IBM Systems – Enterprise Networking Solutions

Leveraging z/OS Communications Server Application Transparent Transport Layer Security (AT-TLS) for a Lower Cost and More Rapid TLS Deployment

SHARE Session 17738

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z/OS Communications Server

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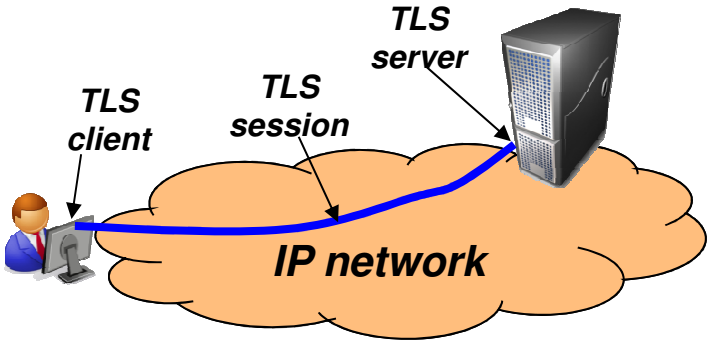
Agenda

- **SSL/TLS Overview**
- **What is AT-TLS?**
- **Why use AT-TLS?**
- **How does AT-TLS work?**
- **Configuring AT-TLS**
- **What's new in z/OS V2R2**

Transport Layer Security (TLS/SSL) overview

- Transport Layer Security (TLS) is defined by the IETF **
  - Based on Secure Sockets Layer (SSL)
    - TLS defines SSL as a version of TLS for compatibility
- Provides secure connectivity between two TLS security session endpoints
  - TLS session
- Full application payload encryption and data authentication / integrity
- TLS security session endpoint plays either a client or server role
- Session endpoint authentication via X.509 certificates
  - Server authentication required
  - Client authentication optional (mutual authentication)



Full application payload encryption

TLS/SSL encryption:

SrcIP	DestIP	SrcPort	DestPort	Data
192.168.100.1	192.168.1.1	50002	443	@%$#*&&^^!:"J)*GVM><

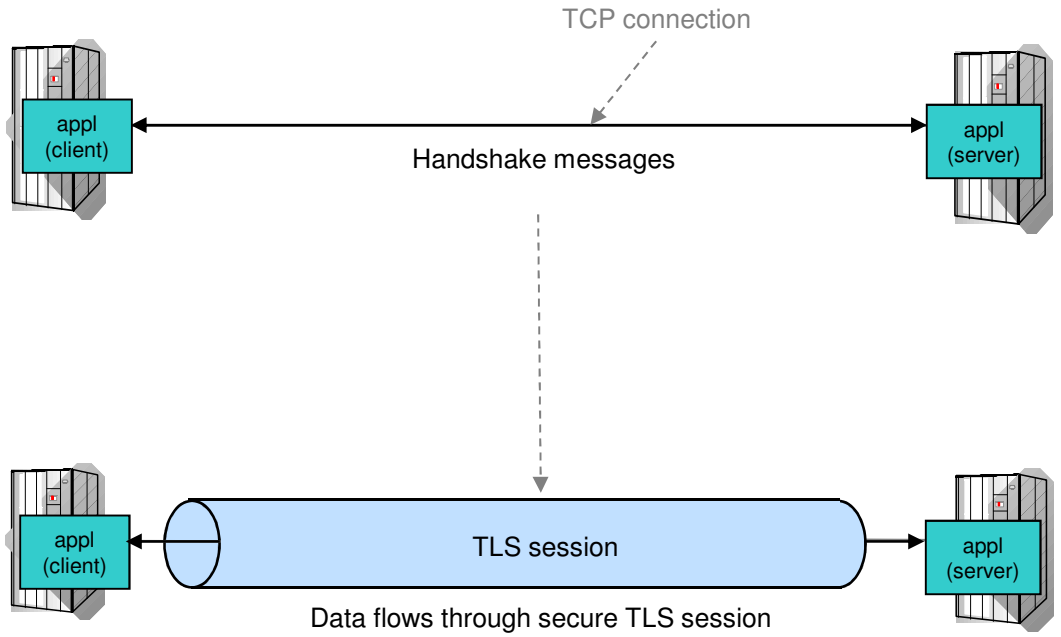
**** For our purposes, SSL and TLS are equivalent and one term implies the other**

TLS/SSL protocol basics

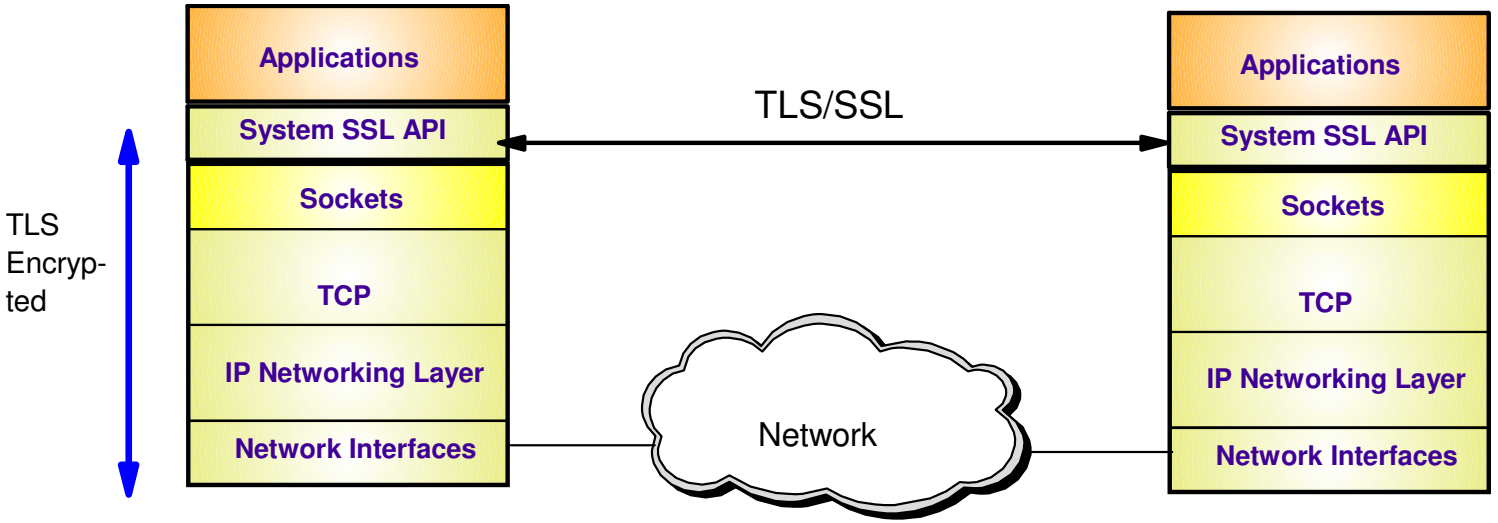
1 Client application initiates TLS handshake which authenticates the server (and, optionally, client) and negotiates a cipher suite to be used to protect data

Upon successful completion of the handshake, a secure TLS session exists for the application partners

2 Data flows through secure session using symmetric encryption and message authentication negotiated during handshake



Transport Layer Security enablement

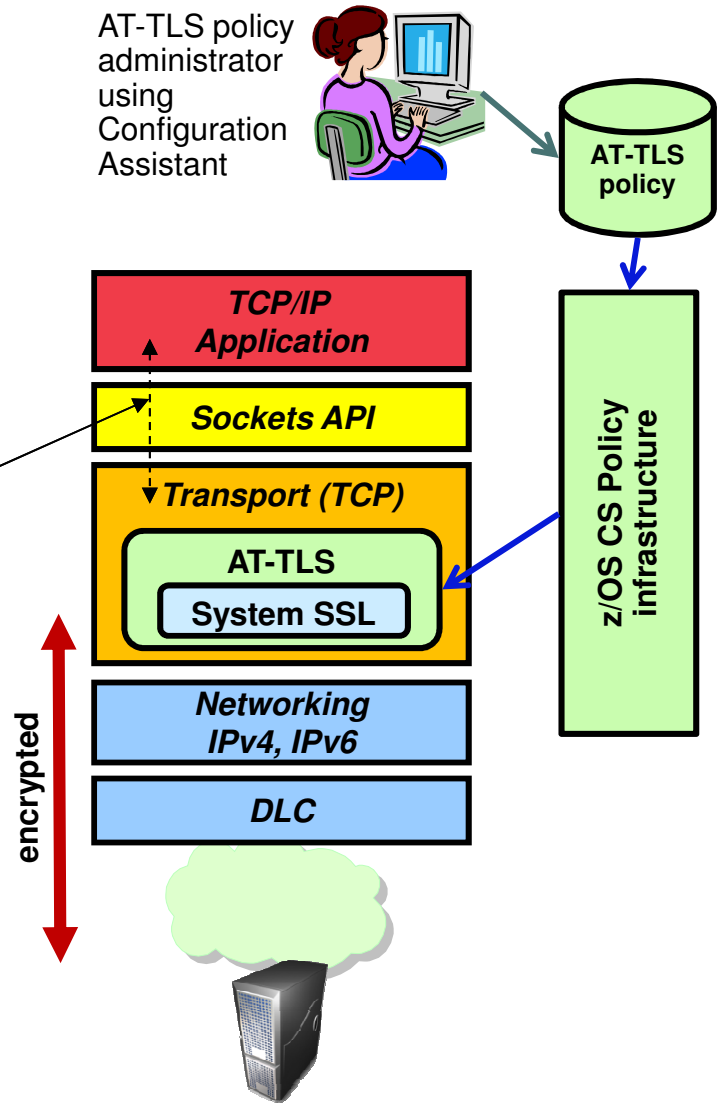


- TLS traditionally provides security services as a socket layer service
  - TLS requires reliable transport layer,
    - Typically TCP (but architecturally doesn't have to be TCP)
  - UDP applications cannot be enabled with traditional TLS
    - There is now a TLS variant called Datagram Transport Layer Security (DTLS) which is defined by the IETF for unreliable transports
- On z/OS, System SSL (a component of z/OS Cryptographic Services) provides an API library for TLS-enabling your C and C++ applications
- Java Secure Sockets Extension (JSSE) provides libraries to enable TLS support for Java applications
  - However, there is an easier way…

… Application Transparent TLS!

z/OS Application Transparent TLS overview

- **Stack-based TLS**
  - TLS process performed in TCP layer (via System SSL) without requiring any application change (transparent)
  - AT-TLS policy specifies which TCP traffic is to be TLS protected based on a variety of criteria
    - Local address, port
    - Remote address, port
    - Connection direction
    - z/OS userid, jobname
    - Time, day, week, month
- **Application transparency**
  - Can be fully transparent to application
  - An optional API allows applications to inspect or control certain aspects of AT-TLS processing – "application-aware" and "application-controlled" AT-TLS, respectively
- **Available to TCP applications**
  - Includes CICS Sockets
  - Supports all programming languages except PASCAL
- **Supports standard configurations**
  - z/OS as a client or as a server
  - Server authentication (server identifies self to client)
  - Client authentication (both ends identify selves to other)
- **Uses System SSL for TLS protocol processing**
  - Remote endpoint sees an RFC-compliant implementation
  - interoperates with other compliant implementations



Some z/OS applications that use AT-TLS

- CommServer applications
  - TN3270 Server
  - FTP Client and Server
  - CSSMTP
  - Load Balancing Advisor
  - IKE NSS client
  - NSS server
  - Policy agent
  - DCAS server
- DB2 DRDA
- IMS-Connect
- JES2 NJE
- IBM Multi-Site Workload Lifeline
- Tivoli Netview applications
  - MultiSystem Manager
  - NetView Management Console
- RACF Remote Sharing Facility
- CICS Sockets applications
- InfoSphere Guardium S-TAP
- 3rd Party applications
- Customer applications

Advantages of using AT-TLS

- **Reduce costs**
  - Application development
    - Cost of System SSL integration
    - Cost of application's TLS-related configuration support
  - Consistent TLS administration across z/OS applications
  - Gain access to new features with little or no incremental development cost

- **Complete and up-to-date exploitation of System SSL features**
  - AT-TLS makes the vast majority of System SSL features available to applications
  - AT-TLS keeps up with System SSL enhancements – as new features are added, your applications can use them by changing AT-TLS policy, not code

- **Ongoing performance improvements**
  Focus on efficiency in use of System SSL

- **Great choice if you haven't already invested in System SSL integration**
  Even if you have, consider the long-term cost of keeping up vs. short term cost of conversion

AT-TLS support for TLS v1.2 and Related Features

…Added in z/OS V2R1

- TLS Protocol Version 1.2 (RFC 5246):
  - Twenty-one new cipher suites
    - 11 new HMAC-SHA256 cipher suites
    - 10 new AES-GCM cipher suites
- Support Elliptic Curve Cryptography (ECC)
  - Twenty new ECC cipher suites
    - ECC cipher suites for TLS (RFC 4492)
- Support for Suite B cipher suites (RFC 5430)
  - TLS 1.2 is required
  - ECC is required
  - Suite B has two levels of cryptographic strength that can be selected
    - 128 or 192 bit
- Transport Layer Security (TLS) Renegotiation Extension (RFC 5746):
  - Provides a mechanism to protect peers that permit re-handshakes
  - When supported, it enables both peers to validate that the re-handshake is truly a continuation of the previous handshake

… Added in z/OS V2R2

- More flexible processing of CRLs from LDAP
- Retrieval of CRLs through HTTP URLs
- Retrieval of revocation information through the Online Certificate Status Protocol (OCSP)

AT-TLS application types

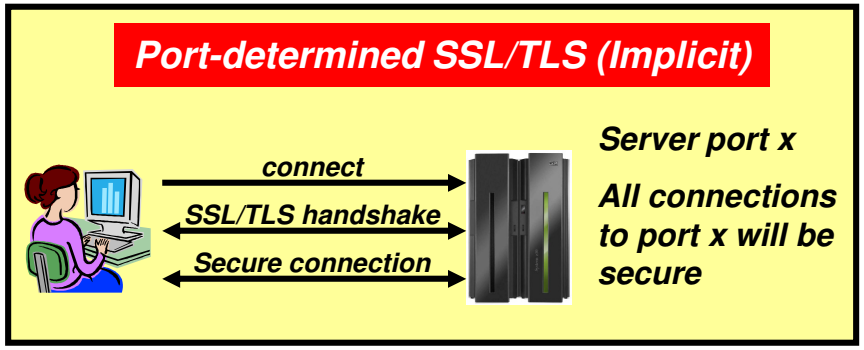
- **Not enabled**
  - No policy or policy explicitly disables AT-TLS for application traffic
  - Application may optionally use System SSL directly
  - Applications that use the Pascal API and Web Fast Response Cache Accelerator (FRCA) fall into this category

- **Basic**
  - Policy enables AT-TLS for application traffic
  - Application is unchanged and unaware of AT-TLS
  - Application protocol unaffected by use of AT-TLS (think HTTP vs. HTTPS)

- **Aware**
  - Policy enables AT-TLS for application traffic
  - Application uses the SIOCTTLSCTL ioctl to extract AT-TLS information such as partner certificate, negotiated version and cipher, policy status, etc.

- **Controlling**
  - Policy enables AT-TLS and specifies ApplicationControlled ON for application traffic
  - Application protocol may negotiate the use of TLS in cleartext with its partner
  - Application uses the SIOCTTLSCTL ioctl to extract AT-TLS information (like an aware application) and to control TLS operations:
    - Start secure session
    - Reset session
    - Reset cipher

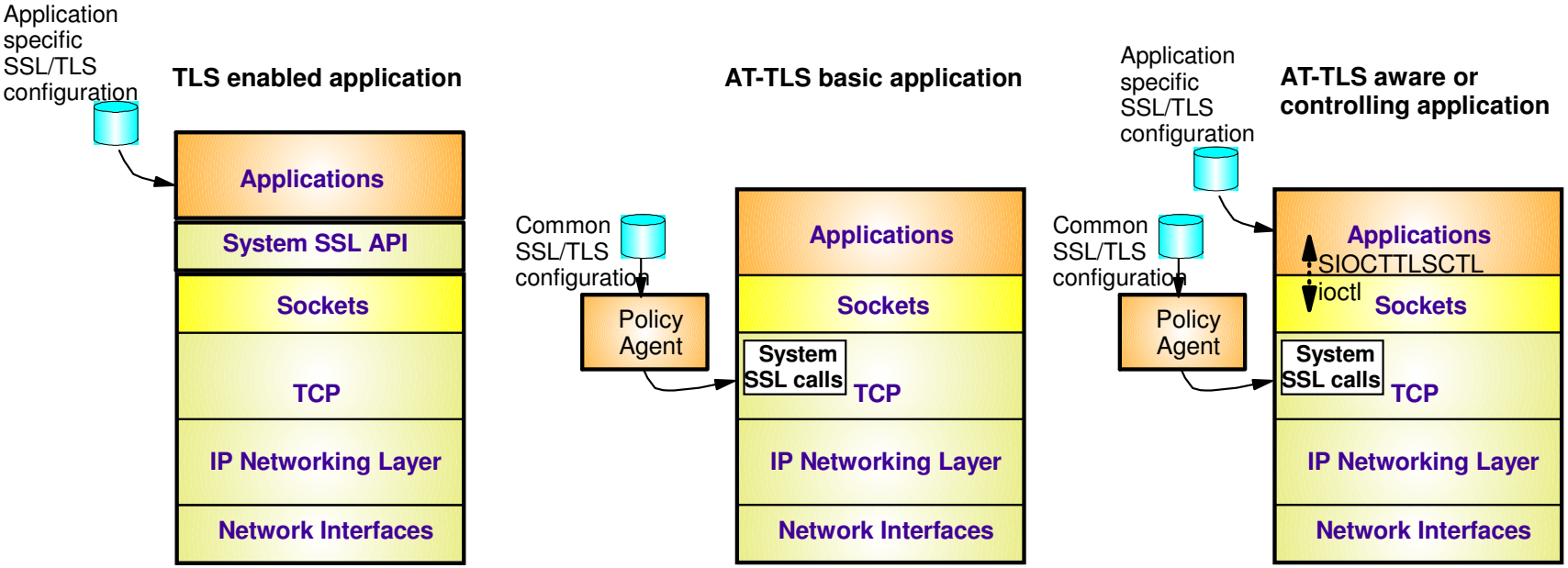
SSL/TLS application types



- As soon as a connection has been established with the server, the SSL/TLS handshake starts
- Examples are the HTTPS port (443), and FTP's secure port (990)
- AT-TLS considerations:
  - Can be done totally transparent to application code
    - This is referred to as an AT-TLS "Basic" application
  - Optionally the application may query SSL/TLS attributes, such as client user ID (if client authentication is used, cipher suite in use, etc)
    - This is referred to as an AT-TLS "Aware" application

- Application protocol includes verbs to negotiate security protocol and options
- Examples are FTP that uses the AUTH FTP command to negotiate use of SSL/TLS or Kerberos, and in some cases a TN3270 server port (Conntype NegtSecure)
- AT-TLS considerations:
  - Application needs to "tell" AT-TLS when to start the SSL/TLS handshake
    - This is referred to as an AT-TLS "Controlling" application
  - Otherwise, use of AT-TLS is transparent to application
  - Optionally the application may query SSL/TLS attributes, such as client user ID (if client authentication is used, cipher suite in use, etc)

TLS configuration cases by application type

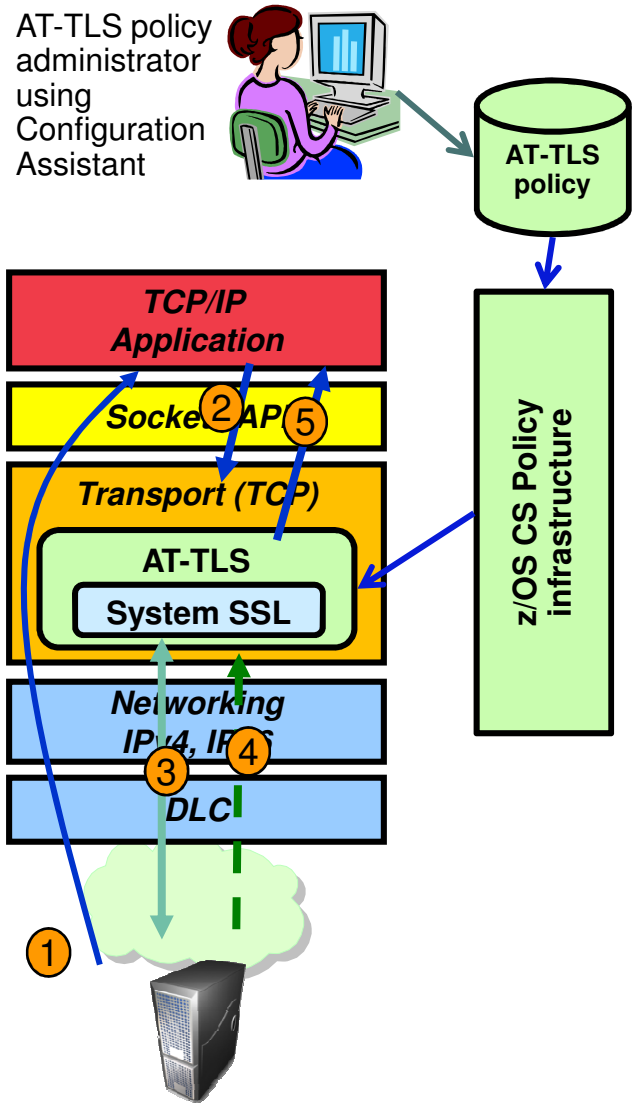


- TLS enabled application
  - Each application has its own configuration to control security policy and TLS functions
- AT-TLS basic application
  - All applications' security policy and TLS functions are governed by a single, consistent AT-TLS policy system-wide
- AT-TLS aware or controlling applications
  - Application specific policy retained but reduced to what application needs for awareness or controlling functions
  - AT-TLS policy continues to control overall AT-TLS function for the application

AT-TLS operation (z/OS as server)

Setup: AT-TLS policy is configured and deployed for the TCP application and the TCP application is started.

1. Client connects to server and connection is established
2. After accepting the new connection, the server issues a read request on the socket. The TCP layer checks AT-TLS policy and sees that AT-TLS protection is configured for this connection. As such, it prepares for the client-initiated TLS handshake
3. The client initiates the SSL handshake and the TCP layer invokes System SSL to perform the TLS handshake under identity of the server.
4. Client sends data traffic under protection of the new TLS session
5. TCP layer invokes System SSL to decrypt the data and then delivers the cleartext inbound data to the server

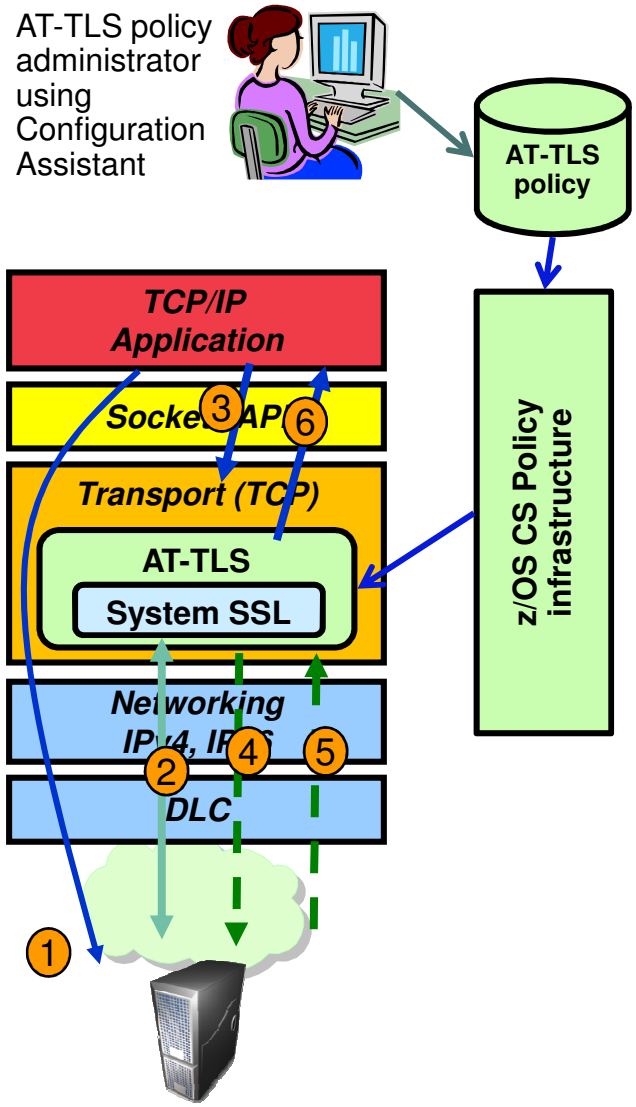


Unencrypted (cleartext) flows
SSL/TLS handshake flows
SSL/TLS-secured (encrypted) flows

AT-TLS operation (z/OS as client)

Setup: AT-TLS policy is configured and deployed for the TCP application and the TCP application is started.

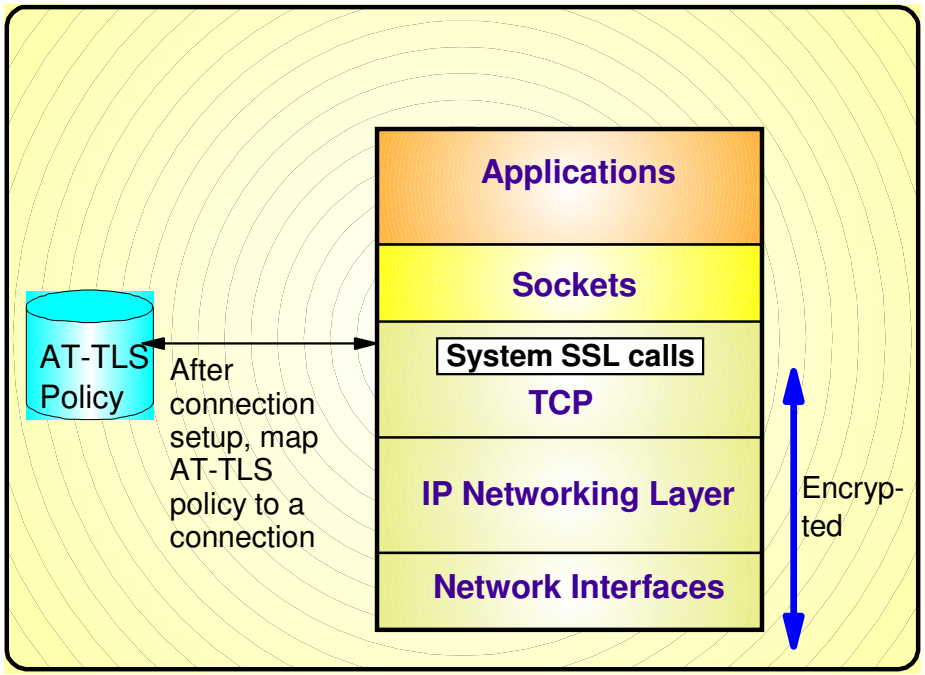
1. z/OS client connects out to server and connection is established
2. TCP layer invokes System SSL to perform the TLS handshake under identity of the client application
3. z/OS client sends data to server
4. TCP layer invokes System SSL to encrypt queued data and then sends it to server
5. Server sends encrypted data, TCP layer invokes System SSL to decrypt it
6. TCP delivers inbound data to z/OS client in the clear



Unencrypted (cleartext) flows
SSL/TLS handshake flows
SSL/TLS-secured (encrypted) flows

Mapping AT-TLS policy to a TCP connection

- An AT-TLS policy rule describes TLS requirements for a TCP connection
- Policy rule is mapped to a connection based on policy condition
  - TCP/IP resource attributes
  - Connection type attributes
  - Local application attributes
- An AT-TLS policy rule is mapped to a connection at well defined points
  - Outbound Connect
  - First Select/Send/Receive after Accept
  - SIOCTTLSCTL ioctl
- If a rule match is found, TCP/IP stack provides TLS protocol control based on the policy action
- Alternate method of mapping policy to a connection
  - Secondary Map
    - Used for applications that have one or more “secondary” connections and one “primary” connection
    - Examples: FTP, rsh, rexec



AT-TLS policy conditions

Criteria	Description
Local address	Local IP address
Remote address	Remote IP address
Local port	Local port or ports
Remote port	Remote port or ports
Connection direction	• Inbound (applied to first Select, Send, or Receive after Accept) • Outbound (applied to Connect) • Both
User ID	User ID of the owning process or wildcard user ID
Jobname	Jobname of the owning application or wildcard jobname
Time, Day, Week, Month	When filter rule is active

AT-TLS policy actions

Criteria	Description
TLS enablement	Specifies whether TLS is enabled for connection matching the policy rule
TLS/SSL versions allowed	SSLv2, SSLv3, TLSv1, TLSv1.1, TLSv1.2
Cipher suites	Set of potential cryptographic algorithms (in order of preference) that this TLS server or client will accept during the TLS handshake
Role	• TLS client • TLS server • TLS server with client authentication
Client authentication type	• Passthru (bypass checking) • Required • Full (Accepted if provided by client) • SAFCheck
Authentication information	• Keyring identifier • Certificate label used for authentication • LDAP, OCSP (V2R2), HTTP (V2R2) controls for certificate revocation
Data trace	Specifies whether to trace cleartext in datatrace or ctrace
AT-TLS trace levels	Specifies level of tracing
Handshake timeout	Time to wait for handshake to complete
Session key lifetime	When session key has been used this specified time period, a new session key must be created
Session ID requirements	Session ID cache size, Session ID timeout, Use sysplex-wide session ID cache
Secondary map used	Specifies whether a matching connection should be used as a "primary" connection in the "secondary policy mapping method"

AT-TLS configuration task steps

- Obtain x.509 certificates and update RACF keyrings
- Update any application-specific configuration files if necessary
- Enabling use of AT-TLS in the TCP/IP stack configuration
- Create AT-TLS policy using Configuration Assistant for z/OS Communications Server
- Create policy infrastructure using Configuration Assistant application setup task checklist

Obtain x.509 certificates and update RACF keyrings

- Same process as with SSL-enabled applications
  - More information on certificate acquisition, configuration using RACDCERT command in appendix
- Keyrings with certificates and private keys used for TLS sessions are specified in the AT-TLS policy
- Keyring can be specified at a:
  - A system image level
  - Policy rule level

Update any application configuration if needed - FTP example

- Some application configuration changes may be necessary if the application is either AT-TLS aware or AT-TLS controlling
- The FTP server is both AT-TLS aware and controlling
- Example below defines an FTP server that supports SSL/TLS connections, but does not require it
  - It depends on the client sending an AUTH command or not
- SSL/TLS is done by ATTLS in this example

```
EXTENSIONS          AUTH_TLS            ; Enable TLS authentication
TLSMECHANISM        ATTLS               ; Server-specific or ATTLS
SECURE_FTP          ALLOWED             ; Security required/optional
SECURE_LOGIN        NO_CLIENT_AUTH      ; Client authentication
SECURE_PASSWORD     REQUIRED            ; Password requirement
SECURE_CTRLCONN     PRIVATE             ; Minimum level of security CTRL
SECURE_DATACONN     PRIVATE             ; Minimum level of security DATA
TLSRFCLEVEL         RFC4217             ; SSL/TLS RFC Level supported
```

Enabling use of AT-TLS in the TCP/IP stack

- AT-TLS is enabled via a TCPCONFIG parameter

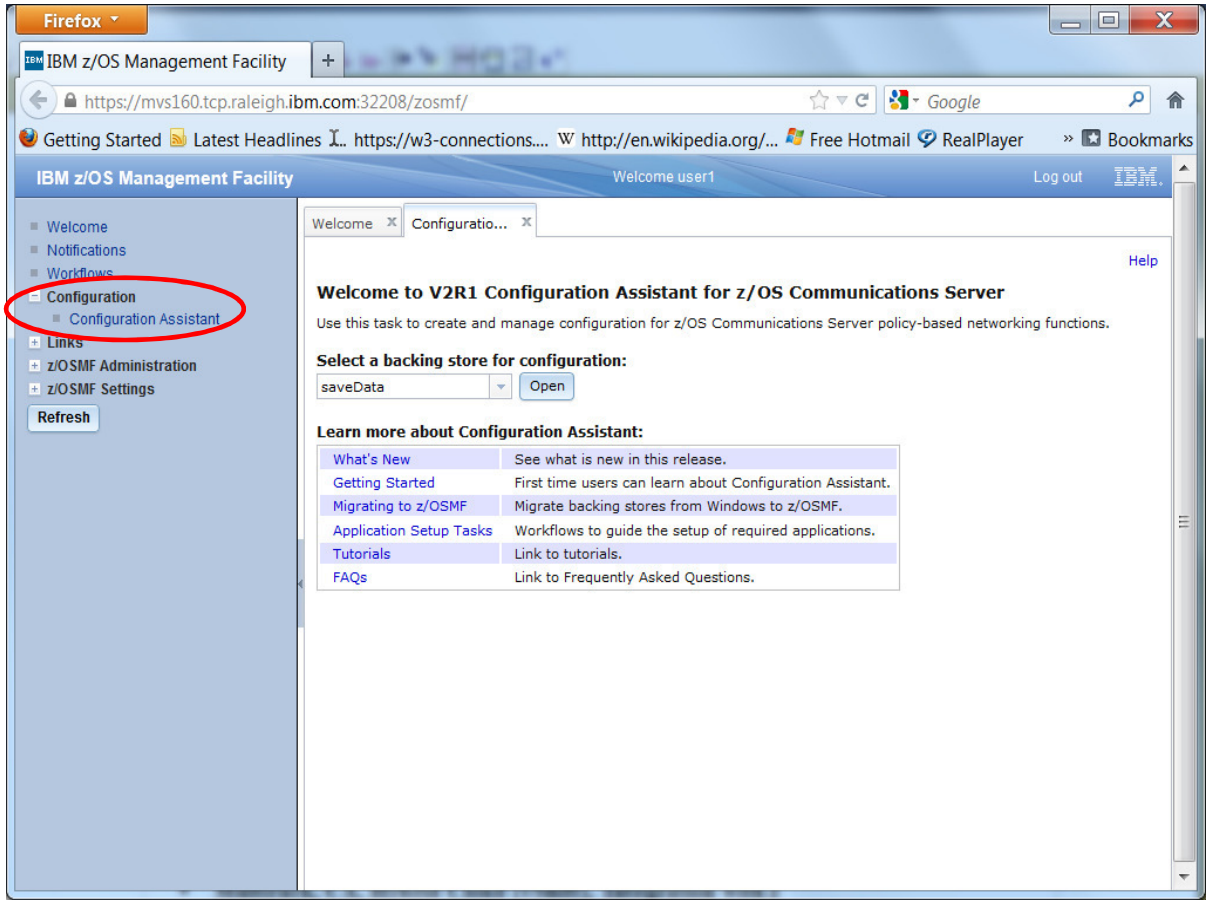
```
TCPConfig TTLS                          ; Enable AT-TLS policies
```

- There may be a short time period between TCP/IP parsing this configuration option and the actual AT-TLS policies being installed into the stack by Policy Agent
  - Since the stack doesn't yet have an AT-TLS policy, it doesn't know which connections to secure
  - What should it do if a new connection is being set up during this short time window?
  - You control that via a SERVAUTH profile:
    - **EZB.INITSTACK.system.stackname**
- When TCP/IP starts with TCPCONFIG TTLS specified, it will issue message EZZ4248E

```
EZZ4248E TCPCS WAITING FOR PAGENT TTLS POLICY
EZZ8771I PAGENT CONFIG POLICY PROCESSING COMPLETE FOR TCPCS : TTLS
EZZ4250I AT-TLS SERVICES ARE AVAILABLE FOR TCPCS
```

- Between messages EZZ4248E and EZZ4250I, the TCP/IP stack will only allow users permitted to the EZB.INITSTACK.system.stack SERVAUTH profile to establish TCP connections.
  - ***Note:*** make sure all your pertinent server address spaces (including PAGENT and OMPROUTE) run under user IDs that are permitted to this profile.

Policy-based network security on z/OS: Configuration Assistant



- **Configures:**
  - AT-TLS
  - IPSec and IP filtering
  - IDS
  - Quality of Service
  - Policy-based routing
- **Separate perspectives but consistent model for each discipline**
- **Focus on concepts, not details**
  - what traffic to protect
  - how to protect it
  - De-emphasize low-level details (though they are accessible through advanced panels)
- **z/OSMF-based web interface**
  - Standalone Windows application
    - Not supported after z/OS V1R13
- **Builds and maintains**
  - Policy files
  - Related configuration files
  - JCL procs and RACF directives
- **Supports import of existing policy files**

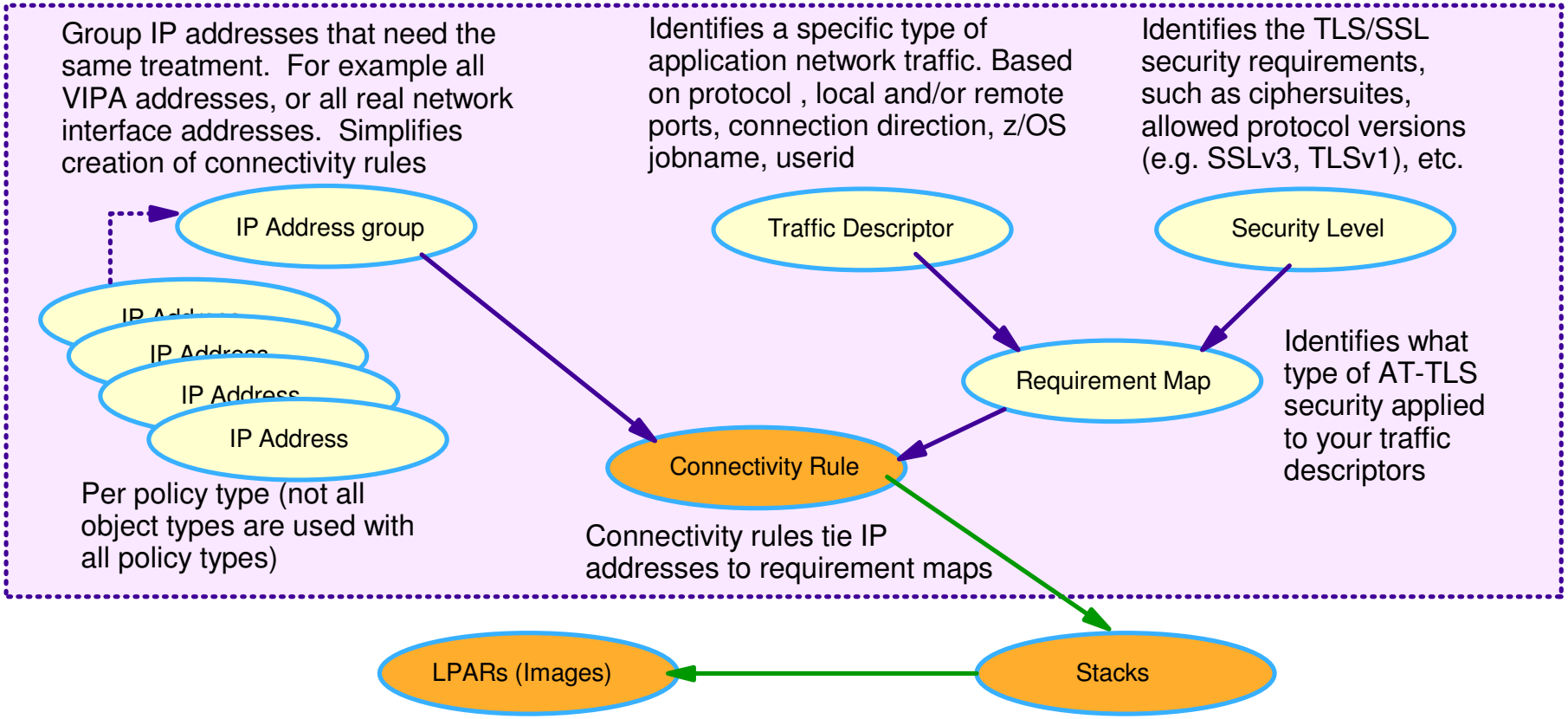
Configuration Assistant policy creation: general approach

- Wizards and dialogs guide you through a top-down approach to configuration
  - Navigational tree supports a bottom-up approach
    - Allows an experienced user to bypass wizard screens

- Define system images and TCP/IP stacks
- Define security levels (reusable)
  - Protection suites (e.g. gold, silver, bronze)
- Define requirements map (reusable)
  - How to protect common scenarios (e.g. intranet, branch office, business partner)
  - Set of traffic descriptors linked to security level
- Define connectivity rules
  - A complete security policy for all traffic between two endpoints
  - Specified data endpoints linked to a requirements map

Optimizations to this approach are provided for common applications!

Configuration Assistant reusable object model



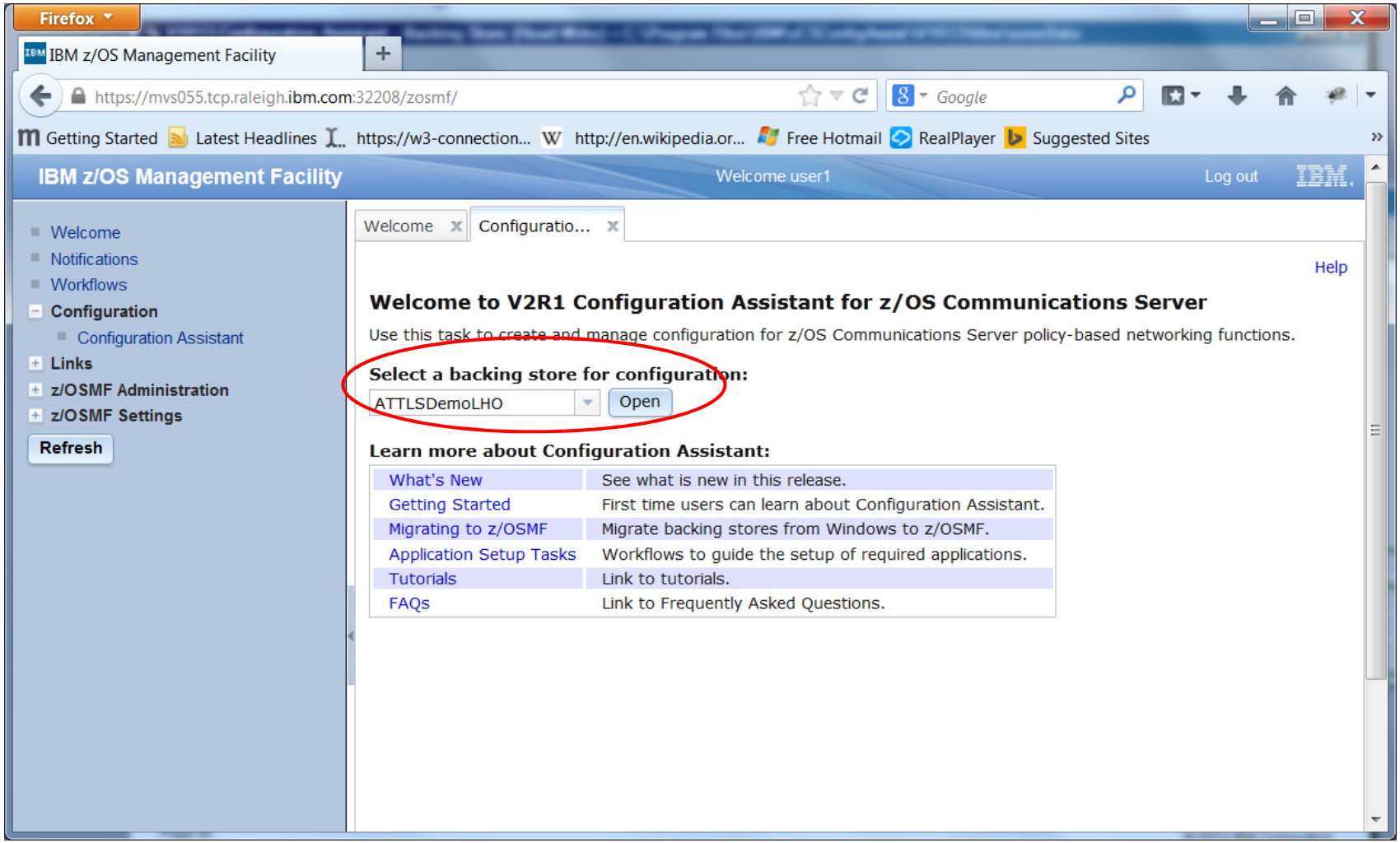
1. Create system image and TCP/IP stack image
2. Create one or more Requirement Maps to define desired security for common scenarios (e.g. intranet, branch office, business partner)
   - Create or reuse Security Levels to define security actions
   - Create or reuse Traffic descriptors to define application ports to secure
3. Create one or more Connectivity Rules between Data Endpoints (IP addresses) and associate with a configured Requirement Map

AT-TLS rule simplification with “pre-defined rules”

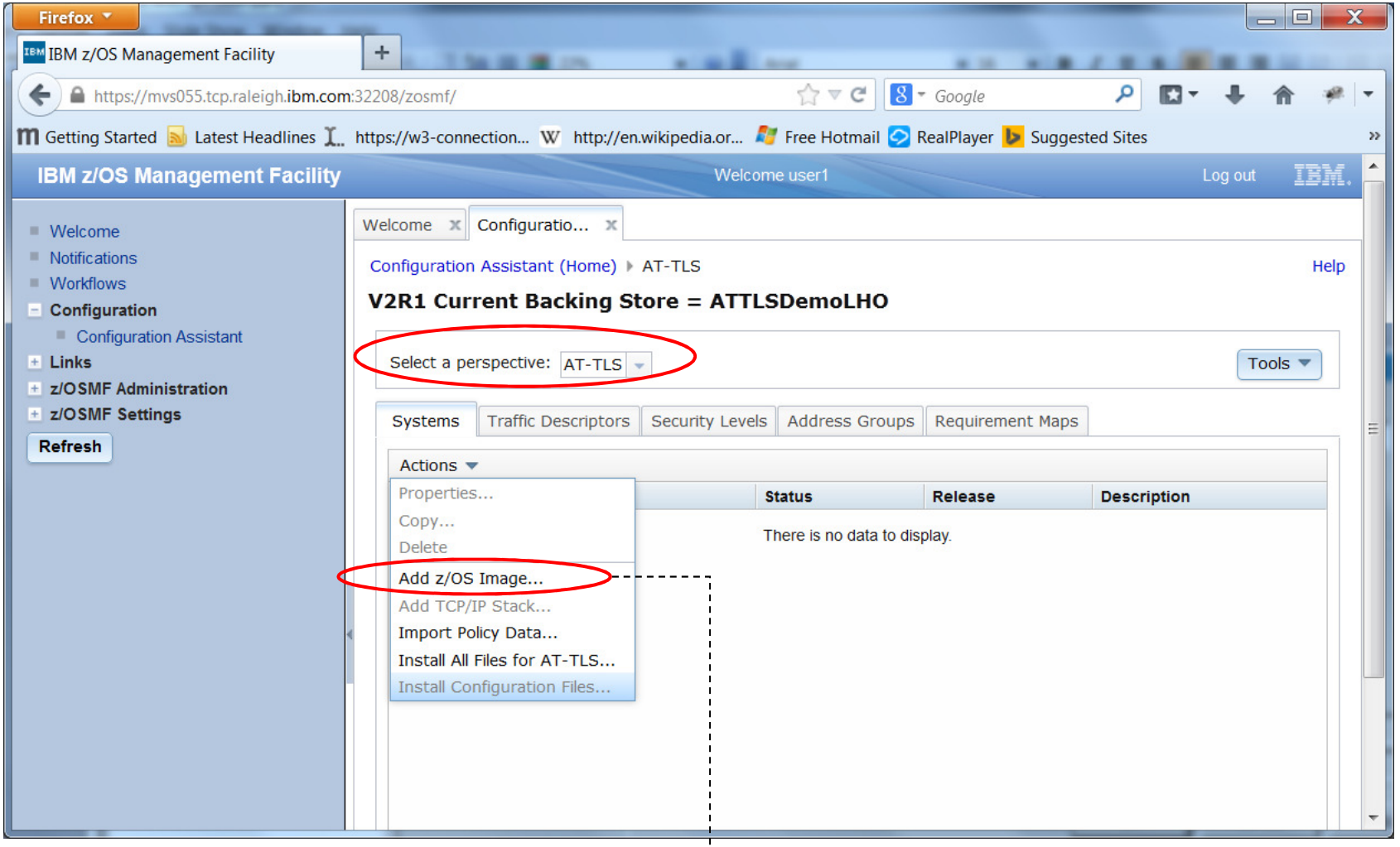
- The Configuration Assistant provides predefined AT-TLS connectivity rules for common applications configured for each stack so that policy rules for common applications can be configured in a few clicks.
- In most cases, these rules need no modification and can be enabled for immediate use.
- Each rule defines an application with default port settings, key ring, and is associated with a default security level.
- The administrator can easily enable the rules they want to have in their policy and install the generated flat file.

The examples that follow use the pre-defined rule approach….

Open the backing store



Select a perspective (AT-TLS)



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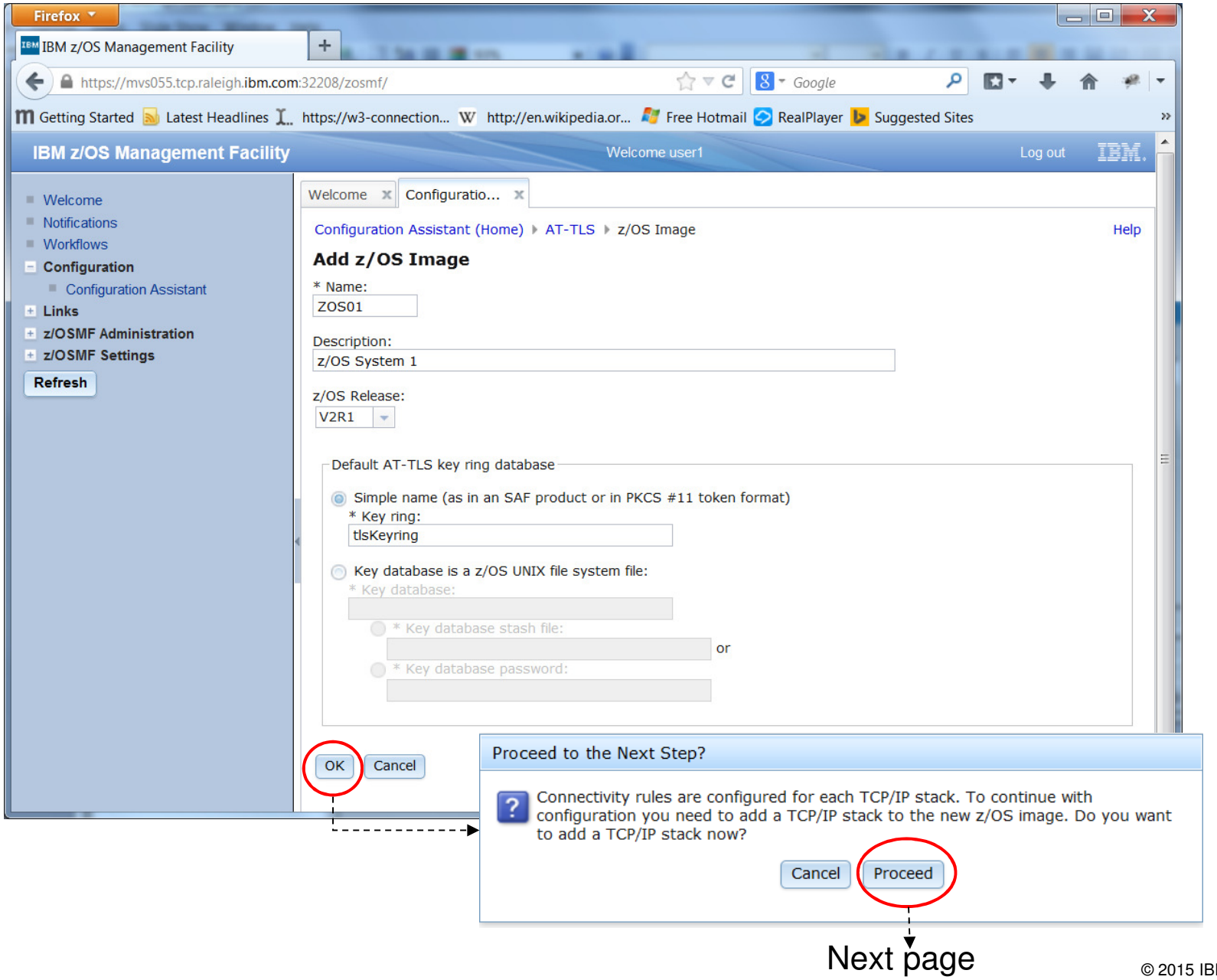
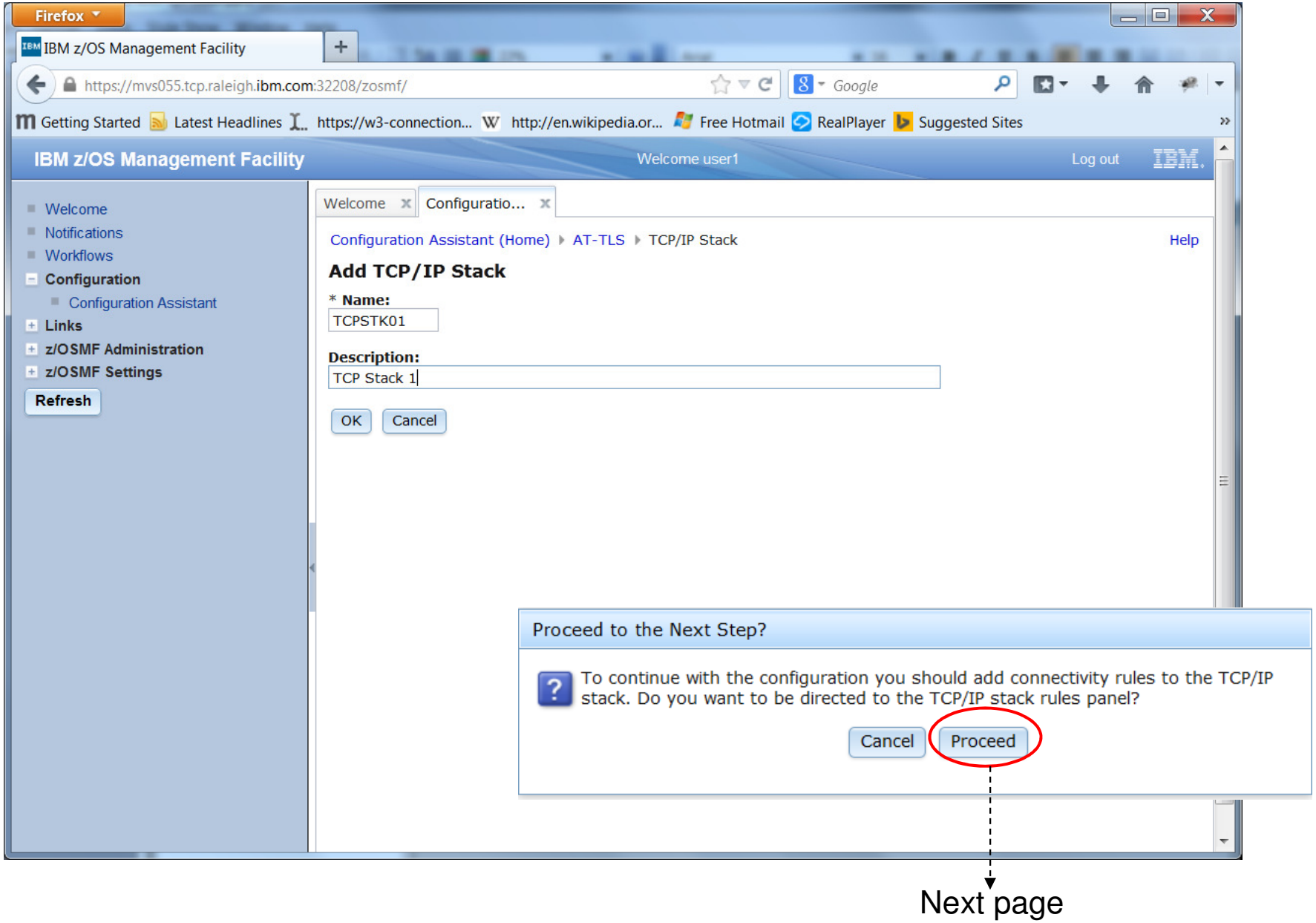
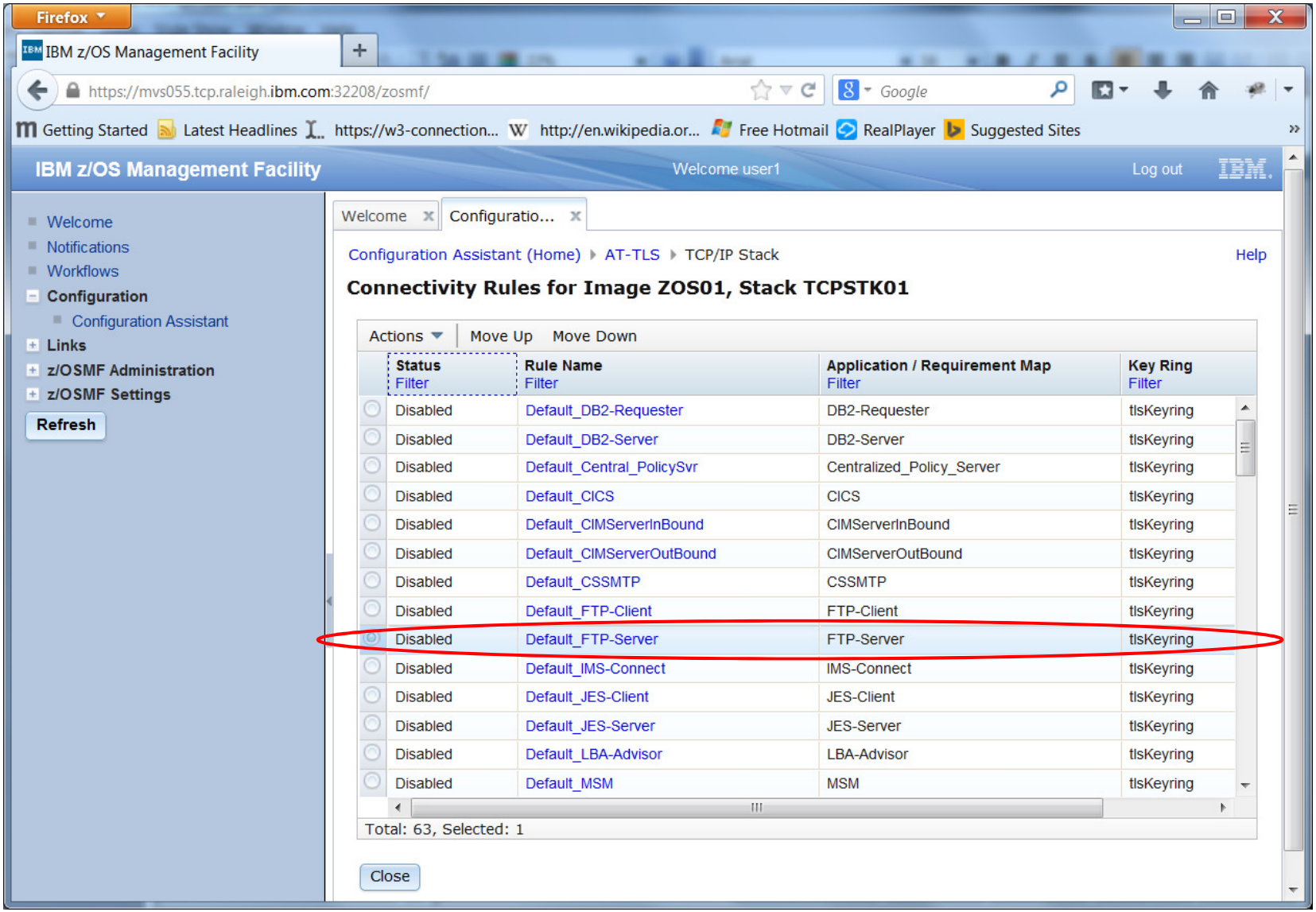
Add a z/OS image and configure default key ring at image level



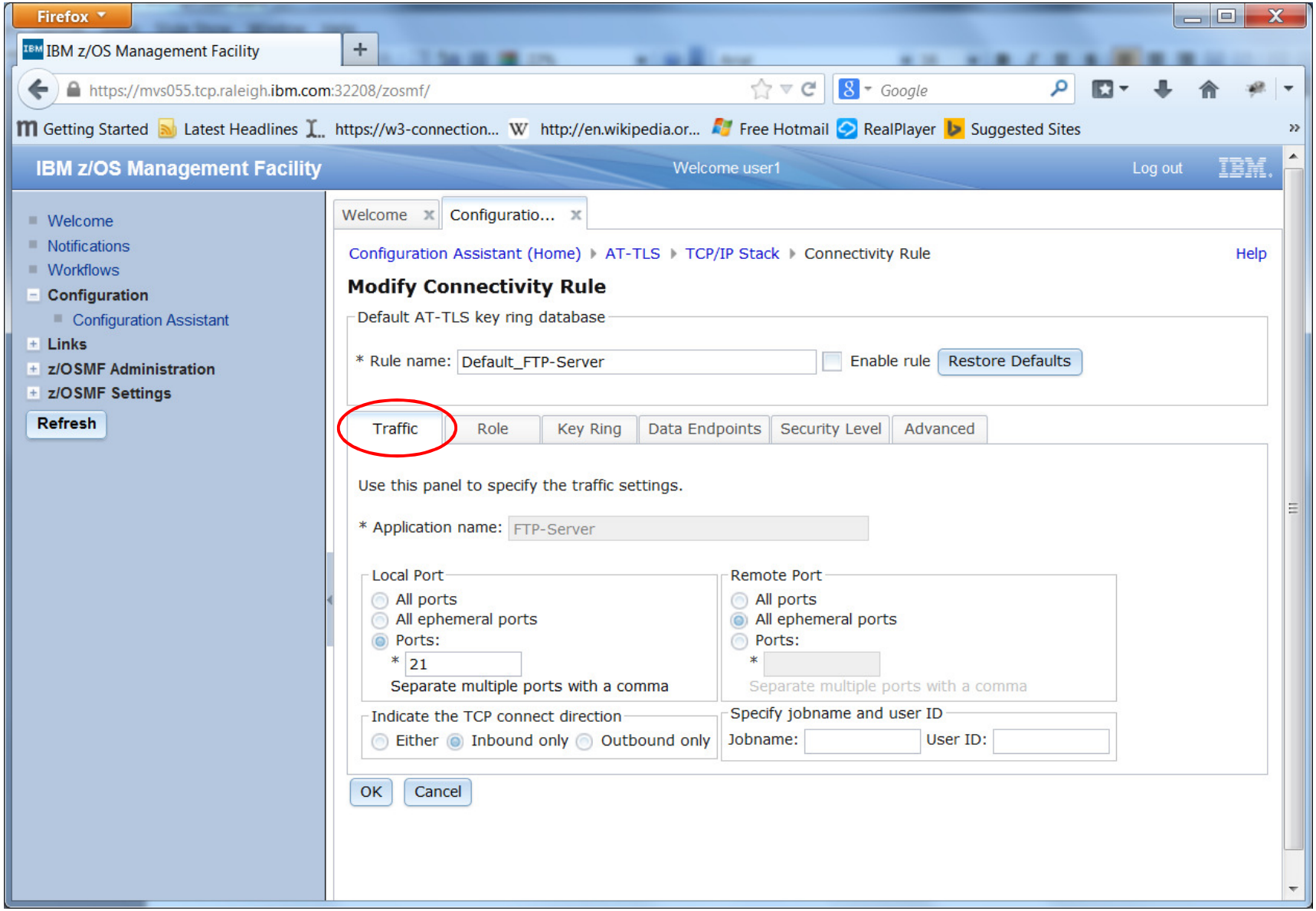
Add a TCP/IP stack



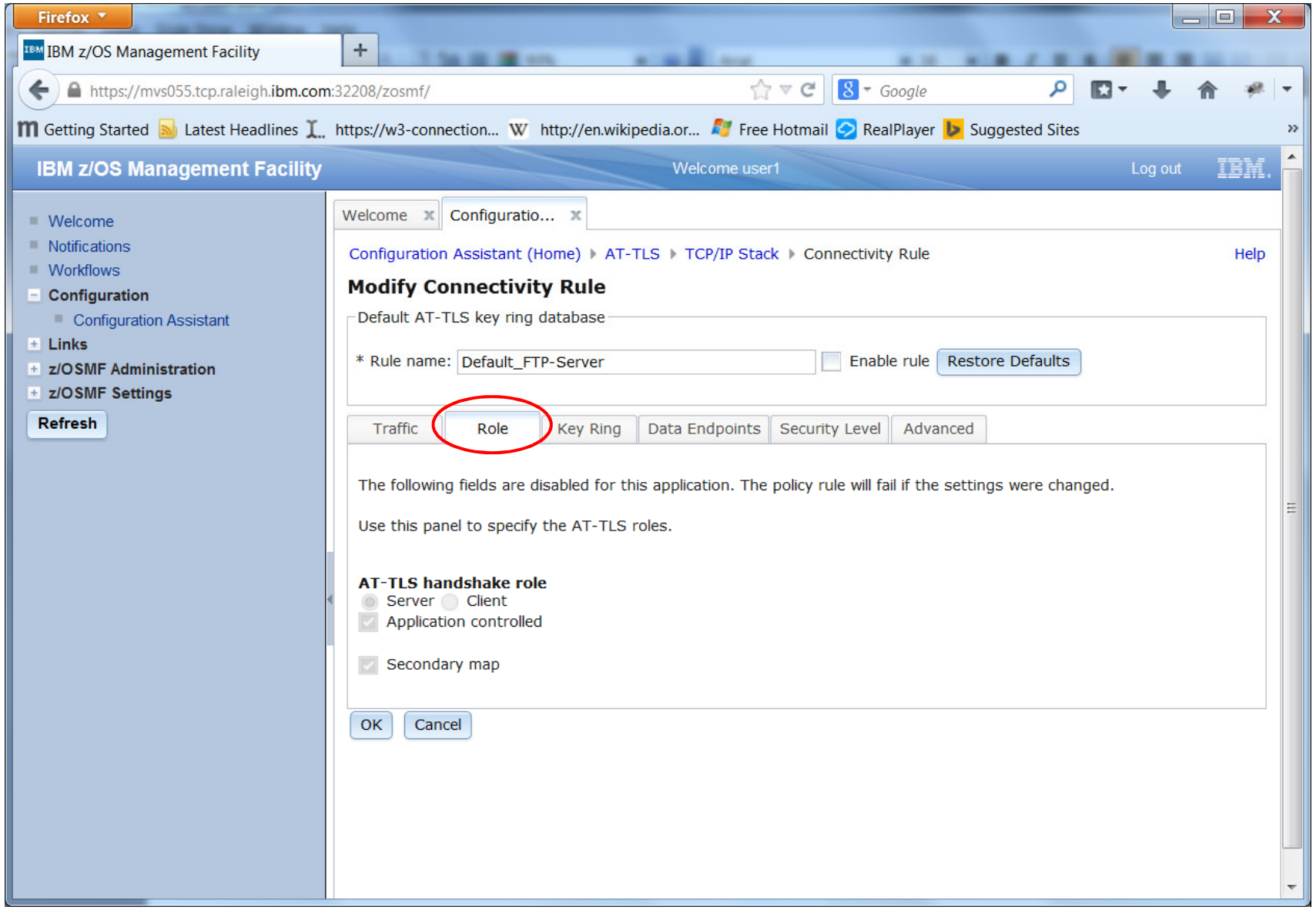
Examining the FTP server pre-defined connectivity rule



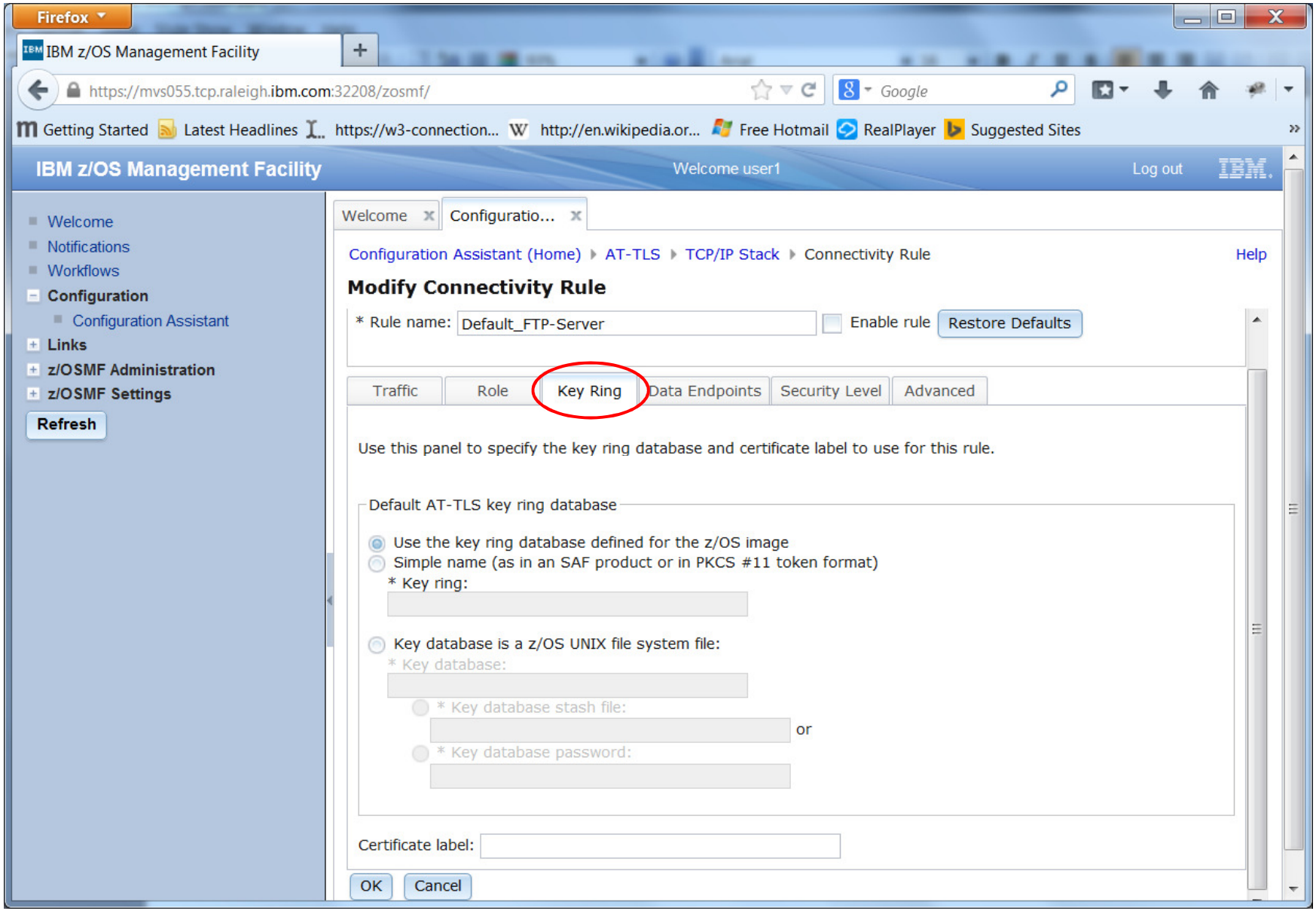
Describe traffic



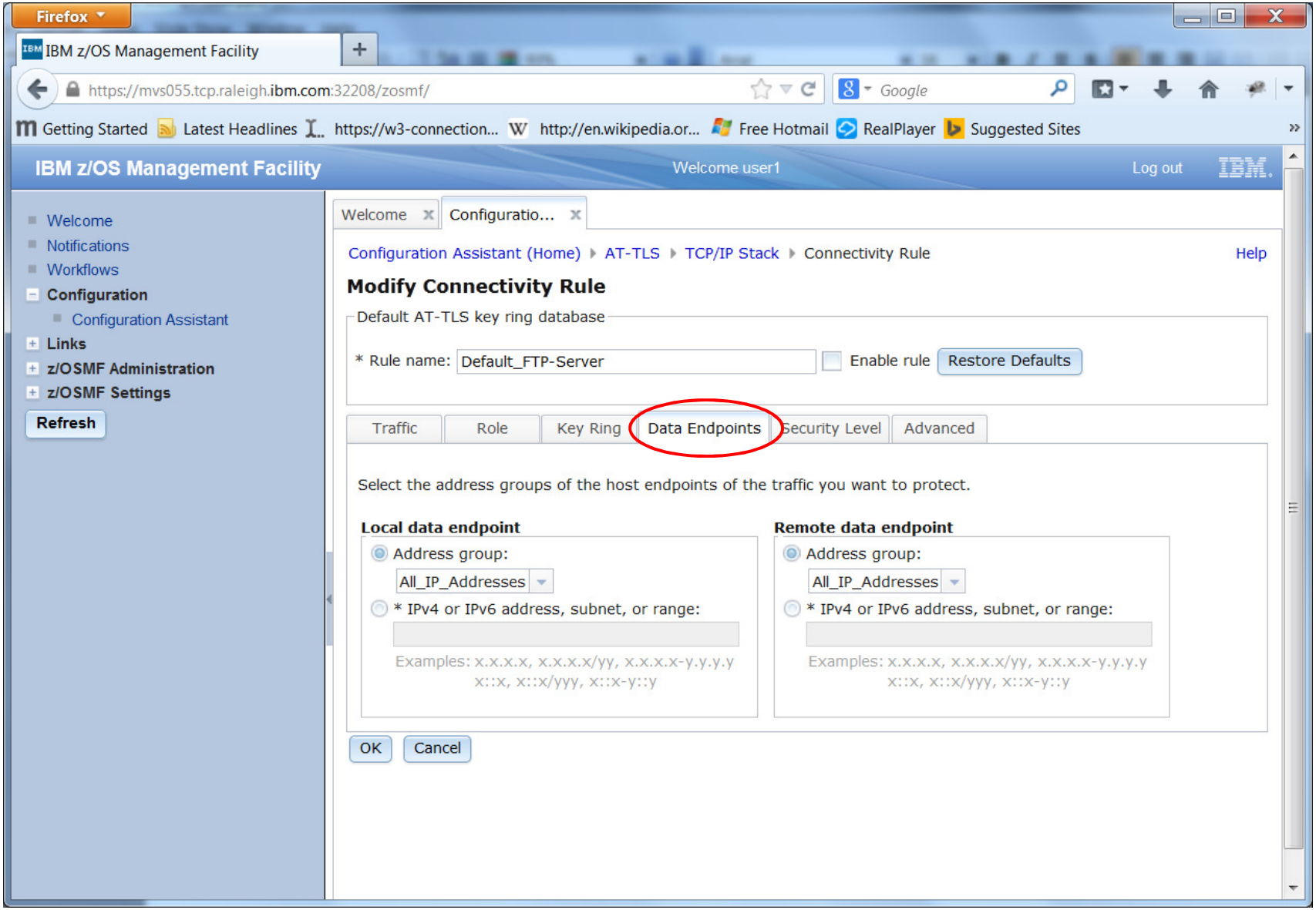
Describe role – Not changeable



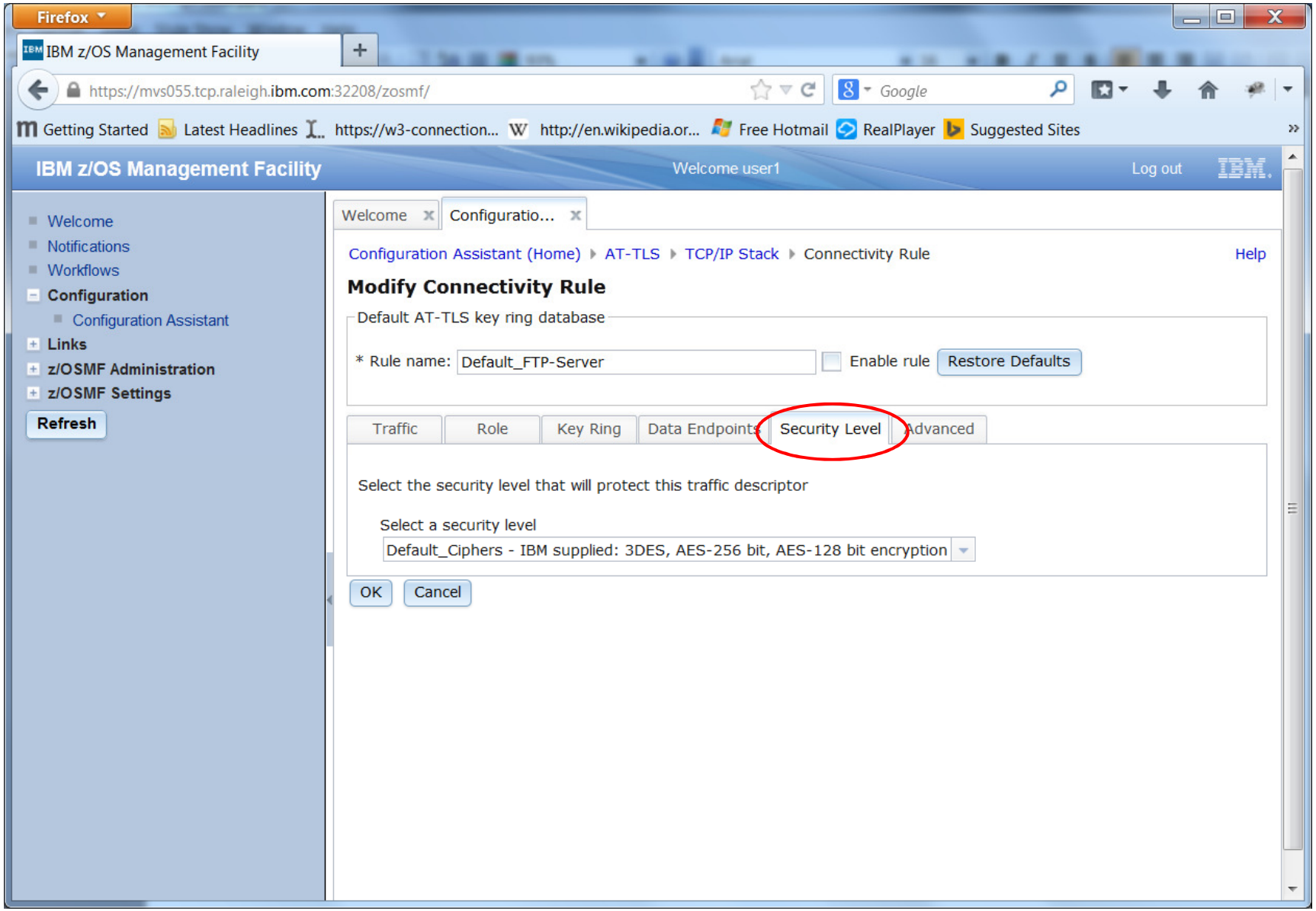
Define key ring – in this case use the z/OS image level key ring



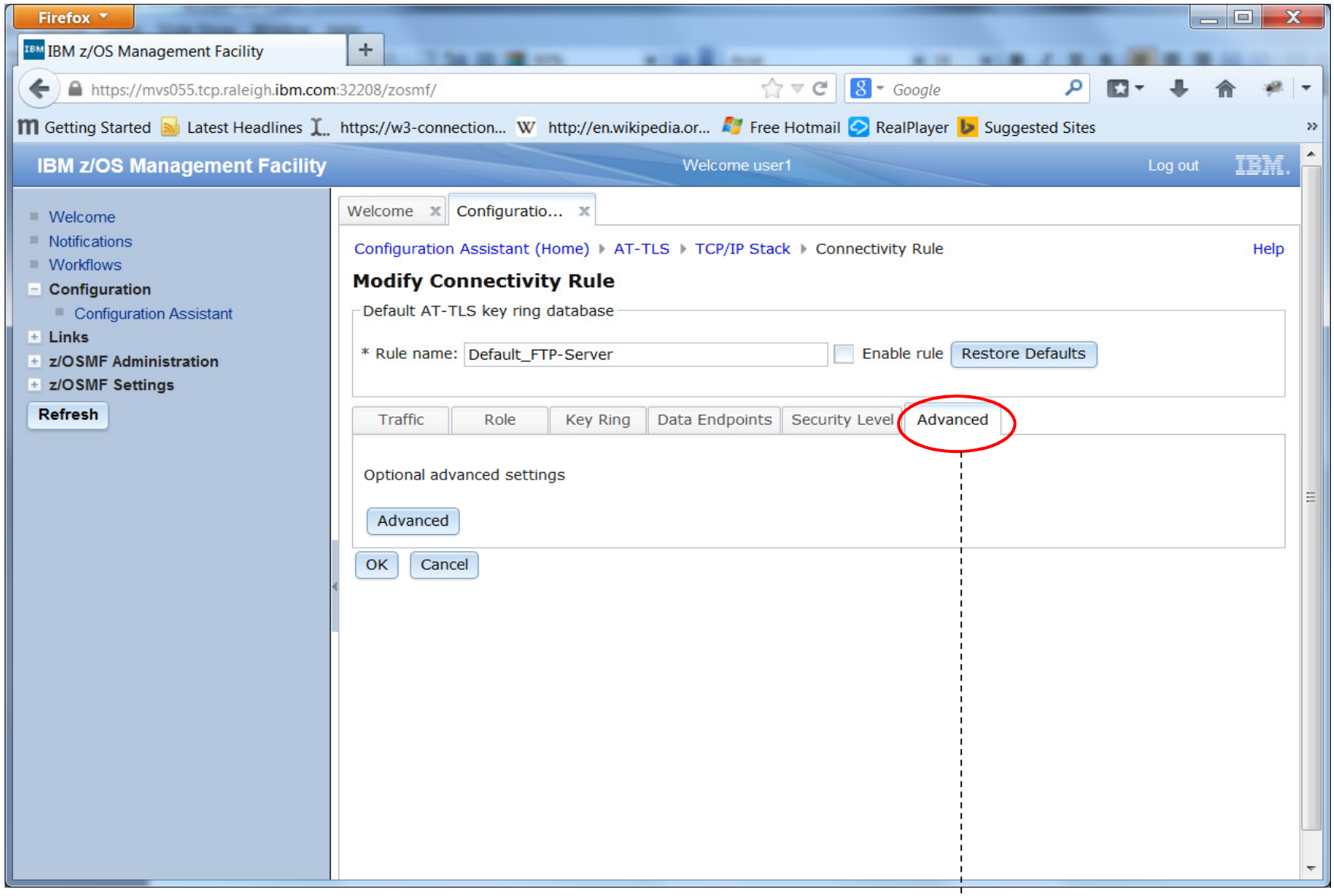
Describe data endpoints – in this case apply rule to all endpoints



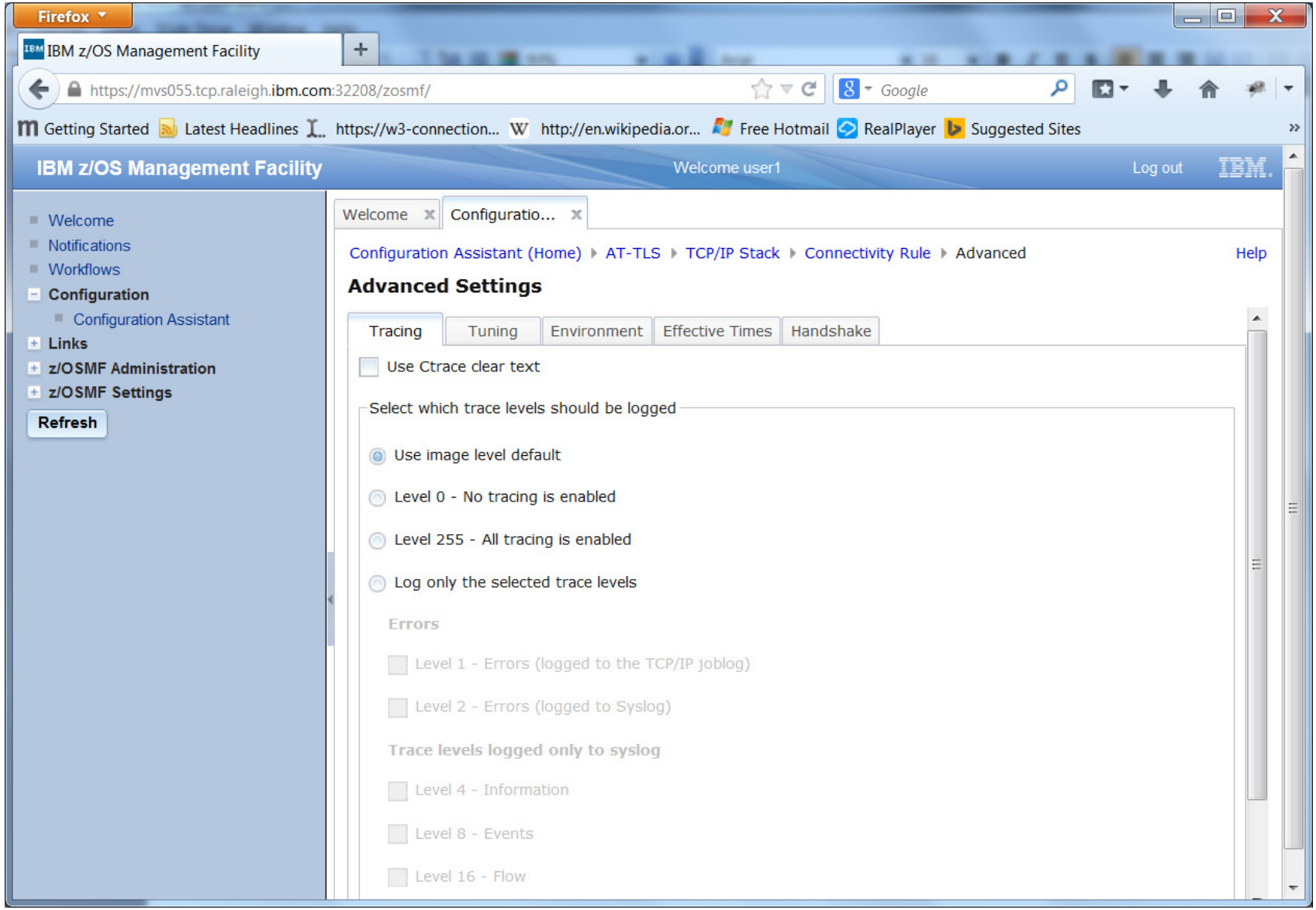
Specify details of TLS protection



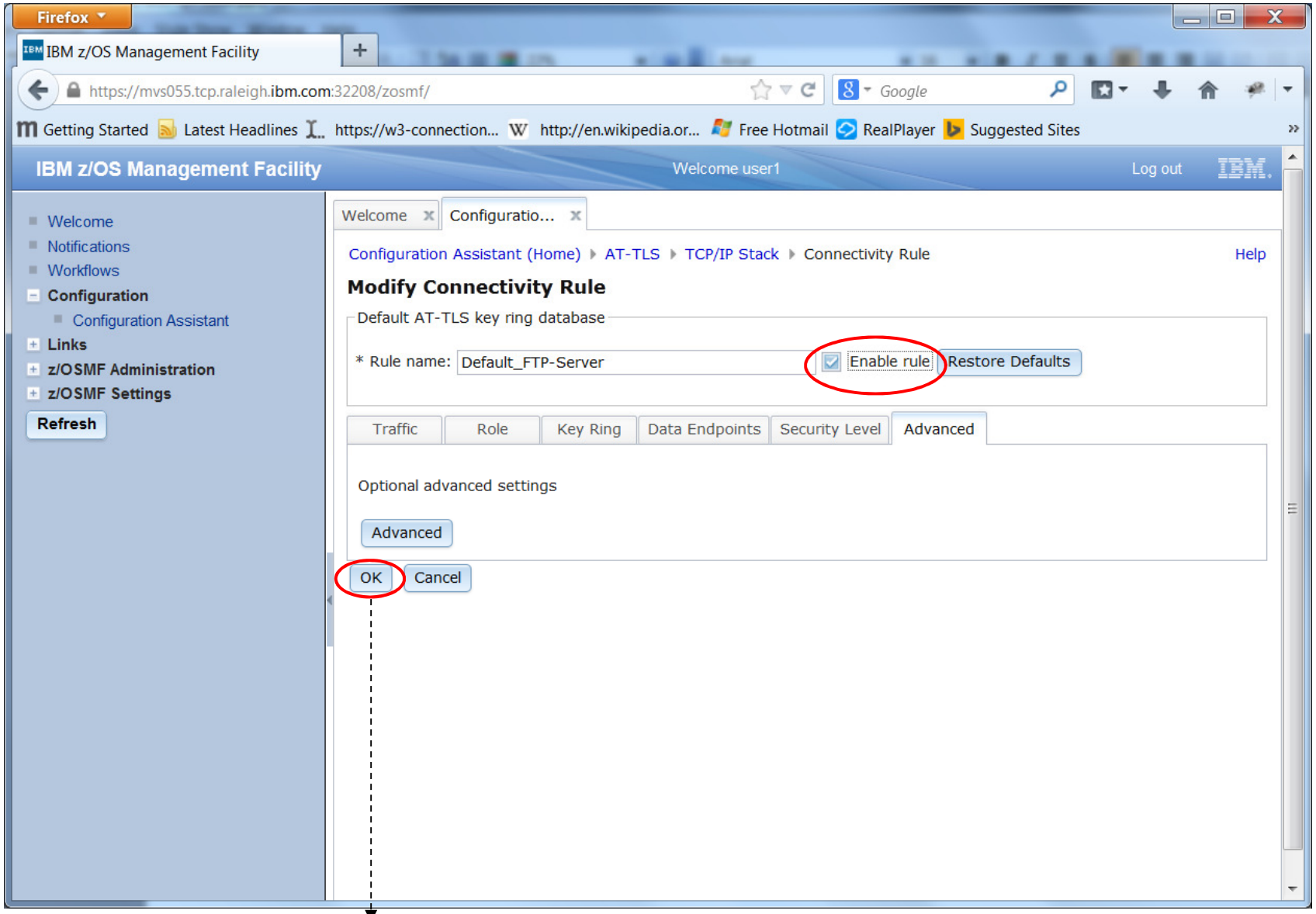
Advanced Settings



Advanced settings – categories of available settings

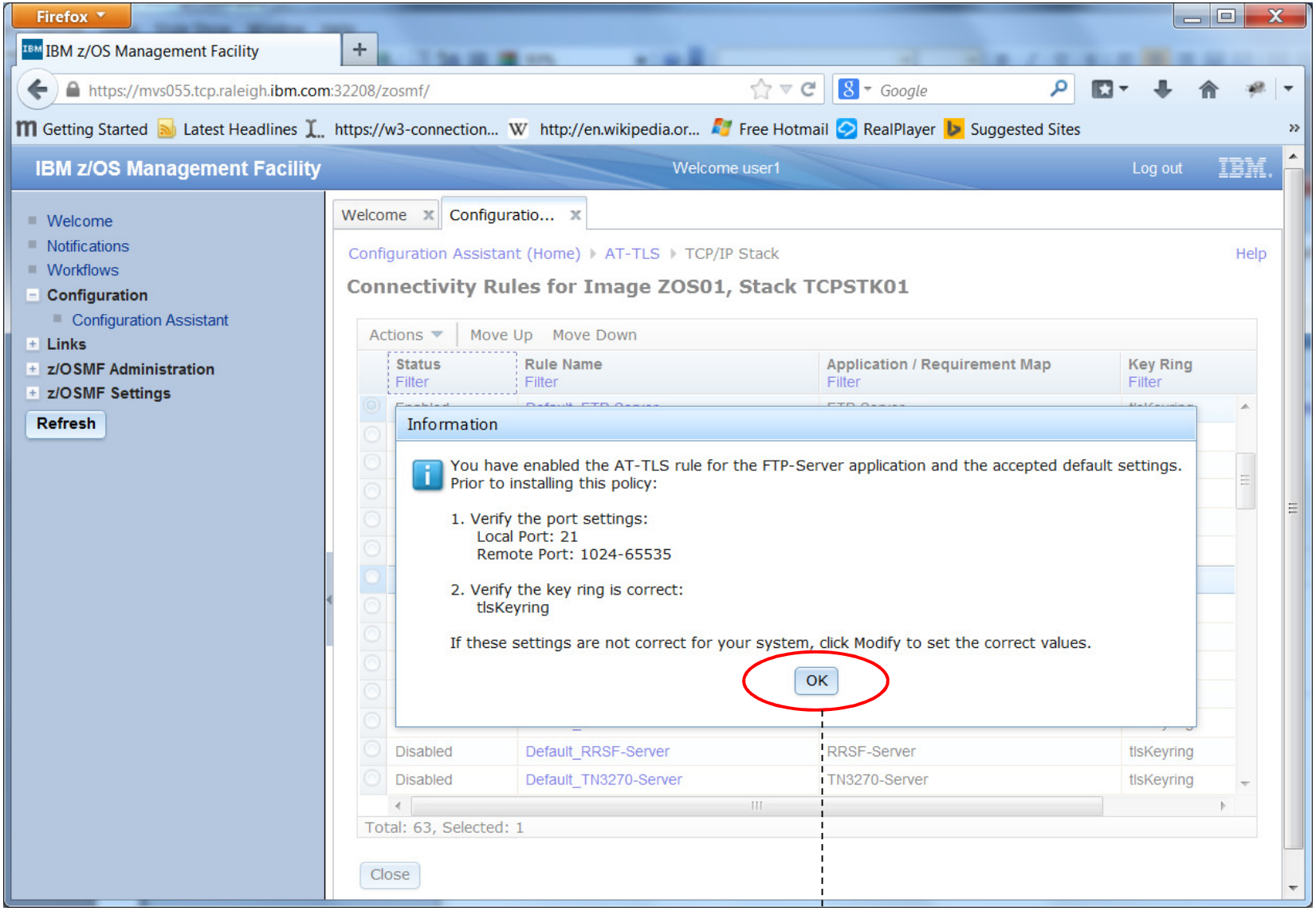


Enable rule



Next page

Are you sure?



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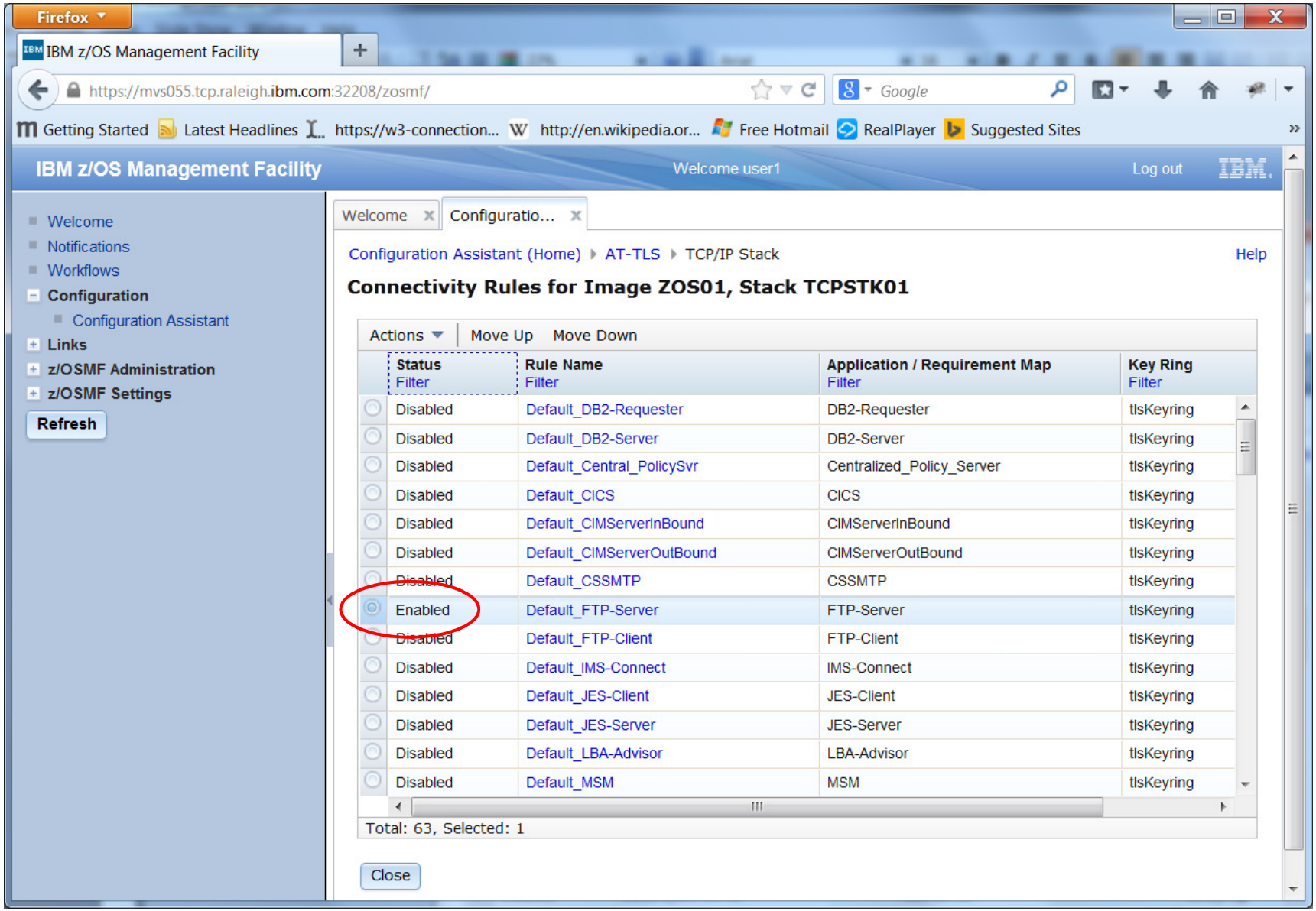
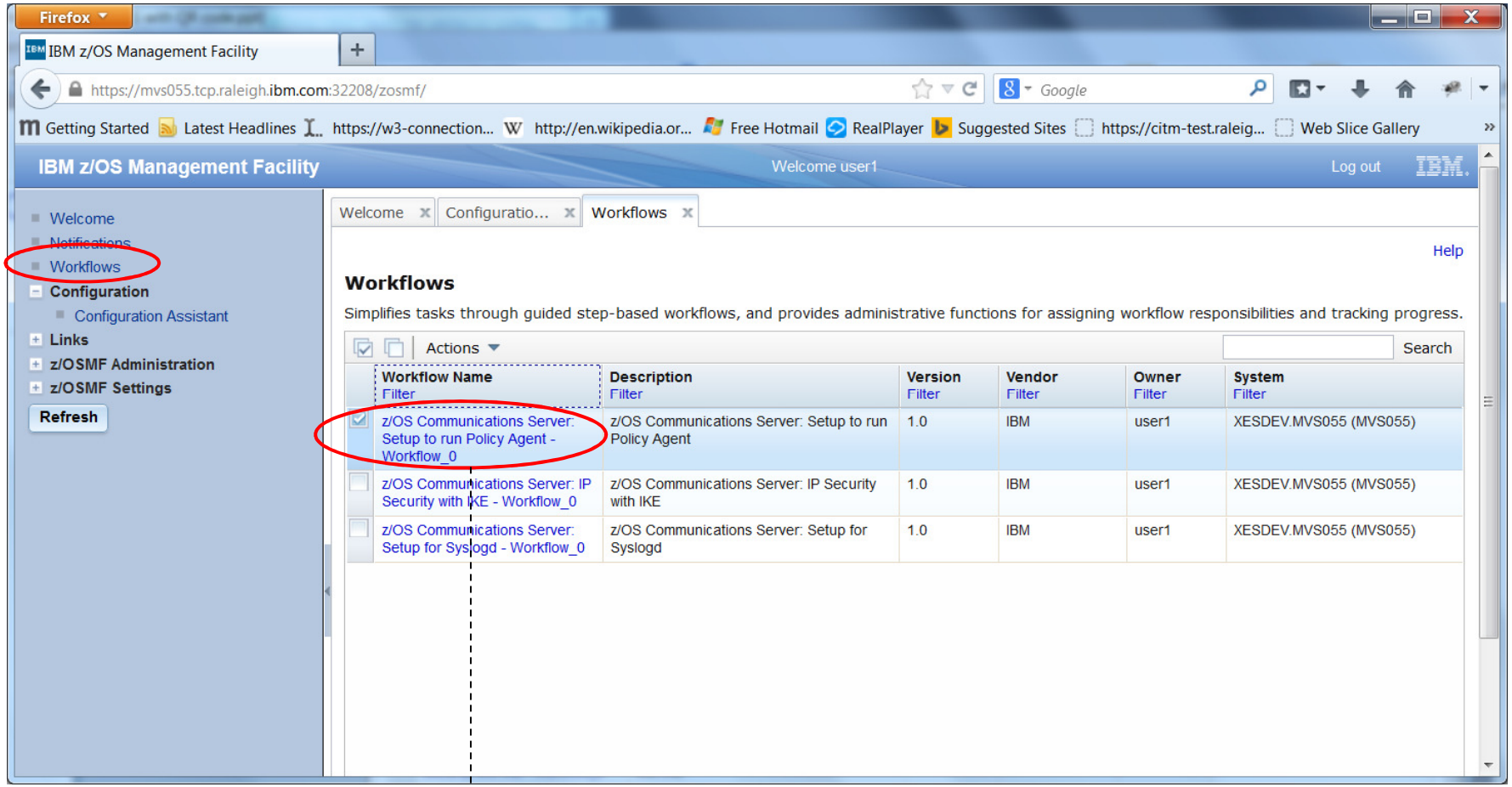
Predefined rule is now enabled

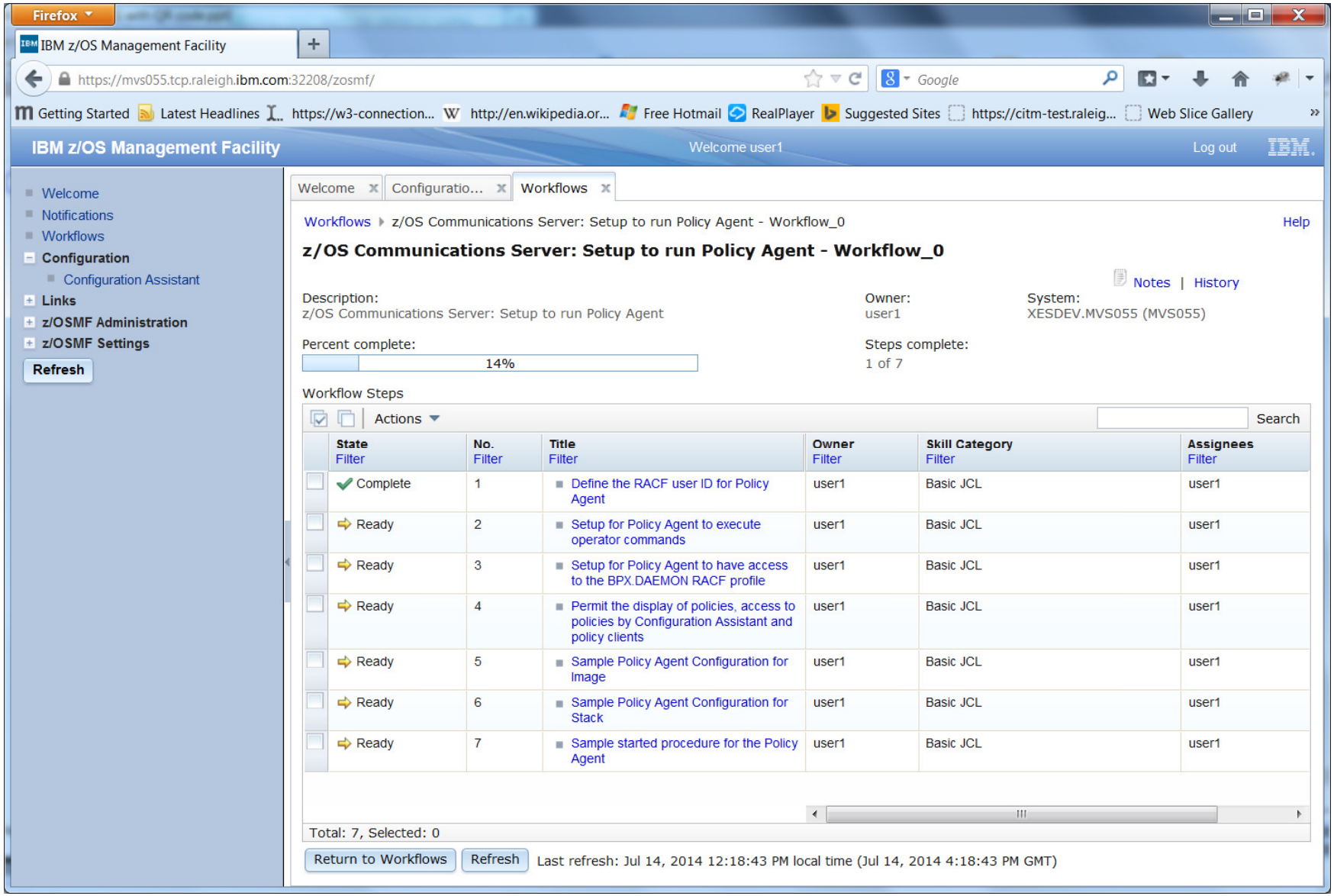


Assistance with the z/OS System preparation tasks – All workflow view …. Found under “Workflows” not Configuration Assistant

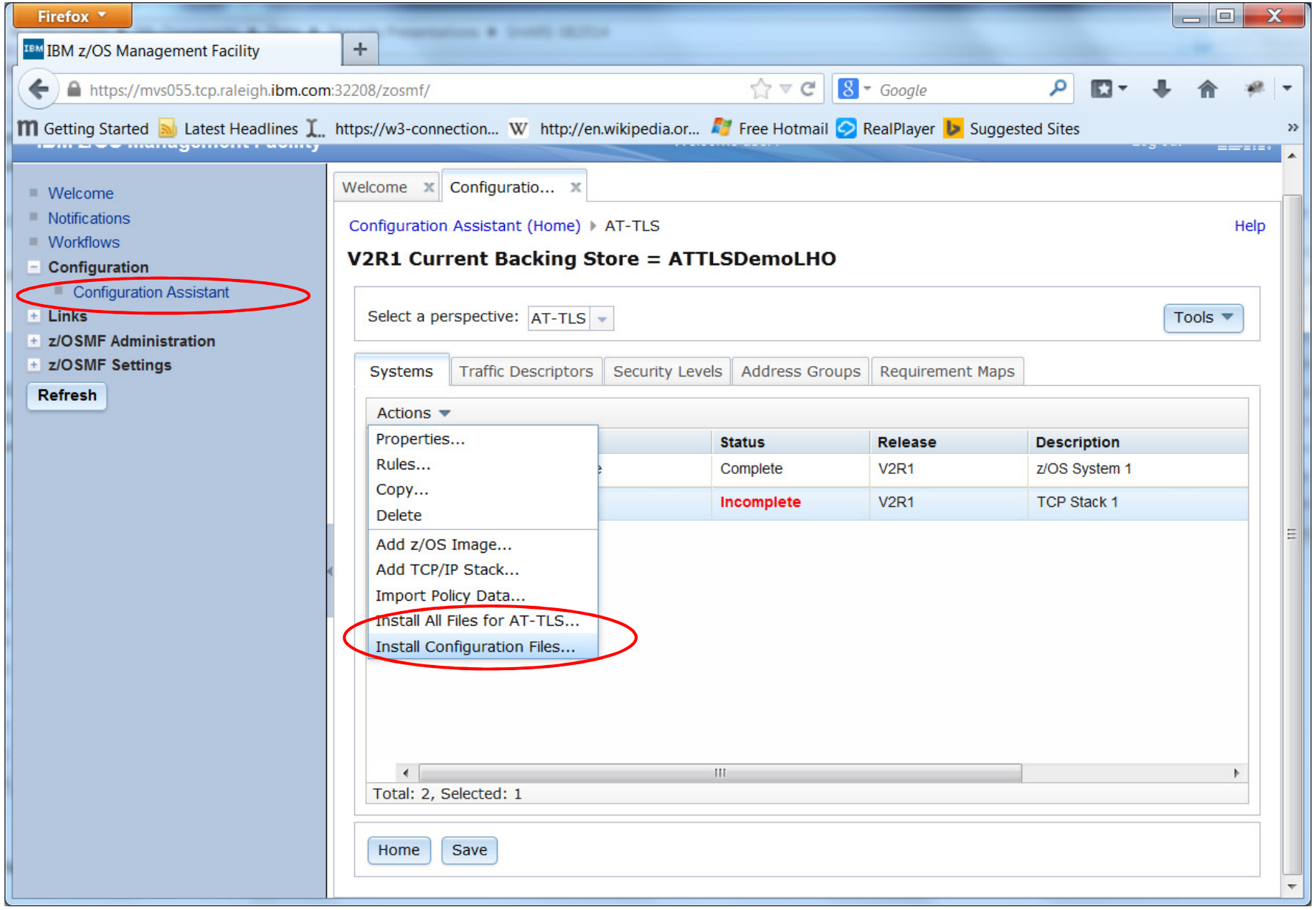


Next page

Assistance with the z/OS System preparation tasks –Specific workflow view



How to install configuration and other related files



New z/OS V2R2 support for enhanced certificate revocation

- Certificates issued by a Certificate Authority (CA) have an expiration date however they can be revoked by the issuing CA before expiration for any number of reasons
  - Encryption keys of the certificate have been compromised
  - Errors within an issued certificate
  - Change in usage of the certificate
  - Certificate owner is no longer deemed trusted

- System SSL (and AT-TLS) has supported certificate revocation through Certificate Revocation Lists (CRLs) from LDAP as optional validation of client certification during the TLS handshake

- In z/OS V2R2, AT-TLS supports new System SSL capabilities that address the need for more timely revocation checking and more revocation flexibility by supporting
  - More flexible processing of CRLs from LDAP
  - Retrieval of CRLs through HTTP URLs
  - Retrieval of revocation information through the online certificate status protocol (OCSP)

- These new capabilities will be exposed externally via AT-TLS policy changes
  - Configured with z/OS Configuration Assistant for z/OS Communications Server
    - Security Level advanced options
  - No impacts to applications

Certificate Revocation List background

- Certificate Revocation List (CRL) is a list of revoked certificates that have been issued and subsequently revoked by a given Certificate Authority
  - Signed by the owning CA to ensure the authenticity of the CRL contents
  - Has a start and end (expiration) date and time
  - Revoked certificates represented by their serial numbers

- Common methods for CRLs storing and retrieving
  - LDAP directory
  - HTTP server
    - URL values in the CRL Distribution Point (CDP) extension of the certificate

  Caching of CRLs is the requesting node's choice

- CRLs provide only periodic information and not reflect latest revocation status of certificate

- Limitations of CRLs stored in LDAP
  - CRLs for an SSL application must reside in the same single LDAP directory
  - Entire cache flushed when the GSK_CRL_CACHE_TIMEOUT value is reached
  - When cache is flushed, repopulating the z/OS TLS cache can require substantial amount of storage and processing overhead due to large size of CRL

New z/OS V2R2 support for CRLs

- More flexible support for existing LDAP CRL support.
  - System SSL honors the next update field in a CRL instead of wiping out the entire cache based on a global timeout value.
  - Now configurable:
    - Maximum number of CRL entries allowed in cache
    - Maximum CRL entry size allowed
    - LDAP response timeout value
    - Configure whether temporary CRLs are added to the cache
      - Temporary CRLs are used when no CRL is found in LDAP
    - Configure the lifetime of the temporary CRL in the cache

- System SSL also extends certificate revocation checking through CRLs retrieved through HTTP by contacting HTTP servers identified within a certificate's CDP extension.
  - Multiple HTTP servers can be listed
  - Attempt to contact each HTTP server is tried and processing stops with the first server that is able to be successfully contacted
  - Results are cached as indicated above for LDAP support

Online Certificate Status Protocol (OCSP) background

- HTTP-based protocol for checking the revocation status of a certificate
- Uses a request/response model
  - Puts less burden on network and client resources
  - Response contains less information than a typical CRL
    - OCSP responder replies with a “good”, “revoked” or “unknown” indication.
- Responses are signed (like CRLs)
- Certificate's Authority Information Access (AIA) extension contains URL for OCSP Responder
- Allows more timely enforcement of certificate revocation
  - OCSP server might have realtime access into the certificate issuer's certificate status database

New OCSP support in z/OS V2R2

- OCSP revocation information can be configured in policy to be obtained through either
  - OCSP responders identified within a certificate AIA extension (URI value)
  - A dedicated OCSP responder specified as a policy action
  - The use of both OSCP responder types can be specified along with an order of precedence

- When processing the values in the AIA extension,
  - Multiple OCSP servers can be listed
  - Attempt to contact each OCSP is tried and processing stops with the first server that is able to be successfully contacted

- The requester HTTP method is also configured as a policy action
  - HTTP POST
  - HTTP GET
    - Allows for the enablement of HTTP caching on the OCSP responder
    - Caching occurs if the request is less than 255 bytes

- In all cases, once an OCSP responder has returned a response, the response is used to determine the revocation state of the certificate being validated.

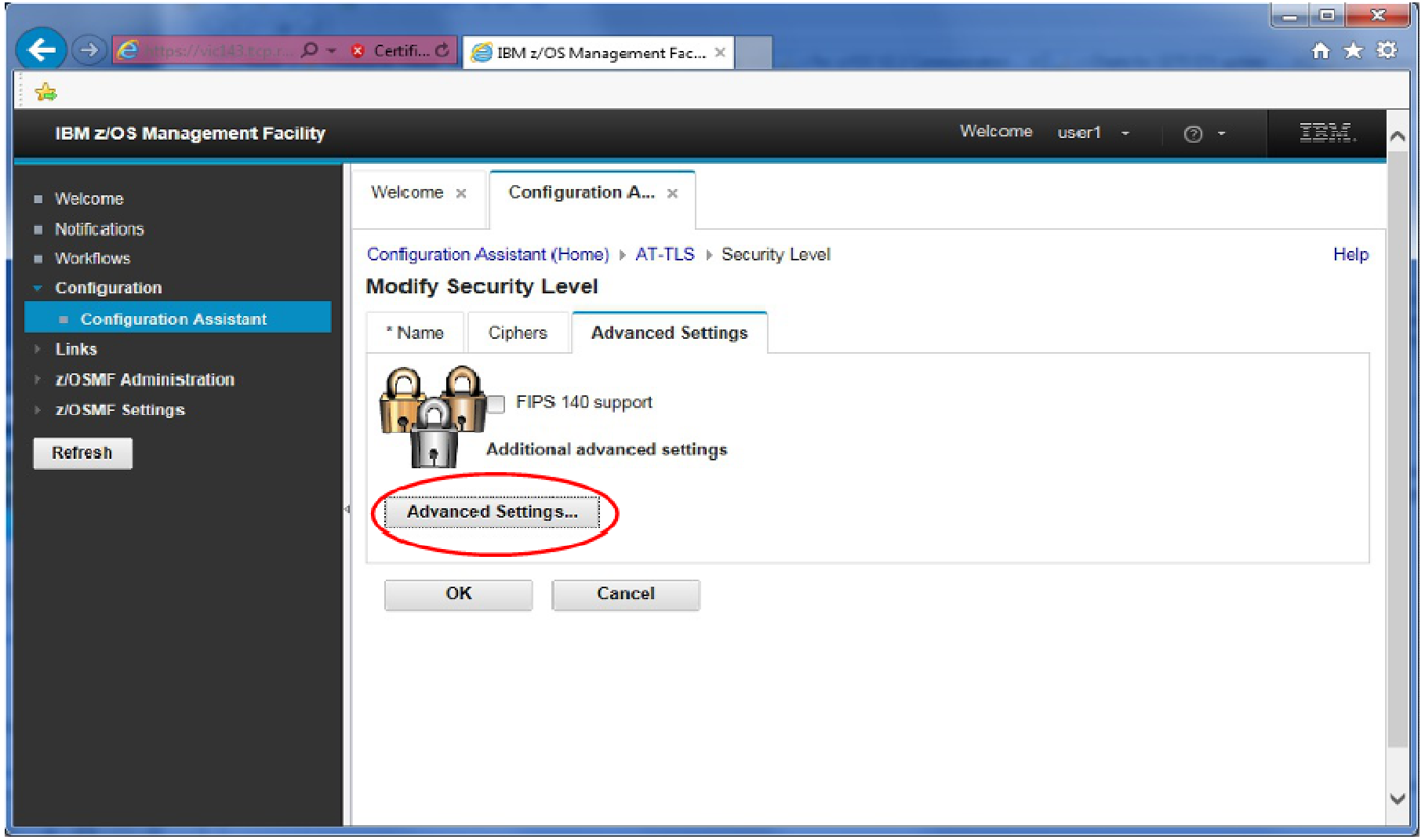
Revocation source selection

- Multiple revocation sources, OCSP, HTTP CRL, and LDAP CRL can be enabled as policy action
  - Order of precedence that is used when checking for certificate revocation information between OSCP and HTTP CRL sources can be specified.
  - If LDAP CRL is specified as possible revocation source, it is always checked last for certificate revocation information if either OCSP or HTTP CDP is enabled.

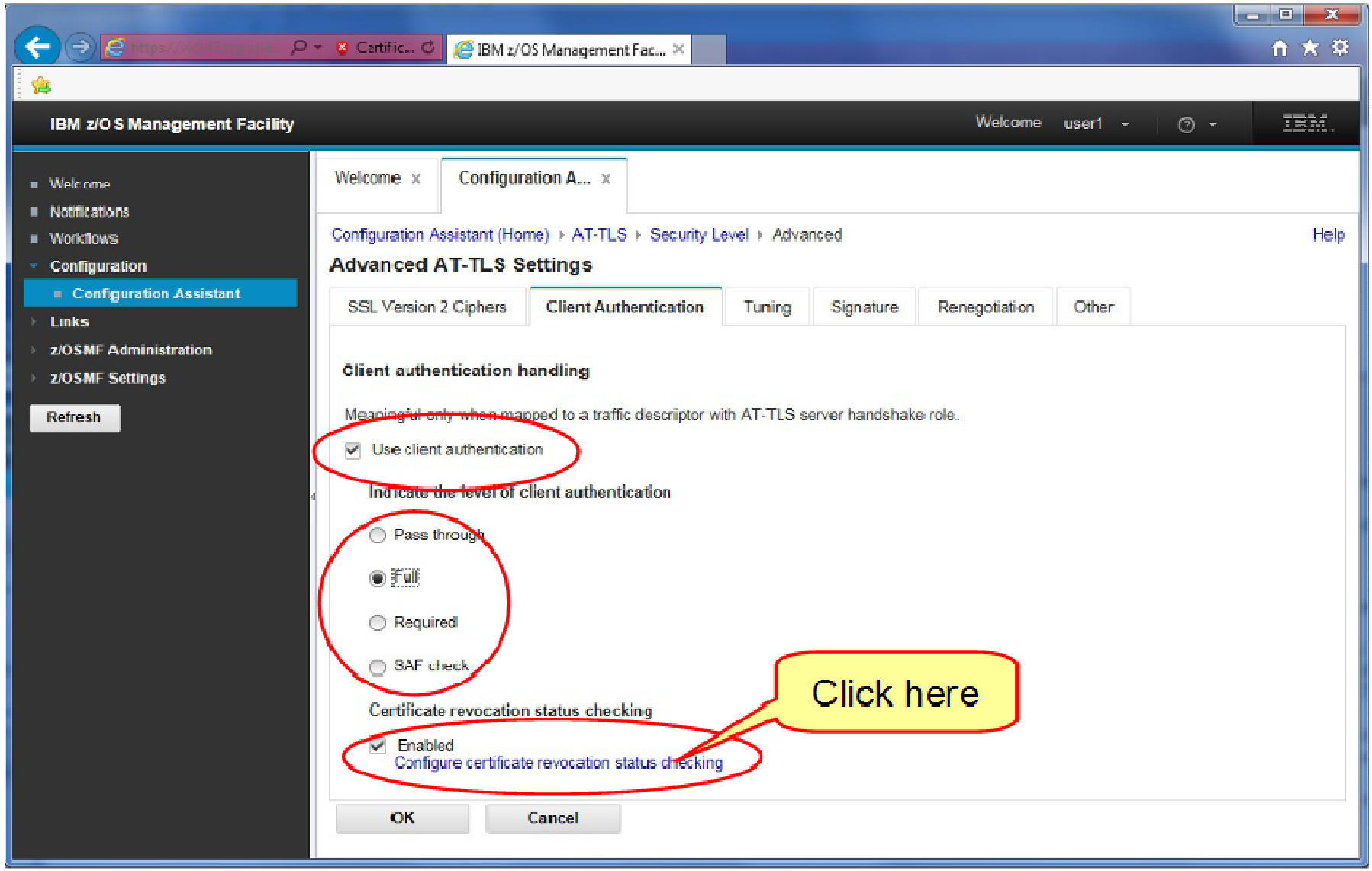
- The revocation security level action setting specifies the level of security to be used when contacting an OCSP responder or an HTTP server specified in the CDP extension.
  - Low - Certificate validation does not fail if the OCSP responder or the HTTP server cannot be contacted
  - Medium - Specified that certificate validation fails if all OCSP responders and HTTP servers are not contactable, or if they are contactable, a valid OCSP response or CRL must be returned
  - High – Specfies that certificate validation fails if revocation information cannot be obtained from any of the specified sources.

- To enable fallback to LDAP, if the OCSP responders or HTTP servers cannot be contacted, the revocation security level must be set to LOW.

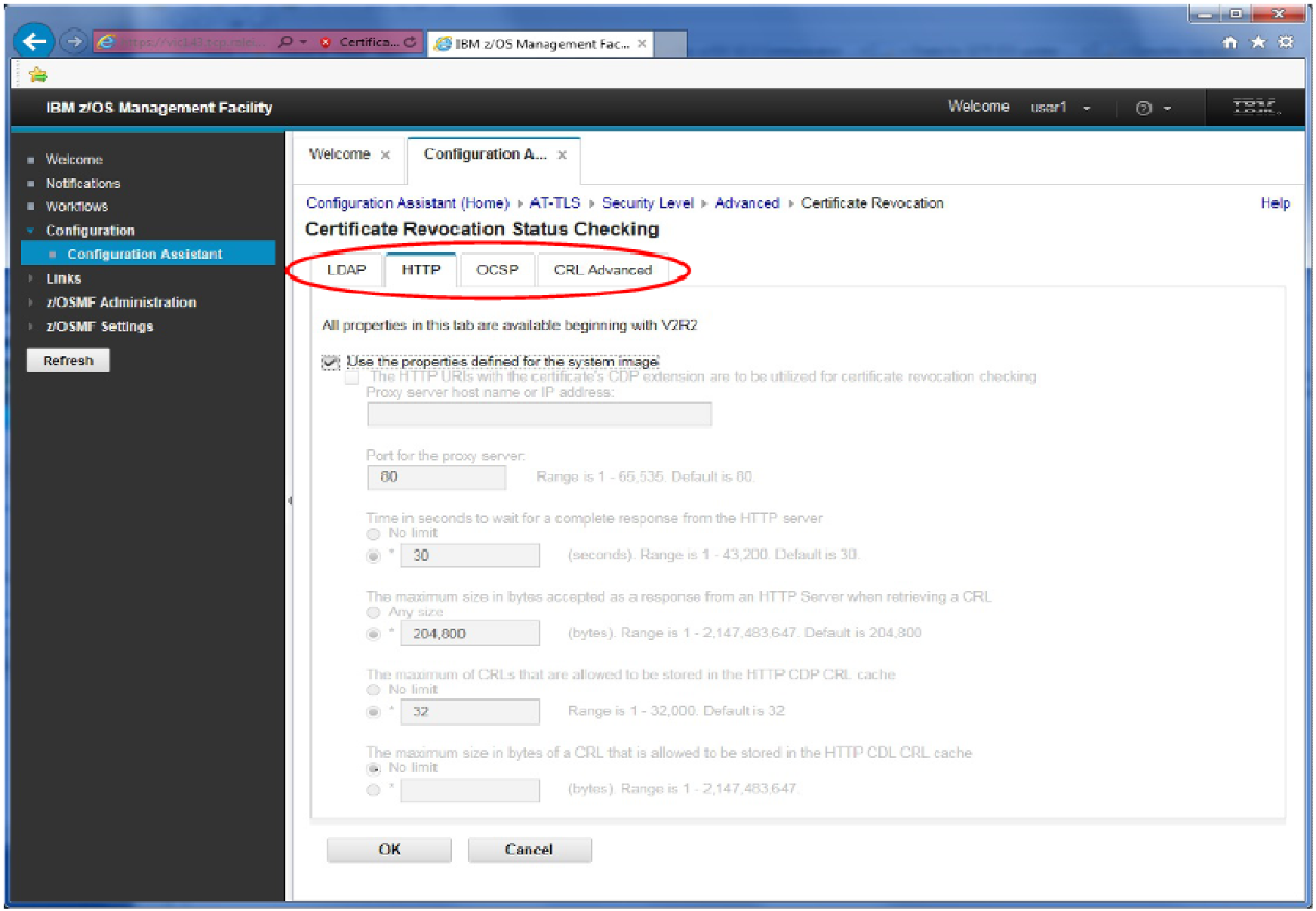
Navigation to certificate revocation configuration (1 of 3)



Navigation to certificate revocation configuration (2 of 3)



Navigation to configuration revocation configuration (3 of 3)

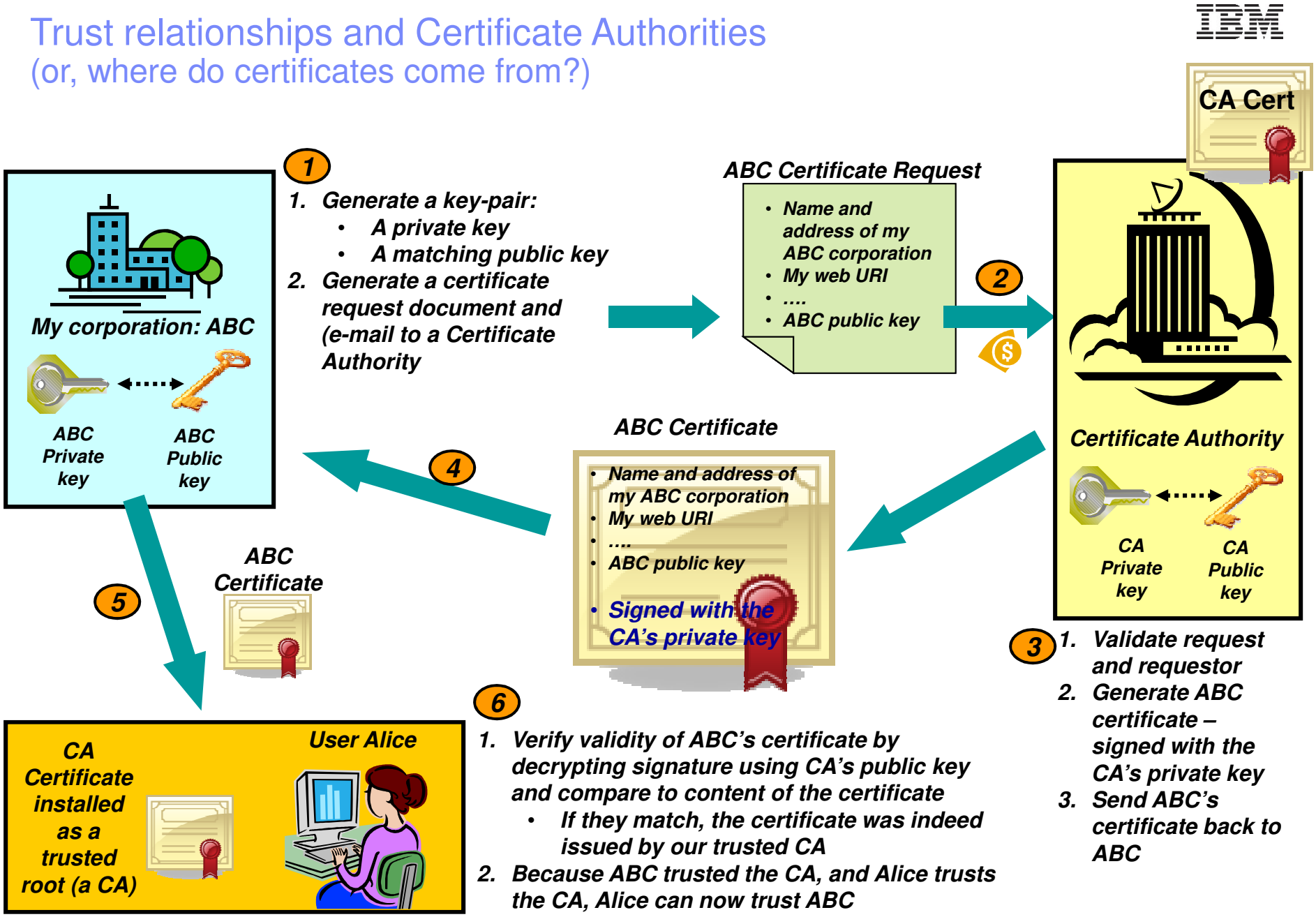


Please fill out your session evaluation

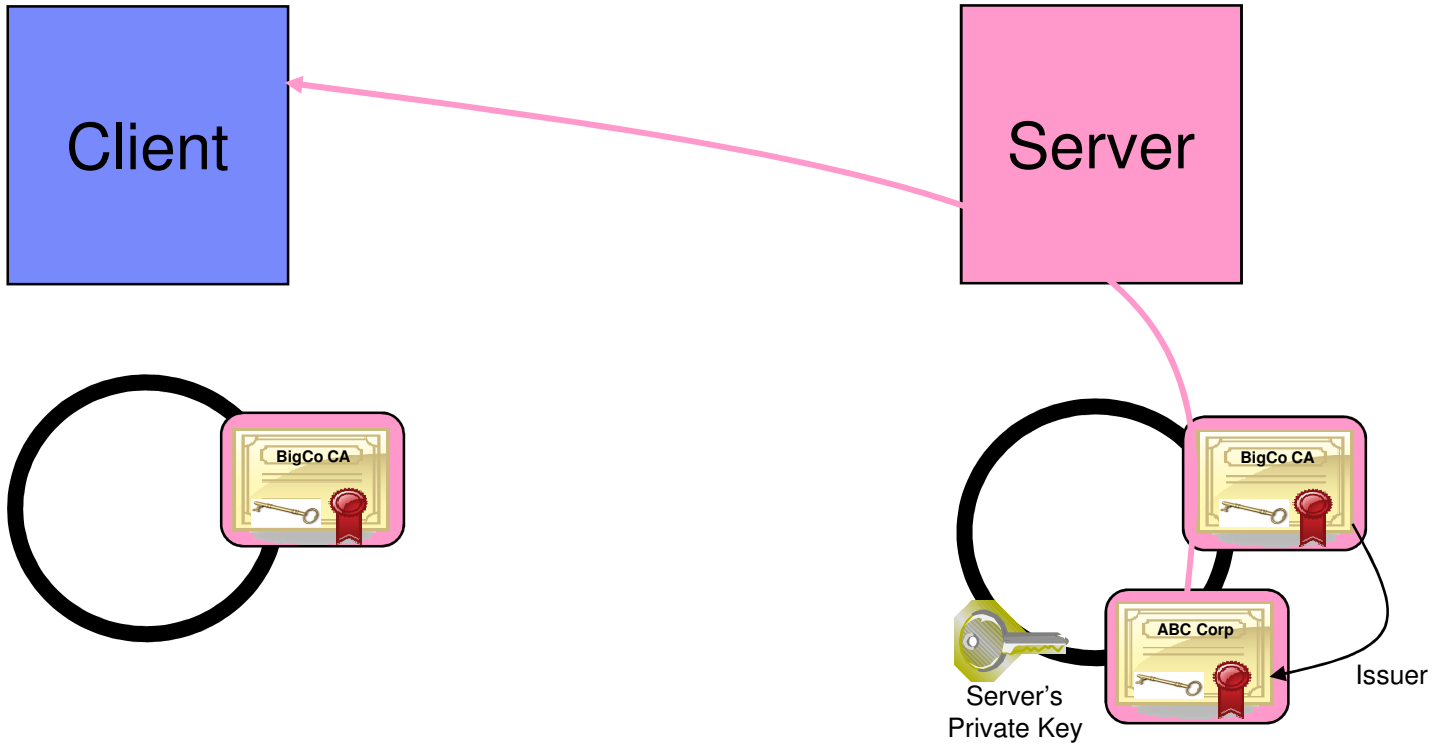
- z/OS Communications Server Application Transparent TLS
- Session # 17738
- QR Code:

Appendix: Obtain x.509 certificates and update RACF keyrings

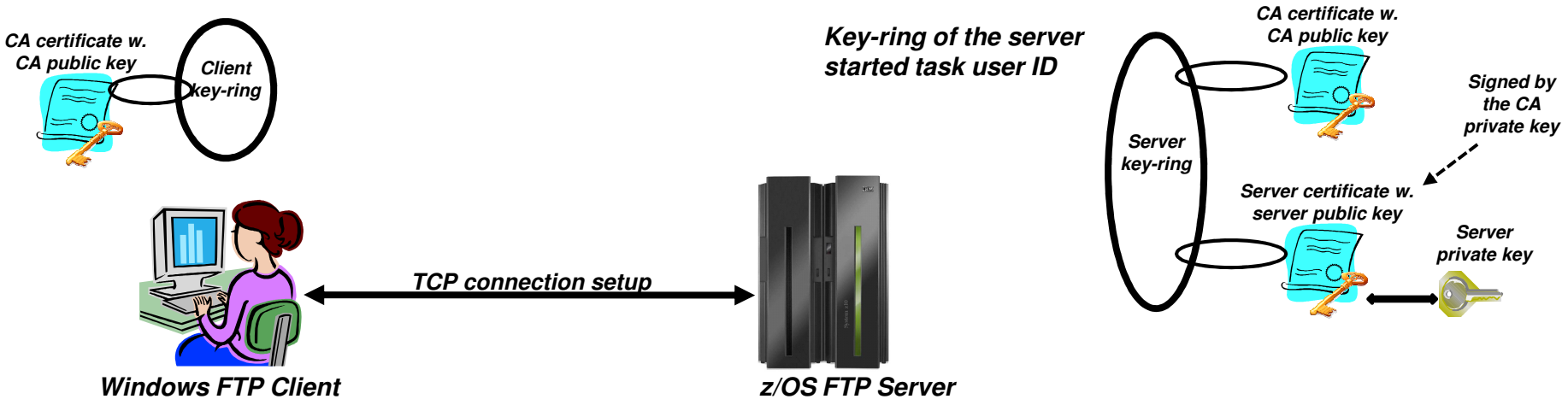
Trust relationships and Certificate Authorities
(or, where do certificates come from?)



Certificates in action: SSL server authentication



What is needed for z/OS Server authentication only (which is sufficient for encrypted data exchange)



- **CA may be an external CA, such as Verisign, or it may be an in-house CA**
  - In both cases, the CA root certificate needs to be present at both the client and the server side
- **The server certificate is signed by the CA and is stored on the server side**
  - On z/OS, this will typically be the default certificate in the server's started task user ID's key-ring in RACF
- **During SSL handshake, the server certificate (not the server private key) is sent to the client**
  - The client verifies the certificates signature using the CA public key in its copy of the CA certificate

Create self-signed root certificate for test purposes

```
RACDCERT CERTAUTH GENCERT +
         SUBJECTSDN( +
           CN('MVS098 Certificate Authority') +
           OU('Z/OS CS V1R9', 'ENS', 'AIM', 'SWG') +
           O('IBM') +
           L('Raleigh') +
           SP('NC') +
           C('US') ) +
         SIZE(1024) +
         NOTBEFORE(DATE(2010-02-01)) +
         NOTAFTER(DATE(2020-12-31)) +
         WITHLABEL('ABCTLS CA') +
         KEYUSAGE(CERTSIGN) +
         ALTNAME( +
           DOMAIN('mvs098.tcp.raleigh.ibm.com') )
```

Create a self-signed root certificate and a private/public key-pair:

- ***CERTAUTH***
- ***KEYUSAGE(CERTSIGN)***
- ***Absence of a SIGNWITH option***

It can become a nightmare when these things expire, so don't create certificates with too short a time span! (Your security czar will likely have an opinion on that)

- In a production environment, you would not need a self-signed root certificate. To sign server and personal certificates, you would use your company root certificate or an external Certificate Authority.
- For testing, a self-signed root certificate is useful. It allows you to familiarize yourself with keys and certificates and allows you to thoroughly test your secure FTP setup on z/OS before deploying it in production.

Create server certificate signed with your own root certificate

```
RACDCERT ID(TCPCS) GENCERT +
         SUBJECTSDN( +
           CN('MVS098 Server Certificate') +
           OU('Z/OS CS V1R11', 'ENS', 'AIM', 'SWG') +
           O('IBM') +
           L('Raleigh') +
           SP('NC') +
           C('US') ) +
         SIZE(1024) +
         NOTBEFORE(DATE(2010-02-01)) +
         NOTAFTER(DATE(2020-12-31)) +
         WITHLABEL('ABCTLS TCPSERV') +
         KEYUSAGE(HANDSHAKE DATAENCRYPT DOCSIGN) +
         ALTNAME( +
           DOMAIN('mvs098.tcp.raleigh.ibm.com') ) +
         SIGNWITH(CERTAUTH LABEL('ABCTLS CA'))
```

Create a server certificate signed with your own root certificate and a private/public key pair:

- ***ID(userID) – the started task user ID of your server***
- ***KEYUSAGE(HANDSHAKE DATAENCRYPT DOCSIGN)***
- ***SIGNWITH(CERTAUTH LABEL('your root certificate')***

- In a production environment, you would use an alternative procedure after having generated the server key pair and certificate:
  - You would generate a certificate signing request and send it to your CA
  - Your CA would process your request and create a certificate signed with the CA private key
  - You would import the signed certificate into RACF

Alternative: use an external CA to sign your server certificate

```
RACDCERT ID(TCPCS) GENCERT +
         SUBJECTSDN( +
           CN('MVS098 Server Certificate') +
           OU('Z/OS CS V1R11', 'ENS', 'AIM', 'SWG') +
           O('IBM') +
           L('Raleigh') +
           SP('NC') +
           C('US') ) +
         SIZE(1024) +
         NOTBEFORE(DATE(2010-02-01)) +
         NOTAFTER(DATE(2020-12-31)) +
         WITHLABEL('ABCTLS TCPSERV') +
         KEYUSAGE(HANDSHAKE DATAENCRYPT DOCSIGN) +
         ALTNAME( +
           DOMAIN('mvs098.tcp.raleigh.ibm.com') )
RACDCERT ID(TCPCS) GENREQ (LABEL('ABCTLS TCPSERV')) +
         DSN('USER1.PKITEST.SERVERS.REQ')

(**** delay here while CA processes your request ****)

RACDCERT ID(TCPCS) +
         ADD('USER1.PKITEST.SERVERS.CRT') +
         TRUST +
         WITHLABEL('ABCTLS TCPSERV')
```

Create a server certificate and a private/public key pair:

- ***ID(userID) – the started task user ID of your server***
- ***KEYUSAGE(HANDSHAKE DATAENCRYPT DOCSIGN)***

Generate a request to have the certificate signed by an external CA

- ***Send the request to the CA***
- ***Receive the response from the CA***

Add the signed certificate into RACF

If not already there, you also need to add the CA's root certificate to RACF as a CERTAUTH certificate !!

Create your z/OS server started task user ID key-ring and connect required certificates to it

```
RACDCERT CERTAUTH +
         EXPORT(LABEL('ABCTLS CA')) +
         DSN('USER1.ABCTLSCA.B64') +
         FORMAT(CERTB64)
RACDCERT ID(TCPCS) ADDRING(TLSRING)
RACDCERT ID(TCPCS) +
         CONNECT(CERTAUTH LABEL('ABCTLS CA') +
         RING(TLSRING) )
RACDCERT ID(TCPCS) +
         CONNECT(LABEL('ABCTLS TCPSERV') +
         RING(TLSRING) +
         DEFAULT)
RACDCERT ID(TCPCS) +
         LISTRING(TLSRING)

Digital ring information for user TCPCS:

  Ring:
       >TLSRING<
  Certificate Label Name                Cert Owner     USAGE      DEFAULT
  ----------------------------------    -----------    --------   -------
  ABCTLS CA                             CERTAUTH       CERTAUTH     NO
  ABCTLS TCPSERV                        ID(TCPCS)      PERSONAL     YES
```

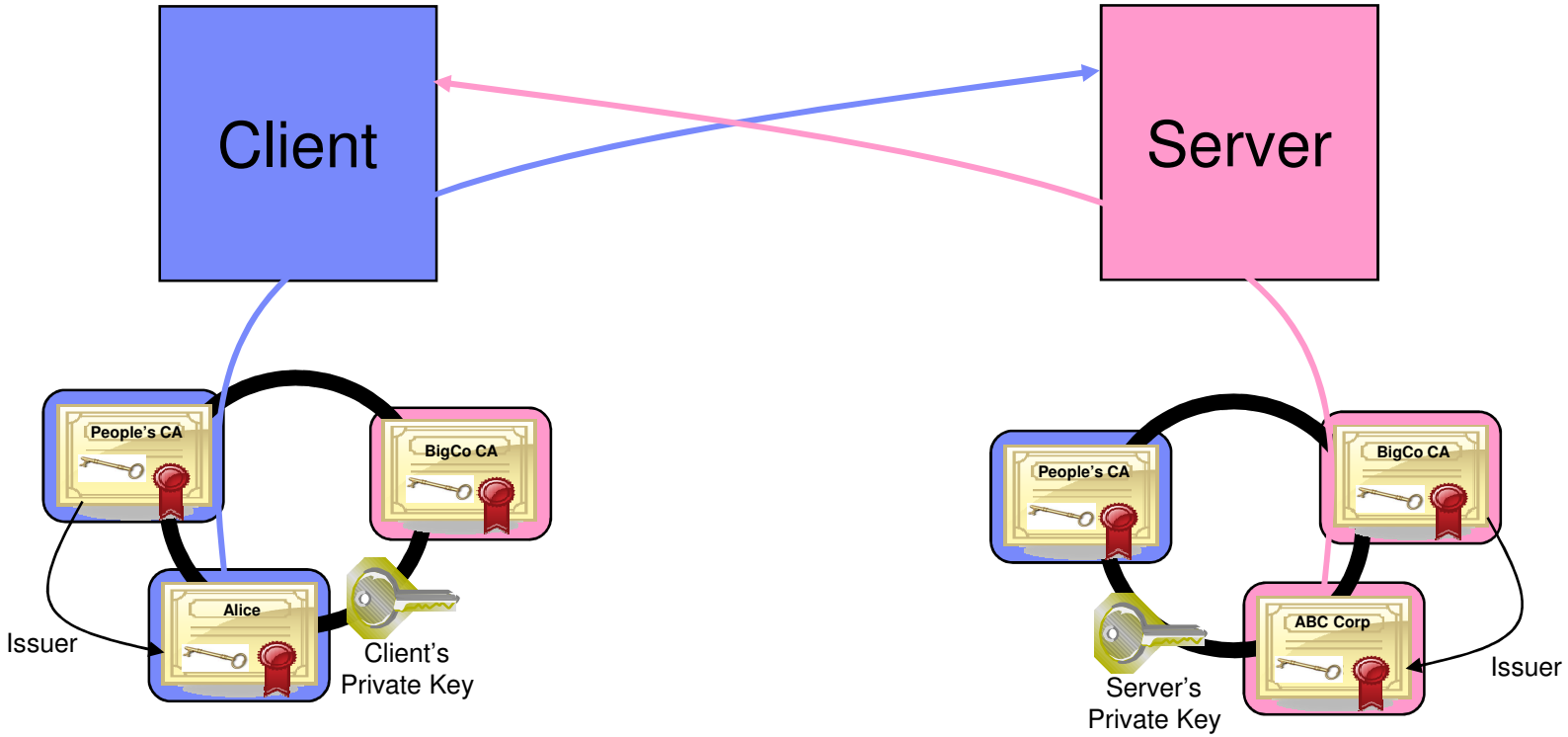
In order for the remote client to successfully authenticate server certificates that are signed with our self-signed root certificate, they need a copy of that root certificate in their local key-rings. Download as a text file to your client workstation

Create key-ring for your started task server user ID

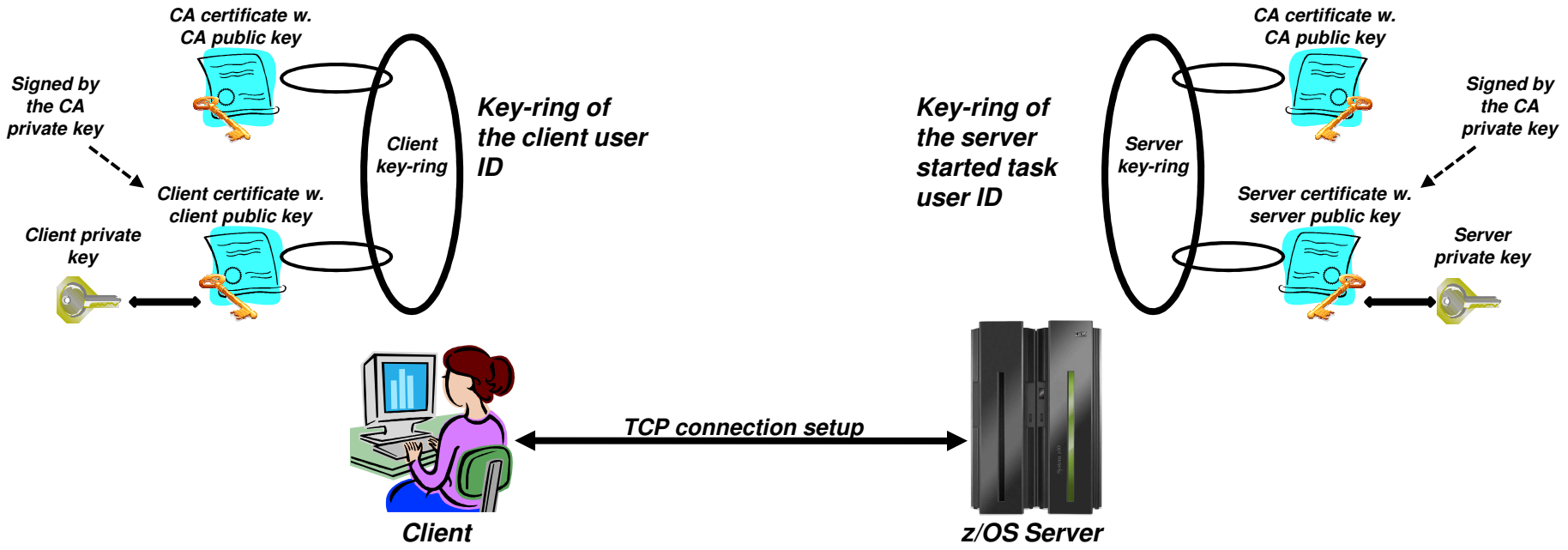
Connect certificates to the key-ring:
- ***Your root certificate***
- ***Your server certificate***

Certificates in action: SSL client authentication

(implies server authentication as well)



What is needed for z/OS Server and client authentication?



1. Verify server certificate has not expired
2. Verify server certificate is valid using CA's public key
3. Do optional checks on the server certificate
4. Store server's public key for later use
5. Generate symmetric key and encrypt under server's public key

1. Verify client certificate has not expired
2. Verify client certificate is valid using CA's public key
3. Do optional checks on the client certificate
   - Does it map to a RACF user ID (authentication level 2)
   - Is the user permitted to use this service (authentication level 3)

For more information…

URL	Content
http://www.twitter.com/IBM_Commserver	IBM Communications Server Twitter Feed
http://www.facebook.com/IBMCommserver	IBM Communications Server Facebook Fan Page
http://www.ibm.com/systems/z/	IBM System z in general
http://www.ibm.com/systems/z/hardware/networking/	IBM Mainframe System z networking
http://www.ibm.com/software/network/commserver/	IBM Software Communications Server products
http://www.ibm.com/software/network/commserver/zos/	IBM z/OS Communications Server
http://www.ibm.com/software/network/commserver/z_lin/	IBM Communications Server for Linux on System z
http://www.ibm.com/software/network/ccl/	IBM Communication Controller for Linux on System z
http://www.ibm.com/software/network/commserver/library/	IBM Communications Server library
http://www.redbooks.ibm.com	ITSO Redbooks
http://www.ibm.com/software/network/commserver/zos/support/	IBM z/OS Communications Server technical Support – including TechNotes from service
http://www.ibm.com/support/techdocs/atsmastr.nsf/Web/TechDocs	Technical support documentation from Washington Systems Center (techdocs, flashes, presentations, white papers, etc.)
http://www.rfc-editor.org/rfcsearch.html	Request For Comments (RFC)
http://www.ibm.com/systems/z/os/zos/bkserv/	IBM z/OS Internet library – PDF files of all z/OS manuals including Communications Server