Lopoco Next Generation Ultra-Efficient Datacenter

### System Overview

The need to make data centers more energy efficient has been identified for several years now. Until now, the focus of many innovations and advancements has been in the areas of cooling, backup power generation and non IT electrical equipment (ie., lights, human inhabitant needs, etc.).

This patent focuses on the one area that remains largely untouched, and that is the efficiency of the data center IT equipment, which includes primarily computer servers, network switching appliances, and computer storage appliances and related equipment.

The efficiency of data center IT equipment is particularly bad primarily because of one simple fact: the provisioning of IT servers and equipment falls to those who don't know what application will be running on them, and, even if they have some advance information about that, they can't know what will be running on the servers in the future. Trying to coordinate between the two disparate responsibilities of provisioning and application selection has been, and is being, attempted on some level by many companies, but it typically a very slow process which neither group is all that interested in, and as such often fails. The result is a that the data center is almost entirely provisioned with a one-size-fits-all (OSFA) server configuration, which can't be designed to any successful level of efficiency. Even if some provisioning is done of a server configuration specifically matched to an application category, when that application is retired which sometimes might be as little as six months later, there exists no criteria by which those servers can be re-purposed and so are replaced with OSFA servers.

This patent description will cover a system by which an ultra-efficient data center can be accomplished.

1. Design for attaining efficiency from IT equipment
   1. In order to create a datacenter that uses its IT equipment efficiently, it must have 3 things:
      1. Servers and storage equipment that can operate efficiently, grouped into categories based on application workload footprint
      2. The dynamic and/or manual ability to match applications with the server configuration/model that is best suited for it on an acceptable efficiency/performance scale, and the ability to seamlessly migrate or run those applications on the equipment selectively suited for it
      3. Data center cooling zones based on the TDP of the server categories housed within each zone – with right-sized HVAC (cooling) provisioned separately for each zone
   2. Therefore data centers will be divided into separate cooling or “category” zones, with the HVAC requirements accurately known for each zone, so cooling equipment requirements will be well understood for each zone and can be very precisely provisioned, allowing for great cost savings over traditional designs, where the cooling is provisioned based on the maximum power available to the entire data center, rather than the actual cooling requirements of the IT equipment. These zones may or may not be separate buildings or structures, so in fact a data center may be comprised of only one zone.
   3. Use of ultra-efficient servers with accurately specified TDP will substantially decrease the amount of cooling required vs. the throughput of the servers, again decreasing costs substantially.
   4. Use of ultra-efficient servers will allow for substantial increase in overall throughput of a data center v. the data center's total power budget, substantially increasing the value of a data center with a specific power budget.
2. Application Control and Migration
   1. Proprietary application management and control software and hardware will be utilized to identify and analyze applications vis-a-vie their computing resource needs, and migrate or launch applications to the server category best suited to handle the application efficiently. This section covers the design and implementation specifics of that sub-system.
   2. Design specifics of app monitoring/migrating/controlling system
3. Ultra-Efficient Server Design
   1. All the stuff regarding the server designs and methodologies, including references to the server TDP testing software and related methodologies. Starting with the draft documents created by Cliff
4. Efficiency and Total Design Power measuring technology
   1. The hardcore description and specifications of the TDP exercising software and associated methodologies.