Course / Programme:	BEng Software Engineering | BSc Computing
Module name and code:	Computing Infrastructure (SWE4202)
Tutor:	Francis Morrissey | Dr Mohammed Benmubarak
Assignment Number:	2
Assignment Title:	Infrastructure development for Suretide
Weighting	40% of overall module grade
Issue Date:	31/03/2023
Submission Deadline:	05/05/2023@ 2355
	For late submission, see Assessment Regulations for Undergraduate Programmes: *https://www.bolton.ac.uk/assets/Assessment-Regulations-for-Undergraduate-Programmes-2022-23-V8.pdf*

Learning Outcomes assessed:

3. Formulate scripted solutions to automate operating system services.

4. Implement practical solutions based on the client/server model to solve a given problem.

Scenario

2022 marked unprecedented increases in the cost of energy worldwide due to a myriad of reasons including a surge of demand after economies emerged from the Covid-19 crises and Russia's invasion of Ukraine resulting in soaring gas prices (Guardian, 2022).

The United Kingdom (UK) has been especially affected due to an inordinate reliance on fossil fuels in comparison to its neighbours in Europe (Guardian, 2022). Statista.com (2023) reports that 78% of households depend on gas for central heating, and 41.9% of electricity has been generated using gas over the past year (grid.iamkate.com, 2023). This issue has been compounded by excessive 'heat loss' since houses in the UK lose heat 'three times faster than houses in Norway and Germany' (tado.com, 2022) thereby resulting in increased energy consumption.

In this contrived scenario, the UK government has promoted the use of renewable energy and has made significant concessions accessible to firms in this sector. Their hope is that by 2030, the majority of energy used in the UK will be generated from renewable sources instead of fossil fuels. Suretide, a new player in the UK market, would like to position themselves as the leader in tidal energy.

Instructions

You have recently begun a graduate internship in SysOps for Suretide. Suretide has advertised a permanent position. The chosen candidate should be capable of configuring and implementing client/server applications, skilled in scripting and should have a good working knowledge of operating systems utilities. Accordingly, they have provided a series of tasks to test your competence in shell scripting, requiring: appropriate use of programming constructs including sequence, selection and iteration; and effective use of built-in utilities including pipe, tail, grep, sort, awk, echo and sed.

General Instructions

There are three (3) tasks, you must do all.

- To support your evidence, incorporate relevant screenshots of scripting code (with embedded comments) and corresponding annotated screenshots of scripts in execution. Include your final script in your report and a create screencasts of your testing process.
- You need to demonstrate your scripts and processes and explain how each works as a screencast demonstration.
- No demonstration means zero marks.

Task 1 of 3 - Resource Monitoring Application [30%]

Suretide recognises that built-in OS resource monitoring tools are functional but are neither very intuitive nor focused for their requirements. To address this, you have been tasked to script a bespoke application to display the following details in real-time `with a 1 second refresh rate:`

- `Host name`
- `Kernel version`
- `Number of tasks running`
- `System up-time`
- `Total and available RAM`
- `Total CPU usage`
- `Total and available disk size`
- `Process details including:`
  - `PID`
  - `User`
  - `%CPU`
  - `%RAM`
  - `process command`

Specific Task Guidance

The expected solution is a BASH script. However, merely presenting your script without background explanation is inadequate. Include the following in your report to demonstrate higher levels of knowledge and analytical skills:

- *wireframe of your planned solution*
- *discussion of design alternatives and justification for chosen layout*
- *pseudocode design including selection, iteration and functions*
- *descriptions of commands and utilities used to interrogate system to extract relevant information*
- *justification of specific commands and utilities used over alternatives*
- *discussion of issues encountered throughout development and analyses of resolutions*
- *test cases and results*
- *captioned images of final script(s) with embedded comments*
- *captioned images of script(s) in execution*

Task 2 of 3 - Content Management System deployment [40%]

Suretide has asked you to deploy a Content Management System (CMS) to create a digital awareness of their services. This will ensure stakeholders and other interested parties are able to keep apprised of key developments with their initiatives. The CIO has suggested the use of a Wordpress CMS which powers 43.2% of websites worldwide (w3techs.com, 2023).

- Implement a Wordpress CMS using LEMP architecture; more specifically, using Ubuntu for the Operating System, Nginx for the Web server, MySQL Community Server for the database and PHP to process the scripted pages.
  - Demonstrate the installation of MySQL Community Server
  - Follow hardening procedures to reduce the risk of security exploits through vulnerabilities
  - Create a database for Wordpress called `suretidewordpress`
  - Create a user called `suretidewordpressuser` with appropriate database privileges
  - Install PHP and necessary extensions
  - Install and configure the Nginx web server
  - Download and decompress the latest stable Wordpress package
  - Configure and install Wordpress
  - Configure the firewall (UFW) with appropriate exceptions
  - Enable UWF
  - Demonstrate how to connect remotely using MySQL Workbench with SSH tunneling so that additional ports will not have to be opened in the firewall which may compromise security.
  - Set up an initial 'landing page' for Suretide.

Specific Task Guidance

The expected solution involves a demonstration of procedures with appropriate explanations to demonstrate knowledge and analytical skills:

- *descriptions of commands and utilities used to achieve task objectives*
- *additional utilities installed and explanations*
- *justification of specific commands and utilities used over alternatives*
- *discussion of issues encountered throughout development and analyses of resolutions*
- *test cases and results*

Task 3 of 3 - Automated remote database backup [30%]

Suretide would like assurance that database backup to a remote server is conducted at a specific time each day to mitigate risks that would impact business continuity.

Write an automated scripted solution which:

- Stops specific services, where necessary

- Performs MySQL dump that is redirected to an appropriate location in the file system

- Appends the current date and time in an appropriate format to each filename.

- Restarts services, where necessary

- Connects to a remote server and copies the dump file using either rsync, scp or sftp

- Add script to Cron to ensure automation with required privileges.

Specific Task Guidance

The expected solution is a BASH script. However, merely presenting your script without background explanation is inadequate. Include the following in your report to demonstrate higher levels of knowledge and analytical skills:

- *pseudocode design including selection, iteration and functions*
- *descriptions of commands and utilities used to achieve task objectives*
- *justification of specific commands and utilities used over alternatives*
- *discussion of issues encountered throughout development and analyses of resolutions*
- *test cases and results*
- *captioned images of final script(s) with embedded comments*
- *captioned images of script(s) in execution – demonstrate before and after states*

Submission

Submission of report should be made to Turnitin via Moodle before the deadline using the file naming convention below:

SWE4202_A2_IDnumber. For example, if your ID Number is 210000, then your file name in Turnitin should be SWE4202_A2_210000.

Secondary Research Requirements

Secondary research support is expected should be correctly cited using Harvard Referencing for both in-text citations and Reference Structure (further details are below). Level HE4 - It is expected that the Reference List will contain between five and ten sources. As a MINIMUM the Reference List should include one refereed academic journal and three academic books.

Grading

A percentage mark will be provided based on *General Assessment Guidelines for Written Assessments*. Grading is as follows:

A: 70 - 100%

B: 60 - 69%

C: 50 - 59%

D: 40 - 49%

Marks below 40% will be classed as fail.

Specific Assessment Criteria:

(Please note that the General Assessment Criteria will also apply).

First class (70-100%):

Students will demonstrate an excellent breadth of knowledge related to Computing Infrastructure including the formulation of scripted solutions to automate operating system services and the development of practical solutions based

on the client/server model in enterprise applications. Sources cited accurately in both the body of text and in the Reference List/Bibliography. Writing style is clear and appropriate to the requirements of the assessment

Second class (60-69%):

Students will demonstrate a thorough breadth of knowledge of Computing Infrastructure including the formulation of scripted solutions to automate operating system services and the development of practical solutions based on the client/server model in enterprise applications. A range of appropriate reference sources selected and drawn upon. Sources cited accurately in the main in the text and in the Reference List/ Bibliography. Writing style is clear and appropriate to the requirements of the assessment.

Second class (50-59%):

Students will demonstrate a sound breadth of knowledge of Computing Infrastructure including the formulation of scripted solutions to automate operating system services and the development of practical solutions based on the client/server model in enterprise applications. Relevant reference sources selected and drawn upon. Writing style is mostly appropriate to the requirements of the assessment.

Third Class (40-49%)

Students will demonstrate a sufficient breadth of knowledge of Computing Infrastructure including the formulation of scripted solutions to automate operating system services and the development of practical solutions based on the client/server model in enterprise applications. Some relevant reference sources selected and drawn upon. Writing style is occasionally not appropriate for the assessment.

Fail (39% and below):

Students who do not meet the requirements of a third-class grade will not successfully complete the assessment activity.

Guidelines for the Preparation and Submission of Written Assessments

1. Written assessments should be word-processed in Arial or Calibri Light font size 12. There should be double-spacing and each page should be numbered.
2. There should be a title page identifying the programme name, module title, assessment title, your student number, your marking tutor and the date of submission.
3. You should include a word-count at the end of the assessment (excluding references, figures, tables and appendices).
4. Where a word limit is specified, the following penalty systems applies:
   - Up to 10% over the specified word length = no penalty
   - 10 – 20% over the specified indicative word length = 5 marks subtracted (but if the assessment would normally gain a pass mark, then the final mark to be no lower than the pass mark for the assessment).
   - More than 20% over the indicative word length = if the assessment would normally gain a pass mark or more, then the final mark will capped at the pass mark for the assessment.
5. All written work should be referenced using the standard University of Bolton referencing style– see: https://libguides.bolton.ac.uk/resources/referencing/
   Harvard Referencing should be used for this assignment.
6. Unless otherwise notified by your Module Tutor, electronic copies of assignments should be saved as word documents and uploaded into Turnitin via the Moodle class area. If you experience problems in uploading your work, then you must send an electronic copy of your assessment to your Module Tutor via email BEFORE the due date/time.
7. Please note that when you submit your work to Moodle, it will automatically be checked for matches against other electronic information. The individual percentage text matches may be used as evidence in an academic misconduct investigation (see Section 13).
8. Late work
   - Late work will be subject to the following penalties:
   - Up to 7 calendar days late = 10 marks subtracted but if the assignment would normally gain a pass mark, then the final mark to be no lower than the pass mark for the assignment.
   - More than 7 calendar days late = This will be counted as non-submission and no marks will be recorded.

- Late submission of assessments on refer and those which are graded Pass/Fail only, is not permitted unless an extension is approved. See below.

9. Extensions
  - In the case of exceptional and unforeseen circumstances, an extension of up to 14 days after the assessment deadline may be requested using the standard University Extension Request Form. For approval there would need to be an explanation and evidence of relevant circumstances. Longer extensions for individual projects and artefacts may be granted, at the discretion of the Programme Leader.
  - Requests for extensions which take a submission date past the end of the module (normally week 15) must be made using the Mitigating Circumstances procedure.
  - Some students with registered disabilities will be eligible for revised submission deadlines. Revised submission deadlines do not require the completion extension request paperwork.
  - Please note that the failure of data storage systems is not considered to be a valid reason for an extension. It is therefore important that you keep multiple copies of your work on different storage devices before submitting it.

Academic misconduct

Academic misconduct may be defined as any attempt by a student to gain an unfair advantage in any assessment. This includes plagiarism, collusion, commissioning (contract cheating) amongst other offences. In order to avoid these types of academic misconduct, you should ensure that all your work is your own and that sources are attributed using the correct referencing techniques. You can also check originality through Turnitin.

Please note that penalties apply if academic misconduct is proven. See the following link for further details: https://www.bolton.ac.uk/student-policy-zone/student-policy-zone-2022-23/academic-misconduct-regulations-and-procedures-2022-23

Bibliography

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GENERAL ASSESSMENT GUIDELINES – LEVEL HE4

	Relevance Learning outcomes must be met for an overall pass	Knowledge and Understanding	Analysis, Creativity and Problem-Solving	Self-awareness and Reflection	Research/ Referencing	Written English	Presentation and Structure
Class I (Exceptional Quality) 85% - 100%	Work is directly relevant and expertly addresses the requirements of the brief. Learning outcomes are met.	Demonstrates breadth of knowledge and understanding of theory and practice beyond the threshold expectation for the level. Demonstrates excellent understanding of key concepts in different contexts.	Presents an excellent and cohesive appraisal of findings through the critical analysis of information. Draws clear, justified and thoughtful conclusions. Demonstrates creative flair, originality and initiative. Demonstrates a critical understanding of problem-solving approaches and applies strong problem-solving skills.	Provides insightful reflection and self-awareness in relation to the outcomes of own work and personal responsibility.	A wide range of contemporary and relevant reference sources selected and drawn upon. Sources cited accurately in both the body of text and in the Reference List/ Bibliography.	Writing style is clear and appropriate to the requirements of the assessment. An exceptionally well written answer with competent spelling, grammar and punctuation. For example, paragraphs are well structured and include linking and signposting. Sentences are complete and different types are used. A wide range of appropriate vocabulary is used.	The presentational style and layout are correct for the type of assignment. Evidence of planning and logically structured. Where relevant, there is effective placement of, and reference to, figures, tables and images.
Class I (Excellent Quality) 70% - 84%	Work is relevant and comprehensively addresses the requirements of the brief. Learning outcomes are met.	Demonstrates an excellent breadth of knowledge and understanding of theory and practice for this level. Demonstrates in-depth understanding of key concepts.	Presents an excellent and cohesive discussion of findings through the interpretation and evaluation of information sources. Draws clear, justified and thoughtful conclusions. Demonstrates clearly creativity and initiative. Applies excellent problem-solving skills.	Provides excellent reflection and self-awareness in relation to the outcomes of own work and personal responsibility.	A range of contemporary and relevant reference sources selected and drawn upon. Sources cited accurately in both the body of text and in the Reference List/Bibliography.	Writing style is clear and appropriate to the requirements of the assessment. An excellently well written answer with competent, spelling, grammar and punctuation. For example, paragraphs are well structured and include linking and signposting. Sentences are complete and different types are used. A wide range of appropriate vocabulary is used.	The presentational style and layout are correct for the type of assignment. Evidence of planning and logically structured. Where relevant, there is effective placement of and reference to, figures, tables and images.
Class II/i (Very Good Quality) 60% - 69%	Work is relevant and addresses most of the requirements of the brief well. Learning outcomes are met.	Demonstrates a thorough breadth of knowledge and understanding of theory and practice for this level. Demonstrates very good understanding of key concepts.	Presents a perceptive and cohesive discussion of findings through the interpretation and evaluation of information sources. Draws clear and justified conclusions. Demonstrates creativity and initiative. Applies strong problem-solving skills.	Provides justified reflection and self-awareness in relation to the outcomes of own work and personal responsibility, as required by the assessment.	A range of appropriate reference sources selected and drawn upon. Sources cited accurately in the main in the text and in the Reference List/ Bibliography.	Writing style is clear and appropriate to the requirements of the assessment. A very well written answer with competent spelling, grammar and punctuation. For example, paragraphs are well structured and include linking and signposting. Sentences are complete and different types are used. A range of appropriate vocabulary is used.	The presentational style and layout are correct for the type of assignment. Evidence of planning and logically structured in the main. Where relevant, there is effective placement of figures, tables and images.
	Relevance Learning outcomes must be met for an overall pass	Knowledge and Understanding	Analysis, Creativity and Problem-Solving	Self-awareness and Reflection	Research/ Referencing	Written English	Presentation and Structure

Class II/ii (Good Quality) 50% - 59%	Work addresses key requirements of the brief. Some irrelevant content. **Learning outcomes are met.**	Demonstrates a sound breadth of knowledge and understanding of theory and practice for this level. Demonstrates sound understanding of key concepts.	Presents a logical discussion of findings through the interpretation and evaluation of information sources. Draws clear and justified conclusions. Demonstrates some creativity and initiative. Applies sound problem-solving skills.	Provides valid reflection and self-awareness in relation to the outcomes of own work and personal responsibility, as required by the assessment.	Relevant reference sources selected and drawn upon. Some sources accurately cited in both the body of text and in the Reference List/Bibliography.	Writing style is mostly appropriate to the requirements of the assessment Grammar, spelling and punctuation are generally competent and minor lapses do not pose difficulty for the reader. Paragraphs are structured and include some linking and signposting. Sentences are complete. A range of appropriate vocabulary is used.	The presentational style and layout are largely correct for the type of assignment. Logically structured in the most part. Where relevant, effective placement of some figures, tables and images.
Class III (Satisfactory Quality) 40% - 49%	Work addresses the requirements of the brief, although superficially in places. Some irrelevant content. **Learning outcomes are met.**	Demonstrates a sufficient breadth of knowledge and understanding of theory and practice for this level. Demonstrates a sufficient understanding of key concepts.	Presents a valid discussion of findings through the interpretation and evaluation of information sources. Draws justified conclusions. Demonstrates creativity and initiative in places. Applies sufficient problem-solving skills.	Provides some reflection and self-awareness in relation to the outcomes of own work and personal responsibility, as required by the assessment.	Some relevant reference sources selected and drawn upon. Some weaknesses in referencing technique.	Writing style is occasionally not appropriate for the assessment. Grammar, spelling and punctuation are generally competent, but may pose minor difficulties for the reader. Some paragraphs may lack structure, and there is limited linking and signposting. Some appropriate vocabulary is used	The presentational style and layout are largely correct for the type of assignment. Adequately structured. Inclusion of some figures, tables and images but not always relevant and/or clear.
Borderline Fail 35% - 39%	Work addresses only some of the requirements of the brief. Irrelevant and superficial content. **One or more learning outcomes have not been met.**	Demonstrates limited knowledge and understanding of theory and practice for this level. Demonstrates a lack of understanding of key concepts.	Presents a limited discussion of findings through the interpretation of information sources. Draws some irrelevant conclusions. Creativity and initiative are lacking. Problem-solving skills are lacking.	Provides limited reflection and self-awareness in relation to the outcomes of own work and personal responsibility, when required.	Sources selected are limited and lack relevance. Poor referencing technique employed.	Writing style is unclear and does not match the requirements of the assessment in question. Deficiencies in spelling, grammar and punctuation makes reading difficult and arguments unclear in places. Paragraphs are poorly structured.	For the type of assignment the presentational style, layout and/or structure are lacking. Figures, tables and images included when required but these lack clarity and relevance.
Fail <34%	Work does not address the requirements of the brief. Irrelevant and superficial content. **One or more learning outcomes have not been met.**	Demonstrates inadequate knowledge and understanding of theory and practice for this level. Demonstrates insufficient understanding of key concepts.	Presents a limited discussion of findings with little consideration of the quality of information drawn upon. Draws irrelevant conclusions. Creativity, initiative and problem-solving skills are absent.	Provides inadequate reflection and self-awareness in relation to the outcomes of own work and personal responsibility, when required.	There is an absence of relevant sources. Poor referencing technique employed.	Writing style is unclear and does not match the requirements of the assessment in question. Deficiencies in spelling, grammar and punctuation makes reading difficult and arguments unclear. Unstructured paragraphs.	For the type of assignment the presentational style, layout and/or structure are lacking. Figures, tables and images are absent when required or lack relevance/clarity.