NIOC MARYLAND ADVANCED COMPUTER NETWORK OPERATIONS COURSE

Coordinated by

Title

- *Content*

WHY ARE WE TEACHING THIS?

- *5 Pillars of IO:*
  - *OPSEC*
  - *MILDEC*
  - *MISO*
  - *EW*
  - *CNO*
- ***The next major conflict will start in cyberspace***
  - *Whether we recognize the signs is another matter*
  - *Recent conflicts have already shown the importance of CNO (Russia/Georgia)*
  - *Think China will make a move on Taiwan without bringing down their communications networks?*
- ***As IW officers (or IDC) – we are expected to know and understand CNO and communicate with decision makers***
- ***Recently announced plans from Command in Chief and Pentagon officials emphasize cyber space operations***
- ***Basic 1810/IDC quals are a good foundation, but CO/XO want you to know more about CNO***

Course Overview

Wednesday, April 11th
Location: OPS2B
2B4118-1

Time	Topic	Briefer
0730-0900	CNO Intro/ TAO Overview	LT [redacted] / CTN1 [redacted]
0900-1000	Analysis	CTN1 [redacted] / CTN2 [redacted]
1000-1100	EAO	CTN1 [redacted] / CTN1 [redacted]
1100-1200	Lunch	
1200-1300	IOD/Scanning	CTN1 [redacted]
1300-1400	DNT	ENS [redacted]
1430-1500	TAO Brief/Tour	ENS [redacted]

Course Overview

Thursday, April 12th
Location: OPS2B 2B4118-3

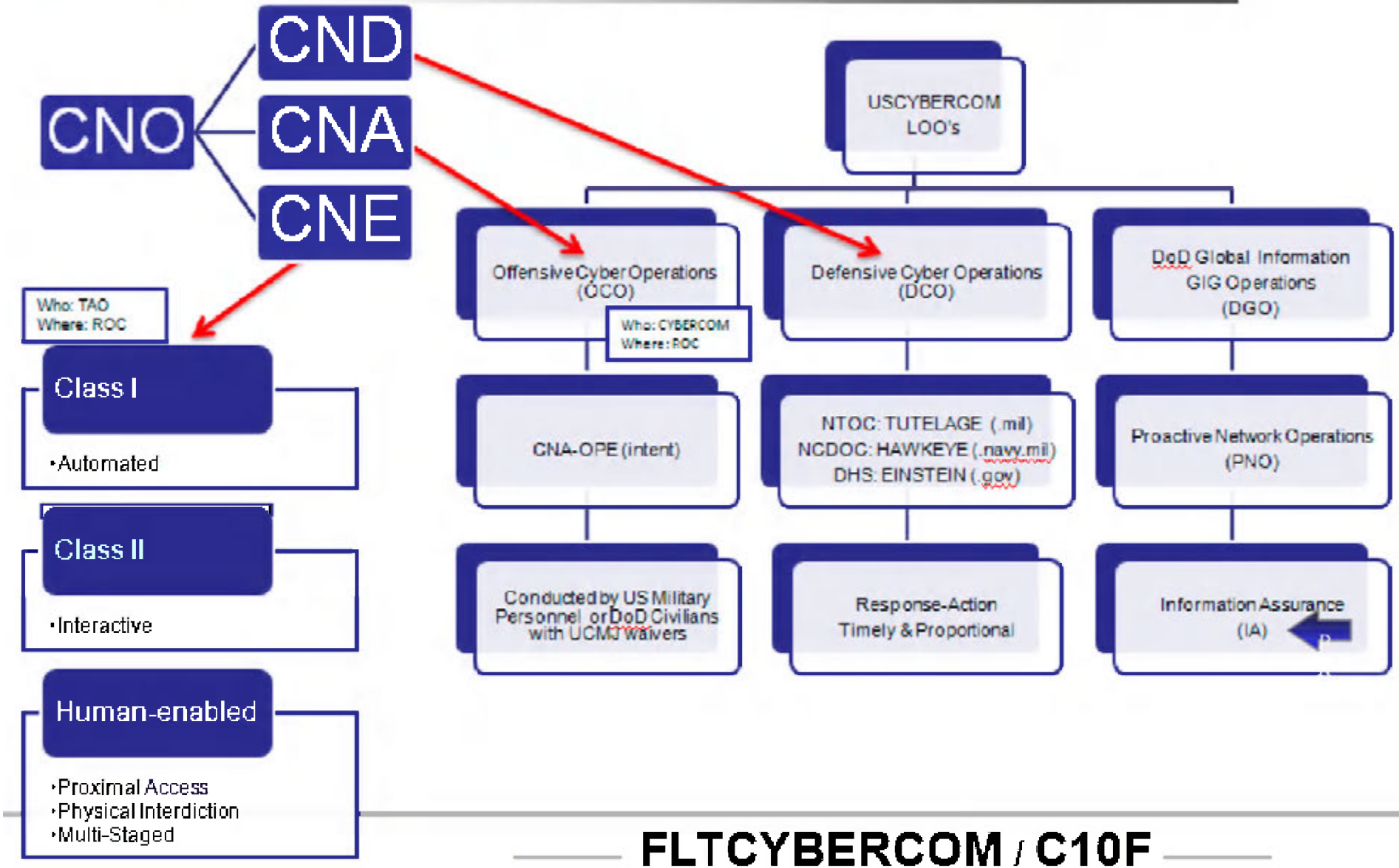
Time	Topic	Briefer
0800-0900	CND Intro/Threat Brief	LTJG [redacted] / LTJG [redacted] (S: [redacted]; U: [redacted])
0900-1000	Red Team Brief	CTN2 [redacted] / CTN2 [redacted] (S: [redacted]; U: [redacted])
1000-1030	Blue Team Brief	LCDR [redacted] (S: [redacted]; U: [redacted])
1030-1100	JCMA Brief	CTR1 Brown/ CTR1 [redacted] (S: [redacted]; U: [redacted])
1100-1130	Hunt Brief	CTN2 [redacted] (S: [redacted]; U: [redacted])
1130-1300	Lunch	
[redacted]	Tutelage Brief	CTN2 [redacted] (S: [redacted]; U: [redacted])
1400-1530	NTOC Brief/Walkthrough	POC: LCDR [redacted]

Course Overview

Friday, April 13th
Location: OPS2B
2B4118-3

Time	Topic	Briefer
0800-0900	POD	CTN2 [redacted]
0900-1000	OCO	LTJG [redacted]
1000-1100	Legal Authorities	LT [redacted] / MAJ [redacted]
1100-1200	Lunch	
1200-1400	PKC/PKI (Asymmetric Encryption)	LT [redacted]
1400-1430	Debrief/Discussion	LT [redacted]

USCYBERCOM LOO's



DoD Global Information Grid Operations (DGO)

- DGO operations consist of aspects of NetOps directing operation of the GIG
- Goal: support efforts to build, configure, secure, operate, maintain and sustain DoD networks
- Desired end-state: enable pillars of Information Assurance
- Achieved via Proactive Network Operations (PNO)
- DISA operates the GIG, but USCYBERCOM ensures operation and availability

Pillars of Information Assurance

- Confidentiality
- Integrity
- Availability
- Non-Repudiation
- Authentication

Responsible Organizations:

- USCYBERCOM
  - NSANet: IAD & NTOC
  - JWICS: DIA
  - navy.mil
    - Navy Cyber Defense Operations Command (CTF 1020)
    - NAVNETWARCOM (CTF 1010)

Defensive Cyberspace Operations (DCO)

DCO:
- Direct and synchronize actions to detect, analyze, counter and mitigate cyber threats and vulnerabilities

Goal:
- Protect critical missions, enable freedom of action in cyberspace

Dynamic Network Defense Operations:
- Flexible response, incorporating Title 10 and Title 50 authorities, to defend the GIG

Responsible Organizations:

USCYBERCOM: .mil	NCDOC: navy.mil	DHS: .gov
NTOC uses **SIGINT**	HAWKEYE	EINSTEIN

Offensive Cyberspace Operations (OCO)

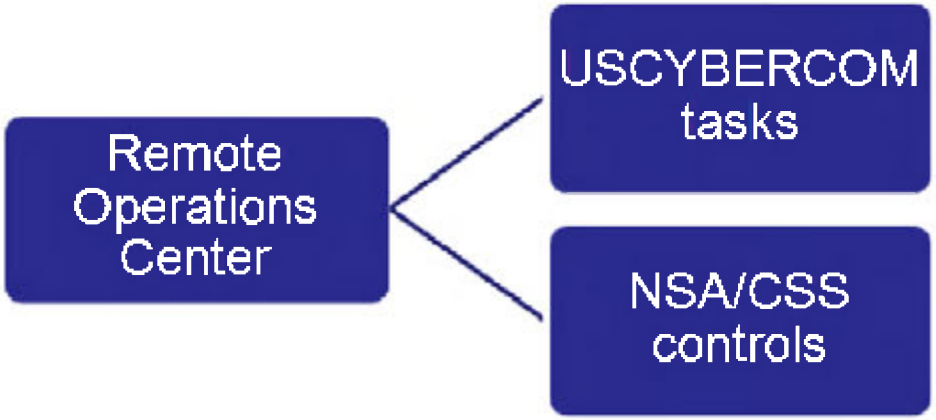
OCO: • Enabling and attack effects in cyberspace

Goal: • Support national and CCDRs' objectives via cyber actions

Who: • Remote Operations Center, civilians and military personnel

Supports DCO: • Enables active defense against cyber actors/adversaries

ROC Relationships:



Navy's Role: Force Provider

10 Department
NIOC Maryland

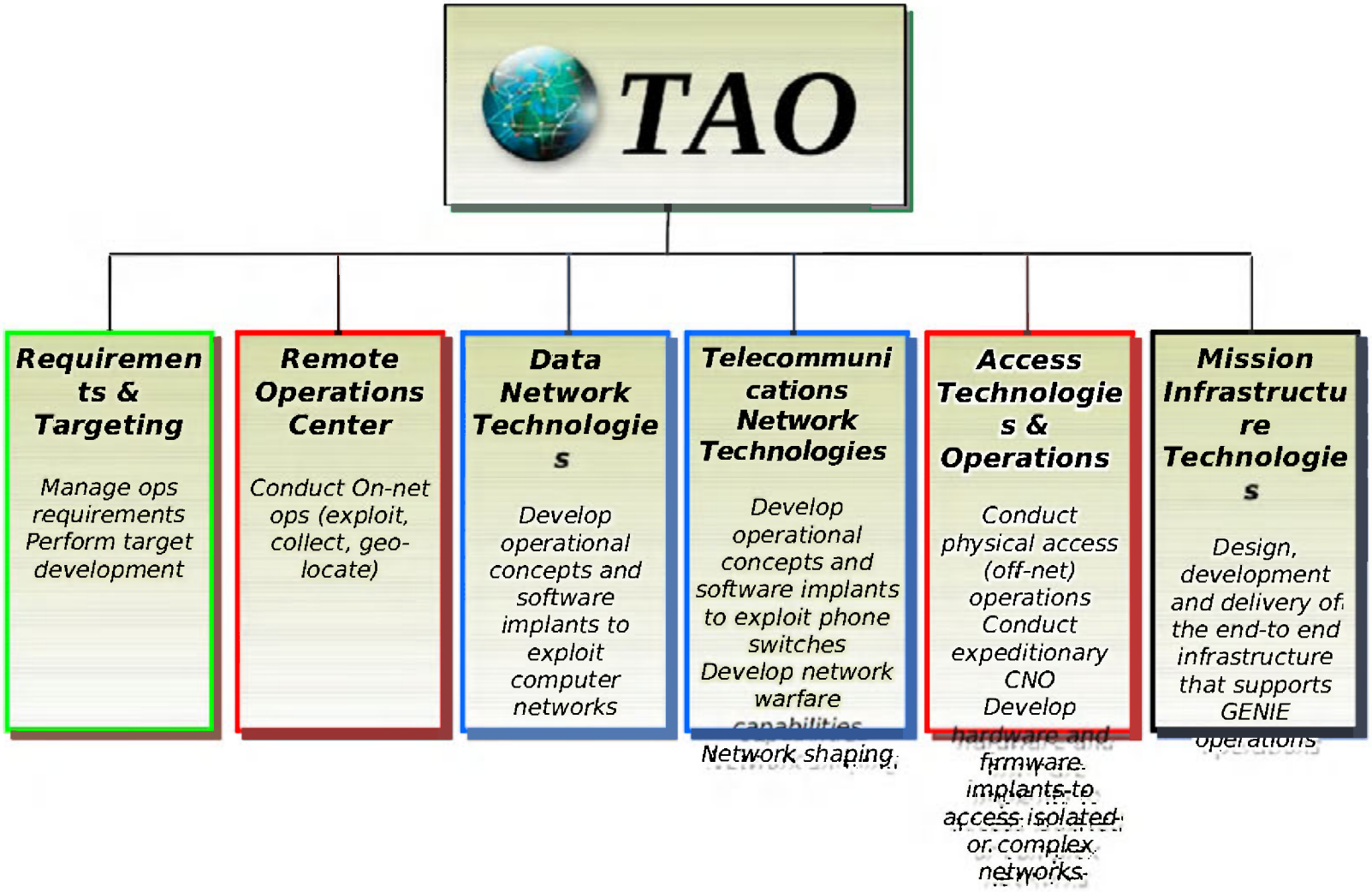
Computer Network Operations

Information Technology Directorate (ITD)

Outline

- ***TAO Overview***
  - *Mission Aligned Cells (MAC)*
- ***Manning / Placement***
- ***Department Operations***
  - *Summary*
  - *Examples: Russia & Lebanon*
  - *Joint Cyber Attack Team*
  - *NCAT Vision*
  - *Afloat CNO*
- ***Discussion Topics***

Directorate (TD)
TAO Organization



Mission Aligned Cells (MACs)

Concept:

- **TAO recently completed a major effort to align resources from R&T, ROC, DNT and MIT into mission focused teams.**
- **Mission Aligned Cells**
  - *Teams composed of operators, analysts and developers working together to focus on a specific target set.*
- **Allows TAO to efficiently resources on high-priority projects and targets.**

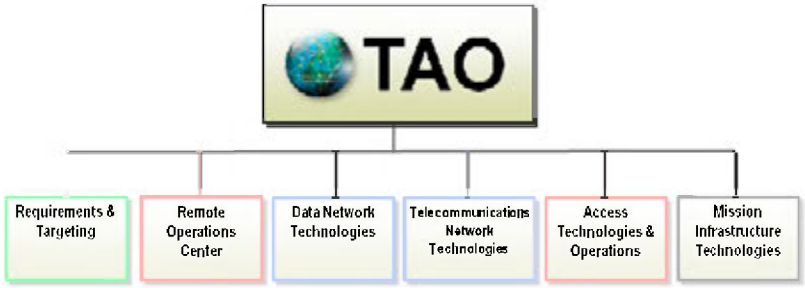
Current MAC's:

- **China/North Korea (NSAW, NSAH)**
- **Iran (NSAW, NSAG)**
- **Russia (NSAW, NSAH)**
- **Cyber Counterintelligence (CCI) (NSAW, NSAG, NSAT, NSAH)**
- **Counterterrorism (CT) (NSAW, NSAG)**
- **Target Service Provider (TSP) (NSAW, NSAT)**
- **Regional Targets (RT) (NSAW, NSAT)**

Information Technology Directorate

Directorate (ITD)

TAO – Front Office (S32)



S32:

Staff (2/2/0)

Leadership Positions:

RDML [redacted]

- *Deputy Chief, TAO*

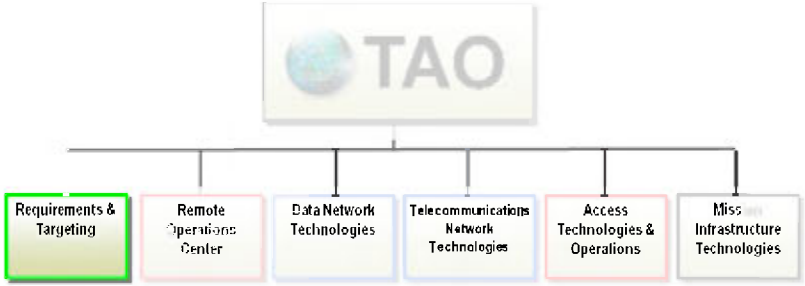
CAPT [redacted]

- *TAO Cyber Operations Integrated Lead (COIL)*
- *Principle advisor to TAO leadership for operational cyber issues*

[Billet Description (BA/COB/Deployed)]

Information Technology Directorate (ITD)

Requirements & Targeting (S327)



S327:

R&T Influence (8/6/0)

Endpoint Exploitation (57/35/0)

Leadership Positions:

LCDR [redacted]

- *D/Chief, CT & Afghanistan*

LCDR [redacted]

- *In training – slated for Hard Targets Division, DPRK Branch*

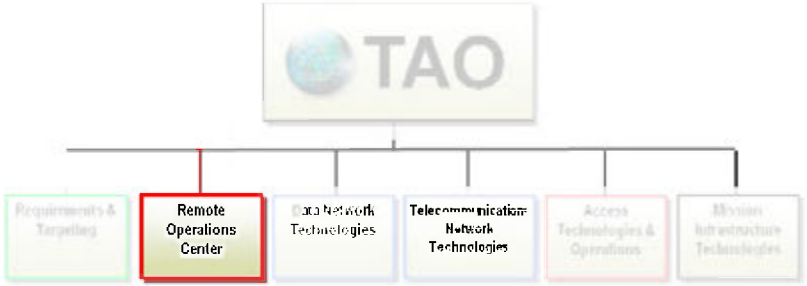
LT [redacted]

- *CNO Coordinator – China/DPRK Branch*

[Billet Description (BA/COB/Deployed)]

Directorate (ITD)

Remote Operations Center (S321)



S321:

ROC Influence (9/9/0)

Lead (3/3/0)

Interactive Operator (49/26/0)

Production Operator (25/14/0)

Leadership Positions:

CAPT [redacted]

- *Deputy Chief, ROC*

LCDR [redacted]

- *D-Chief, STO*

LT [redacted]

- *Chief, Iran MAC (IMAC)*

CTNCS [redacted]

- *ROC SER*

LCDR [redacted]

- *Chief, Cyber Operations Branch*

LTJG [redacted]

- *Tech Lead, Cyber Operations Branch*

[Billet Description (BA/COB/Deployed)]

Information Technology Directorate (ITD)

Data Network Technologies (S323)

Leadership Positions:

LT [redacted]

- *Chief, Cyber Technologies Branch*

LT [redacted]

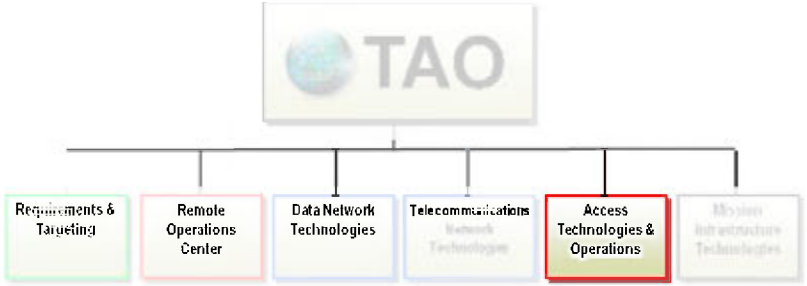
- *Chief, Engineering Services Division*

S323:

Development (Officer) (2/2/0)
Development (Enlisted) (16/6/0)

[Billet Description (BA/COB/Deployed)]

Information Technology Directorate (ITD)
Access Technologies & Operations (S328)



Leadership Positions:

LT [redacted]

- *Chief, Operations Branch*

LT [redacted]

- *D-Chief, EAO*

S328:

ATO (Officer) *(4/4/0)*
ATO (Enlisted) *(23/15/1)*

[Billet Description *(BA/COB/Deployed)]*

Information Technology Directorate (ITD)

Remaining Personnel / Summary

S325 - Mission Infrastructure Technologies:

Infrastructure (Enlisted) (7/1/0)

S352 – Global Access Operations:

Global Access (Officer) (0/1/0)

Global Access (Enlisted) (1/1/1)

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10 Dept Summary:

Officers**

- ***28 BA / 26 COB*** = 93%

Enlisted

- ***182 BA / 101 COB*** = 55%

*****2/9 CS P-coded officer billets filled; need M.S. Computer Science personnel***

[Billet Description (BA/COB/Deployed)]

Directorate (ITD)

Operations Summary

Weekly Interactive CNE operations

ALL				
	Operators		Ops Conducted	
All	208	100.00%	2588	100.00%
CIV	70	33.65%	1059	40.92%
NAVY	52	25.00%	674	26.04%
AF	44	21.15%	343	13.25%
ARMY	29	13.94%	376	14.53%
USMC	11	5.29%	108	4.17%
USCG	2	0.96%	28	1.08%

NAVY				
	Operators		Ops Conducted	
NAVY	52	100.00%	674	100.00%
NIOC-M	28	53.85%	292	43.32%
NIOC-T	10	19.23%	133	19.73%
NIOC-G	8	15.38%	107	15.88%
NIOC-H	6	11.54%	142	21.07%

Target Sets – R&T Analysts

- China
- Russia
- Iran
- Afghanistan
- Pakistan
- India
- Iraq
- Counterterrorism
- Cyber Counterintelligence (CCI)

Supporting Roles

- ROC Senior Watch Officers
- Development

Target Example: [redacted] MAC

Team [redacted]

- ***MAC: Mission Aligned Cell – puts analysts and operators together to increase target familiarity and efficiency of operations***
  - *Joint military and civilian entity*

[redacted]

Information Technology Directorate

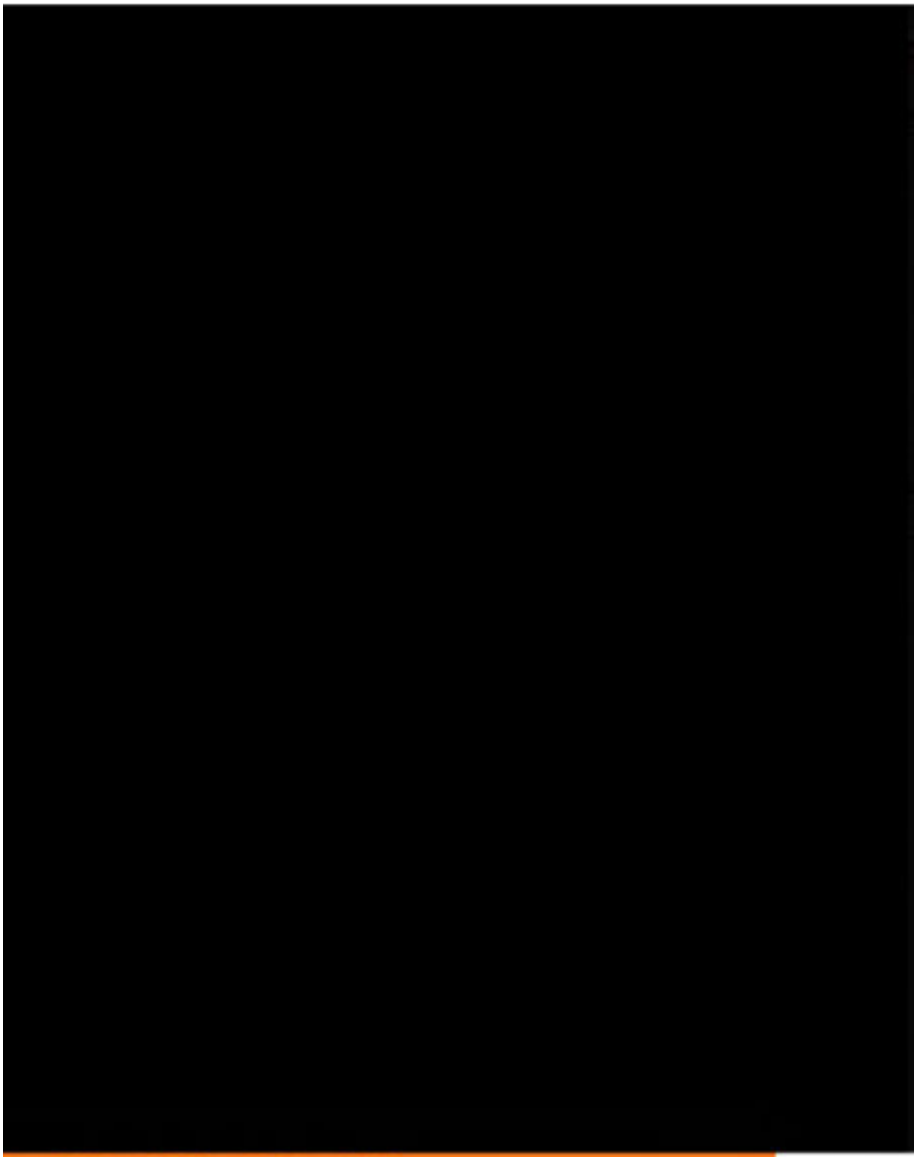
Directorate (

Target Example: [redacted]

- **Current TAO Targets**
  - *Political*
    - *[redacted] leadership to include Ministry of Interior, Parliament Members, and Presidential Palace*
  - *Military*
    - *Former Commander of [redacted] Common Border Force [redacted]*
    - *Col. [redacted] - [redacted] IT Directorate*
    - *Gen. [redacted] - [redacted] Medical Command*
    - *Gen. [redacted] - (affiliation unknown)*
    - *Col. [redacted] - Instructor, Army Staff and Command College*
    - *Lt. Col. [redacted] – Defense Ministry*

- **Recent Reporting**
  - *[redacted] Armed Forces Reviewed Personnel Issues Regarding Retirement, Communications, and Health Care*

[redacted] (NSA-G)



ITD Information Technology Directorate

CTU 1060.1.1 - NROC

FLEET FOCUS

Framework and support for Navy requirements

JOINT FOCUS

Navy support to joint priorities

- CTU CDR [O-6]
  - D/CDR [O4-5]
    - Chief of Operations [O-3]
    - Technical Director [Civilian]

Provides structure to develop holistic Navy capability

Structure supports manning requirements levied on Navy

Support five (5) Combined Task Elements

CTE 1060.1.1.1	CTE 1060.1.1.2	CTE 1060.1.1.3	CTE 1060.1.1.4	CTE 1060.1.1.5	CND-RA 1020.6.1

CTE Manning

Unix and Windows Operators:

Exploiter Qualified
(Minimum Requirement)

Router and Firewall Operators:

May shift between CTE's depending on operator specialty and mission requirement

Mission Alignment

- NCAT
- Service-led JCAT
- JCAT Support
- Service CNE Support

Information Technology Directorate (ITD)

Joint Cyber Attack Team (JCAT)

JCAT Concept of Operations:

- **Assembled for Title 10 execution support**
- **Mission Commanders and Operators provide full-time support to CNE operations outside of JCAT**

Requirements:

- **CAUI Support**
  - *1 Mission Commander*
  - *2 CNA Operators*
- **TASKORD 11-0335**
  - *3 Mission Commanders*
  - *10 CNA Operators*

Current Navy Participation:

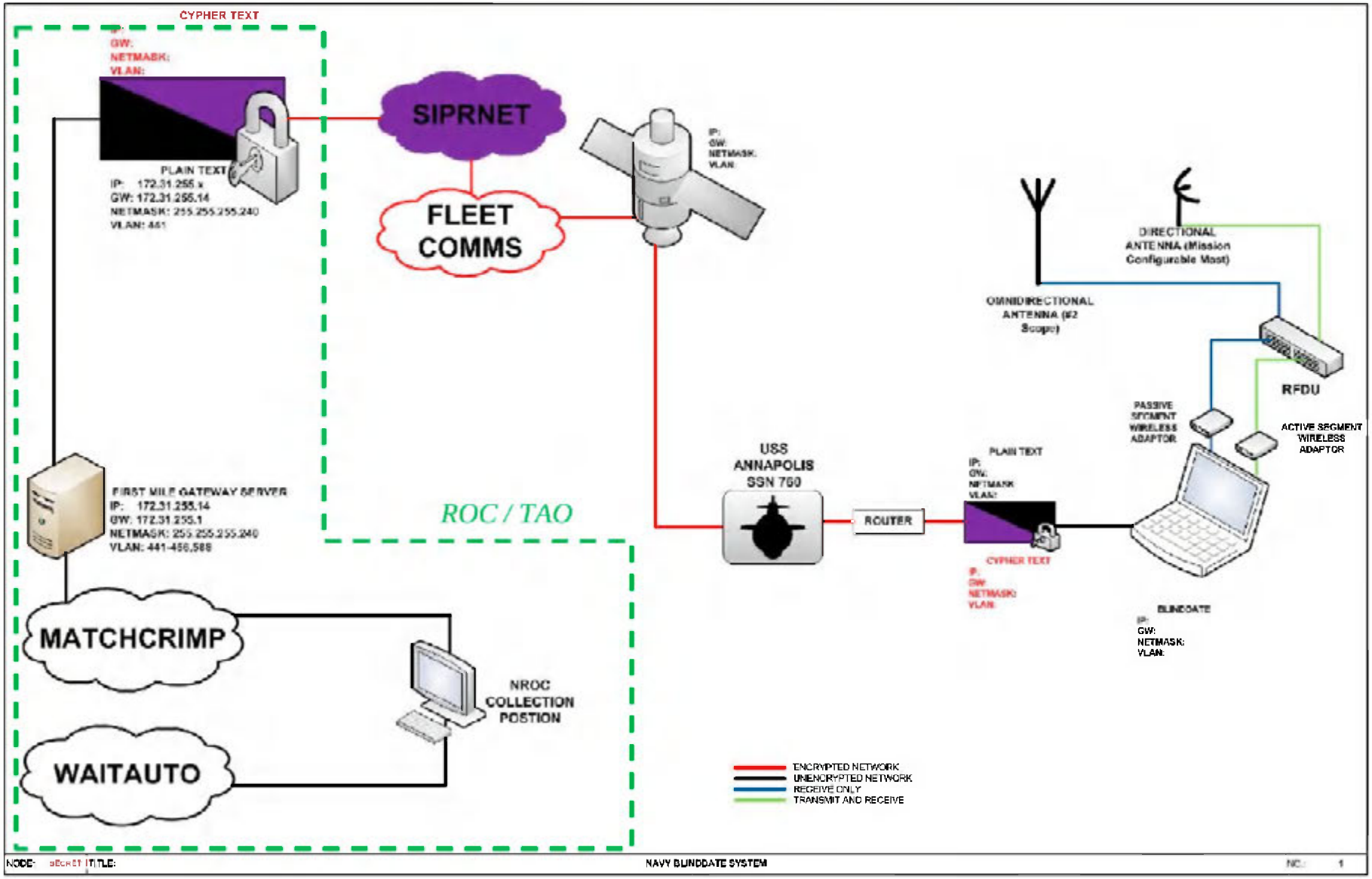
- **Mission Commanders:**
  - *LTJG* [redacted]
  - *Qualification based on JQS administered by the Cyber Operations Branch*
  - *Five (5) additional officers in training*
- **Operators:**
  - *Working to certify all qualified Interactive Operators for JCAT*
  - *Requires LOAC/ROE Briefing and Tool Training*

AUTEC testing with USS Annapolis. 18 NOV 2011

- ***Interactive Operations***
  - *Connection via: NEPTUNETHUNDER, BLINDDATE/HAPPYHOUR*
  - *Successful exploits at 4, 6, and 8 NM with 4 watt Access Point (AP).*
  - *Predict max connection distance to standard 100 mw AP to be 4 NM.*
- ***Man On the Side Operations***
  - *Inject using: BLINDDATE/NITESTAND*
  - *Successful inject at 4 NM to 100 mw client computer.*

Information Technology Directorate (ITD)

Afloat Computer Network Operations



Questions?

TAO.

Network Operations - Overview

Overall classification of this brief is:

Networking Fundamentals

- *Describe the following network component/terms:*
  - *Proxy Server:*
    - *An intermediary computer that completes application network requests on behalf of a host.*
  - *Router*
    - *A layer 3 device used to route traffic between networks*
  - *File Server*
    - *A server dedicated to the hosting and sharing of files.*
  - *Perimeter Network*
    - *The network segment located between LAN and Internet, used to place Internet facing services like Web and Mail Servers.*
  - *Internet*
    - *The aggregate of publicly connected networks implementing the IP addresses*

Networking Fundamentals

- *Describe the following network component/terms:*
  - *Intranet*
    - *A private network not normally accessible through the internet.*
  - *Firewall*
    - *A mechanism to filter network traffic using rules based on attributes like source, destination, packet type, port, and session status.*
  - *IDS (Intrusion Detection System):*
    - *Network traffic analyzer that uses patterns to detect malicious activity.*
  - *TACACS (Terminal Access Controller Access Control System).*
    - *Provides authentication, authorization, and accounting control to network devices via central server.*
  - *RADIUS (Remote Authentication Dial In User Service)*
    - *Authentication protocol for remote users to access network resources via network access methods like Dial-in, VPN, DSL, and WAP.*

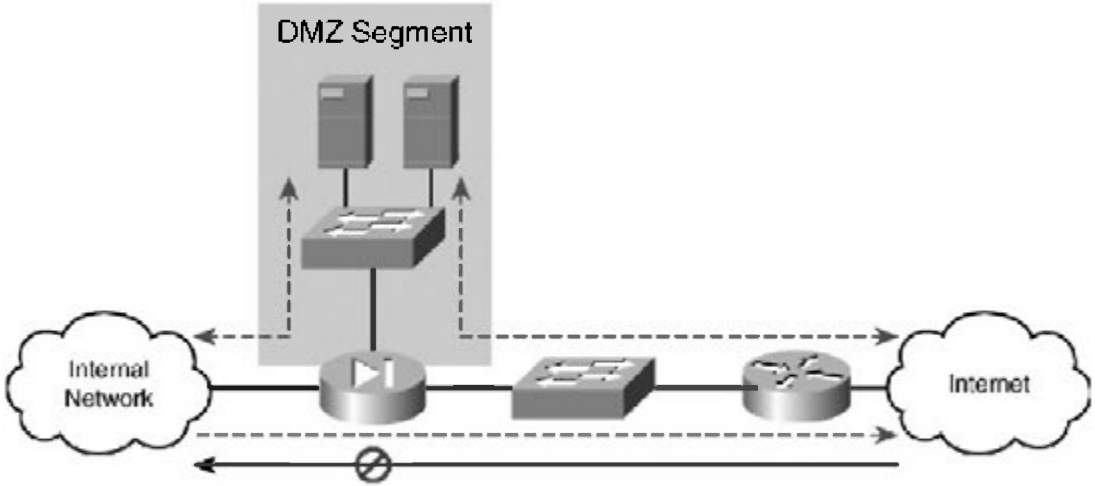
Networking Fundamentals

- *Define the following cross domain solutions:*
  - *High Assurance Guards*
    - *Connects networks operating within different security domains. Filters traffic like a firewall but operates on all levels of the TCP/IP stack.*
  - *SABI (Secret and Below Interoperability)*
    - *Connection of Secret Security Domain to Security Domains of lesser classification levels.*
  - *TSABI (Top Secret and Below Interoperability)*
    - *Connection of Top Secret Security Domain to domains of lesser classification levels.*
  - *Bastion Host*
    - *A host on an internal network that is also publicly exposed to the Internet or another public network. Usually used for service hosting (web, email, etc) or as part of a firewall solution.*

Networking Fundamentals

- *Describe the location of the following components in a simple networked environment:*

  a. *Proxy Server*
  b. *Router*
  c. *Firewall*
  d. *Workstation*
  e. *DMZ*
  f. *Switch*



Wireless Networking

- *Define wireless networking to include the following aspects:*
  - *Wireless Access Point*
    - *Wired to Wireless bridging.*
  - *802.11 Protocols*
    - *The set of layer 1 & 2 protocols defining the RF physical layer and media access control.*

STANDARD	Frequency Range	Modulation Method	Bit Rate
– 802.11a	5.0 GHz	OFDM	54 Mbps
– 802.11b	2.4 GHz	DSSS	11 Mbps
– 802.11g	2.4 GHz	OFDM	54 Mbps
– 802.11n	2.4 or 5 GHz	SDM	600 Mbps

    - *Other wireless technologies in the 2.4 GHz range include Bluetooth (802.15), cordless phones, microwaves, baby monitors, etc…*
  - *MAC Filtering*
    - *Only defined hardware addresses can connect to network*

Networking Fundamentals

- *Define the following application protocols/services and identify their port numbers:*
  - *Telnet: TCP 23*
  - *NTP (Network Time Protocol): TCP/UDP 123*
  - *NetBEUI (NetBIOS Extended User Interface): Non routable transport protocol used in pre-WinXP LAN's.*
  - *Net BIOS (Network Basic Input/Output System): TCP/UDP 139*
  - *FTP (File Transfer Protocol): TCP 21*
  - *POP3 (Post Office Protocol 3): TCP 110*
  - *RPC (Remote Procedure Call):*
    - *SUN/UNIX: TCP 111, 32771*
    - *WIN: TCP/UDP 135*
  - *HTTP (Hypertext Transfer Protocol): TCP 80*

Networking Fundamentals

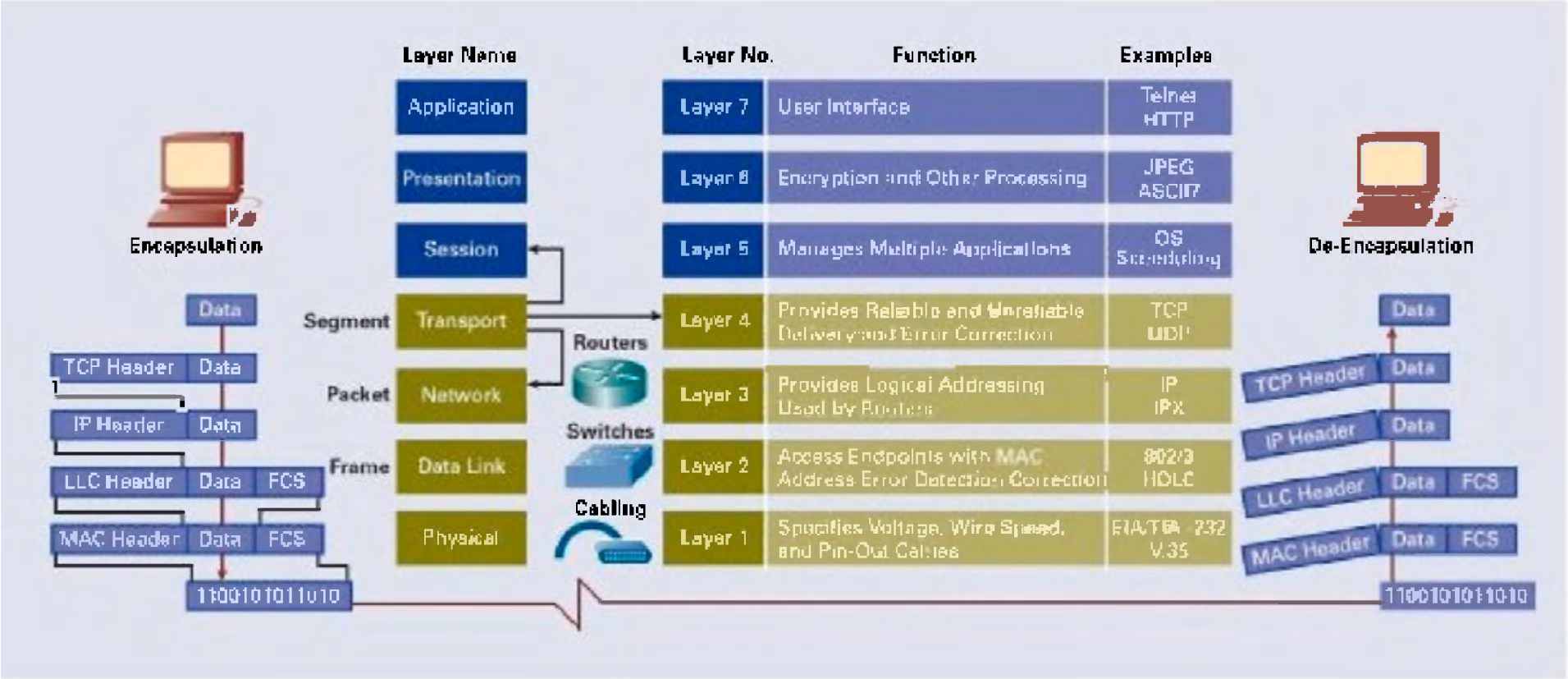
- *Define the following application protocols/services and identify their port numbers (continued…) :*
  - *SMTP (Simple Mail Transfer Protocol): TCP 25*
  - *DNS (Domain Name System): TCP/UDP 53*
  - *SNMP (Simple Network Management Protocol): UDP 161*
  - *SSL (Secure Socket Layer): Presentation Layer protocol for use by applications to secure communications*
  - *SSH (Secure Shell): TCP 22*
  - *TFTP (Trivial FTP): UDP 69*
  - *HTTPS (HTTP Secure): TCP 443*
  - *FTPS ():*
  - *DHCP (Dynamic Host Configuration Protocol): UDP 67*

Network Layer Protocols

- *Define the following network layer protocols to include their relationship to TCP/IP:*
  - *IP*
    - *Layer 3 (Network) used for network addressing and routing*
  - *TCP*
    - *Layer 4 (Transport) used for application session and reliable delivery*
  - *UDP*
    - *Layer 4 (Transport) used for application communication.*
  - *ARP*
    - *Layer 2 (Link) used for Mapping IP addresses to MAC Addresses*
  - *RARP*
    - *Layer 2 (Link) used for Mapping MAC addressees to IP Addresses*
  - *ICMP*
    - *Layer 3 (Network) used for Network Diagnostics*

OSI Model

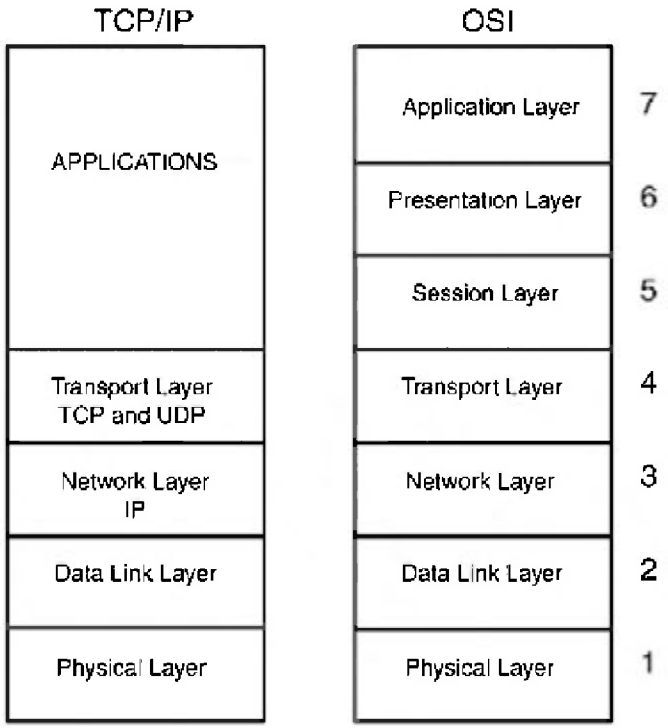
- *List and describe the 7 layers of the OSI Model:*



TCP/IP Model

- *List and describe the 4 layers of the TCP/IP Model to include how they relate to the OSI Model:*

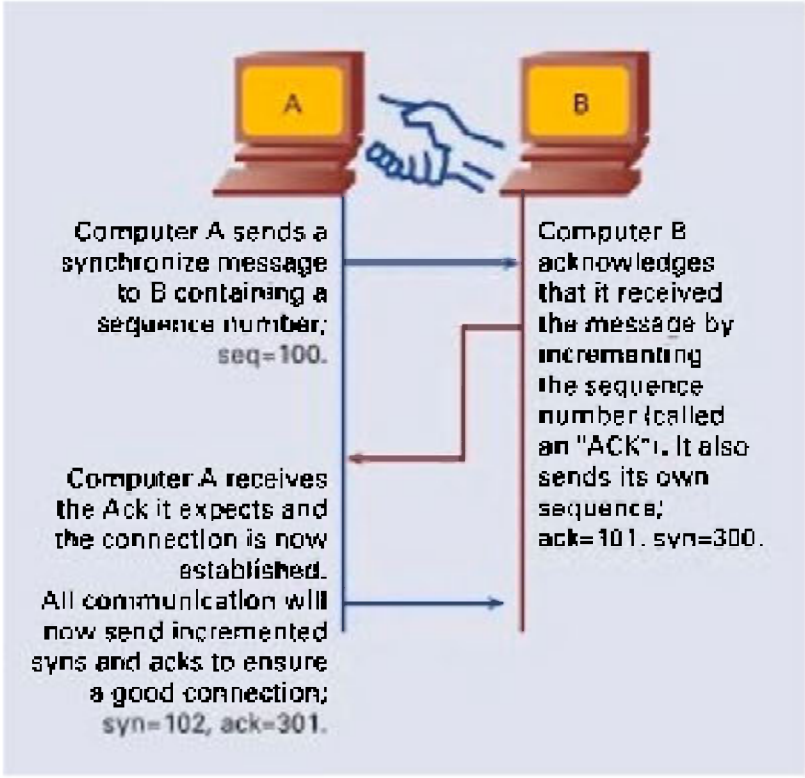
  – *The TCP/IP model combines the Session and Presentation layers with the Application layer. It is assumed if a program has need of layer 5 or 6 functionality, then the program will have to provide it.*



TCP 3-Way Handshake

- *Define and illustrate the TCP 3-Way Handshake*

– The 3-Way handshake is the method that all TCP sessions use to initialize connections and session parameters. It follows the sequence SYN, SYN-ACK, ACK. Application data can begin sending with the final ACK packet.

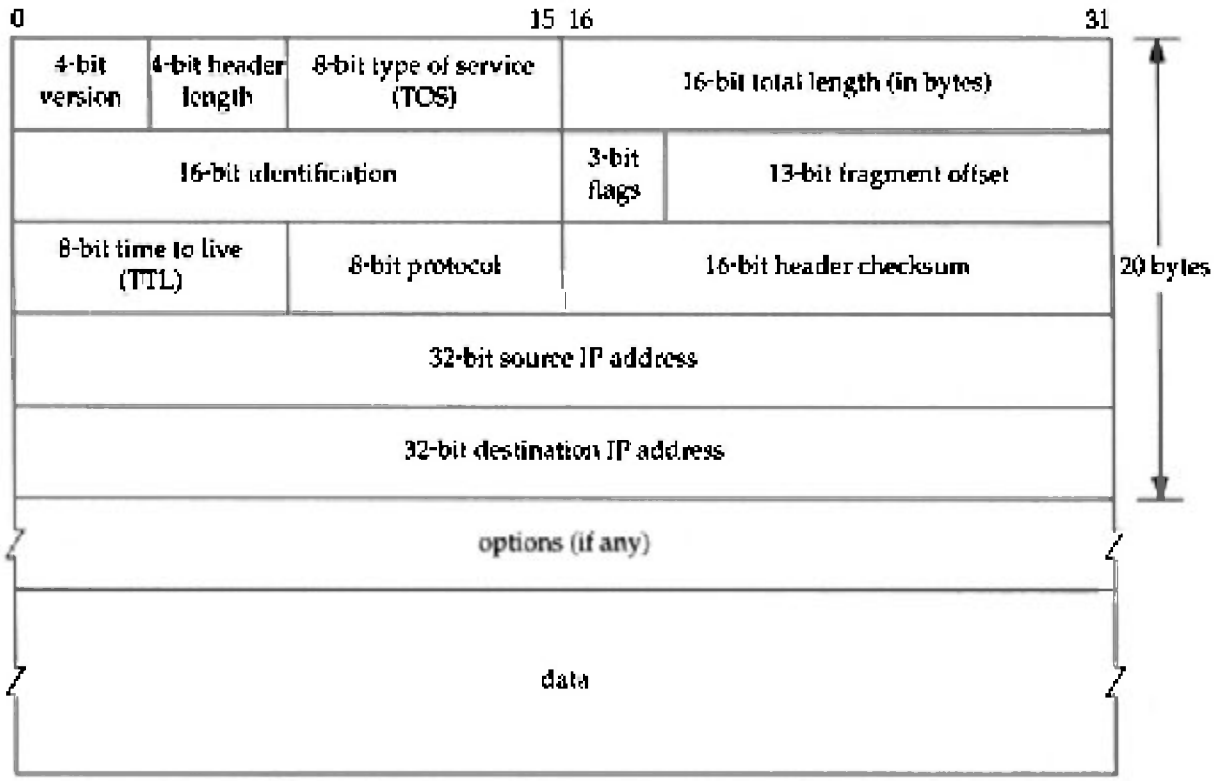


TCP Flags

- *Define and briefly describe the use of the following TCP flags:*
  - *SYN: Used to initialize the TCP by setting the packet sequence number*
  - *ACK: Used to acknowledge receipt of all package sequences up the number indicated*
  - *PSH: Indicates that that all data already received should be given to the application as soon as possible. Flushes the buffer.*
  - *URG: Urgent Data. Commonly used for interrupts.*
  - *FIN: Indicates there is no more data to send from that end of the connection. Session closes after both ends acknowledge FINs*
  - *RST: Immediate termination of connection. Commonly used to indicate unavailable service.*

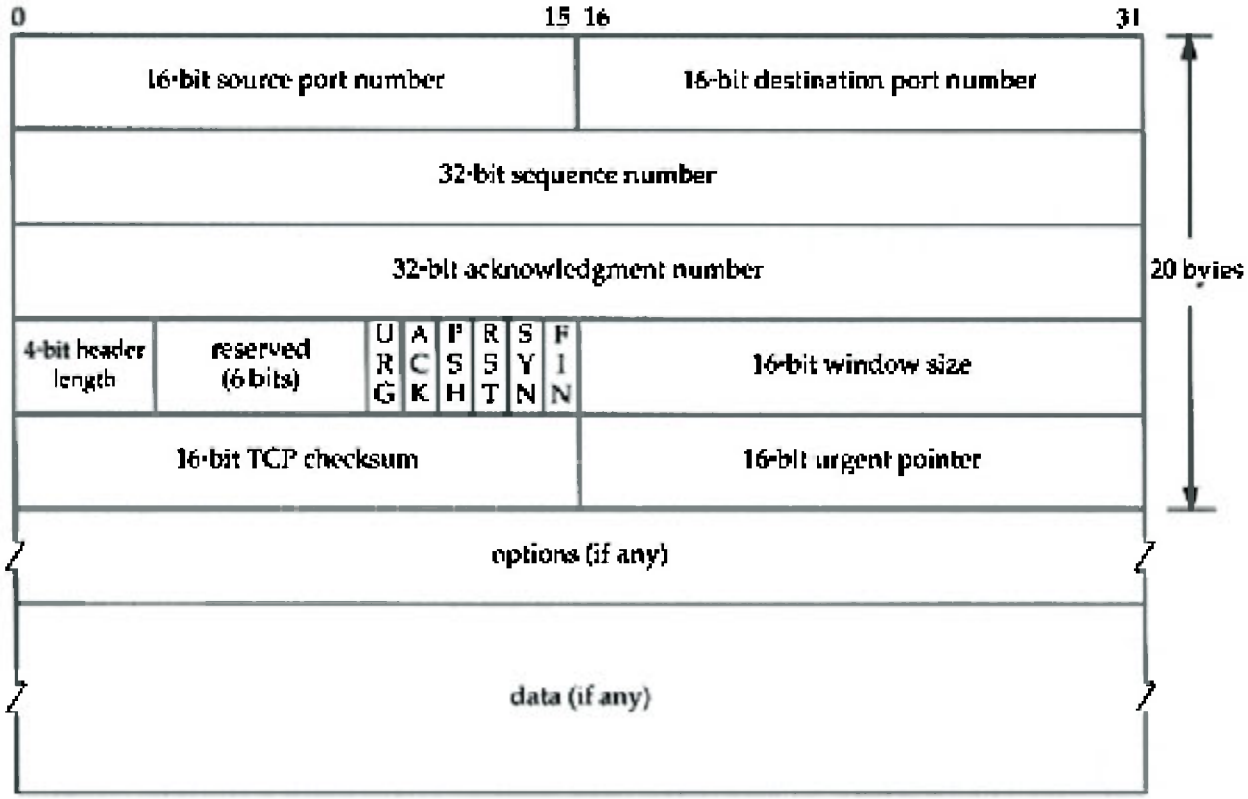
Protocol Headers

- *Define and describe the structure of the following protocol headers:*
  - *IP*



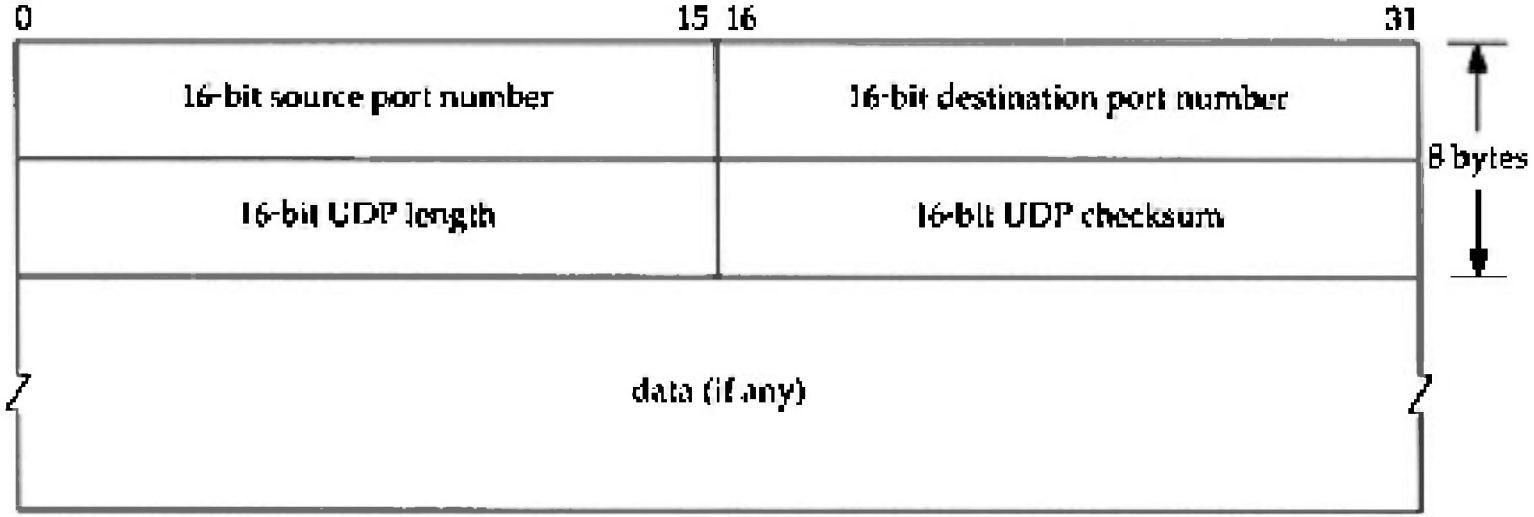
Protocol Headers

- *Define and describe the structure of the following protocol headers:*
  - *TCP*



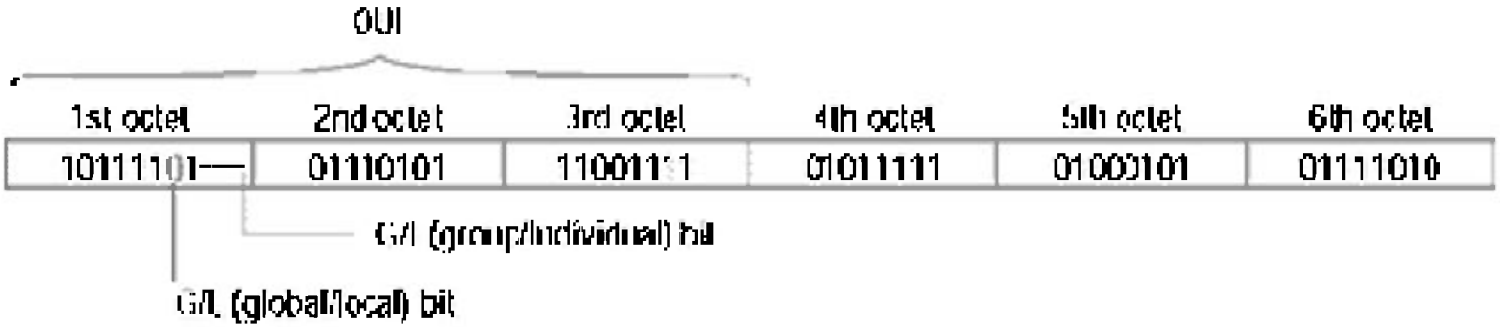
Protocol Headers

- *Define and describe the structure of the following protocol headers:*
  - *UDP*



MAC Addressing

- *Discuss the following as it pertains to MAC Addressing:*
  - *LENGTH OF MAC ADDRESS IN BITS:* ***48***
  - *DISPLAY OF MAC ADDRESS:* ***Hexadecimal Format 00:8e:f0:59:31:ae***
  - *LOCATION OF MAC ADDRESS:* ***First 48 bits in message***
  - *MANUFACTURER SPECIFIC BITS:* ***First 3 Octets***
  - *HOST SPECIFIC BITS:* ***Last 3 Octets***



ARP

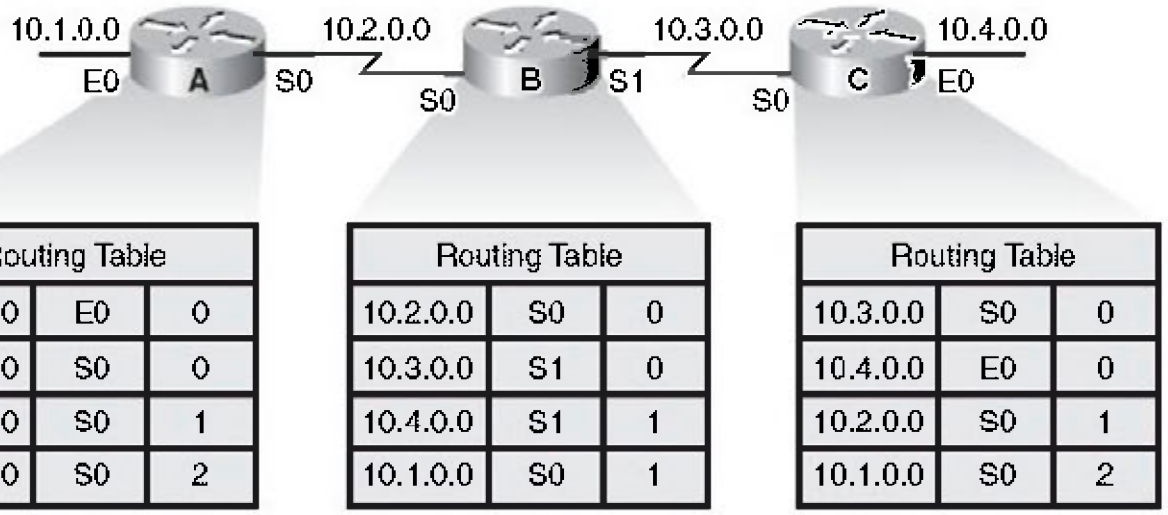
- *Discuss the following as it pertains to ARP:*
  - *ADDRESS RESOLUTION:*
    - *ARP (Address Resolution Protocol) facilitates the mapping between hardware addresses (MAC Address) and logical network addresses (IP Addresses). This mapping can be stored in a file or can determined through ARP broadcast requests on a local network.*

ICMP

- *Discuss the following as it pertains to ICMP:*
  - *ICMP is a protocol that defines a collection of message types commonly used for network diagnostics.*
    - *Layer of the OSI model: ICMP (usually) consists of Layer 3 (Network) messages transported by IP.*
    - *Ping: Message Type 8 (request) and 0 (reply). Used to determine if a device is active on the network.*
    - *Traceroute: Uses a combination of the IP time-to-live (TTL) field and the ICMP messages 11 (time exceeded) and 3.3 (port unreachable) to determine the route a packet takes through the network.*

Routing Table

- *Discuss the routing table as it pertains to the router:*
  - *The Routing Table Stores what networks are reachable through each interface along with metadata about that route.*



Routing Table		
10.1.0.0	E0	0
10.2.0.0	S0	0
10.3.0.0	S0	1
10.4.0.0	S0	2

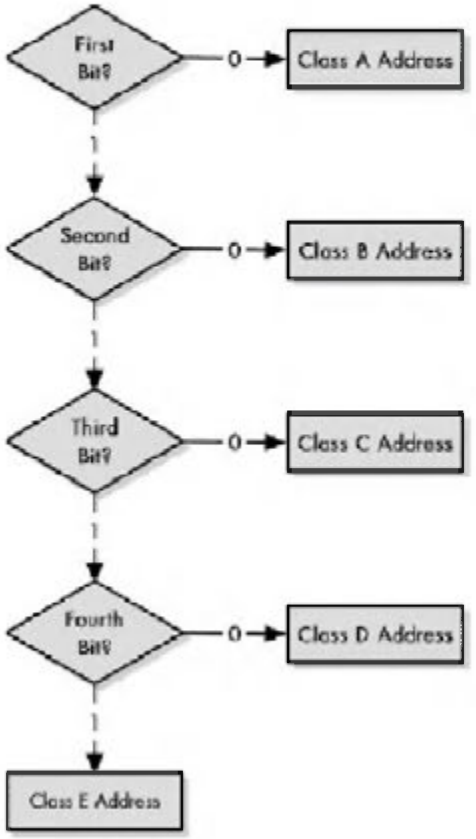
Routing Table		
10.2.0.0	S0	0
10.3.0.0	S1	0
10.4.0.0	S1	1
10.1.0.0	S0	1

Routing Table		
10.3.0.0	S0	0
10.4.0.0	E0	0
10.2.0.0	S0	1
10.1.0.0	S0	2

IP Addressing

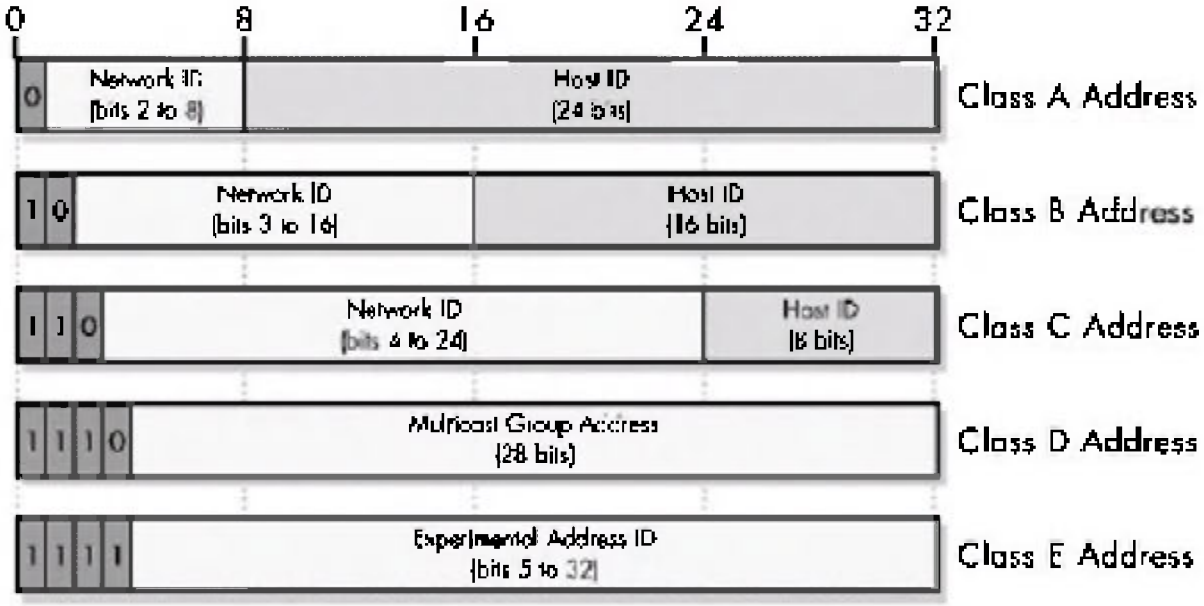
- *Discuss the following as it pertains to ranges of IP addressing:*

  - *Classful networks were the original method of distributing address groups to organizations.*
    - *Class A: First 8 bits for Network ID and the last 24 bits for Host ID.*
      - *126 Networks : 16,277,214 Hosts/net*
    - *Class B: First 16 bits for Network ID and the last 16 bits for Host ID.*
      - *16,384 Networks : 65,534 Hosts/net*
    - *Class C: First 24 bits for Network ID and the last 8 bits for the Host ID.*
      - *2,097,152 Networks : 254 Hosts/net*



TCP/IP

- *Discuss the following as it pertains to TCP/IP:*
  - *Number of bits in an IP address:* ***32***
  - *Number of octets contained in an IP address:* ***4***



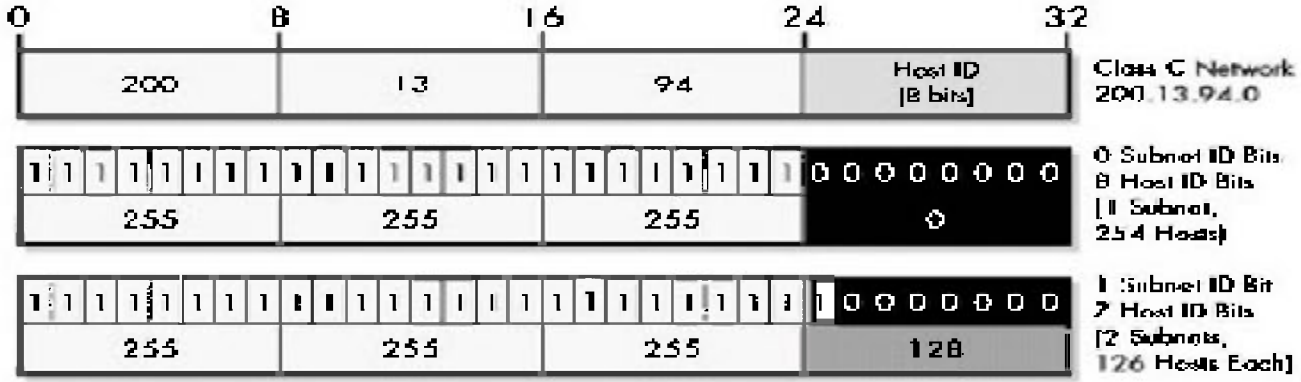
- ***IPv6 has 128 bits, roughly a 300 trillion 300 trillion more***
  - *90,000,000,000,000,000,000,000,000,000 times the space of IPv4*

Networking Fundamentals

- *Discuss the following as it pertains to the following protocols:*
  - *TCP*
  - *UDP*

IP Subnets

- *Discuss the following as it pertains to IP Subnets:*
  - *Number of bits used in a subnet mask.*
  - *How the subnet mask identifies the network portion of the of the IP address.*
  - *Borrowing bits from the host portion of the address.*
  - *Benefits of subnetting.*



TELNET

- *Discuss the following as it pertains to TELNET:*
  - *Use: Create a Network Virtual Terminal session on a r*
  - *Type of connection: TELNET uses TCP as the s*
  - *Default port number: 23*

DO NOT USE EVER!!!

References

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4. *TCP/IP Illustrated, Volume 1: The Protocols by W. Richard Stevens. Publisher: Addison-Wesley Professional. Pub Date: December 31, 1993. Print ISBN-10: 0-201-63346-9.*
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6. *Intelipedia Articles.*
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Questions

- *Questions?*