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The Internet of Things, Fog Computing and Cloud Computing

Key Stage 5 Computer Science

Model Answers

2019

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Resource One
Model Answers

Answers

1. A dumb object is a non-internet enabled device.

2. Devices connected to the internet can be made 'smart' – for example, they can communicate and interact with other devices, decide to perform action or respond to a signal automatically, without the need of the user to be involved.

3. The first internet appliance was a coke machine at Carnegie Mellon University in the early 1980s. Programmers could check the contents of the machine remotely using the internet.

4. Approximately 40 billion.

5. Examples: consumer market – a smart watch that monitors your heartrate; industry – smart machines that self-monitor their wear-and-tear; infrastructure – smart traffic light systems to reduce traffic.

6. IoT security is the technology area concerned with safeguarding connected devices and networks in the internet of things. Allowing devices to connect to the internet opens them up to several serious vulnerabilities if they are not properly protected.

Resource Two
Model Answers

Answers

1. Analyse the number of searches on Google, number of tweets on Twitter and number of posts on LinkedIn, per month.

2. An internet enabled thermostat would allow users to control house temperature remotely. For example, one could turn the heating on before arriving, so that the house is already warm. Or the thermostat could anticipate environmental changes based on weather forecasts and respond sooner. The smart thermostat also allows the user to monitor energy usage more carefully.

3. IoT wearables, such as smart watches allow communication, which might be a problem during an exam, and a distraction during study.

4. -

5. While net employment may increase in automated industries, often jobs in certain occupations are eliminated. ... Hence automation is still highly disruptive even if it does not cause mass unemployment. Some people argue that current technologies are more likely to cause unemployment because the pace of change is faster.

Resource Three
Model Answers

Answers

1. A multi-tenant cloud environment accessed over the internet
2. Both #1 and #2
3. –
4. –
5. Loss or theft of data, loss of control over data, malware infections

Resource Four
Model Answers

Answers

1. Big Data is a phrase used to mean a massive volume of both structured and unstructured data that is so large it is difficult to process using traditional database and software techniques. In most enterprise scenarios the volume of data is too big, or it moves too fast or it exceeds current processing capacity.

2. Fog computing is a term created by Cisco that refers to extending cloud computing to the edge of an enterprise's network. Also known as Edge Computing or fogging, fog computing facilitates the operation of compute, storage and networking services between end devices and cloud computing data centres.

3. Latency is the time taken for information to get to its destination and back again. It is usually measured in milliseconds.

4. Cloud computing provides extensive computation and storage capacity but has a high latency. Fog computing serves as solution to latency problems because it provides computation, storage, and networking resources closer to things and users, therefore reducing service delay for end user applications.

5. As the number of edge devices grows, fog nodes might become overloaded. One solution to this is to replace heavyweight software executed at the nodes with more efficient, lightweight algorithms that can process data faster.

Resource Five
Model Answers

Answers

1. See Figure 1: things layer, network layer (edge network, aggregation network, core network), cloud layer

2. Fog Burst: sending a set of data packets as a group, accompanied by a control packet.

3. The control packet contains important information for delivering the burst, including the destination address.

4. Assembling packets into groups reduces the number of control packets that need to be created, which reduces overhead (excess computation).

	Timer-based burst	Length-based burst
If burst is too short...	Overhead increases because more control packets need to be created	Overhead increases because more control packets need to be created
If burst is too long...	Delays are incurred, which is problem for applications like streaming	The burst contains many packets, risking large data loss if the burst is lost

6. In a hybrid approach, if the timer value is reached before the length value, then a timer-based burst is triggered. If the length value is reached before the timer-value, then a length-based fog burst is triggered. This reduces the likelihood of the burst being too short or too long.

Resource Six
Model Answers

Answers

1. More and more data will be handled via Fog Computing, but Cloud Computing will still be called upon to run heavy algorithms and to share data with devices across the IoT.

2. Fog Computing eliminates the need for data round-trip to a Cloud Computing location, reducing bandwidth requirements and therefore cost.

3. Fog Computing eliminates the need for the data round-trip to a Cloud Computing location, thereby reducing the chance of the data being intercepted.

4. Contention occurs when two data packets attempt to reserve a resource e.g. a switch. One of the packets will ultimately be dropped. Resending leads to increased delays.

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