# Project Report

The network Architecture is designed for the new internet online G4A, this network is design based on the Centralized System. In this centralized system there is one main site which controls and monitors every regional site which are connected to main site.

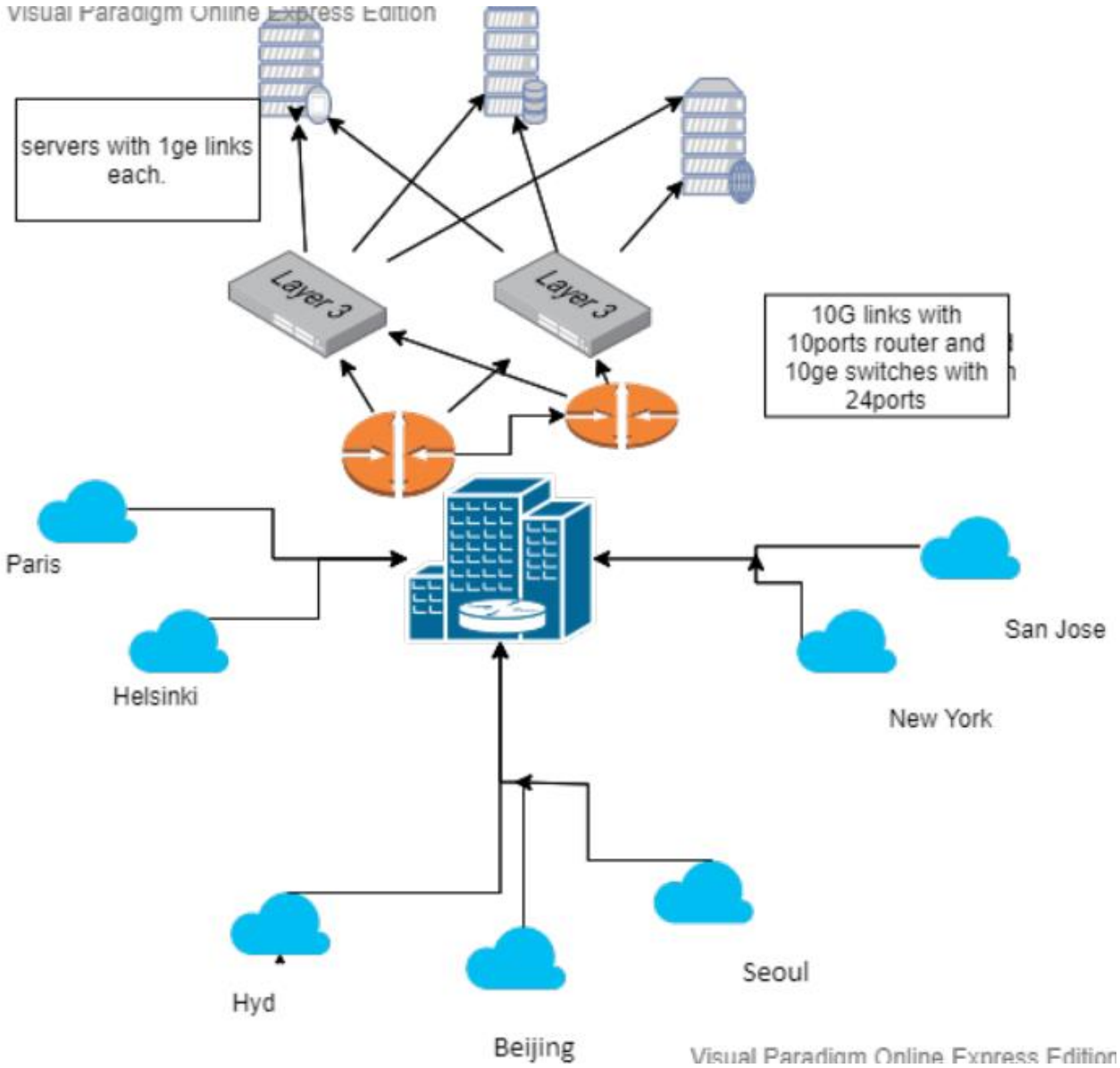
## Architecture

The architecture consists of the Routers, Switches, Servers which are interconnected according to the region wise and links assigned to each connection has been connected to specific region port, every region is connected to main site through ISP. The three region cities have its own network having servers and managing their own gaming requirements. It starts from main site Router through ISP to regional Router and from there to City Routers this would be very flexible and easy to connect. For every region there is two Routers and switches one is acting as the main router and another router. Network is totally operated by L2/L3 switches, Routers, and servers.

In case of any Router failure (this is because the user should play game smoothly) and the regional routers are interconnected to City routers through VPN for enduring secure connection, because these are connected via internet. The VPN works as creating a tunnel between end-to-end network and encrypt data for secure transfer. The open VPN provides more secure and faster rates at lower latency.

## Regional Site

In this regional site, we have production servers connected via switches as the server can run three games at a time would be heavy task and cost so Virtual Servers would initiate the load and decrease the number of physical servers. The virtual servers are Flexible and reduces the hardware utilization. The players get access and connect to game through nearby regional cities via internet. Total no of players per/map is 1000players once, the map is full the server starts and run minimum of 30 min and max of 60 min. In any case the player is out of game due to network problem from player side and network issue solves then player can reenter game at certain time limit (if the connecting time ends player cannot enter previous match). The Game is not going to start until the map fills the players will be in buffer until the map fills, the servers are running continuously so no player no need to wait until the previous match ends. If another map is ready who downloaded required 100Kbytes from server, the second game starts.




## Calculation part

To play a game each player require a 256 Kbps up/down link speed should be downloaded. so, to get link speed the total number of players should be multiplied with download speed (256*1000=256000kbps, 1MB=1024,256Mbps).

i.e., For each game 256Mbps is required

The total number of games should run simultaneous are 200, The total games are distributed according to

regions, 100 games for Europe region, 50 games for Asia region and 50 for North America region. These are divided equally according to the region cities. Europe(50%Paris,50Helsinki), Asia (17Hyderabad,17beijing, 17seoul), North America (25% san Jose, 25% New York).
By taking the above data we calculate the link speed capacity for each region:

## Asia:

17*256Mbps=4.352Gbps for each city in this Asia region requires 4.352Gbps (Hyderabad, Beijing, Seoul)

The total data to download for Europe region can be calculated according to the given data 100kbytes has to download when game starts, the total no of players is 1000/game.

i.e 100*1000*100Kbytes = 10Gbytes per 30min

for every 30min 10Gbytes must be download per game in Europe that means for Paris 5Gbps and for 5Gbps for Helsinki.

## Europe:

50*256Mbps=12.80Gbps for each city in Europe requires 12.80Gbps (Paris, Helsinki)
The total data must be download for Asia region is

i.e., 50*1000*100Kbytes= 5Gbytes per game

for every Asia region every 30 min 5Gbytes must be download per game and the data must be shared between 3 cities and each city needs 1.66Gbytes (Hyderabad, Beijing, Seoul) per game.

## North America:

25*256Mbps=6.40Gbps New York and San Jose requires 6.40Gbps (New York, San Jose).

The total data must be downloaded for North America is

i.e., 50*1000*100Kbytes= 5Gbytes

for every Asia region every 30 min 5Gbytes must be download per game and the data must be shared between 2 cities and each city needs 2.5Gbytes (New York, San Jose) per game.

The data rates that are calculated are average data rates between the city data center and main site. The games are not deployed at the same time one game may end soon are may takes more time depends upon players in region. If we take worst case as 10sec to deploy the game let us calculate the data rates.
For Europe traffic between city and main site = 50*1000*100 = 5Gbytes

i.e. in bits = 5*8*1000/10= 4Gbps

for Asia, the traffic between city and main site = 17*1000*100 = 17Gbytes

i.e. in bits = 17*8*1000/10 = 1.36Gbps

for north America between city and main site = 25*1000*100= 25Gbps

i.e., in bits = 25*8*1000/10 = 2Gbps

total data traffic at main site = 16.8 Gbps

**Architecture link capacities**:
The total link capacity for each region in Europe is 16.8 Gbps
To connect for city region, it requires =12.8 Gpbs
To start game and connect to main site = 4Gbps
The link capacity can be taken 8+8+1

The total link capacity for each region Asia is 5.71 Gbps
To connect for city region, it requires =4.35 Gpbs
To start game and connect to main site = 1.36 Gbps
The link capacity can be taken 4+2

The total link capacity for each region North America is 8.4 Gbps
To connect for city region, it requires =6.4 Gpbs
To start game and connect to main site = 2 Gbps
The link capacity can be taken 4+4+1

Total no of routers= 16
Total no of switches=28
Total no of SPU's=70
For each router has 10 ports and switch have 24 port (I prefer it because if we take highest number of port switch and in case it fails suddenly all the servers will go down so if we divide the servers between the switches the another will be running, and router has already backup plan).

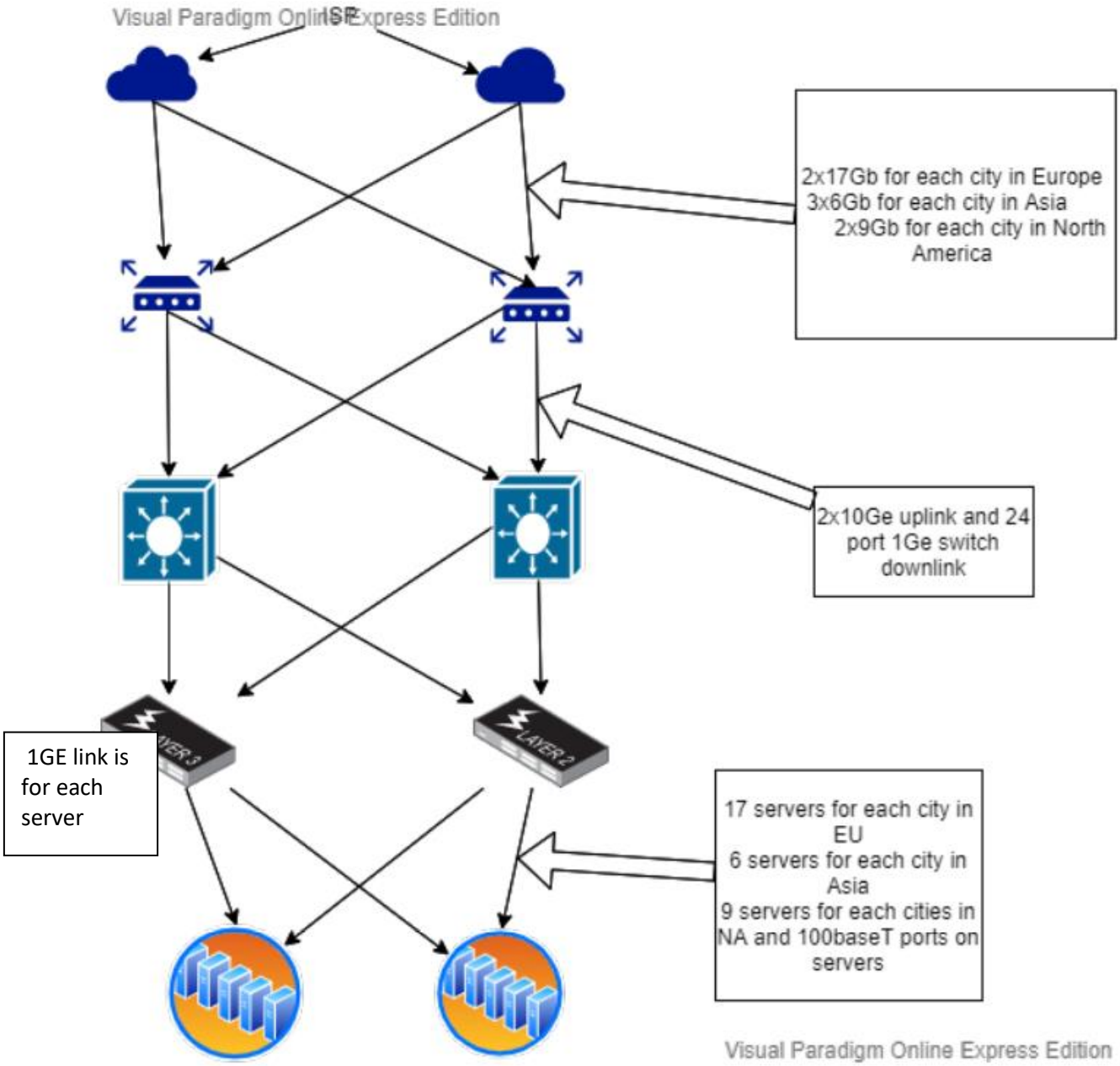
For Europe region in total of 100 games 50 were divide for Paris and 50 Helsinki so a server can run 3 simultaneous games at a time (50/3=17SPU for City).

For Asia region in total of 50 games 17 servers were divide as three cities (Hyderabad, Beijing, Seoul) so total 17(17/3=6SPU).

For North America in total of 50 Games 25 servers for City (New York, San Jose) so 25/2=9SPU.

## Discussion

The architecture is centralized, routers are connected to switches and from switches to servers. The servers inside are virtual servers so it handles multiple servers and total no of server's install are depend upon data center traffic. The most common effective thing is monitoring a large network performance of servers and managing the service address. The major task here is monitoring performance of servers and configuration of routers, switches. hardware infrastructure must choose according to network size and is capable of giga bit data link configuration. If hardware infrastructure is chosen lower than the recommended one it will not last long. The network size is little bit complicate and larger, so there is more chance for overlapping of address or conflicts may occur, it would be best to use DHCP for addressing. The server performance should be monitored continuously if any low performance is finding in server or any issues found it should be handled remotely, because it is not possible to go server room frequently. In any case servers goes down or switch off, it can be rectified remotely because of features servers. The new generation servers are having integrated out of band management within the server. If out-of-band is assigned in network, then servers can access remotely.




## Any single point Failure

In case any failure of Router or Switch or server or cable connection immediately it will change to backup. For every hardware, the backup setup is configured.so any failure occurs it automatically switches to another working Router or Switch or Server. This Backup is Idle until the problem arrives and works only in any Failure conditions only. From each city region to until main site region multiple links are created for resilience purpose (in case of any chaos monkey issues). In case any routing path failed to work then the connection is lost so by considering that point link aggregation is used. So, data can transmit even one path fails.

## Growth

This network architecture is designed and planned by considering if the company wants to grow the network in future. According to the given growth 50 games in EU, 27 games in Asia, 18 games to NA. The Architecture is designed in a flexible and scalable way that can support according to increment with small changes like increasing the bandwidth, link capacities according to number of SPU's running and the increase of servers and switches. If the architecture is designed as considering the future growth there will be no problem in IP address, subnet mask if not then there will be shortage of addresses. Again, we should reconfigure the address, subnet mask and DNS should be updated in data center. As we should have enough IP Address to allocate and have enough ports for it to connect to switch. To overcome this network Architecture is designed with Multilayer Switch so that servers can provide additional room for additional new servers. The IP Address allocation has given in the form of the subnet mask which accommodate to increase of Hosts easily.

According to the given the growth data is given already so there be will increase of bandwidth and link capacity at city data center and main site. As per the ports on the switches are not enough, we will add new switch to multilayer switch in each region and add servers according no of games run in each region.

Here coming to monitoring tool, network performance monitoring refers to measuring, diagnosing, and optimizing service quality of a network. Nagios is an open free source software which monitors systems networking and infrastructure. As in the network the switches, application, servers, and services are monitored and alerts users when things go wrong and alerts them when resolved. Nagios provides Nagios agent, Nagios Remote Plugin Executor (NRPE), Nagios Remote Data (NRDP), Nagios Cross Platform Agent (NCPA), Nagios XI. This monitoring tool provides processor load, system logs, probes, temperature, and alerts. The remote plugin executor monitor system load, CPU usage and no of users currently logged in are also monitored to reduce downtime. Nagios agent is installed on network nodes to monitor (routers, switches, and end devices in network) the monitoring tool is installed in both city center and at main site. Nagios agent continuously monitoring the network health and collects traffic flow of data rates, bandwidth utilization, throughput, uplink, downlink, error rate and if performance goes beyond the threshold rate immediate notification is send to main server. The Nagios tools monitors every end service in the network including the power supply, server performance like when server goes down, when the server is started everything is observed and reported in metric form.