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Problem 4. In Section 3.7 we introduced the concept of energy-proportional systems and we saw that different system components have different dynamic ranges. Sketch a strategy to reduce the power consumption in a lightly loaded cloud, and discuss the steps for placing a computational server in standby mode and then for bringing it back up to active mode.

Answer: A lightly loaded cloud basically implies that it is not operating at maximum capacity and hence, at reduced efficiency. Such a cloud will have many hosts running at sub-optimal capacity. In order to reduce power consumption, we must focus on reducing the number of hosts and maximizing the number of hosts in sleep mode.

Keeping in mind that conserving power is our end goal, we can look at shifting the load from lightly loaded hosts onto other host while ensuring that this VM migration exercise frees up as many host machines as possible. In any cloud environment, all hosts will be running a variable load. As discussed in the paper-*Reducing Total Power Consumption Method in Cloud Computing Environments*, in order to free up hosts, we need to migrate VMs from the most lightly loaded to other hosts in the system [1]. Refer the diagram given below:

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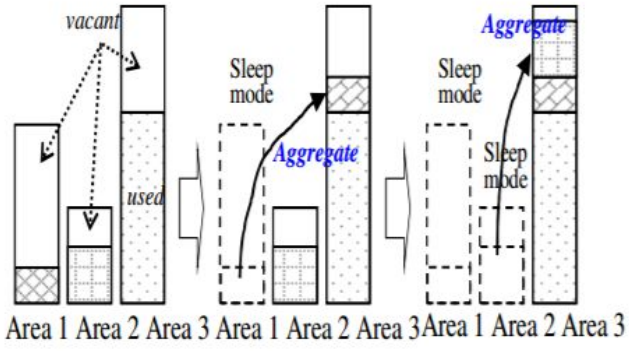

Figure 5. Example of area migration according to Policy II

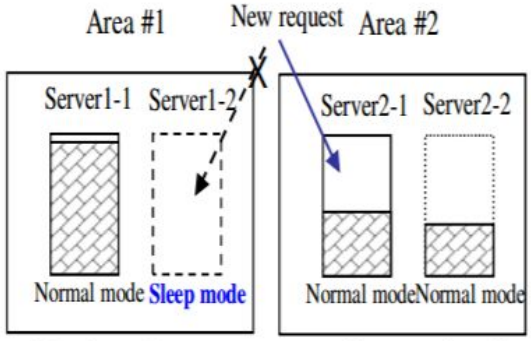

Figure 6. Example of server selection according to Policy III

As seen from the diagram, it makes more sense to move load from extremely lightly loaded serves to other servers ensures us to put these servers in sleep mode.

Additionally, the approach mentioned in the paper also suggest to moving aggregating all bandwidth-hungry and processing-intensive applications onto the same host. This will result in releasing additional hosts that can be put into sleep mode as can be seen from the diagram given below:

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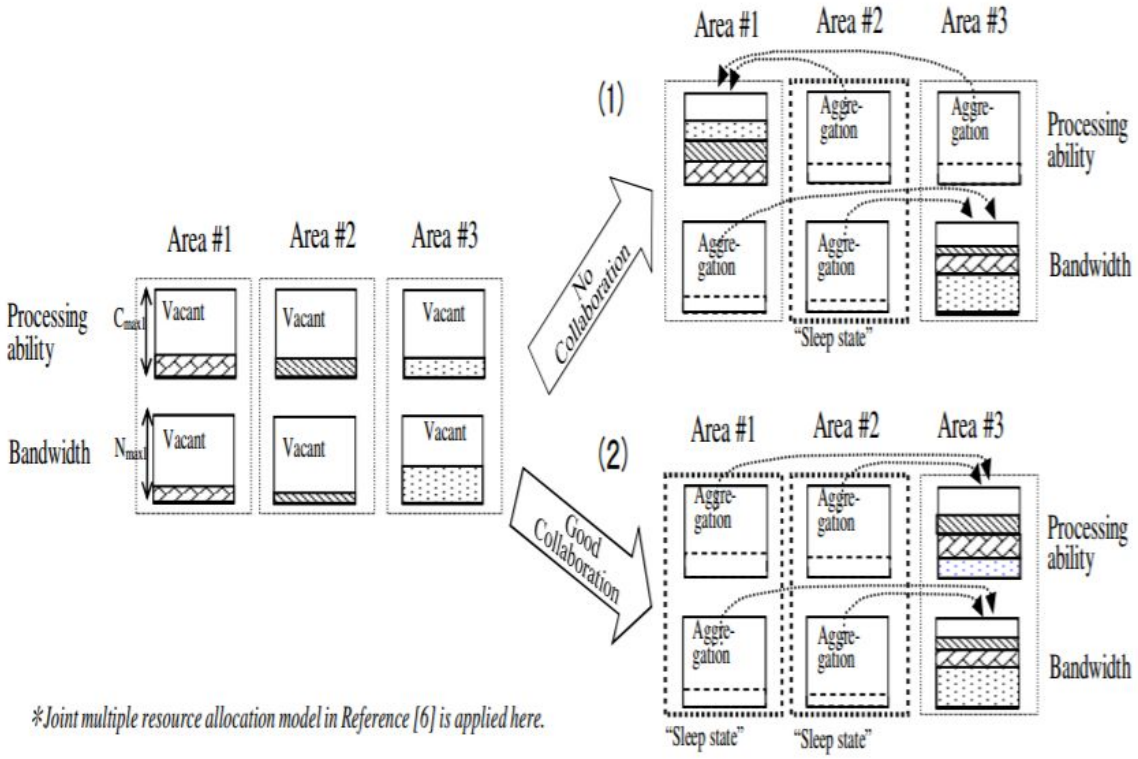

Figure 4. Collaboration image between servers and communication network

Now, let us look at the steps involved in putting a server in standby mode. The server in question is in idle state. Before we put it in standby mode, we will need to save it's state so that it can be brought back to active mode quickly whenever required. The snapshot of the server can be stored as an image onto a disk. Once the state has been saved, the server can be safely put in sleep mode. In the future, at any point, if a need arises for additional processing power, this server can be turned back on and its state can be restored from the image stored on the disk. The environment will now be informed that an additional system is back in active mode and will start allocating applications to the server.

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Problem 8: Evaluate the SLA toolkit at www.service-level-agreement.net. Is the interactive guide useful? What does it miss? Does the SLA template include all the clauses that are important in your view? If not, what is missing? Are the examples helpful?

Answer: The SLA toolkit mentioned on the website aims to be the de facto standard of SLA creation. It aims to give a general guideline to the person authoring the SLA at an organization. It comes bundled with a bunch of other utilities like:

1. A template
2. An interactive guide
3. A presentation giving an overview of SLA and why it is needed
4. Auditing and review information of existing SLAs
5. SLA Management approach

The 'Interactive SLA Guide' mentioned on the site provides an SLA template and a walk through every single clause of the agreement. It also provides a few links to screenshots of an existing template document. While it seems to cover most common topics that are expected to be part of an SLA, it does not seem to talk about the framework for understanding; A critical aspect of any SLA is framework that helps in understanding clearly the definition of service classes and the costs involved. This seems to be the only point that is missing from the SLA Templates. The examples provided while helpful in understanding some aspects of the template, cannot be used as the only basis to write a comprehensive SLA.

These are the only points that I found were missing from the SLA guide and templates. In order to get a much better idea of the toolkit, it will help to get access to the paid version of the same.

References:

1. Shin-ichi Kuribayashi, *"Reducing Total Power Consumption Method in Cloud Computing Environments",* in International Journal of Computer Networks & Communications (IJCNC) Vol.4, No.2, March 2012