



onapsis
Securing Business Essentials

SAP[®] Backdoors

A ghost at the heart of your business

Mariano Nuñez Di Croce
mnunez@onapsis.com

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Who is Onapsis?

- Specialized company focused in the **Security of Business-critical Applications** (**SAP**®, Siebel®, Oracle® E-Business Suite™, JD Edwards® ...).
- Core business areas:
 - Development of specialized security software solutions.
 - Security consultancy services.
 - Trainings on business-critical systems security.

Who am I?

- **Director of Research and Development at Onapsis.**
- Degree in Computer System Engineering.
- Originally devoted to **Penetration Testing** and **Vulnerability Research**.
- Discovered **vulnerabilities** in Microsoft, Oracle, SAP, IBM, ...
- **Speaker/Trainer** at Black Hat, HITB, Sec-T, Hack.lu, DeepSec, Ekoparty..

Agenda

- Introduction
- A Ghost in the User Master
- Backdoors in SAP Business Modules
- Backdoors in the Authentication Procedure
- Onapsis Integrity Analyzer for SAP
- Conclusions

Introduction

What is SAP?

- **Largest** provider of **business management solutions** in the world.
 - More than 140.000 implementations around the globe.
 - More than 90.000 customers in 120 countries.
- Used by **Fortune-500 world-wide companies**, **governmental organizations** and **defence facilities** to run their every-day business processes.
 - Such as Revenue / Production / Expenditure business cycles.

FINANCIAL PLANNING **TREASURY** **PAYROLL**

SALES **INVOICING** **LOGISTICS** **BILLING**

PRODUCTION **PROCUREMENT**

Backdoor

... special methods that are implemented in an information system, usually after an *unauthorized compromise*, with the purpose of *securing future access* to the system while attempting to *remain undetected....*

Why are SAP Backdoors special?

- Backdoors have been known since the origins of computer systems.
- However, there is very little (no) public information about how they can affect SAP platforms.
- “Not Public” != “Not currently being exploited”
- The biggest mis-conception in the term “SAP Security”: **SAP Security is much more than Segregation of Duties!**
 - Most standards & regulations still don't get it.
 - Most Auditing companies still don't get it.
 - Some customers still don't get it.

SoD is not enough to prevent Backdoors!

From the trenches:

During an assessment, a “SoD compliant” SAP system (which had costed \$\$\$\$ⁿ to implement), could be remotely compromised in a matter of seconds through the exploitation of a vulnerability in a technological component.

With that kind of privilege, a backdoor could have been installed.

Ok, but... which is the real risk?

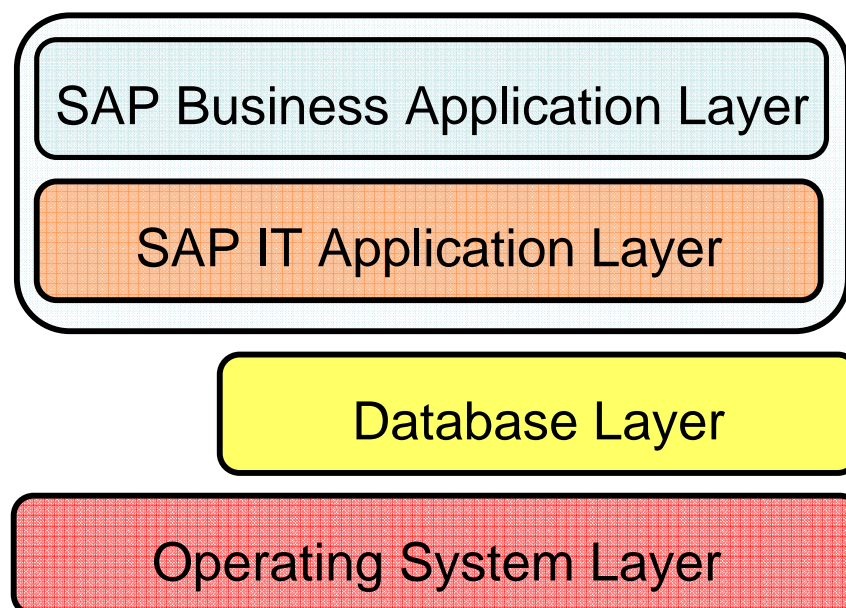
ESPIONAGE

SABOTAGE

FRAUD

The Initial Compromise

- In order to install a backdoor, the attacker **needs to compromise the system first**, and obtain high privileges.
- The Threat Model map includes the following components:



Wide Attack Surface

- Due to **intrinsic Trust relationships**, a high-privileged **takeover of one** technological component results in a complete **compromise of the whole platform**.
- **OS Administrator <==> DBA <==> SAP_ALL !!**
- *Check the **Onapsis' "Penetration Testing SAP Systems" Presentation^[1]** for further insights.*

A Ghost in the User Master

Welcome to the SAP world...

- You connect to your company's Production SAP system through SAPGUI.
- **You have to specify access credentials:**
 - Client (logical "independent" unit in the SAP system)
 - Username
 - Password
- The system checks your saved password from the User Master.
- If your provided passwords matches the stored one... access granted.
- You start performing business processes and making the company earn billions.

Oops! Downwards compatibility...

- SAP has implemented different password hashing mechanisms to make systems stronger (from 8-characters MD5 to 40-characters SHA-1)
- The problem happens when a “weak” system wants to connect with a “strong” one... **integration fails -> business fails.**
- **Workaround: By default, the User Master shall contain the downwards-compatible hashes, as well as the strong one.**
- This opens room for several attacks. Check Onapsis’s “SAP Security In-Depth” Publication, issue #2 ^[2]

Oops! Downwards compatibility...

- **Which** password hash to use for comparison?
- Controlled through profile parameter `login/password_downwards_compatibility`

Value	Impact
0	Downwards-compatibility disabled. No weak hashes are generated.
1	Downwards-compatibility enabled. Weak hashes generated for integration with older releases. Weak hashes not evaluated.
2	If the logon attempt using the downwards-incompatible password fails, check if the downwards-compatible would work. Log and deny access.
3	The same as with 2, but the logon is considered as successful. This is registered in the system log.
4	The same as with 3, but no system log entry is written.

- Parameter can be modified dynamically! (No SAP restart required)

Live demo

Protection / Countermeasure

- Monitor the value of the specified profile parameter to detect insecure values.
- Implement a dedicated authorization group for U* tables.
- Check SAP Note 1023437.

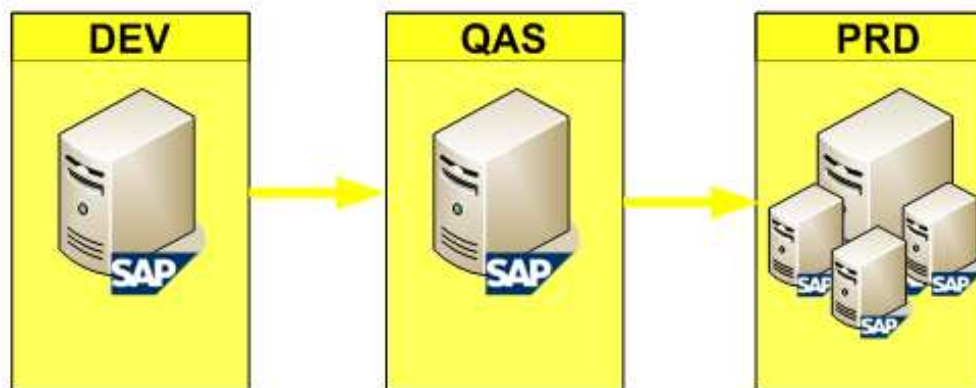
Backdoors in SAP Business Modules

Welcome (back) to the SAP World...

- Once logged-in, you interact with the system running Transactions.
- In fact, **you are running ABAP Programs/Reports.**
- ABAP Programs can be divided in:
 - **Standard** (Developed and Shipped by SAP A.G)
 - Custom (Developed in-house by the company. Starts with Z* or Y*)
- Standard programs can be modified, but strongly discouraged.
- **SSCR** steps in =>You must ask SAP A.G for a special key.
- ABAP Programs are stored in the **system's database.**
 - Table **REPOSRC** contains compressed source-code.
 - Table **REPOLOAD** contains ABAP load (~ bytecode).

The Change and Transport System

- Typical SAP system landscape:



- Developments and changes “can only be done in the DEV system”.
- **The PRD system is configured to block any attempt to modify programs directly in the system.**
- Through this procedure, it is expected that *“the quality and availability of the SAP production systems is maximized”*.

**Unauthorized modification
of ABAP Programs
directly in the
Production System
is possible.**

SAP's Heart: The Database

- Unauthorized modification at the SAP layer **may be possible, but not trivial.**
- What about the usually **mis-configured-left-by-default-LAN-accessible Database??**
 - SAP + Oracle Authentication Weakness.
 - Default *SAP Database user's* credentials.
 - Database exploits.
- The attacker can still get to the Database through the SAP system, due to the **intrinsic Trust relationships!**
- No CRC or signature check on the stored ABAP code.
- **Simple SQL queries will do the trick!**

Live demo

Backdoors in the Authentication Procedure

Protection for Critical ABAP Programs

- Certain **critical standard ABAP programs are protected** to prevent access to their source code from the SAP System, i.e. using transaction SE80.
- Started researching on **how this feature was implemented**:
 - REPOSRC.SQL = 'X' ? No noticeable results.
 - **Special ABAP “Magic String”**: *@#@@[SAP]
- If the source code contains the magic string, **the SAP Kernel rejects access to the source code.**
- However, there seems to be something else...

SAPMSYST – The SAP's Cop

- Probably the most critical ABAP piece of code in an SAP system.
- Handles the **User Authentication Procedure**.
- **This program is protected** through a specific, hard-coded **Kernel check!**
- The check is performed on the ABAP program's name...
- **Bypass is possible by pivoting the program in the Database.**

Live demo

Protection / Countermeasure

- It's not possible to detect and protect against backdoors from within the SAP system itself.
- External tools are needed.

Onapsis Integrity Analyzer for SAP

Onapsis Integrity Analyzer for SAP

- Purpose: **Detect modifications of ABAP code in an SAP system.**
- Free download from <http://www.onapsis.com/ianalyzer> (upcoming...)
- **Proof-of-concept:** Only working for SAP/Oracle 10g.
- Developed by Jordan Santarsieri and me @ the Onapsis Research Labs.

- Why you need it? **It's not feasible to detect backdoors from inside the SAP system itself:**
 - Backdoors can leave the Program's "Last modified date" untouched.
 - The analysis programs may have also been manipulated to hide the backdoor's presence!

Onapsis Integrity Analyzer for SAP

- Want to do it manually? Number of SAP programs are measured in hundred of thousands (and even more).
- *Onapsis Integrity Analyzer* connects with the **Database** and **performs “snapshots” of sensitive ABAP report tables.**
- Periodically, new snapshots are compared with older snapshots and modified programs are identified.
- Tracking of SAP Notes is also considered.

The detection of suspicious modifications should trigger a special investigation.

Live demo

Conclusions

Some Thoughts on SAP Backdoors

- **The Backdoor threat** affects every information system; **it's not a specific SAP platform' risk.**
- Once an attacker obtained maximum privileges over an information system, it is **really** difficult to restrict his activities, and **SAP is not the exception.**
- **SAP Backdoors can have devastating impacts over Business.**
- These backdoors won't be installed for fun, **it's about MONEY.**

The only sustainable choice the industry faces is the objective and responsible analysis of this threat.

Some Thoughts on SAP Backdoors

- The best cost/effective protection: **Minimize probability of the initial compromise.**
 - Automated controls.
 - **Periodic technical security assessments of SAP platforms.**
 - Vulnerability Assessments.
 - Penetration Tests.
 - Security Audits.
- **Onapsis's Integrity Analyzer for SAP** can help you to implement more in-depth reactive controls.

References

References

- [1] http://www.onapsis.com/research/slides/ONAPSIS-Penetration_Testing_SAP.pdf
- [2] <http://www.onapsis.com/resources/get.php?resid=ssid01>

¿Questions?

mnunez@onapsis.com

Thank you!



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