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# ***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

<u>Time</u>	<u>Topic</u>	<u>Briefer</u>
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	[REDACTED]
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

<u>Time</u>	<u>Topic</u>	<u>Briefer</u>
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] [REDACTED]; U: [REDACTED])
1000-1030	Blue Team Brief	LCDR [REDACTED] (S: [REDACTED] [REDACTED]; U: [REDACTED])
1030-1100	JCMA Brief	CTR1 Brown/ CTR1 [REDACTED] (S: [REDACTED]; U: [REDACTED])
1100-1130	Hunt Brief	CTN2 [REDACTED] (S: [REDACTED] [REDACTED]; U: [REDACTED])
1130-1300	Lunch	[REDACTED]
1400-1530	Tutelage Brief	CTN2 [REDACTED] (S: [REDACTED] [REDACTED]; U: [REDACTED])



# Course Overview

Friday, April 13th

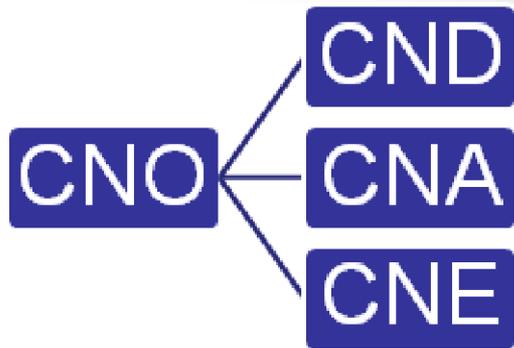
Location: OPS2B

2B4118-3

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



# USCYBERCOM LOO's



Who: TAO  
Where: ROC

**Class I**

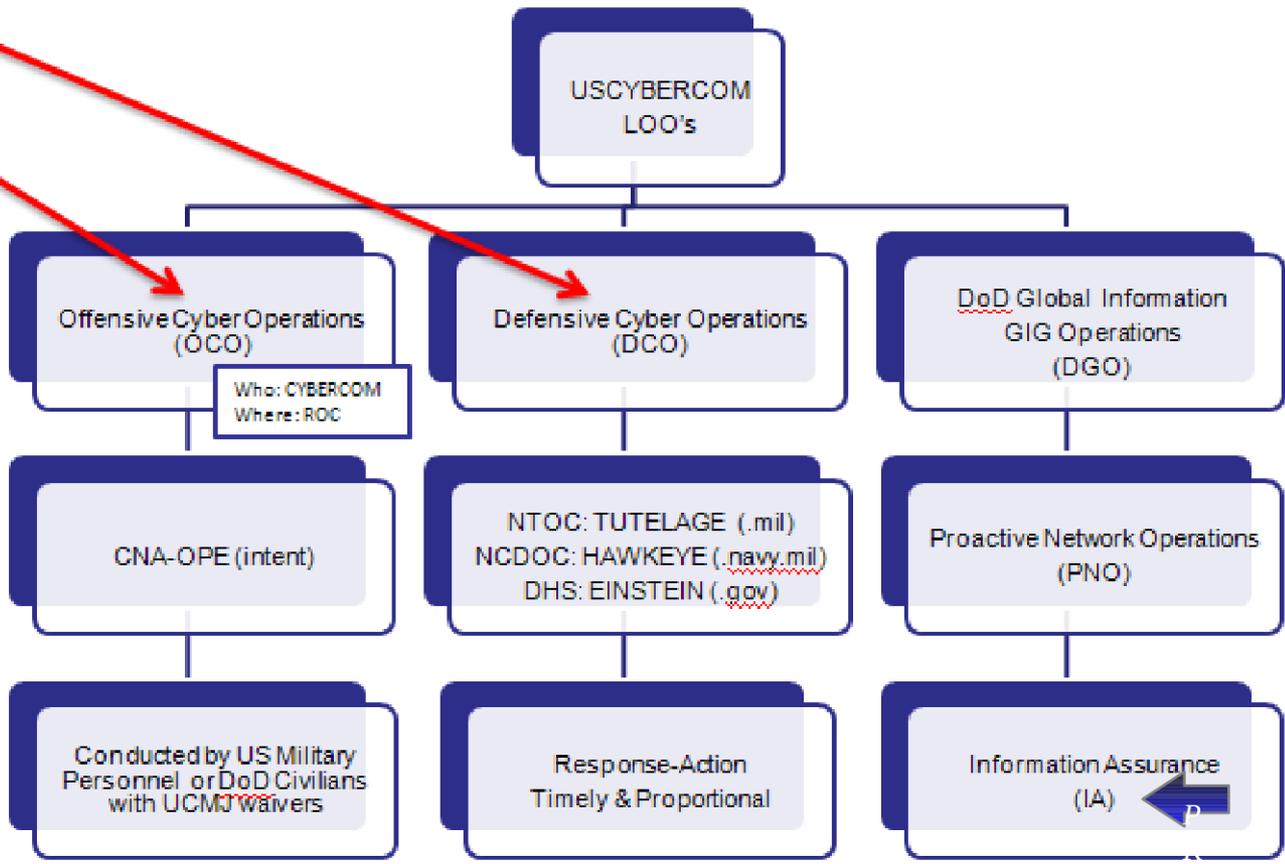
- Automated

**Class II**

- Interactive

**Human-enabled**

- Proximal Access
- Physical Interdiction
- Multi-Staged



## FLTCYBERCOM / C10F



# 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)

FLTCYBERCOM / C10F

★★★ U.S. FLEET CYBER COMMAND / U.S. TENTH FLEET ★★★



# 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

FLTCYBERCOM / C10F

★★★ U.S. FLEET CYBER COMMAND / U.S. TENTH FLEET ★★★



# 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:





# 10 Department NIOC Maryland

## Computer Network Operations





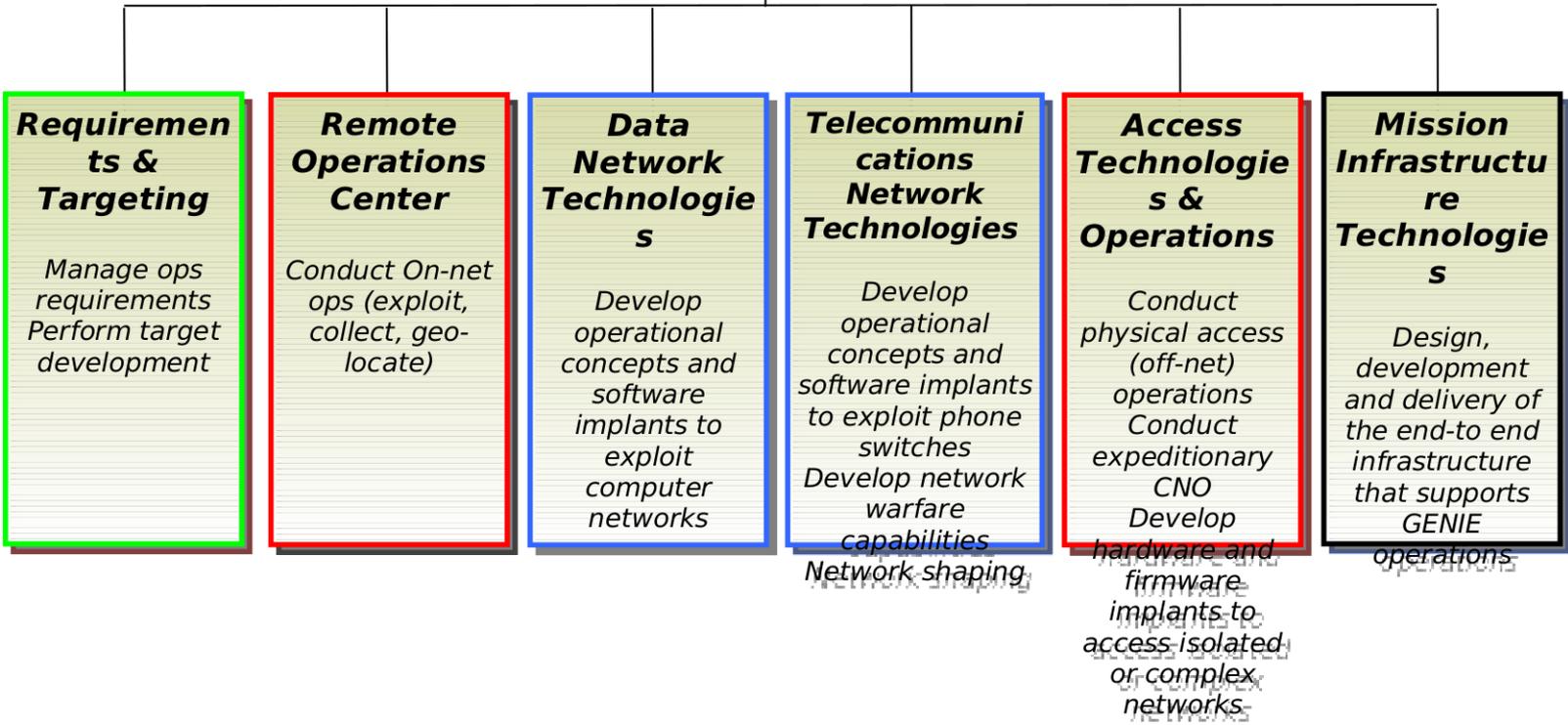
# Outline



- **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 (ITD) TAO Organization



**Requirements & Targeting**

Manage ops requirements  
Perform target development

**Remote Operations Center**

Conduct On-net ops (exploit, collect, geo-locate)

**Data Network Technologies**

Develop operational concepts and software implants to exploit computer networks

**Telecommunications Network Technologies**

Develop operational concepts and software implants to exploit phone switches  
Develop network warfare capabilities  
Network shaping

**Access Technologies & Operations**

Conduct physical access (off-net) operations  
Conduct expeditionary CNO  
Develop hardware and firmware implants to access isolated or complex networks

**Mission Infrastructure Technologies**

Design, development and delivery of the end-to end infrastructure that supports GENIE operations



# 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:

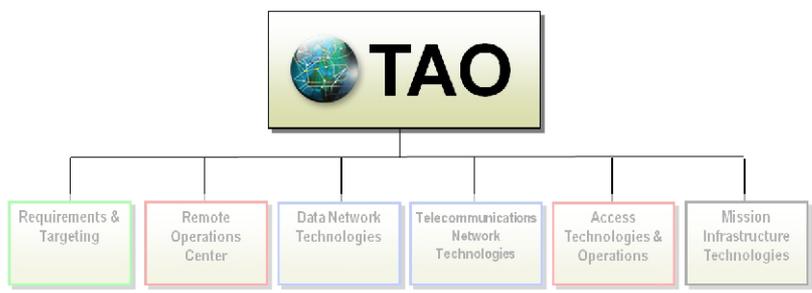
- **China/North Korea (NSAW, NSAH)**
- **Iran (NSAW, NSAG)**
- **Russia (NSAW, NSAH)**
- **Cyber Counterintelligence (CCI) (NSAW, NSAG, NSAT, NSAH)**
- **Counterterrorism (CT) (NSAW, NSAG)**
- **Target Service Provider (TSP) (NSAW, NSAT)**
- **Regional Targets (RT) (NSAW, NSAT)**



Directorate (ITD)



# TAO – Front Office (S32)



S32:

Staff (2/2/0)

## Leadership Positions:

**RDML** [REDACTED]

- *Deputy Chief, TAO*

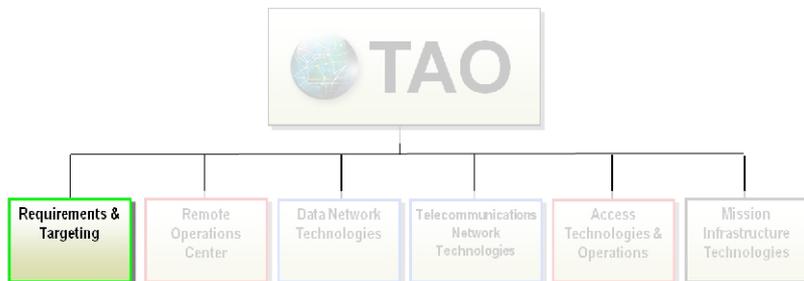
**CAPT** [REDACTED]

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

[Billet Description (BA/COB/Deployed)]



# 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*

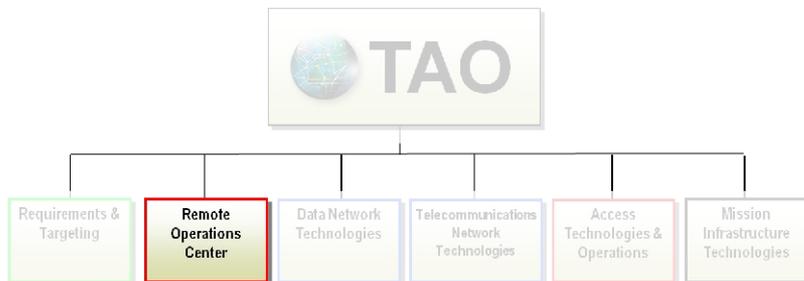
**LT** [REDACTED]

- *CNO Coordinator – China/DPRK Branch*

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



# 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

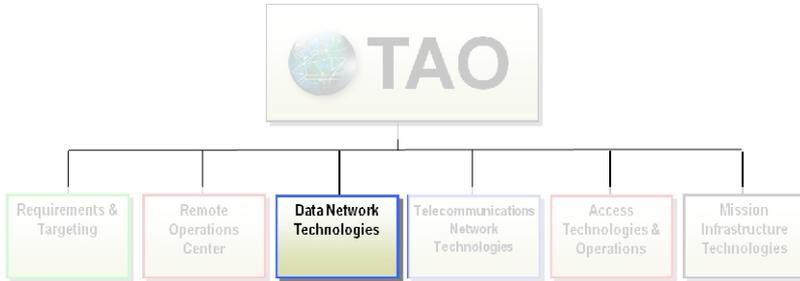
**LTJG** [REDACTED]

- Tech Lead, Cyber Operations Branch

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



# Data Network Technologies (S323)



## Leadership Positions:

**LT** [REDACTED]

- Chief, Cyber Technologies Branch

**LT** [REDACTED]

- Chief, Engineering Services Division

### S323:

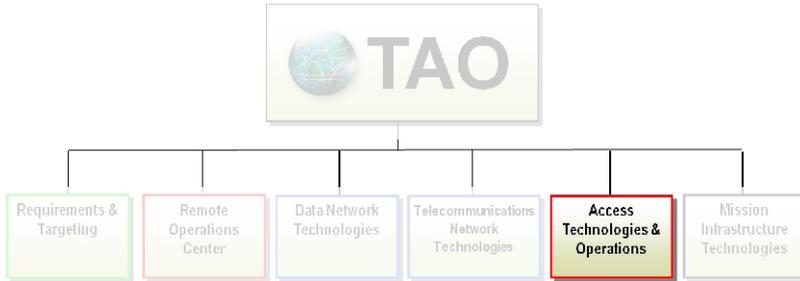
**Development (Officer) (2/2/0)**

**Development (Enlisted) (16/6/0)**

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



# 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)]**



# 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)

## 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%	<b>2588</b>	100.00%
CIV	70	33.65%	1059	40.92%
NAVY	52	<b>25.00%</b>	<b>674</b>	<b>26.04%</b>
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	<b>53.85%</b>	292	<b>43.32%</b>
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**



Directorate (ITD)

# 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



# Target Example: [REDACTED] (NSA-G)

- **Current TAO Targets**

- Political

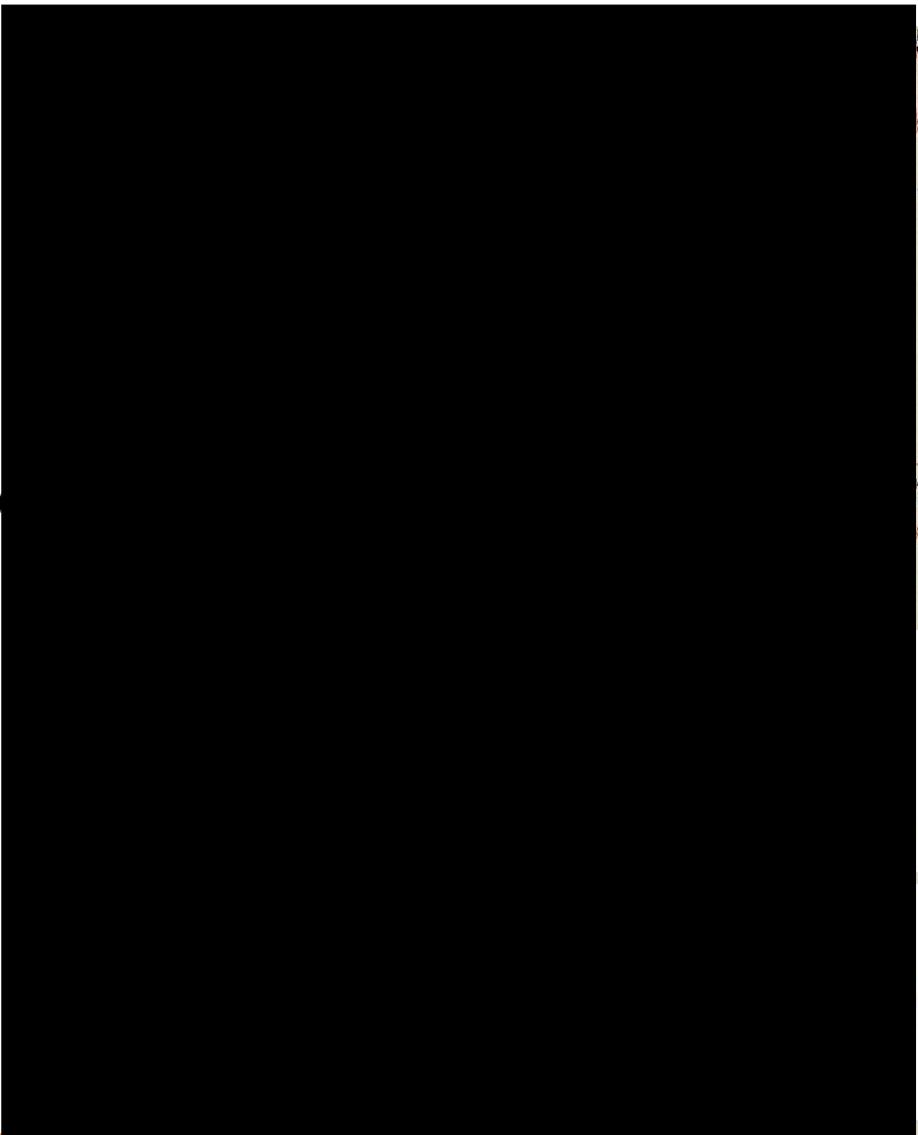
- [REDACTED] leadership to include Ministry of Interior, Parliament Members, and Presidential Palace

- 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





# 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]

**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**

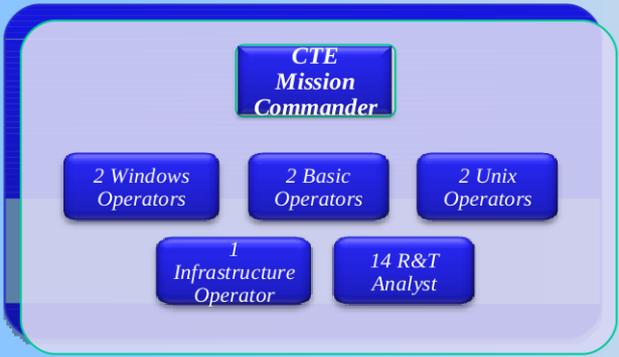
*Provides structure to develop holistic Navy capability*

*Structure supports manning requirements levied on Navy*

## CTE Manning

Unix and Windows Operators:  
Exploiter Qualified  
(Minimum Requirement)

Router and Firewall Operators:  
May shift between CTE's depending on operator speciality and mission requirement



## Mission Alignment

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



# 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



# Afloat Computer Network Operations

## *AUTEC testing with USS Annapolis. 18 NOV 2011*

- **Interactive Operations**

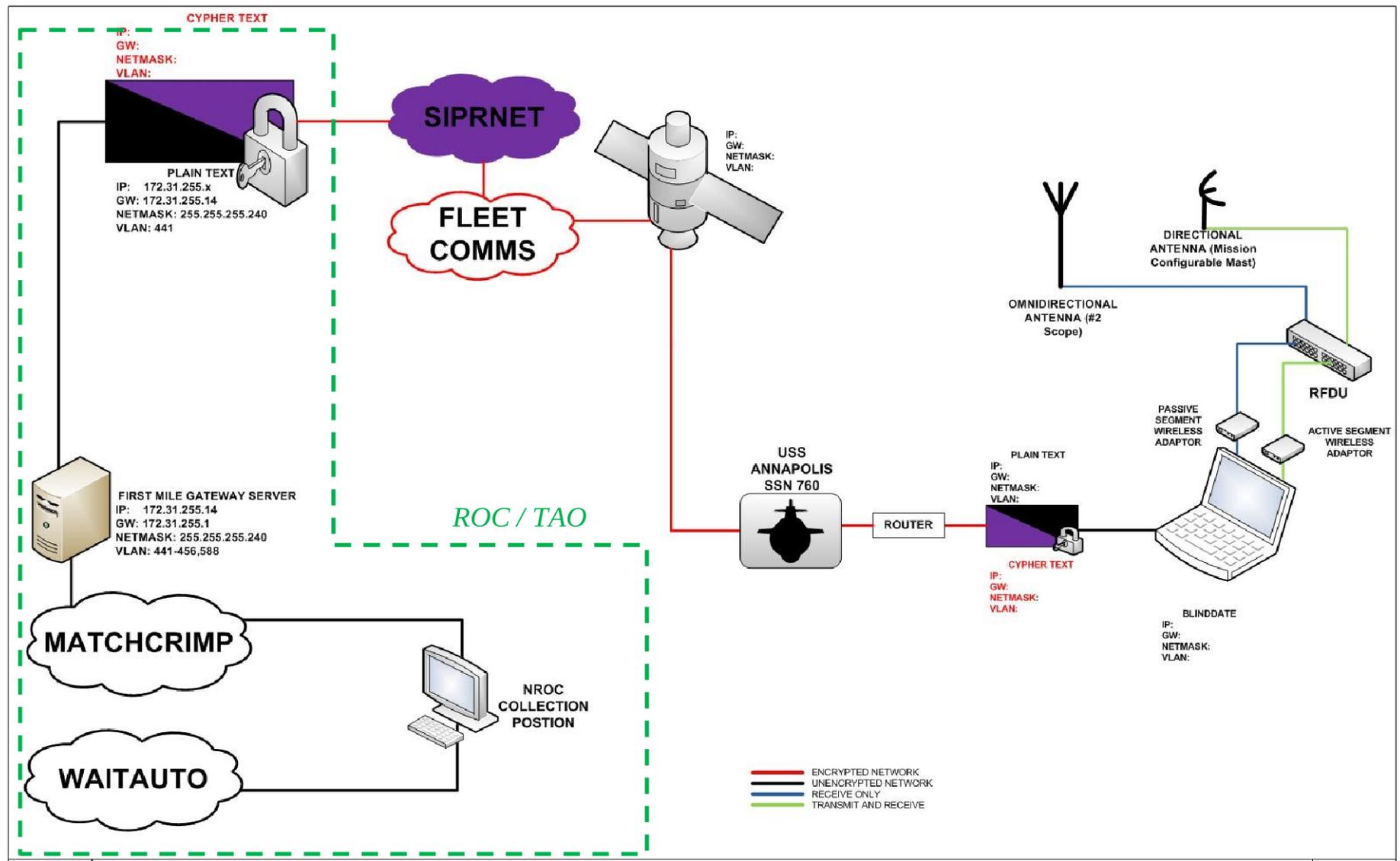
- Connection via:  
NEPTUNETHUNDER,  
BLINDDATE/HAPPYHOUR
- Successful exploits at 4, 6,  
and 8 NM with 4 watt  
Access Point (AP).
- Predict max connection  
distance to standard 100  
mw AP to be 4 NM.

- **Man On the Side  
Operations**

- Inject using:  
BLINDDATE/NITESTAND
- Successful inject at 4 NM to  
100 mw client computer.



# Afloat Computer Network Operations





*Questions?*

**TAO.**



## **Network Operations - Overview**

**Overall classification of this brief is:**

Derived From: NSA/CSSM 1-52  
Derived From: NSA/CSSM 1-52  
Dated: 20070108  
Declassify On: 20070108  
Declassify On: 20350101



# 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.





# 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.

<u>STANDARD</u>	<u>Frequency Range</u>	<u>Modulation Method</u>	<u>Bit Rate</u>
– 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



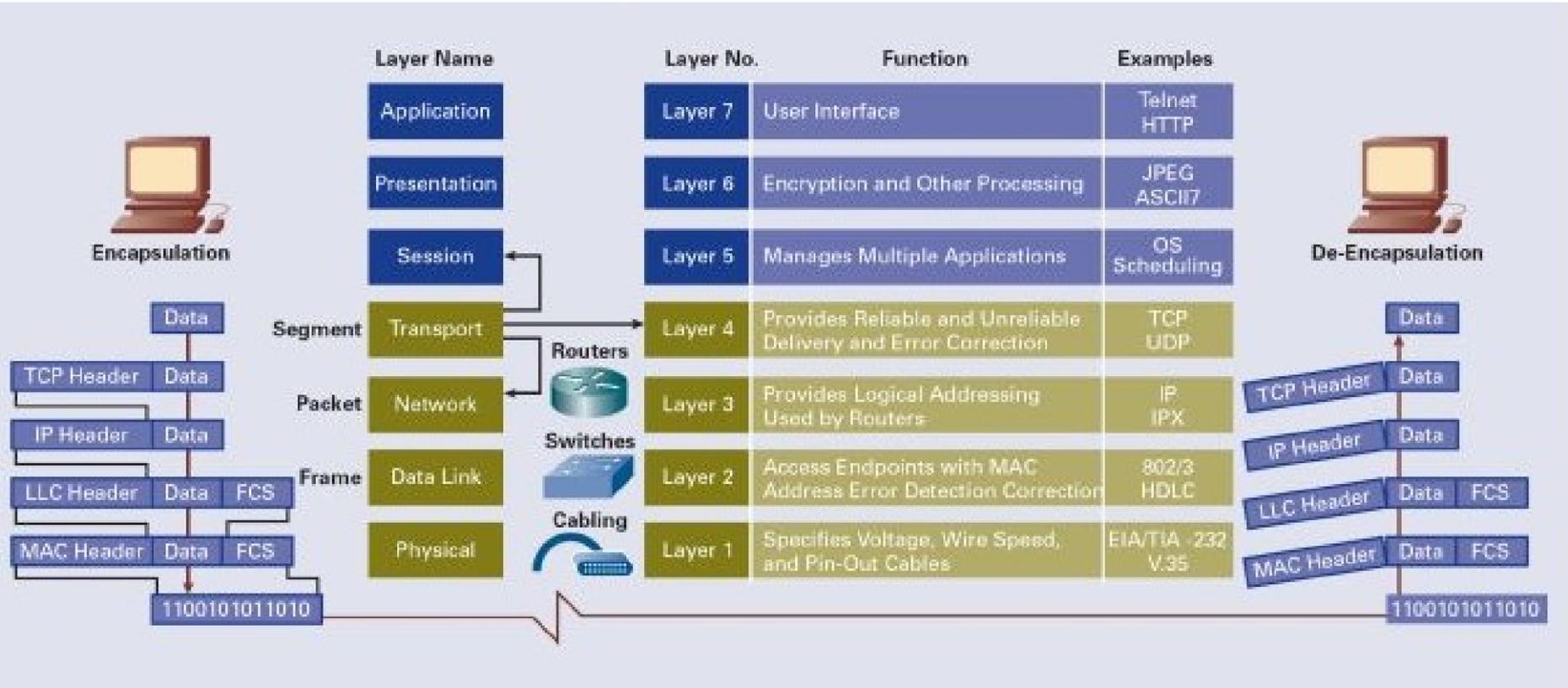
# Network Layer Protocols

- 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:

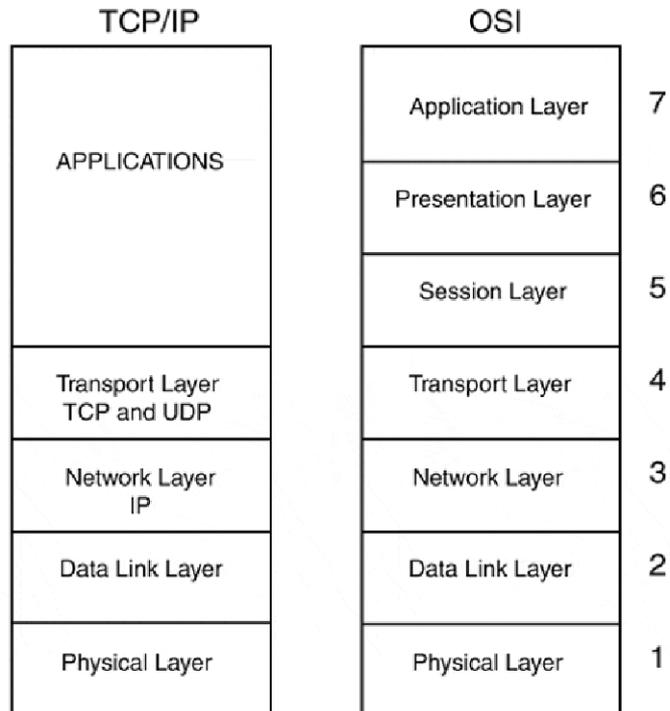




# TCP/IP Model

- 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.

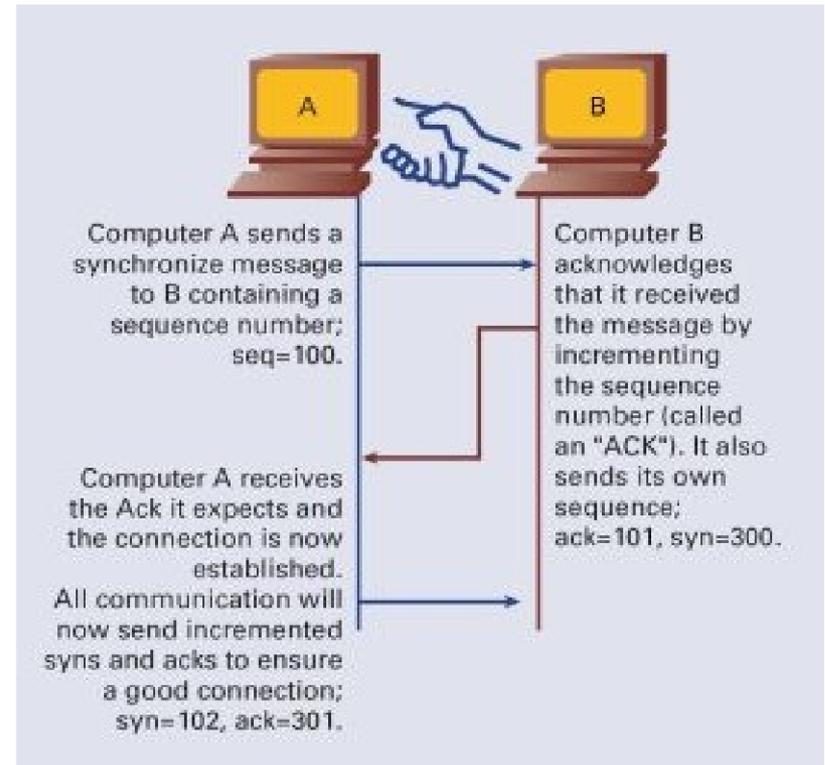




# TCP 3-Way Handshake

- 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

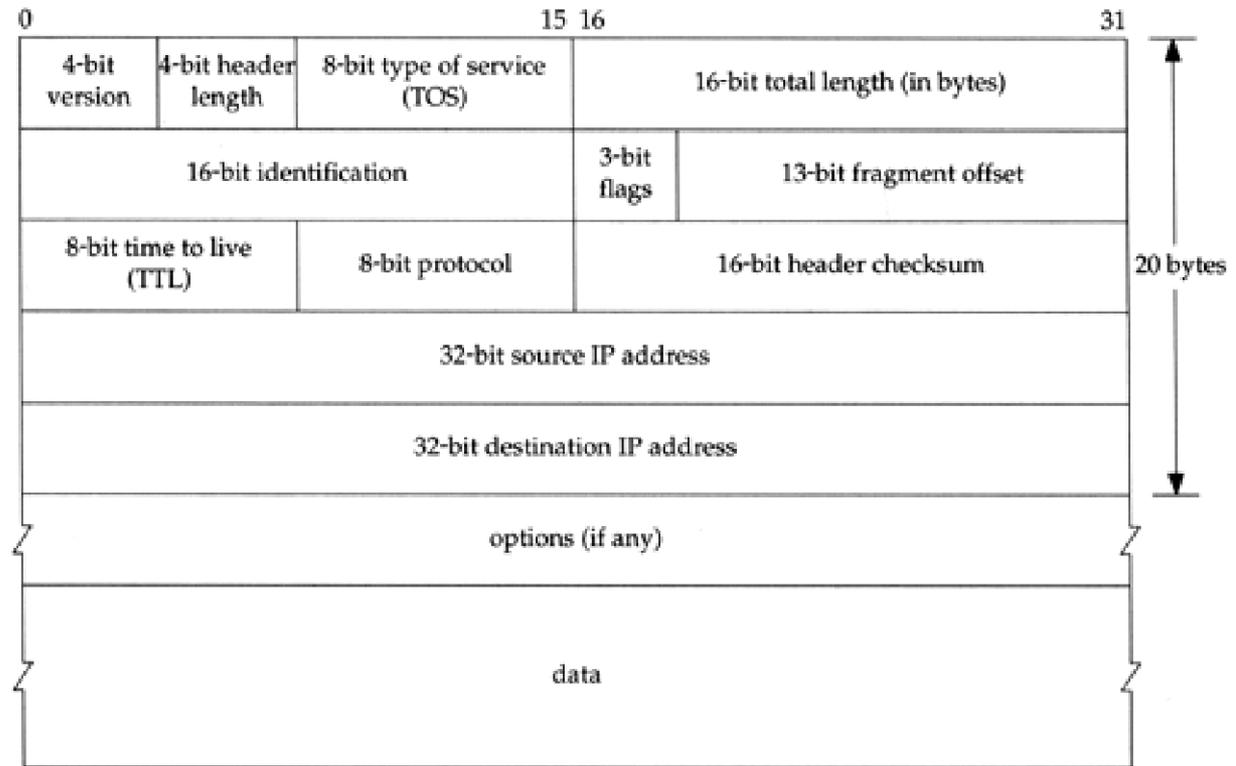
- Define and briefly describe the use of the following TCP flags:
  - SYN: Used to initialize the TCP by setting the packet sequence number
  - ACK: Used to acknowledge receipt of all package sequences up the number indicated
  - PSH: Indicates that that all data already received should be given to the 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

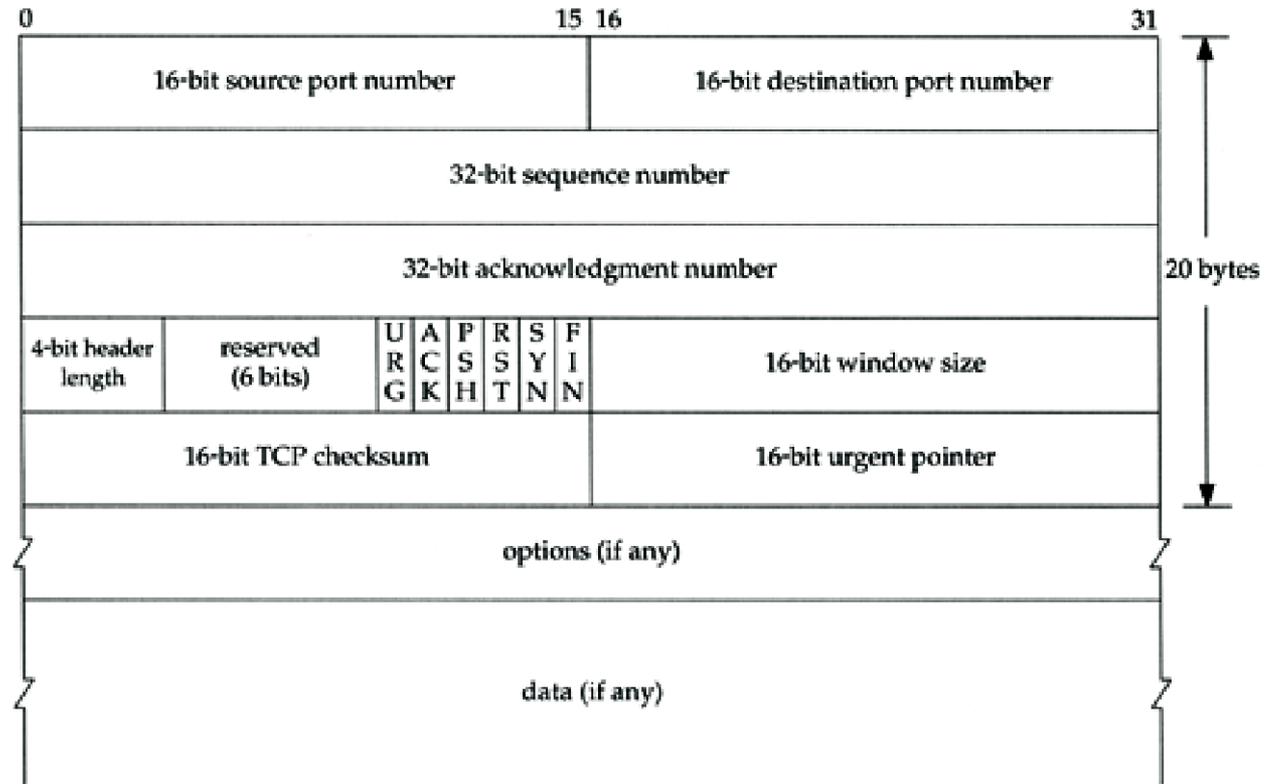




# Protocol Headers

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

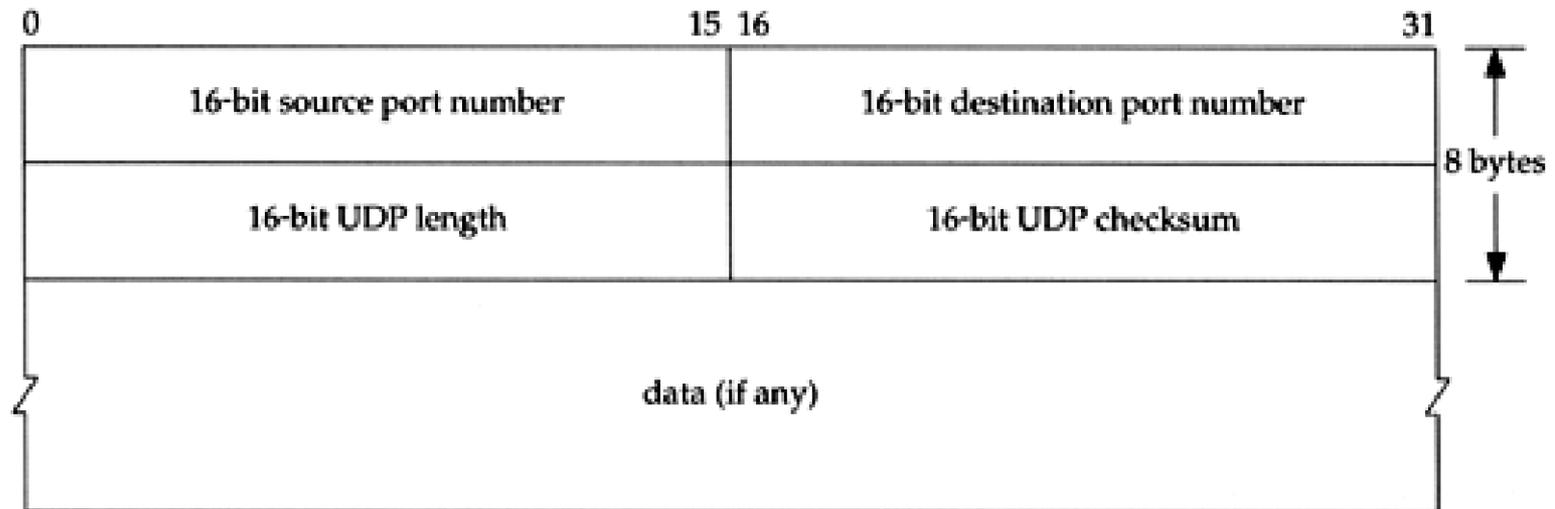
– TCP





# Protocol Headers

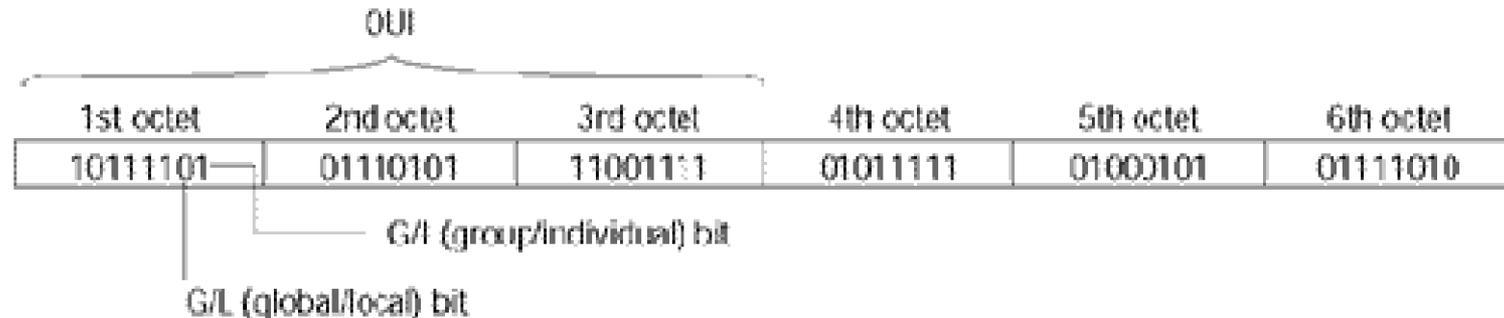
- Define and describe the structure of the following protocol headers:
  - UDP





# 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 be determined through ARP broadcast requests on a local network.*



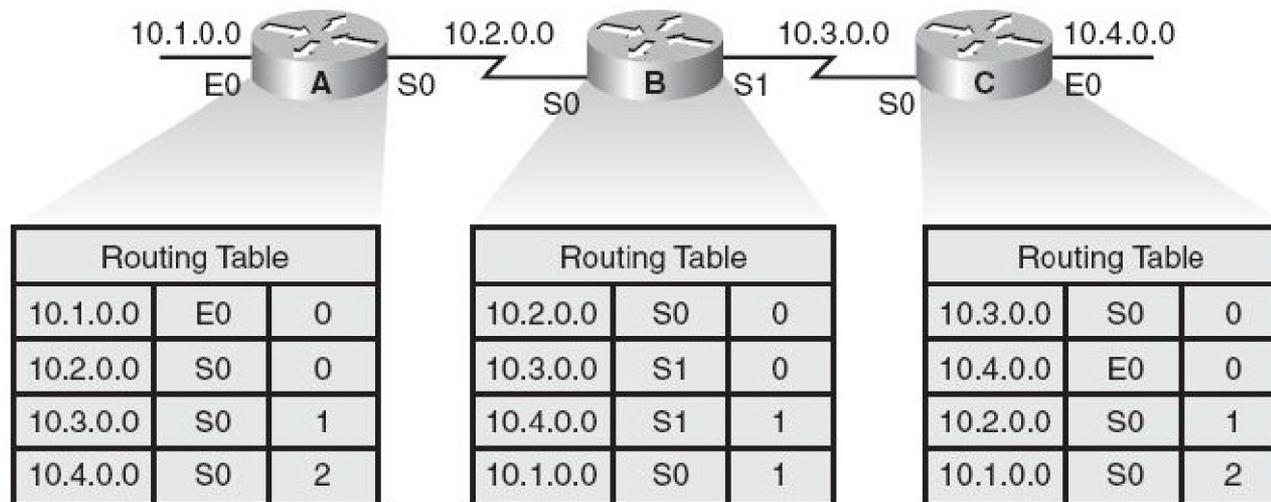
# ICMP

- *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.

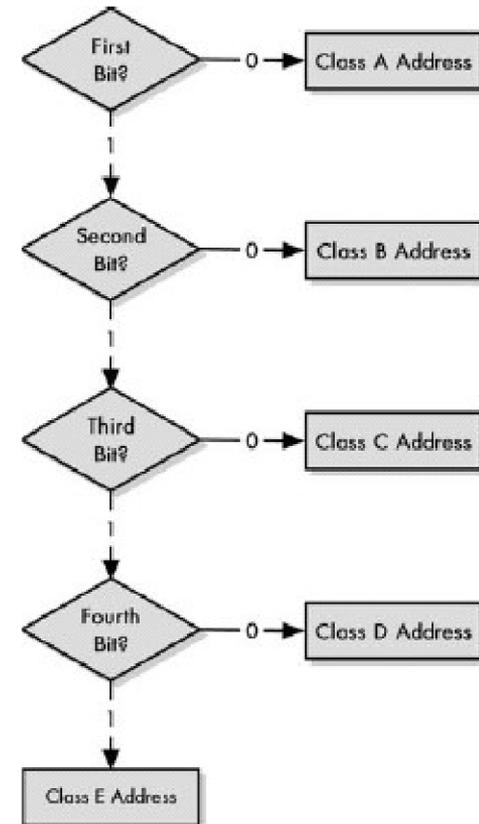




# IP Addressing

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

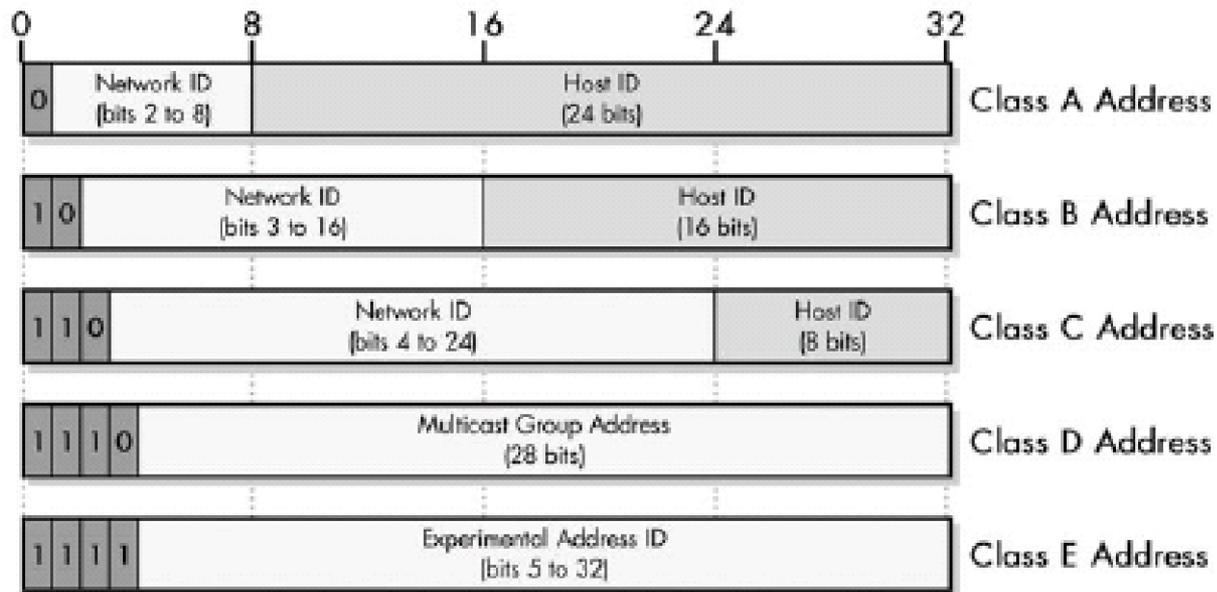
- Classful networks were the original method of distributing address groups to organizations.
  - Class A: First 8 bits for Network ID and the last 24 bits for Host ID.
    - 126 Networks : 16,277,214 Hosts/net
  - Class B: First 16 bits for Network ID and the last 16 bits for Host ID.
    - 16,384 Networks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



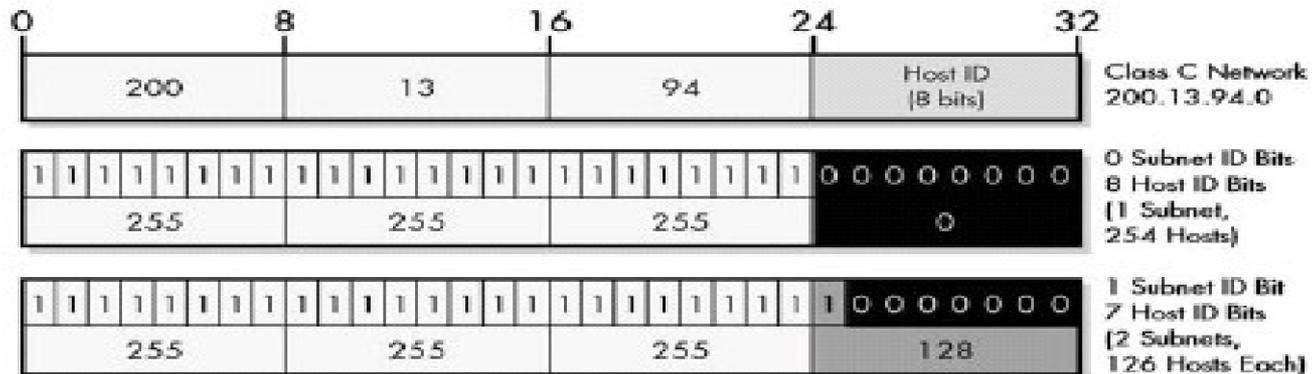
# Networking Fundamentals

- *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 remote host.
  - Type of connection: TELNET uses TCP as the session protocol.
  - Default port number: 23

**DO NOT USE EVER!!!**



## References

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2. *Cisco Networking Simplified, Second Edition* by Jim Doherty; Neil Anderson; Paul Della Maggiora. Publisher: Cisco Press. Pub Date: December 18, 2007. Print ISBN-10: 1-58720-199-2.
3. *TCP/IP Guide, 1st Edition* by Charles M. Kozierok. Publisher: No Starch Press. Pub Date: October 4, 2005. Print ISBN-13: 978-1-593-27047-6.
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.
5. *Building Internet Firewalls, 2nd Edition* by Elizabeth D. Zwicky; Simon Cooper; D. Brent Chapman. Publisher: O'Reilly Media, Inc. Pub Date: 2000/06/26.
6. Intelipedia Articles.
7. NSA Wiki Articles.



# Questions

- *Questions?*