Reliable Asynchronous Messaging Profile (RAMP) Toolkit

Version 1.0
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Contents

Overview

The Reliable Asynchronous Messaging Profile (RAMP) consists of a set of Web Services specifications, along with clarifications and amendments to those specifications which promote interoperability. More information about RAMP is available from the IBM developerWorks website:

http://www-128.ibm.com/developerworks/webservices/library/specification/ws-ramp

The RAMP Toolkit is designed to allow customers to demonstrate the usage of Web Services specifications included in the profile (WS-Addressing, WS-ReliableMessaging and WS-SecureConversation). The toolkit adds support for these specifications to the IBM WebSphere Application Server Version 6. The toolkit is designed to operate with existing web services.

This technology is part of the Emerging Technologies Toolkit (ETTK), a special collection of emerging technologies from IBM's software development and research labs.

Installation

Required Software

The RAMP Toolkit is designed to work with the IBM WebSphere Application Server Version 6. If you do not have WebSphere already installed, a free 60-day trial version is available from the IBM developerWorks website:

http://www-128.ibm.com/developerworks/downloads/ws/was

NOTE: The RAMP Toolkit includes a modified version of the IBM web services engine containing example code and limited function implementations of Web Services specifications. The toolkit is intended for demonstration purposes only and should NOT be installed on a production WebSphere Application Server.

The RAMP Toolkit is installed as an update (maintenance package) for WebSphere Application Server Version 6. To install the package, you must first ensure that you have the latest version of the Update Installer for WebSphere Application Server Version 6. The Update Installer is available from the IBM WebSphere support website:

http://www-1.ibm.com/support/docview.wss?rs=180&uid=swg24008401

Installing the RAMP Toolkit

- Stop the WebSphere Application Server if it is currently running.

- Start the update installer by running the "update" executable in the "WebSphere/AppServer/updateinstaller" directory.

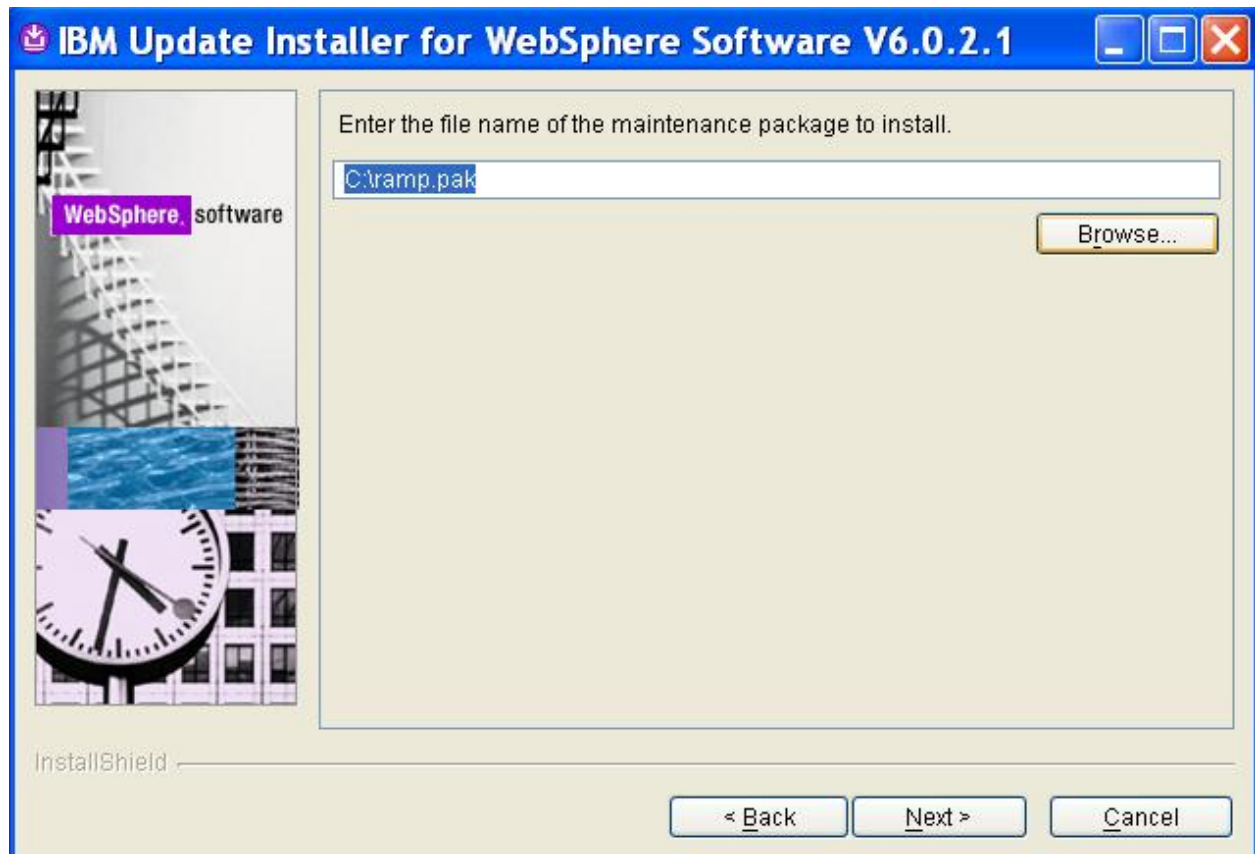- The first panel is informational, press *Next* to continue.

- Enter the path to the installation directory (or accept the default if it is correct) and press *Next* to continue.

- Select *Install maintenance package* and press *Next* to continue.
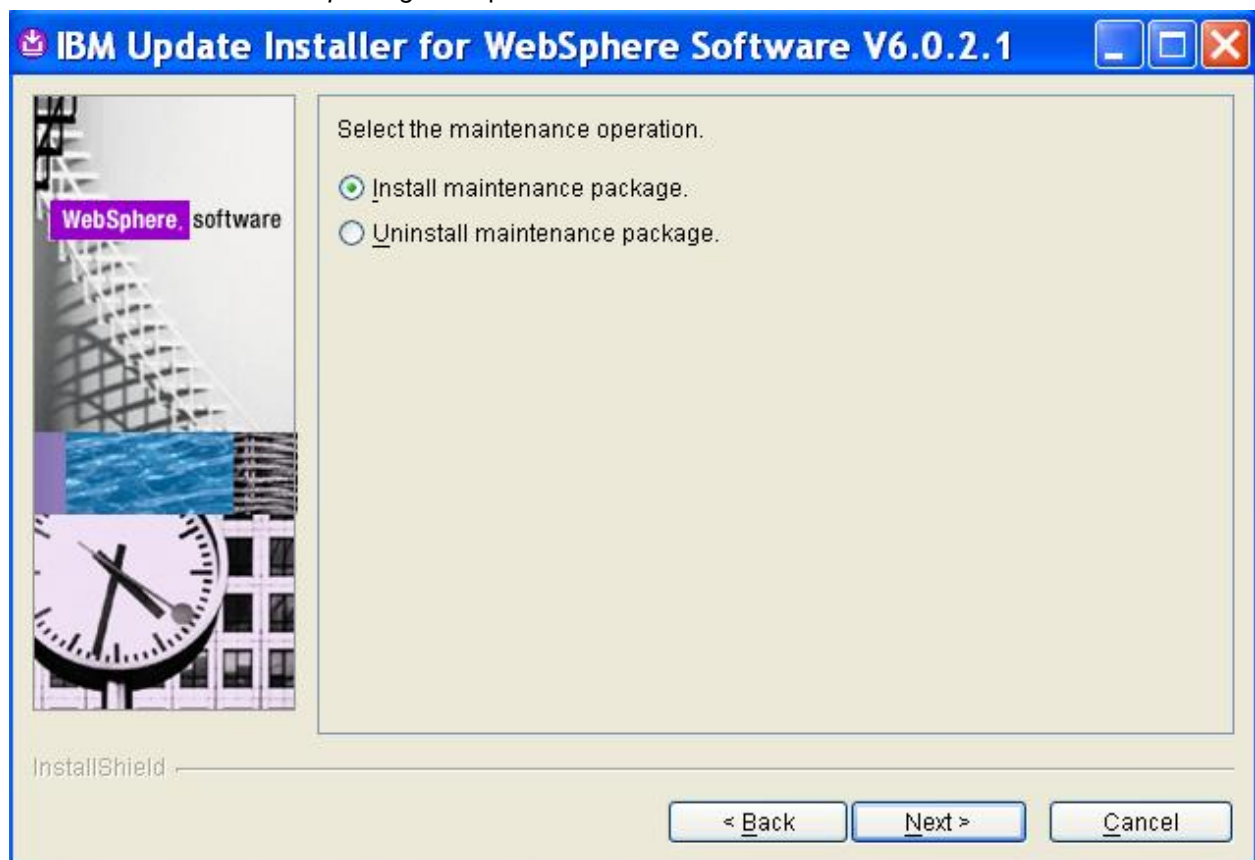
- Select *Browse* and select the RAMP maintenance package that you have downloaded to your system. Press *Next* to continue.

- Press *Next* to begin the installation. The configuration script 01FDeployRAMPapps may take several minutes to complete.

- Press *Finish* when the installation is done.

- Start the WebSphere Application Server

After installation, the on-line version of the RAMP Toolkit documentation (including links to the RAMP Monitor and Web Service Sample) is available by accessing the ramp web application in your browser. For example, if your application server is running on port 9080, the the URL to be used would be "http://localhost:9080/ramp".

NOTE: The RAMP Toolkit installation will install the runtime support, documentation, RAMP monitor and web service sample in the "default" WebSphere Application Server profile.

Removing the RAMP Toolkit

The Update Installer for WebSphere Application Server Version 6 may also be used to uninstall the RAMP Toolkit.

NOTE: The RAMP Toolkit should be uninstalled before installing any other maintenance packages.

- Stop the WebSphere Application Server if it is currently running.

- Start the update installer by running the "update" executable in the "WebSphere/AppServer/updateinstaller" directory.

- The first panel is informational, press *Next* to continue.

- Enter the path to the installation directory (or accept the default if it is correct) and press *Next* to continue.

- Select *Uninstall maintenance package* and press *Next* to continue.

- Select *ramp.pak* and press *Next* to continue.

- Press *Next* to begin the uninstallation. The configuration script 01FRemoveRAMPapps can take several minutes to complete.

- Press *Finish* when the uninstallation is done.

- Start the WebSphere Application Server.

Configuration

The RAMP Toolkit configuration is used to specify the configuration options that will be used by the toolkit runtime to implement WS-Addressing asynchronous responses, WS-Reliable Messaging and WS-Secure Conversation.

The RAMP Toolkit configuration panels accessed through the WebSphere Administrator Console. Log in to the WebSphere Administrative Console and expand the *Ramp* entry in the left side panel. Click on the *Configuration* entry to display the RAMP configuration panel.

The RAMP Toolkit allows the administrator to provide unique configuration options based upon the endpoint address being referenced. This means that the configuration options associated with an endpoint address will be used by the RAMP Toolkit runtime whenever a client application invokes a web service that is located at the associated address or when an incoming web service request is targeted at the associated address.

To simplify the configuration, the administrator also provides the ability to specify a wildcard character (*) as part of an endpoint address. This allows the same configuration to be used for multiple endpoints. The wildcard character is used to match zero or more arbitrary characters. For example, the address "http://*test" would match any address that begins with "http://" and ends with "test". Note that if more than one set of configuration options have a matching endpoint address, only the first set of configuration options will be used (i.e. order is important). To modify the order, select the configuration entry you wish to move and use the *Up* or *Down* buttons.

The options associated with a configuration may be set or modified by clicking on the configuration name.

NOTE: The RAMP configuration *Save* button must be pressed before any changes will take effect. The RAMP configuration *Save* button has no effect on the WebSphere master configuration and saving the WebSphere master configuration has no effect on RAMP configuration. Each configuration must be saved independently.

Creating a New Configuration

An administrator may press the *New* button to manually enter a name and endpoint address. The name must be unique and is only used within the RAMP configuration to assist the administrator in managing configurations.

The RAMP Toolkit also provides assistance to administrators when configuring web services that have a WSDL file available. Pressing the *Import* button will display a panel used to create configurations from WSDL files.

Expanding the *WSDL Loader* control allows the administrator to browse the local file system for a WSDL file or to specify the address of a remote WSDL. Pressing the *Apply* button will then read the WSDL and display a list of endpoint addresses.

Similarly, the *Get Deployed* button may be used by the administrator to search the application server for deployed WSDL files. All endpoint addresses that are found will also be added to the displayed list.

Select the endpoint addresses to be added and press *Finish*.

WS-Addressing Configuration

To specify WS-Addressing options for a configuration, click on the configuration name that you wish to modify and select the *WS-A* tab.

The RAMP Toolkit runtime uses asynchronous responses as part of the implementation of the WS-ReliableMessaging and WS-SecureConversation specification. To support asynchronous responses, a client application must have a valid RAMP asynchronous listener available to receive these responses.

Stand-alone client applications (that are not running in the same Java virtual machine as an application server) will have a listener created automatically by the RAMP Toolkit runtime. By default, this listener will be opened on any available port (specified with a value of 0). If your client and server are communicating through a firewall, it may be necessary to specify a specific port that will be opened by changing the value of the *Port* field.

Client applications that are running within an application server do not require the RAMP Toolkit runtime to start a new listener. Instead, the RAMP Toolkit runtime provides an HTTP servlet listener that is pre-deployed on the application server for this purpose. The default URL for the listener will be displayed in the *URL* field. The default address includes the current TCP/IP address of the system and assumes the server is running on port 9080. If the server cannot be accessed by the TCP/IP address or if it is running on a different port, then the address will need to be modified.

WS-ReliableMessaging Configuration

To specify the WS-ReliableMessaging options for a configuration, click on the configuration name that you wish to modify and select the *WS-RM* tab.

The RAMP Toolkit runtime provides a basic implementation of the WS-ReliableMessaging specification. This implementation only supports the "AtLeastOnce" and "InOrder" delivery assurances.

The *Use WS-Reliable Messaging* checkbox must be checked for the remaining WS-RM options to be enabled.

The *Timeout* field is used to specify the length of time (in seconds) that a WS-RM sequence will be active if it is not explicitly terminated. This field has a default value of 300 seconds (5 minutes). A value of 0 is used to indicate that a WS-RM sequence will not time out and must be explicitly terminated.

The WS-RM Policy Assertion specification requires that endpoints declaring only input messages should reject wsrm:CreateSequence messages that contain a wsrm:Offer element. By default, the RAMP Toolkit

runtime will include a wsrm:Offer element with each wsrm:CreateSequence message. Uncheck the *Send Offer* option to not include the wsrm:Offer element.

The *Inactivity Timeout* field allows an administrator to specify an inactivity timeout value (in seconds). If there are no application or control messages associated with a sequence for the specified amount of time, the RAMP Toolkit runtime will consider the WS-RM sequence terminated due to inactivity. Leave this field empty or use a value of 0 to indicate that there is no inactivity timeout.

The *Retransmission Interval* field specifies the amount of time (in seconds) that the RAMP Toolkit runtime will wait before resending messages that have not been acknowledged. If this field is blank, a default value of 10 seconds is used.

The *Exponential Backoff* option is used to indicate that the retransmission interval will be adjusted using the commonly known exponential backoff algorithm.

The *Acknowledgement Interval* specifies the amount of time that the RAMP Toolkit runtime may wait before sending an acknowledgement once a message has been received. If this field is blank, the runtime will not wait before sending an acknowledgement message.

NOTE: The current RAMP Toolkit implementation of WS-ReliableMessaging may not be used with the standard WS-Security support provided by WebSphere Application Server. If you require secure WS-RM communication, you must configure the RAMP Toolkit runtime for WS-SecureConversation.

WS-SecureConversation

The current RAMP Toolkit runtime provides a limited implementation of the WS-SecureConversation specification. This implementation uses a pair of corresponding keystore files to define the RSA key pairs and trusted certificates that will be used for signing and encryption. Since only one pair of keystores may be specified for an associated address, all client applications will use the same security credentials when communicating with the endpoint address and the application server will use the same security credentials for all web service responses from the endpoint address.

The RAMP Toolkit runtime uses a pre-defined set of known elements to determine which parts of a message will be signed or encrypted.

- WS-Addressing headers are signed

- WS-ReliableMessaging headers are signed

- WS-SecureConversation headers are signed and encrypted

- The message body is signed and encrypted (except for messages related to creating or terminating a WS-RM sequence which are only signed).

NOTE: The current RAMP Toolkit implementation of WS-SecureConversation may not be used with the standard WS-Security support provided by WebSphere Application Server.

Client WS-SecureConversation

To specify the client WS-SecureConversation options for a configuration, click on the configuration name that you wish to modify and select the *Client WS-SC* tab.

The *Use WS-Secure Conversation* checkbox indicates that client applications should use WS-SecureConversation. This option must be checked for the remaining client options to be available.

The *Key Store* field specifies the name of the key store file containing the client RSA key pair and server trusted certificate. The key store file may be located anywhere in the classpath of the WebSphere application server or the full path for the key store file may be specified. The RAMP Toolkit provides a sample client keystore file (client.jks) that may be used.

The *Password* field specifies the password to be used when accessing the key store file. The sample client key store file provided by the RAMP Toolkit uses a password of "password".

The *Self Alias* field specifies the alias to be used when accessing the client RSA key pair stored in the keystore. The password for the client RSA key pair must match the password specified for the key store file. The sample client keystore file provided by the RAMP Toolkit uses an alias of "self" for the client RSA key pair.

The *Partner Alias* field specifies the alias to be used when accessing the server trusted certificate stored in the keystore. The password for the server trusted certificate must match the password specified for the key store file. The sample client keystore file provided by the RAMP Toolkit uses an alias of "partner" for the server trusted certificate.

Server WS-SecureConversation

To specify the server WS-SecureConversation options for a configuration, click on the configuration name that you wish to modify and select the *Server WS-SC* tab.

The *Key Store* field specifies the name of the keystore file containing the server RSA key pair and client trusted certificate. The key store file may be located anywhere in the classpath of the WebSphere application server or the full path for the key store file may be specified. The RAMP Toolkit provides a sample server keystore file (server.jks) that may be used.

The *Password* field specifies the password to be used when accessing the key store file. The sample server keystore file provided by the RAMP Toolkit uses a password of "password".

The *Self Alias* field specifies the alias to be used when accessing the server RSA key pair stored in the key store. The password for the server RSA key pair must match the password specified for the key store file. The sample server keystore file provided by the RAMP Toolkit uses an alias of "self" for the server RSA key pair.

The *Partner Alias* field specifies the alias to be used when accessing the client trusted certificate stored in the key store. The password for the client trusted certificate must match the password specified for the key store file. The sample server keystore file provided by the RAMP Toolkit uses an alias of "partner" for the client trusted certificate.

Keystores

You can create your own keystores for use in the RAMP Toolkit by using the keytool utility provided by the Java 2 SDK.

For example, the following commands will generate keystore files named "MyClient.jks" and "MyServer.jks" which both have a password of "MyPassword" and use an alias of "MySelf" for their respective RSA key pairs.

```
keytool -genkey -alias MySelf -keyalg RSA -keystore MyClient.jks -storepass
MyPassword
```

```
keytool -genkey -alias MySelf -keyalg RSA -keystore MyServer.jks -storepass
MyPassword
```

The keystore files now need a copy of the other keystore's trusted certificate. The following commands will export the trusted certificates to files named "MyClient.cert" and "MyServer.cert" respectively.

```
keytool -export -alias MySelf -file MyClient.cert -keystore MyClient.jks
```

```
keytool -export -alias MySelf -file MyServer.cert -keystore MyServer.jks
```

The following commands may then be used import the trusted certificates into the other keystore with an alias of "MyPartner".

```
keytool -import -alias MyPartner -file MyClient.cert -keystore MyServer.jks
```

```
keytool -import -alias MyPartner -file MyServer.cert -keystore MyClient.jks
```

NOTE: When generating a key store file to be used by the RAMP toolkit, the password specified for the key store must match the password associated with each alias stored in the file.

For more information about the keytool utility, please refer to the [Java 2 SDK documentation](#).

RAMP Monitor

Since the RAMP toolkit does not require code changes to existing web services, it is difficult for users to understand the benefits provided by the profile or what function the toolkit is providing. To solve this problem, the runtime for the RAMP toolkit includes a web-based monitoring tool that shows the RAMP related events occurring on the system (for both clients and servers).

The monitor shows events related to WS-Addressing asynchronous responses, WS-ReliableMessaging and WS-SecureConversation. The monitor is designed to provide a very high level view so that users can get a good understanding of the benefit provided by the RAMP Toolkit.

In addition, detailed information about each activity is also made available for users requiring a more in-depth understanding of events (including changes made to SOAP messages). Click on the [icon] button for an event

to toggle the display of detailed information.

The RAMP monitor may be accessed by loading "ramp/monitor.html" in your browser. For example, if your application server is running on port 9080, the URL to be used would be "http://localhost:9080/ramp/monitor.html".

Web Service Sample

For users who are evaluating the benefits of the RAMP technologies but do not have an existing web service, a simple web service sample is provided by the RAMP toolkit.

This sample provides a simple "echo" web service that accepts a text string as input and returns an uppercase version of the string back.

Input: Hello World

Run Web Service

Output: HELLO WORLD

The web service sample may be accessed by loading "EchoSampleClient/demo.html" in your browser. For example, if your application server is running on port 9080, the URL to be used would be "http://localhost:9080/EchoSampleClient/demo.html".

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3. LOST PROFITS, BUSINESS, REVENUE, GOODWILL, OR ANTICIPATED SAVINGS.

SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

5. General

1. Nothing in this Agreement affects any statutory rights of consumers that cannot be waived or limited by contract.

License

2. In the event that any provision of this Agreement is held to be invalid or unenforceable, the remaining provisions of this Agreement remain in full force and effect.

3. You may not export the Program.

4. You agree to allow IBM to store and use Your contact information, including names, phone numbers, and e-mail addresses, anywhere they do business. Such information will be processed and used in connection with our business relationship, and may be provided to contractors, Business Partners, and assignees of IBM for uses consistent with their collective business activities, including communicating with You (for example, for processing orders, for promotions, and for market research).

5. Neither You nor IBM will bring a legal action under this Agreement more than two years after the cause of action arose unless otherwise provided by local law without the possibility of contractual waiver or limitation.

6. Neither You nor IBM is responsible for failure to fulfill any obligations due to causes beyond its control.

7. This Agreement will not create any right or cause of action for any third party, nor will IBM be responsible for any third party claims against You except, as permitted by the Limitation of Liability section above, for bodily injury (including death) or damage to real or tangible personal property for which IBM is legally liable.

6. Governing Law, Jurisdiction, and Arbitration

Governing Law

Both You and IBM consent to the application of the laws of the country in which You acquired the Program license to govern, interpret, and enforce all of Your and IBM's rights, duties, and obligations arising from, or relating in any manner to, the subject matter of this Agreement, without regard to conflict of law principles.

The United Nations Convention on Contracts for the International Sale of Goods does not apply.

Jurisdiction

All of our rights, duties, and obligations are subject to the courts of the country in which You acquired the Program license.

Part 2 - Country-unique Terms

AMERICAS

ARGENTINA: Governing Law, Jurisdiction, and Arbitration (Section 6): The following exception is added to this section:

Any litigation arising from this Agreement will be settled exclusively by the Ordinary Commercial Court of the city of Buenos Aires.

BRAZIL: Governing Law, Jurisdiction, and Arbitration (Section 6): The following exception is added to this section:

Any litigation arising from this Agreement will be settled exclusively by the court of Rio de Janeiro, RJ.

CANADA: Limitation of Liability (Section 4): The following replaces item 1 in the first paragraph of this section:

1) damages for bodily injury (including death) and physical harm to real property and tangible personal property caused by IBM's negligence; and

General (Section 5): The following replaces the terms in item 7:

7. This Agreement will not create any right or cause of action for any third party, nor will IBM be responsible for any third party claims against You except as permitted by the Limitation of Liability section above for bodily injury (including death) or physical harm to real or tangible personal property caused by IBM's negligence for which IBM is legally liable.

Governing Law, Jurisdiction, and Arbitration (Section 6): The phrase "the laws of the country in which You acquired the Program license" in the Governing Law subsection is replaced by the following:

the laws in the Province of Ontario

PERU: Limitation of Liability (Section 4): The following is added at the end of this section:

In accordance with Article 1328 of the Peruvian Civil Code, the limitations and exclusions specified in this section will not apply to damages caused by IBM's willful misconduct ("dolo") or gross negligence ("culpa inexcusable").

UNITED STATES OF AMERICA: General (Section 5): The following is added to this section:

U.S. Government Users Restricted Rights - Use, duplication or disclosure restricted by the GSA ADP Schedule Contract with the IBM Corporation.

Governing Law, Jurisdiction, and Arbitration (Section 6): The phrase "the laws of the country in which You acquired the Program license" in the Governing Law subsection is replaced by the following:

the laws of the State of New York, United States of America

ASIA PACIFIC

AUSTRALIA: No Warranty (Section 3): The following is added:

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Limitation of Liability (Section 4): The following is added:

Where IBM is in breach of a condition or warranty implied by the Trade Practices Act 1974, IBM's liability is limited to the repair or replacement of the goods, or the supply of equivalent goods. Where that condition or warranty relates to right to sell, quiet possession or clear title, or the goods are of a kind ordinarily acquired for personal, domestic or household use or consumption, then none of the limitations in this paragraph apply.

Governing Law, Jurisdiction, and Arbitration (Section 6): The phrase "the laws of the country in which You acquired the Program license" in the Governing Law subsection is replaced by the following:

the laws of the State or Territory in which You acquired the Program license

CAMBODIA, LAOS, and VIETNAM: Governing Law, Jurisdiction, and Arbitration (Section 6): The phrase "the laws of the country in which You acquired the Program license" in the Governing Law subsection is replaced by the following:

the laws of the State of New York, United States of America

The following is added to this section:

Arbitration

Disputes arising out of or in connection with this Agreement shall be finally settled by arbitration which shall be held in Singapore in accordance with the Arbitration Rules of Singapore International Arbitration Center ("SIAC Rules") then in effect. The arbitration award shall be final and binding for the parties without appeal and shall be in writing and set forth the findings of fact and the conclusions of law.

The number of arbitrators shall be three, with each side to the dispute being entitled to appoint one arbitrator. The two arbitrators appointed by the parties shall appoint a third arbitrator who shall act as chairman of the proceedings. Vacancies in the post of chairman shall be filled by the president of the SIAC. Other vacancies shall be filled by the respective nominating party. Proceedings shall continue from the stage they were at when the vacancy occurred.

If one of the parties refuses or otherwise fails to appoint an arbitrator within 30 days of the date the other party appoints its, the first appointed arbitrator shall be the sole arbitrator, provided that the arbitrator was validly and properly appointed.

All proceedings shall be conducted, including all documents presented in such proceedings, in the English language. The English language version of this Agreement prevails over any other language version.

HONG KONG S.A.R. and MACAU S.A.R. of China: Governing Law, Jurisdiction, and Arbitration (Section 6): The phrase "the laws of the country in which You acquired the Program license" in the Governing Law subsection is replaced by the following:

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If no suit or other legal action is brought, within three years after the cause of action arose, in respect of any claim that either party may have against the other, the rights of the concerned party in respect of such claim will be forfeited and the other party will stand released from its obligations in respect of such claim.

Governing Law, Jurisdiction, and Arbitration (Section 6): The following is added to this section:

Arbitration

Disputes arising out of or in connection with this Agreement shall be finally settled by arbitration which shall be held in Bangalore, India in accordance with the laws of India then in effect. The arbitration award shall be final and binding for the parties without appeal and shall be in writing and set forth the findings of fact and the conclusions of law.

The number of arbitrators shall be three, with each side to the dispute being entitled to appoint one arbitrator. The two arbitrators appointed by the parties shall appoint a third arbitrator who shall act as chairman of the proceedings. Vacancies in the post of chairman shall be filled by the president of the Bar Council of India. Other vacancies shall be filled by the respective nominating party. Proceedings shall continue from the stage they were at when the vacancy occurred.

If one of the parties refuses or otherwise fails to appoint an arbitrator within 30 days of the date the other party appoints its, the first appointed arbitrator shall be the sole arbitrator, provided that the arbitrator was validly and properly appointed.

All proceedings shall be conducted, including all documents presented in such proceedings, in the English language. The English language version of this Agreement prevails over any other language version.

JAPAN: General (Section 5): The following is inserted after item 5:

Any doubts concerning this Agreement will be initially resolved between us in good faith and in accordance with the principle of mutual trust.

MALAYSIA: Limitation of Liability (Section 4): The word "SPECIAL" in item 2 of the third paragraph is deleted:

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Although IBM specifies that there are no warranties, You may have certain rights under the Consumer Guarantees Act 1993 or other legislation which cannot be excluded or limited. The Consumer Guarantees Act 1993 will not apply in respect of any goods which IBM provides, if You require the goods for the

purposes of a business as defined in that Act.

Limitation of Liability (Section 4): The following is added:

Where Programs are not acquired for the purposes of a business as defined in the Consumer Guarantees Act 1993, the limitations in this Section are subject to the limitations in that Act.

PEOPLE'S REPUBLIC OF CHINA: Governing Law, Jurisdiction, and Arbitration (Section 6): The phrase "the laws of the country in which You acquired the Program license" in the Governing Law subsection is replaced by the following:

the laws of the State of New York, United States of America (except when local law requires otherwise)

PHILIPPINES: Limitation of Liability (Section 4): The following replaces the terms of item 2 of the third paragraph:

2. special (including nominal and exemplary damages), moral, incidental, or indirect damages or for any economic consequential damages; or

Governing Law, Jurisdiction, and Arbitration (Section 6): The following is added to this section:

Arbitration

Disputes arising out of or in connection with this Agreement shall be finally settled by arbitration which shall be held in Metro Manila, Philippines in accordance with the laws of the Philippines then in effect. The arbitration award shall be final and binding for the parties without appeal and shall be in writing and set forth the findings of fact and the conclusions of law.

The number of arbitrators shall be three, with each side to the dispute being entitled to appoint one arbitrator. The two arbitrators appointed by the parties shall appoint a third arbitrator who shall act as chairman of the proceedings. Vacancies in the post of chairman shall be filled by the president of the Philippine Dispute Resolution Center, Inc. Other vacancies shall be filled by the respective nominating party. Proceedings shall continue from the stage they were at when the vacancy occurred.

If one of the parties refuses or otherwise fails to appoint an arbitrator within 30 days of the date the other party appoints its, the first appointed arbitrator shall be the sole arbitrator, provided that the arbitrator was validly and properly appointed.

All proceedings shall be conducted, including all documents presented in such proceedings, in the English language. The English language version of this Agreement prevails over any other language version.

SINGAPORE: Limitation of Liability (Section 4): The words "SPECIAL" and "ECONOMIC" are deleted from item 2 of the third paragraph.

General (Section 5): The following replaces the terms of item 7:

Subject to the rights provided to IBM's suppliers and Program developers as provided in Section 4 above (Limitation of Liability), a person who is not a party to this Agreement shall have no right under the Contracts (Right of Third Parties) Act to enforce any of its terms.

EUROPE, MIDDLE EAST, AFRICA (EMEA)

Rights in Data (Section 2): In EMEA, the following replaces the terms of this section in their entirety:

You assign to IBM all rights, title, and interest throughout the world (including ownership of copyright) in any data, suggestions, and written materials that 1) is related to Your use of the Program and 2) You provide to IBM. Such assignment of rights includes, but is not limited to, assignment of the rights to prepare and have prepared derivative works of the written materials, and to use, have used, execute, reproduce, transmit, display, perform, transfer, distribute and license the written materials and such derivative works in any medium or distribution technology, and to grant others some or all of the rights granted herein, for the duration of all such rights, title and interest. If IBM requires it, You will sign an appropriate document to assign such rights. Neither party will charge the other for rights in data or any work performed as a result of

License

this Agreement.

No Warranty (Section 3): In the European Union, the following is added at the beginning of this section:

In the European Union, consumers have legal rights under applicable national legislation governing the sale of consumer goods. Such rights are not affected by the provisions of this Section 3.

Limitation of Liability (Section 4): In Austria, Denmark, Finland, Greece, Italy, Netherlands, Norway, Portugal, Spain, Sweden and Switzerland, the following replaces the terms of this section in its entirety:

Except as otherwise provided by mandatory law:

1. IBM's liability for any damages and losses that may arise as a consequence of the fulfillment of its obligations under or in connection with this agreement or due to any other cause related to this agreement is limited to the compensation of only those damages and losses proved and actually arising as an immediate and direct consequence of the non-fulfillment of such obligations (if IBM is at fault) or of such cause, for a maximum amount equal to the charges You paid for the Program.

The above limitation shall not apply to damages for bodily injuries (including death) and damages to real property and tangible personal property for which IBM is legally liable.

2. UNDER NO CIRCUMSTANCES IS IBM, OR ANY OF ITS PROGRAM DEVELOPERS, LIABLE FOR ANY OF THE FOLLOWING, EVEN IF INFORMED OF THEIR POSSIBILITY: 1) LOSS OF, OR DAMAGE TO, DATA; 2) INCIDENTAL OR INDIRECT DAMAGES, OR FOR ANY ECONOMIC CONSEQUENTIAL DAMAGES; 3) LOST PROFITS, EVEN IF THEY ARISE AS AN IMMEDIATE CONSEQUENCE OF THE EVENT THAT GENERATED THE DAMAGES; OR 4) LOSS OF BUSINESS, REVENUE, GOODWILL, OR ANTICIPATED SAVINGS.

3. The limitation and exclusion of liability herein agreed applies not only to the activities performed by IBM but also to the activities performed by its suppliers and Program developers, and represents the maximum amount for which IBM as well as its suppliers and Program developers, are collectively responsible.

Limitation of Liability (Section 4): In France and Belgium, the following replaces the terms of this section in its entirety:

Except as otherwise provided by mandatory law:

1. IBM's liability for any damages and losses that may arise as a consequence of the fulfillment of its obligations under or in connection with this agreement is limited to the compensation of only those damages and losses proved and actually arising as an immediate and direct consequence of the non- fulfillment of such obligations (if IBM is at fault), for a maximum amount equal to the charges You paid for the Program that has caused the damages.

The above limitation shall not apply to damages for bodily injuries (including death) and damages to real property and tangible personal property for which IBM is legally liable.

2. UNDER NO CIRCUMSTANCES IS IBM, OR ANY OF ITS PROGRAM DEVELOPERS, LIABLE FOR ANY OF THE FOLLOWING, EVEN IF INFORMED OF THEIR POSSIBILITY: 1) LOSS OF, OR DAMAGE TO, DATA; 2) INCIDENTAL OR INDIRECT DAMAGES, OR FOR ANY ECONOMIC CONSEQUENTIAL DAMAGES; 3) LOST PROFITS, EVEN IF THEY ARISE AS AN IMMEDIATE CONSEQUENCE OF THE EVENT THAT GENERATED THE DAMAGES; OR 4) LOSS OF BUSINESS, REVENUE, GOODWILL, OR ANTICIPATED SAVINGS.

3. The limitation and exclusion of liability herein agreed applies not only to the activities performed by IBM but also to the activities performed by its suppliers and Program developers, and represents the maximum amount for which IBM as well as its suppliers and Program developers, are collectively responsible.

Governing Law, Jurisdiction, and Arbitration (Section 6)

Governing Law

The phrase "the laws of the country in which You acquired the Program license" is replaced by:

License

1) "the laws of Austria" in Albania, Armenia, Azerbeijan, Belarus, Bosnia-Herzegovina, Bulgaria, Croatia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, FYR Macedonia, Moldavia, Poland, Romania, Russia, Slovakia, Slovenia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan, and FR Yugoslavia;
2) "the laws of France" in Algeria, Benin, Burkina Faso, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo Republic, Djibouti, Democratic Republic of Congo, Equatorial Guinea, French Guiana, French Polynesia, Gabon, Gambia, Guinea, Guinea- Bissau, Ivory Coast, Lebanon, Madagascar, Mali, Mauritania, Mauritius, Mayotte, Morocco, New Caledonia, Niger, Reunion, Senegal, Seychelles, Togo, Tunisia, Vanuatu, and Wallis & Futuna;
3) "the laws of Finland" in Estonia, Latvia, and Lithuania;
4) "the laws of England" in Angola, Bahrain, Botswana, Burundi, Egypt, Eritrea, Ethiopia, Ghana, Jordan, Kenya, Kuwait, Liberia, Malawi, Malta, Mozambique, Nigeria, Oman, Pakistan, Qatar, Rwanda, Sao Tome, Saudi Arabia, Sierra Leone, Somalia, Tanzania, Uganda, United Arab Emirates, the United Kingdom, West Bank/Gaza, Yemen, Zambia, and Zimbabwe; and
5) "the laws of South Africa" in South Africa, Namibia, Lesotho and Swaziland.

Jurisdiction

The following exceptions are added to this section:

1) In Austria the choice of jurisdiction for all disputes arising out of this Agreement and relating thereto, including its existence, will be the competent court of law in Vienna, Austria (Inner-City);
2) in Angola, Bahrain, Botswana, Burundi, Egypt, Eritrea, Ethiopia, Ghana, Jordan, Kenya, Kuwait, Liberia, Malawi, Malta, Mozambique, Nigeria, Oman, Pakistan, Qatar, Rwanda, Sao Tome, Saudi Arabia, Sierra Leone, Somalia, Tanzania, Uganda, United Arab Emirates, West Bank/Gaza, Yemen, Zambia, and Zimbabwe all disputes arising out of this Agreement or related to its execution, including summary proceedings, will be submitted to the exclusive jurisdiction of the English courts;
3) in Belgium and Luxembourg all disputes arising out of this Agreement or related to its interpretation or its execution, the law, and the courts of the capital city, of the country of Your registered office and/or commercial site location only are competent;
4) in France, Algeria, Benin, Burkina Faso, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo Republic, Djibouti, Democratic Republic of Congo, Equatorial Guinea, French Guiana, French Polynesia, Gabon, Gambia, Guinea, Guinea-Bissau, Ivory Coast, Lebanon, Madagascar, Mali, Mauritania, Mauritius, Mayotte, Morocco, New Caledonia, Niger, Reunion, Senegal, Seychelles, Togo, Tunisia, Vanuatu, and Wallis & Futuna all disputes arising out of this Agreement or related to its violation or execution, including summary proceedings, will be settled exclusively by the Commercial Court of Paris;
5) in Russia all disputes arising out of or in relation to the interpretation, the violation, the termination, the nullity of the execution of this Agreement shall be settled by Arbitration Court of Moscow;
6) in South Africa, Namibia, Lesotho and Swaziland both of us agree to submit all disputes relating to this Agreement to the jurisdiction of the High Court in Johannesburg;
7) in Turkey all disputes arising out of or in connection with this Agreement shall be resolved by the Istanbul Central (Sultanahmet) Courts and Execution Directorates of Istanbul, the Republic of Turkey;
8) in each of the following specified countries, any legal claim arising out of this Agreement will be brought before, and settled exclusively by, the competent court of a) Athens for Greece, b) Tel Aviv-Jaffa for Israel, c) Milan for Italy, d) Lisbon for Portugal, and e) Madrid for Spain; and
9) in the United Kingdom both of us agree to submit all disputes relating to this Agreement to the jurisdiction of the English courts.

Arbitration

In Albania, Armenia, Azerbeijan, Belarus, Bosnia- Herzegovina, Bulgaria, Croatia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, FYR Macedonia, Moldavia, Poland, Romania, Russia, Slovakia, Slovenia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan, and FR Yugoslavia all disputes arising out of this Agreement or related to its violation, termination or nullity will be finally settled under the Rules of Arbitration and Conciliation of the International Arbitral Center of the Federal Economic Chamber in Vienna (Vienna Rules) by three arbitrators appointed in accordance with these rules.
The arbitration will be held in Vienna, Austria, and the official language of the proceedings will be English. The decision of the arbitrators will be final and binding upon both parties. Therefore, pursuant to paragraph 598 (2) of the Austrian Code of Civil Procedure, the parties expressly waive the application of paragraph 595 (1) figure 7 of the Code. IBM may, however, institute proceedings in a competent court in the country of installation.

In Estonia, Latvia and Lithuania all disputes arising in connection with this Agreement will be finally settled in

arbitration that will be held in Helsinki, Finland in accordance with the arbitration laws of Finland then in effect. Each party will appoint one arbitrator. The arbitrators will then jointly appoint the chairman. If arbitrators cannot agree on the chairman, then the Central Chamber of Commerce in Helsinki will appoint the chairman.

AUSTRIA: General (Section 5): The following is added to item 4:

For purposes of this clause, contact information will also include information about You as a legal entity, for example revenue data and other transactional information.

GERMANY: Limitation of Liability (Section 4): The following paragraph is added to this Section:

The limitations and exclusions specified in this Section will not apply to damages caused by IBM intentionally or by gross negligence.

General (Section 5): The following replaces the terms of item 5:

Any claims resulting from this Agreement are subject to a statute of limitation of three years.

HUNGARY: Limitation of Liability (Section 4): The following is added at the end of this section:

The limitation and exclusion specified herein shall not apply to liability for a breach of contract damaging life, physical well-being, or health that has been caused intentionally, by gross negligence, or by a criminal act.

The parties accept the limitations of liability as valid provisions and state that the Section 314.(2) of the Hungarian Civil Code applies as the acquisition price as well as other advantages arising out of the present Agreement balance this limitation of liability.

IRELAND: No Warranty (Section 3): The following is added to this section:

Except as expressly provided in these terms and conditions, or section 12 of the Sale of Goods Act 1893 (as amended by the Sale of Goods and Supply of Services Act 1980 ("the 1980 Act")), all conditions and warranties (express or implied, statutory or otherwise) are hereby excluded including, without limitation, any warranties implied by the Sale of Goods Act 1893 as amended by the 1980 Act (including, for the avoidance of doubt, section 39 of the 1980 Act).

Limitation of Liability (Section 4): The following replaces the terms of this section in its entirety:

For the purposes of this section, a "Default" means any act, statement, omission, or negligence on the part of IBM in connection with, or in relation to, the subject matter of an Agreement in respect of which IBM is legally liable to You whether in contract or tort. A number of Defaults which together result in, or contribute to, substantially the same loss or damage will be treated as one Default occurring on the date of occurrence of the last such Default.

Circumstances may arise where, because of a Default, You are entitled to recover damages from IBM. This section sets out the extent of IBM's liability and Your sole remedy.

1. IBM will accept unlimited liability for (a) death or personal injury caused by the negligence of IBM, and (b) subject always to the Items for Which IBM is Not Liable below, for physical damage to Your tangible property resulting from the negligence of IBM.

2. Except as provided in item 1 above, IBM's entire liability for actual damages for any one Default will not in any event exceed the greater of 1) EUR 125,000, or 2) 125% of the amount You paid for the Program directly relating to the Default. These limits also apply to any of IBM's suppliers and Program developers. They state the maximum for which IBM and such suppliers and Program developers are collectively responsible.

Items for Which IBM is Not Liable

Save with respect to any liability referred to in item 1 above, under no circumstances is IBM or any of its suppliers or Program developers liable for any of the following, even if IBM or they were informed of the possibility of such losses:

1. loss of, or damage to, data;

2. special, indirect, or consequential loss; or

3. loss of profits, business, revenue, goodwill, or anticipated savings.

ITALY: General (Section 5): The following is added to this section:

IBM and Customer (hereinafter, individually, "Party") shall comply with all the obligations of the applicable provisions of law and/or regulation on personal data protection. Each of the Parties will indemnify and keep the other Party harmless from any damage, claim, cost or expense incurred by the latter, directly and or indirectly, as a consequence of an infringement of the other Party of the mentioned provisions of law and/or regulations.

SLOVAKIA: Limitation of Liability (Section 4): The following is added to the end of the last paragraph:

The limitations apply to the extent they are not prohibited under §§ 373-386 of the Slovak Commercial Code.

General (Section 5): The terms of item 5 are replaced with the following:

THE PARTIES AGREE THAT, AS DEFINED BY APPLICABLE LOCAL LAW, ANY LEGAL OR OTHER ACTION RELATED TO A BREACH OF THIS AGREEMENT MUST BE COMMENCED NO LATER THAN FOUR YEARS FROM THE DATE ON WHICH THE CAUSE OF ACTION AROSE.

SWITZERLAND: General (Section 5): The following is added to item 4:

For purposes of this clause, contact information will also include information about You as a legal entity, for example revenue data and other transactional information.

UNITED KINGDOM: No Warranty (Section 3): The following replaces the first sentence in the first paragraph of this section:

SUBJECT TO ANY STATUTORY WARRANTIES WHICH CANNOT BE EXCLUDED, IBM MAKES NO WARRANTY OR CONDITION EITHER EXPRESS OR IMPLIED, INCLUDING (WITHOUT LIMITATION) THE IMPLIED WARRANTIES OF SATISFACTORY QUALITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON- INFRINGEMENT, REGARDING THE PROGRAM.

Limitation of Liability (Section 4): The following replaces the terms of this section in its entirety:

For the purposes of this section, a "Default" means any act, statement, omission, or negligence on the part of IBM in connection with, or in relation to, the subject matter of an Agreement in respect of which IBM is legally liable to You, whether in contract or tort. A number of Defaults which together result in, or contribute to, substantially the same loss or damage will be treated as one Default.

Circumstances may arise where, because of a Default, You are entitled to recover damages from IBM. This section sets out the extent of IBM's liability and Your sole remedy.

1. IBM will accept unlimited liability for:

a. death or personal injury caused by the negligence of IBM;

b. any breach of its obligations implied by Section 12 of the Sale of Goods Act 1979 or Section 2 of the Supply of Goods and Services Act 1982, or any statutory modification or re- enactment of either such Section; and

c. subject always to the Items for Which IBM is Not Liable below, for physical damage to Your tangible property resulting from the negligence of IBM.

2. IBM's entire liability for actual damages for any one Default will not in any event, except as provided in item 1 above, exceed the greater of 1) £75,000, or 2) 125% of the amount You paid for the Program directly relating to the Default. These limits also apply to IBM's suppliers and Program developers. They state the

maximum for which IBM and such suppliers and Program developers are collectively responsible.

Items for Which IBM is Not Liable

Save with respect to any liability referred to in item 1 above, under no circumstances is IBM or any of its suppliers or Program developers liable for any of the following, even if IBM or they were informed of the possibility of such losses:

1. loss of, or damage to, data;

2. special, indirect, or consequential loss; or

3. loss of profits, business, revenue, goodwill, or anticipated savings.

Z125-5544-02 (11/2002)

LICENSE INFORMATION

The Programs listed below are licensed under the following terms and conditions in addition to those of the International License Agreement for Early Release of Programs.

Program Name: alphaWorks Emerging Technology
Program Number: 100608

Specified Operating Environment

The Program's specifications and specified operating environment information may be found in documentation accompanying the Program, if available, such as a read-me file, or other information published by IBM, such as an announcement letter.

Evaluation Period

The evaluation period begins on the date that you agree to the terms of this Agreement and ends after 90 days.

D/N: L-APAL-5L22XX
P/N: L-APAL-5L22XX