Distributed Systems — Power actions in a smart grid

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1 Context/background

Since the beginning of the 21st century the roles of energy suppliers has changed. In the beginning the suppliers only delivered energy to their customers for a fixed tariff, which the energy suppliers produced when there was a demand for it. Since the emergence of natural energy production from sources such as the sun and wind, the energy suppliers have to deal with a production of energy even if there is no demand for it. This results in a problem where the energy supplier gets stuck with an overproduction of energy. This problem in combination with several other factors led to the development of the Smart Grid. One of the features of a smart grid is an automatic load balancing based on production of energy. For example by shutting down or starting up a refrigerator in order to deal with the imbalance between production and consumption of energy on the grid. An extra functionality it offers in combination with the balancing function here above is to stimulate balancing of the grid by offering discounts on the energy price in case of overproduction or higher prices in case of energy shortage. By doing this local energy users, as for example server farms, can decide to reduce or increase its usage and so saving money and reducing the imbalance on the grid.

A second change in technology since the beginning of the 21st century is the shift from local computing to cloud computing. Today more and more services and software are placed in the cloud. The cloud is a general name for a large network of servers connected with each other through the Internet. By connecting a large group of server the storage, computing power and other resources of individual servers can be combined to process more complex task or balance multiple tasks over the servers that are idle at that moment.

A smart grid also has to be present in a data center. The data center itself receives a steady stream of power that it has to split among the nodes in its grid. nodes are in general servers in the data center. A server may sometimes require less power and may sometimes require more. A server should always receive its required amount of power. In general, servers are not turned off and thus in total there should always be enough power for all servers.

2 State of the Art

Advanced metering infrastructure Multicast

3 Problem statement

as more and more computing take place on servers it becomes interesting if tasks are cost efficient. are the costs lower than the potential revenue generated by it.

4 Relation to Distributed Systems

Dynamic host discovery, server can be added or removed. Needs to be a broker, so a leader inside the system. Server must be ensured that they actually can bid and use energy, so reliable channels to the broker are important.

5 Solution details

main solution algorithms IP multicast bully algorithm

6 Results

technical implementation Fault tolerance