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Dynamic analysis of agent network in self organisation using service level agreement technique

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ABSTRACT: *Self-organisation mechanism synthesizes the three principles: cloning, resource exchange and relation adaptation to achieve the better agent network structure. Self organization is usually defined as "the mechanism or the process enabling the system to change its organization without explicit external command during its execution time". By the mechanism, an agent selected by task that particular agent having resource to complete it. When task given to the agent is overloaded then generate clone agents using famous method, Hybrid Model of Q-learning and also provide the guarantee of the agent network using SLA(Service Level Agreement) technique. The mechanism is evaluated through a comparison with the three approaches are the benefit of individual agent and the entire agent network, the load balancing among the agents and the time consumption to finish the task execution.*

KEYWORDS - : *Distributed multi agent system Self-Organisation, reinforcement learning.*

I. INTRODUCTION

A wireless sensor network (WSN) consists of spatially distributed autonomous sensors to monitor physical or environmental conditions, such as temperature, sound, pressure, etc. and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, also enabling control of sensor activity. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring, and so on. Self-organization is an important component for a successful ability to establish networking whenever needed. Such mechanisms are also referred to as Self organizing networks. It is driven by the plug and play paradigm, and that wireless networks need to be relatively simpler to manage than that used to be.

Only certain kinds of networks are self organizing. These are known as small world networks, or scale free networks. These emerge from bottom-up interactions, and appear to be limitless in size. These are typical of organizations, and have severe size limits. The self organization mechanism aims at a general but problem in multi agent systems, distributed task allocation. Task allocation simply means that an agent has several tasks to complete but it cannot complete them by itself, so it has to allocate some of these tasks to other agents to complete.Self-organization provides a suitable paradigm for developing self managed complex distributed systems, such as grid computing and sensor networks. Unlike current related studies, which propose only a single principle of self-organization, this mechanism synthesizes the three principles of self organization: cloning , resource exchange and relation adaptation by hybrid model. To avoid communication congestion at runtime. To decrease management cost for maintaining tasks and more communication. Self-organising multi-agent systems should have the following three properties:

- ***No external control:***

All of the adaptation processes should be initiated internally and these processes can change only the internal state of the system.

- ***Dynamic and continuous operation:***

The system is expected to evolve as time progresses, and the self-organisation process should be continuous.

- ***No central control:***

The self organisation process should be operated only through local interactions of individual components in the system without centralized guidance. Self-organisation mechanism is in an agent network, where each agent is directly connected with some other agents, called neighbours, and each agent can communicate only with its neighbours. It is difficult to combine three existing approaches to realize the self organization mechanism, because existing approaches have been devised based on different purposes, different models and different environmental settings. Self-managed systems can save labour time of human managers and are able to adapt to environmental changes and ensure their own survivability. Agent-based modelling is very suitable to build distributed autonomous systems. Thus, self-organising multi-agent systems are good choices for developing such distributed autonomous systems. The self-organising distributed systems can continuously and autonomously arrange and rearrange their organisational structures, without any external control, so as to adapt to environmental changes. For each principle, develop an innovative and efficient approach, and these three approaches can effectively work together as a whole.

The original "principle of the self organizing dynamic system" was formulated by the deterministic dynamic system will automatically evolve towards a state of equilibrium or in more modern terminology, an attractor. As such it will leave behind all non-attractor state, the attractor's basin, and thus select the attractor out of all others. Once there, the further evolution of the system is constrained to remain in the attractor. This constraint on the system as a whole implies a form of mutual dependency or coordination between its subsystems or components.

II. PROPOSED METHOD:

2.1). AGENT

The research is limited to self organising multi-agent systems. An intelligent agent is an entity that can perceive its environment through sensors and act upon that environment via effectors. A multi-agent system is composed of several intelligent agents, and individual agents may perform different roles. An intelligent agent is able to make rational decisions autonomously in a dynamic environment by blending pro-activeness and re activeness, showing rational commitments to decision making, and exhibiting flexibility when facing an uncertain and changing environment. Agent has process for all the task in dynamic environment. It is complete set of task at a given time and also each agent directly connected with some other agent and it's communicate with only neighbours agent. The aim of data aggregation is that eliminates redundant data transmission and enhances the lifetime of node in wireless sensor network. Task aggregation is the process of one or several sensors then collects the detection result from other sensor. The collected data must be processed by sensor to reduce transmission. It can be the base station or sometimes an external user who has permission to interact with the network.

2.2). CLONING

Cloning happens when an agent has too many neighbours, which means that the agent has a heavy overhead for managing relations with other agents. In this situation, to avoid possible communication congestion, the agent clones a new agent, and assigns half of its neighbours to the cloned agent. The cloned agent has the same resources as the original agent has, and maintains a peer relation with the original agent. Unlike the apprentice agents, the cloned agent will not destroy itself even if it remains in an idle status. Instead, the original and cloned agents will recombine together, once the total number of their neighbours is less than a predefined threshold It should be noted that the cloning and the recombination can happen recursively. In typical wireless sensor networks, sensor nodes are usually resource-constrained and battery-limited. In order to save resources and energy, data must be aggregated to avoid overwhelming amounts of traffic in the network. Cloned agent can't establish relation with other agent. And also cloned agent will not destroy itself even if it idle status. Cloning operation for reduce the workload and also overcome the latency of the process execution.For cloning select a famous model, Hybrid Model. One main view is there its performed two operation one is create and another one is clone in processor if that time create to take more amount of time compared with the clone operation so in this project using the clone operation for reducing the latency of the processor execution. In this situation, to avoid possible communication congestion, the agent clones a new agent, and assigns half of its neighbours to the cloned agent. The cloned agent has the same resources as the original agent has, and maintains a peer relation with the original agent.

2.3). RESOURCE EXCHANGE

A single agent when a resource hasn't been used for long time. So the agent will transfer the resource to a neighbour agents for managed the resources if it's any resources for has not managed in agent at that time suddenly exchange the resources with other agent. When a clone is generated the agent will transfer the resource to a neighbouring agent, which needs these resources to handle the load. The steps here are obtained through experimental attempts to achieve best results.

In real applications, such as human social networks, such a resource might be a tool, If a person has a hammer, he/she will share the hammer to another person who helps him. Since this paper considers a cooperative agent network, an agent directly gives its resources to another agent.Various PC vendors have been proponents of Token networks at different times and thus these types of networks have been implemented in many organizations. Resource flexibility is one of the most important requirements in the next generation of mobile communications. Techniques are required to increase the flexibility of the network to deal with new services and the consequent new traffic profiles and characteristics. This investigates some of the drawbacks of fully reactive channel allocation schemes and proposes a more flexible scheme using intelligent agent will lead to an efficient solution under moderate and heavy loads. Initialize the network. Select one random node is considered as the temporary cluster head. Then cluster head sends messages to its neighbours. Then each neighbour calculates the respective benefit. Then the node with the highest weight will become the agent. When a node receives message it sends Join message to the agent head to request joining. When the agent head node receives Join message it will compare the size of cluster with threshold to accept new member. Otherwise it rejects the request. Clone agent heads do the role of aggregator which aggregate data received from cluster members locally. If redundant data occurs means dropped the packet. Otherwise transmit the result to base station. The agent is stable for a while until the process of reflecting cluster head the clone agent reflection based on the recycle period. The agent head gathers the weight of all member nodes and then selects the node with highest weight as the next cluster head node. The reflecting of cluster head occurs in the old agent, so the broadcast of temporary head and the corresponding responses of all neighbours are unnecessary. The agent architecture adopted provides greater autonomy to the base stations and a method for allowing co-operation and negotiation between them; this autonomy and co-operation allows an increase in flexibility to deal with new traffic situations and an increase of the robustness of the network as a whole.

For an agent, resource transfer and cloning have the same meaning with regard to reducing its overhead. However, transferring a resource to a neighbour may help that neighbour to finish some tasks on time, so resource transfer has higher priority than cloning. Again, finishing tasks on time is the most important thing for all agents, so the priority of resource transfer is higher than relation adaptation as well.

2.4). RELATION ADAPTATION

Agent should be able to create new specific relations between agent in order to remove the middle agent. Task allocation process for must be adapt in all agent. The aspect of each agents for selecting a group of agents to initialise the relation adaptation process. Each agent has the information of tokens, which entered and left the agent during previous task allocation processes. Then, each agent uses the local information provided by the tokens to choose candidates For an agent, resource transfer and cloning have the same meaning with regard to reducing its overhead. However, transferring a resource to a neighbour may help that neighbour to finish some tasks on time, so resource transfer has higher priority than cloning. Again, finishing tasks on time is the most important thing for all agents, so the priority of resource transfer is higher than relation adaptation as well.

The relation adaptation is based on historical information of individual agents. Specifically, agents use the information regarding previous task allocation processes to evaluate their relations with other agents. Develop load balancing learning algorithm to tackle the relation adaptation problem Agents should be able to create new specific relations between agents. Relation adaptation should be executed before cloning. This is because of the triggering condition of cloning, namely that cloning happens when an agent has too many neighbours. Therefore, if relation adaptation could be executed first, some neighbours may be removed from the agent's neighbour set, and then, it may be unnecessary for cloning to be executed. When a network becomes open sourced it can be managed properly with online collaboration software. As companies rely on applications like electronic mail and database management for core business operations, computer networking becomes increasingly more important. Most network load balancing systems also incorporate the ability to balance both outbound and inbound traffic. Load balancing technique aims at task performance and thus improves the lifetime of energy constrained wireless sensor network. In wireless sensor network, data transmission took place in multi-agent fashion where each node forwards its data to the neighbour node which is nearer to agent. Each node sends data to clone agent or and then clone agent perform resources balancing to execute the task and then send it to original agent which cause energy consumption.Load balancing distributes workloads across multiple computing resources, such as computers, a computer cluster, network links, central processing units or disk drives. Load balancing aims to optimize resource use, maximize throughput, minimize response time, and avoid overload of any single resource. Using multiple components with load balancing instead of a single component may increase reliability through redundancy. Load balancing usually involves dedicated software or hardware, such as a multilayer switch or a Domain Name System server process.

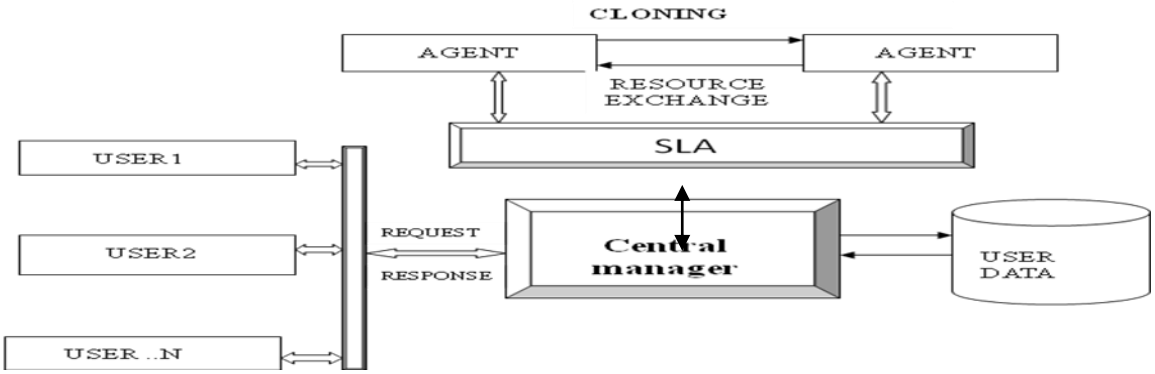
2.5). CENTRAL MANAGER

The ideal centralised task allocation approach, in which there is an external omniscient central manager that maintains information about all the agents and tasks in the network, the agent inter-connections in the task allocation network are generated using the Small World network, where most neighbours of an agent are connected to each other. The benefit of a task is simply as double as the amount of resources required to complete the task. A recurring theme on complex networks is the way in which simple probabilistic models can rapidly become design principles for new types of networked

systems. Small world networks, one observes this phenomenon in the development of protocols for peer-to-peer file sharing. The design of such protocols has become an active topic of research in the area of computer systems, motivated in part by the explosion of popular interest in peer-to-peer applications following the file-sharing The sharing application of these systems ran into significant legal difficulties; but independent of the economic and intellectual property issues raised by this particular application.The Monitoring and Discovery Services (MDS) are mainly concerned with the collection, distribution, indexing, archival, and otherwise processing information about the state of various resources, services, and system configurations. The information collected is used to either discover new services or resources, or to enable monitoring of system status. At each time step, a task arrives at the network with a certain probability and is randomly given to one of the agents in the network. A time step is simply modelled as a microsecond. The approach presented in deals with only one type of relation between agents in the network. Thus modify the approach to accommodate multiple relations by randomly changing the relation between two neighbouring agents.The central manager is able to interact with all the agents in the network without cost. Agent is just an empty shell unable to perform any task. Without the interaction skill, an agent is isolated from the "rest of the world" and therefore loses any interest. Moreover without communication an agent will not be able to learn new skills from others. They are sufficient since it suffices to an agent to use his interactive skill to get in touch with a gifted agent and then to use his acquirement skill to learn some new talent. Then every ability can be given to an agent through learning from a agent functional ability that is exchanged not some kind of experience.

2.6 SLA : In this technique support to guarantee of the network performance and also provide the duration of task execution using learning algorithm in agent network. And it's worked with in the agent network. Clients have interacted with agent. If the agent processed for More than one client request .In that time to occurred failure/maintenance problem in network. Because overloading of task execution in the self organization of their network. To overcome this problem now using SLA method .In this method provides the guarantee of the network. And also used EDF (Earliest Deadline First) into the SLA method. If its provide the guarantee all the deadlines in the system at higher loading. In the EDF algorithm used to find the turnaround time of the task execution in agent network. And it's should be reach the goal quickly of organization in network.

III SYSTEM DESIGN



The systems architect establishes the basic structure of the system, defining the essential core design features and elements that provide the framework for all that follows, and are the hardest to change later. The systems architect provides the architects view of the users' vision for what the system needs to be and do, and the paths along which it must be able to evolve, and strives to maintain the integrity of that vision as it evolves during detailed design and implementation.

IV. ALGORITHM

1.Following algorithm named q-learning used in the hybrid model of agent network for the new agent creation.

A= {a1, a2, ..., ak} // a set of neighbors of A;
Task={r1,r2,…,ri}//a set of resources
Task, State = Init, SLDR = 0
Procedure:
H = H1(Task/A);
If(Hn,max=(H3→A , H4 →A'))then
State = H3;Task benefit received
endif
Start WAIT timer;
while State = H4 Init do
if State = Hmax and A create A' messages received H then
State = Task process;
endif
if task process timeout and there are at least one A in Init then
For each ak ∈ A do

d(a1) ← a2(r) ↔ a1(r);
π (Ar) ← limit π (task);
End
State = Task benefit ; Stop;
endif
endwhile.

2.Following algorithm named EDF used in the hybrid model of agent network for the calculate of Turn Around Time of the organization.

T={t1,t2,t3……..tn} // set of task
H=H1(t1 to t10/A)
While(ready queue!= NULL)
{
For i=1 to n do
{
If

$$U=\sum_{i=1}^{n} Ci/Ti \leq 1$$

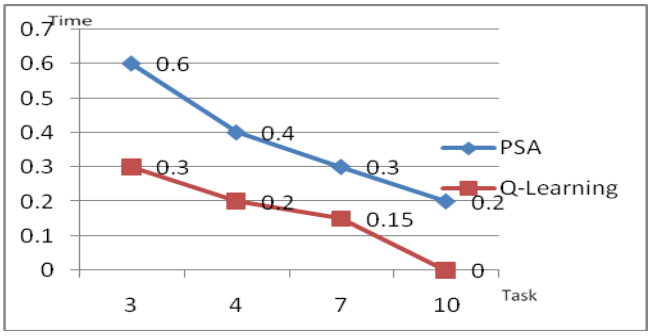
Tt=Ft-At
Else
Li=Di-Ci
}
Endfor
}
Endwhile
End

V. EXPREMENTAL RESULTS:

These graphs are the comparison of already existing three approaches with our mechanism to evaluate the performance of our mechanism. As to the best of our knowledge, there does not exist a mechanism which combines the three self-organization principles together i.e., cloning/spawning, resource exchange and relation adaptation for using the hybrid model of q-learning technique. In this technique to performed delay and improvement of the network process

a). Time Delay

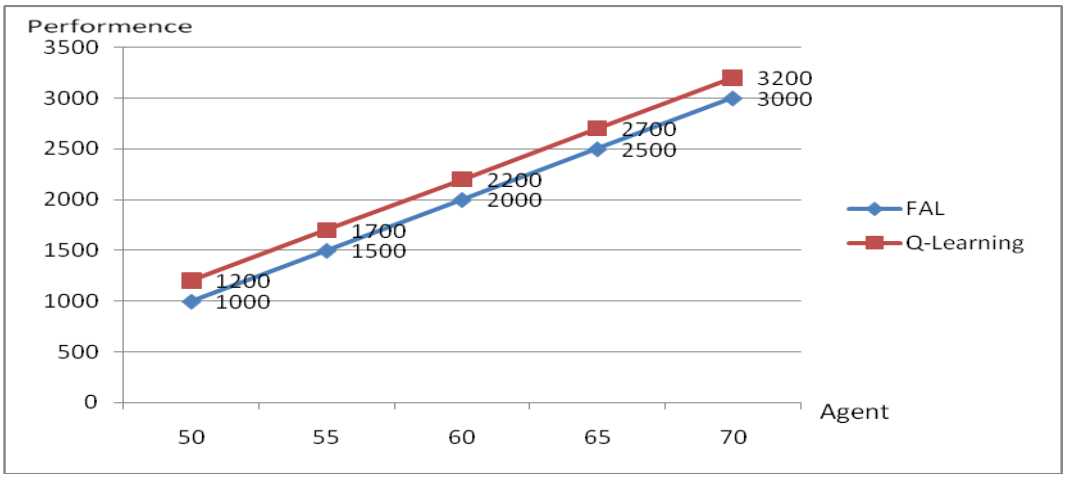
Task	***PSA***	***Q-Learning***
3	*0.6*	*0.3*
4	*0.4*	*0.2*
7	*0.3*	*0.15*
10	*0.2*	*0*



PSA –Policy Search Algorithm

b.Network Performance

Agent	FAL	Q -Learning
50	1000	1200
55	1500	1700
60	2000	2200
65	2500	2700
70	3000	3200



FAL-Fair Action Learning

VI. CONCLUSION

An integrative self-organization for coordination decentralized mechanism, which combines the three principles of self organization, cloning/spawning, resource exchange and relation adaptation. Each agent has identical capacity to complete task which is given by agent. This assumption could be relaxed by using Q-learning agent creation algorithm and also the Q-learning avoids the delay and congestion from the organization of the agent process.

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