Percent Utilization of Total Capacity

How much of a given resource are we actually using? This is an important metric because using too much of the total amount of an available resource may incur business risks, such as creating an inability to meet occasional surges in demand (e.g. creating situations of insufficient network bandwidth or storage capacity that have a cascading impact on business activities), while using too little of a resource means that money is being tied up in excess capacity that otherwise could be allocated to further business objectives. Fortunately, this metric is relatively simple to measure. Suppose we have a hundred of something (i.e. "Capacity"), but are only using 23 of them (i.e. "Utilization"), then we may say that we are using 23/100, or 23% of that resource. We call this metric "Percent Utilization".

"Percent Utilization", denoted by the capital of the Greek letter Upsilon (Υ), is simply the Utilization (U) of any resource divided by its Capacity (C):

$$\Upsilon \equiv \frac{Utilization}{Capacity} = \frac{U}{C}$$

This metric is "normalized", scale independent, dimensionless (i.e. the units cancel out), and easy to grasp. Its values range from a minimum of zero (when there is no utilization) to a maximum of one (when utilization is equal to capacity):

$$\{0 \leq \Upsilon \leq 1\}$$

But what about the need for a metric that goes beyond a single kind of resource? Suppose, for example, that one wishes to "roll up" a collection of capacity metrics for various types of resources to arrive at a single, aggregate metric that could represent how the organization is doing in terms of its overall capacity utilization? For the purpose of aggregating percent utilization metrics within or across resource domains, we may achieve this by applying a weight (w) to each individual metric before summing them all together:

$$\Upsilon_{Aggregate} = \sum_{i=1}^{n} w_i \frac{U_i}{C_i}$$

Weighting "scales" the contribution of each individual capacity utilization metric to the overall sum. This, however, begs the question of how to arrive at an appropriate weighting system. There are many different ways of going about this. The following are three weighting methods that could applied.

Equal weighting – In this method, the individual metrics are weighted equally, i.e. the sum of all metrics simply is divided by the number of metrics in the aggregate equation (n).

$$\Upsilon_{Aggregate} = \frac{i}{n} \sum_{i=1}^{n} \frac{U_i}{C_i}$$

Proportional weighting – In this method, the individual metrics are each weighted proportionately according to that component's contribution to overall capacity, with the sum of all weights being equal to one.

$$\Upsilon_{Aggregate} = \sum_{i=1}^{n} \left(\frac{C_i}{\sum_{i=1}^{n} C_i} \frac{U_i}{C_i} \right) = \sum_{i=1}^{n} \left(\frac{U_i}{\sum_{i=1}^{n} C_i} \right) = \frac{\sum_{i=1}^{n} U_i}{\sum_{i=1}^{n} C_i}$$

Value weighting – In this method, individual metrics are weighted by the relative value of each component (formula not shown). If a given resource is more valuable *to the organization* than another, it is given a greater weight.

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