z/TPF EE V1.1

# *TPF Users Group Fall 2007*

## z/TPF Enhancements for SOAP Provider Support and Tooling for Web Services Development

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# Developing Web services for z/TPF

- Exposing existing application logic via Web services, or creating new Web services to be run on z/TPF, has been a manual process that required a wide assortment of skills
- In depth knowledge of several Web services-related specifications was needed:
  - eXtensible Markup Language (XML)
  - SOAP 1.1 and/or SOAP 1.2
  - Web Services Description Language (WSDL)
  - Universal Discovery Description and Integration (UDDI)
- In depth knowledge of structures and concepts used by the z/TPF SOAP runtime:
  - Manual interrogation and manipulation of `infoNodes` structure for processing the XML-formatted SOAP request
  - Code updates required to the `tpf_soap_appl_handler` to deploy or undeploy implemented Web services

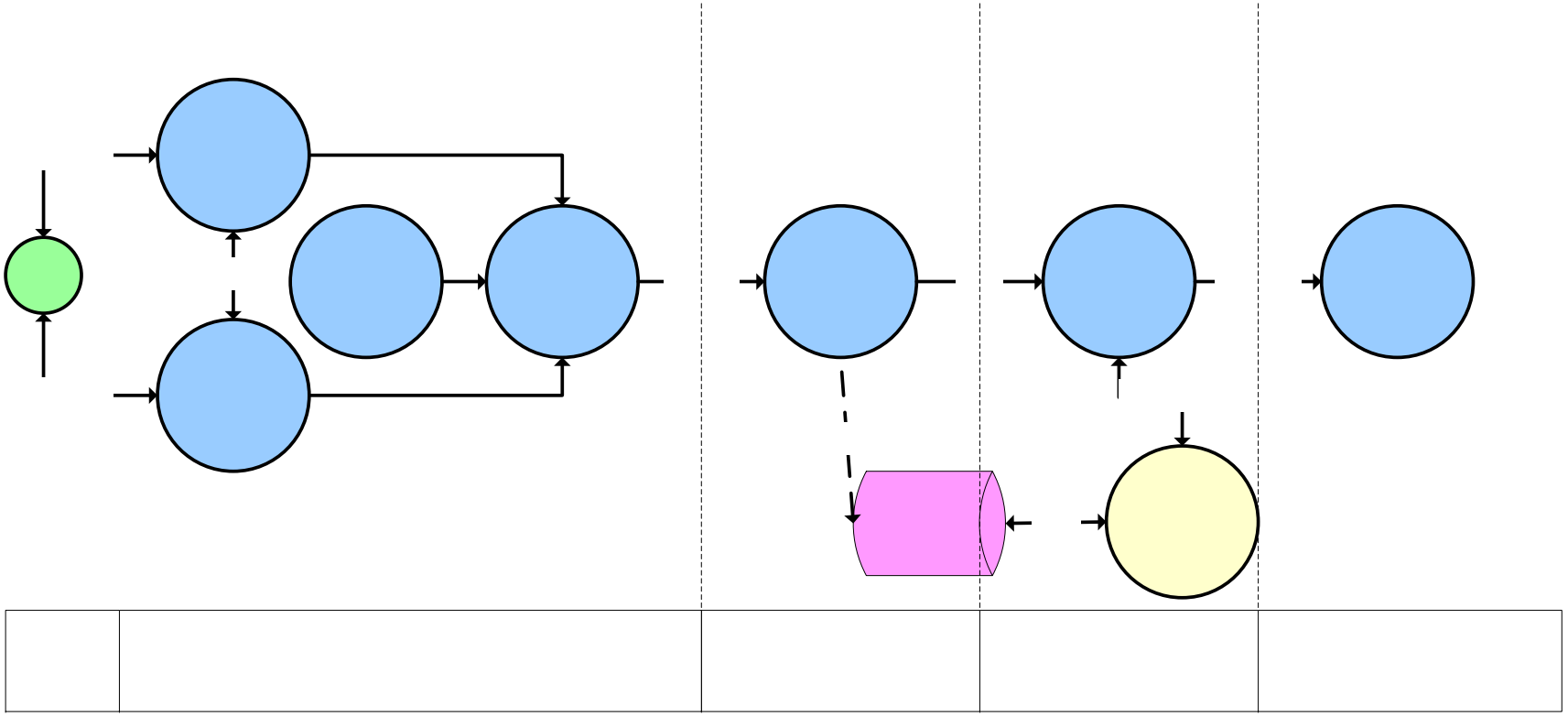
# Improving Web services development for z/TPF

- Earlier efforts had begun to address the complexity involved with developing Web services on z/TPF:
  - z/TPF XML APIs (PJ30866, PUT 2) made it so users no longer had to code to the internal `infoNodes` structure directly
  - Sample communications binding for receiving SOAP requests over WebSphere MQSeries was placed on the z/TPF Web site.
- Our goal is to make the development, deployment, and management of Web services on z/TPF, in both procedures and required skills, similar to those needed on other platforms
  - Knowledge of underlying standards and specifications is still required, but not at the level of detail previously necessary
  - A greater isolation of system and user code, with well-defined interfaces
- The result: *improved usability, greater flexibility,* and *faster time-to-market*

# Enhancements for z/TPF SOAP provider support

- z/TPF APAR PJ32215 (PUT 4)
  - An improved deployment and management mechanism for Web service resources:
    - Provider Web services
    - SOAP message handlers
  - Infrastructure to enable users to implement optional SOAP features (WS-*) with SOAP message handlers
  - Web Services Interoperability Organization (WS-I) conformance checking
  - SOAP bridge support to invoke traditional z/TPF applications
- TPF Toolkit 3.2.3
  - Web Tools Platform (WTP) Eclipse plug-in integrated in TPF Toolkit
  - z/TPF-specific tooling for generating Web service artifacts needed by SOAP runtime

# Typical Web service development process

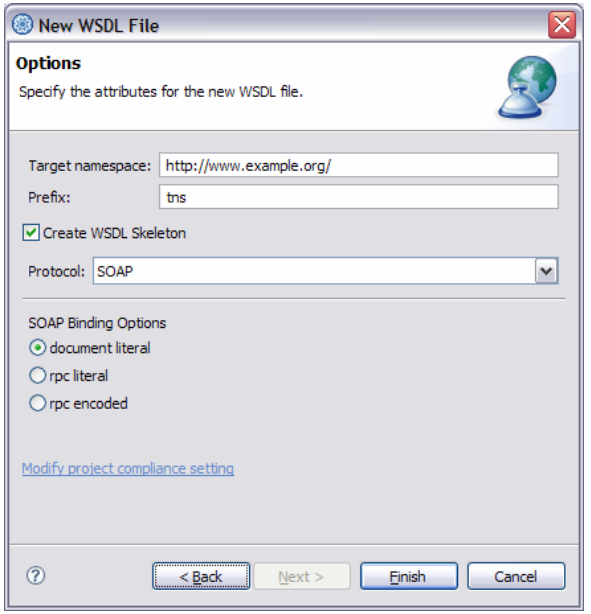


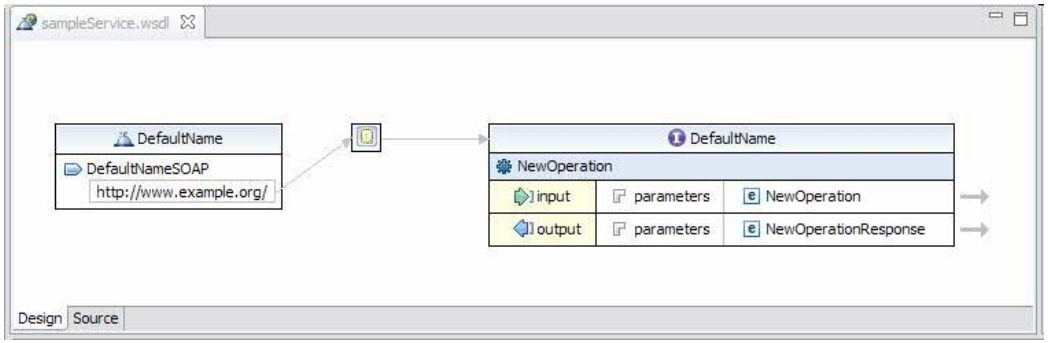
# Building a provider Web service

- 4 primary *artifacts* that each provider Web service should have:
  - **WSDL document:** defines the interface to the Web service for Web service consumers
  - **Provider Web service deployment descriptor:** defines the runtime characteristics of the Web service to the z/TPF SOAP handler
  - **Web service wrapper program:** processes the SOAP request message, invokes the Web service application, constructs the SOAP response message
  - **Web service application:** provides the actual service being requested

# WSDL: Define interface to the Web service

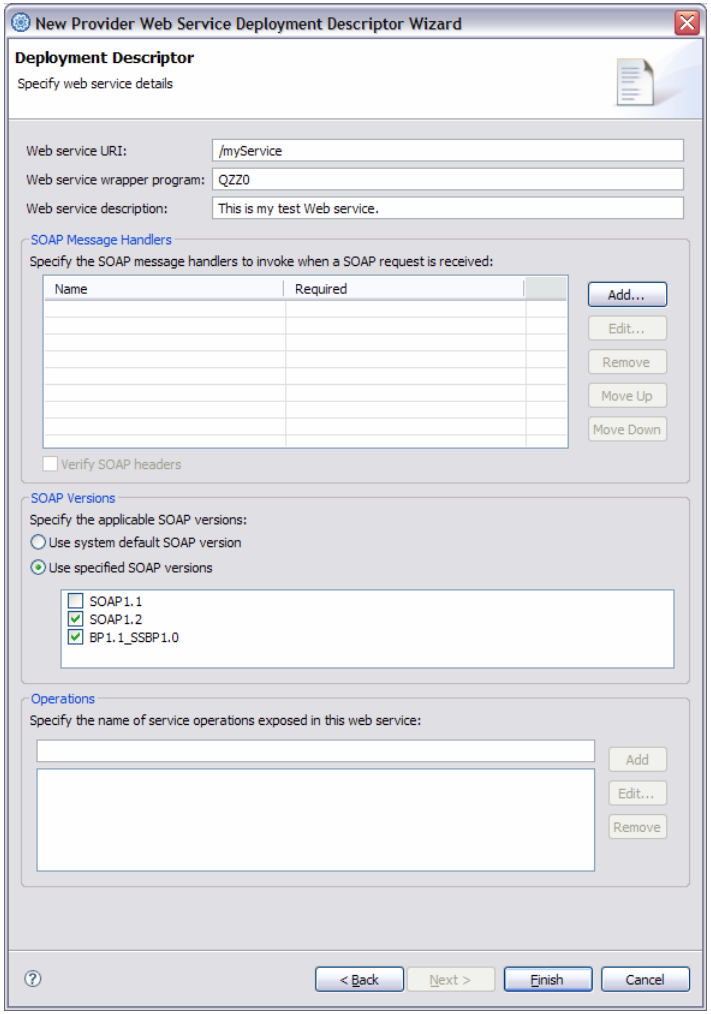
- Use the TPF Toolkit to create a **WSDL document** that defines the interface to the Web service you are exposing on z/TPF
- WSDL creation wizard will generate an initial template that acts as the starting point for your WSDL document
- WSDL editor provides a **Design** view and a **Source** view for editing the WSDL document



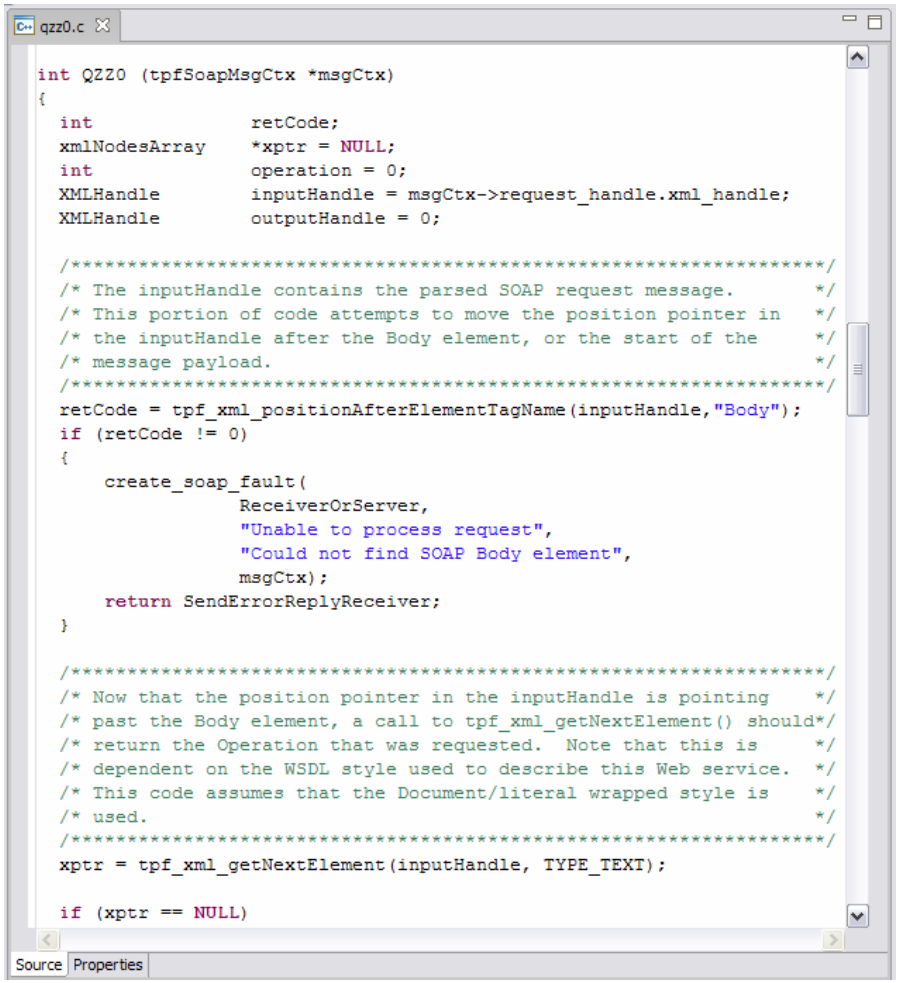
# Deployment descriptor: Define runtime characteristics

- Use the TPF Toolkit to create a **provider Web service deployment descriptor** that defines the runtime characteristics of the Web service to the z/TPF SOAP handler
- Deployment descriptor is an XML document that directs the processing path for an inbound SOAP request:
  - Verify request is in expected SOAP version format (including WS-I conformance checks)
  - Optionally verify that all SOAP headers marked as *mustUnderstand* are actually understood
  - Invoke specified chain of SOAP message handlers
  - Invoke specified Web service wrapper program



# Web service wrapper: Process a SOAP request

- Use the TPF Toolkit to create a template for your **Web service wrapper program** using the WSDL document you previously created
- Edit the generated Web service wrapper program:
  - Use the z/TPF XML APIs to extract any parameters from the SOAP request and transform those parameters from XML into the data representation expected by the underlying application
  - Invoke the correct application
  - Use the z/TPF XML APIs to create a SOAP response or SOAP fault to be returned to the z/TPF SOAP handler
- Compile and link the program like any other z/TPF shared object


qzz0.c

```
int QZZ0 (tpfSoapMsgCtx *msgCtx)
{
  int              retCode;
  xmlNodesArray    *xptr = NULL;
  int              operation = 0;
  XMLHandle        inputHandle = msgCtx->request_handle.xml_handle;
  XMLHandle        outputHandle = 0;

  /*************************************************************************/
  /* The inputHandle contains the parsed SOAP request message.             */
  /* This portion of code attempts to move the position pointer in         */
  /* the inputHandle after the Body element, or the start of the           */
  /* message payload.                                                      */
  /*************************************************************************/
  retCode = tpf_xml_positionAfterElementTagName(inputHandle,"Body");
  if (retCode != 0)
  {
      create_soap_fault(
                  ReceiverOrServer,
                  "Unable to process request",
                  "Could not find SOAP Body element",
                  msgCtx);
      return SendErrorReplyReceiver;
  }

  /*************************************************************************/
  /* Now that the position pointer in the inputHandle is pointing          */
  /* past the Body element, a call to tpf_xml_getNextElement() should      */
  /* return the Operation that was requested.  Note that this is           */
  /* dependent on the WSDL style used to describe this Web service.        */
  /* This code assumes that the Document/literal wrapped style is          */
  /* used.                                                                 */
  /*************************************************************************/
  xptr = tpf_xml_getNextElement(inputHandle, TYPE_TEXT);

  if (xptr == NULL)
```

Source | Properties

# Web service application: Provide requested service

- The **Web service application** may consist of business logic that already exists on the z/TPF system, or it may be newly written code
  - *If the application already exists:* code does not need to change in order to expose it via a new Web services interface
  - *If the application is new:* code does not need to be written to manipulate XML documents
- The application processes the request using any parameters passed to it from the Web service wrapper program and returns the necessary output
  - SOAP message presentation is handled by the Web service wrapper, not the application
- Compile/assemble and link the program like any other z/TPF shared object

# z/TPF SOAP bridge support for Web service wrappers

- Use **z/TPF SOAP bridge support** if the Web service application is a "traditional" z/TPF application:
  - Expects input message in application message format (AM0SG)
  - Activated via the system message router (segment COA4)
  - Sends output message via ROUTC macro or an equivalent
- Support consists of 6 new APIs intended for use in Web service wrapper programs:
  - `tpf_soapBridge_register`: Register a line number, interchange address, terminal address (LNIATA) for use by SOAP bridge support
  - `tpf_soapBridge_route`: Route an input message to a traditional z/TPF application
  - `tpf_soapBridge_receive`: Receive an output message from a traditional z/TPF application
  - `tpf_soapBridge_unregister`: Unregister a LNIATA from use by SOAP bridge support
  - `tpf_convertToAMSG`: Utility function to convert a byte array into AM0SG format
  - `tpf_convertFromOMSG`: Utility function to convert an output message in OMSG format to a byte array

# Packaging a provider Web service

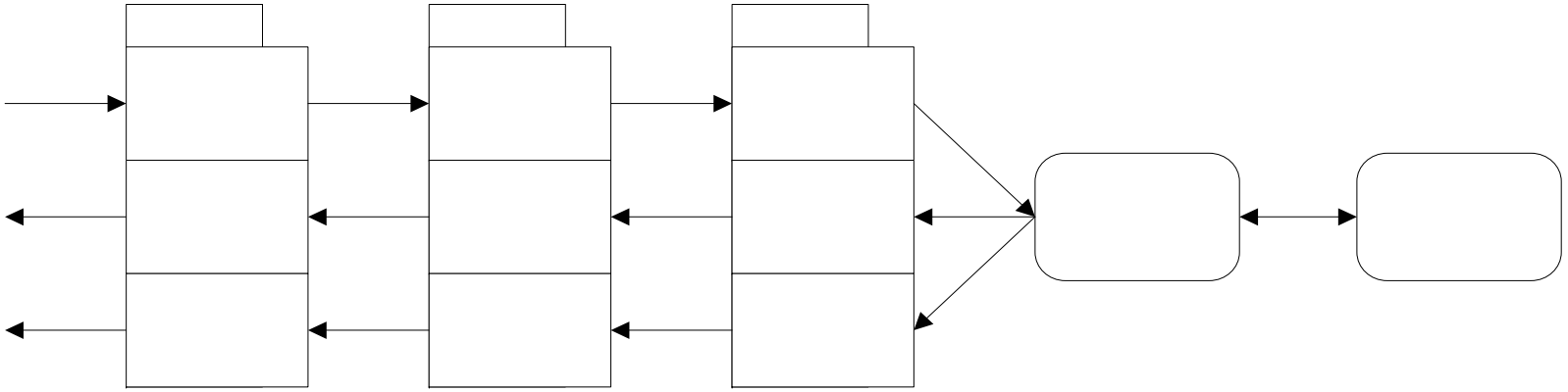
- Some of the artifacts built for a provider Web service are used online by z/TPF, others are intended for use offline only
  - **WSDL document:** used offline only
  - **Provider Web service deployment descriptor:**
    - FTP manually (in ASCII) to the `/etc/tpf-ws/` directory of the z/TPF file system
    - Use the TPF Toolkit to automatically transfer to the z/TPF file system
  - **Web service wrapper program:** load as part of E-type loader loadset
  - **Web service application:** load as part of E-type loader loadset (if not already on the z/TPF system)

# SOAP message handlers: Extend basic SOAP protocol

- **SOAP message handlers** provide an infrastructure that allows many different Web services to take advantage of common processing that is used to extend the basic SOAP protocol
- SOAP message handlers can be written to provide an interface to various Web service extensions:
  - *Standard SOAP features:* WS-Security, WS-Addressing, WS-*
  - *User-specific functionality:* request/response logging, etc.
- SOAP message handler artifacts (packaging and usage is identical to artifacts associated with provider Web services):
  - **SOAP message handler deployment descriptor:** defines the runtime characteristics of the SOAP message handler
  - **SOAP message handler program:** performs necessary processing using the inbound SOAP request and the outbound SOAP response
- Each provider Web service that requires a SOAP message handler to be called must include the message handler's name in the `SOAPMessageHandlerChain` element of its own deployment descriptor

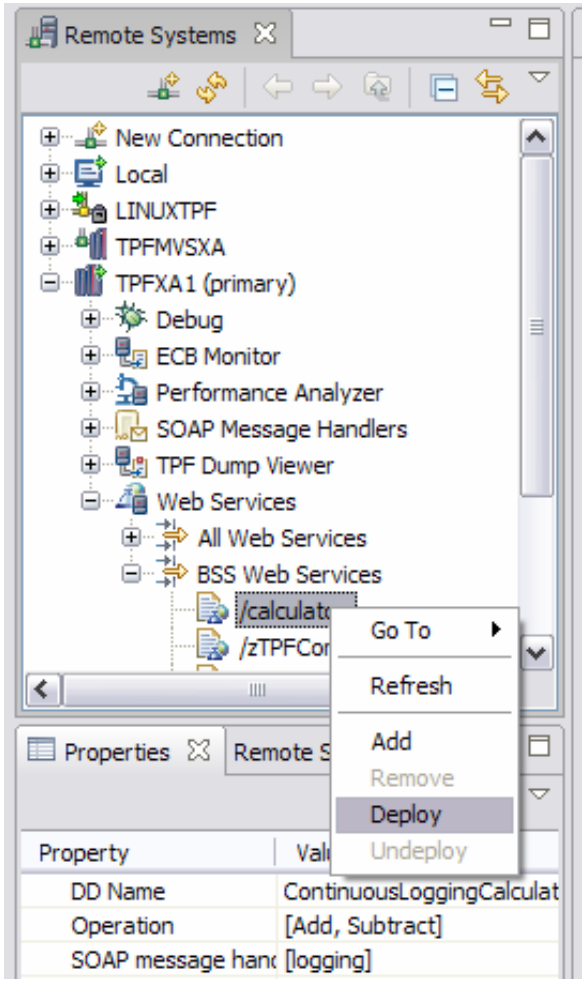
# SOAP message handler processing flow

- SOAP message handlers are invoked by z/TPF SOAP handler in the following situations:
  - **SOAP request:** called in the order they are listed in the Web service's SOAP message handler chain *before* calling the Web service wrapper
  - **SOAP response:** called in the reverse order they are listed in the Web service's SOAP message handler chain *after* calling the Web service wrapper
  - **SOAP fault:** called in the reverse order they are listed in the Web service's SOAP message handler chain



# Deploying Web service resources

- 2 alternatives for deploying Web service resources to the z/TPF SOAP handler:
  - Use the **TPF Toolkit's Remote System Explorer (RSE) perspective** to generate a list of available Web service resources
    - Right-click on one or more Web service resources listed and select the "Deploy" action
  - Use the **`ZWSAT DEPLOY`** command directly on z/TPF
- All programs that will be called to process a SOAP request must be loaded and active for a deployment to be successful:
  - SOAP message handler program
  - Web service wrapper program

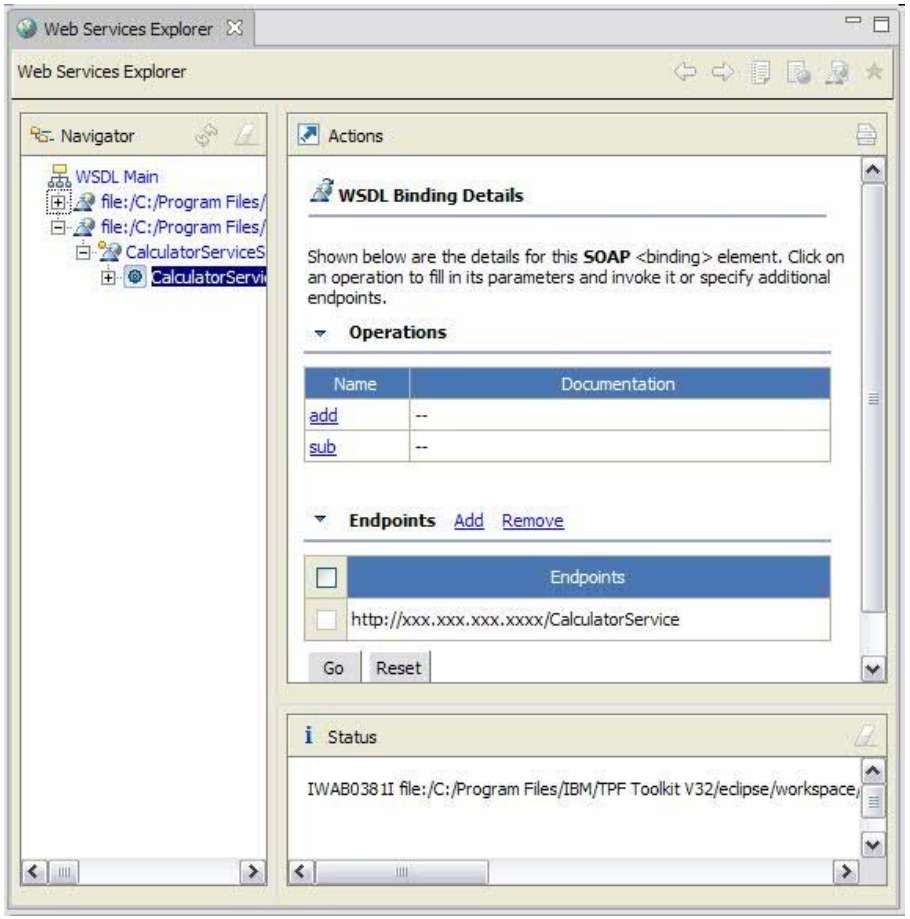


# Web services deployment table

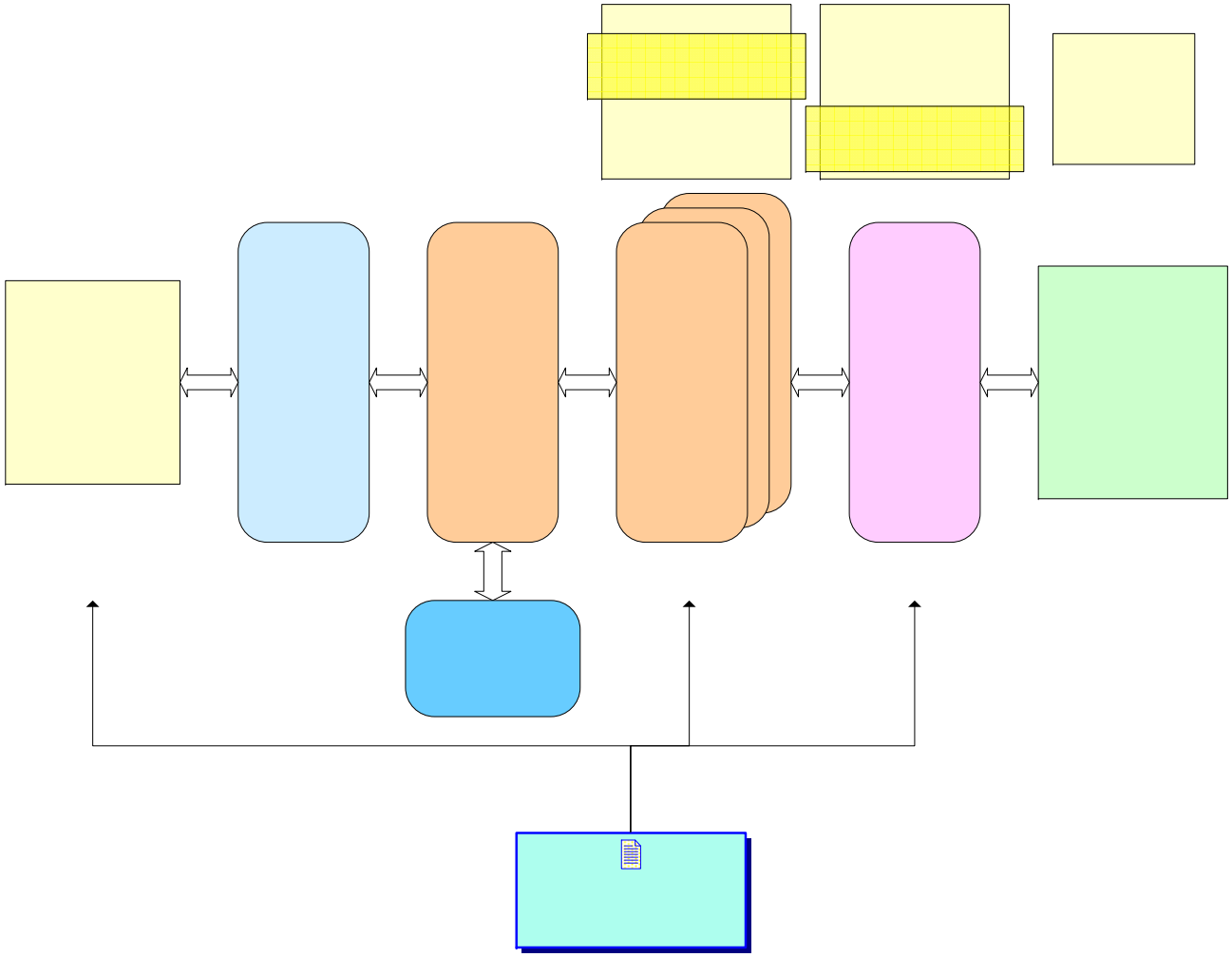
- z/TPF SOAP handler uses the new **Web services deployment table (WSDT)** when processing inbound SOAP requests
- The WSDT keeps track of all **Web service resources** (provider Web services and SOAP message handlers) that have been *deployed* or have been marked as *undeployed*
- The WSDT contains an internal representation of the data contained in each Web service resource's deployment descriptor
  - z/TPF SOAP handler does not interrogate deployment descriptors in XML format while servicing SOAP requests
- If a SOAP request is received for a Web service that does not have an entry in the WSDT, the existing `tpf_soap_appl_handler` user exit will be invoked to route the request

# Testing a provider Web service

- Use the TPF Toolkit to test the newly created Web service interface
- Register the desired program for debugging using the existing **Debug Subsystem**
  - SOAP message handler program
  - Web service wrapper program
- Generate a test SOAP request message using the new **Web Services Explorer**
  - Use the WSDL document that defines the Web service interface to generate a sample HTML form that acts as a SOAP client
  - Sends a complete SOAP request to z/TPF using HTTP



# Running a provider Web service



# Managing Web service resources

- Use the **ZWSAT** command to manage the Web service resources in a z/TPF complex
  - DEPLOY: adds a Web service resource to the WSDT *and* makes it available for use by the z/TPF SOAP handler
  - UNDEPLOY: marks a previously deployed Web service resource as unavailable to the z/TPF SOAP handler
  - ADD: adds a Web service resource to the WSDT *but* leaves its status as undeployed so it is not available to the z/TPF SOAP handler
  - REMOVE: removes a Web service resource from the WSDT
  - DISPLAY:
    - display the attributes and status of a specific Web service resource
    - display a summary of all Web service resources based on resource type or deployment status

# Redeploying Web service resources

- During the life cycle of a Web service resource, it may become necessary to change the runtime characteristics that are associated with that resource. For example:
  - Change the program that implements the resource
  - Update the SOAP message handler chain for a provider Web service
  - Update the supported SOAP versions for a provider Web service
- These updates can be made in real time with *no downtime* for the resource
  - Transfer the updated deployment descriptor to the `/etc/tpf-ws/` directory in the z/TPF file system
  - Use the `ZWSAT DEPLOY` command to “redeploy” the updated deployment descriptor that defines the Web service resource
  - When prompted, enter `ZWSAT CONTINUE` to continue with the deployment even though the resource is already deployed
  - All subsequent SOAP requests that make use of this Web service resource will begin using the new runtime characteristics

# Summary of new features in z/TPF

- Web services deployment mechanism
  - Deployment descriptor defines processing attributes for each Web service (for example, “wrapper” program, supported SOAP versions, etc.)
  - ZWSAT command:  Deploy, undeploy, and display Web service resources
- SOAP message handler infrastructure
  - Programs for extending one or more provider Web services
  - Used to implement standard SOAP features (WS-*) or user-specific extensions
- Web Services Interoperability Organization (WS-I) conformance checking
  - Basic Profile 1.1
  - Simple SOAP Binding Profile 1.0
- SOAP bridge support
  - 6 z/TPF-unique APIs for use in Web service wrapper programs for routing input messages to and receiving output messages from traditional z/TPF applications

# Sample Web service artifacts available for download

- 4 new samples have been created to demonstrate the usage of this new support, and are available for download at the z/TPF Web site
- Sample Web service wrapper (`/CalculatorService`)
  - Implements a simple calculator service with add and subtract operations
  - Includes: WSDL, deployment descriptor, Web service wrapper program, and HTML client
- Sample SOAP message handler (`logging`)
  - Implements a SOAP message handler that writes info to syslog (intended for use with `/CalculatorService` sample)
  - Includes: SOAP message handler deployment descriptor, provider Web service deployment descriptor, and SOAP message handler program
- Sample SOAP bridge wrapper (`/zTPFCommand`)
  - Implements a Web browser interface to z/TPF system message processor (SMP)
  - Includes: WSDL, deployment descriptor, Web service wrapper program, and HTML client
- Sample `mod_tpf_soap` (Apache 1.3 SOAP communications binding) updated to include additional message validation checks for WS-I Simple SOAP Binding Profile 1.0 conformance

# Summary of new features in IBM TPF Toolkit 3.2.3

- Web Tools Platform (WTP) Eclipse plug-in integrated in TPF Toolkit:
  - XML editor
  - Web Services Description Language (WSDL) creation wizard and editor
  - Web Services Inspection Language (WSIL) creation wizard
  - Publish WSDL documents to a Universal Discovery Description and Integration (UDDI) registry
  - Web services explorer (SOAP client for testing)
- Tooling specific to z/TPF added to TPF Toolkit:
  - Deployment descriptor creation wizard
  - Wrapper template creation wizard
  - Web Services and SOAP Message Handlers subsystems added to Remote systems explorer (RSE)

# Reminder

- Wednesday
  - **TPF Education Session:** *Creating Web Services for Your z/TPF System* (Edwin van de Grift)

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