

The Value of DB2 Buffer Pool Measurement, Analysis, and Modeling

A White Paper from the Responsive Systems Company

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Motivation. *The prevalence of consolidation, downsizing and debt reduction during the 1990s necessitate cost-controlling measures. Common-sense procedures that financial officers take in identifying wasteful practices and containing costs are suggested. These include purchase of only needed services and materials, solicitation of bids from other suppliers, saving 'hard' dollars by offering 'soft' dollars, taking advantage of cash discounts and testing for mathematical errors in invoices. Moreover, financial executives are encouraged to negotiate or question a billing, recruit specialists for certain tasks, obtain special tools for certain problems and preventive tasks, utilize internal labor and resources efficiently, and appropriately assess buy-lease decisions. It is stressed that in most cases, common sense is enough to minimize costs and increase savings.*¹

Common sense - an invaluable skill. To apply it, we usually need data to evaluate so that we can reach that all-important decision. Getting the data is often difficult and time consuming. Thus, obtaining a special tool that can harvest the data, analyze it, and allow us to ask '*what-if*' questions to which we would get predictions about performance and service levels would allow us to apply our common sense skills.

Introduction

What is *value* within IT? Emerging trends show that by the year 2000:

- Poor attention to basic service quality will be at the root of 70% of the instances in which IT organizations are pronounced ineffective;
- Customer satisfaction metrics will be in place at 70% of IT organizations. Performance against technical metrics will represent only 20% of the total satisfaction score;
- 50% of IT organizations will elevate their perspective enough to earn a spot in the executive committee; the remainder will remain in a tactical mode that isolates them from major IT decisions.²

Most IT organizations today operate with the wrong focus and at the wrong level; most are technically focused (rather than on business/service/client focused) and they operate at a tactical or operational level rather than at a strategic level. IT leaders are often entangled in day-to-day technical crises at the expense of long term vision and business-related strategy.

¹ Stuart F. Fleischer, CPA, is a senior vice president and the chief financial officer of Communications Diversified, a promotional marketing company. This quote comes from his article *Common Sense Guide To Cost Control And Greater Corporate Profits*, CPA in Industry.

² Tunick and Bosik, *Translating IT Activities Into Value in Midsize Enterprises*, Gartner Group Strategic Analysis Report, 17 Feb 97.

The value of IT is created as a result of wise reflection and judgement at the level of direction, strategy and vision. Using measurement and analysis tools like Buffer Pool Tool from Responsive Systems will help reform the IT culture from an internally focused technical culture to a business-like, client-focused, cost-effective service culture. A key benefit occurs when management attention is refocused into thinking how IT strategy can support the business in its quest for competitive advantage. Measurement, analysis and modeling at this level is fundamentally important, because it is at this level that IT can deliver the most value.

Our objective is simple: to study the value - to the budget and to quality - that the right tool can bring to an organization. The state-of-the-art for performance predictions and capacity planning by using such a tool is rising to a new level.

Benefits of DB2 Buffer Pool Analysis, Modeling and Prediction. DB2 Buffer Pool analysis and modeling offers both immediate and delayed benefits. Immediate benefits arise from better tuning and exploitation of existing resources, which translates into improved productivity gains seen immediately. Future delayed benefits arise through capacity planning with risk mitigation and cost reduction.

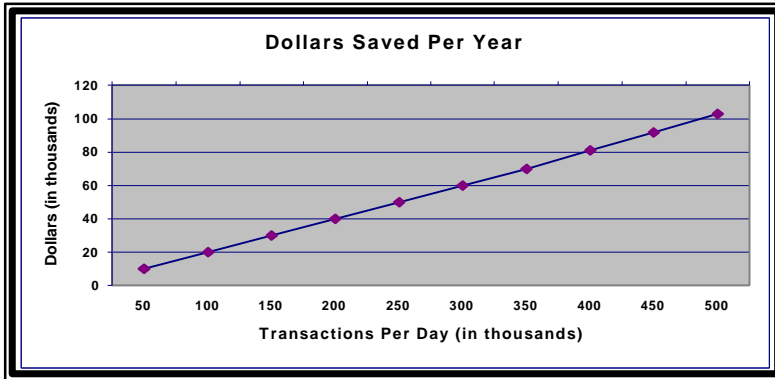
From Scott McLeod: Diversified Pharmaceuticals:

We always suspected we had more space allocated to bufferpools than we needed, and the paging indicated we had exceeded the amount of real storage on the machine. Using Buffer Pool Tool simulations we were able to determine how much we could reduce the pools without impacting performance. We were able to save 350 Megabytes! The elimination of paging saved us 10 MIPs from our daily transaction load. Since we are outsourced, and our FM vendor charges us for everything we do and use, the savings of memory and MIPs are actual bottom line dollar savings well into the six figure range.

Immediate Benefits. The benefits that arise immediately from DB2 Buffer Pool analysis and modeling will manifest themselves as improvements in performance for specific applications. The modeling *engine* can make configuration and tuning recommendations that improve application performance immediately.

When living in an environment where there is major growth in DB2 usage, it is not difficult to find the environment spiraling out of control ... sometimes quickly! It should be obvious that the sooner one takes control of that environment, the sooner performance/service improvements can be attained. A large bank recently recognized this situation, and began what could have been a painful self-study process. After securing *Buffer Pool Tool*, the bank saw a reduction of over 2,000,000 I/O per day eliminated in one of their online applications, which, during the peak hour, was a reduction of 100 I/Os per second. The application hit ratio improved to between 87% and 92% (depending on the application object referenced), and overall there was a 13% reduction in elapsed time, and a nearly 7% reduction in CPU time. In another online application, they saw the I/O reduced by over 20% (over 725,000 I/Os per day were eliminated); the application hit ratio improved to as much as nearly 95%; a 20% improvement in elapsed time; and similar reductions to CPU time.

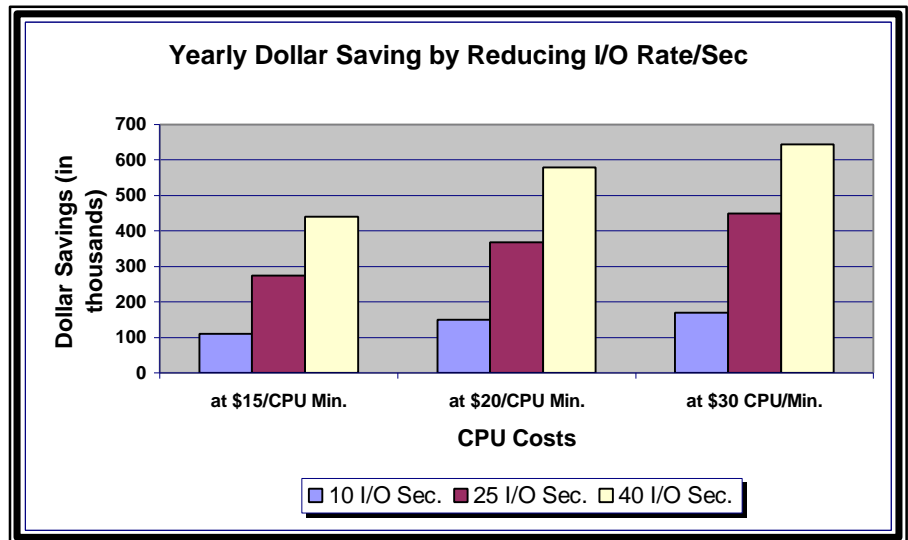
Delayed Benefits. The future benefits arise mostly from the use of DB2 Buffer Pool analysis and modeling are within the discipline of capacity planning. This involves using the model to make future predictions about performance, capacity, response time, and other application characteristics. These predictions can help avoid major performance "foul-ups" through proper capacity planning, and can also reduce costs over a period that include strategies that defer hardware upgrades until needed (more on this later).



Tuning your DB2 system and applications can save vast amounts of money. This money can be saved by reducing the execution cost of the applications, and by avoiding or delaying a processor upgrade. If your installation charges for CPU usage, this graph illustrates the real cost saving from system and application tuning. It illustrates the yearly cost saving from

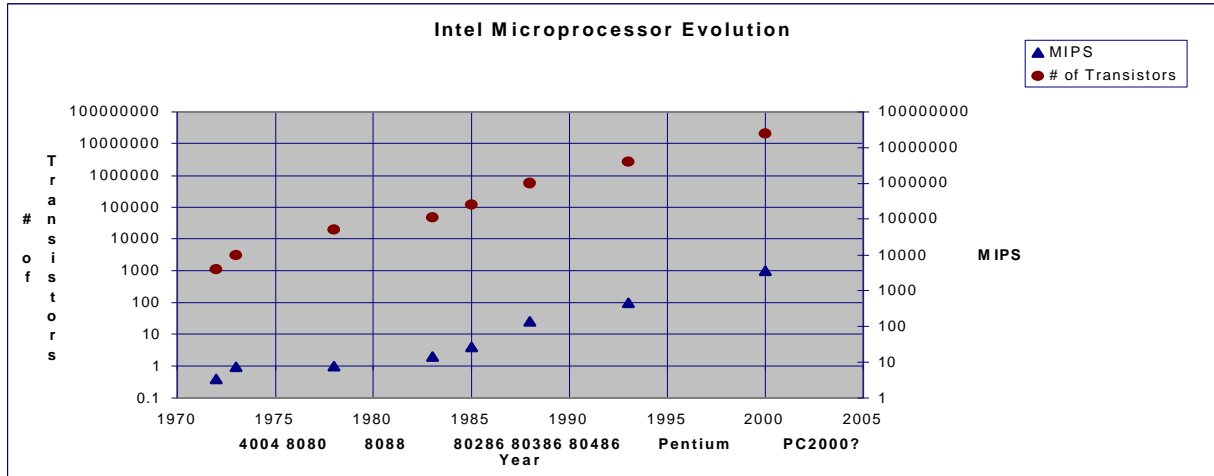
improving user productivity by reducing Transaction elapsed times by 0.1 seconds, at a loaded salary rate of \$30,000 per person.

This next graph illustrates hard savings that can be gained from applying sizing and object placement recommendations generated after a Buffer Pool Tool analysis. We'll assume that the approximate cost of a physical I/O is 1.5 milliseconds of CPU time on a 60 MIPS engine. Given this cost and assuming a 22 hour day, we transform the CPU time required for physical I/O into actual dollars saved, using several different I/O rates at different CPU-minute charging rates.



Deferring Those Upgrades. In 1965 Gordon Moore, who later co-founded Intel, predicted that the capacity of a computer chip would double every year. Moore had looked at the price/performance ratio of computer chips - the amount of performance available per dollar - over the previous 3 years and simply projected it forward. Moore himself didn't believe that this rate of improvement would last long. But ten years later, his forecast proved true, and Moore then predicted that chip capacity would double every two years. To this day Moore's predictions have held up, and engineers now call the average rate

of capacity increase - a doubling about every 18 months - *Moore's Law*. Moore's Law is likely to hold up for at least another 20 years. Thus, the theory is you buy enough capacity to do your processing now, and if additional capacity is required in the future, it is acquired at a reduced unit-cost because of the constant improvement in price/performance ratios.



*Intel Microprocessors Approximately Doubling In Transistor Count Every Eighteen Months,
In Accordance With Moore's Law*

Cost Versus Value. The areas of benefits from Buffer Pool analysis and modeling can also be categorized in terms of "cost" and "value" enhancement. The *cost* side involves such issues as reducing *Total Cost of Ownership (TCO)*. The *value* side of the equation involves assuring the business through improved reliability and quality assurance and thereby benefiting all end users and the entire parent organization.

Cost Reduction. Buffer Pool analysis and modeling can reduce TCO and thereby reduce IT budget pressures. Some of the methods where costs are reduced include:

- *Just-in-time* hardware upgrades.
- Full exploitation of existing hardware resources.
- Capacity downgrades or resource transfers.
- Workload balancing analysis.
- Tuning and configuration recommendations.
- Server consolidation recommendations

Cost reduction occurs by reducing hardware acquisition and maintenance. Analysis and modeling detects under-utilized resources to be transferred to other servers or downgraded. Buffer Pool analysis and modeling can provide performance recommendations so that an application can better exploit

existing hardware, either on a single node or workload-balanced over multiple nodes, and thus further delay hardware upgrades.

Value Increases. The other side of the benefits is the value side. This is how Buffer Pool analysis and modeling not only reduces costs, but also serves to better leverage the entire technology layer in a corporation. As the technology becomes more reliable and efficient, the surrounding parent organization can become more productive in its chosen business.

- Long-term guarantee of service availability and reliability (i.e. "quality of service").
- Improved performance for end users through simulation-driven tuning recommendations.
- Avoiding "*just-too-late*" upgrades.
- Capacity planning risk mitigation.

The largest long-term benefit on the value side is avoiding a major capacity melt down and associated service failure. Buffer Pool analysis and modeling predictions can avoid such an embarrassing situation by anticipating it early enough for resolution. Through the use of the simulation feature of Buffer Pool Tool, our major bank found were easily able to determine the effects of changing the size of their Buffer Pools and corresponding thresholds. They simulated what would happen when adding Hiperpools and were actually able to see exactly when buffers were being over-allocated. In general, these '*what-if*' simulations were quite accurate and if anything, were somewhat conservative.

The other major benefit to end users arises from performance improvements. These can occur both immediately and over time. Performance modeling can identify tuning recommendations to make immediately. Modeling can also help migration workloads to more effective resource configurations and thereby improve overall system performance via modeling attention. In the case of our major bank, they found several application problems using Buffer Pool Tool. In the first application, they found a transaction performing a table-scan at 690K Get Pages / Hour. After reviewing the underlying SQL code with the development staff, the same transaction now yields 3000 Get Pages / Hour, and they reduced the average response time from 14 seconds to sub-second response time. Not only was performance improved, but the estimate in cost savings from identifying and correcting this problem was nearly \$150,000 / year. The staff now claims to have one more avenue to explore when a problem with a DB2 application is thought to be occurring.

Current benefits. Many of these benefits are available today in the *DB2 Buffer Pool Tool* from Responsive Systems. This offers both performance analysis for immediate benefits, and future benefits through predictive modeling and capacity planning.

For More Information

We provide unique solutions for your difficult DB2 performance problems. To learn more about Responsive System's software products, performance solutions, or consulting services, visit our web site and contact us either by email or by calling one of the telephone numbers below.

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