Integrated Intrusion Detection Services for z/OS Communications Server

Lin Overby - overbylh@us.ibm.com

Trademarks and notices

The following terms are trademarks or registered trademarks of International Business Machines Corporation in the United States or other countries or both:

- Advanced Peer-to-Peer Networking®
- AIX®
- alphaWorks®
- AnyNet®
- AS/400®
- BladeCenter®
- Candle®
- CICS®
- DB2 Connect
- DB2®
- DRDA®
- e-business on demand®
- e-business (logo)
- e business(logo)®
- ESCON®
- FICON®
- GDDM®
- HiperSockets
- HPR Channel Connectivity
- HyperSwap
- i5/OS (logo)
- i5/OS®
- IBM (logo)®
- IBM®
- IMS
- IP PrintWay
- IPDS
- iSeries
- LANDP®
- Language Environment®
- MQSeries®
- MVS
- NetView®
- OMEGAMON®
- Open Power
- OpenPower
- Operating System/2®
- Operating System/400®
- OS/2®
- OS/390®
- OS/400®
- Parallel Sysplex®
- PR/SM
- pSeries®
- RACF®
- Rational Suite®
- Rational®
- Redbooks
- Redbooks (logo)
- Sysplex Timer®
- System i5
- System p5
- System x
- System z
- System z9
- Tivoli (logo)®
- Tivoli®
- VTAM®
- WebSphere®
- xSeries®
- z9
- zSeries®
- z/Architecture
- z/OS®
- z/VM®
- z/VSE

- Java and all Java-based trademarks are trademarks of Sun Microsystems, Inc. in the United States, other countries, or both.
- Microsoft, Windows, Windows NT, and the Windows logo are trademarks of Microsoft Corporation in the United States, other countries, or both.
- Intel, Intel Inside (logos), MMX and Pentium are trademarks of Intel Corporation in the United States, other countries, or both.
- UNIX is a registered trademark of The Open Group in the United States and other countries.
- Linux is a trademark of Linus Torvalds in the United States, other countries, or both.
- Red Hat is a trademark of Red Hat, Inc.
- SUSE® LINUX Professional 9.2 from Novell®
- Other company, product, or service names may be trademarks or service marks of others.
- This information is for planning purposes only. The information herein is subject to change before the products described become generally available.
- All statements regarding IBM future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.

All performance data contained in this publication was obtained in the specific operating environment and under the conditions described and is presented as an illustration. Performance obtained in other operating environments may vary and customers should conduct their own testing.

Refer to www.ibm.com/legal/us for further legal information.

Integrated Intrusion Detection Services

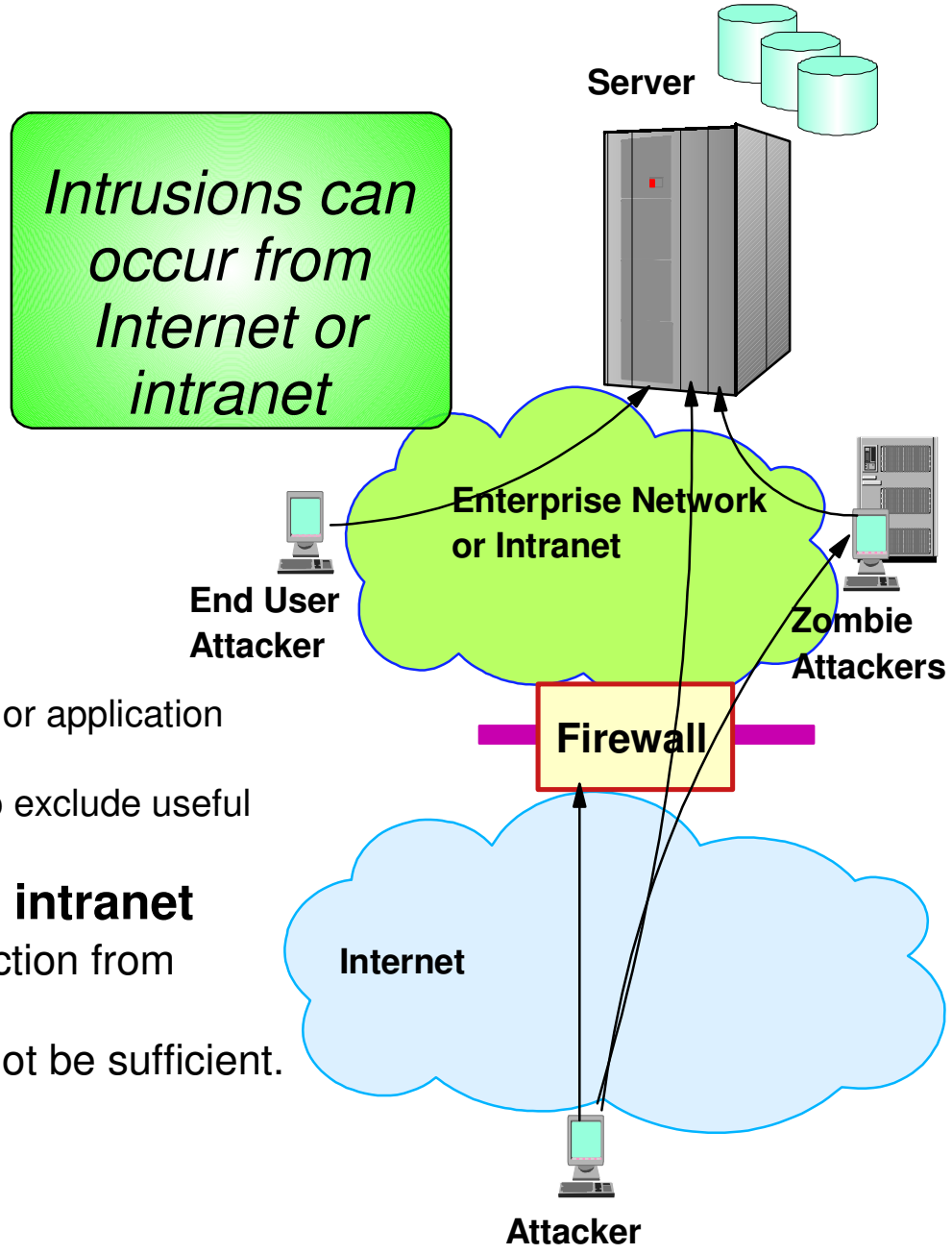
z/OS Communications Server provides an integrated Intrusion Detection Services (IDS) for TCP/IP . This session will describe the Communications Server IDS and how it can be used to detect intrusion attempts against z/OS.

This session will cover the following topics

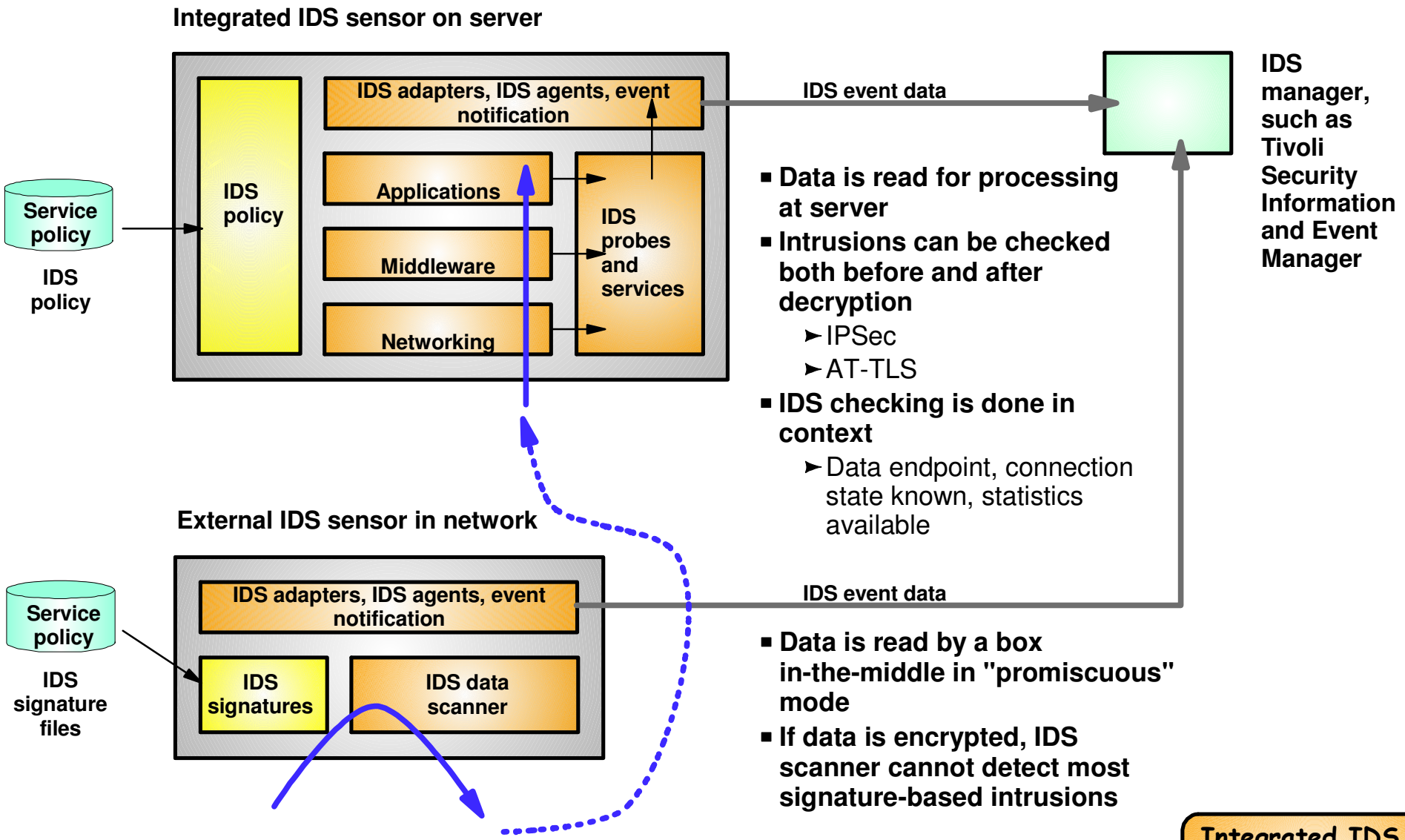
- IDS Overview
- Intrusion events detected by z/OS IDS
- IDS Actions
  - Recording Actions
  - Defensive Actions
- IDS Reports
- Automation for IDS
- Working with IDS policy

The Intrusion Threat

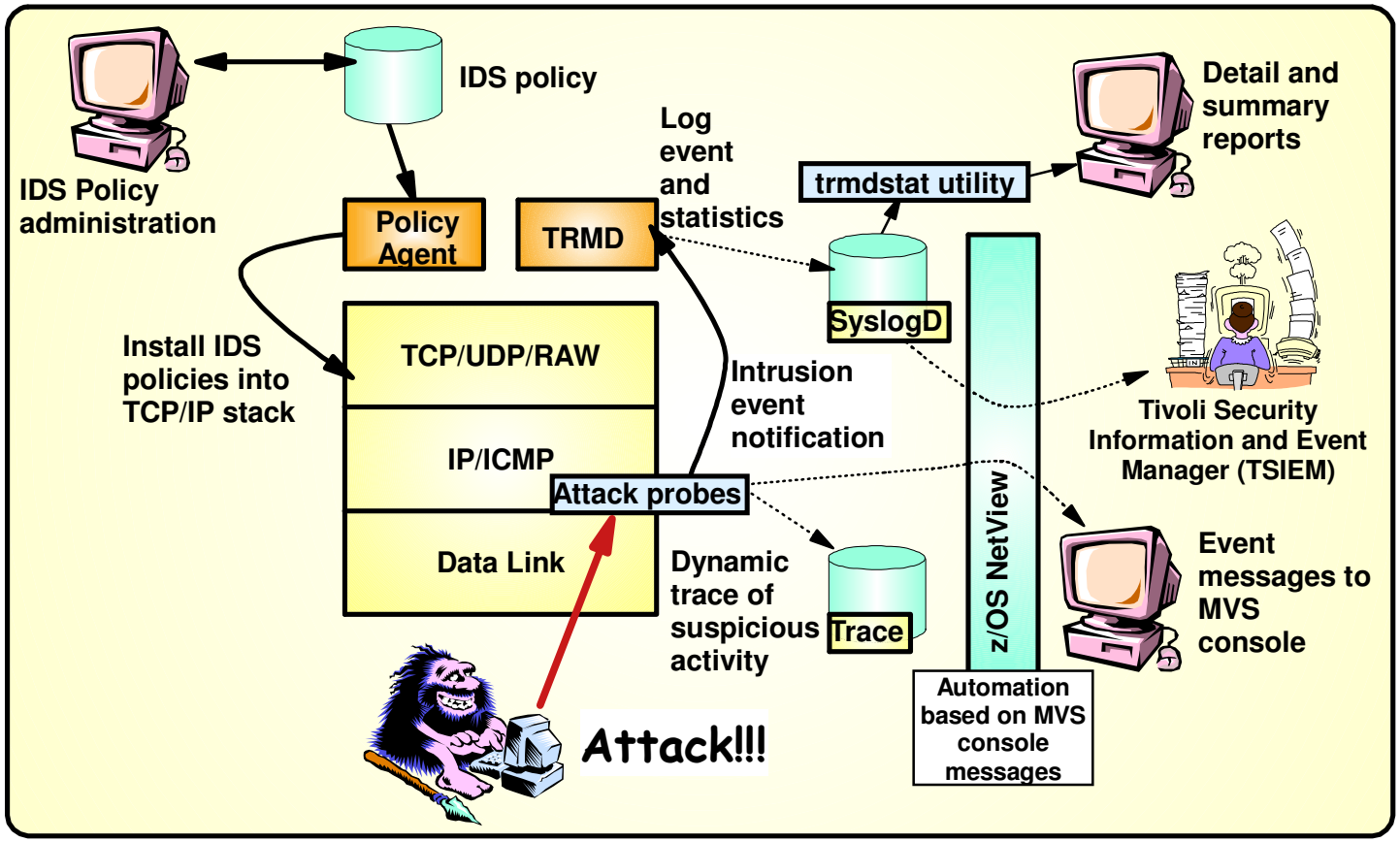
- **What is an intrusion?**
  - ► Information Gathering
    - – Network and system topology
    - – Data location and contents
  - ► Eavesdropping/Impersonation/Theft
    - – On the network/on the server
    - – Base for further attacks on others
      - ✓ Amplifiers
      - ✓ Robot or zombie
  - ► Denial of Service
    - – Attack on availability
      - ✓ Single Packet attacks - exploits system or application vulnerability
      - ✓ Multi-Packet attacks - floods systems to exclude useful work
- **Attacks can occur from Internet or intranet**
  - ► Firewall can provide some level of protection from Internet
  - ► Perimeter Security Strategy *alone* may not be sufficient.
    - – Considerations:
      - ✓ Access permitted from Internet
      - ✓ Trust of intranet



Integrated vs. External Intrusion Detection Concepts



Intrusion Detection Services Overview



Events detected
- Scans
- Attacks Against Stack
- Flooding (both TCP and UDP)

Defensive methods
- Packet discard
- Limit connections

Reporting
- Logging,
- Event messages to local console,
- IDS packet trace
- Notifications to Tivoli NetView and Tivoli Security Information and Event Manager (TSIEM)

IDS Policy Repositories
- Flat file support
- LDAP

Integrated Intrusion Detection Services under policy control to identify, alert, and document suspicious activity

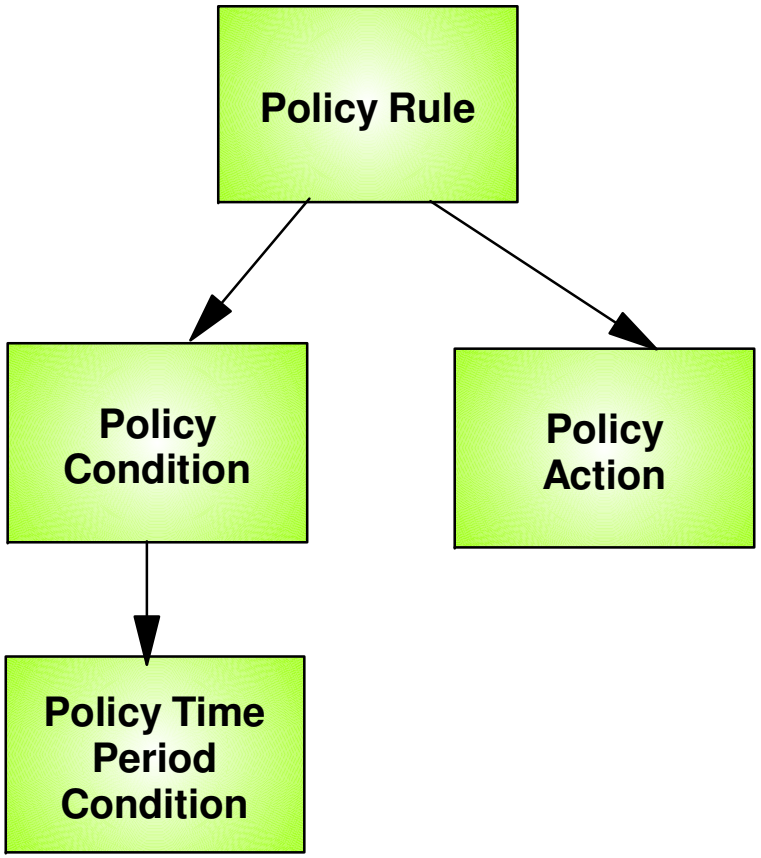
z/OS IDS broadens intrusion detection coverage:
- Ability to evaluate inbound encrypted data - IDS applied after decryption on the target system
- Avoids overhead of per packet evaluation against table of known attacks - IDS policy checked after attack detected
- Detects statistical anomalies real-time - target system has stateful data / internal threshholds unavailable to external IDSs
- Policy can control prevention methods on the target, such as connection limiting and packet discard

IDS Configuration

- IDS is configured with IDS policy
  - IDS policy defines intrusion events to monitor and actions to take
- Policy definitions are stored in policy repository
  - File or data set
  - LDAP
- Policy Agent reads policy definitions from policy repository
  - Policy definitions are processed by Policy Agent and installed in the TCP/IP stack

Policy Model Overview

Basic Policy Objects



Policy objects relationship:
IF condition THEN action

Policies consist of several related objects

- Policy Rule is main object and refers to one or more objects:
  - Policy Condition
    - Defines IDS conditions which must be met to execute the Policy action
  - Policy Action
    - Defines IDS actions to be performed when Policy Condition is met
  - Policy Time Period Condition
    - Determines when a policy rule is active

Intrusion Events Types Detected

- **SCAN**
- **ATTACK**
- **TRAFFIC REGULATION**

Intrusion Event Types Supported

- Scan detection and reporting
  - ➤ Intent of scanning is to map the target of the attack
    - – Subnet structure, addresses, masks, addresses in-use, system type, op-sys, application ports available, release levels
- Attack detection, reporting, and prevention
  - ➤ Intent is to crash or hang the system
    - – Single or multiple packet
- Traffic regulation for TCP connections and UDP receive queues
  - ➤ Could be intended to flood system OR could be an unexpected peak in valid requests

Scanning... the prelude to the attack

- z/OS IDS definition of a scanner
  - Source host that accesses multiple unique resources (ports or interfaces) over a specified time period
    - Installation can specify via policy number of unique events (Threshold) and scan time period (Interval)
- Categories of scan detection supported
  - Fast scan
    - Many resources rapidly accessed in a short time period (less than 5 minutes)
      - ✓ usually less than five minutes, program driven
  - Slow scans
    - Different resources intermittantly accessed over a longer time period (many hours)
      - ✓ scanner trying to avoid detection
- Scan events types supported
  - ICMP scans
  - TCP port scans
  - UDP port scans

Scan Policy Overview

Scan policy provides the ability to:

- Obtain notification and documentation of scanning activity
  - Notify the installation of a detected scan via console message or syslogd message
  - Trace potential scan packets
- Control the parameters that define a scan:
  - The time interval
  - The threshold number of scan events
- Reduce level of false positives
  - Exclude well known "legitimate scanners" via exclusion list
    - e.g. network management
  - Specify a scan sensitivity level
    - by port for UDP and TCP
    - highest priority rule for ICMP

Scan Event Counting and Scan Sensitivity

- Each scan event is internally classified as normal, suspicious or very suspicious
  - ➤ Socket state, ICMP type affect this classification
- Scan sensitivity determines whether a scan event is "countable"

Sensitivity (from policy)	Normal Event	Possibly Suspicious Event	Very Suspicious Event
Low			Count
Medium		Count	Count
High	Count	Count	Count

- Countable scan events count against an origin source IP address
  - ➤ Total number of countable events for all scan event types is compared to policy thresholds
    - – If threshold exceeded for a single IP address, policy-directed notification and documentation is triggered
- Scan instance event classification by event type included in appendix A

Attacks Against The TCP/IP Stack

- The system already silently defends itself from many attacks against the TCP/IP stack.
- IDS adds capability to control recording of intrusion events and to provide supporting documentation.
- IDS adds controls to detect and disable uncommon or unused features which could be used in an attack.

Attack Categories

- Malformed packet events
  - Detects packets with incorrect or partial header information
- Inbound fragment restrictions
  - Detects fragmentation in first 256 bytes of a datagram
- IP protocol restrictions
  - Detects use of IP protocols you are not using that could be misused
- IP option restrictions
  - Detects use of IP options you are not using that could be misused
- UDP perpetual echo
  - Detects traffic between UDP applications that unconditionally respond to every datagram received
- ICMP redirect restrictions
  - Detects receipt of ICMP redirect to modify routing tables.
- Outbound RAW socket restrictions
  - Detects z/OS RAW socket application crafting invalid outbound packets
- Flood Events
  - Detects flood of SYN packets from "spoofed" sources
  - Detects high percentage of packet discards on a physical interface

Attack Policy Overview

Attack policy provides the ability to:

- Control attack detection for one or more attack categories independently
- Generate notification and documentation of attacks
  - ► Notify the installation of a detected attack via console message or syslogd message
  - ► Trace potential attack packets
- Generate attack statistics on time interval basis
  - ► Normal or Exception
- Control defensive action when attack is detected

Interface Flood Detection

- Packet discard rate by physical interface is tracked to determine if there is a potential attack
  - A high percentage of discarded packets on a physical interface may indicate the interface is under attack.
- Notification and traces provided when a possible interface flood condition is occurring (according to the discard threshold value).
- Provides information to help determine the potential cause of the interface flood
  - Narrows flood condition to a local interface so you can
    - Vary the interface offline
      - ✓ This action not controlled with IDS policy
    - Start tracing flood back to source
  - Source MAC address of the "prior hop" (for OSA QDIO and LCS devices)
  - Source IP address from the outer IPSec header if the packet had been received as IPsec tunnel mode.
    - Source IP address could be a gateway or firewall
      - ✓ Could allow source tracking closer to the source than "prior hop"

Interface Flood Detection Process

- Policy related to interface flood detection
  - ►Specified on Attack Flood policy
  - ►2 actions attributes provided
    - – ibm-idsIfcFloodMinDiscard (default 1000)
    - – ibm-idsIfcFloodPercentage (default 10)
- For each interface, counts are kept for
  - ►The number of inbound packets that arrived over the physical interface
  - ►The number of these packets that are discarded
- When the specified number of discards (ibm-idsIfcFloodMinDiscard) is hit:
  - ►If the discards occurred within **one minute** or less:
    - – the discard rate is calculated for the interval :
      - ✓ # discards during the interval / # inbound packets for the interval
    - – If the discard rate equals or exceeds the specified threshold, an interface flood condition exists
  - ► If discards occurred during period longer than 1 minute, not a flood condition
- Once an interface flood is detected, this data is collected and evaluated for the interface at 1 minute intervals. The interface flood is considered ended if the discards for a subsequent interval:
  - ►Fall below the minimum discard value OR
  - ►Discard rate for the interval is less than or equal to 1/2 of the specified threshold

Interface Flooding Example

- Assume the IDS flood policy specifies:
  - ibm-idsIfcFloodMinDiscard: 2000
  - ibm-idsIfcFloodPercentage:10%

- Consider the following sequence for interface X:

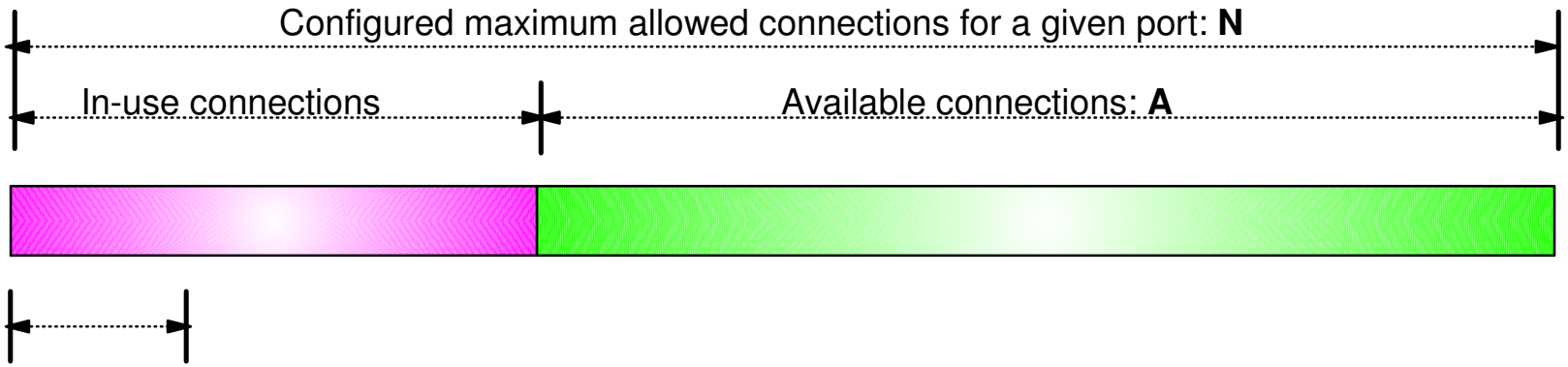
time

time interval	inbound cnt	discard cnt	discard rate	notes
> 1 min	13,000	2000	N/A	took longer than a minute to see the minimum discard count, so not a flood and discard rate not calculated.
< 1 min	30,000	2000	6.6%	not a flood, rate <10%
< 1 min	20,000	2000	10%	***interface flood start detected.*** Run 1 minute timer until flood end detected.
+1 min	40,000	3000	7.5%	flood condition still exists, reset 1 minute timer.
+1 min	50,000	2500	5%	***Interface flood end detected.*** Discard rate <= half of policy specified rate.

Traffic Regulation for TCP

- Allows control over number of inbound connections from a single host
  - Can be specified for specific application ports
    - Especially useful for forking applications
  - Independent policies for multiple applications on the same port
    - e.g. telnetd and TN3270
- Connection limit expressed as
  - Port limit for all connecting hosts AND
  - Individual limit for a single connecting host
- Fair share algorithm
  - Connection allowed if specified individual limit per single remote IP address does not exceed percent of available connections for the port
    - All remote hosts are allowed at least one connection as long as port limit has not been exceeded
      - ✓ QoS connection limit used as override for concentrator sources (web proxy server)

TCP connection regulation algorithm



If a new connection request is received and A=0, the request is rejected.

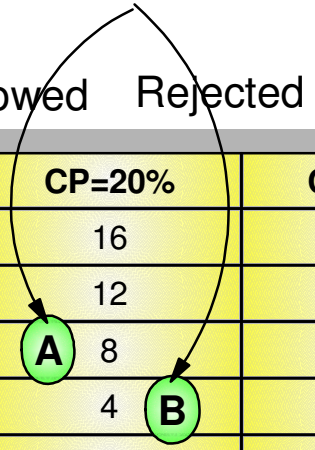
If a new connection request is received and A>0 and the request is from a source that already has connections with this port number (in this example: IP@x), then:

If X+1 < CP*A then
    Allow the new connection
Else
    Deny the new connection

Purpose: If close to the connection limit, then a given source IP address will be allowed a lower number of the in-use connections.

Regulation algorithm example

Source IP address X attempts its fifth connection



Total Allowed	Connections	Available	CP=10%	CP=20%	CP=30%
100	20	80	8	16	24
100	40	60	6	12	18
100	60	40	4	8	12
100	80	20	2	4	6
100	90	10	1	2	3

A If we currently 40 connections available (A=40) and a controlling percentage (CP) of 20%, when source IP address X tries to establish its fifth connection, it will be allowed (40 * 20% = 8, so 5 connections is within the acceptable range).

B If we have 20 connections available (A) and CP is again 20%, when source IP address X tries to establish its fifth connection, it will be rejected (20 * 20% = 4, so 5 would exceed the allowable number of connections).

Traffic Regulation for UDP

- Allows control over length of inbound receive queues for UDP applications
  - Specified on a per-port basis
  - Can be applied to ports of your choosing
- Before TR for UDP, UDP queue limit control was requested globally for all queues
  - UDPQueueLimit ON | OFF in TCP/IP Profile
- If neither TR UDP or UDPQueueLimit is used, a stalled application or a flood against a single UDP port could consume all available buffer storage
  - TR UDP supercedes UDPQueueLimit specification
- TR UDP queue limit expressed as abstract queue length
  - VERY SHORT
  - SHORT
    - For applications that tend to receive data faster than they can process it
  - LONG
  - VERY LONG
    - Useful for fast or high priority applications with bursty arrival rates

IDS Actions

- **Recording actions**
- **Defensive actions**

Recording Actions

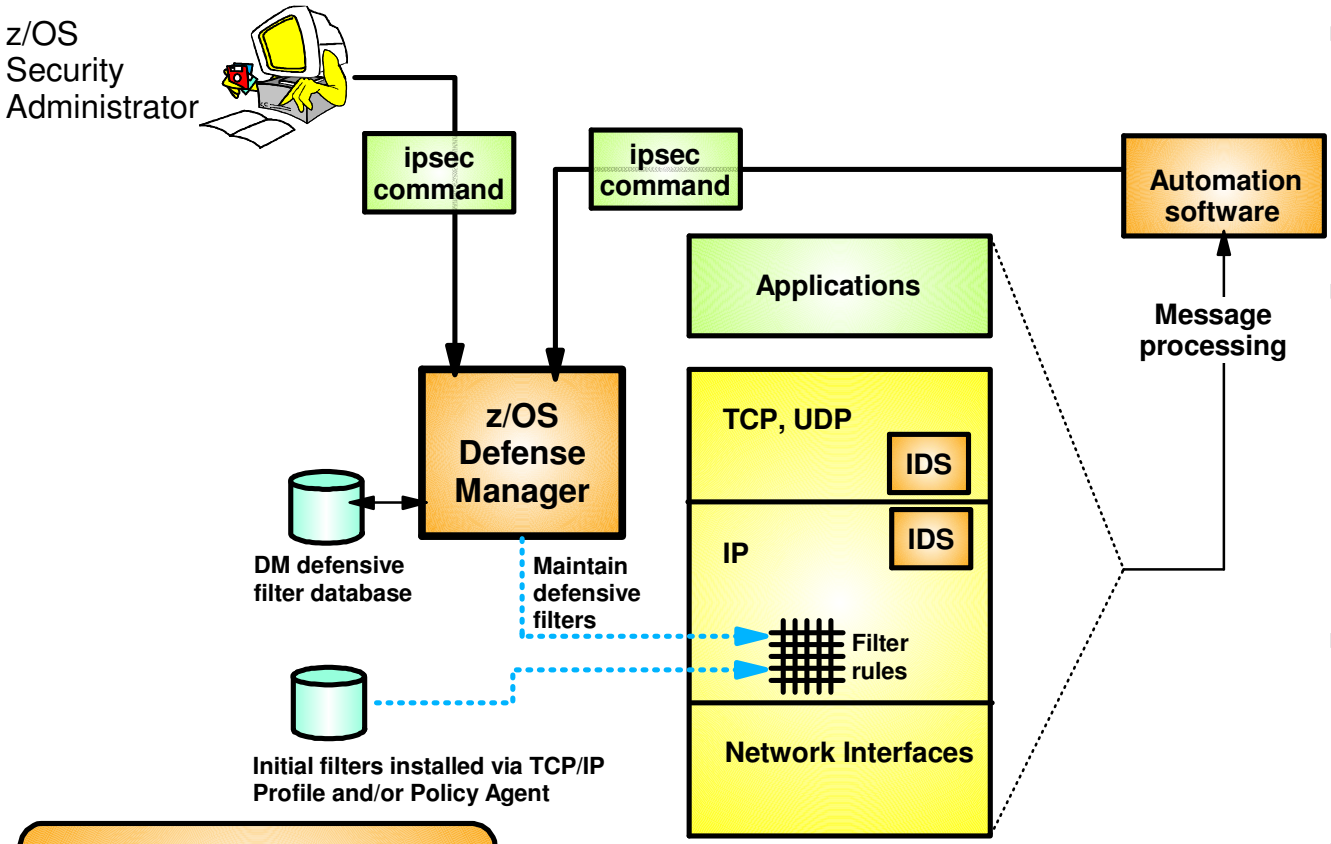
- Recording options controlled by IDS policy action specification
- Options
  - Event logging
    - Syslogd
      - ✓ Number of events per attack subtype recorded in a five minute interval can be limited
    - Local Console
      - ✓ Recording suppression provided if quantity of IDS console messages reach policy-specified thresholds
  - Statistics
    - Syslogd
      - ✓ Normal and Exception conditions
  - IDS packet trace
    - Activated after attack detected
      - ✓ Number of packets traced for multipacket events are limited
      - ✓ Amount of data trace is configurable (header, full, byte count)
- All IDS events recorded in syslog and console messages, and packet trace records have probeid and correlator
  - Probeid identifies the point at which the event detected
  - Correlator allows association of corresponding syslog and packet trace records

Defensive Actions by Event Type

- Scan Events
  - No defensive action defined
- Attack Events
  - Packet discard
    - Certain attack events always result in packet discard and are not controlled by IDS policy action
      - ✓ malformed packets
      - ✓ flood (synflood discard)
    - Some attack types controlled by IDS policy action
      - ✓ ICMP redirect restrictions
      - ✓ IP option restrictions
      - ✓ IP protocol restrictions
      - ✓ IP fragment
      - ✓ outbound raw restrictions
      - ✓ perpetual echo
  - No defensive action defined
    - ✓ flood (interface flood detection)
- Traffic Regulation Events
  - Controlled by IDS policy action
    - TCP - Connection limiting
    - UDP - Packet discard

IDS and Defensive Filtering

- **The Defense Manager component allows authorized users to dynamically install time-limited, defensive filters:**
  - A local security administrator can install filters based on information received about a pending threat
  - Enables filter installation through automation based on analysis of current attack conditions
- **Defensive filtering is an extension to IDS capabilities**
  - Adds additional defensive actions to protect against attacks



Enable dynamic defensive actions on z/OS

- **Requires minimal IP Security configuration to enable IP packet filtering function**
  - Uses ipsec command to control and display defensive filters
- **Defense Manager**
  - Manages installed defensive filters in the TCP/IP stack
  - Maintains record of defensive filters on DASD for availability in case of DM restart or stack start/restart
- **Defensive filter scope may be:**
  - Global - all stacks on the LPAR where DM runs
  - Local - apply to a specific stack
- **Defensive filter are installed "in-front" of configured/default filters**

Intrusion Detection Reports for Analysis

IDS Log Reports

trmdstat command produces reports based on IDS data recorded in syslog

- Types of reports generated for logged events
  - Overall summary reports
    - Connection and IDS
  - Event type summary reports
    - For Connection, Attack, Flood, Scan, TCP and UDP TR information
  - Event type detail reports
    - For Connection, Attack, Flood, Scan, TCP and UDP TR information
- Types of reports generated for statistics events
  - Details reports
    - Attack, Flood, TCP and UDP TR reports

Tivoli Support for IDS Events

- Tivoli NetView provides local z/OS management support for IDS
  - NetView provides ability to trap IDS messages from the system console or syslog and take predefined actions based on IDS event type such as:
    - Route IDS messages to designated NetView consoles
    - email notifications to security admistrator
    - Run trmdstat and attach output to email
    - Issue pre-defined comands
- Tivoli Security Information and Event Manager (TSIEM) provides enterprise-wide management support for IDS
  - Automated aggregation and correlation of events, logs, and vulnerabilities
    - Broad device support for multi-vendor environments, including security, network, host, and applications
    - Support includes processing for z/OS Communications Server syslog messages for IDS events
  - Automates policy and regulatory compliance
    - Policy and Regulatory based policy monitoring and reporting

Working with IDS Policy

- **Controlling, displaying, and validating policy**
- **Defining IDS policy**
- **IDS policy configuration with Configuration Assistant for z/OS Communications Server example**

Controlling Active IDS Policy

- Configurable policy deletion controls in Policy Agent configuration file
  - TcpImage statement
    - FLUSH | NOFLUSH {PURGE | NOPURGE}
  - FLUSH and NOFLUSH take effect at Policy Agent initialization
    - FLUSH - specifies that any active policy should be deleted
    - NOFLUSH - specifies that active policy should not be deleted
  - PURGE and NOPURGE take effect at Policy Agent termination
    - PURGE - specifies that any active policy should be deleted
    - NOPURGE - specifies that active policy should not be deleted
- Refresh Policy
  - At Interval (1800-second default) specified on TcpImage statement
  - With MODIFY PAGENT command (REFRESH option)
  - When Policy Agent configuration file (HFS only) is updated (refresh is automatic)

Displaying IDS Policy

- pasearch command
  - ➤ Displays IDS policy read by Policy Agent
- netstat command
  - ➤ Displays installed IDS policy in TCP/IP stack
  - ➤ Displays statistics by policy category

✓ Tip:

Restrict access to IDS policy displays using SAF SERVAUTH resources:

- ➤ EZB.PAGENT.sysname.tcpname.IDS
- ➤ EZB.NETSTAT.sysname.tcpname.IDS

Steps for Validating IDS Policy

1. Inspect configured IDS policy for correctness
2. Invoke PAGENT and TRMD
3. Issue PASEARCH and verify that the correct policy is installed
4. Keep policy in force for a trial period
5. Issue IDS netstat to view active IDS policy and statistics
6. Run TRMDSTAT reports to verify syslog messages for intrusion events
7. Adjust the policy as required

Defining IDS Policy

- **GUI-based approach to configuring:**
  - IDS
  - AT-TLS
  - IPSec and IP filtering
  - QoS
  - Policy-based Routing (PBR)
  - Defense Manager Daemon **(V1R11)**
- **Focus on high level concepts vs. low level file syntax**
- **Runs on Windows and under z/OSMF (V1R11)**
- **Builds and maintains**
  - Policy files
  - Related configuration files
  - JCL procedures and RACF directives **(V1R11)**
- **Supports import of existing policy files (V1R10)**

Download the Windows-based Configuration Assistant at: **http://tinyurl.com/cgoqsa**

IDS Policy Configuration Steps with the Configuration Assistant

1. Download and install the Configuration Assistant configuration tool
   http://tinyurl.com/cgoqsa

2. Configure IDS policies
   a. Examine IDS defaults and base policy on defaults
   b. Copy IDS defaults into a new IDS requirements map
   c. Make changes to new requirements map as needed

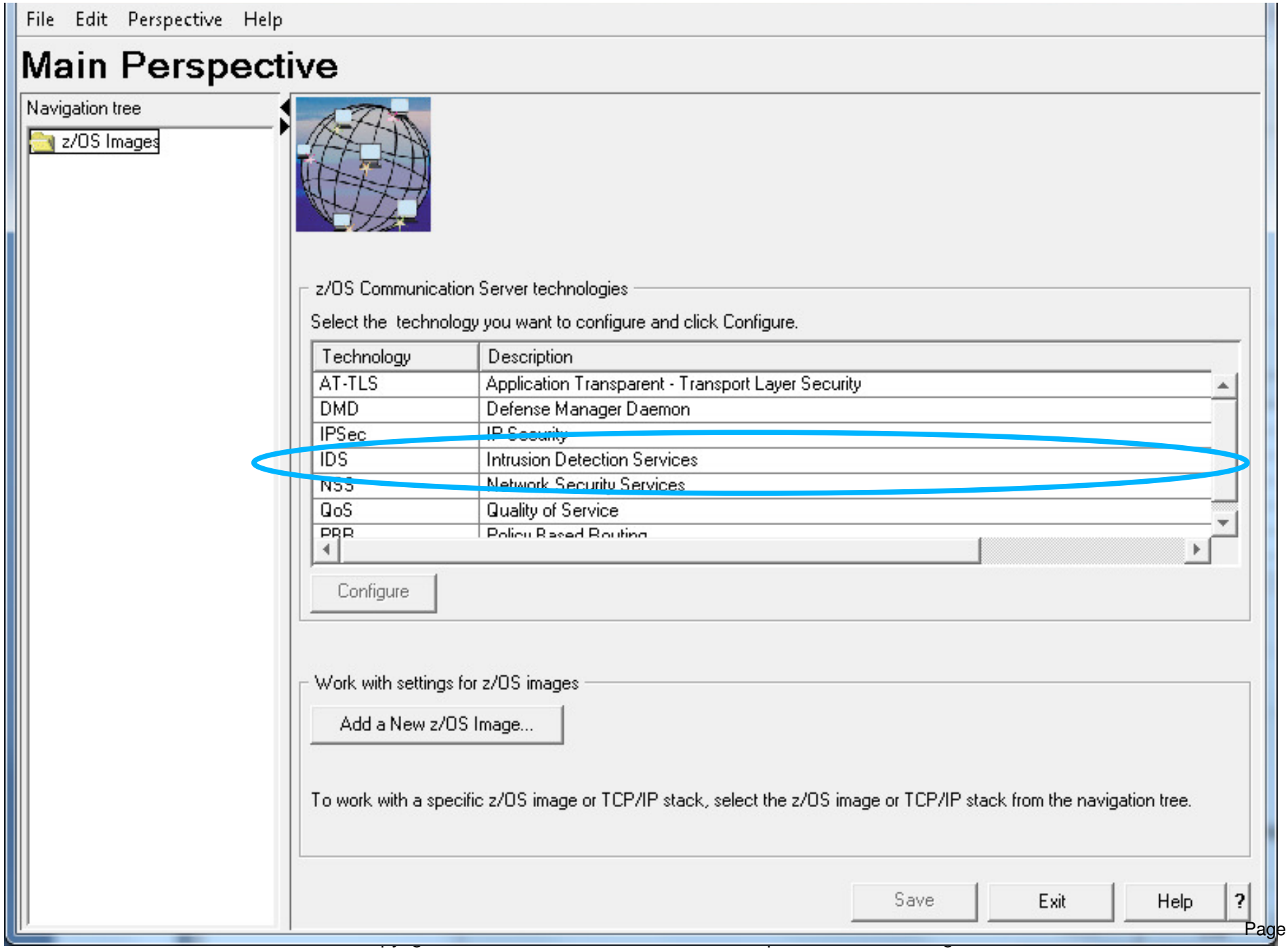
3. Create system image and TCP/IP stack image

4. Associate new requirements map with TCP/IP stack

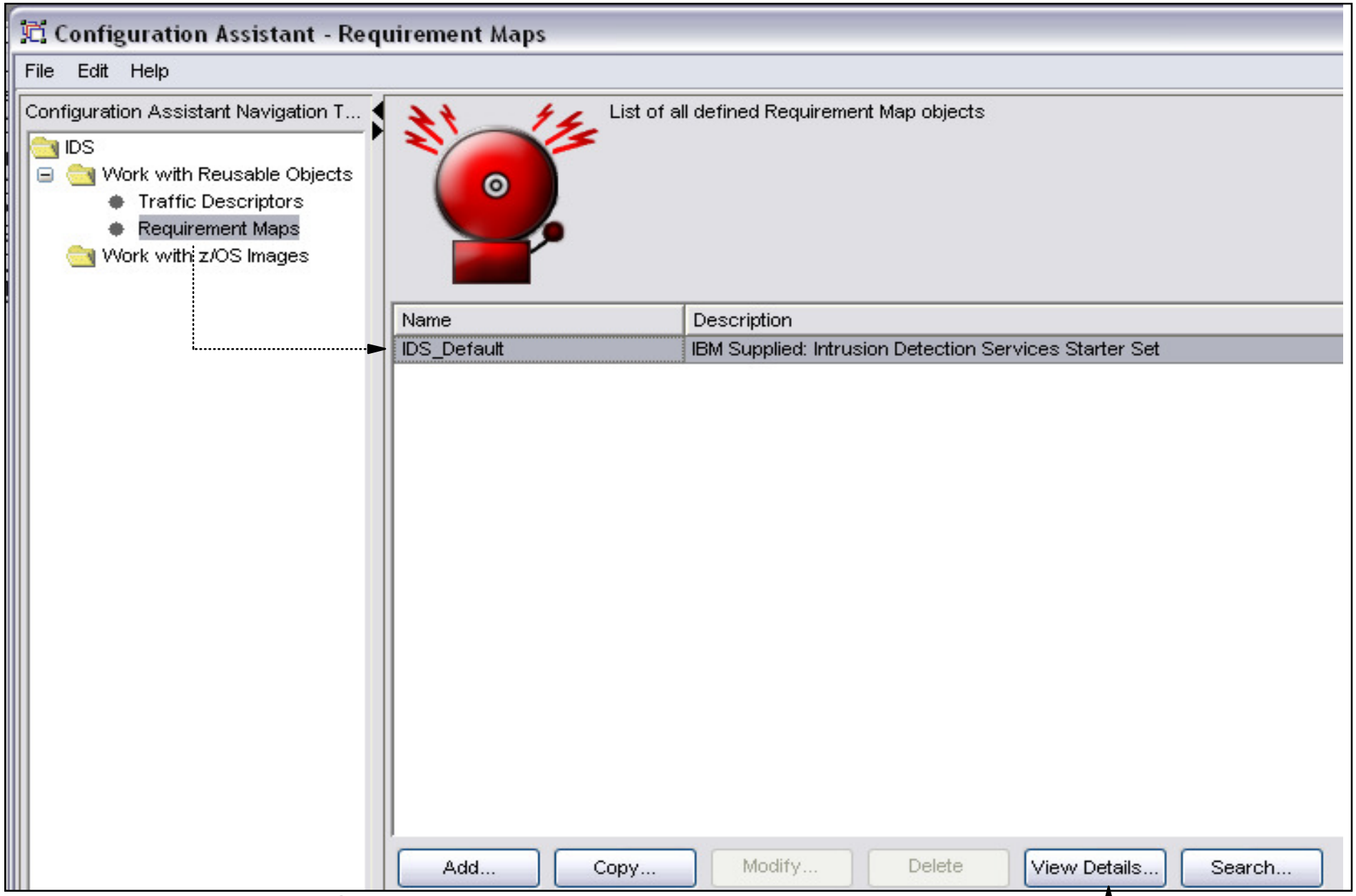
5. Transfer IDS policy to z/OS

Configuration Assistant for z/OS Communications Server

Start a new IDS configuration



Evaluate IDS_Default Requirements Map



IDS_Default provided as default requirement map

- Display details of the requirement map
- Evaluate whether they meet your requirements

Details View of IDS_Default Requirements Map (1 of 4)

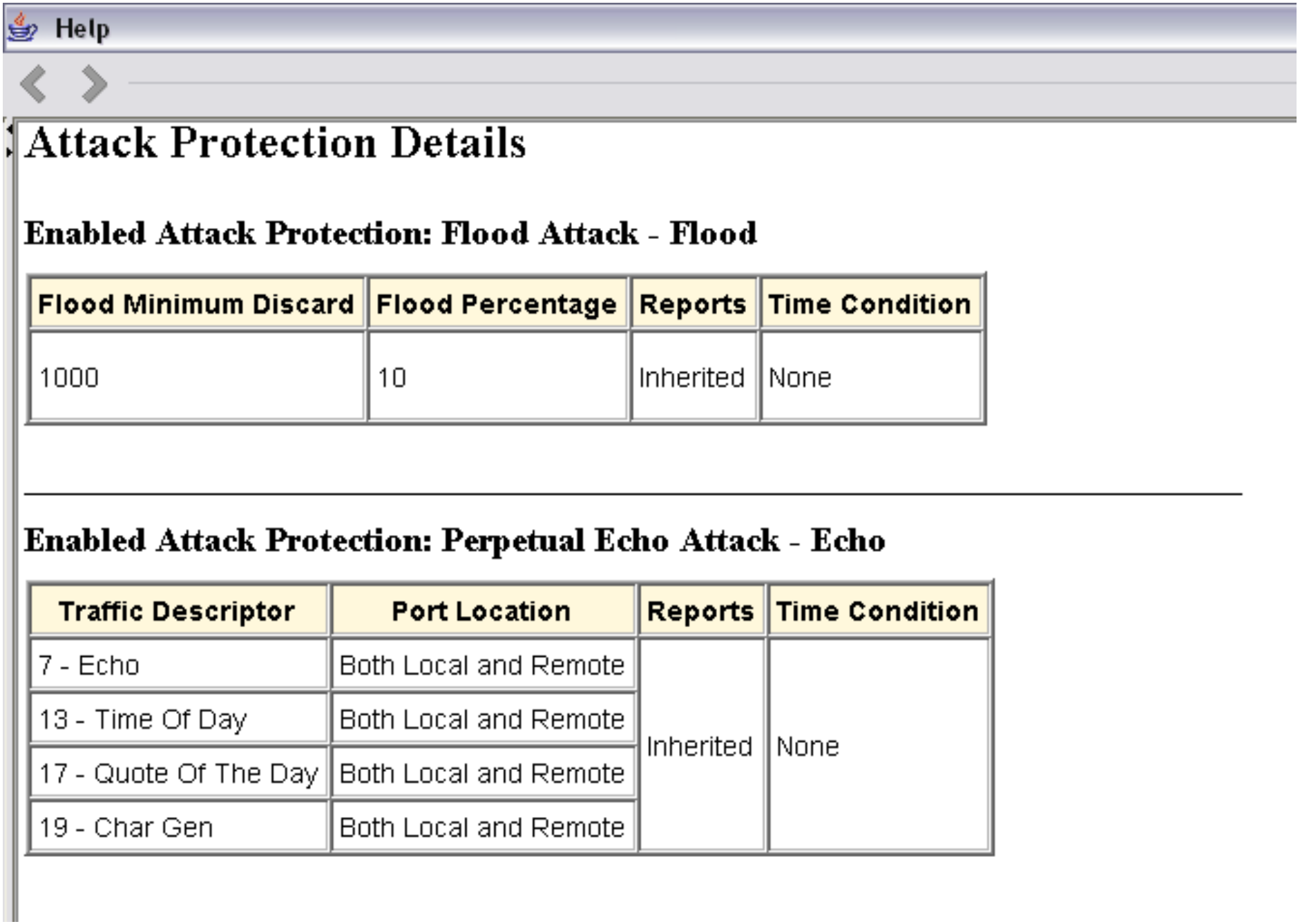
Help

Requirement Map: IDS_Default - IBM Supplied: Intrusion Detection Services Starter Set

Attack Protection Summary

Enabled Attack Protection	Rule Name	Actions	Reports	Time Condition	Report Settings
Flood Attack	Flood	Both Discard and Report	Inherited	None	**Console Parameters:** No --- **SYSLOG Parameters:** SYSLOG: Yes SYSLOG Level: 4 - Warning --- **Statistics Parameters:** Statistics: Yes Statistics Interval: 60 Report Stat if no events: No --- **Trace Parameters:** No
Perpetual Echo Attack	Echo	Report Events	Inherited	None	
Unwanted IP Protocols Attack	IPProtocol	Report Events	Inherited	None	
Unwanted IP Options Attack	IPOption	Report Events	Inherited	None	
ICMP Redirect Attack	ICMPRedirect	Report Events	Inherited	None	
Malformed Packet Attack	MalformedPacket	Both Discard and Report	Inherited	None	
Outbound Raw Attack	OutboundRaw	Report Events	Inherited	None	
IP Fragment Attack	IPFragmentation	Report Events	Inherited	None	

Details View of IDS_Default Requirements Map (2 of 4)



Details View of IDS_Default Requirements Map (3 of 4)

Enabled Attack Protection: Unwanted IP Protocols Attack - IPProtocol

Starting Protocol	Ending Protocol	Reports	Time Condition
0	0	Inherited	None
3	3		
5	5		
7	16		
18	45		
48	49		
52	88		
90	93		
95	255		

Enabled Attack Protection: Unwanted IP Options Attack - IPOption

Starting Option	Ending Option	Reports	Time Condition
2	6	Inherited	None
8	67		
69	81		
83	255		

Details View of IDS_Default Requirements Map (4 of 4)

Enabled Attack Protection: Outbound Raw Attack - OutboundRaw

Starting Protocol	Ending Protocol	Reports	Time Condition
0	0	Inherited	None
2	88		
90	255		

Enabled Attack Protection: IP Fragment Attack - IPFragmentation

Reports	Time Condition
Inherited	None

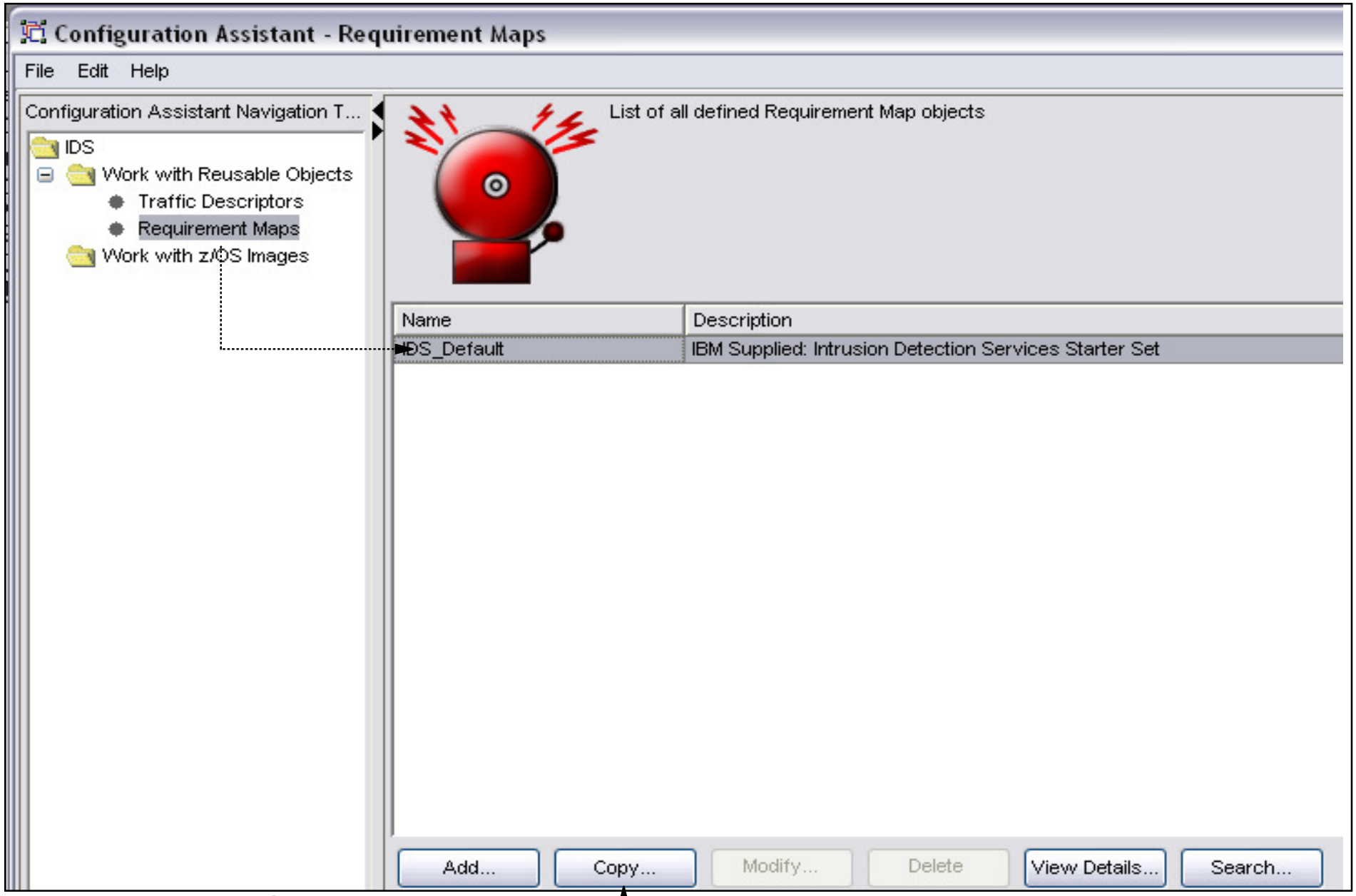
Scan Protection Summary

No Scan Protection Configured

Traffic Regulation Summary

No Traffic Regulation Configured

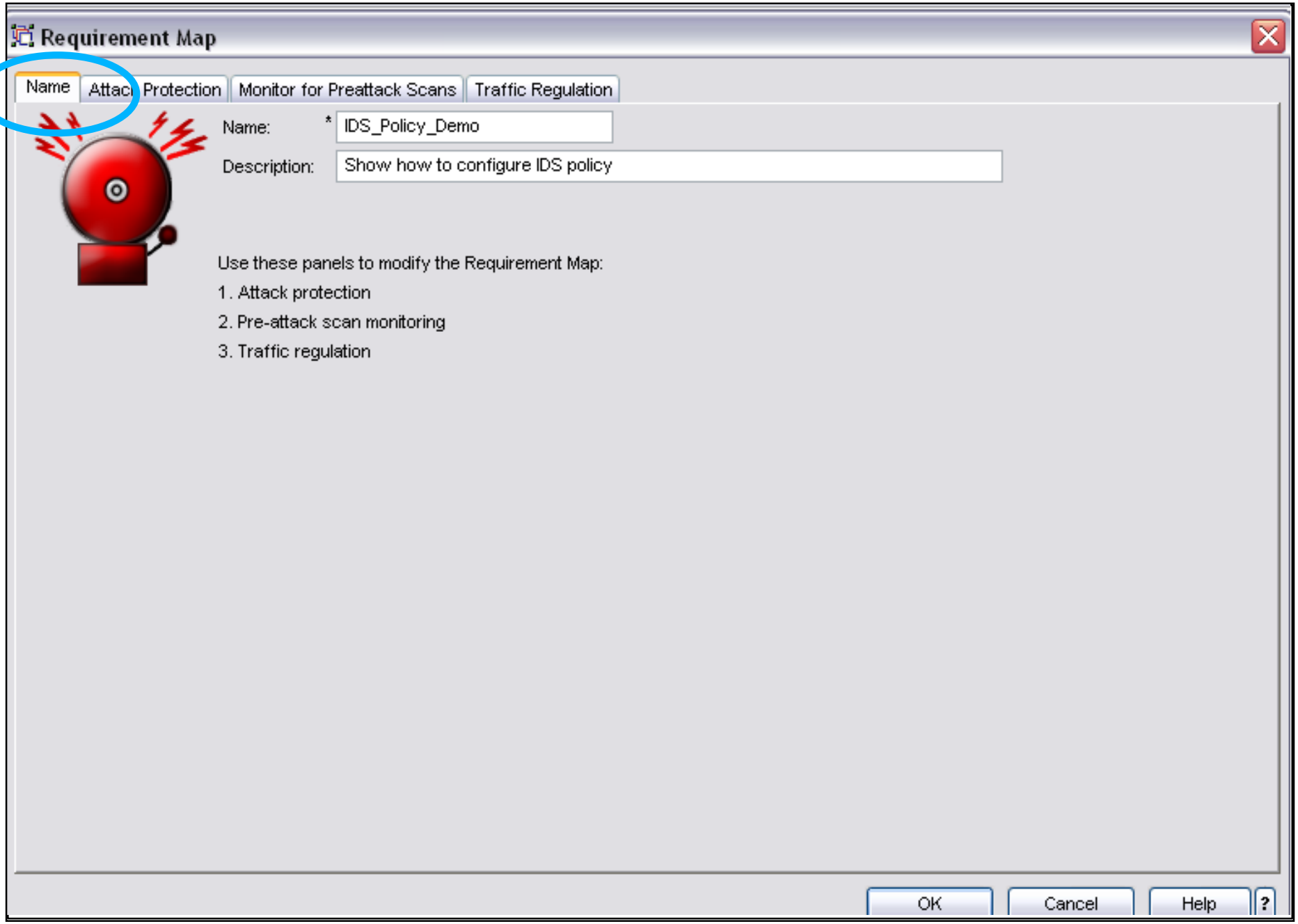
Using IDS_Default as a Starting Point



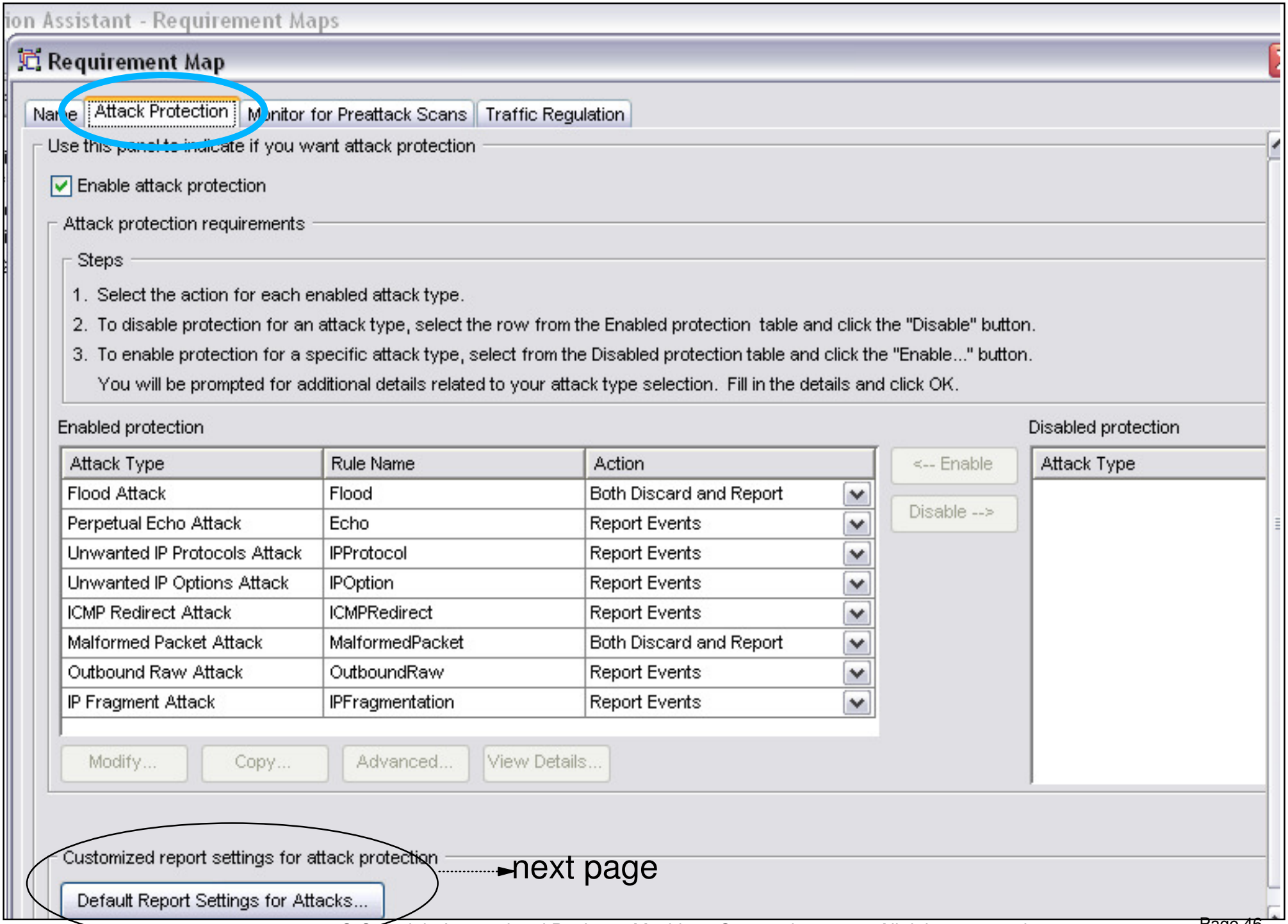
Using IDS_Default as a base

- Copy IDS_Default
- Create new requirements map using copied IDS_Default as a base

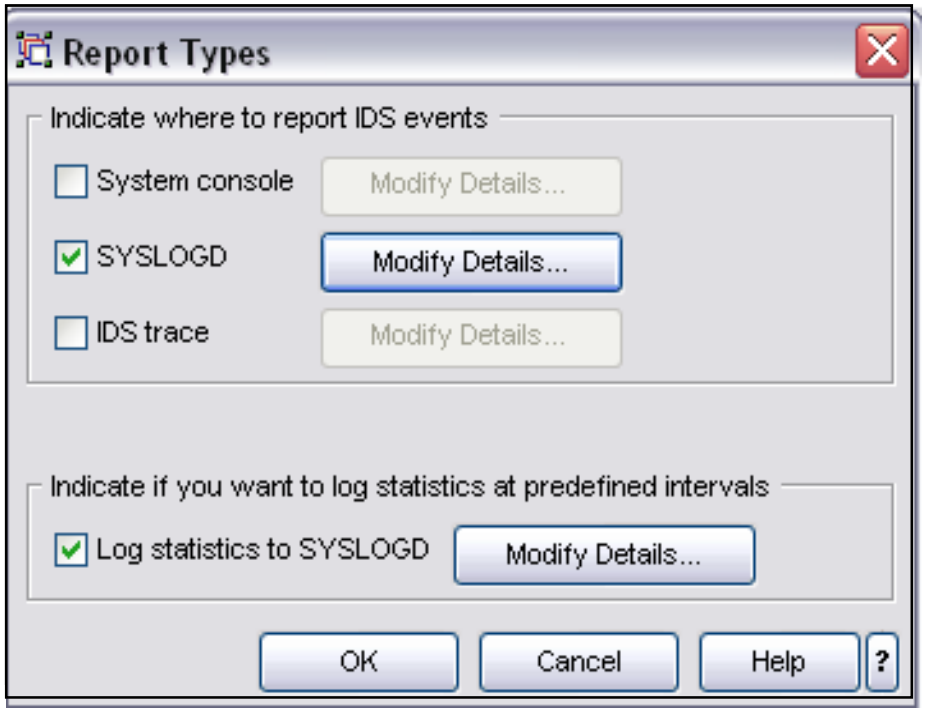
Name new requirements map



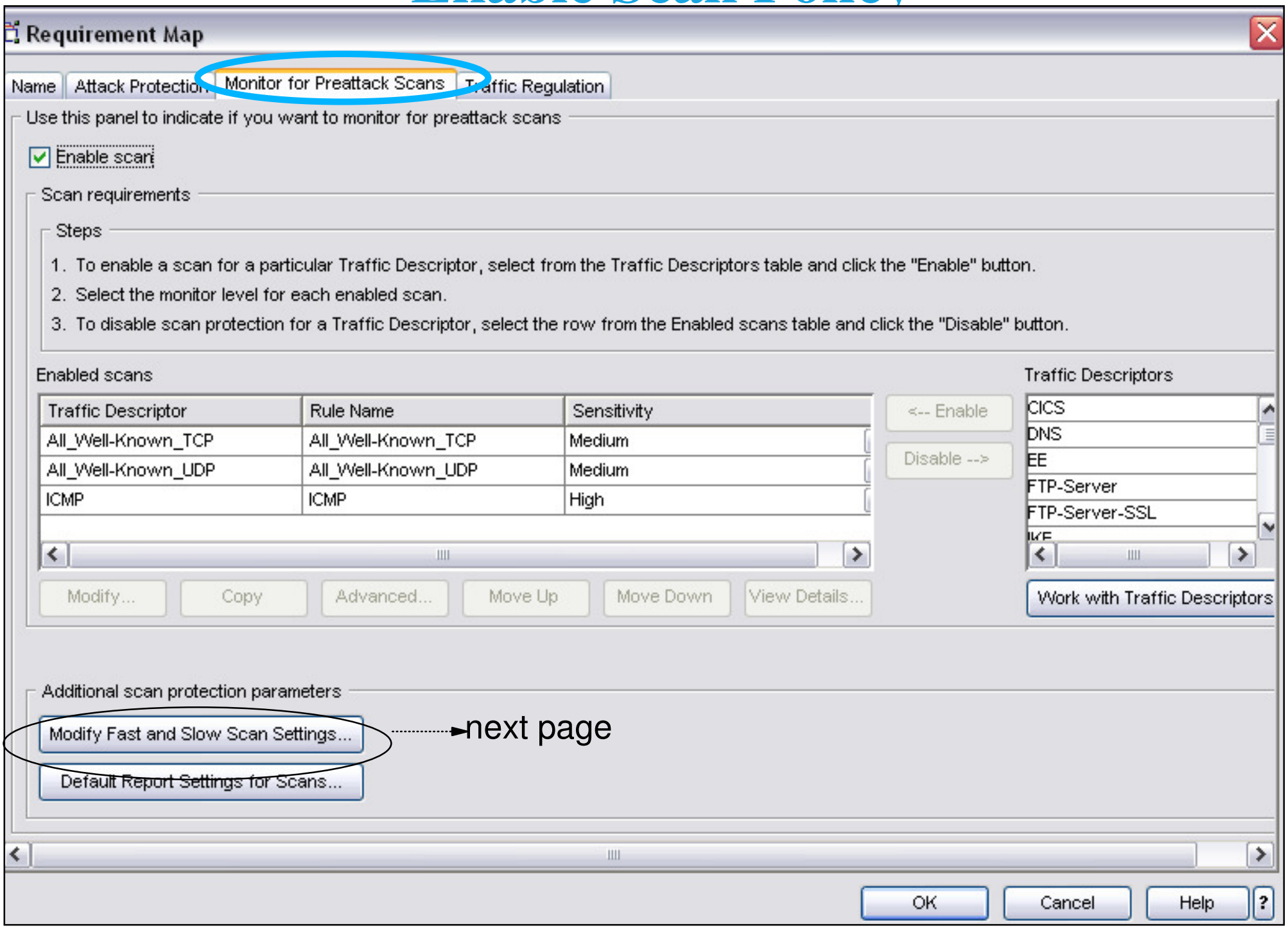
Attack protection enabled by default



Customize report settings

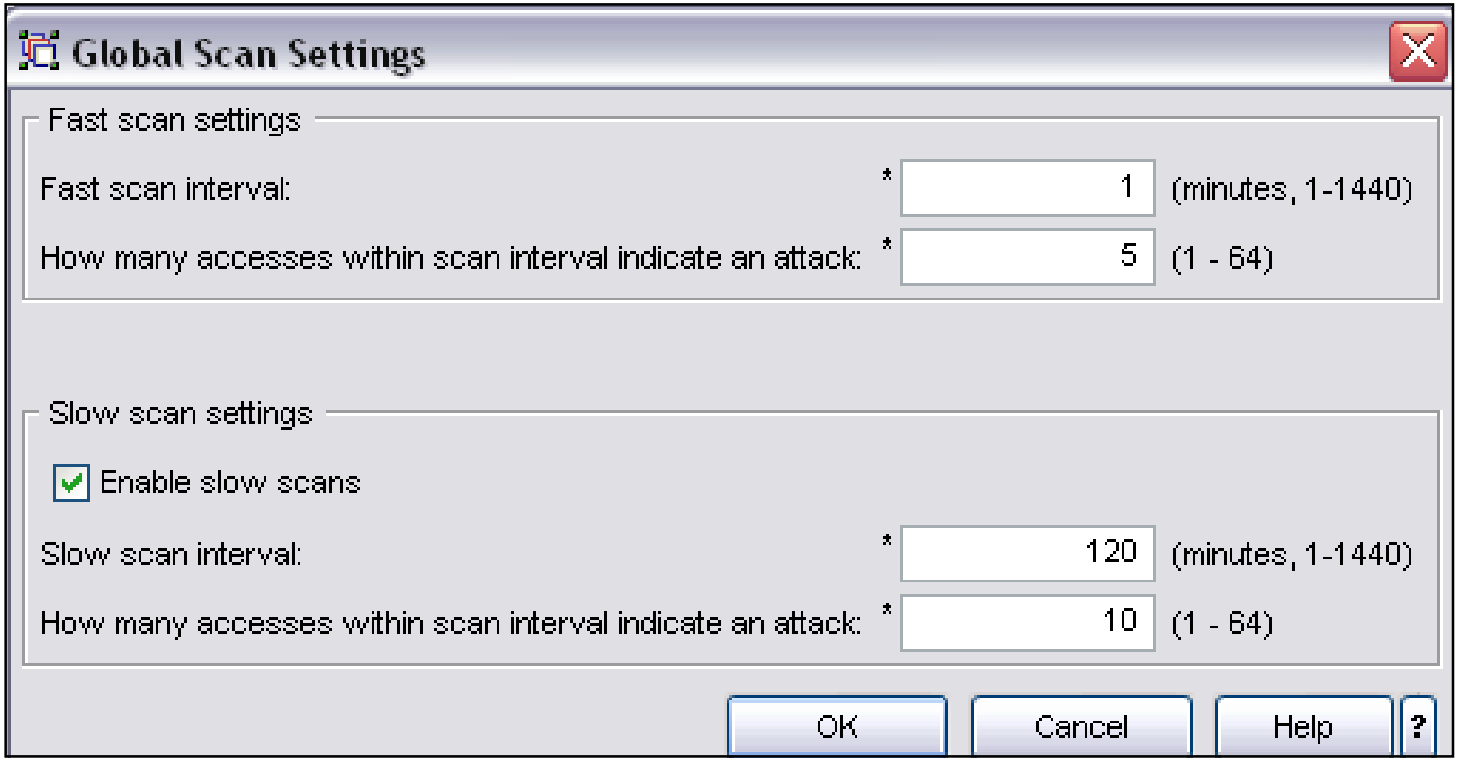


Enable Scan Policy

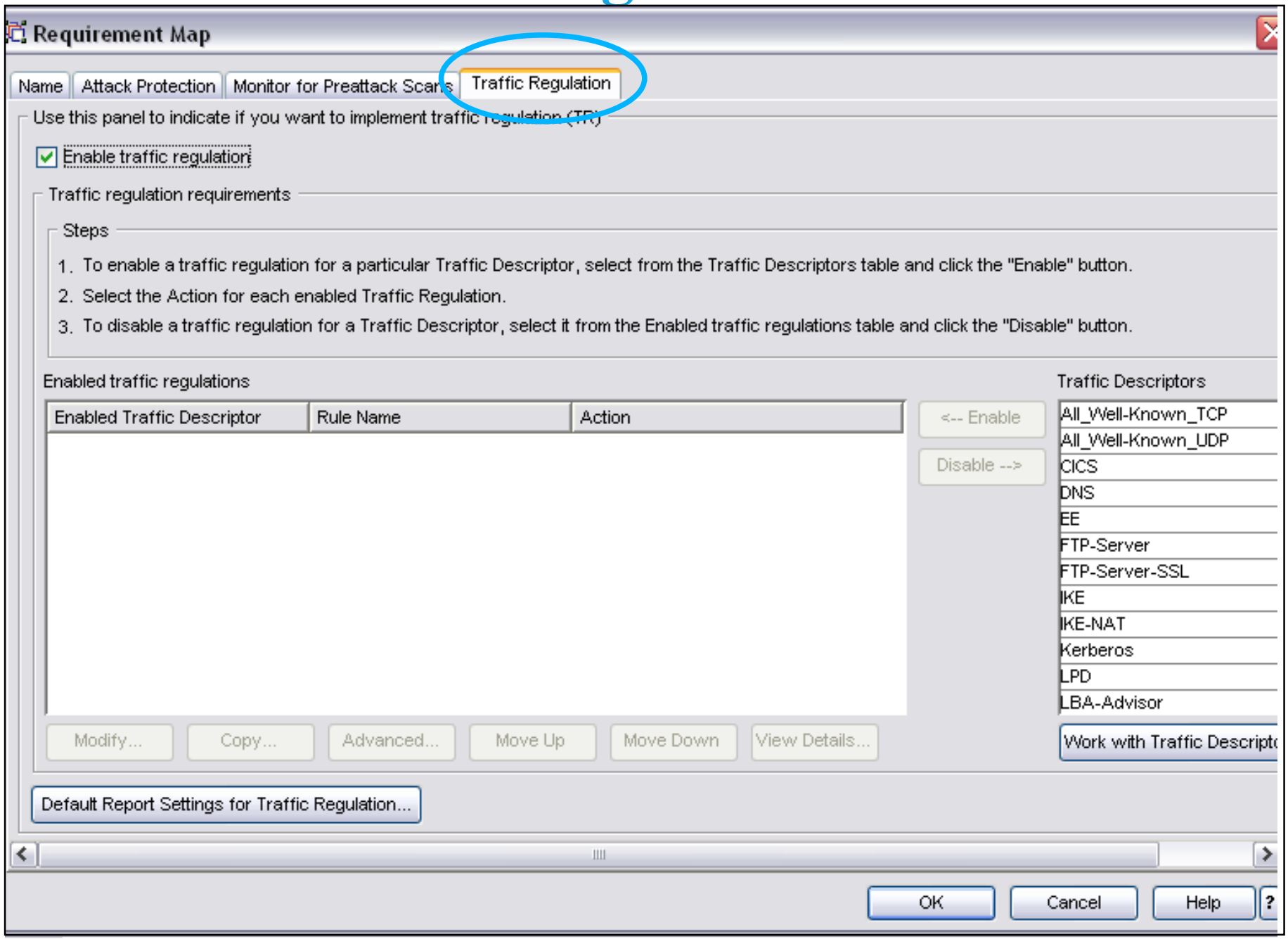


next page

Modify Global Scan Settings



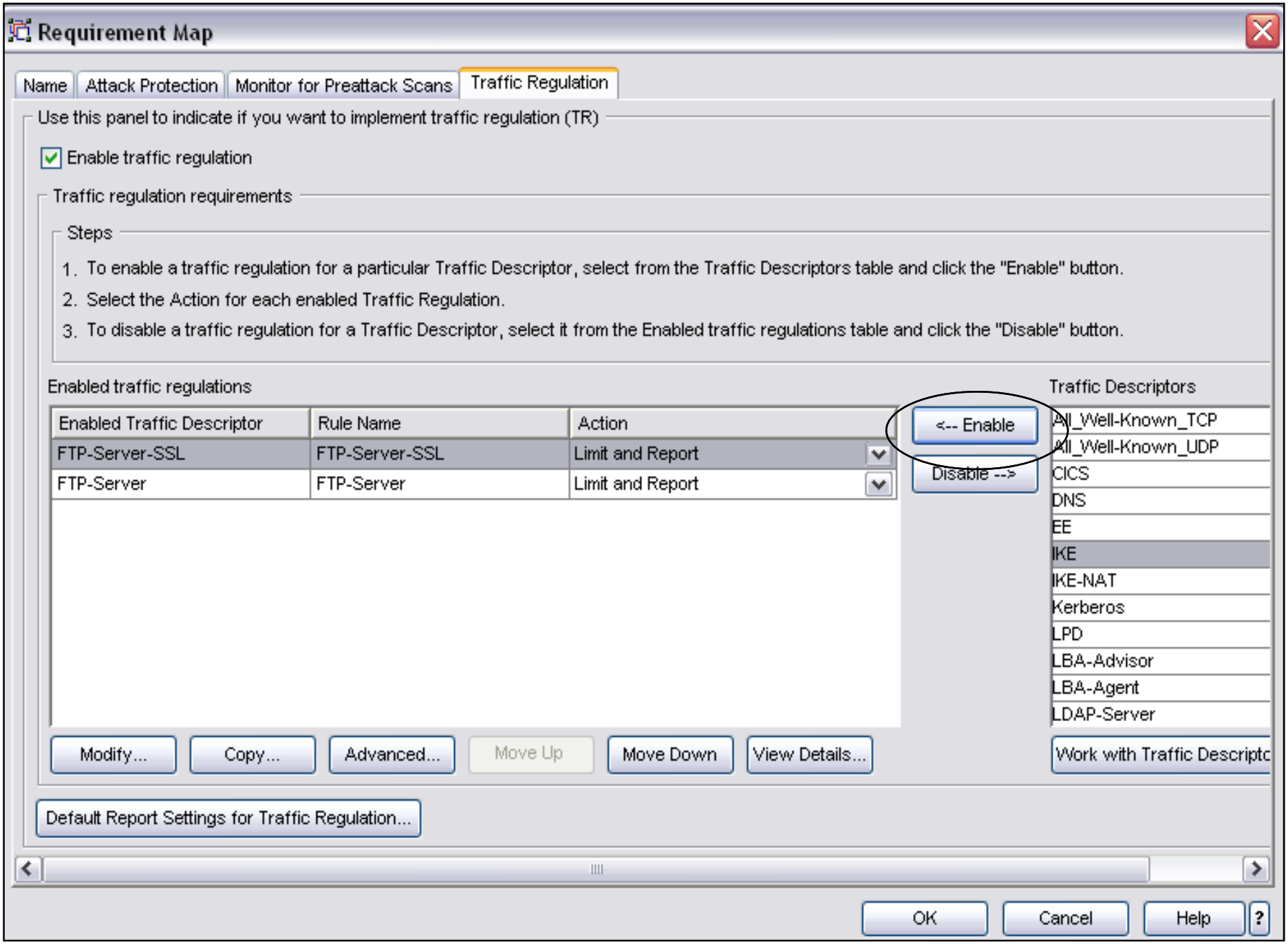
Enable Traffic Regulation Protection



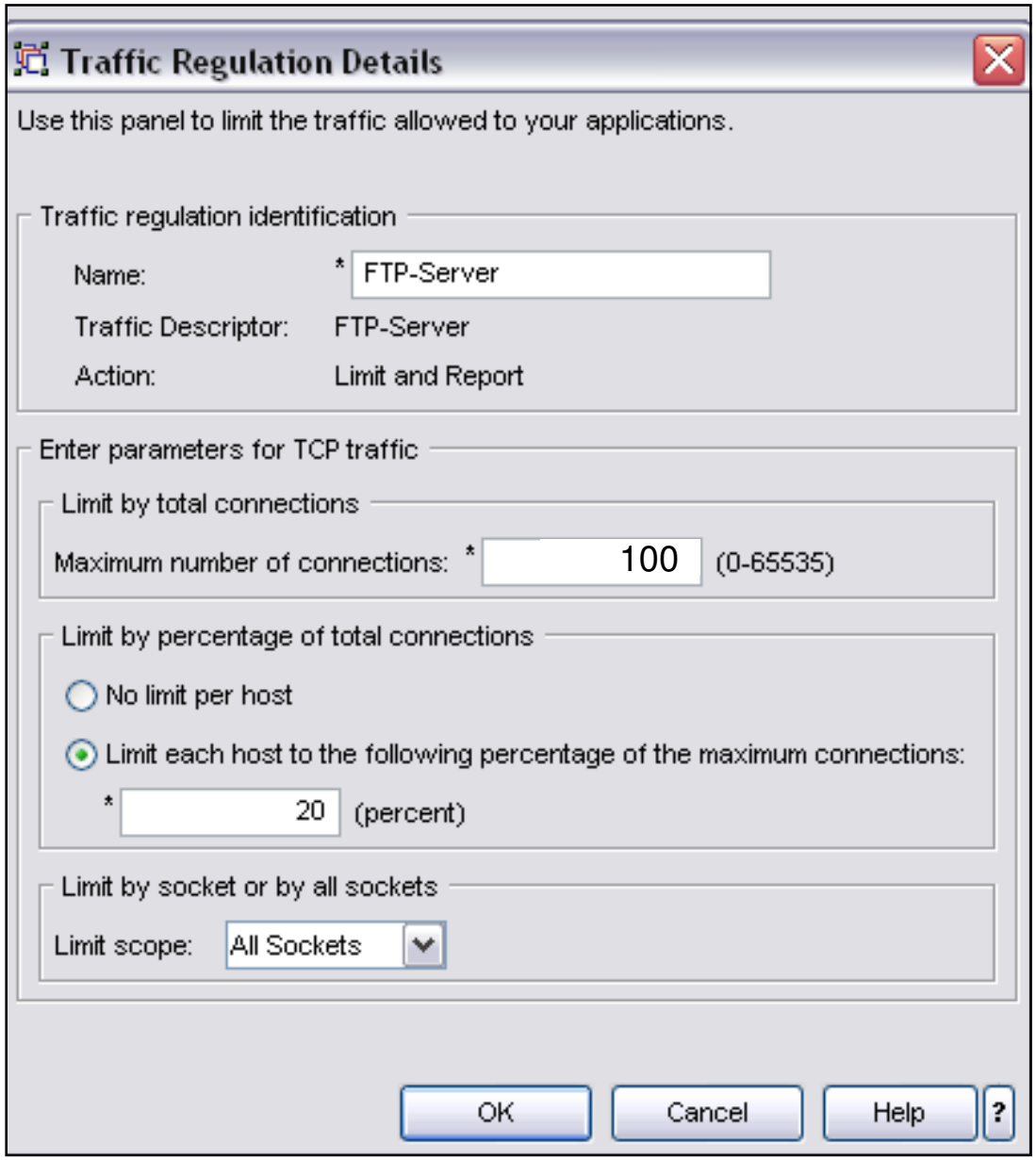
No traffic regulation defaults

- Policy selections are very system dependant
- System capacity a consideration in setting maximum limits

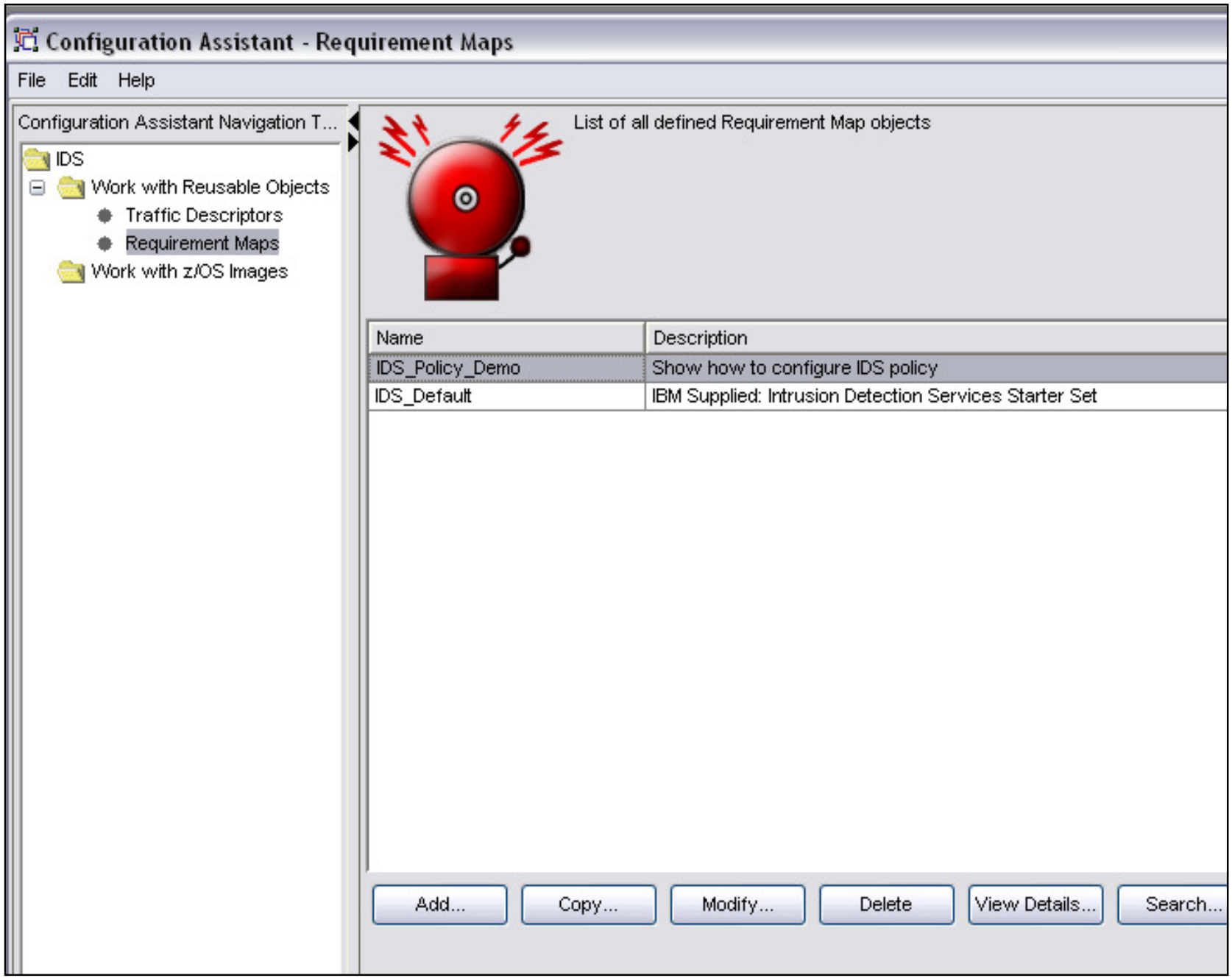
Define TCP TR Policy for FTP



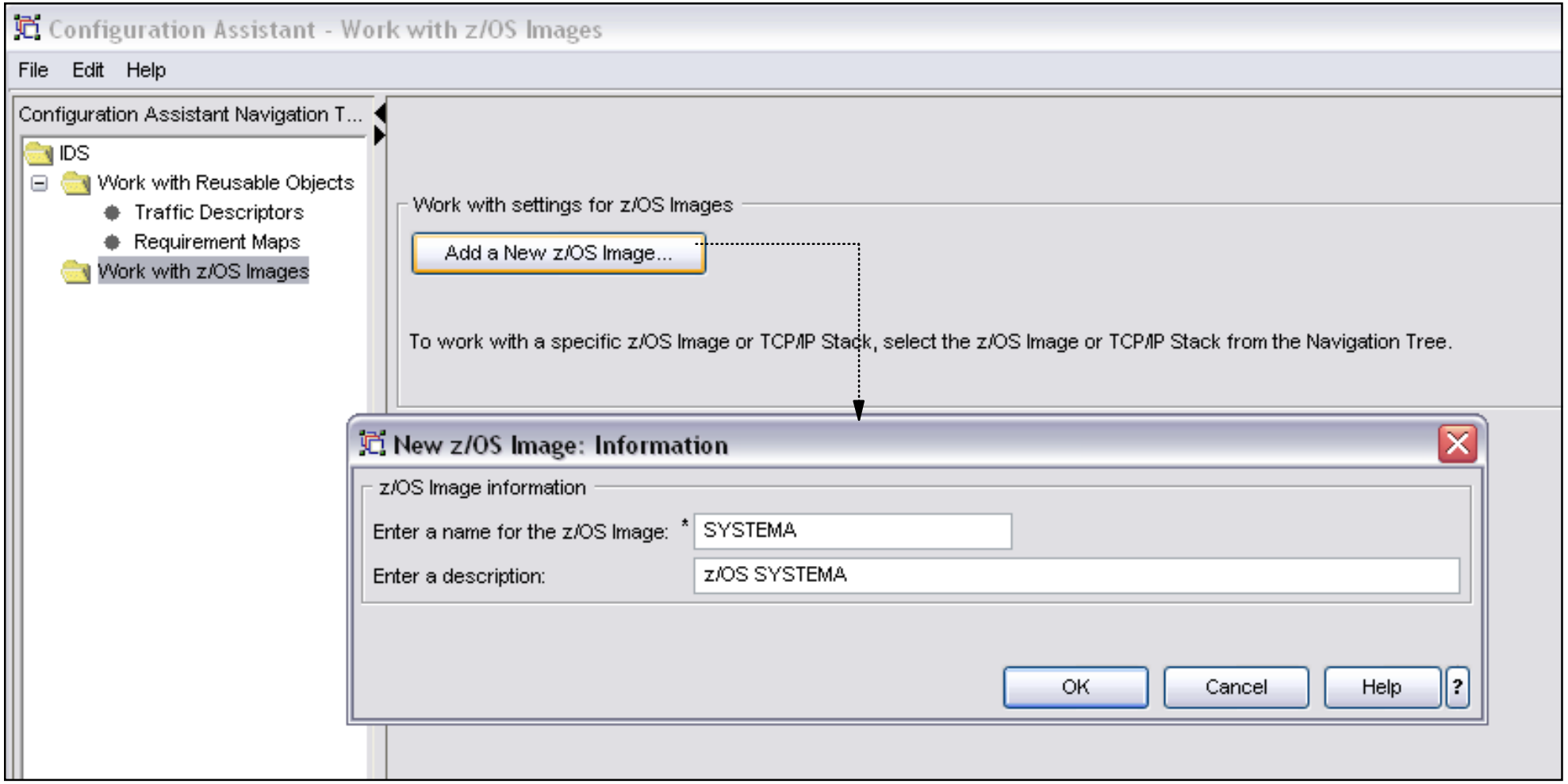
Set details for TR



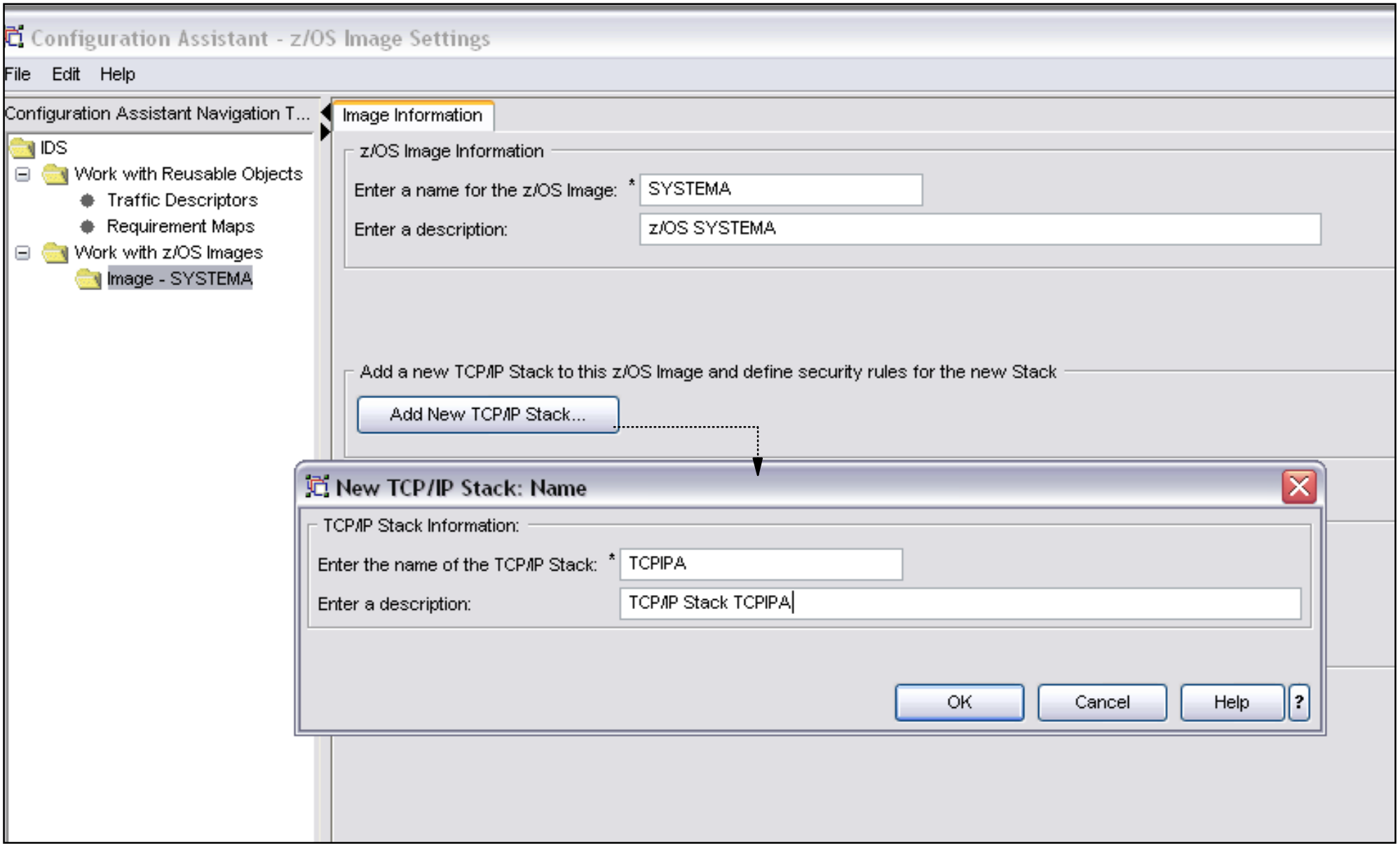
IDS_Policy_Demo
Requirements Map Now Created



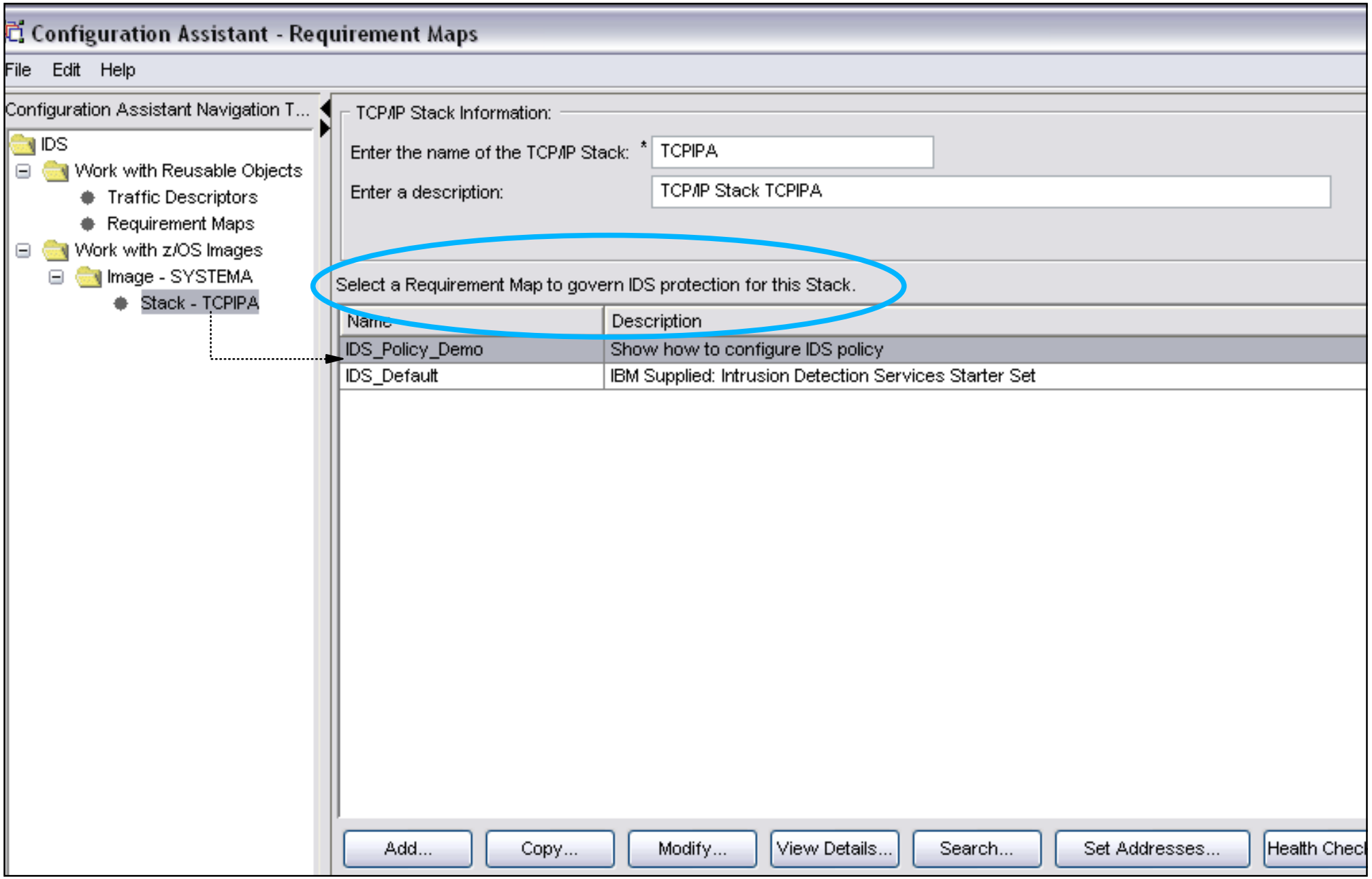
Create System Image



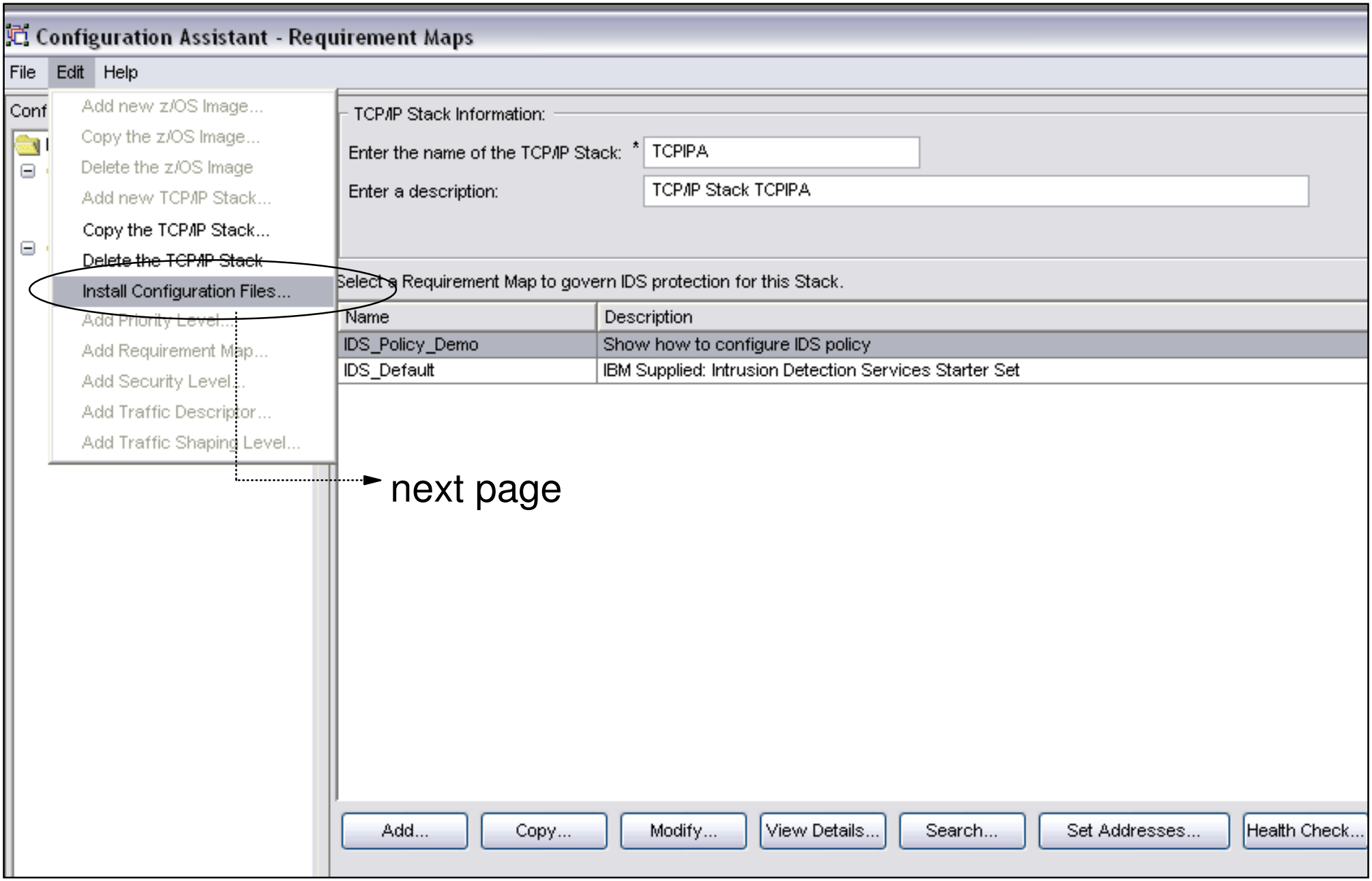
Create TCP/IP Stack



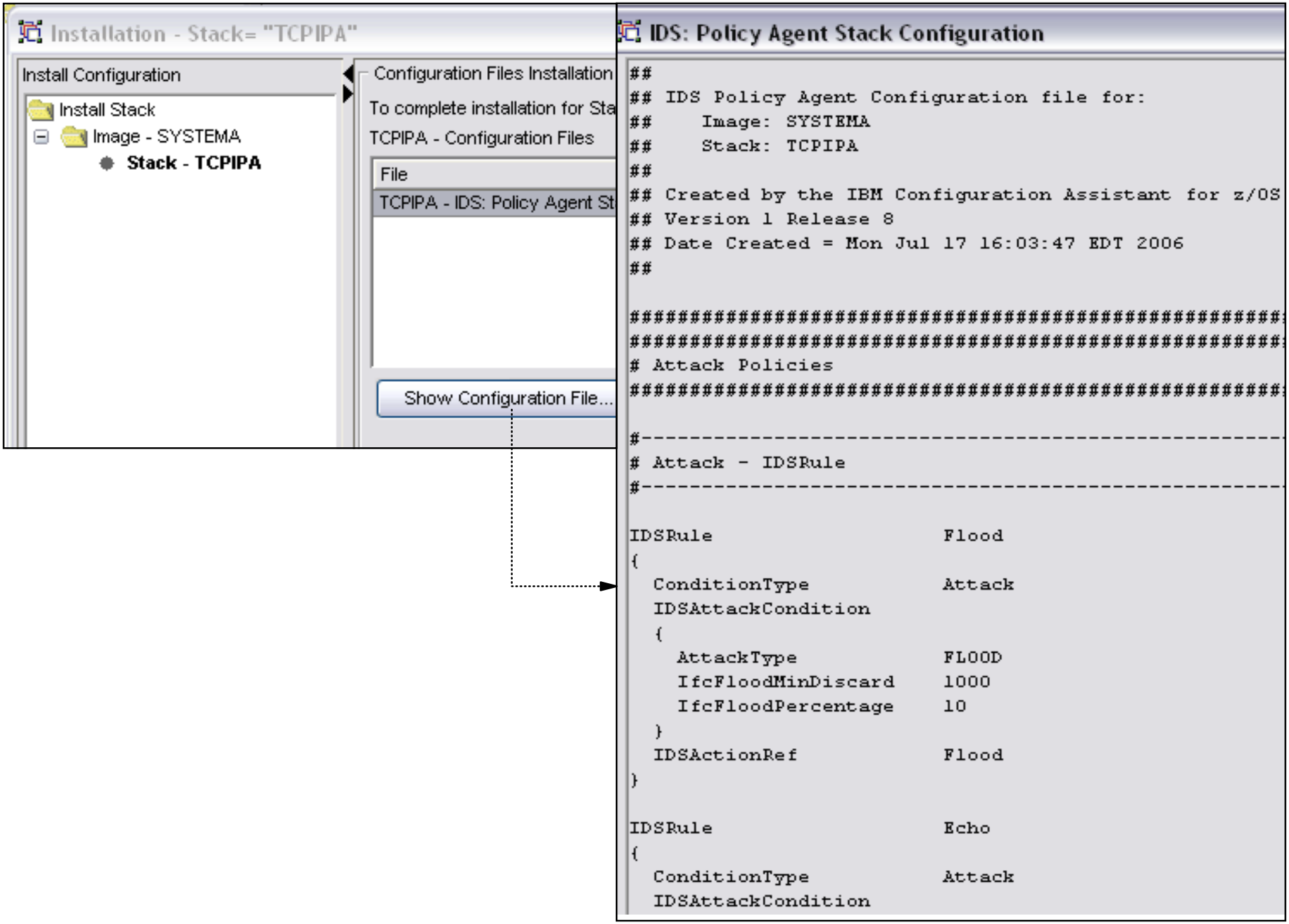
Associate TCP/Stack with Requirements Map



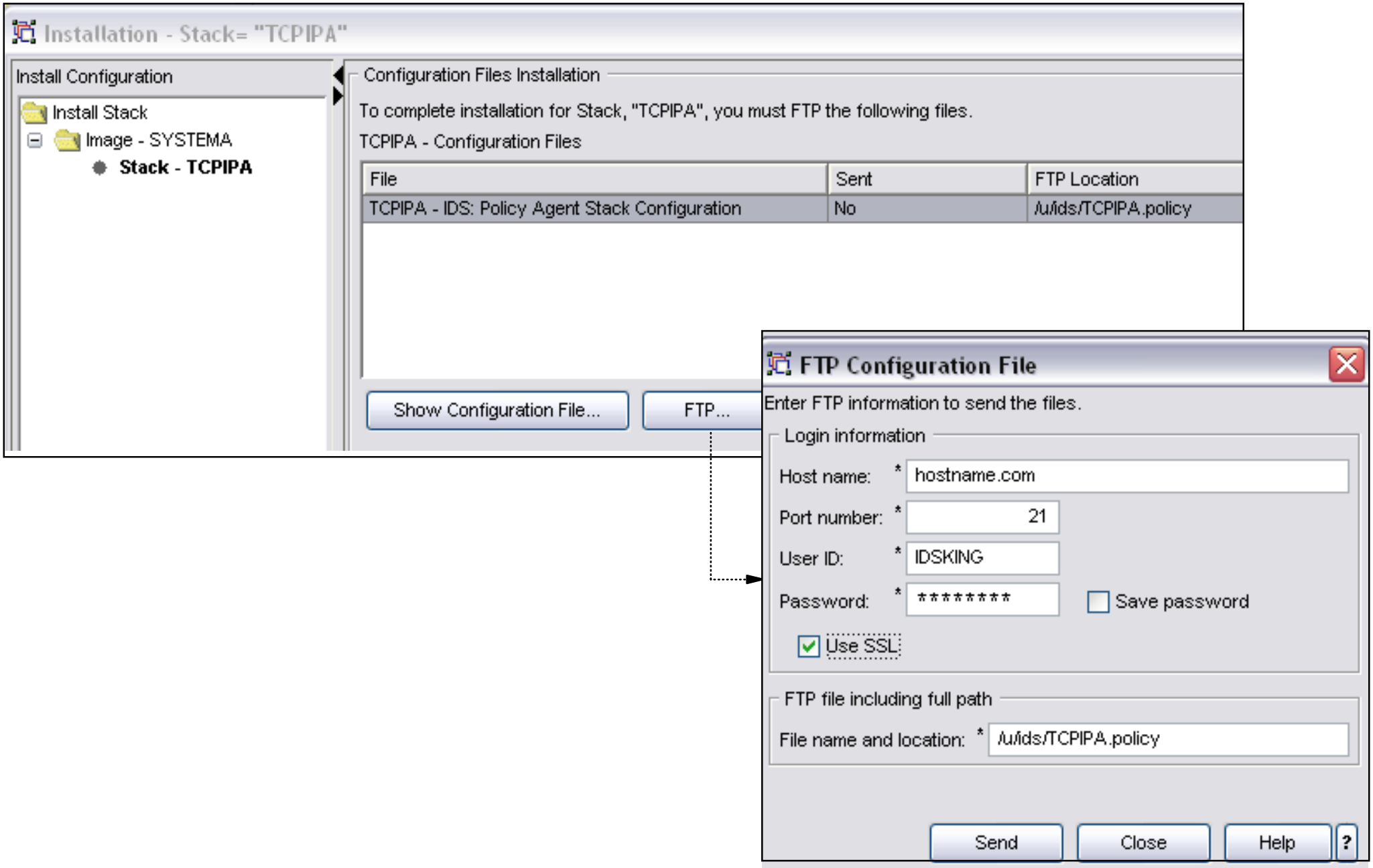
Install Configuration Files



Show the configuration file to be installed



Set up to transfer policy file to z/OS



z/OS Communications Server Security

Features Summary

IDS Features Summary

- **IDS events detected include:**
  - **Scan detection**
    - TCP port scans
    - UDP port scans
    - ICMP scans
      - ✓Sensitivity levels for all scans can be adjusted to control number of false positives recorded.
  - **Attack detection**
    - Malformed packet events
    - Outbound raw restrictions
    - Inbound fragment restrictions
    - IP option restrictions
    - IP protocol restrictions
    - ICMP redirect restrictions
    - Flood events (Synflood, Interface flood)
    - UDP perpetual echo
  - **Traffic Regulation**
    - UDP backlog management by port
      - ✓Packets discard
    - TCP total connection and source percentage management by port
      - ✓Connection limiting
- **IDS recording options**
  - **Event logging**
    - syslogd, local console
  - **Statistics**
    - syslogd
      - ✓normal, exception
  - **IDS packet trace after attack detected for offline analysis**
    - Number of packets traced for multi-packet events are limited
- **Reports and event handling**
  - **trmdstat produces reports from IDS syslogd records**
    - Summary and detailed
  - **IDS event handling by**
    - Tivoli NetView
    - Tivoli Security Information and Event Manager
- **Defensive filtering (z/OS V1R10)**
  - **Installed through ipsec command**
  - **Manually (by human being) or through automation (via external security event manager)**

z/OS Communications Server Security

Appendix A

- **Scan Probe Instance Event Classifications**

ICMP Scan Probe Instance Classification

Request Type	***Destination Address***	***Event Classification***
any	subnet base or broadcast	very suspicious
Information req	single host	possibly suspicious
Subnet Mask req	single host	possibly suspicious
Echo with IP Option Record Route	single host	possibly suspicious
Echo with Record Timestamp	single host	possibly suspicious
Echo or Timestamp, denied by QOS policy	single host	normal
Echo or Timestamp	single host	normal

UDP Scan Probe Instance Classification

Socket State	***Event***	***Event Classification***
RESERVED to no one	recv any packet	very suspicious
Unbound, not RESERVED	recv any packet	possibly suspicious - app may be temporarily down
Bound	packet rejected by QOS policy	normal
Bound	packet rejected by FW filtering	possibly suspicious
Bound	recv any packet	normal

TCP Scan Probe Instance Classification

Socket State	***Event***	***Event Classification***
Any state	recv unexpected flags (SYN+FIN...)	very suspicious
RESERVED	recv any packet	very suspicious
Unbound, not RESERVED	recv any packet	possibly suspicious - app may be temporarily down
Listen	recv SYN	classification deferred if syn queued.
Half open connection	recv ACK	normal - connection handshake completed
Half open connection	recv RST	possibly suspicious - scanner covering tracks?
Half open connection	final time out (and not syn flood)	very suspicious - scanner abandoning handshake?
Any connected state	seq# out of window	normal - perhaps duplicate packet
Any connected state	recv standalone SYN	normal - perhaps peer reboot
Any connected state	final time-out	possibly suspicious - peer abandoned connection

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/servers/eserver/zseries/networking	Networking: IBM zSeries Servers
http://www.ibm.com/software/network/commserver	IBM Software Communications Server products
http://www.ibm.com/software/network/commserver/zos/	z/OS Communications Server
http://www.ibm.com/software/network/commserver/z_lin/	Communications Server for Linux on zSeries
http://www.ibm.com/software/network/ccl	Communication Controller for Linux on zSeries
http://www.ibm.com/software/network/commserver/library	Communications Server products - white papers, product documentation, etc.
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	Requests For Comment (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