ORACLE

.NET Development with Oracle Database 21c

Oracle Database offers easy to use free tools and data access providers for developing .NET (Core) and .NET Framework applications. They include:

- Oracle Developer Tools for VS Code – a free extension for Visual Studio Code that enables editing and executing SQL and PL/SQL, exploring the database schema, and exploring and managing Oracle Autonomous Database resources
- Oracle Data Provider for .NET (ODP.NET) – optimized and feature-rich ADO.NET data access to Oracle database
- Oracle Developer Tools for Visual Studio - a free extension for Visual Studio that enables editing and executing SQL and PL/SQL, exploring the database schema, and exploring and managing Oracle Autonomous Database resources

These tools and data providers can be used with the latest .NET and Visual Studio (Code) features to work with any currently supported Oracle Database, from version 11.2.0.4 to 21, including cloud and Oracle Autonomous Database instances. They are freely downloadable from popular software repositories: NuGet Gallery and Visual Studio Marketplaces. In this new version, ODP.NET and Oracle Developer Tools introduce numerous enhancements to for the latest Oracle Database, cloud, .NET, and Visual Studio (Code) features.

Key Benefits

- No charge
- Supports on-premises, cloud, and Autonomous Database
- Available on NuGet Gallery and Visual Studio (Code) Marketplaces
- Supports all database editions and versions 11.2.0.4 and higher
- Supports popular developer IDEs: Visual Studio Code and Microsoft Visual Studio

Oracle Developer Tools for VS Code

Oracle Developer Tools for VS Code enables Visual Studio Code developers to connect to Oracle Database and Oracle Autonomous Database, edit and execute SQL and PL/SQL scripts, view data, and explore the database schema.

Oracle Cloud Infrastructure Explorer allows developers to connect, browse and manage Autonomous Database (ADB) resources easily including Autonomous Transaction Processing Databases, Autonomous Data Warehouses, and Autonomous JSON Databases.

Developers can quickly create Always Free ADB instances, automatically download credentials files and be connected to the database to work on their code within minutes.

Developers can execute SQL and PL/SQL and view and save results. View errors in the Problems panel and navigate to the line in the script with the error. SQL*Plus commands are supported.

Oracle Database Explorer tree control allows developers to connect and explore the database schemas; show data for tables and views and save as CSV or JSON

files; auto-generate SQL for table CREATE, INSERT, and DELETE; view, edit and save PL/SQL packages, procedures and functions. Developers can run stored procedures and functions with a dialog for entering parameter values.

Users can edit SQL and PL/SQL with autocompletion of schema object names, procedure/function parameters, and SQL*Plus commands. The editor also features intellisense, code snippets, and syntax coloring. Easily navigate through scripts using breadcrumbs.

For frequently used SQL and PL/SQL commands, SQL command history and custom bookmarks are available.

For more information, visit the Visual Studio Marketplace page for Oracle Developer Tools for VS Code.

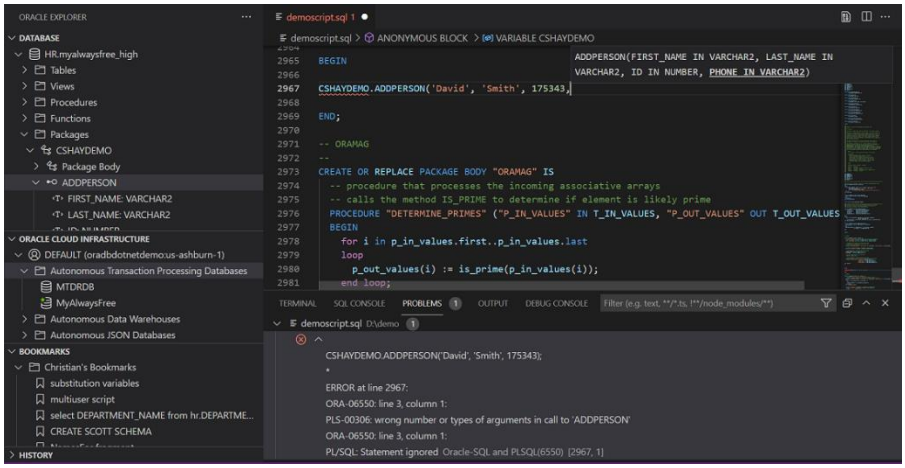

Figure 1: Oracle Explorer tree control (top left) lets developers explore their database schema and manage Autonomous Database resources. SQL script editing includes autocomplete (top right) which makes it easy to remember stored procedure parameter types or table columns. Integration with the Problems Panel (bottom right) lets developers view errors and click to go to the line in the script with the error.

ODP.NET

ODP.NET features optimized ADO.NET data access to Oracle database while providing full access to the latest .NET Framework and .NET (Core) features. Developers can take advantage of Oracle's unique database functionality, including Transparent Application Continuity, Fast Connection Failover, REF Cursors, and multitenant container databases. ODP.NET gives .NET apps better performance, flexibility, and more feature availability through features, such as performance self-tuning, sharding, and runtime load balancing.

ODP.NET has three provider types:

- ODP.NET Core – multi-platform, fully-managed code .NET (Core) driver
- Managed ODP.NET – fully-managed .NET Framework driver
- Unmanaged ODP.NET – .NET Framework driver that uses Oracle database client

For .NET Framework apps, Oracle recommends managed ODP.NET for data access. With managed ODP.NET, side-by-side installations are easier to manage. Provider deployments have fewer files and smaller disk footprints. All three

New ODP.NET Features

- .NET 6
- EF Core 6
- User-defined types (core and managed ODP.NET)
- Binary JSON data type
- Client Initiated Continuous Query Notification

ODP.NET provider types share nearly the same feature set and application programming interfaces (APIs).

ODP.NET 21c introduces the following new capabilities:

- .NET 5 and 6 runtimes
- Entity Framework Core (EF Core) 5 and 6
- User-defined types (UDTs)
- Binary JSON data type
- Client Initiated Continuous Query Notification (CICQN)
- Sharding
- Set administrative privileges
- Trace redaction

ODP.NET Core 21c supports .NET 5 and Entity Framework Core 5. .NET 5 is the newest .NET runtime. EF Core 5 is the latest version of the object-relational mapper. In late 2021, Microsoft will release version 6 of .NET and EF Core. Oracle intends to support these new versions by the end of 2021.

In ODP.NET Core 21c and managed ODP.NET 21c, developers can now incorporate Oracle UDTs in their .NET apps. Previously, UDT APIs were only available in unmanaged ODP.NET. The three providers share significant parity among their UDT APIs and functionality. Migrating existing unmanged ODP.NET UDT apps to managed ODP.NET or ODP.NET Core is straightforward. For most apps, migration involves just searching and replacing a few lines of code.

Another major new ODP.NET feature is support for the binary JavaScript Object Notation (JSON) column data type in Oracle Database 21c. The data type is optimized for query and DML processing, yielding performance improvements for ODP.NET apps without requiring coding customizations to use.

ODP.NET CICQN is similar to traditional Continuous Query Notification (CQN). In CQN, client applications receive a notification when a server-side change occurs that could alter the client's cached query result set. This notification is out of process, occurring without an ODP.NET connection. With CICQN, the notification is now in-process to support cloud deployments and when firewalls or load balancers sit between ODP.NET and the database.

Additional new ODP.NET features include database sharding support in managed ODP.NET and ODP.NET Core; the ability to assign task-specific and least-privileged administrative privileges to enable database administrative duty separation (i.e. SYSBACKUP, SYSDG, etc.); and a new tracing level that excludes SQL statements and network packet contents.

Oracle Developer Tools for Visual Studio

Oracle Developer Tools for Visual Studio (ODT) is a tightly integrated extension for Microsoft Visual Studio 2019 and Visual Studio 2017.

ODT makes developing .NET code for Oracle easy and fast, allowing developers to stay in Visual Studio for the entire development lifecycle. ODT makes it easy to browse and edit Oracle schema objects using integrated visual designers and

can automatically generate .NET code. Developers can easily modify table data, execute Oracle SQL statements, edit and debug PL/SQL code, and generate SQL deployment scripts.

ODT includes Oracle Cloud Explorer which allows developers to connect, browse and manage Autonomous Database (ADB) resources easily and intuitively. Developers can quickly create Always Free ADB instances, automatically download credentials files and be connected to the database to work on their code within minutes. All ADB features are supported, including Autonomous Database Dedicated and Autonomous Data Warehouse.

Oracle Database multitenant container databases (CDBs) are integrated into Server Explorer, allowing developers to easily and quickly create, clone, plug or unplug pluggable databases (PDBs) for use during development and testing.

The SQL Tuning Advisor tool helps developers tune arbitrary SQL statements and an Oracle Performance Analyzer, which analyzes a running .NET application's use of the Oracle database and provides detailed recommendations.

Schema Compare tools allow developers to detect changes between individual Oracle schema objects or entire schemas. Schema comparisons can be performed against live database instances or against a set of SQL scripts stored in an Oracle Database Project.

For Visual Studio 2019 developers, ODT is available on OTN as a single small footprint .VSIX file for simplified installation.

For more information, visit Oracle Developer Tools for Visual Studio website.

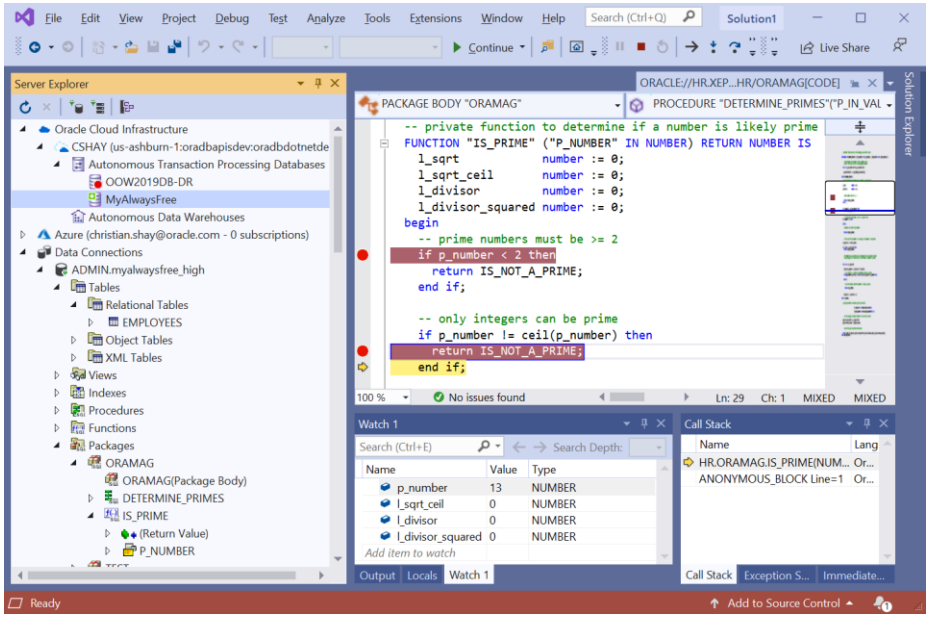

Figure 1: Browsing and managing Oracle Autonomous Database (left) and editing and debugging PL/SQL (right) are just two examples of Oracle's tight Visual Studio integration.

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