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## Rule WLM607:     Insufficient outbound paths were defined

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**Finding:**       There was a significant value in the "ALL PATHS UNAVAILABLE" field for a transport class. Any significant value in the "ALL PATHS UNAVAILABLE" field for a transport class usually indicates that you have too few outbound paths defined. Alternatively, there may be an error in the path definitions (for example, you may have a typographical error).

**Impact:**       This finding can have a MEDIUM IMPACT or HIGH IMPACT on the signalling performance of the sysplex. The level of impact depends upon how often the "ALL PATHS UNAVAILABLE" condition was experienced, and on the message characteristics of (1) the transport class experiencing "ALL PATHS UNAVAILABLE" and (2) the transport classes to which XCF routes messages.

**Logic flow:**   This a basic finding. There are no predecessor rules.

**Discussion:**   The XCF component of MVS/ESA allows authorized programs on one MVS system in a sysplex to communicate with programs on the same system or on other systems. A typical example of this communication is between CICS regions; CICS regions often communicate with other CICS regions in the same system or with CICS regions on other systems in the sysplex.

Please refer to the discussion associated with Rule WLM601 for additional information about XCF buffers.

XCF group members communicate with each other using the XCF *signalling* mechanism. The communication is done via signalling paths consisting of ESCON channels operating in channel-to-channel (CTC) mode, a coupling facility list structure (beginning with MVS/ESA Version 5), or 3088 Multisystem Channel Communication Unit. Messages are sent over the signalling paths, and the paths have one or more buffers associated with them to hold the messages as they are sent or received.

Outbound paths are assigned to transport classes by using the CLASS parameter on the PATHOUT statement (or by using the SETXCF PATH command after IPL). At least one outbound signalling path should be assigned to each transport class<sup>1</sup>. If there is high message traffic in the transport class, you may wish to assign **more** than one signalling path to

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<sup>1</sup>You are not required to assign a signalling path to a transport class. If no signalling path is assigned to a transport class, the XCF groups in the transport class compete for signalling resources of other transport classes. This situation can degrade signalling performance.

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the transport class. Additionally, you may wish to assign more signalling paths for redundancy.

XCF usually uses sends messages only on the signalling paths associated with a transport class. However, if there are no paths available to the transport class, XCF will route messages to other paths. Routing messages to other paths generates additional overhead for XCF to send the outbound message.

Additionally, using other paths may cause conflicts with the normal message traffic on these paths. As described in Rule WLM601, some messages are long and some are short; some messages have critical timing for system performance and some are less critical. If non-critical messages are routed to paths associated with a transport class with critical traffic, any resulting delays to the critical traffic could cause overall system performance problems.

SMF Type 74 (Subtype 2) provides statistics about the number of messages sent by XCF groups in a transport class, where the messages are sent, and how often the "ALL PATHS UNAVAILABLE" condition was experienced.

CPEXpert analyzes this information to determine whether the XCF experienced the "ALL PATHS UNAVAILABLE" condition for an excessive percent of the outbound messages. CPEXpert computes the total outbound message traffic for a transport class. CPEXpert concludes that too few paths may be available to the transport class when the "ALL PATHS UNAVAILABLE" condition occurred more than one percent of the outbound messages for the transport class.

CPEXpert produces Rule WLM607 to alert you that there may be too few outbound paths assigned to the transport class.

The following example illustrates the output from Rule WLM607:

RULE WLM607: THERE MAY BE AN ERROR IN PATH DEFINITION				
There was a significant value in the "ALL PATHS UNAVAILABLE" field for the DEF <small>SMALL</small> transport class. Any significant value in the "ALL PATHS UNAVAILABLE" field usually indicates that there may be an error in the path definitions (for example, you may have a typographical error). This finding applies to the following RMF measurement intervals:				
MEASUREMENT INTERVAL	MESSAGES	SENT TO	PCT ALL PATHS UNAVAILABLE	NUMBER OF PATHS
13:00-13:30,26MAR1996	63,359	J90	4.8	2
13:00-13:30,26MAR1996	34,633	JB0	4.3	2
13:00-13:30,26MAR1996	28,471	JC0	4.2	2
13:00-13:30,26MAR1996	26,648	JD0	4.0	2
13:00-13:30,26MAR1996	21,621	JE0	3.8	2
13:00-13:30,26MAR1996	20,652	JF0	3.7	2

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**Suggestion:** If Rule WLM607 is regularly produced, CPEXpert suggests that you consider the following alternatives<sup>2</sup>:

- A likely cause of the "ALL PATHS UNAVAILABLE" condition is that you may have an error in the path definitions (for example, you may have a typographical error) in the DEVICE parameter list or the STRNAME parameter list of the PATHOUT statement associated with the transport class. Please verify that the list is correct.
- You should determine whether the number of outbound paths for the transport class is less than you defined. The number of paths can decrease because a path failed or because an operator deleted a path (using the SETXCF STOP, PATHOUT,DEVICE=outdevnum) command. CPEXpert will display the number of paths for any RMF interval in which Rule WLM607 is produced. Please compare the number of paths with the number of paths specified on the DEVICE parameter or STRNAME parameter of the PATHOUT statement associated with the transport class.
- You should evaluate the number of outbound paths specified for the transport class. You should examine the DEVICE parameter or the STRNAME parameter list of the PATHOUT statement associated with the transport class to determine whether additional paths should be assigned.

In evaluating the number of paths assigned to the transport class, you should consider (1) the importance of the messages in the transport class, (2) how often the "ALL PATHS UNAVAILABLE" condition was experienced, and (3) the potential impact on other transport classes when XCF must route the outbound messages to paths assigned to other transport classes.

- You should evaluate whether the XCF groups are properly assigned to transport classes. It may be preferable to reassign XCF groups to transport classes. In practice, this situation is unlikely to occur as most installations will have a relatively small number of transport classes.
- XCF groups can be assigned to more than one transport class. When evaluating which transport class to use (when XCF groups are assigned to more than one transport class) XCF will select the transport class with the smallest buffer that will hold the message

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<sup>2</sup>**WARNING:** There exists little practical experience with analyzing coupling facility data and with selecting proper values for the controlling parameters. The CPEXpert analysis and suggestions are based on (1) the information contained in the referenced documents and (2) our analysis of data provided by IBM or CPEXpert users. Please keep this paucity of knowledge in mind when considering the alternatives. Additionally, **please** provide Computer Management Sciences with feedback!

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being sent. You potentially can "optimize" the buffer space used by assigning XCF groups to more than one transport class.

All groups assigned to a transport class have equal access to the signalling resources of that class. Consequently, you should make sure that you do not assign "low priority" groups to transport classes that have high performance requirements if the "low priority" groups could cause performance degradation to the "high priority" groups.

Fortunately, SMF Type 74 (Subtype 2) records contain information about the XCF groups and XCF members, including the number of signals sent and received by each member. This information is in the **Member Data Section** of the Type 74 records, and can be analyzed to assess the impact of message traffic of the XCF members and XCF groups.

- If Rule WLM607 occurs frequently and there is no action you wish to take, you can exclude the transport class from CPEXpert's analysis, using the **EXCLASSn** guidance variables. The EXCLASSn guidance variables allow you to exclude one or more transport classes from analysis.

**Reference:** MVS/ESA: Setting Up a Sysplex (GC28-1449)  
Section 5: Planning Signalling Services in a Sysplex

MVS/ESA: Initialization and Tuning Reference (GC28-1452)  
COUPLExx (Cross-System Coupling Facility Parameters)

OS/390: Setting Up a Sysplex (GC28-1779)  
Section 5: Planning Signalling Services in a Sysplex

OS/390: Initialization and Tuning Reference (GC28-1752)  
COUPLExx (Cross-System Coupling Facility Parameters)

z/OS: Setting Up a Sysplex (SA22-7625)  
Section 5: Planning Signalling Services in a Sysplex

z/OS: Initialization and Tuning Reference (SA22-7592)  
COUPLExx (Cross-System Coupling Facility Parameters)

"Parallel Sysplex Performance: tuning tips and techniques,"  
Kelley, Joan (IBM, Poughkeepsie, NY), SHARE 86, February 1996.