HIGH CAPACITY RECORDERS FOR RADIO ASTRONOMY DIGITAL BACK-ENDS

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I - INTRODUCTION

In the near future e-VLBI (Very Long Baseline Interferometry) will drive data at real-time from each radio astronomy station to a computing unit using normal Internet. Until this becomes true a high capacity recorder system to accommodate the four-gigabit-per-second data stream is needed. Unfortunately, the relation between amount of disks and transfer rate does not behave proportionally when the first factor is increased. Even so, usually the system speed does not increase expectedly. Hence, an optimal selection of disk capacity and data bus model is required.

The objective of this investigation is to determine the feasibility of building a next-generation 4 Gbps VLBI data recorder using commercial-off-the-shelf computer components and standard Linux operating system. The preliminary results are very promising, reliable 4 Gbps recording from 10 Gbps Ethernet to disks has been achieved. This speed will further improve in the future when new faster disks and computer hardware become available.

II - MATERIALS AND METHODS

For the last half year, several of the latest motherboards, high capacity disks, PCI-Express disk controllers and Port Multipliers (PMP) boards have been tested. A list of material used is shown in Table 1.

Motherboards	Disks	PMP	Disk controllers
Asus L1N64SL1 WS	Seagate 500 GB	Addonics AD5SAPM	RocketRaid 2522
Asus P5NT WS	Samsung F1 750 GB	Addonics AD5SAPM-E	Addonics ADSA3GPX8
Asus PQ5 Pro	Samsung F1 1 TB		HP SC44Ge
Asus P5K WS			
Asus Striker II Extreme			
Asus Rampage Extreme			

Table 1. the list of electronic components tested in our laboratory for the 4 Gigabit experiments.

In addition to the common Linux tools, such as iperf, netcat, hdparm and others, two main software programs have been in use to perform the tests: Wr-nexgen [1] and

Tsunami-UDP [2]. Both of them have been designed and developed by the Metsähovi Radio Observatory team and are available as open source code.

III – RESULTS

Even though the native SATA ports are the fastest in recording rate tests, its motherboard built-in limitations oppose directly to disk expansion capabilities. Furthermore, PMP are rarely supported with the current North/Southbridge chips and it is not clear which path the next generation of chipsets will take.

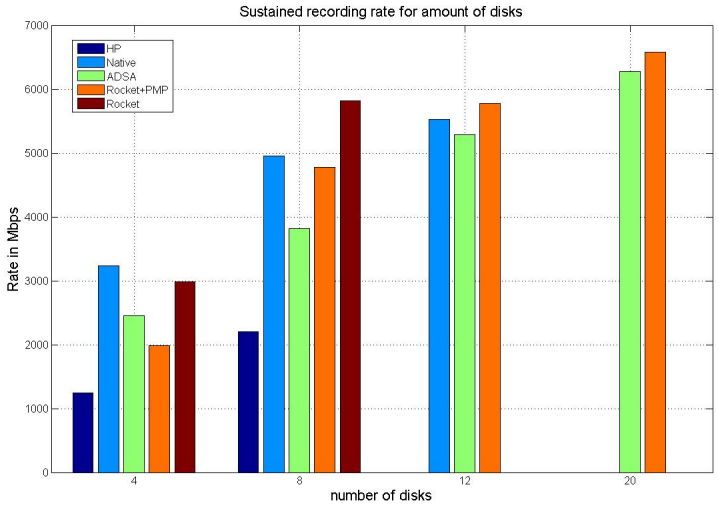

Figure 1 - shows the sustained rate for each device according to the amount of disks used in RAID.

PCI-Express based disk controllers might be an inexpensive solution. They offer fast communication bus (usually 16x or 8x lanes) and PMP support, but the complexity of the system increases. In contrast, the HP SC44Ge[1] has been the first to be discarded due to recording rate low performance, disk capacity limitation and no PMP support.

On the other hand, both Rocket 2522 [2] and ADSA3GPX8 [3] have shown good recording rate performance to fulfill 4 Gbps requirements. Likewise, RAID systems of 20 to 32 disks can be built thanks to its PMP support. However, extra PMP boards and the wiring to connect HDD's and PCI-E device is the price we must pay for it.

REFERENCES

[1] – VSIB software package - *http://www.metsahovi.fi/en/vlbi/vsib-tools/index*
[2] – Tsunami UDP Protocol - *http://tsunami-udp.sourceforge.net/*

[1] HP SC44Ge - LSI Logic LSISAS1068E controller
[2] HighPoint RocketRAID 2522 - 2 x external miniSAS driven by two Marvell 88SX6042 chips
[3] Addonics ADSA3GPX8 – 4 x eSATA + SiI3124 PCI-X chip