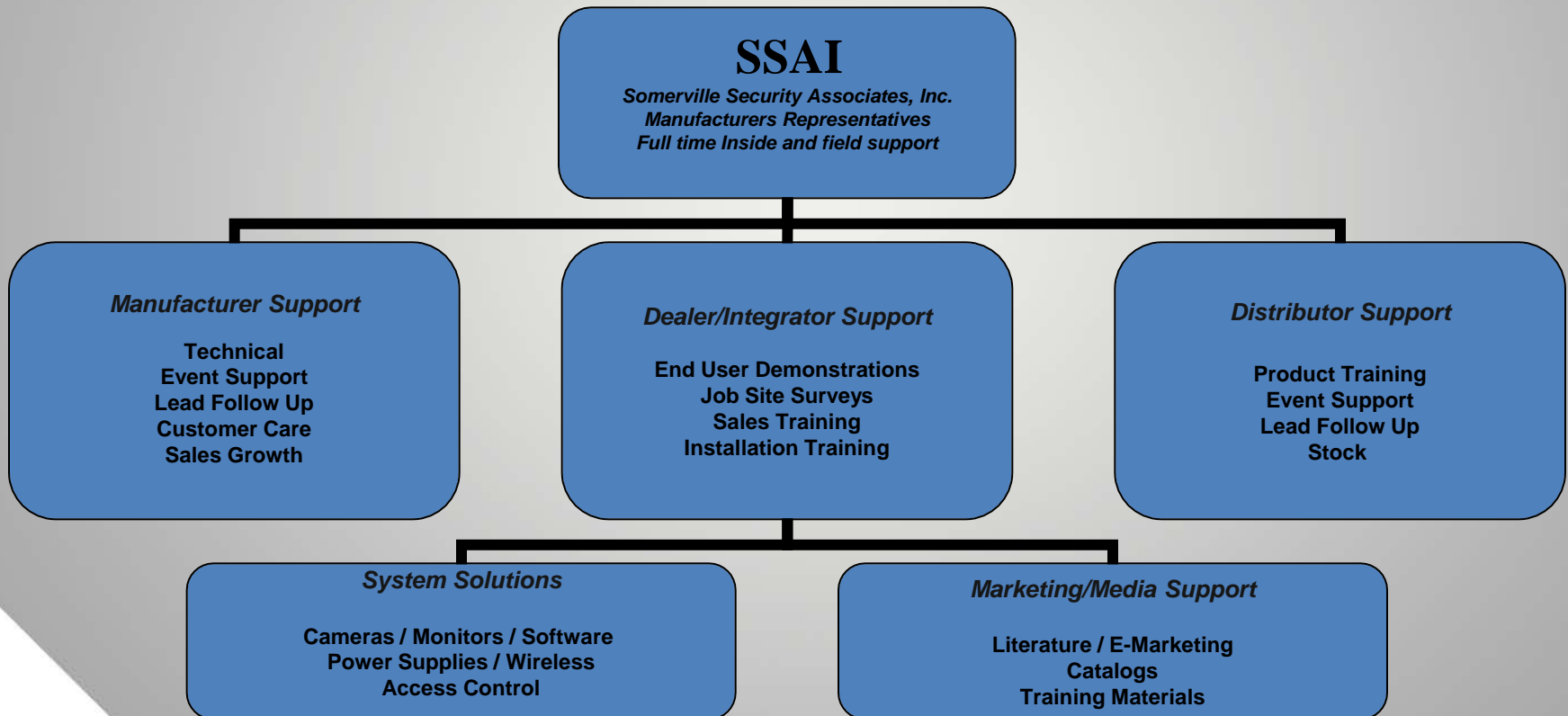




*Everything's Digital*

## ***Networking Essentials***

# We Are Here to HELP



# Resources

- [www.whatis.com](http://www.whatis.com) – IT Terminology
- [www.compTIA.com](http://www.compTIA.com) – CompTIA serves the IT industry as the world's largest developer of vendor neutral IT certifications.

# Objective

- Help you understand basic computer networking terminology and knowledge necessary for implementing IP Video Surveillance Systems.

# Overview

- What is network?
- How does data move, and how to make it move efficiently?
- Power over Ethernet [PoE]
- Network Organization
- Network Terms

# What is a network?

- Two or more computers connecting to share resources
  - Files
  - Printer
  - Internet connection
- A network makes its computers powerful because they can share information and resources
- Primary components of network are:
  - Workstations
  - Servers
  - Hosts
- A cluster of stand-alone computers communicating with one another is a Basic Network

# Network Categories

## ○ LAN (Local Area Network)

- Confined to a relatively small geographic area
  - Building
  - Office
  - Department
- Number of computers ranges from two to thousands

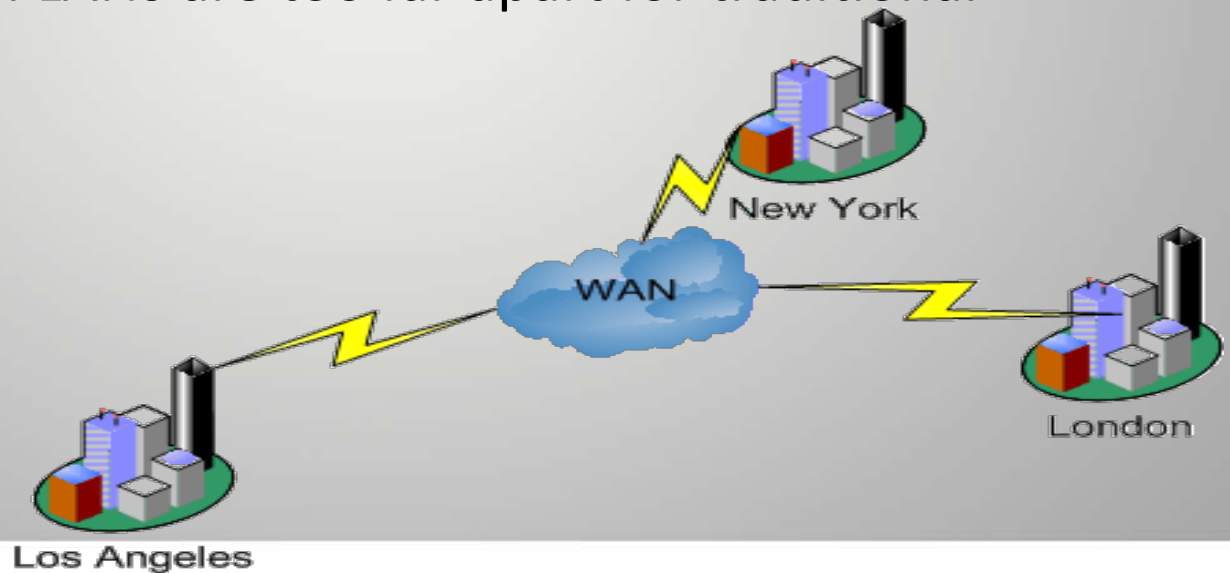
## ○ MAN (Metro Area Network)

- Connects distant entities
  - Buildings
  - Campus
  - Offices in geographically separate areas
- Range from 1 to 30 miles radius

# Network Categories

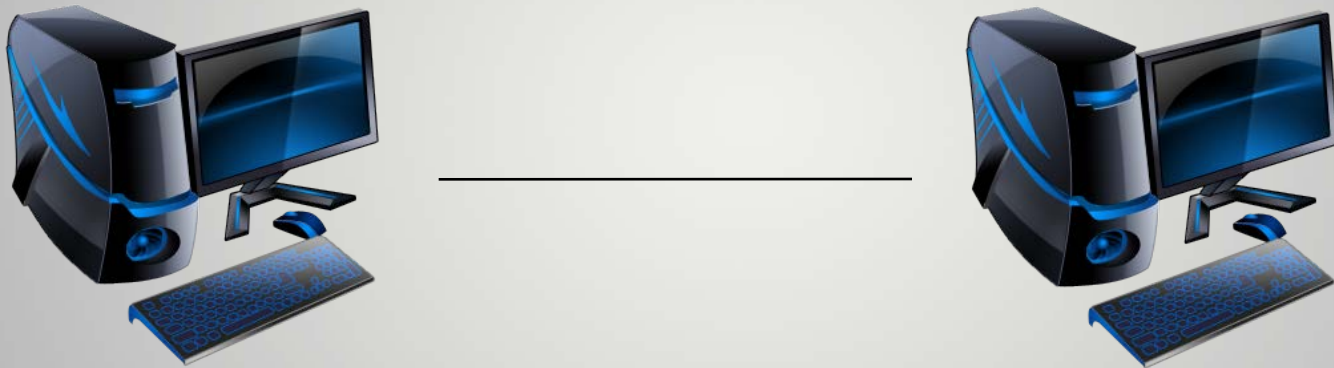
## ○ WAN (Wide Area Network)

- Connects geographically disbursed areas.
- Large scale network
- Connecting multiple LANs via public carriers.
- Used when LANs are too far apart for traditional cabling.



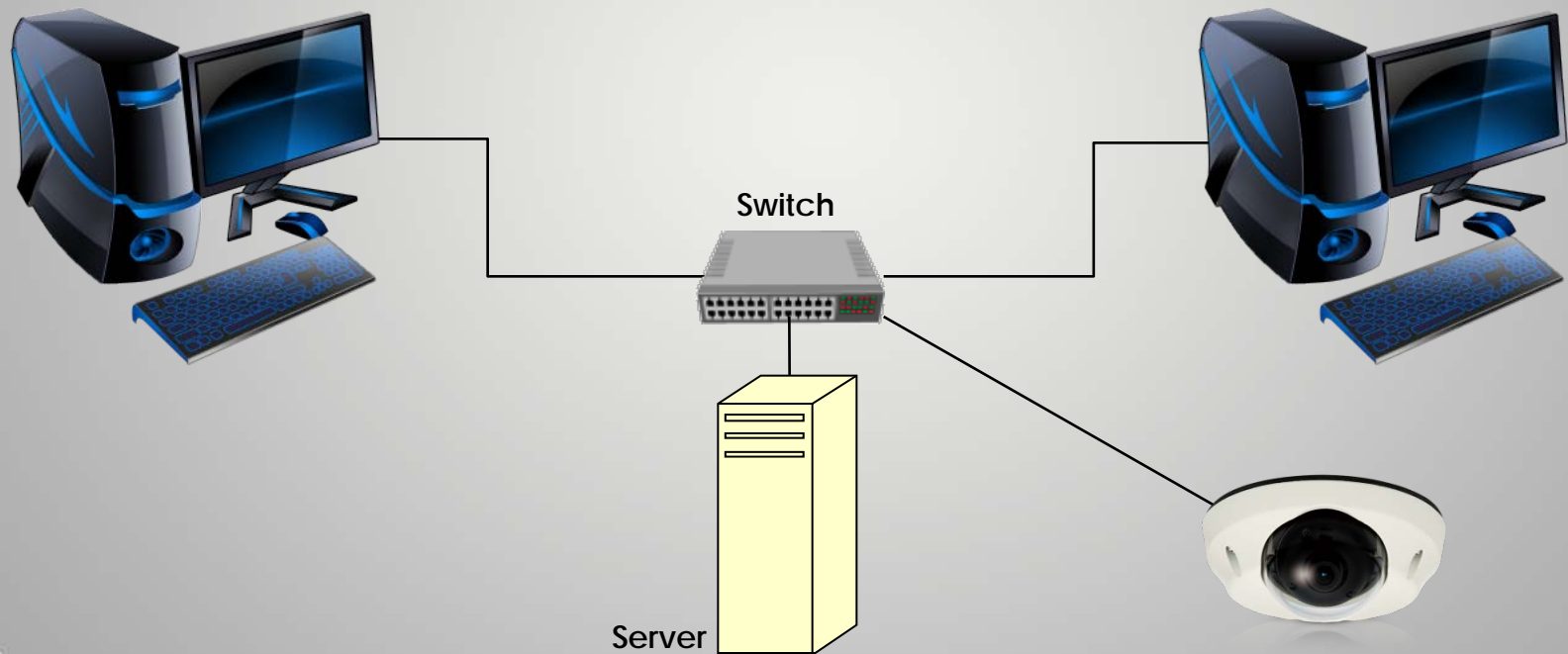
# A Simple Network

Peer-to-Peer Network, easy to share files



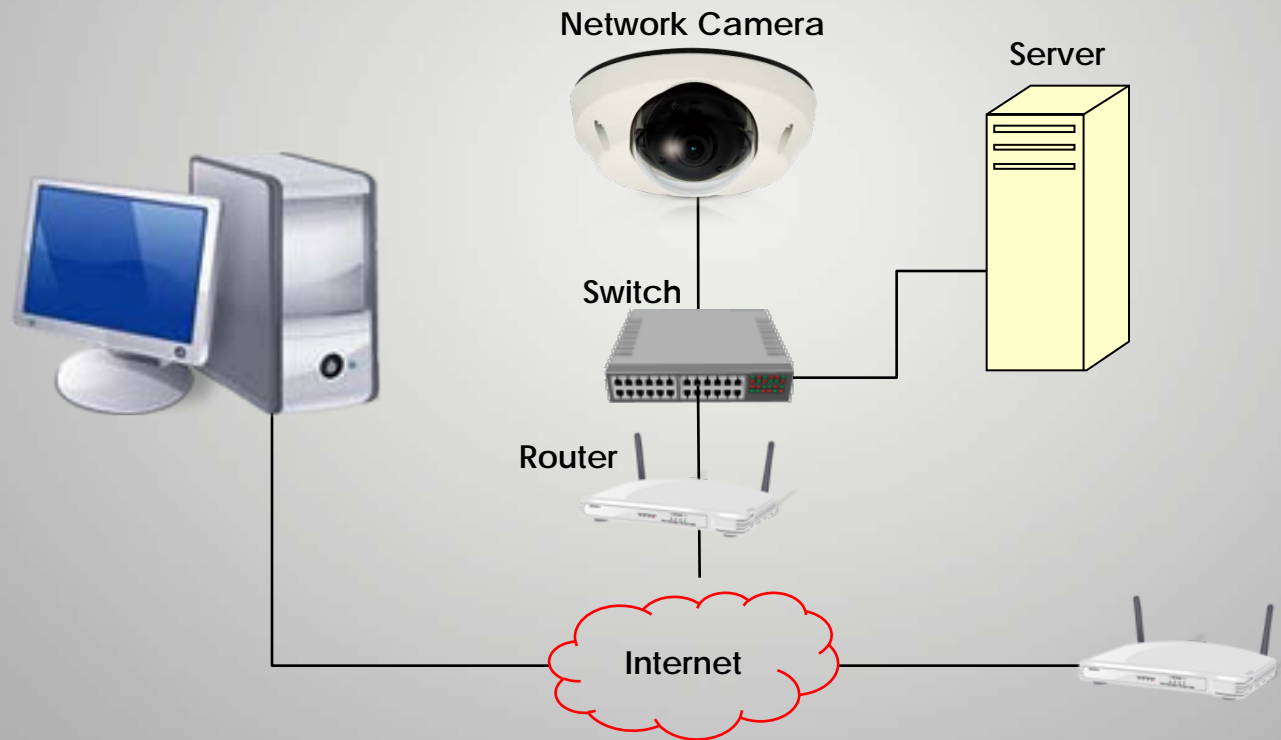
# A Simple Network

Simple network with file server for shared files and IP camera.



# Common IP Camera & Data Network

Common network with IP cameras local and remotely.



FIRST THING'S FIRST!

# UNDERSTANDING IT TERMINOLOGY

# What is IT and IP?

- **IT** = Information Technology
- **IP** = Internet Protocol
  - Also known as TCP/IP (Transmission Control Protocol/Internet Protocol)
  - Basic communication language (protocol) of the Internet

# Bandwidth in Computer Networks

- Used as a synonym for data transfer rate
- The amount of data that can be carried from one point to another in a given time period
- Expressed in bits per second (bps)

# Basic Terminology

- **Bits-** determine data transfer rates
  - 56Kbps phone line modem/ 1.5Mbps cable modem
- **Bytes-** describe capacity or storage
  - 512MB of RAM/ 250GB HD
- There are **8 bits** in a **byte**
- Usually,
  - Kb, Mb, & Gb= For bits
  - MB, GB, & TB= For bytes
- Bps = bits per second
- Kbps = Kilobits per second (thousand bits per second)
- Mbps = Megabits per second (million bits per second)
- Gbps = Gigabits per second (billion bits per second)

# Bandwidth / Throughput

Low Bandwidth/  
Throughput



High Bandwidth/  
Throughput



# VMAX Flexibility

Record rates and resolution separate from live stream!  
*Bandwidth Throttle*

The screenshot displays the VMAX Web Viewer interface. On the left is a navigation menu with options: MENU, SYSTEM, DEVICE, RECORD, NETWORK, and QUICK SETUP. The RECORD section is active, showing a 'RECORD SETUP' table with 8 channels. Each channel has settings for Resolution, FPS, Quality, Event, Pre-Alarm, Post-Alarm, and Mode. Below this table is a 'REMAINING FPS' summary row showing 369 FPS for Continuous and 30 FPS for Event. A 'Copy Setting' button and an 'Advanced' checkbox are also present. The 'LIVE STREAM' section below shows a table with 8 channels, each with a 'USE' checkbox, Resolution, FPS, Quality, and Audio settings.

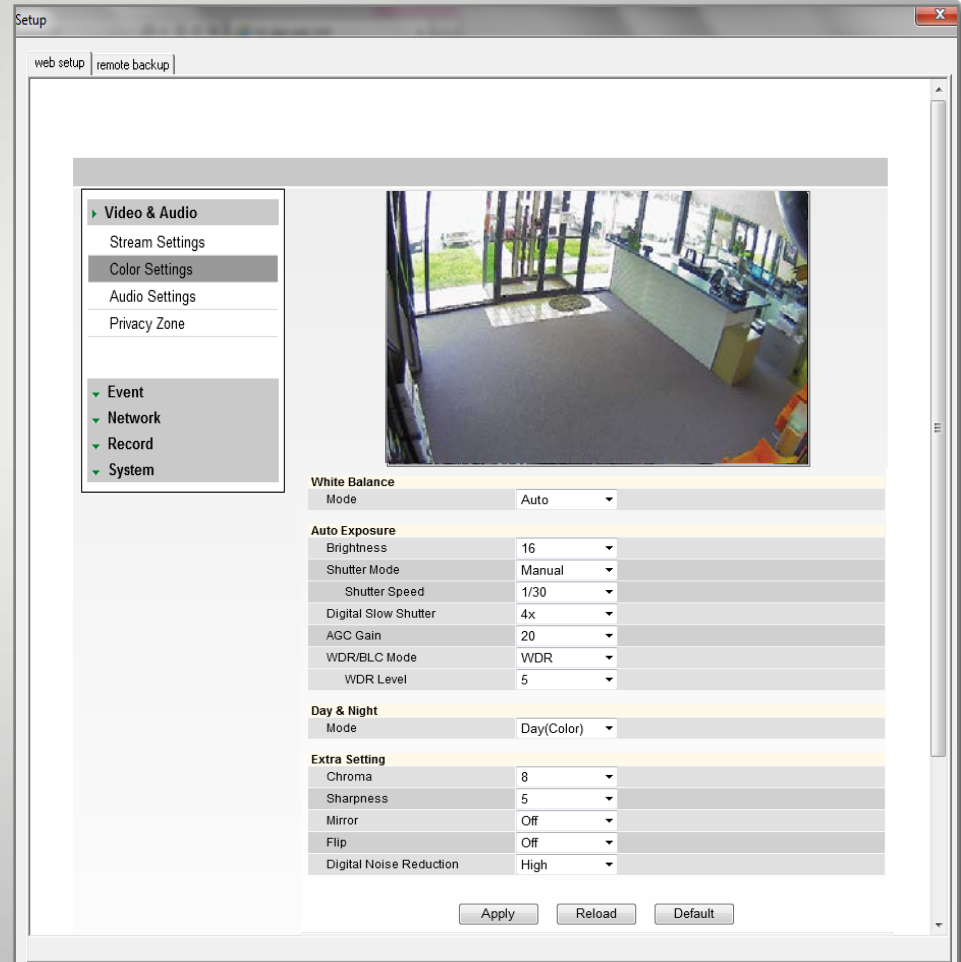
CH	RESOLUTION	CONTINUOUS		EVENT		PRE-ALARM	POST-ALARM	MODE
		FPS	QUALITY	FPS	QUALITY			
01	704x480	10	High	30	Highest	0	0	C+M
02	704x240	10	High	30	Highest	0	0	C+M
03	704x240	10	High	30	Highest	0	0	C+M
04	704x240	7	High	30	Highest	0	0	C+M
05	704x240	7	High	30	Highest	0	0	C+M
06	352x240	1	High	30	High	0	0	NONE
07	352x240	1	High	30	High	0	0	NONE
08	352x240	1	High	30	High	0	0	NONE
REMAINING FPS		369		30				

Copy Setting ☐ Advanced

CH	USE	RESOLUTION	FPS	QUALITY	AUDIO
01	<input checked="" type="checkbox"/> Use	352x240	15	High	OFF
02	<input checked="" type="checkbox"/> Use	352x240	10	High	OFF
03	<input checked="" type="checkbox"/> Use	352x240	15	High	OFF
04	<input checked="" type="checkbox"/> Use	352x240	10	High	OFF
05	<input checked="" type="checkbox"/> Use	352x240	7	High	OFF
06	<input type="checkbox"/> Use	352x240	5	High	OFF
07	<input type="checkbox"/> Use	352x240	5	High	OFF
08	<input type="checkbox"/> Use	352x240	5	High	OFF

# IP Camera Flexibility

- Go beyond factory default
- Impact Bandwidth & Storage
- Change settings to fit the application
- What are you trying to accomplish?



# IP Address, Subnet Mask, and Gateway

Obtained from a Network Administrator or internet service provider (ISP).

- IP Address:
  - Unique to each device (node) on the network
  - Dynamic or Static
- Subnet Mask
  - Identifies the subnet to which an IP address belongs
- Gateway
  - An entrance point to another network
  - Usually the IP address of the router
  - Necessary when accessing a network remotely

# Network Segments & Subnets

- Segments physically separate related computers into groups.
- Improve network performance and security.
- Only computers on the same segment receive packets broadcasted between themselves
- Network segments and subnets serve similar purposes
  - Both create a grouping of computers. The difference is:
  - **A segment is the physical network construction**
  - **A subnet is a higher-level software configuration**

# Subnets and Subnet Masks

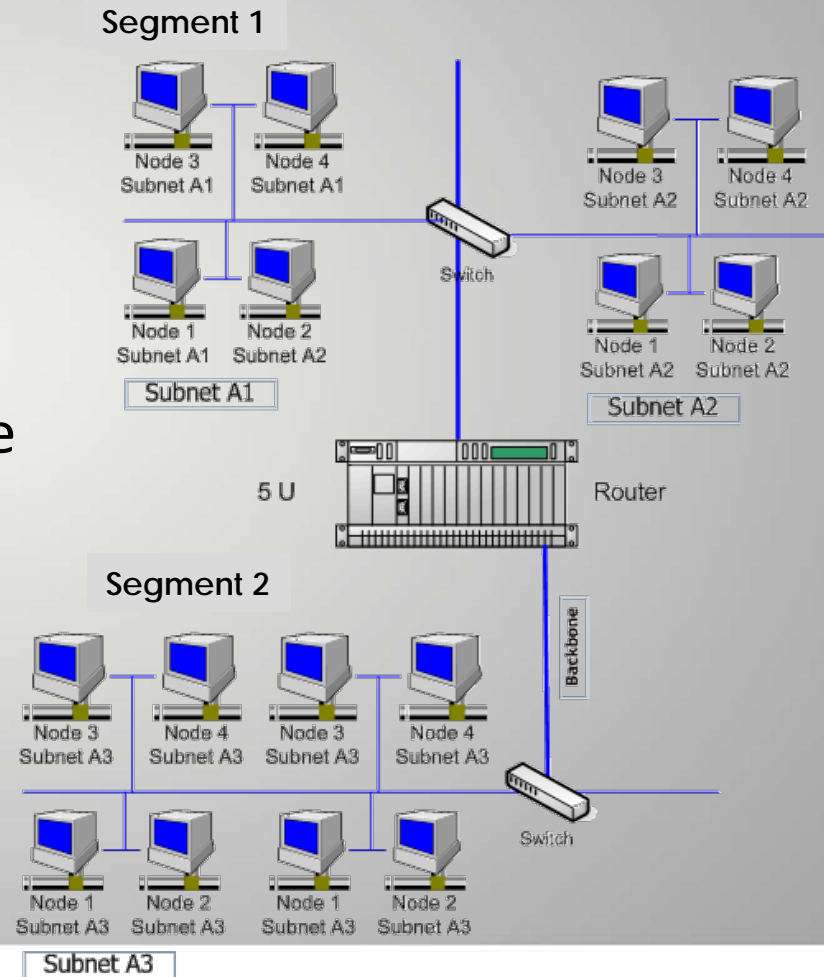
- Divides the network into smaller sections.
- Makes it easier to administer the network and the equipment in it.
- Increase security.
- Enhances performance.

# Segment

- A part of the network that has common characteristics and connections.
- “Segmenting the Network” simply means dividing it into smaller parts”.
- A segment is typically bounded by routers and switches.
- The most common practice to increase available bandwidth.
- If segmented correctly, most of the traffic from a segment will stay within the segment.

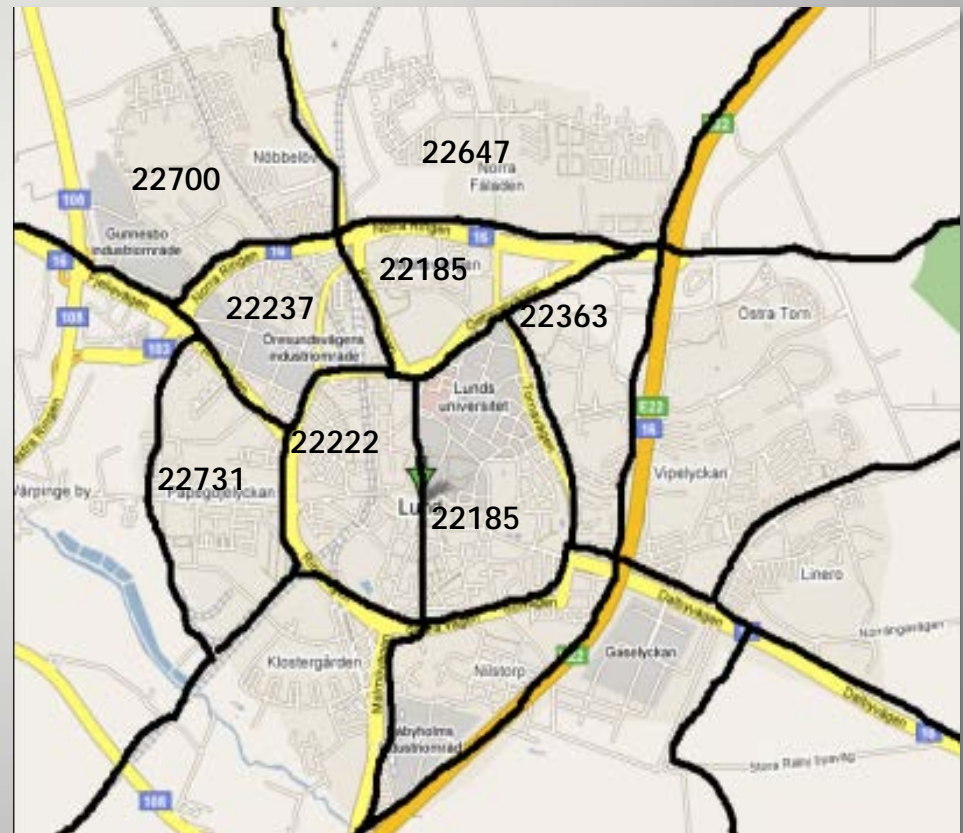
# Subnetting an IP Address

- Dividing a network into smaller, manageable parts
- Advantages of Subnetting:
  - Performance Enhancement
  - Restrict data transfer on the subnet to increase security.
- Example: Separation between Video and Office Network
- A subnet is to a network what a network is to the Internet



# Subnet and Subnet Masks

- A subnet mask can be compared to a zip code—the part of the address that defines an area or specific region of the network



# IP Addresses

- **Static IP**- assigned to a computer by an ISP or a Network Administrator as a permanent address
- **Dynamic IP**- received for a duration of the session on the network or a specified time period. (Ex. Temporary phone number)
- **DHCP** (Dynamic Host Configuration Protocol) lets network administrators manage and automate IP assignment in a network.

# **DNS (Domain Name System) & DDNS (Dynamic Domain Name System)**

## **○ DNS-**

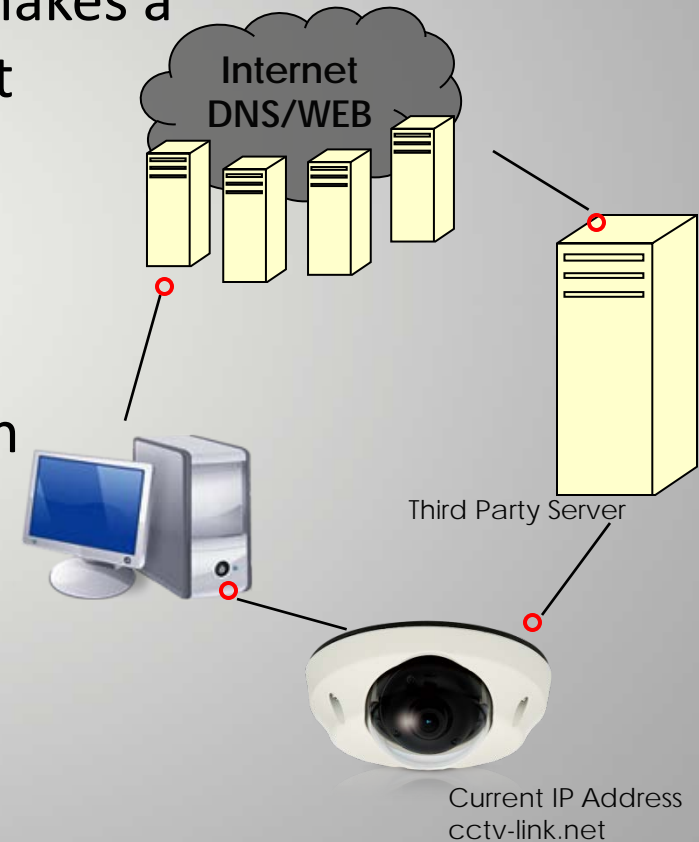
- Assigns names (URLs) to IP addresses
- (Ex. [www.google.com](http://www.google.com) versus 72.125.224.243)

## **○ DDNS-**

- Free or charges a small fee
- Allows IP based products to remotely connect with a dynamic IP address

# DDNS

1. Using a web browser a workstation makes a request: `http://joespizza.cctv-link.net`
2. The request hits the internet DNS servers
3. DNS Server sends request to DDNS
4. DDNS Server receives the information from the remote device, redirecting the client to the proper IP address
5. Workstation can view video



# Dynamic DNS Services

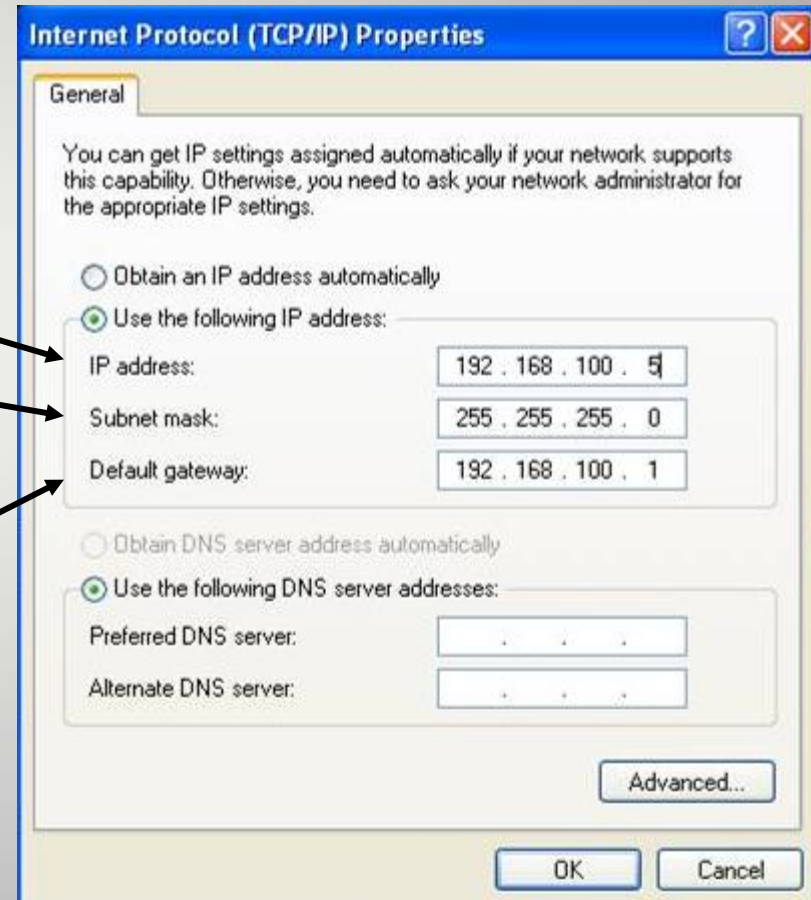
- no-ip.com
- Tzo.com
- dynDNS.org
- **Digital Watchdog – <http://dwddns2.net/>**



# Static Setting in Windows XP

## Subnet mask

# Standard gateway



# Static setting on DW's DVR

The screenshot shows the 'NETWORK' configuration window with the 'NETWORK' tab selected. The 'NETWORK TYPE' is set to 'STATIC IP'. The 'IP ADDRESS' is 72.243.193.207, the 'SUBNET MASK' is 255.255.255.192, and the 'GATEWAY' is 72.243.193.193. Other settings include 'DNS SERVER' 4.2.2.4, 'TCP/IP PORT' 9010, 'MOBILE PORT' 9011, 'WEB PORT' 80, and 'BANDWIDTH LIMIT' 100 Mbps. There are checkboxes for 'USE UPNP' and 'AUTO PRIVATE IP SET UP(NAT TRAVERSAL)'. The window has 'SAVE', 'CANCEL', and 'HELP' buttons at the bottom.

Field	Value
NETWORK TYPE	STATIC IP
IP ADDRESS	72.243.193.207
SUBNET MASK	255.255.255.192
GATEWAY	72.243.193.193
DNS SERVER	4.2.2.4
TCP/IP PORT	9010
MOBILE PORT	9011
WEB PORT	80
BANDWIDTH LIMIT	100 Mbps
USE UPNP	<input type="checkbox"/>
AUTO PRIVATE IP SET UP(NAT TRAVERSAL)	<input type="checkbox"/>

IP-address

Subnet mask

Standard gateway

# Static setting on DW's MEGApix

IP-address

Subnet mask

Standard gateway

**Network Settings**

**IP Mode**

☐ DHCP

☐ PPPoE

Username :

Password :

☒ Static IP

IP Address :

Subnet Mask :

Gateway :

**DNS**

Primary DNS :

Secondary DNS :

**IPv6 Mode**

☒ Not Use

☐ Auto  / 64

☐ Static  / 0

**MAC Address :** 00:1C:A6:01:21:8E

**PORT**

Command Port :	<input type="text" value="7000"/>	Live Port :	<input type="text" value="7001"/>
2Way Audio Port :	<input type="text" value="7002"/>	Web Port :	<input type="text" value="80"/>
Recording Port :	<input type="text" value="7004"/>		

Apply Reload

# Setting Up a Linksys Router

Login to router via Internet Browser. Typically 192.168.1.1\*

The screenshot shows the Linksys WRT54GX4 router's web-based setup interface. The top navigation bar includes 'Setup', 'Wireless', 'Security', 'Access Restrictions', 'Applications & Gaming', 'Administration', and 'Status'. The 'Setup' tab is active, and the 'Internet Setup' section is selected. The 'Internet Connection Type' is set to 'Automatic Configuration - DHCP'. The 'Router Name' is 'SSAI SRX400 Demo'. The 'Host Name', 'Domain Name', 'MTU', and 'Size' fields are empty. The 'Local IP Address' is '192.168.1.55' and the 'Subnet Mask' is '255.255.255.0'. The 'DHCP Server' is set to 'Enable'. The 'Starting IP Address' is '192.168.1.56', the 'Maximum Number of DHCP Users' is '10', and the 'Client Lease Time' is '0 minutes'. The 'IP Address Range' is '192.168.1.56 ~ 192.168.1.65'. The 'Static DNS 1' and 'Static DNS 2' fields are empty. The 'Time Zone' is set to '(GMT-08:00) Pacific Time (USA & Canada)'. The 'Automatically adjust clock for daylight saving changes' checkbox is checked. The 'Save Settings' and 'Cancel Changes' buttons are at the bottom.

LINKSYS®  
A Division of Cisco Systems, Inc.

Firmware Version: 1.00.20  
WRT54GX4

Setup | Wireless | Security | Access Restrictions | Applications & Gaming | Administration | Status

Basic Setup | DNS | MAC Address Clone | Advanced Routing

Internet Setup

Internet Connection Type: Automatic Configuration - DHCP

Optional Settings (Required by some ISPs)

Router Name: SSAI SRX400 Demo

Host Name:

Domain Name:

MTU: Auto

Size: 1500

Local IP Address: 192 . 168 . 1 . 55

Subnet Mask: 255 . 255 . 255 . 0

DHCP Server: ☒ Enable ☐ Disable

Starting IP Address: 192.168.1.56

Maximum Number of DHCP Users: 10

Client Lease Time: 0 minutes (0 means one day)

IP Address Range: 192.168.1.56 ~ 192.168.1.65

Static DNS 1: 0 . 0 . 0 . 0

Static DNS 2: 0 . 0 . 0 . 0

Time Setting

Time Zone: (GMT-08:00) Pacific Time (USA & Canada)

☒ Automatically adjust clock for daylight saving changes

Automatic Configuration - DHCP: This setting is most commonly used by Cable operators.

Host Name: Enter the host name provided by your ISP.  
Domain Name: Enter the domain name provided by your ISP.  
More...

Local IP Address: This is the address of the router.  
Subnet Mask: This is the subnet mask of the router.

DHCP Server: Allows the router to manage your IP addresses.  
Starting IP Address: The address you would like to start with.  
Maximum number of DHCP Users: You may limit the number of addresses your router hands out.  
More...

Time Setting: You may choose Automatically if you wish to use an NTP server to keep the most accurate time.  
More...

Save Settings Cancel Changes

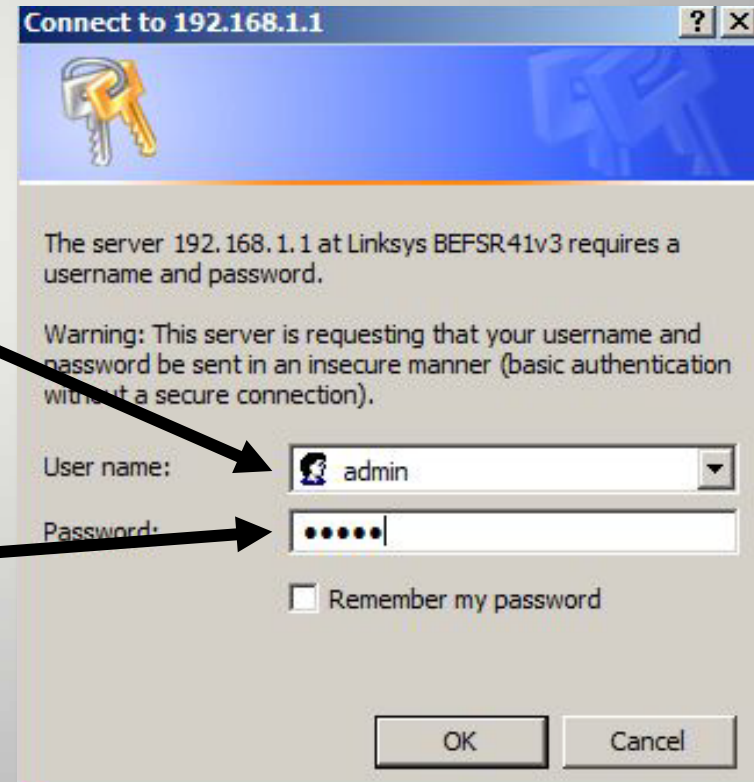
CISCO SYSTEMS

\*Setup Process may vary by Router Make & Model

# Logging in to the Router

This may be blank

Default password is "admin"



Connect to 192.168.1.1

The server 192.168.1.1 at Linksys BEFSR41v3 requires a username and password.

Warning: This server is requesting that your username and password be sent in an insecure manner (basic authentication without a secure connection).

User name:

Password:

☐ Remember my password

OK Cancel

\*Setup Process may vary by Router Make & Model

Wherever you are, Whatever you need.

DHCP Range

**Etherfast® Cable/DSL Router**

**Setup**

Setup | Security | Applications & Gaming | Administration | Status

Basic Setup | DDNS | MAC Address Clone | Advanced Routing

**Internet Setup**

Internet Connection Type: Obtain an IP automatically

Optional Settings (required by some ISPs)

**Network Setup**

Router IP

Local IP Address: 192 . 168 . 1 . 1

Subnet Mask: 255 . 255 . 255 . 0

Local DHCP Server: ☒ Enable ☐ Disable

Start IP Address: 192.168.1.4

Number of Address: 200

DHCP Address Range: 192.168.1.4 to 192.168.1.203

Client Lease Time: 0 minutes (0 means one day)

Static DNS 1: 0 . 0 . 0 . 0

Static DNS 2: 0 . 0 . 0 . 0

Static DNS 3: 0 . 0 . 0 . 0

WINS: 0 . 0 . 0 . 0

**Basic Setup**

The Basic Setup screen is where basic configuration is performed. Some ISPs (Internet Service Providers) will require that you enter the DNS information. These settings can be obtained from your ISP. After you have configured these settings, you should set a router password from the Administration->Management screen.

Completing the Internet Setup section is all that is required to set up for your specific ISP. Please look at the table below to configure the Router for your Internet connection.

[More...](#)

Save Settings Cancel Changes

\*Setup Process may vary by Router Make & Model

# Setting Up Port Forwarding

## ○ Port Forwarding

- Referred to as port mapping
- Forwarding a network port from one network node to another
- Used to allow remote Internet access to a private IP address (inside a LAN)

# Ports

- A port is a virtual data connection allowing programs to exchange information directly
- **TCP** (Transmission Control Protocol) and **UDP** (User Datagram Protocol) **Ports** are the most common used on the Internet.
- Addressing a port is done by the “IP Address:Port Number.”  
(Ex: 192.168.0.90:**80**)

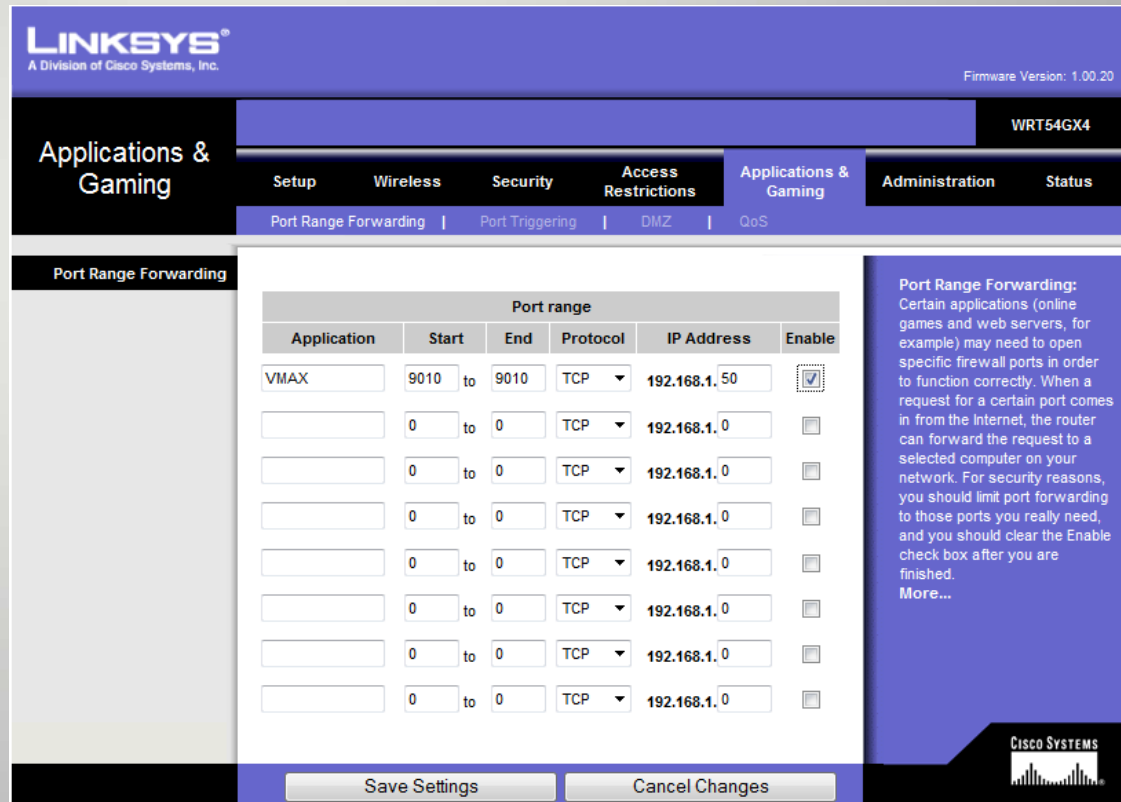


# Common Port Numbers

- 21: File Transfer Protocol (FTP)
- 80: Default Web Server - Hypertext Transfer Protocol (HTTP)
- 110: Post Office Protocol V3 (POP3)
- 25: Simple Mail Transfer Protocol (SMTP)

# Setting Up Port Forwarding

1. Click Applications & Gaming
2. Set Port Range
3. Set IP Address



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Firmware Version: 1.00.20

WRT54GX4

Applications & Gaming

Setup | Wireless | Security | Access Restrictions | **Applications & Gaming** | Administration | Status

Port Range Forwarding | Port Triggering | DMZ | QoS

**Port Range Forwarding**

Port range					
Application	Start	End	Protocol	IP Address	Enable
VMAX	9010	to 9010	TCP	192.168.1.50	<input checked="" type="checkbox"/>
	0	to 0	TCP	192.168.1.0	<input type="checkbox"/>
	0	to 0	TCP	192.168.1.0	<input type="checkbox"/>
	0	to 0	TCP	192.168.1.0	<input type="checkbox"/>
	0	to 0	TCP	192.168.1.0	<input type="checkbox"/>
	0	to 0	TCP	192.168.1.0	<input type="checkbox"/>
	0	to 0	TCP	192.168.1.0	<input type="checkbox"/>
	0	to 0	TCP	192.168.1.0	<input type="checkbox"/>

Save Settings Cancel Changes

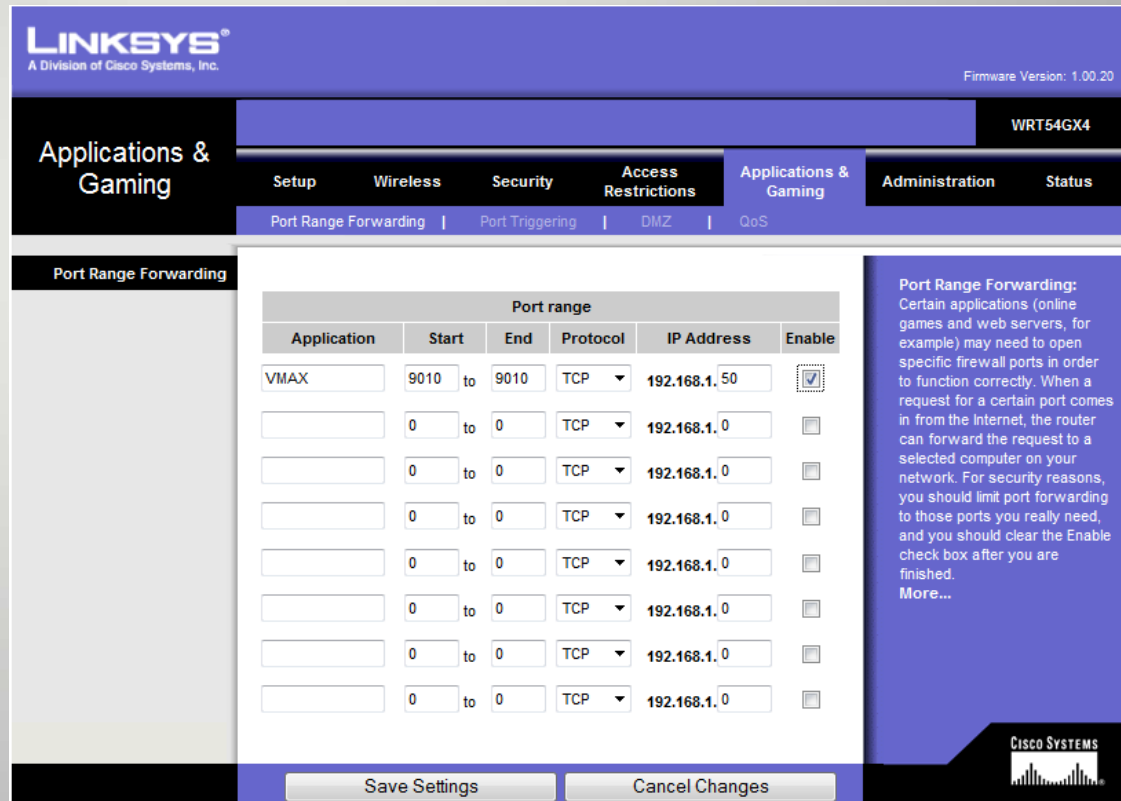
**Port Range Forwarding:** Certain applications (online games and web servers, for example) may need to open specific firewall ports in order to function correctly. When a request for a certain port comes in from the Internet, the router can forward the request to a selected computer on your network. For security reasons, you should limit port forwarding to those ports you really need, and you should clear the Enable check box after you are finished.  
[More...](#)

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# Applications & Gaming Tab

4. For each device, you will need to know:

- IP Address
- default ports



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Firmware Version: 1.00.20

**Applications & Gaming**

Setup | Wireless | Security | Access Restrictions | **Applications & Gaming** | Administration | Status

Port Range Forwarding | Port Triggering | DMZ | QoS

**Port Range Forwarding**

Port range						
Application	Start	End	Protocol	IP Address	Enable	
VMAX	9010	to 9010	TCP	192.168.1.50	<input checked="" type="checkbox"/>	
	0	to 0	TCP	192.168.1.0	<input type="checkbox"/>	
	0	to 0	TCP	192.168.1.0	<input type="checkbox"/>	
	0	to 0	TCP	192.168.1.0	<input type="checkbox"/>	
	0	to 0	TCP	192.168.1.0	<input type="checkbox"/>	
	0	to 0	TCP	192.168.1.0	<input type="checkbox"/>	
	0	to 0	TCP	192.168.1.0	<input type="checkbox"/>	
	0	to 0	TCP	192.168.1.0	<input type="checkbox"/>	

Port Range Forwarding: Certain applications (online games and web servers, for example) may need to open specific firewall ports in order to function correctly. When a request for a certain port comes in from the Internet, the router can forward the request to a selected computer on your network. For security reasons, you should limit port forwarding to those ports you really need, and you should clear the Enable check box after you are finished.  
[More...](#)

Save Settings | Cancel Changes

CISCO SYSTEMS

# Check What Ports Need to be Open

The screenshot shows a 'NETWORK' configuration window with the following settings:

Setting	Value
NETWORK TYPE	STATIC IP
IP ADDRESS	72.243.193.207
SUBNET MASK	255.255.255.192
GATEWAY	72.243.193.193
DNS SERVER	4.2.2.4
TCP/IP PORT	9010
MOBILE PORT	9011
WEB PORT	80
BANDWIDTH LIMIT	100 Mbps

Additional options at the bottom include:

- ☐ USE UPNP
- ☐ AUTO PRIVATE IP SET UP(NAT TRAVERSAL)

Buttons at the bottom: SAVE, CANCEL, HELP.

Remote  
Software

Moblie App Port

Web Port

# Port Forwarding a Device

5. Enter a name for the DVR/Camera,
6. Enter starting & ending ports
7. Enter IP Address of the device
8. Check "Enabled"\*

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Firmware Version: 1.00.20

WRT54GX4

Applications & Gaming

Setup Wireless Security Access Restrictions Applications & Gaming Administration Status

Port Range Forwarding | Port Triggering | DMZ | QoS

**Port Range Forwarding**

Port range					
Application	Start	End	Protocol	IP Address	Enable
VMAX	9010	to 9010	TCP	192.168.1.50	<input checked="" type="checkbox"/>
	0	to 0	TCP	192.168.1.0	<input type="checkbox"/>
	0	to 0	TCP	192.168.1.0	<input type="checkbox"/>
	0	to 0	TCP	192.168.1.0	<input type="checkbox"/>
	0	to 0	TCP	192.168.1.0	<input type="checkbox"/>
	0	to 0	TCP	192.168.1.0	<input type="checkbox"/>
	0	to 0	TCP	192.168.1.0	<input type="checkbox"/>
	0	to 0	TCP	192.168.1.0	<input type="checkbox"/>

Port Range Forwarding: Certain applications (online games and web servers, for example) may need to open specific firewall ports in order to function correctly. When a request for a certain port comes in from the Internet, the router can forward the request to a selected computer on your network. For security reasons, you should limit port forwarding to those ports you really need, and you should clear the Enable check box after you are finished.  
[More...](#)

Save Settings Cancel Changes

CISCO SYSTEMS

\*Always click "Save Settings" to avoid losing all the information you have entered!

# The DDNS Tab

- Set the router to work with services like TZO or DynDNS.com.
- To access the DVR from outside the network if DVR/Camera does not host its own DDNS Server

The screenshot shows the 'Setup' page of a router's web interface, specifically the 'DDNS' tab. The page is titled 'Etherfast® Cable/DSL Router' and 'BEFSR41 V3'. The 'DDNS' tab is selected, and the 'DynDNS.org' service is chosen from a dropdown menu. The configuration fields are as follows:

Field	Value
DDNS Service	DynDNS.org
User Name	jastout9999
Password	••••••
Host Name	jeffshomevideo.dyndns.org
Internet IP Address	10.38.253.4
Status	DDNS is updated successfully.

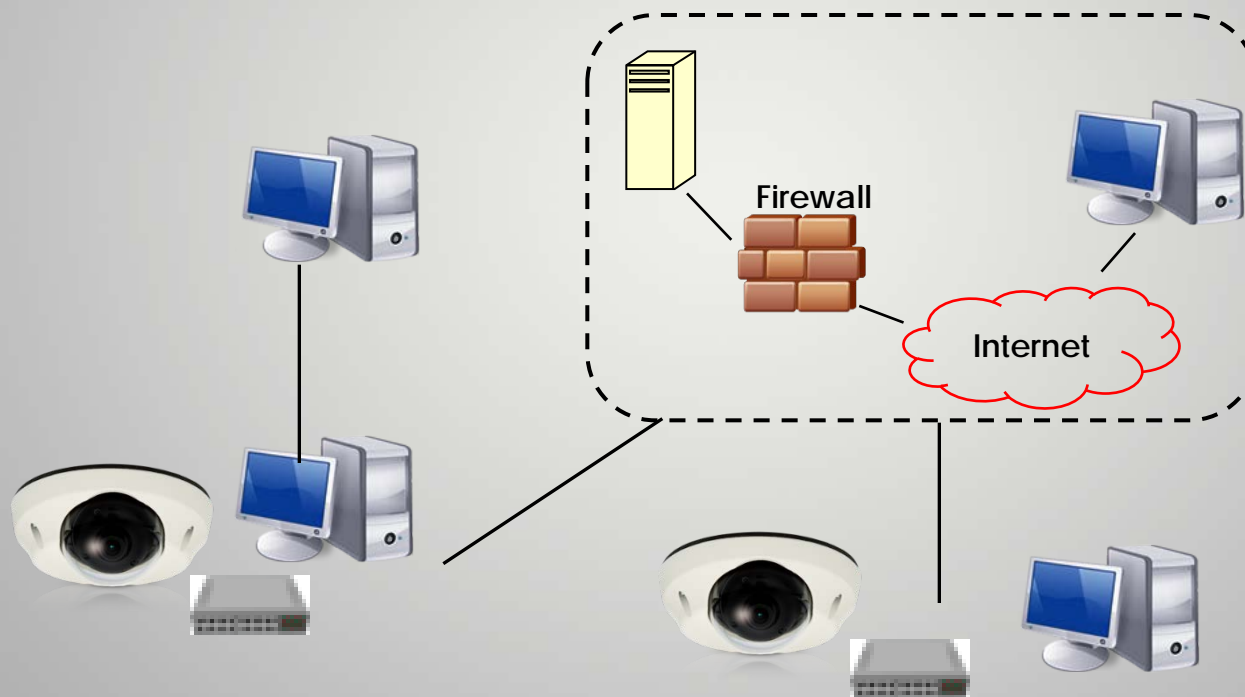
At the bottom of the page, there are two buttons: 'Save Settings' and 'Cancel Changes'. The Cisco Systems logo is visible in the bottom right corner.

# **OTHER NETWORK TERMINOLOGY**

# Firewall

- Hardware and and/ or Software
- Control Incoming and outgoing data
- Between LAN and Internet
- Prevent forbidden communications
  - Blocks IP Addresses in the private network
  - Limit and control application ports
  - Built-in into the router
- Needs to be configured to open ports for communications

# Firewall



# Linksys Router Setup

Additional Access Restrictions:  
Permit only PC within a specific IP  
Range or MAC Addresses.

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Firmware Version: 1.00.20

WRT54GX4

Wireless

Setup Wireless Security Access Restrictions Applications & Gaming Administration Status

Basic Wireless Settings Wireless Security Wireless Network Access Advanced Wireless Settings

Wireless MAC Filter

Wireless MAC Filter: ☐ Disable ☒ Permit only PCs listed to access the wireless network

Permit only:

MAC 1: 00:16:B6:56:2B:0A	MAC 26:
MAC 2: 00:26:08:2E:FD:EC	MAC 27:
MAC 3: 00:16:E3:8F:D6:CA	MAC 28:
MAC 4: 00:26:08:E7:F2:EA	MAC 29:
MAC 5:	MAC 30:
MAC 6:	MAC 31:
MAC 7:	MAC 32:
MAC 8:	MAC 33:
MAC 9:	MAC 34:
MAC 10:	MAC 35:
MAC 11:	MAC 36:
MAC 12:	MAC 37:
MAC 13:	MAC 38:
MAC 14:	MAC 39:
MAC 15:	MAC 40:
MAC 16:	MAC 41:
MAC 17:	MAC 42:
MAC 18:	MAC 43:
MAC 19:	MAC 44:
MAC 20:	MAC 45:
MAC 21:	MAC 46:
MAC 22:	MAC 47:
MAC 23:	MAC 48:
MAC 24:	MAC 49:

Wireless MAC Filter: The Wireless MAC Filter feature allows you to control which wireless-equipped PCs may or may not communicate with the Router, depending on their MAC addresses. To disable the Wireless MAC Filter feature, keep the default setting, Disable. Choose Permit only to allow selected PCs to access the wireless network. More...

# Network Interface Card

- Physically connects a device to a network
- All NICs have a MAC (Media Access Control) Address
  - Assigned by the manufacturer of NIC
  - Contains 12 hexadecimal digits.
  - First 6 hex digits are the manufacturer's ID,
  - Last 6 are the devices unique ID and serial number
  - Provided by a governing body.
- Ex: 00 – AD – 34 – 50 – 0B – 80
  - └──────────┘      └──────────┘
  - MFG ID              Unique ID

# Network Addresses / Identities

Each network device must have an individual MAC Address.

Ex: 00:1C:A6:01:22:D7

Organizationally Unique  
Identifier (OUI)  
Assigned by IEEE

Product Unique Identifier  
Assigned by Manufacturer

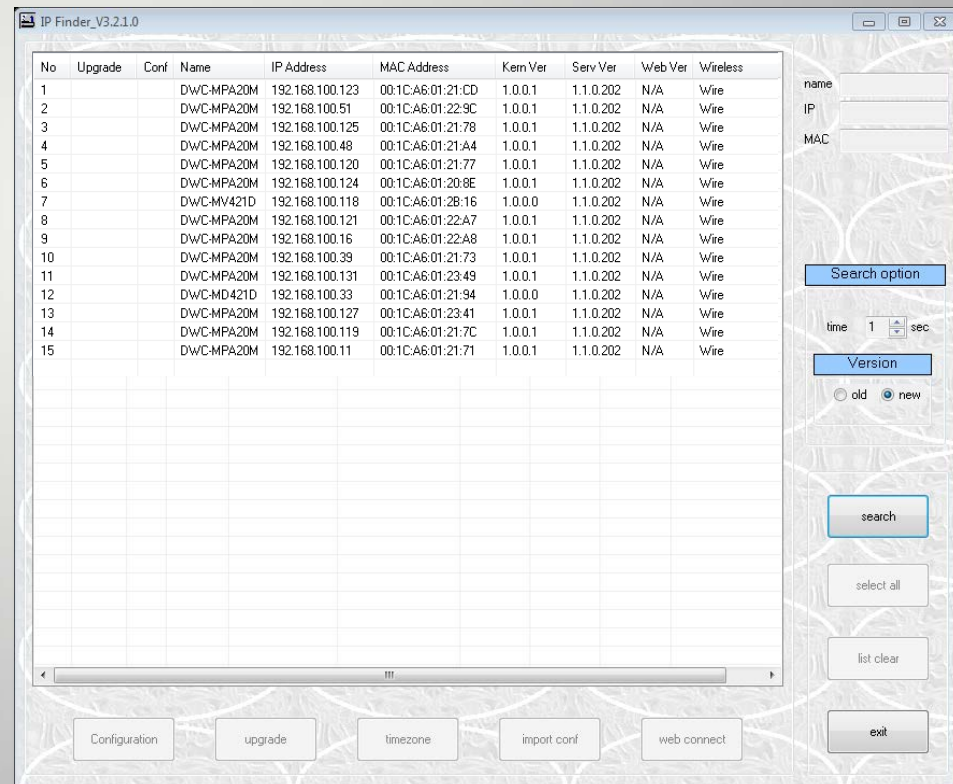


MAC Address & Serial Number

# Digital Watchdog IP Finder

Easy to use

Scans local subnet for Digital  
Watchdog's IP cameras



Infrastructure and Active Components

**LET'S GET PHYSICAL!**

# The Network Infrastructure



# Network-Structured Cabling

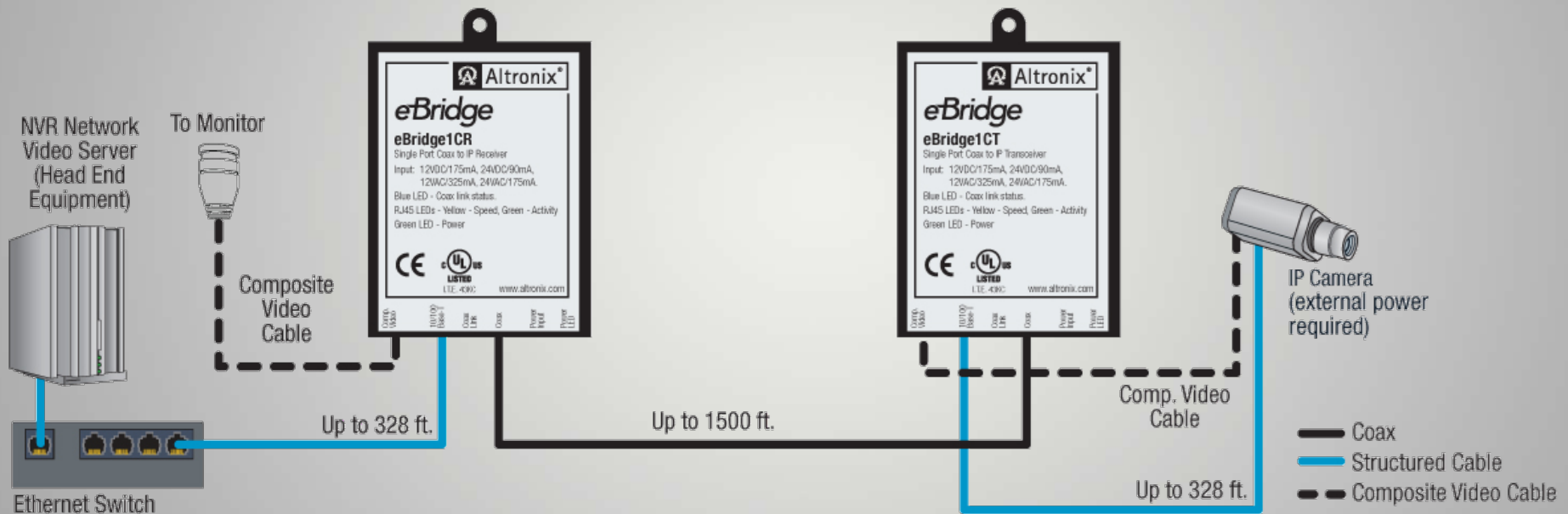
- **CAT-5** (Category 5)
  - Network cabling
  - 4 copper twisted pairs, terminated by RJ45 connectors
  - Up to 100 Mbps (100Base-T & 10Base-T networking).
- **CAT-5e** (Category 5 enhanced)
  - More stringent standards than CAT-5.
  - Recommended for all new installations
  - Up to 1000Mbps (gigabit) per second (Gigabit Ethernet).
- **CAT-6**
  - Higher price
  - Better performance

# Ethernet Over Coax (eBridge Ethernet Adapter)

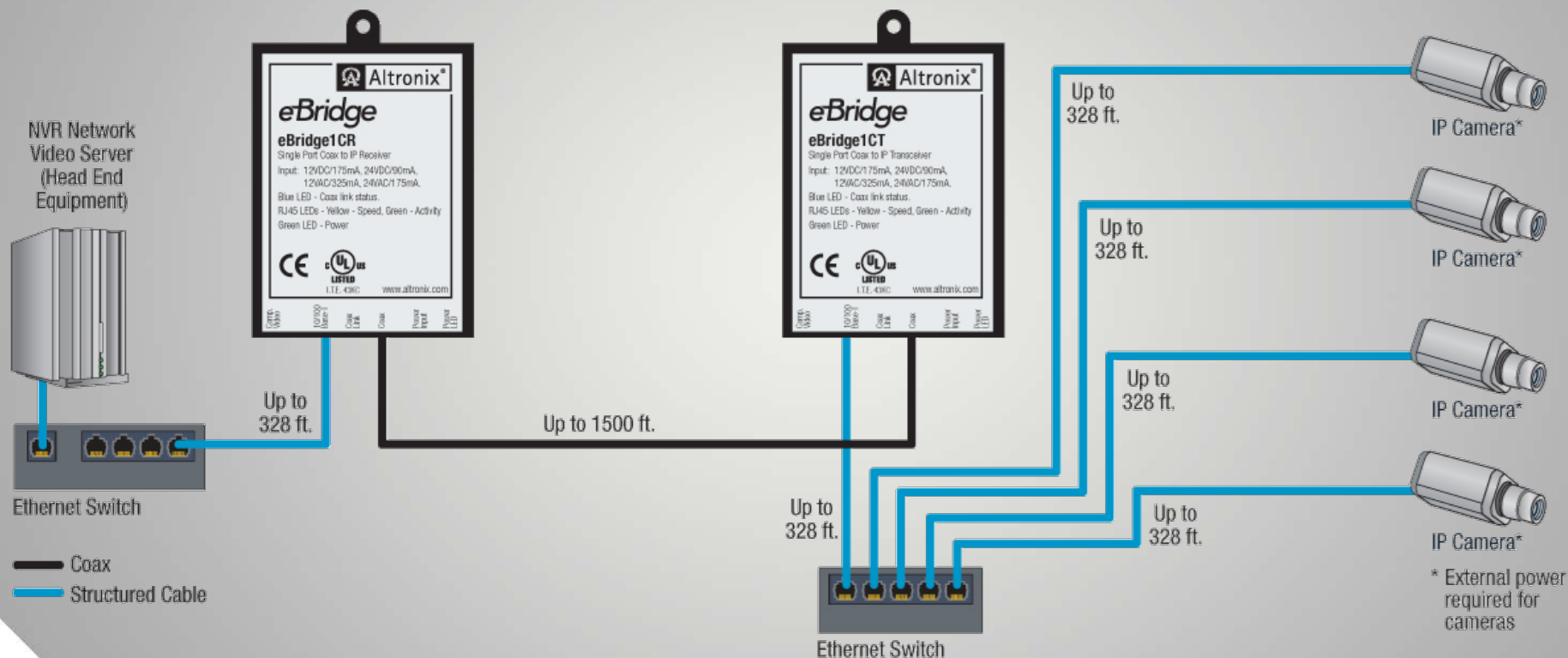
- Transmit IP video & data over coax 1500ft with no repeaters
- Retrofit Digital IP cameras in analog CCTV installation
- Works with Megapixel, HD720, HD1080
- Extend Network distance
- Upgrade CCTV Coax to a digital network for Retail, Casinos, Airports, Schools, Hospitals, etc.
- Simultaneously use Composite Video for monitor display & control, & digital IP for the NVR camera recording



# Ethernet Over Coax (eBridge Ethernet Adapter)



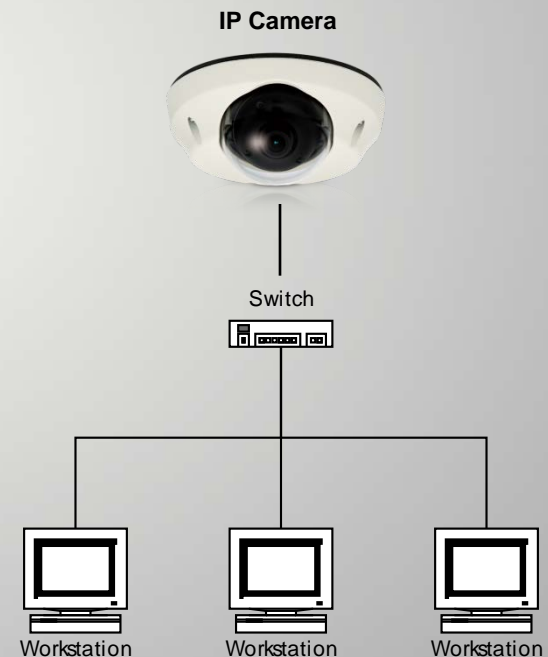
# Ethernet Over Coax (eBridge Ethernet Adapter)



**Note:** Multiple cameras require higher bandwidth and processing speed. It is recommended to test this configuration. eBridge is rated to pass 25mbps of data up to 1500 ft. With proper head end equipment, multiple Megapixel cameras can be used.

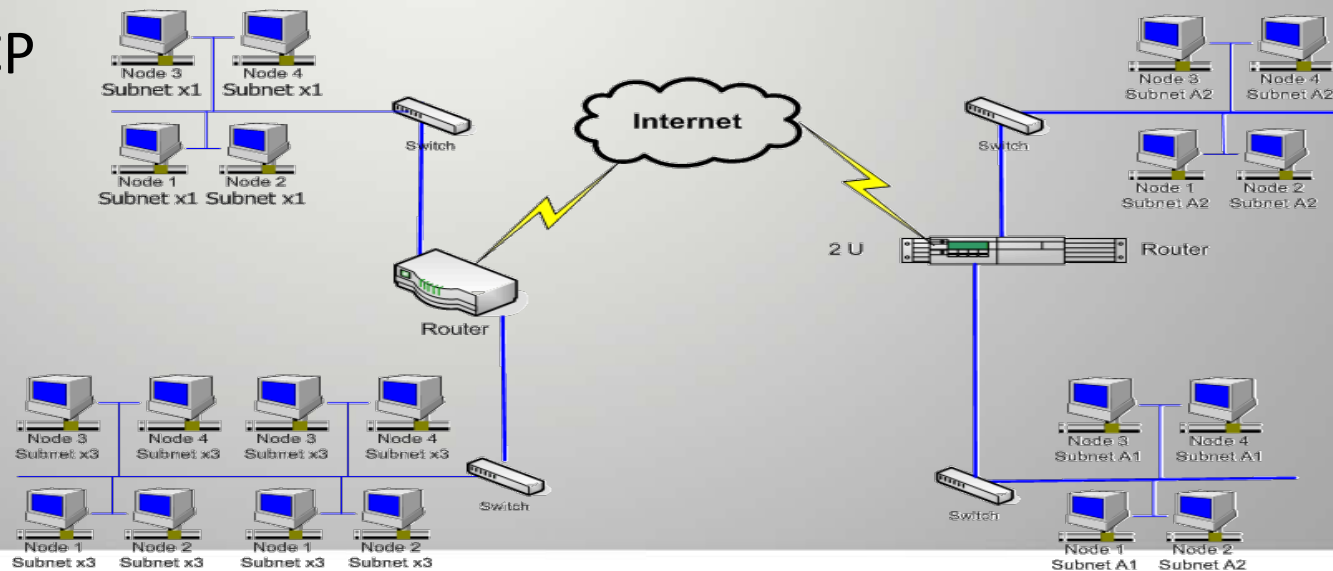
# Switch

- Forwards incoming packets to their appropriate ports
- Larger Networks:
  - Core switches
  - Edge switches
- Smaller Networks:
  - Single Switch
- Features:
  - Security & IP addressing
  - Power management
  - bandwidth control



# Router

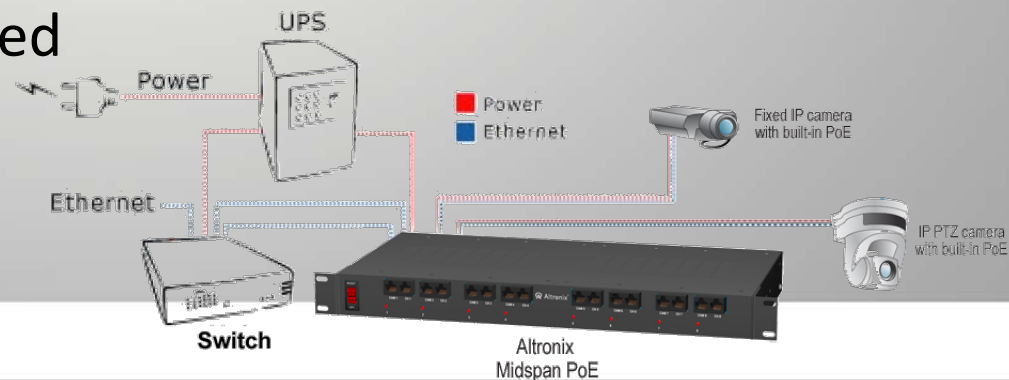
- Forwards packets between networks
- Connects LANs to the Internet
- Operates as a firewall
- Assigns IP Addresses internally
- Manages DHCP



# **POE - POWER OVER ETHERNET**

# What is Power over Ethernet?

- Using the same cable to provide network devices power and network connection
- Data & Power over a single Ethernet cable
- Very useful for places where it may be too expensive to power a device from a power outlet
- Transmitting safe and uninterrupted power (15W, 48V) over existing LAN infrastructure
- IEEE 802.3af Standard-Based



# PoE Technology Overview

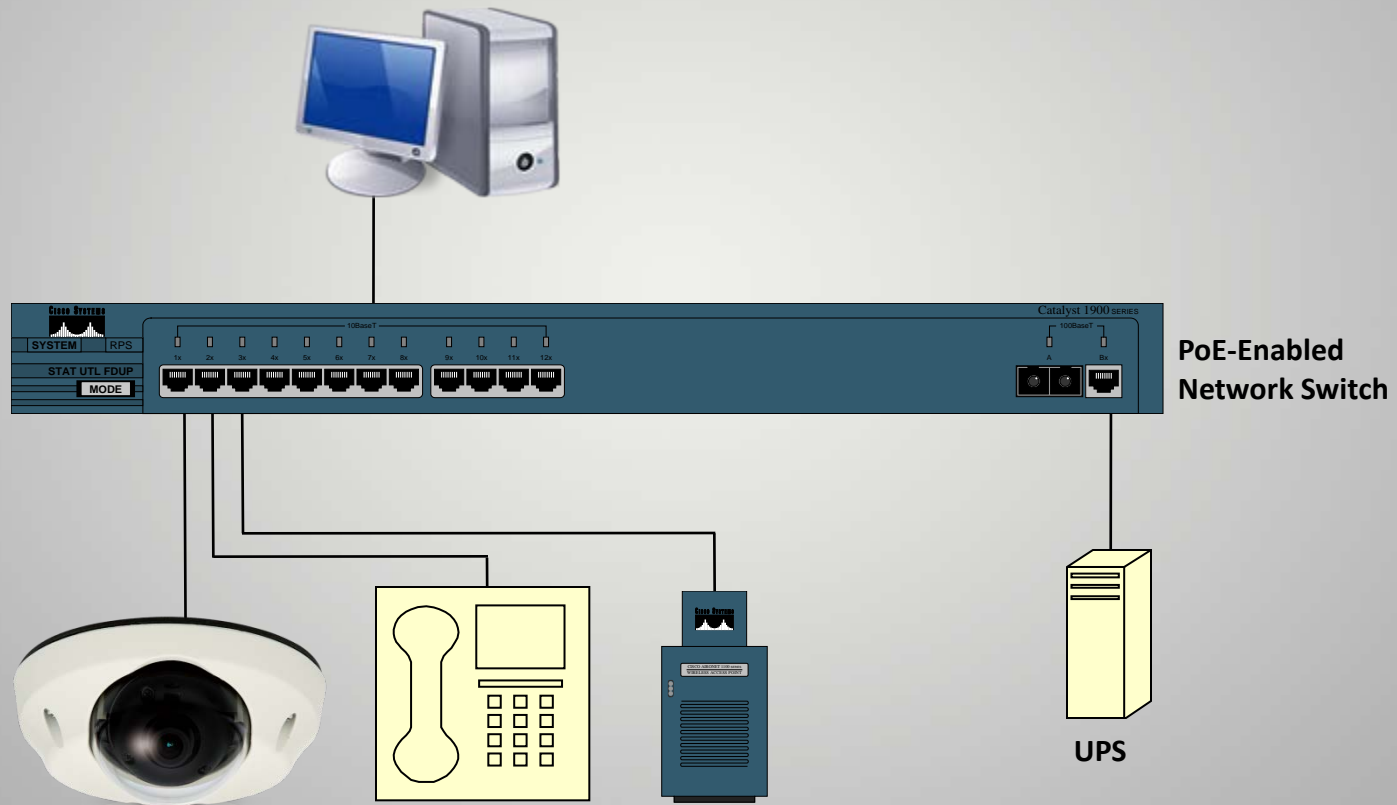
- Current standard- **802.3af.\***
  - 48 VDC, 15.4W max on the switch/mid-span side (PSE – Power Sourcing Equipment)
  - 12.95W on the device's side (PD – Powered Device)
- No effect on data transmission or cable length
- Backwards Compatible
- **Hi-PoE** standard- **802.3at.**
  - 48 VDC, 30W max on the switch or mid-span side (PSE)
  - 24W on the device/camera side (PD)

\*This accounts for the voltage drop after 100m

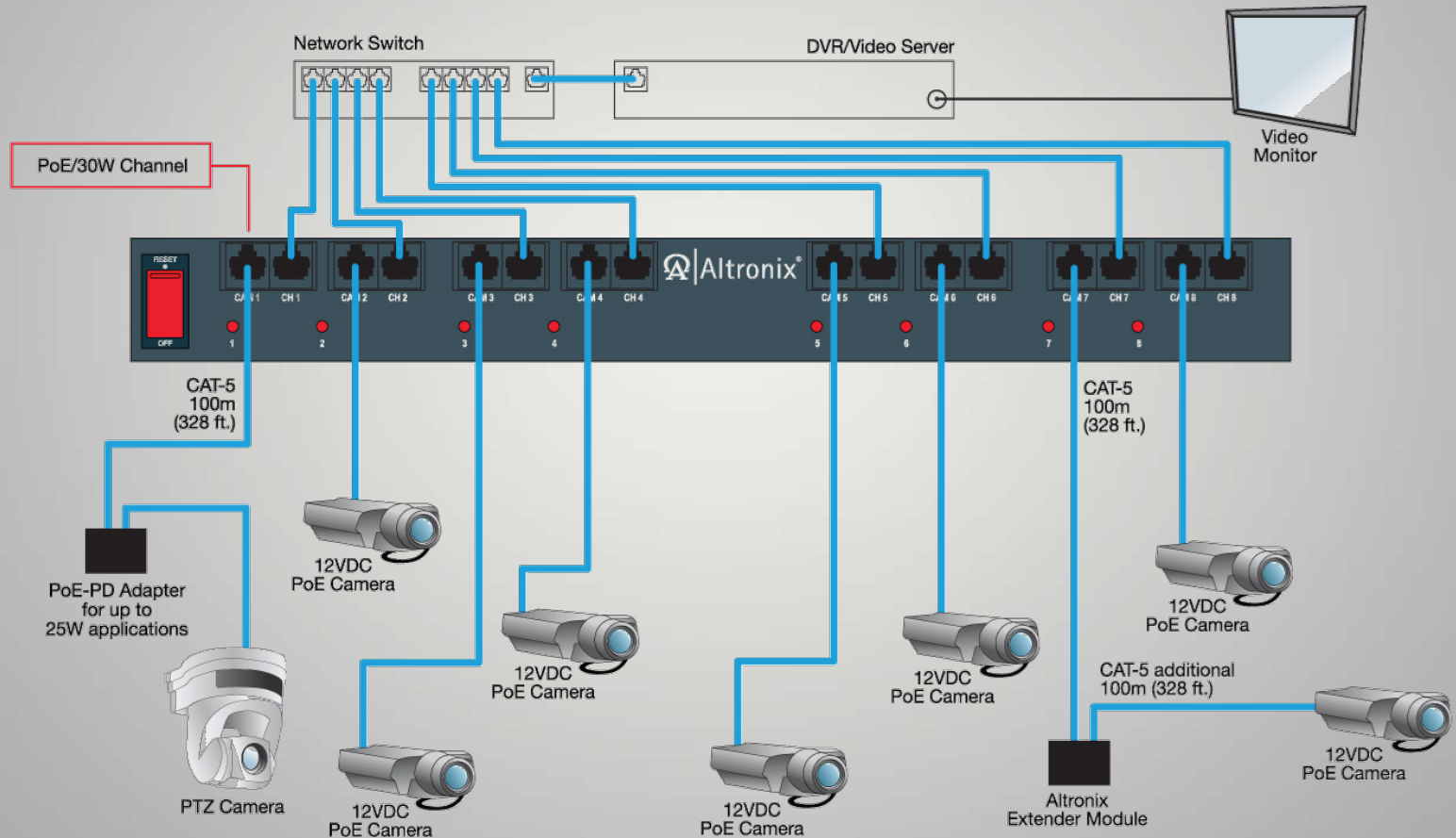
# Advantages of PoE

- More Flexibility, Better Profit Margins
- Alternate mounting locations & adding more cameras
- Fast installation & integration
- Easy to provide UPS on application server & PoE switch
- Centralize mid-spans
- LEDs verify state of devices
- Cost Savings
  - No new AC power cables and outlets needed
  - No need for a certified electrician
  - Fewer safety approvals

# Using PoE Switch (End-span)



# Using PoE Mid-span & Switch

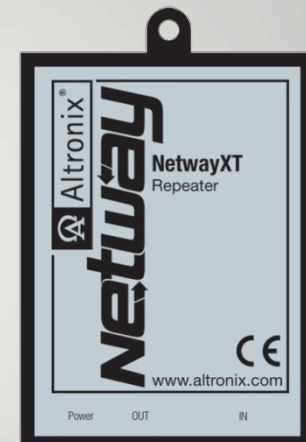
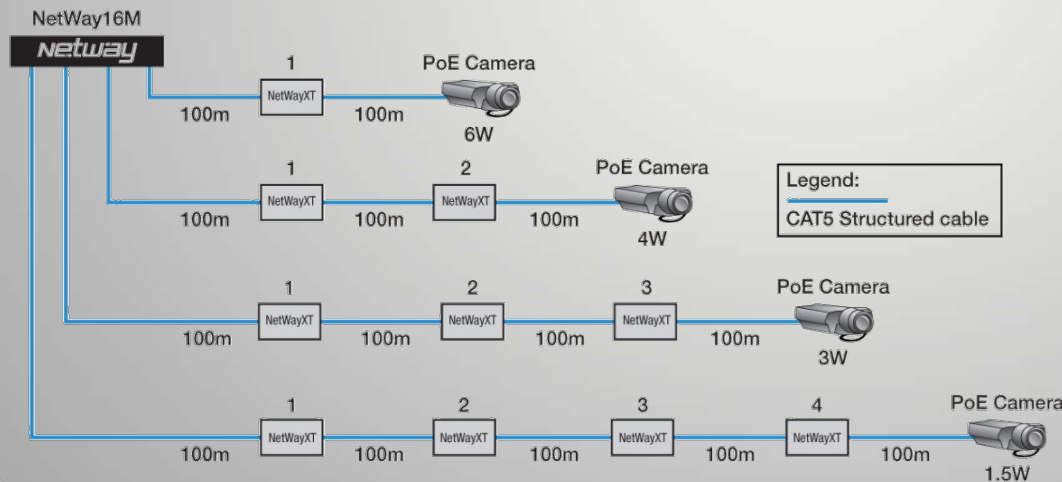


# PoE Extender

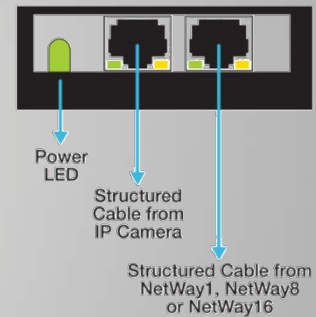
**Repeater-** extends data for NetWay mid-spans and injectors.

## *NetWayXT Repeater:*

- Extends data 100m (328 ft.) per port.
- Multiple units may be used to extend range.\*



NetWayXT



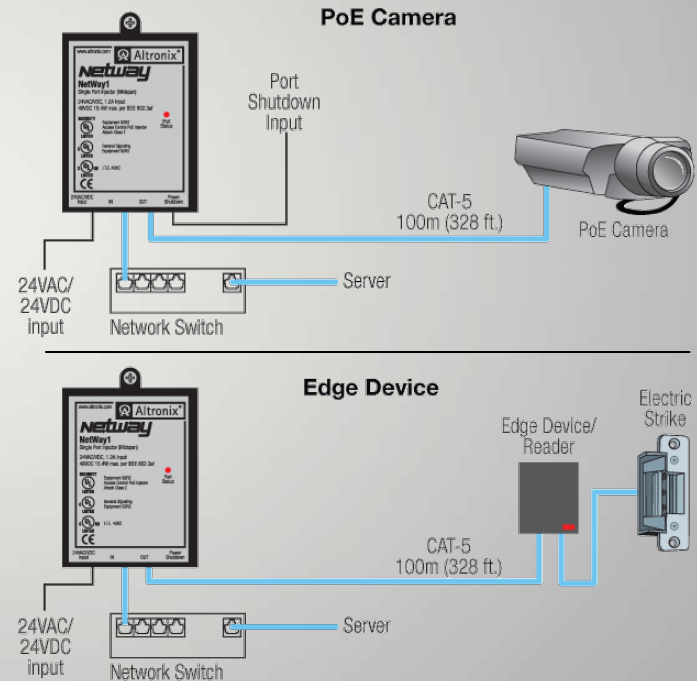
# of NetWayXTs	Range	Available Power (current)
1	200m	6W
2	300m	4W
3	400m	3W
4	500m	1.5W

# Single Port PoE

**Midspan injector-** provides power for IP surveillance cameras.

## *NetWay1\**

- One (1) port rated @ 15.4W max.  
IEEE 802.3AF
- Port status LED indicator
- PoE shutdown feature Operates at  
24VAC/24VDC





\*UL/CUL Listed for IT Equipment (UL 60950-1).  
UL Listed for Access Control Systems (UL 294).  
CUL Listed – CSA Standard C22.2 No.205-M1983, Signal Equipment.

# Managed PoE

## NetWayM Setup Screen:

Port priority, I.D. & Enable/Disable, Power Allocation Mode - Class Restricted or Dynamic Mode



Setup

[Status](#) : [Network Settings](#) : [Change Password](#)

Ports	Priority	Device	PoE		PoE Shutdown	
1	1	Door1	<input checked="" type="radio"/> Disable	<input type="radio"/> Enable	<input type="radio"/> Disable	<input checked="" type="radio"/> Enable
2	2	Door2	<input type="radio"/> Disable	<input checked="" type="radio"/> Enable	<input type="radio"/> Disable	<input checked="" type="radio"/> Enable
3	3	HallwayA	<input checked="" type="radio"/> Disable	<input type="radio"/> Enable	<input checked="" type="radio"/> Disable	<input type="radio"/> Enable
4	4	HallwayB	<input type="radio"/> Disable	<input checked="" type="radio"/> Enable	<input type="radio"/> Disable	<input checked="" type="radio"/> Enable
5	5	HallwayC	<input checked="" type="radio"/> Disable	<input type="radio"/> Enable	<input checked="" type="radio"/> Disable	<input type="radio"/> Enable
6	6	HallwayD	<input type="radio"/> Disable	<input checked="" type="radio"/> Enable	<input type="radio"/> Disable	<input checked="" type="radio"/> Enable
7	7	Office1	<input checked="" type="radio"/> Disable	<input type="radio"/> Enable	<input checked="" type="radio"/> Disable	<input type="radio"/> Enable
8	8	Office2	<input type="radio"/> Disable	<input checked="" type="radio"/> Enable	<input type="radio"/> Disable	<input checked="" type="radio"/> Enable

Ports	Priority	Device	PoE		PoE Shutdown	
9	1	Office3	<input checked="" type="radio"/> Disable	<input type="radio"/> Enable	<input checked="" type="radio"/> Disable	<input type="radio"/> Enable
10	2	Office4	<input type="radio"/> Disable	<input checked="" type="radio"/> Enable	<input type="radio"/> Disable	<input checked="" type="radio"/> Enable
11	3	Office5	<input checked="" type="radio"/> Disable	<input type="radio"/> Enable	<input checked="" type="radio"/> Disable	<input type="radio"/> Enable
12	4	Office6	<input type="radio"/> Disable	<input checked="" type="radio"/> Enable	<input type="radio"/> Disable	<input checked="" type="radio"/> Enable
13	5	Office7	<input checked="" type="radio"/> Disable	<input type="radio"/> Enable	<input checked="" type="radio"/> Disable	<input type="radio"/> Enable
14	6	Office8	<input type="radio"/> Disable	<input checked="" type="radio"/> Enable	<input type="radio"/> Disable	<input checked="" type="radio"/> Enable
15	7	Waiting1	<input checked="" type="radio"/> Disable	<input type="radio"/> Enable	<input checked="" type="radio"/> Disable	<input type="radio"/> Enable
16	8	Waiting2	<input type="radio"/> Disable	<input checked="" type="radio"/> Enable	<input type="radio"/> Disable	<input checked="" type="radio"/> Enable

[Enable All](#)
[Disable/Enable All](#)

Power Allocation Mode ☐ Class Restricted ☒ Dynamic

[Reset to Factory Default Settings](#)
[Submit](#)

# Managed PoE

## *NetWayM Status Screen:*

Port Priority, Current Draw & Status, Device I.D. & Status, PoE Shutdown Status



# Netway 16M

**Status**
[Setup : Network Settings](#)

Ports	Priority	Device Type/Location	Maximum Curent Draw (Watts)	Actual Curent Draw (Watts)	Device Status	Port Status	PoE Shutdown
1	1	Door1	6.49	3.632	On	Enabled	Disabled
2	2	Door2	6.49	2.42	On	Enabled	Enabled
3	3	HallwayA	3.84	1.527	On	Enabled	Enabled
4	4	HallwayB	6.49	4.215	On	Enabled	Enabled
5	5	HallwayC	12.94	3.641	On	Enabled	Disabled
6	6	HallwayD	12.94	3.625	On	Enabled	Enabled
7	7	Office1	25.5	16.831	On	Enabled	Disabled
8	8	Office2	6.49	2.364	On	Enabled	Disabled
Maximum allowed power consumption for ports 1-8: 150 Watts			Total: <b>81.18</b>	Total: <b>38.215</b>	Total power remaining for Ports: 1-8: 111.785 Watts		

Ports	Priority	Device Type/Location	Maximum Curent Draw (Watts)	Actual Curent Draw (Watts)	Device Status	Port Status	PoE Shutdown
9	1	Office3	3.84	2.561	On	Enabled	Disabled
10	2	Office4	6.49	3.521	On	Enabled	Enabled
11	3	Office5	12.94	12.836	On	Enabled	Enabled
12	4	Office6	12.94	7.315	On	Enabled	Disabled
13	5	Office7	25.5	12.068	On	Enabled	Disabled
14	6	Office8	6.49	2.029	On	Enabled	Enabled
15	7	Waiting1	3.84	3.83	On	Enabled	Disabled
16	8	Waiting2	6.49	3.263	On	Enabled	Enabled
Maximum allowed power consumption for ports 9-16: 150 Watts			Total: <b>78.53</b>	Total: <b>47.423</b>	Total power remaining for Ports: 9-16: 102.577 Watts		

 Power Allocation Mode: **Dynamic**

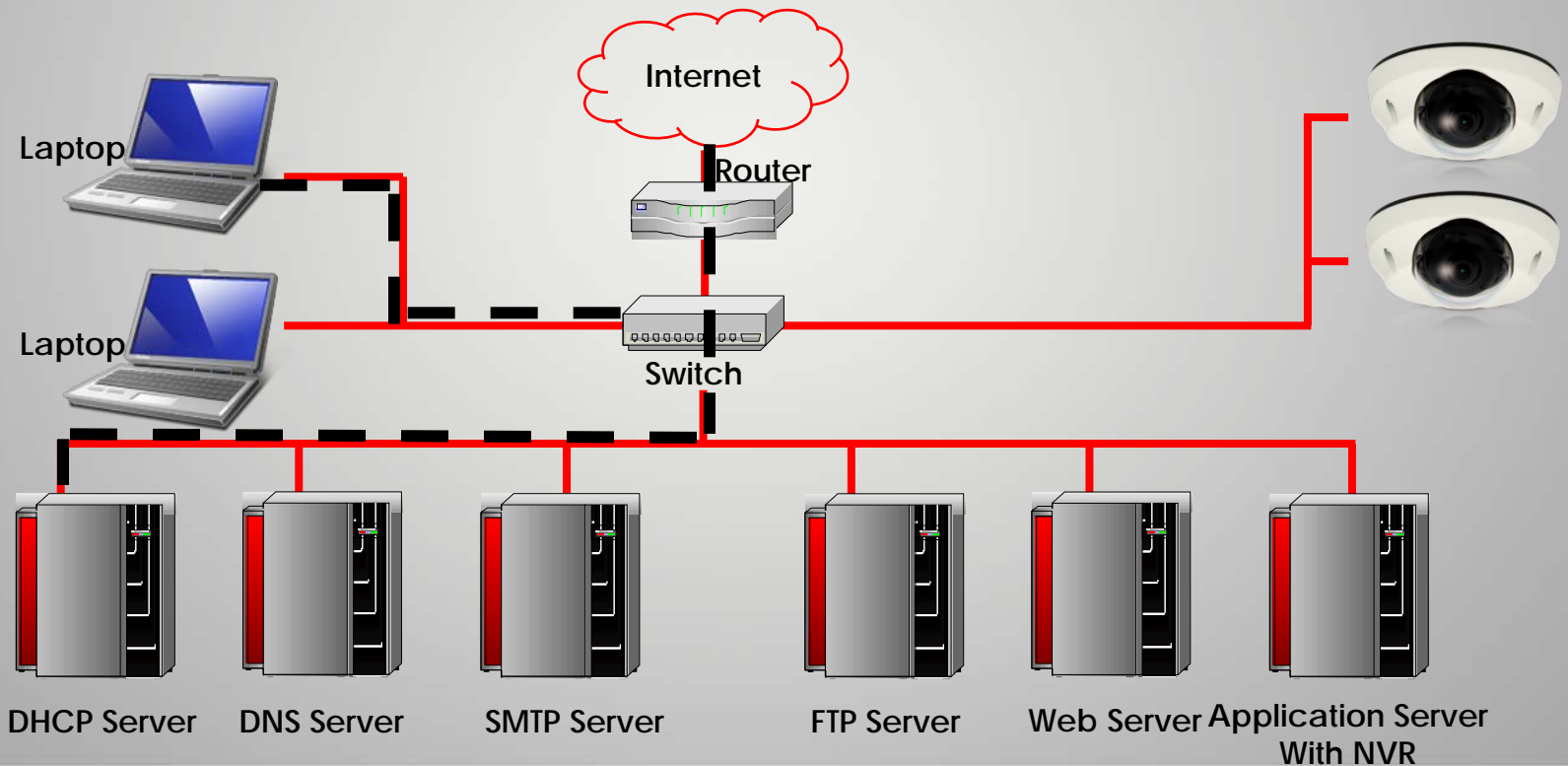
# Servers, What are they?

- Application/ device performing services for connected clients
- Part of a client-server architecture
- What do servers “serve”?
  - E-mail Server → manages e-mail traffic
  - Application Server → network server dedicated to running a particular application
  - Database Server →
  - FTP Server → File Transfer Protocol Server

# **DHCP Server** (Dynamic Host Configuration Protocol)

- Assigns IP addresses, Subnet mask, Default router, & DNS server information
- Advantageous when deploying large number of devices
- Moving devices easy & seamless
- IP address is “leased” for a certain amount of time

# DHCP Server



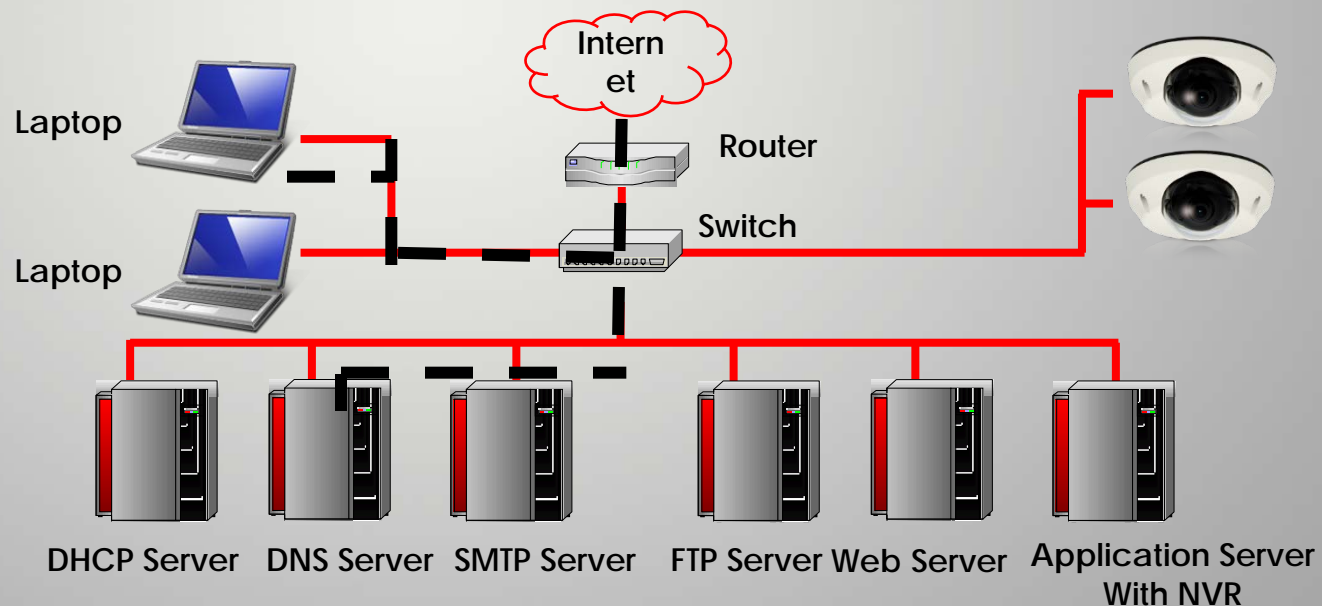
# DNS & DDNS Servers

- **DNS (Domain Name Server)**
  - Resolves IP addresses to URL
  - Ex: 259.154.0.31 → www.camera.com
  - Can be used in a LAN for naming cameras
- **DDNS (Dynamic Domain Name Server)**
  - Allows dynamic IP to have an Internet address
  - Register a host name with a DDNS service provider
  - When IP changes, service provider updates DNS servers
  - Solution for small business or home users

# DNS Server

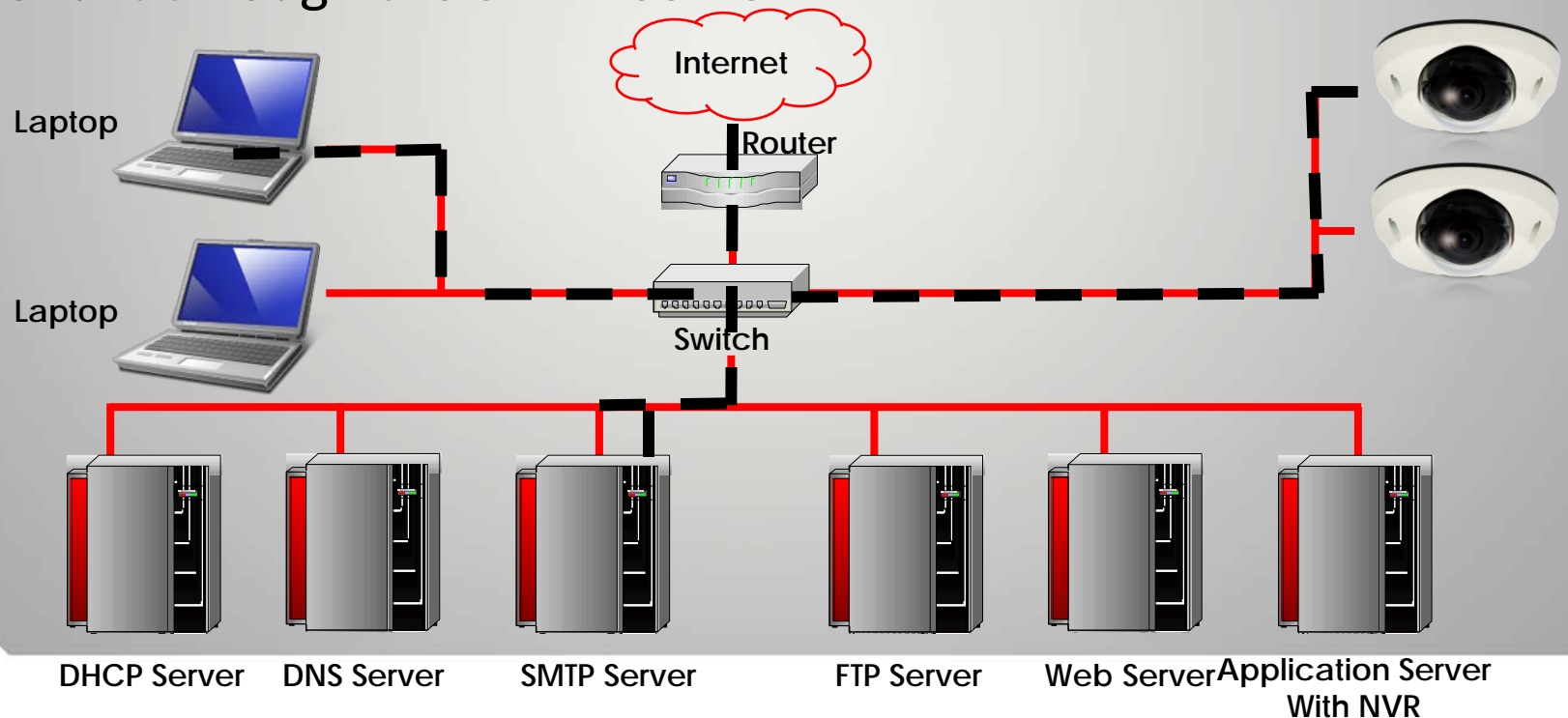
Types `www.____.com` into web browser.

DNS Server finds “.com” as “216.23.181.212” and forwards this information to the user.



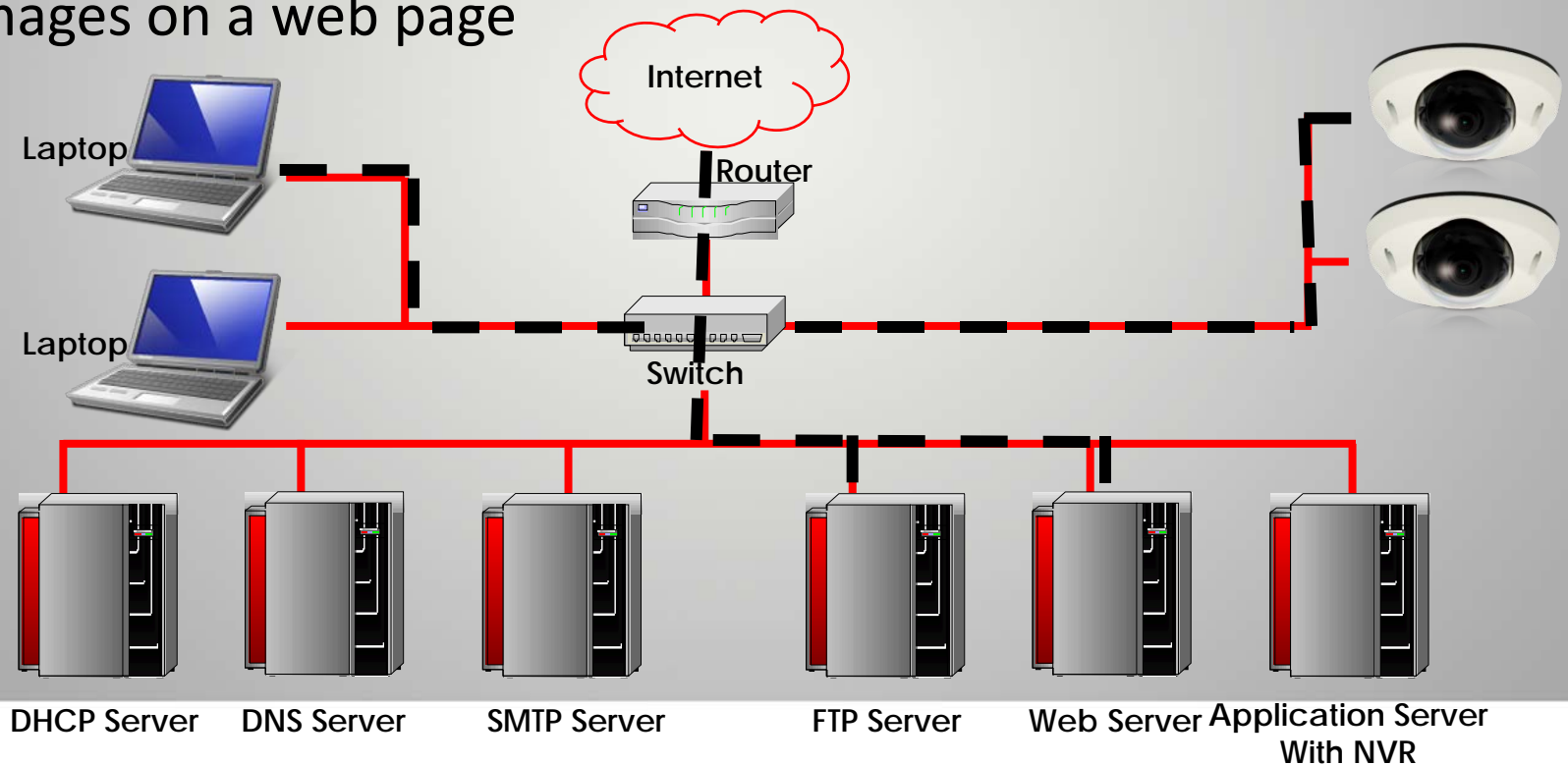
# SMTP Server (Simple Mail Transfer Protocol)

- E-mail standard for transmission over the Internet
- IP Cameras do not send mail by themselves, but they send it through the SMTP server



# FTP & Web Server (File Transfer Protocol)

- Transfer files between computers
- IP camera can transfer images to an FTP server to time lapse images on a web page





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