数据技术嘉年华

// Data Technology Carnival

开源 · 融合 · 数智化 — 引领数据技术发展 释放数据要素价值

数据技术嘉年华

Oracle 23c创新技术与SQL增强

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介绍

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□ ITPUB数据库管理区版主

□ 参与编写《Oracle数据库性能优化》、《Oracle DBA手记》、《Oracle DBA手记3》和《Oracle性能优化与诊断案例精选》

□ 二十二年的一线DBA经验

□ 个人BLOG中积累了2500篇原创技术文章

□ 云和恩墨联合创始人兼CTO

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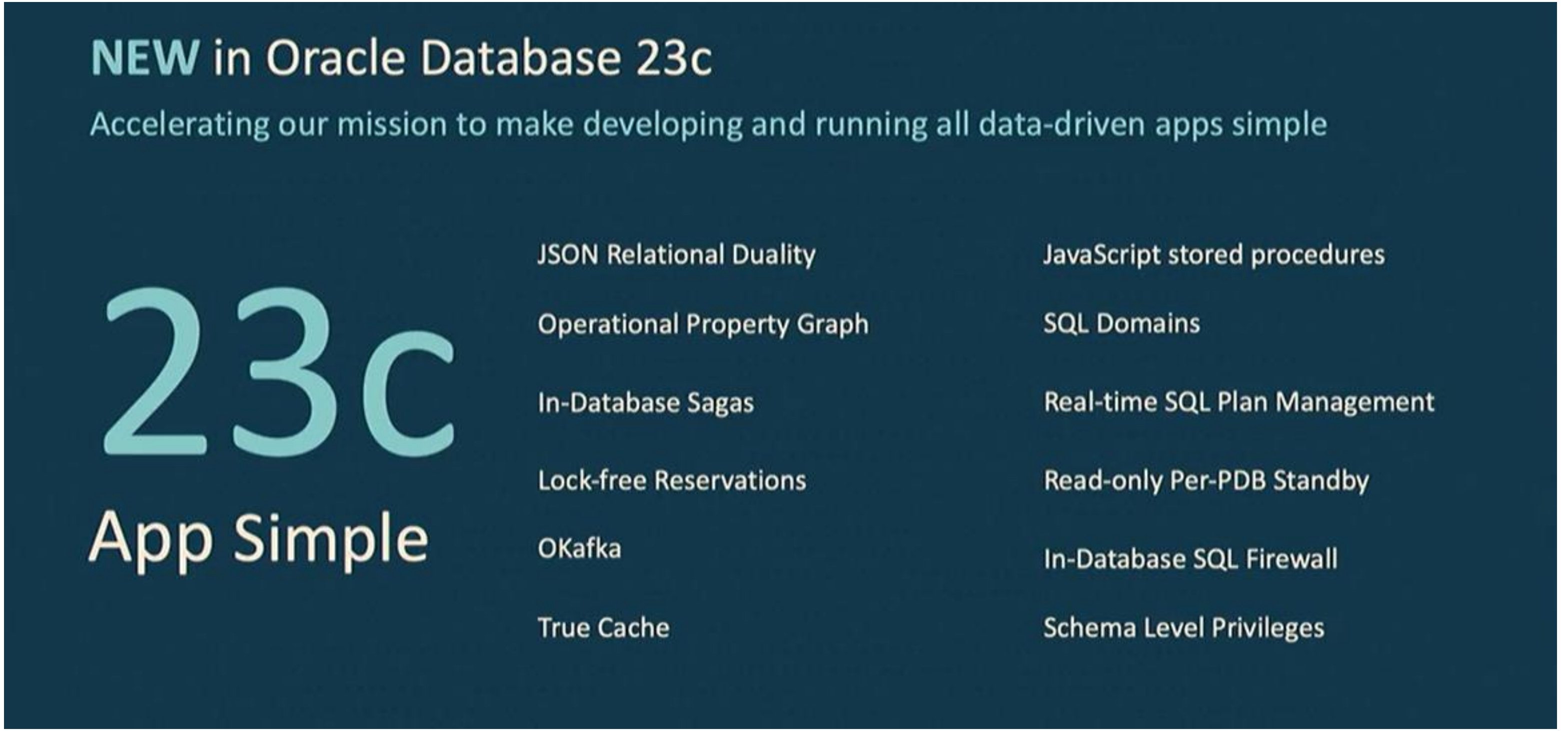
Oracle23c 概述

- 23c的主要目标：应用简化



NEW in Oracle Database 23c

Accelerating our mission to make developing and running all data-driven apps simple

23c

App Simple

JSON Relational Duality

Operational Property Graph

In-Database Sagas

Lock-free Reservations

OKafka

True Cache

JavaScript stored procedures

SQL Domains

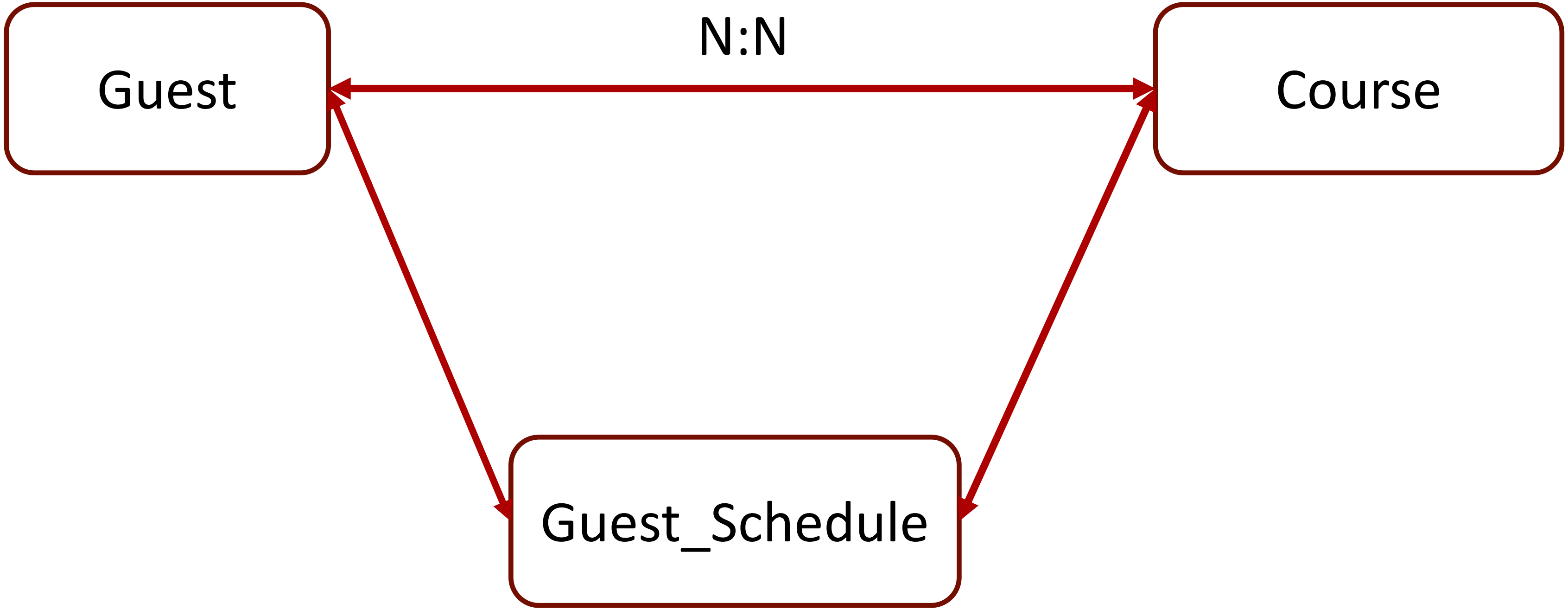
Real-time SQL Plan Management

Read-only Per-PDB Standby

In-Database SQL Firewall

Schema Level Privileges

Oracle23c创新特性：JSON RELATIONAL DUALITY



Oracle23c创新特性：JSON RELATIONAL DUALITY

```
SQL> CREATE TABLE GUEST
  2  (G_ID NUMBER GENERATED BY DEFAULT ON NULL AS IDENTITY ,
  3  NAME VARCHAR2(30),
  4  CONSTRAINT PK_STUDENT PRIMARY KEY (G_ID));

Table created.

SQL> CREATE TABLE COURSE
  2  (C_ID NUMBER GENERATED BY DEFAULT ON NULL AS IDENTITY,
  3  NAME VARCHAR2(60),
  4  TIME VARCHAR2(30),
  5  ROOM VARCHAR2(20),
  6  TEACHER_NAME VARCHAR2(30),
  7  CONSTRAINT PK_COURSE PRIMARY KEY (C_ID));

Table created.

SQL> CREATE TABLE GUEST_SCHEDULE
  2  (SCHED_ID NUMBER GENERATED BY DEFAULT ON NULL AS IDENTITY,
  3  G_ID NUMBER, C_ID NUMBER,
  4  CONSTRAINT PK_STUD_SCHED PRIMARY KEY (SCHED_ID),
  5  CONSTRAINT FK_GUEST  FOREIGN KEY (G_ID) REFERENCES GUEST(G_ID),
  6  CONSTRAINT FK_COURSE FOREIGN KEY (C_ID) REFERENCES COURSE(C_ID));

Table created.
```

Oracle23c创新特性：JSON RELATIONAL DUALITY

```
SQL> CREATE OR REPLACE JSON DUALITY VIEW GUEST_DV AS
  2  SELECT JSON {
  3     'GUEST_ID'  : G.G_ID,
  4     'GUEST_NAME': G.NAME,
  5     'COURSE'    :
  6             [SELECT JSON {
  7                     'SCHEDULE_ID': GS.SCHED_ID,
  8        'COURSE_INFO': (
  9        SELECT JSON{
 10          'COURSE_ID'   : C.C_ID,
 11          'TIME'        : C.TIME,
 12          'COURSE_NAME' : C.NAME,
 13          'ROOM'        : C.ROOM,
 14          'TEACHER_NAME': C.TEACHER_NAME WITH NOCHECK}
 15       FROM COURSE C WITH NOINSERT NOUPDATE NODELETE
 16              WHERE C.C_ID = GS.C_ID)}
 17     FROM GUEST_SCHEDULE GS WITH INSERT UPDATE DELETE
 18     WHERE GS.G_ID = G.G_ID]}
 19  FROM GUEST G WITH INSERT UPDATE DELETE;

View created.
```

Oracle23c创新特性：JSON RELATIONAL DUALITY

```
SQL> CREATE OR REPLACE JSON DUALITY VIEW COURSE_DV AS
  2  SELECT JSON {
  3      'COURSE_ID'     : C.C_ID,
  4      'TIME'          : C.TIME,
  5      'COURSE_NAME'   : C.NAME,
  6      'ROOM'          : C.ROOM,
  7      'TEACHER_NAME'  : C.TEACHER_NAME}
  8      FROM COURSE C WITH INSERT UPDATE DELETE;

View created.

SQL> INSERT INTO COURSE_DV
  2  VALUES ('{ "COURSE_ID"     : 407008,
  3             "TIME"          : "2023-04-07 11:35:00",
  4             "COURSE_NAME"   : "回归数据本原，企业级数据库的技术演绎",
  5             "ROOM"          : "宴会厅C",
  6             "TEACHER_NAME"  : "张成伟、金毅" }');

SQL> INSERT INTO COURSE_DV
  2  VALUES ('{ "COURSE_ID"     : 408309,
  3             "TIME"          : "2023-04-08 16:00:00",
  4             "COURSE_NAME"   : "Oracle Database 23c 创新特性和SQL增强",
  5             "ROOM"          : "宴会厅C",
  6             "TEACHER_NAME"  : "杨廷琨" }');
```

Oracle23c创新特性：JSON RELATIONAL DUALITY

```
SQL> INSERT INTO COURSE_DV
  2  VALUES ('{ "COURSE_ID"     : 407302,
  3             "TIME"          : "2023-04-07 14:40:00",
  4             "COURSE_NAME"   : "构建自治智能的数据库云管平台，加速国产数据库应用进程",
  5             "ROOM"          : "宴会厅C",
  6             "TEACHER_NAME"  : "巩飞" }');

SQL> INSERT INTO COURSE_DV
  2  VALUES ('{ "COURSE_ID"     : 408406,
  3             "TIME"          : "2023-04-08 14:00:00",
  4             "COURSE_NAME"   : "为数据插上智能的翅膀，数据智能技术助力企业降本增效",
  5             "ROOM"          : "多功能厅",
  6             "TEACHER_NAME"  : "徐培" }');

SQL> INSERT INTO COURSE_DV
  2  VALUES ('{ "COURSE_ID"     : 407204,
  3             "TIME"          : "2023-04-07 16:00:00",
  4             "COURSE_NAME"   : "面向多样化数据库的数据底座--数据库存储2.0",
  5             "ROOM"          : "宴会厅B",
  6             "TEACHER_NAME"  : "刘宇" }');
```

Oracle23c创新特性：JSON RELATIONAL DUALITY

```
SQL> INSERT INTO COURSE_DV
  2  VALUES ('{ "COURSE_ID"    : 408307,
  3             "TIME"         : "2023-04-08 14:40:00",
  4             "COURSE_NAME"  : "MogDB中自治异步事务提交的设计与实现",
  5             "ROOM"         : "宴会厅C",
  6             "TEACHER_NAME" : "王春玲" }');

SQL> INSERT INTO GUEST_DV VALUES ('
  2  {"GUEST_ID"   : 100000,
  3   "GUEST_NAME" : "贾年华",
  4   "COURSE"     :
  5     [{"SCHEDULE_ID": 101,
  6      "COURSE_INFO" : {"COURSE_ID"     : 408309,
  7                       "TIME"          : "2023-04-08 16:00:00",
  8                       "COURSE_NAME"   : "Oracle Database 23c 创新特性和SQL增强",
  9                       "ROOM"          : "宴会厅C",
 10                       "TEACHER_NAME"  : "杨廷琨" }},
 11     {"SCHEDULE_ID" : 102,
 12      "COURSE_INFO" : {"COURSE_ID"     : 407204,
 13                       "TIME"          : "2023-04-07 16:00:00",
 14                       "COURSE_NAME"   : "面向多样化数据库的数据底座--数据库存储2.0",
 15                       "ROOM"          : "宴会厅B",
 16                       "TEACHER_NAME"  : "刘宇" }}]}');
```

Oracle23c创新特性：JSON RELATIONAL DUALITY

```
SQL> SELECT * FROM GUEST;

      G_ID NAME
---------- ------------------------------------------------------------
    100000 贾年华

SQL> SELECT NAME, TEACHER_NAME TEACHER, SUBSTR(TIME, 1, 16) TIME, ROOM FROM COURSE;

NAME                                            TEACHER     TIME             ROOM
----------------------------------------------- ----------- ---------------- --------
回归数据本原，企业级数据库的技术演绎             张成伟、金毅 2023-04-07 11:35 宴会厅C
Oracle Database 23c 创新特性和SQL增强           杨廷琨      2023-04-08 16:00 宴会厅C
构建自治智能的数据库云管平台，加速国产数据库应用进程 巩飞      2023-04-07 14:40 宴会厅C
为数据插上智能的翅膀，数据智能技术助力企业降本增效   徐培      2023-04-08 14:00 多功能厅
面向多样化数据库的数据底座--数据库存储2.0         刘宇        2023-04-07 16:00 宴会厅B
MogDB中自治异步事务提交的设计与实现               王春玲      2023-04-08 14:40 宴会厅C

SQL> SELECT * FROM GUEST_SCHEDULE;

  SCHED_ID       G_ID       C_ID
---------- ---------- ----------
       101     100000     408309
       102     100000     407204
```

Oracle23c创新特性：JSON RELATIONAL DUALITY

```
SQL> SELECT REPLACE(JSON_QUERY(DATA, '$.COURSE'), ',', ',' || CHR(10)) FROM GUEST_DV;

REPLACE(JSON_QUERY(DATA,'$.COURSE'),',',','||CHR(10))
-----------------------------------------------------------------
[{"SCHEDULE_ID":101,
"COURSE_INFO":{"COURSE_ID":408309,
"TIME":"2023-04-08 16:00:00",
"COURSE_NAME":"Oracle Database 23c 创新特性和SQL增强",
"ROOM":"宴会厅C",
"TEACHER_NAME":"杨廷琨"}},
{"SCHEDULE_ID":102,
"COURSE_INFO":{"COURSE_ID":407204,
"TIME":"2023-04-07 16:00:00",
"COURSE_NAME":"面向多样化数据库的数据底座--数据库存储2.0",
"ROOM":"宴会厅B",
"TEACHER_NAME":"刘宇"}}]
```

Oracle23c创新特性：JSON RELATIONAL DUALITY

```
SQL> UPDATE GUEST_SCHEDULE SET C_ID = 407302 WHERE SCHED_ID = 102;

1 row updated.

SQL> SELECT REPLACE(JSON_QUERY(DATA, '$.COURSE'), ',', ',' || CHR(10)) FROM GUEST_DV;

REPLACE(JSON_QUERY(DATA,'$.COURSE'),',',','||CHR(10))
----------------------------------------------------------------------------------------
------------------------------------------------------------------------
[{"SCHEDULE_ID":101,
"COURSE_INFO":{"COURSE_ID":408309,
"TIME":"2023-04-08 16:00:00",
"COURSE_NAME":"Oracle Database 23c 创新特性和SQL增强",
"ROOM":"宴会厅C",
"TEACHER_NAME":"杨廷琨"}},
{"SCHEDULE_ID":102,
"COURSE_INFO":{"COURSE_ID":407302,
"TIME":"2023-04-07 14:40:00",
"COURSE_NAME":"构建自治智能的数据库云管平台，加速国产数据库应用进程",
"ROOM":"宴会厅C",
"TEACHER_NAME":"巩飞"}}]
```

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Oracle23c新特性：查询省略FROM

```
SQL> select banner_full from v$version;

BANNER_FULL
--------------------------------------------------------------------------------
Oracle Database 23c Free, Release 23.0.0.0.0 - Developer-Release
Version 23.2.0.0.0

SQL> select 100;

       100
----------
       100

SQL> select to_char(sysdate, 'yyyy-mm-dd');

TO_CHAR(SY
----------
2023-02-02

-----------------------------------------------------------------
| Id  | Operation         | Name | Rows  | Cost (%CPU)| Time     |
-----------------------------------------------------------------
|   0 | SELECT STATEMENT  |      |     1 |     2   (0)| 00:00:01 |
|   1 |  FAST DUAL        |      |     1 |     2   (0)| 00:00:01 |
-----------------------------------------------------------------
```

Oracle23c新特性：表支持4096列

```
SQL> CREATE TABLE T_1001_COLUMNS (
  2  C0001 NUMBER,
  3  C0002 NUMBER,

.
.
.
999  C0998 NUMBER,
1000  C0999 NUMBER,
1001  C1000 NUMBER,
1002  C1001 NUMBER);
C1001 NUMBER)
*
ERROR at line 1002:
ORA-01792: maximum number of columns in a table or view is 1000

SQL> SHOW PARAMETER MAX_COLUMNS

NAME                                 TYPE        VALUE
------------------------------------ ----------- ------------------------------
max_columns                          string      STANDARD
```

Oracle23c新特性：表支持4096列

```
SQL> ALTER SYSTEM SET MAX_COLUMNS = EXTENDED;

System altered.

SQL> CREATE TABLE T_1001_COLUMNS (
  2  C0001 NUMBER,
  3  C0002 NUMBER,
  4  C0003 NUMBER,
.
.
.
999  C0998 NUMBER,
1000  C0999 NUMBER,
1001  C1000 NUMBER,
1002  C1001 NUMBER);

Table created.

SQL> SELECT COUNT(*) FROM USER_TAB_COLUMNS WHERE TABLE_NAME = 'T_1001_COLUMNS';

  COUNT(*)
----------
      1001
```

Oracle23c新特性：Boolean类型

```
SQL> CREATE TABLE T_BOOL (ID NUMBER, BOOL BOOLEAN);

Table created.

SQL> INSERT INTO T_BOOL VALUES (1, TRUE);

1 row created.

SQL> INSERT INTO T_BOOL VALUES (2, FALSE);

1 row created.

SQL> INSERT INTO T_BOOL VALUES (3, NULL);

1 row created.

SQL> INSERT INTO T_BOOL VALUES (4, 'T');

1 row created.

SQL> INSERT INTO T_BOOL VALUES (5, 0);

1 row created.
```

Oracle23c新特性：Boolean类型

```
SQL> SELECT ID FROM T_BOOL WHERE BOOL;

        ID
----------
         1
         4

SQL> SELECT * FROM T_BOOL;

        ID BOOL
---------- -----------
         1 TRUE
         2 FALSE
         3
         4 TRUE
         5 FALSE
```

Oracle23c新特性：GROUP BY别名

```
SQL> create table t as select rownum id, a.* from dba_objects a;

Table created.

SQL> SELECT TRUNC(CREATED, 'MM') MON, COUNT(*) FROM T
  2  GROUP BY TRUNC(CREATED, 'MM');

MON            COUNT(*)
------------ ----------
01-OCT-22         76378
01-DEC-22          5289
01-JAN-23         10164
01-FEB-23           683

SQL> SELECT TRUNC(CREATED, 'MM') MON, COUNT(*) FROM T
  2  GROUP BY MON;

MON            COUNT(*)
------------ ----------
01-OCT-22         76378
01-DEC-22          5289
01-JAN-23         10164
01-FEB-23           683
```

Oracle23c新特性：SCHEMA级授权

```
SQL> CREATE USER YANGTK_SELE IDENTIFIED BY SELECTONLY DEFAULT TABLESPACE USERS;

User created.

SQL> GRANT CREATE SESSION TO YANGTK_SELE;

Grant succeeded.

SQL> GRANT SELECT ANY TABLE ON SCHEMA YANGTK TO YANGTK_SELE;

Grant succeeded.

SQL> CONN YANGTK_SELE/SELECTONLY@pdb1
Connected.
SQL> SELECT * FROM SESSION_PRIVS;

PRIVILEGE
----------------------------------------
CREATE SESSION

SQL> SELECT * FROM SESSION_ROLES;

no rows selected
```

Oracle23c新特性：SCHEMA级授权

```
SQL> SELECT OWNER, TABLE_NAME FROM ALL_TABLES WHERE OWNER NOT IN ('SYS', 'SYSTEM', 'XDB',
'MDSYS', 'CTXSYS');

OWNER                          TABLE_NAME
------------------------------ ------------------------------
YANGTK                         STUDENT_SCHEDULER
YANGTK                         T
YANGTK                         T_1001_COLUMNS

SQL> SELECT TABLE_NAME, PRIVILEGE FROM USER_TAB_PRIVS;

TABLE_NAME                     PRIVILEGE
------------------------------ ----------------------------------------
YANGTK_SELE                    INHERIT PRIVILEGES

SQL> SELECT COUNT(*) FROM YANGTK.T;

  COUNT(*)
----------
     92514
```

Oracle23c新特性：SCHEMA级授权

```
SQL> CONN YANGTK/yangtk@pdb1
Connected.
SQL> CREATE TABLE T_NEW (ID NUMBER);

Table created.

SQL> CONN YANGTK_SELE/SELECTONLY@pdb1
Connected.
SQL> SELECT OWNER, TABLE_NAME FROM ALL_TABLES WHERE OWNER NOT IN ('SYS', 'SYSTEM', 'XDB',
'MDSYS', 'CTXSYS');

OWNER      TABLE_NAME
---------- --------------------
YANGTK     STUDENT_SCHEDULER
YANGTK     T
YANGTK     T_1001_COLUMNS
YANGTK     T_NEW
```

Oracle23c新特性：SCHEMA级授权

```
SQL> conn YANGTK_SELE/SELECTONLY@pdb1
Connected.
SQL> select dbms_METADATA.get_ddl('VIEW', 'ALL_TABLES', 'SYS') FROM DUAL;

DBMS_METADATA.GET_DDL('VIEW','ALL_TABLES','SYS')
--------------------------------------------------------------------------------
  CREATE OR REPLACE FORCE NONEDITIONABLE VIEW "SYS"."ALL_TABLES" ("OWNER", "TABLE_NAME",
"TABLESPACE_NAME", "CLUSTER_NA
.
.
.

       or /* user has system privileges */
         ora_check_sys_privilege (o.owner#, o.type#) = 1
      )
  and t.dataobj# = cx.obj# (+)
  and cx.owner# = cu.user# (+)
  and bitand(t.property, power(2,65)) = 0 -- Do not show granular token sets
  and t.obj# = svc.obj# (+)
  and svc.subpart#(+) is null
```

Oracle23c新特性：SCHEMA级授权

```
SQL> SELECT USER#, NAME FROM SYS.USER$ WHERE NAME IN ('YANGTK', 'YANGTK_SELE', 'DEV');

     USER# NAME
---------- ------------------------------
       138 DEV
       136 YANGTK
       137 YANGTK_SELE

SQL> SHOW USER
USER is "YANGTK_SELE “

SQL> SELECT ORA_CHECK_SYS_PRIVILEGE(136, 2) QUERY_PRIV_FOR_YANGTK,
  2  ORA_CHECK_SYS_PRIVILEGE(137, 2) QUERY_PRIV_FOR_SELE,
  3  ORA_CHECK_SYS_PRIVILEGE(138, 2) QUERY_PRIV_FOR_DEV;

QUERY_PRIV_FOR_YANGTK QUERY_PRIV_FOR_SELE QUERY_PRIV_FOR_DEV
--------------------- ------------------- ------------------
                    1                   0                  0
```

Oracle23c新特性：DDL支持EXISTS

```
SQL> SELECT * FROM TAB;

TNAME                                              TABTYPE        CLUSTERID
-------------------------------------------------- ------------- ----------
STUDENT_SCHEDULER                                  TABLE
T                                                  TABLE
T_1001_COLUMNS                                     TABLE
T_NEW                                              TABLE
T_BOOL                                             TABLE

SQL> DROP TABLE T_NOTEXIST;
DROP TABLE T_NOTEXIST
           *
ERROR at line 1:
ORA-00942: table or view does not exist


SQL> DROP TABLE IF EXISTS T_NOTEXIST;

Table dropped.

SQL> DROP TABLE IF EXISTS T_NEW;

Table dropped.
```

Oracle23c新特性：DDL支持EXISTS

```
SQL> SELECT * FROM TAB;

TNAME                                              TABTYPE        CLUSTERID
-------------------------------------------------- ------------- ----------
STUDENT_SCHEDULER                                  TABLE
T                                                  TABLE
T_1001_COLUMNS                                     TABLE
T_BOOL                                             TABLE
BIN$87V21hTqU+jgU6YWFKyjyQ==$0                     TABLE

SQL> CREATE TABLE T (ID NUMBER);
CREATE TABLE T (ID NUMBER)
             *
ERROR at line 1:
ORA-00955: name is already used by an existing object

SQL> CREATE TABLE IF NOT EXISTS T (ID NUMBER);

Table created.
```

Oracle23c新特性：新开发者角色

```
SQL> CREATE USER DEV IDENTIFIED BY DEV DEFAULT TABLESPACE USERS;

User created.

SQL> GRANT DEVELOPER TO DEV;

Grant succeeded.

SQL> CONN DEV/DEV@pdb1
Connected.
SQL> SELECT * FROM SESSION_ROLES;

ROLE
------------------------------------------------------------------------------
DEVELOPER
SODA_APP
```

Oracle23c新特性：新开发者角色

```
SQL> SELECT * FROM SESSION_PRIVS;

PRIVILEGE
----------------------------------------
CREATE DOMAIN
CREATE MLE
CREATE ANALYTIC VIEW
CREATE HIERARCHY
CREATE ATTRIBUTE DIMENSION
.
.
.
CREATE MATERIALIZED VIEW
CREATE TRIGGER
CREATE PROCEDURE
FORCE TRANSACTION
CREATE SEQUENCE
CREATE VIEW
CREATE SYNONYM
CREATE TABLE
CREATE SESSION

24 rows selected.
```

Oracle23c新特性：新开发者角色

```
SQL> SELECT * FROM DBA_PENDING_TRANSACTIONS;

no rows selected

SQL> SELECT COUNT(*) FROM V$SQL;

  COUNT(*)
----------
       454

SQL> SELECT COUNT(*) FROM V$SQL_PLAN;

  COUNT(*)
----------
      4018

SQL> SELECT COUNT(*) FROM V$SESSION;

  COUNT(*)
----------
       127
```

Oracle23c新特性：新开发者角色

```
SQL> SELECT COUNT(*) FROM V$SESSTAT;

  COUNT(*)
----------
    202819

SQL> SELECT COUNT(*) FROM V$STATNAME;

  COUNT(*)
----------
      2537
```

Oracle23c新特性：构建多行记录

```
SQL> WITH S (A, B, C) AS (
  2  VALUES (1, 'A', SYSDATE),
  3  (2, 'B', TO_DATE('20230202', 'YYYYMMDD')),
  4  (3, 'ABCD', SYSDATE - 1))
  5  SELECT A, B, TO_CHAR(C, 'YYYYMMDD') FROM S;

         A B    TO_CHAR(
---------- ---- --------
         1 A    20230202
         2 B    20230202
         3 ABCD 20230201

------------------------------------------------------------------------
| Id  | Operation         | Name | Rows  | Bytes | Cost (%CPU)| Time     |
------------------------------------------------------------------------
|   0 | SELECT STATEMENT  |      |   18E|   15E|     6   (0)| 00:00:01 |
|   1 |  VIEW             |      |   18E|   15E|     6   (0)| 00:00:01 |
|   2 |   VALUES SCAN     |      |      |      |            |          |
------------------------------------------------------------------------
```

Oracle23c新特性：构建多行记录

```
SQL> CREATE TABLE T_MULROW (ID NUMBER, NAME VARCHAR2(30));

Table created.

SQL> INSERT INTO T_MULROW VALUES (1, 'A'), (2, 'B'), (3, 'ABC');

3 rows created.

-------------------------------------------------------------------------------
| Id  | Operation                   | Name       | Rows  | Cost (%CPU)| Time     |
-------------------------------------------------------------------------------
|   0 | INSERT STATEMENT            |            |    18E|     6   (0)| 00:00:01 |
|   1 |  LOAD TABLE CONVENTIONAL    | T_MULROW   |       |            |          |
|   2 |   VALUES SCAN               |            |       |            |          |
-------------------------------------------------------------------------------
```

Oracle23c新特性：更新JOIN结果

```
SQL> SELECT * FROM T_BOOL;

        ID BOOL
---------- -----------
         1 TRUE
         2 FALSE
         3
         4 TRUE
         5 FALSE

SQL> SELECT * FROM T_MULROW;

        ID NAME
---------- ------------------------------
         1 A
         2 B
         3 ABC
```

Oracle23c新特性：更新JOIN结果

```
SQL> UPDATE T_MULROW SET NAME = LOWER(NAME)
  2  FROM T_BOOL
  3  WHERE T_MULROW.ID = T_BOOL.ID
  4  AND BOOL;

1 row updated.

--------------------------------------------------------------------------------
| Id  | Operation           | Name      | Rows  | Bytes | Cost (%CPU)| Time     |
--------------------------------------------------------------------------------
|   0 | UPDATE STATEMENT    |           |     3 |    30 |     6   (0)| 00:00:01 |
|   1 |  UPDATE             | T_MULROW  |       |       |            |          |
|*  2 |   HASH JOIN         |           |     3 |    30 |     6   (0)| 00:00:01 |
|*  3 |    TABLE ACCESS FULL| T_BOOL    |     3 |    12 |     3   (0)| 00:00:01 |
|   4 |    TABLE ACCESS FULL| T_MULROW  |     3 |    18 |     3   (0)| 00:00:01 |
--------------------------------------------------------------------------------

SQL> SELECT * FROM T_MULROW;

        ID NAME
---------- ------------------------------
         1 a
         2 B
         3 ABC
```

Oracle23c新特性：更新JOIN结果

```
SQL> ALTER TABLE T_BOOL ADD PRIMARY KEY (ID);

Table altered.

SQL> ALTER TABLE T_MULROW ADD CONSTRAINT FK_ID FOREIGN KEY (ID) REFERENCES T_BOOL;

Table altered.

SQL> UPDATE
  2  (SELECT M.NAME, M.ID MID, B.ID BID FROM T_MULROW M, T_BOOL B WHERE M.ID = B.ID)
  3  SET NAME = LOWER(NAME)
  4  WHERE MID = BID;

3 rows updated.

--------------------------------------------------------------------------------
| Id  | Operation           | Name     | Rows  | Bytes | Cost (%CPU)| Time     |
--------------------------------------------------------------------------------
|   0 | UPDATE STATEMENT    |          |     3 |    18 |     3   (0)| 00:00:01 |
|   1 |  UPDATE             | T_MULROW |       |       |            |          |
|*  2 |   TABLE ACCESS FULL| T_MULROW |     3 |    18 |     3   (0)| 00:00:01 |
--------------------------------------------------------------------------------
```

Oracle23c新特性：RETURN支持OLD

```
SQL> SET SERVEROUT ON SIZE 100000
SQL> DECLARE
  2      V_NAME_O VARCHAR2(30);
  3      V_NAME_N VARCHAR2(30);
  4   BEGIN
  5      UPDATE T_MULROW SET NAME = UPPER(NAME) WHERE ID = 1
  6      RETURN OLD NAME, NEW NAME
  7      INTO V_NAME_O, V_NAME_N;
  8      DBMS_OUTPUT.PUT_LINE('OLD NAME: ' || V_NAME_O);
  9      DBMS_OUTPUT.PUT_LINE('NEW NAME: ' || V_NAME_N);
  10     COMMIT;
  11   END;
  12   /
OLD NAME: a
NEW NAME: A

PL/SQL procedure successfully completed.
```

Oracle23c新特性：完善报错信息

```
SQL> conn yangtk/yangtk@172.25.1.100/pdb1
ERROR:
ORA-12514: Cannot connect to database. Service pdb1 is not registered with the
listener at host 172.25.1.100 port 1521.
(CONNECTION_ID=9KOsZHiJwDLgU6YWFKwCVQ==)
```

Oracle23c新特性：SQL DOMAINS

```
SQL> CREATE DOMAIN ID_NUMBER AS VARCHAR2(18)
  2  CONSTRAINT C_LEN CHECK (LENGTH(ID_NUMBER) = 18
  3   AND LTRIM(SUBSTR(ID_NUMBER, 1, 17), '0123456789') IS NULL
  4   AND SUBSTR(ID_NUMBER, 18) IN ('X', '0', '1', '2', '3', '4', '5', '6', '7', '8', '9')
  5   AND MOD(SUBSTR(ID_NUMBER,1,1)*7 + SUBSTR(ID_NUMBER,2,1)*9 + SUBSTR(ID_NUMBER,3,1)*10
  6   + SUBSTR(ID_NUMBER,4,1)*5 + SUBSTR(ID_NUMBER,5,1)*8 + SUBSTR(ID_NUMBER,6,1)*4
  7   + SUBSTR(ID_NUMBER,7,1)*2 + SUBSTR(ID_NUMBER,8,1) + SUBSTR(ID_NUMBER,9,1)*6
  8   + SUBSTR(ID_NUMBER,10,1)*3 + SUBSTR(ID_NUMBER,11,1)*7 + SUBSTR(ID_NUMBER,12,1)*9
  9   + SUBSTR(ID_NUMBER,13,1)*10 + SUBSTR(ID_NUMBER,14,1)*5 + SUBSTR(ID_NUMBER,15,1)*8
 10   + SUBSTR(ID_NUMBER,16,1)*4 + SUBSTR(ID_NUMBER,17,1)*2, 11) =
 11   MOD(12 - CASE (SUBSTR(ID_NUMBER, 18)) WHEN 'X' THEN 10 ELSE
TO_NUMBER(SUBSTR(ID_NUMBER, 18)) END, 11))
 12  DISPLAY SUBSTR(ID_NUMBER, 1, 10) || '****' || SUBSTR(ID_NUMBER, 15)
 13  ORDER TO_NUMBER(SUBSTR(ID_NUMBER, 7, 11));

Domain created.

SQL> CREATE TABLE T_IDEN (ID NUMBER, NAME VARCHAR2(30), IDEN VARCHAR2(18) DOMAIN ID_NUMBER);

Table created.
```

Oracle23c新特性：SQL DOMAINS

```
SQL> INSERT INTO T_IDEN VALUES (1, 'A', '110101198001010010');

1 row created.

SQL> INSERT INTO T_IDEN VALUES (2, 'B', '220381197001010014');

1 row created.

SQL> INSERT INTO T_IDEN VALUES (3, 'C', '33010519900101002X');

1 row created.

SQL> INSERT INTO T_IDEN VALUES (4, 'D', '330105199001010021');
INSERT INTO T_IDEN VALUES (4, 'D', '330105199001010021')
*
ERROR at line 1:
ORA-02290: check constraint (YANGTK.SYS_C008298) violated


SQL> COMMIT;

Commit complete.
```

Oracle23c新特性：SQL DOMAINS

```
SQL> SELECT ID, NAME, IDEN, DOMAIN_DISPLAY(IDEN) D_ID
  2  FROM T_IDEN ORDER BY IDEN;

        ID NAME                 IDEN               D_ID
---------- -------------------- ------------------ --------------------------------
         1 A                    110101198001010010 1101011980****0010
         2 B                    220381197001010014 2203811970****0014
         3 C                    33010519900101002X 3301051990****002X

SQL> SELECT ID, NAME, IDEN, DOMAIN_DISPLAY(IDEN) D_ID
  2  FROM T_IDEN ORDER BY DOMAIN_ORDER(IDEN);

        ID NAME                 IDEN               D_ID
---------- -------------------- ------------------ --------------------------------
         2 B                    220381197001010014 2203811970****0014
         1 A                    110101198001010010 1101011980****0010
         3 C                    33010519900101002X 3301051990****002X
```

Oracle23c新特性：无锁列值托管

```
SQL> CREATE TABLE T_ESCROW (ID NUMBER PRIMARY KEY, ESC_LOCK NUMBER ESCROW, NORMAL_LOCK
NUMBER);

Table created.

SQL> INSERT INTO T_ESCROW VALUES (1, 1, 1), (2, 2, 2), (3, 3, 3);

3 rows created.

SQL> COMMIT;

Commit complete.

SQL> SELECT * FROM T_ESCROW;

        ID   ESC_LOCK NORMAL_LOCK
---------- ---------- -----------
         1          1           1
         2          2           2
         3          3           3
```

Oracle23c新特性：无锁列值托管

```
SQL> UPDATE T_ESCROW SET ESC_LOCK = ESC_LOCK + 1 WHERE ID = 1;

1 row updated.

--sqlplus登陆新的会话，用SQL标识符SQL2>来表示第二个会话进行的操作
SQL> SET SQLP 'SQL2> '
SQL2> UPDATE T_ESCROW SET ESC_LOCK = ESC_LOCK - 1 WHERE ID = 1;

1 row updated.

SQL2> COMMIT;

Commit complete.

SQL> COMMIT;

Commit complete.
```

Oracle23c新特性：无锁列值托管

```
SQL> UPDATE T_ESCROW SET NORMAL_LOCK = NORMAL_LOCK + 1 WHERE ID = 1;

1 row updated.

SQL> SELECT L.SID, L.TYPE, ID1, LMODE, CTIME, BLOCK FROM V$LOCK L, V$SESSION S
  2  WHERE L.SID = S.SID AND S.USERNAME = USER AND L.TYPE IN ('TX', 'TM');

       SID TY        ID1      LMODE      CTIME      BLOCK
---------- -- ---------- ---------- ---------- ----------
       506 TM     119484          3         13          2
       506 TX    1376279          6         13          2

SQL> SELECT * FROM T_ESCROW;

        ID   ESC_LOCK NORMAL_LOCK
---------- ---------- -----------
         1          1           2
         2          2           2
         3          3           3

SQL> COMMIT;

Commit complete.
```

Oracle23c新特性：无锁列值托管

```
SQL> UPDATE T_ESCROW SET ESC_LOCK = ESC_LOCK + 1 WHERE ID = 1;

1 row updated.

SQL> SELECT L.SID, L.TYPE, ID1, LMODE, CTIME, BLOCK FROM V$LOCK L, V$SESSION S
  2  WHERE L.SID = S.SID AND S.USERNAME = USER AND L.TYPE IN ('TX', 'TM');

       SID TY        ID1      LMODE      CTIME      BLOCK
---------- -- ---------- ---------- ---------- ----------
       506 TX    1376285          6         19          2
       506 TM     119485          3         19          2
       506 TM     119484          3         19          2

SQL> SELECT OWNER, OBJECT_NAME FROM DBA_OBJECTS WHERE OBJECT_ID IN (119484, 119485);

OWNER                          OBJECT_NAME
------------------------------ ------------------------------
YANGTK                         T_ESCROW
YANGTK                         SYS_ESCROWJRNL_119484
```

Oracle23c新特性：无锁列值托管

```
SQL> SELECT * FROM T_ESCROW;

        ID   ESC_LOCK NORMAL_LOCK
---------- ---------- -----------
         1          1           2
         2          2           2
         3          3           3

SQL> COMMIT;

Commit complete.

SQL> SELECT * FROM T_ESCROW;

        ID   ESC_LOCK NORMAL_LOCK
---------- ---------- -----------
         1          2           2
         2          2           2
         3          3           3
```

Oracle23c新特性：无锁列值托管

```
SQL> UPDATE T_ESCROW SET ESC_LOCK = ESC_LOCK - 1 WHERE ID = 1;

1 row updated.

SQL> SELECT * FROM T_ESCROW;

        ID   ESC_LOCK NORMAL_LOCK
---------- ---------- -----------
         1          2           2
         2          2           2
         3          3           3

SQL> ROLLBACK;

Rollback complete.

SQL> SELECT * FROM T_ESCROW;

        ID   ESC_LOCK NORMAL_LOCK
---------- ---------- -----------
         1          2           2
         2          2           2
         3          3           3
```

Oracle23c新特性：无锁列值托管

```
SQL> CREATE TABLE T_ESCROW (ID NUMBER, ESC_LOCK VARCHAR2(30) ESCROW, NORMAL_LOCK NUMBER);
CREATE TABLE T_ESCROW (ID NUMBER, ESC_LOCK VARCHAR2(30) ESCROW, NORMAL_LOCK NUMBER)
                                                              *
ERROR at line 1:
ORA-55748: Escrow column is supported only on columns of types Oracle NUMBER, INTEGER, and
FLOAT.

SQL> CREATE TABLE T_ESCROW (ID NUMBER, ESC_LOCK NUMBER ESCROW, NORMAL_LOCK NUMBER);
CREATE TABLE T_ESCROW (ID NUMBER, ESC_LOCK NUMBER ESCROW, NORMAL_LOCK NUMBER)
*
ERROR at line 1:
ORA-55728: Escrow columns can only be specified on tables with a primary key.

SQL> UPDATE T_ESCROW SET ESC_LOCK = 0 WHERE ID = 1;
UPDATE T_ESCROW SET ESC_LOCK = 0 WHERE ID = 1
       *
ERROR at line 1:
ORA-55782: Operation is not supported on escrow columns.

SQL> UPDATE T_ESCROW SET ESC_LOCK = ESC_LOCK + 1 WHERE NORMAL_LOCK = 3;
UPDATE T_ESCROW SET ESC_LOCK = ESC_LOCK + 1 WHERE NORMAL_LOCK = 3
       *
ERROR at line 1:
ORA-55732: Escrow update should specify all the primary key columns
```

Oracle23c新特性：无锁列值托管

```
SQL> DROP TABLE T_ESCROW PURGE;
DROP TABLE T_ESCROW PURGE
           *
ERROR at line 1:
ORA-55764: Cannot drop/move an escrow table. First run alter table <table_name> modify
(<escrow_column_name> NOT ESCROW) and then drop/move the escrow table


SQL> ALTER TABLE T_ESCROW MODIFY (ESC_LOCK NOT ESCROW);

Table altered.

SQL> DROP TABLE T_ESCROW PURGE;

Table dropped.
```

Oracle23c新特性：自动事务终止

```
SQL> SHOW PARAMETER TXN

NAME                                 TYPE        VALUE
------------------------------------ ----------- ------------------------------
global_txn_processes                 integer     1
txn_high_priority_wait_target        integer     2147483647
txn_medium_priority_wait_target      integer     2147483647
txn_priority                         string      HIGH
SQL> ALTER SESSION SET TXN_PRIORITY = MEDIUM;

Session altered.

SQL> UPDATE T_BOOL SET BOOL = FALSE WHERE ID = 3;

1 row updated.

SQL> SELECT XID, STATUS, USED_UREC, START_TIME, TXN_PRIORITY, TXN_PRIORITY_WAIT_TARGET FROM
V$TRANSACTION;

XID              STATUS  USED_UREC START_TIME         TXN_PRI TXN_PRIORITY_WAIT_TARGET
---------------- ------  --------- ------------------ ------- ------------------------
0C0010004E0C0000 ACTIVE          1 02/14/23 16:44:07   MEDIUM                        0
```

Oracle23c新特性：自动事务终止

```
SQL2> ALTER SYSTEM SET TXN_HIGH_PRIORITY_WAIT_TARGET = 10;

System altered.

SQL2> SHOW PARAMETER TXN

NAME                                 TYPE        VALUE
------------------------------------ ----------- ------------------------------
txn_high_priority_wait_target        integer     10
txn_medium_priority_wait_target      integer     2147483647
txn_priority                         string      HIGH
SQL2> SET TIMING ON TIME ON
16:44:18 SQL2> UPDATE T_BOOL SET BOOL = TRUE WHERE ID = 3;

1 row updated.

Elapsed: 00:00:10.68
16:44:36 SQL2> SELECT XID, STATUS, USED_UREC, START_TIME, TXN_PRIORITY,
TXN_PRIORITY_WAIT_TARGET FROM V$TRANSACTION;

XID              STATUS  USED_UREC START_TIME           TXN_PRI TXN_PRIORITY_WAIT_TARGET
---------------- ------ ---------- -------------------- ------- ------------------------
15000B00311C0000 ACTIVE          1 02/14/23 16:44:25    HIGH                          10
```

Oracle23c新特性：自动事务终止

```
SQL> SELECT XID, STATUS, USED_UREC, START_TIME, TXN_PRIORITY, TXN_PRIORITY_WAIT_TARGET FROM
V$TRANSACTION;
SELECT XID, STATUS, USED_UREC, START_TIME, TXN_PRIORITY, TXN_PRIORITY_WAIT_TARGET FROM
V$TRANSACTION
*
ERROR at line 1:
ORA-03113: end-of-file on communication channel
Process ID: 2684285
Session ID: 1229 Serial number: 33384
```

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Oracle23c升级策略

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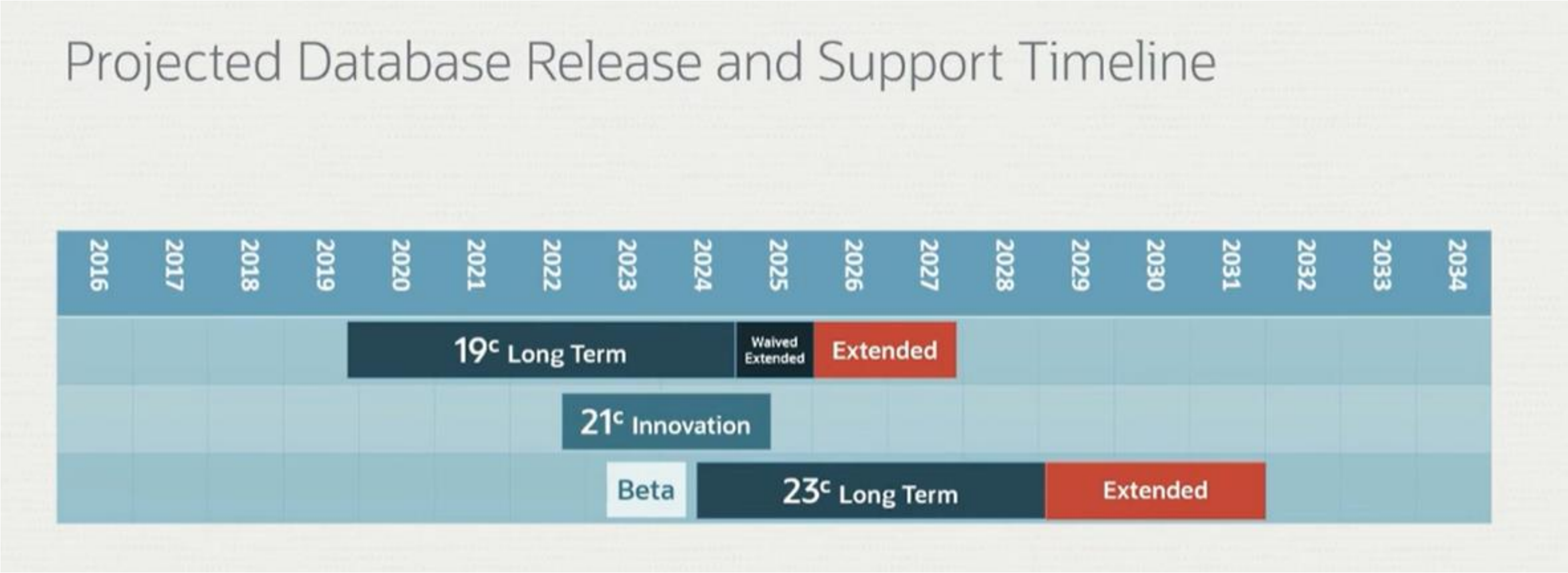
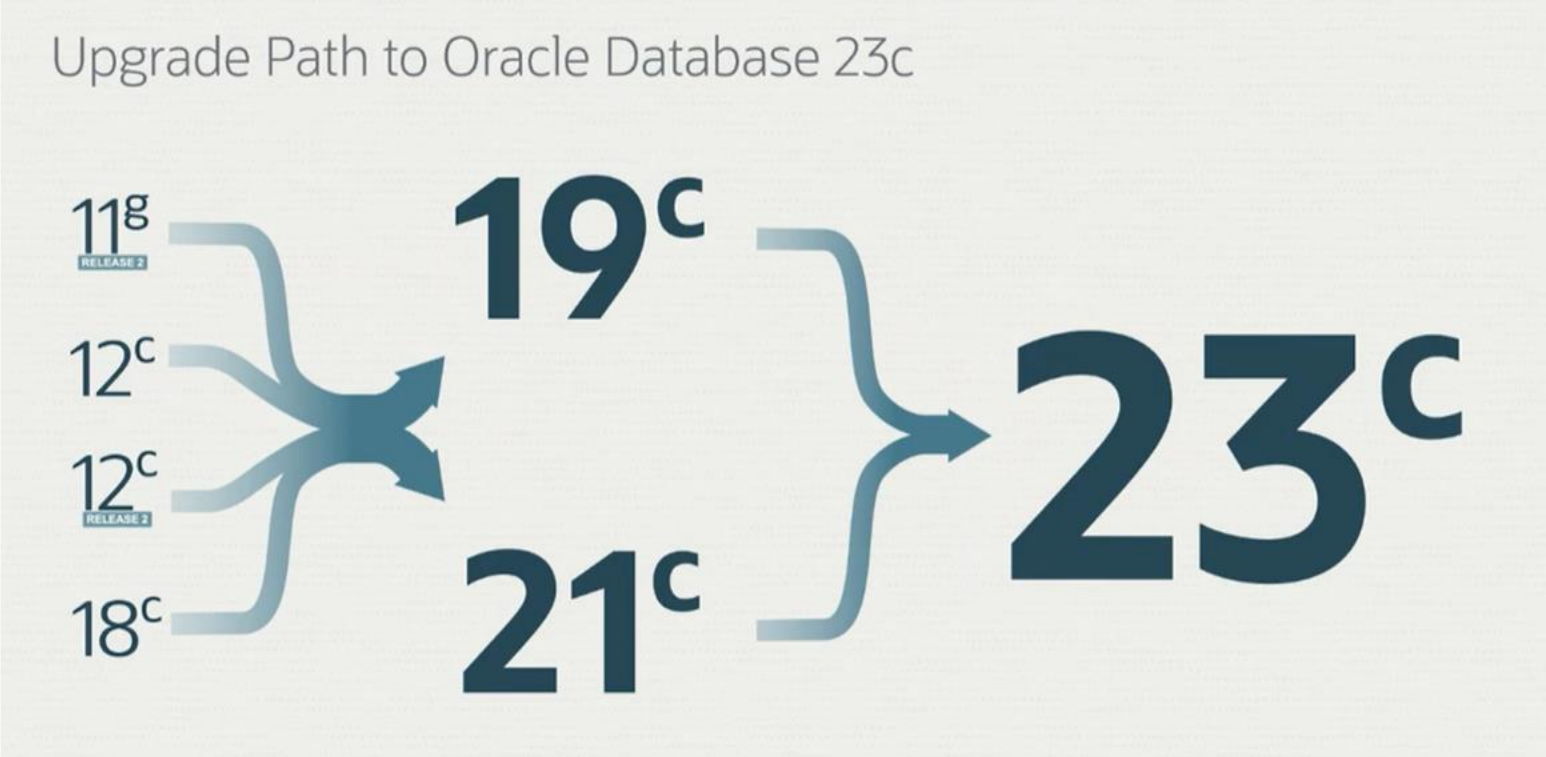


Projected Database Release and Support Timeline

Oracle23c升级策略

- 23c升级路径



谢谢观看

THANKS FOR WATCHING

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