

Peer-to-Peer Lab

BAT-111: Building Automation Systems



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Name:

Peer-to-Peer Lab

SYNOPSIS

In order to be able to configure our controller, we need to set up a peer-to-peer network between the laptop and the controller.

OBJECTIVES

Upon completion of this activity the student will be able to:

- 1. Set appropriate network settings on laptop to communicate with the BAScontrol22.
- 2. Verify communication between laptop and controller.

PARTS AND EQUIPMENT

- Contemporary Controls BAScontrol22 or BAScontrol22S
- Ethernet cable
- Windows Laptop

REFERENCES

• Contemporary Controls BAScontrol22 User Manual

BACKGROUND

We are going to connect our laptop using the ethernet port to the ethernet port of the BAScontrol22. We need to make sure our laptop is on the same network as our controller. When we are saying the same network, we are not only saying physically connected but they must have the ability to communicate together based upon the network settings.

1.1 - IP address

To send information to a particular device (computer, controller, etc.) on a network there must be a way to uniquely identify that device. An IP address is a unique address for a device on a local network. There are two main IP schemes which are IPv4 and IPv6.

IPv4

This was the address scheming, which was created in 1978, and it was made up of 32 binary (0 or 1) digits. 32 binary digits allows $2^{32} = 4,294,967,296$ addresses which is over 4 billion addresses.

For a human, reading 32 binary numbers would be tedious and prone to errors in transposing. We use the dotted decimal format as a way to express IPv4 addresses. The dotted decimal format

Wake Tech BAT Lab	2 of 12	Last updated:
https://www.waketech.edu/progr	rams-courses/credit/building-automation	6/6/2023

is expressed as four numbers separated by a decimal. The numbers between the decimals are referred to as an octet and can be 0 - 255.

For example, the BAScontrol22 has a default IP address assigned out of the box:

- Binary: 11000000101010000101110001000100
- Dotted decimal: 192.168.92.68

It is a lot simpler to use the dotted-decimal format for an IP address.

IPv6

Even with over 4 billion IPv4 addresses, the world started running out of IP addresses. As the internet grew, there was some design issues which were also addressed in IPv6.

IPv6 addresses are 128 binary digits are therefore there are $2^{128} = 3.4 \times 10^{38}$ unique addresses which is approximately 340 trillion trillion IP addresses.

We are going to use IPv4 addressing with our controllers.

1.2 - IP address assignment

An IP address can be statically assigned, or it can get it's IP address from the network.

Static IP address

The device has its IP address set as part of its configuration. A static IP address is easy to find a device; however, it just starts using this address regardless of any conflicts with other devices using the same IP address.

Dynamic IP address

When a device comes onto the network using dynamic addressing. It will request an IP address on the network from a DHCP server. The DHCP server will lease out an IP address for a period of time to that device. The DHCP server will recycle usage of the addresses in its pool.

1.3 - Peer-to-Peer network

A peer-to-peer (P2P) network exists when multiple devices (laptops, controllers, sensors, etc.) exist and share resources without a server.

PROCEDURES

Part 1: Laptop network settings

We need to configure out laptop to be in the same local network as the BAScontrol22.

The default BAScontrol22 network address:

- BAScontrol22 controller
 - IP address: 192.168.92.68
 - Subnet mask: 255.255.255.0

The subnet mask must match for all our devices on the same local network.

What is the default IP address of the BAScontrol22?____

More than likely our laptop is set up to automatically get it's IP address dynamically from the network using DHCP. We need to set our laptop's IP address statically so that it is on the same local network as our controller. The IP address will be different for each device, but it will have the same subnet mask.

Our simple P2P network for the lab is just going to be a laptop and a controller connected via one ethernet cable without any other devices.

1.1 - IP address

Since this is a very simple P2P network, we just need to choose an IP address for our laptop, that does not conflict with our controller.

We are going to choose the following settings for our laptop:

- Laptop
 - IP address: 192.168.92.20
 - Subnet mask: 255.255.255.0
 - Default gateway: 192.168.92.1

The IP address for our laptop does not have to be 192.168.92.20. According to the subnet mask, the first three octets must be the same, however, the last octet can be between 0 and 255. We should not use 0, 1, & 255 due to networking and we should not use 68 as that would set the IP address for the laptop to the same as the controller and that would not work.

What are you going to change your laptop's IP address to?_____

1.2 - Change laptop IP address

We are going to change our IP address via the Network Connections settings.

Open Windows Network Connections

🖅 Run		×
	Type the name of a program, folder, document, or Internet resource, and Windows will open it for you.	
<u>O</u> pen:	ncpa.cpl	×.
	OK Cancel <u>B</u> rowse	•

Open a run prompt by typing Window-R. In the Open command, type ncpa.cpl and click "Ok". This will bring up the Network Connections. There may be only one network connections listed or many. We want to change the IPv4 address of the ethernet connection.



Open Properties of the ethernet adaptor

Look through all the connections and make sure you are going to change the correct ethernet connection for your ethernet port. The ethernet connection will not necessarily look exactly like the screen shot above.

You can exclude some of the network connections that are obviously not ethernet by looking at the name and description.

Some of the connections which can be **excluded** are:

- Wi-Fi
- Bluetooth
- VPN
- Virtual

Right-click the ethernet network connection and select "Properties"

Open IPv4 properties

Properties	×					
Networking Sharing						
Connect using:						
Intel(R) Ethemet Connection (6) I219-LM						
Configure						
This connection uses the following items:						
Client for Microsoft Networks	^					
File and Printer Sharing for Microsoft Networks						
🗹 🏪 QoS Packet Scheduler						
Internet Protocol Version 4 (TCP/IPv4)						
Microsoft Network Adapter Multiplexor Protocol						
Microsoft LLDP Protocol Driver						
Internet Protocol Version 6 (TCP/IPv6)						
< >						
Install Uninstall Properties						
Description						
Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.						
OK Cano	el					

Select "Internet Protocol Version 4 (TCP/IPv4)" and click the "Properties" button.

Peer-to-Peer Lab

BAT-111: Building Automation Systems

Edit IPv4 properties

More than likely your laptop is set to get it's IP address dynamically using DHCP from the network. The setting "Obtain an IP address automatically" means that the laptop is configured to use DHCP to dynamically get it's IP address. This means the IP address is assigned to you from the network.

Internet P	Internet Protocol Version 4 (TCP/IPv4) Properties						
General	Alternate Configuration						
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.							
() Ob	tain an IP address automatical	У					
OUs	e the following IP address: —						
IP ad	dress:		1.				
Subn	et mask:						
Defa	ult gateway:						
() Ob	tain DNS server address auton	natically					
OUs	e the following DNS server add	resses:					
Prefe	erred DNS server:						
Alter	nate DNS server:						
Va	alidate settings upon exit			Adva	nced		
			OK		Cancel		

We need to change the IP address of our laptop to a static IP address so that it is on the same network as our controller.

- Select "Use the following IP address:"
- IP address: 192.168.92.20
- Subnet mask: 255.255.255.0
- Default gateway: 192.168.92.1

Click "OK" to close the IPv4 properties page.

Click "Close" to close the ethernet properties.

Close the Network Connections page.

Internet Protocol Version 4 (TCP/IPv4) Properties			
General			
You can get IP settings assigned autom this capability. Otherwise, you need to for the appropriate IP settings.	natically if your network supports ask your network administrator		
Obtain an IP address automatical	у		
• Use the following IP address:			
IP address:	192 . 168 . 92 . 20		
Subnet mask:	255.255.255.0		
Default gateway:	192.168.92.1		
Obtain DNS server address autom	natically		
• Use the following DNS server addr	resses:		
Preferred DNS server:			
Alternate DNS server:	• • •		
Validate settings upon exit	Advanced		
	OK Cancel		

Part 2: Verify laptop IP address

2.1 - Set up simple P2P network

We are going to physically connect one end of the ethernet cable to the laptop and the other end to our controller. Make sure the controller is powered on.

2.2 - Open a command prompt

There are several dos commands that help us identify information our laptop's network configuration.

We are going to use the dos command ipconfig to look at our ip address that we statically assigned.

Open a run command and type "cmd" and click "OK"

2.3 - ipconfig

The dos command ipconfig is used to display information about the laptop's network configuration.

From the command prompt, type "ipconfig" and click the Enter button.

	C:\WINDOWS\system32\cmd.exe	—	×
	Media State Media disconnected Connection-specific DNS Suffix . :		^
L	vireless LAN adapter Local Area Connection* 2:		
	Media State Media disconnected Connection-specific DNS Suffix . :		
	Ethernet adapter Ethernet:		
	Connection-specific DNS Suffix .: Link-local IPv6 Address : fe80::de44:483b:2dd5:455c%17 IPv4 Address : 192.168.92.20 Subnet Mask : 255.255.0 Default Gateway : 192.168.92.1		
L	Vireless LAN adapter Wi-Fi:		
	Connection-specific DNS Suffix .: waketech.edu Link-local IPv6 Address: fe80::be89:d948:4932:9246%8 IPv4 Address : 10.1.224.21 Subnet Mask : 255.255.240.0 Default Gateway : 10.1.224.1		
8	Ethernet adapter Bluetooth Network Connection:		
	Media State Media disconnected Connection-specific DNS Suffix . :		
(C:\Users\zltaylor>		~

While your output may be different, you should be able to find the configuration settings for your ethernet adapter that you set previously. You might have to scroll the window.

For the ethernet adapter:

What is the IPv4 Address?
What is the Subnet Mask?
What is the Default Gateway?
Are these entered all correct as entered?

Part 3: Check connectivity to the controller

We have verified the IP settings on our adaptor and the next is to check connectivity to our controller.

3.1 - ping

The dos command ping is a TCP/IP command used to troubleshoot connectivity.

The simplest usage of the ping is with just one parameter which is the IP address of the destination you are trying to reach. The ping command sends a request to that destination IP and then waits a short period for a response. By default, the ping command will send out 4 requests and detail the status.

We are going to see if we can ping our controller. From the dos prompt, type "ping" then followed by the IP address of the controller.

What is the default IP address of the BAScontrol22?_____

If you do not receive back a proper response, you need to diagnose the connection to the BAScontrol22.

What is the average round trip time?_____



If you did not get all 4 replies, you will need to troubleshoot your connection to the controller.

Part 4: BAScontrol22

4.1 - Browser to access the BAScontrol22

What is your laptop's IP address?_____

What is the default IP address of the BAScontrol22?_____

We are going to use a web browser to access the BAScontrol22. Open a browser window and in the address field enter the BAScontrol22's IP address.

4.2 - User authentication

<u>File Edit View History B</u> ookmarks <u>T</u> ools <u>H</u> elp		-	- r	٥	×
🧉 🔢 192.168.92.68 × +					\sim
\leftarrow \rightarrow C \textcircled{a} Q 192.168.92.68			\bigtriangledown	பி	\equiv
🚯 Blackboard 📲 Self Service 🧐 WakeTech Employee SP 🚯	Content				
	⊕ 192.168.92.68				
	This site is asking you to sign in.				
	Username				
	admin				
	Password				
	•••••				
	Sign in Cancer				

Credentials are used to make sure only authorized users are allowed access. Each user account has different permissions on what that user is allowed to do.

The BAScontrol22 has two default users:

- admin
- user

We are going to use the admin user. Use the following credentials to logon the BAScontrol22 web page.

- Username: admin
- Password: admin

4.3 - BAScontrol22

CC BAScontrol	225 ×	+			~ -			
\leftrightarrow \rightarrow C	▲ Not secure	192.168.92.68			Q 🖻 🖈	□ 😩 🗄		
		Universal Inputs	Binary Inputs	Analog Outputs	Binary Outputs			
	Universal Input 1 UI1 0.007	Universal Input 5	Binary Input 1 BI1 0	Analog Output 1 AO1 0.000	Binary Output 1 BO1 0			
	Universal Input 2 UI2 0.003	Ulio 0.009	Binary Input 2 BI2 0	Analog Output 2 AO2 0.000	Binary Output 2 BO2 0			
	Universal Input 3 UI3 0.006	Universal Input 7	Binary Input 3 BI3 0	Analog Output 3 AO3 0.000	Binary Output 3 BO3 0			
	Universal Input 4 UI4 0.007	Universal Input 8	Binary Input 4 BI4 0	Analog Output 4 AO4 0.000	Binary Output 4 BO4 0			
					Binary Output 5 BO5 0			
					Binary Output 6 BO6 0			
BAScontrol22S								
[System Config System Status Set Time Virtual Points Web Components BACnet Utility Restart Controller							
l		Convrint	Auto Refresh OFF	reserved		J		
		Fi NOTE: A GREEN	imware Revision 4.0.2 : Web Page Revision 7.0.10 label indicates that the I/O point has been placed of	on the wire sheet				
SAE BASbackup								

Once you can view the BAScontrol22 web page, you have successfully set up a peer-to-peer (P2P) network between your laptop and the BAScontrol22.

What is the firmware revision found at the bottom of the webpage?_____