

## Slide 1



WebSphere Education

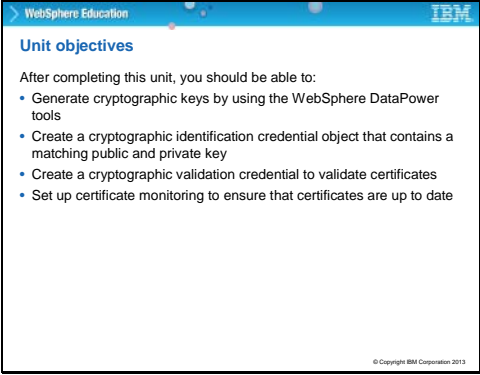
**DataPower cryptographic tools**

IBM

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The slide features a blue header bar with the text 'WebSphere Education' on the left and the IBM logo on the right. The main content area is white with the title 'DataPower cryptographic tools' in bold black text. In the bottom left corner, there is a decorative graphic consisting of several overlapping circles in light blue and green, with small colored dots scattered around them. At the bottom center, there is a small copyright notice: '© Copyright IBM Corporation 2013. Course materials may not be reproduced in whole or in part without the prior written permission of IBM.'

## Slide 2



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**Unit objectives**

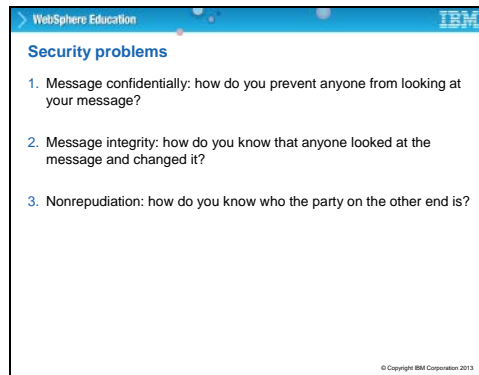
After completing this unit, you should be able to:

- Generate cryptographic keys by using the WebSphere DataPower tools
- Create a cryptographic identification credential object that contains a matching public and private key
- Create a cryptographic validation credential to validate certificates
- Set up certificate monitoring to ensure that certificates are up to date

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This presentation talks about how to use the DataPower cryptographic tools to create public-private key pairs. In addition, students learn how to create cryptographic objects that are used in SSL, also actions such as sign, verify, encrypt, and decrypt.

## Slide 3



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### Security problems

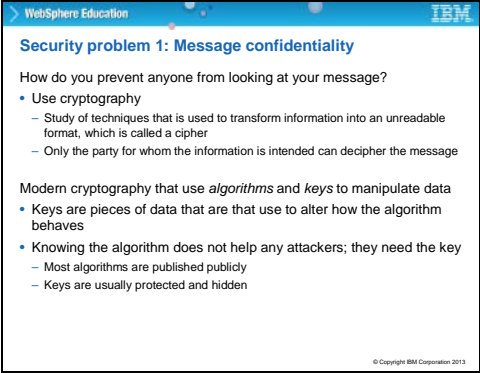
1. Message confidentiality: how do you prevent anyone from looking at your message?
2. Message integrity: how do you know that anyone looked at the message and changed it?
3. Nonrepudiation: how do you know who the party on the other end is?

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### **Security problems**

What are the fundamental problems of security? This slide sums them up under three headings; confidentiality, integrity, and non-repudiation. This presentation looks at each of these points in turn.

## Slide 4



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### Security problem 1: Message confidentiality

How do you prevent anyone from looking at your message?

- Use cryptography
  - Study of techniques that is used to transform information into an unreadable format, which is called a cipher
  - Only the party for whom the information is intended can decipher the message

Modern cryptography that use *algorithms* and *keys* to manipulate data

- Keys are pieces of data that are that use to alter how the algorithm behaves
- Knowing the algorithm does not help any attackers; they need the key
  - Most algorithms are published publicly
  - Keys are usually protected and hidden

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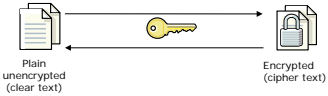
### Security problem 1: Message confidentiality

The first problem is how to stop any third party from looking at your message. In fact, the problem is not really how to stop them looking; it is how to stop them understanding what they see. Cryptography, meaning secret writing or hidden writing, is the technique of making information unintelligible while it is in transit. There are two ways the technique can be used. First, two parties might agree on the meaning of a word or a phrase. So for example, "the tree is green" means "sell half the stock". Obviously, while this system can have some applicability; it is far too restrictive in the variety of information that can be transmitted. It is typically used to code operations or development projects. The Manhattan Project is probably the best-known example. Some 35 years ago a different system of encryption was put forward. The project algorithms were seeded by a key. While there are different ways of doing the processing, one of the most widespread is the use of a public-private key pair. The algorithm is seeded by using the public key, and the encrypted result cannot be reverse-engineered. The only way back to the original document is by seeding the same algorithm with the private key. An example of seeding is covered in a couple of slides. First, view symmetric encryption.

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### Symmetric key encryption

- Symmetric key: a secret key that is used to both encrypts and decrypt messages
  - Known only by sender and receiver
  - Relatively fast
  - Challenges: Exchanging keys with many people




The diagram illustrates the symmetric key encryption process. On the left, a document icon is labeled 'Plain unencrypted (clear text)'. An arrow points from this document to a document icon with a lock, labeled 'Encrypted (cipher text)'. A yellow key icon is positioned above the arrow, indicating that the same key is used for both encryption and decryption.

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### Symmetric key encryption

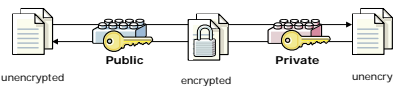
In symmetric key encryption, there is only one key that is used both for encryption and for decryption. Symmetric key encryption is like locking a box with a key and then unlocking it with the same key. To be effective, the key is secret, known only to the two sides of the communication path. The problem therefore is how to exchange the key over a channel that is open that is to say, not secure before the key is used.

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### Asymmetric key encryption

Public key cryptography

- Two keys that are cryptographically related:
  - Public key (can share with everyone)
  - Private key (must never be shared; possession is proof)
- Keys are asymmetric:
  - Given message is encrypted with one key and decrypted with another
  - Symmetric, secret key technology uses the same key for encryption and decryption



The diagram illustrates the asymmetric encryption process. It starts with an 'unencrypted' message (represented by a document icon). This message is combined with a 'Public' key (represented by a yellow key icon) to produce an 'encrypted' message (represented by a document icon with a lock). The 'encrypted' message is then combined with a 'Private' key (represented by a red key icon) to produce the final 'unencrypted' message (represented by a document icon). Above the diagram, the 'Public' and 'Private' keys are shown as a pair of interlocking keys, one yellow and one red.

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### Asymmetric key encryption

In asymmetric key encryption, there are two keys, one to encrypt, and a different one to decrypt. There is an analogy here with the night deposit box at the bank. Each person who must deposit has a 'public key', one that opens the front door of the night deposit. The bank has a private key that opens the other side of the night deposit box. It does not matter that you have the same key as someone else. The only thing that you can do is deposit; you cannot remove anything through the front of the box. Likewise, the public key is freely available for encryption because when encrypted the message cannot be decrypted with the same key.

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### Security problem 2: Message integrity

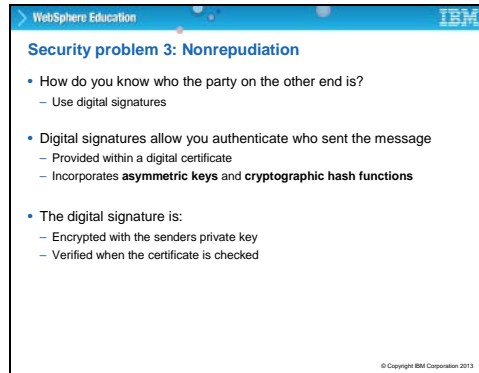
- How do you know that anyone looked at the message and changed it?
  - Use a cryptographic hash.
- A *cryptographic hash* function is an algorithm that transforms a string of characters into a shorter number of a fixed length. This value is called the message digest.
  - If anyone tampers with the message, it results in a different message digest or hash number.
- Purposefully creating two separate messages that create the same hash code is difficult.

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### Security problem 2: Message integrity

The second problem that was stated at the beginning of this unit is the question of integrity. Is the message that you are receiving the same as the one that was sent? The process to verify that the message is the original message is to create a hash value for the message. You can think of a hash in this way: take each letter of a word, find the numeric position in the alphabet, and add the numbers. For example, if "John" is the word, the total is "J + O + H + N", or "10 + 15 + 8 + 14", which gives 47. If some hacker now modifies the message to pretend that "Joan" sent the message, the addition becomes "J + O + A + N", or "10 + 15 + 1 + 14", which gives 40. With a little thought, you can invent different names that add up to the same value, for example "Mary" and "George". The actual hash algorithm is obviously more complex than the simple example shows. However, the principle is the same, which is why the third bullet does not state that it is impossible to create two different messages with the same hash value! But it is difficult.

## Slide 8



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### Security problem 3: Nonrepudiation

- How do you know who the party on the other end is?
  - Use digital signatures
- Digital signatures allow you authenticate who sent the message
  - Provided within a digital certificate
  - Incorporates **asymmetric keys** and **cryptographic hash functions**
- The digital signature is:
  - Encrypted with the senders private key
  - Verified when the certificate is checked

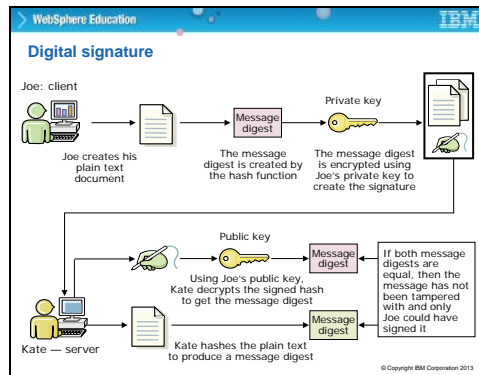
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### Security problem 3: Nonrepudiation

The third problem that is stated at the beginning was non-repudiation. I send you a message and then I deny sending it, how can you prove that it was from me? In fact, I do not have to deny sending it! You are able to prove that I sent the message for security reasons: a hacker might be trying to impersonate me. The solution to the impersonation is a digital signature. The digital signature is created by applying a private key to the message, or more usually, to the hash of the message. The validity of the message can then be verified by using the public key. Take a closer look at the steps here.



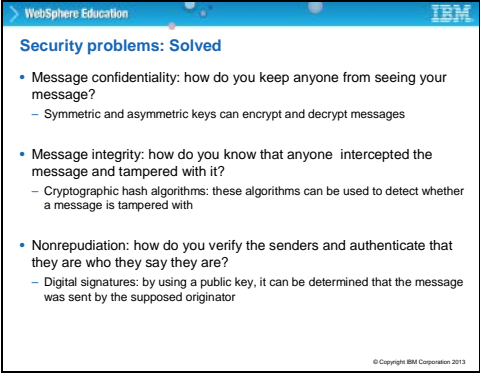
## Slide 9



### Digital signature

Joe, the client, creates a message digest from the document he intends to send to Kate, then applies his private key to it. Kate receives the message and does exactly what Joe did – she creates a message digest from the document by using a hash function. She must use the same hash function Joe that is used, or this does not work. She then takes Joe's encrypted message digest and decrypts it using Joe's public key. If the digests match, the message is authentic. What happens if a hacker intercepts the message? They can decrypt the digest, because they need the public key to do that. But here is the problem: if they change the message, the hash must be recalculated, and the recalculation can be done with Joe's private key. Remember that asymmetric encryption is a one-way thing, you cannot decrypt and encrypt with the same key. Jane would therefore detect that the hash encrypted by Joe did not correspond to the message hash she created, and she would reject the message

## Slide 10



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### Security problems: Solved

- Message confidentiality: how do you keep anyone from seeing your message?
  - Symmetric and asymmetric keys can encrypt and decrypt messages
- Message integrity: how do you know that anyone intercepted the message and tampered with it?
  - Cryptographic hash algorithms: these algorithms can be used to detect whether a message is tampered with
- Nonrepudiation: how do you verify the senders and authenticate that they are who they say they are?
  - Digital signatures: by using a public key, it can be determined that the message was sent by the supposed originator

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### Security problems: Solved

In conclusion, to prevent anyone that understands your message, you encrypt it. Note again that the slide says “seeing”. Seeing refers to “seeing the clear text message”. To verify integrity you use a hash value of the original message, and to validate the sender, you create a digital signature by using the hash value.



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### Digital certificates

- The problem with public-private key pairs is that they do not identify anyone
  - Given a message encrypted (or signed) using a private key, you can determine which public key goes with it, but so what?
- The solution is digital certificates
  - A special **public key**
  - Contains your identity information in the form of a distinguished name
- A digital certificate contains:
  - The name of the certificate holder
  - A serial number
  - Validity dates
  - A copy of the public key of the certificate holder
  - A **digital signature**, to verify that the certificate is not altered since it is signed by the issuer
  - An indication of the issuer of the certificate: "the trusted signer"
- A digital certificate does **not** contain the **private key** although the private key and certificate together are often referred to as "the certificate"

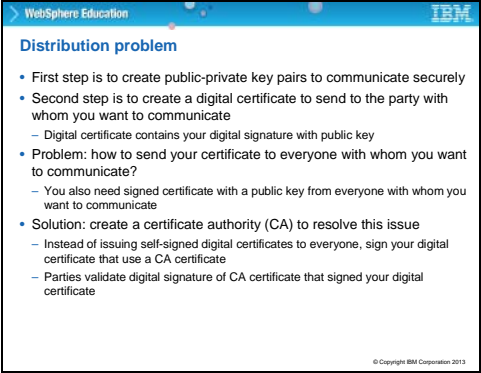
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## Digital certificates

The digital signature that is covered on the previous slide is used as a part of a complete object – the digital certificate. The thing here is that when you see a public key or a private key, there is no information that tells you who they belong to. The digital certificate wraps more information together that identifies the certificate holder. Information such as the name and a specific serial number (like an id number), and also the date from which the certificate is invalid. It also contains the public key. The first statement of the second bullet might be misleading, that the digital certificate is a 'special public key'. The certificate contains the public key; it is not a key in itself.

How do you know that the digital certificate itself is not just a hacker's invention? Good question! And now is where you reach the realm of trust: there must be some point where you can say "I trust this". A certificate authority provides the trust point. VeriSign is an example of a certificate authority. They take it upon themselves to validate a company, and they issue the certificate. When you receive the certificate, you can be sure about the identity of the sender because you can say "I trust VeriSign". The certificate is therefore self-signed – by the certificate authority. This signature is commonly known and can easily be verified.

## Slide 12



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### Distribution problem

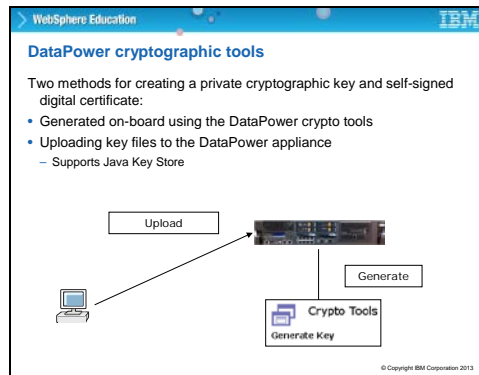
- First step is to create public-private key pairs to communicate securely
- Second step is to create a digital certificate to send to the party with whom you want to communicate
  - Digital certificate contains your digital signature with public key
- Problem: how to send your certificate to everyone with whom you want to communicate?
  - You also need signed certificate with a public key from everyone with whom you want to communicate
- Solution: create a certificate authority (CA) to resolve this issue
  - Instead of issuing self-signed digital certificates to everyone, sign your digital certificate that use a CA certificate
  - Parties validate digital signature of CA certificate that signed your digital certificate

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### Distribution problem

What you saw on the previous slide is linked to the problem of distribution. Although you might distribute self-signed certificates (and in many cases the distribution is a good solution), it is much better to have a third party that everyone can trust. The certificate authority issues you a CA certificate, and you use the certificate to create your own digital certificates.

There are about 30 CA certificates that are shipped with DataPower. The certificates are known as root certificates.



### DataPower crypto tools

Self-signed certificates are often a suitable solution. For example, for communication within a company, there is usually less need for the complete assurance of a third-party CA certificate. DataPower has two ways to create self-signed certificates. First, you can use DataPower tools to create the certificate on-board. Second, you can upload keys to the appliance by using a Java keystore.

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Generating cryptographic (asymmetric) keys on the DataPower appliance (1 of 2)

- From WebGUI vertical navigation bar, expand **ADMINISTRATION** and select **Miscellaneous > Crypto Tools**

– Enter key information

– Only **Common Name** is required

Generate Key

LDAP (reverse) Order of RDNs ☐ on ☒ off

Country Name (C)

State or Province (ST)

Locality (L)

Organization (O)

Organizational Unit (OU)

Organizational Unit 2 (OU)

Organizational Unit 3 (OU)

Organizational Unit 4 (OU)

Common Name (CN)

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### Generating crypto (asymmetric) keys on board (1 of 2)

Here is how to create asymmetric keys on DataPower. You expand the Administration section of the left navigation bar and select Crypto Tools under the Miscellaneous heading. On the dialog that opens there are three tabs – Generate Key, and Export and Import Crypto Object. The dialog is long, and so it is split over two slides. This slide shows the top half.

The most important thing you put in here is the common name, the name that identifies the key. For more precise identification, you can optionally include information that ranges from the country (the largest division) down to four indications of unit (the finest division). You cannot see the RSA key length on the slide: the field is off to the right – but you can specify a key length of 1024 bits, 2048 bits, or 4096 bits. Keys have validity periods, and by default the period is set to one year.

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### Generating crypto (asymmetric) keys on board (2 of 2)

- Keys cannot be exported from DataPower appliance to workstation
  - Except when **Export Private Key** is selected
  - Also exported to **temporary:** directory
- The entered object name is used to represent the key and certificate object
- Click **Generate Key** to generate the key and certificate

☒ on ☐ off Export Private Key  
☒ on ☐ off Generate Self-Signed Certificate  
☒ on ☐ off Export Self-Signed Certificate  
☒ on ☐ off Generate Key and Certificate Objects

Object Name:

Using Existing Key Object:

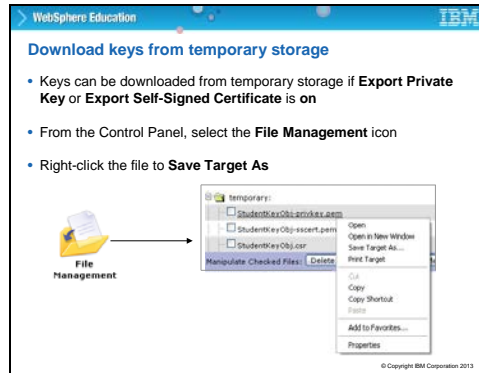
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### Generating crypto (asymmetric) keys on board (2 of 2)

You have one opportunity to export a private key from DataPower, at the moment you create it! First, you toggle the Export Private Key button to 'on' before you click the Generate Key button at the bottom of the dialog. This action writes a copy of the key to the temporary storage directory. You can then pick it up from there and export it. This is generally a good thing to do. You want to keep a copy of your certificates and private keys as backup in case of major problems with the appliance. If you do not turn on this option, then the key goes only to the cert directory. The cert directory is an encrypted directory; you do not have a choice about that action. When your key goes in there, you cannot retrieve it.

You might wonder how temporary is 'temporary'? The copies sit in the temporary directory until the domain is reset or the appliance is recycled. Restarting the domain does not empty the temporary directory. It simply restarts the services.

At the same time, you can generate the self-signed certificate and export that. This process is in addition to creating the key and certificate objects that are associated with the files, and that you use in the DataPower services you create. You would in this case provide the name that identifies the object.



### Download keys from temporary storage

When you click the button to generate the key, you get a dialog that asks you to confirm that you want a 1024-bit RSA key pair and a CSR generated. CSR is a certificate signing request that you would send off to your certificate authority. After generating the key, you go to the temporary directory, and (assuming that you asked to export the private key) you can right-click the private key file and select 'Save Target As...'. There are three files that are listed in the screen capture: the private key, the self-signed certificate, and the certificate signing request file. The file names are composed from the information you gave in the field 'object name'. You saw this one on the previous slide – together with the indication as to what the file represents, the private key or the self-signed certificate, or privkey and sscert. By the way, the name you can see on the slide is StudentKeyObj. If this name corresponded to the information that you saw on the previous slide, it would say AliceKeyObj.





## Keys and certificates are objects

You do not manipulate the key and certificate files directly, but rather the objects that point to them. You do not memorize file names that might be complex; you can give a key object name and a certificate object name that can be easy to remember. The name is the name that you enter in the object name field that you saw two slides ago. On this slide you can see a crypto certificate called AliceCert. This object points to the actual file called Alice-sscert.pem, in the cert directory. You can click the details button and examine things such as the distinguished name, or the validity dates. You cannot change the values!

Now is the second time that you are seeing the 'Password Alias' field. It was not discussed earlier, but now is an appropriate time to present some information about this field. You can set up a password for a key, and each key might have a different password. You can then set up a password alias that points to the actual password. You might use the same password alias for different keys. You do not require an alias if you set up the password.

You can choose to ignore any expiration date that is in the key. Normally, if the key or certificate is out of date there is a warning about compromised validity. You might want to be able to use the objects without these warnings.

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### Crypto shared secret (symmetric) key

- Generate a secret key object by using key file:
  - From vertical navigation bar, select **Objects > Crypto > Crypto Shared Secret Key**
  - The "Crypto Shared Secret Key" page allows you to create a secret key object for the symmetric key
  - Provides more level of security by providing indirection reference to file

Crypto Key

Name

Administrative State ☒ enabled ☐ disabled


File Name

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### Crypto shared secret (symmetric) key

The shared secret key is another term for a symmetric key. Remember that the key is a key that is identical for the sender and the receiver. Whereas the asymmetric key is a technology that was invented relatively recently (around 35 years ago), the symmetric key technique is known and used for a long time, possibly even thousands of years. The problem is how to distribute the key in a secure manner. It also requires a different key for each sender-receiver pair.

There is no tool on DataPower to generate symmetric keys. It generates asymmetric keys. You would use some other external tool to generate the key, and then upload it to DataPower.



The image shows a screenshot of the WebSphere Education interface for configuring a Crypto Certificate. The title bar at the top reads 'WebSphere Education' and 'IBM'. The main heading is 'Crypto certificate'. Below it, there are instructions: 'Create certificate object from key file', 'From vertical navigation bar, select Objects > Crypto > Crypto Certificate', and 'Provides more level of security by providing indirect reference to file'. A diagram shows a box labeled 'Crypto certificate' with an arrow pointing to a box labeled 'Public key or cert file'. To the right is a form titled 'Crypto Certificate' with fields for Name, Admin State (radio buttons for enabled/disabled), File Name (with a dropdown for 'cert' and a text input for '(none)'), Password, Confirm Password, Password Alias (radio buttons for on/off), and Ignore Expiration Dates (radio buttons for on/off). The bottom right corner has a copyright notice: '© Copyright IBM Corporation 2013'.

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### Crypto certificate

- Create certificate object from key file
  - From vertical navigation bar, select **Objects > Crypto > Crypto Certificate**
  - Provides more level of security by providing indirect reference to file

**Crypto certificate** → **Public key or cert file**

**Crypto Certificate**

Apply Cancel

Name:

Admin State: ☒ enabled ☐ disabled

File Name:  cert:  (none)

Password:

Confirm Password:

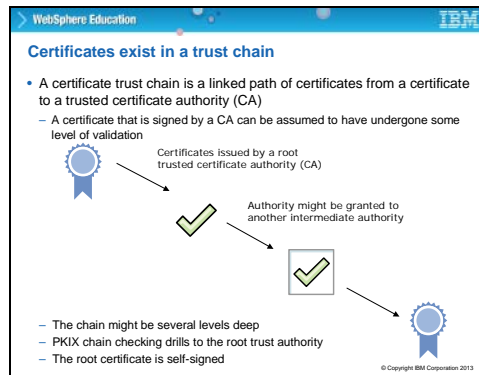
Password Alias: ☐ on ☒ off

Ignore Expiration Dates: ☐ on ☒ off

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### Crypto certificate

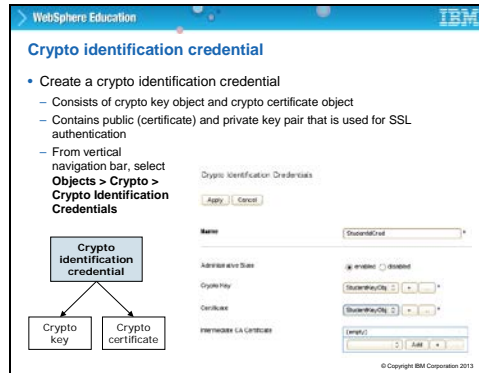
The crypto certificate object provides the indirect reference to the certificate file. You give the object a name. Then, choose the file to which to object is making reference. You can add a password if you want, and you can choose to ignore the validity dates to avoid warning messages.



### Certificates exist in a trust chain

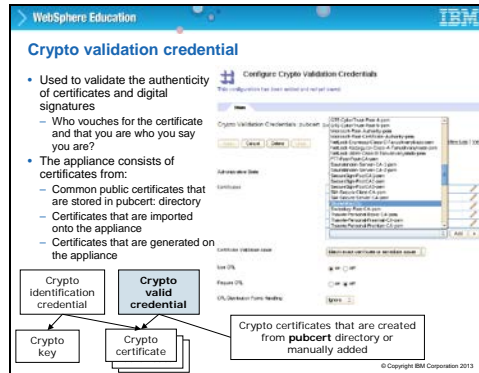
The certificate that you use might not itself be issued by a certificate authority. For example, an enterprise might go to a trusted authority such as VeriSign to get a root certificate, and then use that as the basis for internally produced certificates. Thus the certificate that the customer might be using is signed by the enterprise, not by VeriSign. The trusted authority is known as an intermediate authority. This might end up being a series of certificates that are known as a chain of trust. Here VeriSign certifies the root certificate, that one is used to certify the enterprise certificate, that on is used to certify the certificate of the software department of the enterprise, and so on. There is a thing that is called the PKIX chain, or Public Key Infrastructure X.509 chain, which can be used to recursively drill down to the original certificate. The original certificate, issued by the root trust authority, is self-signed. It represents the point at which trust is assumed; in other words, do you trust VeriSign (or any other certificate authority) when they say you should trust a specific certificate?

As was mentioned earlier, DataPower ships with about 30 certificates that are signed by IBM. VeriSign vouches for IBM, and IBM vouches for the certificates on DataPower, so do you trust those certificates? The answer is a business decision. For many enterprises this trust would not be a problem. Some military clients systematically delete all the certificates on DataPower when they get the appliances; they then load their own certificates that they are confident are valid.



### Crypto identification credential

This presentation has been about the lowest level of objects: the key object, and the certificate object. There is another level of object above the current objects, the crypto identification credential, which points to two things: the crypto key, which is the private key, and the crypto certificate, which contains the public key that is associated with the private key. You can think of the crypto identification credential as the object that groups together related keys. The screen capture shows how it is defined, by pointing not to the files themselves but to the objects that point to the files



## Crypto validation credential

If a certificate is presented to DataPower during some request from a client, how is DataPower going to validate it? There are two options. First, DataPower can match the exact certificate. In this case, the certificate is been presented must be available on the appliance. Second, a complete check might be required, by using a PKIX chain back to the root certificate. This process can be defined in a validation credential. This credential does not have anything to do with keys; it is concerned with certificates. It defines which certificates can be used to validate a presented one. You can also decide whether you want to use a CRL, or Certificate Revocation List. There is an opportunity to take a closer look at this list in a few slides.

The screenshot shows the 'Crypto profile' configuration page in the WebSphere Education console. The page includes a 'Name' field, 'Administration' and 'Validation' tabs, and various configuration options like 'Enable client certificates' and 'Require TLS version 1.2'. Overlaid on the left is a diagram showing the relationships between crypto objects:

```

graph TD
    CP[Crypto profile] --> CIC[Crypto identification credential]
    CP --> CVC[Crypto valid credential]
    CIC --> CK[Crypto key]
    CVC --> CC[Crypto certificate]
  
```

Below the diagram, the text reads: © Copyright IBM Corporation 2013.

## Crypto profile

There is yet another level above the crypto identification credential and the crypto validation credential: the crypto profile object. The object points either to a crypto identification credential object, or to a crypto validation credential object, or to both. It depends on the situation. There are two types of profile, depending on which direction you are coming from. The server profile says that the DataPower appliance is acting as a server; some client is calling it. The client profile says that the DataPower appliance is acting as a client; it is calling another server.

The crypto profile that is shown in this slide is used by the DataPower appliance during an SSL connection when the appliance is acting as the SSL server. Since no validation credential object is specified, it implies that the DataPower appliance is not requesting a certificate from the client.

You come back to the crypto profile when you look at SSL in the next unit.

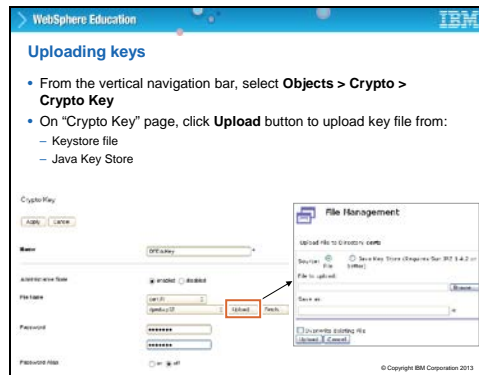


## Import and export crypto objects

A few slides back you looked at generating asymmetric keys. You might remember that there were three tabs: generate keys, export crypto object, and import crypto object. This slide looks at these last two tabs.



The dialogs are simple, and similar. Export places a copy of the exported file in the temporary directory. You can then open the directory and select to save the file. An import can be from a remote location, and so there is a button that allows you to upload files.





## Uploading keys

You might have keys that are generated in a different environment that you upload to the DataPower appliance. You would do the upload for example if you generated keys by using the Java keystore. This Java keystore is a Java security object that holds keys and certificates. From the crypto key page, you would click the upload button and browse to where ever you place the file.

### Java keytool command

- IBM JDK includes a keytool utility to generate a keystore
  - A keystore is a database of private keys and an X.509 certificate chain, where the first certificate in the chain contains the public key
  - Users can create their own public-private key and self-signed certificate
  - The `keytool` command has the following syntax:
 

```
keytool -genkey {-alias alias} {-keyalg keyalg}
{-keysize keysize} {-sigalg sigalg} [-dname dname]
[-keypass keypass] {-validity valDays} {-storetype storetype}
{-keystore keystore} [-storepass storepass] [-provider
provider_class_name] {-v} {-Jjavaoption}
```
  - Example `keytool` command:
 

```
keytool -genkey -v -alias dpedu -keypass dpadmin -keystore dpedu.p12
-storepass dpadmin -storetype "pkcs12" -dname "cn=dpedu, o=ibm, c=ca"
-keyalg "RSA"
```
  - Generates a keystore file that is called `dpedu.p12` that contains a public-private key pair
  - Generates a self-signed certificate that contains the public key and entity name with values given by `-dname` flag

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### Java keytool command

The syntax is an example of a command sequence that generates a keystore. The Sun JDK has a keytool utility, and also the IBM JDK. The syntax is shown in the middle of the slide, and a typical command sequence at the bottom. Notice that the file name is defined by using the `-keystore` directive. The distinguished name is created with three values, common name, organization and country, and the algorithm is used to generate the key is the RSA algorithm.

You saw RSA earlier. The presentation does not cover security algorithms. Just as an side note, you might be interested to learn that the security algorithm RSA is the initials of the three people who developed the first algorithm that might be used for asymmetric encryption, Rivest, Shamir, and Alderman.

The slide is titled "Certificates can expire or get revoked" and is part of a WebSphere Education presentation. It contains the following content:

- Certificates are valid only for a certain time **and can expire**
- A certificate monitor can constantly check certificates that are stored on the appliance and warn before expiration invalidates the certificate
  - This object is UP by default

On the right side, there is a blue ribbon icon with the text "Valid until 01-11-2012".

Below the text, there are two screenshots of the WebSphere configuration interface:

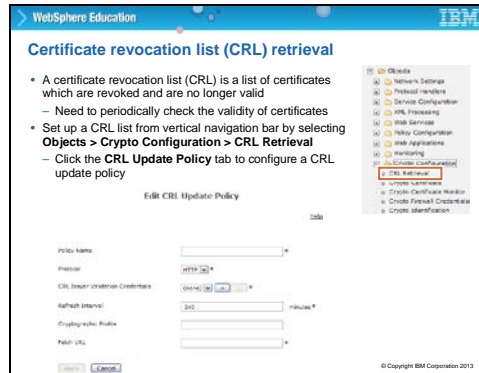
- The first screenshot shows the "Configure Crypto Certificate Monitor" page. It has a "Name" field with the value "Crypto Certificate Monitor [x2]".
- The second screenshot shows the "Configure CRL Retrieval" page. It has a "Status" field set to "CRL Policy".

At the bottom left, there is a red 'X' icon. At the bottom right, there is a small copyright notice: "© Copyright IBM Corporation 2013".

### Certificates can expire or get revoked

A few slides back you saw mention of a CRL. Here is some more discussion of what a CRL is.

Certificates typically are only valid for a limited period. From the DataPower perspective, you would not want to suddenly find yourself with execution problems because an essential certificate expired yesterday! It can be that your server environment becomes inaccessible because certificates are no longer valid, which means that you would suddenly stop doing business. DataPower therefore has a certificate monitor that constantly checks expiration dates of all the certificates that are stored on the appliance. This monitor function gives timely warning to the administrator, for example, starting one month before the expiration date. Some slides later in this presentation provide a closer look at how CRLs are set up. The same principle holds for certificates that other environments present to DataPower. Maybe a company ceased to exist and its certificates are no longer used, or maybe it is discovered that a certificate was set up fraudulently. How can the appliance know whether they are still valid? It determines their validity by consulting a Certificate Revocation List, or CRL.




### Certificate revocation list (CRL) retrieval

Here is the dialog for setting up a CRL, which is only available from the default domain, and you need administrative privileges to add or modify a policy. You give the retrieval policy a name. Then, indicate whether you retrieve the list from an LDAP server or some other place by selecting the appropriate protocol. You set up one to go to VeriSign, one to go to another authority. Where ever you are getting your certificates from. You can set up a refresh interval according to how often you think you must get a new revocation list.





### Crypto certification monitor

Here is the dialog to set up the certificate monitor, which periodically checks all your certificates for expiration. You set up the polling interval, the reminder time, and the log level. The polling interval is typically one day because expiry cannot be set to smaller time intervals than the day. You can set expiry to be on April 1, but not on April 1 at 11 in the morning! Reminder time indicates how long before the expiry date you want to start getting warned. You get warnings every day from this point, since if you do not renew a certificate. The next day the monitor is going to still see that it is going to expire and will report it. The log level can be set to give a specific level of logging of the impending expiry. Finally, you can decide what to do with certificates that expired. Do you want to allow them to be used, while the warnings continue to be issued, or do you want them disabled until someone does something about it?

WebSphere Education 

### Hardware security module (HSM)

- Appliances with hardware security module (HSM) hardware that is installed can export or import private keys
  - Appliance where key is exported or imported must also have HSM hardware installed
- DataPower supports FIPS 140-2 level 2 and level 3 security



Private Key Exportable via Ismkek ☐ on ☐ off

Export Private Key ☐ on ☒ off

Generate Self-Signed Certificate ☒ on ☐ off

Export Self-Signed Certificate ☒ on ☐ off

Generate Key and Certificate Objects ☒ on ☐ off

Object Name

Generate Key on HSM ☐ on ☒ off

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### Hardware security module (HSM)

When you purchase an appliance, you can request that an extra module called the hardware security module. The security module provides some extra flexibility that regards key storage on the appliance. If you have this module installed, there are some extra fields that are added to the dialog for generating keys that allow you to specify that you want the key that is generated on the HSM. The process allows you to export it at any time, not just at key generation time.

## Slide 31

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### Unit summary

Having completed this unit, you should be able to:

- Generate cryptographic keys by using the WebSphere DataPower tools
- Create a cryptographic identification credential object that contains a matching public and private key
- Create a cryptographic validation credential to validate certificates
- Set up certificate monitoring to ensure that certificates are up to date

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### Checkpoint questions

1. Match the corresponding asymmetric and symmetric key encryptions:

Description	Definition
1. Symmetric key	A. Uses two different keys for encrypting and decrypting
2. Asymmetric key	B. Uses the same key

2. What does a digital certificate contain?

- A. Your name, a serial number, expiration dates, a copy of the certificate holders public key, a digital signature
- B. Your name, credit card number, expiration date, pin code
- C. Digitalized company certificate with verification turned on

3. True or False: Keys that are generated on-board cannot be exported.

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## Slide 33

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### Checkpoint answers

1. Match the corresponding asymmetric and symmetric key encryptions:

Description	Definition
1. Symmetric key	A. Uses two different keys for encrypting and decrypting
2. Asymmetric key	B. Uses the same key

2. A. What does a digital certificate contain?

- ✓ A. Your name, a serial number, expiration dates, a copy of the certificate holders public key, a digital signature
- B. Your name, credit card number, expiration date, pin code
- C. Digitalized company certificate with verification turned on

3. False. Keys can be exported to the **temporary** directory if the **Export Private Key** radio button is selected when generating a key on the appliance.

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## Slide 34

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### Exercise

Creating cryptographic objects

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### Exercise objectives

After completing this exercise, you should be able to:

- Generate cryptographic keys by using the WebSphere DataPower cryptographic tools
- Upload key files to the WebSphere DataPower SOA Appliance
- Create a cryptographic identification credential that use a cryptographic key object
- Validate certificates that use a validation credential object

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Slide 36

