SMB Hijacking.
Kerberos is defeated.

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Intro

The last thing i wanted to do was to talk about SMBRelay (or actually NTLM-Relay) one more time. It was discussed many times before, even by me.
Just to remind, it is about manipulating user's credentials that can be redirected to third-party resource. This kind of manipulation (called relaying) gives us an ability to authenticate and get access to that resource. Usually an attacker is able to execute some code remotely.

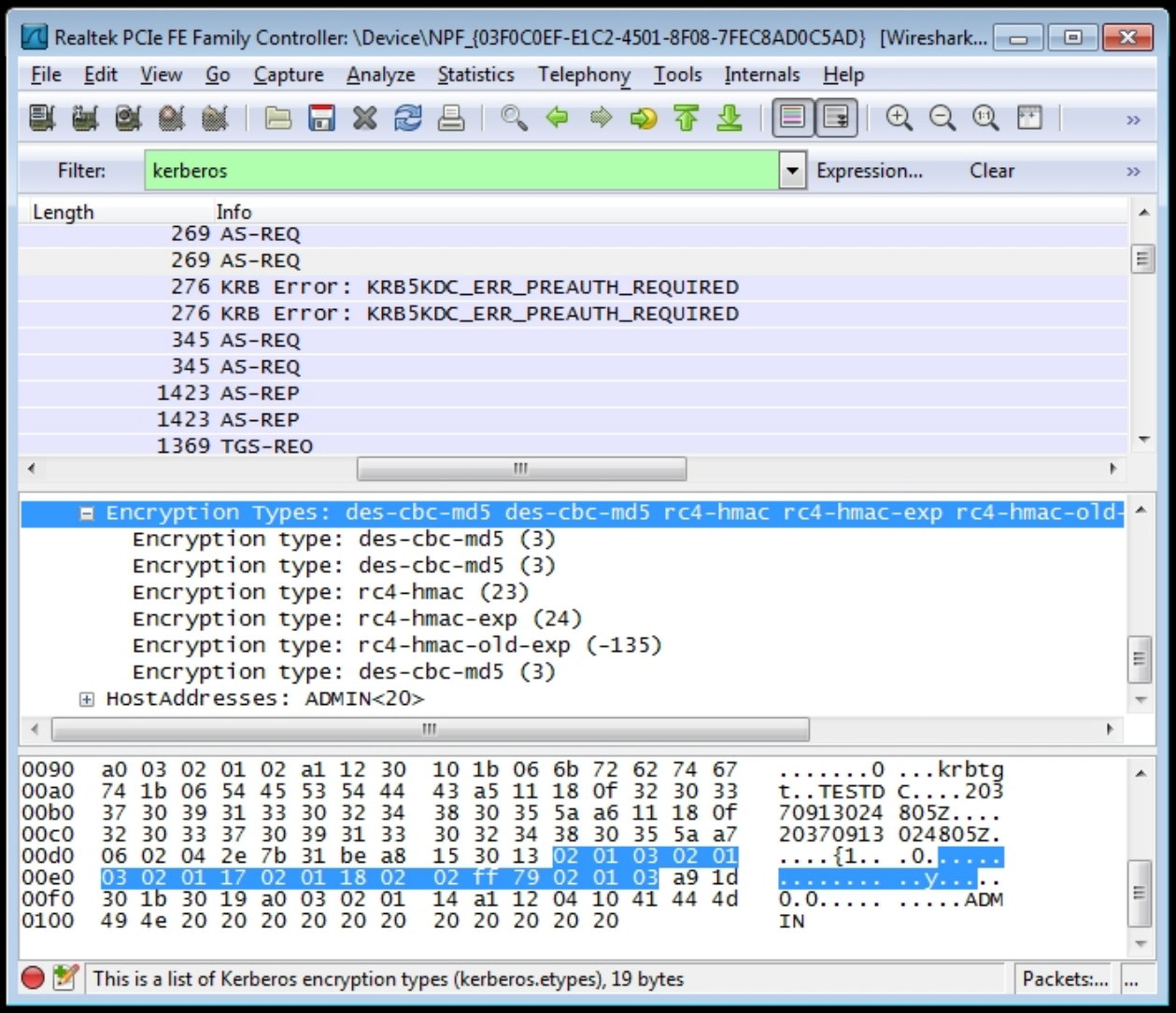
Development of SMBRelay has stopped for a while. Right, it seems that everything is done and known already. A year ago Intercepter-NG learned to perform SMBRelay with NTLM version 2. After a few months NTLMv2-relay appeared in Metasploit. Well, this is the logical end. The SMBRelay itself is outdated and almost unusable. It is much easier to perform NTLM-relay against another protocols such as HTTP. Furthermore, using SMBRelay in the networks with Domain is complicated by usage of "undefeatable" Kerberos, that is usually called "the cure against SMBRelay". In this research i want to break this myth and introduce a completely new way of attack against SMB protocol. It is necessary to note that this kind of attack is not actually SMBRelay, let's call it SMB Hijacking.

Getting started

Working on the new version of Intercepter i created NTLM-response grabber in WPAD MiTM. To quickly check if the NTLM-response (and other types of hashes) were easy to crack i added an option to invoke John the Ripper right from the program. Looking through Wireshark's archive of packet captures i found one with Kerberos data inside. Cain was able to get some kind of hash from it and recover password by means of bruteforce attack. The bruteforce is possible because the AS-REQ request to authentication server contains a timestamp that is encrypted by user's password, and some part of the timestamp is known beforehand. The Kerberos dissector was added to Intercepter and tested on the live Domain Controller (Windows 2008 R2). Unfortunately nothing was intercepted.
But why? The deal is that new encryption algorithms were added to Windows 2008 and old rc4-hmac was replaced by new aes256-cts-hmac-sha1-96. After little modifications new hash type was intercepted, but a new problem occurred. There are no suitable tools to recover password from aes-encrypted timestamp. On the openwall's maillist i found that someone coded a patch for JTR (john the ripper), but it still seems kinda raw. Moreover, bruteforcing aes is hundred times slower than rc4.

That's how Kerberos Downgrade feature appeared in Intercepter-NG. Old DES encryption was completely disabled starting from Windows 7\2008 R2, hence there was no reason to downgrade aes down to des. The lowest possible algorithm is rc4 now.

It became my starting point to dig into Kerberos a little bit deeper.



The downgrade is easy: just replace available encryption types in outgoing packet.

SMB Hijacking

So, reading different documents about Kerberos i've learned that it is vulnerable to the some kind of replay attacks. However i found only two real tools that perform evil tricks with Kerberos tickets: an old one kdcspoof, by Dug Song and a tool by Emmanuel Bouillon. It is no surprise, dealing with Kerberos is really hard when theory comes to the practice.

After deep thoughts and some traffic analysis i asked myself a question: **why do we need to replay anything at all? Actually, we dont!**

See what the typical SMB session is:

(1). Host_A connects to Host_B
(2). Session protocol negotiation
(3). Authentication protocol negotiation
(4). SMB commands...

We don't have to redirect user's credentials to another resource because the user can authenticate himself !

All we have to do is to stay in the middle and proxify connection between Host_A and Host_B and then take over control of the session into our own hands.
At the step (4) we already authenticated and can inject our own commands. Bingo! It absolutely doesn't matter how the user authenticated to the system, using NTLM or Kerberos. The packets of SMB session are not encrypted and SMB Signing is not used between common computers (only DC). In addition to greater abilities, this technique is more elegant than SMBRelay. There is no need to code a pretty complex SMB authentication algorithm. Very little amount of SMB commands is necessary to be coded, only those to perform file uploading and service execution.

The functionality described above was added to the new version of Intercepter-NG and was tested on latest versions of Windows 2008 and Windows 7\8.

Let's see what's been done to accomplish this task...
Starting from Windows Vista a new SMB version 2 appeared. It was meant to simplify the command set and improve performance . The packet structure is also different from the previous SMB implementation. Two new fields are especially important for us: the Session ID and the Command Sequence Number. To inject our own commands we have to track the ID and increment command counter every new step.

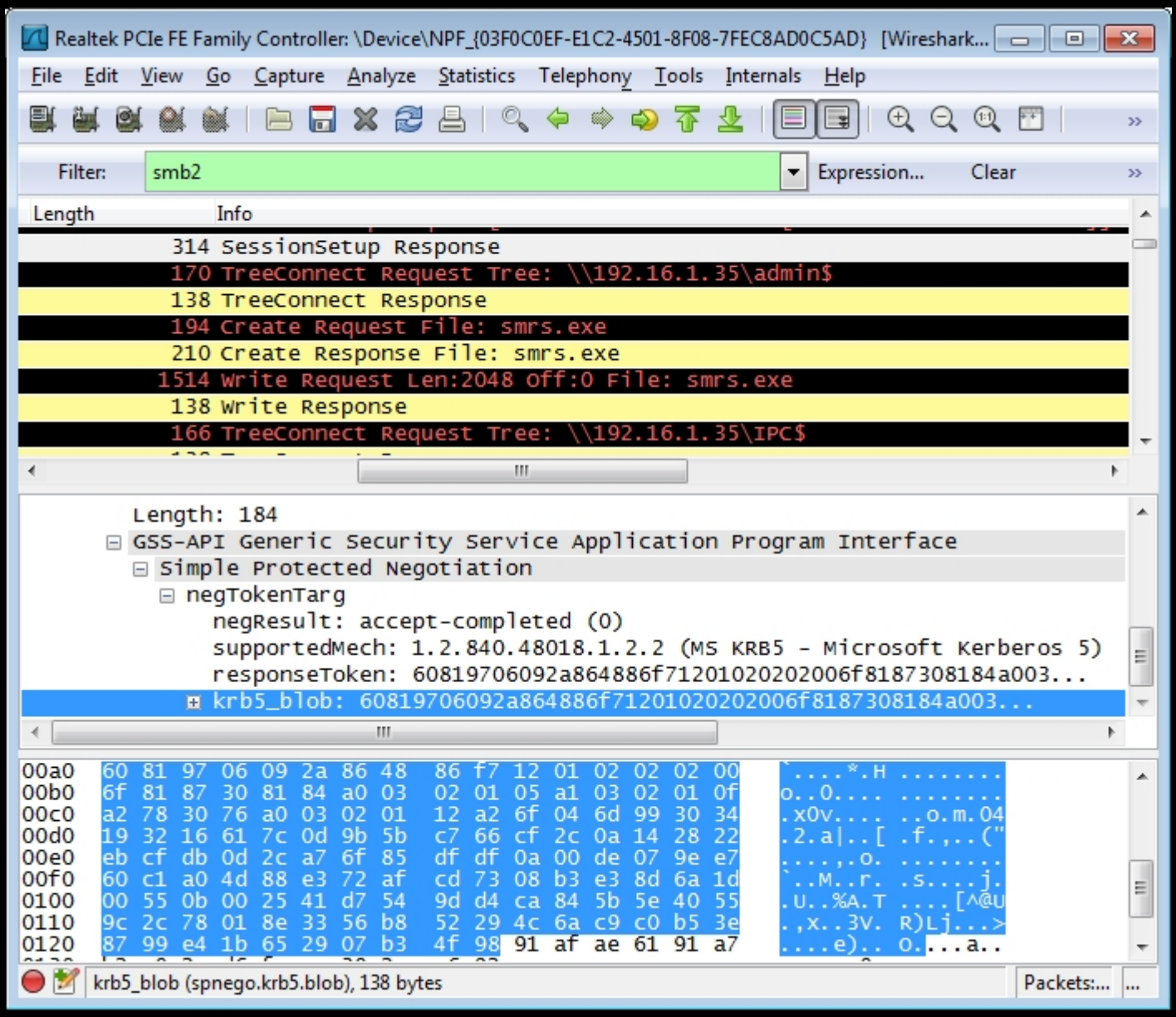
Existing SMBRelay code in Intercepter is based on smbrelay3 by Tarasco Security and it uses an old SMB format. That's why i decided to create a completely new code for SMBv2.

The logic of the injection process is the following:
1. Get in the middle between the target and a third-party host
2. Wait for successful SessionSetup Response
3. Get Session ID and current command's number
4. Upload a file to administrative share (admin$)
5. Create a service that will execute it
6. Run the service
7. Profit!

The 5 and 6 steps are possible because Microsoft implemented a transfer of RPC calls over SMB protocol.

That's all. This technique is perfect for the common domain based networks. Usually, there is at least one centralized software that connects to the user's shares with administrative privileges. You can also choose administrator as a target.

We start injection after SessionSetup command.



Conclusion

Thus the Kerberos is "defeated" or in fact avoided. By the way, Kerberos is used only if the SMB connection established by computer name. In case of IP address, NTLM negotiation will occur.

SMB Hijacking is also suitable for a workgroups, just make sure that your target has access to the third-party host. Earlier i discussed a "passive" way of attack, however Intercepter speeds up the process by means of injecting UNC link of the third-party host into target's pc web traffic.

Whether your attack was successful or not you have to break hijacked connection, because it's no longer usable for target user - command sequence is broken. To avoid deadlock situation of unstoppable hijacking and let the user access remote resource without problems and suspicions Intercepter marks the connection and lets it pass through.

The only effective way of preventing SMB Hijacking is using SMB Signing: an attacker will not be able to create a valid signature of injected commands, thus the server will reject them.