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Are Managed Support Services in your Future?

Moving Data Quickly with GoldenGate

Utilising New Technologies for Improved UX

OracleScene

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Spring 17 | Issue 63



**Making Life Easier
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UK ORACLE USER GROUP

SPRING 17

Welcome to Oracle Scene

Inside this issue

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www.ukoug.org/about-us/governance

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OracleScene
DIGITAL

View the latest edition online and join UKOUG to access the archive:
www.ukoug.org/os

First word

Welcome to the first edition of 2017

Our user group is constantly evolving, growing and changing. All of this is not possible without a very dedicated group of volunteers. New volunteers are always needed to help out with the various SIG groups, arranging meet-ups, helping out with conferences etc. You don't have to be an expert or a long time member of the user group to contribute. Members of all levels of experience are needed & welcomed. If you are newbie or in the early stages of your Oracle career, you can help guide a SIG with the type of topics your peers are particularly interested in or contribute with judging papers and reviewing articles. Check out the UKOUG website for a current listing of various volunteer roles and the next time you are at a SIG ask the committee or UKOUG team how you can get involved.

With Oracle Scene we are looking to recruit some members to help out in a deputy editor role. We are looking to recruit two deputy editors to cover the Tech area and one deputy editor for the Apps area. The role of the deputy editor is to: help source & review articles, assist authors with improving their content, helping select which articles will be included in the edition, taking part in an editorial call and proof reading the chosen content. This may sound like a lot of work but for each edition

it probably takes about 4 hours over a 3 week period. I'm sure you can find the time for that? If this is something that you are interested in take a look at www.ukoug.org/editorialteam, then get in touch at, editor@ukoug.org.

In this issue, we have an article from Jonathan Lewis about problems with database statistics and from the next edition Jonathan will be commencing an 'Ask Jonathan' column. This is where you, the reader, can submit questions for him to answer. Now is your chance to challenge his encyclopedic knowledge of the Oracle Database. Get your thinking caps on! Check out page 15 for more details on how you can submit and get your question answered.

The popularity of Oracle Scene continues to grow, not just with readership numbers but also with the number of submissions we are receiving. For this edition we could have published at least twice the number of articles. Oracle Scene is definitely seen as the premier publication in the Oracle community around the World.

So thank you for the continued support and keep submitting those articles. ■



ABOUT THE EDITOR

Brendan Tierney

Brendan is an Oracle ACE Director, independent consultant and lectures on Data Mining and Advanced Databases in DIT in Ireland. Brendan has extensive experience working in the areas of Analytics, Data Mining, Data Warehousing, Data Architecture and Database Design for over 20 years. He started working with the Oracle 5 Database, Forms 2.3 and ReportWriter 1.1, and has worked with all versions since then. Brendan is editor of the UKOUG Oracle Scene magazine and is the deputy chair of the OUG Ireland BI SIG. Brendan is a regular presenter at conferences around the world.

Contact Brendan at: editor@ukoug.org

More information on submitting an article can be found online at: www.ukoug.org/oraclescene

2017 is a year for celebration...

the UKOUG Partner of the Year Awards hits a milestone

It's the 10th year anniversary of this prestigious event, and what better way to reward your team for their achievements, and receive recognition for the outstanding work & contribution you provide to the Oracle community, than by being a recipient of one of these coveted awards.

These awards are solely voted for by Oracle customers so winning really does give you that respected industry status.

Look out for nominations opening in April at www.ukoug.org/pya



REFRESH YOUR SKILLS

WITH OUR UPCOMING SPECIAL INTEREST GROUP EVENTS

MARCH

- 14th UKOUG Business Analytics SIG, Solihull
- 21st UKOUG Development SIG, Solihull
- 23rd UKOUG Middleware & Integration SIG, Solihull

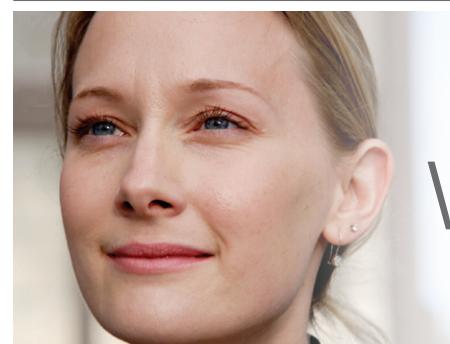
APRIL

- 25th UKOUG Higher Education SIG, Solihull

MAY

- 9th UKOUG Public Sector Applications & Financials SIG
- 10th UKOUG Spatial & Graph SIG, Reading
- 18th UKOUG Public Sector HCM SIG, Solihull
- 23rd UKOUG APEX SIG, Solihull
- 25th UKOUG HCM Solutions SIG, London

Event dates correct at time of print



by Debra Lilley, UKOUG Member Advocate

Women in IT Update

At UKOUG we are always listening to feedback as to what works and what you want us to try. When everyone at UKOUG 2015 said having the Women in IT session as a breakfast forum, so as to not be against an educational session, worked, we knew 2016 needed to be in the same format. However we were also aware that we need to think about what we want to do, if anything, between conferences for WIT.

Like last year we had a full house of delegates happy to arrive early, drink coffee and eat bacon butties. We sat around tables and asked each group to share what their organisations do around WIT, if anything, and what they thought we should do, as well as capturing any issues they experience.

Then James Jeynes (UKOUG Executive Director) and I wandered around the tables and consolidated the post-its at the end

of the session. Ideas captured included: starting them young, engagement with fun technology ie 3D printers and dedicated events.

Overwhelmingly this was a positive bunch, agreeing that children as early as possible, probably of primary school age, need to be encouraged to work in and not just with IT. We talked about joining up with existing schemes to share with schools and I had nearly 20 volunteers, so watch this space.



Moving with the times – a new name and a new focus

2017 sees the Application & Middleware SIG going through a process of change and rejuvenation. Whilst the committee remains the same, the name is changing and we have several other activities happening. The committee put forward to the UKOUG Board the proposal to change the name to Middleware & Integration SIG and this has been accepted.

Why the new name? In the last couple of years we have seen enormous change and rejuvenation within Oracle's middleware portfolio and we wanted to reflect this change. This is not just in the arrival of cloud which still includes the trusty WebLogic WebServer as a core engine, which in some cases we can see, in others we know it is there but certainly hidden from our reach; but we are seeing a great number of offerings that go beyond WebLogic, SOA, OSB - new identity products, API products, Traffic Director (which doesn't even use WebLogic) and the support of open source technologies such as Node.js, Kafka and Docker. It is no longer just about the Application Server; it

is the app server and much, much, more, be that on-premise, cloud or hybrid.

The SIG has looked beyond, just the configuration and management of the middleware platform but considers the use of these technologies to be the glue that makes the web, mobile, social, bots and other solutions work with the applications and data stores. We hope that the change will help give more clarity to this as well.

New name, old SIG and same faces? Yes and no, whilst SIG content has been evolving under its old name we're hoping some new faces will be attracted to get involved and contribute; after all there

is so much to draw from here. We're also looking at some new ideas to share and collaborate. Last year the Journey to the Cloud event committee arranged a couple of one hour webinars which enjoyed very good attendance. Clearly such sessions are easier to engage with - no escaping the office for the day or travel demands. So we are currently exploring similar ideas for this SIG and by the time you are reading this, you may have seen something in the regular newsletters. We hope that you can join us for these events.

Dates for your diary:

23rd March	Solihull
20th June	Reading
28th September	London

Other SIG name changes to look out for:

The Apps DBA SIG has changed its name to become UKOUG Apps Tech SIG and the HCM & HCM in the Cloud including Taleo SIG will become UKOUG HCM Solutions and will be for those interested in Oracle Cloud and E-Business Suite HCM Solutions.

UKOUG CONFERENCES

Call For Papers

4-6 DECEMBER 2017 | ICC BIRMINGHAM



Next month (April) we open the call for papers for the UKOUG conferences, where we look to the Oracle community to share their knowledge around all aspects of Oracle Technology, Analytics & Reporting & Applications.

If you've never presented before but are tempted to try – do take a look at the article in the last edition of Oracle Scene by first time presenter Brian Dwyer – his first experience was presenting at a SIG and now he's got the bug and ready for more.

Register your interest at: www.ukoug.org/conferences

If you're interested in sponsorship and exhibition opportunities at this year's events, please view our Partner Guide to the right and contact Kerry Stuart for more information.

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We have sponsorship options to fit every budget, with packages to suit your specific needs and accelerate your sales cycle. For more information, contact Kerry Stuart, Head of Sales, on +44 (0)20 8545 9685 / +44 (0) 7775 758 878 or email kerry.stuart@ukoug.org.



15 minutes

with
Paul Fitton



Meet Paul Fitton, UKOUG's New President

This month sees Linda Barker's two year term as UKOUG President come to an end and although we are sad to see Linda step down, we're delighted to welcome Paul Fitton, who transitions from President Elect into the role.

Hi Paul, some readers may have seen you on stage at the UKOUG's co-located conferences in December, where you gave a brief introduction about yourself, but for those that missed it can you tell us a little about yourself.

I was really pleased to be invited on stage at the conference last year by Linda to briefly introduce myself to the attendees, it really is a fantastic idea to have a period of time where I can shadow Linda and get up to speed before becoming the President. I work for an organisation called Home Group where I am Head of IS Architecture, managing a small team of domain and solution specialists in the design and management of our entire IT landscape. It's a demanding job, but I love it and I love what we do; we're England's number one provider of care and support services and one of the largest housing associations in the UK so it's easy to connect what we do in IT to the good we do as an organisation. I've been our main contact for the UKOUG membership since we joined, when we first started on our Oracle implementation 3 years ago. I have found the experience very beneficial hence why I put myself forward to become a part of the organisation.

As you are now making the transition from President Elect to President – how will the roles differ?

Well, right now all I'm really doing is shadowing Linda and getting up to speed with things. I've attended a number of board meetings and have started my induction. When I take over, I hope to take a more active role at some of our events

and really start to get out and meet the membership. Maybe even do a few site visits if people are willing to have me!

What made you keen to stand for nomination for President?

I'm fairly new to Oracle and I've found it a pretty "closed" community, so when I came across the UKOUG and first experienced some of the events and content they provided for their membership, I realised just how valuable the organisation was. I've always believed that being new to something has as many advantages as it does disadvantages, and although I might ask a few silly questions at times, I think a fresh pair of eyes to compliment the wealth of experience that currently sits on the board is something I was keen to add.

Ultimately, I want to be in a position to help influence where we go as an organisation and to speak on your behalf to continue our solid relationship with Oracle.

What are you most looking forward to about the role?

I'm someone who enjoys connecting with people, particularly those who work in similar fields and will have similar experiences to those I have faced, or am likely to. This is probably what excites me

the most about this role, the ability to get to know our membership and find out more about what they need from us and how we can, together, become an even better organisation.

Do you have a message for the members?

I'd just like to reiterate what I said on stage; that I'm really pleased to have been given this opportunity and I genuinely am looking forward to connecting with you all so please do get in touch! I might not be able to respond immediately, but I will in due course.

What are your first official duties in the role?

One of the first things I'll be doing is attending the UKOUG Applications' Journey to the Cloud event in March, which I'm really looking forward to! Hopefully I'll be able to connect with a number of members and also soak up some really useful information.

Do you know what else is in store for your first year?

I'm definitely aiming to get around a number of SIGs and Events in my first year to understand the many perspectives that exist within our membership. I'm also keen to meet with members and understand how they benefit from their membership and how we might improve as an organisation. I'll be attending some events on behalf of our membership too such as the EMEA User Group meeting and also be looking to cement a positive working relationship with Oracle leadership in the UK.

In your manifesto you said you were keen to see UKOUG appeal to a wider audience. How will you be working with the UKOUG board & team to achieve this?

Before I was successful in being appointed as President Elect I worked with the strategy group on how we take the organisation forward in 2017 and beyond so I've been engaged on this for a little while now. We are very lucky as a board to have a good mix of experience and fresh new ideas so our challenge now is to distil this mix of ideas and pragmatism down into a business plan that will take us in the right direction.

I am keen to hear from the members on this one though and would welcome any input from them as to what the make-up

of their membership is and who uses it for what purposes.

You also said that some organisations don't understand the value of joining a User Group – what value has being a member made to your organisation?

Oh we've seen massive benefits from being a member. You should see our teams the first couple of weeks after coming back from conference in December; it's like a melting pot of ideas and everyone is excited to explain what they've seen to everyone else. We like to do debrief very soon afterwards in order to capture as many of the ideas as possible and categorise them into quick-wins vs. longer term initiatives. That's just the conference too; we're starting to attend some more SIGs now we've got a bit more time to do so and the Oracle Scene magazine regularly gets a mention in team meetings. Having said all of that though, I know there is more we could benefit from and more that the UKOUG could do for us moving forward, and I'm keen to understand how other members feel about this also.

The IT industry and especially the Oracle world is an ever changing place, what made you want to get in to a career in IT?
Honestly? I wasn't really sure what to do with my life! I finished school, stumbled into University – didn't really enjoy that and then one day found myself needing to get a job (never mind a career). Luckily for me, I was able to take an apprenticeship in the IT department at a local council where I quickly realised something I hadn't cottoned onto before... I enjoyed hard work! After that it was just a natural progression thing, I worked hard and learnt fairly quickly. IT is really dynamic and fast paced but the thing I've always loved about it is you're very often the person tasked with solving a problem and how you do so is not predefined.

It's a world of continual improvement and innovation and never stops still, which is a challenge, but means that you too don't get to rest on your laurels.



Very often I've found myself returning to a problem I've previously not been able to fully solve only this time with new knowledge or different applications in the portfolio which can make the improvements required on the second pass.

What do you see the biggest challenge for the User Group over the next few years?

Maybe a little bit of the answer to my last question; moving with the times. The Oracle market is changing, much like the markets of many of the other major software vendors. More cloud, more loosely coupled platform applications that do specific things very well but are interchangeable and compete on quality, function and cost rather than being the "whole package". IT departments are changing too, meaning our members are changing also. Gone are the days where huge teams of internal resources are dedicated to "keeping the lights on" and more focus is on vendor management and service delivery roles. But much like my previous answer, we should see these challenges as opportunities.

We want our current membership to come with us on this journey, to embrace new members, new content and different types of events and engagements from the UKOUG but also to figure out where they fit in the new world and how we can help learn together as a community.

Thanks for your time Paul, if the members wanted to get in touch what is the best way?

I'm a keen social media advocate so would encourage anyone who wants to, to seek me out on Twitter (@paulfitton) or on LinkedIn but equally, happy to receive email through my UKOUG address which is, paul.fitton@ukoug.org ■

Don't forget

UKOUG members vote in their Member Advocate

At the time of printing UKOUG members were voting to elect a Member Advocate to represent them for the next two years on the UKOUG Board. Find out the results in the next edition or sign up to the UKOUG ebulletin (www.ukoug.org/ebulletin) to hear the news when announced.

The Importance of User Experience for Enterprise HCM Applications

Modern consumer applications are engaging and easy to use. Leading brands like Facebook and Uber devote huge budgets to ensuring their user experience outrivals competitor apps and meets customer demand.

Adrian Biddulph
Managing Consultant
Claremont

If these applications fail to innovate their user experience continually, they risk losing consumers – and with them, revenue. The battle to create the most attractive, intuitive app has raised the user experience bar.

At home, a user is a consumer; at work, he or she is an employee – and their expectations, when it comes to the usability of technology, are no different in the workplace than anywhere else.

Where are we now with UX for the Enterprise?

'Enterprise' applications are under the same usability pressures as 'consumer' applications. Modern businesses depend on them for collecting and organising the large amounts of data that allow them to make strategic business decisions.

But employees are now demanding access to technologies that are flexible, accessible and user friendly. So, enterprise applications must up their game, when it comes to usability, if they are going to continue to deliver what the business needs. Traditionally, enterprise applications, like Oracle E-Business Suite HCM have neglected to put usability first, but it has now become a key challenge that business and IT leaders realise they must address.

This is reflected in Sierra Cedar's 2016-2017 HR Systems Survey, which found that 71% of users reported Oracle E-Business Suite to have "a poor user experience." 66% of the organisations who gave their vendors a low satisfaction rating, in this survey, also identified "poor user experience" as their primary reason for doing so.

This was a 40% increase on previous years – an upsurge likely due to the rising consumer (and therefore employee) expectations for user experience. As Stacey Harris and Erin Spencer put it: "Employees are becoming consumers of HR services and HR is seeing a shift in its role from administrator to service provider" (Sierra Cedar, 2016-2017, HR Systems Survey).

There is no question that businesses must address and respond to this shift. Organisations rely on employees engaging with enterprise applications, to collect the data needed to make strategic business decisions. Timely and accurate absence and holiday tracking, for example, is crucial to any HR or payroll department, which relies on this information for accurate payment. Information like this empowers businesses to know their



workforce better, to make operational changes, if required, and to respond quickly to legislative changes.

Driving user adoption wherever you are on your Oracle journey

Applications, like Oracle E-Business Suite HCM, were designed to provide businesses with important data – but they need to be used if they are going to deliver that critical information.

For organisations looking to get the most out of their HR technology investments, and increase employee adoption of these applications, improving the user experience is a critical first step.

Depending on where you are on your Oracle journey, you will have different options available to you. For example, there are some organisations that have made an investment in Oracle E-Business Suite with the view that it will underpin their business for the foreseeable future. These organisations can look to new technologies, which sit on top of applications to improve their usability. There are also those organisations that are ready and eager to embrace the latest in enterprise application software, deployed in Oracle's cloud.

New technologies for improved UX

One way to improve the user experience, and therefore, the user engagement, is through specialised software, which sits on top of Oracle E-Business Suite applications.

By way of example, Applaud Solutions works in this way to add a modern, fresh and intuitive user interface to Oracle E-Business Suite. This is complemented by native mobile and tablet applications.

The National Trust has taken this approach and seen significant improvements in user adoption of their Oracle HCM applications. They have seen a 100% increase in logged annual leave and over 47% increase in logged sick leave – the business now has much more, and better quality, information at its disposal.

This 360-degree view of staff has empowered The National Trust to improve operations, boost employee engagement and empower management to support employees. More data means smarter business decisions.

For those organisations who are looking to optimise Oracle E-Business Suite, Applaud Solutions is a great way to do this.

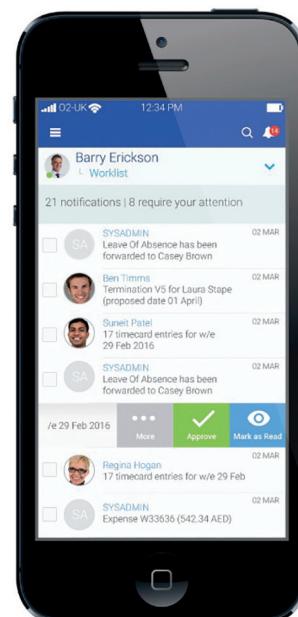
Oracle Cloud for greater usability

More and more organisations are making the jump to Oracle Cloud applications – a move that is becoming increasingly inviting as the product matures and benefits are realised.

With Oracle HCM Cloud, organisations gain a modern, intuitive user interface across desktop and mobile. Oracle has acknowledged the importance of, and the challenges surrounding, user experience, and has built the answer into the application. Oracle's commitment

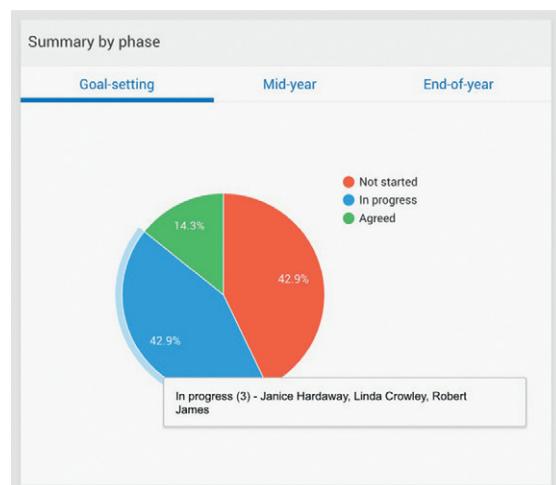
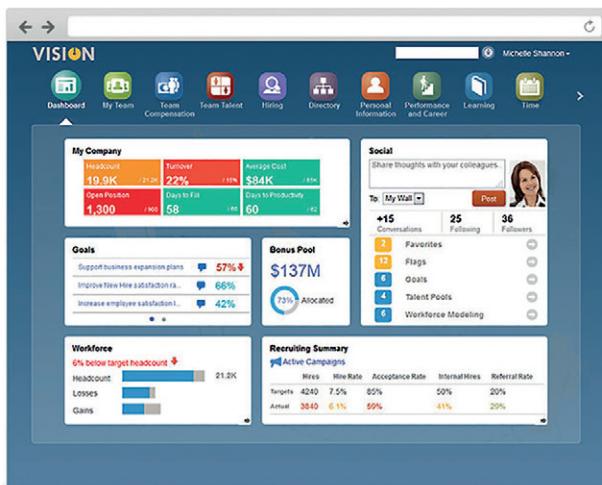
and investment to user experience in its suite of cloud applications is undeniable. Simplicity, mobility, extensibility and consistency are themes that run across all products; giving a great, consumer grade HCM experience to employees, managers and professional users alike.

As we saw in last quarter's Oracle Scene, Oracle's commitment to UX here in the UK goes back many years. The UX team has been attending the UKOUG APPS Conference for over a decade, allowing the team to interact directly with customers and test the latest UX design patterns with UK customers.



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Applications: Adrian Biddulph



Of course, the expectations around user experience are always evolving. But, because Oracle HCM Cloud is consistently updated and patches are regularly applied, organisations can feel secure in the knowledge that the user experience will be continually optimised to keep up with user demand.

What does this mean for my business?

There is a plethora of options available for businesses looking to optimise the user experience of their Oracle applications, to drive user adoption and get employees and all stakeholders equally invested in the business's HR technology.

Whichever route you choose to take, it is always helpful to work with an experienced, proactive partner to help shape a solution that is right for your organisation. No matter where you are on your Oracle journey – UX can no longer take a back seat. ■



ABOUT THE AUTHOR

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Adrian is a Managing Consultant for Claremont and is responsible for the delivery of all things from a HCM technology perspective. With over fifteen years' of global consultancy experience, Adrian is a leading expert in the implementation and on-going support of complex Human Capital Management solutions.



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The Stage Awaits

Share your EPM & Hyperion knowledge

We've an agenda to fill and an audience wanting to hear about real life experiences and product insight that they can use to benefit their business. We're particularly looking for:

Customer insight stories

- How does your business utilise its EPM systems between on-premise & cloud
- Your cloud journey & experiences
- Implementation tales & migration quick wins

Can you help others to improve their?

- Planning, Budgeting & Forecasting
- Financial Processes & Close
- Profitability & Cost Management
- Data Integration
- Reporting

To take part in this event, submit your abstract by 3rd April at www.ukoug.org/epmhyperion



Problems From Statistics

Jonathan Lewis
Freelance Consultant
JL Computer Consultancy

If you want to give the optimizer the best chance of finding a good execution plan in a reasonable time you need to have a well-structured database that has been described sufficiently accurately through a set of suitable statistics.

If you have a poorly designed database there's often little you can do to change the structure but you may have some scope to do something about the statistics, so it's important to be able to recognise the problems and patterns of instability that appear when the optimizer is using guesswork rather than the actual statistics that you can see stored in the data dictionary.

Correlated Columns

Perhaps the most commonly known bit of guesswork the optimizer uses has to do with correlated columns. If column **c1** is known to hold 100 distinct values and **c2** is also known to hold 100 distinct values the optimizer still doesn't know anything about the number of combinations of the pair that actually exist in the table and simply assumes that there are $100 * 100 = 10,000$ distinct combinations. If you know that there is some significant overlap in the "meaning" of these two columns you may know that the number of distinct values is far less than Oracle expects, so the optimizer may give a predicate like: "**c1 = {constant} and c2 = {constant}**" a **much lower** cardinality

than you're expecting which, in turn, can lead to a highly inappropriate execution plan.

We have a workaround, of course: Oracle allows us to declare "column groups" using the "extended stats" approach so we may gather stats using a **method_opt** that includes the phrase "*for columns (c1,c2) size 1*". This will give us a hidden column in the data dictionary that (amongst other things) tracks the number of combinations of **c1** and **c2**. It does mean a little extra work for future stats collections and in 12.1 Oracle may generate a few sets of column groups automatically without giving us much of a clue that it is doing so. (This mechanism is part of the bundle enabled by the **optimizer_adaptive_features** parameter in 12.1 but has been isolated to a specific parameter in 12.2, with a backport available for 12.1, that replaces **optimizer_adaptive_features** with the two parameters **optimizer_adaptive_plans** and **optimizer_adaptive_statistics**).

There are, however, instability traps associated with column groups; specifically the issue of the column group "suddenly"

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Technology: Jonathan Lewis

not working. This tends to happen for two reasons – the first is a classic optimizer problem in a different guise: the “out of range” issue (which I’ll be coming back to). As time passes and the data grows you may find that the actual data values move outside the range recorded as the low and high values for the two columns; if, at this point, you optimize a query that references out of range values the optimizer doesn’t use the column group stats but reverts to multiplying up individual selectivity (*num_distinct*) values – potentially introducing dramatic changes in plans when “nothing changed”.

The second reason for column groups suddenly becoming irrelevant relates to the inherent instability of creating histograms (a threat that shrinks dramatically in 12c – at least for frequency histograms and the new top-N histograms). If any of the individual columns in a column group triggers Oracle into creating a histogram when the column group itself doesn’t have a histogram on it the optimizer stops using those column group stats. This is just one of the things that makes a *method_opt* of “*for all columns size auto*” a dangerous strategy.

As you can see from the previous two paragraphs you have a Catch-22 to deal with: if you fail to maintain your stats you may suddenly find unexpected changes in plans relating to column groups, on the other hand if you DO run some code to maintain your stats then that, too, may result in unexpected changes in plans. You just have to know that column groups have side effects that are strongly dependent on the group and its constituent columns having consistent stats.

Unknown Values

Here’s a quick and dirty bit of SQL to create a table with 100,000 rows – a nice easy number to help us spot coincidences. I’ve used the view *all_objects* as the basis for this data set because it has a set of well-known and easily remembered column names and with a full Enterprise install of 11.2.0.4 there are far more than 50,000 rows in the view:

```
create table t1 as select * from all_objects where rownum <= 50000;
update t1 set object_id = object_id + (select max(object_id) from t1);
insert into t1 select * from all_objects where rownum <= 50000;
create unique index t1_i1 on t1(object_id);
execute dbms_stats.gather_table_stats(user,'t1', method_opt=>'for all columns size 1')
```

Note that my call to *gather_table_stats* doesn’t request any histograms even though, for example, the distribution of the *object_type* column would probably make it a good candidate for a frequency histogram. It’s also worth remembering in tests like this that even though I haven’t declared any columns as mandatory some columns will have picked up the NOT NULL constraint from the *all_objects* view.

Consider a query based on the maximum *object_id* for rows where the *object_type* is a particular value:

```
select      *
from        t1, t1 t2
where       t1.object_id >= (
                    select      max(object_id)
                    from        t1
                    where       object_type = '&m'
)
and        t2.object_name = t1.object_name
;
```

If the substitution variable *&m* is defined as “SYNONYM”, the query returns (for my dataset) 6 rows. If the variable is defined as “SEQUENCE” the query returns 168,148 rows. Clearly, in the absence of histograms or dynamic sampling, the optimizer can only produce one plan for the query so we need to know how it will decide on suitable cardinality estimates.

Below is the plan:

Id	Operation	Name	Rows	Bytes	Cost	(%CPU)	Time
0	SELECT STATEMENT		18494	3503K	222	(6)	00:00:02
* 1	HASH JOIN		18494	3503K	222	(6)	00:00:02
2	TABLE ACCESS BY INDEX ROWID	T1	5000	473K	17	(0)	00:00:01
* 3	INDEX RANGE SCAN	T1_I1	900		4	(0)	00:00:01
4	SORT AGGREGATE		1	14			
* 5	TABLE ACCESS FULL	T1	4762	66668	200	(4)	00:00:02
6	TABLE ACCESS FULL	T1	100K	9472K	203	(6)	00:00:02

Predicate Information (identified by operation id):

```
1 - access("T2"."OBJECT_NAME"="T1"."OBJECT_NAME")
3 - access("T1"."OBJECT_ID">>= (SELECT MAX("OBJECT_ID") FROM "T1" "T1"
   WHERE "OBJECT_TYPE"='SEQUENCE')
5 - filter("OBJECT_TYPE"='SEQUENCE')
```

You can see from the access predicate at operation 3 that Oracle drives the query from the subquery outwards, first producing a single value that can be used to drive the rest of the query. (This behaviour is an example of “subquery pushing”). Notice the strange cardinality estimates for operations 3 and 2 – having dictated a path that finds a specific *object_id* (which, of course, has to be treated as an “unknown value” at optimization time) the optimizer concludes that an index range scan using this value will identify 900 index entries which will then expand to 5,000 rows when Oracle visits the table. The optimizer has no idea what value it will get from the subquery and uses a pair of inconsistent guesses (0.9% and 5%) for the selectivity of the predicate “column >= {unknown value}”. (The same guesses appear for the other inequalities: “>”, “<”, “<=”.)

The anomaly doesn't stop there. If you use a between clause with two subqueries a further inconsistency appears:

```

select      *
from        t1, t1 t2
where       t1.object_id between (
                                select      min(object_id)
                                from        t1
                                where       object_type = '&m'
                            )
and        (
                                select      max(object_id)
                                from        t1
                                where       object_type = '&m'
                            )
and        t2.object_name = t1.object_name
;

-----| Id | Operation          | Name | Rows | Bytes | Cost (%CPU) | Time      |
-----| 0  | SELECT STATEMENT   |       | 925  | 175K | 215    (7) | 00:00:02 |
| * 1  | HASH JOIN          |       | 925  | 175K | 215    (7) | 00:00:02 |
| 2  | TABLE ACCESS BY INDEX ROWID| T1  | 250  | 24250 | 10     (0) | 00:00:01 |
| * 3  | INDEX RANGE SCAN   | T1_I1 | 450  |       | 3      (0) | 00:00:01 |
| 4  | SORT AGGREGATE     |       | 1    | 14   |       |           |
| * 5  | TABLE ACCESS FULL  | T1  | 4762 | 66668 | 200   (4) | 00:00:02 |
| 6  | SORT AGGREGATE     |       | 1    | 14   |       |           |
| * 7  | TABLE ACCESS FULL  | T1  | 4762 | 66668 | 200   (4) | 00:00:02 |
| 8  | TABLE ACCESS FULL  | T1  | 100K | 9472K | 203   (6) | 00:00:02 |

Predicate Information (identified by operation id):
-----
1 - access("T2"."OBJECT_NAME"="T1"."OBJECT_NAME")
3 - access("T1"."OBJECT_ID">>= (SELECT MIN("OBJECT_ID") FROM "T1" "T1"
   WHERE "OBJECT_TYPE"='SEQUENCE') AND "T1"."OBJECT_ID"=<= (SELECT
   MAX("OBJECT_ID") FROM "T1" "T1" WHERE "OBJECT_TYPE"='SEQUENCE'))
5 - filter("OBJECT_TYPE"='SEQUENCE')
7 - filter("OBJECT_TYPE"='SEQUENCE')

```

The plan tells us that Oracle will start by running the two scalar subqueries to find a couple of values to drive an index range scan at operation 3. In one respect the estimates in this plan are consistent with the previous plan and the general rules for multiple predicates – the estimated cardinality of the first t1 access (operation 2) is 250 which is a selectivity of 0.25%, in other words 5% of 5%; the optimizer has used the standard “multiply the two selectivities” rule. On the other hand the index cardinality (operation 3) is an “arbitrary” 450 – a hard-coded selectivity of 0.45% - producing the strange prediction that the number of table rows will be less than the number of rowids found in the index.

In fact there's one further anomaly we can get from this test. It's not always legal for the optimizer to “push” subqueries, a limitation we can model by putting the /*+ no_push_subq */ hint into the subqueries. With this hint in place the predicted cardinality for both queries changes to 369,000. This is a class of defect that shows up fairly frequently in the optimizer – a change in the choice of transformation can result in a significant change in cardinality estimates. This is one of the details that makes hinting difficult – a hint to control the optimizer's choice of transformation may result in such a drastic change in cardinality estimate that the optimizer manages to produce an even worse plan as a consequence.

We can get some minor variations in some of the intermediate cardinality estimates if we create histograms or pick a suitable level of dynamic sampling, and there are some minor differences between 11g and 12c, but essentially the problem with this query is that the optimizer has no idea about what the max (object_id) might be for a given object type – so it has to guess

unless you supply some variant of a cardinality hint (SQL Profile, SQL Patch or opt_estimate hint) to give it some help.

On the plus side – if you're using partitioned tables, a query that uses scalar subqueries of this type to identify partition key(s) allows the optimizer to produce a “key/key” plan that the runtime engine can use to access only the required partitions.

Histograms

There are three main problems with histograms. The primary one is the cost of production; the other problems are a side effect of trying to minimize this cost. If you want a “stable” histogram you need a large sample size but a large sample size means that it's very expensive to generate the histogram from the data. A large fraction of this problem disappears in 12c where a new algorithm allows Oracle to generate a good frequency histogram or “Top-N” histogram very efficiently using 100% of the data – but in earlier versions of Oracle the default “auto_sample_size” would often result in a sample of around 5,500 rows being used even for data sets with millions of rows (and this small sample size still appears in the “Hybrid” histogram introduced in 12c to replace the older height-balanced histogram).

Essentially the different histogram types in Oracle can tell the optimizer something about “popular” values i.e. specific values that appear relatively frequently in the data set; on top of this, height-balanced or hybrid histograms can also tell you something about how unevenly your values are spread across different ranges (contrary to popular opinion, a histogram on a unique key column may sometimes be useful for exactly this reason, see: <https://jonathanlewis.wordpress.com/2016/09/26/pk-histogram/>).

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Technology: Jonathan Lewis

The two cardinality problems relate to the differences between “popular” and “non-popular” values and the probability that a small sample size will fail to capture good enough information consistently. If a value does appear frequently in the full data set it is likely to be captured as a “popular” value even in a small sample, but if it doesn’t appear frequently enough in the full data set then there is a good chance that it won’t appear in a small sample – and that’s likely to matter because it’s often the low (or lower) frequency data values that are the most interesting.

Consider, for example, a data set with 10M rows, with a flag column that can hold only 5 distinct values, ‘A’, ‘B’, ‘C’, ‘X’, ‘Z’. Scattered around the most recent 10,000 rows in the table there are about 100 rows for each the values B C and X – and these are the rows you’re most interested in querying. We’ll use this data set to demonstrate the principles of how frequency histograms (in particular) can introduce instability.

On (probably extremely rare) good days the default sample size might capture one row each of B C and X, with about 2,250 rows each of A and Z: so the optimizer will know that it has three rare values for which an indexed access path may be a good idea. Even with this “best possible” information the optimizer’s estimate of selectivity will be roughly 1/5500 for each of the three rare values, which means a cardinality estimate of $10M/5500 = 1,818$; an error factor of 18, which could easily be sufficient to encourage the optimizer to pick the wrong path in a more complex query.

More commonly you might find just one or two of the three rare values appearing in the histogram – in which case a query for a rare value that wasn’t captured by the histogram would use the rule “half the frequency of the least common value”, accidentally producing a better (though still poor) cardinality estimate of 909.

Finally, on a really unlucky day, you might find that Oracle didn’t find any of the rare values it built in the histogram – in which case the same “half the frequency” rule would apply but this time the cardinality estimate would be 2.5M because the “least common” value would be one of the two popular values.

From day to day, then, a frequency histogram could cycle you through dramatically different cardinality estimates and execution plans. On top of everything else, you could be even more confused to find that the problem never appeared with one set of data, but appeared fairly frequently with a second similar set of data – which could happen if, for example, one of the rare values was also a low or high value in the first set, while the low and high were both popular values in the second set.

Bear in mind, also, that the timing of when you collected the stats could make a difference – perhaps the rare values come into existence between 7:00 am and 10:00 pm and have all disappeared by midnight. What happens if your stats collection happens to take place around 11:00 pm – perhaps on some nights all of the rare values have already disappeared, on other nights some of them still exist.

The second cardinality problem highlights the weakness of height-balanced histograms (and helps to explain the introduction of the hybrid histogram in 12c). Imagine we have requested a histogram of 254 buckets for one of our columns because we know that it holds too many distinct values for a

frequency histogram – conveniently (for our arithmetic) the sample happens to select 5,334 rows, exactly 21 rows per bucket.

For height-balanced histograms Oracle records one end-point of each bucket, and identifies a value as popular if it appears as the end-point of at least two buckets. Consider the two special cases: a value that appears in 22 rows in the sample and a value that appears 41 times in the sample. With a little luck a value that appears 22 times could appear once at the end of one bucket and 21 times in the next bucket – making it a popular item; with a little luck a value that appears 41 times could appear 21 times in one bucket and 20 times in the next, just failing to be seen as a popular item. This means the value that (statistically) represents a much smaller amount of data is seen as the more popular value; given the randomness of the sampling it’s entirely possible that a height-balanced histogram could cause plans to change every time it is gathered because a critical value could change from popular to non-popular (and vice versa) every time you gather stats.

There are strategies for dealing with some of the problems of frequency histograms and rare values (upgrade to 12c, for example, or create and code for virtual columns that “hide” the popular values); but short of creating histograms programmatically it’s generally quite hard to deal with the instability that height-balanced histograms introduce if they rely on a small sample size.

Out of Range

The last common class of optimizer problem reflects the fact that the stats you gather on time-based (or sequence based) columns can go dangerously out of date the moment you’ve finished gathering them. The impact they have is that cardinality estimates can change catastrophically, leading to dramatic changes in execution plans. Fortunately (though, perhaps, bafflingly) it’s a problem that doesn’t always appear for data sets that seem to be fairly similar.

To keep things simple I’ll talk about a data set that doesn’t need any form of histogram, though the problem does appear (with a couple of extra sources of instability) when you have histograms in place. Imagine that on New Year’s Eve you have a column that holds date-only values covering the whole of 2016 (and nothing else) for a total of 366 days at approximately 1,000 rows per day. Since, by default, statistics will only be gathered automatically after the number of table modifications exceeds 10% of the current row count, the automatic stats gathering job might not refresh the stats until roughly 5th Feb 2017. What does the optimizer do if we run a query requesting “all the data for 15th Jan 2017” at some time around the end of January?

Based on our knowledge of the data we expect to return roughly 1,000 rows. The optimizer notes that we are running a query for data that is outside the recorded date range of 1st Jan to 31st Dec 2016 and scales its initial estimate down according to a simple “linear decay” rule. The existing data range (from Oracle’s perspective) is 365 days ($31/12/2016 - 01/01/2016 = 365$), so the optimizer assumes that in a further 365 days from 31st Dec 2016 the number of rows per day will have dropped from 1,000 to zero. So its arithmetic will say that on 15th Jan 2017 the number of rows per day will have dropped by $1,000 * 15/365$,

giving an estimate of 959 rows – which probably isn't too bad in this particular example.

Things get worse, though, if we start working with range-based predicates. If, around the end of Jan 2017, we were to run a query requesting data where the date is greater than 15th Jan, we probably expect an estimate of about 15,000 rows. Unfortunately the optimizer is not self-consistent with what it sees as “the future”; the estimated cardinality for “`date_col >= 15th Jan`” is the same as “`date_col = 15th Jan`” – and the estimate of 959 rows is suddenly much more of a threat. (As a minor note, the estimated cardinality for the predicate “`date_col between 15th Jan and 30th Jan`” would actually go back to 1,000, i.e. using an estimate that didn’t allow for linear decay, but at the same time ignored the actual date range.)

Unlucky variations on this theme can be catastrophic, especially when you remember that a single parse call can optimize a query (sensibly, we hope, and with a good cardinality estimate) and leave a sharable cursor in place that is used for hours, or even days, very efficiently. Eventually such a cursor may be flushed from memory and the statement re-optimized at a

Conclusion

I've covered a few of the commonest patterns that lead to unexpected execution plans. Some of the problems are "static" problems – the plan is always bad – some are the rather more puzzling "dynamic" problems where plans change catastrophically at random intervals for no apparent reason.

There are always ways to work around these problems, though some of the workarounds are basically undesirable and some of them tend to be contrary to company policy or support contracts for 3rd party applications; nevertheless we can often make some headway against even the worst problems if we recognise the patterns that cause them and invest some effort in controlling the statistics that the optimizer is basing its decisions on. ■



ABOUT THE AUTHOR

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Jonathan's experience with Oracle goes back more than 25 years. He specialises in physical database design, the strategic use of the Oracle database engine and solving performance issues. Jonathan is the author of 'Oracle Core', 'Cost Based Oracle – Fundamentals' and 'Practical Oracle 8i – Designing Efficient Databases' and has contributed to three other books about Oracle. He is one of the best-known speakers on the UK Oracle circuit, as well as being very popular on the international scene, having worked or lectured in 50 different countries. Further details of his published papers, presentations and tutorials can be found through his blog.

Blog: jonathanlewis.wordpress.com



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Submit your questions, listing the topic area to editor@ukoug.org. Jonathan may summarise your question and, with your prior agreement, may contact you to fill in a bit of background.

ASK JONATHAN ASK JONATHAN

Oracle's Modern Analytics Platform

Antony Heljula, Technical Director,
Peak Indicators 

About 10 years ago I was absorbed into Oracle, along with many others, through its acquisition of Siebel. Siebel's dominance in the CRM market was of course the big attraction to Oracle at the time, but let's not forget about Siebel CRM, the real jewel in the crown was Siebel Analytics!

Siebel Analytics was quickly renamed Oracle Business Intelligence Enterprise Edition (OBIEE) and became Oracle's strategic BI platform (there wasn't much competition within Oracle, to be frank). Whilst Siebel CRM eventually ended up being overtaken by other products (e.g. Oracle CX Cloud) and is essentially obsolete, OBIEE has evolved continuously and today it remains a key player in the analytics space.

Back in those Siebel days, Siebel Analytics was easily dismissed by competitors as a "CRM-only reporting tool". By simply changing its name to OBIEE, the product instantly became an "enterprise" reporting tool that was capable of supporting any industry vertical.

But for years we witnessed the same old battle over and over again. OBIEE vs Qlik. OBIEE vs Tableau, or to put it another way: "Enterprise" vs "Self-Service".

The Tableau sales people were always great at showing how quickly you can create cool visualisations ("you mean we don't need IT?"). The problem was that after 6 months of Tableau the customers would be in trouble since their "self-service" BI strategy had become the dark web.....no control, no standards, no security, no governance.

But on the other hand, nobody wants to wait 6 months for IT to deliver a report either. Deadlock.

The same competition exists even today, but the situation has changed significantly. Whilst the likes of Tableau continue to operate in one segment of the analytics market, Oracle now operates in three.

We are seeing the analytics marketplace segment into three different types of product designed to support three specific business needs or functions:

- Enterprise e.g. HR Manager
- Self-Service e.g. HR Analyst
- Search e.g. HR Operations

Figure 1 opposite is a graphic that outlines the high-level differences in each of the three segments:



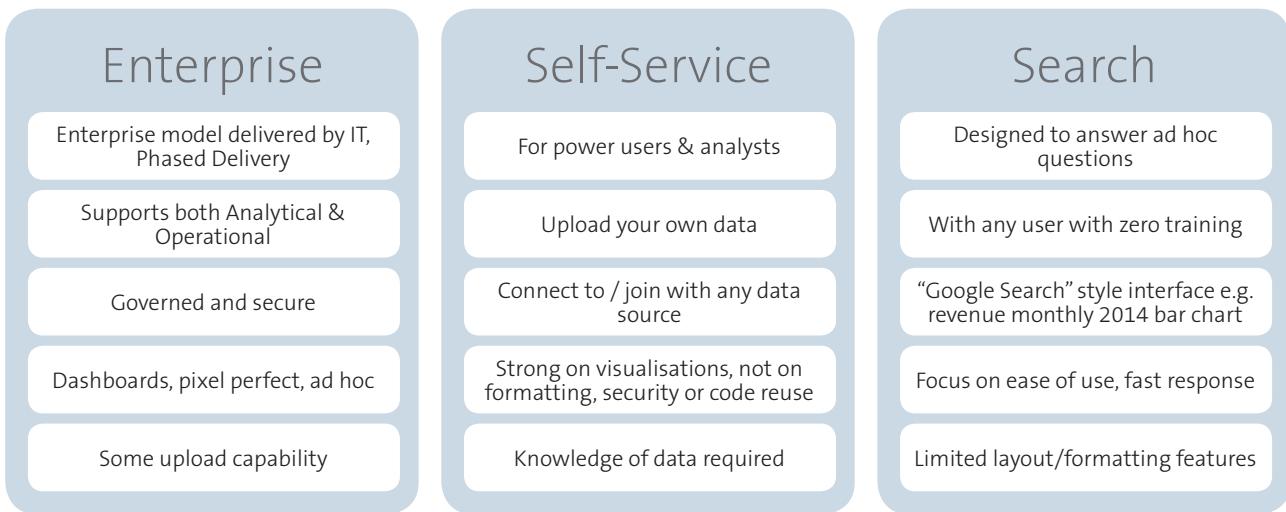


FIGURE 1

The above capabilities all together form, what I would like to define, as a modern analytics platform. Great if you have all three, tough if you only have one!

Let's now take a look at how Oracle's modern and unified analytics platform delivers the above functions.

1) Enterprise



BI Dashboards have always been a core part of OBIEE, and in more recent times, the Oracle BI Cloud Service (BICS). The core capabilities of OBIEE as an Enterprise tool are:

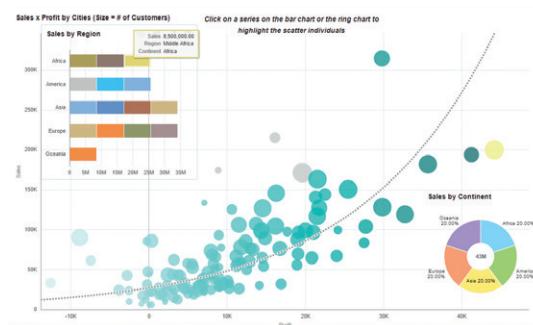
- Self-service dashboards delivered via IT (typically phased releases)
- Role based & personalised
- Interactive & intuitive
- Supports both analytical and operational (real-time) needs
- Ability to build custom ad hoc reports (against IT delivered data sources)
- Drill-down from summary to detail
- Governed & strong on security
- Great integration features (javascript, security, 3rd party portals etc)
- High fidelity, pixel-perfect reporting (BI Publisher)
- Mobile enabled

Enterprise tools are excellent from a governance and security view point, but will often have limitations such as:

- Limited capability for end users to consume their own custom content and data sources (e.g. spreadsheets)

- Data sources typically have to be logically modelled by a developer before end users can build reports
- The tools have a wide variety of charts and formatting features, but are lacking the more advanced charting features available in other visualisation tools (e.g. Oracle Data Visualization)

2) Self-Service



Oracle Data Visualization has enabled Oracle to take a giant leap into the self-service market. Feedback from our customers is that it is much easier to use and more intuitive to use than other "legacy" self-service tools on the market.

Here are its key features:

- Ideal for Business Analysts & Power Users
- Does not require involvement from IT
- Comes embedded within Oracle BI or as its own standalone desktop version
- Excellent on visualisations & ease of use
- Provides connectors to a wide variety of on-premise & cloud systems. Users can seamlessly pull data from "governed" data sources such as OBIEE (via logical SQL or analyses)
- Great features such as trends, outliers, storyboarding, forecasting, free-form layout
- Supports "mash-ups" involving a wide variety of data sources (cloud, on-premise databases, spreadsheets etc)

Self-Service tools are extremely versatile but do come with limitations:

- End users will need to have some technical experience as well

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Business Analytics: Antony Heljula

as knowledge of the backend data sources

- Governance & security can often be an issue – it is harder to control who has access to reports and to restrict what information people can see
- Administrators have little or no visibility of what reports are available or if users are building duplicate reports
- Self-service tools do not benefit from code re-use, you could have 10 reports using the same metrics but each with a slightly different definition
- Enterprise features such as variables and dashboard prompts are not as comprehensive, so it is harder to build sophisticated security models or applications in a Self-Service tool
- When you build visualisations within Oracle Data Visualization, the content cannot be viewed on OBIEE Dashboards – the visuals are completely separate to dashboards (maybe this will change in the future)

NOTE: Oracle Big Data Discovery is another self-service analytics product, this offers powerful data discovery and visualisation features aimed at data analysts / data scientists.

3) Search: BI Ask



BI Ask has had a relatively quiet introduction into the market, you may not have heard of it! But it comes embedded in Oracle BI (part of Oracle Data Visualization) and its simple “google search” style interface offers great potential as a “zero training” ad hoc question & answer tool:

Revenue X 2010 X Per NameMonthX bar chart X

The key features are:

- Designed for ad hoc questions & answers
- Google-style search bar
- Any user, zero training required
- Type-ahead / auto-complete features
- Metadata & data indexed
- Queries run against data sources provisioned by IT (Subject Areas)
- Voice integration planned

The search capability is achieved through indexing Subject Area contents within Oracle BI (both metadata and data).

Search tools naturally will come with limitations:

- They are designed for simple questions (e.g. “Sales 2016 Region Bar-Chart”), so you cannot ask questions that involve complex filters or calculations
- Limited opportunity to modify the layout and formatting
- Data sources need to be indexed prior to use, and re-indexed whenever fresh data is available
- Similar to search engines that are available on the internet, end users will expect results to appear promptly, so there is additional pressure on IT to make sure the queries generated will be fully optimised

In Summary

The analytics landscape has changed!

Oracle has delivered a modern analytics platform that provides comprehensive enterprise, self-service and search capabilities to meet the differing needs of your business functions, all within a single front-end. Customers no longer need to choose between “enterprise” or “self-service” vendors.

Analytics tools always have their pros and cons and it can be a challenge to balance the governed vs ungoverned ways of working. It is essential therefore to have a long-term strategy in place to make sure the available tools will be used effectively and appropriately.



ABOUT THE AUTHOR

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Antony is an Oracle ACE for Business Intelligence and is one of Europe's leading BI architects with a focus on the Oracle BI and related database and middleware products including BI Foundation, Exalytics, BI Applications, Spatial, Real-Time Decisions (RTD), Big Data Discovery, Data-Mining, Endeca, SOA Suite and Oracle VM. He has over 15 years' experience working with Oracle BI and Data Warehousing and is the Technical Director at Peak Indicators.

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Responsive Design With ADF

Responsive Design means building your applications so they change in response to the available screen size. This allows you to build one application that will look good on both large and small screens. This used to be cumbersome to achieve in ADF, but with the new features available in ADF 12c release 2, it has become much easier.

This article will cover two important new features in ADF 12.2.1.x.x: The flowing Masonry layout and the `<af:matchMediaBehavior>` tag. We'll see how they work, where they don't work and how you can put them to use in your applications.

Sten Vesterli, More Than Code 

Stretch and Squeeze

Most ADF applications start with a stretchable outer layout container like a PanelStretchLayout or a PanelGridLayout. This ensures that your application makes use of the entire available screen area when running on a large screen, but doesn't help you when your screen gets smaller. A stretchable layout on a small screen will behave erratically, because some components can be squeezed smaller, while others can't.

Another Brick in the Wall

To handle the situation of moving to a smaller screen, you can use the new ADF 12c release 2 Masonry layout manager. In my mind, this name conjures up an image of a fixed wall with bricks solidly set in mortar, but that's not what Oracle means with the Masonry layout manager.

Instead, ADF is laying the bricks as it draws the screen, and re-arranges them as you resize the screen. The bricks in a masonry layout can be any ADF Faces component that you provide with one of the special masonry CSS style classes.

How Big is a Brick?

Just like Lego bricks only fit together because they all have an exact 8 mm stud distance, the ADF Masonry layout only

fits together if you use bricks of standard sizes. The smallest "brick" is 170 x 170 pixels, and you can make an ADF Faces component this size by setting the Style Class property to AFMasonryTileSize1x1.

Several standard brick sizes are already defined for you: 1x1, 1x2, 1x3, 2x1, 2x2, 2x3, 3x1, and 3x2.

Each brick has an 8-pixel border, so there are 16 pixels between bricks. This means that a 2x1 brick is 356 pixels wide (two times the standard size of 170 plus an extra 16 pixels, making it as wide as two 1x1 bricks with standard distance).

If you are not happy with these sizes, you can apply your own skin and override the standard brick size. However, the Masonry layout is already fickle, so I do not recommend messing with non-standard brick sizes. You can also extend the brick sizes to larger bricks like a 4x4 by defining extra style classes in your skin.

Bricklaying

When ADF renders a masonry layout, it adds bricks in the order they are listed in our ADF source code inside the `<af:masonryLayout>` tag. They are added in reading order, i.e. from left to right, unless you have reconfigured your ADF application for a right-to-left language. It adds bricks in one row

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Technology: Sten Vesterli

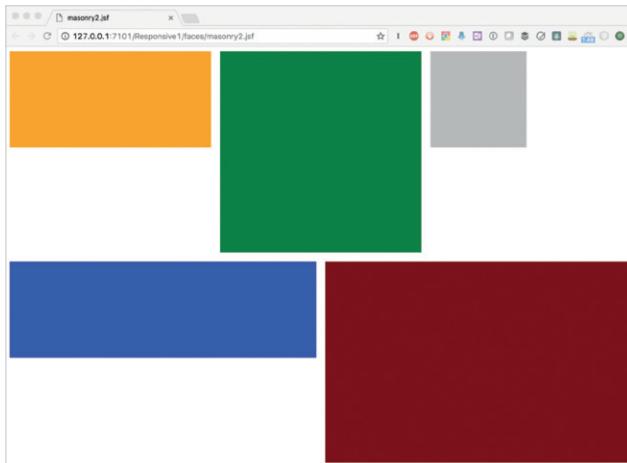
until it gets to the end of the screen or any layout container the masonry layout is embedded in and then breaks to the next line.

From now on, whenever ADF picks up the next brick, it tries to fit it into any open space that it had to leave open in an earlier row. ADF might break to a new row when presented with a wide 3x1 brick, but it will keep trying to fit smaller bricks into the space at the end of a line. Also, if you have bricks of different heights, there might be space left in the middle of a line that ADF can fill later with a smaller brick.

Building Ugly Walls

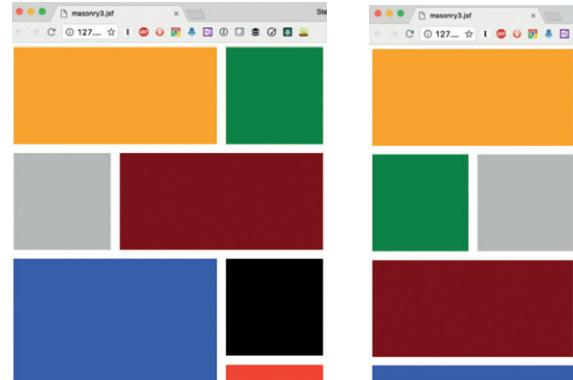
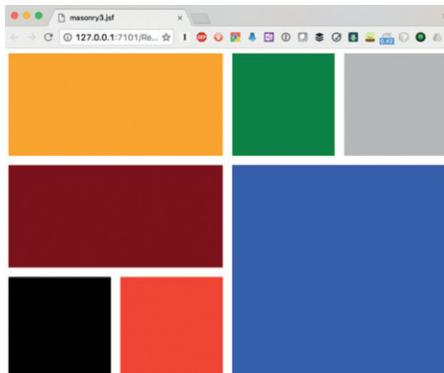
Pretty masonry is built from lots of little uniform bricks. Ugly masonry is built from coarse bricks of uneven size.

If you want to use the Masonry layout, don't just add bricks of various sizes in random order. ADF follows a simple algorithm for placing tiles and cannot automatically create a nice layout if you give it pieces that don't fit.

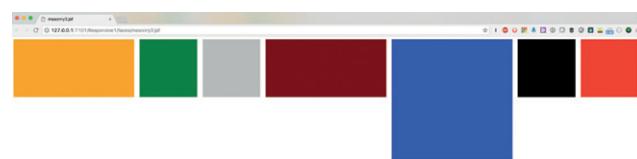


Building Pretty Walls

If you want to use the Masonry layout to achieve an acceptable layout, you need to make sure you have a sufficient supply of small bricks, i.e. elements inside the `<af:masonryLayout>` styled with AFMasonryTileSize1x1. If you have enough of these, ADF will eventually fill out all the holes in the masonry layout caused by larger bricks not fitting tightly together.



Note that you probably don't want to allow a masonry layout to expand without limit. On my large monitor workstation, the above layout looks like this:



So, if you decide to use a masonry layout so your application will look good on tablets and/or phones, place your masonry layout inside an outer container that limits it to something that still looks good. For example, a Panel Group Layout with a max-width style, like this:

```
<af:panelGroupLayout id="pgl1" layout="vertical"
    inlineStyle="max-width:750px;">
    <af:masonryLayout id="ml1">
        <af:spacer id="s1" styleClass="AFMasonryTileSize2x1"
            inlineStyle="background-color:orange;"/>
        <af:spacer id="s2" styleClass="AFMasonryTileSize1x1"
            inlineStyle="background-color:green;"/>
```

Remember to use max-width, not the fixed width CSS style. If you place a masonry layout inside something that has a fixed width, the tiles are never reordered. On the other hand, a max-width just means that the reordering stops once the outer container has reached that width.

Explicit Responses

If you want to react with more precision to changes in the display size, you can use the `<af:matchMediaBehavior>` tag. This tag allows you to change property values based on a CSS media query string.

MatchMediaBehavior Example

You use this tag inside another tag to change a property value on the tag, like this:

```
<af:panelFormLayout id="pfl1" rows="6">
    <af:matchMediaBehavior propertyName="rows"
        matchedPropertyValue="12"
        mediaQuery="screen and (max-width: 768px)"/>
```

This setting means that if the screen width is less than 768 pixels, the rows property has the value 12 instead of the default 6. The syntax for the mediaQuery property is a standard CSS media query – you can see some examples at http://www.w3schools.com/css/css3_mediaqueries_ex.asp.

Undocumented Feature...

Unfortunately, the `<af:matchMediaBehavior>` tag is almost completely undocumented, except for a brief section in the documentation, providing only an example like the above. The Tag Reference for Oracle ADF Faces (12.2.1.2) doesn't even contain this tag, and the ADF Faces demo application just shows the same example as the documentation.

...That Barely Works

The reason for this lack of documentation seems to be that this exact example is the only thing that works. If, for example, you don't explicitly set the property that you refer to in your `<af:matchMediaBehavior>` tag, your application comes crashing down with a `NullPointerException`:

Error 500–Internal Server Error

```
java.lang.NullPointerException
  at oracle.adfinternal.view.faces.taglib.behaviors.
    MatchMediaBehaviorTag.getBehaviorString
    (MatchMediaBehaviorTag.java:70)
  at oracle.adfinternal.view.faces.facelets.rich.
    MatchMediaBehaviorHandler.getBehavior
    (MatchMediaBehaviorHandler.java:72)
```

This happens in the above example if the `PanelFormLayout` doesn't contain the `rows` property.

There are many places where this would be useful, but few of them seem to work. The obvious use case is to de-clutter your user interface on smaller screens, but try as I may, I cannot change the rendered or visible property of anything. As the feature is effectively undocumented except for a few attributes, we are unable to raise bugs against it.

Conclusion

If you are building an application that needs to work on a desktop and on a tablet in both orientations and you have a number of very small pieces of information, masonry layout could be just what you are looking for. On the other hand, masonry layout is very inflexible about its tiles – they have an exact pixel size and your information needs to fit in the box.

The `<af:matchMediaBehavior>` tag should be considered a beta feature and not be used in production applications. It is unable to do any of the useful things you'd expect it to do, but it can crash your application with ugly HTTP-500 errors. The idea is good though, so check this feature again in future releases. ■



ABOUT THE AUTHOR

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Principal, More Than Code ♠

Sten Vesterli is one of the world's leading experts on Oracle ADF. He has written two books on ADF already and is currently writing a third, called *ADF Survival Guide*. Sten is an Oracle ACE Director and helps ADF customers world-wide with ADF online and in-person training, mentoring and architecture.

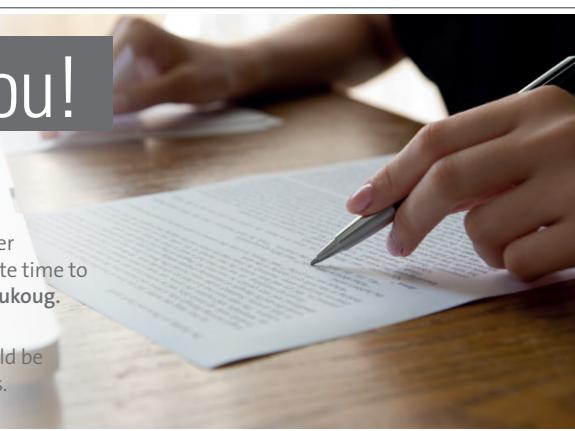
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What to Expect From Oracle Database 12c

With each new release of the Oracle Database comes fundamental architectural changes, driven by new technologies and user requirements, as well as smaller enhancements that make life easier for DBAs and developers.

Maria Colgan, Oracle

This has never been more evident than with Oracle Database 12c, which has been the most rapidly adopted release in over a decade. In this article I'll share some of my favourite new 12c features both big and small, to give you a flavour of what to expect after upgrading to the latest release!

Fundamental Changes

Multitenant

With Oracle Database 12c, comes a major change in the database architecture. Instead of having a stand-alone database for every application, Oracle Multitenant provides a new database consolidation model in which multiple Pluggable Databases (PDBs) are consolidated

within a Container Database (CDB). This allows the PDBs to share the memory and background processes of a common CDB, while keeping many of the isolation aspects of single databases.

The obvious benefit of this new approach is consolidation. By sharing memory and the background processes you can accommodate more databases on a single server. There is also less administrative overhead, as you can manage multiple databases as one, making back ups and patching more efficient. But what is probably the most appealing part of the new architecture is the ability to unplug and plug a PDB from one CBD to another, making upgrading either the database software or the underlying server less painful.

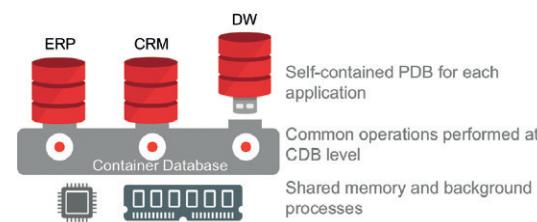


FIGURE 1: ORACLE'S NEW MULTITENANT ARCHITECTURE

However, my favourite aspect of Multitenant came with Oracle Database 12c Release 2, the ability to provision a new database by hot cloning a PDB.

Hot cloning allows you to create full copies of a production database for

testing or development without interrupting operations on the production PDB.

The default install with 12c automatically creates a CDB with one PDB. No application changes are required to take advantage of this new architecture, so there is no harm in trying it.

Database In-Memory

It's long been known that a column format is ideal for analytics, as it allows faster data retrieval when only a few columns are selected but the query accesses a large portion of the data set. Up until now the Oracle Database has only stored data in a row format. With the introduction of Database In-Memory, data can now be populated into memory both in a row format (the buffer cache) and a new in-memory optimized column format, simultaneously.



FIGURE 2: ORACLE'S UNIQUE DUAL-FORMAT IN-MEMORY ARCHITECTURE

The database maintains full transactional consistency between the row and column formats, just as it maintains consistency between tables and indexes. The Oracle Optimizer is fully aware of what data exists in the column format and automatically routes analytic queries to the column format and OLTP operations to the row format, ensuring both outstanding performance and complete data consistency for all workloads without any application changes. There remains a single copy of the data on storage (in a row format), so there are no additional storage costs or redo / undo generated.

It's extremely easy to begin using Database In-Memory, as only two setup steps are required.

First you need to allocate an In-Memory column store, which is a new component of the System Global Area (SGA), called the *In-Memory Area*. It is a static pool within the SGA, whose size is controlled by the initialisation parameter `INMEMORY_SIZE` (default 0). Then you need to specify the new `INMEMORY` attribute either on a tablespace, table, (sub)partition, or materialised view, as only objects with the `INMEMORY` attribute are populated into the In-Memory column store. Once the objects are populated, your application will automatically begin utilising the columnar format for any analytical queries.

Sharding

Starting with Oracle Database 12c Release 2 it is possible to horizontally partition or shard a very large database across a pool of independent databases called shards (up to 1000 shards). Each shard runs on separate server and no shared storage or clusterware is required. There is complete fault isolation between shards and data is partitioned across the pool based on a sharding key. The pool of databases is presented to the application as a single logical database. By specifying the

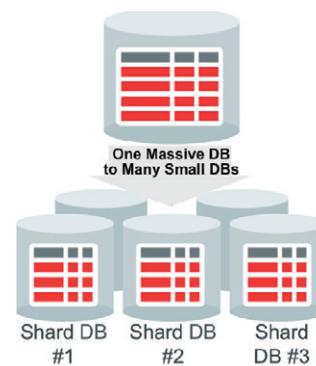


FIGURE 3: ONE MASSIVE ORACLE DATABASE CAN NOW BE SHARDED INTO A POOL OF SMALLER DATABASES

sharding key, application queries are automatically directed to the appropriate database or shard.

However, it is possible to execute queries across all shards to get a holistic view of the entire data set. Sharding enables applications scale data, transactions, and users to any level, simply by adding additional databases (shards) to the pool.

JSON in the Database

Although storing JSON (JavaScript Object Notation) in the database is not an architectural change, it is extremely useful technology worthy of a mention! Unlike XML, there is no new JSON data type in 12c. Instead JSON is stored as text, in any table column, using a `VARCHAR2`, `CLOB` or `BLOB` data type. Using existing data types ensures that JSON data is automatically supported with all of the existing database functionality, including Oracle Text search and Database In-Memory.

It's extremely easy for existing database users to access information within a JSON document, using the standard dot notation in SQL.

For example, you can select the city for each customer from within the JSON column using the following command:

```
SELECT c.json_column.address.city FROM customers c;
```

There are also a number of new JSON operators including `IS JSON` (to filter column values or to create constraints), `JSON_VALUE` (to select one scalar value in the JSON data and return it to SQL), `JSON_EXISTS` (to use a in the WHERE clause to filter rows based on properties), and `JSON_QUERY` (to select (scalar or complex) value in the JSON data).

```
SELECT json_query(custdata,'$.address[*].city' with ARRAY wrapper) FROM customers;
```

Small But Useful Enhancements

Some of the most appealing new features in Oracle Database

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Technology: Maria Colgan

12c are small enhancements. Here is a couple that I think will make your life easier and shouldn't require a huge effort to take advantage of.

Online Statistics Gathering

From Oracle 9i onwards, whenever an index is created, Oracle automatically gathers optimizer statistics. The database piggybacks the statistics gather on the full data scan and sort operation necessary for the index creation. This approach has worked so well, few people even realise it's happening. So in Oracle Database 12c, the same technique is now applied for direct path operations such as, Create Table As Select (CTAS) and Insert /*+APPEND */ As Select (IAS) operations into an empty table or partition. Piggybacking the statistics gather as part of the data loading operation, means no additional full data scan is required to have statistics available immediately after the data is loaded.

The additional time spent on gathering statistics is small, compared to a separate statistics collection process, and guarantees accurate statistics readily available from the get-go.

Longer names

Prior to Oracle Database 12c Release 2, all object names were limited to 30 bytes. Starting in 12.2 the limit has been increased to 128 bytes, making it easier to give all database objects descriptive names. However, you should remember that the limit is now 128 bytes, not characters. If you're using a multi-byte character set be careful you don't get too carried away with your descriptive names.

Create table for Partition Exchange

One of the benefits of partitioning is the ability to load data quickly and easily with minimal impact on the users by using an

exchange partition command. The exchange partition command allows you to swap the data in a non-partitioned table into a particular partition in your partitioned table via a sub-second dictionary operation (no physical data moves). The command can only succeed if the non-partitioned table is identical to the partitioned table both in shape and semantics. In Oracle Database 12c, Release 2, a new DDL command (`CREATE TABLE FOR EXCHANGE WITH`) was introduced that will create a new table, absolutely identical in both shape and semantics to the partitioned table, so the partition exchange command will always succeed.

```
CREATE TABLE sales_JAN_2017 FOR EXCHANGE WITH sales;
```

Approximate Analytic Functions

In some cases the level of precision within an analytical query can be reduced, in a trade off for a shorter elapse time. For example 'how many distinct visitors came to our website last month' An approximate answer that is for example within 1% of the actual value but is returned 10X faster is not only sufficient but also preferable. In order to address this requirement, Oracle has introduced three new approximate functions that provide approximate results in a fraction of the time: APPROX_COUNT_DISTINCT (12.1), APPROX_PERCENTILE, and APPROX_MEDIAN. Let's take APPROXIMATE_COUNT_DISTINCT as an example. This function uses a HyperLogLog algorithm, which enables the processing of large amounts of data significantly faster than COUNT DISTINCT with negligible deviation from the exact result. The APPROX_COUNT_DISTINCT function does not use sampling and its results are 100% deterministic. This technique was originally designed to improve the performance of statistics gathering in 11g and is used by the DBMS_STATS package to calculate the number of distinct values in a column when the ESTIMATE_PERCENT parameter is set to AUTO_SAMPLE_SIZE (the default).

Upgrading to a new release is always a daunting task but hopefully some of these new features will make it worth your while! ■



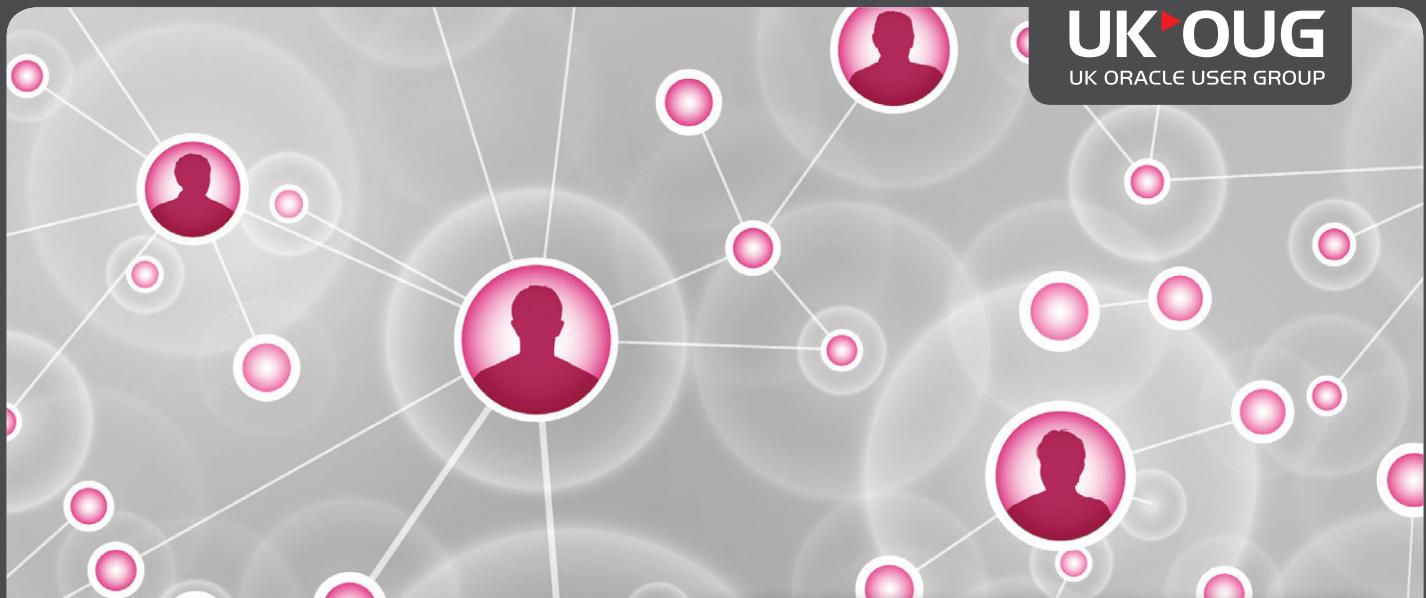
ABOUT THE AUTHOR

Maria Colgan
Master Product Manager, Oracle

Maria Colgan is a Master Product Manager at Oracle and has been with the company since version 7.3 was released in 1996. Maria's core responsibility is the Oracle Database In-Memory Option. She is responsible for evangelising new database functionality and getting feedback from customers and partners incorporated into future releases of the product.

Based on Maria's extensive experience in Oracle's Server Technology Performance Group - she creates material and lectures on the Oracle Database In-Memory Option and the best practices for incorporating it into Oracle environments. She is also a contributing author to the In-Memory blog <http://blogs.oracle.com/In-Memory>.

Blog: <https://sqlmaria.com>
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8 MARCH 2017 | LONDON

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The agenda hosts over 55 sessions on subjects surrounding: Business Analytics & Big Data, Database, Development and Cloud & APEX. Day one culminates with an event

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26 APRIL 2017 | LONDON

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27 APRIL 2017
MANCHESTER

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UKOUG EPM & HYPERION 2017

14 JUNE 2017 | ESHER

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OUG SCOTLAND 2017

21 JUNE 2017 | GLASGOW

The largest annual gathering of Scotland's Oracle users will once again return to the Radisson Blu Hotel in Glasgow.

This multi stream event will deliver the latest Oracle insights by leading industry experts. Look out for the agenda, available in April, at www.oug.org/scotland

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UKOUG LICENCE MANAGEMENT EVENT 2017

24 OCTOBER 2017 | LONDON

The much talked about licensing event will address members concerns over auditing, compliance and answer how best to engage with Oracle's License Management Services team.

Presentations will be delivered from companies such as:

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VLSS, Flexara Software, Version1, CGI and Nymad Limited and attendees will also have the opportunity to hear from their peers in dedicated roundtable sessions. For the full agenda and further details on the day visit: www.ukoug.org/lme



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Oracle E-Business Suite

Taking Oracle E-Business Suite From the Back Office to Mobile

In today's highly competitive business environment, business users want all the information to be available at their fingertips no matter where they are. Traditional ERP applications have been used as back office applications accessed using desktops and laptops, which are confined to a closed office space, most of the time.

Vishal Goyal, Program Manager, Fujitsu Consulting India

This creates a new business opportunity to make ERP systems available on mobile phones with real time access no matter where we are. This is creating huge demand to have mobile apps being made available for ERP applications with no or minimal additional investments.

It is very unfortunate that in this digital age, so many organisations still keep using their ERP applications as back office and do not take them to mobile devices.

Fault is mostly with IT managers of these organisations who do not take these solutions to the business users. Business users can be unaware of the different options available and how tough or easy it is to go mobile. Onus is therefore on IT managers to explore these options and to help users improve their experience of using Oracle E-Business Suite and improve their efficiency and productivity in completing these day to day functions.

There are several options available to digitise Oracle E-Business Suite and expand it on mobile apps.

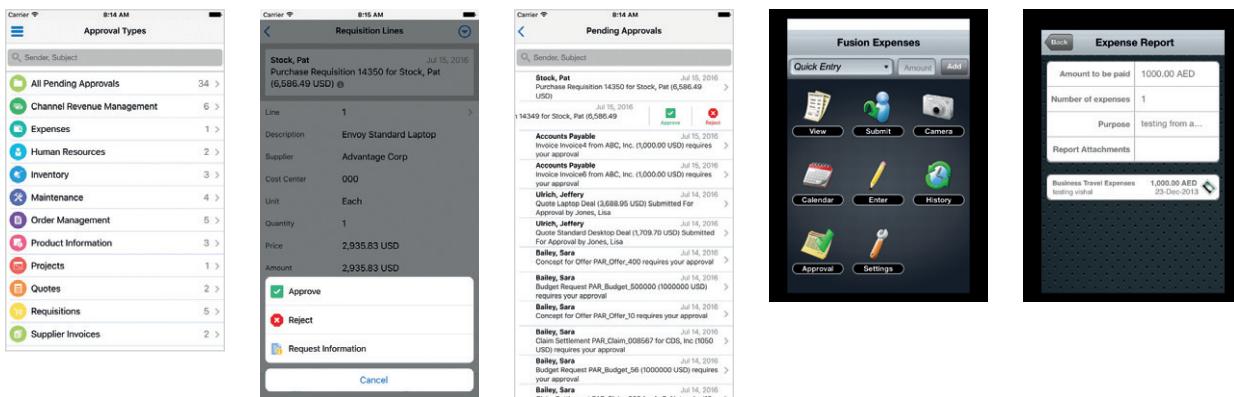
Standard Mobile Apps

To start with, it can be as simple as using standard mobile apps like the ones available from Oracle for Oracle E-Business Suite,

JD Edwards etc. Oracle has released standard mobile applications across different modules (Asset Management, HCM, Financials, Logistics, Procurement, Projects, Manufacturing) which will help business users perform multiple functionalities no matter where they are.

These are standard apps and they come with no additional license cost. All one needs to do is to patch the application, download and configure the app and start using it. It is the quickest way to go mobile with your Oracle E-Business Suite. On the flip side, this approach needs the user to use a different app for each application area which means login / logout as many times as number of apps being used. Also, lot of additional functionalities cannot be included in this case. An example of some of the standard apps which can be configured with Oracle E-Business Suite is shown below. There are apps available for more than 20 modules in Oracle and same is the case for JD Edwards.

Log in to Oracle E-Business Suite mobile apps using your Oracle E-Business Suite login credentials (user name and password). Mobile apps are compatible with both Release 12.1.3 and Release 12.2.3 and onwards, as well as iOS 8.0 or higher and Android 4.1 or higher. The next images show live screen shots for iProcurement, Procurement, Approvals and Fusion Expenses mobile apps.



If clients want to follow this approach, they need to decide which of the mobile apps best fits their business needs. Below is a suggested approach.

- Client assesses different mobile apps available and which one best suits them
- Relevant Oracle E-Business Suite functional consultant will advise the patches to be applied on the server and will also take care of the additional configuration required
- Mobile app to be installed on the test devices and Oracle E-Business Suite URL configured
- If client's Oracle E-Business Suite is behind a firewall, client VPN will need to be installed on the mobile devices. If Oracle E-Business Suite is exposed on internet, no VPN may be required
- Once testing is done, step 2 above can be repeated in UAT and production instances
- Mobile app can be distributed through any MDM solution which client may be using or communication sent to business users on how to download the apps and steps to use them

Indicative Cost Assessment

There is no additional license cost. Oracle E-Business Suite mobile apps are available as part of existing product licenses and all of them are built using Oracle Mobile Application Framework (Oracle MAF), as well as additional components specific to Oracle E-Business Suite provided through the Oracle E-Business Suite Mobile Foundation. To use these mobile apps, you only need to apply consolidated server-side patches and perform some setup tasks to configure your mobile apps on the server. Different versions of the mobile apps may require different configuration steps on the Oracle E-Business Suite server. With the latest mobile foundation release, some level of customisations and branding of the apps is also possible.

If clients are interested in doing that, than an additional mobility consultant will be required for this project.

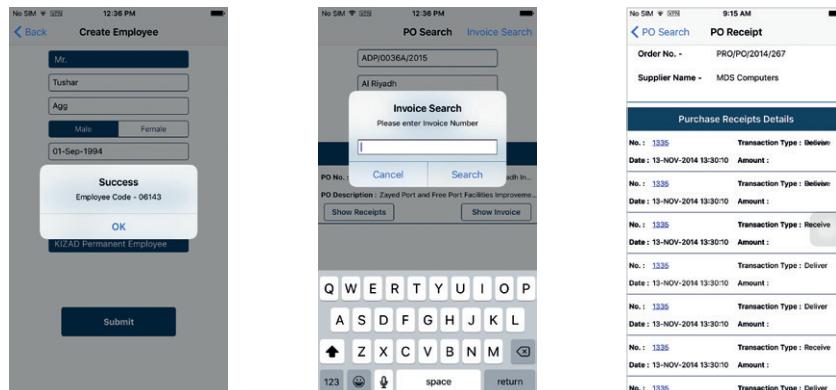
This is the simplest and almost zero cost approach for clients, but has its own limitations with regards to functionality offered in the standard mobile apps.

Digitising Oracle Forms Using Mobile Applications

Another option is to look at Oracle Forms modernisation using 3rd party solutions. Oracle Forms is still being used to deliver most of the functionalities in Oracle E-Business Suite. I have built solutions working with Auraplayer. Auraplayer offers an adapter which helps create REST services on top of Oracle E-Business Suite and consumes these web services into a mobile app using any platform. There is no coding required and no changes on Oracle Forms. All one needs to do is to buy license from Auraplayer and start using it. License costs may look higher initially, but given how easy it is to expose Oracle Forms logic as is, without any change, makes it worth the investment.

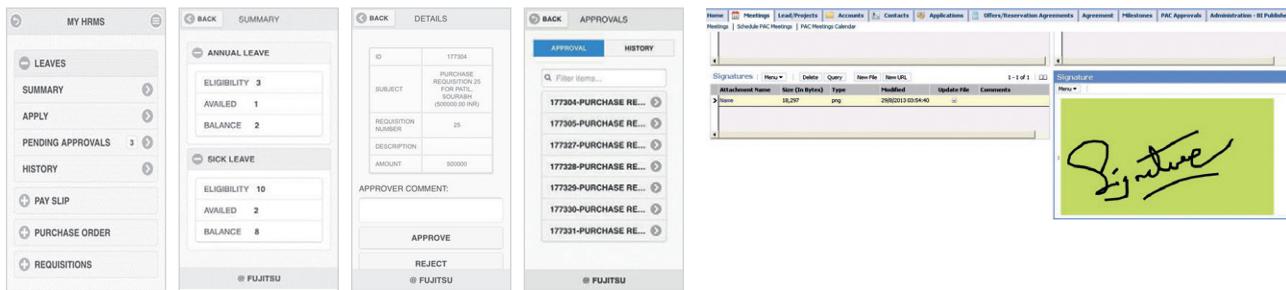
Indicative Cost Assessment

1. Annual Subscription License from 3rd party vendor
2. Existing Oracle apps DBA and Oracle E-Business Suite consultants can work on installation and creation of web services
3. Dedicated mobility consultant will be required to build the mobile app using the framework selected by client (Hybrid, Native etc)
4. A normal business scenario like automating "Creation of employee in HR module" can be modernised in 4-6 working days. Accordingly we can assess the total time required based on all the business scenarios to be modernised using mobile apps



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Oracle E-Business Suite: Vishal Goyal



Being able to automate the Oracle Forms which business users are very accustomed to is a great way to go mobile. This not only helps avoid lots of testing by the business but also the introduction of any changes, as it uses the existing code already built in the form (which is supported by Oracle).

Custom Mobile Apps

More complex business requirements need complete custom mobile apps development as per the customisations done in the source application. Any functionality can be built, exposed as a web service and then consumed into a mobile app using a hybrid approach or native app development. This approach takes much longer but is tailor made to the business needs, meets any requirement, can be built using any platform (Native SDK, Xamarin, Oracle MAF etc) and includes any other functionality like digital signature. Another big advantage is single login helps access all functionalities.

Indicative Cost Assessment

1. Since this is complete custom development, it requires proper requirement gathering with business users to understand the different scenarios to be built. This can take between 2-3 weeks depending on the scope of work
2. Dedicated Oracle E-Business Suite functional, technical, middleware and mobility consultants will be required to do the development and testing. This development effort could range from 2-3 weeks to several months depending on complexity and scope

Building a customised mobile app has its own advantages. Though this is costly and time consuming, complex business needs may need this level of investment to get real benefits of taking Oracle E-Business Suite to mobile devices.

Conclusion

Oracle ERP can no longer be restricted as a back office application and taking it to mobile devices needs to be considered. It takes the entire experience to a new level, makes business users more productive and efficient and helps create a rich user experience. There are host of approaches to go mobile and the option to be used needs to be discussed among IT and business teams to ensure the right solution is selected with benefits which will make the investment worth it. Happy Mobility to all. ■



ABOUT THE AUTHOR

Vishal Goyal
Program Manager, Fujitsu Consulting India

Vishal is an experienced and proven technology consultant with a 16-year track record of delivering results, adding value and motivating teams. Diverse experiences include leading application support, as well as managing and leading global project teams working across different geographies. For the last 6 years he has worked managing the rich technology stack which includes: Oracle ERP, Siebel CRM, Hyperion Planning, WebCenter Content, and Mobile applications with Fujitsu.



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Oracle Management Cloud –

Finding the Needle in a Haystack

It's been said probably more times than you care to remember that; there has been a huge shift in IT with the on-set of Cloud. Systems management technology has evolved over the years; but our way of managing and monitoring environments hasn't, i.e. the culture of infrastructure monitoring. The scale of infrastructure we have to work across is huge; and transient, finding issues can be like...well finding a needle in a haystack.

Philip Brown, Director of Cloud Strategy, Red Stack Tech 

Oracle Management Cloud is a suite of monitoring and management tools for today's modern IT infrastructure. There are a couple of key things you need to understand about the Oracle Management Cloud; firstly, it's based in the Cloud; this isn't an on-premise solution which you need to feed and water. The only thing you install is agents which gather operational data. The next thing to know is that this is a suite of tools. You can use these services individually but the benefits of the solution become more compelling when you combine the services. At the time of writing there are seven services; Application Performance Monitoring, Log Analytics, IT Analytics, Infrastructure Monitoring, Orchestration, Compliance, Security Monitoring and Analytics.

In this article, we are going to explore the Oracle Management Cloud Log Analytics service. Here we will see how this service enables you to work across infrastructure and application tiers to provide a better understanding of errors and issues and turn the huge volumes of operational log data into a useful commodity.

The Problem...

Here is a little equation for you; $((\text{applications} + \text{databases}) * \text{virtualisation}) * \text{cloud} = ???$ Fundamentally it equals lots of technology; tiers and tiers of technology all generating information which IS vital to the smooth running of the applications and enterprise. Even the simplest application with one application server and a database server you could have the following log files:

- Host Logs
- Database Alert Log
- Database Audit Log
- Listener Log
- Web Server Logs
- Access Logs
- Application .out Logs

The challenge is that we need to search these log files efficiently and effectively. All the files will be in different locations on different servers so in reality there is no easy way to search all these logs. Traditional monitoring will search for each message in these logs but that is just searching silos of information. Being able to search these logs in a single command and look for trend analysis across these logs AND link this back to application performance issues is actually what we want to be doing. Log information is also transient and quickly gets deleted, being able to look retrospectively across time periods can also provide insight.

The Tools...

Oracle Management Cloud is a PaaS solution providing Log Analytics, IT Analytics and Application Performance Monitoring. At Oracle OpenWorld this year more services were introduced, Infrastructure Monitoring, Security and Compliance and Security Analytics. Here we are going to talk about one of these components; Log Analytics. As Oracle Management Cloud is

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Technology: Philip Brown

a PaaS solution you don't provide the Platform, Oracle does that for you. All you need to do is send the information to the Management Cloud.

The Setup...

Oracle Management Cloud Log Analytics requires a Cloud Agent which collects the data from the server. This is sent to the Management Cloud directly or via a 'Gateway' which is effectively a proxy agent. In terms of terminology, here is what you need to know.

- Entity – this is the thing, host, database, server, listener, WLS
- Log Source – a logical collection of log files
- Log Entity – a single log file as part of a log source
- Log Parser – this digests the log information

Adding targets into the Management Cloud is done either by editing a pre-defined JSON file with key information or auto discovery. Not all 'Oracle' components are auto-discovered but I believe this will be changing.

```
"name": "orcl12c",
"type": "omc_oracle_db_instance",
"displayName": "orcl12c",
"timezoneRegion": "PST",
"properties": {
"host_name": {
"displayName": "ldndb01",
"value": "ldndb01.redstack.com"
...
"adr_home": {
"displayName": "ADR Home",
"value": "/u01/app/oracle/diag/orcl12c/ORCL12C/edoms"
}
}
}
```

Editing a file is straight forward, but prior to starting gather all the information of entity names, log locations etc first as it will fast track the setup. The documentation is very good and clearly explains what needs to be done. It shouldn't take no longer than a day from getting access to the Cloud service to uploading log data. For Log Analytics you don't need anything other than a Cloud Agent on the target server.

The Analysis...

In this example, we are looking at Alert Logs across a group of systems. The key thing here is searching at scale and visualisation of data to 'fast track' analysis. If you haven't seen the Log Analytics in Oracle Management Cloud I've annotated the picture:



A: Display Fields – What information do you want to see about each entity

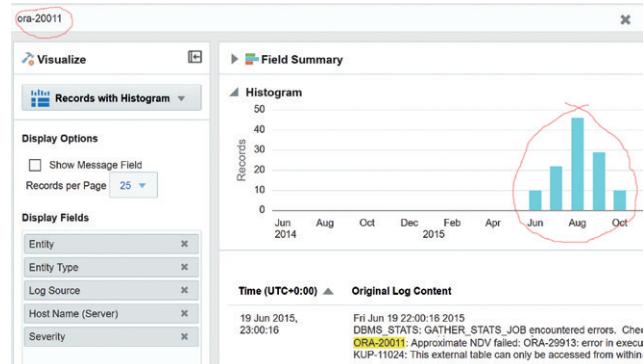
B: Group By – For each log entity the log parser has broken down each log message into groupable attributes

C: Field Summary – Visualisation of Displayed Fields and Group By Fields

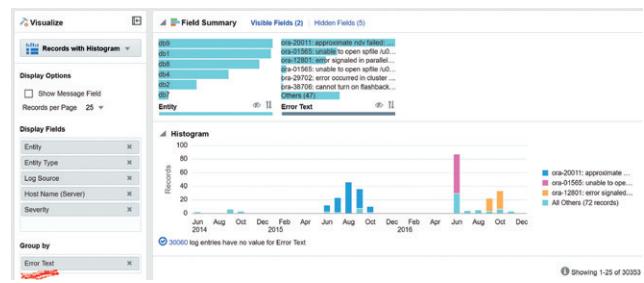
D: Histogram – Y Axis records and the X Axis is Date

E: Log Records – Ordered by Date

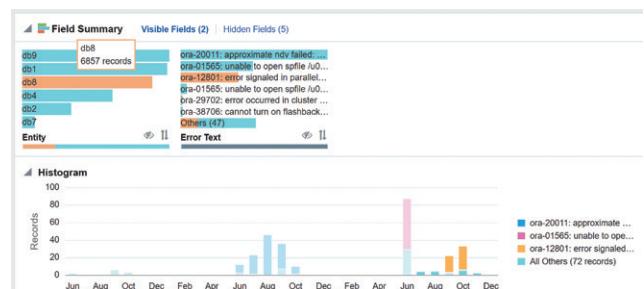
To search it's simple just type what you want to look for; in this example ORA-20011. What this has allowed us to do is search all alert logs for that error; to be fair existing systems management technology would be able to do this, to a certain degree. However, what existing systems management tools can't do is quickly visualise the search and provide a drilldown for further analysis.



So to take it up a level; how about what are the common ORA-errors across all our environments? Because the Management Cloud has an Alert Log parser we can drag and drop fields into the 'group by' criteria. The log parser allows us to group on 'Error Text'. If we expand down the field summary suddenly we have a clear visualisation of our issues. So we have managed to search across all our alert log sources quickly and categorise ORA- errors without having to pre-define which ones we are looking for. This brings the ability to quickly search large volumes of data with the added intelligence of the log parser understanding the key components of those log messages.



By hovering over the 'Error Text' we can see which targets have been affected, alternatively by hovering over the 'Entity' we can see which ORA- errors they have hit. If we then click, the histogram is updated to then allow drill into times and dates.



Logs Logs and More Logs...

While searching across a number of alert log files is definitely a move forward in our ability to diagnose and troubleshoot issues, middleware logs provide more of a challenge. The first challenge is volume, while databases have one key alert log, middleware can have ten and they can be much more verbose in their output. While some log files will be automatically discovered we want to also add log files in. To do this we simply, create a log source, which is just a logical definition of a collection of log files, then we add in the specific log files. Depending on the log type they could be a pre-defined parser for it, if not we can use a generic parser or create our own.

The screenshot shows the Oracle Management Cloud Log Analytics interface. A modal window is open for creating a new log source. The configuration includes:

- Source:** Application Log
- Source Type:** File
- Entity Type:** WebLogic Server
- File Parser:** Automatically parse file only (radio button selected)
- Author:** Philip.brown@redstk.com
- Auto-Associate:** Unchecked
- Included Patterns:** (empty)
- Excluded Patterns:** (empty)
- Extended Fields:** (empty)
- Data Masking:** (empty)
- Labels:** (empty)
- Add** and **Remove** buttons

Quantity not Quality?

Quantity is the issue, not just in the number of log locations but the volume of data that you need to search. Here are some stats from a recent collection of Weblogic Server Logs. The count is the number of log entities across one logical log group (i.e. a collection of log files). Therefore, in the first logical collection we are looking at 2.7 billion log entries, combined with the second that takes us to 4.7 billion. Do we want to search all that data...maybe...can we...yes! That is the key really, Log Analytics gives us the capability to search across these logs to find the needle in the haystack, we don't have to pick or choose what we want, the platform enables us to search across 5 minutes or 5 weeks and the volume of logs is inconsequential.

You Want More Logs...

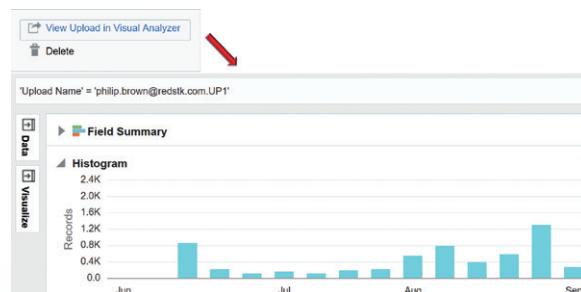
Log Analytics is used to trend and analyse log files currently being generated but you can also look at any log files from any system or logs from a particular system in which you need to do

some 'one-off' analysis and don't need on-going log analytics. For the Oracle Management Cloud loading data 'On-Demand' is done via a CURL command. The command is simple and the key parameters are highlighted in RED.

```
curl --insecure \
-u 'redstack.drbrown@redstack.com' \
-X POST \
-H 'X-USER-IDENTITY-DOMAIN-NAME:redstack' \
--form 'data=@C:/cygwin64/alert_orcl.log' \
"https://redstack.loganalytics.management.us2.oraclecloud.com/serviceapi/logan/uploads?uploadName=Upload1&targetName=orcl&targetType=omc_oracle_db_instance&createTarget=true&logSourceName=DBAlertLogSource&logParserName=db_dbalertlog_body_logtype"
```

The log file can either be a single log file or a ZIP file, it doesn't matter. The uploadName parameter is a way of logically grouping uploads into the Oracle Management Cloud, more on that in a sec. Finally, the logSourceName and logParserName determine how that log file will be interpreted.

As you load 'On Demand' through the CURL statement you will see the logs appear in the Management Cloud. From here you can drill directly into Analysis. If you give your logs different upload names it will logically group them separately.



Final Thought...

So going back to the phrase from the beginning of the article '...huge shift in IT...' makes me want to draw out a particular point, and this isn't due to the on-set of Cloud. IT now more than ever needs to demonstrate value fast. Anything that takes months to enable and deep technical knowledge to derive benefit is going to lose before it even gets going. For me the compelling part of Oracle Management Cloud Log Analytics is that you can derive value immediately, it provides Log Analytics capability with pre-defined Log Parsers that understand the data. We shouldn't view Oracle Management Cloud services in isolation and the more we put into the tool the more we can get out. ■



ABOUT THE AUTHOR

Philip Brown
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Philip is the Director of Cloud Strategy at Red Stack Tech. His role is to enable clients to successfully adopt Cloud technology in all its IaaS, PaaS and SaaS forms. He is an active member of the Oracle community presenting at UKOUG events since 2008 and regularly blogs and writes articles on topics such as Oracle Management Cloud and Oracle Enterprise Manager.

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15 minutes

with
Sarah Green
Office for National
Statistics

The Office for National Statistics and Their Journey From Oracle E-Business Suite to Cloud Applications

The phrase ‘journey to cloud’ is heard all the time, but what does this actually mean for the existing Oracle E-Business Suite team?

Sarah Green, project manager for the Office for National Statistics (ONS), talks to Debra Lilley, VP of Certus Solutions about their move from Oracle E-Business Suite (EBS) to Oracle Cloud in 2016.

Firstly congratulations on your Go Live
Thank you, we are really proud of what we have achieved and the difference it is making at ONS. We are still on our journey but have come a long way.

What were your drivers for moving to Cloud?

Our Oracle E-Business Suite system was old and the risk from being out of support was unsustainable. Our business is data driven, providing the official statistics for the country and yet our corporate systems were old fashioned and didn't inspire people to work for us.

A journey has to start somewhere, where were ONS?

ONS implemented Oracle E-Business Suite in 2004, covering all finance and HR modules but not payroll. We were on Release 11, no longer in premium support but as we didn't use payroll it still worked.

ONS hosted their system and have a small team of around 4 who have supported the system and the business use of it since we first implemented it. Like most Oracle E-Business Suite users we had customised the system considerably. It was well documented, we knew what we had done

and why, but there wasn't much else we could do with it. Our team were probably one of the most experienced end user EBS teams around.

Tell me about those customisations?

A good number of the customisations were around managing the system technically: tablespace alerts, processing stats, monitoring etc. As we are now using SaaS someone else looks after the technology so those are redundant.

Other customisations were to allow us to do things, which we can do in the native Cloud, to be honest some could be done in Oracle E-Business Suite but we had customised in earlier releases and not taken up the standard functionality later on.

The flexibility of the Cloud system has allowed us to deliver what we needed, so most of the customisations simply aren't needed.

We took an approach of ‘like for like’, if it was done in Oracle E-Business Suite it has to be done by Cloud. The system had to be able to do what we had done before, but not necessarily in the same way. In most cases the functionality is better and in some cases it is different, but we haven't

compromised any outcome. The phrase 'but we always did it' was banned.

We also had a lot of unnecessary checks in the system, I think when we implemented Oracle E-Business Suite there was a lack of trust in some of our processes, and so we checked everything. We are a much more mature organisation today, with a lot more trust. An example is expenses, today the Cloud system defaults to their manager, but in Oracle E-Business Suite we allowed them to route to whomever they wanted. Explaining that your manager should be aware, and they can reroute it as necessary, made sense.

ONS took this opportunity to have a new chart of accounts, so there was a lot of mapping to do. Probably the biggest area was the many, many reports specific to ONS. Everyone in ONS was on board, we knew we couldn't customise and we didn't want to; we wanted to get the best out of the system.

Cloud Applications don't stand alone, what about your interfaces?

All ONS interfaces are outbound, and technically it was simply a case of replicating the files from the Cloud application. Sounds simple, and in many cases it was. A few were more tricky, and testing without live data was a challenge but we were confident they would work.

We had elected to have a 'big bang' upgrade so we had contingencies in place for each of the interfaces.

Not surprisingly the interface with our payroll provider was the highest profile and the most difficult to test. People get understandably nervous but we had layers of contingency here, ranging from manual input to amending the last electronic file. We also had almost 3 weeks from the go live date till the first file was needed so we were able to create files with live data in that period and test again.

How long was the implementation and when did you go live?

We committed to Cloud in May 2015, but we kicked off the implementation on 6th January 2016 and went live on the 31st October.

How was that go-live day?

Personally I was tired and nervous but also very excited. As project manager I was in control of everything until that final switchover.

The migration happened over the weekend and if I'm honest the cutover was quicker and less frantic than I expected, but then we had done the preparation and testing; we were ready for it. People were trained and we had floor-walkers on hand for any thing in those first few weeks.

Although it was a 'big bang' and we went live on 31st October, it doesn't all happen on day one.

It took almost five weeks for all areas to be considered live, not because parts were not live but because there were several milestones before all processes were used. Self-service for HCM was the first area people adopted, our users had HR self service in Oracle E-Business Suite so were keen to use the new system. Another major milestone was that payroll extract, and then the first expenses run. Once we had our first month end in Finance I was able to relax in the knowledge we were truly live.

"Did we have challenges?

Yes of course we did but as I explained at several steering boards, we had ice cubes to deal with, not icebergs".

Why did you choose a 'big bang'?

Mainly because of where we came from, our Oracle E-Business Suite was integrated Finance and HR, if we took a phased approach we would have had to run the two in parallel and unstitch EBS as we rolled Cloud out. A 'big bang' was less risky and much less messy.

We didn't go for a year-end though, we will have been live for 5 months before our next year end, plenty of time to iron out any issues and be even more confident of our new system.

What did the users think of the new system?

The biggest change for users is the 'look and feel', and change management was

a big part of the project, but we have had great feedback. The system is intuitive and users say once they understand the navigation, which is a simple training exercise, they can understand what they need to do much better.

The user experience is very different but in a good way. People like using it.

Reporting is the other big change. A big deal is made of the analytics in Cloud rather than simple transaction reporting, and we still have a lot to exploit here. Our 'like for like' approach meant we have created reports in the first instance where the delivered analytics didn't cover what we needed.

One example of where we had embedded analytics immediately was in performance. When we went live we were about to start mid term reviews in ONS. In the past managers needed HR to run reports to see how much had been completed, now it is available as standard in the manager's dashboard. All the managers love having that immediate insight into their teams.

What are your support team doing now?

They still have some bedding in to do, but their role has changed. They had extended EBS to its limits and were kept busy reacting to issues. The continuous innovation through 2 releases a year means upgrading is now actually Business as Usual, but also understanding that this new functionality can deliver for ONS.

Today they are pro-active, looking at how they can add value to the business with the tools available to them. There are massive opportunities to improve how the business uses this single source of data.

The EBS team were like a runner on a treadmill, lots of effort but really boring and not going anywhere, now they are running free with endless opportunities.

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Interview with Sarah Green

Everybody is excited by it. Our executive sponsor, Paul Layland has been really supportive and encouraging – this is good for both our staff personally and for ONS.

One of the pro-active tasks the support team will be working on is taking some of our specific reports and adding them to dashboards. They have just taken our ‘temporary promotion’ report and turned that into an infolet, which drills down into the detail; again instant information.

How would you sum up the change to analytics?

The business of ONS is data, we encourage our staff to be curious about statistical data and now they can apply that same curiosity to our corporate data.

How did the engagement with your systems implementer work?

We had a really good relationship with Certus and it truly was a single project team, don't underestimate how important

this is. Our support team had to be more than just resources to the project.

When we had a challenge with the implementation, it was addressed together. No blame, no witch-hunt, just a resolution. The approach Certus took with prototyping the system, and the mutual challenging of decisions in a positive environment meant we were really comfortable with our build.

ONS have been very public with their project – why?

We are public sector; we are funded by public money. We should be open as to how we are spending that investment. It is also important we share our learning and experience with other public sector bodies, saving them more of that public money when they make their move.

As active members of UKOUG we have benefited in the past from other users' knowledge sharing – now it is our turn to share.

And what is next for ONS?

Lots of that pro-activity I mentioned and a roll out to our field force who never had access to EBS. This will remove the cultural divide we currently have.

Then we have phase II to start after year-end, we will be considering adding EPM for our budgeting, and workforce planning.

We will also look forward to enhancing our payroll processes, for example we currently manage overtime in Lotus Notes. Standard functionality in Cloud HCM will allow us to do that in a much more efficient way, again improving our business from our single source of data.

This has been and continues to be challenging journey but we are up for it and excited about the possibilities.



ABOUT THE AUTHORS

Sarah Green

Project Manager, Office for National Statistics

Sarah is the Project Manager for the Oracle Cloud implementation for the Office for National Statistics and successfully delivered Oracle Cloud ERP and HCM for the organisation in October 2016. This was the first such implementation in government. Sarah now leads the team to embed the Oracle Cloud solution within the Office and maximise its potential for the organisation as the product continues to develop.



Debra Lilley

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Debra Lilley is a VP of Certus Cloud Services, an ACE Director and Member Advocate at UKOUG. She has worked with Oracle Applications for 20 years and now works exclusively with Cloud Applications.

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Improving Statspack Experience

When you are in Standard Edition, or when you are in Enterprise Edition without the Diagnostic Pack, you cannot use AWR and the performance pages of Enterprise Manager (dbconsole, EM express or Cloud Control) are empty. As we often have to troubleshoot performance problems that occurred in the past, it is recommended to install Statspack, which requires no additional option licensing.

Franck Pachot, dbi services 

Installing Statspack is not difficult at all and is documented in the `spdoc.txt` provided in Oracle Home `rdbms/admin` directory. But, through the years of using it on different versions and environments, there are few, or more, things I do to enhance its usage. In this article, I would like to share: some best practices, code snippets and ideas to improve your experience with Statspack.

I recommend to have Statspack collecting snapshots at least every hour in any database which is not covered by Diagnostic Pack. When a user comes and tells me that the database was slow this morning, but is back to normal now, I can see nothing without a history of snapshots. But I will probably see lot of

system and application statistics if I have snapshots from that time.

Installation

Statspack is not installed by default but is easy to install by running `spcreate.sql` which you find in `ORACLE_HOME/rdbms/admin`.

Here is the script ([Listing 1](#)) that I use to create a `STATSPACK` tablespace and install Statspack, to be run when connected as sysdba. As I recommend to put Statspack tables in their specific tablespaces instead of `SYSAUX`, you just have to customise the file name. I usually start with a 2GB tablespace but you can increase it if you have lot of big SQL statements and want a long retention.

```
set echo on
whenever sqlerror exit failure
create tablespace STATSPACK datafile '+DATA' size 100M autoextend on maxsize 2G;
define default_tablespace='STATSPACK'
define temporary_tablespace='TEMP'
column random new_value perfstat_password noprint
select '"'||dbms_random.string('a',30)||'"' random from dual;
alter session set "_oracle_script=true";
@?/rdbms/admin/spcreate
alter session set "_oracle_script=false";
```

LISTING 1- STATSPACK INSTALLATION

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Technology: Franck Pachot

You connect as sysdba to run it and if you want to install it in a pluggable database, you first have to ALTER SESSION SET CONTAINER, or connect through the listener to the PDB service. If you want to install Statspack in CDB\$ROOT, and I'll explain why later, in 12cR1 you need to set “_oracle_script” to true, so that the Statspack schema, the PERFSTAT user, can be created without C## prefix. It's an Oracle maintained script anyway, so no problem in doing that. In 12.2.0.1 this setting is in **spcreate.sql** but still missing from **spddrop.sql** (Bug 25233027 opened for this).

You can see that I set a random password. Even if it's only performance data, they include SQL statements, bind values, and information about your application, it's better to protect it. Change the password later or just don't connect with PERFSTAT. You will probably use it from your own DBA user (all tables are accessible via public synonyms) and can then even lock PERFSTAT account.

The creation should finish with ‘successful’. In case of error, you can deinstall with **spddrop.sql**.

Filter and Access Predicates

Actually before installing, there's something I sometimes ‘hack’ in **spcpkg.sql** because the gathering of execution plans bypasses the most interesting information: the where clause predicates. This comes from old bugs in 9i where this gathering used to encounter an ORA-7445 because those columns from v\$sql_plan are a bit special. The predicate information is not stored as-is and has to do some ‘reverse parsing’. However, there is no issue in the current versions, I query those columns very often and don't tend to see problems anymore. Then, you can replace the commented lines:

```
, 0 -- should be max(sp.access_predicates) (2254299)
, 0 -- should be max(sp.filter_predicates)
```

and change them to the ones commented out as ‘should be’:

```
, max(sp.access_predicates) -- not supported --
, max(sp.filter_predicates) -- not supported --
```

If you had already run the **spcreate.sql** above, just reload the package by running **spcpkg.sql** (set the current schema to PERFSTAT) but, it's better to do that before taking any snapshot or you will have some plans that miss the predicates. Be aware that this is not supported, and I'm not responsible for any side effects.

Snapshot Level

By default, Statspack snapshots are taken at level 5, but I want to gather execution plans and gather segment statistics and both are collected only from level 7.

Before setting the default to level 7 and running automatic jobs, I want to be sure that the level 7 gathering only takes a few seconds:

```
SQL> set timing on
SQL> exec statspack.snap(i_snap_level=>7);
PL/SQL procedure successfully completed.
Elapsed: 00:00:03.04
```

I've seen few cases where it takes longer and it's better to fix the issue before setting the default level to 7. One cause can be lot of data in PERFSTAT with no statistics gathering. Another reason is when the SGA is sized too large, then the shared pool may become huge, and long to read.

So, a few seconds is ok, then you can set the default level to 7 (**Listing 2**).

```
SQL> exec STATSPACK.MODIFY_STATSPACK_PARAMETER (i_snap_level=>7, i_instance_number=>null);
PL/SQL procedure successfully completed.
```

LISTING 2 - SET STATSPACK DEFAULT LEVEL TO 7

If you are in RAC, you have to do that for each instance.

Scheduled Jobs

Now it's time to schedule the jobs that will be owned by the PERFSTAT user so that they will be dropped if we de-install Statspack. If you used the random password for the create, you can connect:

```
connect perfstat/&perfstat_password
```

You will be sad to see that I still use the deprecated dbms_job and you are free to use dbms_scheduler, but I have this script (**Listing 3**) that I've used for years which has the advantage to create the job with the instance number. If you are in RAC you have to run it on each instance because statistics gathering and purge is done per instance.

There is one job to take a snapshot every hour and one job to call the purge job every week, keeping 45 days of history.

Check the jobs:

```
SQL> select last_sec,next_date,next_sec,log_user,instance,what from dba_jobs;
LAST_SEC NEXT_DATE NEXT_SEC LOG_USER WHAT
-----
29-JAN-17 10:00:00 PERFSTAT statspack.snap;
06-JAN-17 00:00:00 PERFSTAT statspack.purge(i_num_days=>45,i_extended_purge=>true);
```

```

connect perfstat/&perfstat_password
variable jobno number
variable instno number
begin
  select instance_number into :instno from v$instance;
  dbms_job.submit(:jobno, 'statspack.snap;', trunc(sysdate+1/24,'HH'),
'trunc(SYSDATE+1/24,''HH'')', TRUE, :instno);
  dbms_job.submit(:jobno, 'statspack.purge(i_num_days=>45,i_extended_purge=>true);',
trunc(SYSDATE)+7, 'trunc(SYSDATE)+7', TRUE, :instno);
  commit;
end;
/

```

LISTING 3 - SCRIPT TO CREATE SNAPSHOT AND PURGE JOBS

```

delete from STATSS$IDLE_EVENT;
insert into STATSS$IDLE_EVENT
select name from V$EVENT_NAME
where wait_class='Idle';
commit;

```

LISTING 4- REPLACE IDLE EVENT LIST BY THE IDLE WAIT EVENT ONES

```

merge into STATSS$SNAPSHOT s
using (
select
dbid,instance_number,snap_id
,ltrim(substr(listagg(name)||';'||ltrim(to_char(time_waited_micro/elapsed_micro,'09.9'))||' '))
within group(order by round(time_waited_micro/elapsed_micro,1) desc,name nulls first),1,21)
,:') ucomment
from (
select
dbid,instance_number,snap_id
,decode(name,'DB time','','DB CPU','CPU','User I/O','I/O','System I/O','I/O',substr(name,1,3)) name
,time_waited_micro-lag(time_waited_micro)over(partition by dbid,instance_number,name order by snap_id) time_waited_micro
,case when lag(snap_time)over(partition by dbid,instance_number,name order by snap_id)-startup_time > 0 then
(snap_time-lag(snap_time)over(partition by dbid,instance_number,name order by snap_id))*24*60*60*1e6
end elapsed_micro
from (
  select dbid,instance_number,snap_id,wait_class name,sum(time_waited_micro) time_waited_micro
  from stats$system_event join v$event_name using(event_id)
  where wait_class not in ('Idle')
  group by dbid,instance_number,snap_id,wait_class
  union all
  select dbid,instance_number,snap_id,stat_name name,value
  from stats$sys_time_model join stats$time_model_statname using (stat_id) where stat_name in ('DB time','DB CPU')
) join stats$snapshot using(dbid,instance_number,snap_id) where ucomment is null
) where elapsed_micro >1e6 and time_waited_micro>1e6
group by dbid,instance_number,snap_id
) l on (s.snap_id=l.snap_id and s.dbid=l.dbid and s.instance_number=l.instance_number)
when matched then update set s.ucomment=l.ucomment;

```

LISTING 5- SET SNAPSHOT COMMENTS WITH AVERAGE DATABASE LOAD

This is an example but you can schedule `exec statspack.snap` and `exec statspack.purge(i_num_days=>45,i_extended_purge=>true)` with whatever you like for scheduling jobs run as sysdba. You can also do it from crontab or Task Manager. The `spauto.sql` script that is provided also uses `dbms_job` but do not schedule any purge. It is always a bad idea to gather information automatically without thinking about retention. Especially as the Statspack tables are stored in SYSAUX and it will grow.

SNAP_ID Sequence

The snapshots are identified with a `SNAP_ID` and some people like to see this number without a gap when they query the Statspack views. I don't need that because I use the `LAG()` analytic function, but if you prefer no gap, no problem, the sequence is not read frequently: `SQL> ALTER SEQUENCE perfstat.stats$snapshot_id NOCACHE;`

When you join Statspack tables, don't forget to include `DBID` and `INSTANCE_NUMBER` in addition to `SNAP_ID`, just in case you use your scripts later on a database with new `DBID` (after a RMAN `DUPPLICATE` for example) or in RAC.

Idle Events

The list of idle events in `STATSS$IDLE_EVENT` often lags behind the new events introduced in new releases. This leads to very misleading wait events as shown at <http://blog.dbi-services.com/statspack-idle-events/>

and my preferred solution, even if it's not the supported one, is to replace this list of idle events by the idle event wait class ([Listing 4](#)).

Date Format

Your locale date format may be larger than what was defined in `spreport`, such as when in the French language:

Instance	DB Name	Snap Id	Snap Started	Snap Level	Comment
CDB	CDB	531	04 Juil. 2016 00:00	7	
		541	04 Juil. 2016 01:00	7	

In that case it's better to set `NLS_LANG=AMERICAN_AMERICA` before running `spreport.sql`.

Snapshot Comment

Statspack has a feature that does not exist in AWR: a comment can be associated with a snapshot. For example, when you take a manual snapshot, you can tag it with a comment:

```
SQL> exec statspack.snap(i_ucomment=>'before load test #15');
```

But the automatic snapshots do not have any comment. I use the script in [Listing 5](#) to set all null comments to one that shows

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Technology: Franck Pachot

Instance	DB Name	Snap Id	Snap Started	Snap Level	Comment
cdb1	CDB	330	12 Jul 2016 17:00	7	I/O:15.1 CPU:01
		332	12 Jul 2016 18:00	7	I/O:14.4 Sch:02
		334	12 Jul 2016 19:00	7	I/O:14.1 CPU:01
		337	12 Jul 2016 20:00	7	I/O:14.1 CPU:01
		338	12 Jul 2016 21:00	7	I/O:13.2 CPU:01
		340	12 Jul 2016 22:00	7	I/O:15.0 CPU:01
		342	12 Jul 2016 23:00	7	I/O:13.3 Sch:03
		345	13 Jul 2016 00:00	7	I/O:13.2 CPU:01
		347	13 Jul 2016 01:00	7	I/O:14.2 CPU:01
		349	13 Jul 2016 02:00	7	I/O:14.6 CPU:01
		350	13 Jul 2016 03:00	7	I/O:13.9 CPU:01
		352	13 Jul 2016 04:00	7	I/O:14.1 CPU:01

LISTING 6 - OUTPUT OF SPREPORT.SQL WITH AAS COMMENTS

```

create or replace view PERFSTAT.DELTA$SNAPSHOT as select
  e.SNAP_ID
 ,DBID
 ,INSTANCE_NUMBER
 ,SNAP_TIME
 ,lag(e.SNAP_ID) over(partition by DBID,INSTANCE_NUMBER,STARTUP_TIME order by e.snap_id) BEGIN_SNAP_ID
 ,ROUND((SNAP_TIME-lag(SNAP_TIME) over(partition by DBID,INSTANCE_NUMBER,STARTUP_TIME order by e.snap_id))*24*60*60) SNAP_SECONDS
 ,STARTUP_TIME,PARALLEL, VERSION, DB_NAME, INSTANCE_NAME, HOST_NAME
FROM  PERFSTAT.STATUS$SNAPSHOT e
join stats$database_instance i using(STARTUP_TIME,DBID,INSTANCE_NUMBER)
/

create or replace view PERFSTAT.DELTA$SYSSTAT as select
  n.snap_time,n.snap_seconds
 ,e.SNAP_ID
 ,e.DBID
 ,e.INSTANCE_NUMBER
 ,e.STATISTIC#
 ,e.NAME
 ,e.VALUE-b.VALUE VALUE
 ,n.startup_time instance_startup_time,n.db_name,n.instance_name,n.host_name
from PERFSTAT.DELTA$SNAPSHOT n join PERFSTAT.STATUS$SYSSTAT e
on(e.snap_id=n.snap_id and e.dbid=n.dbid and
e.instance_number=n.instance_number)
join PERFSTAT.STATUS$SYSSTAT b
on(n.begin_snap_id=b.snap_id AND e.dbid=b.dbid AND
e.instance_number=b.instance_number and e.NAME=b.NAME)
/

```

LISTING 7 - CUSTOM 'DELTA\$' VIEWS FOR STATUS\$SNAPSHOT AND STATUS\$SYSSTAT INFORMATION

the Average Active Sessions (AAS), and main timed event.

With the comments set with **Listing 5** the `spreport.sql` list of snapshots id looks like the output in **Listing 6**. In this example, you can see that the Average Active Session is between 17 and 21 and the highest wait classes: 'I/O' for 'User I/O', 'CPU' for 'DB CPU', 'Sch' for 'Scheduler', etc.

Running these scripts helps to identify the period of time where you have activity.

Delta Values

The Statspack tables store only the cumulative values from the start of the instance. They make sense only when calculating the delta values between two snapshots, which is what `spreport.sql` does.

When you want to go beyond the report, you can query the tables, but then you need to self-join the tables to get the

previous snapshot and calculate the difference. An example of this for STATUS\$SNAPSHOT and STATUS\$SYSSTAT is in **Listing 7**. DELTA\$SNAPSHOT adds the elapsed time (SNAP_SECONDS) and previous SNAP_ID (BEGIN_SNAP_ID) using the analytic function LAG(). DELTA\$SNAPSHOT joins to DELTA\$SNAPSHOT and joins to itself to get previous snapshot values to subtract.

I didn't want to write those kind of views for each Statspack table and maintain them with Statspack evolution, so 10 years ago I created a script (see http://www.dba-village.com/village/dvp_scripts.ScriptDetails?ScriptIdA=3128) to generate them (see **Listing 8**). It calculates the delta value for all nullable number datatype columns, and joins on primary key. The script generates the view creation in `delta.tmp` and runs it.

Pack Management

When you are in Enterprise Edition and don't have Diagnostic Pack, you will use Statspack, but by default, AWR is still activated:

SQL> show parameter pack		
NAME	TYPE	VALUE
control_management_pack_access	string	DIAGNOSTIC+TUNING

```

define owner=PERFSTAT
define prefix=DELTA

whenever sqlerror exit failure
whenever oserror exit failure

CREATE OR REPLACE VIEW &owner..&prefix.$$SNAPSHOT AS
SELECT
  e.SNAP_ID
 ,DBID
 ,INSTANCE_NUMBER
 ,SNAP_TIME
 ,lag(e.SNAP_ID)over(partition by DBID,INSTANCE_NUMBER,STARTUP_TIME order by e.snap_id) BEGIN_SNAP_ID
 ,ROUND((SNAP_TIME-lag(SNAP_TIME)over(partition by DBID,INSTANCE_NUMBER,STARTUP_TIME order by e.snap_id))*24*60*60) SNAP_SECONDS
 ,STARTUP_TIME,PARALLEL, VERSION, DB_NAME, INSTANCE_NAME, HOST_NAME
FROM  &owner..STATS$$SNAPSHOT e
join stats$database_instance i using(STARTUP_TIME,DBID,INSTANCE_NUMBER)
/

```

```

BEGIN
FOR v IN (
  SELECT table_name , '&prefix.'||SUBSTR(table_name,INSTR(table_name,'$')) view_name FROM ALL_TAB_COLUMNS
  WHERE table_name LIKE 'STATS$$' AND table_name NOT IN ('STATS$$SNAPSHOT','STATS$DATABASE_INSTANCE')
  AND nullable='N' AND column_name IN ('SNAP_ID','DBID','INSTANCE_NUMBER') GROUP BY table_name HAVING COUNT(*) = 3
) LOOP
  dbms_output.put_line('');
  dbms_output.put_line('create or replace view &owner..'||v.view_name||' as select n.snap_time,n.snap_seconds');
  FOR c IN (
    SELECT * FROM ALL_TAB_COLUMNS
    WHERE NOT(nullable='Y' AND data_type  IN ('NUMBER')) AND table_name=v.table_name AND owner='&owner.'
  ) LOOP
    dbms_output.put_line(' ,e.'||c.column_name);
  END LOOP;
  FOR c IN (
    SELECT * FROM ALL_TAB_COLUMNS
    WHERE nullable='Y' AND data_type  IN ('NUMBER') AND table_name=v.table_name AND owner='&owner.'
  ) LOOP
    dbms_output.put_line(' ,e.'||c.column_name||'-b.'||c.column_name||' '|||c.column_name);
  END LOOP;
  dbms_output.put_line(' ,n.startup_time instance_startup_time,n.db_name,n.instance_name,n.host_name');
  dbms_output.put_line('from &owner..&prefix.$$SNAPSHOT n join &owner..'||v.table_name||' e ');
  dbms_output.put_line(' on(e.snap_id=n.snap_id and e.dbid=n.dbid and e.instance_number=n.instance_number)');
  dbms_output.put_line(' join &owner..'||v.table_name||' b');
  dbms_output.put(' on(n.begin_snap_id=b.snap_id AND e.dbid=b.dbid AND e.instance_number=b.instance_number)');
  FOR c IN (
    SELECT * FROM ALL_CONS_COLUMNS join ALL_CONSTRAINTS USING(owner,constraint_name)
    WHERE constraint_type='P' AND column_name NOT IN ('SNAP_ID','DBID','INSTANCE_NUMBER')
    AND owner='&owner.' AND ALL_CONSTRAINTS.table_name=v.table_name
  ) LOOP
    dbms_output.put(' and e.'||c.column_name||'=b.'||c.column_name);
  END LOOP;
  dbms_output.put_line('');
  dbms_output.put_line('/');
END LOOP;
dbms_output.put_line('');
END;
.

set feedback off serveroutput on size 100000
spool delta.tmp
/
spool off
set feedback on echo on
start delta.tmp

```

LISTING 8 - CREATE DELTA\$ VIEWS WITH SNAPSHOT INFORMATION AND DELTA VALUES FOR ALL METRICS

It is an overhead and in addition to that it is a risk that someone uses it and gets it flagged in DBA_FEATURE_USAGE_STATISTICS, which will be a problem in the case of a license audit. My recommendation is that you set **control_management_pack_access** to none. Oracle recommends to leave it set because some functions accessible without the licensed option are based on AWR framework. Some examples are segment advisors and undo advisors. In my opinion the risk to pay millions because of a recorded usage is more important. It's different in 12.2 multitenant because lockdown profiles help finer control on features used.

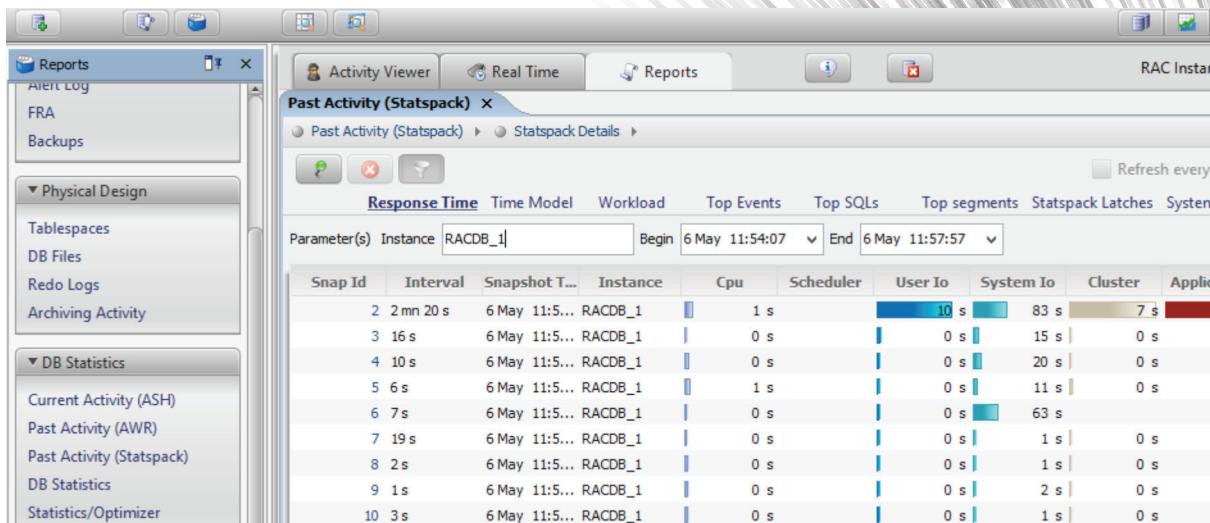
In Standard Edition, the **control_management_pack_access** is set to none by default and it is not recommended to change that.

Graphical View

What is missing with Statspack are the graphics that you can see on EM Express or Cloud Control performance pages. They are unfortunately only based on AWR so you have nothing when you don't have the Diagnostic Pack license. An alternative is to build your own queries, using the 'DELTA' views I've built above, and display the result on SQL Developer reports, or on Excel.

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Technology: Franck Pachot



```
column "SNAP_ID" new_value end_snap noprint
column "LAG(SNAP_ID)OVER(ORDERBYSNAP_TIME)" new_value begin_snap noprint
select snap_id,lag(snapshot_id)over(order by snap_time) from stats$snapshot order by snap_time;
define report_name=sp_last.txt
@?/rdbms/admin/spreport
exit
```

LISTING 9 - SPLASTREP.SQL TO GENERATE THE LATEST REPORT

There are also third party tools that can do that and I recommend Orachrome Lighty which can graphically display what you get from Statspack reports:

And Lighty can go further with a job that simulates ASH and then can really simulate AWR. I've described how to test it in a blog post: <http://blog.dbi-services.com/exploring-oracle-se-a-e-performance-statistics-with-orachrome-lighty/>.

Other Possible Enhancements

The nice thing about Statspack is that we have the source, which is very useful to understand where the statistics come from and how ratios are calculated. We can also do some changes, for example, for 12c you can gather snapshots for V\$EVENT_HISTOGRAM_MICRO and add a section in the report. The enhancement request to add it for AWR was accepted for 12.2 but not as yet in Statspack.

I often use the following `splastrep.sql` script to automatically generate a report on the two latest snapshots. When the `begin_snap`, `end_snap` and `report_name` variables are defined, then `spreport.sql` does not require any user input. Run Listing 9 with `sqlplus` (`spreport.sql` formatting is not compatible with `sqlcl`).

You can also try to set `markup html` on, on some sections if you prefer html reports over text ones but you will see that some sections are better displayed with preformatted text.

Multitenant

In multitenant you install Statspack in each container. Oracle does not support installing it at CDB\$ROOT, but my opinion is different because you may want to capture activity of sessions that switched to CDB\$ROOT through metadata or data links. Having a report that covers the whole instance may be a good start for system-wise performance analysis. In each PDB, the statistics are related to the container (what you see locally from V\$ views), but be careful as some statistics have a meaning only at CDB level (redo for example).

Conclusion

Many features that are available with options, like AWR, have their counterparts, which you need to spend time customising. The good thing is that Statspack is very similar to AWR. AWR was an enhancement of Statspack (which itself was an enhancement of UTLBSTAT/UTLESTAT which are still there in ORACLE_HOME). They are based on the same metrics: statistics and wait events, so the interpretation can be done with the same knowledge and the help of Oracle Database reference documentation.

Statspack has several interesting features that are not well known. You can baseline some snapshots to keep them beyond the purge retention (`statspack.make_baseline`). You can export/import Statspack repository with Data Pump to a centralised one. When you upgrade the database you have to upgrade Statspack, or better: export the old repository elsewhere and re-create it in new version.

If you are running Active Data Guard you can use Statspack to analyse performance on the standby. You install it in the primary (with `sbcreate.sql` and `sbaddins.sql`) and snapshot gathering uses database links to query the standby performance

views. This has been available since 11gR1 and Statspack is the only way, even with Diagnostic Pack, because the support of AWR for Active Data Guard appears only in 12cR2.

Final word: remember that in addition to the snapshots you schedule (hourly for example) you can gather snapshots manually. Always try to analyse a report that covers a homogenous sample of your performance issue. With a good method to analyse them, the 20 years old Statspack reports are more powerful than most tuning tools found in other RDBMS. ■



ABOUT THE AUTHOR

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Franck Pachot is principal consultant, trainer and technology leader at dbi-services in Switzerland. He has over 20 years of experience in Oracle databases in all areas from development, data modeling, performance, administration and training, Franck is an Oracle Certified Master 11g and 12c and an Oracle ACE Director. Franck is co-author of 'Oracle 12cR2 Multitenant' (<https://www.amazon.com/Oracle-Database-Release-Multitenant-Press/dp/1259836096>).

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Are Managed Support Services the Future for Oracle E-Business Suite?

It's hard to escape from all the talk of moving your systems and data to 'the cloud' these days: with even Oracle trying to persuade users of its E-Business Suite (EBS) to set their legacy systems aside and migrate their ERP functions onto Oracle Cloud.

Andy Nellis, Managing Director, e-Resolve

The thing is, while we're sure that most enterprise level users will ultimately do so, we believe that for many, there's a five to 10 year roadmap for this to happen.

That's because not only are many organisations not yet ready to take such a dramatic step, there is also a significant business case for current EBS users to maintain their current platforms in order to fully realise the value of their investment.

Having said that, we believe that some changes are likely to happen right away, as an orderly transition to a cloud-based service is likely to involve many organisations taking a fresh look at the way they resource their current IT infrastructures. Discussions with new and incumbent clients across the public and private sectors is supporting this.

Managing the expected shortfall in skilled personnel

Highly skilled IT personnel hate to be left behind by technology; so the resource pool for EBS specialists is already starting to decline, as the brightest and the best start retraining and moving to more future-proof platforms.

This is bound to show itself with increased recruitment and retention costs for every big EBS user, as even the most loyal staff will want to move onto opportunities with greater long-term security.

A lack of trained Oracle E-Business Suite staff will also be felt more sharply in local government organisations. Here, the pressure to reduce headcounts in IT, combined with zero pay rises due to austerity cuts, could leave many organisations struggling to maintain their HR and financial infrastructure sooner rather than later.

Moving towards a managed support service

The business case for maintaining legacy Oracle E-Business Suite platforms in the medium term is inescapable for many organisations. It represents a very significant investment, and whether you have shareholders or stakeholders in mind, you need to do everything possible to realise its full value.

Yet the increased difficulty and expense of maintaining their own infrastructure has already led many major businesses



and governmental organisations to move towards a managed support solution for legacy Oracle E-Business Suite platforms. In our case, we're delivering a managed service with a blended mix of operational and strategic consultancy to provide transitional support to one local government organisation and are submitting on others.

In the first instance, this provides immediate cost savings, enabling valuable IT personnel who are already on the payroll to be deployed elsewhere, and eliminating the need for future investment in hardware.

Perhaps even more importantly than the cost savings, outsourcing to a specialist company provides a guarantee that essential HR and financial functions will continue to receive expert support throughout the lengthy transition to a cloud-based solution.

This certainty extends to the cost of maintaining your existing services; as ongoing costs can be agreed in advance, and you will only pay for additional services should they become necessary, e.g. in the event of new financial legislation.

Understanding that outsourcing is a collaborative process

In our experience, many organisations initially hold back from outsourcing the management of their Oracle E-Business Suite infrastructure because it feels like giving up control of essential business functions.

The fact is that while outsourcing takes away many worries and responsibilities, it still leaves you in full control, yet with the support of a trusted partner.

For one thing, most of e-Resolve's new relationships start with us providing a series of 'tweaks' to legacy systems that make them work more efficiently. We pride ourselves on then building lasting relationships by putting in the time and effort to understand the evolving needs of our clients and behave proactively to ensure they receive the best value. The co-creation of managed services agreements, based on our reviews of their current EBS landscape is an effective methodology for clients. The resulting managed service requirements specification enables them move forward into procurement with a defined path to achieving operational stability. The



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Andy Nellis is the CEO of e-Resolve who are a specialist e-Business Suite consultancy. Andy been working in the field of ERP over 20 years. Starting out as an Oracle user, moving into support, then consultancy and today as a founder and CEO of e-Resolve.

 www.linkedin.com/in/andy-nellis-9158514/

upfront investment in time and resource pays dividends in helping clients find the appropriate support partner.

Ensuring that your procurement framework offers a balanced scorecard

I believe it almost goes without saying that outsourcing your Oracle E-Business Suite support will provide cost savings, together with a host of other benefits.

Having said that, this essential function is too important for you to make cost the main criteria when choosing a provider. Quality of service costs money, if your chosen partner is going to be able to resource the contract with the time and experience it will require.

So, if you're looking for a trusted, long-term partner to look after your legacy Oracle E-Business Suite, perhaps the first step you need to take is to re-evaluate the way in which services like this are scored during the procurement process. ■

Getting Started With Oracle GoldenGate

Replicating data between databases in a timely fashion can be a surprisingly tricky thing to do. There are many ways to replicate data, from home-grown code and database trigger based solutions, to Oracle Streams, Materialized Views over Database Links and several 3rd Party replication products, such as Dell Shareplex and DBVisit Replicate. The more timely and resilient you want your solution to be, the harder it becomes to implement.

Neil Chandler, Chandler Systems 

Whatever your reasons for moving data; migrating to the Cloud or to a new system/platform, feeding a Data Warehouse, performing an upgrade with minimal or zero downtime, or even implementing a bespoke Business Continuity system where only a fraction of the data is required for DR, GoldenGate will allow you to implement data movement across platforms and different storage engines easily and quickly, with built-in resilience.

GoldenGate is a platform independent data extraction, transformation and load tool (ETL). I have used it to reliably replicate data from Mainframe SQL/MX databases, transform it into Oracle, and modify and transform it again into SQL Server, as well as designing and implementing one-to-one and one-to-many data migrations and feeds on Oracle-centric systems. I have also implemented a multi-master ACTIVE/ACTIVE solution.

Basic uni-directional replication, which will encompass most GoldenGate implementations, is straightforward to setup. The best way to understand GoldenGate is to install it and use it in

a test environment. For the purposes of this introduction, I will concentrate on showing how we can setup a simple Oracle-to-Oracle Master-to-Slave replication of an entire schema. This example replication will be done on Oracle VM VirtualBox “Developer Days” Servers, downloadable here:

<http://www.oracle.com/technetwork/database/enterprise-edition/databaseappdev-vm-161299.html>

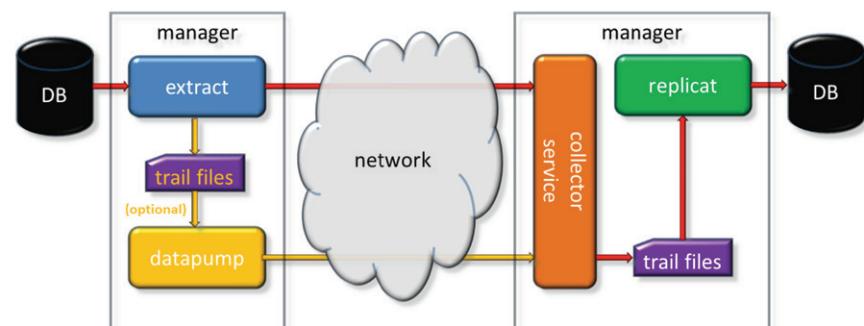
Architectural Overview

GoldenGate consists of several processes.

The **EXTRACT** process connects to the database, captures transactions and writes the transactions to a TRAIL FILE. The TRAIL FILE can either be local to the EXTRACT to be used by a DATAPUMP, or directly sent to a remote destination server.

The **DATAPUMP** process is used to pick up transactions which have been written to a local TRAIL FILE and sends them to a

GoldenGate Logical Architecture



```
$ cd /home/oracle/install
$ unzip fbo_ggs_Linux_x64_shiphome.zip
$ cd /home/oracle/install/fbo_ggs_Linux_x64_shiphome/Disk1/ogg.rsp

$ cat ogg.rsp
#-----
# Do not change the following system generated value.
#-----
oracle.install.responseFileVersion=/oracle/install/rspfmt_ogginstall_response_schema_v12_1_2

# Specify a release and location to install Oracle GoldenGate
INSTALL_OPTION=ORA12c
SOFTWARE_LOCATION=/home/oracle/app/goldengate
INVENTORY_LOCATION=/home/oracle/app/oraInventory
UNIX_GROUP_NAME=oracle

$./runInstaller -silent -responseFile /home/oracle/install/fbo_ggs_Linux_x64_shiphome/Disk1/ogg.rsp
Starting Oracle Universal Installer...

Checking Temp space: must be greater than 120 MB.  Actual 23701 MB  Passed
Checking swap space: must be greater than 150 MB.  Actual 2063 MB  Passed
Preparing to launch Oracle Universal Installer from /tmp/OraInstall2017-01-07_01-30-23PM. Please wait ...
You can find the log of this install session at:
/home/oracle/app/oraInventory/logs/installActions2017-01-07_01-30-23PM.log

The installation of Oracle GoldenGate Core was successful.
Please check '/home/oracle/app/oraInventory/logs/silentInstall2017-01-07_01-30-23PM.log' for more details.
Successfully Setup Software.
```

FIGURE 1

remote destination server. NOTE: The DATAPUMP is an optional step, but it is best practice to use a DATAPUMP. This is to protect against running out of memory should the remote destination have any availability issues. It is technically a specialised EXTRACT process, and runs as an extract.

The **COLLECTOR** process on the remote destination server writes the transactions to a TRAIL FILE on the destination server. The COLLECTOR process is spawned automatically by the MANAGER when the EXTRACT or DATAPUMP connects to the remote servers. It requires no other configuration.

The **REPLICAT** process reads the TRAIL FILE on the destination server and applies the change records to the destination database.

The **MANAGER** process looks after all of the other processes, and can start and restart them automatically. It also cleans up old TRAIL FILES and listens on a TCP port (7809) for incoming connections from source EXTRACT and DATAPUMP processes.

The **TRAIL FILE** is a series of binary files in a canonical format which contains all of the transactions we have captured in the EXTRACT. The TRAIL FILE format is identical, regardless of the source or destination system type. It is written-to by EXTRACT processes, and read by DATAPUMP and REPLICAT processes. You can only name the file using 2 characters, so there's no real opportunity for a meaningful naming standard. The TRAIL FILE is defined with a maximum size which should relate to the number of transactions you are putting through the system. Once the maximum size is reached, or if you stop and start the extract process, a new TRAIL FILE will be started. The file format of the TRAIL FILE is XXnnnnnnnn, where XX is your 2 character name and nnnnnnnnn is the incrementing sequence number (note: this is restricted to 6 characters pre v12.2 of GoldenGate). The old filename format - using the FORMAT keyword in the EXTRACT - may be required depending upon the platform to which you are replicating data.

Installing GoldenGate

GoldenGate is a straightforward install and is easily done via a responseFile as there are few parameters to supply. Unzip the downloaded installation file to an appropriate installation directory on each server, setup a response file [ogg.rsp] to identify the SOFTWARE_LOCATION of the GoldenGate install and perform a silent install. You will need to install GoldenGate for both the source and destination database servers.

Example GoldenGate Install on Target Server (See Figure 1).

Initial Configuration

First of all we need to configure some global settings, directories and the GoldenGate Manager on the source and target servers. We should create a GLOBALS file in the GoldenGate Home installation directory /home/oracle/app/goldengate. The GLOBALS file is read each time we use the GoldenGate Command Interpreter "ggsci" and contains parameters which apply to the entire GoldenGate instance.

```
-- /home/oracle/app/goldengate/GLOBALS
ggschema goldengate
checkpointtable goldengate.checkpoint_table
```

We need to ensure all appropriate GoldenGate sub-directories have been created underneath the GoldenGate Home. We can use the "create subdirs" command within "ggsci" to do this. The 3 key subdirectories are:

dirprm – this contains all of the parameter files group extract, datapump and replicat groups as well as the parameter file for the manager and any include files

dirrpt – this contains all of the report log files from each group, showing information relating to group and manager processing

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Technology: Neil Chandler

dirdat – this is the default directory for all of the trail files produced by the extract and datapump/collector processes. The files in this directory will contain all of the data for every transaction which is replicated, and so we need to ensure it has sufficient size and performance resources

To complete the basic setup, we need to create the Manager parameter file and start the Manager.

```
$ ggsci
Oracle GoldenGate Command Interpreter for Oracle

GGSCI 1 > create subdirs
Creating subdirectories under current directory /home/oracle/
app/goldengate

Parameter files          /home/oracle/app/goldengate/
dirprm: created          /home/oracle/app/goldengate/
Report files             /home/oracle/app/goldengate/
dirrpt: created          /home/oracle/app/goldengate/
Checkpoint files         /home/oracle/app/goldengate/
dirchk: created          /home/oracle/app/goldengate/
Process status files     /home/oracle/app/goldengate/
dirpcs: created          /home/oracle/app/goldengate/
SQL script files         /home/oracle/app/goldengate/
dirsqli: created          /home/oracle/app/goldengate/
Database definitions files /home/oracle/app/goldengate/
dirdef: created          /home/oracle/app/goldengate/
Extract data files       /home/oracle/app/goldengate/
dirdat: created          /home/oracle/app/goldengate/
Temporary files          /home/oracle/app/goldengate/
dirtmp: created          /home/oracle/app/goldengate/
Credential store files   /home/oracle/app/goldengate/
dircrd: created          /home/oracle/app/goldengate/
Masterkey wallet files   /home/oracle/app/goldengate/
dirwl1: created          /home/oracle/app/goldengate/
Dump files               /home/oracle/app/goldengate/
dirdmp: created          /home/oracle/app/goldengate/

GGSCI 2> edit param mgr
GGSCI 3> start mgr
Manager started.

GGSCI 4> info mgr
Manager is running (IP port DevDaysSourceGG.7809, Process ID
11713).
```

The Manager Parameter File looks like this:

```
--/home/oracle/app/goldengate/dirprm/mgr.prm
PORT 7809           -- listener port
DYNAMICPORTLIST 7810-7830 -- port range for spawned server
"collector" processes

--Uncomment the below once everything is configured and running
smoothly
--PURGEOLDEXTRACTS /u01/app/gg12/dirprm/AA, USECHECKPOINTS
--AUTOSTART ER *
--AUTORESTART ER *, RETRIES 5, WAITMINUTES 1, RESETMINUTES 60

-- Interval at which problems and errors should be written to
the ggserr.log file
DOWNREPORTMINUTES 15
LAGREPORTMINUTES 30 -- Interval at which lag is checked
LAGINFORMINUTES 5 -- Threshold at which lag is reported
LAGCRITICALMINUTES 15 -- Critical threshold reporting value
```

In the Database – Check the schema to be replicated

There is one key requirement for replicating data. It must be possible to uniquely identify each row of data. There are 3 ways to do this; a Primary Key (PK), a Unique Key(UK) or a combination of up to 38 columns which can be concatenated together to form a unique value. By default this will be the first 38 columns of any given table with no PK or UK, but you can define any 38 columns for this using the KEYCOLUMNS parameter. If one of these conditions cannot be met, you cannot successfully replicate the data. I would recommend that if a table does not

contain a unique identifier, and you are able to modify the schema, that a surrogate key column be added and populated. It can be a simple population using a DEFAULT sequence next-value to capture new values automatically (e.g. `create sequence <table_seq>; alter table <table> add surrogate_unique_col default <table_seq>.nextval;`).

There are a few other schema-based problems which may need to be overcome, such as deferred constraints. There is a script within MOS article **1296168.1** which performs a check of your schema for replication compliance and provides some advice and metrics too.

If you need to replicate sequences, you must run the **sequence.sql** script in the target database. This script is located in the GoldenGate Home directory.

In the Database – Initialization parameters and database settings

There are a few recommended and mandatory settings for the source and target databases:

Setting / initialization parameter	Description
<code>alter database force logging</code>	To ensure that you do not miss any NOLOGGING operations. You may wish to do this at a more granular level, such as tablespace.
<code>alter database add supplemental log data</code>	This adds required supplemental logging on at a database level. Whilst this is low impact to the redo logs, you may wish to do this at a more granular level within ggsci using <code>add trandata <schema>.<table></code>
<code>alter database add supplemental log data (primary key) columns;</code> <code>alter database add supplemental log data (unique) columns;</code>	This always includes the primary and/or unique key data in the redo stream to ensure we can identify each row, even if those columns have not been referenced by the transaction.
<code>alter system set undo_retention=28801 scope=both sid='*' ;</code>	Keep undo for as long as it may be needed for the longest database transaction. This should be balanced with Bounded Recovery, which defaults to 4 hours, so at least 8 hours of UNDO is needed. Oracle recommends keeping 1 day of undo if possible.
<code>alter system set enable_goldengate_replication=TRUE scope=both sid='*' ;</code>	From Oracle 11.2.0.4 / 12.1.0.2+ this is mandatory. It enables access to certain internals for GoldenGate in relation to TDE, LOGREADER access, trigger suppression, deferred constraints and other integration points.
<code>alter system set streams_pool_size=200M scope=spfile sid='*' ;</code>	Integrated EXTRACT and REPLICAT use Streams technology. The streams pool should be at least 200M. Use the advisors to determine the optimal size for throughput for your system.

In the Database – GoldenGate accounts

There needs to be a GoldenGate account in both the source and the target databases. The Source EXTRACT will be mainly reading from the in-memory REDO stream to capture transactions. The target REPLICAT will be playing those transaction into the database.

The source database consists of a container database called “cdb1” and a pluggable database called “orcl” (this pre-exists in the downloaded VM image).

The target database consists of a container database called “cdb1” and a pluggable database called “orcltarget” (this is a newly created PDB in the downloaded VM image).

In the source container database, we need a *common user* for the EXTRACT, with GoldenGate-specific and PDB-level privileges:

```
SYS@cdb1 > create user c##goldengate identified by goldengate ;
User created.

SYS@cdb1 > exec dbms_goldengate_auth.grant_admin_
privilege('C##GOLDENGATE',container=>'ALL');
PL/SQL procedure successfully completed.

SYS@cdb1 > grant dba to c##goldengate container=all;
Grant succeeded.
```

In the target database, we need a GoldenGate user within the PDB itself:

```
SYS@orcltarget > create user goldengate identified by
goldengate;
User created.

SYS@orcltarget > exec dbms_goldengate_auth.grant_admin_
privilege('GOLDENGATE');
PL/SQL procedure successfully completed.

SYS@orcltarget > grant DBA to goldengate;
Grant succeeded.
```

NOTE: If you are not using Pluggable Databases, setup both GoldenGate users the same as the target GoldenGate user in the PDB.

Setup the EXTRACT and DATAPUMP

Before we synchronise the data between source and target, we should configure and start the Extract Process. This will ensure data overlap and means we will not miss any transactions. We need to create it, configure TRAIL FILES, register and start it

```
$ ggsci
Oracle GoldenGate Command Interpreter for Oracle
GGSCI 1> edit param e_hr

GGSCI 2> dblogin userid c##goldengate, password goldengate
Successfully logged into database CDB$ROOT.

GGSCI 3> add extract e_hr, integrated tranlog, begin now
EXTRACT (Integrated) added.

GGSCI 4> add exttrail ./dirdat/AA, extract E_HR, megabytes 20
EXTTRAIL added.

GGSCI 5> register extract e_hr database container (orcl)

2017-01-08 15:34:05  INFO    OGG-02003  Extract E_HR
successfully registered with database at SCN 6252571.
```

We have ensured that all transactions after SCN 6252571 will be captured to the TRAIL FILES.

The EXTRACT parameter file looks like this:

```
-- /home/oracle/app/goldengate/dirprm/e_hr.prm

-- Setup Environment Variables so we login to the database
correctly
SETENV (ORACLE_HOME='/home/oracle/app/oracle/product/12.1.0/
dbhome_1')
SETENV (ORACLE_SID='cdb1')

-- Name the extract
EXTRACT e_hr

-- Login Details. These can be encrypted.
USERID c##goldengate, PASSWORD goldengate

-- Add our standard reporting options for every extract and
replicat
include /home/oracle/app/goldengate/dirprm/i_report.prm

-- Name the Trail File. We only get 2 characters!
EXTTRAIL ./dirdat/AA

-- Makes trail files smaller and helps with primary key updates
UPDATERECORDFORMAT COMPACT

-- We want to replicate DDL too
DDL INCLUDE MAPPED

-- And report all DDL operations in full in the report logs.
DDLOPTIONS REPORT

-- Finally list the objects we are replicating: pdb.schema.
object
-- Wildcard matching is OK as long as we aren't doing any data
-- transformation in this step.
SEQUENCE orcl.hr.*;
TABLE   orcl.hr.*;
```

For the DATAPUMP, we need to create, configure the remote TRAIL FILES, and start it

```
GGSCI 1> info all
Program      Status      Group      Lag at Chkpt  Time Since
Chkpt
MANAGER      RUNNING
EXTRACT      RUNNING      E_HR        00:00:10      00:00:06

GGSCI 2> edit param p_hr

GGSCI 3> add extract p_hr, exttrailsource /home/oracle/app/
goldengate/dirdat/AA
EXTRACT added.

GGSCI 4> add rmttrail /home/oracle/app/goldengate/dirdat/AA,
extract p_hr, megabytes 20
RMTTRAIL added.

GGSCI 5> start p_hr
Sending START request to MANAGER ...
EXTRACT P_HR starting

GGSCI 6> info all
Program      Status      Group      Lag at Chkpt  Time Since
Chkpt
MANAGER      RUNNING
EXTRACT      RUNNING      E_HR        00:00:02      00:00:01
EXTRACT      RUNNING      P_HR        00:00:00      00:00:08
```

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The DATAPUMP parameter file looks like this:

```
-- /home/oracle/app/goldengate/dirprm/p_hr.prm

-- Setup Environment Variables so we login to the database
correctly
SETENV (ORACLE_HOME='/home/oracle/app/oracle/product/12.1.0/
dbhome_1')
SETENV (ORACLE_SID='cdb1')

-- Name the datapump. Note that its' really a special type of
extract
EXTRACT p_hr

-- Add our standard reporting options for every extract and
replicat
include /home/oracle/app/goldengate/dirprm/i_report.prm

-- Specify where the trail file is being transmitted-to
RMTHOST DevDaysTargetGG , MGRPORT 7809
RMTTRAIL /home/oracle/app/goldengate/dirdat/AA

-- If you are not doing any transformation in the datapump
-- this parameter increases performance by up to 30%
PASSTHRU

-- This is needed to capture any data issues.
-- It is useful when debugging problems.
DISCARDFILE ./dirrpt/p_hr.dsc, PURGE

-- And capture the relevant objects.
SEQUENCE orcl.hr.*;
TABLE    orcl.hr.*;
```

Initial Loading and Data Synchronisation

This can be the hardest part of any replication. Seeding the target to match the source can be difficult, especially across DB formats. This is possible within GoldenGate using a “Special Replicat”, which is beyond the scope of this introduction. Special Replicats can be slow to run with large data volumes but may be your best option if replicating between different database types. With Oracle-to-Oracle, my two preferred initialisation methods are to either:

- Create a Physical Standby, start the extract, stop Data Guard, and force open the standby R/W noting the V\$DATABASE. STANDBY_BECAME_PRIMARY_SCN
- Use Export Datapump to extract the source data as of a particular SCN

I will be using the Export Datapump method here as I wish to rename the schema in the target system. Note the use of FLASHBACK_SCN in the Export Datapump to fix the point in time of the data extraction. We will use this SCN when starting the playback of transactions in the target later.

```
SYS @ cdb1 > select current_scn from v$database;

CURRENT_SCN
-----
6302652

$ expdp c##goldengate/goldengate@orcl directory=gg dumpfile=gg.
dmp logfile=gg_exp.log schemas=hr flashback_scn=6302652

Copy the .dmp file to the target and import, with relevant re-
mappings

$ impdp goldengate/goldengate directory=gg dumpfile=gg.
dmp logfile=gg_imp.log remap_schema=hr:hr_target remap_
tablespace=users:hr
```

If you are unable to ensure definitive extract points, such as when you are using flat files extract and load to perform an initial population, it may be necessary to use the

HANDLECOLLISIONS parameter in the REPLICAT. This **temporary** parameter may be used to get your REPLICAT started should you have transactions in your TRAIL FILE which are already in the database, and it endeavours to align your source and target using some sensible rules to handle clashes e.g. if a record to be deleted does not exist, just ignore the fact it is not there as it will have the same outcome as if we deleted it. However HANDLECOLLISION does not cope with all potential scenarios and it should be switched off [NOHANDLECOLLISIONS] as soon as possible after initial REPLICAT synchronisation otherwise it may slowly corrupt the target dataset.

Setup the REPLICAT

First of all we need to check that the GoldenGate DATAPUMP is transmitting changes to the target server by looking for the TRAIL FILE. Running multiple **ls -l** commands will show if transactions are being transmitted as the TRAIL FILE grows:

```
$ ls -l /home/oracle/app/goldengate/dirdat
total 4
-rw-r----- 1 oracle oracle 2227 Jan 11 14:22 AA000000000

$ ls -l /home/oracle/app/goldengate/dirdat
total 4
-rw-r----- 1 oracle oracle 2690 Jan 11 14:23 AA000000000
```

Excellent, the TRAIL FILE exists and is growing! We can now use this to start at the correct SCN, playing transactions into the target database. In Oracle, we refer to the “SCN” or System Change Number to keep track of transactional changes. GoldenGate refers to the “CSN” or Change System Number as it needs to cope with multiple formats of CSN from different source databases. These terms can be used interchangeably.

For the REPLICAT we need to create a checkpoint table (used by all replicats to keep track of where they are), register the replicat and start it after the SCN we used for the Export Datapump:

```
GGSCI 1> info all

Program      Status      Group      Lag at Chkpt  Time Since
Chkpt
MANAGER      RUNNING

GGSCI 2> edit param r_hr

GGSCI 3> dblogin userid goldengate password goldengate
Successfully logged into database ORCLTARGET.

GGSCI 4> add checkpointtable

No checkpoint table specified. Using GLOBALS specification
(goldengate.checkpoint_table)...
Logon catalog name ORCLTARGET will be used for table
specification ORCLTARGET.goldengate.checkpoint_table.

Successfully created checkpoint table ORCLTARGET.goldengate.
checkpoint_table.

GGSCI 5> add replicat r_hr integrated exttrail /home/oracle/
app/goldengate/dirdat/AA
REPLICAT (Integrated) added.

GGSCI 6> info all

Program      Status      Group      Lag at Chkpt  Time Since
Chkpt
MANAGER      RUNNING
REPLICAT    STOPPED     R_HR       00:00:00      00:05:03

GGSCI 7> start r_hr aftercsn 6302652
Sending START request to MANAGER ...
```

```
REPLICAT R_HR starting
GGSCI 8> info all
Program     Status      Group      Lag at Chkpt  Time Since
Chkpt

MANAGER    RUNNING
REPLICAT   RUNNING      R_HR        00:00:00      00:00:02
```

Total updates	0.00
Total deletes	0.00
Total discards	0.00
Total operations	93605.00

End of Statistics.

The REPLICAT parameter file looks like this:

```
-- /home/oracle/app/goldengate/dirprm/r_hr.prm

-- Setup Environment Variables so we login to the database
correctly
-- NOTE the TWO_TASK to connect to the correct PDB directly
SETENV (ORACLE_HOME='/home/oracle/app/oracle/product/12.1.0/
dbhome_1')
SETENV (TWO_TASK='orcltarget')

-- name the replicat
REPLICAT r_hr

-- Login to the DB
USERID goldengate PASSWORD goldengate

-- Add our standard reporting options for every extract and
replicat
include  /home/oracle/app/goldengate/dirprm/i_report.prm

-- Controlling REPLICAT memory use and parallelism
DBOPTIONS INTEGRATEDPARAMS (max_sga_size 200, parallelism 1)

-- Key file used to show failed records. Needed when
troubleshooting problems.
DISCARDFILE ./dirrpt/p_orcl2.dsc, PURGE

-- This is how we map the tables across from source to target
MAP orcl.hr.* , TARGET hr_target.*;
```

And the standard reporting i_report.prm file we have included in every group parameter file looks like this:

```
-- configure reporting to provide throughput stats
REPORT AT 23:59
REPORTROLLOVER AT 00:01 ON MONDAY
REPORTCOUNT EVERY 30 MINUTES, RATE
REPORTCOUNT EVERY 100000 RECORDS, RATE
```

And What has GoldenGate been Doing?

We can use the stats command to see how much traffic has been going through each group. Here we look at what went through the EXTRACT and the REPLICAT since they started.

EXTRACT e_hr STATS

```
GGSCI 1> stats e_hr, total
Sending STATS request to EXTRACT E_HR ...
Start of Statistics at 2017-01-11 15:37:00.

Output to ./dirdat/AA:

Extracting from ORCL.HR.JOB_SUBTASKS to ORCL.HR.JOB_SUBTASKS:
*** Total statistics since 2017-01-08 15:04:01 ***
      Total inserts          4.00
      Total updates          0.00
      Total deletes          0.00
      Total discards          0.00
      Total operations        4.00

Extracting from ORCL.HR.JOB_SUBTASKS to ORCL.HR.JOB_SUBTASKS:
*** Total statistics since 2017-01-08 15:04:01 ***
      Total inserts          93605.00
```

REPLICAT r_hr STATS

```
GGSCI 1> stats r_hr, total
Sending STATS request to REPLICAT R_HR ...
Start of Statistics at 2017-01-11 15:31:41.

Integrated Replicat Statistics:
      Total transactions        4.00
      Redirected                  0.00
      DDL operations               0.00
      Stored procedures             0.00
      Datatype functionality       0.00
      Event actions                 0.00
      Direct transactions ratio    75.00%
      Total inserts                  3.00
      Total updates                  0.00
      Total deletes                  0.00
      Total discards                  0.00
      Total operations                3.00

Replicating from ORCL.HR.JOB_SUBTASKS to ORCLTARGET.HR_TARGET.JOB_SUBTASKS:
*** Total statistics since 2017-01-11 15:04:59 ***
      Total inserts          93605.00
      Total updates          0.00
      Total deletes          0.00
      Total discards          0.00
      Total operations        93605.00

End of Statistics.
```

You may notice that there is one less insert in HR_TARGET.JOB_SUBTASKS than were extracted. This is because the EXTRACT was started before the Export Datapump extracted the full schema. Between the starting of the EXTRACT and the Export Datapump, there was one insert transaction in the HR.JOB_SUBTASKS table, but this was ignored in the REPLICAT as we started it from the SCN at the point of export datapump, not the point that the initial EXTRACT started.

Can you Prove That? Sure.

The EXTRACT was started at SCN: **6252571**. Most rows were already in-place at this time, having an SCN of **6165829**.

Row "IT_DBA" was inserted at SCN: **6284117** and therefore captured by the EXTRACT, but not needed as the Export Datapump was executed with SCN: **6302652**.

Rows "IT_SDBA", "IT_VSDBA", "IT_GGDBA" were inserted at SCN: **6310258** and were therefore captured by the EXTRACT and used by the REPLICAT.

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ORA_ROWSCN	JOB_ID	JOB_TITLE	MIN_SALARY	MAX_SALARY
6165829	AC_ACCOUNT	Public Accountant	4200	9000
6165829	AC_MGR	Accounting Manager	8200	16000
6165829	AD_ASST	Administration Assistant	3000	6000
6165829	AD_PRES	President	20000	40000
6165829	AD_VP	Administration Vice President	15000	30000
6165829	FI_ACCOUNT	Accountant	4200	9000
6165829	FI_MGR	Finance Manager	8200	16000
6165829	HR REP	Human Resources Representative	4000	9000
6284117	IT DBA	Database Admin	4000	10000
6310258	IT_GDBA	GoldenGate DBA	3000	9000
6165829	IT_PROG	Programmer	4000	10000
6310258	IT_SDEA	Senior DBA	8000	20000
6310258	IT_VSDBA	Very Senior DBA	9999	25000
6165829	MKT MAN	Marketing Manager	9000	15000
6165829	MKT REP	Marketing Representative	4000	9000
6165829	PR REP	Public Relations Representative	4500	10500
6165829	PU CLERK	Purchasing Clerk	2500	5500
6165829	PU MAN	Purchasing Manager	8000	15000
6165829	SA MAN	Sales Manager	10000	20000
6165829	SA REP	Sales Representative	6000	12000
6165829	SH CLERK	Shipping Clerk	2500	5500
6165829	ST CLERK	Stock Clerk	2000	5000
6165829	ST MAN	Stock Manager	5500	8500

Conclusion

At a basic level, GoldenGate is very straightforward to implement but you need to take care. It is highly configurable and programmable, and a badly configured set of transformations will corrupt your target dataset.

You don't "switch on" GoldenGate, like you switch on Data Guard. It needs to work with the application to produce the best outcomes. ■



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Neil has been working in IT since 1988, focused primarily within Oracle, SQL Server and their related Server technologies: UNIX, Linux, Windows and SAN. He has been a successful technical lead for FTSE 100 Companies with Development and Production Systems experience gained in the Financial, Real-Time Logistics, Property and Accountancy sectors. Neil is also an Oracle ACE and is Chairman of the UKOUG RAC, Cloud Infrastructure and Availability SIG, and is a regular presenter at Oracle conferences around the world.

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Recover Without Recover – Use Flashback

A main task of being a DBA is planning and operating a backup strategy that meets all the requirements in terms of performance, recovery windows and the time to recover. The typical methods that are used to implement these backups ensure recoverability of physical failures, like lost files and corrupted data blocks. But it is probably not the typical day-by-day task to repair such failures. It is much more likely that the data is wrong. It may happen because of human errors or software bugs that the data got changed or deleted by accident. It is most probably difficult to recover those failures and it will require much time and effort. That is when the different methods of Oracle Flashback kick in. Flashback in general provides efficient and easy-to-use methods to cope with these data errors. Some of these methods I will discuss and explain in this article.

Marco Mischke, Lead Consultant, Robotron Datenbank-Software GmbH 

Imagine the following scenario. Suddenly the phone rings and as you pick it up one of the developers in your company nervously tells you that some important data got deleted accidentally by a well-tested script to reorganise the master data. Actually the script wasn't tested at all, the developer simply chose the wrong database to test it, but that is something he cannot tell. The whole thing happened an hour ago, the developer was trying to recover the data himself but did not succeed. As the database is production, you can't just stop the database and roll it back to as it was one hour ago. You would do a restore and point-in-time recovery which means losing all the changes that were done in that hour. Or you could do a tablespace point-in-time recovery on a separate system, but that would last too long. Now Flashback comes into play.

Flashback – What it is

The thing called "Flashback" covers a couple of different methods and uses different technologies inside the database.

- Flashback Database: Used to roll back the whole database to a specific point in time
Relies on Flashback Logs
- Flashback Drop: Used to undo drop operations of tables
Requires activated recycle bin
- Flashback Query: Provides access to data as it was at some time in the past
Relies on undo data
- Flashback Version Query: Allows querying different versions of a specific dataset as it evolves over time

- Relies on undo data
- Flashback Transaction: Can back out specific transactions
Relies on undo data
- Flashback Data Archive: Allows long time storage of historical versions of changes to tables
Requires Flashback Data Archives
- Flashback Export: Enables exports (datapump or conventional) to export data for a specific point in time
Relies on undo

I will mainly cover Flashback Query which makes use of the consistent read mechanism of the Oracle Database. It's been available since Version 9 and has been enhanced over time. Besides that, it comes for free with all editions of Oracle Database.

Flashback Query – Prerequisites

All the changes that do transactions to an Oracle Database are tracked in the UNDO segments to enable rollback of these transactions and allow consistent reads for all the sessions. By default Oracle keeps 15 minutes of committed transactions. This can be changed by setting the "undo_retention" parameter. Since the datafiles of the UNDO tablespace are typically autoextending, the database keeps only these 15 minutes regardless of the available space in the tablespace. When the datafiles of the UNDO tablespace are fixed size, then the value of "undo_retention" is ignored and the database will use all the available space to keep undo information. The actual value is available in the TUNED_UNDORETENTION column of the V\$UNDOSTAT view.

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```
SQL> select * from (
 2  select TUNED_UNDORETENTION
 3  from V$UNDOSTAT
 4  order by END_TIME desc
 5 )
6 where ROWNUM = 1;

TUNED_UNDORETENTION
-----
36356
```

Flashback Query – How it works

In order to guarantee consistent sets of data during reads the database session remembers the SCN at the beginning of the transaction. If another session is modifying data, the previous version of the data is kept in UNDO. Now, if the reading session is trying to read blocks that were modified in the meantime, these blocks have a higher SCN than the one that is stored with the beginning of the transaction, it uses the UNDO information to roll back those blocks until the SCN is lower than the stored one.

Flashback Query just makes use of this technique. It just does not use the SCN that is current at the beginning of the transaction but instead it estimates a SCN that was current at some specific point in time. And as long as the UNDO information is still present, this works fine. Otherwise it will return the usual ORA-0155: Snapshot “too old” error. This simply means that the UNDO information is not available anymore. So the “undo_retention” parameter simply defines how long the database can remember old data.

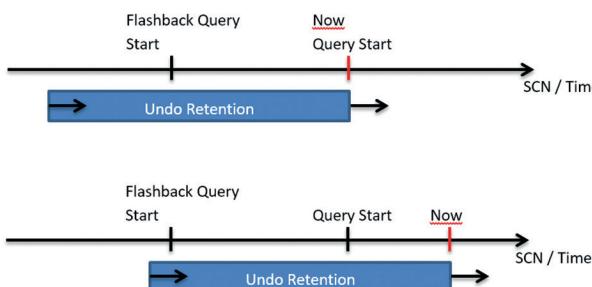


FIGURE 1: FLASHBACK QUERY, UNDO – TIME RELATIONSHIP

Simply size the UNDO tablespace to allow keeping 10-12 hours of UNDO. This will enable you to cover a typical work day which can be very beneficial in case of accidentally modified or deleted or even added data.

Flashback Export

Now back to the developer that ran the script by accident. What do we do first? The UNDO information is definitely going to be deleted in the near future. So we can materialise it by simply by doing a schema export using Data Pump. Just take care of the date and time format which is best set as: ‘YYYY-MM-DD-HH24:MI:SS’. The command would then be something like this:

```
$ expdp system/Oracle-1 dumpfile=scott_flashback.dmpdp \
  logfile=scott_flashback.expdp.log \
  directory=data_pump_dir \
  flashback_time='2016-05-11:11:00:00' schemas=scott
```

You could even use the old „exp“ utility:

```
$ exp system/Oracle-1 file=/tmp/scott_flashback.dmp \
  log=/tmp/scott_flashback.exp.log \
  flashback_time='2016-05-11:11:00:00' owner=scott
```

The flashback_time parameter can be combined with any other parameters that you already know and use. For instance you can just export some tables instead of a whole schema.

Having this export, you can simply import the data into another database or just another schema in the same database and then start comparing and repairing.

Flashback Query

Now that there is an export of the data, when everything was fine, we can now try to repair the data directly. We can simply create a copy of a table with the data from the past. To achieve that we use the Create Table As Select and use the “as of timestamp” syntax to go back in time:

```
SQL> create table emp_old
 2  as
 3  select *
 4  from emp as of timestamp
 5  to_timestamp('2016-05-11 11:00:00',
 6  'yyyy-mm-yy hh24:mi:ss');
```

Now both tables can be compared to find changed or deleted data by simple SQL queries:

```
SQL> select * from emp_old
 2  minus
 3  select * from emp;
```

Since the “as of timestamp” clause can be used in every kind of SQL, we can even compare the data directly without creating a backup table:

```
SQL> select * from emp as of timestamp
 2  to_timestamp('2016-05-11 11:00:00',
 3  'yyyy-mm-dd hh24:mi:ss')
 4  minus
 5  select * from emp;
```

In the easiest case we can simply re-add the deleted records back into the table:

```
SQL> insert into emp
 2  select * from emp as of timestamp
 3  to_timestamp('2012-10-01 11:00:00',
 4  'yyyy-mm-dd hh24:mi:ss')
 5  minus
 6  select * from emp;
SQL> commit;
```

Following this principle we can also recover records that were accidentally modified. The example shows how to reset the salary to the original values:

```
SQL> update emp e_live
 2  set sal = (select sal
 3  from emp as of timestamp
 4  to_timestamp('2016-05-11 11:00:00',
 5  'yyyy-mm-dd hh24:mi:ss') e_orig
 6  where e_orig.empno = e_live.empno
 7  )
 8 ;
```

There are lot more things that can be done. The above examples outline the possibilities when using Flashback Query.

```

SQL> show recyclebin
ORIGINAL NAME RECYCLEBIN NAME          OBJ. TYPE   DROP TIME
-----
EMP           BIN$yxLVQQOoC6rgQBAKtBUK1A==$0 TABLE    2016-05-11:13:29:19

SQL> select ORIGINAL_NAME, OBJECT_NAME, OPERATION, DROPTIME
  2  from USER_RECYCLEBIN;

ORIGINAL_NAME OBJECT_NAME          OPERATION DROPTIME
-----
EMP           BIN$yxLVQQOoC6rgQBAKtBUK1A==$0 DROP      2016-05-11:13:29:19
PK_EMP        BIN$yxLVQQOpC6rgQBAKtBUK1A==$0 DROP      2016-05-11:13:29:19
IX_ENAME      BIN$yxLVQQOoC6rgQBAKtBUK1A==$0 DROP      2016-05-11:13:29:19
IX_MGR        BIN$yxLVQQOnC6rgQBAKtBUK1A==$0 DROP      2016-05-11:13:29:19

```

FIGURE 2

Flashback Drop

In the above scenarios Flashback Query was used to recover unwanted DML. What if our developer dropped one or more tables by accident? Since this is DDL, such operations won't be logged to UNDO, at least not in the way as DML is being logged. The Oracle Database offers a "Recyclebin" to cover such scenarios. By default the recyclebin is switched on, the parameter "recyclebin" is used to enable or disable it. Now, if a table is being dropped, the segment in the tablespace is marked as free but it is not being released. If another segment needs more space, it first allocates free space in a tablespace. Only, if there is no more free space left, it starts using released segments of dropped objects. As long as the released segment was not overwritten, it is possible to restore it, this is called Flashback Drop.

To find out which segments can be restored, we can use the SQL*Plus command "show recyclebin" or simply query the USER/ALL/DBA_RECYCLEBIN view (see Figure 2 above). As you can see, SQL*Plus only shows the dropped tables while the views list all the dropped segment tables as well as the corresponding indexes. From the output we see that the accidentally dropped table can be restored:

```

SQL> flashback table emp to before drop;
Flashback complete.

SQL> select ORIGINAL_NAME, OBJECT_NAME, OPERATION, DROPTIME
  2  from USER_RECYCLEBIN;

No rows selected

```

No rows left in the view means the database did not only restore the table but also the indexes. Let's crosscheck that:

```

SQL> select index_name from user_indexes
  2  where table_name='EMP';

INDEX_NAME
-----
BIN$yxLVQQOoC6rgQBAKtBUK1A==$0
BIN$yxLVQQOnC6rgQBAKtBUK1A==$0
BIN$yxLVQQOpC6rgQBAKtBUK1A==$0

```

The tables indexes are back again, but they still have the names from the recyclebin. In order to correct that, we need to rename the indexes to the original names. That's why it is important to query the USER_RECYCLEBIN view before doing the Flashback Drop. Afterwards there is no chance to get the original names. The rename operation itself is quite simple:

```

SQL> alter index
  "BIN$yxLVQQOoC6rgQBAKtBUK1A==$0" rename to
  IX_ENAME;

```

Make sure to put the name in double quotes since it contains special characters as well as lower and upper case letters. The only thing we cannot restore are foreign key constraints. Those need to be checked manually and recreated if necessary.

More of Flashback

As mentioned at the very beginning there are some more Flashback features that are only available in Enterprise Edition.

Flashback Version Query can show a history of modifications to a specific row which includes INSERTs, UPDATEs as well as DELETEs. It can show the start and end date as well as the transaction ID for a specific version of a row. Flashback Transaction Query unveils information about a specific transaction and what it has done to the data. The FLASHBACK_TRANSACTION_QUERY view lists these changes. Flashback Table can roll back a whole table or even a set of tables to a specific point in time. This is useful when tables are linked by foreign key constraints. Flashback Transaction can back out a whole transaction. It even takes care of dependent transactions that happened afterwards. One can choose if all dependent transactions should be backed out too or if they should be kept.

Last but not least, Flashback Database rolls back the whole database. This requires separate logs called Flashback Logs. The retention for these logs can be controlled via the "db_flashback_retention_target" initialisation parameter. This feature is particularly useful for test environments when several scenarios should be tested against the same set of values. Simply flash back the database to a restore point right after the test has finished. Then start over with the next test.

Summary

Even the Standard Edition of Oracle Database provides powerful tools and methods to recover unwanted changes to the data without influencing the availability of the database. The examples in this article just show the direction, there are many more possibilities but, I have given you a rough understanding of the technology and shown you a different way of coping with such situations. ■



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