NETWORKING 101

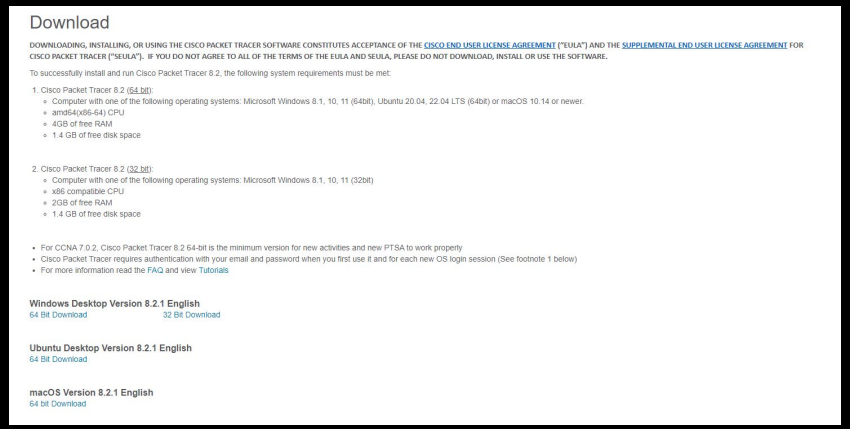
SJU ACM STUDENT CHAPTER

SJU ACM
Student Chapter

SIGN IN FORM:

BEFORE WE BEGIN:

- WE WILL BE USING CISCO PACKET TRACER FOR THE LIVE CHALLENGE PART OF THIS LAB
- DOWNLOADING CISCO PACKET TRACER IS A TWO-STEP PROCESS:
  - (1) LOG INTO WWW.NETACAD.COM, AND SIGN IN!
    - IF YOU DO NOT HAVE AN ACCOUNT ALREADY, MAKE ONE FOR FREE!
  - (2) ONCE LOGGED IN, SEE THE RESOURCES TAB AT THE TOP OF THE NETACAD PAGE > CLICK DOWNLOAD PACKET TRACER > SCROLL TO THE BOTTOM AND DOWNLOAD THE VERSION SUITABLE FOR YOUR MACHINE
- IF YOU HAVE ANY QUESTIONS, RAISE YOUR HAND & ONE OF THE BOARD MEMBERS WILL BE AROUND TO ASSIST YOU!



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DOWNLOADING, INSTALLING, OR USING THE CISCO PACKET TRACER SOFTWARE CONSTITUTES ACCEPTANCE OF THE CISCO END USER LICENSE AGREEMENT ("EULA") AND THE SUPPLEMENTAL END USER LICENSE AGREEMENT FOR CISCO PACKET TRACER ("SEULA"). IF YOU DO NOT AGREE TO ALL OF THE TERMS OF THE EULA AND SEULA, PLEASE DO NOT DOWNLOAD, INSTALL OR USE THE SOFTWARE.

To successfully install and run Cisco Packet Tracer 8.2, the following system requirements must be met:

1. Cisco Packet Tracer 8.2 (64 bit):
   - Computer with one of the following operating systems: Microsoft Windows 8.1, 10, 11 (64bit), Ubuntu 20.04, 22.04 LTS (64bit) or macOS 10.14 or newer.
   - amd64(x86-64) CPU
   - 4GB of free RAM
   - 1.4 GB of free disk space

2. Cisco Packet Tracer 8.2 (32 bit):
   - Computer with one of the following operating systems: Microsoft Windows 8.1, 10, 11 (32bit)
   - x86 compatible CPU
   - 2GB of free RAM
   - 1.4 GB of free disk space

- For CCNA 7.0.2, Cisco Packet Tracer 8.2 64-bit is the minimum version for new activities and new PTSA to work properly
- Cisco Packet Tracer requires authentication with your email and password when you first use it and for each new OS login session (See footnote 1 below)
- For more information read the FAQ and view Tutorials

Windows Desktop Version 8.2.1 English
64 Bit Download 32 Bit Download

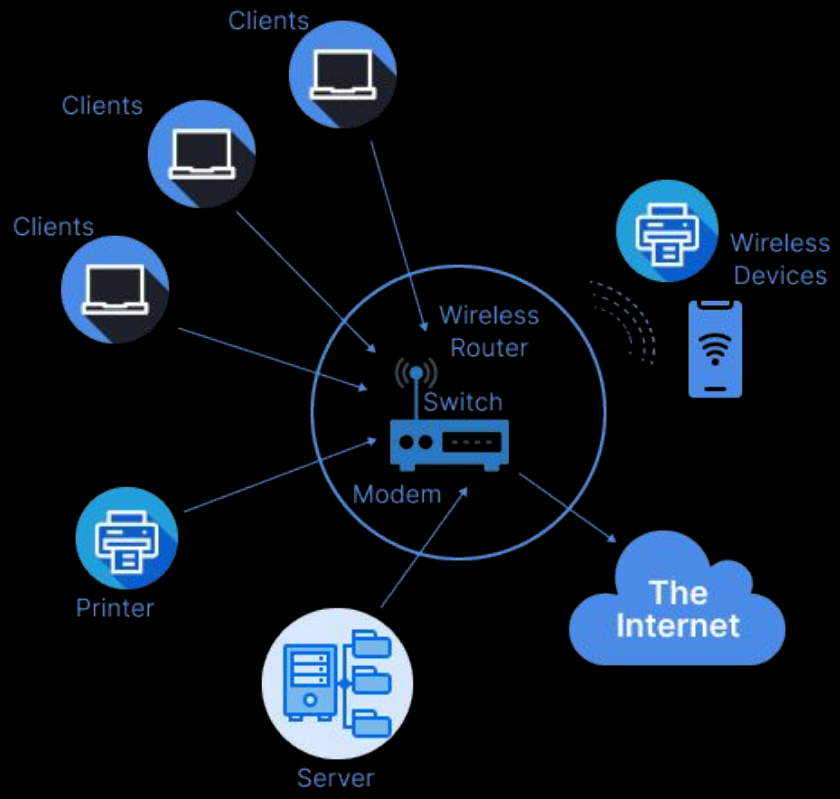
Ubuntu Desktop Version 8.2.1 English
64 Bit Download

macOS Version 8.2.1 English
64 bit Download

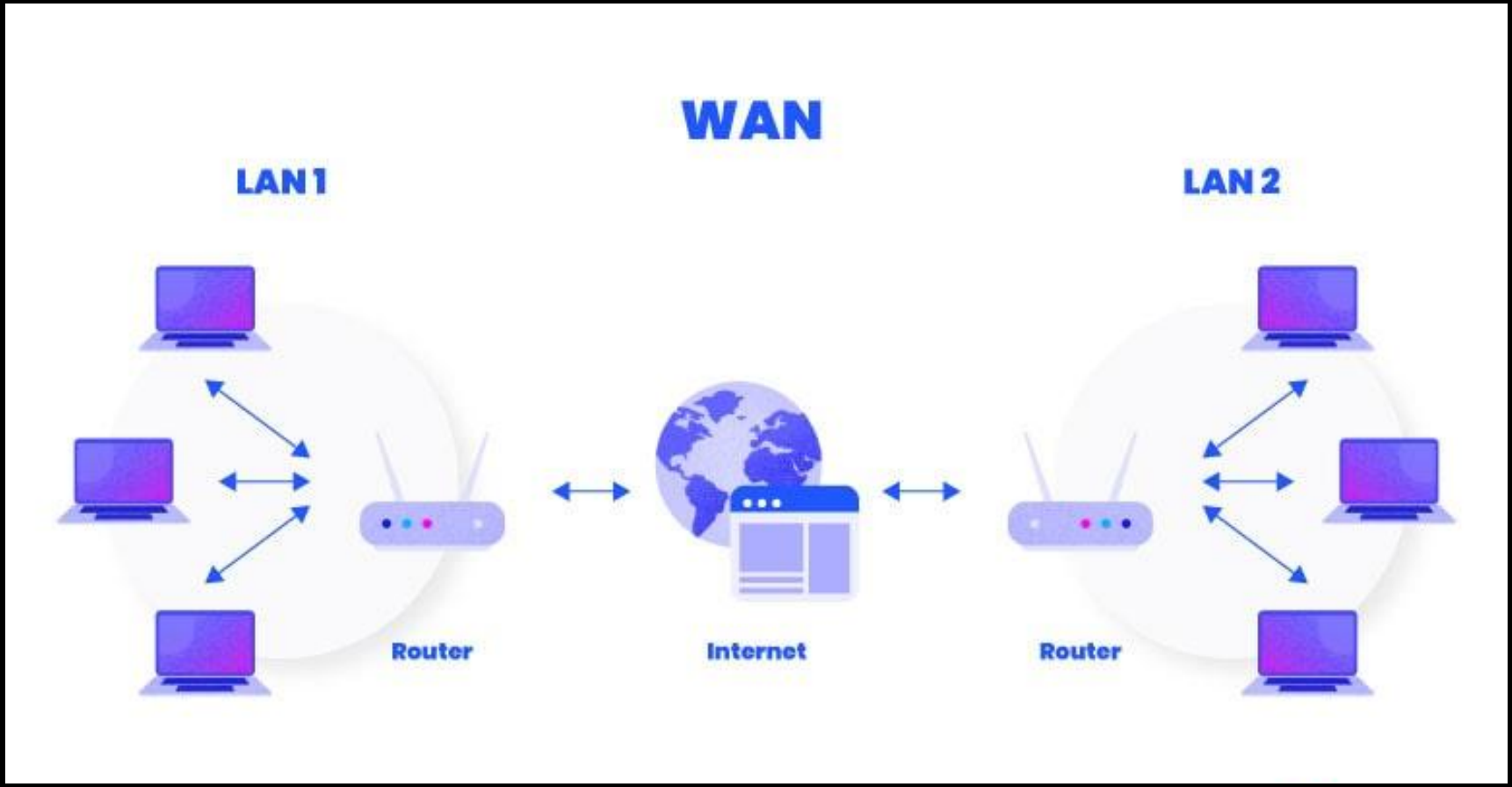
WHAT IS COMPUTER NETWORKING?

~~PROFESSIONAL~~ COMPUTER NETWORKING

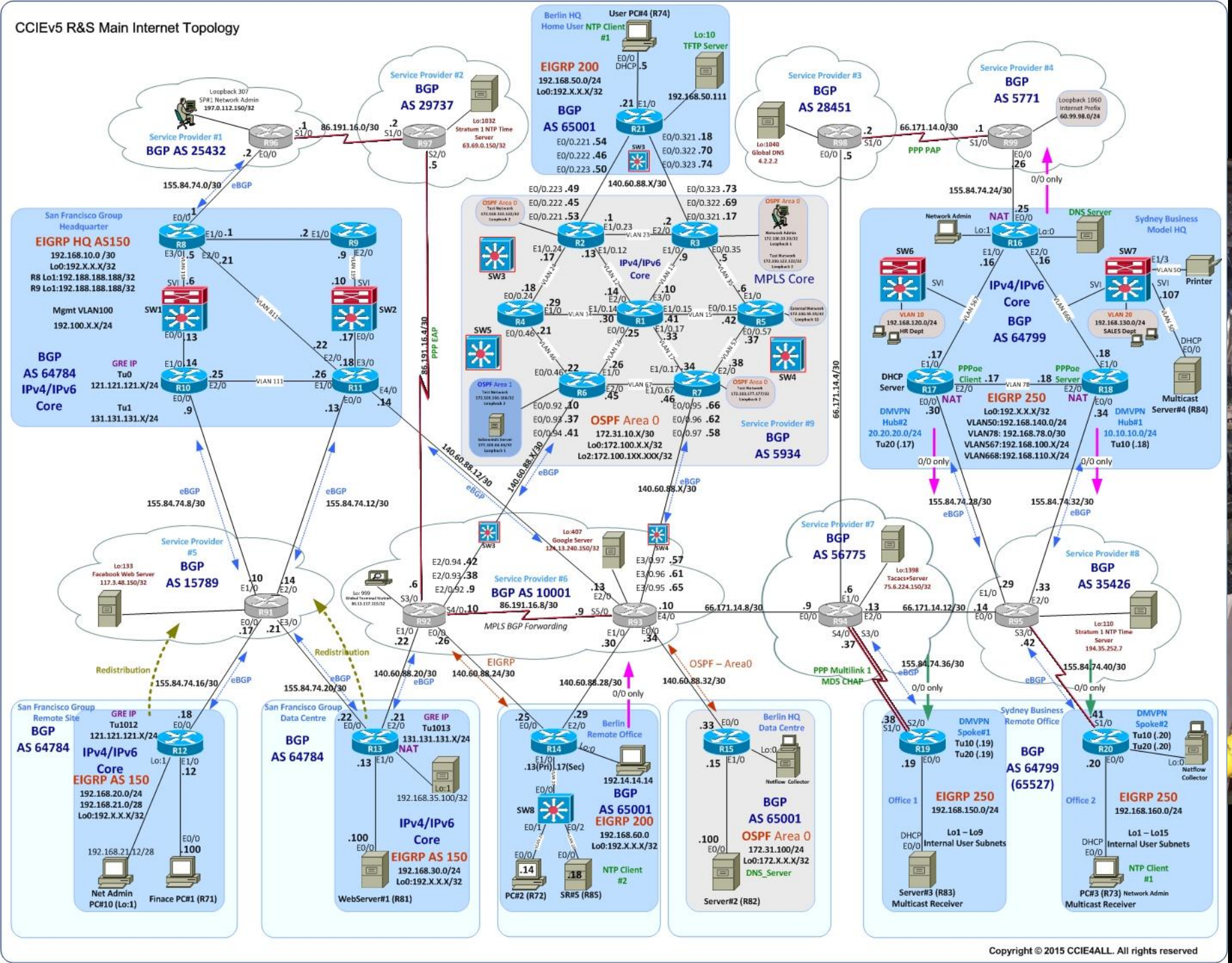
- CISCO REFERS TO COMPUTER NETWORKING AS:
  - CONNECTED COMPUTING DEVICES (SUCH AS LAPTOPS, DESKTOPS, SERVERS, SMARTPHONES, AND TABLETS) AND AN EVER-EXPANDING ARRAY OF IOT DEVICES (SUCH AS CAMERAS, DOOR LOCKS, DOORBELLS, REFRIGERATORS, AUDIO/VISUAL SYSTEMS, THERMOSTATS, AND VARIOUS SENSORS) THAT COMMUNICATE WITH ONE ANOTHER
- COMPUTER NETWORKS GREATLY VARY IN TERMS OF THEIR COMPLEXITY
  - LOCAL-AREA NETWORK (LAN) - HOME/SMALL OFFICE
  - WIDE-AREA NETWORK (WAN) - EXPANDS ACROSS A LARGE GEOGRAPHICAL AREA AND CONNECTS LANS
  - ENTERPRISE NETWORKS - NETWORKS BUILT SPECIFICALLY FOR FUNCTIONALITY IN ONE COMPANY - MAY COMBINE LANS AND WANS
  - SERVICE-PROVIDER NETWORK - NETWORKS CONTROLLED BY AN ISP



LAN VERSUS WAN



CCIEv5 R&S Main Internet Topology

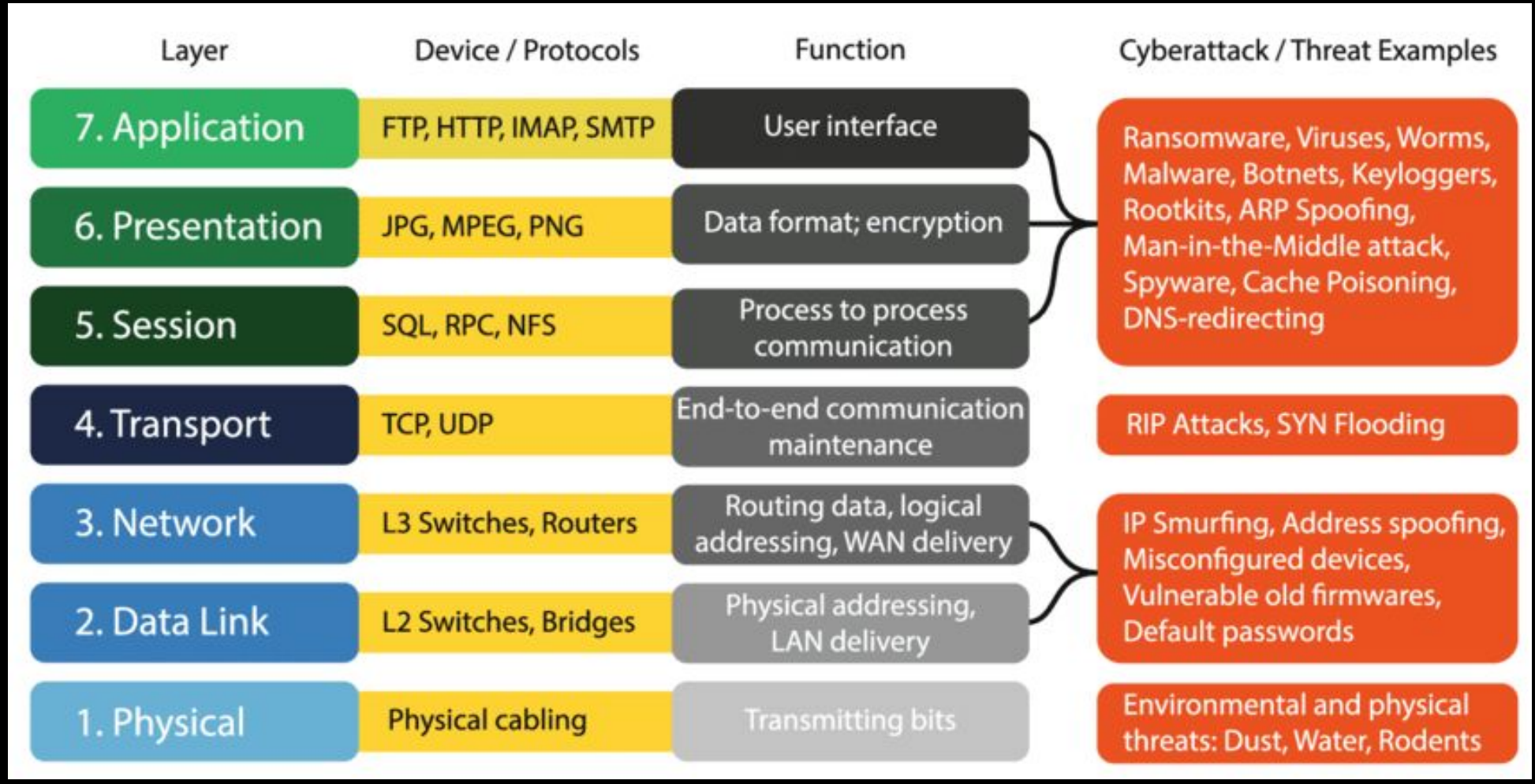


WHY SHOULD YOU LEARN COMPUTER NETWORKING?

BENEFITS OF COMPUTER NETWORKING

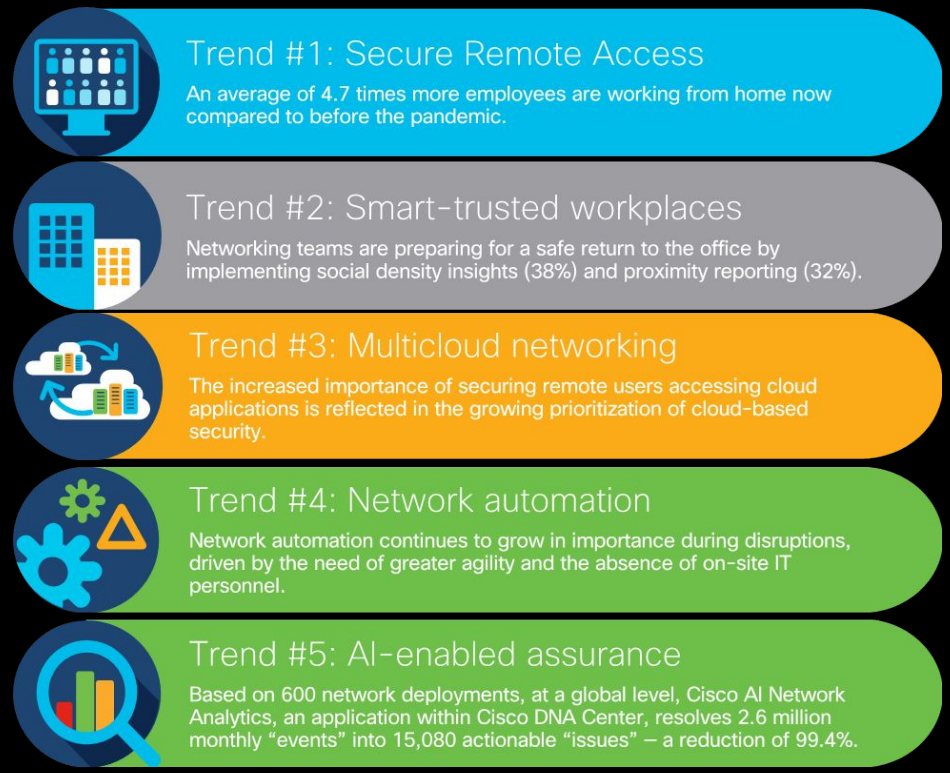
- COMPUTER NETWORKING IS OFTEN TAUGHT THROUGH THE LENS OF THE OSI MODEL
  - CONSISTS OF 7-LAYERS AND PROVIDES A METHOD TO VISUALIZE HOW TRAFFIC IS COMMUNICATED OVER A NETWORK (HOST TO HOST)
- WITH THE OSI MODEL YOU CAN TROUBLESHOOT ON A PER LAYER BASIS, ISOLATING THE PROBLEM TO ONE LAYER
- WE CAN LEVERAGE THIS NOTION TO FOCUS UNDERSTAND WHERE OUR THREATS ORIGINATE FROM AND HOW WE CAN WORK TO PROTECT THESE THREATS AT THAT LAYER

THREATS AND THE OSI MODEL



BENEFITS OF COMPUTER NETWORKING:

- HELPS TO CRAFT BETTER PROGRAMS - PROGRAMS YOU DEVELOP AS A SOFTWARE ENGINEER/DEVELOPER WILL OFTEN BE ON A LIVE NETWORK & YOU WANT TO ENSURE IT INTEGRATES WELL INTO THE CURRENT NETWORK INFRASTRUCTURE
- ALLOWS FOR A FLEXIBLE CAREER PATH, ALLOWING YOU TO INTEGRATE YOURSELF INTO ANY INDUSTRY
    - LIKE SWE AND CYBER SECURITY ANALYSTS, COMPUTER NETWORKING IS NEEDED EVERYWHERE
- FIND YOURSELF DEALING WITH CUTTING-EDGE TECHNOLOGY THAT DIRECTLY IMPACTS DAILY USAGE OF THE INTERNET (5G, WI-FI 6, AI AND ML, SD-WAN)



WHAT ARE THE FUNDAMENTALS OF COMPUTER NETWORKING?

WHAT DO WE NEED TO BUILD OUT OUR NETWORK?

- PHYSICAL COMPONENTS
  - HOSTS - PCS, LAPTOPS, PRINTERS, SERVERS, MOBILE PHONES, ETC.
  - SWITCH - "THE BUILDING BLOCKS FOR ANY NETWORK"
    - CONNECT MULTIPLE DEVICES ON A NETWORK, ALLOWING THESE DEVICES TO SHARE INFORMATION AND TALK TO EACH OTHER
  - ROUTER - PROVIDES THE BEST ROUTE FOR TRAFFIC TO TAKE AS IT TRAVERSES FROM ONE NETWORK TO ANOTHER
  - CABLES - ETHERNET, FIBER OPTIC, ETC.
    - WIRELESS ALSO FALLS INTO THE CATEGORY OF A MEDIUM TO TRANSFER DATA
- LOGICAL COMPONENTS
  - CONFIGURATION SETTINGS - JUST LIKE YOUR PHONE OR COMPUTER, SWITCHES, AND ROUTERS HAVE AN OS THAT ALLOWS US TO CONFIGURE THEIR SETTINGS
  - IP ADDRESSING - SIMILAR TO OUR HOME ADDRESSES, PROVIDING A WAY TO DENOTE A COMPUTER ON A NETWORK
    - DEFAULT GATEWAY - "THE FRONT DOOR OF THE NETWORK"; THE DEFAULT ROUTE TAKEN WHEN NO ROUTING IS CONFIGURED

LIVE DEMO

LAYING OUT THE SCENARIO

- THE METS AND YANKEES HAVE THEIR OWN LOCAL-AREA NETWORKS AND WANT TO COMMUNICATE WITH EACH OTHER
- THE METS OPERATE ON THE SUBNET 192.168.1.0/24
    - THE /24 INDICATES A SUBNET MASK OF 255.255.255.0
- THE YANKEES OPERATE ON THE SUBNET 192.168.2.0/24
- THE HIGHLIGHTED PORTION OF EACH ADDRESS IS MEANT TO SIGNIFY WE ARE DEALING WITH TWO DISTINCT NETWORKS
    - THINK ABOUT LITERAL GEOGRAPHY: THE YANKEES OCCUPY THE BRONX AND THE METS OCCUPY QUEENS
- SWITCHES ALLOW METS PLAYERS/STAFF AND YANKEES PLAYERS/STAFF TO COMMUNICATE WITH EACH OTHER
- WE NEED A WAY TO JOIN THESE NETWORKS
    - WE IMPLEMENT A ROUTER TO HAVE THE TWO NETWORKS TALK TO EACH OTHER
    - THE ROUTER, LABELED AS MLB HQ, IS MANHATTAN - THE MIDDLE GROUND BETWEEN QUEENS AND THE BRONX
- WE ALSO WANT TO CONFIGURE THESE ROUTER, SWITCHES, AND HOSTS APPROPRIATELY

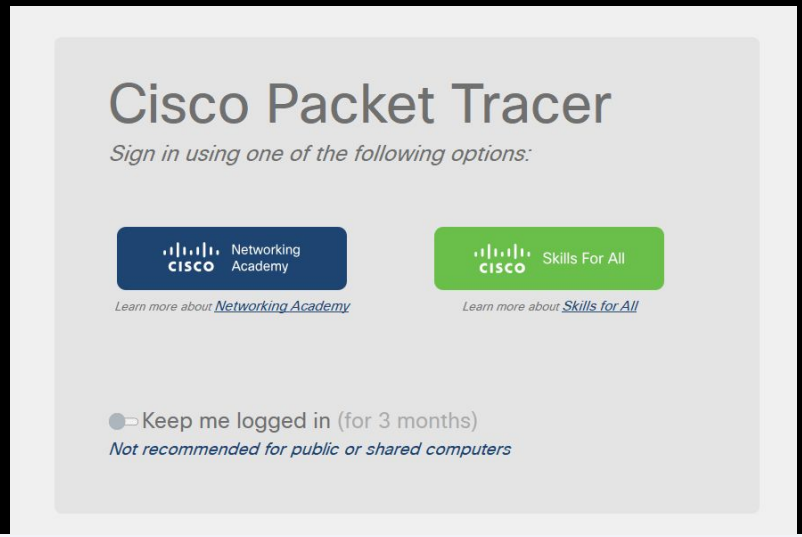
KEY NETWORK DETAILS

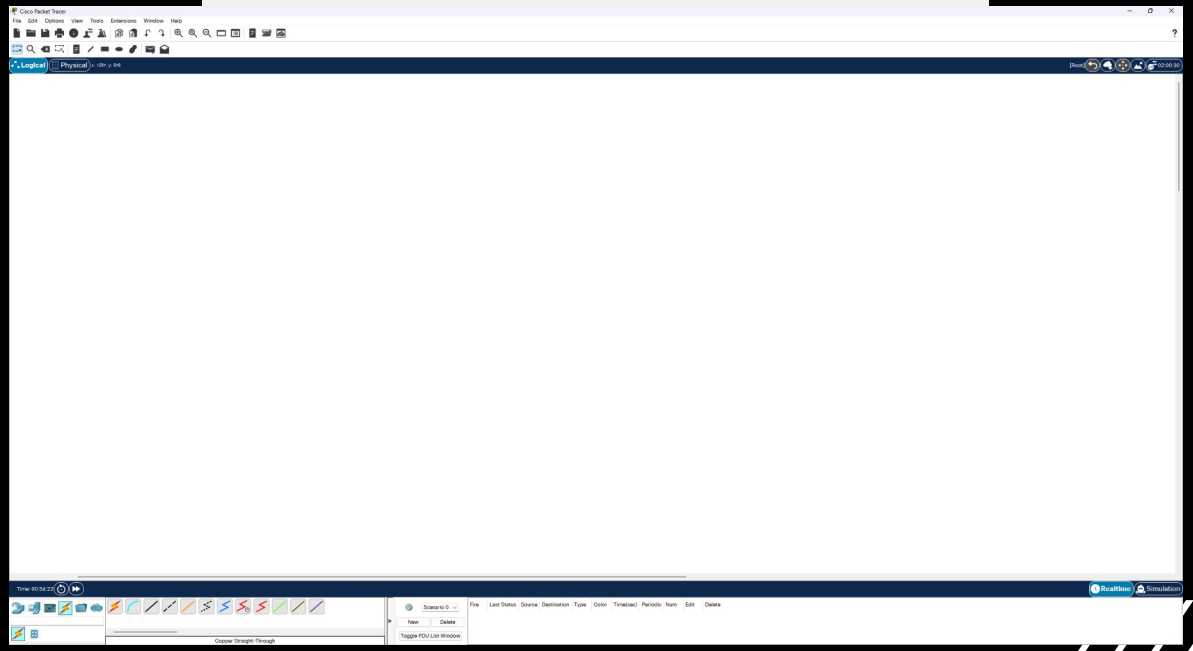
	INTERFACE LINKED TO MLBHQ-R1	NETWORK ADDRESS	IP DEFAULT GATEWAY AND SUBNET MASK
NYM-SW1	G0/0	192.168.1.0/24	192.168.1.1 | 255.255.255.0
NYY-SW1	G0/1	192.168.2.0/24	192.168.2.1 | 255.255.255.0

	IP ADDRESS	SUBNET MASK	DEFAULT GATEWAY
SHOWALTER-PC1	192.168.1.2	255.255.255.0	192.168.1.1
LINDOR-LT1	192.168.1.3	255.255.255.0	192.168.1.1
BOONE-PC1	192.168.1.2	255.255.255.0	192.168.2.1
JUDGE-LT1	192.168.1.3	255.255.255.0	192.168.2.1

STEP 1: OPENING CISCO PACKET TRACER

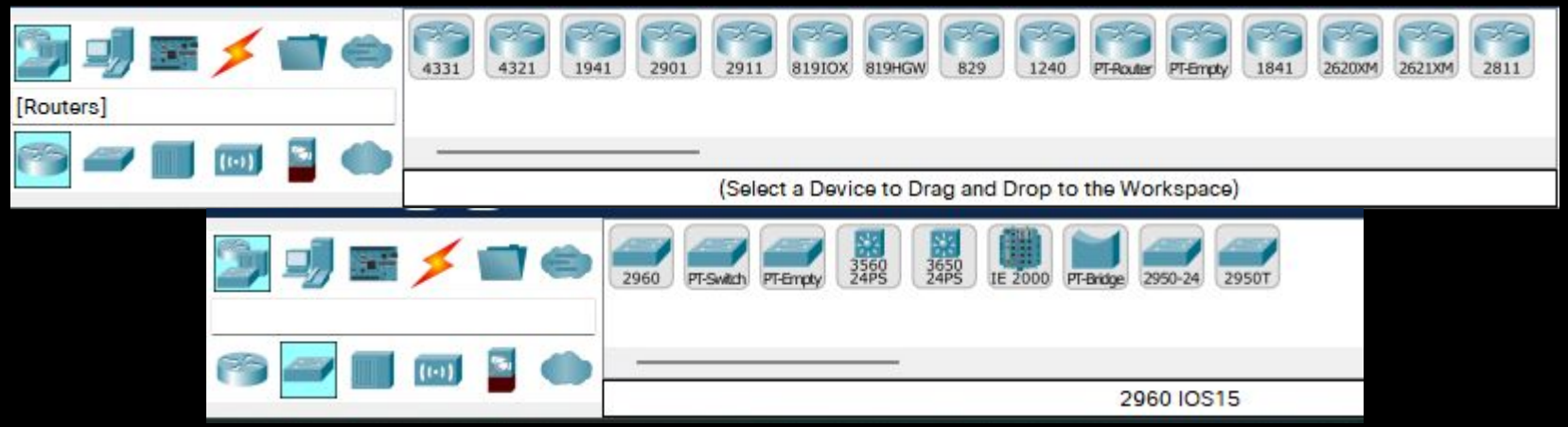
- MANY OF US MAY BE FAMILIAR WITH CISCO PACKET TRACER BECAUSE OF NET-1011 OR NET-1015
- THE APPLICATION IS A WONDERFUL WAY TO LEARN, BUILD, AND TEST NETWORKS
- ONCE YOUR OPEN THE APPLICATION, YOU WILL BE PROMPTED TO SIGN IN TO EITHER A NETWORKING ACADEMY OR SKILLS FOR ALL ACCOUNT
    - SELECT THE NETWORKING ACADEMY OPTION AND SIGN IN WITH THE SAME ACCOUNT CREDENTIALS YOU USED WHEN DOWNLOADING CISCO PACKET TRACER
- ONCE LOGGED IN, YOU WILL SEE A BLANK WORKSPACE





STEP 2: PLACING OUR PHYSICAL EQUIPMENT

- IN THE BOTTOM LEFT CORNER YOU WILL SEE A BUNCH OF ICONS THAT REPRESENT MAINLY PHYSICAL EQUIPMENT YOU CAN PLACE ONTO YOUR TOPOLOGY, BEGINNING WITH NETWORK DEVICES ON THE TOP ROW, AND DIRECTLY UNDER THAT THE DIFFERENT TYPES OF NETWORK DEVICES (ROUTERS, SWITCHES, HUBS, WIRELESS, SECURITY, AND WAN EMULATION)
- CISCO PACKET TRACER USES A DRAG AND DROP METHOD OF PLACING THIS EQUIPMENT - WE WILL BEGIN BY PLACING ONE 2911 MODEL OF A CISCO ROUTER ONTO THE WORKSPACE
- WE ARE NOW GOING TO SELECT THE SWITCHES OPTION, LOCATED DIRECTLY TO THE RIGHT OF ROUTER AND WILL DRAG AND DROP TWO 2960 MODEL SWITCHES



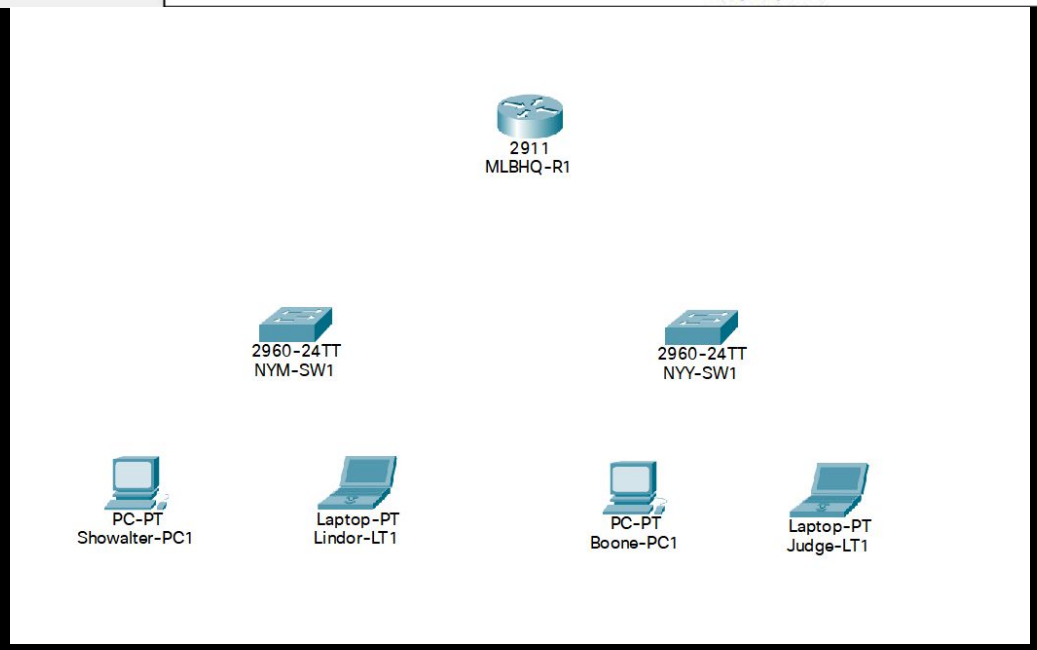
2911
MLBHQ-R1

2960-24TT
NYM-SW1

2960-24TT
NYY-SW1

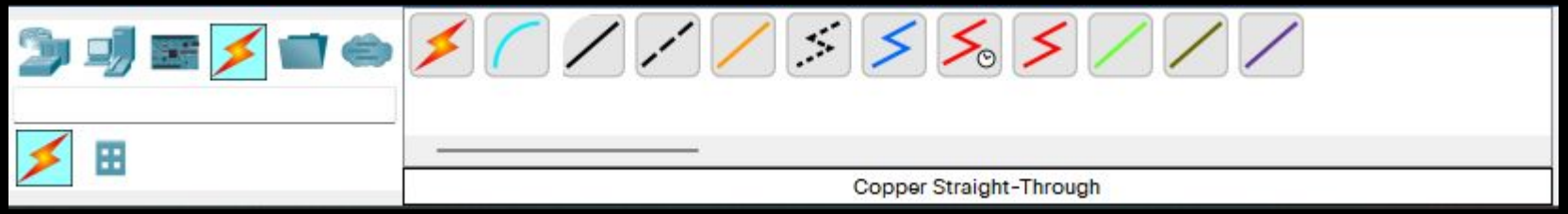
STEP 2: PLACING OUR PHYSICAL EQUIPMENT

- MOVING FORWARD TO OUR END DEVICES OR HOSTS, WE NAVIGATE RIGHT OF THE NETWORK DEVICES AND INTO END DEVICES
  - THE SUBTAB OF END DEVICES HAS PCS, LAPTOPS, SERVERS, PRINTERS, IP PHONES, ETC.
  - TO KEEP THINGS SIMPLE WE WILL DRAG AND DROP ONE PC AND ONE LAPTOP TO EACH LOCAL-AREA NETWORK



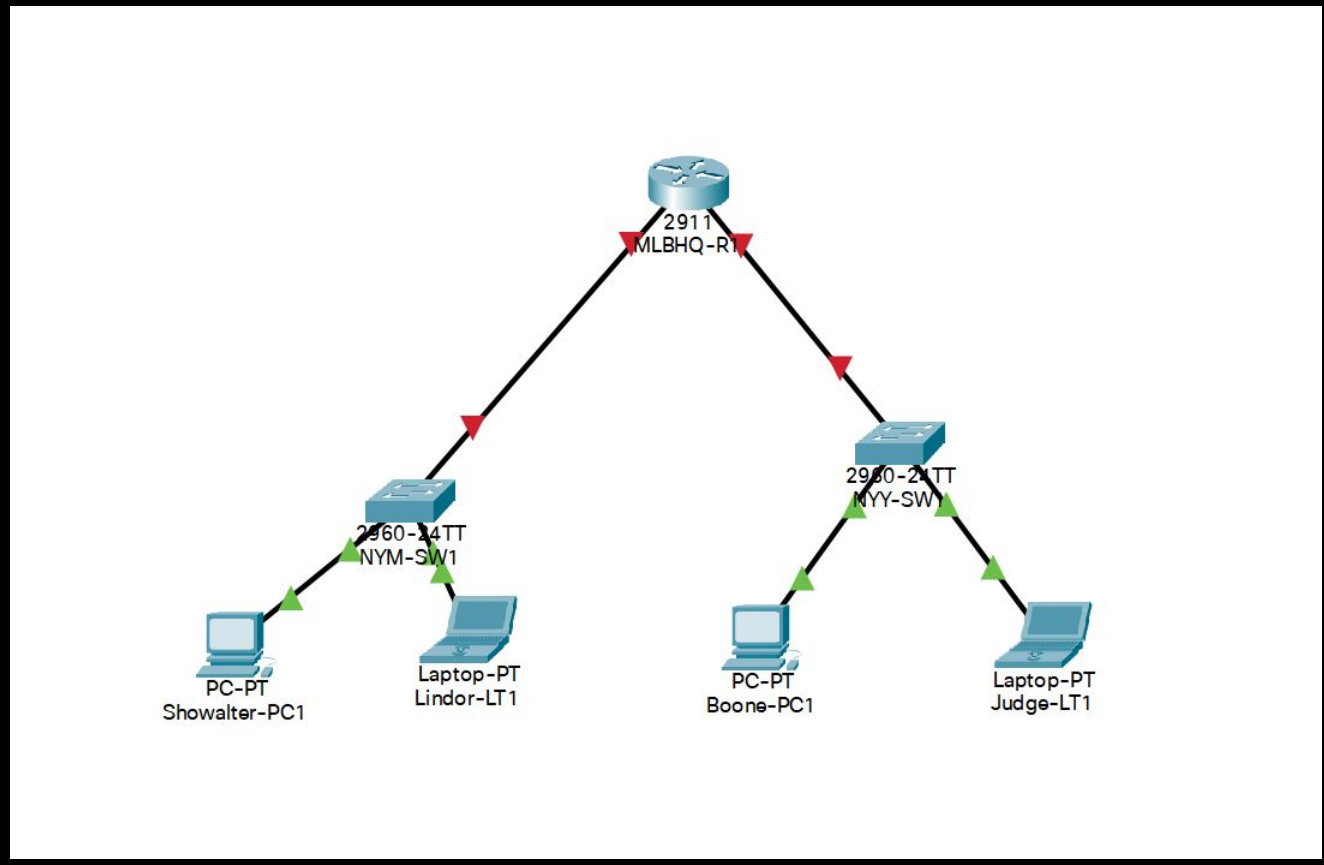
STEP 2: PLACING OUR PHYSICAL EQUIPMENT

- CABLING IS OUR FINAL STEP OF PHYSICAL EQUIPMENT
  - NAVIGATE TO THE LIGHTNING BOLT IN THE BOTTOM LEFT CORNER AND YOU WILL FIND THE DIFFERENT CABLING AVAILABLE
  - WE WILL SELECT THE STRAIGHT BLACK CABLE, WHICH IS NAMED COPPER STRAIGHT-THROUGH
- AFTER SELECTING THIS CABLE, LEFT CLICK ON YOUR ROUTER AND YOU SHOULD SEE A MENU THAT APPEARS WITH A BUNCH OF DIFFERENT PORTS/INTERFACES
  - SELECT GIGABITETHERNET 0/0
  - THEN LEFT CLICK ON THE SWITCH DESIGNATED TO ONE OF THE LANS AND SELECT GIGABITETHERNET 0/1
- REPEAT THIS PROCESS FOR THE SECOND SWITCH ON THE OTHER LAN, BUT SELECT GIGABITETHERNET 0/1 ON THE ROUTER AND GIGABITETHERNET 0/1 ON THE SWITCH



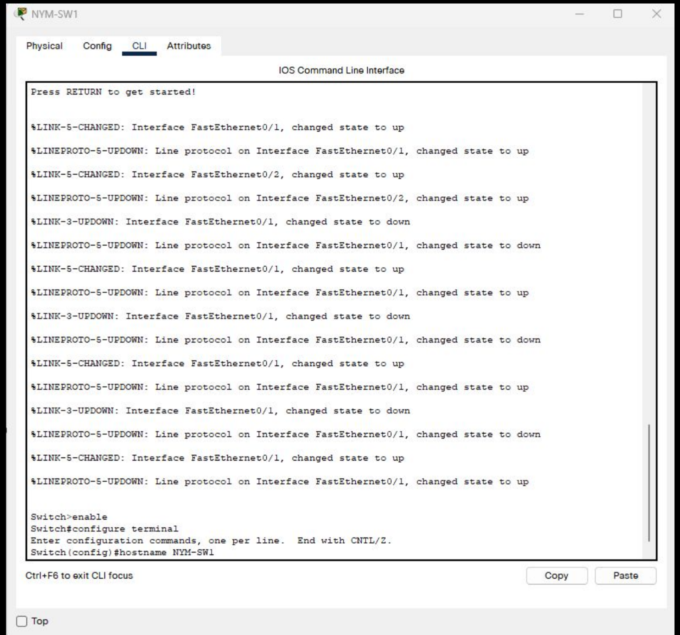
STEP 2: PLACING OUR PHYSICAL EQUIPMENT

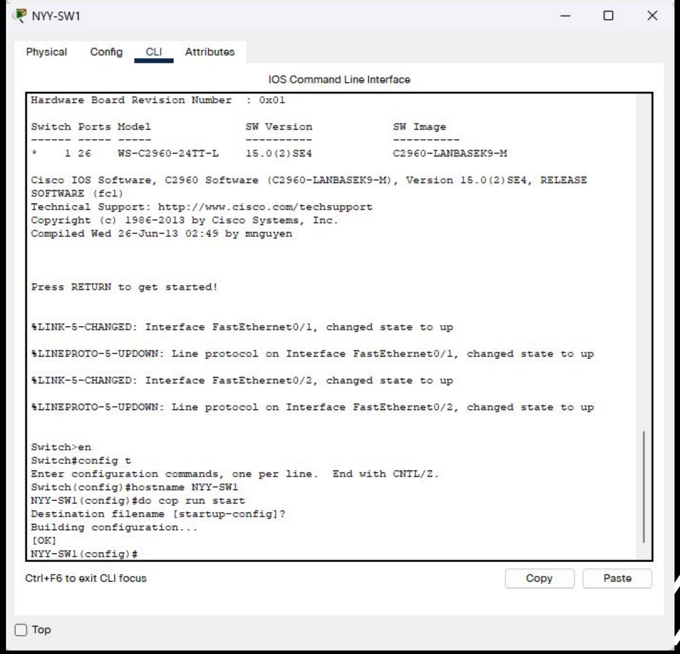
- WE CONTINUE BY HOOKING UP OUR HOSTS TO OUR SWITCH
  - TAKE THE COPPER STRAIGHT-THROUGH CABLE, CLICK EITHER THE LAPTOP OR PC AND SELECT FASTETHERNET0, AND THEN CLICK THE CORRESPONDING SWITCH AND SELECT FASTETHERNET 0/1 OR FASTETHERNET 0/2 (TRY TO GO IN ORDER TO PORT 0/1 THEN PORT 0/2)



STEP 3: CONFIGURATIONS

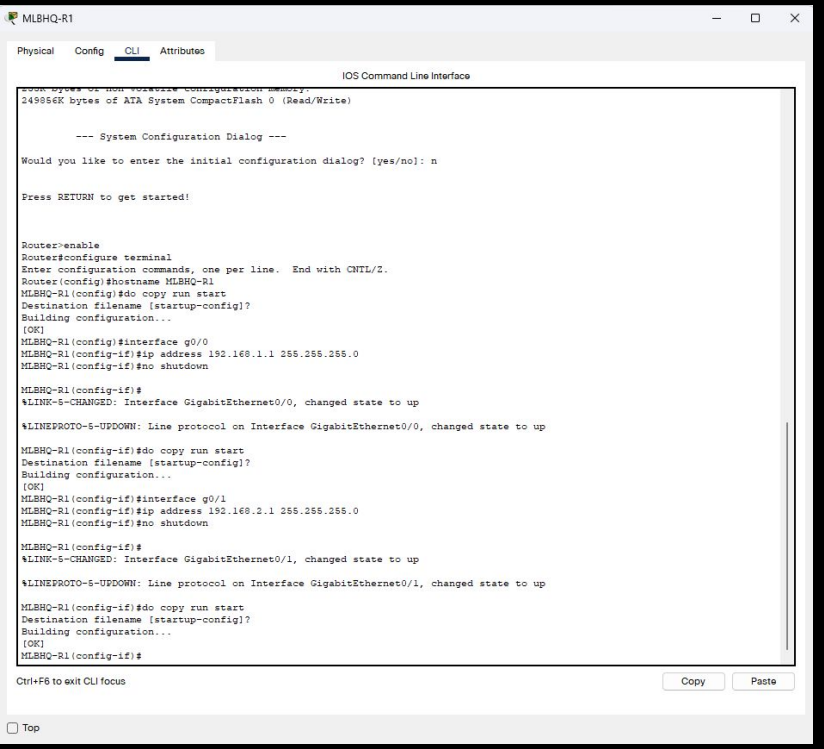
- AS MENTIONED EARLIER, WE WANT TO CONFIGURE A SWITCH APPROPRIATELY
    - WE BEGIN BY CHANGING ITS HOSTNAME FROM THE DEFAULT
- TO CONFIGURE THIS CHANGE, CLICK ON ONE OF THE SWITCHES AND SELECT THE CLI TAB
- YOU WILL NOTICE THE INTERFACE APPEAR AS SWITCH>
- AT THE PROMPT ENTER THE FOLLOWING TWO COMMANDS, ONE AFTER THE OTHER:
    - ENABLE
    - CONFIGURE TERMINAL
- YOU WILL SEE SWITCH(CONFIG)#, WHICH REPRESENTS GLOBAL CONFIGURATION MODE:
    - HERE WE CAN CHANGE THE DEFAULT NAME OF THE SWITCH TO REFLECT THE SWITCH WE ARE WORKING ON THROUGH USING THE COMMAND HOSTNAME *[NAME]*
- TO SAVE THIS CHANGE, WE CAN EXECUTE THE FOLLOWING COMMAND:
    - DO COPY RUN START → HIT ENTER TO CONFIRM
- WE WILL REPEAT THIS PROCESS FOR THE SWITCH ON THE OTHER END OF THE ROUTER





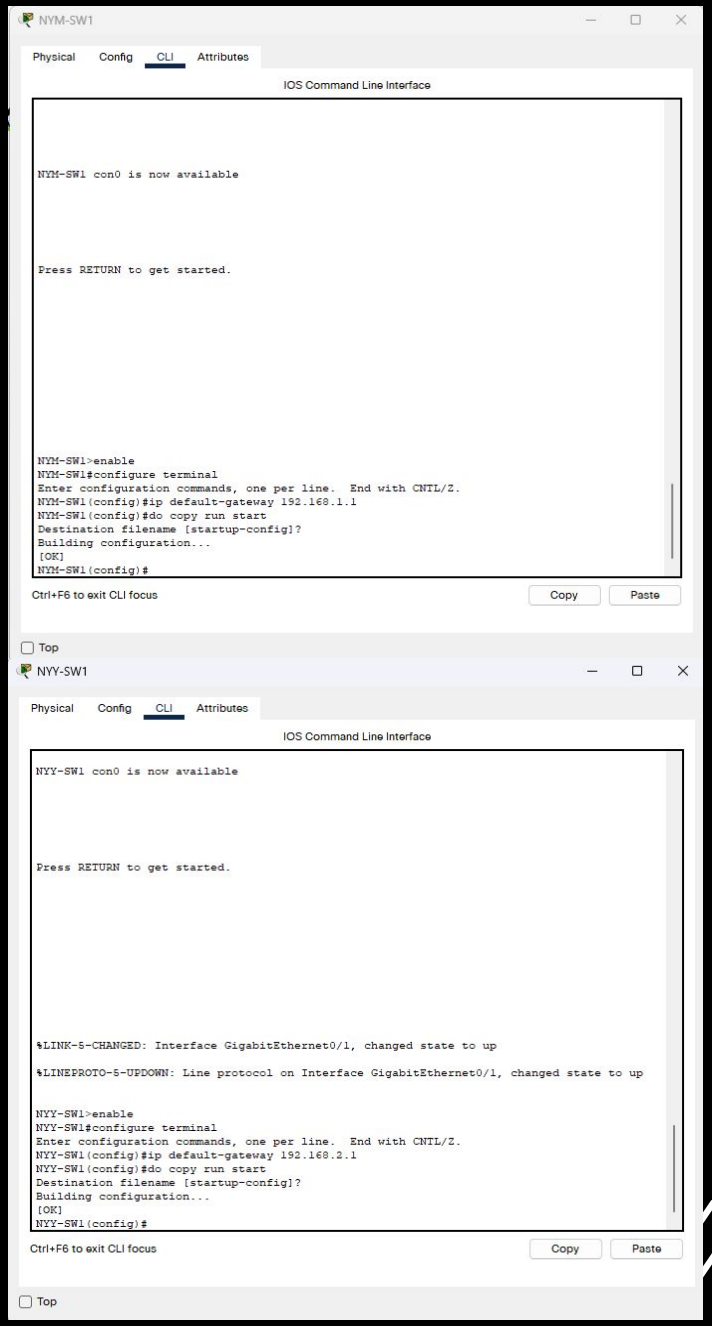
STEP 3: CONFIGURATIONS

- WE FOLLOW A SIMILAR PROCESS FOR THE ROUTER BY CLICKING ON THE DEVICE, AND SELECTING THE CLI TAB
  - IT WILL ASK “WOULD YOU LIKE TO ENTER…” - TYPE N AND HIT ENTER TWICE
- YOU WILL SEE THE DEFAULT NAME OF ROUTER, WHICH WE WILL CHANGE BY ONCE AGAIN USING THE FOLLOWING SERIES OF COMMANDS
  - ENABLE
  - CONFIGURE TERMINAL
  - HOSTNAME *[NAME]*
  - DO COPY RUN START ⟶ HIT ENTER TO CONFIRM
- WE ALSO WANT TO ASSIGN OUR PORTS WITH IP ADDRESS
  - TO DO SO WE WILL ENTER INTERFACE CONFIGURATION MODE BY EITHER ENTERING THE COMMAND INTERFACE G0/0 OR INTERFACE G0/1
  - YOU WILL THEN ENTER THE COMMAND IP ADDRESS *[DEFAULT GATEWAY] [SUBNET MASK]*
    - YOU MUST ENSURE THE INFORMATION YOU ENTER HERE IS CONSISTENT WITH THE INTERFACE POINTING TOWARDS THE LAN YOU ARE CONFIGURING
  - IT IS THEN VERY CRITICAL THAT YOU ENTER THE COMMAND NO SHUTDOWN
  - REPEAT THIS PROCESS FOR THE OTHER INTERFACE THAT YOU HAVE NOT YET CONFIGURED
  - YOU CAN THEN ONCE AGAIN DO A DO COPY RUN START ⟶ HIT ENTER TO CONFIRM



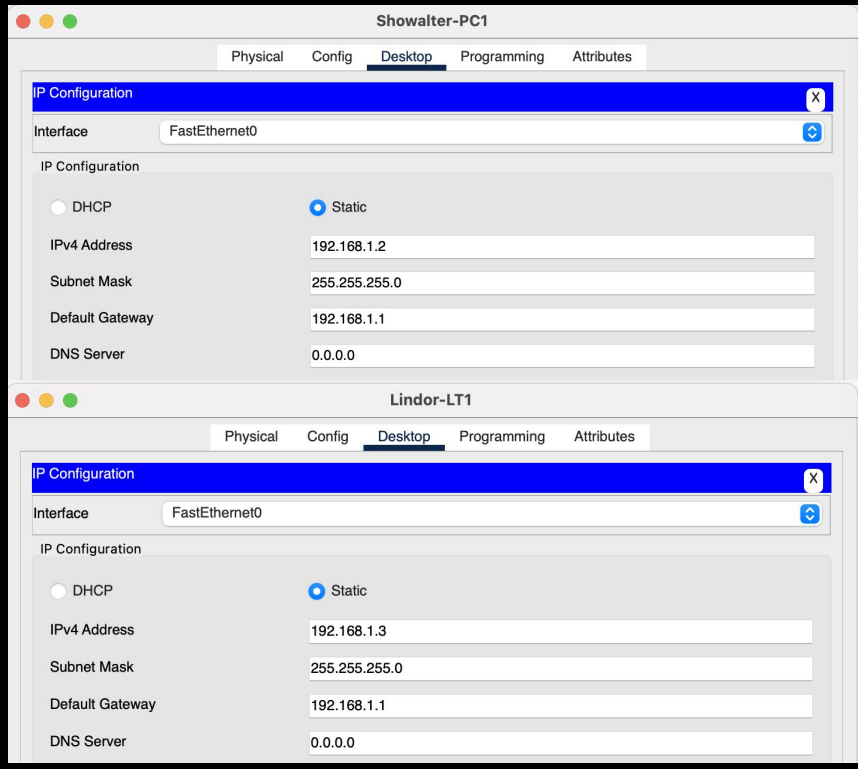
STEP 3: CONFIGURATIONS

- GOING BACK TO OUR SWITCHES, WE MUST NOW INDICATE OUR DEFAULT GATEWAY, WHICH WE SETUP WITH OUR CHANGES TO THE ROUTER IN THE LAST SLIDE
- THIS PROCESS IS RELATIVELY STRAIGHT FORWARD AND REQUIRES ONE COMMAND:
  - IP DEFAULT-GATEWAY *[DEFAULT GATEWAY]*
    - IF YOU GO BACK TO YOUR SWITCH AND DO NOT SEE (CONFIG)#, RATHER SEE >, USE THE ENABLE AND CONFIGURE TERMINAL COMMANDS
  - THE DEFAULT GATEWAY WILL BE DIFFERENT BY ROUTER AS IT DEPENDS ON THE IP ADDRESS OF THE INTERFACE POINTING TO THE LAN FROM THE ROUTER
- YOU CAN CAP THIS OFF BY DOING DO COPY RUN START ⟶ HIT ENTER TO CONFIRM



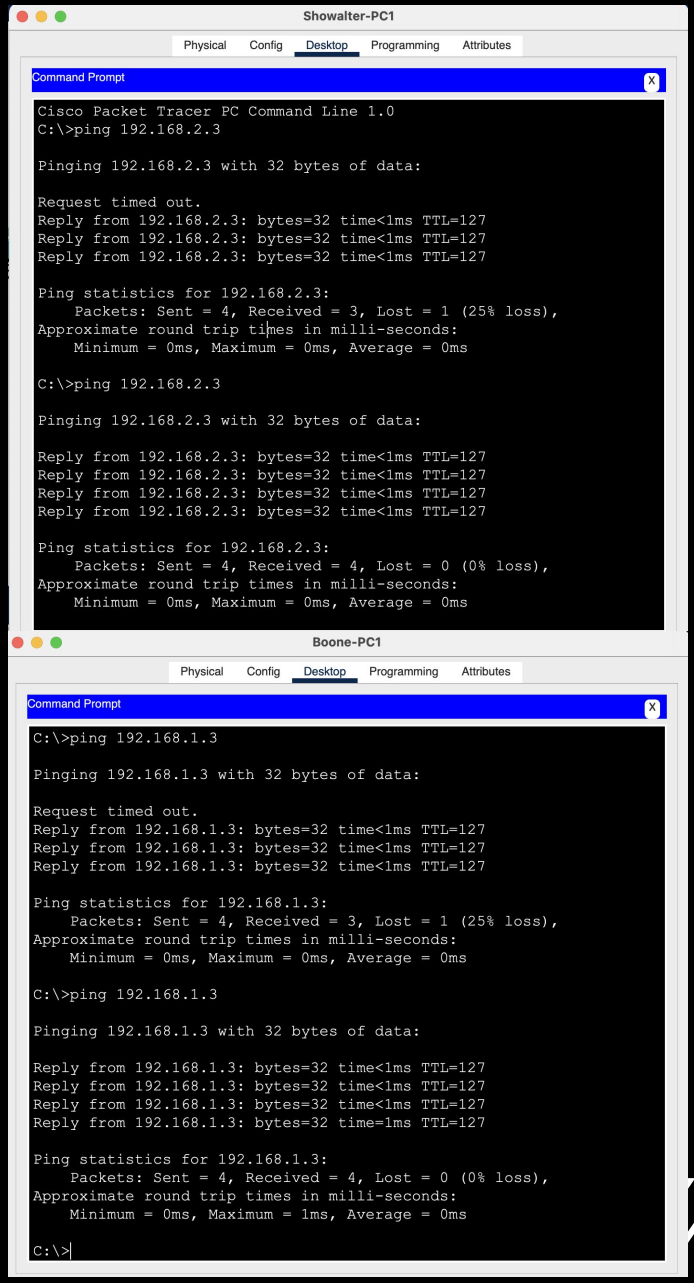
STEP 3: CONFIGURATIONS

- THE FINAL STEP IS TO ASSIGN OUR END DEVICES WITH IP ADDRESSING
  - THIS IS USUALLY DONE DYNAMICALLY IN ENTERPRISE ENVIRONMENTS, UTILIZING A DHCP SERVER TO PROVIDE IP ADDRESSES TO END POINTS
- WE WILL STATICALLY ASSIGN IP ADDRESSING TO EACH OF THE FOUR END DEVICES
- CLICK ON THE APPROPRIATE END DEVICE > DESKTOP TAB > IP CONFIGURATION > SET THE IPV4 ADDRESS TO THE ONE PROVIDED VIA THE KEY NETWORK DETAILS TABLE
- WHEN YOU TYPE IN THE IPV4 ADDRESS, THE SUBNET MASK SHOULD AUTOFILL TO 255.255.255.0
- IN THE DEFAULT GATEWAY PORTION, TYPE IN THE DEFAULT GATEWAY THAT ALIGNS WITH THE DEFAULT GATEWAY OF THAT LAN
- SEE PICTURE FOR A SAMPLE CONFIGURATION



STEP 4: TESTING THE NETWORK

- WITH ALL OF OUR CONFIGURATIONS SET, WE HAVE BUILT OUT OUR NETWORK!
- HOWEVER, WE WANT TO TEST CONNECTIVITY, SO WE WILL SEND A FEW PINGS TO ENSURE DEVICES CAN COMMUNICATE WITH EACH OTHER
- WE WILL TAKE THE SHOWALTER-PC1 AND NAVIGATE TO THE DESKTOP TAB, AND SELECT THE COMMAND PROMPT TILE
  - ISSUE THE COMMAND PING 192.168.2.3 TO TEST CONNECTIVITY TO JUDGE-LT1; WE WANT TO SEE 4 SUCCESSFUL PINGS (SEE IMAGE)
- WE WILL DO THIS PROCESS ON AN END DEVICE ON THE YANKEES LAN, HAVING BOONE-PC1 SPEAK TO LINDOR-LT1
  - ISSUE THE COMMAND PING 192.168.1.3 TO TEST CONNECTIVITY



LIVE CHALLENGE TIME

LAYING OUT THE SCENARIO + KEY NETWORK DETAILS

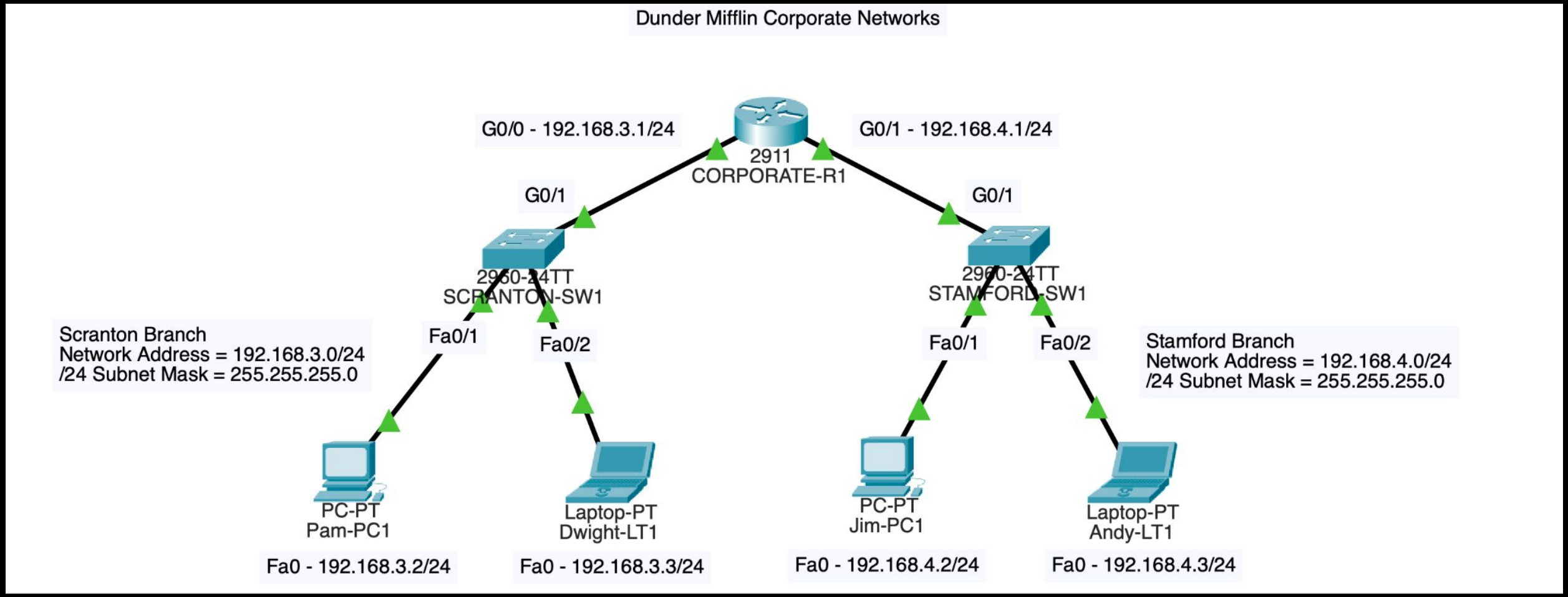
DUNDER MIFFLIN, INC. PAPER COMPANY

- DUNDER MIFFLIN IS PREPARING FOR MEMBERS OF THEIR STAMFORD BRANCH TO RELOCATE TO THEIR SCRANTON BRANCH
  - BEFORE THE MOVE, THEY WANT EACH BRANCH TO BEGIN COMMUNICATIONS WITH EACH OTHER
- THE SCRANTON BRANCH OPERATES ON THE SUBNET 192.168.3.0/24
- THE STAMFORD BRANCH OPERATES ON THE SUBNET 192.168.4.0/24
- CONFIGURE A NETWORK THAT ALLOWS PAM-PC1 TO PING JIM-PC1 AND ANDY-LT1 TO PING DWIGHT-LT1

	INTERFACE LINKED TO CORPORATE-R1	NETWORK ADDRESS	IP DEFAULT GATEWAY AND SUBNET MASK
SCRANTON-SW1	G0/0	192.168.3.0/24	192.168.3.1 | 255.255.255.0
STAMFORD-SW1	G0/1	192.168.4.0/24	192.168.4.1 | 255.255.255.0

	IP ADDRESS	SUBNET MASK	DEFAULT GATEWAY
PAM-PC1	192.168.3.2	255.255.255.0	192.168.3.1
DWIGHT-LT1	192.168.3.3	255.255.255.0	192.168.3.1
JIM-PC1	192.168.4.2	255.255.255.0	192.168.4.1
ANDY-LT1	192.168.4.3	255.255.255.0	192.168.4.1

SAMPLE TOPOLOGY



COMMAND CHEAT SHEET

ROUTER:

- HOSTNAME *[NAME]*
- INTERFACE *[INTERFACE]*
  - INTERFACE IS EITHER G0/0 OR G0/1
- IP ADDRESS *[DEFAULT GATEWAY] [SUBNET MASK]*
- NO SHUTDOWN
- DO COPY RUN START

SWITCH:

- HOSTNAME *[NAME]*
- IP DEFAULT-GATEWAY *[DEFAULT GATEWAY]*
  - DEFAULT GATEWAY WILL BE LAN-SPECIFIC
- DO COPY RUN START

BIT.LY/SJUACM101

THANK YOU!