Oracle *Recovery Manager* Tips and Tricks for On-Premises and Cloud Databases

CON6677

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ORACLE

Safe Harbor Statement

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Program Agenda

1 ▸ Recovery Manager History

2 ▸ RMAN New Features & Enhancements

3 ▸ RMAN and Data Deduplication

4 ▸ RMAN Cloud Module

5 ▸ Oracle Secure Backup 12.2

6 ▸ RMAN for Recovery Appliance , Intel Experience

Recovery Manager History

| Oracle 8, Oracle 8i, Oracle 9i **Circa 1997-2002**	Oracle 10g, Oracle 11g **Circa 2003-2012**	Oracle 12c **Today**
• Parallel Backups • DUPLICATE • Block Media Recovery • Automatic Control File & SPFILE Backup • CONFIGURE Persistent Settings • BACKUP BACKUPSET • And more …	• Fast Recovery Area • Fast Incremental Backups • Incrementally Updated Backups • SWITCH TO COPY • Offload Backups to Standby Database • And more …	• Table Level Recovery • Cross-Platform Backup & Recovery enhancements • Fast Active DUPLICATE • Fast Standby Database Synchronization • Multitenant Database Backup & Recovery • And more ..

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RMAN Beyond the Backup Utility

Cloning and Platform Migration

Data Guard

Backup to disk
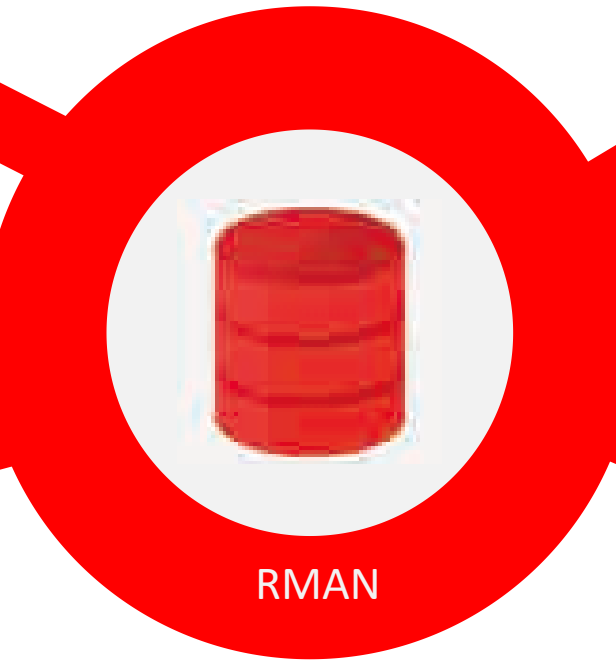
RMAN

Backup to cloud storage

Oracle Secure Backup or 3rd party backup applications

Oracle Zero Data Loss Recovery Appliance

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Oracle Database 18c: Key RMAN Benefits/Enhancements

CONTENT NOT AVAILABLE AT THIS TIME

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RMAN and Data Deduplication

- Hash-based deduplication solutions
  - Work well for generic files not so good for Oracle DBs
  - Single digit dedup ratios for RMAN backups
  - Long full backup winfows, slow restore (re-hydration)

- Incremental Merge-based solutions
  - Based on standard RMAN feature
  - Fast data access for recovery, but slow restore
  - Incremental forever-like backups, but DB server resources are used by merge process

- Oracle Recovery Appliance
  - True incremental forever – based on Oracle block changes
  - Minimal load on DB server – no full backup window and resources
  - Zero to Sub-Second RPO – real-time changes captured in backup via redo transport

Hash based deduplication solutions
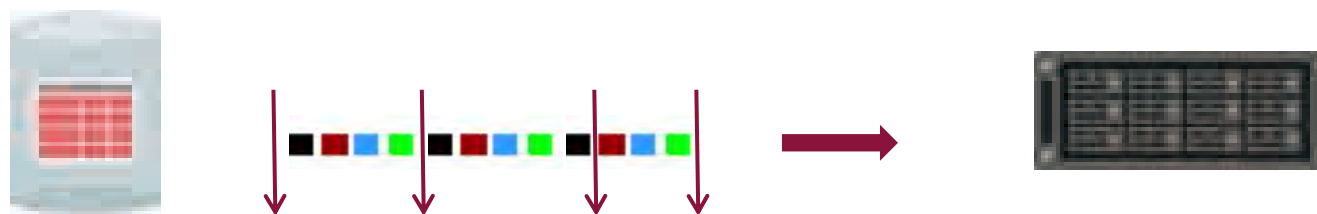
How they work

- Backup stream is divided in variable-length chunks

- Hashing algorithm is applied to chunks to calculate hash values

- Hash are stored in a database running on controller

- Hash database is checked to determine if chunk is unique or duplicate

- If duplicate, data are discarded and replaced with a pointer

- If unique, hash database is updated

- Software compression is applied and data stored

RMAN implications

- Do not use RMAN encryption or compression

- Use FILESPERSET=1

- Whole data is read from disk

- Whole data is transferred over network (target side dedupe) or DB resources are used for deduplication job (source side dedupe)

- Incremental and archived logs provide very poor deduplication ratios (mostly unique data)

Incremental merge based solutions
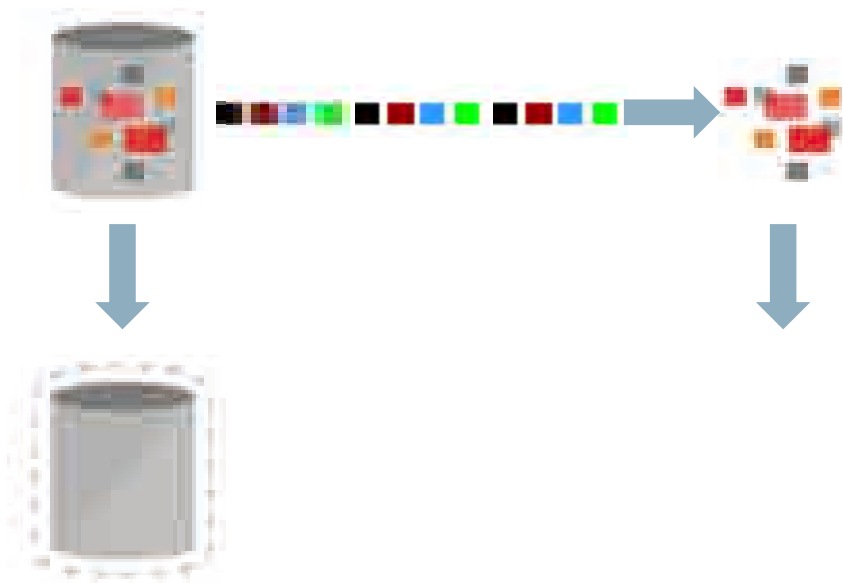

```
RUN {
RECOVER COPY OF DATABASE WITH TAG 'incr_update';
BACKUP INCREMENTAL LEVEL 1 FOR RECOVER OF COPY WITH TAG 'incr_update'
DATABASE;
}
```

- Incremental Level 0 image copy backup taken to NFS share

- Incremental Level 1 taken to an alternate location

- Snapshot of NFS share created to preserve original image copy

- Incrementals applied to roll forward image copy to the same SCN as incremental level 1

- Uses DB server resources to apply incrementals to image copy

- Plus, storage operations involved to restore older snapshot and coordinate with RMAN recovery

- Net-net: this is an RMAN feature, not unique in storage products

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Zero Data Loss Recovery Appliance

Created by Oracle Database team to protect your Oracle databases

- Unique, deep database understanding
- Real Incremental Forever
- Designed for DBA and application owners
- Ensures rapid database recovery to any point-in-time
- Know recovery status - at all times
- Backup only changed DB blocks
- Reduce Clients Load during backups

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Oracle Database Backup Cloud Service

Oracle Database Backup Cloud Module

Database Backup

ORACLE CLOUD

Oracle Database Cloud Backup Module
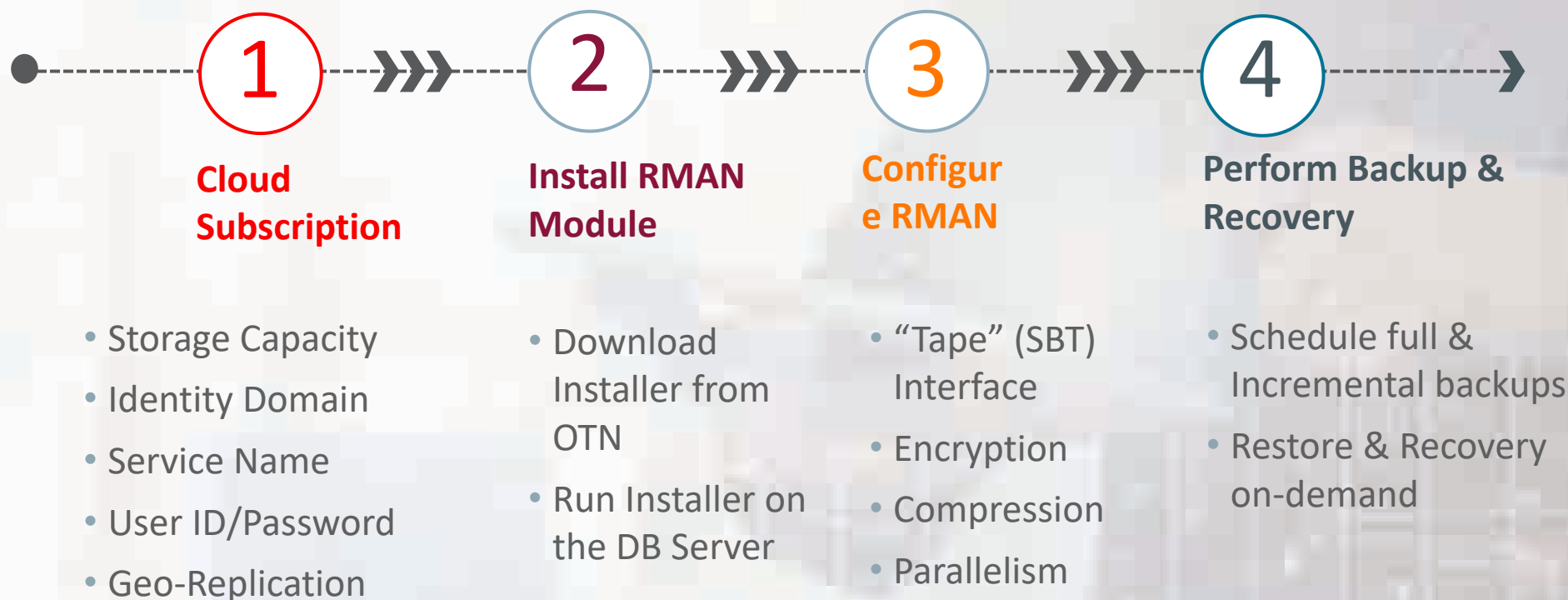
Oracle RMAN

Customer Data Center
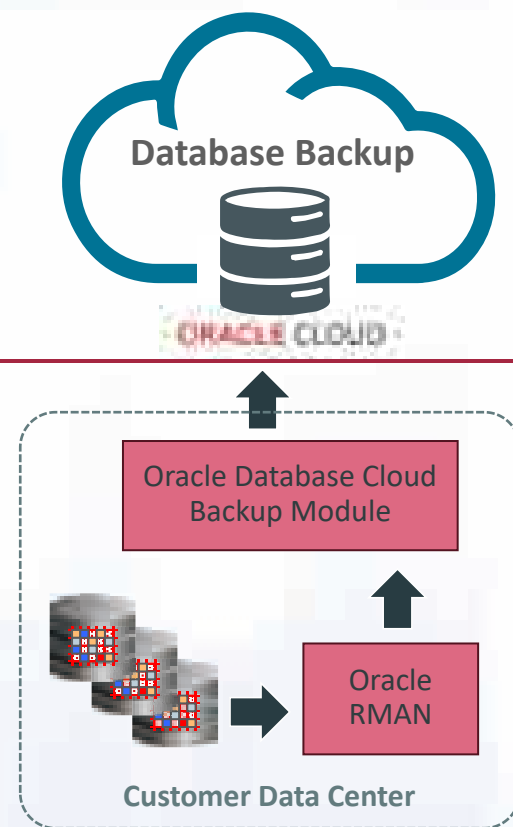
- Cloud Side
  - Cloud Object Storage

- Client Side
  - RMAN driven backup/recovery via SBT Module
  - RMAN encryption* for backups is enforced (mandatory)
  - RMAN compression* for optimal transfers (optional)
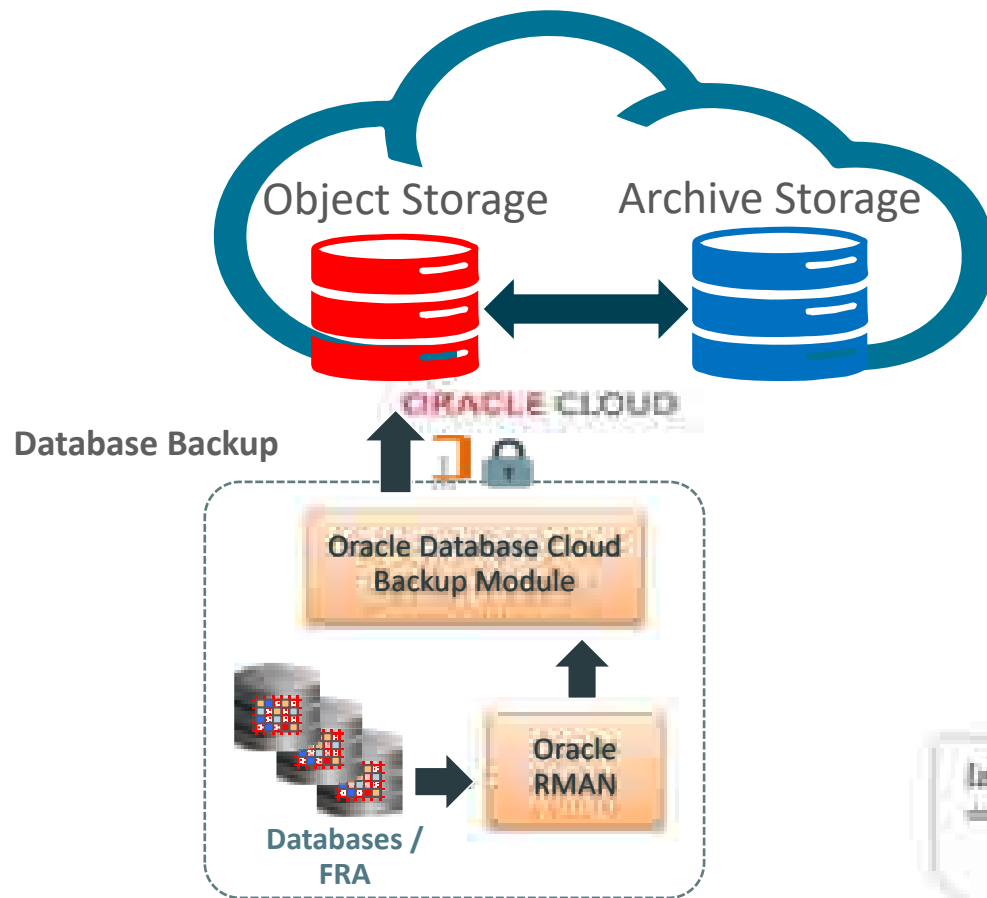 - Data is securely transmitted to the cloud over HTTPS

* RMAN Compression & RMAN Encryption included with subscription

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Backup Service: For your On-Premises Database Backups

Simple 4-Step Process

1 Cloud Subscription

2 Install RMAN Module

3 Configure RMAN

4 Perform Backup & Recovery

- Storage Capacity
- Identity Domain
- Service Name
- User ID/Password
- Geo-Replication

- Download Installer from OTN
- Run Installer on the DB Server

- "Tape" (SBT) Interface
- Encryption
- Compression
- Parallelism

- Schedule full & Incremental backups
- Restore & Recovery on-demand

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Introducing: Archive Storage Support

Archive Storage is for long term retention, infrequently accessed data.

4 hours delay in accessing archived data

Archive Storage is less expensive than Object Storage

RMAN backs up to an archive or tiering container, files are moved to Archive Storage based on policy

RMAN RESTORE PREVIEW command is used to determine if backup pieces are available for restore or must be recalled from Archive Storage

Cloud Backup Best Practices

- Bandwidth requirements
  - Start with your RTO and RPO requirements and consider:
    - Full DB backupset size, daily change rate, archivelog production, compressibility of your data
    - Use a bandwidth calculator

- Compression
  - Use LOW or MEDIUM compression, HIGH saves more space but it is very CPU intensive.

- # Channels, section size
  - Using multiple channels in parallel may improve your backup speed
  - Start with 4 channels and test increasing until you reach the cap
  - Adapt section size accordingly (largest single datafile /(number of channels * 2))

- Use dual backup strategies (to local and cloud targets) to reduce RTO

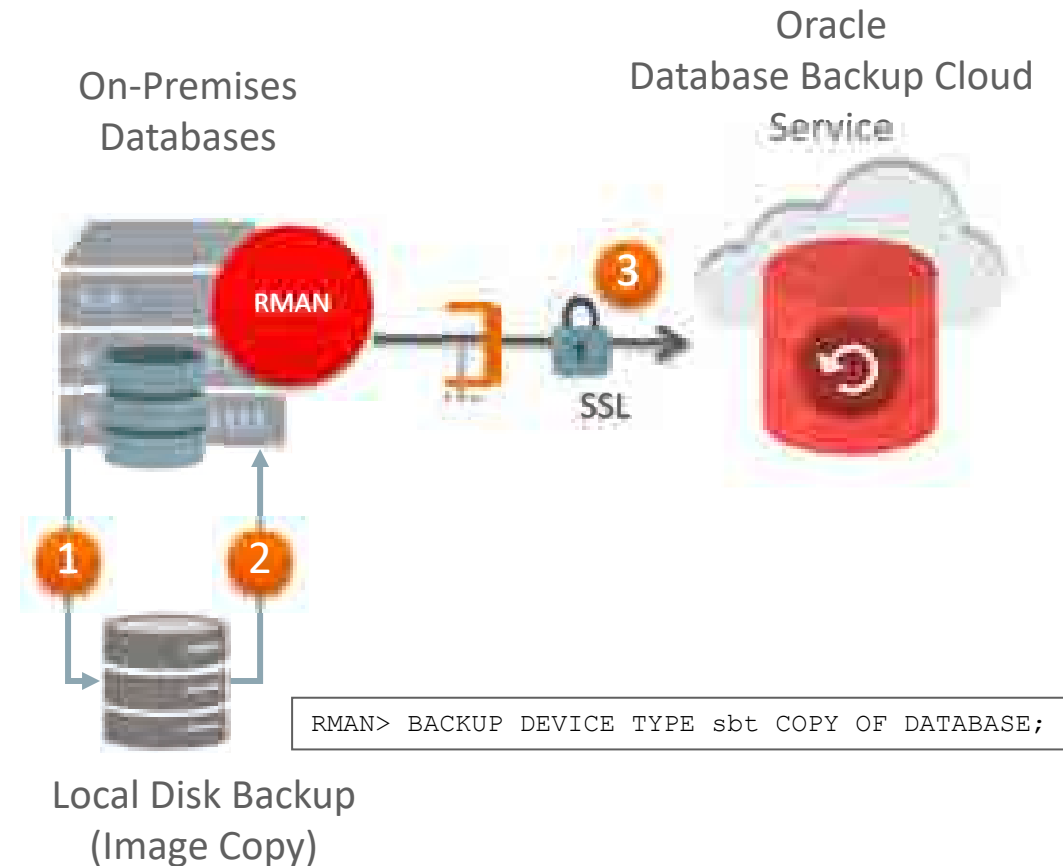- Use Bulk Data Transfer service for workloads lift and shift

Dual Backup Strategies: Local Image Copy

- **Scenario**
  - A number of business critical production databases
  - Wants to store recent backups on local disk and older backups in the cloud for long term retention
  - Database server is connected to the internet
  - Shorter RTO for near-term, longer RTO for older data
  - Retention
    - Local disk: 1 month, Cloud: years

- **Solution**
  - Do RMAN image copy backups to local disk
  - Backup those image copies to the cloud using RMAN from the same DB server

On-Premises Databases

Oracle Database Backup Cloud Service

RMAN

SSL

3

1   2

```
RMAN> BACKUP DEVICE TYPE sbt COPY OF DATABASE;
```

Local Disk Backup (Image Copy)

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Dual Backup Strategy

Backing to a local SBT destination and cloud with separate Full/Incremental patterns.

- RMAN **backup backupset** command cannot be used because of different SBT libraries
- On the Weekends

  — Run the local weekly L0

  ```
  set echo on
  run {
  allocate channel c1 device type sbt parms "SBT_LIBRARY=<library>,
  ENV=(<envs>)";
  backup incremental level 0 tag LOCAL_TGT database format '%d_%U';
  }
  ```

  — Run the cloud L0

  ```
  set echo on
  run {
  allocate channel c1 device type sbt parms "SBT_LIBRARY=<libopc>,
  ENV=(<envs>)";
  backup incremental level 0 tag CLOUD_TGT database format '%d_%U';
  }
  ```

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Dual Backup Strategy

Backing to a local SBT destination and cloud with separate Full/Incremental patterns.

- On the Weekdays
  - Run the local daily incremental

```
set echo on
run {
allocate channel c1 device type sbt parms "SBT_LIBRARY=<library>, ENV=(<envs>)";
backup incremental level 1 for recover of tag LOCAL_TGT database format '%d_%U';
}
```

  - Run the cloud incremental

```
set echo on
run {
allocate channel c1 device type sbt parms "SBT_LIBRARY=<libopc>, ENV=(<envs>)";
backup incremental level 1 for recover of tag CLOUD_TGT database format '%d_%U';
}
```

Dual Bakcup Strategy

- On Weekends and Weekdays
  - Run the Archived Logs backup script

```
backup device type disk archivelog all tag ARCHIVE_DISK delete all input;

run {
allocate channel c1 device type sbt parms "SBT_LIBRARY=<library>, ENV=(<envs>)";
backup backupset from tag ARCHIVE_DISK force tag ARCHIVE_LOCAL format '%d_%U';
}

run {
allocate channel c1 device type sbt FORMAT '%d_%U' PARMS "SBT_LIBRARY=<libopc>,
ENV=(<envs>)";
backup backupset from tag ARCHIVE_DISK force tag ARCHIVE_CLOUD format '%d_%U';
}

delete backup tag ARCHIVE_DISK;
```

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Lift and Shift Using Bulk Upload

Linux x64 only

- Upload existing DISK backups to the Cloud Storage
  - Either using FTCLI, REST APIs or the Storage Bulk Transfer Service

- Start a Cloud DB instance configured to access the target container and use the RMAN export command to "export" the backup pieces

```
rman target /
RMAN> startup force nomount;
run {
    allocate channel t1 device type sbt parms='SBT_LIBRARY=libopc.so';
    send channel t1 '
     export backuppiece /import/o1_mf_nnndf_TAG20160105T155102_c8roq9hh_.bkp;
     export backuppiece /import/c-4078121813-20160105-02;
    ';
}
```

- Export command will create the metadata needed by RMAN to restore those pieces from object storage

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OSB 12.2 new features

- Serves as File System Backup software and Media Manager for RMAN
  - Supports Tape and Disk Pool devices

- Introducing support for Oracle Cloud Storage and Archive
  - Now supports Oracle Cloud Storage as a backup target
  - Object Storage and Archive Storage
  - All cloud backups encrypted, keys stored locally

- New Staging Devices
  - Support staging to disk, tape or cloud
  - Scheduled Rule-based migration or duplication
  - Independent retention time

- Policy Based Compression
  - Per host or per job, 4 levels HIGH, MEDIUM, LOW, BASIC

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Data Protection WITH recovery manager

Gagan Singh

Sr. Database Architect

Technology and Manufacturing Group (TMG)

Intel Corporation

Agenda

- INTEL Corporation – Introduction
- Database Environment Summary
- Legacy Backup Overview
- Challenges
- Recovery Manager – Use Cases
- ZDLRA integration with RMAN
- Recovery Manager with ZDLRA – Key advantages

History of Intel

- 1968: Intel is founded by Robert Noyce and Gordon Moore

- 1971: World's first microprocessor

- Now: Innovation that expands the reach and promise of computing
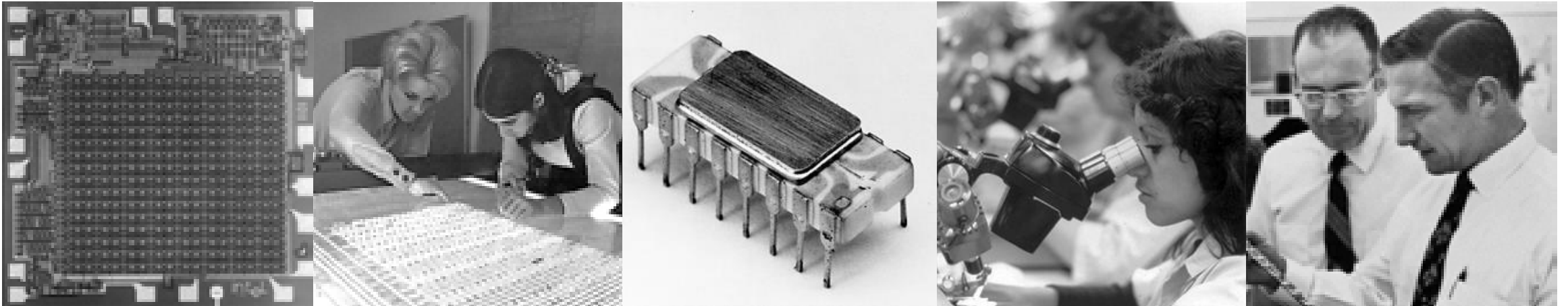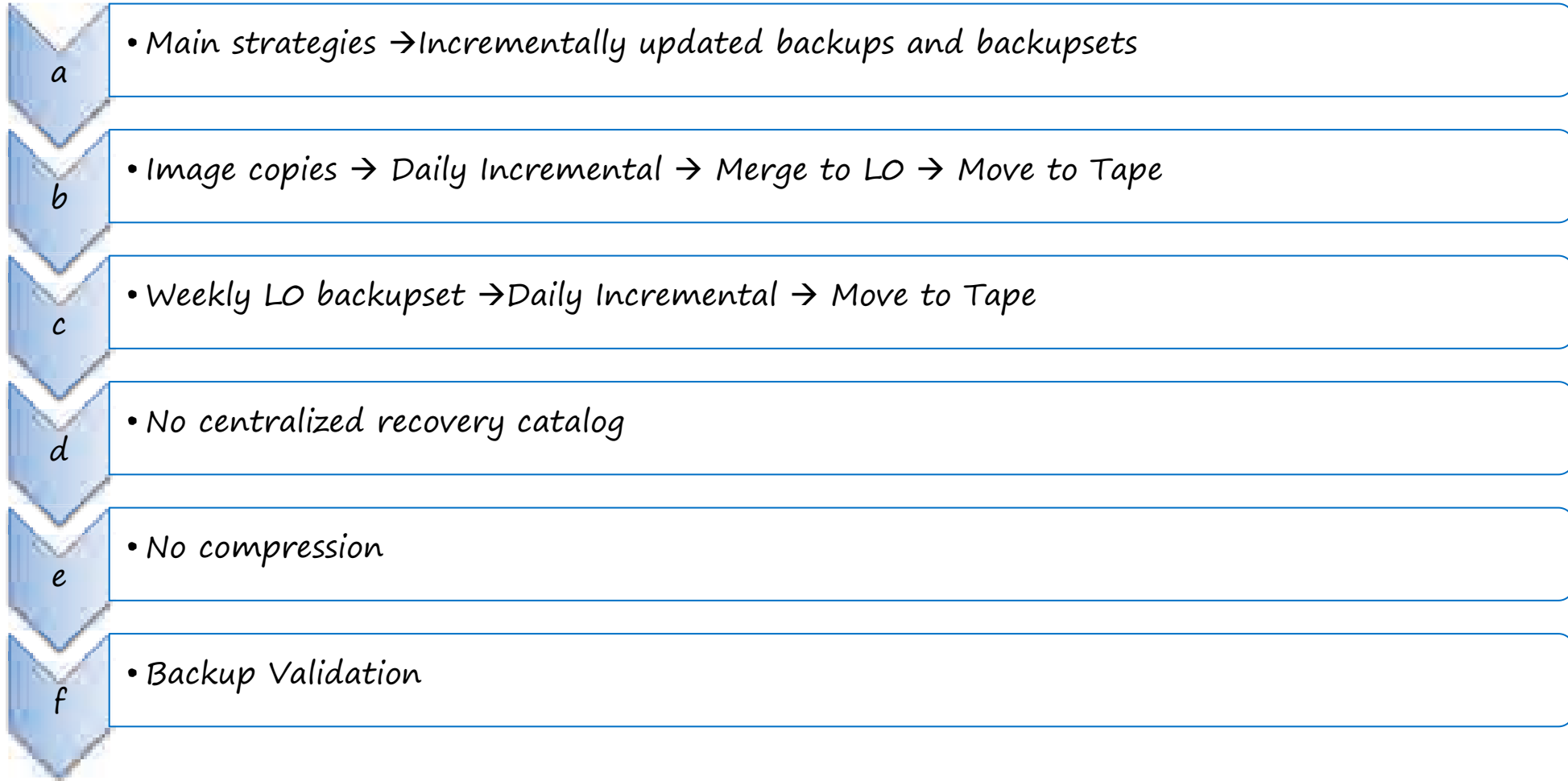
Intel Corporation

- Leading Manufacturer of Computer, Networking Communications Products, Memory solutions, Security & Programmable solutions.

- $59.38B in Annual Revenues

- Over 100K Employees Globally

THE ONLY THING MORE AMAZING THAN OUR TECHNOLOGY IS WHAT THE WORLD DOES WITH IT

Database Environment Summary

- Automated manufacturing with complex integrated systems.

- Goals include –Yield analysis, process improvement, failure mode analysis and test time reduction.

- Database sizes ranging from few GB's to ~350 TB.

- Mix of Oracle Engineered systems and other vendors

- 24 x 7 uptime.

- Monitoring and Availability is key.

- Strict reporting SLA's.

Legacy Backup Overview

a
- Main strategies →Incrementally updated backups and backupsets

b
- Image copies → Daily Incremental → Merge to LO → Move to Tape

c
- Weekly LO backupset →Daily Incremental → Move to Tape

d
- No centralized recovery catalog

e
- No compression

f
- Backup Validation

Challenges

- Allocate equal storage for backups on Tier 1 SAN
- Several operational issues managing backups
  - Validation taking longer and resource intensive
  - Data movement to SBT added another layer of complexity for VLDBs
- Resource impact
  - Prolonged Server resource utilization
  - I/O impacts on Tier 1 SAN when writing backups to disks
- Restores involved multiple steps and archive log management.
- Inconsistent scripts/backup types
- Multi vendor footprint – Challenges during troubleshooting.

Recovery Manager – Use Cases

- Leverage BCT
- Validation: restore database validate, restore database preview
- Data Recover Advisor
- Duplicate Database : Enhanced in12c. Clone Database, Build STANDBY, Migrate Database (cross platform), Migrate Cross Endian with TTS.
- For VLDBs Convert Older partitions to 'Read ONLY'
- Uniform secure configuration: Store RMAN scripts in catalog
- Transparent to Dataguard role changes.
  - Time and resource saving through 'restore …… from service' feature in 12c
- Use of Multi Section : 12c → Supported with Incremental backups and image copies.

ZDLRA integration with RMAN

- ZDLRA: Leverage different protection policies →''Recovery Window'' is important
- ZDLRA: Backups : Filesperset 1 for datafiles | maxpiecesize is not supported | as ZDLRA uses this value on restores
- ZDLRA: EM integration reduces operational overhead
- ZDLRA: Do not make any changes to Recovery Appliance servers
- ZDLRA: System Activity Script (Doc ID 2275176.1)
- Backup Strategy with ZDLRA :

One time Level 0 (backupset) → Enable Redo Shipping (optional) → Daily Incremental
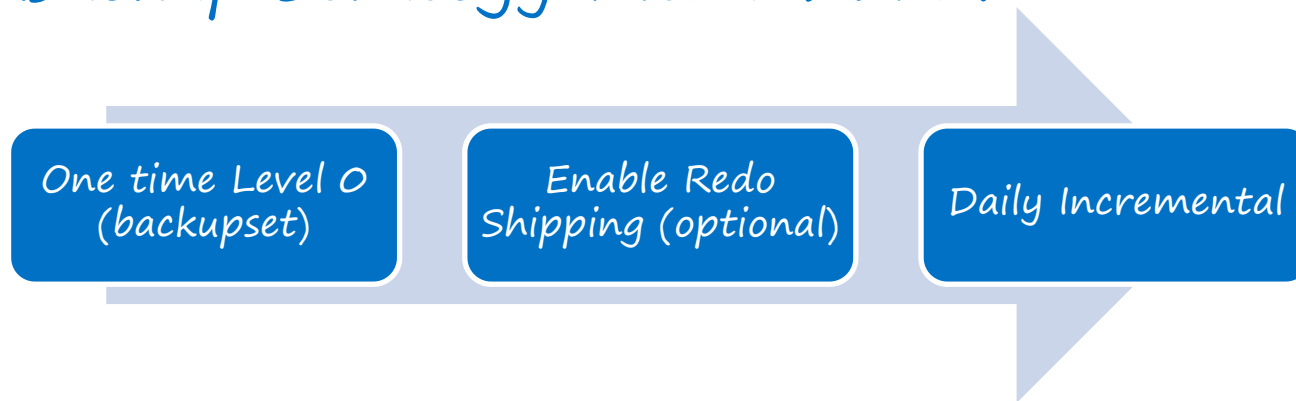
Recovery Manager with ZDLRA – Key advantages

- Reduce resource load on target(protected) DBs.
- Storage saving through compression on ZDLRA layer.
- Uniform Backup Environment: Single backup strategy.
- Flexible Backup Retention: Protection Policies, Recovery Windows.
- Reduce operational overhead: Reporting and Monitoring through Enterprise Manager
- Reliability, Availability & Performance: Hosted on Exadata HW
- Backup – Better RPO and RTO : Updated Level 0 restores
- Reduce vendor footprint.

intel

Where To Go Next?

- Zero Data Loss Recovery Appliance: The World's Best Database Protection
  - Tim Chien, Today at 4:30pm, Moscone West 3006

- Zero Data Loss Recovery Appliance: Deep Dive and Best Practices from Development
  Kelly Smith/Jony Safi, Wednesday at 1:00pm, Moscone West 3006

- Maximum Availability Architecture Best Practices and Techniques for Oracle Cloud
  - Sridhar Ranganathan, Wednesday at 11:00am, Moscone West 3006

- Maximum Availability Architecture Best Practices: Oracle Database 18c
  - Mike Smith, Tuesday at 5:45pm, Moscone West 3006

Stay Informed After OpenWorld

Twitter: @OracleZDLRA

LinkedIn: Oracle IT Infrastructure group

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Note: The speaker notes for this slide include instructions for when to use Safe Harbor Statement slides.
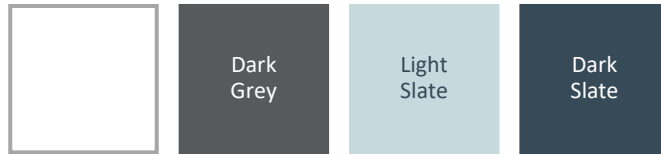
Tip! Remember to remove this text box.

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Integrated Cloud
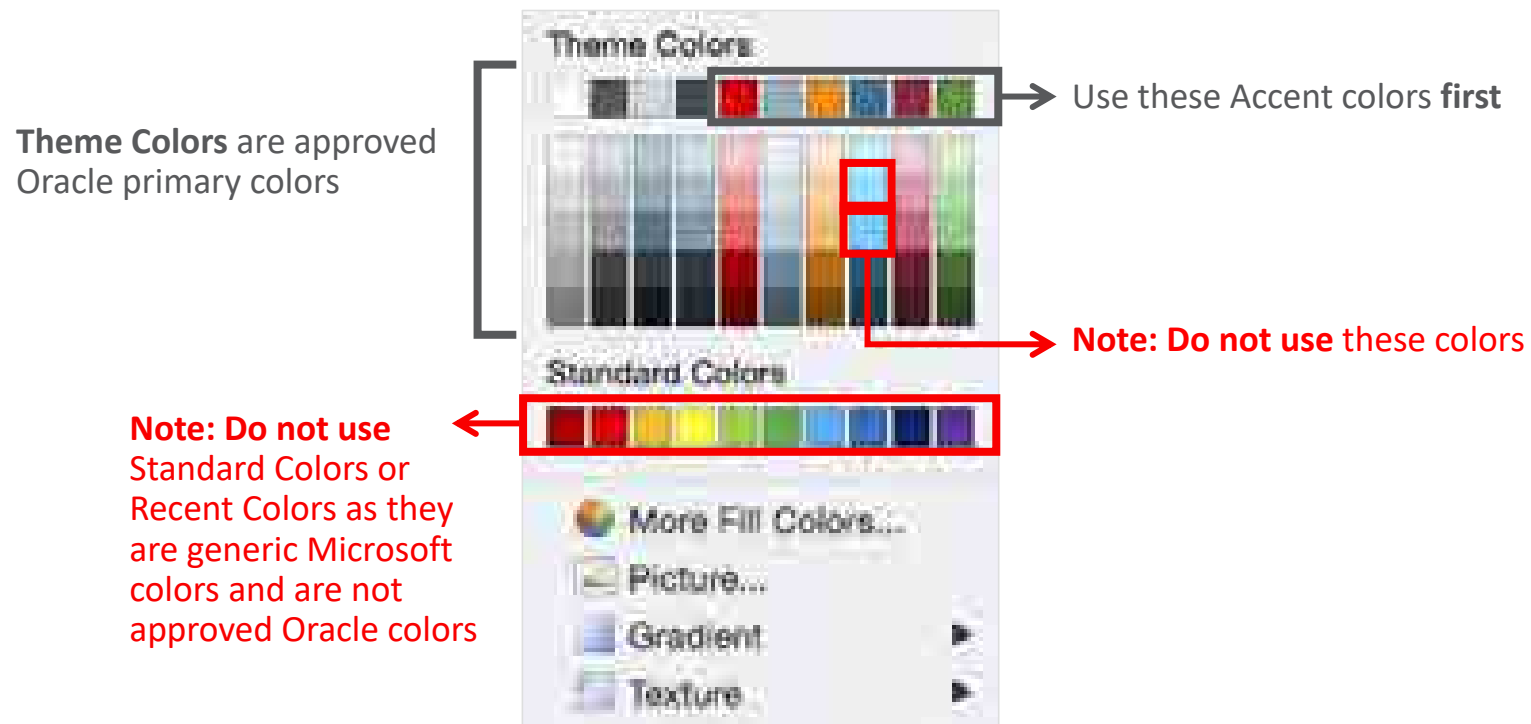Applications & Platform Services

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Oracle Color Palette

Lights/Darks

	Dark Grey	Light Slate	Dark Slate

Accents and default chart color order

Oracle Red	Oracle Slate	Oracle Orange	Oracle Blue	Oracle Burgundy	Oracle Green

Note: Colors used in this PPT template have been optimized specifically for use in PowerPoint, and they intentionally vary from the master brand RGB color values. For further RGB color guidance for use beyond PowerPoint, please reference the Oracle Brand Guidelines.
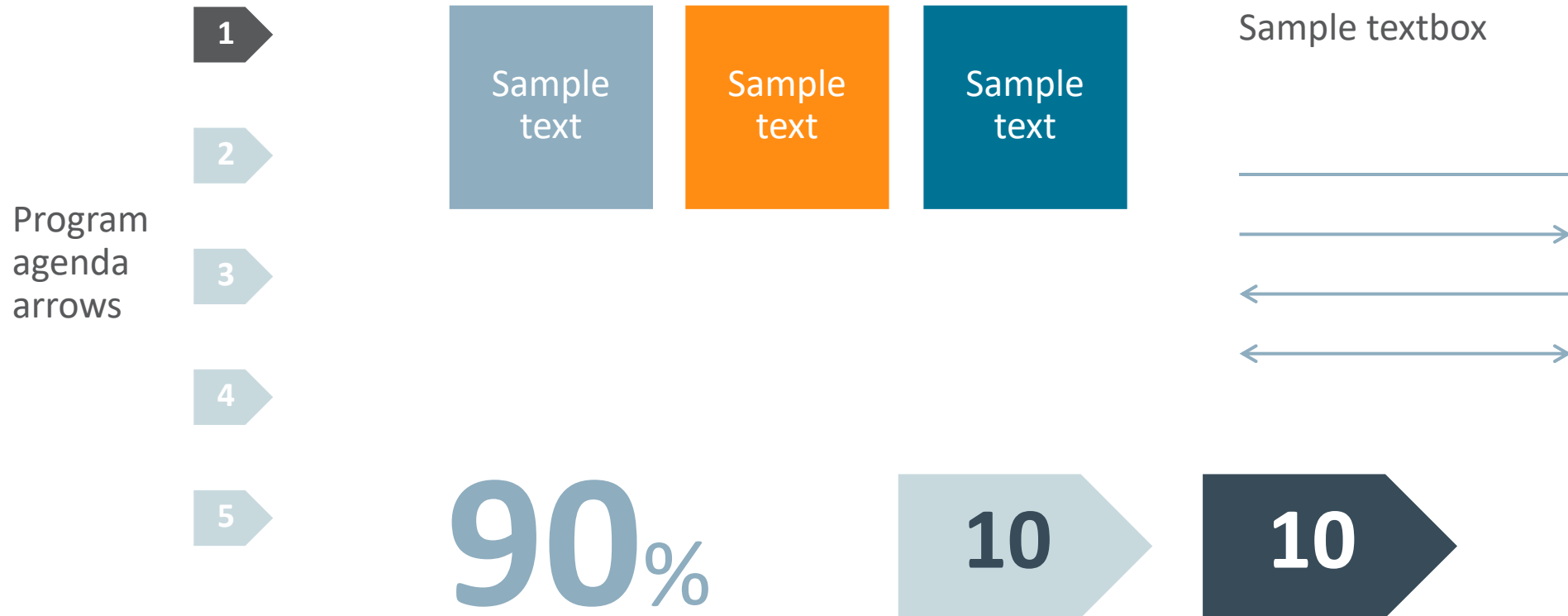
http://my.oracle.com/site/mktg/creative/Resources/BrandingGuidelines/cnt2346120.pdf

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Theme Colors

Theme Colors are approved Oracle primary colors

Use these Accent colors **first**

Note: Do not use these colors

Note: Do not use Standard Colors or Recent Colors as they are generic Microsoft colors and are not approved Oracle colors

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Graphic Shapes: Premade sample shapes to copy and paste for greater ease of use

Sample subtitle—copy and paste as needed

1

2

Program agenda arrows

3

4

5

Sample text

Sample text

Sample text

Sample textbox

90%

10

10

Text and Background Contrast

Use **White** text over dark backgrounds and **Text 1** or **Text 2** over light backgrounds.

Oracle Color Palette

	Background 2	Accent 2	Accent 3	Accent 4	Accent 5	Accent 6
	Text 1 / Text 2	White	White	White	White	White
	Text 2	Text 1 / Text 2	Text 1 / Text 2	Text 1 / Text 2	Text 1 / Text 2	Text 1 / Text 2
	Text 2	Text 1 / Text 2	Text 1 / Text 2	N/A	Text 2	Text 2
	White	Text 1 / Text 2	Text 1 / Text 2	N/A	White	Text 2
	White	White	White	White	White	White
	White	White	White	White	White	White

Oracle Cloud Visualizations

**The following master assets were developed for Oracle Cloud Marketing.
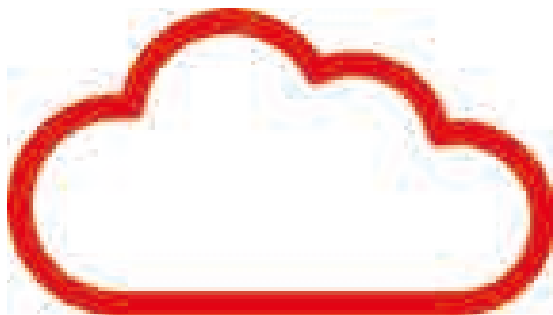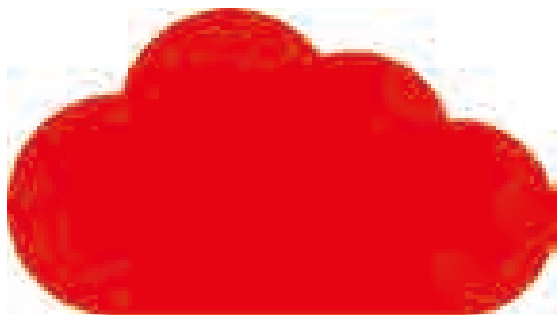Use these visualizations when discussing Oracle Cloud topics.**

Master Cloud Campaign

Applications. Platform. Infrastructure.

Cloud Icons

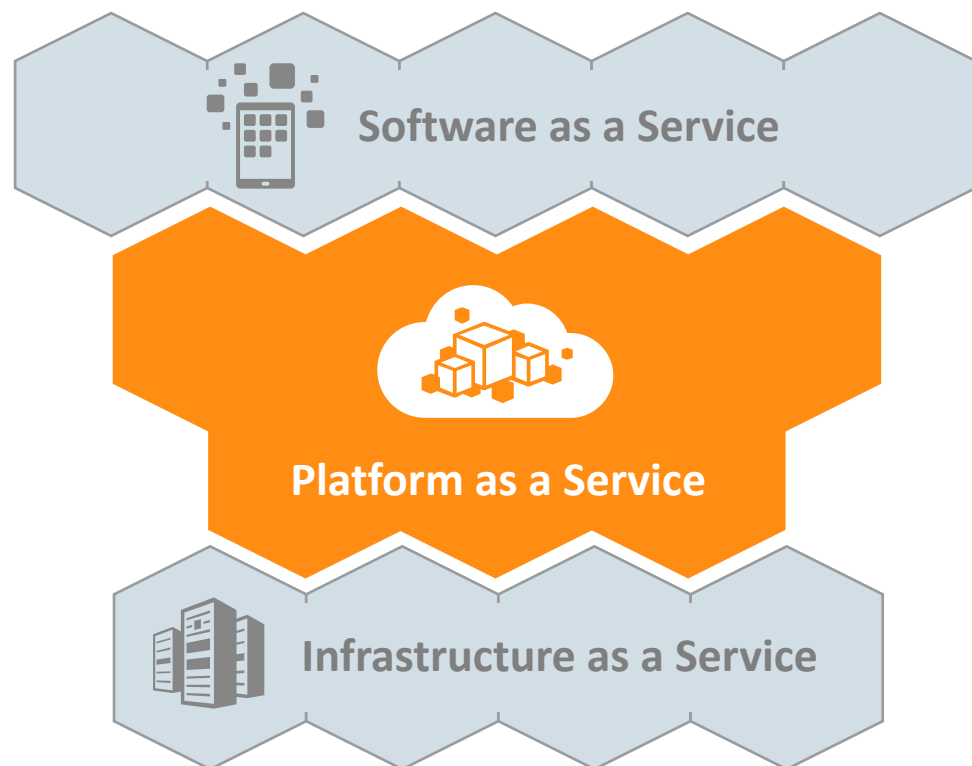Cloud   Cloud Outline   Cloud Detailed   Oracle Cloud Services

Oracle Cloud Platform & Oracle Cloud Infrastructure

Visualizations

Month Day, 2017

Industry's Most Comprehensive Cloud Platform Strategy

Software as a Service

Platform as a Service

Infrastructure as a Service

Bring Oracle's leading database and middleware technology software to customers and partners anywhere in the world through the cloud.

# Broad, Deep and Integrated Cloud Platform Capabilities

ORACLE CLOUD
PLATFORM

BUSINESS ANALYTICS

CONTENT AND PROCESS

MOBILE

SYSTEMS MANAGEMENT

INTEGRATION

DATA MANAGEMENT

APPLICATION DEVELOPMENT

ORACLE

Cloud Platform Services for All Enterprise Personas

ORACLE CLOUD
PLATFORM

Why Oracle Cloud IaaS?

Software as a Service

Platform as a Service

Infrastructure as a Service
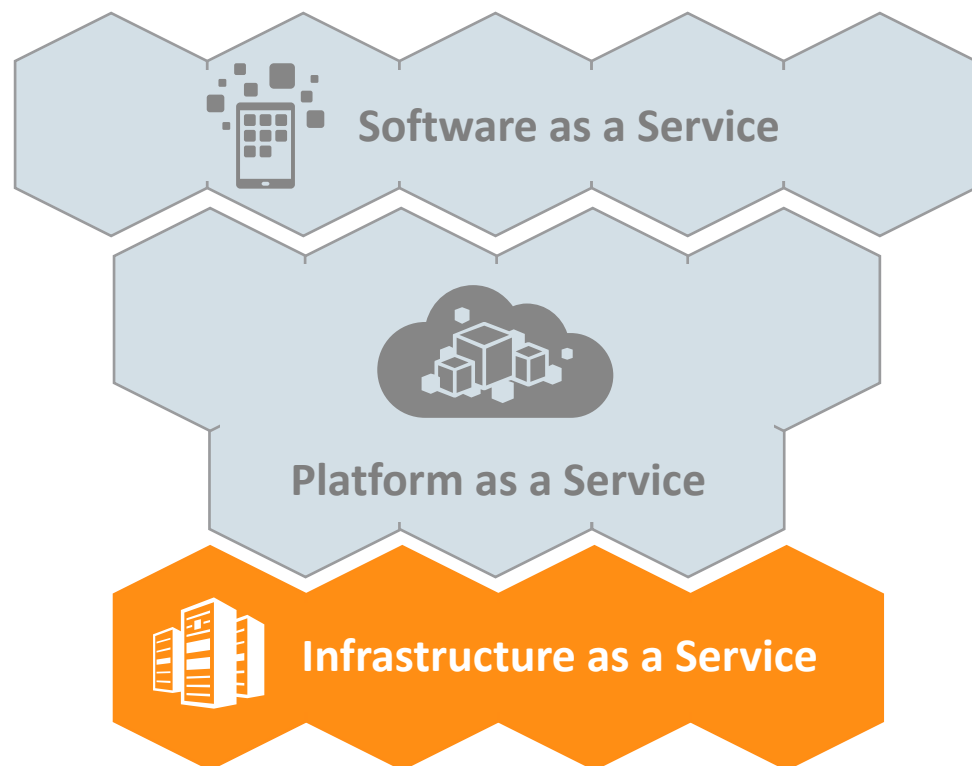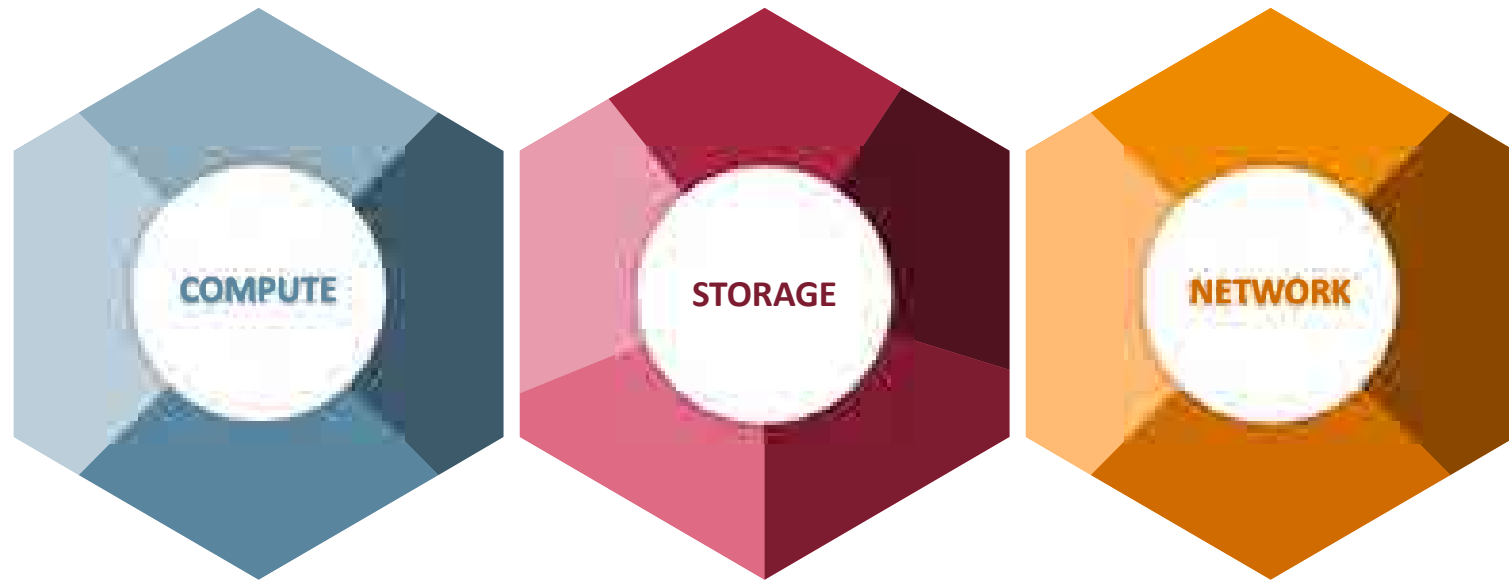
Oracle Cloud IaaS offers a comprehensive set of integrated, subscription-based infrastructure services that enable businesses to run any workload in an enterprise-grade cloud managed, hosted, and supported by Oracle.

ORACLE

Oracle Cloud Infrastructure

ORACLE CLOUD
INFRASTRUCTURE

COMPUTE

STORAGE

NETWORK

ORACLE

Oracle Cloud Infrastructure for Developers & Operations
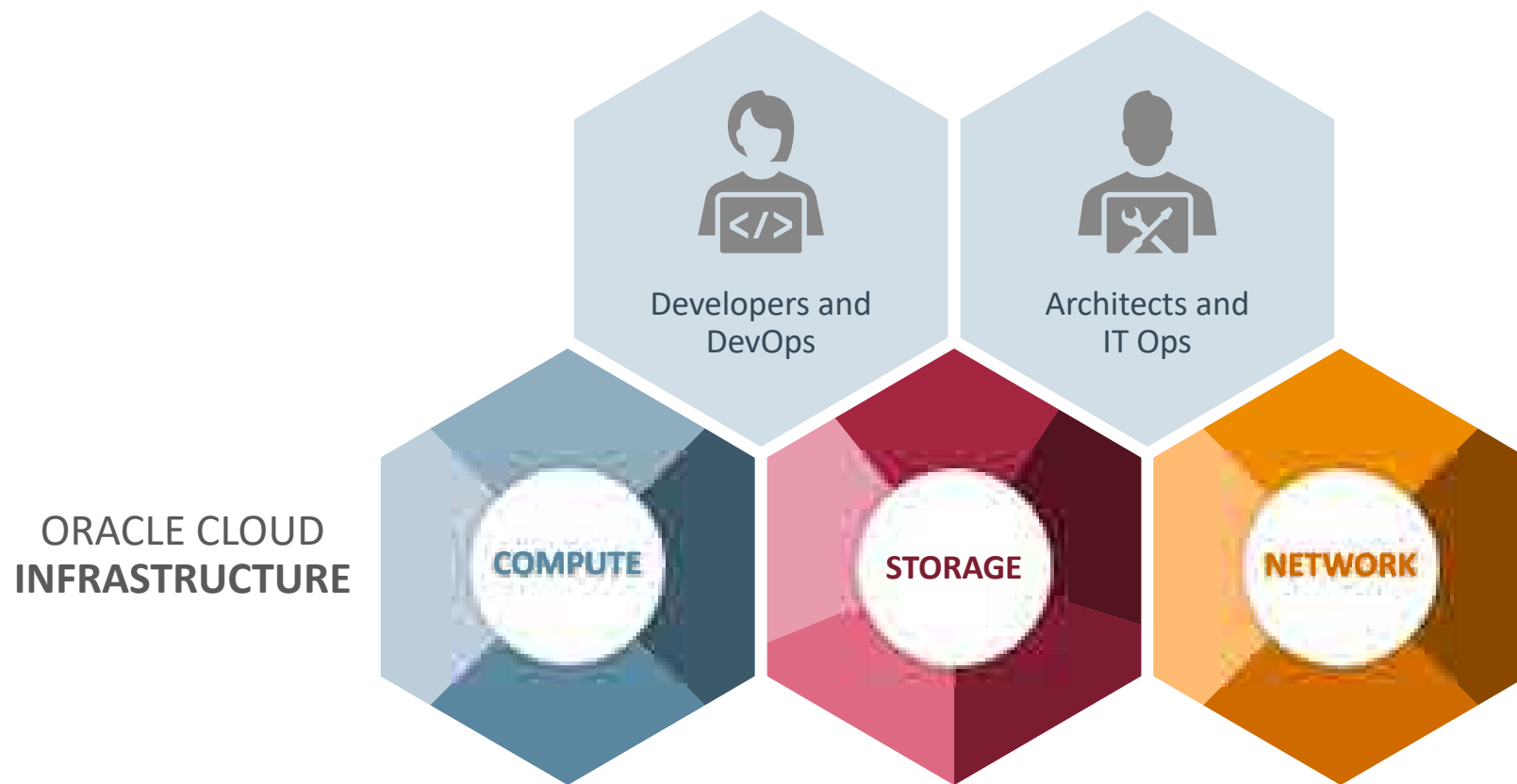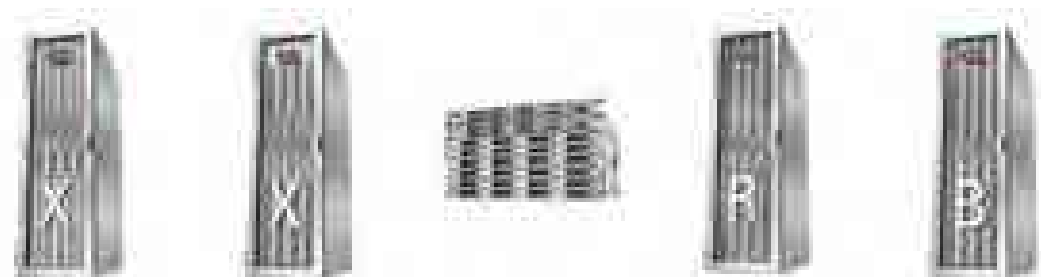
Oracle Product Stack

Additional Resources

Oracle Brand Photo Collection

my.oracle.com/site/mktg/creative/Graphics/Photography/index.html

Oracle Corporate Hardware Photography

my.oracle.com/site/mktg/creative/Graphics/Photography/index.html

Personas_Developer-F   Mobile_Application   Business_Big-Data

Oracle Brand Icon Collection

my.oracle.com/site/mktg/creative/Graphics/Icons/index.html

New Logo Style   Legacy Logo Style

Oracle Brand Creative is launching a new corporate logo style and will be updating all relevant logos through FY18. During the transition, there will be a period of coexistence where logos will be available in either style. Please check Oracle Media Manager for the most current logo updates that are relevant to your specific marketing needs.

Oracle Corporate Logos

my.oracle.com/site/mktg/creative/Logos/index.html