What’s New For Oracle and .NET

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Senior Principal Product Manager
Program Agenda

- Supported Oracle Database 12c Features
  - Oracle Multitenant
  - High Availability and Scalability
  - Ease of Use and Application Migration
  - Entity Framework

- Schema Compare and Tools
Program Agenda

- ODP.NET, Managed Driver
- Current and Future ODAC Releases
Oracle Multitenant – New in Oracle Database 12c
Multitenant Architecture

Components of a Multitenant Container Database (CDB)

Pluggable Databases (PDBs)

PDBs
Root
CDB
Multitenant for Test and Development

Clone production, plug into development. Clone/destroy test instances
Deployment

- Unplug from development/test environment
- Plug into production environment
Oracle Multitenant in Visual Studio
PDB Functionality in Server Explorer

- **Pluggable Databases Node**
  - Menu: New pluggable database, Plug

- **Pluggable Databases Node**
  - Menu: Clone, Unplug, Open, Close, Delete

- **Server Explorer connections automatically made to new or cloned pluggable databases**
Oracle Multitenant in Visual Studio

Plug Pluggable Database

Database name: PDBORCL
XML file name: PDBORCL.xml
XML file location: C:\APP\ORACLEHOME\ORADATA\ORCL\PDBORCL

Specify the names and locations of the data files of the existing pluggable database. This is only necessary if the names or locations of the data files are not specified correctly in the XML file, and need to be overridden.

<table>
<thead>
<tr>
<th>Tablespace</th>
<th>Data File Name</th>
<th>Data File Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXAMPLE</td>
<td>EXAMPLE01.DBF</td>
<td>C:\APP\ORACLEHOME\ORADATA\ORCL\PDBORCL</td>
</tr>
<tr>
<td>SYSAUX</td>
<td>SYSAUX01.DBF</td>
<td>C:\APP\ORACLEHOME\ORADATA\ORCL\PDBORCL</td>
</tr>
<tr>
<td>SYSTEM</td>
<td>SYSTEM01.DBF</td>
<td>C:\APP\ORACLEHOME\ORADATA\ORCL\PDBORCL</td>
</tr>
<tr>
<td>TEMP</td>
<td>PDBORCL_TEMP01.DBF</td>
<td>C:\APP\ORACLEHOME\ORADATA\ORCL\PDBORCL</td>
</tr>
<tr>
<td>USERS</td>
<td>SAMPLE_SCHEMA_USERS01.DBF</td>
<td>C:\APP\ORACLEHOME\ORADATA\ORCL\PDBORCL</td>
</tr>
</tbody>
</table>
Oracle Multitenant with ODP.NET

- ODP.NET works implicitly with PDBs
  - Connect to the PDB service name
  - Hostname and port are same as container
- Requires Oracle Database 12c and ODAC 12c
For More Information

- **Oracle OpenWorld session**
  - ALM with Visual Studio: SQL and PL/SQL Development, Source Control, and Deployment
    - CON8889
    - Wednesday, September 25, 3:30 PM - 4:30 PM
    - Marriott Marquis - Golden Gate C2
High Availability and Scalability – New in Oracle Database 12c
Global Data Services

- Extend RAC services to a global basis
  - Access to FCF, load balancing, and affinity capabilities
  - RAC, Active Data Guard, and GoldenGate can participate

- Benefit
  - Optimizes utilization, HA, and performance

- No code changes

- Requires Oracle Database 12c and ODP.NET 12c
Global Data Services

Concepts

Without GDS

GoldenGate

Sales Service

With GDS

GoldenGate

Sales Global Service
Faster and More Graceful Planned Outage

- Offline DB alerts ODP.NET of impending downtime
- ODP.NET stops allocating and closes idle connections
  - Connections returned to the pool are closed
- Benefit
  - DB brought offline as quickly as possible without end user disruptions
- Set ODP.NET attribute “HA Events = true”
- Requires Oracle Database 12c and ODP.NET 12c
Transaction Guard

- ODP.NET can determine whether a transaction committed even upon a DB failure

- Benefit
  - Ensures transaction commits at most once

- App can query transaction outcome
  - `OracleConnection` properties return transaction ID and status
  - `OracleLogicalTransactionStatus` class

- Requires Oracle Database 12c and ODP.NET 12c
Recoverable Error Detection and Recovery

- After DB error, ODP.NET determines if failed transaction is recoverable or not
  - Returns error message if operation cannot be retried
- `OracleException.IsRecoverable` property indicates if transaction recoverable and can be retried

**Benefit**
- Determine with certainty whether can rollback or resubmit

- Requires Oracle Database 12c and ODP.NET 12c
Transaction Guard Scenario

1. ODP.NET receives FAN down event or error.

2. IsRecoverable=false ➔ roll back.
   IsRecoverable=true ➔ re-submit.

3. To re-submit, retrieve LogicalTransactionId.

4. Obtain new session and retrieve txn status.

5. If committed and completed, done.
   If not committed nor completed, re-submit.
ODP.NET FAN Uses ONS

- Oracle Notification Service (ONS) replaces AQ
- Benefits
  - Faster, more scalable, eliminates firewall issue, supports Active Data Guard, and consolidates publish/subscribe service
- No code changes required
  - But configuration changes required
- Managed and unmanaged always uses ODP.NET 12c
  - Except unmanaged with Oracle DB 11.2 or earlier
Ease of Use and Application Migration – New in Oracle Database 12c
Boolean Data Type

- ODP.NET OracleBoolean data type
  - Can be used with PL/SQL Booleans

- Benefit
  - Eases parameter binding
    - Stored procedures
    - Entity Framework Function Imports
Identity Column

- DB automatically increments for next value as needed
  - Supports ANSI’s IDENTITY keyword

- Benefit
  - Easier to set up auto incrementing values (e.g. primary keys)

- Integrated with ODT and ODP.NET
  - E.g. ODT: Create table with auto-incrementing Identity column
  - E.g. ODP.NET: Add row without explicitly providing identity value
Large VARCHAR2, NVARCHAR2, and RAW

- ODP.NET VARCHAR2, NVARCHAR2, and RAW data types now can be up to 32 KB in size

- Benefit
  - Continue using fundamental data types even with larger data
    - No need to modify schema or use more advanced type
Return Row Count Per Array DML Iteration

- ODP.NET returns number of rows affected for each input value, not just the total number of rows affected
- New OracleCommand.ArrayBindRowCount property
  - Returns number of affected rows for each executed array bound DML iteration
- Benefit
  - Provides more info on DML correctness and efficiency
Enhanced Implicit REF CURSOR (RC)

- ODP.NET retrieves result set without explicit RC declaration nor metadata in .NET config
- Can retrieve multiple implicit RCs
  - ExecuteNonQuery – Returns array of RCs
  - ExecuteReader – Returns DataReader, each accessible via calling NextResult
- Benefit
  - Simplifies retrieving result sets from PL/SQL
Enhanced Implicit REF CURSOR (RC)

- Calling `DBMS_SQL.RETURN_RESULT(cursor)`
  - Returns RC implicitly to ODP.NET
  - Intended to support DBs and apps migrated to Oracle

- Entity Framework
  - Still requires RC metadata, but new auto-generation feature
Entity Framework
Entity Framework - Implicit RC

- RC metadata can be automatically generated specifically for EF implicit result sets

- Steps
  - 1. While in EF project, run stored procedure in Server Explorer
  - 2. Check off “Select for Config” box(es)
  - 3. Click “Add to Config” button

- Benefit
  -Eliminates hand-coding metadata thereby increasing productivity
EF: RC Metadata Auto Generation
New Entity Framework Features

- All DB versions
  - Implicit RC automatic metadata generation
  - Boolean

- Oracle DB 12c and higher
  - Identity column
  - SQL “APPLY” keyword for lateral views
Schema Compare and Tools
Schema Compare Tool in Visual Studio

- New in Oracle Developer Tools for Visual Studio
  - ODAC 12c
  - Oracle Database 10.2 or higher

- Compare two schemas in the same or different DBs
  - Visually inspect differences using UI
  - Generate a diff script for deployment purposes
  - Reverse schema compare to “rollback” changes
  - Can compare down to granularity of schema type
    - e.g. compare all tables, or all packages, etc.
Schema Compare – View Differences

![Schema Compare Diagram]

```
ALTER TABLE "EMPLOYEES" ADD ("BIRTHDAY" DATE);
```
Schema Compare

Typical Use Case of Visual Studio Developer

- 1. Development schema identical to production schema
- 2. Development schema evolves to meet needs of app
- 3. Use Schema Compare to inspect what has changed
- 4. Use Schema Compare to generate diff script
- 5. Deploy diff script with app
For More Information

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Automated ODP.NET Connection Configuration

- OUI copies tnsnames.ora and sqlnet.ora files from an existing Oracle Home into the new ODAC home
- If no existing Oracle Home present, OUI will ask for database alias and connectivity info
Automated ODT Connection Configuration

- Server Explorer Connection Dialog
  - Added EZ Connect connection type
  - For TNS
    - Retrieves current tnsnames.ora aliases in current Oracle Home
    - Use aliases defined in other Oracle Homes
      - 1. Dialog to search for tnsnames.ora in other homes
      - 2. Once found, available aliases displayed
      - 3. ODT copies aliases over to current tnsnames.ora
Managed ODP.NET
Current ODP.NET Architecture
Managed and Unmanaged

Managed

ODP.NET Oracle.Data Access.dll

Unmanaged

ODP.NET Unmanaged DLLs
OCI
NET

Database
Oracle
Forthcoming ODP.NET Architecture

Fully Managed

ODP.NET
Oracle.Managed
DataAccess.dll

Oracle

Managed

Database
Managed ODP.NET vs. Unmanaged ODP.NET

Benefits

- One assembly for both 32-bit and x64
- Easier side by side deployment
- Deploy smaller and fewer binaries
  - Before: 150 MB
  - After: Less than 10 MB
- Easier patching process
- Fully integrated with Code Access Security
Managed ODP.NET

- 100% managed provider
- Assembly
  - Oracle.ManagedDataAccess.dll
- No other Oracle Client files required
  - Unless using distributed transactions
- Namespaces
  - Oracle.ManagedDataAccess.Client
  - Oracle.ManagedDataAccess.Types
Managed ODP.NET

- Same assembly for either 32-bit and x64 Windows
- Can be deployed side by side
  - With unmanaged ODP.NET
  - With managed ODP.NET
- Installable via OUI and xcopy
Managed ODP.NET Certification

- Certified with
  - .NET Framework 4 and 4.5
  - Visual Studio 2010 and 2012
  - Windows
    - Client: 7 and 8
- Supports Oracle DB 10.2 and higher
Hello (Managed) World
Managed ODP.NET Features

- Standard ADO.NET provider objects, methods, and properties
- Oracle Developer Tools for Visual Studio
  - Server Explorer connections
  - Drag and drop code generation
- Connection pooling features
  - Min, Max, Timeout, Lifetime, Increment, Decrement
  - RAC Load Balancing and Fast Connection Failover
  - Performance counters
Managed ODP.NET Features

- Full SQL or PL/SQL
- Entity Framework
  - ODT and ODP.NET
- Native Oracle data types
  - REF Cursor, LOBs, Date, String, Decimal, Binary, TimeStamp, etc.
  - SecureFiles/LOB and LONG retrieval APIs
  - Oracle data types in DataSet
- Self-tuning
Distributed Transactions

- Requires an additional managed DLL (for now)
  - Oracle.ManagedDataAccessDTC.dll
  - Only needed if using distributed transactions
  - Provides enlistment and commit services
  - Implicitly loaded

- Recovery services via unmanaged Windows service

- Two DLL versions with same name
  - One for 32-bit and one for x64
  - Must match 32-bit or 64-bit COM calls
Managed ODP.NET vs. Unmanaged ODP.NET

Features Unavailable in First Release

- User defined types
- Oracle-specific XML features and data types
- Advanced Queuing
- Client Result Cache
- BulkCopy
- Transaction Guard
- …
Managed ODP.NET Deployment Concepts

- Option 1: single configuration file deployment
  - .NET config file contains TNS, SQL*Net, and LDAP settings
    - i.e. Machine.config, web.config, app.config

- Option 2: multi-file configuration
  - .NET config file
  - Tnsnames.ora, sqlnet.ora, and ldap.ora

- Option 3: no configuration files
  - Store connect info in Data Source attribute
Deploying Managed ODP.NET
Unmanaged to Managed Migration

- Application migration process
  - 1. Replace Oracle.ManagedDataAccess.dll reference to project
  - 2. Modify namespace(s) to Managed ODP.NET
  - 3. Change .NET config settings for Managed ODP.NET
    - Include *.ora file settings

- Managed ODP.NET APIs same as ODP.NET APIs
  - Initially, Managed ODP.NET does not support all ODP.NET features
  - Plan is eventual feature parity
Current and Future ODAC Releases
Current ODAC Releases

- Oracle Database 12c Release 1
  - Managed ODP.NET
  - High availability
  - Ease of development
  - Oracle Multitenant data access

- ODAC 12c Release 1
  - Oracle Schema Compare
  - Oracle Multitenant tools
  - Managed ODP.NET only download
Upcoming ODAC Releases

- ODAC 12c Release 2 – End of 2013/Beginning of 2014
  - Visual Studio 2013
  - .NET Framework 4.5.1

- Post-ODAC 12c Release 2
  - Release timeframe TBD
  - More Entity Framework features
  - Add more data types to managed ODP.NET
Conclusion and Q & A
Additional Oracle .NET Resources

OTN
otn.oracle.com/dotnet

Twitter
twitter.com/OracleDOTNET

YouTube
youtube.com/OracleDOTNETTeam

Email
alex.keh@oracle.com
Upcoming .NET Sessions

Tuesday Sept 24

- PL/SQL Programming for .NET Developers: Tips, Tricks, and Debugging
  - 3:45 PM - 4:45 PM, Marriott Marquis - Golden Gate C2
Upcoming .NET Sessions

Wednesday Sept 25

- ALM with Visual Studio: SQL and PL/SQL Development, Source Control, and Deployment
  - 3:30 PM - 4:30 PM, Marriott Marquis - Golden Gate C2

- Oracle Database 12c on Windows
  - 5:00 PM – 6:00 PM, Moscone South - 104
Upcoming .NET Sessions
Thursday Sept 26

- Hands-on Lab: Building .NET Applications with Oracle
  - 11:00 AM - 1:30 PM, Marriott Marquis - Salon 3/4

- Oracle and .NET: Best Practices for Performance and Deployment
  - 2:00 PM - 3:00 PM, Marriott Marquis - Golden Gate C2
Visit .NET Experts at the Demogrounds

Monday through Wednesday

- .NET Development for Oracle Database 12c
  - Moscone South, Left Rear in Oracle Database Section
  - Booth # SL-044
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