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z/OS Preventive Maintenance Strategy to Maintain System Availability

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z/OS Preventive Maintenance Summary

Having a robust preventive maintenance process is a best practice in managing any IT environment including z/OS®. By avoiding known defects, which can have a major impact on the functioning of the system, preventive maintenance improves availability. Having a proactive preventive service strategy can reduce the number of rediscovered defects and help you avoid unplanned outages. IBM recommends that preventive maintenance be installed at least two to four times a year. In addition, IBM recommends that HIPER, PE Fix, Security/Integrity and Pervasive PTFs be installed more frequently.

One of IBM Z System® with z/OS's strengths is its tight integration of the technologies across the hardware, firmware, operating system and middleware. To continue that strength throughout the products' lifecycle, IBM developed an additional test effort known as Consolidated Service Test (CST) and a recommended preventive maintenance strategy which is directly tied to this effort. Introduced in 2001, the Recommended Service Upgrade (RSU) continues to provide a consistent, installable, and tested preventive maintenance level for the z/OS operating system, key subsystems such as CICS®, Db2®, IMS™, MQSeries®, WebSphere® Application Server, and many of the other IBM tools and products that run on the z/OS platform. For many years, each IBM product had its own preventive maintenance strategy and had its own recommendations as to what maintenance to install. The inconsistencies of the recommendations led to confusion. With the RSU recommendation, the benefit is that all IBM products have the same recommendation for preventive maintenance.

As part of IBM's commitment to quality, CST is a service environment that exists to test the maintenance for the operating system and key subsystems. The intent is to verify that the PTFs and products work well together, and to identify problems that might impact the process. The result of the testing is a package of maintenance across the product set that has been tested together. The testing done in CST is in addition to any testing that would be done prior to the release of the PTF as corrective service. The RSU provides integrated and tested service packages for the customer to install. The process used to create the RSU provides for a reduced risk of encountering defective maintenance (PEs). Since its introduction, the RSU has become accepted as the maintenance strategy by many of IBM's customers based on customer feedback. Also based on feedback from many customers, their experience has shown that using the RSU results in more stable systems.

The CST environment consists of two Parallel Sysplexes running on a mixture of currently supported hardware and software products. CST simulates customer production-like workloads to exercise the products that are installed. One Sysplex in the CST environment is configured as a multi-site GDPS®/ Metro and the other with GDPS®/MGM DASD configuration. Each Sysplex has GDPS Control Systems to ensure the orderly fail-over of all work if a site

failure occurs. Site failures and both planned and unplanned HyperSwaps are performed on a monthly basis. On one Sysplex, processes are interrupted, and failures are forced to occur. The other Sysplex is used for stress and recovery testing, as well as longevity testing to expose problems that occur over time.

An approach to applying maintenance is to stage the roll-out of the RSU by product, or groups of products, on any single system, and to not change all major products all at once (such as z/OS, Db2, IMS, CICS,, GDPS, Java™, WebSphere MQ, WebSphere Application Server for z/OS). This approach may be desirable since changing many products in a single system simultaneously may complicate the tasks of problem diagnosis and PTF back-out, if a severe problem were to occur.

However, IBM recognizes that many customers have limited maintenance windows and need to upgrade several products at the same time. Therefore, CST installs and tests the maintenance for their entire software stack all at once to ensure that the RSU works as a whole and can be installed in its entirety. CST testing does not replace the need for thorough customer application testing with the RSU prior to rolling it to production.

Additional information about the RSU and CST, can be found at the CST website at: https://www.ibm.com/support/pages/ibm-zos-consolidated-service-test-and-rsu

Disclaimer
Please note that the service recommendations are based on testing in IBM's CST environment. Your environment and applications will differ, and therefore your results may also differ.

Introduction

This paper reviews the concepts and tools available for servicing z/OS and IBM products running on the z/OS platform. It assumes that the reader is familiar with and has a basic understanding of the maintenance installation procedure.

Maintenance can be corrective or preventive. Corrective maintenance is necessary after a system has already encountered a problem. Regardless of the impact of the actual problem, the need to install the corrective maintenance may result in an unscheduled outage, which can have a larger impact. A preventive maintenance strategy enables you to schedule the servicing of the z/OS system based your business needs.

IBM recommends having an unambiguous process to install preventive maintenance on a regular basis. It is beneficial to understand the concepts and different aspects of the z/OS service principles in order to create a process that is well defined.

Preventive maintenance of IBM products is an integral part of system stability and essential for achieving the highest availability of your z/OS system. Proactively servicing your z/OS system will safeguard against failures and unnecessary outages that are caused by known problems with available fixes. Having a preventive maintenance strategy has proven to be effective and is generally recommended by IBM.

IBM is committed to identify defects, to accurately diagnose the root cause of problems, and to provide quality fixes in a timely manner. The support team ensures that APARs are updated with precise information relevant to the acknowledged defect and flags the APARs appropriately to aid in your service decisions. To complement these commitments, IBM has created the Recommended Service Upgrade (RSU) Maintenance Strategy. Following the RSU Maintenance Strategy reduces your exposure to known problems and improves overall availability.

APARs

IBM documents defects of z/OS products in Authorized Program Analysis Reports (APAR). Corrections for the defects are provided by IBM in a release level PTF (Program Temporary Fix). APARs also offer a means to supply a new function for a product that is already generally available. An APAR may be flagged by IBM under special circumstances that warrant extra attention.

- **HIPER**
  APARs are marked HIPER for high impact problems, in which the problem addressed is critical and normal processing is adversely affected. Circumstances include, but are not limited to, the need to re-IPL, restart or recycle a subsystem in order to recover,

loss of a major function, data loss, recursive or unrecoverable failures, and severe performance degradation. HIPER APARs are considered severe and IBM suggests that the fix is installed, or the circumvention is implemented as soon as possible.

- **SPECIAL ATTENTION**
  APARs are marked SPECIAL ATTENTION if they are considered important for the customer to install. Situations include, but are not limited to, a new function to the product, problems encountered during the installation of the product, problems encountered during the installation of service updates, and problems related to a particular condition or environment.
- **PERVASIVE**
  HIPER APARs and SPECIAL ATTENTION APARs may also be marked PERVASIVE. A pervasive APAR has high probability of affecting a large number of systems.
- **PE**
  APARs may be marked to identify an error in a PTF after the PTF is made generally available. Situations that characterize a PE (PTF in Error) APAR include, but are not limited to: if the PTF solves the original problem but creates a new problem that did not previously exist, if the PTF does not solve the original problem, if the supplied SMP/E application control statements in the PTF contain errors or prohibit it from applying correctly, or there is a documentation error that negatively affects the system.
- **SECURITY/ INTEGRITY**
  Integrity APARs identify problems that might allow unauthorized access and compromise system controls. Security APARs address problems with existing security measures that might lead to security exposures to the system or to an IBM product that runs on the system. The content of Integrity and Security APARs is classified as IBM Confidential to protect all clients on the IBM Z platform from the exposure. Information that pertains to Integrity and Security APARs is available through the IBM Z Security Portal. The portal enables z/OS licensed clients to receive information about the latest security and system integrity fixes and provides the Common Vulnerability Scoring System (CVSS) ratings for the APARs. For additional information and to register for access to the portal, refer to the zSystem Integrity document:

  https://www.ibm.com/it-infrastructure/z/capabilities/system-integrity

Notification of HIPER and PE Critical Fixes

Being made aware of critical fixes is the first step to a successful preventive maintenance plan. IBM provides various notification methods to aid in this part of the process including HOLDDATA, PSP Buckets, and ServiceLink applications.

Enhanced HOLDDATA

IBM supplies a single source text file with information pertaining to critical fixes called Enhanced HOLDDATA. This one file encompasses all IBM z/OS platform products and is updated daily. When the file is received, SMP/E ignores FMIDs that are not installed, so that HOLDDATA can be used on any system. The Enhanced HOLDDATA file is a reliable source for identifying HIPER and PE fixes that are available and comparing them to what is installed on the system when used as input to SMP/E. Security/Integrity HOLDDATA is available to authorized customers through the IBM Z Security Portal.

- **ERROR**
  IBM identifies HIPER and PE PTFs in an Enhanced HOLDDATA file with the ERROR construct.

```
++HOLD(HBB77C0) FMID(HBB77C0) REASON(CA57022) ERROR DATE(19107)
 COMMENT(SMRTDATA(SYMP(FUL) CHGDT(190417)))
 CLASS(HIPER).
++HOLD(UA99557) FMID(HBB77C0) REASON(CA57934) ERROR DATE(19233)
 COMMENT(SMRTDATA(FIX(UJ00393) CHGDT(190821))) CLASS(PE).
```

The HOLDDATA provides information to identify the reason for the hold and the fixing PTF. For a PE APAR, the hold is against the PTF in error. The Enhanced HOLDDATA is received into the SMP/E global zone. The command

SMP/E REPORT ERRSYSMODS

can then be used on any target zone to identify missing critical service that applies to the system. The report lists the exception SYSMODs, the APAR numbers, the resolving SYSMODs that have not been installed yet, and the hold symptoms. This is an example of the output from REPORT ERRSYSMODS.

```
EXCEPTION SYSMOD REPORT FOR ZONE TZONE1

HOLD     SYSMOD   APAR      ---RESOLVING SYSMOD----   HOLD    HOLD
FMID     NAME     NUMBER    NAME    STATUS RECEIVED   CLASS   SYMPTOMS
-------------------------------------------------------------------------

HBB7750  HBB7750  AA21480  UA43849  GOOD   YES        HIPER   FUL
                  AA22164  UA42721  GOOD   YES        HIPER   FUL
                  AA22176  UA42779  GOOD   YES        HIPER   FUL
                  AA24575  UA41687  GOOD   YES        HIPER   PRF
                           UA41948  HELD   YES
                  AA24592  UA42246  GOOD   YES        HIPER   FUL
         UA45336  AA31404  UA52824  GOOD   YES        PE
         UA45370  AA29166  UA48054  GOOD   YES        PE

SMPPUNCH dataset has the SMP/E statements needed for APPLY processing.
SET BDY (TZONE1 ).
APPLY    SELECT (
    UA43849 /* PTF      RESOLVES AA21480 FOR HBB7750 FMID(HBB7750) */
    UA42721 /* PTF      RESOLVES AA22164 FOR HBB7750 FMID(HBB7750) */
    UA42779 /* PTF      RESOLVES AA22176 FOR HBB7750 FMID(HBB7750) */
    UA41687 /* PTF      RESOLVES AA24575 FOR HBB7750 FMID(HBB7750) */
 /* UA41948    PTF      RESOLVES AA24575 FOR HBB7750 FMID(HBB7750) */
    UA42246 /* PTF      RESOLVES AA24592 FOR HBB7750 FMID(HBB7750) */
    UA52824 /* PTF      RESOLVES AA31404 FOR UA45336 FMID(HBB7750) */
    UA48054 /* PTF      RESOLVES AA29166 FOR UA45370 FMID(HBB7750) */
              )
          GROUP REDO.
```

- **FIXCAT**
  In the Enhanced HOLDDATA file, a construct called FIXCAT is used to identify a function or product category that the PTF may be associated with. FIXCAT categorizes preventive maintenance to allow selectively choosing which service is applicable to your system and can be ordered. More information about the FIXCAT construct can be found in the SMP/E Reference manual. Here is an example of the Enhanced HOLDDATA with FIXCAT:

```
++HOLD(HBB77C0) FIXCAT FMID(HBB77C0) REASON(CA56359) RESOLVER(UA98873)
 CATEGORY(IBM.Function.HyperPAV)
 DATE(19107).
++HOLD(HPV77B0) FIXCAT FMID(HPV77B0) REASON(AA56632) RESOLVER(UA98412)
 CATEGORY(IBM.Device.Server.z10-EC-2097.CapacityProvisioning,
 IBM.Device.Server.z10-BC-2098.CapacityProvisioning)
 DATE(19030).
```

More information about the z/OS Enhanced HOLDDATA, including downloading the latest data file, is available on the website: www.ibm.com/support/pages/enhanced-holddata-zos

Preventive Service Planning
Refer to PSP bucket information for IBM Z products page for details on how to obtain information concerning the installation of IBM products, including the latest service recommendations and cross-product dependencies.

ServiceLink using IBMLink
IBM provides methods of automatic notification of problems and fixes relating to IBM products through ServiceLink. The ASAP (Automatic Software Alert Process) application and the Alert for IBM eServer™ zSeries® application allow you to subscribe to IBM products of interest and receive electronic notification pertaining to critical software problems as they are identified.
https://www.ibm.com/ibmlink/servicelink

My Notifications
IBM clients may opt-in to receive email notifications on the IBM Support Portal through My Notifications. Subscribe to selected Products (z/OS, Db2, etc.) and stay informed of critical software and hardware updates. More information about My Notifications can be found at https://www.ibm.com/support/pages/my-notifications-subscription-service

Red Alert
Red Alerts are used for urgent communication about critical actions that IBM recommends be taken immediately, or planned actions that should be avoided for exceptional circumstances. Red Alerts are independent notifications and are not intended to replace the HIPER process in any way. There are no specific criteria for a Red Alert. It is more about the immediate action than the impact. Subscription services are available for Red Alerts through My Notifications. More information on Red Alerts can be found at:
https://www.ibm.com/support/pages/node/959863

IBM z/OS Preventive Service Deliverables

IBM has various resources for obtaining necessary fixes, including ShopzSeries and the automated SMP/E Internet Service Retrieval function.

ShopzSeries

ShopzSeries is a web application that you can use to obtain individual PTFs or service product packages. You can customize the ordering process by uploading reports from the z/OS host, which indicate the current service level and products installed on the host system. CBPDO (Custom Built Product Delivery Option) is available to order multiple IBM software products, up to a specified PUT level, all packaged on one tape or available for internet delivery. A PUT (Program Update Tape) level identifies when the PTF became available with sourceid PUTyymm.

ShopzSeries is available at: http://www.ibm.com/software/shopzseries

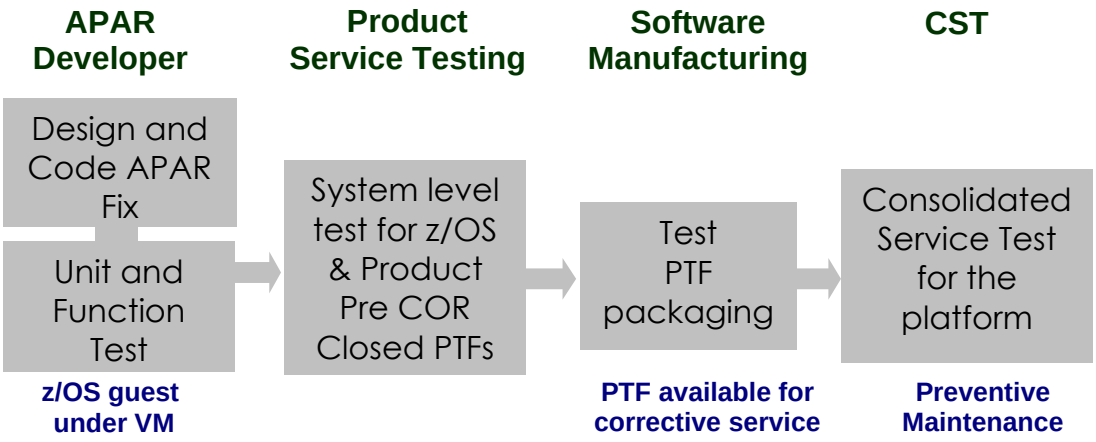
SMP/E Internet Service Retrieval

SMP/E Internet Service Retrieval is a one-step automated method to create and upload a service inventory file from your SMP/E CSI dataset, submit a service order, wait for the package to be ready, download the package electronically and processes the service package. The service order can be corrective service, naming specific APARs and PTFs. The service order can also be preventive service, requesting critical (HIPER, PE), recommended (RSUyymm) or all PTFs. The order might also be just for a two-year file of Enhanced HOLDDATA without PTFs. The RECEIVE ORDER command accomplishes this task, and the process can be manually initiated or scheduled to complement your preventive service strategy. More information is available in the SMP/E User's Guide: https://www.ibm.com/docs/en/zos/3.1.0?topic=zos-smpe or presentation http://publibz.boulder.ibm.com/zoslib/pdf/smpeiret.pdf

Recommended Service Upgrade (RSU) Preventive Maintenance Strategy

Installing maintenance across the z/OS platform can be a tedious task. Determining which maintenance is missing, which maintenance is important for the business, and which maintenance is essential for the system stability are complex decisions. IBM has developed the RSU Maintenance Strategy to make it more manageable and reliable. The RSU Maintenance Strategy also allows scheduling maintenance windows based on the predictable availability of RSU packages. RSU packages contain the IBM recommended maintenance needed to sustain high system availability. The prime objective of a Parallel Sysplex® is continuous availability. Installing and activating maintenance on one system at a time, referred to as rolling IPLs, is the recommended procedure in this environment.

IBM follows a rigorous testing sequence for all PTFs. There are specialized teams for each level of testing and every fix completes each phase of the testing cycle, including Unit and Regression Test prior to Consolidated Service Test (CST). CST is responsible for testing already available maintenance for z/OS and subsystems as a comprehensive system. Subsystems include Db2, IMS, CICS, WebSphere Application Server and MQ. This figure illustrates the testing sequence for PTFs. Note that CST testing is the last stage.



IBM testing sequence for PTFs

The CST team tests the RSU on the z/OS platform. The goal is to ensure that all products work well together and provide a complete end to end solution. The CST environment is designed as a customer like production environment. Both online and batch workloads are active, and are steady state and stress tested, with specific testing for z/OS, CICS, IMS,

WebSphere Application Server, Db2 and MQ. As an example, the CST environment below includes three levels of z/OS (current level n, n-1, n-2) and two levels of subsystems (current level n, n-1). There are two Parallel Sysplexes: Plex 1 is an 8-way with one 6-way and two 3-way datasharing groups, and two GDPS images. Plex 2 is a 9-way with one 8-way, one 3-way and two 4-way datasharing groups and two GDPS images. A GDPS environment exists on both sysplexes. This figure illustrates the software and configuration of Plex 1 and Plex 2.

3931/z16	8561/z15	3906/z14	
SA0/n-1 SB0/n SC0/n-2 SD0/n-1 CFRP CSK/n	SE0/n SF0/n-2 CF1A	K12/n-1 SG0/n SH0/n CF1C	Plex 1 8 way 1-6 way and 2-3 way datasharing groups
SJ0/n-1 SK0/n SN0/n SO0/n-1 CF1B	K22/n SI0/n SM0/n CF2B	SL0/n SP0/n-2 SQ0/n-2 K21/n-1 CF45	Plex 2 9 way 1-8 way and 2-4 way and 1-3 way datasharing groups

z/OS n current level
Plex 1 n-1 middleware
Plex 2 n middleware

CST test systems Plex 1 and Plex 2

Current CST configuration information can be found in the CST quarterly report linked from the CST web page at https://www.ibm.com/support/pages/ibm-zos-consolidated-service-test-and-rsu.

RSUs can be obtained through SMP/E Internet Service Retrieval as well as in service orders placed through Shopz and ServiceLink. The deliverables include ++ASSIGN statements that identify the RSU maintenance to be installed. The ++ASSIGN statements appear similar to the following example:

```
++ASSIGN SOURCEID(RSU1912)  TO(UA96731).
++ASSIGN SOURCEID(RSU1912)  TO(UA99080).
```

The SOURCEID identifies the RSU ID in the form of RSUyymm. The SOURCEID is the date the service completed the CST test cycle and was recommended - it is **not** the date that the service became available. RSUs are available monthly in the first few days of the month, and are available in two cycles. **RSUs are not cumulative, therefore all RSUs must be installed.**

- **Quarterly RSUs** (yy03, yy06, yy09, yy12)
  RSU service packages delivered each quarter include ALL maintenance that has been available as corrective service at the beginning of the prior quarter. The PTFs are added to the CST environment at the beginning of the quarter and tested for a full three months. For example, a severity 3 PTF is made available on July 16th. It is added to the CST environment on October 1st, tested for 3 months and made available on the RSU delivered in January (RSUyy12).
- **Monthly RSUs** (yy01, yy02, yy03, yy04 ...)
  For those customers who prefer more regular and frequent service upgrades, a monthly RSU is available. It contains HIPER, PE, Security/Integrity and Pervasive fixes. The fixes are added to the CST environment on the first of the month and tested for one full month. The fix is then included on the next RSU released. For example, the corrective service for a HIPER APAR is made available on January 12th. The PTF is added to the CST environment on February 1st. It is then included on the RSU delivered in March (RSUyy02).

RSUs comprise maintenance from multiple products available on the z/OS platform, including CICS, IMS, Db2, WebSphere Application Server and MQ. Detailed information about CST is available at: https://www.ibm.com/support/pages/ibm-zos-consolidated-service-test-and-rsu.

General Suggestions for Maintenance Practices

It is suggested to upgrade two to four times per year to the latest RSU Preventive Maintenance that is available. HIPER and PE fixes should be reviewed weekly, and installed weekly or monthly if possible. HIPER fixes can be ordered and received for immediate installation if needed. Security/Integrity APARs and Red Alerts should also be monitored regularly.

Conclusion

The value of availability of a system varies depending on the user. However, any outage, even a small one, can impact the business as a whole. There are some effects that can be measured financially, such as loss of revenue and the cost of labor related to recovery from the outage. There are also effects that can be measured in other ways, including lost opportunity, business image, and unrecoverable productive time.

Maintaining availability of your z/OS system takes commitment and focus from key resources in the process. IBM is dedicated to provide the tools and foundations needed to service your z/OS system to the highest extent. RSU is the foremost preventive service resource available to meet the expectations of z/OS.

Websites of Interest

Description	URL
CST	www.ibm.com/support/pages/ibm-zos-consolidated-service-test-and-rsu
FIXCAT	www.ibm.com/support/pages/ibm-fix-category-values-and-descriptions
GDPS	redbooks.ibm.com/redpieces/abstracts/sg246374.html
HOLDDATA	www.ibm.com/support/pages/enhanced-holddata-zos
Parallel Sysplex	redbooks.ibm.com/abstracts/sg246485.html
Red Alerts	www.ibm.com/support/pages/node/959863
ServiceLink	www.ibm.com/ibmlink/servicelink
ShopzSeries	www.ibm.com/software/shopzseries
SMP/E	www.ibm.com/docs/en/zos/2.4.0?topic=zos-smpe
SMP/E Internet Service Retrieval	publibz.boulder.ibm.com/zoslib/pdf/smpeiret.pdf
z/OS Basics: Software Maintenance	www.ibm.com/docs/en/zos-basic-skills?topic=maintenance-zos-software
z/OS Home Page	www.ibm.com/products/zos
z/OS Support	www.ibm.com/mysupport
z/OS Security/Integrity	www.ibm.com/it-infrastructure/z/capabilities/system-integrity

Notices

IBM provides information in this document to assist customers with planning a Preventive Maintenance process to help ensure the highest levels of availability. IBM does not guarantee the results.

All statements regarding IBM's future direction and intent are subject to change or withdrawal without notice and represent goals and objectives only.

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