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***Cloud Computing and Distributed Technologies***

**Due date: 14<sup>th</sup> Dec 2018**

**Name: Madhurya Manjunath Mamulpet**

**ID: 8369749**

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# CloudSim

## 1. Introduction

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It is a new extensible simulation framework that enables modeling, simulation and experimentation of emerging Cloud Computing infrastructure (Calheiros *et al.*, 2010) and application service that enables developers to perform a test of their provisioning policies in a control and repeatable environment. It helps to analyse the worst-case scenarios before the real-world deploys it.

## 2. Capabilities of CloudSim

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Capabilities of Cloud computing supports simulation and modeling of cloud computing in a large-scale environment, that includes data centers in a single computing node physically. It is a platform that is self-contained for modeling cloud, provisioning **self-service** and allocating policies. It supports simulation network connections compared to all other system elements.

Offers facility for simulation of federated cloud environment of resources that is inter-networked from public and private domains.

The virtualization engine that is available to help create and manage multiple virtualized services in a data center node.

The allocation of processing cores is flexible to switch to space -shared or time shared in virtualized services.

CloudSim is a stimulating tool that enables developers to perform a test of their provisioning policies in a control and repeatable environment. It helps to analyse the worst-case scenarios before the real- world deploys it.

- Pooling resources
- Broad Network access on demand
- Self-service

## 3. CloudSim Architecture

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CloudSim Architecture (Calheiros *et al.*, 2010) contains different computing levels

User level where applications are directly accessible by the end-users. Example: Enterprise and Scientific.

middleware **SaaS** it contains software frameworks, like Web2.0 Interfaces, That help developer in creating cost-effective and user-interfaces.

Core middleware (**PaaS**) (Haider and Wahab, 2011) develops the platform services that includes run-time environment which helps in hosting and managing the user level application services

**IaaS** System level. It is an existing large physical resource that powers the data centers

User code is the basic entities that include their specification, application requirements, number of users, VMs, type, and Scheduling policies.

Simulation layer of CloudSim I includes dedicated interfaces for storage, bandwidth, and VMs.

Related Classes (Kumar and Goudar, 2012)

CloudSim is the main class, that is responsible for event managing queues and step by step controlling simulation events.

the future queue is a class that develops the future event queue used by CloudSim.

Deferred Queues the class that develops the deferred event queue accessible by CloudSim.

#### 4. Comparison of various CloudSim

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Features Compared	Package org.CloudSim. or bus.examples	Package org.CloudSim.orgbus. examples.network	Package org.CloudSim.orgbus. examples.network. datacenter
Data Centers	A datacentre is developed with one or two hosts, It is a resource class whose host List are visualized	A datacentre is developed that must run within cloudlets	Requires data center
Hosts		Contains a host associated with VM scheduler with cloudlets	Host packet that travels through the virtual network with a host
VM & CLOUDLETS			-
PE (Processing Elements)	There is two type of time shared allows sharing of processing elements by multiple VMs and spaces shared doesn't pallow sharing of PEs.	-	-
Scheduling Policy		-	Network Cloudlet Space Shared Scheduler develops a scheduling policy performed by a VM
Network & Topologies	It includes structured network packets	It contains a network topology Topological node is a network node that restores information from a topological-generated file. It contains delay logical information for the network	Edge switch enables to simulate edge switch for data center network

Table 1 – Comparison of various Cloudsim

## Package org.CloudSim.orgbus.examples

This class includes a structured **network packet**(Calheiros *et al.*, 2010)

The data center is a resource class whose **host List** are visualized

Characteristics of data center represent static properties such as architecture of a resources, Operating System (OS), **management policy** , time zone along which the resource is located along resource configuration.

There is two type of time shared **allows sharing of Processing elements by multiple Virtual machines**.and spaces shared doesn't allow sharing of PEs.

## Package org.CloudSim.orgbus.examples.network

The **topological graph** is that class that represents a graph containing nodes and edges, that are used for input with a network layer.

Topological link is a class that s and **link (edge)** from a graph

Topological node is a network node that revives information from a generated file.

## Package org.CloudSim.orgbus.examples.network.datacenter

Edge switch enables to simulate **edge switch** for data center network

Host packet a data packet which passes through the **virtual network** with a host

Network **Cloudlet Space Shared Scheduler** develops a scheduling policy is performed by VM machine

## 5. 2a -simulation

### a) Space-Space

```
83 //create two VMs
84 Vm vm1 = new Vm(vmid, brokerId, mips, pesNumber, ram, bw, size, vmm, new CloudletSchedulerSpaceShared());
85
86 vmid++;
87 Vm vm2 = new Vm(vmid, brokerId, mips, pesNumber, ram, bw, size, vmm, new CloudletSchedulerSpaceShared());
88
89 //add the VMs to the vmList
90
91 long bw = 1000;
92 int pesNumber = 1; //number of cpus
93 String vmm = "Xen"; //VMM name
94
95 //create two VMs
96 Vm vm1 = new Vm(vmid, brokerId, mips, pesNumber, ram, bw, size, vmm, new CloudletSchedulerTimeShared());
97 vmid++;
98 Vm vm2 = new Vm(vmid, brokerId, mips, pesNumber, ram, bw, size, vmm, new CloudletSchedulerTimeShared());
99
100 //add the VMs to the vmList
101 vmList.add(vm1);
102 vmList.add(vm2);
103
104 //submit vm list to the broker
105 broker.submitVmList(vmList);
106
107 //Fifth step: Create two Cloudlets
```

org.cloudsim.examples.CloudSim1 > main > try >

Output - CloudSim1 (run) X

Cloudlet ID	STATUS	Data center ID	VM ID	Time	Start Time	Finish Time
0	SUCCESS	2	0	5000	0.1	5000.1
2	SUCCESS	2	0	5000	0.1	5000.1
4	SUCCESS	2	0	5000	0.1	5000.1
6	SUCCESS	2	0	5000	0.1	5000.1
8	SUCCESS	2	0	5000	0.1	5000.1

CloudSimExample2 finished!  
BUILD SUCCESSFUL (total time: 0 seconds)

## b) Space-Time

```

Source History
74 //VM description
75 int vmid = 0;
76 int mips = 250;
77 long size = 10000; //image size (MB)
78 int ram = 512; //vm memory (MB)
79 long bw = 1000;
80 int pesNumber = 1; //number of cpus
81 String vmm = "Xen"; //VMM name
82
83 //create two VMs
84 Vm vm1 = new Vm(vmid, brokerId, mips, pesNumber, ram, bw, size, vmm, new CloudletSchedulerSpaceShared());
85
86 vmid++;
87 Vm vm2 = new Vm(vmid, brokerId, mips, pesNumber, ram, bw, size, vmm, new CloudletSchedulerSpaceShared());
88
89 //add the VMs to the vmList
90 vmList.add(vm1);
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```

```

Source History
88 String vmm = "Xen"; //VMM name
89
90 //create two VMs
91 Vm vm1 = new Vm(vmid, brokerId, mips, pesNumber, ram, bw, size, vmm, new CloudletSchedulerTimeShared());
92
93 vmid++;
94 Vm vm2 = new Vm(vmid, brokerId, mips, pesNumber, ram, bw, size, vmm, new CloudletSchedulerTimeShared());
95
96 //add the VMs to the vmList
97 vmList.add(vm1);
98 vmList.add(vm2);
99
100 //submit vm list to the broker
101 broker.submitVmList(vmList);
102
103
104 //Fifth step: Create two Cloudlets
105 cloudletList = new ArrayList<Cloudlet>();
106

```

## 6. 2b simulation

### a) Time-Time

```

85 Vm vm1 = new Vm(vmid, brokerId, mips, pesNumber, ram, bw, size, vmm, new CloudletSchedulerTimeShared());
86
87 vmid++;
88 Vm vm2 = new Vm(vmid, brokerId, mips, pesNumber, ram, bw, size, vmm, new CloudletSchedulerTimeShared());
89
90 //add the VMs to the vmList
91 vmList.add(vm1);
92 vmList.add(vm2);

```

```

===== OUTPUT =====
Cloudlet ID   STATUS   Data center ID   VM ID   Time   Start Time   Finish Time
0            SUCCESS   2               0       1000    0.1          1000.1
1            SUCCESS   2               1       1000    0.1          1000.1
2            SUCCESS   2               0       1000    1000.1       2000.1
3            SUCCESS   2               1       1000    1000.1       2000.1
4            SUCCESS   2               0       1000    2000.1       3000.1
5            SUCCESS   2               1       1000    2000.1       3000.1
6            SUCCESS   2               0       1000    3000.1       4000.1
7            SUCCESS   2               1       1000    3000.1       4000.1
8            SUCCESS   2               0       1000    4000.1       5000.1
9            SUCCESS   2               1       1000    4000.1       5000.1

CloudSim2c finished!
BUILD SUCCESSFUL (total time: 0 seconds)

```

### b) Space-Space

```

83 //create two VMS
84 Vm vm1 = new Vm(vmid, brokerId, mips, pesNumber, ram, bw, size, vmm, new CloudletSchedulerSpaceShared());
85
86 vmid++;
87 Vm vm2 = new Vm(vmid, brokerId, mips, pesNumber, ram, bw, size, vmm, new CloudletSchedulerSpaceShared());
88
89 //add the VMs to the vmList
90 vmList.add(vm1);
91 vmList.add(vm2);

```

```

209 hostList.add(
210     new Host(
211         hostId,
212         new RamProvisionerSimple(ram),
213         new BwProvisionerSimple(bw),
214         storage,
215         peList,
216         new VmSchedulerSpaceShared(peList)
217     )

```

```

===== OUTPUT =====
Cloudlet ID   STATUS   Data center ID   VM ID   Time   Start Time   Finish Time
0             SUCCESS   2               0       1000    0.1          1000.1
1             SUCCESS   2               1       1000    0.1          1000.1
2             SUCCESS   2               0       1000    1000.1       2000.1
3             SUCCESS   2               1       1000    1000.1       2000.1
4             SUCCESS   2               0       1000    2000.1       3000.1
5             SUCCESS   2               1       1000    2000.1       3000.1
6             SUCCESS   2               0       1000    3000.1       4000.1
7             SUCCESS   2               1       1000    3000.1       4000.1
8             SUCCESS   2               0       1000    4000.1       5000.1
9             SUCCESS   2               1       1000    4000.1       5000.1
CloudSim2b finished!
BUILD SUCCESSFUL (total time: 0 seconds)

```

### c) Space-Time

```

84 | | | | | Vm vm1 = new Vm(vmid, brokerId, mips, pesNumber, ram, bw, size, vmm, new CloudletSchedulerSpaceShared());
85 | | | | |
86 | | | | | vmid++;
87 | | | | | Vm vm2 = new Vm(vmid, brokerId, mips, pesNumber, ram, bw, size, vmm, new CloudletSchedulerSpaceShared());
88 | | | | |
89 | | | | | //add the VMs to the vmList
90 | | | | | vmList.add(vm1);
91 | | | | | vmList.add(vm2);

```

```

===== OUTPUT =====
Cloudlet ID   STATUS   Data center ID   VM ID   Time   Start Time   Finish Time
0             SUCCESS   2               0       5000    0.1          5000.1
2             SUCCESS   2               0       5000    0.1          5000.1
4             SUCCESS   2               0       5000    0.1          5000.1
6             SUCCESS   2               0       5000    0.1          5000.1
8             SUCCESS   2               0       5000    0.1          5000.1
1            SUCCESS   2               1       5000    0.1          5000.1
3            SUCCESS   2               1       5000    0.1          5000.1
5            SUCCESS   2               1       5000    0.1          5000.1
7            SUCCESS   2               1       5000    0.1          5000.1
9            SUCCESS   2               1       5000    0.1          5000.1
CloudSim2a finished!
BUILD SUCCESSFUL (total time: 0 seconds)

```

```

206 | | | | | // 3. Create PEs and add these into a list.
207 | | | | | peList.add(new Pe(0, new PeProvisionerSimple(mips)));
208 | | | | | peList.add(new Pe(1, new PeProvisionerSimple(mips))); // need
209 | | | | |
210 | | | | | //4. Create Host with its id and list of PEs and add them to
211 | | | | | int hostId=0;
212 | | | | | int ram = 2048; //host memory (MB)
213 | | | | | long storage = 1000000; //host storage
214 | | | | | int bw = 10000;
215 | | | | |
216 | | | | | hostList.add(
217 | | | | |     new Host(
218 | | | | |         hostId,
219 | | | | |         new RamProvisionerSimple(ram),
220 | | | | |         new BwProvisionerSimple(bw),
221 | | | | |         storage,
222 | | | | |         peList,
223 | | | | |         new VmSchedulerTimeShared(peList)
224 | | | | |     ); // This is our machine
225 | | | | |
226 | | | | |

```

### d) Time-Space

```

91 | | | | | Vm vm1 = new Vm(vmid, brokerId, mips, pesNumber, ram, bw, size, vmm, new CloudletSchedulerTimeShared());
92 | | | | |
93 | | | | | vmid++;
94 | | | | | Vm vm2 = new Vm(vmid, brokerId, mips, pesNumber, ram, bw, size, vmm, new CloudletSchedulerTimeShared());
95 | | | | |
96 | | | | | //add the VMs to the vmList
97 | | | | | vmList.add(vm1);
98 | | | | | vmList.add(vm2);

```



```

===== OUTPUT =====
Cloudlet ID   STATUS   Data center ID   VM ID   Time   Start Time   Finish Time
0             SUCCESS   2               0       2500   0.1          2500.1
1             SUCCESS   2               0       2500   0.1          2500.1
2             SUCCESS   2               0       2500   0.1          2500.1
3             SUCCESS   2               0       2500   0.1          2500.1
4             SUCCESS   2               0       2500   0.1          2500.1
5             SUCCESS   2               1       2500   0.1          2500.1
6             SUCCESS   2               1       2500   0.1          2500.1
7             SUCCESS   2               1       2500   0.1          2500.1
8             SUCCESS   2               1       2500   0.1          2500.1
9             SUCCESS   2               1       2500   0.1          2500.1
CloudSim2d finished!
BUILD SUCCESSFUL (total time: 0 seconds)

```

## 7. 2c Simulation

### a) Time-Time

```

213         hostList.add(
214             new Host(
215                 hostId,
216                 new RamProvisionerSimple(ram),
217                 new BwProvisionerSimple(bw),
218                 storage,
219                 peList,
220                 new VmSchedulerTimeShared(peList)
221             )
222         ); // This is our first machine
223
224         //create another machine in the Data center
225         List<Pe> peList2 = new ArrayList<Pe>();
226
227         peList2.add(new Pe(0, new PeProvisionerSimple(mips)));
228
229         hostId++;
230
231         hostList.add(
232             new Host(
233                 hostId,
234                 new RamProvisionerSimple(ram),
235                 new BwProvisionerSimple(bw),
236                 storage,
237                 peList2,
238                 new VmSchedulerTimeShared(peList2)
239             )
240         ); // This is our second machine
241

```

```

88         //create two VMs
89         Vm vm1 = new Vm(vmid, brokerId, mips, pesNumber, ram, bw, size, vmm, new CloudletSchedulerTimeShared());
90
91         //the second VM will have twice the priority of VM1 and so will receive twice CPU time
92         vmid++;
93         Vm vm2 = new Vm(vmid, brokerId, mips * 2, pesNumber, ram, bw, size, vmm, new CloudletSchedulerTimeShared());
94
95         //add the VMs to the vmList
96         vmList.add(vm1);

```

```

===== OUTPUT =====
Cloudlet ID   STATUS   Data center ID   VM ID   Time   Start Time   Finish Time
5             SUCCESS   2               1       400    0.1          400.1
6             SUCCESS   2               1       400    0.1          400.1
7             SUCCESS   2               1       400    0.1          400.1
8             SUCCESS   2               1       400    0.1          400.1
9             SUCCESS   2               1       400    0.1          400.1
0             SUCCESS   2               0       800    0.1          800.1
1             SUCCESS   2               0       800    0.1          800.1
2             SUCCESS   2               0       800    0.1          800.1
3             SUCCESS   2               0       800    0.1          800.1
4             SUCCESS   2               0       800    0.1          800.1
CloudSim3a finished!
BUILD SUCCESSFUL (total time: 0 seconds)

```

## b) Space-Time

```

90 //create two vms
91 Vm vm1 = new Vm(vmid, brokerId, mips, pesNumber, ram, bw, size, vmm, new CloudletSchedulerSpaceShared());
92
93 //the second VM will have twice the priority of VM1 and so will receive twice CPU time
94 vmid++;
95 Vm vm2 = new Vm(vmid, brokerId, mips * 2, pesNumber, ram, bw, size, vmm, new CloudletSchedulerSpaceShared());
96
215 hostList.add(
216     new Host(
217         hostId,
218         new RamProvisionerSimple(ram),
219         new BwProvisionerSimple(bw),
220         storage,
221         peList,
222         new VmSchedulerTimeShared(peList)
223     ); // This is our first machine
224
225 //create another machine in the Data center
226 List<Pe> peList2 = new ArrayList<Pe>();
227
228 peList2.add(new Pe(0, new PeProvisionerSimple(mips)));
229
230 hostId++;
231
232 hostList.add(
233     new Host(
234         hostId,
235         new RamProvisionerSimple(ram),
236         new BwProvisionerSimple(bw),
237         storage,
238         peList2,
239         new VmSchedulerTimeShared(peList2)
240     ); // This is our second machine
241
===== OUTPUT =====
Cloudlet ID      STATUS      Data center ID  VM ID      Time      Start Time      Finish Time
5                SUCCESS      2              1           80         0.1             80.1
0                SUCCESS      2              0           160        0.1             160.1
6                SUCCESS      2              1           80         80.1            160.1
7                SUCCESS      2              1           80         160.1           240.1
1                SUCCESS      2              0           160        160.1           320.1
8                SUCCESS      2              1           80         240.1           320.1
9                SUCCESS      2              1           80         320.1           400.1
2                SUCCESS      2              0           160        320.1           480.1
3                SUCCESS      2              0           160        480.1           640.1
4                SUCCESS      2              0           160        640.1           800.1
CloudSim3b finished!
BUILD SUCCESSFUL (total time: 0 seconds)

```

## c) Space-Space

```

215 hostList.add(
216     new Host(
217         hostId,
218         new RamProvisionerSimple(ram),
219         new BwProvisionerSimple(bw),
220         storage,
221         peList,
222         new VmSchedulerSpaceShared(peList)
223     ); // This is our first machine
224
225 //create another machine in the Data center
226 List<Pe> peList2 = new ArrayList<Pe>();
227
228 peList2.add(new Pe(0, new PeProvisionerSimple(mips)));
229
230 hostId++;
231
232 hostList.add(
233     new Host(
234         hostId,
235         new RamProvisionerSimple(ram),
236         new BwProvisionerSimple(bw),
237         storage,
238         peList2,
239         new VmSchedulerSpaceShared(peList2)
240     );
241

```

```

90 //create two VMs
91 Vm vm1 = new Vm(vmid, brokerId, mips, pesNumber, ram, bw, size, vmm, new CloudletSchedulerSpaceShared());
92
93 //the second VM will have twice the priority of VM1 and so will receive twice CPU time
94 vmid++;
95 Vm vm2 = new Vm(vmid, brokerId, mips * 2, pesNumber, ram, bw, size, vmm, new CloudletSchedulerSpaceShared());
96
===== OUTPUT =====
Cloudlet ID   STATUS   Data center ID   VM ID   Time   Start Time   Finish Time
5            SUCCESS   2                1       80     0.1          80.1
0            SUCCESS   2                0       160    0.1          160.1
6            SUCCESS   2                1       80     80.1         160.1
7            SUCCESS   2                1       80     160.1        240.1
1            SUCCESS   2                0       160    160.1        320.1
8            SUCCESS   2                1       80     240.1        320.1
9            SUCCESS   2                1       80     320.1        400.1
2            SUCCESS   2                0       160    320.1        480.1
3            SUCCESS   2                0       160    480.1        640.1
4            SUCCESS   2                0       160    640.1        800.1
CloudSim3c finished!
BUILD SUCCESSFUL (total time: 0 seconds)

```

#### d) Time-Space

```

88 //create two VMs
89 Vm vm1 = new Vm(vmid, brokerId, mips, pesNumber, ram, bw, size, vmm, new CloudletSchedulerTimeShared());
90
91 //the second VM will have twice the priority of VM1 and so will receive twice CPU time
92 vmid++;
93 Vm vm2 = new Vm(vmid, brokerId, mips * 2, pesNumber, ram, bw, size, vmm, new CloudletSchedulerTimeShared());
94
95 //add the VMs to the vmList
96 vmList.add(vm1);
215
216 hostList.add(
217     new Host(
218         hostId,
219         new RamProvisionerSimple(ram),
220         new BwProvisionerSimple(bw),
221         storage,
222         peList,
223         new VmSchedulerTimeShared(peList)
224     ); // This is our first machine
225
226 //create another machine in the Data center
227 List<Pe> peList2 = new ArrayList<Pe>();
228
229 peList2.add(new Pe(0, new PeProvisionerSimple(mips)));
230
231 hostId++;
232
233 hostList.add(
234     new Host(
235         hostId,
236         new RamProvisionerSimple(ram),
237         new BwProvisionerSimple(bw),
238         storage,
239         peList2,
240         new VmSchedulerTimeShared(peList2)
241     );

```

## 8. Result Analysis

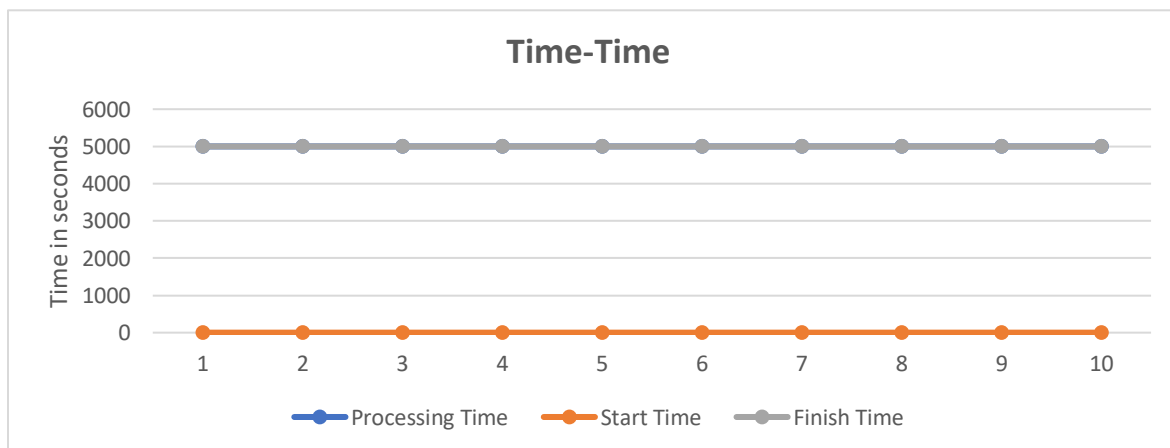
### Task1-(3) Results Presentation and Discussion

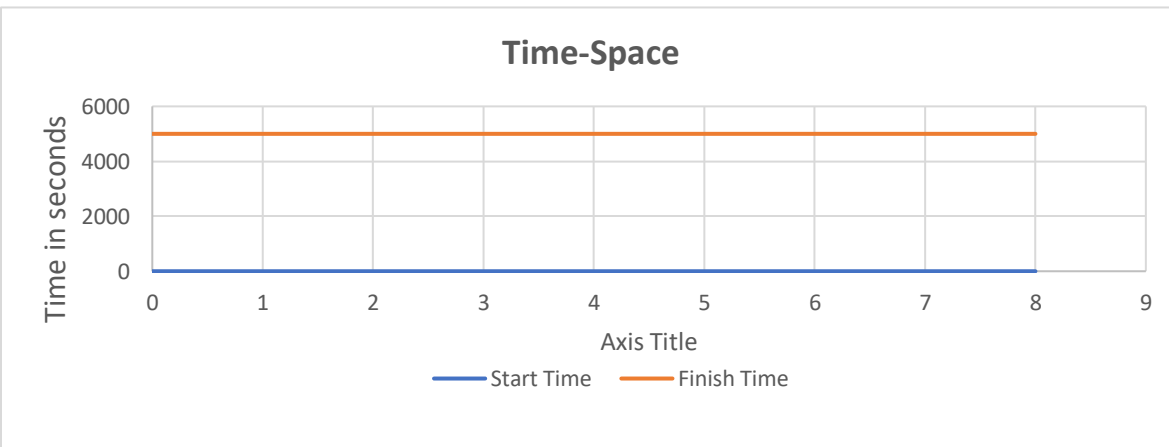
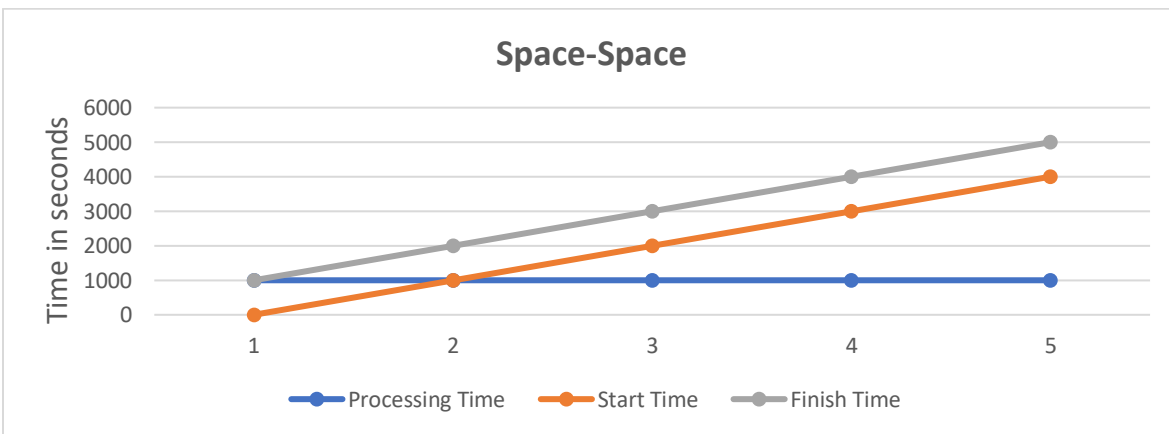
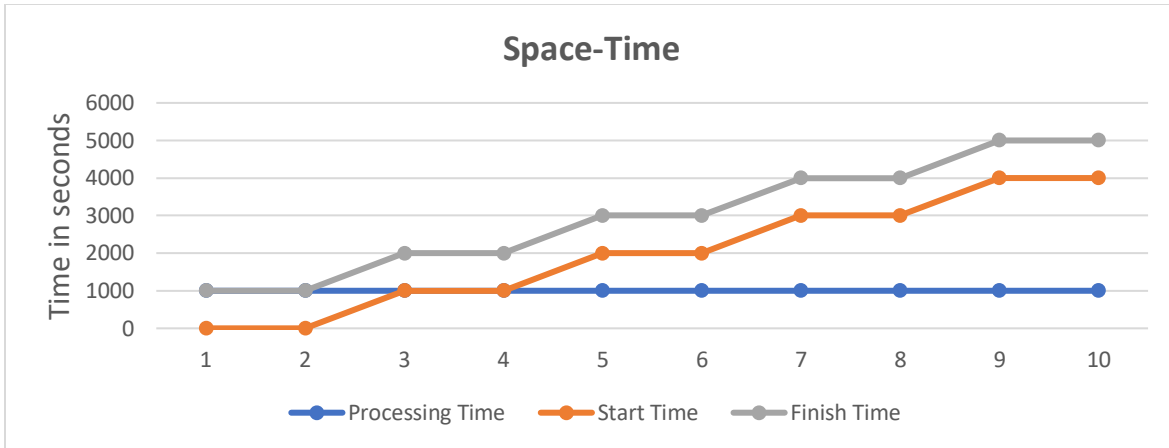
Comparison results of CloudSim simulation (Goyal, Singh and Agrawa, 2012)

In all the simulation 5 cloudlets are assigned to one virtual machine (vmid-0) and 5 cloudlets to the other virtual machine (vmid-1)

#### a) 2a Simulation

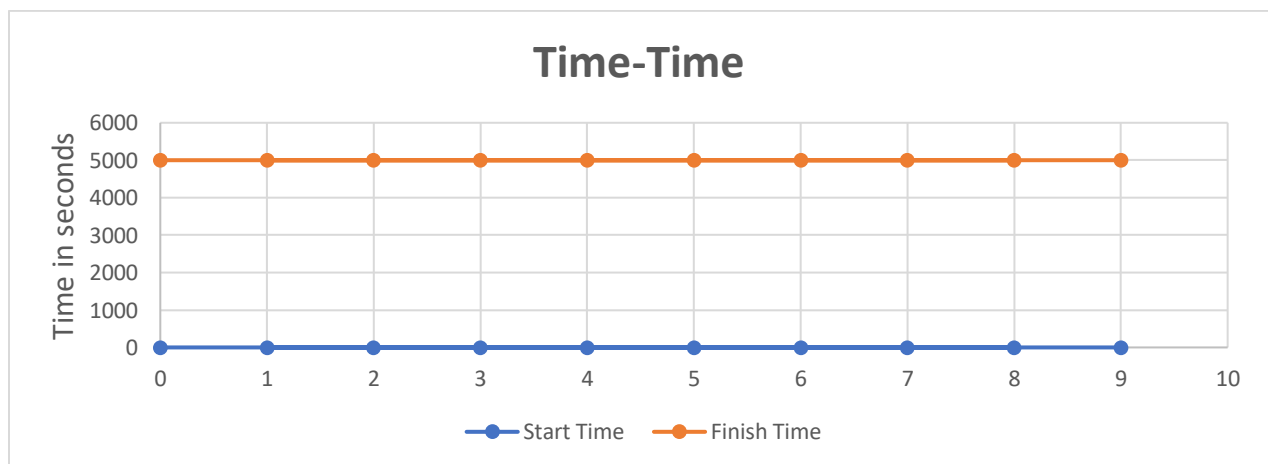
Scheduling policies	Cloudsim simulation of Time-Time shared policy	Cloudsim simulation of Space-Time shared policy	Cloudsim simulation of Space-Space shared policy	Cloudsim simulation of Time-Space shared policy
Total Processing Time	5000 s	1000 s	1000 s	5000 s
Total number of cloudlets	10	10	5	5
Time taken per cloudlet	5000	1000	1000	5000
Processing Elements	1	1	1	1
Virtual Machines	2	2	1	1
Data Centers	1	1	1	1
Host	1	1	1	1
	Remarks: All 10 cloudlets are simulated simultaneously, it takes more time for execution due to a single processor	Remarks: All 10 cloudlets run simultaneously the execution time is faster as space is first allocated	Remarks: Only 5 cloudlets have been executed as there is only one processing element running on both space shared policies	Remarks: 5 cloudlets are executed which are assigned to only one VM id where the

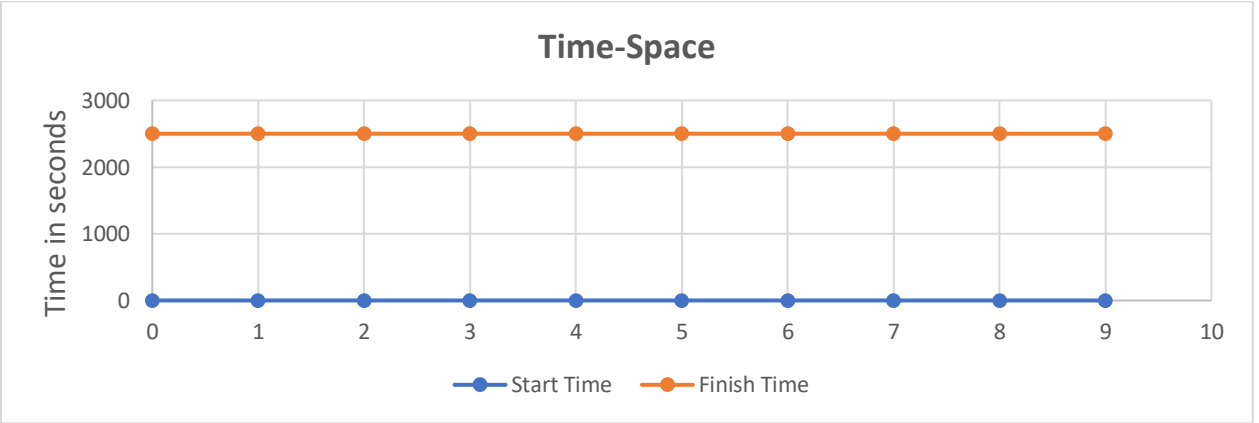
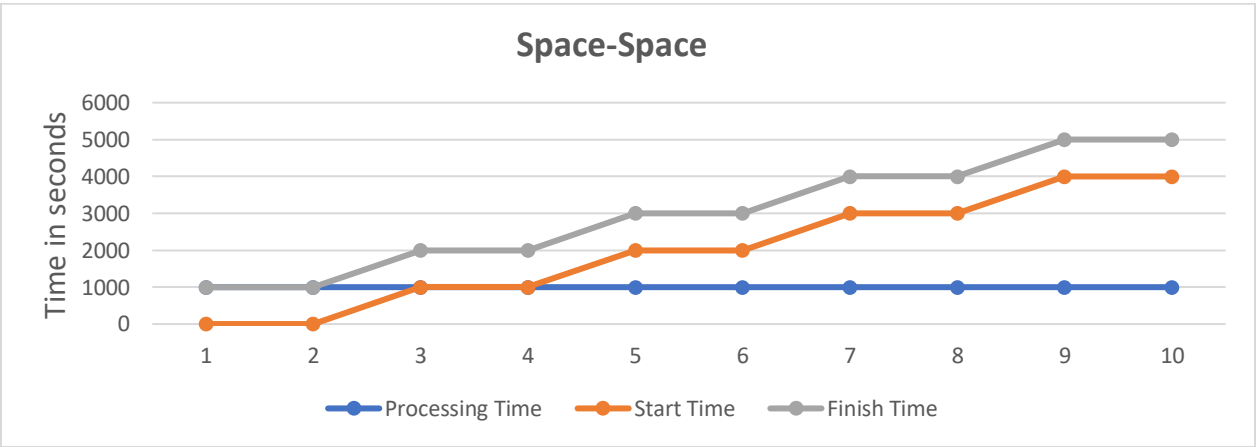
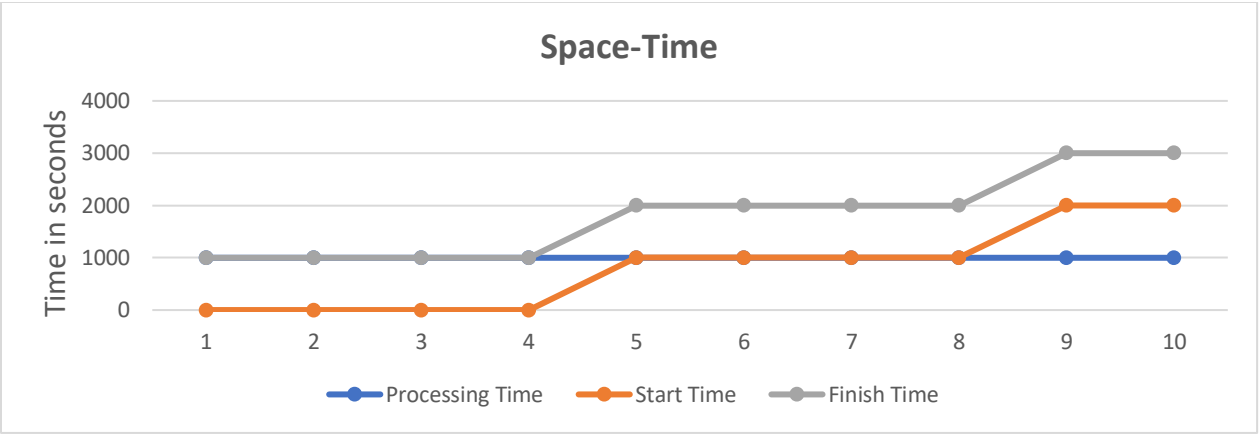




b) 2bSimulation

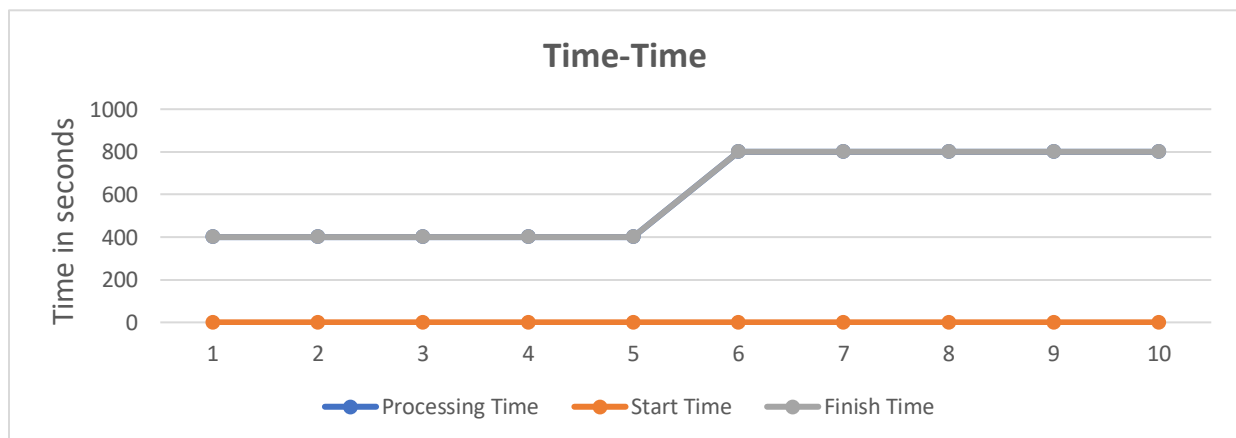
Scheduling policies	Cloudsim simulation of <b>Time-Time</b> shared policy	Cloudsim simulation of <b>Space-Time</b> shared policy	Cloudsim simulation of <b>Space-Space</b> shared policy	Cloudsim simulation of <b>Time-Space</b> shared policy
<b>Total Processing Time</b>	5000 s	1000 s	1000 s	2500 s
<b>Total number of cloudlets</b>	10	10	10	10
<b>Time taken per cloudlet</b>	5000	1000	1000	2500
<b>Processing Elements</b>	2	2	2	2
<b>Virtual Machines</b>	2	2	2	2
<b>Data Centers</b>	1	1	1	1
<b>Host</b>	1	1	1	1
<b>Remarks:</b>	It executes 10 cloudlets simultaneously since there are two processing elements each processor simulates 5 cloudlets at a time.	It simulates 4 cloudlets at a time and two cloudlets assigned to each of the two virtual machines hence the processing time is fast	It simulates 2 cloudlets at a time and one cloudlet assigned to each of the two virtual machine processing time is faster for individual cloudlets	It simulates 10 cloudlets at a time 5 assigned to each of the two virtual machines due to which the processing time is faster compared to all other policies in this simulation model



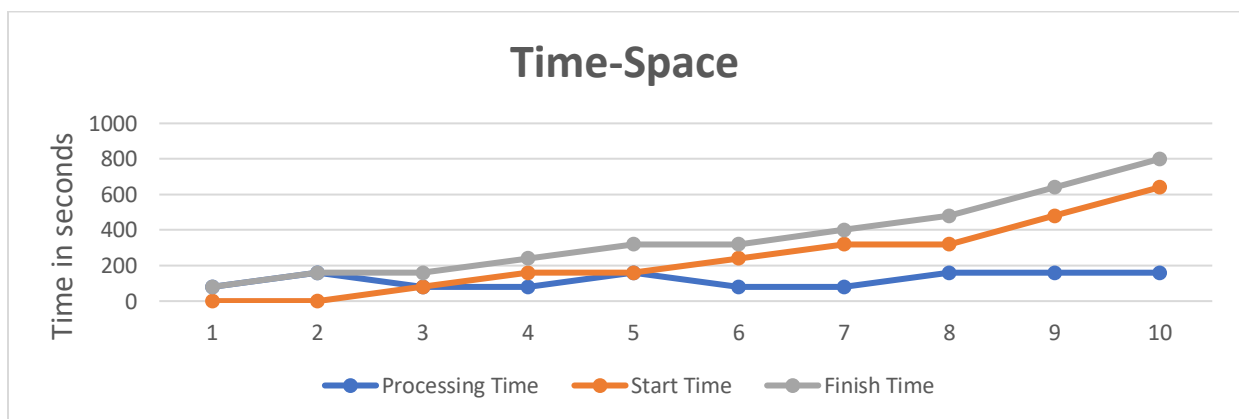
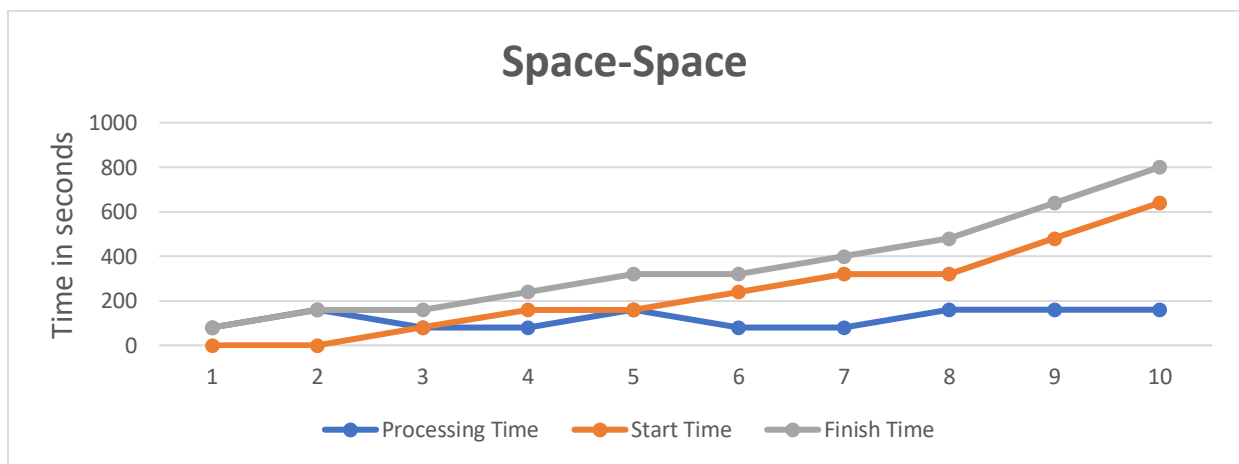
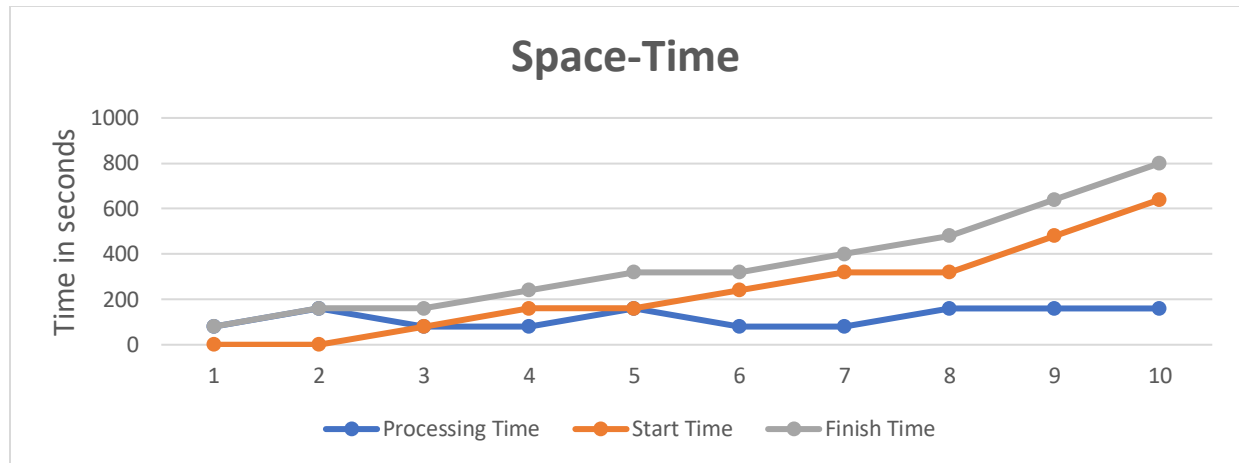


c) 2c Simulation

Scheduling policies	Cloudsim simulation of <b>Time-Time shared policy</b>	Cloudsim simulation of <b>Space-Time shared policy</b>	Cloudsim simulation of <b>Space-Space shared policy</b>	Cloudsim simulation of <b>Time-Space shared policy</b>
<b>Total Processing Time</b>	800 s	160 s	160 s	160 s
<b>Total number of cloudlets</b>	10	10	10	10
<b>Time taken per cloudlet</b>	400	80	80	80s
<b>Processing Elements</b>	1	1	1	1
<b>Virtual Machines</b>	1	1	1	1
<b>Data Centers</b>	1	1	1	1
<b>Host</b>	2	2	2	2
	It simulates 10 cloudlets at a time where it executes first 5 cloudlets the second set of cloudlets need to wait before they could be executed. There is a delay time for the second set of cloudlets due to the single processing element.	It simulates 2 cloudlets at a time where it executes only 1 cloudlet the second cloudlet needs to wait before it could be executed. There is a delay time for the second cloudlet due to the single processing element.	It is the same as the Space-Time shared policy. But it simulates the third cloudlet as soon as the second cloudlet is being executed because it executes the cloudlet allocated to the first virtual machine then the other.	It is same as the Space-Space shared policy







## 9. Task 2: Business Organization

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### Fashion

E-commerce Management(Palar, Manongga, and Utomo, 2012)

The revolution of fashion has given a new transformation in the advancement of e-commerce online retail that is prone for specifically only for clothing and type of fabrics this model is best fit for the upcoming business transformation idea makes shopping go easy.

This business model is specific for the type of fabric clothes such as cotton, nylon, lyre and many admins has access to all a minimum of 100terabyte storage cloud is allocated due to the globally distributed sellers and must compensate with all the system specification

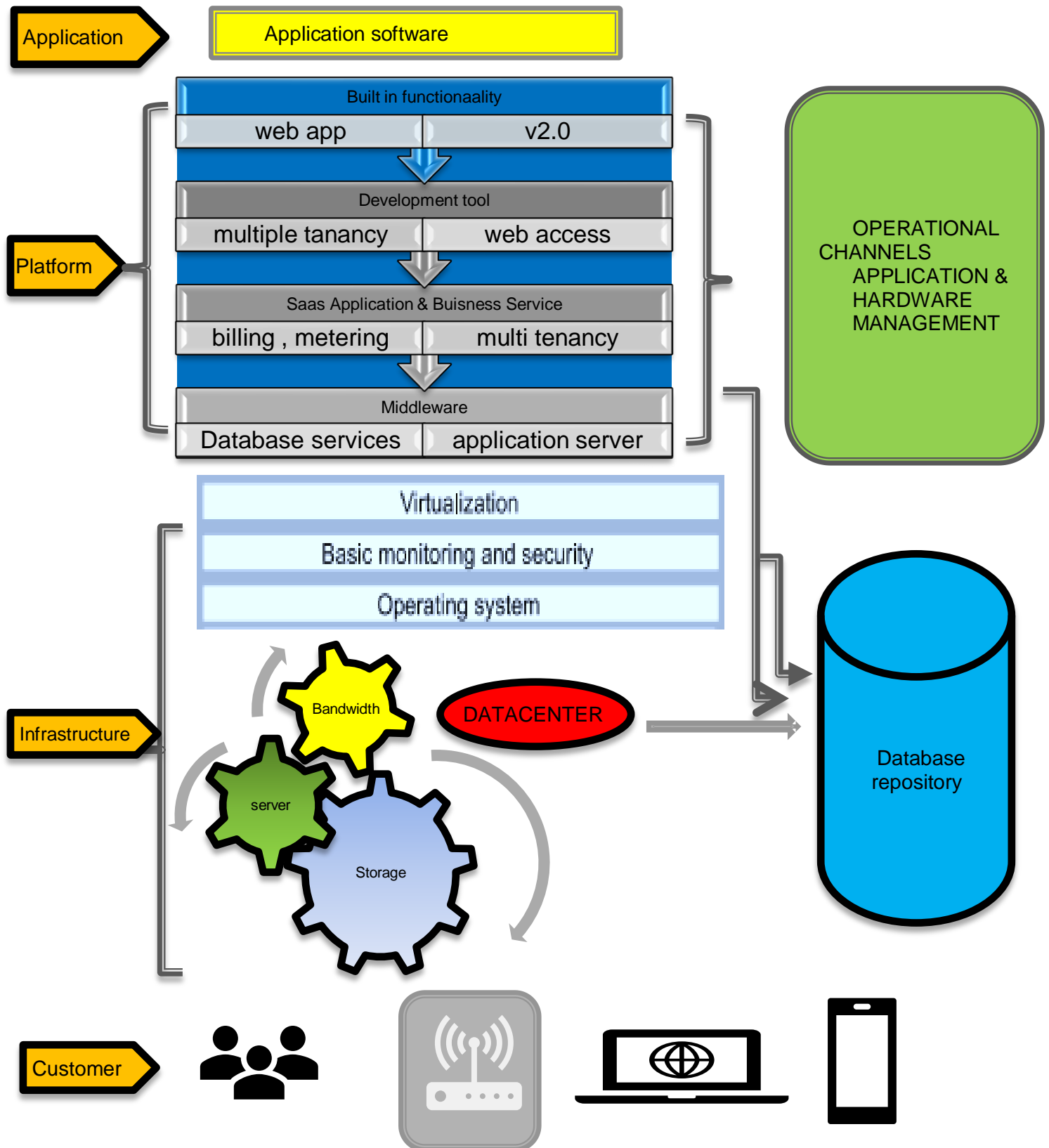
The features of it are as follows

(a) **Centralized infrastructure**(Humane and Varshapriya, 2015) with lower costs in a certain location.

(b) Improves **efficiency** of the unutilized system for maximum utilization(Humane and Varshapriya, 2015)

The resources are available to end user uses a **hybrid cloud** they make unique storage that benefits from resources storage of confidential and non-confidential information between the private and public cloud it eases more secure control over the cloud and allows various parties to access information over the Internet. The public cloud contains the type of the fabric, clothes of various type size and stocks available and its prices the private cloud contains information about the users logged the fabric that needs to be restocked and seller information about which seller is selling the particular fabric or cloth type. The payment connection with the seller's payment account information with a commission taken by the cloud. The platform SaaS is used as a third-party application available for end-user access available in laptop and mobile where the user can get info of fabrics and cloth from world wide suppliers that sell under one platform. The Cloud storage repository contains all the information about users, supplier, list of clothes, and payment information's checks for demand about which cloth type has higher demand and sales then it request seller for restocking the service provide is an end to end user friendly platform where user can provide his info and address, choose the type of clothes he likes and selects the size there is further a tool that could help the buyer to be more confident on the cloth by making the user answer few questions and suggesting the style based on their answers. The advantage of this model is the use of **Saas** doesn't require much of cost and user can use the web application very easily the service provider doesn't require much of high-end development tools that to complex the centralized infrastructure

## 10. Cloud Computing Architecture



## 11. Scalability in cloud environments area unit as follows:

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Many third-party web applications are hard to scale in large size. Particularly communication infrastructure technologies(Goyal, Singh and Agrawa, 2012). They work stable until a certain scale reached and then fails. So they are forced to build their own.

Proactive scaling is to predict the scalability level, where the traffic requests are expected or this we should first understand the expected traffic flow in order to perform proactive scaling(Falatah and Batarfi, 2014). but scheduling things that creates a way to problems when expectations turn wrong.

There might be an occurrence of a red zone that is the time when there is an increase in web traffic and high bandwidth where the cloud must be able to justify the encrypted at a high and non-encrypted data speed. There is a limitation in bandwidth for cloud access.

**Data Storage:** Business-based User cloud service are concerned with in capabilities of controlling the place where the data is to be stored, replaced, portioned and distributed. This is due to the inability of control that makes client wary of procedure policies in use.

Data redundancy and replication is the major concern where many sellers info is stored in multiples in a single data center though it prevents from loss of data it increases the difficulty of identification of the uniqueness of particulars(Alshammari, Singer and Storer, 2017).

Software if there is a concern about manipulating the information in the cloud then all the services must be downloaded on all the devices.

### **Design issues**

Isolating a large portion of the cloud while designing affects restrictions in the handling of application states is automatically dealt with the scaled applications.

Loosely coupled since the cloud environment is globally distributed there are a large number of IT resources on which the application relay on that frequently changes that increases the application dependency components which impact on the failure of a component in the application.

Elasticity, resources are continuously added and deleted during execution time. The increasing number of workload leads to scale out of cloud application where the individual resources are incapable of handling a large number of data.

## 12. Business continuity:

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The main aim of the organization is to extend the business growth

Downtime Elimination, SaaS make sure emails are not lost Generally concerning invisible to complete users in spite of anything that happens to employees or the centralized infrastructure. Better Network and Information Security Management. The company supplies non-critical applications and information to the cloud with which it can run with higher performance. Which permits the corporate IT department for specializing in crucial applications. This also improves in the network security and user access management.

The successful backup from a disaster relays on the frequency and quality of backups. Cloud provides much higher stratified recovery strategy(Palar, Manongga, and Utomo, 2012). This feature provides a stronger backup Point Objective. Disaster Recovery – Geographic Redundancy. Cloud offers an inbuilt geographically redundancy is in the style of regions and accessibility zones. This characteristic offers to decrease the Recovery Time Objective . We remember that many of the events in Table one are geographically connected. Avoid or eliminate disruption of operations. Some clouds expose a hash once store object, then eliminating the need for Rhetorical image verification time. Increased accessibility. The scalability characteristic of cloud computing facilities permits for larger accessibility.

Redundancy is present all over the cloud environments and as per demand resource capacity

can increase service accessibility. DoS Attack Depreciation. Redundancy as per requirement scalability of resources is done collectively offer higher resistance if distributed denies service attacks, and for faster backup from serious traumas.

Availability of cloud no cloud is free of failure. This is a major challenge for services and applications where components compete for resources and rely on other internal or external components/services that fail or rely on faulty software. Planning for the detection, logging, fixing and recovery of these failures involves not only developers but all teams.

each provides customers with its own interface to interact with underlying infrastructures. The information security requirements of each Business Cloud model with ISO standards are also investigated. This gives confidence in the selection of an appropriate and highly protected cloud framework

Automated management is because the elasticity in cloud applications .wherever the data center hosts many VM's in a very single physical machine that has excess resources to fulfill the demand.

Distribution: Cloud environments are globally distributed environments made up of several IT resources. Due to which , Cloud applications need to be split into separate application components that will be distributed with all the environmental resources.

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