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Cellar: Securing Data for Twister

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Abstract

Twister is an iterative framework for Google's MapReduce programming. Twister runs within a cloud computing environment using several Virtual Machines (VMs) to divide up complex problems into manageable sections that are then dispersed to the VMs for processing. The goal of this paper is to evaluate Trusted Platform Module (TPM) as a protection measure for Twister.

Keywords

Trusted Platform Module, Trusted Computing, Twister, VTPM, Virtual Machines.

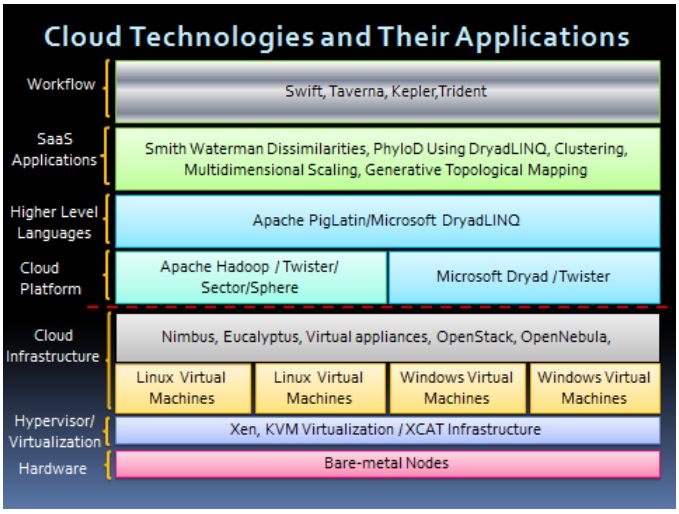
Introduction

MapReduce is a software framework that was created by Google in 2004, in an effort to simplify large data sets that they frequently work with. In 2010, several Indiana University researchers produced Twister; an iterative overlay for MapReduce in order to parallelize the work performed to be more efficient and reduce runtimes of the programs. In both cases, security and trust relationships were not the main concern. As cloud computing sees a rise in popularity, security and trust are the most common concerns for users.

The Trusted Platform Module is a chip that resides in the computer independent of the BIOS or Operating System. The TPM offers security by providing security keys and attestation of a system to users both locally and remotely. The provided keys can be used for encryption, identity verification, and secure communication channels.

Our focus will be on securing Twister and the cloud infrastructure that it depends on with the TPM. By adding a security framework and verification to the Twister model, we can give the information owner greater assurances that their data is not being compromised or read by unauthorized parties. This means that the VMs loaded by the information owner, as well as their data must be protected and that trust should be measureable, hence our choice of the TPM. This will allow us to ensure that the VMs that are loaded and the processes that those VMs run do so correctly and in a trusted manner without any compromises or potential for misuse.

A. Background of Cloud Computing



The Layers of Cloud Technologies

There are two types of hardware virtualization: Full Virtualization and Host-based Virtualization. Host-based Virtualization uses the underlying hardware directly, with several modifications to the main operating system. Our focus with Twister is on Full Virtualization, using the KVM hypervisor. [1] Full Virtualization does not have to modify the host operating system. It depends on a binary translation between the guest OS and host, provided by a virtualization layer. The hypervisor is responsible for implementation and management of the virtual machines installed on the same hardware. Hypervisor helps reduce the cost of hardware by offering better utilization and provides the capability to have many operating systems on one piece of hardware.

The base system for our work is openSUSE. We are using KVM-QEMU, which is an open source software hypervisor. The base system takes care of all needed operations for interacting with the hardware, but it also affects the integrity of the virtual environment(s) during their lifetime. If the base system is damaged or its data corrupted, potentially all of the virtual environments could be damaged since the data storage is a single piece of hardware. This issue is easily overcome however by having mirrored drives, backups of the systems, and dispersing the systems over several cloud locations.

Moving up the levels of the cloud computing model we come to the virtual machines. A virtual machine is a software implementation of a system that acts like just like a physical machine. Each virtual machine is configured to be self-contained to the resources allocated to it and it cannot grow beyond or access more resources than what is allowed by the Hypervisor. These VMs are independent of the underlying system in that they can run any potential Operating System that the cloud owner or information owner wants, depending on the level of service being provided. In Twister, the information owner is creating the entire VM, including the OS and programs that will be installed on it.

In Twister, the Master Node and Worker Nodes are all Virtual Machines, each with set parameters and pre-defined resources that are requested by the

Information Owner and allocated by the Cloud Owner (CO). This self-encapsulation means that when properly configured, VMs are unaware of other VMs running on the same hardware, and access to their files is restricted to the VM that data belongs to, unless it is shared as a network resource. As mentioned before, by running several VMs on a single piece of hardware, the cloud owner is able to better utilize their hardware resources and avoid wasted cycles. However, this does mean that any number of IOs may have data or be running VMs in the same cloud.

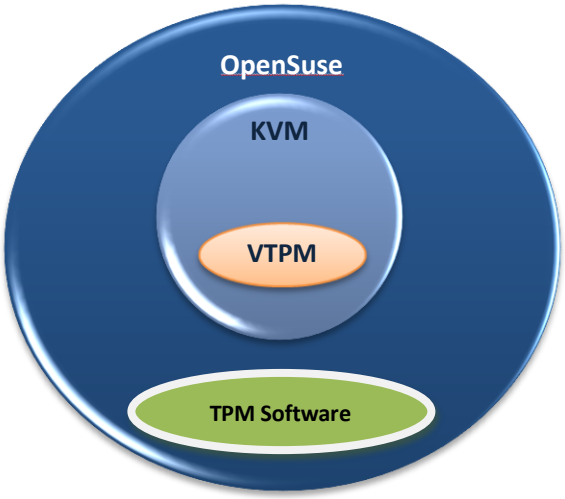


Fig. 1: Base System Relationships

Looking at cloud computing which is virtualization on a large scale. There are four types of cloud computing (Public, Private, Community, Hybrid). Service models are categorized into: 1) *Infrastructure as a Service* (IaaS), a low level setup. The Information Owner is able to control everything from the boot loader up, except the hardware and data center. 2) *Platform as a Service* (PaaS) is the mid-level setup that allows the information owner to control the software and

setup, but the OS is setup by the Cloud Owner. 3) Softw*are as a Service* (SaaS) is the high level configuration that only allows the information owner to control the application's configuration.

Hackers [8] see the development of cloud computing as a growth of potential resources for misuse. If all of the machines have the same vulnerabilities, there are more systems to compromise and misuse. While we take care of securing the image, we do not cover securing the communication channels between nodes. This option is discussed further in the future works section.

B. Software solutions

There are several new methods for establishing trust in a cloud computing environment that have been developed. These methods and mechanisms allow trust to be built into a variety of cloud computing models. Some of the latest released mechanisms include the Locator Bot (LoBot)[2], and the Trusted Virtual Environment Model (TVEM)[2]. By building on these trust mechanisms, we hope to increase the usefulness of Twister.

LoBot pre-measures security properties by using Trusted Execution Technology (TXT)[2] and the Virtual Trusted Platform Module (vTPM), [2] which makes sure the cloud platform has the integrity and trustworthiness required by the information owner. LoBot is used to make sure the cloud platform is trusted and prevents execution of a program or system if the verification fails. Additionally, it provides secure provisioning and migration of virtual machines.

The TVEM accomplishes its security provisioning by providing a more specific application programming interface, cryptographic algorithm flexibility, and a configurable modular architecture. The main components of the TVEM infrastructure are: the TVEM manager, the Virtual Trusted Network (VTN) control, and the TVEM Factory. TVEM is more robust than vTPM, as it does not lose its encryption keys when the system is powered off. In addition, TVEM has a multiple interfaces that provide flexibility in verification. The options available

include an API for implementation that reduces errors, and a driver version for ease of use.

The physical platform TPM is a piece of hardware which is located on the motherboard. This microcontroller security chip is used to keep data safe from attacks. It is where the root of trust is established by using an endorsement key provided by the manufacturer. The vTPM's trust is rooted to this physical platform. As discussed in the Approach to Securing Twister, the TVEM is an extensible architecture and has persistent storage for keys and settings even if the system is powered off. TVEM provides an integrity that is specific for the virtual environment and isolated from the hosting platform. This configuration provides the trust and integrity required by the information owner in a cloud environment by dividing the verification of trustworthiness between the service provider's platform and the information owner's domain. By implementing the TVEM for attestation and trusted storage for virtual environments, the authors were able to provide trust and security without the need for limited TPM specifications.

Establishing Infrastructure Trust in Twister

A. Entities of Twister

Twister and the MapReduce program it is built upon have several elements that must work together. These entities include: the Master Node, Worker Nodes, the Broker Network, individual broker systems and the storage resources. [5] The Master Node is responsible for the main Twister program. It delegates task(s) to Worker Nodes on the Broker Network, and processes the results of the computation(s). The Worker Nodes perform the computations for the MapReduce function, and notify the Master Node of their completed work. The Broker Network is the cloud service where the Twister program is running. It is comprised of one or more Broker Servers that host the data and processes that are run as part of the Twister program. Twister interacts with the broker network via the Master Node and the information owner's input.

Twister operates by using a pre-configured VM image stored in the cloud that is loaded at the request of the Information Owner. This requires interactions between the storage system and the Virtual Machines to load the correct image, and allocate the necessary resources for that VM. The master node is also a VM loaded on the broker network, but it has additional privileges to delegate work to the nodes. The master node then divides the work up into smaller sections for processing, and requests the number of threads necessary to process these requests. If there are more threads of work than Virtual Machine workers available, the work will be divided up into as many cycles as needed to complete the work. As data is processed and completed, those threads are either given additional work to perform, or they are unloaded from the broker network, and the data is written to the storage system. Twister's script then collects and displays the results to the information owner.

B. Communication within Twister

There are many aspects of communication that are involved with Twister. These include:

- Information Owner to the Broker Network
- Broker Network to Data Storage
- Master Node to Worker Nodes
- Worker Nodes to the Master Node

The information owner communicates with the Broker Network to perform the tasks they need, as well as uploading their data and Virtual Machine images. This communication can take place through a number of cloud management interfaces like Eucalyptus or Nimbus from the information owner's location to the Broker Network. Once the data processing begins, the Broker network must transmit data and requests back and forth between the Master Node and the worker node(s). The data necessary for these computations is stored in a data storage array within the cloud. The inter-VM communication currently takes place through KVM via several Virtual Ethernet Interface (VEI) connections. [7] As these interfaces work

just like standard Ethernet communications and securing them would simply require an encryption protocol that the VMs could use to prevent eavesdropping by malicious entities, such as SSH.

The data that is owned by the user could also be stored in an encrypted format, which would be decrypted by the worker node as it is accessed. The VMs for the Master Node and Worker Nodes would be treated like any other piece of data, as they would be encrypted before being uploaded to the broker network by the information owner and then decrypted by KVM when the user requests that they be loaded.

Trust Relations

Based on Grandson's research [2] we have identified these trust relations:

- Delegation [6]: The information owner is delegating work to the cloud, via the Master Node. Twister's Master Node delegates work to the worker nodes as part of its programming. The Master Node also delegates data retrieval to the worker nodes so they can process their work, and write back the results to the Data Storage Array. In each instance, the person or program needing something done without their interaction is giving up some control, with the expectation that the entity doing the work is doing so as requested. If a node is not reliable, or it is not returning reliable results, Twister cannot work. Twister expects the worker nodes to process the work sent to them and in the manner that Twister wants the work done without any alterations.

- Infrastructure trust [6]: The information owner should trust the infrastructure where their data is being stored and processed. The Master Node and Worker Nodes should also trust the workstation infrastructure. This means that the Cloud Owner's infrastructure is running the underlying system(s) and program(s) that the information owner is expecting. A deviation from the expected setup could indicate a violation of the cloud's

integrity. Twister depends on the infrastructure's resources to quickly process its large amounts of data.

- Provision of Service by the Trustee [6]: The Information Owner should trust a broker (or Cloud Owner) to map and allocate physical resources. A broker is expected to state these resources accurately. If the Information Owner requests a resource and the Cloud Owner fails to provision the correct resources, the processes need by the information Owner may fail. This could also indicate an issue with the cloud's integrity.

Approach of Securing Twister

A. Establishing Trust

We have identified the issues with Twister's current setup and lack of security in maintaining the information owner's data securely. In order to ensure Twister's Integrity within the cloud, we propose establishing a root of trust for Twister using the TPM. This will also allow future work in securing Twister/VMs in the cloud entirely using the TPM. In this section we will break down how the interactions within Twister occur in the Cloud.

Information Owner to the Cloud

The Information Owner and their data is the focus of this project. They want their Twister program to run in the cloud properly and reliably. Using the TPM, the information owner is given a way to ensure that the VMs they are allocated by the Cloud Owner are the ones they requested. In this manner, they can be assured that the programs will run in the way they expect. When the IO is ready to process a Twister program, they will again request and attestation of the VMs that they previously uploaded to the cloud. Both the Master Node and all of the Worker Nodes must pass this challenge for the program to continue. If the challenge returns the expected results, the Twister program can run and it begins processing its work. The IO may desire to challenge the CO's servers before the results are returned to ensure the integrity of the cloud at that time.

Software Used

- KVM hypervisor 0.14.0
- TPM – Trousers 0.3.6
- TPM – TPM-tools 1.3.5
- Twister package .9
- ActiveMQ 5.4.2
- OpenSuse 11.4
- Redhat 5.4
- TrustedGRUB 1.1

Hardware Used

- Broadcom TPM 1.2.
- Intel VT for full virtualization.
- PC – HP xw4300 Workstation.

Method

For our implementation we chose a single-system setup. Our base system, an HP xw4300, was used as our cloud infrastructure. We setup the BIOS to enable the TPM security. Next openSUSE 11.4 Linux, QEMU-KVM and the software needed to use the TPM was installed. We then configured TrustedGRUB to secure the boot-up sequence. Within openSUSE we used the QEMU-KVM hypervisor to setup a single VM of Red Hat Enterprise Linux 5.4 for Twister v0.9.

We chose to use a single VM to control for variances in timing and communication within Twister as well as ensuring outside influence of the base system did not adversely affect our measurement. For our setup the VM is a 16GB image with 1GB of RAM allocated. The CPU is a 3.2Ghz Intel Core2 Duo with one core allocated to the VM.

We then measured how long two Twister programs took to run. As shown in Figure 2, Twister run times can vary widely depending on the amount of data being processed, and the amount of computing power given to the VM. In each case, we ensured that the base system was up to date, and that no additional

programs were running in the background. The VM operating system was also updated and any un-necessary programs were terminated before running Twister.

Program Name	Amount	Time to Run
K-means	Numbers between 80 and 80000	22.82 seconds
Word Count	1 Gigabyte of Text	268.076 seconds

Fig. 2

Status and Results

Due to several issues with the TPM-tools [10] and the Broadcom TPM, we were unable to complete the measurements of our VM. However, as a proof of concept we were able to see the TPM within the VM and TPM functions were responsive on the base system. Given several measurements from related works [3] we expect a 16 GB VM to scan in about 80 seconds. If this were to be proven true the use of a TPM as a protection tool is ineffective for use with Twister. It is possible to reduce the VM size to 8 Gb thereby reducing the time to around 40 seconds, but this is still more time than it took for the K-means program to run, and approximately 14% of the time it took the Word Count program to run. This is a significant overhead to the Twister program and one that greatly reduces its effectiveness.

Adding additional security would also be ineffective as many Twister programs use large datasets; sometimes several to tens of gigabytes of data per program. Attestation of the datasets would only exacerbate the overhead presented by using the TPM as a protection tool.

Future work

Our current work is just about building the trusted system that the VM sits on using TPM. We then measure VM(s). Expanding on our project, possible future work could include:

- Reducing the large overhead produced by Twister's measurements. A cryptographic co-processor may be able to process the measurements more quickly.
- Securing the interactions between worker nodes with SSH using TPM secured keys. Currently Twister uses SSH, but logins are automatic and keys are generated on the server.
- Encrypting and decrypting the information stored on the data storage array.

These works would help improve Twister's environment by having a more complete security framework, thereby preventing misbehavior or unintended actions by using TPM. However, these parameters would need to overcome the significant overhead produced by the attestation.

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The effect of Risperidone and Haloperidol on clinical picture and some biochemical parameters of schizophrenia Libyan patient.

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ملخص البحث:

الانفصام (Schizophrenia) هو اضطراب عقلي شديد، يتميز بالاضطرابات الأساسية في التفكير والإدراك والعواطف. أكثر من 100 سنة من الأبحاث لم تكن قادرة تماما على حل اللغز الذي يمثل الانفصام. الانفصام يشار إلى أنه اضطراب وليس مرض ، لأنه لا يوجد هناك أي عامل مسبب للمرض واضح وموثوق به ومحدد. وعلي الرغم من أن الانفصام ليس مرضا متكرراً ، فهو من أكثر الأمراض المرهقة والمكلفة في جميع أنحاء العالم . الوقاية من الانتكاس (prevention of) relapse هو الهدف الرئيسي من العلاج في المرضى الذين يعانون من اضطرابات نفسية . الدليل الطبي قسم أعراض المرض إلى فئتين كبيرتين : الأعراض الإيجابية (positive symptoms) والأعراض السلبية (negative symptoms). الأعراض الإيجابية هي الانحرافات السلوكية التي تشمل الهلوسة والأوهام ، وضعف الإدراك وضعف التفكير الاستدلالي ، والتفكير الغير منطقي ، والسلوك الغريب .أما الأعراض السلبية فهي العجز السلوكي التي قد يشمل نقص الطاقة والمبادرة، بالإضافة إلى ضعف التركيز و الانتباه، والانسحاب الاجتماعي ، ونقص التجاوب العاطفي ، ونقص المهارات الاجتماعية و ضعف المعيشة اليومية (الجمعية الأمريكية للطب النفسي ، 1994). هدا البحث سوف يتضمن اجراء مقارنة بين أحدث الأدوية المهدئة ريسبيريدون (Risperidone) مع أحد الأدوية التقليدية المهدئة هالوبيريدول (Haloperidol)، والمقارنة بينهما من حيث التأثير على وظائف الكلى ووظائف الكبد ومن حيث وجود الأعراض السلبية والأعراض الإيجابية في المرضى الذين يعانون من الانفصام و الاضطراب الانفصامي العاطفي بعد ثلاثة أسابيع وخمسة أسابيع من العلاج.

Keywords : Schizophrenia, Haloperidol, Risperidone, positive and negative symptoms.

Introduction

Schizophrenia is a severe mental disorder, it is characterized by fundamental disturbances in thinking, perception and emotions. More than 100 years of research have not been able to fully resolve the puzzle that schizophrenia represents (Bentall, 2004, Rsssler et al., 2005). The Diagnostic and Statistical Manual (DSM-IV) is considered the most authoritative resource for the characterization of mental health disorders (American Psychiatric Association, 1994,2000). The Manual divides the symptomology of the disease into two broad categories: positive symptoms and negative symptoms. Positive symptoms are behavioral abnormalities that include "hallucinations, delusions, impaired perception, impaired inferential thinking, illogical thought progression, bizarre behavior **(**Stahl, 2002)**.** The "negative symptoms" are behavioral deficits that may include a lack of energy, drive, initiative, and interest, in addition to poor concentration and attention, social withdrawal, emotional unresponsiveness, and impaired social and daily living skills **(**Winograd-Gurvich et al., 2006). The disease is further complicated by the unwillingness of those affected by the disease to report the symptoms of their illness. In addition to the costs of treatment and lack of productivity, the devastating consequences on an individual's family life, social relations, and productive cognitive capacities affect his or her future employment prospects **(**Andreasen and Schultz**,** 1996).

Material and methods

Site of the study:

All participants included in the study were Libyans from the whole country. Patients were chosen from private mental hospital (AL- Razi) in Tripoli.

Materials:

1- New 50 cases of schizophrenia Libyan patients

2- Needle and Syringe (sterilized).

3- Disinfectant (alcohol) to clean up the place drawing blood, cotton and medical bandages.

4- Tourniquet.

5 - Diaper to save the blood samples of temperatures.

6 - Centrifuges to separate blood samples.

7- ARCHITECT c4000. 8- Spinreact spinlab -180.

9- Test tube carrier. 10- Biochemistry tube.

11- Questionnaire format. 12- S.P.S.S V.20.

13- Drugs (haloperidol and risperidone).

Method:

50 new cases of patients with positive disorder of schizophrenia were diagnosed by a specialist of Psychiatry Hospital, AL- Razi Psychiatric and Neurological unit Tripoli, Libya and taken for therapy. Patients were divided on the basis of the presence of positive and negative symptoms of schizophrenia. The positive symptoms were dominant in the hospital. And includes 46 cases and cases of negative symptoms were four. All cases were divided into two groups, i.e. 25 cases treated with Haldol and another 25 cases treated by risperidone. Samples blood was taken after 3 weeks of treatment is for the first time under the supervision of a Psychiatrist, hailed all the cases that are diagnosed were conducted for analysis of liver and renal functions as part of routine before taking it therapy medical laboratory of private hospital AL-Razi psychiatric and neurological unit. Blood samples were withdrawn again after 5 weeks of treatment taken.

Blood samples (5 ml each) were collected in separate test tubes from each patient by qualified Nurse in Medical Laboratory of AL-Razi Hospital for Psychiatric and Neurological disease. Each test tube and patient questionnaire

were marked with special number for each patient sample. All samples were centrifuged for 6 minutes at 4000 rpm . The upper layer (serum) from each sample was separated and kept in a test tube and each test tube was labeled with a special number as marked on patient questionnaire. The samples were kept in snow Portfolio in order to maintain the normal effectiveness of enzymes such as (GOT, GPT, ALK. Phosphatase) and kidney functions. Samples were taken out from snow portfolio and kept for 15 -30 minutes at room temperature (30 ºC) for conducting further enzymes and kidney function tests as follows:

1-GOT, GPT, bilirubin, creatinine, urea, Na, K and Cl by ARCHITECT c4000.

2- ALK. Phosphatase conducted by spinreact spinlab -180.

Statistical methods:

Statistical results were done by the Statistical Package for Social Sciences (SPSS), version 20, Echo soft Corp USA, 2011.

Analytical statistics (Student's-t-test):

Differences between the mean of groups were assessed by Student's t-test adopted for either equal or unequal variances.

$$t = \frac{M_1 - M_2}{\sqrt{\frac{(SD_1)^2 - (SD_2)^2}{N_1 + N_2}}}$$

M_1 = mean of first group. M_2 = mean of second group.
SD_1 = SD of first group. SD_2 = SD of second group.
N_1 = number of cases of first group. N_2 = number of cases of second group.
N.B.: P. Value (probability) means level of significance
- P> 0.05 not significant. - P< 0.05 significant.

Results

Table (1) *comparative Data Analysis by means of liver enzyme and kidney function test by dosage of Risperidone & Haloperidol treatment.*

Dosage	Type of test	Haloperidol		Risperidone	
		Means		Means	
		3 week	5 week	3 week	5 week
2 mg	GOT	16.50	18.50	15.22	13.89
	GPT	19.00	25.88	16.44	15.89
	Alk. Phosphatase	186.00	195.00	163.33	158.67
	Bilirubin	0.49	0.58	0.50	0.57
	Blood urea	25.05	20.70	20.11	18.20
	Creatinine	0.49	0.58	0.52	0.57
	Na	135.50	139.00	137.33	137.67
	K	4.14	4.00	3.83	3.84
	Cl	102.13	101.63	101.67	101.89
4 mg	GOT	31.08	29.77	32.87	34.87
	GPT	39.69	42.46	41.53	49.33
	Alk. Phosphatase	225.92	221.31	252.40	240.80
	Bilirubin	0.70	0.75	0.76	0.81
	Blood urea	21.73	22.91	21.65	20.23
	Creatinine	0.49	0.55	0.64	0.65
	Na	137.85	138.54	135.47	138.13
	K	3.88	4.06	4.07	3.76
	Cl	101.38	101.92	102.27	101.27
5 mg	GOT	124.50	75.00	89.00	76.00
	GPT	145.50	106.50	126.0	84.0
	Alk. Phosphatase	456.0	338.0	364.0	324.0
	Bilirubin	2.57	1.71	1.65	1.00
	Blood urea	35.50	33.60	15.30	17.40

	Creatinine	0.89	0.86	0.36	0.72
	Na	131.00	136.50	137.00	134.00
	K	4.65	4.20	3.80	4.60
	Cl	102.00	101.00	106.00	103.00
10 mg	GOT	78.00	50.00	------	-------
	GPT	99.50	63.50	------	-------
	Alk. Phosphatase	334.00	185.00	------	-------
	Bilirubin	1.57	0.78	------	-------
	Blood urea	30.35	26.55	------	-------
	Creatinine	0.73	0.58	------	-------
	Na	137.00	140.00	------	-------
	K	4.15	3.60	------	-------
	Cl	103.50	101.50	------	-------

It appears from the table 1 above comparative data of haloperidol and risperidone treatments (dosage 2 mg and 4 mg) that means test values of GOT enzyme, GPT enzyme, ALK. Phosphatase enzyme & bilirubin levels at 3 weeks of haloperidol treatments are slightly higher (GOT, GPT & alk. phosphatase) or almost equal (bilirubin) to risperidone treatments at a dosage of 2mg but lower at a dosage of 4mg, however, blood urea, creatinine, Na, K and Cl levels are insignificantly alter between haloperidol and risperidone drugs treatments after 3 weeks. GOT, GPT, alk. phosphatase enzyme levels are higher or equal (bilirubin) to dosage 2mg after 5 weeks in case of haloperidol treated patients than risperidone treated patients, but blood urea, creatinine, Na, K and Cl levels insignificantly alter between haloperidol and risperidone treated patients after 5 weeks. However, at dosage 4 mg treated patients with haloperidol GOT enzyme, GPT enzyme, alk. phosphatase enzyme & bilirubin levels after 5 weeks of haloperidol treatments are slightly lower than risperidone treated patients, but blood urea, creatinine, Na, K and Cl levels are insignificantly alter between haloperidol and risperidone drugs treatments after 5 weeks. At dosage 5mg treated patients, the means test levels of GOT enzyme ,GPT enzyme , alk.phosphatase enzyme , bilirubin , blood urea, creatinine, K and Cl levels are significantly higher

in haloperidol treated patients than risperidone treated patients after 3 weeks, however, the levels of the said liver and kidney functions variables are comparatively decreased in both drugs treated groups after 5 weeks of treatments but the levels of both liver and kidney functions variables are higher in haloperidol treated patients than risperidone treated patients. Comparative data of means test values of GOT enzyme ,GPT enzyme ,alk.phosphatase enzyme & bilirubin shows the significantly decreased levels after 5 weeks in haloperidol (dosage10mg) treated patients than 3weeks treated patients.

Table (2) *illustrates cases negative symptoms of schizophrenia Profile, which improved with medication after 3 weeks.*

Dosage (after 3 weeks)			Negative symptoms of schizophrenia		Total
			Improved	unimproved	
4mg	type of drugs	Risperidal	1	----	1
	Total		1	----	1
2mg	type of drugs	Haldol	----	2	2
		Risperidal	----	1	1
	Total		----	3	3
Total	type of drugs	Haldol	0	2	2
		Risperidal	1	1	2
	Total		1	3	4

Chi-square (x^2) table

Df	Chi-Square (X^2)	P. Value
1	1.333	0.248

From the data analysis in table 2 it appears that the P. Value = 0.248 (24.8%) exhibits largest level of significance of 5%, and therefore we accept that there is

independence of effect between drugs, risperidal treatment has improved negative symptoms better than haloperidol treatment.

Table (3) *illustrates cases negative symptoms of schizophrenia*

Profile, which improved with medication after 5 weeks.

Dosage (after 5 weeks)			Negative symptoms of schizophrenia		Total
			improved	unimproved	
4mg	type of drugs	Risperidal	1	----	1
	Total		1	----	1
2mg	type of drugs	Haldol	1	1	2
		Risperidal	1	0	1
	Total		2	1	3
Total	type of drugs	Haldol	1	1	2
		Risperidal	2	0	2
	Total		3	1	4

Chi-square (x^2) table

Df	Chi-Square (X^2)	P. Value
1	**1.333**	**0.248**

From the data analysis in table 3 it appears that the P. Value = 0.248 (24.8%) exhibits largest level of significance of 5%, and therefore we accept that there is independence of effect between drugs, risperidal treatment has improved negative symptoms better than haloperidol treatment.

Table (4) *illustrates cases positive symptoms of schizophrenia Profile, which improved with medication after 3.*

Dosage			Positive symptoms of schizophrenia		Total
			improved	Unimproved	
4mg	type of drugs	Haldol	4	9	13
		Risperidal	4	10	14
	Total		8	19	27
5mg	type of drugs	Haldol	----	2	2
		Risperidal	----	1	1
	Total		----	3	3
2mg	type of drugs	Haldol	1	5	6
		Risperidal	2	6	8
	Total		3	11	14
10mg	type of drugs	Haldol	----	2	2
	Total		----	2	2
Total	type of drugs	Haldol	5	18	23
		Risperidal	6	17	23
	Total		11	35	46

Chi-square (x^2) table

Df	Chi-Square (X^2)	P. value
1	**0.119**	**0.730**

From the data analysis in table 4 it appears that the P. value = 0.730 (73.0%) exhibits largest level of significance of 5%, and therefore we accept that there is independence of effect between drugs , and both drugs have improved positive symptoms .

Table (5) *illustrates cases positive symptoms of schizophrenia Profile, which improved with medication after 5 weeks.*

Dosage			positive symptoms of schizophrenia		Total
			improved	unimproved	
4mg	type of drugs	Haldol	4	9	13
		Risperidal	5	9	14
	Total		9	18	27
5mg	type of drugs	Haldol	----	2	2
		Risperidal	----	1	1
	Total		----	3	3
2mg	type of drugs	Haldol	2	4	6
		Risperidal	4	4	8
	Total		6	8	14
10mg	type of drugs	Haldol	----	2	2
	Total		----	2	2
Total	type of drugs	Haldol	6	17	23
		Risperidal	9	14	23
	Total		15	31	46

Chi-square (x^2) table

Df	Chi-Square (X^2)	P. value
1	**0.890**	**0.345**

From the table 5 data analysis it appears that the P. value = 0.345 (34.5%) exhibits largest level of significance of 5%, and therefore we accept that there is independence of effect between drugs , and both drugs have improved positive symptoms.

Discussion:

The causes of schizophrenia are still unknown and treatments mainly focus on eliminating the symptoms of the disease. Treatments include antipsychotic medications and various psychosocial treatments. Antipsychotic medications have been available since the mid-1950's. The older types are called conventional, or "typical" antipsychotics. Some of the more commonly used typical medications include: Chlorpromazine (Thorazine), Haloperidol (Haldol) ,Perphenazine (Etrafon, Trilafon) ,Fluphenazine (Prolixin) etc. In the 1990's, new antipsychotic medications were developed. These new medications are called second generation, or "atypical" antipsychotics. One of these medications, clozapine (Clozaril) is an effective medication that treats psychotic symptoms, hallucinations, and breaks with reality, but clozapine can sometimes cause a serious problem called agranulocytosis, which is a loss of the white blood cells that help a person fight infection. This problem and the cost of blood tests make treatment expensive with clozapine difficult for many people. Other atypical antipsychotics were also developed that not cause agranulocytosis include: Risperidone (Risperdal), Olanzapine (Zyprexa), Quetiapine (Seroquel), Ziprasidone (Geodon), Aripiprazole (Abilify), Paliperidone (Invega) etc. Some people have side effects when they start taking these medications. Most side effects go away after a few days and often can be managed successfully. People who are taking antipsychotics should not drive until they adjust to their new medication. Side effects of many antipsychotics include: drowsiness, dizziness when changing positions, blurred vision, rapid heart beat ,sensitivity to the sun ,skin rashes, menstrual problems for women. Atypical antipsychotic medications can cause major weight gain and changes in a person's metabolism. This may increase a person's risk of getting diabetes and high cholesterol (Lieberman et al, 2005). A person's weight, glucose levels, and lipid levels should be monitored regularly by a doctor while taking an atypical antipsychotic medication. Typical antipsychotic medications can cause side effects related to physical movement, such as: rigidity, persistent muscle spasms, tremors, restlessness. In the present investigation, the comparison of the effects of

treatments of currently used atypical antipsychotic drug, risperidone with a conventional antipsychotic typical drug haloperidol on the liver enzymes and kidney function tests revealed that mean test values of enzymes and bilirubin at three weeks have higher than 5 week treatment in case of Haldol treated patients than Risperidal treated patients. It is also apparent from the mean test values of Na, K, Cl, blood urea and creatinine in Haldol and Risperidal drugs treated patients that there occurs no significant alteration on these kidney function test values after three and five weeks of treatments. Previous authors concluded that haloperidol induces a cholestatic form of injury8, 9 or primary liver damage and injury, to liver cells caused by cholostasis (Thomas, 1995; Dolle and Martini, 1984).

The comparative data of haloperidol and risperidone treatments (2mg, 4mg, 5mg and 10 mg per day) in schizophrenic patients revealed that compared to haloperidol, resperidone is most effective and efficacious for the treatment of " negative" and "positive" schizophrenic symptoms in patients taking dose of 4mg/ day after five weeks of treatment than three weeks and had no significant harmful effect on liver and kidney functions. We therefore hypothesized that treatment with risperidone would be superior to haloperidol in reducing the risk of relapse among outpatients with schizophrenia or schizoaffective disorder. These findings are consistent with earlier findings (Glick et al, 2001).

Conclusion

Schizophrenia is a chronic illness with a lifetime prevalence of significant numbers in Libya and with a serious physical, social and economic consequences. The economic burden of schizophrenia in society was estimated significantly much of cost due to the consequences of psychotic relapse. The course of schizophrenia varies, but most potent have a chronic cause with frequent relapse, typically characterized by exacerbation of psychosis and rehabilitation. Successive relapses can reduce the degree and next recession. To prevent relapse maintenance

treatment with an antipsychotic drug is obligatory for most patients who have schizophrenia or schizoaffective disorders. Nevertheless, long term outcomes have generally been disappointing. The currently available antipsychotic agents are not useful in all psychotic patients and many a times they cause serious neurological side effects. Some patients responding to them are left with serious neurological side effects. Some patients responding to them are left with serious disabilities. Such limitations have made psychiatrists to look for agents with better or at least or similar efficacy and with lesser side effects causing potential.

Comparative results of the effects on negative schizophrenic symptoms after giving the treatments of Haldol and Risperidal (doses- 2mg &4mg) to schizophrenic patients for three weeks and five weeks revealed that one patient treated with risperidol (dose -4mg) showed significantly absence of negative symptoms after three weeks of treatment , however, total three patients including one with Haldol(dose-2mg) and two with Risperidol (dose-2mg , 4mg) treatments showed significant improved negative symptoms in patients after five weeks .

Comparative results of the effects on positive schizophrenic symptoms after giving the treatments of Haldol and Risperidal (doses- 2 mg ,4mg,5 mg,10 mg) to schizophrenic patients for three weeks and five weeks revealed that total eleven patients including- six patients (4 cases with 4 mg dose & 2 cases with 2 mg dose) treated with Risperidol and five patients (4 cases with 4 mg dose & 1 case with 2 mg dose) showed significantly absence of positive symptoms after three weeks of treatments , however, total fifteen patients including six with Haldol (4 cases with 4 mg dose & 2 cases with 2 mg dose) and nine with Risperidol (5 cases with 4 mg dose & 4 cases with 2 mg dose) treatments showed significant improved positive symptoms in patients after five weeks.

Comparative data on the effects of Haldol and Risperidone treatments on the liver enzymes and kidney function tests revealed that in most of the findings mean test values of GOT enzyme, GPT enzyme, alkaline phosphatase enzyme and bilirubin at three weeks are higher than 5 week treatment in case of Haldol treated patients than Risperidone treated patients. It is also revealed from the mean test values of

Na, K, Cl, blood urea and creatinine in Haldol and Risperidone (2 mg, 4mg ,10 mg & 5mg of Risperidone) drugs treated patients that there is no significant alteration of these kidney function test values after three and five weeks of treatments. But, Haldol (5 mg) have changed in the mean test values (blood urea and creatinine) in three weeks and five weeks, but this change in the normal limit. It is apparent from the comparative data of haloperidol and risperidone treatments in schizophrenic patients that compared to haloperidol, risperidone had superior improvement of negative and positive symptoms of patients, no harmful effect on liver and kidney functions and greater efficacy and faster recovery from schizophrenic symptoms in patients. On the basis of our findings of the present study, we concluded that treatment with risperidone is superior to haloperidol in reducing the risk of relapse among outpatients with schizophrenic disorders.

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