C2110 UNIX and programming

6th Lesson

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OP Vzdělávání pro konkurenceschopnost

INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

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Scripts

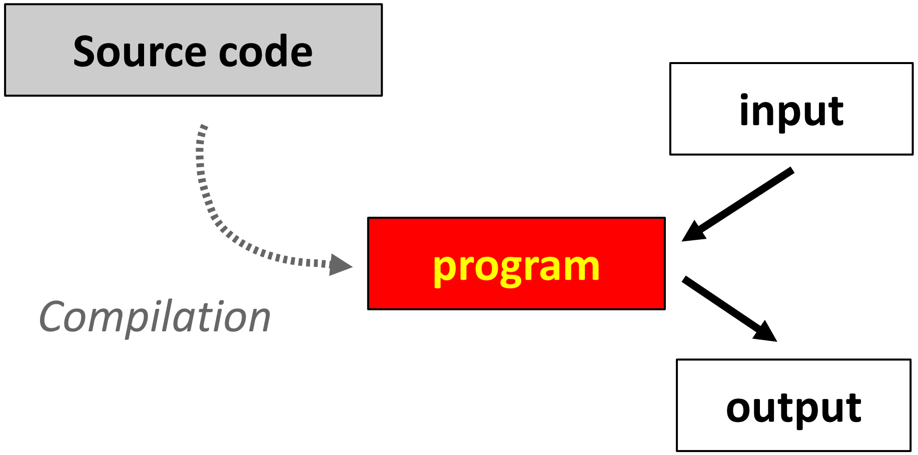
- Scripts vs. programs
- Program compilation
- Running sample script and program

Programs *vs.* Skripts

Program is machine instruction file processed directly by processor. It is created by procedure called **compilation** from source code.

Compiled languages:

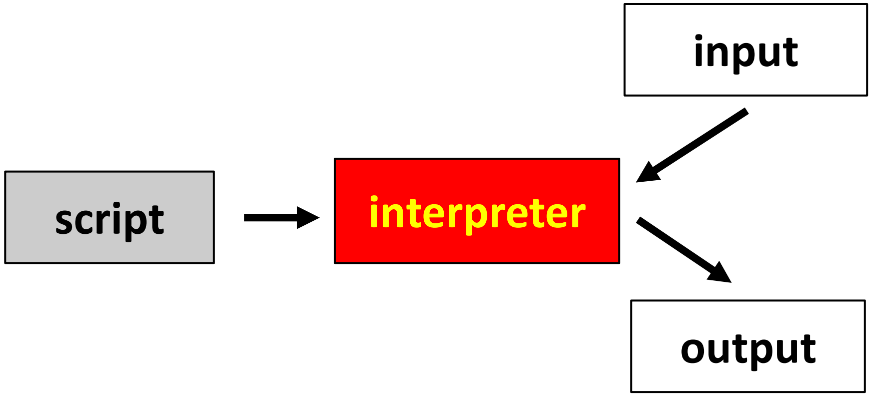
C/C++
Fortran



Script is text file containing commands and special constructions, these are processed by interpreter of scripting language.

Skriptovací jazyky:

bash
gnuplot
awk
JavaScript
PHP



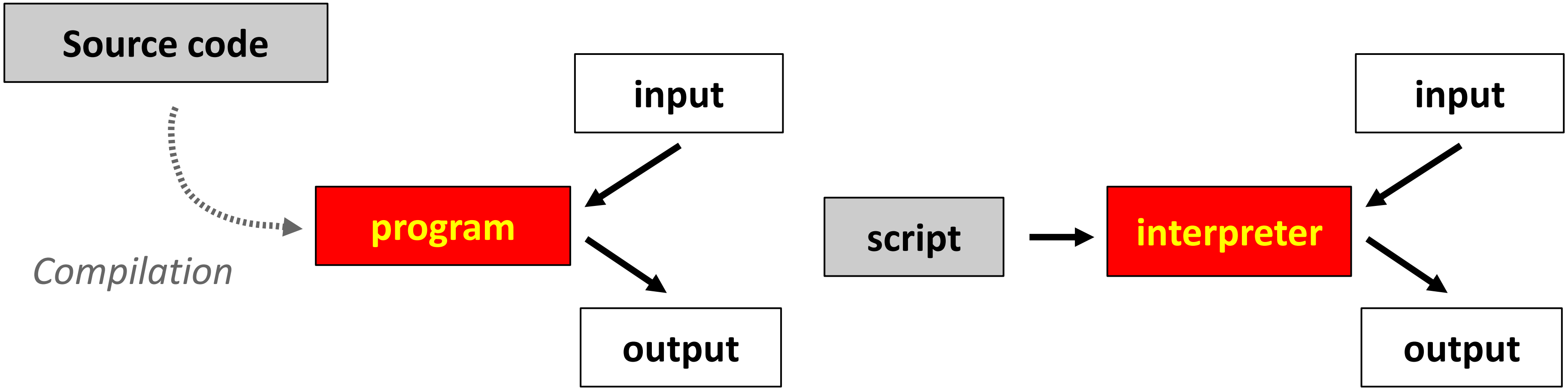
Programs *vs* Scripts, ...

- Easy optimization
- Fast processing

- Recompilation needed
- Self run code not available

- No recompilation
- Program can generate and run self running code

- Poor optimization
- Slower processing



How to write programs and scripts

Scripts are text files – thus any text editor can be used, that enables saving pure text (without any format metadata).

Text editors:

- vi
- **kwrite**
- kate
- gedit

For complex programs and scripts development environments can be used – **IDE** (Integrated Development Enviroment). IDE contains next to editor extra tools as: project manager, debugger and more. Usually for more advanced and complex languages: *JavaScript*, *Python*, *PHP*, etc.

IDE:

- Kdevelop
- qtcreator
- NetBeans
- Eclipse

Program in C

Source code

```
#include <stdio.h>

int main(int argc,char* argv[])
{
  printf("This is C program! \n");
  return(0);
}
```

Compilation

```
$ gcc program.c -o program
```

C language compiler

Program name

Running program

```
$ ./program
```

file **program** needs permission to **execute**

Program in Fortran

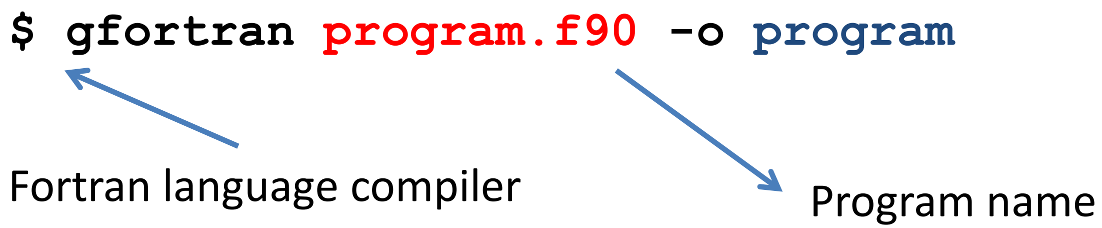
Source code

```
program Hello

   write(*,*) 'This is Fortran program!'

end program
```

Compilation



```
$ gfortran program.f90 -o program
```

Fortran language compiler

Program name

Running program

```
$ ./program
```

file **program** needs permission to **execute**

Script in Bash

Script

```
#!/bin/bash

echo 'This is Bash script!'
```

Running script

```
$ bash script.bash
```

interpret Bash

file script.bash **does not need** permissions to **execute**

Script in gnuplot

Script

```
#!/usr/bin/gnuplot

set title "This is gnuplot script!"
plot sin(x)

pause -1
```

Running script

```
$ gnuplot skript.gnuplot
```

interpret gnuplot

file **script.bash** **does not need** permissions to **execute**

Exercise

1. Create four directories with names **task01, task02, task03, task04**
2. From directory **/home/kulhanek/Data/programs** copy **program.c , program.f90, skript.bash, a skript.gnuplot** to particular directories you created in 1.
3. Compile source codes of language C and Fortran. Run compiled programs.
4. What is size of compiled program in C language? Open program file in text editor, what is inside?
5. Run scripts **skript.bash a skript.gnuplot**.

Running scripts

1) Un-direct running

We run interpreter and as its argument we put script name.

```
$ bash my_bash_script_name

$ gnuplot my_gnuplot_script_name
```

Scripts **does not need** permission x (executable).

2) Direct running

We run directly script (shell runs interpreter automatically).

```
$ ./my_bash_script

$ ./muj_gnuplotu_script
```

Scripts **must have** x (**executable**) set and interpreter (first script line).

Interpreter specification

Interpreter specification (first script line):

```
#!/absolute/path/to/interpreter/of/script
```

Script in bash

```
#!/bin/bash

echo “This is bash script!"
```

Skript in gnuplot

```
#!/usr/bin/gnuplot

set xrange[0:6]

plot sin(x)

pause -1
```

- If no interpreter is specified, then system shell interpreter is used.
- Interpreter is ignored in case of un-direct running.

Interpreter specification

If absolute path may be changed over time (for example by using software modules), it may be specified dynamically:

```
#!/usr/bin/env interpreter
```

Interpreterhas to be in system path of variable PATH.

Script in bash

```
#!/usr/bin/env bash

echo “This is bash script!"
```

Script in gnuplot

```
#!/usr/bin/env gnuplot

set xrange[0:6]

plot sin(x)

pause -1
```

Exercise

1. Change access permissions to files **skript.bash a skript.gnuplot** (command **chmod**).
2. Make sure that scripts can be run directly.
3. What happens when we use interpreter bash for **script skript.gnuplot**?

Variables

- Variable setting and unsetting
- Variables and processes
- String types

Variables

In Bash language variable is **named memory place**, that contain value. Variable value is **always** of type **string (test)**.

No space between variable name and **=**

Variable set:

```
$ VARIABLE_NAME=value
$ VARIABLE_NAME="value with spaces"
```

Access to variable value:

```
$ echo $VARIABLE_NAME
```

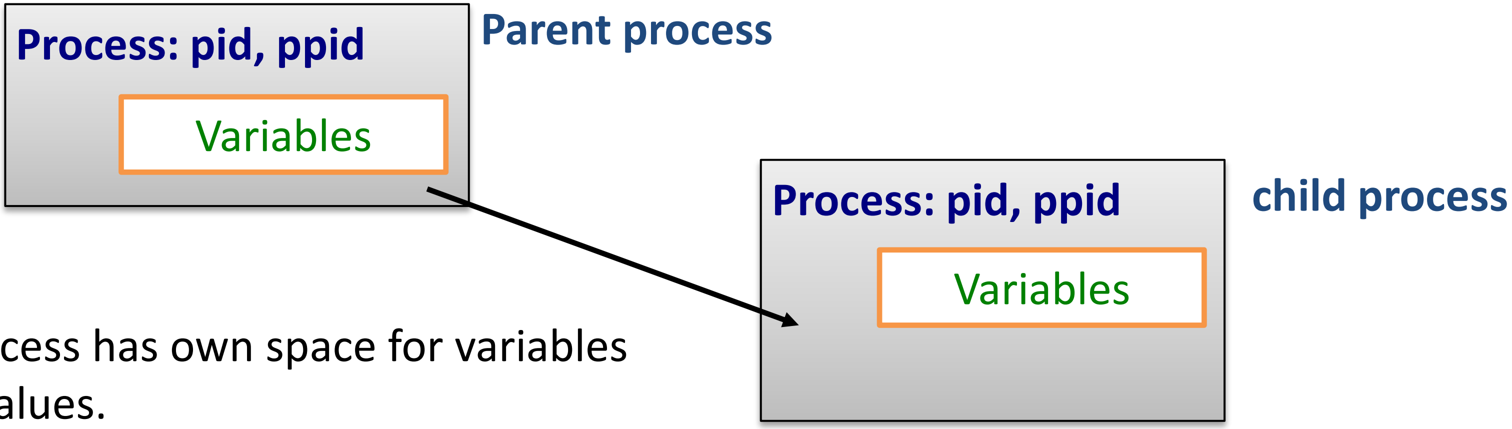
Unsetting of variable:

```
$ unset VARIABLE_NAME
```

Overview of all variables:

```
$ set
```

Variables and processes



Each process has own space for variables and its values.

Child process when started gets **copy** of **exported** variables and its values from parent process. These variables can be changed by any way or remove them and new variables can be defined too. **All these changes are not visible to original variables in parent process and are deleted when child process finishes.**

Export proměnné:

```
$ export VARIABLE_NAME
$ export VARIABLE_NAME= "value"
```

export

export with assignment

Strings

In Bash llanguage there are four string types:

- **no quotes**

```
A=pokus
B=*
C=$A
```

Expands to list of files and directories in current working directory (advanced constructions can be used)

Value of variable A is inserted

- **with quotes**

```
A="pokus hokus"
B="* $A"
```

Variable contains value with 2 words separated by space

Value of A is inserted but no expansion is done (star is in quotes)

- **single quote (apostrophe)**

```
A='pokus hokus'
B='* $A'
```

Text is saved in exact way, no variable insertion, no expansion is done.

- **backward single quote (backward apostrophe)**

```
A=`ls -d`

B=“number : `ls | wc -l`"
```

To **place** where are backward apostrophes, **command output** is inserted

Exercise

1. Set variable **A** to value 55.
2. Print value of variable **A** (command **echo**)
3. List all variables. Is there variable A (try to use command **grep** and **pipe**)?
4. Change variable value to **"this is long string"**.
5. Print value of variable **A**.
6. Unset variable **A**.
7. Make sure it is unset (use procedure as in 3).
8. Set variables **A**, **B** and **C** as on previous page. Check their values.