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1. **A new topology brite file that contains the information shown in the two pictures (20 points)**

Attached the brite file.

1. **Source code. (20 points)**

Attached the file.

1. **Running result (not the screen shot) (10 points)**

Starting NetworkExample...

Initialising...

Topology file: topology.brite

Starting CloudSim version 3.0

Datacenter\_0 is starting...

Datacenter\_1 is starting...

Datacenter\_2 is starting...

Broker1 is starting...

Broker2 is starting...

Broker3 is starting...

Entities started.

0.0: Broker1: Cloud Resource List received with 3 resource(s)

0.0: Broker2: Cloud Resource List received with 3 resource(s)

0.0: Broker3: Cloud Resource List received with 3 resource(s)

9.199999809265137: Broker2: Trying to Create VM #0 in Datacenter\_0

11.399999618530273: Broker3: Trying to Create VM #0 in Datacenter\_0

13.800000190734863: Broker1: Trying to Create VM #0 in Datacenter\_0

[VmScheduler.vmCreate] Allocation of VM #0 to Host #0 failed by MIPS

[VmScheduler.vmCreate] Allocation of VM #0 to Host #0 failed by MIPS

18.499999618530275: Broker2: VM #0 has been created in Datacenter #2, Host #0

18.499999618530275: Broker2: Sending cloudlet 0 to VM #0

21.299999809265138: Broker3: Creation of VM #0 failed in Datacenter #2

21.299999809265138: Broker3: Trying to Create VM #0 in Datacenter\_1

21.700000381469728: Broker1: Creation of VM #0 failed in Datacenter #2

21.700000381469728: Broker1: Trying to Create VM #0 in Datacenter\_1

[VmScheduler.vmCreate] Allocation of VM #0 to Host #0 failed by MIPS

28.999999713897708: Broker3: VM #0 has been created in Datacenter #3, Host #0

28.999999713897708: Broker3: Sending cloudlet 0 to VM #0

31.80000038146973: Broker1: Creation of VM #0 failed in Datacenter #3

31.80000038146973: Broker1: Trying to Create VM #0 in Datacenter\_2

45.700000572204594: Broker1: VM #0 has been created in Datacenter #4, Host #0

45.700000572204594: Broker1: Sending cloudlet 0 to VM #0

187.6999994277954: Broker2: Cloudlet 0 received

187.6999994277954: Broker2: All Cloudlets executed. Finishing...

187.6999994277954: Broker2: Destroying VM #0

Broker2 is shutting down...

196.59999961853026: Broker3: Cloudlet 0 received

196.59999961853026: Broker3: All Cloudlets executed. Finishing...

196.59999961853026: Broker3: Destroying VM #0

Broker3 is shutting down...

219.50000076293946: Broker1: Cloudlet 0 received

219.50000076293946: Broker1: All Cloudlets executed. Finishing...

219.50000076293946: Broker1: Destroying VM #0

Broker1 is shutting down...

Simulation: No more future events

CloudInformationService: Notify all CloudSim entities for shutting down.

Datacenter\_0 is shutting down...

Datacenter\_1 is shutting down...

Datacenter\_2 is shutting down...

Broker1 is shutting down...

Broker2 is shutting down...

Broker3 is shutting down...

Simulation completed.

Simulation completed.

=============> User 5

========== OUTPUT ==========

Cloudlet ID STATUS Data center ID VM ID Time Start Time Finish Time

0 SUCCESS 4 0 160 52.6 212.6

=============> User 6

========== OUTPUT ==========

Cloudlet ID STATUS Data center ID VM ID Time Start Time Finish Time

0 SUCCESS 2 0 160 23.1 183.1

=============> User 7

========== OUTPUT ==========

Cloudlet ID STATUS Data center ID VM ID Time Start Time Finish Time

0 SUCCESS 3 0 160 32.8 192.8

NetworkExample finished!

**(4) Explanation of the running result (why does each time stamp has such a value, why does this particular virtual machine creation fail, etc) (50 points)**

Explanation: -

* At 0.0: Broker1, Broker2 and Broker3 received information of three datacenters present in the system.

Broker 2:

• “9.199999809265137: Broker2: Trying to Create VM #0 in Datacenter\_0”

Shortest path to datacenter\_0 is 3.5+1.1 = 4.6 i.e., node 5 to node 2 to node 0. Total it takes 4.6\*2 approx. 9.2 to get response back from DC0, it takes 3.5\*2 = 7 to get response from DC1 and it takes 4.5\*2 = 9 to get response from DC2. So, after when booker2 gets responses from all the datacenters, at approx. 9.2 (9.199999809265137) broker2 is ready to send out request to create VM(s).

• “Allocation of VM #0 to Host #0 failed by MIPS” it is because we have used “space shared” VM allocation policy in which a computer can only hold one virtual machine at a time, so when we try to create second virtual machine in the same host (Computer), it won’t get created and displayed an error message.

• Broker2 will send VM creation request to DC0. Output of the console is described below:

“18.499999618530275: Broker2: VM #0 has been created in Datacenter #2, Host #0”:

Broker2 sends VM creation request to DC0, DC0 receives the request at 9.2 + 4.6 = 13.8 DC0 takes 0.1 to create VM, takes 4.6 to replies to broker2

9.2 + 4.6 + 0.1 + 4.6 = 18.4 (18.499999618530275).

• “187.6999994277954: Broker2: Cloudlet 0 received”

4.6 (send request to run cloudlet in VM in DC0) +160 (1000/250) +4.6+18.4 = 187.6 (187.6999994277954).

• At 187.6999994277954: Broker2 starts Destroying VM #0

• Start Time = 18.4 (18.499999618530275) +4.6 (request from broker2 to DC0) = 23.1

• Time = (Length of the CloudLet/MIPS of CPU) = 1000/250 = 160

• Finish Time = Start Time + Time = 23.1 + 160 =183.1

Broker 3:

• “11.399999618530273: Broker3: Trying to Create VM #0 in Datacenter\_0”

Shortest path to datacenter\_0 is 3.8+1.1 = 4.9 i.e., node 9 to node 2 to node 0. Total it takes 4.9\*2 approx. 9.8 to get response back from DC0, it takes 3.8\*2 = 7.6 to get response from DC1 and via nodes 9 to 2 to 6 to 7, it takes (3.8+0.8+1.1) \*2 = 5.7\*2 = 11.4 to get response from DC2. So, when booker3 gets responses from all the datacenters, at approx. 11.4 (11.399999618530273) broker3 is ready to send out request to create VM(s).

• “Allocation of VM #0 to Host #0 failed by MIPS” it is because we have used “space shared” VM allocation policy in which a computer can only hold one virtual machine at a time, so when we try to create second virtual machine in the same host (Computer), it won’t get created and displayed an error message.

• “21.299999809265138: Broker3: Creation of VM #0 failed in Datacenter #2”

Broker3 will send creation request to DC0, DC0 receives the request at 11.4+4.9, 0.1 for VM creation (failed), information goes back to broker3 (4.9)

11.4+4.9+0.1+4.9= 21.3 (21.299999809265138) (broker3 learns that creation of datacenter0 is failed).

• “28.999999713897708: Broker3: VM #0 has been created in Datacenter #3, Host #0

28.999999713897708: Broker3: Sending cloudlet 0 to VM #0”.

• At 21.3, broker 3 requests to create VM in DC1, it takes 3.8 for the request to be at DC1, 0.1 for VM creation, 3.8 to go back to broker3, so 21.3+3.8+0.1+3.8 = 29(28.999999713897708).

At 28.999999713897708 broker2 sends request to run cloudlet in VM in DC1.

• “196.59999961853026: Broker3: Cloudlet 0 received”

3.8 (send request to run cloudlet in VM in DC1) + 160 (1000/250 )+3.8+29 =196.6 (196.59999961853026) when broker3 receives cloudlet from DC1.

• At 196.59999961853026: Broker3 starts destroying VM #0

• Start Time = 29 (28.999999713897708) +3.8 (request from broker3 to DC1) = 32.8

• Time = (Length of the CloudLet/MIPS of CPU) = 1000/250 = 160

• Finish Time = Start Time + Time = 32.8 + 160 =192.8

Broker 1:

• “13.800000190734863: Broker1: Trying to Create VM #0 in Datacenter\_0”

Shortest path to datacenter\_0 is 3.9 = 3.9, total it takes 3.9\*2 approx. 7.8 to get response back from DC0, via nodes 3 to 0 to 2 it takes (3.9+1.1)\*2 = 5.0\*2= 10.0 to get response from DC1 and via nodes 3 to node 0 to node 2 to node 6 to node 7, it takes (3.9+1.1+0.8+1.1)\*2 = 6.9\*2 = 13.8 to get response from DC2. So, when booker1 gets responses from all the datacenters, at approx. 13.8 (13.800000190734863) broker1 is ready to send out request to create VM(s).

• “Allocation of VM #0 to Host #0 failed by MIPS” it is because we have used “space shared” VM allocation policy in which a computer can only hold one virtual machine at a time, so when we try to create second virtual machine in the same host (Computer), it won’t get created and displayed an error message.

• “21.700000381469728: Broker1: Creation of VM #0 failed in Datacenter #2”

Broker1 will send creation request to DC0, DC0 receives the request at 13.8+3.9, 0.1 for VM creation (failed), information goes back to broker1 (3.9)

13.8+3.9+0.1+3.9= 21.7 (21.700000381469728) (broker3 learns that creation of datacenter0 is failed)

• “31.80000038146973: Broker1: Creation of VM #0 failed in Datacenter #3”

Broker1 will send creation request to DC1, DC1 receives the request at 21.7+5.0, 0.1 for VM creation (failed), information goes back to broker1 (5.0)

21.7+5.0+0.1+5.0= 31.8 (31.80000038146973) (broker3 learns that creation of datacenter1 is failed)

• “45.700000572204594: Broker1: VM #0 has been created in Datacenter #4, Host #0

45.700000572204594: Broker1: Sending cloudlet 0 to VM #0”

Broker1 will send creation request to DC2, DC2 receives the request at 31.8+6.9, 0.1 for VM creation, information goes back to broker1 (6.9)

31.8+6.9+0.1+6.9= 45.7 (45.700000572204594).

• “219.50000076293946: Broker1: Cloudlet 0 received”

At 45.700000572204594 broker1 sends request to run cloudlet in VM in DC2.

6.9 (send request to run cloudlet in VM in DC2) +160 (1000/250) +6.9+45.7 =219.5 (219.50000076293946) when broker3 receives cloudlet from DC2.

• At 219.50000076293946: Broker1 starts destroying VM#0.

• Start Time = 45.7+5.0 (request from broker1 to DC2) = 52.7 (approx. 52.6)

• Time = (Length of the CloudLet/MIPS of CPU) = 1000/250 = 160

• Finish Time = Start Time + Time = 52.6. + 160 =212.6