Department of Information Technology

LAB MANUAL

Semester-VIII

Storage Network Management and Retrieval

Institute Vision, Mission & Quality Policy

Vision

To foster and permeate higher and quality education with value added engineering, technology programs, providing all facilities in terms of technology and platforms for all round development with societal awareness and nurture the youth with international competencies and exemplary level of employability even under highly competitive environment so that they are innovative adaptable and capable of handling problems faced by our country and world at large.

Mission

The Institution is committed to mobilize the resources and equip itself with men and materials of excellence thereby ensuring that the Institution becomes pivotal center of service to Industry, academia, and society with the latest technology. RAIT engages different platforms such as technology enhancing Student Technical Societies, Cultural platforms, Sports excellence centers, Entrepreneurial Development Center and Societal Interaction Cell. To develop the college to become an autonomous Institution & deemed university at the earliest with facilities for advanced research and development programs on par with international standards. To invite international and reputed national Institutions and Universities to collaborate with our institution on the issues of common interest of teaching and learning sophistication.

Quality Policy

ज्ञानधीनं जगत् सर्वम।

Knowledge is supreme.

Our Quality Policy

It is our earnest endeavour to produce high quality engineering professionals who are innovative and inspiring, thought and action leaders, competent to solve problems faced by society, nation and world at large by striving towards very high standards in learning, teaching and training methodologies.

Our Motto: If it is not of quality, it is NOT RAIT!

Dr. Vijay D. Patil
President, RAES

Department Vision & Mission

Vision

- The mission of the IT department is to prepare students for overall development including employability, entrepreneurship and the ability to apply the technology to real life problems by educating them in the fundamental concepts, technical skills/programming skills, depth of knowledge and development of understanding in the field of Information Technology.
- To develop entrepreneurs, leaders and researchers with exemplary level of employability even under highly competitive environments with high ethical, social and moral values.

Mission

- To pervade higher and quality education with value added engineering, technology programs to deliver the IT graduates with knowledge, skills, tools and competencies necessary to understand and apply the technical knowledge and to become competent to practice engineering professionally and ethically in tomorrow's global environment.
- To contribute to the overall development by imparting moral, social and ethical values.

Index

Sr. No.	Contents	Page No.
1.	List of Experiments	4
2.	Experiment Plan and Course Outcomes	5
3.	Study and Evaluation Scheme	6
4.	Experiment No. 1	7
5.	Experiment No. 2	17
6.	Experiment No. 3	26
7.	Experiment No. 4	37
8.	Experiment No. 5	44
9.	Experiment No. 6	57
10.	Experiment No. 7	67
11.	Experiment No. 8	78
12.	Experiment No. 9	89
13.	Experiment No. 10	102

List of Experiments

Sr. No.	Experiments Name
1	To create software RAID array in windows 7
2	To create mirrored image of a storage disk using Windows 7/ windows 8
3	To study and plan implementation of ILM for healthcare information system
4	To install the simulation software for storage area network (SimSAN)
5	To connect and launch SimSAN agent, Engine and the console
6	To study SAN administration tasks for day-to-day routing in SimSAN tool
7	To study SAN node configurations, analyzer and traces in SimSAN tool
8	To study Online engine configuration in SimSAN tool
9	To create virtual hard disk (VHD) drive in windows
10	To study text processing tool AntConc

Experiment Plan & Course Outcome

Course Outcomes:

CO1	Student will be able to understand the need for storage centric architecture and basics of storage network.
CO2	Students will be able to evaluate storage architectures, including storage subsystems, SAN, NAS and IP-SAN.
CO3	Students will be able to understand storage virtualization and examine the requirement of business continuity and backup and recovery.
CO4	Define information retrieval in storage network and identify different storage virtualization technologies.

Module No.	Week No.	Experiments Name	Course Outcome
1	W1	To create software RAID array in windows 7	CO1
2	W2	To create mirrored image of a storage disk using Windows 7/ windows 8	CO1
3	W3	To study and plan implementation of ILM for healthcare information system	CO2
4	W4	To install the simulation software for storage area network (SimSAN)	CO2
5	W5	To connect and launch SimSAN agent, Engine and the console	CO3
6	W6	To study SAN administration tasks for day-to-day routing in SimSAN tool	CO3
7	W7	To study SAN node configurations, analyzer and traces in SimSAN tool	CO4
8	W8	To study Online engine configuration in SimSAN tool	CO4
9	W9	To create virtual hard disk (VHD) drive in windows	CO6
10	W10	To study text processing tool AntConc	CO3,CO4

Study and Evaluation Scheme

Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
BEITC801	Storage Network Management and Retrieval	04	02	--	**04**	**01**	**-**	**05**

Course Code	Course Name	Examination Scheme		
		Term Work	Oral	Total
BEITC801	Storage Network Management and Retrieval	25	25	50

Term Work:

1. Term work assessment must be based on the overall performance of the student with every experiment graded from time to time. The grades should be converted into marks as per the Credit and Grading System manual and should be added and averaged.
2. The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.

Practical & Oral:

1. Oral exam will be based on the entire syllabus of Communication Engineering Laboratory-616A Storage Network Management and Retrieval lab

Storage Network Management and Retrieval

Experiment No. : 1

To create Software RAID array in Windows 7

Experiment No. 1

1. **Aim:** To create software RAID array in windows 7

2. **What will you learn by performing this experiment?**

   Configuration of various RAID levels in Windows 7.

3. **Hardware / Software Requirement:**

Minimum 2 external hard drives of 80 GB each. Windows 7, 1 GB RAM, Min 80GB Hard Disk.

4. **Theory:**

Redundant Array of Independent Disk (RAID) is based on three mechanisms:

- Striping
- Mirroring
- Parity

There are two types of RAID implementation namely:

- Hardware RAID and
- Software RAID

The different RAID Levels are

Levels	**Brief Description**
RAID 0	Striped array with no fault tolerance
RAID 1	Disk mirroring
RAID 2	Bit-level striping with dedicated Hamming-code parity
RAID 3	Parallel access array with dedicated parity disk
RAID 4	Striped array with independent disks and a dedicated parity disk
RAID 5	Striped array with independent disks and distributed parity
RAID 6	Striped array with independent disks with dual distributed parity
Nested	Combinations of RAID levels: RAID 0+1 and RAID 1 + 0

Using Hardware RAID one can implement all the RAID levels. Whereas in Software RAID all RAID levels cannot be implemented.

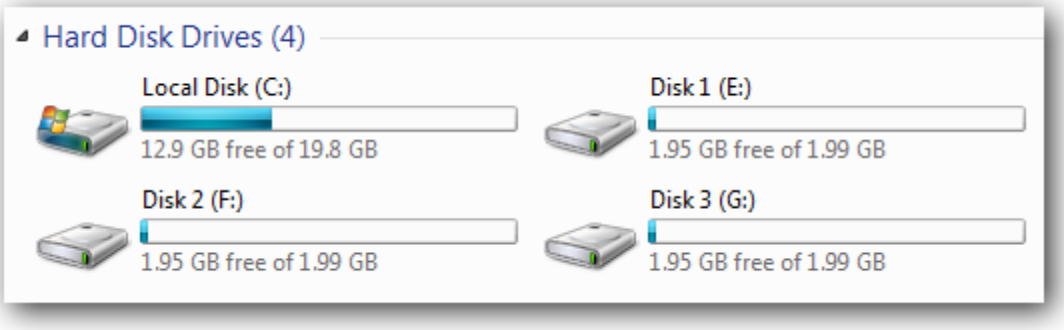
5. Procedure

Windows 7 has built in functionality to set up a software RAID (Redundant Array of Inexpensive Disks). The existing spare hard drives can be pooled to create a large storage or even redundant backups.

Here we set up a spanned disk that takes three 2 GB disks and creates one 6 GB disk using Windows 7.

Step 1: Set up the disks

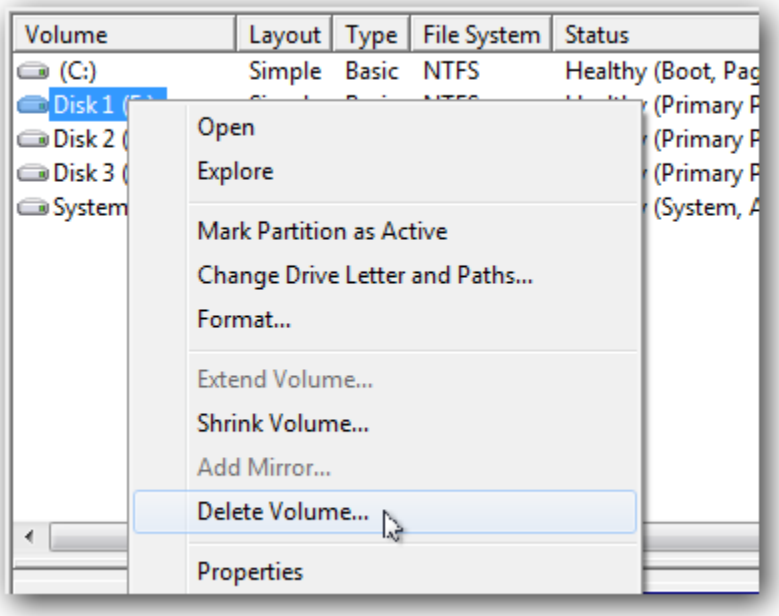
1. First take a backup of the disks to be used in RAID configuration.



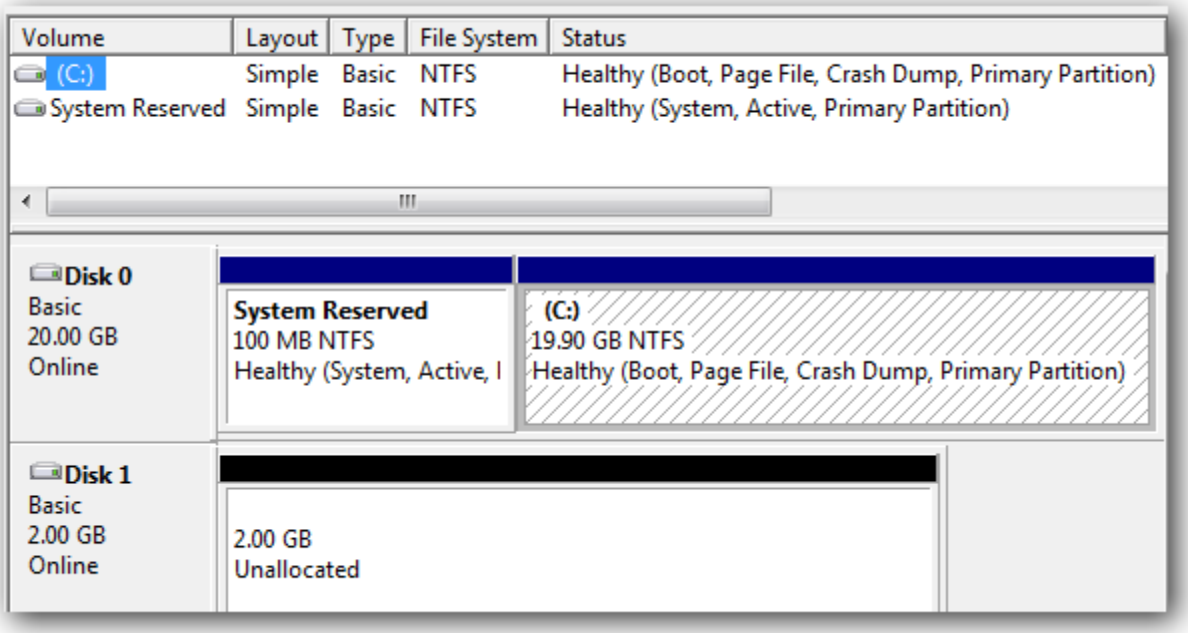
2. Right click on My computer and open manage

Right click the disk management on the left side. The disks to be included in RAID need to be deleted from top area of disk management.

So that the disks which are not to be included in the RAID are left in the top area of disk management.



The deleted disk will be present in the lower pane of disk management and these will be unallocated and these disks will be included in RAID storage.



Step 2: Create RAID

Instead of traditional 0,1,5,10 RAID levels, windows uses spanned, striped and mirrored as the options for creating software RAIDs.

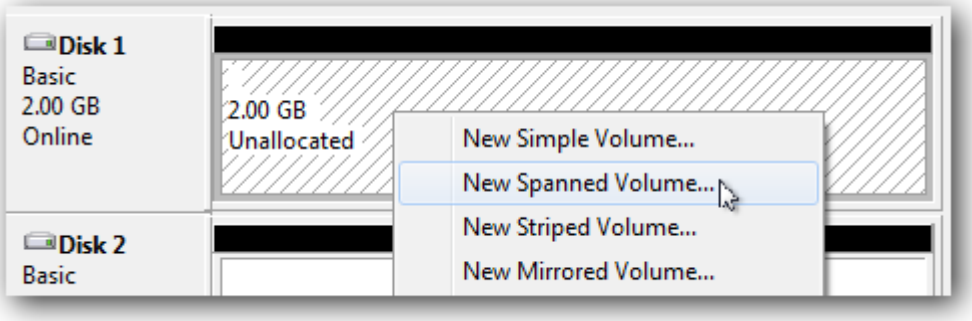
Spanned Volume: Creates a single partition that will literally span all the included disks.

Striped volume: Stores the files on multiple disks by breaking it up, to improve the read and write performance.

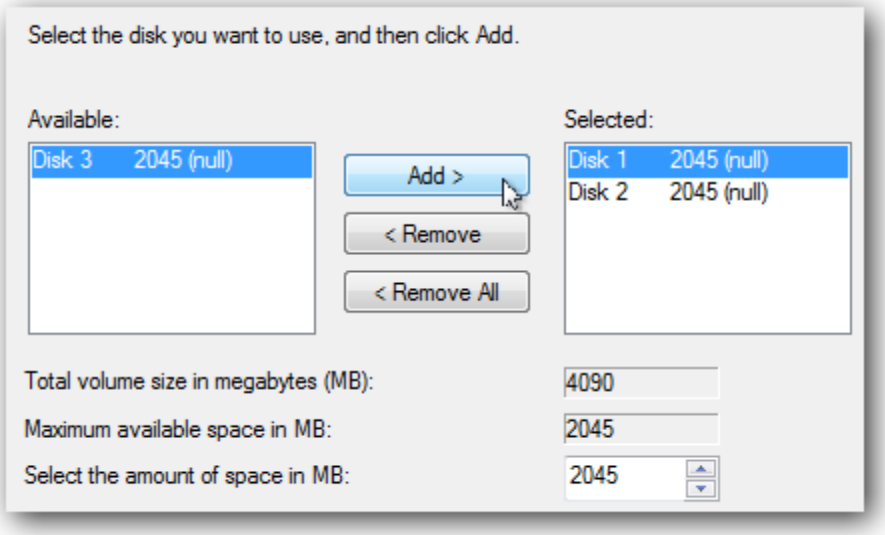
Mirrored volume: Creates a mirror volume to store the mirror copy of data.

Given below are the steps to create a spanned volume.

1. Right-click on "Unallocated space." Select New Spanned Volume.

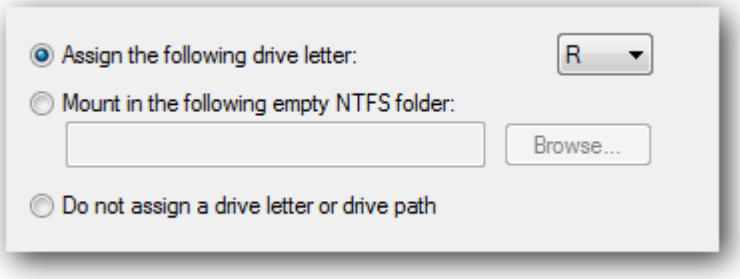


2. The New Spanned Volume wizard appears. Click Next.
3. The Select Disks screen will appear. Select the disk you want to add to the spanned volume. Click Add.

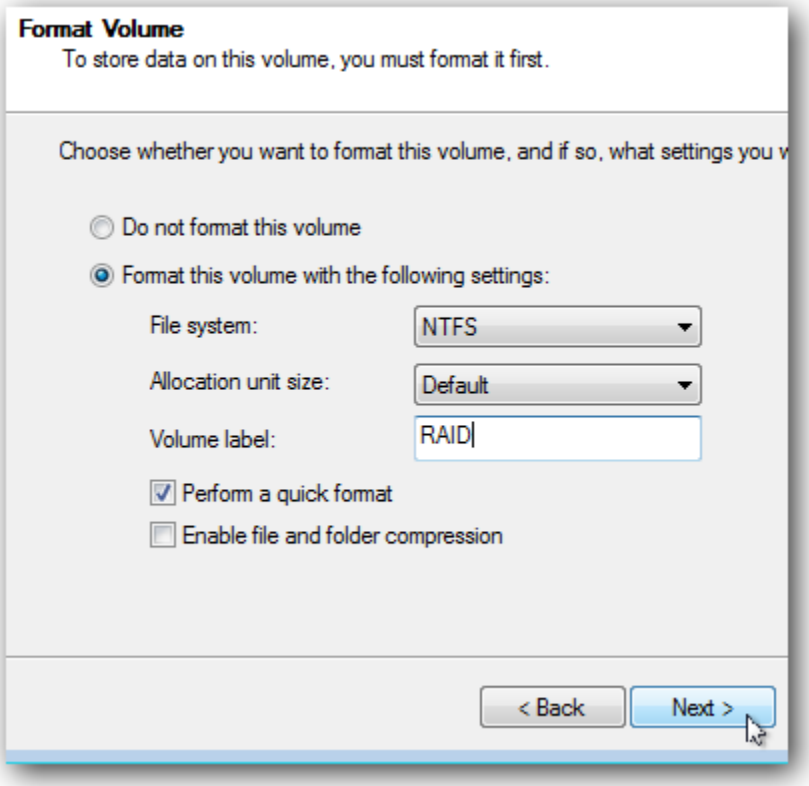


4. Once the disk is added, you can specify how much disk space from the disk you want to add to the spanned volume. Click Next.

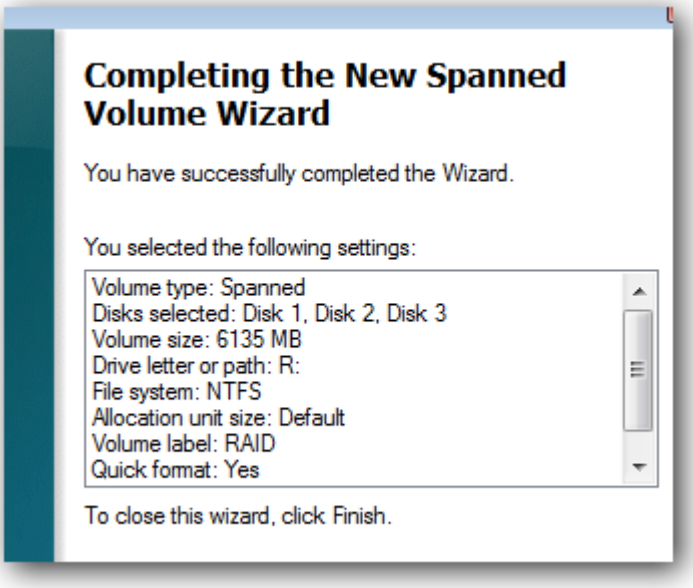
5. On the Assign Drive Letter or Path screen, choose the desired drive letter for the new volume. Click Next.



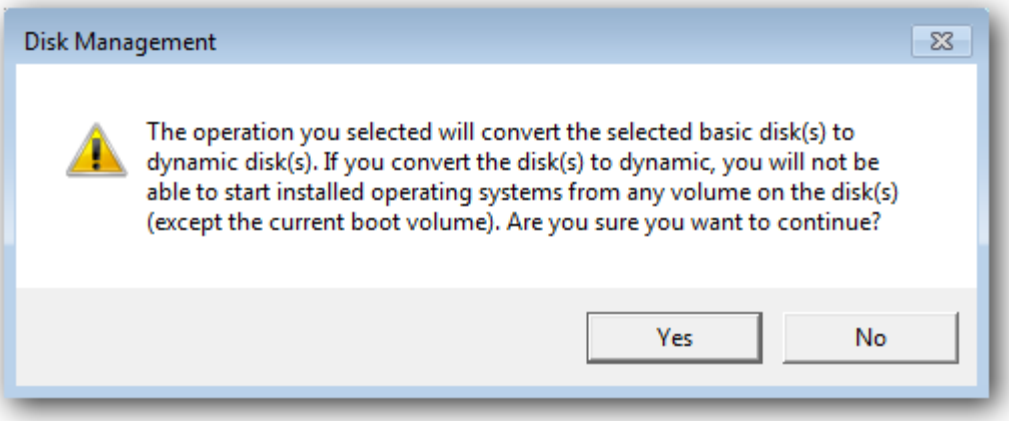
6. On the Format Partition screen, choose the option for "Format this volume using the following settings."
7. Choose the NTFS file system. Enter a volume label. Select the option for Perform a Quick Format. Click Next.



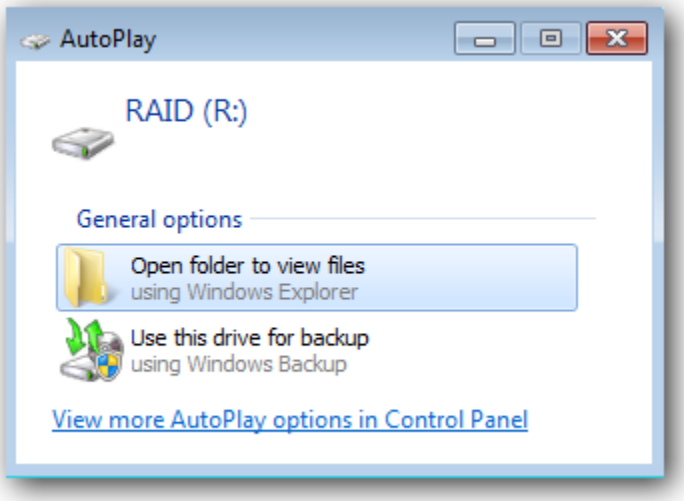
8. The final step reviews all the settings before the disk is formatted and mounted as a new volume.



A warning is highlighted that the volumes used in RAID will get converted to dynamic volume instead of a logical volume. Also if an operating system is present in any of the volume used in RAID then it will not be accessible any more.



Finally the disk will be formatted and the drive is mounted.



Browsing through the windows explorer a new volume with combined storage space of three individual disks is created and is visible.

In similar lines the striped and mirrored volume is created.

Steps to create striped volume:

Striped volumes and spanned volumes are similar, but have one big difference: Both types of volumes can stretch across multiple disks. Striped volumes use the same amount of disk space on all disks, whereas spanned volumes can use a different amount of space on each disk. To create a new striped volume, follow these steps:

1. Open the Disk Management MMC snap-in.
2. Right-click "Unallocated space." Select New Striped Volume.
3. The New Striped Volume wizard appears. Click Next.
4. The Select Disks screen appears. Select the disks you want to add to the spanned volume. Click Add.
5. Once the disks are added, you can specify how much disk space from the disk you want added to the striped volume. This will be the same for all disks.
6. Click Next.
7. On the Assign Drive Letter or Path screen, choose the desired drive letter for the new volume. Click Next.
8. On the Format Partition screen, choose the option for "Format this volume using the following settings."
9. Choose the NTFS file system. Enter a volume label. Select the option for Perform a Quick Format. Click Next.
10. On the Completing the new Striped Volume Wizard screen, click Finish. The new volume will be formatted and should show a status of Healthy on each of the disks to which it was added.

Steps to create Mirrored Volume:

In mirroring a copy of the data is maintained in two disks, so if one disk fails then the second disk provides the copy of the data. Thus mirroring provides fault tolerance and redundancy.

1. Open the Disk Management MMC snap-in.
2. Right-click on "Unallocated space." Select New Mirrored Volume.
3. The New Mirrored Volume wizard appears. Click Next.
4. The Select Disks screen appears. Select the disks you want to add to the mirrored volume. Click Add.
5. Once the disks are added, you can specify how much disk space from the disks you want to be mirrored. This will be the same for all disks.
6. Click Next.
7. On the Assign Drive Letter or Path screen, choose the desired drive letter for the new volume. Click Next.
8. On the Format Partition screen, choose the option for "Format this volume using the following settings."
9. Choose the NTFS file system. Enter a volume label. Select the option for Perform a Quick Format. Click Next.
10. On the Completing the new Mirrored Volume Wizard screen, click Finish. The new volume will be formatted and should show a status of Healthy on each of the disks to which the mirror was added.

Stripping leads to RAID 0 whereas Mirroring leads to RAID 1. Similarly RAID 5 can be implemented by changing BIOS setting.

6. Conclusion and Discussion:

RAID levels are easy to configure in windows 7. One can only configure software RAID. Not all RAID levels can be implemented.

7. QUIZ / Viva Questions:

- What are different RAID technologies?
- What is the difference between Software RAID and Hardware RAID?
- What are the different RAID levels that can be configured in Windows 7
- Why it is not possible to configure all the RAID levels in Software?

8. References:

1. ULF Troppen, Rainer Erkens and Wolfgang Muller , " Storage Networks Explained: Basic and Applications of Fibre Channel SAN, NAS and ISCSI and Infifniband " , Wiley
2. EMC Educational Services, "Information Storage and Management", wiley India
3. Vaishali Kahirnar, Nilima Dongre" Storage Network Management and Retrieval", Wiley
4. Robert Spalding, " Storage Networks: The Complete Reference", Tata McGraw Hill

Storage Network Management and Retrieval

Experiment No. : 2

To create mirrored image of a storage disk using Windows 7/ Windows 8

Experiment No. 2

1. **Aim:** To create a mirrored image of storage disk using Windows 7/ Windows 8

2. **What will you learn by performing this experiment?**

After conducting this experiment we come to know how we can create mirrored images of hard drives or any storage space.

3. **Hardware/Software Required:** 2GB RAM, 320 GB hard, dual core processor, Windows 7/ Windows 8 Operating System. Minimum two hard drives connected to the system each of same size

4. **Theory:**

"Storage Spaces" in Windows 8 can combine multiple hard drives into a single virtual drive. It can mirror data across multiple drives for redundancy or combine multiple physical drives into a single pool of storage. Storage pools larger than amount of physical storage can also be created. One can even create storage pools larger than the amount of physical storage space available. Storage Spaces is similar to RAID or LVM on Linux.

Windows 8 has four options to configure the storage pool as given below:

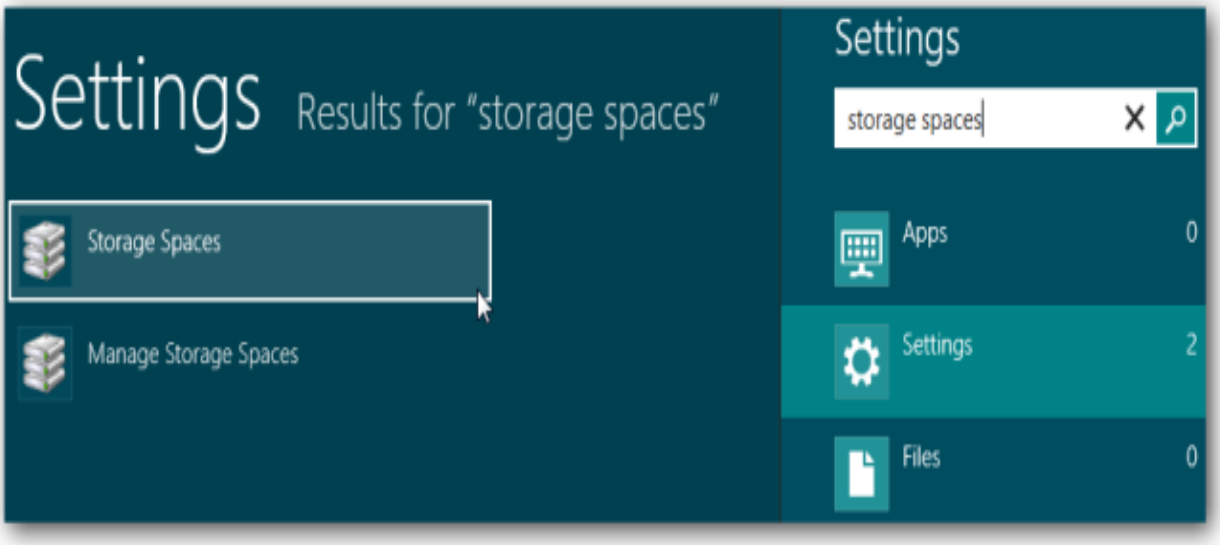
- None: (corresponds to RAID 0) Windows will store only a single copy of your data. You'll lose the data if one of your drives fails, but no space will be used on backups.
- Two-way mirror: (corresponds to RAID 1) Windows will store two copies of your data. If one of your drives fails, you won't lose your data. This requires at least two drives.
- Three-way mirror: Windows will store three copies of your data. If one or two of your drives fails, you won't lose your data. This requires at least three drives.
- Parity: (corresponds to RAID 5) Windows stores parity information with the data, protecting you from a single drive failure. Parity uses drive space more efficiently than mirroring, but file access times are slower. Parity is ideal for drives with large, infrequently updated files, such as video files.

Windows tells the maximum physical capacity of storage that can be pooled. But the user can select the storage capacity as per his/her requirement and can specify arbitrarily a large logical

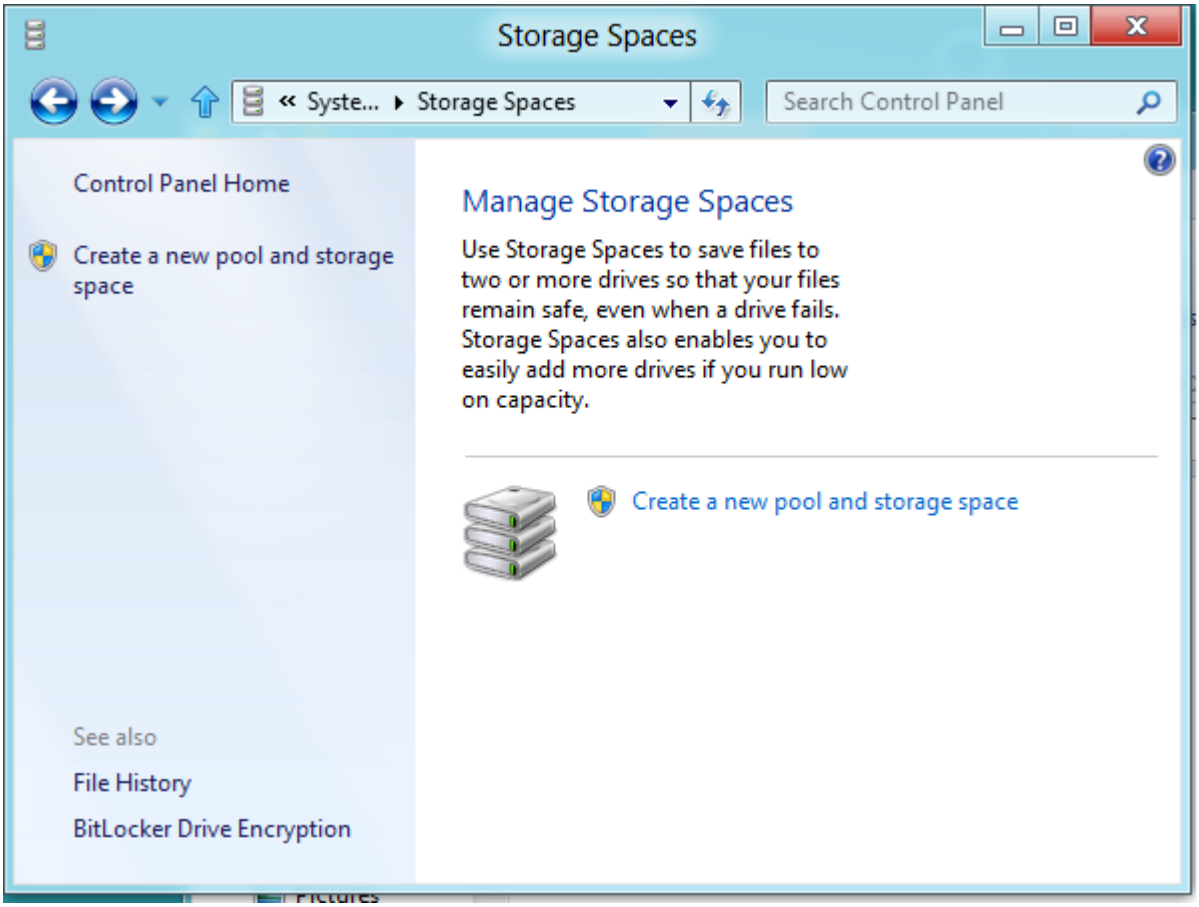
size. For example, one could pool two 20GB drives and select a combined size of 500GB. The storage space will appear to Windows and other programs as a drive that has 500GB of available storage. When the drive begins to fill up and nears the 40GB physical limit, Windows will display a notification in the Action Center, prompting you to add additional physical storage space.

Steps for create a mirrored image of a storage disk:

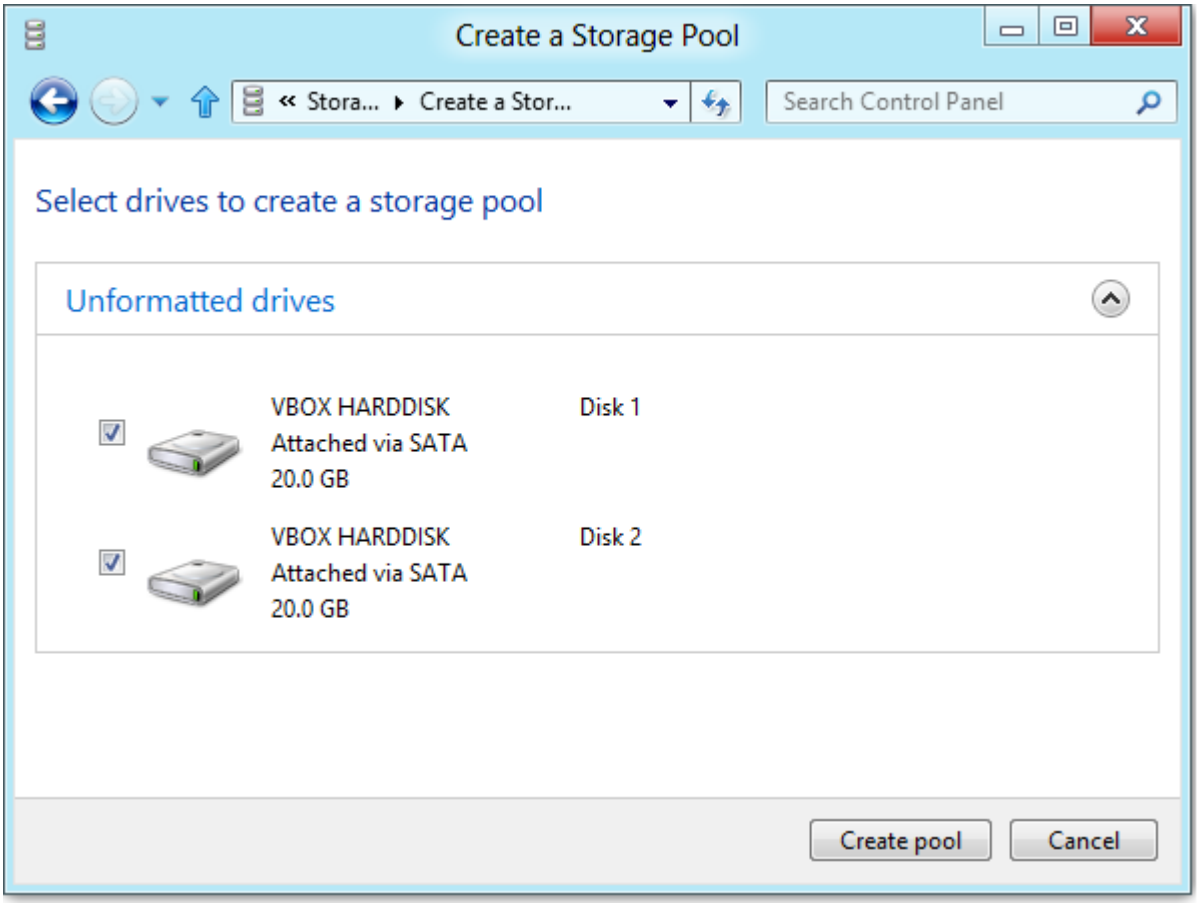
1. Make sure that the system has multiple hard disk drives. If not external hard drives can be attached
2. Open storage spaces configuration window from control panel or by bringing up the start screen with windows key, typing "storage Spaces", clicking setting category and selecting storage space.



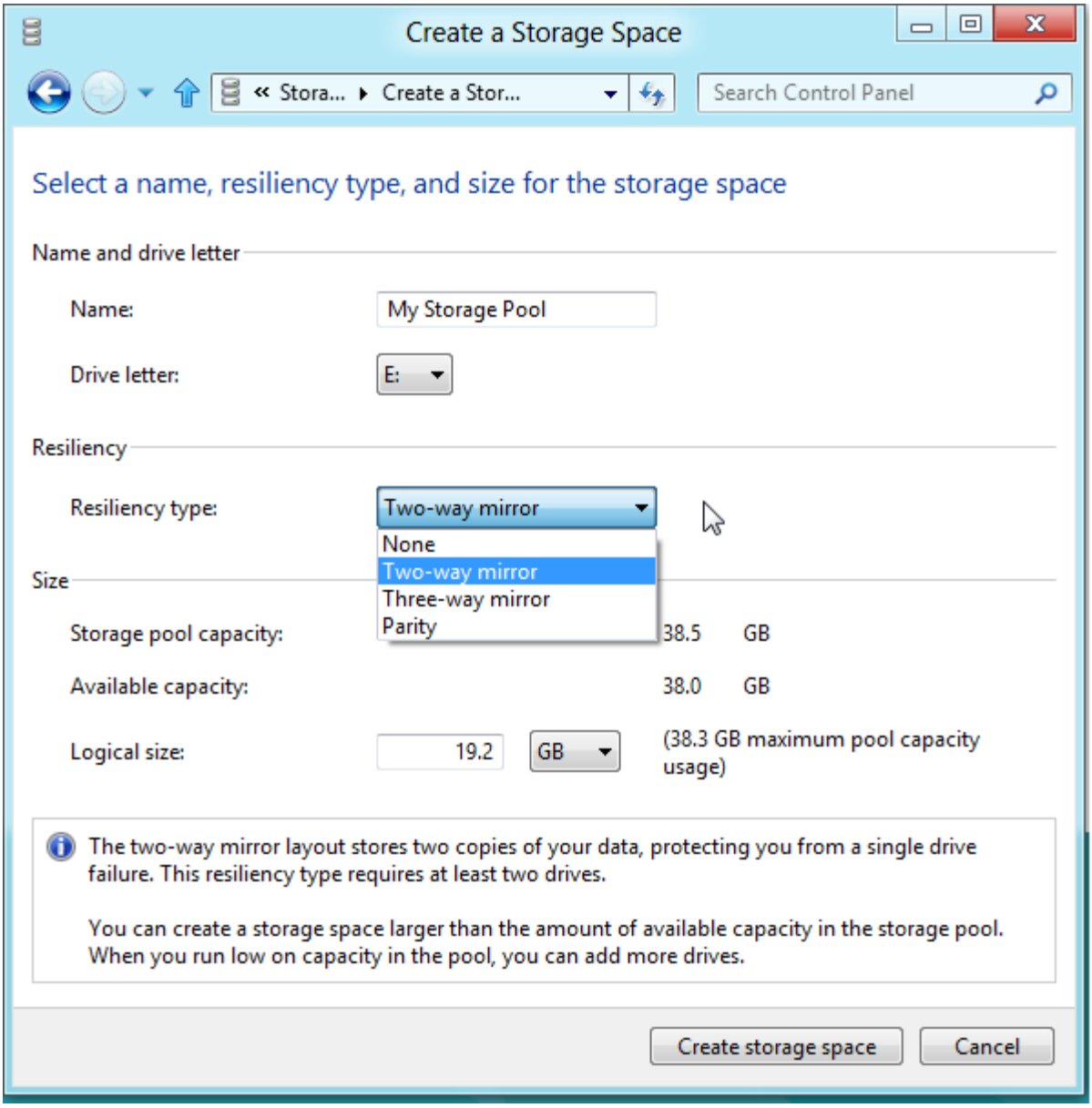
3. If the storage space is not yet configured or set, then an option to create a new pool and storage pool is visible. On clicking this option a wizard will open guiding through the steps to create the storage pool.



4. Select drives to be used for the storage space and click the “create pool” button to continue. On selecting the drives already data which is present on the drive is erased, hence one should first get the copy of a data saved for later use.

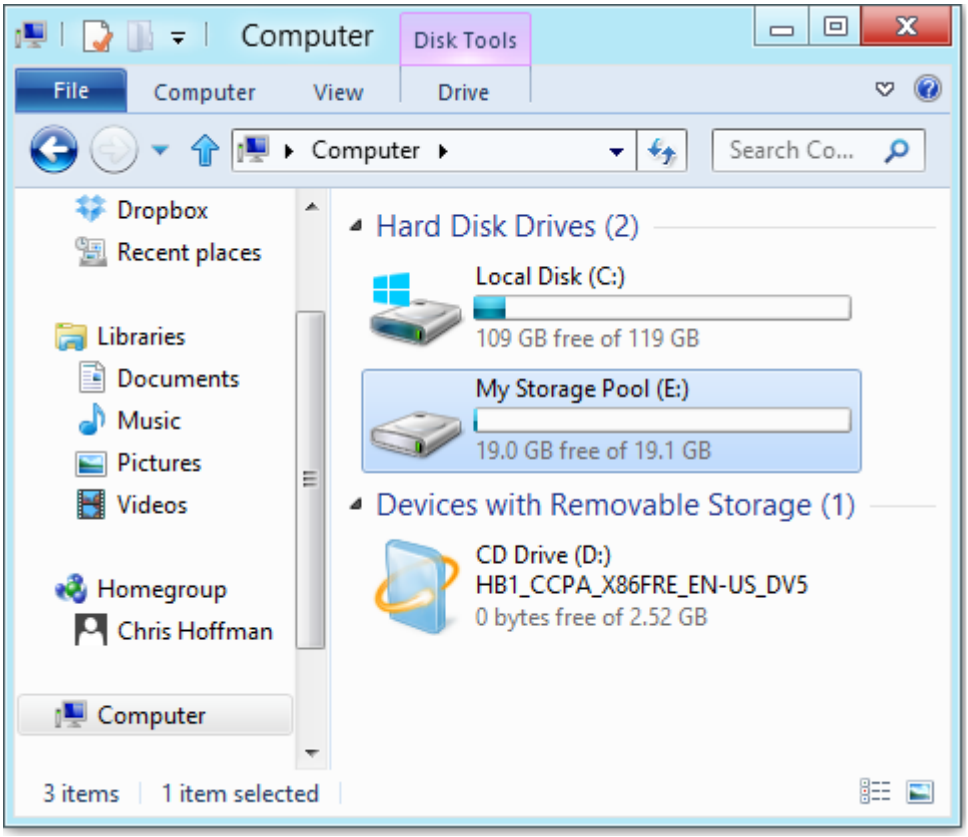


5. After selecting the drives to pool, one has to configure the new storage. The user has to specify, the name to the storage space, select the configuration type and specify the drive letter. Here we are configuring the storage pool as “Two-way mirror” which implements the concept of mirroring making it equivalent to RAID 1.

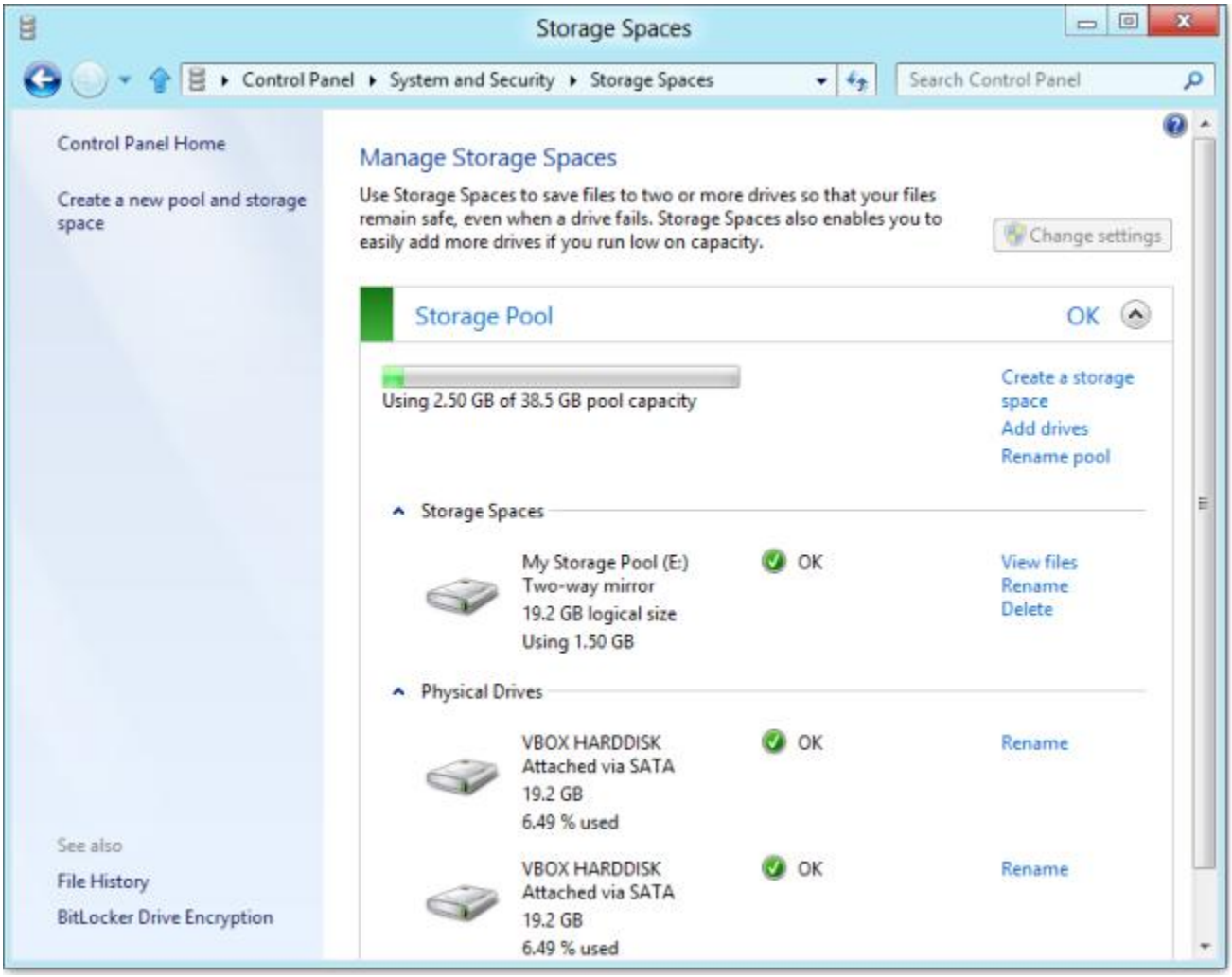


6. After you've entered your settings, click the "Create storage space" button and Windows will create and format the storage space.

7. **Using a Storage Space:** The new storage space will appear in Windows Explorer as a normal drive with a single drive letter. The storage space appears no different from a normal, physical drive to Windows and the programs you use. The user can use this storage pools as per his requirements.



8. **Managing Storage Spaces:** After creating a storage space, you can revisit the Storage Spaces control panel to view information about your storage spaces. From this window, you can view the available space in your storage pool, add additional drives, and create new storage spaces.



9. The additional storage space management tasks include creating and deleting storage space and storage pools, adding and removing hard drives, renaming hard drives and providing Bitlocker encryption to the drive.

7. Conclusion and Discussion:

We come to know Storage Spaces in windows 8 can be utilized . Mirroring helps to maintain a extra copy of the data on the system. This data on the mirrored copy is synchronized as it updates or modified

8. QUIZ / Viva Questions:

- What is a storage space in windows?
- What are the benefits of mirroring?

9. References:

1. ULF Troppen, Rainer Erkens and Wolfgang Muller , " Storage Networks Explained: Basic and Applications of Fibre Channel SAN, NAS and ISCSI and Infifniband " , Wiley
2. EMC Educational Services, "Information Storage and Management", wiley India
3. Vaishali Kahirnar, Nilima Dongre" Storage Network Management and Retrieval", Wiley.

Storage Network Management and Retrieval

Experiment No. 3

To study and plan implementation of ILM for healthcare information system

Experiment No. 3

1. **Aim:** To study and plan implementation of ILM for healthcare information system

2. **What will you learn by performing this experiment?**

The phases of ILM are understood. How to apply to a health care system with the help of case study on HIPPA is also studied?

3. **Theory:**

ILM is a proactive strategy that enables an IT organization to effectively manage the data through the life cycle based on defined business policies.

The change in the value of the information over a period of time is called the information lifecycle Data at the time of its creation has the highest value. When it is accessed frequently, the value of the data is high. After some time, when the data is accessed less frequently, the value of the data decreases. Different type of information has different type of value spans. As per the changing value of the information or data, the storage infrastructure can be designed. ILM has five phases as given below.

- Create
- Access
- Migrate
- Archive
- Dispose

The critical requirement of the business enterprises for data is its availability and security. The data centres fulfill these business requirements by proper and efficient use of the storage infrastructure. Alongside, there should be a strong information management policy to support infrastructure to get the best possible benefits.

Based on predefined business policies, Information Lifecycle Management (ILM) is a proactive strategy facilitating the IT organisations to manage the data efficiently throughout its lifetime. This facilitates the IT organisation to avail maximum return on investment (ROI) of the storage infrastructure. The ILM has the following characteristics:

1. **Business-centric:** The ILM strategy is incorporated with the main business processes to cater the current and future information requirements.

2. **Centrally managed:** It is mandatory that the complete information related to the business should be controlled centrally under ILM strategy.
3. **Policy-based:** ILM should not be implemented partially; rather it should be as one of the business policy common for all applications, resources and other assets.
4. **Heterogeneous:** ILM strategy should be platform-independent and consider all types of storage technologies.
5. **Optimised:** ILM strategy should consider the changing value of information and assign the storage as per the requirements.

Implementing ILM

The ILM strategy is implemented in four steps as explained below:

1. **Classify data:** Data and applications are classified based on the business rules and policies. The changing value of information is responsible for building the business rules and policies. These rules and policies enable the ILM strategy to organise and process the data and applications as per their significance.
2. **Implement policies:** Policies are implemented using management tools beginning from the creation of data and ending at its disposal.
3. **Manage environment:** The operational complexity is reduced by integrating different tools.
4. **Organise storage:** Based on the value of the information, the data are organised in tiers to associate with a respective application and allocate right type of data storage infrastructure.

The implementation of an ILM is a continuous process in any enterprise. The entire ILM can be implemented in three steps:

1. Tiered storage.
2. Application-specific ILM.
3. Enterprise-wide ILM.

Benefits of ILM

The ILM benefits address the complexities and related challenges of information management.

1. **Improved utilisation:** The utilisation is improved by implementing tiered storage and more accessibility of the information.
2. **Simplified management:** Integrating different tools for processes, interfaces and automation, simplify the information management.
3. **A wide range of options:** More options are available for backup and recovery, which avoids downtime and outages in business.

4. **Maintaining compliance:** As per the value of information, its lifetime and security can be planned.
5. **Lower total cost of ownership (TCO):** The proper alignment of infrastructure and management helps to reduce the cost along with the information value. This reduces the wastage of resources and facilitates simplified management as well as balances low-value data with high-value data.

Thus an ILM solution should be able to provide features such as:

- Application Transparency; data classification is transparent: allows changes to be made to the data without impacting the applications using that data allowing data to be moved easily at different stages of lifecycle.
- Fine-grained; managing data at individual row level
- Low-Cost; uses low cost to reduce costs: facilitating low cost despite different types of storage devices by making the data access hardware independent.
- Enforceable Compliance Policies; define and enforce policies: Data should be retained and managed in accordance with the regulations.

Case Study on Health care system

Applying Information Lifecycle Management for managing Healthcare Information system

Organization Profile:

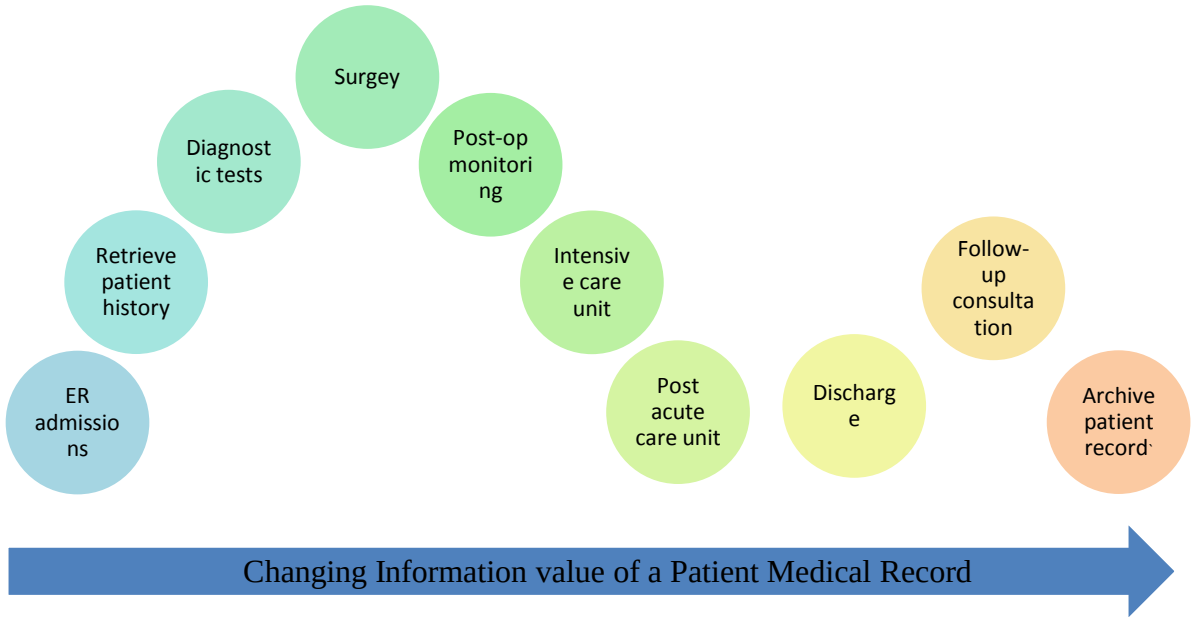
The information of the patients at any healthcare organizations across the world may be at risk every time critical information is not available to make an immediate diagnosis at the point of care. At the same time, healthcare providers face a delicate balancing act as they attempt to decrease costs while improving patient safety and the quality of care.

As digital information continues to explode, healthcare organizations need to adopt strategies to manage the lifecycle of patient information—which often must be kept for decades to meet state, federal, and country laws and regulations. Applying information lifecycle management methodologies enables healthcare providers to take control of information throughout a patient's lifetime, making information available wherever and whenever it is needed.

Healthcare Information Technology Challenges

As healthcare digital assets are continuously growing there is need to create a centralized and unified information infrastructure to view and speed up care decisions, enhance the patient experience, and leads to reduced length of patient stay. In short, to address the inefficiencies in the accessibility of information to support patient care decision making.

In the existing paper based and manual system the physicians still manually write orders and request information from multiple departments within and outside their healthcare organization. These requests can take hours to days to fulfill due to the retrieval time needed for archived information. At the same time, hospital staff may duplicate efforts as patient information is manually input two or more times, which further contributes to rising healthcare costs and increases the risk of human errors. By moving paper-based and manual processes online, healthcare providers will ultimately gain operational efficiencies leading to accelerated clinical care decision making.



	Patient-Centric Information Infrastructure
Hospital Information System	Software for improved asset utilization, simplified and automated management, cost effective business continuity, ensured compliance
Clinical Information systems	Tiered network storage that handles a wide range of service levels and price/ performance requirements.
Point of Care systems	Services to help plan, build and manage the information infrastructure and keep it running optimally.

Analysis for planning and implementing Information Lifecycle Management

The challenges within healthcare organizations which are discussed above can be resolve by implementing the information life cycle management. The ILM strategies will be able to effectively manage, retrieve, archive, reuse, and selectively delete information generated throughout the healthcare continuum that in turn will accelerate clinical workflow and turnaround times for Radiology and Electronic Health Record applications and improve operational efficiencies.

The value of the patient information changes through its lifecycle. However, these changes do not occur in linear fashion. A patient entering the emergency situation may require an instant availability of information regarding patient history. Additionally, authorized caregivers require patient information immediately, whether at a remote location, such as a home office, or within the hospital unit.

Single online view of a patient information from different sources or multiple providers which includes x-ray images, medication, test results, allergy histories, and previous care episodes, should also be made possible. All of this information may be generated by a variety of clinical applications from multiple application vendors and clinical services (i.e., Radiology, Cardiology, and Pediatrics) and is often stored on heterogeneous systems and media.

Implementing an ILM strategy can help improve the challenges associated with healthcare information management. This includes:

- Centralised Single patient information view: Single view of all patient information across multiple clinical and financial systems across the system to develop a safe treatment plan.
- Tiered Network Storage: Improves storage utilization across platforms and software to increase visibility into all enterprise information.
- Automation: Simplified management through increased automation and by integrating process steps and interfaces to the individual tools in place today.
- Backup and Recovery: Offering a wider range of backup, protection, and recovery options to balance the need for continuity with the cost of losing specific information.
- Improved compliance: Improving compliance with state, federal, and country laws and regulations by having better knowledge and control up front regarding what data needs to be protected and for how long.

Building an Information Lifecycle Management Strategy

ILM strategies utilize a combination of hardware, software, and services, typically implemented in a phased approach.

- Classifying data and applications: Based on clinical priority or business rules and policies to enable differentiated treatment of information.
- Automated policies: To leverage information management tools, from creation to disposal of patient data.
- Integrated tools and interface: Managing the environment to interface with multi-vendor platforms and reduce operational complexity.
- Tiered Storage: Tiering storage resources by classes of data, storing information on the right type of infrastructure based on its current value.
- Regulatory Compliance: To address state, federal, and country laws and regulations for security and transaction standards;
- Backup and recovery: Provide efficient email archiving, applications infrastructure, consolidation, replication, and backup and continuity solutions.
- Information access: Should enable fast, efficient access to critical information, healthcare organizations can provide safe, quality patient care.

The Lifecycle of a Patient Record

- **ER admissions**
- **Retrieve patient history**
- **Diagnostic tests**
- **Surgery**
- **Post-op monitoring**
- **Intensive care unit**
- **Post acute care unit**
- **Discharge**
- **Follow-up consultation**
- **Archive patient record**

The lifecycle of a patient record given above mostly contribute to three phases of ILM, namely create, access and migrate. The last phase contributes to the archive phase of ILM.

- Create, Access Phases of ILM: the initial phases deal with the tools used to create and access the data. As per the different data created such as X-ray images, monitoring reports etc., the hardware and software tools used are different. Hence the different type of data created need to be processed differently to produce the reports or diagnose the disease.
- Migrate: Once the patient is cured the Patient data can be stored for specific number of years as per the regulatory compliance. This requires that the patient's history data to be migrated from high performance tier to a low cost tier.
- Archive: The patient data is archived in a low cost tier which has large storage capacity.

The ILM here can be implemented in 4 steps as given below:

- Define the Data Classes

To define data classes first it in important to understand:

- which data is important, where is it and what needs to be retained
- how this data flows within the organization
- what happens to this data over time and is it still needed
- the degree of data availability and protection that is needed
- data retention for legal and business requirements

Later Data classes can be defined based on:

- age or date
- Diagnostic type
- Disease type
- Treatment type

The data is treated as per different classification of data, based on the phase in which the data is present. Policies can be specified as per applications used as well as enterprise wide policies

o Application Specific Policies: Designing policies to manage the information in most effective and efficient way considering the performance requirement of the enterprise. Maintaining data integrity and making retrieval secured.
o Enterprise wide Policies: Designing policies for information security and privacy adhering to the standards to be followed. Protecting the data from unauthorized access and prevent malware attacks

- Create Storage Tiers for the Data Classes.

o The Costs Savings of using Tiered Storage: Cost is saved by using multiple tiered storage such as fast and expensive storage in performance tier whereas slow and less expensive storage in archive tier.
o Assigning Classes to Storage Tiers

Following storage tiers can be established:

- High Performance: important and frequently accessed data is present. In healthcare information system, in case of emergency this type of tier is very useful. This storage tier can be implemented using faster disks o high performance storage devices.
- Low Cost: Less frequently accessed data can be stored here. In Health care information system, data regarding patient Health history which need to be archived after the patient is cured

can be stored in this storage tier. This storage tier can be implemented using less costly large capacity storage disks.

- Online Archive: Data is never or hardly accessed can be stored. Extremely large data is stored. There is need for data compression.
- Offline Archive (optional): It is optional, because it is only used when there is a requirement to remove data from the database and store it in some other format such as XML on a tape

- Create Data Access and Migration Policies
  - Managing Access to Data: Regulatory requirements are beginning to place exacting demands on how data can be accessed. Controlling what authorized users of the database may see is to use database views or implement security policies using virtual private database which determines which data base can be seen by which user. Say a patient can view only its historical data.
  - Migrate Data between Classes Regulatory Compliance: During the lifecycle of the data it will be necessary to move it at various times and this occurs for a variety of reasons, such as:
  - for performance, only a limited number of orders are held on the high performance disks
  - data is no longer frequently accessed and is using valuable high performance storage and needs to be moved to a low-cost storage device
  - legal requirements demand that the information is always available for a given period of time, and it needs to be held safely at the lowest possible cost
  - Whenever data is moved from its original source, then it is very important to ensure that the process selected adheres to any regulatory requirements, such as, the data cannot be altered, is secure from unauthorized access, easily readable and stored in an approved location
  - The regulatory requirements related to data privacy plays a key role in the long-term retention of data because they are imposing strict rules on how data is held. The organizations then have to protect against unauthorized changes and possibly show details of every change ever made to a record.

- Define and Enforce Compliance Policies
  - When data is decentralized and fragmented, compliance policies have to be defined and enforced in every data location, which could easily result in a compliance policy being overlooked. However, using central location for storing data, enforcing compliance policies is easy as they are all managed and enforced from one central location. When defining compliance policies there are five areas to consider:
    - Retention
    - Immutability
    - Privacy
    - Auditing
    - Expiration
  - The retention policy will describe how the data is to be retained, for how long it must be kept and what happens at life end. Therefore, an example of a retention policy is that a record

must be stored in its original form, no modifications are allowed, it must be kept for some specified years and then it may be deleted..

- Immutability is concerned with proving to an external party that data is complete and has not been modified. Cryptographic signatures can be created and held either inside or outside of the database, to show that data has not been altered or tampered in any way.
- Privacy of data is essential with so much data to be retained. To ensure this, the access to data can be strictly controlled using security policies defined using Virtual Private Database (VPD), which define exactly which information a user may see. Maintained at the database level, these policies cannot be violated by anyone.
- An auditing capability to track all access and changes to data should also be provided. These can be defined at the table level or via fine-grained auditing which specifies the criteria for when an audit record should be generated.
- Database Vault ensures that data, is only ever accessed by authorized personnel, and Audit Vault provides an audit warehouse of all activity upon the database.
- Ultimately, data may expire for business or regulatory reasons and its need to be removed from the database.

Benefits of ILM for Health care system

On applying ILM, there is an improved online clinical workflow and fully digitized and networked healthcare environments is build, physicians gain immediate access to live and archived Picture Archiving Communications Systems (PACS) and Electronic Health Record data to make realtime critical clinical decisions. ILM provides a flexible, tiered networked storage infrastructure allowing healthcare organizations to match the value of patient data with a corresponding price and performance layer of storage. The rapid access to complete, online patient history, caregivers are able to make accurate diagnoses faster, uncover medication allergies and improve patient safety, while delivering a consistently successful patient outcome.

4. Conclusion and Discussion:

The ILM is studied in detail to apply it into the organizations. ILM provides proper organization of information to improve the efficiency of information handling.

5. QUIZ / Viva Questions:

- What is ILM and its benefits ?
- How management of information can be done intelligently using ILM?
- What are the advantages and disadvantages of ILM?

6. References:

1. ULF Troppen, Rainer Erkens and Wolfgang Muller , " Storage Networks Explained: Basic and Applications of Fibre Channel SAN, NAS and ISCSI and Infifniband " , Wiley
2. EMC Educational Services, "Information Storage and Management", wiley India
3. Vaishali Kahirnar, Nilima Dongre" Storage Network Management and Retrieval", Wiley
4. Robert Spalding, " Storage Networks: The Complete Reference", Tata McGraw Hill.

Storage Network Management and Retrieval

Experiment No. : 4

To install simulation software for Storage Area Network (SimSAN)

Experiment No. 4

1. **Aim:** To install the simulation software for storage area network (SimSAN)

2. **What will you learn by performing this experiment?**

The installation of Storage area network simulation software SimSAN is done.

3. **Hardware/Software Required:** 2GB RAM,320 GB hard, dual core processor Windows operating system., SimSANs simulator

- Microsoft Windows 7, Windows 2003/R2, Windows 2008/R2, both 32-bit and 64-bit
- Microsoft .NET Framework 3.5 SP1: dotnetfx35setup.exe
- Microsoft Chart Controls for .NET 3.5 SP1: MSChart.exe
- For Windows 2008: .NET 3.5 SP1 (aka .NET 3.5.1) is a feature, which can be added from "Server Manager".

4. **Theory:**

About SimSANs: SimSANs is a Data Center Storage Area Networking design and simulation tool which is open source. It is used in infrastructure design and I/O performance analysis of SCSI over Fibre Channel and FCoE based data center storage area networks.

SAN (Storage Area Network) Infrastructure Design

SimSANs is a convenient SAN (Storage Area Network) infrastructure design tool for transitioning existing FC (Fibre Channel) SAN into emerging converged data center SAN, FCoE (Fibre Channel over Ethernet) SAN. It allows the SAN designers or engineers to dry-run the exact real-world SAN deployments, study the network behavior and performance bottleneck, and therefore come with the best solution for smooth transition of FC SAN into FC/FCoE mixed SAN, and eventually to FCoE SAN.

SCSI Traffic I/O Performance Analysis

SimSANs is an easy-to-use simulation tool to help study FC/FCoE SAN based SCSI I/O performance including I/O throughput and IOPS (I/O Per Second). It precisely simulates all major SAN components throughout the I/O path in the SAN, but hides enough protocol implementation details to allow user run the simulations just like they operate the daily SAN management, administration, and I/O application tasks in the real world. This is all realized via a set of well designed GUI tools coupled with high-speed simulation core.

5. Procedure/ Program:

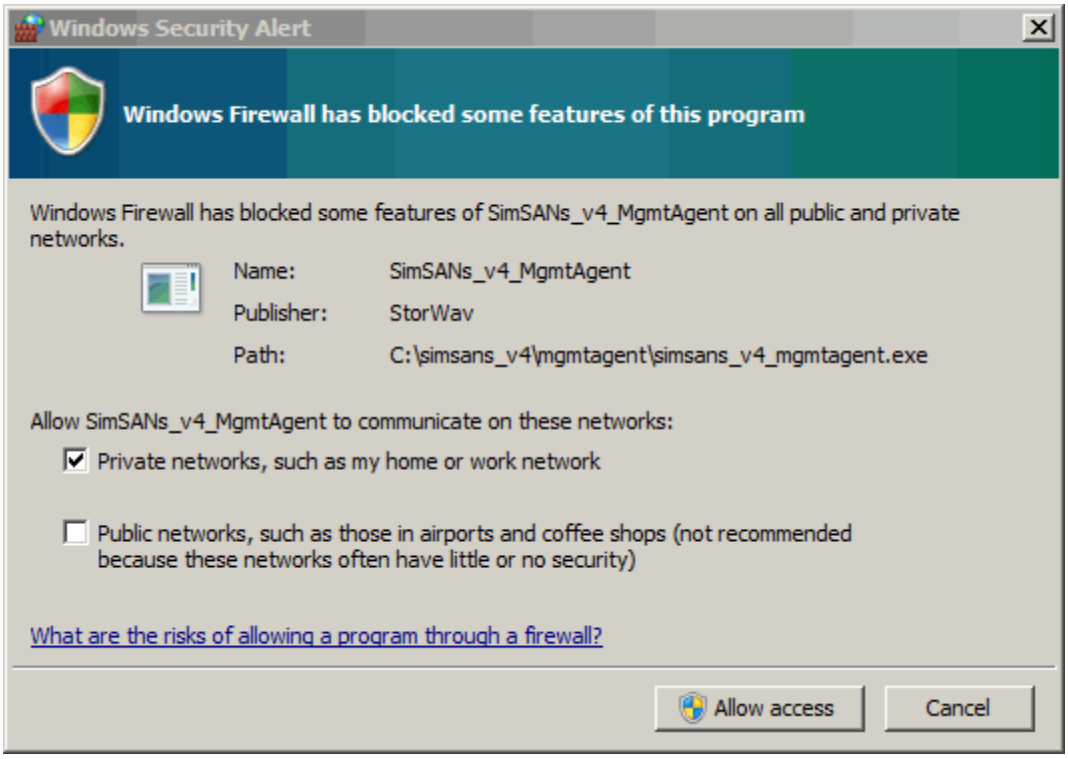
Before Installation

Before installing SimSANs package, user should familiarize with the following terms:

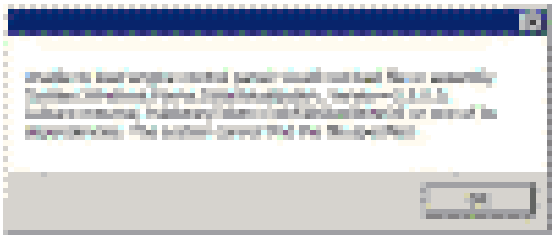
- SimSANs Engine (Engine): The OMNeT++ based SimSANs simulation instance.
- SimSANs Management Agent (Agent): The utility to directly control and operate Engine by accepting the commands from Console.
- SimSANs Management Console (Console): The GUI tool to remotely control and operate Engine via Agent.
- Backend Agent Host: The host running Engines and Agent utility that communicates with frontend Console host via TCP.
- Frontend Console Host: The host running Console GUI that communicates with backend Agent host via TCP.
- Online Engine: The simulation Engine that is currently running on the Agent host.
- Offline Engine: The simulation Engine that is not yet launched.

It is always recommended that the Console and Agent are launched from separate hosts, however, they are allowed to run from the same host.

- For Windows 2008: Windows firewall may need to add a rule to allow host listening on TCP port 10028.
- For Windows 7: Windows firewall may pop up a warning window when SimSANs Agent is launched. Please click "Allow Access" button to get it pass.



Note: MS Chart Controls must be installed, or an error will pop up:



Download Steps

SimSANs, Simulating Storage Area Networks, is a Data Center Storage Networking design and simulation tool. It is especially useful in infrastructure design and performance analysis of SCSI over Fibre Channel and FCoE based data center storage networks. The latest SimSANs version is **4.0 for Windows 7.**

Download Link: http://www.simsans.org/Downloads/download.htm

.NET 3.5 SP1

MS Chart Control for .NET 3.5.

Please download and install them before launching SimSANs.

SimSANs_v4_20110412_4016b.zip

MD5 signature: 95d1f41685c50237718d4e1ad8c3164a

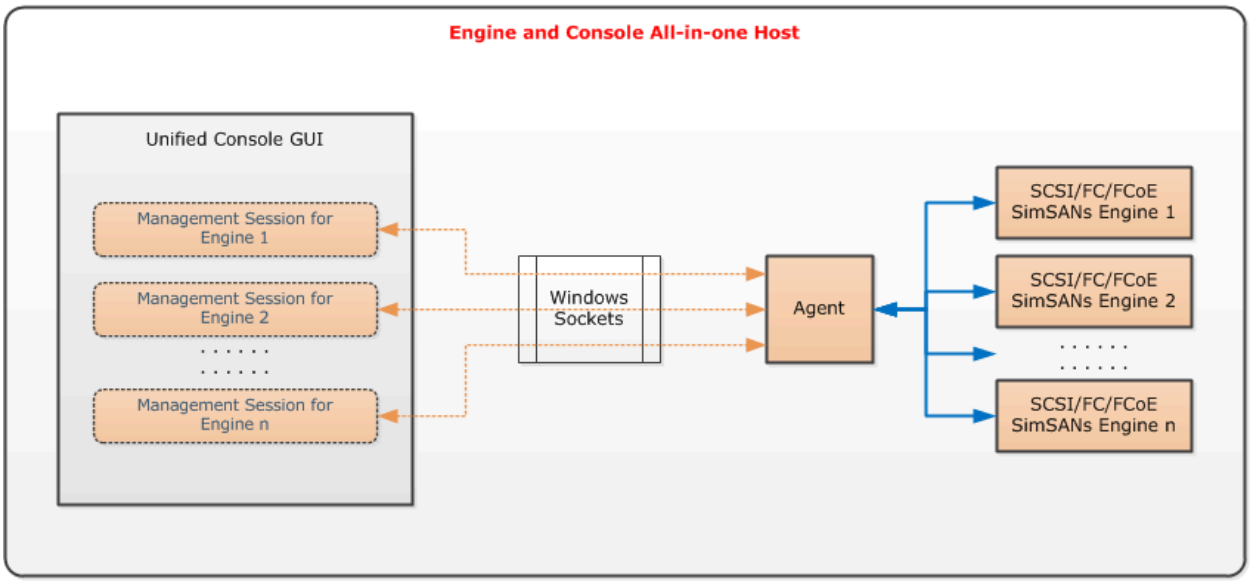
Installation Steps

Simply copy **SimSANs_v4_[build].zip** to drive C (or any other drive or directory) and unzip it, then directory "C:\SimSANs_v4" will be created. "**C:\SimSANs_v4**" directory (let's call it **SimSANs root directory**), has two sub-directories:

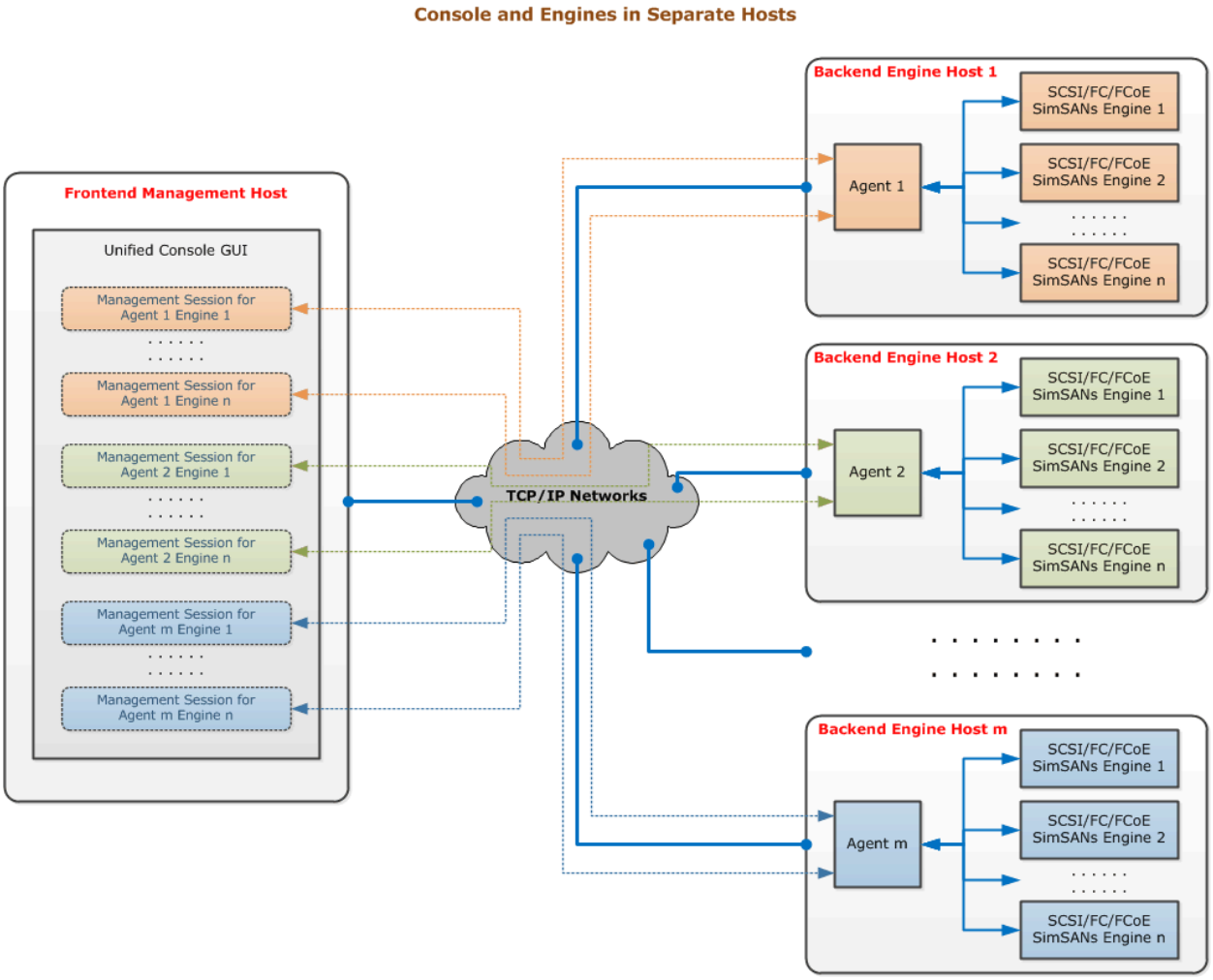
- **Console**: holding frontend console utility **SimSANs_v4_Console.exe**
- **MgmtAgent**: holding agent utility **SimSANs_v4_MgmtAgent.exe** and its associated backend simulation engines

Installation is done here if you just want to launch Console and Agent/Engines from the same host.

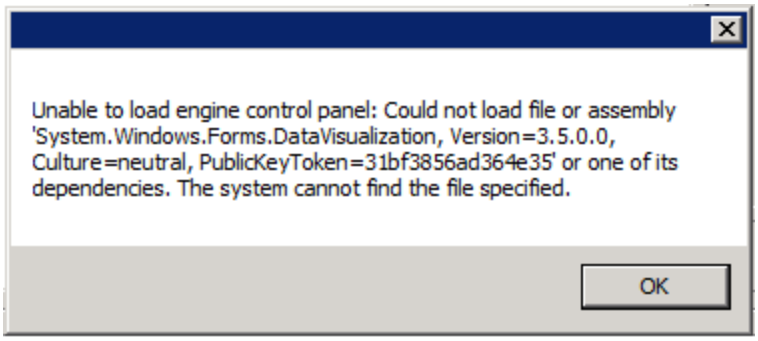
Console and Engines in the Same Host



If you want to launch Console and Agent/Engines from separate hosts, you must do the same installation for each host - the one to run Console is called **Frontend Console Host**, and the one to run Agent/Engines is called **Backend Engine Host**.



Note: MS Chart Controls must be installed, or an error will pop up:



6. **Conclusion and Discussion:**

The installation steps of SimSAN simulator are very easy. It provides the simulation environment for Storage Area Network

7. QUIZ / Viva Questions

- What is SimSAN used for?
- What are the various facilities provided by the simulator?
- What are the advantages and disadvantages?

8. References:

1. ULF Troppen, Rainer Erkens and Wolfgang Muller , " Storage Networks Explained: Basic and Applications of Fibre Channel SAN, NAS and ISCSI and Infifniband " , Wiley
2. EMC Educational Services, "Information Storage and Management", wiley India
3. Vaishali Kahirnar, Nilima Dongre" Storage Network Management and Retrieval", Wiley
4. Robert Spalding, " Storage Networks: The Complete Reference", Tata McGraw Hill
5. http://www.simsans.org/

Storage Network Management and Retrieval

Experiment No. : 5

To Connect and launch SimSAN agent, Engine and console

Experiment No. 5

1. **Aim:** To connect and launch SimSAN agent, Engine and console
2. **What will you learn by performing this experiment?**

After performing this experiment we come to know that how to launch a front end console using SimSAN agent. The communication between the console and the backend agent is done.

3. **Hardware/Software Required:**

2GB RAM,320 GB hard, dual core processor SimSANs simulator.

- Microsoft Windows 7, Windows 2003/R2, Windows 2008/R2, both 32-bit and 64-bit
- Microsoft .NET Framework 3.5 SP1: dotnetfx35setup.exe
- Microsoft Chart Controls for .NET 3.5 SP1: MSChart.exe
- For Windows 2008: .NET 3.5 SP1 (aka .NET 3.5.1) is a feature, which can be added from "Server Manager".

5. **Theory:**

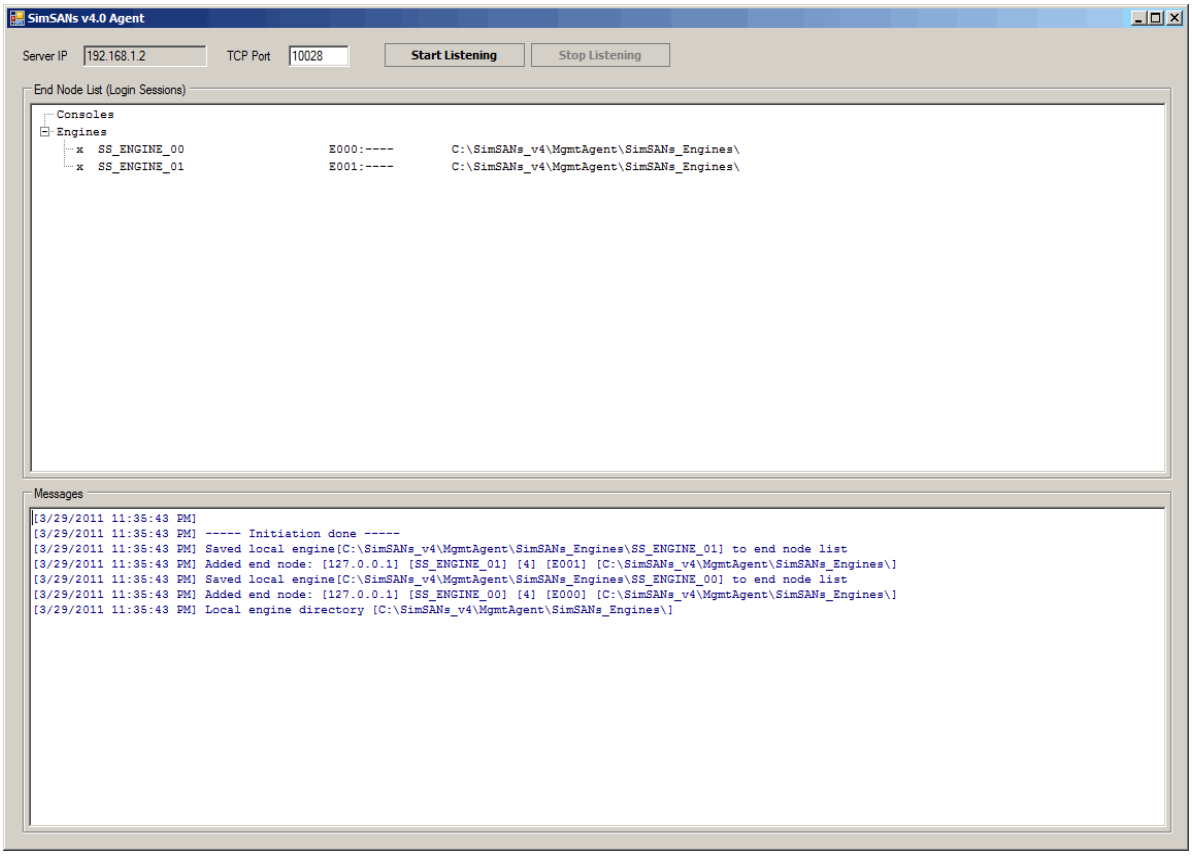
SimSANs, Simulating Storage Area Networks, is a Data Center Storage Networking design and simulation tool. It is especially useful in infrastructure design and performance analysis of SCSI over Fibre Channel and FCoE based data center storage networks. The latest SimSANs version is **4.0**.

6. **Procedure**

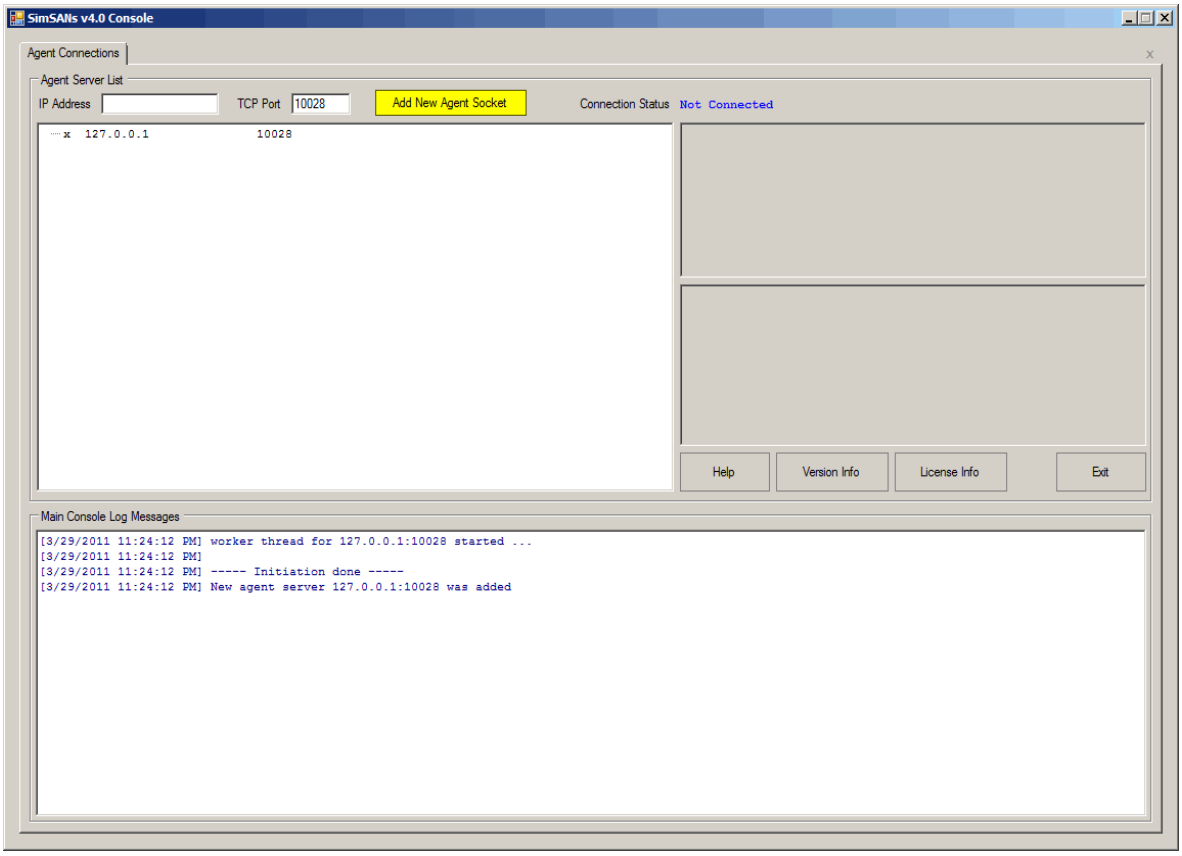
Note: All the **(ROOT)** mentioned in this user guide refers to SimSANs root directory, for example, directory "C:\SimSANs_v4".

SimSANs simulation engine is always launched and controlled from frontend Console GUI, through communications between Console and backend Agent. User should not manually launch Engine. Simply follow the steps below to launch and manage SimSANs engines:

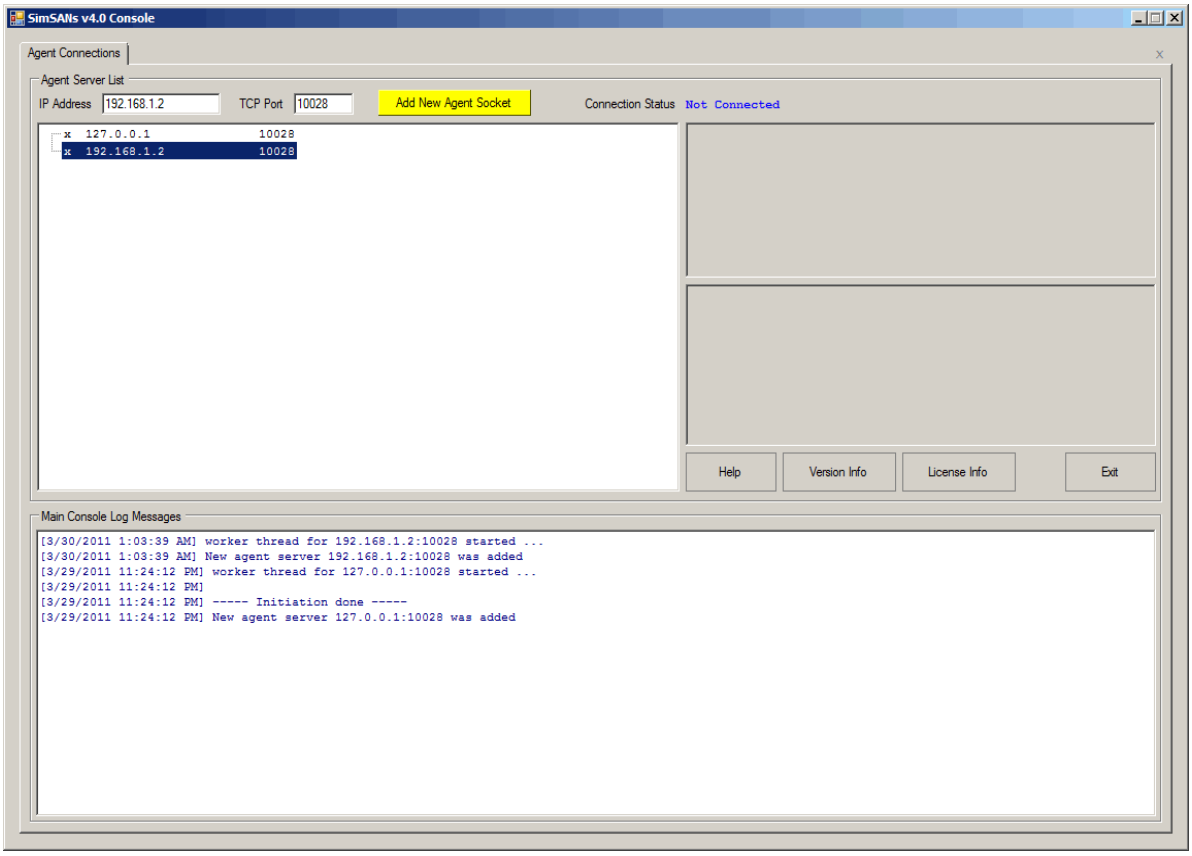
- Step 1 - Launch Agent: Run Agent utility SimSANs_v4_MgmtAgent.exe from (ROOT)\MgmtAgent directory to pop up Agent window. All Engines associated with this Agent will get listed under "Engines" category.



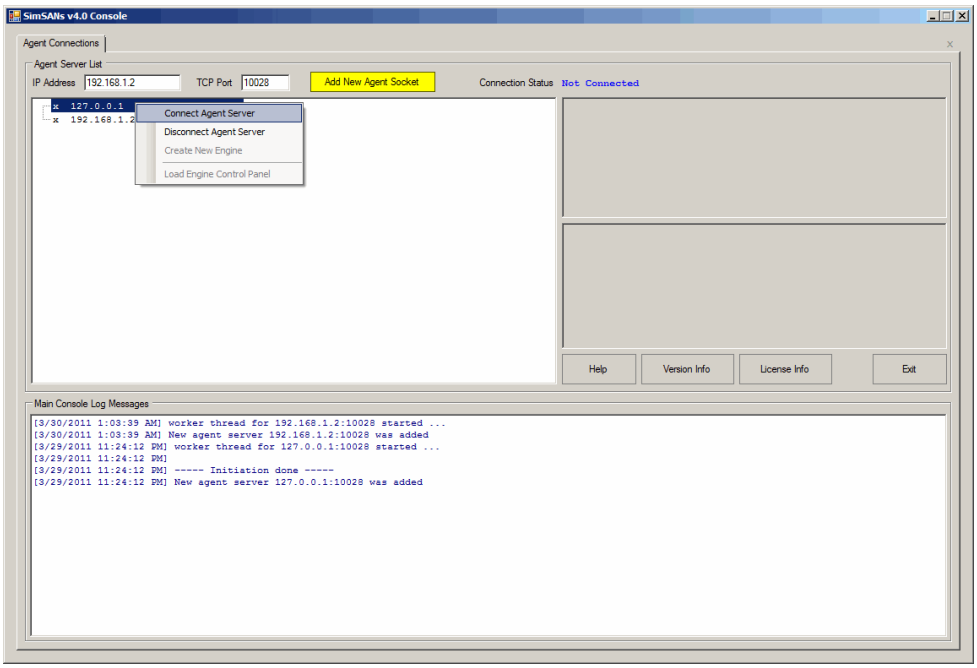
- Step 2 - Get Agent Ready: The Agent window shows the host IP as well as the default listening TCP port, 10028, for accepting incoming requests form Console. It is not recommended to change the default TCP port unless there's port confliction. Simply click "Start Listening" button to get Agent ready to accept management commands.
- Step 3 - Launch Console: Run Console utility SimSANs_v4_Console.exe from (ROOT)\Console directory to pop up Console window.



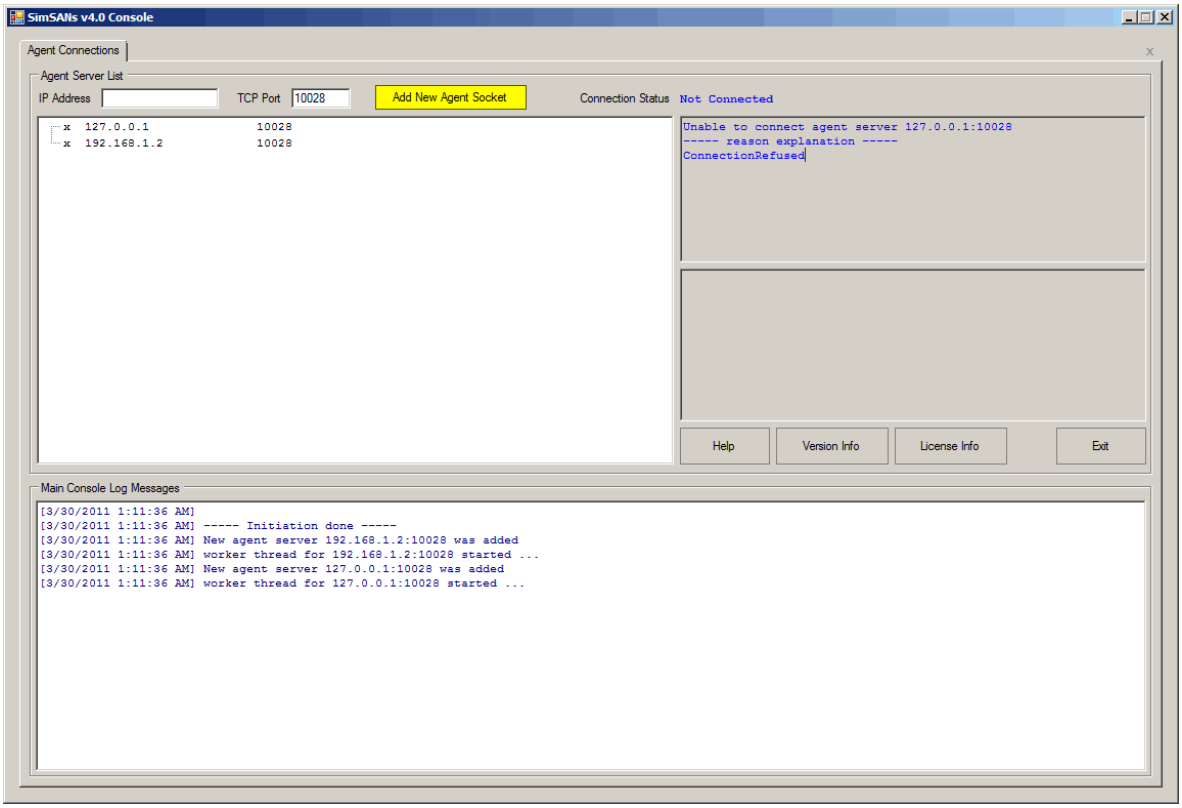
- Step 4 - Connect Agent: By default, local host (127.0.0.1) is already listed. To add a new Agent host, type in its IP as well as TCP port (default 10028), then click "Add New Agent Socket" button to get it listed.



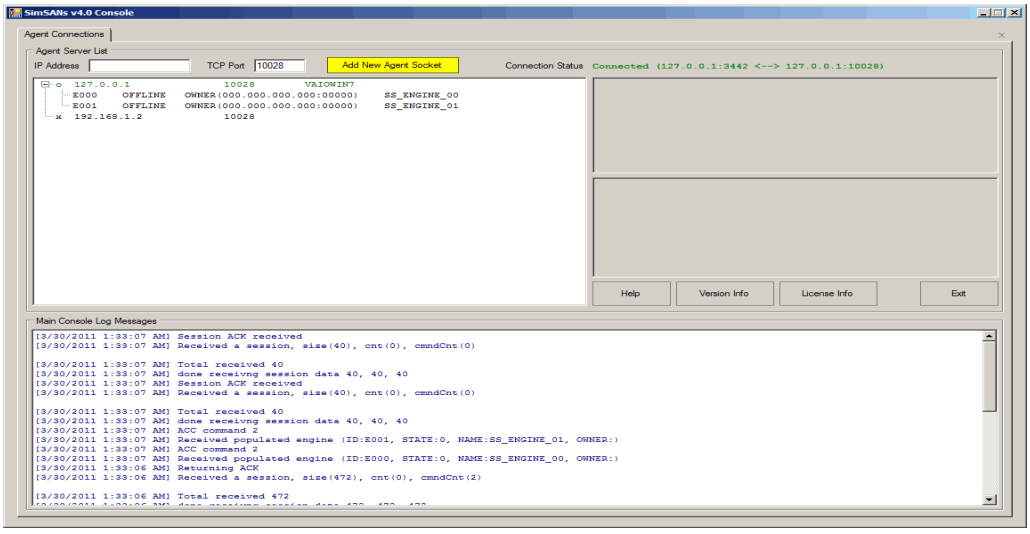
To connect an Agent host in the list, right-click that Agent and select "Connect Agent Server".



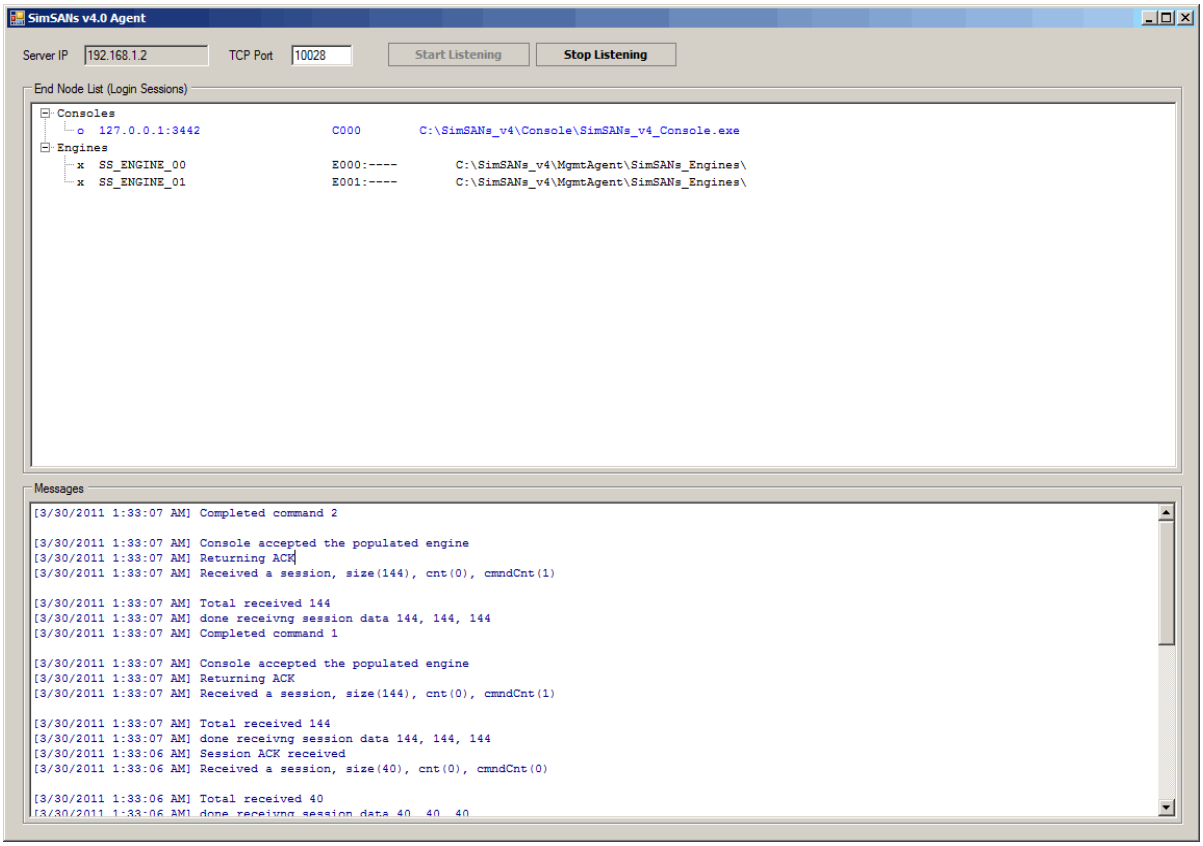
Once connection is created successfully, connection status should show "Connected" otherwise error status.



A success connection will get all the associated Engines listed under this Agent host.

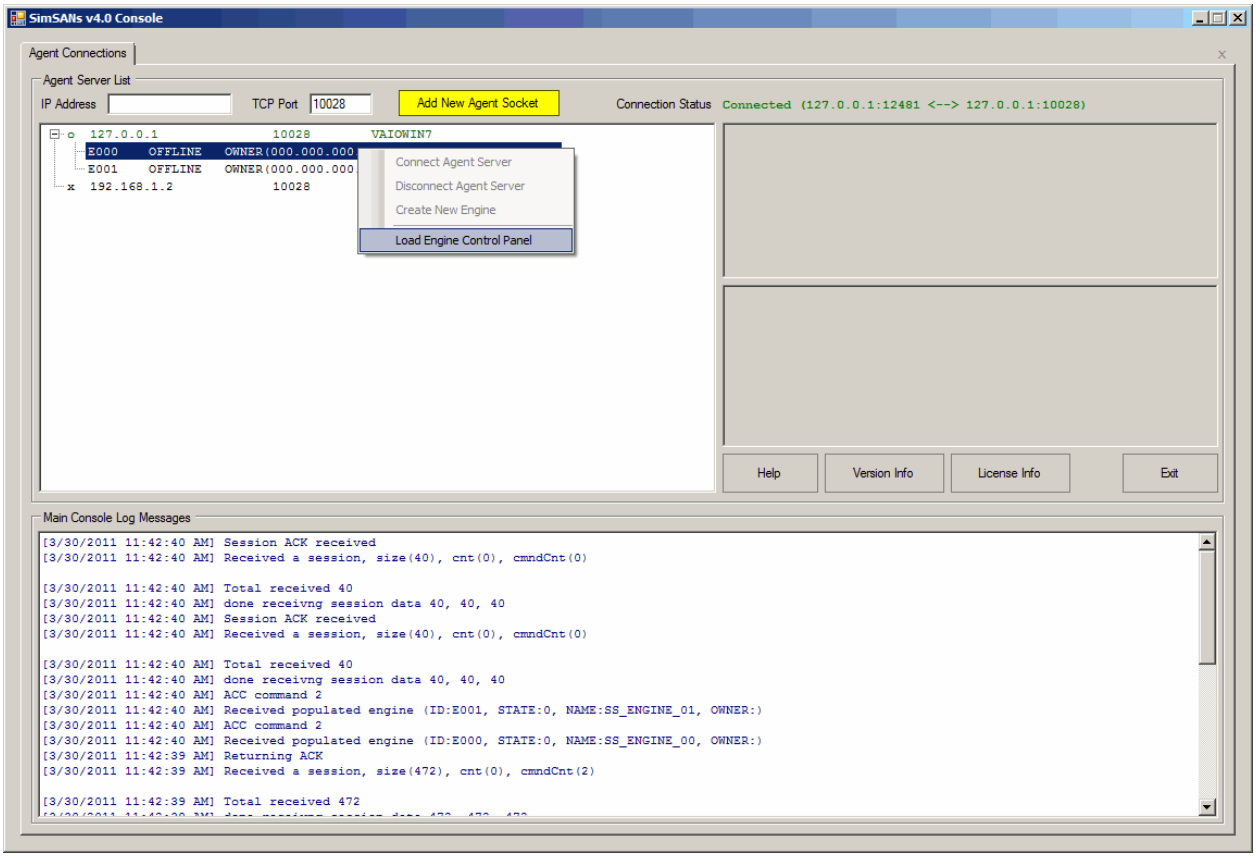


User can then select Engines from the list to launch or control the simulations. On Agent host side, connected Console shows up under "Consoles" category.

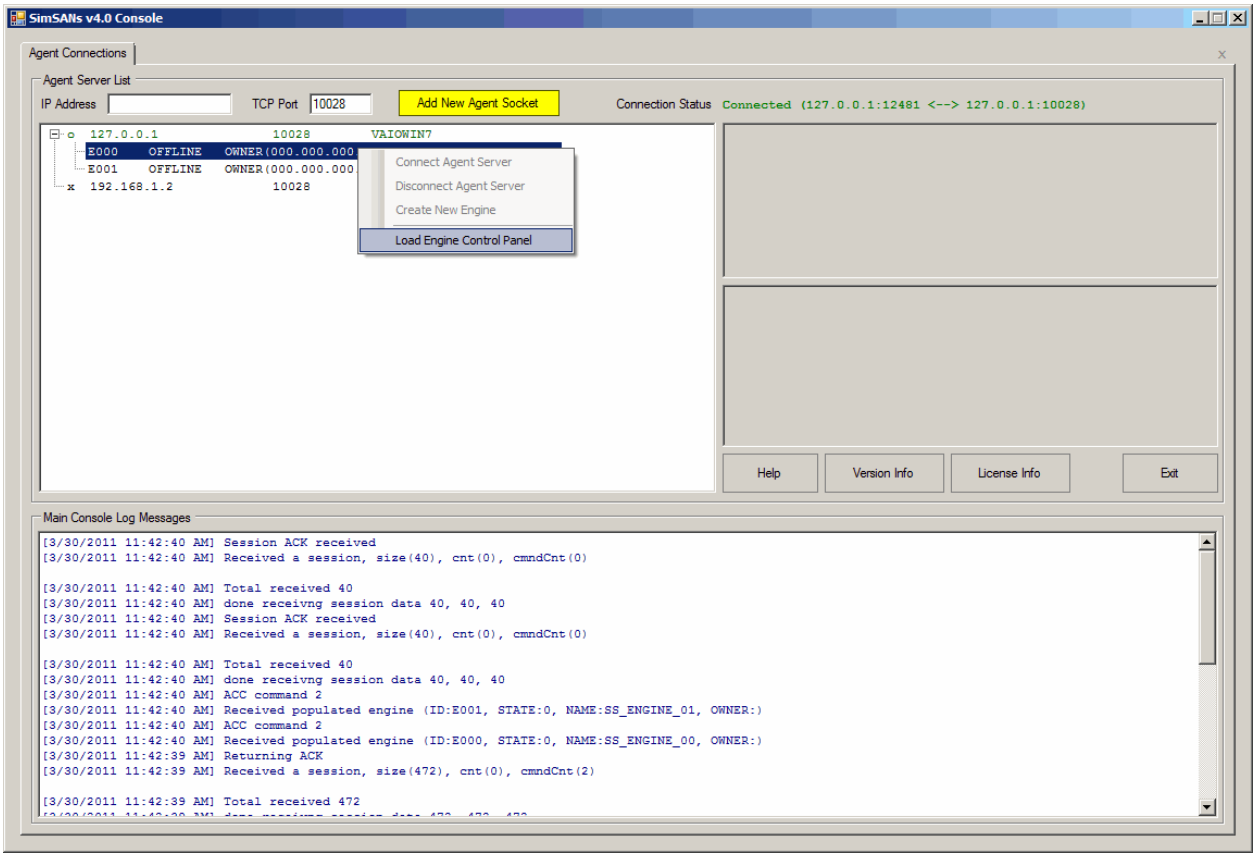


Launch SimSANs Engine

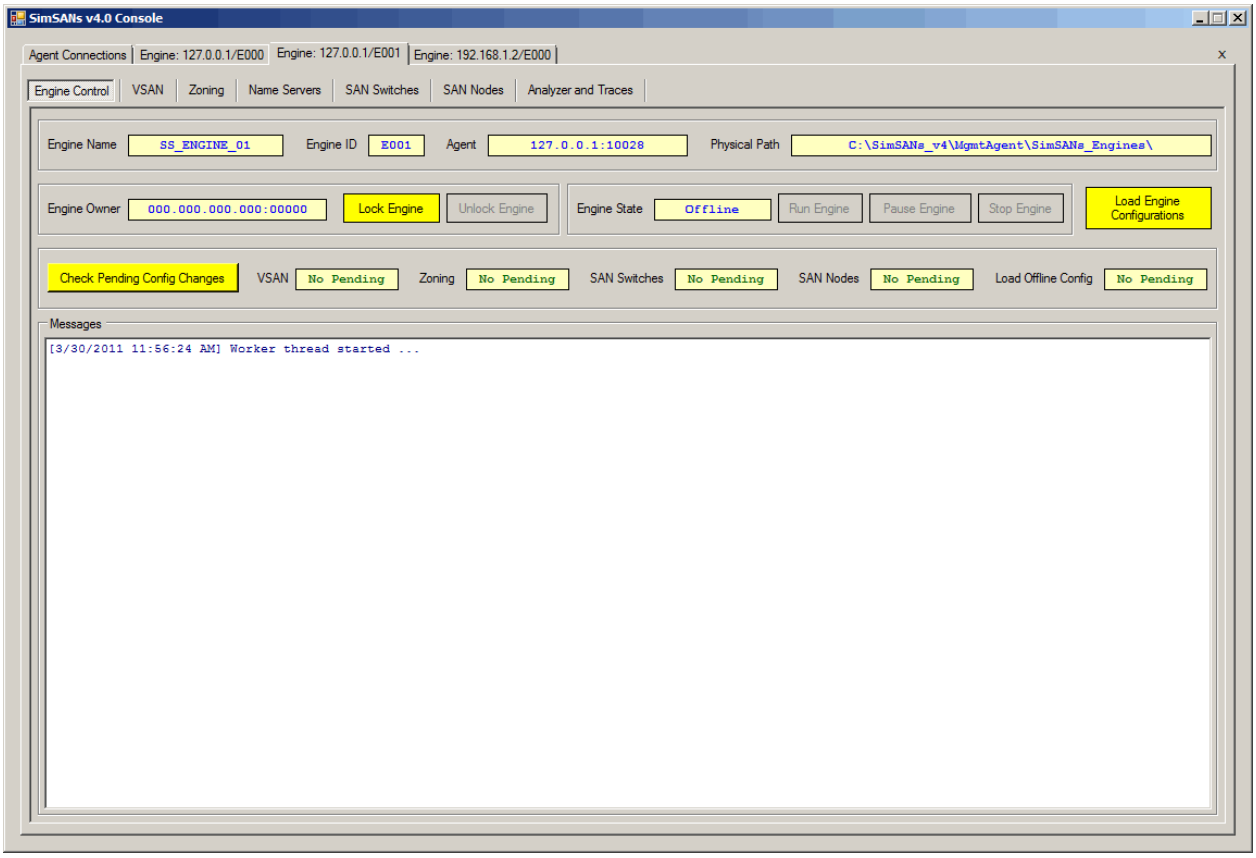
A list of associated Engines should show up under each connected Agent host. Select the Engine you want to manage, then right-click to choose "Load Engine Control Panel" from the menu.



This will pop up the control panel titled "Engine: [Agent IP][Engine ID]", indicating which Engine from which Agent host. For example, "Engine: 127.0.0.1/E000" means this is the control panel for Engine E000 from Agent host 127.0.0.1.

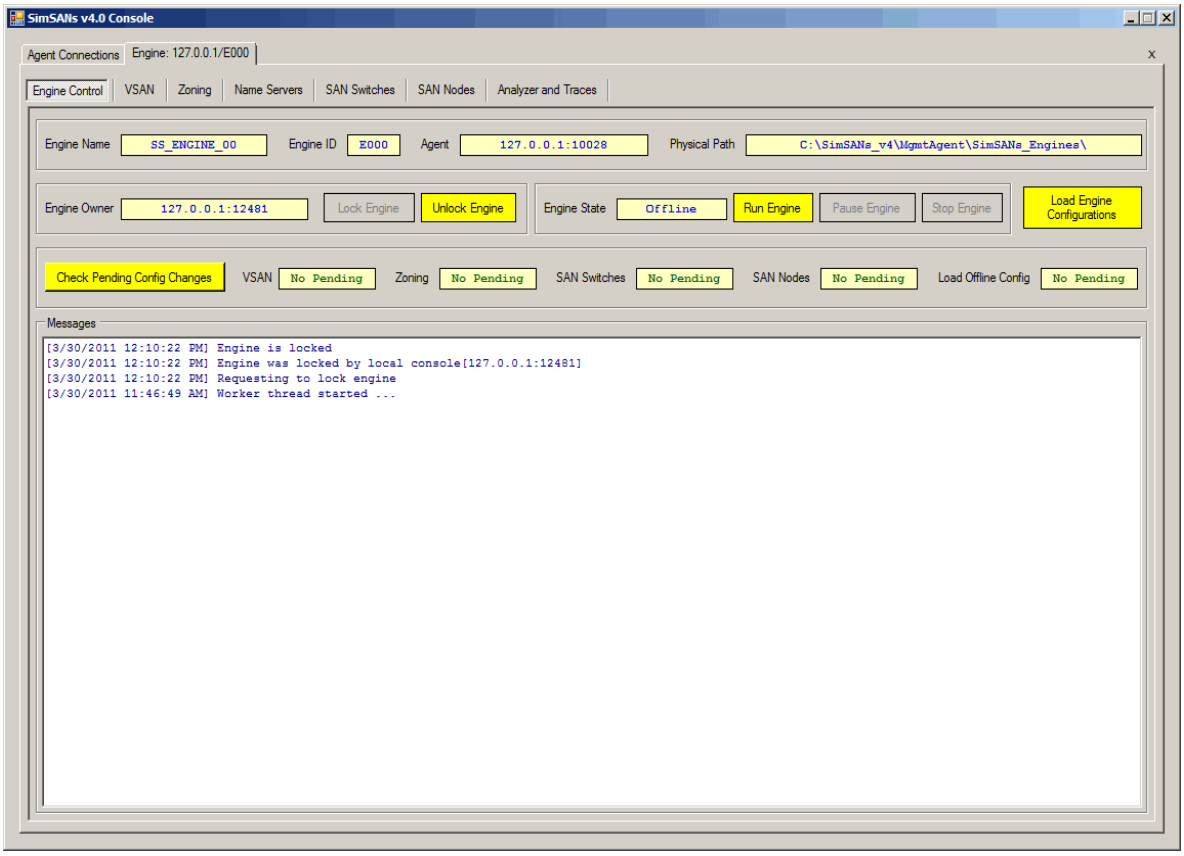


You certainly can bring up other Engine's control panels from the same Console GUI.

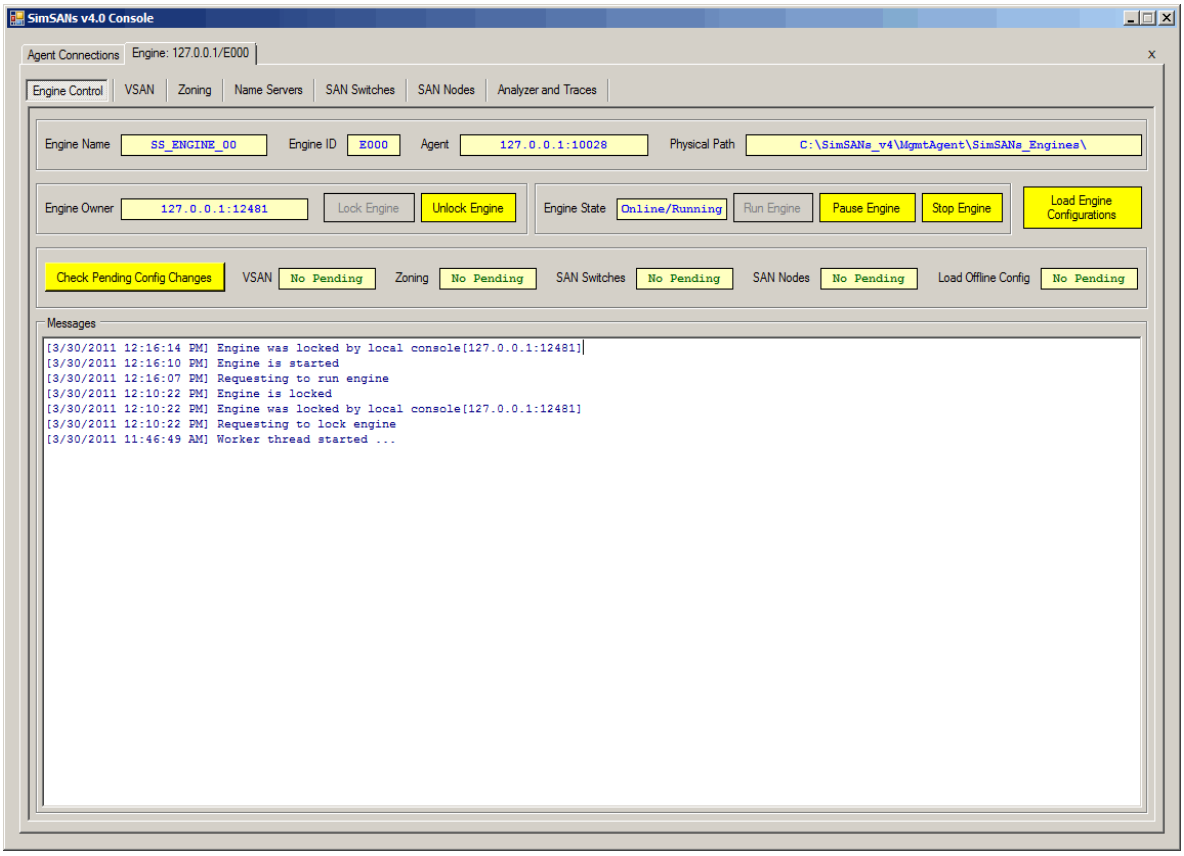


Each Engine must be managed from its own control panel. To launch an Engine simulation run, go to that Engine's control panel, then follow the steps below:

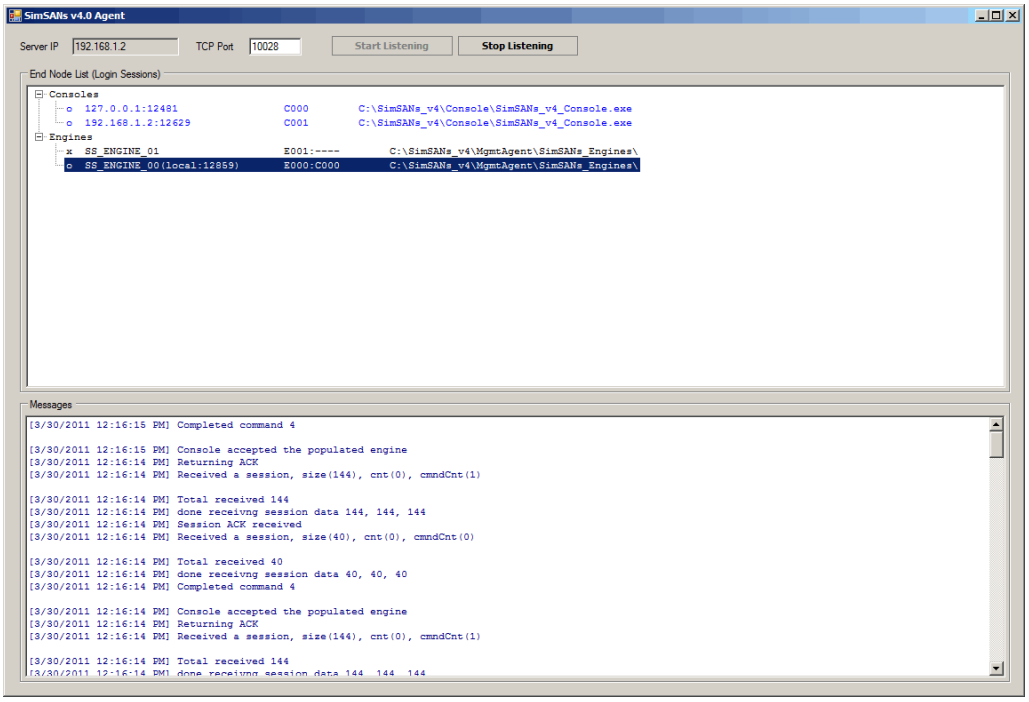
- Step 1 - Lock Engine: Click "Lock Engine" button to attempt to become the owner of the Engine. Engine cannot be controlled or operated until it is locked by current Console socket, which becomes the Engine owner.



- Step 2 - Run Engine: "Run Engine" button should show up once the Engine is locked by current Console socket. Simply click this button to launch the Engine simulation run. A successfully launched Engine will show up "Online" Engine state.



Also, on Agent host side, the online Engine should show up its own socket as well as which Console socket is the owner.



6. Conclusion and Discussion:

The agent and the corresponding engines are connected with the help of ports. Every engine can be controlled from its own control panel.

7. Quiz/Viva

- What are the different components of console?
- What is the need to lock a engine?
- What is the use of control panel in the simulator?

8. References :

1. ULF Troppen, Rainer Erkens and Wolfgang Muller , " Storage Networks Explained: Basic and Applications of Fibre Channel SAN, NAS and ISCSI and Infifniband " , Wiley
2. EMC Educational Services, "Information Storage and Management", wiley India
3. Vaishali Kahirnar, Nilima Dongre" Storage Network Management and Retrieval", Wiley
4. Robert Spalding, " Storage Networks: The Complete Reference", Tata McGraw Hill
5. http://www.simsans.org

Storage Network Management and Retrieval

Experiment No. : 6

To study SAN administration tasks for day to day routine

Experiment No. 6

1. **Aim:** To study SAN administration tasks for day to day routine

2. **What will you learn by performing this experiment?**

Learn how to manage SAN administration activities and its components by configuring zones, VSANs, engines etc .

3. Hardware/Software Required:

2GB RAM,320 GB hard, dual core processor SimSANs simulator.

- Microsoft Windows 7, Windows 2003/R2, Windows 2008/R2, both 32-bit and 64-bit
- Microsoft .NET Framework 3.5 SP1: dotnetfx35setup.exe
- Microsoft Chart Controls for .NET 3.5 SP1: MSChart.exe
- For Windows 2008: .NET 3.5 SP1 (aka .NET 3.5.1) is a feature, which can be added from "Server Manager".

4. **Theory:**

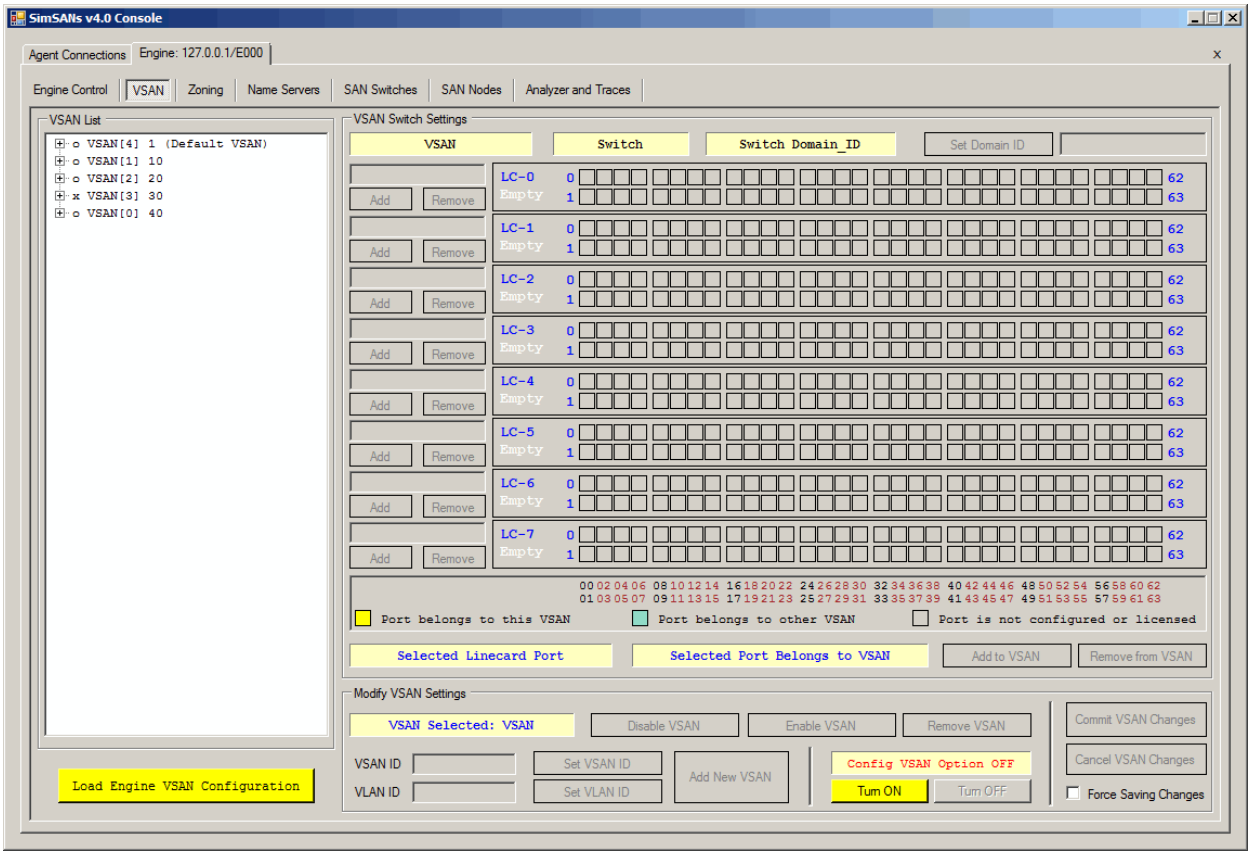
SimSANs, Simulating Storage Area Networks, is a Data Center Storage Networking design and simulation tool. It is especially useful in infrastructure design and performance analysis of SCSI over Fibre Channel and FCoE based data center storage networks. The latest SimSANs version is **4.0**.

5. **Procedure**

Control and Monitor SimSANs Engine Run

This part is the essence of SimSANs - capable of simulating **daily SAN administration tasks**. But before you go on manage SimSANs online Engines, please ensure the following operations have been completed:

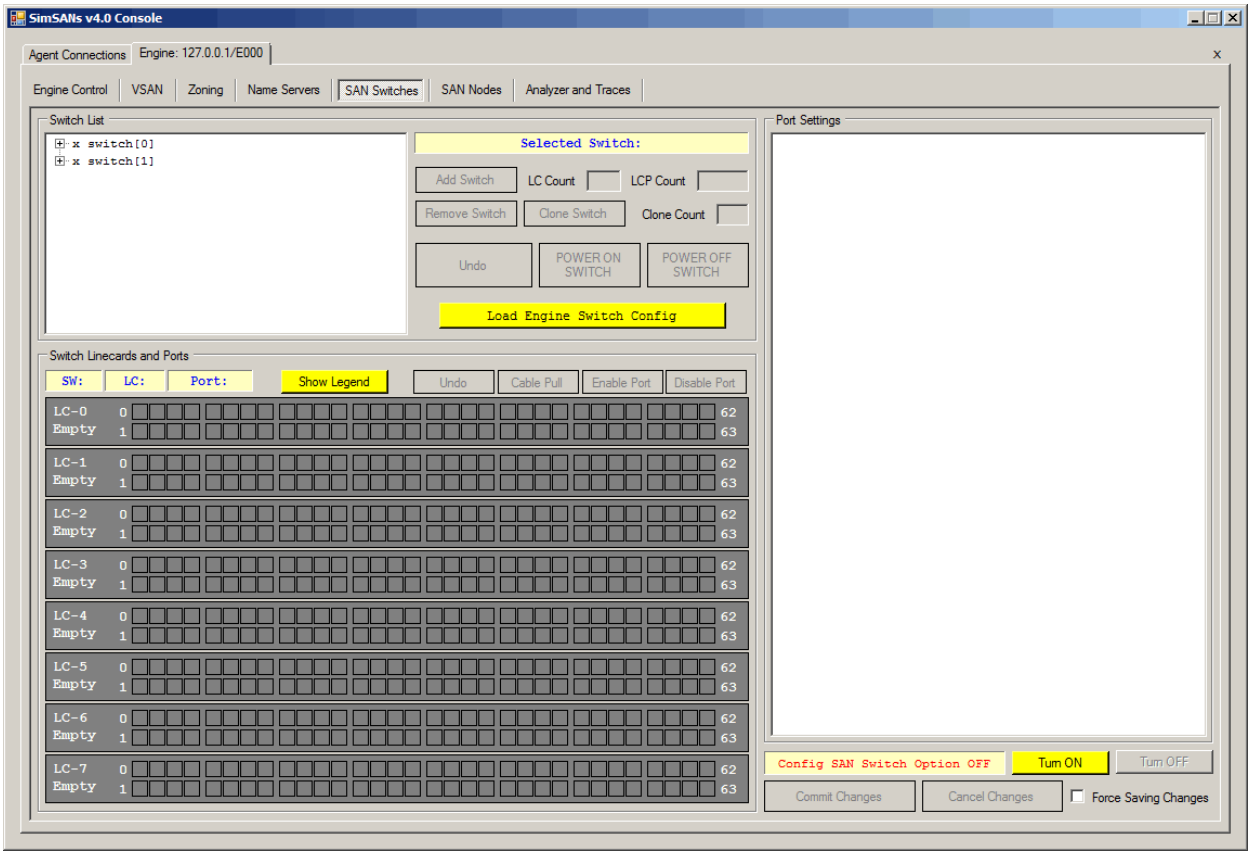
- **Engine is brought online** (Check "Run Engine")
- **Engine is locked** by current Console socket (Check "Lock Engine")
- **Engine configurations are loaded** - click "Load Engine Configurations" button on the Engine control panel and wait for the operation is done. Successful load operation will get a list of VSANs (in VSAN tab),

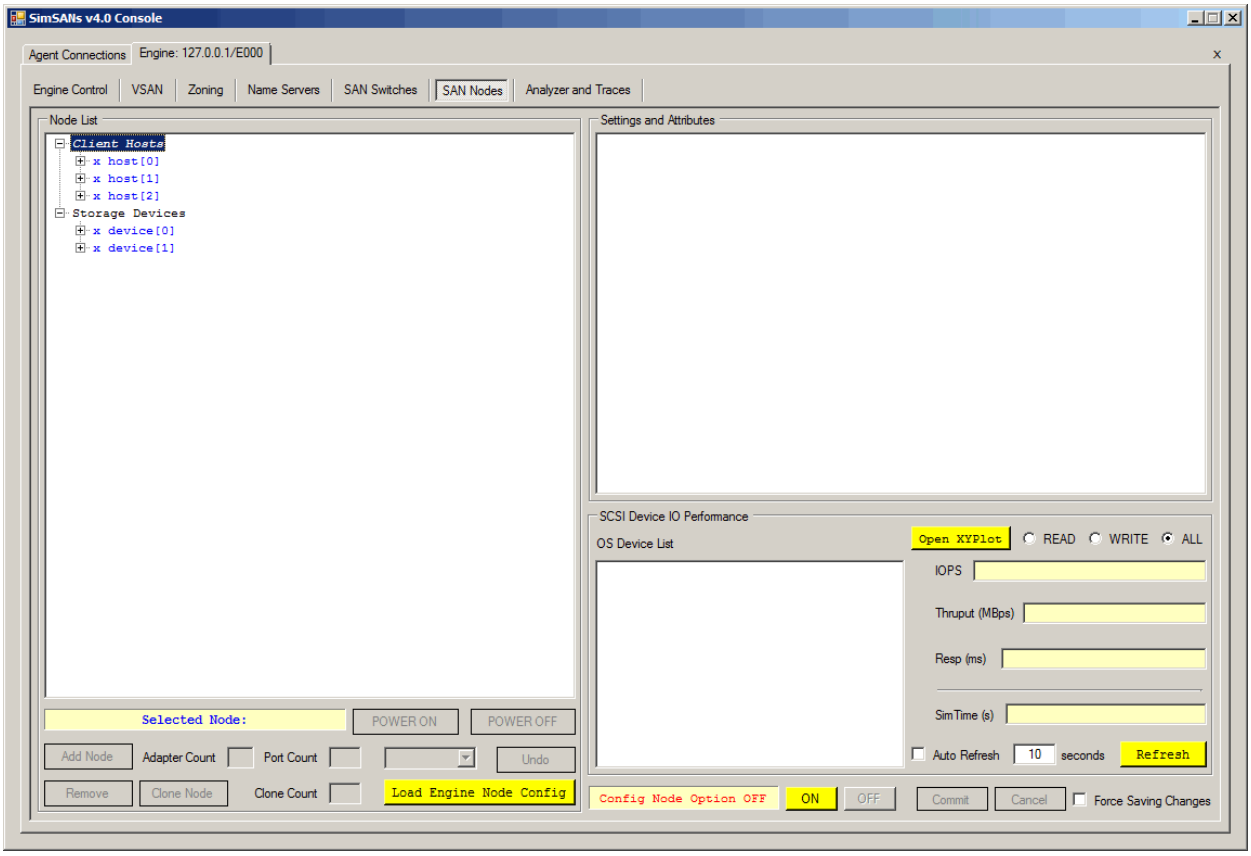


VSAN (Virtual Storage Area Network) Definition: A virtual storage area network (VSAN) is a logical partition in a storage area network (SAN). VSANs allow traffic to be isolated within specific portions of a storage area network.

VSAN is used for multiple VSANs which can make a system easier to configure. Users can be added or relocated without the need for changing the physical layout. If any problem occurs in one VSAN, that problem can be handled with a minimum of disruption to the rest of the network. Because of the independence of VSANs minimizes the total system's vulnerability, security is improved. VSANs also offer the possibility of data redundancy, minimizing the risk of catastrophic data loss.

A list of SAN Switches (in SAN Switches tab), and a list of Client Hosts and Storage Devices (in SAN Nodes tab)

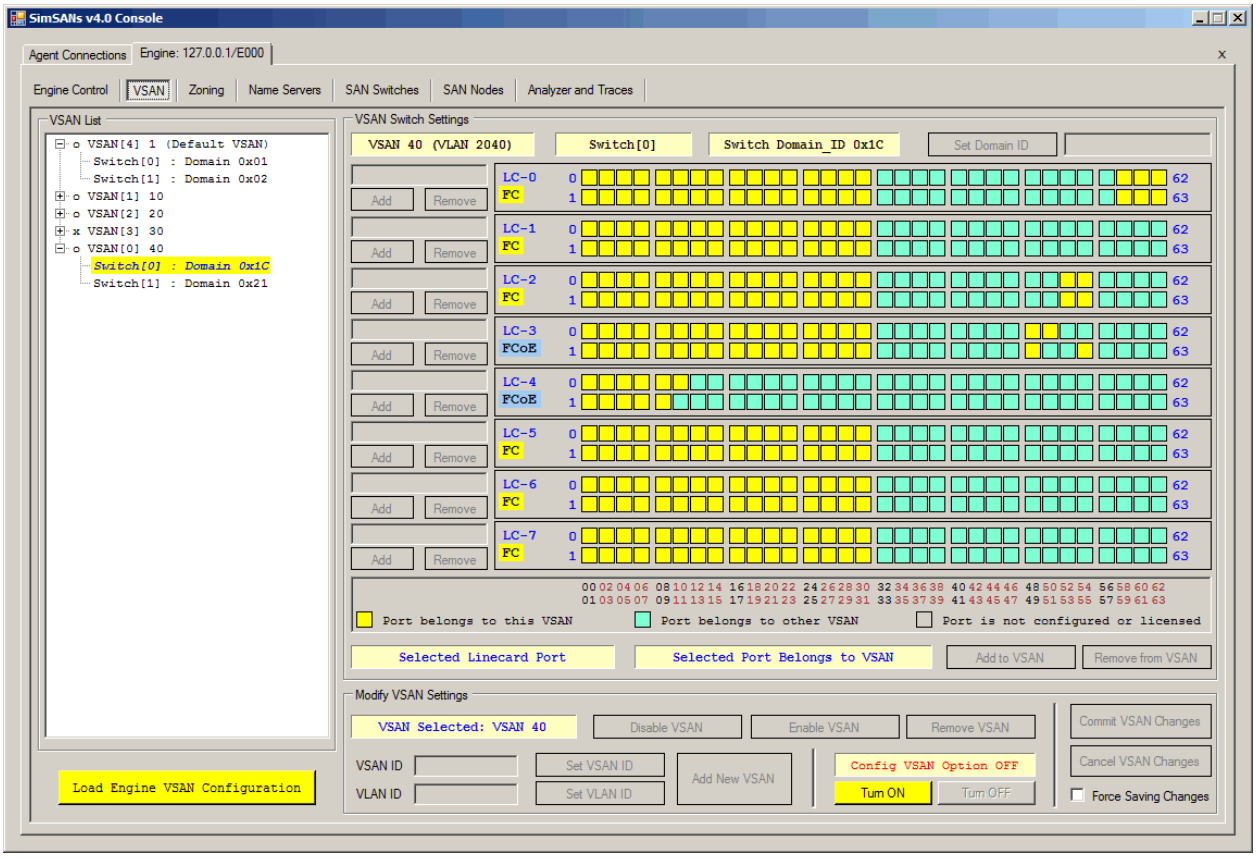

SimSANs v4.0 Console
Agent Connections
Engine: 127.0.0.1/E000
Engine Control
VSAN
Zoning
Name Servers
SAN Switches
SAN Nodes
Analyzer and Traces
Switch List
x switch[0]
x switch[1]
Selected Switch:
Add Switch
LC Count
LCP Count
Remove Switch
Clone Switch
Clone Count
Undo
POWER ON SWITCH
POWER OFF SWITCH
Load Engine Switch Config
Port Settings
Switch Linecards and Ports
SW:
LC:
Port:
Show Legend
Undo
Cable Pull
Enable Port
Disable Port
LC-0 Empty
LC-1 Empty
LC-2 Empty
LC-3 Empty
LC-4 Empty
LC-5 Empty
LC-6 Empty
LC-7 Empty
Config SAN Switch Option OFF
Turn ON
Turn OFF
Commit Changes
Cancel Changes
Force Saving Changes



Now you can go to following sub-sections for the details of each SAN related configuration available in SimSANs:

VSAN Configurations

Please select "VSAN" tab from Engine control panel. Each VSAN should have a list of member switches. Simply select the switch to get the port distribution.



Zone Configurations

Zoning Definition: In a storage area network (SAN), zoning is the allocation of resources for device load balancing and for selectively allowing access to data only to certain users.

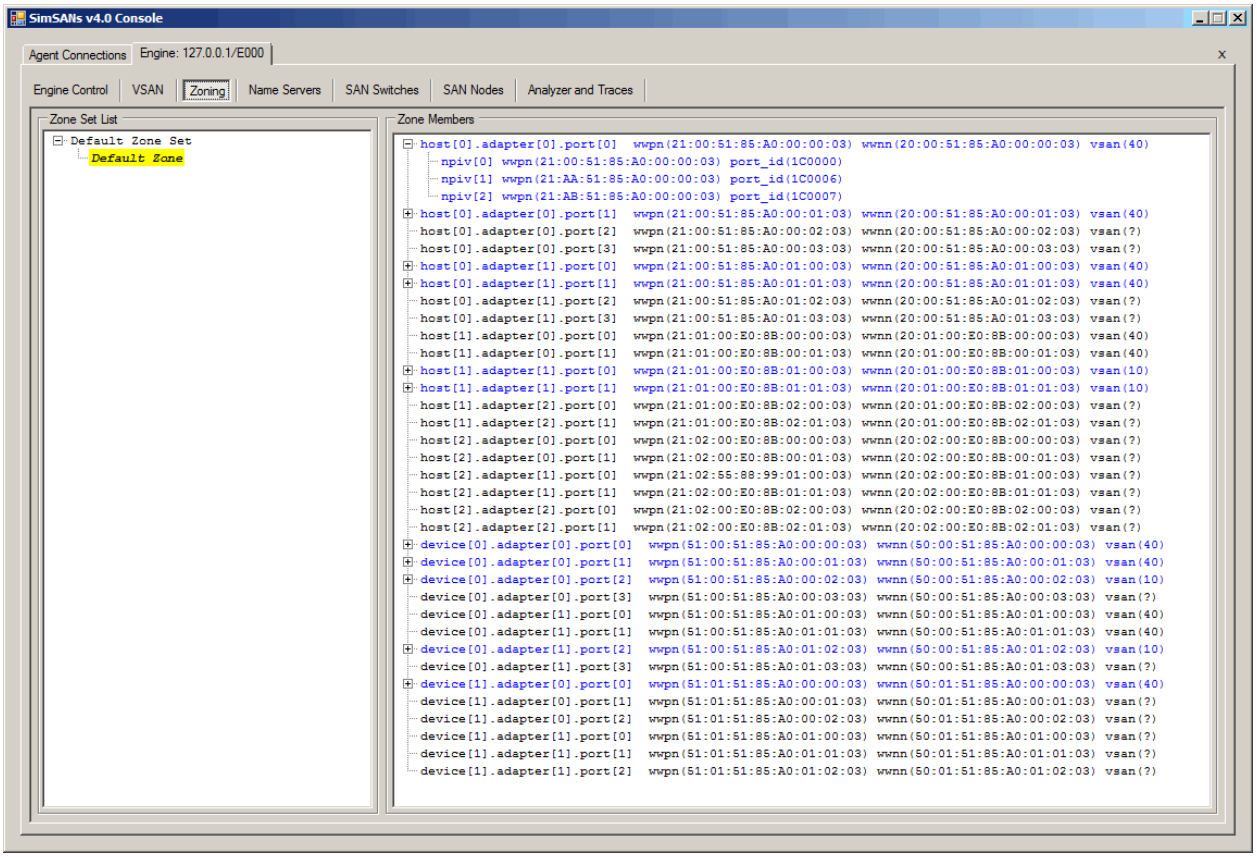
Zoning is done using a similar structure to that of a computer file system. A zone is the equivalent of a folder or directory. There are two types of zoning which can be either hard or soft. In hard zoning, each device is assigned to a particular zone, and this assignment does not change. In soft zoning, device assignments can be changed by the network administrator to accommodate variations in the demands on different servers in the network.

The user of zoning is said to minimize the risk of data corruption, help secure data against hackers, slow the spread of viruses and worms, and minimize the time necessary for servers to reboot. However, zoning can complicate the scaling process if the number of users and servers in a SAN increases significantly in a short period of time.

Zone Configuration Steps:

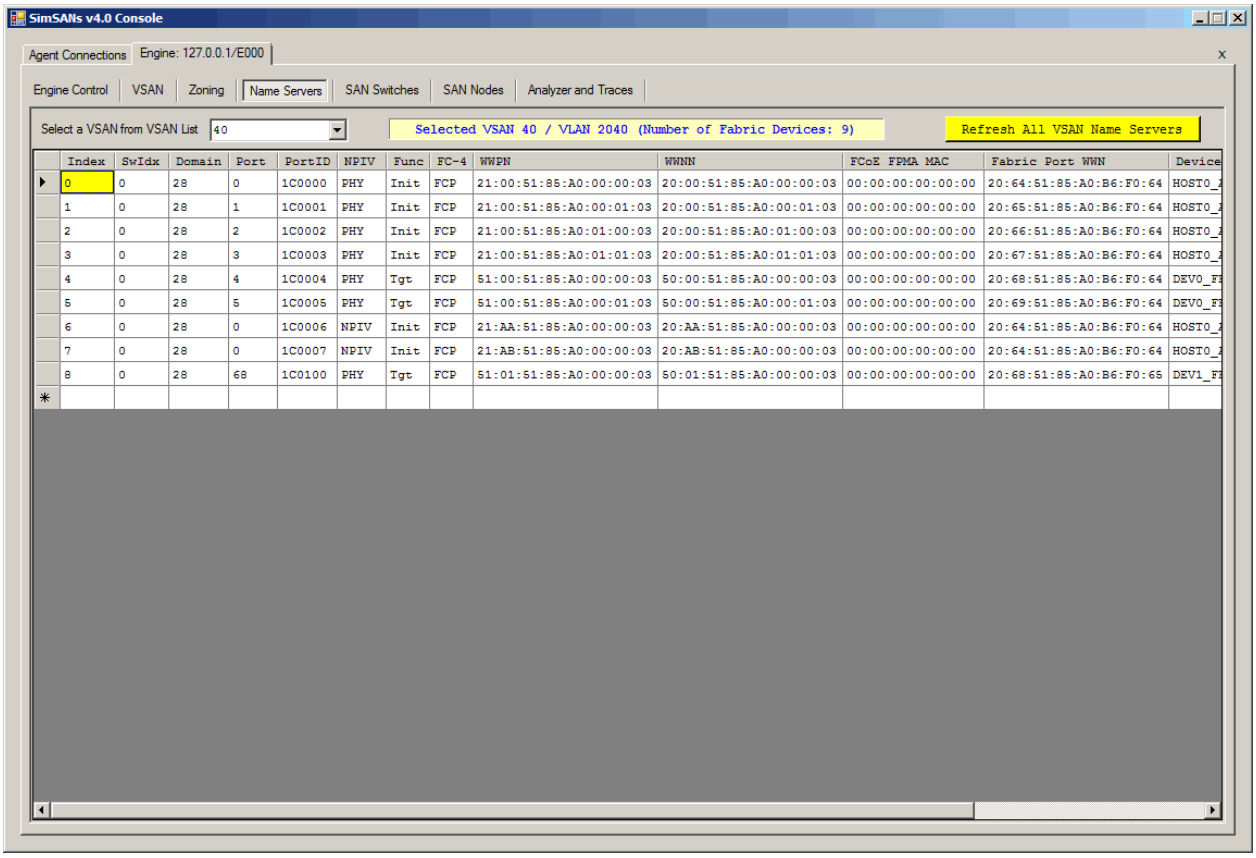
Please select "Zoning" tab from Engine control panel. Default zone is used which put all available node ports into the same big zone, even though they may belong to different VSANs.

Note: IVR (Inter-VSAN Routing) is not implemented in SimSANs so the ports are unable to talk each other if they are not in the same VSAN.



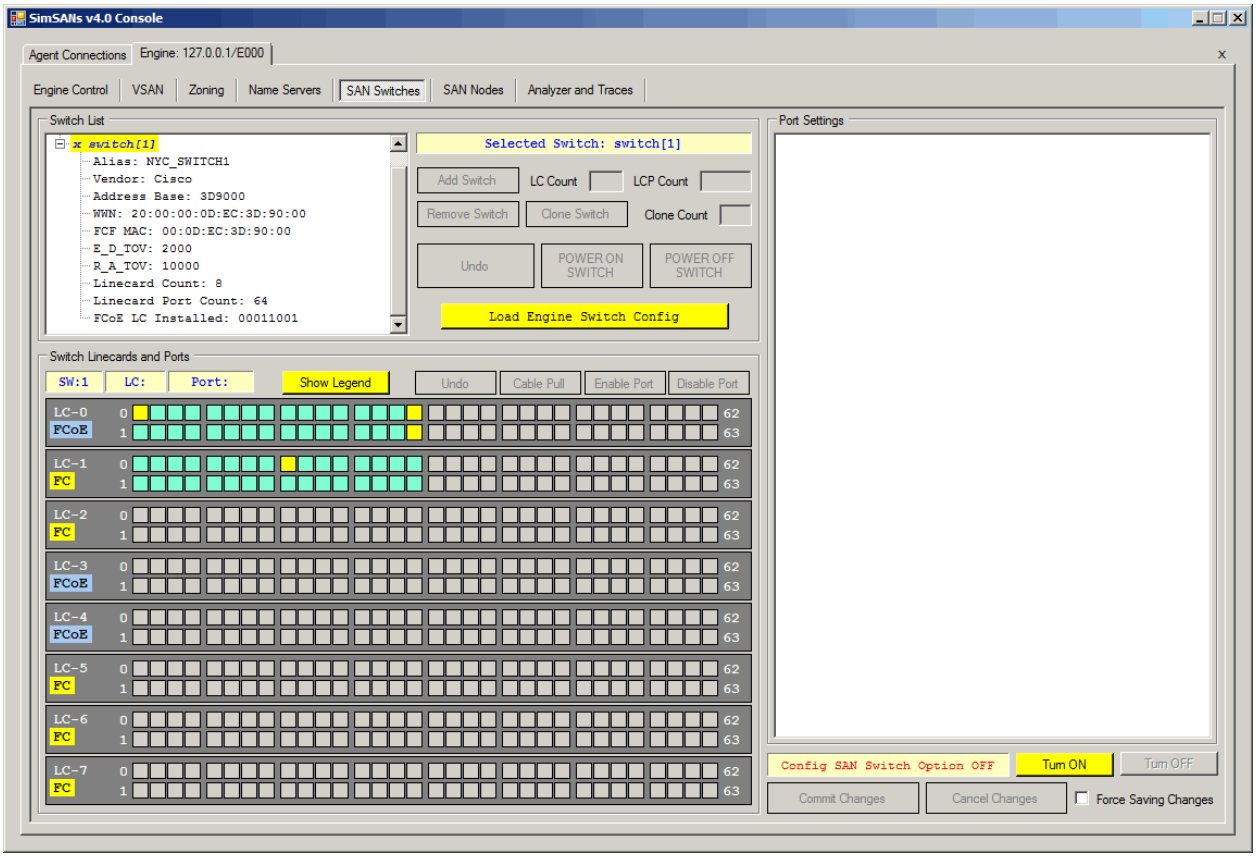
Name Servers Query

Please select "Name Servers" tab from Engine control panel, then click "Refresh All VSAN Name Servers" button. Name server table is collected, one for each VSAN. Simply select a VSAN from VSAN list, then its associated name server table will show up.

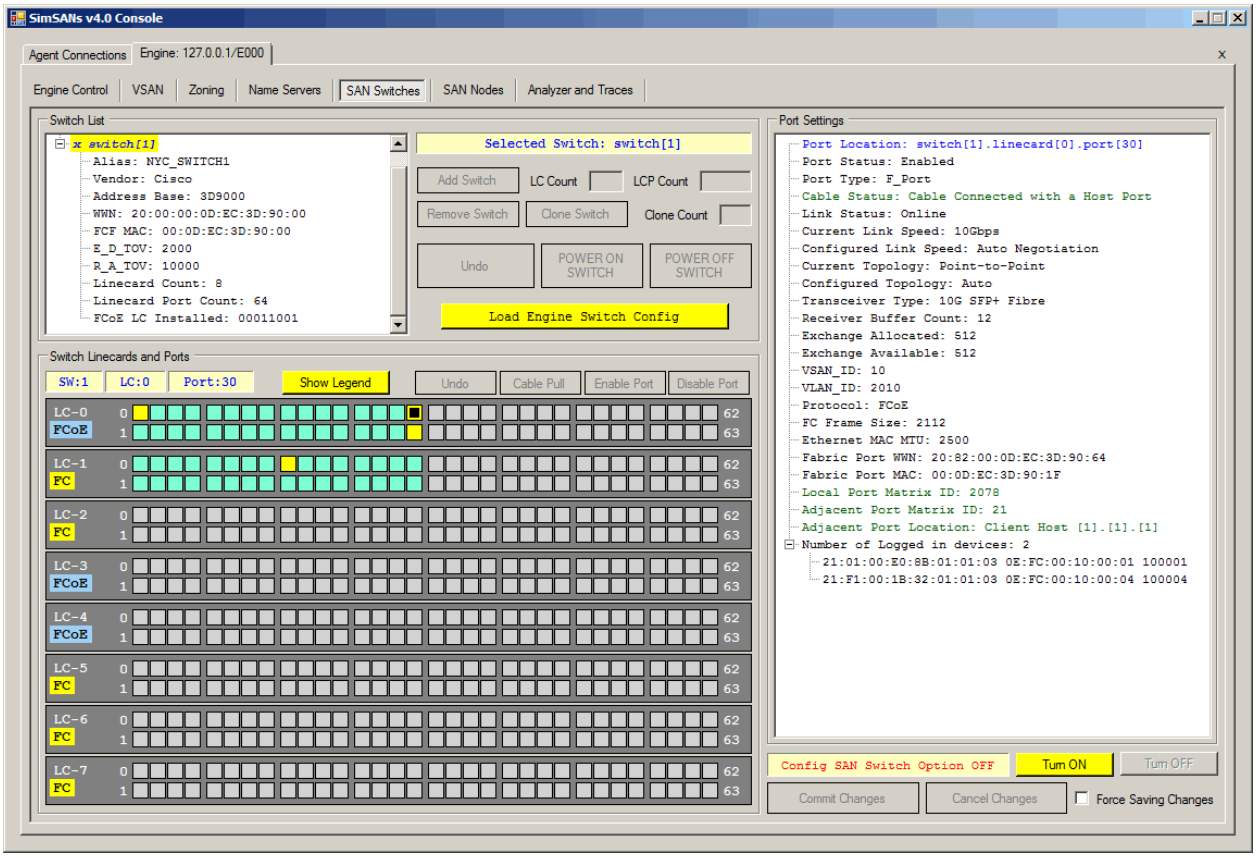


SAN Switch Configurations

Please select "SAN Switches" tab from Engine control panel. Select a switch from the switch list will show up switch information as well as line card port layout.



Click on a port from the line card port layout graph will show up the detailed port information on "Port Settings" panel.



6. Conclusion and Discussion:

The daily activities of SAN administration includes Zoning, Switch configuration, Name server configuration and other management activites

7. Quiz/Viva

- What is zoning?
- What is the use of Name servers?
- What are the different types of switches?

8. References :

1. ULF Troppen, Rainer Erkens and Wolfgang Muller , " Storage Networks Explained: Basic and Applications of Fibre Channel SAN, NAS and ISCSI and Infifniband " , Wiley
2. EMC Educational Services, "Information Storage and Management", wiley India
3. Vaishali Kahirnar, Nilima Dongre" Storage Network Management and Retrieval", Wiley
4. Robert Spalding, " Storage Networks: The Complete Reference", Tata McGraw Hill
5. http://www.simsans.org

Storage Network Management and Retrieval

Experiment No. : 7

To study SAN node configurations, analyser and Traces

Experiment No. 7

1. Aim: To Study SAN node configuration, analyser and traces in SimSANs tool

2. What will you learn by performing this experiment?

After performing this experiment we will learn how to configure the SAN node and trace different protocol

3. Hardware/Software Required:

2GB RAM,320 GB hard, dual core processor SimSANs simulator.

- Microsoft Windows 7, Windows 2003/R2, Windows 2008/R2, both 32-bit and 64-bit
- Microsoft .NET Framework 3.5 SP1: dotnetfx35setup.exe
- Microsoft Chart Controls for .NET 3.5 SP1: MSChart.exe
- For Windows 2008: .NET 3.5 SP1 (aka .NET 3.5.1) is a feature, which can be added from "Server Manager".

4. Theory:

SimSANs, Simulating Storage Area Networks, is a Data Center Storage Networking design and simulation tool. It is especially useful in infrastructure design and performance analysis of SCSI over Fibre Channel and FCoE based data center storage networks. The latest SimSANs version is **4.0**.

SAN Node Configurations

The FC or FCoE port functioning as SCSI initiator or SCSI target is a node port(N_Port). The entity holding node port is a node entity, which usually is client host (initiator) or storage device (target) in a normal SAN environment.

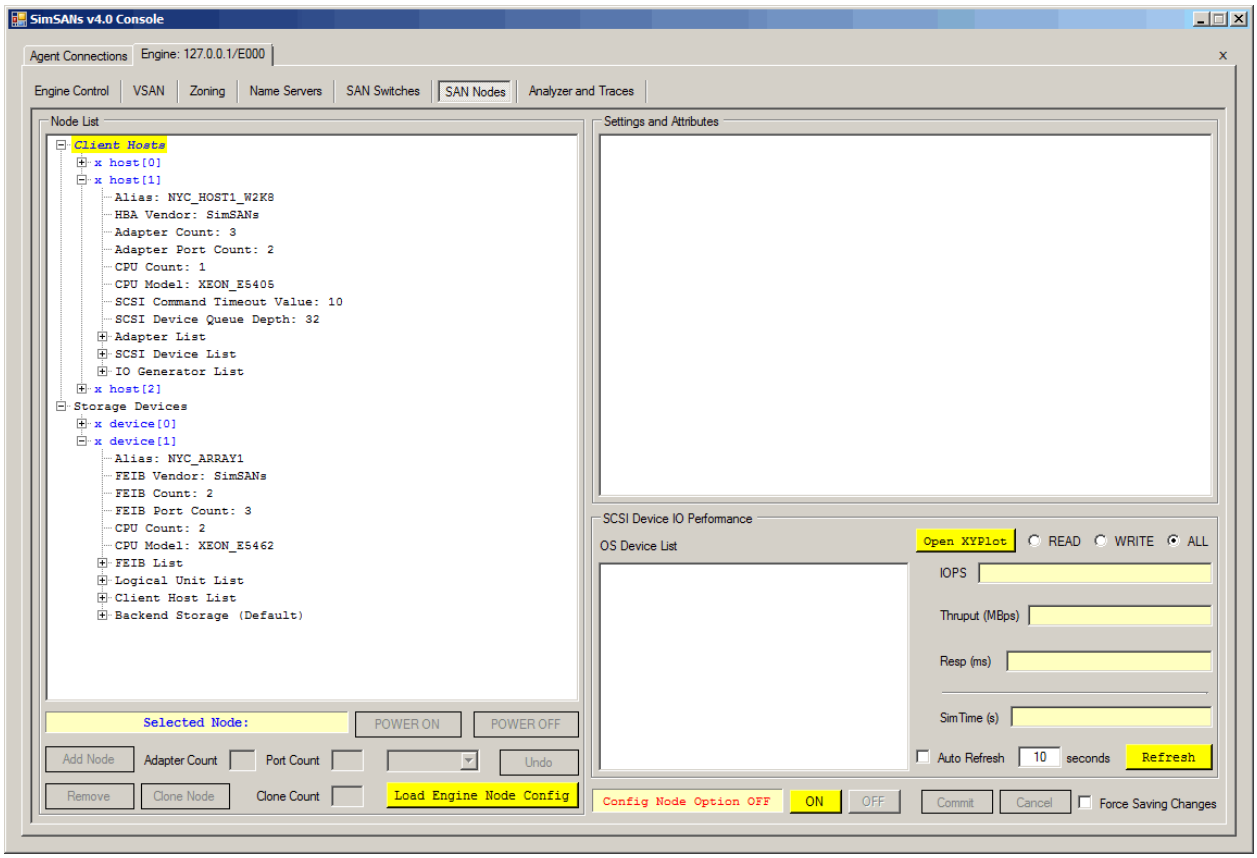
Analyzer and Traces

The real-world FC/FCoE protocol analyzer, such like Finisar (now JDSU) **Xgig**or **Wireshark**, is simulated here to tracing protocol level FC, FCoE, and FIP frames, though the actual trace control capability is much more simplified than the real-world ones, for example, only one port can be traced at one time.

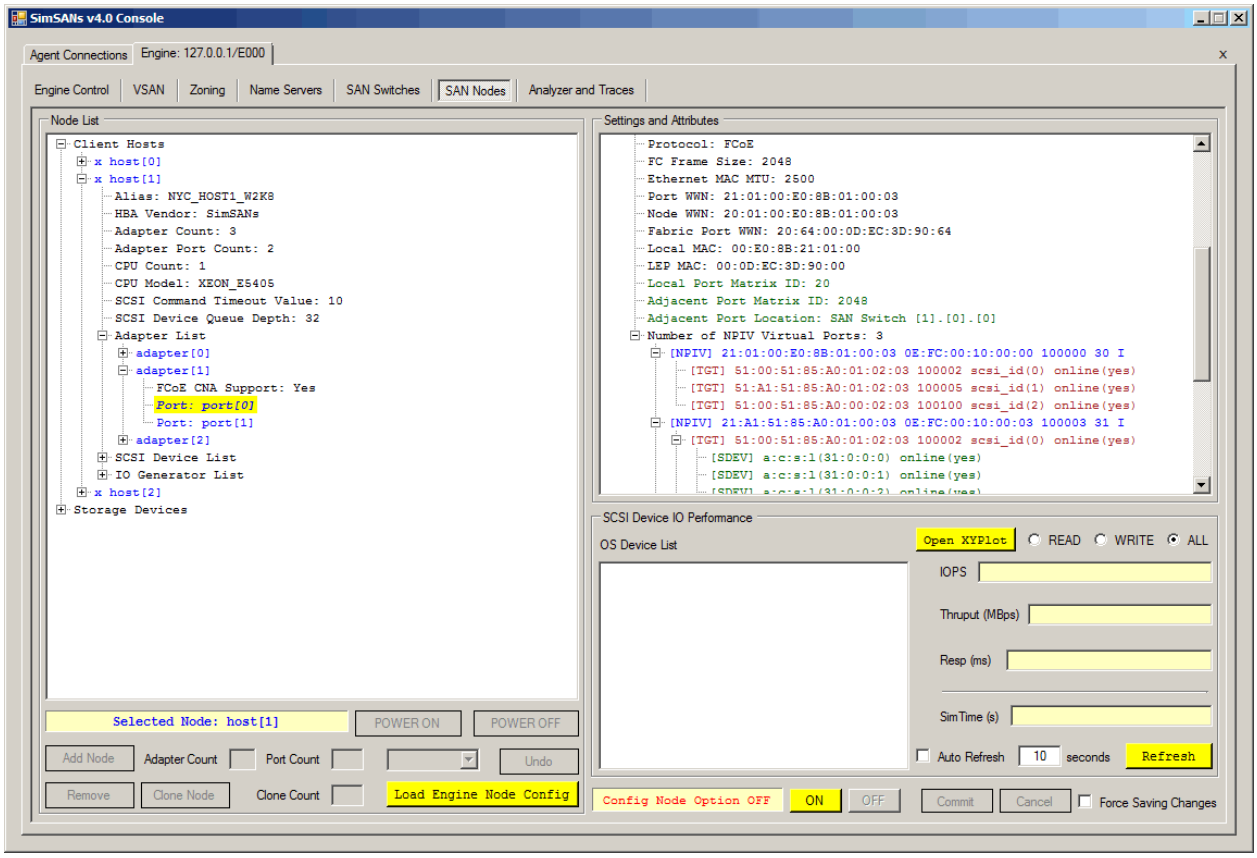
4. Procedure

SAN Node Configurations

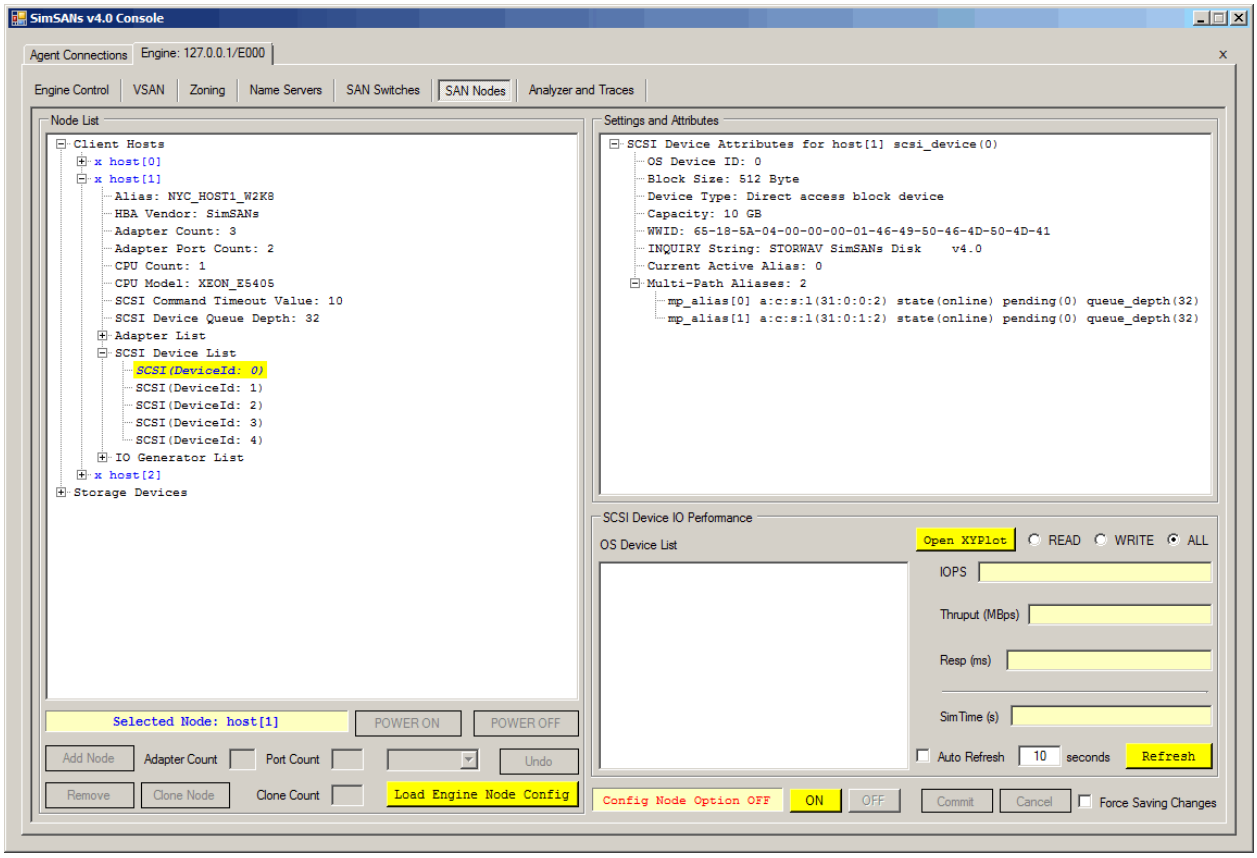
Please select "SAN Nodes" tab from Engine control panel then you should be able to get a client host list and a storage device list. Select a host will show up host information including host HBA list, SCSI device list, and IO generator list. Select a device will show up device information including FEIB (**F**ront **E**nd **I**nterface **B**lade) list, logical unit list, client list, and backend storage setup.



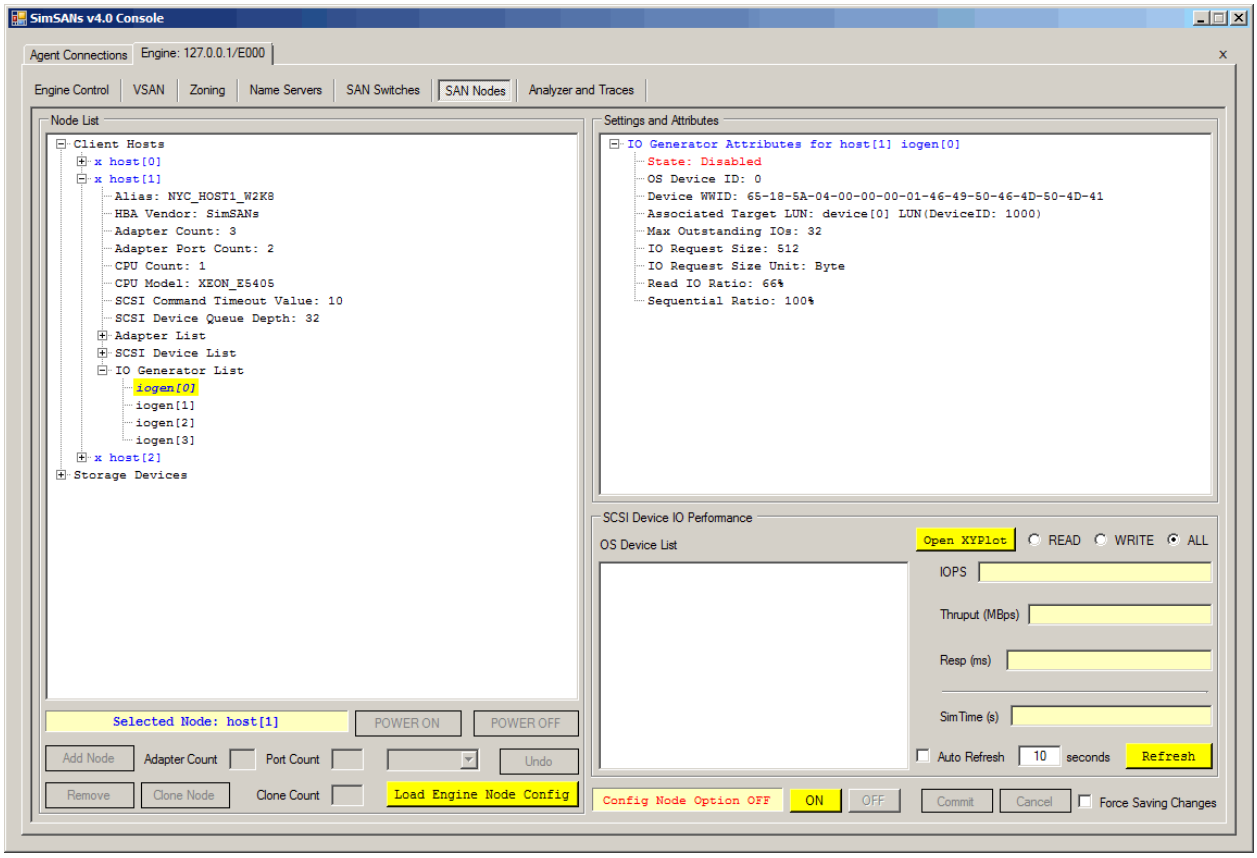
- (Host) Adapter List: Select an HBA from the adapter list will show up the FCoE CNA support as well as the port list. Select a port from port list shows the detailed port configurations in "Settings and Attributes" panel. Particularly, the LUNs discovered from remote target controllers for each NPIV port also show up there.



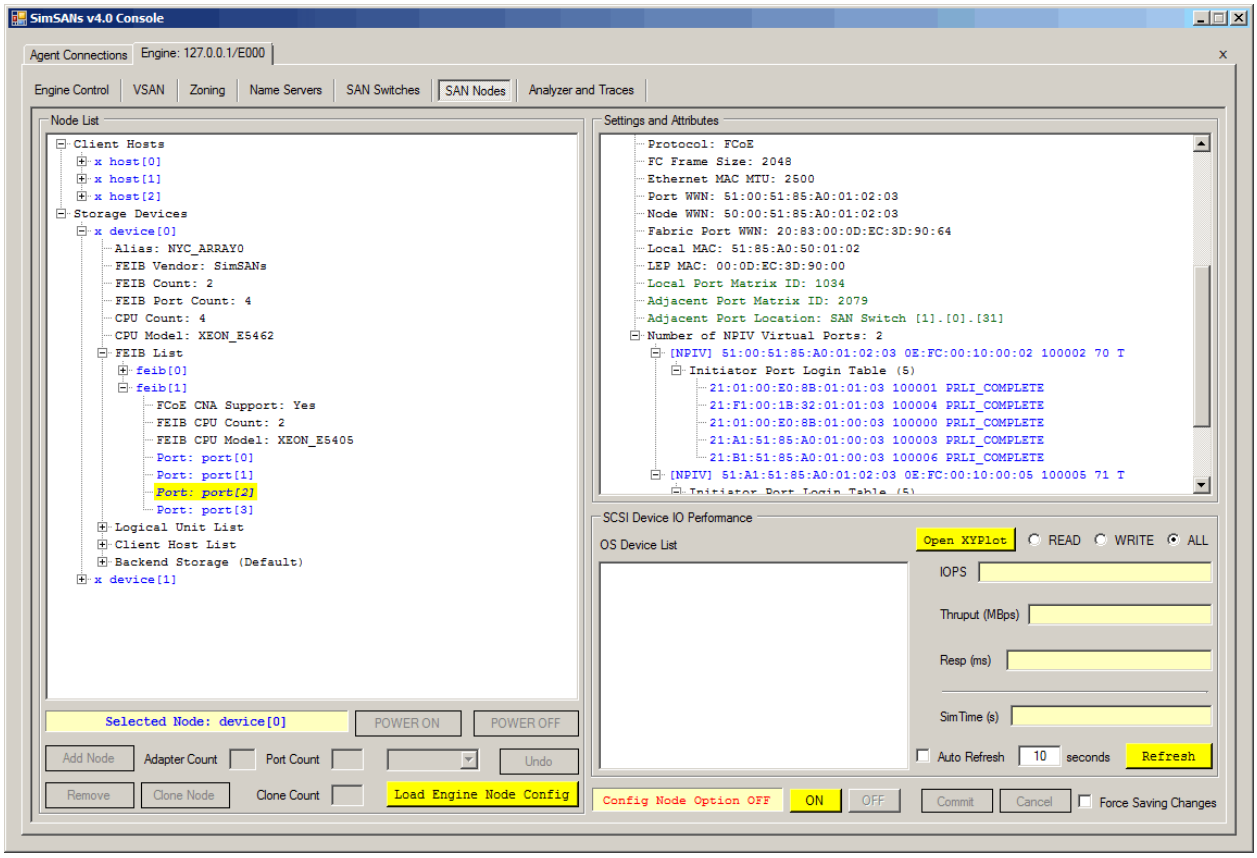
- (Host) SCSI Device List: All SCSI devices discovered in this host show up here, each of which get a SCSI ID assigned, starting from zero. Select any SCSI device will show detailed device information in "Settings and Attributes" panel, including multi-path information.



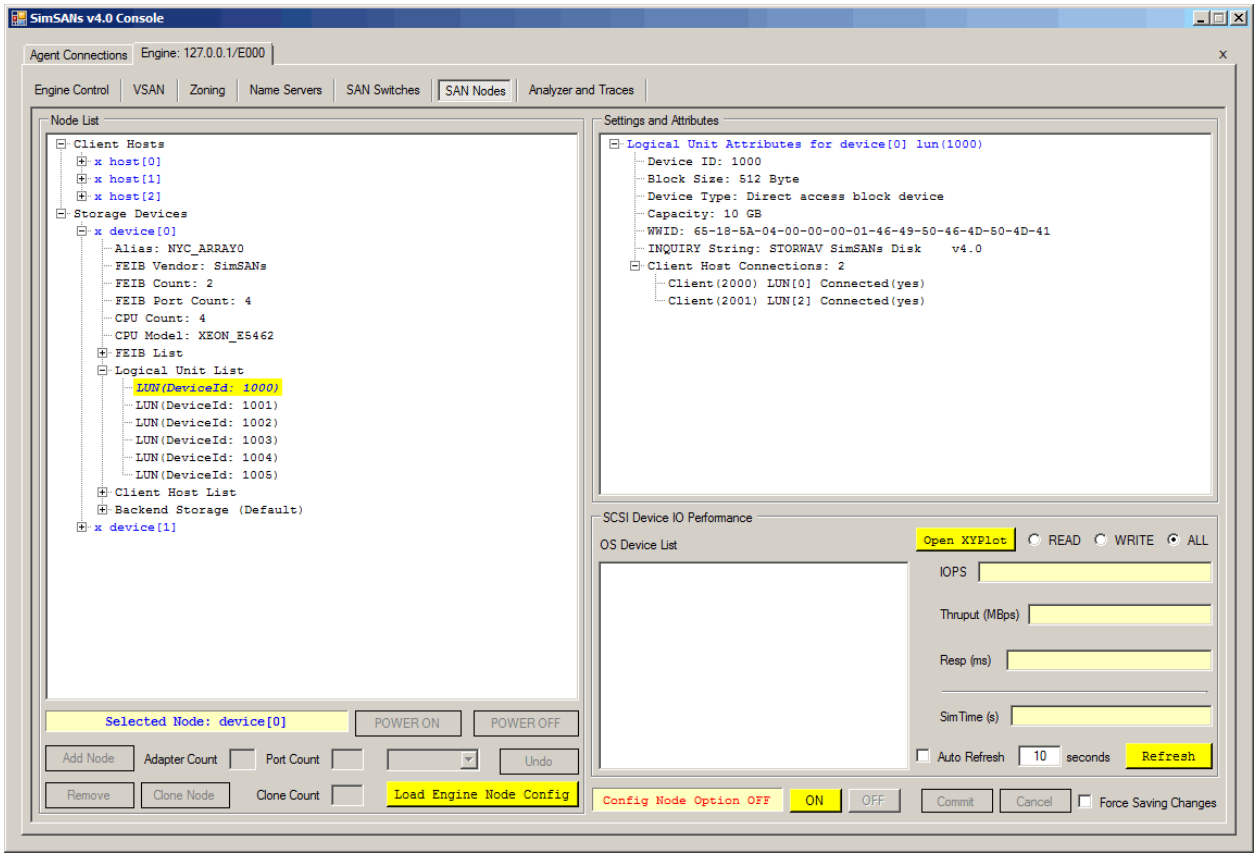
- (Host) IO Generator List: All IO generators configured for this host show up here. Select any IO generator will show detailed configuration information in "Settings and Attributes" panel.



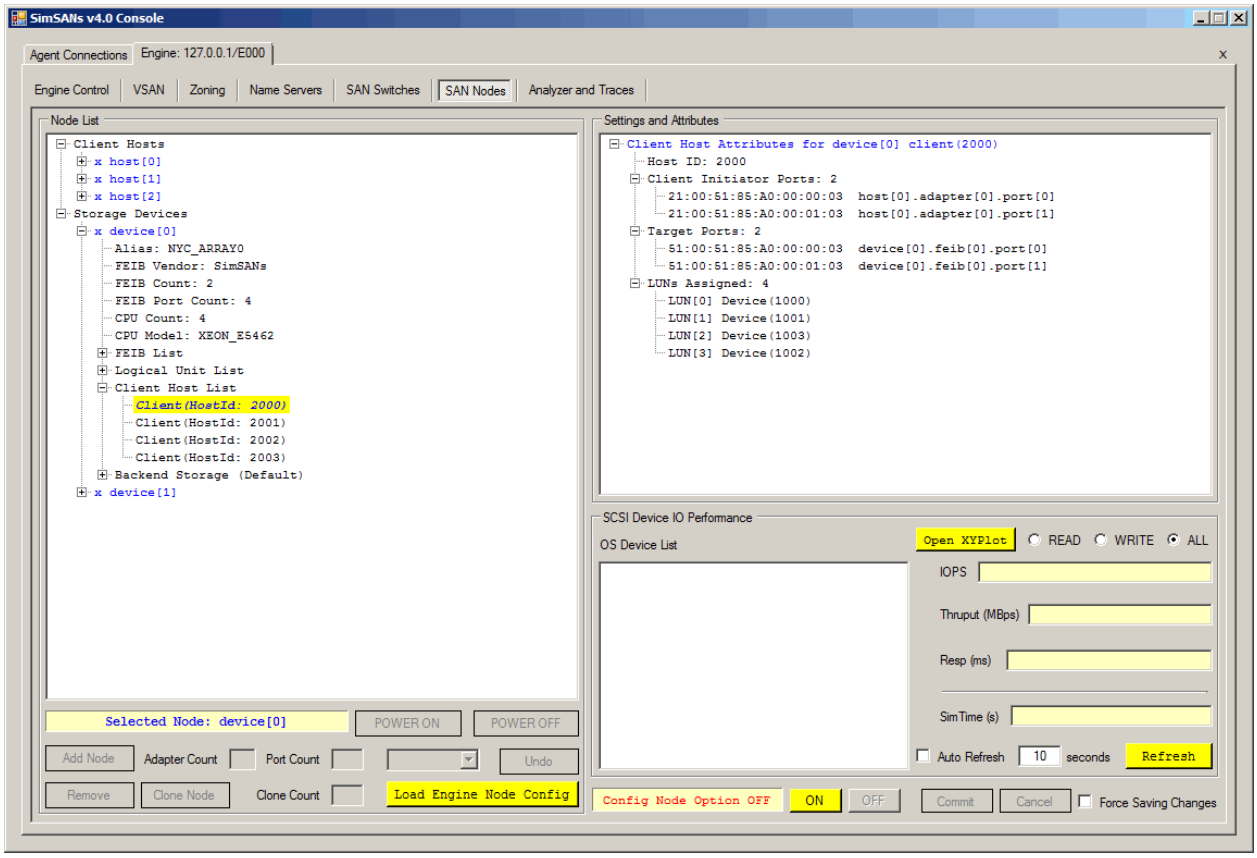
- (Device) FEIB List: Similar to Host HBA List except that in the port configuration, each NPIV port (the target port) shows up an initiator login table telling which initiators are currently logged in.



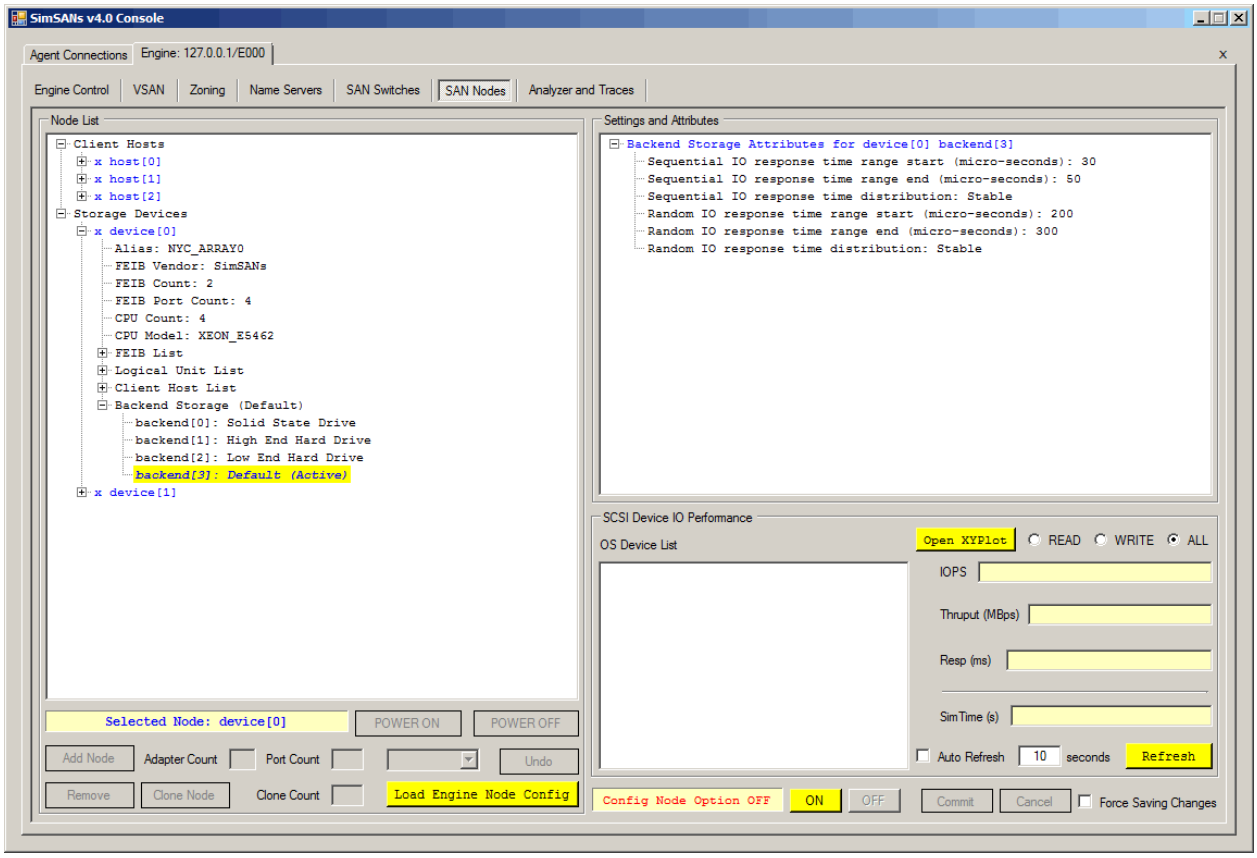
- (Device) Logical Unit List: All logical units configured in this device show up here, each of which get a Device ID assigned, starting from 1000. Select any LU will show detailed device information in "Settings and Attributes" panel, including LUN connections from client host.



- (Device) Client Host List: This is the place where client LUN assignment get setup. Each client get a unique Host ID assigned, starting from 2000. Simply select a client will show detailed assignment information in "Settings and Attributes" panel, which including the assignment of client initiators, storage targets, and LUNs.

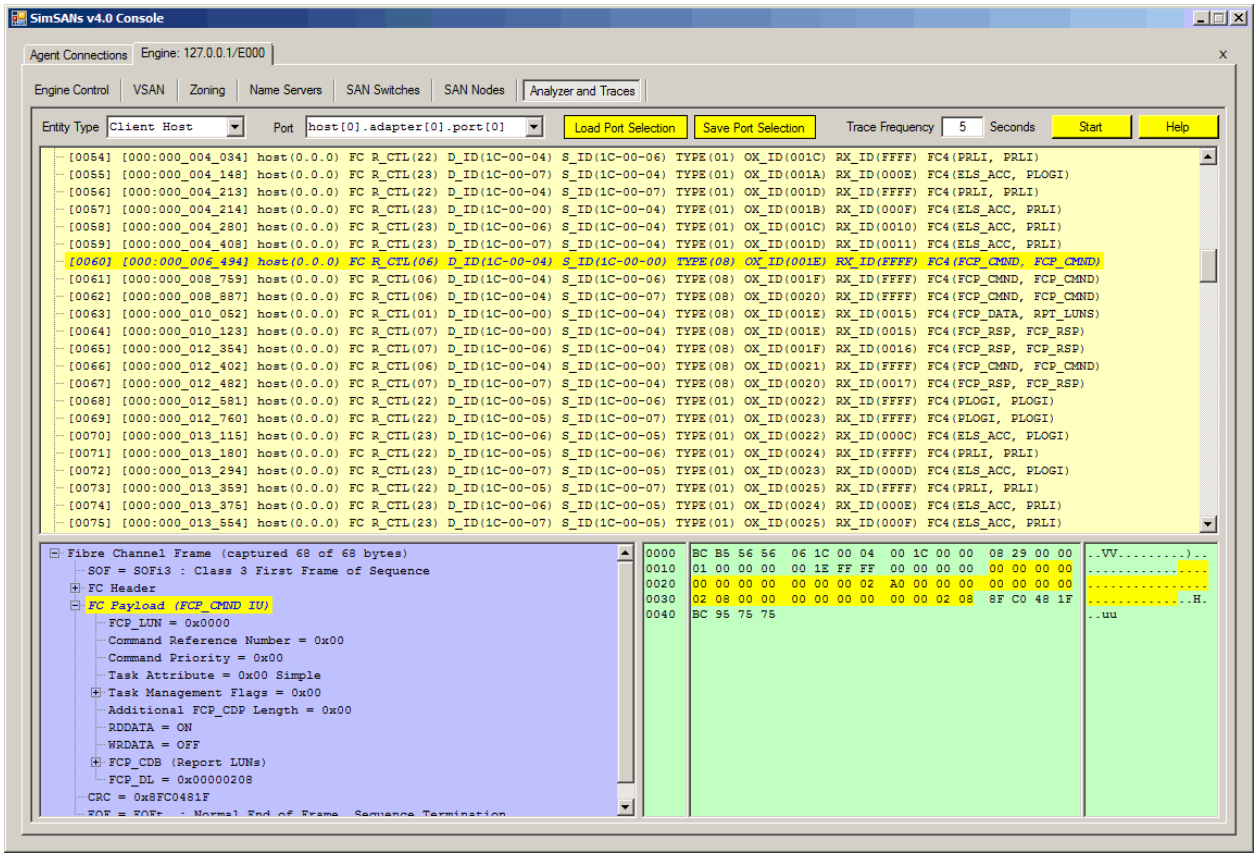


- (Device) Backend Storage: This is the list of backend storage available to select. The one marked "Active" is what currently being used. Select any of it shows its associated IO response time cost in "Settings and Attributes" panel.



Analyzer and Traces

Simply go to "Analyzer and Traces" tab from Engine control panel, select the port you want to trace, then click "Start" button to begin tracing.



6. Conclusion and Discussion:

The SAN node can be configured as SCSI initiator or SCSI target. Similarly the traces of the various kinds of frames are found.

7. Quiz/Viva

- What are various SAN node ports?
- What are FC/FCoE protocols?
- What is the use analyzer and tracer?

8. References :

1. ULF Troppen, Rainer Erkens and Wolfgang Muller , " Storage Networks Explained: Basic and Applications of Fibre Channel SAN, NAS and ISCSI and Infifniband " , Wiley
2. EMC Educational Services, "Information Storage and Management", wiley India
3. Vaishali Kahirnar, Nilima Dongre" Storage Network Management and Retrieval", Wiley
4. Robert Spalding, " Storage Networks: The Complete Reference", Tata McGraw Hill
5. http://www.simsans.org

Storage Network Management and Retrieval

Experiment No. : 8

To study online and offline engine configuration

Experiment No. 8

1. Aim: To Study online and offline engine configuration

2. What will you learn by performing this experiment?

After performing this experiment we will learn how to configure the engine offline and online dynamically.

3. Hardware/Software Required:

2GB RAM,320 GB hard, dual core processor SimSANs simulator.

- Microsoft Windows 7, Windows 2003/R2, Windows 2008/R2, both 32-bit and 64-bit
- Microsoft .NET Framework 3.5 SP1: dotnetfx35setup.exe
- Microsoft Chart Controls for .NET 3.5 SP1: MSChart.exe
- For Windows 2008: .NET 3.5 SP1 (aka .NET 3.5.1) is a feature, which can be added from "Server Manager".

5. Theory:

SimSANs, Simulating Storage Area Networks, is a Data Center Storage Networking design and simulation tool. It is especially useful in infrastructure design and performance analysis of SCSI over Fibre Channel and FCoE based data center storage networks. The latest SimSANs version is **4.0**.

5. Procedure

Online Engine Configurations

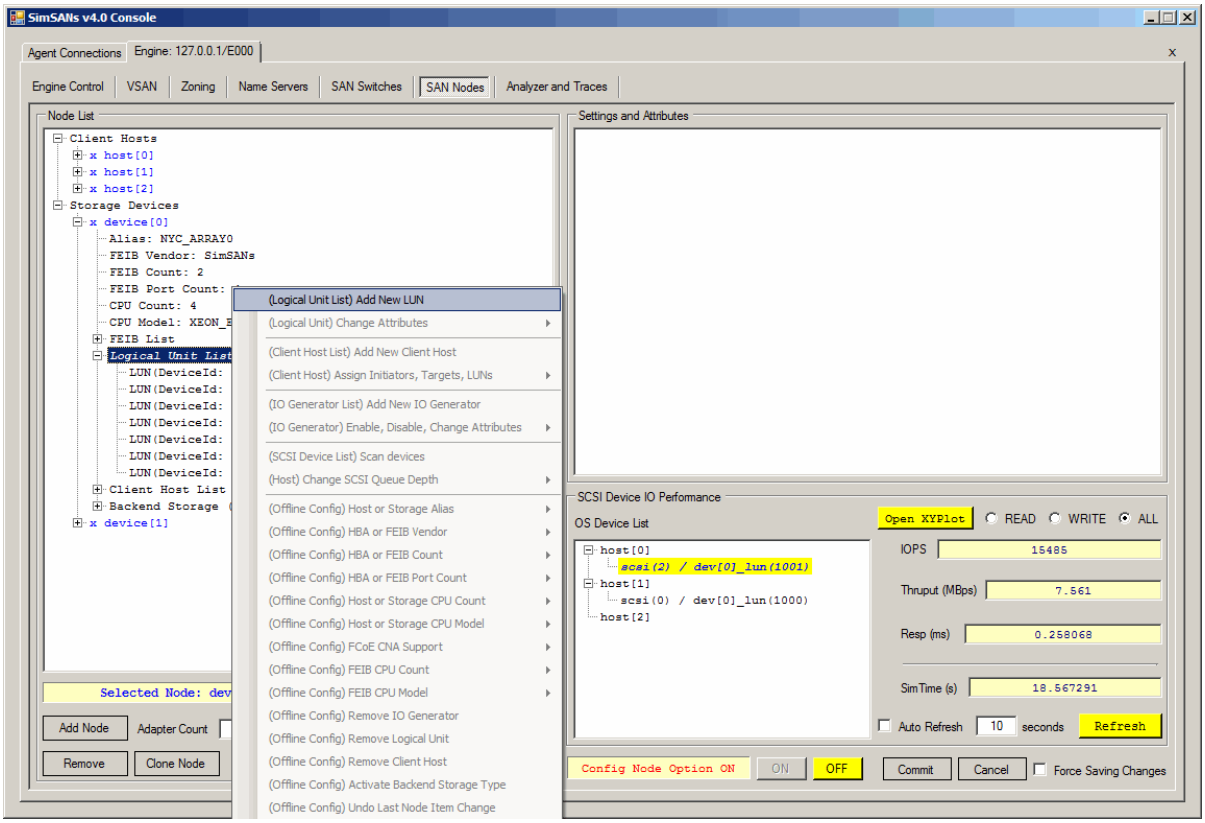
In SimSANs v4, we're able to run some dynamic configurations while Engine is running. Previously in v3, Engine configurations must be done when Engine is offline.

Note: In current SimSANs v4 build, all available online configurations are related to SAN Node, meaning they are for Client Host or Storage Device.

The following sub-sections show what can be configured online. Before running those configurations, please ensure **Engine is locked** by current Console socket, and "**Config Node Option ON**" is turned on in "**SAN Nodes**" tab.

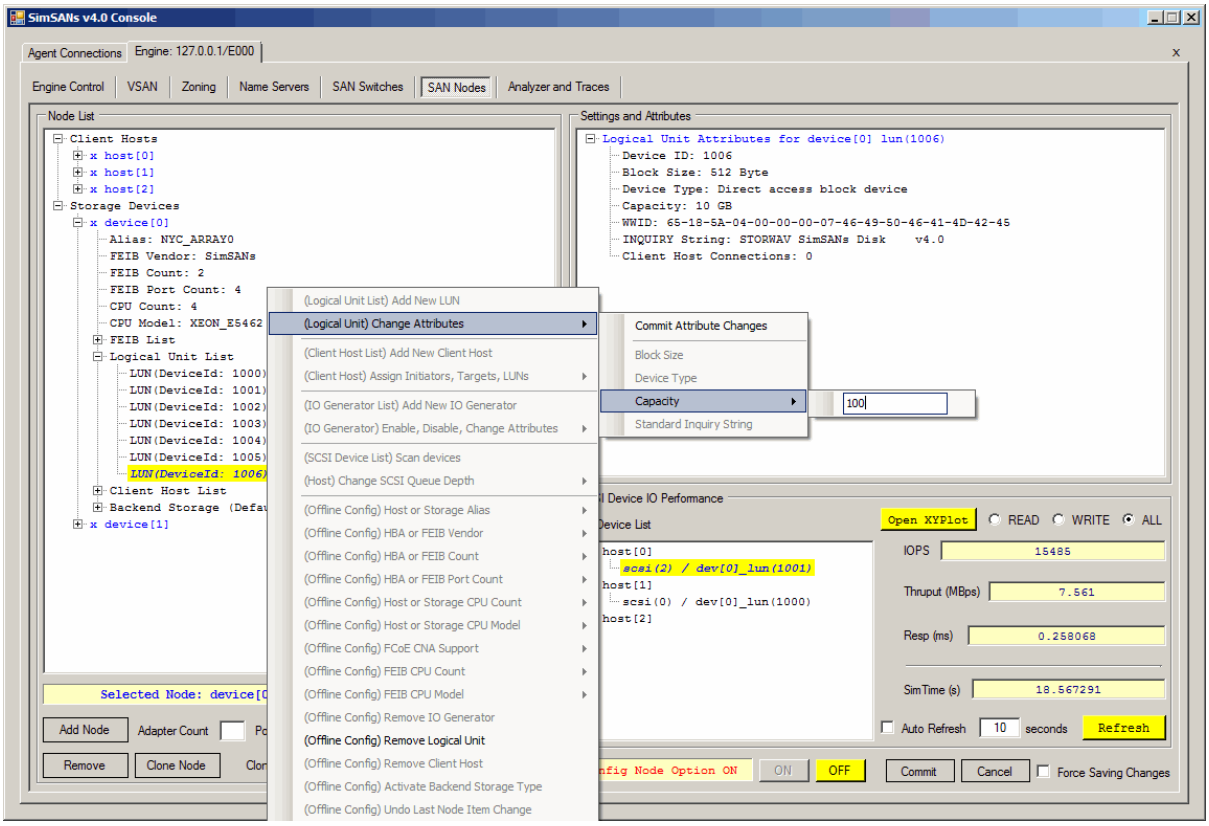
(Storage Device) Add New Logical Unit

Select a device, right-click "Logical Unit List", then you're able to add a new logical unit. The new LUN will show up in the list.



(Storage Device) Change Logical Unit Capacity

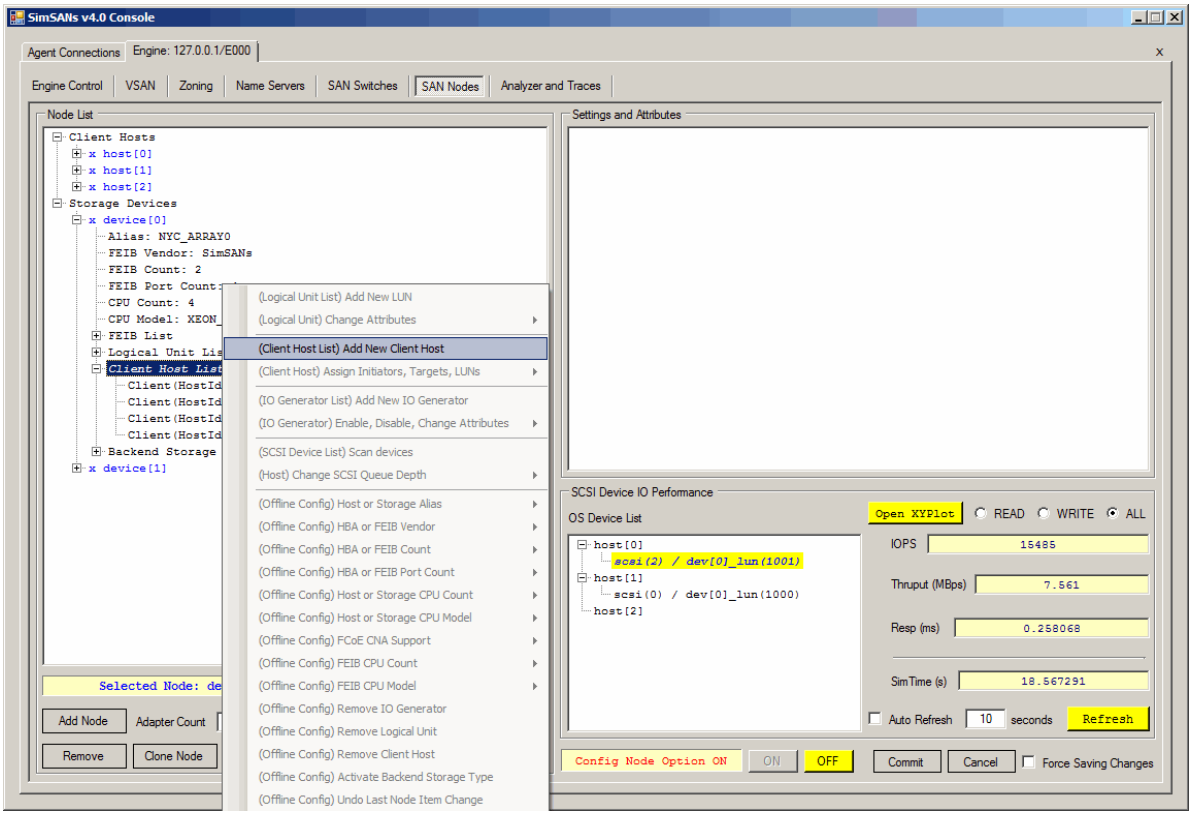
Select a LUN from "Logical Unit List", right-click it, then you're able to set the LUN capacity in the unit of GB.



Note: You cannot set capacity if the LUN is already assigned to a client host.

(Storage Device) Add New Client Host

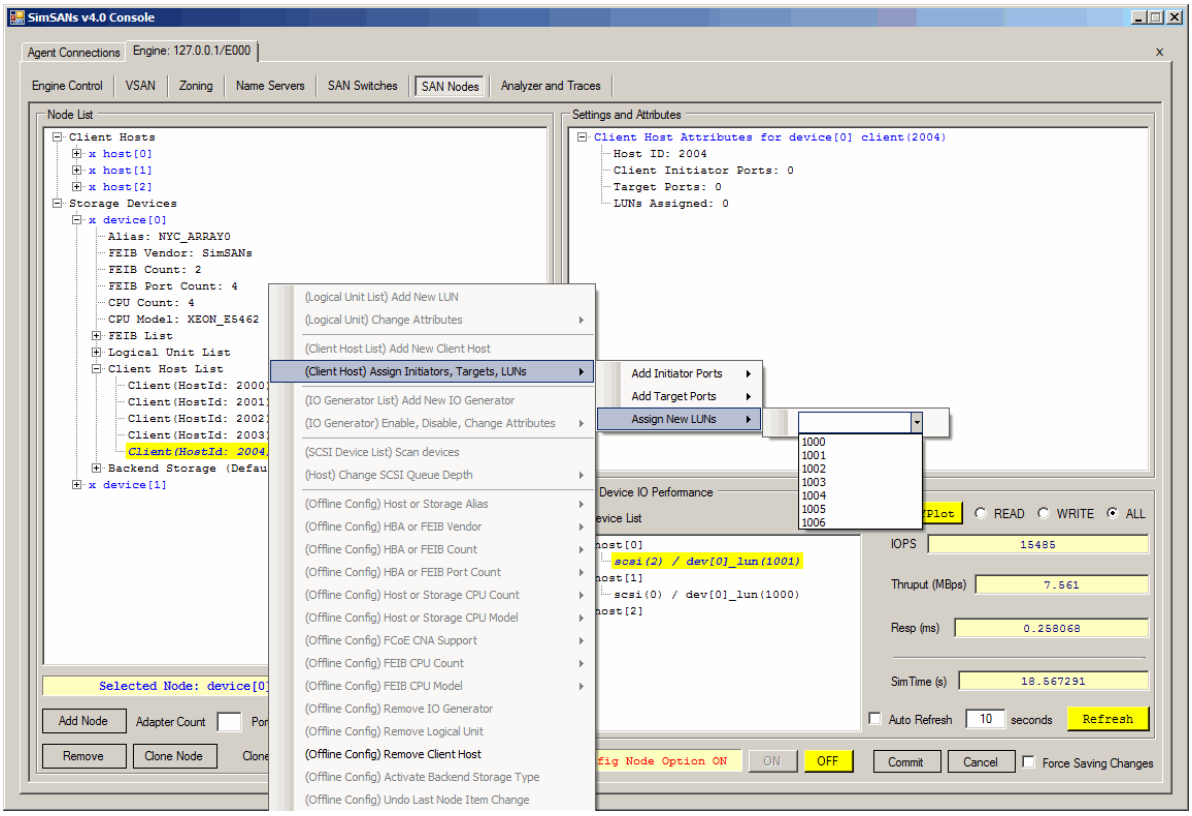
Select a device, right-click "Client Host List", then you're able to add a new client. The new client will show up in the list.



Please noted that the newly created client does not have any initiator, target, or LUN assigned. Refer to section 6.4 for how to assign initiator/target/LUN to client.

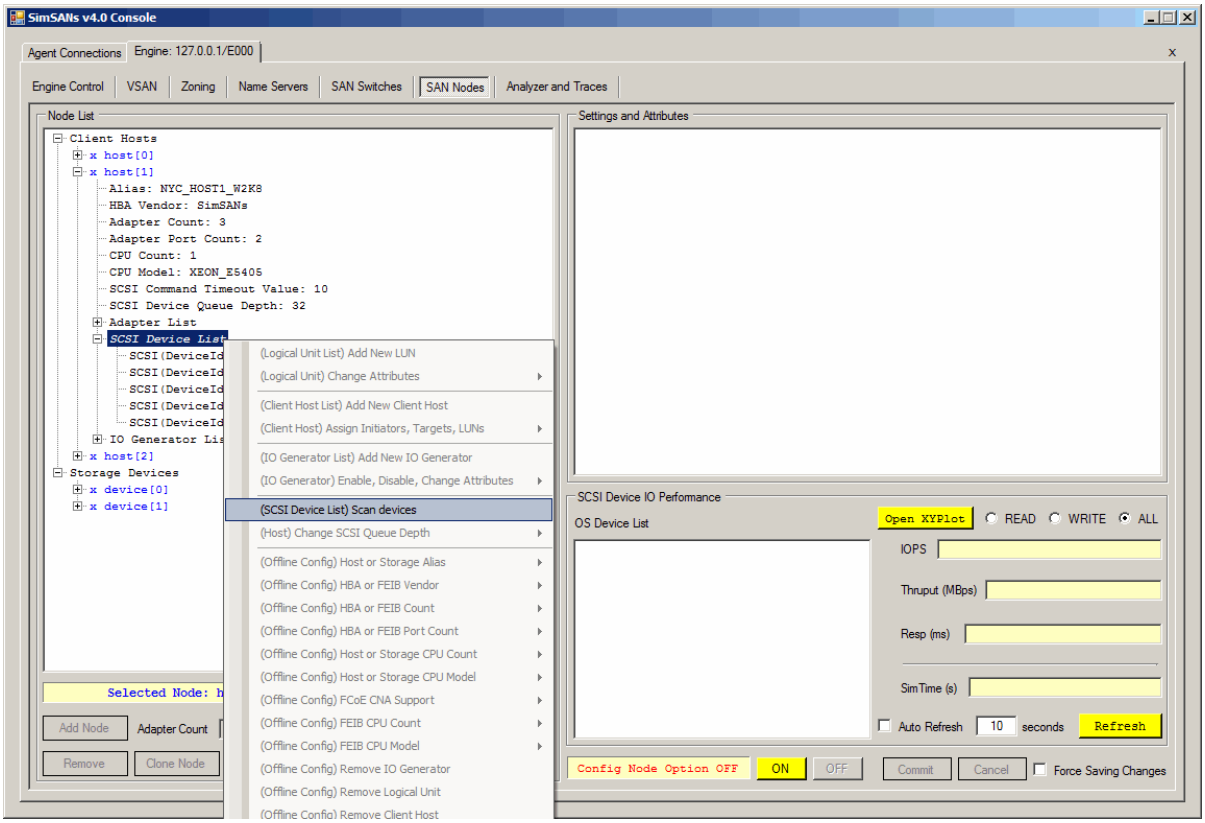
(Storage Device) Assign Initiators, Targets, and LUNs to Client Host

Select a client from "Client Host List", right-click it, then you're able to assign initiator ports, target ports, or LUNs to the client.



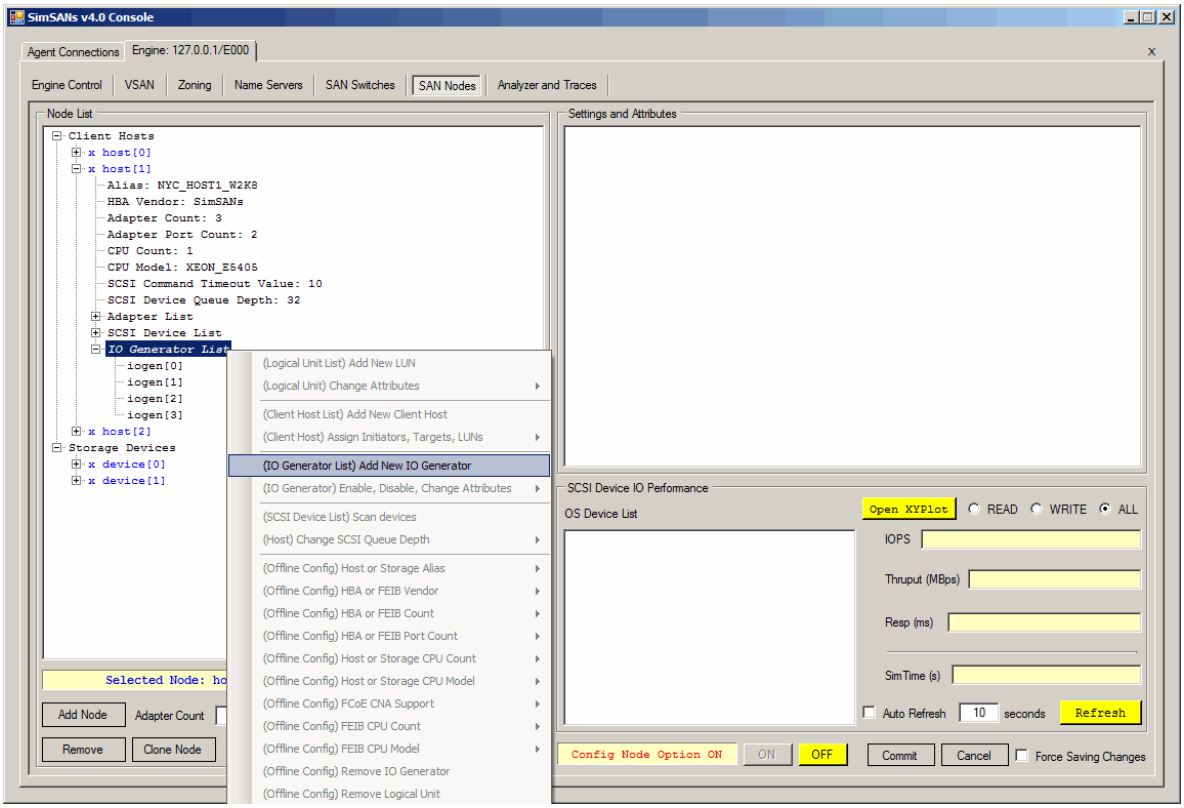
(Client Host) Scan SCSI Devices

Select a host, right-click "SCSI Device List", then you're able to scan out SCSI devices. If a new LUN is assigned from storage device, then the new SCSI device should show up after scanning.



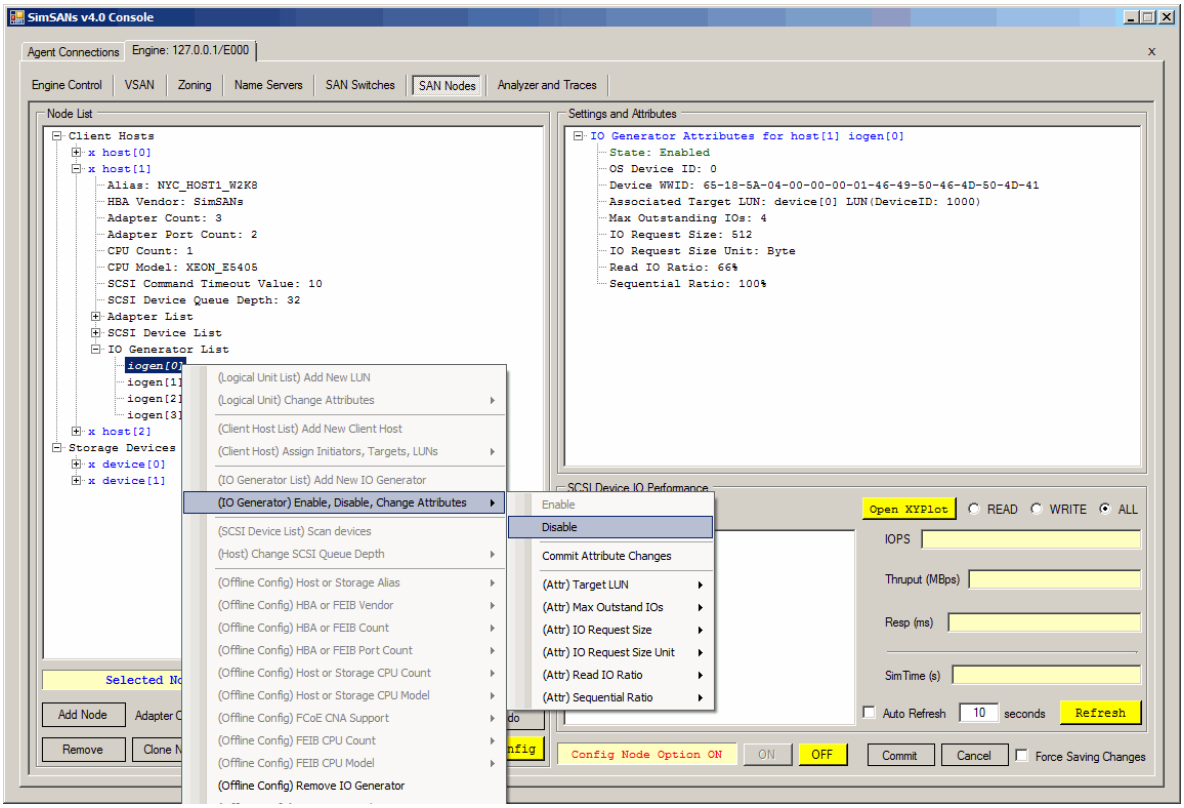
(Client Host) Add New IO Generator

Select a host, right-click "IO Generator List", then you're able to add a new IO generator. See this picture. The newly added IO generator, by default, is disabled. Refer to section 6.7 for how to enable it.



(Client Host) Enable or Disable IO Generator

Select a iogen from "IO Generator List", right-click it, then you're able to enable or disable it on the fly.



Note: If the IO generator is running IO, disable it will stop the IO. If IO Generator is disabled, re-enable it will start the IO.

(Client Host) Change IO Generator Attributes

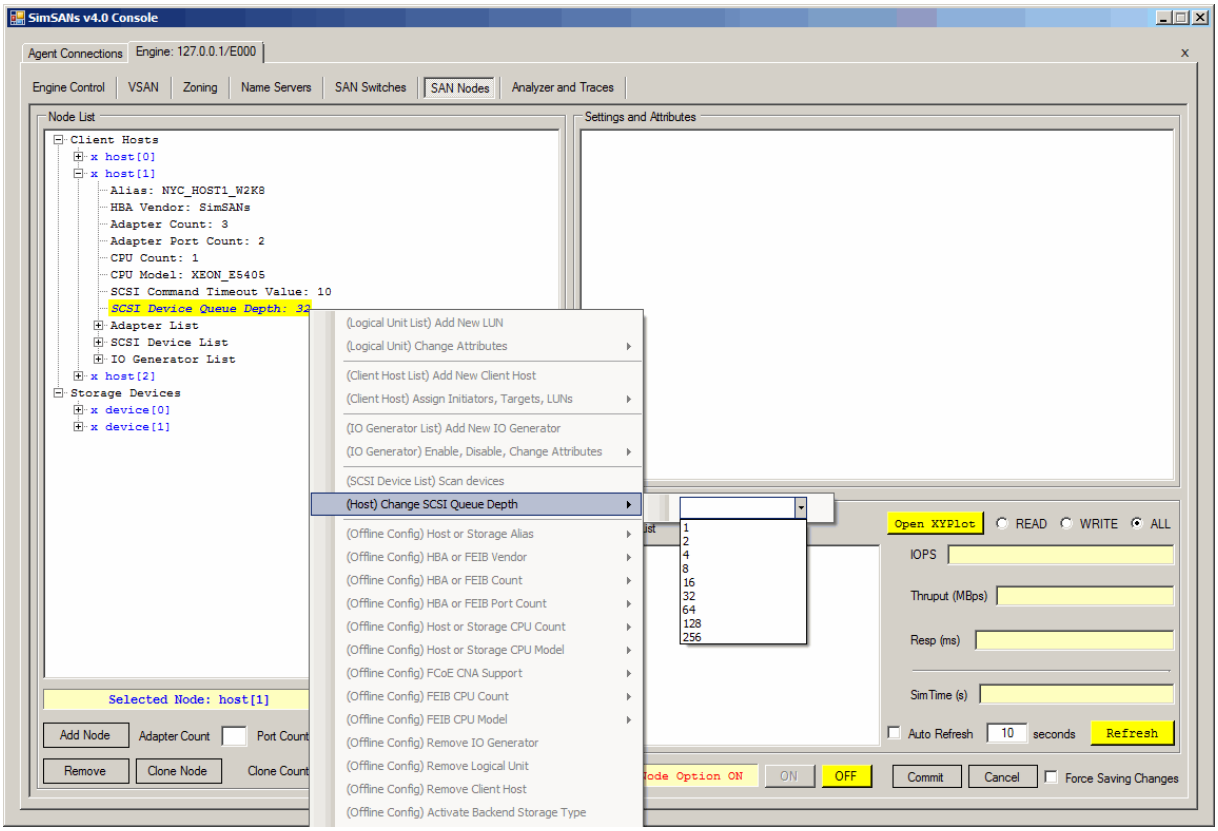
Select a iogen from "IO Generator List", right-click it, then you're able to change its attributes including target LUN, outstanding IO count, IO request size, READ IO ratio, and sequential IO ratio.

Note: "Commit Attribute Changes" has to be selected from the right-click menu to get changes take effect.

(Client Host) Change SCSI Device Queue Depth

Select a host, right-click "SCSI Device Queue Depth", then you're able to change the queue depth for all SCSI devices discovered by this host.

Note: change queue depth may affect IO performance.



(Client Host) Monitor SCSI IO Performance

There's a "SCSI Device IO Performance" panel in "SAN Nodes" tab. It is used to monitoring IO performance data for SCSI devices from host side. The IO performance data includes **IOPS**, **Throughput**, and **IO Response Time**.

Click "Refresh" button to get all active SCSI devices that currently having IO activities. Click "Auto Refresh" check-box will collect performance data periodically. Click "Open XYPlot" will pop up XY Plot Graph. You can combine "Auto Refresh" with "XYPlot" to have a clear picture of real-time IO activities.

6. Conclusion and Discussion:

The engines are dynamically configured online by changing the attributes of the nodes. Also new connections can be added.

7. Quiz/Viva

- What is SCSI initiator and SCSI target?
- How to monitor SCSI IO performance?
- What is the difference between online and offline engine?

8. References :

1. ULF Troppen, Rainer Erkens and Wolfgang Muller , " Storage Networks Explained: Basic and Applications of Fibre Channel SAN, NAS and ISCSI and Infifniband " , Wiley
2. EMC Educational Services, "Information Storage and Management", wiley India
3. Vaishali Kahirnar, Nilima Dongre" Storage Network Management and Retrieval", Wiley
4. Robert Spalding, " Storage Networks: The Complete Reference", Tata McGraw Hill
5. http://www.simsans.org

Storage Network Management and Retrieval

Experiment No. : 9

Create virtual hard disk drive in Windows operating system

Experiment No. 9

1. **Aim:** Create virtual hard disk drive in windows 7 operating system

2. **What will you learn by performing this experiment?**

Creation of virtual hard disk drive which can be used as vault to store file.

3. **Theory**

VHD (Virtual Hard Drive) is a file format which represents a virtual hard disk (HDD). It may contain what is found on a physical HDD such as disk partitions and file system, which I turn can contain files and folders. It is used as the hard disk for a virtual machine.

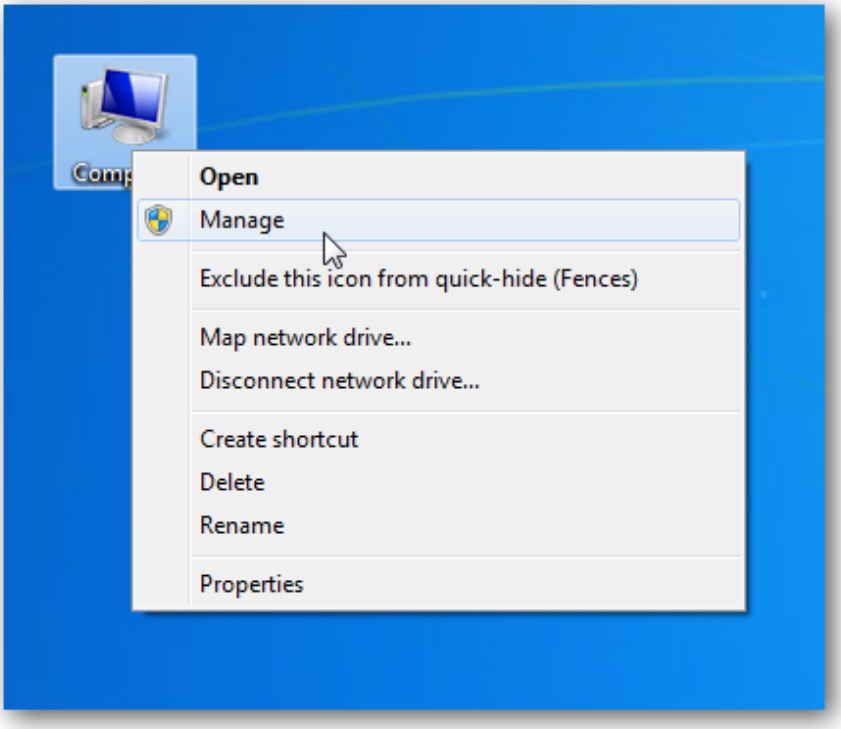
Hard Disk is used to store files, share, or set aside as an encrypted vault. One of the new features in Windows 7 is the ability to create Virtual Hard Disk Drive

4. **Procedure**

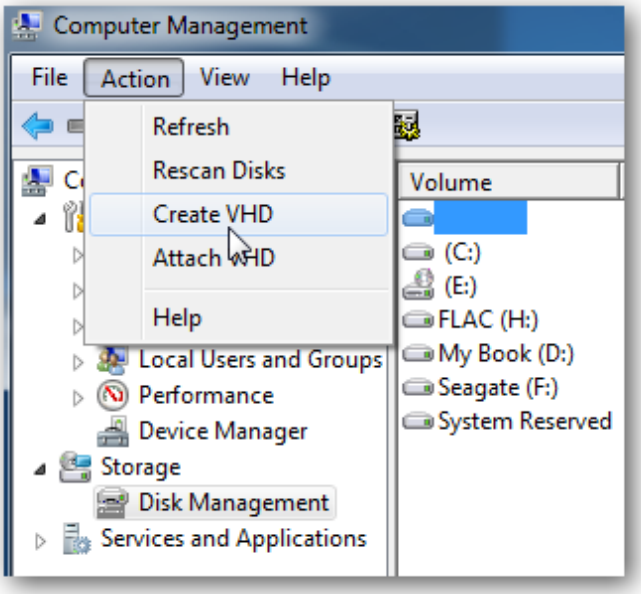
Create a Virtual Drive

VHD minimum size is 3MB.

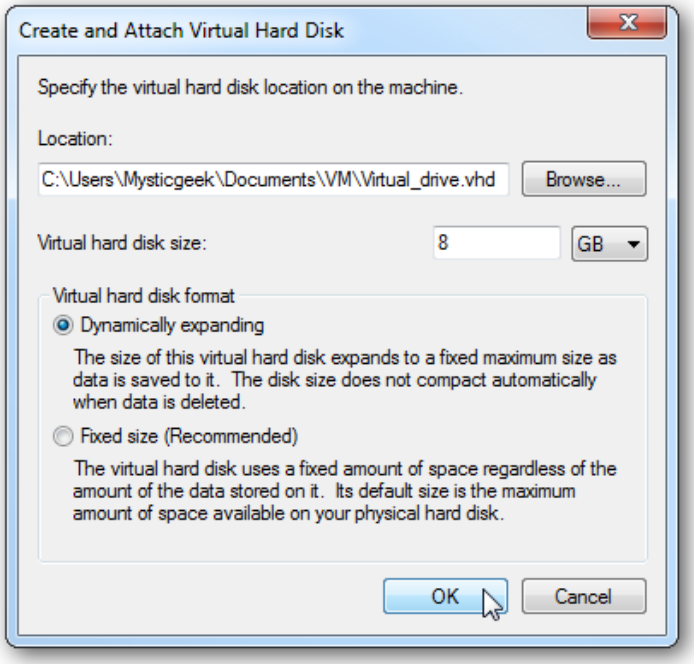
Step 1: Right-click on My Computer and select to Manage.



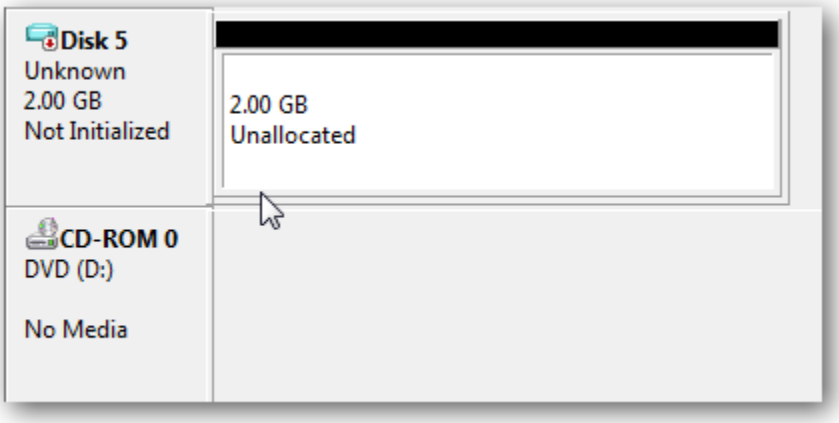
Step 2: The Computer Management screen opens click on Disk Management then Action and Create VHD



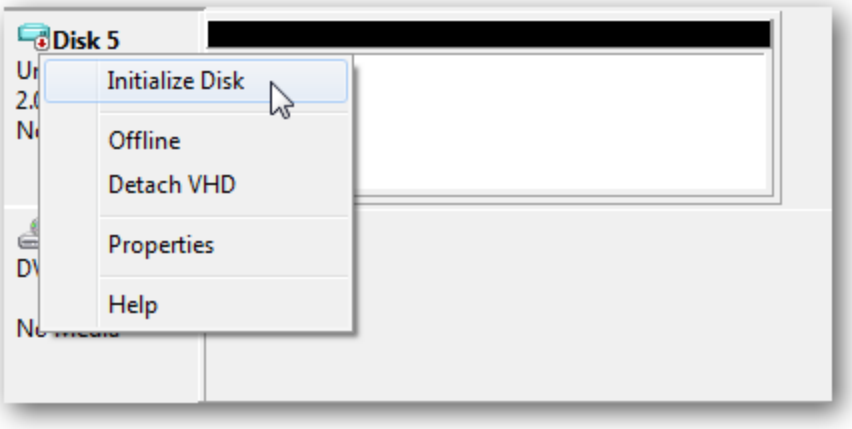
Step 3: Browse to the directory you want the disk to reside, choose the size you want it to be, and select dynamic or a fixed. If you want the disk to expand in size as you add files to it, then pick dynamically expanding. Check Fixed size if you want a specific size and for it to stay that way.



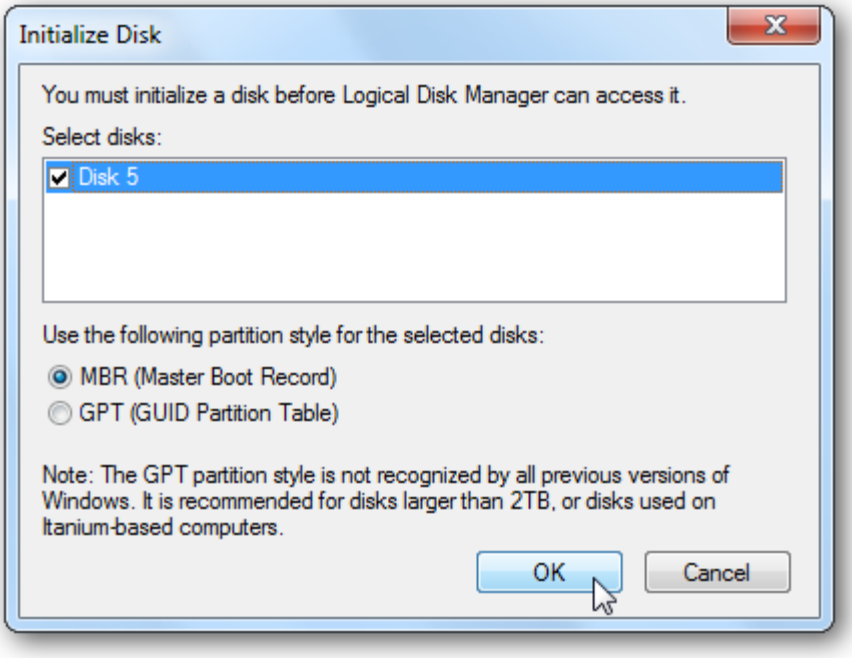
Step 4: In Disk Management you will see the virtual drive listed as unallocated space.



Step 5: To begin using it need to Right-click and select Initialize Disk.

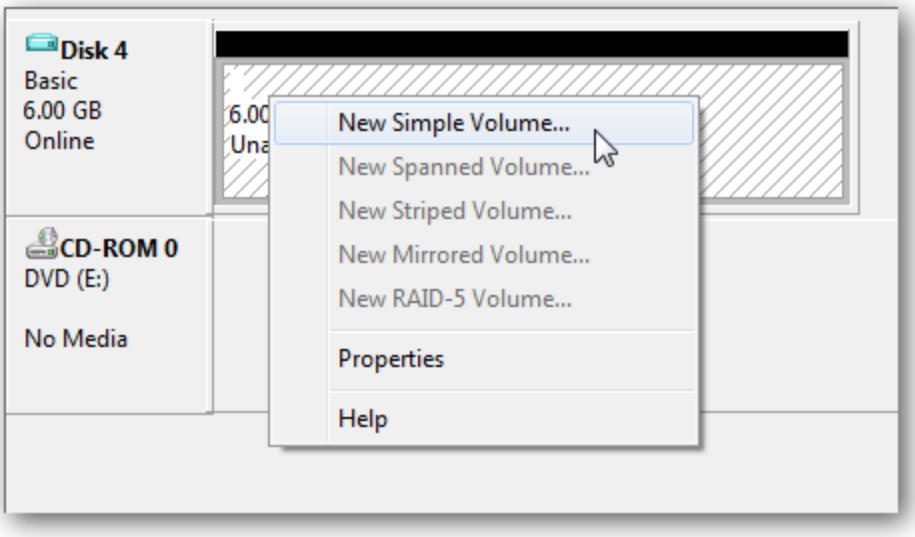


Step 6: In the initialize disk box just keep MBR selected and hit OK.

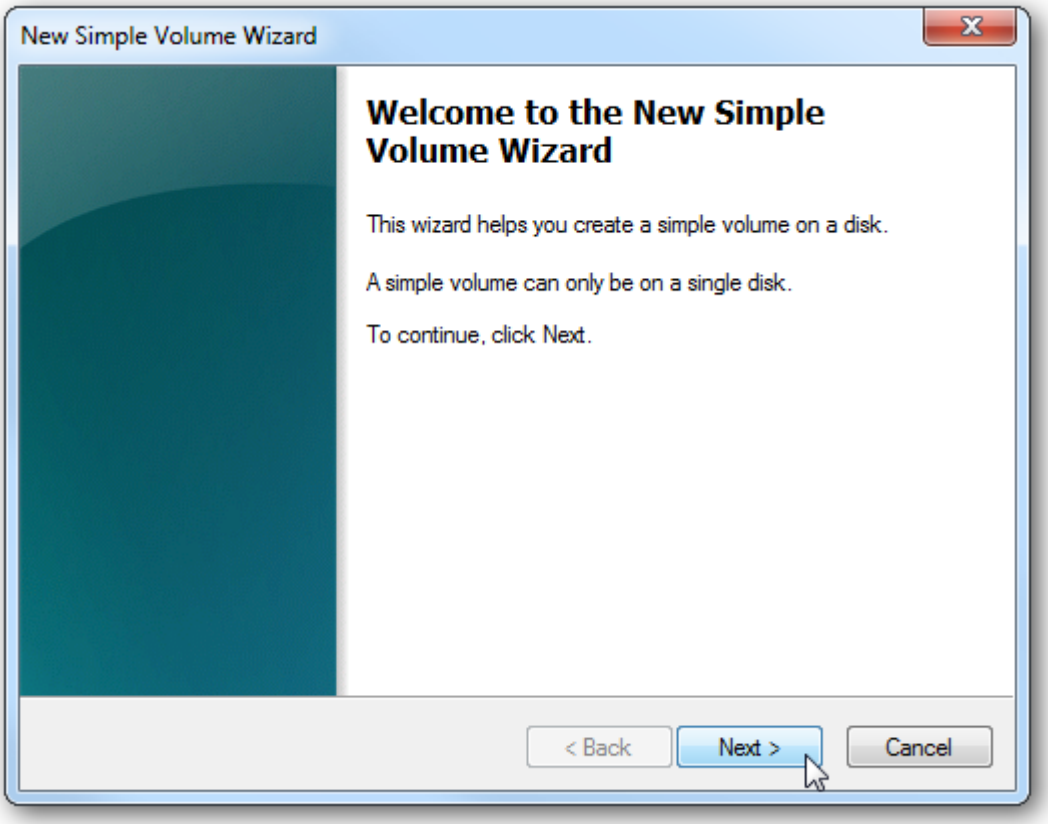


Step 7: **Create a Volume**

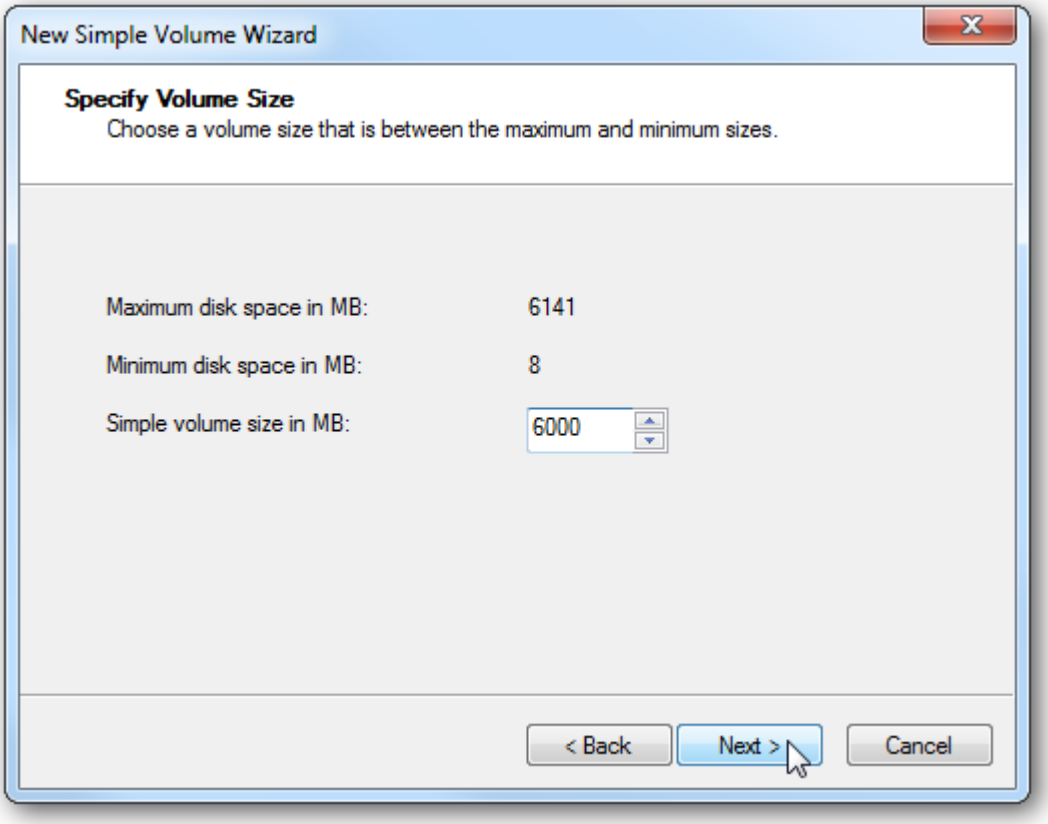
Now create a volume by Right-clicking the unallocated space and select New Simple Volume.



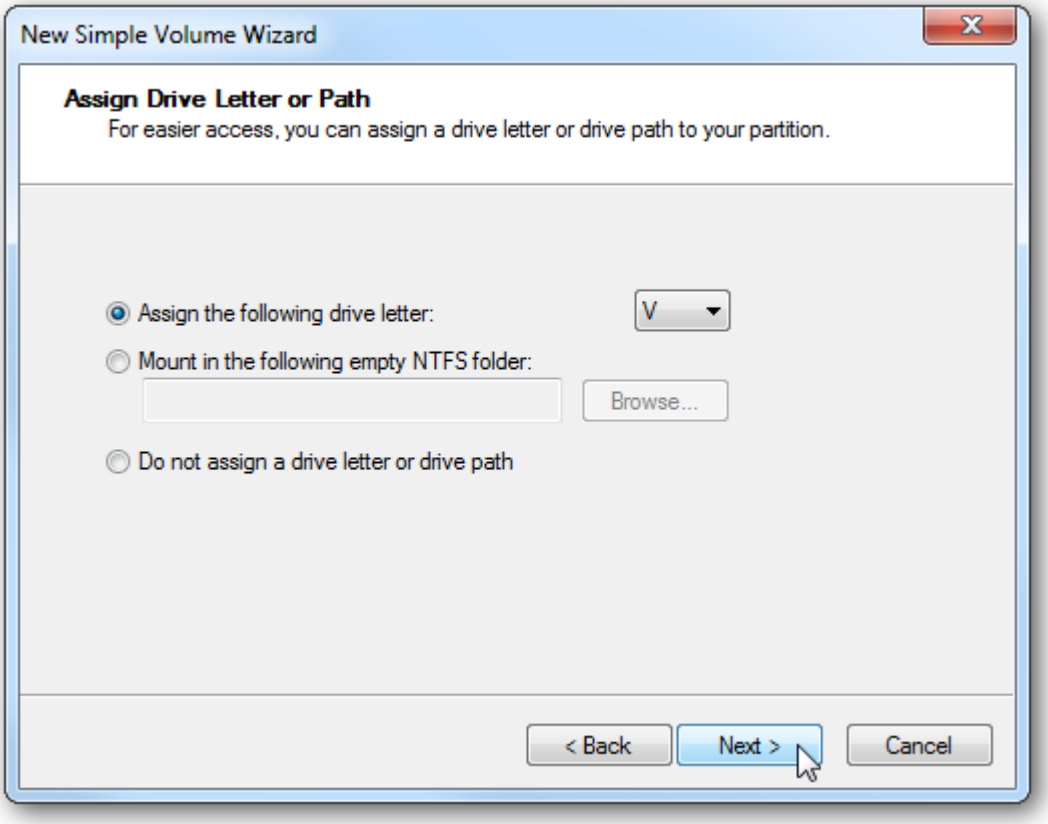
Step 8: The New Simple Volume Wizard starts up and just on completing it.



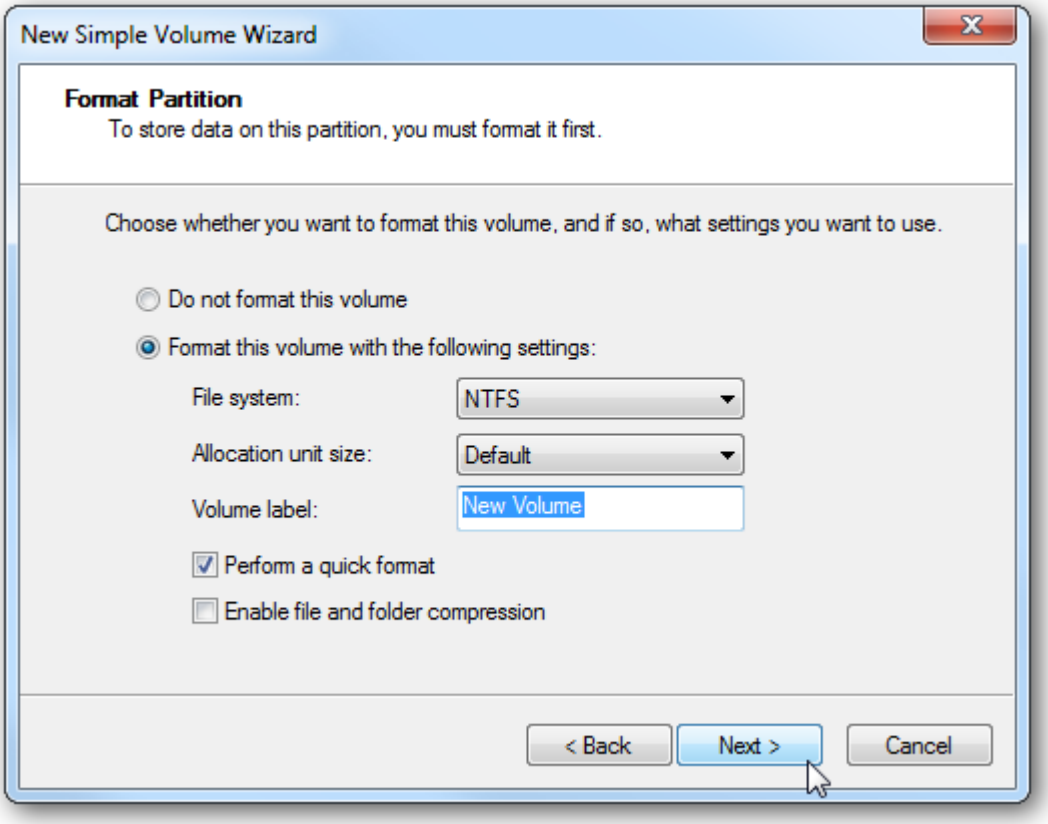
Step 9: Choose the amount of space you want to use for the volume.



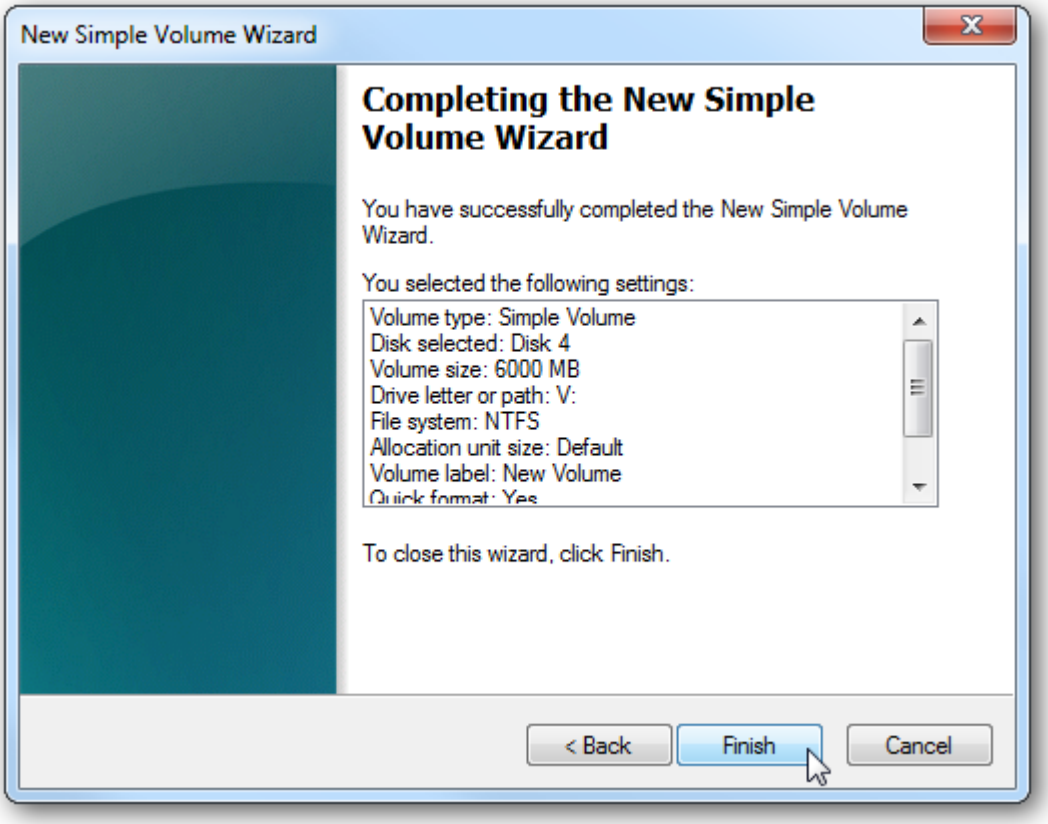
Step 10: Assign it a dive i.e. V that is not currently being used.



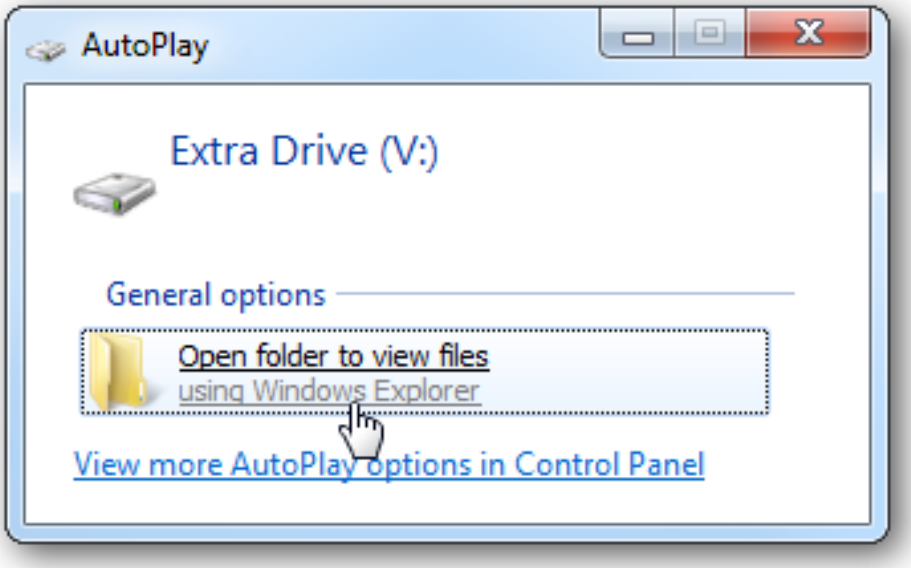
Step 11: Format the new volume as NTFS, FAT32, or FAT. Check if you want a quick format and file compression.



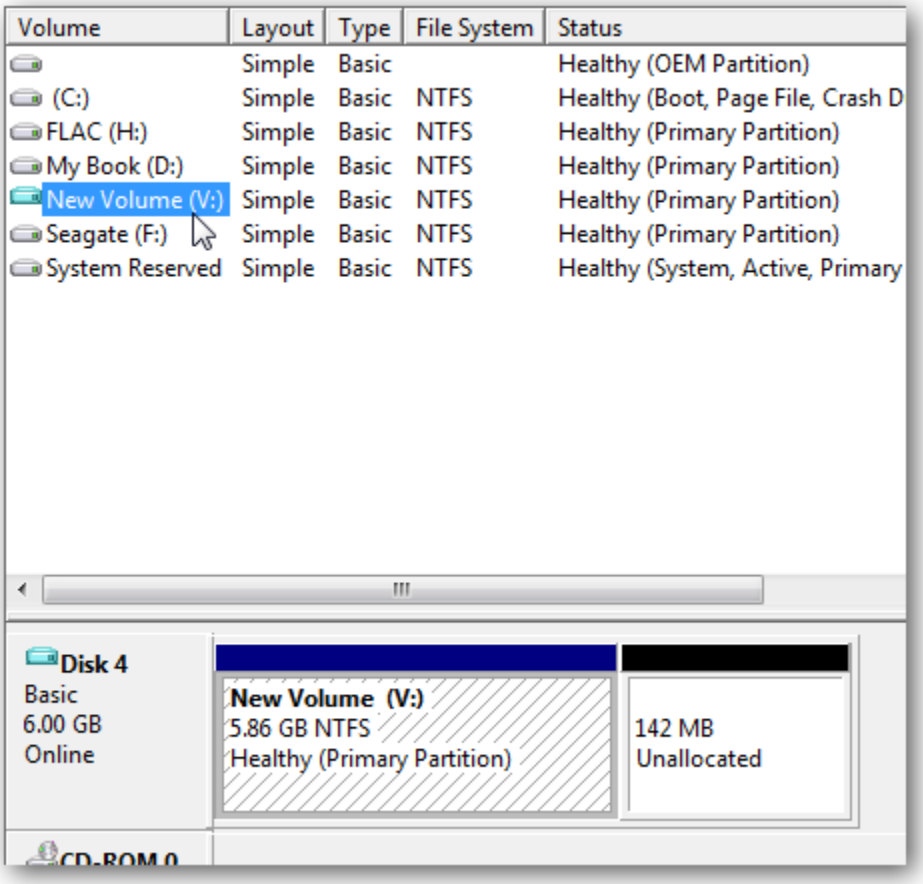
Step 12: The wizard is complete, click on Finish.



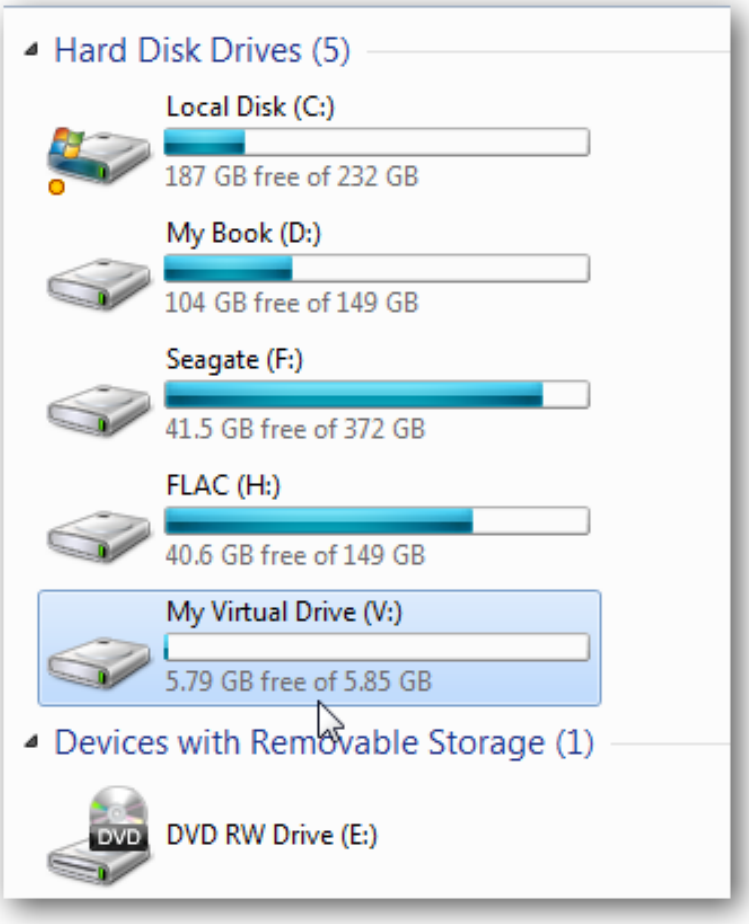
Step 13: If you have AutoPlay enabled it should pop up for you to open up your new virtual hard disk.



Step 14: It will be listed with the other disks in Disk Management.



Step 15: Of course you will also see it listen under My Computer.



This is really cool feature that will let you use the disk as you would any type of real disk. You can encrypt it, share it out to other systems, store files to it…however you would use an extra disk connected to your system.

This is a new feature in Windows 7 that will add extra functionality and options to your current system. There are several ways you can use your VHD including making it bootable.

5. Conclusion

Windows has an extra functionality to create a virtual drive. This virtual drive can be used for various purposes.

6. Quiz/ Viva

- What is the use of virtual hard disk drive?
- Can we make the virtual drive bootable?

7. References

1. ULF Troppen, Rainer Erkens and Wolfgang Muller , " Storage Networks Explained: Basic and Applications of Fibre Channel SAN, NAS and ISCSI and Infifniband " , Wiley
2. EMC Educational Services, "Information Storage and Management", wiley India
3. Vaishali Kahirnar, Nilima Dongre" Storage Network Management and Retrieval", Wiley
4. Robert Spalding, " Storage Networks: The Complete Reference", Tata McGraw Hill

Storage Network Management and Retrieval

Experiment No. : 10

To study text processing tool AntConc

Experiment No. 10

1. **Aim**: To study text processing tool AntConc

2. **What will you learn by performing this experiment?**

After performing this experiment we will be able to process a text document and find the keywords, their ranking and occurrences. Also we will be able to explore the tools associated with AntConc

3. **System Requirements**

Dual Core system Windows 7, 1 GB RAM,

4. **Theory**

AntConc is a freeware, multiplatform tool for carrying out corpus linguistics research and data-driven learning. It is developed in Perl using various compilers to generate executables for the different operating systems

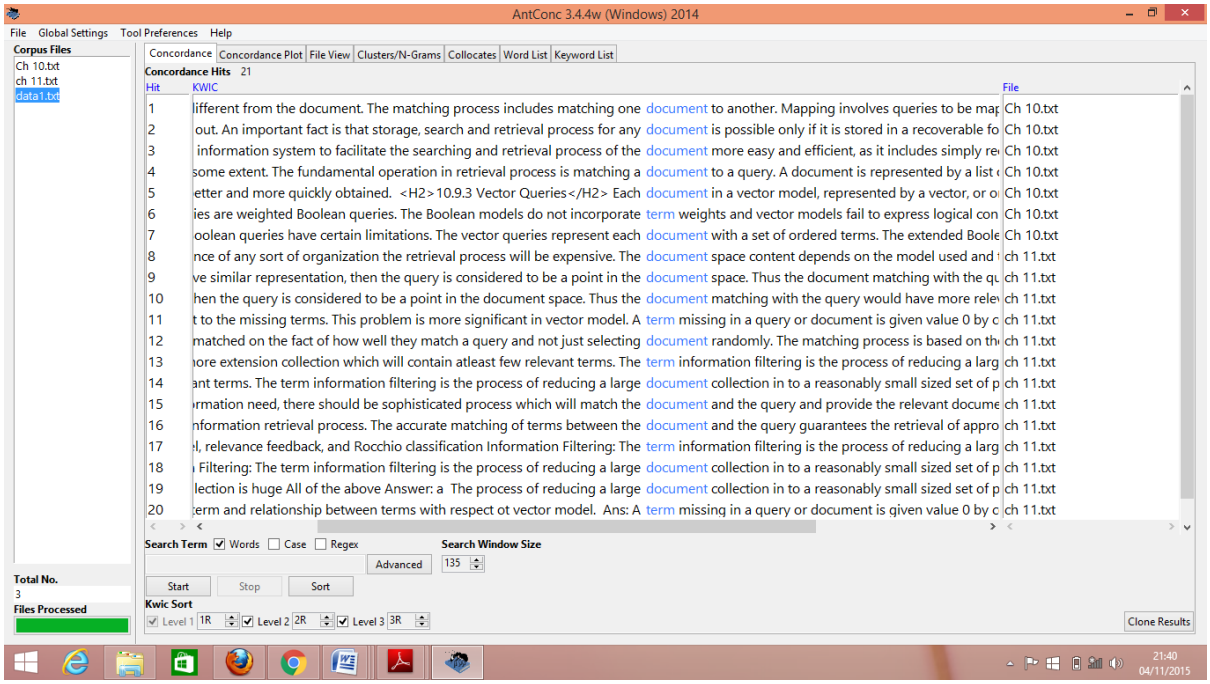
5. **Procedure**

Download Link
http://www.laurenceanthony.net/software.html

Available Tools in Antconc

AntConc contains seven tools that can be accessed either by clicking on their 'tabs' in the tool window, or using the function keys F1 to F7.

Concordance Tool:
This tool shows search results in a 'KWIC' (KeyWord In Context) format. This allows you to see how words and phrases are commonly used in a corpus of texts.



The following steps produce a set of concordance lines from a corpus and demonstrate the main features of this tool.

1) Select one or more files for processing from using the 'Open File(s)...' or 'Open Dir...' options in the 'File' menu. The list of selected files is shown in the left frame of the main window.

2) Enter a search term on which to build concordance lines in the search box.

3) Choose the number of text characters to be outputted on either side of the search term, using the increase and decrease buttons on the right of the button bar under the "Search Window Size" title. (default value is 50 characters)

4) Click on the 'Start' button to start the concordance lines results generation. The concordance generation can be halted at any time by clicking on the 'Stop' button.

5) Use the Kwic Sort options to rearrange the concordance lines at three different levels. 0 is the search word, 1L, 2L... are words to the left of the target word, 1R, 2R... are words to the right of the target word.

6) Click on the 'Sort' button to start the sorting process.

7) Move the cursor over the highlighted search term in one of the concordance lines. The cursor will change to a small hand icon. Clicking on the highlighted search term, will allow you to view the search term hit as it appears in the original file via the File View Tool (see below).

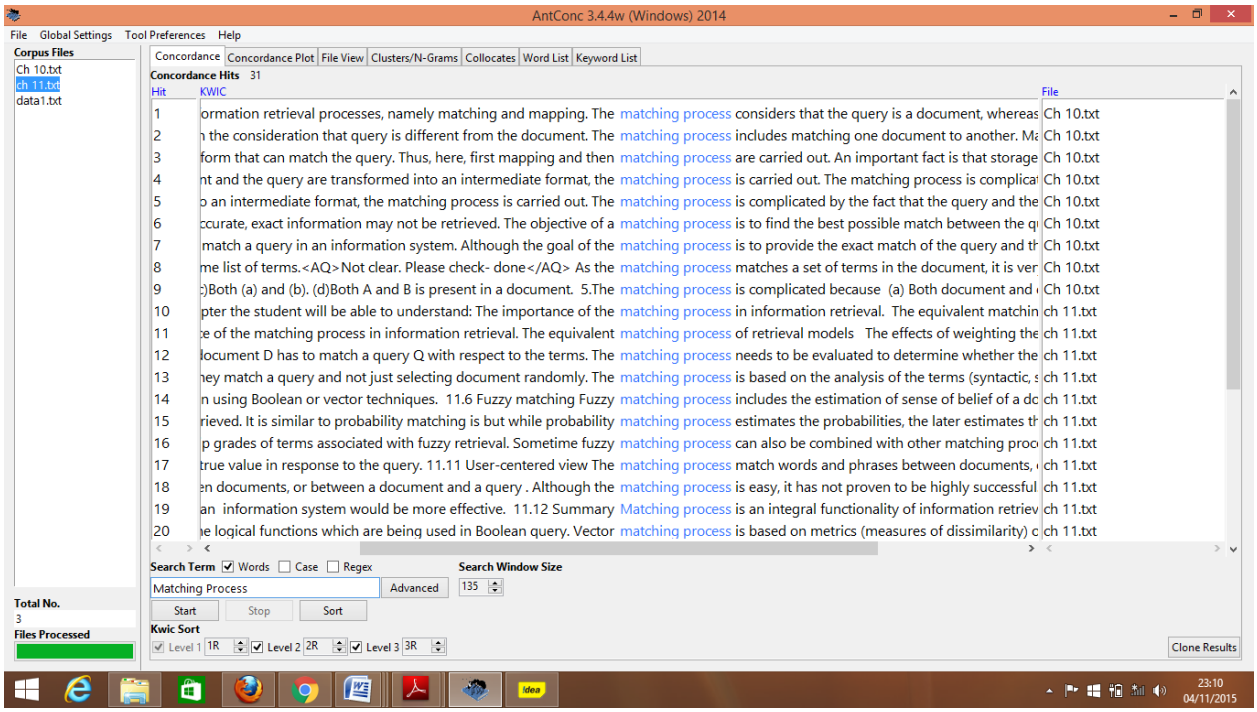
8) Click on the “Clone Results” button to create a copy of the results so that different sets of results can be compared.

The total number of concordance lines generated (Concordance Hits) is shown at the top of the tool window. This number will flash with the word "FINISHED" when processing has been completed, and will flash with the word "NO HITS", if not hits are generated for a particular search term.

To query about a term there are two ways

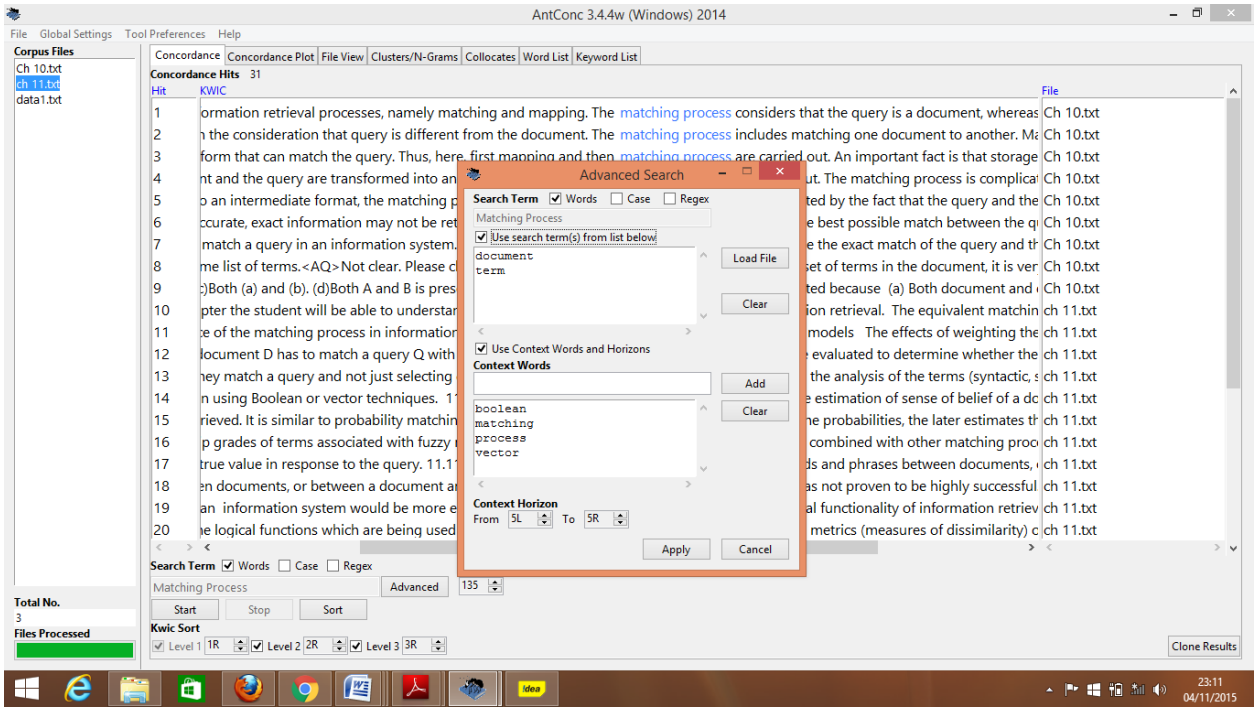
1. Query for a single term or word.

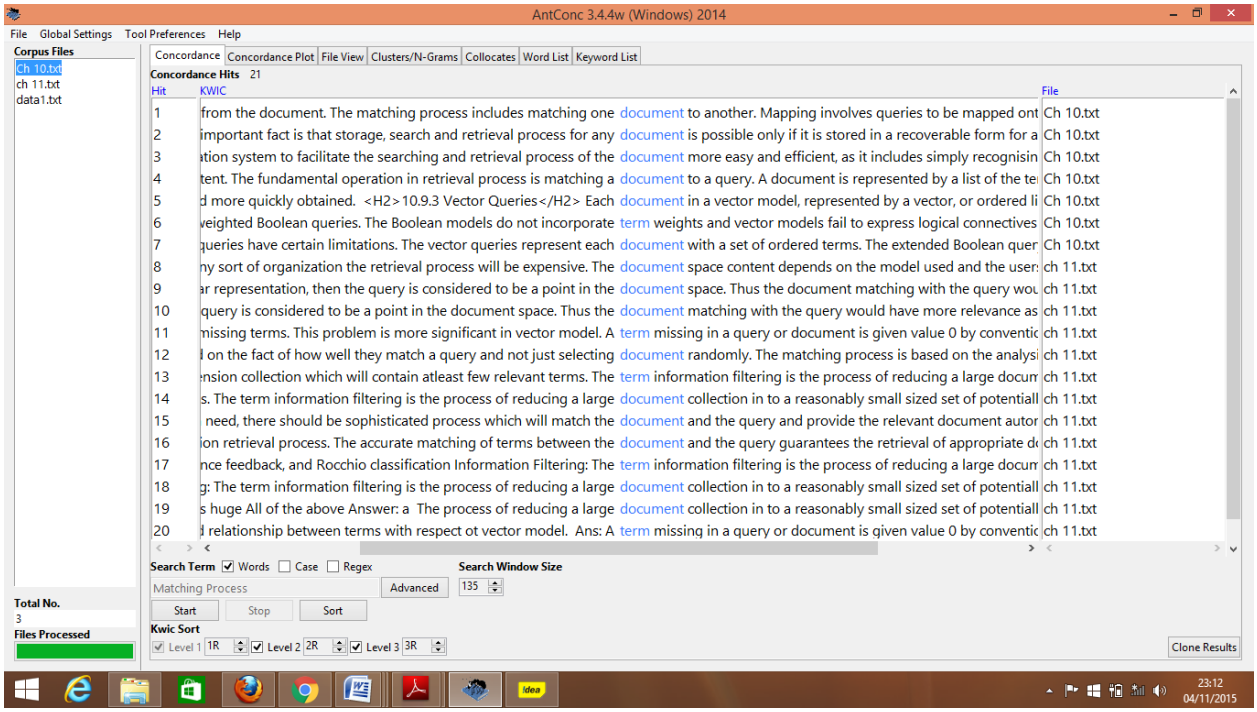
Search terms can be specified as being "words" (default) or "character strings" by activating or deactivating the "Word" search term option. Also, searches can be either “case insensitive” (default) or “case sensitive” by activating or deactivating the "Case" search term option. Searches can also be made using full regular expressions by activating the "Regex" option. For details on how to use regular expressions, consult one of the many texts on the subject, e.g., Mastering Regular Expressions (O'Reilly & Associates Press) or type "regular expressions" in a web search engine to find many sites on the subject (e.g., http://www.regular-expressions.info/quickstart.html). AntConc supports Perl regular expressions.



2. Advanced search

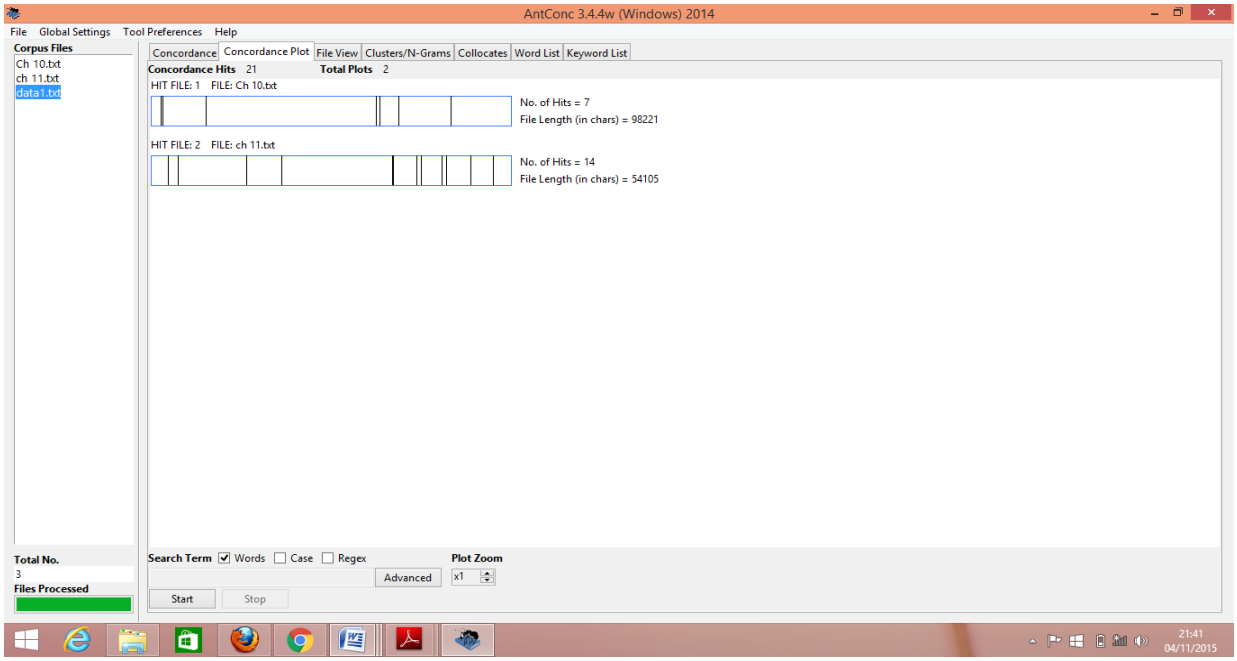
By clicking on the "Advanced Search" button, more complex searches become possible. The first advanced search option allows you to import a set of search terms, either by typing them one per line, or by loading in a list of search terms from a file. Here, each line will be treated as a separate search term. This feature allows you to use a large set of search terms without having to re-type them each time. The second advanced search option allows you to define context words and a context window within which the search term(s) must appear. For example, to search for "student" where it appears at least three words to the left or right of the word "university," set the search term as "student," the context word as "university," and set the context window as 'From' 3L 'To' 3R.


AntConc 3.4.4w (Windows) 2014
File Global Settings Tool Preferences Help
Corpus Files
Ch 10.txt
ch 11.txt
data1.txt
Concordance Concordance Plot File View Clusters/N-Grams Collocates Word List Keyword List
Concordance Hits 31
Hit KWIC File
Advanced Search
Search Term Words Case Regex
Matching Process
Use search term(s) from list below
document
term
Load File
Clear
Use Context Words and Horizons
Context Words
Add
Clear
boolean
matching
process
vector
Context Horizon
From 5L To 5R
Apply Cancel
Search Term Words Case Regex
Matching Process
Advanced
135
Start Stop Sort
Kwic Sort
Level 1 1R Level 2 2R Level 3 3R
Clone Results
Total No.
3
Files Processed
23:11
04/11/2015


AntConc 3.4.4w (Windows) 2014
File Global Settings Tool Preferences Help
Corpus Files
Ch 10.txt
ch 11.txt
data1.txt
Concordance Concordance Plot File View Clusters/N-Grams Collocates Word List Keyword List
Concordance Hits 21
Hit KWIC File
Search Term Words Case Regex
Search Window Size
Matching Process
Advanced
135
Start Stop Sort
Kwic Sort
Level 1 1R Level 2 2R Level 3 3R
Clone Results
Total No.
3
Files Processed
23:12
04/11/2015

Concordance Plot Tool

This tool shows search results plotted as a 'barcode' format. This allows you to see the position where search results appear in target texts.



This tool shows concordance search results plotted in a 'barcode' format, with the length of the text normalized to the width of the bar and each hit shown as a vertical line within the bar. This allows you to see the position where search results appear in target texts. The tool also allows you to see which files include the target search term, and can also be used to identify where the search term hits cluster together. An example of the use of the Plot Tool is in determining where specific content words appear in a technical paper, or where an actor or story character appears during the course of a play or novel.

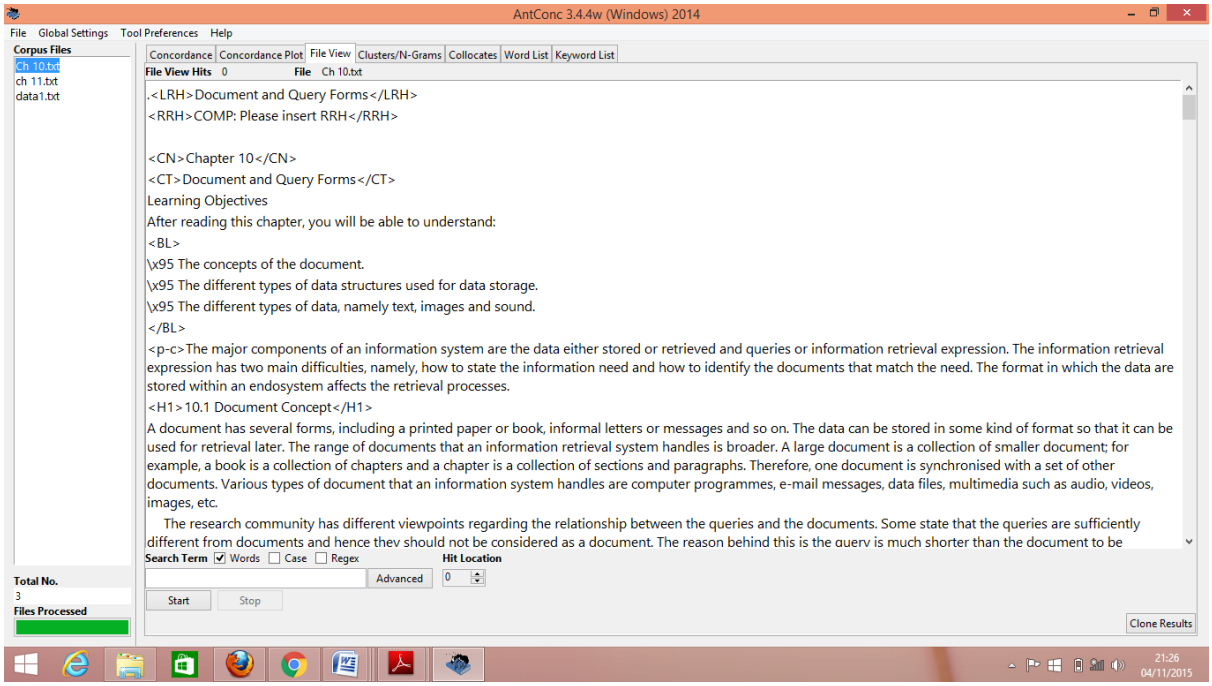
The number of hits and length of each text is shown to the right of the barcode plot, and the plot itself can be enlarged or reduced in size using the “Plot Zoom” buttons.

If you move the cursor over the highlighted search term in one of the concordance lines, the cursor will change to a small hand icon. Clicking on the highlighted search term will allow you to view the search term hit as it appears in the original file via the File View Tool (see below).

Search terms can be specified as being "words" (default) or "character strings", and searches can be “case insensitive” (default), “case sensitive,” or "Regex" based. Advanced searches are also available. For details see the Concordance Tool explanation.

File View Tool

This tool shows the text of individual files. This allows you to investigate in more detail the results generated in other tools of AntConc.



This tool shows the raw text of individual files. This allows you to investigate in more detail the results generated in other tools of AntConc.

The following steps produce a view of the original file and demonstrate the main features of this tool.

1) Select a file to view in the “Corpus Files” list on the left of the main window.

2) If a search term has been specified, the search term hits will be highlighted throughout the text. Search options are the same as for the Concordance Tool and Concordance Plot Tool.

3) Use the "Hit Location" buttons to jump to the appropriate hit in the file.

4) Change the search term and click on the 'Start' button to view other hits in the file.

5) Click on the highlighted text to generate a set of KWIC lines using the highlighted text as the search term.

6) Click on the “Clone Results” button to create a copy of the results so that different sets of results can be compared.

Search terms can be specified as being "words" (default) or "character strings", and searches can be “case insensitive” (default), “case sensitive,” or "Regex" based. Advanced searches are also available. For details see the Concordance Tool explanation.

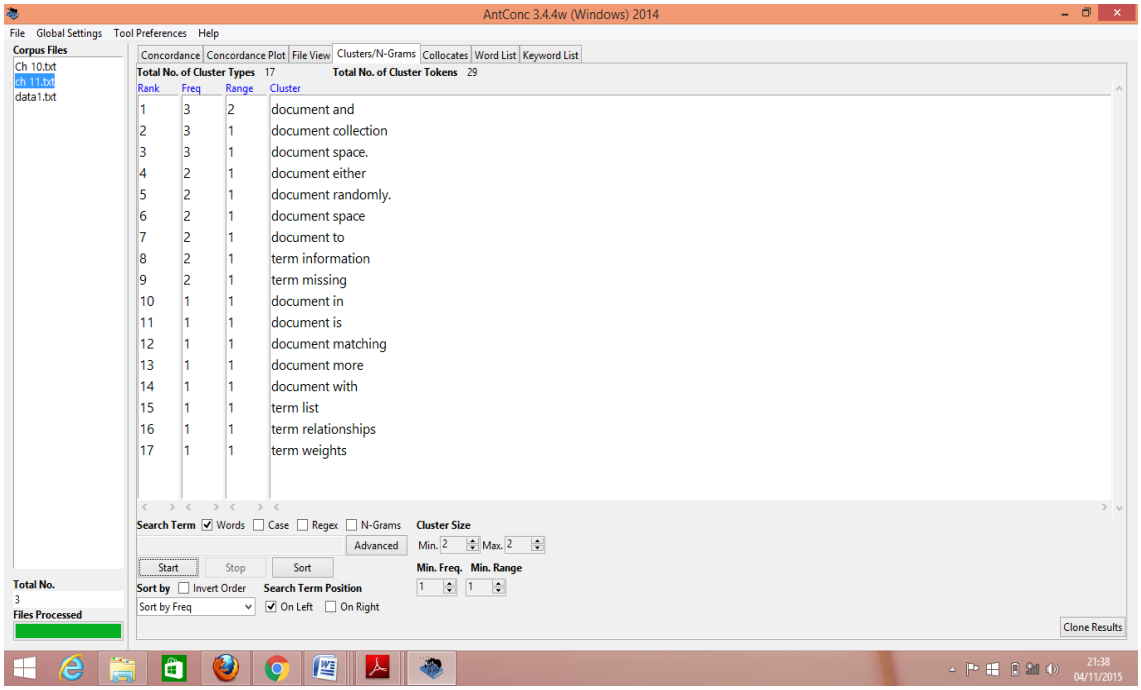
The following shortcut is unique to the File View Tool:

CTRL-Click = Jumps to the nearest hit in the window

Clusters/N-Grams

The Clusters Tool shows clusters based on the search condition. In effect it summarizes the results generated in the Concordance Tool or Concordance Plot Tool. The N-Grams Tool, on the other hand, scans the entire corpus for 'N' (e.g. 1 word, 2 words, …) length clusters. This allows you to find common expressions in a corpus.

In both the Clusters Tool and N-Grams Tool, search terms can be specified as being "words" (default) or "character strings", and searches can be “case insensitive” (default), “case sensitive,” or "Regex" based. Advanced searches are also available for the Clusters Tool



The Clusters Tool

This allows you to search for a word or pattern and group (cluster) the results together with the words immediately to the left or right of the search term. In effect it summarizes the results generated in the Concordance Tool or Concordance Plot Tool.

The clusters can be ordered by frequency, the start or end of the word, the range of the cluster (number of files in which the cluster appears), or the probability of the first word in the cluster preceding the remaining words. All list orderings can also be inverted by activating the “Invert Order” option. Also, you can select the minimum and maximum length (number of words) in each cluster, and the minimum frequency of clusters displayed. It is also possible to select if the search term always appears on the left (default) or right of the cluster.

Note: In the current version, if more than one word is specified as the search term, only the first word will appear on the right if the "Search Term on Right" option is selected.)

The following steps produce a set of cluster results and demonstrate the main features of this tool.

1) Choose the appropriate ordering options (see above for details).

2) Press the 'Start' button. At any time, the generation of the clusters list can be halted using the 'Stop' button.
3) Click on the cluster to generate a set of KWIC lines using the text as the search term.
4) Click on the “Clone Results” button to create a copy of the results so that different sets of results can be compared.

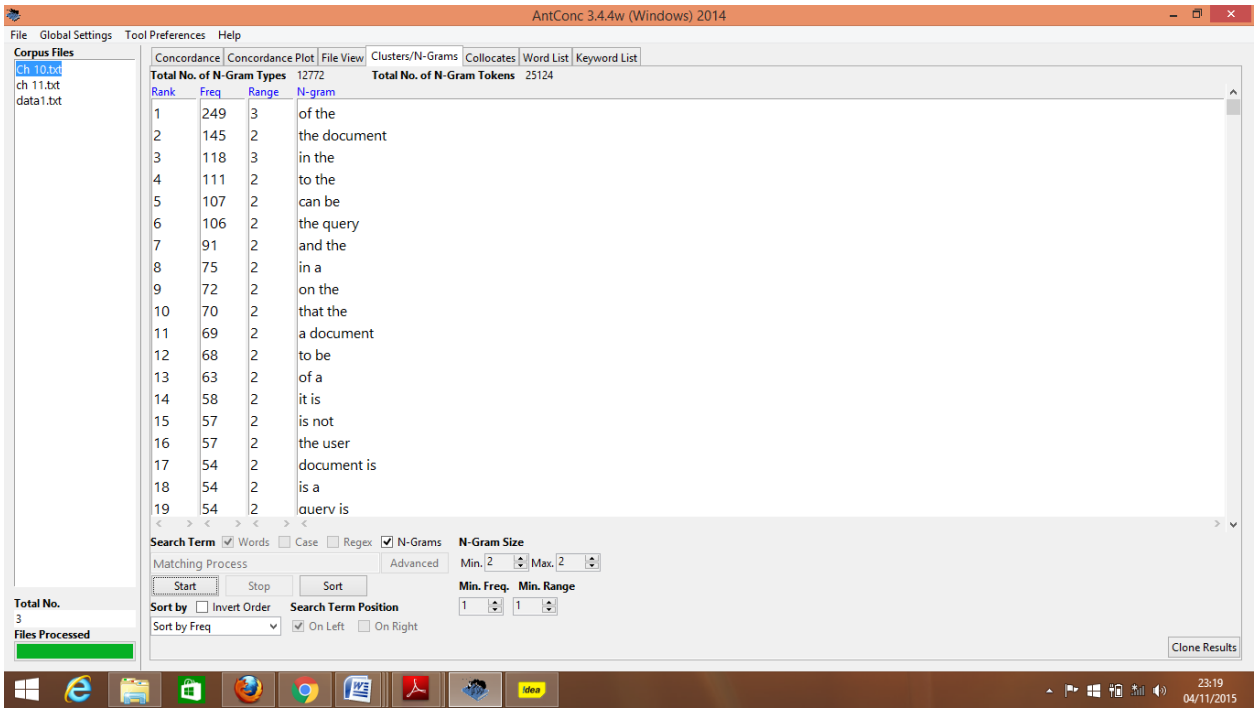
The N-Grams Tool

This allows you to scan the entire corpus for 'N' word clusters (e.g. 1 word, 2 words,…). This allows you to find common expressions in a corpus. For example, n-grams of size 2 for the sentence "this is a pen" are 'this is', 'is a' and 'a pen'.

All ordering options available in the Clusters Tool are also available in the N-grams tool. You can also select the minimum and maximum size (number of words) in each n-gram, and the minimum frequency and range of n-grams displayed.

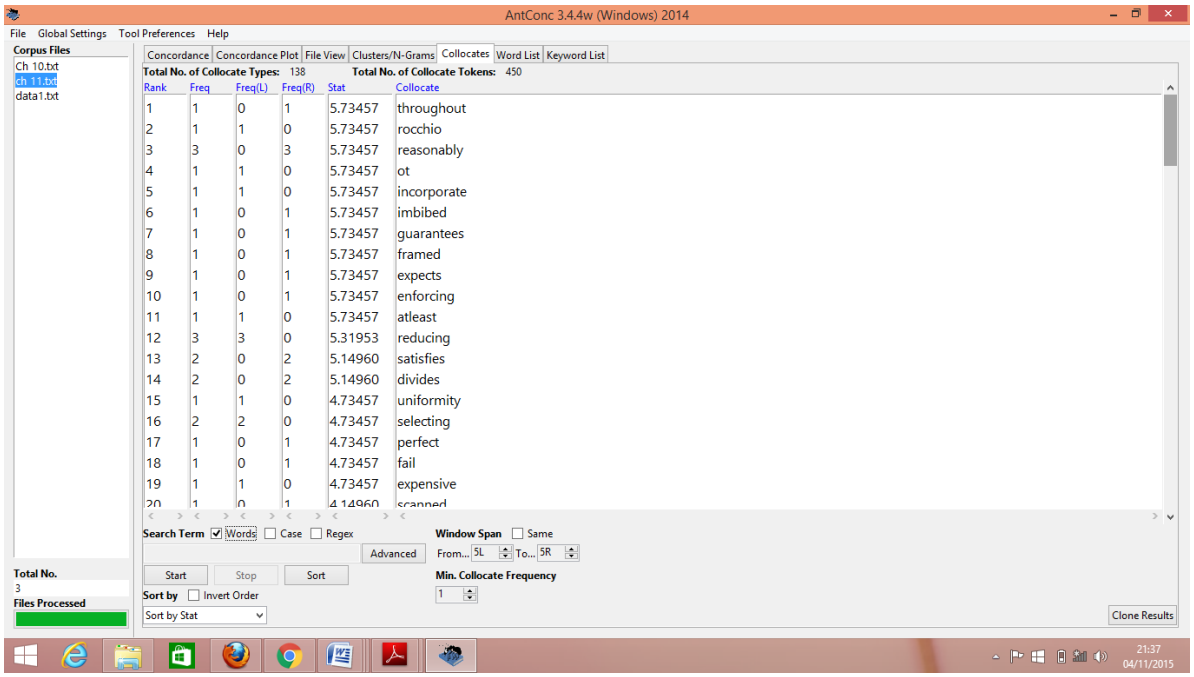
The following steps produce a set of N-gram results and demonstrate the main features of this tool.

1) Click on the "N-Grams" option above the search entry box.
2) Choose the appropriate ordering options.
3) Press the 'Start' button. At any time, the generation of the n-grams list can be halted using the 'Stop' button.
4) Click on the n-gram to generate a set of KWIC lines using the text as the search term.
5) Click on the “Clone Results” button to create a copy of the results so that different sets of results can be compared.



Collocates:

This tool shows the collocates of a search term. This allows you to investigate non-sequential patterns in language.



The collocates can be ordered either by total frequency, frequency on the left or right of the search term, or the start or end of the word. They can also be ordered by the value of a statistical measure between the search term and the collocate. The value measures how 'related' the search term and the collocate are. Current possible statistical measures are listed below. All list orderings can also be inverted. Also, you can select the span of words to the left and right of the search term in which to find collocates, and the minimum frequency of collocates displayed. If only a one-word span is required, for example, to see which words appear directly on the right of the search term, check the "Same" box, to keep the minimum and maximum span size the same.

Statistical Measures:

The following steps produce a set of collocate results and demonstrate the main features of this tool.

1) Choose the appropriate ordering options.

2) Press the 'Start' button. At any time, the generation of the collocates list can be halted using the 'Stop' button.

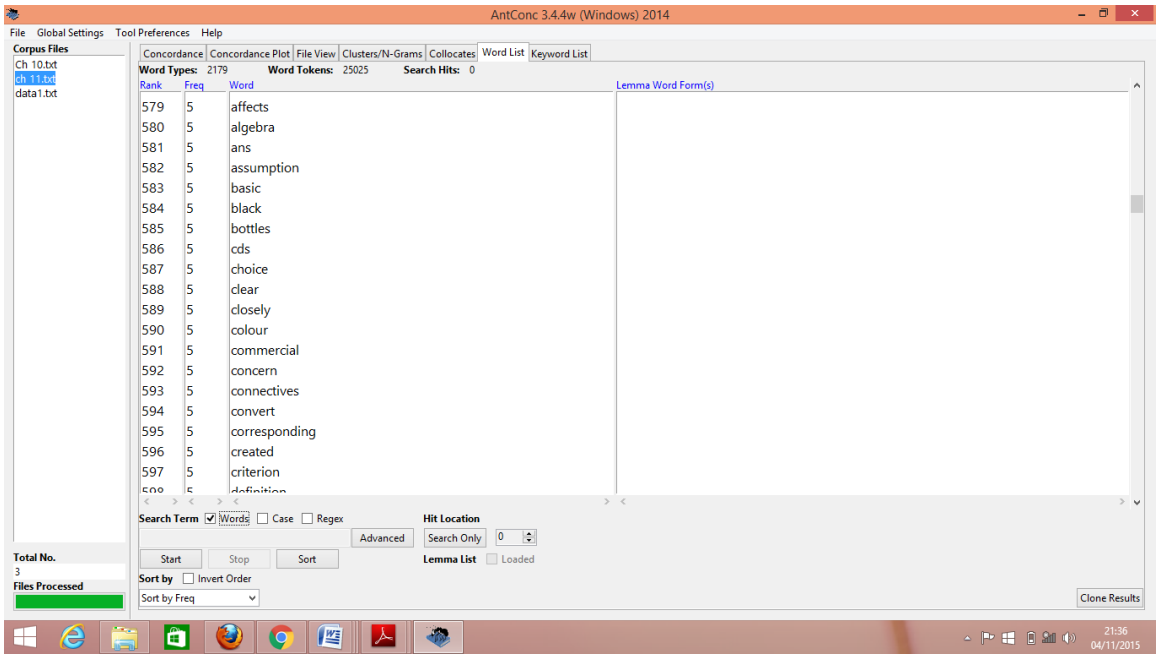
3) Click on one of the collocates to generate a set of KWIC lines using the text as the search term.

4) Click on the “Clone Results” button to create a copy of the results so that different sets of results can be compared.

Search terms can be specified as being "words" (default) or "character strings", and searches can be “case insensitive” (default), “case sensitive,” or "Regex" based. Advanced searches are also available for the Collocates Tool.

Word List:

This tool counts all the words in the corpus and presents them in an ordered list. This allows you to quickly find which words are the most frequent in a corpus.



This tool counts all the words in the corpus and presents them in an ordered list. This allows you to quickly find which words are the most frequent in a corpus.

The words can be ordered either by frequency or the start or end of the word, and the ordering can be inverted. The word list can also be generated in case-insensitive mode, where words in upper and lower case are treated the same (default) or case-sensitive, where words in upper and lower case are treated separately.

The following steps produce a word list and demonstrate the main features of this tool.

1) Choose the appropriate ordering options.

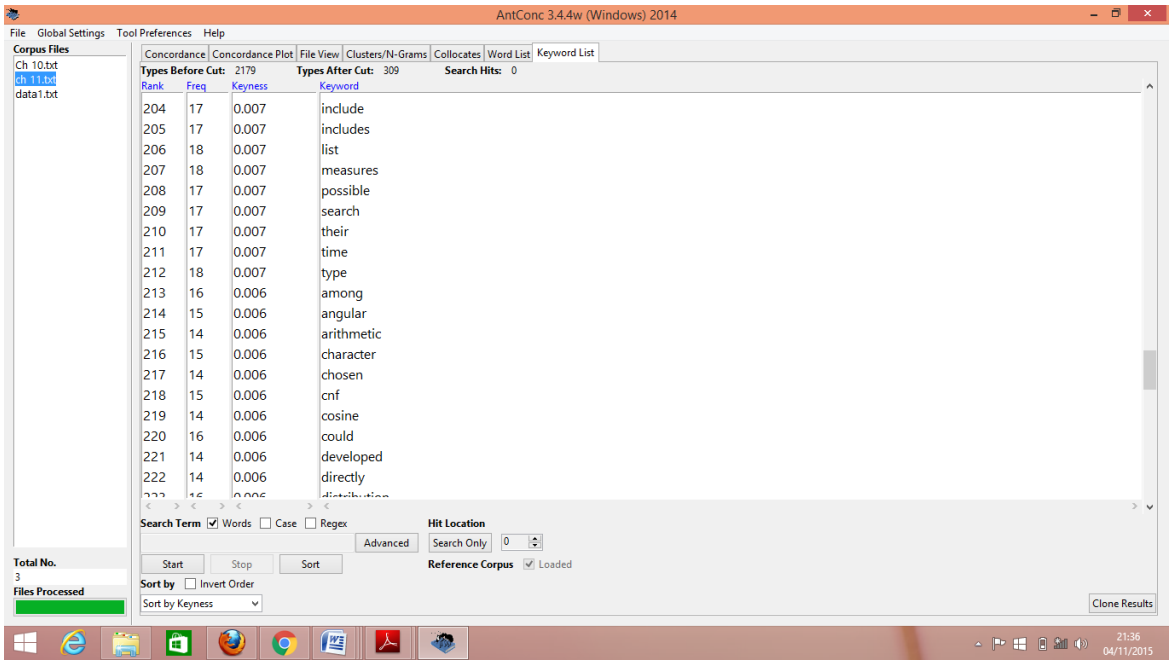
2) Press the 'Start' button. At any time, the generation of the word list can be halted using the 'Stop' button.

3) Click on the word to generate a set of KWIC lines using the text as the search term.

4) Click on the “Clone Results” button to create a copy of the results so that different sets of results can be compared.

Keyword List:

This tool shows the which words are unusually frequent (or infrequent) in the corpus in comparison with the words in a reference corpus. This allows you to identify characteristic words in the corpus, for example, as part of a genre or ESP study.



The following steps produce a keyword list and demonstrate the main features of this tool.

1) Select a set of target files.

2) Go to the 'Preferences' menu and chose the 'Keyword Preferences' option.

3) Choose the keyword generation method (a statistical measure) to calculate the 'keyness' of the target file words. The default setting of Log Likelihood is recommended. When using either Log Likelihood or Chi-squared as the statistical measure, the following significance values apply

95th percentile;	5% level;	$p < 0.05$;	critical value = 3.84
99th percentile;	1% level;	$p < 0.01$;	critical value = 6.63
99.9th percentile;	0.1% level;	$p < 0.001$;	critical value = 10.83
99.99th percentile;	0.01% level;	$p < 0.0001$;	critical value = 15.13

4) Choose a threshold for the number of keywords to be displayed.

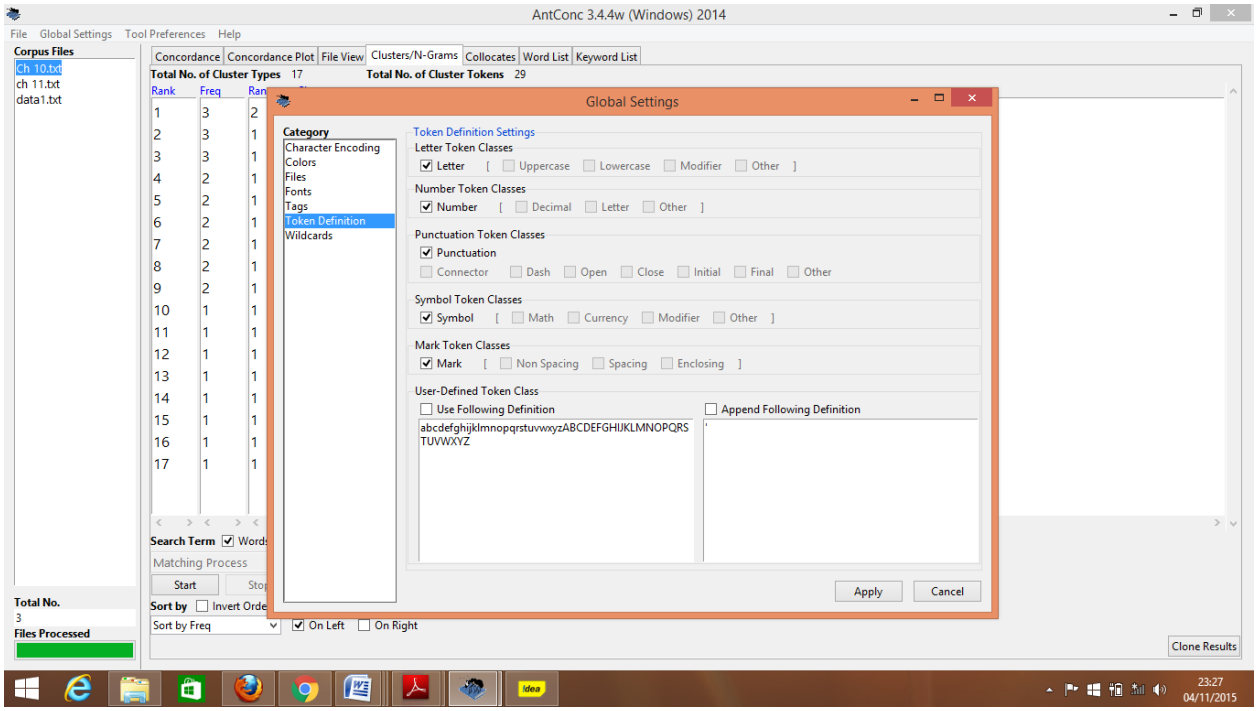
5) Choose whether or not to view 'Negative Keywords' (target file words with an unusually low frequency compared with the frequency in the reference corpus)

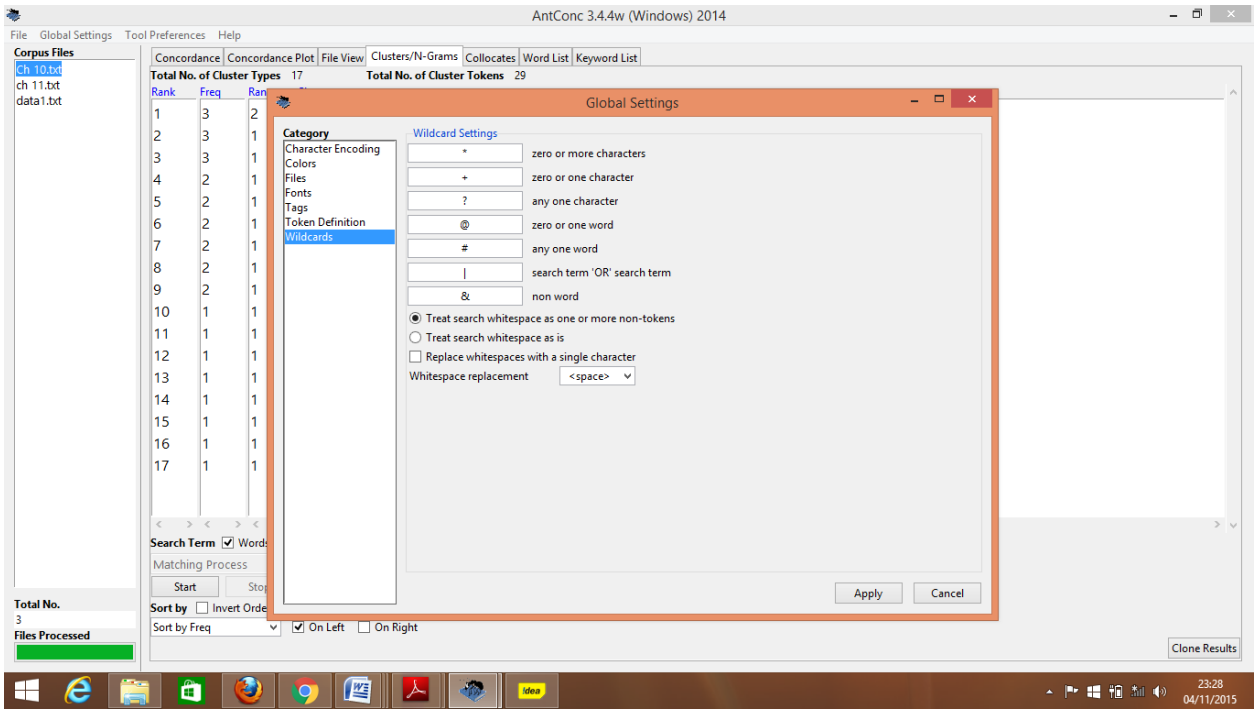
6) Choose one of the reference corpus options. Select "Use raw file(s)" when you will use raw text (.txt) files to serve as the reference corpus. Select "Use word list(s)" when you will use one of more word lists that are generated from a reference corpus. The "Use word list(s)" option allows you to generate keywords even when the original reference corpus is not available. The format for a word list is:

RANK FREQUENCY WORD (separated by any type of white space, including spaces and tabs).
1 12838 the
2 11289 a
3 8583 of
...
Note that blank lines and lines beginning with # will be ignored. Also, AntConc will check that the file(s) are correctly formatted and report any errors.
7) Load the reference corpus of text (.txt) files, in the same way that the target files are chosen.
8) The reference corpus directory will be shown (if appropriate), and the list of reference corpus files will appear at the bottom of the Keyword Preferences option menu.
9) Click 'Apply' in the Keyword Preferences menu and return to the main Keywords window.
10) Choose suitable options for displaying the list of generated Keywords (in a similar manner to the options for generating a Word List).
11) Press the 'Start' button. At any time, the generation of the keyword list can be halted using the 'Stop' button.
12) Click on the keyword to generate a set of KWIC lines using the text as the search term.
13) Click on the "Clone Results" button to create a copy of the results so that different sets of results can be compared.

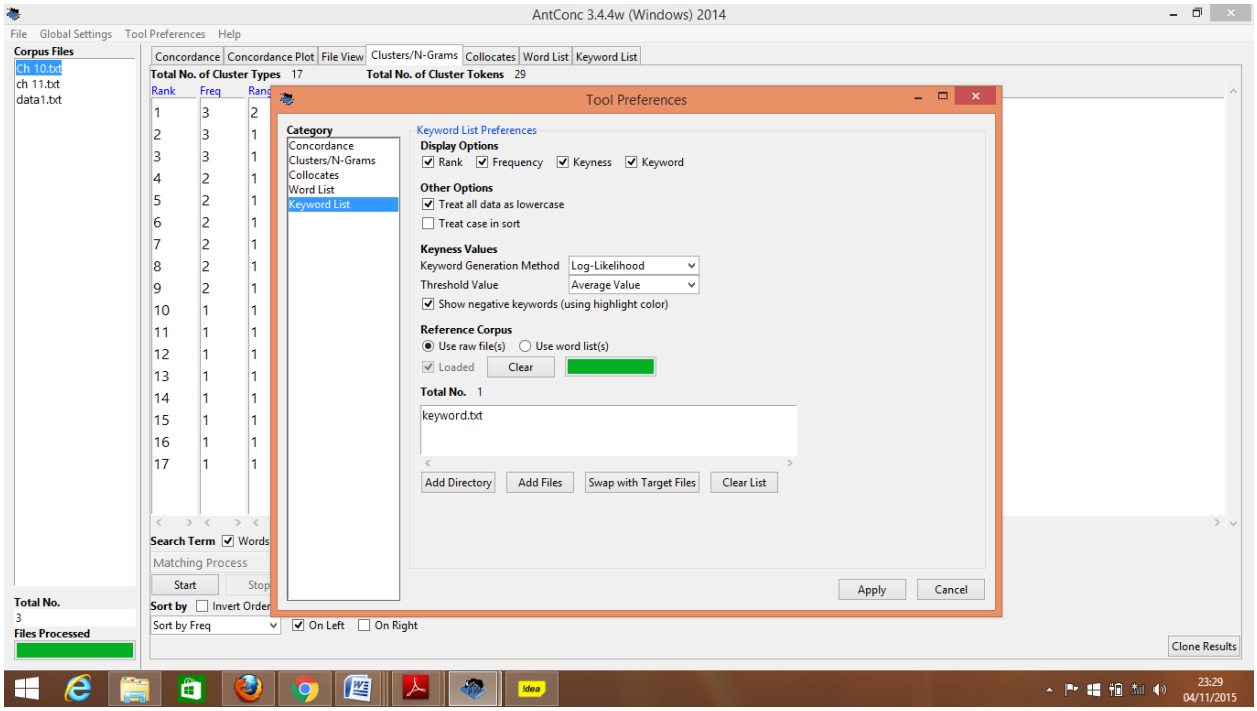
Menu Options:

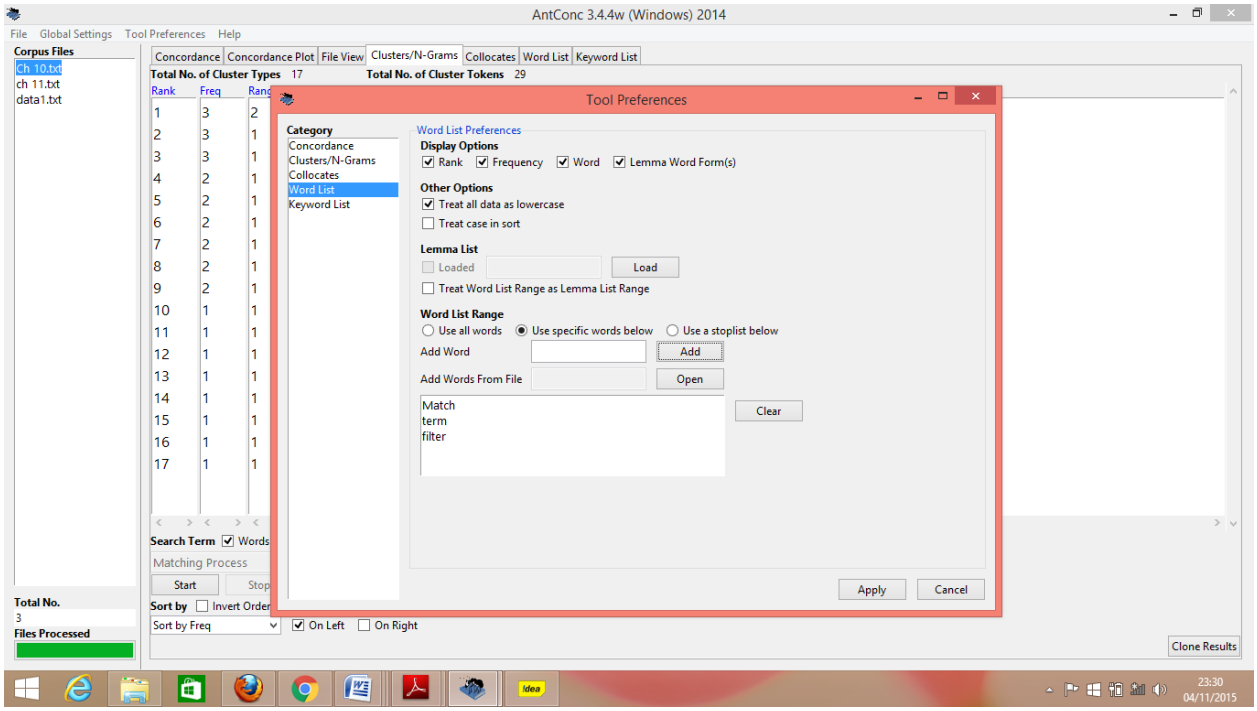
1. Global Settings
    a. Character encoding
    b. Colors
    c. Files
    d. Tags
    e. Toke Definition
    f. Wildcards

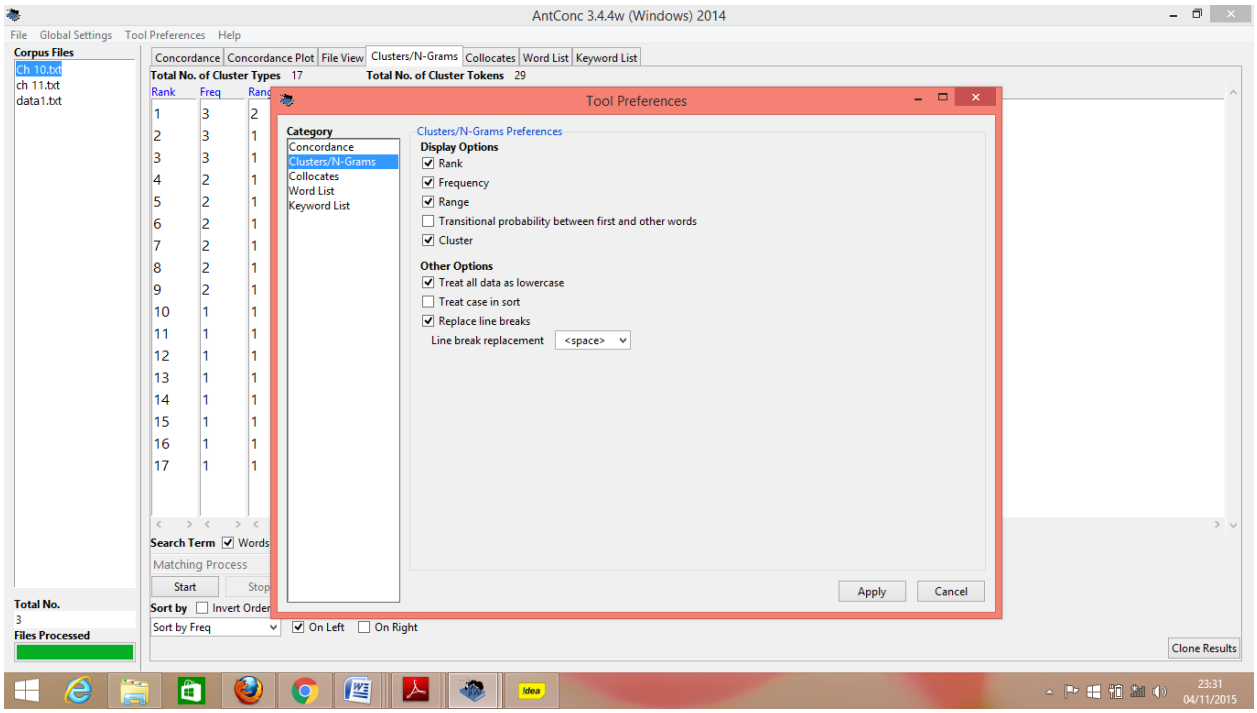

AntConc 3.4.4w (Windows) 2014
File Global Settings Tool Preferences Help
Corpus Files
Ch 10.txt
ch 11.txt
data1.txt
Concordance Concordance Plot File View Clusters/N-Grams Collocates Word List Keyword List
Total No. of Cluster Types 17
Total No. of Cluster Tokens 29
Rank Freq
Global Settings
Category
Character Encoding
Colors
Files
Fonts
Tags
Token Definition
Wildcards
Token Definition Settings
Letter Token Classes
Letter [Uppercase Lowercase Modifier Other]
Number Token Classes
Number [Decimal Letter Other]
Punctuation Token Classes
Punctuation
Connector Dash Open Close Initial Final Other
Symbol Token Classes
Symbol [Math Currency Modifier Other]
Mark Token Classes
Mark [Non Spacing Spacing Enclosing]
User-Defined Token Class
Use Following Definition
Append Following Definition
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRS
TUVWXYZ
Apply
Cancel
Search Term
Matching Process
Start
Sort by
Sort by Freq
On Left
On Right
Total No.
3
Files Processed
Clone Results
23:27
04/11/2015


AntConc 3.4.4w (Windows) 2014
File Global Settings Tool Preferences Help
Corpus Files
Ch 10.txt
ch 11.txt
data1.txt
Concordance Concordance Plot File View Clusters/N-Grams Collocates Word List Keyword List
Total No. of Cluster Types 17
Total No. of Cluster Tokens 29
Global Settings
Category
Character Encoding
Colors
Files
Fonts
Tags
Token Definition
Wildcards
Wildcard Settings
* zero or more characters
+ zero or one character
? any one character
@ zero or one word
# any one word
| search term 'OR' search term
& non word
Treat search whitespace as one or more non-tokens
Treat search whitespace as is
Replace whitespaces with a single character
Whitespace replacement
<space>
Apply
Cancel
Search Term
Matching Process
Start
Sort by
Sort by Freq
On Left
On Right
Total No.
3
Files Processed
Clone Results
23:28
04/11/2015

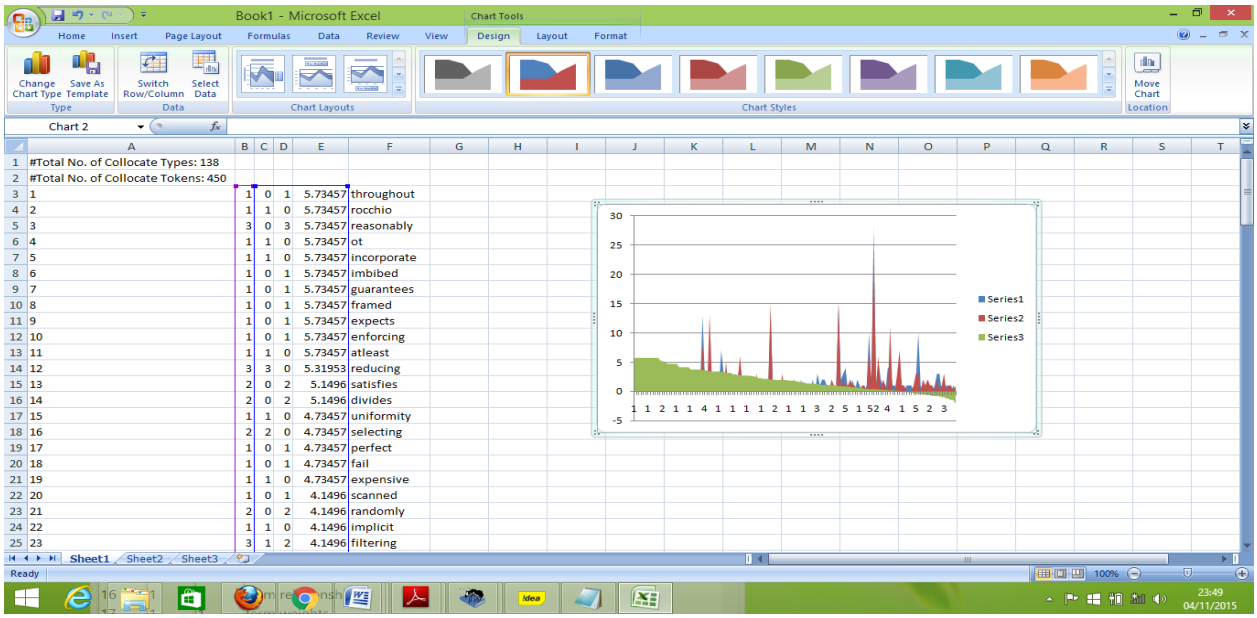
2. Tool Preferences
    a. Concordance
    b. Clusters/ N-Grams
    c. Collocates
    d. Word List
    e. Keyword List




AntConc 3.4.4w (Windows) 2014
File Global Settings Tool Preferences Help
Corpus Files
Ch 10.txt
ch 11.txt
data1.txt
Concordance Concordance Plot File View Clusters/N-Grams Collocates Word List Keyword List
Total No. of Cluster Types 17
Total No. of Cluster Tokens 29
Rank Freq Rang
Search Term Words
Matching Process
Start Stop
Sort by Invert Order
Sort by Freq
On Left On Right
Total No.
3
Files Processed
Clone Results
Tool Preferences
Category
Concordance
Clusters/N-Grams
Collocates
Word List
Keyword List
Word List Preferences
Display Options
Rank Frequency Word Lemma Word Form(s)
Other Options
Treat all data as lowercase
Treat case in sort
Lemma List
Loaded
Load
Treat Word List Range as Lemma List Range
Word List Range
Use all words Use specific words below Use a stoplist below
Add Word
Add
Add Words From File
Open
Match
term
filter
Clear
Apply
Cancel


AntConc 3.4.4w (Windows) 2014
File Global Settings Tool Preferences Help
Corpus Files
Ch 10.txt
ch 11.txt
data1.txt
Concordance Concordance Plot File View Clusters/N-Grams Collocates Word List Keyword List
Total No. of Cluster Types 17
Total No. of Cluster Tokens 29
Search Term Words
Matching Process
Start Stop
Sort by Invert Order
Sort by Freq
On Left On Right
Total No.
3
Files Processed
Clone Results
Tool Preferences
Category
Concordance
Clusters/N-Grams
Collocates
Word List
Keyword List
Clusters/N-Grams Preferences
Display Options
Rank
Frequency
Range
Transitional probability between first and other words
Cluster
Other Options
Treat all data as lowercase
Treat case in sort
Replace line breaks
Line break replacement
<space>
Apply
Cancel

The students should store the Statistical data in text format of several documents. Afterwards a comparative analysis with respect to different parameters can be done by importing this data into MS-excel



6. Conclusion

The text processing tool AntConc is studied. Different facilities provided by the tool to process the text within a document using various tools provided by AntConc are also studied

7. Quiz/ Viva

- What is ranking? How do find word ranking using AntConc?
- What is term frequency?
- What are the different facilities AntConc provides for Word processing?

8. References

1. R. R. Korfhage, “Information Storage and Retrieval”, Wiley
2. Vaishali Kahirnar, Nilima Dongre” Storage Network Management and Retrieval”, Wiley