December 21, 2018

PROVISIONING DAY-ZERO CONFIGURATIONS THROUGH PASSIVE RADIO-FREQUENCY IDENTIFICATION

Santosh Patil

Shyam Vaidyanathan

Prashant Kumar

Manoj Gupta

PROVISIONING DAY-ZERO CONFIGURATIONS THROUGH PASSIVE RADIO-FREQUENCY IDENTIFICATION

AUTHORS:
Santosh Patil
Shyam Vaidyanathan
Prashant Kumar
Manoj Gupta

ABSTRACT

Embodiments presented herein provide a mechanism for setting the day-zero configuration of a network device without having to power on or unbox the device. Using an embedded passive radio-frequency identification (RFID) tag situated in a device, the device can be programmed at a distance using a mobile device.

DETAILED DESCRIPTION

Deployment of networking devices, such as WiFi access points, switches, and routers, at customer premise typically involves day-zero provisioning. Zero-day provisioning may include performing operations such as manual staging of devices and/or using an onboarding Plug and play (PnP) server. For cost-sensitive markets that require low-cost devices and low operation cost (OPEX), also referred as "volume segment" markets, current day-zero mechanisms are not efficient and have several limitations. Manual staging may be costly and time-consuming, requiring a technical resource in a separate staging system in order to provision the devices, at which point the devices may be sent to the customer deployment site. Furthermore, some onboarding servers (PnP) require a device to contact a server over the internet in order to receive the device's initial day-zero configuration. However, in many deployments, devices are used in private networks and are unable to reach the on-boarding server over the internet Traditional methods of device configuration typically include removing each device from its packaging, setting up and starting the device, and loading or setting configurations on the running device. Since configuration is done on a per-device basis for all devices to be configured, day-zero provisioning for an organization can become very time-consuming.

The embodiments presented herein relate to a mechanism for performing day-zero provisioning of networking devices using integrated passive radio-frequency identification (RFID) tags. The RFID tags can receive day-zero configuration through a mobile device or other local equipment, and store the configuration data on a memory accessible to the new device upon startup. This solution is cost-effective, less time-consuming, and does not require a device to have direct internet connectivity. Present embodiments can be performed when a device is not powered on and prior to unboxing of the device. Furthermore, devices may be provisioned without a staging server, and do not require a technical expert to be on-site.

A device may be provided with a passive RFID tag that can receive day-zero configurations from a mobile device that has an RFID writer (or other external programming equipment). An application on the mobile device may connect to a configuration management system to receive the required day-zero configuration. Once received, the mobile device can push the day-zero configuration to a new device through its integrated passive RFID tag, even when the new device is not currently powered on.

Present embodiments involve equipping devices with RFID Electrically Erasable Programmable Read-Only Memory (EEPROM) semiconductor chips and an RFID antenna, enabling devices to be programmed without being powered on. Thus, a customer can pre-configure and customize devices without opening the packaging, so that the devices need only to be unpacked at the point of final installation. An RFID EEPROM integrated circuit (IC) using the I2C protocol features a high memory capacity, which can be used to upload configuration data to the embedded microprocessor upon power-up of the new device.

Figure 1 depicts an example of wireless access point hardware having RFID EEPROM connectivity with an access point (AP) system board.

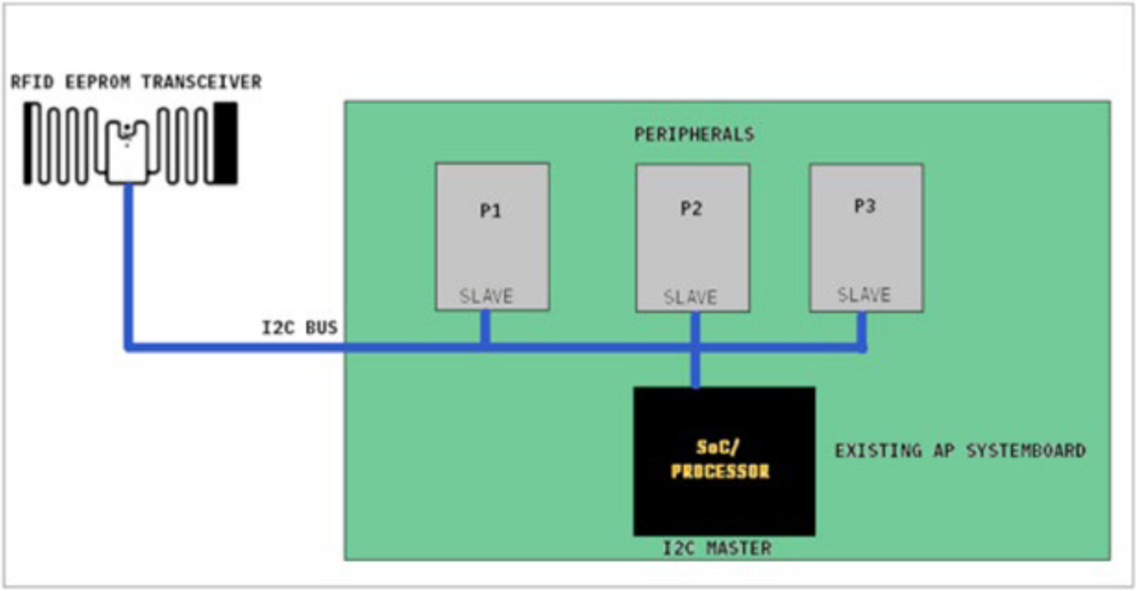

Figure 1

Present embodiments utilize a secondary mobile device to execute a mobile application that communicates with a configuration management system server in order to receive day-zero configuration for devices. The day-zero configuration may be based on a device's serial number or media access control (MAC) address. The mobile device can have an additional hardware plugin module that provides RFID reader and writer functionality, and the mobile application can push the received configuration data through the RFID writer hardware module in order to write to a device's RFID tag in a contactless manner. Thus, it is possible to program multiple devices simultaneously as long as they are within the range of the mobile device's RFID writer. Instead of a mobile device, a personal computer-based or handheld RFID transponder can also be used to write the configuration data.

During a manufacturing phase, devices are manufactured with integrated passive RFID tags. Each passive RFID is programmed with the device's serial number and/or MAC address. At deployment, a customer may log into a mobile application, and authenticate with a configuration management server. Next, a customer may take the mobile device near any device requiring day-zero configurations, and the mobile device's RFID reader module reads device serial numbers and/or MAC addresses that has been embedded during the manufacturing. Optionally, a user can manually enter device identities if devices are not provided with serial numbers during manufacturing.

Next, a configuration management server verifies each device's serial number and its ownership with the authenticated user. A configuration management server may transmit data including a day-zero configuration to the mobile device. A day-zero configuration can involve various different configuration aspects that provide a device with basic functionality, enable the device to connect to appropriate configuration systems that manage and control such devices, and the like. For example, in case of a wireless access point, a day-zero configuration can involve wireless controller IP address, on-premise PnP server IP address, access point (AP) group configuration, telemetry server IP addresses, and the like. The application running on the mobile device then pushes the configuration data to any device (even devices that are powered off) in range using the RFID writer on the mobile device. When a device boots up, the device checks an internal memory to determine if there is a day-zero configuration, and if no configuration is found, then the device reads data from memory associated with the device's passive RFID tag to load the day-zero configuration. Figure 2 depicts an example of devices being provisioned with day-zero configuration in accordance with present embodiments.

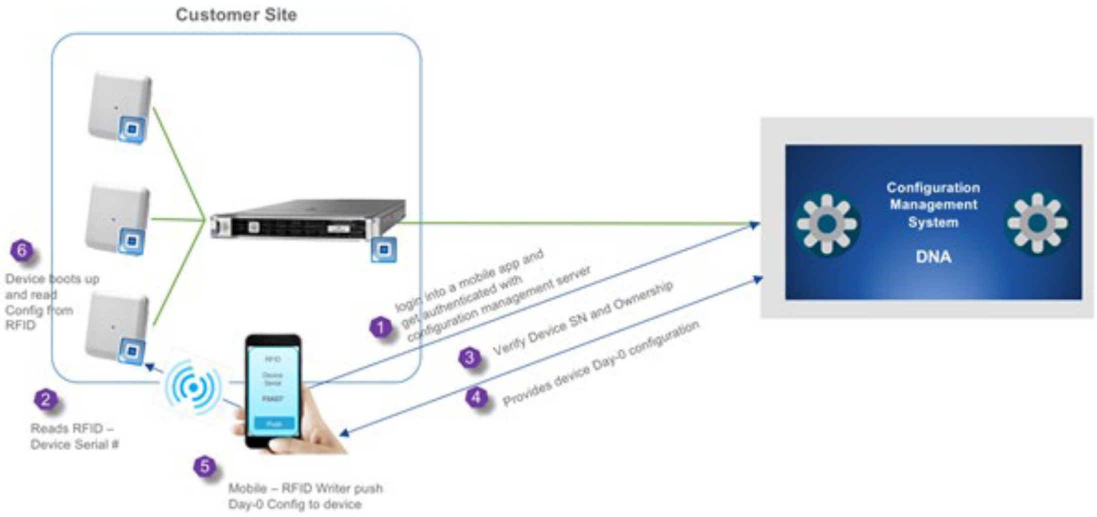
Customer Site
Configuration Management System
DNA
1 login into a mobile app and get authenticated with configuration management server
2 Reads RFID – Device Serial #
3 Verify Device SN and Ownership
4 Provides device Day-0 configuration
5 Mobile – RFID Writer push Day-0 Config to device
6 Device boots up and read Config from RFID
RFID
Device Serial
Push

Figure 2