	2002	Intel/DELL 1650	(2)1.3-GHz/400 P4 2-GB RAM	Intel donation	licenses	1500
Netshow0l	2003	Intel/DELL 6650	(2)2.83-GHz Xeon 3.5-GB RAM	(by Ferenc)	streaming video	3000
iesg	2000	DELL OptiPlex GX11O	(2) 200-MHz Pill 512-MB RAM	(by Ferenc)	WEB server	3000
california	7???	Intel/DELL	447-MHHz P11 896-MB RAM	(by Ferenc)	WEB server	3000
						$329,000.00

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