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CICS
What's in it for the Application Programmer?
Share session 12438

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Abstract

According to the CICS Information Center, a CICS application is "a collection of programs that together perform a business operation. Each program runs as part of a transaction under the control of CICS and using CICS-provided services and interfaces to access resources." But what are these services and interfaces? In today's environment with many application servers available, why would an application programmer choose to develop applications for CICS? How does CICS benefit the application programmer? You'll find answers to these questions and more at this session.

Agenda

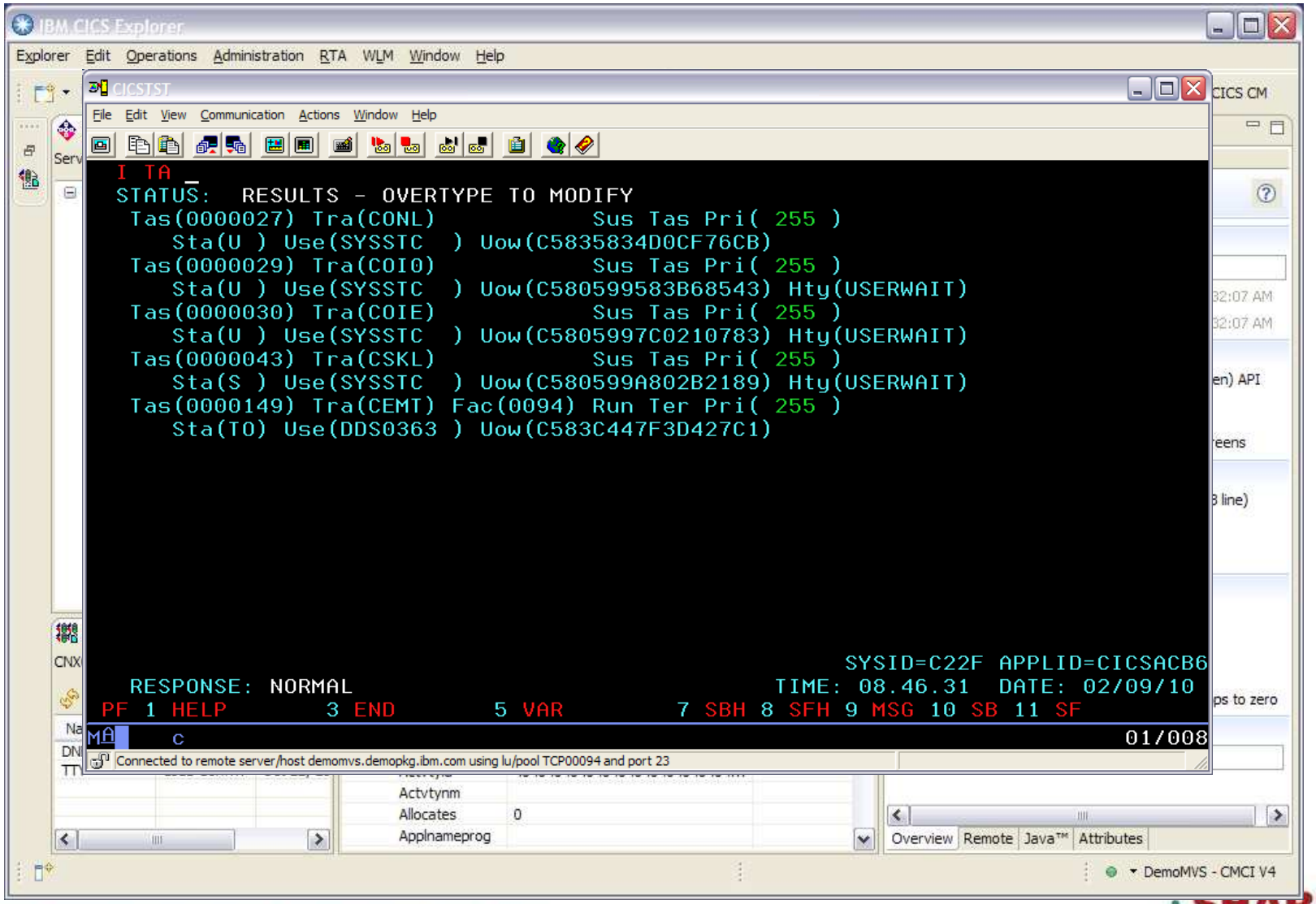
- CICS Explorer
- Application development
  - Languages
  - APIs
- Connectivity
- Events
- Interfaces

CICS Explorer

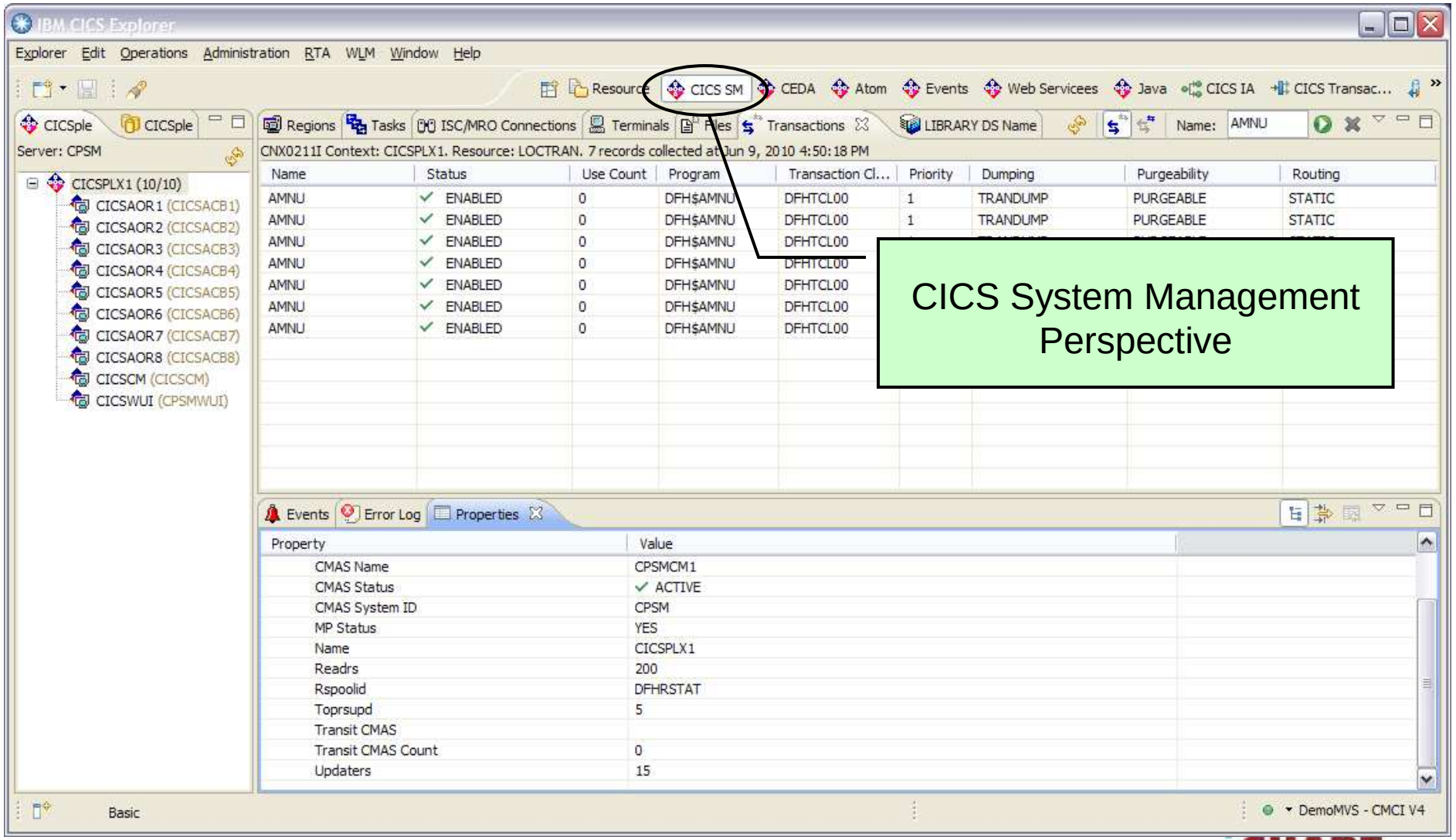
IBM CICS Explorer - The New Face of CICS

- New Modern Interface
  - Common look and feel
- Base functionality for operations
  - CEMT
  - CEDA
- Provides a Platform for Product and Tools PlugIns
- New Function Enabler for application developers
  - Event Binding Editor
  - ATOM Binding Editor
  - OSGI Binding Editor
  - Application Binding Editor
- Interfaces with RDz as a PlugIn
- Customizable Interface via SDK

IBM CICS Explorer – New Modern Interface



IBM CICS Explorer – CICS System Management Views



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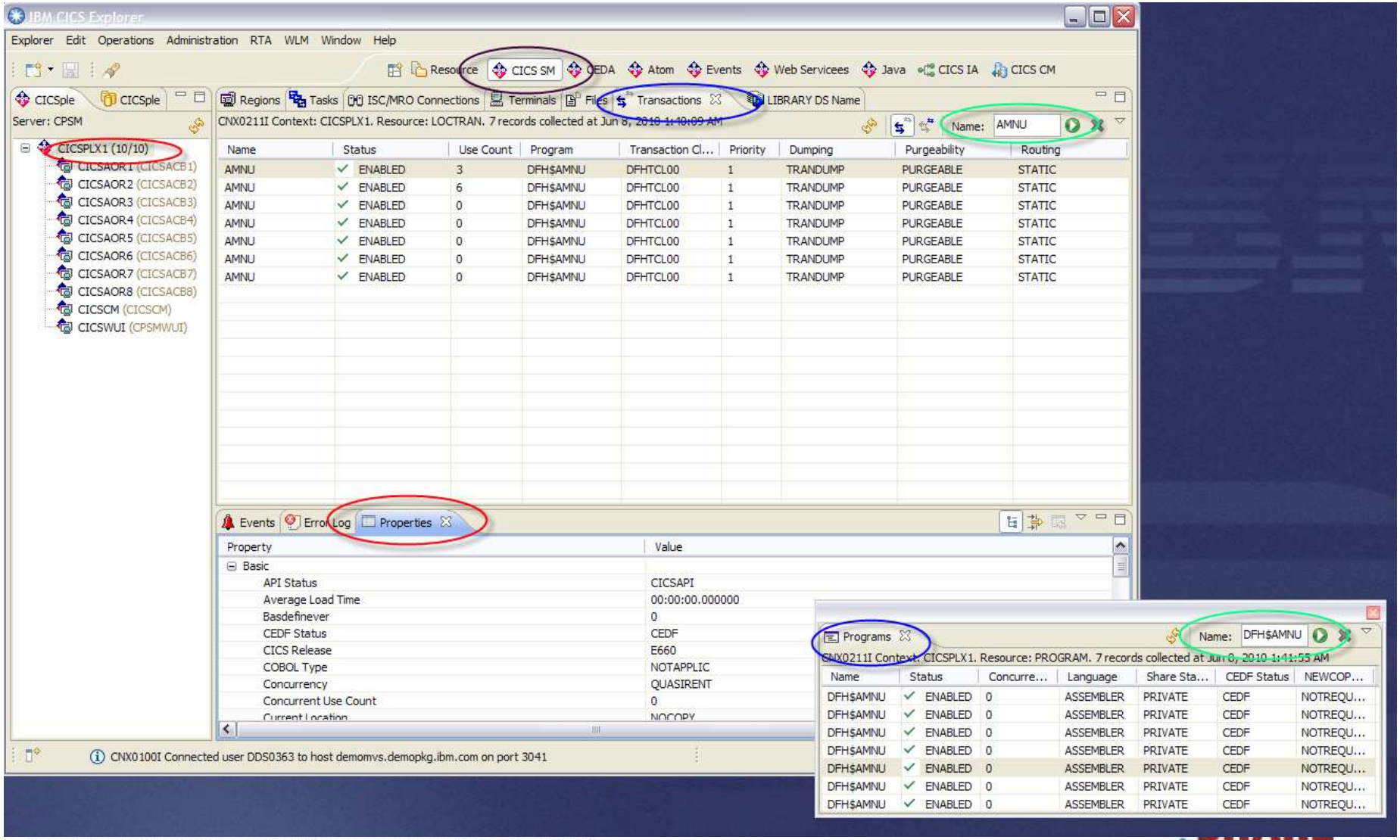
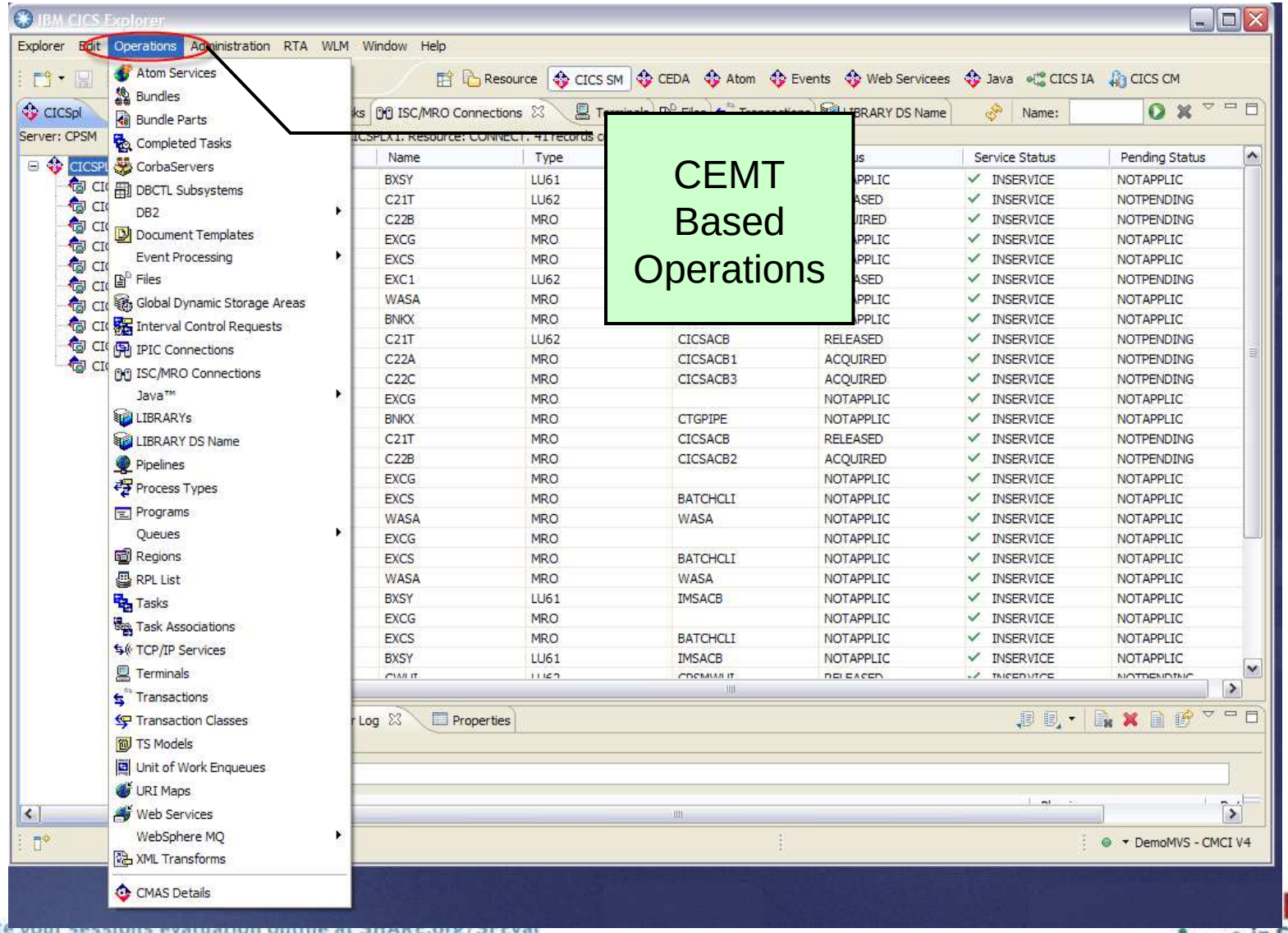
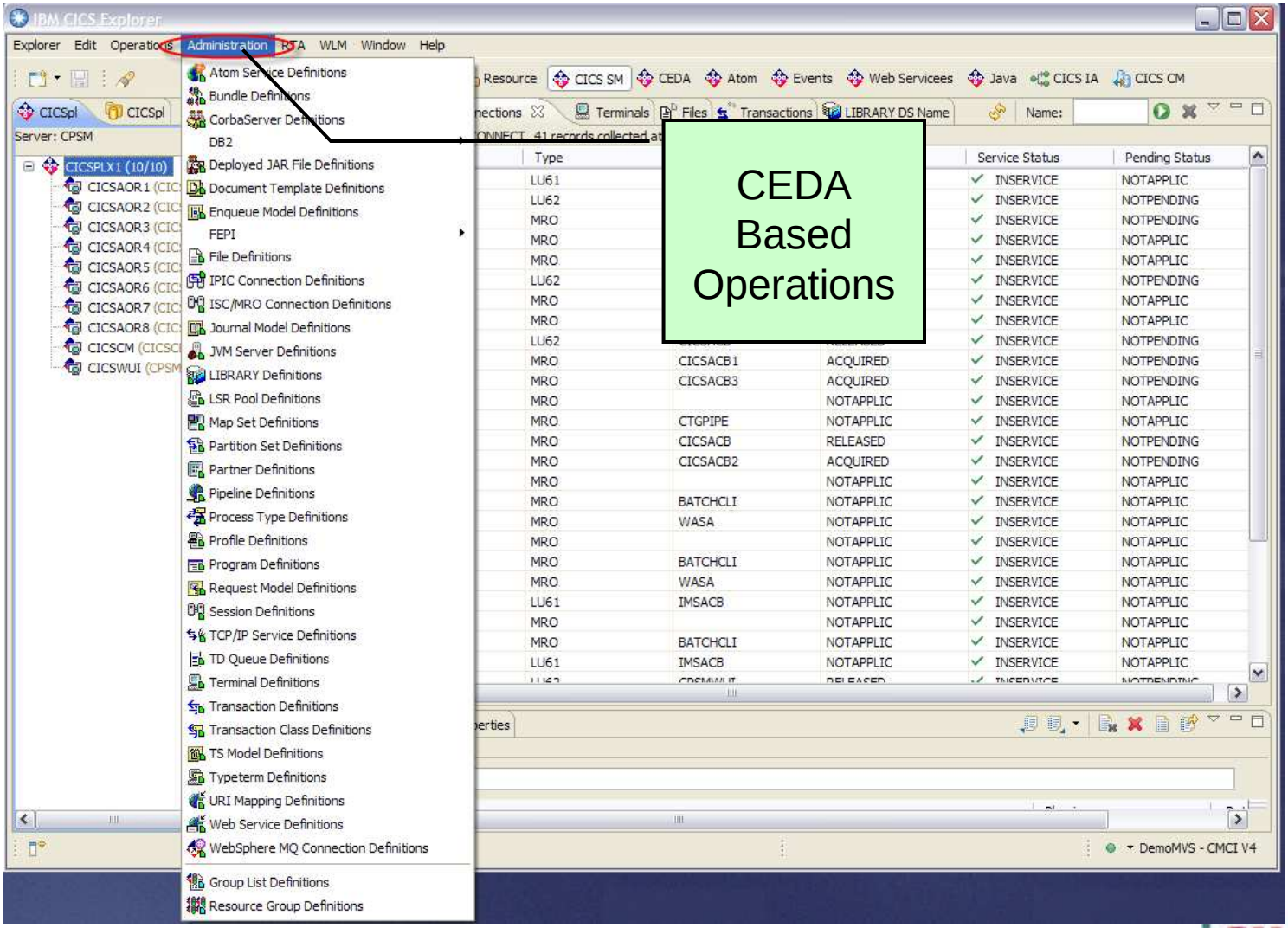


IBM CICS Explorer – Operations Views



IBM CICS Explorer – Administration Views



IBM CICS Explorer – CICS Event Binding Editor

Business Leader

CICS Business Applications

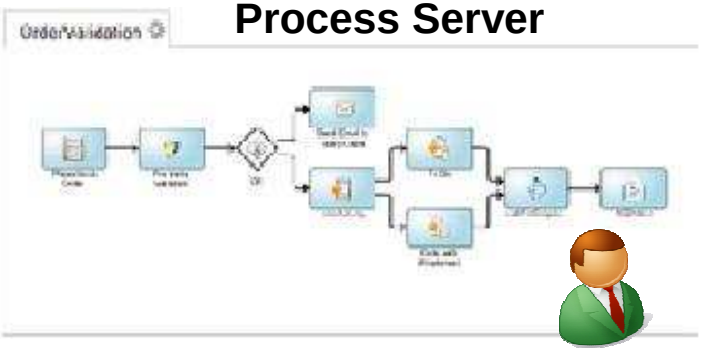
CICS TS 4.1

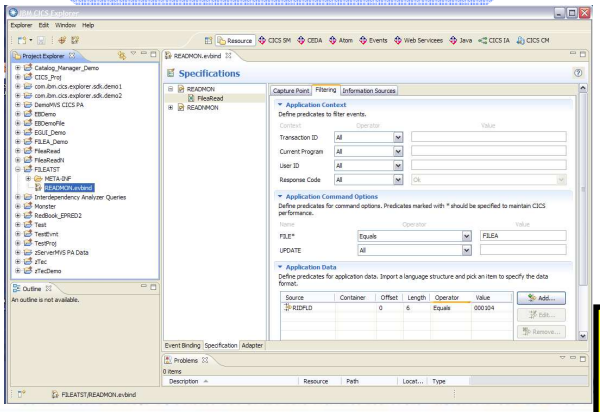
CICS TS Version 4.1

WebSphere Business Events

WebSphere Business Monitor

WebSphere Process Server

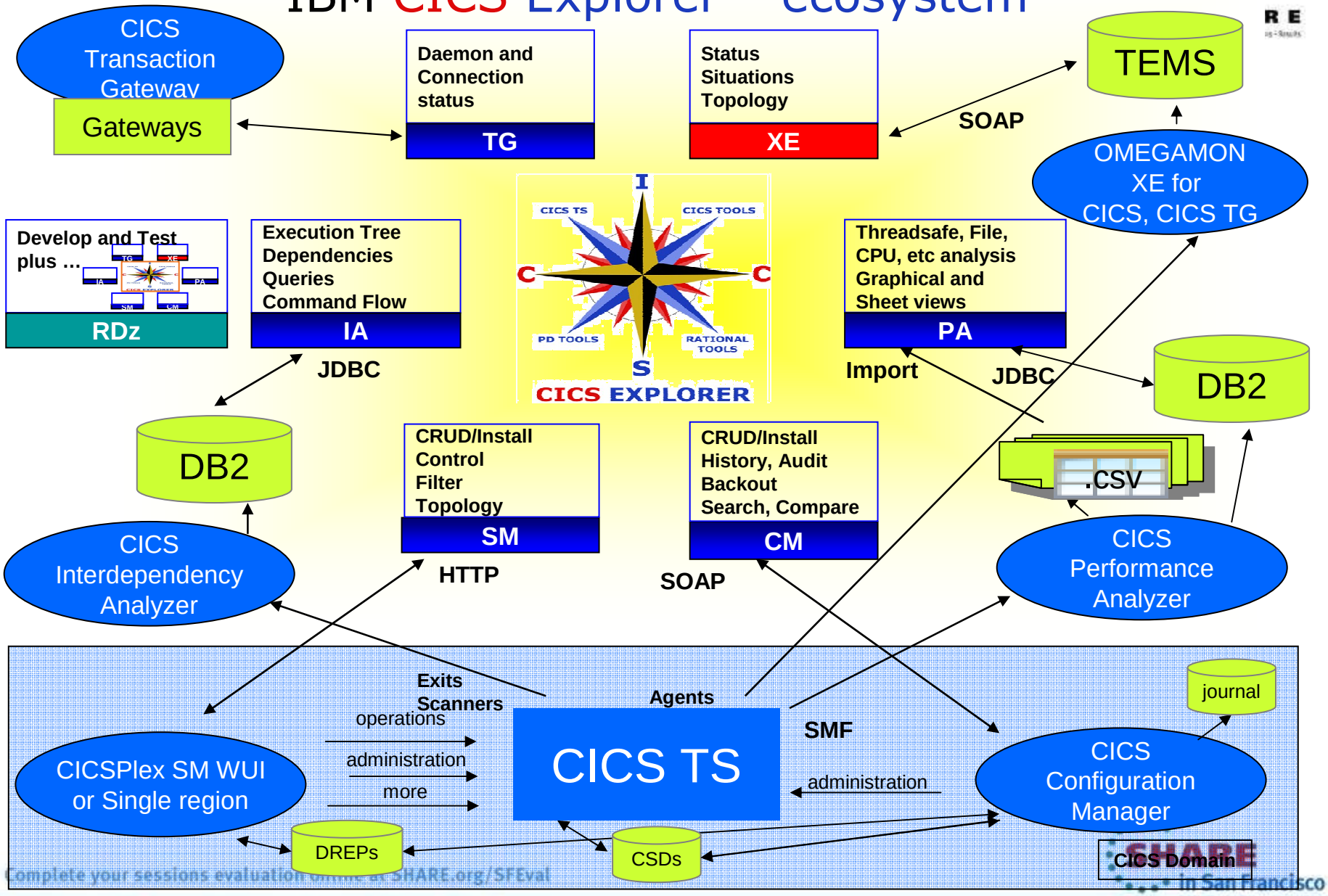




NO APPLICATION CHANGE REQUIRED with CICS V4.1

Business Professional

IBM CICS Explorer™ ecosystem



Development

Programming Languages

- ASM
- COBOL
- PL/I
- C/C++
- REXX
- Java
- PHP

APIs

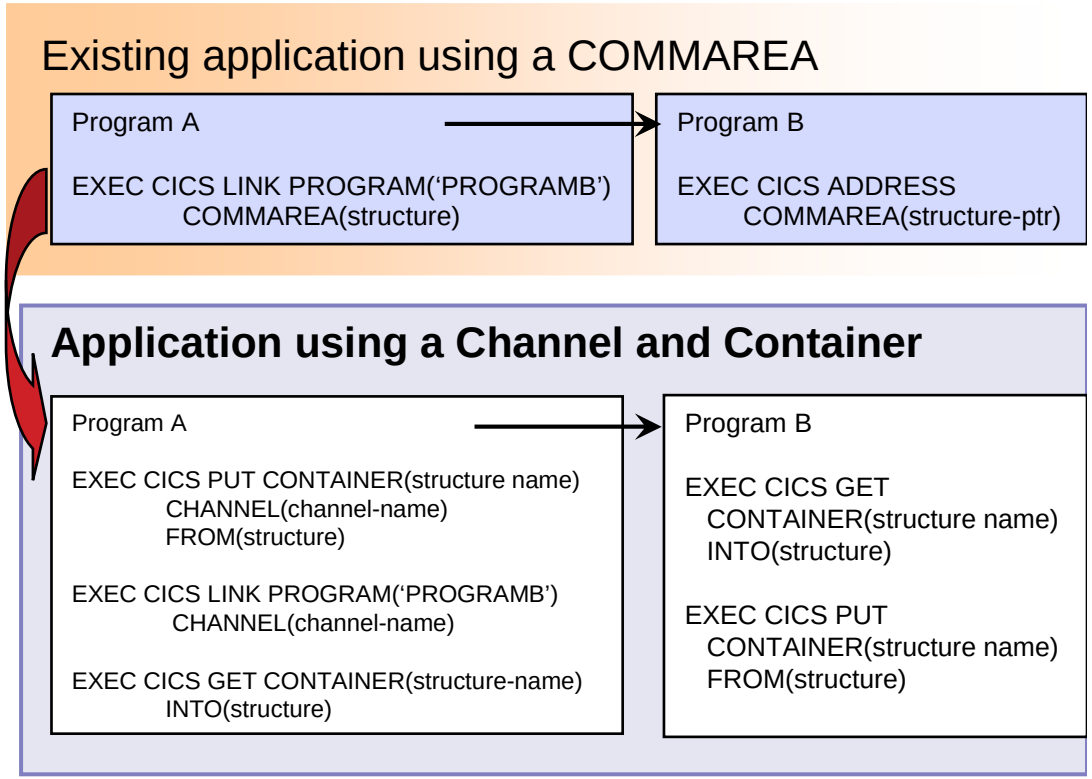
- CICS
  - Application Programming Interface (EXEC CICS)
  - Systems Programming Interface
  - JCICS classes
- Databases
  - DB2 (EXEC SQL)
  - IMS (EXEC DLI)
- Messaging
  - WMQ (CALL ‘MQPUT’, etc.)
- Communications
  - Socket API (CALL ‘EZASOKET’)

The CICS API

- File control – VSAM data sets
- Interval control – timer services
- Terminal control and Basic mapping services
- Storage control and task control
- Transient data and Temporary storage
- Documents
- Business Transaction Services
- FEPI – 3270 terminal simulation

Optimized data exchange between CICS programs with Channels and Containers

- Offers a more flexible and intuitive alternative to the COMMAREA
  - By using separate containers for logically different data it will simplify language structures and minimize the impact of changes to the interface
    - For example; input, output, error
    - Avoids “overloading”
  - Dynamic creation and discovery by applications
- Enables large amounts of data to be passed between CICS applications
  - Not subject to 32KB restriction
- Optimized and managed by CICS
- Requires minimal application changes required to use



Channels and Containers

- **Container**
  - Named block of data designed for passing information between programs
  - No CICS enforced size limitation
    - Channels are stored above the bar in CICS TS V3.2 and above
  - Multiple containers can be passed between programs
- **Channel**
  - A group of Containers
    - No limit on the number of containers in a channel
  - Non-persistent
    - Non-recoverable resource
  - Specified on LINK, XCTL, START and RETURN commands
    - Only one channel can be passed
    - Channels and COMMAREAS are mutually exclusive
- Supported between CICS regions and within the Web services support
  - Only modified data is transferred between regions
- Dynamic data conversion via GET and PUT APIs and transport resource definitions
  - Uses CICS or z/OS Support for Unicode

Channel and Container commands

- Container commands
  - PUT CONTAINER
  - GET CONTAINER
  - MOVE CONTAINER
  - DELETE CONTAINER
- Program transfer commands
  - LINK PROGRAM [CHANNEL|COMMAREA]
  - XCTL PROGRAM [CHANNEL|COMMAREA]
- Inquiry commands
  - ASSIGN CHANNEL(data-area)
  - STARTBROWSE CONTAINER [CHANNEL(data-area)]
  - GETNEXT CONTAINER (data-area)
  - ENDBROWSE CONTAINER

Transaction transfer commands

- RETURN TRANSID [CHANNEL|COMMAREA]
- START TRANSID [CHANNEL|FROM]

New JCICS classes Channel, Container, ContainerIterator provide access to containers and channels for Java programs

CICS XML Extensions

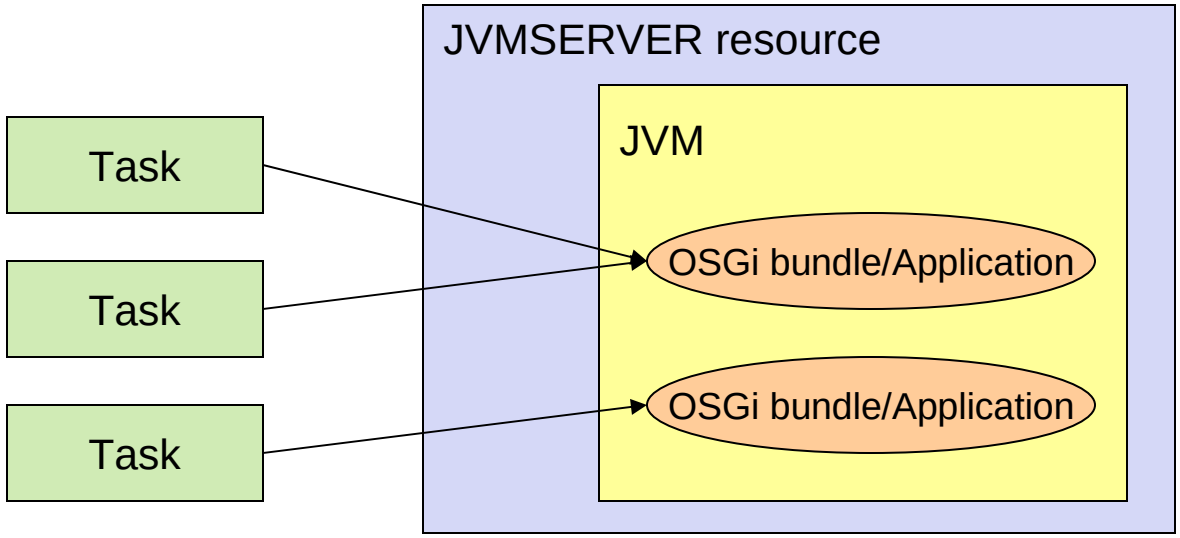
- New Markup Language Domain (ML)
- Generic XML Mapping
  - EXEC CICS TRANSFORM command
    - XML to Data
    - Data to XML
- New XML Assistants
  - Generates a language structure from a schema
  - Generates a schema from a language structure

Java

Java and CICS

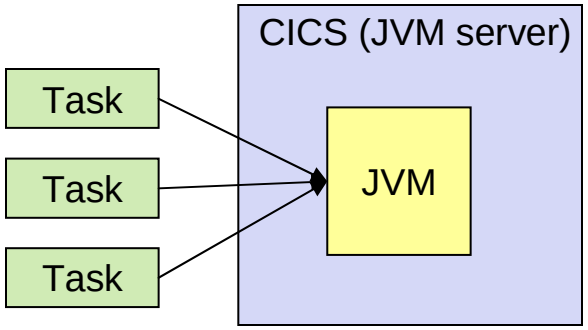
- Support for 64 bit JVMs
  - Java stack and heap are now allocated in above the bar storage
  - Java 6.0.1 for CICS TS V4.1
  - Java 7 for CICS TS V5.1
    - IBM zEnterprise optimized version of Java
      - *Exploits new z196 and EC12 instruction sets*
      - *Improved GC*
      - *Improved JIT*
      - *Significant performance improvements*
  - Support for 31 bit JVMs dropped
- OSGi
  - OSGi development and packaging now required to deploy CICS applications to a JVM server
  - Existing CICS Java applications using main() method linkage can run unchanged if wrapped in an OSGi bundle
  - All JVM server applications must be thread-safe

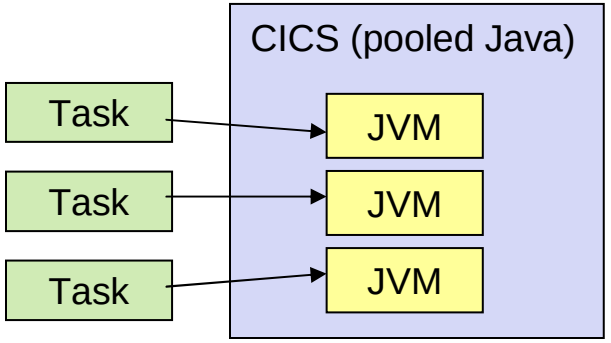
What is a JVM server…?



- A new CICS resource containing a **long-running** JVM.
- The strategic direction of Java in CICS
  - Pooled Java discontinued in V5.1
- A JVM that serves multiple transactions concurrently.
- A JVM in which applications/tasks run as OSGi bundles.

JVM server vs. previous Java support?

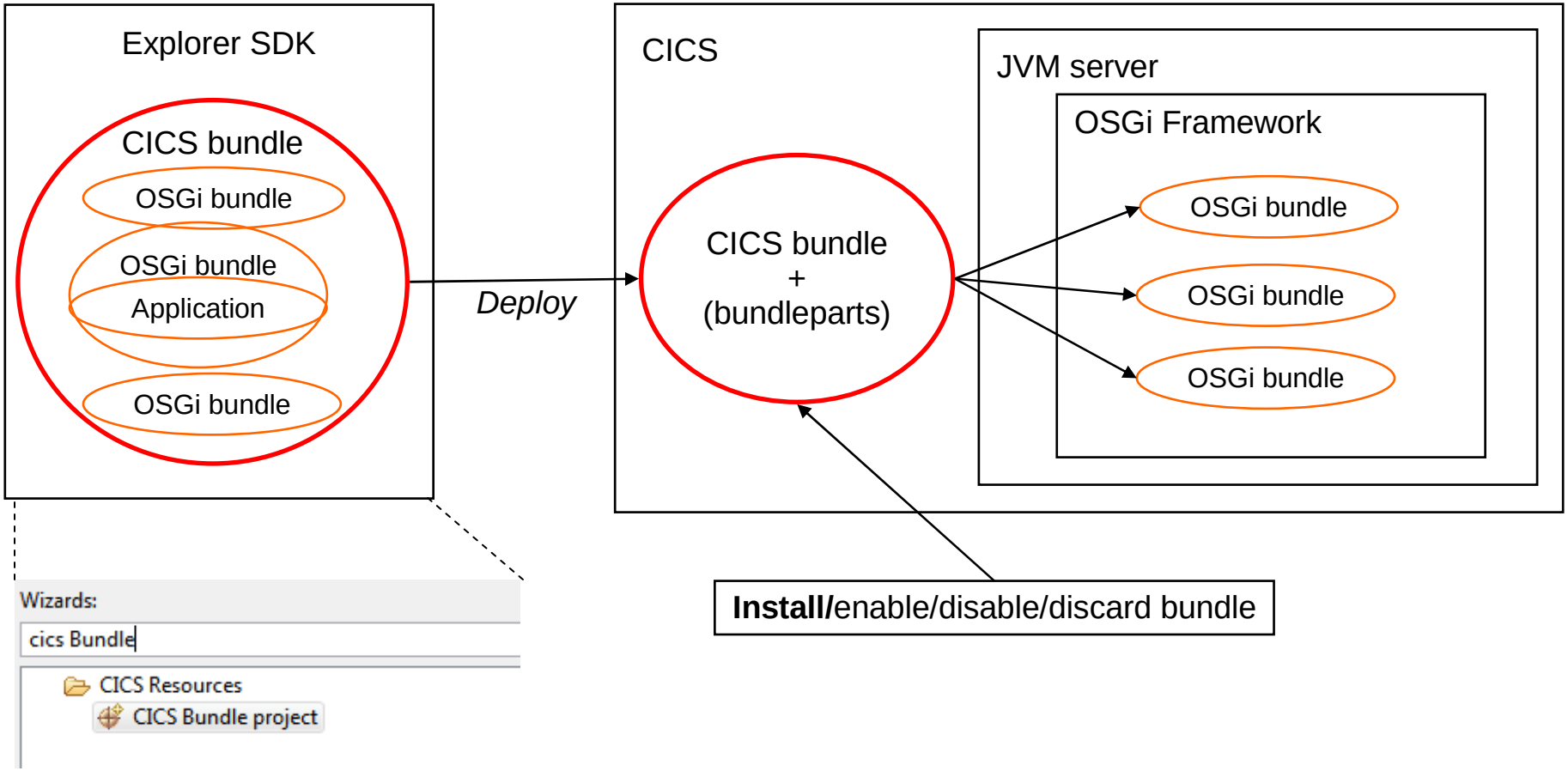




Single JVM - serves many tasks (reduced storage)	Pool of JVMs - each serves only a single task.
(concurrent, multi-threaded, up to 256 threads per JVM server)	Java Program Isolation
T8 (CICS key)	J8 (CICS key), J9 (User key)
MAXTHRDTCBS (automatically calculated), up to max of 1024 per region	MAXJVMTCBS, SIT parm
More standard Server model (+ data-sharing)	Difficult, convoluted to share data and state.
Dynamic update and replace of modules	JVMs must be restarted to effect changes

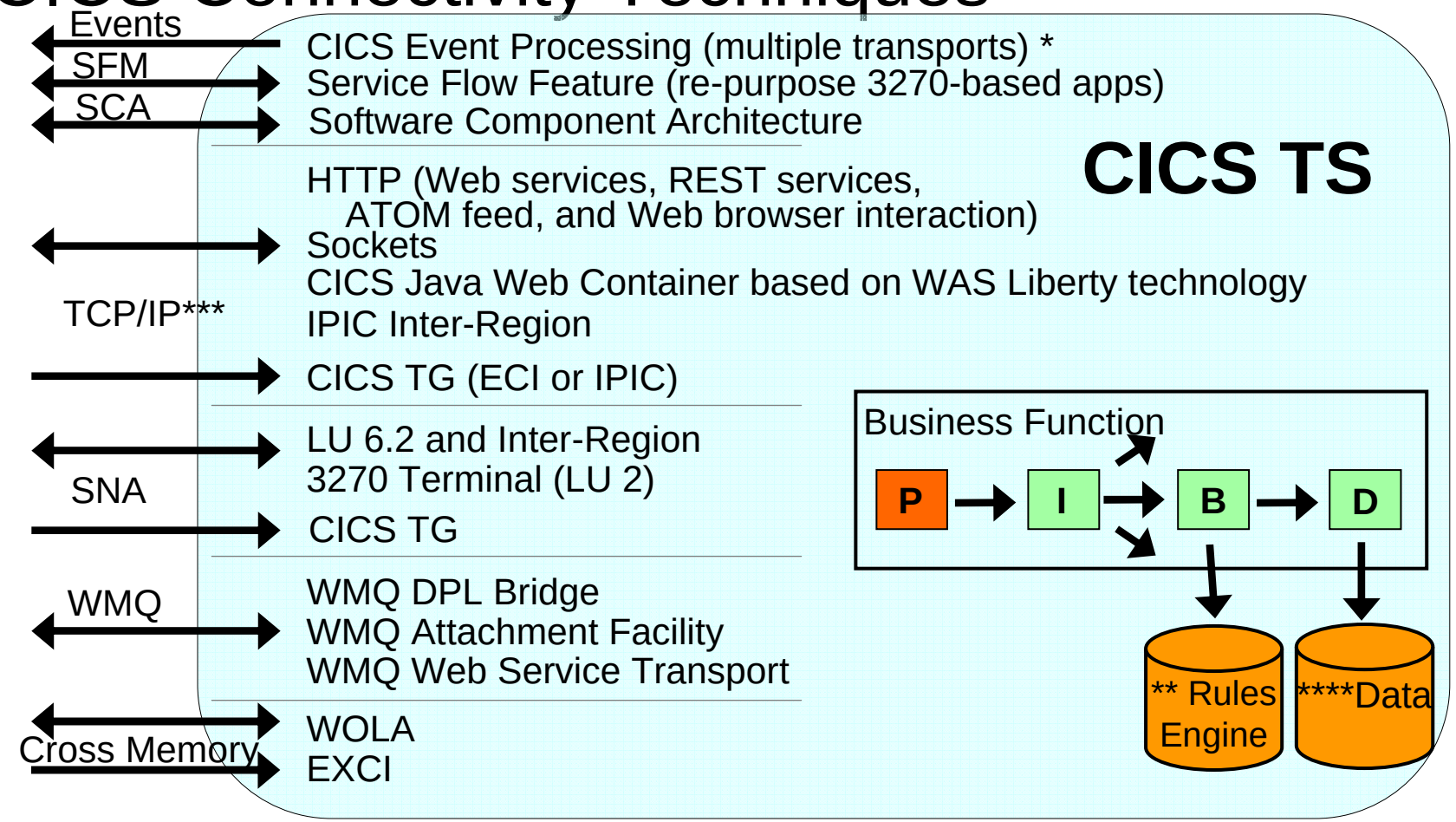
CICS TS V4 Java…

Deploying OSGi Applications



Connectivity

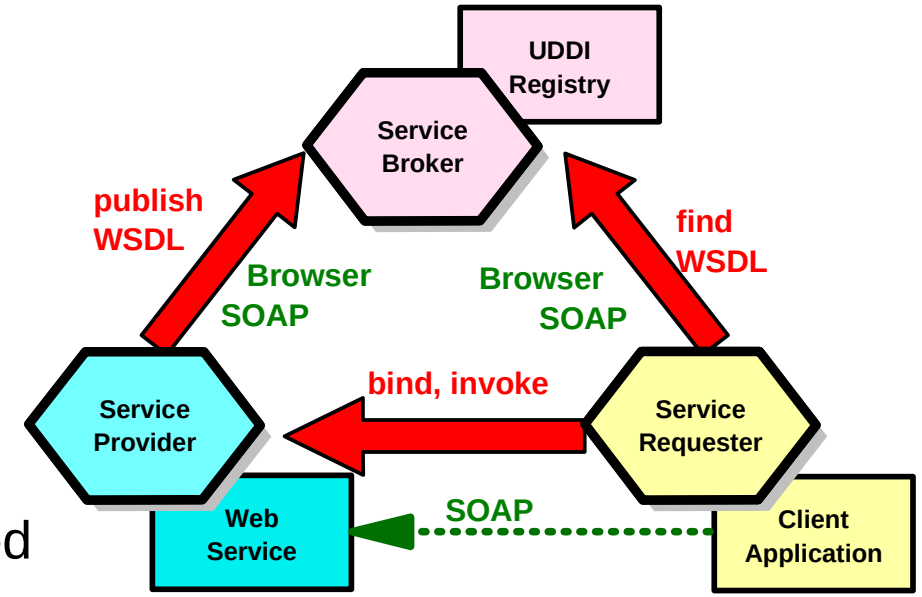
CICS Connectivity Techniques



* Events can have different transports or CICS can process its own events
** IBM Operational Decision Manager
*** IBM Worklight – can access CICS Data using REST, Web Services, and ATOM feeds
**** VSAM, DB2, and IMS

Web Services

- Architecture for
  - Application to application
    - Communication
    - Interoperation
- Definition:
  - Web Services are software components described via **WSDL** that are capable of being accessed via standard network protocols such as **SOAP** over **HTTP**
- WS-I.org (Web Services Interoperability Organization):
  - An organization to ensure interoperability

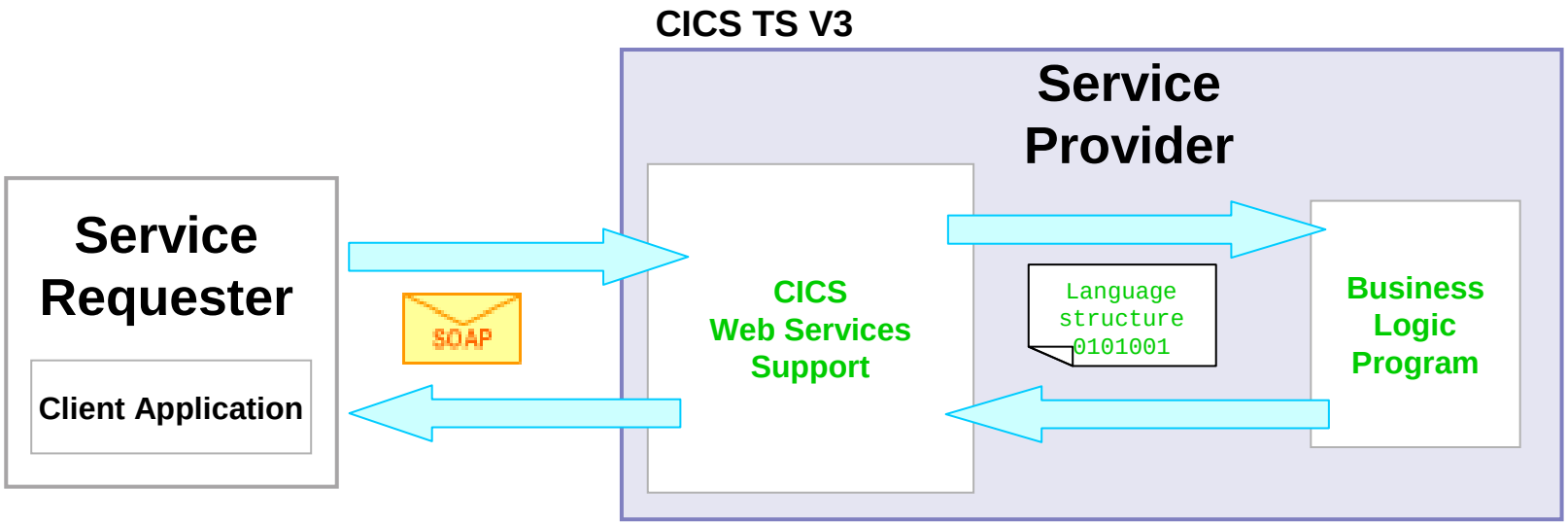


The entire industry is agreeing on one set of standards !!

Reasons to use Web Services in CICS

- Transform Existing Applications
- Extend existing applications to new audiences and opportunities
- Exploit existing resources and skills
- Improve performance of existing workloads for faster response times and reduced costs
- Improve system management to enable management of more with less
- Simplify the development process to reduce application development costs and time to deployment

Very High Level: CICS Web Services



SOAP Message - XML, tag delimited data

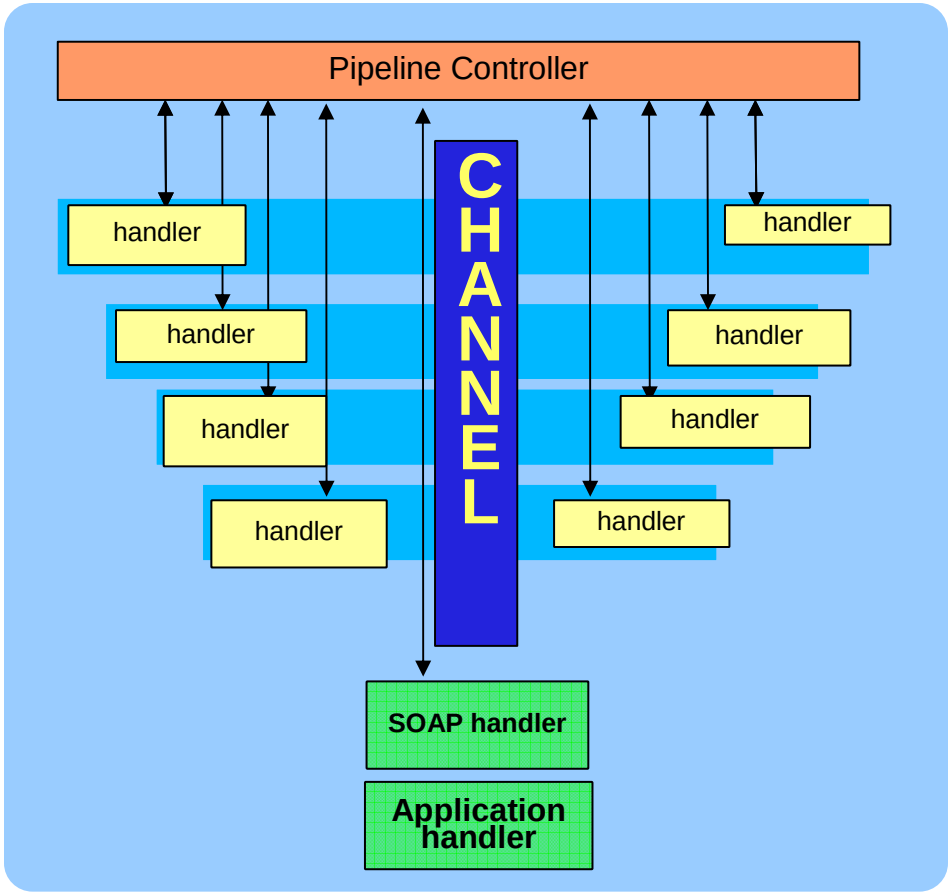
zero or more headers | **body containing application data**

Languages Structure – e.g. COBOL copybook

```
01 DFHCOMMAREA.
      03  CUSTOMER-FIRST-NAME  PIC X(30).
      03  CUSTOMER-LAST-NAME   PIC X(30).
      ...
```

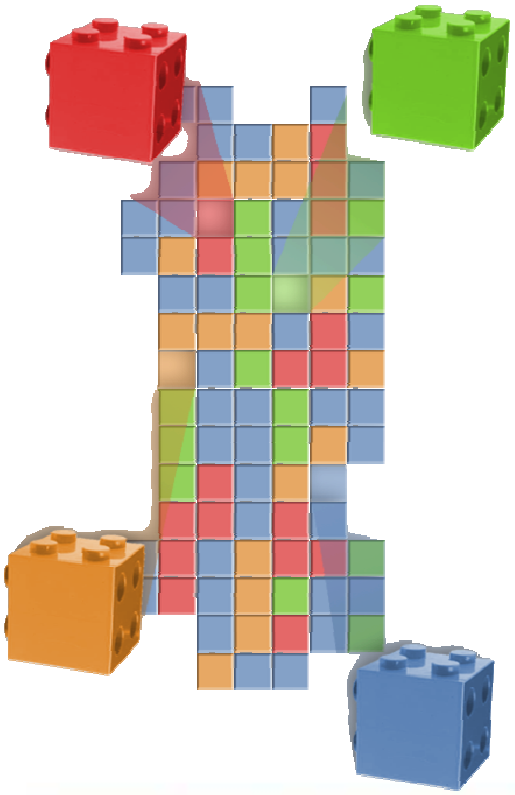
Axis2 for Web Services

- Axis2
  - Java-based open source web services engine
- Axis2 Java SOAP message handlers
  - Axis2 SOAP processing and some of the CICS pipeline processing become eligible for zAAP offload
- Application handler written in Java
  - Executes in a JVMSERVER
  - Eligible for zAAP off-load processing
  - XML data conversion can be off-loaded



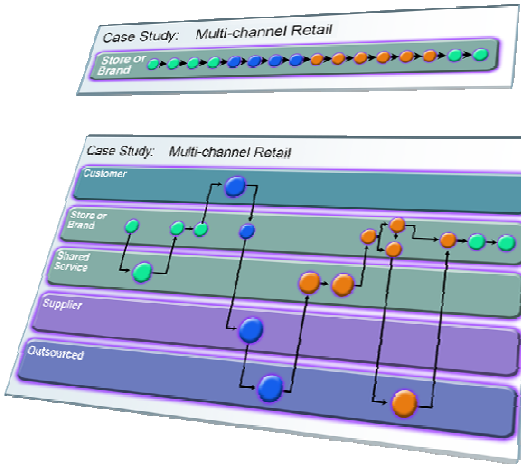
Service Oriented Architecture

- Reuse of Services (encapsulated Business functions)
- Align with Business process to respond faster to Business needs
- Compose new applications by combining Services



SOA Levels

- Service Enablement - Transform existing applications to services
- Service Integration –Align with business, abstract integration layer, look into ESB
- Process Integration – Composite applications with process choreography and service aggregation



Web 2.0: A Philosophy, not just a Technology

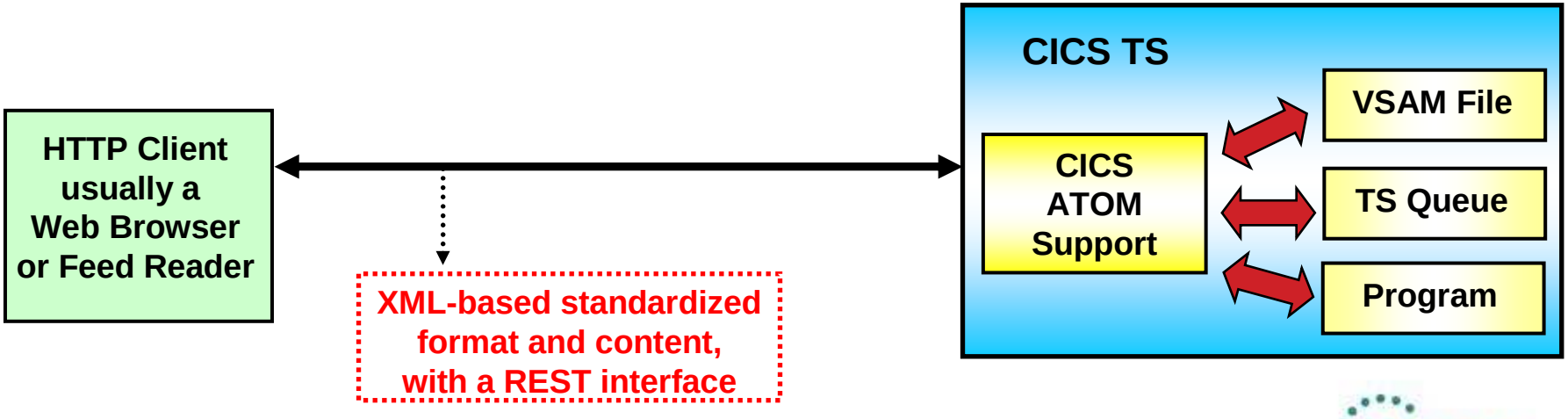
- An important trend in delivering software applications
- An enabler for richer web applications
  - New business models
  - Peer-to-peer user participation
  - New technologies
  - Interactive filtering, presentation, data entry
- A combination of core technology components
  - Rich user experience (maps, grids, animation, D&D,
  - Loose-coupling, composite applications via reuse and
  - Technologies (SOAP, REST, JSON, ATOM, Java, PHP, D , Ruby, Python, Perl, etc)

REST Services

- Similar in concept to hyperlinked data
- Lightweight data transfer
- Representational State Transfer
  - Nouns (URLs) indicate what is being worked on
  - Verbs (GET, PUT, POST, DELETE) indicate the action to be performed (List, Create, Read, Update, Delete)
- Format of results is not defined
  - Popular formats of returned data are XML and JSON
- Can use EXEC CICS TRANSFORM for XML parse/create
- Approaches in CICS
  - CICS WEB API
  - ATOM Feed (CICS TS V4.1+)
  - Dynamic Scripting (CICS TS V4.1 and CICS TS V4.2)

CICS ATOM Support…

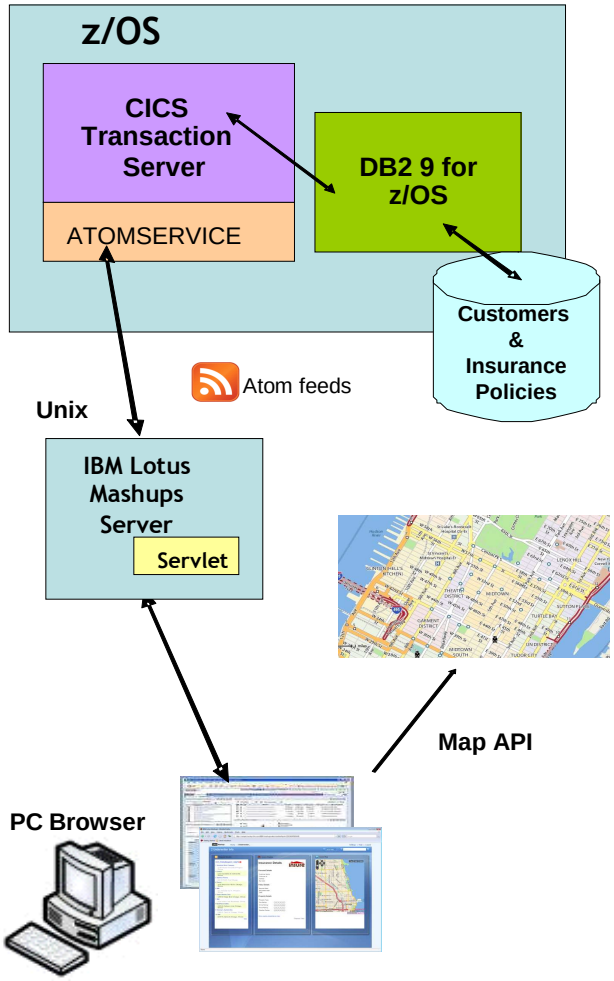
- An Atom Feed is a standards-based protocol and XML format for content publishing
  - Provide XML-based feed of updated content
  - Process is known as syndicating a feed
    - *Follow-on to Real Simple Syndication (RSS)*
  - Simple publish/subscribe implementation
    - *Polling model*



CICS ATOM Support…

- Enables CICS applications to:
  - Provide live information for Web 2.0 consumption
  - Integrate with related data
  - Give full picture in a single holistic view
- Create new applications based on up-to-date content and information
  - Decision-support tools for knowledge workers
  - Composite user interfaces for expert workers
  - Information feeds & widgets to consumers for use in their own mashups
- Develop using WebSphere sMash or RD/z with EGL

Example High level architecture: CICS Atom feeds



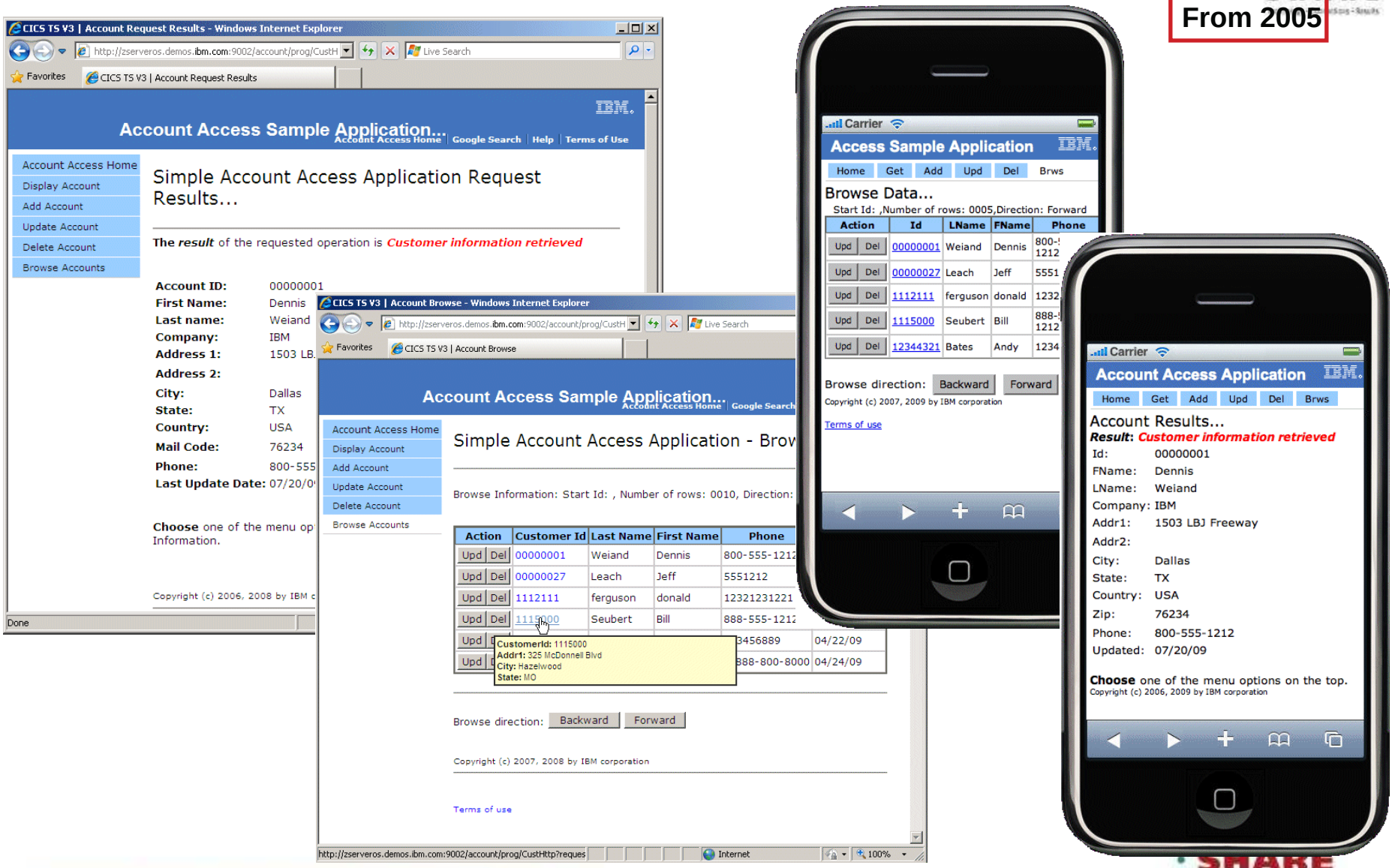
Modern Application Interfaces

Modern Application Interfaces

- CICS Web Support
  - CICS API commands for HTTP communication
  - CICS Document support
- Dynamic Scripting Feature Pack for CICS
  - PHP and Groovy for CICS TS V4.1 and V4.2
- Liberty Profile Web Container
  - Standard Java servlet and JSP support in CICS TS V5.1
- Interoperability with Mobile Apps
  - Browser-based
  - REST & Web 2.0
  - Web services
  - Etc.

Browser-based Application Interface

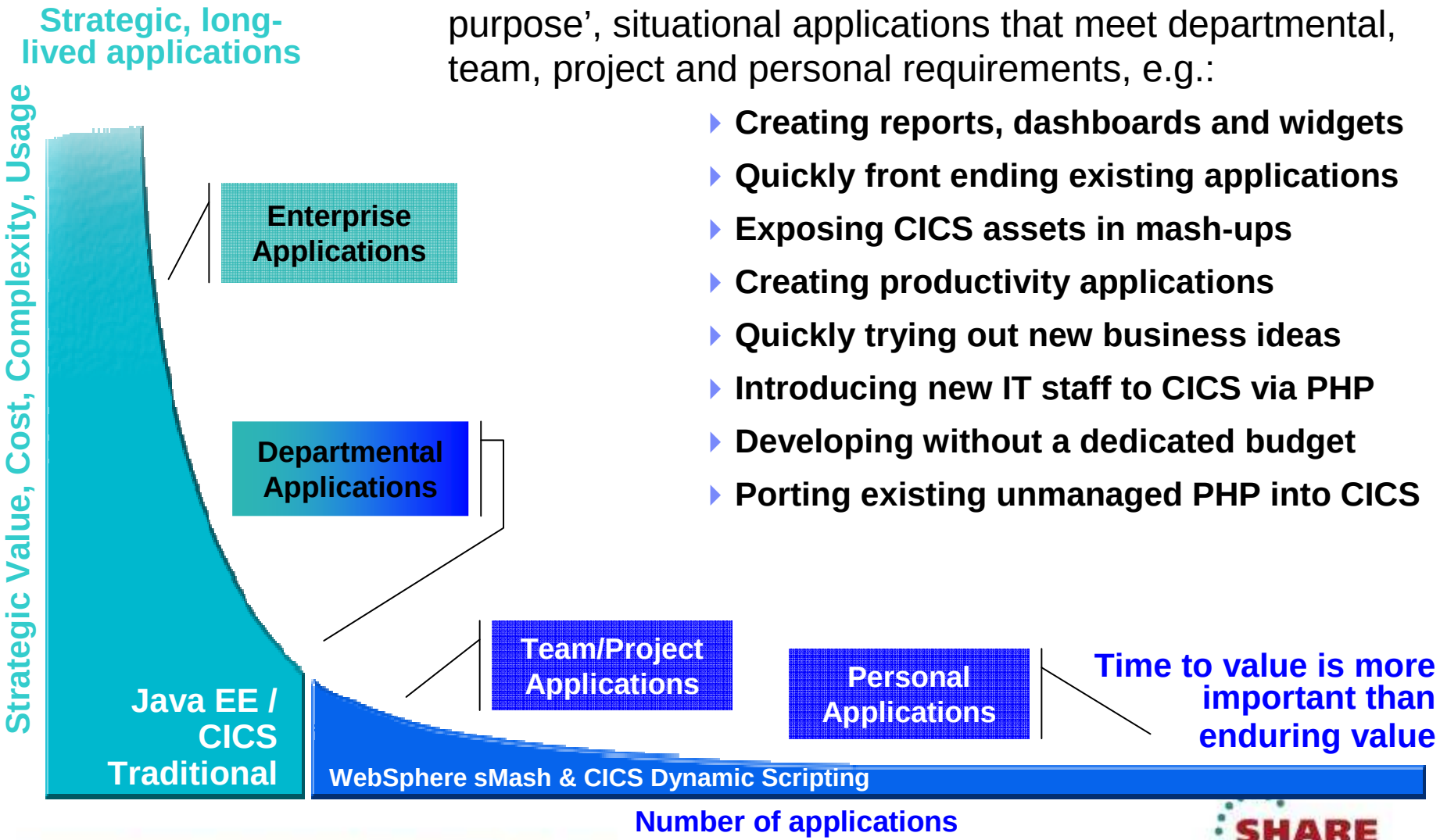
From 2005



CICS Dynamic Scripting

Can be used to develop and deploy lightweight, 'fit for purpose', situational applications that meet departmental, team, project and personal requirements, e.g.:

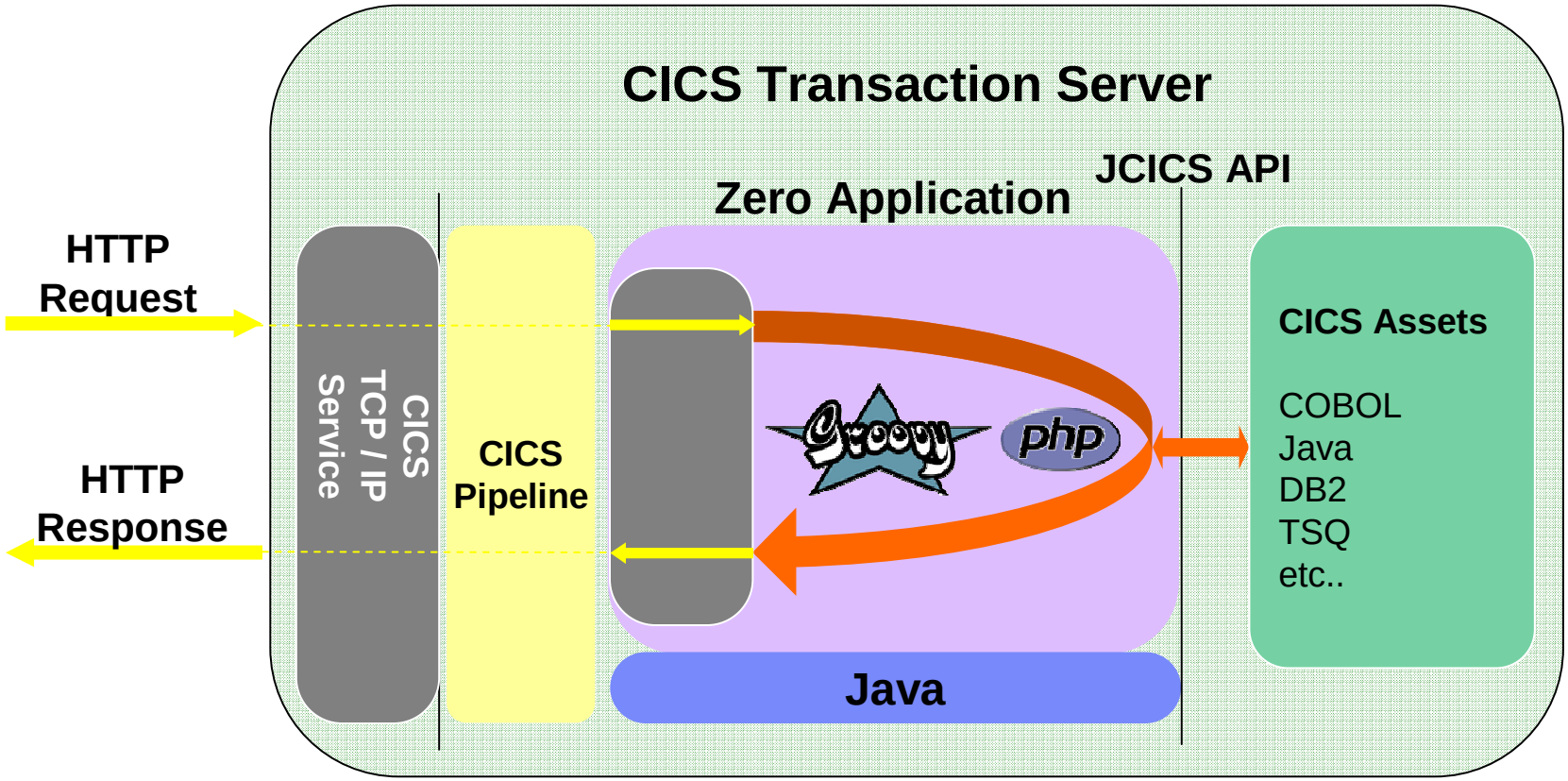
- **Creating reports, dashboards and widgets**
- **Quickly front ending existing applications**
- **Exposing CICS assets in mash-ups**
- **Creating productivity applications**
- **Quickly trying out new business ideas**
- **Introducing new IT staff to CICS via PHP**
- **Developing without a dedicated budget**
- **Porting existing unmanaged PHP into CICS**



CICS Dynamic Scripting Feature Pack

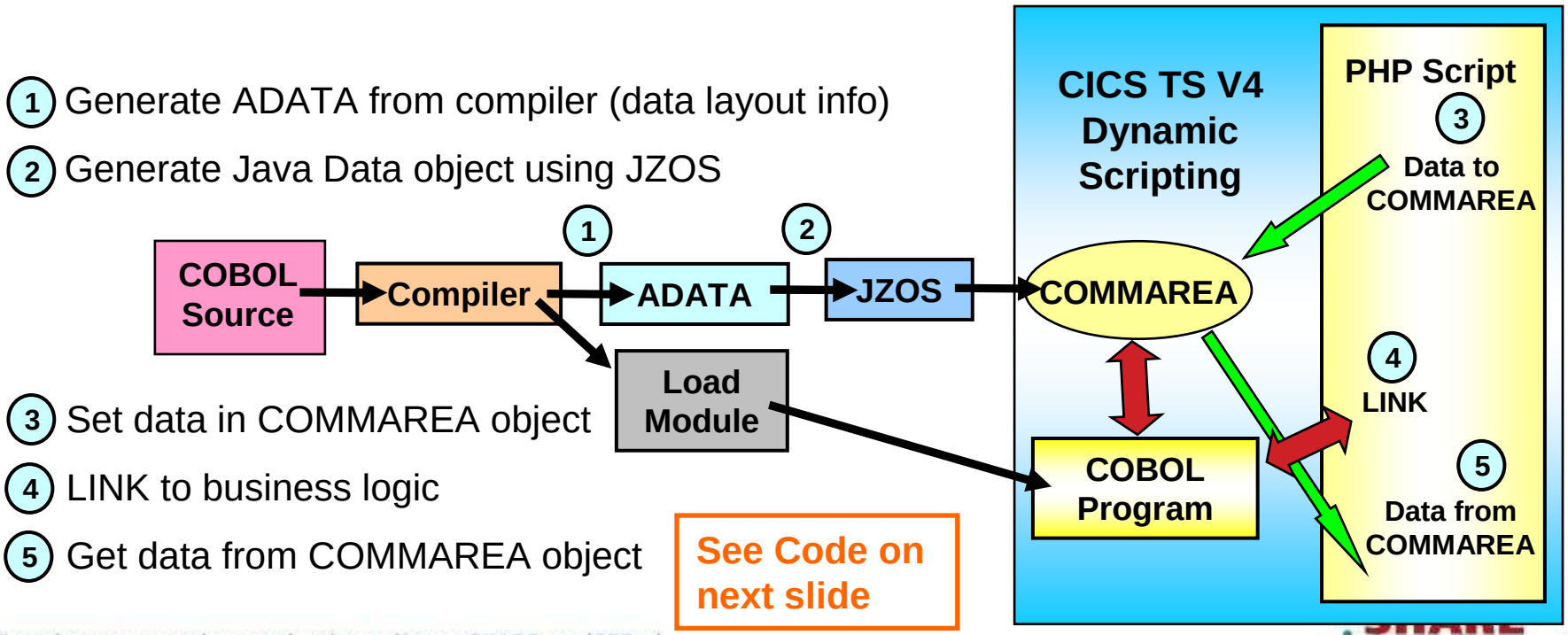
- Provides PHP and Groovy support in CICS – agile, productive environment
- Technology from Project Zero, WebSphere sMash v1.1.1.3 (projectzero.org)
- Robust environment for situational reports, dashboards, and Web feeds
- Manageability, Scalability, and Security
- Zero Resource Model (ZRM) with data managed by DB2 for z/OS
- Uses CICS TS JVMServer Technology
- Situational applications - Quickly try business ideas
- Introduce new staff to CICS via PHP
- Run unmanaged PHP and WebSphere sMash applications in CICS
- Easily expose CICS assets with RESTful interfaces
- Optional no charge product extension to CICS TS V4.1 and V4.2

Project Zero Environment **(in CICS)**



Interacting with CICS

- Data passed to or from CICS is in byte arrays
- Can generate a Java data class with getters and setters plus a method to get and set the data as a byte array
  - Using JZOS classes supplied with Java on z/OS
  - Using RAD and CICS Java Data Bindings

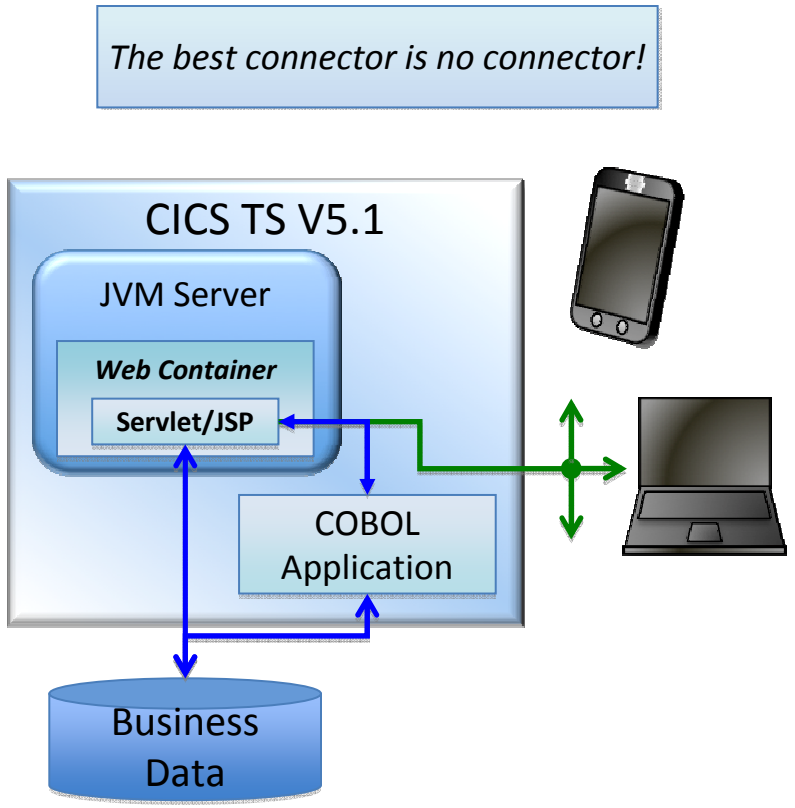


Liberty Profile Web Container

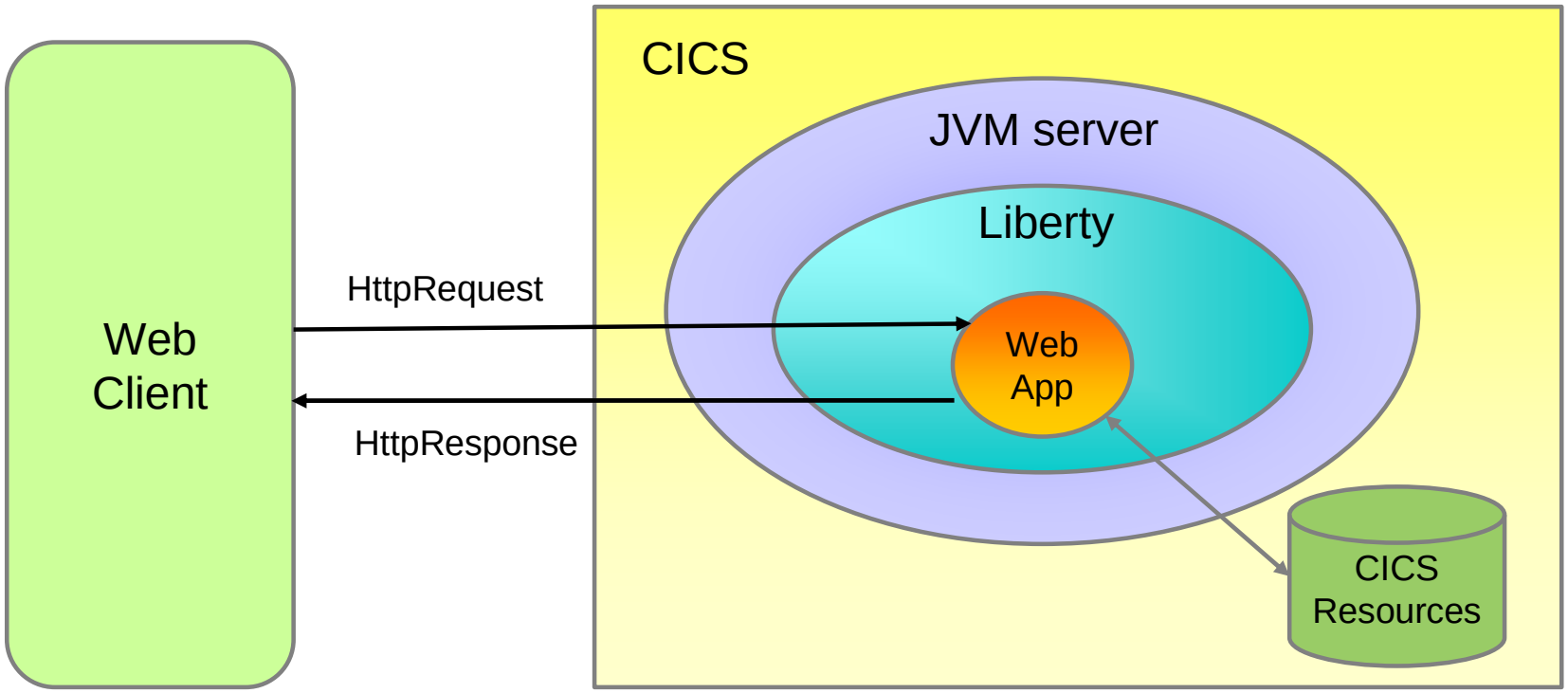
- New Java web container is built on WebSphere Application Server Liberty profile technology:
  - Liberty is a lightweight, composable, ‘profile’ of WebSphere Application Server
    - Provides a fast and lightweight Java web container
  - Provides “off the shelf” Web-server capabilities (JSPs and Servlets)
  - Provides potential to re-use even more WebSphere technology in CICS.
  - JSP and Web servlets have direct, local, access to CICS data and resources.
  - Servlets can take advantage of existing CICS OSGi applications to provide a Dynamic Web front end.

Liberty Profile Web Container

- The Web Container enables:
  - A production-ready web container with CICS qualities of service
  - Deployment of lightweight Java servlets and Java Server Pages (JSP)
  - Improved performance through local access to CICS applications and data
  - Rapid roll-out of interface updates through OSGi-packaged deployments
  - Full integration with first-class applications and platforms
  - Technology built on the WebSphere Application Server Liberty profile for compatibility



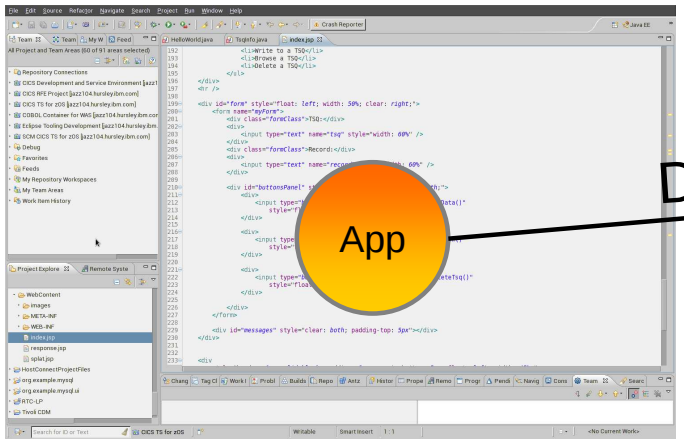
Liberty Profile WEB Container



- Liberty Profile runs in a JVMSERVER
  - Use sample JVMSERVER profile DFHWLP
- Web App developed and deployed using Eclipse IDE & CICS Explorer SDK

Modern interfaces - Putting it all together

Eclipse with CICS Explorer SDK & Liberty Tools



Deploy

zFS

App

Enable

zOS

CICS

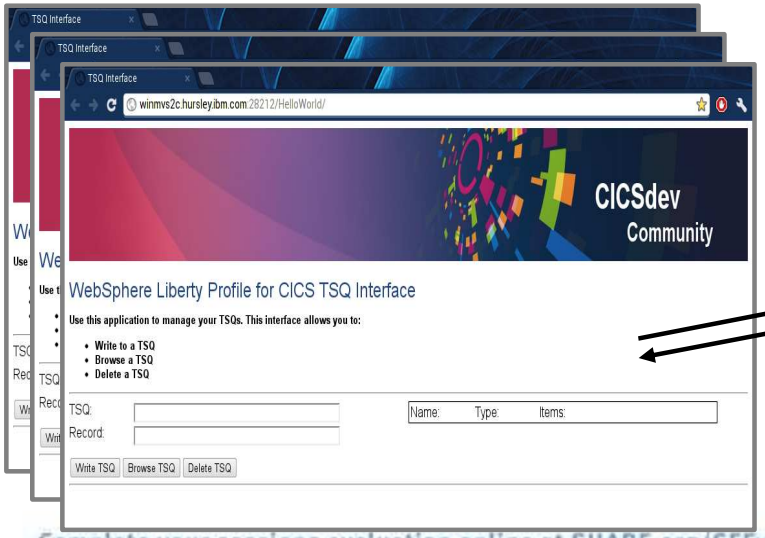
JVM server

Liberty

App

CICS Resources

Use



Events

What is Business Event Processing?

"Turn insight into action"

Event

Pos Purchase

Business Context

2nd purchase in a week and total purchases this year > $1000

Action: Offer loyalty program membership before customer leaves the store

Event

No meter signal

Business Context

Third consecutive period without signal

Action: Trigger automated troubleshooting process

Event

GPS Signal

Business Context

Calculated arrival > 30 min over SLA

Action: Phone customer to re-arrange delivery

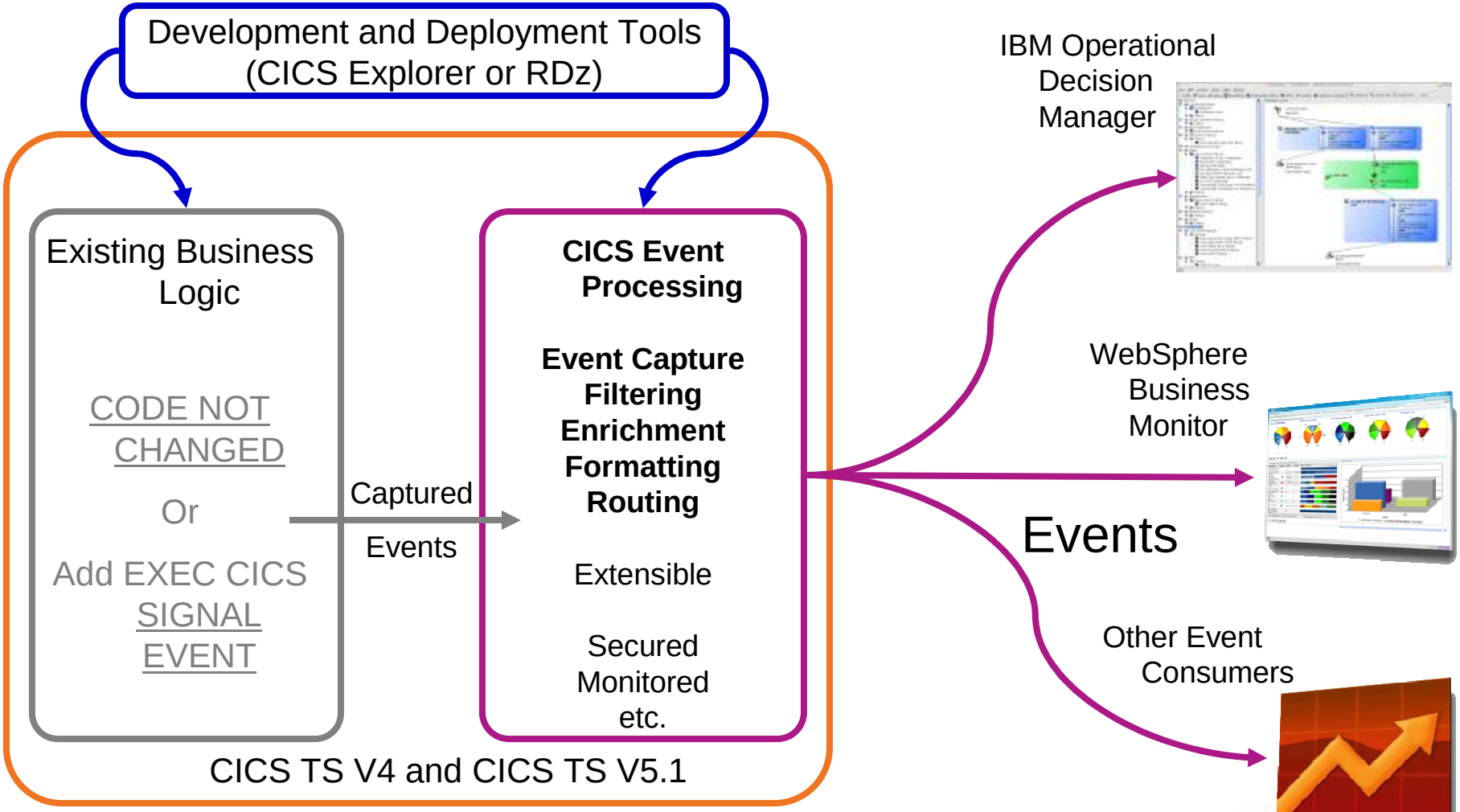
Event Processing…

- An event is something that happens that is relevant to the business
  - "**simple**" event: meaningful in itself (not an aggregation of information)
    - Order placement, stock trade
  - "**complex** event processing": detect and respond to patterns of events
    - 3 orders from a customer in 2 days, suspicious pattern of ATM activity
  - "Business Event Processing" extends event processing capabilities to business users
- CICS can be significant source of events
  - Focus is on events relevant to the Line-of-Business
  - ***CICS emits single events***
  - Events emitted by CICS could
    - Drive another CICS transaction
    - Be written to a temporary storage queue
    - Be input to a monitor or business manager's dashboard
    - Be sent to a "complex event processing" engine such as IBM Operational Decision Manager
- Can be business events (CICS TS V4.1+)
- System events (CICS TS V4.2+)
- Policy notifications (CICS TS V5.1)

CICS Event Processing

- Provide information relevant to your business processes to a variety of systems
  - IBM Operational Decision Manager
  - WebSphere Business Monitor
  - Emit to WMQ queues or via HTTP
  - CICS-based transactions and programs
  - User-written programs
- Receiving system analyzes business information from one or more sources and takes appropriate action

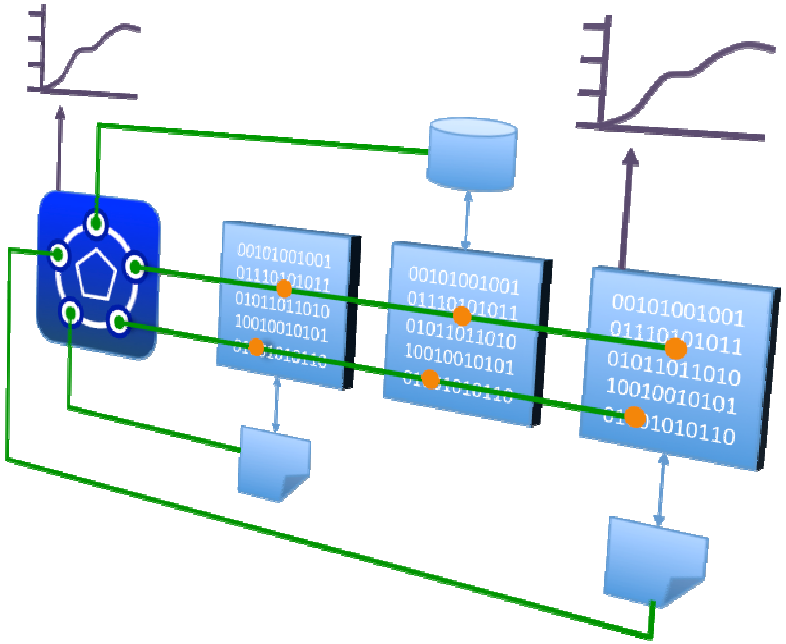
Event Processing…



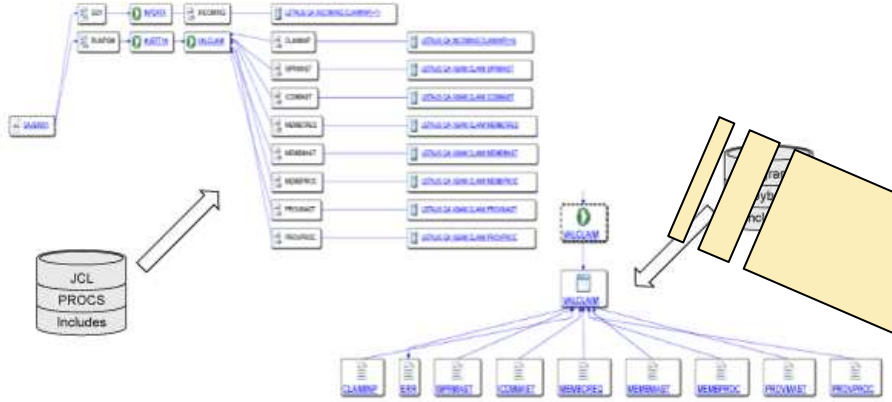
New view of applications

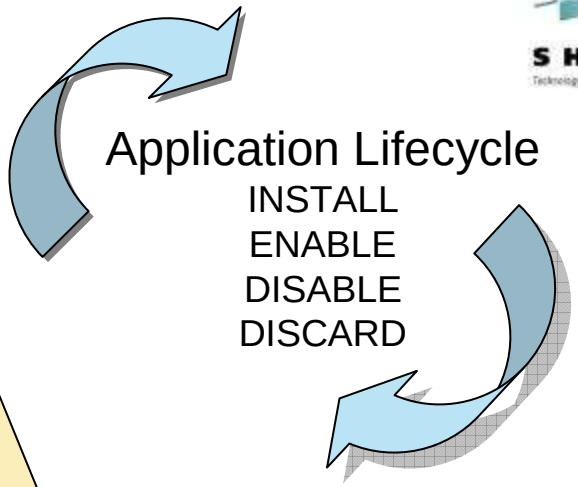
Create agile services from existing assets

- By defining an application you can:
  - Combine and manage disparate application resources as a single entity
  - Rapidly move versioned applications through development, test and production
  - Automate dependency management throughout the application lifecycle
  - Ensure rigorous yet flexible provisioning with application bindings
  - Measure entire application resource usage for tracking and internal billings
  - Dynamically manage applications by applying policies during runtime



First-class applications





Application

Name
- org.maw.banking.Loans

Version
- 1.2.1

Resources
- LIBRARY, PROGRAM, TRANSACTION, URIMAP
- (EVENTBINDING, OSGIBUNDLE, …)

Dependencies
- DB2CONNECTION, JVMSERVER, TCPIPSERVICE, …

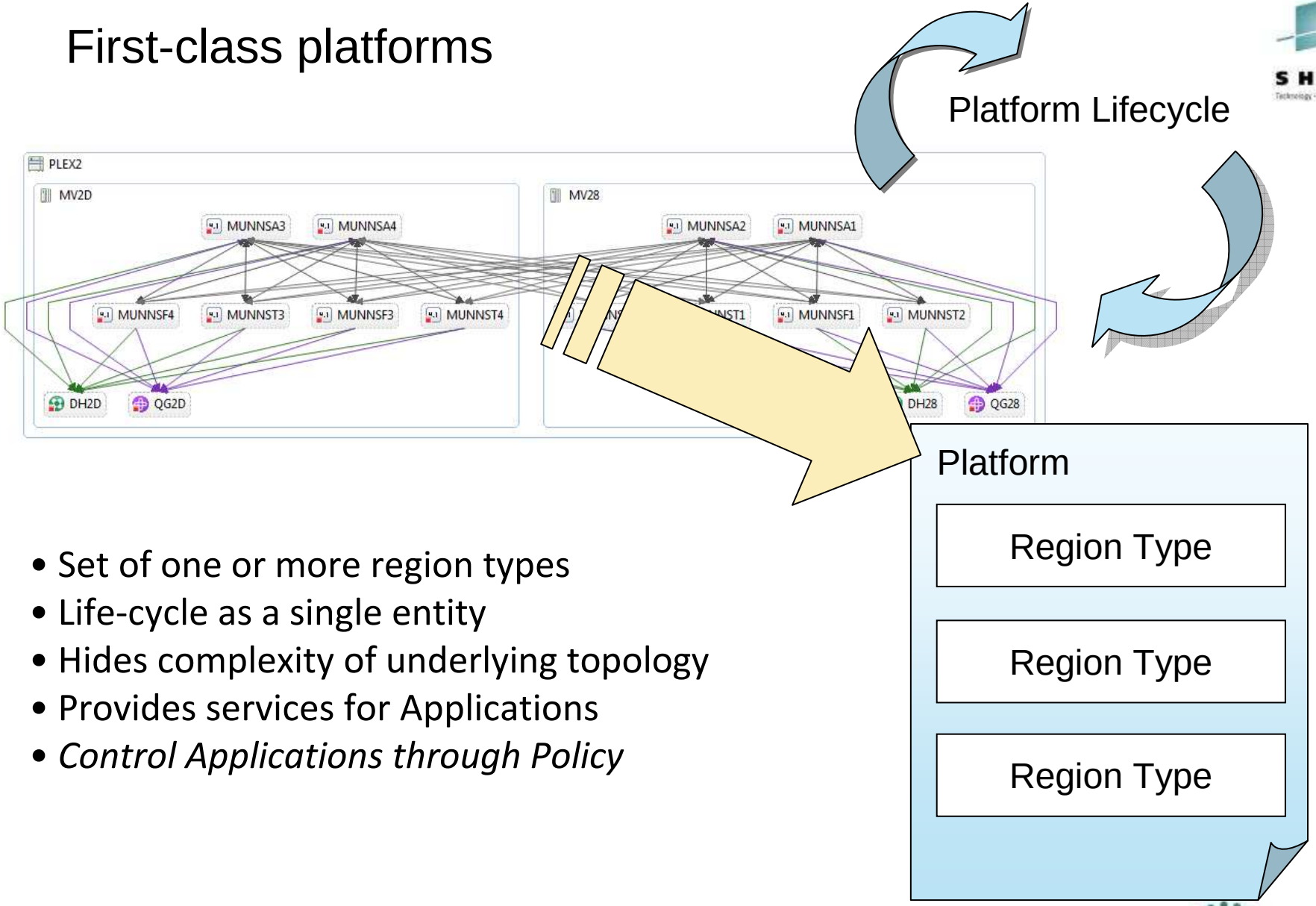
Entry points
- operation: browse, update, …
- resource: PROGRAM

- 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

Application context

- Allows measurement and resource usage control at the application level
- Define the application entry point
  - PROGRAM…
- Associate Task with Application operation
  - PROGRAM LINK…
- The application context follows the application flow from Task to Task & Region to Region across MRO and IPIC connections
- Recorded in monitoring data
  - Includes Platform, Application, Version (major.minor.micro), Operation

First-class platforms



- Set of one or more region types
- Life-cycle as a single entity
- Hides complexity of underlying topology
- Provides services for Applications
- *Control Applications through Policy*

Summary

- CICS TS provides
  - An environment for running transactions; CICS Transaction Server manages concurrency, sharing of resources, integrity of data, and prioritization of work.
  - Support for business applications written in COBOL, C, C++, PL/I, Java, and Assembler, providing an application programming interface to access CICS services.
  - Access by applications to data stored in DB2 and DL/I databases and in VSAM and BDAM data sets.
  - Connectivity with WebSphere MQ and access to the Message Queue Interface from CICS application programs.
  - Distribution of work between multiple CICS regions in a z/OS sysplex.
  - Connectivity with other systems in client/server and peer-to-peer configurations.
  - Interfaces for configuring and managing your CICS regions.
  - Aids for debugging application programs, and for diagnosing problems in your system.