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Multidimensional Testing

QA approach for Storage networking

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Introduction

- Who I am Yohay Lasri, QA Manager at Visuality Systems
- Visuality Systems the leading commercial provider of SMB solutions for all market sectors such as
  - Embedded
  - IoT
  - Java
  - Storage
- Visuality Systems experience covers porting onto following platforms
  - Embedded devices
  - Java applications
  - Standalone NAS
  - Cluster

Visuality Systems solutions crosses numerous platforms thus the main challenge for the Visuality Systems QA team is the diversity of storage solutions. The 'art-of-QA' is to choose the right test strategy and continue improving this strategy by learning from customers, partners and suppliers on going market requires.

Session Plan

This presentation will cover QA stories when it comes to testing's a network solution for storage

- How to choose key configurations
    - Factors defining storage configuration
    - Storage classification from the QA point of view
- How to consider use cases
    - Consult Visuality Systems customers, partners and suppliers.
    - The Japanese Round Robin method by holding periodical internal "Think Meetings"
- How to choose right tools
    - Different test methodologies require different tools
- How to develop a good Test Plan
    - Consider all the above conclusions and then think a little more.

Configurations : Factors

The factors defining Storage configurations:

- Software
    - Platform OS
    - Other software – e.g., layers above Linux
    - Network stacks: TCP/IP, RDMA, DPDK
    - File Sharing Protocols: SMB and NFS. Cross-protocol option
- Hardware
    - Types of CPU
    - Memory size
    - Network infrastructure: 1GB / 10GB / Fiber
    - NIC: Ethernet / InfiniBand / RoCE / WARP
    - Drive(s): HDD / SAS / SSD as well as controller types PCI / SATA / ISCSI etc.
- Cluster
    - Number of nodes
    - Node roles (AA or AP)

Configurations : Examples

Typical storage configurations:

- <u>SOHO NAS</u>: ARM 1.2GHz Dual Core, HDD
- <u>Mid-level storage</u>: Atom® 2.13GHz Quad Core, HDD
- <u>Top-end storage</u>: Intel® Xeon® 3.4GHz Quad Core/IBM Power8, SSD

It is impossible to cover all types of configurations. The idea is to select the appropriate configuration by using **storage classification**

Storage classification

To choose the key configurations, first QA has to create a storage classification

- Storage for general purpose
  - Basic Storage – price first, scalability second
- Mid-level Storage
  - balanced
- Top-end Storage
  - Dedicated platform
  - scalability only

Use cases

- Areas
  - Data Centers
  - Clouds
  - Dedicated areas (Video Streaming again)
- Frameworks
  - Hyper-V
  - SQL Server
  - SAP
  - Name it
- Number of simultaneous connections
  - Dedicated NAS may ask for 5-10
  - General purpose NAS – 20-50
  - SAN from 100 to 10,000 and more

Use cases (cont.)

- Load is usually forced by applications but may be also specified explicitly, e.g., - for bulk file transfer:
  - Records per second
  - Read/write sizes
    - Some customers care only about 4-8K chunks. This is common for SQL Server
    - File transfer will be happy with 1MB chunks
    - Video streaming may need even more
  - Intensity of meta-data operations
    - Usually customers mostly care about reads/writes
    - SIEM may think differently

QA techniques

- QA techniques can be categorized as follows:

    - Functional

    - Stress / Performance

    - Negative and security

Functional

- Protocol level
- API Level
- User experience

Type	Explanation	Advantages	Disadvantages	Sample tools
Protocol level	Generates protocol (SMB) packets by the spec(s)	Formally covers the spec(s)	Does not reflect real traffic	Microsoft test suite / Smbtorture
API Level	Enumerates (relevant) Win API calls	Covers potential traffic generated by applications	Does not cover all possible traffic combinations	Visuality SMB test suite
User experience	Runs the most common application	Covers real traffic	Cannot cover all applications	Manual tests / Ranorex

Stress / Performance

- Single connection
  - Using full capacity of network interface – Video streaming or upload large files
- Multiple connections
  - 1000 connections to a single folder on a share, read / write 1 mb file
  - 1000 connection to 1000 folders on a share, read / write 1 mb file
- File transfer
  - Upload / Download 1GB, 5GB and 20GB files
  - Upload 1000 files (1MB each file)
- Various buffer sizes for Read / Write

Buffer size	Usage
4 – 16 kb	Typically for SQL or Metadata
1 – 8 mb	File transfer / Video streaming

Negative and security

- Erroneous transactions, e.g.
  - Writing to a non-existing file
  - Delete on read only file
  - And more

- Sending malformed inputs
  - Writing a file using unsupported buffers
  - Reading file using unsupported buffers
  - And more

The above techniques compliment one another. A complete QA test requires all of the above.

Tools for functional tests - Protocol Level

- Windows Protocol Test Suites – Developed by Microsoft validates protocols including the File Server (SMB) tests
  - Build verification tests
  - Non build verification tests
  - Positive
  - Negative
    - Compatibility
    - Invalid definer
    - Out of boundary
    - Unexpected context
    - Unexpected fields

- Smbtorture – An open source test suite that runs series of tests against an SMB server

Tool for functional tests - API Level

- Visuality Systems test Suite – Test Posix and WinAPI commands on a network storage
  - Posix
    - Testing of open, rename and delete file operations
    - Testing of read and write file operations
    - Testing of operations on file attributes
    - Testing of directory create, rename, attributes, and scan operations
  - WinAPI
    - Testing of create, open and delete file operations
    - Testing of read and write file operations
    - Testing file copy, move and attributes operations
    - Testing 16-bit file operations
    - Testing directory creation, delete, info, copy, move, replace and scan operations
    - Testing volume information operations
    - Testing network operations
    - Testing of local user management operations

Tools for functional tests - User experience

- Manual tests – By using Windows Clients Visuality Systems can generate set of manual tests such as:
  - Upload/Download files
  - Create files
  - Edit files
  - Rename files
  - Delete files
- Ranorex – Automated user experience. This tool records user experience scenarios and generate these scenarios upon demand in an automated environment
  - Scenarios for Example
    - Create Microsoft Office files: Word, Excel, Power Point
    - Open
    - Write
    - Close
    - Rename
    - Delete

Tool for Stress

- Virtual Instruments (Load Dynamics) - VI is a peace of hardware that knows to simulate numerous clients. As being script-driven it allows custom scripting thus potentially covering any scenario
  - Also good for reproducing abnormal traffics
  - Allows to generate various traffic types (we are limited to SMB experience)
- Stress test cases
  - Create large File and write to it using large buffers
  - Run 1000 connections to a share while reading and writing 1 MB file
  - Run 1000 connections that connects instantly.

Tools for Performance tests

☐ Performance tools

Tool	Method	Loads	Notes
SpecSFS 2014	Load generator	•Desktop •Streaming •Compilation •Database	Only generic results, Very high loads. (in terms of traffic)
I/O meter	Read/write load	•Database •Streaming •Mix	Drill-down results
Diskspd	SQL Server simulation	•Database	Basic benchmarking only
LoadDynamics	Hardware simulator	•Any + multiple connections	Very high loads (also in terms of connections)

☐ "Nobody's perfect!.." – there is no single tool that measures everything

☐ Visuality Systems experience is - each customer has his favorite tool and methods

Negative and security tool

Synopsys (Defensics) – Defensics generates malformed SMB (and not only SMB) traffic in any possible way in order to crash the server

- This allows to prevent attacks and erroneous generated packets
- Five years ago Visuality Systems were using Defencis for the first time, It took 10ms to crash our server
- Now it runs hours under very heavy load

QA techniques guidelines

Prior using the QA techniques and tools the following points should be considered:

- Prepare test documents
- Estimate time to test for each technique
- Human factor
- Availability of hardware resource (Lab time)

Go testing

Taking into account the points described in this presentation, Visuality Systems can draw the multidimensional QA testing's as follows

- Build short term test plans for alpha and beta versions that will include:
  - Running functional test per feature
  - Running manual tests per feature
  - Running stress and performance tests per feature

- Build long term test plans for final release that will include:
  - Running functional tests for full system requirements
  - Running manual tests full system requirements
  - Running stress and performance full system requirements

Thank You!

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