Migrating OpenSource Applications to HP-UX on Itanium

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Agenda:

- Why porting Open Source may not be easy
- Easiest ways to get (some) Open Source
- Almost easy way to run Open Source
- Sort of porting Open Source
- Porting Open Source code
- Porting the Open Source Tool Chain

Objectives: (You will know…)

- The sources of Open Source software that is already ported to HP-UX.
- What HP's Linux Runtime Environment (LRE) is and what it can do.
- What HP's Linux Porting Kit (LPK) is good for.
- What the Open Source Toolchain is.
- How much fun you can have porting the Open Source Tool Chain.

Why porting Open Source code to HP-UX may not be easy:

The HP-UX toolchain

- Basically a few components:
  - `aCC` - compiler
  - `ld` - linker
  - `make` – dependency resolution and building
  - `lex, yacc` – parsers
  - maybe your favourite other tool(s)
- All built by HP to work together, all installed together
  - No issues of component version compatibility

The Open Source toolchain on HP-UX

- A few more components:
  - `GCC` – Gnu Compiler Collection
  - `ld` - linker
  - `gmake` – dependency resolution and building
  - `lex, yacc, flex` – parsers
  - `autoconf`
  - `automake`
  - `bison`
  - `m4`
  - `binutils`
  - `gas` – the assembler (maybe)
- All built by different groups to work together, all installed separately
  - May be issues of component version compatibility

Open Source tool issues on HP-UX

- Versions:
  - Many different versions of each tool available at any one time
  - Which version did the software creator use?
  - Will other versions work?
  - Can you use `aCC` instead of `gcc`?
  - Can you use HP-UX `ld`, or must you use Open Source `ld`?
  - Does the 'working' set include only one version of each tool, or might older or newer versions of some tools work?
- Infrastructure:
  - Open Source expects the system API's in `glibc`, not HP `libc`
  - And all the other libraries

Easiest Ways to get some Open Source tools and applications

Open Source tools included in HP-UX

- Apache - web server
- Tomcat - servlet engine
- XML – web server tools
- Webmin - administrative tool
- Mozilla - browser
- Ipfilter – IP traffic control
- Bastille – system security / hardening
- mySQL – database
- GTK+ - graphics toolkit
- Gettext – NLS library
- libiconv – character set conversion library
- OpenGL – graphics run time
- CIFS – Windows file sharing

Open Source tools: Internet Express

http://www.software.hp.com/cgi-bin/swdepot_parser.cgi/cgi/displayProductInfo.pl?productNumber=HPUXIEXP1111

Downloadable or orderable as two CDs containing PA and Itanium 2 versions. Version 3.0 for Itanium contains:

Ant	->	A.03.00-1.6.1	Ant is a Java based build tool
Calamaris	->	A.03.00-2.58.	Cache Log Analyzer
Curl	->	A.03.00-7.11.	A Command Line Tool For Transfering Data
CyrusIMAP	->	A.03.00-2.2.3	A secure IMAP email server
CyrusSASL	->	A.03.00-2.1.1	Simple Authentication Security Layer
DanteSOCKS	->	A.03.00-1.1.1	A Socks Client And Server Implementation
Ethereal	->	A.03.00-0.10.	Protocol Analyzer
Fetchmail	->	A.03.00-6.2.5	Mail Retrieval And Forwarding Utility
Fsh	->	A.03.00-1.2.0	Fast Remote Command Execution
Horde	->	A.03.00-2.2.5	Web Application Framework
Hsqldb	->	A.03.00-1.7.1	Java SQL Database Engine
Hypermail	->	A.03.00-2.1.8	HTML mail archiver
IMP	->	A.03.00-3.2.4	Internet Messaging Program
Jabber	->	A.03.00-1.4.3	Jabber Server Implementation
Jetty	->	A.03.00-4.2.1	Application Server
Libpcap	->	A.03.00-0.8.3	Packet Capture Library

Internet Express (cont'd)

Majordomo	->	A.03.00-1.94.	Automates the Management of Internet Mailing Lists
Nessus	->	A.03.00-2.0.1	Security Scanner
Net-SNMP	->	A.03.00-5.1.1	Simple Network Monitoring protocol
OpenJMS	->	A.03.00-0.7.6	Java API For Java Message Service
OpenLDAP	->	A.03.00-2.1.2	The Lightweight Directory Access Protocol
OpenSAML	->	A.03.00-0.9.0	Open Source Security Assertion Markup Language
Perl-LDAP	->	A.03.00-0.31.	Collection Of LDAP Perl Modules
Pine	->	A.03.00-4.58.	A Sophisticated, Easy-To-Use Electronic Mail
PostgreSQL	->	A.03.00-7.4.2	Object-Relational Database Management System
ProFTPD	->	A.03.00-1.2.9	FTP Server
ProcMail	->	A.03.00-3.22.	Mail Processing Program
Qpopper	->	A.03.00-4.0.5	POP3 Server
SOAP	->	A.03.00-2.3.1	Java API For Simple Object Access Protocol
SSLDUMP	->	A.03.00-0.9b3	SSLv3/TLS network protocol analyzer
Snort	->	A.03.00-2.1.1	The Open Source Network Intrusion Detection System
Squid	->	A.03.00-2.55a	Squid Web Proxy Cache
Stunnel	->	A.03.00-4.05.	Stunnel SSL Wrapper
Sudo	->	A.03.00-1.6.7	Super User Do
Tcpdump	->	A.03.00-3.8.3	Network Monitoring and Data Acquisition
UDDI4J	->	A.03.00-2.0.2	Java API for UDDI registry
UW-IMAP	->	A.03.00-2002e	IMAP Server

Internet Express (cont'd)

UW-IMAP	->	A.03.00-2002e	IMAP Server
VOCAL	->	A.03.00-1.5.0	Voice-over-ip server
Xalan-C	->	A.03.00-1.7.0	An XSLT Processor
Xerces-C	->	A.03.00-2.5.0	Xerces-C C++ Parser
Xinetd	->	A.03.00-2.3.1	Secure Replacement For inetd
MySQL	->	A.03.00-4.0.1	MySQL Database

----- Second CD----------

Axis	->	A.03.00-1.1.0	Axis is an implementation of the SOAP
Eclipse	->	A.03.00-2.1.3	An Open Extensible IDE
Globus	->	A.03.00-3.2	Grid Development Toolkit
Jboss	->	A.03.00-3.2.3	Application Server

HP-UX Porting Archive

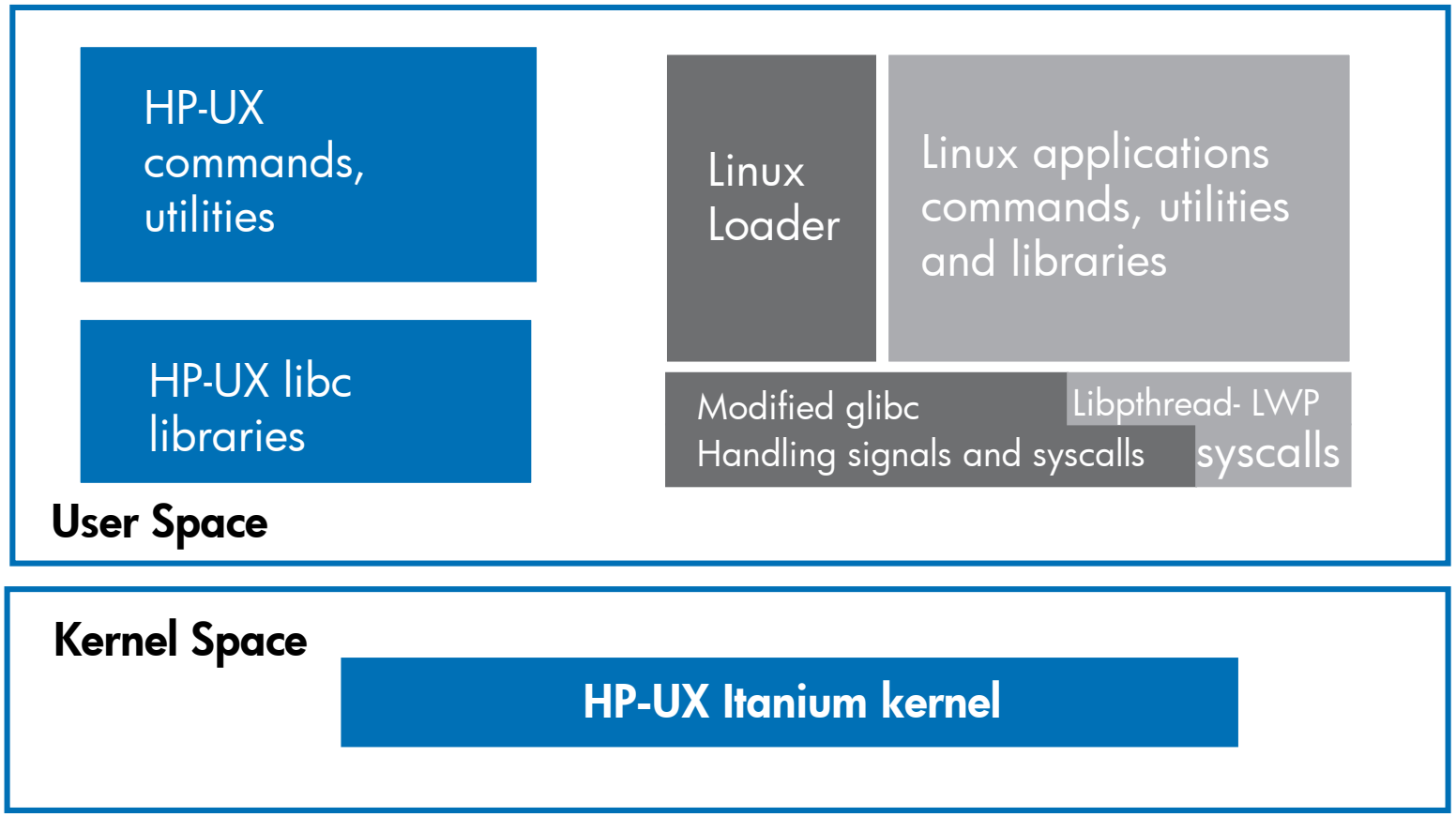
- To find, 'google' for "HP-UX porting archive" and pick the one nearest you – sites in UK, Germany, US, France, Canada, Netherlands, Italy, Japan, South Africa
- Contains about **2200** prebuilt tools, libraries and applications – there's a version of just about any Open Source tool in reasonably common use
- Come as a swinstall depot, ready to use
- Dependencies are mentioned in description
- Newness or oldness of versions may vary
- Operated by connect.org.uk
- Source Packages are available for most of the components

Almost easy way to run Open Source Applications (Linux Runtime Environment)

Linux Runtime Environment on HP-UX

- What does it do?
  - Allows 64 bit Linux Itanium binaries to run on HP-UX 11i V2
- What is it?
  - version of glibc-2.2.4 modified to run on HP-UX on Itanium
  - modified Linux library loader for dependent libraries
  - modified pthread library
  - HP-UX native version of RPM (for loading packages)
  - Linux-based ABI scanner for checking applications
- Where do I get it?
  - http://h21007.www2.hp.com/dspp/tech/tech_TechSoftwareDetailPage_IDX/1,1703,5757,00.html
- How does it work?
  - See next slides

LRE Overview



LRE: The process

1. Kernel recognizes a Linux app and maps it into memory
2. Kernel maps Linux dynamic loader into memory
3. Kernel switches to little-endian mode and transfers control to the dynamic loader
4. Dynamic loader relocates the Linux application, and then it loads and relocates the dependent Linux libraries into the HP-UX address space
5. Dynamic loader transfers control to the application's main entry point
6. Application runs

LRE: System calls (inside HP's glibc)

1. Linux application makes a system call
2. If required, the parameters are marshalled
3. Mode is switched to big-endian
4. Corresponding HP-UX system call is made
5. HP-UX system call returns
6. Mode is switched back to little-endian
7. If an error occurs, HP-UX error is mapped to Linux error, and –1 is returned to application
8. Else return values are marshalled if required and control is returned to the application

LRE: What won't work

- 32 bit IA-32 applications
- Applications bound to archived libraries through which system calls are invoked
- Kernel-intrusive applications
- Applications that use /proc (not on HP-UX yet)
- Applications that use Linux specific kernel APIs
- Applications that access Linux specific system files
- Applications which have a signal set mismatch between HP-UX and Linux – unknown signal will cause Linux application to die

LRE: In practice

- Not everything is still using glibc-2.2.4 – corresponds to RedHat 7.2 and RedHat advanced Server 2.1
- Until you know what you're doing, it's best to have the application on a Linux system from which you can keep transferring libraries until you have all that are needed
- Runtime performance may be 0-10% less than on Linux – depends on number and type of system calls
- Native RPM does allow direct download and install of Linux RPM packages
- Linux libraries should be placed in `/opt/lre/lib` or pointed to by `LD_LIBRARY_PATH`
- If an application passes the ABI scanner, it will run
  - If it doesn't, it may still run with some libraries added

LRE: Examples

- Simple commands and utilities work – may need to add a library or two to `/opt/lre/lib`
- A large application, like GIMP (the Linux Graphical Image Manipulation Program) has more dependencies, and may take a little longer.
  - think of this as more like a porting effort
  - need to know the application - how should it work, etc
  - includes many files - plugins, images, libraries *(dependencies)*
  - one way is to use RPM to install the application:
  - `# rpm -I --ignoreos --nodeps \ /mnt/cdrom/RedHat/RPMS/gimp-1.2.1-7.ia64.rpm`
  - install script may fail, but usually files are put in place
  - may still want/need things like *locale* support - native languages
  - GIMP has an issue with shared memory - `# gimp --no-shm`

Sort of Porting Open Source Applications (Linux Porting Kit / Software Transition Kit)

Linux Porting Kit (LPK)

- Set of needed Open Source tools (GCC toolchain)
- `libhplx` – library containing 96% of the Linux system API's, implemented on HP-UX
- needed header files (come with ANSI C Developer bundle)
- Documentation
- Found at: http://www.hp.com/go/LPK
  - hp-ux 11 open source tool kit -> should get the tools
  - libhplx library – gets the HP glibc and header files
  - Swinstall from libhplx_ipf.tar, and /usr/local/hplx/lib and /usr/local/hplx/include are populated

Linux Porting Kit tools

The LPK is currently at V2, but here are no CD's – it's download only. The pointer to the Open Source tools doesn't point to a chosen collection, just a long page of tools. If you want to assemble a current version of the collection yourself, the tools in V1 are:

autoconf 2.13
bzip2 1.0.0
enscript 1.6.1
gawk 3.0.4
gettext 0.10.35
GNU emacs 20.7
gzip 1.2.4a
less 340
m4 1.4
Python 1.6
TCL 8.2.3
textutils 4.0
Xalan 0.40
xpm 3.4

automake 1.4
ddd 3.2.1
expect 5.32.1
GCC 2.9.2000-03-01
GhostScript 5.10
grep 2.4.2
imake R6.3
libgd 1.8.3
ncurses 5.1
readline 4.1
tcp_wrappers 7.6
Tk 8.2.3
Xaw3d 1.5
zip 2.3

bash 2.04
dejagnu 2000714
fileutils 4.0
gdb 4.18
glib 1.2.8
GTK+ 1.2.8
jpeg 6b
libpng 1.0.6
patch 2.5.4
sed 3.02
tcsh 6.09
unzip 5.40
Xemacs 21.1.0
zlib 1.1.3

bison 1.28
diffutils 2.7
Flex 2.4.5a
GBDM 1.8.0
gmake 3.78.1
gv 3.5.8
LCLint 2.5m
libtiff 3.5.4
Perl 5.005_03
tar 1.13
texinfo 4.0
vim 5.7
Xerces 1.2.0a

S/W Transition Kit (STKL)

- Two source file scanners
  - `lxscansummary` – helps assess the amount of work, generates a web or text report
  - `lxscandetail` – identifies specific lines of source code with porting issues, and provides solutions – web or text report
- Documentation – HTML format, local or on HP
- Found at: http://www.hp.com/go/STKL
  - Under *Linux Transition to HP-UX*
    - Select *download*, then scroll down on the resulting page and select *Download and Install the Linux STK*
    - Select *Linux STK for HP-UX 11i for IPF ver 2*
    - Fill out the form and download B4580AL.tar
  - Swinstall using B4580AL.tar as the depot – no need to untar
  - This gets you the scanners and the HTML documentation

Installing the STKL

- Read the web based install instructions for more detail
- Swinstall using B4580AL.tar as the depot
- Edit `/etc/opt/STKL/config/client`
  - `STK_HOME=http://<host_ip>/STKL`
  - `STK_CGI_BIN=http://<host_ip>/cgi-bin/STKL`
  - `STK_EDITOR=editor-of-choice (vi, emacs)`
- Link the documentation to the web server:
  - `ln -s /opt/STKL/htdocs-linux /opt/hpws/apache/STKL`
- Enable cgi-bin by linking it into the web server
  - `ln -s /opt/STKL/cgi-bin /opt/hpws/apache/cgi-bin/STKL`

Installing the STKL (cont'd)

- Configure web server to execute programs by editing the ScriptAlias block in /opt/hpws/apache/conf/http.conf:

```
ScriptAlias /cgi-bin/STKL/ /opt/hpws/apache/cgi-bin/STKL
<Directory /opt/hpws/apache/cgi-bin/STKL/>
  AllowOverride None
  Options FollowSymLinks ExecCGI
  Order allow,deny
  Allow from all
</Directory>
```

- Make the first line of `/opt/STKL/cgi-bin/printerfriendly.cgi` points at Perl:

  `#!/opt/perl/bin/perl` or wherever your Perl is

- Add `stkedit` as a type (application) in your web browser
- Add `/opt/STKL/bin` to user's PATH if needed

Using the tools - briefly

For a complete description of the use of `libhplx` and its limitations, read the Linux Porting Guide for HP-UX on Itanium. Basically:

- To turn on global use of `libhplx` for gcc-based compiles:

  `/usr/local/hplx/bin/hplxGccSpecFile`

- And to turn it off:

  `/usr/local/hplx/bin/hplxGccSpecFile -d`

For HP aCC based compiles, to the compiler invocation, add:

```
-D__HPLX -I/usr/local/hplx/include \
         -L/usr/local/hplx/lib -lhplx -lsec
```

Use `lxscansummary` to scope out the types of code changes required.

Use `lxscandetail` to locate the individual lines to change

Command line options

lxscansummary and lxscandetail have the same command line options and share the same man page (lxiscansummary)

- input file options:
  - `file` - absolute or relative path to file(s) to scan
  - `-f filelist` - path to file containing a list of files to scan
  - `-r rootdir` - path to a directory - scan recursively down
  - `-R cdfs|nfs|vxfs|lofs` - only descend directories of file systems of specified type
  - `-u` - do not scan files of unknown type
  - `-y` - follow symbolic links
- list option:
  - `-d` - list all classification and synopsis ID abbreviation definitions

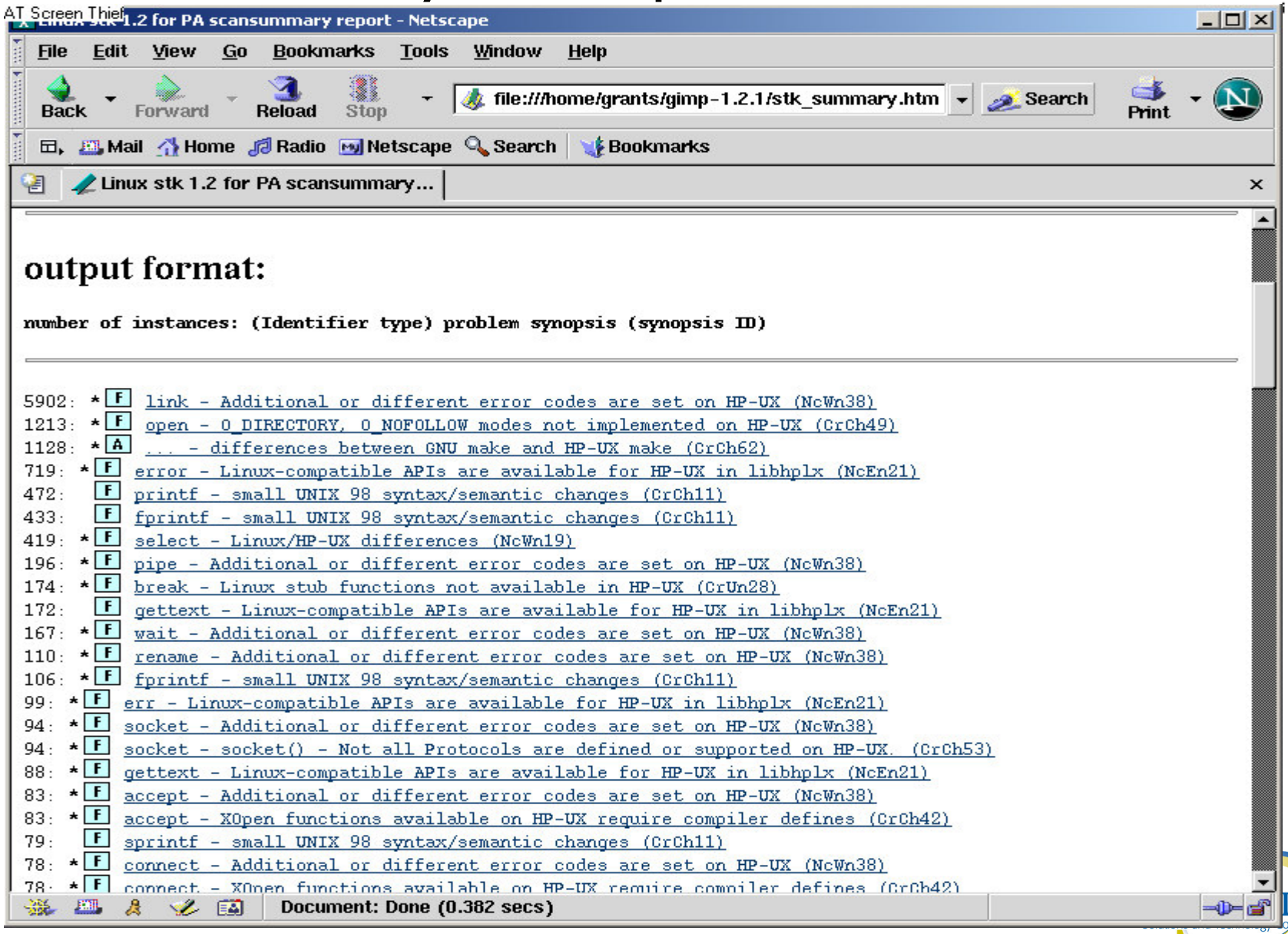
Command line options (cont'd)

- filtering options:
  - `-F file` - exclude file from scan
  - `-L file:lineno` - exclude output for lineno in file
  - `+/-` - include or exclude the items specified by the option letter
  - `C` - impact classifications - KN, NW, ST, TH, UN
  - `I` - synopsis ID
  - `S` - impact severity - Cr, Nc, Ns, Wn, En
  - `Y` - identifier type - F, H, I, K, M, Mf, S, A, C, L, P

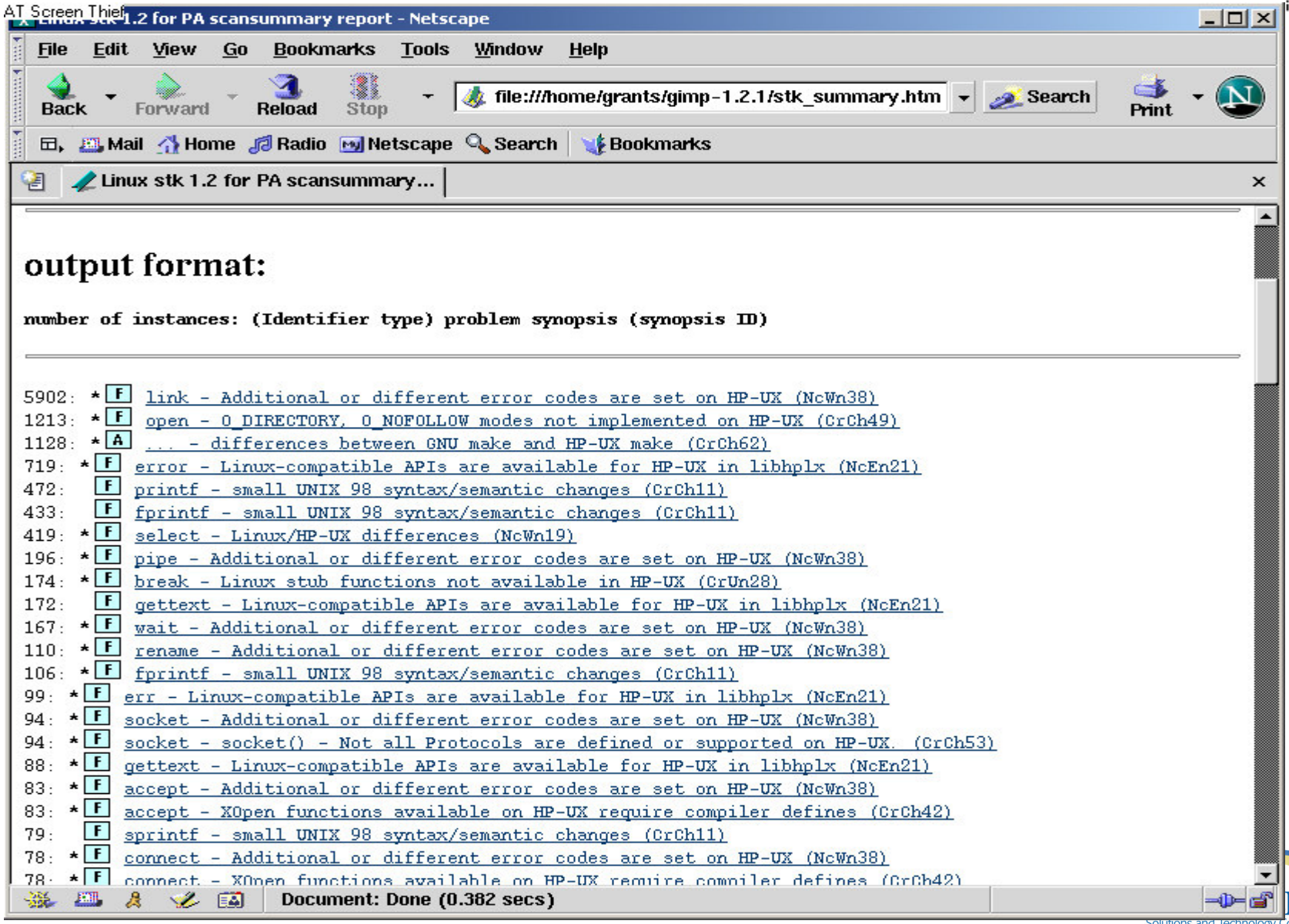
Command line options (still)

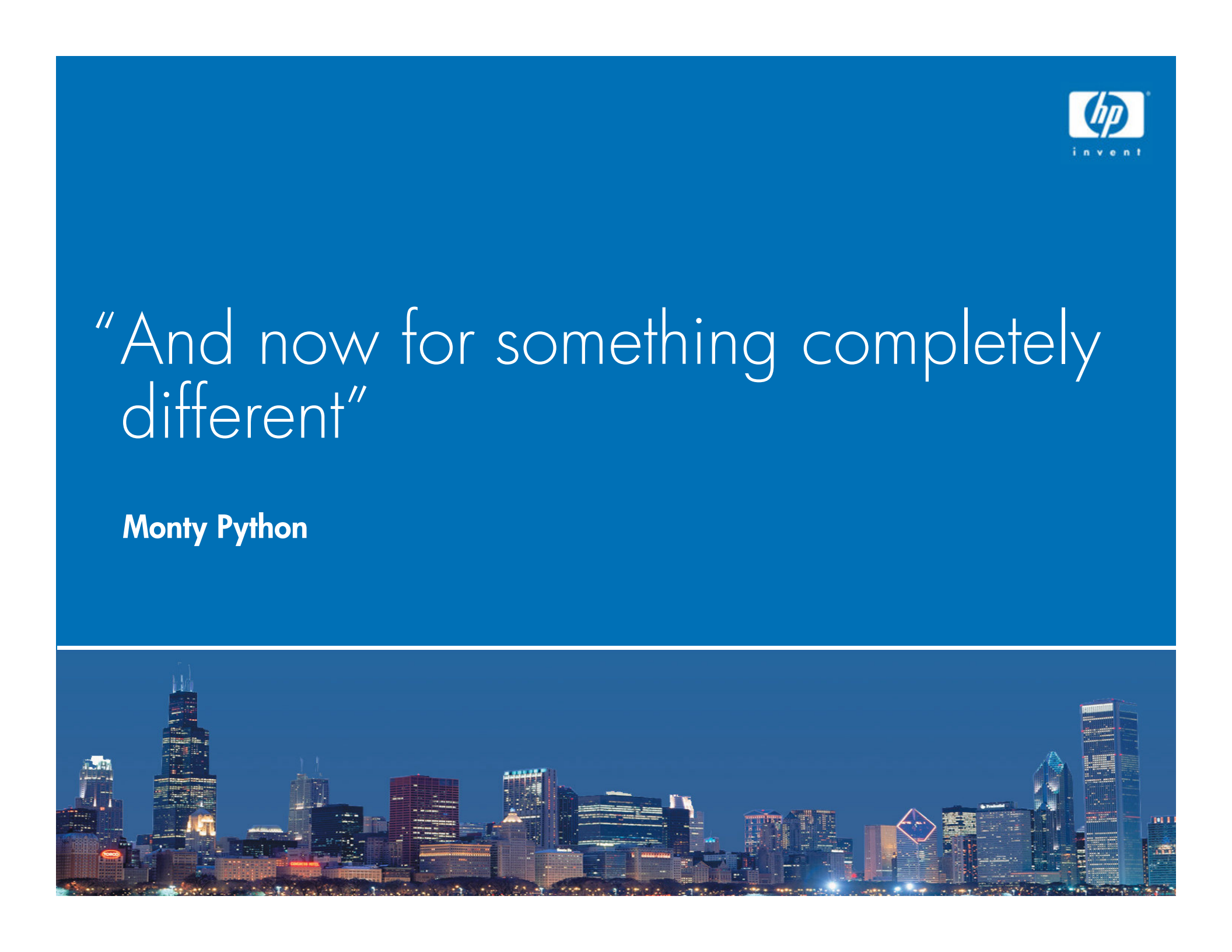
- ifdef options:
  - `-D sym` - define sym and invoke ifdef processing
  - `-U sym` - undefine sym and invoke ifdef processing
- output options:
  - `-m message` - use message as title for report
  - `-o html|text` - select output format
  - `-p prefix` - replace 'STK' in report name
  - `-s lineno|synopsis` - sort by file/line or impact (detail)
  - `-s class` - sort by classification, not # of impacts (summary)
  - `-v` - verbose output - info as it runs

scansummary example



scandetail example




hp
invent
"And now for something completely different"
Monty Python

HP-UX Based GCC Toolchain

HP-UX Ports

Bootstrap Installation

GCC Source Based Builds

HP-UX Based GCC Toolchain

Depots

HP Pre Configured Depots – Porting and Archive Center

- GCC 3.2.1 11.22 based Binary Depot
- GCC 3.3.1 11.22 based Binary Depot
- GCC 3.4.1 11.23 based Depot – Now!

http://www.hp.com/go/gcc

First Level Tools required by the Depots

- BISON - Gnu package 1.875
- LEX - hpux
- M4 - Gnu package 1.4
- MAKE - Gnu gmake 3.80
- YACC - not necessarily
- FLEX - current Gnu Package

- The depots come with a version of binutils embedded
- Installed via SWINSTALL

HP-UX Based GCC Toolchain

Native GCC Build on HP-UX

Sample Build for 3.3

Pre Build Requirements

Native from Source

- Have a recent binutils package installed - Build 2.15
- It is easier to build new versions of the compiler from a GCC base
- If using the aCC compiler – results in some changes to your Makefiles
- You may need to take a bricks and mortar approach – no recursive configure support
- You will need to use the HP Linker - /usr/ccs/bin/ld
- You will need a coherent set of GNU tools (m4, flex , etc)

Some Useful Tools

- BISON - 1.875 – depot or build
- FLEX - 2.5.4a - depot or build
- M4 - 1.4 - depot
- PERL - 5.8.3 - depot or build
- RANLIB nc
- LEXLIB nc
- ZLIB optional maintainer req
- PATH=/usr/local/bin:$PATH

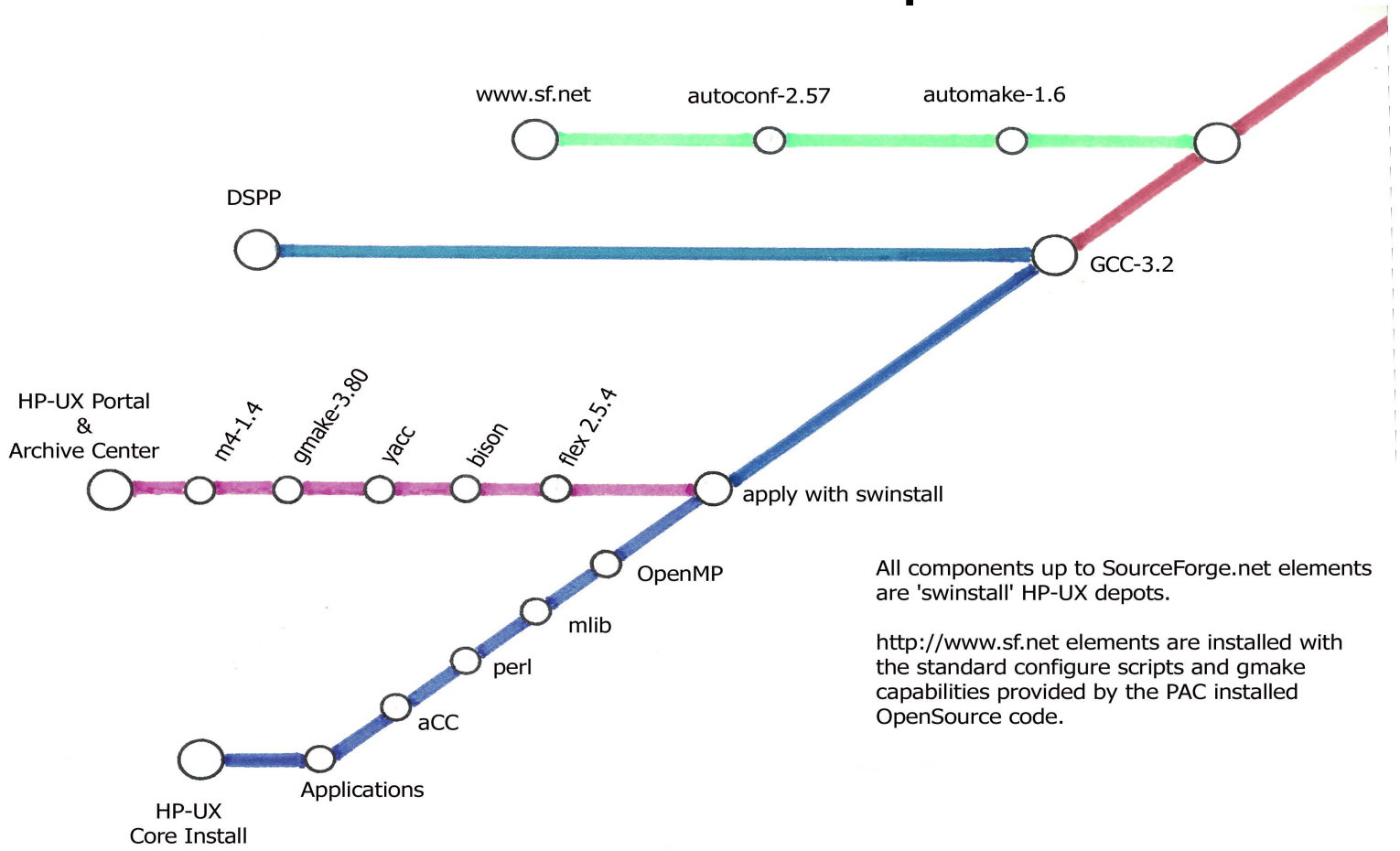
missing sometimes misses things that are there – even in PATH

Tools Delivery and Setup

- supplied as a tarball – not a *depot* or *swinstall* package
- env requirements
  - export CC=/opt/ansic/bin/cc
  - insure /usr/local , /usr/local/bin is in PATH
  - install make (gmake) 3.80
- Unpack and install infrastucture
  - Install m4 from depot (11.22)
    - export M4=/usr/local/bin/m4
  - Configure autoconf-2.57 then 'gmake' then 'gmake install'
  - Configure automake-1.6 then 'gmake' then 'gmake install'
  - LD_LIBRARY_PATH -- SHLIB_PATH

You are ready to start the GCC-3.3.2 Toolchain Setup

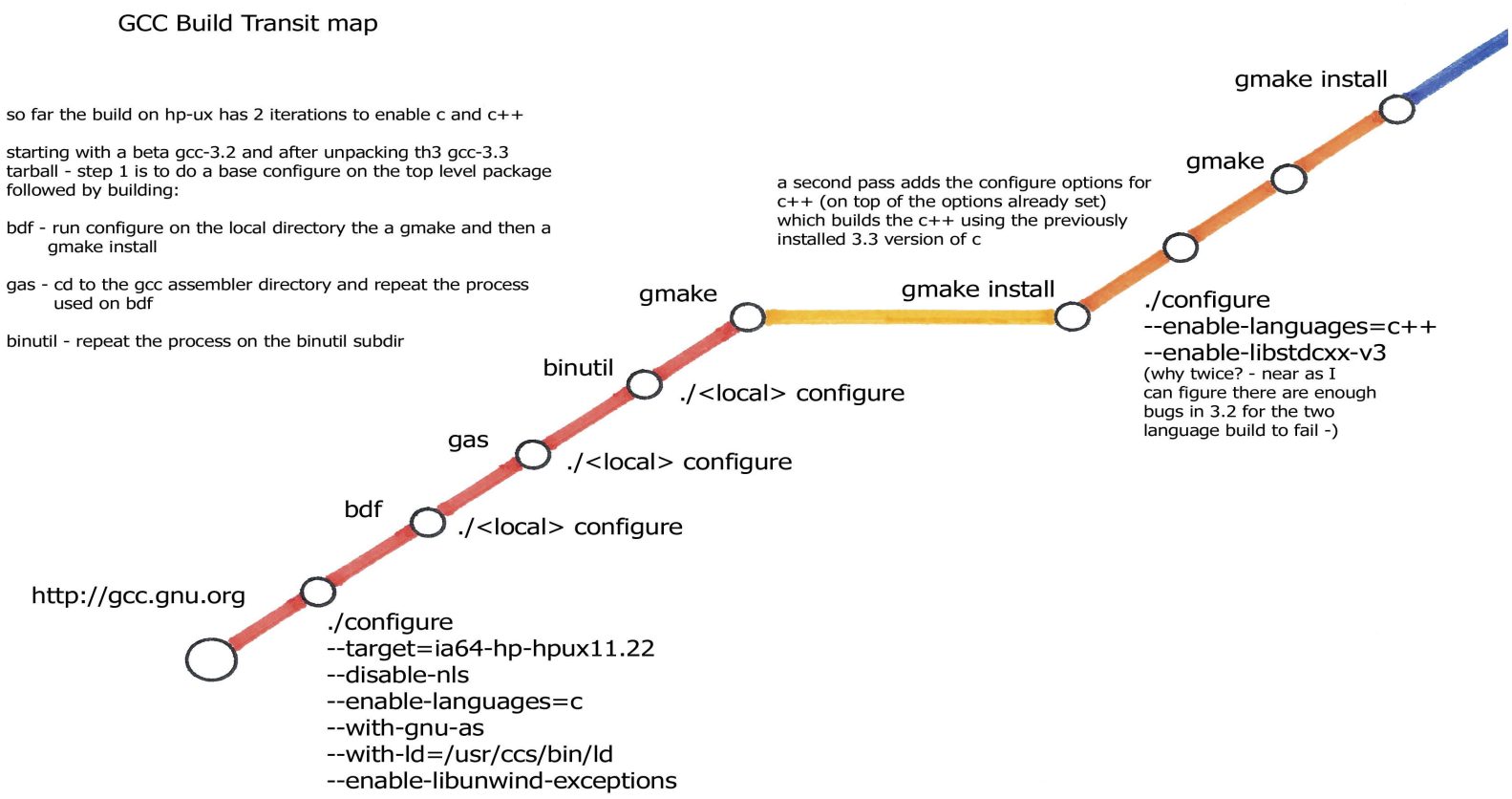
HP-UX Initial Software Setup for GCC



All components up to SourceForge.net elements are 'swinstall' HP-UX depots.

http://www.sf.net elements are installed with the standard configure scripts and gmake capabilities provided by the PAC installed OpenSource code.

GCC Build Steps for 3.2



HP-UX Based GCC Toolchain

Native GCC Build on HP-UX for 3.4.1

Bootstrap – bring bricks and mortar (not)

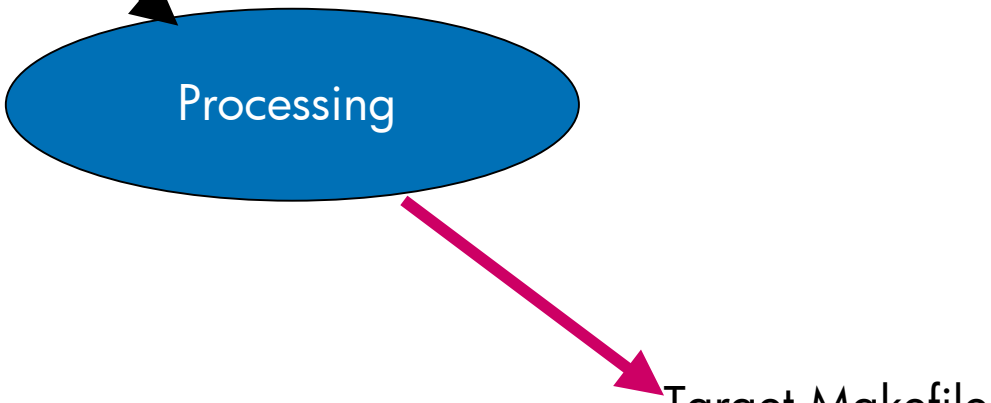
The GCC Toolchain

What the parts do

configure

./configure

- Makefile.in
- Makefile.dep
- Makefile.tpl
- configure.in
- Targets
- Missing
- m4
- excerpts from scripts for Star Trek Season 2



Bootstrap Dependencies

1. So far will only work if you have a pre-installed GCC - (supplies infrastructure elements) or build the dependent utilities one by one
2. The compiler builds itself (3 passes)
3. gmake bootstrap - C, C++
4. gmake bootstrap-lean - C only

Works on 3.4.1 Source with gmake, binutils , flex, bison …

First Level Tools required by the Native Build 3.4.1

yacc	v1.85 (not absoulutely required – (bison))
bison	v1.875
m4	(v 1.4 or better)
gcc make	(gmake) 3.80
autoconf	2.59
automake	1.6
autogen	5.3/6.x
binutils	2.15
gas	v2.13.90 (from bunutil)
bfd	built from binutul
perl	latest gnu
flex	2.5.4a

Some Useful ‘configure ‘ Options

- --with-ld=/usr/ccs/bin/ld
- --with-gnu-as
- --enable-shared (default on 3.4.1)
- --disable-nls (obsolete?)
- --enable-languages=“< c, c++, etc >”
- --with-libiconv-prefix – resolved some c89 issues on 3.4.0 build attempts

Additional Useful Parameters and cmds 'Local Compiler and ENV'

- CC -- default will look for /usr/local/bin/gcc
- CC=/opt/ansic/bin/cc – HPUX Itanium Compiler
- CCOPTS -- this is HPUX – be safe "unset"
- CFLAGS -- passes args to gcc as well as ansic (HP)
- CXXFLAGS – if you are controlling a c++ build
- LDOPTS -- only if you want something specific
- LD_LIBRARY_PATH
- PATH -- add /usr/local/bin
- gmake clean
- gmake distclean

GCC Compiler Build Configuration

- Using gcc
  - unset CCOPTS
  - export CFLAGS="-On"
  - default is –g –O2
- Using ansic
  - unset CCOPTS
  - export CFLAGS="+On +z"
  - export PICFLAG=" +z"
  - export CXXFLAGS=

GCC configure options

- Using ansic or gcc

--prefix=

--srcdir=

--bindir=

--without-gnu-ld

--with-ld=/usr/ccs/bin/ld

--with-gnu-as

--with-as=/usr/local/bin/as

--with-libiconv-prefix=/usr/local

--enable-nls=no

--enable-languages=c,c++

GCC configure options –our build

- Using ansic or gcc

--prefix= $O - target for objects – no compile in the source tree!

--srcdir= $S

$S/configure –prefix=$O –srcdir=$S –with-libiconv-prefix=/usr/local \
--with-gnu-as –with-as=/usr/local/bin/as \
--without-gnu-ld –with-ld=/usr/local/bin/ld \
--enable=nls=no –disable-nls \
--enable-languages=c (done as a first pass on ansic build)
Second pass
--enable-languages=c++ --enable-libunwind-exceptions (?)

HP-UX Based GCC Toolchain

Core GCC Application Development Toolchain on HP-UX

Building and Management of Applications using the Native GCC Toolchain on HP-UX

- CVS Support - Build or Install (depot)
- Autoconf - 2.59 from Depot or build from GNU
- Automake - 1.8 from Depot or build from GNU
- Libtool - 1.5 from Depot
- Autogen - 2.5.10 Build

Summary

GCC or Hp aCC?

- Use GCC if:
  - Portability is more important than performance.
  - The code is 'normally' built with GCC, and the work to change to aCC isn't justified.
- Use aCC if:
  - Maximum performance is important.
  - It's the compiler used for everything else, and maintenance of the GCC toolchain is onerous.

Summary – Building gcc

1. Pre built Depots – usually not current
2. Build from source (current) – easy way – with a prior gcc
3. Build from source – aCC compiler – Bricks and Mortar – Options

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