

Procedural and Object-oriented Programming 6

Commands

Business Programming 1

Business Programming 2



Basics,
Parsing

Commands,
APIs

Window-
Automatisation,
Web-Scripting

Security,
Debugging

Graphical User
Interfaces (GUI),
Sockets,
...

Commands, 1

- Directed to the operating system
- Typed on the command line, e.g.
 - "dir" (Windows), "ls" (Unix) ... list entries
 - "copy" (Windows), "cp" (Unix) ... copy files
 - "sort" (Windows, Unix) ... sort files
- Commands may have switches and arguments
 - "dir /s" (Windows), "ls -R" (Unix)
 - ... list also entries in subdirectories
 - "dir a* /s" (Windows), "ls -R a*" (Unix)
 - ... list entries starting with "a"
 - "sort /R" (Windows) "sort -r" (Unix)
 - ... sort in reverse order

Commands, 2



- Commands always have a numeric **return code (RC)**
 - Upon return of a command REXX sets a REXX variable named **RC** to the command's return code
 - It is therefore very easy to learn about return codes in REXX
 - If the return code is **0**, then the command executed without errors
 - Any other value for the return code and its meaning is usually documented with the command
- **Attention! Commands with file and path names may contain blanks!**
 - The command line interpreter splits commands at blanks, unless double quotes get used!
 - Therefore always enquote file/path names with double quotes!
 - Windows example: `dir /s "c:\abc def\this is a file with blanks.txt"`
 - Unix example: `ls -al "/abc def/this is a file with blanks.txt"`



Commands, 3



- REXX can run commands directly from strings, e.g.

```
"dir /s" -- execute command
```

- REXX will submit the string as the command to the system for execution
- Upon return the REXX **RC** variable refers to the command's return code

- REXX can run commands referred to by variables, e.g.

```
command="dir /s" -- assign to variable command  
command -- execute command
```

- Use the **ADDRESS** keyword statement explicitly, e.g.

```
ADDRESS SYSTEM "dir /s" -- execute command  
-- OR  
command="dir /s" -- assign to variable command  
ADDRESS SYSTEM command -- execute command
```

Commands, 4



- One can assign the command to a Rexx variable and use that

```
-- get current operating system
parse source op_sys +1 -- "W"...Windows, everything else is regarded to be Unix
if op_sys="W" then command="dir /s" -- list directory and subdirectories
                else command="ls -R" -- list directory and subdirectories
command          -- execute command via the operating system (command line)
say "Rexx, RC="rc
```

Output (Windows), maybe:

```
Directory of e:\tmp
10.11.2020  13:38    <DIR>      .
10.11.2020  13:38    <DIR>      ..
10.11.2020  13:40    <DIR>      .idea
10.11.2020  13:16                546 example1.rex
                2 File(s)          1 287 bytes

Directory of e:\tmp\.idea
...cut...
Rexx, RC=0
```

Operating System "Process"

- For each program that needs to be executed Unix or Windows
 - Creates a management unit named "*process*" and
 - Reserves memory
 - Reserves processor time
 - Sets up the following "standard files"
 - "standard input file ('*stdin*', file descriptor number **0**)": default input via the keyboard
 - "standard output file ('*stdout*', file descriptor number **1**)": default output to the screen (window)
 - "standard error file ('*stderr*', file descriptor number **2**): default output to the screen (window)
 - Sets up the process "environment"
 - Defines environment variables like
 - *PATH* ... determines the directories and the order for seeking programs
 - *JAVA_HOME* ... determines the Java directory to use
 - *CLASSPATH* ... determines the directories and the order for seeking Java classes
 - Manages and supervises the program execution (using a single or multiple threads)

"Redirecting Standard Files", 1

- Redirecting the standard files when running a program in a process
 - Redirection operators: '<' (*stdin*), '>' (*stdout*, *stderr*) and '>>' (*stdout*, *stderr*)
 - '>' will delete the output file, whereas '>>' will append output to the output file
 - Examples

```
rex  myprogram.rex  0<myinput.txt
```

```
rex  myprogram.rex   <myinput.txt
```

- Redirect input from the keyboard to the file "*myinput.txt*"

```
rex  myprogram.rex  1>myoutput.txt
```

```
rex  myprogram.rex   >myoutput.txt
```

- Redirect output from the screen to the file "*myoutput.txt*" (will delete file if it exists)

```
rex  myprogram.rex  2>myerrors.txt
```

- Redirect error output from the screen to the file "*myerrors.txt*" (will delete file if it exists)

"Redirecting Standard Files", 2

- Redirecting standard files when running a program in a process

```
rexx myprogram.rex 0<myinput.txt 1>myoutput.txt 2>myerrors.txt
```

```
rexx myprogram.rex <myinput.txt >myoutput.txt 2>myerrors.txt
```

- Input from file "*myinput.txt*" instead of keyboard, output to "*myoutput.txt*" instead of screen and error output to "*myerrors.txt*" instead of screen

- Redirecting *stderr* to *stdout*

- Redirect output to a file and also redirect error output to the same file

```
rexx myprogram.rex >myoutput.txt 2>&1
```

- Output goes to "*myoutput.txt*" instead of screen
- Error output goes to where *stdout* goes to, i.e. "*myoutput.txt*" as well
- Important note: always redirect *stdout* first and then redirect *stderr* to *stdout*!

- Redirecting and *appending* to *stdout* and to *stderr*

```
rexx myprogram.rex >>myoutput.txt 2>>myerrors.txt
```


"Redirecting Standard Files", 3

- "Piping"

- Redirect *stdout* of one program to *stdin* of the next program
 - The output of one program becomes the input of another program
- Piping operator: vertical bar ("|")
- Example

```
rex myprogram.rex | rex myfilter.rex
```

- The output (*stdout*) of "*myprogram.rex*" becomes the input (*stdin*) of "*myfilter.rex*"

- One can redirect and pipe to/from multiple programs

```
rex myprogram.rex < myinput.txt | rex myfilter.rex 2>removed.txt | sort
```

- "*myprogram.rex*": input is taken from the text file "*myinput.txt*", its output (*stdout*) gets piped to the next program's ("*myfilter.rex*") *stdin*
- "*myfilter.rex*": input is taken from *stdout* of the previous program, *stderr* gets redirected to "*removed.txt*", *stdout* gets piped to next program's ("*sort*") *stdin*
- "*sort*": input is taken from *stdout* of the previous program, output (*stdout*) goes to the screen

"Redirecting Standard Files", 4

- "Null device"

- Any output redirected to the "null device" gets discarded!

- Unix null device, a file named

- `/dev/null`

- Windows null device, a pseudo file named

- `nul`

- Used in redirections, examples

- ```
rexex myprogram.rex >nul
```

 (Windows)

- ```
rexex myprogram.rex >/dev/null
```

 (Unix)

- Show errors only (discard *stdout* output)

- ```
rexex myprogram.rex 2>nul
```

 (Windows)

- ```
rexex myprogram.rex 2>/dev/null
```

 (Unix)

- Show output only (discard *stderr* output, i.e. do not show error messages)

"Redirection", Example, 1

```
/* myprogram.rex: write input lines (stdin) to output (stdout) */  
do until value=""      -- if empty input, leave  
  parse pull value    -- read line from stdin, assign to variable "value"  
  say value           -- write to stdout  
end
```

Command (Unix, Windows):

```
rex myprogram.rex < myinput.txt
```

Output:

```
Max  
und  
Moritz  
konnt  
der  
Lehrer ...
```



```
myinput.txt:  
Max  
und  
Moritz  
konnt  
der  
Lehrer ...
```

"Redirection", Example, 2

```
/* myprogram.rex: write input lines (stdin) to output (stdout) */
do until value=""      -- if empty input, leave
  parse pull value     -- read line from stdin, assign to variable "value"
  say value            -- write to stdout
end
```

```
/* myfilter.rex: if value contains 'r' then write it to stdout, else to stderr */
do until value=""
  parse pull value     -- read line from stdin, assign to variable "value"
  if pos('r',value)>0 then say value -- write value to stdout
                        else call lineout 'stderr',value -- write value to stderr
end
```

Command (Windows):

```
rex myprogram.rex < myinput.txt | rexx myfilter.rex >nul
```

Command (Unix):

```
rex myprogram.rex < myinput.txt | rexx myfilter.rex >/dev/null
```

Output:

```
Max
und
konnt
```



myinput.txt:
Max
und
Moritz
konnt
der
Lehrer ...



"Redirection", Example, 3

```
/* myprogram.rex: write input lines (stdin) to output (stdout) */
do until value=""      -- if empty input, leave
  parse pull value    -- read line from stdin, assign to variable "value"
  say value           -- write to stdout
end
```

```
/* myfilter.rex: if value contains 'r' then write it to stdout, else to stderr */
do until value=""
  parse pull value      -- read line from stdin, assign to variable "value"
  if pos('r',value)>0 then say value -- write value to stdout
                        else call lineout 'stderr',value -- write value to stderr
end
```

Command (Windows):

```
rex myprogram.rex < myinput.txt | rexx myfilter.rex 2>nul
```

Command (Unix):

```
rex myprogram.rex < myinput.txt | rexx myfilter.rex 2>/dev/null
```

Output:

```
Moritz
der
Lehrer ...
```

myinput.txt:
Max
und
Moritz
konnt
der
Lehrer ...

"Redirection", Example, 4a (PARSE PULL)

```
/* myprogram.rex: write input lines (stdin) to output (stdout) */
do until value=""      -- if empty input, leave
  parse pull value     -- read line from stdin, assign to variable "value"
  say value            -- write to stdout
end
```

```
/* myfilter.rex: if value contains 'r' then write it to stdout, else to stderr */
do until value=""
  parse pull value     -- read line from stdin, assign to variable "value"
  if pos('r',value)>0 then say value -- write value to stdout
                        else call lineout 'stderr',value -- write value to stderr
end
```

Command (Windows):

```
rex myprogram.rex < myinput.txt | rex myfilter.rex 2>nul | sort
```

Command (Unix):

```
rex myprogram.rex < myinput.txt | rex myfilter.rex 2>/dev/null | sort -f
```

Output:

```
der
Lehrer ...
Moritz
```

myinput.txt:
Max
und
Moritz
konnt
der
Lehrer ...

"Redirection", Example, 4b (PARSE LINEIN)

```

/* myprogram2.rex: write input lines (stdin) to output (stdout) */
signal on notready -- raised, if no input data anymore
loop -- loop eternally, same as: do forever
  parse linein value -- get line from stdin, raises notready if no data anymore
  say value -- write to stdout
end
notready: -- label to signal, if no input anymore

```

```

/* myfilter2.rex: if value contains 'r' then write it to stdout, else to stderr */
signal on notready -- raised, if no input data anymore
do forever -- loop eternally, same as: loop
  parse linein value -- get line from stdin, raises notready if no data anymore
  if pos('r',value)>0 then .output~say(value) -- write value to stdout
  else .error ~say(value) -- write value to stderr
end
notready: -- label to signal, if no input anymore

```

Command (Windows):

```
rex myprogram2.rex < myinput.txt | rex myfilter2.rex 2>nul | sort
```

Command (Unix):

```
rex myprogram2.rex < myinput.txt | rex myfilter2.rex 2>/dev/null | sort -f
```

Output:

```

der
Lehrer ...
Moritz

```

myinput.txt:

```

Max
und
Moritz
konnt
der
Lehrer ...

```

Commands, 5



- Commands may include all desired redirections and pipes!
- Possible to redirect the command's standard files to and from ooRexx!
- Use the **ADDRESS ... WITH** statement for redirections
 - **INPUT** option: command's *stdin* provided by an ooRexx collection object
 - **OUTPUT** option: command's *stdout* gets appended to an ooRexx collection object
 - **ERROR** option: command's *stderr* gets appended to an ooRexx collection object
- Example
 - Use two ooRexx arrays to receive *stdout* and *stderr* output from command

```
outArr=.array~new
errArr=.array~new
ADDRESS SYSTEM "some command" WITH OUTPUT USING (outArr) ERROR USING (errArr)
```



- Redirecting command's *stdout* to an ooRexx array

```
-- get current operating system
parse source op_sys +1 -- "W"..Windows, everything else is regarded to be Unix
if op_sys="W" then command="dir /s" -- list directory and subdirectories
                else command="ls -R" -- list directory and subdirectories

say "Rexx, command:" quote(command)
say "Rexx, current directory:" quote(directory())

-- redirect standard output to the 'arrOut' array
arrOut=.array~new -- create Rexx array for fetching standard output
-- execute command, redirect output to Rexx array
ADDRESS SYSTEM command WITH OUTPUT USING (arrOut)
say "Rexx, RC="rc
say "Rexx, arrOut~items:" arrOut~items "(lines)"

::routine quote -- enquote argument in double quotes
return '"' || arg(1) || '"'
```

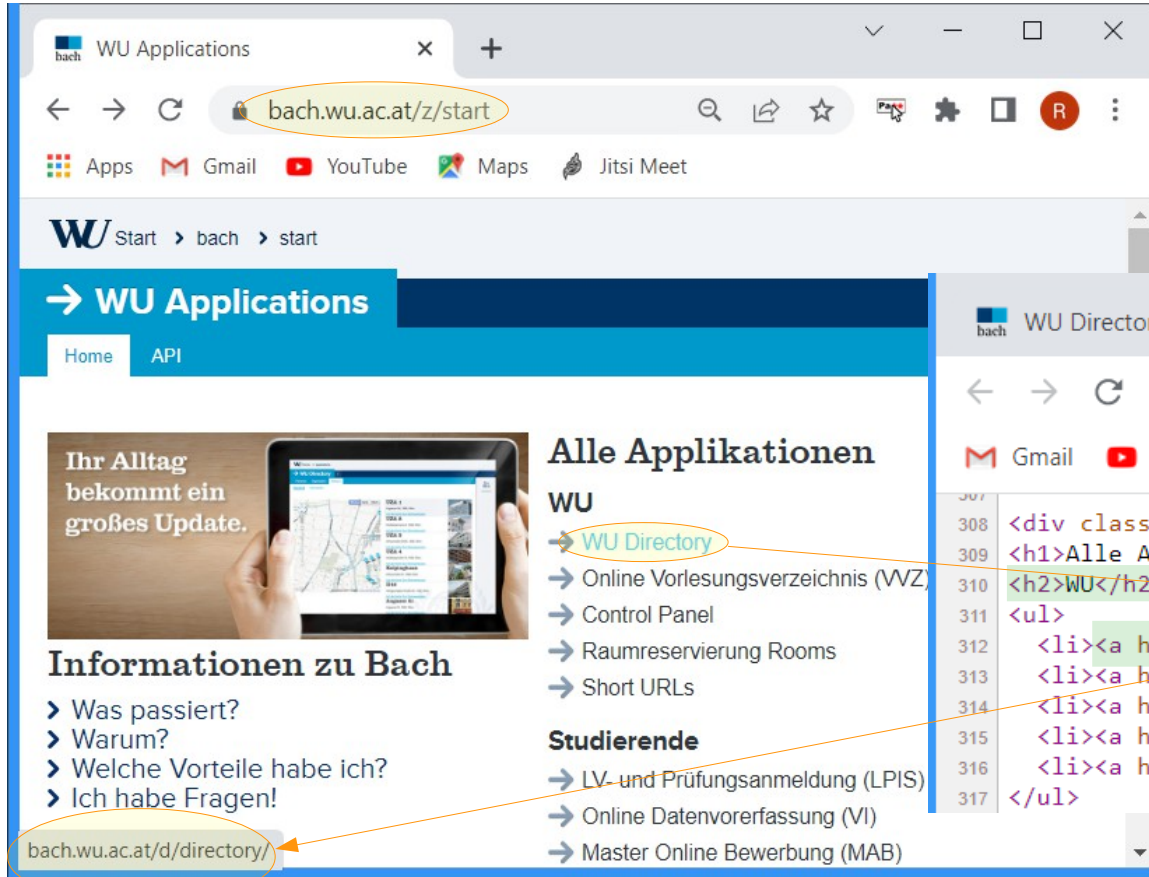
Output (Windows), maybe:

```
Rexx, command: "dir /s"
Rexx, current directory: "e:\tmp"
Rexx, RC=0
Rexx, arrOut~items: 26 (lines)
```

"curl" Command

- "curl"
 - Command "Client URL (cURL)" to allow accessing web resources
 - A Utility originating from Unix available for Windows 10, Linux and MacOS as well
 - Very powerful, very popular, quite easy to use
 - Uses standard files
 - *stdin* e.g. for data to upload
 - *stdout* for the fetched data from the server
 - *stderr* for information about the operation and errors, if any
 - Links for more information on "curl"
 - Wikipedia: <<https://en.wikipedia.org/wiki/CURL>>
 - Tutorials:
 - <<https://curl.se/docs/httpscripting.html>>
 - <<https://curl.se/docs/manual.html>>
 - <<https://www.baeldung.com/curl-rest>>

"curl" Example 1, Extracting Link from HTML Text, 1



bach.wu.ac.at/z/start

WU Start > bach > start

→ WU Applications

Home API

Ihr Alltag bekommt ein großes Update.

Alle Applikationen

WU

- WU Directory
- Online Vorlesungsverzeichnis (VZ)
- Control Panel
- Raumreservierung Rooms
- Short URLs

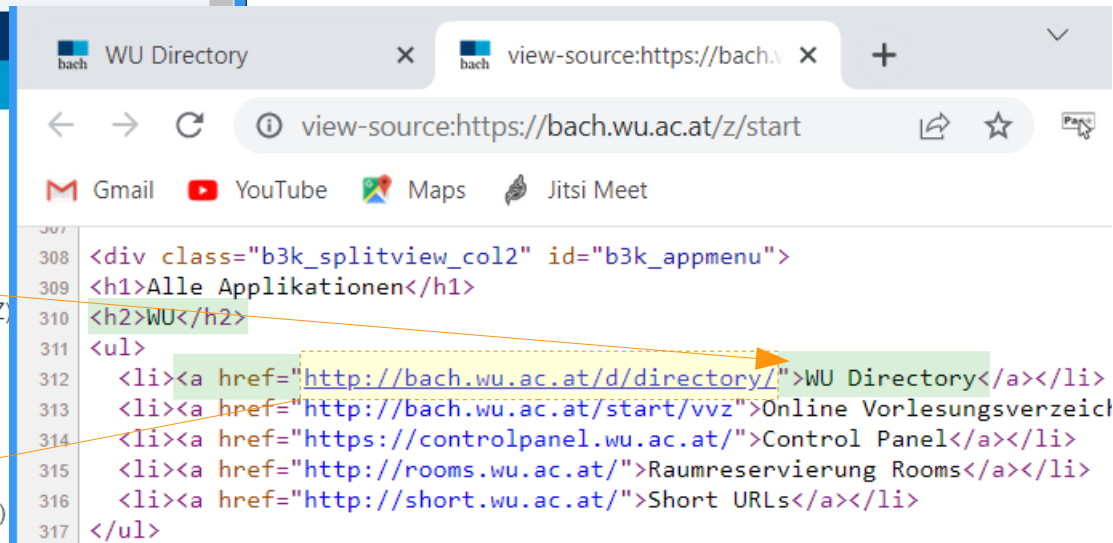
Studierende

- LV- und Prüfungsanmeldung (LPIS)
- Online Datenerfassung (VI)
- Master Online Bewerbung (MAB)

Informationen zu Bach

- > Was passiert?
- > Warum?
- > Welche Vorteile habe ich?
- > Ich habe Fragen!

bach.wu.ac.at/d/directory/



```

307
308 <div class="b3k_splitview_col2" id="b3k_appmenu">
309 <h1>Alle Applikationen</h1>
310 <h2>WU</h2>
311 <ul>
312 <li><a href="http://bach.wu.ac.at/d/directory/">WU Directory</a></li>
313 <li><a href="http://bach.wu.ac.at/start/vvz">Online Vorlesungsverzeich
314 <li><a href="https://controlpanel.wu.ac.at/">Control Panel</a></li>
315 <li><a href="http://rooms.wu.ac.at/">Raumreservierung Rooms</a></li>
316 <li><a href="http://short.wu.ac.at/">Short URLs</a></li>
317 </ul>

```

"curl" Example 1, Extracting Link from HTML Text, 2

- Extracting WU's Directory URL (as of 2022-05-24)
 - Get WU BACH's home page from the URL: <https://bach.wu.ac.at/z/start>
 - Parse the received data for the WU directory URL and display it

```
command="curl https://bach.wu.ac.at/z/start"
outArr=.array~new          -- array for stdout
ADDRESS SYSTEM command WITH OUTPUT USING (outArr)
source=outArr~makeString   -- turn array into string
parse var source '<h2>WU</h2>' . '<a href="' url '>WU Directory<'
say "Current URL of BACH-WU Directory:" url
```

Output:

% Total	% Received	% Xferd	Average Speed	Time	Time	Time	Current	
			Dload Upload	Total	Spent	Left	Speed	
100	15583	100	15583	0	0	423k	0	--:--:-- --:--:-- --:--:-- 434k
Current URL of BACH-WU Directory: http://bach.wu.ac.at/d/directory/								

from
curl's
stderr

"curl" Example 1, Extracting Link from HTML Text, 3

- Extracting WU's Directory URL (as of 2022-04-03)
 - Version that intercepts *stderr* output from *curl* to inhibit it to be displayed

```
command="curl https://bach.wu.ac.at/z/start"
outArr=.array~new          -- array for stdout
errArr=.array~new          -- array for stderr: curl's information goes here
ADDRESS SYSTEM command WITH OUTPUT USING (outArr) ERROR USING (errArr)
source=outArr~makeString   -- turn array into string
parse var source '<h2>WU</h2>' . '<a href="" url "">WU Directory<'
say "Current URL of BACH-WU Directory:" url
```

Output:

```
Current URL of BACH-WU Directory: http://bach.wu.ac.at/d/directory/
```

"curl" Example 2 – Using a Weather API (wttr.in)

- Most websites have APIs (**A**pplication **P**rogramming **I**nterfaces), which allow to specify the response cURL gets using **URL query strings**.

```
curl https://wttr.in/Vienna?format="%l:+%t+%w"
```

- Websites describe what responses can be delivered:
 - [<https://github.com/chubin/wttr.in#one-line-output>](https://github.com/chubin/wttr.in#one-line-output)

```
command='curl https://wttr.in/Vienna?format="%l:+%t+%w" '
outArr=.array~new          -- array for stdout
errArr=.array~new          -- array for stderr: curl's information goes here
ADDRESS SYSTEM command WITH OUTPUT USING (outArr) ERROR USING (errArr)
SAY outArr
```

Output:

Vienna:	+15°C	→33km/h
%l:	+%t	+%w

"curl" Example 3 – Using a Translation API (DeepL.com)

- Many websites require an authorization key, which is often free and available under certain conditions.
 - Get the DeepL.com authorization key (2022-04-19): <<https://www.deepl.com/pro#developer>>
 - A list of websites for inspiration (2022-04-19): <<https://github.com/public-apis/public-apis>>

```
url = "https://api-free.deepl.com/v2/translate"
key = "yourAuthorizationKey"      -- you need to obtain a valid key from deepl.com!
original_text = "ooRexx die Sprache der unbegrenzten Möglichkeiten."
translate_to = "EN"
command="curl" url "-d auth_key=key" "-d text="quote(original_text)" "-d target_lang="translate_to
outArr=.array~new                -- array for stdout
ADDRESS SYSTEM command WITH OUTPUT USING (outArr) ERROR USING (.array~new)
parse var outArr . ':' translated_from ',' text ':' translated_text '' -- parse turns array into string
say "Translated by DeepL.com from" translated_from "to" translate_to
say "Translated text:" translated_text

::routine quote -- encloses text in quotes, such that it may contain blanks
return '' || arg(1) || ''
```

Output (if authorization key is correct):

```
Translated by DeepL.com from DE to EN
Translated text: ooRexx the language of unlimited possibilities.
```

"curl"-Related Links (as of 2023-08-25)



- Documentation and examples
 - <https://curl.se>
- cURL for websites that support "clear URLs" a.k.a. "RESTful URLs"
 - Wikipedia
 - https://en.wikipedia.org/wiki/Clean_URL
 - https://en.wikipedia.org/wiki/Query_string
 - https://en.wikipedia.org/wiki/Representational_state_transfer
 - Tutorial
 - <https://www.baeldung.com/curl-rest>
- Public RESTful sites: <https://documenter.getpostman.com/view/8854915/Szf7znEe>
 - A Star Wars RESTful site: <https://swapi.dev/>

