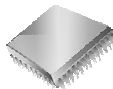




EUI-48™ Programmed Serial EEPROMs

“MAC Address Chips”



- EUI-48™ & EUI-64™ Compatible
- Available in SPI, I²C and UNI/O® Bus
- Low Cost, Easy Access

Hello and welcome to this web seminar on Microchip’s new MAC Address Chips.

My name is Aditya Rao, product marketing Engineer in Microchip’s memory products division. This 15-minute web seminar will look at Microchip’s new EUI-48™ enabled MAC address chip.

Microchip’s MAC address chips are uniquely pre-programmed with EUI-48™ node addresses. These Serial EEPROM devices are designed to work on the SPI, I²C and UNI/O busses and come with up to 1.5Kb of EEPROM. These devices are also EUI-64 compatible. A robust serial interface combined with standard packaging and EEPROM functionality including high endurance, low operating currents and low power draw make these devices ideally suited for applications in the embedded networking market. Finally, easy access to these plug-and-play devices ensure faster design times and their low costs help bring down the overall system cost.

In this webinar, I’ll talk about the two MAC address standards defined by the IEEE and then go over some of the features, advantages and benefits of these devices. Finally, I will go over an application example and show how you can get set-up quickly.



Questions to Ask Yourself?

Do you need plug-and-play access to MAC addresses to help you get to market quickly?

Looking for easy, inexpensive access to MAC addresses for your application?

Are you looking for MAC addresses with no volume restriction on quantity ordered?




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MPLAB® Starter Kit For Serial Memory Products

Slide 2

Here are a few questions to think about and ask yourself as we go over this web seminar:

Are you looking for easy, inexpensive access to MAC addresses for your application?

One solution to obtain MAC Addresses is to source them directly from the IEEE. But, this will require programming and serialization which is time consuming, expensive and will increase time to market, is that acceptable?

Or, will easy, plug-and-play access to MAC Address chips enable quicker designs and help you get to market quicker?

Finally, do you need just a few MAC addresses and looking for a vendor with no volume restrictions?

MAC address chips from Microchip will help solve the issues above and this web seminar will show you how.

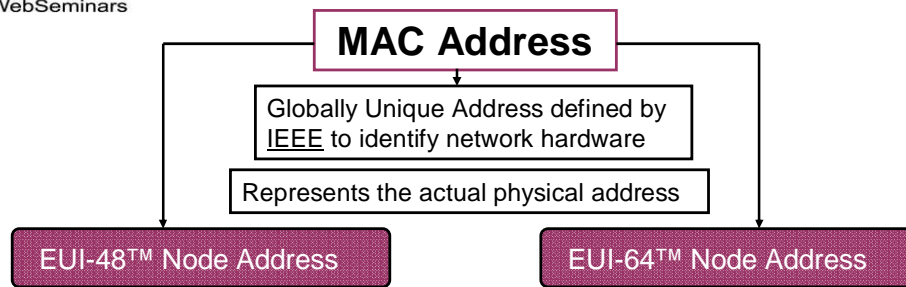
Now, let's look at our agenda.

Agenda

- **EUI-48™ and EUI-64™ MAC addresses**
 - **Converting EUI-48™ to EUI-64™**
 - **Applications by EUI standard**
 - **Product Features and Benefits**
- **Obtaining EUI-48™ addresses today**
- **Application Set-Up**
- **Ordering Info and more...**

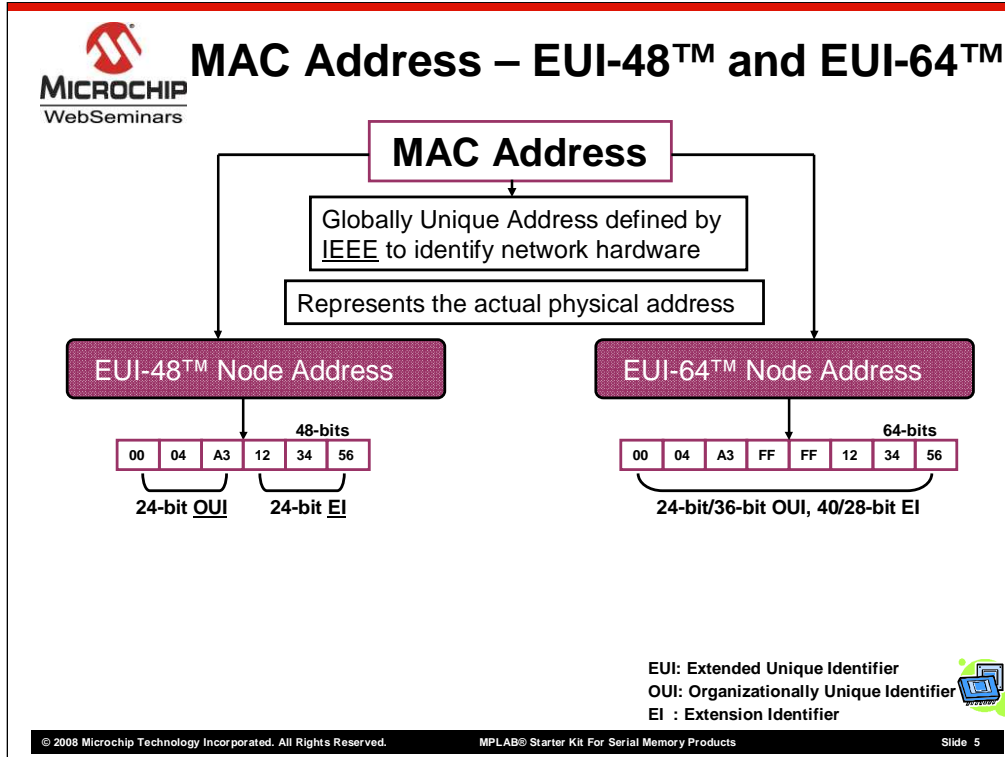
We'll start by looking at MAC addresses, and specifically the EUI-48™ and EUI-64™ standards. Then, we'll go over the different application segments defined by the two standards. We will then go over specific product features and benefits and compare the different options available for obtaining EUI-48™ addresses. After that, we'll expand on these benefits and we'll go over a typical application set-up and show you how to add these to your existing application. Finally, we will look at the ordering information and where to go online for additional information.

MAC Address – EUI-48™ and EUI-64™



Now, let's take a look at the two types of MAC addresses defined by the IEEE, but first, what are MAC addresses?

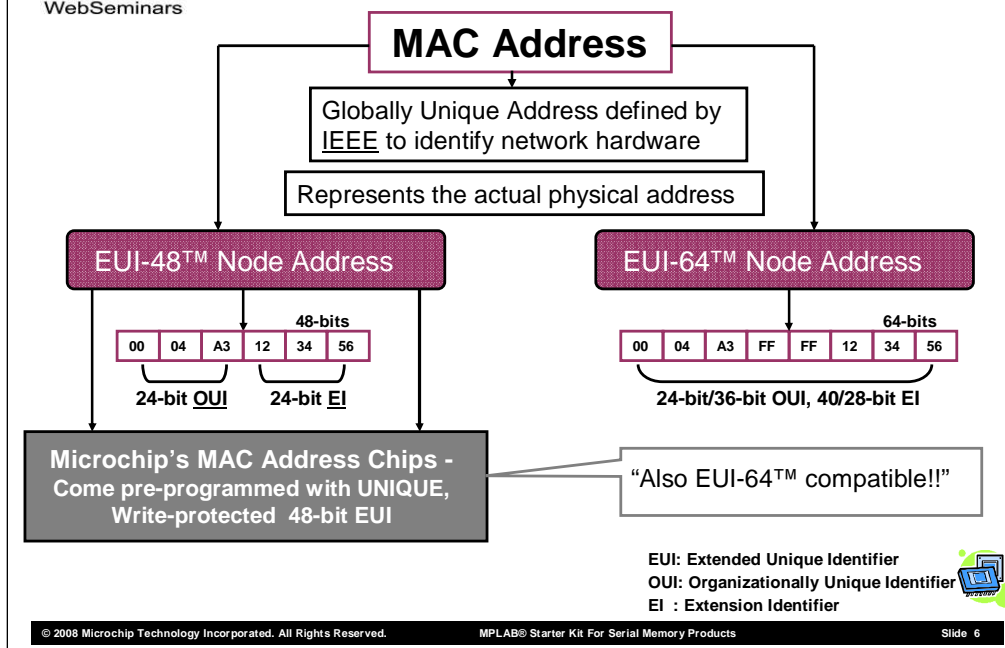
MAC addresses are globally unique addresses defined by the IEEE to uniquely identify the physical address of a network hardware device. The IEEE has two MAC address standards, the 48-bit EUI-48™ and the 64-bit EUI-64™ standard. These go into different applications as we will see later in this webseminar.



Both of these node addresses consists of two parts - a unique OUI or the organizational Unique Identifier issued by the IEEE and a unique EI or the Extension Identifier. The OUI is generally purchased by different organizations (companies) directly from the IEEE and they are globally unique for each organization. These organizations are then responsible for ensuring that a unique EI will go into every device they use or ship, and, in doing so, they would ensure a globally unique EUI node address.

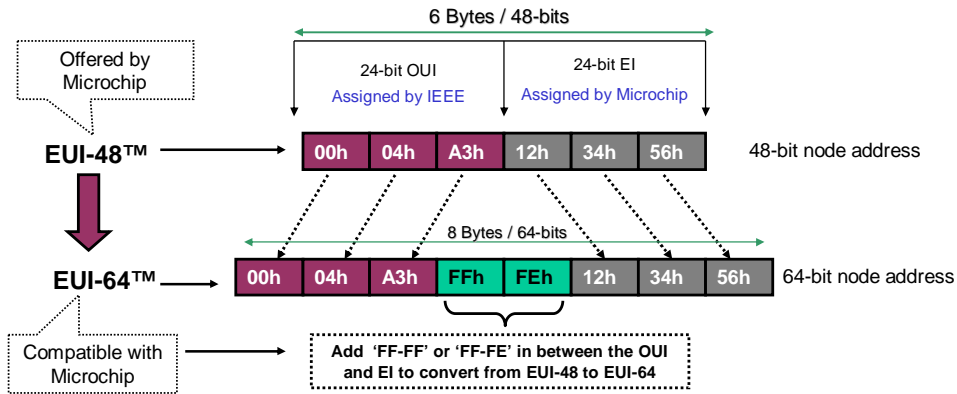
The EUI-48 node address consists of a 24-bit OUI and a 24-bit EI as you can see on the slide, the EUI-64™ consists of either a 24 or 36 bit OUI and a 40 or 28bit EI respectively. The EI's in both cases is assigned by the Organization.

MAC Address – EUI-48™ and EUI-64™



Microchip's MAC address chips come with uniquely pre-programmed and write-protected 48-bit EUI addresses. These EUI-48™ node addresses from Microchip are also compatible as EUI-64™ addresses as we will see next.

Converting Microchip's EUI-48™ to EUI-64™



Note: IEEE also issues individual EUI-64 addresses

Corresponding EUI-48™ node address (hex): 00-04-A3-12-34-56

Corresponding EUI-64™ node address (hex): 00-04-A3-FF-FE-12-34-56

Now, let's take a closer look at the EUI-48™ and EUI-64™ node addresses. Microchip's MAC address chips are EUI-64™ compatible as well - By having your software insert the 16-bits "FF-FF" or "FF-FE" in between the OUI and EI the EUI-48™ address can be converted to a unique EUI-64™ node address. These 16-bit codes have been specifically reserved by the IEEE to help convert an EUI-48™ node address to a unique 64-bit MAC address. So in the example here, the 48-bit node address is 00-04-A3-12-34-56 while the corresponding 64-bit node address is 00-04-A3-FF-FE-12-34-56. The above addresses are in hex.

Note: The IEEE also issues Individual OUI's for EUI-64™ blocks but they ensure that they don't use the 2 bytes above.

EUI-48™ & EUI-64™ Applications

EUI -48™	EUI-64™
•Ethernet	•ZigBee / IEEE 802.15.4
•Bluetooth	•MiWi
•802.11 Wi-Fi	•FireWire
•ATM Networks	•IPv6
•Serial Attached SCSI and Fiber Channel	
•Most other IEEE 802.x	

- Every EEPROM will be uniquely pre-programmed
- Every EEPROM shipped will have code write protected to ensure code cannot be accidentally erased or tampered with.
- Also known as MAC address, NIC Address, Ethernet Address, Vendor ID.
- Code to be programmed into the last 6 bytes of the array.

Here are some applications that use the EUI-48™ and EUI-64™ standards. The EUI-48™ is needed in the Ethernet, bluetooth and Wi-Fi segments while the EUI-64™ standard is used in the IEEE 802.15.4 standard also known as ZigBee, they are also used in MiWi and FireWire applications.

Microchip will ship uniquely programmed write-protected chips to ensure that the code cannot be accidentally over-written or erased. This write-protect feature will be in hardware for our I2C parts with half the array write protected. Our SPI and UNI/O parts will have write protection via software with quarter of the 2 Kbit array write protected. Finally, note that these codes will be programmed into the last 6 bytes of the memory array.

Key Product Features

	24AA02E48 2Kbit	25AA02E48 2Kbit	11AA02E48 2Kbit
Bus	I ² C – 2 Wire	SPI – 4-Wire	UNI/O® – Single I/O
Voltage	1.7V – 5.5V	1.8V – 5.5V	1.8V -5.5V
WP Scheme	½ Array, Hardware	¼ Array, Software	¼ Array, Software
Bus Speed	400KHz	10MHz	100KHz
Temperature	-40°C to +85°C	-40°C to +85°C	-40°C to +85°C
Available EEPROM	1Kb	1.5Kb	1.5Kb

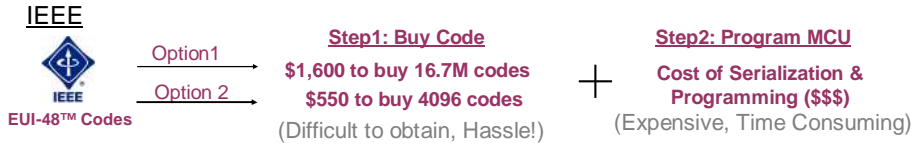
- Available in SPI, I2C and UNI/O® bus
- Write-Protected Codes
- SOIC and SOT-23
- 1M E/W cycles, 200 years data retention
- Low operating and standby currents

Now will be a good time to look at Microchip’s product offering and quickly glance over the key product features.

Microchip’s EUI-48™ enabled MAC address EEPROMs are available in the SPI, I2C and UNI/O bus. These standard well known protocols will help you get designed in quickly and get to market sooner. They will be available in the popular SOIC and SOT-23 packages and come with write protected codes as explained previously. These 2Kbit devices will come with standard EEPROM features including at least 1M cycles endurance, 200 years data retention, low operating and stand-by currents.

Where to go for EUI-48™ codes?

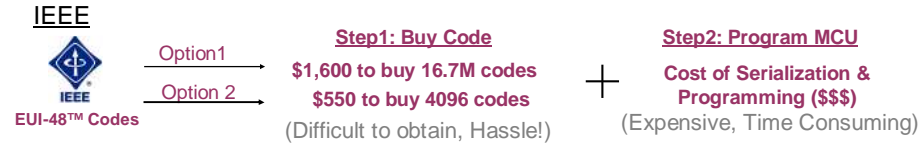
Option 1: Buy codes directly from IEEE



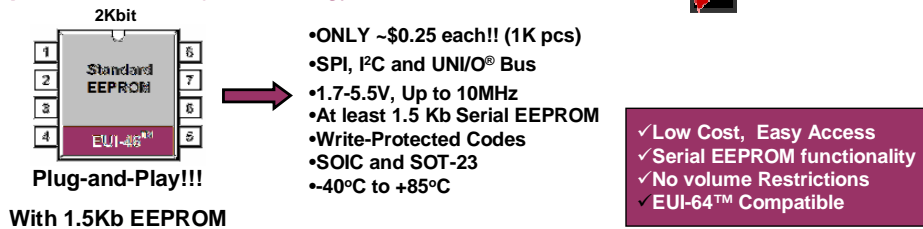
So, where do you go if you need MAC addresses today? One way to obtain EUI-48™ codes is to buy them directly from the IEEE. They offer two options, the first is to buy 16.7M (or 2^{16}) codes for approximately \$1,600, or, the other option if you don't need that many codes is to buy 4096 codes for approximately \$550. As you can see, these codes are not easy to obtain and come with volume restrictions. Also, once these codes have been purchased, they need to be programmed on an MCU and this cost of serialization is often very expensive and time-consuming especially for small and mid-sized volumes.

Where to go for EUI-48™ codes?

Option 1: Buy codes directly from IEEE



Option 2: Microchip Technology Inc – We do ALL the above!!!



“No Buying Codes, No Serialization needed, No Volume Restrictions, No Hassle!”

The other option to obtain MAC addresses is to buy Microchip’s MAC address chips. We do ALL of the above for you and more. Our pre-programmed EUI-48 enabled MAC address chips come with up to 1.5Kb of Serial EEPROM that can be used to store configuration settings, routing tables or buffer small amounts of data. These plug-and-play devices come in three standard busses – The I2C, SPI and UNI/O bus. These codes are write-protected to ensure tamper proof codes and finally, they are low-cost, easy to access and come with NO volume restrictions.

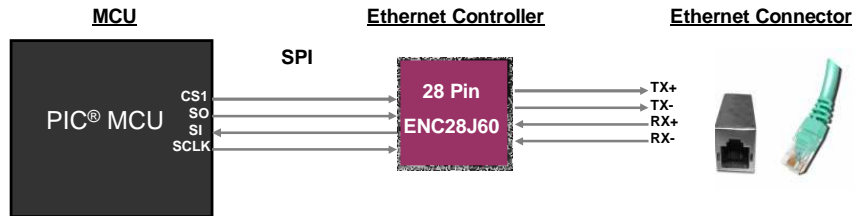
They are priced at approximately \$0.25 for 1K pieces on the web. We will see how to order them online and where to go on our website to get more information later in this demo.

Feature – Benefit - Result

Feature	Advantage	Benefit
48-bit EUI™ Embedded in a Serial EEPROM	Easy access to IEEE MAC addresses Same code is EUI-64 Compatible	Buy codes only when needed. Lower overall costs No Serialization/ Programming hassles
At least half the array available as a standard EEPROM	Additional non-volatile memory.	Scratch-pad area to store configuration settings or to buffer small amounts of data.
Available in standard busses – SPI, I ² C, UNI/O®	Faster design times Easy to incorporate into existing designs – Plug-and-Play	Well-known protocols Design Flexibility
Write Protected Codes	Any modifications to the array will not affect these codes	Ensures unique tamper-proof codes.
Standard EEPROM features	High endurance; Large operating voltage and temperature range; Low operating and stand-by currents	Create more robust designs Serial Interface Low power draw.

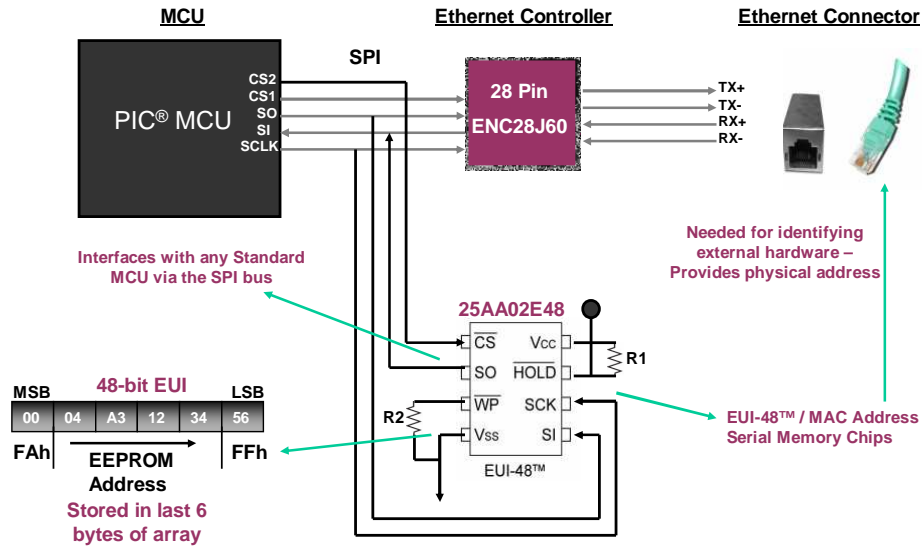
Now, let's again summarize all the features and benefits of the MAC address chip. As we have seen, these devices are easy to access, no IEEE, no registration, no hassle and no volume restrictions, order these parts online as you build them into your designs. These codes are also EUI-64 compatible allowing you to use the same code as an EUI-64 node address. Standard busses and packages allow you to quickly incorporate them to existing designs with little overhead allowing you to get to market sooner. Finally, additional EEPROM non-volatile memory can be used to store routing tables, configuration settings or to buffer data.

Typical Application Set-Up



Now, let's take a look at a typical application set-up. Here we use Microchip's ENC28J60 Ethernet controller to add ethernet functionality to an application. Note that the 28-pin ENC28J60 interfaces to the MCU using the standard SPI bus. The Ethernet controller, being a network peripheral needs a unique MAC address to help identify it. This MAC address needs to be obtained from the IEEE and then programmed into the PIC. This is expensive and time consuming as we have already seen.

Typical Application Set-Up



The easier alternative is to buy a MAC address chip from Microchip and set it up as shown using the SPI interface on the 25AA02E48 MAC address chip. You're set-up and ready to go using just one extra chip-select pin on the MCU. This plug-and-play device also comes with additional EEPROM capability to help store configuration settings or lookup tables or buffer small amounts of data. These chips are available in SPI, I2C and the UNI/O® bus to offer designers the flexibility to select the one that best fits into their application. As we can see, there is no need to obtain and pre-program the MCU with a MAC address, just drop in the MAC address chip and you no longer need to worry about MAC addresses for your application. No IEEE and no volume restrictions. It really is just THAT simple.

Also note that the actual EUI-48™ node address is stored in the last 6 bytes of the memory array with the Most Significant Bit in the lowest memory address or the Big Endian convention. Next let's take a look at the part naming convention and ordering information.

Ordering Info.

24AA02E48T-I/SN

11 - UNI/O®
24 - I²C
25 - SPI

TT 3-SOT-23
OT 5,6-SOT-23
SN 8-SOIC (150 mil)

I - Industrial (-40°C to +85°C)

02 - 2 Kbit

Blank Tube
T Tape and Reel

AA 1.8V - 5.5V

E48 - EUI-48™

Here is the part number decoder. These parts have a similar naming convention to our standard EEPROM parts. Notice they have an E48 embedded into the part number to indicate these are EUI-48™ enabled MAC address chips.

For More Info...

- **Device Data Sheets and Product Briefs**
- **Website**
<http://www.microchip.com/MAC>
- **Sample Today**
<http://www.microchip.com/samples/>
- **Buy Online Now!**
www.microchipDirect.com and click,
Products->Memory->MAC Address Chips
- **Tools**
[MPLAB Starter Kit for Serial Memory Products](#)



For more information about the MAC address chips be sure to check out our web site at www.microchip.com/MAC. For specific product information, see our data sheets and product breifs. We also have several educational app notes that should provide more information. Sample these parts today at www.microchip.com/samples or if you need to place an order for production quantities you can do so online by visiting our e-commerce portal, microchipDirect at www.microchipDirect.com. Finally, to help in your product development efforts and help get you started with your design get hold of the MPLAB starter kit for serial Memory products tool.

MAC Address Chips

- **Flexible**
 - EUI-48™ & EUI-64™ Compatible
 - Up to 1.5Kbit EEPROM
 - Plug-and-Play
- **Low Cost**
 - No Serialization
 - SPI, I2C and UNI/O bus – Design Flexibility
 - Incorporate easily into existing design
- **Easy Access**
 - Available online
 - No Volume Restrictions
 - No IEEE, Buy codes only when needed

And this completes the web seminar on Microchip's MAC address chips.

I'd like to summarize the important benefits of the MAC address chips:

First, microchip's pre-programmed MAC address chips are both EUI-48™ and EUI-64™ compatible as we have seen. These plug-and-play devices are available in standard pin-outs and they contain up to 1.5Kb of Serial EEPROM allowing you to use this scratch-pad memory to store settings or to buffer data.

Second, they are designed to work on standard serial busses like the SPI, I2C and our new single I/O UNI/O® bus allowing you to easily incorporate them into existing designs and get set up quickly as we saw in the application example earlier. Also, with these device you no longer need to serialize each MCU with a unique MAC address thereby saving additional costs and time. This helps you reduce your overall system costs and get to market faster.

Finally, these devices are easy to access, they can be sampled and ordered online through our website. They have no volume restrictions, allowing you to buy these codes as and when needed making it easy to obtain MAC addresses.

Thank You very much for your time and be sure to check our website for the latest updates.