

RASPBERRY PI 3B+ AND VMWARE PULSE 1.1

Version 0.1

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Executive Summary

Business Case

The Internet of Things (IoT) is rapidly transforming traditional business models and operational processes to boost innovation and growth. An IoT-ready infrastructure has unique requirements with onboarding, configuring, managing, and securing connected devices, and as a tidal wave of IoT use cases reaches your organization, your IT and Operational Technology (OT) departments may struggle to keep up. VMware can help organizations achieve IoT infrastructure excellence and deliver successful business outcomes that meet the needs of both your IT and OT organizations.

VMware Pulse™ IoT Center™ is a secure, enterprise-grade, end-to-end IoT infrastructure management solution that allows OT and IT to have complete control over their IoT use cases, from the edge all the way to the cloud. It helps companies to onboard, manage, monitor, and secure all things and infrastructure for IoT.

Raspberry Pi 3 B+ is a small and affordable computer that you can use to put the power of computing and digital making into the hands of people all over the world. It enables more people to harness the power of computing and digital technologies for work, to solve problems that matter to them, and to express themselves creatively. Raspberry Pi is commonly used in a wide variety of Internet of Things projects and applications.

This Solution Paper is intended to validate that VMware Pulse IoT Center can be used to onboard, manage, monitor and secure one or a fleet of Raspberry Pi devices.

Solution Overview

This reference architecture is a showcase of using VMware Pulse IoT Center to effectively and efficiently onboard, manage, monitor and secure a Raspberry Pi.

- We demonstrate the architecture of the deployment.
- We successfully onboard a Raspberry Pi as a managed Edge System.
- We monitor the health of a Raspberry Pi by collecting system metrics.

Introduction

Purpose

This reference architecture outlines the supportability of a Raspberry Pi as a managed Edge System on VMware Pulse IoT Center.

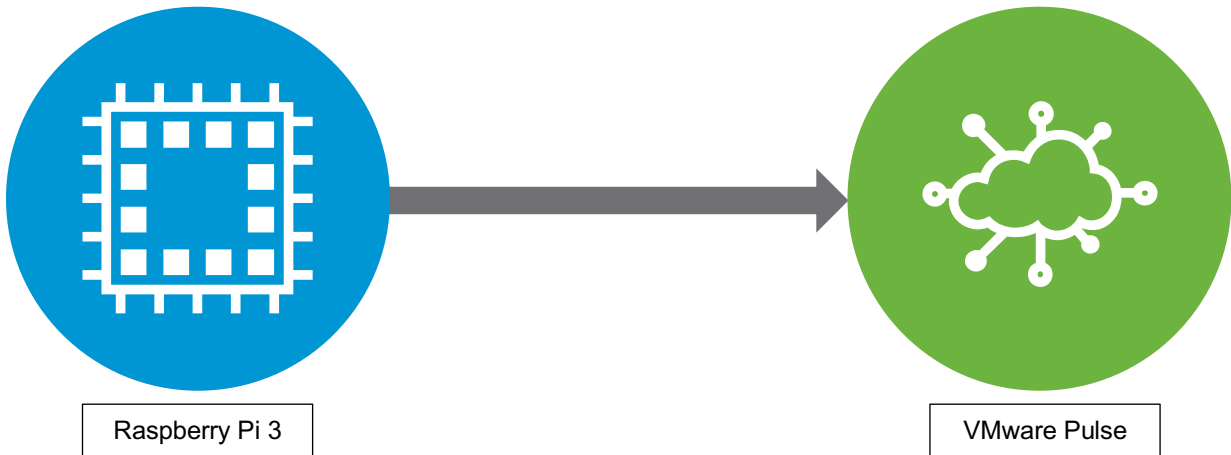
Audience

This reference architecture is intended for IT and OT administrators and IoT Architects involved in planning and managing Internet of Things Infrastructure, Applications and Services.

Solution Configuration

Solution Architecture

For this solution, we have a Raspberry Pi 3B+ connected via WiFi or Ethernet to your internal network. From there it connects to VMware Pulse IoT Center which is either installed on-premises or hosted in the cloud. In this case, we will be onboarding a Raspberry Pi 3B+ as a Managed Edge System/Gateway.



Assumptions

- You have access to a Raspberry Pi 3B+ running Raspbian Jessie/Stretch.
- You have access to a VMware Pulse IoT Center version 1.1 environment on the cloud or set-up in your On-Prem environment.
- The Raspberry Pi has a WiFi or LAN connection and the ability to reach out to internet.
- You have a basic understanding of navigating through Linux Command Line Interface.
- You have access to the Raspberry Pi via SSH or SCP.
- You have a Technician User created on VMware Pulse.

Pre-Requisites**Software Requirements**

<u>Software/Applications/Frameworks</u>	<u>Value</u>
OS Distro	Raspbian Stretch
Python Version	2.7.9 - 2.7.15
Snap Version (if Applicable)	2.32.6
OpenSSL Version	1.1.1
LibC	2.19
LibCrypto	Yes
Root Access	Yes
Complete File Structure Access to Root/Sudo	Yes

Network Requirements

<u>Source</u>	<u>Destination</u>	<u>Port</u>
RPi 3B+	EMQTT Broker	8883
RPi 3B+	Lifecycle Management Server	443
RPi 3B+	Lifecycle Management Server	2001
RPi 3B+	Pulse API Server	443

Solution Validation

Onboard

Creating a Technician User

In VMware Pulse IoT Center v1.1, designated technician user(s) created in the Pulse Console can initiate multiple gateway registrations. To create a Technician user:

- Login to the Pulse console as sysadmin/Pulse admin.
- Navigate to the Admin tab and create a user using the following steps:
 - Click Create Admin
 - Enter the details in the Create User dialog box and click Save.
 - By default, the role will be Alert Admin.
- Follow these steps to change the role to that of a technician:
 - Click Edit icon corresponding to the user created in the previous step.
 - In the Update Role dialog box, from the Role Name drop-down menu, select Technician and click Save.
 - Login to the console using the user credentials of the technician and change the password.
 - Read and accept the EULA. If you do not accept the EULA, you cannot carry out enrollments. Once accepted, the account is activated.
 - You will be logged out of the console without further access to the Pulse console through this technician user.
 - The credentials of the technician user are used by API's Enrollment Service to generate enrollment users for the enrollment of the gateway.

Creating a Sideload Staging Package

- Create a Profile Component with the Root CA Cert for Raspberry Pi to trust the VMware Pulse servers.
 - From the Lifecycle management console, navigate to Devices > Staging & Provisioning > Components > Profiles. Ensure that you are under the intended organization group.
 - Click the Add Profile button > Select Linux.
 - In the General section, enter a name and select Both as the profile scope.
 - Click Credentials in the left pane.
 - Click Configure and upload the Root Certificates of the servers – EMQTT Broker, Pulse API, Lifecycle Management Server (AirWatch Component). If the Root Certificates are different, create separate profiles for the same.
 - Click Save and you will see that the profile you created is listed on the Profiles page.
 - Similarly, you can create more profiles using the Intermediate and Identity Certificates of the aforementioned servers.
- Create Files/Actions Components Containing Liota Registration Packages
 - From the device management console, navigate to Devices > Staging & Provisioning > Components > Files/Actions.
 - Click Add Files/Actions > Select Linux.
 - In the Files section, click the Add Files button and upload the Liota User Package files required for registration of the gateways:
 - `iotcc_mqtt.py`

- `general_edge_system.py`
 - Click Save.
 - Provide the download path on the gateway for all the Liota user package files as `/opt/liota-packages/` and click Save.
- Create the Staging Package
 - When you create the staging package, the right agent must be added.
 - To check what the agent to use, run this command “`uname -a`” on the gateway.
 - From the device management console, navigate to Devices > Staging & Provisioning > Staging.
 - Click Add Staging > Select Linux.
 - In the General section, complete the following:
 - Enter a name and description for the staging package.
 - Select the intended organization group for this staging package.
 - Select an appropriate Pulse agent version for the agent.
 - In the Manifest section, click Add.
 - From Actions to Perform, select Install Profile.
 - In the textbox corresponding to Profile, type/select the certificate profiles.
 - Select Install Files/Actions.
 - For Files/Actions, select the previously created Files/Actions that contains Liota user packages files.
 - From Actions to Perform, select Install Files/Actions.
 - Select any previously created Files/Actions that must be installed as a prerequisite and Click Save.
 - The staging package that was created is listed on the staging page.

Downloading a Sideload Staging Package

- From the device management console, navigate to Devices > Staging & Provisioning > Staging.
- Double-click the sideload staging button on the right side of the intended sideload package.
- Ensure that the correct organization group is displayed and that the universal flag is not selected.
- Enter a passphrase for the sideload package.
- Click Download.
- A sideload staging package file called *SideLoadStaging_<string based on package name, version, organization group>.tar.gz* is downloaded.

Copying a Sideload Staging Package

- On the edge system gateway, copy the sideload staging package file to the file system such as the `/tmp/` directory over SSH or by using a USB drive.

Installing the Sideload Staging Package

- Extract the sideload staging package into the `/tmp/` directory.
 - For example, `$ tar xvf SideLoadStaging_iceclientx86demo_xyz.tar.gz -C /tmp/`
- Ensure that the Pulse Agent installer under `/tmp/agent` has execute permissions.

- For example, `$ chmod +x /tmp/agent/ice-client-Linux-x86_64-0.1.1018.sh`
- Execute the Pulse Agent installer present under /tmp/agent/ with root privileges.
 - For example, `$ sudo /tmp/agent/ice-client-Linuxx86_64-0.1.1018.sh`

Onboarding the Raspberry Pi

- Execute the iotcc utility.
 - For example, `$ sudo /opt/ice-client/iotcc`
- Enter the user ID and password of the technician when prompted.
- After you run the script, on successful registration, onboarding credentials are generated along with the name of the edge system and the UUID.
- After successful installation and registration, the IoT edge system is listed in the Pulse Console.

Monitor

Publish Metrics through Liota Package Manager

We monitor the health of a Raspberry Pi by collecting system metrics.

- Download the `iotcc_mqtt_edge_system_stats.py` file from the Liota Page on GitHub.
- Copy the file over to this path on the gateway: `/usr/lib/liota/packages`.
- Run the command `chmod +x iotcc_mqtt_edge_system_stats.py` to allow execution.
- On the gateway, use CLI and run this command to get the SHA1 checksum:
 - `$ sha1sum iotcc_mqtt_edge_system_stats.py`
- Run this command to load the file on to the Liota Package Manager:
 - `/usr/lib/liota/packages/liotad/liotapkg.sh load -r iotcc_mqtt_edge_system_stats <checksum>`
 - Please note that the “-r” is to make sure that it loads after reboot.
- Once done, tail the `/var/log/liota/liota.log` file to confirm that the system stats are being sent to Pulse.
- Wait for a few minutes and check on the Pulse Console to view the metrics graphs.
- You can also do the aforementioned steps as part of Product Provisioning through Pulse.

Create Alert Definitions

Navigate to the **Alert Definitions** tab and complete the following steps:

- Click the **Add New** button at the top right of the page to add alerts.
- Enter the metadata for the alert definition and click **Next**.
- Select the symptoms to trigger an alert.
- Click **Create Symptom** to create a new symptom.
- Enter the metadata for the alert definition and click **Next**.
- Specify the recommendations to remedy the situation of the alerts in this category.
- Review and **Save** the alert.



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