**Information security audit report LDIL**

Group A

Bachelor’s thesis or Master’s thesis

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Technology, communication and transport

Cyber Security

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# Introduction

This auditing report is a group exercise and it is part of the Auditing and Testing Technical Security course. Report includes external and internal network security tests performed against the LDIL corporate network. The goal of the technical security audit is to form overall picture relating to state of the security and offer recommendations for future improvements.

# Target organization

LDIL is a national e-tailing company that also has one physical retail store with a POS-system. LDIL business environment consists of information systems and different network domains. Target of this evaluation is LDIL's systems and networks related to customer and payment information.

# Scope of the audit

The reference framework used in this audit is Payment Card Industry Data Security Standard (PCI DSS). Based on this framework, all components that are part of cardholder data environment should be included to the scope of audit. Also, as assignment required, all other component that were available for testing were included. Even so, reference framework was required to transform priority rating for different systems to support audit priorities (findings, recommendations, etc.).

As a notice, it should be reminded that this audit is purely technical and do not include any administrative parts relating to used framework.

From technical perspective audit can also be divided to internal and external audit as presented below:

* **Internal audit** was performed inside LDIL’s network. Detailed information about network structure and host credentials were available for deep inspection.
* **External audit** was performed against LDIL’s publicly available network interface.

Detailed scope of technical functions (networks, etc.) is presented in next chapter.

# Audit activities

Three groups were created from group A auditing personnel and each group was assigned part of the LDIL network segments to perform the audit. The auditing groups were formed to most effectively utilize the assessor’s skills. Petri and Jouni were chosen as lead auditors to facilitate the auditing process.

Groups were following:

* Vesa & Pinja (Publicly available networks)
* Pauli, Jani, Otso & Janne (Workstation network and WEB testing)
* Jouni, Teemu & Petri (Management networks)

Network segments to be audited were divided based on workload estimates and by logical entities.

Internal auditing activities were conducted by using virtualized Kali workstations and tools installed on them. These workstations had interfaces on all relevant network segments. External auditing activities were conducted by using RGCE internet workstation located outside of the LDIL network perimeter and RGCE Nessus service.

LDIL firewall rules (Palo Alto and pfsense) were reviewed to find possible shortcomings.

## Publicly available networks (DMZ, etc.)

Kertokaa omin sanoin mitä tehty

* Tools
* Short description of the network
  + Perustuu saatuun excel-listaukseen

## Workstation network and WEB testing (Internal and branch)

Internal and Branch networks included the following network segments:

* Internal 10.0.100.1/24
* Branch 192.168.10.1/24

Web testing was conducted to corresponding web-services found in internal-branch  
- servers   
The focus of web testing was to discover application flaws or misconfigurations. Web testing revealed certain issues regarding the used libraries, operating system and applications. Verbose error http responses are spreading out too much information about the target machines, e.g. stating the version of PHP, OS and Apache.  
  
Threats regarding the application were discovered by either manually testing or automatically scanning the target machines with Owasp ZAP and Nessus.

We were comparing the regarding the vulnerability scanning, by evaluating both Nessus and OpenVAS - but we ended up using Nessus because of company policy, other participants in the conducted audit were also using the Nessus.

More detailed issue reports can be found on chapter 7. In addition to verbose http responses or error messages, there were also buffer overflows,  
misconfigured application/server issues found.

## Management networks (MGMT, warehouse and staff)

Management networks included the following network segments:

* MGMT 10.99.0.1/24
* Warehouse 172.20.0.0/24
* Staff-we 10.10.0.0/24
* Branch-staff 192.168.20.0/24

From the PCI DSS point of view, especially MGMT-segment is critical. Most of the management devices are located in this network segment as well as log servers just to mention a few. In order to ensure the security of CPE environment, these can be seen as critical components.

Auditing were conducted first by running a Nessus discovery scan to discover all connected hosts in all the segments. Results from this scan were compared to the LDIL service catalog provided by LDIL personnel. After determining host’s operating systems and that no unrecognized hosts were not found, a new and more specific Nessus scans were conducted to acquire more information about the systems. Some findings were verified by using OpenVAS tool.

# Main findings

* Segmentti kohtaiset kriittisimmät huomiot palveluihin liittyen
* Muistetaan PCI DSS näkökulma

Based on their auditing findings each subgroup presented main findings and summary of these findings is presented here.

Firewall rule

* Yksi näkökulma: Verrattuna siihen olemassa olevaan dokumentaation (asiakkaan luovuttamaa)

## Publicly available networks (DMZ, etc.)

* Yleiskuvaus verkon tilasta

## Workstation network (Internal and branch)

Based on information gathered during the auditing activities most of the systems were poorly updated and therefore many security vulnerabilities were found.

## Management networks (MGMT, warehouse and staff)

Based on information gathered during the auditing activities most of the systems were poorly updated and therefore many security vulnerabilities were found.

# Recommendations

* Edellä kuvattuihin kriittisiin havaintoihin liittyvät prioriteetit
  + Arvioidaan PCI DSS näkökulmasta
  + ”Yhteenveto”
    - Ei vastaa PCI DSS
    - Suositellaan korjattavaksi
    - Vastuutetaan ja aikataulutetaan

Fix update process to keep everything updated and fix firewall rules.

Disable old encryption protocols and update encryption software to newest version.

# Detailed Technical Report

* Tooling
* Executed test cases
* Information gathering
  + Haastateltu
  + Tutustuttu dokumentaatio
  + Service catalogin sisältö

Group A technical security testers were utilized to test and audit the LDIL corporate network thoroughly. Throughout the testing process, set of tools and preplanned test cases are planned - based on use cases given on LDIL business logic. The architecture of the LDIL is known as well as LDIL personnel are aware that audit and testing is performed to the corporate system. The testing type lies between crystal and grey-box combination - mainly testing the tester’s effectiveness and also the vulnerabilities on outdated system.

## Tooling

The following tools listed in table 1 were used to conduct the security assessment. The tools are divided into information gathering, vulnerability scanning and also on web testing.

Table 1 Tools and versions used.

|  |  |
| --- | --- |
| Tools and version | |
| Nmap | 6.40 |
| Nessus | 5.9 |
| Openvas |  |
| Burp Suite | 1.7.03 |
| Owasp ZAP | 2.7.0 |

## Executed Test Cases

Table 2 contains a list of tests that were conducted during the test. This table does not contain any indication whether or not the test found any vulnerabilities. Summary of detected vulnerabilities are listed in section 7.5.

Apart from the detailed test cases, also exploratory testing was applied by using Burp suite and Owasp ZAP.

Table 2 Executed test cases

|  |  |
| --- | --- |
| Test Cases | |
| Executed tests provided by Nmap | Port and service enumeration scan. |
| Executed tests provided by Nessus | Vulnerability scan |
| Executed tests provided by OpenVas | Vulnerability scan |
| Burp Suite / Owasp ZAP | Web application testing, penetration testing |

## Information Gathering

The information gathering portion of a test focuses on identifying the scope of the vulnerability assessment. During this test, YII14S1 security tester was tasked with KAPUTO OY’s public network. The specific IP addresses were:

**KAPUTO OY’s public IP-address**

192.168.1.2

## Vulnerability Summary

* Tähän otsikkoon ei liitetä yksityiskohtaisia Nessus-raportteja
  + Tärkeimmät nostot voidaan ottaa mukaan
* Listataan jokaisessa verkkoalueesta skannauksessa havaitut hostit
  + IP-osoite, palvelu ja haavoittuvuudet
  + Ajatuksena yhteenveto aiemmin avatuista (otsikko 5) segmenttikohtaisista haavoittuvuuksista

### DMZ vulnerability summary

Table 3 DMZ internal vulnerabilities summary

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Host** | **Service** | **Critical** | **High** | **Med** | **Low** | **Info** |
| 10.10.10.4 | ns1 | 16 | 89 | 101 | 7 | 38 |
| 10.10.10.8 | ns2 | 16 | 89 | 101 | 7 | 38 |
| 10.10.10.10 | extranet | 19 | 90 | 131 | 9 | 60 |
| 10.10.10.20 | www | 22 | 95 | 136 | 12 | 69 |
| 10.10.10.30 | Mail | 0 | 0 | 11 | 9 | 54 |
| 10.10.10.40 | Helpdesk | 19 | 95 | 124 | 7 | 35 |

sdafas

Table 4 DMZ external vulnerabilities summary

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Host** | **Service** | **Critical** | **High** | **Med** | **Low** | **Info** |
| 60.254.143.2 | Branch FW | 0 |  | 3 | 0 | 0 |
| 79.99.193.10 | extranet | 0 | 0 | 0 | 0 | 4 |
| 79.99.193.20 | www | 0 | 0 | 0 | 0 | 4 |

### Management networks vulnerabilities summary

Table 5 Management network vulnerabilities summary

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Host** | **Service** | **Critical** | **High** | **Med** | **Low** | **Info** |
| 10.99.0.1 | Firewall | 0 | 1 | 8 | 2 | 29 |
| 10.99.0.10 | Log1 | 12 | 49 | 52 | 8 | 49 |
| 10.99.0.11 | Log2 | 11 | 49 | 52 | 8 | 49 |
| 10.99.0.110 | FSPM | 10 | 144 | 32 | 2 | 94 |
| 10.99.0.120 | PRTG | 1 | 0 | 4 | 0 | 23 |
| 10.99.0.130 | CCTV-Manager | 0 | 0 | 3 | 2 | 27 |

Table 6 Warehouse vulnerabilities summary

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Host** | **Service** | **Critical** | **High** | **Med** | **Low** | **Info** |
| 172.20.0.10 | HR | 19 | 90 | 126 | 9 | 52 |
| 172.20.0.20 | Front Accounting | 0 | 0 | 0 | 0 | 13 |

### Internal and Branch vulnerabilities summary

Table 7 Internal vulnerabilities summary

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Host** | **Service** | **Critical** | **High** | **Med** | **Low** | **Info** |
| 10.0.100.10 | DC | 4 | 0 | 9 | 0 | 41 |
| 10.0.100.20 | Files | 2 | 0 | 0 | 0 | 20 |
| 10.0.100.30 | Intra | 0 | 0 | 12 | 4 | 33 |
| 10.0.100.50 | MySql | 0 | 0 | 2 | 2 | 23 |
| 10.0.100.91 | CCTV | 0 | 0 | 1 | 0 | 17 |

Table 8 Branch vulnerabilities summary

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Host** | **Service** | **Critical** | **High** | **Med** | **Low** | **Info** |
| 192.168.10.10 | DC | 3 | 0 | 1 | 0 | 30 |
| 192.168.10.20 | POS | 0 | 0 | 3 | 2 | 31 |
| 192.168.10.30 | InfoTV | 0 | 0 | 0 | 0 | 4 |
| 192.168.10.51 | CCTV-Branch1 | 0 | 0 | 2 | 0 | 18 |
| 192.168.10.52 | CCTV-Branch1 | 0 | 0 | 1 | 0 | 18 |

## Vulnerability Details

* Tähän otsikkoon listataan kriittisimmät ja mielenkiintoisimmat haavoittuvuudet ja niiden yksityiskohdat
* Riskiarvio (todennäköisyys ja vaikuttavuus) sanallisesti
* Haavoittuvuuden ikä (voi mainita)
* Jako segmenteittäin
* Esimerkki SINISELLÄ

Objective of this title is to issue more technical and detailed information about the most important vulnerabilities presented above. In addition to technical explanation and possible mitigation proposal, overview includes severity and risk assessment to support decision making.

Information is divided based on group responsibilities presented in title four. Full technical records regarding all audit activities are attached to this document.

### List of vulnerabilities

### Vulnerability in DNS Resolution

**Synopsis:** Arbitrary code can be executed on the remote host through the installed Windows DNS client.

**Vulnerable Targets:**

[files.ldil.de](http://files.ldil.de) / 10.0.100.20

[dc.ldil.de](http://dc.ldil.de) / 10.0.100.10

rodc.ldil.de / 192.168.10.10

**Vulnerability Explanation**: A flaw in the way the installed Windows DNS client processes Link-local Multicast Name Resolution (LLMNR) queries can be exploited to

execute arbitrary code in the context of the NetworkService account. On Windows Vista, 2008, 7, and 2008 R2, the issue can be exploited remotely.

**Vulnerability Fix**: Install patch for Windows 2008 R2.

**Severity: CRITICAL**

### Microsoft Windows SMB Server vulnerabilities

**Synopsis:** Multiple vulnerabilities in Microsoft Server Message Block 1.0 (SMBv1)

**Vulnerable Targets:**

[dc.ldil.de](http://dc.ldil.de) / 10.0.100.10

[files.ldil.de](http://files.ldil.de) / 10.0.100.20

rodc.ldil.de / 192.168.10.10

**Vulnerability Explanation**: Multiple remote code execution vulnerabilities exist in Microsoft Server Message Block 1.0 (SMBv1) due to improper handling of certain requests. Exploiting vulnerability is possible for unauthenticated attacker via specially crafted packet, to achieve arbitrary code execution. Related vulnerabilities in National Vulnerability Database: CVE-2017-0143, CVE-2017-0144, CVE-2017-0145, CVE-2017-0146, CVE-2017-0148.

Also, an information disclosure vulnerability exists in SMB. Exploiting vulnerability is possible for unauthenticated attacker via specially crafted packet, to disclose sensitive information. Related vulnerability in NVD: CVE-2017-0147

In addition, SMB vulnerabilities exist that are exploited by WannaCry/WannaCrypt ransomware, EternalRocks worm and Petya ransomware.

**Vulnerability Fix**: Install patch for Windows 2008 R2.

**Severity: CRITICAL**

|  |
| --- |
| DNS Server Could Allow Remote Code Execution**Synopsis:** MS11-058: Vulnerabilities in DNS Server Could Allow Remote Code Execution **Vulnerable Targets:**  [dc.ldil.de](http://dc.ldil.de) / 10.0.100.10  rodc.ldil.de / 192.168.10.10  **Vulnerability Explanation**: A remote code execution vulnerability exists in the way that the Windows DNS Server improperly handles a specially crafted NAPTR query string in memory. An attacker who successfully exploited this vulnerability could run arbitrary code in the context of the system. An attacker could then install programs; view, change, or delete data; or create new accounts with full user rights.  **Vulnerability Fix**: Microsoft has released a set of patches for Windows 2003, 2008, and 2008 R2. <http://technet.microsoft.com/en-us/security/bulletin/ms11-058>  **Severity: HIGH** |

|  |
| --- |
|  |

|  |  |
| --- | --- |
| **Vulnerability in Schannel Could Allow Remote Code Execution****Synopsis:** The remote Windows host is affected by a remote code execution vulnerability. **Vulnerable Targets:**   |  | | --- | | [dc.ldil.de](http://dc.ldil.de) / 10.0.100.10 |   **Vulnerability Explanation**: The remote Windows host is affected by the following vulnerabilities :  - Multiple remote code execution vulnerabilities exist in Microsoft Server Message Block 1.0 (SMBv1) due to improper handling of certain requests. An unauthenticated, remote attacker can exploit these vulnerabilities, via a specially crafted packet, to execute arbitrary code. (CVE-2017-0143, CVE-2017-0144, CVE-2017-0145, CVE-2017-0146, CVE-2017-0148)  - An information disclosure vulnerability exists in Microsoft Server Message Block 1.0 (SMBv1) due to improper handling of certain requests. An unauthenticated, remote attacker can exploit this, via a specially crafted packet, to disclose sensitive information. (CVE-2017-0147)  **Vulnerability Fix**: Microsoft has released a set of patches for Windows Vista, 2008, 7, 2008 R2, 2012, 8.1, RT 8.1, 2012 R2, 10, and 2016. Microsoft has also released emergency patches for Windows operating systems that are no longer supported, including Windows XP, 2003, and 8.  **Severity: HIGH** |

|  |  |
| --- | --- |
| **Vulnerability in DNS Resolution Could Allow Remote Code Execution****Synopsis:** Arbitrary code can be executed on the remote host through the installed Windows DNS client. **Vulnerable Targets:**   |  | | --- | | 10.0.100.10 445/tcp Microsoft Windows SMB service |   **Vulnerability Explanation**: The remote Windows host is affected by the following vulnerabilities:  - Multiple remote code execution vulnerabilities exist in Microsoft Server Message Block 1.0 (SMBv1) due to improper handling of certain requests. An unauthenticated, remote attacker can exploit these vulnerabilities, via a specially crafted packet, to execute arbitrary code. (CVE-2017-0143, CVE-2017-0144, CVE-2017-0145, CVE-2017-0146, CVE-2017-0148)  - An information disclosure vulnerability exists in Microsoft Server Message Block 1.0 (SMBv1) due to improper handling of certain requests. An unauthenticated, remote attacker can exploit this, via a specially crafted packet, to disclose sensitive information. (CVE-2017-0147)  **Vulnerability Fix**: Microsoft has released a set of patches for Windows Vista, 2008, 7, 2008 R2, 2012, 8.1, RT 8.1, 2012 R2, 10, and 2016. Microsoft has also released emergency patches for Windows operating systems that are no longer supported, including Windows XP, 2003, and 8.  **Severity: HIGH** |

Outdated jQuery library in use

Synopsis: jQuery library is outdated and possibly vulnerable to exploits

Vulnerable Targets: <http://intra.ldil.de> / 10.0.100.30

Vulnerability Explanation: Ability Server 2.34 is subject to a buffer overflow vulnerability in STOR field. Attackers can use this vulnerability to cause arbitrary remote code execution and take completely control over the system.

Vulnerability Fix: Update jQuery as well as the dependent libraries to the latest version.

Severity: MEDIUM

Outdated PHP version in use

**Synopsis:** PHP framework is outdated and possibly vulnerable to exploits

**Vulnerable Targets:** <http://intra.ldil.de> / 10.0.100.30

**Vulnerability Explanation**: Intra-server is running unsupported PHP framework version, meaning there is no longer fixes and updates received from the PHP community.

**Vulnerability Fix**: Update PHP to at least to the one of the supported versions. Current version is not supported and might contain vulnerabilities as the support is no longer extended.

**Severity: MEDIUM**

### Verbose information about system version available in http response

**Synopsis:** HTTP response includes information the operating system.

**Vulnerable Targets:** <http://intra.ldil.de> / 10.0.100.30

**Vulnerability Explanation**: HTTP response gives out unneeded information to the end user and thus compromising the system security.

**Vulnerability Fix**: Hide the verbose response of currently used software versions from the http response.

**Severity: MEDIUM**

### Verbose information about PHP and Apache version available in http response

**Synopsis:** Verbose information about the PHP and Apache versions present in http response.

**Vulnerable Targets:** <http://intra.ldil.de> / 10.0.100.30

**Vulnerability Explanation**: Exposing the system version information to end-users is not needed. If it is needed internally, use different methods than printing it to http responses in plain-text (“Hi! I am using version..”).

**Vulnerability Fix**: Disable unneeded information sharing to end-users.

**Severity: MEDIUM**

### Buffer overflow detected

**Synopsis:** Buffer overflow errors are happening when the overwriting of memory spaces of the background web process, which should never been modified intentionally or unintentionally. Overwriting values of the IP (instruction pointer), BP (base pointer) and other registers causes exceptions, segmentation faults and the other process errors to occur.

**Vulnerable Targets:** <http://intra.ldil.de> / 10.0.100.30

**Vulnerability Explanation**: Potential buffer overflow detected. The script closed the connection and threw a 500 Internal Server Error.

**Vulnerability Fix**: Rewrite the background program using proper return length checking. This will require a recompile of the background executable.

**Severity: MEDIUM**

**Proof of Concept Code Here:**

GET

<https://intra.ldil.de/wp-content/themes/twentysixteen?query=xlScCqlemqpPtXbFamPILdDaLkKPaUyLMWHUlAa>...... Basically any long enough query

### Directory browsing is enabled

**Synopsis:** Directory browsing is enabled and it is possible to view the directory listing

**Vulnerable Targets:** [https://intra.ldil.de/wp-admin /](https://intra.ldil.de/wp-admin%20/) 10.0.100.30

**Vulnerability Explanation**: It is possible to view the directory listing. Directory listing may reveal hidden scripts, include files, backup source files which can be accessed to read sensitive information.

**Vulnerability Fix**: Disable directory browsing. If the directory browsing cannot be disabled because of some other service needing it, make sure the listed files do not include any risks.

**Severity: MEDIUM**

### Format string error

**Synopsis**: A format string error occurs when the submitted data of an input string is evaluated as a command by the application.

**Vulnerable Targets:** <http://intra.ldil.de> / 10.0.100.30

**Vulnerability Explanation**: Potential format string error occurred. The script closed the connection on a /%s

**Vulnerability Fix**: Review the background program using proper deletion of bad character strings (parameterize). This will require a recompile of the background executable.

**Severity: MEDIUM**

### X-frame-options header not set

**Synopsis:** X-Frame-Options header is not included in the HTTP response

**Vulnerable Targets:**

<http://intra.ldil.de> / 10.0.100.30

<http://helpdesk.ldil.de> / 10.10.10.40

**Vulnerability Explanation**: X-Frame-Options header should be included in the HTTP response to protect against ClickJacking attacks.

**Vulnerability Fix**: Most modern web browsers support the X-Frame-Options HTTP header. Ensure it is set on all web pages returned to your site.

**Severity: MEDIUM**

### SSH Weak Algorithms Supported

**Synopsis:** The remote SSH server is configured to allow weak encryption algorithms or no algorithm at all.

**Vulnerable Targets:** pos.ldil.de / 192.168.10.20

**Vulnerability Explanation**: Remote SSH server is configured to use the Arcfour stream cipher or no cipher at all. RFC 4253 advises against using Arcfour due to an issue with weak keys.

**Vulnerability Fix**: Update and configure SSH server to disable weak algorithm.

**Severity: MEDIUM**

### HTTP TRACE / TRACK Methods Allowed

**Synopsis:** Debugging functions are enabled on the remote web server.

**Vulnerable Targets:** <http://pos.ldil.de> / 192.168.10.20

**Vulnerability Explanation**: The remote web server supports the TRACE and/or TRACK methods. TRACE and TRACK are HTTP methods that are used to debug web server connections.

**Vulnerability Fix**: Refer to Apache web server documentation on how to disable these methods.

**Severity: MEDIUM**

### XSS-protection is not enabled

**Synopsis:** Web browser XSS protection is not enabled or is disabled by the configuration of the X-XSS-Protection HTTP response header on the webserver.

**Vulnerable Targets:** <http://intra.ldil.de> / 10.0.100.30

**Vulnerability Explanation**: The X-XSS-Protection HTTP response header allows the web server to enable or disable the web browser´s XSS protection mechanisms. The following values would attempt to enable it: X-XSS-Protection: 1; mode=block.

The X-XSS-Protection HTTP response header is currently supported on IE, Chrome and Safari.

**Vulnerability Fix**: Ensure that the web browser´s XSS filter is enabled by setting the X-XSS-Protection HTTP response header to “1”.

**Severity: MINOR**

# Sample Report – Attachments

Tiedostoina!!!

Nimeäminen:

* Segmentti\_Numero\_Työkalu\_Tarkenne

Sisältö:

* Nessus-raportit
* Openwas-raportit
* NMAP-raportit
* Zap-raportit
* OWASP-raportit

Esittäminen:

* Taulukko
  + Liitteen nimi
  + Sisältö

Table 7 Attachment files

|  |  |
| --- | --- |
| Attachment name | Attachment description |
| StoreBranch\_01\_Nessus\_portscan.pdf | Nessus port scan of store branch network segment |
| Internal\_02\_Nessus\_portscan.pdf | Nessus port scan of internal network segment |
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