Cloud Platform

Lecture 0 – Course Introduction

상명대학교
컴퓨터과학과
강상욱 교수

This slides are credited by
https://kubernetes.io/
https://github.com/kubernetes/kubernetes
https://docs.cloudfoundry.org/

Definition of Cloud Computing

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.

Motivation of Cloud Computing

"Planning without taking action is the slowest route to victory. Taking action without planning is the noise before defeat." – Sun Tzu, The Art of War

1. New service platform of Web Services
2. Inevitable platform of big data processing and analysis
3. Most adequate computational platform for artificial intelligence technology

Netflix Case Study

Overview

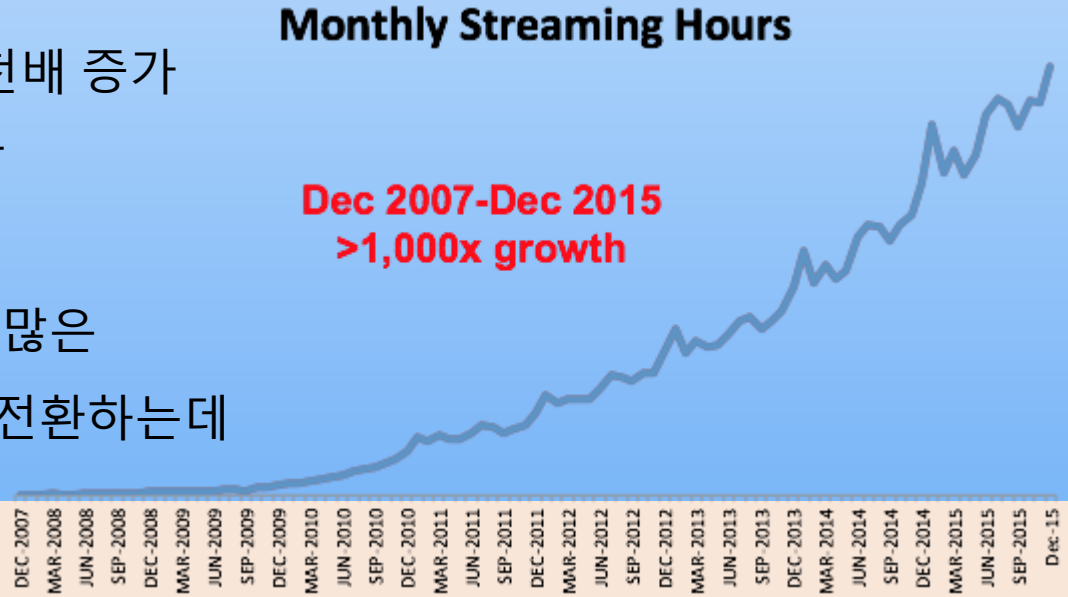
- Netflix는 190개 이상의 국가에서 2억 6,000만 명 이상의 회원을 보유한 세계 최고의 엔터테인먼트 서비스 중 하나
- Netflix는 데이터베이스, 분석, 권장 엔진, 비디오 트랜스코딩 등 AWS에서 10만 개 이상의 서버 인스턴스를 사용하는 수백 가지 기능을 비롯하여 거의 모든 컴퓨팅 및 스토리지 요구에 AWS를 사용
- 2008년에 클라우드 컴퓨팅으로 전환 (Cloud migration)

Cloud migration
The process of transferring an organization's digital assets, such as data, applications, and IT infrastructure, from on-premises servers to cloud-based platforms.

Netflix Case Study

Cloud Migration

- 심각한 DB 손상으로 3일간 DVD 배송이 지연, 피크타임 수요 대처, 글로벌 서비스로의 확장 문제를 겪은 후 2008년 8월 전환 착수
- 기존 데이터 센터 기반 인프라 → Amazon Web Services
- 2016년 1월 클라우드 마이그레이션 최종 완료 (약 7년)
- 이후, 회원수 8배 및 시청량 1천배 증가
- 190개국 이상으로 서비스 확장
- 서비스 가동시간 99.99% 달성
- 7년간의 마이그레이션 시간의 많은 부분은 cloud native 방식으로 전환하는데 사용



Netflix Case Study

Innovations

- An innovative breakthrough of hardware accelerators for AI software
  - ex) Google alphaGo
- Global data centers can collect massive amount of data being generated all over the world.
  - Easier to train machine learning models.
- Analyzing customer data for personalized customer assistance
  - Movie recommendation
  - British House of Cards (제작비 1억불, 26 episodes)

Netflix Case Study

Agility

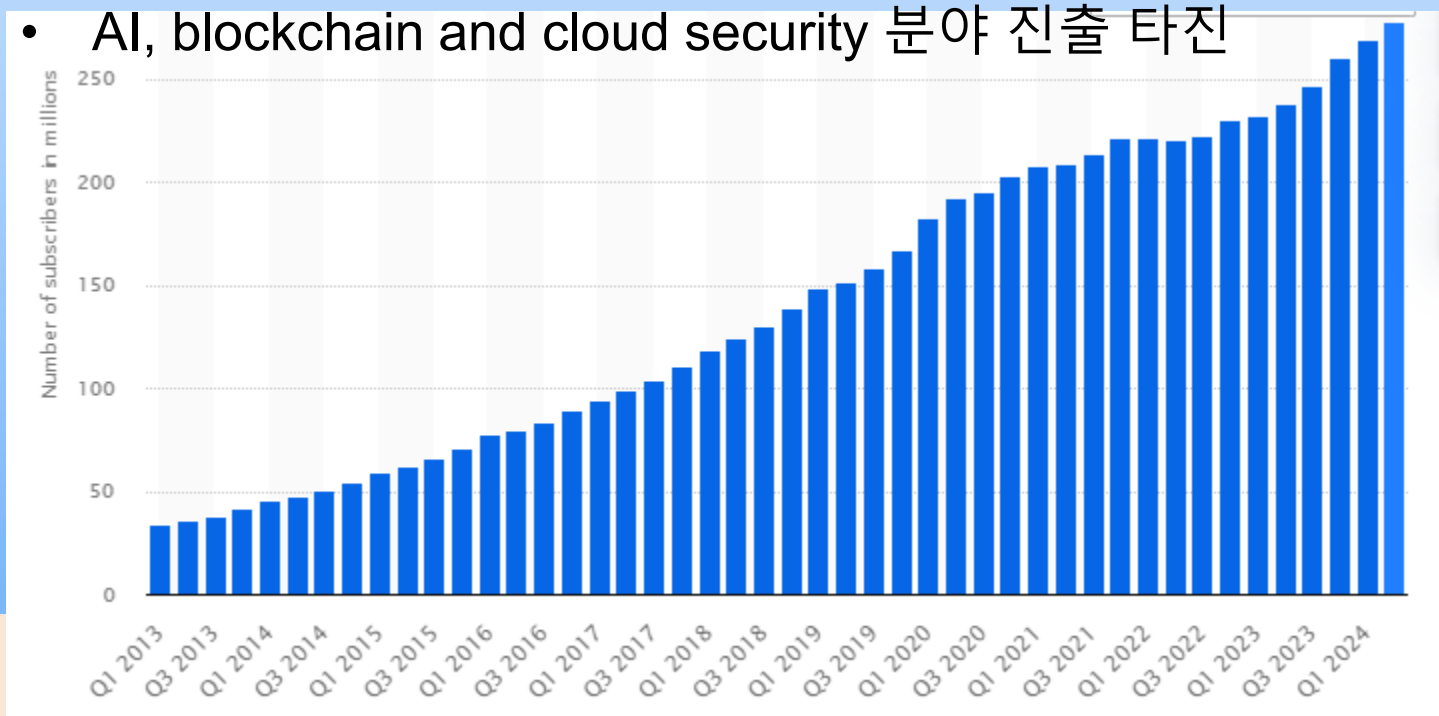
- Agility : the rapid provisioning of computing resources
- The Cloud can provide computer instances or storages in minutes.
  - Reduced time to develop, test and deploy software applications.
- Netflix는 개인화 서비스를 출시할 때 마다 시간 절감을 하였고, 최고 수준의 개인 추천 서비스를 제공

Netflix Case Study

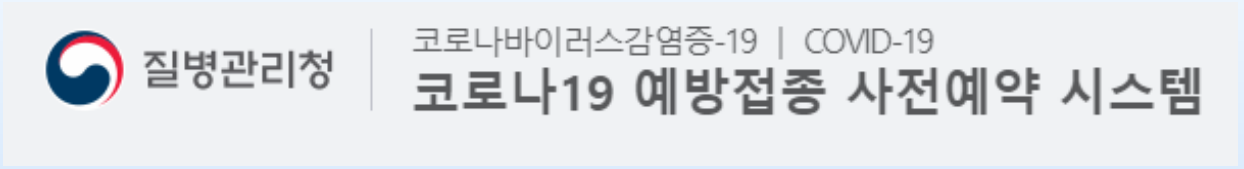
Scalability

- The user's needs must be met on matter what changes and the response time should not get longer.
  - 전세계로의 서비스 확장과 일정한 서비스 품질
  - 매일 1억 5,000만 시간의 콘텐츠를 소비하는 8,600만 고객

- AI, blockchain and cloud security 분야 진출 타진



질병관리청



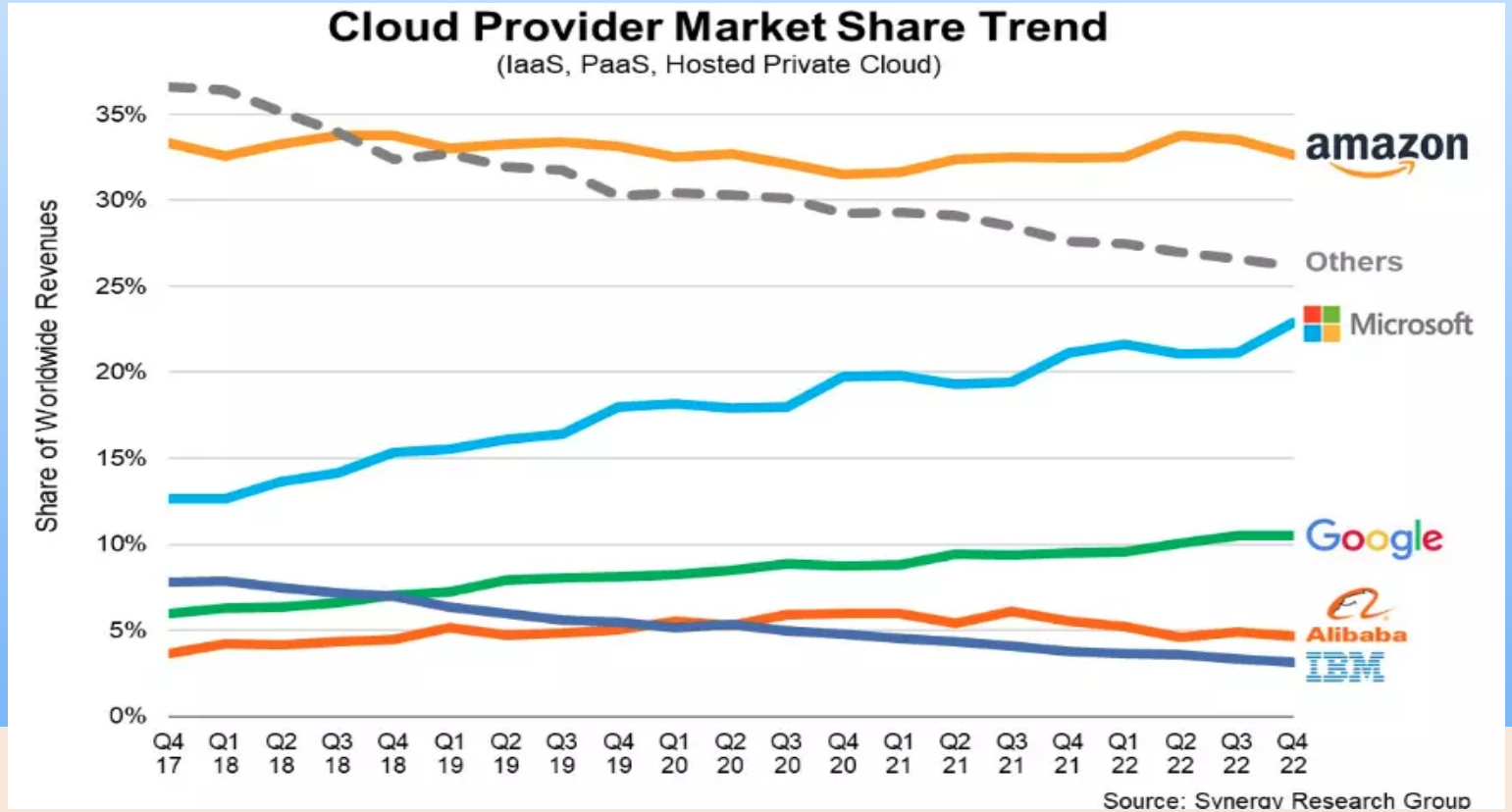
2주만에 백신예약 시스템의 가용성 문제 해결

- 한번에 30만명 접속 가능한 서버로 수백만명의 예약을 받으려고 함 (50대 352만명, 18~49세 1,770만명)
- 기존의 물리적 서버를 늘리는 방법으로는 확장에 2달 소요
- 결국은, 보안을 문제로 도입하지 않았던 민간 클라우드 도입

https://biz.chosun.com/it-science/ict/2021/08/22/ZYFZ5KLSDVCEJBYG4SPWSDKO5M/?utm_source=chosun.com&utm_medium=referral&utm_campaign=chosun-main

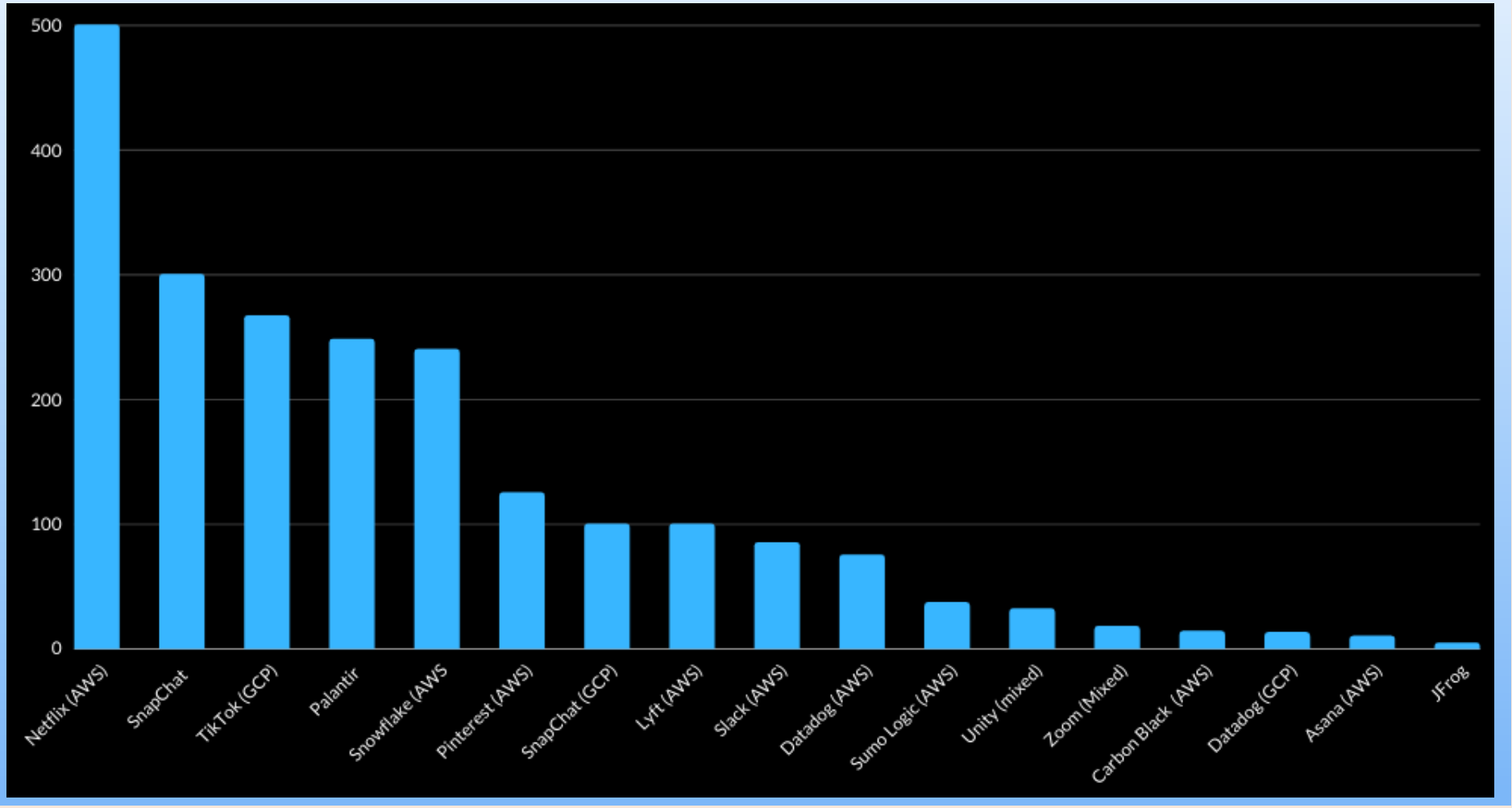
Cloud Service Providers' Market

- In Q2 2022, AWS commanded 34% of the cloud market, a 1% increase year-over-year. Azure is second with 21% of the market, followed by Google Cloud (10%), Alibaba (5%), and IBM (4%).
- Amazon's revenue from AWS grew from 5.62% in 2014 to 13.24% in 2021.
- The survey also showed the cloud market continues to grow 34% year-over-year.



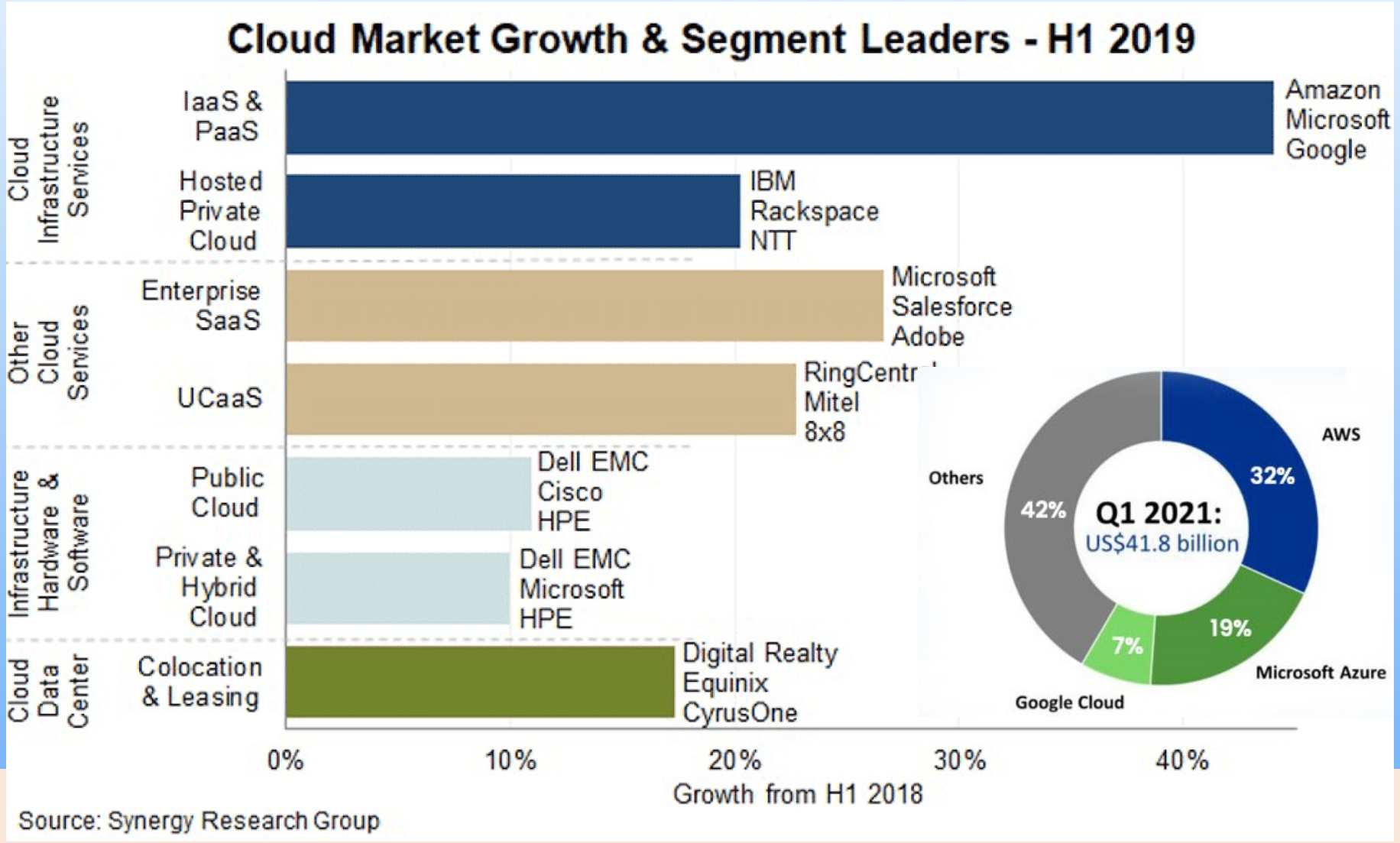
Annual Costs Spent by Cloud Customers

(unit : million US dollars)



(출처: 베스핀글로벌, 2020년9월)

The World of Business



The World of Business

- AWS maintains the highest market share at 32%, followed by Microsoft Azure (23%) and Google Cloud (10%), while Alibaba Cloud and Tencent Cloud are notable players in the Asia-Pacific market.

- AWS leads the IaaS sector, whereas PaaS and SaaS markets show significant growth with diverse key players and a combined market value projected in the billions.

- North America leading, rapid growth in Asia Pacific, and steady expansion in Europe, while security measures and emerging technologies like AI, ML, edge, and serverless computing are critical to future market evolution.

How Many Companies Use Cloud Computing?

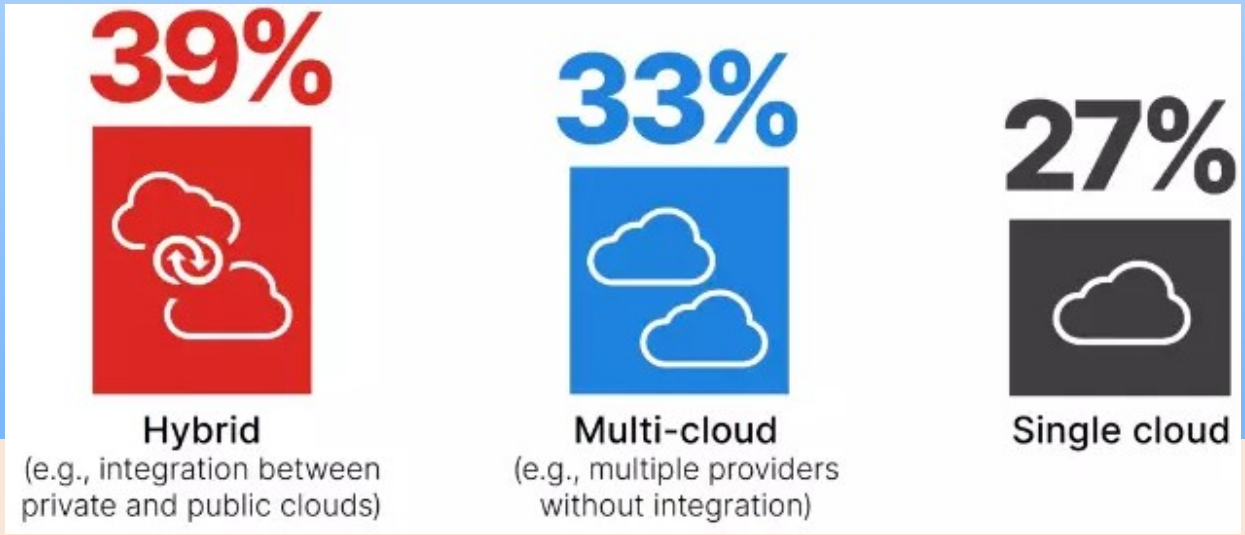
More than 90% of organizations use the cloud.

- About two-thirds of respondents currently operate in a public cloud and 45% use a private cloud — versus 55% who still rely on traditionally managed on-premises systems.
- 48% plan to migrate at least half of their applications to the cloud in the next year; 20% intend to move all their applications to the cloud.
- 47% are pursuing a cloud-first strategy; 30% are already cloud-native; 37% intend to be cloud-native in about three years.
- Only 5% plan on switching from the cloud to on-premises infrastructure (cloud repatriation).

Public Vs. Private Vs. Hybrid Vs. Multi-cloud

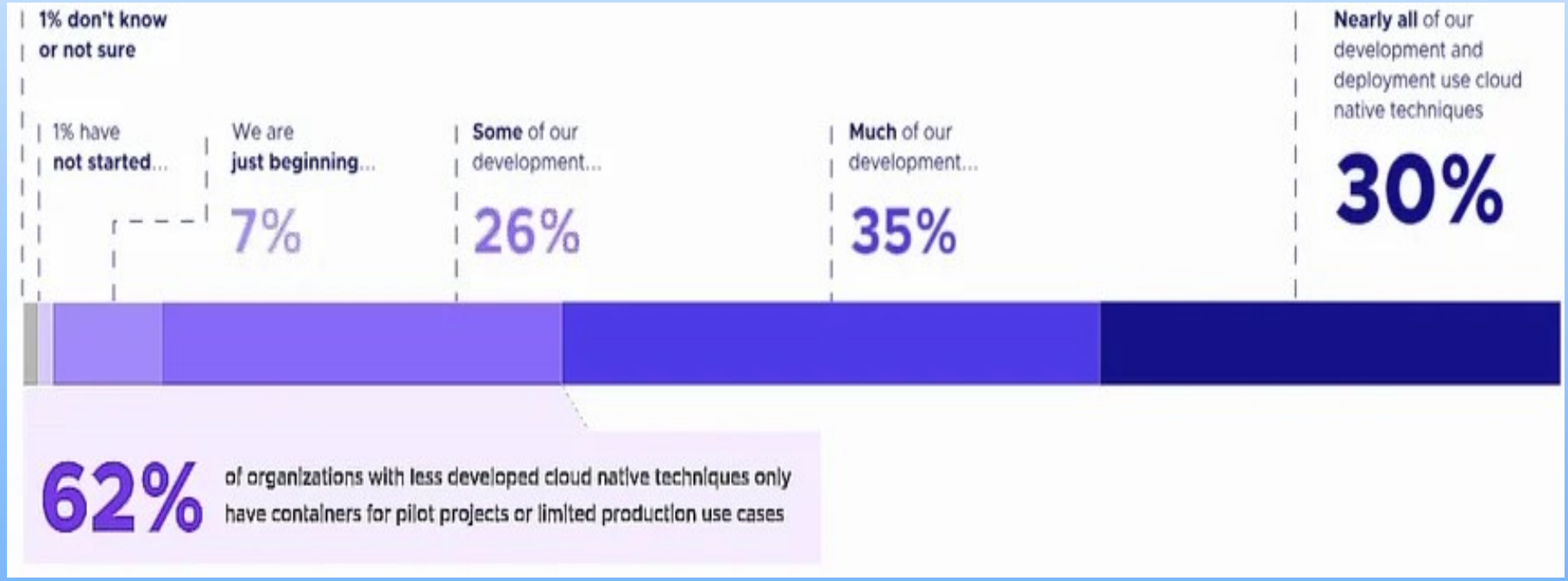
Organizations are using two or more clouds at the same time.

- Going hybrid or multi-cloud is not just about preventing vendor lock-in.
- Most organizations deploy a hybrid cloud (39% vs 36% last year) or a multi-cloud strategy (33%) to leverage multiple services, achieve scalability, or support business continuity.



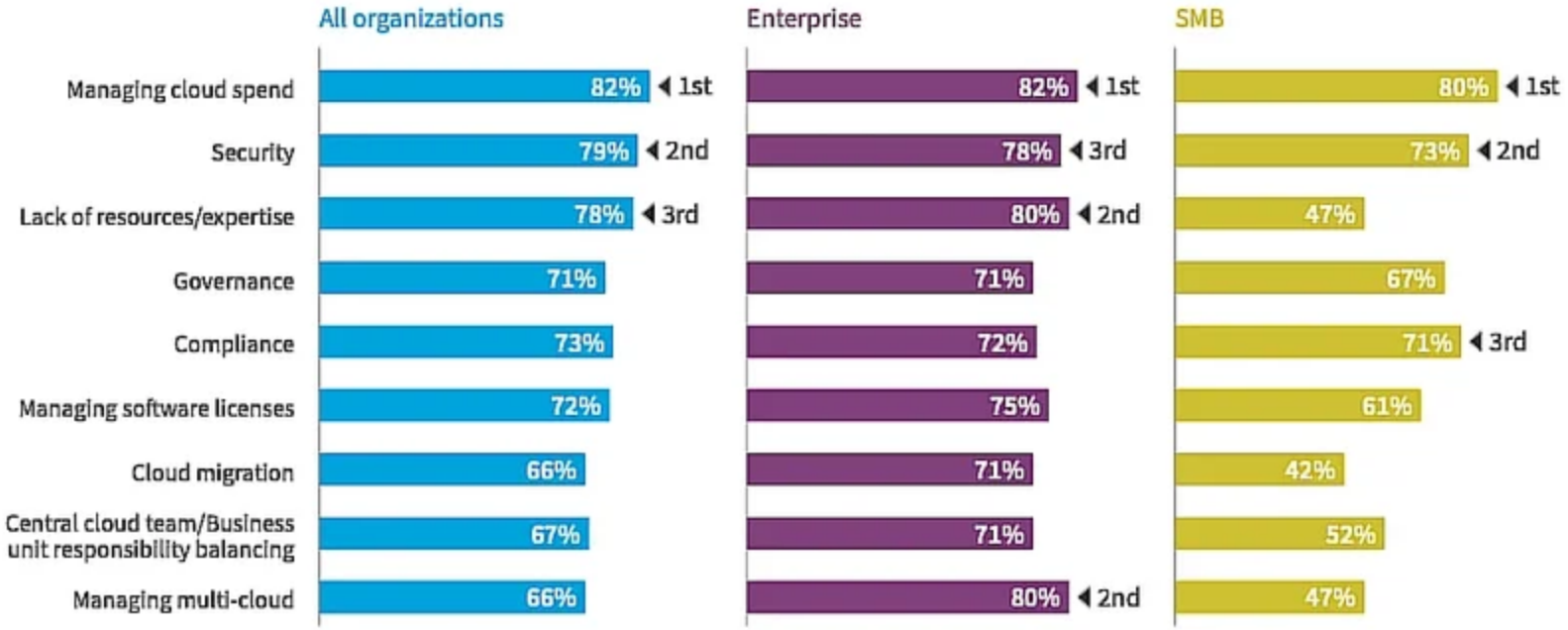
Cloud Native Computing

30% of tech companies are using cloud-native techniques for development, such as GitOps, containers, and rapid release cycles (CI/CD).



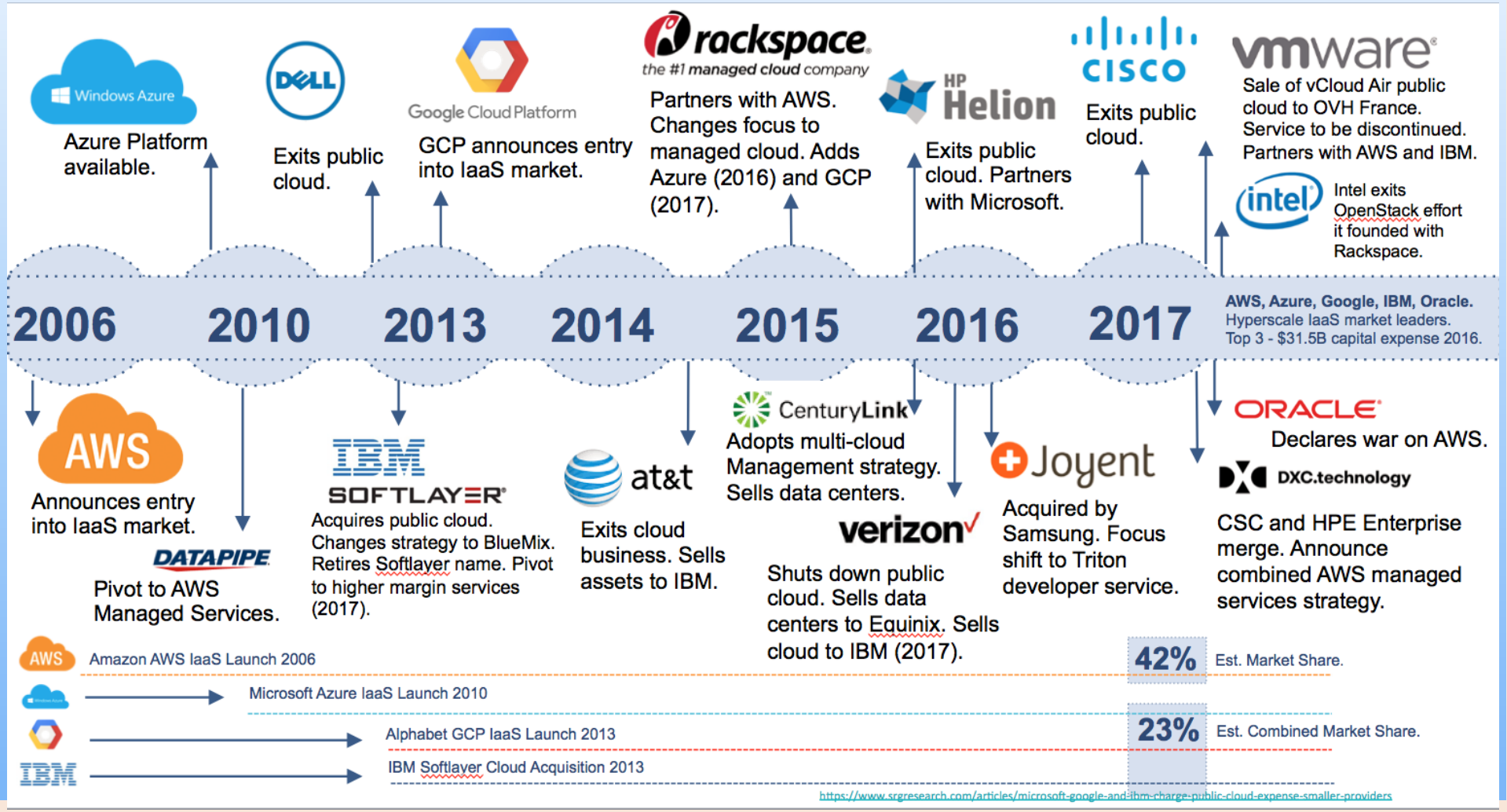
Top Cloud Challenges

Managing cloud costs and security were the main reasons



All organizations: N=750, Enterprise: N=627, SMB: N=123
Source: Flexera 2023 State of the Cloud Report

History


Windows Azure
Azure Platform available.
DELL
Exits public cloud.
Google Cloud Platform
GCP announces entry into IaaS market.
rackspace
the #1 managed cloud company
Partners with AWS. Changes focus to managed cloud. Adds Azure (2016) and GCP (2017).
HP Helion
Exits public cloud. Partners with Microsoft.
CISCO
Exits public cloud.
vmware
Sale of vCloud Air public cloud to OVH France. Service to be discontinued. Partners with AWS and IBM.
intel
Intel exits OpenStack effort it founded with Rackspace.
2006
2010
2013
2014
2015
2016
2017
AWS, Azure, Google, IBM, Oracle.
Hyperscale IaaS market leaders.
Top 3 - $31.5B capital expense 2016.
AWS
Announces entry into IaaS market.
DATAPIPE
Pivot to AWS Managed Services.
IBM SOFTLAYER
Acquires public cloud. Changes strategy to BlueMix. Retires Softlayer name. Pivot to higher margin services (2017).
at&t
Exits cloud business. Sells assets to IBM.
CenturyLink
Adopts multi-cloud Management strategy. Sells data centers.
verizon
Shuts down public cloud. Sells data centers to Equinix. Sells cloud to IBM (2017).
Joyent
Acquired by Samsung. Focus shift to Triton developer service.
ORACLE
Declares war on AWS.
DXC.technology
CSC and HPE Enterprise merge. Announce combined AWS managed services strategy.
AWS
Amazon AWS IaaS Launch 2006
Microsoft Azure IaaS Launch 2010
Alphabet GCP IaaS Launch 2013
IBM Softlayer Cloud Acquisition 2013
42%
Est. Market Share.
23%
Est. Combined Market Share.
https://www.srgresearch.com/articles/microsoft-google-and-ibm-charge-public-cloud-expense-smaller-providers

Lecture Goals

1. Understanding the fundamental concepts, engineering principles, and practical skills pertaining to the effective use of cloud computing

2. Experiencing the PaaS architecture (K-PaaS) & operation and cloud programming environment.

3. Application development on the K-PaaS and AWS platforms.

Agenda

1. Understanding Cloud Computing and Cloud Models (W1)
2. Cloud Native Architectures (W2)
3. Understanding Cloud Platforms(W3)
4. Docker & Kubernetes (W4-5)
5. Making the PaaS platform (W6-7)
6. Midterm Exam (W8)
7. Introduction to Node.js (W9)
8. Programming with Node.js (W10-11)
9. Programming on AWS and Naver Cloud (W12-14)
10. Final Exam (W15)

Grading Policy

Midterm Exam

40%

Final Exam

40%

Mini Project

20%.

Notes for this course

파스타 오픈랩 지원과정

- 참여대학 : 상명대, 건국대, 숭실대, 한국산업기술대, 한국폴리텍대, 이화여대, 광주대
  - https://zdnet.co.kr/view/?no=20210701143838
- K-PaaS 기반 서비스 개발 및 아이디어 공모전 참가 (2024년 3월 25일 ~ 10월 31일)
  - https://contest.k-paas.org/
- 오픈랩 지원 포털 운영
  - https://k-paas.or.kr/

Course Homes

- Github : https://github.com/K-PaaS/
  - lecture notes, lab guide, Q&A, mini-project guide, other information
- 학교 e-campus
  - 강의 자료 및 강의 정보

Notes for this course

2024년 공모전 참가 실적

- 12개 수상작 중 3개 부문 수상
- 총상금 500만원 수령

서비스 개발 아이디어 공모전 수상작 발표

서비스 개발 부문		
금상 (과학기술정보통신부장관상)	송이네 PaaS타	Plog
은상 (한국지능정보사회진흥원장상)	VOBO	딥러닝 기반 AI 보이스피싱 감지 및 예방 앱, VOBO
동상 (숭실대학교총장상)	CL-PaaS	누구쇼(NUGUSHOW)
동상 (OPA의장상)	울프	PRO MEMORIA(기억을 위하여) 인공지능을 활용한 치매 조기 진단 및 예방 서비스
특별상 (네이버클라우드상)	코딩메리호	TLE(Time Limit Exceeded) - LLM을 활용한 코딩 테스트 스터디 플랫폼
특별상 (엔에이치엔클라우드상)	5-stars	MSA 장애인 PT 플랫폼, PTFD
특별상 (케이티클라우드상)	펭귄구조대	클라우드 내 딥러닝 워크로드의 탄소 발자국 절감을 위한 그린 어카운팅 플랫폼
특별상 (CCCR이사장상)	클라우딩요	K-BarrierFree
특별상 (KAIT협회장상)	국방대전 구름지원단	Will-Be
특별상 (OPDC이사장상)	배프	관광약자를 위한 배리어프리 관광 정보 서비스 - 배프트립
아이디어 부문		
금상 (과학기술정보통신부장관상)	자르바다	국민모두의복지를위한플랫폼'모지'
은상 (한국지능정보사회진흥원장상)	소울메이트	마음나침반(Mind Compass)

Lecturer

이름 : 강상욱

- 연구실 : M327
- Artificial Intelligence & Multimedia Security Lab : R320
- Web Home : https://sm-aims-lab.github.io/home.html
- Email : sukang@smu.ac.kr

이름 : 김진

- 연구실 : M206
- Email : jinkim@smu.ac.kr