National College of Ireland

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M.Sc in Cloud Computing – Full-time – Year 1 – MSCCLOUD11

Semester One Examinations – 2016/2017

Thursday 5th January 2017
10.00am – 12.00pm

Cloud Architecture

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Answer all Questions

Duration of exam: 2 hours
Attachments: None.

Requires: Calculator

1. Define (a) High-performance computing (HPC) system (6 marks) and (b) High-throughput computing (HTC) system (6 marks), (c) providing an example of when to use HPC and HTC at an enterprise setting, discussing the importance of Amdahl Law in computing systems (8 marks).

[TOTAL: 20 marks].

2. Define (a) Public Cloud (3 marks) and (b) Private Cloud (3 marks) including examples of each one. Provide an example on how a Private Cloud can be converted into a Public one (4 marks).

[TOTAL: 10 marks].

3. Consider the multicore processor with 4 heterogeneous cores labelled C1, C2, C3, and C4. Assume cores C1 and C4 have the same speed. C2 runs twice as fast as C1 and core C3 runs 3 times faster than C1. Assume all four cores start executing the application SQUARE-X at the time and no cache misses are encountered in all core operations. Suppose the SQUARE-X application computes the square of each element in an array of 256 elements. Assume 1 unit of time for C1 (or C4) to compute the square of an element.
   Given the following division of labour in four cores:
   C1 32 elements; C2 128 elements; C3 64 elements; C4 32 elements

   a) Compute the total execution time (in time units) for the four-core processor to compute the square of 256 elements in parallel (5 marks).
   b) Propose an improved allocation of processors and calculate its utilisation (15 marks).

[TOTAL: 20 marks].

4. Define and critically contrast (a) full virtualisation (5 marks) and (b) para virtualisation (5 marks). Justify your answer via pros-cons of each mode and/or an example of a product for each one. Enumerate 5 major issues addressed by virtual machines and virtual clusters in cloud computing. Justify your answer (20 marks total with 4 marks per advantage/disadvantage).

[TOTAL: 30 marks].

5. Describe a Hadoop architecture, delineating the roles of the key components and the HA, scalability and fault resilience/tolerance features it provides.

[TOTAL: 20 marks].