School of Computing: COMP5123M Coursework 2

Module title	Cloud Computing Systems
Module code	COMP5123M
Assignment title	Coursework 2
Assignment type and description	In-course Assessment
Rationale	The coursework demonstrates that you can discuss, reason and construct practical outcomes from learned knowledge. You need to review the material covered in the lectures and lab. sessions in week 5-6.
Word limit and guidance	-
Weighting	20%
Submission deadline	20/03/2025, 10:00
Submission method	Gradescope
Feedback provision	24/04/2025 on Gradescope.
Learning outcomes assessed	1. Design a high-level framework of a Cloud architecture; 2) Use a range of middleware tools to implement and evaluate a cloud application.
Module lead	Karim Djemame
Other Staff contact	Antonio Alberti, Chunwei Xia

1. **Assignment guidance** This exercise aims to give you some practical experience of using serverless architectures. It will also give you the opportunity to research on the cloud computing domain of Function as a Service (FaaS), technologies and performance.

   Serverless computing is revolutionising cloud application development as it offers the ability to create modular, highly-scalable, fault-tolerant applications, with minimal operational management. In order to contribute to its widespread adoption of serverless platforms, the design and performance of *language runtimes* that are available in FaaS serverless platforms is key. This coursework aims to investigate the performance impact of such language runtimes on two different platforms: commercial and open-source.

   You should carefully review the lecture notes on this topic before you start work.

2. **Assessment tasks**

   (a) For the investigation, consider the following platforms: 1) commercial: Microsoft Azure Functions serverless solution, Google Cloud Run functions, Amazon Web Services Lambda, and 2) open source: Knative, Openwhisk, OpenFaas. Choose ONE commercial and ONE open source platform.

   (b) Research into the performance of *language runtimes* supported by serverless platforms (commercial and open-source) to provide insight into their capabilities and increase awareness of their potential. Identify at least two research papers that report on language runtimes in serverless environments. Extra marks will be allocated when considering a thorough review of the literature. For a start, see:

   Djemame, K , Datsev, D and Kelefouras, V (2022) Evaluation of language runtimes in open-source serverless platforms. In Proceedings of the 12th International Conference on Cloud Computing and Services Science, Apr 2022, Online. SciTePress , pp. 123-132, https://eprints.whiterose.ac.uk/186083/

   (c) Consider a serverless application of your choice, e.g. image processing, parallel processing, machine learning etc. Feel free to

consider a workflow of functions.

(d) Design a set of experiments to assess the capabilities and performance of the serverless platforms. Investigate the performance impact of one language runtime of your choice. You can choose among Python, Java, Node.js, .NET etc.

(e) Propose a cloud-based technical solution for benchmarking and analysis using a set of test functions and demonstrate the language runtime performance in terms of effectiveness and efficiency. Consider the aspect of scalability by increasing the number of function invocations;

(f) Report your performance results.

Notes.

(a) You need to install the open source serverless solution, e.g. on a Virtual Machine running on Microsoft Azure.

(b) An important aspect of the implementation of the serverless functions is *how they are triggered*, see lecture slides and examples on the Azure portal.

(c) You need to demonstrate your *ability to write code* to implement your own serverless functions. In case you consider using a workflow, you are allowed to implement one function in the workflow that interacts with *third-party services* through, e.g. APIs.

3. **General guidance and study support** Learning resources and useful links are available in COMP5123M area on Minerva. Help is also available on the module Teams channel.

4. **Assessment criteria and marking process**

   Address the questions in relation the problem motivation, related work, experimental design and implementation, discussion of results, and evidence of execution. Distribution of marks:

Report

Problem motivation and related work	10
Experimental Design and Implementation - Commercial	10
Experimental Design and Implementation - Open source	10
Results and evaluation	15
Code/scripts	5
	50

Coursework feedback and return of marks will be available on **Gradescope** (expected date: 4 weeks after coursework submission).

5. **Presentation and referencing**

   The quality of written English will be assessed in this work. As a minimum, you must ensure:

   - Paragraphs are used
   - There are links between and within paragraphs although these may be ineffective at times
   - There are (at least) attempts at referencing
   - Word choice and grammar do not seriously undermine the meaning and comprehensibility of the argument
   - Word choice and grammar are generally appropriate to an academic text.

6. **Submission requirements**

   The following deliverables are expected:

   (a) **Research report** on the domain of investigation: answer all the individual questions available on Gradescope;

(b) **Material** developed as part of the experiment design (code, scripts). To submit your code for the exercise, you can either: 1) provide a link to Git, or 2) create a Zip or tar archive of the files which make up your system and upload it on Gradescope. If you have organised your files into a directory hierarchy, then package this as a single Zip or tar archive;

(c) **Demonstration**: produce a short video (maximum 2 minutes long) to demonstrate your solution and results. You can either: 1) upload it on Gradescope, or 2) upload on any cloud platform of your choice, e.g. Youtube and provide the link.

7. **Academic misconduct and plagiarism**

   The category of this assessment is RED: AI tools cannot be used.

   Academic integrity means engaging in good academic practice. This involves essential academic skills, such as keeping track of where you find ideas and information and referencing these accurately in your work.

   By submitting this assignment you are confirming that the work is a true expression of your own work and ideas and that you have given credit to others where their work has contributed to yours.

8. **Assessment/marking criteria grid**

   This coursework is marked out of 50 and accounts for 20% of the assessment. A lateness submission penalty will apply (5% of the maximum available mark per day).