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# Wireless Grid and Intruder Detection Server

**Shrawan kumar, Arun Pratap Srivastava**

*Abstract*-**Wireless Grid is an emerging communication and resource sharing architecture in recent years. It is getting more and more researches and application in mission, industry, business, science research. Wireless grid technique is developing and improving, especially with the storage capacity rising. Storage resource can be managed by wireless grid and ensure the grid availability and reliability by replica, cache pre-fetch and buffer.**

**Extracting information or discovering knowledge from wireless or mobile grids has become increasingly important issue. Many researches in grid environment only consider data mining time. Other constraints, such as energy consumption and immediate bandwidth that are more important in mobile computing, will physically affect the performance and system availability.**

**If Grid system is integrated with the wireless network devices, Grid applications will soon be popularly and widely deployed in different domains to serve many more people in the world. Wireless Grid-based mobile agent system (WGMAS) which integrates mobile agent techniques and wireless environment with a Grid system, to provide a wireless accessible mobile agent system to users.**

**An Intruder is a person who attempts to gain unauthorized access to a system, to damage that system, or to disturb data on that system. In summary, this person attempts to violate Security by interfering with system Availability, data Integrity or data Confidentiality.**

**The goal of an Intrusion Detection System (IDS) is to "identify, preferably in real time, unauthorized use, misuse, and abuse of computer systems by both system insiders and external penetrates". An IDS is used as an alternative (or a complement) to building a shield around the network. The shielding approaches deficient in several ways, including failure to prevent attacks from insiders**

*Index Terms*- **Network attached Storage(NAS), Directed Acyclic Graph(DAG), Wireless Wide Area Network(WWAN), Wireless Metro Area Network(WMAN), Wireless Local Area Network(WLAN), Wireless Personal Area Network(WPAN).**

## I. INTRODUCTION

Grid computing is expanding from traditional high performance, distributed and fixed station computing to pervasive, wireless computing. Wireless grid is cooperative and resource sharing network comprised of wireless, mobile or static wireless devices. Due to the characteristics of limited CPU power, memory and energy, load balance should be considered between wireless nodes to avoid several nodes failover ahead. Different strategy and algorithm from wired grid should be adopted in routing, cache or buffer, security in wireless grid. The basic goal is to decrease cost of communication, computing and storage, and to increase availability, reliability and security. Wireless grid is applied in industry, transportation, environmental monitoring, health care, emergency, security system and so on. Governments and enterprises often owns local wireless grid.

Wireless bandwidth is increasing and this ensures transporting more data and sharing wireless storage. Wireless network may be members of grid resources, such as wireless storage and mobile services.

To ensure wireless node storage consistency and availability multiple proxies based on hierarchical architecture, presents power-aware replica node selection algorithm so as to take over storage resource when source node disconnection temporarily; and when source node recovers to copy data or replay log to update the storage state.

Recently, many commercial and industry wireless communication standards have been developed. By the transmission distance and application domain, they can be classified into several types, including: Wireless Wide Area Network (WWAN), Wireless Metro Area Network (WMAN), Wireless Local Area Network (WLAN) and Wireless Personal Area Network (WPAN), among which WLANs have been widely constructed around us. Users worldwide can access the Internet through them. This occurrence provides us with a convenient network environment to enrich our daily life.

## II. WIRELESS GRID ARCHITECTURE

Wireless grid is mainly consisted of backbone networks and wireless ad hoc sub networks, partially similar to P2P network. P2P networks, such as Napster, Gnutella and Kazaa, have the common characteristics as follows: heterogeneity devices cooperative sharing resources, transfer across unreliable network connection, no pre-arrangement, little station failure warn message. Wireless grid limited by the device resources, there is a typical architecture that a backbone grid comprised of wired and fixed grid devices, several access grid comprised of wireless devices which can access the processing, storage, bandwidth of backbone grid illustrated as Fig.1(with dashed standing for wireless, solid

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**Shrawan kumar,** Research Scholar, Vishveshwarya Institute of Engineering & Technology, Dadri, G.B. Nagar,India. (e-mail: shrktr123@gmail.com)
**Arun Pratap Srivastava,** Associate Professor, Computer Science & Engineering Department, Vishveshwarya Institute of Engineering & Technology, Dadri, G.B. Nagar, India.(e-mail: arun019@yahoo.com)

for wired). Access grid connects to backbone grid by wireless mode, such as UWB, ZigBee, WLAN, Cellular network (2G/2.5G/3G/B3G/4G), etc.

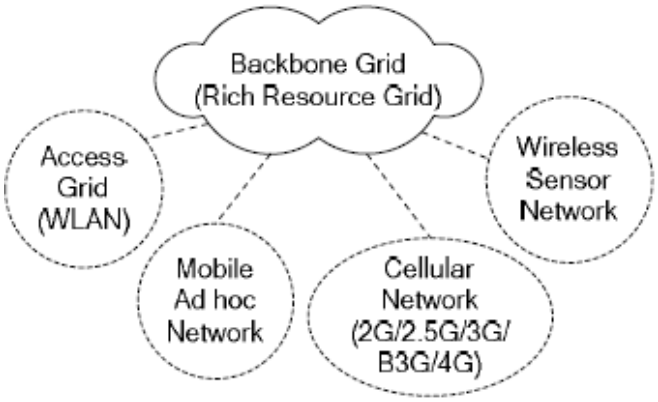


Fig 1: Pervasive wireless grid

Along with the development of mobile storage technology, the storage resources of wireless devices
increase greatly. Wireless devices can get enough distributed storage resources, and alleviate the shortage of storage resource of some wireless devices. We can use replica strategy to rise the availability and reliability to disconnection devices. Wireless grid can integrate distributed storage systems to wireless users.
Besides, Grid computing infrastructures have been quickly developed, but most of them are used in scientific computing or to provide huge storage to their users only, not very helpful in serving ordinary people. Also, they connect nodes with hard-wired links. Seldom adopt wireless technology and mobile devices. If we can integrate wireless network devices, techniques and resources with a Grid system to form a wireless accessible infrastructure to provide different kinds of terminal devices, Grid will soon be popularly and widely deployed in different domains and applications to serve many more people in the world. This occurrence will make Grid become much more practical and useful.
Moreover, wireless networks and access points (APs)
have been extensively built. Peripheral prices are also
significantly reducing. They are now entering users' life, education and entertainment speedily. Although the computing capability and storage capacity of mobile devices have become more powerful and larger respectively, day by day, the limited resolution of screen size, unacceptable power consumption and less multitasking functionality make it difficult replace PC, laptop and work station overall in the near future. However, integrating these wireless resources with Grid to bridge users and a Grid infrastructure will make mobile computing be pervaded as other network devices.
Additionally, a mobile agent (MA) is a software program of which the main purpose is moving among
nodes within a network to perform its predefined task. It can process a given task based on its designed logic, and then return the result to users. Autonomy and mobility are its key features. Numerous mobile agent systems (MASs) have been developed and applied to many domains, such as information retrieval and percolation, e-commerce, mobile communication and distributed computing.
Basically, communication is one of the key issues in MAS. An agent has to communicate with others before it can properly cooperate with them to finish their given tasks. Therefore, a reliable communication protocol is required. However, "reliable" often induces a sophisticate validation process or mechanism which often degrades the performance of MAS, and even makes MAs unable to accomplish the desired mission.
Currently the trend of wireless grid is connecting to
Wire grid by gateway, and wireless grid has both access grid and resource grid function. Wireless grid has backbone grid by router or gateway, and every router or gateway can connect or act as proxy node, the local proxy manages local area wireless nodes.
Hierarchical multiple level wireless grid proxy to design wireless grid architecture as Fig. 2.which has the following characteristics:

***A. Connectivity:*** Due to the limited communication distance of wireless devices, it is adaptive to use local center or proxy to manage area wireless nodes. Proxy can connect each other by multiple hops.

***B. Intelligence***. Due to the low energy of wireless devices, energy consuming should be considered. It's Power-ware, and available storage space is also aware.

***C. Self-organizing.*** Local area grid can be self-organizing, self-managing ad hoc network. Every proxy manages local area and can broadcast data in parallel I/O mode.

***D. Scalability***. Proxy nodes can use P2P (Peer-to-Peer)
Mode to communicate with each other to cooperative
computing and resource sharing.

***E. Interaction***. Every proxy contains three modules: index server to record local resource and neighbor node resource, station IP, available service; Cache server to save hotspot data; crawler server to search Grid services (including storage service).

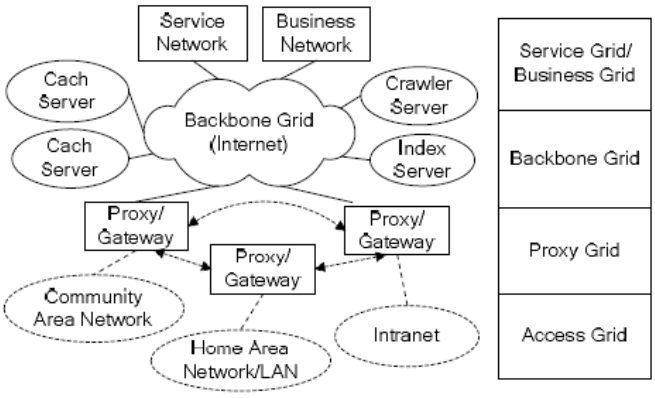


Fig 2: Wireless grid architecture

Recently, the rapid growing in wireless and sensor technologies has facilitated the wide deployment of sensor nodes, which also greatly encourages the research of wireless sensor networks (WSN). In a WSN, sensor nodes collect data based on the request from a sink node and then forward data hop-by-hop to the sink node. Although the forwarding fashion in a WSN is very similar to that in a wireless ad hoc network, it has some major differences in that a sensor node has small buffer size, low transmission bit rate, and less computing and electrical power. To define the low-rate wireless personal area network (LR-WPAN), IEEE 802.15.4 develops two different MAC protocols, the beacon-enabled and the non-beacon-enabled. The former uses slotted *CSMA/CA* to synchronize the data forwarding among different sensor nodes, while the latter uses un-slotted *CSMA/CA* protocol very similar to the contention mode in IEEE 802.11.

Previous researches in WSN can be classified into four categories based on different network topologies, chain-based, tree-based, cluster-based and grid-based. Fan Ye et al. proposed TTDD (Two Tier Data Dissemination), a grid-based WSN proposed by, establishes different grid networks with length between two neighboring nodes for different groups of source nodes (sensors). To save the energy in maintaining different mesh topologies, Xuan et al. proposed a common grid network by utilizing sensor nodes for data forwarding. A transfer port was designed by Kao et al for the grid network to collect different types of data. A virtual grid structure proposed in for sensor nodes to disseminate data over the shortest paths in the grid network. Finally, Shim et al.developed a locator that can periodically report the location of a mobile sink to the source nodes, which then use greedy algorithm to forward data hop-by-hop back to the sink over the grid network.

An adaptive data collection (ADC) with dynamic grid-length adjustment is proposed for mobile sinks in a grid-based WSN. Two novel designs in ADC are: (i) It can adaptively adjust transmission range between two primary grid nodes (PGNs) and (ii) it can dynamically change the main data collection axis while the sink is moving along the X axis and Y axis of the grid. The purpose of re-adjusting transmission range is to save power in PGNs and to facilitate data forwarding by allocating one or more temporary grid nodes (TGNs). Through the inserted TGNs and the dynamic changes of main data collection axis, data pick up becomes more convenient and traffic distribution is more even. Additionally, less power is consumed in PGNs for sustaining longer lifetime, and since TGNs provide extra buffer spaces for data forwarding, the overall packet loss ratio is reduced.

In the past, mobile devices were just cell-phones that had conversation and message functions. The gradual progress of time led to PDAs, Smart Phones, and lap-tops, among others. Now, anyone can have these mobile devices for business or amusement. Though the wireless network is not mature at present, some improvements in processing power, storage capacity and connectivity have been made in recent years.

According to the report of eTForecasts the number of people who used wireless network came to 200 million in 2004 from 79 million in 2001. Even has the possibility to grow to 779 million in 2010.

Because wireless users increase and the rapid growth of the wireless communication that promote huge amount of manufacturing investment in the development of wireless devices. Provide more convenient and friendly applications for mobile devices have popularized them among users.

## III. WIRELESS GRID STORAGE SYSTEM DESIGN

Wireless grid is used in communication and computing service infrastructure to provide data transfer and message services. Along with storage volume increasing, we can provide storage service in wireless grid, or add wireless interface to current storage system, and this can boost the efficiency of storage, especially to compensate wireless storage resources. So we design wireless grid storage system, and emphasizes on the wireless storage related. As Fig. 3, the wireless grid storage system is designed
by the following properties.

(a) Deploy wireless storage system in the proxy, and we can use flexible NAS (Network Attached Storage) with wireless interface.

(b) Storage system of Local area wireless devices can connect to the proxy in parallel I/O mode. Data can be transferred striped and multi-thread coped. To a large file such as multimedia content, the data can strip across multiple storage devices intro local area and read or write at parallel.

(c) When partial storage nodes fail, clients can access continually by replica strategy and lay some copies in other nodes. The numbers of replicas depend on the access frequency and priority.

(d) Replica destination node can be selected by power-aware.

(e) Multiple storage nodes form logical DAG (Directed Acyclic Graph). Storage nodes can communicate with each other by proxy.

(f) Every proxy area nodes within area can store data to proxy storage or neighbor node, and register in the index server. When wireless devices lose connection to failure, others can access backup storage data, write to log file; and when the failure node recovers, it can fetch log files and replay.

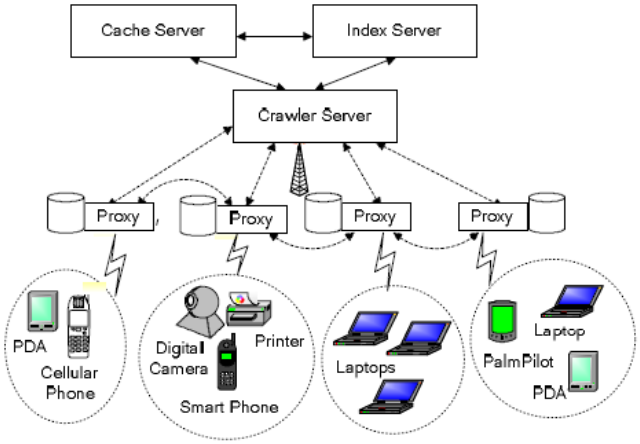


Fig 3: Multi-proxy wireless grid storage system

Grid Computing was originated with the concept of linking geographically dispersed supercomputers but now it has grown far beyond its original intent. Rapid advances, wide availability and attractive form factors have caused wireless technology to penetrate
the lives of people from all walks of life. Wireless technology such as 802.11, GPRS, are main source for bringing wireless devices in reach to the man on street. With the ubiquity and indispensability of wireless technologies established, these technologies are now making roads into Grids. Exploiting available idle resources in wireless devices can provide a more cost effective alternative for certain applications.

## IV. ATTACKS IN INTRUDER DETECTION SERVER

### *A. The Wormhole Attack*

The wormhole attack is a severe threat against packet routing in sensor networks that is particularly challenging to detect and prevent. To launch such an attack, an adversary establishes a low-latency link, referred as a wormhole link, between two points of the network, as shown in the fig. Once the wormhole link is operational, the adversary eavesdrops messages at one end and tunnels them (possibly selectively) to the other end, where the packets are retransmitted

### *B. The Sybil Attack*

A Sybil attack is one in which an attacker uses a malicious device to create a large number of pseudonymous entities, using them to gain a disproportionately large influence. We refer to a malicious device's additional identities as Sybil nodes. it introduce taxonomy of the different forms of the Sybil attack in sensor networks. In terms of communication, Sybil nodes can communicate directly or indirectly with legitimate nodes.

### *C. The HELLO Flood Attack*

Many WSN protocols require nodes to broadcast HELLO packets for neighbor discovery purposes. After just a few messages have been exchanged, most nodes have a complete picture of their immediate vicinity and a routing topology logically forms in a self-organizing fashion. However, if a laptop-class attacker broadcasts such packets with large enough transmission power, she could convince every node in the network that the adversary is its neighbor and advertise attractive routing pathways through it. After convincing portions of the net-work that it is truly the best routing option, it might choose to ignore incoming messages, effectively disabling large portions or even the entire network.

**(a) Resource Monitoring System**

Resource status information coherency has to be maintained between grid information server and monitored devices. These sections introduce regular, skewed and interleave based monitoring mechanisms to reflect the dynamically changing resource status. The interleaved scheme tries to minimize the unnecessary observations of some resources and maximizes the observations of critical resources. Thus, it minimizes the monitoring load and increases the degree of accuracy of resource status.

**(b) Resource Monitoring System Architecture**

Fig. 4 shows the environment considered for proposed scheme. It consists of wireless devices that monitor their local resource status, and a Grid Information Server (GIS), which maintains the most recent status of each device resource in its resource repository (RR).

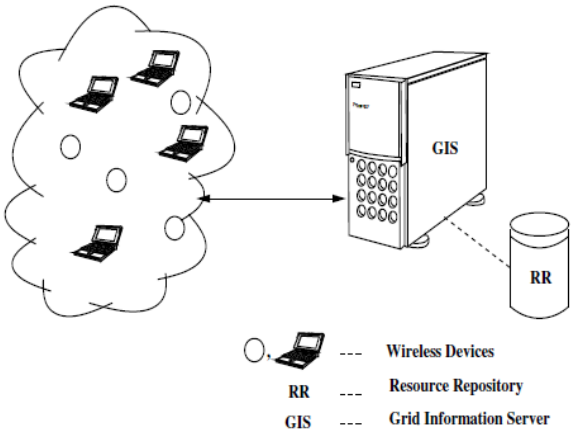


Fig 4: System Environment

**(c) Wireless Device**: It consists of resources like processor, primary memory, secondary memory, bandwidth, operating system(s), software applications, etc. The attributes of resources such as availability, affordability, speed, etc, will be affected with time. That is, resource state will be affected by number of jobs allocated/running, device mobility, signal strength, and battery power. Processor load, memory usage, and bandwidth used of a device keep on changing dynamically.

## V. CONCLUSION

Wireless grid researchers often consider communication quality, routing and jobs scheduling algorithm, pay little attention to the storage of wireless grid. Wireless multimedia

remote transferring and download service (such as color ring, music, video, photo, etc.), mass storage space is needed. When wireless devices have not enough storage spaces, a practical avenue is to make use of wireless grid storage and stream technology to implement VOD with wireless devices.

In architecture of grid storage is presented, namely GAS (Grid Architecture Storage), which goal is to take use of free storage in grid. In the algorithm of power aware hierarchical scheduling, and considers multiple proxy area energy

Wireless grid is still a technology more located in laboratories. Along with the standards being mature,

people will pay more attention to the security, QoS (Quality of Service), auditing, context aware and knowledge mining. By view of the similarity to current P2P (Peer-to-Peer), ad hoc, wireless grid will be more automatic and lightweight and intelligent.

Wireless grid and storage architecture based on research state, present power aware replica target selection algorithm to ensure wireless node availability even when failure. In future work, we will research the cooperative algorithm between the wireless grid storage and wired grid storage, concern the security and seamless service of wireless grid node storage resource efficiency, and implement trusted computing and secure storage services.

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