Self Healing Software System to Fix Post Release Errors

Availability & Reliability are the two critical terms used basically to describe the robustness of any software system but these two parameters are affected mostly by post released errors. The biggest loophole in current system is the lack of adequate intelligence in the software to response reactively at the time of failure. Self Healing System is a reactive protection technique resource to the higher level software components without human intervention for the post release errors with an expansion from lower level hardware & network.

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AVAILABILITY & Reliability are the two basic objectives which every system irrespective of whether a software or hardware eager to achieve. Instead of adopting latest and innovative testing process, tools & remarkable R&D works in the area of fault tolerance as well as reliability, the software remains notoriously susceptible to crash and post release errors.

In the current approach after experiencing a post release error in any software, only a subset of total users reports to the vender about the specific error. Then the vender engages it in identifying the root of the error and the team develops a fix in the form of a patch file. The release of the new patch file to fix the particular error used to be informed through e-media to all the users. Now again the subset of all users who received the information and have connectivity upgraded their system with latest patch. But sometimes installation of one patch solves a particular vulnerability issue while creating some new issues and forms a loop of action as shown below. According to the statistic on an aver-age this error-fix cycle usually takes one to two weeks time, which in the galaxy of IT is normally considered as quite enough for unaffordable damage to the system.

SELF HEALING SOFTWARE

SHS is a reactive protection techniques for the post release errors with an expansion from lower level hard ware & network resources to the higher level software components without or very minimal human intervention and automates the self recovery at run time system failures. It attempts to "heal" themselves in the sense of recovering from faults and regaining normative performance levels. The concept of 'Self Healing' derived from the manner in which a biological system heals a wound. Through billions of years nature has created extraordinary mechanisms to perform robustness and self-healing. Various biological features have inspired development of computational models to create problem-solving techniques. Among those various characteristics of nature, immune systems of biology have inspired researchers to model 'Self Healing System' at various levels.

ARCHITECTURE OF SHS

Specialized SHS systems differ with each other on the basis of their area of implementation, required attributes and respective context of design. Every vender of SHS have their own specialized design patterns to full fill their respective commercial requirements but in this article a more generalized view of SHS components has been presented.
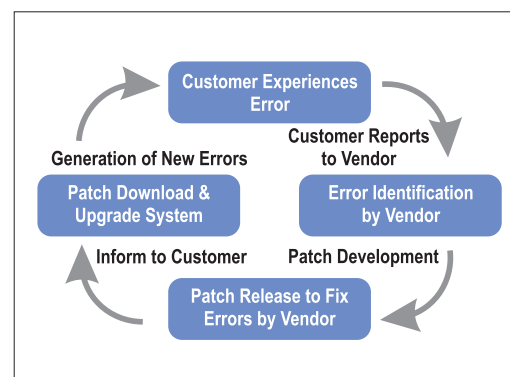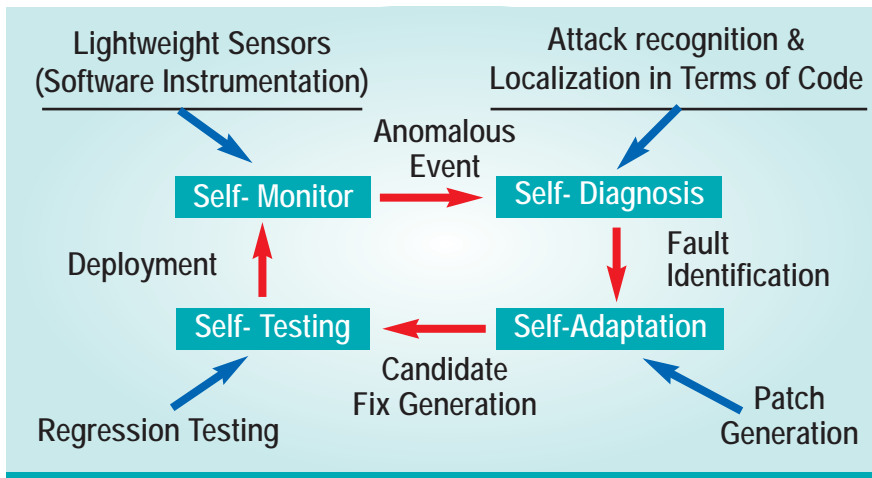
SHS SYSTEM CONSISTS OF FOUR BASIC COMPONENTS

Monitor: This component acts as a light weight error sensor and monitors continuously the heartbeat of the software system. The responsibility of the component is limited to sensing the error and throws an event with parameters to diagnosis component.

Diagnosis: The basic responsibility of this component is to identify the fault and extract as much as information with respect to its cause, symptom impact, sequence of events that lead to the error, region of code where fault occurs and other information necessary to develop the patch.

Adaptation: In this component system will create one & more possible patches to fix the error to the particular instance of the fault. The common strategies for error fixing are snap shots-rollback, processes isolation & rescheduling etc.

Testing: Several form of testing in isolated environment takes place on all patches generated from the Adaptation phase to verify the efficiency & the side effect on the system like performance degradation, downtime etc. Based on the test result the patches are prioritized. The most suitable patch is identified & updated accordingly.

SHS & OPERATING SYSTEM

The most basic level of implementation of SHS is at OS Level and many steps has been taken up to build Self Healing GRID enabled OS. The first self-healing features are available as part of the SolarisTM 10 Operating System (OS).

SELF HEALING FEATURES

Automatic monitoring and diagnosis of CPU, memory, and I/O subsystems

- Automatic off lining of faulty resources while the Solaris OS is running
- Administrator tools to view self-healing logs
- Standardized messaging for all self-healing diagnosis results
- Knowledge article Web site linking to online diagnosis messages

SHS & GRID COMPUTING

Grid computing is typically a very promising computing area, which caters to industry needs. In a Grid, number of nodes may vary from very few to thousands. Any number of nodes in the Grid may be removed, malfunction, stopped in between the operation, so Grid applications must self-heal themselves dynamically to changing environments. The heterogeneous nature of the network and the running modules, the dynamic load balancing requirements, and the ever changing user needs make adaptation an important necessity for grid appli-

cations. The mechanisms of the system must continuously adapt to additions, removals, and failures of nodes in large scale Grid. This is an important property since the human interventions to efficiently restore failed resources for large numbers of nodes is not feasible.

SHS & WEB PORTAL

Many of the web portals are currently integrating various new features on an iterative manner. This kind of approach attracts the user as well as facilitate more services at one place but the performance degradation is always remains an issue for the developer. Some time during heavy traffic hour a web application may fail to load and behave abnormally to show graphics. To deal with this situation many

Implementation of SOA, GRID Computing, and Web Portal technology in e-Governance are on top notch. So to make the system more robust the role of Self Healing System in e-Governance can't be avoided.

web application now being released with Basic, Standard and professional mode, so that user can select any one of the mode based on its hardware & network resources. In this scenario the SHS may play major role by monitoring such kind of load error, low bandwidth, network traffic etc and automatically switching from professional to Standard or Basic optimizing the portal to minimum functionalities. This will reduce the chance of failure and provide high availability to web application.

SHS & SERVICE ORIENTED ARCHITECTURE

Service Oriented Architectures (SOA)

is a flexible coordination paradigm that enables components to export and discover services over the network. With popularity of SOA, there are future threats about its effective management & real time binding which may cause to crash many applications at a time. In this scenario SHS may be used to make robust SOA based framework. During the process of service binding failure can happen at any interoperable point. A system may unable to find a service due to network or server failure as a result of which it may crash. In this case the evolutionary SHS concept can play a major role by modifying the process to obtain the "same" results, but in a different way, that is, through a different composition of available services. A SHS can be implemented to provide alternatives of three strategies called retry, rebind, and restructure.

SELF HEALING DATABASE SYSTEM

On attacks by malicious transactions, a Self-Healing Database System can automatically estimate, locate, isolate, contain, and repair damage caused by attacks in such a way that the database can heal self on-the-fly and continue delivering essential services in the face of attacks. But the traditional secure database systems rely on prevention controls. The database system is a five phase process. Phase I can detect intrusions, and locate and repair the damage caused by the intrusions. In Phase II isolate attacks so that the database can be immunized from the damage caused by a lot of attacks. Phase III dynamically contains the damage in such a way that no damage will leak out during the attack recovery process. Phase IV has ability to adapt the self-healing controls to the changing environment so that a stabilized level of healthiness can be maintained. Phase V it deliver differential, quantitative QoIA services to customers.

CONCLUSION

The Govt. of India, Department of Information Technology, has initiated National e- Governance Plan (NeGP) for the execution of e-governance projects in the country, both at Central and State levels. National Informatics Centre (NIC) of the Department of Information Technology is providing network backbone and e-Governance support to Central Government, State Governments, UT Administrations, Districts and other Government bodies. SAN (Storage Area Network) Data Centers and SWANs (State Wide Area Network) have been established in all 35 states/UTs through NIC as a part of NICNET. By connecting all these Data Centers (SAN) into a cloud, where in all the computational resources such as the CPUs, disk storage system, specialized software systems, etc., will be provisioned to all the users connecting to the cloud. Using the enabling technologies enumerated, e-governance applications can be deployed as web services to provide interoperability, business continuity, transaction persistence, server provisioning etc.

UPCOMING ICT EVENTS

2011 International Conference on e-Commerce, e-Administration, e-Society, e-Education, and e-Technology
18 to 20 January 2011
Tokyo, Japan
http://www.e-CASE.org/2011

GreenTech 2011
19 to 21 January 2011
Kerala, Idukki, India
http://www.marianresearch.org/greentech/

International Conference on e-Government and e-Governance
11 March 2011
Ankara, Turkey
http://www.icegeg.info

World Congress on Sustainable Technologies
21 to 23 March 2011
London, England, United Kingdom
http://www.wcst.org

11th European Conference on e-Government
16 to 17 June 2011
Ljubljana, Slovenia
http://academic-conferences.org/eceg/eceg2011/eceg11-home.htm