

Bottleneck Modeling in Information Technology Service Management

Authors : Abhinay Puvvala, Veerendra Kumar Rai

Abstract : A bottleneck situation arises when the outflow is lesser than the inflow in a pipe-like setup. A more practical interpretation of bottlenecks emphasizes on the realization of Service Level Objectives (SLOs) at given workloads. Our approach detects two key aspects of bottlenecks – when and where. To identify ‘when’ we continuously poll on certain key metrics such as resource utilization, processing time, request backlog and throughput at a system level. Further, when the slope of the expected sojourn time at a workload is greater than ‘K’ times the slope of expected sojourn time at the previous step of the workload while the workload is being gradually increased in discrete steps, a bottleneck situation arises. ‘K’ defines the threshold condition and is computed based on the system’s service level objectives. The second aspect of our approach is to identify the location of the bottleneck. In multi-tier systems with a complex network of layers, it is a challenging problem to locate bottleneck that affects the overall system performance. We stage the system by varying workload incrementally to draw a correlation between load increase and system performance to the point where Service Level Objectives are violated. During the staging process, multiple metrics are monitored at hardware and application levels. The correlations are drawn between metrics and the overall system performance. These correlations along with the Service Level Objectives are used to arrive at the threshold conditions for each of these metrics. Subsequently, the same method used to identify when a bottleneck occurs is used on metrics data with threshold conditions to locate bottlenecks.

Keywords : bottleneck, workload, service level objectives (SLOs), throughput, system performance

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