ĐIỆN TOÁN ĐÁM MÂY
(Cloud Computing)

PRACTICES
Practice 8 – Cloud Programming

Presenter: **Dr. Nguyen Dinh Long**
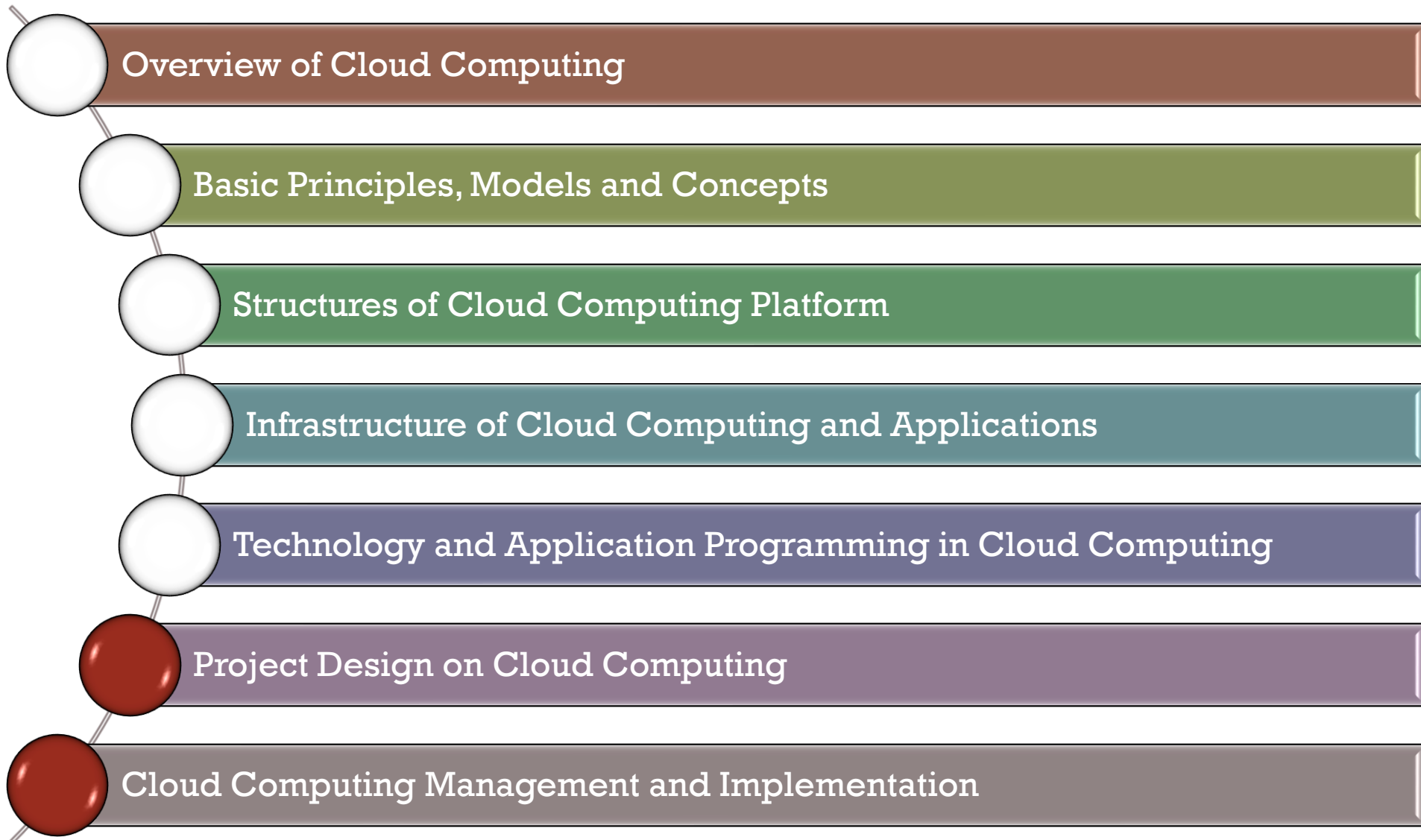
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Dec. 2022

Outline

- Overview of Cloud Computing
- Basic Principles, Models and Concepts
- Structures of Cloud Computing Platform
- Infrastructure of Cloud Computing and Applications
- Technology and Application Programming in Cloud Computing
- Project Design on Cloud Computing
- Cloud Computing Management and Implementation

References

Main:

- Thomas Erl, Zaigham Mahmood, and Ricardo Puttini. 2013. *Cloud Computing Concepts, Technology & Architecture*. Prentice Hall.

- Michael J. Kavis. 2014. *Architecting the Cloud: Design Decisions for Cloud Computing Service Models*. Wiley

- Arshdeep Bahga, and Vijay Madisetti. 2013. *Cloud Computing: A Hands-On Approach*. CreateSpace Independent Publishing Platform

More:

- Rajkuma Buyya, Jame Broberg and Andrzej Goscinski. 2011. *Cloud Computing –Principles and paradigms*, Wiley

- Nick Antonopoulos, and Lee Gillam. 2010. *Cloud Computing - Principles, Systems and Applications*, Springer-Verlag London Limited.

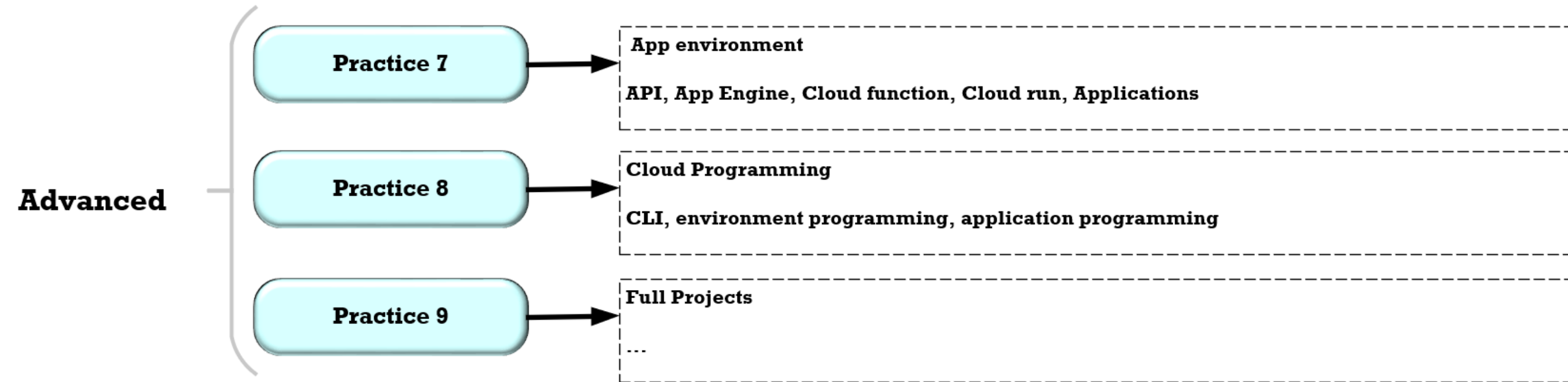- Slides here are modified from several sources in Universities and Internet.

Cloud Computing: Practices

Levels: Beginning (3 weeks) – Intermediate (3 weeks) – **Advanced (3 weeks)**

Groups: 9 with 5 person/group

Practice: submit a report for each group, submit to our Google Classroom

Cloud Computing: Practices

Advanced

Practice 7 →	**App environment** API, App Engine, Cloud function, Cloud run, Applications
Practice 8 →	**Cloud Programming** CLI, environment programming, application programming
Practice 9 →	**Full Projects** …

Content of Practice 8

1. Top Cloud programming

2. App Engine
3. Cloud Run
4. Cloud Functions

5. Standard vs Flexible environment: Choose an App environment

6. Applications

Programming Languages in Cloud Platform

*How do you choose the cloud programming language
that best suits your current and future needs?*

Google cloud does not have a specific programming language that it uses. This can be confusing for developers who are used to working with a specific language for their projects. It is important to be aware of this before starting development on a project using Google cloud.

Cloud Programming

❏ **CLOUD-BASED APPLICATION:**

▪ The cloud tech area has experienced enormous investment in the past decade. In 2018, the global cloud market size was estimated at $272 billion and it is projected to reach over $623 billion by the end of 2023.

A cloud-based app is an Internet-run program with components stored online with some (or all) processes executed in the cloud.
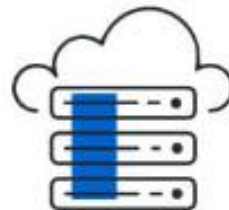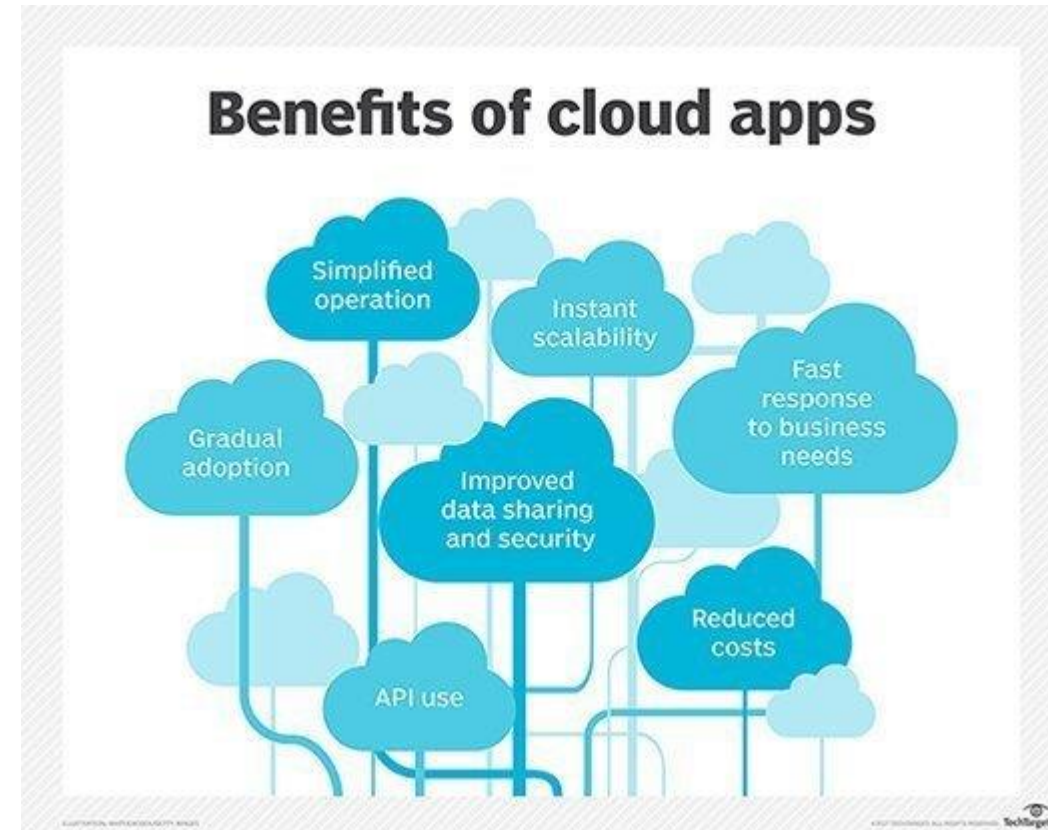
Smart
spending

Scalable
solution

User
research

Provider's
support

Benefits of cloud apps

Simplified operation

Instant scalability

Fast response to business needs

Gradual adoption

Improved data sharing and security

Reduced costs

API use

Cloud Programming

❏ **CLOUD-BASED APPLICATION:**

A cloud-based app is an Internet-run program with components stored online with some (or all) processes executed in the cloud.

MOST USED ENTERPRISE CLOUD APPS

|		
1 **Facebook** Social	6 **Google Docs** Productivity	11 **Salesforce** Customer relationship management/sales force automation
2 **Google Drive** Cloud storage	7 **YouTube** Consumer	12 **Cisco WebEx** Collaboration
3 **Google Gmail** Webmail	8 **LinkedIn** Social	13 **Evernote** Productivity
4 **Twitter** Social	9 **Dropbox** Cloud storage	14 **RingCentral** Telecom
5 **iCloud** Cloud storage	10 **Microsoft OneDrive** Cloud storage	15 **Okta** Security

Source: *Netskope Cloud Report* 2015

Cloud Programming
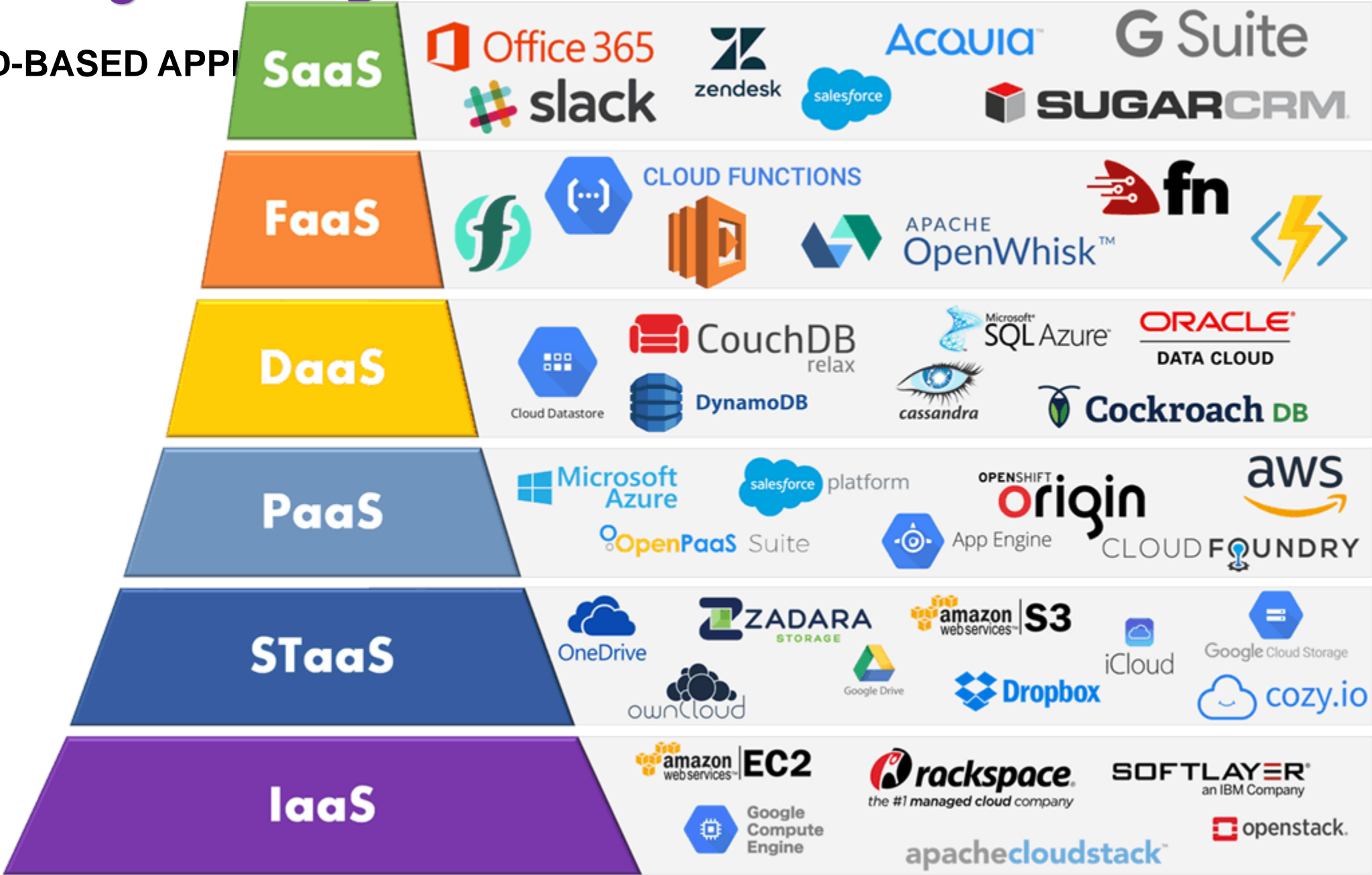
☐ **CLOUD-BASED APP**

Cloud Programming
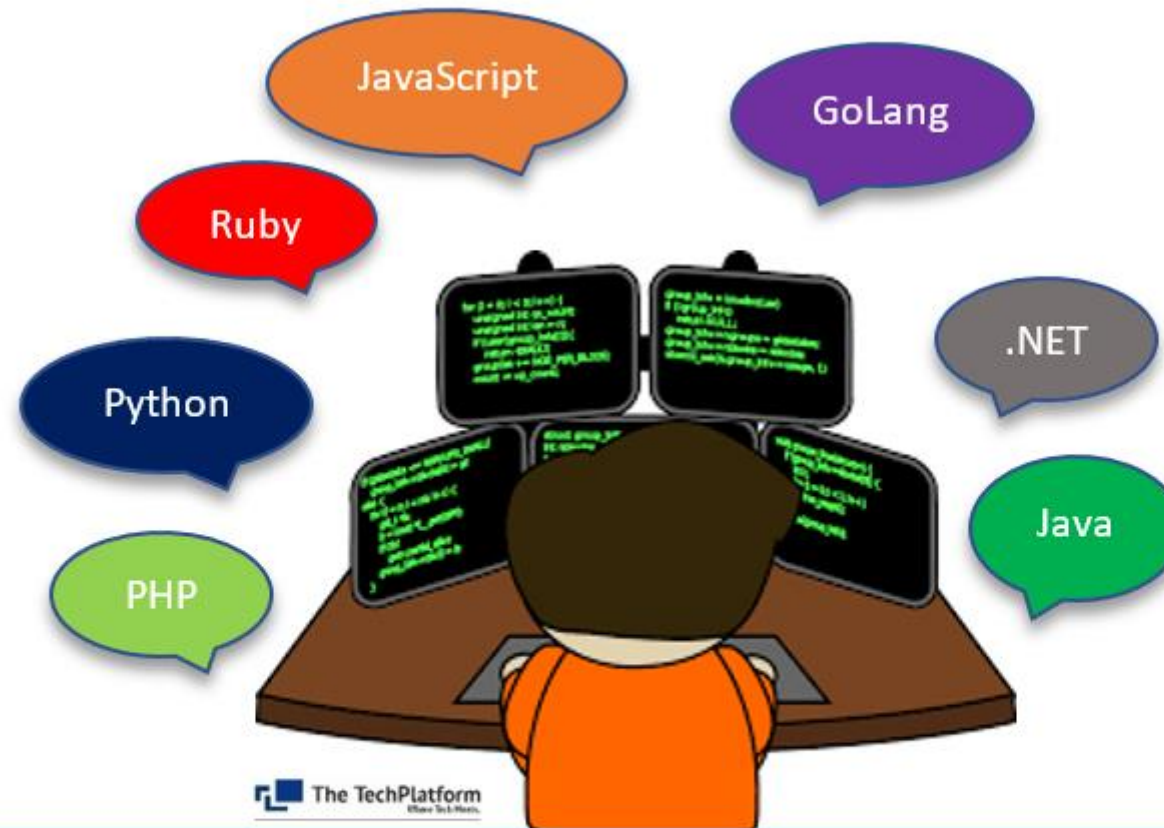
❑ **Cloud programming languages:**

Cloud Programming

❑ **Cloud programming languages:**

https://www.techtarget.com/searchcloudcomputing/tip/11-cloud-programming-languages-developers-need-to-know
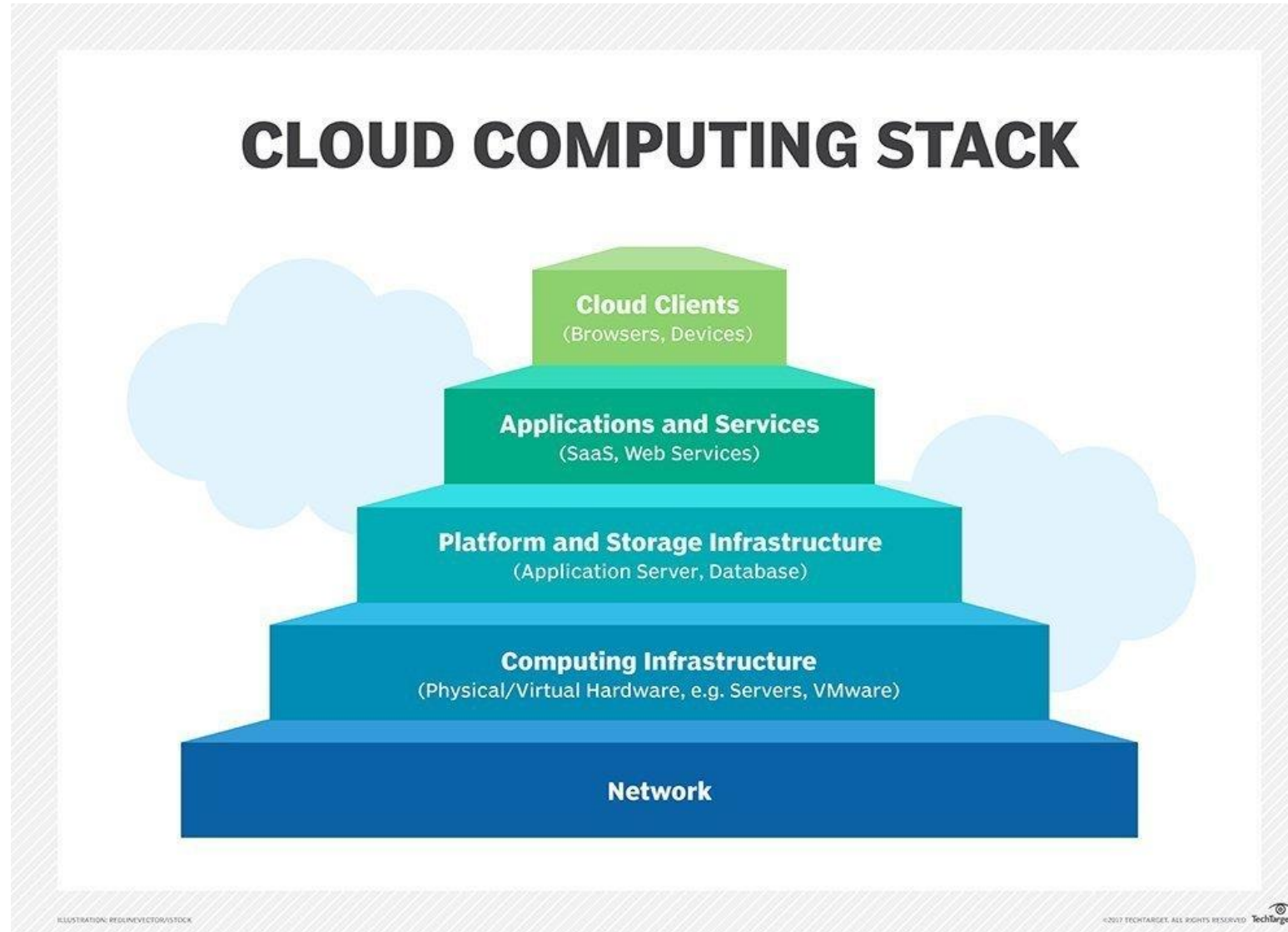
Cloud Programming

❑ **Common Cloud programming languages:**

Cloud computing programming takes many forms.

- For back-end developers, it might mean the development of a cloud-native app or the continuous delivery of an interconnected set of microservices.

- For administrators, it might mean the development of a script that automatically provisions cloud-based resources.

- For web developers, it might mean the development of an Angular or React app that consumes cloud-hosted resources.

To choose the best cloud programming language for your needs, carefully consider the selection criteria below. Explore the details of some popular programming languages and their use cases.

Organizations should take these four factors into account when choosing a cloud programming language:

- cloud clients and services

- targeted cloud stack layer
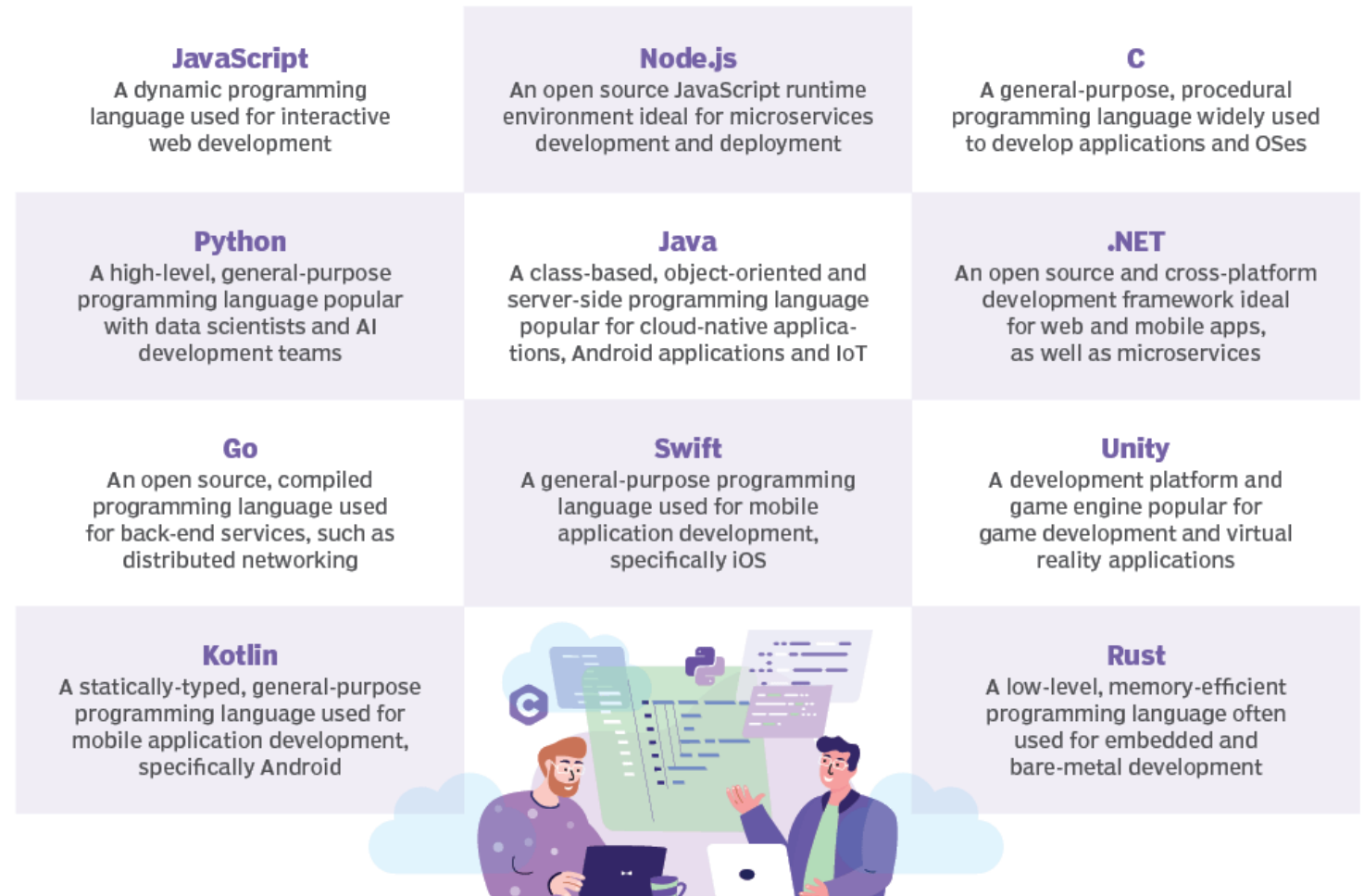
- familiarity

- risk averseness

13

Cloud Programming

❑ **Cloud programming languages:**

▪ Cloud clients and services: The first step to determine which programming language is right for you is to ask which types of clients you will create and which types of cloud-based services you will access.

▪ Targeted cloud stack layer: Another consideration is whether you need a general, all-purpose programming language that does a variety of things well, or one that targets a specific technology.

▪ Familiarity: IT and development teams don't always have to leave their comfort zone. Sometimes, it is best to tap into your existing knowledge of a given platform or framework. If you already have strong Java or .NET skills, for example, that is a compelling reason to choose Java or .NET.

▪ Risk averseness: Lastly, an organization must determine its comfort with risk. For example, Rust is a programming language that developers can use at almost every layer of the cloud stack. However, the Rust for Linux project has not yet integrated any code into an official kernel build, and software development kit (SDK) support from the predominant cloud vendors is not universal. If an enterprise wants to avoid risk, it is a better option to choose a more establish language.

14

Cloud Programming

❑ **Cloud programming languages:**
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Popular cloud programming languages and frameworks

JavaScript
A dynamic programming language used for interactive web development

Node.js
An open source JavaScript runtime environment ideal for microservices development and deployment

C
A general-purpose, procedural programming language widely used to develop applications and OSes

Python
A high-level, general-purpose programming language popular with data scientists and AI development teams

Java
A class-based, object-oriented and server-side programming language popular for cloud-native applications, Android applications and IoT

.NET
An open source and cross-platform development framework ideal for web and mobile apps, as well as microservices

Go
An open source, compiled programming language used for back-end services, such as distributed networking

Swift
A general-purpose programming language used for mobile application development, specifically iOS

Unity
A development platform and game engine popular for game development and virtual reality applications

Kotlin
A statically-typed, general-purpose programming language used for mobile application development, specifically Android

Rust
A low-level, memory-efficient programming language often used for embedded and bare-metal development

Cloud Programming

❑ **Cloud programming - JavaScript**

\+ For the development of rich, HTTP-based clients that need access to a swath of cloud services, such as Storage or secure authentication, client-side JavaScript is the best option.

\+ JavaScript can interact directly with managed cloud services, eliminated the need to implement a complex, RESTful middleware layer.

\+ Client-side JavaScript may be the only language they need. Every browser supports it, developers can render an application written in JavaScript on any laptop, phone, tablet, smart TV or desktop computer.

\- JavaScript does have its limitations, such as security. A web browser's basic username and password authentication mechanism is not as trusted and secure as the cryptographic key handshake required by a secure shell (SSH) connection.

\- Most organizations require access keys or SSH connections to provision cloud-based infrastructure programmatically.

\- Client-side JavaScript is a good fit for the consumption of cloud-based resources. For automation and resource provisioning, a server-side language is required.

Cloud Programming

❑ **Cloud programming - Java**

\+ Java has long been at the top of developers' lists because it is cross-platform and object-oriented. It is a reliable and practical language to create cloud-native microservices. Java frameworks have standardized and simplified the development of cloud-native apps.

\+ Java has been actively developed for so long that connectors and drivers exist for every server-side technology, such as a legacy database, mail server, document store or file-system driver. This makes Java the ideal choice to create applications that can glue together different parts of an enterprise architecture.

\- Other languages may be even better suited for a developer who wants to "get into the weeds of data science".

https://www.techtarget.com/searchcloudcomputing/tip/11-cloud-programming-languages-developers-need-to-know

Cloud Programming

❑ **Cloud programming - Java**

▪ Build, deploy, and monitor your Java-based apps

Google Cloud has the tools Java developers need to be successful building cloud-native applications. Leverage deep integrations with familiar tools like Spring, Maven, Kubernetes, and IntelliJ to get started quickly.

Libraries optimized for Java

Idiomatic libraries make writing Java apps for Google Cloud simple and intuitive. Libraries handle all the low-level details of communication with the server, including authenticating with Google so you can focus on your app.

Deep IDE integrations

Cloud Code helps you write, run, and debug cloud-native apps quickly and easily. Extensions to IDEs provide turnkey support for Java development on Google Cloud including specific tools for Kubernetes and Serverless app development.

Find, diagnose, and fix complex issues

Google Cloud's operations suite provides tracing, debugging, logging, monitoring, and error reporting. Gain insights into the health, performance, and availability of cloud-powered applications, enabling you to find and fix production issues faster.
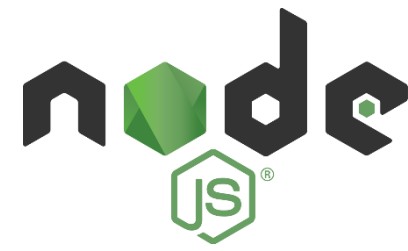
Spring framework support

Spring Cloud GCP provides comprehensive idiomatic integration for Spring Boot to quickly adopt managed services with Spring Data, and monitor your apps with Spring Cloud Sleuth and Micrometer.

Run workloads anywhere

Google Cloud lets you choose the best environment to run your Java applications, with options for serverless, Kubernetes, VMs, or custom hardware. Native image support also provides enhanced performance for your applications.

Maven artifact management

Artifact Registry is a hosted registry for container images and Maven artifacts. You can share and manage your container images and Java artifacts produced by Maven and Gradle with granular access controls, and repository-native IAM.

Cloud Programming

❑ **Cloud programming - Node.js**

\+ Node.js and the Node package manager (npm) turned JavaScript into a viable cloud programming language.

\+ Node.js is ideal for microservices development and deployment because npm provides a simple mechanism to add RESTful API support. Connectors to data-tier resources and utility libraries that simplify commonly performed tasks and functions.

\+ Node.js makes it possible for organizations to unify client-side and server-side cloud tasks under one umbrella.

\+ Node.js and its support for JavaScript is a good choice for organizations that want a single language that will work across many use cases.

\- Code that runs on a VM, like the Chrome engine, will never perform as well as close-to-the-metal languages such as Go, Rust or C. In situations where every megabyte of memory counts, you might find Node.js applications lack the required runtime optimization.

https://www.techtarget.com/searchcloudcomputing/tip/11-cloud-programming-languages-developers-need-to-know

Cloud Programming

❏ Cloud programming - Node.js

- Build, deploy, debug, and monitor Node.js applications

Google Cloud has the tools JavaScript developers need to successfully build cloud native applications. Build your apps quicker with SDKs, in-IDE assistance, and native runtime support on Cloud Run, Cloud Functions, and GKE. Google Cloud can run your application end-to-end.

Libraries optimized for Node.js

Idiomatic libraries make writing Node.js apps for Google Cloud simple and intuitive. Libraries handle all the low-level details of communication with the server, including authenticating with Google so you can focus on your app.

Deep IDE integrations

Cloud Code helps you write, run, and debug cloud-native apps quickly and easily. Extensions such as Visual Studio Code and IntelliJ provide support for Node.js and Typescript development including code completion, linting, and snippets.

Find, diagnose, and fix complex issues

Node.js on Google Cloud integrates with Cloud Monitoring, Cloud Trace, Cloud Logging, and Error Reporting, allowing you to transparently instrument live production applications to diagnose performance bottlenecks and software bugs.

Run workloads anywhere

Google Cloud lets you choose the best environment to run your Node.js applications, with options for serverless, Kubernetes, VMs, or custom hardware.

Universal artifact management

Artifact Registry integrates with CI/CD and Google Cloud runtimes to streamline your software delivery process. Manage the full artifact lifecycle with support for multiple repositories, granular access controls, repository-native IAM, and more.

Cloud Programming

❑ **Cloud programming - PHP**

▪ Build, debug, and monitor

Google Cloud has the tools PHP developers need to successfully build cloud-native applications. Build your apps quicker with SDKs and native runtime support on Cloud Run, App Engine, and GKE. Google Cloud can run your application from end to end.

Libraries built and optimized for PHP

Idiomatic libraries make writing PHP apps for Google Cloud simple and intuitive. Libraries handle all the low-level details of communication with the server, including authenticating with Google so you can focus on your app.

Find, diagnose, and fix complex issues

PHP on Google Cloud integrates with Cloud Monitoring, Cloud Logging, and Error Reporting, allowing you to transparently instrument live production applications to diagnose performance bottlenecks and software bugs.

Run workloads anywhere

Google Cloud lets you choose the best environment to run your PHP applications, with options for serverless, Kubernetes, VMs, or custom hardware.

Scalable Wordpress hosting

WordPress is a free and open source content management system and the world's largest self-hosted blogging tool. You can easily deploy WordPress on Google Cloud in a variety of ways, including Compute Engine, Containers, or App Engine.

Access fully managed MySQL, NoSQL, or PostgreSQL databases

Google Cloud provides flexible database hosting options. Set up and manage your relational PostgreSQL or MySQL databases with Cloud SQL or choose Cloud Bigtable, a NoSQL database service optimized for low-latency reads and high-throughput writes.

21

Cloud Programming

❑ **Cloud programming - Python**

+ Python is popular with developers because it supports imperative programming → functional programming, this approach enables developers to write simple, succinct functions that perform complex logic.

+ With Python, developers can quickly write scripts that provision infrastructure with vendor SDKs. When cloud platforms release new features, the Python SDK is prioritized for updates.

+ Python is a favorite language among data scientists and AI development. For organizations that use AWS AI services or Google's ML tools, it makes sense to use Python-based SDKs to interact with cloud-based services.

- Languages like R or Julia may be even better suited for a developer who wants to "get into the weeds of data science."

- Perhaps, Python is not familiar who work with C, C++, JavaScript for many years.

Cloud Programming

❏ **Cloud programming - Python**

▪ Build, deploy, and monitor

Google Cloud has the tools Python developers need to be successful building cloud-native applications. Build your apps quicker with SDKs and in-IDE assistance and then scale as big, or small, as you need on Cloud Run, GKE, or Anthos.

Libraries optimized for Python

Idiomatic libraries make writing Python apps for Google Cloud simple and intuitive. Libraries handle all the low-level details of communication with the server, including authenticating with Google so you can focus on your app.

Deep IDE integrations

Cloud Code helps you write, run, and debug cloud-native apps quickly and easily. Extensions to IDEs provide turnkey support for Python development including code completion, linting, and snippets.

Find, diagnose, and fix complex issues

Python on Google Cloud integrates with Cloud Monitoring, Cloud Trace, Cloud Logging, and Error Reporting, allowing you to transparently instrument live production applications to rapidly diagnose performance bottlenecks and software bugs.

Run workloads anywhere

Google Cloud lets you choose the best environment to run your Python applications, with options for serverless, Kubernetes, VMs, or custom hardware.

Managed JupyterLab notebooks

AI Platform Notebooks is a managed service that offers an integrated and secure JupyterLab environment for data scientists and machine learning developers to experiment, develop, and deploy models into production.

Cloud Programming

❑ **SaaS, Software as Service**

Examples: …

▪ This is the most widespread type of cloud app. Most of the cloud apps (including those that serve individuals) are SaaS. These apps are run on third-party hardware — not the users' device — and its software is also hosted remotely. The major benefit of SaaS usage is that customers don't have to spend money on expensive hardware or buy licenses for each software update

Cloud Programming
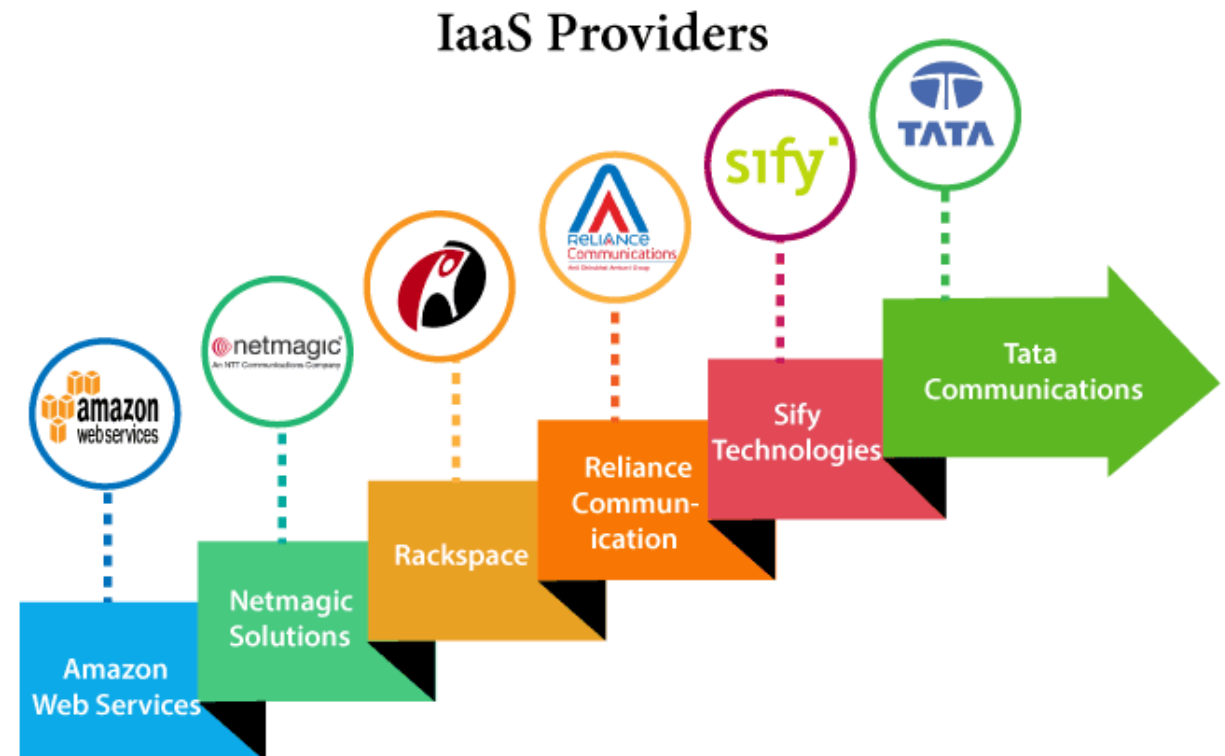
❏ **PaaS, Platform as a Service**

Examples: …

▪ This type of cloud-based application development typically requires only the application code from the customer's side. PaaS providers allow customers to use their hardware (including storage) and basic development software (ready-made solutions).

▪ Benefits — cost-efficiency and flexibility of a customer's product. There are also three cloud types: a private cloud (extremely secure, designed for internal use), a public cloud (for anybody on the internet), and a hybrid cloud.

Cloud Programming

❑ IaaS, Infrastructure as a Service

Examples: …

- This is a type of product that requires middleware and app support from the client's side. The IaaS owner provides their customer with a complex infrastructure and further support, and the customer has to create a custom programming bridge between the application and its operating system. The approach helps companies to build a customized product without developing their basic components from scratch.

IaaS Providers

Cloud Programming - Report

TASK I: Cloud Language Programming

https://cloud.google.com/python

https://cloud.google.com/php

https://cloud.google.com/java

Phân tích các ưu điểm của các Language programming:

- Java
- PHP
- Python

(lưu ý: bằng tiếng Việt!)

Cloud Programming - Report

TASK II: Cloud-based Applications

https://lanars.com/blog/cloud-based-applications-development#section-3

❑ **Phân loại các dạng cloud-based application bên dưới (bằng tiếng Việt!)**

▪ **SaaS: Software as Service**

▪ **FaaS: Functions as a Service**

▪ **DaaS: Database as a Service**

▪ **PaaS: Platform as a Service**

▪ **IaaS: Infrastructure as a Service**

Cloud Programming - Report

TASK III: Cloud-based Applications

https://lanars.com/blog/cloud-based-applications-development#section-3

❑ **Phân loại các applications thuộc dạng cloud-based nào (SaaS, PaaS, IaaS):**

AWS	Digital Ocean	Google App Engine
Google Drive	Microsoft Office (Office 365)	Dropbox
Hubspot	Google Applications (G Suite)	Google Compute Engine
Salesforce	Netflix	VMWare

Cloud Programming - Report

TASK VI: Getting started with App Engine & Python programming

https://codelabs.developers.google.com/codelabs/cloud-app-engine-python3#2

https://flask.palletsprojects.com/en/2.2.x/

☺ **How to deploy a simple Python web app written with the Flask web framework**

- Sử dụng account group-1 cho group-4 & group-5

- Sử dụng account group-2 cho group-6 & group-7

- Sử dụng account group-3 cho group-8 & group-9

Theo các bước hướng dẫn (link trên) thực hiện viết một ứng dụng Web-App

Tạo tên folder cho Chương trình Web-App: CC-practice08-group-# (# là số thứ tự nhóm)