Virtual Loops, PILs and LIF

An Update on HP-IL

(HP Interface Loop )
Intro Remarks

- Where am I coming from?
  - Just informing, not creating
  - Lovingly ignored HP-IL ~1986-2013
  - HHC 2013 comments spurred PIL-Box interest
  - HP-71B bias blatantly obvious
    - Learning HP-75 now, Re-learning HP-41 now
- HP-IL experience in audience? Ctrlr Types?
- Please ask topical questions during talk
- Interest in show-and-tell on Sunday?
Today’s Topics

• HP-IL Review
• LIF Volumes
• PIL-Box
• ILPer Client
• Virtual HP-IL Extensions
• Examples
• Resources and Credits
HP-IL Review

• Serial Interface, Loop Config.
• Devices connected daisy-chain
• Each device has 1-In, 1-Out
• Only 1 controller active \textit{at a time} on the Loop
• Devices can be addressed by current address, class, role, or exact type (lots of ways to talk)
• Devices can also send to each other, not just the controller (tell one to listen, another to talk)
HP-IL Controllers

• Terminal-like device for issuing commands, collecting and processing data
• HP-71B most refined, plus it can also be an IL device
• HP-41 & HP-75 – Initial clients, slightly less flexibility
• HP-110 Portable and Portable Plus (integrated use)
• PC using HP-82973 ISA-slot Add-in Card (DOS)
• HP-80 series Personal Computers
• HP-150 Desktop PC
HP-IL Devices

• Printers (and Plotters)
  – 82162A Thermal Printer – IL version of 82143A
  – 2225B ThinkJet – 80 column, graphics, fonts, etc.

• Mass Storage
  – 82161A Tape Drive – 128KB Micro Cassettes
    • Uses “Filbert” Protocol – presumes tape-like behavior
    • Most tapes are actually still good – pressure pad repairs
  – 9114B Diskette Drive (also 9114 aka 9114A)
    • Uses “SS/80” Protocol – presumes disk-like (and Filbert)
    • Today, frequently need eject mechanism cleaning
HP-IL Devices

• Data Acquisition
  – HP3421A Data Acquisition Unit (30-chan AC/DC)
    • HP-41 IL Cmds (tedious) and 71B (with Data Acq Pac)

• Instruments
  – 3468A/B DMM
  – Logic analyzer, Freq counter, spectrum analyzer
  – Gas Chromatograph (!!)

• PCs slaved for special purposes
  – J-F Garnier’s TERM71 – uses 110 as 71 terminal
HP-IL Interface Options

- 40- and 80-column video
- Acoustic coupler (modem)
- 82164A – RS-232C (serial port)
- 82165A – GPIO (parallel port)
- 82169A – HP-IB
- 5061-3166 – SCSI
- Products for embedded use
How Much Do I Need to Know?

- If you can describe all possible data paths for above diagram, you’re set
- But, if you can copy files in DOS, you’re probably all set too...
LIF Volumes

• Logical Interchange Format (LIF)
  – HP cross-platform media (disk, tape) image format
  – Can be used like a ZIP file (without compression)
• Supported across all HP machines 41 to 9000
• Filenames, but no “extensions” (it’s pre-DOS)
• File Type and Implementation Bytes Fields
• If you’re only going to read 1 article on LIF
  – http://www.hpmuseum.org/cgi-sys/cgiwrap/hpmuseum/articles.cgi?read=24
LIF Volumes

• Programs easily exchanged
  – “Mount” volume w/PIL-Box s/w (it’s coming...)
  – Connect your controller
  – Copy program to the MassMem volume
  – Close PIL-Box s/w
  – Email, burn, etc. volume just as any other file

• Direct DOS <-> LIF file x-fer possible, but tricky
  – HPDIR (http://hp9845.net/9845/projects/hpdir/), Linux
  – File type and implem. bytes not supported in DOS
PIL-Box

• USB interface for PC, primarily for PC / HP-IL file transfer
• Provides virtual Mass Storage and Printer devices
• Simple USB driver installation and easy to use client

• Created by Jean Francois Garnier (J-F)
• Widely used in Enthusiast Community
  – Introduced 2009
  – Over 150 in use
  – F/W Upgrade 5/2014
PIL-Box “Assembly”

• Avail complete or kit
• ~1 week from France
• User supplies IL cable
  – Becoming more rare...
  – Cut 1 cable, atch ends
  – Trivial, takes < 5 mins
• Firmware upgradeable
  – Perf update in May ‘14
  – Possible Future SS/80
PIL-Box Virtual Devices

- Mass Storage Device (DEVID$=“HDRIVE1”)
  - Uses Filbert Protocol (SS/80 in future, 10MB+)
  - 616KB Max volume size, up to 640 file entries
  - Addressed as :TAPE(2), :MASSMEM(3), :HDRIVE1
  - “D:” drive from HP-110; holds DOS diskette img

- Printer Device (DEVID$=“DISPLAY” [old name])
  - “Printed” output displayed in scrollable window
  - Text only. No graphics, ESC sequence processing
  - Supports Win Clipboard – Copy/Paste to Win Apps
IL-Peripheral Emulator

- Original client (VB) by J-F Garnier (PPC France, JPC-ROM, EMU71/D)
- Enhanced client (VC) by Christoph Giesselink (EMU48, EMU71/W)
- Open Source – “easily” extensible (genius-class folks take note)
ILPer Client

- "Printer" output window
  - Scrollable, large buffer
  - Captures “Printed” output
  - Log console activity
- HP-IL Scope window
  - Toggle on / off
  - Learn low-level HP-IL
  - Loop is slow when On
- Configuration controls
- Select Volume File
ILPer Client – Same for Dif Controllers

For HP-41

For HP-110 Portable Plus
When Virtual is not enough

• Virtual Monitors (82163A and 92198) by C.G.
  – For true video out (e.g. DISPLAY IS... on 71B)

• HP-IL frame code debugger by C.G.
  – Trace and analyze IL Frames

• ILPer provides 1 Mass Mem and 1 Ptr Device

• What if I want 2+ virtual mass mem devices?
  – Copying files from one “disk” to another
  – Reading from one disk, Writing to another
Simple ILPer Flow
ILPer Enhanced by TCP/IP

Virtual HP-IL

PC1
- ILbox
- ILPer1: Printer, Mass Storage
- ILPer2: Printer, Mass Storage

PC2
- ILPer3: Printer, Mass Storage
- ILScope: IL frame graver

USB

PIL-Box

HP-71B or HP-41

Real HP-IL

Real HP-IL hardware
ILPIL-Box “Gateway”
TCP/IP Config Surprisingly Easy
Tools to do Virtually Everything …or Everything Virtually

- IL View LIF File
- Connect 9914B or 82161A via PIL-Box
- Use ILVlif as virtual controller
- Examine/ Print physical media catalogs
- No need to find and connect handheld
Tools to do Virtually Everything
...or Everything Virtually

- **ILCtrl** – Controller
- Send HP-IL Commands without device
- Requires moderate+ knowledge of HP-IL
- Easy to create log of commands & replies
- Useful to see typically hidden replies/errors
- Enhanced vers. by C.G.

9/20/2014

HHC 2014 Update on HP-IL
What can I do with these tools?

• Mass Memory Example
  – Copy files from LIF volume to device

• Printer Example
  – How to copy a ROM using a printer

• Larger Projects...
Copy Files from LIF Volume

- Hypothetical Scenario – Arrive at a conference and find your machine says “Memory Lost”
  - Connect PIL-Box to USB port and HP-71B
  - Start ILPer – select RPP.LIF – click “Start”
  - “Restore IO” on HP-71B to ID/config devices
  - “COPY ROMCOPY:TAPE TO :PORT(1)”
  - “ROMCOPY JPCROM:TAPE TO :PORT(3)"
  - “COPY LexFile:TAPE TO :PORT(1)”
  - “COPY MYPROG:TAPE” (to :MAIN)
How to copy a ROM using a printer

• I want to use my ‘71 MATH ROM, in EMU71
  – Use simple program to “Print” ROM contents
  – Copy/paste output to text file mathrom.dmp
  – Convert: “DMP2ROM mathrom.dmp mathrom.bin”
    • Existing utils from C.G. using Derek Nickel's Voyager fmt
  – Verify ROM CRC: “TITANCHK mathrom.bin”
    • TITANCHK Util included with EMU71
  – Load mathrom.bin into EMU71

• You can’t do that with a physical printer!
How to copy a ROM using a printer

10 DIM A$[64]
20 A=IP(HTD(ADDR$("EDTEXT"))/256)*256 ! Start address of ROM to dump
30 FOR I=0 TO 16*32-1 ! Length of ROM (here for 16KB)
40   A$=PEEK$(DTH$(A+I*64),64)
50   OUTPUT :3 ;A$ ! PIL-Box is address 3 & 4 on my loop, 3 is printer
60 NEXT I

• 20 Get address of 1st file in the ROM (in this example, Text Editor)
• 30-60 Loop on all bytes in the ROM
• 40 Get the next 64 nibs (32 bytes)
• 50 “Print” them to the virtual Printer
Key HP-IL Resources

• J-F Garnier’s HP-IL Website

• Christoph Giesselink’s HP-IL Website

• Museum of HP Calculators Forum

• eBay – All items discussed still available
Credits

• Huge Thanks to Creators of these Tools!!
  – J-F Garnier
  – Christoph Giesselink
• Both Enormously *Generous* & Accomplished Politicians
  – “Bob, replies to this question would benefit all” (use Forum!)
• Thanks for inspiration and tireless patience (with me)
  – Joe Horn
  – Dave Frederickson, Sylvain Cote
  – eBay hudendai, jones.sebago.lake, vintagecalculatorsinc
In Closing...

• Contributions from audience
  – Other uses?
  – War stories?

• Questions?

• Demos on Sunday?

• What Else Can One Build...