Stay Secure With Oracle Solaris

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Oracle ACE „Solaris“

Agenda

- About JomaSoft
- Oracle ACE Program

- Solaris 11: Secure by Default
- Virtualization
- Compliance tool
- SPARC Silicon Secured Memory
- Compliance and Hardening using VDCF

About JomaSoft

ORACLE Gold Partner
Specialized
Oracle Solaris 11

ORACLE Gold Partner
Specialized
SPARC T5-Based Servers

- Engineering company founded July 2000
- specialized in **Solaris** and software development, operations and consulting
- Product **VDCF** (Virtual Datacenter Cloud Framework)
  Installation, Management, Operations, Monitoring, Security and DR for Solaris 10/11,
  Virtualize using LDoms and Solaris Zones
- VDCF is used in production since 2006

swisscom
Zürcher Kantonalbank
NOTENSTEIN PRIVATBANK
VOLKSBANK LIECHTENSTEIN

About JomaSoft

- Flexible and Customer focused
- Oracle Certified Employees
- 17 Years Solaris Experience
- Regular Oracle Solaris Beta Tester
- Well connected with Oracle Solaris & LDOM Engineering Teams

500+ Technical Experts Helping Peers Globally

ORACLE ACE PROGRAM


ORACLE ACE Director


ORACLE ACE


ORACLE ACE Associate

3 Membership Tiers

- Oracle ACE Director
- Oracle ACE
- Oracle ACE Associate

bit.ly/OracleACEProgram

Connect:

oracle-ace_ww@oracle.com

Facebook.com/oracleaces

@oracleace

ORACLE Developer Community

Nominate yourself or someone you know: acenomination.oracle.com

IT Security

- Not Topic of this Session
  - Firewalls
  - Applikation Development

- OS Security with Oracle Solaris
  - What's there by default
  - How can I check my Servers?
  - How can I protect my Applications?
  - Hardening

Solaris 11 – Secure by Default (1/7)

- No direct root Login

```
g0086 console login: root
Password:
Roles can not login directly
Login incorrect

g0086 console login: marcel
Password:
Last login: Wed Sep 20 15:42:30 2017 from g0069.jomasoft-
Oracle Corporation      SunOS 5.11      11.3    March 2017
-bash-4.4$ su
Password:
Sep 20 17:16:55 g0086 su: 'su root' succeeded for marcel on /dev/console
```

Solaris 11 – Secure by Default (2/7)

- No direct root Login

```
-bash-4.4$ id
uid=501(larry) gid=10(staff)

-bash-4.4$ su
Password:
Roles can only be assumed by authorized users
su: Sorry


-bash-4.4$ grep roles=root /etc/user_attr
admin::::lock_after_retries=no;profiles=System Administrator;roles=root
marcel::::profiles=VDCF Logger,VDCF admin Module;roles=root
```

Solaris 11 – Secure by Default (3/7)

- Auditing is activated (for Logins)

```
# auditreduce -c lo | praudit -l | tail -4

header,69,2,login - ssh,fe,g0087,2017-09-01 15:37:32.707
+02:00,subject,root,root,root,root,root,6021,3233957173,15531 196630
g0069.jomasoft-lab.ch,return,failure,Permission denied
header,69,2,login - ssh,na:fe,g0087,2017-09-01 15:37:38.864 +02:00,subject,-
1,-1,-1,-1,-1,6023,3999938775,12434 196630 g0069.jomasoft-
lab.ch,return,failure,No account present for user
header,69,2,login - ssh,,g0087,2017-09-01 15:37:42.013
+02:00,subject,marcel,marcel,staff,marcel,staff,6026,3889292888,15007 65558
g0069.jomasoft-lab.ch,return,success,0
file,2017-09-01 15:37:42.000 +02:00,
```

Solaris 11 – Secure by Default (4/7)

- Unsafe Services are not running or not installed

```
-bash-4.4$ telnet g0086
Trying 192.168.100.86...
telnet: Unable to connect to remote host: Connection refused

-bash-4.4$ ftp g0086
ftp: connect: Connection refused

-bash-4.4$ ssh g0086
Last login: Wed Sep 20 17:18:35 2017 from g0069.jomasoft-
Oracle Corporation      SunOS 5.11      11.3    March 2017
-bash-4.4$
```

Solaris 11 – Secure by Default (5/7)

- Daemons as non-root with Privileges

```
# ps -f -u netadm,daemon,smmsp,dladm

     UID   PID  PPID   C    STIME TTY      TIME CMD
  daemon    75     1   0   Aug 28 ?        0:00 /lib/crypto/kcfd
  netadm    46     1   0   Aug 28 ?        0:00 /usr/sbin/ibmgmtd
  netadm    66     1   0   Aug 28 ?        0:02 /lib/inet/ipmgmtd
   dladm    52     1   0   Aug 28 ?        0:02 /usr/sbin/dlmgmtd
  daemon   448     1   0   Aug 28 ?        0:00 /usr/sbin/rpcbind -w
  daemon   204     1   0   Aug 28 ?        0:00 /usr/lib/utmpd
  netadm   315     1   0   Aug 28 ?        0:02 /lib/inet/nwamd
   smmsp   644     1   0   Aug 28 ?        0:00 /usr/lib/inet/sendmail -Ac-q15m
```

Solaris 11 – Secure by Default (6/7)

- Restrictive umask

```
-bash-4.4$ umask
0022
-bash-4.4$ touch /tmp/test
-bash-4.4$ ls -l /tmp/test
-rw-r--r--   1 marcel   staff          0 Sep  1 15:53 /tmp/test
```

Solaris 11 – Secure by Default (7/7)

- Role-based access control (RBAC)

```
-bash-4.4$ profiles -a | grep ZFS
ZFS File System Management
ZFS Storage Management

# usermod -P+"ZFS File System Management" marcel

-bash-4.4$ zfs create rpool/test1
cannot create 'rpool/test1': permission denied

-bash-4.4$ pfbash
bash-4.4$ zfs create rpool/test1
```

Solaris 11 – pkg verify

- Detect changes

```
-# ls -l /etc/shadow
-r--------   1 root     sys           807 May  8  2017 /etc/shadow

# chmod o+r /etc/shadow

# ls -l /etc/shadow
-r-----r--   1 root     sys           807 May  8  2017 /etc/shadow

# pkg verify
PACKAGE                                                 STATUS
pkg://solaris/system/core-os                            ERROR
        file: etc/shadow
                ERROR: Mode: 0404 should be 0400
```

Solaris 11 – pkg fix

- Revert changes

```
# pkg fix core-os
                Packages to fix:   1
       Create boot environment:  No
Create backup boot environment: Yes
Repairing: pkg://solaris/system/core-os@0.5.11,5.11-
0.175.3.14.0.5.0:20161105T004625Z
PACKAGE                                          STATUS
pkg://solaris/system/core-os                     ERROR
        file: etc/shadow           ERROR: Mode: 0404 should be 0400
PHASE                                            ITEMS
Updating modified actions                         1/1
Updating package state database                  Done
Updating package cache                            0/0
Updating image state                             Done
Creating fast lookup database                    Done
Updating package cache                            2/2
# ls -l /etc/shadow
-r--------   1 root     sys          807 May  8  2017 /etc/shadow
```

CVE

- **C**ommon **V**ulnerabilities and **E**xposures

  Industrie Standard

  Namingconvention for Security Bugs

  Format: CVE-<jahr>-<nr>

  Sample: CVE-2014-7187 (Bash/Shellshock)

  Scoring: Common Vulnerability Scoring System (CVSS)

  Medium 4 – 6.9 / High 7 – 8.9 / Critical 9 – 10

  Search u.v.a. https://www.cvedetails.com/

Oracle Solaris	376
Redhat Enterprise Linux	426
Windows 7	820

Solaris 11.3 – CVE Metadata

- Required: Metadata Package installed

```
# pkg install solaris-11-cpu
```

- Analysis

Is Fix installed for CVE-2014-7187 (Bash/Shellshock)?

```
-bash-4.4$ pkg search -l CVE-2014-7187
INDEX      ACTION VALUE          PACKAGE
info.cve   set    CVE-2014-7187 pkg:/support/critical-patch-update/solaris-11-
cpu@2017.6-1
```

Is CVE-2017-3629 (Local Privilege Escalation) installed?

```
-bash-4.4$ pkg search -l CVE-2017-3629
-bash-4.4$
```

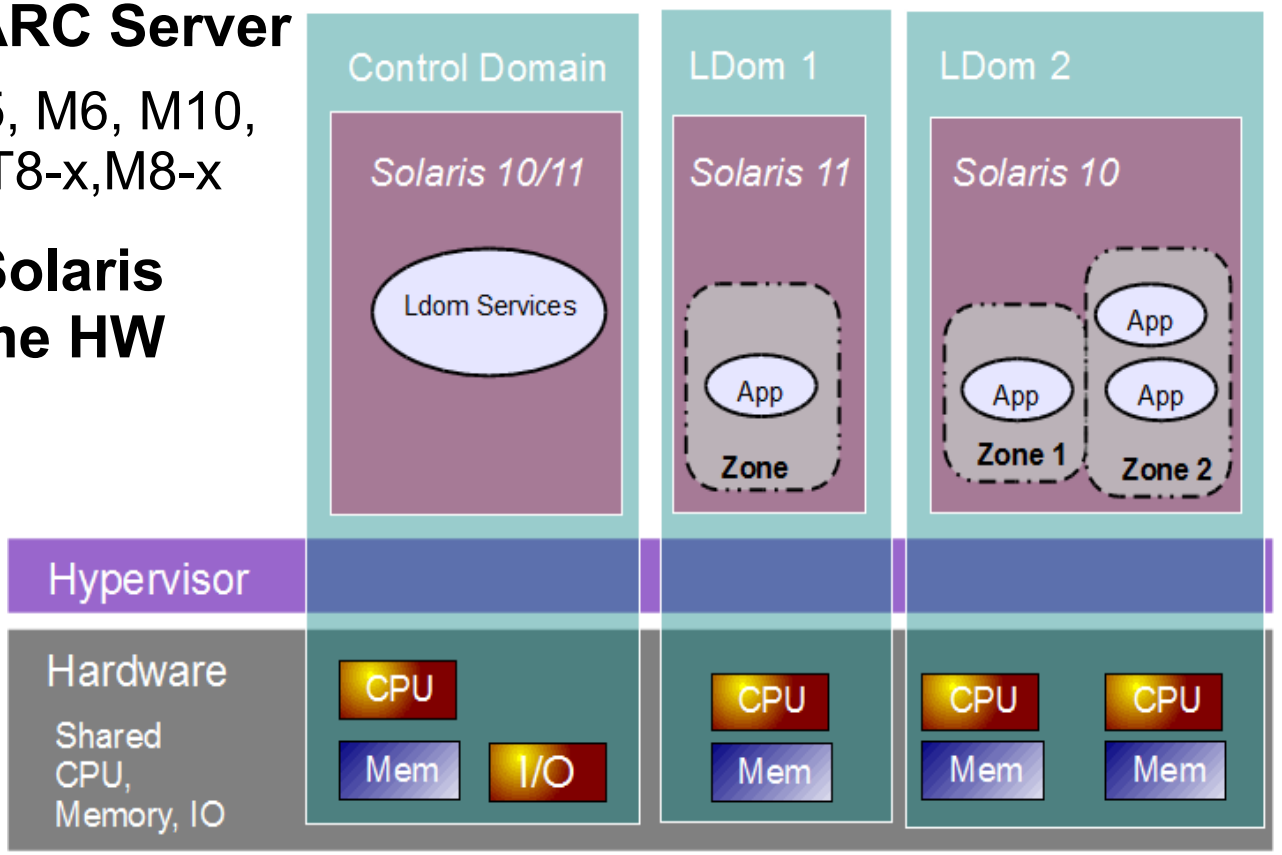
Which Update is required for CVE-2017-3629?

```
-bash-4.4$ pkg search  CVE-2017-3629: | head -2
INDEX          ACTION VALUE
               PACKAGE
CVE-2017-3629 set    pkg://solaris/network/legacy-remote-utilities@0.5.11,5.11-
0.175.3.22.0.3.0 pkg:/support/critical-patch-update/solaris-11-cpu@2017.7-1
```

SPARC-Virtualization: LDoms / Zonen

- **Oracle & Fujitsu SPARC Server**

  Systeme: T4-x, T5-x, M5, M6, M10, T7-x, M7-x, S7-2, M12, T8-x,M8-x
- **Multiple, separated Solaris Instances on the same HW**
- **Combine with Zones**
- **Dedicated Memory**
- **Hacker on one Zone or LDom has limited Impact**



Solaris – Virtualization using Zones

- Immutable (Read-Only) Zones

A) file-mac-profile=flexible-configuration

```
# touch /bla
touch: cannot change times on /bla: Read-only file system

# pkg install apache-22
pkg install: Could not complete the operation on /var/pkg/lock:
read-only filesystem.

# touch /etc/test
# touch /var/myfile
```

Solaris – Virtualization using Zones

- Immutable (Read-Only) Zones

B) file-mac-profile=fixed-configuration

```
# touch /bla
touch: cannot change times on /bla: Read-only file system

# pkg install apache-22
pkg install: Could not complete the operation on /var/pkg/lock:
read-only filesystem.

# touch /etc/test
touch: cannot change times on /etc/test: Read-only file system

# touch /var/myfile
```

Solaris – Virtualization using Zones

- Immutable (Read-Only) Zones

C) file-mac-profile=strict

Completely Read-Only / Only Remote Logging

```
# touch /bla
touch: cannot change times on /bla: Read-only file system
# pkg install apache-22
pkg install: Could not complete the operation on /var/pkg/lock:
read-only filesystem.
# touch /etc/test
touch: cannot change times on /etc/test: Read-only file system
# touch /var/myfile
touch: cannot change times on /var/myfile: Read-only file system
```

Solaris – Virtualization using Zones

- Trusted Path for Immutable (Read-Only) Zones

Beispiel mit **file-mac-profile=strict**

```
-bash-4.1$ touch /etc/test
touch: cannot change times on /etc/test: Permission denied
```

On the global Zone / No RW Reboot required

```
# zlogin -T v0128
[Connected to zone 'v0128' pts/3]
Oracle Corporation      SunOS 5.11      11.2    August 2014
root@v0128:~# touch /etc/test
```

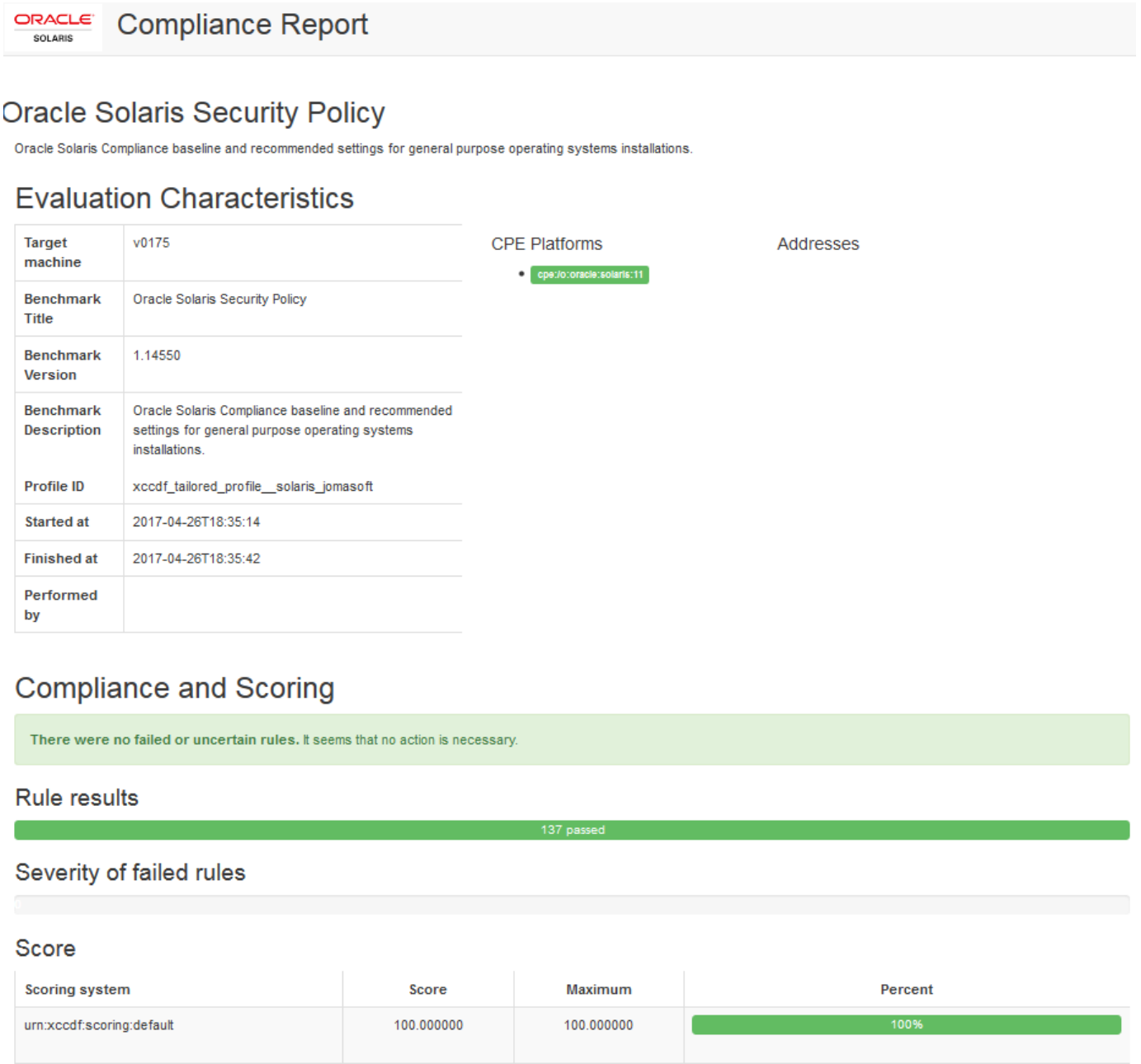
Solaris 11.3 – Compliance tool

- Based on OpenSCAP
- Checks Systems against predefined Rules
- Allows to detect changes on the System
- Produces detailed HTML Report

- Execution:

```
compliance assess -b solaris -p Baseline
compliance assess -b solaris -p Recommended
compliance assess -b pci-dss
```

Solaris 11.3 – Compliance tool



ORACLE SOLARIS

Compliance Report

Oracle Solaris Security Policy

Oracle Solaris Compliance baseline and recommended settings for general purpose operating systems installations.

Evaluation Characteristics

Target machine	v0175
Benchmark Title	Oracle Solaris Security Policy
Benchmark Version	1.14550
Benchmark Description	Oracle Solaris Compliance baseline and recommended settings for general purpose operating systems installations.
Profile ID	xccdf_tailored_profile__solaris_jomasoft
Started at	2017-04-26T18:35:14
Finished at	2017-04-26T18:35:42
Performed by	

CPE Platforms

- cpe:/o:oracle:solaris:11

Addresses

Compliance and Scoring

There were no failed or uncertain rules. It seems that no action is necessary.

Rule results

137 passed

Severity of failed rules

Score

Scoring system	Score	Maximum	Percent
urn:xccdf:scoring:default	100.000000	100.000000	100%

Solaris 11.3 – Compliance tool

- compliance Output

```
# compliance assess -b solaris -p Baseline
Assessment will be named 'solaris.Baseline.2017-09-01,16:37'
        Package integrity is verified
        OSC-54005
        pass

        The OS version is current
        OSC-53005
        pass

        Service svc:/network/ftp:default is in disabled state
        OSC-17510
        pass

        Service svc:/network/rpc/gss is enabled if and only if Kerberos is
        configured
        OSC-63005
        fail
```

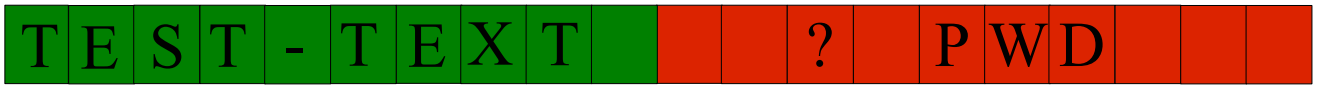
SPARC – Silicon Secured Memory

- Integrated in SPARC CPU M7/M8 and S7
- You detect and prevent
  - Memory Reference Errors
  - Buffer Overruns
  - Memory Usage after free
- Alternatives in Software are expensive and 30x – 70x slower
- Oracle Developer Studio Compiler includes Support for Discovery at Development
- Demo Video about OpenSSL Heartbleed https://swisdev.oracle.com/_files/ADI-Demo.html

SPARC – Silicon Secured Memory

```
void main(int argc, char *argv[])
{
   char *buffer = malloc( sizeof(char) * 10);
   strcpy(buffer, "Test-Text");
   for (int i = 0; i < 20; ++i)
      printf( "%c ", buffer[i] );
   printf("|\n");
   free(buffer);
}
```

```
/opt/solarisstudio12.4/bin/cc -m64 -g -o buffer_overrun buffer_overrun.c
```




```
-bash-4.4$ ./buffer_overrun
T e s t - T e x t           |
```

SPARC – Silicon Secured Memory

With SSM (ADI) activated the Program is stopped and can't access foreign Memory.

```
-bash-4.4$ LD_PRELOAD_64=/lib/64/libadimalloc.so.1 ./buffer_overrun
Segmentation Fault (core dumped)

-bash-4.4$ echo ::status | mdb core
debugging core file of buffer_overrun (64-bit) from g0072
file: /export/home/marcel/buffer_overrun
initial argv: ./buffer_overrun
threading model: native threads
status: process terminated by SIGSEGV (Segmentation Fault), pc=100000bb0
, ADI version d mismatch for VA ffffffff7e93ffc0
```

SPARC – Silicon Secured Memory

Detailed Results when using the Compiler Libraries

```
LD_PRELOAD_64=/opt/developerstudio12.5/lib/compilers/sparcv9/libdiscoverADI.so ./
buffer_overrun
T e s t - T e x t                |
```

1. ABR: reading memory beyond array bounds at address 0x2fffffff7cc7e040

main() + 0x60 (line ~12) in "buffer_overrun.c"

```
 9:    strcpy(buffer, "Test-Text");
10:
11:    for (int i = 0; i < 20; ++i)
12:      printf( "%c ", buffer[i] );
13:    printf("|\n");
14:
15:    free(buffer);
```

was allocated at (0x2fffffff7cc7e000, 64 bytes):

main() + 0x10 (line ~7) in "buffer_overrun.c"

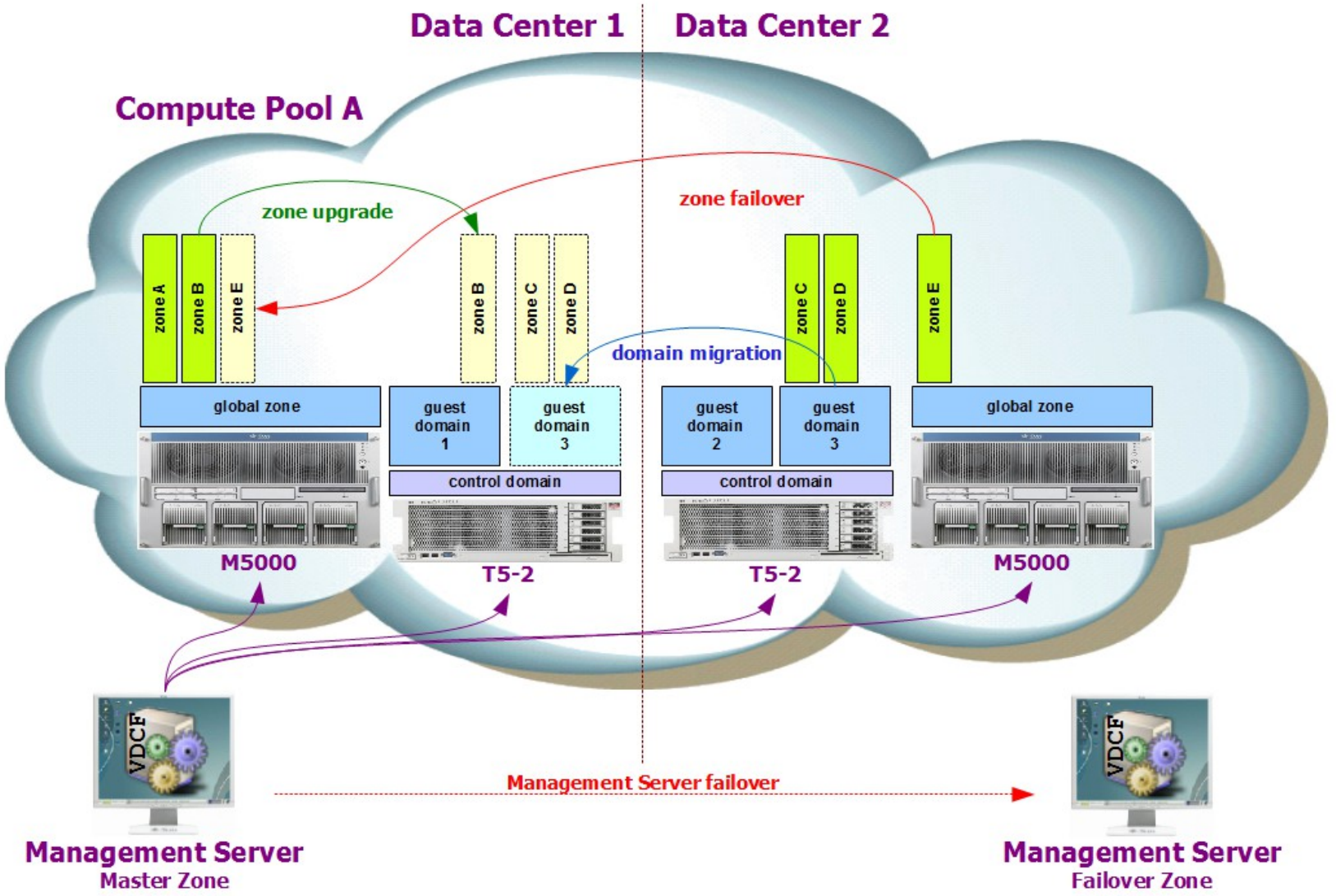
```
 4:
 5:  void main(int argc, char *argv[])
 6:  {
 7:    char *buffer = malloc( sizeof(char) * 10);
 8:
 9:    strcpy(buffer, "Test-Text");
10:
```

VDCF – Virtual Datacenter Cloud Framework

- Management Tool for Zones and LDOMs

  Installation, Operation, Migration,
  Monitoring, Security and Failover/DR
- Supports Solaris 10 + 11 on SPARC/x86
- In productive use since 2006
- Dynamic Virtualization
  Live / Cold Migration and Failover
- Resource Configuration and Monitoring
- Agility for your Enterprise Private Cloud
- Implemented by Admins for Admins

Dynamic Virtualization



VDCF – Compliance Assess

- 3 Standard Benchmarks: baseline, recommended, pci-dss

- VDCF Benchmarks: default & cdom

-bash-4.4$ more /var/opt/jomasoft/vdcf/conf/compliance**/cdom.tailor**

```
.....
# ------------------------------
# commented, activate if required
# ------------------------------
....
# OSC-53005: The OS version is current
#exclude OSC-53005
...
# -------------------------
# disabled to avoid failures
# -------------------------
# OSC-55010: The r-protocols services are disabled in PAM
exclude OSC-55010
# OSC-73505: ssh(1) is the only service binding a listener to non-loopback addresses
exclude OSC-73505
# ------------------------------------
# added to detect more than the baseline
# ------------------------------------
.....
# OSC-47500: Passwords require at least 1 digits
include OSC-47500
# OSC-49500: Passwords require at least 1 upper-case characters
include OSC-49500
# OSC-93005: User home directories have appropriate permissions
include OSC-93005
....
```

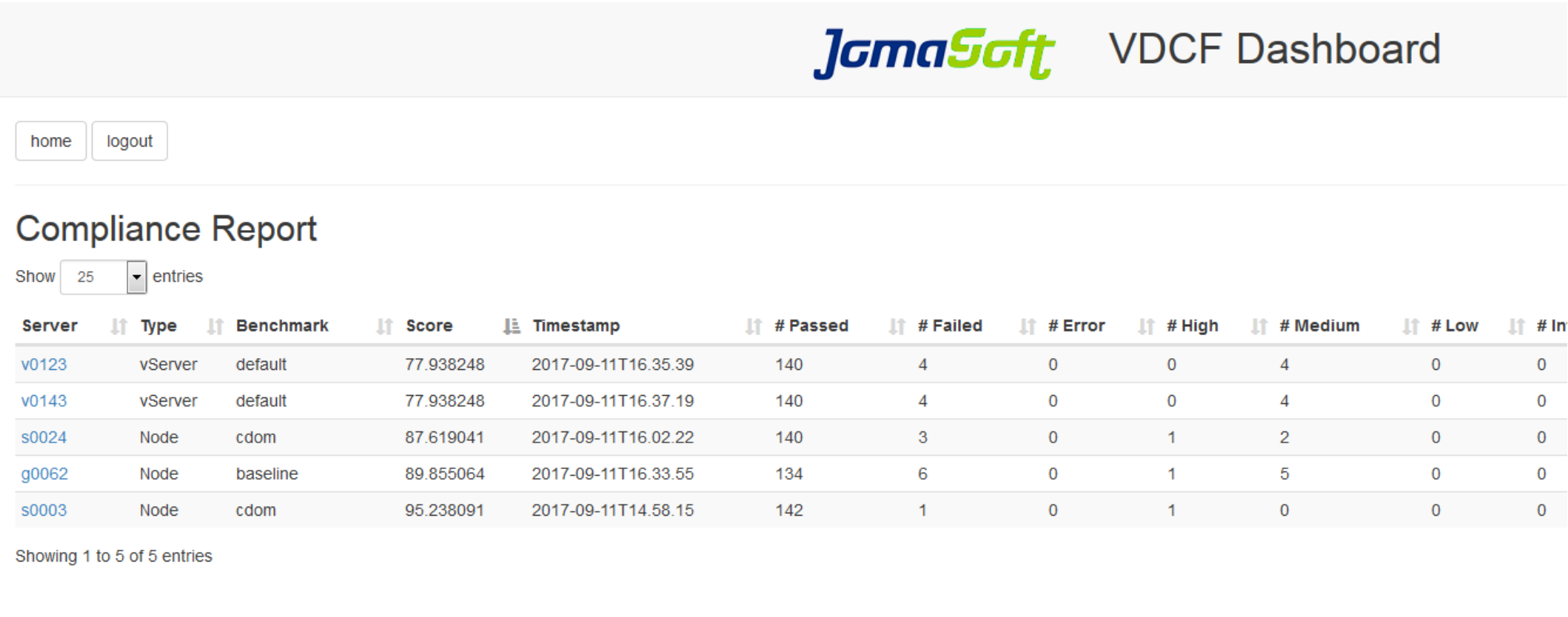
- Individual Benchmarks for Customers and Servers

VDCF – Compliance Assess

- Fully automated Compliance check over the Datacenter

```
osmon -c assess all all_vserver
```

- Compliance Report



VDCF – Hardening

- Individual Hardening Profiles

```
-bash-4.4$ more /var/opt/jomasoft/vdcf/conf/compliance/baseline.hardening
OSC-12510: Service svc:/network/nfs/fedfs-client:default is in disabled state
OSC-63005: Service svc:/network/rpc/gss is enabled if and only if Kerberos is
configured
OSC-93005: User home directories have appropriate permissions
OSC-34010: Service svc:/application/cups/in-lpd:default is in disabled state
OSC-85000: The maximum number of waiting TCP connections is set to at least
1024
OSC-99011: Service svc:/system/rad:remote is in enabled state
```

- Hardening

```
-bash-4.4$ node -c harden name=g0087 profile=baseline
Hardening started ...
OSC-12510: Service svc:/network/nfs/fedfs-client:default is in disabled state
- DONE
OSC-34010: Service svc:/application/cups/in-lpd:default is in disabled state
- DONE
OSC-63005: Service svc:/network/rpc/gss is enabled if and only if Kerberos is
configured - DONE
OSC-85000: The maximum number of waiting TCP connections is set to at least
1024 - DONE (Changed from 128 to 1024)
OSC-93005: User home directories have appropriate permissions - DONE
OSC-99011: Service svc:/system/rad:remote is in enabled state - DONE
Hardening of 6 items on Node g0087 was successful
```

VDCF – Online Ressources

- **Produkt Documentation Online**

  Complete Documentation and Videos on Webpage available

- **Free Edition**

  No-Cost Test Version with limited number of managable Servers.

- **Test using combined POC**

  Install and test together with JomaSoft on-site in your Test environment.

- **Webpage**

  https://www.jomasoft.ch/vdcf

Ending Slide

Questions?

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Oracle ACE „Solaris“