ATE: Workload-oriented DB2 tuning in action

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1 Introduction

Databases are growing rapidly in scale and complexity. High performance, availability and further service level agreements need to be satisfied under any circumstances to please customers. In order to tune the DBMSs within their complex environments highly skilled database administrators are required. Unfortunately, they are becoming rarer and more and more expensive. Improving performance analysis and moving towards automation of problem resolution requires a more intuitive and flexible source of decision making.

This demonstration points out the importance of best-practices knowledge for autonomic database tuning and addresses the idea of formalizing and storing this knowledge for the autonomic management process in order to minimize user intervention and enable the system to (re)act autonomously. For this purpose, we propose an architecture for autonomic database tuning of IBM* DB2* UDB for Linux*, UNIX* and Windows* and demonstrate our system's tuning performance under changing workload.

2 ATE Architecture

The architecture of our Autonomic Tuning Expert (ATE) [WRRA08] implements a component-based MAPE loop [IBM05] and is based on widely accepted and influential

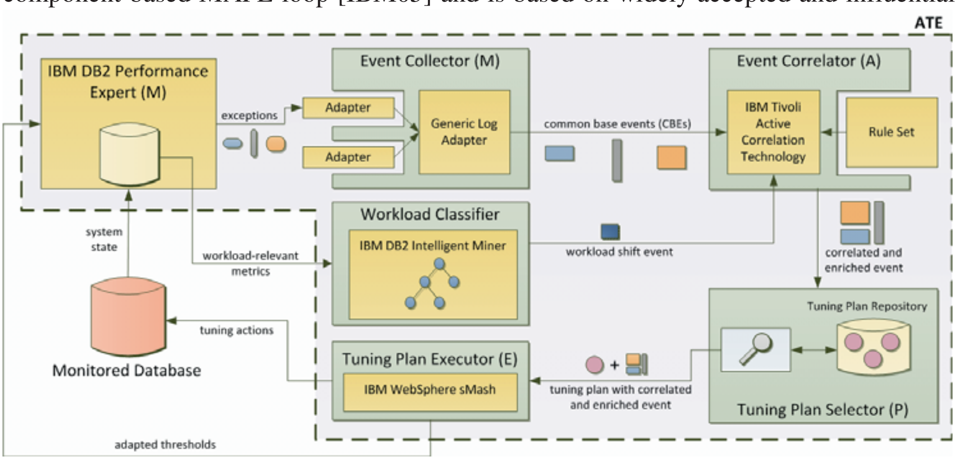
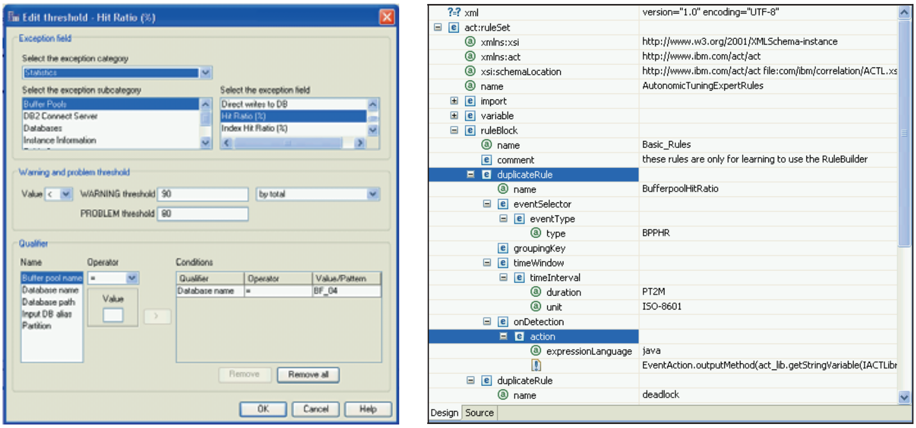


Figure 1: Architectural Blueprint of ATE



a) PE threshold definition b) ACT complex event definition

Figure 2: Problem formalization

technologies and industry-proven products like Eclipse, Generic Log Adapter (GLA), IBM DB2 Performance Expert (PE), Tivoli* Active Correlation Technology (ACT), and Common Base Events (CBE), as illustrated in Figure 1.

PE's periodic exception processing feature [CBM06] regularly provides information about all pre-defined exception situations in XML format (atomic events). GLA obtains these atomic events, transforms them into the CBE format and finally sends them to the Event Correlator. The Event Correlator deploys ACT [BG05] for filtering and correlating events and enables the framework to determine the context of the problems indicated by atomic events. Every time the ACT engine detects a complex correlated event, a rule response is created. This response consists of the original CBE containing information – like the name of the database, names of the affected objects, etc. – and additional meta information – like the recognized workload on the monitored database system – that is appended to the CBE. The Tuning Plan Selector is now responsible for browsing through the Tuning Plan Repository and retrieving a tuning plan that best resolves the problem identified by the Event Correlator. After a proper tuning plan is determined, the Tuning Plan Executor is invoked. The problem context representing CBE is passed along to the Tuning Plan Executor ensuring that the knowledge about the problem itself is available for tuning plan execution as well. The Tuning Plan Executor is implemented by the help of a light-weight workflow engine integrated in IBM WebSphere* sMash (WSM) application server [IBM08]. It enables the execution of user-defined database tuning workflows.

As tuning of a database system heavily depends on the current workload type, a general workload classification framework has been implemented and integrated into ATE. The classification framework, based on IBM DB2 Intelligent Miner* [IBM06], is used to capture workload characteristics and to establish a system and tuning independent database workload classification model. At run-time this model can be used to determine the current workload on the monitored database.

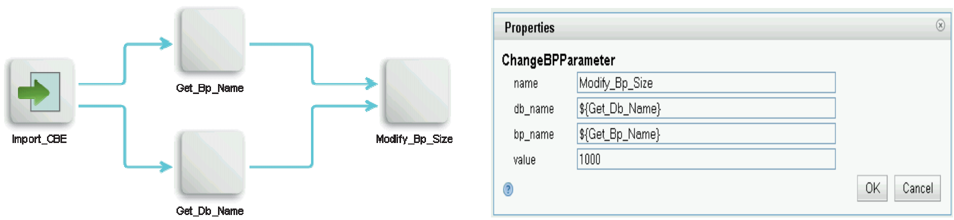


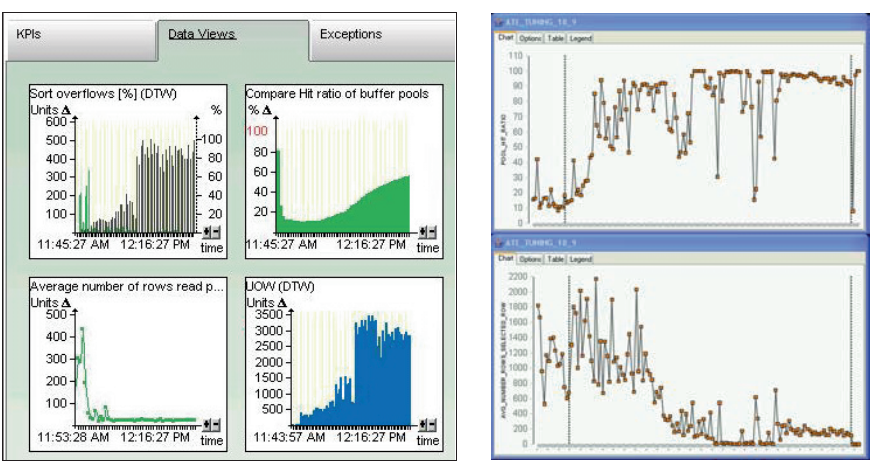
Figure 3: Websphere sMash workflow editor

3 Demonstration Setup

At the demonstration stand we show how ATE automatically reacts to user-defined problems with user-defined tuning plans by re-configuring the environment under control considering the current workload.

Initially, problem situations need to be encapsulated into atomic and complex events by defining PE thresholds and ACT correlation patterns (Figure 2). Furthermore, tuning plans for resolving these tuning problems need to be implemented and integrated into the system as well. WSM's visual workflow editor allows users to create new or adapt existing tuning workflows by combining pre-defined database tuning steps using control structures (Figure 3). In addition, upper and lower boundaries for numeric configuration parameters depending on the amount of physical memory available can be specified. They are captured in a simple resource restriction model that helps to avoid resource overallocations.

ATE's Workload Classifier enables workload-oriented problem detection and resolution. At the moment, it can distinguish TPC-C-like [TPCC07] and TPC-H-like [TPCH08] workload types. However, further workload classes could be integrated with little



a) PE system overview b) ATE KPI Visualizer tool

Figure 4: Tools for the evaluation of ATE

overhead. For evaluating the prototype's effectiveness, an arbitrary sequence of both workload types can be used.

Users can verify if iterative tuning has the desired effect on relevant Key Performance Indicators (KPI) either at run-time by using PE performance data real-time visualization or afterwards by means of our ATE KPI Visualizer tool that additionally can display ATE-internal metadata such as start or stop of ATE, event occurrences and corresponding tuning plan executions (Figure 4). Furthermore, pre-defined scripts can be used to obtain current parameter values and object allocations.

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*Trademarks