CHAINING SOFTWARE SECURITY VULNERABILITIES

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WHO AM I?

- Security Research Manager @Trustwave SpiderLabs
- Reported various vulnerabilities in the past: databases (Microsoft SQL Server, Oracle Database, MySQL, SAP Adaptive Server Enterprise, IBM DB2 LUW), antiviruses (Avast, Sophos), routers (NETGEAR), hard drives (WD), service applications (Lenovo), mobile applications etc.

WHY TALK ABOUT CHAINED VULNERABILITIES?

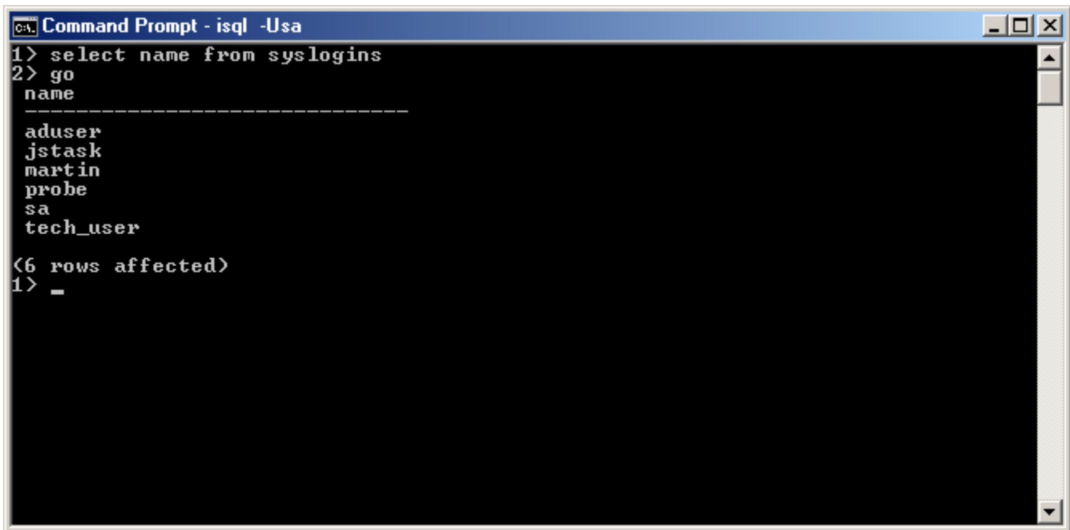
- Often developers consider “minor” vulnerabilities a small risk
- Prove they are wrong: chaining several *small* bugs leads to a complete compromise!

DATABASES: SAP ASE 16

- A lot of built-in functionality: Java support, extended procedures, distributed transactions, Web Services etc.
- Historically had many security issues, huge number reported by Trustwave (~36)

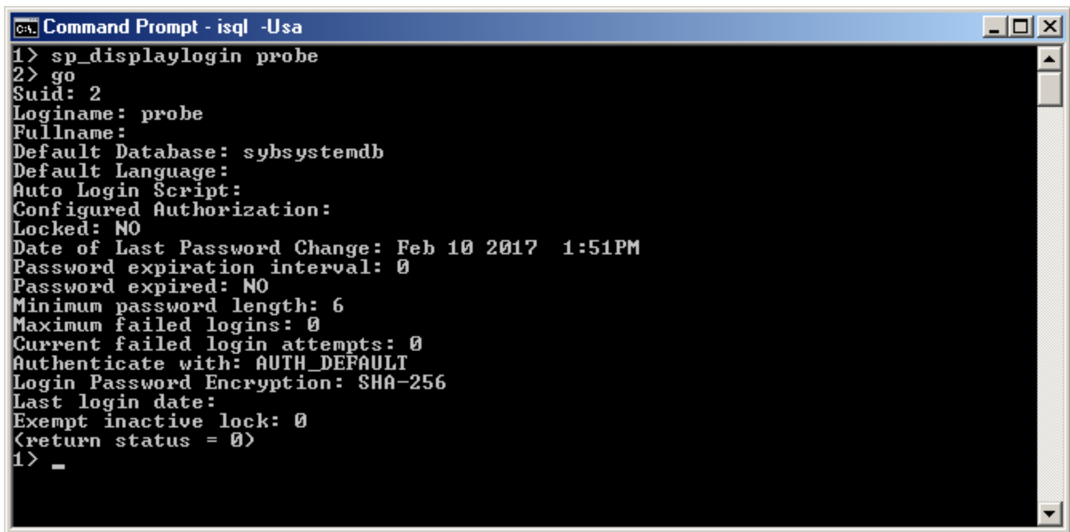
VULNERABILITY I: "SPECIAL" LOGIN ACCESS

- `probe` account exists by default on any ASE and is enabled

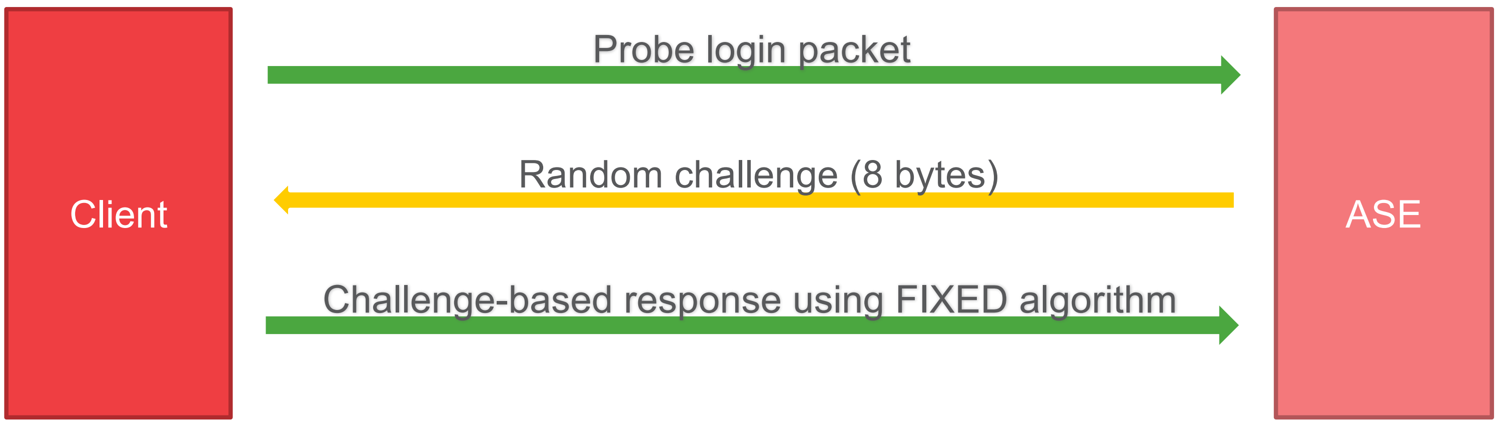


VULNERABILITY I CONTINUED

- This account uses special logon mechanism though…



VULNERABILITY I CONTINUED



What to do: Never assume that some (secret) mechanism will not be uncovered

VULNERABILITY II: FILESYSTEM ACCESS VIA JAVA

- There is a check that prevents write to locations under `$SYBASE`, but is that enough?
- **What to do:** do not forget to implement all `SecurityManager` methods properly, think about **all** edge cases.

VULNERABILITY III: CODE EXECUTION VIA JAVA

- **What to do:** again, implement all methods (`CheckLink`) of the `SecurityManager` class

CHAINED ATTACK ON SAP ASE

1. Login as probe using provided library
2. Write malicious payload to some location on server disk
3. Load just written payload – executes as server process owner!

ROUTERS: NETGEAR R8500

- Tri-Band WiFi Router with many functions: USB storage, UPnP, Cloud
- One attack surface is the Web Management facility.

VULNERABILITY I: CSRF PROTECTION BYPASS

- Web management uses page-specific tokens to protect from CSRF
- Exposed on some pages without authentication, aren't session-bound
- `CSRF_TOKEN = SHA1(g_rand AND SHA1(page_name))`
- Trivially brute-forced for all pages
- **What to do:** do not expose sensitive data without authentication, bind CSRF to individual sessions.

VULNERABILITY I: CSRF PROTECTION BYPASS

```
//-->
</SCRIPT>
<BODY bgColor=#ffffff leftMargin=0 topMargin=0 marginheight="0" marginwidth="0">
<form name="frmLanguage" method="POST" action="lang_top.cgi?id=fcd9975b3257ed36661f958d5f811e9609c57490">

<!--
    <input type="hidden" name="curlang" value="Auto">
-->

    <input type="hidden" name="curlang" value="English">
```

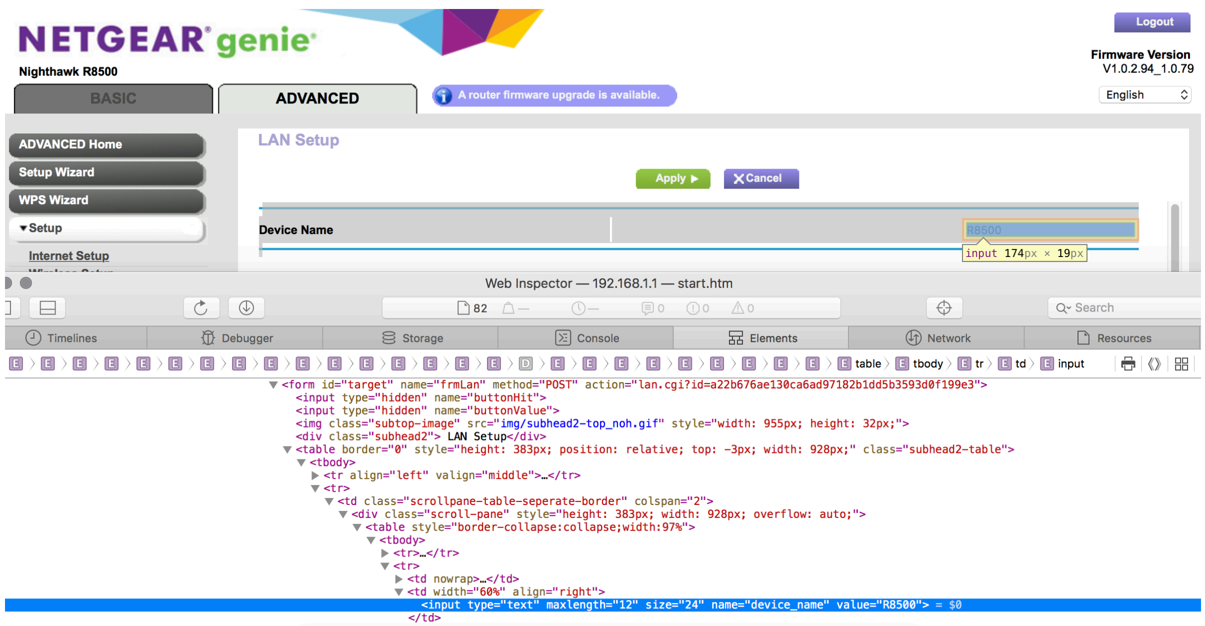
VULNERABILITY II: THE *GENIE* MAGIC

- Authentication bypass by adding `genie` to the query string
- Probably intended to allow the Genie app manage the device ☺
- **What to do:** do NOT use hacks like “secret” strings in you apps!

VULNERABILITY III: SHELL COMMAND INJECTION

- The `lan.cgi` page consumes some input without sanitizing
- The `device_name` parameter can be abused to embed any shell command
- Note that on the Web UI it has a limitation of 12 characters – but in reality it can be longer
- **What to do:** sanitize all input and do NOT rely on client-size filters like HTML input length restrictions.

VULNERABILITY III: SHELL COMMAND INJECTION



CHAINED ATTACK ON NIGHTHAWK X8

1. Grab the `MNU_top.htm` page and extract current CSRF
2. Using utility brute force `g_rand` counter value used to calculate CSRFs
3. Calculate CSRF for the `lang.cgi` page
4. Fetch the `lan.cgi` page passing CSRF along with genie and OS command
5. Observe the router's filesystem for results

Q&A

- https://www.trustwave.com/Resources/SpiderLabs-Blog/
- https://www.trustwave.com/Resources/Security-Advisories/
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