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PL/SQL Programming for .NET Developers: Tips, Tricks, and Debugging

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Program Agenda

- PL/SQL Development Lifecycle in VS
- Using PL/SQL with ODP.NET
 - Introduction
 - PL/SQL Data Types Mapping in .NET
 - Anonymous PL/SQL Blocks
 - Using Oracle Supplied PL/SQL Packages in .NET
 - VARRAYs and Nested Tables
- PL/SQL Debugging in Visual Studio
- Next Steps



A man with dark hair and a beard is sitting on a green couch, smiling while looking at a laptop. He is wearing a light grey t-shirt and blue jeans. The background is a bright, out-of-focus indoor space. A large red semi-transparent rectangle is overlaid on the left side of the image, containing the title text. A word cloud of various programming and database technologies is positioned behind the title text.

PL/SQL Development Lifecycle with Visual Studio

SQL and PL/SQL Development Lifecycle

- Create Users, and Roles and grant privileges to them
 - User and Role Designers
 - Grant and Revoke Privileges Wizard
- Create Schema Objects, PL/SQL procedures, functions, packages
 - Oracle Wizards
 - Query Window – Ad Hoc SQL
 - Run SQL*Plus Scripts for existing scripts
 - Import Table Wizard
- Create SQL and PL/SQL scripts
 - Generate Create Script from existing schema objects
- Store scripts in source control
 - Oracle Database Project

SQL and PL/SQL Development Lifecycle

- Edit SQL and PL/SQL Scripts
 - Oracle SQL Editor – file based
 - Oracle PL/SQL Editor – database based
- Tune SQL
 - Oracle Performance Analyzer
 - SQL Tuning Advisor
- Create client side .NET code
 - (C#, VB.NET, ASP.NET)
 - Use Oracle Data Provider for .NET to call PL/SQL
- Debug .NET and PL/SQL together
 - PL/SQL Debugger in Visual Studio
- Deploy

PL/SQL Development Lifecycle

- Oracle Developer Tools for Visual Studio
 - Tightly integrated “Add-in” for Visual Studio 2010, 2008, 2005
- ODP.NET
 - ADO.NET compliant data provider
 - Native access to Oracle database
 - Utilize advanced Oracle Database features
 - RAC, performance, security, data types, XML, etc.
- Both available for free download today
 - <http://www.oracle.com/technetwork/topics/dotnet/>

PL/SQL Development Lifecycle

Oracle Developer Tools for Visual Studio

- Fully integrated with Visual Studio 2010, 2008 and 2005
- Automatic code generation – Winform and ASP.NET
- Oracle Wizards and Designers
- Oracle Data Window
- Oracle Database Project
 - Edit and Run SQL scripts
 - SQL*Plus is built in
 - Source control integration

PL/SQL Development Lifecycle

Oracle Developer Tools for Visual Studio

- Integrated PL/SQL Editor and Debugger
- Oracle Query Window
 - Ad Hoc SQL
 - SQL Tuning Advisor
 - Explain Plan
- .NET Stored Procedure Deployment
- Integrated help system – SQL, PL/SQL keywords



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PL/SQL Lifecycle

Using PL/SQL with ODP.NET

Introduction

- Any PL/SQL Call is Supported
 - Stored Procedure
 - Stored Function
 - Package Method
 - Anonymous block
 - Batch SQL support

PL/SQL Data Types Available in .NET

- Data Types
 - PL/SQL Types
 - REF Cursor
 - Associative Array (formerly index-by table)
- ODP.NET Types vs. .NET types
 - OracleParameter.DbType
 - OracleParameter.OracleDbType
 - .NET DataSet can store ODP.NET types
 - Available in ADO.NET 2.0
 - OracleDataAdapter.ReturnProviderSpecificTypes = true



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Hello PL/SQL

Batching SQL and deferring fetching

- You want to execute SQL queries in Stored Procedures and then fetch as needed from the client
- You want to “batch SQL” – multiple SQL statements in one PL/SQL anonymous block
- Solution: Use REF CURSORS and Anonymous PL/SQL

REF Cursors

- Characteristics
 - Pointer to result set on server side
 - Read only
 - Forward only
- Advantages
 - Input REF Cursor parameters
 - Retrieve multiple REF Cursors in a single round trip



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REF Cursors

Passing large amounts of data

- You want to pass in or retrieve large amounts of data in one round trip with best performance possible
- You are using scalar types
- Solution: Use associative arrays

Associative Arrays

- Characteristics
 - Must declare size of array
 - Index key must be sequential
 - Index key must be non-negative integers
- Advantages
 - Pass large amount of data between the DB and .NET in one array
 - Reduces number of parameters
 - Reduces round trips
 - Easier batch processing

Using Associative Arrays in .NET

- Steps to bind an associative array parameter
 - Set `OracleParameter.CollectionType` to `OracleCollectionType.PLSQLAssociativeArray`
 - Set `OracleParameter.ArrayBindSize` for *each* array element
 - Only necessary for variable-length data types
 - Set `OracleParameter.Size` for number of array elements



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Associative Arrays

Anonymous PL/SQL

- Executes multiple SQL statements in a single batch
 - Saves DB round trips
 - Execute as CommandType.Text
- Generate dynamically based on application requirements

```
// C#  
string cmdtxt = "BEGIN " +  
"OPEN :1 for select * from emp where deptno = 10; " +  
"OPEN :2 for select * from dept where deptno = 20; " +  
"INSERT INTO DEPT VALUES (50, 'IT', 'SAN FRANCISCO');" +  
"END;";
```



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Anonymous PL/SQL

Using Pre-Defined PL/SQL Packages

- DB server provides PL/SQL packages to all of Oracle's key functionality
 - Can be used from ODP.NET, similar to any other PL/SQL call
 - Sample pre-packaged functionality
 - DBMS_AQ
 - DBMS_OLAP
 - DBMS_STREAMS
 - SDO_GEOM

VARARRAYs and NESTED TABLES

- Newly supported in ODAC 11g
 - Use Custom Class Code Generation wizard
 - Check out code samples in directory
<OH>\odp.net\samples\2.x\UDT

```
MyVarrayCustomClass pa = new MyVarrayCustomClass();
pa.Array = new Int32[] { 1, 2, 3, 4 };

pa.StatusArray = new OracleUdtStatus[] {
    OracleUdtStatus.NotNull...
};
param.OracleDbType = OracleDbType.Array;
param.Direction = ParameterDirection.Input;
param.UdtTypeName = "MYVARRAY";
param.Value = pa;
```

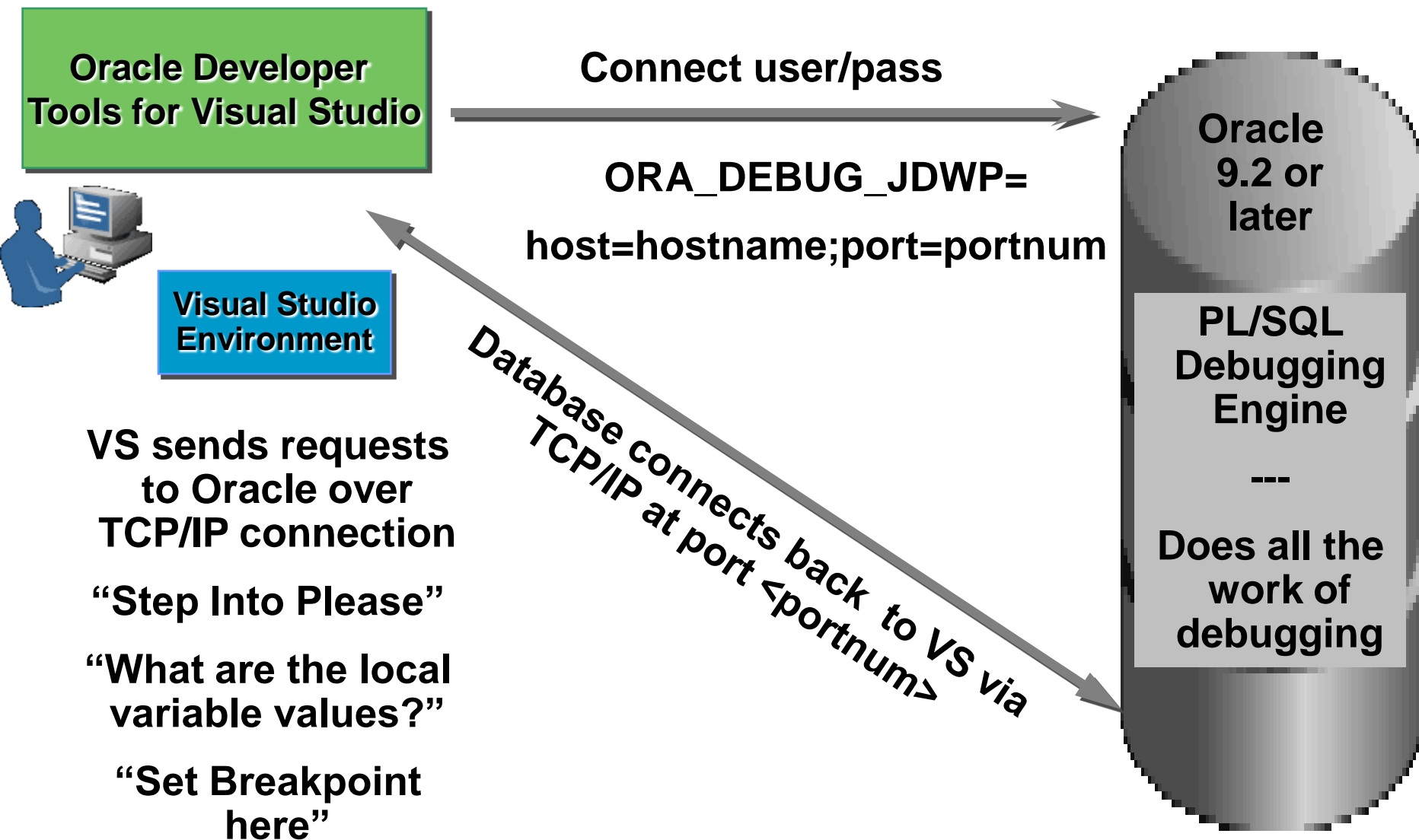


PL/SQL Debugging from Visual Studio

PL/SQL Debugging in Visual Studio

- Direct Database Debugging
 - “Step into” a SP directly from Server Explorer
- Application Debugging
 - Step from application code (eg C# or ASP.NET code) directly into PL/SQL and then return back
- External Application Debugging
 - Set breakpoints and debug SPs called by external applications running on other machines or platforms

Oracle PL/SQL Debugging Architecture



PL/SQL Debugging Configuration

- GRANT debug privileges as SYSDBA
 - 9.2 or later: GRANT DEBUG ANY PROCEDURE TO username, and
 - 10g or later also requires: GRANT DEBUG CONNECT SESSION TO username
- Set port range in Debugging Options page
 - Tools -> Options->Oracle Developer Tools
- Compile PL/SQL units for Debug
 - Via menu in PL/SQL editor or in Oracle Explorer

Direct Database Debugging

- “Step Into” from Server Explorer
- “Run Debug” from Server Explorer
- Enter parameters manually

Application Debugging Mode

- Step from .NET code into PL/SQL and back
- Check off “Tools -> Oracle Application Debugging”
- ODT automatically starts listener using port in range given in Options page
- **Uncheck** "Enable the Visual Studio hosting process" in the .NET Project Properties Debug tab



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PL/SQL Debugging

External Application Debugging

- Debug Application from
 - ANY 9.2 client or later
 - Running on ANY platform
- Set ORA_DEBUG_JDWP in client environment
 - SET ORA_DEBUG_JDWP=host=mymachine;port=4444
- Start Listener
 - Tools-> “Start Oracle External Application Debugger”



External PL/SQL Debugging

Advanced Debugging

DBMS_DEBUG_JDWP Package

- Allows you to pick and choose when debugging is turned on
- Enable External Application Debugging
- Add calls to these PL/SQL Procedures to your SP:
 - DBMS_DEBUG_JDWP.CONNECT_TCP(*HOST VARCHAR2*, *PORT VARCHAR2*)
 - DBMS_DEBUG_JDWP.DISCONNECT
 - Compile Debug
 - Set Breakpoint
 - Call SP from external application

Next Steps

[illegible]

Upcoming Oracle Develop .NET Sessions

- Today: 4:45 pm – Hotel Nikko – Nikko Ballroom I:
 - **Database Development Lifecycle Management with VS**
- Thursday 12:30 pm – 4:30pm - Hilton Imperial Ballroom A
 - **Hands on Lab: Building .NET Applications with Oracle**

.NET Hands On Lab!

- Developing and Deploying a .NET Stored Function
- Using Database Change Notification With ODP.NET and Oracle 11g
- Building ASP.NET Web Applications with Oracle Developer Tools for Visual Studio
- Getting Started with Oracle Data Provider for .NET
- Building .NET Applications Using Oracle Developer Tools for Visual Studio
- Debugging Oracle PL/SQL from Visual Studio
- Optimizing Data Access Performance with ODP.NET
- Using Oracle User-Defined Types with .NET and Visual Studio
- Tuning .NET Applications in Visual Studio with SQL Tuning Advisor and Oracle Performance Analyzer
- Using Oracle Providers for ASP.NET

More Oracle .NET Resources

- .NET Technology Center
 - <http://www.oracle.com/technetwork/topics/dotnet/>
- For more questions
 - christian.shay@oracle.com


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