



IDUG DB2 Tech Conference

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Application Development Best Practices for .NET and ODBC for DB2 and DB2 Connect

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IBM

Session Code: E01

Tues May 15 12:45 – 1:45 | Platform: Cross Platform





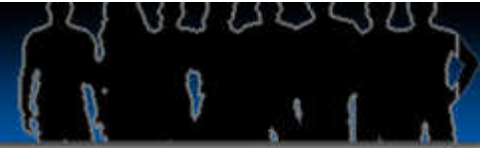
Agenda

- ODBC and .NET Applications
- DB2 Connect Configurations
- Client Packages and Deployment
- Client Configuration
- Function Rollout
- pureQuery Client Optimization
- Performance Hints and Tips

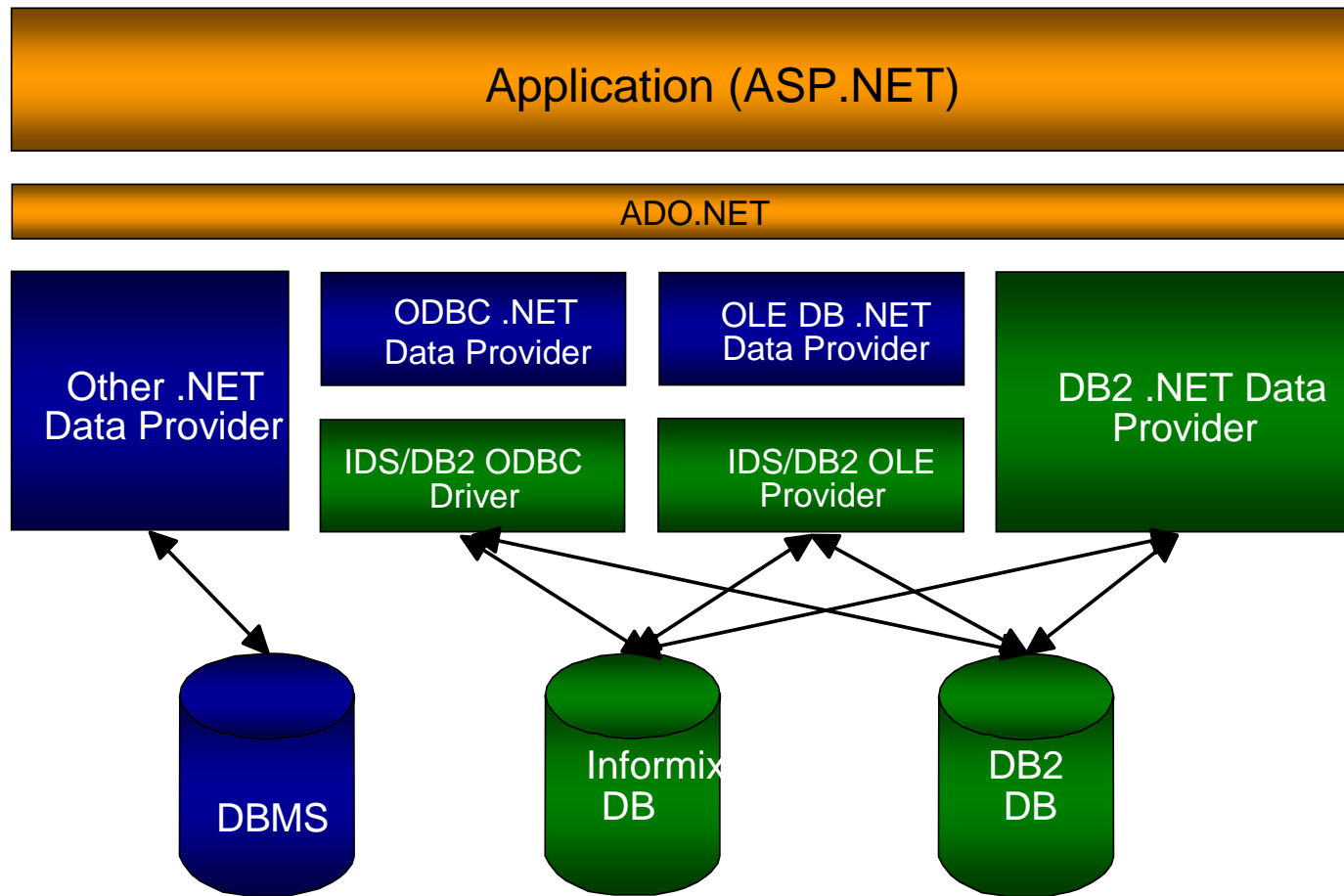


ODBC – Typical Applications

- ODBC / CLI user interchangeable
 - Think of CLI as ODBC ++
- ISV applications
 - Every database has an ODBC driver
 - Has been a mainstay for nearly two decades
 - Open source drivers
 - Current Perl, Python, Ruby drivers written to vendor ODBC libraries
- Popular end user apps
 - Excel, Access

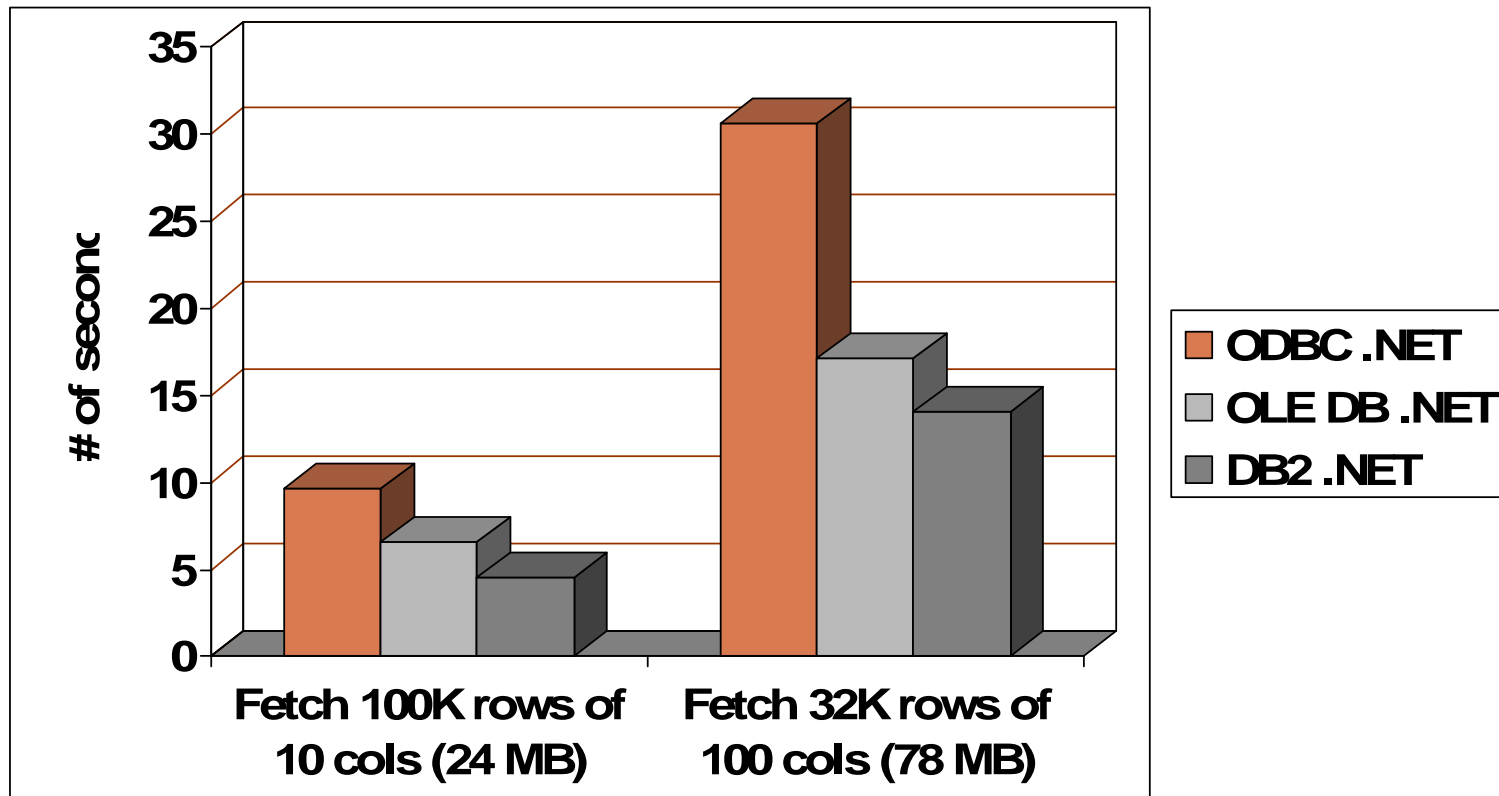


ADO .NET Providers





DB2 V8.1.4 .NET Data Provider Comparison





.NET Data Provider Comparison

- Bridge providers do not have newer data types and features
 - DB2BulkCopy, DB2ResultSet
 - XML - integration with XmlReader
 - Decimal Float
 - Higher timestamp precision
- Difficulty in diagnosing problems
 - Limitations in MS Bridge providers or ODBC / OLE DB interfaces
 - Connection pooling often an issue
- IBM VS Addins for DB2 .NET provider only



DB2 .NET Data Provider

- IBM's .NET support is designed to operate in the .NET environment as .NET programmers expect
 - Our documentation is reference oriented
 - Documentation also provides best practices / examples for our unique features
- VS Addins fully leverage rapid application development
 - VS Addins also exploit IBM unique features
- Current .NET and Visual Studio skills transportable
- Entity Framework is the latest .NET paradigm
 - Object layer on top of ADO.NET



VS Addins Function Summary – VS 2008 / 2010

- Server Explorer
 - Enumeration - **filtering**
 - View Data, Script
 - Drag n drop – windows app, web app, Entity Framework
 - Schema evolution - developers
- Stored Procedures
 - SQL Procedure designer
 - SQL keyword highlighting and Intellisense
 - End to end debugging – **merged call stack**, step into, run to breakpoint
- XML
 - **XML Schema, generate sample**
 - **XML index designer**
- Web Services
 - IIS (ASP.NET)



Integration with OMPE

- OMPE (OPM) Extended Insight Feature
 - Provides end to end performance information
- Need to communicate driver information to OPM server
 - Client side component to aggregate driver information and handshake with OPM server
 - Location of OPM server comes from OPM controller
 - Extended Insight Client – Data Tools Runtime Client (DTRC)
- DTRC
 - Jar file to be in classpath for Java based apps
 - Shared library for non-Java
 - Requires location to be specified in db2dsdriver.cfg file
 - Location of controller needs to be configured at each client

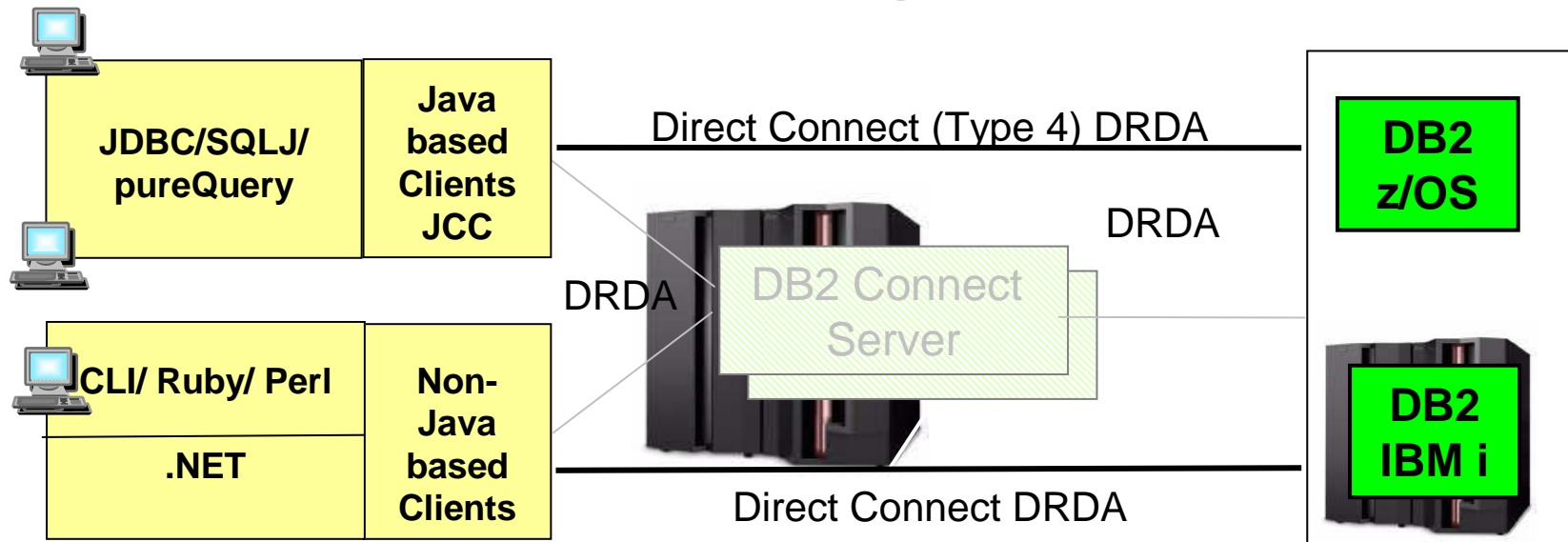


Integration with OMPE

- In general, full exploitation of new features requires driver, CMX and OPM server upgrades
 - Minimum level for non-Java is V9.7 FP3
- Usability focus items
 - Determine location of OPM server from app database
 - Simplifies setup, no controller involved
 - Auto-load DTRC shared library from fixed location
 - Would eliminate any client side setup



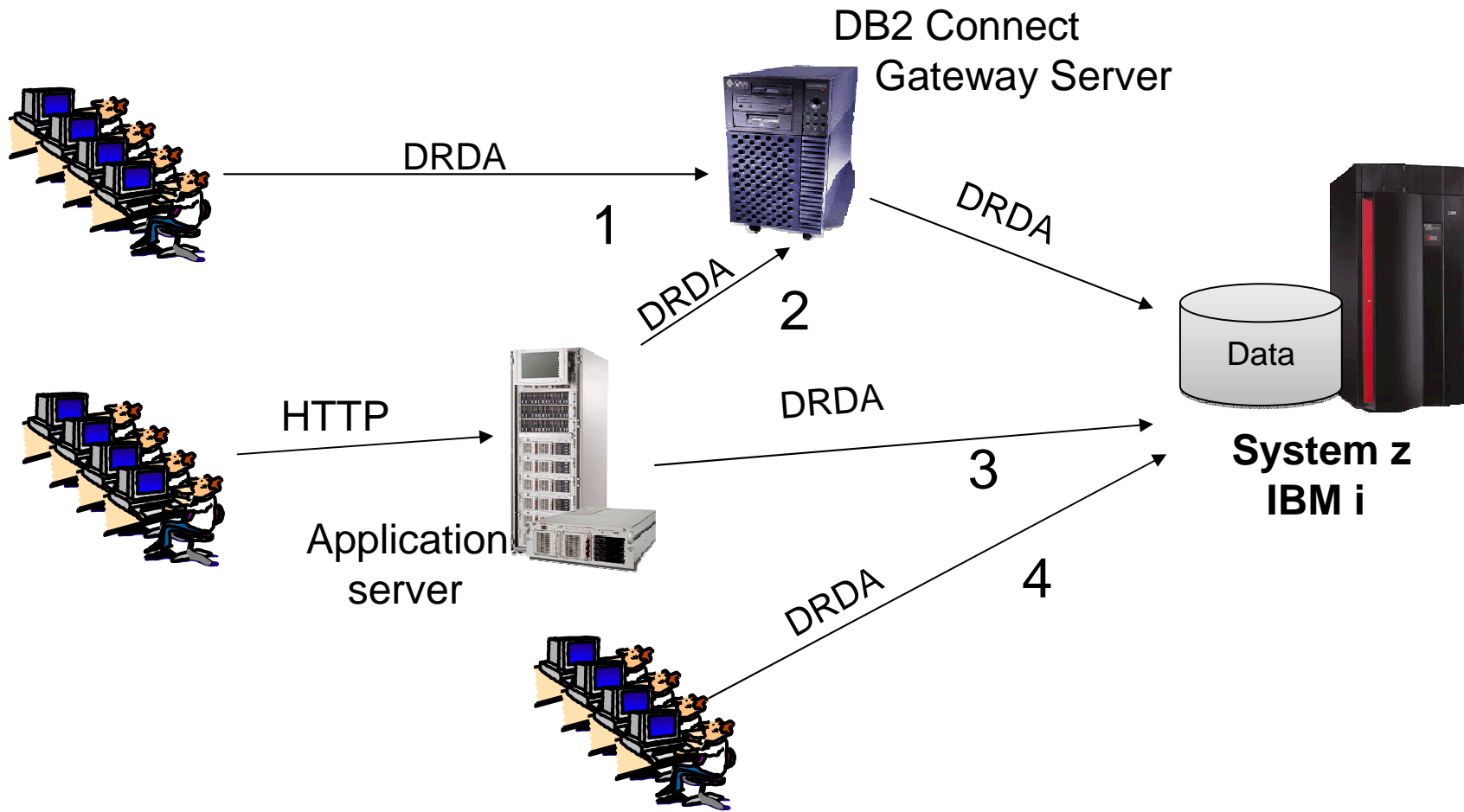
DB2 Connect Client Configuration – Recap



- Clients using DRDA directly allows DB2 Connect Server to be removed
- Clients - especially application server - access DB2 for z/OS directly
- Sysplex Workload Balancing was supported by JCC type 4 since V8 and by non-Java since 9.5 FP3



DB2 Connect Configurations





What is the current best practice?

- Lightweight client packages utilized throughout the enterprise
 - IBM Data Server Driver Package (ds driver - recommended)
 - Staying current with driver levels much easier to attain
- Direct connection to DB2 for z/OS or IBM i server
 - No DB2 Connect Server to maintain
- Server based DB2 Connect license key
 - One time install to server, no need for license key on client workstations
 - DB2 Connect Unlimited Edition for z/OS



DB2 Connect Configurations

- DB2 Connect licensing is required in all configurations
- DB2 Connect Server does not change licensing, it is only a possible component of all editions except DB2 Connect Personal Edition



Licensing Pitfalls – Unlimited/Advanced Editions

- Scenario - Missing Host Licenses (for System z only)
 - a) Customer has MSU Licenses, but no host server license
 - Both are required
 - b) Customer has MSU Licenses, but fewer host server licenses (one host license is needed per “production” DB2 Subsystem or DB2 Data Sharing Group)
 - V9.1 and earlier needed one host server license per Sysplex, but V9.5 and later require one host server license per “production” DB2 Subsystem or DB2 Data Sharing Group
- Scenario - Missing MSU licenses
 - a) Customer never purchased MSU licenses, only host server licenses
 - b) Customer has upgraded to a higher capacity z system (e.g. z10), but may not have purchased additional DB2 Connect MSUs
 - c) Customer has upgraded to a higher capacity System i, but may not have purchased additional DB2 Connect PVUs (for System i)



Licensing Pitfalls

- Scenario - Using DB2 LUW Enterprise Edition V9.x to connect to DB2/z or DB2/i without purchasing DB2 Connect
 - a) Customers erroneously assume DB2 LUW ESE includes license to connect to DB2/z and DB2/i
 - DB2 LUW V8.x used to include 5 licenses of DB2 Connect, but this was removed in V9. Customers who migrated from V8 to V9 and remained current on S&S are entitled to a 25 Authorized User pack of DB2 Connect Enterprise Edition.
 - There is no technical enforcement of this in V9.x
- Scenario - Wrong Edition or Charge Metric
 - a) Authorized User (AU) instead of Concurrent User (CU)
 - Authorized users must be unique countable users (direct or indirect)
 - Use of Concurrent User in direct connect scenarios
 - b) Personal Edition instead of Enterprise Edition
 - Personal Edition can only be used by a single user on a single workstation



Why Would I use DB2 Connect Server

- Two Phase Commit
 - Many transaction managers still require a DB2 Connect Server for two phase commit if they use a dual transport model
 - For example, Tuxedo, Encina
 - DB2 and MS DTC are two transaction managers that do not require a DB2 Connect Server
- Federation
 - Homogeneous Federation is possible with DB2 Connect Server
 - Use of nicknames to other DB2 and Informix data servers
- Licensing
 - DB2 Connect Enterprise Edition with concurrent user licensing requires DB2 Connect Server configurations only



Environment surrounding client package decision

- Latest code levels required for new server feature exploitation
 - For example, DB2 9.7 FP3a drivers required for new z/OS V10 datatypes
- Latest code levels required for API specific features
 - For example, .NET 4.0 or Visual Studio 2010 require DB2 9.7 FP4
- Larger client packages require more effort to upgrade
 - Many customers still at V8.2 DB2 Client
 - Approx 130 SQL packages to rebind in Client
 - A rebind required with each FP upgrade



Client Packages

- Familiar names
 - DB2 Application Development Client
 - IBM Data Server Client
 - DB2 Client
 - IBM Data Server Client
 - DB2 Runtime Client
 - IBM Data Server Runtime Client
 - Thin client
 - IBM Data Server Driver Package
 - ds driver
 - IBM Data Server Driver Package



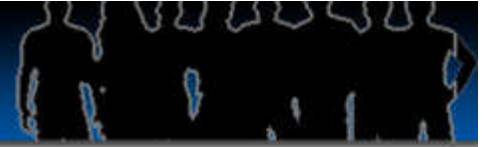
Client Packages

- What has changed - Customer Feedback
 - Clients are too big
 - From both a size and complexity point of view
 - Unnecessary configuration and migration steps
 - Focus now on “collections” of drivers vs clients
 - DB2 client instance
 - Requires migration version to version – binary file
 - Difficult to deploy to multiple similar workstations
 - Client SQL Packages
 - Requires rebind, thus potentially a server outage
 - Added support for Informix
 - Rename from DB2 -> IBM Data Server



Client Packages

- SQL Packages
 - Dynamic SQL packages standardized between CLI, .NET and JCC in V8
 - Only changed once since then (driven by z/OS type 2 unique change)
 - Changes documented:
 - <http://www.ibm.com/developerworks/wikis/display/DB2/DB2+and+.NET+FAQs#DB2and.NETFAQs-ChangesinCLI%2F.NETandJDBCpackages>
 - Need for rebinds removed!



Client Packages

- IBM Data Server Driver for ODBC and CLI (cli driver - V9.5 GA)
 - Not an end customer driver
 - CLI / ODBC only, English only, all platforms
 - No client database instance / directory
 - Not an end customer driver
 - Designed to be embedded by ISVs (e.g. DataStage, SAP) - hidden
 - No install or end user “friendlies”
 - Only included here for awareness, history
- IBM Data Server Driver Package (ds driver – V9.5 FP3)
 - cli driver, enabled for all languages
 - Includes JCC, Open Source, CLPPlus
 - On Windows, includes OLE DB and .NET
 - Introduced db2dsdriver.cfg file for configuration
 - Best practice for enterprise deployment – all servers



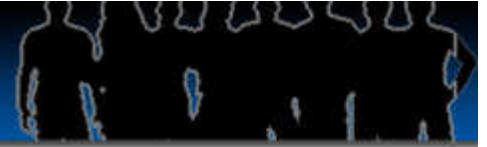
Client Packages

- IBM Data Server Driver for JDBC and SQLJ (JCC – V8)
 - Standalone download of Java support only
 - Packaged with many other deliverables
 - Data Studio, Websphere, etc.
- IBM Database Addins for Visual Studio (VSAI – V9.5)
 - Standalone download of .NET tooling
 - Augments ds driver and Data Server Runtime Client
 - Must match .NET driver level



Client Packages

- IBM Data Server Runtime Client
 - No additional APIs above ds driver (except load)
 - Adds the DB2 CLP, plus database directory (client instance)
 - Includes many DB2 LUW specific utilities
 - Approx 3x the size of ds driver
- IBM Data Server Client
 - Runtime client plus all development and admin tooling
 - Approx 10x the size of ds driver
- DB2 Connect Personal Edition
 - Client plus DB2 Connect PE license
 - Not generally recommended



Deployment Best Practices

- Runtime deployment
 - ds driver highly recommended
 - Lightest runtime focused client package
 - Common client config across multiple levels
 - No migration to move to newer levels
 - No database directory
- Developer deployment
 - Essentially runtime plus tooling
 - Start with ds driver
 - Add Tooling package
 - Data Studio for Java
 - VSAI for .NET



Client Availability

- Strong focus on downward compatibility
 - Client upgrade independent of server upgrade
- Allows new client levels to be installed to exploit latest API enhancements
 - Traditionally upgrades driven by server side
 - Recently seeing more upgrades driven by API and tooling side



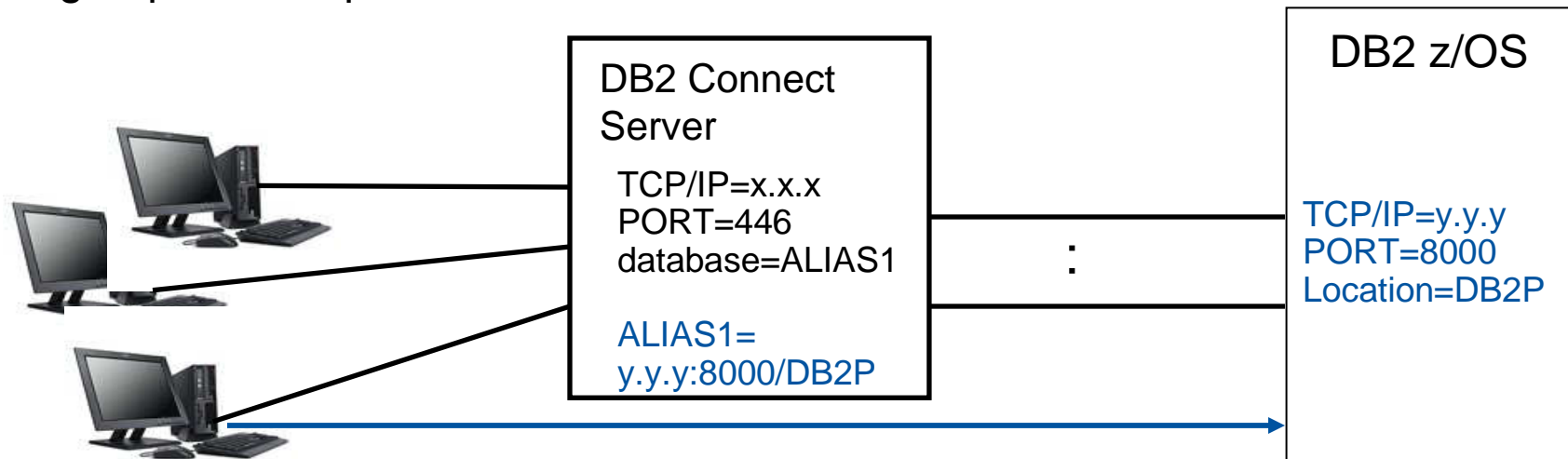
Client Configuration

- Recommend ds driver, but no database directory?
 - Replaced with db2dsdriver.cfg file
 - User editable file (XML based)
 - Can be stored centrally
 - No migration necessary
 - Unknown settings simply ignored
 - Validate tool available at each driver level
 - Supported by all non-Java APIs
 - CLI / ODBC
 - OLE DB
 - .NET
 - Perl, PHP, Ruby, Python
 - Embedded
 - CLPPlus



Client Configuration

- Client connectivity information needs to change from pointing to the DB2 Connect Server to pointing to DB2 for z/OS
- If DB2 for z/OS is a Data Sharing group, DVIPA plus location should be used
- If certain applications should only access some members in the data sharing group, DVIPA plus location alias needs to be used



OLD:x.x.x:446/ALIAS1
NEW:y.y.y:8000/DB2P



db2dsdriver.cfg File

- Think of it as an evolution of database directory, db2cli.ini file
- Introduced for ds driver in V9.5 FP3
- Added to instance based client packages:
 - V9.7 FP3a for CLI
 - V9.7 FP4 for .NET
- Stored in the “application data”/cfg directory by default
 - Environment variable available to set location
- Unrecognized keywords silently ignored
 - Allows one file across multiple client package versions
 - Syntax errors and invalid values do cause errors



db2dsdriver.cfg File

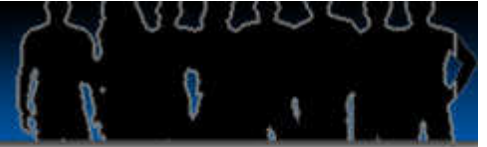
- Contains:
 - Location of a database – name, ip and port
 - Mapping of one or more aliases (dsn) to a database
 - Settings for a dsn, database, or globally
 - For example isolation level, current schema
- Also contains settings for WLB and ACR
 - Applicable for all client packages from V9.5 FP3
 - Can only be set in the database section
- db2cli tool will validate against schema
 - `db2cli validate –database sample:gross.toroab.ibm.com:50000`
 - `db2cli validate –dsn samplea`
 - connect option to do actual connect



db2dsdriver.cfg File

- Simple Example:

```
<configuration>
  <databases>
    <database name="sample" host="gross.torolab.ibm.com" port="50000">
      <parameter name="CurrentSchema" value="OWNER1"/>
      <wlb>
        <parameter name="enableWLB" value="true"/>
        <parameter name="maxTransports" value="50"/>
      </wlb>
      <acr>
        <parameter name="enableACR" value="true"/>
      </acr>
    </database>
  </databases>
</configuration>
```



db2dsdriver.cfg File

- More Complete Example:

```
<configuration>
  <dsncollection>
    <dsn alias="sampleap" name="sample" host="gross.torolab.ibm.com" port="50000">
      <parameter name="executionMode" value="static"/>
      <parameter name="allowDynamicSQL" value="false"/>
      <parameter name="sqlLiteralSubstitution" value="enable"/>
      <parameter name="pureQueryXML" value="testclcop.pdqxml"/>
    </dsn>
    <dsn alias="samplea" name="sample" host="gross.torolab.ibm.com" port="50000">
    </dsn>
  </dsncollection>
  <databases>
    <database name="sample" host="gross.torolab.ibm.com" port="50000">
      <parameter name="CurrentSchema" value="OWNER1"/>
      <wlb>
        <parameter name="enableWLB" value="true"/>
        <parameter name="maxTransports" value="50"/>
      </wlb>
      <acr>
        <parameter name="enableACR" value="true"/>
      </acr>
    </database>
  </databases>
  <parameters>
    <parameter name="GlobalParam" value="Value"/>
  </parameters>
</configuration>
```




db2dsdriver.cfg File

- db2cli validate –dsn samplea

db2dsdriver.cfg Validation :

```
-----  
[ DB2DSDRIVER_CFG_PATH env var : unset ]  
[ db2dsdriver.cfg Path :  
  C:\ProgramData\IBM\DB2\DB2COPY1\cfg\db2dsdriver.cfg ]  
-----  
[ Valid keywords used for DSN : samplea ]  
Keyword                               Value  
-----  
DATABASE                               sample  
HOSTNAME                                gross.torolab.ibm.com  
PORT                                     50000  
COMMPROTOCOL                            TCPIP  
  
[ Keywords UNKNOWN for DSN : samplea ]  
Keyword                               Value  
-----  
GlobalParam                             Value  
-----
```



db2dsdriver.cfg - Notes

- Entire file is optional – connection information can be specified on connection string
- Database location information
 - Database node entry mandatory
 - Anchor point for WLB and ACR settings
 - WLB can only be enabled at the database node
 - All connections mapping to that database will share the same transport pool
- Default failure behavior
 - Try all members in the member list
 - Try the configured group IP (DVIPA)
 - Try alternate group if configured
 - Fail the connection



Configuration Best Practices

- Continuous customer, driver, server interaction to improve availability with Sysplex and pureScale
- Transports allocated based on app connection
 - Default max of 1000 transports per member
- ConnectionTimeout overrides all other timeouts
 - Connect will fail when expired
- CommandTimeout overrides all other timeouts
 - Triggers interrupt when expired
- Above behavior will be reflected in next V9.7 FP of DB2 Connect



Configuration Best Practices

- `maxTransportIdleTime` - 60 seconds
 - Time an unused transport hangs around before being closed
- `maxTransportRefreshInterval` – 10 seconds
 - Time between updates of WLM weights with server
- `maxTransportWaitTime` – 1 second
 - Max time an app will wait for a transport to free up before getting pool full behavior
- `memberConnectTimeout` - 1 second
 - Timeout to be used when communicating with a member in the server list
- `tcpipKeepAlive` – 15 seconds
 - Timeout for all other communication requests



License Keys Best Practice

- In a DB2 Connect Server configuration, DB2 Connect entitlement is stored in the DB2 Connect Server and not individual clients
- With direct client connectivity, DB2 Connect entitlement needs to be stored at each client
 - Need to establish plans to rollout DB2 Connect entitlement together with client rollout
- Access entitlement check at the DB2 for z/OS server supported in DB2 Connect 9.7 FP3
 - DB2 Connect Unlimited Edition for z/OS only
 - Applicable to all APIs



Useful Links

- db2cli validate page
 - <http://publib.boulder.ibm.com/infocenter/db2luw/v9r7/index.jsp?topic=/com.ibm.swg.im.dbclient.install.doc/doc/r0058814.html>
- DB2 Connect Unlimited Edition server based license key
 - <http://publib.boulder.ibm.com/infocenter/db2luw/v9r7/topic/com.ibm.db2.luw.licensing.doc/doc/t0057375.html>



Function Rollout Overview

- New function rollout limited to Fixpack stream of current release only
 - V9.5 FP3 was last set of enhancements for V9.5
 - Current enhancements are in V9.7 stream
 - Expected last V9.7 enhancements will be V9.7 FP after FP5
- All active releases fully supported
 - APARs backfit based on customer request and severity
- Unless stated, function applies to
 - DB2 for z/OS V8 and later
 - DB2 for IBM i V5R4 and later



Leading up to V9.1

- Cross API
 - Single client instance install
 - DB2 Runtime Client (> 100 MB)
 - DB2 Client (almost 500 MB)
 - DB2 Connect Personal Edition
- ODBC / CLI
 - Terms used interchangeably
- .NET
 - Framework (FW) 1.0, 1.1
 - Visual Studio (VS) VS.NET 2002, VS.NET 2003
 - 32-bit only



V9.1

- Cross API
 - Multiple copy support (concept of default copy)
 - XML datatype (DB2 for z/OS V9 only)
- .NET
 - FW 2.0, VS 2005
 - Dropped FW 1.0
 - DB2ResultSet (scrollable, server locking semantics)



V9.1 FP2

- .NET
 - 64-bit Provider
 - End to End SQL Procedure debugging for z/OS V9 servers
 - Single step from application into SQL stored procedure
 - Merged call stacks



V9.5

- ODBC / CLI
 - cli driver package available
 - Approx 15 MB, designed for ISVs to embed
- .NET
 - VS 2008 supported
 - FW 3.0, 3.5 supported



V9.5 FP1

- Cross API
 - 18 character location names (connection string)
 - Previously only 8 characters supported



V9.5 FP2

- Cross API
 - SSL
- ODBC / CLI
 - Interleaved SQLPutData for dealing with stream data
- .NET
 - Enterprise Library (via CodePlex)
 - Entity Framework public beta
 - VS 2008 WPF and WWF integration
 - End to end SQL procedure debugging for z/OS V8 servers



V9.5 FP3

- Cross API
 - IBM Data Server Driver Package (ds driver)
 - db2dsdriver.cfg configuration file introduced
- ODBC / CLI
 - SQLCreatePackage API (similar to bind command)
- .NET
 - pureQuery static profiling (DB2 Connect Advanced Edition)
 - Entity Framework at FW 3.5 SP1 level
 - Schema node in VS Server Explorer



V9.5 FP3

- Cross API
 - z/OS Sysplex exploitation
 - Client reroute and workload balancing
 - Functions previously only available with DB2 Connect Server
 - Seamless failover
 - Failures in first SQL can be seamlessly rerouted to alternate server without application awareness
 - Configurable in all client packages with dsdriver.cfg file
 - Primary scenario is application servers
 - Performance benefit by removing gateway



V9.7

- ODBC / CLI
 - Interleaved fetch and rollback during streaming
- .NET
 - Remove any accidental db2cli.ini support
 - Dropped FW 1.1
 - Program Name and Program ID client information properties
 - VS tooling for pureQuery static profiling



V9.7 FP1

- Cross API
 - Environment variable for config file location
 - Ability to reload config file for ACR section
 - Failback to primary support for client affinity
- ODBC / CLI
 - pureQuery static profiling
 - Interleaved insert with streaming
- .NET
 - Full alter support for procedures in VS
 - VS 2008 LINQ over XML reference (z/OS only)



V9.7 FP2

- ODBC / CLI
 - Command line to register ODBC data source
- .NET
 - 32-bit and 64-bit coexistence
 - Entity Framework Filtering
 - Override for with hold cursors



V9.7 FP3a

- Cross API
 - Unlimited Edition server based license key (z/OS only)
 - DB2 for z/OS V10 exploitation
 - Binary XML
 - Timestamp precision plus timezone
 - Currently committed semantics
 - Extended indicators
 - Explain modes



V9.7 FP3a (continued)

- Cross API
 - Performance Manager Extended Insight integration
- ODBC / CLI
 - Network statistics API
 - Retrieve last member used on connection
 - Instance based client support with dsdriver.cfg
- .NET
 - Entity Framework canonical functions
 - .NET 4.0, VS 2010, Entity Framework 4.0 beta



V9.7 FP4

- Cross API
 - Sysplex migration support for z/OS V10
- ODBC / CLI
 - db2cli32 in 64-bit builds
 - db2cli to report on unrecognized settings
 - CLI load enabled for async operation
- .NET
 - .NET 4.0, VS 2010, Entity Framework 4.0 GA
 - High precision timestamp and decfloat mapping into dataset
 - Instance based client support with dsdriver.cfg



V9.7 FP5

- Cross API
 - Schema filter in connection string
 - Passphrase up to 100 characters
 - Command line tool to add entry to dsdriver.cfg
 - Alternate group failover
 - Password in dsdriver.cfg file
- ODBC / CLI
 - ODBC 3.8
- .NET
 - Block for n rows override capability
 - Ability to disable auto-rebind
 - CommandBuilder CompareRowVersion support
 - Array Input (batching extension)
 - MS Trace Integration



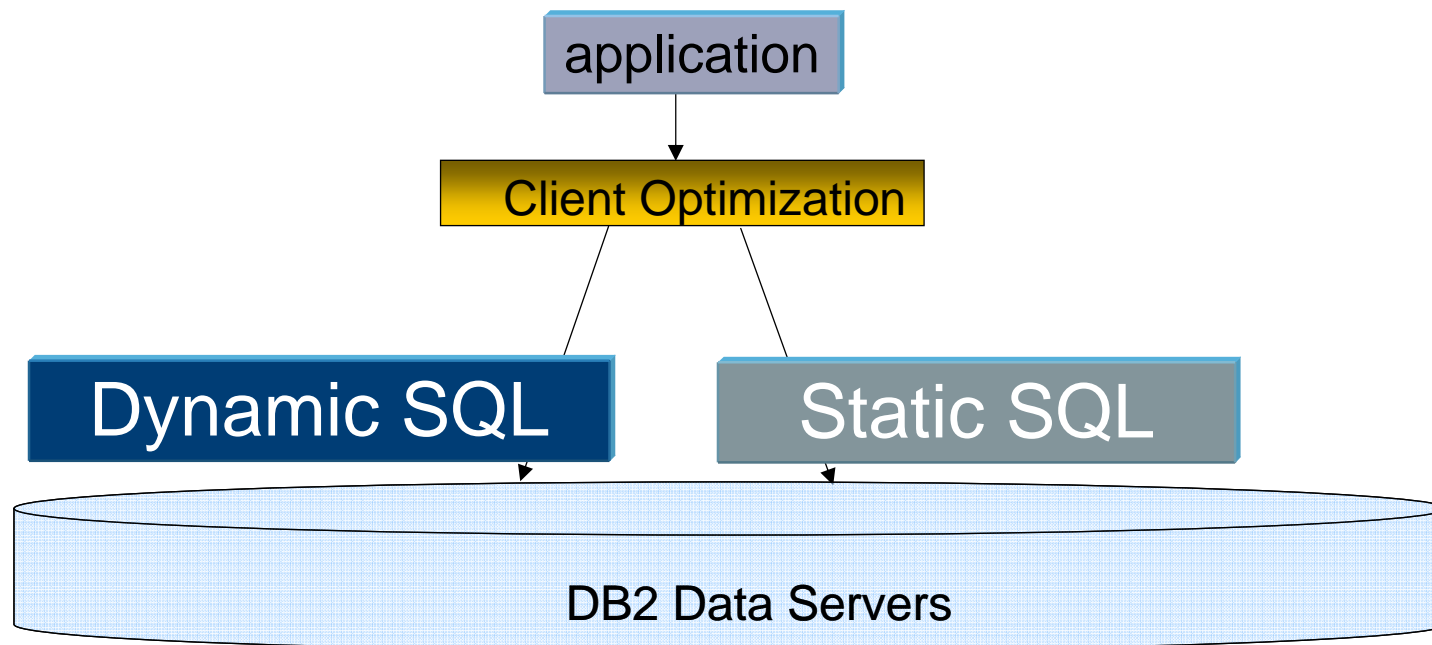
High Priority Requirements

- Cross API
 - z/OS SSL authentication (V10)
 - Seamless improvements for Sysplex, pureScale
 - Client Info default values
- ODBC / CLI
 - Validate improvements
- .NET
 - Additional filtering criteria - dbname



pureQuery Client Optimization

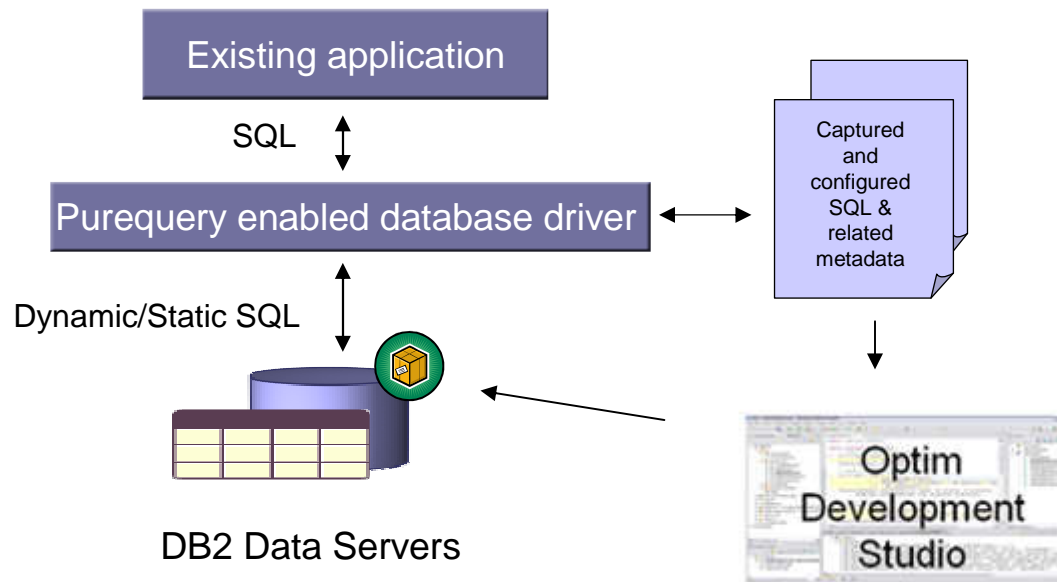
- pureQuery client optimization enables dynamic SQL execution and static execution for existing applications without any code changes



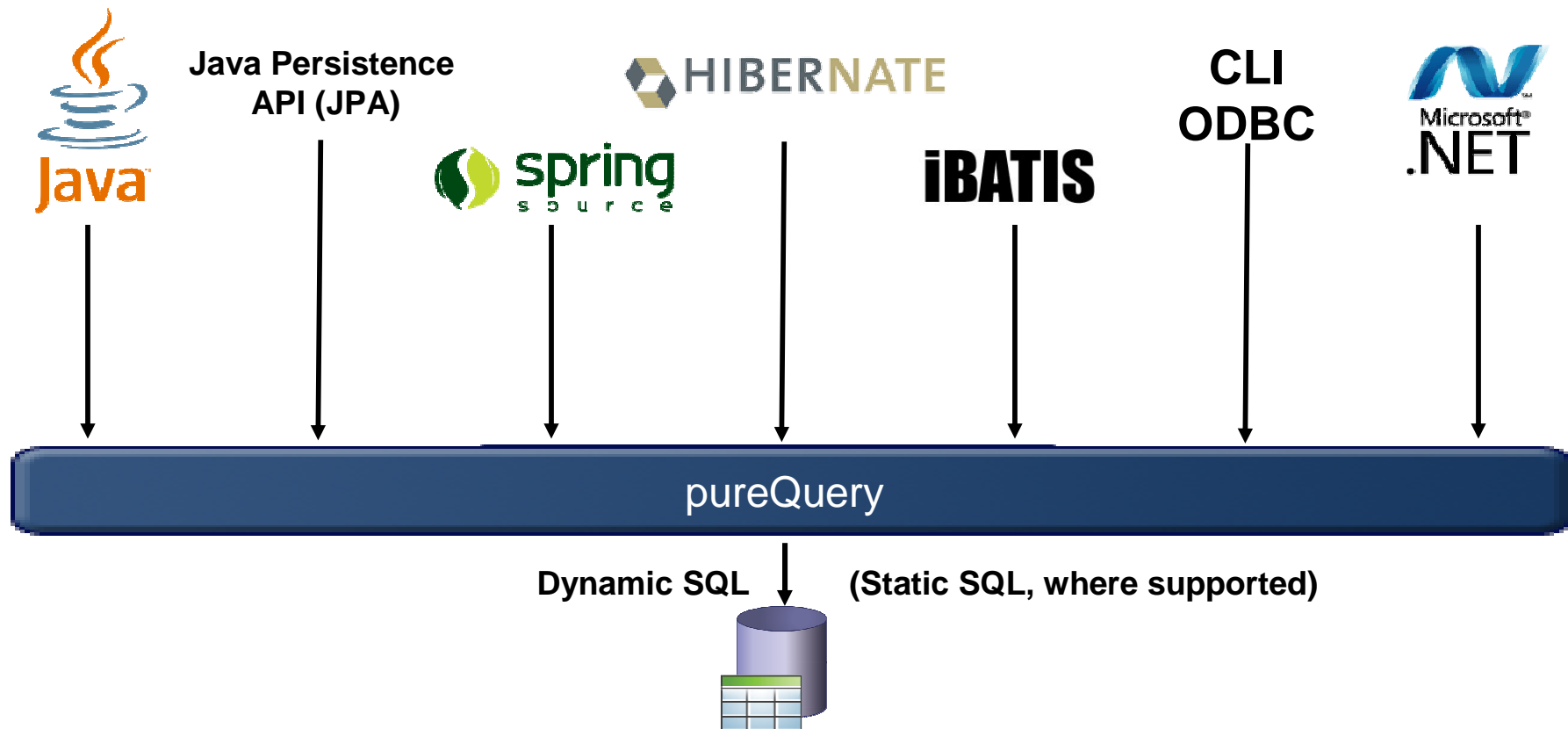


How does pureQuery client optimization work?

Capture/Configure  Bind  Execute

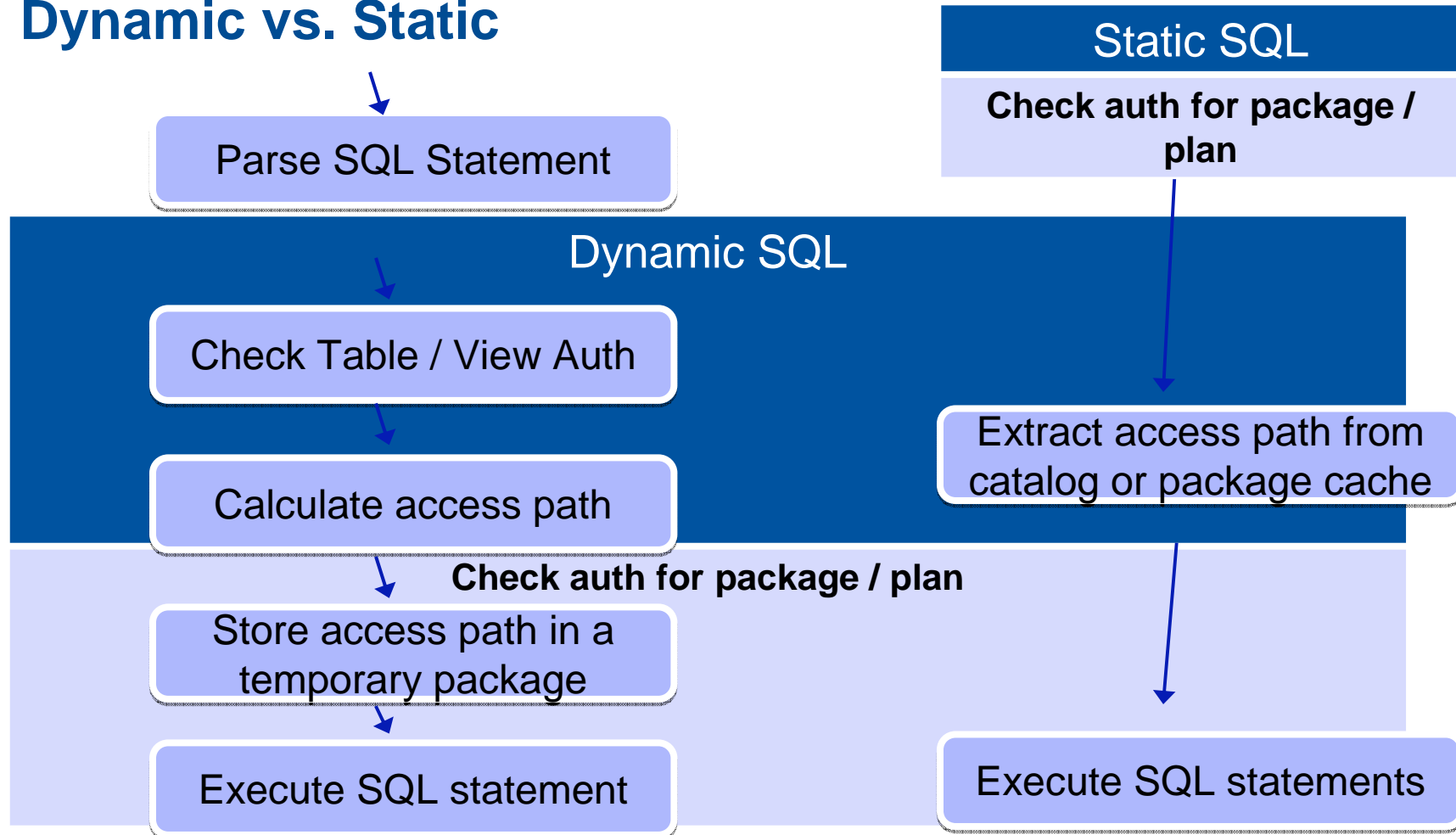


Database Access and pureQuery Many On-ramps for New and Existing Applications



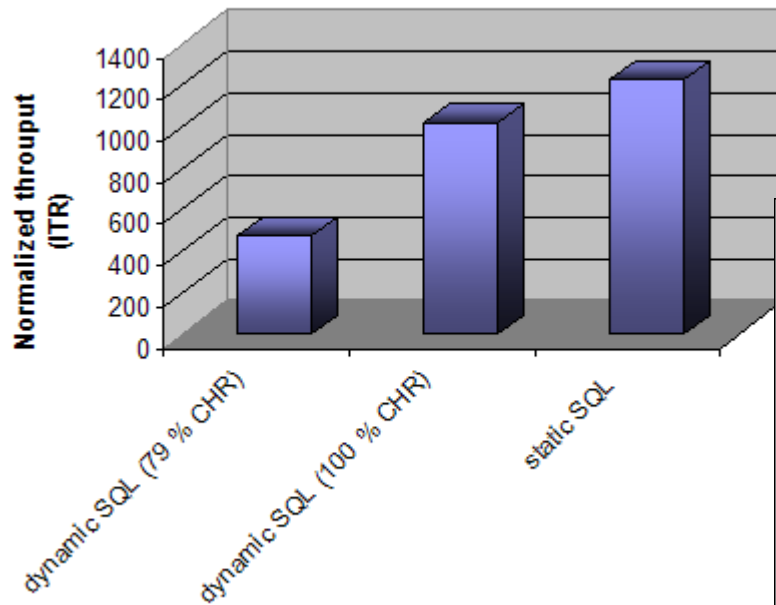


SQL Execution – Dynamic vs. Static



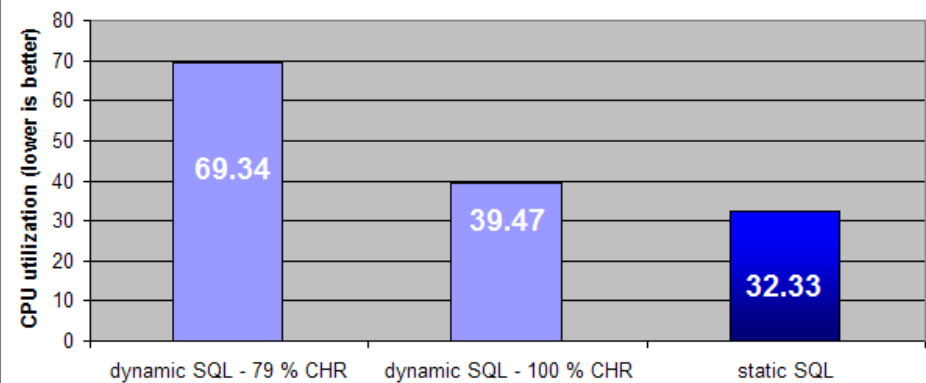


Normalized throughput by SQL execution mode



- **IRWW – OLTP application**
- **Application runs in IIS and accesses DB2 for z/OS**

z/OS CPU utilization by SQL execution mode



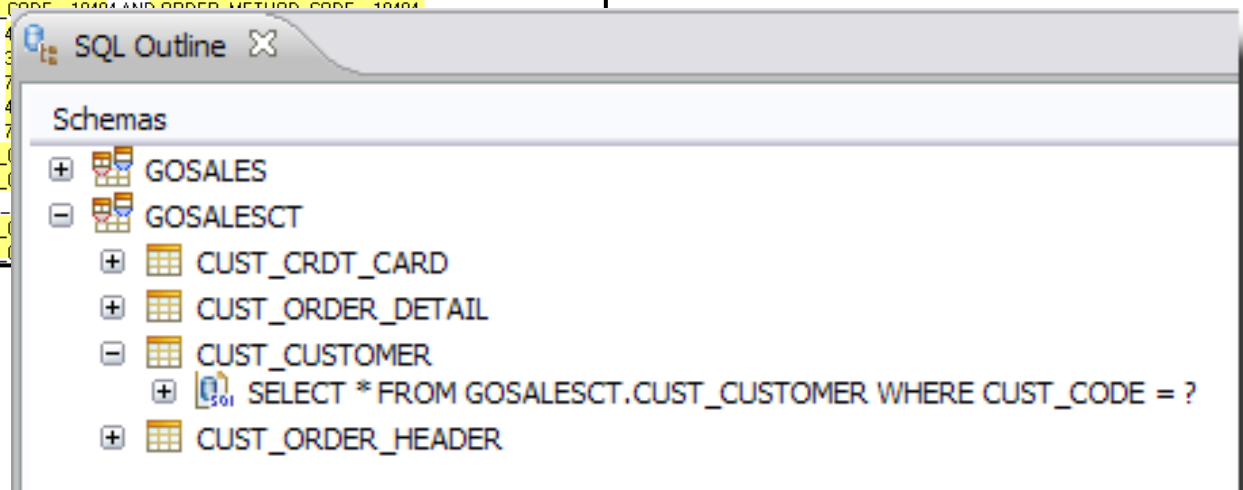
**Any performance data contained in this document were determined in various controlled laboratory environments and are for reference purposes only. Customers should not adapt these performance numbers to their own environments as system performance standards. The results that may be obtained in other operating environments may vary significantly. Users of this document should verify the applicable data for their specific environment.*



Improve Performance Without Changing Code- e.g. literal replacement

- Review SQL coming from applications
- Consolidate SQL by replacing literals with parameter markers at runtime
- Optimize database resources (e.g. dynamic statement cache) usage

```
SELECT COUNT(*) FROM GOSALESCT.CUST_ORDER_HEADER WHERE CUST_CODE = 35213 AND ORDER_METHOD_CODE = 35213
SELECT COUNT(*) FROM GOSALESCT.CUST_ORDER_HEADER WHERE CUST_CODE = 31842
SELECT * FROM GOSALESCT.CUST_ORDER_HEADER WHERE CUST_CODE = 27368 AND CUST_CC_ID = 27368 ORDER BY CUST_ORDER_DATE ASC
SELECT * FROM GOSALESCT.CUST_ORDER_HEADER WHERE CUST_CODE = 20022 AND CUST_ORDER_STATUS_CODE = 2 ORDER BY CUST_ORDER...
SELECT COUNT(*) FROM GOSALESCT.CUST_ORDER_HEADER WHERE CUST_CODE = 48679
SELECT * FROM GOSALESCT.CUST_ORDER_HEADER WHERE CUST_CODE = 22302 AND CUST_ORDER_STATUS_CODE = 2 ORDER BY CUST_ORDER...
SELECT * FROM GOSALESCT.CUST_ORDER_HEADER WHERE CUST_CODE = 11161 AND CUST_ORDER_STATUS_CODE = 2 ORDER BY CUST_ORDER...
SELECT COUNT(*) FROM GOSALESCT.CUST_ORDER_HEADER WHERE CUST_CODE = 10404 AND ORDER_METHOD_CODE = 10404
SELECT * FROM GOSALESCT.CUST_ORDER_HEADER WHERE CUST_CODE = 4
SELECT * FROM GOSALESCT.CUST_ORDER_HEADER WHERE CUST_CODE = 3
SELECT * FROM GOSALESCT.CUST_ORDER_HEADER WHERE CUST_CODE = 7
SELECT * FROM GOSALESCT.CUST_ORDER_HEADER WHERE CUST_CODE = 4
SELECT * FROM GOSALESCT.CUST_ORDER_HEADER WHERE CUST_CODE = 7
SELECT COUNT(*) FROM GOSALESCT.CUST_ORDER_HEADER WHERE CUST_CODE = 4
SELECT COUNT(*) FROM GOSALESCT.CUST_ORDER_HEADER WHERE CUST_CODE = 7
SELECT COH.CUST_ORDER_NUMBER, COH.CUST_ORDER_DATE, COH.CUST_CODE, COH.CUST_ORDER_STATUS_CODE, COH.CUST_ORDER_METHOD_CODE
SELECT COUNT(*) FROM GOSALESCT.CUST_ORDER_HEADER WHERE CUST_CODE = 7
SELECT COUNT(*) FROM GOSALESCT.CUST_ORDER_HEADER WHERE CUST_CODE = 7
```





Performance Hints – Reduce .NET Memory Usage

- None of these are bugs, but they will help prevent out of resource errors on the server
- Managed environment – why do I care about memory
 - Try and make the system work less to cleanup after you
- Select only what you need
 - Applies to rows as well as columns
 - `DB2DataReader.Read` assumes all columns will be Get'd
 - BIG cost in ASP.NET
- Free early to avoid generation 2 allocations
 - The longer an object lives, the harder it is to delete it
 - The more long term objects the system has, the hard it has to work to free memory



Performance Hints – Reduce .NET Memory Usage

- Connections – open late, close early
 - Maximize the use of connection pooling
- Access columns in order selected
 - This will reduce internal buffering and make the most of streaming
- Other objects – close / dispose, set reference to null
 - `DB2DataReader.Close`, `DB2Command.Dispose`
 - Allows the server to free locks and clean up locators earlier
 - It will eventually get done in the Finalizer, which is run even less often than the garbage collector



Productivity Tips

- Named parameters (.NET)
 - Readability
 - Select * from EMPLOYEE where FNAME = @firstname and LNAME = @lastname
 - Parameters.Add("lastname", ...);
 - Parameters.Add("firstname", ...);
 - Allows binding parameters in any order
- Use Parameter markers vs. building statement from strings
 - Higher hit rate on server side shared statement cache
 - Avoids SQL injection attacks when parameter values come from user input



Summary

- ODBC and .NET Applications
 - DB2 .NET Provider
- DB2 Connect Configurations
 - Direct Connect
- Client Packages and Deployment
 - Ds driver
- Client Configuration
 - db2dsdriver.cfg file
- Function Rollout
- pureQuery Client Optimization
- Performance Hints and Tips



Online references

- Developer Works Visual Studio Zone
 - <http://www.ibm.com/developerworks/db2/zones/vstudio/>
- DB2 .NET FAQ
 - <http://www.ibm.com/developerworks/wikis/display/DB2/DB2+and+.NET+FAQ>
- IBM .NET Forum
 - http://www.ibm.com/developerworks/forums/dw_forum.jsp?forum=467&cat=19



More samples and tutorials

- VS Addins Tutorials
 - VS Addins with IDS
 - http://www.ibm.com/developerworks/db2/library/techarticle/dm-0703jayakumar/?S_TACT=105AGX11&S_CMP=LP
 - Good overview of .NET with VS Addins
 - http://www.ibm.com/developerworks/db2/library/techarticle/dm-0710jayakumar/?S_TACT=105AGX11&S_CMP=LP
 - http://www.ibm.com/developerworks/db2/library/techarticle/dm-0711kumar/?S_TACT=105AGX11&S_CMP=LP



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Session E01

*Application Development Best
Practices for .NET and ODBC for DB2
and DB2 Connect*

