ORACLE

Analysis of Database Issues using AHF and Machine Learning

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VP AIOps for the Autonomous Database

@sandeshr

https://www.linkedin.com/in/raosandesh/
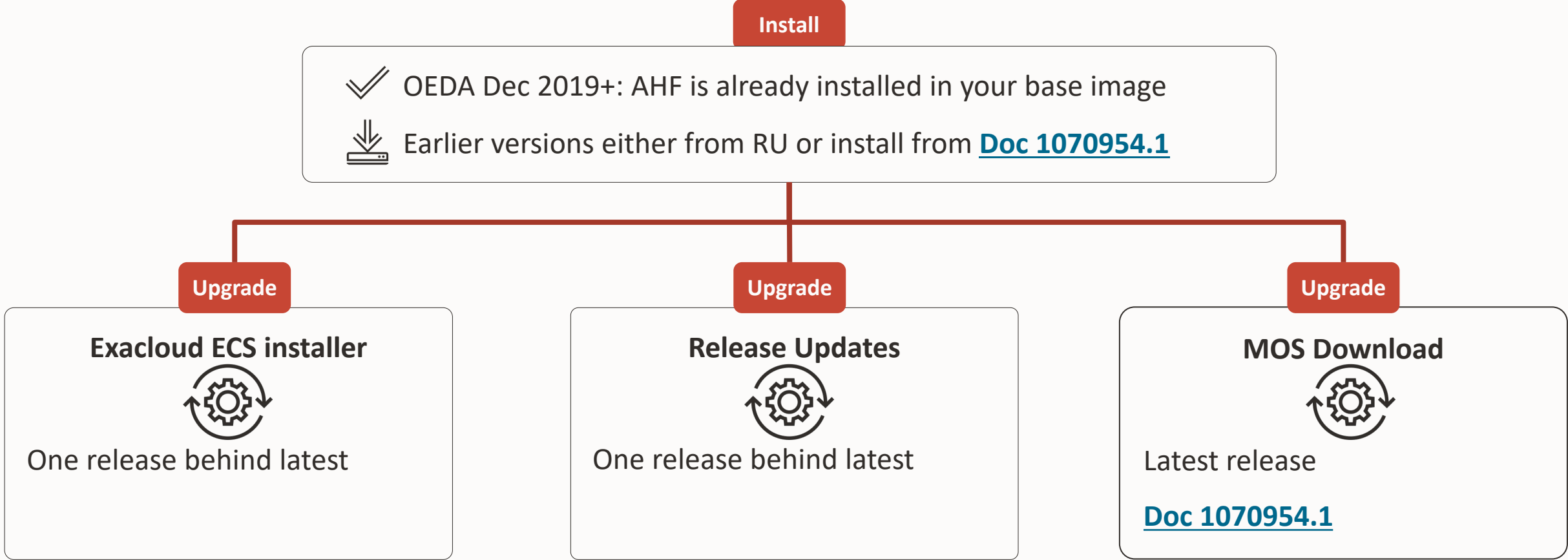
https://www.slideshare.net/SandeshRao4

What is AHF

1 EXAchk

Automatic compliance checking and warnings when drifting away from best practices as well as offering pre and post upgrade advice

2 TFA

Automatic issue detection, diagnostic collection and analysis along with a single interface for Database support tools

Compliance Checking → Fault Detection → Diagnostic Collection → Fault Notification → Support Upload

Installation and staying up to date

Install

- ✓✓ OEDA Dec 2019+: AHF is already installed in your base image
- ⤓ Earlier versions either from RU or install from **Doc 1070954.1**

Upgrade

Exacloud ECS installer

One release behind latest

Upgrade

Release Updates

One release behind latest

Upgrade

MOS Download

Latest release

Doc 1070954.1

Auto Upgrade

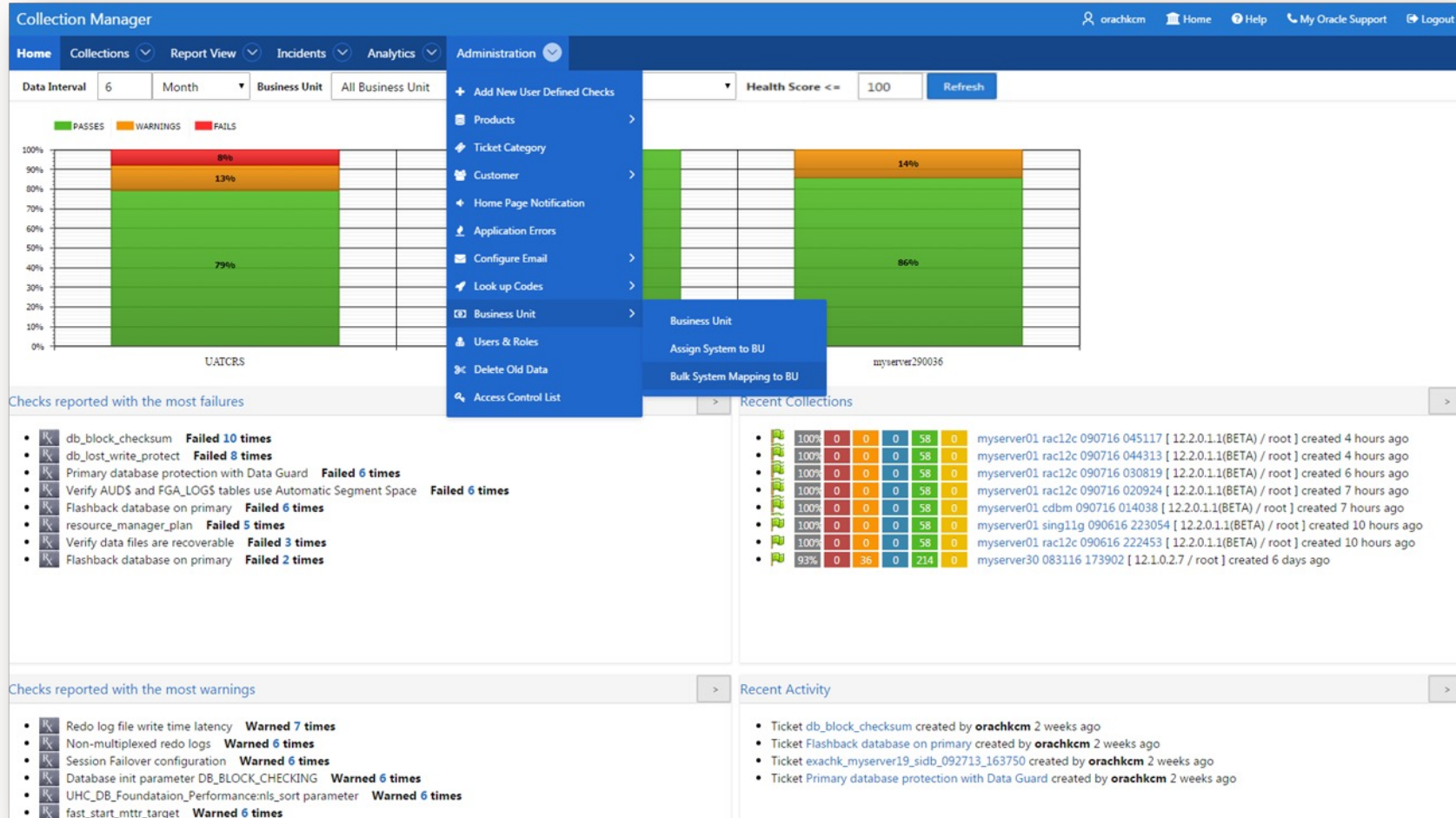Automatically upgrade AHF if a new version is available at the software stage location

```
ahfctl setupgrade -autoupgrade <on/off> -swstage path
```

Example setting autoupgrade to check for a new version in stage location every 30 days

```
ahfctl setupgrade -all
Enter autoupgrade flag <on/off> : on
Enter software stage location : /scratch/ahf_stage
Enter auto upgrade frequency : 30
AHF autoupgrade parameters successfully updated
Successfully synced AHF configuration
```

EXAchk

Compliance checks for most impactful reoccurring problems

Automatic proactive warnings before you're impacted

Results viewable in the tool of your choice

Regular emails with check results

No need to send anything to Oracle

REDUCE YOUR RISK
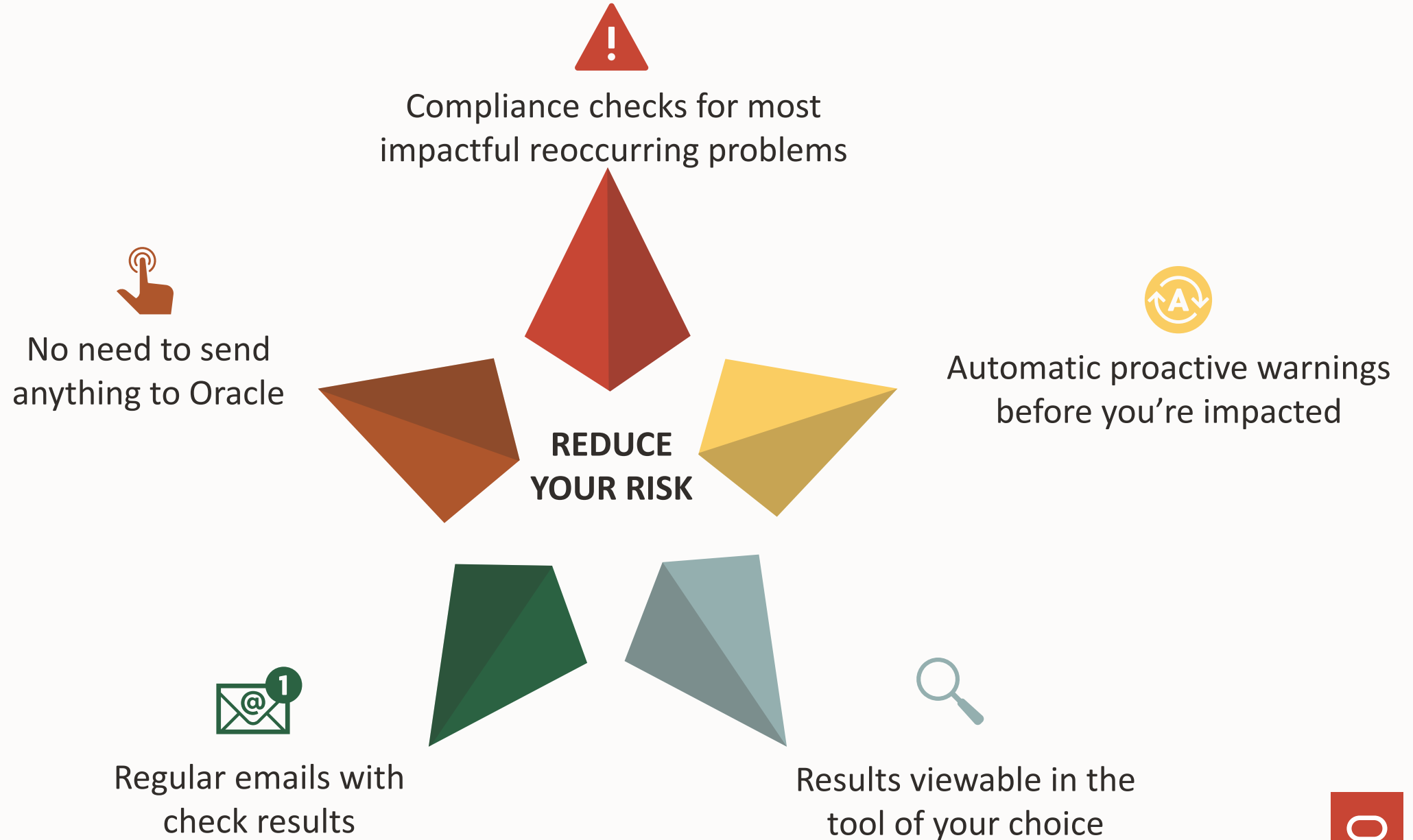
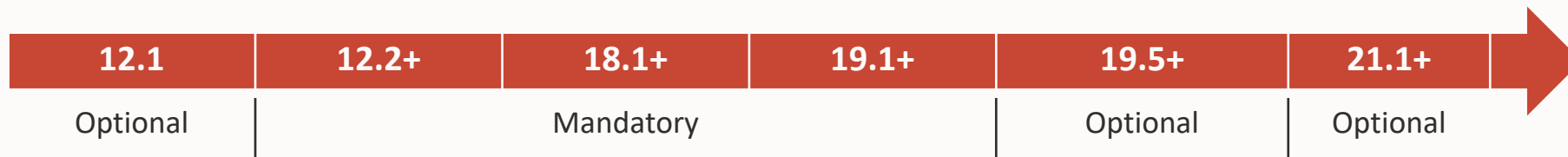# Oracle Health Check Collection Manager Dashboard

The GIMR – Your Oracle Cluster Diagnostics Repository

1. **PROS**

   - Stores Autonomous Health metrics for real-time and post-mortem analysis
     - Cluster Health Monitor (CHM)
     - Cluster Health Advisor (CHA)
     - DB QoS Management (QoSM)
   - Default 72 hours of storage
   - Minimized resource footprint
   - Built-in Automatic Lifecycle management
   - Automatic HA failover support
   - No DBA management required

1. **CONS**

   - Requires minimum 30GB of shared disk
   - GI Patching and Upgrade integration requires significantly longer maintenance window

12.1	12.2+	18.1+	19.1+	19.5+	21.1+
Optional	Mandatory			Optional	Optional

Local Option

How To Install a Local 21c GIMR in 3 Steps

1. **Install the Oracle 21c Grid Infrastructure with Default GIMR Option.**

   - If using ASM, create a disk group for the GIMR (ex: MGMT)

2. **Install an Oracle 21c Database Home in a separate directory as the GI User.**

   - Install on all nodes as you would an Oracle RAC database.

3. **Create the GIMR Database**

   - `OH/bin/mgmtca createGIMRContainer [-storageDiskLocation disk_location]`

AHF Component - Cluster Health Monitor (CHM)

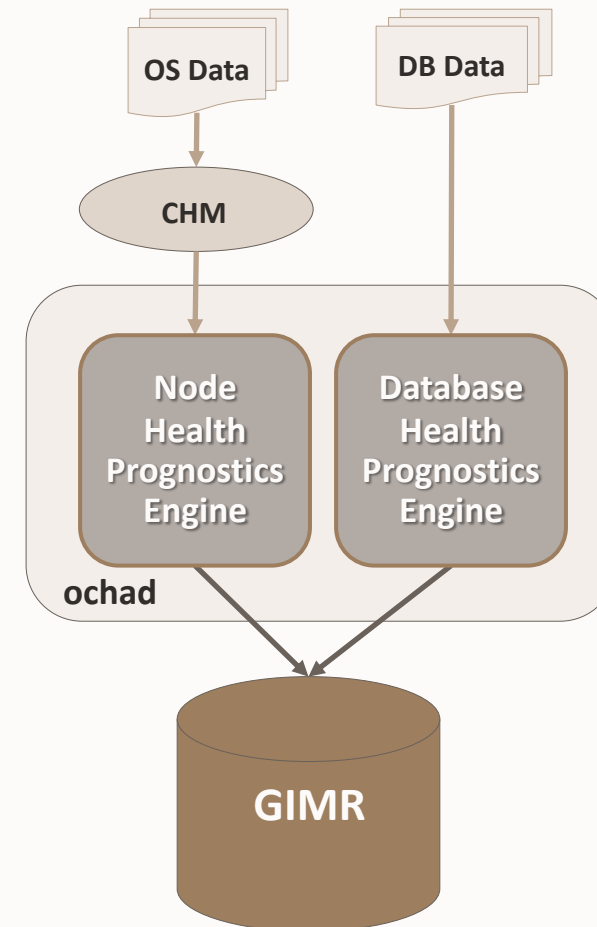Generates view of Cluster and Database diagnostic metrics

- Always on - Enabled by default
- Provides Detailed OS Resource Metrics
- Assists Node eviction analysis
- Locally logs all process data
- User can define pinned processes
- Listens to CSS and GIPC events
- Categorizes processes by type
- Supports plug-in collectors (ex. traceroute, netstat, ping, etc.)
- New CSV output for ease of analysis
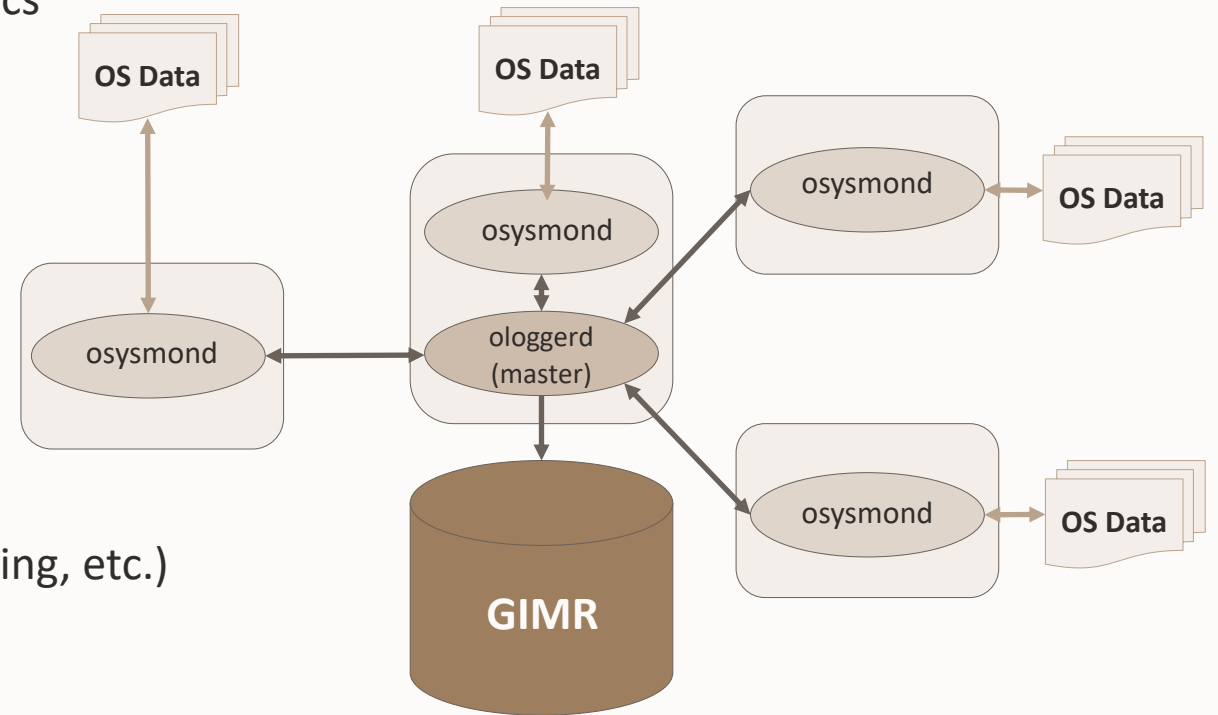
AHF Component - Cluster Health Advisor (CHA)

- Always on - Enabled by default

- Detects node and database performance problems

- Provides early-warning alerts and corrective action

- Supports on-site calibration to improve sensitivity

- Integrated into EMCC Incident Manager and notifications

OS Data

DB Data

CHM

ochad

Node Health Prognostics Engine

Database Health Prognostics Engine

GIMR

Oracle Database Alert Log

PRO

- Destination for Important DB Events
- Single file to monitor by DBAs
- Many tools available to parse
- Supported by TFA for generating alarms

CONS

- Includes both critical and non-critical events
- Incudes messages not intended for DBAs
- Inconsistently reports severity level
- Can report unintuitive cause and action
- New undocumented messages in every release

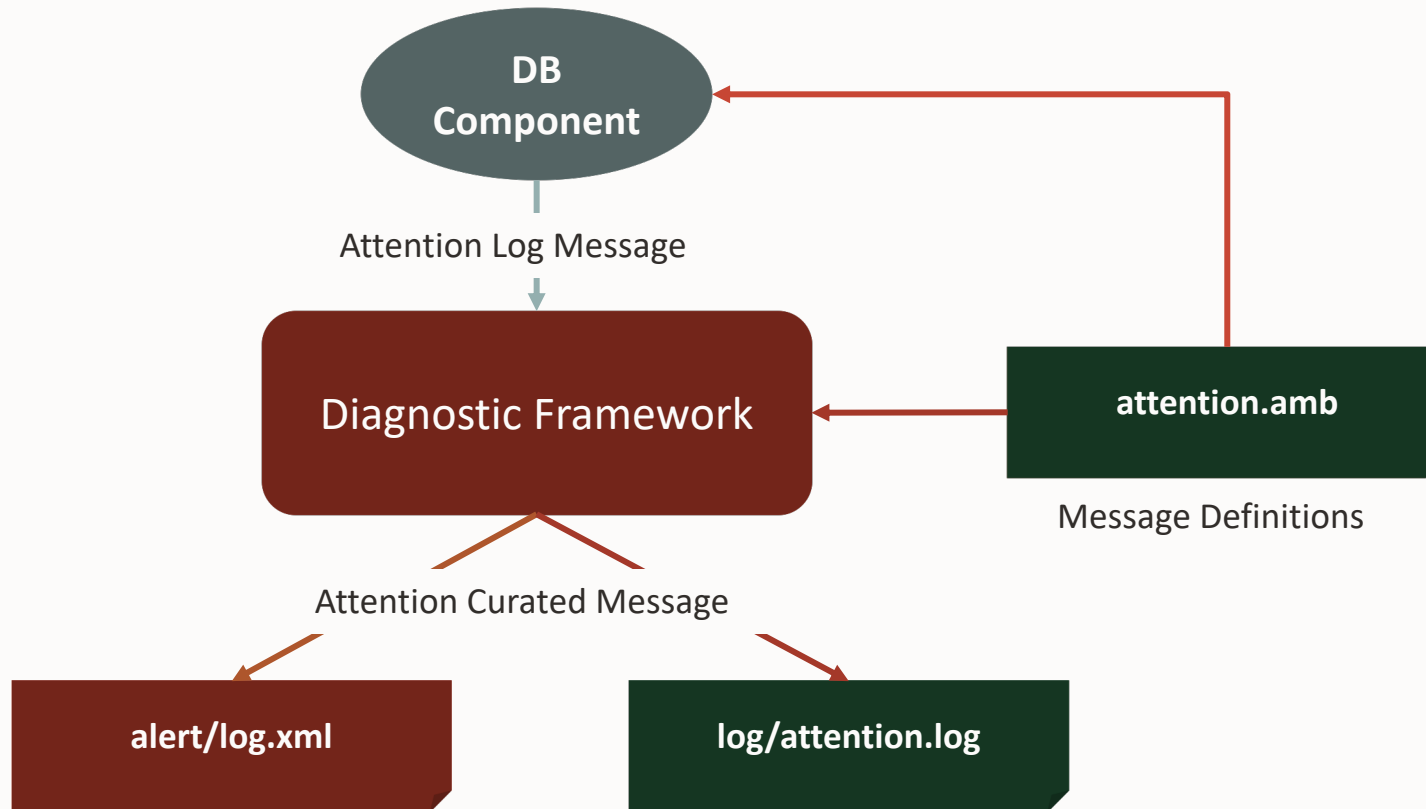# The Curated Solution - New 21c Attention Log

Contains only important events requiring customer attention

Includes documented set of messages and attributes

All Messages include these attributes:

- Type
- Urgency
- Scope
- Target User
- Cause and Action
- Additional debug information

Oracle Database Attention Log Message Flow

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Attention Log Curation - Message Attributes

TYPE

1. Error
2. Warning
3. Notification

URGENCY

1. Immediate
2. Soon
3. Deferable
4. Info

SCOPE

1. Session
2. Process
3. PDB-Instance
4. CDB-Instance
5. CDB-Cluster
6. PDB-Persistent
7. CDB-Persistent

TARGET USER

1. App-Dev
2. Sec-Admin
3. Net-Admin
4. Cluster-Admin
5. PDB-Admin
6. CDB-Admin
7. Server-Admin
8. Storage-Admin
9. DataOps-Admin

Database Health - Applied Machine Learning

Discovers Potential Cluster & DB Problems

Actual Internal data drives model development

Applied purpose-built Applied ML for knowledge extraction

Expert Dev team scrubs data

Generates Bayesian Network-based diagnostic root-cause models

Uses BN-based run-time models to perform real-time prognostics
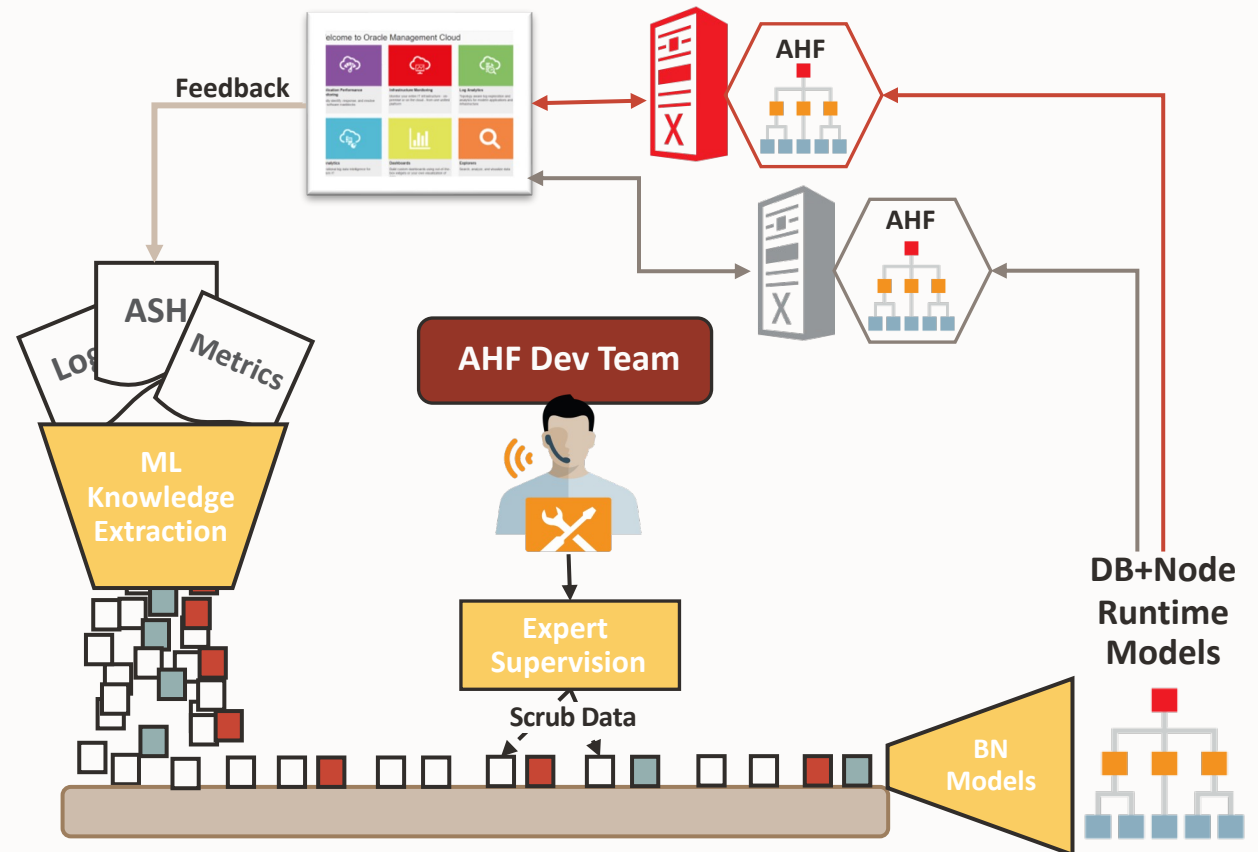
Cluster Health Advisor

CHA Operational Flow : Anomaly Detection -> Diagnostics -> Prognosis

For each data point …

Data Validation	Operating State Estimation	Fault Identification	Diagnostic Decision	Prognosis
Is data valid ?	Is behavior expected ?	Is there a problem ?	What is causing the problem ?	Is a failure likely ?

Machine Learning, Pattern Recognition, & BN Engines
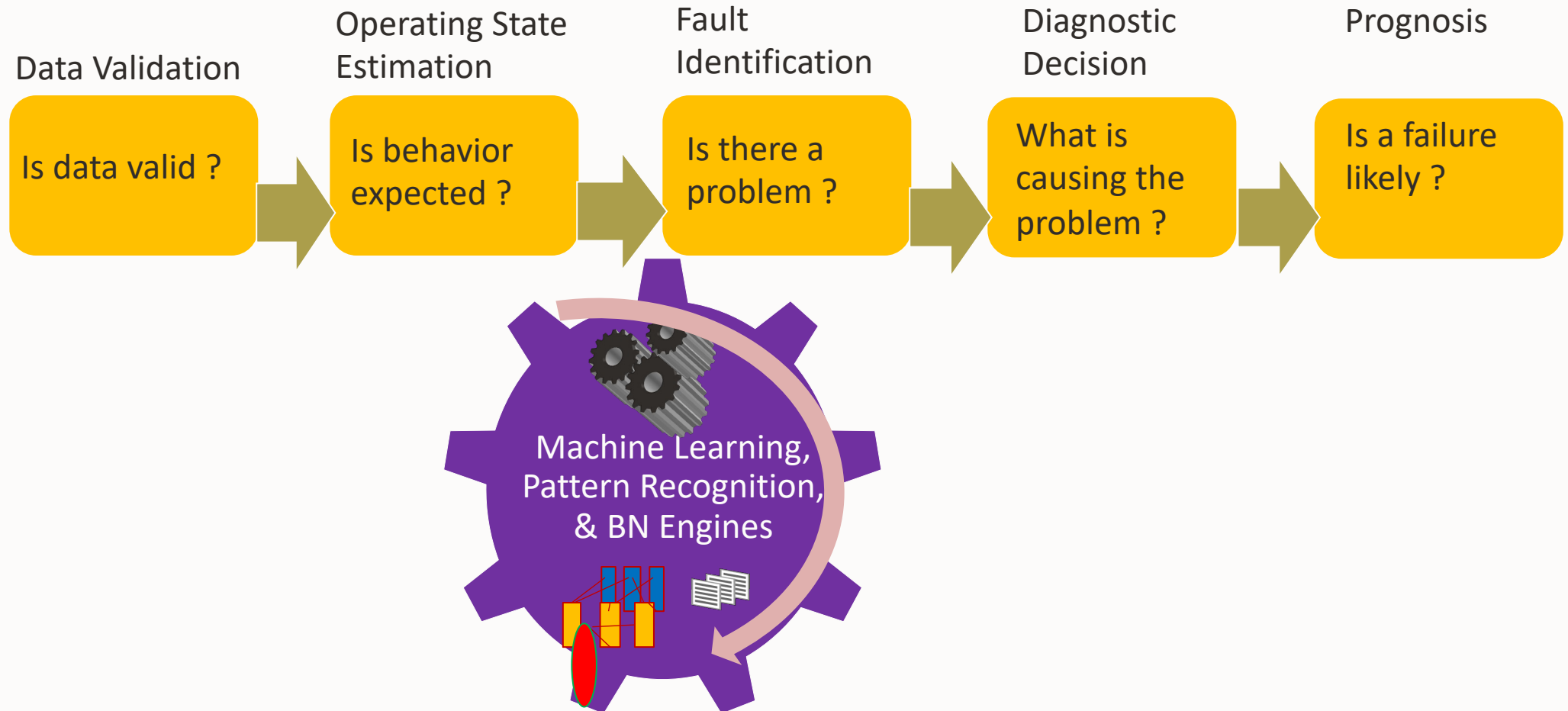
AHF and Machine Learning

- *Machine Learning and Statistical Inference* address *scale, dynamics and interdependency* in Clusters and Clouds

- *An ML Mode*l is *an in-memory representation* of a *normally behaving application* over time*, learned from historical operational data ,* in the form of a collection of *vectors of operational data*

- The *similarity or distance* of a monitored data point to a vector in the in-memory model is the *basis to for a comparison between the normal data and the actual data*

Step by Step on how to perform an autopsy of a problem

- ORAchk/EXAchk provides a single source for all upgrade checks

  - ORAchk , EXAchk checks , Database AutoUpgrade checks , Cluster Verification Utility (CVU) checks

- AHF proactive findings

- Tail Alert and Attention logs and build the timeline

- Dig deeper – AHF to either collect data , analyze

- Performance Issue

- OS or Network Issue

- Node Evictions ?

- AHF Insights and AHF Scope

ORAchk/EXAchk provides a single source for all upgrade checks

- To check an environment before upgrading run:

```
orachk –preupgrade
```

- To check an environment after upgrade run:

```
orachk –postupgrade
```

- To check an environment for best practice violations

```
orachk
```

- Setup Collection Manager to aggregate the results for a birds eye view
  - **Autonomous Health Framework (AHF) - Including TFA and ORAchk/EXAchk (Doc ID 2550798.1)**

Calibrating AHF to your RAC deployment

Choosing a Data Set for Calibration – Defining "normal"

```
chactl query calibration –cluster –timeranges 'start=2021-12-01 07:00:00,end=2021-12-01
13:00:00'
Cluster name : mycluster
Start time : 2021-12-01 07:00:00
End time : 2021-12-01 13:00:00
Total Samples : 11524
Percentage of filtered data : 100%

1)  Disk read (ASM) (Mbyte/sec)
        MEAN        MEDIAN      STDDEV      MIN         MAX
        0.11        0.00        2.62        0.00        114.66
        <25         <50         <75         <100        >=100
        99.87%      0.08%       0.00%       0.02%       0.03%
...
```

Calibrating AHF to your RAC deployment

Choosing a Data Set for Calibration – Defining "normal"

```
...
2) Disk write (ASM) (Mbyte/sec)
      MEAN       MEDIAN      STDDEV      MIN         MAX
      0.01       0.00        0.15        0.00        6.77
      <50        <100        <150        <200        >=200
      100.00%    0.00%       0.00%       0.00%       0.00%
...
```

Calibrating AHF to your RAC deployment

Choosing a Data Set for Calibration – Defining "normal"

```
...
3) Disk throughput (ASM) (IO/sec)
        MEAN        MEDIAN      STDDEV      MIN         MAX
        2.20        0.00        31.17       0.00        1100.00
        <5000       <10000      <15000      <20000      >=20000
        100.00%     0.00%       0.00%       0.00%       0.00%

4) CPU utilization (total) (%)
        MEAN        MEDIAN      STDDEV      MIN         MAX
        9.62        9.30        7.95        1.80        77.90
        <20         <40         <60         <80         >=80
        92.67%      6.17%       1.11%       0.05%       0.00%
...
```

Calibrating AHF to your RAC deployment

Create and store a new model

```
chactl query calibrate cluster –model daytime –timeranges 'start=2021-
12-01 07:00:00, end= 2021-12-01 13:00:00'
```

Begin using the new model

```
chactl monitor cluster –model daytime
```

Confirm the new model is working

```
chactl status –verbose

monitoring nodes svr01, svr02 using model daytime
monitoring database qoltpacdb, instances oltpacdb_1, oltpacdb_2 using model DEFAULT_DB
```

Command line operations

Check for Health Issues and Corrective Actions with CHACTL QUERY DIAGNOSIS

```
chactl query diagnosis -db oltpacdb -start "2021-12-01 01:42:50" -end "2021-12-01 03:19:15"
2021-12-01 01:47:10.0 Database oltpacdb DB Control File IO Performance (oltpacdb_1) [detected]
2021-12-01 01:47:10.0 Database oltpacdb DB Control File IO Performance (oltpacdb_2) [detected]
2021-12-01 02:59:35.0 Database oltpacdb DB Log File Switch (oltpacdb_1) [detected]
2021-12-01 02:59:45.0 Database oltpacdb DB Log File Switch (oltpacdb_2) [detected]
Problem: DB Control File IO Performance
Description: CHA has detected that reads or writes to the control files are slower than expected.
Cause: The Cluster Health Advisor (CHA) detected that reads or writes to the control files were
slow because of an increase in disk IO.
The slow control file reads and writes may have an impact on checkpoint and Log Writer (LGWR)
performance.
Action: Separate the control files from other database files and move them to faster disks or
Solid
State Devices.
Problem: DB Log File Switch
Description: CHA detected that database sessions are waiting longer than expected
for log switch completions.
Cause: The Cluster Health Advisor (CHA) detected high contention during log switches
because the redo log files were small and the redo logs switched frequently.
Action: Increase the size of the redo logs.
```

Command line operations

HTML diagnostic health output available (**-html <file_name>**)

Timestamp	Target Information	Event Name	Detected/Cleared
2016-07-03 01:49:30.0	Host svr02	Host CPU Utilization	detected
2016-07-03 01:49:50.0	Host svr01	Host CPU Utilization	detected
2016-07-03 05:54:55.0	Host svr01	Host Memory Consumption	detected
2016-07-04 03:40:00.0	Host svr02	Host CPU Utilization	cleared
2016-07-04 03:40:05.0	Host svr01	Host CPU Utilization	cleared
2016-07-04 03:40:05.0	Host svr01	Host Memory Consumption	cleared

Problem	Description	Cause	Action
Host CPU Utilization	CHA detected larger than expected CPU utilization on this node. The available CPU resource may not be sufficient to support application failover or relocation of databases to this node.	The Cluster Health Advisor (CHA) detected an unexpected increase in CPU utilization by databases or applications on this node.	Identify CPU intensive processes and databases by reviewing Cluster Health Monitoring (CHM) data. Relocate databases to less busy machines, or limit the number of connections to databases on this node. Add nodes if more resources are required.
Host Memory Consumption	CHA detected that more memory than expected is consumed on this server. The memory is not allocated by sessions of this database.	The Cluster Health Advisor (CHA) detected an increase in memory consumption by other databases or by applications not connected to a database on this node.	Identify the top memory consumers by using the Cluster Health Monitor (CHM).

Autonomous Health – Database Performance

Data Sources and Data Points

A *Data Point* contains > 150 signals (statistics and events) from *multiple sources*

OS, ASM , Network → | ← DB (SH, AWR session, system and PDB statistics)

| Time	CPU	ASM IOPS	Network % util	Network_ Packets Dropped	Log file sync	Log file parallel write	GC CR request	GC current request	GC current block 2-way	GC current block busy	Enq: CF - conten tion	...
15:16:00	0.90	4100	13%	0	2 ms	600 us	0	0	300 us	1.5 ms	0	

Statistics are collected at a *1 second internal sampling* rate , synchronized, smoothed and aggregated to a Data Point *every 5 seconds*
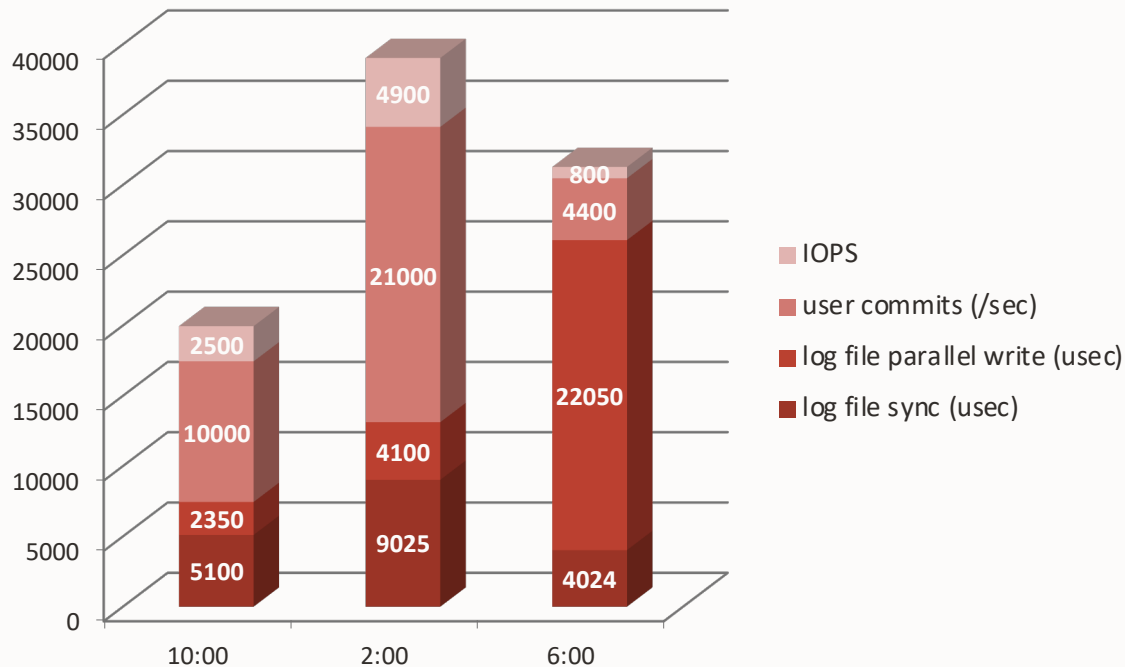
Autonomous Health – Database Performance

Data Flow Overview
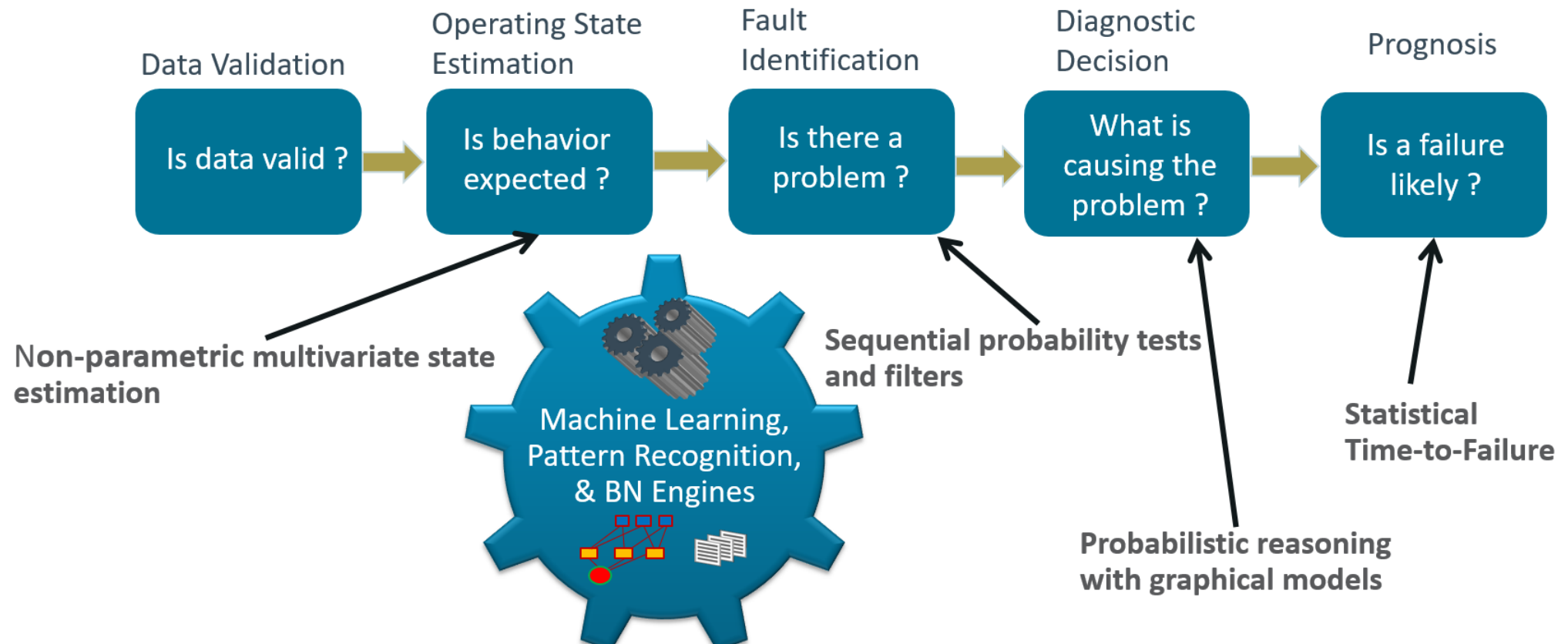
Models Capture all Normal Operating Modes

Models Capture the Dynamic Behavior of all Normal Operation

In-Memory Reference Matrix
(*Part of "Normality" Model*)

IOPS	####	2500	4900	800	####
User Commits	####	10000	21000	4400	####
Log File Parallel Write	####	2350	4100	22050	####
Log File Sync	####	5100	9025	4024	####
...	...	...	...	...	...

A model captures *the **normal load phases*** and their statistics over time , and thus the characteristics for all load intensities and profiles . During monitoring *, **any data point similar*** to one of the vectors is NORMAL. One could say **that *the model REMEMBERS the normal operational dynamics over time***

Autonomous Health – Database Performance

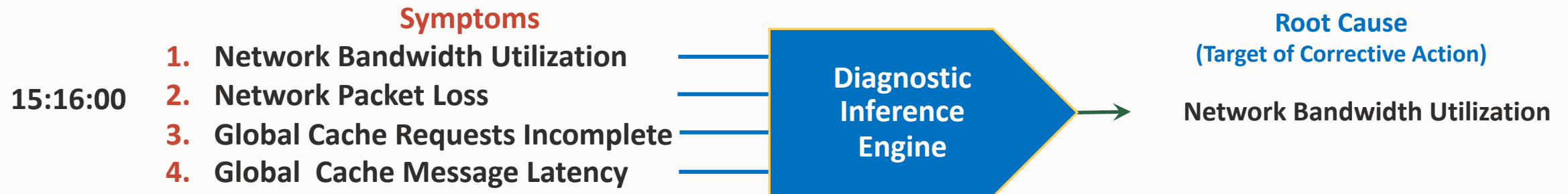*Inline and Immediate Fault Detection and Diagnostic Inference*

Input : Data Point at Time *t*

Time	CPU	ASM IOPS	Network % util	Network_ Packets Dropped	Log file sync	Log file parallel write	GC CR request	GC current request	GC current block 2-way	GC current block busy	Enq: CF - conten tion	...
15:16:00	0.90	4100	88%	105	2 ms	600 us	504 ms	513 ms	2 ms	5.9 ms	0	

Fault Detection and Classification

Time	CPU	ASM IOPS	Network % util	Network_ Packets Dropped	Log file sync	Log file parallel write	GC CR request	GC current request	GC current block 2-way	GC current block busy	Enq: CF
15:16:00	OK	OK	HIGH 1	HIGH 2	OK	OK	HIGH 3	HIGH 3	HIGH 4	HIGH 4	OK

Diagnostic Inference

Symptoms

15:16:00

1. **Network Bandwidth Utilization**
2. **Network Packet Loss**
3. **Global Cache Requests Incomplete**
4. **Global Cache Message Latency**

Diagnostic Inference Engine

Root Cause
(Target of Corrective Action)

Network Bandwidth Utilization

Autonomous Health - Cluster Health Advisor

Cross Node and Cross Instance Diagnostic Inference

Node 1

Diagnostic Inference

15:16:00

Root Cause
(Target of Corrective Action)

Node 2

Diagnostic Inference Engine

15:16:00

Root Cause
(Target of Corrective Action)

Network Bandwidth

Node 3

Diagnostic Inference Engine

15:16:00

Root Cause
(Target of Corrective Action)

Network Bandwidth Utilization

Cross Target Diagnostic Inference

Corrective Action Target
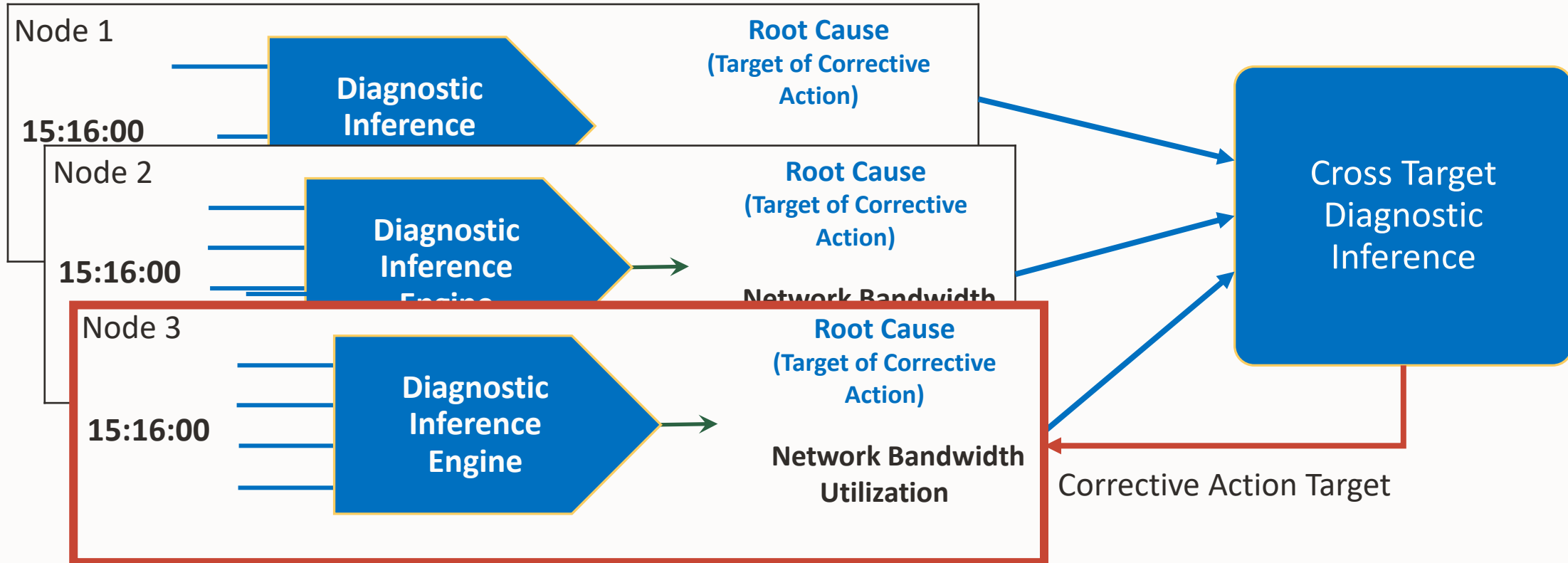
CHA Diagnoses Focus Areas

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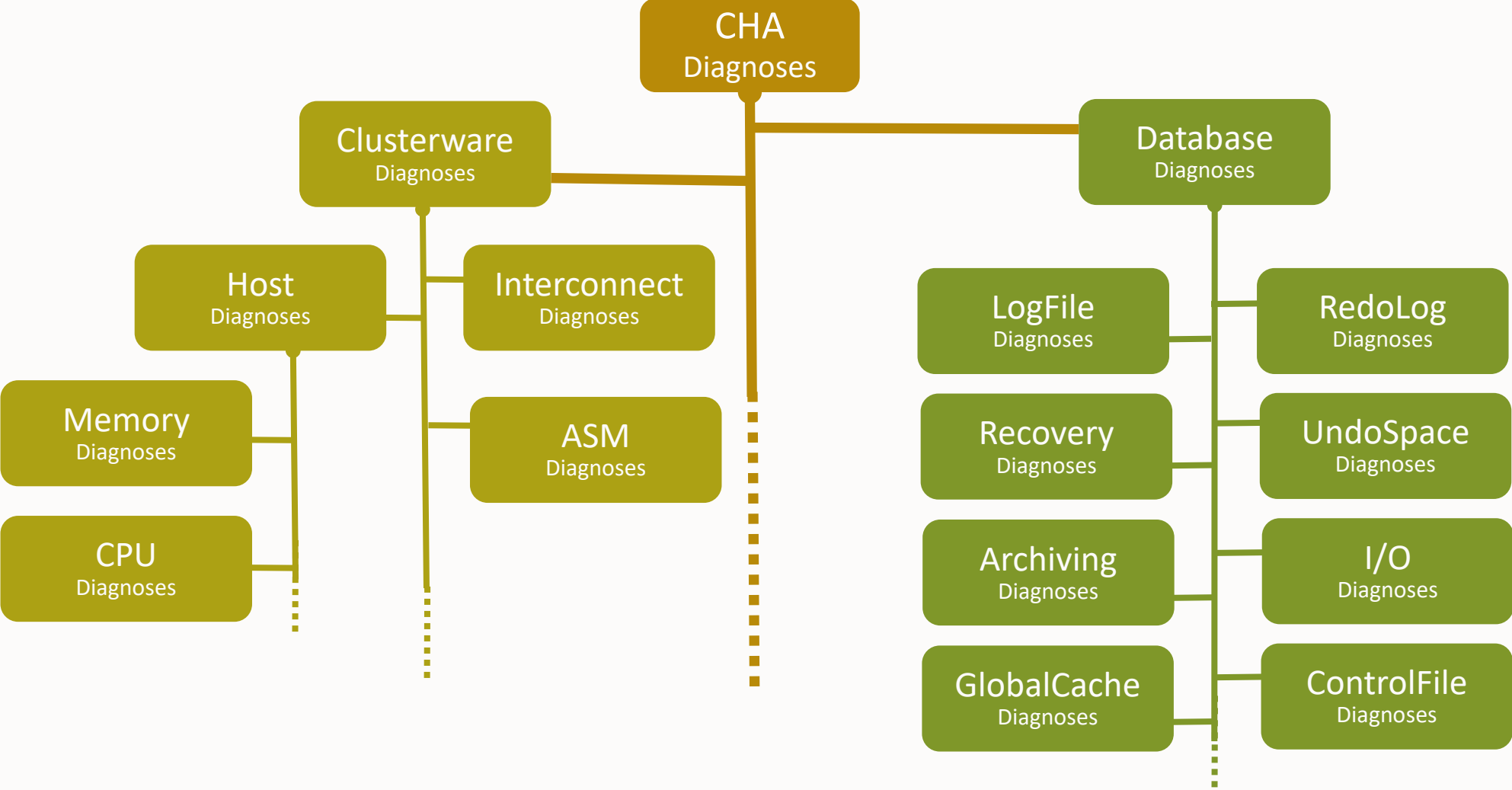
Critical CHA Diagnoses and Their Impacts

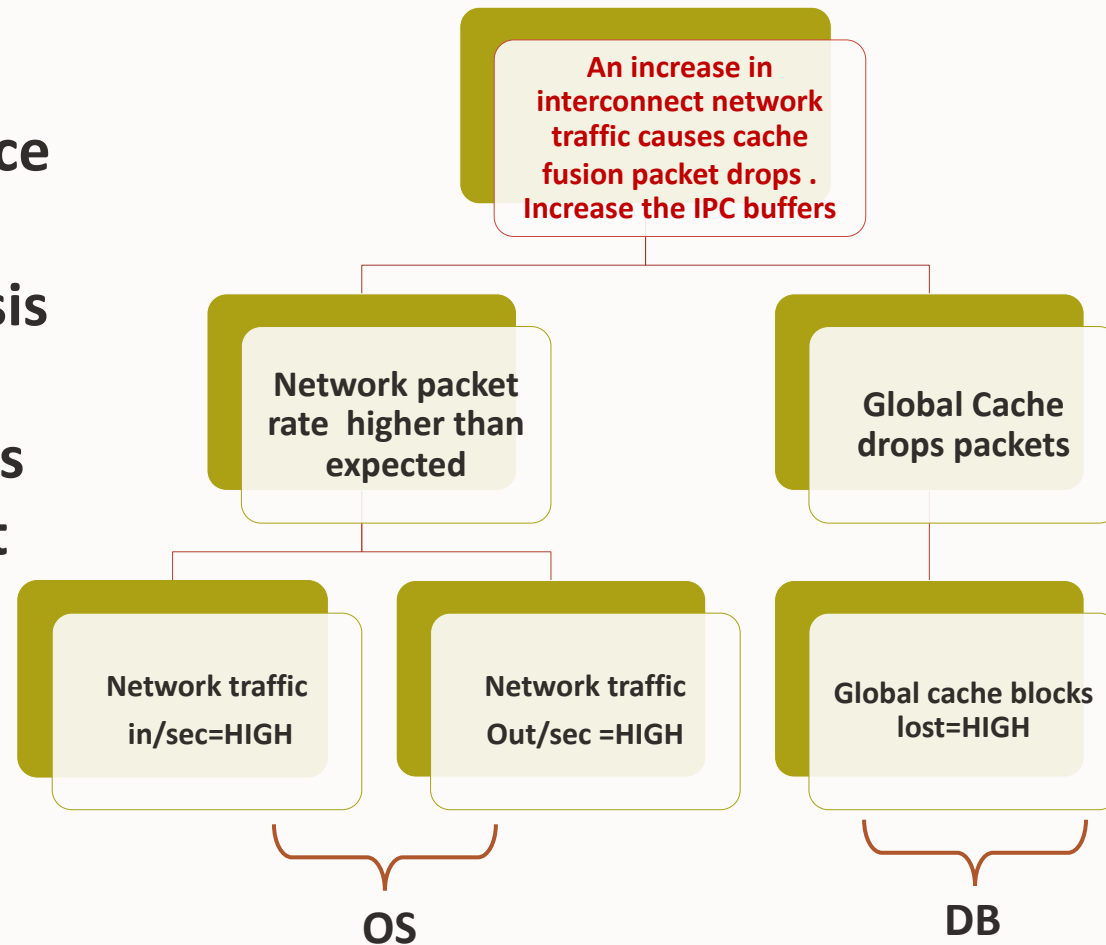| Diagnosis ID	Description	Impact
CHA_PRIV_NW_PATH	CHA detects abrupt, significant decrease in message traffic on the cluster Interconnect	Instance Eviction Node Eviction
CHA_PRIV_IC_LOSS	CHA detects slow response times for Global Cache messages	Hang Instance Eviction
CHA_GCS_BUSY	CHA detects a capacity issue in the Global Cache Services	Hang
CHA_PRIV_NETWORK_MSG	CHA detects Socket Buffer Overflows	Hang Instance Eviction
CHA_GC_NIC_CONFIG	CHA detects network packets are discarded by private network interface	Hang Instance Eviction Node Eviction
CHA_GC_IPC_CONGESTION	CHA detects global cache messages on the private interconnect are lost	Hang Instance Eviction

AHF Diagnostics Model

AHF Diagnostics Logic: What is in a "Model" ?

When multiple faults are detected, they are passed as evidence to a Probabilistic Bayesian Belief Network for Cause and Effect Analysis

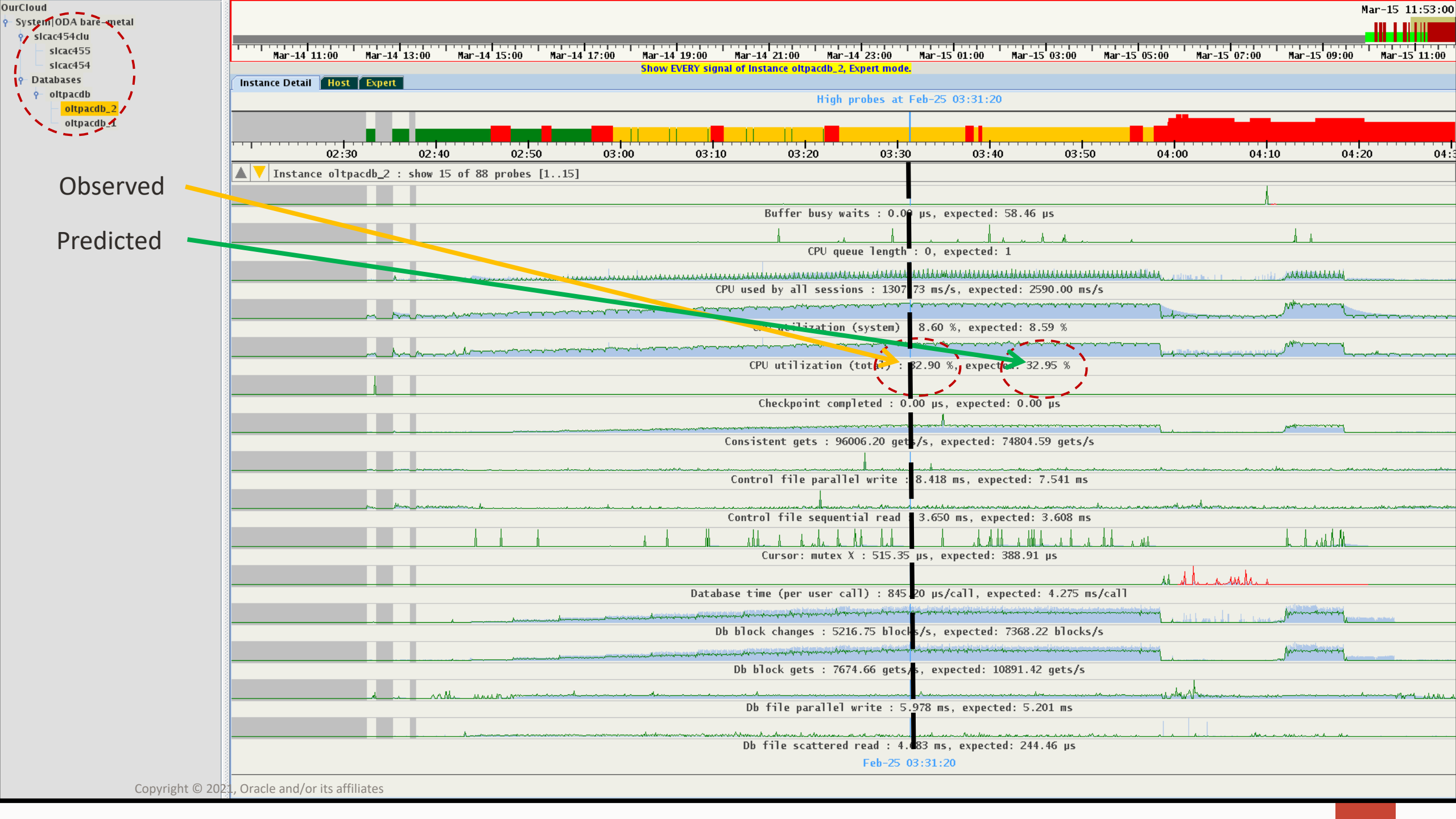**Prior Probabilities and Dependencies are determined during development Based on historical cases**

An increase in interconnect network traffic causes cache fusion packet drops . Increase the IPC buffers

Network packet rate higher than expected

Global Cache drops packets

Network traffic in/sec=HIGH

Network traffic Out/sec =HIGH

Global cache blocks lost=HIGH

OS

DB

What's AHF Scope (new in 22.3)

Statistics from OS, Storage,DB, Network etc. Grouped into component groups

The Curated Solution - New 21c Attention Log

Contains only important events requiring customer attention

Includes documented set of messages and attributes

All Messages include these attributes:

- Type
- Urgency
- Scope
- Target User
- Cause and Action
- Additional debug information

Example Attention Message Definition – CDB Warning

```
// TYPE      - 1 error,  2 warning,  3 notification
// URGENCY   - 1 immediate, 2 soon, 3 deferable, 4 info
// SCOPE     - 1 session, 2 process, 3 pdb-instance, 4 cdb-instance, 5 cdb-cluster, 6 pdb-
persistent, 7 cdb-persistent
// TARGETUSER - 1 app-dev, 2 sec-admin, 3 net-admin, 4 cluster-admin, 5 pdb-admin, 6 cdb-
admin, 7 server-admin, 8 storage-admin, 9 dataops-admin

ID::2000
TYPE::2
URGENCY::1
SCOPE::4
TARGETUSER::6
TEXT::Parameter %s specified is high
CAUSE::Memory parameter specified for this instance is high
ACTION::Check alert log or trace file for more information relating to instance configuration,
reconfigure the parameter and restart the instance
STARTVERSION::21.1
```

Example Attention Log Curated Message – CDB Warning

```
[
   IMMEDIATE       Parameter SGA_MAX_SIZE specified is high
   CAUSE:          Memory parameter specified for this instance is high
   ACTION:         Check alert log or trace file for more information relating to instance
                   configuration, reconfigure the parameter and restart the instance
   CLASS:          CDB Instance / CDB ADMINISTRATOR / WARNING / AL-2000
   TIME:           2020-05-01T11:09:02.223-07:00

   ADDITIONAL INFO: -
   WARNING: SGA_MAX_SIZE (6144 MB) is too high - it should be
        less than 5634 MB (80 percent of physical memory).
]
```

Example Attention Log Curated Message – CDB Error

```
[
    IMMEDIATE Shutting down ORACLE instance (abort) (OS id: 8394)
    CAUSE:  A command to shutdown the instance was executed
    ACTION: Check alert log for progress and completion of command
    CLASS:  CDB Instance / CDB ADMINISTRATOR / ERROR / AL-1002
    TIME:   2020-05-08T17:09:33.773-07:00

    ADDITIONAL INFO: -
    Shutdown is initiated by sqlplus@den02tlh (TNS V1-V3).
]
```

Example Attention Log Curated Message – Server Warning

```
[
    SOON           Heavy swapping observed on system
    CAUSE:         Memory usage by one more application is leading to heavy swapping
    ACTION:        Check alert log for more information, use tools to analyze memory
                   usage and take action
    CLASS:         CDB Instance / SERVER ADMINISTRATOR / WARNING / AL-2100
    TIME:          2020-05-01T11:09:02.223-07:00

    ADDITIONAL INFO: -
    WARNING: Heavy swapping observed on system in last 15 mins.
    Heavy swapping can lead to timeouts, poor performance, and instance eviction.
]
```

Attention Log Use Cases – Autonomous Health Framework

Attention Log

Autonomous Health Framework

Trace File Analyzer

Repository

CDB DBA

Sys Admin

PDB DBA
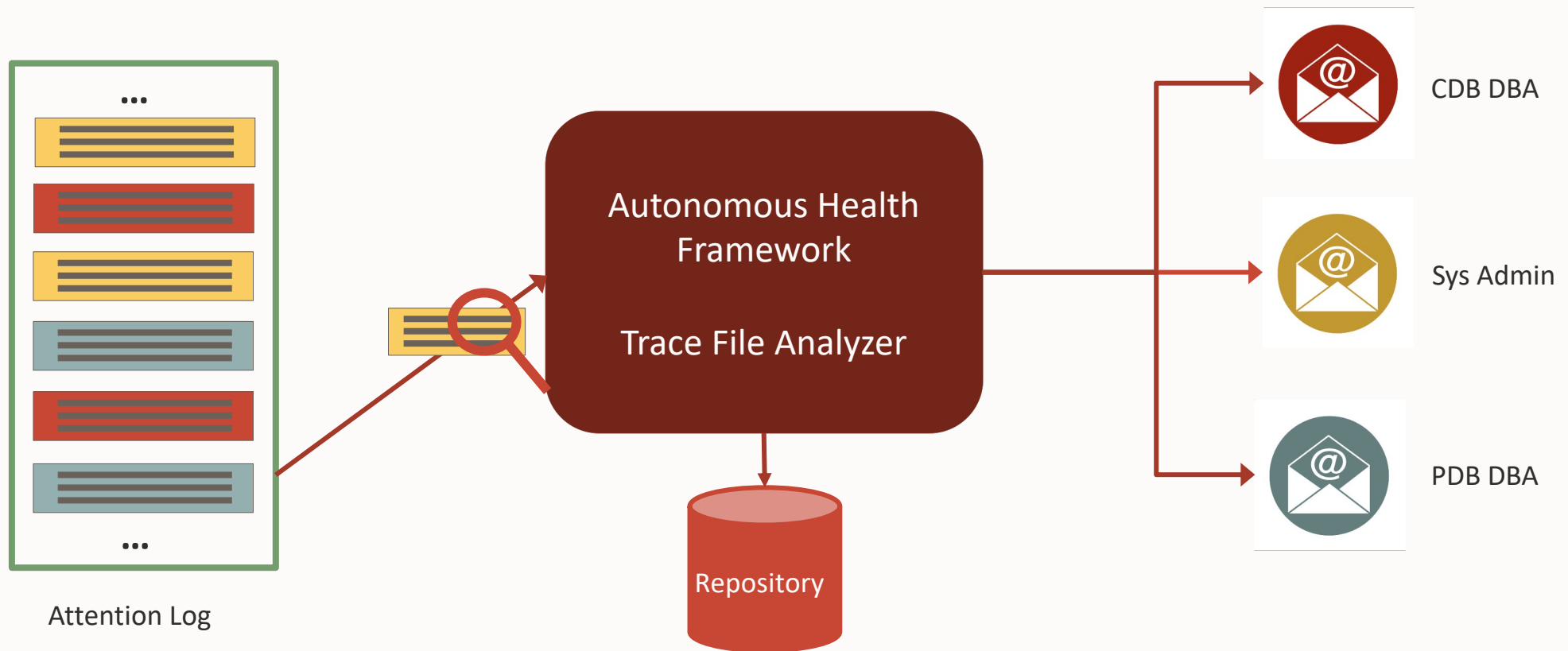
Attention Log Use Cases – 3rd Party Monitoring

attention.amb

Message Definitions

3rd Party Monitoring, Parsing and Routing

Attention Log

Ops Dashboard

Runbooks

Ops Admin
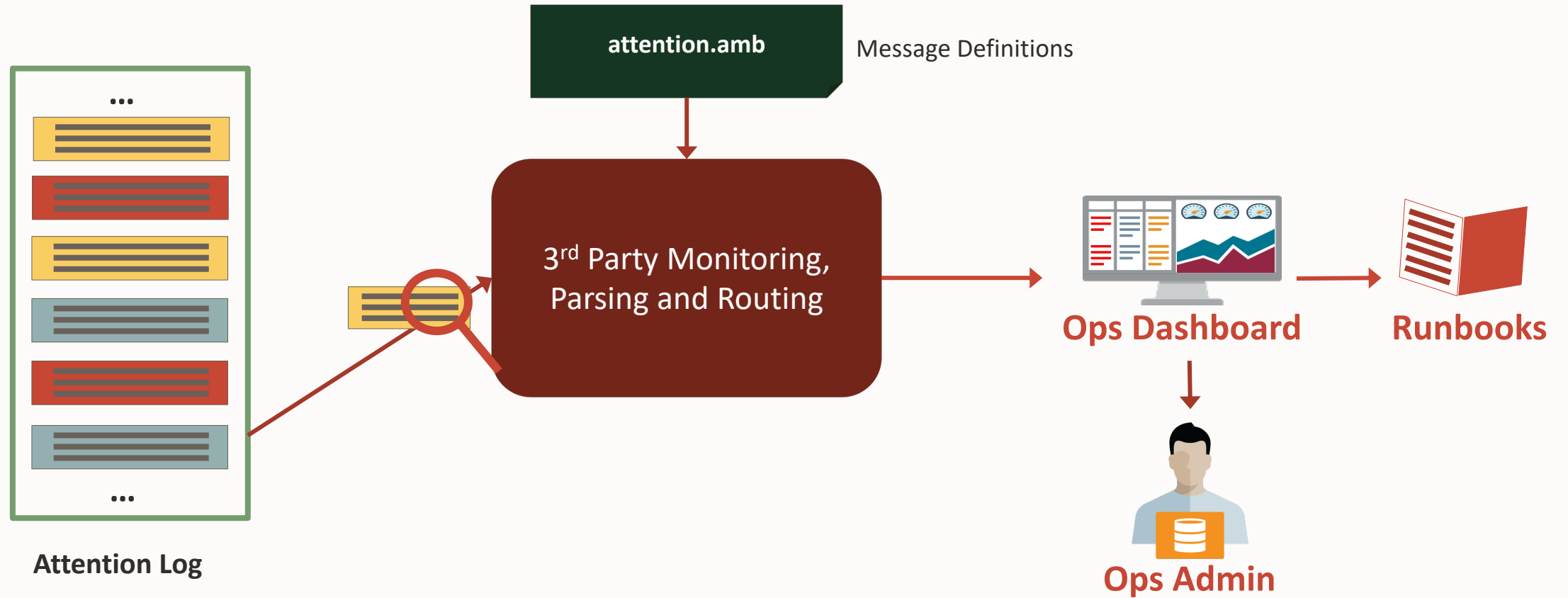
Has anything changed recently?

```
tfactl changes
Output from host : myserver69
------------------------------
[Dec/01/2021 04:54:15.397]: Parameter: fs.aio-nr: Value: 95488 => 97024
[Dec/01/2021 04:54:15.397]: Parameter: fs.inode-nr: Value: 764974 131561 => 740744 131259
[Dec/01/2021 04:54:15.397]: Parameter: kernel.pty.nr: Value: 2 => 1
[Dec/01/2021 04:54:15.397]: Parameter: kernel.random.entropy_avail: Value: 189 => 158
[Dec/01/2021 04:54:15.397]: Parameter: kernel.random.uuid: Value: 36269877-9bc9-40a3-82e0-
1619865096f2 => 7551c5e7-c59f-40fa-b55f-5bd170e8b1ab
[Dec/01/2021 05:46:15.397]: Parameter: fs.aio-nr: Value: 119680 => 122880
[Dec/01/2021 05:46:15.397]: Parameter: fs.inode-nr: Value: 1580316          810036 => 1562320
        768555
[Dec/01/2021 05:46:15.397]: Parameter: kernel.pty.nr: Value: 19 => 18
[Dec/01/2021 05:46:15.397]: Parameter: kernel.random.uuid: Value: 37cc31aa-ee31-459e-8f2a-
0766b34b1b64 => f5176cdc-6390-415d-882e-02c4cff2ae4e
...
```

Has anything changed recently?

```
...
Output from host : myserver70
------------------------------
[Dec/01/2021 04:54:15.397]: Parameter: fs.aio-nr: Value: 95488 => 97024
[Dec/01/2021 04:54:15.397]: Parameter: fs.inode-nr: Value: 764974 131561 => 740744 131259
[Dec/01/2021 04:54:15.397]: Parameter: kernel.pty.nr: Value: 2 => 1
[Dec/01/2021 04:54:15.397]: Parameter: kernel.random.entropy_avail: Value: 189 => 158
[Dec/01/2021 04:54:15.397]: Parameter: kernel.random.uuid: Value: 36269877-9bc9-40a3-82e0-
1619865096f2 => 7551c5e7-c59f-40fa-b55f-5bd170e8b1ab
[Dec/01/2021 05:46:15.397]: Parameter: fs.aio-nr: Value: 119680 => 122880
[Dec/01/2021 05:46:15.397]: Parameter: fs.inode-nr: Value: 1580316        810036 => 1562320
        768555
[Dec/01/2021 05:46:15.397]: Parameter: kernel.pty.nr: Value: 19 => 18
[Dec/01/2021 05:46:15.397]: Parameter: kernel.random.uuid: Value: 37cc31aa-ee31-459e-8f2a-
0766b34b1b64 => f5176cdc-6390-415d-882e-02c4cff2ae4e
[Dec/01/2021 16:56:15.398]: Parameter: fs.aio-nr: Value: 97024 => 98560
```

tail files

```
tfactl tail alert

Output from host : myserver69
-------------------------------
/scratch/app/11.2.0.4/grid/log/myserver69/alertmyserver69.log
2021-12-01 23:28:22.532:
[ctssd(5630)]CRS-2409:The clock on host myserver69 is not synchronous with the mean cluster
time. No action has been taken as the Cluster Time Synchronization Service is running in
observer mode.

2021-12-01 23:58:22.964:
[ctssd(5630)]CRS-2409:The clock on host myserver69 is not synchronous with the mean cluster
time. No action has been taken as the Cluster Time Synchronization Service is running in
observer mode.
...
```

tail files

```
...

/scratch/app/oradb/diag/rdbms/apxcmupg/apxcmupg_2/trace/alert_apxcmupg_2.log


Wed Dec 01 06:00:00 2021 VKRM started with pid=82, OS id=4903

Wed Dec 01 06:00:02 2021 Begin automatic SQL Tuning Advisor run for special tuning task
"SYS_AUTO_SQL_TUNING_TASK"

Wed Dec 01 06:00:37 2021 End automatic SQL Tuning Advisor run for special tuning task
"SYS_AUTO_SQL_TUNING_TASK"

Wed Dec 01 23:00:28 2021 Thread 2 advanced to log sequence 759 (LGWR switch)

  Current log# 3 seq# 759 mem# 0: +DATA/apxcmupg/onlinelog/group_3.289.917164707

  Current log# 3 seq# 759 mem# 1: +FRA/apxcmupg/onlinelog/group_3.289.917164707

...
```

Around 100 problem types covered

Database areas

Errors / Corruption

Performance

Install / patching / upgrade

RAC / Grid Infrastructure

Import / Export

RMAN

Transparent Data Encryption

Storage / partitioning

Undo / auditing

Listener / naming services

Spatial / XDB

Other Server Technology

Enterprise Manager

Data Guard

GoldenGate

Exalogic

Full list in documentation

```
tfactl diagcollect –srdc <srdc_type> [-sr <sr_number>]
```

Manual collection vs TFA SRDC for database performance

Manual method

1. Generate ADDM reviewing [Document 1680075.1](#) (multiple steps)

2. Identify "good" and "problem" periods and gather AWR reviewing [Document 1903158.1](#) (multiple steps)

3. Generate AWR compare report (awrddrpt.sql) using "good" and "problem" periods

4. Generate ASH report for "good" and "problem" periods reviewing [Document 1903145.1](#) (multiple steps)

5. Collect OSWatcher data reviewing [Document 301137.1](#) (multiple steps)

6. Collect Hang Analyze output at Level 4

7. Generate SQL Healthcheck for problem SQL id using [Document 1366133.1](#) (multiple steps)

8. Run support provided sql scripts – Log File sync diagnostic output using [Document 1064487.1](#) (multiple steps)

9. Check alert.log if there are any errors during the "problem" period

10. Find any trace files generated during the "problem" period

11. Collate and upload all the above files/outputs to SR

TFA SRDC

1. Run

```
tfactl diagcollect –srdc dbperf [-sr <sr_number>]
```

One command SRDC

tfactl diagcollect –srdc <srdc_type>

- Scans system to identify recent events
- Once the relevant event is chosen, proceeds with diagnostic collection

```
tfactl diagcollect -srdc ORA-00600
Enter the time of the ORA-00600 [YYYY-MM-DD HH24:MI:SS,<RETURN>=ALL] :
Enter the Database Name [<RETURN>=ALL] :

1. Dec/01/2021 05:29:58 : [orcl2] ORA-00600: internal error code, arguments: [600], [], [],
[], [], [], [], [], [], [], [], []
2. Dec/01/2021 06:55:08 : [orcl2] ORA-00600: internal error code, arguments: [600], [], [],
[], [], [], [], [], [], []

Please choose the event : 1-2 [1]
Selected value is : 1 (Dec/01/2021 05:29:58 )
```

One command SRDC

All required files are identified

- Trimmed where applicable
- Package in a zip ready to provide to support

```
...
2021/12/01 06:14:24 EST : Getting List of Files to Collect
2021/12/01 06:14:27 EST : Trimming file :
myserver1/rdbms/orcl2/orcl2/trace/orcl2_lmhb_3542.trc with original file size : 163MB
...
2021/12/01 06:14:58 EST : Total time taken : 39s
2021/12/01 06:14:58 EST : Completed collection of zip files.
...
/opt/oracle.ahf/data/repository/srdc_ora600_collection_Wed_Dec_1_06_14_17_EST_2021_node_loca
l/myserver1.tfa_srdc_ora600_Wed_Dec_1_06_14_17_EST_2021.zip
```

Understand Database log disk space usage

```
tfactl managelogs -show usage
...
.----------------------------------------------------------------------.
|                          Grid Infrastructure Usage                    |
+---------------------------------------------------------+-----------+
| Location                                                | Size      |
+---------------------------------------------------------+-----------+
| /u01/app/crsusr/diag/afdboot/user_root/host_309243680_94/alert    | 28.00 KB  |
| /u01/app/crsusr/diag/afdboot/user_root/host_309243680_94/incident | 4.00 KB   |
| /u01/app/crsusr/diag/afdboot/user_root/host_309243680_94/trace    | 8.00 KB   |
...
+---------------------------------------------------------+-----------+
| Total                                                   | 739.06 MB |
'---------------------------------------------------------+-----------'
...
```

Use **-gi** to only show grid infrastructure

Understand Database log disk space usage

```
...

     .------------------------------------------------------.
    |                  Database Homes Usage                  |
    +------------------------------------------+-----------+
    | Location                                 | Size      |
    +------------------------------------------+-----------+
    | /u01/app/crsusr/diag/rdbms/cdb674/CDB674/alert    | 1.06 MB   |
    | /u01/app/crsusr/diag/rdbms/cdb674/CDB674/incident | 4.00 KB   |
    | /u01/app/crsusr/diag/rdbms/cdb674/CDB674/trace    | 146.19 MB |
    | /u01/app/crsusr/diag/rdbms/cdb674/CDB674/cdump    | 4.00 KB   |
    | /u01/app/crsusr/diag/rdbms/cdb674/CDB674/hm       | 4.00 KB   |
    +------------------------------------------+-----------+
    | Total                                    | 147.26 MB |
     '------------------------------------------+-----------'
```

Use **-database** to only show database

Understand Database log disk space usage variations

```
tfactl managelogs -show variation -older 30d

Output from host : myserver74
-------------------------------
2021-12-01 12:30:42: INFO Checking space variation for 30 days


.--------------------------------------------------------------------------------.
|                          Grid Infrastructure Variation                         |
+--------------------------------------------------------+----------+------------+
| Directory                                              | Old Size | New Size   |
+--------------------------------------------------------+----------+------------+
| /u01/app/crsusr/diag/asm/user_root/host_309243680_96/alert  | 22.00 KB | 28.00 KB  |
+--------------------------------------------------------+----------+------------+
| /u01/app/crsusr/diag/clients/user_crsusr/host_309243680_96/cdump | 4.00 KB | 4.00 KB |
+--------------------------------------------------------+----------+------------+
| /u01/app/crsusr/diag/tnslsnr/myserver74/listener/alert | 15.06 MB | 244.10 MB |
+--------------------------------------------------------+----------+------------+
...
```

Run a database log purge

```
tfactl managelogs -purge -older 30d

Output from host : myserver74
----------------------------
Purging files older than 30 days

Cleaning Grid Infrastructure destinations

Purging diagnostic destination "diag/afdboot/user_root/host_309243680_94" for files - 0 files deleted , 0 bytes freed
Purging diagnostic destination "diag/afdboot/user_crsusr/host_309243680_94" for files - 1 files deleted , 10.16 KB freed
Purging diagnostic destination "diag/asmtool/user_root/host_309243680_96" for files - 1 files deleted , 10.16 KB freed
Purging diagnostic destination "diag/asmtool/user_crsusr/host_309243680_96" for files - 2 files deleted , 29.18 KB freed
Purging diagnostic destination "diag/tnslsnr/myserver74/listener" for files - 2 files deleted , 29.18 KB freed
Purging diagnostic destination "diag/diagtool/user_root/adrci_309243680_96" for files - 2 files deleted , 29.18 KB freed
Purging diagnostic destination "diag/clients/user_crsusr/host_309243680_96" for files - 2 files deleted , 29.18 KB freed
Purging diagnostic destination "diag/asm/+asm/+ASM" for files - 2 files deleted , 29.18 KB freed
Purging diagnostic destination "diag/asm/user_root/host_309243680_96" for files - 2 files deleted , 29.18 KB freed
Purging diagnostic destination "diag/asm/user_crsusr/host_309243680_96" for files - 2 files deleted , 29.18 KB freed
Purging diagnostic destination "diag/crs/myserver74/crs" for files - 2 files deleted , 29.18 KB freed
...
```

Monitor Database performance

```
tfactl run oratop -database ogg19c
```

```
Oracle 19c - shl 02:01:57 up: 4.3d,   2 ins,    128 sn,     1 us,    10G sga,    84.6%db
ID %CPU %DCP LOAD   AAS    ASC   ASI   ASW   IDL   MBPS  %FR   PGA UTPS   RT/X DCTR DWTR
 2 19.2 13.7 10.2 39.2     11     4    22    26   100M    7  3.1G  656    56m   17    81
 1 20.3 16.9 15.6 42.0     15     1    22    27   104M   14  2.7G  719    48m   16    78


EVENT (C)                              TOT WAITS     TIME(s)   AVG_MS   PCT     WAIT CLASS
log file sync                          17841193      266406     14.1    39         Commit
DB CPU                                               154327             23
gc current block busy                  71129790      108578      1.5    16        Cluster
gc buffer busy acquire                  8896661       73845      9.9    11        Cluster
enq: TX - row lock contention           3220952       71866     24.0    11    Application


ID     SID     SPID USR PROG S   PGA SQLID/BLOCKER OPN   E/T STA STE EVENT/*LA   W/T
 1      35    35023 TPC tpcc D 5.3M 4dxgf9wkjvbz8 INS      0 ACT I/O db file s   29m
 1     932    35058 TPC tpcc D 5.3M ahlvrygbhqdry DEL      0 ACT WAI enq: TX -   12m
 2       6     7416 TPC tpcc D 5.2M 5zbjl8g6dz0gk SEL      0 ACT I/O db file s   10m
 1     995    35051 TPC tpcc D 6.3M 462cz6g854c88 INS      0 ACT I/O db file s   10m
 2    1282     7328 TPC tpcc D 3.4M 5j4ntzvntxqxm UPD      0 ACT I/O db file s 9.4m
 2      71     7343 TPC tpcc D 5.4M 5j4ntzvntxqxm UPD      0 ACT I/O db file s 7.5m
 1    1251    35081 TPC tpcc D 4.3M 57kvfpfmx9801 UPD      0 ACT WAI enq: TX - 6.2m
 1    1447    35015 TPC tpcc D 5.1M 236ksg44h80ht UPD      0 ACT WAI gc buffer 5.7m
 1    1220    35079 TPC tpcc D 4.3M 57kvfpfmx9801 UPD      0 ACT WAI enq: TX - 5.1m
 1       4    35021 TPC tpcc D 5.3M 4j8r6zsm6upcv UPD      0 ACT WAI gc curren 5.0m
 2     902     7376 TPC tpcc D 5.1M                        0 ACT WAI log file  4.4m
 1      34    35159 TPC tpcc D 5.3M gz8100xp0fbc9          0 ACT CPU cpu runqu 3.9m
 1    1446    35097 TPC tpcc D 5.4M 4j8r6zsm6upcv UPD      0 ACT WAI gc buffer 3.7m
 2     582     7356 TPC tpcc D 5.1M                        0 ACT WAI log file  3.6m
 1     102    35164 TPC tpcc D 4.5M 236ksg44h80ht UPD      0 ACT WAI gc curren 2.6m
 2    1473    49080 B/G LGWR D 2.7M           2:1        4.3d ACT WAI LGWR any  2.2m
 1       1    31199 B/G LG00 D 2.4M                      2.8d ACT CPU cpu runqu 2.2m
```

Querying metrics in AHF

System metric-set detailing the summarizing state of the system.

ex : oclumon dumpnodeview local -system

```
-------------------------------------------------
Node : den03ceb Clock : '2020-09-08 07.31.34'
-------------------------------------------------

SYSTEM:
[CPU]  ⬅
pCpus[#]:4, cores[#]:4, vCpus[#]:4, cpuHT:Y, osName:Linux, chipName:Intel Core Processor (Haswe
ll, no TSX, IBRS), usage[%]:2.7, system[%]:1.02, user[%]:1.68, nice[%]:0.0, ioWait[%]:0.15, ste
al[%]:0.0, cpuQ[#]:0, loadAvg1:0.69, loadAvg5:0.76, loadAvg15:0.6, intr[#/s]:3597, ctxSwitch[#/
s]:8027

[MEMORY]  ⬅
totalMem[KB]:14770492, freeMem[KB]:734904, avblMem[KB]:9257560, shMem[KB]:1830780, bufferAndCac
he[KB]:10574276, buffer[KB]:258528, cache[KB]:10315748, pgCache[KB]:7738936, slabReclaim[KB]:25
76812, swapTotal[KB]:15359968, swapFree[KB]:14498448, hugePageTotal[#]:0, hugePageFree[#]:0, hu
gePageSize[KB]:2048, swpIn[KB/s]:0, swpOut[KB/s]:0, pgIn[#/s]:1, pgOut[#/s]:59

[DEVICE]  ⬅
disks[#]:2, ioR[KB/s]:1, ioW[KB/s]:59, numIOs[#/s]:15

[NETWORK]  ⬅
nics[#]:2, rxTotal[KB/s]:18.04, txTotal[KB/s]:9.38, nicErrs[#/s]:0

[PROCESS]  ⬅
procs[#]:446, procsOnCpu[#]:1, procsBlocked[#]:0, rtProcs[#]:13, procsDState[#]:0, fds[#]:21056
, sysFdLimit[#]:6815744

[NFS]  ⬅
nfs[#]:07
```

Querying Process Aggregate

➢ Metrics aggregated by Process Groups (DB FG/DB BG/Other/Clusterware)

• ex. OTHER group is consuming ~96% (across 350 processes) and DB BG ~4%(across 75 processes) of total 29.56% CPU utilization.

• **ex : oclumon dumpnodeview local -procagg**

```
------------------------------------------------------
Node : den03ceb Clock : '2020-09-10 05.22.39'
------------------------------------------------------

PROCESS_AGGREGATE:
 category cpuWeight[%]  cpu[%]    rss[KB]  shMem[KB]  thrds[#]  fds[#]  processes[#]      sid
    OTHER        95.93   28.36    5147760      86344      1055    6495           350      N/A
    MDBBG         3.36    0.99   19986580    1084556        83    4638            75  -MGMTDB
    CLUST         0.70    0.21     117908     102372         4      10             1      N/A
    MDBFG         0.00    0.00    2253296     994304         7     234             7  -MGMTDB
```

Querying Process Metric Set

Processes ordered by CPU, RSS, IO and Open FD's

ex : oclumon dumpnodeview local -process

```
-----------------------------------------------------------------------
Node : den03ceb Clock : '2020-09-08 06.42.04'
-----------------------------------------------------------------------

PROCESS:
[CPU]
               name      pid   pri  cpu[%]   vmem[KB]    rss[KB]  shMem[KB]  fds[#]  thrds[#]  ioT[KB/sec]  state
             python    23673    20    8.34     195068      14412       6928       5         1         0.00      S
   ora_vktm_-MGMTDB    18841    -2    1.66    2442188      28104      24184      54         1         0.00      S
               java    19078    20    1.24    4813692     207476       5360     120        28         0.02      S
            osysmond   29857    20    1.22     385116     117744     102372      10         4         0.15      S
          orarootagent   4380    20    0.94    1433248      30308       5772     125        14         0.00      S


[RSS]
               name      pid   pri  cpu[%]   vmem[KB]    rss[KB]  shMem[KB]  fds[#]  thrds[#]  ioT[KB/sec]  state
   ora m000 -MGMTDB     1958    20    0.00    2525688    1155016    1088284      76         1         0.00      S
   ora_m002 -MGMTDB    19028    20    0.00    2558296    1125832    1056432      76         1         0.00      S
   ora_m003 -MGMTDB    10088    20    0.18    2525592    1003764     951680      76         1         0.00      S
   ora_m001 -MGMTDB    18654    20    0.00    2541848     950980     899164      75         1         0.00      S
      oracle-MGMTDB    30646    20    0.17    2464824     925180     916904      16         1         0.00      S


[IO]
               name      pid   pri  cpu[%]   vmem[KB]    rss[KB]  shMem[KB]  fds[#]  thrds[#]  ioT[KB/sec]  state
            osysmond   29857    20    1.22     385116     117744     102372      10         4         0.15      S
               rwhod    1447    20    0.19       6488         64          0       4         1         0.15      S
    ora_lgwr_-MGMTDB   18910    -2    0.00    2461940      41720      34688      62         1         0.14      S
        jbd2/vda1-8     533    20    0.00          0          0          0       2         1         0.07      S
    ora_ckpt_-MGMTDB   18916    20    0.18    2461940      85928      78996      74         1         0.05      S


[FD]
               name      pid   pri  cpu[%]   vmem[KB]    rss[KB]  shMem[KB]  fds[#]  thrds[#]  ioT[KB/sec]  state
           ohasd.bin    2431    20    0.57    2398124      77148      18492     300        60         0.00      S
            oraagent    4001    20    0.56    2323864      66408      19376     258        31         0.00      S
                crsd    3116    20    0.37    2425116      80548      18508     218        62         0.00      S
            osysmond   30461   -30    0.70    1756256     107308      34108     196        24         0.04      S
          orarootagent   2479    20    0.19    1698328      29176      12532     194        22         0.01      S
```

Querying Device and NIC Metric Set

➢ Devices details ordered by **service time**.

```
-------------------------------------------------------------------
Node : den03ceb Clock : '2020-09-08 08.36.29'
-------------------------------------------------------------------

DISK:
    name  ioR[KB/s]  ioW[KB/s]  numIOs[#/s]  qLen[#]  aWait[msec]  svcTm[msec]  util[%]              type
    vdb        1.80      46.90        12.00     0.00         0.00         0.43     0.55              DISK
   vda1        0.00     130.40        28.00     0.00         1.00         0.14     0.41         PARTITION
    vda        0.00     130.40        28.00     0.00         1.00         0.14     0.41              DISK
```

➢ Network interfaces ordered by **net transmission rate** .

ex : oclumon dumpnodeview local -nic

```
-------------------------------------------------------------------
Node : den03ceb Clock : '2020-09-09 23.48.24'
-------------------------------------------------------------------

NIC:
    name  rx[KB/s]  tx[KB/s]  total[KB/s]  rxErr[#/s]  txErr[#/s]  rxDscrd[#/s]  txDscrd[#/s]
    eth0      2.51     37.02        39.53           0           0             0             0
      lo      7.65      7.65        15.29           0           0             0             0
```

Querying CPU and File System Metric Set

➢ Individual CPU Core Details (ordered by usage)

```
-------------------------------------------------------------------------
Node : den03ceb Clock : '2020-09-08 08.47.59'
-------------------------------------------------------------------------

CPU:
    cpuId    usage[%]    system[%]      user[%]     nice[%]    ioWait[%]    steal[%]
        3       31.84       13.79        18.05        0.00        0.20        0.00
        2       31.28       13.29        17.99        0.00        0.00        0.00
        0       29.37       13.88        15.49        0.00        0.00        0.00
        1       28.01       12.67        15.33        0.00        0.20        0.00
```

➢ File System Details

ex : oclumon dumpnodeview local -filesystem

```
-------------------------------------------------------------------------
Node : den03ceb Clock : '2020-09-08 08.49.39'
-------------------------------------------------------------------------

FILESYSTEM:
    mount        type   total[KB]    used[KB]    avbl[KB]    used[%]    ifree[%]         tag
        /        ext4   51473888    33168200    15667916      68.00       86.00   GRID_HOME
```

AHF Insights (coming in 22.3)

AHF Insights - Summary AHF23.0.0.0

System State : **Stable** | System Type : Exadata | Time Range : 25-MAR-2022 08:50 to 25-MAR-2022 10:50 **(2 Hours)**

System Topology

1	**5**	**2**	**12**	**1**
Cluster	Databases	Database Servers	Storage Servers	RDMA Network Fabric Switch
GI Version : 21.3.0.0.0	**5 CDB(s) [5 PDB(s) / [5 open]]**	**X4-8**	**X5-2, X5-3**	**ROCE Switch**

Insights

8	**3**	**17**	**12**	**2**
Timeline	Operating System Issues	Best Practice Issues	System Change	Recommended Software
All Log & Metric events	**Memory, Network Issue**	**Health Score : 86**	**12 changes in 30 days**	**All Components**

2		****		
Management Server	RPM List	Database Parameters		
2 Uncleared Alerts	**List of RPMs**	**List of Database Parameters**		

ORACLE

Thank you

OGBEMEA Sep 2022

Sandesh Rao

VP AIOps for the Autonomous Database

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