PGP SupportPac for IBM Integration Bus v9

Part-1: A User Guide for PGP SupportPac Installation, Configuration, Key Management and Messageflow Development

By

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Summary

MyOpenTech
(PGP SupportPac)

This article is the first in a multi-part series of articles describing PGP security implementation in IBM Integration Bus v9. This series of articles introduces an industry standard solution to Data Security in IBM Integration Bus, enforcing data confidentiality and integrity by implementing PGP cryptographic solution. This solution is developed as a custom pluggable feature (or SupportPac) of IBM Integration Bus v9, attached with this article as an additional artifact. This article describes a step-by-step user guide of **PGP SupportPac** (v1.0.0.1) installation, configuration including PGP key/repository management and application development. Assuming intended readers (Architects/Designers/Developers) are familiar with basics of PGP encryption, decryption and signature processes, this article does not discuss PGP basics. However it provides a list of useful resources at reference section.

Introduction

Security facilities in IBM Integration Bus are typically based on Websphere MQ security, transport layer security (e.g. SSL/TLS) provided by underlying transport mechanism, and Access Controls (e.g. Authentication and Authorization) mechanism powered by internal (broker's security manager) and external security providers (e.g. WS-Trust V1.3 compliant security token servers, Tivoli Federated Identity Manager [TIFM], Lightweight Directory Access Protocol [LDAP]). If the message flow implements Web Services using SOAP nodes, WS-Security standards can be implemented through appropriate Policy sets and bindings.

But in today's enterprise integration world, Webservice technology is not considered as a preferred solution for asynchronous and one-way data communication especially while dealing with large volume of data. Apart from WS-Security standard (**which is applicable for Web services only**), IBM Integration Bus does not provide any in-built solution for application layer security enforcing data confidentiality and integrity. It requires implementing an industry standard cryptographic solution to enforce data security.

PGP (Pretty Good Privacy) is a widely used cryptographic solution for data communication. It was created by Phil Zimmermann in 1991. PGP follows the OpenPGP standard (RFC 4880) for encrypting and decrypting data. Besides data confidentiality and integrity, PGP also supports strong data compression.

PGP SupportPac (*version 1.0.0.1***) for IBM Integration Bus v9** implements PGP cryptographic solution providing encryption, decryption, and signature functionalities as an extended feature (SupportPac). It leverages Bouncy Castle PGP Java libraries for core PGP functionalities. Bouncy Castle is a Java based open source solution for PGP implementation, available under MIT License.

This **SupportPac** ships with a Java based command-line tool (**pgpkeytool**) for PGP key generation and key management. You do not need any third-party open source or commercial tool for PGP key management.

Installation and Configuration

Following set of variables are used throughout the article, because it varies from platform to platform. Make sure you set correct and suitable directory path as per your system.

Table-1: List of variables used in this article.

S/N	Variable Name	Windows	UNIX	Description
1	TOOLKIT_INSTALL_DIR	C:\Program Files\IBM\WMBT700	/opt/ibm/WMBT700	WMB Toolkit v9 installation directory.
2	MQSI_ROOT_DIR	C:\ Program Files \IBM\MQSI\7.0	/opt/ibm/mqsi/7.0	WMB v9 installation directory.
3	MQSI_JRE_HOME	C:\ Program Files \IBM\MQSI\7.0\jre16	/opt/ibm/mqsi/7.0/jre16	MQSI Java Runtime Environment home directory.
4	MQSI_USR_LILPATH	C:\MQSI\7.0\USR\LIL	/var/mqsi/7.0/usr/lil	Directory that contains the user-defined extension libraries. This should be customized based on your system/platform.
5	KEY_REPOSITORY	C:\PGP\KeyRepository	/var/pgp/keyrepository	Directory that contains individual private/public key files.
6	SDR_KEY_REPOSITORY	C:\PGP\KeyRepository \Sender	/var/pgp/keyrepository/sender	Directory that contains key repository files for Sender (PGP Encrypter) messageflow.
7	RCVR_KEY_REPOSITORY	C:\PGP\KeyRepository \Recipient	/var/pgp/keyrepository/recipient	Directory that contains key repository files for Recipient (PGP Decrypter) messageflow.

Download **PGP SupportPac v1.0.0.1.zip** from GitHub repository (https://github.com/dipakpal/MyOpenTech-PGP-SupportPac/tree/master/binary/IIBv9) and unzip it in a temporary directory. Zip file contains following directory structure and files.

```
PGP SupportPac v1.0.0.1/
                        lib/
                            bcpg-jdk16-146.jar
                            bcprov-ext-jdk16-146.jar
                            com.ibm.broker.supportpac.PGP.jar
                        plugins/
                                PGPSupportPac_1.0.0.1.jar
```

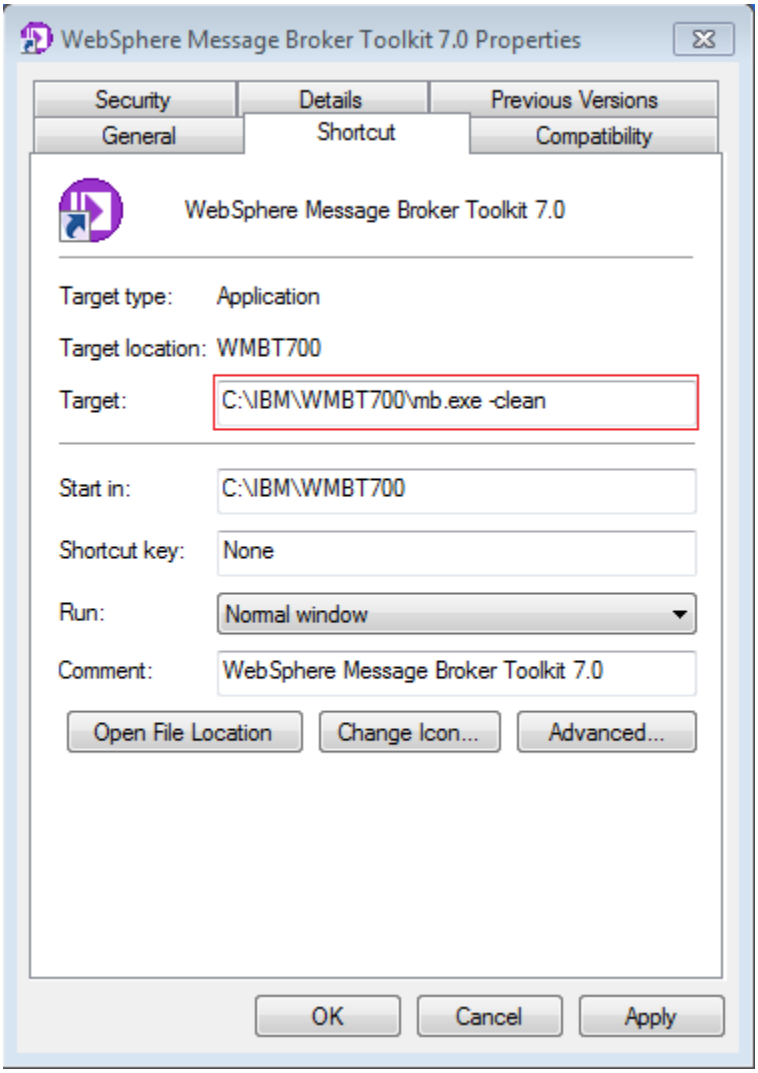
This supportPac consists of following two components.

- PGP SupportPac plugins for IBM Integration Bus toolkit.
- PGP SupportPac runtime libraries (.jar files) for IBM Integration Bus.

Install PGP SupportPac plugins for IBM Integration Bus (v9) toolkit

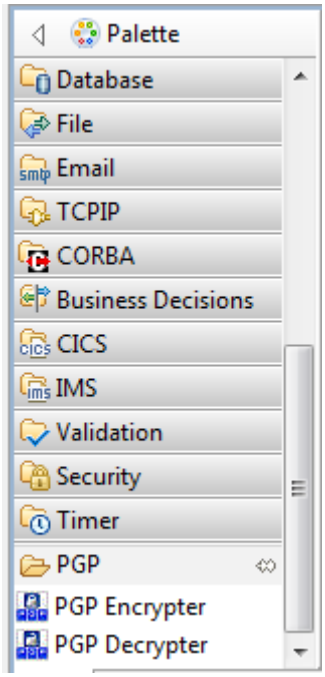
Copy **PGPSupportPac_1.0.0.1.jar** into IBM Integration Bus Toolkit's plugins directory (i.e. **$TOOLKIT_INSTALL_DIR**/plugins). Restart the toolkit with **–clean** option in order to make the PGP Encrypter/Decrypter nodes shown up in the palette.

Figure-1: Restart IBM Integration Bus Toolkit with –clean option.



Once PGP supportPac plugins is applied to the IBM Integration Bus Toolkit, PGP Encrypter/Decrypter nodes will be available in the PGP drawer of the message flow node palette.

Figure-2: PGP drawer of the message flow node palette.



Install PGP supportPac runtime libraries (jar files) on IBM Integration Bus

Install the supportPac runtime libraries (.jar files) on the broker on which you want to configure it. Following steps describe how to install and configure these supportPac runtime libraries.

Step 1: Create a directory (**$MQSI_USR_LILPATH**) if you do not already have one for this purpose. Add the directory to the broker's LILPATH by using the **mqsichangebroker** command. Make sure you stop the broker and then execute this command.

Sample command:

mqsichangebroker WMBBROKER -l C:\MQSI\7.0\USR\LIL

Step 2: Copy following jar files into **$MQSI_USR_LILPATH** directory you created at step 1.

bcpg-jdk16-146.jar
bcprov-ext-jdk16-146.jar
com.ibm.broker.supportpac.PGP.jar

Note: Do not put these .jar files in the IBM Integration Bus installation directory, because they might be overwritten by the broker. Make sure broker has access to these jar files. For example, on Linux or UNIX, use the **chmod 755 *.jar** command on the file.

Step 3: In comply with the United States of America export restrictions, IBM's SDKs/JREs ship with strong but limited jurisdiction policy files. Unlimited jurisdiction policy files can be obtained from the IBM site (https://www14.software.ibm.com/webapp/iwm/web/preLogin.do?source=jcesdk).
To work with strong encryption and larger key size, replace following two jar files in **$MQSI_JRE_HOME/lib/security** with following unrestricted JCE policy jar files obtained from IBM site.

local_policy.jar
US_export_policy.jar

Step 4: Start the broker and it is now ready for messageflow deployment, containing PGP Encrypter/Decrypter nodes.

PGP Key pair generation and Key repository management

Examples in this article consist of a PGP Encrypter messageflow (Sender application) and a PGP Decrypter messageflow (Recipient application), use two separate pair of PGP key repositories.

PGP Private Key Repository ($SDR_KEY_REPOSITORY/private.pgp): PGP private key repository is a container (file) contains multiple private keys in binary data format. Once you create a PGP key pair, make sure you import the private key into private key repository file.

PGP Public Key Repository ($SDR_KEY_REPOSITORY/public.pgp): PGP public key repository is a container (file) contains multiple public keys in binary data format. Once you create a PGP key pair or received public keys from your partner (sender or recipient) applications, make sure you import public keys into public key repository file.

Following steps illustrate how to generate PGP Key pairs and manage key repositories. Refer to **pgpkeytool** manual for installation, environment setup and supported command details.

Step 1: Generate PGP key pairs

Following table illustrates a list of various key generation parameters for both the PGP key pairs used by Encrypter/Decrypter (Sender/Recipient) messageflows. Refer to fourth article (Part-4) of this series for installation and configuration guide of **pgpkeytool**.

Note: Make sure you use key generation parameters as per your organization standard.

Table-2: List of various key generation parameters.

S/N	Key Parameters	PGP Encrypter messageflow (Sender application)	PGP Decrypter messageflow (Recipient application)
1	**Key User Id**	Sender <sender-pgp-keys@ibm.com>	Recipient <recipient-pgp-keys@ibm.com>
2	**PGP Signature Key Algorithms**	DSA	DSA
3	**PGP Encryption Key Algorithm**	ELG (El Gamal)	RSA
4	**Private key passphrase**	sdrpassphrase	rcvrpassphrase
5	**ASCII Armored**	true	true
6	**Key size (DSA)**	1024	1024

7	**Key size (RSA)**	N/A	2048
8	**Key size (ELG)**	2048	N/A
9	**Cipher Algorithm**	AES_256	AES_256
10	**Private key file**	**$KEY_REPOSITORY**/SenderSecretKey.asc	**$KEY_REPOSITORY**/RecipientSecretKey.asc
11	**Public key file**	**$KEY_REPOSITORY**/SenderPublicKey.asc	**$KEY_REPOSITORY**/RecipientPublicKey.asc
12	**Private key repository file**	**$SDR_KEY_REPOSITORY**/private.pgp	**$RCVR_KEY_REPOSITORY**/private.pgp
13	**Public key repository file**	**$SDR_KEY_REPOSITORY**/public.pgp	**$RCVR_KEY_REPOSITORY**/public.pgp

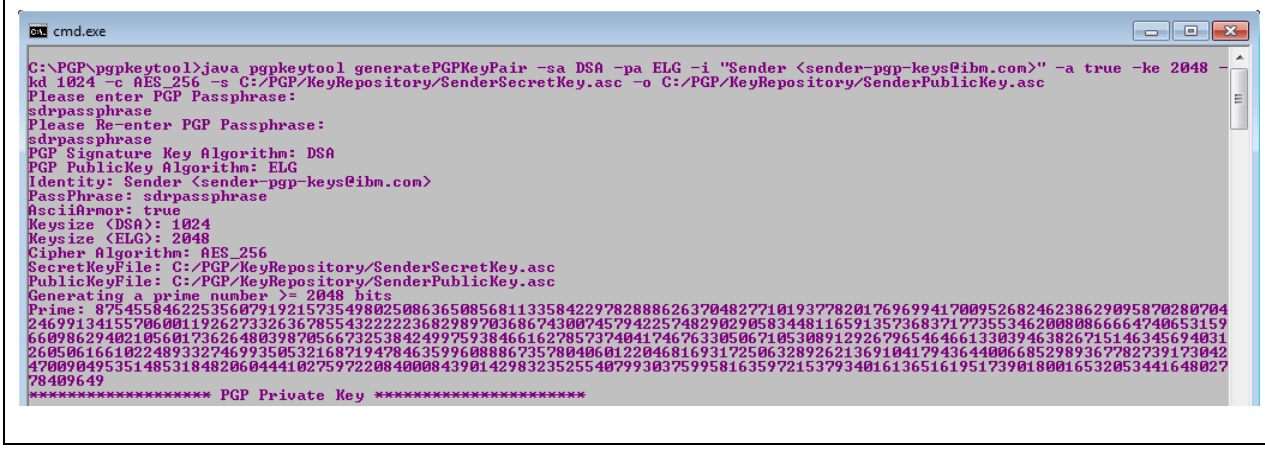
PGP key generation command for Sender's PGP key pair.

```
java pgpkeytool generatePGPKeyPair -sa DSA -pa ELG -i "Sender <sender-pgp-keys@ibm.com>" -a true -ke 2048 -kd 1024 -c AES_256 -s C:/PGP/KeyRepository/SenderSecretKey.asc -o C:/PGP/KeyRepository/SenderPublicKey.asc
```

PGP key generation command for Recipient's PGP key pair.

```
java pgpkeytool generatePGPKeyPair -sa DSA -pa RSA -i "Recipient <recipient-pgp-keys@ibm.com>" -a true -kr 2048 -kd 1024 -c AES_256 -s C:/PGP/KeyRepository/RecipientSecretKey.asc -o C:/PGP/KeyRepository/RecipientPublicKey.asc
```

Figure-3: pgpkeytool screen-shot of PGP key pair generation in Windows system.



```
-----BEGIN PGP PRIVATE KEY BLOCK-----
Version: BCPG v1.46

lQHpBFI+DigRBADfxNdygtgRjt7Y8EtpghpOqHHXWF7RWljHv39KIE+gayrVFxal
H50g1t3oJKpLYbxthv4uMIyMIe/uvehsiN0bSmp0D62oZUGijZttjsZwJSPEUQ5X
J7SHYsNHhj0vUZIQPXzR5O8sm0DGvuhRQrUU7mw1TXcylYrmno3TF3CwVQCgzCOo
pYaoC/ij1P4OStfCFc69mecEALdKZ6tUSOI7dnTc8Ssj1uolTp8Iiuygn9Jk28ea
2TtJ39YFp/aXd8cMiDAKlN8vBfIMCKb2/4jsyTfc62jlLW7JxABYcQM7Cno50fQZ
Usevce2YZ1bZNUAxaR+xH3coRqVGw8R8KQtZiFRPAqSI7P1NJIAQtAaHDrBq5Cbb
3q91A/0dSIq9aork9STJr985jFqm0aIFrBPv/bbJA1vXaWEDH9aelkJtgTSsv7u1
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Rkc1BrTe+XiQHHyNij6NFWil5jVUxIA0sLXQOJ1LYYzEPWfU4/4JAwJlMj8Z2WKm
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AJ4t5QAgAFAT9sMw+Q/G/h9o/uYzZp0ETgRSPg4oEAggoXeACWznEdMwUjv9HSlZ
rw1yEj/Uy9uMJ/oi6ww8zX0DvjfJL2JZgYW+s6jxRzXXHNXKK6fAiaLbDUnPgsfY
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3A4H5ugtJFkydV+/SaJCpfK6yFZoGzpNTv8O6QUFCRsCt7Y4vBGiDqBZ/8cXI7IR
w4Kk1QY9XAmk5QAsMUSeI5cc1cRzeylwuXeJCBiFRQwo9Eqcz6E6GEnY2aUwrZyt
WRicuDQd8MeZwuxyKlgICF5Cg7OmrRln6g2fAUGjrvqigvnoeELh1EcZhKxELOe8
7u39LOb1x8uKNjU6hK7E/wg1A7/0P+vlKJzo35Fckx/Uheh7mkXhIOj2IO/tMxPa
l3gX539yIMfAnb2CPB5vu/82QTAzc+YaBqD/Y/Zf8nElsQa9bS7e9MjYGr8XgugB
BhJkhQ6AcJf6aYQni7NqHXiWLUDluL5ReYfrmPYeCCCGBNqjYZEKWIJU9KZe1Uav
0kc3rUC9KgizAKjn98fPLRFLGSMWgS8opFq27NHzF/ZoXzACUBZ7whIPk83LiSsT
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wGPiFqRaMM0S0BdohPPlr+CH5EPsiwCJPyGbALtZ5TUoHqKdnrku0SGcFOmSdpqR
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s3Znyoo1Cx6cJxlZiSbmOCi4rkewOa8BbOor6kB71Dx1ms+aSChW53eEcjA6b/vO
ad+rEjK5SLCJILcN4hjxSTHvyOpjkxSIRgQVEQIABgUCUj4OKQAKCRAbVF7QRe52
26myAJwJnHTng5u5++oX59LcYokvRTnj9QCfRKoquAvqdggNp2Iwx6S+5PUCOo4=
=PR5p
-----END PGP PRIVATE KEY BLOCK-----
```

```
********** PGP Public Key **********

-----BEGIN PGP PUBLIC KEY BLOCK-----
Version: BCPG v1.46

mQGiBFI+DigRBADfxNdygtgRjt7Y8EtpghpOqHHXWF7RWljHv39KIE+gayrVFxal
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Rkc1BrTe+XiQHHyNij6NFWil5jVUxIA0sLXQOJ1LYYzEPWfU47QgU2UuZGUyIDxz
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jg==
=us1m
-----END PGP PUBLIC KEY BLOCK-----
```
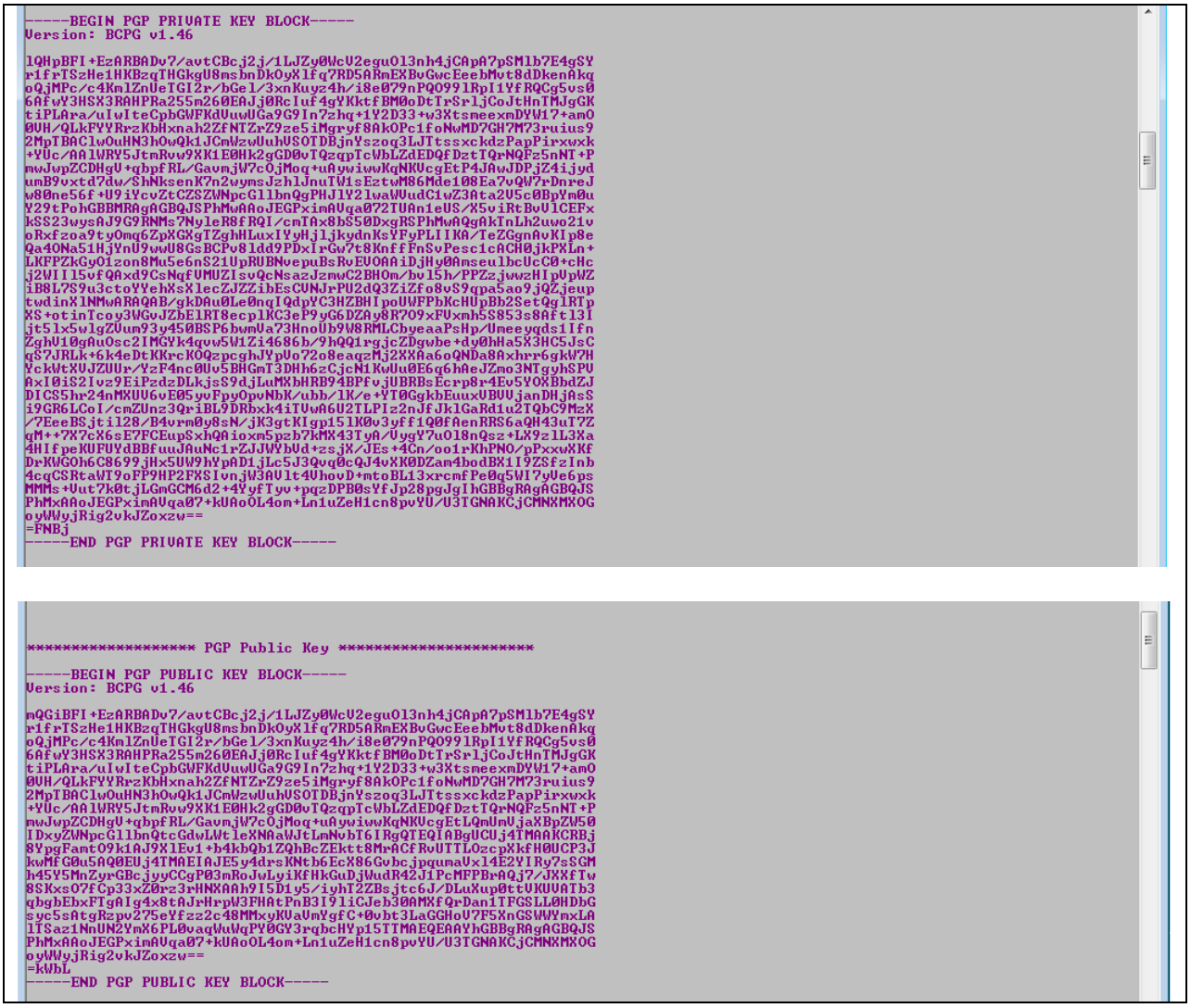

```
C:\PGP\pgpkeytool>java pgpkeytool generatePGPKeyPair -sa DSA -pa RSA -i "Recipient <recipient-pgp-keys@ibm.com>" -a true -kr
2048 -kd 1024 -c AES_256 -s C:/PGP/KeyRepository/RecipientSecretKey.asc -o C:/PGP/KeyRepository/RecipientPublicKey.asc
Please enter PGP Passphrase:
rcvrpassphrase
Please Re-enter PGP Passphrase:
rcvrpassphrase
PGP Signature Key Algorithm: DSA
PGP PublicKey Algorithm: RSA
Identity: Recipient <recipient-pgp-keys@ibm.com>
PassPhrase: rcvrpassphrase
AsciiArmor: true
Keysize (RSA): 2048
Keysize (DSA): 1024
Cipher Algorithm: AES_256
SecretKeyFile: C:/PGP/KeyRepository/RecipientSecretKey.asc
PublicKeyFile: C:/PGP/KeyRepository/RecipientPublicKey.asc
********** PGP Private Key **********
```



Step 2: Import Sender's private key into Sender's private key repository.

Command:

```
java pgpkeytool importPrivateKey -sr C:/PGP/KeyRepository/Sender/private.pgp -i true -sf C:/PGP/KeyRepository/SenderSecretKey.asc
```

Step 3: Import Recipient's private key into Recipient's private key repository.

Command:

```
java pgpkeytool importPrivateKey -sr C:/PGP/KeyRepository/Recipient/private.pgp -i true -sf C:/PGP/KeyRepository/RecipientSecretKey.asc
```

Step 4: Import Sender's public key into Sender's public key repository.

Command:

```
java pgpkeytool importPublicKey -pr C:/PGP/KeyRepository/Sender/public.pgp -i true -pf C:/PGP/KeyRepository/SenderPublicKey.asc
```

Step 5: Import Recipient's public key into Sender's public key repository.

Command:

```
java pgpkeytool importPublicKey -pr C:/PGP/KeyRepository/Sender/public.pgp -i true -pf C:/PGP/KeyRepository/RecipientPublicKey.asc
```

Step 6: Import Recipient's public key into Recipient's public key repository.

Command:

```
java pgpkeytool importPublicKey -pr C:/PGP/KeyRepository/Recipient/public.pgp -i true -pf C:/PGP/KeyRepository/RecipientPublicKey.asc
```

Step 7: Import Sender's public key into Recipient's public key repository.

Command:

```
java pgpkeytool importPublicKey -pr C:/PGP/KeyRepository/Recipient/public.pgp -i true -pf C:/PGP/KeyRepository/SenderPublicKey.asc
```

Figure-4: pgpkeytool key management screen-shots.

```
C:\PGP\pgpkeytool>java pgpkeytool importPrivateKey -sr C:/PGP/KeyRepository/Sender/private.pgp -i true -sf C:/PGP/KeyReposito
ry/SenderSecretKey.asc
Private Key imported successfully: C:/PGP/KeyRepository/SenderSecretKey.asc

List of PGP Private Keys:
KeyId (Hex): [0x45EE76DB] Key User Id: [Sender <sender-pgp-keys@ibm.com>]


C:\PGP\pgpkeytool>java pgpkeytool importPublicKey -pr C:/PGP/KeyRepository/Sender/public.pgp -i true -pf C:/PGP/KeyRepository
/SenderPublicKey.asc
Public Key imported successfully: C:/PGP/KeyRepository/SenderPublicKey.asc

List of PGP Public Keys:
KeyId (Hex): [0x45EE76DB] Key User Id: [Sender <sender-pgp-keys@ibm.com>]


C:\PGP\pgpkeytool>java pgpkeytool importPublicKey -pr C:/PGP/KeyRepository/Sender/public.pgp -i true -pf C:/PGP/KeyRepository
/RecipientPublicKey.asc
Public Key imported successfully: C:/PGP/KeyRepository/RecipientPublicKey.asc

List of PGP Public Keys:
KeyId (Hex): [0x15A9AD3B] Key User Id: [Recipient <recipient-pgp-keys@ibm.com>]
KeyId (Hex): [0x45EE76DB] Key User Id: [Sender <sender-pgp-keys@ibm.com>]


C:\PGP\pgpkeytool>
C:\PGP\pgpkeytool>java pgpkeytool importPrivateKey -sr C:/PGP/KeyRepository/Recipient/private.pgp -i true -sf C:/PGP/KeyRepos
itory/RecipientSecretKey.asc
Private Key imported successfully: C:/PGP/KeyRepository/RecipientSecretKey.asc

List of PGP Private Keys:
KeyId (Hex): [0x15A9AD3B] Key User Id: [Recipient <recipient-pgp-keys@ibm.com>]


C:\PGP\pgpkeytool>java pgpkeytool importPublicKey -pr C:/PGP/KeyRepository/Recipient/public.pgp -i true -pf C:/PGP/KeyReposit
ory/RecipientPublicKey.asc
Public Key imported successfully: C:/PGP/KeyRepository/RecipientPublicKey.asc

List of PGP Public Keys:
KeyId (Hex): [0x15A9AD3B] Key User Id: [Recipient <recipient-pgp-keys@ibm.com>]


C:\PGP\pgpkeytool>java pgpkeytool importPublicKey -pr C:/PGP/KeyRepository/Recipient/public.pgp -i true -pf C:/PGP/KeyReposit
ory/SenderPublicKey.asc
Public Key imported successfully: C:/PGP/KeyRepository/SenderPublicKey.asc

List of PGP Public Keys:
KeyId (Hex): [0x45EE76DB] Key User Id: [Sender <sender-pgp-keys@ibm.com>]
KeyId (Hex): [0x15A9AD3B] Key User Id: [Recipient <recipient-pgp-keys@ibm.com>]


C:\PGP\pgpkeytool>
```

Step 8: Validate PGP key repository files.
List PGP keys contained by Sender/Recipient private/public key repository files.

Commands:

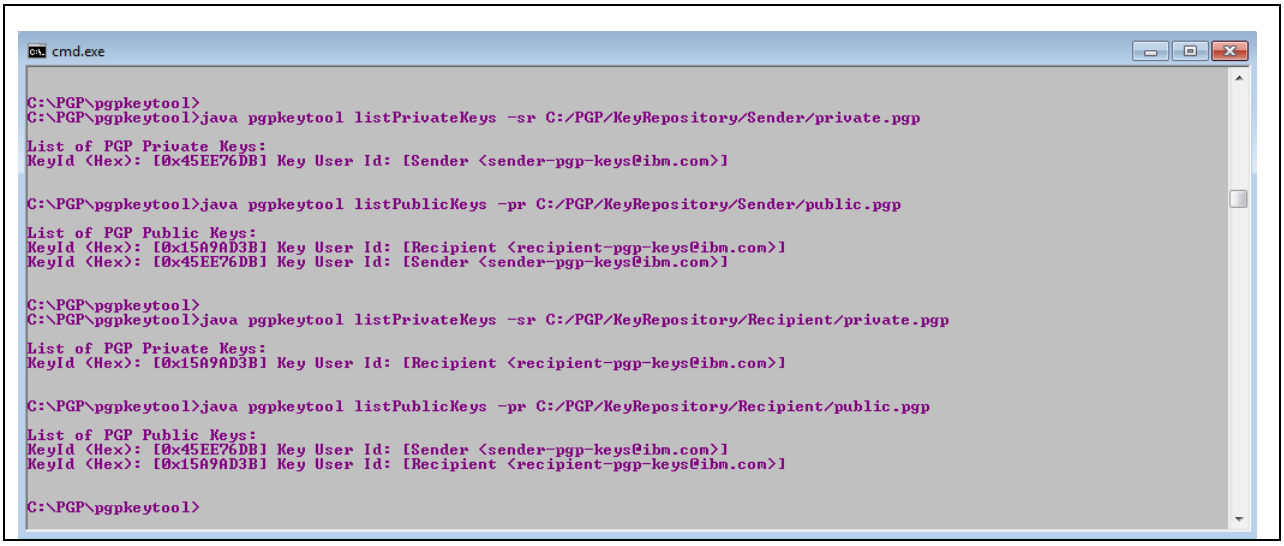
java pgpkeytool listPrivateKeys -sr C:/PGP/KeyRepository/Sender/private.pgp

java pgpkeytool listPublicKeys -pr C:/PGP/KeyRepository/Sender/public.pgp

java pgpkeytool listPrivateKeys -sr C:/PGP/KeyRepository/Recipient/private.pgp

java pgpkeytool listPublicKeys -pr C:/PGP/KeyRepository/Recipient/public.pgp

Figure-5: pgpkeytool screen-shots for listing key repositories.



Step 9: Create UserDefined Configurable services

PGP Encrypter/Decrypter nodes read default signature key user Id, default decryption/sign key passphrases and private/public keys from respective key repository files specified at User Defined Configurable Service. By using a configurable service, you can change the PGP private/public key repository details, default signature key User Id, default decryption/sign key passphrases information without the need to redeploy the messageflow. You need to restart the execution group for the change of property values to take effect.

You can also use the IBM Integration Bus Explorer to view, add, modify and delete the configurable service.

Alternatively, use the following commands to create the user defined configurable service. Examples illustrated by this article use two UserDefined Configurable services consist of two separate pair of PGP key repository files. In general all the interfaces (messageflows) deployed in a Message Broker instance use a single pair of PGP key repository represented by a UserDefined Configurable Service. However you can design your interfaces if there is a need to create multiple pair of PGP key repositories and UserDefined Configurable Services as per your organization best practices/standards.

MQSI Command to create UserDefined Configurable Service.

```
mqsicreateconfigurableservice WMBBROKER -c UserDefined -o "PGP-SDR-CFG-SERVICE" -n
DefaultDecryptionKeyPassphrase,DefaultSignKeyPassphrase,DefaultSignKeyUserId,Private
KeyRepository,PublicKeyRepository -v sdrpassphrase,sdrpassphrase,"Sender <sender-pgp-
keys@ibm.com>",C:/PGP/KeyRepository/Sender/private.pgp,C:/PGP/KeyRepository/Send
```

```
er/public.pgp
mqsicreateconfigurableservice WMBBROKER -c UserDefined -o "PGP-RCVR-CFG-SERVICE" -n
DefaultDecryptionKeyPassphrase,DefaultSignKeyPassphrase,DefaultSignKeyUserId,Private
KeyRepository,PublicKeyRepository -v rcvrpassphrase,rcvrpassphrase,"Recipient
<recipient-pgp-
keys@ibm.com>",C:/PGP/KeyRepository/Recipient/private.pgp,C:/PGP/KeyRepository/Re
cipient/public.pgp
```

Figure-6: Screen-shot of MQSI Command to create UserDefined Configurable Service

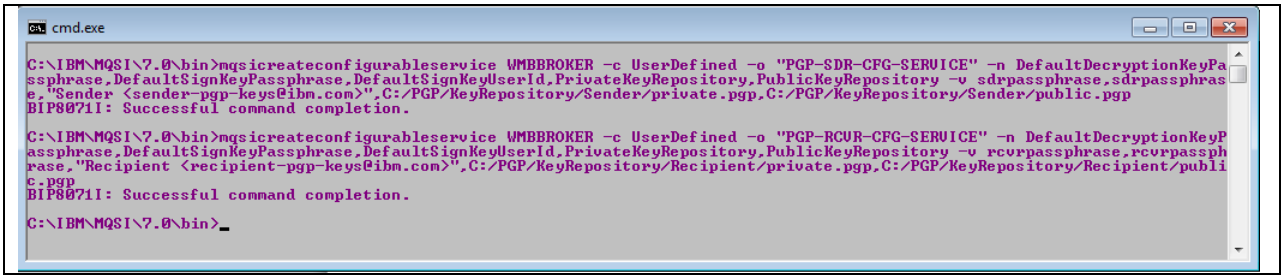
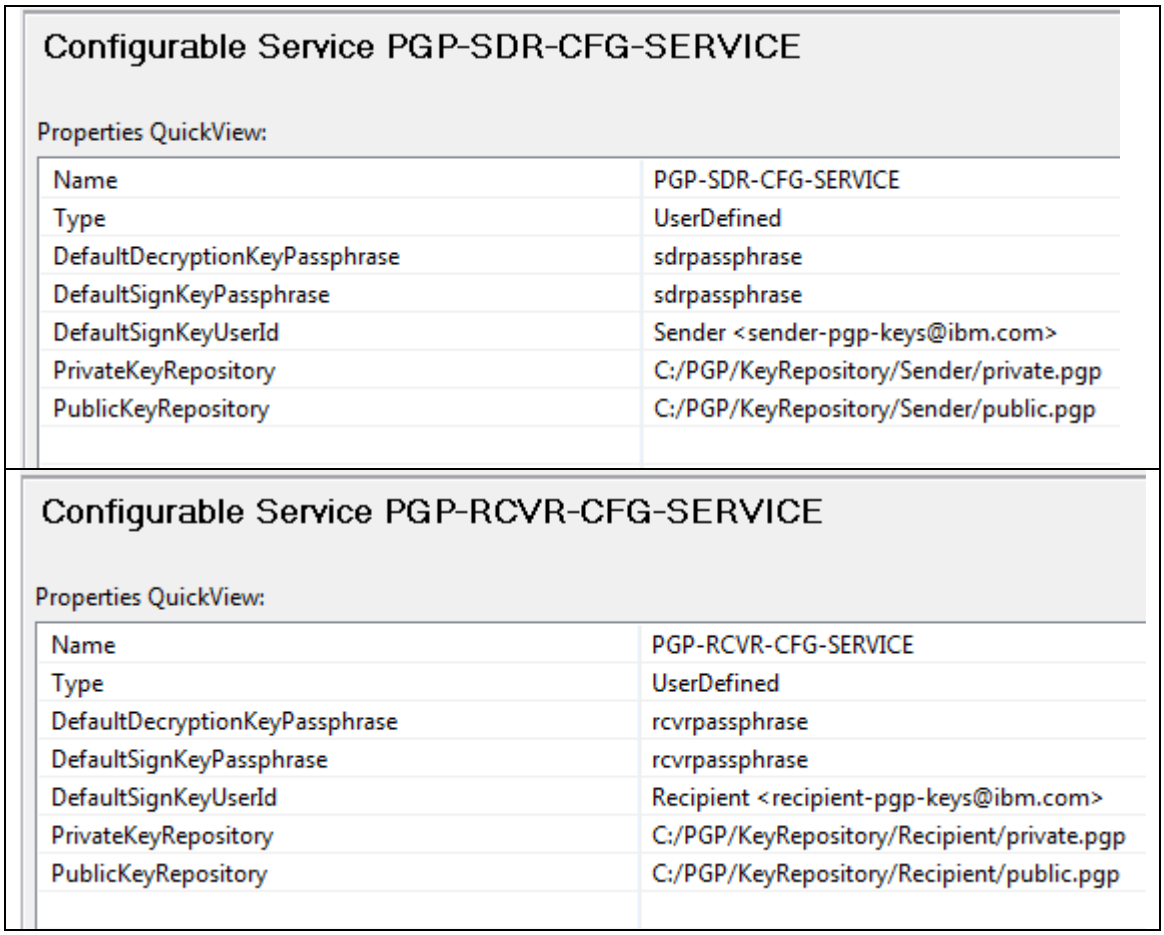


Figure-7: UserDefined Configurable Services shown at Broker Explorer



Messageflow Development

Following examples illustrate how to use PGP Encrypter/Decrypter nodes in messageflows. Refer to second (Part-2) and third (Part-3) articles of this series for node properties details of PGP Encrypter/Decrypter nodes.

Example-1:

This example consists of a PGP Encrypter (**Sender: PGPEncrypterMF.msgflow**) messageflow and a PGP Decrypter (**Recipient: PGPDecrypterMF.msgflow**) messageflow. It implements MQ message encryption/decryption by using PGP Encrypter/Decrypter nodes mostly configured with default node properties.

PGPEncrypterMF.msgflow: This messageflow receives input message through MQ Input node, uses PGP Encrypter node to sign and encrypt the message and place the encrypted data into output queue. Flow uses **PGP-SDR-CFG-SERVICE** configurable service to load private/public key repositories and default sign key/passphrase details. It uses Sender's private key [Key user Id: **Sender <sender-pgp-keys@ibm.com>**] to sign the data and Recipient's public key [Key User Id: **Recipient <recipient-pgp-keys@ibm.com>**] for encrypting purpose. Note that PGP Encrypter node uses default sign key and corresponding passphrase configured at **PGP-SDR-CFG-SERVICE** configurable service.

Figure-8: Messageflow diagram

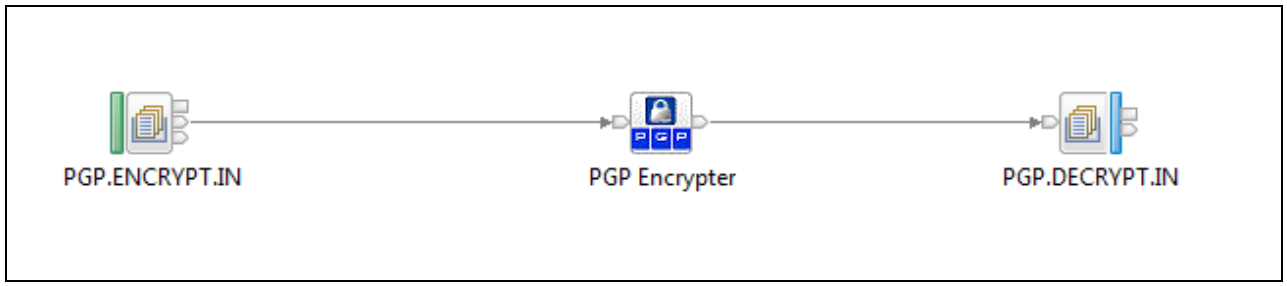
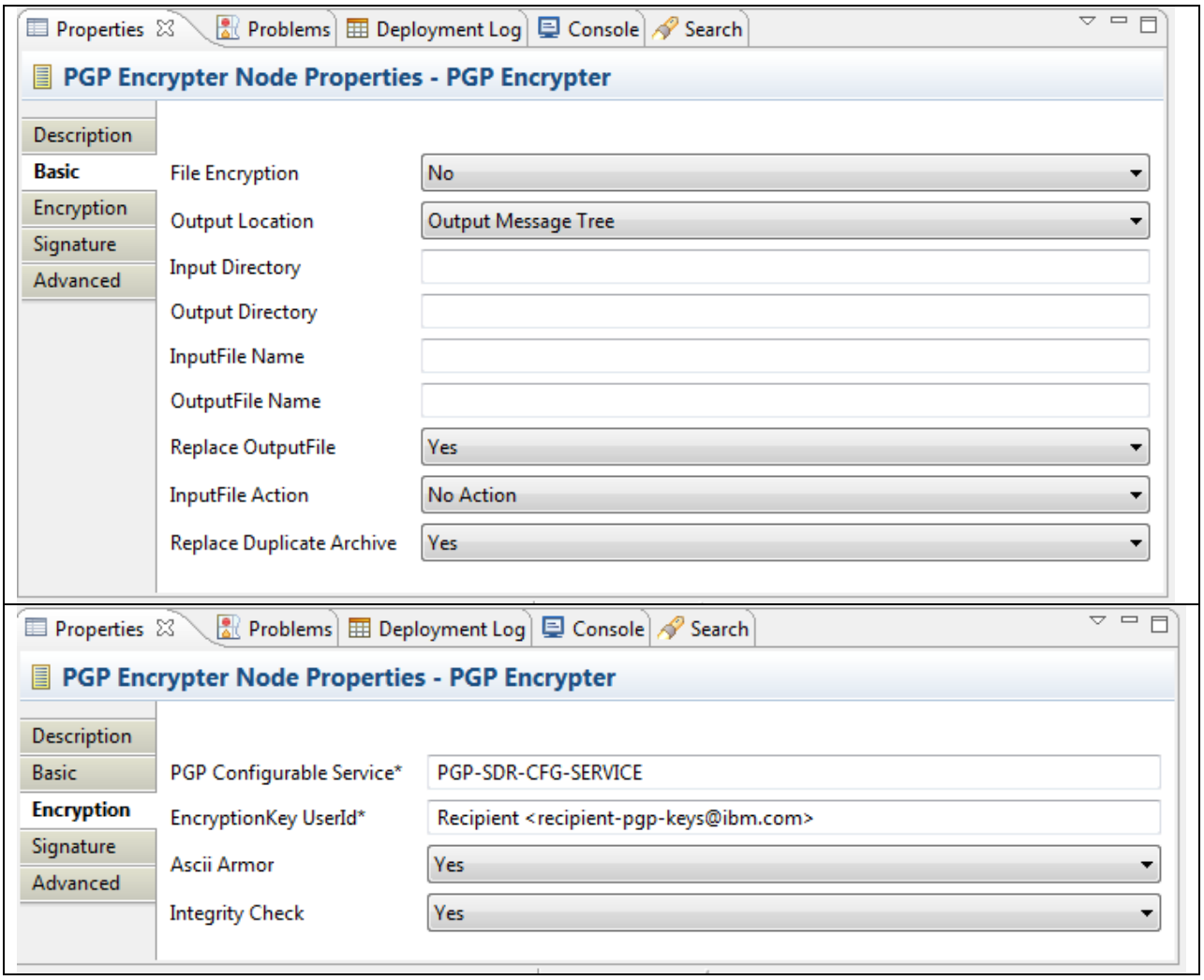
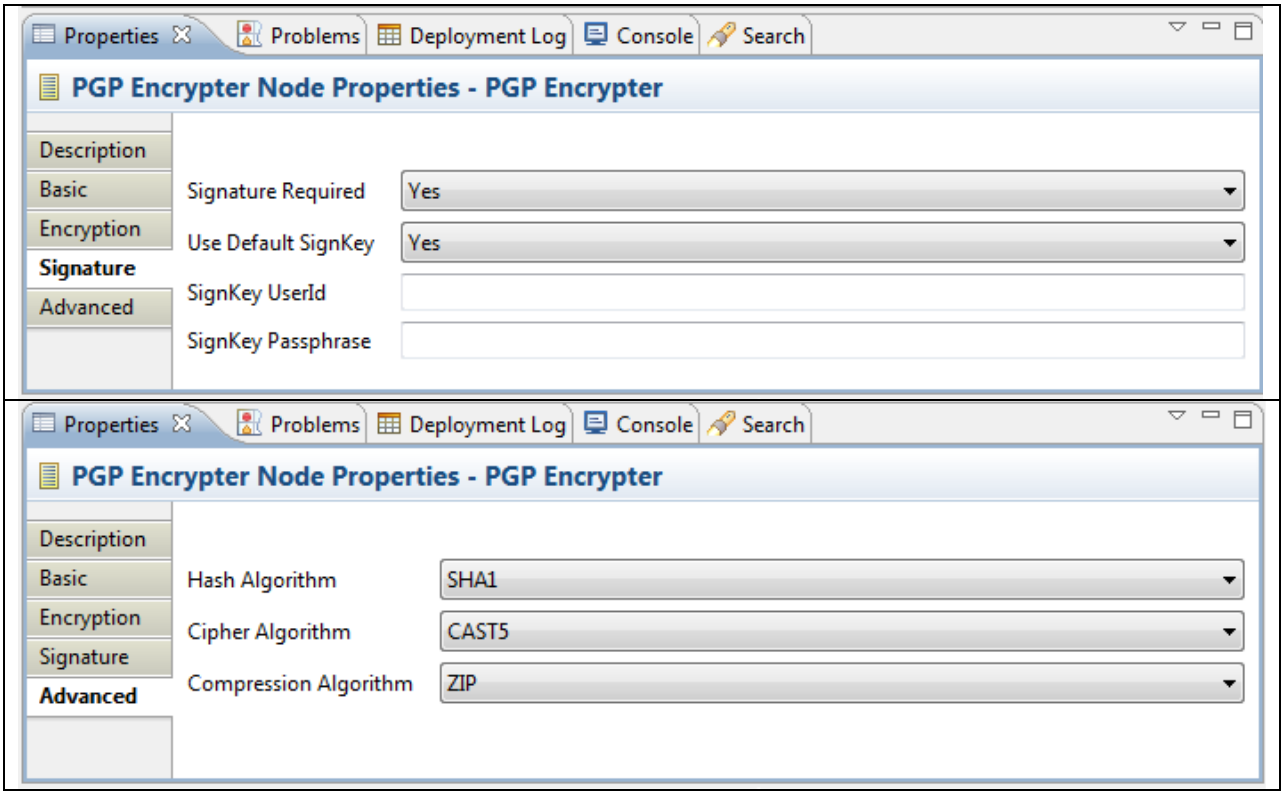


Figure-9: PGP Encrypter node properties





PGPDecrypterMF.msgflow: This messageflow receives input message through MQ Input node, uses PGP Decrypter node to decrypt encrypted message, validates PGP signature, put the decrypted data into output queue. Flow uses **PGP-RCVR-CFG-SERVICE** configurable service to load key repositories.

Figure-10: Messageflow diagram

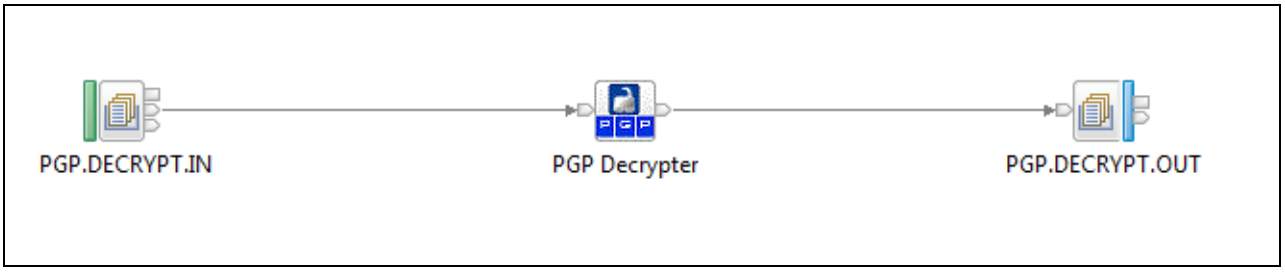
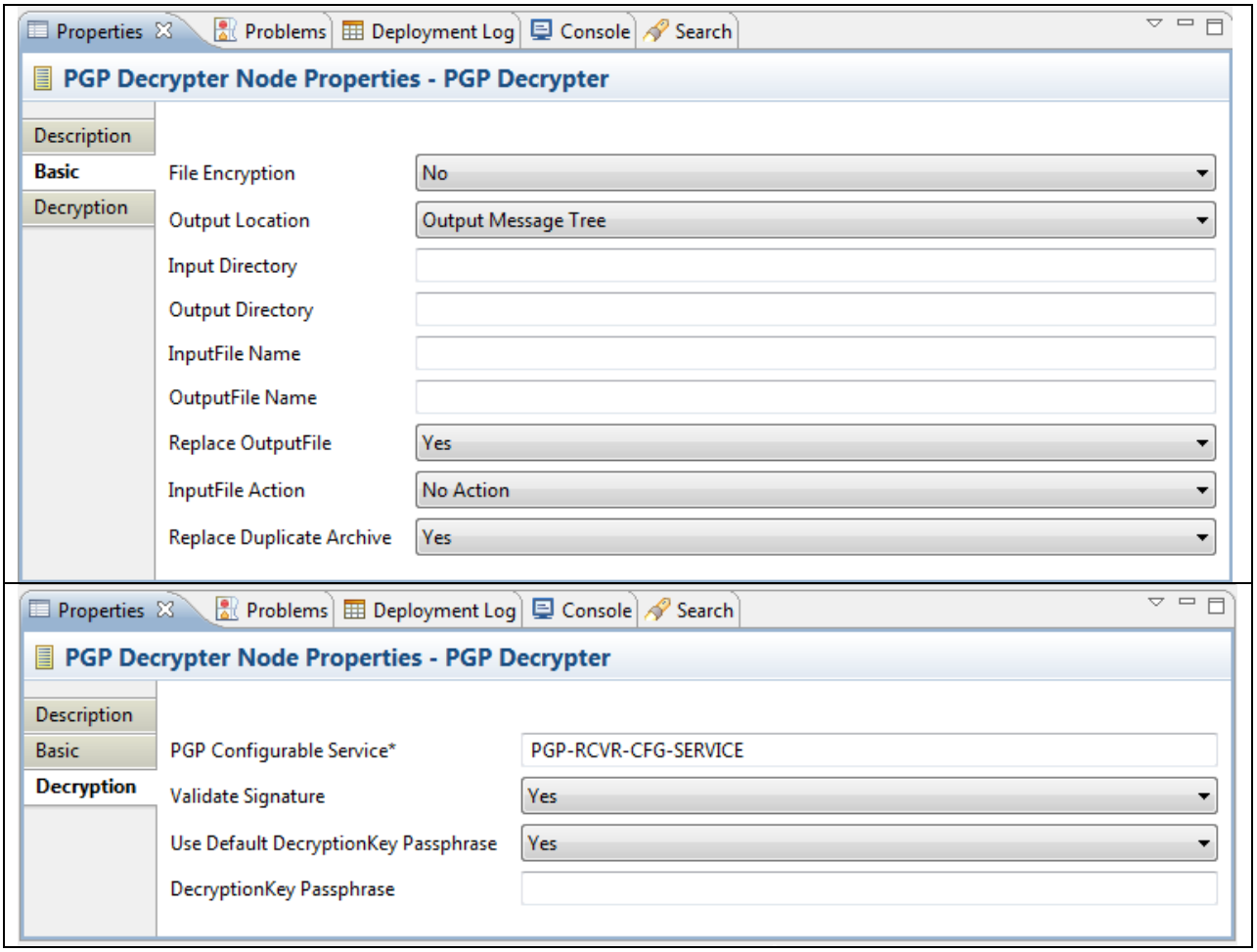


Figure-11: Node properties



Test: Put a sample text message into input queue of the **PGPEncrypterMF.msgflow.** Get signed and encrypted message at output queue. Use this signed and encrypted data as input message for **PGPDecrypterMF.msgflow** and get decrypted message at output queue. **PGP Decrypter** node throws exception if signature validation failed.

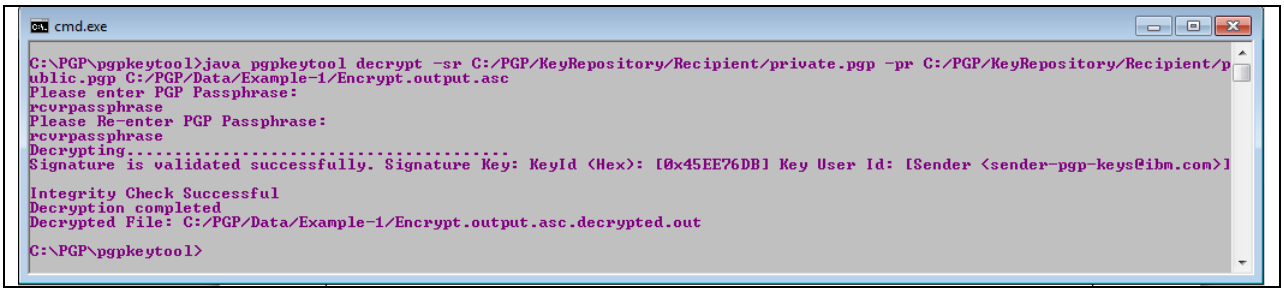
Sample Signed & Encrypted message:

```
-----BEGIN PGP MESSAGE-----
Version: BCPG v1.46

hQEMA9AYGr8LqnmoAQf9HdGn05yLZf989ncPPHN/vxhxpOqO9YdydY1KbhZ9FTIJ
MMypprcEfFfX9PCHr5gldwOZRemlKY3XsBoP3wKkdFA3BH3+KUcMO58HbaDIrnc
HYAnoAc/92rXmqEfVi4ra/sZc975YA/gFYPj0RbIYCFFbgFzmCMA+EYbKOt9gFgr
DYY/zbqq5zL1TXWXsn5fII6lQfXuQFftNPF7kErWNf33UJDB47LnZiQT2jUzjB6E
CxuUngh3uOCcCOCaLtnSkzSBC0KvZFytDJzoxLYIbW1D8bBjmG8xwyQuO6mIHUnt
VAk0pcgEMSy/t6QMCCBV3Lv+pnYzgXak4n+d1ZJoitKyATOzGaeoAdu9yhweld0X
mU8lW8mBlif/J82O/G1qyGQ0dIhYLCg8LlB/+dCrOCGFtnKU5U/McitCuDJDBbqD
B5ciM7frgbLjRDJv6wrSOgu6gtCunLog4kIsDoYP6RQ51/XMlNVGWG9HDNQ9ssF/
LLLjRPjVlYn3s/seR45VWns1EJOVsvAHmzVxwkdenbr6I7HLkrXxVl4DfabnQBdv
MqtOw1H9V87RwLWV8OAaEdXohw==
=Xj1N
-----END PGP MESSAGE-----
```

Optionally you can use **pgpkeytool** to decrypt and validate signature of the output message generated by **PGPEncrypterMF.msgflow.** Save signed and encrypted message into a file (C:/PGP/Data/Example-1/Encrypt.output.asc) and use following command to decrypt the message.

```
java pgpkeytool decrypt -sr C:/PGP/KeyRepository/Recipient/private.pgp -pr
C:/PGP/KeyRepository/Recipient/public.pgp C:/PGP/Data/Example-1/Encrypt.output.asc
```

Figure-12: pgpkeytool decryption screen-shot



Example-2

This example consists of a PGP Encrypter (**Sender: PGPEncrypterMF.msgflow**) messageflow and a PGP Decrypter (**Recipient: PGPDecrypterMF.msgflow**) messageflow illustrating file encryption/decryption processes.

PGPEncrypterMF.msgflow: This messageflow starts with a MQ Input node just to get triggered by a dummy input message. Flow uses a PGP Encrypter node to sign and encrypt the file specified at node properties and place the encrypted data into file system. It load private/public key repositories from **PGP-SDR-CFG-SERVICE** configurable service and uses Sender's private key [Key user Id: **Sender <sender-pgp-keys@ibm.com>**] specified at node properties to sign the data and Recipient's public key [Key User Id: **Recipient <recipient-pgp-keys@ibm.com>**] for encrypting purpose.

Figure-13: Messageflow diagram

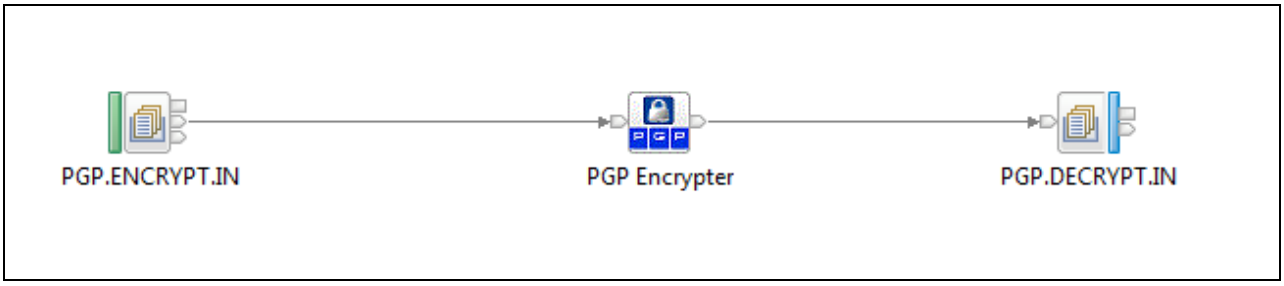
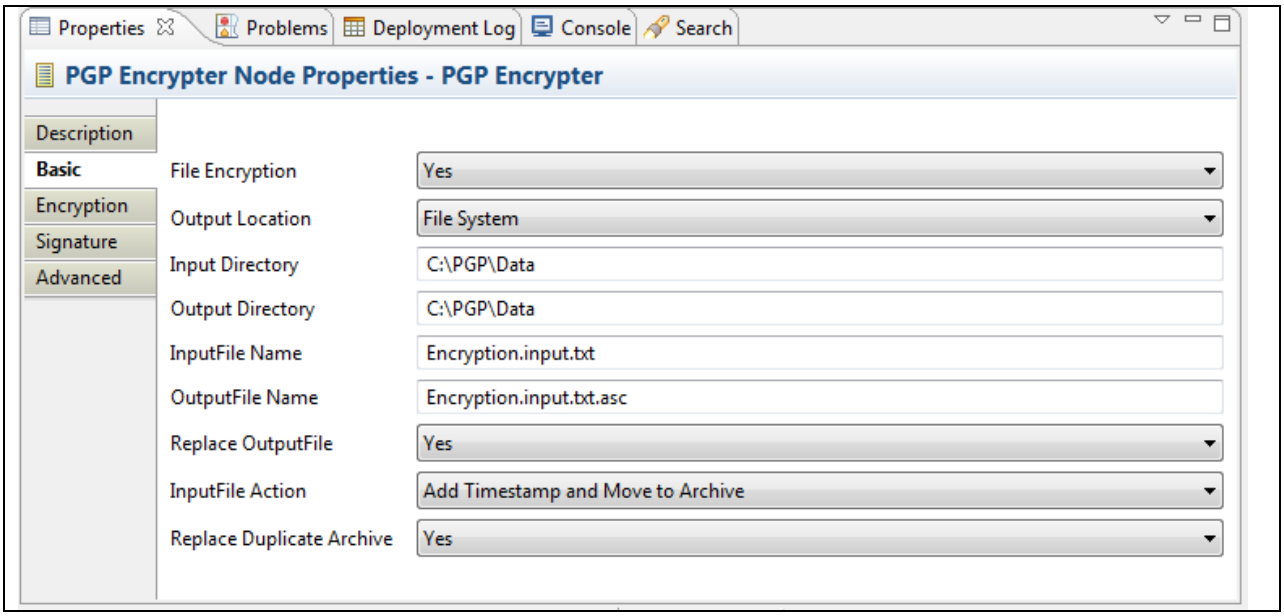
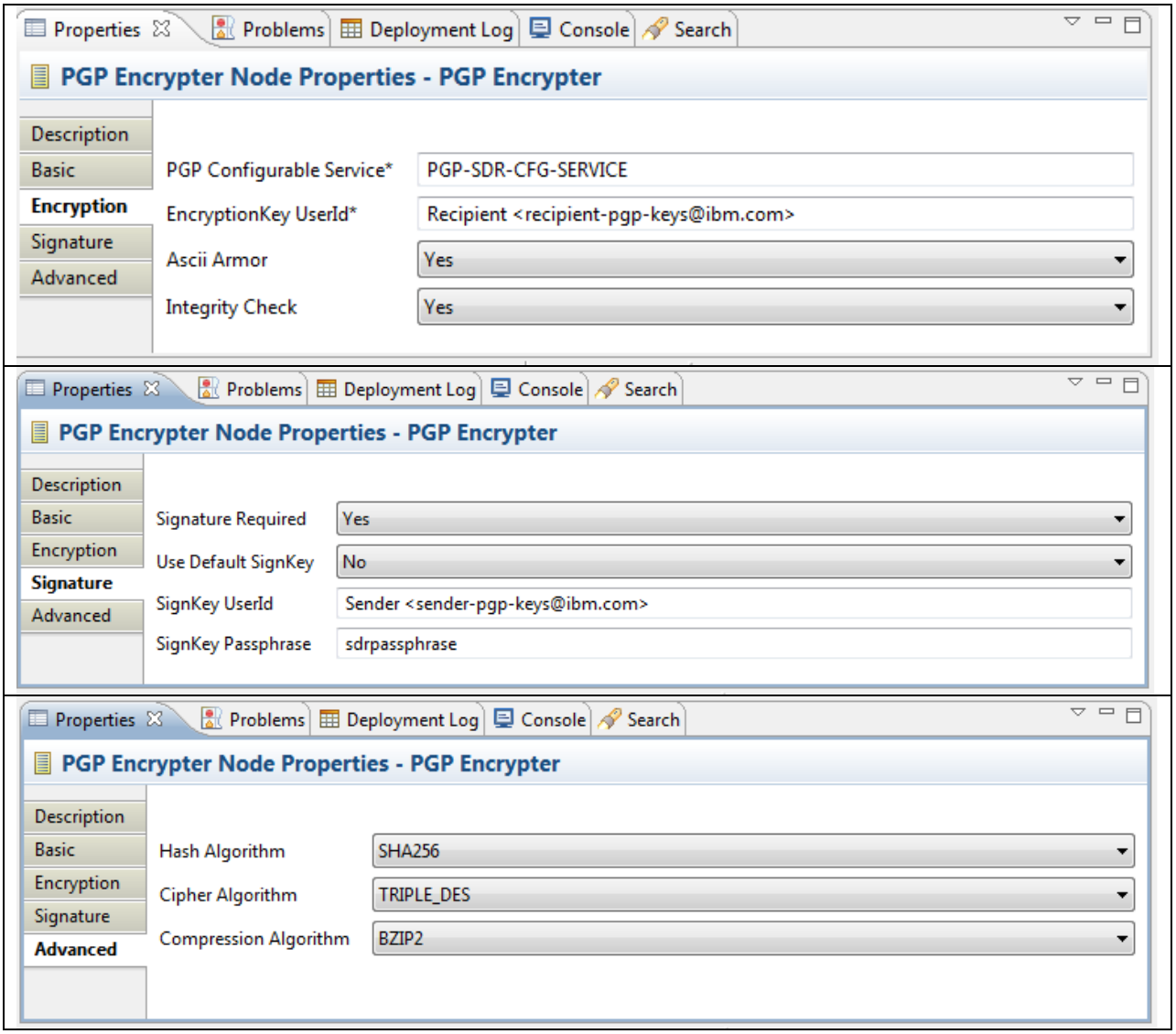


Figure-14: PGP Encrypter node properties





PGPDecrypterMF.msgflow: This messageflow starts with a MQ Input node just to get triggered by a dummy input message. Flow uses PGP Decrypter node to decrypt and validate signature of the encrypted file specified at node properties and place the decrypted data into file system. Flow load key repositories specified at **PGP-RCVR-CFG-SERVICE** configurable service.

Figure-15: Messageflow diagram

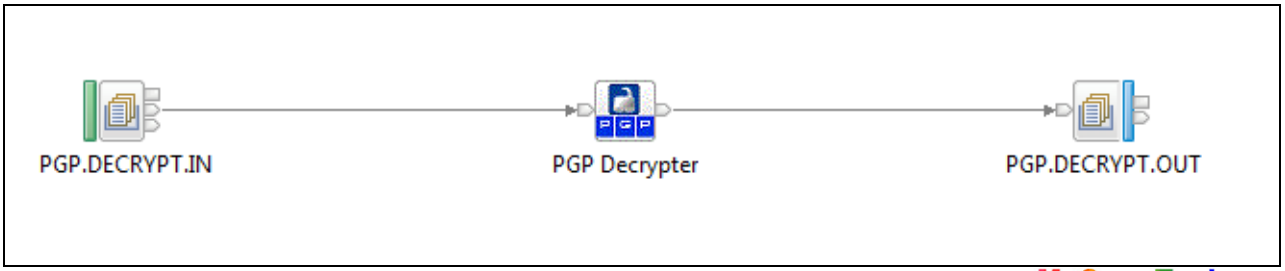
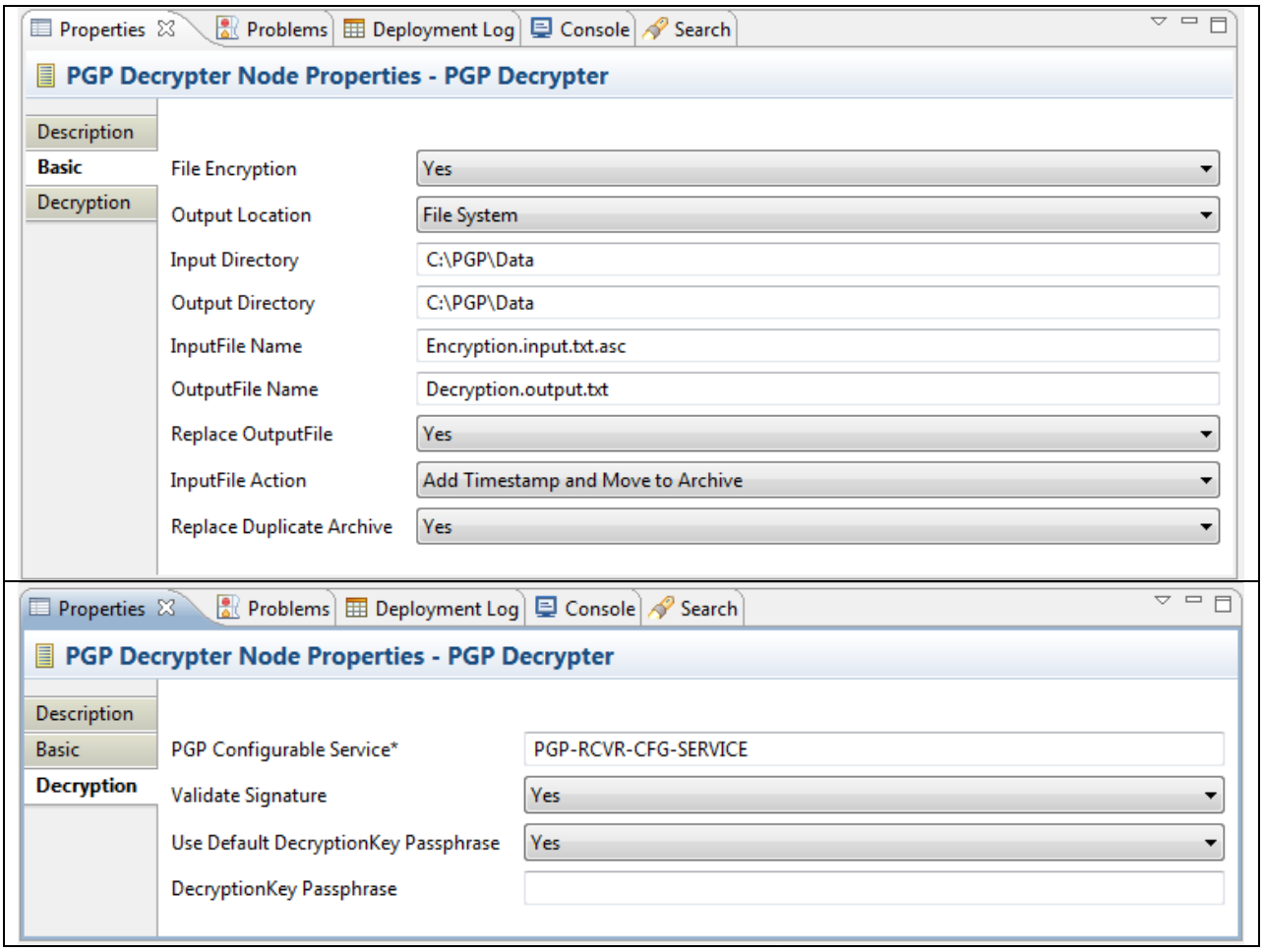


Figure-16: Node properties



Test: Create a sample text file (Encryption.input.txt) in C:\PGP\Data directory. Put a dummy trigger message into input queue of the **PGPEncrypterMF.msgflow**. Flow read the file (C:\PGP\Data\Encryption.input.txt), signs and encrypts, writes the encrypted data into file system (C:\PGP\Data\Encryption.input.txt.asc) specified at node properties. As per **InputFile Action** property **(Add Timestamp and Move to Archive)** specified in node properties, PGP Encrypter node moves the input file renamed with current timestamp suffix into archive directory (C:\PGP\Data**pgparchive**). Note that archive directory name is fixed (**pgparchive**) and cannot be altered or overridden.

Example-3

This example consists of a PGP Encrypter (Sender: PGPEncrypterMF.msgflow) messageflow and a PGP Decrypter (Recipient: PGPDecrypterMF.msgflow) messageflow. It describes file encryption/decryption processes with overriding node properties at nodes' local input environment.

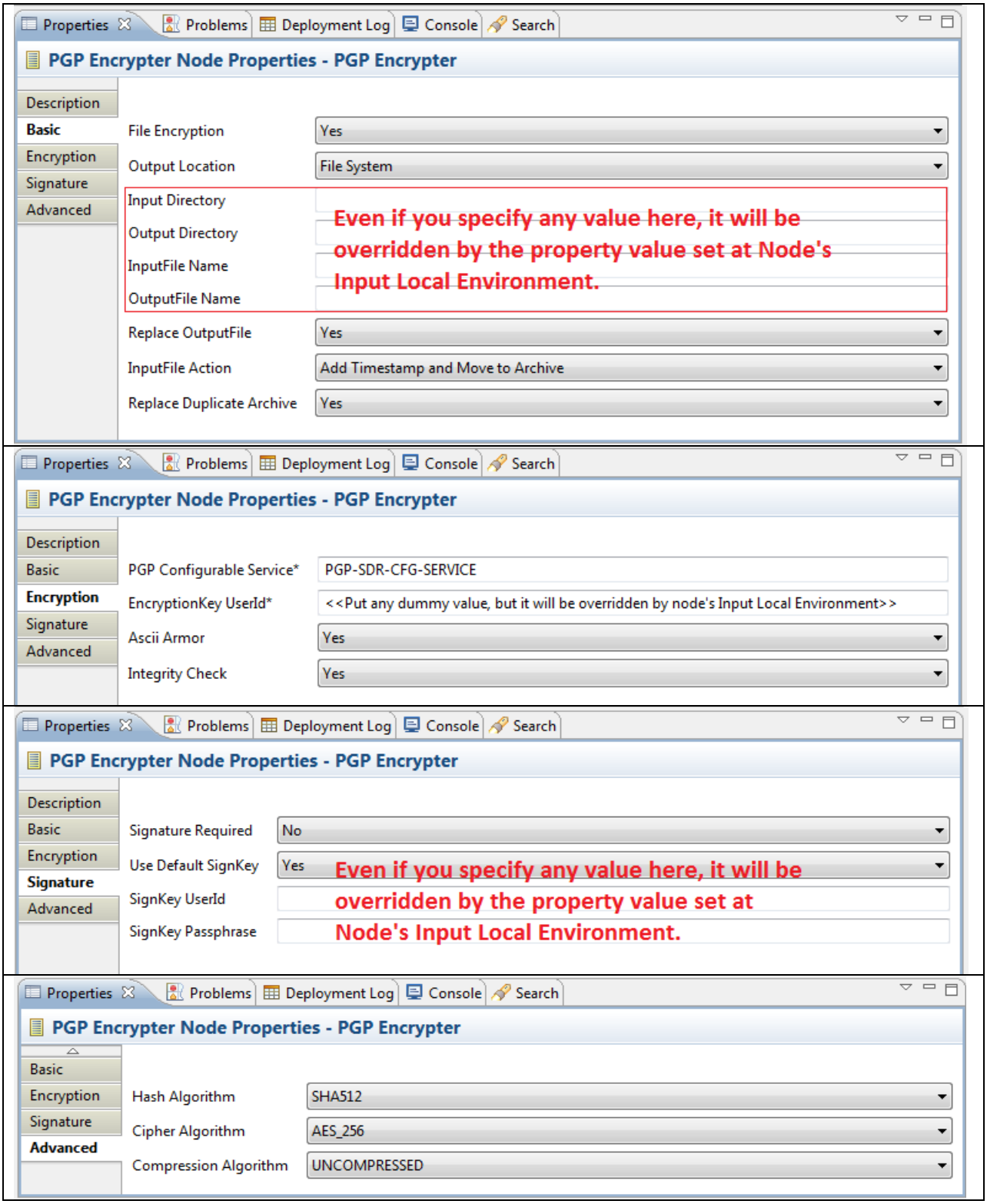
PGPEncrypterMF.msgflow: This messageflow starts with a MQ Input node just to get triggered by a dummy input message. Flow contains a compute node to override required node properties at PGP Encrypter node's local input environment. It uses PGP Encrypter node to sign and encrypt the specified file and place the encrypted data into file system. Flow uses **PGP-SDR-CFG-SERVICE** configurable service to load key repositories.

Figure-17: Messageflow diagram

Figure-18: ESQL code overrides required node properties

```
BEGIN
    CALL CopyEntireMessage();

    -- Override PGP Encrypter node properties runtime
    SET OutputLocalEnvironment.PGP.Encryption.InputDirectory        = 'C:\PGP\Data';
    SET OutputLocalEnvironment.PGP.Encryption.InputFileName         = 'Encryption.input.txt';
    SET OutputLocalEnvironment.PGP.Encryption.OutputDirectory       = 'C:\PGP\Data';
    SET OutputLocalEnvironment.PGP.Encryption.OutputFileName        = 'Encryption.output.asc';
    SET OutputLocalEnvironment.PGP.Encryption.EncryptionKeyUserId   = 'Recipient <recipient-pgp-keys@ibm.com>';
    SET OutputLocalEnvironment.PGP.Encryption.SignatureRequired     = 'Yes';
    SET OutputLocalEnvironment.PGP.Encryption.SignKeyUserId         = 'Sender <sender-pgp-keys@ibm.com>';
    SET OutputLocalEnvironment.PGP.Encryption.SignKeyPassphrase     = 'sdrpassphrase';

    RETURN TRUE;
END;
```

Figure-19: PGP Encrypter node properties



PGPDecrypterMF.msgflow: This messageflow starts with a MQ Input node just to get triggered by a dummy input message. Flow contains a compute node to override required

node properties at PGP Decrypter node's local input environment. It uses PGP Decrypter node to decrypt and validate signature of the specified encrypted file and place the decrypted data into file system. It uses **PGP-RCVR-CFG-SERVICE** configurable service to load key repositories.

Figure-20: Messageflow diagram

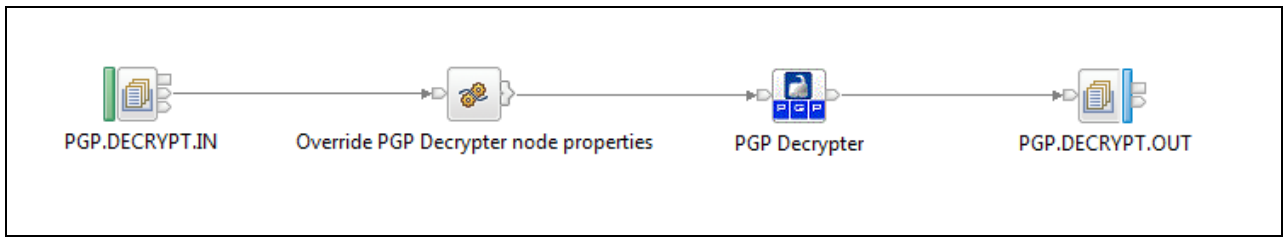
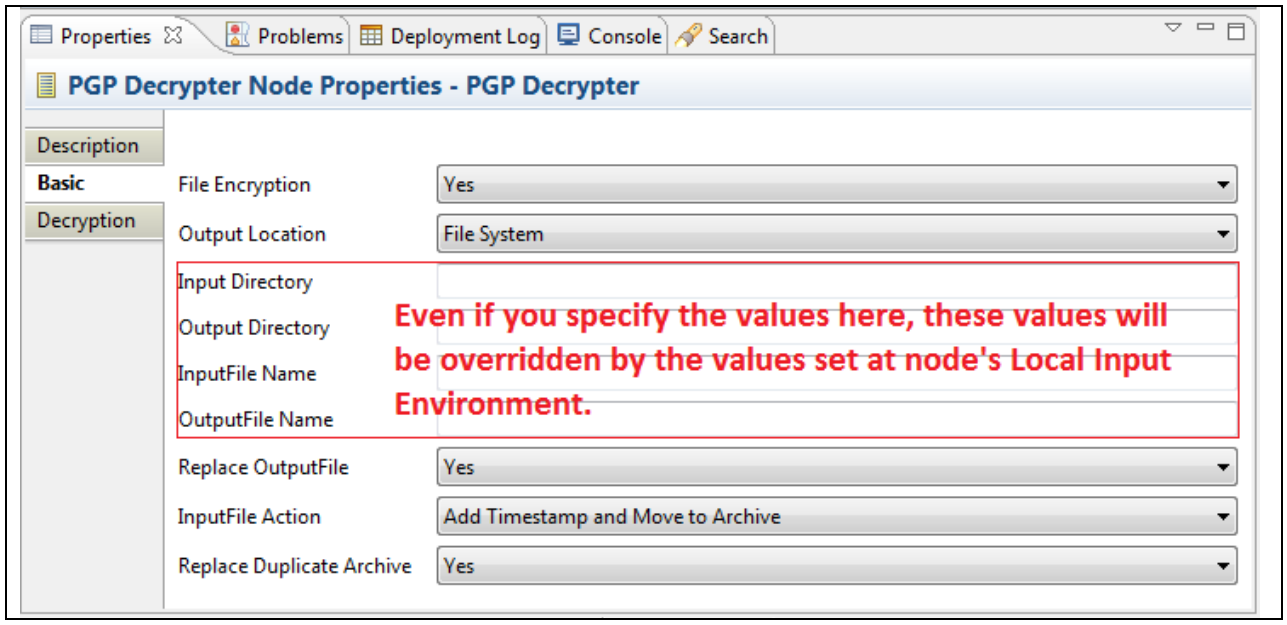
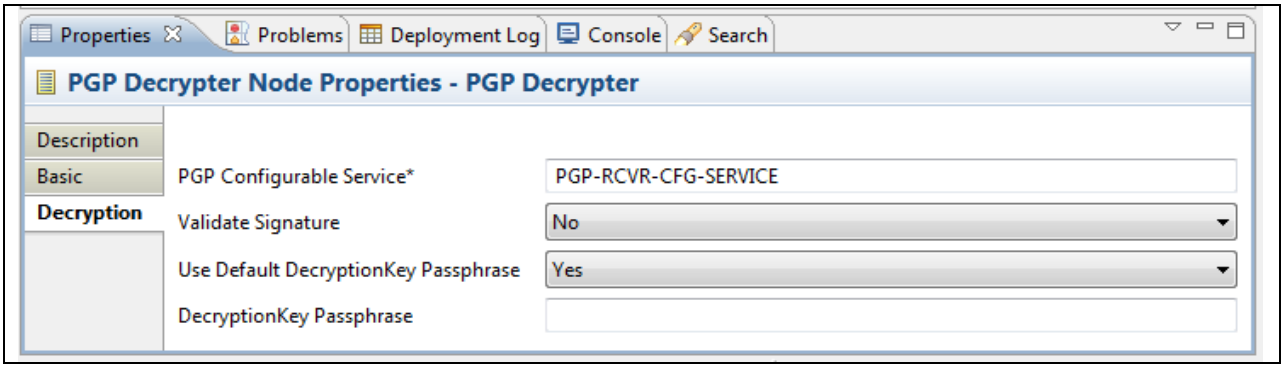


Figure-21: ESQL code overrides required node properties

```
BEGIN
    CALL CopyEntireMessage();

    -- Override PGP Decrypter node properties runtime
    SET OutputLocalEnvironment.PGP.Decryption.InputDirectory           = 'C:\PGP\Data';
    SET OutputLocalEnvironment.PGP.Decryption.InputFileName            = 'Encryption.output.asc';
    SET OutputLocalEnvironment.PGP.Decryption.OutputDirectory          = 'C:\PGP\Data';
    SET OutputLocalEnvironment.PGP.Decryption.OutputFileName           = 'Decryption.output.txt';
    SET OutputLocalEnvironment.PGP.Decryption.ValidateSignature        = 'Yes';
    SET OutputLocalEnvironment.PGP.Decryption.DecryptionKeyPassphrase  = 'rcvrpassphrase';

    RETURN TRUE;
END;
```

Figure-22: Node properties





Test: Create a text file (Encryption.input.txt) in C:\PGP\Data directory. Put a dummy trigger message into input queue of the **PGPEncrypterMF.msgflow**. Flow read the file (C:\PGP\Data\Encryption.input.txt) from file system, signs and encrypts, writes the encrypted data into file system (C:\PGP\Data\Encryption.input.txt.asc) specified at node's input local environment. As per **InputFile Action** property **(Add Timestamp and Move to Archive)** specified in node properties, PGP Encrypter node moves the input file renamed with current timestamp suffix into archive directory (C:\PGP\Data**pgparchive**). Note that archive directory name is fixed (**pgparchive**) and cannot be altered or overridden.

Troubleshooting

Following table illustrates some common errors and their troubleshooting guide.

Table-3: List of some common errors and their troubleshooting guide

S/N	Error Message	Troubleshooting Guide
1	com.ibm.broker.plugin.MbUserException class:com.ibm.broker.supportpac.pgp.impl.**PGPEncrypterNode** method:evaluate source:Message Encryption Failed! key: **Exception creating cipher message**	Make sure you updated **$MQSI_JRE_HOME/lib/security** directory with following unrestricted JCE policy jar files obtained from IBM site. • **local_policy.jar** • **US_export_policy.jar**
2	com.ibm.broker.plugin.MbUserException class:com.ibm.broker.supportpac.pgp.impl.**PGPEncrypterNode** method:evaluate source:Message Encryption Failed! key: **PGP Public Key not found: *Recipient1 <recipient1-pgp-keys@ibm.com>***	Verify whether the specified public key [Key User Id: **Recipient1 <recipient1-pgp-keys@ibm.com>**] exists in PGP public key repository specified at userdefined configurable service used by the PGP Encrypter node for encrypting the message/file.
3	com.ibm.broker.plugin.MbUserException class:com.ibm.broker.supportpac.pgp.impl.**PGPEncrypterNode** method:evaluate source:Message	Verify whether the specified private key [Key User Id: **Sender1 <sender1-pgp-keys@ibm.com>**] exists in PGP private

	Encryption Failed! key: **PGP Private Key not found: *Sender1 <sender1-pgp-keys@ibm.com>***	key repository specified at userdefined configurable service used by the PGP Encrypter node to sign the message/file.
4	com.ibm.broker.plugin.MbUserException class:com.ibm.broker.supportpac.pgp.impl.**PGPEncrypterNode** method:evaluate source:Message Encryption Failed! key: **Private (Sign) key [0x45EE76DB] not found at Key Repository. Verify the key repository and/or passphrase.** Root cause: checksum mismatch at 0 of 20	Make sure whether passphrase of the PGP sign key (Signer's private key) is correct.
5	com.ibm.broker.plugin.MbUserException class:com.ibm.broker.supportpac.pgp.impl.**PGPDecrypterNode** method:evaluate source:Message Encryption Failed! key: **Private key [0xBAA79A8] not found at Key Repository [PGP-RCVR-CFG-SERVICE]. Verify the key repository and/or passphrase**. Root cause: checksum mismatch at 0 of 20	Possible reasons: • Message is encrypted by a public key whose conjugate private key does not exist at recipient's private key repository. • Passphrase of the PGP decryption key (Recipient's private key) is not correct.
6	com.ibm.broker.plugin.MbUserException class:com.ibm.broker.supportpac.pgp.impl.**PGPDecrypterNode** method:evaluate source:Message Encryption Failed! key: **Invalid Signature: Cannot find the public key [0x471B2AD9] in the PublicKey Repository [PGP-RCVR-CFG-SERVICE]**	Encrypted message is signed by a private key whose conjugate public key does not exist in recipient's public key repository. Get signer's public key and import into recipient's public key repository.

Conclusion

This article provides an industry standard solution that mitigates a huge gap in IBM Integration Bus Data Security zone. This solution (SupportPac) is not an IBM supplied in-built feature of IBM Integration Bus. This SupportPac is developed by the author of this article. Current version (v1.0.0.1) of this SupportPac only supports integrated signature generation/validation combined with PGP encryption/decryption processes. However future version will provide isolated signature generation/validation functionalities. Also future version of **pgpkeytool** will be enhanced with user-friendly GUI similar to IBM Key Management tool shipped with Websphere MQ.

You can post any query regarding to this PGP SupportPac at following IBM DeveloperWorks public community forum, author of this article will address those queries.

PGP SupportPac for IBM Integration Bus
(https://www.ibm.com/developerworks/community/groups/community/pgpsupportpaciib)

References

- **PGP Basics**
  - PGP Basics: PGP basic concepts (http://www.pgpi.org/doc/pgpintro/)
  - Bouncy Castle: Bouncy Castle Resources (http://www.bouncycastle.org/)
  - Gpg4Win: PGP encryption/decryption command line and GUI tool (http://www.gpg4win.org/index.html)
  - Portable PGP: Java based GUI tool for PGP (http://ppgp.sourceforge.net/)
  - GnuPG: GnuPG PGP library (http://www.gnupg.org/)
  - GitHub: Samples and other Artifacts (https://github.com/dipakpal/MyOpenTech-PGP-SupportPac)

- **Public Community at IBM DeveloperWorks**
  - PGP SupportPac for IBM Integration Bus:

https://www.ibm.com/developerworks/community/groups/community/pgpsupportpaciib

- **IBM Integration Bus resources**
  - IBM Integration Bus product page
    Product descriptions, product news, training information, support information, and more.
  - IBM Integration Bus V7 information center
    A single Web portal to all IBM Integration Bus V6 documentation, with conceptual, task, and reference information on installing, configuring, and using your IBM Integration Bus environment
  - Download free trial version of IBM Integration Bus
    IBM Integration Bus is an ESB built for universal connectivity and transformation in heterogeneous IT environments. It distributes information and data generated by business events in real time to people, applications, and devices throughout your extended enterprise and beyond.
  - IBM Integration Bus documentation library
    IBM Integration Bus specifications and manuals.
  - IBM Integration Bus forum
    Get answers to technical questions and share your expertise with other IBM Integration Bus users.
  - IBM Integration Bus support page
    A searchable database of support problems and their solutions, plus downloads, fixes, and problem tracking.

- **WebSphere resources**
  - developerWorks WebSphere
    Technical information and resources for developers who use WebSphere products. developerWorks WebSphere provides product downloads, how-to information, support resources, and a free technical library of more than 2000 technical articles, tutorials, best practices, IBM Redbooks, and online product manuals. Whether you're a beginner, an expert, or somewhere in between, you'll find what you need to build enterprise-scale solutions using the open-standards-based WebSphere software platform.
  - developerWorks WebSphere application integration developer resources
    How-to articles, downloads, tutorials, education, product info, and other

resources to help you build WebSphere application integration and business integration solutions.

- Most popular WebSphere trial downloads
  No-charge trial downloads for key WebSphere products.
- WebSphere forums
  Product-specific forums where you can get answers to your technical questions and share your expertise with other WebSphere users.
- WebSphere demos
  Download and watch these self-running demos, and learn how WebSphere products can provide business advantage for your company.
- WebSphere-related articles on developerWorks
  Over 3000 edited and categorized articles on WebSphere and related technologies by top practitioners and consultants inside and outside IBM. Search for what you need.
- developerWorks WebSphere weekly newsletter
  The developerWorks newsletter gives you the latest articles and information only on those topics that interest you. In addition to WebSphere, you can select from Java, Linux, Open source, Rational, SOA, Web services, and other topics. Subscribe now and design your custom mailing.
- WebSphere-related books from IBM Press
  Convenient online ordering through Barnes & Noble.
- WebSphere-related events
  Conferences, trade shows, Webcasts, and other events around the world of interest to WebSphere developers.