CMP SCI 635: Modern Computer Architecture

Joint Optimization of Idle and Cooling Power in Data Centers While Maintaining Response Time

Name: Kunjal Panchal Date: 10th Dec, 2019 Student ID: 32126469

Paper: 24 – Data Centers [Ahmad10]

Strengths:

1. For datacentres, we want things properly grounded. We want things to stay at the right temperature and humidity. We want the design to be serviceable once everything is installed. We want the electrics and the HVAC system to be sufficiently redundant and resilient. We want the cabinets aligned so that air flows properly, and we want them aligned so that the heat can be dispersed while taking in the cool air from the chillers. We want the racks cabled so that we never need to come into the datacentre to run more cable ever again. We want the network gear aligned in the racks so that if we would ever lose a whole rack, it doesn't take our network down. We want servers staged across the cabinets so that applications that are running across them don't go down if a single cabinet goes down. We want the cabinets balanced in such a way that they are drawing power evenly off of both feeds. This paper covers the power requirements in thorough detail.

2. Ideally for cooling, we need two systems, one that is our primary should also have humidity control to either add / remove humidity as needed to actually make the space liveable for humans. Hot / cold isles should be well thought out as well as the flooring tiles, raised floor to pipe cold air through is the best, but not always easy to get. If we can't do that, we must make sure to have returns installed in the hot isles above the exhausts.

Weaknesses:

1. The paper doesn't mention the heater, but don't we have to install a block heater and recirculation pump for the coolant so the start-up is always warm no matter what the weather. Time until on generator is sub 30 seconds, year-round. This also helps extend the life of the UPS and batteries since it spends much less time doing the lifting while waiting for the engine to get to temp. You can't go on load with a cold block.

2. The paper came out in 2010, so it's not really a weakness of it. But, raised floor is out-of-date now. Switch and other serious contenders have gone to overhead cooling on concrete floor since increasing density becomes a weight issue for a raised floor. Then for cooling, we can go for the hot isle solution, and trench the floor for the chiller plant.

Questions/Assertions:

1. We shouldn't use APC's in each cab unless we are going to use two. Ideally, we want two large UPS units to feed A/B power legs in each cab. The UPS only needs to last long enough for the generator to spin up. We don't need a redundant generator in most cases. But be sure about testing all of our power equipment at least semi-annually.

2. Do we have to replace cooling and generator every X number of years?

3. Just some tips I gathered from current data centre practices:
   Top of rack switches. Heavy stuff at the bottom. In the back, 2 pdu's on one side, networking on the other. A/B power to different pdu's. Color code the pdu's, and power cables. Zipties for power, Velcro for network. One rack to put all the core switches in, put in space between the switches, and cable management. If it is not built raised floor, look at cable trays. Avoid hard edges. Run more runs from core to leaf switches.

4. It also matters weather the facility is a ground floor build out or on an elevated floor? If the latter, and we intend to do high performance computing, we must make sure the floor is built for the potential weight per sq ft. Cooling - Ducted (chimney) return to plenum with solid back door for cooling efficiency.

5. Do all data centers have "redundant power" and extra fuel for generator? Is there any other source of redundant power in case of emergency, other than generators?