

Game name:

SimNetwork

Game audience:

Everyone

Style:

Real-Time Strategy

Goal of the game:

1. Teach the basic fundamental techniques involved in the design of computer networks
2. Teach network administration through simulation of ISP network.

Concepts being taught:

Network Layers of Internet networks and the workings of individual elements of the network, as well as Network Administration.

Network Layers of Internet:

1. Layer 1 – Physical/Link Layer
2. Layer 2 – Internet Layer
3. Layer 3 – Transport Layer
4. Layer 4 – Application Layer

The main idea of the game is to give user control of the ISP. The goal of the gameplay is to attract as many customers as possible to your ISP. The challenge is to keep your customers happy, as dissatisfied customers will leave the network and find their network solutions with players' competition. Also, the other challenge is to keep the network efficient.

Interface

Player sees a screen on which we can see a 3D view of a terrain. Player can freely move the camera around (possibly including zoom in, zoom out – depending on how hard is this to implement). The camera movement will be restricted to make sure player does not look on the terrain from 'underneath'

On the top of the screen, user is presented with a set of tools. The tools are divided by the layer type:

The building tools for Transport layers will work a little different. User will use them to assign to a particular type of server/desktop/workstation a primary protocol type to be used. The tools to choose from will be:

1. UDP
2. TCP

User will need to choose the right type depending on application being used at the host. If wrong one is chosen there will be data loss (e.g. FTP over UDP) or transmission will be too slow (eg. Video over TCP). See application layer description on how this will be done.

In addition, layer 3 tools will include:

1. Routers
2. Firewalls

Player will place these highly configurable network elements to complete/secure the networks.

The building tools for Application layer will be hosts. Customers of the system will indicate to player what they want to do with the network and user has to choose the appropriate types of hosts: Web Server, FTP server, Telnet server, desktop, laptop computer, DNS server, entire LAN, (for businesses), etc. Once player chooses one, he/she needs to assign a Transport type, which he/she will do by dragging from Transport Layer onto the host. Small icon in the corner of host will indicate what type of application the host will use and protocol type. Then the host will need to be connected via layer1 tools (wire, etc.) to network layer tools (routers, switches, etc.)

Each tool will cost money and there will be some concept of how much money player has at all times. If player goes under \$0, player loses the game,

Not all tools will be available at once. Just like in SimCity, different tools are available after some time has passed to simulate the progression of history of networking and availability of different technologies at different points in time.

Gameplay:

Game starts with a screen on which there is a main building, an ISP's headquarters with a backbone to which player will be able to connect elements using available tools. Also, player will see customers (represented by small houses or businesses). Player needs to connect the customers to the network. At the beginning none of the customers will be connected to player's ISP. Player starts by choosing the layer1 tool (for example telephone wire) and starts putting it on the terrain, connecting customer to a backbone). Player will be able to measure the distance between the customers and nearest backbone/router/switch and using this information, together with total bandwidth requirements and current topology, decide which type of connection to use. Switches or routers can be placed in between to connect customers to each other for better

connectivity (eliminate congestion, improve speed, etc.). Also, each customer will indicate the type of service it wants: for example user might want to be able to receive e-mail (small text underneath the building). For each of these, player will need to build the host somewhere in specially designated buildings in which servers can be placed and then connect the customer (through the use of network) to the right host. Also, desktop or laptop computer will need to be placed at customer's house (or if business, a new LAN will need to be dragged from tools menu into the business's building).

Once a customer is connected through network of wires and routers/switches to desired host, the packets will start flowing in the network (tiny, SimCity car like movement will be animated to show the utilization of network and additionally different parts of network will have color indicators to indicate 'health' of particular network part; health will be the utilization of the device/wire/host). If the health of the router for example goes down (too much congestion, router hanged, etc.) the router will need to be restarted, replaced, or configured, etc. In addition to color coding, each router/host etc. element will have utilization bar helping player to find problem with the network parts.

As more and more customers are added, the network gets congested more. Also, there will be simulated disasters:

1. Physical disasters -> wire fail, flooding, fire, hardware failure, power outage
2. Maintenance disasters -> server restart after software update, software update, choosing different routing/congestion control algorithm, etc.
3. Attacks on the net: Hackers (build a firewall -> this will require more maintenance as player needs to open up the right ports, e.g 23 for FTP); DoS attacks – player will need to shut down parts of the network or set up filtering rules on firewalls to filter out bad traffic

When the disaster strikes, player will be able to visually see dropped parts of network by color indication and words error appearing near the failed elements.

Player will have some control over parameters of different building blocks. For example, at router levels, user will be able to click on router and be presented with a screen with choices about routing algorithms (Shortest Path, Flooding, Distance Vector, etc.), congestion relieve technique (leaky bucket, token bucket, etc.). Depending on the choice, the network will behave in different way. Player will also be able to type the subnet of the router and ip address of the router. At firewall, player will be able to open ports (choice of few popular ports), and set up filters to filter traffic by port or ip or both (when firewall will be put in place, it might prevent some legitimate traffic from coming through, so user will need to open ports to let the traffic through). For Transport layer tools player will be able to set length of TTL, size of packet, UDP or TCP connections, etc. For application layer tools, player will be able to customize different types of servers/computers by giving them name and ip and open port number (servers) or (desktops) which service they are looking for: name of servers, name of database, connection type, etc.

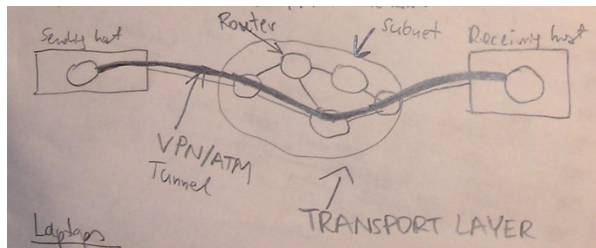
There will also be a budget where player would indicate to each customer how much she/he would charge per month for service. Charging too much will make customers

unhappy, charging too little will cause player not to make profit due to costs of maintaining the network. Just like in SimCity, player will be charged for maintenance of different elements of network (wires, firewalls, hosts, etc.). As customers leave the network, the building representation of the customer will change color and an 'x' will be placed through the 3D model of the building.

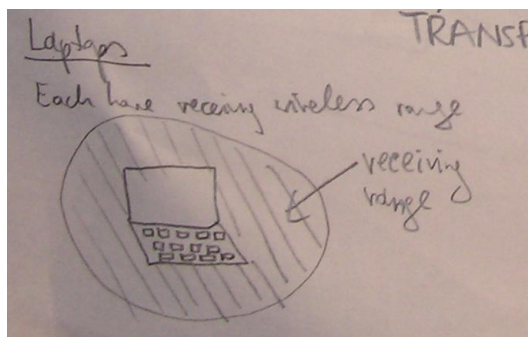
Some ideas to improve gameplay

In decreasing order of importance):

1. At transport layer, we could teach player the connection establishment/release by having the player test the connection when he/she is setting one up (3 way handshake animated picture would be shown, which could fail at one of the 3 steps)
2. 2 views: ground level view vs. network view
3. Allow user to mark multiple routers as part of WAN and collapse view of WAN for better network visibility when networks get big
4. VPN/ATM networks to teach idea of secure connectivity to workplace:



5. Teach security – encryption as one of building tools (e.g. customer wants to bank online)
6. Wireless networks – laptops would be assigned to movable customers and will need to build access points to accommodate these users



7. Computer vs. player gameplay