ASSIGNMENT COVER PAGE

Programme	Course Code and Title
UCSEW - BACHELOR OF COMPUTER SCIENCE (HONS) / UCNT - BACHELOR OF COMPUTER SCIENCE (HONS) IN COMPUTER AND NETWORK TECHNOLOGY	CAT3053/N Distributed Computing

Student's name / student's id	Lecturer's name
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Date issued	Submission Deadline	Indicative Weighting
Week 3 – 13/02/2023	Week 7 – 17/03/2023	30%

Assignment [1] title	Programming & Report Writing

This *assessment* assesses the following course learning outcomes

# as in Course Guide	UOWM KDU Penang University College Learning Outcome
CLO1	Explain the concepts of foundations of distributed computing, distributed algorithms, middleware, infrastructure, and shared data. (C2, PLO1)

# as in Course Guide	University of Lincoln Learning Outcome
	N/A

Student's declaration

I certify that the work submitted for this assignment is my own and research sources are fully acknowledged.

Student's signature: *Zhe Yuan*

Submission Date: **17/3/2023**

TurnItIn Similarity Report

Asgn1

ORIGINALITY REPORT

3%	0%	0%	3%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

| 1 | Submitted to New Zealand School of Education
Student Paper | 3% |
|---|---|---|

Exclude quotes	Off	Exclude matches	Off
Exclude bibliography	On		

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Main Report
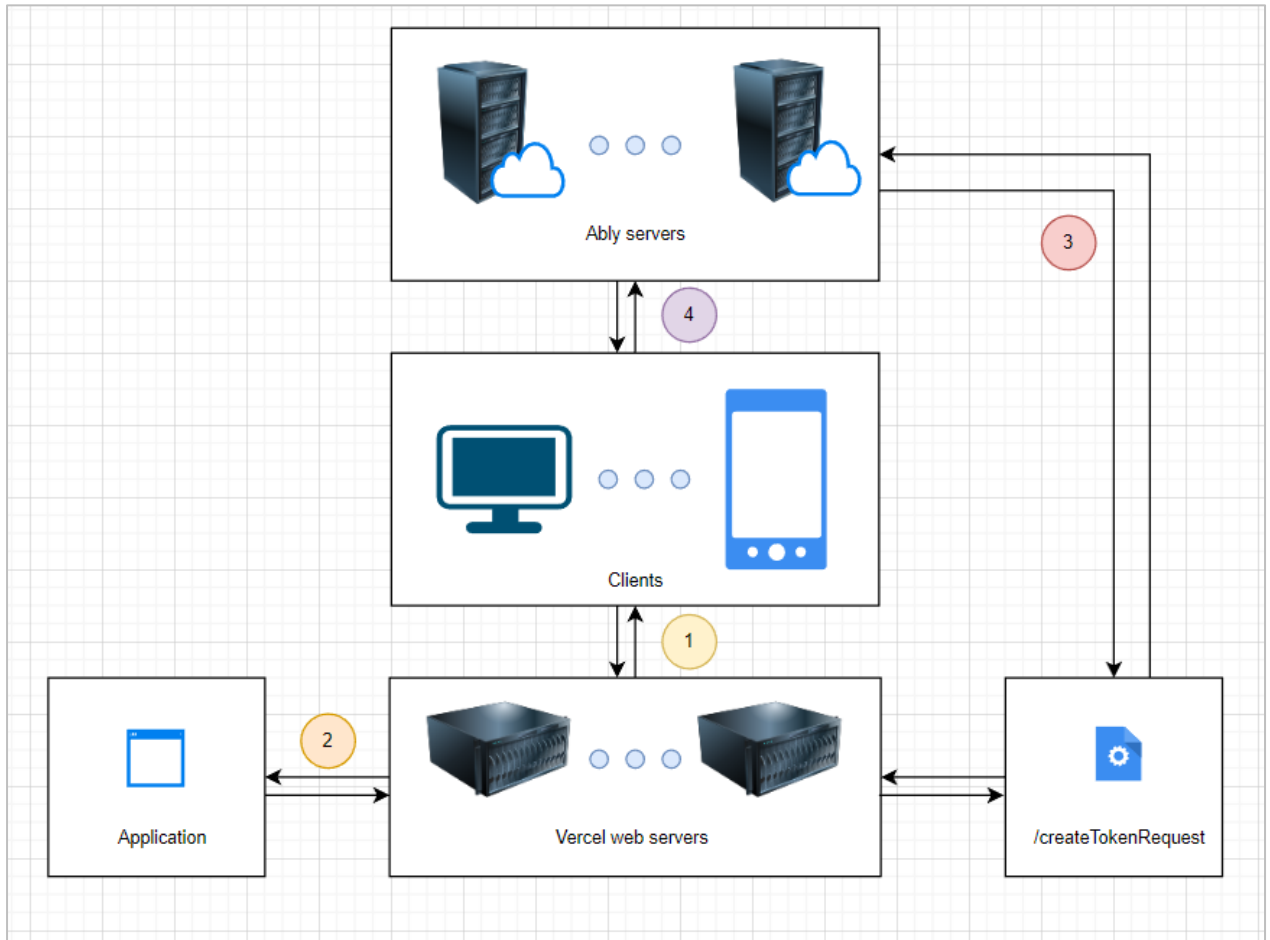
- **Chat system network architecture**

Figure 1: Chat system network architecture

Based on the network diagram above, the developed chat system comprises of clients, Vercel web servers, and Ably servers. Ably had been chosen as the system's real-time communication framework because it offers a free plan for normal users, delivers data at the lowest possible latency across the world (Ably, 2023), and works well with Vercel-hosted system components (Vercel, 2023). System components such as the actual application and Ably token request processes need to be hosted with Vercel to make them accessible online without being constrained to any devices and enable internetworking between different network nodes. In terms of redundancy, Vercel and Ably servers are automatically replicated to maximize the availability of their services (Vercel, 2023; Ably, 2023).

Clients and servers undergo a few processes to establish end-to-end communication between clients. The following descriptions illustrate and elaborate about the steps that were labelled in **Figure 1**:

1. Firstly, the client visits the URL of the hosted chat system on Vercel. The URL is autogenerated when the system is initially hosted and points to the resource location in Vercel web servers.
2. After loading the application, the application uses token authentication and requests for a server token from the **/createTokenRequest** process. Token authentication is an authentication method where tokens are issued to clients with a configured set of permissions

for a limited period of time. It abstracts out the API credentials and prevent them from being compromised easily (Ably, 2023).

3. The **/createTokenRequest** process sends a token request to the Ably servers on behalf of the clients. Once a token is received from the server, the token is passed back to the client.

4. The client uses the token received from the **/createTokenRequest** process to connect to the servers. Clients can now directly communicate with Ably servers within the time constrained imposed by the token.

The Ably API ensures that clients remain connected to Ably servers by automatically requesting a new token before the previous one expires, preventing authentication failures from being thrown to the client (Ably, 2023). When Ably servers are down and connection cannot be established, clients do not need to take any action as well because Ably's API will automatically retry the connection at every 15-second interval (Ably, 2023).
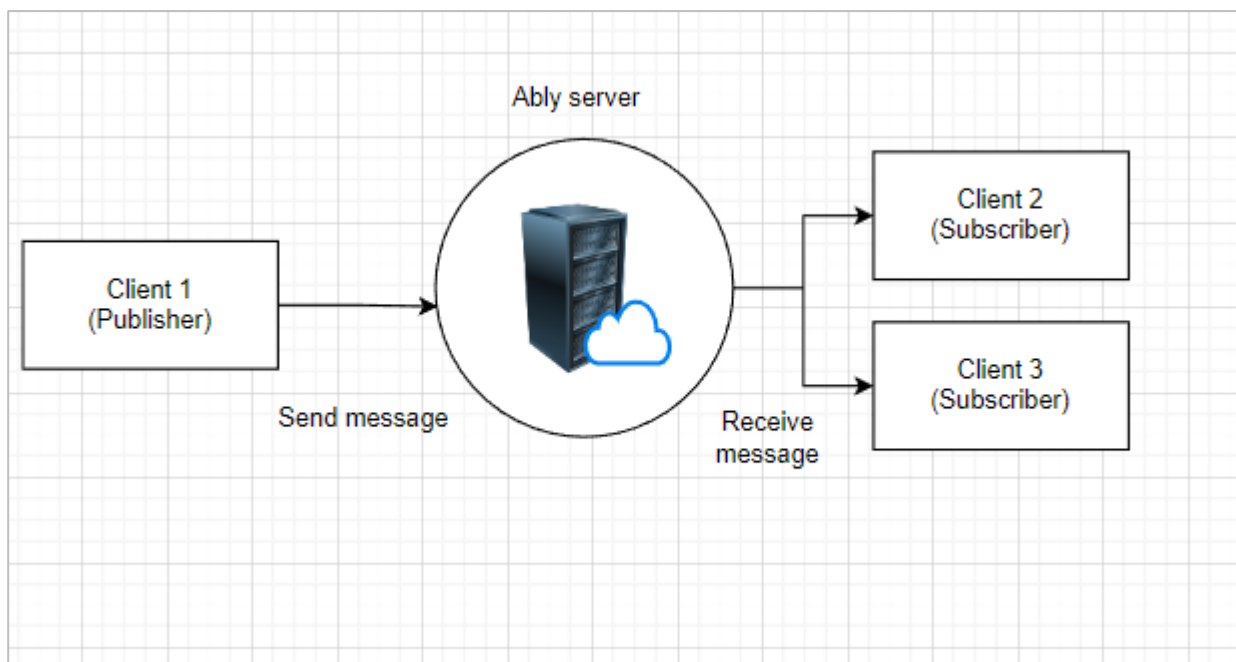
- **Communication method**

Figure 2: Chat system Pub/Sub communication method

Using the chat system, clients are able to communicate with each other using the concept of **Pub/Sub**. As the name suggests, the Publish/Subscribe (Pub/Sub) architectural pattern is a pattern that allows a flexible number of publishers and subscribers that are decoupled to exchange data through channels. As long as the connection remains, subscribers will continue to obtain new data from publishers as it becomes available (Ably, 2023).

For the chat system, the application only connects clients to 1 channel, called 'main'. When a message is sent by a client, the message will be published to the 'main' channel. Once the message is published, all clients which are already in the 'main' channel will receive the new message. Each client will then render a new message on screen based on the information provided from the new message.

References

Ably (2023) *Auth and Security: Token Authentication*. Available at https://ably.com/docs/core-features/authentication#token-authentication [Accessed 5 March 2023].

Ably (2023) *Pub/Sub*. Available at https://ably.com/docs/core-features/pubsub [Accessed 5 March 2023].

Ably (2023) *Is it necessary to implement auto-renewal of tokens when using Token Auth?* Available at https://faqs.ably.com/is-it-necessary-to-implement-auto-renewal-of-tokens-when-using-token-auth [Accessed 5 March 2023].

Ably (2023) *What happens if an Ably datacenter crashes or is terminated?* Available at https://faqs.ably.com/what-happens-if-an-ably-datacenter-crashes-or-is-terminated [Accessed 5 March 2023].

Ably (2023) *Where are Ably's servers and datacenters located around the world?* Available at https://faqs.ably.com/where-are-ablys-servers-and-datacenters-located-around-the-world [Accessed 5 March 2023].

Vercel (2023) *Publish and Subscribe to Realtime Data on Vercel*. Available at https://vercel.com/guides/publish-and-subscribe-to-realtime-data-on-vercel [Accessed 5 March 2023].

Vercel (2023) *Your infrastructure, simplified*. Available at https://vercel.com/features/infrastructure [Accessed 5 March 2023].

CAT3053/N Distributed Computing Marking Rubric
ASSIGNMENT [1] Porgramming & Report Writing (Weighted marks: 30%)

REPORT COMPONENT (100%)

LEARNING OUTCOME	MARKING CRITERIA	SCALE					YOUR MARKS/COMMENTS
		Fall (0-49)	3rd Class (50-59)	2nd Lower Class (60-69)	2nd Upper Class (70-79)	1st Class (80-100)	
CLO1: Explain the concepts of foundations of distributed computing, distributed algorithms, middleware, infrastructure, and shared data. (P6, PLO3)	1. Program and demonstrate distributed system. [CLO1] (60%)	Program did not fulfil any requirements. No program output. Students are not able to present the system.	Program fulfils less than half of the requirements. Program output convey minimal information. Students present the system in with vague and ambiguity.	Program fulfils more than half of the requirements. Program output convey suffice information. Students present the system in with slight vague and ambiguity.	Program fulfils all the requirements. Program output are well organized and convey suffice information. Students present the system clearly.	Program fulfils all the requirements with extra functionality. Program output are excellent and convey extra information. Students present the system in a clear and precise manner with creativity.	
	2. Elaboration on understanding regarding the Concept of Distributed Computing (30%)	No analysis or meaning making related to elaboration on understanding regarding the Concept of Distributed Computing	No analysis or meaning making. Shows some thinking and reasoning but most ideas are underdevelop and unoriginal related to elaboration on understanding regarding the Concept of Distributed Computing	Little or unclear analysis or meaning making. Analysis indicates thinking and reasoning applied with original thought on a few ideas related to elaboration on understanding regarding the Concept of Distributed Computing	Some analysis and meaning making. Critical thinking is weaved into points. Analysis indicates original thinking and develops ideas with sufficient and firm evidence related to elaboration on understanding regarding the Concept of Distributed Computing	Comprehensive analysis and meaning making. Reveals high degree of critical thinking. Analysis indicates synthesis of ideas, in-depth analysis and evidence original thought and support for the topic related to elaboration on understanding regarding the Concept of Distributed Computing	
	3. References, Sources &Citation (10%)	Some sources are not accurately documented. Diagrams and illustrations are not accurate OR do not add to the reader's understanding of the topic. Missing or no citation and major flaws on the format.	All sources (information and graphics) are accurately documented, but many are not in the desired format. Some diagrams and illustrations are not accurate OR do not add to the reader's understanding of the topic. Very minimal amount of cited works, with incorrect format.	All sources (information and graphics) are documented, but an adequate amount is not in desired format. Diagrams and illustrations are neat and accurate and sometimes add to the reader's understanding of the topic. Adequate amount cited works, both text and visual, are done in the correct format. Inconsistencies evident	All sources (information and graphics) are accurately documented, but a few are not in the desired format. Diagrams and illustrations are accurate and add to the reader's understanding of the topic. All, both text and visual, are done with minimal errors on the format.	All sources (information and graphics) are accurately documented in the desired format. Diagrams and illustrations are neat, accurate and add to the reader's understanding of the topic. All cited works, both text and visual, are done in the correct format with no errors.	
						Total (100%)	

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