OS Security mit Oracle Solaris 11

Marcel Hofstetter

hofstetter@jomasoft.ch
https://www.jomasoftmarcel.blogspot.ch

Geschäftsführer / Enterprise Consultant
JomaSoft GmbH

Oracle ACE „Solaris“

Inhalt

- Wer ist JomaSoft?
- Solaris 11: Secure by Default
- Compliance tool
- SPARC Silicon Secured Memory
- Virtualisierung
- Compliance und Hardening mit VDCF

Wer ist JomaSoft?

ORACLE Gold Partner
Specialized
Oracle Solaris 11

ORACLE Gold Partner
Specialized
SPARC T-Series Servers

- Software Unternehmen gegründet im Juli 2000
- Spezialisiert im Bereich **Solaris,**
  Software Entwicklung & Services/Beratung
- Produkt **VDCF** (Virtual Datacenter Cloud Framework):
  Installation, Management, Betrieb, Monitoring, Security
  und DR von Solaris 10/11, sowie Virtualisierung
  mittels LDoms und Solaris Zonen
- VDCF wird seit 2006 produktiv in Europa genutzt

Love Work Play Mobistar

swisscom

LOTERIE ROMANDE

bmvit
Bundesministerium für Verkehr, Innovation und Technologie

VOLKSBANK LIECHTENSTEIN

Wer ist JomaSoft?

ORACLE Gold Partner
Specialized
Oracle Solaris 11

ORACLE Gold Partner
Specialized
SPARC T-Series Servers

- Flexibel und Kunden fokussiert
- Oracle zertifizierte Mitarbeiter
- 19 Jahre Solaris Erfahrung
- Regelmäßige Oracle Solaris Beta Tester
- Gute Beziehungen zu Oracle Solaris & LDom Engineering Teams

Marcel Hofstetter

Informatiker seit 25+ Jahren
Solaris seit 21 Jahren
CEO bei der JomaSoft GmbH seit 19 Jahren

Internationaler Speaker:
Oracle OpenWorld, DOAG, UKOUG, SOUG, AOUG

Oracle ACE „Solaris“

SOUG (Swiss Oracle User Group) – Speaker of the Year 2016

Hobby: Familie, Reisen, Wine & Dine, Kino

https://www.linkedin.com/in/marcelhofstetter

https://twitter.com/marcel_jomasoft

https://jomasoftmarcel.blogspot.ch

IT Security

- Kein Thema in diesem Vortrag
  - Firewalls
  - Applikationsentwicklung

- Sicherheit mit Oracle Solaris
  - Was ist per Default vorhanden
  - Wie kann ich meinen Server prüfen?
  - Wie kann ich meine Applikation schützen?
  - Hardening

Solaris 11 – Secure by Default (1/7)

- Kein direkter root Login

```
g0086 console login: root
Password:
Roles can not login directly
Login incorrect
Mar 19 15:04:17 g0086 login: login account failure: Permission denied


g0086 console login: marcel
Password:
Last login: Mon Mar 18 19:52:34 2019 from 192.168.100.69
Oracle Corporation      SunOS 5.11      11.4    January 2019
-bash-4.4$ su
Password:
Mar 19 15:05:08 g0086 su: 'su root' succeeded for marcel on /dev/console
```

Solaris 11 – Secure by Default (2/7)

- Kein direkter 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 ist aktiviert (für 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)

- Unsichere Services sind nicht aktiv

```
-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: Tue Mar 19 15:05:05 2019 on console
Oracle Corporation      SunOS 5.11      11.4    January 2019
-bash-4.4$
```

Solaris 11 – Secure by Default (5/7)

- Daemons als non-root mit Privilegien

```
# 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)

- Restriktive 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

- Änderungen entdecken

```
-# 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

- Änderungen zurücksetzen

```
# 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

  Industriestandard

  Namenskonvention für Sicherheitslücken

  Format: CVE-<jahr>-<nr>

  Beispiel: 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

Seit Solaris 11.3 – CVE Metadaten

- Voraussetzung: Metadaten Package installiert

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

- Auswertungen

Ist ein Fix für CVE-2014-7187 (Bash/Shellshock) installiert?

```
-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
```

Und CVE-2017-3629 (Local Privilege Escalation) installiert?

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

Welcher Update ist notwendig für CVE-2017-3629?

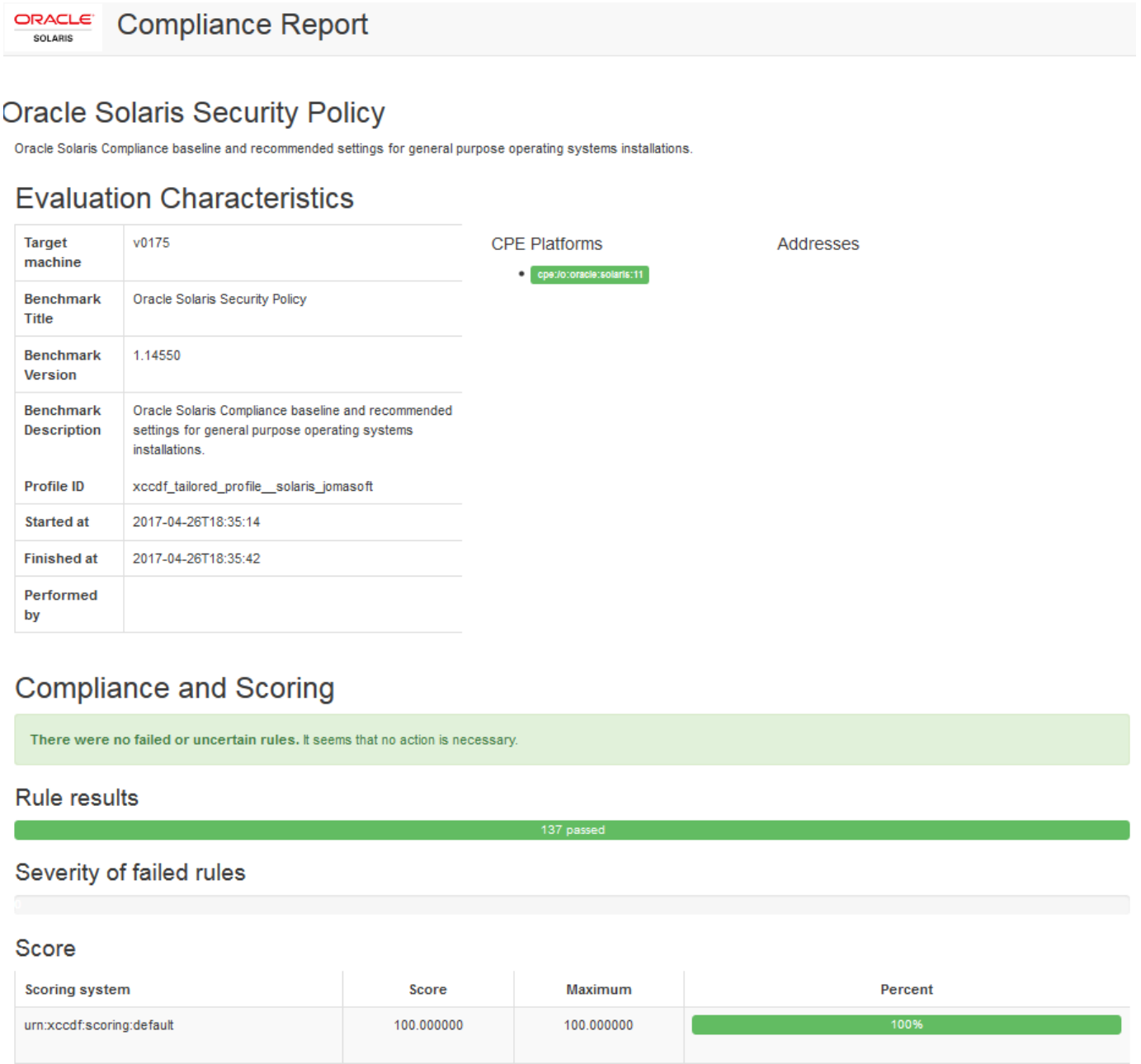
```
-bash-4.4$ pkg search  CVE-2017-3629: | head -2
INDEX          ACTION VALUE
               PACKAGE
CVE-2017-3629 set    pkg://solaris/network/legacy-remote-utilities@0.5.11,5.11-
0.175.3.22.0.3.0 pkg:/support/critical-patch-update/solaris-11-cpu@2017.7-1
```

Seit Solaris 11.3 – Compliance tool

- Basiert auf OpenSCAP
- Prüft Systeme gegen vordefinierte Regeln
- Damit können Änderungen am System erkannt werden
- Produziert HTML Report
- Ausführung:

```
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
```

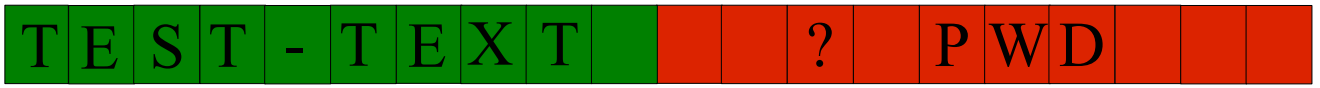
SPARC – Silicon Secured Memory

- In den SPARC CPU M7/M8 und S7 integriert
- Damit entdeckt und verhindert man
  - Memory Referenz Fehler
  - Buffer Overruns
  - Memory Nutzung nach Freigabe
- Alternativen in Software sind teuer und 30x – 70x mal langsamer
- Oracle Developer Studio Compiler enthält Unterstützung für Discover während Entwicklung

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

Mit SSM (ADI) aktiviert, wird Programm beendet und kann nicht auf fremdes Memory zugreifen

```
-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

Entwickler untersucht mit Compiler Tools

```
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):

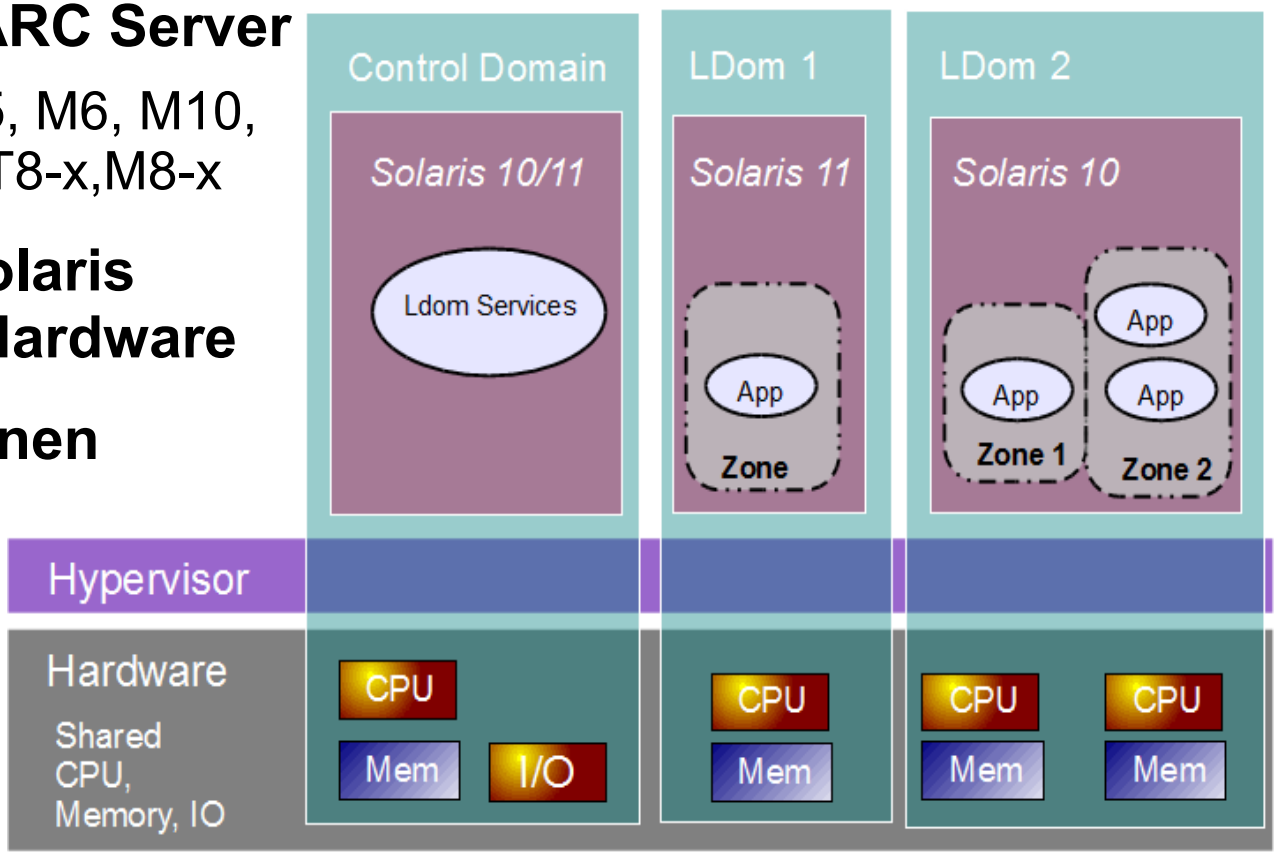
main() + 0x10 (line ~7) in "buffer_overrun.c"

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

SPARC-Virtualisierung: 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
- **Mehrere, separate Solaris Instanzen auf einer Hardware**
- **Kombinierbar mit Zonen**
- **Dediziertes Memory**
- **Einbruch auf Zonen und LDoms hat begrenzte Auswirkung**



Solaris – Virtualisierung mit Zonen

- 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 – Virtualisierung mit Zonen

- 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 – Virtualisierung mit Zonen

- Immutable (Read-Only) Zones

C) file-mac-profile=strict

Wirklich Read-Only / Nur 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 – Virtualisierung mit Zonen

- Trusted Path für 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
```

Aus globaler Zone / Kein RW Reboot notwendig

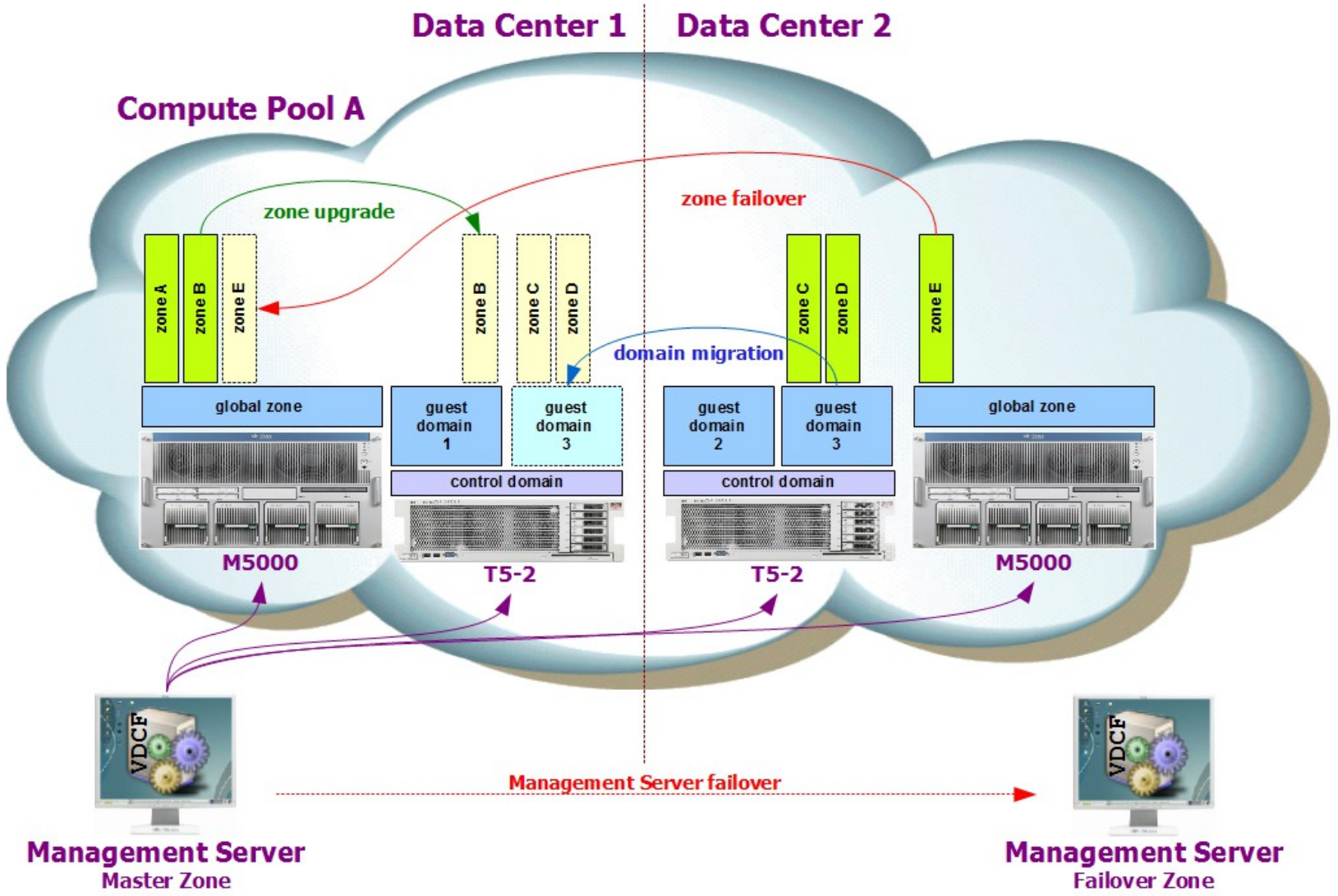
```
# zlogin -T v0128
[Connected to zone 'v0128' pts/3]
Oracle Corporation      SunOS 5.11      11.2    August 2014
root@v0128:~# touch /etc/test
```

VDCF – Virtual Datacenter Cloud Framework

- Management Werkzeug für Zonen und LDoms:
  Installation, Betrieb, Migration,
  Monitoring, Security und DR/Failover
- für Solaris 10 + 11 / SPARC und X86
- Seit 2006 produktiv genutzt
- Dynamische Virtualisierung:

  Live / Cold Migration und Failover
- Ressource Konfiguration und Monitoring
- Agilität für Enterprise Private Cloud
- Von Admins für Admins

Dynamische Virtualisierung



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
....
```

- Individuelle Benchmarks von Kunden und für Server

VDCF – Compliance Assess

- Automatisierter Compliance check übers Datacenter

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

- Compliance Report

JamaSoft VDCF Dashboard

home logout

Compliance Report

Show 25 entries

Server	Type	Benchmark	Score	Timestamp	# Passed	# Failed	# Error	# High	# Medium	# Low	# In
v0123	vServer	default	77.938248	2017-09-11T16.35.39	140	4	0	0	4	0	0
v0143	vServer	default	77.938248	2017-09-11T16.37.19	140	4	0	0	4	0	0
s0024	Node	cdom	87.619041	2017-09-11T16.02.22	140	3	0	1	2	0	0
g0062	Node	baseline	89.855064	2017-09-11T16.33.55	134	6	0	1	5	0	0
s0003	Node	cdom	95.238091	2017-09-11T14.58.15	142	1	0	1	0	0	0

Showing 1 to 5 of 5 entries

VDCF – Hardening

- Individuelle 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 – Mehr Infos

- **Produkt Dokumentation Online**

  Komplette Dokumentation und Videos ab Webpage verfügbar

- **Free Edition**

  Kostenlose Test-Version in der Anzahl verwaltbare Objekte limitiert.

- **Testen via POC**

  Zusammen mit JomaSoft vor Ort eine Installation in Ihrer Testumgebung.

- **Webpage**

  https://www.jomasoft.ch/vdcf

OS Security mit Oracle Solaris 11

Fragen?

Marcel Hofstetter

hofstetter@jomasoft.ch
https://jomasoftmarcel.blogspot.ch

CEO / Enterprise Consultant
JomaSoft GmbH

Oracle ACE „Solaris“

https://www.linkedin.com/in/marcelhofstetter

https://twitter.com/marcel_jomasoft

https://jomasoftmarcel.blogspot.ch