YOU'RE RUNNING THAT ON WHAT?

DEVELOPING SOFTWARE FOR NON-X86 ARCHITECTURES

ELIZABETH K. JOSEPH, IBM
@PLEIA2

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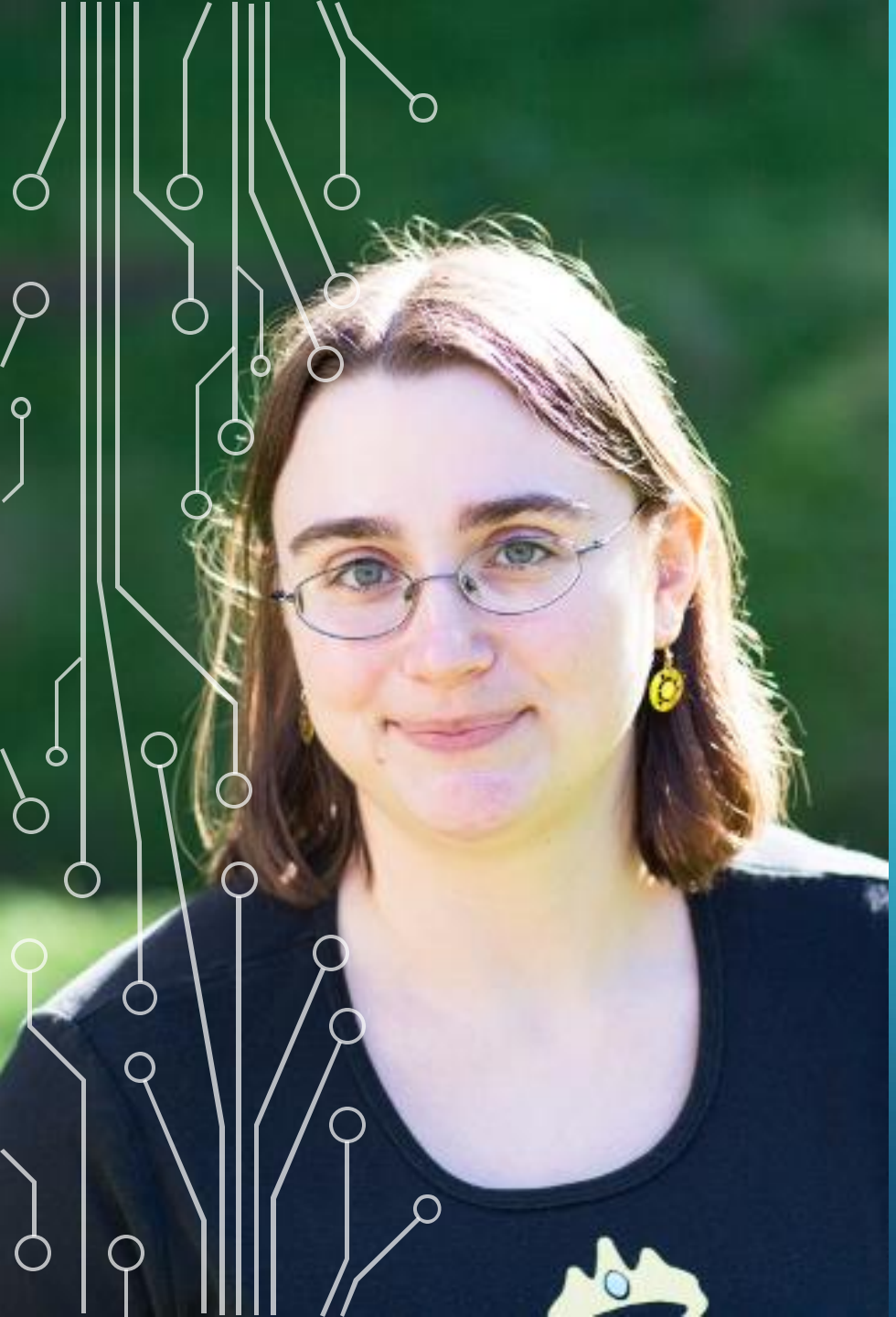
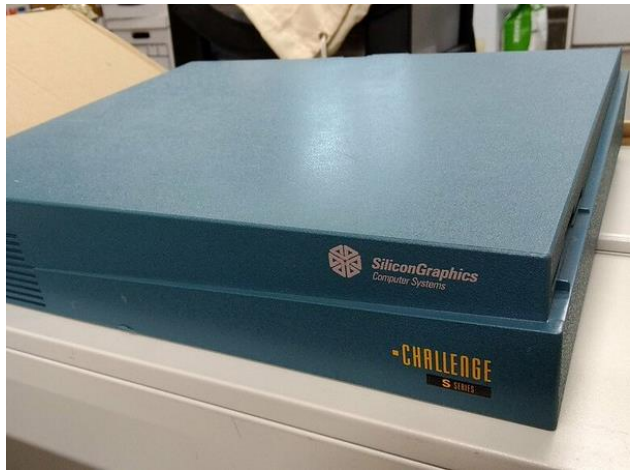
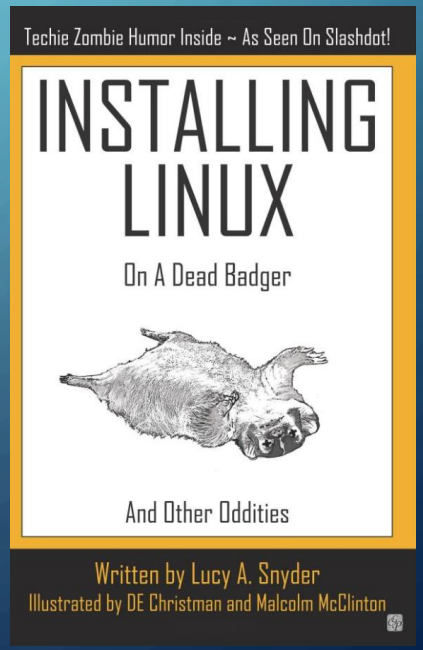


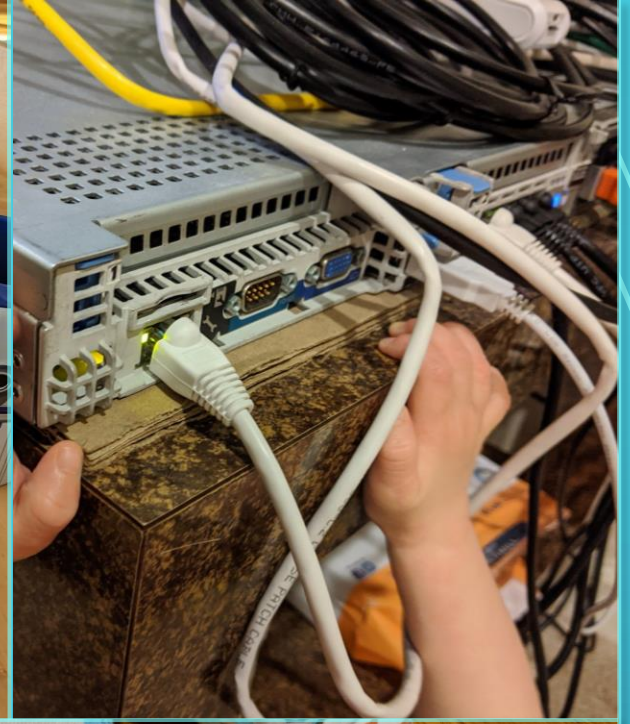
ELIZABETH K. JOSEPH

- Linux Systems Administrator turned Developer Advocate for IBM Z
- Author of books on Ubuntu Linux and OpenStack
- Contributor to open source communities for 20 years
- @pleia2 on Twitter, Instagram

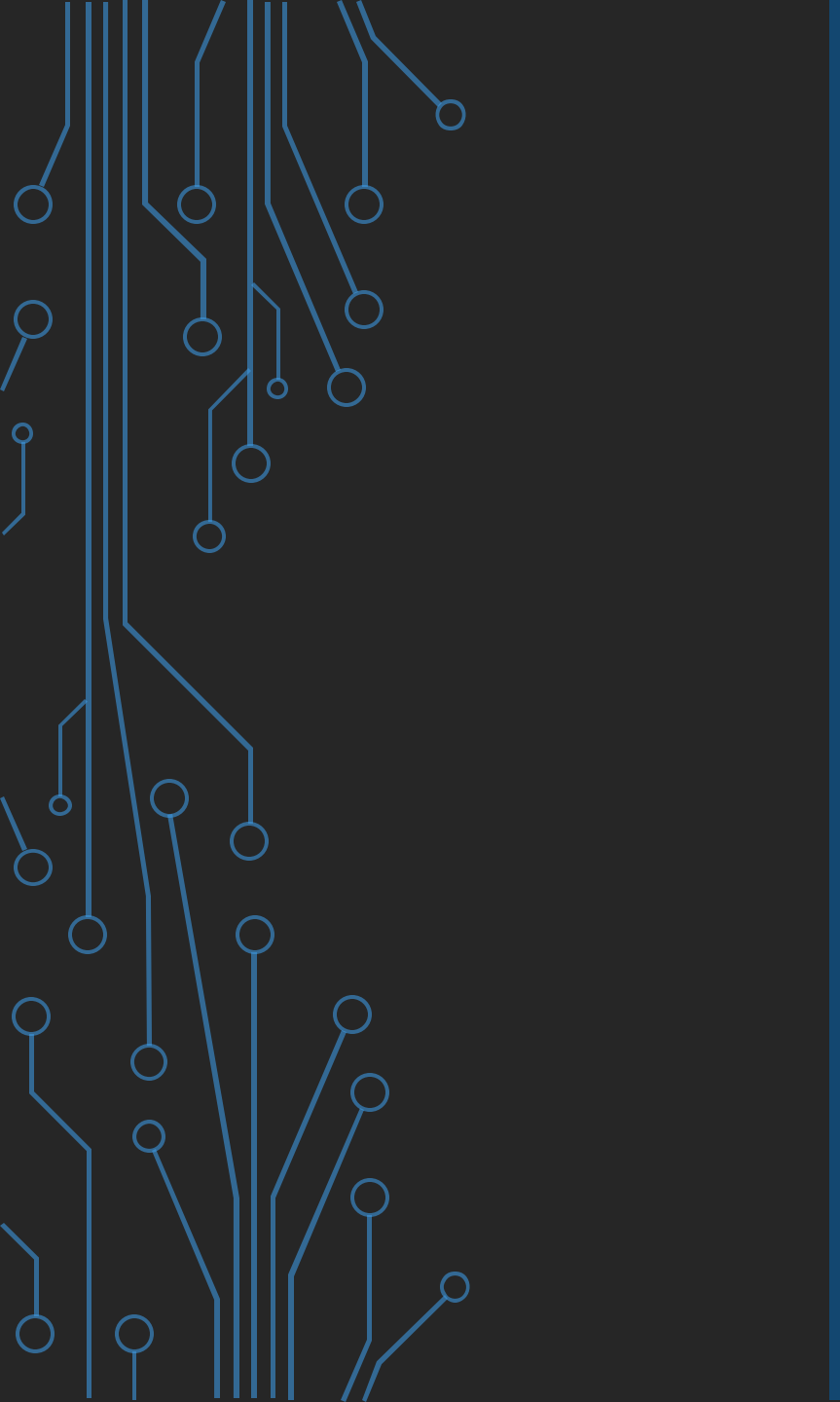


ONCE UPON A TIME, THERE WERE MANY ARCHITECTURES





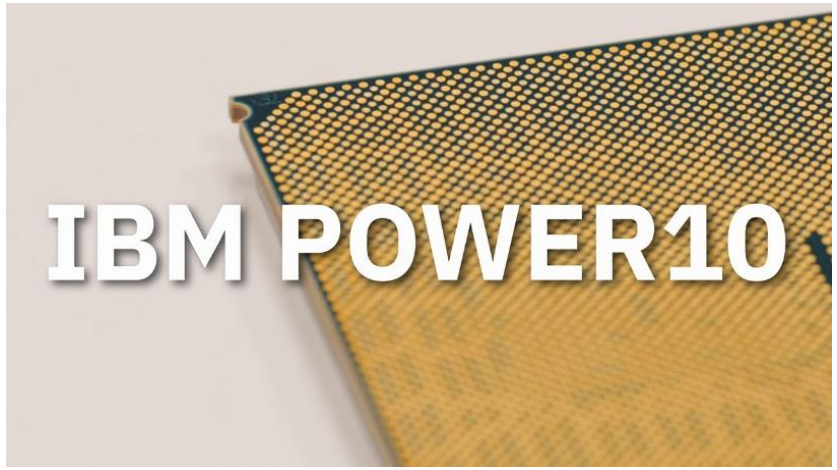
THEN WE KINDA CONSOLIDATED ON X86



NOW THERE ARE MANY AGAIN!

KIND OF, THEY NEVER REALLY WENT AWAY ;)

IBM Z – S390X / ZARCHITECTURE



OpenPOWER™

IBM POWER / OPENPOWER

RASPBERRY PI - ARM

iPhone

YOUR PHONE - ARM

APPLE M1 - ARM

COMPILING SOFTWARE 101 – ARCHITECTURE

Today the commodity architecture is 64-bit x86, based on instructions developed in the early 1980s.

As a result, most developers don't pay much attention to architecture! But we are seeing an increasing need to do so as non-x86 architectures become more common.

COMPILING SOFTWARE 101 – CODE

- At the lowest levels, classic* computing still only understands 0 and 1. That's what all those billions of tiny transistors are doing.
- Compilers and interpreters take human-readable code that you write and convert it to something the computer can understand, ultimately a series of 0s and 1s.
- The code you see is just the first step in the process as far as the computer is concerned.

* What is beyond Classic Computing? Quantum!

COMPILING SOFTWARE 101 – OPEN SOURCE

When something is "open source" you have access to the human-readable code, it's available in the open.

You then compile that code to create a binary. This code must be compiled for the respective architecture you're targeting since it needs to be built for that CPU hardware (x86, s390x, ARM, Power, etc).

HIGHER VERSUS LOWER-LEVEL LANGUAGES

It has very little to do with how "hard" the language is, and more to do with how much abstraction is between your code and the hardware.

Lower-level is closer to the hardware, and may have optimizations: Assembler, C, C++

Higher-level is further from the hardware, and often doesn't care where it's run: Python, Node.js

WHAT'S A DEVELOPER TO DO?

Well, you could do nothing, carry on!

Especially if you're working with higher-level languages or SDKs for your platform, you may not run into issues (this is often the case with mobile app development).

But being aware of diverse architectures will make you a better programmer!

WHAT'S A DEVELOPER TO DO?

- Learn more about architecture-specific components of your language
  - Be mindful about your usage and don't use them unless you have a specific reason to do so
  - Avoid making assumptions about hardware-specific things like pointer sizes or byte ordering
  - Document the usage, so it's easier for anyone who may wish to port your code in the future

WHAT'S A DEVELOPER TO DO?

- Avoid "tricks" with CPU-specific instructions and caching
  - Some developers over-optimize their code and drop to Assembler
  - Modern compilers are already pretty smart!
  - Today's tricks may not even work on tomorrow's compiler, or x86 system
- Don't make assumptions about hardware enumeration or memory regions

WHAT'S A DEVELOPER TO DO?

- Try running your code on another architecture!
  - A Raspberry Pi 4 (ARM) kit with 4G of RAM will run you about $100, and several major Linux distributions will run on it
  - You can sign up for an s390x Linux virtual machine for free for 120 days with in the IBM LinuxONE Community Cloud: https://linuxone.cloud.marist.edu/

GOING DOWN THE RABBIT HOLE

- Learn about the following key terms
  - RISC verse CISC
  - ISA (Instruction Set Architecture)
  - Conditional execution
  - Hardware registers (interface between hardware and software)
  - Hardware threads and hyperthreading
  - CPU cache and the Translation Lookaside Buffer (TLB)
  - Endianness (memory ordering, big- verses little-endian)
  - …probably a lot more, but this is a good start!

CONTACT

Elizabeth K. Joseph

@pleia2 on Twitter and Instagram

lyz@princessleia.com | lyz@ibm.com