General coding

stirlingcodingclub.github.io/coding_types/slides.pdf

Stirling Coding Club

02 November 2022

How does code actually work?

- Programmers work with **source code** (e.g., R, python)
- Computers execute **machine language** (binary)
- To get from source code to machine language, we can *compile* code or *interpret* it.

Compiled versus interpreted code

Compiled code

- Directly translates everything to machine language
- Transatlation must occur before running code
- C, C++, FORTRAN, Pascal (low-level languages)[1]
- Two steps to execute code
- Faster performance (executes immediately after compiling)
- Slower and more laborious to code

Interpreted code

- Code is run bit by bit through an interpreter
- Interpreter breaks down and executes code 'on the fly'
- R, Perl, MATLAB, Python (high-level languages)[1]
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[1] Technically, any language *could* be compiled or interpreted.

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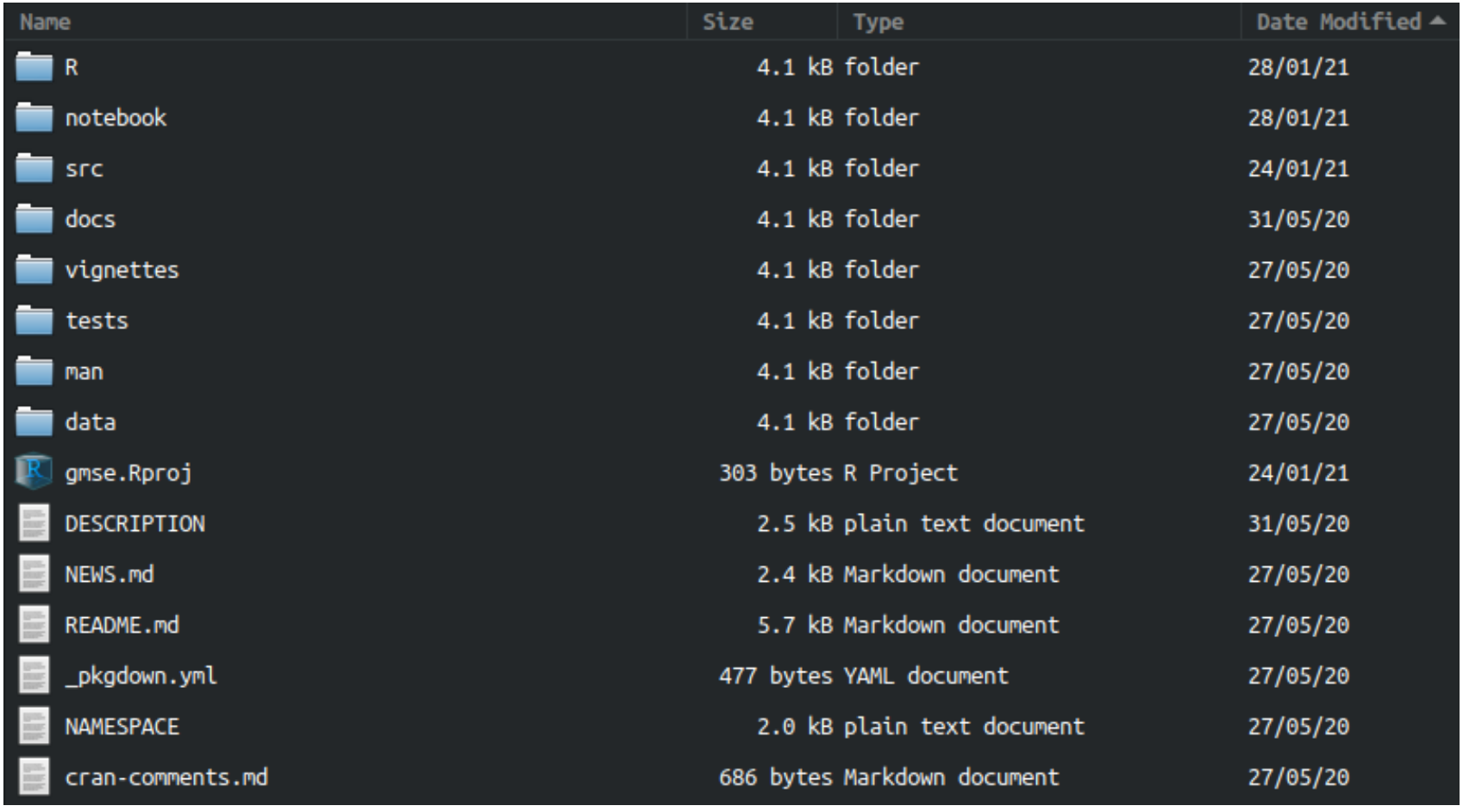
R packages can include both compiled and intereted code



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notebook	4.1 kB	folder	28/01/21
src	4.1 kB	folder	24/01/21
docs	4.1 kB	folder	31/05/20
vignettes	4.1 kB	folder	27/05/20
tests	4.1 kB	folder	27/05/20
man	4.1 kB	folder	27/05/20
data	4.1 kB	folder	27/05/20
gmse.Rproj	303 bytes	R Project	24/01/21
DESCRIPTION	2.5 kB	plain text document	31/05/20
NEWS.md	2.4 kB	Markdown document	27/05/20
README.md	5.7 kB	Markdown document	27/05/20
_pkgdown.yml	477 bytes	YAML document	27/05/20
NAMESPACE	2.0 kB	plain text document	27/05/20
cran-comments.md	686 bytes	Markdown document	27/05/20

R packages can include both compiled and intereted code

An R file named 'resource.R'

```
run_resource <- function(RESOURCE_c, LANDSCAPE_c, PARAMETERS_c){
    .Call("resource", RESOURCE_c, LANDSCAPE_c, PARAMETERS_c);
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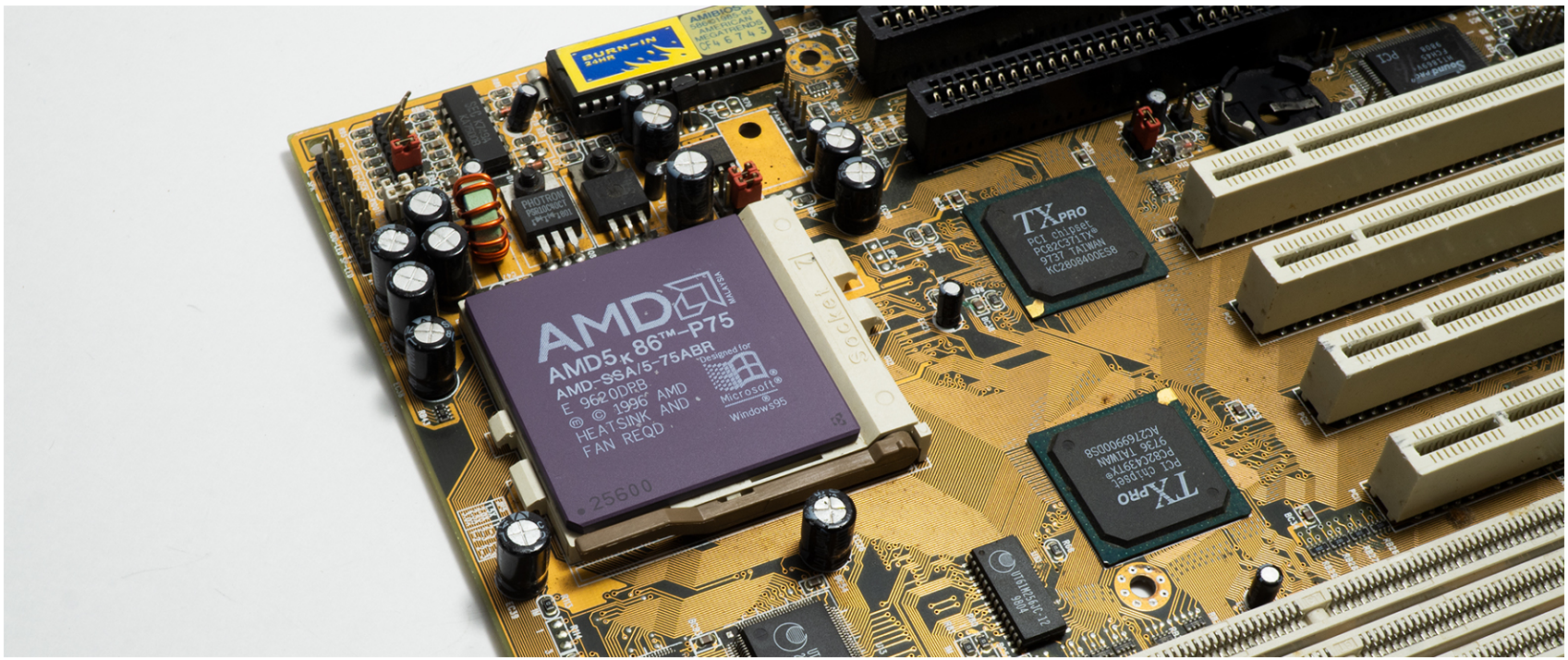
A C file named 'resource.c'

```
SEXP resource(SEXP RESOURCE, SEXP LANDSCAPE, SEXP PARAMETERS){

    /* SOME STANDARD DECLARATIONS OF KEY VARIABLES, POINTERS   */
    /* ================================================== */
    int xloc, yloc;     /* x and y locs in the RESOURCE array  */
    int land_x, land_y; /* x and y maximum loc given LANDSCAPE */
    int zloc, land_z;   /* z locations                         */
    int resource;       /* Index for resource (rows RESOURCE)  */
    int resource_new;   /* Index for resource in new array     */
    int trait;          /* Index for resource traits           */
    int res_number;     /* Resources included (default = 1)    */
```

The role of the processor

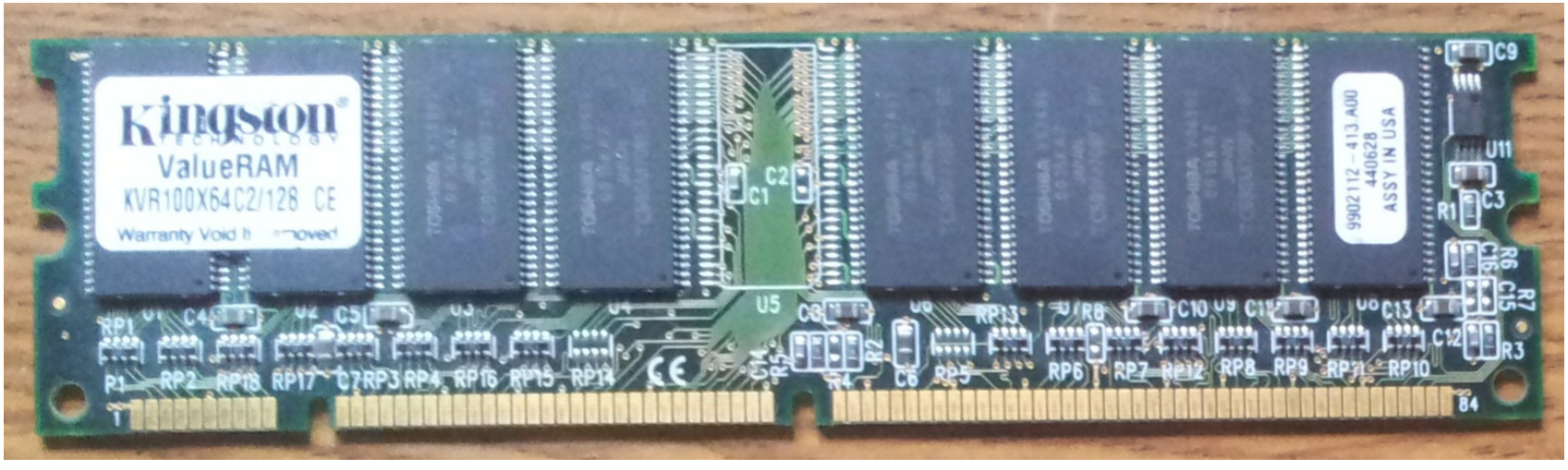
- Machine code: list of instructions written in binary (1s & 0s)
- Binary instructions sent to the *Central Processing Unit (CPU)*
  - CPUs read & write to memory, and do maths (that's it)
  - Instructions tell CPU to read & write information to memory

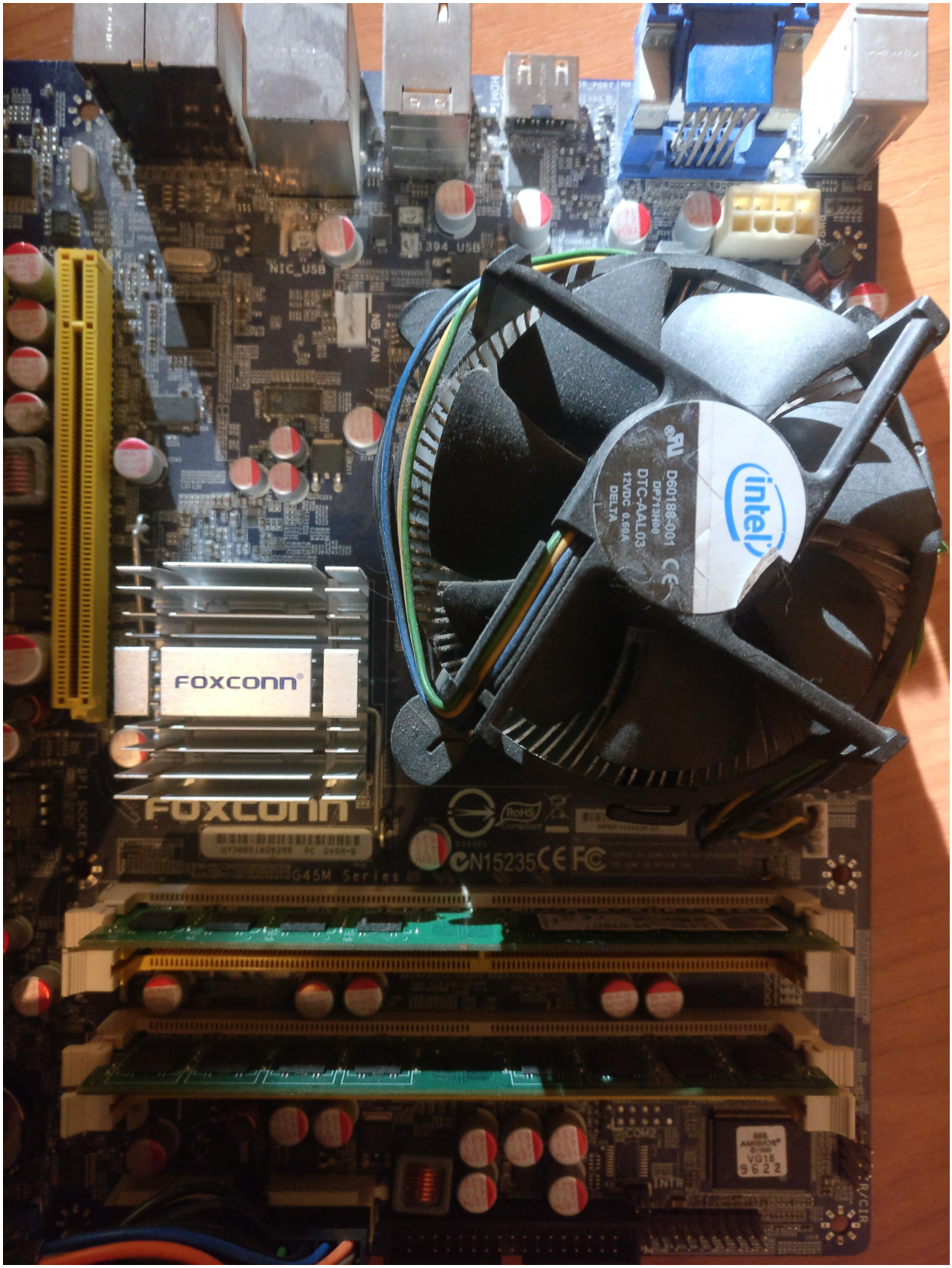


[1] **Image:** Public domain

The role of memory

- Random-access memory (RAM, or just ‘memory’) is separate from the CPU, and holds data that can be read and changed
  - Memory exists as binary digits (‘bits’) of ones and zeros
  - Bits are grouped in chunks of eight to make one ‘byte’: *Unit of data storage large enough to hold any basic character*.




NIC_USB
1394_USB
NB_FAN
FOXCONN
FOXCONN
G45M Series
intel
D60188-001
DF713RH0
DTC-AAL03
12VDC 0.60A
DELTA
RoHS
N15235
COM2
INTR

Thinking about computer memory

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```c
array_1 = malloc(6 * sizeof(double));
```

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Row 1	3	5	4
Row 2	1	7	6

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```
##      [,1] [,2] [,3]
## [1,]    3    5    4
## [2,]    1    7    6
```

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