Cerner’s Fleet Voyage

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Cerner today

- **22,000** associates
- **5,431** hospitals
- **OVER 450,000** physician users
- **5,594** physician practices
- **3,888** extended care facilities
- **98** clients named Health Care’s 2015 Most Wired
- **52** client hospitals named US News and World Report Most Connected
- **345+** patents worldwide
- **OVER $4.9B** cumulative R&D investment
- **$4.4 BILLION** 2015 revenue
- **OVER 20,000** client facilities
- **30+** countries
- **414** acute clients
- **184** ambulatory clients
- **43**
- **6**
- **7**

Updated 4/2016
$4.9 billion of cumulative R&D investments since 1979

R&D continues to be focused on population health, physician experience, open platforms, revenue cycle and mobility

With scale from additional Health Services R&D, we expect to maintain industry-leading R&D investment while also getting financial leverage
Secure from the start

Security built in, not bolted on

Reactive

Predictive

Proactive
Health Care Information Technology

Intersection of two fast-paced, quickly changing industries

Health Care
- Increasing regulatory requirements
- Changing reimbursement models
- Focus on population management
- Evolving care practices

Information Technology
- Mobility
- Big Data
- Security
- Device Integration
- Cloud

“New Normal” requires our clients to remain current on the latest IT
How do you patch almost 1600 DB hosts every 90 days?
The Cerner Conundrum – Scale

- 1600 Database Hosts
- 2500 Database Instances
- 50 Database Administrators

- Oracle Patching every other business day

- 1 Hour per host = 66 Days of patching time per quarter
The Cerner Conundrum – Patch Conflicts

• Several Overlay / Merge / Interim Patches
• Only validate from two PSU’s prior
• 30 Days to validate a new PSU
• Multiple PSU hops required if a host falls behind

• We want to replace statements like this:
  • Patch 22571752 replaces patch 21033886. Patch 21033886 will be rolled back during the installation of patch 22571752.
  • Patch 22807421 replaces patches 17079301 and 18385424. These patches will be rolled back during the installation of patch 22807421.
The Cerner Conundrum – Current State

~50% on 2016 PSU
Fleet to the Rescue

• Homogenous environment
  • All DBs on 11.2.0.4 by 2017

• Known end-state
  • 11.2.0.4
  • Most Recent PSU

• Gold Copy
Cerner Requirements and Use Cases

• Minimal loss of redundancy
  • Only one bounce of each Oracle Instance
  • No PSU Downtime (OJVM not installed or Patched)

• Two – Five Node RAC
  • Grid Clusterware

• Single Node
  • Grid Restart
What It’s Doing

• Out of Place Grid Infrastructure and RDBMS Patching
  • Deploy up to date Grid and RDBMS kernels without interference

• Rolling Patch Application – One node at a time
  • Stop DB Instances
  • Stop Grid Infrastructure
  • Start Grid in new home
  • Start Instances in new home
  • Repeat on next node
  • Apply post steps (catbundle.sql)

• Also can be used for individual Grid / RDBMS Patches
How Cerner will Deploy

• OEM 13.2
• Dedicated Patch Designer
• RHEL 6.x and Oracle 11.2.0.4 +
• EMCLI Deployed locally
• Scripted Interface for Fleet operations
How Cerner will Deploy

- Scripted Interface for Fleet operations
  - Creates Monitoring Credentials
  - Verifies Agent and Target Configuration
  - Checks and Maintains Target Subscriptions
  - Executes Pre and Post steps
  - Creates and Submits the Fleet Operations
  - Tracks Fleet execution from the Host
  - Manages ORACLE_HOME’s
[oracle@cerngsdb6]$ ./fleet.ksh
Verifying Configuration ...

Named Credentials Located
Using the following credentials:
Oracle: oracle_cerngcs
Privileged: root_cerngcs

The following instances discovered:
stig1 - cerngsdb6 - /u01/oracle/product/11.2.0.4/db_1
stig2 - cerngsdb7 - /u01/oracle/product/11.2.0.4/db_1

OEM Targets to be patched:
rac_database - stig.world
cluster - STIG_Cluster

Verifying Target Subscription ...
rac_database subscribed to: 11204_RAC_Image
cluster subscribed to: 11204_Cluster_Image

Current Target Version ...
rac_database: 11204_PSU_20160419
cluster: 11204_PSU_20160419

Gold Image Current Version ...
rac_database: 11204_PSU_20160719
cluster: 11204_PSU_20160719

Deploy New Version? (Y/N) :

Verifying new ORACLE_HOME ...

Deploying new rac_database for: stig.world
cerngsdb6: /u01/oracle/product/11.2.0.4/db_2
cerngsdb7: /u01/oracle/product/11.2.0.4/db_2

Following job execution at the following link:
https://:7799/em/faces/core-jobs-procedureExecutionTracking?
How It Works at Cerner

• Patch Designer Installs Quarterly PSUs and Additional Patches
• New Image Version is created and marked Current
• DBA’s then operate in a Self-Service model
  • Initial Target Subscription
  • Gold Image Deploy
  • Switch over to new home
How It Helps

- Pre-Stage of new Homes saves time
- Any Version to any Version despite additional patches
- Multiple hops eliminated
- Reduce human error
- Ability to quickly “Rollback” – Switchback
- Amount of instance downtime reduced
- Set it and Forget it – Push button automation
How It Helps

• Two-Node Cluster Patched in **25 Minutes**
  • Over **2 months** of patching reduced to **2 weeks**

• **1280 Hours saved** per quarter
  • 25 Hours given back to the DBAs for more important work
Lessons Learned

- Target Configuration Matters
  - Wrong Homes / Incorrect Relationships

- Repvfy is awesome
  - List and fix common OEM issues

- Configuration Search is your friend
  - Query Repository for Misconfiguration

- Custom things depend on a static ORACLE_HOME
  - Scripts / Toolkits / Aliases

- OEM Patchability Report
Information Publisher Reports

EM Target Patchability Report (Preview)

This report depicts the breakup of the patch-ability of the targets, the issues and problems found with the targets are detailed in the table.

### Break up of all Targets

![Break up of all Targets](image)

- Unpatchable Targets (190)
- Patchable Targets (5,967)

### Break up of unpatchable targets

![Break up of unpatchable targets](image)

- Unsupported Configuration (100)
- Missing Properties (90)

### Analysis report of unpatchable targets

<table>
<thead>
<tr>
<th>Target Name</th>
<th>Target Type</th>
<th>Version</th>
<th>Problem</th>
<th>Details</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>wboprod-cluster</td>
<td>Cluster</td>
<td></td>
<td>Missing Properties</td>
<td>Version is empty</td>
<td>The target is not properly configured or unavailable. Reconfigure or check for metric collection errors</td>
</tr>
<tr>
<td>t1639-world_t16391</td>
<td>Database Instance</td>
<td></td>
<td>Missing Properties</td>
<td>Version is empty</td>
<td>The target is not properly configured or unavailable. Reconfigure or check for metric collection errors</td>
</tr>
<tr>
<td>t1043-world_t10431</td>
<td>Database Instance</td>
<td></td>
<td>Missing Properties</td>
<td>Version is empty</td>
<td>The target is not properly configured or unavailable. Reconfigure or check for metric collection errors</td>
</tr>
<tr>
<td>p05791_tdadubb1.cernerasp.com</td>
<td>Database Instance</td>
<td>11.2.0.4.0</td>
<td>Unsupported Configuration</td>
<td>RAC Instance does not have an associated RAC Database</td>
<td>Rediscover the RAC Target and Add the RAC Instance to the RAC Database</td>
</tr>
<tr>
<td>p0111.world</td>
<td>Database Instance</td>
<td>11.2.0.4.0</td>
<td>Unsupported Configuration</td>
<td>RAC Instance does not have an associated RAC Database</td>
<td>Rediscover the RAC Target and Add the RAC Instance to the RAC Database</td>
</tr>
<tr>
<td>mock1_VANIDTNDB1.CERNERASP.COM</td>
<td>Database Instance</td>
<td>11.2.0.3.0</td>
<td>Unsupported Configuration</td>
<td>RAC Instance does not have an associated RAC Database</td>
<td>Rediscover the RAC Target and Add the RAC Instance to the RAC Database</td>
</tr>
<tr>
<td>c1639.world_c16391</td>
<td>Database Instance</td>
<td></td>
<td>Missing Properties</td>
<td>Version is empty</td>
<td>The target is not properly configured or unavailable. Reconfigure or check for metric collection errors</td>
</tr>
<tr>
<td>WINMN_ADMIN.WORLD_admin1</td>
<td>Database Instance</td>
<td>11.1.0.7.0</td>
<td>Unsupported Configuration</td>
<td>RAC Instance does not have an associated RAC Database</td>
<td>Rediscover the RAC Target and Add the RAC Instance to the RAC Database</td>
</tr>
<tr>
<td>VIRTNJ_ADMIN.WORLD_admin1</td>
<td>Database Instance</td>
<td>11.2.0.3.0</td>
<td>Unsupported Configuration</td>
<td>RAC Instance does not have an associated RAC Database</td>
<td>Rediscover the RAC Target and Add the RAC Instance to the RAC Database</td>
</tr>
<tr>
<td>VAILCO_ADMIN.WORLD_admin1</td>
<td>Database Instance</td>
<td>11.1.0.7.0</td>
<td>Unsupported Configuration</td>
<td>RAC Instance does not have an associated RAC Database</td>
<td>Rediscover the RAC Target and Add the RAC Instance to the RAC Database</td>
</tr>
</tbody>
</table>
Target With No Home

Query

```
SELECT
    s5.target_name,
    s5.target_type,
    s5.host_name
FROM
    MGMT$TARGET s5
WHERE
    NOT EXISTS
    (
        SELECT
            s6.target_name
        FROM
            MGMT$TARGET s6,
            GC$ASSOC_INST_WITH_INVERSE s6a1
        WHERE
            s6a1.SOURCE_ME_GUID = s5.TARGET_GUID
            AND s6a1.DEST_ME_GUID = s6.TARGET_GUID
            AND s6.TARGET_TYPE = 'oracle_home'
            AND s6a1.ASSOC_TYPE = 'installed_at'
    )
AND s5.TARGET_TYPE IN ('cluster','has','oracle_database','oracle_listener','osm_cluster','osm_instance','rac_database')
```
## Configuration Search Library

### Instances without ASM target

#### Target Type: Database Instance

### Commonly Used Search Criteria

<table>
<thead>
<tr>
<th>Target Name</th>
<th>Configuration Item</th>
<th>All</th>
<th>Member Of</th>
<th>Member Of</th>
<th>On Host</th>
</tr>
</thead>
</table>

### Database Instance

#### Initialization Parameters

| Name    | Value     | db_create_file_dest | + |

#### Automatic Storage Management (Database Instance->Stores On->Automatic Storage Management)(Advanced Options - Condition: Does not exist)

### View

- Export...
- Print...
- Detach

---

Search results for the criteria defined above.

<table>
<thead>
<tr>
<th>Database Instance Name</th>
<th>Total Number of Rows: 227</th>
</tr>
</thead>
</table>

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What’s Next for Cerner?

• OEM GUI

• Mass Deployment?
  • Patch all Non-Production in a single event
  • Deploy new software everywhere once it’s been validated

• Oracle 12c
  • OEM Automation for Upgrades