DISTRIBUTED SYSTEMS: COMPUTING ARTEFACT

Version 1.0
BSc(Hons) Computing for Games
COMP260

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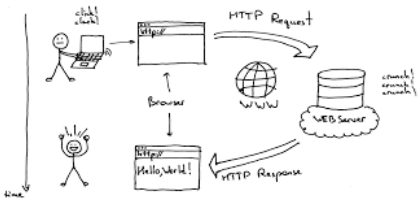

"Essentially everyone, when they first build a distributed application, makes the following eight assumptions:

The network is reliable;

Latency is zero;

Bandwidth is infinite;

The network is secure;

Topology doesn't change;

There is one administrator;

Transport cost is zero;

The network is homogeneous.

All prove to be false in the long run and all cause big trouble and painful learning experiences."

— Peter Deutsch

Introduction

This assignment is in two parts (Parts I & Part II) and should provide material for the Technical Report assignment. Part I is concerned with building a turn-based game that can be remotely hosted on a Digital Ocean droplet whilst Part II is concerned with building a real-time game using appropriate middleware to handle object replication across nodes. For both parts of the assignment, you have a free choice of technology stacks, though the module will concentrate on Python, C# and Unity.

Part I Turn-based Service Provision

This part of the assignment is concerned with designing, implementing and hosting a simple turn-based game on a remotely hosted server using Digital Ocean as a service provider. By *turn-based*, we are referring to a class of games where players take it in turns to play, like board games, card games and classical multi-user dungeons.

To complete this part of the assignment:

(A) Use UML to **Analyse** existing turn-based client/server applications to determine how clients and servers work together to create a network-based service.

(B) Use UML to **Design** an architecture that will support your game of choice using an appropriate application technology stack.

(C) **Implement** your application and **host** your server on a Digital Ocean droplet.

Part A

Use UML to Analyse existing turn-based client/server applications

To complete this part of the assignment, we will have in-class sessions that use UML to analyse the structure, function and data communications of several client/server applications.

You will receive **informal feedback** from your **tutor** during the tutorial sessions and you will receive **formal feedback** from your **tutor** three weeks after the final submission deadline.

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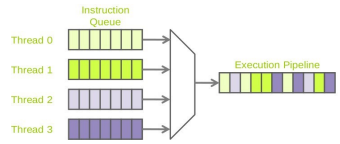

Multi-threading is commonly used to improve performance in games.

A computer lets you make more mistakes faster than any invention in human history - with the possible exceptions of handguns and tequila.

-Mitch Ratcliffe

Part B

Use UML to Design an architecture that will support your game service

To complete this part of the assignment, create an appropriate set of UML documentation that captures the structure, function and data communications aspects of the service that you wish to create.

You will receive **informal feedback** from your **tutor** during the tutorial sessions and you will receive **formal feedback** from your **tutor** three weeks after the final submission deadline.

Part C

Implement your application and host your server on a Digital Ocean droplet

To complete this part of the assignment, implement your client/server solution using an appropriate technology stack and host it on a provided Digital Ocean droplet.

Care should be taken to remember that the Digital Ocean droplet may not have exactly the same functionality as your development Windows machine, so some consideration should be given to how you will undertake development and testing.

You will receive **informal feedback** from your **tutor** during the tutorial sessions and you will receive **formal feedback** from your **tutor** three weeks after the final submission deadline.

Part II DevOps - Deployment

This part of the assignment focuses on identifying and integrating the most appropriate techniques for deploying your server to the cloud. The Platform as a Service (PaaS) approach to server deployment is fast becoming the most common and quickest way create and maintain distributed systems.

To complete this part of the assignment:

(A) Build an image of your server
(B) Push the image to a registry of your choice
(C) Deploy the server by pulling it from the registry. Evidence the process by recording a video.

Part A

Create a Dockerfile.

Using YAML, define an image for your server ensuring that the correct ports are accessible.

Part B

Push the image to a registry

Identify your preferred registry. This could be one hosted by a third-party or one that you spin yourself on a cloud service like Azure. Authenticate using the Docker CLI and push your container to the registry.

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Part C

Pull from the registry to your desired server and run the image as a container. Evidence the functionality by recording a video

To complete, the second assignment, pull the image from your chosen registry and then run it on your desired host. Update the initial client experiments from assignment one to use the new remote server. Record a short video that evidences the remote server functioning as it should and include some explanation/justification for how you approached the task.

Additional Guidance

Creating reliable client/server services sounds like a big task that is both hard and complex. In reality it is actually comprised of several hard and complex tasks that are fairly small, and we will discover that by breaking large tasks down into smaller tasks they become soluble.

A common pitfall is poor planning or time management. Often, students underestimate how much work is involved in first learning programming concepts and then actually applying them. Programming is quite unlike other subjects in that it cannot be crammed into a last-minute deluge just before a deadline. It is, therefore, very important that you begin work early and sustain a consistent pace: little and often. The live deployment in this assignment, is an added dimension. Aim to complete your client and server a week early so you have sufficient time to troubleshoot your Digital Ocean instance, your server stability, and the network protocols you are using.

Part I Turn-based Service Provision

The Digital Ocean droplet provides a *headerless* server which can only be accessed remotely. This can make development and debugging difficult. In addition, cross-platform languages (C# & Python) may not be as compatible across different operating systems as we would expect. A common solution to these issues is to develop in Linux, either on a standalone box or a virtual machine running on a Windows host.

Material on UNIX-based servers and commands will not be formally covered again. Here is a resource to remind yourself: http://mally.stanford.edu/~sr/computing/basic-unix.html

Part II Real-time gaming provision

FAQ

- **What is the deadline for this assignment?**
  Falmouth University policy states that deadlines must only be specified on the MyFalmouth system.

- **What should I do to seek help?**

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	You can email your tutor for informal clarifications.

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Marking Rubric – Part I: Turn-based Service Provision

Learning Outcome Name	Learning Outcome Description	Criteria	Weighting	Refer for Resubmission	Adequate	Competent	Very Good	Excellent	Outstanding
Architect & Research	Integrate appropriate data structures and interoperating components into computing systems, with reference to their merits and flaws.	Analysis	20%	No analysis presented	Some analysis of client & server components Incomplete class hierarchy, state model and/or data communications models	Competent analysis of client & server components Fairly complete class hierarchy, state model and/or data communications models with only small aspects missing / wrong	Good analysis of client & server components Complete class hierarchy, state model and/or data communications models	Excellent analysis of client & server components Complete class hierarchy, state model and/or data communications models Some consideration of issues in source materials	Outstanding analysis of client & server components Complete class hierarchy, state model and/or data communications models Significant consideration of issues in source materials and solutions presented
		Design	30%	No design presented	Some design of planned client & server components Incomplete class hierarchy, state model and/or data communications models	Competent design of planned client & server components Fairly complete class hierarchy, state model and/or data communications models with only small aspects missing / wrong	Good design of planned client & server components Complete class hierarchy, state model and/or data communications models Implementation appears possible from design specs	Excellent design of planned client & server components Complete class hierarchy, state model and/or data communications models. Implementation appears straightforward from design specs	Outstanding design of planned client & server components Complete class hierarchy, state model and/or data communications models Implementation appears simple from design specs
		Remote Hosting	50%	No working software presented	Client & server only work locally	Client & server work faultlessly locally Client & server work sporadically remotely	Client & server work faultlessly locally Client & server work fairly well remotely	Client & server work faultlessly locally Client & server work faultlessly remotely	Client & server work faultlessly locally Client & server work faultlessly remotely Working support for sharding

Marking Rubric – Part 2: DevOps PaaS

Learning Outcome Name	Learning Outcome Description	Criteria	Weighting	Refer for Resubmission	Adequate	Competent	Very Good	Excellent	Outstanding
Architect & Research	Integrate appropriate data structures and interoperating components into computing systems, with reference to their merits and flaws.	Analysis	20%	No justification for approach to PaaS	Some justification for approach	Competent Justification of approach	Very Good justification of approach	Excellent justification of approach	Outstanding justification of approach
		Design	30%	No design presented	Some design of planned client & server components Incomplete class hierarchy, state model and/or data communications models	Competent design of planned client & server components Fairly complete class hierarchy, state model and/or data communications models with only small aspects missing / wrong	Good design of planned client & server components Complete class hierarchy, state model and/or data communications models Implementation appears possible from design specs	Excellent design of planned client & server components Complete class hierarchy, state model and/or data communications models. Implementation appears straightforward from design specs	Outstanding design of planned client & server components Complete class hierarchy, state model and/or data communications models Implementation appears simple from design specs
		Final Design	50%	No working software presented	The server is functional but with issues and without the use of containers	The server is functional and a docker image is present	The server works well and containers have been deployed to registry	Remote server works well and containers have been deployed to registry. There is consideration for scaling and load balancing	Remote server works well and containers have been deployed to registry. Docker compose has been utilised for ensuring that multiple instances are available. Load balancing is working well