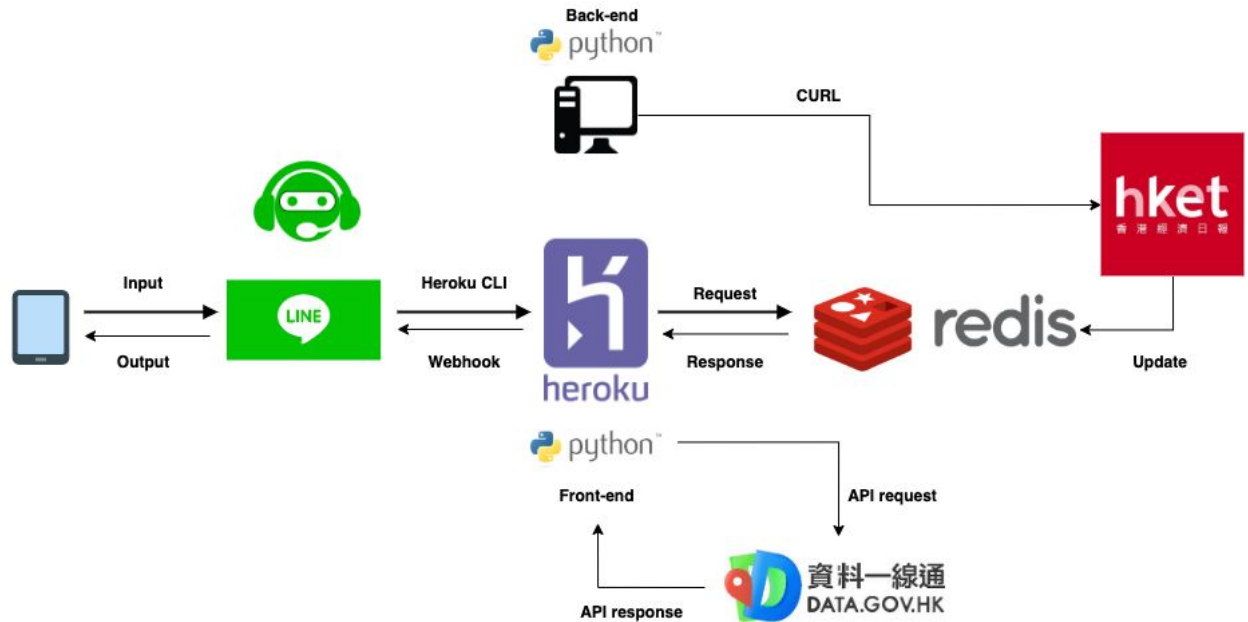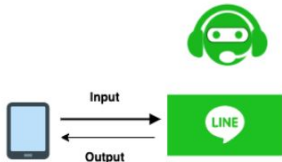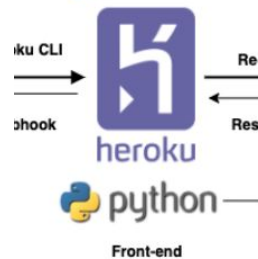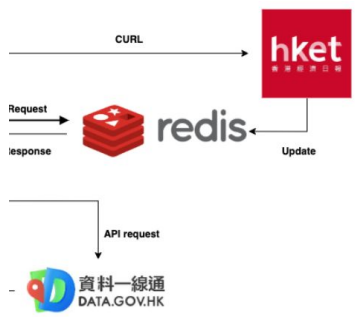1. How is your project architecture related to the theory taught in the lecture?

1.1) Project architecture

1.2) Three-tier Architecture

Tier	Part	The Use
1 - Presentation		This layer is the user interface that translates and results in the "information" that the user needs.
2 - Business Logic		This layer coordinates the application that handles logical decisions and processing commands. It also moves and processes data between tier 1 and tier 3.

3 - Data & Resource		This layer is to store data and retrieve or get updates from external sources by API. The data will be passed back to tier 2 for processing, and then displayed to the user with the processed information.

1.3) Client-Server Model
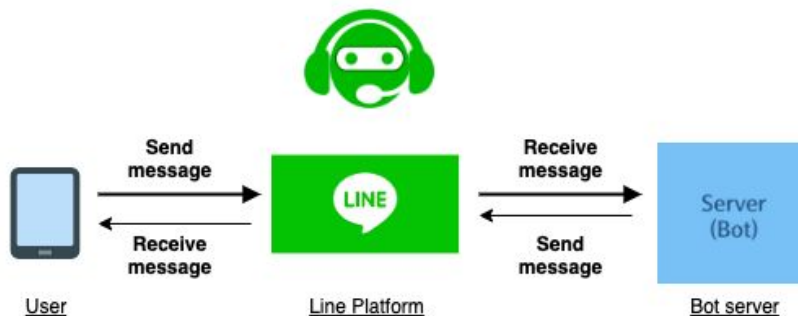
Role	The use
User	Send message via LINE APP
Line Platform	Transfer data/information between the user and bot server
Bot Server	Develop LINE Bot

User's messages can be transmitted to the Bot server through the LINE Platform. The Bot server is able to respond to the user through the LINE Platform actively.

The webhook part is set between the LINE Platform and the Bot server. Both sides can communicate with each other via webhook for different webhook events through the Messaging API.

2. **Can you demonstrate, with some screen cap, how to increase the capacity of your chatbot service?**

   Upgrade Heroku CPU, RAM, Auto Scalability, Dyno Linux container and relocate cloud server region to the closest data center

		PROFESSIONAL	
Free	**Hobby**	**Standard** 1X 2X	**Performance** M L
Ideal for experimenting with cloud applications in a limited sandbox.	Perfect for small scale personal projects and hobby apps.	Enhanced visibility, performance, and availability for powering your professional applications.	Superior performance when it's most critical for your super scale, high traffic apps.
CORE PLATFORM FEATURES	CORE PLATFORM FEATURES	ALL HOBBY FEATURES +	ALL STANDARD FEATURES +
SLEEPS AFTER 30 MINS OF INACTIVITY	NEVER SLEEPS	SIMPLE HORIZONTAL SCALABILITY	MIX WITH STANDARD 1X, 2X DYNOS
USES AN ACCOUNT-BASED POOL OF FREE DYNO HOURS	FREE SSL & AUTOMATED CERTIFICATE MANAGEMENT FOR CUSTOM DOMAINS	THRESHOLD ALERTS	DEDICATED
CUSTOM DOMAINS	APPLICATION METRICS	PREBOOT	AUTOSCALING
	MULTIPLE WORKERS FOR MORE POWERFUL APPS	LANGUAGE RUNTIME METRICS	2.5GB OR 14GB RAM
		512MB OR 1GB RAM	
512 MB RAM | 1 web/1 worker	512 MB RAM | 10 Process Types	∞ Process Types	
Free	**$7** per dyno/month _prorated to the second_	✓ **$25 - $500** per dyno/month _prorated to the second_	

- Upgrade number of dedicated database, memory size, and number of connection in Redis to increase capacity
- Use Multi-AZ replication. It will help to create the same standby in another AZ when you start an RDS and physical synchronous everything to the another AZ. It will automatically synchronize data to multiple az standby RDS instances,
- When doing DB patching, OS upgrading or hardware upgrade or deployment, it will start with standby first to increase master availability prevent RDS from downtime

ESSENTIALS
Low Throughput

HIGH AVAILABILITY

| No HA | Replication (optional) | Multi-AZ |

30MB	**100MB**	**250MB**	**500MB**
1 Database	4 Databases	8 Databases	12 Databases
Free	$7/mo	$18/mo	$36/mo

Cloud Essentials

250MB
8 Databases
$18/mo

SIGN UP FOR THIS PLAN

Memory size	250 MB
Replication	✓
Auto-failover	✓
Data persistence to EBS	✓
Daily and instant backups	✓
Dedicated databases	8
Connections	256
Security Groups / Source IP auth. rules	1/4
24/7 toll-free support hotline	✓

Availability – Read and Write – Multi-AZ
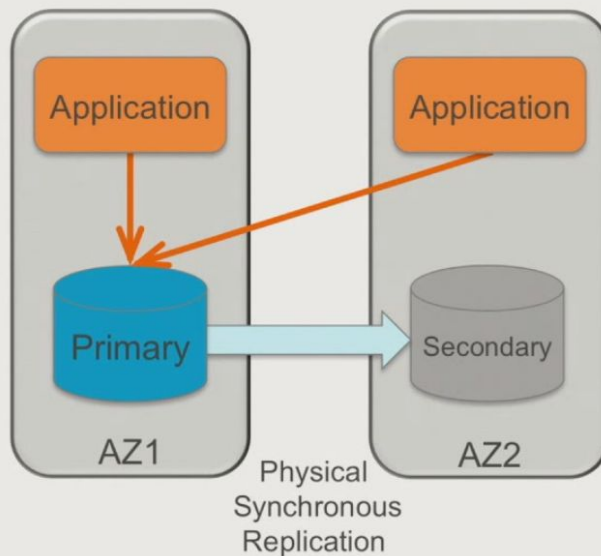
2.4) Coding enhancement - Memory Cache
- FIFO（First In, First Out）

- *LFU（Least Frequently Used*
- *LRU（Least Recently Used）*
- *NMRU（Not Most Recently Used)*

3. **Can you identify if your bot is one of the examples of PaaS, IaaS, SaaS? Explain your answer.**

SaaS:
As an end-user perspective, our Line Chatbot will be SaaS platform type as SaaS uses the internet to provide the services to end-user and run via a web browser, so no downloads or installations will be needed on the client's side. The chatbot application owner will handle all possible technological issues, including data, middleware, servers, and storage, the end-user only need to enjoy the services. The end users may obtain details such as the supply of medical disposable face masks, the number of covid-19 cases in HK and safety tips from the chatbot. For example Google Search, Google Translate, Salesforces, Dropbox

PaaS:
As Line chatbot owner perspective. our Line Chatbot will be a PaaS platform type, as PaaS offers a platform for developers to build on and use in creating custom applications. All servers, storage, and networking are handled by the cloud service provider, while the chatbot owner will retain application and data governance. As our Line Chatbot is using the Heroku cloud application platform and Redis as a database, it enables millions of requests per second for real-time applications. The server management can be omitted, and most of the effort can be placed on the chatbot application optimization and refinement. For example Google App Engine, Heroku

IaaS:
For both end-user or chatbot owners' perspective, it will not be the IaaS platform type, as the IaaS, the user needs to manage and configure most of the infrastructure, from the operating system, infrastructure to the specification of virtual machine computing resources. For example setting up a cloud server instance in AWS, Microsoft Azure, Alicloud, Huawei cloud.