On Virtualization

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Abstract

A precise definition of *virtualization* has been elusive. Given the advent of virtualization as a major compute, storage and networking building block a working definition of virtualization would be helpful....blah blah blah

1 Introduction

Virtualization is a relationship between producers and consumers of a given resource. For example, a physical server may provide sharing of cores (virtualization) to some number of consumers of those cores. Let P_r be the set of producers of a resource r such that

$$P_r = \sum_{i=1}^{n} P_{i,r} \tag{1}$$

and let C_r be the set of consumers of a resource r such that

$$C_r = \sum_{j=1}^{m} C_{j,r} \tag{2}$$

Then the *virtualization* of a resource r, V_r is defined to be

$$V_r = (P_r, C_r, F_r(P_r, C_r)) \tag{3}$$

where

$$F_r = \iint_{i,j} f_{r_{x,y}}(P_{x,r}, C_{y,r})\, dx\, dy \tag{4}$$

and

$$f_{r_{x,y}} : C_{y,r} \to P_{x,r} \tag{5}$$

That is, a resource r is "virtualized" by a function F_r. That is, $F_r : C_r \to P_r$. Note that $V_r \approx L(r)$, i.e., *virtualization is a layering.*

1.1 Interesting Boundary Conditions

There are several interesting cases for $P : C$, namely

- $1 : 1$ – This is the "no virtualization" case
- $1 : M$ – This is the hypervisor case
- $N : 1$ – This is the "big switch" case
- $N : M$ – This is the "scale out" case