A practical guide to RFID badge copying

5 Replies

During red teaming assignments we are sporadically asked to attempt to gain access to certain physical “flags”. These flags could be the inside of a server room, or the workstation of a member of the management team.

Aside from these red teaming assignments, in most organisations, access badges are often the single factor of security that stands between us and the inside of a building, a server room or an office. There are many different RFID card reading systems on the market. Unfortunately, the security they provide is often lacking. With this blog post we want to demonstrate how easy it is to bypass the card reader security mechanism when it is insufficiently secured.

Specialised hardware is required to clone existing RFID cards, this hardware can easily be obtained and is relatively inexpensive. For this case study, we use the Proxmark3, which is a device developed by Jonathan Westhues that allows sniffing, reading and cloning of RFID (Radio Frequency Identification) tags.

DISCLAIMER: This blog post, and by extent any other blog post written by NVISO LABS, are intended for educational purposes only. It is not intended and should not be used for the illegitimate cloning of RFID badges without prior permission.

Cloning and abusing the card

May 3, 2018

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May 3, 2018

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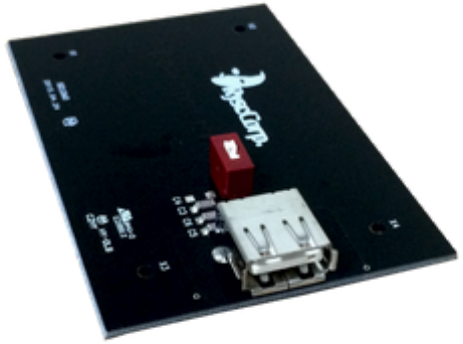
Lab rats represent! Meep Meep 🚀 @HackBelgium #hackbelgium

Below we'll provide a step by step example on how to clone an HID global RFID card. Note that the Proxmark3 is able to copy many different types of cards.

We have two types of antennas that we can connect to our Proxmark3: a low frequency one and a high frequency one. The low frequency card, operating at 125kHz and 134kHz, can communicate with e.g. HID Prox II, HITAG, and EM4100 tags. The high frequency card, operating at 13.56Mhz, can communicate with e.g. Mifare Classic/Ultralight and iClass tags.



After starting up the proxmark3 interface, we can run the"*hw tune*"command to see if any card is detected. Currently the LF antenna is connected to the Proxmark3 and at this point there is no card in the presence of our LF antenna.

Apr 26, 2018

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Didier Stevens
@DidierStevens

My SDR workshop at #HITB2018AMS :-)

Apr 12, 2018

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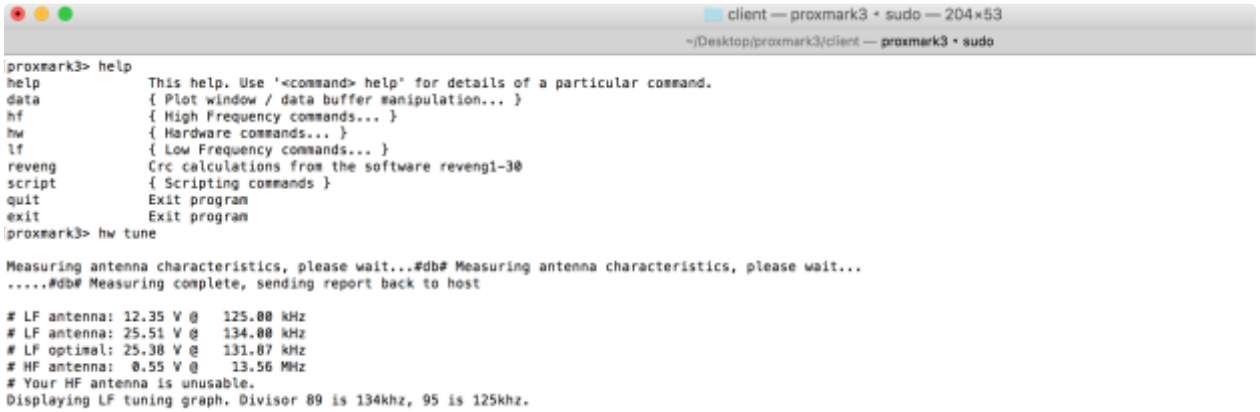
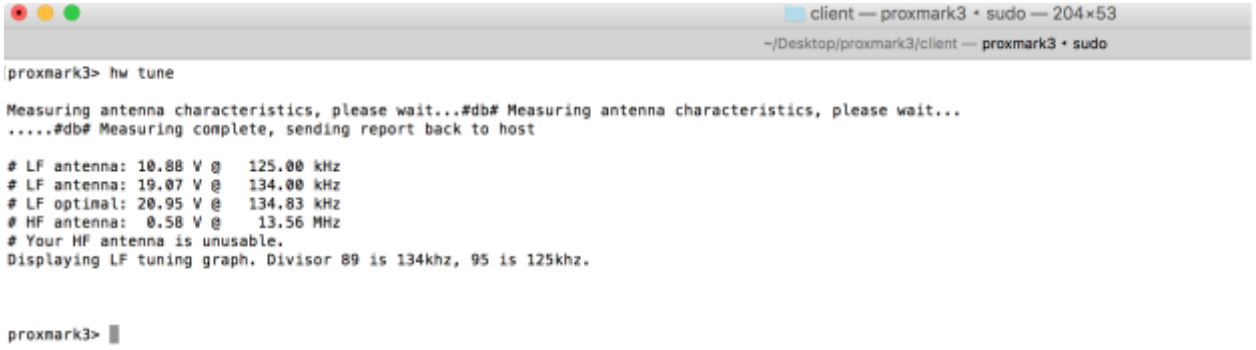
Erik Van Buggenhout
@ErikVaBu

We just published a new Cuckoo auto install script (original version by Buguroo Security) used in @SANSInstitute #SEC599!

Check it out at



When repeating the "*hw tune*" command, this time with the card within reach of our antenna, we see a clear difference in voltage in comparison with the previous screenshot. This indicates we are dealing with a low frequency card.



Our next step is finding the type of card we have. Using the "*lf search*" command we can scan the card. Before executing this command, make sure the card is already on the antenna. If not, the search command will return errors.

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The proxmark3 confirms we are working with a HID global RFID card and we discover its ID: 07848XXXX (redacted). Now we need to use the according command to clone the card.

Using the Proxmark3 help function for the HID cards, we see we can use the clone function.

```
proxmark3> lf hid help
help             This help
fskdemod         ['1'] Realtime HID FSK demodulator (option '1' for one tag only)
sim              <ID> -- HID tag simulator
clone            <ID> ['l'] -- Clone HID to T55x7 (tag must be in antenna)(option 'l' for 84bit ID)
proxmark3>
```

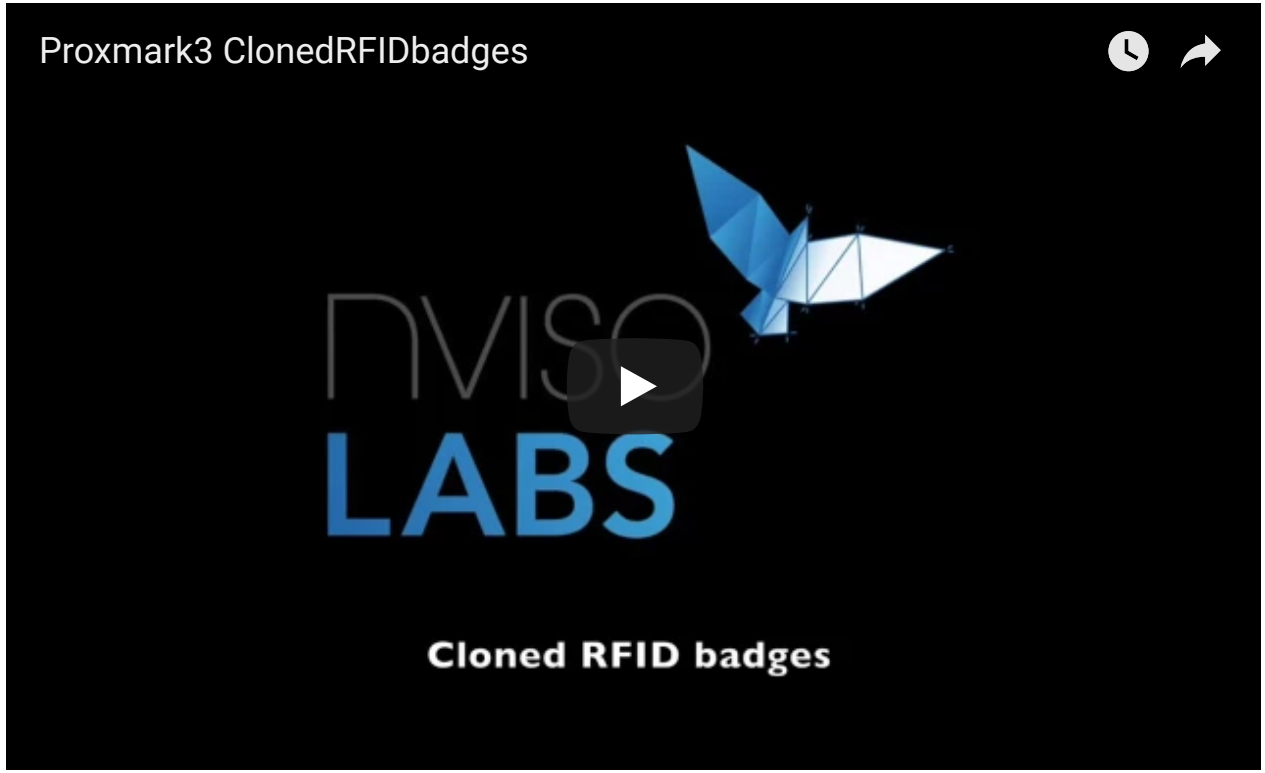
The T55x7 you see in the output above, is a type of card that is extremely versatile and supports multiple encoding formats of the majority of 125 Khz RFID tag transponders. We can thus use this type of card to emulate our HID card.

```
proxmark3> lf hid clone 07848[redacted]
Cloning tag with ID 07848[redacted]
#db# DONE!
proxmark3>
```

After executing the command above, including the HID Prox TAG ID identified in the previous steps, we have successfully cloned our card.

ARCHIVES

That's all it takes! Check the video below for proof.



On a final note, when your office building is protected by such an insecure card reading system, often the only solution to fix this vulnerability is to replace the card reading infrastructure and all access badges. Needless to say this will have a significant impact on your organisation.

The following recommendations can be made to improve the security:

- Use of encryption to ensure that the ID is not sent in clear text. Think of challenge response authentication;
- Use of contactless smart cards which have encryption, mutual authentication and message replay protection incorporated.

Additionally, it is known that attackers try to covertly copy your RFID cards, for example during a trip on the metro. You can try using an RFID protected sleeve/wallet, but research has shown that not all of them are effective at preventing covert copying. Be sure to test yours out and share your findings!

This entry was posted in Uncategorized on January 11, 2017 by sasjareynaert.

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5 thoughts on “A practical guide to RFID badge copying”

June 2013 (1)
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Wagner Bertolini Junior
January 14, 2017 at 9:42 pm

That's why we use Mifare's with data encrypted inside. Then, you need a key to (authenticate and) read data. But you are right, at almost all physical access security systems this basic logic (unique id) its used to give access to someone.

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Reply ↓

Amal
February 21, 2017 at 11:30 pm

If you're talking about Mifare S50 1k or S70 4k "classic" tags, they use Crypto1 which has been broken, and can easily be cloned using the Proxmark (or other tools). It took me a matter of minutes to unlock all access keys and clone an entire Mifare 4k tag.

★ Like

Reply ↓

Wagner Bertolini Junior
March 1, 2017 at 10:23 am

@Amal, i didn't know about it! Is there a guide or something to learn how to exploit it?

Besides cloning is it possible to extract its encryption key?

Thanks!

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