# Pengoptimalan keandalan alokasi sumber daya pada mobile ad hoc grid dengan teknik replikasi tugas = Optimizing reliability of resource allocation in mobile ad hoc grid with task replication method / Sri Chusri Haryanti

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Abstrak

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Meningkatnya keberadaan, ketersediaan, kemampuan dan konektifitas perangkat bergerak telah menghasilkan paradigma baru dalam komunikasi bergerak. Salah satunya adalah implementasi fungsionalitas grid computing pada jaringan mobile ad hoc, yang dewasa ini dikenal dengan mobile ad hoc grid. Mobile ad hoc grid memungkinkan node dalam jaringan mobile ad hoc berbagi sumber daya komputasi untuk menyelesaikan suatu masalah.
Dibandingkan dengan sistem grid computing tradisional, pengaturan sumber daya komputasi mobile ad hoc grid lebih kompleks mengingat lingkungan jaringan mobile ad hoc lebih dinamis dan sangat rentan terhadap kegagalan (fault).
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Penelitian ini bertujuan untuk mendapatkan pendekatan alokasi sumber daya pada mobile ad hoc grid yang memberikan keandalan (reliability) dan unjuk kerja yang tinggi dengan menerapkan metode fault prevention dan fault tolerance. Pemilihan node berdasarkan mobilitas relatif antara node sumber daya dengan node yang meminta bantuan diusulkan sebagai metode fault prevention. Replikasi tugas diusulkan sebagai metode fault tolerance. Penelitian ini merumuskan model analitikal keandalan untuk layanan sumber daya pada mobile ad hoc grid, yang diperoleh dengan menggunakan pendekatan hirarki. Model tersebut mempertimbangkan tugas dependen pada arsitektur mobile ad hoc grid terpusat. Dalam penelitian ini juga diusulkan pengoptimalan keandalan pelaksanaan tugas dengan mencari kombinasi replikasi tugas menggunakan metode branch and bound. Pengoptimalan dilakukan mengingat jumlah sumber daya pada mobile ad hoc grid relatif terbatas. Metode branch and bound digunakan karena sederhana, efisien dan dapat menemukan solusi kombinasi tugas dalam waktu yang singkat.
Simulasi dengan NS2 menunjukkan bahwa pemilihan node sumber daya berdasarkan prediksi mobilitas dan replikasi tugas dapat mempercepat waktu penyelesaian tugas, memperkecil rata-rata end-to-end delay dan memperkecil presentase kegagalan tugas. Simulasi juga memperlihatkan bahwa replikasi tugas hanya tepat diterapkan pada lingkungan dengan mobilitas node yang relatif rendah (v ≤ 3 m/dt). Simulasi model analitikal keandalan alokasi sumber daya menggunakan Matlab menunjukkan bahwa replikasi tugas dapat meningkatkan keandalan dan kombinasi replikasi tugas yang berbeda akan menghasilkan tingkat keandalan yang berbeda. Simulasi pengoptimalan keandalan menggunakan metode branch and bound dengan Matlab menunjukkan bahwa perlu ada trade-off antara tingkat keandalan dengan waktu yang diperlukan dalam mendapatkan hasil kombinasi replikasi tugas.;
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ABSTRACT<br>
The increasing availability, capability, and connectivity of mobile devices has resulted in new paradigms in

mobile communication. One of such new paradigms is the implementation of Grid computing functionality in a mobile ad hoc network, what is nowadays known as mobile ad hoc Grid. In a mobile ad hoc Grid, mobile nodes can share computational resources for accomplishing a specific task.
Compared to the traditional Grid computing system, the management of computing resources in mobile ad hoc Grid is more complex as the environment of mobile ad hoc network is more dynamic and very susceptible to fault. The objective of this research is to find resource allocation approach that gives high reliability and performance by implementing fault prevention and fault tolerance methods. For fault prevention method, it is proposed to select certain nodes from all available nodes that are willing to share resources based on relative mobility between resources nodes and requesting node. In addition, it proposes to implement task replication as fault tolerance method.
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This research also introduces analytical model of resource allocation service in mobile ad hoc Grid by applying hierarchical model, in which it considers dependent tasks in centralized mobile ad hoc Grid architecture. Furthermore, this research also proposes the optimization of task execution reliability by discovering task replication combination using branch and bound method. The optimization needs to be done considering that the number of resources in mobile ad hoc Grid is limited. The branch and bound method is proposed as it is simple and efficient as well as being able to find the solution of task combination within the limited time. The NS2 simulation shows that the selection of resource nodes based on mobility prediction and task replication is able to accelerate task completion time, reduce the average of end-to-end delay, and reduce the percentage of unfinish tasks. The simulation also demonstrates that task replication is only suitable to be implemented in the environment with relatively low node mobility (v ≤ 3 m/dt). The simulation of analytical model for resource allocation reliability using Matlab exhibits that task replication is able to enhance resource allocation reliability, and different combination of task replication number will generate different reliability level. Moreover, the optimization simulation of reliability with branch and bound model using Matlab denotes that we need to make a trade-off between reliability level and the time required to obtain the result of task replication combination., The increasing availability, capability, and connectivity of mobile devices has resulted in new paradigms in mobile communication. One of such new paradigms is the implementation of Grid computing functionality in a mobile ad hoc network, what is nowadays known as mobile ad hoc Grid. In a mobile ad hoc Grid, mobile nodes can share computational resources for accomplishing a specific task.
Compared to the traditional Grid computing system, the management of computing resources in mobile ad hoc Grid is more complex as the environment of mobile ad hoc network is more dynamic and very susceptible to fault. The objective of this research is to find resource allocation approach that gives high reliability and performance by implementing fault prevention and fault tolerance methods. For fault prevention method, it is proposed to select certain nodes from all available nodes that are willing to share resources based on relative mobility between resources nodes and requesting node. In addition, it proposes to implement task replication as fault tolerance method. This research also introduces analytical model of resource allocation service in mobile ad hoc Grid by applying hierarchical model, in which it considers dependent tasks in centralized mobile ad hoc Grid architecture. Furthermore, this research also proposes the optimization of task execution reliability by discovering task replication combination using branch and bound method. The optimization needs to be done considering that the number of resources in mobile ad hoc Grid is limited. The branch and bound method is proposed as it is simple and efficient as well as being able

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