



Power over Ethernet (PoE)

The Intel Galileo Board Gen2 can be powered with an Ethernet cable, which means you don't need a separate power supply. It requires that you install the Power over Ethernet (PoE) module that complies with IEEE 802.3af, which you must purchase separately.

Once you install the PoE module on Intel Galileo Gen2, all you need to do to power the board is connect the Ethernet cable that's fed by the PoE injector.

Depending on the nature of your project, it might be necessary to install the Intel Galileo board in difficult-to-access environments, such as from a rooftop. Such access can mean it's difficult to install new cables and gain access to a power supply.

In other segments, such as with industrial automation, there are many protocols used on this environment—including Profibus, ModBus, and many others—that require specific and expensive equipment to be installed on the network. However, regular LAN devices are affordable and offer data speed that's good enough to attend to the industrial environment. This provides an affordable alternative in the automation control segment.

Other criteria to be considered are mobility and flexibility. It can be important to provide easier installation options by reducing the concern about cables in general. The idea is to connect a single cable that provides data and power to your device.

With these constraints and requirements in mind, the goal is to reduce the complexity of the installation process and increase the mobility of your device around the network. To meet these concerns, a new standard was created called IEEE 802.3af.

With the IEEE 802.3af PoE, devices can operate up to 15.4W with a minimum of 44VDC and 350mA. In the real world, however, it is possible to have devices operating at 36VDC.

The first devices to use this technology were IP cameras, VoIP phones, WLAN routers, and remote POS (point of sales) systems. You can count Intel Galileo Gen2 on that list as well.

There is no software-specific discussion in this chapter; it is exclusively for Intel Galileo Gen2 boards because this board has a physical space to install the PoE modules. If you have one of the first Intel Galileo board releases, this chapter is not applicable.

Following the instructions in this chapter, your Intel Galileo Gen2 will be powered over an Ethernet cable up to 328ft using a PoE module and will operate normally.

Project Details

In order to set up Intel Galileo Gen2 to be able to receive power over Ethernet, it is necessary to install a PoE module that does not come with the board. Not everybody will use the PoE feature, so it doesn't make sense to increase the cost just to provide this feature.

You might wonder, if the USB cables provide data and power, why you would have to use the PoE technology? The answer is very simple—the USB cables are designed for short distances. They operate at a maximum of 16ft, with only 2.5W, while the PoE module can reach 328ft.

Intel Galileo Gen2 does not come with the PoE module embedded in the board but provides an area where you can solder a PoE module if you want to use the board for this purpose.

The area reserved for the PoE module is one of the factors that contributes to Intel Galileo Gen2 being a little bit bigger than its first version. Other factors that make the Intel Galileo Gen2 bigger are explained in more detail in Chapter 1.

The estimated cost is US \$38, excluding the cost of Intel Galileo Gen2 board.

Materials List

This project requires the PoE module recommended by Intel, as well as a PoE power injector, Ethernet cables, and common material for soldering. Table 10-1 list other materials you'll use.

Table 10-1. *Additional Materials*

Quantity	Components
1	PoE module IEEE 802.3af compliant with AG9120-S
1	PoE injector; recommended TP-LINK model TL-POE150S
1	Handle soldering iron
1	Ethernet CAT5 cable with connector RJ-45
N	0.6mm tin lead solder wires

The PoE injector TL-POE150S comes with CAT5 Ethernet cable, but it is generally too short (around 3ft) to be helpful.

It's very important that you use CAT5 Ethernet cables because they have four pairs of twisted cooper wires, which are needed to make the PoE work properly. You need 328ft of CAT5 cable.

Assembling the PoE Module

This project uses the module model AG9120-S, which is manufactured by Arduino and works with conventional twisted pair Ethernet cables (CAT5). It complies with the IEEE 802.3af standard.

The module has a DC/DC converter that operates between 36VDC and 57VDC and supports 15W to the port. It was initially designed to be used with the Arduino Ethernet shield, but the Intel Galileo Gen2 supports it regardless of any extra shield.

Figure 10-1 shows the front view of the AG9120-S module.

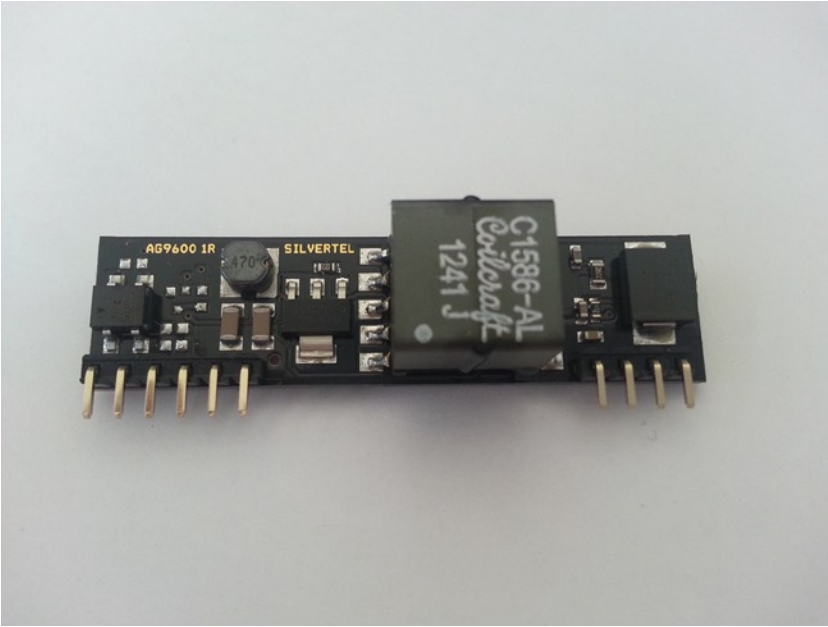


Figure 10-1. Front view of the Power over Ethernet module AG9120-S

If you flip the Intel Galileo Gen2 board over, you will see a grid of 10 holes, with four holes on the left and the other six on the right. They are indicated by the “Power Over Internet” label, as shown in Figure 10-2.

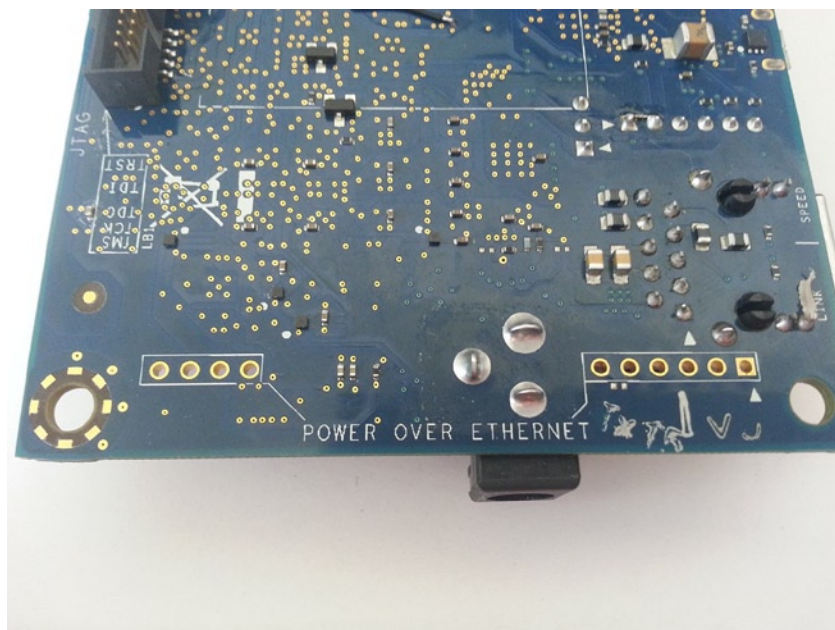


Figure 10-2. Bottom view of the Intel Galileo board and PoE space

These holes fit perfectly with the PoE AG9120-S module. All you need to do is place the AG9120-S module over the holes (see Figure 10-3) and solder the pins to the bottom of your board (see Figure 10-4).

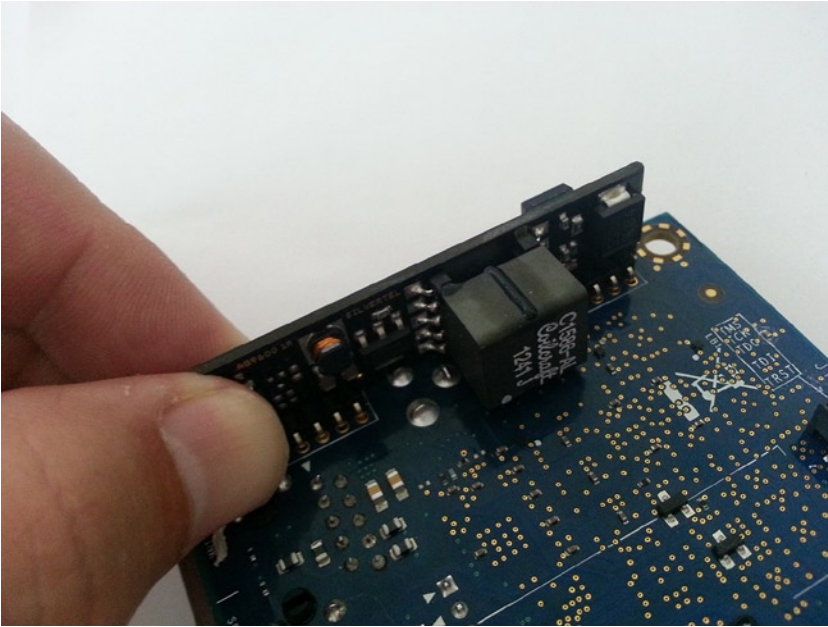


Figure 10-3. Inserting the PoE module

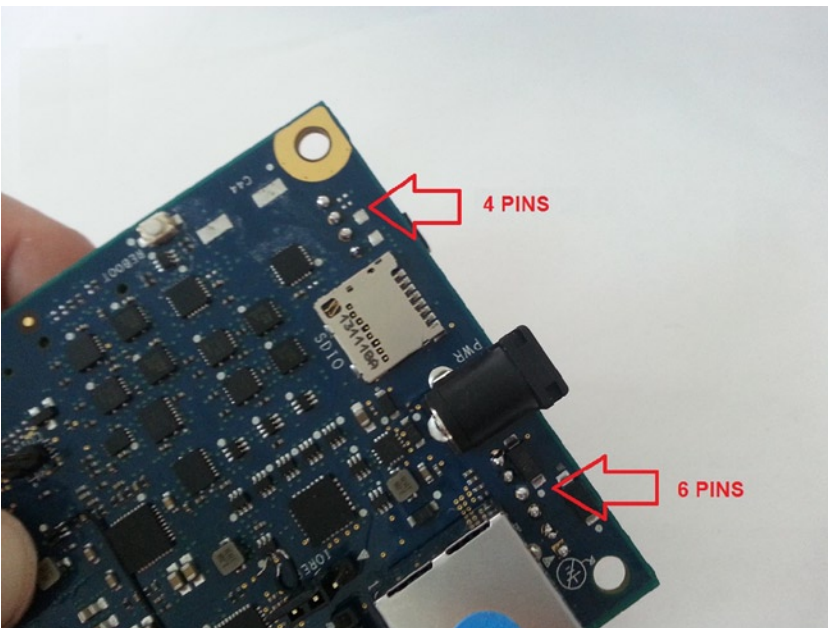


Figure 10-4. Upper view of the pins to be soldered to the PoE module

Powering On with the PoE Injector

After you have soldered the PoE module to the Intel Galileo Gen2, you simply need to connect the PoE injector.

As mentioned in the Table 10-1, it is recommended for this project that you use the PoE injector TP-LINK model TL-POE150S, which is shown in Figure 10-5.



Figure 10-5. The PoE injector TP-LINK TL-POE150S

The PoE injector is powered by a 48VDC power supply and contains two Ethernet ports, called “LAN IN” (see Figure 10-6, left) and “POWER+DATA OUT” (see Figure 10-6, right).

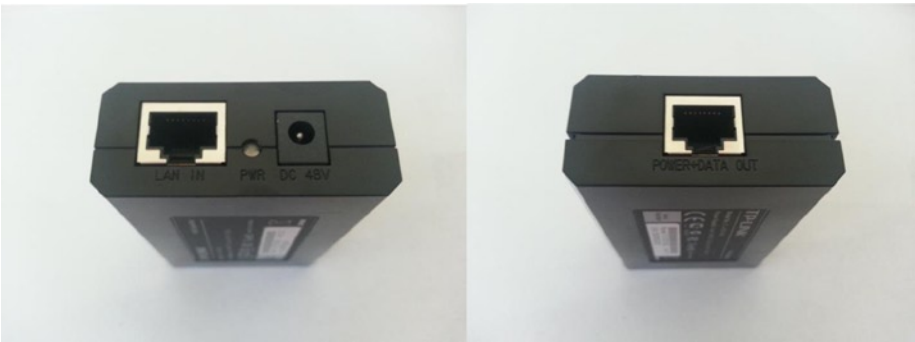


Figure 10-6. The LAN IN (left) and POWER+DATA OUT (right) ports

The POWER+DATA OUT port connects the Ethernet cable to the Intel Galileo Gen2 board. If you are using the recommended PoE injector, it comes with an Ethernet CAT5 UTP cable; however, the cable is short (around 3ft), which means you will probably need to buy another one or assemble your own. Search the Internet for how to assemble such an Ethernet cable and you will find several tutorials. This chapter does not teach you how to assemble your own Ethernet cables.

The LAN IN port is where you connect your switcher or router that accesses the Internet or intranet. You can also use a regular Ethernet cable to make this connection.

Figure 10-7 shows how the system must be connected to the Intel Galileo Gen2 board.

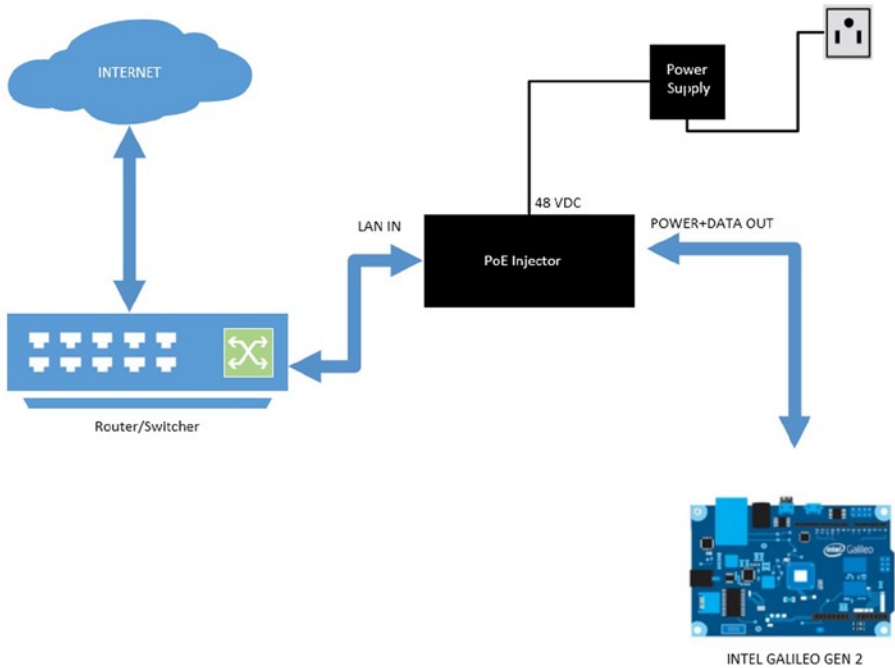


Figure 10-7. Scheme for PoE connection

How It Works

Figure 10-8 shows how the energy is provided by a single cable.

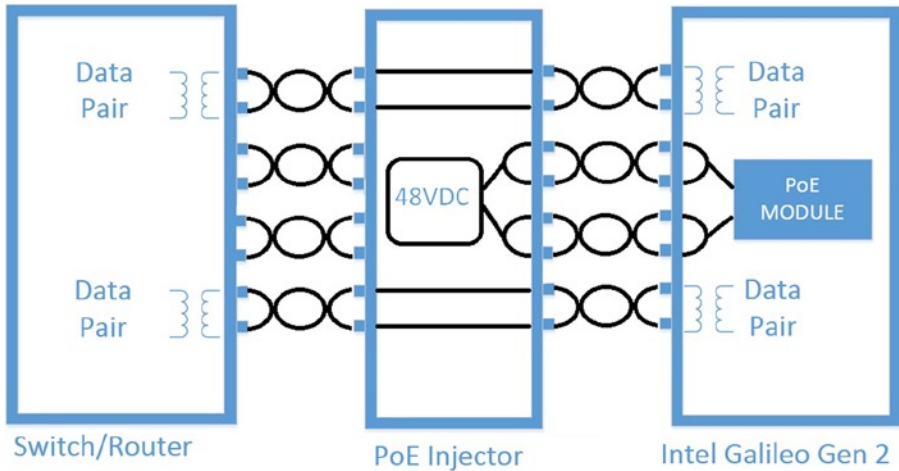


Figure 10-8. How the PoE system works with Intel Galileo Gen2

The PoE injector uses the two twisted pairs of wires in the cable to inject 48VDC, which is transmitted to the PoE module installed on the Intel Galileo Gen2. Then, the PoE module provided by an internal DC/DC converts the 48VDC to the 5VDC required to power up the Intel Galileo Gen2.

The other twisted pairs are the “data pair” and they are passed directly from the router or switcher through the PoE injector to the Intel Galileo Gen2.

Figure 10-8 shows why it is necessary to use Ethernet CAT5 cables between the PoE injector and Galileo. All four twisted pairs are necessary in order to make the system work perfectly.

The mechanism is very simple but very smart at the same time. The system is flexible and it reduces the installation cost and time.

Ideas for Improving the Project

If you do not like the idea of soldering the PoE module directly to your Intel Galileo Gen2 board, you can solder female stackable headers instead.

You need one 1x6 header (see Figure 10-9, left) and one 1x4 header (see Figure 10-9, right) to support the 10 pins. You then solder them the same way that’s shown in Figure 10-4. Here, though, you solder these stackable headers instead of the module. Then you connect the module to the stackable headers.

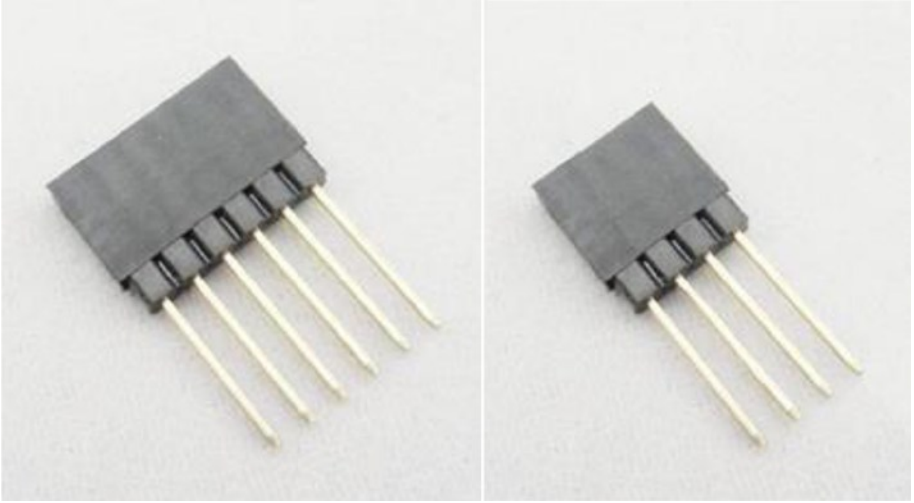


Figure 10-9. Female stackable headers—1x6 (left) and 1x4 (right)

Summary

Power over Ethernet is a simple but very powerful technology that provides many advantages discussed in this chapter. Fortunately, Intel Galileo Gen2 is prepared for this technology.

There is no special software required. You just need to be able to solder the PoE module and the capacitor to the Intel Galileo Gen2 and then install it on your system.