



PROTECT your DATA against intrusion, natural disasters and application faults

Speaker & coauthor:

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DBA & Software Architect @ Abakus Plus d.o.o.



Specialized
Oracle Database



Abakus plus d.o.o.

History

- from 1992, ~20 employees

Applications:

- DeJaVu – virtual databases
- ARBITER – the ultimate tool in audit trailing
- APPM - Abakus Plus Performance Monitoring Tool

Services:

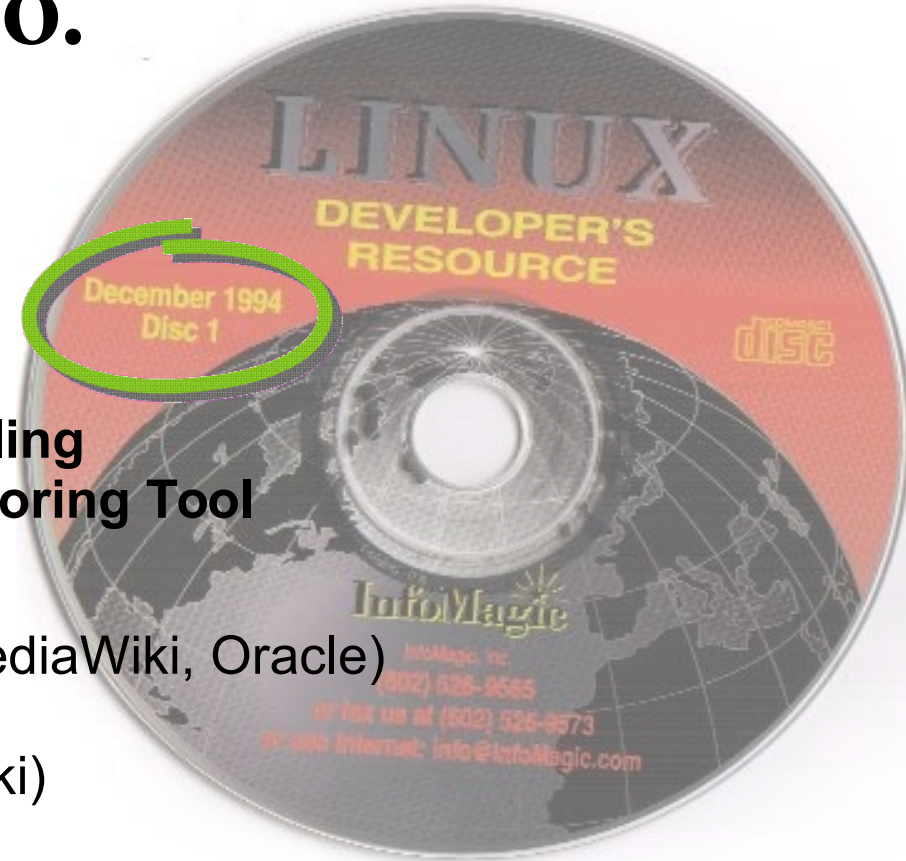
- DBA, OS administration , programming (MediaWiki, Oracle)
- networks (services, VPN, QoS, security)
- open source, monitoring (Nagios, OCS, Wiki)

Infrastructure / hardware:

- servers, **SAN storage**, firewalls, **backup servers**

Experience:

- from 1995 GNU/Linux (**~20 years of experience !**)
- Oracle on GNU/Linux: since RDBMS 7.1.5 & Forms 3.0 (**before Oracle !**)
- **>25 years of experience with High-Availability !**



Mestna občina Ljubljana



Aerodrom Ljubljana



Threats

- Unauthorized access
- Hardware or software failures
- Application faults

Solutions

- Unauthorized access
 - Application change
 - Requires skillful programmers.
 - Purchase of additional [Oracle] products
 - Known standard procedures.

Oracle Label Security

User Label
Sensitive



SELECT *
FROM projects



79845	LUJ1	Highly Sensitive	✗
10841	LUR3	Sensitive	✓
36583	LUX4	Confidential	✓

Oracle Virtual Private Database



bob



tim



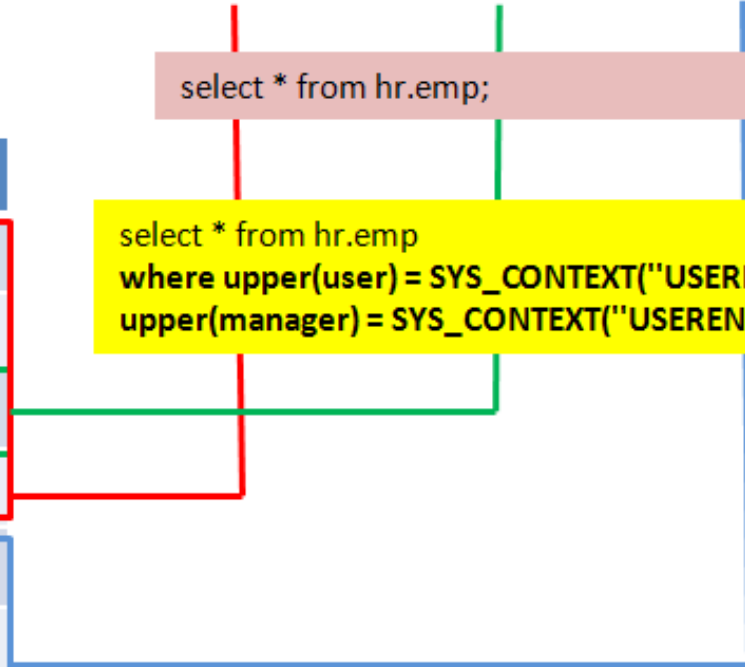
anne

emp table

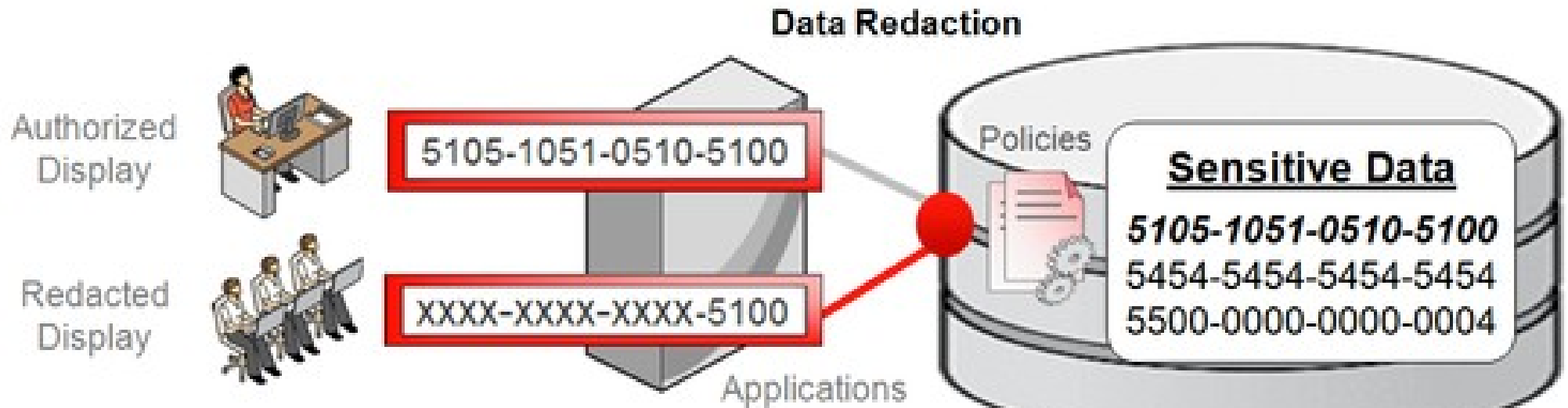
ename	title	manager	deptid	salary
bob	manager	-	1	10000
alice	engineer	bob	1	8000
tim	engineer	bob	1	7000
eve	analyst	bob	1	7500
anne	manager	-	2	10500
denis	engineer	anne	2	9000
jack	engineer	anne	2	9500

```
select * from hr.emp;
```

```
select * from hr.emp  
where upper(user) = SYS_CONTEXT('USERENV', 'CURRENT_USER') OR  
upper(manager) = SYS_CONTEXT('USERENV', 'CURRENT_USER');
```



Oracle Data Redaction



Oracle Data Masking

NAME	SALARY
AGUILAR	501355
BENSON	357898
CHANDRA	607652
DONNER	103456



Production

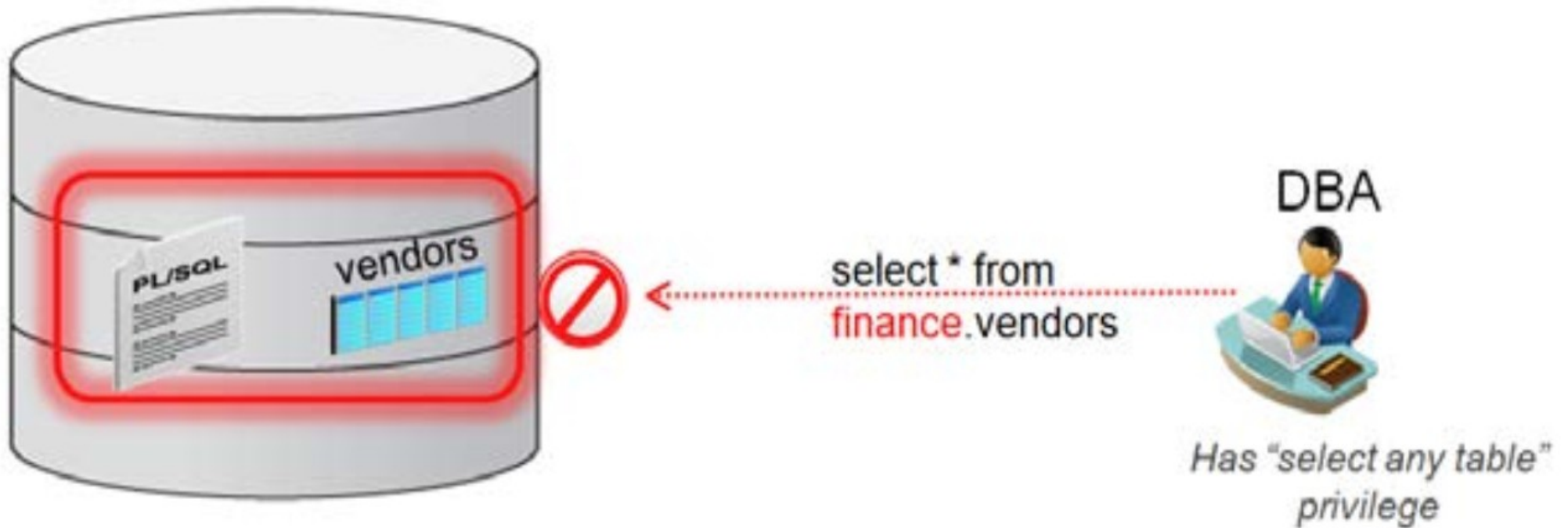
101100101
001001001
100010010



Test/Dev

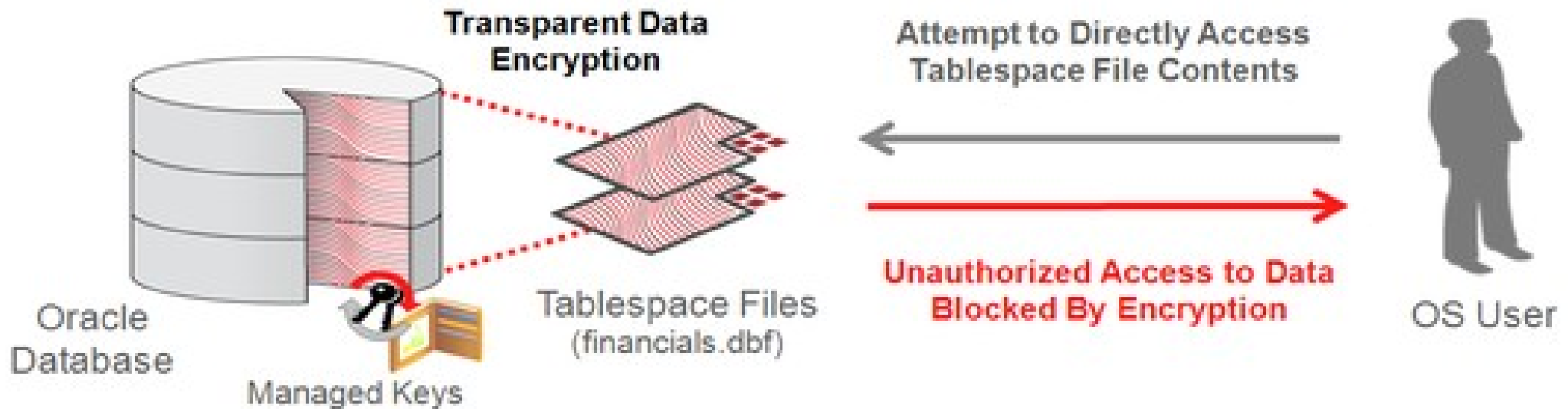
NAME	SALARY
KRIS	356762
RAJESH	765468

Oracle Database Vault



People factor, role separation

Transparent Data Encryption



Application solution examples

- CREATE VIEW :)
- PKI, application provides column encryption

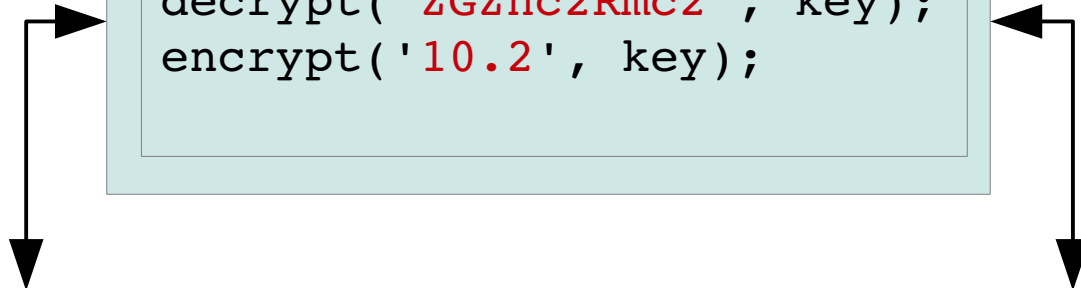
Application

```
decrypt('ZGZhc2Rmc2', key);  
encrypt('10.2', key);
```

Database

ID	Ime	Znesek
1	Janez Novak	ZGZhc2Rmc2
2	Marija Horvat	NTZlZmh1ZT
3	Peter Kovač	YXNkYXNkJA

Public Key Infrastructure



Audit trail

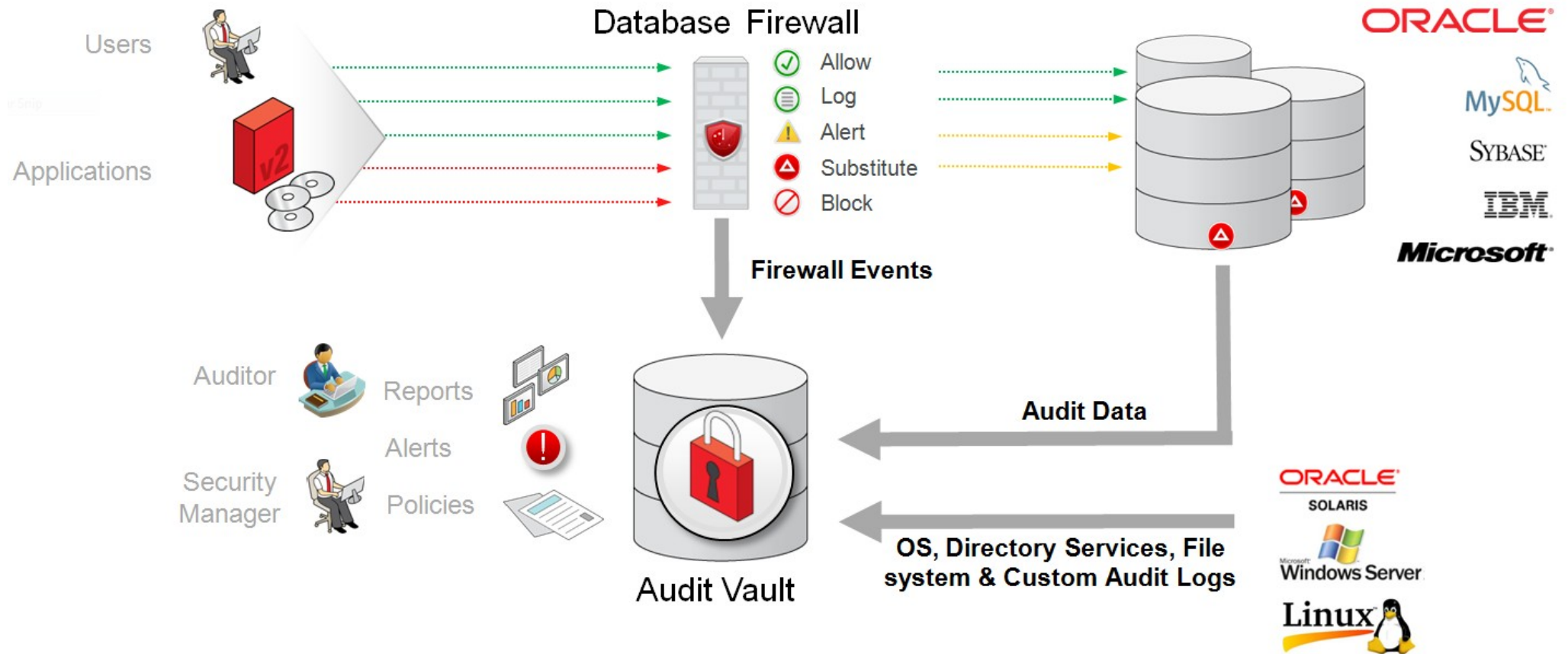
- Audit trail levels:
 - Application
 - Database
 - Operating system
 - Network
- Higher levels provide more application data
- Lower levels provide more generic data

Solutions

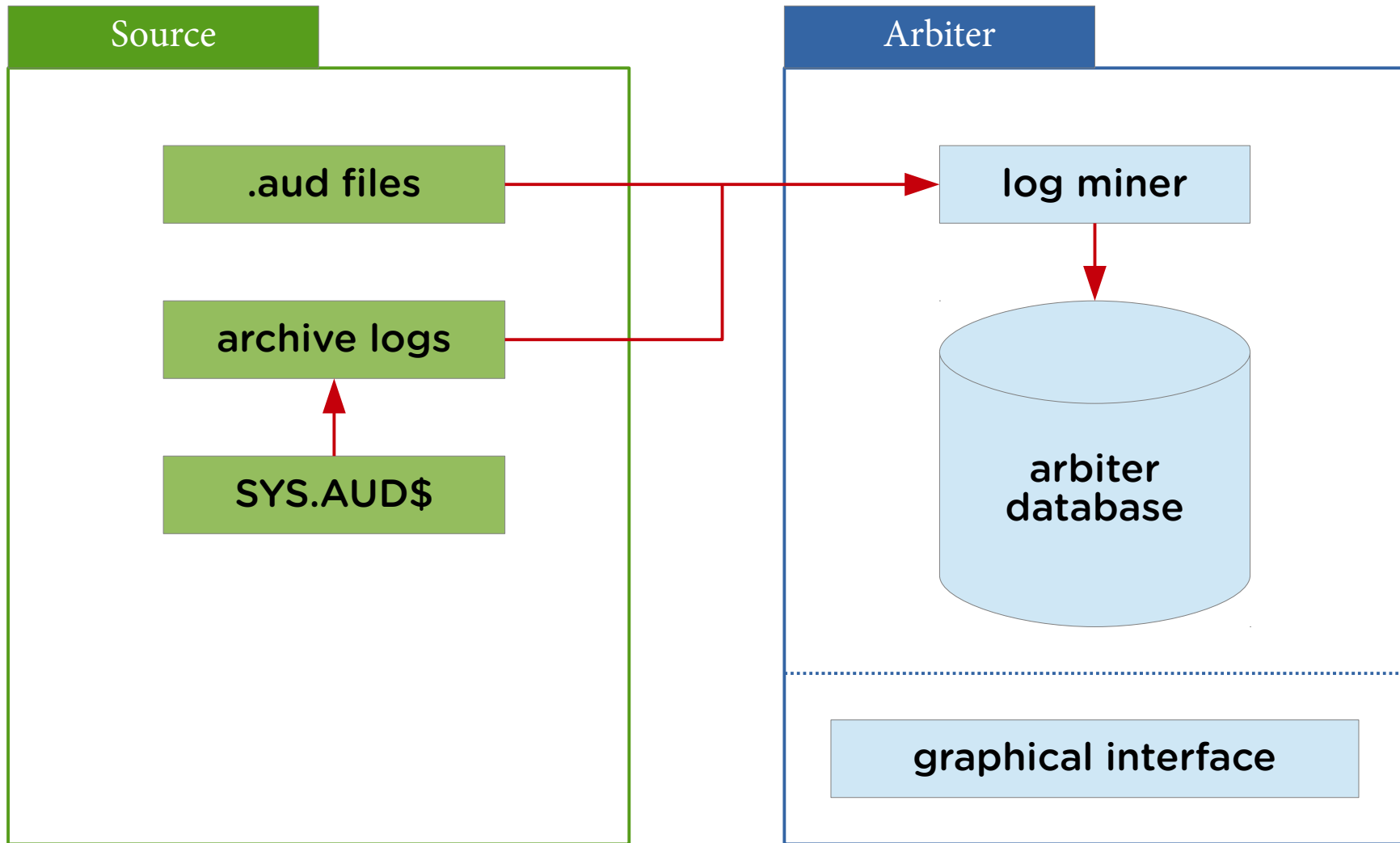
- Oracle Audit Vault
- Abakus Arbiter

- Splunk
- ELK (Elastic Search, Logstash, Kibana)

Oracle Audit Vault



Abakus Arbiter



Abakus Arbiter

- Arbiter ALP
- Query Analytics
 - SELECT Parser
 - PLAN Analyzer (Execution plans)
 - Remote Query Test

Arbiter – Screenshot 1



#Transaction 2593 (19.07.2012 09:24:50 - 19.07.2012 09:24:50), #Session 13177 (19.07.2012 09:24:44)									
PRODUCTS (SCOTT.PRODUCTS)				PRODUCT_ID		PRODUCT_NAME		PRODUCT_PRICE	
User	Operation	Table	Timestamp (start)	OLD	NEW	OLD	NEW	OLD	NEW
SCOTT	UPDATE	SCOTT.PRODUCTS	19.07.2012 09:24:50	1		Woody		92.67	10
SCOTT	UPDATE	SCOTT.PRODUCTS	19.07.2012 09:24:50	1		Woody		10	20
SCOTT	UPDATE	SCOTT.PRODUCTS	19.07.2012 09:24:50	1		Woody		20	30
#Transaction 2594 (19.07.2012 09:24:50 - 19.07.2012 09:24:50), #Session 13177 (19.07.2012 09:24:44)									
SCOTT	UPDATE	SCOTT.PRODUCTS	19.07.2012 09:24:50	2		Buzz Lightyear		30.28	10
SCOTT	UPDATE	SCOTT.PRODUCTS	19.07.2012 09:24:50	2		Buzz Lightyear		10	20
<div style="display: flex; justify-content: space-around; background-color: #ffff00; padding: 2px;"> Transaction Statements Session Statements Transaction Details Data Details </div>									
SCOTT	UPDATE	SCOTT.PRODUCTS	19.07.2012 09:24:50	2		Buzz Lightyear		20	30
SCOTT	UPDATE	SCOTT.PRODUCTS	19.07.2012 09:24:50						20
SCOTT	UPDATE	SCOTT.PRODUCTS	19.07.2012 09:24:50						10
SCOTT	UPDATE	SCOTT.PRODUCTS	19.07.2012 09:24:50						30.28
#Transaction 2595 (19.07.2012 09:24:50 - 19.07.2012 09:24:50), #Session 13177 (19.07.2012 09:24:44)									
SCOTT	UPDATE	SCOTT.PRODUCTS	19.07.2012 09:24:50	3		Etch		102.27	10

Arbiter – Screenshot 2

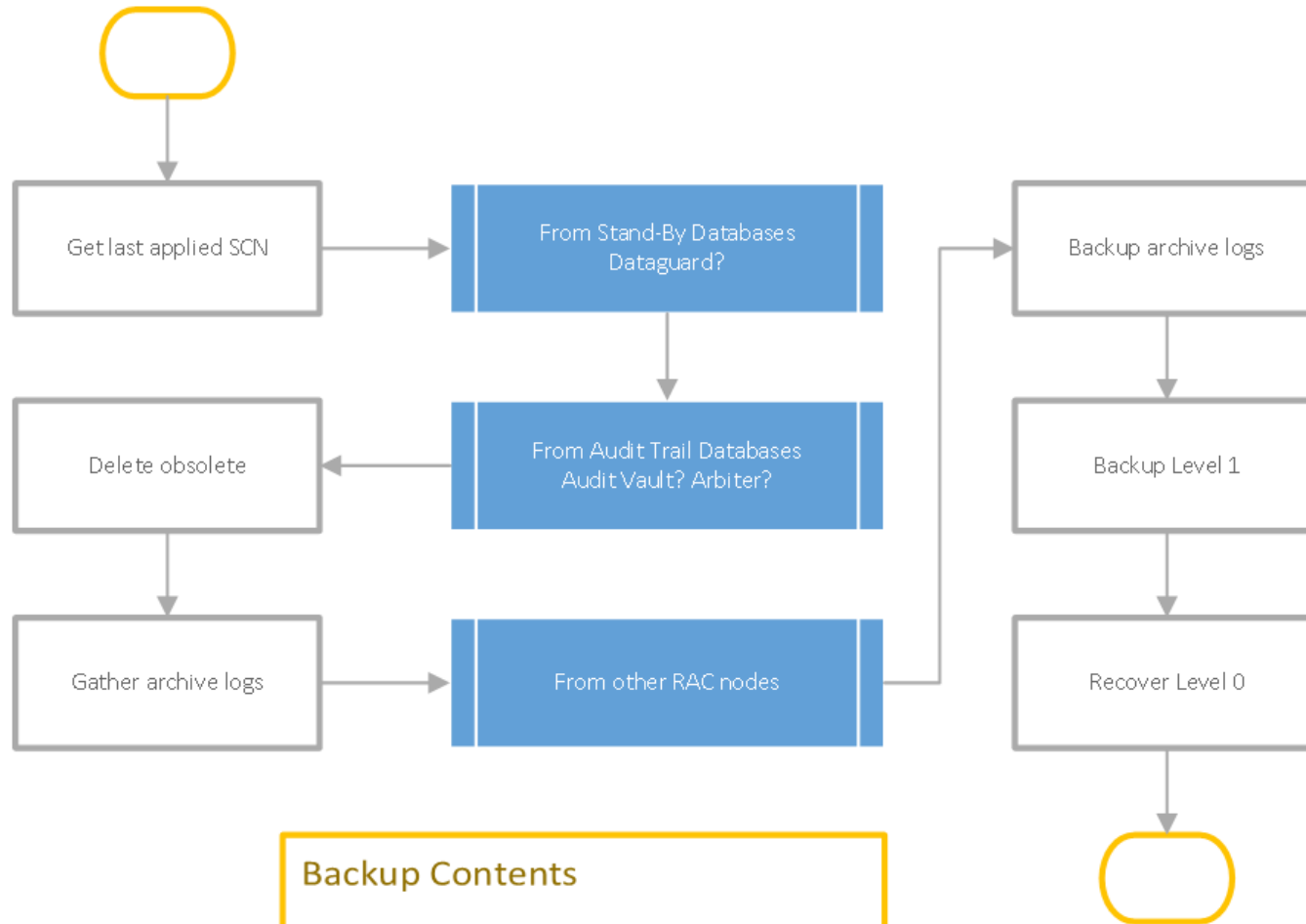


Action	Object / Table	Timestamp	#Session	#Transaction	Username	OS Username	Hostname	Terminal
UPDATE	SCOTT. DEPT	02.07.2012 16:17:46	2328	204	URH	oracle	atlas.abakus.si	pts/1
▶ update scott.dept set loc = 'BLED' where deptno = 37								
INSERT	SCOTT. DEPT	02.07.2012 16:17:46	2328	201	URH	oracle	atlas.abakus.si	pts/1
▼ insert into scott.dept (deptno, dname, loc) values (40, 'OPERATIONS', 'BOSTON')								
Transaction Data Transaction Details Transaction Tables Session Tables Bind Variables Audit Details Download Statement								
INSERT	SCOTT. DEPT	02.07.2012 16:17:46	2328	201	URH	oracle	atlas.abakus.si	pts/1
▶ insert into scott.dept (deptno, dname, loc) values (30, 'SALES', 'SENCUR')								
INSERT	SCOTT. DEPT	02.07.2012 16:17:46	2328	201	URH	<u>oracle</u>	atlas.abakus.si	pts/1
▶ insert into scott.dept (deptno, dname, loc) values (20, 'RESEARCH', 'KRANJ')								
INSERT	SCOTT. DEPT	02.07.2012 16:17:46	2328	201	URH	oracle	atlas.abakus.si	pts/1
▶ insert into scott.dept (deptno, dname, loc) values (10, 'ACCOUNTING', 'SENCUR')								
INSERT	SCOTT. DEPT	02.07.2012 16:17:46	2328	201	URH	oracle	atlas.abakus.si	pts/1
▶ insert into scott.dept (deptno, dname, loc) values (44, 'MARKETING', 'KRANJ')								

Hardware or software failures

- Redundancy
 - Backup
 - Physical standby
 - Real Application Clusters
 - **Abakus(r) Active Backup Server**

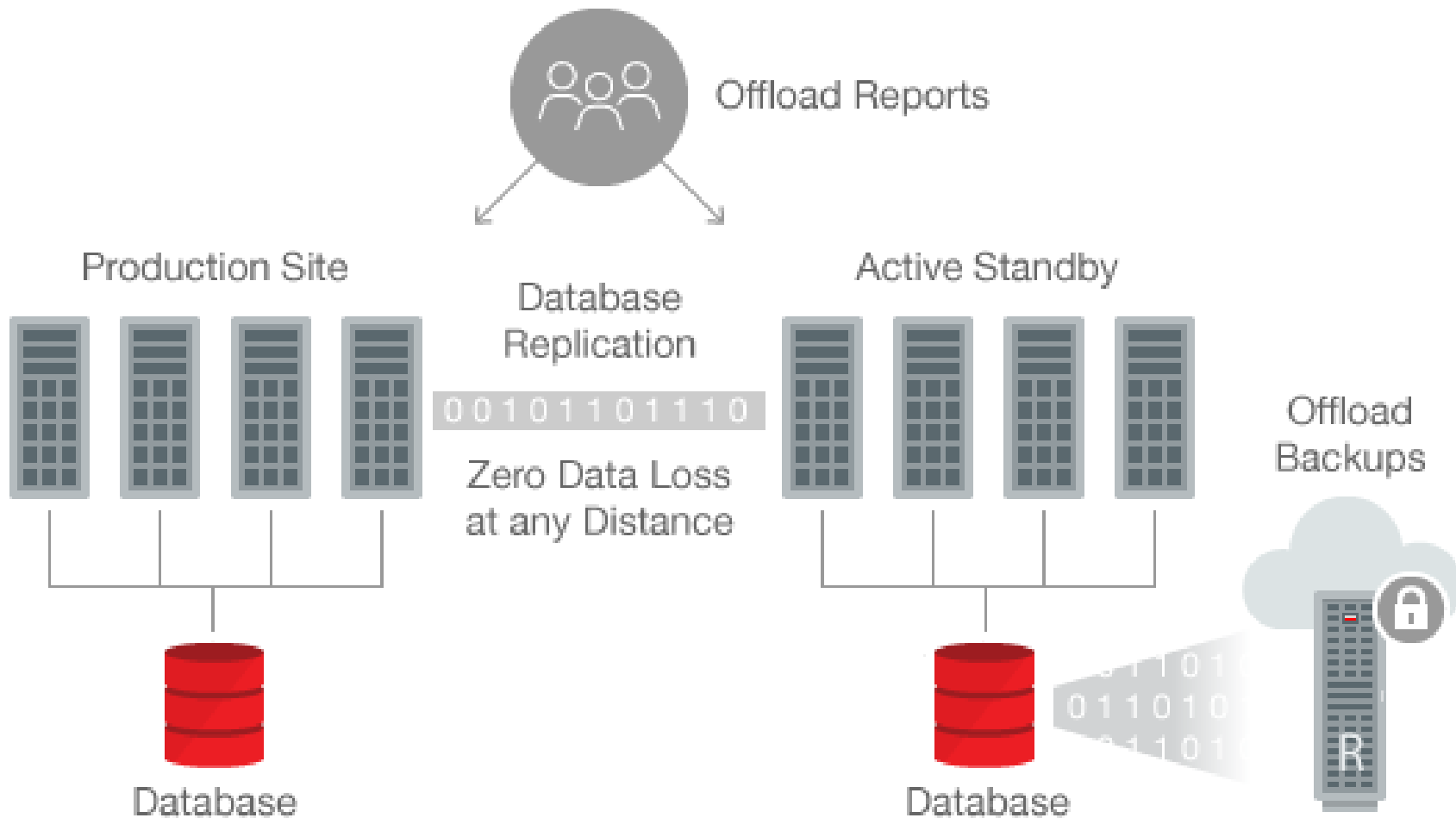
Abakus Amon - Backup Script



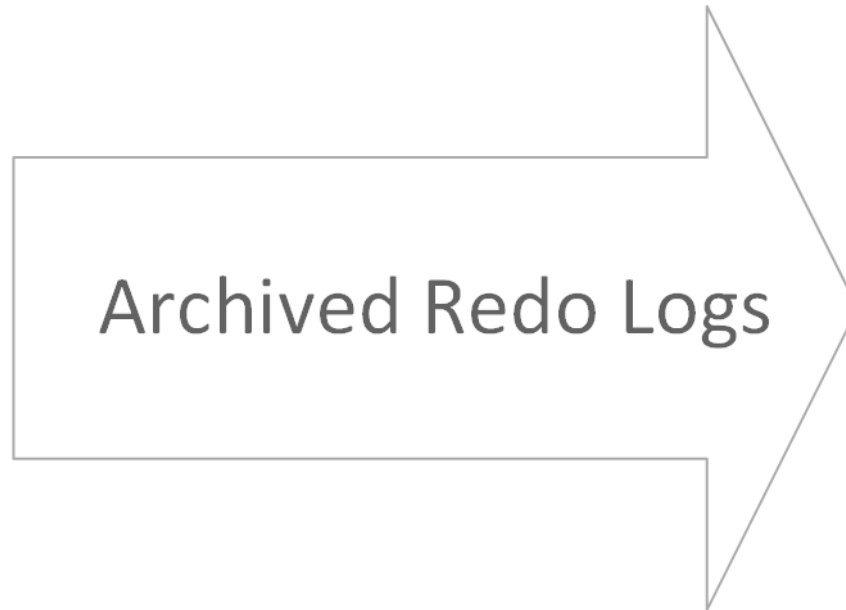
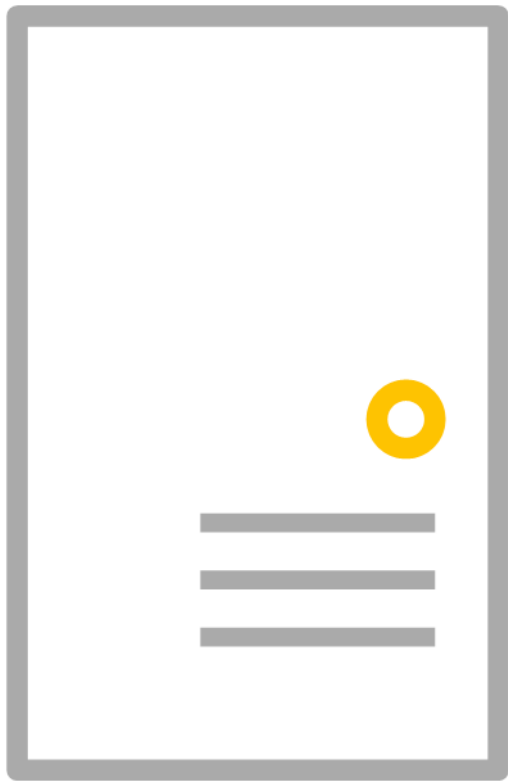
Backup Contents

Level 0	Archive logs
Incremental 1	
Incremental 2	

Oracle Data Guard – physical standby



Abakus Amon - physical standby



Oracle Real Application Clusters

- Protects only against hardware failure
- Does not protect against application faults.
- In some cases application has to be RAC aware:
 - gv\$view vs v\$view
 - dbms_pipe,
dbms_service, ...



Abakus Backup Server

- “Stand-By” space
 - For current physical standby copy.
- Compressed space
 - Archive redo logs storage.
- Deduplicated space
 - For daily database backup copies.

- **431,98TB** of backup data is stored on 17,53TB / 20,00TB physical volume.

Abakus Backup Server

Backup Server **backup** : **72.82TB** of backup data is stored on 842.39GB / **4.88TB** physical volume.

[Refresh](#) | [Logout](#)

Resources				
Type	Name	Flash Date	First Date	Last Date
database	INSUR	2015-06-26 06:08:31	2014-07-18 11:26:00	2015-06-25 22:00:00

[Create Resource](#)

Path	Size	Taken	Actual	Status
/zbackup/INSUR-2015-06-25-22-00	260 G	2015-06-25 22:00:00	2015-06-25 17:57:37	UNKNOWN
/zbackup/INSUR-2015-06-24-22-00	260 G	2015-06-24 22:00:00	2015-06-24 18:02:36	UNKNOWN
/zbackup/INSUR-2015-06-23-22-00	260 G	2015-06-23 22:00:00	2015-06-23 18:10:05	UNKNOWN
/zbackup/INSUR-2015-06-22-22-00	260 G	2015-06-22 22:00:00	2015-06-22 18:09:17	UNKNOWN
/zbackup/INSUR-2015-06-21-22-00	260 G	2015-06-21 22:00:00	2015-06-21 18:09:10	UNKNOWN
/zbackup/INSUR-2015-06-20-22-00	260 G	2015-06-20 22:00:00	2015-06-20 18:03:44	UNKNOWN
/zbackup/INSUR-2015-06-19-22-00	260 G	2015-06-19 22:00:00	2015-06-19 18:09:47	UNKNOWN
/zbackup/INSUR-2015-06-18-22-00	259 G	2015-06-18 22:00:00	2015-06-18 18:00:58	UNKNOWN
/zbackup/INSUR-2015-06-17-22-00	249 G	2015-06-17 22:00:00	2015-06-17 18:03:45	UNKNOWN
/zbackup/INSUR-2015-06-16-22-00	249 G	2015-06-16 22:00:00	2015-06-16 18:05:14	UNKNOWN
/zbackup/INSUR-2015-06-15-22-00	249 G	2015-06-15 22:00:00	2015-06-15 10:02:39	UNKNOWN
/zbackup/INSUR-2015-06-15-13-45	249 G	2015-06-15 13:45:00	2015-06-15 10:02:39	UNKNOWN
/zbackup/INSUR-2015-06-14-22-00	249 G	2015-06-14 22:00:00	2015-06-14 17:57:43	CORRUPTED
/zbackup/INSUR-2015-06-13-22-00	249 G	2015-06-13 22:00:00	2015-06-13 18:07:16	CORRUPTED

Abakus Backup Server

Backup Server **backup** : **72.82TB** of backup data is stored on 842.39GB / **4.88TB** physical volume.

[Refresh](#) | [Logout](#)


Resources				
Type	Name	Flash Date	First Date	Last Date
database	INSUR	2015-06-26 06:08:31	2014-07-18 11:26:00	2015-06-25 22:00:00

[Create Resource](#)

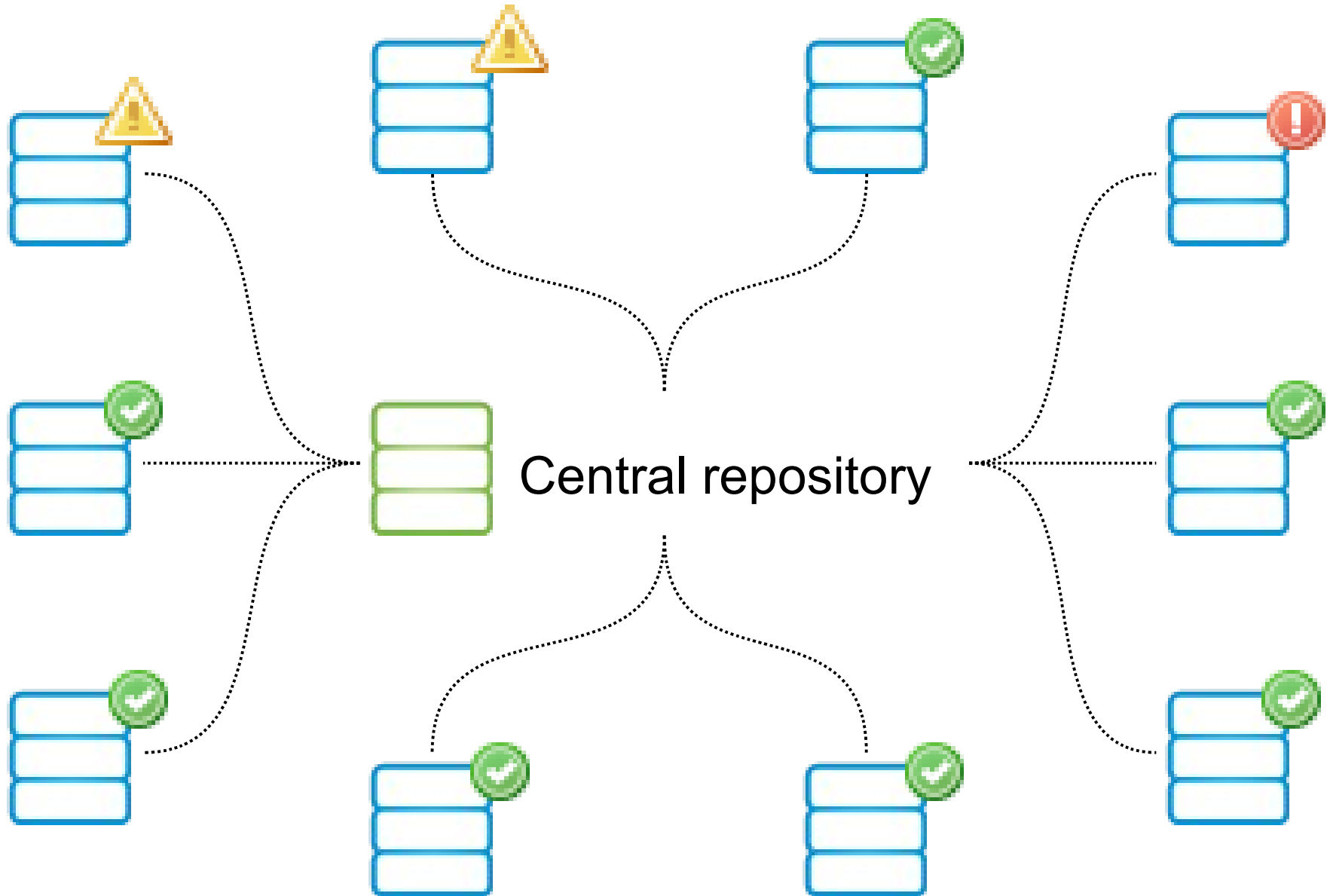
Backups | **Oracle Instances** | Configuration

Slot	SID	Purpose	Control File Time	Open Mode	Status
AC	acinsur	ACCEPTANCE			OFFLINE
TT	ttinsur	TEST			OFFLINE
U0	u0insur	USER	2015-06-23 18:10:05	READ ONLY	ONLINE
U1	u1insur	USER			OFFLINE
U2	u2insur	USER			LOCKED
U3	u3insur	USER			OFFLINE
U4	u4insur	USER			OFFLINE
U5	u5insur	USER			OFFLINE

Open Close **Status** [alert.log](#), [bsctrl.log](#), [bsctrl_vm.log](#)



Central IT Monitoring



Central IT Monitoring – Solutions

- Microsoft Operations Manager
- Oracle Enterprise Manager
- Nagios
- **Abakus AMON**

AMON Screenshot 1

2015-08-10 15:58:28 | urh (my profile | logout)

Abakus Amon

Dashboard

Instances

Databases

Hosts

Worklog

Partners

Profiles

Users

Settings

External

Collector Control

Last run: 2015-08-10 15:45.
Queue length: 0, Active tasks: 0

- collect@██████████
- collect@██████████
- collect@██████████
- collect@██████████
- collect@██████████
- collect@██████████
- collect@██████████
- collect@██████████
- collect@██████████

[Complete Log](#) | [Deploy All](#) | [Collect All](#)

Active Tasks

No active tasks.

[My Report](#) | [My Task](#)

Auto Refresh

Enable auto refresh

Support Contacts

dba@abakus.si
sistem@abakus.si
+386 (4) 287-11-00

[Hide Sidebar](#)

Software Version

appm-monitor: 2.36
appm-cron: 2.0-SNAPSHOT
appm-profiles: 2.914

Dashboard



Log is empty. You can run self-diagnostic by clicking the following link: [run diagnostics](#)

You can download connections.xml file which can be imported to SQL Developer: [download connections.xml](#)

Top 10 Checks

Severity	SSH Host [/ Instance SID]	Check Category / Name	Last Update	Options
100	██████████	appm_db/scr_scripts.StandbyRecover	2015-08-10 14:59:18	🗑️ 🔍 ⚙️
10	██████████	appm_os_247, appm_db_247/tests.os.Diskspace	2015-08-10 15:13:01	🗑️ 🔍 ⚙️
10	██████████	appm_os_247, appm_db_247/tests.os.Diskspace	2015-08-10 15:13:05	🗑️ 🔍 ⚙️
10	██████████	appm_db/tests.oracle.rdbms.Datafiles	2015-08-10 14:39:20	🗑️ 🔍 ⚙️
10	██████████	arbiter/arb_partitions_indexes	2015-08-10 02:00:19	🗑️ 🔍 ⚙️
10	██████████	appm_os_247, appm_db_247/tests.os.Diskspace	2015-08-10 15:13:00	🗑️ 🔍 ⚙️
10	██████████	arbiter/arb_partitions_existence	2015-08-10 02:00:20	🗑️ 🔍 ⚙️
10	██████████	appm_db/tests.oracle.rdbms.ResourceLimits	2015-08-10 15:41:00	🗑️ 🔍 ⚙️
5	██████████	appm_db_247, appm_os_247/tests.oracle.asm.VotingDisk		🗑️ 🔍 ⚙️
5	██████████	appm_db_247, appm_os_247/tests.oracle.asm.VotingDisk		🗑️ 🔍 ⚙️

[Show All](#)

AMON Screenshot 2

2015-08-10 16:01:07 | urh (my profile | logout)

Abakus Amon

[Dashboard](#)
[Instances](#)
[Databases](#)
[Hosts](#)
[Worklog](#)
[Partners](#)
[Profiles](#)
[Users](#)
[Settings](#)
[External](#)

Collector Control

Last run: 2015-08-10 16:00.
Queue length: 0, Active tasks: 0

- ✔ collect@[redacted]
- ✔ collect@[redacted]
- ✔ collect@[redacted]
- ✔ collect@[redacted]
- ✔ collect@[redacted]
- ✔ collect@[redacted]
- ✔ collect@[redacted]
- ✔ collect@[redacted]
- ✔ collect@[redacted]

[Complete Log](#) | [Deploy All](#) | [Collect All](#)

Active Tasks

No active tasks.

[My Report](#) | [My Task](#)

Auto Refresh

Enable auto refresh

Support Contacts

dba@abakus.si
sistem@abakus.si
 +386 (4) 287-11-00

[Hide Sidebar](#)

Software Version

appm-monitor: 2.36
 appm-cron: 2.0-SNAPSHOT
 appm-profiles: 2.914

Database 9: [redacted]

Database ID:

Unique Name:

Global Name:

Cluster Name:

Arbiter Server:

Delete Applied Logs:

Checks Enabled:

Environment:

Database Type:

Backup Root Dir:

Backup Site:

Backup Server:

| [Create](#) | [Cancel](#)

Instances

ID	SSH Host	Instance SID	Options
14	[redacted].abakus.si	prod1	delete edit
15	[redacted].abakus.si	prod2	delete edit

Pluggable Databases

ID	Container Name	Options
		add: disassociated new

Relations

Referenced Database	Reference Type	Primary Database	Options
[redacted]/ARBN	is AUDIT for	[redacted] prod	Configure Switchover Delete
[redacted]/stby	is STANDBY for	[redacted]/prod	Configure Switchover Delete

[New Relation](#)

APPM Screenshot

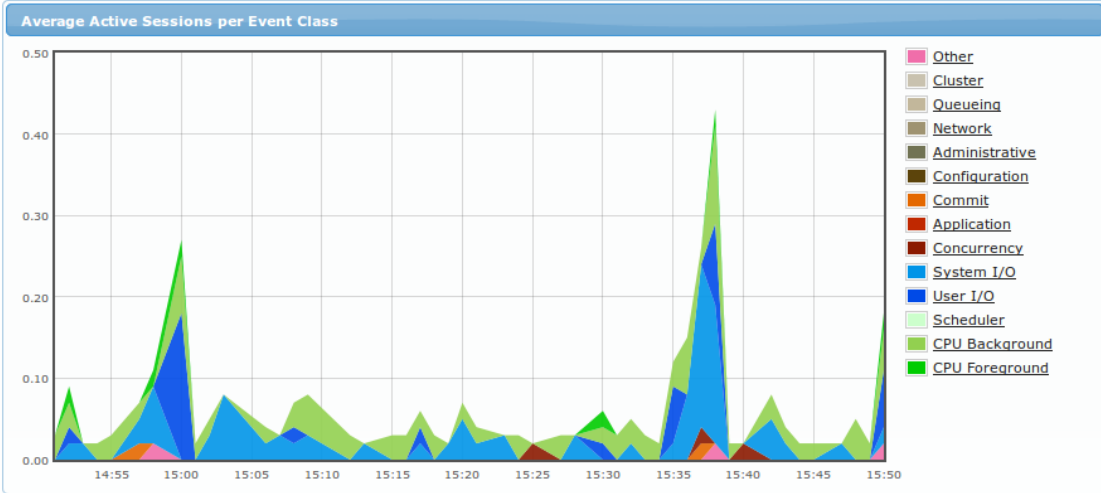
Query Parameters | **Collector Job**

Data Source: For Instance: Exclude APPM:

From Time: Sample by: Exclude Lab128:

To Time:

Refresh Manual 5s 15s 1m Historical

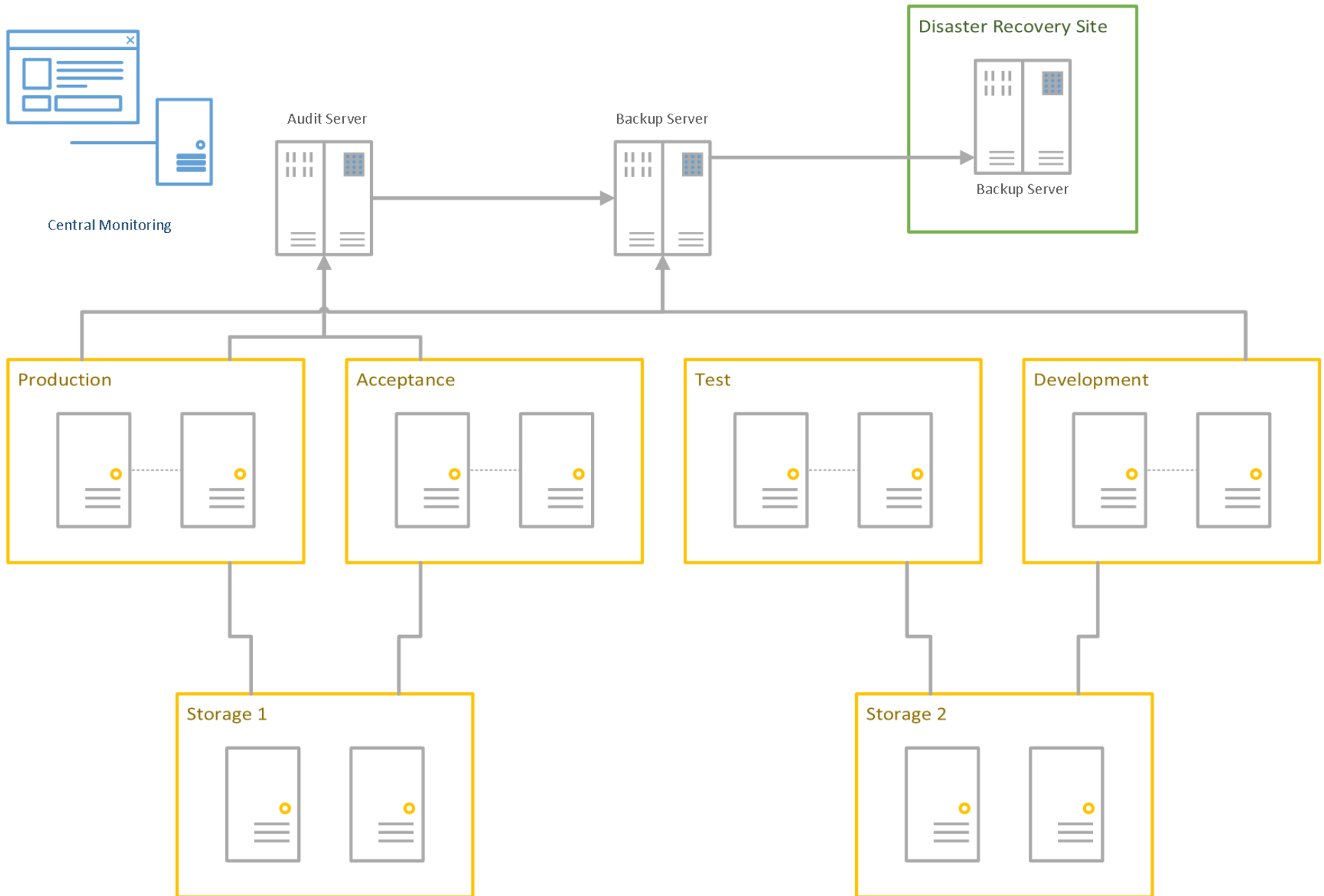


Top Waits | **Current Waits**

Inst	Event	Time	Count	Time (μ)	Since Last (μ)
1	db file sequential read	18	14	137354	112042
1	control file sequential read	44	10	108765	5704
1	os thread startup	1	4	39758	113
1	log file sync	3	1	10424	740
1	log file parallel write	4	0	1690	1686
1	ASM file metadata operation	10	0	1313	90
1	control file parallel write	3	0	1154	2363
1	db file parallel write	3	0	491	103
1	db file scattered read	1	0	335	229
1	SQL*Net break/reset to client	4	0	174	1730
1	SQL*Net message to client	17	0	42	50211
1	SQL*Net vector data to client	2	0	40	5

Activity	SQL ID	SQL Text	Child Number
	5yv7yviqixuqg	select TIME_WAITED_MICRO from V\$SYSTEM_EVENT where event = 'Shared IO Pool Memory'	0
	1p36ta7p3d7fu	select file#, block#, ts#, blocks from seg\$ where type# = 3	0
	d4k9au56kqsrq	SELECT x.tablespace_name, x.contents, x.gb_used,	1
	8xk3dx2380d1n	SELECT * FROM (SELECT * FROM (SELECT trunc(ash.sample_time, 'mi') sam	0
	bv35bq4sdccuf1	SELECT snap_id , SQL_ID FROM (SELECT /*+ ordered use_nl(t2) index(t2) */ t2.snap_id , t1.SQLID_KEY	0
	953bqvrvryq1	insert into wrh\$_filestatxs (snap_id, dbid, instance_number, file#, creation_change#, phyrds, p	0
	b4qw7n9wq64mh	INSERT /*+ APPEND LEADING(@SEL\$F5BB74E1" "H"@SEL\$2" "A"@SEL\$1") USE_NL(@SEL\$F5BB74E1" "A"@SEL	0
	9ds1amk0qtnh	insert into "SYSMAN"."MGMT_TASK_QTABLE" (q_name, msgid, corrd, priority, state, delay, expiration,	1
	8ca8v2ik772ps	DELETE MGMT_METRICS_1DAY WHERE TARGET_GUID = :B3 AND ROLLUP_TIMESTAMP < :B2 AND ROWNUM <= :B1	0
	7qihf5dzmazsr	SELECT snap_id , OBJ#, DATAOBJ# FROM (SELECT /*+ ordered use_nl(t2) index(t2) */ t2.snap_id , t1.O	0

The Big Picture?





Abakus

As na disku.

