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STUDY ABOUT GRID COMPUTING, ITS NEEDS, SERVICES, ISSUES AND SOLUTIONS

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ABSTRACT

Grid computing enlarge with computing platform which is collection of heterogeneous computing resources connected by a network across dynamic and geographically dispersed organization to form a distributed high performance computing infrastructure. Grid computing solves the complex computing problems amongst multiple machines. Grid computing solves the large scale computational demands in a high performance computing environment . In this paper we study about Grid Computing ,its needs ,services, and security issues in Grid Computing and solutions for security issues in Grid Computing.

I.   INTRODUCTION

Grid Computing is the collection of computer resources from multiple location to reach a common goal. Grid computing can in the cloud or may not, this depends on what kind of users use it. If the user is an administrator and integrator, they will care about how to maintain the cloud, and upgrade, install, and virtual servers and applications. If the user is a consumer, it will have no need to care about how the system is running.Grid computing requires the use of software can be divided into multiple parts, and the fragments of the program as a great system image are passed to thousands of computers:-

A typical view of Grid Environment: -
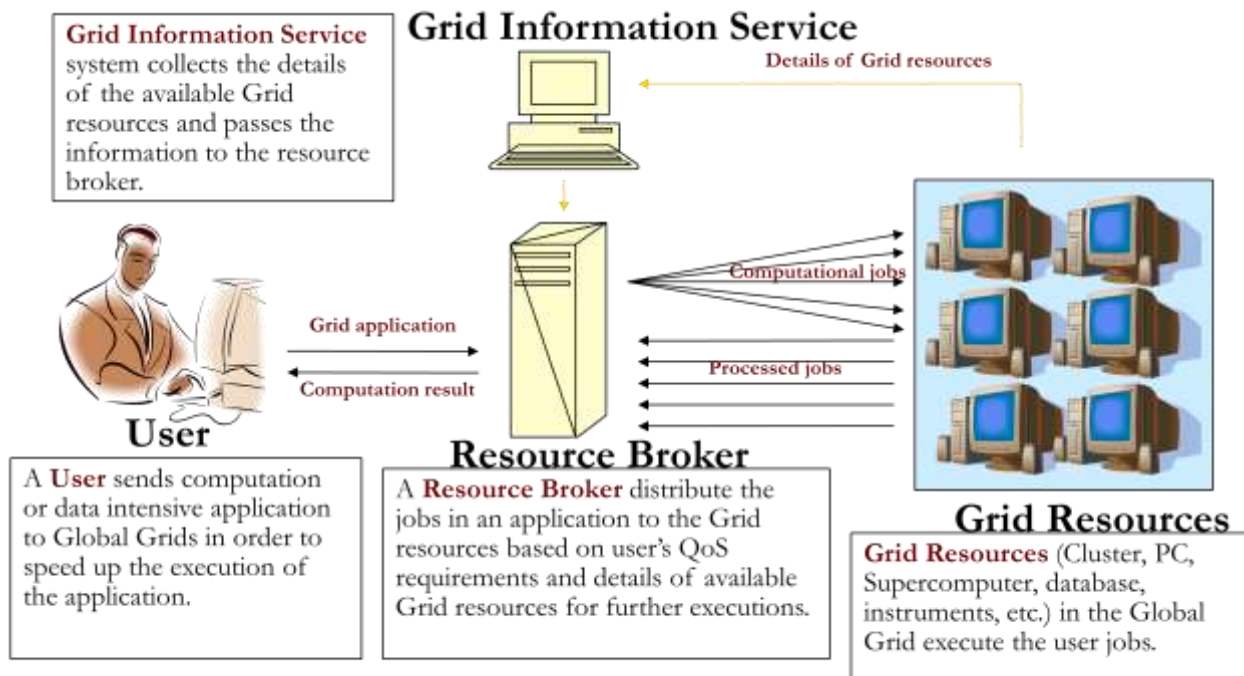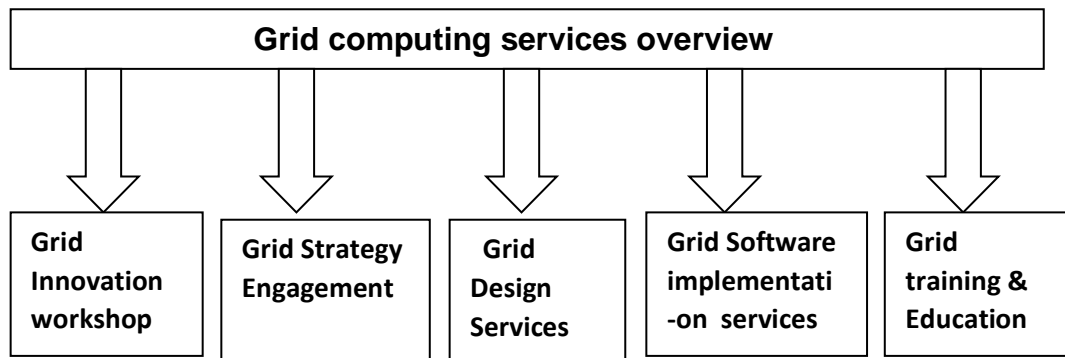

II.   WHY WE USE GRID COMPUTING

In a typical enterprise, IT resources are locked into silos and data resides in separately owned domains. Some IT resources are under-utilized, while others can't meet peak business demands. For multinational companies with data centers in many locations, efficient IT utilization is a serious challenge. With grid computing, your far-flung and disparate IT resources can act as a single 'virtual data centre'. The virtualization of your heterogeneous IT resources means these resources are available when and where

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you need them. It allows you to provision applications and allocate capacity among business groups that are geographically and organizationally dispersed. Through the use of this technology you can:

- Enable secure, real-time collaboration among global teams, including partners and suppliers outside your company
- Deploy resources for new initiatives rapidly
- Accelerate new product development and improve time to market
- Reduce IT costs and increase return on investment

Handle peaks and troughs in demand by provisioning resources where needed

III.   GRID COMPUTING SERVICES

Grid computing services overview

Grid Innovation workshop	Grid Strategy Engagement	Grid Design Services	Grid Software implementati-on services	Grid training & Education

1.) Grid Innovation Workshop :- Typically a 3~5 days workshop, its main goal is to provide a grid computing design overview that can be used as a basis for follow-up engagements.

2.) Grid Strategy Engagement :- Engagement service that defines the vision for a client to leverage innovative grid computing solutions. It also identifies how grid computing technologies can impact an organization's existing enterprise architecture and business model.

3.) Grid Design Services :- Design service that precedes grid computing implementation services. Its main goal is to provide a detailed design to be implemented afterwards.

4.) Grid Software Implementation Services :- Service in which implementation, testing, and deployment activities of the grid computing environment, outlined and designed by the previous services, take place.

5.) Grid Training & Education :- Training and education offering available to complement and leverage the skills of the interveners in the grid computing implementation roadmap.

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IV.   SECURITY ISSUES IN GRID COMPUTING

Security Issues in Grid Computing

Architecture Issues | Infrastructure Issues | Management Issues

Info. Sec. | Authorization | Host | Network | Cred. Mgmt | Trust Mgmt

Secure Commu.

Vo level

Data Protection

Access Control

Trust creation

Routing Sensor Grid

Repositories

Authenti- cation

Trust Nego.

SSO & Delegation

Resource Level

Job Starvation

Multi casting High Perf.
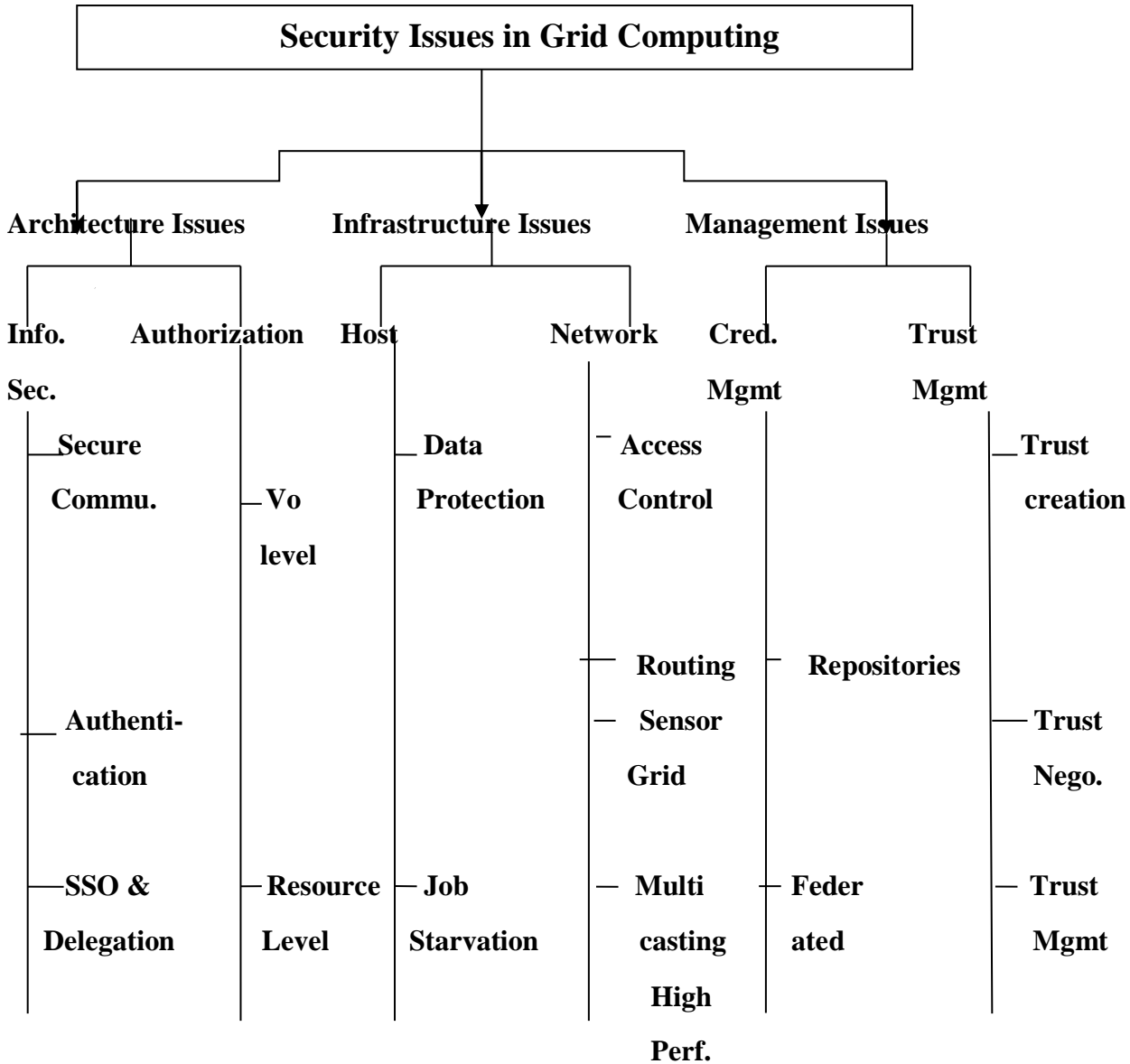
Feder ated

Trust Mgmt

Figure :- Categories Of Security Issues in Grid Computing

The above figure shows the Categories Of different Security Issues in Grid Computing. The grid security issues can be categorized into three main categories architecture related issues , infrastructure relate issues , and management related issues.

V.   ARCHITECTURE RELATED ISSUES

These Issues address concerns pertaining to the architecture of the grid. This issue is also categorized into two categories Information Security and Authorization.

I.   Information Security :-

We define information security as the security related to the information exchanged between different hosts or between hosts and users . The concerns at the information security level of the grid can be broadly described as issues pertaining to secure communication , authentication ,and issues concerning single sign on and delegation. The Secure communication issues include those security concerns that arises during the communication between two entities.

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There are also issues related to authentication , where the identities of entities involved in the overall process can be accurately asserted. In addition to the secure communication features users are also concerned about single sign on capability provided by the grid computing infrastructure. In single sign on the authentication is done once.

The information security issues exist in all fields of computing and communication and have been studied for quite some time. In the grid computing area ,the researchers and practitioners have come together to create the Global Grid Forum(GGF)(now called OGF). They have released an open standard called Open Grid Standards Architecture (OGSA).There is a Grid Security Infrastructure (GSI) layer of OGSA which addresses most of the information security challenges mentioned above.

II. Authorization :-

Another important security issue is that of authorization. Like any resource sharing system, grid system also require resource specific and system specific authorizations. It is particularly important for systems where the resources are shared between multiple departments or organizations, and department wide resources usage patterns are predefined . Each department can internally have specific resource authorization also. The authorization systems can be mainly divided into two categories : **VO Level Systems** and **Resource Level Systems**. Virtual organization or VO Level system have a centralized authorization system which provides credential for the users to access the resources. Resource Level authorization systems, on the other hand , allow the users to access the resources based on the credentials presented by the users.

VI.   INFRASTRUCTURE RELATED ISSUES

These issues relate to the **network** and **host** components which constitute the grid infrastructure .

1. Host Security Issues :-

Host level security issues are those issues that make a host apprehensive about affiliating itself to the grid system. The main sub issues here are : **data protection, job starvation** , and **host availability** .Whenever a host is affiliated to the grid, one of the chief concerns is regarding the protection of the already existing data in the host . The concerns stems from the fact that the host submitting the job may be untrusted or unknown to the host running job. To the host running the job, the job may well be a virus or a worm which can destroy the system . This is called the Data Protection Issue. Job Starvation refers to a scenario where jobs originating locally are deprived of resources by alien jobs scheduled on the host as part of the grid system.

2. Network Security Issues :-

In the context of the grid computing , network security issues assume significant importance mainly due to the heterogeneity and high speed requirements of many grid applications. **Access Control** and isolation are important requirements for traffic flowing through the grid networks. **Routing** of packets in networks based on routing tables is a specific network issue. Attacks in routing include link and router attacks which may cause significant destruction. **Multicasting** is an efficient means of information dissemination and may assume importance for the grid network in future. Member authentication and, key management, and source authentication are specific security issues in multicasting. Another topic in the grid network is the integration of Sensor networks with grid technologies. Several sensor network attacks like Sybil attacks, wormhole, and sinkhole attacks. Finally, there are security issues in high performance interconnects.

VII.   MANAGEMENT RELATED ISSUES

The third set of issues pertains to the management of the grid. The grid management is important as the grid heterogeneous in nature and may consist of multiple entities, components users, domains, policies, and stake holders. 0The different management issues that grid administrators are worried about are credential management, trust management.

1. Credential Management :-

Management of credentials becomes very important in a grid context as there are multiple different systems which require varied credential to access them. Credential management systems store and manage the credentials for a variety of systems and user can access them according to their needs. For typical grid credential management systems mechanisms should be provided to obtain the initial credentials. Credential management systems are mainly of two types **Credential Repositories** and **Credential Federation systems**. The first set of the systems are responsible for storing credentials while the second set of systems are responsible for sharing credentials across multiple systems or domains.

2. Trust Management :-

Another important management issue which needs to be addressed is the issue of managing trust. Managing trust is crucial in a dynamic grid scenario where grid nodes and users join and leave the system. Therefore, there must be

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mechanism to understand and manage the trust levels of systems and new nodes joining the grid. The trust life cycle is composed of mainly three different phases: **trust creation phase , trust negotiation,** and **trust management phase.** The trust creation phase generally is done before any trusted group is formed and it includes mechanism to develop trust functions and trust policies. Trust negotiation, on the other hand ,is activated when a new untrusted system joins the current distributed system or group. Trust management phase is responsible for recalculating the trust values based on the transaction information, distribution or exchange of trust related information, updating and storing the trust information in a centralized or in a distributed manner.

VIII.   SOLUTIONS FOR SECURITY ISSUES IN GRID COMPUTING
Solution to Architecture Related Issues :-
➢   **Solution to Information Security issues :-**
The Grid Security Infrastructure(GSI) independently and later integrated as part of the OGSA standards, addresses all the stated architectural concerns. GSI is based on proven such as public key encryption, X.509 certificates and the Secure Sockets Layer(SSL) and enables secure communication and authentication over computer networks.

- **Secure Communication:-** The GSI uses public key cryptography, as the basis for creating secure grids and **SSL/TLS** for data encryption. In public key cryptography, the entities generate public/private key pairs based on some cryptographically secure mathematical function. A message when encrypted by the public key can only be decrypted by the private key corresponding to the public key. The public keys are known to everyone.
- **Authentication:-** A central concept in GSI authentication is the certificate. Every user and service on the grid is identified via a certificate, which contains information vital to identified and authenticating the user or service.
- **Single Sign On and Delegation:-** The GSI provides a Single Sign On and Delegation capability, which reduce the number of times the user must enter his/her pass phrase when multiple resources are used, which is common in a grid scenario. This is done by creating by a proxy. A proxy consist of a new certificate and a new private key. The new certificate is signed by the owner, rather than a Certification Authority(CA). The certificate also includes a time notation after which the proxy should no longer be accepted by others.

➢   **Solutions for Grid Authorization :-**
Several authorization systems can be applied to the grid context.
- **VO Level Systems :-** VO level grid authorization systems are centralized authorization for an entire Virtual Organization (VO). These types of systems are necessitated by the presence of VO which has a set of users and several Resource Providers (RP)who own the resources to be used by the users of the VO. Whenever
  A user wants to access certain resources owned by a RP, he / she obtain rights to the users. Example of the VO level grid authorization systems are Community Authorization Services (CAS) Virtual Organization Membership Services (VOMS).
- **Resource Level System :-** Unlike the VO level authorization systems, which provide a consolidated authorization service for the virtual organization, the resource level authorization systems implement the decision to authorize the access to a set of resources.

IX.   SOLUTIONS TO THE INFRASTRUCTURE RELATED ISSUES
Several solution have been proposed for Host and Network Security issues.
➢   **Solutions to the Host Security Issues :-**
Several solution have been proposed for Data Protection and Job Starvation issues.
- **Data Protection:-** Solution in this space use isolation to restrict the data to the grid or external applications. There are some isolation techniques like application level sandboxing, virtualization, and sandboxing.
- **Job Starvation :-** Different solutions which look at the problem of job starvation can be categorized as advanced reservations and priority reduction techniques. Under advanced reservation system, a user requests a set of resources for a specified amount of time for the set of jobs to run. Priority reduction techniques, on the other hand, reduce the priorities of the long running jobs to reduce the possibility of starvation.

➢   **Solutions to the Grid Network Issues :-**
Several solution have been proposed for Access Control, Routing, Sensor Grid and Multicasting & high Speed Networks.
- **Access Control :-** Many of the grid and web services solutions cannot work effectively with firewalls and virtual private networks (VPN) which have become ubiquitous in today's enterprises.

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- **Secure Routing :**- Most Routing protocols are digitals signatures and passwords for message exchange which do not solve the advanced attacks like source misbehavior.
- **Secure Multicasting :**- This has been an active area of research for the last few years. Most of the solutions presented in this area are research outputs and rarely implemented in a large scale.
- **Sensor Grids :**- Security is sensor networks is a very important issues due to the computational constraints imposed by the devices and network and bandwidth constraints. This is an active area of research and several solutions have been proposed like SPINS and Tiny Sec.

Solutions to the Management Related Issues :-

➢ **Trust Management Solutions :-** Trust management is an active area of research and several trust management systems have been proposed and implemented in a limited manner in the labs of different universities. The main characteristics of the trust management systems are scalability, reliability, and security. The different trust management systems can be broadly categorized into reputation based and policy based trust management systems.

X.   CONCLUSION

Grid computing is an interesting and high potential solution for the most enterprises. The main aim of this paper is to provide a services by the Grid computing and introduce about various types of issues in Grid Computing and solutions for there issues. However, security is one of the major impediments in widespread grid adoption. We categorized the issues related to grid computing security into three main categories like, architecture related issues, infrastructure related issues, and management related issues. These all issues and their solutions are described in our paper .

XI.   REFERENCES

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