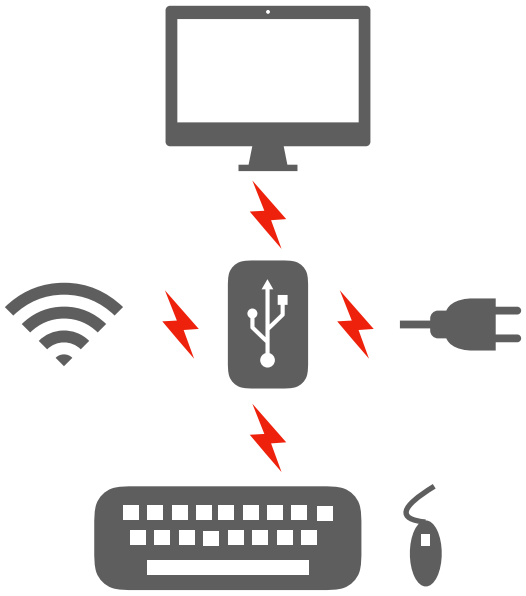
A STEM APPROACH TO RESILIENCE



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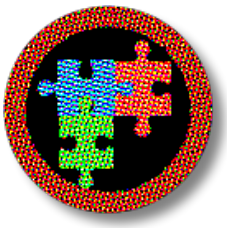


STEM APPROACH TO EXAMINE RESILIENCE AND SOCIAL SUPPORT

Meaning: Few would challenge the idea that technology is changing us. Technology has quickly and dramatically changed the way we work, socialize, and communicate. Can we also look to technology to enable us to better adapt to these rapid changes?

While we may agree technology is changing us, there is debate as to whether technology is unifying us or alienating us from one another. This is important because how we cope with stress related issues depends upon our personal resilience and social support system. Let us first define resilience as the development and use of skills needed to manage stress in an optimal way (Resilient, 2018). Let us further consider the view of the World Health Organization (WHO). WHO looks at resilience by recognizing the role of protective factors relative to suicide risk factors at both the personal and community level. A key protective factor is the social support system. A healthy support system is where we both give and receive support. Another factor, according to WHO, is spirituality when it provides a socially united and supportive community with a shared set of values. And, finally, having lifestyle practices of positive coping strategies, good self-esteem, self-efficacy and effective problem solving-skills. This includes the ability to reach out and find help when needed (Suicide, 2014).

The social support system is considered an essential protective factor when coping with challenges and adversity. System, by definition, is a group of interacting elements that form a complex whole. If we apply the definition of system to social support, then each person within our social support system serves a specific purpose, perhaps a personal need. As a complex whole, the social support system forms a tight and supportive community that we can reach out to. Reaching out is two-way action. There is an expectation that we will sustain those in our social support system as they sustain us. One way that we can sustain our social support system is practicing and sharing positive coping strategies. We consider these positive-coping skills because our intent is to take personal challenges and create a more positive and less stressful outcomes. We title these skills Belief, Persistence, Strength, Trust, and Adaptability for our learning. What is Belief when we are talking resilience. The way we perceive things is shaped by our beliefs. Beliefs control our actions and our attitude. Attitude is the way we feel about something. We may need to persist to bring about a more positive belief. That is our next skill, Persistence, facing a challenge with the belief we will ultimately succeed. Followed by Strength, the physical aspect of our mental armor contributing to good self-care that includes diet, exercise, relaxation and sleep. Then, Trust the skill of reaching out and developing and sustaining a social support system. And, lastly Adaptability, that we don't forget it's not the strongest nor fastest, but most adaptable that ultimately survives. These skills serve as a personal protective factor and help us to sustain our social support systems. With practice, we become more effective and successful problem solvers thus improving our self-efficacy and self-esteem. Self-efficacy is a belief in one's ability to complete tasks and reach a goal. Whereas, self-esteem is a favorable impression of oneself and may be a consequence of self-efficacy. We now have a shared idea of what it means to be resilient and the importance of a social support system.

Thus, the challenge and the goal of this exercise is to *determine if current technology can serve as a means to better understand resilience and the social support system*.

About: A substantial body of evidence-based research supports both resilience and effective learning. The resilience skills presented here are representative of this research as are the methods for learning these skills. We refer to these resilience skills as positive-coping skills because our intent is to take a personal challenge and create a more positive and less stressful outcome. In addition to donning mental armor to better protect us from stressful challenges, there is the added benefit that we are preparing ourselves for educational success. These skills and the associated learning methods will contribute to academic success (Galatzer-Levy, Burton, & Bonanno, 2012; Hartley, 2011; Martin & Marsh, 2006; Martin & Marsh, 2008).

STEM focuses heavily on the subjects of Science, Technology, Engineering, and Mathematics. The STEM learning is intended to increase interest and literacy in the areas of science and technology and encourage higher education and associated careers. Falling well within a STEM technology curriculum, this exercise introduces the concepts of resilience and social support without adding appreciable time to existing STEM initiatives. The further benefit of transfer-of-learning of subject material outside of the traditional STEM curricula allows us to better understand that learning from one discipline can be applied to another discipline. Our intent, then, is to blend the STEM discipline with the discipline of resilience and social support.

How: Our social support system is expected to have the distinct purpose of helping us cope with challenges and adversity. Often, a family member or members, close friend and associate will be a part of our social support system. There are a myriad of methods that connect us. Yet, wouldn't it be nice to have the opportunity to simply share the thought that "I am thinking about you" with those in our social support system? Therein is the intent of this technology, to share this unimposing idea of "thinking about you" without any expectation of a complicated reply. Could we do this as a text message to the mobile phones of everyone in the social support system? Yes, certainly. But, recall that our goal is to take an educational approach to exploring technologies. We expect to learn something about ourselves and technology from this exercise. Finding communication parallels we display as humans and those of technology could give us with greater insight into how we communicate within our social support system. An outcome might be a better understanding of empathy, a survival skill, that allows us critical insight into another's world.

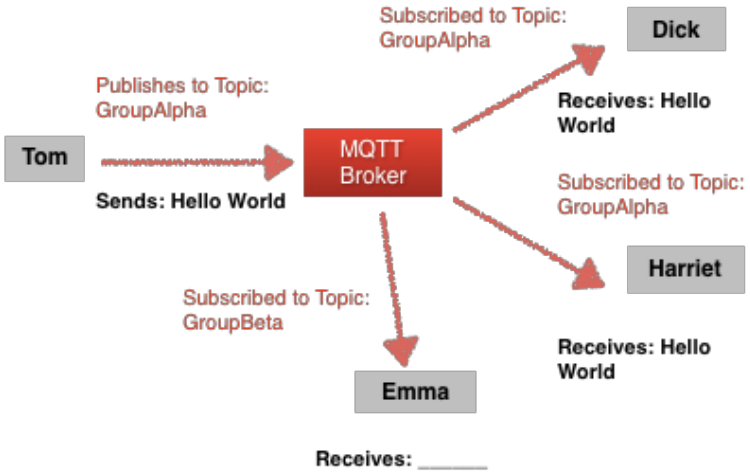
Empathy is often described as putting aside one's own beliefs and instead "seeing through the eyes of another" or "walking in the shoes of another." It is important to understand that empathy is not the same as sympathy, rather it is a critical thinking skill to help give us insight. This creates a bridge to understanding and communication. Therefore our focus in this exercise is more on the process of personal change than on the development of a technology device. Our technology will be relatively simple and minimal. Indeed, our desire is to provide simple and unimposing communication between people in our social support system.

In this exercise, you collaborate with other people. Who you want to work with is up to you, but consider someone with whom you are comfortable communicating such as a family member, friend, or associate. We will also be working on another type of communication, an entirely machine-based method of communication called MQTT.

MQTT is a simple messaging transport protocol for communicating between devices using a wireless network or the Internet (MQTT, n.d.). MQTT does not require extensive programming nor resources, making it ideal for data exchanges in Machine-to-Machine (M2M) and Internet-of-Things (IOT) where devices

need to exchange data with each other. These devices, called clients, communicate by joining, or subscribing, to a central communication point, called a broker, that dispatches messages between the clients. The client that sends, or publishes, a message to the broker, does so with an identifying name, called a topic, along with the message. Each client wishing to receive the message needs to be subscribed to that topic. The topic becomes the common identifier allowing each subscribed client to continue to receive messages sent by the broker. If we look to parallels with our social support system, we might consider each client to be a personal member of a social support system. So, let us assume that MQTT will serve as a workable communication protocol, a technology method we will use for exchanging information within our social support system.

How might this work? Let's say that Tom sends the message "Hello World" using the topic name "GroupAlpha" to an MQTT broker. Because Dick and Harriet are also subscribed to the topic "GroupAlpha" they will receive the message. But, Emma happens to be subscribed to the topic "GroupBeta" and will therefore not receive any message unless it originates from the topic "GroupBeta."



We next need to identify a tool that will use MQTT to allow the social support system to share the simple message of "thinking about you." This development tool needs to be able to connect devices and online services in support of Internet of Things (IoT) without the need of extensive programming. One such tool is Node-RED. Node-RED works in conjunction with our Web browser to form a work area, called a canvas, for developing our activity, or program (Node-RED, n.d.). Node-RED contains a menu, called a palette, of icon-like objects, called nodes, that we can drag and drop on to our canvas and connect together. Each node provides a different function or operation. For example, a button node could be used to start an acton on a connected MQTT node that is used to publish a message to a broker. While a node brings a lot of functionality without any complex programming, a node may still require adjustments making it usable for our specific needs. For example, the MQTT publish node will need to be told the name of the MQTT broker and the topic we want to use for our social support system.

A problem that can be broken down into a series of steps can probably be developed into a visual representation using Node-RED without the need for complex programming. Our program will, however, require that we assemble several nodes, adjust them, and connect them. Cumulatively, these nodes will permit us to send and receive a simple "thinking about you" message with people in our social support system.

Finally, we need to consider the physical technology device that can use MQTT for communication. As our focus is on the learning process, we will look to a minimal technology that provides a simple pathway for using MQTT. The ESP8266 and ESP32 are very common “minimalist” devices, that is, small, low power, low cost, and have the technology resources to meet our needs. These devices act as both as micro controller and permit MQTT communication. But, these devices would require considerably more technology support, such as soldering, and complex programming that is better saved for a later more advanced exercise. An internet search will, however, reveal that there are nicely developed “thinking about you” systems using the ESP8266 that are well worth reviewing (Michel, 2015).

Our alternative is to consider a simple, low cost computer-based system that will permit rapid development of MQTT communication without the need of more complex programming. The Raspberry Pi 3 provides us with sufficient resources to fully develop our technology without additional support and is heavily supported as an educational tool (Raspberry, n.d.). Raspberry Pi 3 is a minimalist $35 (USD) single-board computer that we supplement with a keyboard, mouse, 5 volt power supply, and an HDMI compatible monitor or TV. The Raspberry Pi, like most computers, requires an operating system (OS) that supports applications such as a Web browser. The most common Raspberry Pi operating system, Raspbian, a Debian Linux derivative, can be freely downloaded or purchased already installed on a microSD card for about $10 and plugged into the Raspberry Pi. One of the many niceties of the Raspbian environment is a graphical user interface complete with all of the application tools, including Node-RED, to develop and apply our MQTT system. Alternatively, if you do not have a Raspberry Pi, Node-RED can be installed on Windows, Macintosh, and Linux computers. The Raspberry Pi Foundation has also made available a downloadable Raspberry PI desktop, with educational software, for Windows and Macintosh computers.

As we work with the technology, we also want to be aware of the positive coping skills that make us resilient. Each of us may find that one or more skills are used for each exercise. You want to keep track of your skill use. Want a method to help remember your skills and keep yourself motivated in the learning process? Consider using a length of paracord, or something similar, and as you find yourself using a skill, tie a knot in the cord. As you complete the exercise, you are asked which of the skills you used and this may help you to remember. Remember that our social support system is one of our most important protective factors in our mental armor. So, when you share the skills with someone in your social support system, you tie the two ends of the cord together and you have begun the process of sustaining your social support system.

1 - RASPBERRY PI SETUP

Meaning: The social support system is our most important sustaining element when coping with challenges and adversity. System, by definition, is a group of interacting elements forming a complex whole. Applying the idea of system to social support, each person within our social support system serves a specific purpose, perhaps addressing a personal need, and forms a tight and supportive community that we can reach out to. We can consider the Raspberry Pi as a system of interacting elements requiring the Raspberry Pi board, NOOBS (New Out Of Box Software), a keyboard and mouse,

monitor, and power supply. Like our social support system, each element in the system serves a specific purpose and forms a complex whole.

Objectives: Recall the challenge and the goal of this exercise is to *determine if current technology can serve as a means to better understand resilience and the social support system*. There are a number of objectives, or steps, that help us achieve that goal to include:

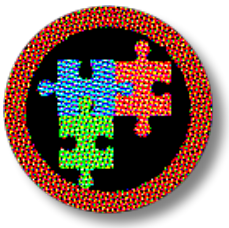
- Define the concept of a system.
- Understand the concept of the roles that different elements play within a system by comparing a Raspberry Pi system to that of a social support system.
- Apply though technology the skills of Belief, Persistence, Strength, Trust, and Adaptability.

Raspberry Pi setup: There are web sites and YouTube tutorials that provide detailed step-by-step builds for getting the Raspberry Pi fully operational (Getting started, n.d.). We will therefore simply provide an overview to the process as a general guideline. Completing these steps helps to explain the goal and objectives.

1. Collect the system hardware, to include a Raspberry Pi 3, USB keyboard, USB mouse, 5 Volt 2.5 Ampere Raspberry Pi power supply, HDMI monitor or TV with HDMI cable, and minimally an 8 GB micro SD card (be sure the micro SD comes with the SD card adapter).
2. A micro SD can be purchased with NOOBS already installed. NOOBS contains the Raspbian OS (Operating System) and other useful third party application software. Or, if you have a microcomputer with access to the internet, you can prepare a micro SD yourself. Preparing the micro SD for Raspberry Pi is a three step process of downloading NOOBS, formatting the micro SD, and copying NOOBS to the micro SD.
3. Download NOOBS, a free download from the Raspberry Pi foundation (NOOBS, n.d.). This is a fairly large file of over 1.5 GB and may take awhile to download.
4. Prepare the micro SD by formatting using a free application, such as SD Formatter for Mac or Windows. Plug your micro SD in its adapter card into your computer card slot and follow the instructions on SD Formatter. Depending upon the memory storage amount on your card, the formatting will take several minutes.
5. Copy the NOOBS files by first unzipping the downloaded folder and then copying the contents of the folder onto the SD card. Be sure you only copy the contents of the NOOBS folder, all of the files, rather than the folder itself.
6. Place the micro SD card into the SD slot of the Raspberry Pi 3.
7. Attach the other parts of the system, to include keyboard, mouse, monitor, and lastly the power supply. Once the power supply is connected, the Raspberry Pi will start up.
8. The installation is rather straightforward and you will need to identify WiFi, your time zone, and location.
9. From the first time startup menu, identify your WiFi connection.
10. From the mid menu, select Raspbian.
11. From the bottom of the menu, select the appropriate Language, e.g. English (US), and click the Install button at the top of the menu.
12. Once the system is installed and the Pixel graphical interface appears, you can set your Country, Language, Timezone, Keyboard type, and change the default password and WIFI network.
13. The newer versions of the installation program will also automatically check for any updates. This updating process can be time intensive depending upon internet connectivity.
14. You have completed the installation and setup of the Raspberry Pi 3 and we are now ready to move forward with using Node-RED. Recognize that NOOBS has added a lot of software to include a full office suite as well as the Node-RED application.

Evaluation. Consider again the challenge and the goal of this exercise is to *determine if current technology can serve as a means to better understand resilience and the social support system*. Answer the following questions.

- Do you have a better understanding of how a system works? Define the concept of a system in your own words.
- Now that you have assembled the pieces necessary to make the Raspberry Pi into a working system, describe how that technology *did or did not* help you to better understand a social support system.
- Did you use Belief, Persistence, Strength, Trust, or Adaptability to complete any part of this exercise?



2 - USING NODE-RED, HELLO WORLD

Meaning: If we again look to parallels with our social support system and the Node-RED application, we see that each node, in Node-RED, is tasked with a specific purpose as are the people in our social support system. As a node may need to be adjusted for operation and for communicating with other nodes so must the people in our social support system be made aware of their roles and assisted with communicating with us and other people in the support system. Whether our social support system or the technology, the act of communication and roles requires our dedication and consideration.

The challenges we encounter change us. A new challenge may further encourage us to alter our social support system to best meet need of that challenge. Change is inevitable. Adapting to deal with change is, however, a choice.

Consider now the challenge of using Node-RED. Using Node-RED is a two step process. We first start Node-RED server and then use a browser, like Chromium, to access Node-RED. We can then develop a computer program using Node-RED. Our first program is the traditional approach to learning almost any programming language. We communicate our presence with a simple program that will declare “Hello World.” Creating this simple program acquaints us with the environment, Node-RED programming, and also assures the technology is working.

Objectives: Recall the challenge and the goal of this exercise is to *determine if current technology can serve as a means to better understand resilience and the social support system*. There are a number of objectives, or steps, that help us achieve that goal to include:

- Recognize that you need to adapt your thinking, your beliefs, and persist in order to get a computer application to work.
- Identify parallels in the Node-RED setup to working with individuals within a social support system.
- Apply though technology the skills of Belief, Persistence, Strength, Trust, and Adaptability.

1. From the Raspberry Pi pull-down menu, select *Programming*, and *Node-RED*. The *Node-RED console* immediately appears in the Raspberry Pi Terminal and describes the startup process of the Node-RED server. An example of a portion of the dialog follows.

Node-RED console
Start Node-RED

Once Node-RED has started, point a browser at http://192.168.0.19:1880
On Pi Node-RED works better with the Firefox or Chrome browser

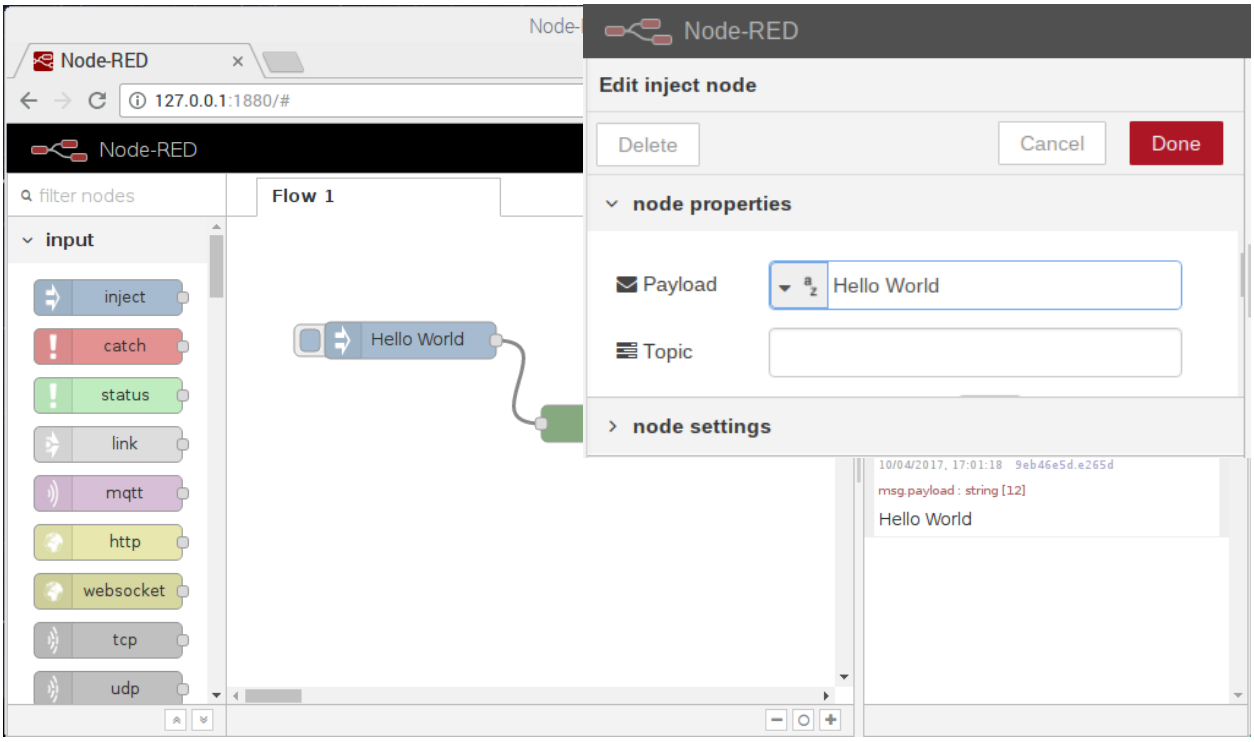
Use node-red-stop to stop Node-RED
Use node-red-start to start Node-RED again
Use node-red-log to view the recent log output
Use sudo systemctl enable nodered.service to autostart Node-RED at every boot
Use sudo systemctl disable nodered.service to disable autostart on boot

2. Notice that the example dialog tells you to point your browser to *http://localhost:1880,* where localhost will be described as an address unique to your setting. Copy and paste the complete address into your browser to see the Node-RED development area. For example, we see, *Once Node-RED has started, point a browser at http://192.168.0.19:1880.* Thus, in this example, we would start our browser, for example, Chromium, and either type in, or copy and paste the localhost link *http://192.168.0.18:1880* into the browser. Chromium browser is currently bundled with the Raspberry Pi and will work with Node-RED, but other browsers will also work.
3. On the browser Node-RED shows itself as a three column development area. The left column displays the available nodes. The large center area, e.g. Flow 1, becomes a canvas where the desired nodes may be dragged from the left column, or palette, to develop a flow-based program, or flow. The right side can serve as an info and debug area where development status and testing can be monitored. The right side info and debug area can be toggled to appear, or not appear, by pressing the CTRL and Space Bar.

It is customary to develop a "Hello World" program in a new programing environment by injecting the text "Hello World" and displaying it in some manner.

4. To do so, drag the *inject* node from the left column into the center canvas development area, identified as *Flow 1*, by moving the cursor over the *inject* node, left-clicking the mouse button and holding it depressed while dragging the node to the canvas. When the node is in the canvas, release the mouse button. Notice that the *inject* label on the node has been changed to *timestamp*. To the right of the screen, the *Info* menu describes the properties of the node.
5. In a similar manner, drag the *debug* node, from the *output* suite of nodes, onto the canvas. Notice that the *debug* label has been changed to *msg payload* allowing it to display the contents, or payload, of the message.
6. "Wire" the two nodes together by clicking the mouse on the small ball icon appearing on the right side, or output, of the *timestamp* node and dragging a line to the small ball icon appearing on the left side, or input, to the *msg payload* node. Thus, the two nodes are now connected.
7. The final step is to test, or *Deploy,* the program. Click on the *Deploy* button at the top right of the editing canvas. If the construction of the program is successful then a message *Successfully deployed* will so indicate.
8. Run the flow by clicking on the tab extending from the left side on the *timestamp* node. The message *Successfully injected: timestamp* appears. And, selecting the *debug* tab on the right side of the canvas displays a date and time stamp along with a msg payload number.

But, recall that we want to display a message, the text string "Hello World," rather than a timestamp. So, we will adapt or edit the inject/timestamp node to do so.



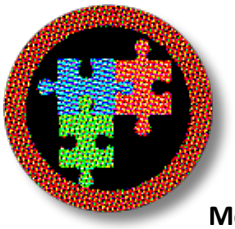
9. Double-click the mouse on the *timestamp* and the *Edit inject node* menu appears.
10. In the *Payload* entry field, click on the small *down arrow* and select *string*. Type *Hello World* in the entry area of the *Payload*. Then, click the *Done* button and notice the *inject* node is now relabeled as the *Hello World* node.
11. Editing has occurred, so click on the *Deploy* button to test the newly edited flow.
12. Run the flow by clicking on the tab on the left side on the *Hello World* node. Selecting the tab labeled *debug* tab on the right side of the canvas shows the message *Hello World* in the *debug.* Every time the tab on the left side of the *Hello World* node is clicked the message will appear. You have persisted and successfully created a Node-RED program!

Finally, Node-RED saves your program, but if you want to save your program elsewhere or perhaps use it on another computer, the Export function of Node-RED can be used. To do so, hold the *shift* key down and click on one of the nodes in the program. Notice that both nodes are highlighted and selected. Click on the three horizontal bar icon beside the Deploy button. Select *Export* and *Clipboard* from the drop down menu. From the *Export nodes to clipboard* menu, click on the *Export to clipboard* button at the bottom of the menu. You can now paste the content into an editor, such as Text Editor in the Raspberry Pi Accessories menu, and save the results.

Evaluation. Consider again the challenge and the goal of this exercise is to *determine if current technology can serve as a means to better understand resilience and the social support system*.

- How did this particular technology exercise help you to begin to understand and adapt to change brought about by technology? More specifically, do you better understand the concept of programming?

- How did the technology enable you to better understand and use resilience and a social support system? More specifically, now that you have created a program made of nodes that each have a specific role to play, do you find parallels to roles individuals play within a social support system?
- Did you use Belief, Persistence, Strength, Trust, or Adaptability to complete any part of this exercise?



3 - MQTT NODE-RED APPLICATION

Meaning: We identified the technology for our simple communications tool for our social support system. Node-RED serves as our development tool, Raspberry Pi 3 as a device, and MQTT as the communication protocol for our social support system. In the prior exercise we displayed a Hello World message. We want to build upon the prior Hello World exercise and develop a working application that sends a simple message to participants in our social support system using a remote MQTT broker.

Objectives: Recall the challenge and the goal of this exercise is to *determine if current technology can serve as a means to better understand resilience and the social support system*. There are a number of objectives, or steps, that help us achieve that goal to include:

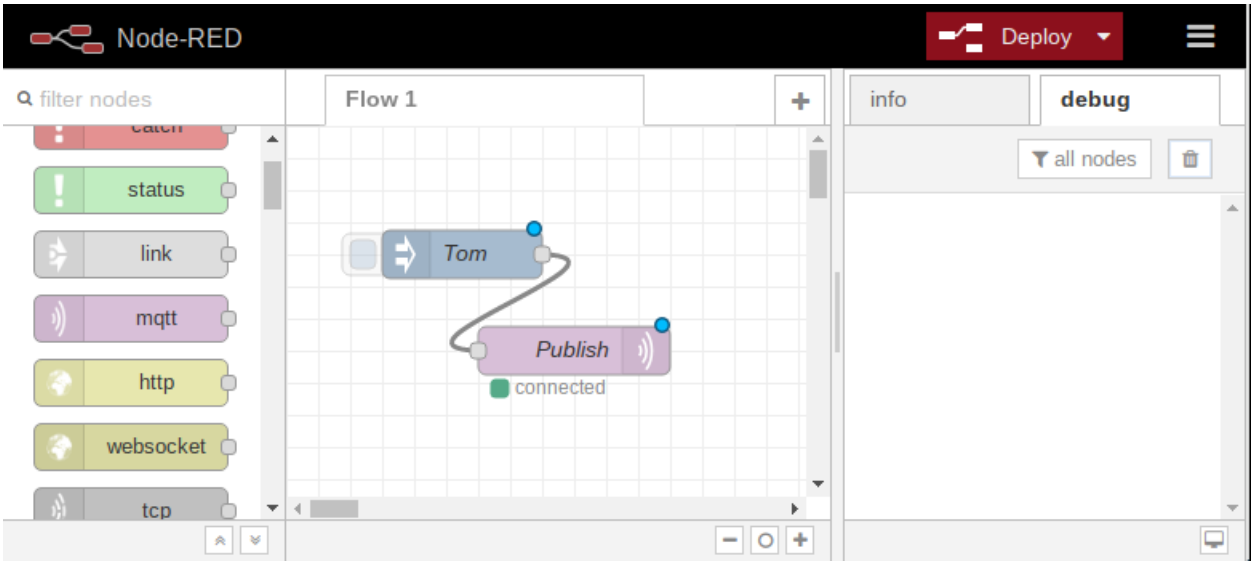
- Compare the roles of system, programming, and communication to the roles played by individuals within a social support system.
- Compare the effort required to get elements within a computer program to effectively communicate and provide results to the effort required to sustain a social support system.
- Apply though technology the skills of Belief, Persistence, Strength, Trust, and Adaptability.

Publishing to a Topic: MQTT is the communication protocol, or language, for communication between participants in our social support system. MQTT uses a publish and subscribe approach to communications. We, as clients, need to subscribe to some topic in order to receive information regarding that topic. And, clients need to publish to that same topic in order to transmit and share information. In this exercise, the information is the message “Hello from Tom” But, where you substitute your name for the “Tom.”

The topic is the common thread that unites our group, That topic can be the name of your support system, for example, “AlphaGroup.”

Finally, to distribute our communications to all of the participants, we need a common server, called an MQTT broker, allowing the participants, called clients, to share information wherever internet connectivity exists. There are a number of “free” MQTT brokers that we can use for testing our support system communications. In this exercise we will use the broker identified as iot.eclipse.org:1883 but feel free to use a broker of your own choice.

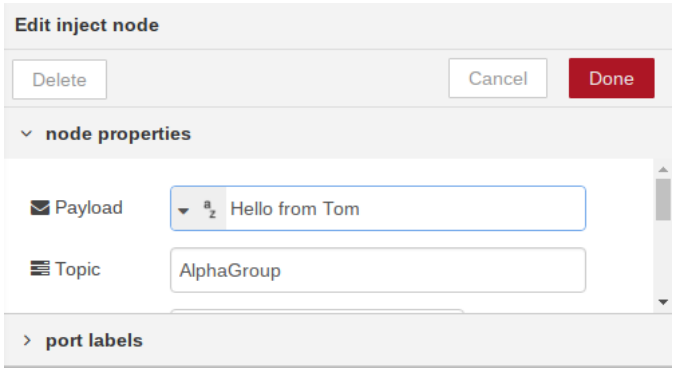
1. From the Raspberry Pi pull-down menu, select Programming, and Node-RED. Once Node-RED has started, the Console will tell you to point your browser at *http://localhost:1880*, where *localhost* will



be described as an address unique to your setting. Copy and paste the complete address into your browser to see the Node-RED development area.

2. Drag the *inject* node into the center canvas development area. Notice that the *inject* label on the node has been changed to *timestamp*. To the right of the screen, the *Info* menu describes the properties of the node. Note that if you have developed a Hello World program in *Flow 1*, you may want to develop this new program in *Flow 2* by clicking on the *+* tab appearing beside the *Flow 1* tab.
3. Drag the *mqtt* node, from the *output* suite of nodes, into the center canvas development area. We are intending to output, or send, a message to the MQTT broker.
4. "Wire" the two nodes together by "clicking" the mouse on the small ball icon appearing on the right side, or output, of the *timestamp* node and dragging a line to the small ball icon appearing on the left side, or input, to the *mqtt* node. Thus, the two nodes are now connected.

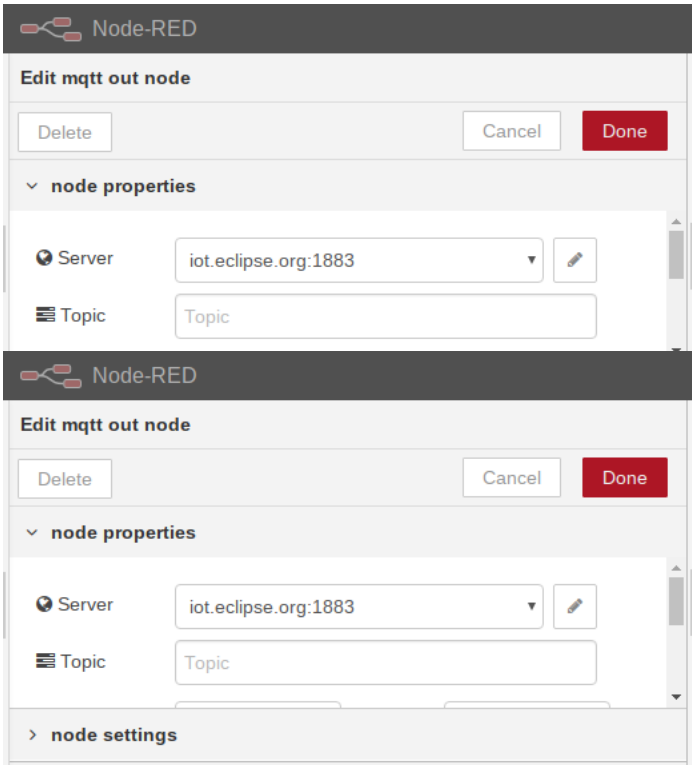
Recall that our challenge is to send a message, for example, "Hello from Tom," rather than a timestamp. Remember to substitute your name in place of "Tom," so that people know your real name. We begin by editing the inject/timestamp node.



5. Double-click the mouse on the *timestamp* and the *Edit inject node* menu appears.
6. In the *Payload* entry field, click on the small *down arrow* and select *string*. Type *Hello from Tom* in the entry area of the *Payload* substituting your name for *Tom*.
7. In the *Topic* entry field, type *AlphaGroup*.
8. In the *Name* entry field, by type your name. Then, click the *Done* button and notice the *inject* node is now relabeled with your name.

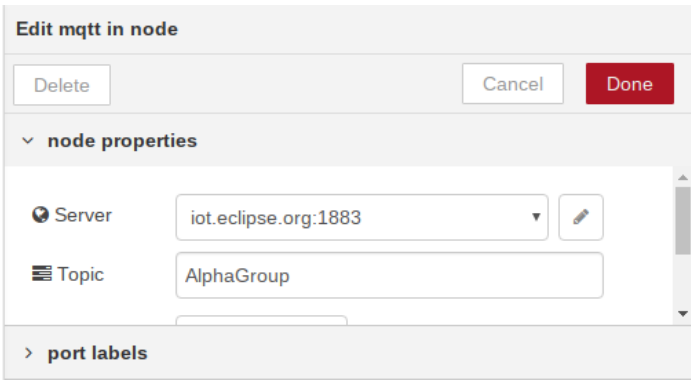
We next need to tell the MQTT node where to send the message, that is we need to tell the node to send the message to a MQTT broker. So, we begin by editing the MQTT node.

9. Double-click on the *mqtt* and an *Edit mqtt out node* menu appears.
10. Click on the *pen* icon appearing by *Server* field to display the *Add new mqtt-broker config node* menu.
11. In the *Server* field, type *iot.eclipse.org* to identify the MQTT broker and select *Add*. Note that port 1883 should be automatically added to the address.
12. In the *Name* field of the *Edit mqtt out node* menu, type *Publish* to rename the *mqtt* node for clarity. Then, click the *Done* button and notice the node is now relabeled *Publish*.
13. Click on the *Deploy* button at the top right of the editing canvas. If the construction was successful then a message will so indicate. A *connected* appearing below the *Publish* node indicates a successful connection with the remote broker.

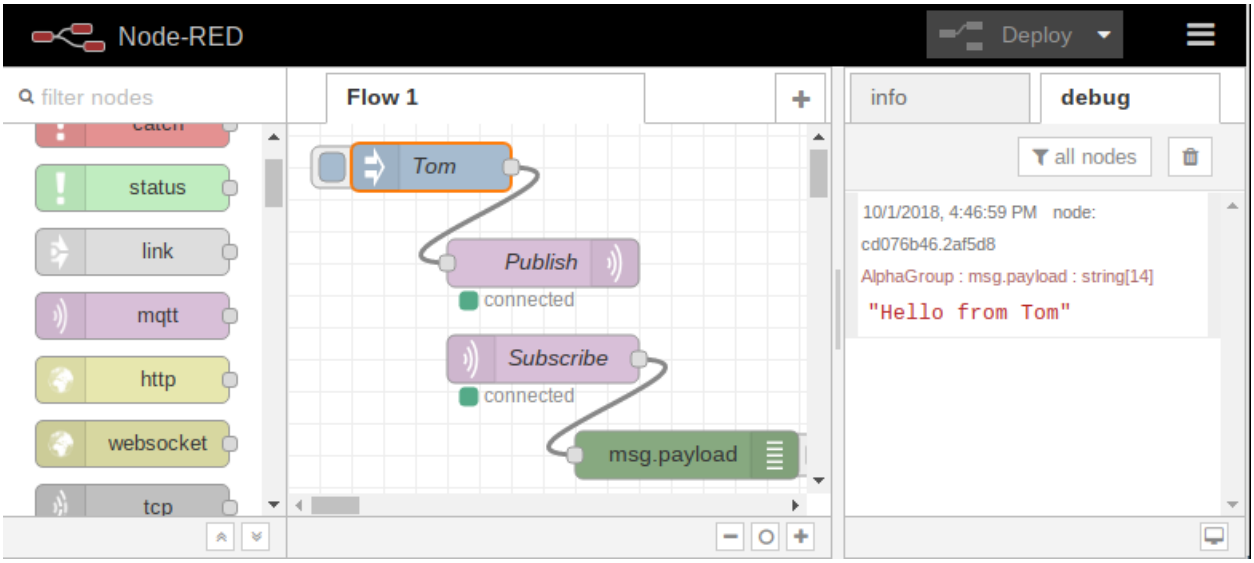


Subscribing to a Topic. Thus far, we have created the flow to publish a message through an MQTT broker. Subscribing to a topic allows us the receive a message. We can receive, or input, the message we publish by subscribing to the broker. So, we add another MQTT node to represent the broker and the debug node to display the message in the debug area of the menu,

14. Drag the *mqtt* node, from the *input* suite of nodes, to the center canvas in the development area.
15. Double-click on the *mqtt* and an *Edit mqtt in node* menu appears.
16. In the *Server* field, type *iot.eclipse.org: 1883* to identify the MQTT broker.
17. In the *Topic* field, type in *AlphaGroup* to subscribe to AlphaGroup.
18. In the *Name* field, type *Subscribe* to rename the mqtt node for clarity. Then, click the *Done* button and notice the button is now relabeled *Subscribe*. If we were to now click on the *Deploy* button, we would see *connected* below the *Subscribe* node indicating a successful connection with the remote broker.
19. Drag the *debug* node, from the *output* suite of nodes, onto the canvas. Notice that the debug label has been changed to *msg payload* allowing it to display the payload of the message.
20. "Wire" the two nodes together by "clicking" the mouse on the small ball icon appearing on the right side, or output, of the *Subscribe* node and dragging a line to the small ball icon appearing on the left side, or input, to the *msg pay load* node. Thus, the two nodes are now connected.



21. Click on the *Deploy* button at the top right of the editing canvas. If the construction was successful then a message will so indicate.
22. Finally, run the flow by clicking on the tab on the left side of the *Tom* node, where of course, you will have substituted your name for Tom. Selecting the tab labeled *debug* tab on the right side of the canvas shows the message *Hello from Tom*. Every time the tab on the left side on the *Tom* node is clicked the message is being sent to the remote broker through the Internet and back again to you. You have successfully created a program to see how the Internet of Things (IoT) communicates using MQTT.



23. Did you do this exercise with others programming their Respberry Pi computers to work with IoT? Are you seeing any other messages? What does it mean?

Evaluation. We return to the questions posed at the beginning of this exercise, as well as any questions you decided to explore, to determine its personal effectiveness. Consider again the challenge and the goal of this exercise is to *determine if current technology can serve as a means to better understand resilience and the social support system*.

- How did this particular technology application enable you to begin to understand and adapt to change brought about by technology? More specifically, do you have a better understanding of such concepts as a system, programming, and communication?
- How did the technology enable you to better understand and use resilience and a social support system? Specifically, now that you have created a program made of nodes that each have a specific role to play and got them to work together, do you see parallels to the roles individuals play within a social support system?
- Did you use Belief, Persistence, Strength, Trust, or Adaptability to complete any part of this exercise?

Remember that having good self-esteem, self-efficacy, effective problem solving-skills, and lifestyle practices of positive coping strategies are important to one's sense of resilience. Did you find you experienced personal change, such as a change in your Belief about being able to program a computer? Consider sharing this change with the people in your support system and perhaps us for our learning.

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On staying resilient

Objective: Completing this evaluation provides a summary of overall learning and personal change.

A look back to what you have accomplished is a way to determine the personal impact of all the learning, that is, you are looking at it summatively to determine its effectiveness upon you. Complete this measurement several weeks after you have completed the learning to get a sense of continuity, where you have been and what to do next. Identify any of your areas of weakness and review and practice those materials with your social support system. Should you want additional background information, consider the companion text, *A Community of One: Building Social Resilience.*

Reaction to Learning Materials and Delivery of the Learning Experience				
Assess *your* perception of the learning materials and delivery of the learning. Check only one response to each of the following.	👎👎 **Very poor**	👎 **Poor**	👍 **Okay**	👍👍 **Very good**
Effectiveness of learning materials and resources.				
Effectiveness of delivery of the learning experience.				

Learning Goals and Objectives Assessment				
Assess the quality of *your* interaction with each of the program objectives. Check only one response to each of the following objectives.	👎👎 **Don't recall doing this**	👎 **Not useful**	👍 **Useful**	👍👍 **Used this again**
Apply Belief to a current challenge in conjunction with a member of your social support system.				
Apply Persistence to a current challenge in conjunction with a member of your social support system.				
Apply Strength to a current challenge in conjunction with a member of your social support system.				
Apply Trust to a current challenge in conjunction with a member of your social support system.				
Apply Adaptability to a current challenge in conjunction with a member of your social support system.				

Change of Behavior				
Assess *your* perception of changes in *your* behavior. Check only one response to each of the following.	👎👎 **Worstened**	👎 **No change**	👍 **Improved**	👍👍 **Much improved**
Ability to apply positive coping resilience skills to personal challenges.				
Ability to reach out to a social support system to better deal with personal challenges.				
Ability to problem solve when dealing with personal challenges.				
Improvement of self-efficacy, defined as the ability to persist in meeting a goal when dealing with personal challenges.				

Change of Behavior				
Assess *your* perception of changes in *your* behavior. Check only one response to each of the following.	👎👎 **Worstened**	👎 **No change**	👍 **Improved**	👍👍 **Much improved**
Improvement of self-esteem.				

Learning to apply these positive-coping skills and developing a social support system might be compared to when you first learned to tie a shoe or perhaps learned to ride a bike. You learned the process, but it was continued practice that made that learning a fluid action requiring little effort. That same mindset needs to be applied to this current learning simply because this in a lifelong endeavor. Keep the mental armor shiny and intact and it will protect you and those closest to you.