

IBM Education Assistance for z/OS V2R2

Item: PFA Private Storage Exhaustion Check

Element/Component: BCP/PFA



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

- Describe the new PFA Private Storage Exhaustion Check
- Describe the changes to tracking “persistent” address spaces for the new check as well as the existing PFA_JES_SPOOL_USAGE check
- Describe the new INCLUDED_JOBS file
- Describe the use of “dynamic severity” for the new check and PFA_COMMON_STORAGE_USAGE



Overview

- Problem Statement / Need Addressed
 - Need a way to detect when a persistent address space is going to exhaust private storage before it causes a problem
- Solutions
 - Created a new PFA_PRIVATE_STORAGE_EXHAUSTION check
 - Added other enhancements required by this check to other PFA checks where applicable
- Benefit / Value
 - Detecting exhaustion of private storage in persistent address spaces avoids potential system outages
 - Other enhancements required for this check also enhance the usability of existing checks.



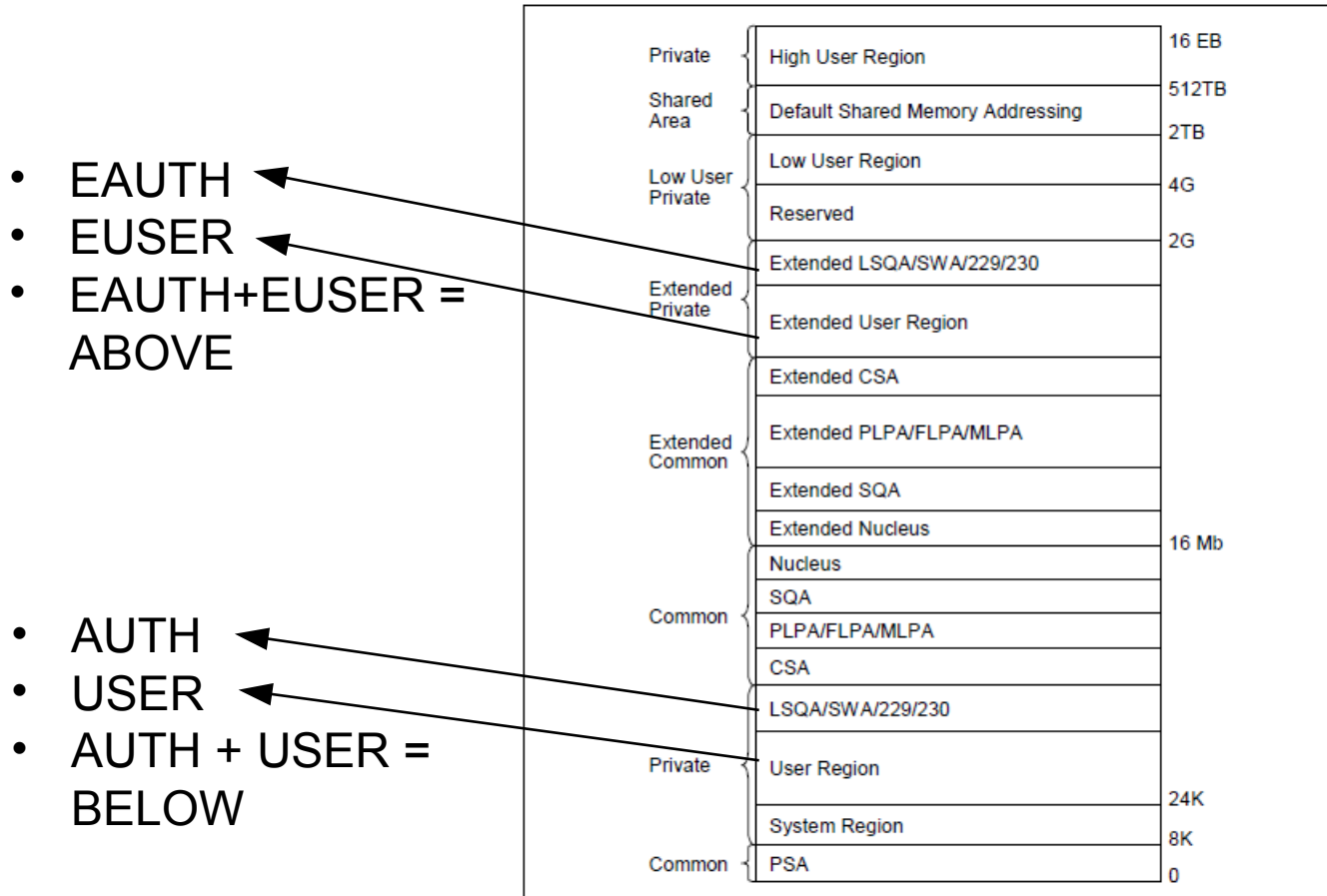
Usage & Invocation

- PFA_PRIVATE_STORAGE_EXHAUSTION check
 - Detects future exhaustion of private storage under 2G in 6 storage locations within individual address spaces
 - Private user region - USER
 - Private authorized area - AUTH
 - Private user + private authorized (i.e., private below the line) – BELOW
 - Extended private user region – EUSER
 - Extended private authorized area – EAUTH
 - Extended private user + extended private authorized (i.e., private above the line) – ABOVE
 - Does not detect exhaustion due to
 - Fragmentation
 - Fast increases of usage that are on a machine-time scale or even faster than one collection interval



Usage & Invocation

The storage diagram below shows the locations detected by this check.



Usage & Invocation

- PFA_PRIVATE_STORAGE_EXHAUSTION check **data collection**
 - Can detect exhaustion in any address space that meets configured criteria
 - We avoid collecting data for address spaces that aren't using “much” storage and those that aren't reasonably “persistent”
 - **COLL%(20)** – Must be using at least 20% of the current capacity for any given storage location before we collect historical data for that location for that address space
 - **COLLUPTIME(180)** – Address space must be up for COLLUPTIME minutes before collecting data
 - **COLLECTINT(5)** – Number of minutes between collections
 - Check doesn't collect for ISPF users, TSO users, *MASTER*, initiators and BPXAS.
 - Starts collecting 1 hour after IPL for address spaces that started within first hour after IPL (so we don't have to wait for COLLUPTIME for those address spaces).
 - Address spaces can be included or excluded using the new **INCLUDED_JOBS** file or the existing **EXCLUDED_JOBS** file.
 - COLLUPTIME(360) added to the PFA_JES_SPOOL_USAGE check.
 - Prior to V2R2, this check only detected significant increases in spool usage by address spaces that started within the first hour after IPL.
 - In V2R2, this check can detect this problem for any address space as long as it has been up for COLLUPTIME minutes.



Usage & Invocation

- PFA_PRIVATE_STORAGE_EXHAUSTION check **data modeling**
 - Creates trends of current usage to detect future usage
 - Trends look ahead 6 hours using individual data from last 5 days and summarized data for days 6-30.
 - **MOD%(40)** – The percentage of current usage to current capacity being used in a storage location before modeling occurs for a storage location in an address space.
 - **MODELINT(720)** – Number of minutes between models
 - Models will occur automatically more frequently when PFA detects...
 - instability in an address space's location previously modeled
 - that address space locations not modeled are being unstable
 - Requires at least 1 hour of collected data and 4 collections for modeling
 - Six storage locations modeled separately per address space
 - Models 15 address spaces per storage location of those whose percentage *increased* the most in the last hour (NOT who is *using* the most)



Usage & Invocation

- PFA_PRIVATE_STORAGE_EXHAUSTION check **comparisons**
 - Comparisons to detect exhaustion performed and results written to health checker report
 - Run after data is collected (**COLLECTINT(5)** – every 5 minutes)
 - Health checker parameter INTERVAL(ONETIME).
 - Do not change this value!
 - **COMP%(100)** – defines “exhaustion” (i.e., exhaustion is 100% of capacity)
 - If the future prediction has reached COMP% (i.e., we are predicting that future usage will reach 100%), the area is compared.
 - If you want comparisons and exceptions to occur earlier, reduce COMP%.
 - If you want comparisons and exceptions to occur later, increase COMP%.



Usage & Invocation

- PFA_PRIVATE_STORAGE_EXHAUSTION operation

- The graph below shows an example of usage over time where the data had been collected, modeling occurred 3 times, and the projected usage exhausted capacity and an exception was issued. (30 days of data not shown to simplify graph.)

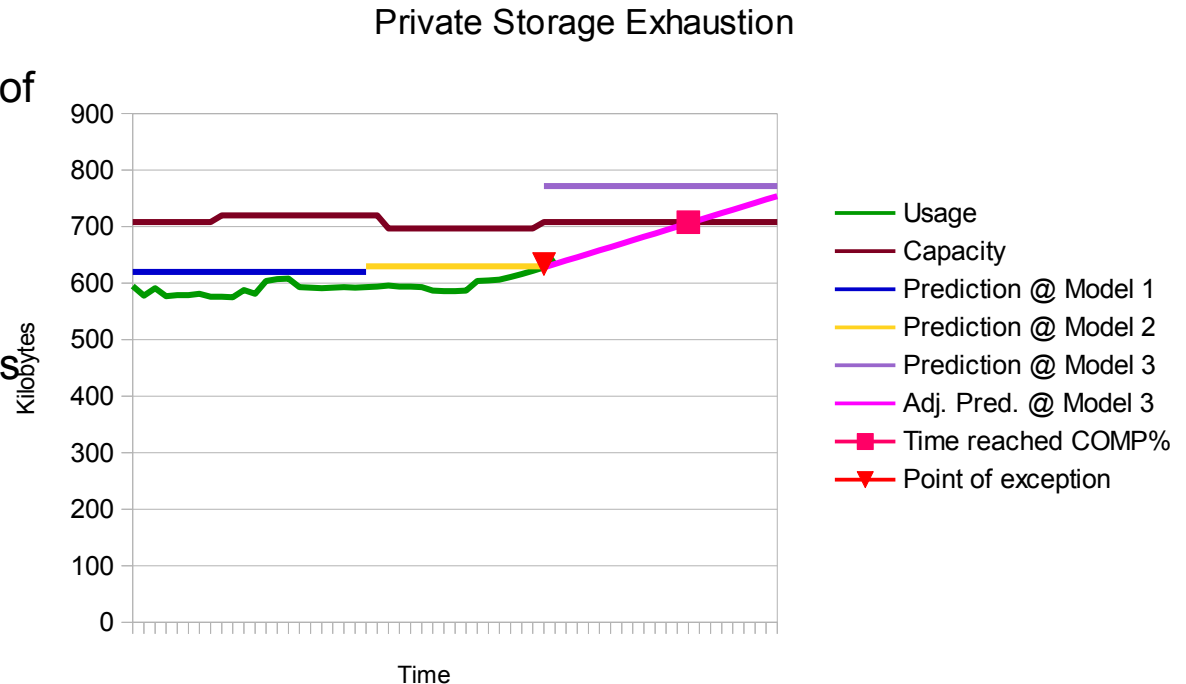
1) The blue and yellow predictions are not COMP%(100) so comparisons are not performed.

2) Usage trended upward at end of yellow model and triggered dynamic model.

3) Purple model created that is now > COMP(100%).

4) Hot pink trend projection shows usage will exceed capacity at red square.

5) Exception is issued at red triangle.



Usage & Invocation

- PFA_PRIVATE_STORAGE_EXHAUSTION check
 - Like other PFA checks...
 - Is added to health checker when PFA is started
 - Existing PFA commands can be used such as displaying the check to see ALL current values for PFA parameters
 - F pfa,display,check(pfa_p*),detail
 - Health checker modify or HZSPRMxx members are used to update parameters
 - F hzsproc,update,check(ibmpfa,pfa_p*),parm('comp%(99)')
 - As with other PFA checks, only the changing parameters need to be specified.
 - Parameters not specified will retain the previously set value or will use the default value if not specifically set.



Usage & Invocation

- PFA_PRIVATE_STORAGE_EXHAUSTION check exception report
 - Section 1 gives heading information like all PFA checks
 - Section 2 gives total capacity information which is the same for all address spaces
 - Section 3 gives summary information for address space locations modeled
 - When there is an exception, only those causing the exception are listed
 - Section 4 gives address space details (only included when there is an exception)

Private Storage Exhaustion Prediction Report

1. Heading information

```

Last successful model time      : 12/11/2014 14:08:16
Next model time                : 12/11/2014 14:23:16
Model interval                 : 20
Last successful collection time : 12/11/2014 14:08:15
Next collection time           : 12/11/2014 14:13:15
Collection interval             : 5
  
```

2. Total capacity

```

Total capacity of User Private Area (Below 16M)      :          9192
Total capacity of Extended User Private Area (Above 16M): 1474248
  
```

3. Summary information for address space locations causing exception

* = Areas that caused the exception.

Address spaces causing exception:

Name	ASID	Area	Current Usage in Kilobytes	Current Prediction in Kilobytes	Current Capacity in Kilobytes	Percentage Used to Capacity
PSETSTAU	0029	*BELOW	6332	12291	9192	69%
PSETSTAU	0029	*AUTH	6324	12283	9184	69%
PSETSTUR	001A	*BELOW	6332	12291	9192	69%
PSETSTUR	001A	*USER	6092	12051	8952	68%

4. Details when

exception (next slide)

Address space details:



Usage & Invocation

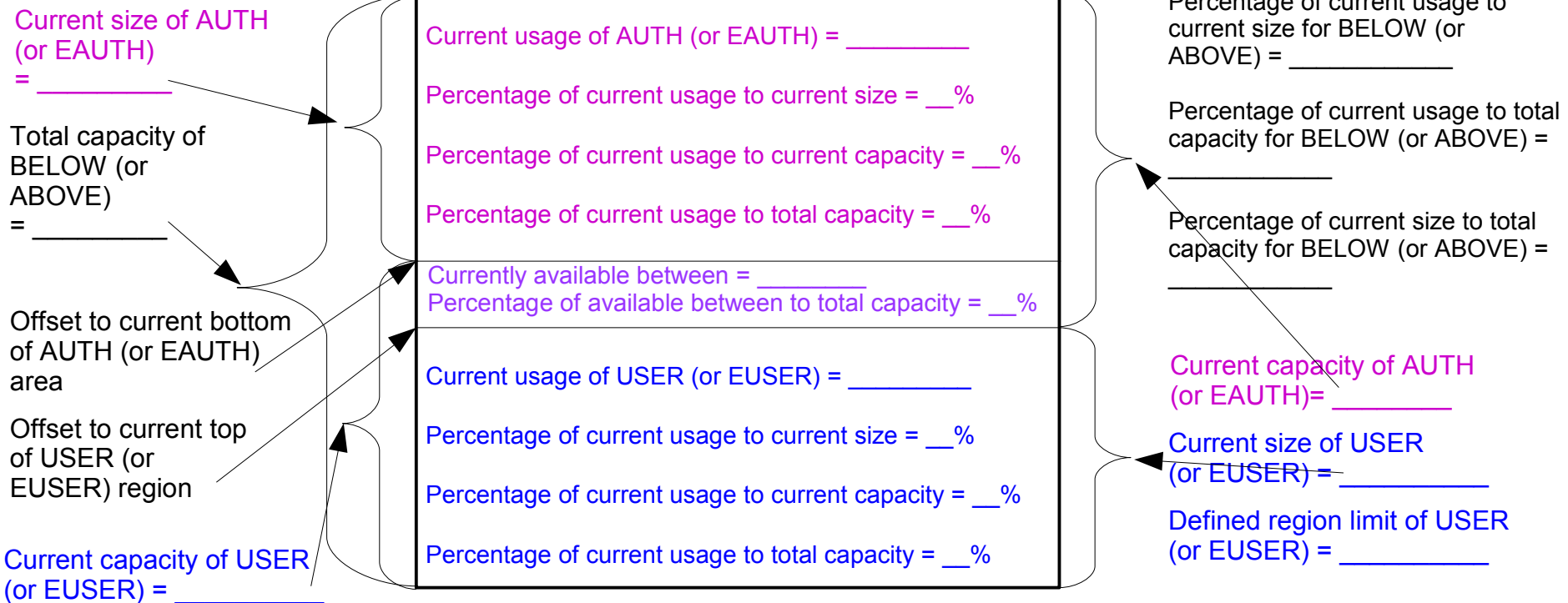
- PFA_PRIVATE_STORAGE_EXHAUSTION check exception report
 - Last section gives details for all address spaces having an exception.
 - Storage locations causing exception identified with *.
 - Data for all areas included even if not modeled.
 - Report is continuous, not side-by-side as shown below

Job name: PSETSTAU			
ASID : 0029			
Extended User Private Area (Above 16M line):			
Total capacity (K)	:	1474248	
Current size (K)	:	2004	
Current usage (K)	:	1912	
Percentage of current usage to current size	:	95%	
Percentage of current usage to total capacity	:	0%	
Percentage of current size to total capacity	:	0%	
Predicted usage (K)	:	Not modeled	
Currently available between EUSER and EAUTH (K)	:	1472244	
Percentage of available between to total capacity:	:	100%	
Extended LSQA/SWA/229/230 Area (EAUTH):			
Current capacity (K)	:	1474240	
Current size (K)	:	1996	
Current usage (K)	:	1904	
Percentage of current usage to current size	:	95%	
Percentage of current usage to current capacity:	:	0%	
Percentage of current usage to total capacity	:	0%	
Percentage of current size to total capacity	:	0%	
Predicted usage (K)	:	Not modeled	
Offset to current bottom of EAUTH area (K)	:	1472252	
Extended User Region (EUSER):			
Current capacity (K)	:	1472252	
Current size (K)	:	8	
Current usage (K)	:	8	
Percentage of current usage to current size	:	100%	
Percentage of current usage to current capacity:	:	0%	
Percentage of current usage to total capacity	:	0%	
Percentage of current size to total capacity	:	0%	
Predicted usage (K)	:	Not modeled	
Offset to current top of EUSER region (K)	:	8	
Defined region limit (K)	:	1481728	
*User Private Area (Below 16M line):			
Total capacity (K)	:	9192	
Current size (K)	:	6332	
Current usage (K)	:	6332	
Percentage of current usage to current size	:	100%	
Percentage of current usage to total capacity	:	69%	
Percentage of current size to total capacity	:	69%	
Predicted usage (K)	:	12291	
Currently available between USER and AUTH (K)	:	2860	
Percentage of available between to total capacity:	:	31%	
*LSQA/SWA/229/230 Area (AUTH):			
Current capacity (K)	:	9184	
Current size (K)	:	6324	
Current usage (K)	:	6324	
Percentage of current usage to current size	:	100%	
Percentage of current usage to current capacity:	:	69%	
Percentage of current usage to total capacity	:	69%	
Percentage of current size to total capacity	:	69%	
Predicted usage (K)	:	12283	
Offset to current bottom of AUTH area (K)	:	2868	
User Region (USER):			
Current capacity (K)	:	2868	
Current size (K)	:	8	
Current usage (K)	:	8	
Percentage of current usage to current size	:	100%	
Percentage of current usage to current capacity:	:	0%	
Percentage of current usage to total capacity	:	0%	
Percentage of current size to total capacity	:	0%	
Predicted usage (K)	:	Not modeled	
Offset to current top of USER region (K)	:	8	
Defined region limit (K)	:	9192	

Usage & Invocation

• PFA_PRIVATE_STORAGE_EXHAUSTION interpreting report

- Location having exception may be exhausted by corresponding location using the storage as the two areas grow into each other
- Useful to use chart shown below to pictorially see root of problem
- Need separate chart for ABOVE and BELOW.
- Refer to slide 7



Usage & Invocation

- INCLUDED_JOBS support
 - Data collected for jobs in INCLUDED_JOBS even if they haven't reached the check's collection requirements (e.g., COLL%, COLLUPTIME, TRACKEDMIN).
 - Address space must be up for at least one full collection before collecting starts
 - In /config subdirectory for checks that support it.
 - PFA_PRIVATE_STORAGE_EXHAUSTION
 - PFA_JES_SPOOL_USAGE
 - PFA_MESSAGE_ARRIVAL_RATE
 - PFA_SMF_ARRIVAL_RATE
 - PFA_ENQUEUE_REQUEST_RATE
 - Can be dynamically updated for PSE and JES spool usage checks:
 - F pfa,update,check(pfa_p*),included_jobs
 - F pfa,update,check(pfa_j*) – reads both EXCLUDED_JOBS and INCLUDED_JOBS
 - Same format as EXCLUDED_JOBS: kka,*,04/05/2015 12:00:00,Include KKA
 - Some jobs not allowed to be included on a per check basis. For example, *MASTER* and BPXAS are not allowed for the PSE check.



Usage & Invocation

- Dynamic severity

- As “time to exhaustion” gets closer, severity of PFA exception increases
- Used for both PFA_COMMON_STORAGE_USAGE and PFA_PRIVATE_STORAGE_EXHAUSTION checks
- Defaults as examples:
 - **E_HIGH(180)**: If time to exhaustion is predicted to be from 0 to 180 minutes from now, a *critical eventual action WTO* is issued.
 - **E_MED(300)**: If time to exhaustion is predicted to be from more than E_HIGH minutes to 300 minutes from now, an *eventual action WTO* is issued.
 - **E_LOW(MAX)**: If time to exhaustion is predicted to be from more than E_MED minutes to the expiration of the prediction, an *informational WTO* is issued.
 - **E_NONE(UNUSED)**: A value of 0 or UNUSED for the number of minutes indicates this dynamic severity is not used.
- Display current values using `f pfa,display,check(pfa_c*),detail`
- Update values using `f hzsproc,update` or using an `HZSPRMxx parmlib mbr`



Migration & Coexistence Considerations

- Existing PFA checks have a new DATE in IBM Health Checker for z/OS
 - DATE(20140313)
- HZSPRMxx statements for PFA checks must be updated with the new date
 - Ensure new parameter defaults for existing checks are appropriate for your installation
 - PFA_JES_SPOOL_USAGE:
 - COLLUPTIME(360)
 - PFA_COMMON_STORAGE_USAGE:
 - E_HIGH(180) E_MED(300) E_LOW (MAX) E_NONE(UNUSED)
 - Ensure interaction between existing and new parameters is appropriate
 - If SEVERITY or WTOTYPE changed on PFA_COMMON_STORAGE_USAGE, consider the new dynamic severity enhancement for that check.



Presentation Summary

- PFA has a new check: PFA_PRIVATE_STORAGE_EXHAUSTION
- PFA now supports an INCLUDED_JOBS file for checks where applicable
- Jobs collected are dynamic for PFA_JES_SPOOL_USAGE and PFA_PRIVATE_STORAGE_EXHAUSTION
- PFA uses dynamic severity for PFA_PRIVATE_STORAGE_EXHAUSTION and PFA_COMMON_STORAGE_USAGE



Appendix

- Publication: *z/OS Problem Management*

