LAN HP-IB Test System Pre-Setup Evaluation And Implementation

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Abstract

HP-IB (GP-IB) is an interface bus that connects a controller (computer) to equipment so that the controller can control the equipment remotely using the standard HP-IB protocol. The connection between equipment and controller used to be connected using a fat HP-IB cable that has a limited length of 15 meter. The limitation of 15 meter has been carry on for years right before the LAN HP-IB gateway appear in the market.

LAN HP-IB test system make used of the LAN HP-IB gateway in replaces of LAN HP-IB card. The combination of using LAN HP-IB gateway and multitasking UNIX controller have make the test system an interesting system to look into. This paper discuss the entire finding obtain during the preparation and evaluation of this new system. A comparison between typical test system and LAN HP-IB system are draw out here in order to make the concept clear. A brief discussion on the Architecture on LAN HP-IB and Terminal Server are done here in order to make the system complete since these two component are the major component use here. Due to break through of using LAN HP-IB, a new test system architecture are drawn here to illustrate that LAN device have allowed us to look into test system at a different angle. A better system architecture can be design since the system hardware and software is easily identified now.

Although the evaluation have smooth up the process in making the major transition from old 300/382 system to new B132b system. This paper did not cover much on this area because the major focus for this paper is on LAN HP-IB test system.

Introduction

LAN HP-IB has been implemented in Plantation and Dublin for some time. However, it was not use in Penang due to cost and not knowing much on the device. Because of the competitive cost offer by the device (LAN HP-IB gateway) and also some success story on using it, it is necessary for us in Penang to study and evaluate this device to see what possible impact the device will affect test system design and development in this region. A project on evaluating LAN HP-IB was carrying out and result was rewarding. During the evaluation, we manage to learn up the concept on using the device. We also look into finding out the advantages, impact and cost benefit in using the device. We have made some notes and guideline in order to smooth up most of our initial setup on LAN HP-IB system. The notes and guideline is enclosed in the Appendix of this paper.

History of Test System

Test system has come a long way to a complex but simple to maintain system that we have today. The complexity of cause is the networking part. However, this complexity has simplified the maintenance part, and makes the system more efficient and robust.

Due to the compatible cost pressure given by PC to the UNIX test system, at one time we were force to

look into PC which have a less robust and high maintainability cost in-term of backward compatibility and support issue due to PC's fast moving trend. PC setup is low cost in short term but high cost in long term. It is good for short live cycle product (2-3 years) but not long-term product (3-10 years).

LAN HP-IB solution have given UNIX an opportunity to fully make use of UNIX well know multitasking capability to compete with PC. The study we done between PC and UNIX have given us an opportunity to some how integrate both system in order to further cut down the system setup cost. LAN HP-IB Compro and LAN HP-IB MATRIS were the two project implemented after this project. However, the integrated system is not the major focus here.

LAN HP-IB Test System

Before looking into LAN HP-IB Test System, this section will start by looking at a typical test system setup. It will then walk through the LAN HP-IB test system setup followed by looking at the concept on two major component, LAN HP-IB gateway and Terminal Server, which were use in LAN HP-IB test system.

Typical Test System

A typical test system setup is shown in figure -1. Normally it have a few Equipment connected to a controller using HP-IB cable that allow controller to send equipment command to set equipment setting. It also have a RS232 cable connected between the radio and controller that allow controller to send radio protocol to set radio to certain test mode.

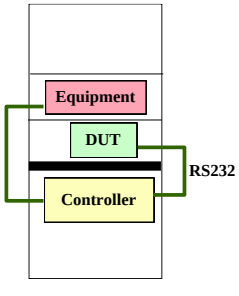


Figure -1

LAN HP-IB Test System

A typical LAN HP-IB test system setup is shown in figure 2. By installing LAN HP-IB gateway and terminal server (more on terminal server in later part of this paper). The controller now can be taken out from the test system and install in a remote side. Controlling the equipment and sending signal to the radio from controller can now done through network. This new setup have made the test system looks more modular.

If we look at the test system as two modules here, that is the system and the controller. We can made the following conclusion: If the response of the system is much slower than the controller CPU speed, a multitasking controller can be use to control a few test system. This is the actual case if we compare the equipment response and radio response Vs controller CPU speed.

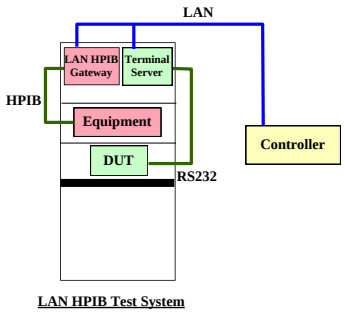


Figure 2

Due to the response in accessing equipment and communication between radio and controller are always much slower than the CPU speed, we can now connect more test system to a single multitasking controller and yet still get the same performance. Figure 3 show this recommended connection. Through network we can easily connect 2, 3 or more system to a single multitasking controller.

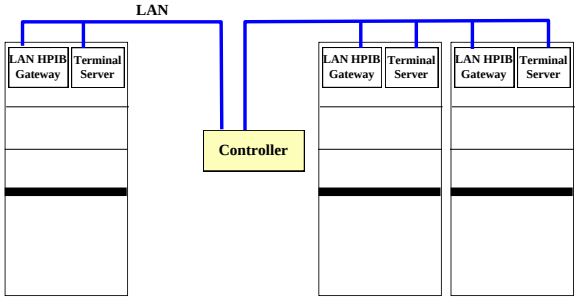
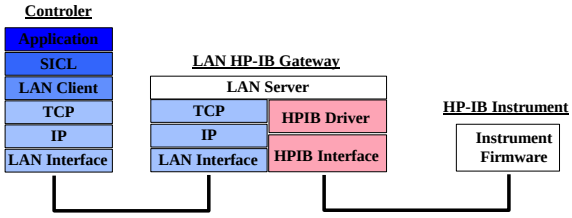


Figure 3

LAN HP-IB Gateway

The major component of LAN HP-IB test system is the LAN HP-IB gateway. LAN HP-IB gateway is an interface box that transform HP-IB protocol to TCP/IP protocol and vise versa. The LAN HP-IB Gateway Architecture is as shown in figure 4. Basically the client system (controller) contains the LAN client software provided with HP SICL and TPC/IP LAN software that is required to access the Gateway. The Gateway contains LAN server and TCP/IP LAN firmware so that it acts as the LAN server. The LAN client software provided with HP SICL uses the TCP/IP LAN protocol suite to pass message between the client system and the server (the HP E2050 LAN/HP-IB Gateway). Therefore, the client sends I/O requests over the network to the server. The server then executes those I/O requests on the appropriate HP-IB based instrument(s) connected to the server.

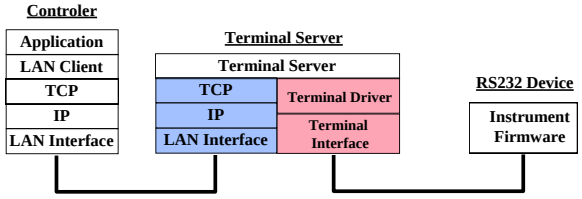


LAN HP-IB Gateway Architecture

Figure 4

Terminal Server

Beside LAN HP-IB gateway, Terminal Server is another important LAN device use in LAN HP-IB test system. It allows controller to access serial port through the network. The reverse telnet is use here to configure the terminal server. Terminal server architecture is quit similar to LAN HP-IB gateway. A set of deamon is running on the client system to take in the virtual serial port signal from the application program and send it to the terminal server physical port through the network using TCP/IP protocol.



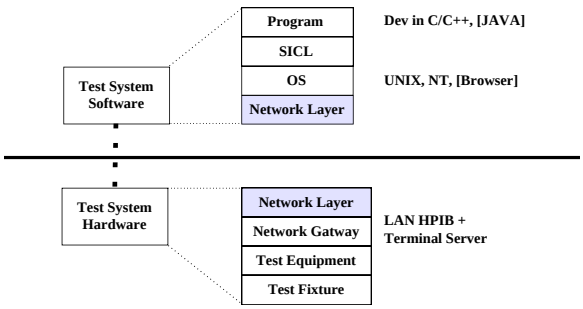
Terminal Server Architecture

Figure 5

LAN HP-IB Test System Architecture

LAN HPIB test system have set a break through in test system design. By moving the controller out from the setup, it is now possible to make the system controller independent from the test system. The controller can be a stand-alone PC unit running windows OS or a multitasking controller running UNIX OS.

With the separation between the controller and system hardware, the LAN HP-IB test system architecture is design to separate the system into software and hardware module. The software module contains the Network Layer, OS, device driver and Program compiler. The hardware module is purely hardware that contains the Network Layer, Network Hardware device, Test Equipment and Test Fixture. Figure 6 show the design of LAN HP-IB test system architecture.



Software and Hardware Architecture in LAN HPIB Test System

Figure 6

With the new architecture, engineers can zoom in to a specific area/module to make improvement on the system since now the hardware is independent from the software.

Network Setup

Since LAN HP-IB test system is strongly depend on LAN Network. A well plan network infrastructure is required. Figure 7 show a propose network for LAN HP-IB setup.

In order to maintain the performance of LAN HP-IB test system, it is recommended that all the test system will have its own subnet that is isolated from a major backbone. By installing two-network card into the controller the isolation can be perform easily.

Propose Network Setup

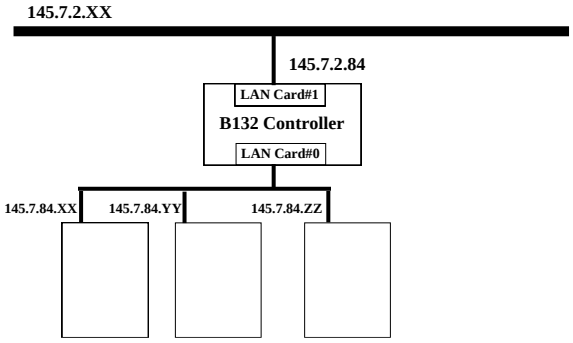


Figure 7

Cost Comparison

Two cost comparisons are performing to evaluate the cost impact in implementing LAN HP-IB test system. The first one is done to compare cost different between Cluster/Server test system and LAN HP-IB test system. The second one is done to compare cost different between PC test system and LAN HP-IB test system.

Cost Comparison between Cluster/Server Test System and LAN HP-IB Test System

This cost comparison was done in order to compare the tradition "dual head cluster/server setup" and LAN HP-IB setup. The comparison is done on total output rather than number of test system.

In the pass, a dual head system will get a factor of 1.36 more output as compare to a single head system. Base on this factor, 6 dual head system will give same number of output as compare to 8 single head test system. As a result, using LAN HP-IB will get A cost saving of 84% or US$131,000. Figure 8 show the detail breakdown and cost comparison between the two systems.

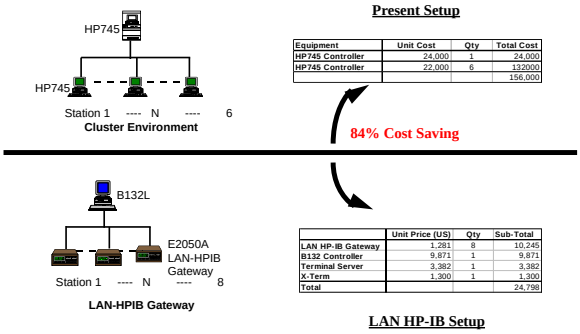


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Figure 8

Cost Comparison between PC Test System and LAN HP-IB Test System

In order to see the cost impact between PC and UNIX, we break the system setup into two parts, infrastructure cost and unit cost. The infrastructure is mainly on initial setup cost in-term of network and server setup. The unit cost is for individual unit once we have the infrastructure setup.

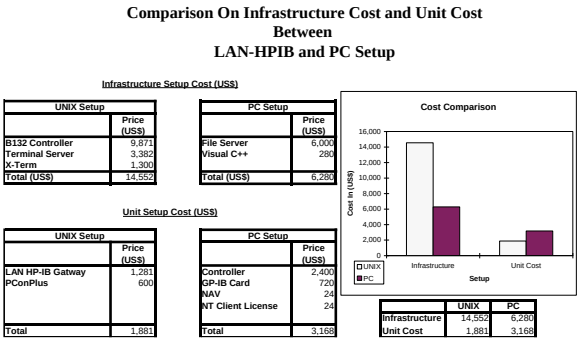
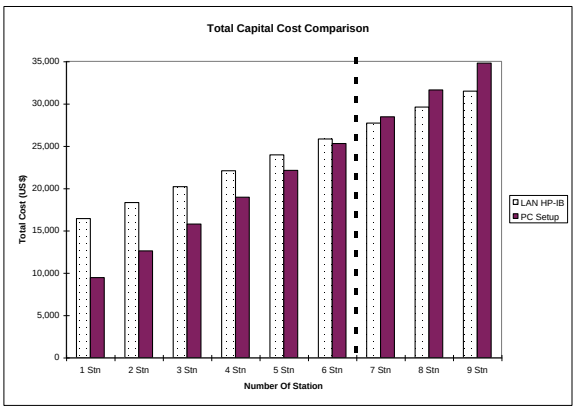


Figure 9

From figure 9, we see that initial setup cost for UNIX system (LAN HP-IB) is higher than PC initial setup. However, addition system setup for LAN HP-IB system is less than PC setup. Base on this fact, we make another analysis to see the break-even point on the two systems. The result is shown in figure 10.

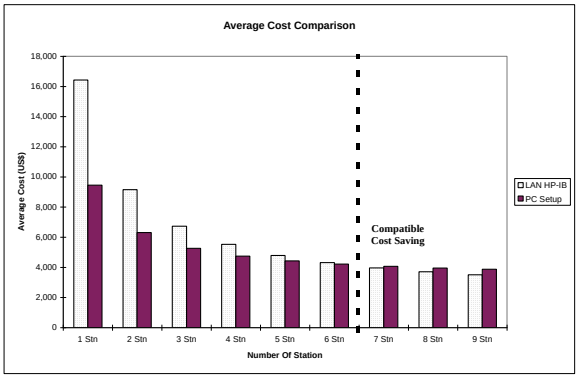


	1 Stn	2 Stn	3 Stn	4 Stn	5 Stn	6 Stn	7 Stn	8 Stn	9 Stn
LAN HP-IB	16,433	18,314	20,194	22,075	23,956	25,836	27,717	29,598	31,478
PC Setup	9,448	12,616	15,784	18,952	22,120	25,288	28,456	31,624	34,792

Figure 10

From figure10 we see that the break-even point occur after setting up the sixth station. After that point on-ward, UNIX (LAN HP-IB) cost become lower compare to PC cost.

Figure 11 is another graph plot to show the cost impact on setting up LAN HP-IB. The initial cost can be really high. However, when more system are setup, cost of each system can be driven down tremendously



	1 Stn	2 Stn	3 Stn	4 Stn	5 Stn	6 Stn	7 Stn	8 Stn	9 Stn
LAN HP-IB	16,433	9,157	6,731	5,519	4,791	4,306	3,960	3,700	3,498
PC Setup	9,448	6,308	5,261	4,738	4,424	4,215	4,065	3,953	3,866

Figure 11

Conclusion

The direction of moving to LAN HP-IB is clear. By installing the network gateway (LAN HP-IB and Terminal Server) into the test system that remove the controller to a remote side allowed a lot of break through in test system design. System design is now clearer cut between hardware and software. Controller is now less independent on OS. Base on the fact that, equipment response is always slower than CPU speed, LAN HP-IB test system allowed us to share controller more efficiently. The initial cost of setting up LAN HP-IB may be very high that stop one from implementing it in order to get the long term cost saving. However, if we are able to make detail study and evaluated on the benefit that the system will bring us, we will definitely make correct decision in selecting this setup.

References

[1] "HP E2050 LAN/HP-IB *Gateway Installation and Configuration Guide*." Hewllett Packard, 3rd Edition, May 1996.

[2] "HP Standard Instrument Control Library. *User's Guide for HP-UX*" Hewllett Packard, 4th Edition, Nov 1995.

[3] "IOLAN User and Administration Guide" Chase Research, 1997 Chase Research PLC.. Ref: IOL/036/100

[4] S.A. Chuah "LAN HP-IB Test System for cost effective backend." Motorola Penang TSE/MIS Project Review, Dec 1997. Dec 1997

[5] S.A.Chuah "LAN HP-IB Test System. Implementation and Setup." Motorola Penang TSE/MIS Project Review, Mar 1998. Mar 1998

APPENDIX

This Appendix enclose all notes and guide line for setting up LAN HP-IB test system

SICL Installation

1) **Run /etc/sbin/swinstall**
   - **GUI Setup program**
2) **Select E2091E E.01.xx**
3) **Select <Install> from <Action> Menu**
4) **Done!**

Configure SICL

1) **At /etc/opt/sicl** (HP-UX10.20)
2) **vi hwconfig.cf**
3) **Add in following line**
   - **30 hpib ilan 0 0 120 25 1 1**
     - **<lu> <symname> ilan <unused> <unused> <sicl_infinity> <lan_timeout_delta> <chain_sigpipe> <log_errors>**

- ◊ **<lu> : Logical Unit Number** (Will be use by PATS)
- ◊ **<symname> : A symbolic name** (Will be use by PATS)

4) **At /etc/sicl/bin run lanconf to confirm setup**
   - **program should return 4 messages that /etc/inetd.conf and /etc/rpc are config**

5) **Done!**

Configure LAN HP-IB Gateway

1) **Do a hardware reset on LAN Gateway**
   - **Press the *preset button* at the same time apply power to gateway to reset the gateway**
2) **At client computer type**
   - **route add host 192.0.0.192 <client_ip>**
3) **Telnet 192.0.0.192**
   - **Note : 192.0.0.192 is default LAN Gateway Address**
4) **Configure Gateway with the following Cmd:**
   - **hostname: hostname_for_gateway**
   - **ip: ip_address_for_gateway**
   - **default-gw: 145.7.XX.253 (Optional)**
   - **subnet-mask: 255.255.255.0**
   - **io-timeout: 0**
   - **lan-timeout: 0**
5) **To view the setting use *config* cmd**
6) **Type reboot to reset the setting**
7) **ping gateway new ip address to confirm working**
8) **Done !**

Configure SICL for PATS

1) **vi** pats_env_file
   - **EQUIP_COMM:**
   - **comm_type 0**
   - **comm_name SICL_HPIB**
   - **config_file /home/pats/HAMMER/files/sicl.config**
   - **init_driver pats_sicl_init**
   - **read_driver pats_sicl_read**
   - **write_driver pats_sicl_write**
   - **cleanup_driver pats_sicl_cleanup**
2) **vi** sicl.config
3) **Add following line into the file**
   - `30 7 lhpib01:hpib`
   - **<lu> <slcode> <gw_hostname: gw_logical_name>**
     - ◊ **<lu>: logical unit name *(Xref with hwconfig.cf)***
     - ◊ **<slcode>: Select Code (use in PATS equip.conf)**
     - ◊ **gw_hostname: Gateway hostname**
     - ◊ **gw_logical_name: Gateway logical name**
     - ◊ **(Xref with hwconfig.cf)**
4) **Done !**

Writting SICL C Program

1) **Compiling the program**
   - **cc -o <filename> <filename.c> -lsicl**
2) **In the source code**

```
⇒ #include <sicl.h>
⇒ #define DEVICE_ADDRESS
   "30,lhpib01:hpib,23"
⇒ INST  id;
⇒ id = iopen(DEVICE_ADDRESS);
⇒ iclose(id);
⇒ other sicl functions
   iprintf(), icsanf(),
   itimeout(), ipromptf()
```

Configure Terminal Server

1) **At client hosts type:**
   - `arp -s a.b.c.d AA.BB.CC.DD.EE.FF`
   - **a.b.c.d : IP_Address**
   - **AA.BB.CC.EE.FF :Ethernet_Address**
2) **telnet a.b.c.d**
   - **(Use xterm and set TERM=vt100)**
3) **Type *set term vt100***
   - **That will bring up GUI set menu**
   - **If set term vt100 does not bring menu up type set menu**
4) **Select *Admin Mode* from Main Menu**
5) **Select password and enter password**
6) **Select server to enter server conf menu**
   - **Set : IP Address**
   - **Set : Subnet mask**
   - **Set : NS Port [53]**
7) **Select port to configure port setting**
8) **Select reboot to reset configuration**
9) **Done!**

Setup Bootpd Daemon

1) **At /etc/inetd.conf uncomment the line :**

- **bootps dgram udp wait /etc/bootpd bootpd**

2) **At /etc/bootptab add the following line :**
   - **iolan:\ ht=ethernet:\ ha=0080D4007A9E:\ ip=145.7.2.84**
3) **ping *ip_address* to confirm connection**
4) **Done!**

Setup Terminal Server Deamon

1) **Create the file ioland.cf at /etc directory**
   - **-x3 -p -h iolan1 10001 lport1**
   - **-x3 -p -h iolan1 10002 lport2**
     - ◊ **-x3 = debug level**
     - ◊ **-p = maintains a continue connection to port**
     - ◊ **-h = will cause a hang-ip on the pseudo tty if tcp connection lost**
     - ◊ **-T = enable telnet portocol processing**
2) **At /sbin/rc add the the following line**
   - **ioland**
3) **Done!**

Setup Terminal Server Deamon (Another Option)

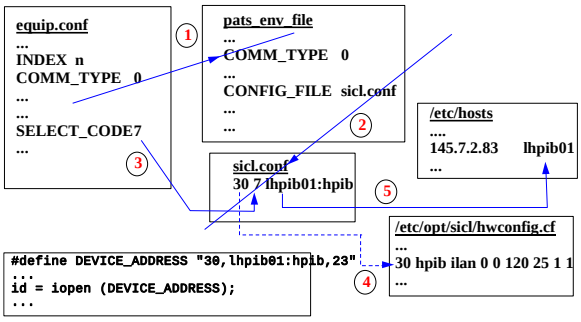
1) **At /sbin/rc add the following line:**
   - **/bin/nohup /usr/local/bin/ptydrv -p10001 -n145.7.2.84 -tttyr0 1> /dev/null 2> /dev/null &**
   - **/bin/nohup /usr/local/bin/ptydrv -p10002 -n145.7.2.84 -tttyr1 1> /dev/null 2> /dev/null &**
2) **Done!**

Configure terminal Server for PATS

1) **vi pats_env_file** *(No Change)*
   - **comm_type 1**
   - **comm_name HPSERIAL**
   - **config_file /home/pats/HAMMER/files/hpserial.config**
   - **init_driver pats_hpserial_init**
   - **read_driver pats_hpserial_read**
   - **write_driver pats_hpserial_write**
   - **cleanup_driver pats_hpserial_cleanup**

2) **vi hpserial.config** *(No Change)*
   - **PORTS:**
   - **/* port #0 */**
   - **select_code 29 (Xref with equip.conf)**
   - **address 2 (Xref with equip.conf)**
   - **mode 5**
   - **device_driver /dev/ttyr0**
   - **init_on_startup 1**

Relationship of PATS config file



Relationship of PATS config file