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Research Article 01: Joint Optimization of Task Scheduling and Image Placement in Fog Computing Supported Software-Defined Embedded System

1. Problem statement

To this Paper, three issues are investigated:

- How to balance the workload on a client device and computation servers, i.e., task scheduling,
- How to place task images on storage servers, i.e., resource management, and
- How to balance the I/O interrupt requests among the storage servers.

2. Objectives

In this paper, we consider a software-embedded system supported by fog computing, where images are stored on a storage server and calculations can be performed on an embedded device or computer server. . Designing an effective task scheduling and resource management strategy with minimum task completion time is critical to improving user experience. To deal with the high computational complexity, an efficient computational solution based on our formulation is proposed and based on extensive simulation.

3. Research method/applied model or technique

Because of its high complexity, MINLP problems are difficult to solve directly. To solve this problem, we propose a three-stage algorithm based on the MINLP formula. The main concept of this algorithm is division and integration.

- Minimize the I/O Time
- Minimize the Computational Time
- Joint Optimization

4. Size of requirements considered

An effective method of resource management and task scheduling is required to provide a superior user experience such as reducing task completion time. Although remote I/O

interrupts are required, we can still achieve high performance by enabling fast compute services on the client.

Research Article 02: Architectural Support for Task Dependence Management with Flexible Software Scheduling

1. Problem statement

This article presents a concurrent hardware/software mechanism (Task Dependency Manager) (TDM), which accelerates time-consuming tasks on a system running on specialized hardware and allows flexible task scheduling policies in software. TDM extends the minimal ISA so that the operating system can handle job creation, job dependencies, job interrupts, and job efficiency. At the architectural level, TDM introduces a Dependency Management Unit (DMU) that maintains a set of tables and lists about running tasks and the dependencies between them. Ready-to-run tasks are exposed to the independent runtime system to enforce software scheduling policies.

2. Objectives

The main contributions of this paper are:

- Newly designed hardware/software engine for rapid deployment and dependency tracking while supporting flexible software applications. Hardware development incorporates new architectural techniques with advanced proposals to reduce diversity in architectures and reduce hardware costs.
- Detailed evaluation of TDM in a complete system simulation that includes application, runtime system, operating system, and architecture layers. On a 32-core processor, TDM showed a 12.3% average speedup and a 20.4% reduction in energy delay product (EDP) compared to the software-based baseline.
- Demonstrate the capabilities of TDM when integrated with five software programs that utilize different manufacturing processes. Thanks to this flexibility, TDM increases overall hardware-based runtime by an average of 4.2%, EDP improves by an average of 6.2%, and footprint decreases by 7.3x.

3. Research method/applied model or technique

Task-based scheduling models are very attractive for large scale multicore. An important aspect of job-parallel scheduling is job granularity, which determines the ability to use available parallelism and ensure load balancing, but also determines the highest cost of system execution time. This paper proposes TDM, a hardware/software based mechanism to accelerate application dependency management processes while allowing flexible application scheduling in software.

Unlike in the past that was fixed by programmers and architecture, the separation of concerns and TDM provides a high degree of flexibility, flexibility and hybrid power, which can be seen in modern equipment and many sockets and off- and shelf accelerators. cracks etc. can benefit from it. Among the benefits of other policies is to schedule work and activities.

In addition, the TDM architecture supports new features to increase efficiency, such as redeploying identifiers to reduce required storage space or setting cache size to avoid infrastructure interference during backups. The program address must be the same. As a result, TDM increases process speed by more than 12.3% and reduces EDP by 20.4%. Compared to pure hardware improvements, TDM achieves an average speed of 4.2% and hardware complexity of 7.3x.

4. Size of requirements considered

All of these features require an integrated network to perform complex operations on the deep data systems of the operating system. In addition, the changes provided by the programming software are very important in the high-performance computing system and the fast processing in the multi-space processing, which can improve the performance and energy efficiency, and restricts the scheduling of applications and data. Animals require software installation. Second, the memory requirements of the index can be reduced because the size of internal identifiers is smaller than the 64-bit identifiers used in real-time systems.

Research Article 03: A Bayesian Critical Path Method for Managing Common Risks in Software Project Scheduling

1. Problem statement

The purpose of this paper is to find the best model for uncertainty management / risk management in software design considering the scheduling and risk aspects of software design.

2. Objectives

Research improved CPM-based scheduling by using BN to help software teams analyze schedules and predict their probability of success, which effectively accounts for uncertainty.

This method makes it possible to capture different areas of risk and use them to analyze the software development process. It also shows the duration of each step and the uncertainty of the overall process and probability distribution.

This approach provides the best way to deal with uncertainties that cannot be controlled by traditional methods, such as uncertainty about the relationship between events and risks. It also improves the quality of the software development program by ensuring that all key aspects of the design (for example, dependencies, capabilities) are provided at a low level in a mathematical model.

3. Research method/applied model or technique

- The RBCPM Method

The tool has the following main functions:

- Model and calculate a project schedule
- Alert project managers about tasks could be over-scheduled

- Calculate the possibility of the schedule
- Calculate the possibility of each task.
- Model the network of risks that have impacts on each task.

4. Size of requirements considered

Need RBCMP Tool to perform this research.

Research Article 04: An Evolutionary Hyper-heuristic for the Software Project Scheduling Problem

1. Problem statement

Our innovations are as follows: (1) this is the first work on evolutionary hyper elasticity optimization for SPSP. (2) This is the first step for adaptive selection of crossover and mutation operators. (3) We develop different validation methods for two types of operators: translation and crossover. And (4) we use a multi-armed bandit strategy to select crossover and mutation operators. We use a 3-size crossover pool and a 3-size transfer pool. Our experiments show that our approach is effective in selecting crossover and mutation operators for SPSP.

2. Objectives

This paper proposes an evolutionary Hyper-heuristic for solving SPSP. Hyper heuristic EA uses a high-level strategy that automatically adapts mutation and crossover operators during its evolution. A sliding window MAB strategy is used to adaptively search both operators. Experiments on a set of 48 reference examples show that the proposed algorithm can improve the SPSP and select strategies using simple random selection of operators and advanced methods from the literature.

3. Research method/applied model or technique

We conducted a series of experiments to determine the effectiveness of the proposed AOS technique for obtaining a simple random selection of crossover and mutation operators. It also allows us to compare the results of this algorithm with those of the mode. We refer to the three algorithms as GA-SMAB, GA-randAOS and GA for convenience. We conducted our experiments on a reference data set used in 48 cases.

For each example, the average results of 30 independent runs of the algorithm are shown. To minimize the variety of parameters, we choose the same parameters as used in the

literature, except for the translation probability, which is set to a value that guarantees the performance of the translation operator.

4. Size of requirements considered

Need Hyper-heuristic Framework to perform this research.

Research Article 05: Scheduling Real-Time Parallel Applications in SaaS Clouds in the Presence of Transient Software Failures

1. Problem statement

Here, we investigate the impact of fine-grained parallel application scheduling strategies in a SaaS cloud on transient software issues that can occur during application implementation. We integrate and compare different simulation techniques that include checkpoints and program-defined approximations to: (a) provide resilience to transient software failures, (b) ensure that all programs meet deadlines, (c) to deliver program outcomes that are high quality and (d) reduce financial costs for end users of approved applications. To the best of our knowledge, none of the scheduling methods presented in the literature addresses all of the above challenges in SaaS cloud environments.

2. Objectives

In this paper, we explore different strategies for organizing fine-grained parallel applications in the SaaS cloud when software issues arise. Through simulations under different workload conditions, we integrate and compare different techniques in program-defined areas and approximation calculations, with multiple objectives of fault tolerance, quality of service and reduction of end-user bills.

3. Research method/applied model or technique

- EDF
- EDF RAC
- EDF FAC
- EDF ADC
- EDF ADC RAC
- EDF ADC FAC

4. Size of requirements considered

SaaS cloud performance was assessed in a series of simulation runs in the implementation process of each research group. To this end, our discrete event simulation program in C++ is

tailored to the needs of the specific problem given the complexity of the system and the workload model under consideration. We use synthetic methods to reduce the uncertainty of the simulation.