Database Administration:

The Complete Guide to Practices and Procedures

Chapter 5

Performance Management

Agenda

- Defining Performance
- Monitoring vs. Management
- Service Level Management
- Types of Performance Tuning
- Performance Tuning Tools
- DBMS Performance Basics
- Questions

Introducing Performance Management

- Performance management is usually reactive.
  - Proactive is better!
- Handling performance problems is truly an enterprise-wide endeavor.
- But enterprise performance management frequently becomes the job of the DBA group.
  - Anyone who has worked as a DBA for any length of time knows that the DBMS is usually "guilty until proven innocent."

Factors Impacting Performance

- Five factors influence database performance:
  - *Workload* – the combination of online transactions, batch jobs, ad hoc queries, data warehousing analysis, and system commands directed through the system at any given time
  - *Throughput* - defines the overall capability of the computer to process data. It is a composite of I/O speed, CPU speed, parallel capabilities of the machine, and the efficiency of the operating system and system software.
  - *Resources* – the combination of hardware and software tools at the disposal of the system
  - *Optimization* – the process of making things run as effective as possible
  - *Contention* - the condition where two or more components of the workload are attempting to use a single resource in a conflicting way

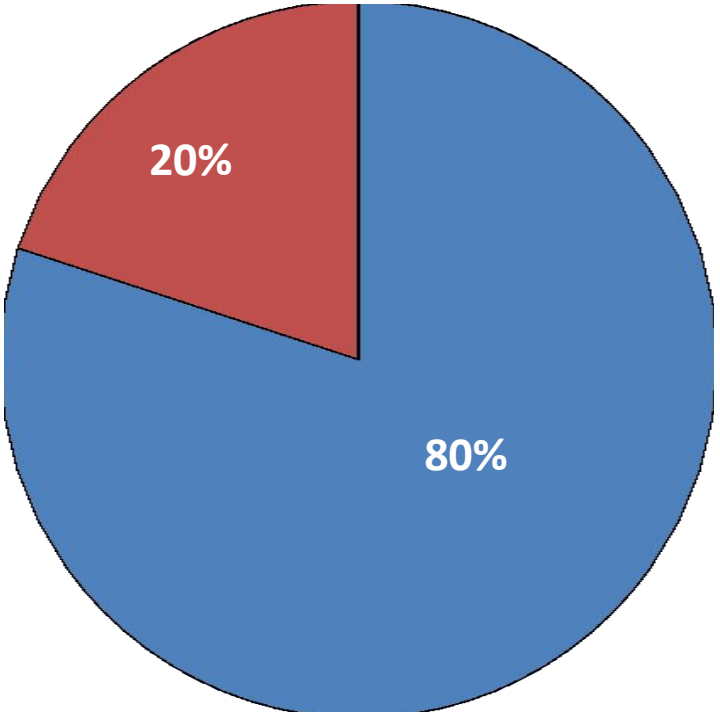
http://www.craigsmullins.com/cnr_db.htm

Defining Database Performance

- Database performance can be defined as the optimization of resource use to increase throughput and minimize contention, enabling the largest possible workload to be processed.

The 80/20 Rule

- The Pareto Principle
  - 80% of the results of tuning come from 20% of the tuning effort
    - 20% of your applications cause 80% of your problems



Don’t try to boil the ocean

http://artsammich.blogspot.com/2012/02/8020-rule.html

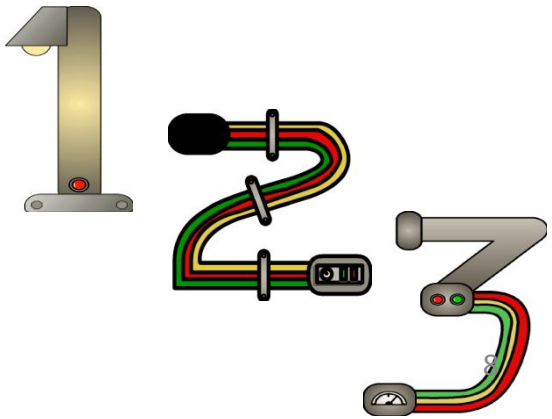
The Tuning Progression

Problem Resolution

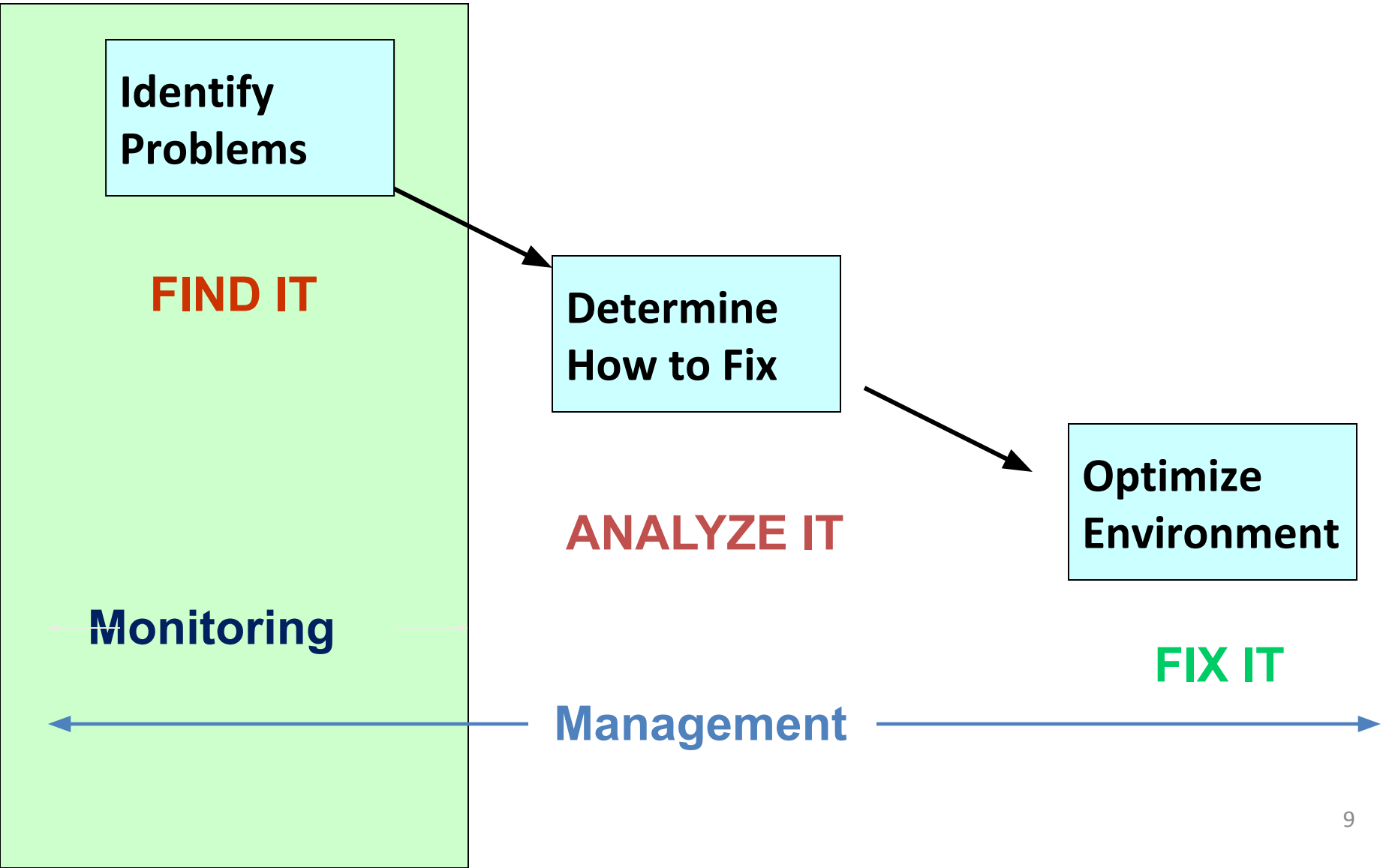
- Application
  - SQL
  - Host Language Code
- Database
  - Indexing
  - Database and Index Organization
  - Database Design (normalization / denormalization)
- System / Subsystem
  - System parms, Pools, Locking, address spaces, etc.
- Environment
  - Network
  - TP Monitor
  - Disk
  - Operating System

Other Basic Tuning Rules

- Tune one thing at a time
  - How else do you know whether the action helped or not?
- All tuning optimizes at least one of three things:
  1. CPU
  2. I/O
  3. Concurrency



Monitoring Versus Management



Monitoring

- The process of identifying problems.
- A monitor collects the pertinent information for making performance tuning and optimization decisions, but it is essentially dumb.

Analysis

- Reviewing the data gathered during monitoring to determine what actions, if any, are required.
- Analysis typically is performed by a skilled technician like a DBA.
  - Some automated tools are capable of performing some types of analysis.

Optimization

- The corrective actions taken after analyzing the monitored environment.
- May be tasks performed by DBAs, procedures run by scripts, or events automatically kicked off by performance tools.

Performance Management

- Database performance management encompasses all three:
  - Monitoring to find problems
  - Analysis to identify corrective actions
  - Optimization to enact changes for better performing systems and applications
- True performance management can be achieved only by using a proactive performance plan.

Proactive versus Reactive

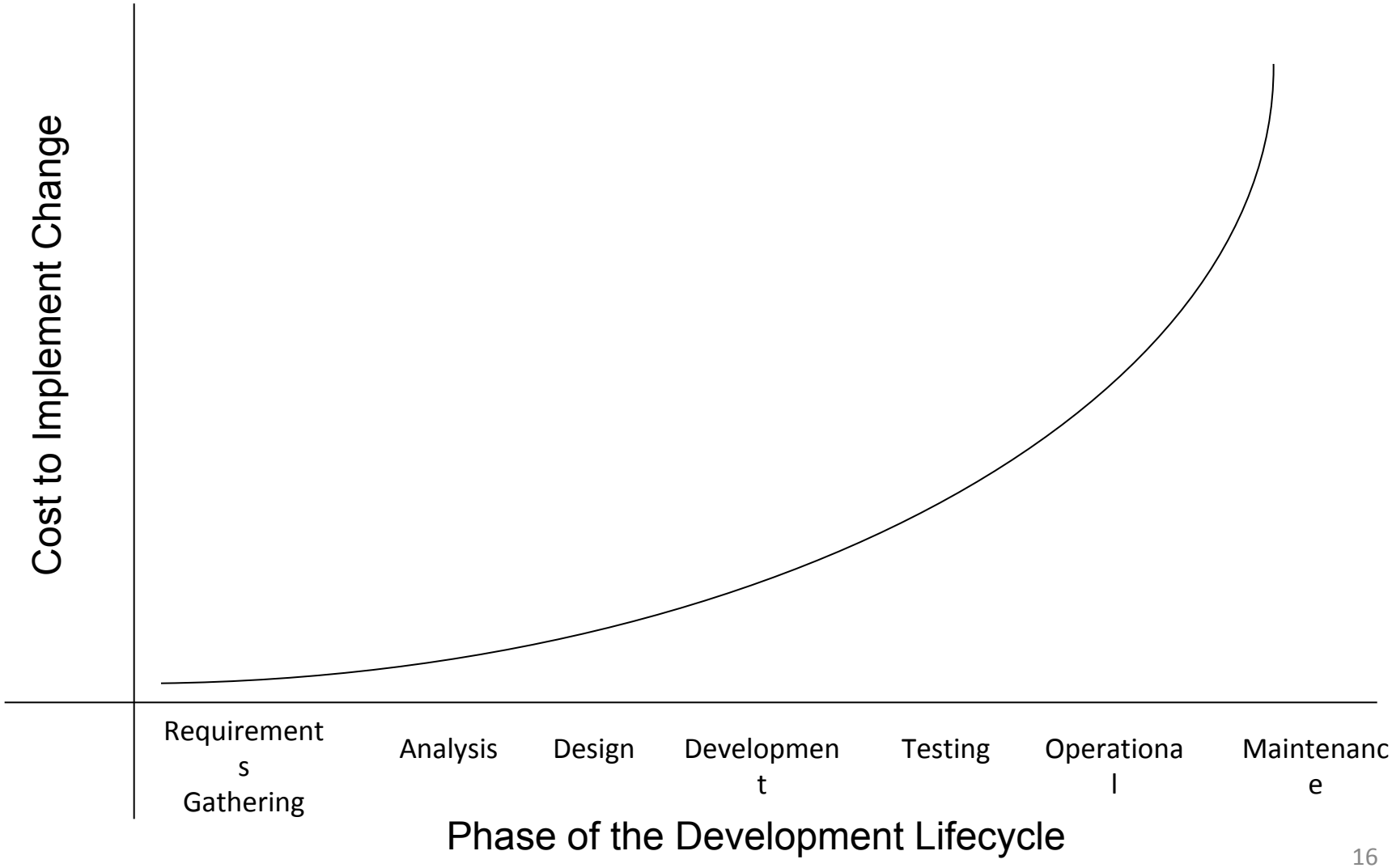
- Proactive
  - Forethought
  - Planning
  - Corrective actions taken before problems occur
  - Automated
  - Minimizes reactive monitoring & tuning requirements
- Reactive
  - Fire fighting
  - Problem exists that needs to be corrected
  - Unplanned problems
  - Can never be totally eliminated

Proactive performance management reduces the amount time, effort, and human error involved in implementing and maintaining efficient database systems

Pre Production Performance Estimation

- Focus on building performance into applications and databases early in the development cycle.
  - Reduces costly redesign and recoding efforts—at least with respect to most performance problems.
- Problems identified earlier in the ADLC are easier to fix and cost less to fix than problems identified later in the application's life.
- Performance should be modeled for the entire application.

Cost of Performance Problems by Phase within the ADLC



Historical Trending

- It can be valuable to capture and analyze resource usage trends and performance statistics over time.
- Track key performance statistics (such as buffer hit ratios, file I/O, and log switches) and store that information.
- Historical trends can illuminate periods when database performance is slower than usual due to increased user activity.

How can you know what *abnormal* is if you do not know what *normal* is?

Service-Level Management

- *Service-level management* (SLM) is the "disciplined, proactive methodology and procedures used to ensure that adequate levels of service are delivered to all IT users in accordance with business priorities and at acceptable cost."*
- A service level is a measure of operational behavior.

* Sturm, Rick, Wayne Morris, and Mary Jander, *Foundations of Service Level Management,* Indianapolis, IN: SAMS Publishing (2000)

Example Service Level Statements

- Example in terms of availability:
  - “99.95% uptime from 9:00 A.M. to 10:00 P.M. on weekdays.”
- Of course, a service level can be more specific:
  - “Average response time for transactions will be two seconds or less for workloads of 500 or fewer users.”

Success Factors for SLAs

- For a service-level agreement (SLA) to be successful, all parties involved must agree on stated objectives for availability and performance.
  - The end users must be satisfied with the performance of their applications
  - The DBAs and technicians must be content with their ability to manage the system to the objectives.
  - Compromise is essential to reach a useful SLA.

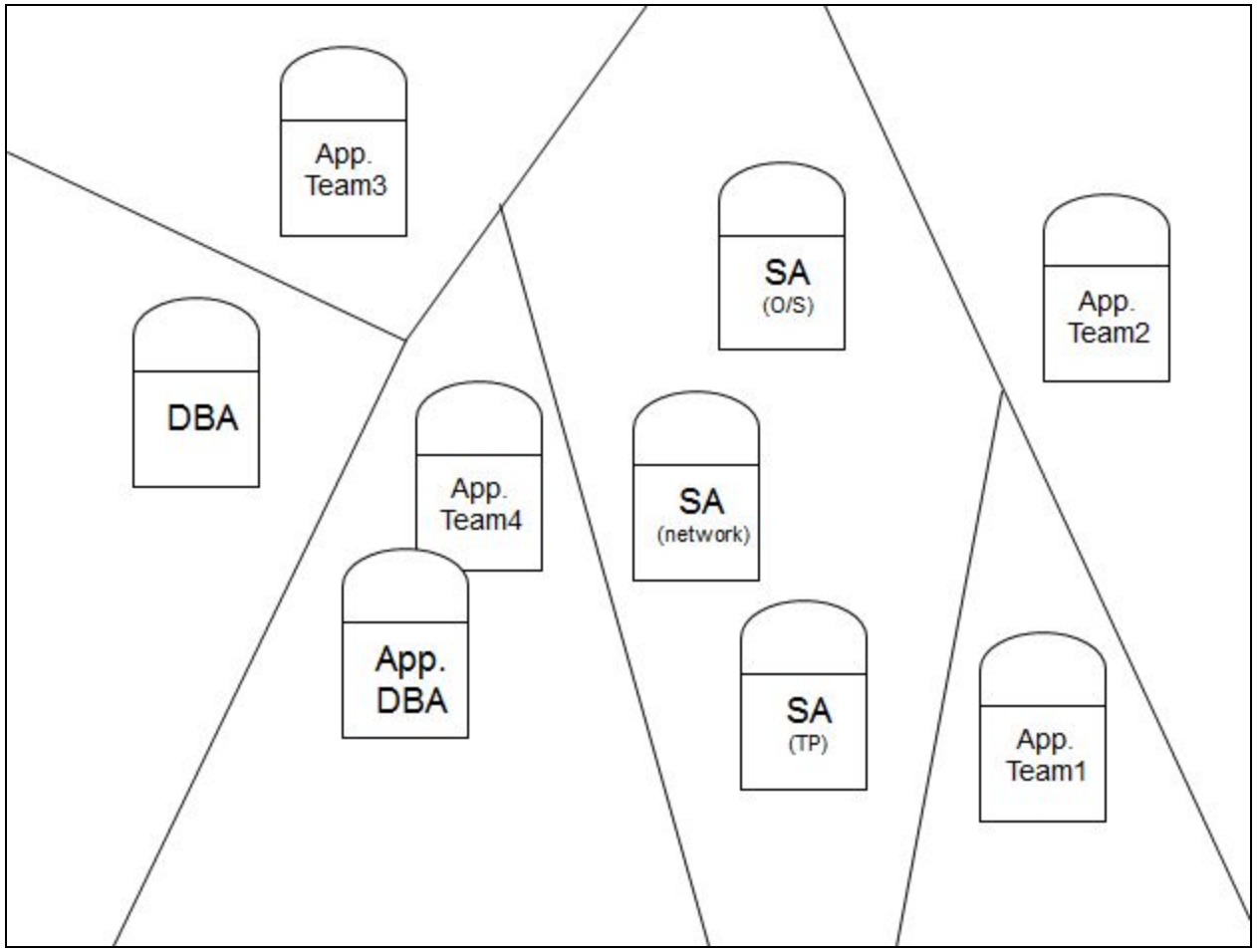
SLM in Practice

- Many organizations do not institutionalize SLM.
  - There may be vague requirements and promises of subsecond response time, but the prioritization and budgeting required to assure such service levels are rarely tackled unless the IT function is outsourced.
- Internal IT organizations are loath to sign SLAs because any SLA worth pursuing will be difficult to achieve.
  - Furthermore, once the difficulties of negotiating an SLA are completed, the business could very well turn around and outsource the SLA to a lower-cost provider than the internal IT group.
- But the blame for not adhering to SLM goes both ways!
  - The business users frequently desire better service but are not willing to make the effort to prioritize their needs correctly or to pay additional cash to achieve better service.

End-to-End SLM

- Most IT professionals view service levels on an element-by-element basis.
  - DBA views performance based on the DBMS, the SA views performance based on the operating system or the transaction processing system, and so on.
- SLM properly views service for an entire application.
  - However, it can be difficult to assign responsibility within the typical IT structure.

IT Silos in a Fractured Environment



SLM = Good

- A robust SLM discipline makes performance management predictable.
- SLM manages the expectations of all involved.
- Without an SLA, how will the DBA and the end users know whether an application is performing adequately?
- With SLM in place, DBAs can adjust resources by applying them to the most mission-critical applications as defined in the SLA.

Types of Performance Tuning

- System Tuning
  - The database instance or subsystem itself and any system parameters and setup details
- Database Tuning
  - The database structures, DDL/parameters and data organization
- Application Tuning
  - The application code and SQL

Performance Management Tools

- Performance Monitors
- Performance Estimation
- Capacity Planning
- SQL Analysis
  - explain
  - query re-write
- System Analysis & Tuning
  - buffer pools
  - cache
  - memory
- Reorganization
- Caching
- Compression
- Sorting

http://www.craigsmullins.com/dbta_051.htm

DBMS Performance Basics

- Do not over tune
- Remain focused
- Communicate clearly
- Accept reality

Questions