

# ORACLE



# Break New Ground

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# Accelerate Oracle Database .NET Application Performance

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# Agenda

- Optimization Process
- ODP.NET – Connections, Data Retrieval/Updates, Data Types
- Caching
- Oracle Performance Analyzer and SQL Tuning Advisor

# Optimization Process

# Oracle .NET Application Performance Workflow

- .NET data access tuning
  - Use ODP.NET best practices
- SQL tuning
  - Use SQL Tuning Advisor in Visual Studio
- Database tuning under real world conditions
  - Oracle Performance Analyzer in Visual Studio detects issues you have missed
  - May need to modify application based on findings
  - Can be used during testing phase or production

# ODP.NET: Connections, Data Retrieval and Updates, Data Types

# Control the Garbage Collector

- Close/Dispose all ODP.NET objects explicitly
  - Garbage collector cannot reliably implicitly dispose objects under heavy load
  - May see increasing memory usage
- Can use “Using” statement instead
- Recommended for all ODP.NET objects

# Connections

- Use connection pooling
  - Min Pool Size = # connections at steady state or average load
  - Max Pool Size = # connections at maximum capacity
    - Min and Max Pool Size always obeyed over other CP attributes
  - See documentation for connection pooling parameter options
- ODP.NET performance counters
  - Monitor with Windows Performance Monitor or programmatically
  - Granular monitoring at app domain, pool, or DB instance level
  - See documentation for details on how to enable



# Connection Management with RAC

- RAC, Data Guard, GoldenGate, and GDS integration
- Fast Application Notification (FAN) infrastructure
  - ODP.NET 12c and 18c (mostly) uses Oracle Notification Service (ONS)
  - ONS delivers FAN events faster than previous AQ infrastructure
- **Run-time** connection load balancing
  - Automated load balancing at connection dispense time
    - Dispense based on real-time load
  - Set “Load Balancing = true” in connection string
    - Now the default in ODP.NET 12.2

# Commands: Bind Variables

- Prevents re-parsing of frequently executed statements
  - Works with SQL and PL/SQL statements
- Improves subsequent command executions
  - Literal value changes force a re-parse
  - Use bind variables instead of literal values
- Executed statements stored in Oracle shared pool
  - Re-parsing and re-optimization uses CPU and requires shared pool locks

# Commands: Statement Caching

- Retains previously parsed statement in shared pool
  - Prevents repeated parsing in server
- Caches most recently used statements
  - Works with SQL and PL/SQL statements
  - Best with bind variables
- Self-tuned cache size – on by default
  - No code changes needed

# Commands: Data Retrieval

- Control how much data is retrieved per DB roundtrip
  - Too much data retrieved – excessive client-side memory used
  - Too little data retrieved – additional round trips
- Use `OracleCommand.RowSize` and `OracleDataReader.FetchSize` to control result size
  - `RowSize` populated after statement execution
    - Can be set dynamically at run-time
  - `FetchSize` can be set as multiple of `RowSize`

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D E M O N S T R A T I O N

# Fetch Size and Row Size

# Commands: Data Updates

- Statement batching
  - Use `OracleDataAdapter.UpdateBatchSize` to batch updates from `DataSet`
  - Execute multiple commands in one DB roundtrip
    - Via anonymous PL/SQL

# Command: Mass Data Movement via Arrays

- PL/SQL associative arrays
  - Pass large amounts of data between .NET and DB of the same data type
- Use parameter array binding
  - Useful if executing the same statement multiple times
  - Bind variables are the same, variable values can be different
  - One execution for each element in the bound array

# REF Cursors

- OracleRefCursor class
- Defers result set retrieval until needed
- Retrieve data as needed
  - Control data retrieved via FetchSize
  - Fill a DataSet with just a portion of the REF Cursor result
- Usage
  - Can create REF Cursors as part of an anonymous PL/SQL block
  - Can return REF Cursors from stored procedures
  - Can pass REF Cursors to database as input stored procedure parameters



# SecureFiles and LOBs

- Data retrieval options
  - Control amount of data returned with `OracleCommand.InitialLOBFetchSize`
  - Retrieve a chunk using `OracleClob` and `OracleBlob` classes `Read` method
    - Use `Search` method to find data to be retrieved
- Update/Insert/Delete SQL statements acting on LOBs
  - Modify LOB without retrieving the data to the client side
    - Uses LOB locator
- `VARCHAR2`, `NVARCHAR2`, and `RAW` now support up to 32 KB
  - ODP.NET 12c and Oracle DB 12c enhancement

# Caching

# Oracle .NET Caching Solutions

- Oracle .NET client-side DB caches
  - Client Result Cache
  - Continuous Query Notification (CQN) – customizable cache
  - TimesTen In-Memory Database
- Automatically updates/alerts client cache upon server changes
- Each meets separate caching requirements
- Server-side caches can be used with .NET
  - DB In-Memory option, server result cache, etc.

# Oracle Client Result Cache

- Automatically updating query result set cache
  - Invalidation notifications piggyback on existing client round trips
- Easy to use
  - Use a SQL hint if it is not turned on for all queries
  - Example: `select /*+ result_cache */ first_name, last_name, salary from employees`
- Snapshot consistent
  - Cache refreshes without user intervention

# Oracle Client Result Cache: How it works

- To use cache results, the following must match
  - SQL text
  - Bind values
  - Session settings
- Different sessions with same user settings share cache results
  - Must exist in same client process
- Different users do not share the same result sets

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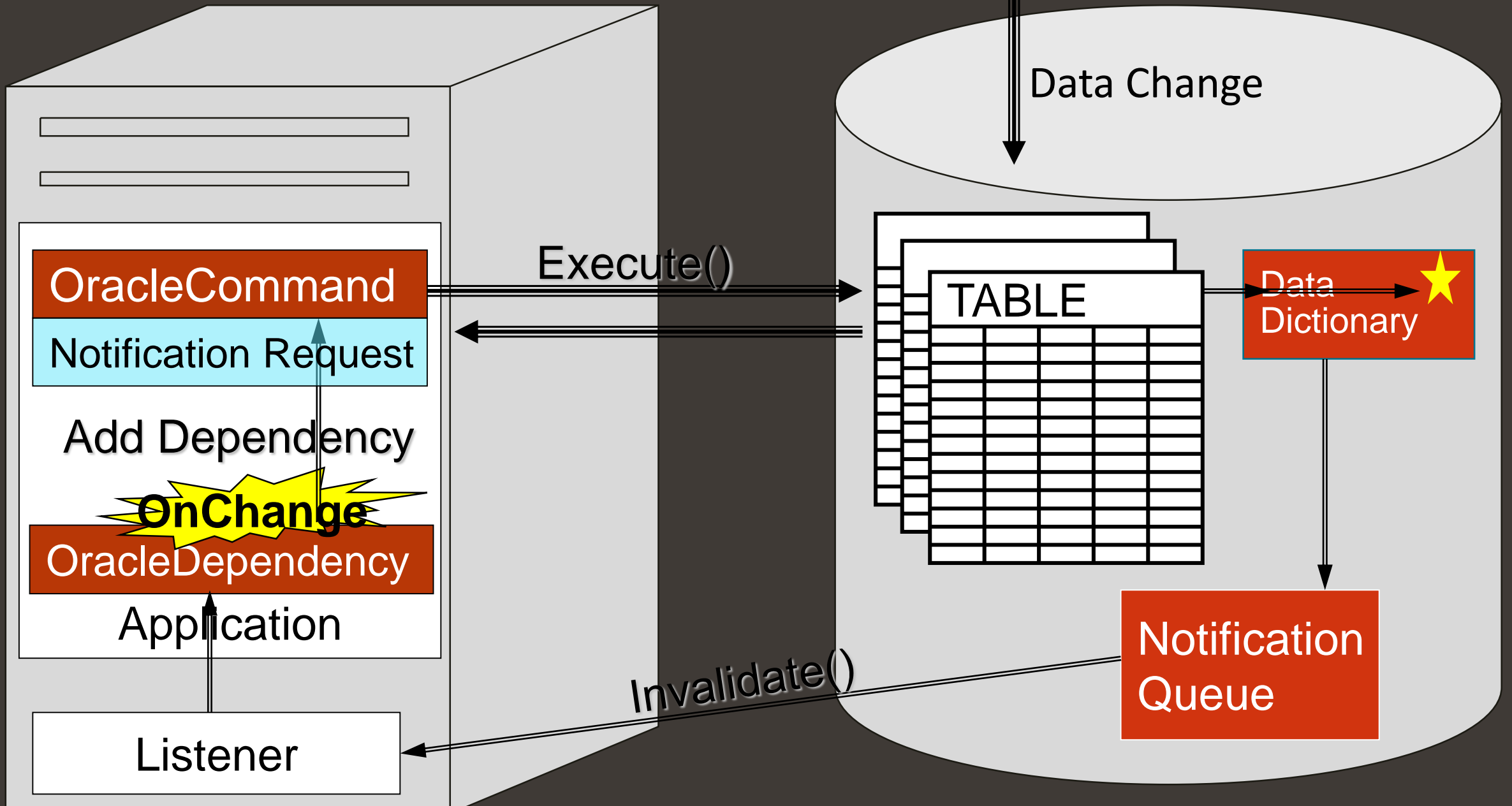
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# Client Result Cache

# Oracle Continuous Query Notification (CQN)

- Programmatic control over cache notifications and updates
- Also known as Database Change Notification
- Benefits over Client Result Cache
  - More control over how cache behavior
  - What if only a subset of the cached data is required?
  - How long should a query be cached?
  - Do I want additional logic executed when the cache is refreshed?
- Requires significant customization

CQN provides cache infrastructure





# Oracle Performance Analyzer and SQL Tuning Advisor in Visual Studio

# SQL Tuning Advisor

- Use when designing new SQL statements
- Tune ad-hoc SQL statements in Query Window
- Tune bad SQL found by Oracle Performance Analyzer
  - (Use if SQL is performing poorly under load)

# SQL Tuning Advisor

- Requirements
  - ADVISOR privilege
  - Oracle Database license for Oracle Diagnostic Pack
  - Oracle Database license for the Oracle Tuning Pack
- How to run:
  - Oracle Query Window “Tune SQL” button
  - Oracle Performance Monitor – Tune SQL button

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# SQL Tuning Advisor

# Oracle Performance Analyzer

- Detects performance issues in an application's use of the database under load
- Requirements
  - SYSDBA
  - Oracle Database license for Oracle Diagnostic Pack
- Can be use during testing
- Can be also used on production applications

# Oracle Performance Analyzer – How To Use

- Connect in Server Explorer as SYSDBA (to container if using Oracle Multitenant)
- Run your application
- Start Oracle Performance Analyzer
- Enter amount of time to analyze
- Press Start to start timer
- Sufficient “database time” required to get results
- View findings and actions
- Implement recommended actions
- Run again for additional recommendations

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DEMONSTRATION

# Performance Analyzer

## What's Ahead

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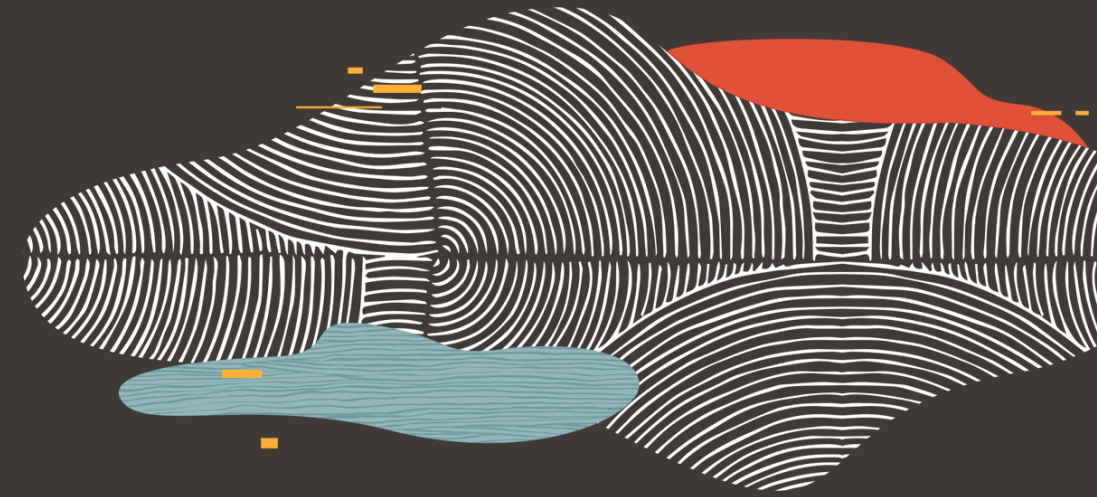
# Today

1:15 – 2:00

Exploring the Multicloud: Working with  
Azure and Oracle Autonomous Database  
- Moscone South 209

2:15-3:00

Running Oracle Database and  
Applications in Docker Containers on  
Windows - Moscone South 313





Questions?

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