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OPINION

Cloud computing

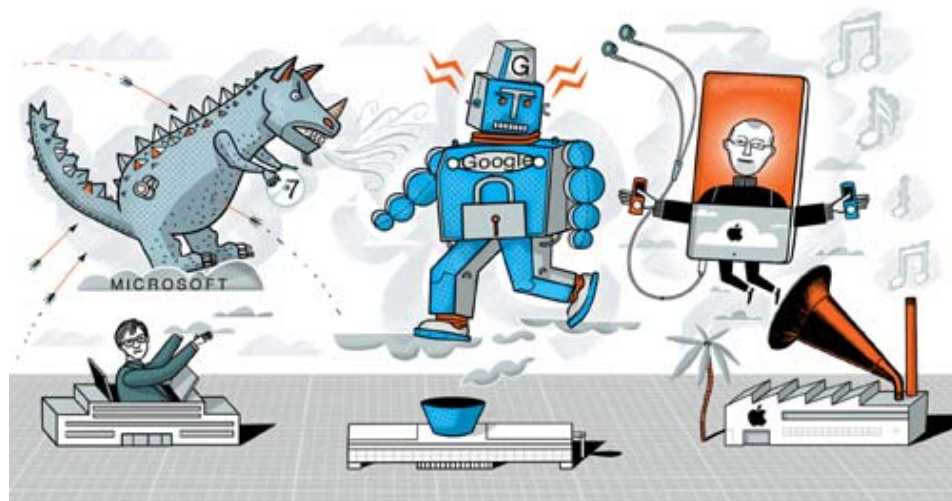
Clash of the clouds

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The launch of Windows 7 marks the end of an era in computing—and the beginning of an epic battle between Microsoft, Google, Apple and others

Illustration by Ian Whadcock



DO YOU have plans for next weekend? If not, don't worry: perhaps a friend will be throwing a party to celebrate the launch of Windows 7, Microsoft's new operating system, on October 22nd. You'll get help installing the program and be shown how to use the new features. To maximise the fun, your friend will get tips from the "HostingYourParty" video on YouTube or go to the dedicated website, complete with downloadable party favours and a trivia quiz (sample question: "The Microsoft Pretzel Hunt is an annual pretzel hunt held at the Redmond campus. True or false?").

This is not satire. It is a toe-curling attempt by Microsoft to create some buzz for its new software. Fortunately for the firm, it will hardly matter, because Microsoft dominates the market for operating systems. After the let-down that was its predecessor, Windows Vista, Windows 7 is certain to be a success. There is plenty of pent-up demand, because Vista's aged predecessor, XP, is still widely used. Reviews of Windows 7 have been positive, some even glowing, although the software is sometimes hard to install.

Windows 7 is not just a sizeable step for Microsoft. It is also likely to mark the end of one era in information technology and the start of another. Much of computing will no longer be done on personal computers in homes and offices, but in the "cloud": huge data centres housing vast storage systems and hundreds of thousands of servers, the powerful machines that dish up data over the internet. Web-based e-mail, social networking and online games are all examples of what are increasingly called cloud services, and are accessible through browsers, smart-phones or other "client" devices. Because so many services can be downloaded or are available online, Windows 7 is Microsoft's first operating system to come with fewer features.

As one window closes...

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The launch of Windows 7 coincides with the closing of the book, after more than a decade, on Microsoft's antitrust woes. The company got into hot water in America and Europe mainly for abusing its dominance of PC operating systems to promote its web browser. On October 7th the European Commission said it had all but reached a settlement with Microsoft. The firm has agreed to give Windows users in Europe a "ballot screen" that allows them to choose a rival browser in place of its own Internet Explorer.

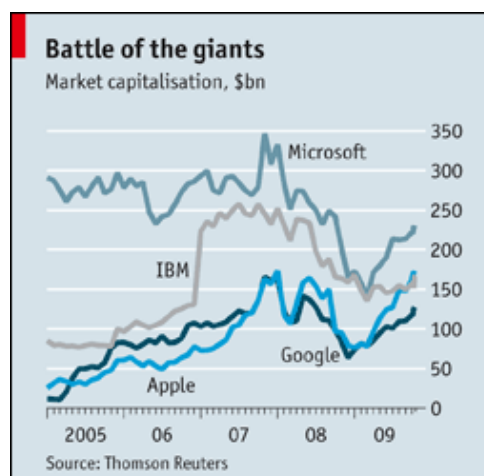
Windows is not going to disappear soon, but cloud computing means it is no longer so important. Other products, some being launched this autumn with less fanfare than Windows 7, represent Microsoft's future. Last month the company opened two data centres that between them will contain more than half a million servers. This month it released a new version of Windows for smart-phones. And next month it will launch Azure, a platform for developers on which they can write and run cloud services.

The rise of cloud computing is not just shifting Microsoft's centre of gravity. It is changing the nature of competition within the computer industry. Technological developments have hitherto pushed computing power away from central hubs: first from mainframes to minicomputers, and then to PCs. Now a combination of ever cheaper and more powerful processors, and ever faster and more ubiquitous networks, is pushing power back to the centre in some respects, and even further away in others. The cloud's data centres are, in effect, outsize public mainframes. At the same time, the PC is being pushed aside by a host of smaller, often wireless devices, such as smart-phones, netbooks (small laptops) and, perhaps soon, tablets (touch-screen computers the size of books).

Although Windows still runs 90% of PCs, the fading importance of the PC means that Microsoft is no longer an all-powerful monopolist. Others are also building big clouds, including Google, a giant of the internet, and Apple, renowned as a maker of hardware, with a market capitalisation that now exceeds those of both Google and IBM, its original arch-rival (see chart above).

Granted, there are hundreds if not thousands of firms offering cloud services—web-based applications living in data centres, such as music sites or social networks. But Microsoft, Google and Apple play in a different league. Each has its own global network of data centres. They intend to offer not just one or two services, but whole suites of them, with services including e-mail, address books, storage, collaboration tools and business applications. They are also vying to dominate the periphery, either by developing software for smart-phones and other small devices or by making such devices themselves.

These three giants (for their vital statistics, see table) are already preparing for battle. In July Google mounted a direct attack on Windows by promising to launch a free PC operating system, Chrome OS. Rumour has it that a basic version may hit the market on the same day as Windows 7, or soon after. Microsoft's new operating system for smart-phones represents its latest effort to catch up with Apple's iPhone and Google's operating system for handsets, called Android. On October 12th Apple and Google severed a tie when Arthur Levinson, a member of both boards, resigned from Google's. In August Eric Schmidt, Google's chief executive, had quit Apple's board because "Google is entering more of Apple's core businesses," in the words of Steve Jobs, the gadget-maker's boss.



How big's your cloud?

	Apple	Google	Microsoft
Revenue*, \$bn	34.6	22.3	58.4
Profit*, \$bn	5.2	4.6	14.6
Market capitalisation latest, \$bn	170.2	127.3	230.4
Employees*	32,000 [†]	19,786	93,000
Share of key market, world, %	69 [†] (digital music)	83 (search)	93 (operating systems)

Sources: Company reports; Net Applications; NPD Group *Year ending June 30th 2009 [†]September 2008 [‡]US only

A taxonomy of giants

Despite the growing similarities among the three, each is a unique beast, says Michael Cusumano, a professor at Massachusetts Institute of Technology's Sloan School of Management. They can be classified according to how they approach the cloud, how they make money and how openly they approach the development of intellectual property.

Google, you might say, has been a cloud company since its birth in 1998. It is best known for its search service, but now offers all sorts of other products and services, too. It has built a global network of three dozen data centres with 2m servers, say some estimates. Among other things, it offers a suite of web-based applications, such as word processing and spreadsheets. Lately it has branched out, releasing Android for phones, and its Chrome web-browser and operating system for PCs.

It took Google a while to come up with a way of making money, but it found one in advertising, its main source of revenue. It handles more than 75% of search-related ads in America. Worldwide its share is even higher. Google is also trying to make money from selling services to companies. On October 12th it said that Rentokil Initial, a pest-control-to-parcel-delivery group, would roll out Google's online applications to its 35,000 employees, making it the biggest company to do so.

Google's reliance on advertising explains its open approach to intellectual property. Giving Android and Chrome OS away as open-source software not only makes life difficult for rivals' paid-for products but also increases demand for Google's services and the reach of its ads. Its openness has limits: Google says little about the architecture of its data centres and search algorithms, because they give the company its competitive edge. The way it organises R&D internally is open and decentralised: self-organising teams come up with ideas for most new services.

If Google was born in the sky, Microsoft started on the ground. Office, its bestselling suite of PC programs, is almost as ubiquitous as Windows. But the company is less a stranger to cloud computing than it may seem. It has built a network of data centres, and is starting to gain traction after losing billions developing online services. Its Xbox games console has powerful online features. Bing, its new search engine, has gained a shade in market share (though it is still miles behind Google). It is even preparing a stripped-down web-based version of Office, and it now offers much of its business software as online services.

However, most of Microsoft's revenue and all of its profit still come from conventional shrink-wrapped software. But the company cannot leave online advertising to Google, because consumers expect cloud services to be free, financed by ads. Hence Microsoft's efforts to convince Yahoo!, another online giant, to merge its search and part of its advertising business with Microsoft's. The deal, sealed in July, means that Microsoft will handle 10% of searches, against Google's 83%, says Net Applications, a market-research firm.

Given Microsoft's history, it is hardly surprising that its treatment of intellectual property differs from Google's. It gives other software firms the technical information they need to write programs that run on, say, Windows. Otherwise, it guards the underlying recipes of its software jealously. That said, the firm now supports many open standards and has even started using bits of open-source software. Internally, its R&D is somewhat more centralised than Google, at least in its online division: teams are bigger, work with more co-ordination and get more guidance from above.

Apple, too, came from outside the cloud. Online services have always been a bit of an afterthought to what the company excels at: pricey but highly innovative bundles of hardware and software, of which the iPhone is only the latest example. Its online offerings—the iTunes store for music and video, the App Store for mobile applications, and MobileMe, a suite of online services—were all originally meant to drive demand for Apple's hardware, but the firm's interest in the cloud has grown. It is building a \$1 billion data centre, possibly the world's largest, in North Carolina.

Still, Apple's financial health thus far has depended mainly on selling hardware. Gadgets generate most of the firm's revenue and profit. The firm does not reveal its revenue from services separately, but it is not to be sneezed at. Apple accounts for 69% of online music sales in America and 35% of all sales, more than Wal-Mart, reckons NPD Group, a market-research firm. Apple has so far forgone advertising revenue: its services are ad-free, but most of them require payment. Apple's services are aimed at consumers, not businesses.

Apple is also the odd one out when it comes to openness. The word does not appear in its vocabulary. It does not allow any other hardware-maker to build machines using its operating system. It blocks iPhone applications it does not approve of from appearing in the App Store. Apple is also secretive about the way it conducts its internal R&D. Mr Jobs clearly calls most of the shots. But insiders say that there is a system of teams that pitch projects to him.

How will this three-way contest play out? The last similar war was in the 1980s and early 1990s, when Apple, IBM and Microsoft fought for mastery of the PC. After much fire and

Illustration by Ian Whadcock



smoke, Microsoft was victorious. Thanks to what economists call strong network effects, which allow winners to take almost all, Windows relegated its rival operating systems to mere sideshows, securing fat profits for its owner.

Such a lopsided result is unlikely this time. One reason is that the economics of the cloud may be different from those of the PC. Network effects are unlikely to be as strong. Much of the cloud is based on open standards, which should make it easier to switch providers. To underline this point and to counter arguments that it is trying to lock users in, Google has set up the Data Liberation Front, a team of engineers whose job is to devise ways of allowing people to transfer their data.



Unfortunately for Google, it is equally unclear whether the most open player will win, as Microsoft did last time. Many of Google's new services have failed to take off. Having control over the software on the PC, smart-phones and other client devices, Microsoft can more easily create what it calls "seamless experiences", for example by keeping a user's address book and other personal information in step. Consumers may also prefer Apple's tightly integrated, easy-to-use devices and services, despite the restrictions they impose. Lots of people buy iPods and download music from iTunes even though it is difficult to play the songs on other devices.

Second, all three giants have reliable sources of cash to sustain them. Windows may be under attack, not least because of the boom in cheap netbooks, which has forced Microsoft to reduce prices, says Matt Rosoff of *Directions on Microsoft*, a newsletter. Even so, the operating system will keep on giving for some time. Microsoft has other strong divisions too, including business and server software. Google may lose some market share in search (and some advertising) to the combination of Bing and Yahoo!, but it is unlikely to be dethroned. Apple is still able to command premium prices, although others make hardware just as slick.

Full war chests

This means that all three will have ample resources to spend in the main areas of the fight: data centres, cloud services and the periphery. In data centres, Google is ahead, but Microsoft is catching up in size and sophistication. Apple has most to learn, but this, too, seems only a question of time and money. Just as much of hardware has become a commodity, knowing how to build huge data centres may not be a big competitive advantage for long. And data centres can get only so big before scale ceases to be an advantage.

In services too, Google is ahead. But in Bing Microsoft may at last have created a worthy rival. The "decision engine", to use the company's term, does a good job of helping people choose a new camera or book a holiday. The big question is whether Apple can catch up. Its iTunes and App stores are successes, to be sure, but for now they are highly specialised. Its broader suite of cloud services, MobileMe, is nothing to write home about.

At the cloud's periphery, however, Apple has a strong position, thanks to the success of the iPhone. More than 30m have been sold so far, 5.2m in the quarter ending in June. Its share of the American market is pushing 14%. The App Store now boasts 85,000 applications and a total of more than 2 billion downloads. But recently Google's Android has gained momentum. Several handset-makers have released smart-phones based on it, or will do so in the next few months. In early October it received the backing of Verizon, America's biggest mobile operator. At the end of 2012, predicts Gartner, a market-research firm, Android phones will have a bigger share of the market than iPhones.

Microsoft's mobile strategy, though, is in disarray. This could prove to be a serious weakness, as people increasingly use mobile devices to reach online services. Plans to build smart-phones of its own seem to be going nowhere. Its music player, Zune, will remain just that, Steve Ballmer, Microsoft's boss, said recently. Pink, a project to develop phones based on technology from Danger, a start-up acquired by Microsoft in 2008, is said to face death by cancellation—even more likely after Danger lost personal data belonging to tens of thousands of its customers earlier this month. And the latest version of Windows Mobile is no match for the iPhone and Android. Some handset-makers, including Motorola, have ditched the software.

However, as with Bing, Microsoft has only recently been getting serious. It has put Windows Mobile under new management. Another version is expected by the end of 2010. Some analysts fancy Microsoft's chances. According to iSuppli, a market-research firm, "Reports of Windows Mobile's death are greatly exaggerated."

What could disrupt the three-sided struggle? The antitrust authorities, possibly. Now that Microsoft has made peace, the other two are likelier targets. Most observers imagine Google would be first, pointing to the hullabaloo caused by a settlement with book publishers that allows Google to create a vast digital library. But Apple may beat Google to the dock. The firm's tight control over its technology is no problem in markets where its share is small (in PCs, it is a mere 7.2%). But in mobile applications and digital music distribution Apple is by far the market leader. America's Federal Communications Commission is looking into its refusal to carry Google Voice, a telephony and messaging application for the iPhone. Its bar on rivals' devices connecting to iTunes may cause trouble too. Tellingly, Apple recently hired a lawyer with antitrust experience: Bruce Sewell, the former general counsel of Intel, the world's biggest chipmaker, which the European Commission wants to pay a fine of more than €1 billion (\$1.5 billion) for abusing its dominance.

Then there are market forces. One of the three may come up with something "insanely great", an expression used at Apple in times past to describe the original Macintosh computer. Apple itself may do so with a tablet computer, rumoured to be ready for release as early as January. Others have built such a dream device, but none has yet overcome the problem of input: typing on a screen is difficult and handwriting recognition has never really worked. If Apple has cracked it, it could upend the PC industry, as the iPhone did the handset market. If the tablet is also a good substitute for paper, the publishing and newspaper industries could be in for more upheaval. The blogosphere is abuzz with rumours that Apple is talking to publishers about offering their content on its device.

The final possibility is for another contender to emerge. The obvious candidates are Amazon, the world's biggest online retailer, and Facebook, the leading social network. Amazon already has a cloud of sorts. It offers cloud computing services to other online firms and has developed the Kindle, an electronic reader, which is due to be available worldwide from October 19th. Facebook runs what is arguably the most successful cloud service, with more than 300m registered users. It provides a platform for people to communicate, share information and collaborate online—all things that businesses want to do, too.

Only one thing seems sure about the future of the digital skies: the company or companies that dominate it will be American. European or Asian firms have yet to make much of an appearance in cloud computing. Nokia, the world's biggest handset-maker, is trying to form a cloud with its set of online services called Ovi, but its efforts are still in their infancy. Governments outside America may harbour ambitious plans for state-funded clouds. They would do better simply to let their citizens make the most of the competition among the American colossi.