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ASSESMENT-1(EDGE COMPUTING)

1A)

In health care, edge computing has several benefits in the form of local processing and swift decision-making. Interoperability problems arise due to the sheer number of devices and platforms employed in health care ranging from wearable health monitoring devices and mobile devices to hospital information systems and cloud infrastructure. Each of these devices may have distinct communication protocols, data structures, and hardware. Such heterogeneity can give rise to problems in seamless data exchange, thus impacting task scheduling and coordination of resources. For instance, if a wearable sensor is not able to communicate effectively with a proximal edge server due to incompatible protocols or data formats, it may result in timely data processing, thus enhancing system latency and responsiveness.

Cybersecurity is another important issue that has a direct impact on the performance and reliability of the edge deployments. Healthcare edge computing is likely to deal with extremely sensitive patient information such as real-time diagnostic images and personal health records. Without proper security features such as encryption, access control, and authentication, the system becomes susceptible to data breaches and cyberattacks. Not only do the attacks compromise patient privacy, but they also result in service downtime, reduced availability, and even physical harm to the patients if decisions are delayed or compromised based on real-time data. Interoperability and cybersecurity issues collectively have negative effects on important deployment metrics such as latency, uptime, reliability, and trustworthiness. Controlling them is essential for the edge computing systems in healthcare to be safe, efficient, and reliable.

2A)

Healthcare edge computing performance assessment must cover a complete set of criteria for measuring both system performance and clinical relevance. Of these, latency is likely most critical. Medical applications usually require real- time response tracking a patient's vital signs, alerting a physician to an abnormal reading, or operating robotic surgical tools. Edge computing reduces latency with closer processing to the source, but the benefit must be monitored continuously to keep it in alignment with medical cases. Accuracy is a very critical measure in instances where AI algorithms are used for diagnostic imaging. Inadequate analysis can lead to false or missed diagnoses, compromising patient health.

Other critical performance indicators include energy usage, particularly for battery-powered health devices such as wearable monitors. Low energy usage means longer device life and minimal disruption in patient monitoring. Resource usage—i.e., the effectiveness with which computing, storage, and communication resources are utilized—is also a critical area in maintaining smooth operation, particularly when many devices compete for edge resources. Cost-effectiveness is also a critical performance indicator, as healthcare systems often need to balance technological innovation with cost. Other indicators such as Quality of Service (QoS) and Quality of Experience (QoE) also indicate the end-to-end efficiency and user satisfaction of edge services. Lastly, privacy and compliance indicators are critical in maintaining data handling within legal and ethical limits, particularly in healthcare where personal data is highly sensitive.

3A)

Utilization of AI algorithms at the edge for patient diagnosis is gaining traction very rapidly, but for making them helpful, such systems must be extensively tested against proper benchmarks. The most essential benchmark is diagnostic accuracy, which is how well the algorithm diagnoses medical conditions. This is typically measured by conventional metrics such as precision, recall, and F1-score. These metrics ensure that the algorithm maintains false positives and false negatives to a bare minimum, which is of utmost concern in healthcare environments where false diagnoses can prove calamitous. Latency is another essential benchmark because timely analysis is essential in healthcare. The ability of an edge AI system to deliver accurate results in real time—without having to send the data back to the cloud—will be essential for uses such as remote patient monitoring or handling emergencies.

Reliability as a measure means consistent behavior of the AI system across scenarios such as different network conditions, device capabilities, and types of patient data. Systems need to be tested for fault tolerance and resilience to ensure they function under resource starvation or hardware failure. Energy efficiency is another measure, especially for wearable and mobile edge devices. Algorithms need to execute within tight energy budgets without compromising on performance. Furthermore, the scalability with growing workloads—also known as throughput—is tested to ensure the AI can process multiple patients or tasks concurrently. Lastly, privacy and compliance measures are also crucial. Edge AI systems in the healthcare sector must not only work but process data securely and under compliance such as HIPAA or GDPR. All these measures collectively constitute an entire framework for testing the readiness of edge AI systems to be deployed into reliable and responsible healthcare diagnostics.

4A)

In edge-computing-powered healthcare applications, the role of system performance metrics cannot be emphasized more, as these determine patient care outcomes, operational efficiency, and institutional credibility. Arguably the most vital metric is latency, particularly in time-sensitive applications like emergency diagnoses or surgical assist systems. Speedy processing guarantees that medical judgments are processed in real time to minimize the probability of delays that may jeopardize patient safety. Throughput, or the capacity for a certain number of tasks or streams of data to be processed within a specified time period, becomes significant in high-traffic situations such as hospitals where various devices and users are simultaneously interacting with edge systems.

The diagnosis accuracy, especially when AI is involved, underpins clinical value in edge computing. AI models need to provide accurate insights all the time, since any misdiagnosis has life-changing consequences. This renders diagnostic accuracy an absolute benchmark. Uptime and system availability are also crucial; medical care cannot support repeated system outages because even short-term unavailability can interrupt monitoring, delay treatment, or impact surgical procedures. Privacy compliance is also paramount, considering the nature of healthcare information. Edge computing must provide secure data processing across all steps, ensuring patient data from unauthorized access and complying with regulatory requirements.

Lastly, cost-effectiveness decides the scalability and sustainability of edge computing in healthcare environments. Clinics and hospitals tend to work under tight budgets, and therefore solutions have to provide high performance without paying exorbitant prices. Resource scheduling is an important part here by optimizing the utilization of computing, storage, and network resources in order to achieve maximum service quality with minimum expenses. When all of these measurements are thoroughly weighed and balanced, edge computing has the potential to be a revolutionary force in providing smarter, speedier, and more secure healthcare.