Appendix – openPDC on Raspberry Pi Installation Example

This implementation summary uses the following software and hardware:

- Grid Protection Alliance openPDC Product Release Latest Stable Version 2.2.70.0
- **Raspberry Pi 3 Model B** with 7" touchscreen and wireless keyboard/mouse
- Raspbian Jessie Full Desktop 2016-05-27

Raspberry Pi Setup

1. Download Raspbian Jessie Full Desktop image from:

   https://downloads.raspberrypi.org/raspbian_latest

2. Write the image to an SD card.

   https://www.raspberrypi.org/documentation/installation/installing-images/README.md

3. Boot the Raspberry Pi using the SD card. Change the default password and hostname using either the Raspbian desktop Menu / Preferences / Raspberry Pi Configuration or a Terminal. Reboot after changing the hostname.

   A. Open a Terminal and change the **pi** user's password from ***raspberry*** to a new password.

   ```
   passwd
   ```

   B. Set the Pi's Hostname by editing the **/etc/hostname** and **/etc/hosts** files

   ```
   sudo nano /etc/hostname
   sudo nano /etc/hosts
   sudo reboot
   ```

4. Configure the Pi's Ethernet to connect to the LAN and Internet.

   A. Make a note of the Pi's IP address

   ```
   sudo ifconfig -a
   ```

5. By default, the Pi can now be accessed by remotely using a terminal running **ssh**

   A. Remotely ping test the network connection. You may need to configure your DNS or PC's hosts file to associate the IP address to the new hostname.

   ```
   ping <the Pi's IP address>
   ping openpdc-pi3
   ```

   B. For example, use **ssh** in a **git-bash** session in Windows

   ```
   ssh pi@openpdc-pi3
   ```

   C. Run the standard update commands.

   ```
   sudo apt-get update
   sudo apt-get dist-upgrade
   ```

6. Install **git**:

```
# Switch to Home folder
cd ~
# Install Git prerequisites – this takes a while
sudo apt-get install build-essential libssl-dev libcurl4-openssl-dev libexpat1-dev tk-dev gettext -y
# Get
wget https://www.kernel.org/pub/software/scm/git/git-2.9.0.tar.gz
tar xzvf git-2.9.0.tar.gz
cd git-2.9.0
# Make Git takes a while, Install Git is quick
make prefix=/usr/local all
sudo make prefix=/usr/local install
# Test Git
git --version
```

7. Install **unzip**: `$ sudo apt-get install unzip`
8. Install **sqlite3**: `$ sudo apt-get install sqlite3`

openPDC Server Mono Installation

9. Derived from instructions found in: http://www.mono-project.com/docs/getting-started/install/linux/

A. Mono Installation Script

```
sudo apt-key adv --keyserver hkp://keyserver.ubuntu.com:80 --recv-keys 3FA7E0328081BFF6A14DA29AA6A19B38D3D831EF
echo "deb http://download.mono-project.com/repo/debian wheezy main" | sudo tee /etc/apt/sources.list.d/mono-xamarin.list
sudo apt-get update
sudo apt-get upgrade
echo "deb http://download.mono-project.com/repo/debian wheezy-apache24-compat main" | sudo tee -a /etc/apt/sources.list.d/mono-xamarin.list
echo "deb http://download.mono-project.com/repo/debian wheezy-libjpeg62-compat main" | sudo tee -a /etc/apt/sources.list.d/mono-xamarin.list
sudo apt-get update
sudo apt-get upgrade
sudo apt-get install mono-devel -y
sudo apt-get install mono-complete -y
sudo apt-get install referenceassemblies-pcl -y
sudo apt-get install ca-certificates-mono -y
```

B. Mono Installation Verification

```
mono -V
wget https://raw.github.com/mono/mono/master/mcs/class/Mono.Security/Test/tools/tlstest/tlstest.cs
mcs tlstest.cs /r:System.dll /r:Mono.Security.dll
mono tlstest.exe https://www.nuget.org
```

10. Enable Root Login for SSH. This is needed to copy files from Windows to the openPDC Server
    A. Edit the server's **/etc/ssh/sshd_config** file:
       `sudo nano /etc/ssh/sshd_config`
       Change: `PermitRootLogin witout-password`
       To: `PermitRootLogin yes`
    B. Restart the ssh service:
       `sudo /etc/init.d/ssh restart`
       See: https://linuxconfig.org/enable-ssh-root-login-on-debian-linux-server for details.

openPDC Server openPDC Software Installation

11. Install openPDC
    A. Download the installation script file
       ```
       cd ~/
       mkdir GPA
       cd GPA
       wget http://www.gridprotectionalliance.org/Products/openPDC/Scripts/install-openPDC.sh
       ```
    B. Run the installation with the Preservation option -p
       ```
       sudo bash install-openPDC.sh -p
       ```
12. Test openPDC
    ```
    sudo mono /opt/openPDC/openPDC.exe -RunAsConsole
    ```
    While the console is running, type **`version`** to verify the openPDC version, the type **`exit`** to quit.
13. Register openPDC to run automatically
    ```
    sudo bash register-openPDC.sh
    ```
14. Test openPDC control commands
    ```
    sudo /opt/openPDC/openPDC stop
    sudo /opt/openPDC/openPDC start
    sudo /opt/openPDC/openPDC restart
    sudo /opt/openPDC/openPDC pause
    sudo /opt/openPDC/openPDC resume
    ```
15. Start openPDC on the openPDC Server and use **openPDCConsole** to assure openPDC is running
    ```
    mono /opt/openPDC/openPDCConsole.exe
    ```
    A. Type *version* to check the openPDC version
    B. Type *exit* to quit openPDC

16. Install and run **x11vnc** to enable Raspbian desktop remote control

```
sudo apt-get install x11vnc
x11vnc -display :0
```

A. On a remote PC, download **ssvnc** from the following website and run it to connect to the Raspberry Pi.

http://www.karlrunge.com/x11vnc/ssvnc.html#download

B. The following is a screenshot of openPDC running on the Raspberry Pi 3, Model B with 7" display.