Compilers & Languages for Parallel Computing – What Have We Achieved?

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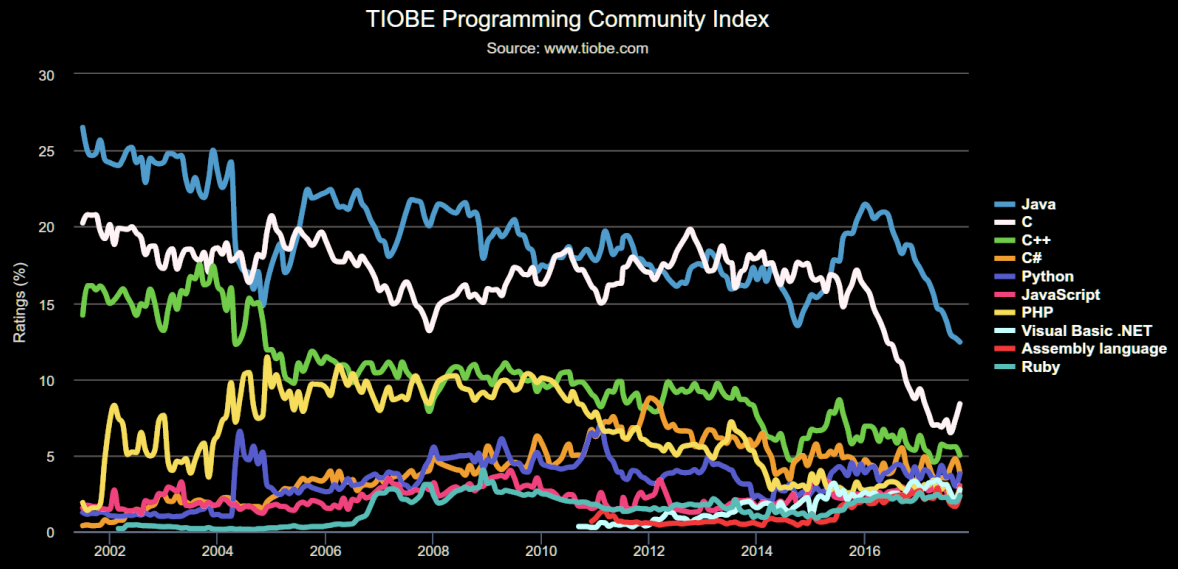
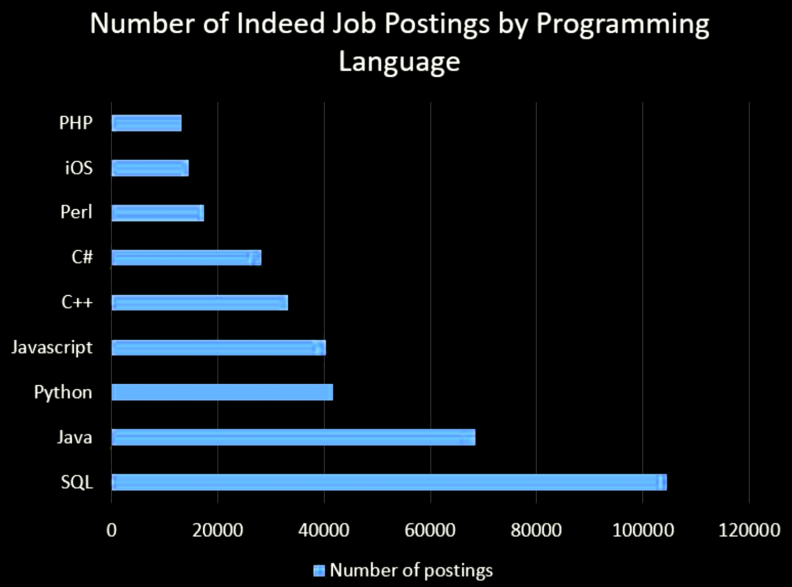
What Problems Have We Been Trying To Solve?

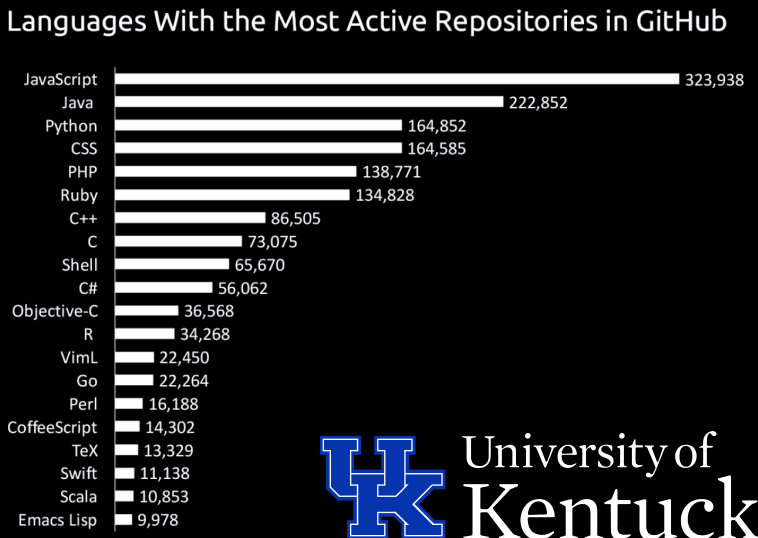
- Not enough parallel programs!
- Writing parallel programs is ***hard***
  - Parallel programming languages and parallel libraries and tools
  - Compiler finds stuff to execute in parallel inside sequential programs… programmers don't need to think parallel
- Efficient parallel execution is ***hard***
  - Better compiler back-ends

Programming Languages?





Language Rank	Types	Spectrum Ranking
1. Python		100.0
2. C		99.7
3. Java		99.5
4. C++		97.1
5. C#		87.7
6. R		87.7
7. JavaScript		85.6
8. PHP		81.2
9. Go		75.1
10. Swift		73.7



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At Least We All Advocate Parallel Programming, Right?

- I often teach MIMD & SIMD programming
- SIMD covered in intro computer architecture
- The ***only*** parallel language required in our computer engineering curriculum is **Verilog**

Give it up.
The whole "parallel computing is the future" is a bunch of crock.

– Linus Torvalds

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At Least The Compilers Work?

- Dependence analysis has improved greatly
  - Still doesn't reliably find huge amounts of large-grain parallelism
  - Best research technologies of 1990s are not yet in every compiler
- Quality of generated code is much better
- Lots of people don't ever recompile code... it isn't theirs to recompile or is interpreted

Depressed? Don't Be. We Won.

- Parallel computing is NOW and the FUTURE
- Parallel languages and libraries and tools
  - Somewhat supported in ***every*** language
  - ***Available when needed*** : MapReduce, CUDA, OpenCL, OpenMP, MPI, ...
- Compiler optimization/parallelization
  - Fine/medium-grain is used everywhere and is tuned for efficient execution
  - People don't know it's there

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This Solved Itself!

- Massive large-grain parallelism happened!
  - Big data
  - Independent runs with parameters

Embarrassingly Parallel?
I'm never embarrassed by parallelism.

– H. J. Siegel

The Next 30 Years

- How to fix a world that runs on random stuff glued together & run in parallel using Python?
- Keep improving compiler tech... it'll get used (although nobody will notice... like BASF)
- Parallel execution within a power budget
- New concerns: new targets, security, ...

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