San Diego IT/CAD

Infrastructure Requirements

Alain Mellan

Executive Summary

Our current SAN-based solution for engineering data storage is insufficient for FCI modeling, design and verification within expected schedule. Our server is 100Mb/s link to standard NFS machine.

An ASIC design configuration for a group of 25 engineer calls for high-performance NAS storage and compute farm directly attached to GbE switch. The NAS need at least parallel 4GbE links to sustain the throughput

There are alternative (read cheaper and less power hungry) solutions to regular HP servers used as compute server: blade systems like Supermicro’s SuperBlade

Solutions that include growth potential for 3-5 years are in the $80,000 - $100,000 range.

An alternative solution is to have all computing centralized in SA with a 40Mb/s link with 40ms latency and have only lab and login servers in SD.

# Introduction

ASIC design is a very resource intensive activity, requiring fast machines, fast networks, lots of storage and 24/7 availability. The current infrastructure is too slow for our current activity and it will get much worse when FCI design and verification gets in full swing.

Activities include:

* LDPC performance simulation (more than 100 cores needed)
* Design (large interactive simulations, large synthesis
* Verification (large number (thousands) of smaller simulations for regression

These activities have large I/O requirements in terms of bandwidth and latency:

* data read and produced by simulations/synthesis (waveforms, log files, etc)
* intermediate data (object files, log files) produced by numerous compilation/debug cycles
* access to applications and licenses

# Current Infrastructure

A simplified view of the current infrastructure is shown below on Figure 1 below.



Figure Current Infrastructure

The heart or our local network is a Cisco 6500, with 10/100Mb/s Ethernet switch extensions. All client machines (sdmatrix01, 02, 03 and lab machines yuma, rhone, etc) mount remote filesystems on sdnfs01 and sdnfs02 with NFS.

Even though sdnfs01 has a Fiber Channel attachement to a SAN fabric (Gb/s), the network connection through 100Mb/s Ethernet is a bottleneck.

Even with a faster network attachement, a simple Linux server like sdnfs01/sdnfs02 is not able to handle the NFS traffic generated by a farm of compute servers under LSF or SGE.

# Requirements

Our requirements for timely delivery of a large block like Iguana’s FCI are the following:

* Fast storage (NAS) shared by all machines in the compute farm. See architecture on Figure 2 below..
  + 1GbE or more network infrastructure.
    - At least one VLAN on the GbE switch has to be dedicated to the matrix\* machines connection to the filer.
    - 4Gb/s is the norm for 25 to 50 users
    - other machines (login server, backup,etc) share the rest of the network
  + for local backup
  + Efficient local backup to allow for fast local restore (dedicated FiberChannel link)
  + A massive disk array (20TB) of slow storage for reference lab data
* A compute farm made of different types of machines under the control of LSF/SGE for batch and interactive jobs
  + compute intensive: large number of powerful single CPU with 4GB of RAM
  + memory intensive: few machines with 32GB of RAM
* At least one gateway machine / login server to hold all the VNC sessions. Usually a ratio of 10 users per quad-core login server with 16GB of RAM.
* /cadtools for design kits and tools (about 1TB to allow different revision of the same tool to be stored)
* /home (small with quota) for local development, documentation, etc
* /projects/iguana, about 1TB , 2TB if need to store preliminary backend work
* transparent access from Linux and Windows to all the above directories (filer exports NFS and CIFS)
* All these directories are local to a site (i.e. not shared across sites), but all paths are identical throughout the company
* Local SVN repository for efficient checkin/checkout of large amount of code/data
* Enough licenses for all engineers to be able to perform their daily work. In some cases (regressions) licenses checkin/checkout may become a bottleneck.

Introducing a fast NAS device like a NetApp storage requires to upgrade the Cisco switch to 1GbE and balance the load over multiple links to the filer. (Typically 4 or 8 Ethernet or Fiber Channel connections for 4 or 8Gb/s aggregate throughput)

The filer will also bring flexibility in storage resource allocation between /home, /projects, /cadtools, as well as deduplication and snapshotting.



Figure Required Computing Infrastructure

# Solution #1

## Storage

|  |  |  |
| --- | --- | --- |
| **Path** | **Size** | **Comment** |
| /home | 250MB / user | Speed indifferent |
| /cadtools | 0.5-1TB | Fastest available |
| /projects/iguana | 1-2TB | Fastest available |
| /projects/sdlab | 20TB | Slow storage |

## Computing

### Design & Verification

LDPC encoder/decoder and FCI verification will require interactive simulations by all developers during the day and large regressions at night. We are currently using machines dedicated to architecture simulations, so we need 3 more machines. All the simulations make intensive use of the file system (lots of small files).

### Architecture

Given the nature of LDPC, any work related to LDPC tuning requires millions of simulations. The team is currently sharing 3 HP Proliant 360 G6 32GB. The need is estimated to 3-5 machines for a total of 6-8 similar machines.

Additionally, when peak demand exceeds compute capacity, a web service such as Amazon Elastic Compute Cloud will be utilized to meet the need.  This will provide us the flexibility to obtain additional compute capacity to meet peak demand while avoiding an over investment in hardware relative to the average demand.  Capacity can be scaled up or down easily, and we are only charged for the capacity in use.

### Alternative Solution

Instead of using full-fledged 1U server blades that bring the estimated cost per core to about $180, we can go for much higher density with technologies like Supermicro’s SuperBlade backplane and blade servers. We can pack a huge amount of computing power is a smaller enclosure, use less power, and for a full SuperBlade bring the cost per core to an estimated $34. (<http://www.supermicro.com/products/SuperBlade/>)

## Licenses

|  |  |  |  |
| --- | --- | --- | --- |
| **License** | **Amount** | **Need by** | **Comments** |
| Synopsys Design Compiler | 1 | ASAP | "Design-Compiler" v2010.06 |
| Synopsys HDL Compiler | 1 | ASAP | "HDL-Compiler" v2010.03 |
| Simvision | 7 | ASAP |  |
| ncsim simulator (multi-language) | 7 | ASAP | Verilog, VHDL, SystemC |
| ncsim SystemVerilog/OVM | 3 | ASAP | make sure it includes Desktop vmanager |
| Enterprise Manager / Planner | 1 | ASAP | Extended version of vmanager + eplanner |

Some clarification on vmanager/eplanner:

vManager is now included with the verification licenses we have for SystemVerilog. It includes for free the following features:

* runs all tests described in a text files
* works with LSF/SGE to balance the load if needed
* collects all pash/fail status
* collects all functional and code coverage and presents it in a GUI
* reads an XML or NTF file describing the verification plan and presents the collected coverage accordingly

Enterprise Planner on top of this brings more productivity with:

* eplanner, a tool to annotate a PDF specification and generate the XML/NTF verification that can be read by vmanager
* extensions to vmanager to:
  + generate HTML reports
  + generate progress graphs, compare regressions, etc
  + allow to rank simulations by their contribution to coverage in order to minimize the simulation time.

# Solution #2

A trend with large multi-site companies is to concentrate all computing and storage resources on one site for economies of scale, and provide a login server with really fast network connection: 40Mb/s with average latency of no more than 80ms, with 40ms being the accepted comfort zone.

# Elements of Budget



# APPENDIX

|  |  |
| --- | --- |
| **Subject** | **NetApp: Sales Contact** |
| **From** | [Grissom, Antonio](mailto:Antonio.Grissom@netapp.com) |
| **To** | Alain Mellan |
| **Cc** | Cook, Adam; Grissom, Antonio |
| **Sent** | Thursday, October 28, 2010 12:26 PM |

Hi Alain,

Per our conversation, the following are some ballpark pricing estimates for a low-end  and high-end FAS2040 system that I believe will adequately address your design activity project. Both of these configurations will provide a little more useable capacity than the 5TB that we discussed because storage purchased with a complete system is far more cost-effective.

Additionally, the suggested solutions that follow will provide STEC, Inc with a storage platform that includes robust application and operating system support and will enable the further growth and innovation of the business. Utilizing technologies, such as Deduplication and hardware-base performance optimization available in the solution, STEC, Inc will additionally be able to save

capital costs both now and in the future. The NetApp storage system will accomplish these goals, while also providing the highest level of data protection.

**Option 1 (Estimated Investment)  $60,000.00**

        FAS2040-R5 1

**Hardware**

DS4243-1507-24S-R5-C DSK SHLF,24x300GB,15K,3Gb SAS,

FAS2040-12-X282B-R5-C FAS2040,Disk Shelf,12x500GB SATA,-Internal Drives

FAS2040-BASE-R5-C FAS2040 **System Single Controller**,-C,

**Software**

SW-2040-ADVANCED-PK-C SW,Advanced PK,

SW-2040-CIFS-C SW,CIFS

SCW-2040-FOUNDATION-PK- SW,Foundation PK,

SW-2040-NFS-C NFS Software,

SCW-2040-PROTECTION-PK- SW,Protection PK

SW-BASE-PK-C SW,BASE Pack

SW-DFM-MGMTSVR-S SW,DFM Management Server,Special

SW-DSANIT-C SW,Disk Sanitization

SW-FLEXCACHE-C SW,FlexCache,

**Service**

CS-A-INST-4R SupportEdge Standard Replace 4hr,Install - Mths:12

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**Option 2 (Estimated Investment) $80,000.00**

FAS2040A-R5 1

**Hardware**

DS4243-1511-24S-R5-C DSK SHLF,24x450GB,15K,3Gb SAS

FAS2040-12-X282B-R5-C FAS2040,Disk Shelf,12x500GB SATA- Internal Drives

FAS2040A-BASE-R5 FAS2040A,**Act-Act,System Controller**,R5

**Software**

SW-2040-ADVANCED-PK-C SW,Advanced PK,

SW-2040-CIFS-C SW,CIFS

SCW-2040-FOUNDATION-PK- SW,Foundation PK,

SW-2040-NFS-C NFS Software,

SCW-2040-PROTECTION-PK- SW,Protection PK

SW-BASE-PK-C SW,BASE Pack

SW-DFM-MGMTSVR-S SW,DFM Management Server,Special

SW-DSANIT-C SW,Disk Sanitization

SW-FLEXCACHE-C SW,FlexCache,

**Service**

CS-A-INST-4R SupportEdge Standard Replace 4hr,Install - Mths:12

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