



The Internet – How it Works

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URL – What is it?

- You want to access a URL
 - E.g. <http://www.google.com>
- What does this mean?
 - Look at the two elements
 - <http://>
 - This is the type of data being accessed
 - Alternatives include https, ftp
 - Not important at this stage
 - We are concentrating on the www part for now



Top Level Domain

- E.g www.google.com
- Read from the right
 - .com = a Top Level Domain
 - Others are
 - .uk
 - .nz
 - .com = USA Commercial
 - Used however as default – not necessarily for USA



UK domains

- .co.uk
 - UK as Top Level Domain
 - www.soroban.co.uk
- .co.uk = UK commercial
- .org.uk = UK non profit organisation
 - .org = USA equivalent
- There are several others



Local Domains

- The next field from the right
 - www.soroban.co.uk
- Identifies the Domain
 - Typically points to a site/company
- The bit to the left identifies a Computer
- There can be additional sub networks e.g. (fictitious)
 - www.csp.soroban.co.uk



But how does it Work?

- The Internet works with IP addresses
 - IP = Internet Protocol
- An IP address is a 32 bit binary number
 - Identifies a single computer
 - At least originally
 - Sort of like a telephone number
- It is divided into 4 groups of 8 bits (octets)
 - Written as 212.159.8.1



IP Addressing

- IP Address is made up of two parts
 - Network Address
 - 212.159.8.x
 - Subnet address
 - x.x.x.1
- Subnet Mask
 - Used to separate the two parts of an IP Address
 - 255.255.255.0
 - All computers on local network are on same subnet



Domain Name vs. IP Address

- A Domain Name translates to an IP address
- How?
 - Via a Domain Name Server (DNS)
 - A DNS has a list of Domain Names with IP addresses
 - Also has a list of other Domain Name Servers
 - To try if it does not know the answer



The Final Part of the Jigsaw

- A Computer has an IP Address
- How does it contact another computer?
 - On same local network (subnet)?
 - Broadcast to local subnet
 - Gets a hardware address back from target
 - Somewhere else? Not on local subnet
 - Sends data to Default Gateway



And now for the Light Relief

- Play the video
- <http://www.warriorsofthe.net/movie.html>



Default Gateway – AKA Router

- Default Gateway IP address known by all computers on a subnet
- Default gateway either
 - Knows how to reach the network containing target address
 - Knows other gateway addresses that may know how to reach the target network
 - The Route – hence Router
 - There is no short cut
 - There is no geographic structure to IP addresses
 - YET



Put it all together – Step 1

- PC browser wants to access www.google.com
 - Sends request to Domain Name Server get IP Address (knows IP address of DNS)
 - DNS is on another network (uses subnet mask to make decision)
 - PC forwards DNS request to Gateway/Router
 - Gateway forwards request to DNS (perhaps via further routers)
 - DNS returns IP address



Put it all together – Step 2

- DNS returns Target IP Address
 - PC now sends web access request to default gateway
 - Default gateway forwards message to next router
 - At some point there are a few large routers that together know all IP networks
 - This issue is getting worse as the network grows
 - A new IP addressing scheme is available
 - Request arrives at destination



Some Additional Devices/Concepts

- Firewall
 - Looks at messages passing through for malicious content
- Proxy
 - Hides internal networks from public
 - Common in corporate networks
 - Usually embedded in a Firewall
- Network Address Translation
 - Another technique for hiding internal addresses
 - Common in home routers



Where do I get an IP address

- How does my PC get an IP address?
 - I can give it one!
- Can I go to the Network configuration dialog box and give it anything I want?
- Not quite - there are some constraints
 - It must be unique – at least within local network
 - All computers on a local network must be in the same subnet



Good IP Addresses to Choose

- 192.168.x.1 to 192.168.x.254
 - x can be anything from 0 to 255
 - 254 addresses available
 - Enough for most of us at home
 - Subnet mask must be 255.255.255.0
 - This is the most common for home use
- 10.x.y.1 to 10.x.y.254
 - Alternative that is sometimes used
 - X and y can each be 0 to 255
 - Subnet mask is usually 255.255.255.0



How do I choose x and y

- If you are not connection to an external router or other such device
 - Flip a coin!, Roll a dice, ...
- If you are connecting to a router
 - it will have a default IP address
 - Go with it – use its default!
 - E.g. 192.168.7.1 (mine)
 - Computers are 192.168.7.100 etc.
 - Only change the default if there is good reason



What else needs to set?

- You must set the following
 - IP Address
 - Subnet mask (typically 255.255.255.0)
 - Default Gateway
 - Usually the IP address of the Router
 - DNS server IP address either
 - Address or addresses given by ISP
 - Address of router

Is there an easier way?

- That is a lot to setup when I connect a computer – is there an alternative?
- Of course there is?
 - **DCHP**
 - Dynamic Host Configuration Protocol
- Most Routers provide this service
 - Needs to be enabled in Router
 - Configure PC to obtain address automatically (XP)

How does DHCP Work?

- PC issues a “broadcast” on the local network
 - is there anyone who understands DHCP?
- DHCP server (e.g. router) responds with
 - IP address
 - Subnet mask
 - Default Gateway address
 - DNS server address



When should I use Static IP Addressing

- If you have a server on your network that is accessed from outside
 - The router needs to map an internal IP address to the external request
 - Easier if it is always the same
- If you want to access your PC from outside
 - Remote Desktop
 - Remote Support
 - Easier if always the same
- Your IP address **MAY** always be the same
 - DHCP Lease will remember the address your PC last had for a time (between a few hours to forever)

That's All Folks!

