# Luminus Technical University College - Assignment Brief (RQF)

## Higher National Diploma in cloud computing

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| **College ID:** | | | **22036351** | |
| **Pearson ID:** | | | RE67250 | |
| **Unit Number and Title** | | **13** | Cloud Architecture Design | | | | | | |
| **Academic Year** | | **2023/2024** | | | | | | | |
| **Unit Tutor** | | **Rawan Baniyounes** | | | | | | | |
| **Internal Verifier Name and Approval (Signature)** | | **Mohammad Al-Rousan** | | | | **Approval Date:01-06-2023** | | | |
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| **Assignment number and Title** | | **1** | **Secure Cloud Architecture Design for Sensitive Data** | | | | | | |
| **Issue Date (1St Submission)** | | **20-05-2023** | | **Submission Date (1st Submission)** | | | **20-06-2024** | | |
| **Issue Date (2nd Submission)** | | **20-06-2023** | | **Completion Date (2nd Submission)** | | | **30-6-2024** | | |
| **Submission Format** | | | | | | | | | |
| * The submission is in the form of: * An individual written report. This should be written in a concise, formal business style using single spacing and font size 14. * Students are mandatory to submit the assignment in due date and in a way requested by the Tutor. The form of submission will be a word document of 1000 words at least, posted on the LMS (D2L). * You are required to make use of headings, paragraphs, and subsections as appropriate. * The Assignment must be your own work, and not copied from another student, or from books etc. If you use ideas, quotes or data (such as diagrams) from books, journals or other sources, you must reference your sources (using the reference style you prefer. Ex: Harvard or any other style). Make sure that you know how to reference properly, and that understand the guidelines on plagiarism. | | | | | | | | | |
| **Unit Learning Outcomes** | | | | | | | | | |
| **LO1** | Produce a cloud feasibility assessment for a defined problem for a small- to-medium-sized organisation | | | | | | | | |
| **LO2** | Use appropriate architectural design principles to design an infrastructure for a defined problem | | | | | | | | |
| **LO3** | Implement an infrastructure solution using cloud architectural design principles based on defined requirements | | | | | | | | |
| **LO4** | Analyse the metric monitoring and alert system to baseline the health of your cloud environment | | | | | | | | |
| Transferable skills and competencies developed | | | | | | | | | |
| **Task : Secure Cloud Architecture Design for Sensitive Data** | | | | | | | | | |
| **Vocational scenario:** | | | | | | | | | |
| You are a cloud architect working for SecureTech Solutions, a cybersecurity firm specializing in securing sensitive data for various clients, including government agencies, healthcare providers, and financial institutions. The firm has recently been contracted by a major healthcare organization, HealthSecure Inc., to design a secure cloud architecture for storing and processing their sensitive patient data.  HealthSecure Inc. is a leading healthcare organization with multiple hospitals, clinics, and research facilities spread across the country. The organization handles vast amounts of sensitive patient data, including personal information, medical histories, treatment records, and payment details. Due to the highly sensitive nature of this data, HealthSecure Inc. must comply with stringent regulatory requirements, such as the Health Insurance Portability and Accountability Act (HIPAA) in the United States, which mandates strict data protection and privacy standards. | | | | | | | | | |
| Assignment activity and guidance | | | | | | | | | |
| Your task is to design a secure cloud architecture for HealthSecure Inc. that addresses the following requirements:   1. Analyze the scalability challenges faced by HealthSecure Inc. and evaluate how cloud transformation can address these challenges.   Additionally,  identify and assess two key business processes of HealthSecure Inc., such as patient data management, billing, treatment scheduling, or medical research, that should be considered in the cloud feasibility assessment.   1. Rationalize the choices made during the cloud feasibility assessment for HealthSecure Inc. and explain how these decisions contribute to meeting the business requirements, considering potential improvements in patient care, cost savings, and operational efficiency gains. 2. Explore the significance of architectural design and fundamental principles in the design of cloud infrastructure for HealthSecure Inc., highlighting the importance of Operational Excellence in enhancing the operational efficiency of HealthSecure Inc. through cloud adoption. 3. Generate a cloud-deployment diagram illustrating the integration of application, platform, and infrastructure components for HealthSecure Inc. before and after migrating to Cloud Computing. 4. Assess the influence of architectural design and fundamental principles (including the security implications of cloud architecture design for HealthSecure Inc.) on the designs formulated to address the specified problem. Propose one security measure. This evaluation requires a detailed examination of how the chosen architectural design and core principles have shaped and impacted the development of solutions for the defined problem. 5. Thoroughly assess the significance of architectural design and fundamental principles in the design processes for HealthSecure Inc. and evaluate the potential cultural impacts of the cloud transformation on internal processes and employee roles within HealthSecure Inc. 6. Perform a cloud-based infrastructure incorporating storage services such as Amazon S3, Amazon EC2, two foundational cloud services (e.g., compute, storage), and open-source tools suitable for a cloud environment. Consider options for PaaS, SaaS, and distributed computing for HealthSecure Inc.'s infrastructure. 7. Disassemble a comprehensive analysis to assess how the developed solution aligns with and meets the explicitly stated requirements. This evaluation entails a meticulous examination of the degree to which the solution tackles and meets the defined criteria and objectives. 8. Scrutinize a foundational metrics, monitoring report, and alert system architecture to evaluate the health and performance of the cloud environment in comparison to established baseline expectations for HealthSecure Inc., considering both host-based and application metrics.   **10. Examine rigorously the potential impact of network bottlenecks, connectivity metrics, and observations derived from the monitoring review, with a focus on identifying areas for improvement in efficiency in the overall performance of HealthSecure Inc.'s cloud infrastructure.**  **11. Assess critically the effectiveness of the proposed logs, monitoring report, and metric monitoring and alert system for HealthSecure Inc. in meeting the specified requirements and contributing to operational efficiency. This involves a comprehensive examination of how well the solution aligns with the defined criteria and enhances overall operational effectiveness.** | | | | | | | | | |
| **سيناريو السؤال:**  **أنت مهندس سحابي تعمل لدى شركة SecureTech Solutions، وهي شركة متخصصة في تأمين البيانات الحساسة للعملاء المختلفين، بما في ذلك الوكالات الحكومية ومقدمي الرعاية الصحية والمؤسسات المالية. وقد تعاقدت الشركة مؤخرًا مع منظمة رعاية صحية كبيرة، HealthSecure Inc.، لتصميم بنية سحابية آمنة لتخزين ومعالجة بيانات المرضى الحساسة.**  **نظرة عامة على HealthSecure Inc.:**  **HealthSecure Inc. هي منظمة رعاية صحية رائدة تضم العديد من المستشفيات والعيادات ومرافق البحث المنتشرة في جميع أنحاء البلاد. تتعامل المنظمة مع كميات كبيرة من بيانات المرضى الحساسة، بما في ذلك المعلومات الشخصية والتاريخ الطبي وسجلات العلاج وتفاصيل الدفع. ونظرًا للطبيعة الحساسة للغاية لهذه البيانات، يجب على HealthSecure Inc. الامتثال لمتطلبات تنظيمية صارمة، مثل قانون نقل التأمين الصحي والمساءلة (HIPAA) في الولايات المتحدة، الذي يفرض معايير صارمة لحماية البيانات والخصوصية.**  **الاسئله**  **مهمتك هي تصميم بنية سحابية آمنة لـ HealthSecure Inc. التي تتناول الشروط التالية:**  **1. قم بتحليل التحديات التي تواجه HealthSecure Inc. فيما يتعلق بالقابلية للتوسع وقيمة كيف يمكن لتحول السحابة التعامل مع هذه التحديات. بالإضافة إلى ذلك، حدد وقم بتقييم عمليتين أساسيتين لـ HealthSecure Inc.، مثل إدارة بيانات المرضى، والفوترة، وجدولة العلاج، أو البحوث الطبية، التي يجب أن تُرَاعى في تقييم الجدوى السحابية.**  **2. ابرر الخيارات التي تم اتخاذها أثناء تقييم الجدوى السحابية لـ HealthSecure Inc. وشرح كيفية مساهمتها في تحقيق متطلبات الأعمال، مع النظر في التحسينات المحتملة في رعاية المرضى، وتوفير التكاليف، وزيادة كفاءة العمليات.**  **3. استكشاف أهمية التصميم المعماري والمبادئ الأساسية في تصميم البنية التحتية للسحابة لـ HealthSecure Inc.، مع التركيز على أهمية التميز التشغيلي في تعزيز كفاءة العمليات لـ HealthSecure Inc. من خلال اعتماد السحابة.**  **4. إنشاء رسم توضيحي لنشر السحابة يوضح دمج مكونات التطبيق والمنصة والبنية التحتية لـ HealthSecure Inc. قبل وبعد الانتقال إلى الحوسبة السحابية.**  **5. قيم تأثير التصميم المعماري والمبادئ الأساسية (بما في ذلك الآثار الأمنية لتصميم البنية التحتية للسحابة لـ HealthSecure Inc.) على التصاميم التي صاغت لمعالجة المشكلة المحددة. اقترح إجراء أمني واحد. يتطلب هذا التقييم فحصًا مفصلًا لكيفية تأثير التصميم المعماري المختار والمبادئ الأساسية على تطوير الحلول للمشكلة المحددة.**  **6. قم بتقييم بدقة أهمية التصميم المعماري والمبادئ الأساسية في عمليات التصميم لـ HealthSecure Inc. وقيّم التأثيرات الثقافية المحتملة لتحول السحابة على العمليات الداخلية وأدوار الموظفين داخل HealthSecure Inc.**  **7. نفذ بنية تحتية سحابية تضم خدمات تخزين مثل Amazon S3، Amazon EC2، وخدمتي سحابة أساسيتين (مثل الحوسبة، والتخزين)، وأدوات مفتوحة المصدر مناسبة لبيئة السحابة. انظر إلى الخيارات المتاحة لـ PaaS، وSaaS، والحوسبة الموزعة لبنية تحتية لـ HealthSecure Inc.**  **8. فك تحليل شامل لتقييم مدى تطابق الحل الذي تم تطويره مع المتطلبات المحددة صراحةً. يتطلب هذا التقييم فحصًا دقيقًا للدرجة التي يتناول فيها الحل ويفي بالمعايير والأهداف المحددة.**  **9. تحليل هيكلية المقاييس الأساسية وتقارير المراقبة ونظام التنبيه لتقييم صحة وأداء بيئة السحابة مقارنة بالتوقعات الأساسية المحددة لشركة HealthSecure Inc.، مع مراعاة كل من المقاييس المعتمدة على المضيف والمقاييس التطبيقية.**  **10. تحليل الأثر المحتمل لاختناقات الشبكة ومقاييس الاتصالات والملاحظات المستمدة من مراجعة المراقبة بدقة، مع التركيز على تحديد المجالات التي يمكن تحسين كفاءتها في الأداء العام لبنية السحابة لـ**  **HealthSecure Inc**   1. **قم بتقييم بشكل حرج فعالية السجلات المقترحة، وتقرير المراقبة، ونظام مراقبة المقاييس والتنبيه لـ HealthSecure Inc. في تحقيق المتطلبات المحددة والمساهمة في الكفاءة التشغيلية. يتضمن ذلك فحصًا شاملاً لمدى مطابقة الحل للمعايير المحددة وتعزيز الكفاءة التشغيلية العامة.** | | | | | | | | | |
| **Recommended Resources**  **Please note that the resources listed are examples for you to use as a starting point in your research – the list is not definitive.**  **Textbooks**  **Books**  Erl, T., Cope, R., Naserpour, A. (2015) *Cloud Computing Design Patterns*. USA: Prentice Hall  Arpaci-Dusseau, R., Arpaci-Dusseau, A. (2018) *Operating Systems: Three Easy Pieces*. Arpaci-  Dusseau Books  Holt, A., Huang, C. (2018) *Embedded Operating Systems: A Practical Approach* (Undergraduate  Topics in Computer Science). Switzerland: Springer International Publishing  **Web**  HN Global (2021) *Reading Lists*. Available at: https://hnglobal.highernationals.com/learningzone/  reading-lists  HN Global (2021) *Student Resource Library*. Available at: https://hnglobal.highernationals.  com/subjects/resource-libraries  HN Global (2021) *Textbooks*. Available at: https://hnglobal.highernationals.com/textbooks | | | | | | | | | |
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**Learning Outcomes and Assessment Criteria**

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| Pass | Merit | Distinction |
| **LO1** Produce a cloud feasibility assessment for a defined problem for a small- to-medium-sized organization. | | **D1** Critically evaluate why  architectural design and core  principles were important in  the designs. |
| **P1** Produce a cloud  feasibility assessment for an infrastructure problem by analyzing the business  requirements. | **M1** Justify the decisions  made in the cloud feasibility assessment and how they help to address the business requirements. |
| **LO2** Use appropriate architectural design principles to  design an infrastructure for a defined problem | |
| **P2** Analyse the importance of architectural design and core principles for cloud infrastructure design.  **P3** Produce diagrams with  consideration for the core  and design principles for a  substantial problem. | **M2** Evaluate the impact of  architectural design and core principles on the designs developed for the defined problem. |

**Learning Outcomes and Assessment Criteria**

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| Pass | Merit | Distinction |
| **LO3** Implement an infrastructure solution using cloud  architectural design principles based on defined  requirements | | **D2** Critically evaluate the  implemented solution in  meeting the defined  requirements and  supporting efficiency. |
| **P4** Implement a cloud-based  infrastructure solution based  on a set of defined  requirements. | **M3** Analyze how the  developed solution meets  the defined requirements. |
| **LO4** Analyze the metric monitoring and alert system to  baseline the health of your cloud environment. | |
| **P5** Analyze the logs, the  metrics and monitoring  report data on the health  and performance of the  cloud environment against  baseline expectations. | **M4** Critically analyze the  findings from the monitoring  review to recommend ways  of improving efficiency. |