z/TPF V1.1

TPF Users Group – Fall 2012

Title:
Performance and Reliability Topics

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AIM Enterprise Platform Software
IBM z/Transaction Processing Facility Enterprise Edition 1.1.0

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- **Channel Redrive**
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Channel Redrive(CR) evolving value

- **Existed to preserve SAP(IOP) capacity**
  - All redrives done in channel engine
    - Total channel capacity very large compared to relatively scarce SAP power
  - Have measured up to 5 redrives per SSCH in customer workloads
  - Could have DEV,CU or switch busy
- **HW evolution has significantly lowered the value of CR**
  - CU queueing eliminates CU and DEV busy
  - FICON packet design means no switch port busy
  - In pure FICON environment there are 0 redrives

Channel Redrive limitations

- **With CR the SAP places the IO on a Round Robin(RR) selected channel**
  - We needed a minimal cost selection algorithm to maximize SAP throughput
- **RR works well with roughly equal server capacity**
  - If one path is weaker due to poor configuration or HW failure then RR will significantly overload that path
- **Standard IOP path selection will do a better job in optimizing unbalanced IO configurations**
  - They work with some function of response time

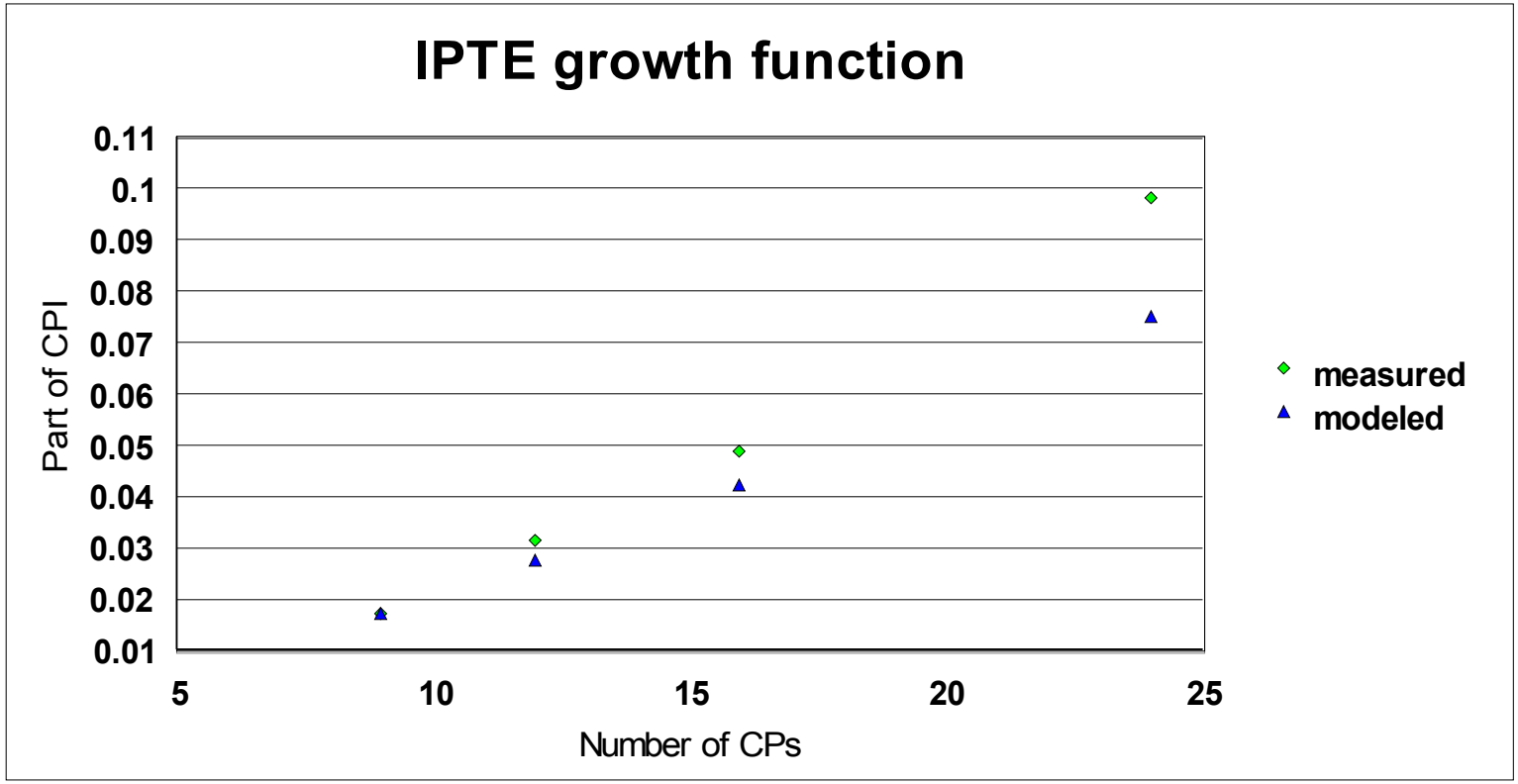
Customer should investigate running with no CR

- **With mixture of FICON/ESCON switch busies will still exist**
  - Examine SAP utilization for sufficient capacity
- **With mixture of CR and no CR CECs the CR CECs may see a slight reduction in IO service time compared to non CR CECs**
  - Have seen 7% delta in production
    - no CEC lockouts expected
    - essentially a sort of priority queue
  - Any sort of imbalance would make this delta vanish
  - All CECs no CR == all CECs CR
    - DASD response time

Invalidate Page Table Entry (IPTE)

- **TPF drives a fairly high rate of IPTEs mainly through Copy on Write**
- **IPTE has each CP update its TLB**
- **Key point------- CP issuing IPTE waits for all other N-1 CPs to update their TLBs**
  - Assume time to update TLB is random variable with exponential distribution
  - Maximum of N exponentials grows like (1+1/2+1/3 …)-> ln(N)
  - Total wait per CP grows roughly as N ln(N)

EC12 has 101 CPs for customers(120 total- 19 for SAP,Spare,Reserved)



Local IPTE(HW Change Requested by TPF Lab)

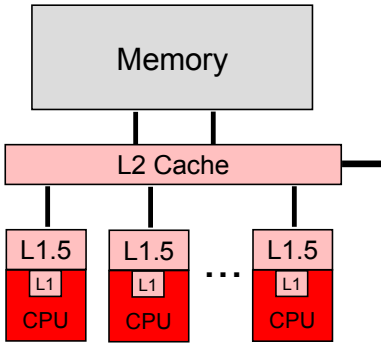
- **First available on the EC12 machine**
- **Local IPTE only updates TLB of issuing CP**
  - Other CPs unaffected and keep running productively
- **TPF now keeps history of CPs an ECB has executed on**
- **TPF makes certain the ECB has the latest copy of static data with every CP it runs on**
- **Can hold IPTE performance cost to a constant small level**
  - Greatly increases MP efficiency

Memory effects

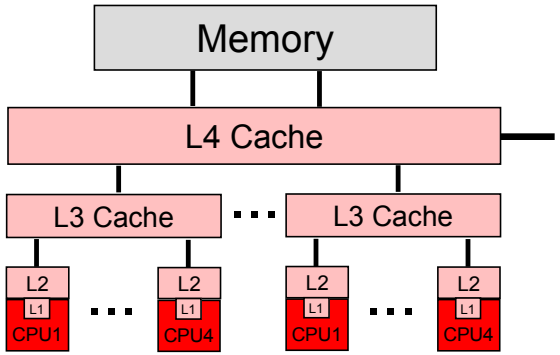
- **EC12 has**
  - 4 levels of cache
  - 2 levels of TLB
- **Increased cache structure needed for continued growth in total CEC MIPS**
  - Memory has been getting faster
  - CPU growing much faster

z196 versus z10 hardware comparison

- z10 EC
  - CPU
    - 4.4 GHz
  - Caches
    - L1 private 64k i, 128k d
    - L1.5 private 3 MB
    - L2 shared 48 MB / book
    - book interconnect: star



- z196
  - CPU
    - 5.2 GHz
    - Out-Of-Order execution
  - Caches
    - L1 private 64k i, 128k d
    - L2 private 1.5 MB
    - L3 shared 24 MB / chip
    - L4 shared 192 MB / book
    - book interconnect: star

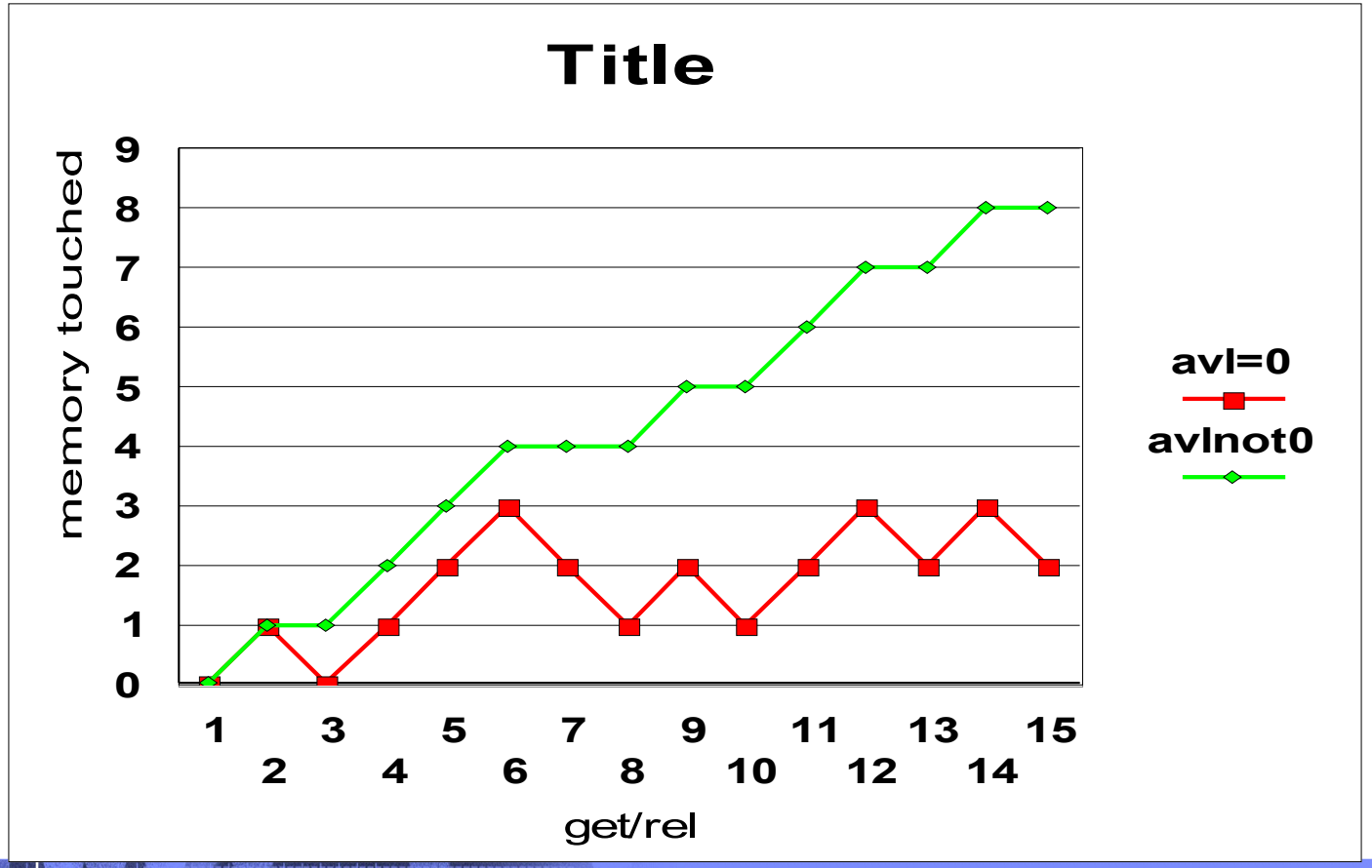


Memory Footprint Effects

- **When we think of performance often we think of instruction pathlength**
- **55 vs 300 trace elements in Lab experiments**
  - Suddenly mills/msg varied by 5-7%
  - Memory footprint per ECB increased
  - The instructions executed were identical

Avl=0 Memory Effect

- **Various cust---3 to 5% gain**
- **Debugging loss—not sig**



Dump Buffer can significantly improve TPF system availability

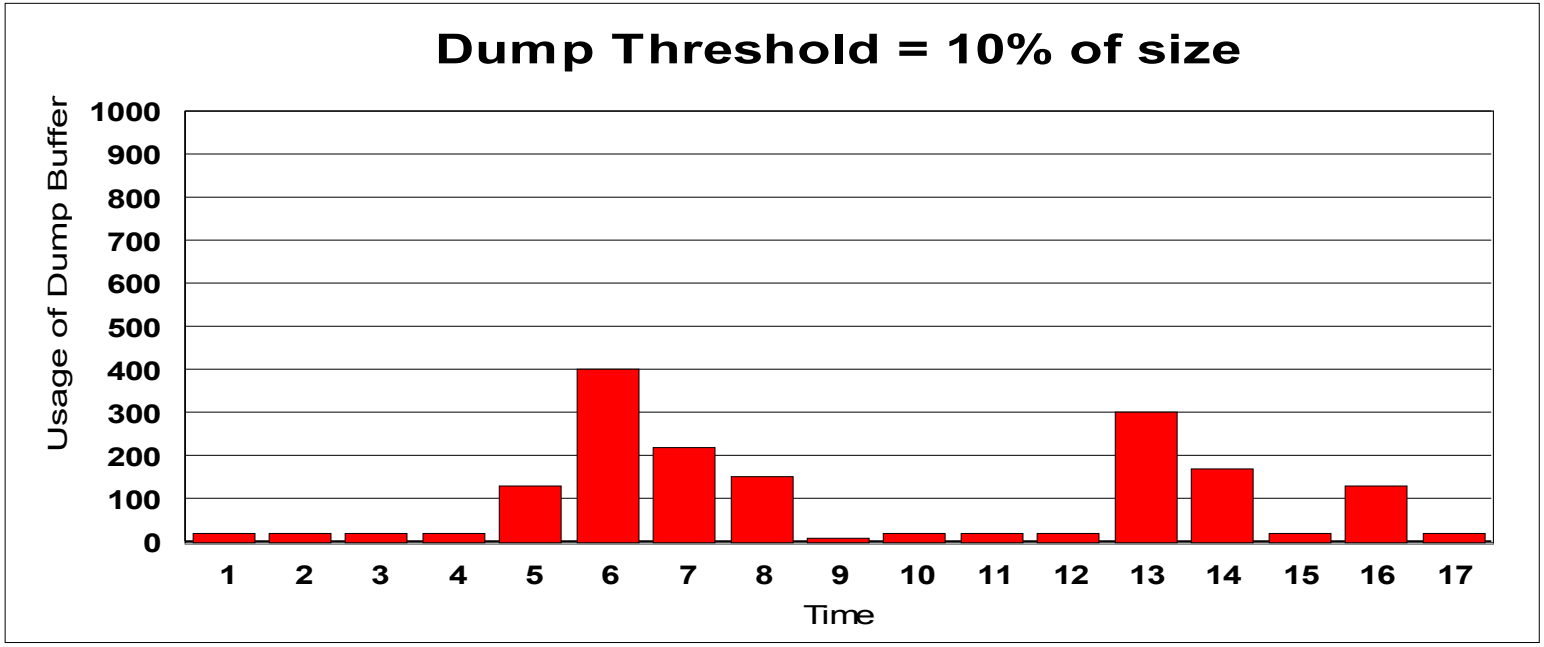
- **When dump to tape the size had to be carefully controlled**
  - 300M at 10M/sec => 30 seconds of CEC dead time
- **Rough time analysis for memory dump**
  - 256 line at 1000 cycles/line
  - 300M => ~1.2E9 cycles
  - Cycle time of .2ns => 1/4 second wait

How much dump space to define

- **Single LPAR in CEC then probably extra memory**
  - Dump buffer doesn't affect performance
  - VFA ~ 1G is a good rule of thumb
- **Too much space – extra memory cost**
- **Too little space – large probability that some dumps will go to tape**
  - View this as an outage

Dump Buffer data collection

- **Peaks over threshold**
- **Recorded values are 400M,300M and 130M**



Dump Buffer Sizing

- **Detailed customer dump pattern knowledge**
  - OPR and CTL dumps are ones of interest
  - Basically frequency x size with time correlation
    - For example
      - Mean rate of 30 dumps per hour
      - maximum of 3 CTLs in a 5 second period
      - max size < 300M
- **Stochastic approach**
  - Above had many not so easily checked assumptions
  - Record 2 to 3 months of dump buffer usage data
  - Feed that into and use Extreme Value Theory
    - 40% of Netherlands below sea level
    - 111 years of storm data
    - Government demand balancing cost and safety
      - Dikes built so Probability (overflow dike in a year) < 1/10000
    - Only 100+ years of data but yet can estimate an extreme quantile
  - Lab is willing to assist in this analysis

CPU Measurement Facility

- **First available on z10**
- **Absolutely critical for complete performance analysis**
- **Has been run at 2 customer sites – no problems**
  - From impact/risk view
    - think of it like running data collection
- **Lab is building HW usage profiles for**
  - RES,GDS,Finance,Rail …
  - Feed into future
    - processor development
    - TPF development

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