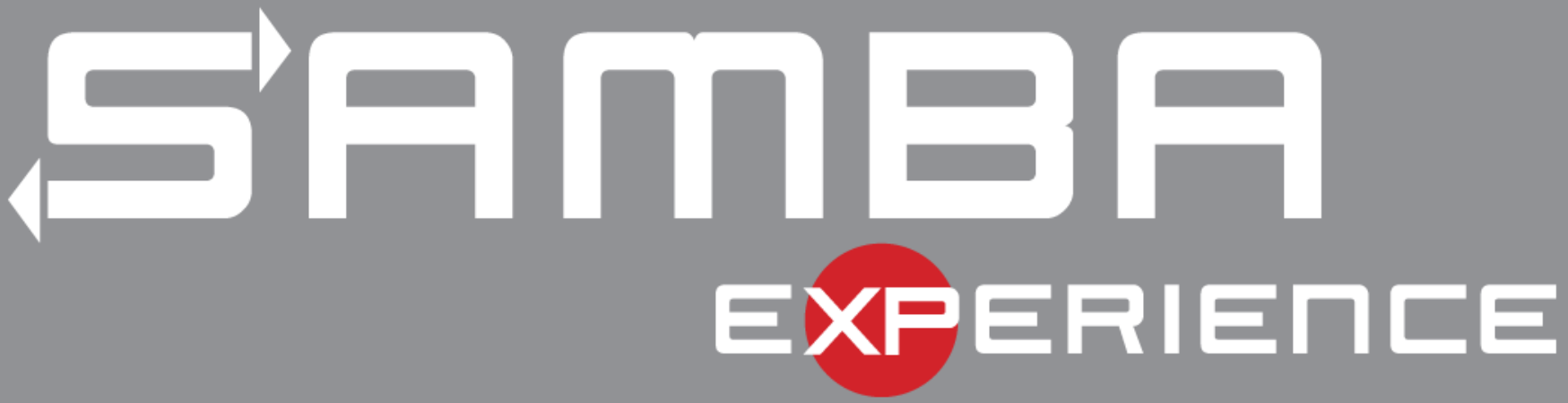

Badlock

One Year In Security Hell

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Samba Team / SerNet

2016-05-11

https://samba.org/~metze/presentations/2016/metze_sambaxp2016_badlock-handout.pdf

Agenda

- History of reports/findings
- The badlock related bugs in detail
- New options
- Behavior changes
- Coordination with Microsoft
- The final sprint
- Coordination with Vendors
- Regressions
- Future improvements
- Thanks!
- Questions?

History (Part 1)

- CVE-2015-3223: LDAP 00 search expression attack
  - Reported on June 9, 2015
  - Fix released on December 16, 2015
- CVE-2015-7540: Bogus LDAP request cause memory DoS
  - Reported on September 20, 2012, but (re-)noticed by CVE-2015-3223
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  - Reported on June 18, 2015
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- CVE-2015-5252: Insufficient symlink verification
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- CVE-2016-2118: SAMR and LSA man in the middle attacks
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- CVE-2016-0771: Read of uninitialized memory DNS TXT handling
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- Release of the first bunch of CVEs on December 23, 2015
  - We tried to get as much as possible out of our way
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CVE-2015-5370: Multiple errors in DCE-RPC code

- The first denial of service problem was found at an interop event by Jouni Knuutinen from Synopsys
- Jeremy Allison did the initial research
- While reviewing the initial patches the nightmare begun
- I found new problems day after day
- About 20 problem classes (mostly denial of service and man in the middle)
- Distributed over 4 DCERPC implemtations (2 servers, 2 clients)
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- While thinking about the CVE-2015-5370 patches I thought about possible related problems
- After a while I found that the DCERPC auth_level can be downgraded and nasty things can be done with it
- My first finding was limited to clients using ncacn_ip_tcp with SAMR
- I created a man in the middle exploit that got the full AD database including all secret keys while joining a Windows DC into a Windows domain
- NOTE THIS IS A FULL TAKEOVER: information leak and remote code execution on all domain member computers (maybe also in trusted domains)
- The attacker only need see the clients network traffic
- I guess it's really not that unlikely that someone might find exploits for unpatched router firmware
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- It is not limited to a join of a new Windows DC
- Every login as an administrator can be used by an attacker
- It is not limited to just Windows domains, also Samba domains are affected
- The problem is a generic to DCERPC over unprotected transports like ncacn_ip_tcp or ncacn_np (without SMB signing)
- Some application layer protocols (e.g. DRSUAPI) only allow secure connections using integrity or privacy protection
- Samba was missing most of these checks which were already available on Windows

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CVE-2016-2110: Man in the middle attacks with NTLMSSP

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- This has implication on encrypted LDAP traffic
- A bit of research revealed that Microsoft already implemented downgrade detection into NTLMSSP when using NTLMv2
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CVE-2016-2111: NETLOGON Spoofing Vulnerability

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- The problem with this was that any domain member was able to ask the domain controller for NTLM session keys of authentication sessions of all other domain members.
- The protection mechanism relies on NTLMv2 being used only via NTLMSSP
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CVE-2016-2112: LDAP integrity protection is not enforced

- Fixing the specific NTLMSSP based problems of CVE-2016-2110 is not enough
- The LDAP client and server also need to verify the authentication (gensec) backend provides the requested features
- This is required in order to prevent Kerberos replay attacks
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- For ldaps:// it only applies to tools like samba-tool, ldbsearch, ldbedit and other ldb tools
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CVE-2016-2114: "server signing = mandatory" not enforced

- While working on CVE-2015-5370 and CVE-2016-2118 I thought a complete audit of all protocols was required
- As all unprotected DCERPC transports are vulnerable to man in the middle attacks it was clear that SMB signing is important
- It turned out that we didn't require SMB signing even if we are configured with mandatory signing
- This is fixed now
- As an active directory domain controller we require signing by default now

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New options

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- New smb.conf options:
  - allow dcerpc auth level connect (G)
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- Changed behaviors:
  - The default auth level for ncacn_ip_tcp: bindings has changed to DCERPC_AUTH_LEVEL_INTEGRITY.
  - "client lanman auth = yes" is now required for LANMAN2 connections
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Coordination with Microsoft

- After a face to face meeting in Redmond in September I had regular phone calls with them
- I proposed a very simple change for the urgent (badlock) problem
- We also discussed some more advanced changes, but they didn't pass Windows regression tests and were therefore postponed
- In order to get the most important fixes out of the door we agreed on April 12, 2016 as target release date
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Coordination with Vendors (Part 1)

- As the Samba Team we only have resources to provide security fixes for 3 maintained branches (currently 4.4, 4.3 and 4.2)
  - 4.4.2 had 323 patches on top of 4.4.0 (note that 4.4.1 had a regression and was superseeded by 4.4.2)
  - samba-4.4.0-security-2016-04-12-final.patch
    227 files changed, 14582 insertions(+), 5037 deletions(-)
  - 4.3.8 had 352 patches on top of 4.3.6 (note that 4.3.7 had a regression and was superseeded by 4.3.8)
  - samba-4.3.6-security-2016-04-12-final.patch
    236 files changed, 14870 insertions(+), 5195 deletions(-)
  - 4.2.11 had 440 patches on top of 4.2.9 (note that 4.2.10 had a regression and was superseeded by 4.2.11)
  - samba-4.2.9-security-2016-04-12-final.patch
    319 files changed, 17636 insertions(+), 7506 deletions(-)
- Given huge amount of changes we (at SerNet) thought it would be good think to inform the public about the target release date
  - http://badlock.org was created in order to provide a central location for information

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The final sprint

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  - This needs to be done in a backward compabible way in order to avoid breaking existing implementatins
  - These ideas will be discussed with Microsoft
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  - Add ways to disable NTLMSSP completely
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  - This is available in Windows 2012 (maybe R2) domains
  - It protects the password based Kerberos authentication using the much more secure machine password
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Thanks!

People who helped out:

- Günther Deschner
- Andreas Schneider
- Ralph Böhme
- Jeremy Allison
- Andrew Bartlett
- Alexander Bokovoy
- Michael Adam
- Others

Questions?

http://badlock.org/

https://www.samba.org/samba/history/security.html

https://www.samba.org/samba/latest_news.html#4.4.2