

Term Project Ideas

Project Proposal (Title + Abstract)

Due

Wednesday, February 9, 2011

Term Project

- Motivation:
 - Your chance to select & customize your learning experience
 - This is your opportunity to share your ideas with class
 - A Focused “360 degree” Learning Exercise for the Student
 - Gain Experience with a Conference Presentation Protocol
- Entire Class Learns from Your Project
 - Your Project will be Presented Orally to Class
 - Your Subject Matter will appear as Exam Questions to Class

Topic

- Formulated and Selected by Student
- Can be:
 - Term Paper (Research of Literature) Centric
 - Programming (Hands on) Centric
 - Combination of Term Paper Research + Programming
- To Identify Potential Topics:
 - Look at News Articles
 - Utilize SJSU library IEEE & ACM Data Bases (Google)
 - Here are some Sample Ideas
 - But don't limit yourself to just these

Software Centric Parallel Programming Languages

- In-Depth Analysis, Comparison of Languages, Sample Code
- Posix Threads – Pthreads
- MPI
- OpenMP
- OpenCL / CUDA
- Map-Reduce / Hadoop
- X10
- Erlang
- Parallel Java

Software Centric Parallel Programming Tools

- Compilers / Programming Environments
- Demonstration / Comparison of Different Tools
 - E.g., Intel Thread Checker
- Debuggers
 - Especially for Race and Deadlock Detection
- Software Re-Engineering (Re-Factoring)
 - Automatic Conversion Sequential to Parallel
 - Slicing
- Simulation Environments
 - E.g. RAMP: Research Accelerator for Multiple Processors

Research Areas in PP Technologies

- Virtualization
- Load Balancing / Energy Efficient Computing
- Research in Solving Race & Deadlock Problems
 - Transactional Memory
 - Lock-free Protocols
 - Formal Proofs of Software Correctness
 - Languages for Correct and Efficient Synchronization

→ Scan the Literature to find something interesting

Not Only Technical Journal & Conference Papers

But, also General News and Business Articles

Resources

- <http://parlab.eecs.berkeley.edu/>
- <http://www.parallel.illinois.edu/>
- <http://ppl.stanford.edu/>
- <http://software.intel.com/en-us/parallel/>
- SJSU Library / Databases / Electrical Engineering
 - ACM Digital Library
 - IEEE Xplore

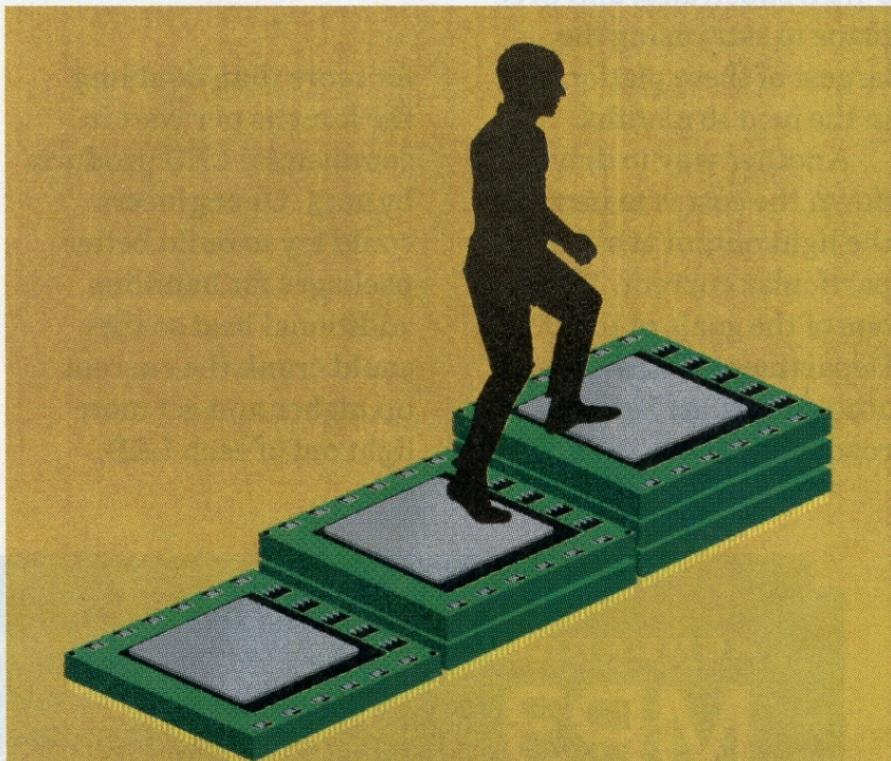
NO. 5

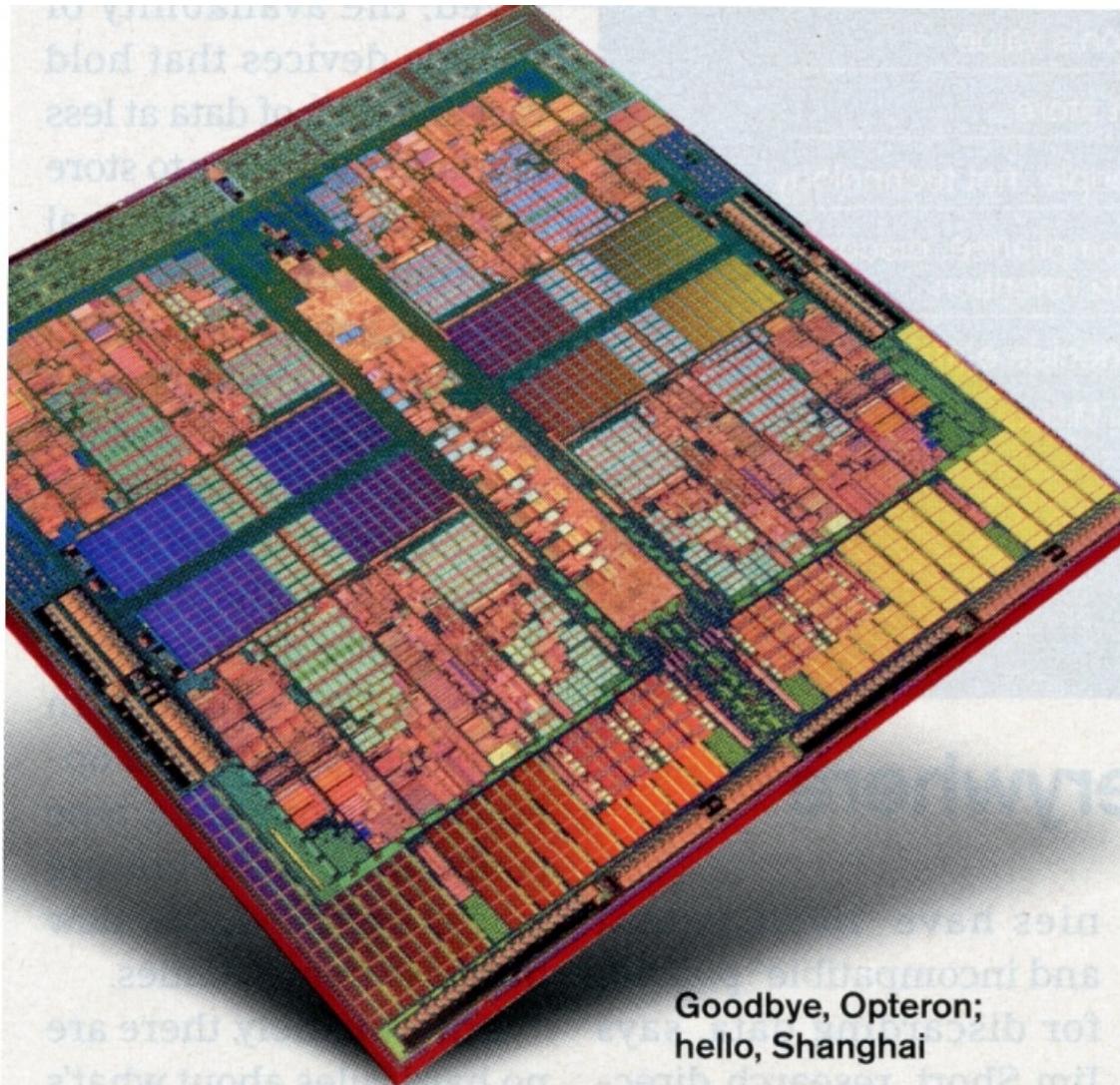
Multicore CPUs

PROCESSOR PROLIFERATION

From multicore to many-core to hard-to-describe-in-a-single-word core

BACK IN 1994, programmers figured that whatever code they wrote would run at least 50 percent faster on a 1995 machine and 50 percent faster still on a '96 system. Coding would continue as it always had, with instructions designed to be executed one after the other.





Goodbye, Opteron;
hello, Shanghai

AMD's Path To 12 Cores

ADVANCED MICRO DEVICES' new road map calls for a six-core chip—its first—next year and a 12-core processor on a new platform in the first half of 2010.

HEALTHCARE IT

Medical Image Viewing on Multicore Platforms Using Parallel Computing Patterns

Yang-Ming Zhu and Steven M. Cochhoff, *Philips Healthcare*

The parallel programming community has accumulated a significant amount of experience in the form of software patterns. Those patterns can be used in medical imaging applications on multicore platforms to improve startup time, runtime throughput, and algorithm reliability.

[Print Article](#) [Close Window](#)

Multicore requires OS rework, Windows architect advises

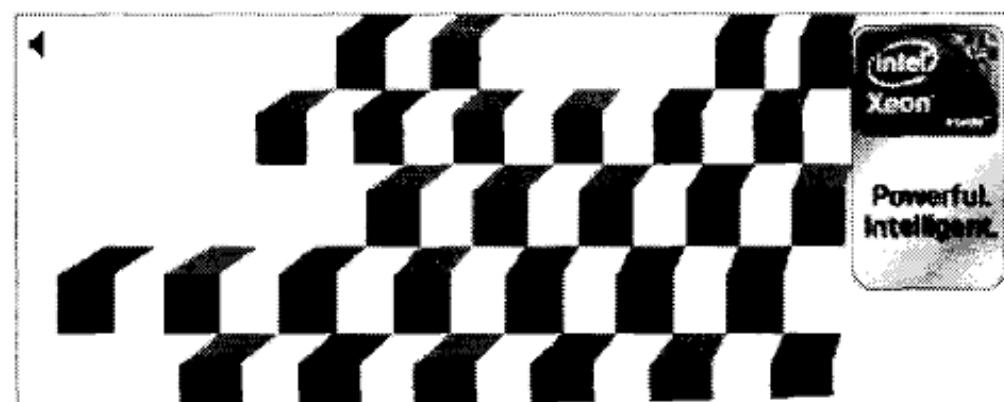
Joab Jackson

March 19, 2010 (IDG News Service) With chip makers continuing to increase the number of cores they include on each new generation of their processors, perhaps it's time to rethink the basic architecture of today's operating systems, suggested Dave Probert, a kernel architect within the Windows core operating systems division at Microsoft.

The current approach to harnessing the power of multicore processors is complicated and not entirely successful, he argued. The key may not be in throwing more energy into refining techniques such as parallel programming, but rather rethinking the basic abstractions that make up the operating systems model.

Today's computers don't get enough performance out of their multicore chips, Probert said. "Why should you ever, with all this parallel hardware, ever be waiting for your computer?" he asked.

Probert made his presentation on Wednesday at the University of Illinois at Urbana-Champaign's Universal Parallel Computing Research Center.



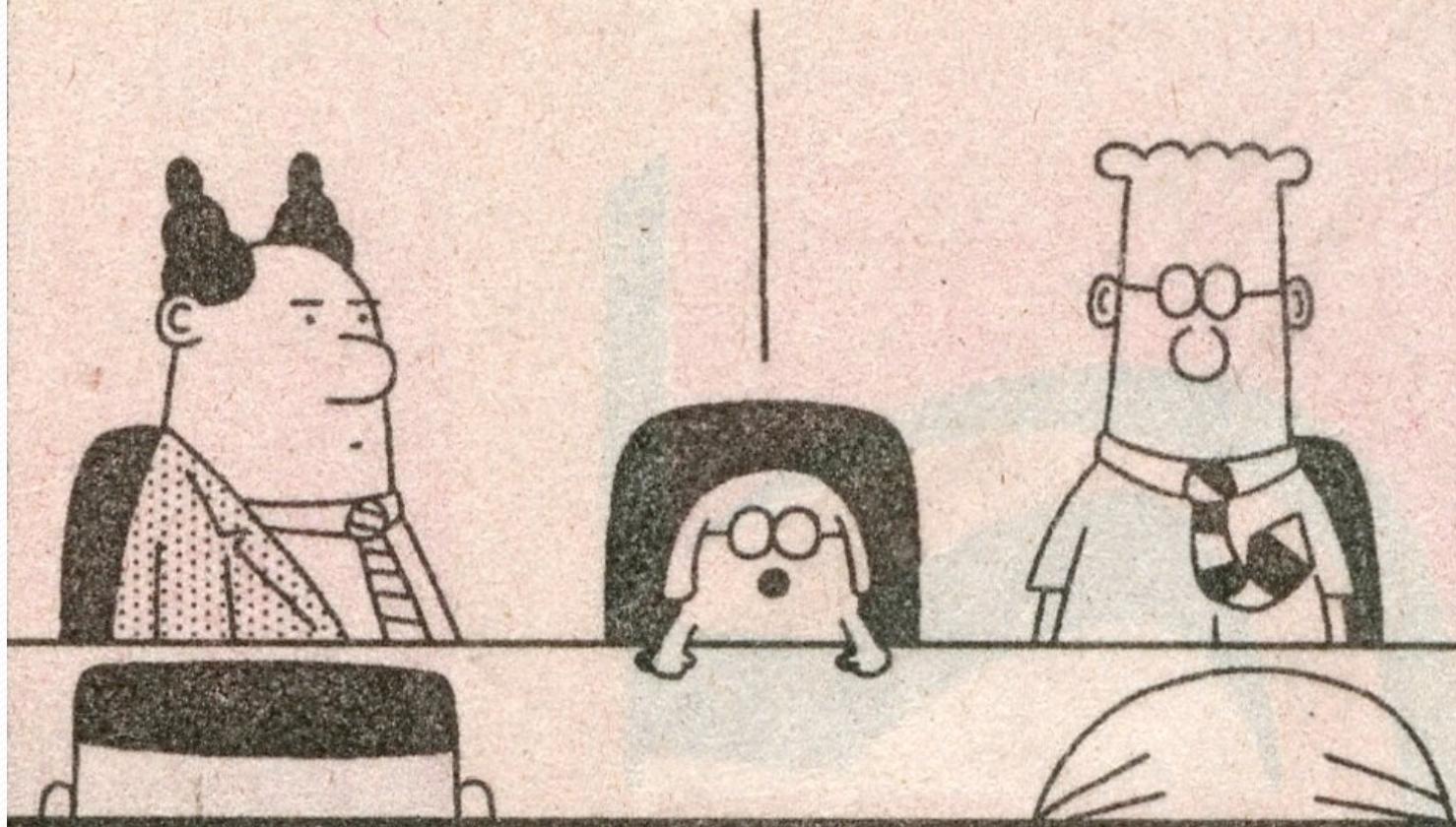
Cloud No. 6 Computing

IT'S ALWAYS
SUNNY IN THE
CLOUD

Cloud computing
puts your desktop
wherever you want it

catapulted into this nebulous state by the powerful convergence of widespread broadband access, the profusion of mobile devices enabling near-constant Internet connectivity, and hundreds of innovations that have made data centers

BLAH BLAH CLOUD.
BLAH BLAH CLOUD.
BLAH BLAH CLOUD.
BLAH BLAH CLOUD.



Forecast for Cloud Computing: Up, Up, and Away

Mobile data to increase 14-fold by 2014, much of it in the cloud

By 2014, cellphones and other mobile devices will send and receive more data each month than they did in all of 2008. Three-fourths of the total will come from Internet access and nearly all the rest from audio and video streaming.

A big part of the increase in mobile data will come from cloud computing applications. Utility software (such as maps), will lead the way, followed closely by productivity tools (especially for sales, data sharing, and collaboration), then social networking and search. So predicts ABI Research, a telecom

\$1.6 BILLION OFFER

HP, Dell in bid war for 'cloud'

EDUCATIONAL SOFTWARE



MARIA J. ÁVILA — MERCURY NEWS

Jinho Kum, foreground, and Luke Peters do class work with Google Documents at Cupertino Middle School in Sunnyvale.

Microsoft, Google fight to get schools on their 'cloud'

By Mike Swift

mswift@mercurynews.com

As they plunged into a project on ancient Egypt this fall, Jay Martino's Cupertino Middle School students probably didn't realize they were on the front lines of a high-stakes battle between Google and Microsoft.

Digital education | [GOOGLE EXTRA](#)

Google, IBM Start Charting A Future Together In The Cloud

AS MICROSOFT AND YAHOO go their separate ways, IBM and Google are cozying up to move into what they think will be the dominant IT delivery model of the future—so-called cloud computing.

Over the next year, IBM and Google plan to roll out a worldwide network of servers from which consumers and businesses will tap everything from online soccer schedules to advanced engineering applications. The IBM-Google cloud, fresh off testing at several major



Palmisano: Picture the IBM-Google cloud as yay big

universities, runs on Linux-based machines using Xen virtualization and Apache Hadoop, an open source implementation of the Google File System.

Google already has launched numerous cloud-based services for consumers, such as e-mail and storage. With the exception of security requirements, "there's not that much difference between the enterprise cloud and the consumer cloud," Google CEO Eric Schmidt said earlier this month during an appearance in Los Angeles with IBM chief Sam Palmisano. "The cloud has higher value in business. That's the secret to our collaboration."

IBM believes the cloud model will allow it to reach small and midsize companies around the world, which it says represent a \$500 billion IT market that it has trouble serving profitably through the usual sales channels. Google and IBM could conceivably supply computer users—both business and consumer—with hosted offerings ranging from basic productivity software like word processing and calendaring to sophisticated management and security tools through IBM's Tivoli brand and Google's Postini unit.

Under a portion of its cloud strategy it's calling the Blue Business Platform, IBM plans to launch an online marketplace offering its own pre-integrated products and services, as well as those from other software developers. Customers will be able to use the software they buy "on premises or in the cloud," Palmisano said.

The IBM-Google alliance started a couple of years ago with a phone call from Palmisano to Schmidt. "Sam called and wanted to know what we thought about distributed computing," Schmidt said. "We weren't looking to sell them anything," Palmisano insisted. Last October, the companies gave their joint platform project to several top engineering universities, including Carnegie Mellon, MIT, and Stanford, to poke away at. Now, IBM and Google say it's ready for wider use.

Their partnership is solidifying just when Microsoft's efforts to acquire Yahoo have broken down. Microsoft's approach to the cloud trend is to move some of its applications to the Internet under a strategy it calls software plus services. But the bulk of its profits still come from products either sold in boxes or preinstalled on PCs. Microsoft's enormous user base gives the company time and space to get its Internet efforts right. But, for the first time in years, Redmond is seeing clouds on the horizon—and they look a lot like Google and IBM.

—PAUL McDougall (paulmcd@techweb.com)

CLOUD PLAY

Startup eyes Xbox, PlayStation territory

OnLive's alternative, for \$99, streams over the Internet

By Troy Wolverton

twwolverton@mercurynews.com

OnLive, the startup online gaming service, will soon take another step toward competing with the giant console-based game systems.

Today, the company will start taking pre-orders for its previously announced MicroConsole. The pint-size device, which is about as big as a deck of cards, will

allow OnLive users to play the system's games on their televisions. It will cost \$99 and start shipping Dec. 2. For that price, OnLive is including a wireless controller, an HDMI cable to connect the box

ONLINE EXTRA

For more on video games, go to blogs.mercurynews.com/aei/category/video-games

to the TV and a free top-of-the-line game on the service.



**WHO WILL YOU TRUST TO
SECURE THE
PRIVATE CLOUD?**

'Cloud computing' is generally reliable

I've been a big fan of "cloud computing," but the public's acceptance of storing vital data on remote servers may take a hit because of media reports about T-Mobile Sidekick users losing personal data.

I remain bullish because I can't think of any other situation where people have lost data stored by a reputable and well-funded company like Microsoft, Google or Yahoo. All these services have experienced outages but, as far as I know, no data loss.

Obviously, it can happen. But the odds of a company with redundant data centers losing data strikes me as a lot lower than the odds of you or me losing our phone or laptop or having a computer's hard drive or a phone's memory fail.

Early this month, some Sidekick users discovered that their address books, photographs and other personal data on their device were no longer accessible. That's because the data is stored on servers operated by Microsoft and not on the device itself.

That's what is meant by "cloud computing." Data is in the "cloud" (actually, in servers connected via the Internet) rather than on the device.

Last year, Microsoft bought Palo Alto-based Danger, which makes the Sidekick smart-phone, which is sold exclusively through T-Mobile.

It's my understanding that the Sidekick offers some local caching or temporary data storage, but permanent storage is handled by the network. For the most part, that works well because the device connects to the network frequently, accessing the latest data.

Because of a technical glitch, Microsoft's servers lost customer data. Early reports indicated that customers were unlikely to ever get their data back. But in a statement posted on its Web site on Monday, T-Mobile said recovering some lost content "may now be possible." The company is offering all customers a free month of data service and promises a \$100 "customer appreciation card" for

"certain customers (who) have experienced a significant and permanent loss of personal content."

As it turns out, the Sidekick is not one of the more popular smart-phones, so the number of people affected by this outage is relatively small. But the problem does raise questions about other cloud computing services operated by Google, Microsoft and other companies.

Google, for example, has long promoted Web services where data is stored by Google and accessible to users via the Internet. All messages and contact information used by millions of Gmail users, for example, are stored "in the cloud." The same is true with Yahoo Mail and Microsoft's Hotmail. And it's not just addresses and e-mail. Google and Yahoo both store calendars, and the Google Docs service allows you to go online to create and edit word processing documents, spreadsheets and presentations stored on Google servers rather than your own device.

In an e-mail, a Google spokes-

person said, "We actually go further than backup." In the case of Gmail, "we provide live replication of data ... and keep multiple copies of data in separate locations for near-instant disaster recovery."

Google also said that for its Android phones, such as the T-Mobile G1 or myTouch, "Gmail, calendar and contacts data is stored locally on the device and is mirrored in the cloud. So whether you lose your phone or the cloud goes down, your data will remain accessible."

Although the BlackBerry and iPhone have plenty of local storage for address books and other data, they, too, could be affected by data stored in the cloud if you wind up syncing bad data over good data.

For example, I synchronize my BlackBerry with my Google account to make sure I have the most recent addresses and calendar items. A few months ago, I had accidentally erased some of the contacts in my Google address book (it was my fault, not Google's) and when my BlackBerry did an

automatic sync, the data was overwritten there as well. Fortunately, I had a third copy of the data stored in my Microsoft Outlook file on my PC, so I was able to restore the data to Google and then to the BlackBerry.

The Palm Pre relies primarily on address data from Gmail or Microsoft Exchange. But it does keep a copy of that data in its memory so, as long as you don't sync bad data over good, you should be OK in the event of a data center outage. Palm also backs up addresses you enter on the device to its own remote storage system.

And, while I realize this seems almost 19th-century, there is no harm in having an old-fashioned hard copy of critical data printed out on paper. It's not very convenient to re-enter it back to a computer, but it's better to have it on paper than not at all.

Contact Larry Magid at larry@larrymagid.com. Listen for his technology chats on KCBS-AM (740) weekdays at 3:50 p.m.

Ready for a Web OS?

A new generation of browsers may finally herald the long-awaited convergence of the Web and operating system.

BACK IN 1995, Netscape co-founder Marc Andreessen predicted that his fledgling Web browser would one day render Windows obsolete. Fifteen years later, Netscape is long gone, and the traditional desktop operating system (OS) remains firmly established on most personal computers. Meanwhile, Web browsers still look a lot like they did in the mid-1990s, running inside application windows. In hindsight, Andreessen may have spoken a bit too soon. But history may yet prove him right.

The hegemony of the desktop OS is starting to fracture with the emergence of a new generation of browsers that may finally herald the long-awaited convergence of Web and OS. An enormous amount of Web OS devel-

vice integration that continue to tilt the balance of power in favor of the desktop OS.

For many average computer users, the browser has become their de facto OS—a tool of choice for e-mail, personal finance, and other activities that were once the domain of desktop applications. Today's Web has come a long way from its original incarnation as a collection of passive, hyperlinked documents. Web developers now routinely use sophisticated scripting languages and other active client-side technologies to provide users with rich experiences that approximate the performance of desktop applications, including features like drag-and-drop, keyboard shortcuts, and other desktop-like affordances that have become commonplace.

tions to be developed. And Web applications will soon benefit from evolved Web standards, such as HTML5, featuring offline support, local storage, geolocation capabilities, graphics acceleration, and perhaps access to client devices, such as a scanner or video camera.

"With HTML5, we're going to see a new generation of rich Web applications," says Adam Barth, a postdoctoral fellow at the University of California at Berkeley who focuses on privacy and browser security. "But I suspect it will take a while for application developers to realize the full potential of the various HTML5 technologies like canvas, local storage, and video."

In a similar vein, experimental technologies, such as Xax and Native Client, allow Web publishers to

Energy-efficient HPC is Heating Up

John Shalf

Although there is a lot of discussion on how to best measure the energy efficiency of supercomputing centers, gauging interest in the topic is much more straightforward, judging by attendance at a Birds-of-a-Feather session at the recent 2010 International Supercomputing Conference in Hamburg, Germany. When we held our first BoF on energy-efficient HPC at ISC'08, only about 25 people turned out. Expecting a similar turnout for the "Setting Trends for Energy-Efficient Supercomputing" BoF this year, we were literally overwhelmed by a standing-room-only crowd estimated at 125 or more. (I co-organized the session with Horst Simon, Natalie Bates, Tahir Cader, Wu-chun Feng and Erich Strohmaier.)

This show of increased awareness indicates that power issues are becoming more urgent and will only become worse unless something dramatic changes. What we learned in the BoF discussion is that there are lots of workshops on this topic, and that people are sharing information through working groups in many countries.

The session brought together a number of key players in this field to seek common ground on how to accurately and completely measure energy use by HPC systems, including representatives of DOE's Lawrence Berkeley National Laboratory, the TOP500 List, the Green500, the Energy Efficient HPC Working Group and The Green Grid. Our goal was to improve the cooperation between industry and academic groups to develop better methods for measuring success when it comes to improving the efficiency of HPC systems. To put it bluntly, the current methods are not achieving that result.

For example, many vendors have adopted peak flop/s per watt as a measure of energy efficiency success for the purpose of marketing. Although factual, these num-



Microsoft focusing on 'cloud computing'

Software moving away from programs installed on PCs

SEATTLE (AP) — Microsoft Corp. leads its industry in part because a vast army of outside computer programmers design software that runs only on its Windows operating system.

Now, the company is fighting to keep those programmers working with its tools as technology undergoes a massive shift.

Microsoft's Chief Software Architect Ray Ozzie told a gathering of software developers in Los Angeles recently that Windows Azure, its system for building software that runs over the Internet, will come out of test mode in January. In February, the software maker will begin charging for use of Azure.

Moving forward with its so-called "cloud computing" plans will help Microsoft compete with companies such as Amazon.com. and Google. Amazon has built a set of Web-based tools including data storage and raw computing power that is popular among startups. Google is challenging Microsoft with e-mail, word processing, spreadsheet and other software that runs in a Web browser instead of on a PC.

The new tools also put

Microsoft firmly ahead of companies such as IBM and Oracle, said Gartner Inc. technology analyst Ray Valdez.

Over the past several years, software over the Internet has gained momentum. People pay subscription fees or look at advertising in exchange for the right to access software through a Web browser instead of buying it to install on their computers.

The setup also makes it easier for software makers to build different versions of the same product for a PC and a mobile phone, for example, all accessing the same data.

Web-based e-mail such as Microsoft's Hotmail and Google's Gmail are common consumer tools that operate "in the cloud."

Now, larger companies are starting to make similar moves, letting Microsoft, Google and others take care of installing and running e-mail and other programs in data centers around the world instead of doing it themselves in-house. And increasingly, they will design their own software using this kind of model.

Valdez said that in recent years, more big companies are building systems based on Microsoft's technology where they once might have used those from IBM, Oracle, Sun Microsystems and others.

Intel will charge for chips' full power

By Jordan Robertson

Associated Press

SAN FRANCISCO — What if you bought a house and were told there's a secret rooftop deck you'll have to pay extra to access?

If you're shopping for a personal computer this holiday season, you might get that kind of proposition from an unlikely source: Intel, the world's biggest maker of personal computer processors.

Intel is including Pentium chips that are better than advertised in some low-end desktop computers. But to unlock their full power, buyers will need to pay an extra fee.

The company says the program will enable people who have bought inexpensive PCs to upgrade them cheaply through the Internet.

It's only a test so far, with the goal of gathering feedback.

News of the test has slipped onto technology blogs and has rankled some hard-core techies because it asks people to pay extra for things the chips are already capable of doing.

"Intel is exploring a way to give customers the flexibility to determine the level of performance they want in their processor, without having to change hardware," Intel said in a statement.

People upgrade many things on their computers but most typically won't swap out the microprocessor, which acts as a PC's "brain." For Intel, the business model could provide an extra revenue stream, and it costs it very little to include a better chip.

But Intel needs to please not just consumers, but also PC makers. They might not like the prospect of one of their most important suppliers helping PC buyers not buy a new PC.

\$212 MILLION DEAL

Salesforce buys Heroku to boost 'cloud' potential

CEO says system for apps 'can accelerate this whole industry'

By Ari Levy and Nick Turner
Bloomberg News

Salesforce.com agreed to buy Heroku for \$212 million in the company's biggest acquisition, bolstering its lineup of products for sharing Internet-based applications.

Heroku is the fastest-growing Internet-based system for applications written in the Ruby programming language, Salesforce said Wednesday in a statement. The company expects to complete the all-cash deal in the quarter that ends Jan. 31.

Salesforce CEO Marc Benioff aims to tap the surging market

for Ruby apps, which often have a social component and can update information instantly. Twitter, Groupon and other startups rely on the language to develop their software. Heroku was founded in 2007 to make it easier to distribute and manage Ruby apps on the Internet via the so-called cloud.

"They're doing amazing work, some of the best computer science I've ever seen," Benioff said Wednesday at the company's Dreamforce conference in San Francisco. "I thought — this is amazing. If we buy this company, we can accelerate this whole industry, move the whole industry to Ruby."

Salesforce has been branching out into new areas, including busi-

See SALESFORCE, Page 4

New version of HP's webOS coming

Palm Pre 2, first device running the software, also close to launch

By Frank Michael Russell
frussell@mercurynews.com

Hewlett-Packard introduced the newest version of its webOS smartphone operating system Tuesday and said the first device running the software — the new Palm Pre 2 — will be available in the U.S. “in the coming months.”

The Palo Alto tech giant acquired webOS in its \$1.2 billion purchase of Palm in July. Although Palm was a pioneer maker of handheld computing devices, it struggled to compete in the smartphone market as rival handsets gained popularity.

As of August, Palm had dropped below Research In Motion's BlackBerry, Apple's iPhone, Google's Android operating system and Microsoft Windows Mobile in U.S. market share among smartphone subscribers, according to a report

from industry researcher Nielsen.

HP said the Pre 2 will be available Friday in France and later in the U.S. from Verizon Wireless and in Canada.

An HP news release described webOS 2.0 as “the most significant update to the platform since its launch in 2009.”

“With webOS 2.0, we’re advancing the innovations we introduced 16 months ago, expanding the features that make webOS great for consumers, enterprises and

developers,” Jon Rubinstein, HP’s senior vice president and general manager of the Palm business unit, said in the news release. Rubinstein was Palm’s CEO when the company was purchased by HP.

Along with a downturn for tech stocks on Wall Street, HP shares finished Tuesday at \$42.83, losing 49 cents, or 1.1 percent, from Monday’s closing price.

Contact Frank Russell at 408-920-5876.

Salesforce.com rides cloud to big stock gain

By Michael Liedtke

Associated Press

SAN FRANCISCO — A hot high-tech concept known as cloud computing is lifting Salesforce.com's stock to lofty heights.

The shares rocketed more than 18 percent Friday after Salesforce issued a strong third-quarter earnings report and an optimistic management forecast that persuaded several analysts that the stock is bound to climb even higher. As it is, Salesforce in nearly 6½ years as a public company is proving to be more fruitful than high-tech darling Google.

The fervor surrounding Salesforce has been swelling during the past year because the company appears to be sitting in a sweet spot as more businesses and government agencies change the way they buy and use software.

After years of paying huge up-front fees to install and maintain applications on individual computers in their offices, more companies are embracing the idea of subscribing to software that can be accessed from any machine with an Internet connection. The trend is becoming so popular that it has been tagged with the catchphrase "cloud computing" to replace its more geeky shorthand of "SaaS," an abbreviation of "software as a service."

The transition has enriched and vindicated Salesforce CEO Marc Benioff, who faced widespread ridicule when he started the company 11 years ago on the presumption that the old way of installing software made by the likes of Microsoft, Oracle and SAP was doomed. Skeptics abounded at the time, contending that businesses would never be willing to trust a vendor to run their critical programs and applications on computers far away from their own premises.

But now Salesforce is seen as being ahead of the curve, as Microsoft, Oracle and SAP all scramble to build their own online subscription services. At the end of its latest quarter, Salesforce boasted 87,200 customers, including Dell and Kaiser Permanente.

Wall Street has become so enamored with Salesforce that its stock is outshining Internet search leader Google, a much more renowned company that went public just two months after Salesforce did in 2004.

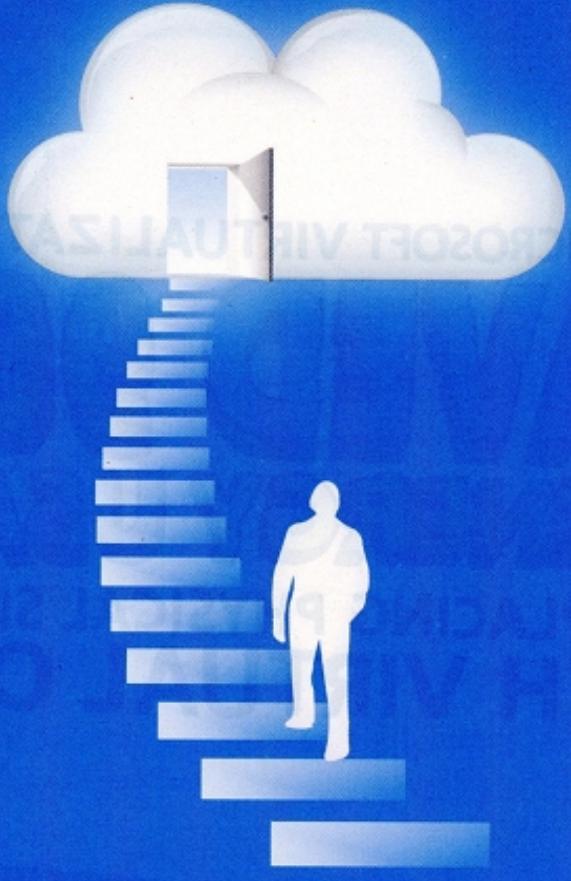
A \$10,000 investment in Salesforce's June 2004 initial public offering would now be worth \$124,000 after Friday's surge left shares with a gain of 85 percent so far this year. A \$10,000 investment in Google's August 2004 IPO would be worth about \$70,000.

Even Google has latched on to some of Salesforce's ideas as it tries to expand its own cloud computing service. Google now offers a suite of word processing, spreadsheet and calendar programs in hopes of luring people away from Microsoft's Office bundle of applications. Salesforce and Google have also teamed up on some cloud computing projects.

Google remains the far larger company with more than 23,000 employees and revenue expected to approach \$30 billion this year. Salesforce employs about 5,000 people and is on track for about \$1.7 billion in revenue in its fiscal year, which ends in January. Salesforce stirred excitement late Thursday when it topped off the release of better-than-expected third-quarter earnings with a prediction that its revenue for the year 2012 would reach \$2 billion for the first time.



Benioff



**THE JOURNEY TO THE
PRIVATE CLOUD
STARTS NOW**

FREMONT COMPANY PURCHASED

Dell deals for room in the cloud

PC maker to buy 3Par to expand cloud computing possibilities, fight HP and IBM

By George Avalos
Bay Area News Group

PC giant Dell made a bid to scoop up Fremont data storage company 3Par in a \$1.15 billion deal announced Monday that would help Dell square off with Hewlett-Packard and IBM.

Word of the pending transaction caused 3Par's shares to soar 86.5 percent higher Monday. By the end of trading Monday, 3Par had jumped \$8.35, and its shares closed at \$18 — precisely the price Dell offered to pay in the all-cash deal.

With the deal, Texas-based Dell would gain access to 3Par's data storage technologies, used as part of cloud computing.

"Dell is trying to make a ma-

jor play here," said Rob Enderle, a San Jose-based market researcher. "Dell recognizes the market is going to turn very heavily toward this concept of the cloud. They want to be sure they are part of that."

3Par's storage servers and software enable big organizations to pool data storage facilities across multiple departments or lines of business, making it more efficient to manage the data.

Some analysts use this analogy for the approach: Like electricity on a grid, digital information, software and other high-tech resources in an organization can be summoned on demand and can then be shared.

In particular, 3Par has pioneered

a type of technology called "thin provisioning," which provides data storage only when it is needed.

"3Par has consistently provided customers with the ability to do more with less," David Scott, 3Par's CEO, said in a prepared release.

The deal is expected to close by year's end, Dell and 3Par said.

According to the news release, Dell intends to keep 3Par's operations in Fremont and "maintain and invest in additional engineering and sales capability." 3Par has 655 employees worldwide.

3Par's sales have begun to surge. In the first quarter of fiscal 2011 that

See 3PAR, Page 3



JIM STEVENS/BAY AREA NEWS GROUP

Fremont's 3Par has received a \$1.15 billion, all-cash buyout offer from Texas-based Dell in a deal that would expand Dell's cloud computing clout. Stock prices for 3PAR soared after Monday's announcement.