

IBM Education Assistance for z/OS V2R2

Item: Health Based Routing

Element/Component: WLM



Agenda

- Trademarks
- Presentation Objectives
- Overview
- Usage & Invocation
- Migration & Coexistence Considerations
- Presentation Summary
- Appendix



Trademarks

- See url <http://www.ibm.com/legal/copytrade.shtml> for a list of trademarks.



Presentation Objectives

- Health Based Routing is an enhancement on today's dynamic workload routing, focused on further reducing installation impact due to middleware server health issues
- WLM contributes to this effort by improving its Setting Server Health service (IWM4HLTH) and providing a new query service to obtain server health states (IWM4QHLT).
- Runtime Diagnostics externalizes address spaces with current server health values < 100.



Overview

- Problem Statement / Need Addressed

- WLM sysplex routing services allow work associated with a server to be distributed across a sysplex
- The services enable distributed client/server environments to balance work among multiple servers by making routing recommendations
- These recommendations consist of weights which represent the relative number of requests each server should receive
- Various capacity considerations are used to calculate these weights
- The recommendations are further qualified by a *server health value* which is a means to provide health status feedback to WLM
 - The IWMSRSRG service allows a server to set its health value when registering with WLM
 - The IWM4HLTH service allows to modify the health value when the health status of the server changes for the worse or better
- Thus, the server health value solely is based on self-assessment with only the last value reported is being kept by WLM



Overview

- Solution

- IWM4HLTH is enhanced to keep track of different health values (for example, reported by XCF/XES and the server himself)
- The algorithm for determining the health indicator for an address space is changed. The health indicator is the minimum value of all the current settings from the different callers of the service since the last RESET. This changes the current operation where the server's health indicator is simply the last value being reported.
- An additional function of IWM4HLTH refers to RAS considerations regarding a server's health state. The RESET function restarts setting of a composite health value by specifying an initial value and discarding the values reported by other callers before.
- New service IWM4QHLLT is introduced allowing to obtain the health values reported. This information will be used for diagnostic and serviceability purposes
- Runtime Diagnostics externalizes address spaces with server health < 100.

- Benefit / Value

- Improved routing recommendations and diagnostic reporting about server health states



Usage & Invocation: IWM4HLTH – Setting Server Health Indicator

- IWM4HLTH is used to inform WLM about the health state of a server. The health indicator is a number which shows in percent how well the server is performing. It can be an integer value between 0 and 100.
- This service is extended with z/OS V2R2
 - IWM4HLTH provides two functions: SET and RESET.
 - With the SET function, which is the main intended use and default function, a caller informs WLM about its view of the health state of a server. WLM then sets the server's health indicator to the *minimum number of all the current settings from the different callers of this service*.
 - The RESET function primarily refers to reliability, availability, and serviceability (RAS) considerations regarding a server's health state. RESET restarts setting the health indicator by specifying an initial value and discarding any values reported by other callers before.
 - Callers can identify themselves by a subsystem type and subsystem name. WLM uses these parameters to recognize different callers of the service. If no subsystem type is passed, the job name of the caller address space is used instead. This information will then also be available to callers of the IWM4QHLT (Query Server Health Indicators) service.
 - Callers can specify the reason or cause of change of the health indicator. The format is undefined and is only meaningful to the caller. This information will then also be available to callers of the IWM4QHLT (Query Server Health Indicators) service.



Usage & Invocation: Syntax of the IWM4HLTH Macro

```

>>+-----+---IWM4HLTH---STOKEN=stoken---+-----+-----+-----+-----+
|                                     |                                     |
+-name-+                               +---,FUNCTION=SET-----+
|                                     |                                     |
|                                     |                                     |
|                                     |                                     |
+---,FUNCTION=RESET---+
|                                     |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+
>+-----+-----+-----+-----+-----+-----+-----+-----+-----+
|                                     |                                     |
+---,SUBSYS=NO_SUBSYS---+           +---,SUBSYSNM=NO_SUBSYSNM---+       +---,HEALTHRSN=NO_RSN-----+
|                                     |                                     |                                     |
|                                     |                                     |                                     |
|                                     |                                     |                                     |
+---,SUBSYS=subsys-----+           +---,SUBSYSNM=subsysnm-----+       +---,HEALTHRSN=healthrsn---+
|                                     |                                     |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+
>+-----+-----+-----+-----+-----+-----+-----+-----+-----+
|                                     |                                     |
+---,RETCODE=retcode---+           +---,RSNCODE=rsncode---+
|                                     |                                     |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+
|                                     |                                     |
+---,PLISTVER=IMPLIED_VERSION---+   +---,MF=S-----+
|                                     |                                     |
>+-----+-----+-----+-----+-----+-----+-----+-----+-----+
|                                     |                                     |
+---,PLISTVER=MAX-----+           +---,MF=(L-,list addr+-----+---,OD---+
|                                     |                                     |
+---,PLISTVER=0-----+           +---,MF=(L-,list addr+-----+---,attr---+
|                                     |                                     |
+---,PLISTVER=1-----+           +---,MF=(E-,list addr+-----+---,COMPLETE---+
|                                     |                                     |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+

```

New parameters



Usage & Invocation: New Parameters of IWM4HLTH Macro

Parameter	Meaning
FUNCTION	<p>An optional parameter which indicates the function to perform. The default is FUNCTION=SET.</p> <ul style="list-style-type: none"> FUNCTION=SET informs WLM about the caller's view of the health state of a server. WLM then sets the server's health indicator to the minimum number of all the current settings from the different callers of the service since the last RESET. FUNCTION=RESET restarts setting the health indicator by specifying an initial value and discarding any values reported by other callers before. RESET primarily refers to reliability, availability, and serviceability (RAS) considerations regarding a server's health state.
SUBSYS	<p>An optional input parameter which contains the generic name or type of the caller of the service. It is used by WLM together with the <i>SUBSYSNM</i> parameter to recognize different callers of this service. This data is also available to callers of the IWM4QHLT service. The default is NO_SUBSYS which indicates that no type was passed.</p> <p>To code: Specify the RS-type address, or address in register (2)-(12), of an 8-character field.</p>
SUBSYSNM	<p>An optional input parameter which contains the name of a specific instance of the caller of the service. It is used by WLM together with the <i>SUBSYS</i> parameter to recognize different callers of this service. This data is also available to callers of the IWM4QHLT service. The default is NO_SUBSYSNM which indicates that no name was passed.</p> <p>To code: Specify the RS-type address, or address in register (2)-(12), of an 8-character field.</p>
HEALTHRSN	<p>An optional input parameter that allows the caller to pass additional information, such as the reason for changing the health indicator. This data is available to callers of the IWM4QHLT service. The format is undefined. The default is NO_RSN which indicates that no additional information is passed.</p> <p>To code: Specify the RS-type address, or address in register (2)-(12), of an 16-character field.</p>
PLISTVER=1	<p>Supports the following parameters and those from version 0:</p> <p>FUNCTION SUBSYS SUBSYSNM HEALTHRSN</p>



Usage & Invocation: IWM4HLTH Caller Requirements

- The minimum authorization requirements for WLM service IWM4HLTH are intensified with z/OS V2R2. Problem state with any PSW key is only sufficient if the space token specified with the STOKEN parameter equals the space token of the home address space. That is, the caller provides a health indicator for itself
- When providing a health indicator for an address space other than the home AS, the minimum authorization requirement is supervisor state or program key mask (PKM) allowing at least one of the keys 0 to 7
- This might require a modification of the application program. As an alternative, the caller can be authorized with UPDATE access in RACF resource IWM.SERVER.HEALTH in the FACILITY class
- From now on, caller can also be disabled and can hold locks.

Minimum authorization - - - - - - -	FUNCTION=SET: Problem state with any PSW key if the space token specified with STOKEN=stoken equals the space token of the home address space. That is, the caller provides a health indicator for itself. When providing a health indicator for an address space other than the home address space, the minimum authorization is Supervisor state or program key mask (PKM) allowing at least one of the keys 0-7 or caller requires UPDATE authority to the resource IWM.SERVER.HEALTH in the FACILITY class. FUNCTION=RESET: Supervisor state or program key mask (PKM) allowing at least one of the keys 0-7 or caller requires CONTROL authority to the resource IWM.SERVER.HEALTH in the FACILITY class.
Dispatchable unit mode	Task or SRB
Cross memory mode	Any PASN, any HASN, any SASN
AMODE	31- or 64-bit. If in 64-bit addressing mode, code SYSSTATE AMODE64=YES before invoking macro
ASC mode	Primary
Interrupt status	Enabled or disabled for I/O and external interrupts
Locks	The caller may hold locks, but is not required to hold any. FRRs may be established.
Control parameters	Control parameters must be in the primary address space



Usage & Invocation: IWM4HLTH Return and Reason Codes

- Following additional return and reason codes are provided by the macro
 -
 -

<i>Return Code</i>	<i>Reason Code</i>	<i>Equate Symbol, Meaning, and Action</i>
-		
-8	xxxx0827	Equate Symbol: lwmRsnCodeRsvdNot0 Meaning: Reserved field in parameter list was non-zero. Action: Check for possible storage overlay of the parameter list.
8	xxxx0829	Equate Symbol: lwmRsnCodeBadOptions Meaning: Parameter list omits required parameters or supplies mutually exclusive parameters or provides data associated with options not selected. Action: Check for possible storage overlay of the parameter list.
C	xxxx0C0E	Equate Symbol: lwmRsnCodeInsufAccess Meaning: Minimum authorization requirements are not fulfilled. Action: Invoke the functions with the authorization requirements fulfilled.



Usage & Invocation: IWM4QHLLT – Query Server Health Indicators

- New service IWM4QHLLT provides information about health indicators which have been set for server address spaces via IWM4HLTH or IWMSRSRG. IWM4QHLLT allows the caller to obtain the health information for
 - all address spaces for which health indicators had been provided
 - a list of particular address spaces
- The caller must provide an area of storage in the ANSAREA=ansarea and the length of that area in the ANSLEN=anslen for IWM4QHLLT to place the health information. IWM4QHLLT returns the actual length of the information in the QUERYLEN=querylen parameter
- If a user does not know the size of the answer area required by the service, he issue IWM4QHLLT with ANSLEN set to zero. The length of the answer area will be placed in QUERYLEN
- The answer area is mapped by the IWMWQHAA data area which is described in z/OS MVS Data Areas, Vol 4
- The information returned is not serialized upon return to the caller, and so may be out of date due to a change in health indicators
-



Usage & Invocation: Syntax of the IWM4QHLT Macro

```

                                +---ASID_LIST=NO_ASID_LIST-----+
                                |                                 |
>>+-----+---IWM4QHLT-----+-----+-----+-----+----->
    |         |               |                                 |
    +-name-+   +-ASID_LIST=asid_list,-ASID_NUM=asid_num--+
                                |                                 |

>-,ANSAREA=ansarea---,ANSLEN=anslen---,QUERYLEN=querylen----->

>+-----+-----+-----+-----+-----+-----+----->
    |         |         |         |         |         |         |
    +--,RETCODE=retcode--+   +--,RSNCODE=rsncode--+
                                |         |         |         |

                                +--,PLISTVER=IMPLIED_VERSION--+   +--,MF=S-----+
                                |         |         |         |         |
>+-----+-----+-----+-----+-----+-----+----->X
    |         |         |         |         |         |         |
    +--,PLISTVER=MAX-----+   |         |         |         |         |
    |         |         |         |         |         |         |
    +--,PLISTVER=0-----+   |         |         |         |         |
                                |         |         |         |         |
                                |         |         |         |         |
                                +--,MF=(L-,list addr+-----+---)-----+
                                |         |         |         |         |
                                |         |         |         |         |
                                |         |         |         |         |
                                |         |         |         |         |
                                +--,MF=(E-,list addr+-----+---)-----+

```



Usage & Invocation: Parameters of IWM4QHLT Macro

Parameter	Meaning
name	An optional symbol, starting in column 1, that is the name on the IWM4QHLT macro invocation. The name must conform to the rules for an ordinary assembler language symbol.
ASID_LIST	<p>An optional input parameter that specifies an area for the list of ASIDs. Each entry (ASID) is a halfword field. A maximum number of 100 entries in the list is supported.</p> <p>To code: Specify the RS-type name, or address in register (2)-(12), of a field specifying the area for the list of ASIDs.</p>
ASID_NUM	<p>Required input parameter for ASID_LIST=asid_list that specifies the number of ASIDs in asid_list.</p> <p>To code: Specify the RS-type address, or address in register (2)-(12), of a fullword field.</p>
ANSAREA	<p>A required output parameter, variable specifying an answer area to contain the data returned by the query service. If the length of the output area is insufficient, no data is returned.</p> <p>To code: Specify the RS-type address, or address in register (2)-(12), of a character field.</p>
ANSLEN	<p>A required input parameter which contains the length of the answer area.</p> <p>To code: Specify the RS-type address, or address in register (2)-(12), of a fullword field.</p>
QUERYLEN	<p>A required output parameter, which contains the length of the storage area required by the IWM4QHLT service. The length of the area may change between invocations.</p> <p>To code: Specify the RS-type address, or address in register (2)-(12), of a fullword field.</p>
RETCODE	<p>An optional output parameter into which the return code is to be copied from GPR 15.</p> <p>To code: Specify the RS-type address, or address in register (2)-(12), of a fullword field.</p>
RSNCODE	<p>An optional output parameter into which the reason code is to be copied from GPR 0.</p> <p>To code: Specify the RS-type address, or address in register (2)-(12), of a fullword field.</p>
PLISTVER	An optional input parameter that specifies the version of the macro. See WLM Services Guide for details.
MF	An optional input parameter that specifies the macro form. See WLM Services Guide for details.



Usage & Invocation: Requirements for Caller of IWM4QHLT

Minimum authorization:	Supervisor state or program key mask (PKM) allowing at least one of the keys 0-7.
Dispatchable unit mode:	Task
Cross memory mode:	Any PASN, any HASN, any SASN
AMODE:	31- or 64-bit. If in 64-bit addressing mode, code SYSSTATE AMODE64=YES before invoking this macro.
ASC mode:	Primary or access register (AR). If in AR mode, specify SYSSTATE ASCENV=AR before invoking this macro.
Interrupt status:	Enabled for I/O and external interrupts
Locks:	No locks may be held. FRR environments may be established
Control parameters:	The caller of IWM4QHLT must provide storage for an answer area mapped by IWMWQHAA. This answer area may reside in the caller's primary address space, or in a dataspace accessible via the current unit of work's dispatchable unit access list (DUAl).



Usage & Invocation: IWM4QHLT Return and Reason Codes

RC	RSN	Equate symbol	Meaning	Action
0	---	IwmRetCodeOk	Successful completion	None required
4	---	IwmRetCodeWarning	Successful completion, unusual conditions noted	
4	xxxx0408	IwmRsnCodeWorkNotFound	An address space matching the input ASID(s) was not found or none of the input ASID(s) has a health factor associated	None required
4	xxxx040A	IwmRsnCodeOutputAreaToo Small	The output area supplied is too small to receive all the available information	None required. If necessary, reinvoke the service with an output area of sufficient size (returned in QUERYLEN) to receive all information
8	---	IwmRetCodeInvocError	Invalid invocation environment or parameters	
8	xxxx0801	IwmRsnCodeSrbMode	Caller is in SRB mode	Avoid requesting this function while in SRB mode
8	xxxx0803	IwmRsnCodeDisabled	Caller is disabled	Avoid requesting this function while disabled
8	xxxx0804	IwmRsnCodeLocked	Caller is locked	Avoid requesting this function while locked
8	xxxx080B	IwmRsnCodeBadPl	Error accessing parameter list	Check for possible storage overlays
8	xxxx0823	IwmRsnCodeDatoff	The caller invoked the service while DATOFF	Avoid requesting this function in this environment
8	xxxx0824	IwmRsnCodeAmode24	The caller invoked the service in 24-bit addressing mode	Request this function only in 31-bit or 64-bit addressing mode
8	xxxx0828	IwmRsnCodeBadVersion	The version number in the parameter list or the version length field is not valid. Or this service was called on a z/OS release where it is not supported	Check for possible storage overlay of the parameter list
8	xxxx0829	IwmRsnCodeBadOptions	Parameter list omits required parameters or supplies mutually exclusive parameters or provides data associated with options not selected or the number of ASIDs specified in ASID_LIST is greater than 100	Check for possible storage overlay of the parameter list
8	xxxx0830	IwmRsnCodeBadAlet	Caller specified an invalid ALET for the storage pointed to by the ANSAREA keyword	Check for possible storage overlay of the parameter list or variable
C	---	IwmRetCodeEnvError	Environmental error	
C	xxxx0C01	IwmRsnCodeNoStg	Storage not available for the request	There is a storage shortage. The function may work successfully at a later time
C	xxxx0C0A	IwmRsnCodeSuspended	Data collection is suspended as a result of a component error. No data can be returned for this IWM4QHLT invocation, future invocations may be successful	Reinvoke this service as it may be successful
10	---	IwmRetCodeCompError	Component error	No action required. Function may be successful if invoked again

Usage & Invocation: IWMWQHAA Answer Area Mapping

- Contains health information of server address spaces which has been set via following services
 - IWM4HLTH (setting server health indicator)
 - IWMSRSRG (register a server for sysplex routing)
- The QHAA header is followed by one or more health information units. Each unit consists of one QHAS section followed by one or more QHAR sections.
 - For the number of QHAR sections belonging to one QHAS section, see field QHAS_QHAR_Num in the QHAS.
- A QHAS section describes an address space for which health indicators have been set.
- A QHAR section describes a unit reporting the health indicator. For each reporting unit, a history of the most recent health indicators is kept. The history is limited to a maximum of 10 entries.

QHAA Size=3328 QHAS_Num=4 QHAR_Num=9	
QHAS QHAS_QHAR_Num=3 Jobname=SERVER_A	
QHAR	<input type="checkbox"/> <input type="checkbox"/> H I S T O R Y <input type="checkbox"/> <input type="checkbox"/>
QHAR	<input type="checkbox"/> <input type="checkbox"/> H I S T O R Y <input type="checkbox"/> <input type="checkbox"/>
QHAR	<input type="checkbox"/> <input type="checkbox"/> H I S T O R Y <input type="checkbox"/> <input type="checkbox"/>
QHAS QHAS_QHAR_Num=1 Jobname=SERVER_B	
QHAR	<input type="checkbox"/> <input type="checkbox"/> H I S T O R Y <input type="checkbox"/> <input type="checkbox"/>
QHAS QHAS_QHAR_Num=2 Jobname=SERVER_C	
QHAR	<input type="checkbox"/> <input type="checkbox"/> H I S T O R Y <input type="checkbox"/> <input type="checkbox"/>
QHAR	<input type="checkbox"/> <input type="checkbox"/> H I S T O R Y <input type="checkbox"/> <input type="checkbox"/>
QHAS QHAS_QHAR_Num=3 Jobname=SERVER_D	
QHAR	<input type="checkbox"/> <input type="checkbox"/> H I S T O R Y <input type="checkbox"/> <input type="checkbox"/>
QHAR	<input type="checkbox"/> <input type="checkbox"/> H I S T O R Y <input type="checkbox"/> <input type="checkbox"/>
QHAR	<input type="checkbox"/> <input type="checkbox"/> H I S T O R Y <input type="checkbox"/> <input type="checkbox"/>

E
X
A
M
P
L
E



Usage & Invocation: IWMWQHAA Answer Area Mapping

Descriptive Name: IWM4QHLLT answer area (QHAA)

EXTERNAL CLASSIFICATION: PI

Function: Contains health information of server address spaces which has been set via following services

- IWM4HLTH (setting server health indicator)
- IWMSRSRG (register a server for sysplex routing)

The QHAA header is followed by one or more health information units. Each unit consists of one QHAS item followed by one or more QHAR items. For the number of QHAR items belonging to one QHAS item, see field QHAS_QHAR_Num. A QHAS item describes an address space for which health indicators have been set. A QHAR item describes the unit setting the health indicator via IWM4HLTH or IWMSRSRG for the address space. Each QHAR item provides a history of its most recent IWM4HLTH or IWMSRSRG invocations for the address space in the QHAS item. The history is limited to a certain amount entries (see value in constant QHAA_H#).

Component: Workload Manager (SCWLM)

Method of Access: ASM: IWMWQHAA
PL/X: Declare QHAAPtr
%INCLUDE SYSLIB(IWMWQHAA)
VIA Attribute:
Specify %QHAAVIA = 'YES' prior to %INCLUDE statement
Declare QHAALET
For VIA(0) specify %GLOBALARMODE='YES'

Size: QHAA -- 32 bytes
QHAS -- 32 bytes
QHAR -- 352 bytes (32 + 10 * 32)

Storage Attributes: Subpool: User assigned
Key: 0-15
Residency: Anywhere

Created by: Caller of IWM4QHLLT
Pointed to by: Pointed to by the ANSAREA_ADDR field in the IWM4QHLLT parameter list



Usage & Invocation: IWMWQHAA Answer Area Mapping

OFFSET DECIMAL	OFFSET HEX	TYPE	LENGTH	NAME (DIM)	DESCRIPTION
0	(0)	STRUCTURE	32	QHAA	Header of answer area
0	(0)	CHARACTER	8	QHAA_NAME	Eyecatcher IWMWQHAA
8	(8)	UNSIGNED	1	QHAA_VERSION	Version number
9	(9)	CHARACTER	3	QHAA_RSV1	Reserved
12	(C)	UNSIGNED	4	QHAA_SIZE	Total size of QHAA and all of its QHAS and QHAR parts
16	(10)	UNSIGNED	2	QHAA_QHAS_NUM	Total number of QHAS entries
18	(12)	UNSIGNED	2	QHAA_QHAS_LEN	Length of one QHAS entry
20	(14)	UNSIGNED	4	QHAA_QHAS_OFFS	Offset from QHAA to first QHAS entry. Each QHAS is followed by one or more QHAR entries.
24	(18)	UNSIGNED	2	QHAA_QHAR_NUM	Total number of QHAR entries
26	(1A)	UNSIGNED	2	QHAA_QHAR_LEN	Length of one QHAR entry
28	(1C)	CHARACTER	4	QHAA_RSV2	Reserved

OFFSET DECIMAL	OFFSET HEX	TYPE	LENGTH	NAME (DIM)	DESCRIPTION
0	(0)	STRUCTURE IsA(QHAS_TYPE)	32	QHAS	QHAS item describing an address space for which a health indicator has been reported by a caller of the IWM4HLTH or IWMSRSG service
0	(0)	CHARACTER	8	QHAS_NAME	Eyecatcher IWMWQHAS
8	(8)	CHARACTER	8	QHAS_JOBNAME	Jobname of address space
16	(10)	BIT(64)	8	QHAS_STOKEN	Space token of address space
24	(18)	BIT(16)	2	QHAS_ASID	Address space ID
26	(1A)	UNSIGNED	2	QHAS_HEALTH	Current health indicator of address space
28	(1C)	UNSIGNED	2	QHAS_QHAR_NUM	Number of QHAR items following this QHAS item
30	(1E)	CHARACTER	2	QHAS_RSV1	Reserved



Usage & Invocation: IWMWQHAA Answer Area Mapping

OFFSET DECIMAL	OFFSET HEX	TYPE	LENGTH	NAME (DIM)	DESCRIPTION
0	(0)	STRUCTURE IsA (QHAR_TYPE)	352	QHAR	QHAR item describing an IWM4HLTH or IWMSRSRG caller reporting a health indicator for an address space. A history of the most recent indicators reported by the caller is kept whereby the latest indicator is in the first slot of the array. For the number of entries in the history, see QHAA_H#.
0	(0)	CHARACTER	8	QHAR_NAME	Eyecatcher IWMWQHAR
8	(8)	CHARACTER	16	QHAR_KEY	Key of caller
8	(8)	CHARACTER	8	QHAR_SUBSYS	Generic name or type of the reporting unit as specified with the SUBSYS parameter of IWM4HLTH. If not specified or IWMSRSRG, job name of caller.
16	(10)	CHARACTER	8	QHAR_SUBSYSNM	Name of a specific instance of the reporting unit as specified with the SUBSYSNM parameter of IWM4HLTH. If not specified or IWMSRSRG, blanks.
24	(18)	CHARACTER	8	QHAR_RSV1	Reserved
32	(20)	CHARACTER	32	QHAR_HISTORY(10)	History of most recent health indicators reported
32	(20)	CHARACTER	8	QHAR_TIME	Time when health indicator was reported (STCK format)
40	(28)	UNSIGNED	2	QHAR_VALUE	Input value as specified with the HEALTH parameter by caller of IWM4HLTH or IWMSRSRG
42	(2A)	UNSIGNED	2	QHAR_HEALTH	Health indicator of address space after Function=Set or Function=Reset applied
44	(2C)	BIT(8) 1... ..	1	QHAR_FLAGS QHAR_SRSRG	Flags If ON, IWMSRSRG was used to set the health indicator. If OFF, IWM4HLTH was used.
		.1... ..		QHAR_SET	Function=Set specified or use as default function
		..1.		QHAR_RESET	Function=Reset specified
45	(2D)	CHARACTER	3	QHAR_RSV2	Reserved
48	(30)	CHARACTER	16	QHAR_REASON	Additional information as specified with the HEALTHRSN parameter of IWM4HLTH, such as the reason for changing the health indicator



Usage & Invocation: Example 1

- To set the health indication value to 80 for a particular server, specify:

```
IWM4HLTH STOKEN=STKN,FUNCTION=SET,HEALTH=80,      X
          SUBSYS=SUBTYPE,SUBSYSNM=SUBSNAME,        X
          HEALTHRSN=HRSN,RETCODE=RC,RSNCODE=RSN
```

*

* Storage areas

*

STKN	DS	CL8	Contains the Stoken associated with
*			the address space
SUBSTYPE	DC	CL8 'MYTYPE01'	Subsystem type
SUBSNAME	DC	CL8 'MYNAME11'	Subsystem name
HRSN	DC	CL16 'SIXTEENCHARACTER'	Diagnostic information
RC	DS	F	Return code
RSN	DS	F	Reason code



Usage & Invocation: Example 2

- To store health values for address spaces 22 and 23 into an area whose address is in register 5, specify:

```
IWM4QHLT  ANSAREA=(R5),ANSLEN=AREALEN,QUERYLEN=RQDLEN,    X
           ASID_LIST=ASIDLIST,ASID_NUM=2,                  X
           RETCODE=RC,RSNCODE=RSN
```

*

* Storage areas

*

AREALEN	DC	F'1024'	Answer area length
ASIDLIST	DC	XL4'00160017'	List with two ASIDs
RQDLEN	DS	F	Required length of area
RC	DS	F	Return code
RSN	DS	F	Reason code



Usage & Invocation: Runtime diagnostics SERVERHEALTH

- Runtime diagnostics exploits IWM4QHLT and returns address spaces with current health value < 100.
 - To invoke Runtime Diagnostics: `f hzr,analyze`
 - Maximum of 5 reporters displayed
 - Only values since the last RESET displayed
 - Additional DEBUG parameter values: `SERVERHEALTH | NOSERVERHEALTH`
 - `F HZR,ANALYZE,DEBUG=(SERVERHEALTH)`
 - Runtime Diagnostics initiates an SVC dump of the HZR address space along with a maximum of 14 address spaces that are associated with each SEVERHEALTH event. If any data spaces exist for the address spaces dumped, they are also included in the dump.
 - `F HZR,ANALYZE,DEBUG=(NOSERVERHEALTH)`
 - When no SERVERHEALTH events are found during the ANALYZE request, Runtime Diagnostics dumps the HZR address space.
- Predictive Failure Analysis (PFA) invokes Runtime Diagnostics for checks that can indicate their metric is too low (as in previous releases).
 - SERVERHEALTH events are now returned to PFA
 - SERVERHEALTH events are now printed in PFA's health checker report



Usage & Invocation: Runtime diagnostics SERVERHEALTH

EVENT 01: HIGH - SERVERHEALTH - SYSTEM: SY1 2014/08/14 - 10:39:18

JOB NAME: IRLM9 ASID: 0150 CURRENT HEALTH VALUE: 0

CURRENT LOWEST HEALTH VALUES:

SUBSYSTEM	SUBSYSTEM NAME	HEALTH SETTING	REASON	REPORTED DATE AND TIME
XCF	XCF	80	00000000000000001	2014/08/14 10:38:29
XES	IRLM9	0	0000000800000000C	2014/08/14 10:37:27

ERROR: ADDRESS SPACE SERVER CURRENT HEALTH VALUE LESS THAN 100.

ERROR: THIS VALUE MAY IMPACT YOUR SYSTEM OR SYSPLEX TRANSACTION

ERROR: PROCESSING.

ACTION: USE YOUR SOFTWARE MONITORS TO INVESTIGATE THE ASID AND TO

ACTION: DETERMINE THE IMPACT OF THE HEALTH OF THE ADDRESS SPACE TO

ACTION: OVERALL TRANSACTION PROCESSING.

- **SERVERHEALTH:** The Runtime Diagnostics event type
- **JOB NAME and ASID:** Name of the server component or gateway job (address space) with this health value.
- **CURRENT HEALTH VALUE:** The current health indicator for the address space.
- **CURRENT LOWEST HEALTH VALUES:** Heading for the reporter information
- **SUBSYSTEM:** Generic name or type of the reporting unit
- **SUBSYSTEM NAME:** Name of the specific instance of the reporting unit
- **HEALTH SETTING:** Health value specified by the reporting unit
- **REASON:** A 16-byte diagnostic reason representing the problem identified by the reporting unit. This value should be included if reporting the problem to IBM service.
- **REPORTED DATE AND TIME:** Date and time of the reported value.



Migration & Coexistence Considerations

- The algorithm for determining the health indicator for an address space is changed.
 - The value is no longer the last value being reported but the minimum value of all the current settings from all the different callers
- The minimum authorization requirements for WLM service IWM4HLTH are intensified with z/OS V2R2.
 - Verify whether the authorization is sufficient if changing the health indicator for an address space other than the caller's home address space. The program's authorization might need to be changed to supervisor state or PKM allowing at least one of the keys 0-7 or the user ID associated with the program must have UPDATE access to the RACF resource IWM.SERVER.HEALTH or an appropriate generic resource profile when generic profile checking is active.
 - To easily identify problem state callers of IWM4HLTH which set the health indicator for other address spaces, it is recommended to temporarily define the IWM.SERVER.HEALTH resource with the WARNING parameter. For any caller with insufficient access authority, RACF issues a warning message and allows temporary access. System administrators can look for RACF message ICH408I for IWM.SERVER.HEALTH and decide whether the user should be granted UPDATE authority. Afterwards, the resource profile definition should be updated by removing the WARNING parameter.



Migration & Coexistence Considerations

- **Avoid setting health values < 100 for reasons other than server health.**
 - Both Runtime Diagnostics and Predictive Failure Analysis expect this value to indicate degraded server health (as opposed to a setting for “maintenance” reasons) and can issue events and exceptions due to this setting.
 - **Runtime Diagnostics** creates diagnostic events for each address space with a server health value less than 100 regardless of reason. Events created for reasons other than server health may be considered as false events by the user of Runtime Diagnostics.
 - **Predictive Failure Analysis** invokes Runtime Diagnostics when it detects a metric that is too low and issues exceptions for Runtime Diagnostics events received for server health values less than 100 regardless of reason. PFA exceptions that are issued when Runtime Diagnostics events are created for reasons other than server health may be considered as false positive exceptions by the user of PFA.



Presentation Summary

- WLM enhances service IWM4HLTH (setting server health indicator)
 - WLM differentiates between health values of the address space reported by itself or reported by another space
 - The algorithm for determining the health indicator for an address space is changed. The value is no longer the last value being reported but the minimum of the values reported by the different callers.
 - An additional function of IWM4HLTH refers to RAS considerations regarding a server's health state. The RESET function restarts setting of a composite health value by specifying an initial value and discarding the values reported by other callers before.
 - Callers of service can specify a reason for cause of change
 - Callers can identify themselves by a subsystem type and subsystem name. WLM uses these parameters to recognize different callers of the service.
 - Users of the service need to check their programs for sufficient program authorization
- WLM provides a new query service (IWM4QHLL) to obtain reported health indicators for diagnostic purposes
 - Callers of service can obtain health values for particular address spaces or for all spaces for which a health value has been set
- Runtime Diagnostics externalizes address spaces with server health values < 100.
 - These values will be propagated to PFA when PFA detects a metric is too low.



Appendix

- Publication references

- 1) *z/OS MVS Programming: Workload Management Services*, SC34-2663
- 2) *z/OS MVS Data Areas, Volume 4*, GA32-0938
- 3) *Runtime Diagnostics: z/OS Problem Management*, SC23-6844

