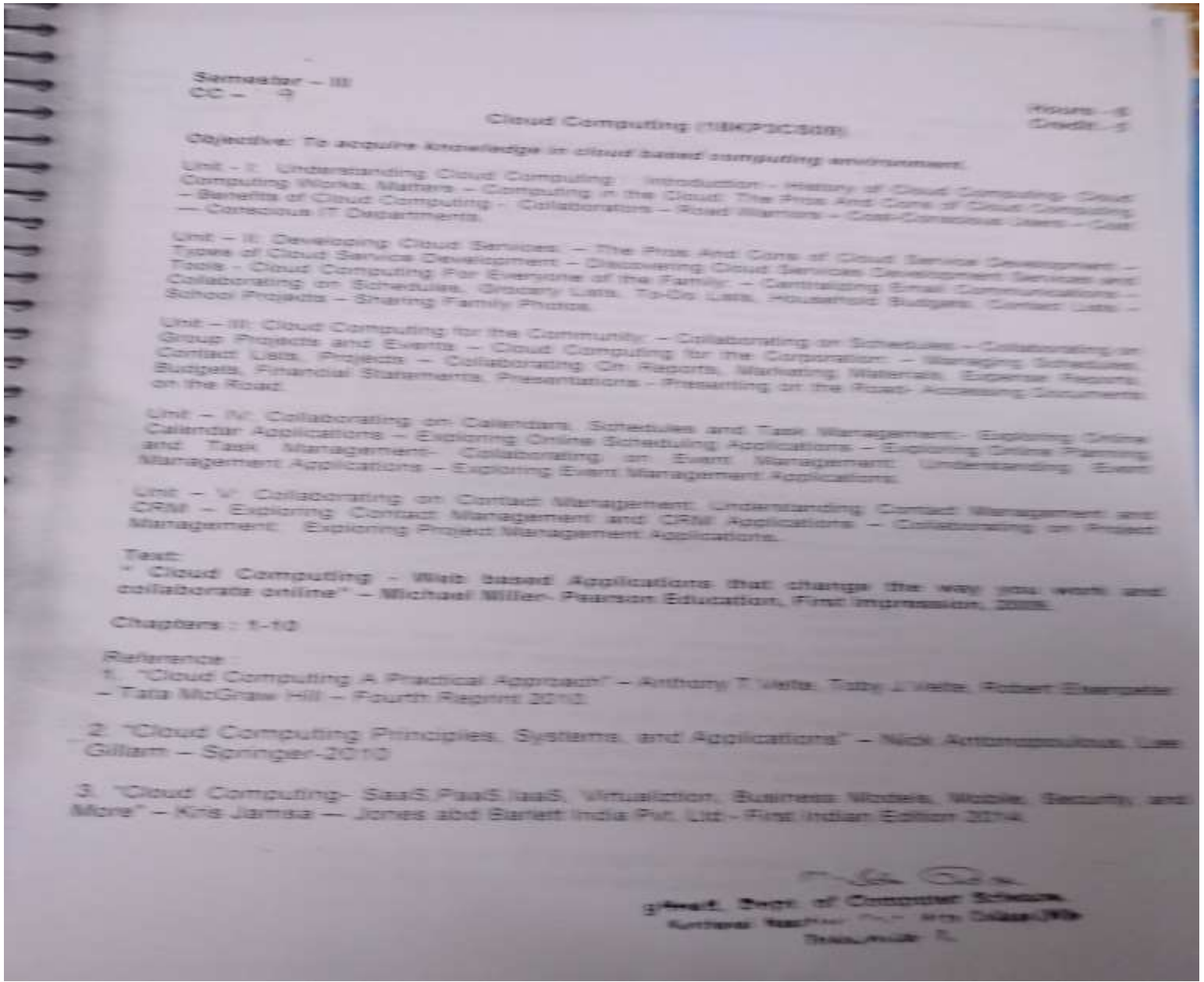
CLOUD COMPUTING
SUB CODE:18KP3CS09

V.Kayalvizhy
Assistant Professor,
Department of Computer Science
K.N Govt Arts College for women(A), Thanjavvur-7.

Syllabus



Semester – III
CC – 9

Cloud Computing (18KP3CC609)

Hours: 6
Credit: 5

Objective: To acquire knowledge in cloud based computing environment.

Unit – I: Understanding Cloud Computing: – Introduction – History of Cloud Computing- Cloud Computing Works, Matters – Computing in the Cloud, The Pros And Cons of Cloud Computing – Benefits of Cloud Computing – Collaborations – Road Warriors – Cost-Conscious Users – Cost-Conscious IT Departments.

Unit – II: Developing Cloud Services: – The Pros And Cons of Cloud Service Development – Types of Cloud Service Development – Discovering Cloud Services Development Services and Tools – Cloud Computing For Everyone of the Family: – Centralizing Email Communications – Collaborating on Schedules, Grocery Lists, To-Do Lists, Household Budgets, Contact Lists – School Projects – Sharing Family Photos.

Unit – III: Cloud Computing for the Community: – Collaborating on Schedules – Collaborating on Group Projects and Events – Cloud Computing for the Corporation: – Managing Schedules, Contact Lists, Projects – Collaborating On Reports, Marketing Materials, Expense Reports, Budgets, Financial Statements, Presentations – Presenting on the Road- Accessing Documents on the Road.

Unit – IV: Collaborating on Calendars, Schedules and Task Management:- Exploring Online Calendar Applications – Exploring Online Scheduling Applications – Exploring Online Planning and Task Management- Collaborating on Event Management: Understanding Event Management Applications – Exploring Event Management Applications.

Unit – V: Collaborating on Contact Management: Understanding Contact Management and CRM – Exploring Contact Management and CRM Applications – Collaborating on Project Management: Exploring Project Management Applications.

Text:
" Cloud Computing – Web based Applications that change the way you work and collaborate online" – Michael Miller- Pearson Education, First Impression, 2008.

Chapters : 1-10

Reference :
1. "Cloud Computing A Practical Approach" – Anthony T Velte, Toby J Velte, Robert Elsenpeter – Tata McGraw Hill – Fourth Reprint 2010.

2. "Cloud Computing Principles, Systems, and Applications" – Nick Antonopoulos, Lee Gillam – Springer-2010

3. "Cloud Computing- SaaS PaaS IaaS, Virtualization, Business Models, Mobile, Security, and More" – Kris Jamsa — Jones and Bartlett India Pvt. Ltd – First Indian Edition 2014.

Note:
Unit I:
Chapters 1,2
Unit II:
Chapters 3,4

Unit 1:

Chapter 1 Beyond the Desktop: An Introduction to Cloud Computing

- New technological trends bloom and fade on almost a daily basis .This trend is called *cloud computing* it will change the way you use your computer and the Internet.
- Major change in how we store information and run applications. Instead of running programs and data on an individual desktop computer, every- thing is hosted in the "**cloud"**—a nebulous assemblage of computers and servers accessed via the Internet
- Cloud computing lets you access applications and documents from anywhere in the world, freeing you from the confines of the desktop, making it easier for group members in different locations to collaborate. The desktop-centric notion of computing that we hold today is bound to fall by the wayside as we come to expect The universal access, 24/7 reliability, and ubiquitous collaboration promised by cloud computing.

Cloud Computing: What It Is—and What It Isn't.

With traditional desktop computing:

1. you run copies of software programs on each computer you own.
2. The documents you create are stored on the computer which they were created.
3. Although documents can be accessed from other computers on the network,
4. They can't be accessed by computers outside the network.

PC-centric.

- With cloud computing, the software programs you use aren't run from your personal computer,
- but are rather stored on servers accessed via the Internet.
- If your computer crashes, the software is still available for others to use.
- Same goes for the documents you create; they're stored on a collection of servers accessed via the Internet.

What Cloud Computing Isn't:

- First, cloud computing isn't network computing.
- Cloud computing is a lot bigger than that. It encompasses multiple companies, multiple servers, and multiple networks .
- Anyone with permission can not only access the documents, but can also edit and collaborate on those documents in real time.
- Unlike traditional computing, this cloud computing model isn't PC- centric, it's document-centric. Which PC you use to access a document simply isn't important.
- cloud services and storage are accessible from anywhere in the world over an Internet connection; with network computing, access is over the company's network only.

What Cloud Computing Is

Key to the definition of cloud computing

- It is the "cloud" itself. For our purposes, the cloud is a large group of interconnected computers.
- These computers can be
  1. personal computers or network servers;
  2. public or private.
- For example, Google hosts a cloud that consists of both smallish PCs and larger servers.
- Google's cloud is a private one (that is, Google owns it) that is publicly accessible (by Google's users).

six key properties of cloud computing:

- Google's perspective, there are six key properties of cloud computing:

1.Cloud computing is user-centric:

- Once you as a user are connected to the cloud, whatever is stored there—documents, messages, images, applications, whatever—becomes yours.
- In addition, not only is the data yours, but you can also share it with others.
- In effect, any device that accesses your data in the cloud also becomes yours.
- This cloud of computers extends beyond a single company or enterprise.
- The applications and data served by the cloud are available to broad group of users.

2. Cross-enterprise and cross-platform:

- Access is via the Internet.
- Any authorized user can access these docs and apps from any computer over any Internet connection.
- And, to the user, the technology and infrastructure behind the cloud is invisible.
- whether cloud services are based on HTTP, HTML, XML, JavaScript, or other specific technologies.

3. Cloud computing is task-centric.

- Instead of focusing on the application and what it can do, the focus is on what you need done and how the application can do it for you.,
- Traditional applications—word processing, spreadsheets, email, and so on—are becoming less important than the documents they create.

4.Cloud computing is powerful.

- Connecting hundreds or thousands of computers together in a cloud creates a wealth of computing power impossible with a single desktop PC.

5. Cloud computing is intelligent.

- With all the various data stored on the computers in a cloud, data mining and analysis are necessary to access that information in an intelligent manner.

6.Cloud computing is programmable.

- Many of the tasks necessary with cloud computing must be automated.
- For example, to protect the integrity of the data, information stored on a single computer in the cloud must be replicated on other computers in the cloud.
- If that one computer goes offline, the cloud's programming automatically redistributes that computer's data to a new computer in the cloud.
- A raft of web-hosted, Internet-accessible, group-collaborative applications are currently available, with many more on the way.

Google family of applications:

1.Google Docs & Spreadsheets

2. Google Calendar

3. Gmail, Picasa, and the like.

All of these applications are hosted on Google's servers, are

accessible to any user with an Internet connection, and can be used for group collaboration from anywhere in the world

II From Collaboration to the Cloud: A Short History of Cloud Computing

- Cloud computing has as its antecedents both client/server computing and peer-to-peer distributed computing.
- It's all a matter of how centralized storage facilitates collaboration how multiple computers work together to increase computing power

A. Client/Server Computing: Centralized Applications and Storage

- In the antediluvian days of computing (pre-1980 or so), everything operated on the *client/server* model.
- All the software applications, all the data, and all the control resided on huge mainframe computers, otherwise known as *servers*.
- If a user wanted to access specific data or run a program,
- he had to connect to the mainframe, gain appropriate access, and then do his business while essentially "renting" the program or data from the server.
- Users connected to the server via a computer terminal, sometimes called a workstation or *client*.
- This computer was sometimes called a *dumb terminal* because it didn't have a lot (if any!) memory, storage space, or processing power.
- The fact is, when multiple people are sharing a single computer, even if that computer is a huge mainframe, No problem—if you don't mind

  waiting until this afternoon, or tomorrow morning.
- There isn't always immediate access in a client/server environment, and seldom.
- So the client/server model, while providing similar centralized storage, differed from cloud computing in that it did not have a user-centric focus.
- with client/server computing, all the control rested with the mainframe—and with the guardians of that single computer. It was not a user-enabling environment.

B.Peer-to-Peer Computing: Sharing Resource

- As you can imagine, accessing a client/server system was kind of a “hurry up and wait” experience.
- The server part of the system also created a huge bottle- neck. All communications between computers had to go through the server first, however inefficient that might be.
- The obvious need to connect one computer to another without first hitting the server led to the development of *peer-to-peer* (P2P) computing.
- P2P computing defines a network architecture in which each computer has equivalent capabilities and responsibilities.
- This is in contrast to the traditional client/server network architecture, in which one or more computers are dedicated to serving the others.
- This relationship is sometimes characterized as a master/slave relationship,

  with the central server as the master

  and the client computer as the slave.
- P2P was an equalizing concept.
- P2P environment, every computer is a client *and* a server; there are no masters and slaves.
- P2P enables direct exchange of resources and services. There is no need for a central server.
- P2P was also a decentralizing concept.
- Control is decentralized, with all computers functioning as equals. Content is also dispersed among the various peer computers.
- No centralized server is assigned to host the available resources and services.
- Under its original ARPAnet guise, as a peer-to-peer system that would share computing resources across the United States.
- The various ARPAnet sites—and there weren’t many of them—were connected together not as clients and servers, but as equals.
- The P2P nature of the early Internet was best exemplified by the Usenet network. .

C. Distributed Computing: Providing More Computing Power

- One of the most important subsets of the P2P model is that of *distributed computing*,
- where idle PCs across a network or across the Internet are tapped to provide computing power for large, processor-intensive projects.
- It's a simple concept, all about *cycle sharing* between multiple computers.
- A personal computer, running full-out 24 hours a day, 7 days a week, is capable of tremendous computing power.
- Most people don't use their computers 24/7, however, so a good portion of a computer's resources go unused.
- Distributed computing uses those resources.
- When a computer is enlisted for a distributed computing project, software is installed on the machine to run various processing activities during those periods when the PC is typically unused.
- The results of that spare-time processing are periodically **uploaded** to the distributed computing network, and combined with similar results from other PCs in the project.
- The result, if **enough computers are involved**, **simulates the processing power of much larger main- frames** and **supercomputers**—which is necessary for some very large and complex computing projects.
- For example, genetic research requires vast amounts of computing power.
- It might take years to solve essential mathematical problems.
- Distributed computing dates back **to 1973,** when multiple computers were networked together at the **Xerox PARC labs** and worm software was developed to cruise through the network looking for idle resources.
- A more practical application of distributed computing appeared in 1988, when researchers at the DEC (Digital Equipment Corporation) System Research Center developed **software that distributed the work to factor large numbers** among workstations within their laboratory.

D. Collaborative Computing: Working as a Group

- From the early days of client/server computing through the evolution of P2P, there has been a desire for multiple users to work simultaneously on the same computer-based project.
- This type of collaborative computing is the driving force behind cloud computing, but has been around for more than a decade.
- Early group collaboration was enabled by the combination of several different P2P technologies.
- The goal was (and is) to enable multiple users to collaborate on **group projects online, in real time.**
- In today's environment, this means instant messaging for text-based communication, with optional audio/telephony and video capabilities for voice and picture communication.
- Most collaboration systems offer the complete range of audio/video options, for full-featured multiple-user video conferencing.
- In addition, users must be able to share files and have multiple users work on the same document simultaneously.
- Real-time white boarding is also common, especially in corporate and education environments.

E. Cloud Computing: The Next Step in Collaboration

- With the growth of the Internet, there was no need to limit group collaboration to a single enterprise's network environment.
- Users from multiple locations within a corporation, and from multiple organizations, desired to collaborate on projects that crossed company and geographic boundaries.
- To do this, projects had to be housed in the "cloud" of the Internet, and accessed from any Internet-enabled location . The concept of cloud-based documents and services took wing with the development of large server farms,
- On the software side, dozens of companies are developing **cloud-based applications and storage services**.

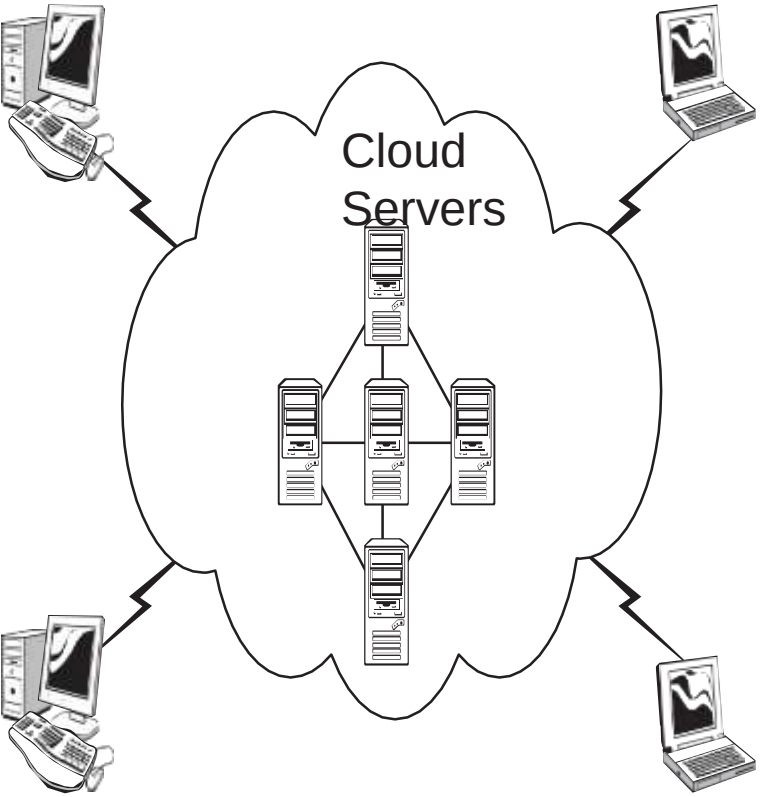
The Network Is the Computer: How Cloud Computing Works

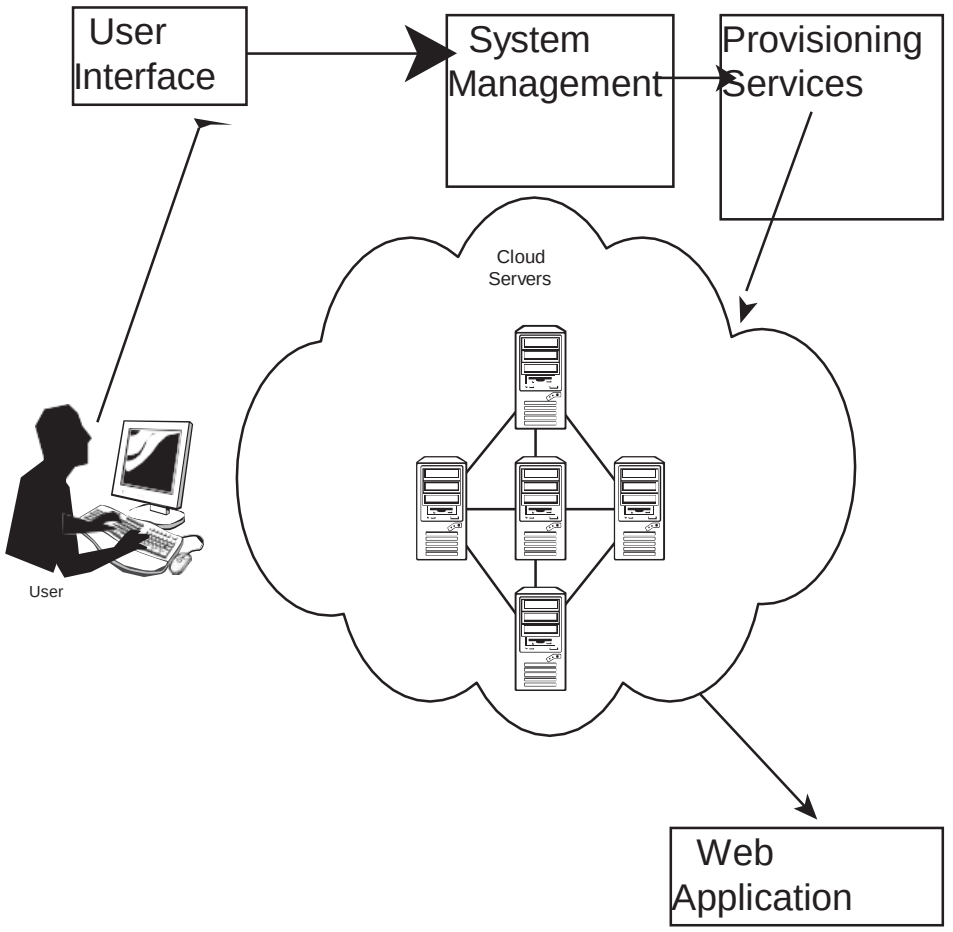
Sun Microsystems's slogan is

- "The network is the computer," and that's as good as any to describe how cloud computing works.
- In essence, a network of computers functions as a single computer to serve data and applications to users over the Internet.
- The network exists in the "cloud" of IP addresses that we know as the Internet,
- offers massive computing power and storage capability, and enables wide scale group collaboration.
- But that's the simple explanation. Let's take a look at how cloud computing works in more detail.

A. Understanding Cloud Architecture

- The key to cloud computing is the "cloud"—a massive network of servers or even individual PCs interconnected in a grid.
- These computers run in parallel, combining the resources of each to generate supercomputing-like power
- What, exactly, is the "cloud"? Put simply, the cloud is a collection of computers and servers that are publicly accessible via the Internet
- This hardware is typically owned and operated by a third party on a consolidated basis in one or more data center locations.
- The machines can run any combination of operating systems; it's the processing power of the machines that matter, not what their desktops look like.
- As shown in Figure 1.1, individual users connect to the cloud from their own personal computers or portable devices, over the Internet.
- To these individual users, the cloud is seen as a single application, device, or document. The hardware in the cloud (and the operating system that manages the hardware connections) is invisible





Architecture behind a cloud Computing System

- This cloud architecture is deceptively simple, although it does require some intelligent management to connect all those computers together and assign task processing to multitudes of users.
- As you can see in Figure 1.2, it all starts user's request then gets passed to the system management, which finds the correct resources and then calls the system's appropriate provisioning services.
- These services carve out the necessary resources in the cloud, launch the appropriate web application, and either creates or opens the requested document.
- After the web application is launched, the system's monitoring and metering functions track the usage of the cloud so that resources are apportioned and attributed to the proper user(s).
- As you can see, key to the notion of cloud computing is the automation of many management tasks. The system isn't a cloud if it requires human management to allocate processes to resources.
- What you have in this instance is merely a twenty-first-century version of old-fashioned data center–based client/server computing.
- For the system to attain cloud status, manual management must be replaced by automated processes

B. Understanding Cloud Storage

- One of the primary uses of cloud computing is for data storage.

cloud storage:

*D*ata is stored on multiple third-party servers, rather than on the dedicated servers used in traditional networked data storage.

- When storing data, the user sees a *virtual server*—that is, it appears as if the data is stored in a particular place with a specific name
- But that place doesn't exist in reality. It's just a pseudonym used to reference virtual space carved out of the cloud.
- In reality, the user's data could be stored on any one or more of the computers used to create the cloud.
- The actual storage location may even differ from day to day or even minute to minute, as the cloud dynamically manages available storage space.
- But even though the location is virtual,

The user sees a “static” location for his data

and can actually manage his storage space as if it were connected to his own PC.

- Cloud storage has both financial and security-associated advantages.
- Financially, virtual resources in the cloud are typically cheaper than dedicated physical resources connected to a personal computer or network.
- As for security, data stored in the cloud is secure from accidental erasure or hardware crashes, because it is duplicated across multiple physical machines;
- since multiple copies of the data are kept continually, the cloud continues to function as normal even if one or more machines go offline.
- If one machine crashes, the data is duplicated on other machines in the cloud.

C. Understanding Cloud Services

- Any web-based application or service offered via cloud computing is called a *cloud service*.
- Almost all large computing companies today, from Google to Amazon to Microsoft, are developing various types of cloud services.
- With a cloud service, the application itself is hosted in the cloud.
- An individual user runs the application over the Internet, typically within a web browser.
- The browser accesses the cloud service and an instance of the application is opened within the browser window.
- Once launched, the web-based application operates and behaves like a standard desktop application.
- The only difference is that the application and the working documents remain on the host’s cloud servers.

Chapter 2
Are You Ready for Computing in the Cloud?

The Pros and Cons of Cloud Computing

Cloud Computing: Advantages

1.Lower-Cost Computers for Users

Here's a quantitative financial advantage:

You don't need a high-powered (and accordingly high-priced) computer to run cloud computing's web-based applications.

Because the application runs in the cloud, not on the desktop PC, that desktop

PC doesn't need the processing power or hard disk space demanded by traditional desktop software.

Hence the client computers in cloud computing can be

1. Lower priced,
2. With smaller hard disks,
3. Less memory,
4. More efficient processors,
5. In fact, a client computer in this scenario wouldn't even need a CD or DVD drive, because no software programs have to be loaded
6. No document files need to be saved.

2. Improved performance

- Let's look further at what results when a desktop PC doesn't have to store and run a ton of software-based applications. (The apps are run from the cloud, instead.)

3.Lower IT Infrastructure Costs

- In a larger organization, the IT department could also see lower costs from the adoption of the cloud computing paradigm.
- Instead of investing in larger numbers of more powerful servers, the IT staff can use the computing power of the cloud to supplement or replace internal computing resources.
- Those companies that have peak needs no longer have to purchase equipment to handle the peaks (and then lay fallow the rest of the time); peak computing needs are easily handled by computers and servers in the cloud

4.Fewer Maintenance Issues

- Speaking of maintenance costs, cloud computing greatly reduces both hard- ware and software maintenance for organizations of all sizes.
- First, the hardware. With less hardware (fewer servers) necessary in the organization, maintenance costs are immediately lowered.
- As to software maintenance, remember that all cloud apps are based elsewhere, so there's no software on the organization's computers for the IT staff to maintain. It's that simple.

5.Lower Software Costs

- Then there's the issue of software cost. Instead of purchasing separate software packages for each computer in the organization, only those employees actually using an application need access to that application in the cloud.
- Even if it costs the same to use web-based applications as it does similar desktop software (which it probably won't), IT staffs are saved the cost of installing and maintaining those programs on every desktop in the organization.
- As to the cost of that software, it's possible that some cloud computing companies will charge as much to "rent" their apps as traditional software companies charge for software purchases.
- However, early indications are that cloud services will be priced substantially lower than similar desktop software.
- In fact, many companies (such as Google) are offering their web-based applications for free—which to both individuals and large organizations is much more attractive than the high costs charged by Microsoft and similar desktop software suppliers.

6.Instant Software Updates

- Another software-related advantage to cloud computing is that users are no longer faced with the choice between obsolete software and high upgrade costs.
- When the app is web-based, updates happen automatically and are available the next time the user logs in to the cloud.
- Whenever you access a web-based application, you're getting the latest version without needing to pay for or download an upgrade.

8.Increased Computing Power

- This is an obvious one. When you're tied into a cloud computing system, you have the power of the entire cloud at your disposal.
- You're no longer limited to what a single desktop PC can do, but can now perform supercomputing-like tasks utilizing the power of thousands of computers and servers.
- In other words, you can attempt greater tasks in the cloud than you can on your desktop.

9.Unlimited Storage Capacity

- Similarly, the cloud offers virtually limitless storage capacity.
- Consider that when your desktop or laptop PC is running out of storage space.
- Your computer's 200GB hard drive is peanuts compared to the hundreds of petabytes (a million gigabytes) available in the cloud. Whatever you need to store, you can.

10.Increased Data Safety

- Unlike desktop computing, where a hard disk crash can destroy all your valuable data, a computer crashing in the cloud doesn't affect the storage of your data.
- That's because data in the cloud is automatically duplicated, so nothing is ever lost. That also means if your personal computer crashes, all your data is still out there in the cloud, still accessible.
- In a world where few individual desktop PC users back up their data on a regular basis, cloud computing can keep data safe.

11.Improved Compatibility Between Operating Systems

- Ever try to get a Windows-based computer to talk to a Mac? Or a Linux machine to share data with a Windows PC? It can be frustrating.
- Not so with cloud computing.
- In the cloud, operating systems simply don't matter.
- You can connect your Windows computer to the cloud and share documents with computers running Apple's Mac OS, Linux, or UNIX.
- In the cloud, the data matters, not the operating system.

12.Improved Document Format Compatibility

- You also don't have to worry about the documents you create on your machine being compatible with other users' applications or operating systems.
- In a world where Word 2007 documents can't be opened on a computer running Word 2003, all documents created by web-based applications can be read by any other user accessing that application.
- There are no format incompatibilities when everyone is sharing docs and apps in the cloud.

13 Easier Group Collaboration

- Sharing documents leads directly to collaborating on documents.
- To many users, this is one of the most important advantages of cloud computing—the ability for multiple users to easily collaborate on documents and projects.
- . It’s an enabling technology.
- Imagine that you, a colleague in your West Coast office, and a consultant in Europe all need to work together on an important project.
- Before cloud computing, you had to email or snail mail the relevant documents from one user to another, and work on them sequentially. Not so with cloud computing.
- Now each of you can access the project’s documents simultaneously;
- The edits one user makes are automatically reflected in what the other users see onscreen. It’s all possible, of course, because the documents are hosted in the cloud, not on any of your individual computers.
- All you need is a computer with an Internet connection, and you’re collaborating.
- Of course, easier group collaboration means faster completion of most group projects, with full participation from all involved.
- It also enables group projects across different geographic locations. No longer does the group have to reside in a single office for best effect.
- With cloud computing, anyone any- where can collaborate in real time

14.Universal Access to Documents

- Ever get home from work and realize you left an important document at the office? Or forget to take a file with you on the road? Or get to a conference and discover you forgot to bring along your presentation?
- Not a problem—not anymore, anyway.
- With cloud computing, you don't take your documents with you.
- Instead, they stay in the cloud, where you can access them from anywhere you have a computer and an Internet connection.
- All your documents are instantly available from wherever you are.
- There's simply no need to take your documents with you—as long as you have an Internet connection, that is.

15 Latest Version Availability

- And here's another document-related advantage of cloud computing.
- When you edit a document at home, that edited version is what you see when you access the document at work.
- The cloud always hosts the latest version of your documents; you're never in danger of having an outdated version on the computer you're working on.

16 Removes the Tether to Specific Devices

- Finally, here's the ultimate cloud computing advantage—you're no longer tethered to a single computer or network.
- Change computers, and your existing applications and documents follow you through the cloud.
- Move to a portable device, and your apps and docs are still available.
- There's no need to buy a special version of a program for a particular device, or save your document in a device-specific format.
- Your documents and the programs that created them are the same no matter what computer you're using.

Cloud Computing: Disadvantages

- That's not to say, of course, that cloud computing is without its disadvantages.
- There are a number of reasons why you might not want to adopt cloud computing for your particular needs. Let's examine a few of the risks related to cloud computing.

1 Requires a Constant Internet Connection

- Cloud computing is, quite simply, impossible if you can't connect to the Internet.
- Because you use the Internet to connect to both your applications and documents, if you don't have an Internet connection, you can't access anything, even your own documents.
- A dead Internet connection means no work, period—and in areas where Internet connections are few or inherently unreliable, this could be a deal breaker.
- If you're used to working on documents on your deck, or while you're at a restaurant for lunch, or in your car, you won't be able to access your cloud- based documents and applications—unless you have a strong Internet connection at all those locations, of course.
- A lot of what's nice about portable computing becomes problematic when you're depending on web-based applications.

2 Doesn't Work Well with Low-Speed Connections

- Similarly, a low-speed Internet connection, such as that found with dial-up services, makes cloud computing painful at best and often impossible.
- Web- based apps often require a lot of bandwidth to download, as do large documents.
- If you're laboring with a low-speed dial-up connection, it might take seemingly forever just to change from page to page in a document, let alone launch a feature-rich cloud service.
- In other words, cloud computing isn't for the slow or broadband-impaired.

3 Can Be Slow

- Even on a fast connection, web-based applications can sometimes be slower than accessing a similar software program on your desktop PC.
- If the cloud servers happen to be backed up at that moment, or if the Internet is having a slow day, you won't get the instantaneous access you're used to with desktop apps.

4 Features Might Be Limited

- This particular disadvantage is bound to change, but today many web-based applications simply aren't as full-featured as their desktop-based brethren.
- Compare, for example, the feature set of Google Presentations with that of Microsoft PowerPoint; there's just a lot more you can do with PowerPoint than you can with Google's web-based offering. The basics are similar, but the cloud application lacks many of PowerPoint's advanced features.
- This has certainly been the case with Google Docs and Spreadsheets, both of which started out somewhat crippled but later added many of the more functions found on Microsoft Word and Excel. Still, you need to look at the features before you make the move.

5 Stored Data Might Not Be Secure

- With cloud computing, all your data is stored on the cloud. That's all well and good, but how secure is the cloud?
- Can other, unauthorized users gain access to your confidential data?
- These are all important questions, and well worth further examination.
- To that end, read ahead to the "The Security Conscious" section later in this chapter,
- where we examine just how safe your data is in the cloud.

6 If the Cloud Loses Your Data, You're Screwed

- I can't put it any more delicately.
- Theoretically, data stored in the cloud is unusually safe, replicated across multiple machines.

II . Who Benefits from Cloud Computing?

- Let's face it, cloud computing isn't for everyone. What types of users, then, are best suited for cloud computing—and which aren't?

1. **Collaborators**

- If you often collaborate with others on group projects, you're an ideal candidate for cloud computing.
- The ability to share and edit documents in real time between multiple users is one of the primary benefits of web-based applications; it makes collaborating easy and even fun.
- Suppose, for example, that you're in charge of an upcoming presentation to the senior management of your company.
- You need to work with the heads of your company's various departments,
- which happen to be based in a half- dozen locations. Given everyone's busy schedules, it's tough enough to schedule a group conference call.
- The solution, in this instance, is to use a web-based presentation program,
- such as Google Presentations. You and the department heads can access the main presentation document at your leisure.
- The changes one person makes are automatically visible when the other collaborators access the document.
- In fact, more than one of you can edit the document at the same time, with each of your changes happening in real time.

- Collaborating with a web-based application is both more convenient and faster than trying to assemble every- one's pieces into a single document managed by one member of the team.
- This type of collaboration isn't limited to the corporate world.
- I like the way families and communities use web-based scheduling programs, such as Google Calendar, to manage their busy schedules.
- On a personal note, my wife and I share a single Google calendar; when she adds an item to the calendar,
- it automatically shows up on the version that I see.
- It makes it easy for the two of us to keep our schedules in sync.
- Similarly, community groups and sports teams can use web-based calendars to alert their members of upcoming activities.
- If authorized, group or team members can add

their own items to the calendar, helping the entire group plan around individual conflicts.

2.Road Warriors

- Another prime candidate for cloud computing is the road warrior.

    1. When you work at one office today,
    2. at home the next day,
    3. and in another city the next,

- It's tough to keep track of all your documents and applications.

- You may end up

1. one version of a document on your work PC,

2. another on your laptop, and a third on your home PC—and that's if you remember to copy that document and take it with you from one location to the next.

Go home and use your web browser

To access the very same app and document via the Internet.

- Travel to another city and the same application and document are still available to you.

- With cloud computing, you don't have to remember

which document is where, or to bring a copy of a document with you.

- You don't even have to worry about whether a particular application is installed on all your PCs.

- Because the apps and docs you use are stored on the web and accessible wherever you have an Internet connection, versioning and compatibility simply aren't issues.

3.Cost-Conscious Users

- Another group of users who should gravitate to cloud computing are those who are cost conscious.

- With cloud computing you can save money on both your hardware and software.

- Hardware-wise, there's no need to invest in large hard disks or super-fast CPUs.

- You can save just as much—if not more—when it comes to software. Instead of laying out big bucks for the latest version of Microsoft Office, you can use Google's versions of these apps (Google Docs, Spreadsheets, and Presentations) for zero expenditure.

- That's right, these web-based applications—and many more from other companies—are completely free to use.
- When your budget is tight, free is a lot better than the hundreds or thousands of dollars you might spend otherwise.
- This is why many universities are abandoning Microsoft and turning instead to Google's suite of online applications.
- Money is always tight on college campuses, and a few hundred dollars savings per student adds up quickly

5.Cost-Conscious IT Departments

- Many corporate IT departments are also becoming enamored of the cloud computing model.
- Although they might appreciate the software savings for them bigger savings result from having to buy fewer central servers.
- corporate network much of the computing takes place on the servers centrally located on the organization's network.
- When users need more computing power, more servers need to be purchased.
- This need for more computing power becomes less of an issue when the organization embraces cloud computing.

6.Users with Increasing Needs

- Hardware-based cost savings also apply to individual computer users.

  Abandon that power- sapping program and use a less-demanding web-based app instead.

  Use the power of the cloud, where thousands of computers are at your disposal.

III Who Shouldn't Be Using Cloud Computing?

1.The Internet-Impaired

- Because cloud computing is based on the Internet cloud and depends on Internet access
- if you don't have Internet access, you're out of luck. Without Internet access, you can't run web-based applications or open documents stored on the web. Users without readily available Internet access simply shouldn't be considering a switch to cloud-based computing—until they get Internet access, that is.
- The same goes if you have slow Internet access, like that found with dial-up Internet connections.
- A slow connection isn't much better than none at all when accessing big apps and docs on the web.
- It takes a long time to download these apps and docs, and that waiting time becomes intolerable on anything less than a broadband connection.

2 Offline Workers

- Along the same lines, anyone who consistently works offline in a non Internet-enabled environment probably isn't the ideal candidate for cloud computing.
- That means

1. Anyone who works out of their vehicle,
2. Anyone who works in an office without Internet access,

1. Anyone who works at home without Internet access,

2. And anyone who travels from office to office without guarantee of an Internet connection.

- No Internet, no cloud computing—it's that simple.

3.The Security Conscious

- Today, we think that cloud computing is safe—but we can't guarantee that.
- It's certainly possible that cloud systems can be hacked and cloud-based documents accessed by unauthorized users;
- it's also possible that your data could be snagged (unexpected difficulties or obstacle) during transmission between your computer and the cloud. It may be unlikely, but it can happen.
- If your documents are confidential, you probably don't want to trust them with cloud computing just yet.
- Just as you wouldn't transmit confidential documents over a public Wi-Fi network,
- you shouldn't upload and store your documents on a cloud computing network with questionable security.
- When security matters, don't take chances.

4.Anyone Married to Existing Applications

- Today, here's probably the most important reason not to sign up for a web- based application:
- You use Microsoft Office.

That's right, many web-based applications are not completely compatible with Microsoft's file formats.

This means it might be difficult if not impossible to open your Word or Excel docs with your web-based app—and vice versa

DARK CLOUDS: BARRIERS TO USING WEB-BASED APPLICATIONS

- What are these barriers to adopting web-based applications? They fall into several general groups:

1.Technical issues.

Establishing a cloud computing system is a technical challenge. Hundreds or thousands of individual computers or servers have to be purchased or otherwise commandeered, linked together, and managed.

- In addition, feature-rich web-based software has to be developed, and served to users with 24/7 uptime. All of this takes significant resources, which smaller companies might not possess.

2.Business model issues.

- Given the expense inherent in building a cloud computing system and developing web-based applications, Right now, Google is supplying its cloud services free of charge, which is a difficult way to generate revenue.
- Even if a company can charge for its cloud services and storage,
- how should those services be priced?
- Making money off of any new technology is a vexing issue, but particularly so with technology that literally exists within a cloud.

3.Internet issues.

- Because cloud computing is viable only when users have constant access to high-speed Internet connections, the unfortunate fact that the United States is behind the curve in broadband access could be a major stumbling point.

4.Security issues.

- Some feel as if this is a false issue, but I'm not so sure. How secure is cloud storage?
- If you save your web- based document in a cloud system, are you guaranteed that

Unit II Chapter 3: Deveoping Cloud Services

Why Develop Web-Based Applications?

- The needs of a typical IT department are daunting: They must deliver adequate computing power and data storage to all users within the company.
- This must be done, of course, within a set budget, and there is the rub; to meet peak needs or to add capacity for new users can often send an IT budget soaring.
- For most companies, it is not financially prudent to add capacity that will be used only a small percentage of the time.
  What the IT department needs is a way to increase capacity or add capabilities without investing in new servers and networking gear, or licensing new software. It is to this need that cloud computing speaks.
- Cloud services, in the form of centralized web-based applications, also appeal to the IT professional. One instance of an application hosted in the cloud is cheaper and easier to manage than individual copies of similar software installed on each user's desktop PC.
- Upgrading a cloud app only has to be done one time, where upgrading traditional software has to be done for each PC on which that software is installed. Then, of course, we have the promise of cloud-enabled collaboration, which just can't be done with traditional desk- top apps.
- The advantages of cloud services development are particularly notable to smaller businesses, who otherwise wouldn't have the budget or resources to develop large-scale applications. By hosting locally developed web applications within the cloud, the small business avoids the cost of purchasing expensive hardware to host similar software.
- Let's face it, most small companies don't have the staff, resources, hardware, or budget to develop and maintain their own applications, or to deal with the rigors of maintaining secure environments. Although they could outsource their software development and hosting, moving those applications to the cloud, companies don't have to invest in locally hosted systems, freeing up their staff and resources to focus on the day-to-day running of their own businesses.

Advantages of Cloud Development

- One of the underlying advantages of cloud development is that of economy of scale. By taking advantage of the infrastructure provided by a cloud computing vendor, a developer can offer better, cheaper, and more reliable applications than is possible within a single enterprise. The application can utilize the full resources of the cloud, if needed—without requiring a company to invest in similar physical resources.
- Speaking of cost, because cloud services follow the one-to-many model, cost is significantly reduced over individual desktop program deployment. Instead of purchasing or licensing physical copies of software programs (one for each desktop), cloud applications are typically "rented," priced on a per-user basis.

The Pros and Cons of Cloud Service Development

- Why would you choose to develop new applications using the cloud services model? There are several good reasons to do—and a few reasons to be, perhaps, a bit more cautious.
- IT departments like cloud applications because all management activities are managed from a central location rather than from individual sites or workstations.
- This enables IT staff to access applications remotely via the web. There's also the advantage of quickly outfitting users with the software they need (known as "rapid provisioning), and adding more computing resources as more users tax the system (automatic scaling).
- When you need more storage space or bandwidth, companies can just add another virtual server from the cloud. It's a lot easier than purchasing, installing, and configuring a new server in their data center.

Disadvantages of Cloud Development

- Perhaps the biggest perceived disadvantage of cloud development is the same one that plagues all web-based applications: Is it secure? Web-based applications have long been considered potential security risks. For this reason, many businesses prefer to keep their applications, data, and IT operations under their own control.

- operation is likely to have better data security and redundancy tools than the aver- age enterprise. In any case, however, even the perceived security danger from hosting critical data and services offsite might dis- courage some companies from going this route
- Another potential disadvantage is what happens if the cloud computing host goes offline. Although most companies say this isn't possible, it has happened. Amazon's EC2 service suffered a massive outage on February 15, 2008, that wiped out some customer application data. (The outage was caused by a software deployment that erroneously terminated an unknown number of user instances.)
- For clients expecting a safe and secure platform, having that plat- form go down and your data disappear is a somewhat rude awakening. And, if a company relies on a third-party cloud platform to host all of its data with no other physical backup, that data can be at risk.

Types of Cloud Service Development

- The concept of cloud services development encompasses several different types of development. Let's look at the different ways a company can use cloud computing to develop its own business applications.

Software as a Service

- Software as a service, or SaaS, is probably the most common type of cloud service development. With SaaS, a single application is delivered to thousands of users from the vendor's servers. Customers don't pay for owning the soft- ware; rather, they pay for using it. Users access an application via an API accessible over the web.
- For customers, SaaS requires no upfront investment in servers or software licensing. For the application developer, there is only one application to maintain for multiple clients.
- Many different types of companies are developing applications using the SaaS model. Perhaps the best-known SaaS applications are those offered by Google to its consumer base

Platform as a Service

- In this variation of SaaS, the development environment is offered as a service. The developer uses the "building blocks" of the vendor's development environment to create his own custom application. It's kind of like creating an application using Legos; building the app is made easier by use of these predefined blocks of code, even if the r
- **Web Services**
- A web service is an application that operates over a network—typically, over the Internet. Most typically, a web service is an API that can be accessed over the Internet. The service is then executed on a remote system that hosts the requested services.
- This type of web API lets developers exploit shared functionality over the Internet, rather than deliver their own full-blown applications. The result is a customized web-based application where a large hunk of that application is delivered by a third party, thus easing development and bandwidth demands for the custom program.

- A good example of web services are the “mashups” created by users of the Google Maps API. With these custom apps, the data that feeds the map is pro- vided by the developer, where the engine that creates the map itself is pro- vided by Google. The developer doesn’t have to code or serve a map application; all he has to do is hook into Google’s web API.
- As you might suspect, the advantages of web services include faster (and lower-cost) application development, leaner applications, and reduced storage and bandwidth demands. **On-Demand Computing**
- As the name implies, on-demand computing packages computer resources (processing, storage, and so forth) as a metered service similar to that of a
- public utility. In this model, customers pay for as much or as little processing and storage as they met.
- Companies that have large demand peaks followed by much lower normal usage periods particularly benefit from utility computing. The company pays more for their peak usage, of course, but their bills rap- idly decline when the peak ends and nor- mal usage patterns resume.
- Clients of on-demand computing services essentially use these services as off- site virtual servers. Instead of investing in their own physical infrastructure, a company operates on a pay-as-you-go plan with a cloud services provider.
- On-demand computing itself is not a new concept, but has acquired new life thanks to cloud computing. In previous years, on- demand computing was provided from a single server via some sort of time-sharing arrangement.

Discovering Cloud Services Development Services and Tools

- As you're aware, cloud computing is at an early stage of its development. This can be seen by observing the large number of small and start-up companies offering cloud development tools. In a more established industry, the smaller players eventually fall by the wayside as larger companies take center stage.
- That said, cloud services development services and tools are offered by a variety of companies, both large and small. The most basic offerings provide cloud-based hosting for applications developed from scratch. The more fully featured offerings include development tools and pre-built applications that developers can use as the building blocks for their own unique web-based applications.

So let's settle back and take a look at who is offering what in terms of cloud service development. It's an interesting mix of companies and services.

- the service is based on large grids of computers operating as a single cloud

Amazon

- That's right, Amazon, one of the largest retailers on the Internet, is also one of the primary providers of cloud development services. Think of it this way: Amazon has spent a lot of time and money setting up a multitude of servers to service its popular website, and is making those vast hardware resources available for all developers to use.
- The service in question is called the Elastic Compute Cloud, also known as EC2. This is a commercial web service that allows developers and companies to rent capacity on Amazon's proprietary cloud of servers which happens to be one of the biggest server farms in the world.
- EC2 enables scalable deployment of applications by letting customers request a set number of virtual machines, onto which they can load any application of their choice. Thus, customers can create, launch, and terminate server instances on demand, creating a truly "elastic" operation.

- Amazon’s service lets customers choose from three sizes of virtual servers:
- Small, which offers the equivalent of a system with 1.7GB of memory, 160GB of storage, and one virtual 32-bit core processor
- Large, which offers the equivalent of a system with 7.5GB of memory, 850GB of storage, and two 64-bit virtual core processors
- Extra large, which offers the equivalent of a system with 15GB of memory, 1.7TB of storage, and four virtual 64-bit core processors
- In other words, you pick the size and power you want for your virtual server, and Amazon does the rest.
- EC2 is just part of Amazon’s Web Services (AWS) set of offerings, which pro- vides developers with direct access to Amazon’s software and machines. By tapping into the computing power that Amazon has already constructed, developers can build reliable, powerful, and low-cost web-based applications. Amazon provides the cloud (and access to it), and developers provide the rest. They pay only for the computing power that they use.
- AWS is perhaps the most popular cloud computing service to date. Amazon claims a market of more than 330,000 customers—a combination of developers, start-ups, and established companies.

Google App Engine

- Google is a leader in web-based applications, so it’s not surprising that the company also offers cloud development services. These services come in the form of the Google App Engine, which enables developers to build their own web applications utilizing the same infrastructure that powers Google’s powerful applications.
- The Google App Engine provides a fully integrated application environment. Using Google’s development tools and computing cloud, App Engine applications are easy to build, easy to maintain, and easy to scale. All you have to do.
- is develop your application (using Google’s APIs and the Python programming language) and upload it to the App Engine cloud; from there, it’s ready to serve your users.

- As you might suspect, Google offers a robust cloud development environment. It includes the following features:
- Dynamic web serving
- Full support for all common web technologies
- Persistent storage with queries, sorting, and transactions
- Automatic scaling and load balancing
- APIs for authenticating users and sending email using Google Accounts
- operation is likely to have better data security and redundancy tools than the aver- age enterprise. In any case, however, even the perceived security danger from hosting critical data and services offsite might dis- courage some companies from going this route
- Another potential disadvantage is what happens if the cloud computing host goes
- offline. Although most companies say this isn’t possible, it has happened. Amazon’s EC2 service suffered a massive outage on February 15, 2008, that wiped out some customer application data. (The outage was caused by a software deployment that erroneously terminated an unknown number of user instances.)
- For clients expecting a safe and secure platform, having that plat- form go down and your data disappear is a somewhat rude awakening. And, if a company relies on a third-party cloud platform to host all of its data with no other physical backup, that data can be at risk.

- It’s not surprising, given the company’s strength in enterprise-level computer hardware, that IBM is offering a cloud computing solution. The company is targeting small- and medium-sized businesses with a suite of cloud-based on- demand services via its Blue Cloud initiative.
- Blue Cloud is a series of cloud computing offerings that enables enterprises to distribute their computing needs across a globally accessible resource grid.
- One such offering is the Express Advantage suite, which includes data backup and recovery, email continuity and archiving, and data security functionality—some of the more data-intensive processes handled by a typical IT department.
- To manage its cloud hardware, IBM provides open source workload-scheduling software called Hadoop, which is based on the MapReduce software used by

  Google in its offerings. Also included are PowerVM and Xen virtualization tools, along with IBM’s Tivoli data center man- agement software.

Salesforce.com

- Salesforce.com is probably best known for its sales management SaaS, but it’s also a leader in cloud computing development. The company’s cloud computing architecture is dubbed Force.com. The platform as a
- service is entirely on-demand, running across the Internet. Salesforce provides its own Force.com API and developer’s toolkit. Pricing is on a per log-in basis.
- Supplementing Force.com is AppExchange, a directory of web-based applications. Developers can use AppExchange applications uploaded by others, share their own applications in the directory, or publish private applications accessible only by authorized companies or clients. Many applications in the AppExchange library are free, and others can be purchased or licensed from the original developers.
- Not unexpectedly, most existing AppExchange applications are sales related— sales analysis tools, email marketing systems, financial analysis apps, and so forth. But companies can use the Force.com platform to develop any type of application. In fact, many small businesses have already jumped on the Force.com bandwagon.
- For example, an April 2008 article in *PC World* magazine quoted Jonathan Snyder, CTO of Dreambuilder Investments, a 10-person mortgage investment company in New York. “We’re a small company,” Snyder said, “we don’t have the resources to focus on buying servers and developing from scratch..

Other Cloud Services Development Tools

- Amazon, Google, IBM, and Salesforce.com aren't the only companies offering tools for cloud services developers. There are also a number of smaller companies working in this space that developers should evaluate, and that end users may eventually become familiar with. These companies include the following:
- 3tera (www.3tera.com), which offers the App Logic grid operating sys- tem and Cloud ware architecture for on-demand computing.
- 10gen (www.10gen.com), which provides a platform for developers to build scalable web-based applications.
- Cohesive Flexible Technologies (www.cohesiveft.com), which offers the Elastic Server On-Demand virtual server platform.
- Joyent (www.joyent.com), which delivers the Accelerator scalable on- demand infrastructure for web application developers, as well as the Connector suite of easy-to-use web applications for small businesses.
- Mosso (www.mosso.com), which provides an enterprise-level cloud hosting service with automatic scaling.
- Nirvanix (www.nirvanix.com), which offers a cloud storage platform for developers, as well as Nirvanix Web Services, which provides file management and other common operations via a standards-based API.
- Skytap (www.skytap.com), which provides the Virtual Lab on-demand web-based automation solution that enables developers to build and configure lab environments using pre-configured virtual machines.
- StrikeIron (www.strikeiron.com), which offers the Iron Cloud cloud- based platform for the delivery of web services, along with various Live Data services that developers can integrate into their own applications

Chapter 4: Cloud Computing for the family

Centralizing Email Communications

- We'll start our tour of cloud computing for families by examining how a typical family can use cloud-based tools to help improve communications between family members. That's right, computing in the cloud can help families improve their communications skills!
- The key here is to enable anywhere/any- time access to email. Precloud computing, your email access was via a single computer,
- which also stored all your email messages. For this purpose, you probably used a program like Microsoft Outlook or Outlook Express, installed on your home computer. If you wanted to check your home email from work, it took a bit of juggling and perhaps the use of your ISP's email access web page. That web page was never in sync with the messages on your home PC, of course, which is just the start of the problems with trying to communicate in this fashion.
- A better approach is to use a web-based email service, such as Google's Gmail (mail.google.com), Microsoft's Windows Live Hotmail (mail.live.com), or Yahoo! Mail (mail.yahoo.com). These services place your email inbox in the cloud; you can access it from any computer connected to the Internet. The messages you receive are stored on the web, as are the messages you send, so nothing depends on a single PC.
- The joy of using web-based email is that it doesn't matter what PC you use, your messages are always where they should be and they're always in sync. It's easy to check your home email from work, or from anywhere you happen to be—in a coffeehouse, at a hotel, or even in an airport terminal. Use your work PC, your home PC, your notebook PC, or a friend's PC, it doesn't matter; your messages are in the cloud, not on any of those PCs.
- Internet and use your web browser to see what the calendar says. And any changes you make, from wherever you are, are registered in the cloud; your other family members immediately see the latest version of the calendar.

Collaborating on Grocery Lists Collaborating on Grocery Lists

- Here's one you might not have thought of. If you're part of a busy family where both spouses work, you might not be able to manually coordinate your grocery lists.
- Your spouse might need shampoo, but if she didn't tell you before you left for work, you can stop at the grocery and get everything but what your spouse needs.
- Likewise if you have a craving for cookies and cream ice cream; if your spouse doesn't know this, your craving will go unfulfilled the next time she stops at the supermarket.
- The solution here is to use a web-based word processing program to manage your joint grocery lists. Use a program like Google Docs (docs.google.com) to create a document, and then authorize access for both you and your spouse.
- Enter the items you need onto the list, one line at a time, and have your spouse do the same. Keep the list going for the week or so it takes you to get to the grocery, opening your web browser and adding new items as they occur to you, whenever and wherever they occur to you (as long as you have web access, of course).
- At the end of the week, when you're ready to go to the supermarket, connect to the Internet and print out a copy of your grocery list on your home or office printer. It's that simple.
- Of course, you don't have to limit access to your grocery list to just you and your spouse. Many families also authorize their children to access their online lists, thus making everyone in the family happy—and inflating your grocery bill with all sorts of unhealthful snack foods. (But at least everyone will be happy!)

Collaborating on To-Do Lists

- A grocery list is just one type of to-do list. If you have a lot of household chores and repairs, it's likely that you have a larger to-do list for your household. And, if your household is like mine, that list grows every day!
- You and your spouse can collaborate on your to-do list by using a web-based word processing application, as we just dis- cussed, or you can use a dedicated web- based planning program.
- These applications, such as Zoho Planner (planner.zoho.com) let you create multiple to-do lists on the web, which you and your spouse can both add to from any computer, at any time.
- You can even set email reminders to refresh your memory when a task is due. Add your tasks one at a time, and then mark them off as they're completed.
- If these applications are too advanced for your needs, consider using a simpler web-based to-do list application. These applications, such as Remember the Milk (www.rememberthemilk.com) and Ta-da List (www.tadalist.com), operate more like a simple notepad-based list.
- Some even let you add tasks via email or access the list when you're on the go with your mobile phone.