TPF Toolkit

TPF Users Group - Fall 2009
Migrating to z/TPF Using TPF Toolkit

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Education Session

AIM Enterprise Platform Software
IBM z/Transaction Processing Facility Enterprise Edition 1.1.0

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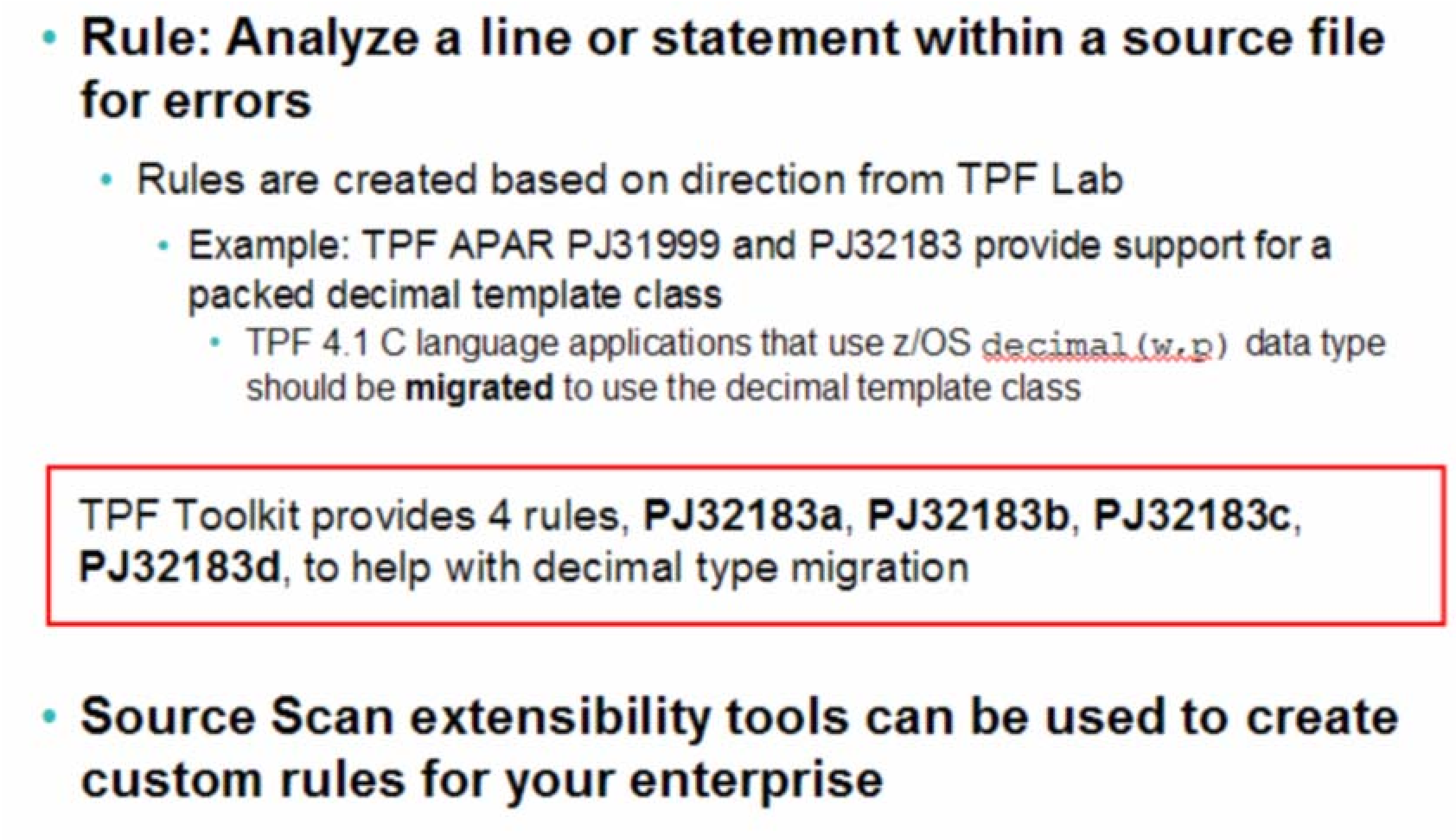
Agenda

- **Overview**
- **Source Scan Concepts**
- **Migration Process Overview**
  - *Analysis* – Planning & Estimation
  - *Implementation*
  - *Validation* – Maintaining Single Source Compliance
- **Source Scan Extensibility Tools**
- **Questions**

Overview – Source Scan

- **Source Scan – Code analysis tool in TPF Toolkit**
  - First introduced in TPF Toolkit v3.0 (2005)
- **What does Source Scan provide?**
  - **Single source**: Modify your source code so that it can be compiled on both TPF 4.1 and z/TPF
    - IBM provides many **rules** to detect migration problems
  - **Extensibility:** Add your own rules to TPF Toolkit to detect and fix migration problems specific to your environment
    - Can also be used for governance, to enforce coding standards
    - Set-up by administrators if required for migration purposes

Source Scan Concept – Rule



- **Rule: Analyze a line or statement within a source file for errors**
  - Rules are created based on direction from TPF Lab
    - Example: TPF APAR PJ31999 and PJ32183 provide support for a packed decimal template class
      - TPF 4.1 C language applications that use z/OS `decimal(w,p)` data type should be **migrated** to use the decimal template class

TPF Toolkit provides 4 rules, **PJ32183a**, **PJ32183b**, **PJ32183c**, **PJ32183d**, to help with decimal type migration

- **Source Scan extensibility tools can be used to create custom rules for your enterprise**

Types of Errors

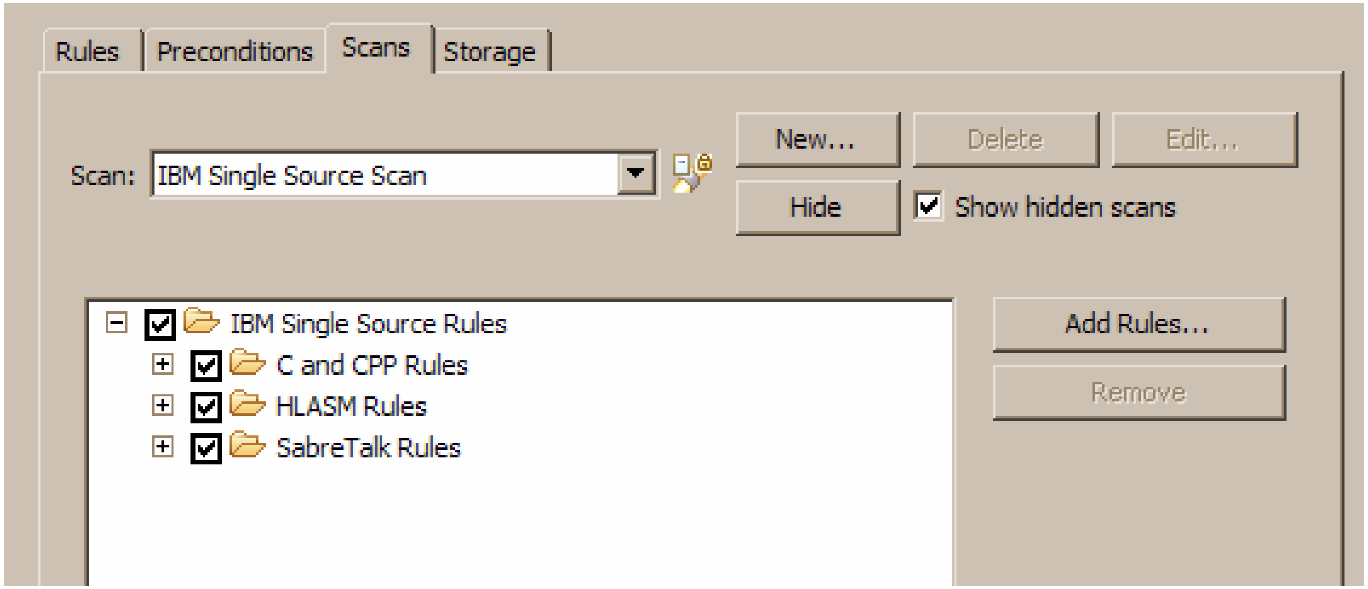
- **Rules flag either a *definite* or *potential* error**
  - *Definite error* – Source Scan has enough information to determine that there is a **definite** migration problem
  - *Potential error* – Source scan does not have enough information but there might be a **potential** migration problem
    - For example, lines in the source code might be a problem if certain runtime conditions are satisfied
    - Potential errors require further investigation by a developer

Types of Errors

- **Rules provide either an *automatic* fix or require a *manual* fix**
  - *Automatic fix* – Source Scan **can make the code change** for you to migrate your source code
  - *Manual fix* – Source scan **cannot make the code change** because additional information is required
    - Manual errors require further investigation by a developer

Source Scan Concept – Scan

- **Scan: A collection of rules used to analyze a file**
  - IBM provides the **IBM Single Source Scan**
    - Contains a set of IBM-supplied C/C++, HLAsm and SabreTalk rules
    - Can be used immediately for migration scans



Scan: IBM Single Source Scan

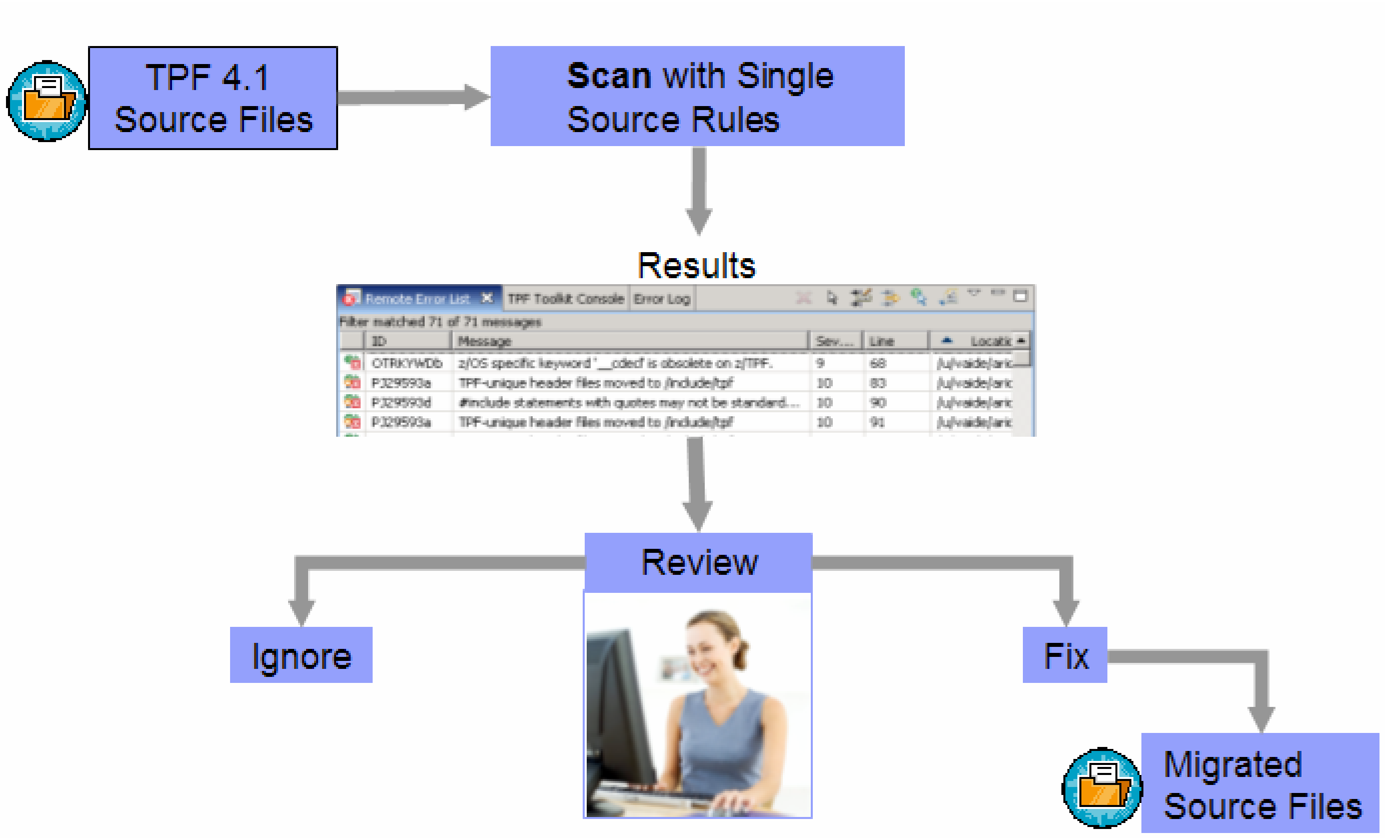
☑ Show hidden scans

- ☑ IBM Single Source Rules
  - ☑ C and CPP Rules
  - ☑ HLASM Rules
  - ☑ SabreTalk Rules

Source Scan Concept – Scan

- **IBM Single Source Scan can be modified to include custom enterprise rules**
- **Single Source extensibility tools can be used to create custom scans for your enterprise**
  - Custom scans can include IBM-supplied rules and custom rules

Migration Process Overview



TPF 4.1 Source Files

Scan with Single Source Rules

Results

Filter matched 71 of 71 messages

ID	Message	Sev...	Line	Locatio
OTRKYWDb	z/OS specific keyword '__cdecl' is obsolete on z/TPF.	9	68	/u/vaide/aric
PJ29593a	TPF-unique header files moved to /include/tpf	10	83	/u/vaide/aric
PJ29593d	#include statements with quotes may not be standard...	10	90	/u/vaide/aric
PJ29593a	TPF-unique header files moved to /include/tpf	10	91	/u/vaide/aric

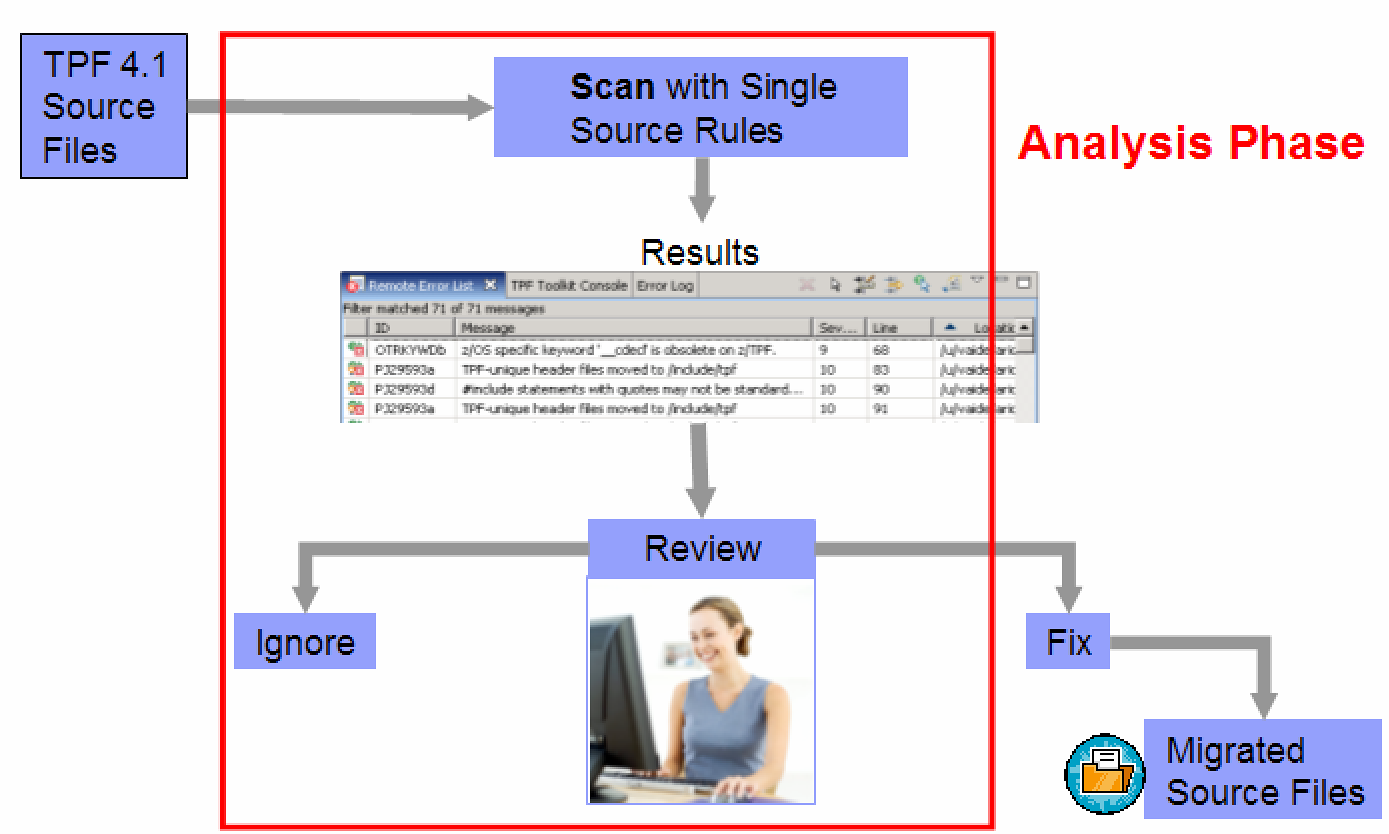
Review

Ignore

Fix

Migrated Source Files

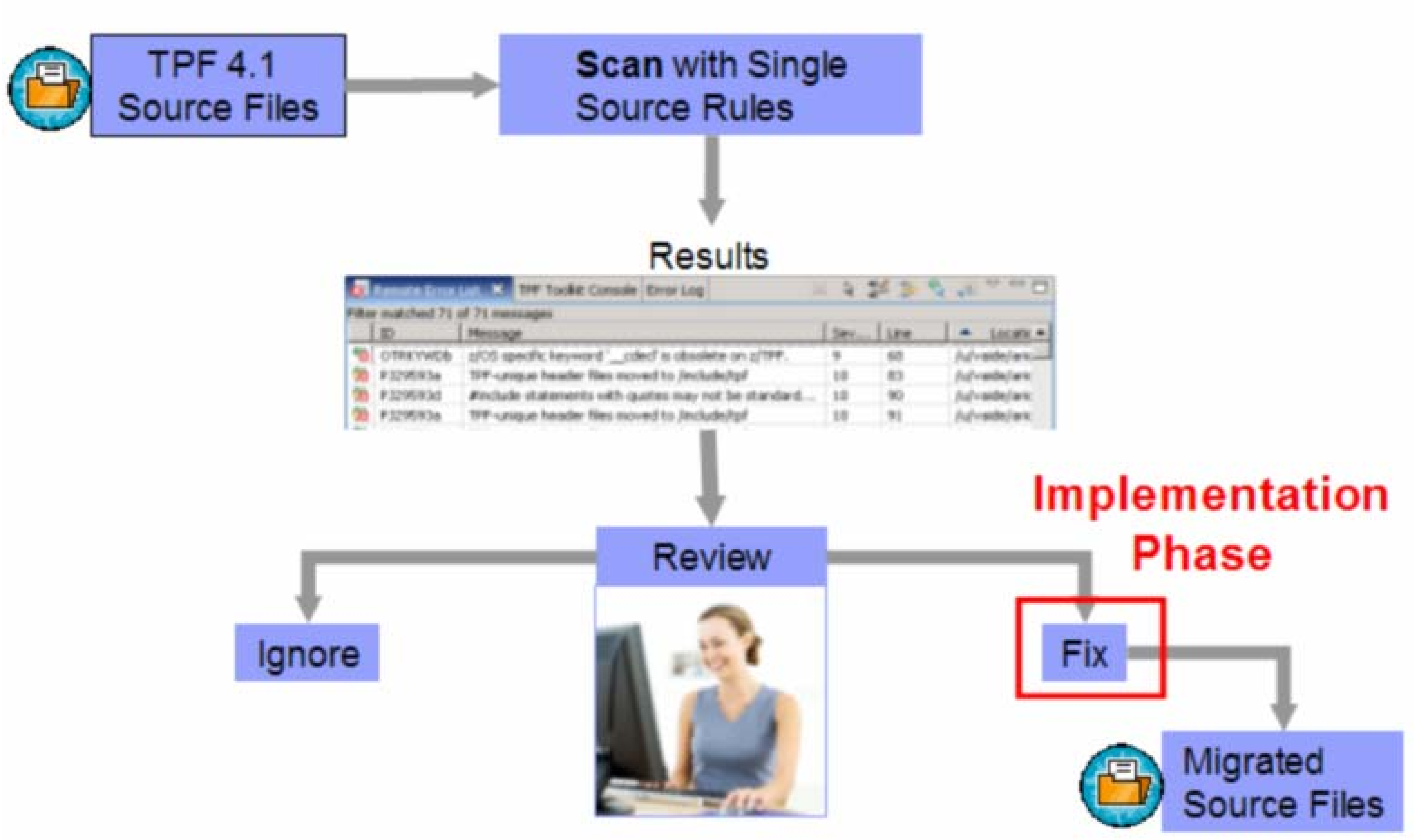
Migration Process Overview



Filter matched 71 of 71 messages

ID	Message	Sev...	Line	Locatic
OTRKYWDb	z/OS specific keyword '__cdecl' is obsolete on z/TPF.	9	68	/u/vaidearic
P329593a	TPF-unique header files moved to /include/tpf	10	83	/u/vaidearic
P329593d	#include statements with quotes may not be standard...	10	90	/u/vaidearic
P329593a	TPF-unique header files moved to /include/tpf	10	91	/u/vaidearic

Migration Process Overview

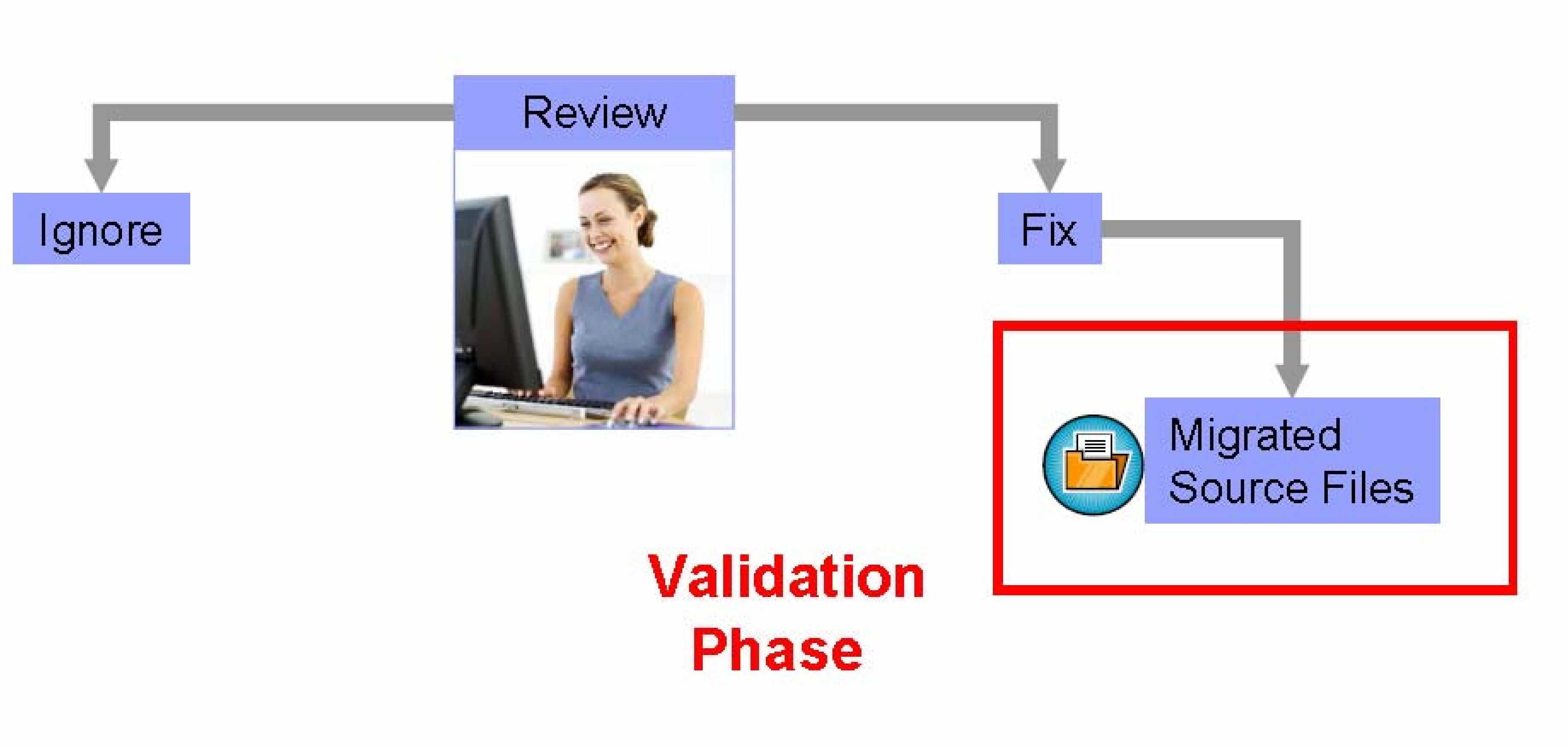


Remote Error List | TPF Toolkit Console | Error Log

Filter matched 71 of 71 messages

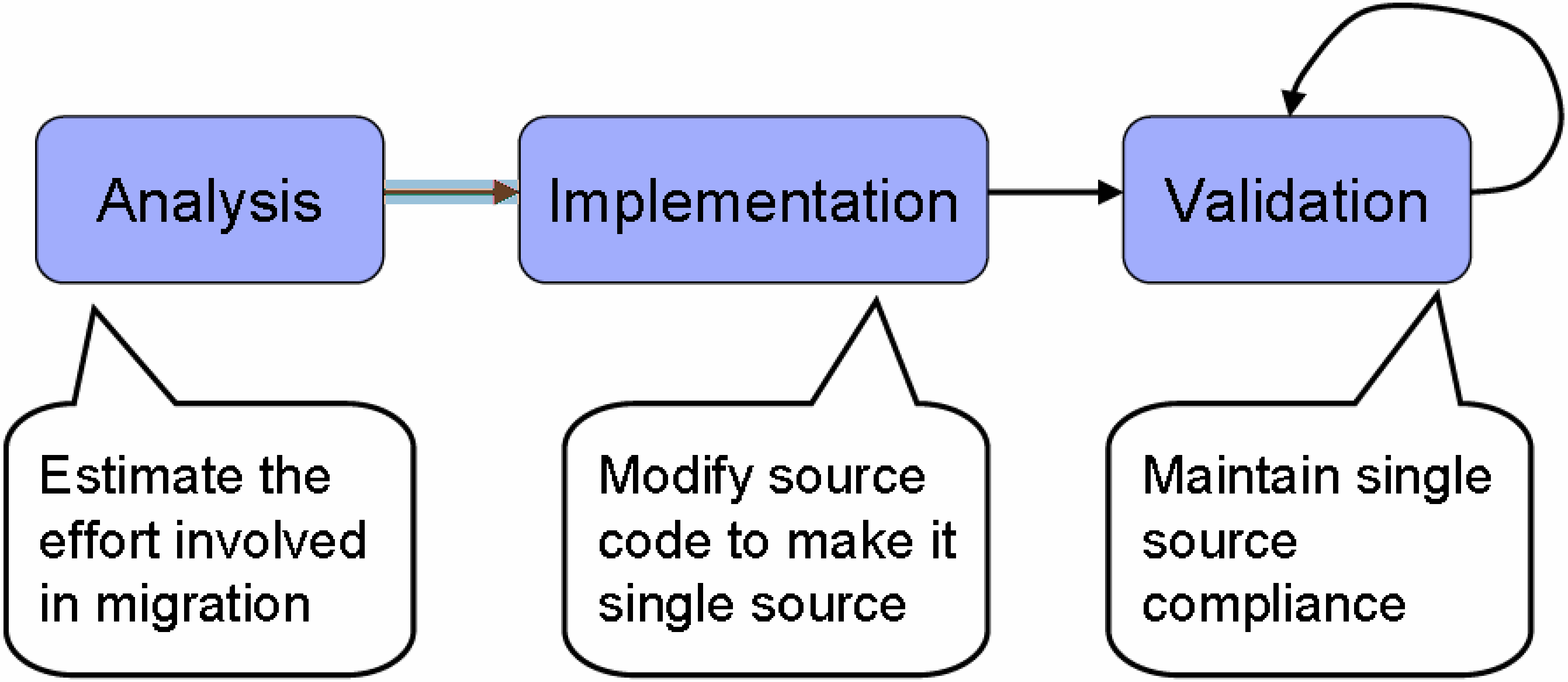
ID	Message	Sev...	Line	Locati...
OTRKYWDB	z/OS specific keyword '__cdecl' is obsolete on z/TPF.	9	60	/u/vaide/arc
P329593a	TPF-unique header files moved to /include/tpf	10	83	/u/vaide/arc
P329593d	#include statements with quotes may not be standard...	10	90	/u/vaide/arc
P329593a	TPF-unique header files moved to /include/tpf	10	91	/u/vaide/arc

Migration Process Overview



Migration Process Overview

- **Three typical stages of a migration effort:**



Analysis

Implementation

Validation

Estimate the effort involved in migration

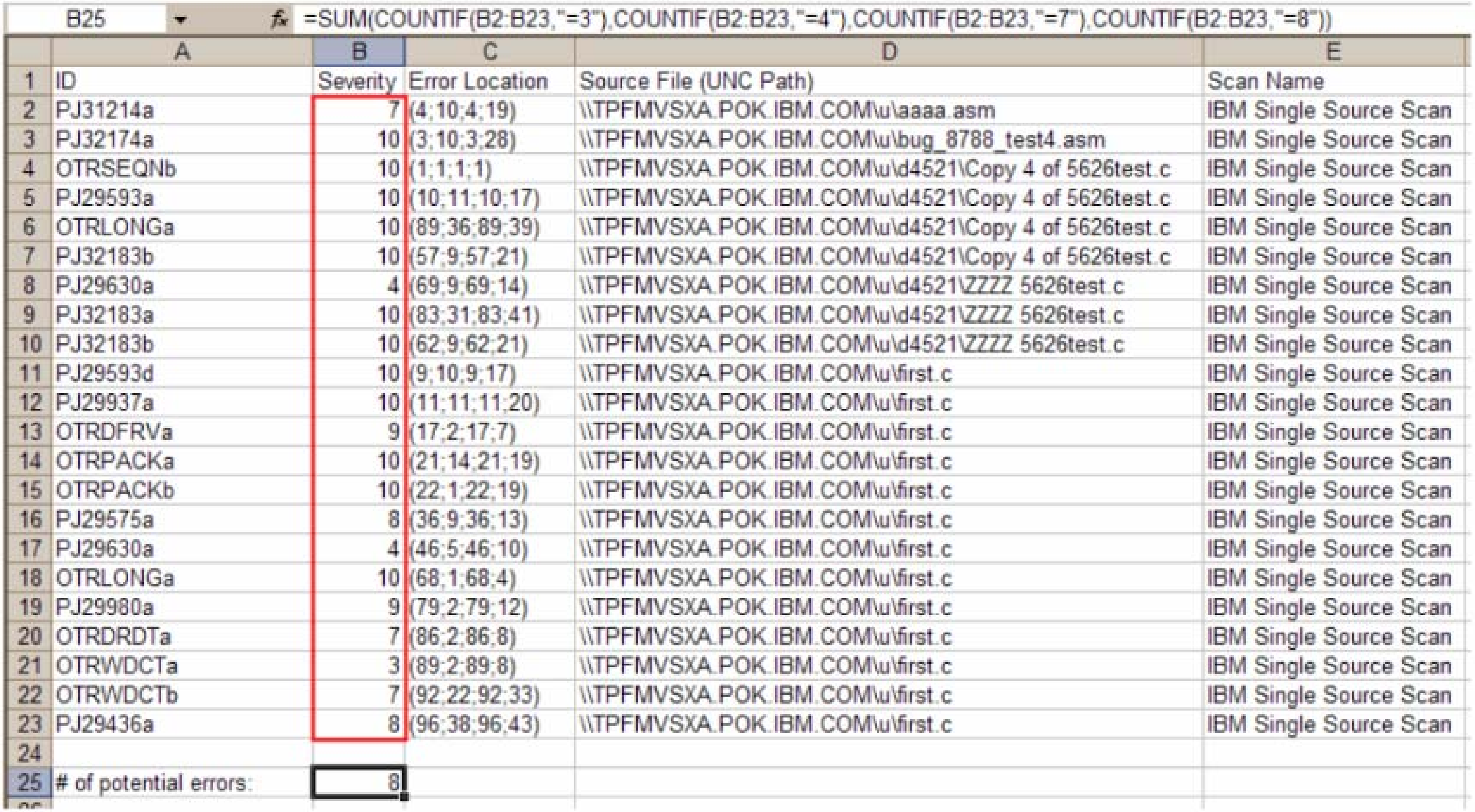
Modify source code to make it single source

Maintain single source compliance

Analysis Phase

- **TPF Toolkit provides ability to scan entire directories and generate a CSV errors file**
  - Errors file can be analyzed to produce metrics
  - For example, CSV file can be imported into Microsoft Excel
- **Estimate migration effort using metrics**
  - # of potential errors – Will require further investigation
  - # of errors with manual fixes – Will require modifications to source code by a developer

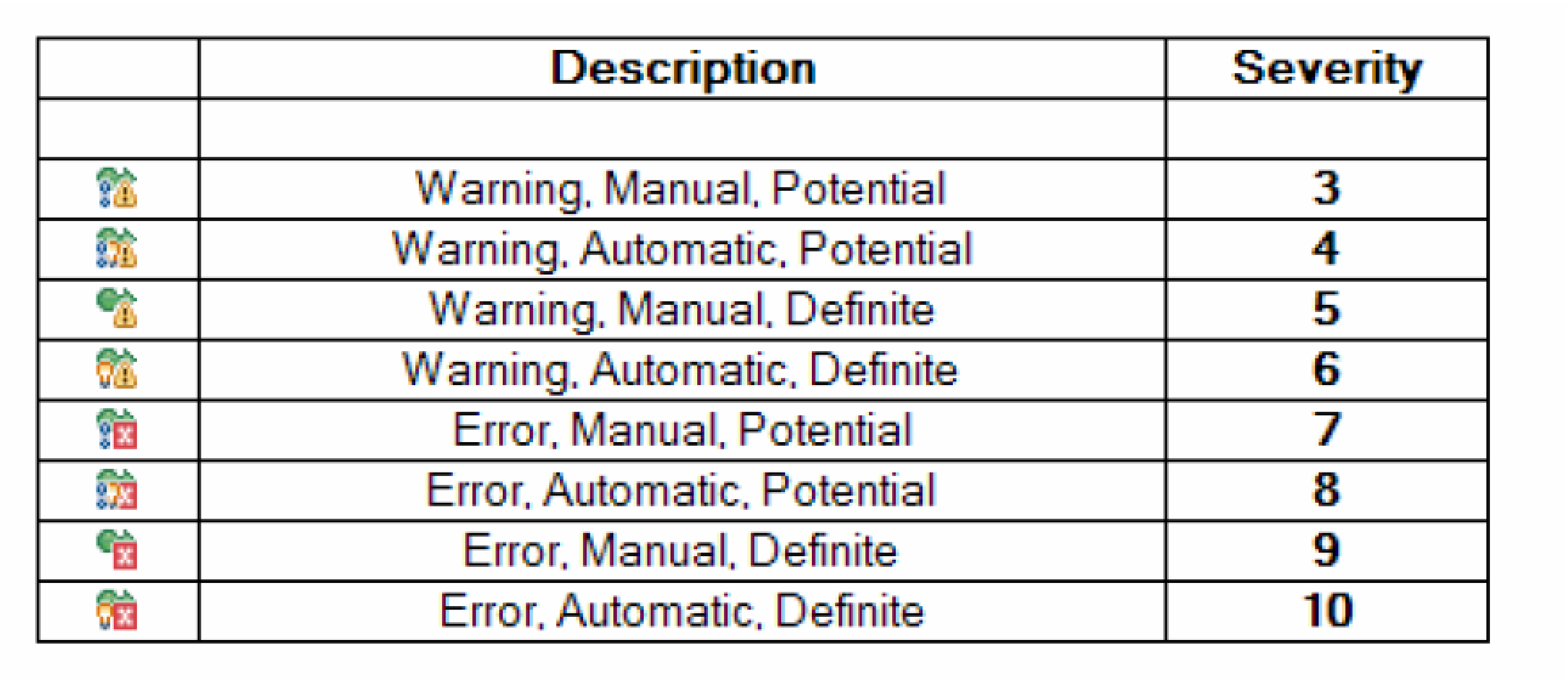
Analysis Phase



B25 fx =SUM(COUNTIF(B2:B23,"=3"),COUNTIF(B2:B23,"=4"),COUNTIF(B2:B23,"=7"),COUNTIF(B2:B23,"=8"))

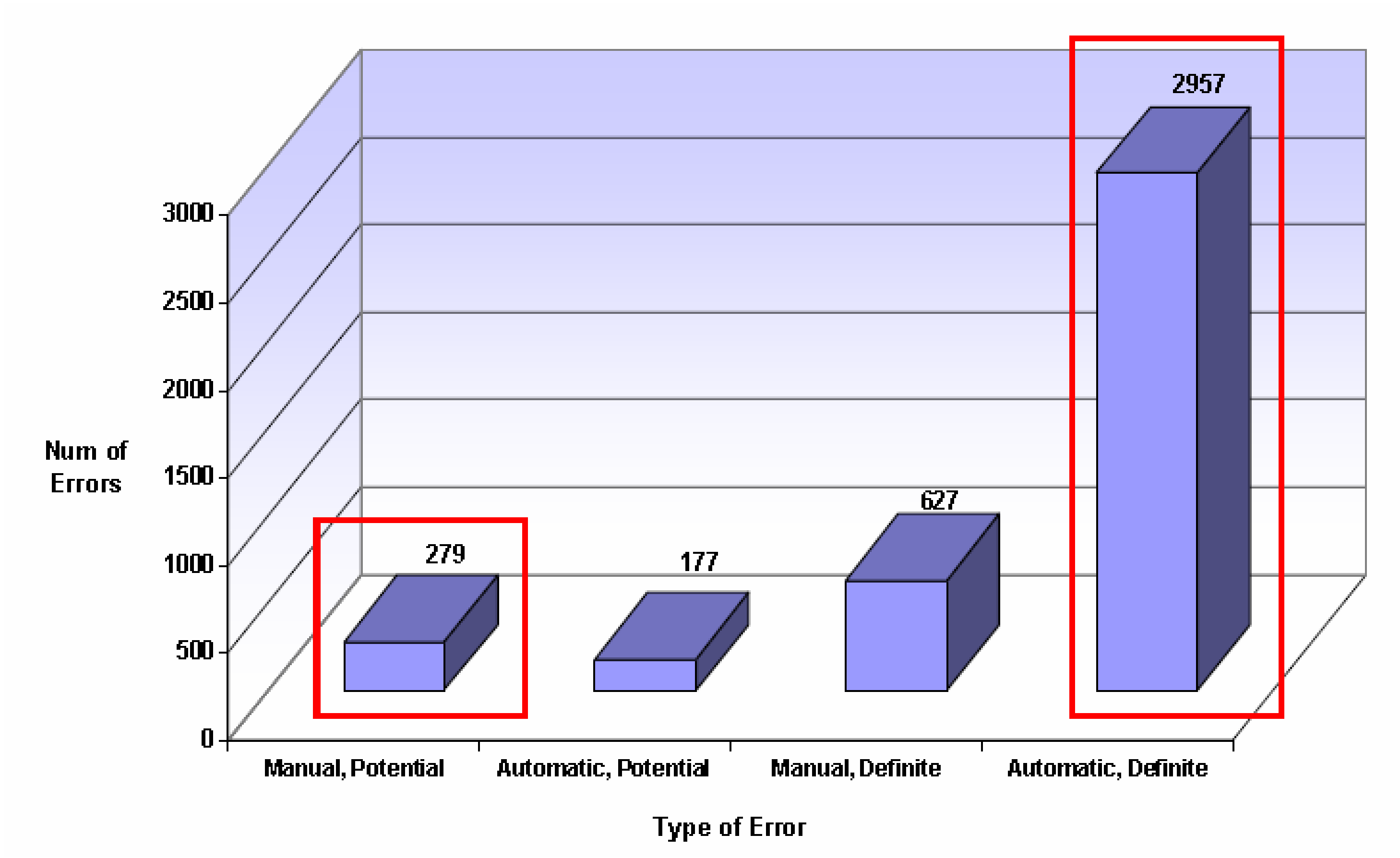
	A	B	C	D	E
1	ID	Severity	Error Location	Source File (UNC Path)	Scan Name
2	PJ31214a	7	(4;10;4;19)	\\TPFMVSXA.POK.IBM.COM\u\aaaa.asm	IBM Single Source Scan
3	PJ32174a	10	(3;10;3;28)	\\TPFMVSXA.POK.IBM.COM\u\bug_8788_test4.asm	IBM Single Source Scan
4	OTRSEQNb	10	(1;1;1;1)	\\TPFMVSXA.POK.IBM.COM\u\d4521\Copy 4 of 5626test.c	IBM Single Source Scan
5	PJ29593a	10	(10;11;10;17)	\\TPFMVSXA.POK.IBM.COM\u\d4521\Copy 4 of 5626test.c	IBM Single Source Scan
6	OTRLONGa	10	(89;36;89;39)	\\TPFMVSXA.POK.IBM.COM\u\d4521\Copy 4 of 5626test.c	IBM Single Source Scan
7	PJ32183b	10	(57;9;57;21)	\\TPFMVSXA.POK.IBM.COM\u\d4521\Copy 4 of 5626test.c	IBM Single Source Scan
8	PJ29630a	4	(69;9;69;14)	\\TPFMVSXA.POK.IBM.COM\u\d4521\ZZZZ 5626test.c	IBM Single Source Scan
9	PJ32183a	10	(83;31;83;41)	\\TPFMVSXA.POK.IBM.COM\u\d4521\ZZZZ 5626test.c	IBM Single Source Scan
10	PJ32183b	10	(62;9;62;21)	\\TPFMVSXA.POK.IBM.COM\u\d4521\ZZZZ 5626test.c	IBM Single Source Scan
11	PJ29593d	10	(9;10;9;17)	\\TPFMVSXA.POK.IBM.COM\u\first.c	IBM Single Source Scan
12	PJ29937a	10	(11;11;11;20)	\\TPFMVSXA.POK.IBM.COM\u\first.c	IBM Single Source Scan
13	OTRDFRVa	9	(17;2;17;7)	\\TPFMVSXA.POK.IBM.COM\u\first.c	IBM Single Source Scan
14	OTRPACKa	10	(21;14;21;19)	\\TPFMVSXA.POK.IBM.COM\u\first.c	IBM Single Source Scan
15	OTRPACKb	10	(22;1;22;19)	\\TPFMVSXA.POK.IBM.COM\u\first.c	IBM Single Source Scan
16	PJ29575a	8	(36;9;36;13)	\\TPFMVSXA.POK.IBM.COM\u\first.c	IBM Single Source Scan
17	PJ29630a	4	(46;5;46;10)	\\TPFMVSXA.POK.IBM.COM\u\first.c	IBM Single Source Scan
18	OTRLONGa	10	(68;1;68;4)	\\TPFMVSXA.POK.IBM.COM\u\first.c	IBM Single Source Scan
19	PJ29980a	9	(79;2;79;12)	\\TPFMVSXA.POK.IBM.COM\u\first.c	IBM Single Source Scan
20	OTRDRDTa	7	(86;2;86;8)	\\TPFMVSXA.POK.IBM.COM\u\first.c	IBM Single Source Scan
21	OTRWDCTa	3	(89;2;89;8)	\\TPFMVSXA.POK.IBM.COM\u\first.c	IBM Single Source Scan
22	OTRWDCTb	7	(92;22;92;33)	\\TPFMVSXA.POK.IBM.COM\u\first.c	IBM Single Source Scan
23	PJ29436a	8	(96;38;96;43)	\\TPFMVSXA.POK.IBM.COM\u\first.c	IBM Single Source Scan
24					
25	# of potential errors:	8			

Types of Errors



	Description	Severity
	Warning, Manual, Potential	3
	Warning, Automatic, Potential	4
	Warning, Manual, Definite	5
	Warning, Automatic, Definite	6
	Error, Manual, Potential	7
	Error, Automatic, Potential	8
	Error, Manual, Definite	9
	Error, Automatic, Definite	10

Analysis Phase



Demo – Generating Metrics in Analysis Phase

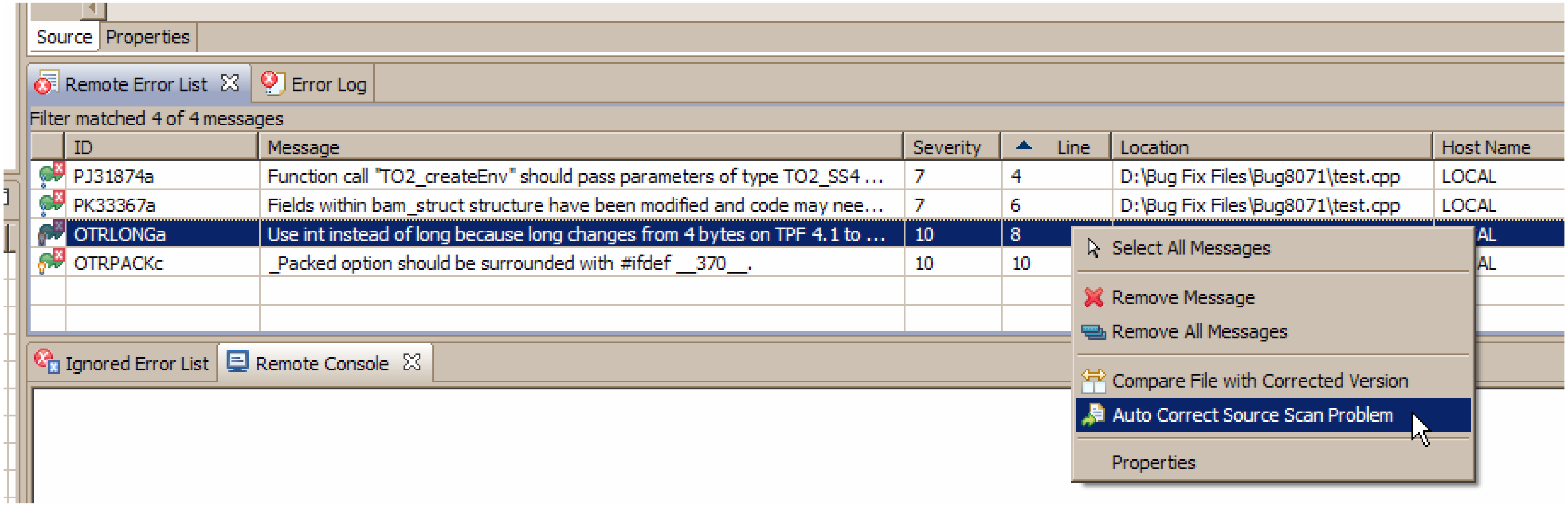
Analysis Phase

- **Potential errors can be ignored through TPF Toolkit**
  - Solution for a multi-user environment
  - Ignored errors are not flagged in subsequent scans by any user

Demo – Ignoring Errors through TPF Toolkit

Implementation Phase: Automatic Fixes

- **Fix errors using TPF Toolkit**
  - *Auto Correct action* – Fix multiple errors automatically through the Remote Error List

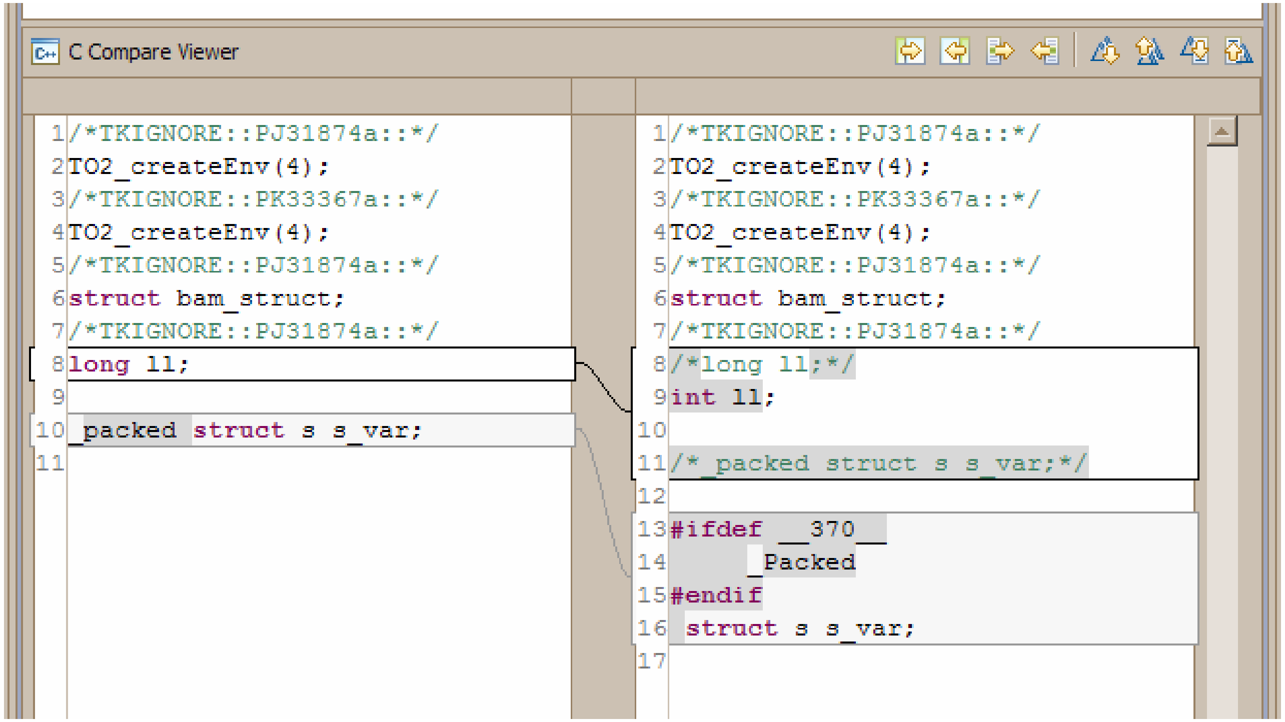


Filter matched 4 of 4 messages

ID	Message	Severity	▲ Line	Location	Host Name
PJ31874a	Function call "TO2_createEnv" should pass parameters of type TO2_SS4 …	7	4	D:\Bug Fix Files\Bug8071\test.cpp	LOCAL
PK33367a	Fields within bam_struct structure have been modified and code may nee…	7	6	D:\Bug Fix Files\Bug8071\test.cpp	LOCAL
OTRLONGa	Use int instead of long because long changes from 4 bytes on TPF 4.1 to …	10	8		AL
OTRPACKc	_Packed option should be surrounded with #ifdef __370__.	10	10		AL

Implementation Phase: Automatic Fixes

- **Fix errors using TPF Toolkit**
  - *Compare editor* – Fix errors by comparing original source file with a corrected version

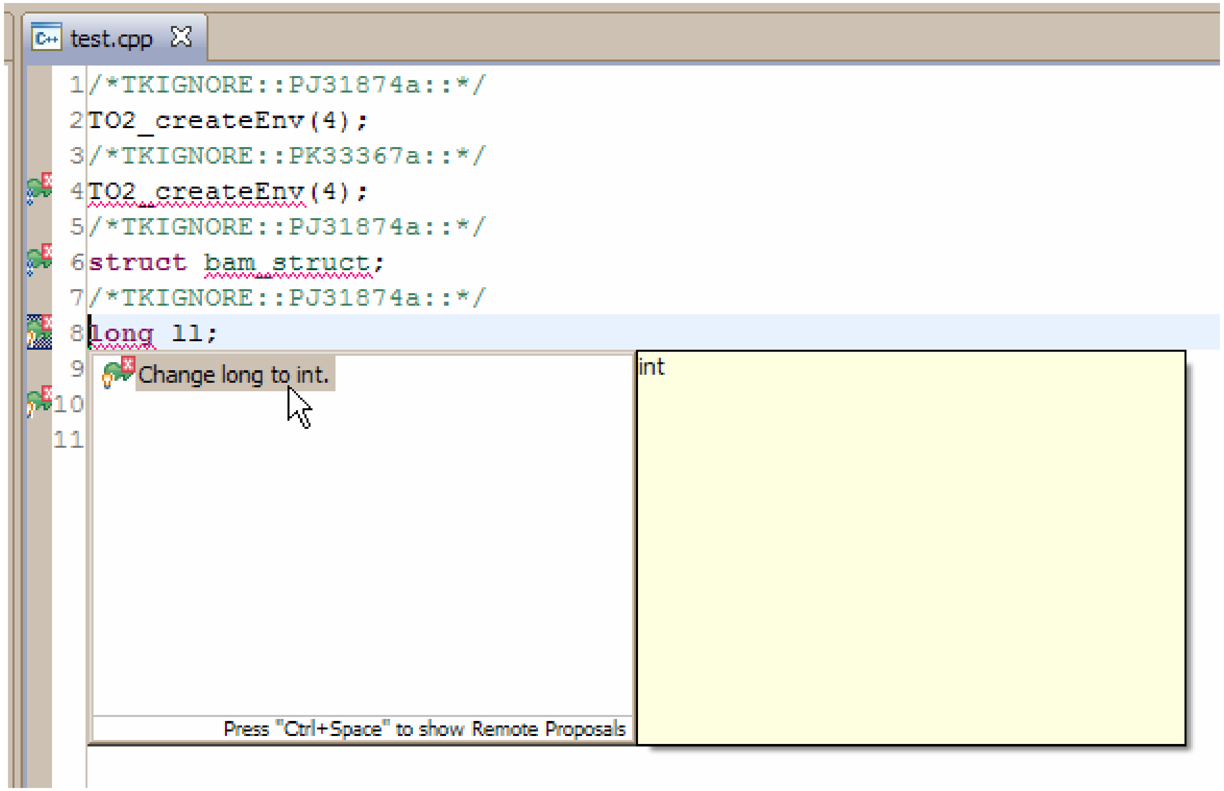


```
/*TKIGNORE::PJ31874a::*/
TO2_createEnv(4);
/*TKIGNORE::PK33367a::*/
TO2_createEnv(4);
/*TKIGNORE::PJ31874a::*/
struct bam_struct;
/*TKIGNORE::PJ31874a::*/
long ll;

_packed struct s s_var;

```

```
/*TKIGNORE::PJ31874a::*/
TO2_createEnv(4);
/*TKIGNORE::PK33367a::*/
TO2_createEnv(4);
/*TKIGNORE::PJ31874a::*/
struct bam_struct;
/*TKIGNORE::PJ31874a::*/
/*long ll;*/
int ll;

/*_packed struct s s_var;*/

#ifdef __370__
      _Packed
#endif
 struct s s_var;

```

Implementation Phase: Automatic Fixes

- **Fix errors using TPF Toolkit**
  - *Quick-fix action* – Fix individual errors through an editor



```
/*TKIGNORE::PJ31874a::*/
TO2_createEnv(4);
/*TKIGNORE::PK33367a::*/
TO2_createEnv(4);
/*TKIGNORE::PJ31874a::*/
struct bam_struct;
/*TKIGNORE::PJ31874a::*/
long ll;
```

Implementation Phase: Manual Fixes

- **Developers need to investigate these errors**
- **A number of resources are available to assist:**
  - TPF Toolkit documentation
  - Information in the TPF Single Source APARs
  - z/TPF Migration Guide

  http://www-306.ibm.com/software/htp/tpf/pages/gtpm1mst.pdf

Demo – Fixing Errors through TPF Toolkit

Validation Phase

- **Ensure that migrated code remains single source compliant**

- **Validation when files are edited by users**
  - Errors are automatically flagged when file is saved

Validation Phase

- **Command-line tool to scan source directories**
  - Schedule nightly scans of source code
- **Validation using custom enterprise actions**
  - For example, create a source check-in action which only proceeds if no single source errors are present in file

Demo – Validation in TPF Toolkit

Source Scan Extensibility Tools

- **Extensibility tools allow you to create:**
  - Custom rules – Detect errors specific to your enterprise
  - Custom scans – Group rules according to your needs
    - For example, create a validation scan containing custom governance rules
  - Custom categories – Used to organize rules
    - For example, organize rules by language

Rule Creation Summary

- **Step 1 – Choose or Create a Category**
- **Step 2 – Invoke the New Rule Wizard**
- **Step 3 – Supply general rule information**
- **Step 4 – Choose a language and Detection Template**
- **Step 5 – Provide required template data**
- **Step 6 – Choose and customize a fix**
- **Step 7 – Add the new rule to a scan**
- **Step 8 – Test the new rule**

Templates

- **Detection Templates**
  - Used to describe what the rule will look for
  - C/C++ detection templates
  - ASM detection template

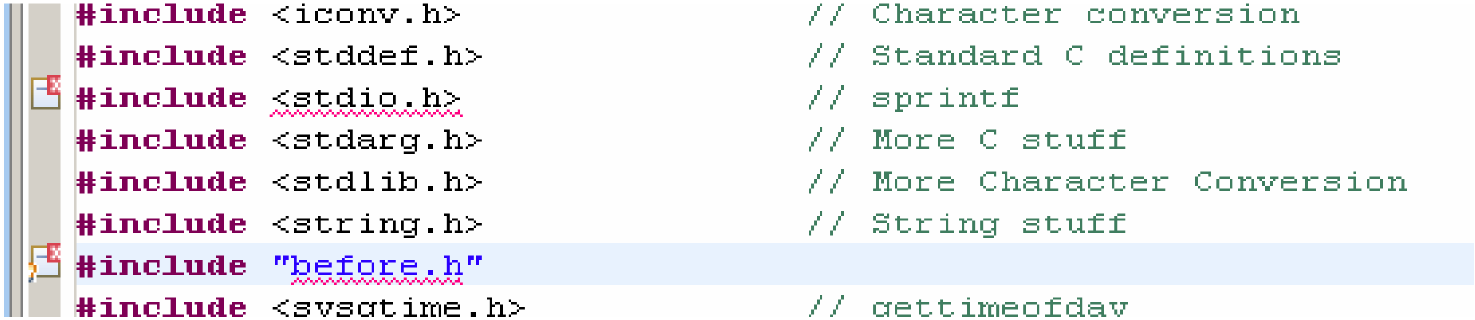
- **Fix Templates**
  - Used to describe how a fix can be made if an error is found
  - C/C++ fix templates
  - ASM fix template

C/CPP Templates

- **CPP Include Statement Rule Template**
- **CPP Plain Text Matching Rule Template**
- **CPP Type Usage Rule Template**
- **CPP Directive Rule Template**
- **CPP Function Call Rule Template**
- **CPP Constant Rule Template**

CPP Include Statement Rule Template

- **Examines only #include directives**
- **Examples:**
  - Flag before.h
  - Flag stdio.h when it is included using angled brackets

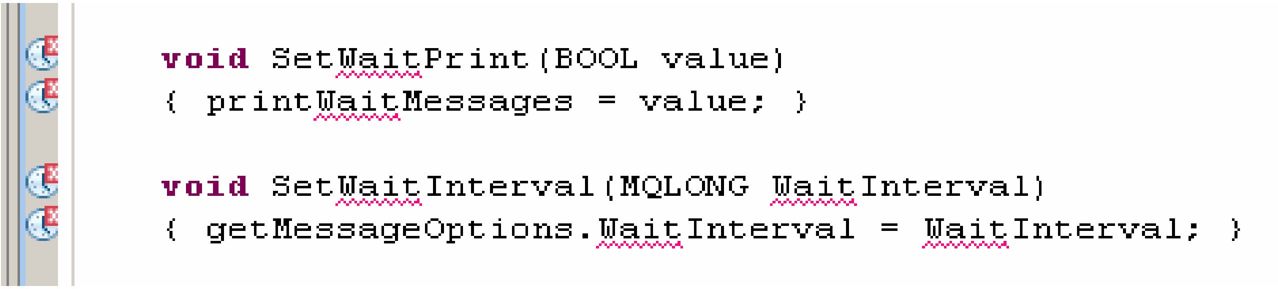


```
#include <iconv.h>                 // Character conversion
#include <stddef.h>                // Standard C definitions
#include <stdio.h>                 // sprintf
#include <stdarg.h>                // More C stuff
#include <stdlib.h>                // More Character Conversion
#include <string.h>                // String stuff
#include "before.h"
#include <sysgtime.h>              // gettimeofday
```

- **Single Source example: PJ29593b - Remove $ symbol from all header file names**

CPP Plain Text Matching Rule

- **Examines all text in the file (option to exclude comment lines)**
- **Most generic rule - use this template when other more specific templates don't apply**
- **Example: Flag all usage of the word 'Wait'**

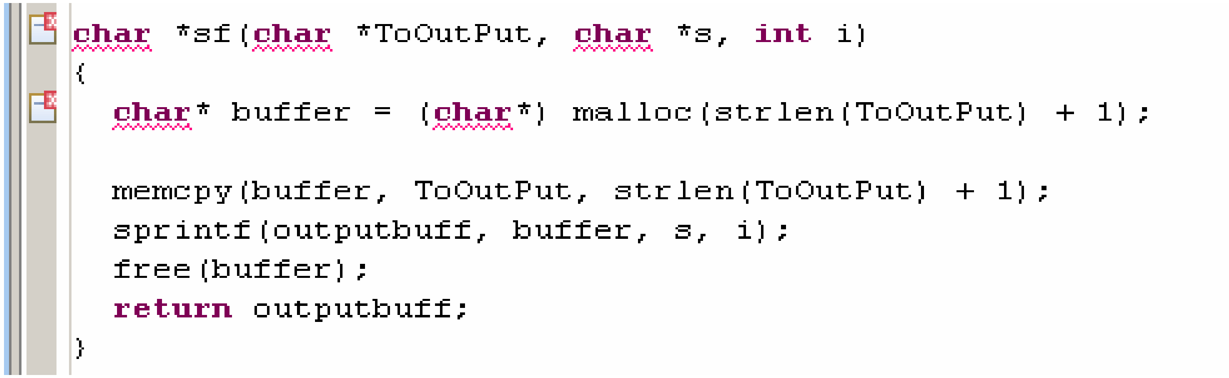


```
void SetWaitPrint(BOOL value)
{ printWaitMessages = value; }

void SetWaitInterval(MQLONG WaitInterval)
{ getMessageOptions.WaitInterval = WaitInterval; }
```

- **Single Source example: PJ29436a - OTREXTCa - Upper case "C" required in linkage specification**

CPP Type Usage Rule

- **Examines text only when it is used as a type name**
- **Example: Flag all char* as return type, parameter type, declaration type, cast type**

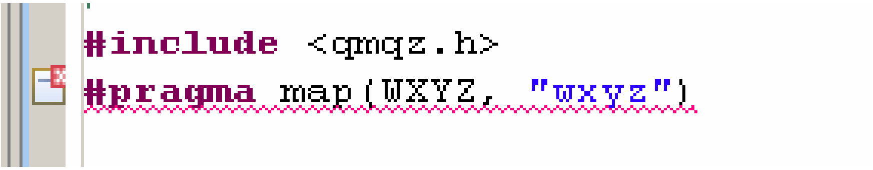


```
char *sf(char *ToOutPut, char *s, int i)
{
   char* buffer = (char*) malloc(strlen(ToOutPut) + 1);

   memcpy(buffer, ToOutPut, strlen(ToOutPut) + 1);
   sprintf(outputbuff, buffer, s, i);
   free(buffer);
   return outputbuff;
}
```

- **Single Source example: OTRWDCTa - Use wide characters (wchar_t) for in-memory processing only**

CPP Directive Rule Template

- **Examines directives only**
- **Example: Flag all usage of #pragma directive**

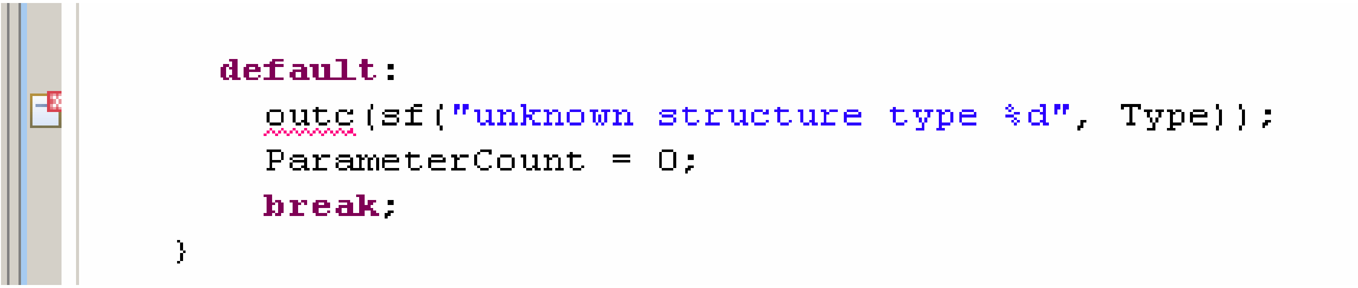


```
#include <qmqz.h>
#pragma map(WXYZ, "wxyz")
```

- **Single Source example: OTRPRAGa - Replace or remove #pragma directives**

CPP Function Call Rule Template

- **Examines function calls only**
- **Example: Calls to function named outc**

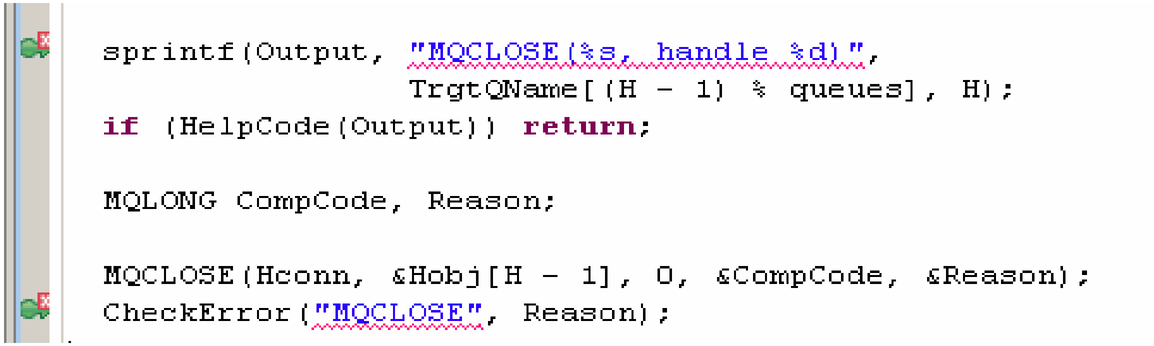


```
    default:
      outc(sf("unknown structure type %d", Type));
      ParameterCount = 0;
      break;
  }
```

- **Single Source example: PJ29957a - setlocale function changed for obsolete category LC_TOD**

CPP Constant Rule Template

- **Examines only constants (i.e. string literals and numbers)**
- **Example: Find MQCLOSE in constants**



```
sprintf(Output, "MQCLOSE(%s, handle %d)",
                TrgtQName[(H - 1) % queues], H);
if (HelpCode(Output)) return;

MQLONG CompCode, Reason;

MQCLOSE(Hconn, &Hobj[H - 1], 0, &CompCode, &Reason);
CheckError("MQCLOSE", Reason);
```

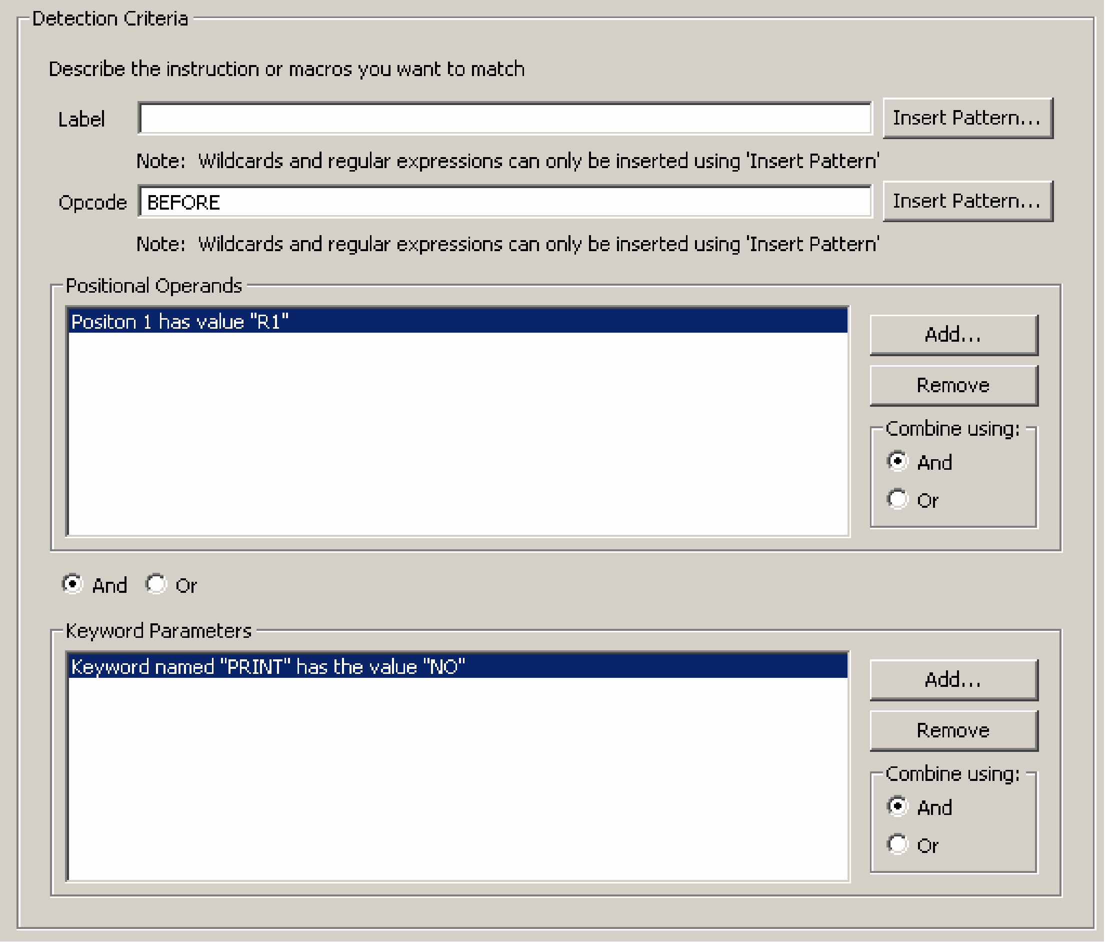
- **Single Source example: OTRWDCTb - Wide characters coded using hex values break single source**

CPP Fix Templates

- **Replace matched text**
  - Replaces all text matched at the error location with the specified replacement text
  - Example: Replace one data type name with another data type name.
- **Insert additional line**
  - Inserts a line into the code
  - Example: Add an include statement

HLASM Detection Template

- **One template matches instructions based on**
  - Label
  - Opcode
  - Positional Operands
  - Keyword Operands



Detection Criteria

Describe the instruction or macros you want to match

Label: (empty)

Note: Wildcards and regular expressions can only be inserted using 'Insert Pattern'

Opcode: BEFORE

Note: Wildcards and regular expressions can only be inserted using 'Insert Pattern'

Positional Operands

Positon 1 has value "R1"

Combine using: ● And ○ Or

● And ○ Or

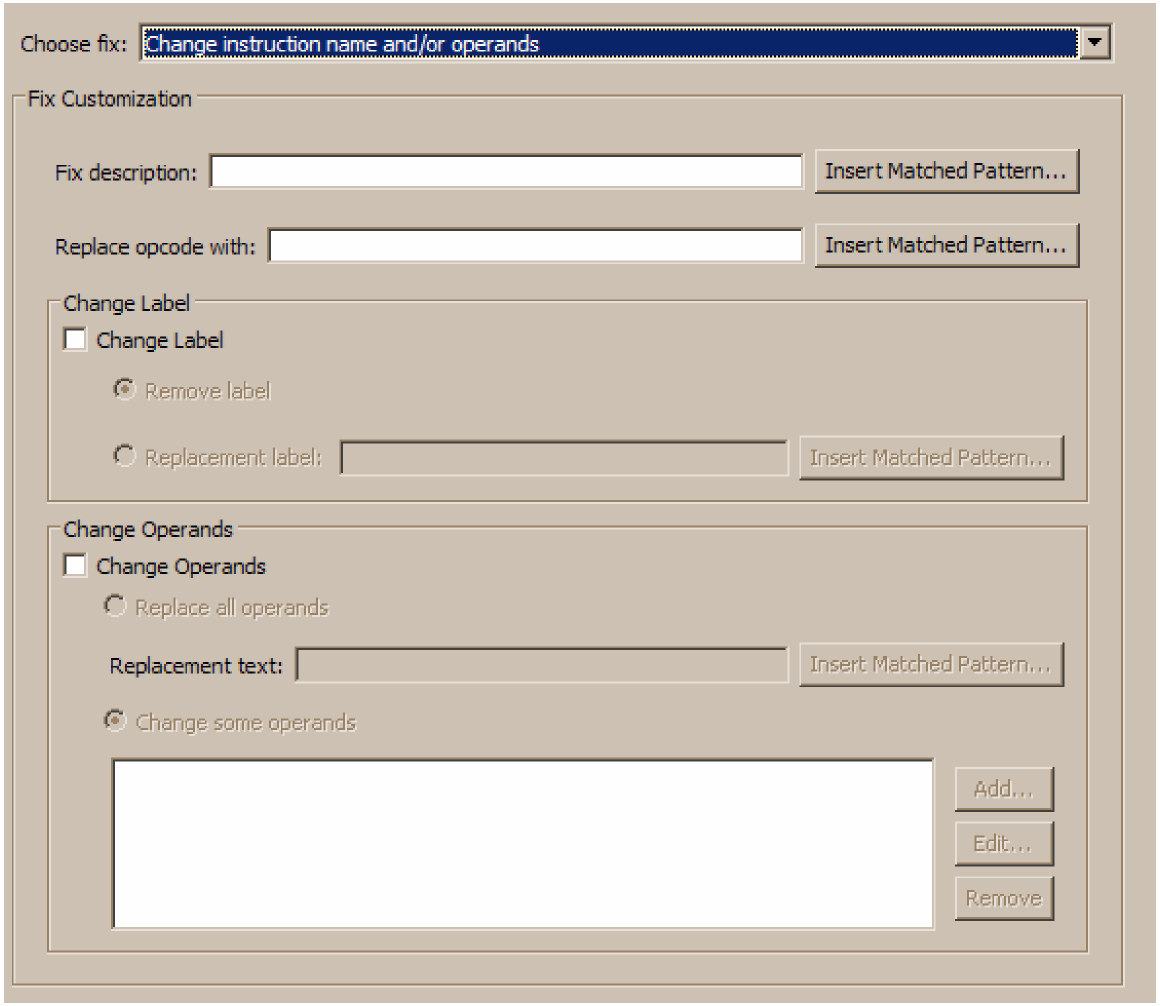
Keyword Parameters

Keyword named "PRINT" has the value "NO"

Combine using: ● And ○ Or

HLASM Fix Template

- **Modify the matched opcode, operands or label**



Choose fix: Change instruction name and/or operands

Fix Customization

Fix description: [Insert Matched Pattern...]

Replace opcode with: [Insert Matched Pattern...]

Change Label

□ Change Label

● Remove label

○ Replacement label: [Insert Matched Pattern...]

Change Operands

□ Change Operands

○ Replace all operands

Replacement text: [Insert Matched Pattern...]

● Change some operands

Demo – Source Scan Extensibility Tools

Questions

- **???**

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