The Julia programming language

Introduction to Julia and its ecosystems for OR

Mathieu Tanneau

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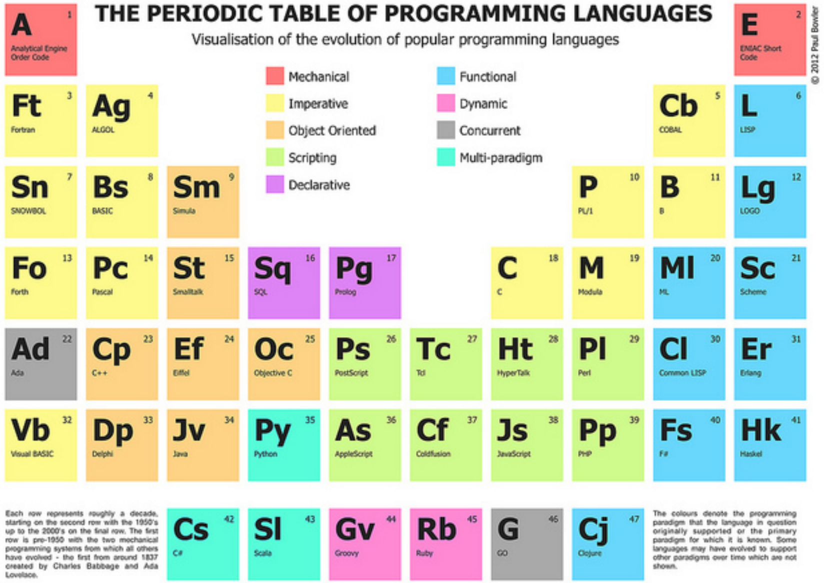
Julia is a programming language.
You can write programs in Julia.

In this talk:

How is Julia different from *other* languages?

Numerical computing in Julia (focusing on linear algebra)

How does it integrate with other languages?



THE PERIODIC TABLE OF PROGRAMMING LANGUAGES

Visualisation of the evolution of popular programming languages

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- 🟥 Mechanical
- 🟨 Imperative
- 🟧 Object Oriented
- 🟩 Scripting
- 🟪 Declarative
- 🟦 Functional
- 🩷 Dynamic
- ⬛ Concurrent
- 🟩 Multi-paradigm

A 1 Analytical Engine Order Code									**E** 2 ENIAC Short Code
Ft 3 Fortran	**Ag** 4 ALGOL							**Cb** 5 COBAL	**L** 6 LISP
Sn 7 SNOWBOL	**Bs** 8 BASIC	**Sm** 9 Simula					**P** 10 PL/1	**B** 11 B	**Lg** 12 LOGO
Fo 13 Forth	**Pc** 14 Pascal	**St** 15 Smalltalk	**Sq** 16 SQL	**Pg** 17 Prolog		**C** 18 C	**M** 19 Modula	**Ml** 20 ML	**Sc** 21 Scheme
Ad 22 Ada	**Cp** 23 C++	**Ef** 24 Eiffel	**Oc** 25 Objective C	**Ps** 26 PostScript	**Tc** 27 Tcl	**Ht** 28 HyperTalk	**Pl** 29 Perl	**Cl** 30 Common LISP	**Er** 31 Erlang
Vb 32 Visual BASIC	**Dp** 33 Delphi	**Jv** 34 Java	**Py** 35 Python	**As** 36 AppleScript	**Cf** 37 Coldfusion	**Js** 38 JavaScript	**Pp** 39 PHP	**Fs** 40 F#	**Hk** 41 Haskel
		Cs 42 C#	**Sl** 43 Scala	**Gv** 44 Groovy	**Rb** 45 Ruby	**G** 46 GO	**Cj** 47 Clojure		

Each row represents roughly a decade, starting on the second row with the 1950's up to the 2000's on the final row. The first row is pre-1950 with the two mechanical programming systems from which all others have evolved - the first from around 1837 created by Charles Babbage and Ada Lovelace.

The colours denote the programming paradigm that the language in question originally supported or the primary paradigm for which it is known. Some languages may have evolved to support other paradigms over time which are not shown.

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You can have a programming language that is **either fast** (C) **or easy to use** (Py), but not both!

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Julia's stance:

Let's have both!

"The speed potential of a language consists almost entirely of the properties that the compiler is able to prove ahead-of-time so that they don't need to be checked at runtime."

[compiler = a human-to-machine translator]

[1] Jameson Nash, `https://juliacomputing.com/blog/2016/02/09/static-julia.html`

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Back to the programmer's dilemma:
the more information you put in the code, the less readable it becomes

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Julia's "*fast and easy*" (mainly) comes from 3 features:

- Dynamic typing
- Multiple dispatch
- Staged compilation

See notebook

See notebook

See notebook

Wrap-up:

Julia is a programming language

- It tries to be fast *and* simple (it's OK to use 'for' loops)
- It is open source, with a strong & growing community
- It is still evolving!
- It does nothing that C/C++/Python can't do!
  Think not *"Can I do this in X?"*
  but *"How easy is it to do this in X?"*

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- Native support for linear algebra
- External libraries available
- Many packages for specific applications

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Julia can call and be called from other languages

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[2] Have you considered Cython?

Should I use Julia?

Some good (and less good) reasons to use/switch to Julia:

- ✓ You want to learn a new language
- ✓ You do a lot of linear algebra, with custom structures
- ✓ You want to use quickly customize an existing framework
- ✓ Your boss tells you to use Julia

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- X Someone told you it would be faster than Python
- X You just want to write fast 'for' loops[2]

[2] Have you considered Cython?

Some useful links:

- Tutorials: `https://github.com/JuliaComputing/JuliaBoxTutorials`
- Official documentation: `https://docs.julialang.org/en/v1/`
- Other resources: `https://julialang.org/learning/`
- `www.google.com`

Questions?