



17252 CICS TS V5 Technical Overview

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Abstract



- CICS Transaction Server for z/OS (CICS TS) is the premier enterprise-grade, mixed-language application server. Trusted by companies for more than 40 years, it has helped them create, extend and evolve mission-critical applications. CICS TS continues to provide innovative and essential technologies that deliver unparalleled connectivity and scalability. As a result, CICS TS fits naturally into the smart infrastructure needed to support a digital business.
- CICS TS V5 provides new and enhanced capabilities in the three main areas of Service agility, Operational Efficiency and Cloud Enablement. Service agility includes enhanced support for Mobile applications and the WebSphere Application Server Liberty profile. Operational efficiencies provide managed operations, greater capacity and performance, increased availability and greater security integration. Cloud enablement of CICS applications and platforms provides lifecycle management and multi-versioning of applications deployed to CICS. CICS TS V5.2 builds on the many advances in service agility, operational efficiency, and cloud capabilities delivered in CICS TS V5.1, and the two releases have together delivered in excess of 200 customer and user group enhancement requests.
- This presentation will discuss the technical content available in CICS Transaction Server for z/OS V5.1 and V5.2, as well as some new capabilities available in the CICS TS V5.3 open beta.

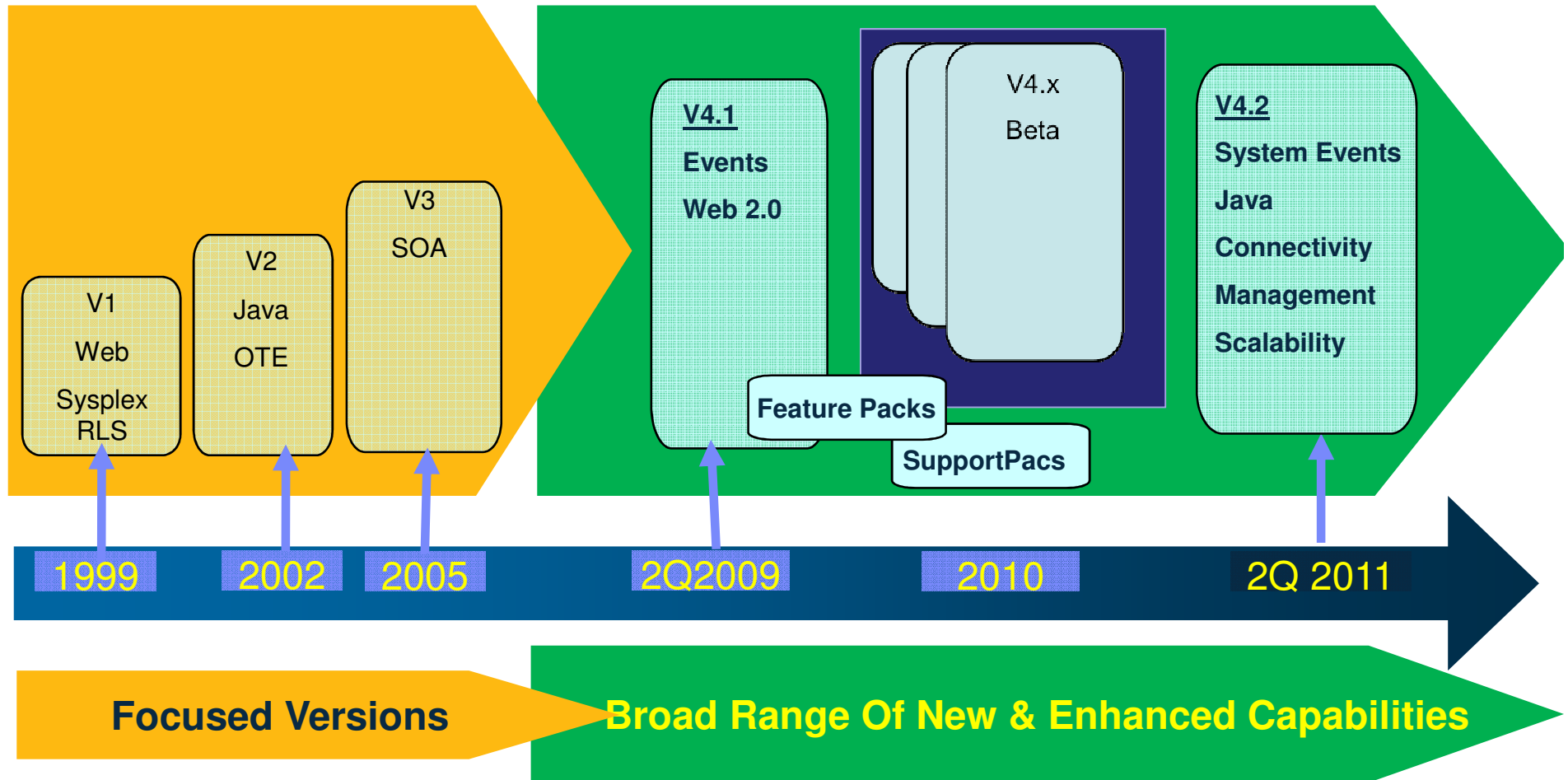
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Session Agenda

- Introduction
- **Service Agility**
 - CICS TS V5.1 Reminder
 - CICS TS V5.2 Overview
 - CICS TS V5.3 open beta taster
- **Operational Efficiency**
 - CICS TS V5.1 Reminder
 - CICS TS V5.2 Overview
 - CICS TS V5.3 open beta taster
- **Cloud Enablement with DevOps**
 - CICS TS V5.1 Reminder
 - CICS TS V5.2 Overview
 - CICS TS V5.3 open beta taster
- **CICS Explorer V5**
- Summary

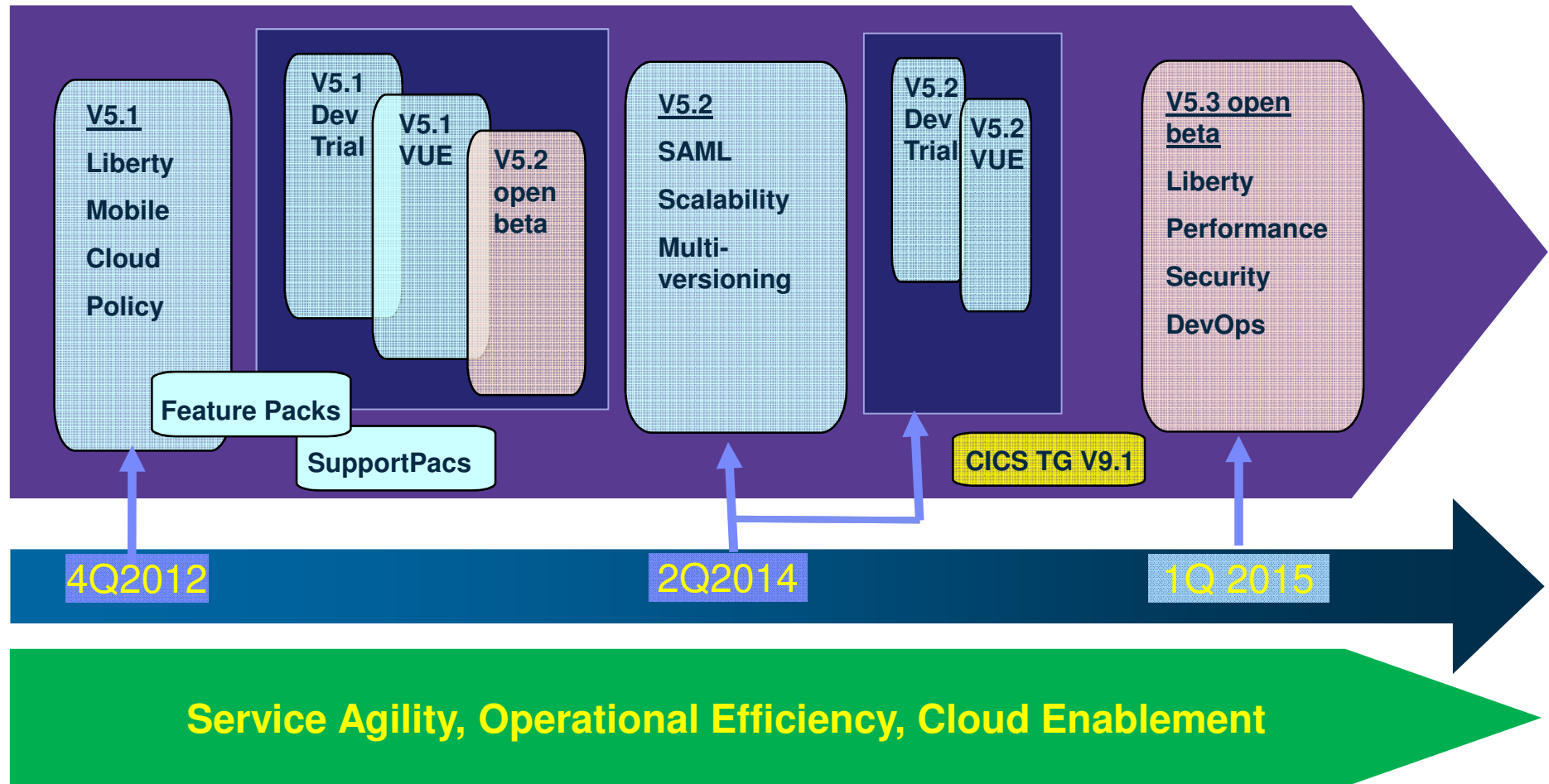


CICS Transaction Server : The Story So Far...



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CICS Transaction Server : The Story Continues...



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CICS TS V5



Service Agility

Runtime support
for production
ready web
applications.

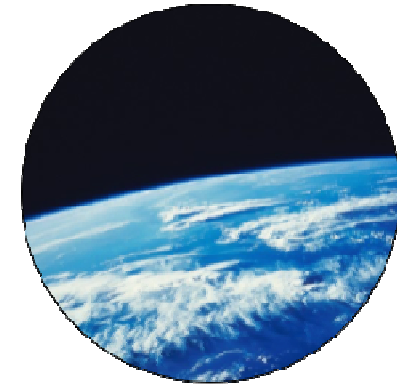
Integration with
mobile
applications.



Operational Efficiency

Increased system capacity
and capability to achieve
more with less.

Automatic control of
critical resources using
policies.



Cloud Enablement

Simplified system
management and rapid
application deployment.

On premise pattern based
cloud deployment.

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CICS TS V5 – Notes



Service agility

CICS TS V5.2 significantly enhances the portability of web applications into CICS, by upgrading WebSphere Application Server Liberty Profile to Version 8.5.5 and supporting a broader set of its features. Java™ database connectivity, transactionality, and security infrastructure are all functionally enhanced. This makes applications written in Java even more capable.

Service-oriented architecture (SOA) support is extended by integrating the JSON and REST capabilities, introduced in the CICS TS Feature Pack for Mobile Extensions, into CICS TS V5.2. This makes it easier to interact with mobile devices and mobile-optimized gateways, such as IBM Mobile First Server.

Operational efficiency

For operational efficiency, the number of supported policy thresholds is expanded to cover an increased number of threshold types, safeguarding critical runtime resources. This enables a wider range of service-level agreement thresholds to trigger automatic actions.

The integration of CICS applications with distributed security standards has been simplified by incorporating the Security Assertion Markup Language (SAML) support, introduced in the CICS TS Feature Pack for Security Extensions, into CICS TS V5.2. Also introduced is support for Kerberos security tokens and stronger cryptographic ciphers. SAML support is provided for both inbound and outbound use of SAML tokens, and SAML tokens can now be augmented by adding new attributes.

Cloud enablement

Major advances are made in CICS TS V5.2 in the area of cloud enablement, to enhance application lifecycle management by allowing different versions of a multi-program application to run concurrently, and simplify deployment of application updates or to easily rollback to an earlier version if required.

Application versioning assists with the consolidation of applications onto fewer CICS regions.

Service Agility



Runtime support
for production
ready **web**
applications

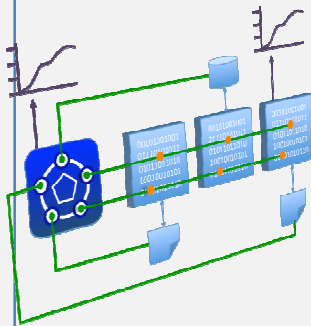
Integration with
mobile applications

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CICS TS 5.1 Service Agility



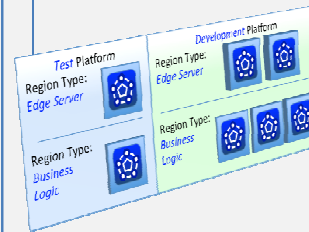
First-class Applications



- Manage disparate resources as a single entity
- Rapidly move through the application lifecycle
- Automate dependency management
- Ensure rigorous yet flexible provisioning
- Measure entire application resource usage
- Dynamically manage applications with policies



First-class Platforms



- Group new and existing regions as platforms
- Decoupling applications from the region topology.
- automatic resource deployment and validation
- De-provision resources when requested
- Deploy applications to regions within a platform
- Dynamically manage platforms with policies



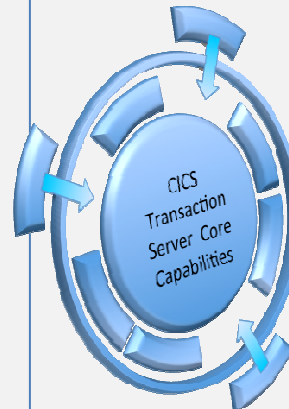
Modern Interfaces



- A production-ready web container
- Deploy lightweight Java servlets and JSPs
- Local access to CICS applications and data
- Roll-out of interface updates through OSGi
- Integration with applications & platforms
- Built on WebSphere Application Server Liberty profile for compatibility
- CICS TS Feature Pack for Mobile



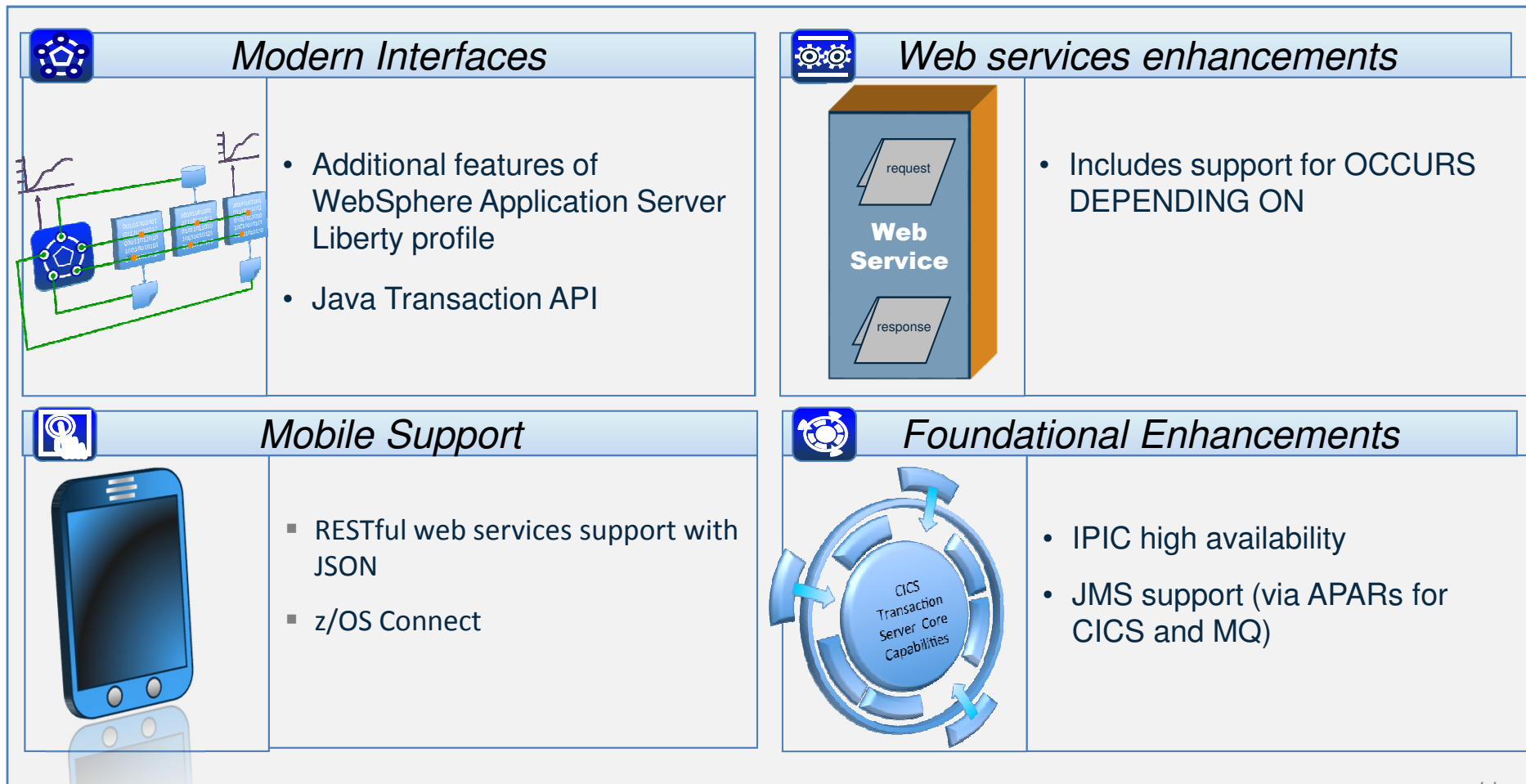
Foundational Enhancements



- CICS supports "one-to-many" event emission and Message Events
- Greater-than-32KB across MQ (DPL) bridge
- Enhancements to IPIC add IMS support
- Reduced application storage needs with GET and PUT container
- Backup and restore entire CICSplex System Manager (CICSplex SM) systems
- Automatic DST adjustment of the CICS clock

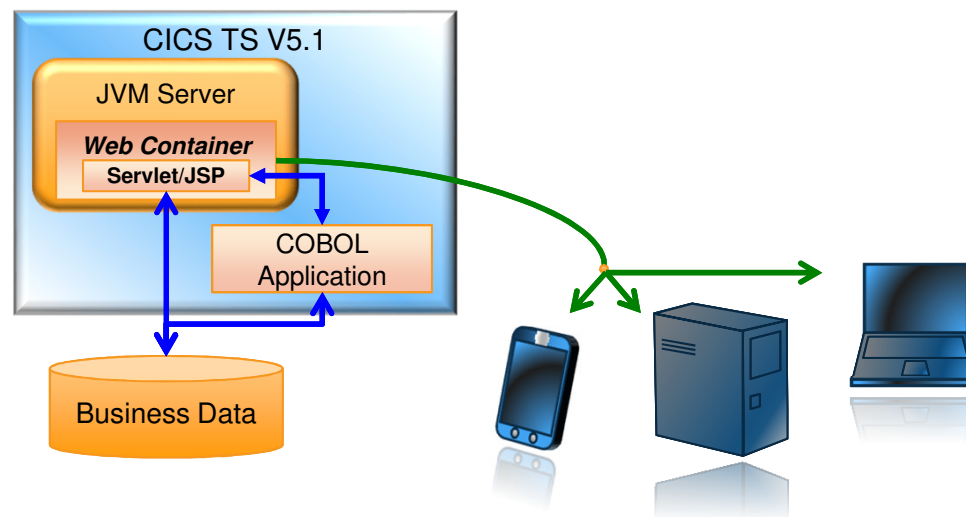
CICS TS 5.2 Service Agility

Integrates **mobile** capabilities and broadens the **web programming model**,
without requiring additional middleware

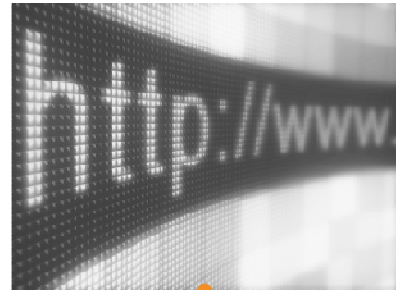


Liberty in CICS TS V5.2

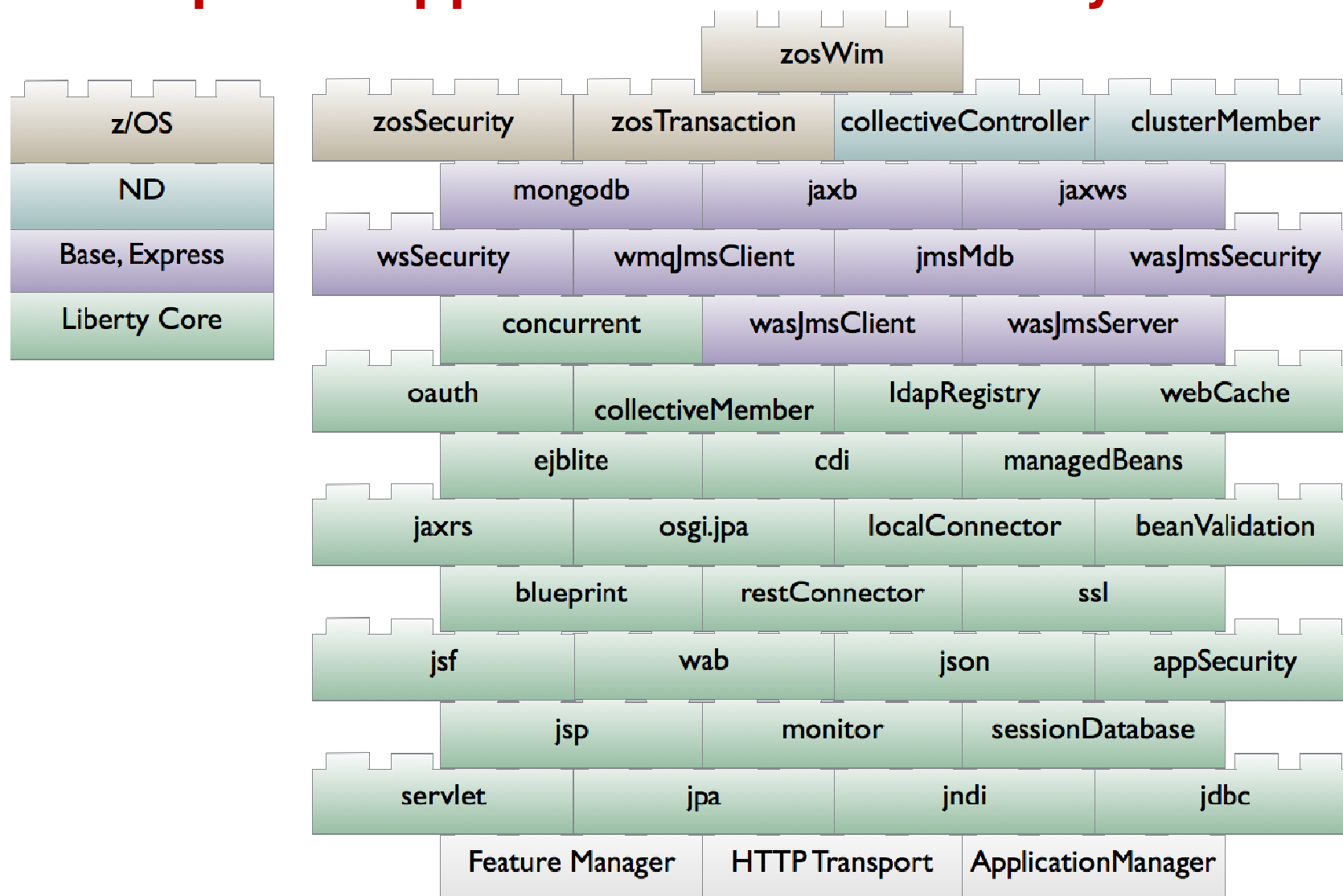
- Liberty
 - Light weight web container
 - Provides Servlets and JSPs support for CICS
 - Runs in a JVMServer
 - Access to CICS functionality through the JCICS API



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WebSphere Application Server Liberty Profile

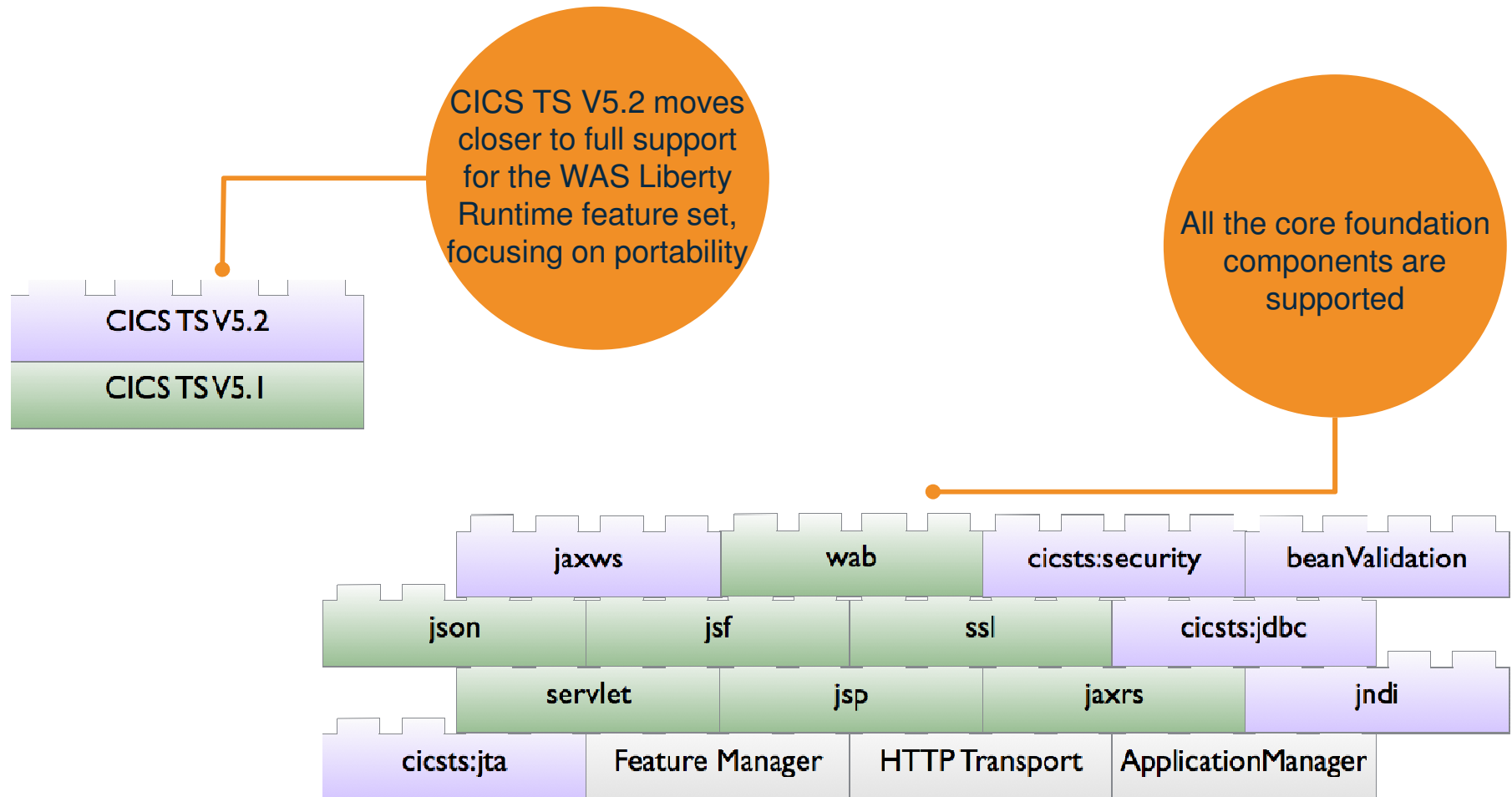


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WebSphere Application Server Liberty Profile in CICS TS V5.2



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Liberty in CICS TS V5.2 – Notes

CICS Transaction Server for z/OS, Version 5 Release 2 upgrades the WebSphere® Application Server Liberty profile to Version 8.5.5 and supports a broader set of its features. Java database connectivity, transactionality, and security infrastructure are all functionally enhanced. The Liberty profile is a lightweight development and application runtime environment that is well-suited to building web applications that do not require the full Java™ EE environment of traditional enterprise application server profiles.

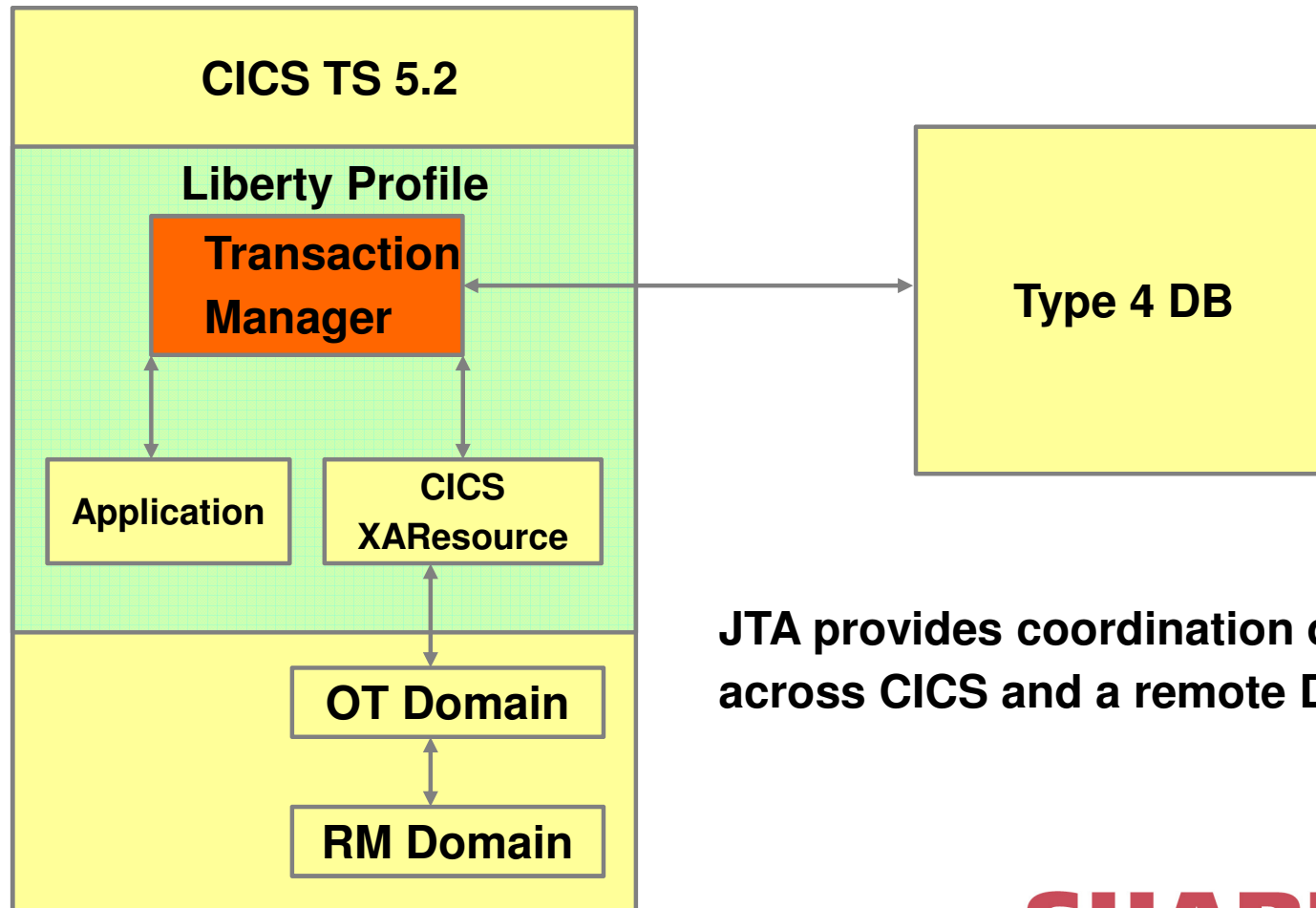
Support is provided for JDBC type 2 data sources. This support enriches your options for access to other data managers. You can use the JDBC DataSource API to access relational data that is stored in either a local DB2® database, managed by CICS resources, or a remote database using JDBC type 4 connectivity.

Java Transaction API (JTA) support enables transactional web application developing using JTA API to be run in a Liberty JVM server and to coordinate transactional updates to both CICS resources and other third party resource managers, such as a JDBC type 4 driver connection using a remote data source.

You can take advantage of the full range of WebSphere Liberty Profile application security functions. These include an extended range of authentication options, including HTTP basic authentication, single sign-on using LTPA cookies, form login, Trust Association Interceptors, and SSL client certificate mapping. Authorization options include both JEE role authorization and CICS transaction and resource security, which is based on the authenticated SAF userid. The Secure Sockets Layer (SSL) support in the Liberty JVM server HTTP listener is extended to support certificates that are stored in both System Authorization Facility (SAF) keyrings and Java keystores.

Liberty JTA

- Java Transaction API

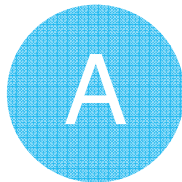
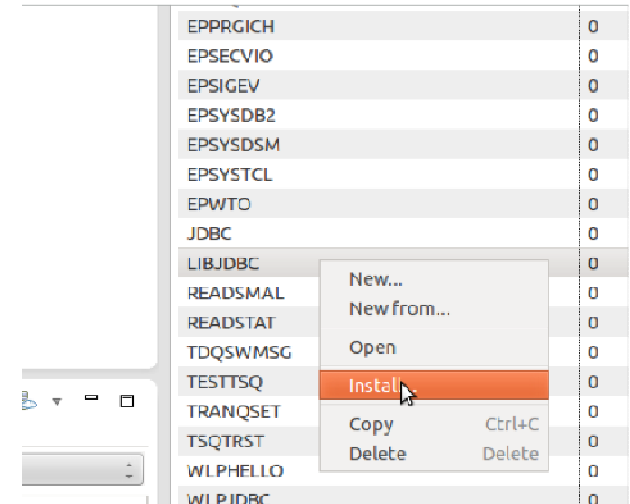
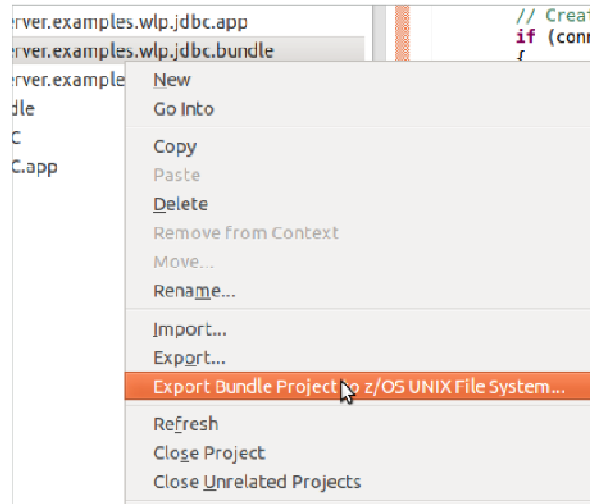


JTA provides coordination of updates across CICS and a remote DB

Liberty scenario

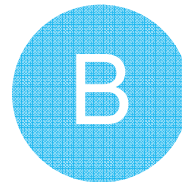
Move JSP or Servlet presentation code into CICS Transaction Server

```
*/  
protected void doGet(HttpServletRequest request, HttpServletResponse  
{  
    // obtain the WHERE clause and connection type from the request  
    String whereClause = request.getParameter("whereClause");  
    String connectionType = request.getParameter("connectionType");  
  
    // set the response contentType and character encoding  
    response.setContentType("text/xml");  
    response.setCharacterEncoding("ASCII");  
  
    // Cache the Response output stream  
    ServletOutputStream out = response.getOutputStream();  
  
    // begin writing XML to the response output stream  
    StringBuilder xml = new StringBuilder();  
  
    // Create a DB2 sample with DB2 connection  
    CICSDB2DynamicSQLExample db2Sample = null;  
    try  
    {  
        db2Sample = new CICSDB2DynamicSQLExample(connectionType);  
    }  
    catch (Exception e)  
    {  
    }  
}
```



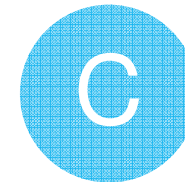
Step 1

Modify application data logic to make JCICS API calls or direct JDBC calls, if required



Step 2

Package application into a EBA for deployment into CICS Liberty

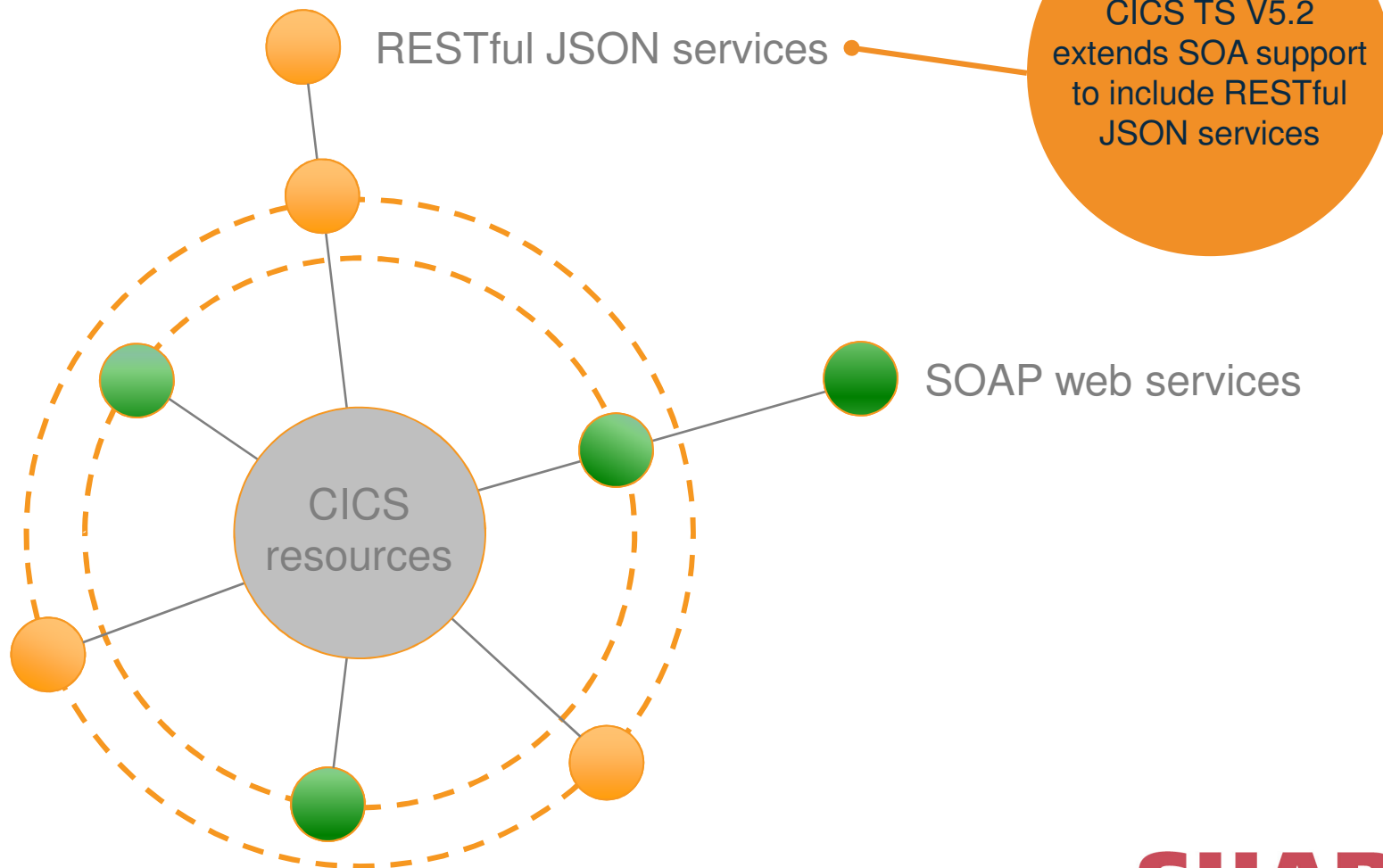


Step 3

Install CICS application into CICS Liberty Server and enable using the CICS Explorer

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Mobile support: RESTful APIs and JSON parsing



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CICS Mobile Support

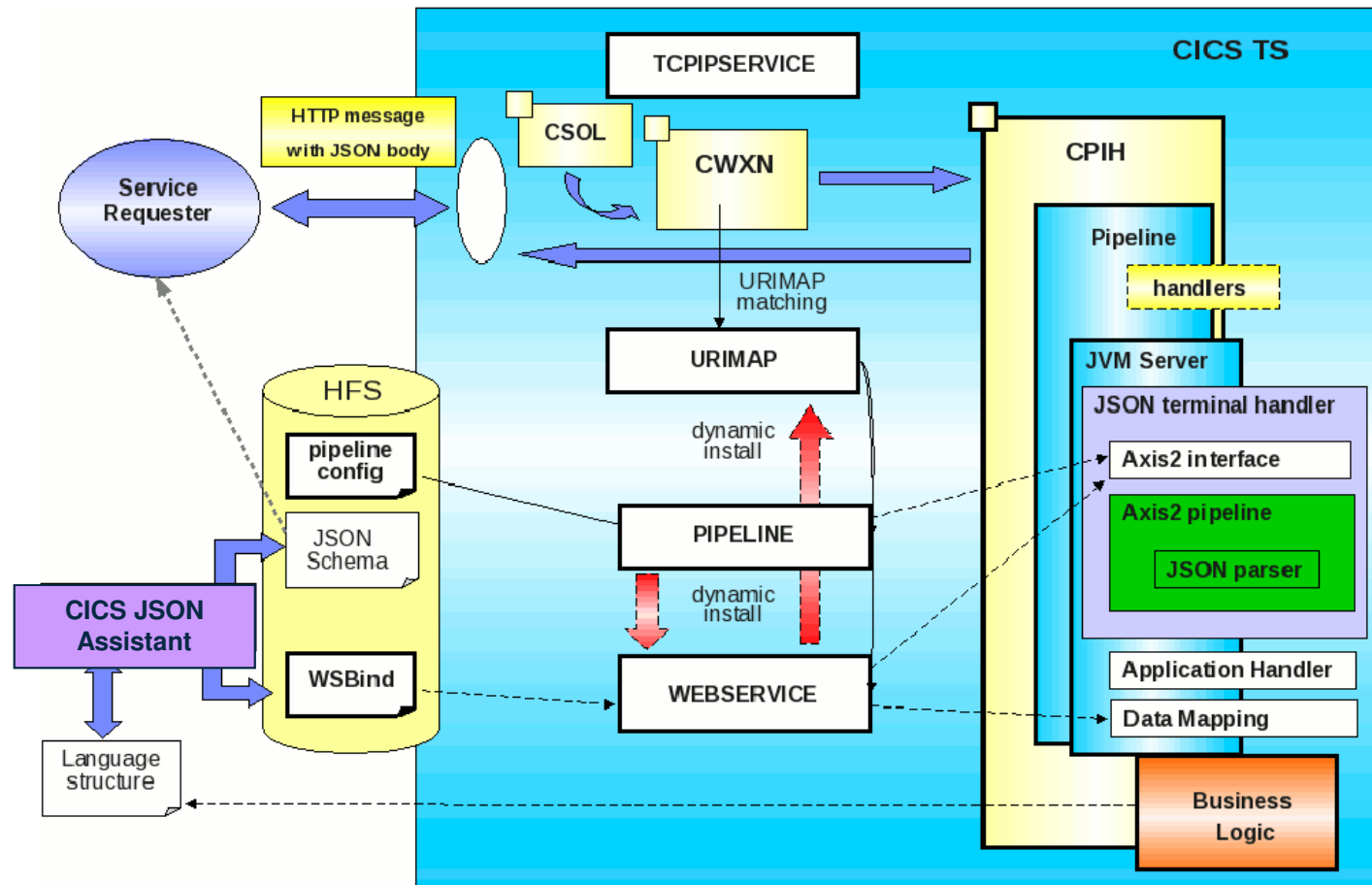


- CICS and Mobile
 - Provides support for RESTful web service requests
 - JSON in the http body
 - New JSON assistant programs
 - Generate a JSON schema and WSBIND file from a copy book
 - COBOL, PLI, C and C++
 - Create a language structure and WSBIND file from a JSON schema
 - New linkable interface
 - Equivalent to EXEC CICS XMLTRANSFORM
 - Allows application programs to process JSON data
 - Provides support for JAX-RS and JSON Liberty features

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CICS TS V5.2 Mobile Support

- Mobile Feature Pack integrated into base CICS



CICS TS V5.2 Mobile – Notes

CICS Transaction Server for z/OS, Version 5 Release 2 provides support for web service requests with JSON and the conversion between JSON and application data. Support for JSON greatly simplifies the use of existing CICS services by mobile applications, particularly those managed by IBM Mobile First Server. You can expose CICS applications as web services with JavaScript Object Notation (JSON) payloads, create new RESTful applications, call existing JSON applications, and convert JSON from any source to and from the application data.

This support for JSON and REpresentational State Transfer (REST) was previously available in the CICS TS Feature Pack for Mobile Extensions.

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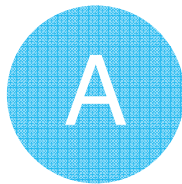
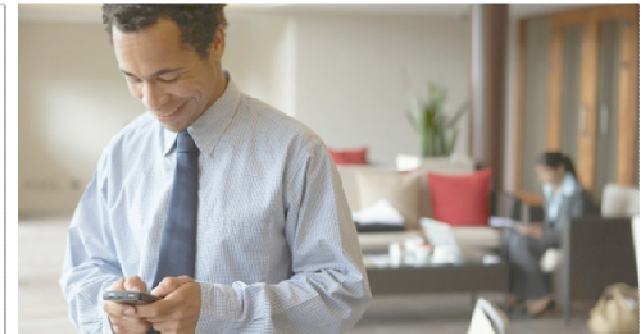
Mobile scenario

Connect directly to CICS from IBM Mobile First using end-to-end JSON

```
./android/mobileapp/cat_request.json
{
  "schema": "http://json-schema.org/draft-04/schema#",
  "description": "Request schema for the STPM01 250M interface",
  "type": "object",
  "properties": {
    "STPM01operation": {
      "type": "object",
      "properties": {
        "small record for webservice": {
          "type": "object",
          "properties": {
            "st_ip comm": {
              "type": "object",
              "properties": {
                "cid": {
                  "schema": "http://json-schema.org/draft-04/schema#",
                  "description": "Request schema for the STPM01 250M interface",
                  "type": "object",
                  "properties": {
                    "STPM01operation": {
                      "type": "object",
                      "properties": {
                        "small record for webservice": {
                          "type": "object",
                          "properties": {
                            "st_ip comm": {
                              "type": "object",
                              "properties": {
                                "cid": {
                                  "type": "string",

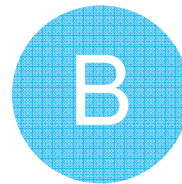
```

```
function getCustomerDetails(custNum) {
  var pathURL = "GENAPP/getCustomerDetails";
  var request=
  {
    "LGICUS010operation":{
      "ca" : {
        "ca_request_id" : "01ICUS",
        "ca_return_code" : "00",
        "ca_customer_num" : custNum,
        "ca_num_policies" : ""
      }
    }
  };
}
```



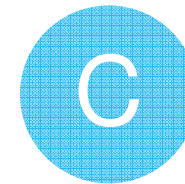
Step 1

DFHLS2JS to generate the JSON artefacts for the target CICS service.



Step 2

Mobile developer uses JSON schema to build a Mobile First adapter.

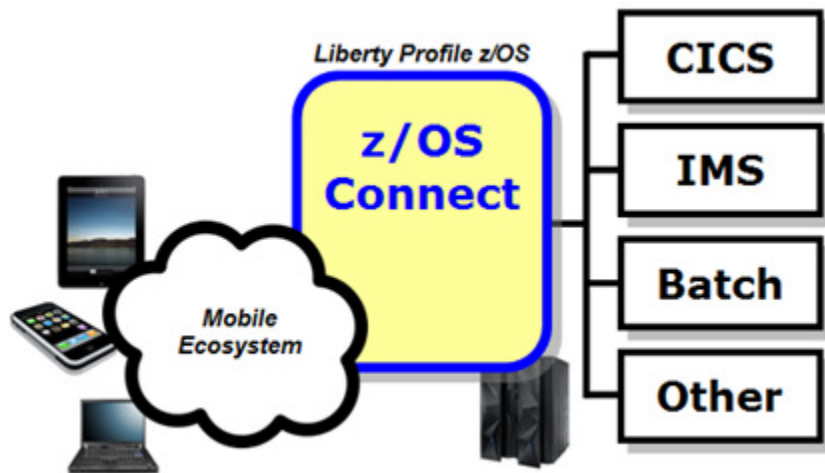


Step 3

Frontend mobile developer calls the Mobile First adapter which calls the service hosted in CICS.

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z/OS Connect



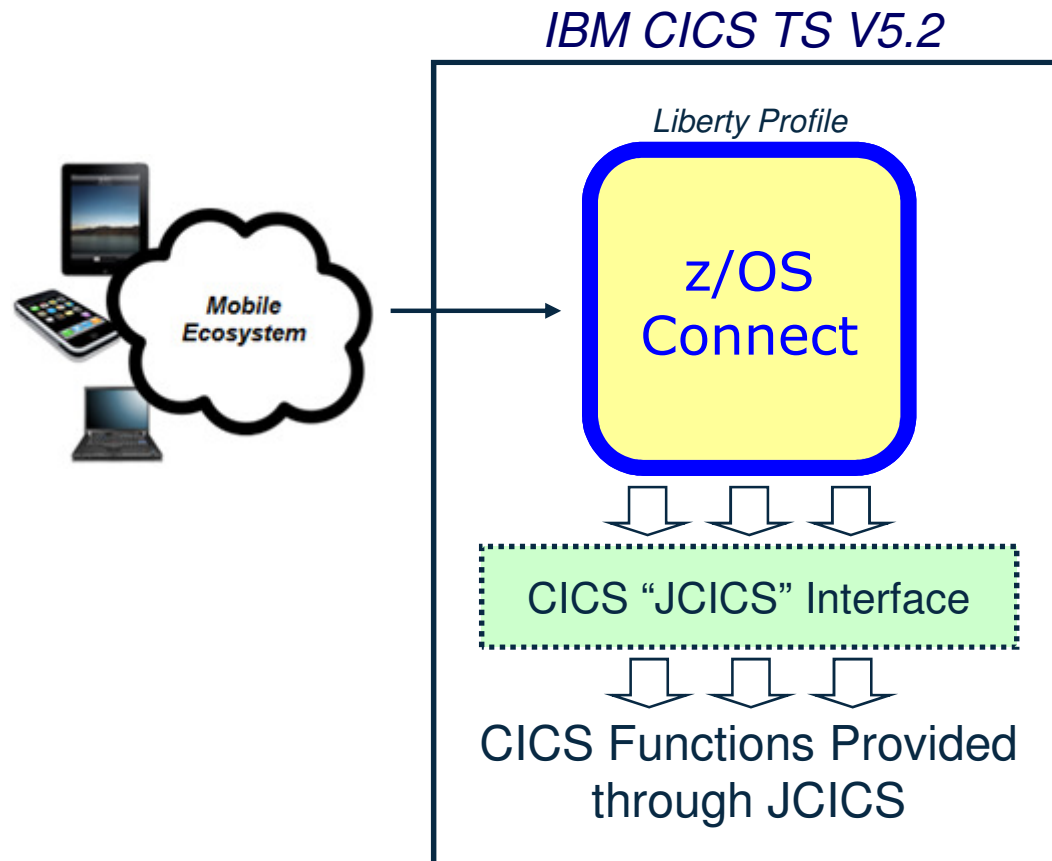
You *could* enable Mobile access without z/OS Connect

z/OS Connect simplifies and makes the environment more consistent and manageable

- Common and consistent entry point for mobile access to one or many backend systems
- Java, so runs on specialty engines
- Shields backend systems from requiring awareness of RESTful URIs and JSON data formatting
- Provides point for authorization of user to invoke backend service
- Provides point for capturing usage information using SMF
- Simplifies front-end functions by allowing them to pass RESTful and JSON rather than be aware of or involved in data transformation

z/OS Connect and CICS

z/OS Connect interacts with CICS using JCICS interface
See announcement letter ENUS214-107:



Liberty Profile runs *inside* the CICS region

The 'Service Provider' is only JCICS ... not WOLA

z/OS Connect available on CICS TS V5.2 via APAR PI25503

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CICS TS V5.2 Web service enhancements

- Simple Occurs Depending On and Occurs Indexed By clauses supported in native web services
 - Native web support
 - JSON
 - Axis2
- AMODE 64 exploitation by native SOAP parser
 - Parser output stays in 64 bit storage
 - SOAP message built in 64 bit storage
 - Code page conversions use 64 bit storage
 - Benefit is 31 bit Virtual Storage Constraint Relief
- Less TCB switching for DYNAMIC(NO) transactions

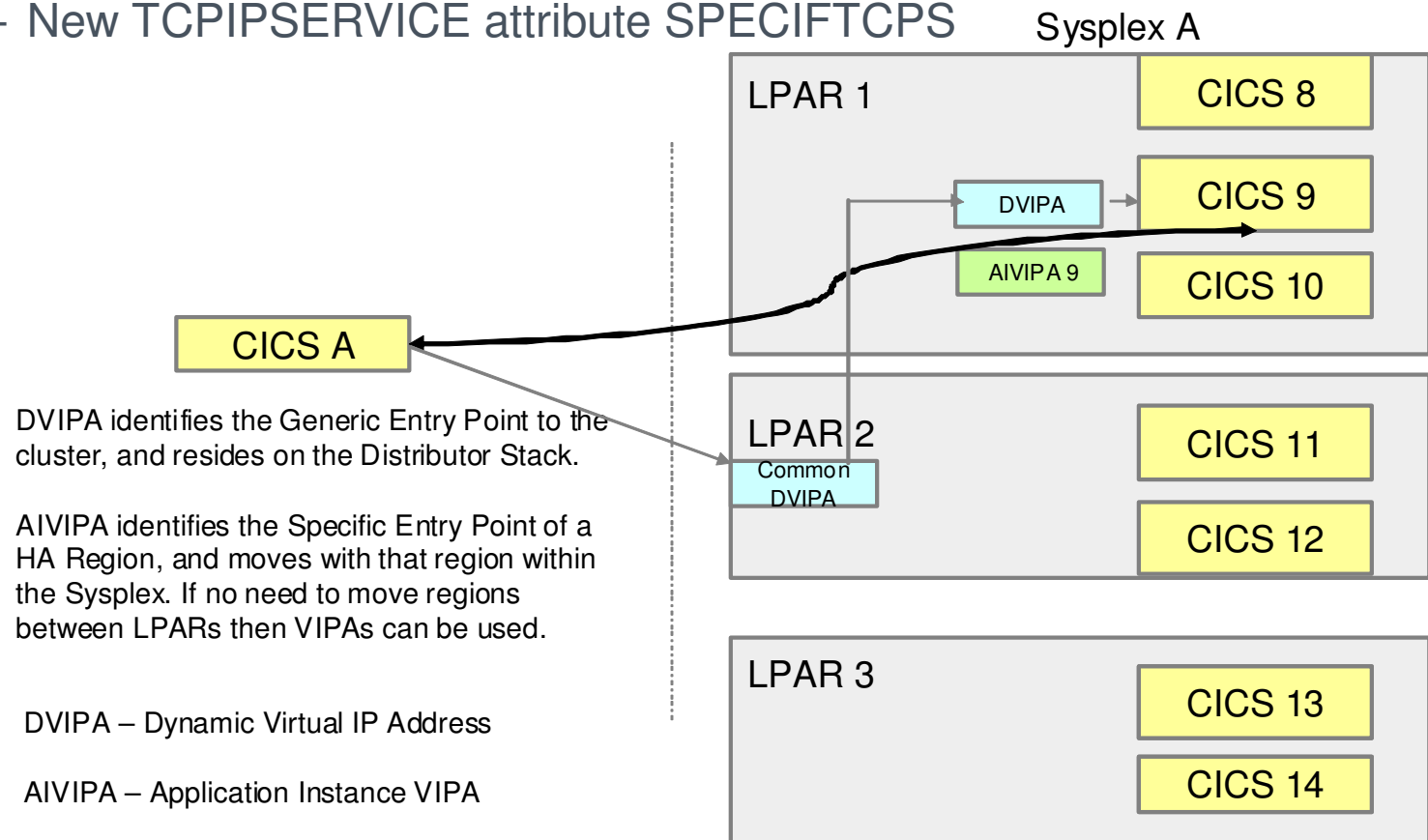
CICS TS V5.2 web services enhancements – Notes

Data mapping for SOAP and JSON web services supports UTF-16 data and more COBOL clauses, including OCCURS DEPENDING ON. With this support, you can represent a larger range of characters in web services application data and the TRANSFORM API. In the CICS® data transformation service for SOAP and JSON web services and the TRANSFORM API, Unicode characters are transformed to UTF-16 data in COBOL, C, C++ and PL/I. Unicode is the widely adopted standard for handling most of the characters in use today and can be used as a basis for globalization of CICS applications. CICS TS V5.2 also supports the COBOL clause OCCURS DEPENDING ON, when the field is last in the structure, and the clause OCCURS INDEXED BY.

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CICS TS V5.2 IPIC High Availability

- IPIC High Availability
 - Allows CICS to connect to a cluster entry point
 - Allows CICS to know the actual endpoint for recovery
 - New TCPIP SERVICE attribute SPECIFTCPS



IPIC High Availability – Notes

IP-connectivity (IPIC) support is extended to support more high-availability scenarios. This support helps to minimize the impact of issues that can arise when CICS® communicates across a wide area network, for example, if the network fails to respond. Groups of regions from CICS Transaction Server for z/OS, Version 5 Release 2 can be clustered together and accessed through a shared TCP/IP end point from other client regions of CICS Transaction Server for z/OS, Version 5 Release 2 . This support enables individual CICS regions to be removed as a single point of failure, while permitting planned or unplanned outages of individual components, and provides a migration path for VTAM® generic resource support when moving from SNA to an IP network

CICS TS V5.3 open beta : Service Agility



Enhanced support for Java and the WebSphere Liberty Profile

Additional Liberty features

Enhanced interoperability

Simplified management

Enhanced Java SE support

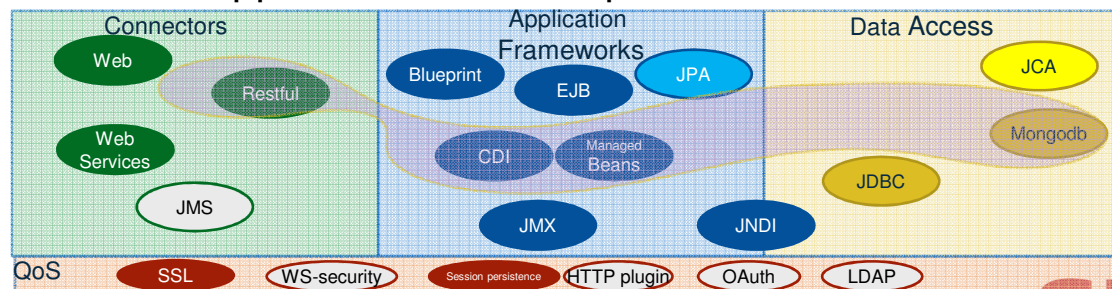
Support for wider range of Java web APIs and application frameworks:

Liberty Profile features added in CICS TS V5.3 open beta:

- Contexts and Dependency Injection (CDI)*
- Enterprise JavaBeans (EJB) Lite subset
- Java Persistence Architecture (JPA) in recent refresh
- Managed Beans*
- MongoDB*
- OSGi Console*
- Session Persistence (JDBC Type 4 driver)*

* Also available in CICS TS V5.2 via APAR PI25503

Existing Liberty features enhanced: EAR support for bundles, SQLJ support for use with DB2 Type 2 driver data sources, transaction support added to Blueprint feature



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CICS TS V5.3 open beta : Service Agility



Enhanced support for Java and the WebSphere Liberty Profile

Additional Liberty features

Enhanced interoperability

Simplified management

Enhanced Java SE support

Technology preview of ability for Liberty Java programs and non-Java programs to call each other using standard CICS API calls:

- JCA (JEE Architecture) for Java applications to invoke CICS programConnectors in any supported language
- EXEC CICS LINK for non-Java CICS programs to invoke Java application running in Liberty JVM server

Liberty **z/OS Connect** feature supported by CICS TS V5.3 open beta*: RESTful APIs with JSON payloads between CICS, mobile devices, and cloud environments.

* Also available in CICS TS V5.2 via APAR PI25503.

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CICS TS V5.3 open beta : Service Agility



Enhanced support for Java and the WebSphere Liberty Profile

Additional Liberty features

Java Management Extensions (**JMX**) can simplify management of Liberty JVM server applications and system objects. Features now supported:

Enhanced interoperability

- Local JMX Connector*
- Monitoring*
- REST connector (for JMX)*

Simplified management

Manage and monitor applications and system objects locally using JMX client API, or remotely using JConsole monitoring tool.

Enhanced Java SE support

Also, simplified process for managing log files: control maximum number of zFS logs, redirect log files to the MVS log, standardized timestamps.

* Also available in CICS TS V5.2 via APAR PI25503.

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CICS TS V5.3 open beta : Service Agility



Enhanced support for Java and the WebSphere Liberty Profile

Additional Liberty features

JMS (Java Message Service) support: Java SE programs in CICS OSGi JVM server can use **WebSphere MQ classes for JMS**, as an alternative to the proprietary WebSphere MQ classes for Java. (Not supported for Liberty JVM servers)

Enhanced interoperability

Easy access to WebSphere MQ for developers familiar with JMS API, CICS MQ attach has been enhanced in support.

Simplified management

Supported in WebSphere MQ for z/OS V7.1 and V8, with:

Enhanced Java SE support

- V7.1 with APAR PI29770 (built on fix pack 7.1.0.6) or later
- V8.0 with base APAR PI28482 and fix pack 8.0.0.2 or later
- CICS TS V5.2 also supported with APAR PI32151

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Service Agility sessions at SHARE



- Monday 1:45 PM-2:45 PM – 17258: Liberté, Égalité, Fraternité – a Mini CICS and WebSphere Revolution (Will Yates)
- Monday 3:15 PM-4:15 PM – 17254: CICS and SOA - What You Don't Know Might Help You (Will Yates)
- Tuesday 11:15 AM-12:15 PM – 17676: What You Need to Know About CICS Java Performance (Ian Burnett)
- Tuesday 1:45 PM-2:45 PM – 17246: 1 Billion Smartphones a Year and Counting – How is Your CICS Connected? (Chris Poole)
- Friday 10:00 AM-11:00 AM – 17255: Connecting CICS with TCP/IP (Gus Kassimis & Will Yates)

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Operational Efficiency



Increased system **capacity**
and capability to achieve
more with less

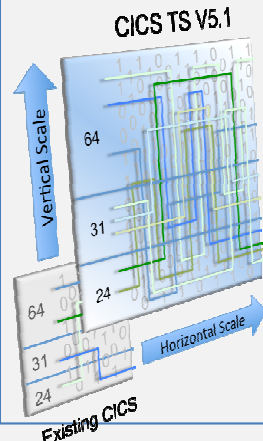
Automatic control of
critical resources using
policies

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CICS TS V5.1 Operational Efficiency



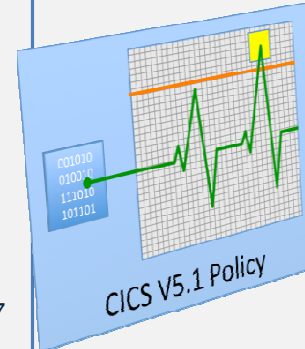
Greater Capacity



- Doubling of the MAXTASK limit to 2,000
- Increased 64-bit and reduced 24-bit storage usage
- Greater parallelism from threadsafe API and SPI
- Greater system parallelism through optimized TCB usage
- Performance improvements from 64-bit Java 7
- Greater access to 64-bit storage from Assembler programs



Managed Operations



- Automated control over critical system resources
- Set data access thresholds on SQL or file access
- Set program loop thresholds on EXEC LINK
- Set storage request thresholds
- Set CPU time thresholds
- Policies can issue messages, abending tasks, or create events



Increased Availability



- Upgrade CICS versions and releases without requiring a z/OS restart
- Modern batch feature pack
- Refresh Secure Sockets Layer (SSL) certificates
- Keep IPIC connections up and running
- Support more IBM GDPS/AA solutions
- Dynamically specify cross-system coupling facility groups
- Better reflect current best practices with updated and simplified defaults



Deeper Insight



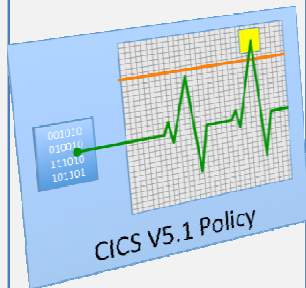
- Auditing of SPI commands that alter the system
- Improved auditing of user IDs that make requests over IP
- Extended identity propagation to include started tasks
- Cipher suites used for SSL connections to be stored in the performance records
- Calculate the actual and potential use of specialty processors
- Regular status updates provided while lost locks recovery is taking place

CICS TS V5.2 Operational Efficiency

Support **distributed security standards** and **automatically safeguard** critical runtime resources,
without requiring additional system code



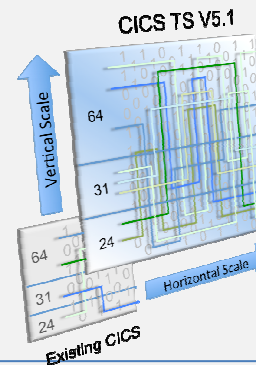
Managed Operations



- Additional threshold policies



Greater Capacity



- Further threadsafe support



Security



- SAML support
- Kerberos Support
- Transaction Channels



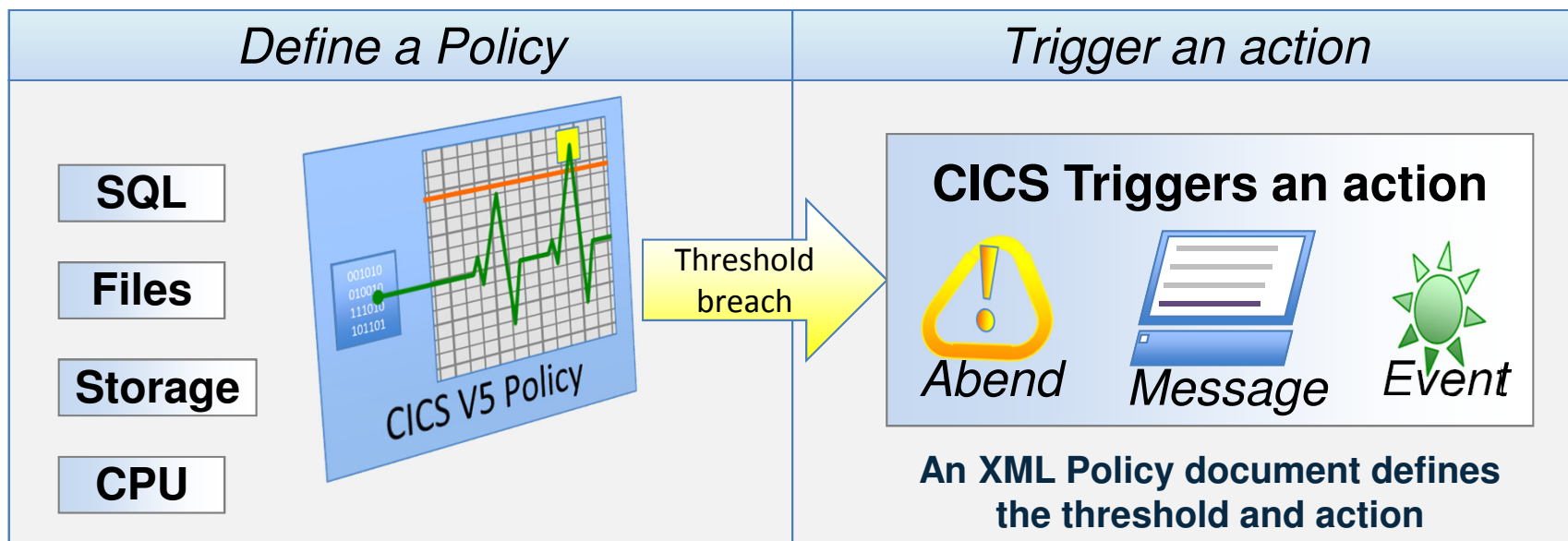
Deeper Insight



- Additional statistics
- Private resource statistics

Operational Efficiency: Threshold Policy

- What is a Policy?
 - Condition and action
 - Action can be:
 - Emit a message
 - Emit a system event
 - Abend the task
- Policies deployed to a specific scope
 - Application scope
 - Operation within an application scope
 - Platform scope
 - No scope (Region scope)



Threshold Policy – Notes

Managed operations are provided through the introduction of policies, which deliver automated control over critical system resources

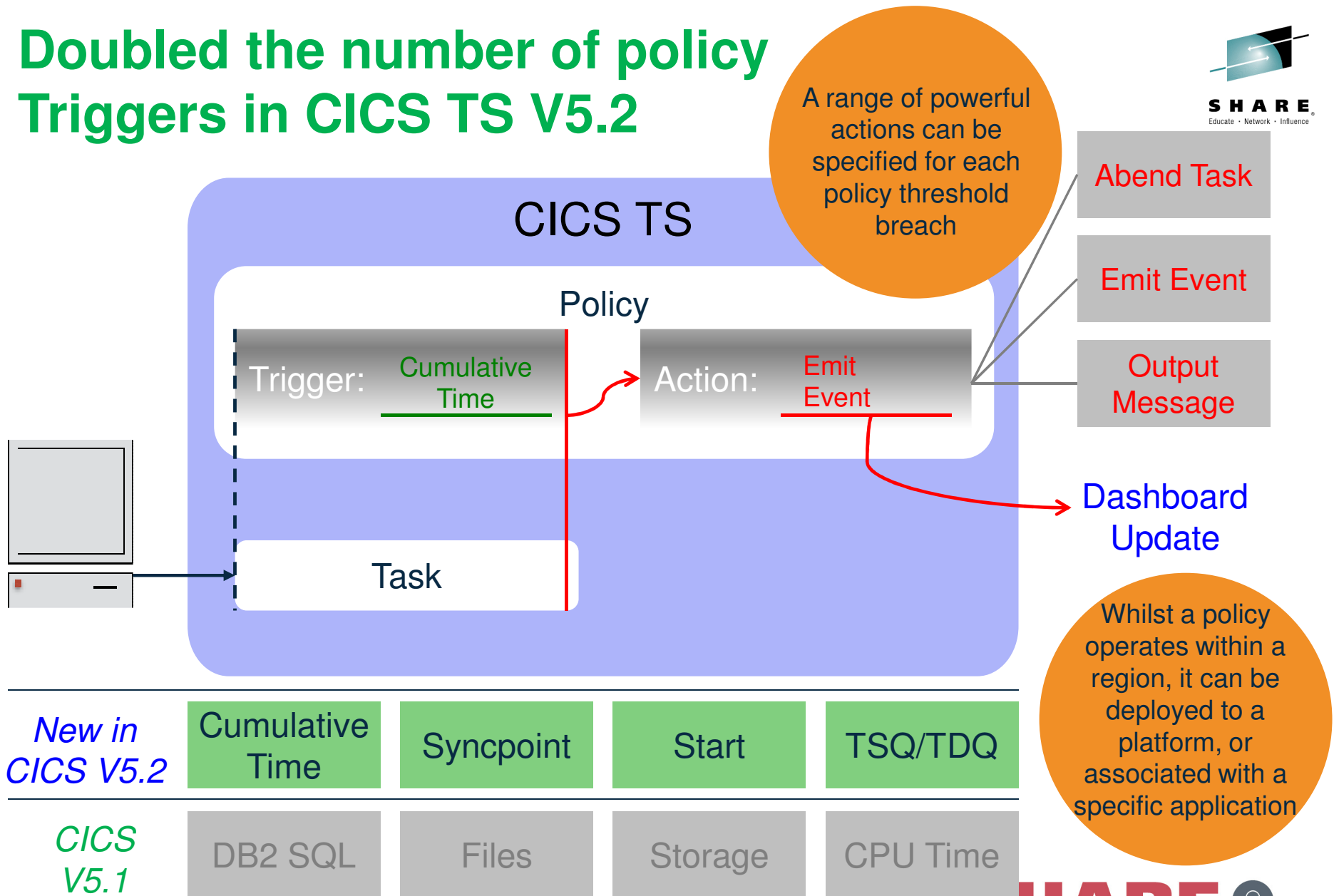
A new, dynamic policy-based management capability is introduced in support of both applications and platforms. Policies enable the behavior of applications and platforms to be managed by determining whether tasks running as part of a platform, as an application, or as types of operation within an application, exceed certain predefined thresholds.

Task thresholds can be set based on data access requests, storage usage, program loops and processor time used. For example, a threshold could be defined based on the amount of above-the-line storage used by a task, the number of times a task accesses IBM DB2 or a file, or the number of EXEC LINK requests issued by a user task.

After a threshold is exceeded, CICS can issue a message, or abend the task with a specific abend. Additionally, policies can be defined to trigger one or more CICS events, which can in turn initiate other actions.

CICS policies are a declarative way of ensuring that applications and platforms continue to run effectively. A policy can be applied to any combination of applications and platforms. Additionally, policies can also be deployed into a single region, independently of defining a platform. Policies are applied dynamically during production operations.

Doubled the number of policy Triggers in CICS TS V5.2



Complete your session evaluations online at www.SHARE.org/Orlando-Eval

CICS TS V5.2 policy triggers – Notes

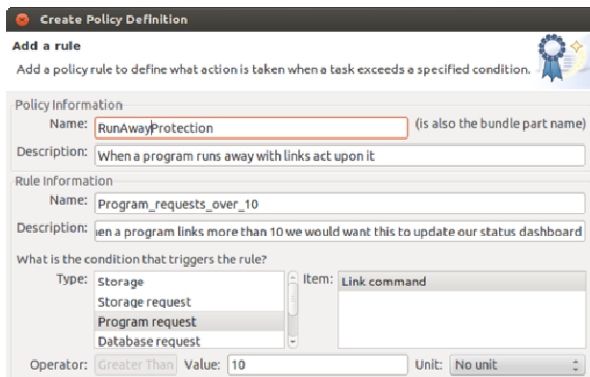
The number of supported policy thresholds in CICS TS V5.2 is expanded to cover a wider range of task thresholds that can be used to trigger autonomic actions.

Thresholds can be set on requests for start, syncpoint, transient data (TD) queues, temporary storage (TS) queues, and elapsed time on a user task.

- New thresholds in CICS TS V5.2
 - Temporary Storage
 - Number of requests or amount of data written
 - Transient Data
 - Number of requests
 - Elapsed Time
 - Check is made at dispatch
 - Action triggered at next API call
 - STARTs
 - Number of requests
 - Syncpoints
 - Number of requests
 - Program Link
 - INVOKE APPLICATION is now included

Policy scenario

Define a policy to trigger an event when an application consumes too much total elapsed CPU time



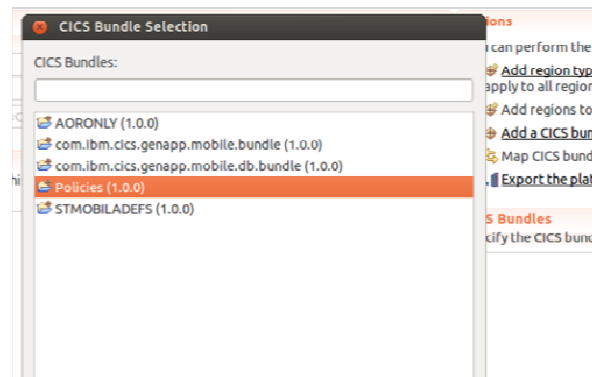
Create Policy Definition

Add a rule
Add a policy rule to define what action is taken when a task exceeds a specified condition.

Policy Information
Name: RunAwayProtection (is also the bundle part name)
Description: When a program runs away with links act upon it

Rule Information
Name: Program_requests_over_10
Description: When a program links more than 10 we would want this to update our status dashboard

What is the condition that triggers the rule?
Type: Storage
Storage request
Program request
Database request
Operator: Greater Than Value: 10 Unit: No unit



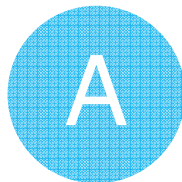
CICS Bundle Selection

CICS Bundles:

- AORONLY (1.0.0)
- com.ibm.cics.genapp.mobile.bundle (1.0.0)
- com.ibm.cics.genapp.mobile.db.bundle (1.0.0)
- Policies (1.0.0)**
- STMOBILEDEFS (1.0.0)

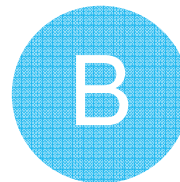
Actions

- Add region types
- Apply to all regions
- Add regions to e
- Add a CICS bundle
- Map CICS bundle
- Export the platf
- S Bundles
- ify the CICS bundle



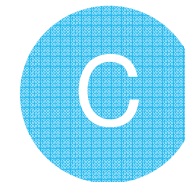
Step 1

Define the policy thresholds and trigger action that CICS should take



Step 2

Associate the policy with the appropriate platform or application and deploy



Step 3

When the threshold is breached, CICS triggers an event, updating an operations dashboard

Complete your session evaluations online at www.SHARE.org/Orlando-Eval

CICS TS V5.2 Security

- Support for TLS 1.2 protocol and FIPS 140.2 Cryptographic Standards
 - FIPS 140.2 mandated by NIST SP800-131A directive
 - Cipher suites can now be defined in XML in a zFS file
 - Greater flexibility and ease of definition
 - APAR PM97207 available for CICS TS 5.1
- System Initialization parameters
 - ENCRYPTION={ALL|TLS12|STRONG|}
 - USSCONFIG={/var/cicsts/dfhconfig|directory}
 - Cipher XML files in USSCONFIG/security/ciphers
- Extend NIST SP800-131A checking beyond sockets domain
 - New System Initialisation parameter
 - NISTSP800131A={NOCHECK|CHECK}
 - CHECK means CICS is required to check for compliance with the NIST SP800-131A security standard
 - Checked by Sockets (SO), Java (SJ) and Pipeline (PI) domains

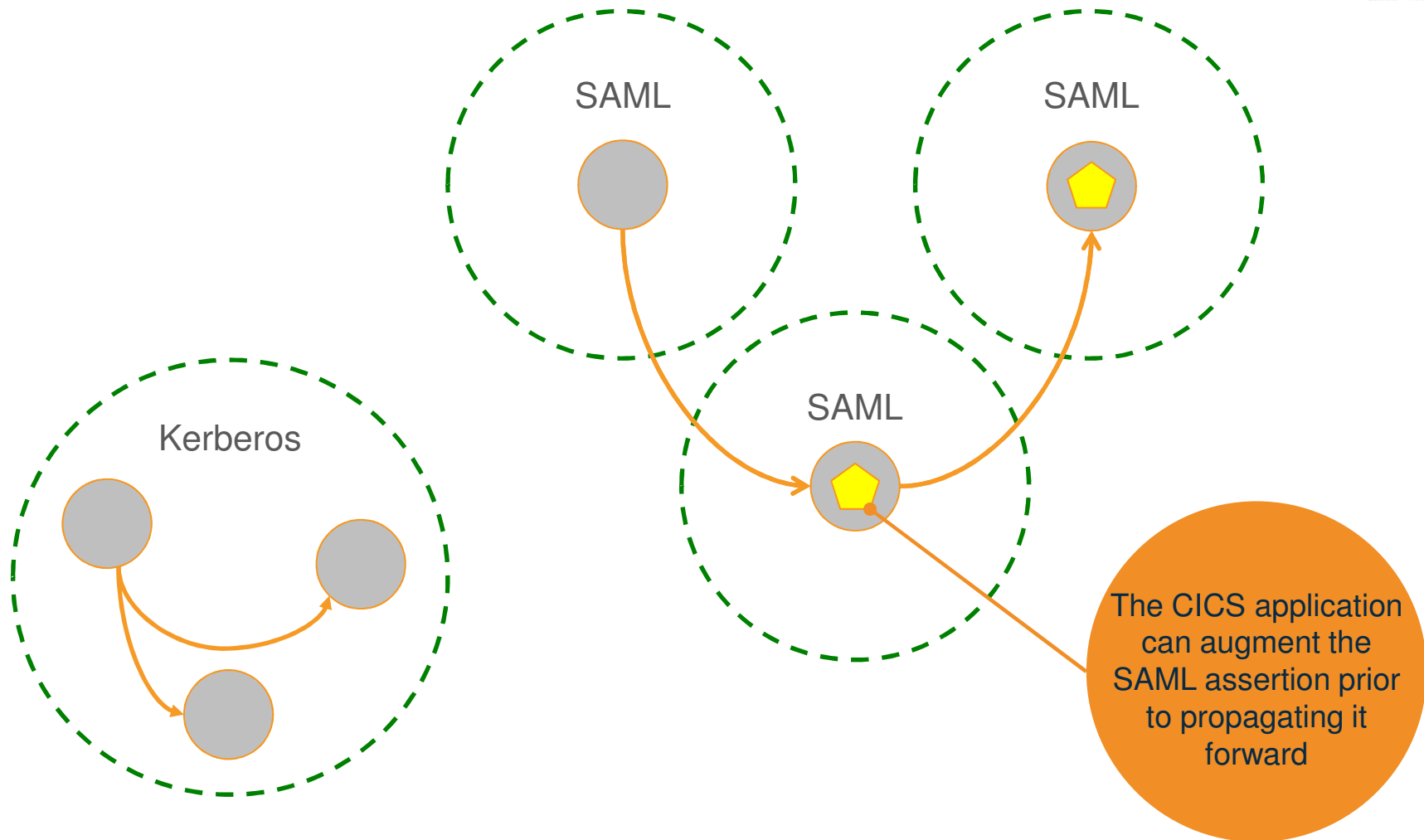
CICS TS V5.2 Security – Notes

Cryptographic ciphers enable CICS to enforce the use of TLS 1.2, and check for conformance to the NIST-SP800-131a security standard.

Support for stronger cryptographic standards allows you to permit all system SSL supported ciphers and protocols, or restrict to those that are supported by Transport Layer Security (TLS) 1.2.

CICS can check and report on conformance to the guidelines in the National Institute of Standards and Technology (NIST) Special Publication 800-131A (NIST-SP800-131A), which includes support for TLS.

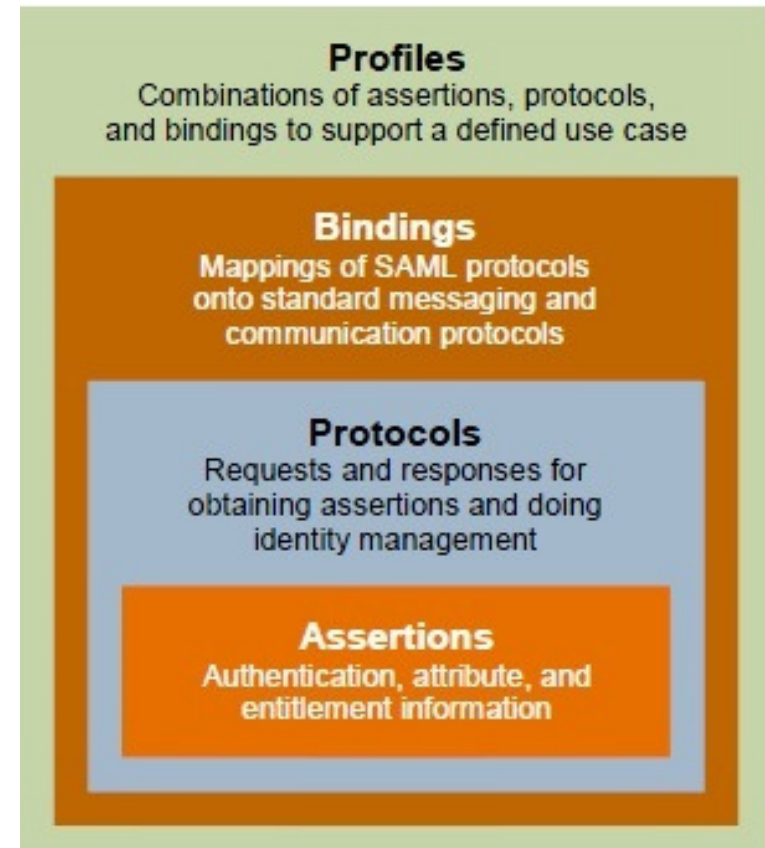
SAML and Kerberos security



Complete your session evaluations online at www.SHARE.org/Orlando-Eval

SAML support

- Security Assertion Markup Language (SAML)
 - OASIS open standard
 - “XML based framework for describing and exchanging security information between on-line business partners.”
 - Web Single Sign-On
 - Dynamic creation of Identity Federations (SSO across domains)



Complete your session evaluations online at www.SHARE.org/Orlando-Eval

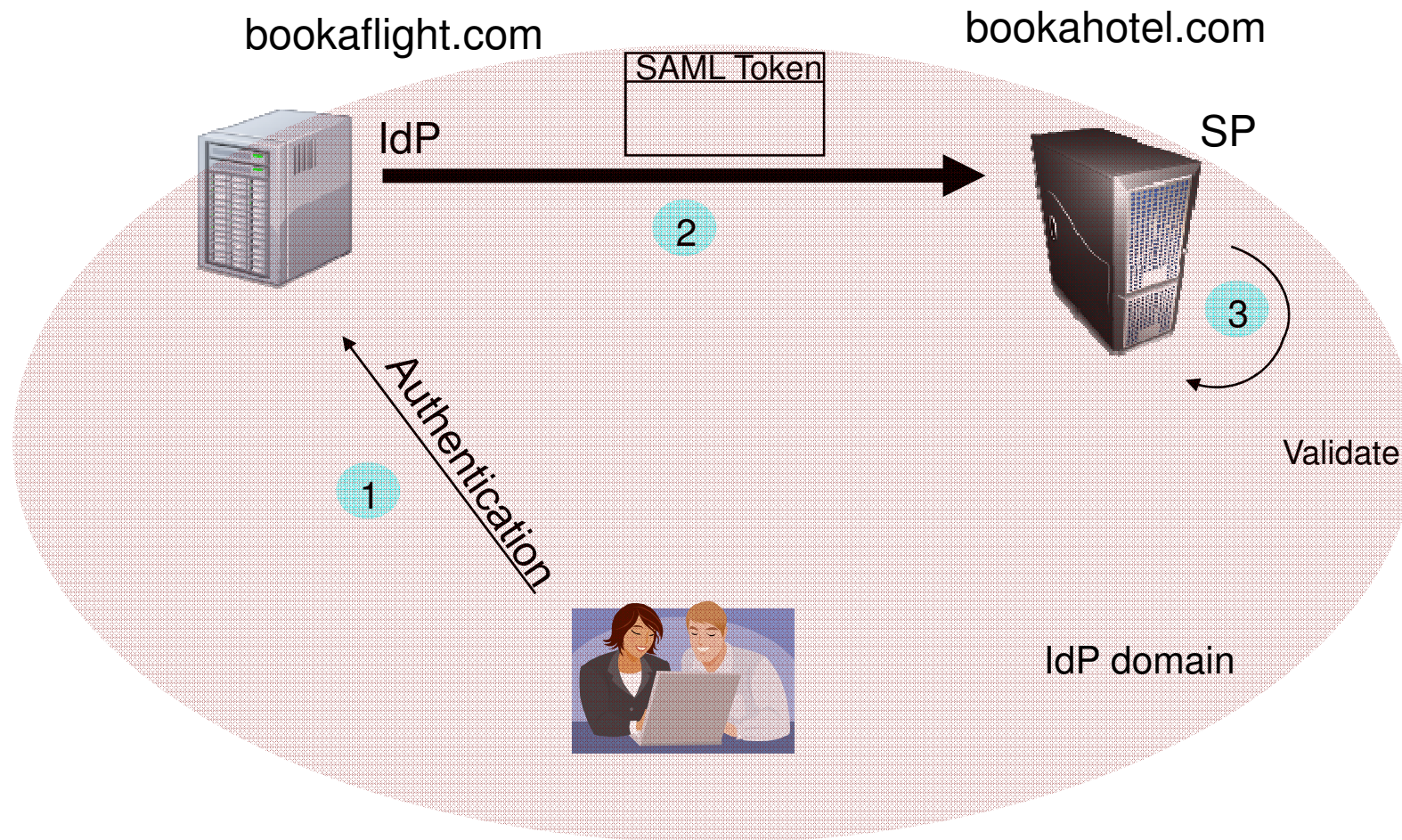
SAML Support – Notes

Security Assertion Markup Language (SAML) is an XML-based framework for describing and exchanging security information between online business partners. This security information is expressed in the form of portable SAML assertions that applications working across security domain boundaries can trust. The OASIS SAML standard defines precise syntax and rules for requesting, creating, communicating, and using these SAML assertions.

SAML provides a solution for a number of problems:

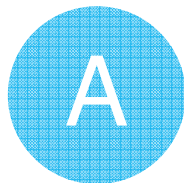
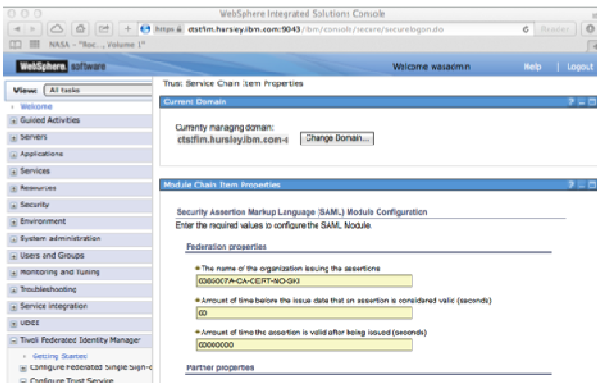
- It provides an open standard for exchanging security information between Service Providers, also known as Federated Identity.
- It provides a means for end-to-end auditing.
- It provides a common source for user role or authority-based information

SAML Example



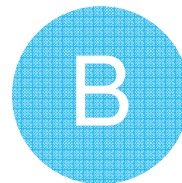
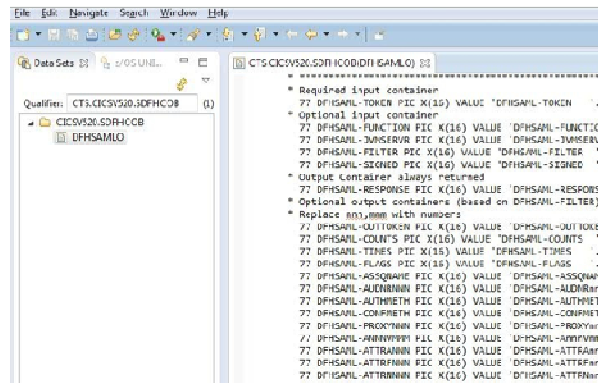
SAML Security scenario

A CICS application developer writes a COBOL program with behavior that's dependent on the SAML security token



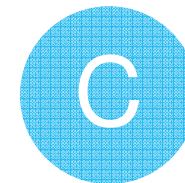
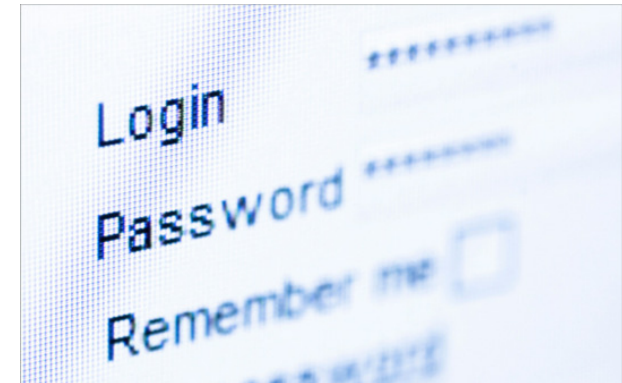
Step 1

Client requests SAML assertion from Tivoli Federated Identity Manager or Datapower



Step 2

CICS COBOL application extracts SAML containers from DFHSAML channel



Step 3

The application can add additional attributes to the assertion for downstream components

Complete your session evaluations online at www.SHARE.org/Orlando-Eval

SAML Scenario – Notes

CICS supports SAML by providing an application programming interface (API), which consists of a linkable interface DFHSAML, a channel, and a set of containers. The API provides the means to enable CICS applications to validate SAML tokens, to extract SAML parts, and to augment SAML assertions by adding attributes.

SAML support for web services provides the following facilities:

- Automatic token validation and extraction of SAML parts for inbound SOAP messages
- Addition of a SAML token into a web service request
- Augmentation of a SAML token before it is added into an outbound SOAP message

Outbound SAML

- Outbound SOAP support for reusing inbound SAML Tokens
 - Previously validated tokens only
 - Requester pipeline retrieves token from DFHSAML-OUTTOKEN container and puts in in WSSE security header of the SOAP request
 - Input SAML token is passed on unchanged
 - Configuration sample samlrequester.xml provided
- Using the DFHTRANSACTION channel
 - No application changes are necessary

Transaction Channel and Containers

- Created for use by SAML, but can be used independently
- No changes to EXEC CICS API
 - A PUT CONTAINER can create the Transaction Channel
 - CHANNEL(“DFHTRANSACTION”)
 - If the Transaction Channel does not exist, a GET CONTAINER command will return CHANNELERR
- New JCICS method in Task class

```
Task t = Task.getTask();  
Channel tranChan = t.getTransactionChannel();
```

Kerberos Support

- Support for inbound tokens from Kerberos systems
- RACF definitions can map the Kerberos principal to a RACF userid
- Web services can be configured to handle Kerberos tokens as the security token
 - Alternatively, the userid extracted from the Kerberos token can be used to run the request
- CICS API enhancement to validate a Kerberos token/extract the RACF userid

EXEC CICS VERIFY

TOKEN() TOKENLEN() TOKENTYPE(KERBEROS)
<ISUSERID(>
<ESM_RESPONSE(> <ESM_REASON(>

Kerberos Support – Notes

CICS TS V5.2 provides support for Kerberos.

CICS supports Kerberos using the external security manager (ESM). The level of support depends on the support provided by the ESM. If your ESM is RACF®, support is based on Kerberos Version 5 and Generic Security Services (GSS).

CICS can verify a Kerberos token by configuring a service provider pipeline or by using the API command VERIFY TOKEN.

Threadsafty in CICS TS V5.2

- New Threadsafty Commands
 - EXTRACT, INQUIRE, SET STATISTICS
 - INQUIRE, SET MONITOR
 - INQUIRE, SET DISPATCHER
 - INQUIRE, SET SYSTEM
 - INQUIRE MVSTCB
 - INQUIRE, SET, DISCARD PROGRAM
 - INQUIRE, SET, DISCARD TRANSACTION
 - INVOKE APPLICATION

Additional statistics

- **Dispatcher Statistics**
 - New fields to **understand TCB pool performance**
 - Last Excess TCB Scan
 - Last Excess TCB Scan–No TCB Detached
 - Pool Limit reached
 - Dispatchable Queue (for single TCB non-Open TCB modes):
 - # dispatchable tasks currently queued for the TCB
 - Peak and Ave. dispatchable tasks that have queued
- **Transaction Statistics**
 - Time MAXTASKS last changed
 - Time last transaction was attached
 - Time MAXTASK was last reached
 - Currently at MAXTASK indicator
- **New Monitoring Domain statistics fields**

• # user transactions ended in interval	• # system transactions ended in interval
• Time last transaction attached	• Time last transaction ended
• MAXTASK at last transaction attached	• Current user tasks at last transaction attached
• Average user response time	• Peak user response time
• Time of peak user response time	• Time of peak user response time

Private resource statistics

- New records to support multi-versioning for private resources
 - Library record
 - JVM Programs
 - Programs
 - Program definitions
- New fields for Platform, Application and Version
- Reports via DFHSTUP

CICS TS V5.3 open beta : Operational Efficiency



Performance optimizations, enhanced metrics, and additional security

Web service optimizations

CICS TS V5.3 open beta delivers optimizations to the CICS Web service infrastructure

Performance improvements

Pipeline processing of **HTTP requests** has been improved, removing the need for an intermediate web attach task (CWXXN transaction) for most types of SOAP and JSON based HTTP CICS Web services, reducing CPU and memory overhead

Enhanced metrics

Additional security options

The optimization can also be used for inbound HTTPS requests using AT-TLS for SSL support (by configuring TCPIP SERVICES as AT-TLS aware)

Even for HTTPS using CICS-provided SSL, improvements have been made by removing a number of TCB switches

Complete your session evaluations online at www.SHARE.org/Orlando-Eval

CICS TS V5.3 open beta : Operational Efficiency



Performance optimizations, enhanced metrics, and additional security

Web service
optimizations

**Performance
improvements**

Enhanced Metrics

Additional security
options

Internal performance improvements in many other areas:

- Exploits some of the hardware instructions introduced with IBM z9, such as STCKF
- Cache alignment for key CICS control blocks
- Reduced lock contention within monitoring algorithms
- Improvements to MRO session management algorithms
- Further tuning of internal procedures

Improvements in efficiency give noticeable improvements in the CICS trace facility, the CICS monitoring facility, and for MRO connections with high session counts

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CICS TS V5.3 open beta : Operational Efficiency



Performance optimizations, enhanced metrics, and additional security

Web service optimizations

*Transaction tracking identifies relationships between application tasks as they flow across CICS systems, and has been extended to transactions started by the CICS-WebSphere MQ bridge. This expands the scope of transactions that can use **transaction tracking**, to help with problem determination, reporting and auditing*

Performance improvements

Enhanced metrics

Metrics have been added to global CICS statistics, including **transaction CPU time** measurements captured without needing CICS monitoring to be active - allows greater insight into CPU resource usage of CICS TS V5.3 open beta regions without the overhead of collecting and processing SMF 110 monitoring records

Additional security options

Complete your session evaluations online at www.SHARE.org/Orlando-Eval

CICS TS V5.3 open beta : Operational Efficiency



Performance optimizations, enhanced metrics, and additional security

Web service optimizations

Performance improvements

Enhanced metrics

Additional security options

New and enhanced security options:

- Support for the Enhanced Password Algorithm implemented in RACF APAR OA43999 – for stronger encryption
- Enhanced support for **Kerberos** via EXEC CICS SIGNON TOKEN command: avoids need to flow a password – applications can validate a Kerberos security token and associate a new user ID with the terminal
- New EXEC CICS REQUEST PASSTICKET API can be used for outbound requests from the current task where basic authentication is required – requests an external security manager, such as RACF, to build a **PassTicket**

Further off-load of authentication requests to open TCBs – reduces contention on RO TCB

Complete your session evaluations online at www.SHARE.org/Orlando-Eval

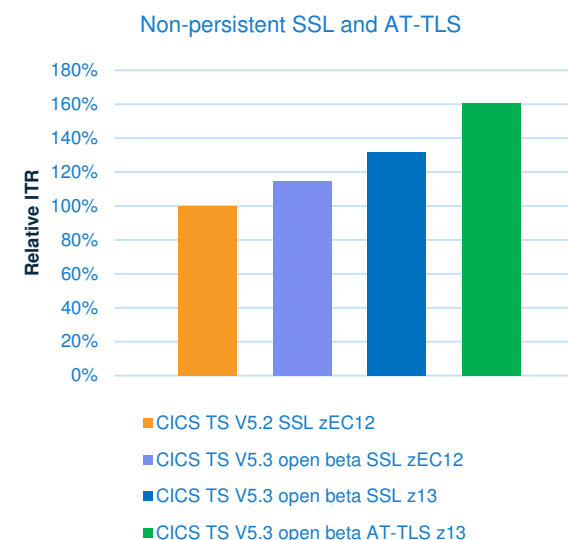
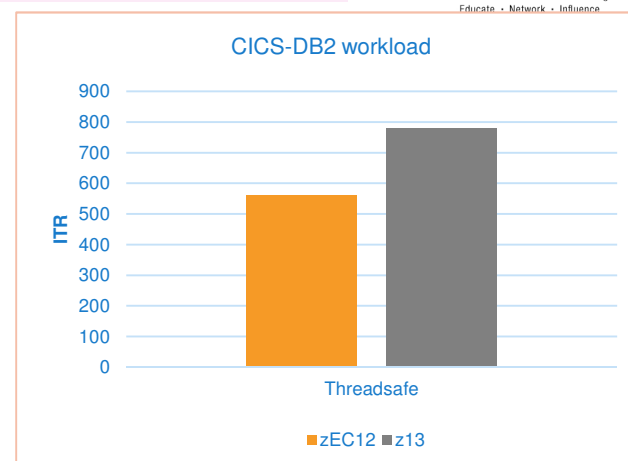
CICS with z13 helps you securely support cloud services and mobile workloads



Workload	Improvement
CICS®-VSAM with function shipping to a file-owning region	24% reduction in CPU per transaction in CICS corresponding to a 31% increase in ITR, when run on z13™ compared with zEC12
Threadsafe CICS-DB2	28% reduction in CPU per transaction in CICS on z13 compared with zEC12, corresponding to a 39% increase in ITR
SSL over HTTP with persistent sessions	35% reduction in CPU per transaction in CICS for SSL over HTTP, exploiting improved CPACF on z13 compared with zEC12
Non-persistent SSL or AT-TLS into a single CICS region	61% cumulative increase in ITR between CICS TS V5.2 on zEC12 using SSL and CICS TS V5.3 open beta on z13 using AT-TLS
CICS workload driven by SSL with full handshake	22% reduction in CPU per request and 77% reduction in response time on z13 compared with zEC12

ITR: Internal Throughput Rate – a measure of throughput per CPU busy second

Disclaimer Performance is based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput or performance that any user will experience will vary depending upon many factors, including considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve results similar to those stated here. Some measurements were obtained using beta developmental code. All measurements were run multiple times, and the results were averaged, and the results were repeatable to within 1%.



Complete your session evaluations online at www.SHARE.org/Orlando-Eval



Operational Efficiency sessions at SHARE



- Tuesday 10:00 AM-11:00 AM – 17253: CICS TS V5 Performance Improvements that You Definitely Don't Know About (Ian Burnett)
- Tuesday 11:15 AM-12:15 PM – 17676: CICS Java Performance (Ian Burnett)
- Tuesday 3:15 PM-4:15 PM – 17264: CICS Extreme Performance (Ed Addison)
- Tuesday 4:30 PM-5:30 PM – 17398: Handling CICS SOS Conditions (Gene Hudders)
- Wednesday 8:30 AM-9:30 AM – 17396: Holistic CICS Performance and Capacity Management (Ivan Gelb)
- Wednesday 1:45 PM-2:45 PM – 17248: CICS Policy Based Management – There's a New Sheriff in Town (Chris Poole)
- Wednesday 3:15 PM-4:15 PM – 17564: CICS Performance and Tuning 101 (Ezriel Gross)
- Thursday 11:15 AM-12:15 PM – 17646: Can CICS Be Hacked? Are Yesterday's Practices Today's Exposure? (Leigh Compton)
- Thursday 3:15 PM-4:15 PM – 17265: Monitoring CICS TS Version 5 Application Performance (Billy Bigelow)
- Friday 8:30 AM-9:30 AM – 17401: Securing MQ Initiated CICS Workload (Lyn Elkins)

Cloud Enablement



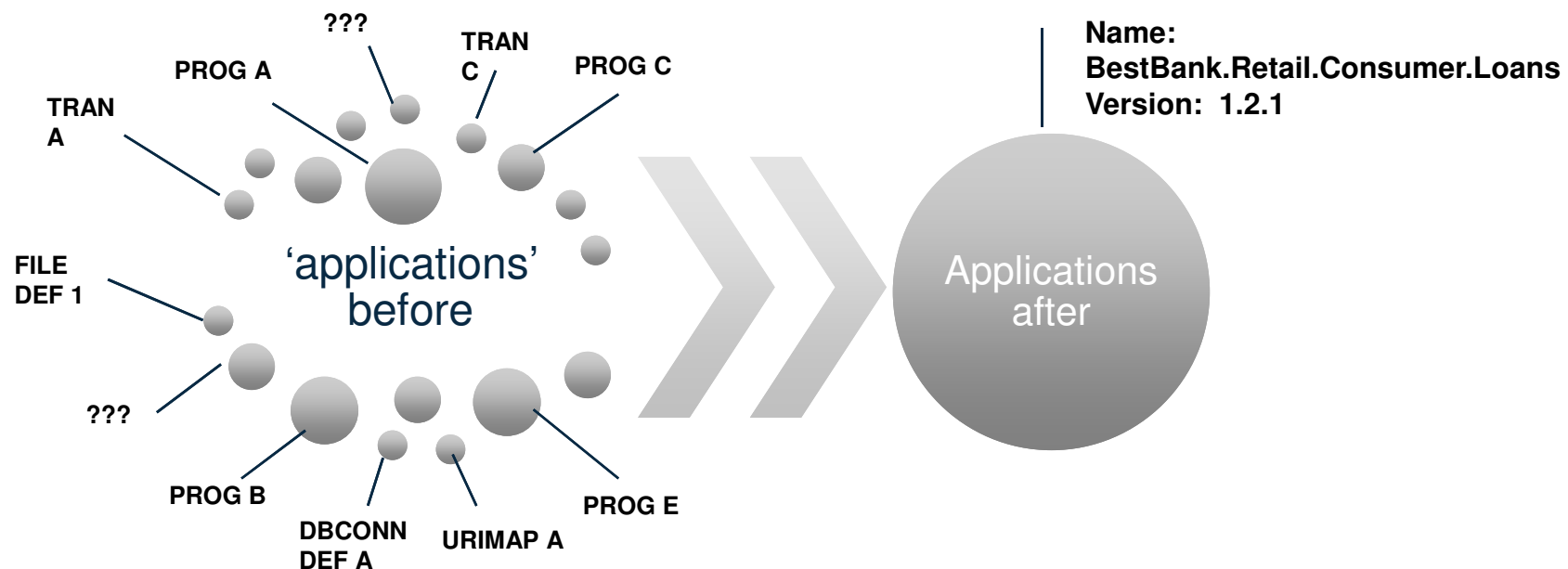
**Simplified system
management and rapid
application deployment**

**On premise pattern based
cloud deployment**

Complete your session evaluations online at www.SHARE.org/Orlando-Eval

Cloud & DevOps

Packaging CICS resources into an application bundle means they can be deployed, managed, and monitored throughout the lifecycle as a single entity

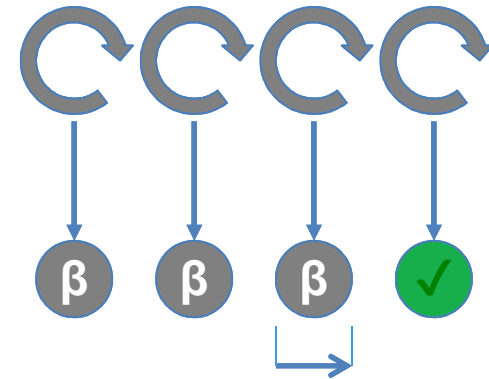
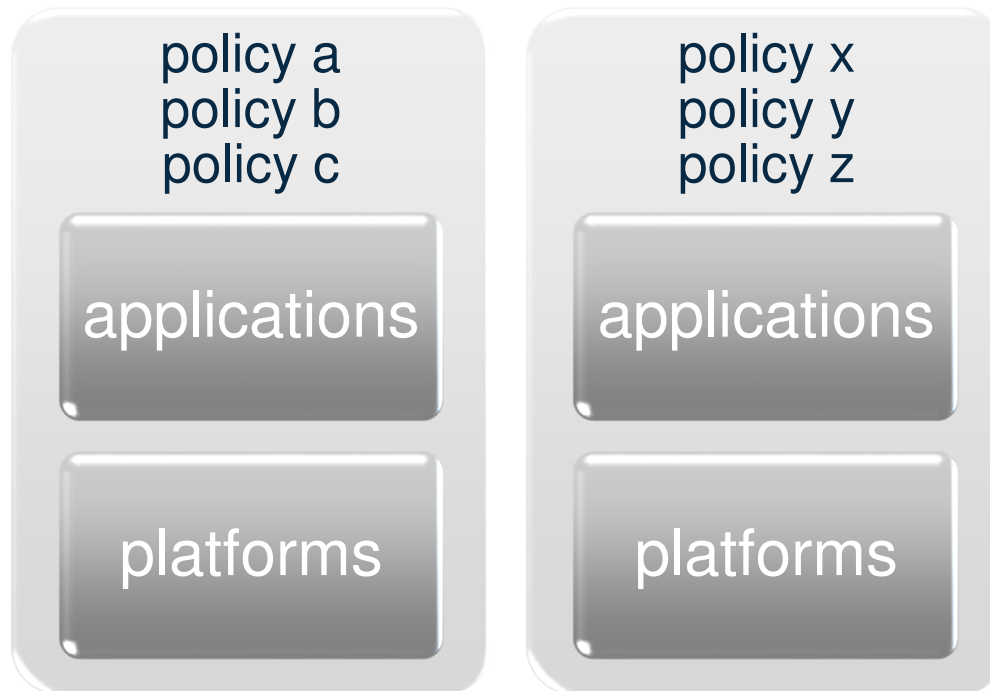


The Forecast is Cloudy...

Complete your session evaluations online at www.SHARE.org/Orlando-Eval

Cloud & DevOps

Applications, running on Platforms, managed according to a set of Policies,
and deployed using DevOps



...with a Strong Chance of DevOps

Complete your session evaluations online at www.SHARE.org/Orlando-Eval

CICS TS V5.1 Summary

Operational Efficiency

- **Greater capacity** - achieve cost savings through consolidation
- **Managed operations** - control critical resource thresholds with policies
- **Increased availability** - reduce the need for planned downtime
- **Deeper insight** - extend performance and compliance information



125+
requirements
satisfied!

Service Agility

- **First-class applications** - create agile services from existing assets
- **First-class platforms** - create agile service delivery platforms
- **Modern interfaces** - build rich web experiences for critical applications
- **Foundational enhancements** - extend core capabilities

... with Cloud Enablement

Consistent with the IBM Cloud Computing strategy
Positioning customers for the next transformational era in technology
Moving towards a cloud oriented service delivery platform

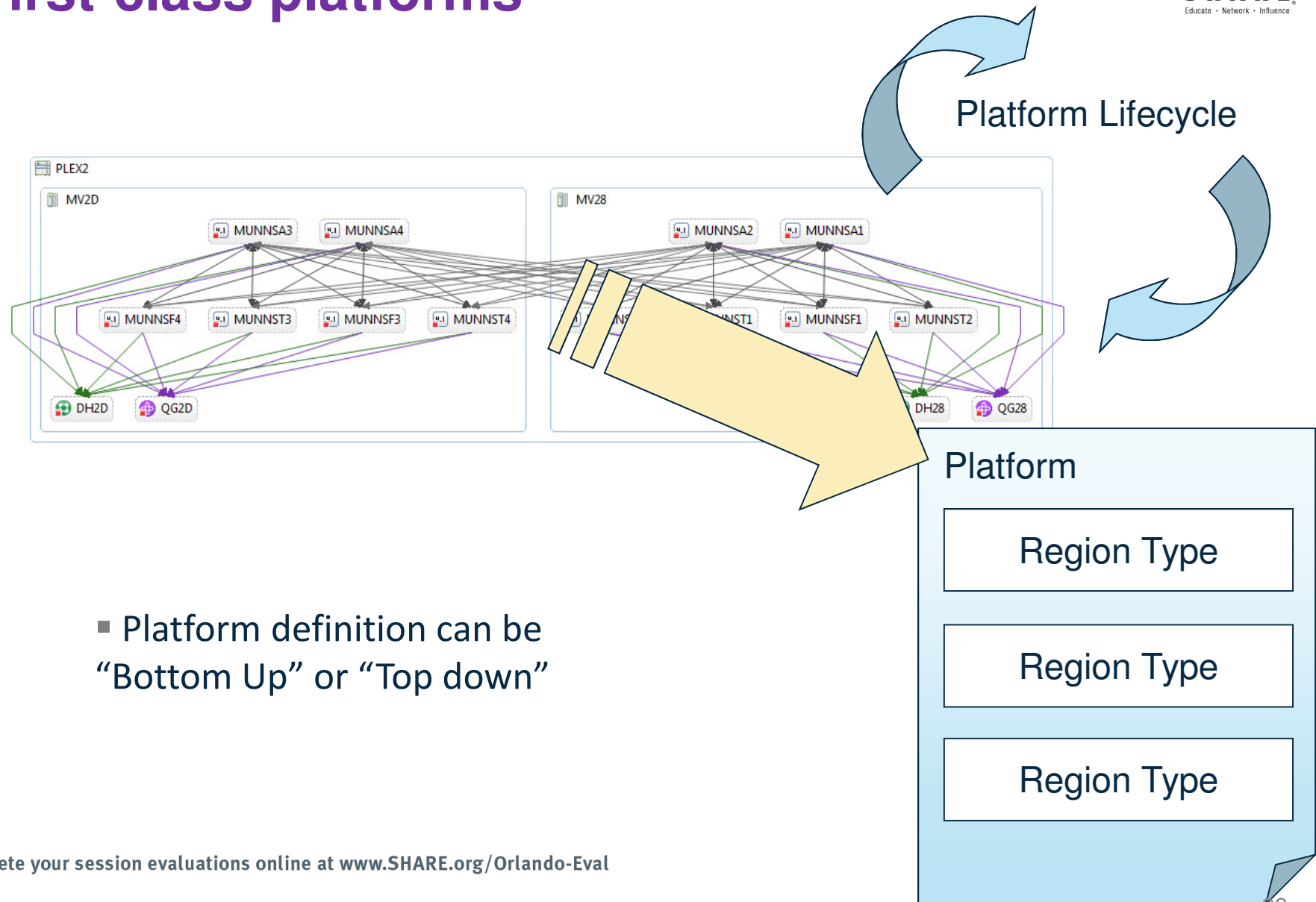
CICS TS V5.2 Cloud Enablement

Deploy and manage several versions of a multi-program application and run them concurrently,
without requiring additional regions



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First-class platforms



Complete your session evaluations online at www.SHARE.org/Orlando-Eval

First-class platforms – Notes

You can package a CICS platform into a platform bundle to deploy, manage, and monitor it as a single entity. With a platform bundle, you can install and manage the resources for the platform in all of the CICS regions in a platform.

You can use platforms to help you manage your requirements as a single entity. This has a number of benefits; for example:

- You can manage legal requirements for specific geographies.

- You can manage applications, resources, and policies as a group.

- You can manage system characteristics in one place.

- You can monitor applications or system resources as a group.

You can monitor platforms as a logical whole, helping users to manage resource usage and process internal charge-back billings.

- You can easily drill down to the resource consumption of individual resources.

You can undertake problem determination starting with the overall platform and drilling down to individual applications, resources, and policies.

Use a platform instead of a CSYSGRP when you want to manage several groups of systems as a single entity. A CSYSGRP is a method of grouping CICS regions together. A platform provides a point of control for deploying, managing, and monitoring the lifecycle of several groups of systems as a single entity.

First-class applications



Application Lifecycle

INSTALL
ENABLE
DISABLE
DISCARD

Application

Name

- org.maw.banking.Loans

Version

- 1.2.1

Resources

- LIBRARY, PROGRAM, TRANSACTION, URIMAP
- (EVENTBINDING, OSGIBUNDLE, ...)

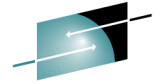
Dependencies

- DB2CONNECTION, JVMSERVER, TCPIPSERVICE, ...

Entry points

- operation: browse, update, ...
- resource: PROGRAM

- A collection of one or more CICS bundles
- Life-cycle as a single entity
- Measure and control resource usage
- Develop in Eclipse/Rational
- Share and promote through SCM



SHARE
FORUM NETWORK COMMUNITY

First-class applications – Notes

You can package a CICS® application into an application bundle to deploy, manage, and monitor it as a single entity. With an application bundle, you can install and manage the resources for the application in all of the CICS regions in a platform.

- Dependency management is handled by CICS, and multiple applications can share individual resources.
- Applications can be monitored as a logical whole across multiple CICS regions within a platform, helping users to manage resource usage and process internal charge-back billings.
- The ability to drill down to the resource consumption of individual application operations is simplified.
- Problem determination can start with the overall application and drill down to individual tasks and resources.

When you have developed a CICS application, you can use the CICS Explorer® to package it for deployment into a Platform. If your application includes Java™, use the CICS Explorer SDK.

To package an application, you first create a CICS bundle for each application component. In the bundle manifest, the CICS bundle declares all the resources that are needed for the application component, grouping them together and enabling you and CICS to manage them as a single entity. The bundle also declares any dependencies on other resources outside the bundle that must be available in the CICS region where the application component runs.

To group together all the resources for all the application components, you then create an application bundle. The application bundle is a type of management bundle that describes the whole application. The application bundle references the CICS bundles that contain the dependencies and resources for each of the application components. When you have created the application bundle, you can export it to the platform where you want to run the application. Each platform has a home directory in zFS where applications and policies are stored.

You also create an application binding to define how the application is deployed to a platform. The application binding is an association that maps the bundles in an application to the region types in the target platform. For example, three bundles might be installed into a single CICS region, or one bundle might be deployed to a region type within the platform, and the other two bundles deployed to another region type within the platform. You may also create more complex application bindings to deploy different bundles to different platforms and region types. The application binding is also stored in the home directory for the platform in zFS.

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CICS TS V5.2 Cloud Enablement



- Bundle definition support for additional resources
 - FILE
 - JVMSERVER
 - TCPIPService
 - PIPELINE
 - WEBSERVICE

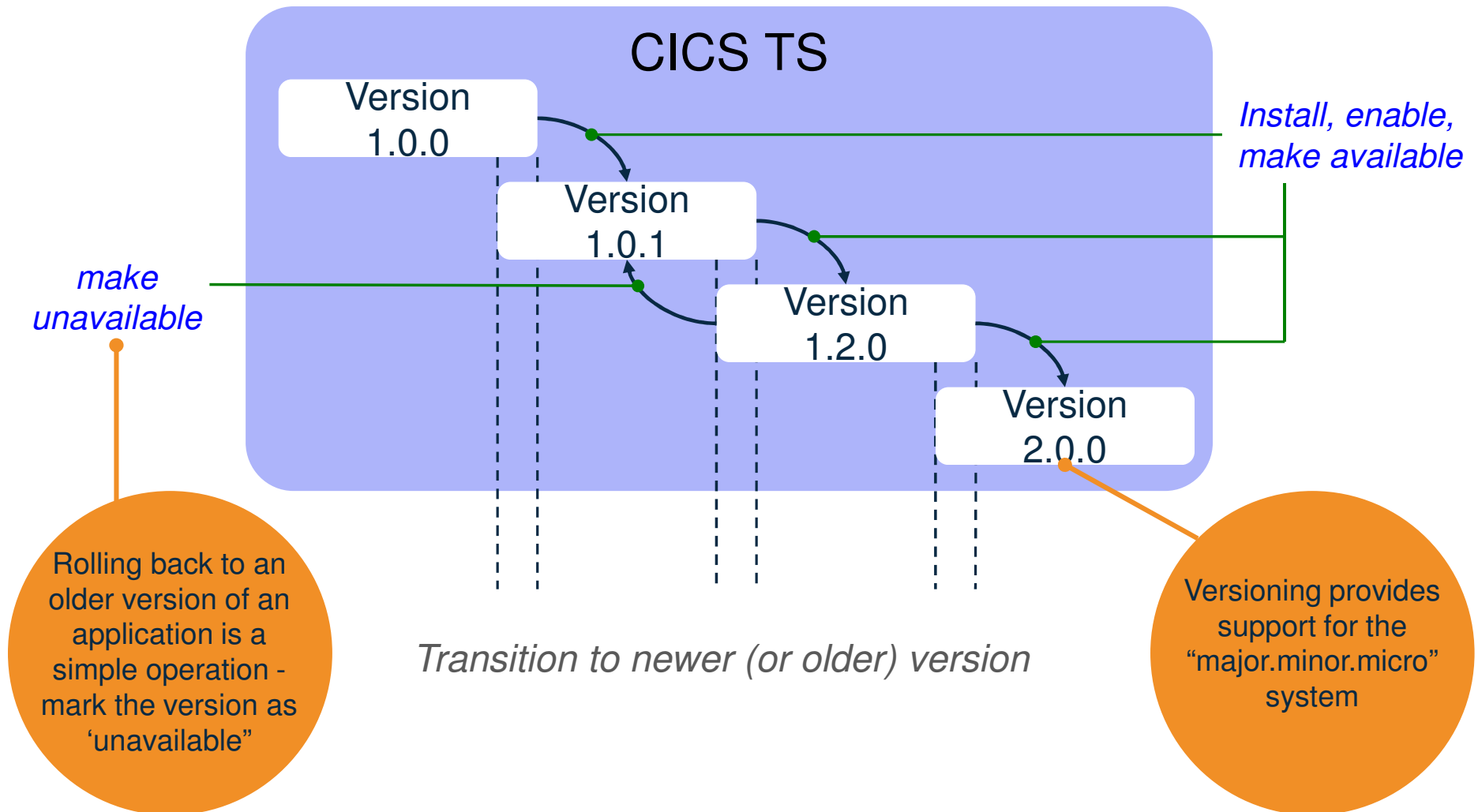
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CICS TS V5.2 Cloud – Notes

The types of resources that can be defined in CICS bundles and managed as part of a platform have been broadened in CICS TS V5.2 to include files, JVM servers, pipelines, TCP/IP services, and web services. In addition, library and program resources that are defined in CICS bundles as part of an application are made private to that version of the application. This facility avoids resource name clashes between applications and application versions, and is particularly useful for server consolidation.

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Application Multi-versioning



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Application multi-versioning – Notes

CICS TS V5.2 enables a platform to host multiple versions of the same application, and multiple applications at the same time. New versions of an application can be deployed to the platform without the need to disable or remove the previous version, and be made available to users without service interruption. This can improve service agility and reduce the business risk of deploying applications as users can be progressively switched to the new version to gain confidence in it, or switched to an older version if there are any issues.

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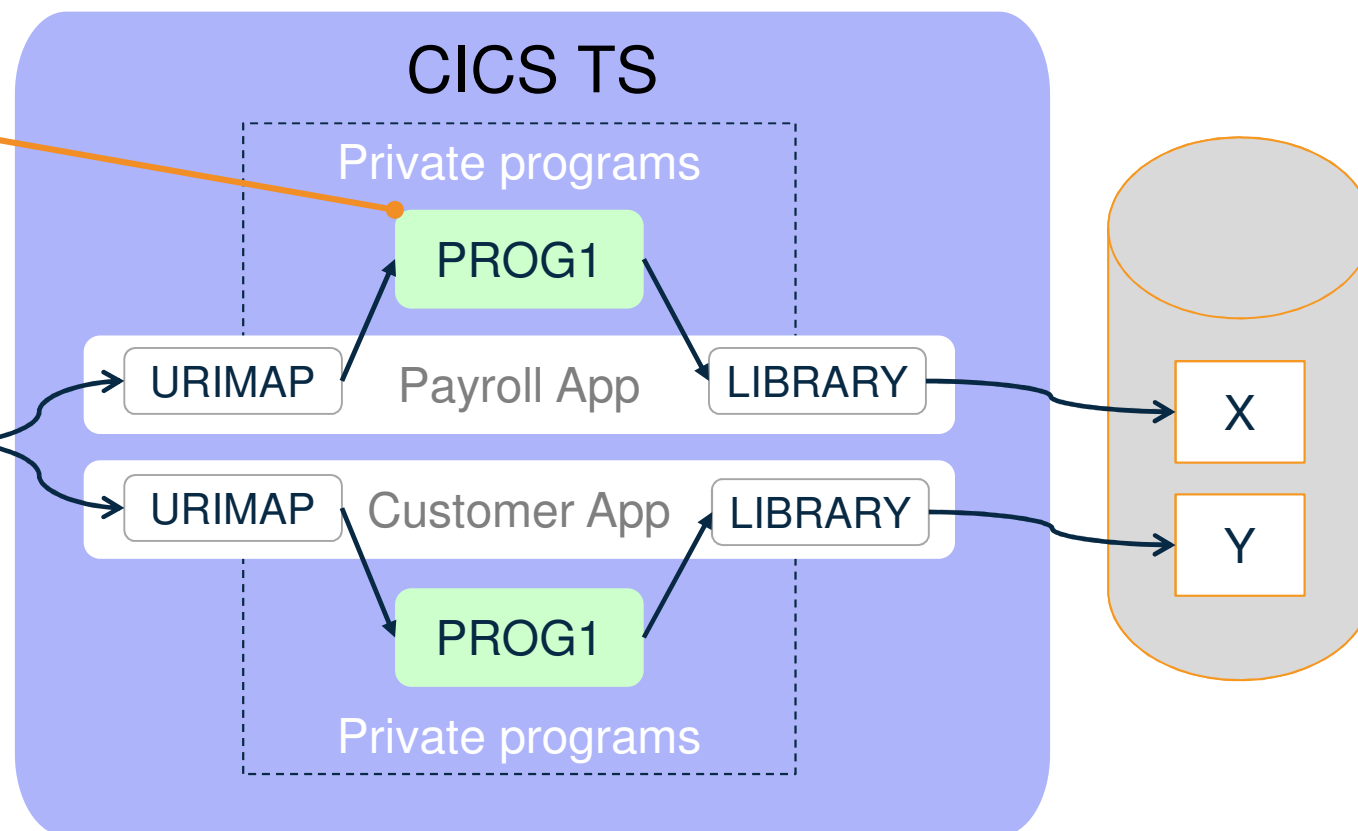
Multi-versioning for region consolidation

Application packaging helps you consolidate onto fewer regions by providing private program definitions



Resources private to an application

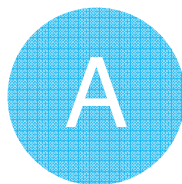
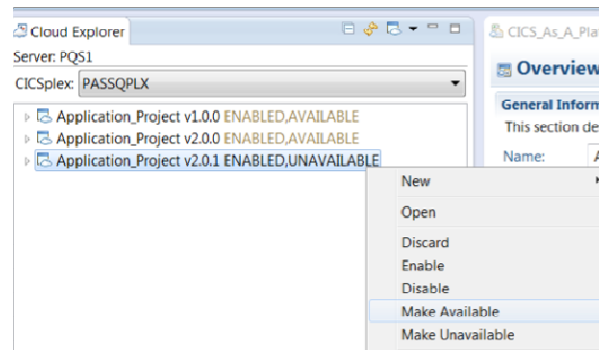
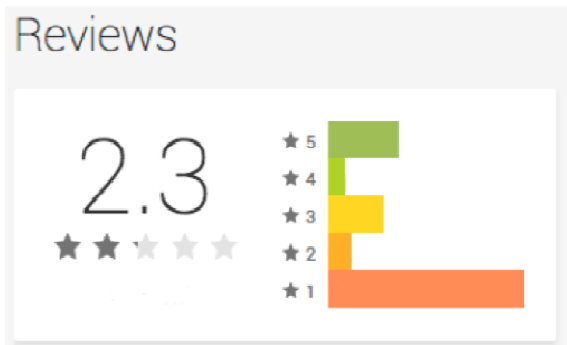
PROGRAM LIBRARY



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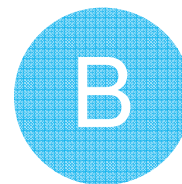
A multi-versioning scenario

A bug has been found and an urgent fix is required immediately



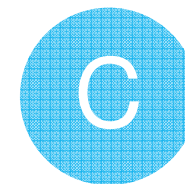
Step 1

After fixing the bug in the code, repackage it with a new micro version number



Step 2

Once installed, switching to a new version of the application is simply a case of making it “available”



Step 3

CICS takes care of moving clients to the new version of the application across all regions within a platform

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CICS TS V5.3 open beta : Cloud with DevOps



New cloud and DevOps support to automate CICS deployments

Automated builds

Cloud applications and bundles: a convenient way to package and manage components, resources, and dependencies in CICS

Scripted
deployments

UrbanCode Deploy
support

Enhanced cloud
enablement

CICS TS V5.3 open beta introduces the **CICS Build Toolkit** – provides a command-line interface for automating the building of CICS projects created using CICS Explorer. CICS cloud applications and bundles, as well as OSGi Java components, can be automatically built from source code

Could be called as part of a script to automatically rebuild an application when a developer makes updates

CICS build toolkit supported on z/OS, Linux and Microsoft Windows; supports CICS TS V4.1 and later



Complete your session evaluations online at www.SHARE.org/Orlando-Eval

CICS TS V5.3 open beta : Cloud with DevOps



New cloud and DevOps support to automate CICS deployments

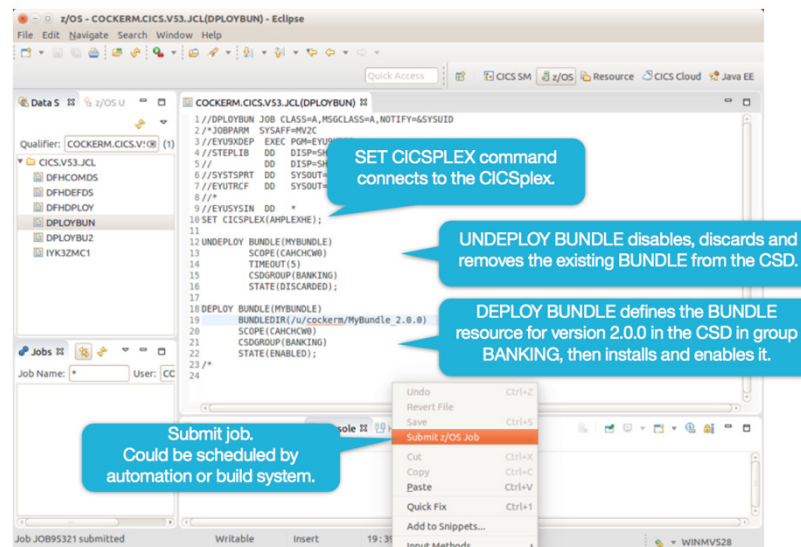
Automated builds

Scripted
deployments

UrbanCode Deploy
support

Enhanced cloud
enablement

- A built CICS project in zFS can be programmatically deployed across CICS systems using a set of scripting commands
- **DFHDPLOY** – new batch utility to support automated provisioning of CICS bundles, OSGi bundles within CICS bundles, and CICS applications
- DFHDPLOY commands can be used to deploy CICS bundles and CICS applications into a desired state, such as 'enabled' or 'available' as well as undeploy and remove them



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CICS TS V5.3 open beta : Cloud with DevOps



New cloud and DevOps support to automate CICS deployments

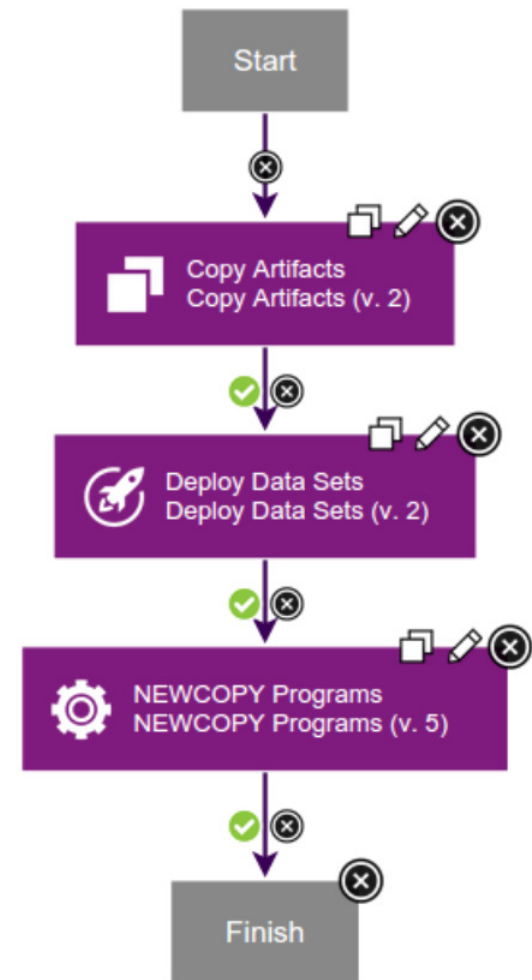
Automated builds

Scripted
deployments

**UrbanCode
Deploy support**

Enhanced cloud
enablement

- *IBM UrbanCode Deploy orchestrates and automates deployment of applications, middleware configurations, and database changes.*
CICS TS plug-in for UrbanCode Deploy supports the deployment of CICS applications as part of these orchestrations
- CICS TS plug-in provides functions for installing and removing resources, NEWCOPY and PHASEIN for programs, and performing a pipeline scan
- UrbanCode Deploy plug-in for CICS TS V4.1 and later at
<https://developer.ibm.com/urbandcode/plugin/cics-ts/>



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in Orlando **2015**  
81

CICS TS V5.3 open beta : Cloud with DevOps



New cloud and DevOps support to automate CICS deployments

Automated builds

Enhancements to core CICS cloud capabilities:

Scripted
deployments

New **threshold policies** for number of WebSphere MQ requests, DL/I requests, named counter requests, and shared temporary storage requests issued by a CICS task – there are now 14 types of thresholds against which an action can be triggered

UrbanCode Deploy
support

**Enhanced cloud
enablement**

Support for **transaction entry points** added for CICS cloud applications (in addition to program and URIMAP entry points already provided) – scope policies to be specific to a particular transaction ID

Recovery of the application infrastructure enhanced – the available or unavailable state of an application is automatically recovered across CICS restarts

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Cloud Enablement sessions at SHARE



- Wednesday 10:00 AM-11:00 AM – 17677: CICS Cloud + CICS DevOps = Agility2 (Chris Poole)
- Wednesday 1:45 PM-2:45 PM – 17248: CICS Policy Based Management – There's a New Sheriff in Town (Chris Poole)
- Wednesday 4:30 PM-5:30 PM – 17256: Five CICS Multi-versioning Scenarios that Reduce the Risk of Change (Catherine Moxey)
- Thursday 10:00 AM-11:00 AM – 17572: CICSplex SM - A Minimalist Approach (Ezriel Gross)
- Also
 - Wednesday 11:15 AM-12:15 PM – 17261: The Future of CICS is Closer than You Might Think (Andy Bates, with Catherine Moxey)
 - Thursday 4:30 PM-5:30 PM – 17251: CICS Q-Box and Hursley Roundtable Discussion

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CICS Explorer



Simple, integrated and
intuitive way of
managing CICS systems

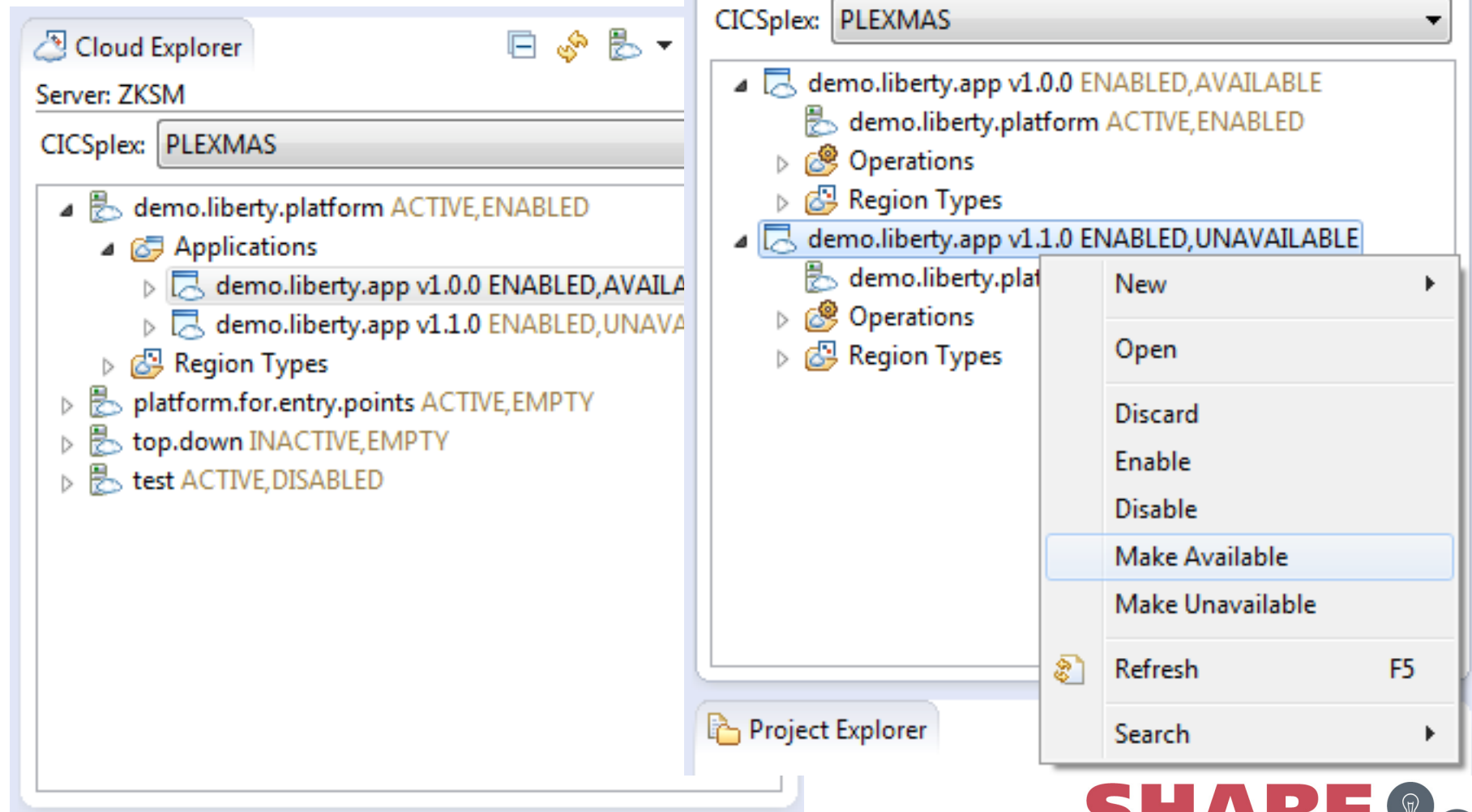
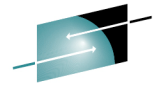
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CLICS Explorer support for CLICS TS V5.2

- Support for new Bundle and Policy definitions
- Purge action for shared TS Queues
- Mixed case credentials
- System group editor
- New views
 - Dumps
 - Task related user exits
 - Repository view
 - Active workloads

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CICS Cloud Explorer



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CICS Explorer – Notes

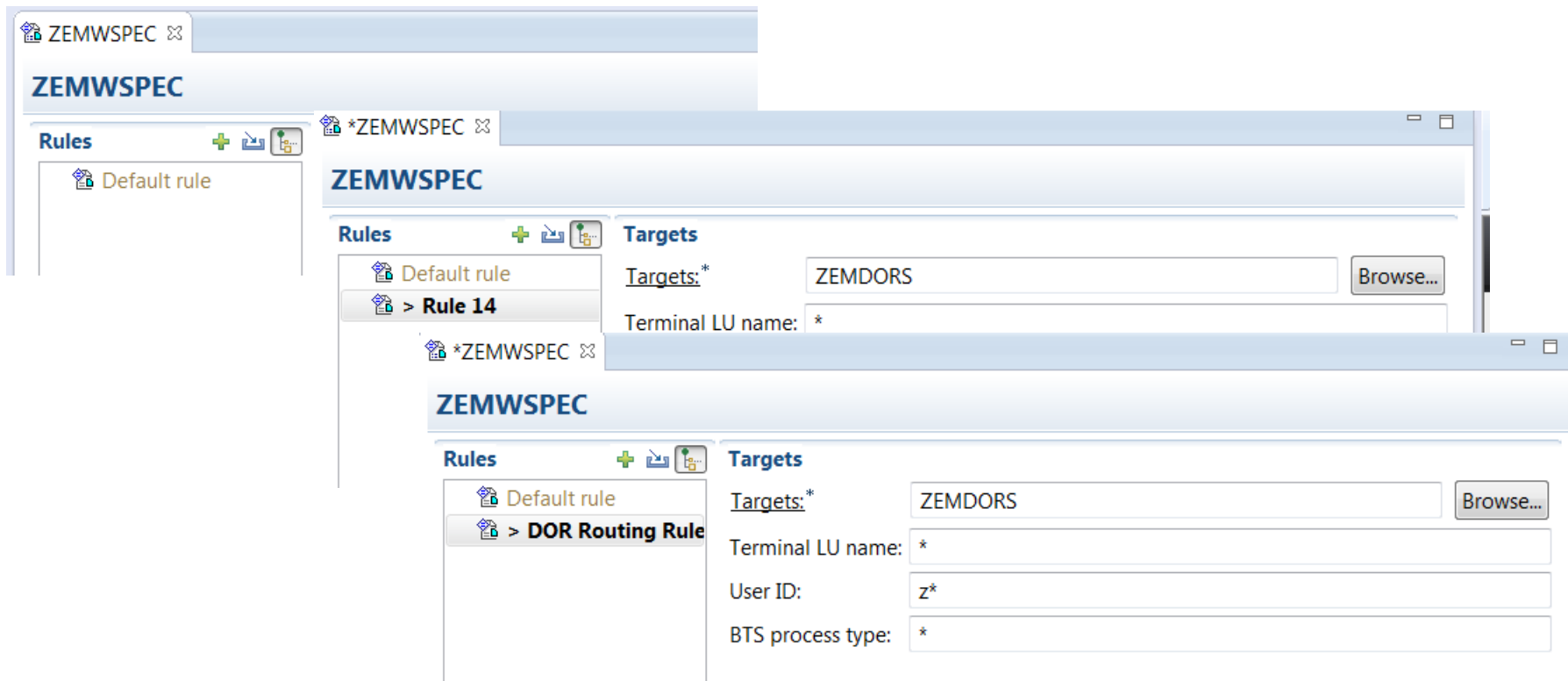
CICS Explorer is the strategic management interface for CICS TS. CICS Explorer V5.2 is updated to include support for the new and enhanced capabilities of this CICS TS deliverable, such as:

- * Enhanced support for CICSplex SM WLM
- * Improvements in support for modification of associated CICSplex SM workload definitions, using a new sophisticated editor
- * Intuitive access to information about the state of running workloads

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CICS Explorer V5.2 – workload specification

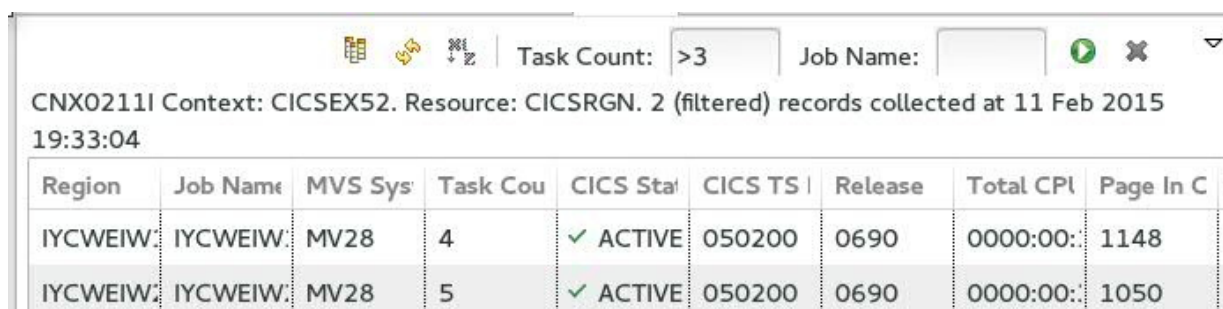
- Workload specification editor
 - Creates default routing rules
 - Add and rename additional routing rules
 - Can import an existing rule



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CICS Explorer V5.3 open beta

- **Mac OS X Support** - Available in CICS Explorer 5.2.0.2
- **Improved filter operators for numeric attributes** (> < !)

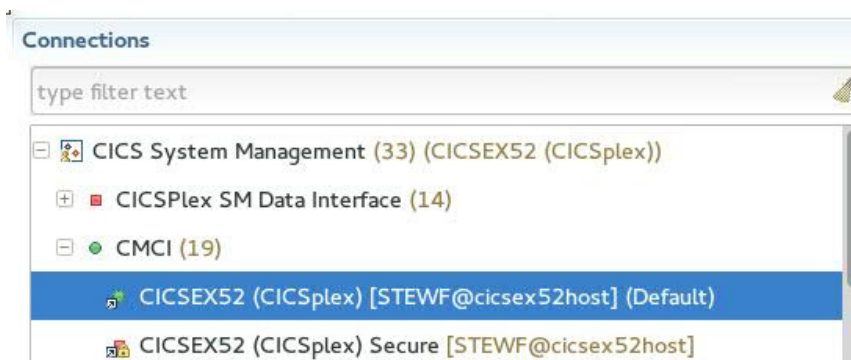


Task Count: >3 Job Name: []

CNX0211I Context: CICSEX52. Resource: CICSRGN. 2 (filtered) records collected at 11 Feb 2015 19:33:04

Region	Job Name	MVS Sys	Task Cou	CICS Sta	CICS TS	Release	Total CPI	Page In C	F
IYCWEIW	IYCWEIW	MV28	4	✓ ACTIVE	050200	0690	0000:00:	1148	2
IYCWEIW	IYCWEIW	MV28	5	✓ ACTIVE	050200	0690	0000:00:	1050	1

- **Auto-connect to default connections**



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CICS TS V5.2 Documentation

<http://www.ibm.com/support/knowledgecenter/>



The screenshot displays the IBM Knowledge Center interface for CICS Transaction Server. The browser address bar shows the URL www-01.ibm.com/support/knowledgecenter/SSGMGV/welcome.html?lang=en. The page features a search bar with the term 'overview' and a 'Save Search' button. Below the search bar, the 'Search Filters' section indicates 'CICS Transaction Server' with 7 results and an 'Auto-select' checkbox. The main content area is titled 'CICS Transaction Server' and includes a paragraph describing its capabilities as a scalable, general-purpose transaction processing solution. It also lists supported products and provides links to 'Learn more' and 'Find documentation'. A sidebar on the left contains a 'Table of Contents' and a list of product versions, with 'CICS Transaction Server for z/OS V5.3 open beta' highlighted. A right sidebar titled 'developerWorks' lists additional resources, including '5 Things To Know About IBM CICS Transaction Server (5 Things To ...)' and 'CICS Transaction Server for z/OS V5.2'. The footer of the page includes links for 'Contact', 'Privacy', 'Terms of use', 'Accessibility', and 'Feedback'.

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CICS Documentation – Notes



Documentation for CICS® is supplied in the IBM® Knowledge Center. This format offers benefits in searching, filtering, saving, customizing, and printing documentation for all IBM products. IBM Knowledge Center provides information for over 2500 IBM products. The information that was previously provided in product information centers is in IBM Knowledge Center. IBM Knowledge Center provides integrated tools for finding, filtering, customizing, saving, and sharing information.

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IBM CICS Transaction Server V5

the premier enterprise grade mixed language application server



Service Agility

Runtime support for production ready web applications.

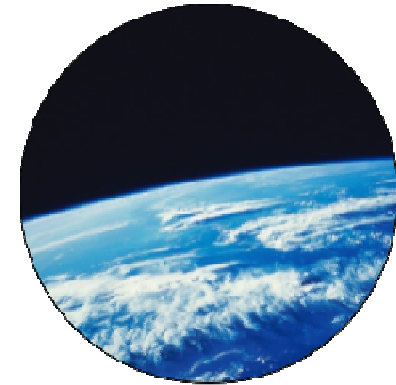
Integration with mobile applications.



Operational Efficiency

Increased system capacity and capability to achieve more with less.

Automatic control of critical resources using policies.



Cloud Enablement

Simplified system management and rapid application deployment.

On premise pattern based cloud deployment.

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