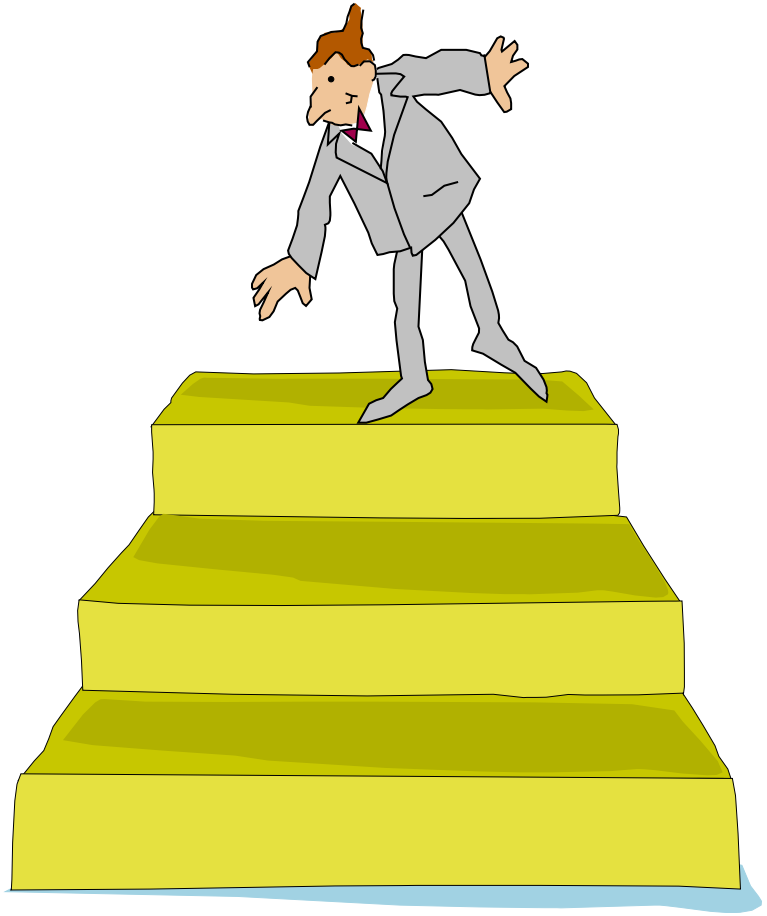
Virtual IMS USER GROUP

IMS performance – taming the beast

Aurora Emanuela Dell'Anno

and who am I…

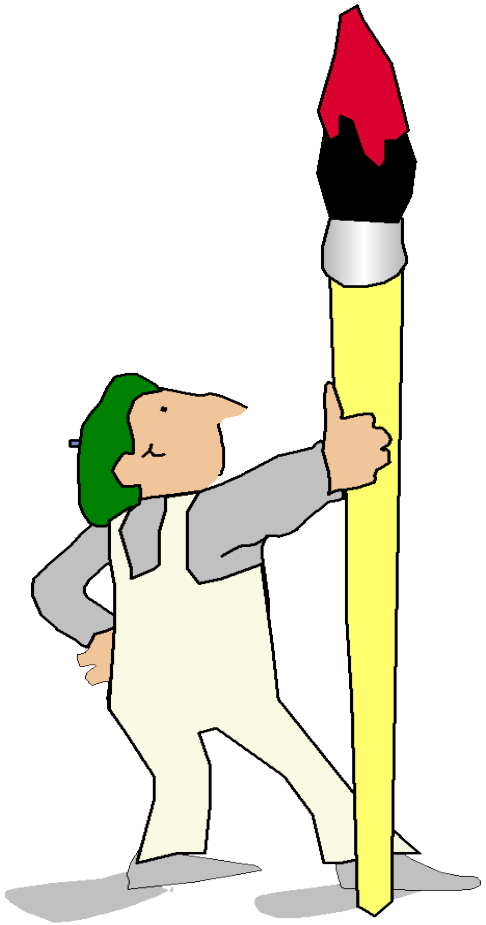
- Systems engineer on IBM mainframe
- Former application programmer
- Specialisation:
  - IMS
  - DB2 Family
    - LUW
    - for z/OS
    - DB2 Server for VSE and VM
  - Data Warehousing
  - Performance Tuning



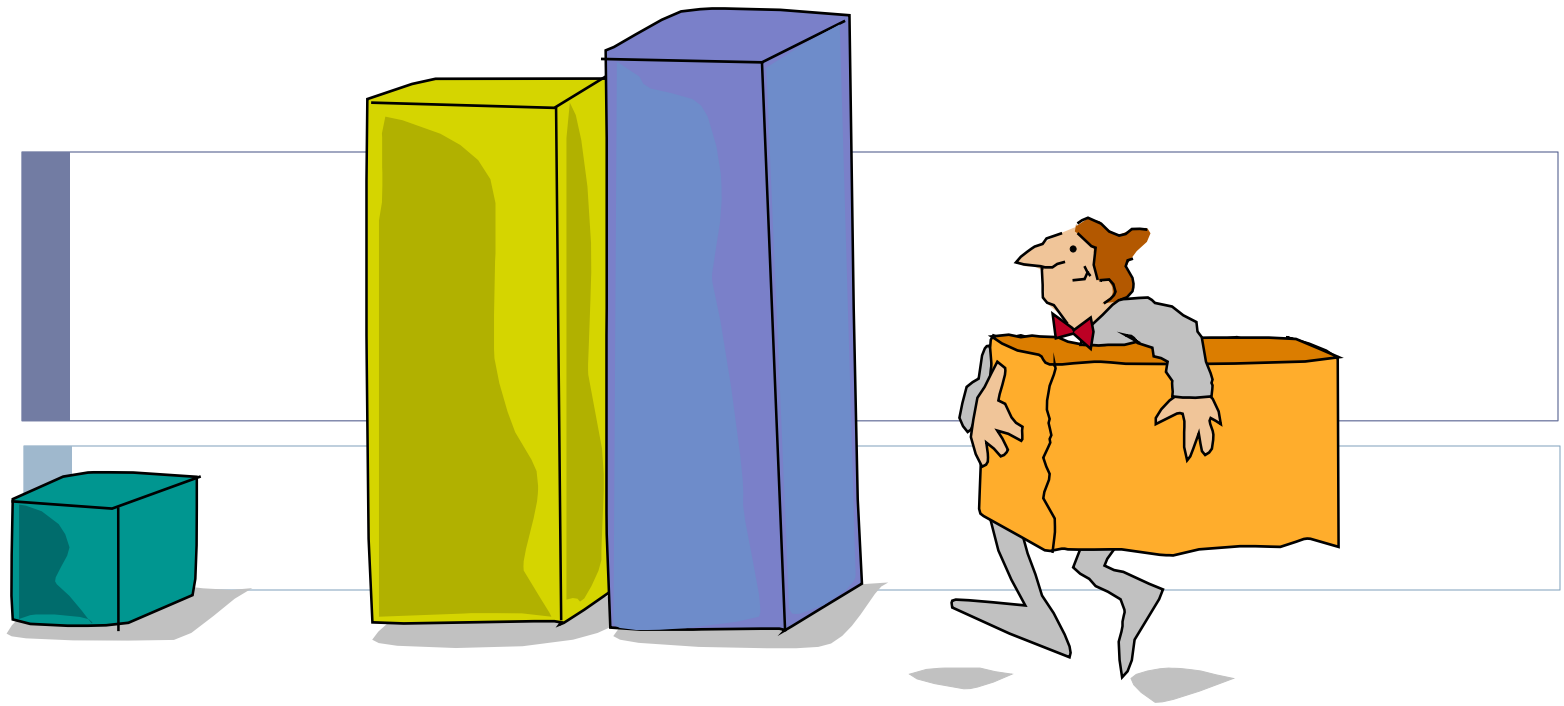
IMS performance – taming the beast

painting the picture

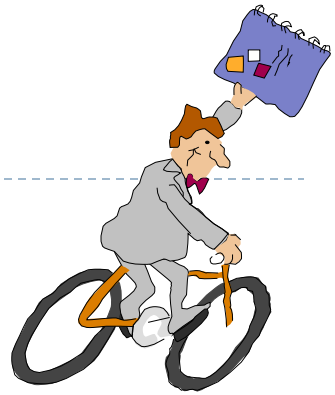
- **The Performance Challenge**
- **Who told you that?**
- **Can you DIG IT?**
- **And this is how we do it…**
- **A Review**



The Performance Challenge



Performance is a moving target!!



Business growth

New applications

New technologies

Mergers/acquisitions

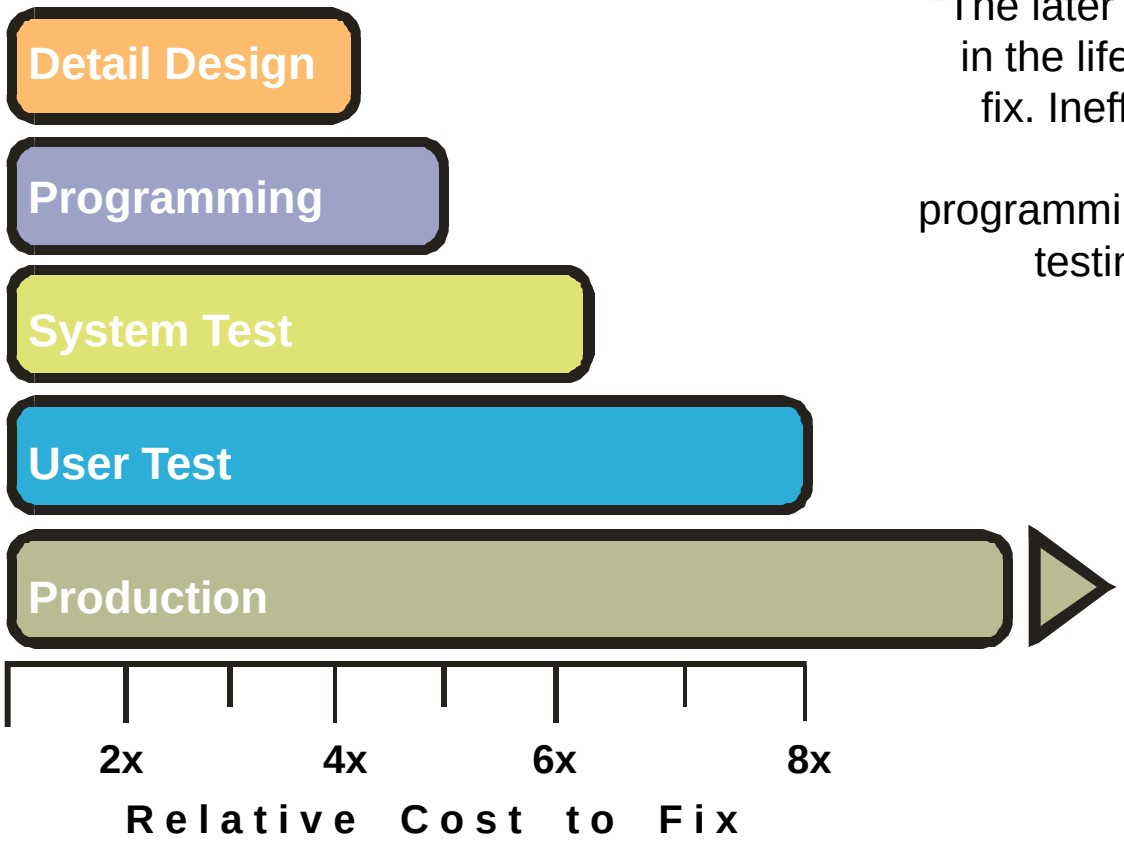
CPU Creep

New system software

Defects and recurring faults

Distributed integration

The Importance of Correcting Performance Problems Early



"The later performance problems are caught in the life cycle, the more costly they are to fix. Inefficiencies introduced in design can cost twice as much to fix during programming, four times more during system testing, and eight times more when the application enters production."

Accenture

Impact of Ineffective Performance Tuning

When performance issues are not dealt with:

- ✓ Poor customer satisfaction
- ✓ Increased processing costs
- ✓ Missed SLAs – penalty charges
- ✓ Lost business due to poor reputation
- ✓ Inability to scale to business requirements and growth

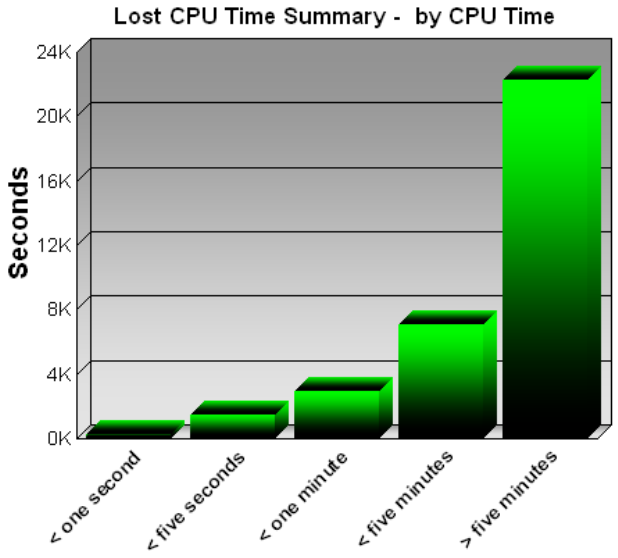
		Requirements	Design	Development	Testing	Production	Resolution cost for 100 defects at x = $100
Cost of problem resolution		1x	2x	10x	50x	100x	
Firefighting	% resolved	0%	0%	0%	0%	100%	
	cost	$0	$0	$0	$0	$1,000,000	**$1,000,000**
Performance verification	% resolved	10%	0%	0%	60%	30%	
	cost	$1,000	$0	$0	$300,000	$300,000	**$601,000**
Performance-driven development	% resolved	10%	40%	25%	20%	5%	
	cost	$1,000	$8,000	$25,000	$100,000	$50,000	**$184,000**

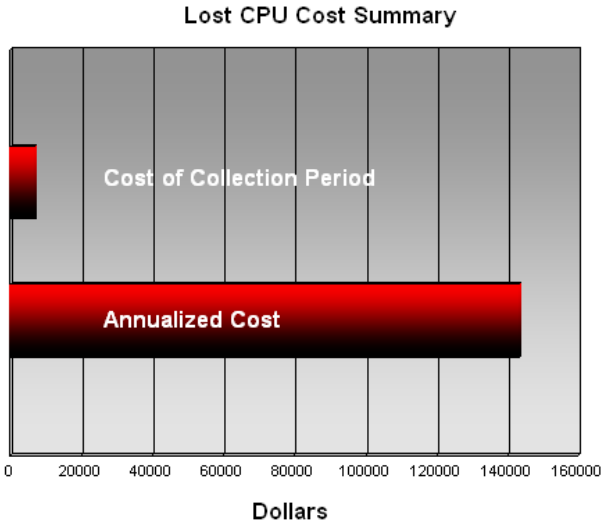
Source: Forrester Research, Inc.

Impact of Ineffective Performance Tuning

Lost CPU Time Summary

CPU Time	Lost CPU Time	Faults	Lost CPU Cost	Pct of Total	Worst Case
< one second	257.94	4429	$53.74	0.8%	1.00
< five seconds	1,482.04	645	$308.76	4.4%	5.00
< one minute	2,939.66	159	$612.43	8.6%	56.84
< five minutes	7,091.06	54	$1,477.31	20.9%	290.80
> five minutes	22,236.15	13	$4,632.53	65.4%	6,036.36
Totals:	**34.007 seconds**	**5,300**	**$7.084.76**		**6.036 seconds**





Lost CPU cost for Sample: $7,084.76

Annualized Lost CPU cost: $143,663.20

The Performance Management Capability Maturity Model

Where is your IMS?

Level 4
Disciplined

Continually evaluate and improve your performance management program

Establish accountability for application performance. Track, measure and report on the *APM* program

Level 3
Process oriented

Define processes for performance evaluation at established checkpoints

Level 2
Proactive

Reclaim production resources through repeatable projects

Respond to production crises

Organisational Benefits

The Performance Management Capability Maturity Model

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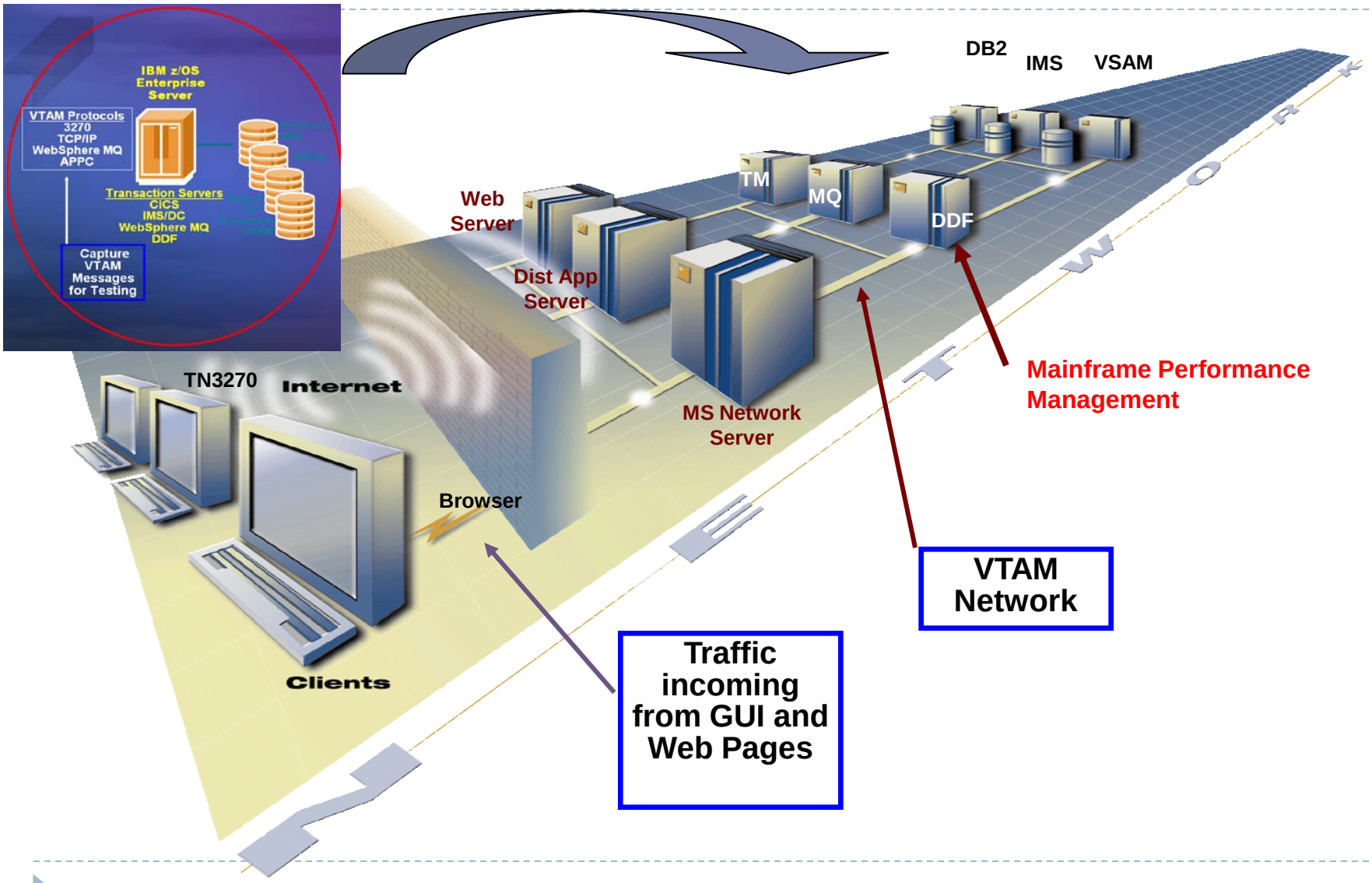
Let us know our systems…



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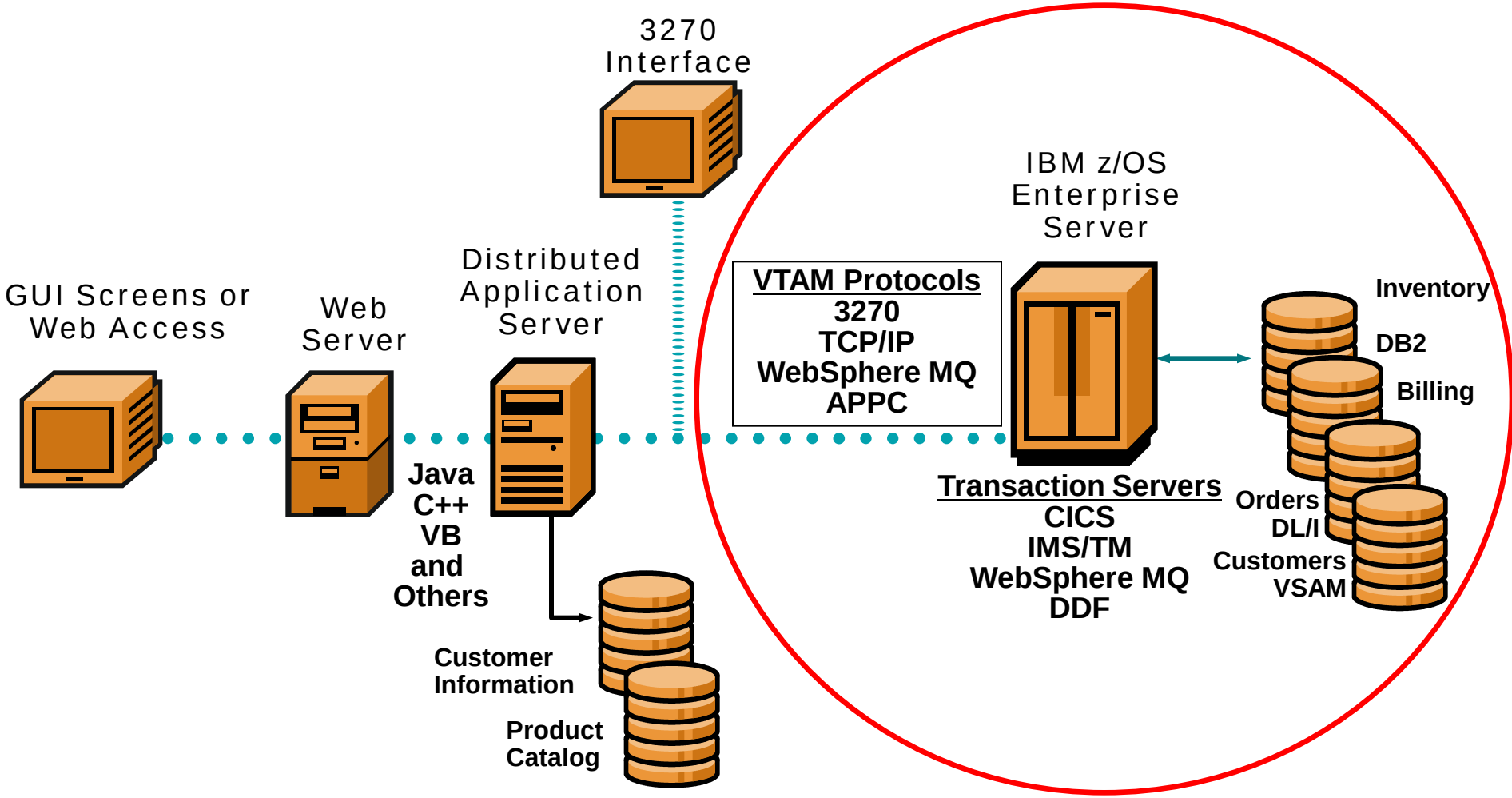


And what is IMS Performance?

- When we think about system health, we think about:
  - Efficiency
  - Code path length
  - Speed
  - Lack of bugs in code

- We also consider how easy new features are to use, whether new functions perform well, and how fault tolerant is our system

An overall health measure for any operating environment, consists of a combination of all these

Have I got a problem?

"The performance of an IMS system is directly related to a number of internal variables.

These variables can be found in the z/OS® operating system, in IMS/TM, in IMS/DM, in the application, or in the hardware.

External variables include the network and the physical infrastructure of your private network.".

RedBook IMS Performance and Tuning Guide http://ibm.com/redbooks

Getting it straight

A performing system

- CPU and DASD capacity planning
- many tools for tracking and predicting need for future hardware upgrades
- High-performing system = healthy system

IS NOT HEALTHY IF…

- No log backups exist
- Most DBs are not registered in DBRC
- You are running IMS Version 6
- Maintenance is current to May 2008
- CPU is running at 100 percent capacity all day, every day

"Most technicians and managers equate health with performance; specifically, an IMS sub-system is healthy if some performance measure or metric remains high

Organisations that simply equate health = performance

spend lots of time on performance tuning

and reacting to real or perceived performance issues

This deals with SYMPTOMS rather than causes"

The goal of any IMS installation

Effective use of system resources!

- CPU cycles
- real storage
- I/O devices

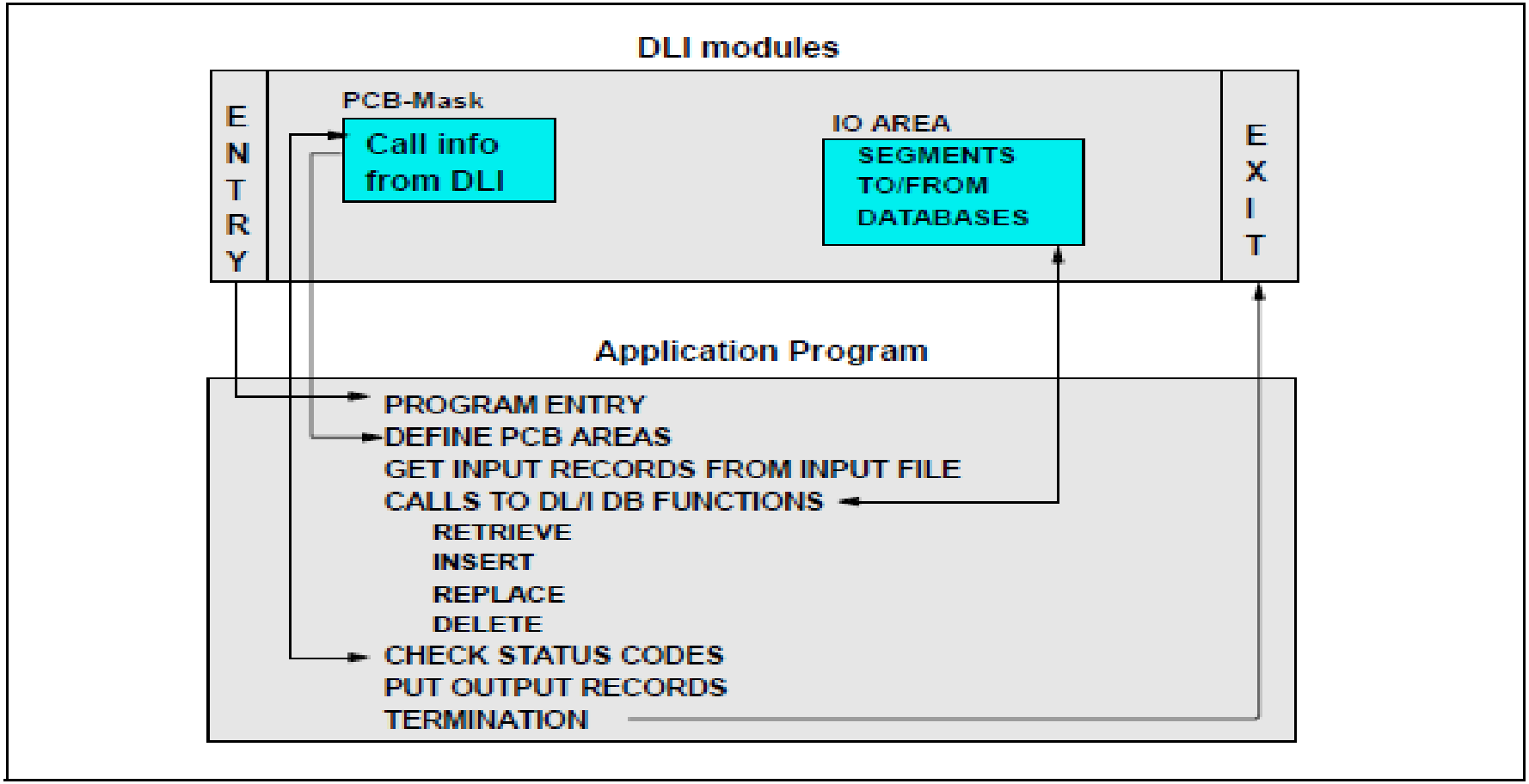
- Is this goal met?
- What specific performance problems exist in the system?

  Let us examine the current use of resources

  And then, when we implement any changes, we must re-evaluate the use of the resources again

Why Tune IMS Applications?

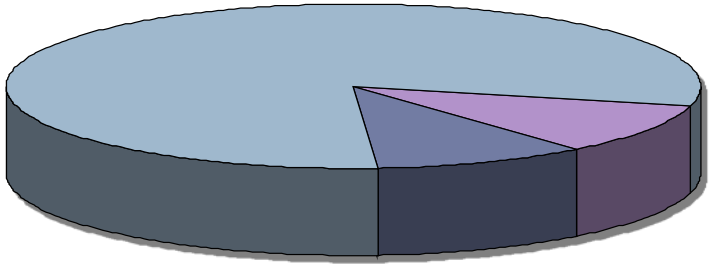
Structure of an IMS application program



Why Tune IMS Applications?

APPLICATION DESIGN
80%

- **Normalization**
- **Physical database design**
- **DL/I design and quality control**
- **Thread processing**
- **Dataset implementation**
- **Utility processing**
- **Etc...**



IMS SUBSYSTEM
10%

- **DBRC**
- **Shared queues**
- **LOG processing**
- **DB2 connections**
- **Etc...**

MVS SYSTEM
10%

- **Sub-system definition**
- **I/O configuration**
- **Etc...**

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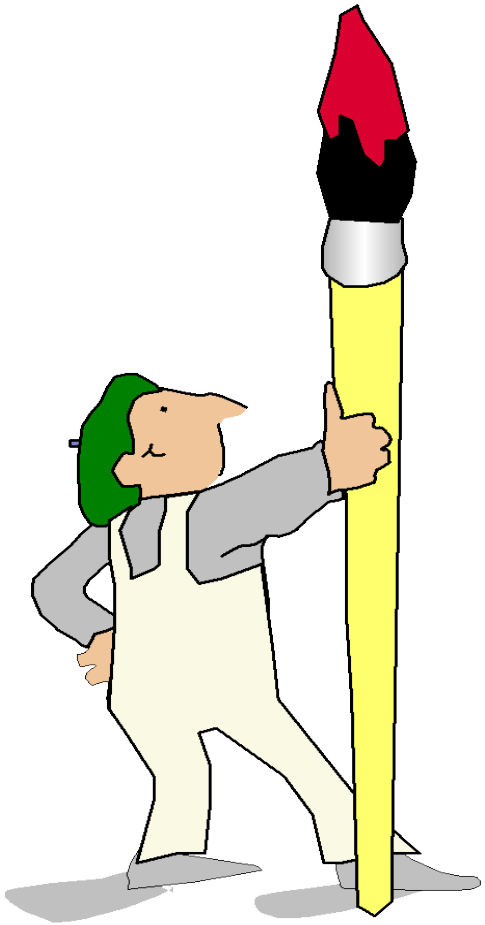


Why and how to monitor Performance

What Is The Value Of Perspective?

What Is The Value Of Perspective?

Performance Monitoring: what we look for

Cost Effective

Easy-to-Implement

High Quality – Reliable

Production-friendly

Methodology Independent

Repeatable – Reusable with minimum effort

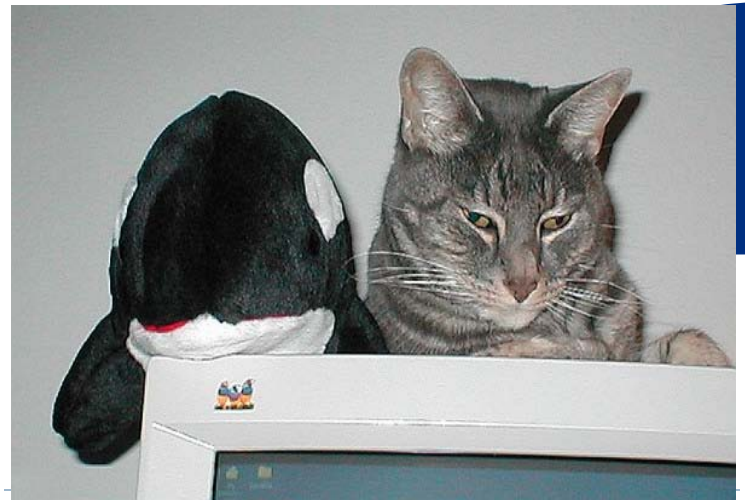
Comprehensive Information

- ***Performance Metrics***
- ***Baseline Information***

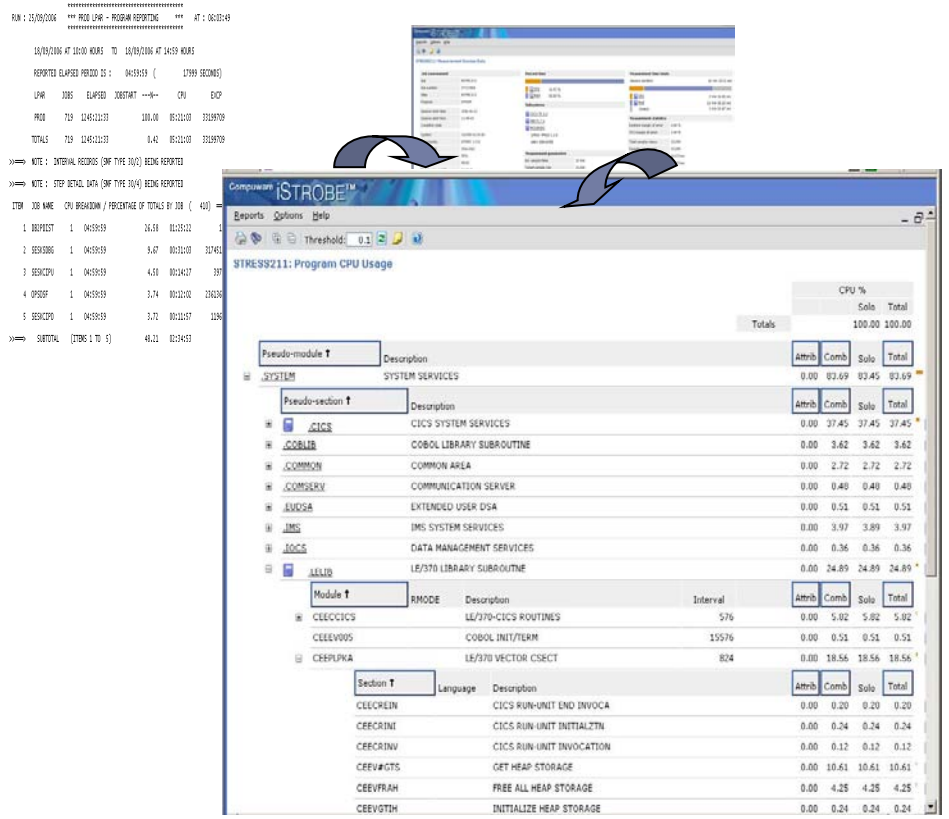
Manageable

World of Monitoring

- **MVS tuning**
- **CICS tuning**
- **DB2 tuning**
- **Efficient SQL**
- **Diagnostic tools:**
  - *Sysview*
  - *MAINVIEW*
  - *TMON*
  - *IMS PA*



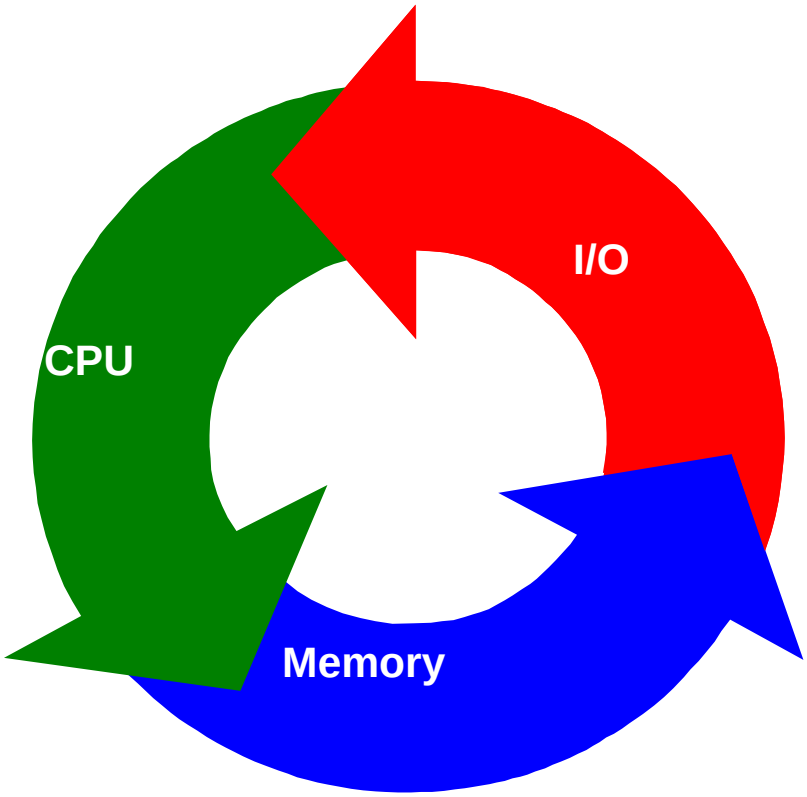
Whatever it is, remember TRACES!



- IMS Monitor trace, PI trace, PSB trace, and Fast Path trace provide a wealth of information:
  - Elapsed time and CPU time
  - Buffer pool statistics
  - Wait counts and times (I/O, locks, latches, etc)
  - Region information
  - DL/I count information
  - DB processing information

About IMS Traces and Monitors

- Recommended regular reports
  - IMS Monitor
    - Buffer pool statistics ,general reports, Region/ Program/Communication summary, I/O details, VSAM Buffer Pool reports
  - KBLA / DFSERA10
    - Log data
  - DFSILTA0
    - Log transaction analysis
  - DFSKMSC0
    - MSC link response times
  - DBCTL
  - IRLM locks
  - IMSplex information
  - IMS Connect information



The Logical Tuning Approach

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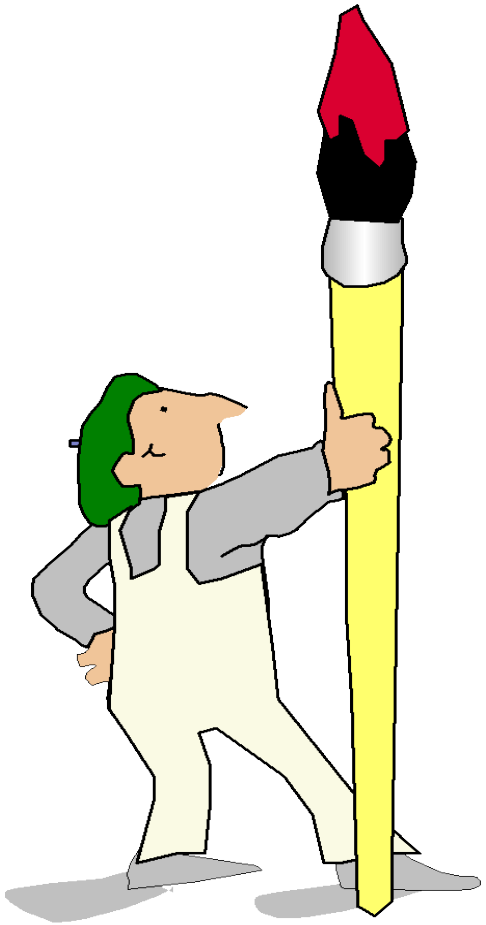


Can you DIG IT?

Sub-system and application tuning…

Check this out for a healthy IMS Sub-system

Basically, these are the main things to be monitored
ANYWAY, even if nobody touches the applications...:

SMP maintenance	includes looking at all the holddata for stuff that has to be rebound (usually every 3-6 months)
Bufferpool / message queue pool settings	if you have enough memory to just make them big, check every couple of months
IMS parameters	some people don't ever change them, but number of log buffers and checkpoint frequency are 2 that can have major impact on performance
backups	to make sure they run and run correctly – OLDS, SLDS, trace and monitor data

Check this out for a healthy IMS Sub-system

1. DR
   - Co-ordination of logs and IC
   - Existence of a D/R plan
   - Backups

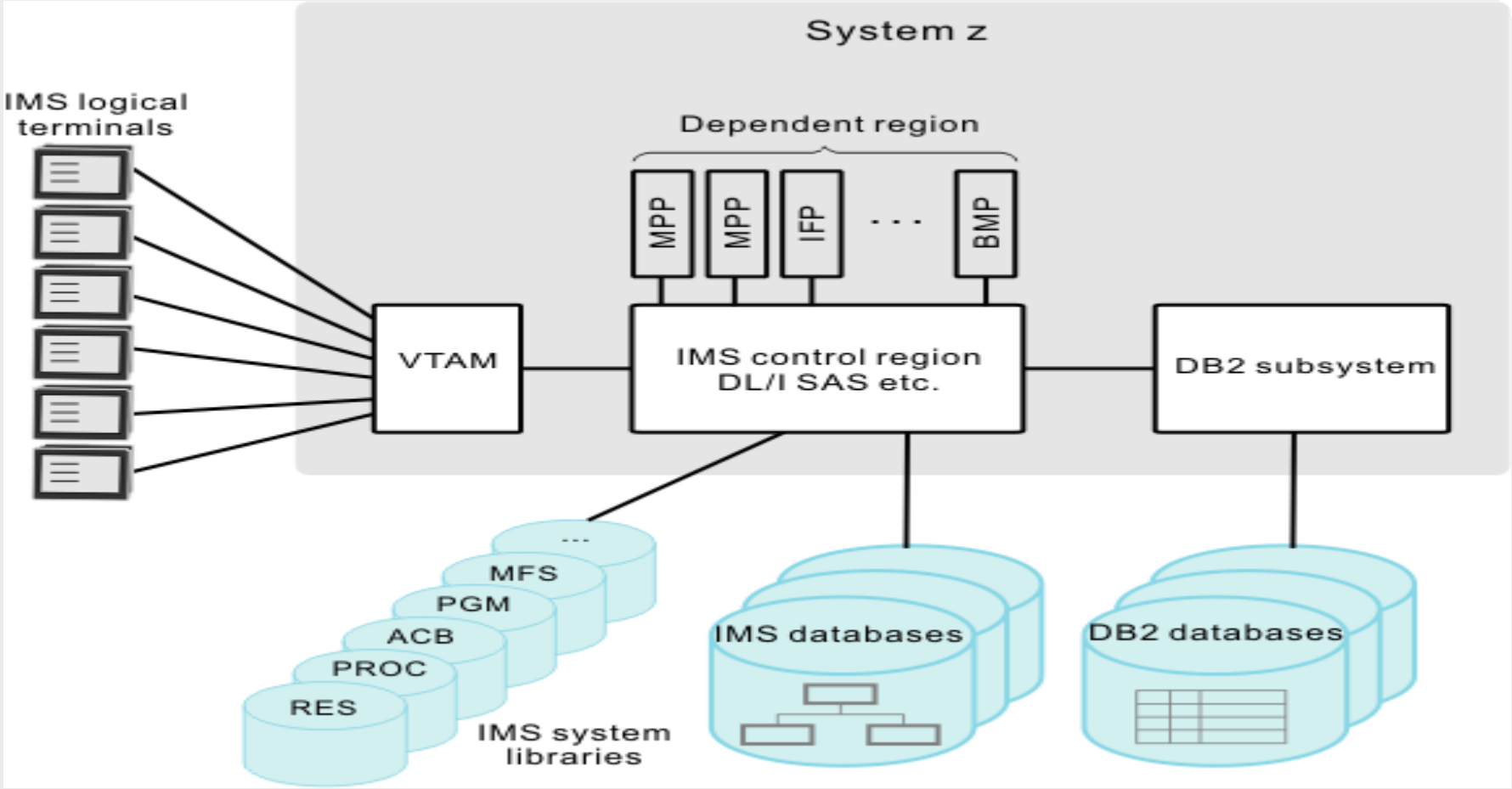
2. Growth
   - Measurement of percent busy
   - CPU-bound vs. I/O-bound
   - Quantity of traffic through DDF
   - Transaction throughput and DL/I calls (query vs. update)
   - Logging activity
   - Memory activity
   - Current bottlenecks

Check this out for a healthy IMS Sub-system

4. Stability
   - Maintenance process (version, currency)
   - Regular upgrades
   - Software maintenance strategy
   - People
     - Business skills – Time management, meetings, communications
     - Problem solving methodology
     - Education, training, certification
   - Process monitoring
     - Documentation: update, upgrade, centralise, review
     - Process measurement

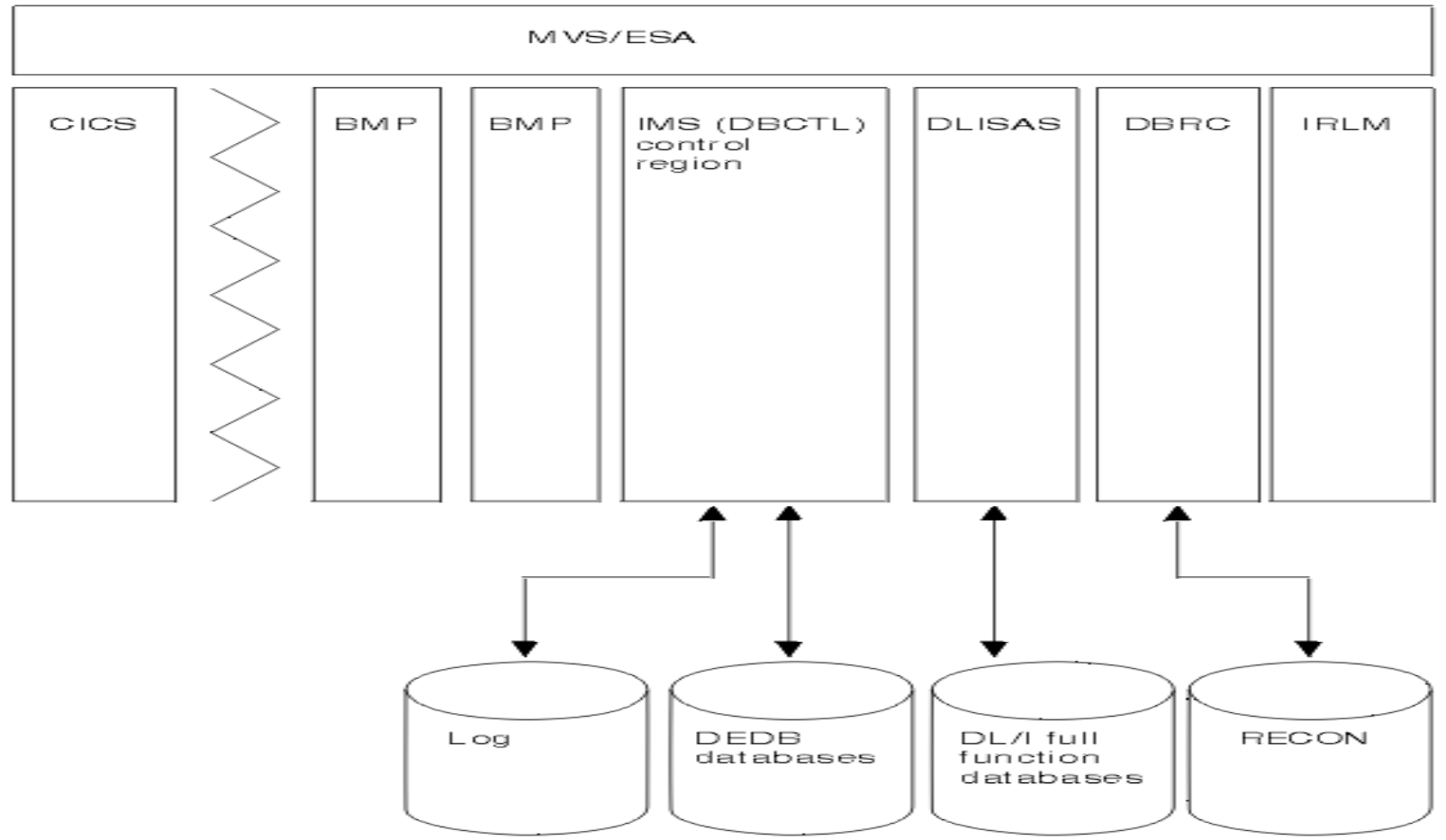
5. Maturity
   - CMM Level

The Mysterious and Complex World of IMS



Typical structure of an IMS online system environment

The Mysterious and Complex World of IMS



CICS-IMS DBCTL environment

WLM Analysis

First degree of separation:

- long running bad transactions from transactions that run quickly

Then:

- transactions that run quickly into high, medium, and low volume transactions

Service Classes definition:

- for all region types based on transaction class rather than transaction codes

Too many service classes can produce unpredictable results

Response times:

- average host response times for all workloads
- what % of workloads will meet the average response times (SLA)?
- set up the workload using response time % and performance goals

Database Performance agents

- Which access method?
  - HISAM / HD, (P)HDAM / (P)HIDAM, HALDB, OSAM / VSAM
  - If you have HALDB: Partition criteria – Key range is generally appropriate
- Block sizes, CI sizes, and record sizes
- Free space
- Randomization parameters: randomization routine, RAPs, RAA, bytes parm
- Fixed length / variable length segments: what type of data goes in them?
- Pointer options: pointer maintenance
- SCAN= parameter on DATASET statement: free space searches
- Multiple data set groups: do you need them?

Database Performance agents

- Compression: storage, I/O and CPU usage considerations
- Encryption: do you need it?
- Secondary indexes: unique keys, duplicate data fields, shared indexes
- Fast Path performance considerations: VSO, Field calls, Buffers
- Non-recoverable databases
- OSAM or VSAM? OSAM is better with IMS but requires attention
- GSAM performance: PROCOPT, BUFNO, DCB=OPTCD=C
- REORG strategy

Transaction Manager Performance agents

- Call scheduling options: processing, classification, queuing
- Program load options: COBOL, DBLDL, LE, LLA
- TRANSACT macro parms: MAXRGN, SEGNO, PARLIM, PRTY, PROCLIM

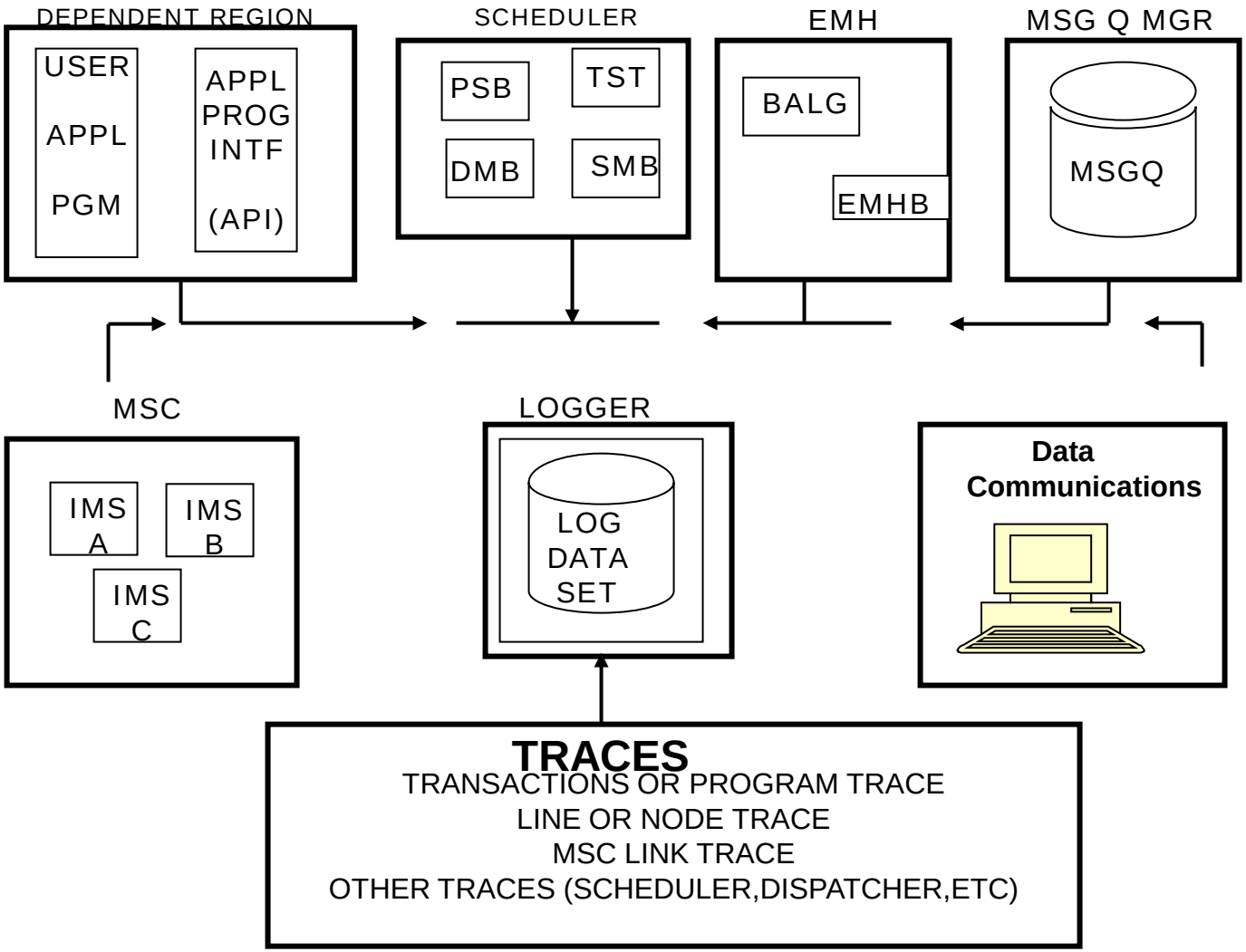
IMS TM Performance agents: IMS Parameters

- Buffer Pools
  - for Fast Path: DBBF, DBFP, DBFX
  - Dynamic Pool manager (DFSPOOL) thresholds
  - Message format BP parms
- IMS I/O Activity and Performance
  - I/O sub-system performance
  - IMS Scheduling and Application I/O performance
  - ECSA / CSA usage
  - Dependent region PST
  - Message Queue buffers
  - RES PSBs and DMBs, page fixing
- IMS Locking Activity
  - IRLM lock activity, Claim and Drain activity
  - Lock contention and Lock escalation
- IMS Logging
  - Number of logs, single/dual logging, log I/O activity and checkpoint activity
- DBRC

DBCTL Performance agents

- DFSPZPxx
  - for Fast Path: FPBUF
  - Overflow buffers
  - Thread parms
- Variable pool allocation parms
- DFSPBxxx
  - Thread parms
  - Storage pool management
- IMS Logging
  - Number of logs, single/dual logging, log I/O activity and checkpoint activity

Logging and IMS



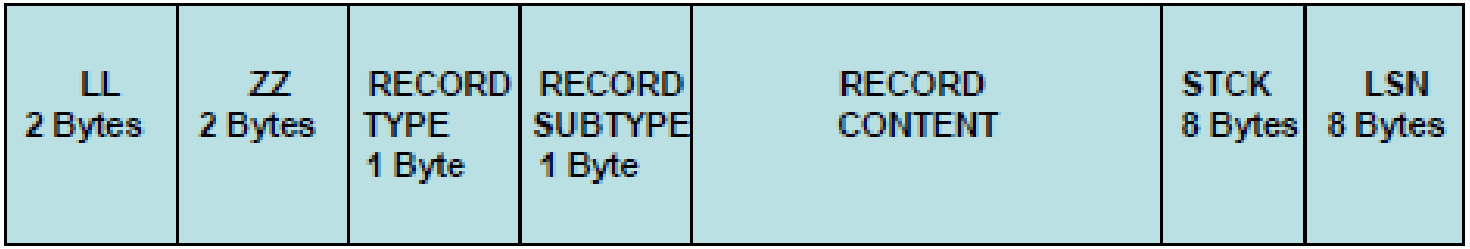
IMS Logging Considerations

- Every task in IMS must log
  - IMS has a physical logger and a logical logger
    - Each of these functions has its own TCBs
  - Two types of logs:
    - write ahead data set (WADS)
    - online log data set (OLDS)

  A large IMS subsystem can perform enormous amounts of logging
    - on CPU with 64-bit support (z/Architecture), log buffers are page fixed above the 2 GB line
    - For this, OLDS block size must be multiple of 4096 (without exceeding half track value)
    - With previous recommended block size of 26 624 we cannot use storage above the line
    - If you increase your log buffers, careful with WADS (size of the WADS must be increased)
    - Ensure the correct number of OLDS buffers are defined in DFSVSMxx

IMS Log Record format

Log record format



LL = Variable length field

ZZ = Usually binary zeroes

STCK = Binary value for hardware clock

LSN = Log sequence number

Record Type and subtype show type of log record.

Other IMS Performance agents

- DBRC - RECONS
  - Dataset definition
  - Dataset contention issues
    - GRS
  - Dataset maintenance
- SMF and RMF
- Batch applications
- IMS Utilities:
  - Change accumulation, pointer checker, image copy, recovery utilities, etc.

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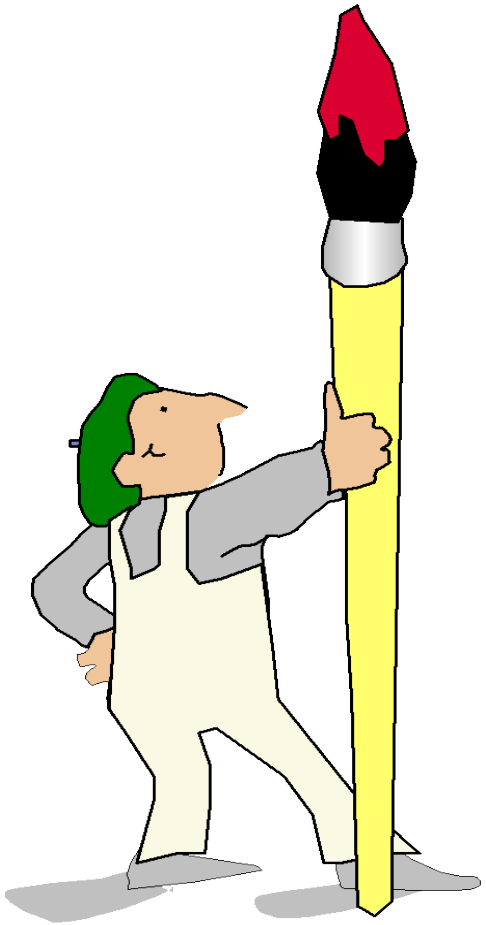
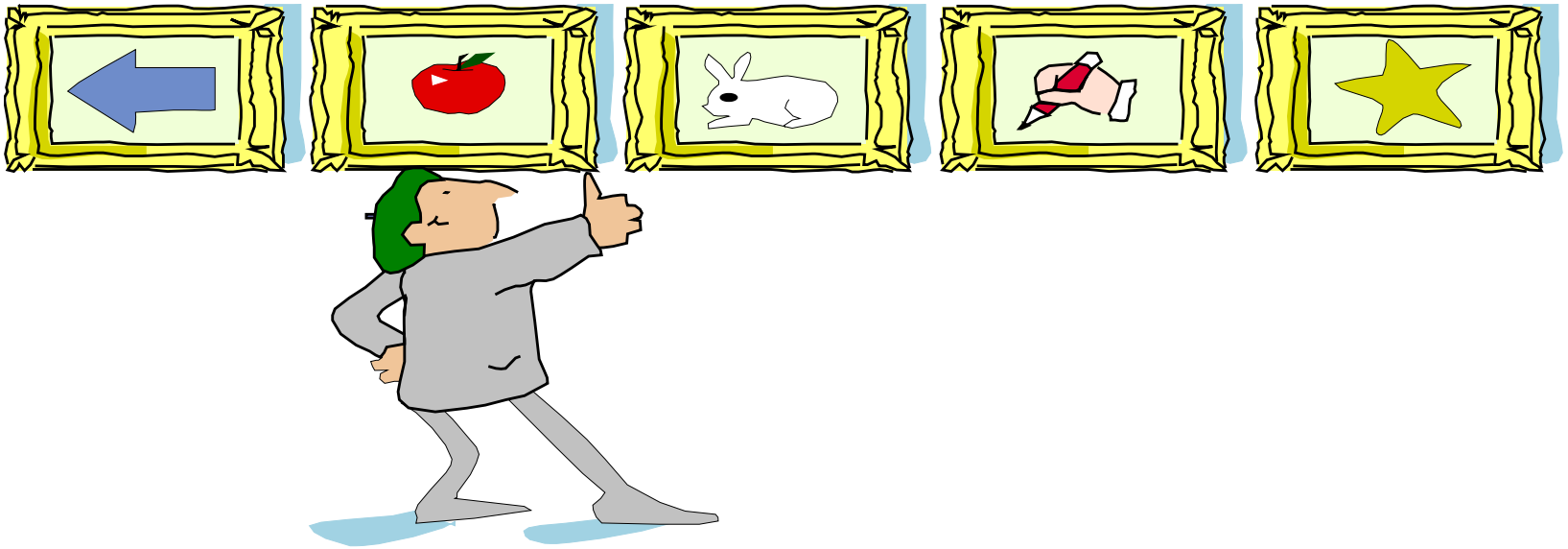


And this is how we do it

Re-writing the process



The tools we need to check our IMS's health

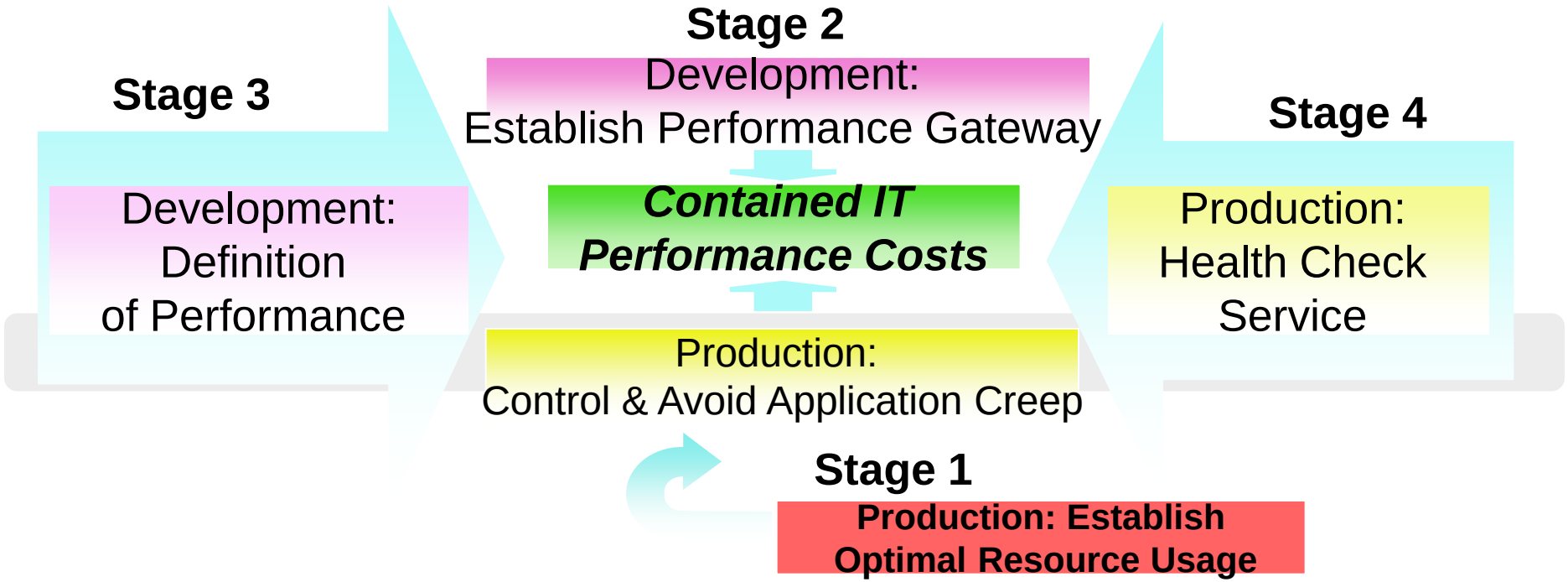
1. Tick-boxes:
   - ✓ DR practices
   - ✓ Capacity Planning
   - ✓ Proactive, predictive, self-healing
   - ✓ Stability
   - ✓ Maturity
2. Tuning knobs:
   - Sub-system configuration
   - Catalog and directory
   - Access Paths
   - Data: volumetric and configuration
   - Process objects

The next steps: Autonomic Computing

1. Collect multiple sources of event, threshold, and statistical data
2. Consolidate, analyse, and report data using performance management tools
3. Use correlations and recommendations available from monitoring software and other sources
4. SCRIPT!
5. Integrate components for dynamic management

Performance monitoring Strategy:

transaction and application profiling



- ✓ The objectives of performance testing are defined for specific applications/transactions
- ✓ Every application/transaction will have its own objectives, and its own limits, according to the use which is made of it

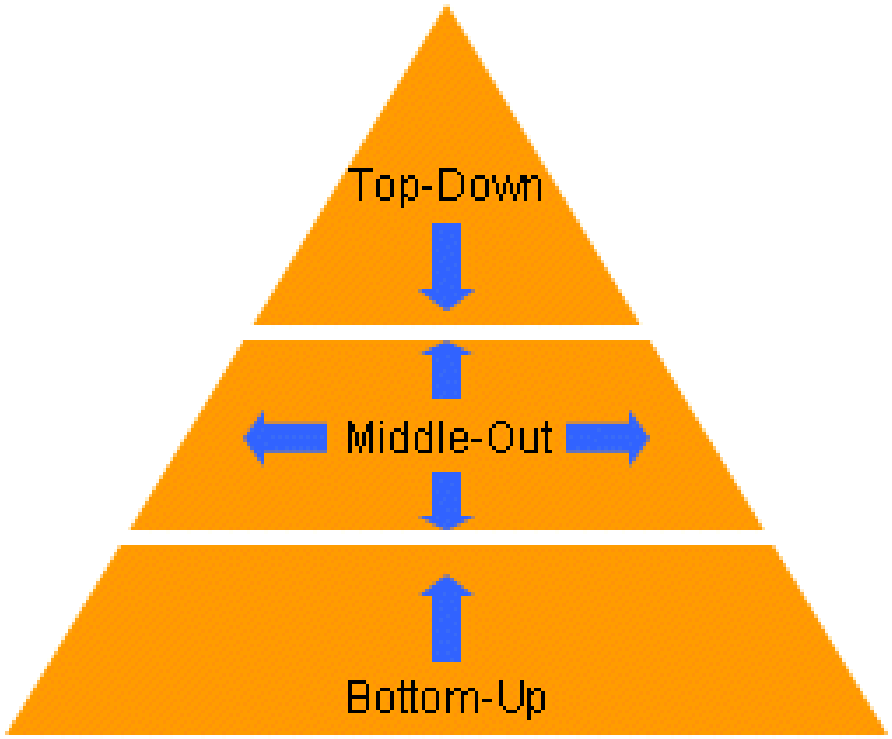
The holistic approach: what is at stake?

Quality

- User benefits
  - Service contracts quality assurance
  - User and customer satisfaction

Budget

- Profitability of the data-processing investment



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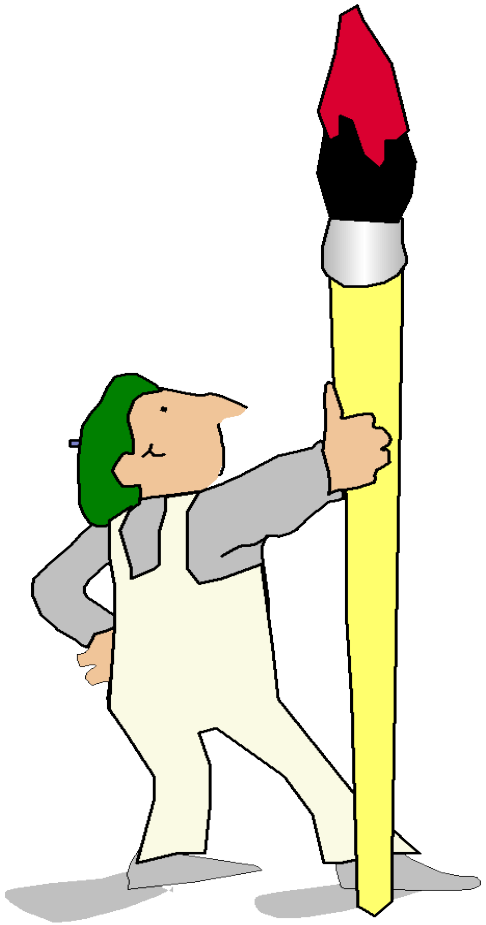
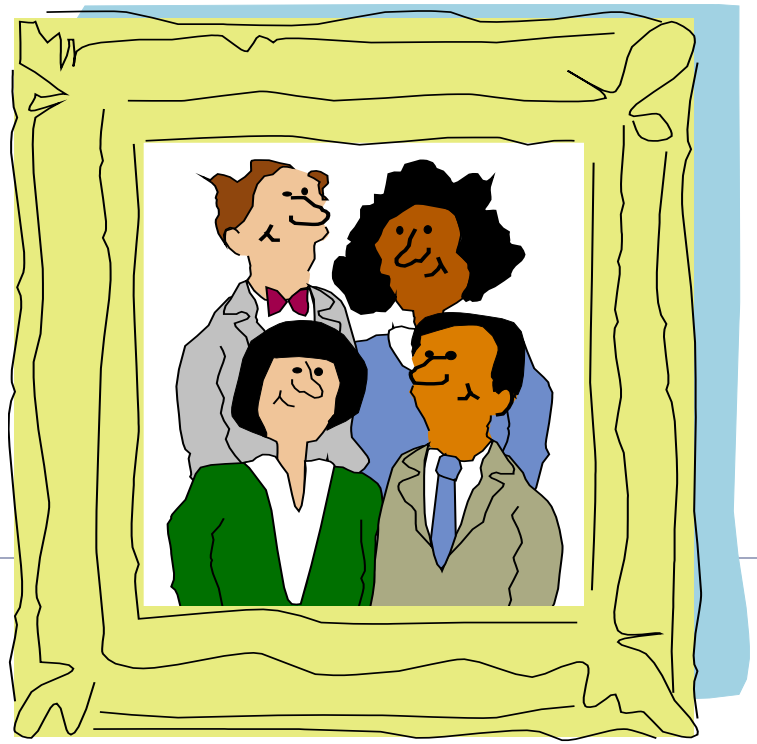
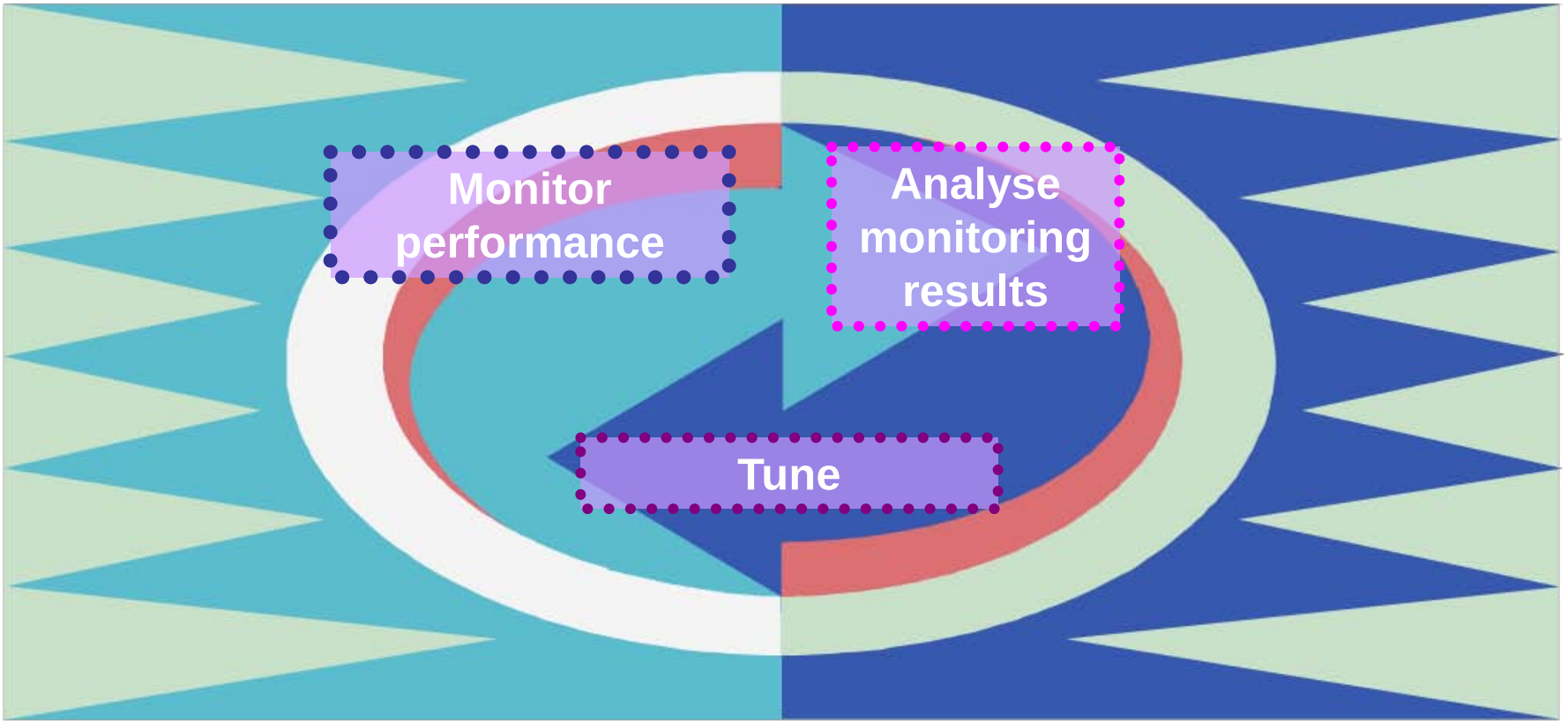




In short - a review

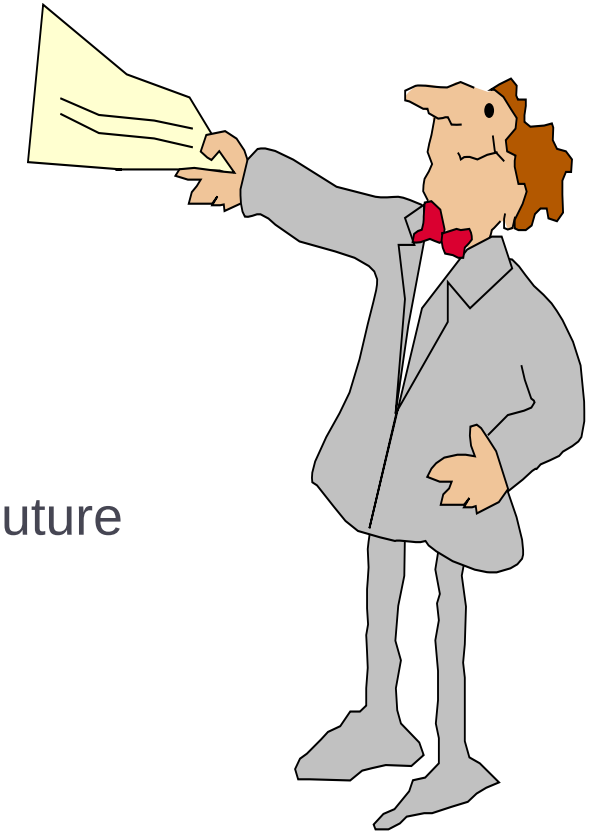
The ultimate holistic approach

1. **Define performance objectives & metrics**
2. **Create monitoring, testing and tuning procedures**
3. **Implementation practice – again from the top!**



Read the books!!!!!

- http://www. ibm.com/ims
- http://www.redbooks.ibm.com



- Manuals and Redbooks:
  - IMS Primer
  - IBM IMS Version 12 Technical Overview
  - Transaction Processing: Past, Present, and Future
  - IMS Performance and Tuning Guide
  - DBRC In Practice – from www.bmc.com

  - http://www.fundi.com/virtualims/index.htm
  - IMS-L: IMS-L@IMSLISTSERV.BMC.COM


Thank you very much!!!
With special thanks to:
S. Larsen, P. Armstrong, J. Janttl, P. Bruni, D. Viguers, P. Sadler, D. Kohli,T. Michielse, E. Maxwell