Games4All Project

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Abstract for this Report:

This report gives the calculations for Physical Servers required for each city and link capacities for main site for downloading player data and data required smooth gaming experience. Next part shows the architecture of Global View and one particular city and all models and specification too mentioned for network devices used.

Calculations for Physical Servers:

As there are 600 similar games and 3 regions with 9 cities and all games are divided equally among the cities.

So, total games in each city will be = 600/9 = 66.66

Approximately each city will have 67 games and all these games have 67 Virtualized servers, So each game needs 1 Virtualized server.

To calculate Physical Servers, we have that each Physical Server can have maximum of 3 Virtualized Servers.

So we make all 67 games as a combination of 3 each so that we get the total Physical Servers needed in each city = 67/3 = 22.33.

Approximately each city will have **23 Physical Servers.**

Total Physical Servers needed for 9 cities = 23 * 9 **= 207**

Calculations for Link Capacities to Main Site:

As it is given each player needs to download 100 Kbytes of data from main site, each player required data = 100 Kbytes = 100 * 1024 bytes

= 100 * 1024 * 8 bits

= 819200 bits

As there are 1000 players per game, So the data required for 1 game = 819200 * 1000 bits

= 819.2 * 10^6 bits

= 819.2 Megabits

As mentioned, the data should be downloaded within 10 to 20 seconds, let us consider 10 seconds as the least possibility so the Link Capacity for each Virtualized Server

= 819.2 Megabits/10 Seconds

Link Capacity for each Virtual Server = 81.92 Mbps

Case 1:

Let us assume that at a maximum of 18 games are starting every second i.e. 2 games from each city because it is not realistic that 600 games start at a time with full capacity.

So, link capacity for 18 games = 81.92 Mbps * 18 = 1474.56 Mbps

The link capacity required for 10 seconds for players to download data = 1474.56 Mbps * 10

= 14745.6 Mbps

= 14.7456 Gbps

Case 2:

If all the 600 games are started at a time:

Link Capacity for each Physical Server = 81.92 * 3 = 245.76 Mbps

Link Capacity for each city will be = 245.76 * 23 = 5652.48 Mbps

= 5652.48/1000 Gbps

= 5.652 Gbps

Total link capacity for the main server that the data will be downloaded by each player

= 5.652 * 9 Gbps

= **50.868 Gbps**

Calculations for Link Capacity for Game:

As mentioned, for good gaming experience each player required speed = 256 Kbps

As there are 1000 player in each game, the link capacity required for each game

= 256 * 1000 Kbps

The Link capacity for each Virtual server (i.e., each game) = 256000 Kbps

= 256000/1000 = 256 Mbps

The Link capacity for each Physical server = 256 * 3 Mbps

= 768 Mbps

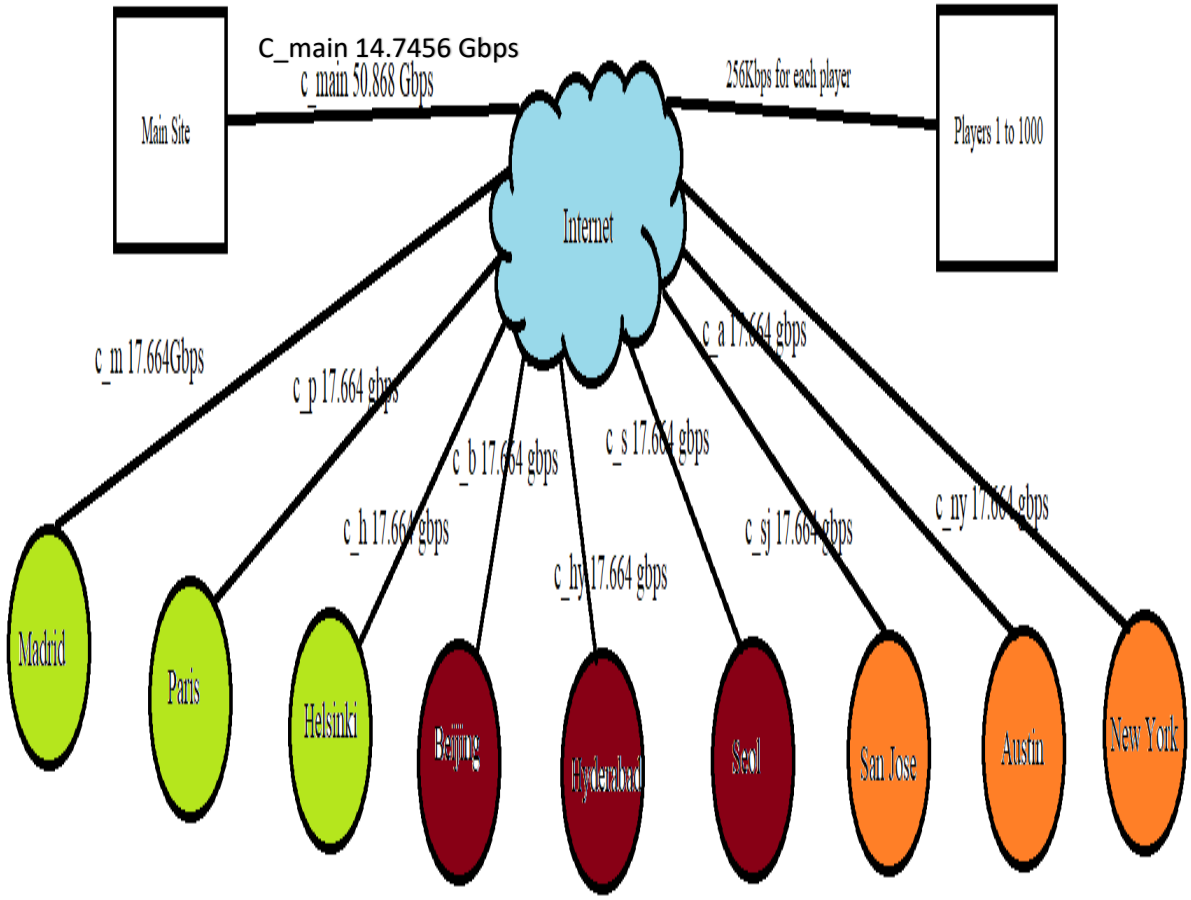
The Link capacity for each city will be = 768 * 23 = 17664 Mbps

= 17664/1000 = **17.664 Gbps**

Therefore, considering 3 ISPs of link capacities for each city as **8Gbps + 8Gbps + 2Gbps** to reach the required link capacity for each city will be appropriate.

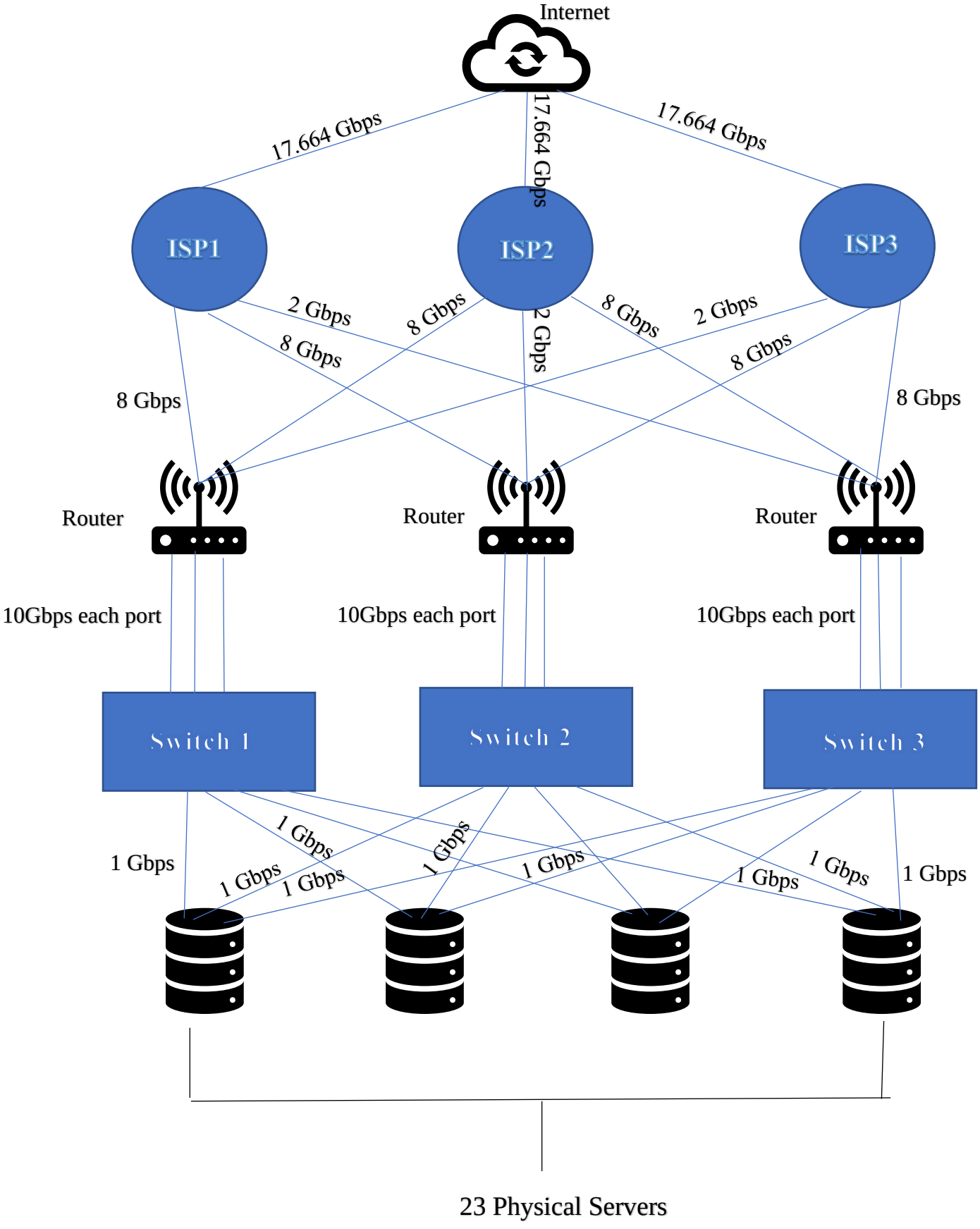
Architecture:

Global View of all Regions and Main Site:



Architecture of Generic City:

Hyderabad:



Number of Network Devices:

A total of 6 Network devices are used for this architecture for each city, 3 of them are routers and 3 of them are switches, 3 each is used because if any one or two network devices fail to work then the overall control will be handled by any one of the network devices.

Total no of Network devices for entire architecture will be = 6 * 9(Total cities) = 54 Network devices.

Model Names of Network Devices Used and their Costs:

Router: All 3 required routers are selected of same type and the model name of the selected router is ***Ubiquiti Networks EdgeRouter Infinity ER-8-XG 8-Port 10G SFP+ Router*** and link to this device is **https://www.bhphotovideo.com/c/product/1356941-REG/ubiquiti_networks_er_8_xg_edgerouter_8_port.html**
Because the selected router has SFP ports we attach a 6 SFP 10 GE port based on the architecture, the selected SFP module is ***Cisco SFP-10G-T-X Compatible 10GBASE-T SFP+ Copper RJ-45 30m Transceiver Module*** and link to this device is https://www.fs.com/de-en/products/66613.html?country=se&currency=SEK&paid=google_shopping&utm_category=9&gclid=Cj0KCQiAnuGNBhCPARIsACbnLzohktyoC5tol3NHpRAjBvwSDU8c3sVz6oZe_6yC7OXYoOGZZbdBo04aAp-7EALw_wcB

Cost of Router selected is = 16900 SEK and the cost of module = 683 SEK but there is a need of 6 modules for each router based on the architecture = 6 * 683 = 4098 SEK
Total cost of Router and the Module attached = 16900 + 4098 = 20998 SEK.
There are 3 Routers required in the architecture which is for 1 city, the cost will be = 62994 SEK.
The total cost for the routers for all cities will be = 62994 * 9 = 566946 SEK.

Switch: All 3 required switches are selected of same type and the model name of the selected switch is ***Aruba 2530 48-Port Gigabit Web Managed Switch*** and link to this device is https://www.dustin.se/product/5010660502/2530-48-port-gigabit-web-managed-switch?priceinclusivevat=1&ssel=true&gclid=Cj0KCQiAnuGNBhCPARIsACbnLzoZ8V42P3Y6w1xQKoQeUKuxRcoxrKd4UIG77UpBFdleo1eXraFx5XMaAoe2EALw_wcB#

Cost of Switch selected is = 10399 SEK

Cost of required 3 switches for the architecture in 1 city = 3 * 10399 = 39197 SEK

Total cost of switches for all 9 cities will be = 9 * 39197 = 352773 SEK

The total cost of the Network devices for the architecture (1 city) = Router cost + Switch cost = 102191 SEK.

The total cost of all Network devices for all cities = Routers total cost + Switches total cost = 919719 SEK.

Impact of cost if games reduced or increased:

If we reduce the games from 600 to 500 games there will be no impact on the Network devices, there will be less usage of physical servers but there will be no change in network devices and if we increase the games from 600 to 700 games there will be need of more physical servers for each city there will be increases of switches to compensate the physical servers so the cost will be increased because we use excess switches than before, the cost of 1 switch will be added to new no of games.

Ports:

All the network devices chosen are fully duplex so every port act as uplink as well as downlink. Every port of Routers will be at 10 Gbps speed and 3 upper ports of switch will be at 10 Gbps speed and the remaining ports will be at 1 Gbps speed.

Link Capacities from ISP:

The link capacities purchased from the ISP are 8Gbps, 8Gbps and 2Gbps. I have used three ISPs for this architecture for redundancy.

Monitoring:

There is a need to monitor four parameters, they are

1.) Latency
2.) Jitter
3.) Throughput
4.) Device Status

Latency: The time taken for a packet to reach the destination is measured by the network latency. It shows that if there are any delay in serving the request and it helps us which factor leading the delay and can be fixed, if there is no delay then the gaming experience will get better and better.

Jitter: Another important metric to be monitored is jitter, the speed fluctuations can impact the game very badly, the speed fluctuations in the network gives the user bad experience while playing the game so it should be monitored carefully to get better gaming experience.

Throughput: Throughput gives us the amount of data passing through the network from source to destination, measuring throughput gives us the speed of the network and it enables us to know how long it takes to reach the destination. So, measuring throughput can help us our network to stable speed without delay.

Device status: Another important parameter that should be monitored is power supply to the network devices, if there is any ups and downs in the power supply there might be a chance of breakdown of network device so that it should be monitored carefully.