

1977

First modern PC -  
Apple II

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The World Wide Web

2000–2020

Cloud Computing  
and the Smart Phone

Emerging trends  
in the 21st century

# 2000–2020

## Cloud Computing and the Smart Phone

Learning Outcomes addressed in this section are listed below.

- 
- 1.8** evaluate the costs and benefits of the use of computing technology in automating processes
- 
- 1.11** discuss the complex relationship between computing technologies and society including issues of ethics
- 
- 1.12** compare the positive and negative impacts of computing on culture and society
- 
- 1.13** identify important computing developments that have taken place in the last 100 years and consider emerging trends that could shape future computing technologies
- 
- 1.14** explain when and what machine learning and AI algorithms might be used in certain contexts
- 
- 1.15** consider the quality of the user experience when interacting with computers and list the principles of universal design, including the role of a user interface and the factors that contribute to its usability
-

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The term **Cloud Computing** is now generally used to mean the delivery of services hosted on the internet. The concept of delivering computing as a service or a utility (like hooking up to the electric grid) is not a new concept. Mainframe computers have existed since modern computing evolved, where end users hook up their terminal to a larger system with greater speed and processing power.

In the 1970's, and before the PC dominated the computing world in the early 1980s, the power of computers was very limited: less processing power than a standard 21st century smart phone. Limited bandwidth and connectivity meant companies could not provide cloud computing on a commercial scale. That all changed in the 1990s as internet bandwidth developed. One of the first companies to capitalise was Amazon. Their Amazon Web Service (AWS), grew out the realisation that their data centres had more computing power than the company could use. So they began to rent their computers as virtual servers to clients who wanted to avail of online storage and computing power. Also the web went from being quite static (web 1.0) to something much more collaborative, responsive, interactive and social (web 2.0). Amongst many innovations, Javascript, one of the prescribed programming languages of the 2017 LCCS specification, has become more and more central to this phenomenon.

What developments have enabled cloud computing and what are some of the key technologies and trends related to Cloud Computing?

## Virtualisation

When a company has computing power, or simply an actual computer, to offer as part of a managed service, it will often segment that single resource into a multiple set of resources. Each of these smaller resources, with the appropriate software, can in turn act as a virtual server or virtual storage. Virtualisation is the simulation of a device or a resource. It creates an environment for a user that is independent of physical infrastructure. You can have virtualisation without cloud computing, but you cannot have cloud computing as we know it without virtualisation.

## Web 2.0

The web was invented by Tim Berners Lee (link to that section) in 1989. It was quite static in the sense that information was presented using html and users either viewed or downloaded content. It was retrospectively called Web 1.0. As its usage grew and network connectivity improved, people wanted more interaction. Software and Infrastructure as a Service expanded the capability of the web. In the mid 2000s the phrase [Web 2.0](#) was coined to capture this transition to a dynamic world wide web. Take Javascript as an example. Javascript was developed in 1995, more a kind of hacking type of solution to give the browser more choice and responsiveness. In the early 2000s, JS could do more and more through web browsers. And as the web become more and more of a business and social tool, technologies such as AJAX (Asynchronous Javascript and eXtensible markup language) allowed pages to update seamlessly without the need for http requests. Google Maps uses an AJAX engine to allow users work on data in real time in their browser.

📺 [Watch a short \(mashable\) video explaining the cloud and cloud storage.](#)

What is the difference between storage in the cloud and storage in a data centre? Is cloud computing different to cloud storage?

*"You don't generate your own electricity. Why generate your own computing?"*

Jeff Bezos, CEO Amazon.

**LO 1.8, 1.13**

[Read a highly concise explanation of Cloud Computing from TechTarget](#)

- ▶ What is the difference between a Public Cloud model and a Hybrid model?
- ▶ The abbreviation "aaS" stands for "as a Service". What does [IaaS, PaaS and SaaS](#) mean, and give some examples.
- ▶ Emerging cloud technologies such as [AI and Machine Learning services](#) are helping to detect fraud, improve weather predictors, etc.

**LO 1.13, 1.14**

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## Cloud Computing makes it possible for dumb to become smart

By the end of 2017 there were more mobile devices connected to the cloud than people living in the world. Smart phones accounted for over half of all internet access, outstripping all other forms of access, such as desktop access.<sup>16</sup> The growth in usage of mobile access is most prevalent in the developing world. The first touchscreen smart phone, the iPhone, was unveiled by Apple in 2007.  [Watch the video](#) and discuss the following questions.

- 1) In the video Steve Jobs claims that Apple have re-invented the phone, and shows a chart as to why the iPhone was unique amongst smartphones. Discuss this chart.
- 2) Examine his claim that the iPhone represented a revolutionary UI and a breakthrough in internet communication.
- 3) Make note of the quote he uses from Alan Kay (who coined the phrase Graphical User Interface (GUI pronounced gooey)) regarding the relationship between software and hardware. Give examples of other hi-tech companies who have followed this trend. (LO 1.12, 1.15)

Why stop at making mobile phones smarter? Imagine if any system which made decisions and had intelligence built into its operation (such as a home heating system) availed of cloud computing and storage? Or if we could intervene early to safeguard a person's health and well-being in their daily lives through data analysers operating in the cloud? The idea is known as the [Internet of Things](#) (IoT). It raises many possibilities and scenarios of an entire world connected to the cloud.



### Brain Buster

If the world of things is being rapidly connected, is it inevitable that the human race itself will be permanently connected to the cloud? Or consider the following, is it more desirable to be integrated into the cloud: "Like many transhumanists, Nick (Bostrom) was fond of pointing out the vast disparity in processing power between human tissue and computer hardware. Neurons, for instance, fire at a rate of 200 hertz (or 200 times per second), whereas transistors operate at the level of gigahertz. Signals travel through our central nervous systems at a speed of about 100 metres per second, whereas computer signals travel at the speed of light. The human brain is limited in size to the capacity of the human cranium, where it is technically possible to build computer processors the size of skyscrapers."<sup>17</sup>

<sup>16</sup> International Telecommunications Union : <https://www.itu.int/en/ITU-D/Statistics/Pages/default.aspx>

<sup>17</sup> O'Connell (2017) *To Be a Machine*. Granta Publications.

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## Stimulate a Debate on Cloud Computing

The strategy below can be used to explore the complex relationship between computing technologies and society. Learning Outcomes [1.11 to 1.18](#) can be covered, depending on the topic being researched and debated. The 4 steps of the classroom strategy to stimulate and facilitate debate are:

1. **Watch a Stimulus Video or read a stimulus piece.**
2. **Prompt questions to provoke class discussion and elicit initial viewpoints.**
3. **Divide into research groups to explore the topic from key standpoints.**
4. **Choose a teaching / facilitation methodology.**

Below are some of the pros and cons of cloud computing designed to act as a stimulus piece for a class debate. The arguments are based on an article on the website [explainthatstuff.com](#). Future trends in cloud computing are also discussed on the same website. Design some prompt questions or use the summary below to help divide the class into research groups to explore the issue from as many standpoints as possible. Facilitation strategies are explained in [A Summary of Teaching & Facilitation Methodologies](#).

### CLOUD COMPUTING PROS

- ▶ Lower upfront costs and reduced infrastructure costs.
- ▶ Easy to grow your applications.
- ▶ Scale up or down at short notice, known as elasticity.
- ▶ Only pay for what you use.
- ▶ Everything managed under Service Level Agreements (SLAs).
- ▶ Overall environmental benefit (lower carbon emissions) of many users efficiently sharing large systems.

### CLOUD COMPUTING CONS

- ▶ Higher ongoing operating costs. Could cloud systems work out more expensive?
- ▶ Greater dependency on service providers. Can you get problems resolved quickly, even with SLAs?
- ▶ Risk of being locked into proprietary or vendor-recommended systems? How easily can you migrate to another system or service provider if you need to?
- ▶ What happens if your supplier suddenly decides to stop supporting a product or system you've come to depend on?
- ▶ Potential privacy and security risks of putting valuable data on someone else's system in an unknown location?
- ▶ If lots of people migrate to the cloud, where they're no longer free to develop neat and whizzy new things, what does that imply for the future development of the Internet?
- ▶ Dependency on a reliable Internet connection.