

MAC Address Pass Through (HBMA)



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Document version history

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1.0	11/11/2016	Isaac Lagnado		
1.1	11/30/2016	Isaac Lagnado		PXE section figures changed order

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1 MAC Address Pass Through Addressing

1.1 Purpose

The purpose of this whitepaper is to describe the BIOS, SW, and HW functionality of a new HP feature known as MAC Address Pass Through or also known as Host Based Mac Address (HBMA) solution. This whitepaper will describe the MAC Address Pass Through feature set and how to configure and utilize the feature for end customers.

1.2 Introduction

1.2.1 MAC Address Pass Through (HBMA) Overview

A per system unique MAC address will be stored (programmed/flushed) within the platform BIOS at the factory. This MAC address is not directly associated with any of the embedded or attached NIC devices; instead it is a “floating” MAC address, in that it can be asserted to any one of the specified NIC devices during Windows and/or PXE operation. When MAC Address Pass Through is enabled on a system, it allows the system administrator or image-deployment professional to uniquely identify that system on the network based on only the MAC address, no matter which NIC, dongle, or dock is used to connect with the network. MAC Address Pass Through allows the attached NIC device to use the BIOS stored MAC address (HBMA address) and hand it off to the attached NIC device, so that the platform can be uniquely identified on the network using just the MAC address.

Optionally, there can also be a user defined “custom” MAC address that would then be used as the HBMA address (instead of the factory stored HBMA address). Although we included this flexibility in the MAC Address Pass Through feature set, more than likely most users will utilize the factory-stored MAC address, so that they do not have to create and maintain a list of unique MAC addresses for their users.

MAC Address Pass Through works for both Windows and PXE environments. The basic overview is seen in flow chart below.

1.3 Supported Devices

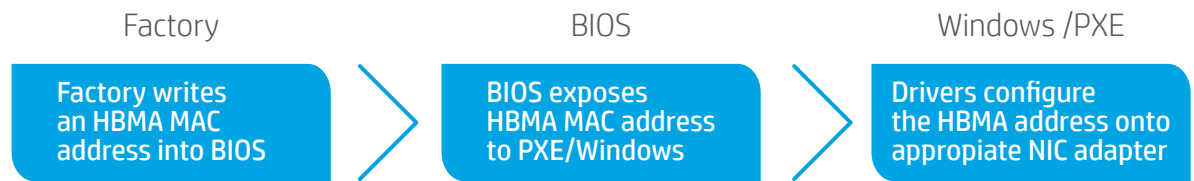
There are several usage cases in which customers want to have a single MAC address exposed to the network for system-identification purposes for both management and security purposes. MAC Address Pass Through works with both the embedded NIC devices in a system as well as any authorized HP NIC accessories such as dongles or docks.

1.3.1 Embedded NIC Devices:

There are also certain use cases in which the embedded NIC device may need to utilize the HBMA address, even though the embedded NIC device already has a platform-unique MAC address (since it is soldered down on motherboard). However, the HBMA address may still be desired in order to provide a unique single MAC address for the system and have it applied to all NIC devices on the system no matter the NIC interface that is chosen (embedded, dongle, or dock). (Note: if multiple NIC devices are on a system only, the MAC Address Pass Through feature only sets one of the devices to the HBMA address; the other NIC devices retain their native MAC address).

1.3.2 External NIC Accessories:

The main intent of MAC Address Pass Through is to provide external NICs that are not embedded on the platform, a platform-unique MAC address that can be uniquely identified as originating from a specific platform. Examples of such



devices are external dongle accessories and/or external dock accessories.

Figure 1 MAC Address Pass Through operation flow

1.4 Supported Operating Systems

The MAC Address Pass Through feature is supported in both PXE and Windows operating system environments.

1.4.1 PXE Operating System:

MAC Address Pass Through is being developed to support PXE environments, to enable customers to uniquely image systems using PXE, especially for those systems that do not have a dedicated embedded NIC (i.e., tablets). These tablet systems typically have external NIC dongles or docks to connect to the PXE network. In this usage case, the MAC Address Pass Through feature allows for a NIC dongle or external dock to utilize the platform's host-based MAC address, and thereby allow the PXE network to uniquely identify and manage the PXE image based on the attached system.

1.4.2 Windows Operating System:

Customers who manage their assets (laptops) via MAC address may have issues if MAC addresses are not unique to the platform. Many current and future dock architectures have integrated NICs within the dock itself; therefore, these MAC addresses are not uniquely associated with a specific platform. In the floating-workplace environments in which docks are used, and those docks are not specifically assigned to a single user, it is impossible to uniquely track and/or manage the user based on MAC address. MAC Address Pass Through solves this issue, by providing a unique platform MAC address to the NIC drivers so the NIC uses the HBMA address.

1.4.3 Other Operating Systems:

Currently only PXE and Windows are targeted for MAC Address Pass Through. There are currently no plans for FreeDOS, WinPE, Linux or others.

1.5 MAC Address Pass Through (HBMA) writing and storage in BIOS

1.5.1 BIOS storage and location

Factory will store a unique MAC address on each host platform. The HBMA MAC address will be different than the embedded MAC address on the platform.

The HBMA System MAC parameter will appear in the BIOS F10 setup pages, and is not able to be changed by the user. The HBMA Custom MAC parameter will also appear in the BIOS F10 setup pages and can be modified by the user.

The Custom HBMA MAC address is reset to 00-00-00-00-00 after BIOS restore of defaults.

1.5.2 MAC Address Format

The IEC standards body (IEC 10039) have defined the format of the MAC address. Based on the IEC standards, the Custom MAC addresses is required to have the second byte either 0, 2, 4, 6, 8, A, C, or E. To accommodate this format, BIOS will perform an error check during each write in order to ensure that the user inputs a MAC address conforming to the required format (second byte of the custom MAC address is always either 0, 2, 4, 6, 8, A, C, or E).

BIOS Location for HBMA addresses location	Stored/Written	Example	Limits
0xTBD Custom (User)	xy-xx-xx-xx-xx-xx	C8-22-33-44-55-66	x=0-9, a-f; y=0, 2, 4, 6, 8, a, c, e

1.5.3 MAC Address Pass Through (HBMA) Parameter Configuration

BIOS maintains the settings for MAC Address Pass Through; this allows for the administrator to setup the parameters and password lock them as needed. Typical HP BIOS configurations, such as BCU tool, have also incorporated the MAC Address Pass Through feature. The BCU tool will allow an administrator to automate the process of HBMA configuration. The MAC Address Pass Through parameter settings configured in BIOS are available for both PXE and Windows environments.

HBMA Enable /Disable – A setting should Enable/Disable using HBMA on the system. “Disabled” is the default setting; when disabled, the HBMA custom and SYSTEM addresses should be grayed out and unavailable for configuration.

Address modification – The Custom MAC address should be available to the user to customize as needed. On a restore default BIOS event, the “Custom” address will be reset to 00-00-00-00-00-00.

Configure Factory/System MAC Address

Current Factory: 66-66-66-66-66-66
 Current System: 66-66-66-66-66-66

Examples: 1234567890AB
 12-34-56-78-90-AB

Leave Blank and press ENTER to clear the MAC address
 The Second Byte must be even digit, either 0, 2, 4, 6, 8, A, C or E

Type the factory /System MAC Address and press ENTER to SAVE

Press ESC to CANCEL

Figure 2 HBMA address configuration

Prioritization Device List – MAC Address Pass Through is capable of being used with several NIC devices. However, based on network architecture and protocol requirements, the HBMA MAC address can only be used/asserted on a single device at any given time. The “HBMA Priority Device List” ensures that only one NIC is configured with the HBMA address at any given time.

Main | Security | Advanced | UEFI Drivers

➔ MAC ADDRESS: C8-D3-FF-ED-87-47

- Pre-boot HBMA Support
- Windows HBMA Support
- Single NIC Operation (Disable All Other NICs when HBMA is active on one NIC) ?

HBMA Priority List:

- ▶ USB NIC Dongle: HP External Adapter
- Thunderbolt Dock: HP Elite Dock
- USB NIC Dongle: HP USB-C Travel Dock
- USB NIC Dongle: HP USB Travel Dock
- USB NIC Dongle: HP 3005pr
- USB NIC Dongle: HP Universal pr

UP/DOWN = Select Item, ESC = Exit, ENTER/SPACE/->=Adjust, F5/ Touch Boot Option = Enable/Disable, ENTER =Accept

1. If there are multiple NIC devices connected to the platform the HBMA Priority List is used to determine which NIC devices with an active Ethernet cables attached should be configured with the HBMA MAC address. The HBMA Priority List is also used to disable NIC devices that a user does not want to be included in the HBMA configuration.
2. To change the priority use the up/down arrow keys to move the white arrow to the NIC device that you would like to change.
3. Press <Enter> to select the NIC device.

Main | Security | **Advanced** | UEFI Drivers

➔ MAC ADDRESS: C8-D3-FF-ED-87-47

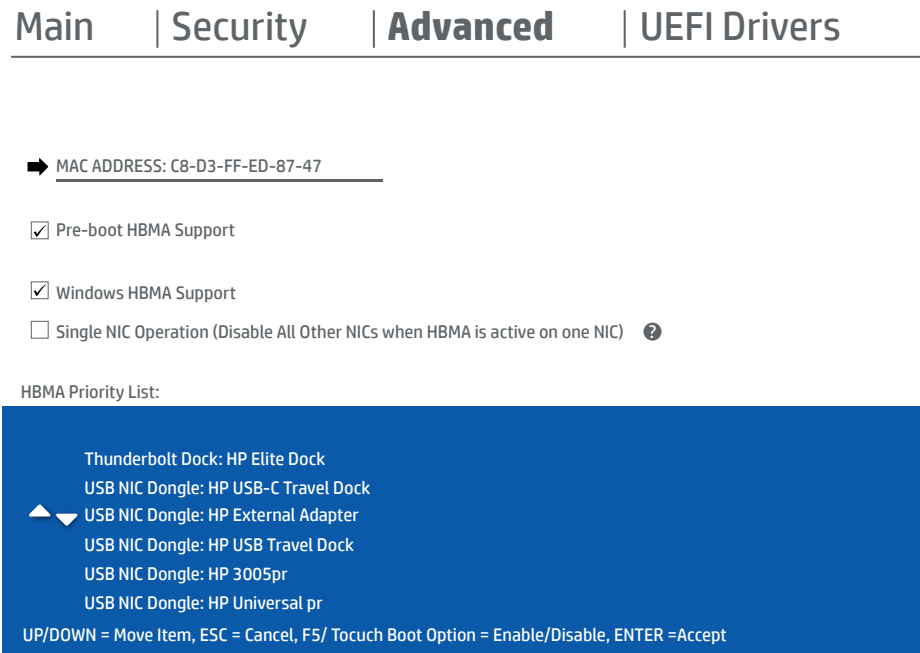
- Pre-boot HBMA Support
- Windows HBMA Support
- Single NIC Operation (Disable All Other NICs when HBMA is active on one NIC) ?

HBMA Priority List:

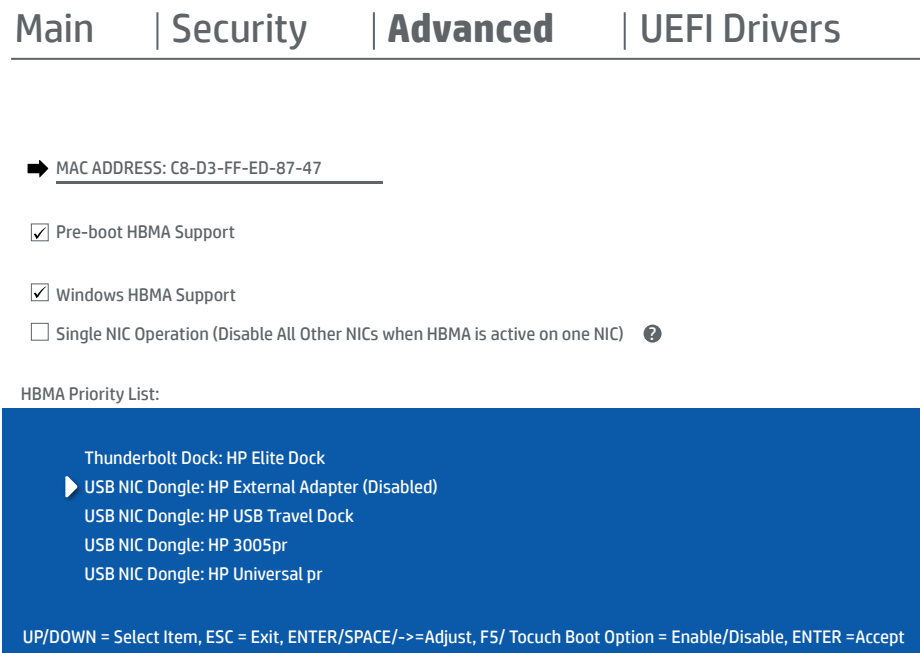
- ▲ ▼ USB NIC Dongle: HP External Adapter
- Thunderbolt Dock: HP Elite Dock
- USB NIC Dongle: HP USB-C Travel Dock
- USB NIC Dongle: HP USB Travel Dock
- USB NIC Dongle: HP 3005pr
- USB NIC Dongle: HP Universal pr

UP/DOWN = Move Item, ESC = Cancel, F5/ Touch Boot Option = Enable/Disable, ENTER =Accept

4. After the NIC device is selected you will see black up/down arrows that allow you to change the priority. Moving the NIC device from top to bottom of the list lowers the priority.



5. Use the up or down arrow keys to adjust the priority. In the above example we moved the “USB NIC Dongle: External Adapter” from the top priority (top of the list) to medium priority (middle of the list).
6. Press <Enter> to accept the priority change.



7. You can also disable/enable NIC devices within the list.
8. Use the up/down arrow keys to move the white arrow to the NIC device that you would like to change.
9. Press <F5> to toggle between Disable/Enable.
10. The above steps are repeated for each device if you need to change the priority or disable/enable.
11. Once all the Priority List changes are complete press <ESC>.

Figure 3 F10 HBMA Priority Listing

This list is similar in operation as the existing F10 boot device menu, where devices can be slid up/down the list to give precedence to a device with HBMA. In addition to the ordering, the administrator will also be able to enable/disable MAC Address Pass Through association with each supported device. This would allow a user/administrator to specify which of the supported NIC devices should be enabled for MAC Address Pass Through configuration. For example, a user could assert and want MAC Address Pass Through to function only on dongles and docks devices, but the user may not want the embedded NIC to be configured by MAC Address Pass Through.

PXE and Windows Selections – The MAC Address Pass Through feature is configurable for both PXE and Windows. If PXE is selected, then the priority will follow the boot order. Windows follows the HBMA priority list.

1.5.4 BIOS BCU MAC Address Pass Through sample

BIOS has exposed the MAC Address Pass Through parameters with the BCU tool settings so that certain field/addresses and parameters can be configured. Sample below.

Host Based MAC Address

- Disable*
- System
- Custom
- Enable*

HBMA Factory MAC Address

- 00-00-00-00-00-00

HBMA System MAC Address

- 00-00-00-00-00-00

HBMA Custom MAC Address

- 00-00-00-00-00-00

Pre-boot HBMA Support

- Disable

Windows HBMA Support

- Disable
- Enable*

Single NIC Operation (Disable All Other NICs when HBMA is active on one NIC)

- Disable*
- Enable

HBMA Priority List

- USB NIC Dongle: Realtek RTL8153H:0BDA_8153

- Embedded NIC: Realtek RTL8111HSH:10EC_8168:103C_8234 (Disabled)

Note:

1. HBMA Factory MAC Address and HBMA Custom MAC Address is 34 byte Unicode with “-”
 2. Priority List Format:
 - PCI device: {Device Type}:{Friendly Name}:{VID_DID}:{SVID_SDID}
 - USB device: {Device Type}:{Friendly Name}:{VID_PID}
-

1.6 MAC Address Pass Through for PXE (Pre-boot eXecution Environment)

1.6.1 PXE usage case

Customers who use PXE want the network to be provided a platform-unique MAC address, instead of the accessory's MAC address. This feature would allow for managing of PXE images based on MAC address. Basically, we want the accessory NIC to behave as if it is a native NIC, with a unique host based MAC address.

Currently, if multiple platforms are plugged into a dock at different times, the MAC address presented to the network is always associated with the dock, and therefore there is no way to differentiate between platforms (or PXE images). MAC Address Pass Through provides a better customer experience using PXE on HP tablets and convertibles when attaching to a network to facilitate image deployments and updates.

1.6.2 Existing PXE problem with external NICs

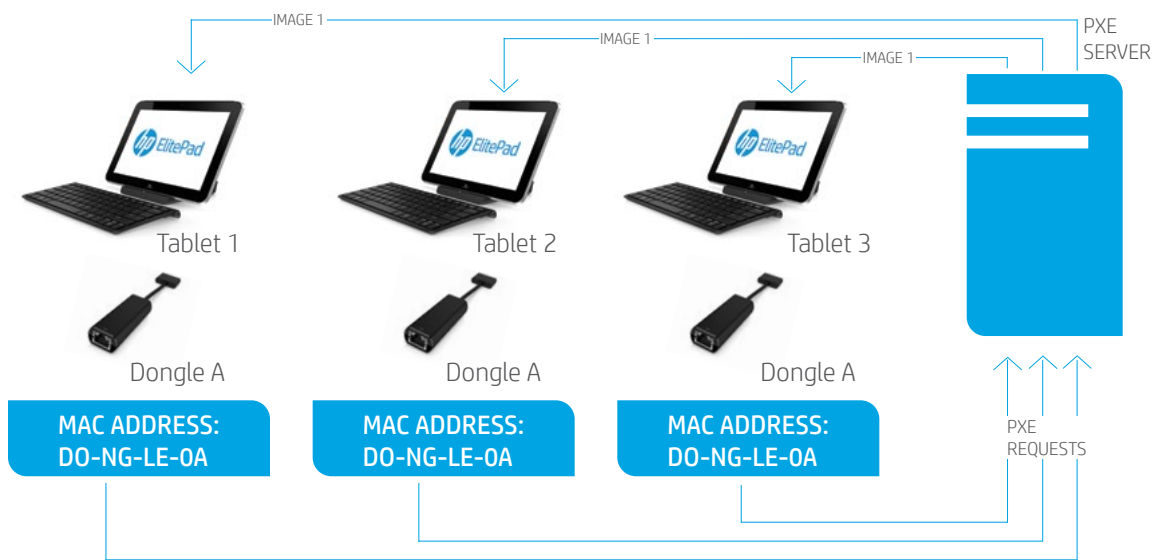


Figure 4 Existing PXE issue with dongles

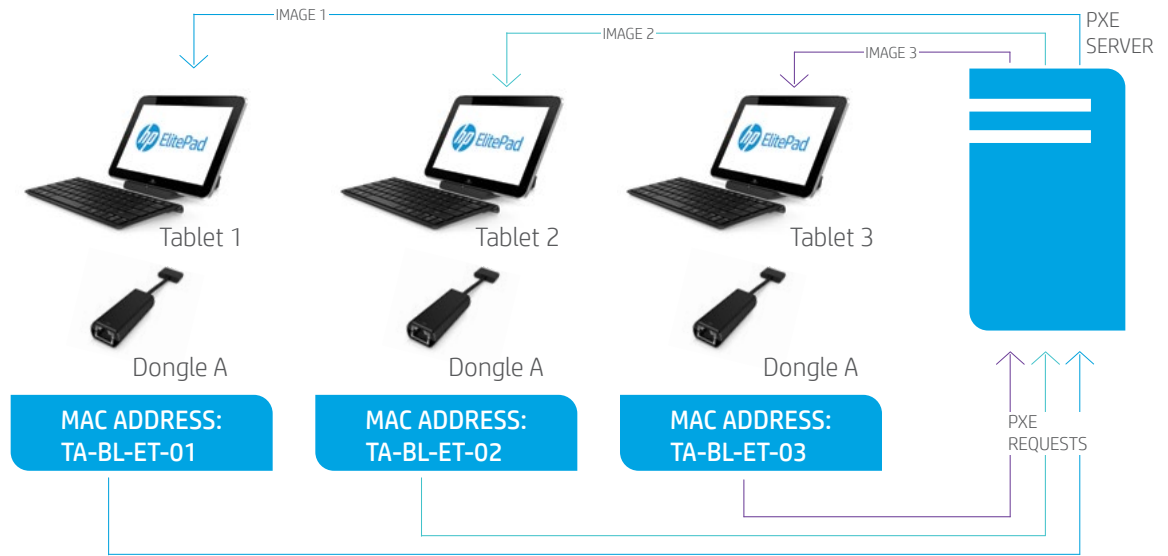


Figure 5 New MAC Address Pass Through PXE solution

1.6.3 PXE solution with MAC Address Pass Through (HBMA)

With MAC Address Pass Through feature enabled, the MAC address presented to the network originates on the host.

The network will see a unique “host based” MAC address and will be able to have PXE server provide a unique image to the platform.

1.7 MAC Address Pass Through in Windows

1.7.1 Windows Operating System:

Customers who manage their assets (laptops or tablets) via MAC address may have issues if MAC addresses are not unique to the platform. Many current and future dock architectures have integrated NICs, which therefore have MAC addresses which are not uniquely associated with a specific platform. In addition, many of the small-form-factor notebook and tablets no longer have embedded NICs, and therefore the external dongles/docks MAC address is not uniquely associated with the system. Therefore, in floating workplace environments in which external dongles/docks are used, and those docks are not specifically assigned to a single user, then it is impossible to uniquely track and/or manage the user based on MAC address. There are other ways for management solutions to handle this, but the typical case is using MAC addresses.

FAQs

1.7.2 Can Multiple device share the HBMA address at the same time?

MAC Address Pass Through is only a single MAC address, and therefore cannot be set onto multiple devices at the same time. The MAC Address Pass Through solution from HP allows the user to create a priority listing, to let the MAC Address Pass Through service know which devices should have higher priority for receiving the MAC address. If a NIC device is hot-plugged into a system and it is determined to have a higher priority than the existing HBMA device, the MAC Address Pass Through service will place the previous (lower priority) device back into native MAC address mode and then set the new (higher priority) device to utilize the HBMA address. At NO time will two NIC devices share the same MAC address.

1.7.3 Does MAC Address Pass Through support WoL?

Yes, if the system supports MAC Address Pass Through, then WoL will also be supported. The one caveat is that the accessory is never to be removed after the system enters a sleep state. In other words, a system must first reside in an active state (S0) with the dongle or dock attached to the system; then, when the system goes into sleep state (S3), MAC Address Pass Through and WoL will still be operational. However, if a user removes or inserts a dongle or dock while the system is asleep, MAC Address Pass Through or WoL will not be functional.

1.7.4 Is the MAC Address Pass Through (HBMA) address unique?

Yes, the HBMA address is unique and is like any native MAC addresses that appear on NIC devices. This address can be uniquely identified by your network.

1.7.5 Why does my native address sometimes appear briefly during device insertion?

Within Windows, MAC Address Pass Through is configured via a Windows service. MAC Address Pass Through only asserts itself on active NIC devices, and since MAC Address Pass Through also works across multiple device options, sometimes a device will first enumerate with its native MAC address and then be provided the HBMA address and re-enumerate. The MAC Address Pass Through service tries to limit the occurrence of this situation, and likely this only occurs when a new NIC device is inserted that has a higher priority than the existing HBMA NIC device.

1.7.6 Does MAC Address Pass Through also force the IP address to remain constant?

Mostly yes. Although MAC Address Pass Through only interacts with the MAC address (layer 2), most DHCP servers will provide the NIC device with the same IP address once it sees the same MAC address requesting it.

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