A VM/370 Online Monitor

CPWATCH is an online performance monitor for VM/370. It displays enough about the current activity of CP to allow an intuitive grasp of system load, gross conflicts, and the currently active users.

It displays its output on DIALled local 3270 MOD 2's.

CPWATCH 3.3 has been developed exclusively on a VM/370 system using Basic Systems Extensions, 5748-XX8, but it should be easy to adapt to unmodified VM/370, or to the Systems Extension Program.

DESCRIPTION

CURRENT STATE

Operational, stabilized. Running on a 4331, and a 3031AP, under VM/370 Release 6.11 with Basic Systems Extensions (5748-XX8).

OPERATION

The monitoring machine must have class E privledges. Command "CPWX" will build a load deck and IPL it. 'DMKLD00E LOADER' must be available on an accessed disk.

It is easiest to AUTOLOG the monitoring machine at VM/370 IPL time.

Note that this program examines CP's linked lists asynchronously, and interruptable. Each examination is *not* at an instant of time, but spread over some period of time; the data it receives may be inconsistant. To minimize this, the monitoring machine should run at maximum priority (priority = 1). The machine will run compute bound when it runs, but that is for short intervals (order of 200 milliseconds) every 10 seconds; the performance impact, even on online applications, should be minimal, and the output will be much better.

To access, use the CP DIAL command on a local 3270. The first screen displayed shows a menu of available commands.

FUTURE DEVELOPMENT

Hard copy output is intended, sometime. It would be in the form of screen images written on the printer.

Direct display to the console of the monitoring Virtual Machine, using the EDGAR interface, is planned. This will allow someone logged on the monitoring machine to control CP's tuning parameters, and see the result (if any) of each change.

The use of the Virtual Machine Communication Facility to send displays to users logged on remote displays, for display using the EDGAR interface, is a possibility.

DISPLAYS

The following listings of displays show the name of the the display and the PFkey to get to it in the title. A short description of each entry is provided.

The ENTER key steps from display to display sequentially, excepting 'System Synonym Table' and 'Clock'.

There are commands to get to each one of the displays, if the 3270 has no PFkeys.

For Systems Programmers into tuning (or trying to understand) VM/370, the sources of the information are named. Users just trying to get a feel for what VM is doing should ignore them.

Menu - PF1

The Menu is brought up when you first DIAL in, and can be called by PF1. It displays the names of displays available, and how to get to them.

System Status - PF2

The System Status display carries the information about the operation of the overall VM/370 system. It is taken mostly from DMKPSA; some information is accumulated from the scan of VMBLOKs and of RDEVBLOKs, and some comes from locations named in DMKSYM.

There are four columns on the display, each reflecting a different class of data.

CPU USAGE column

This covers the actual use that the CPU cycles were put to over the last snap interval. All values are expressed in percentages.

Problem State - time with a problem state PSW loaded, i.e. when a Virtual Machine was dispatched (PROBTIME in DMKPSA).

Page Wait - time in wait state, when most outstanding I/O requests were for page I/O (PAGEWAIT in DMKPSA).

I/O Wait - time in wait state, most outstanding I/O requests were for fast devices and not for paging (IONTWAIT in DMKPSA).

Idle Wait - time in wait state, most outstanding I/O requests were to slow (ie terminal) devices (IDLEWAIT in DMKPSA).

Overhead - time executing in supervisor state (100% minus all the above).

The next two lines offer a summary of the preceeding four:

CPU Busy - Problem State + Overhead.

CPU Idle - Page Wait + I/O Wait + Idle Wait.

The next line normally is blank if the value is a true zero:

SVC Rate - the number of SVC's per second handled by CP (PSASVCCT in DMKPSA). When running VM ASSIST with ASSIST ON,SVC only SVC 76 (Error Recording) will be handled by CP. Note that 'CP TRACE' of non-priveleged instructions results in SVC ASSIST being turned off for the duration of the trace.

STORAGE column

These values measure the allocation of real core, and the paging operations used to keep it going.

Real Core - the total (K) of real memory on the machine and being used by CP (DMKSYSRM).

Free Core - the total (K) of real memory which is being available to pageable usage, ie Real Core less the non-pageable nucleus less pages fixed for I/O less locked pages (DMKDSPNP).

VM calculated paging performance:

Page Rate - page reads plus page writes per second (PAGERATE in DMKPSA) smoothed over 8 minutes. Calculated in DMKSTP.

Page Load - Smoothed (over 8 minutes) average page wait (PAGELOAD in DMKPSA. Calculated in DMKSTP.).

The following are taken from locations in DMKPTR named in the system name table.

Page Requests - page reads (PGREAD in DMKPSA) plus pages reclaimed from the flush list (DMKPTRPR), per second. Should also include pages for which no read was necessary, ie pages which had no equivalent on the flush list or on auxiliary storage, but this information does not seem to be available easily.

Flushes - (DMKPTRFF) page frames taken from the flush list, i.e. containing pages marked by the LRU algorithm as old and unlikely to be used.

Steals - (DMKPTRSS) pages taken from in Queue users.

Reclaimed - (DMKPTRPR) pages placed on the flush list, but requested again before the page frame was re-used.

Share Res - (DMKPTRSC) number of real page frames containing 'Shared Segment' pages.

QUEUES

This column summarizes the users on the system.

Logged On - number of users logged on. (DMKSYSNM in SYSLOCS)

Dialled - number of local 3270 and start-stop devices which have accessed a multi-user virtual machine with the DIAL command. (DMKSYSND in SYSLOCS).

The following are counted during the scan of the VMBLOKs. Since this takes place asynchronously with the maintainence of this chain, the numbers are not necessarily exact; i.e., Active+Inactive+Asleep may not instantaneously add up to Logged On.

Active - number of virtual machines which used some CPU time over the last snap interval.

Inactive - number of virtual machines which used no CPU time, but were not asleep.

Sleep - number of virtual machines which have issued 'CP SLEEP' command.

Queue 1 - number of virtual machines found in Q1 in last scan.

Queue 2 - ditto, Q2

Queue 3 - ditto, Q3 (BSEP).

Eligible - number of eligible users.

CHANNEL SIOs

This gives the START I/O count per second for each channel, and the total START I/O's per second issued by the system. The information is accumulated from a scan of the system RDEVBLOKS.

Terminal Device Status - PF3

This display shows the addresses, and SIO rate, of those real devices considered terminal devices.

ADDR - real address of the device (note for remote 3270's, entry is by cluster rather than by network name.

SIOS - SIO rate to this device during the last snap interval.

If the device is ATTACHed or DIALled to a multi-user virtual machine (rather than LOGged on), the letter 'A' will display between the real address and the SIO rate. If the device is a remote 327X cluster, and is not dedicated (ie, is run by CP for console devices), the letter 'C' will appear.

Real Device Status - PF4

Display of all real devices not considered terminals.

ADDR - real address of the device.

SIOS - start i/o rate, unsmoothed, averaged over snap interval.

SERIAL - volume serial number (for disk devices). 'CP' appears in front of the VOLSER if the disk is CP owned. If the device is dedicated to a virtual machine, the USERID of the owning machine is displayed instead of the VOLSER.

All Users - PF5

Display information about all LOGged on Virtual Machines.

USERID - name of the virtual machine.

S - status. May be 'A' (active), 'I' (inactive), or 'S' (asleep).

CON - Real Address of Console, if connected. Blank if disconnected, 4-digit Network ID if logged on a remote 3270 cluster, 'VMPT' if logged on through VM Pass-through (5748-RC1).

PRIO - the user's dispatching priority, 1-99. If the user is FAVORed, it will be preceeded by an 'F'. If the user is FAVORed NN percent, it will be preceeded by a '%'. If the user has RESERVEd pages, it will be followed by an 'R'.

A virtual machine is considered 'Active' if it used any CPU cycles in the last Snap Interval.

Active Users - PF6

Display information about resource usage by Active users.

USERID - name of virtual machine (VMUSER).

CON - Real Address of Console, if connected. Blank if disconnected, 4-digit Network ID if logged on a remote 3270 cluster, 'VMPT' if logged on through VM Pass-through (5748-RC1).

VRT% - Time virtual machine was dispatched, as a percentage of wall clock time. (VMVTIME)

TOT% - Total time (dispatched + CP time) charged to user, as a percentage of wall clock time. (VMTTIME).

Q - Queue (1, 2, 3) user was in when examined, or 'E' if user was eligible.

F - 'F' if the user is FAVORed; '%' if the user is FAVORed N percent.

RUN - Running status of virtual machine, i.e. status as seen by the virtual machine itself. May be RUN, SIO, WAIT, TIOB.

DISP - Dispatching status of virtual machine, i.e. status as seen by CP/370. May be DISP (dispatched), CMPB (compute bound), PRIV (Simulating a priveleged instruction), PGWT (waiting for a CP paging operation), IOWT (waiting for the result of an I/O instruction), or SL (has gone to sleep).

SIOS - Non-spooled SIO instructions issued, per second (VMIOCNT).

PGRT - Page rate, reads + writes per second (VMPGREAD + VMPGWRIT).

CORE - Real page frames, in K, occupied by virtual machine when examined (VMPAGES). If the user has SET RESERVE pages, it will be followed by 'R'.

PRWS - Projected working set, in K (VMWSPROJ).

Symbol Table - PF7

This display shows the entries in DMKSYM and their values, sorted in alphabetical order.

Symbol Table - PF8

This displays the DMKSYM entries, in address order.

Clock - PF12

Just for fun, this displays a digital clock on the 3270. It is only updated every minute, so it is quite inexpensive.

The code for generating VM/370 printer separator pages was borrowed to generate the digits.

MAINTAINENCE

To re-assemble individual modules, use 'CPWA xxx'. CPBSE and DMKMAC MACLIBS must be available on an accessed disk. Disk D is assumed to be a temporary disk to dump listings, etc. on.

Non-BSEP Operation Notes

CPWATCH 3 has not yet been tested under a non-BSEP system. The author would appreciate hearing from anyone who tries to put it up on one.

The only known incompatabilities with unmodified VM/370 are in the presence of a 'QUEUE 3' in BSEP. To create a version which (should) run on unmodified VM/370:

&1 - take 'DMKB10' out of the 'GLOBAL MACLIB' command in 'CPWA EXEC'.

&1 - change CPWPRM COPY to SETB global variable '&BSEP' to 0.

&1 - re-assemble CPWSYS and CPWUSR with 'CPWA SYS' and 'CPWA USR'.

Module Descriptions

CPWSUP - Supervisor and I/O handler.

CPWDSP - Display definitions, and service functions.

CPWSYS - Examine PSA and build global system page.

CPWDEV - Examine RDEVBLOKS and build Terminal and Device pages.

CPWUSR - Examine VMBLOKS and build Active and Logged On user pages.

CPWMAN - Main line logic.

CPWASM - Date / Time of last modification.

CPWEND - Initialization/termination routines.

COPY CODE

CPWPRM - parameters for assembly.

CPWDSC - cross-module DSECTS.

SPASSEM - documentation for structured programming macros.

MACROS

CALL - Call a 'PROC'.

CMD - Issue a CP command.

CPWSUP - Generate low core CSECT or DSECT.

CPWSVC - Generate SVC table entry.

DATA - Enter Data CSECT

DCP - Request DIAG x'04', display real core.

DCPLIST - Generate plist for DCP macro.

DEVENTRY - Generate entry in output device table.

DO - Structured programming DO group.

DSPENTRY - Generate entry in Display table.

DSUB - Doubleword integer subtract.

EDITD - Edits packed number into external display field.

IF - Structured programming IF group.

MODULE - Define application CSECT

PROC - Define application subroutine.

SETIME - Set interval timer value.

SPENDCHK - Check for all structured programming figures closed.

SPOPTION - Structured programming options.

STORAGE - Enter dynamic storage DSECT.

WAIT - Wait on interval timer.

WTO - Write to monitoring machine console.

Problems

Please address any problems or questions to:

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