

CSCI 5409 Cloud Computing – Fall, 2023
Week 2 – Lecture 1 (Sep 11, 2023)

The Background of Cloud Computing

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Housekeeping and Feedback

- First lab will be happening tomorrow
- Teams channels
- Certification vouchers

Objectives

- Understand the concept of cloud computing
- Understand the term and Kubernetes assignment
- Understand the history and future of cloud computing

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K8s



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What is Cloud Computing



What is Cloud Computing

“Simply put, cloud computing is the delivery of computing services – including servers, storage, databases, networking, software, analytics and intelligence – over the Internet (“the cloud”) to offer faster innovation, flexible resources and economies of scale. Typically, you only pay for cloud services you use, helping you lower your operating costs, run your infrastructure more efficiently and scale as your business needs change.”



<https://azure.microsoft.com/en-ca/overview/what-is-cloud-computing/#benefits>

What is Cloud Computing – The way to learn

Experiential Learning

- Cloud computing is not a programming language, API, formula or mathematical theory. It is a paradigm for arranging IT resources.
 - After instruction in the fundamentals, learning happens by doing.
- **The most important skill you must develop is courage**; the courage to dive in and arrange gizmos and fiddle knobs until your stuff works.
- Be tenacious!
 - Google error messages, don't stop at the first couple of links
 - Use binary searches to find problems
 - Try try try try try try try **THEN** ask **Teams-> TA -> Lu**

What is Cloud Computing – Business Drivers

Capacity Planning

- Determining and fulfilling future demands of an organization's IT resources
- Capacity = Maximum amount of work delivered in a period of time
- If not matched to demand, systems go down or become unavailable

Organizational Agility

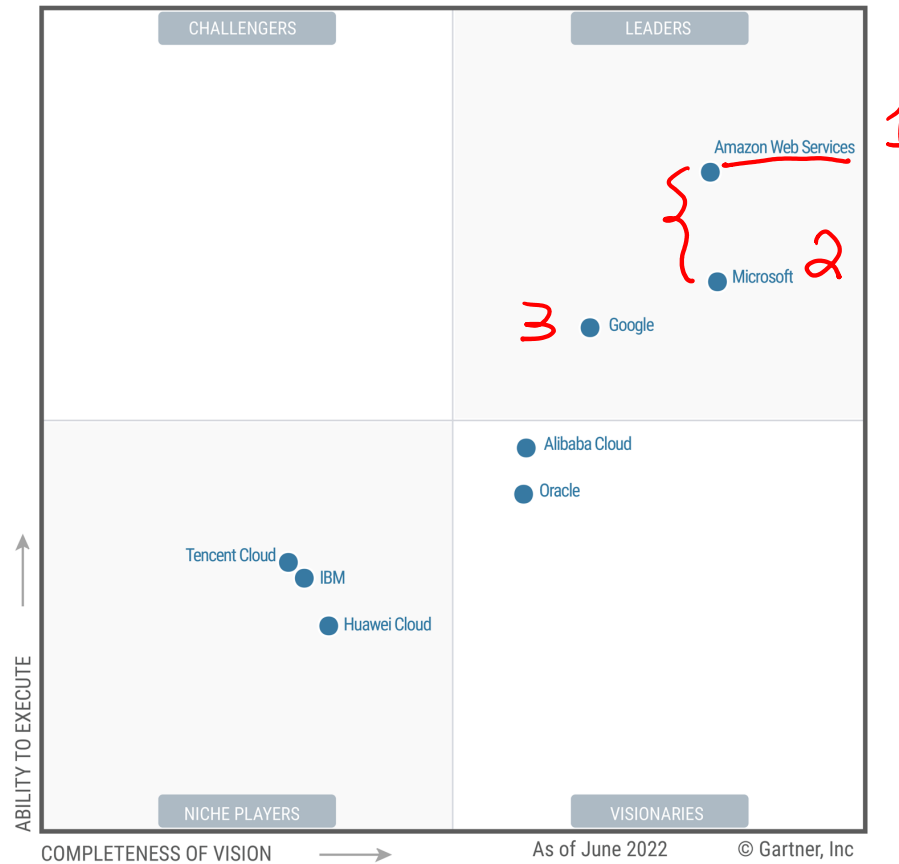
- Organizational Agility:
 - Covid-19 is the perfect demonstration of this, as everyone went home suddenly demand for online resources skyrocketed, without cloud computing we would not be talking right now
 - Organizations can freely and safely attempt to scale their business without worrying about IT resources keeping up

Cost Reduction

- Cost Reduction:
 - Constant need to balance requirements with over-expenditure on infrastructure
 - Reduced costs:
 - IT personnel
 - Utility and capital expenses
 - Security / access control measures and audits
 - Software licenses

What is Cloud Computing – Major Players

Figure 1: Magic Quadrant for Cloud Infrastructure and Platform Services



<https://aws.amazon.com/blogs/aws/aws-named-as-a-leader-in-the-2022-gartner-cloud-infrastructure-platform-services-cips-magic-quadrant-for-the-12th-consecutive-year/>



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Term Assignment & Kubernetes Assignment

Term Assignment - Using AWS

AWS Academy & AWS Credits

① AWS Academy
Foundation
\$100

- 3 types of accounts: *learner lab* ←
- ② • **AWS Academy lab account** – Free, no credit card, \$100 credit for our class
 - Everything we create here is in a special sandbox that is not the real AWS
 - Everything is deleted when the course ends
 - If you run out of credits, **then that's it!**
- **AWS starter account** – Free, no credit card, promotional credit?
- **Regular AWS developer account** – **Not free**, credit card required BE CAREFUL
- If you run out of credits, you're on your own!
 - Learning to be careful and manage your credits and the cost of the services you deploy is part of this course
 - OpenStack, or paying for credits on your own is your only recourse.

Kubernetes Assignment – Using GCP

Google Cloud Platform (GCP)

- You can use any GCP services. Google is always generous!
- We focus on cloud-native CI/CD tools and Google Kubernetes Engine (GKE)
- \$50/student

The slide features a white background with blue corner elements. On the left, a large blue square contains a series of concentric circles in shades of gray and blue, with a yellow number '3' in the center. On the right, a similar blue square contains a series of concentric circles in shades of gray and blue.

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History of Cloud Computing

History of Cloud Computing – Wild Thinking

Terms or technologies you can think of about the history of cloud computing

Internet Servers Virtualization Storage
Network(VPC) data center OS
Regions & AZs CDN Containerization
Security Scalability

History of Cloud Computing – The journey

Time sharing:

"The computers would handle a number of problems concurrently. Organizations would have input-output equipment installed on their own premises and would buy time on the computer much the same way that the average household buys power and water from utility companies"

John Backus, Dec 1958

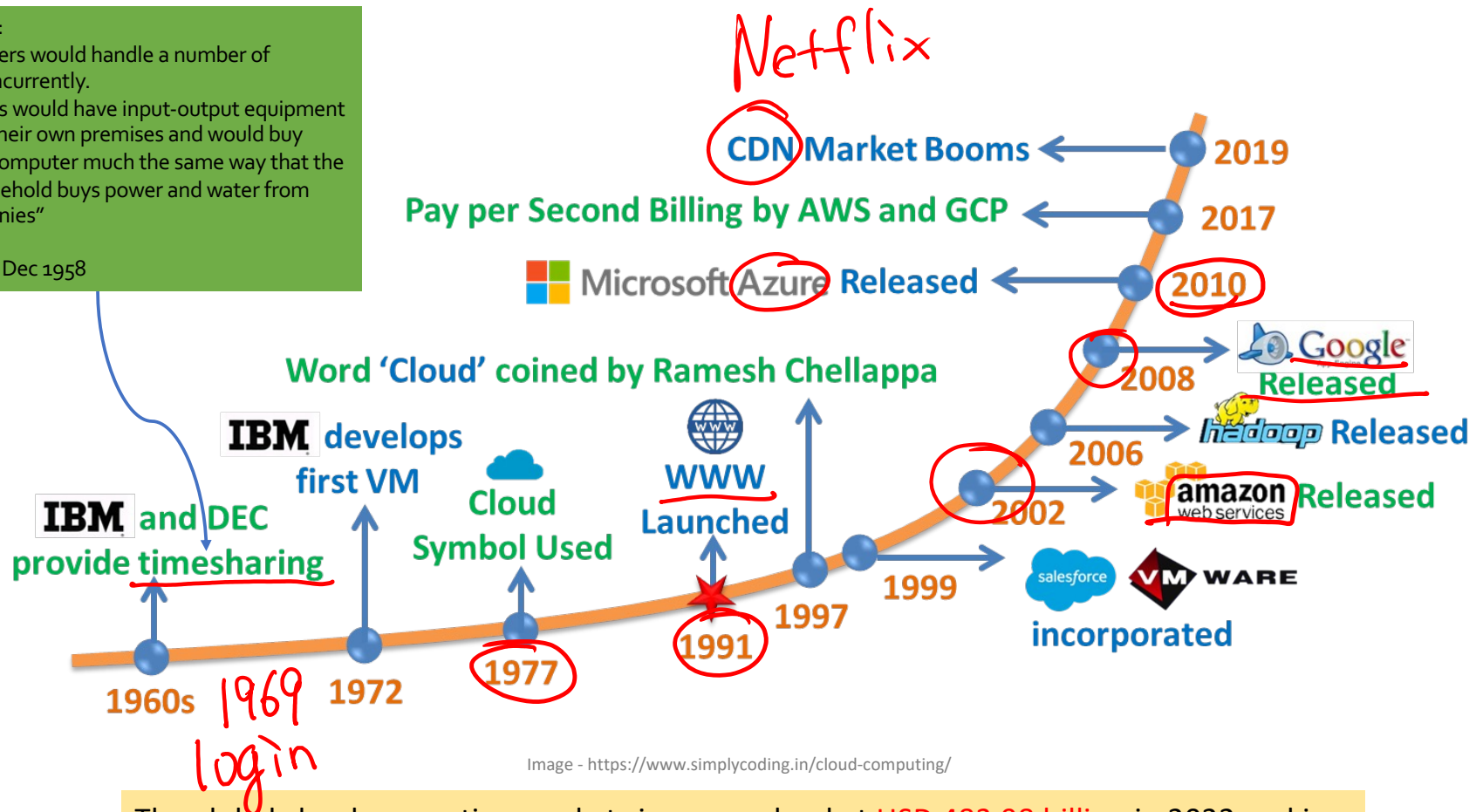


Image - <https://www.simplycoding.in/cloud-computing/>

The global cloud computing market size was valued at **USD 483.98 billion** in 2022 and is expected to grow at a compound annual growth rate (CAGR) of **14.1%** from 2023 to 2030

<https://www.grandviewresearch.com/industry-analysis/cloud-computing-industry>

History of Cloud Computing – The journey

It's not even finished growing...

- 2002 – Amazon Web Services (AWS) launched as a free service.
- 2006 – AWS started offering web-based computing infrastructure services, now known as cloud computing.
- 2007 – IBM partnered with Google to promote cloud computing in universities.
- 2008 – Google announced App Engine, a developer tool that allowed users to run web applications on Google infrastructure.
- 2010 – Microsoft released Azure, its cloud computing service.
- 2011 – IBM introduced the SmartCloud framework.
- 2011 – Facebook launched the Open Compute Project (OCP) to share specifications for energy efficient data centres.
- **2013 – Docker introduced open source container software.**
- 2015 – Google and Microsoft lead massive build outs of data centres.
- 2017 – Huawei and Tencent joined Alibaba in major data centre build-outs in China.
- **2018 – Leading data centre operators started the migration to 400G data speeds.**
- **2018 – Silicon photonics technology started to positively impact data centre networking architectures.**
- 2020 – Edge computing will revise the role of the cloud in key sectors of the economy.
- 2021 – Data centre speeds are expected to exceed 1,000G.
- 2024 – GlobalData forecasts that spending on cloud services (SaaS, PaaS, and IaaS) will be more than \$429bn.

<https://www.verdict.co.uk/cloud-computing-timeline/>

History of Cloud Computing – Four eras

Four Eras

Prehistoric (1950-1970)

ARPA (1958)

Modems (1958)

Inter-glactic Computer Network (1960)

Time Sharing Systems (1959, 1963/64)

ARPANET (1968/69)

First Word transmitted via ARPANET (1968/69)

CompuServe (1969)

Era Summary

- Reliable telephone line-based connections
- Modems to transmit data
- Expensive main-frames
- Computers cost around \$5M
- Network used by Governments and Academics

Middle-ages (1970-1990)

ARPANET Demo (1972)

First Local Networks (1977)

TCP/IP & DNS (1983)

Early Internet Services: CompuServe (1984), Prodigy (1984), The World (1989), and AOL (1991)

Tim Berners Lee's Proposal for future WWW (1989)

Era Summary

- Reliable and fast comms infrastructure
- Essential protocols developed
- Developments in processing & computers are cheap enough for individuals (\$1200ish)

Modern day (1990-date)

Mosaic Released (1993)

Jeff Bezos founded Cadabra Inc (1994)

"Cloud Computing" used by George Favaloro (1996)

Mrac Benioff founded Salesforce (1999)

Large data centers

AWS Released (2002)

OS for the Internet proposed (2003)

AWS Expanding

Google Cloud Platform (2008)

Alibaba Cloud (2009)

Microsoft Azure Released (2010)

Docker (2013) and Kubernetes (2015)

Cloud War

Era Summary

- Web browser released
- Early-stage cloud computing platform created
- AWS, Microsoft, and Google lead the cloud computing war

<https://www.youtube.com/watch?v=61ArSpwDRFE>

https://en.wikipedia.org/wiki/Main_Page

<https://www.forbes.com/sites/bernardmarr/2020/11/02/the-5-biggest-cloud-computing-trends-in-2021/?sh=4d2aad5912d9>

<https://www.analyticsinsight.net/top-10-cloud-computing-trends-to-look-out-for-in-2023/#:~:text=It%20is%20used%20by%20every,%2C%20Cloud%20Security%2C%20and%20more.>

Future (>2019)

10 trends in 2023

- Edge computing
- AI and ML
- Disaster recovery
- Multi and hybrid cloud
- Cloud security
- Cloud gaming
- Kubernetes
- Serverless computing
- Blockchain
- IoT

Takeaway

- Learnt the concept of cloud computing
- Learnt the term and Kubernetes assignment
- Learnt the history and future of cloud computing