PROJECT REPORT

AIM: To propose a network architecture for a startup, Games4all(G4A).

GIVEN DATA:

1. Network should be able to handle 200 games at a time with 1000 players per game.
2. Each player requires 256Kbps of up/down link speed.
3. Each player required to download 100KBytes of data from main site for every 30 mins.
4. Overall, these 200 games are distributed with regions and sub regions.

a. Europe 50% of games (Paris, Helsinki).
b. Asia 25% of games (Beijing, Hyderabad, Seol).
c. North America 25% of games (San Jose, New York).

CALCULATIONS:

Every game has 1000 players and each requires 256 kbps of up/down speed i.e, **1000*256kbps = 256Mbps** of up/down speed. This just the network capacity for one game.

For calculating 50 games then the calculation will be **50*256*1000kbps = 12.8Gbps.**

Similarly, calculation for every region is represented in the below table.

Region	No. of games	No. of players	Link capacity	No. Of physical server required
Helsinki	50	50,000	12.8Gbps	17
Paris	50	50,000	12.8Gbps	17
Beijing	17	17,000	4.35Gbps	6
Hyderabad	17	17,000	4.35Gbps	6
Seol	17	17,000	4.35Gbps	6
San Jose	25	25,000	6.4Gbps	9
New York	25	25,000	6.4Gbps	9

3 virtual servers are stacked into a physical server and each physical server is capable to run 3 games on its 3 virtual servers at a time. i.e, one server serves one game.

No.of physical servers required = (no. of games)/3.

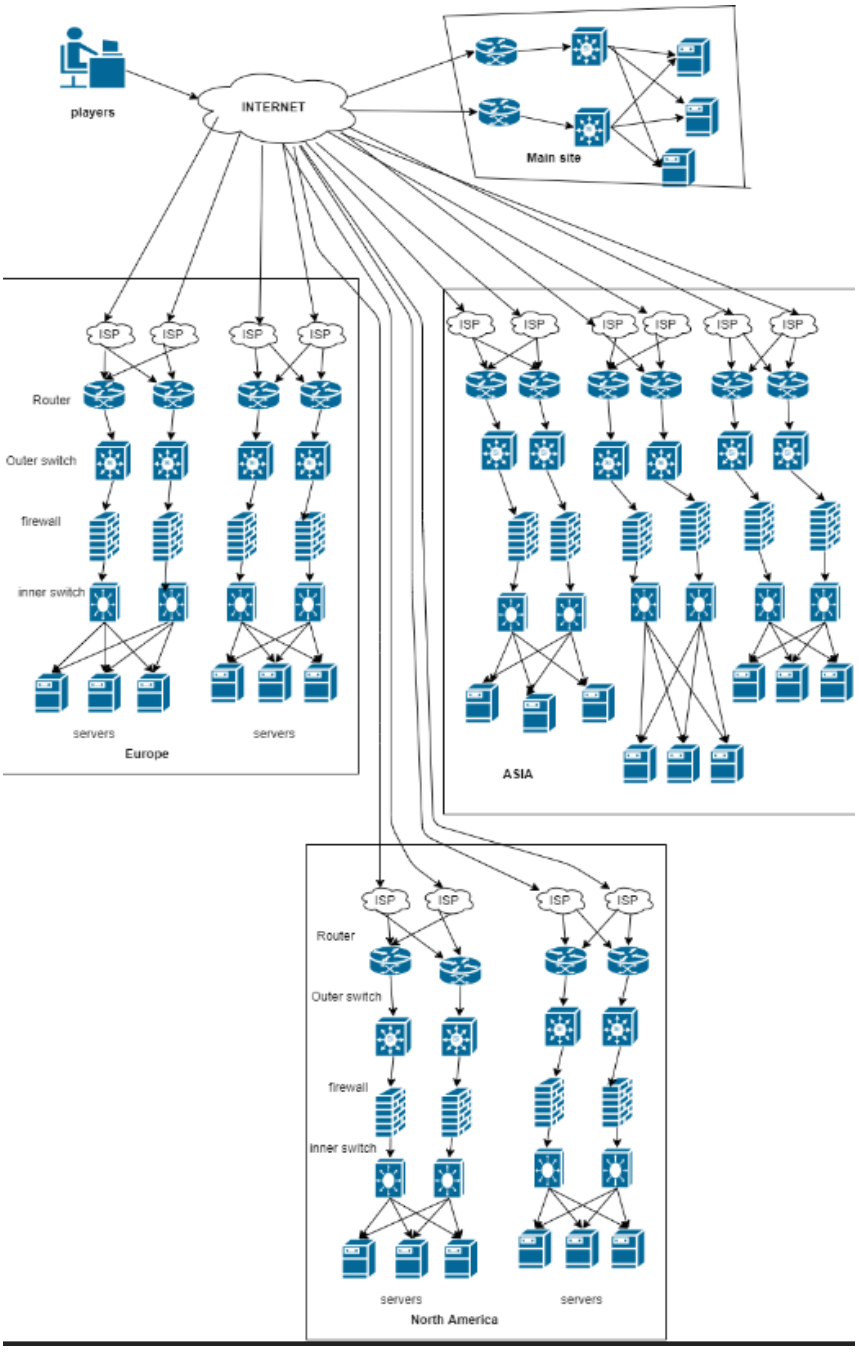
every physical server requires capacity of **3*256Mbps = 768Mbps.** Where 1Gbps cable will be sufficient to handle this traffic. So, 1Gbps cables are used to connect from physical server to the switch.

ISP PACKAGES:

1. **Europe:** Required link capacity is 12.8 Gbps. So, we will use two 10Gbps port from ISP to the Switch (where physical devices are connected) by link aggregation method. As per the requirement we can buy **(8Gbps + 4Gbps + 1Gbps)** from ISP.
2. **Asia:** Required link capacity is 4.35 Gbps. So, we will use 10Gbps port from ISP to the Switch (where physical devices are connected) this can accommodate more traffic and helps when network grows in future. As per the requirement we can buy **(4Gbps + 400Mbps)** from ISP.
3. **North America:** Required link capacity is 6.4 Gbps. So, we will use 10Gbps port from ISP to the Switch (where physical devices are connected) by link aggregation method. As per the requirement we can buy **(4Gbps + 2Gbps + 800Mbps)** from ISP.

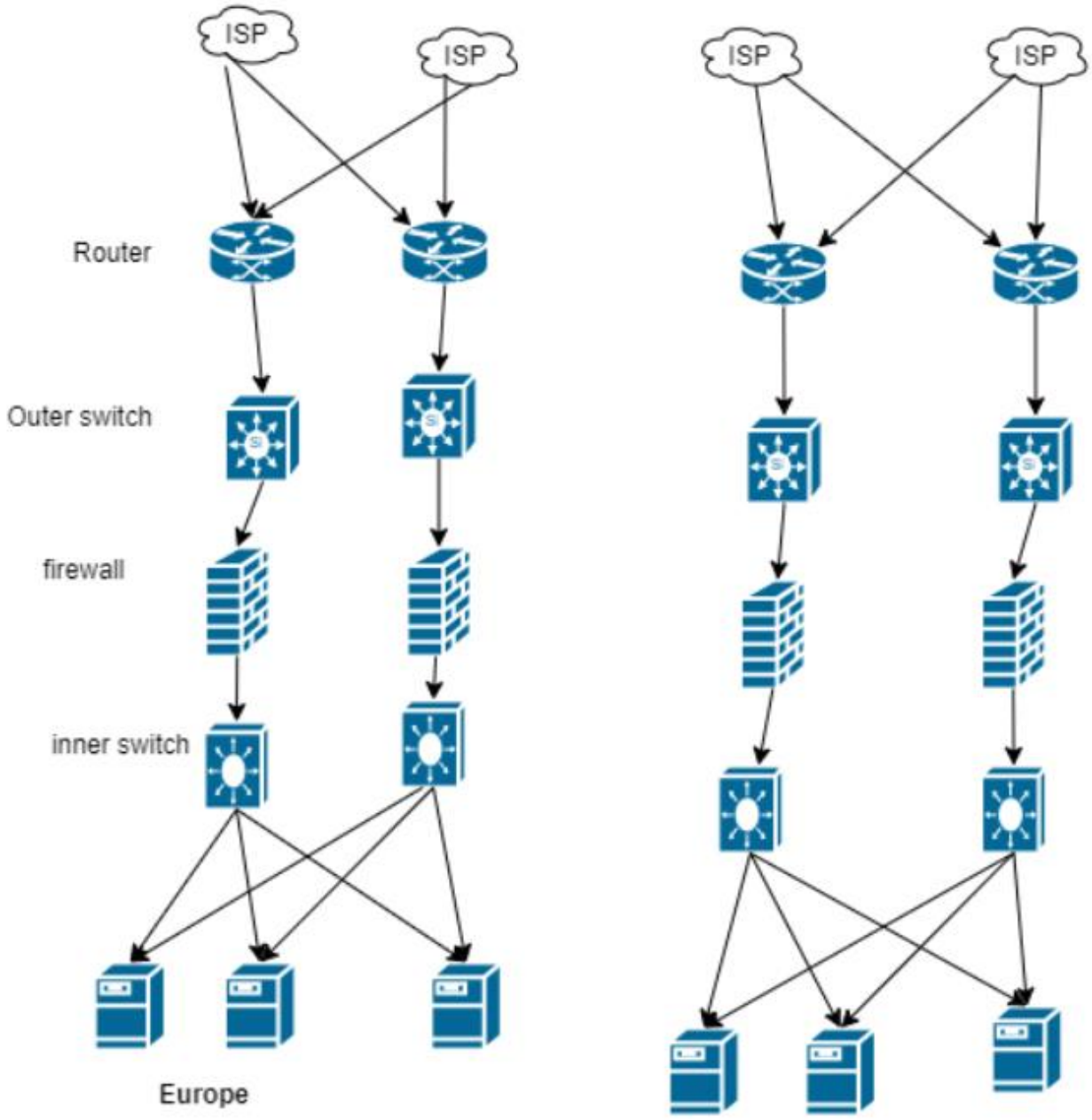
NETWORK ARCHITECTURE:

Below is the main network architecture map. Where all regions are connected to internet and with different link capacities. For every region the link capacities are different.


players
INTERNET
Main site
ISP
Router
Outer switch
firewall
inner switch
servers
Europe
ASIA
North America

Above fig is used as the reference and understanding the network between the servers, routers, switches.

Players download the 100kbytes data from the main site and ISPs collects the details of the players in their region from the internet. This data is sent to the routers to route their perceptive server. 2 routers are used in between the Local ISP and game servers and act as a backup when one of the router fails.



Above fig represents clear view of a sub-region.

In between there are switches and firewall (used to block the unwanted traffic). All the network devices we have used are double because if any network device fails to connect the other works as a backup. In this way no connection can be lost.

From the link capacities we use 1Gbps cable in between the gaming servers and inner switches. And 10Gbps cable is used to connect to ISP.

NETWORK DEVICES AND PORTS:

All the network devices we used are similar in all the regions. As per the requirement we have to calculate the switch ports required to connect to the servers can be known from the no. Of physical servers in each region.

1. **Cisco SPS2024** switch is used to connect the servers. Which has 24 ports and each port is capable of connecting 10 baseT/ 100 base TX/ 1000 base T cables. We only used 1Gbps cable in between the switch and game servers so this switch can support. For Europe region we only require 17/24 ports, Asia we only need 6/24 ports, North America we need 9/24 ports and the remaining are used in future when network grows.
2. **Cisco ASR 1001-X** router is used to connect between the ISP and switches. Which can give 20Gbps throughputs and we only require for Europe 12.8Gbps, Asia 4.35Gbps, North America 6.4Gbps.

MONITORING:

1. For monitoring the network, we have to mainly focus on how fast server respond when a request is sent. So, we need to measure RTT (round trip time). RTT tells us travel time of the packet to reach the server and response from the server. Lesser the time value indicates better the performance of the server.
2. PTGR tool is used to monitor the network factors like

a. band width utilization: which will helpful in knowing up and down link speeds.
b. Ping latency: figures out any devices with problem in connecting.
c. port monitoring: help to monitor the switch ports.
d. Notifies when the link is down and failure in devices.

GROWTH:

25 games were added to each city in Europe, 9 games were added to each city in North America and Asia.

After all calculation of link capacities and physical servers utilization, following is the updated data after the growth in network.

Region	No. of games	Link capacity	No. Of physical server required
Helsinki	75	19.2Gbps	25
Paris	75	19.2Gbps	25
Beijing	26	6.6Gbps	9
Hyderabad	26	6.6Gbps	9
Seol	26	6.6Gbps	9
San Jose	34	8.7Gbps	12
New York	34	8.7Gbps	12

Europe: After the growth in the network, we have capacity of 19.2 of overall city. So, two 10Gbps port from ISP to the Switch (where physical devices are connected) by link aggregation method will be sufficient. As per the requirement we have to buy extra **(4Gbps + 2Gbps + 400 Mbps)** package from the ISP and the router and switches will be able to handle the traffic.

Asia: we have overall capacity of 6.6Gbps. So, 10Gbps port from ISP to the Switch (where physical devices are connected) will be sufficient as per the requirement we can have to buy extra of **(2Gbps + 400Mbps)** from ISP and router and switches will be able to handle the traffic.

North America: we have overall capacity of 8.7Gbps after growth. As per the requirement we need to buy extra **(2Gbps + 400Mbps)** from ISP and all routers, switches can handle the traffic.