The primary challenge of cloud service providers is finding ways to maintain a high degree of Quality of Service (QoS) in a cost-effective manner to ensure either profitability (for business-based cloud service providers) or cost avoidance (for government cloud service providers). The traditional approach to improving system performance is to upgrade the servers and/or network backbone, an expensive undertaking. The authors used OPNET Modeler to represent distributed system architecture supporting a variety of application services and defined a framework for measuring QoS from the end-user's perspective and discovered that there is no direct relationship between server/network upgrades and overall QoS in distributed systems. This framework can be used as a decision support tool for cloud service providers to optimize the QoS of their systems by choosing upgrade strategies that provide the greatest "bang for the buck." 

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**Index Terms**

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