Connecting applications, including mobile and cloud, with data on z Systems

Session 17211

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Agenda

- The lay of the land – new applications, new interfaces to systems of record
- z/OS Connect
- DB2 Connect (and the IBM Data Server Driver)

The lay of the land – new applications, new interfaces to systems of record
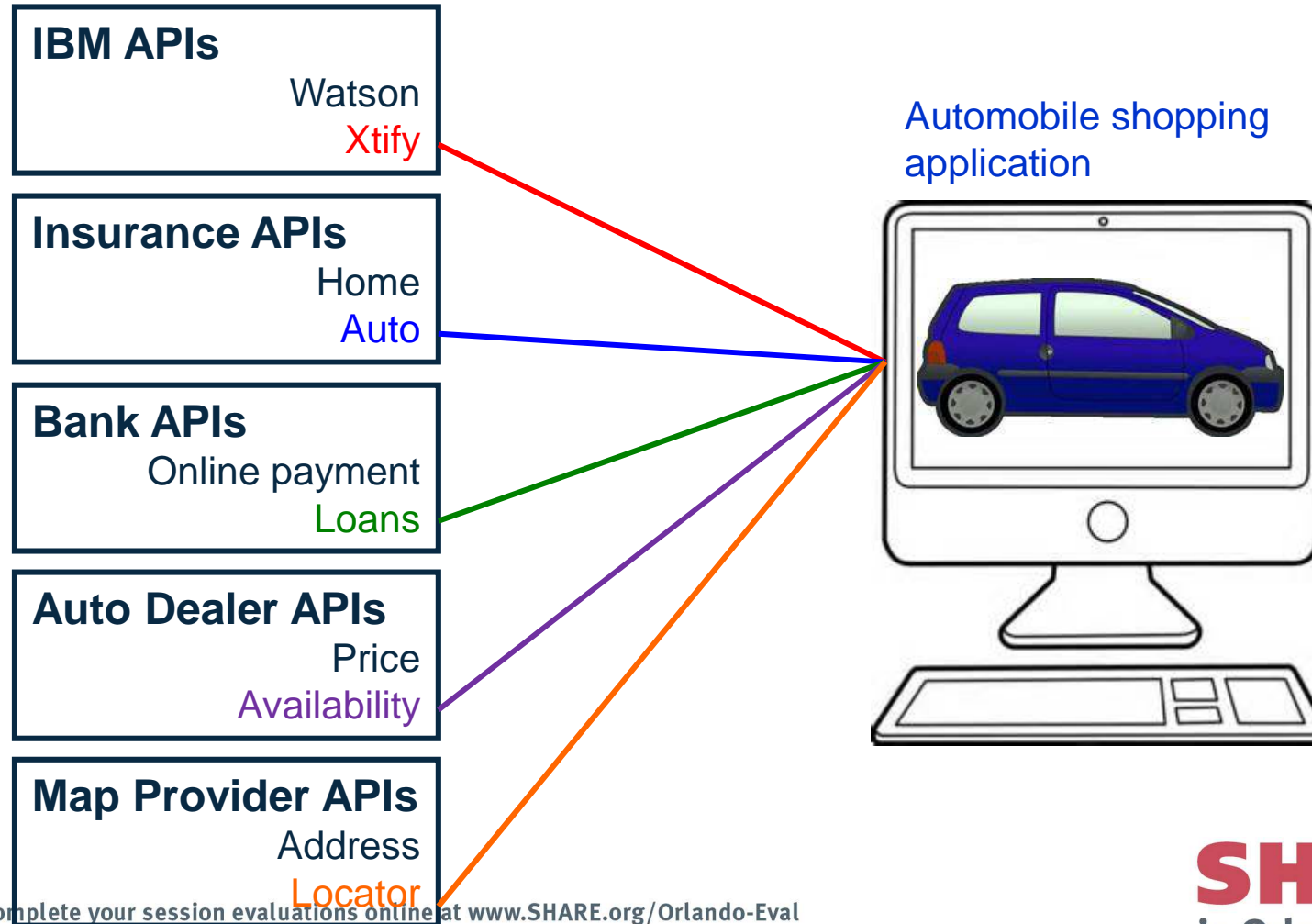
APIs are the new building blocks for applications

(application programming interfaces)

- The "API economy" has changed the way developers think about building applications, and the way in which organizations deploy applications
- Consider a bank, and the services it might externalize

Bank APIs
- Mortgage
- Online payment
- Loans
- Account query
- Calculators

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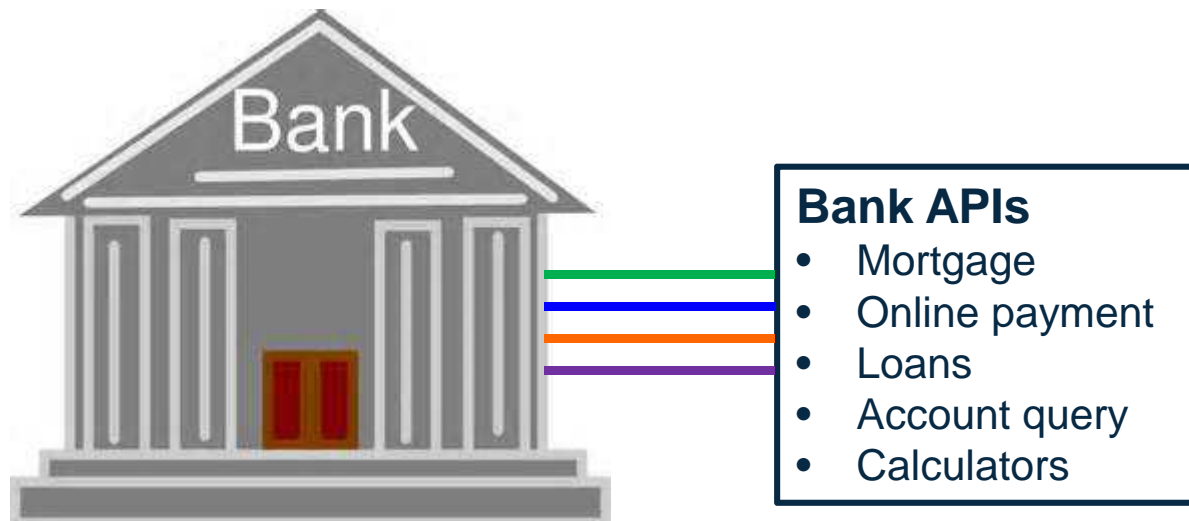
A team of developers could use several APIs to build a new app

IBM APIs
Watson
Xtify

Insurance APIs
Home
Auto

Bank APIs
Online payment
Loans

Auto Dealer APIs
Price
Availability

Map Provider APIs
Address
Locator

Automobile shopping application

This new way of building apps benefits developers, API providers

- Developer benefits
  - Accelerate time to market
  - Drive innovation
  - Focus on core competence
  - Create new business opportunities
  - Reach new customers through API providers' ecosystems
- API provider benefits
  - Expand into new customer bases that you might not otherwise reach on your own
  - Focus on your core value
  - Expand your brand and brand loyalty
  - Realize profit from new business models
  - Reduce development costs and time

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What does all this mean for z Systems?

- Cloud and mobile providers need a uniform way to interact with z-based middleware for discovery, provisioning, data transformation, and service invocation
- Organizations have called for a common way to interact with z/OS business and infrastructure assets via interfaces and protocols commonly used in cloud-based and mobile applications – namely, REST and JSON
  - REST (Representational State Transfer) – a protocol built on HTTP, using HTTP verbs (e.g., GET, PUT, POST, DELETE), and URIs (uniform resource identifiers) to indicate requested services
  - JSON (JavaScript Object Notation) – a standard representation of data in the form of name/value pairs (passed back and forth along with REST requests and responses)

z/OS Connect

Think of mobile as a new channel into the enterprise

"Legacy" Web

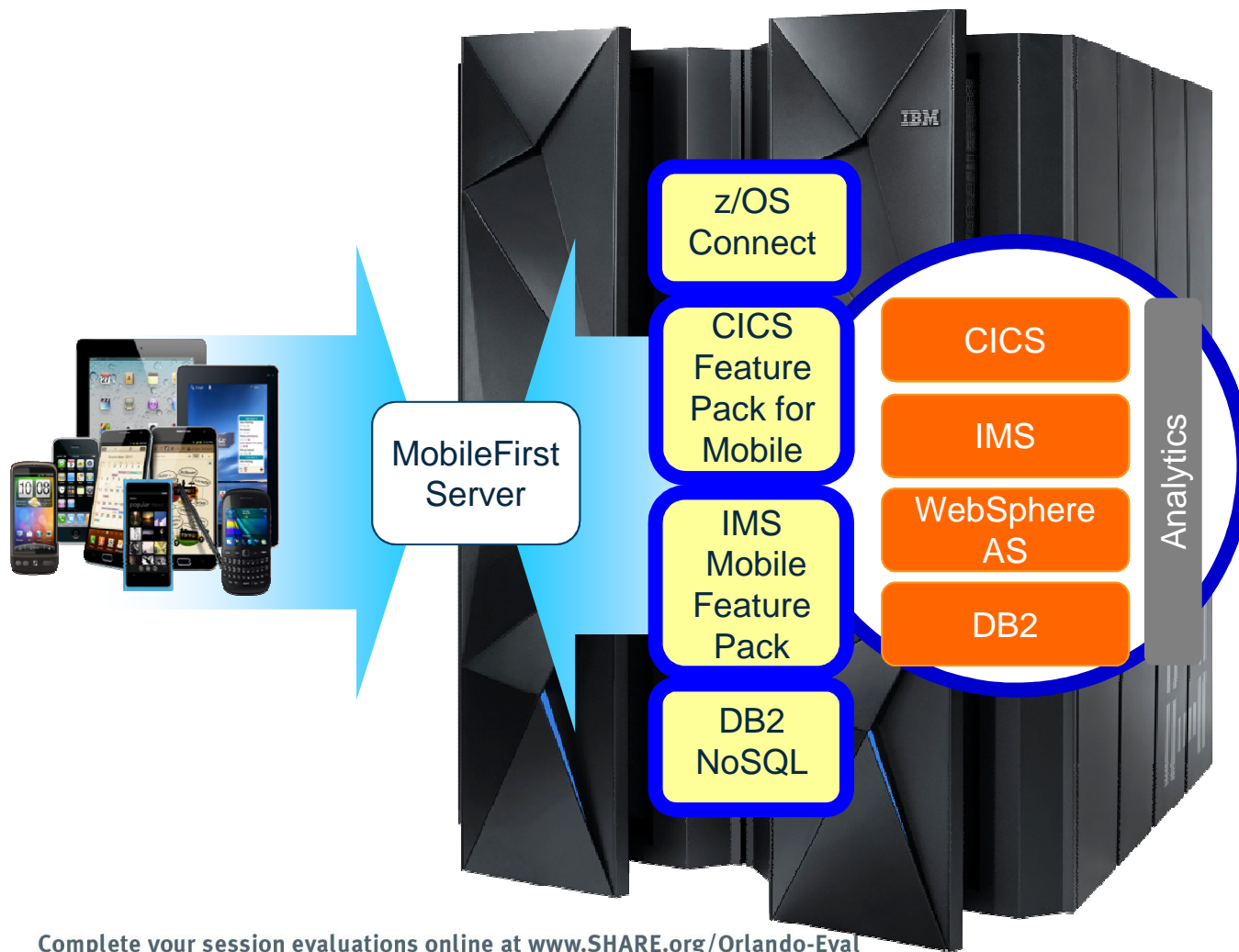The infrastructure you've built here over the past 10-15 years can be reused here

"New" mobile

WebSphere Application Server

MobileFirst Server

CICS

IMS

DB2

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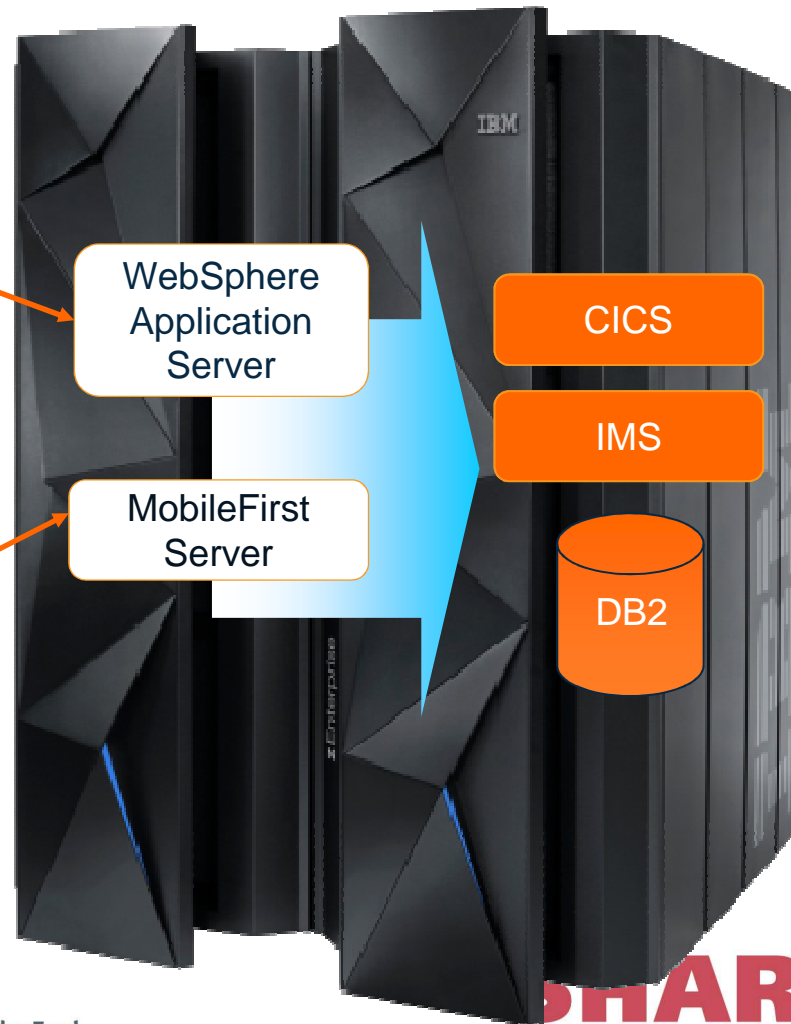
Re-purposing existing data and transactions for mobile apps

z/OS
Connect

CICS
Feature
Pack for
Mobile

IMS
Mobile
Feature
Pack

DB2
NoSQL

MobileFirst
Server

CICS

IMS

WebSphere
AS

DB2

Analytics

- Subsystems (CICS, IMS, DB2) mobile-friendly with new APIs

- z/OS transactions more mobile-friendly with z/OS Connect

- Seamlessly channel back-end enterprise systems to mobile devices with MobileFirst Server

- Enable end-to-end security from mobile device to mainframe with z/OS, RACF and other IBM software products

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IBM MobileFirst Foundation – extending your business to mobile
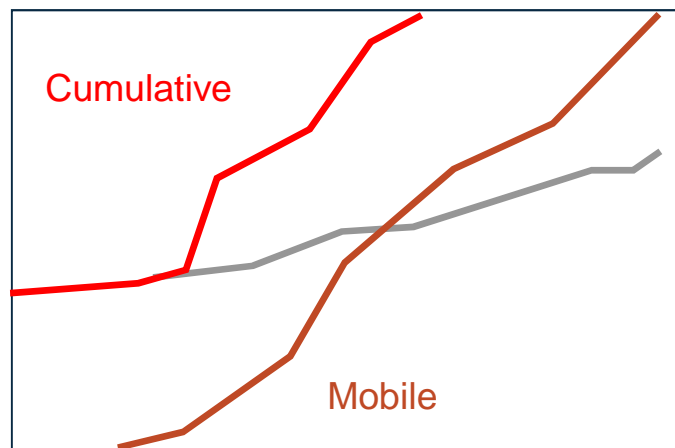
- **MobileFirst Server** – mobile-optimized middleware that serves as a gateway between applications, back-end systems and cloud-based services
- **MobileFirst Studio** – one of the leading tools for native and hybrid development that helps optimize code reuse and accelerate development
- **MobileFirst Device Runtime Components** – runtime client APIs designed to enhance security, governance and usability
- **MobileFirst Application Center** – enables setting up an enterprise app store that manages the distribution of production-ready mobile apps
- **MobileFirst Console** – an administrative GUI designed to provide near-real-time operational analytics for the server, adapters, applications and push services to help manage, monitor and instrument mobile apps

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Mobile Workload Pricing for z/OS

Cumulative

Mobile

Large bank increased
mobile transaction volumes
by 40% in two years

Current z/OS
peak utilization

Adjusted z/OS
peak utilization

Mobile
workloads
CPU

Mobile

Eligible for
reduction

Other z/OS
workloads
CPU

Other
workloads
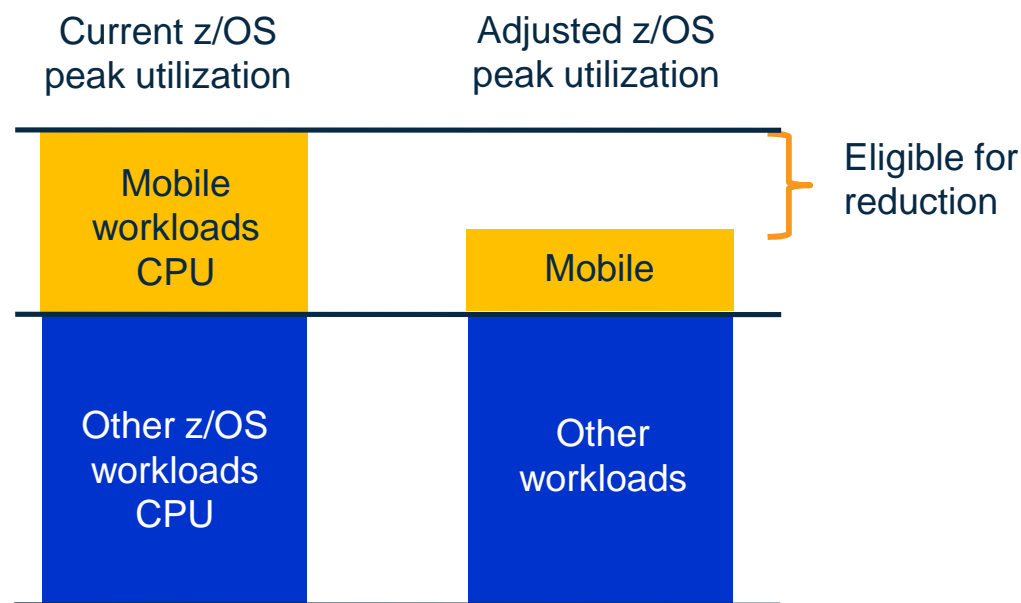
- Reduce z/OS peak MSUs attributable to mobile workloads – up to 60%
- No Infrastructure changes required (such as separate LPARs)
- Requires tagging and tracking z/OS CPU seconds from mobile workloads.

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IBM WebSphere Liberty z/OS Connect

Secure and consistent enterprise connectivity for mobile

Ships with WebSphere Application Server for z/OS, CICS, and IMS
- **Built for z/OS** – Builds on z/OS qualities of service – security, auditing, chargeback
- **Unifies connectors** – A common solution for mobile, cloud, and Web
- **Simplified integration** – Hide complexity of connecting to z/OS using REST calls
- **API management** – Mobile developers can discover the transactions you choose

On-premise applications

Mobile apps

Cloud APIs

NEW

z/OS Connect

Liberty profile

Batch

IMS   DB2

Transactions

Enterprise applications

Enterprise data

Enterprise transaction processing

Systems of Engagement

Systems of Record

z/OS Connect: a new solution for z/OS connectivity

The aim: get REST and JSON into your z Systems environment in a way that enables you to take best advantage of the assets that exist there
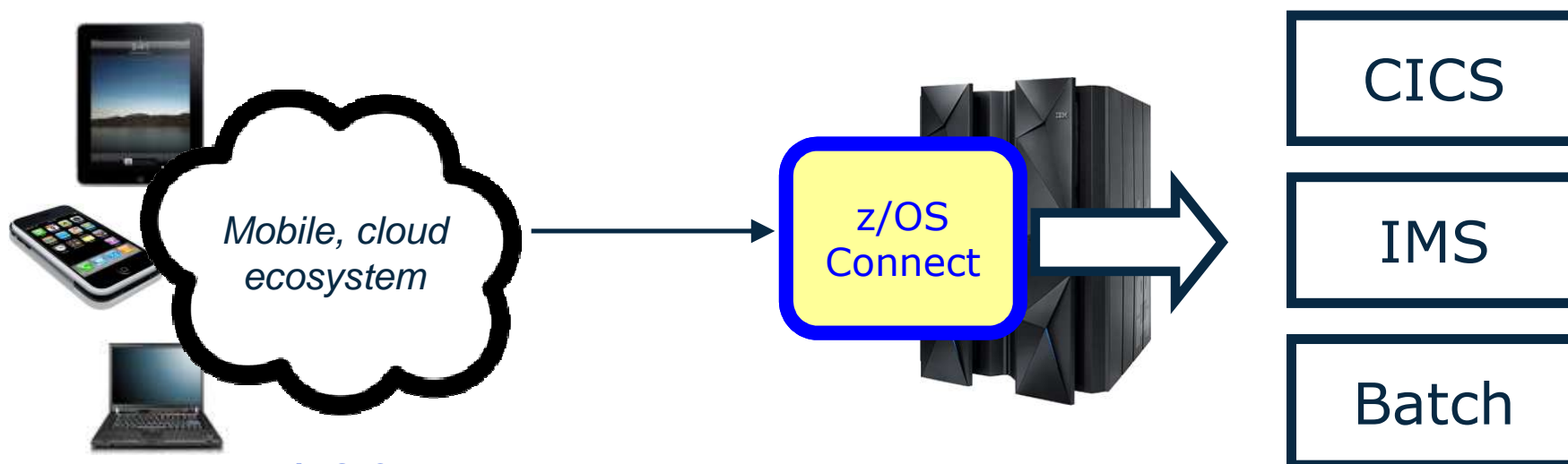
z/OS Connect

• Runs in the WebSphere Liberty Profile for z/OS (a lightweight WebSphere Application Server – IBM's Bluemix uses it)

• No-charge function provided with license entitlement to WAS z/OS, CICS, IMS

Complete your session ev

What z/OS Connect does for you

- It simplifies cloud and mobile application connectivity to z/OS programs and data, and makes this environment more consistent and manageable
  - Provides a common and consistent entry point for mobile access to back-end systems
  - It's written in Java, so it runs on zIIP engines and is portable
  - Shields back-end systems from requiring awareness of RESTful URIs and JSON data formatting
  - Simplifies front-end functions by allowing them to use REST calls and JSON data representation
  - Provides point for authorization of requester to invoke back-end services
  - Provides point for capturing usage information using SMF

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How z/OS Connect is delivered

- WebSphere Application Server for z/OS
  - Delivered as function that runs inside the Liberty Profile for z/OS
  - Initially will use WOLA (WebSphere Optimized Local Adapters) to access back-end services
- CICS
  - Delivered as part of Liberty Profile that runs inside of CICS region
  - Uses JCICS interface to access CICS functions
- IMS
  - Similar to the WAS for z/OS approach (the Liberty Profile for z/OS with z/OS Connect inside)
  - Difference: IMS z/OS Connect uses an IMS-supplied JCA adapter to talk to IMS Connect to get access into IMS (JCA = J2EE Connector Architecture)

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Front-end perspective: RESTful services

Mobile, cloud ecosystem

URI = Uniform resource identifier

```
https://mysite.com/CustomerApp/getCustomer?cn=1234
```

- If the URI is understood by the receiving server, the implied action is taken
- Knowing what URIs the server supports is important, which is why z/OS Connect has a discovery function that can be used to query for configured services and details on those services
- RESTful services are growing in popularity because it's easier to implement than other Web service protocols such as SOAP, which involves XML and WSDL and parsing …

Where JSON fits in

It's a way of passing data back and forth as a series of name/value pairs

Mobile, cloud ecosystem

URI = Uniform resource identifier

```
https://mysite.com/CustomerApp/getCustomer?cn=1234
```

```
{
    "firstName": "John",
    "lastName": "Smith",
    "age": 25,
    "address": {
        "streetAddress": "1234 Main Street",
        "city": "Anytown",
        "state": "NY",
        "postalCode": "10021-1234"
    },
}
```

Data being passed in is appended to the URL and passed to the server

JSON can be passed back to the client as well

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The z/OS Connect discovery function

Allows developers to query for a list of configured services, and drill down for details on a given configured service

Query for configured services

```
https://mysite.com/zosConnect/services
```

JSON object with list of exposed services and their service URLs

z/OS Connect

Liberty Profile z/OS

Query for details on a given configured service

```
https://mysite.com/zosConnect/services/serv1
```

JSON object with more details on the specific service

z/OS Connect

Liberty Profile z/OS

Complete your session evaluations
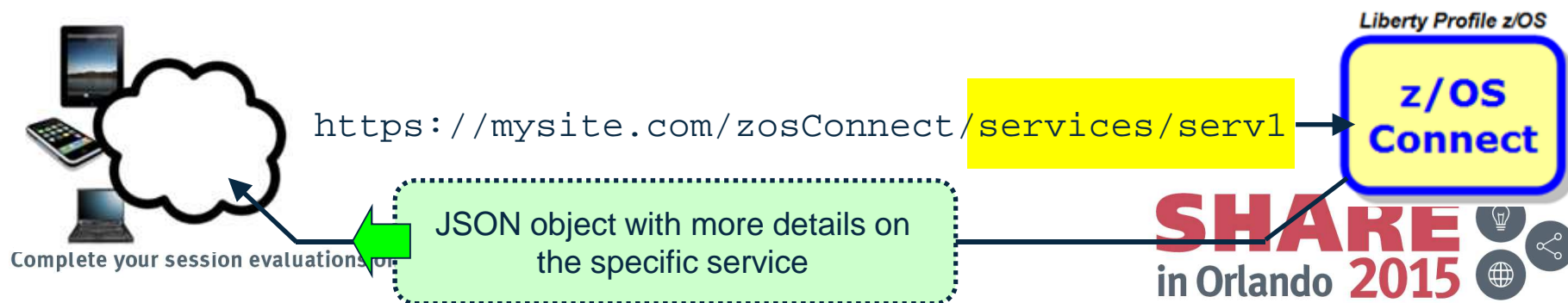
Putting this in a DB2 for z/OS context

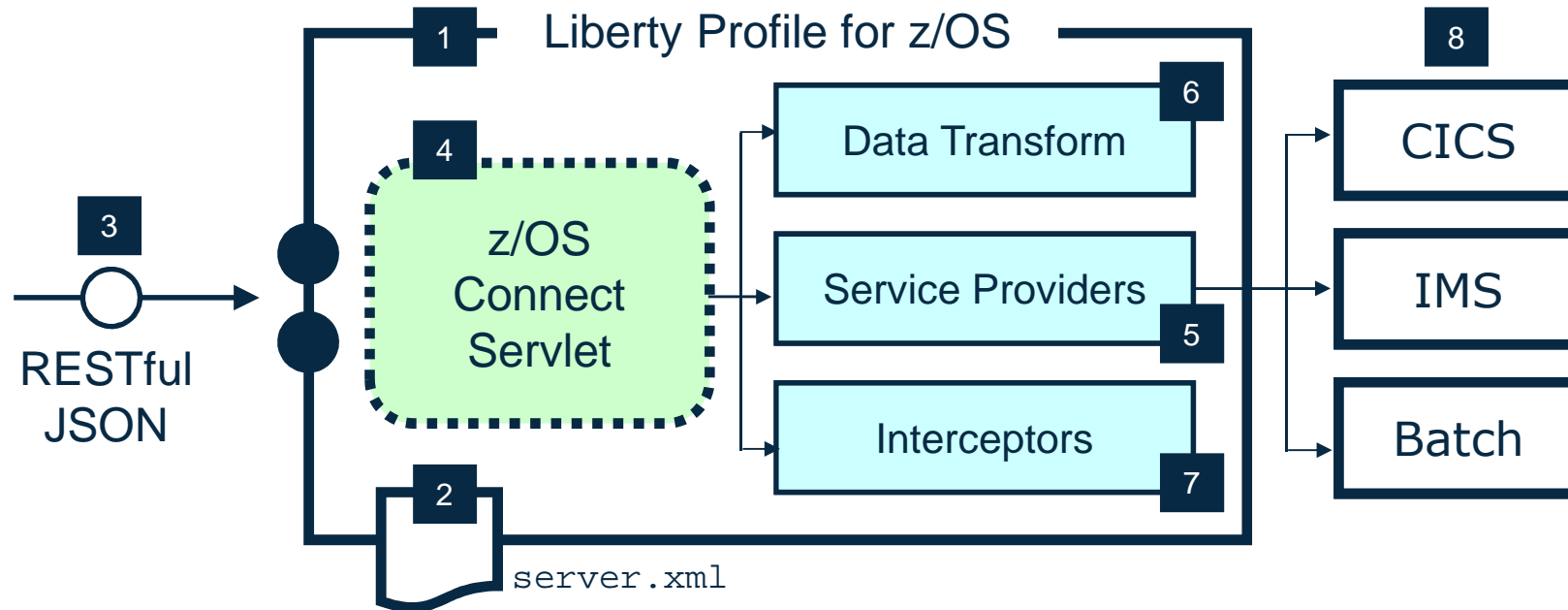1. For now, access to DB2 for z/OS data via z/OS Connect is through CICS, IMS, and batch programs
   - Direct access to DB2 from z/OS Connect is being worked on

z/OS Connect

CIC S

IM S

Batc h
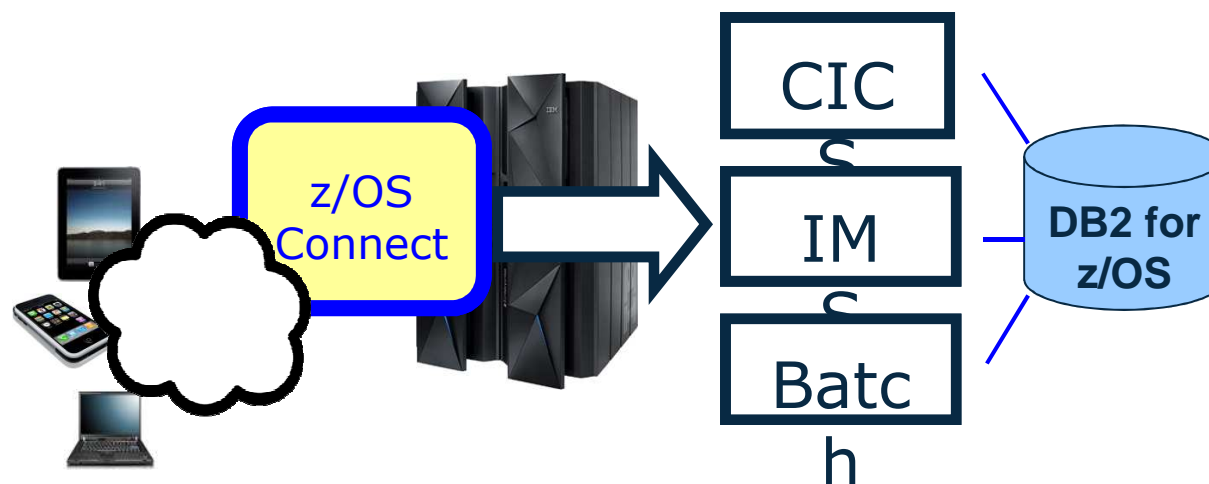
DB2 for z/OS

2. References to JSON in this overview of z/OS Connect are NOT related to the JSON support for DB2 for z/OS recently delivered for DB2 11
   - JSON support for DB2 is a feature of the IBM DB2 Accessories Suite for z/OS V3.2 (a no-charge offering) that enables DB2 for z/OS to be a JSON document store
   - Allows applications to manage JSON documents in DB2 for z/OS using a new (API) based on the MongoDB data model and query language
   - Among other things, allows Java programs to access JSON data through the same JDBC driver used for SQL access

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The z/OS Connect summary-on-a-slide

1 — Liberty Profile for z/OS

3 RESTful JSON

4 z/OS Connect Servlet

6 Data Transform

5 Service Providers

7 Interceptors

2 server.xml

8 CICS / IMS / Batch

1 z/OS Connect is software function that runs in Liberty Profile for z/OS

2 z/OS Connect is described and configured in the Liberty `server.xml` file

3 z/OS Connect is designed to accept RESTful URIs with JSON data payloads

4 One part of z/OS Connect is a servlet that runs in Liberty Profile for z/OS

5 A 'Service Provider' is software that provides the connectivity to the backend system

6 z/OS Connect provides the ability to transform JSON to layout required by back-end

7 'Interceptors' are callout points where software can be invoked to do things such as SAF authorization and SMF activity recording

8 Initially the backend systems supported are CICS, IMS and batch

DB2 Connect (and the IBM Data Server Driver)
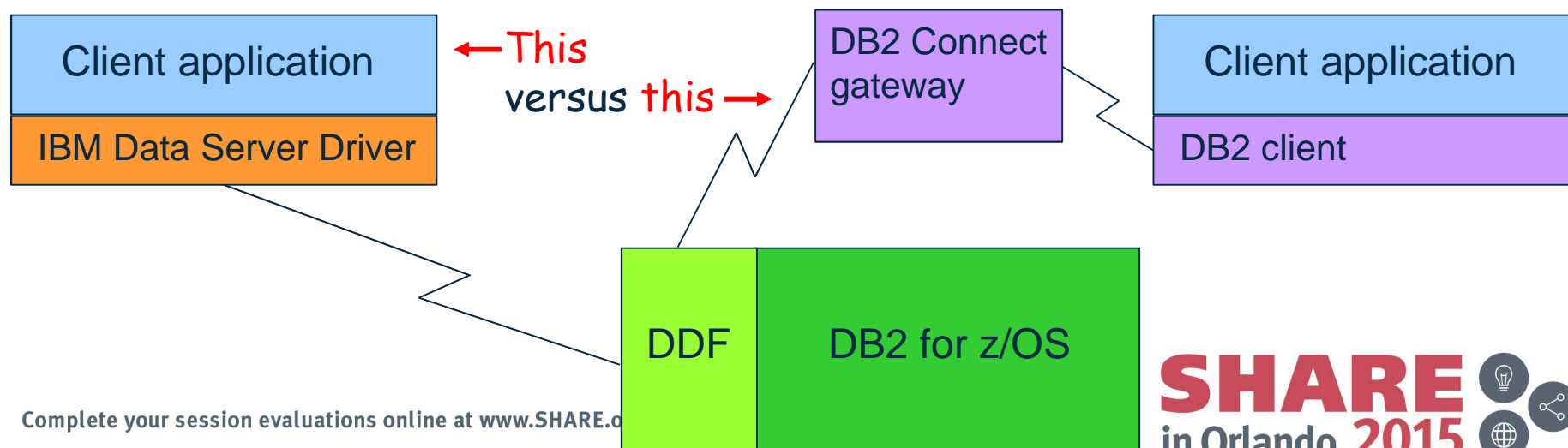
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For starters…

- DB2 Connect and the IBM Data Server Driver remain what they have been: the means by which network-connected application servers access DB2 for z/OS systems
- They translate a client application's data interface protocol to DRDA (distributed relational database architecture), which is processed through the DB2 for z/OS distributed data facility (DDF)
- Generally speaking, if you're licensed for DB2 Connect then you can use the IBM Data Server Driver – and the Data Server Driver is what you <u>should</u> be using

Client application
IBM Data Server Driver

DRDA

DDF	DB2 for z/OS

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The Data Server Driver vs. a DB2 Connect "gateway" server

- Simpler infrastructure
- Improved performance (eliminates a "hop" between client and DB2)
- Has the features you need, including connection pooling, transaction pooling, and Sysplex workload balancing
- Lighter weight, easier to upgrade
- Utilizes "type 4" driver technology

More on the Data Server Driver

- The one you probably want is called the IBM Data Server Driver Package (or DS Driver, for short)
  - No client database instance / directory
  - Includes JCC, ODBC / CLI, Open Source, CLPPlus
  - On Windows, includes OLE DB and .NET
  - Introduced db2dsdriver.cfg file for configuration
  - Best practice for enterprise deployment – all servers
- Another option: the IBM Data Server Driver for JDBC and SQLJ
 - Standalone download of Java support only

Best licensing option, for convenience

- DB2 Connect Unlimited Edition for z Systems
  - Unlimited deployment
  - One-time install to server
  - No need for license key on client systems
- New licensing option: DB2 Connect Unlimited Advanced Edition
  - Includes DB2 Connect Unlimited Edition for z Systems
  - <u>and</u> InfoSphere Optim PureQuery Runtime for LUW

    Refers to application server on which it's deployed, not target data server

    - For better performance, better control of dynamic SQL client-server applications
  - <u>and</u> InfoSphere Optim Configuration Manager for DB2
    - For dynamic, centralized control of client application connections to DB2 for z/OS

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You want drivers? We've got drivers
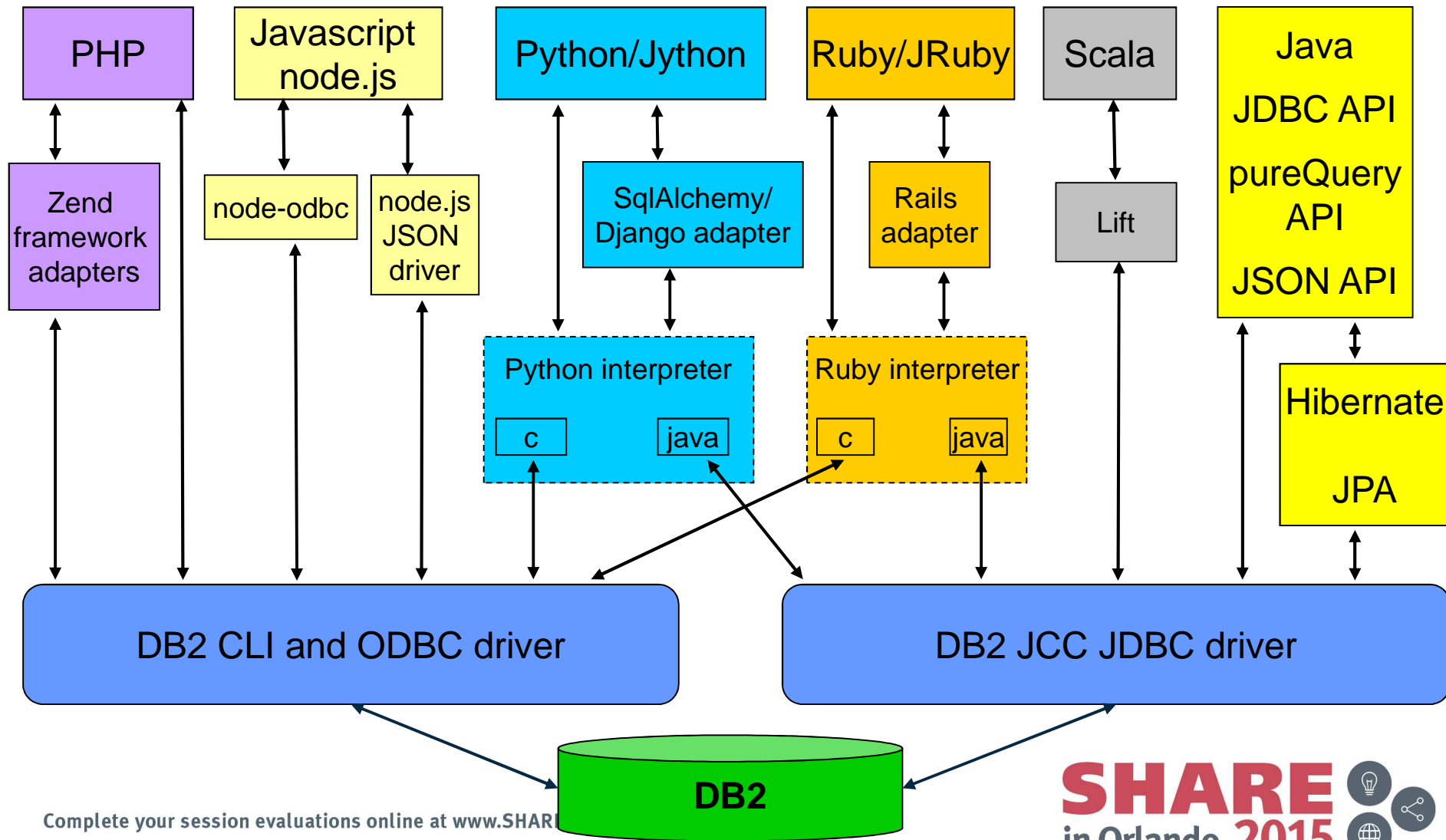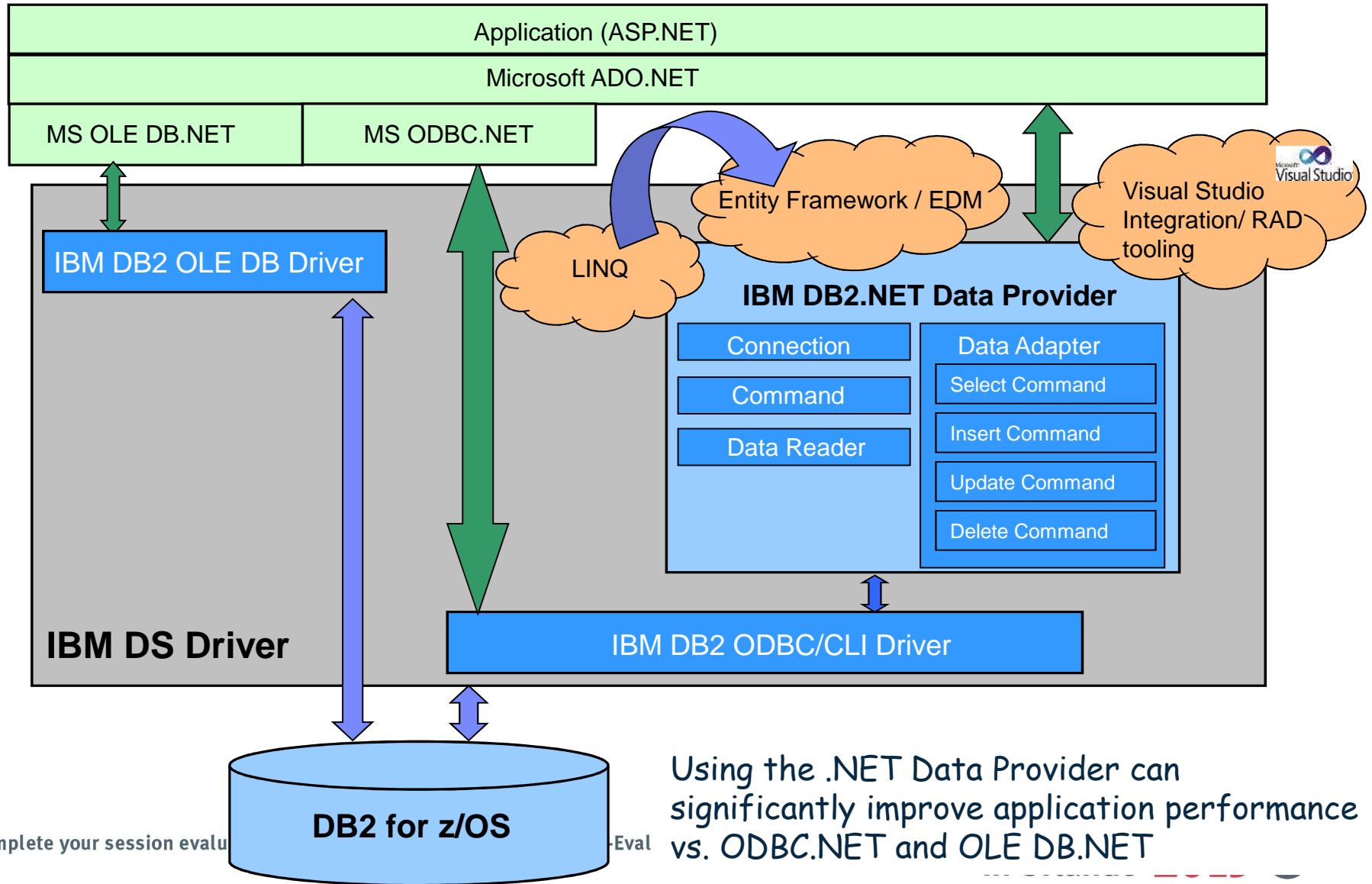
The IBM DB2 .NET Data Provider

- We talk a lot about Java access to DB2, and about our ODBC driver
- Some people may wonder, "Is .NET client support important to IBM?"
- Answer: YES – we have a long history of support for .NET
  - .NET Provider for .NET Framework 1.0 and support for each level up to current 4.5
  - Visual Studio add-ins for Visual Studio .NET 2002 and each level up to the current Visual Studio
  - Visual Studio Industry Partner member since inception of VSIP program
- Cooperative development with Microsoft
  - Cooperative effort on development of the Entity Framework
  - Cooperative effort on Visual Studio for Database Professionals

IBM APIs for .NET

Application (ASP.NET)

Microsoft ADO.NET

MS OLE DB.NET   MS ODBC.NET

IBM DB2 OLE DB Driver

LINQ

Entity Framework / EDM

Visual Studio Integration/ RAD tooling

IBM DB2.NET Data Provider

Connection

Command

Data Reader

Data Adapter

Select Command

Insert Command

Update Command

Delete Command

IBM DS Driver

IBM DB2 ODBC/CLI Driver

DB2 for z/OS

Using the .NET Data Provider can significantly improve application performance vs. ODBC.NET and OLE DB.NET

Complete your session evalu...   -Eval

Better performance for DB2 for z/OS network-attached applications

(Database access threads – the kind used by applications that are network-connected to DB2)

- High-performance DBATs
- Introduced with DB2 10 for z/OS (in conversion mode)
- How they're activated: a DBAT used to execute a package bound with RELEASE(DEALLOCATE) <u>becomes</u> a high-performance DBAT
  - DBAT will stay dedicated to connection through which it was instantiated and can be reused by 200 transactions (then it will be terminated to free up resources allocated to the thread)
- Benefit: high-performance DBATs enable you to get for DB2 client-server workloads the CPU-efficiency benefits of RELEASE(DEALLOCATE) packages + persistent threads
  - Conceptually similar to executing RELEASE(DEALLOCATE) packages with CICS-DB2 protected entry threads
  - For simple transactions, could reduce in-DB2 CPU time by 10% or more

More on high-performance DBATs

- One way to activate high-performance DBATs: bind the IBM Data Server Driver packages (or DB2 Connect packages) with RELEASE(DEALLOCATE)
  - If you do that, consider binding these packages into the standard NULLID collection with RELEASE(COMMIT), and into another collection with RELEASE(DEALLOCATE)
    - Then, by way of client-side data source property, point applications to one collection or the other – this allows you to use high-performance DBATs in a more granular fashion, vs. for all client-server applications
- Another way to activate high-performance DBATs: bind packages of DB2 stored procedures called by DRDA requesters with RELEASE(DEALLOCATE)

More granular control of network connections to DB2

- For a long time, several important settings related to applications accessing DB2 via network connections could only be specified at the ZPARM level
  - The number of connections to the DB2 subsystem (CONDBAT)
  - The number of active threads (MAXDBAT)
  - The idle thread timeout value (IDTHTOIN)
- Starting with DB2 10 for z/OS, those settings could be specified at a much more granular level (e.g. for an application server at a certain IP address, or for a certain authorization ID)
  - Accomplished by inserting rows into two DB2 tables:
    - DSN_PROFILE_TABLE (To what does a set of specifications apply?)
    - DSN_PROFILE_ATTRIBUTES (What is controlled for a given profile?)
- A still greater degree of control over network-attached applications can be exerted more dynamically and more easily via IBM Optim Configuration Manager for DB2 (see slide 21)

Thanks for your time!

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