Running Oracle EBS in the cloud

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ABOUT PYTHIAN

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TECHNICAL EXPERTISE

- **Advanced Analytics**: Mining data for insights & business transformation using data science
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- **DevOps**: Providing critical velocity in software deployment by adopting DevOps practices
- **Big Data**: Harnessing the transformative power of data on a massive scale
- **Databases**: Ensuring databases are reliable, secure, available and continuously optimized
- **Infrastructure**: Transforming and managing the IT infrastructure that supports the business

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Millennia of experience gathered and shared over 19 years
Agenda

• Certification basics.
• How to architect. Recommendations. AWS.
• Advanced configurations.
• R12.2.
• Microsoft Azure and Oracle Cloud review.
• Cloud deployment automation and the most common scenario - auto-scaling.
What is cloud?

Compute
Storage
Database
Migration
Networking & Content Delivery
Developer Tools
Management Tools
Security, Identity & Compliance
Analytics
Artificial Intelligence
Mobile Services
Application Services
Messaging
Business Productivity
Desktop & App Streaming
Internet of Things
Game Development
See All Products

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What is cloud?

• It’s not just a hosting.
  • Infrastructure-as-a-service (IaaS)
  • Software-as-a-service (SaaS)
  • Platform-as-a-service (PaaS)

• Public cloud, Private cloud, Hybrid cloud
What is cloud?

- **Pros**
  - Hardware support and maintenance. This is your cloud service provider responsibility.
  - Hardware pool. Workload is shared and distributed.
  - Transparency. You run only what you need to run.
  - "Pay per use" model.
  - No termination fees.

- **Cons**
  - Security
    - Design of your network, its access, and security of the data is the main key point for success.
    - Encryption
    - Single Point of Disaster (AWS console). IAM and Root account protection.
  - Possible network latency with cloud service provider.
Oracle E-Business Suite – Apps Tier

• SaaS or PaaS
  • Ready solution. You don’t manage the software.
  • **NOT** applicable for Apps Tier.

• IaaS
  • Same as running it on local physical hardware.
  • You are still in the The Captain role.
Oracle E-Business Suite – DB Tier

• AWS EC2
  • Amazon RDS for Oracle (DBaaS) - **NOT** supported.
  • Sorry, only IaaS deployment.

• MS Azure
  • Only IaaS for Oracle, in general.

• Oracle Cloud
  • Something special is there.
    • Database Cloud Service
    • Exadata Cloud Service
Licensing

• Licensing primary source:

• AWS EC2, MS Azure - Authorized Cloud Environments.
  • Example for Standard Edition:
    ▪ Less than 4 vCPUs: counted as 1 socket = 1 processor licensed.
    ▪ More than 4 vCPUs: "closest vCPU multiple of 4" counted as number of sockets = number of processors licensed.
    ▪ Azure - replace 4 vCPUs with 2 Azure CPU cores within your calculations.
  • Example for Enterprise Edition:
    ▪ 2 vCPUs = 1 processor licensed.
    ▪ Azure - replace 2 vCPUs with 1 Azure CPU cores within your calculations.

• Licensing models
  • Pay per use rates, included in cloud service provider pricing model (* not everything applies).
  • BYOL (Bring Your Own License). Named User Plus licensing is possible.
Licensing – Oracle E-Business Suite

• DB tier requires Enterprise Edition.
  • Pay per use model is available only on Oracle Cloud.
  • For other IaaS based deployments – BYOL.

• Apps tier is separately licensed – BYOL.

• VMware – Sorry! Nothing changed. You need to license the whole hardware pool.

• Cost efficiency: do your own calculations!
How to architect. Recommendations.
Overview

• Our talk will be primarily based on "wrong cloud" – Amazon EC2.

• Oracle E-Business Suite R12.1.
  • Standard 1 Apps Tier & 1 DB Tier configuration.

• High level overview.
#0: Important start note

- You are the Solution Architect.
- How you design it will be the way the system is going to run.
#1: Network

- Everything should start with a proper network design.

- Regions / Availability Zones
  - Subnets
  - Network interfaces
  - Route tables

- Security
  - Network ACLs
  - Security Groups
  - Internet Gateway

- Virtual Private Gateway
  - IPSec VPN tunnel with your on-premise network

#1: Network
#1: Network

**IP address**
- Private IP addresses – **dynamic**. Can’t be reserved and may change during instance restart.
- Public IP addresses – dynamic, but a static IP address can be assigned via Elastic IP feature.
  - Note: Public IP traffic is routed through the public internet.

**DNS**
- By default provided by Amazon.
- Each region has it’s own sub-domain. Automatically updated via internal DHCP.
  - But contains Private IP address in the name space:
    - ec2-10-10-10-1.eu-central-1.compute.amazonaws.com
- Route 53
  - Configure your own DNS.
  - Assign host and domain names to instances.
#2: Instances

- Instance – actual virtual machine

- Instance types
  - General purpose
  - Compute optimized
  - Memory optimized
  - Storage optimized
  - Accelerated Computing

- It’s all about your “hardware” power and requirement
  - vCPU, T2 instances with CPU credits / burst
  - Memory
  - GPU
  - Storage

Amazon documentation reference:
#2: Instances

- **Instance types #2**
  - On-Demand (default).
  - Spot Instances – short term workload.
  - Reserved Instances or Dedicated Hosts – long term resource pre-allocation.

- Mainly affects pricing

- **AMIs (Amazon Machine Images)**
  - Image of the instance
  - Public and Private repositories

- **What AMI to use?**
  - EC2 standard: RHEL, SLES, Windows Server, “pay per use” licensing model.
  - Public AMI repos: Oracle Linux, for example. Use for free, but don’t forget about ULN licensing terms.
#2: Instances – Oracle E-Business Suite

• Example that can be used for Oracle E-Business Suite

  • Apps Tier: m3.xlarge, 4 vCPU, 15 GB Memory.

  • DB Tier: r3.4xlarge, 16 vCPU, 122 GB Memory.

• 122 GB RAM for Oracle EBS database?
  • Sometimes memory size is not the primary criteria for instance type selection.
  • Each instance type has different IOPS and IO throughput limits.
#3: Storage

- **Storage types**
  - **Amazon EBS (Elastic Block Store)**
    - Standard SAN-like disk volumes. Can be mounted to **one** EC2 instance at a time.
  
  - **Amazon EC2 Instance Store (Ephemeral)**
    - Local disks.
    - **IMPORTANT**: All data is lost once Instance is stopped or restarted. Ideal for temporary storage.
  
  - **Amazon EFS (Elastic File System)**
    - NAS analog from Amazon – NFS based. Still with a limited region availability.
  
  - **Amazon S3**
    - Object based storage module.
    - By default used for storing AMIs and Amazon EBS disk snapshots.

Amazon documentation reference:
#3: Storage – Oracle E-Business Suite

- Example that can be used for Oracle E-Business Suite

- Apps Tier file system
  - Elastic Block Store – standard option for single Apps Tier approach.
  - Elastic File System is preferable if scale-out plans are there.
  - Make your own “NAS server” instance, mount Amazon EBS disks, and export them via NFS.
  - gp2 standard type is absolutely enough. Based on IO credits / burst.
  - Cheap HDD based disks should be considered only for low IO workload targets (conc. log / out data, or interfaces).
#3: Storage – Oracle E-Business Suite

• Example that can be used for Oracle E-Business Suite

• DB Tier

  ▪ Elastic Block Store. Local File-System or ASM.

  ▪ No universal recommendation on IOPS / throughput. You MUST test, benchmark, and evaluate your own system performance per workload requirements.

  ▪ **Hint**: Database Smart Flash Cache feature can greatly improve your performance. Configure it on Instance Store (Ephemeral) disks.

```sql
SQL> show parameter db_flash_cache

NAME          TYPE         VALUE
------------- ----------- ----------
db_flash_cache_file  string    /dev/xvdal
db_flash_cache_size  big integer 200G
SQL>
```

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#4: IOPS

- Most difficult part to understand.
  - IOPS / Throughput depends not only on Instance and Storage type, but also on the size of the volume.
  - Provisioned IO (io1) volumes are not always the most efficient option for IO intensive workload.
    - Larger “gp2” volumes can provide similar or better IO performance than smaller “io1”. And for less cost.
    - Can experiment putting multiple gp2 into LVM drives.

- Wrong type chosen can be a big problem.
  - Example: cheap HDD “sc1”.

- IOPS size:
  - SSD (gp2, io1) - 16KiB.
  - HDD (st1, sc1) - 1 MiB.

- Oracle Database: multiblock reads
  - DB IOPS <> EC2 IOPS !!!
#4: IOPS

- Classical reaction reading IOPS related docs for different areas (EC2, EBS, RDS).

- Experiment, Benchmark
- Find better setup that will suit your requirement and budget.
#5: Backup / Recovery

- EC2 provides EBS storage snapshot feature only
  - Apps tier: Make snapshots for Apps Base file system.
  - DB tier:
    - Setup RMAN on dedicated volumes. Make periodic snapshots.
    - Elastic File System (NAS).
    - S3 sync for backup sets, but requires complex scripting effort.
  - Can be automated via CLI.

Amazon documentation reference:
#6: Monitoring

- CloudWatch
  - [https://aws.amazon.com/cloudwatch/](https://aws.amazon.com/cloudwatch/)

- Free:
  - Very limited.

- Paid:
  - Complete monitoring solution for the instances.
  - Alarms. SWS / SNS integration.

- Not versed for Oracle.
- You can use your own custom monitoring. Setup EM agents.
#7: Amazon RDS

• You can still use RDS for Oracle service for other integrated components.

• Oracle Fusion Middleware 12c

• Not supported with Oracle Fusion Middleware 11g, but with some “tweaks” you can still get your Metadata Repository loaded into the RDS instance.
  ▪ Main challenge: no SYSDBA access. Replaced with ORACLE_MASTER and RDS PL/SQL API.
  ▪ Doable, but not certified and not supported.

• Example:
  • Identity and Access Management for Single Sign-On, or BI.
Advanced configurations
#1: Oracle RAC

- **NOT** supported.
  - No shared storage.
  - No multicast support for interconnect.

- But… non-official solutions.
  - Deploying Scalable Oracle RAC on Amazon EC2
    - [https://aws.amazon.com/articles/7455908317389540](https://aws.amazon.com/articles/7455908317389540)
    - Became an official guide by Amazon.
  - Do your own interconnect via OpenVPN.
  - Flashgrid VSAN solution.
  - Try to adopt Amazon EFS (NFS).

- Complex and not recommended.
#2: Apps Multi-Tier / PCP

- No limits.
- Shared file-system can be implemented via EFS or your own NFS solution.

- Elastic Load Balancing (LBaaS)
  - Has all requirements to front-end Oracle E-Business Suite.
    - Sticky session
    - SSL

Amazon documentation reference:
https://docs.aws.amazon.com/elasticloadbalancing/latest/userguide/what-is-load-balancing.html?icmpid=docs_elbv2_console
#3: External Tier

- Similar to standard Apps Multi-Tier deployment.

- DMZ network restrictions can be implemented via a dedicated VPC security group.
#4: SSL

- Native SSL – same as on-premise.
- SSL termination via ELB (LBaaS).
- AWS Certificate Manager is available to maintain and provision the certificates.
#5: Integrations

- **EC2:**
  - No ready SaaS / PaaS solutions certified and ready out-of-the-box for Oracle EBS.

- **Hybrid cloud deployment**
  - Evaluate your network latency with target availability zone.
  - For heavy data exchange processes and systems integrated it might be a good idea to move them along with your Oracle E-Business Suite on the same side.

- **Examples:**
  - BI, ETL.

- Or adjust your expectations and SLA.
#6: Disaster Recovery

- IaaS – similar “on-premise” approach.
- No automation.

- Availability zones. Regions.
- For initial clone, EC2 EBS volume snapshots are transferable.

- RDS for Oracle (DBaaS) – built-in and automated feature.
  - But between Availability Zones, not Regions.
#7: Encryption

- Applications level: implement TDE.
- Storage level: implement encryption at rest for EC2 EBS volumes.
What is different with R12.2?

• Everything that is related to R12.1.

• ADOP
  • Private IP addresses
    ▪ Number of FND tables must contain valid IP addresses of all nodes.
    ▪ EC2 Instance restart might change the private IP – it must be updated.
  • Validation of the /etc/hosts
    ▪ Same private IP addresses – hosts file has to enlist them, and with required format.
  • You can setup a custom OS service
    ▪ Run during instance startup to update hosts file and FND table with $(hostname -l) value.
    ▪ Any other node dependencies via AWS CLI.

• IOPS / IO throughput planning is important
  ▪ ADOP fs_clone and file system synchronization management through online cycles.
  ▪ DB workload handling edition objects.
  ▪ Example: “fs_clone force=yes” run duration on 220 GB standard gp2 volume: 42 minutes.
Microsoft Azure

• IaaS only.

• In respect to Oracle E-Business Suite it has all main analogs available.
  • Virtual Network, Load Balancing, Storage, Site Recovery.
  • Linux Virtual Machine support.

• Important note: compute limits.
  • Main disadvantage comparing EC2 and Azure was the compute option availability. EC2 provided more powerful capacity options. Almost 10 times.
  • Things are getting changed.
    ▪ 20 vCPU max quota (30 West Europe region). But can be extended via support request.
    ▪ 100+ GB RAM.
    ▪ Enough storage options.
Oracle Public Cloud

- Completely based on Oracle’s own stack.
- IaaS
- With PaaS support for DB Tier:
  - Database Cloud Service
  - Exadata Cloud Service
  - RAC support !!!
- “Lift and Shift” – “one-button” your on-premise instance migration to cloud.
- Easy multi-node provisioning for Oracle EBS.
- Quick deployment for rapid development needs.
Oracle Public Cloud – Management

• EBS Cloud Admin Tool central management.
  • Provisioning.
  • Vertical scaling.

• OpenWorld 2017 roadmap announcement:
  • Managed Oracle EBS environment via GUI console or CLI.
  • Full scaled and managed Backup / Restore for Oracle EBS instance.
  • Fast Cloning feature available with DBaaS.
  • Automated provisioning and cloning, with post provisioning custom framework support.
  • Managed horizontal scaling.
  • Automated DMZ and External application configuration.
  • Automated DB tier PSU patching.
  • Fully automated DR creation and failover.
Oracle Public Cloud – Integrations

• Oracle EBS is really bound to Oracle’s own products for integrations.

• With other cloud service providers it’s IaaS based setup – you do everything on your own.

• Integrations Cloud Service
  • Examples:
    ▪ SOA cloud service is supported.
    ▪ Identity cloud service is NOT supported there yet.
Oracle Public Cloud – EBS or SaaS Applications

• There is an ongoing shift to SaaS based Applications.
  • Limited modules are implemented. Still in active development.
  • Oracle’s vision for Hybrid co-existence (options in R12.2).

• Oracle E-Business Suite is still on the radar.
  • Roadmap, at least, till 2030. R12.3 is on the way (~2020).

• Recommendation: Do not rush!
  • Implement, Test, Evaluate, Compare costs, Migrate.

Getting Started with Oracle E-Business Suite on Oracle Cloud (Doc ID 2066260.1)
https://www.facebook.com/groups/EBS.SysAdmin/
https://twitter.com/Oracle_EBS
Cloud deployment automation. Auto-scaling.
What is Vertical scaling?

• Increase of the compute resources of a particular instance
  • Change instance type with more RAM, more compute power.
  • Might dramatically increase your cost.

• Still has limits. 😊

• In respect to Oracle EBS
  • JVM memory heap size increase.
  • JVM process / server count increase.

• Downtime
What is Horizontal scaling?

- Increase of the compute resources by adding more compute instances
  - Add more nodes
  - Flexibility
- In respect to Oracle EBS
  - Add more apps tiers.
- No Downtime
What if we want to automate it?

• Business case:
  • We would like to automatically add web nodes on-demand, if existing stack is overloaded.

• Auto-Scaling group is created
  • Minimum, maximum, and desired node count parameters
  • Scaling plans – when and how to scale. Specific time, or can be based on CloudWatch monitoring. Rules for scaling in.
  • Launch configurations / Instance configuration. Image to create new instance from.
  • Automatically adds your new created node into the Elastic Load Balancer configuration.

Documentation
https://aws.amazon.com/documentation/autoscaling/
What if we want to automate it?

• New node startup from AMI
  • We can put a custom first-boot shell script which will handle certain actions (cloud-init).

• Pricing for Auto-Scaling
  • It is free.
  • You pay only standard rates running your additional EC2 compute resources.

• Limits

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<td>Step adjustments per scaling policy</td>
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Oracle E-Business Suite - Challenge

• Oracle E-Business Suite is very tight on it’s internal configuration repository
  • FND tables, like FND_NODES

• Nightmare with R12.2 and ADOP.

• Scaling with a new node.
  • Find the best combination of pairs file to minimize post manual correction of the context file and instance configuration for “perl adclonectx.pl addnode”.
  • Manually generate the required context file and feed it into adclonectx.pl.

• Node deletion
  • R12.1: Downtime, setup_clean, re-run of all autoconfigs on each node in 2 rounds.
  • R12.2: supports Abandoned node state, supports node deletion***
Adding a new Web Node

• **OS setup**
  - Software, kernel, limit configuration can come from created private AMI image.
  - Hostname: We need to set a unique hostname on the server, DNS, update `/etc/hosts`.
  - Mount the Apps Base storage layer.

• **Apps setup**
  - Generate new context file `/perl adclonectx.pl addnode`.
  - Run `AutoConfig` on all existing nodes. Or, at least, “generatetns” step.
  - Reload Apps TNS listeners on all existing nodes.
  - Optional: any custom post configuration.
  - Service restart on new created node.

• **Elastic Load Balancer**
  - Will enable the node once the TCP socket ping succeeds.
Removing a Web Node

• Instance termination
• Elastic Load Balancer – automatic drop of the removed instance

• Apps setup - Master node to trigger the node deletion process.
  • R12.1
    ▪ No process of node deletion without a complete downtime and setup_clean process.
    ▪ Concurrent Service Managers configured for new node can be just disabled from back-end.
    ▪ OAM dashboard – sorry, you can’t avoid the red status there.
    ▪ File system cleanup.

  • R12.2
    ▪ Abandon the node.
    ▪ “perl $AD_TOP/patch/115/bin/adProvisionEBS.pl ebs-delete-node”
    ▪ “txkSetAppsConf.pl -configoption=removeMS”
    ▪ File system cleanup.
Re-use of a removed Web Node

• Node remove is very costly. Re-use of the existing configuration can be easy.

• R12.1
  • Easy. But we should not delete the INST_TOP then.
  • Re-enable the Concurrent Service Managers.
  • Just launch the instance, configure the OS part, and restart the services.

• R12.2
  • Abandoned node – only a complete delete / add process.
  • Required even if we do not delete the node and do not delete the file system content.
  • We can’t allow to delete an instance without Abandoned node state – affects ADOP.
Periodic housekeeping

• Once you have a downtime window, it’s worth to go through “setup_clean” process to have everything re-registered clean and drop the garbage.
R12.2 ADOP considerations

- Scaling automation and ADOP online patch cycle – how safe it is?
  - Scale out: process creates a new node for RUN file system. PATCH – fs_clone requirement. Conflict if a cycle is already opened.
  - Scale in: abandoned node state is safe to complete the cycle.
  - Cutover: likely a failure is expected.

- CloudWatch doesn’t know anything about what’s going on in Oracle EBS.

- During ADOP open cycle or maintenance window Auto Scale group, probably, should be completely disabled.
Summary

• Oracle EBS implementation on cloud is more less straightforward.
• Mostly IaaS. Oracle Public Cloud offers PaaS for Oracle Database and other integrations, like SOA.
• IO performance is the main bottleneck risk. Good design, evaluation of estimates and testing are required to confirm the requirements.
• Security is an extra overhead and highly important.
• Cost efficiency is a subject of detailed evaluation and calculation.
• Auto-scaling – interesting, possible, but still is a manually controlled process.
THANK YOU

Q & A