Helping Programmers Write Better Programs

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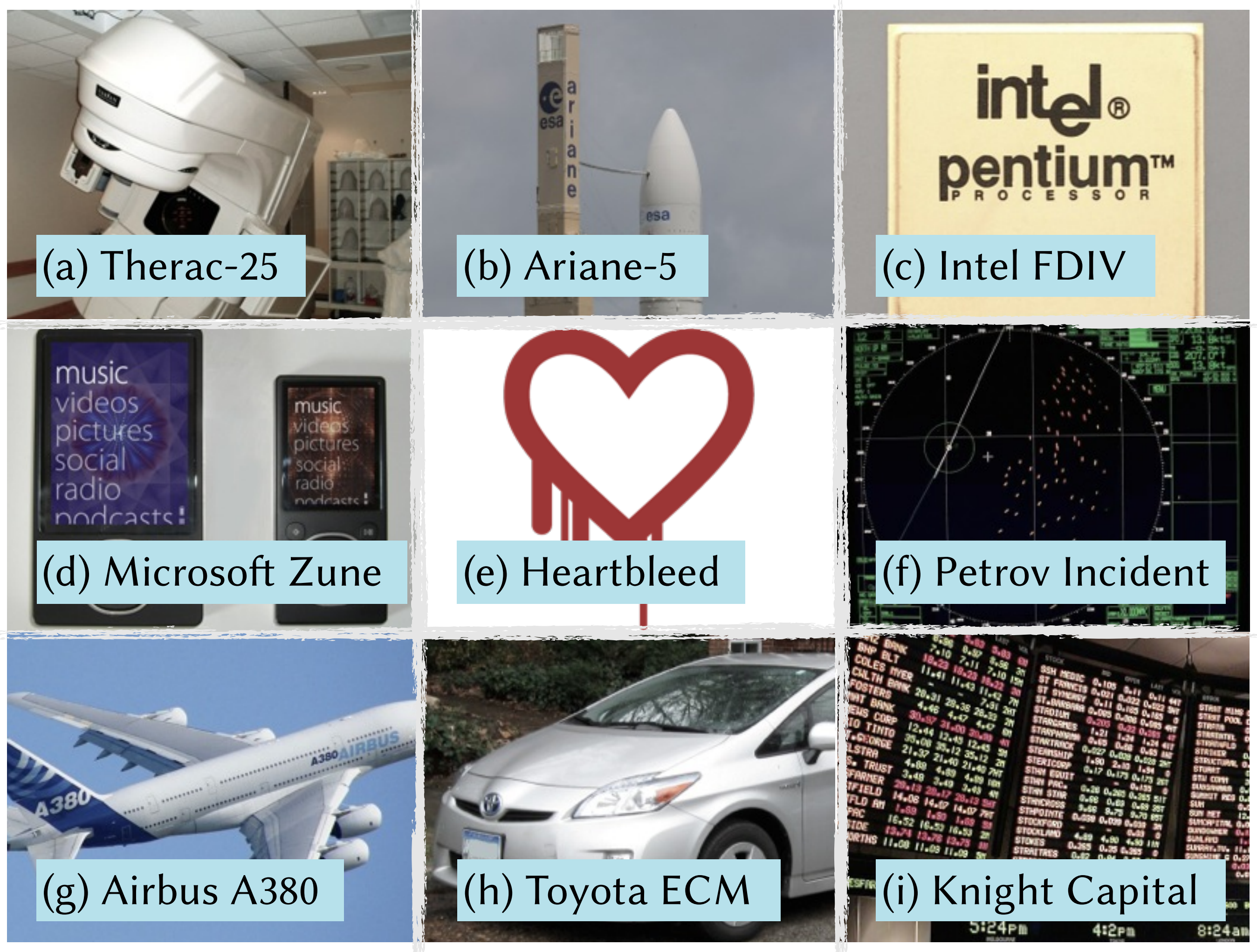
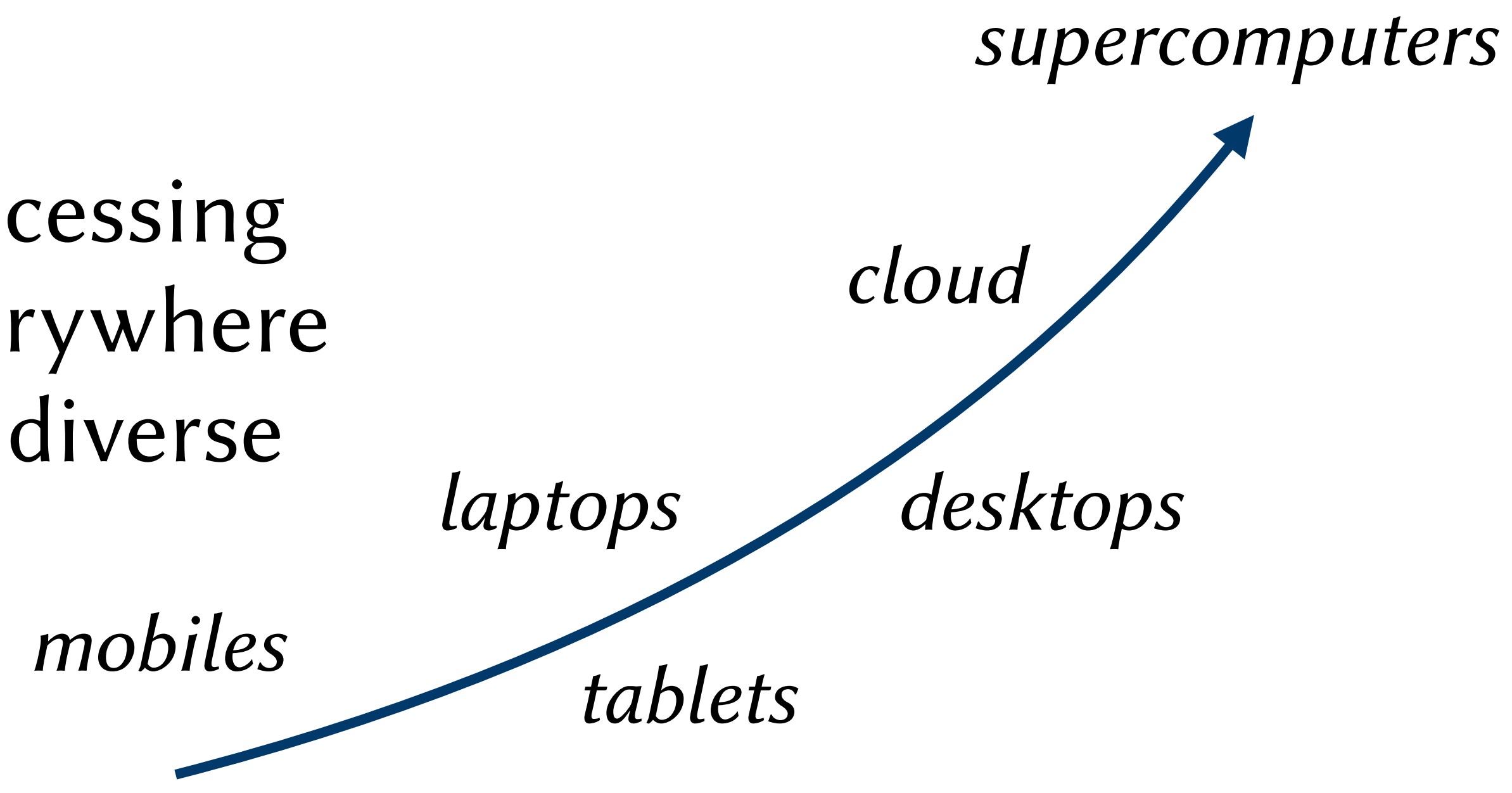
1. Technology (Bugs) Everywhere

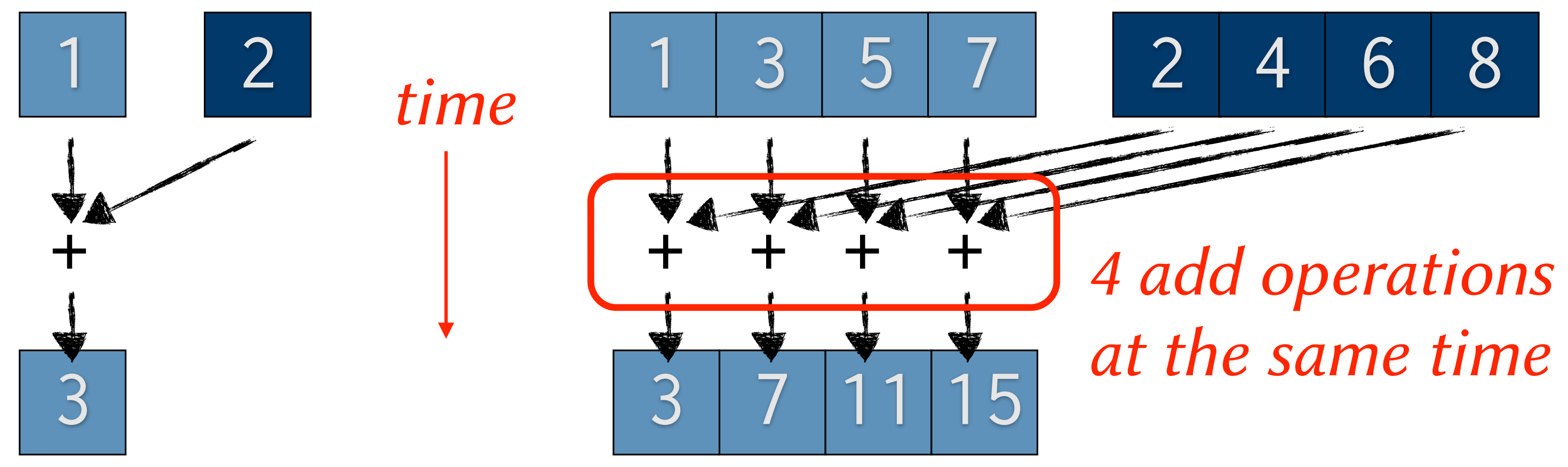


(a) Varian radiation therapy machine by IndyDina with Mr. Wonderful (CC BY 2.0) (b) Ariane 5ES by DLR German Aerospace Center (CC BY 2.0) (c) Intel Pentium by Konstantin Lanzet (CC BY-SA 3.0) (d) Zune80and4 by Bkwparadox (CC BY-SA 3.0) (e) Heartbleed Logo (CC0) (f) Radar by Monitor Ambiental (CC BY-NC 2.0) (g) Airbus A380 by Axwel (CC BY 2.0) (h) Prius (public domain) (i) Ticker Monitor (public domain)

2. GPUs

Graphics Processing Units are everywhere and used for diverse applications.

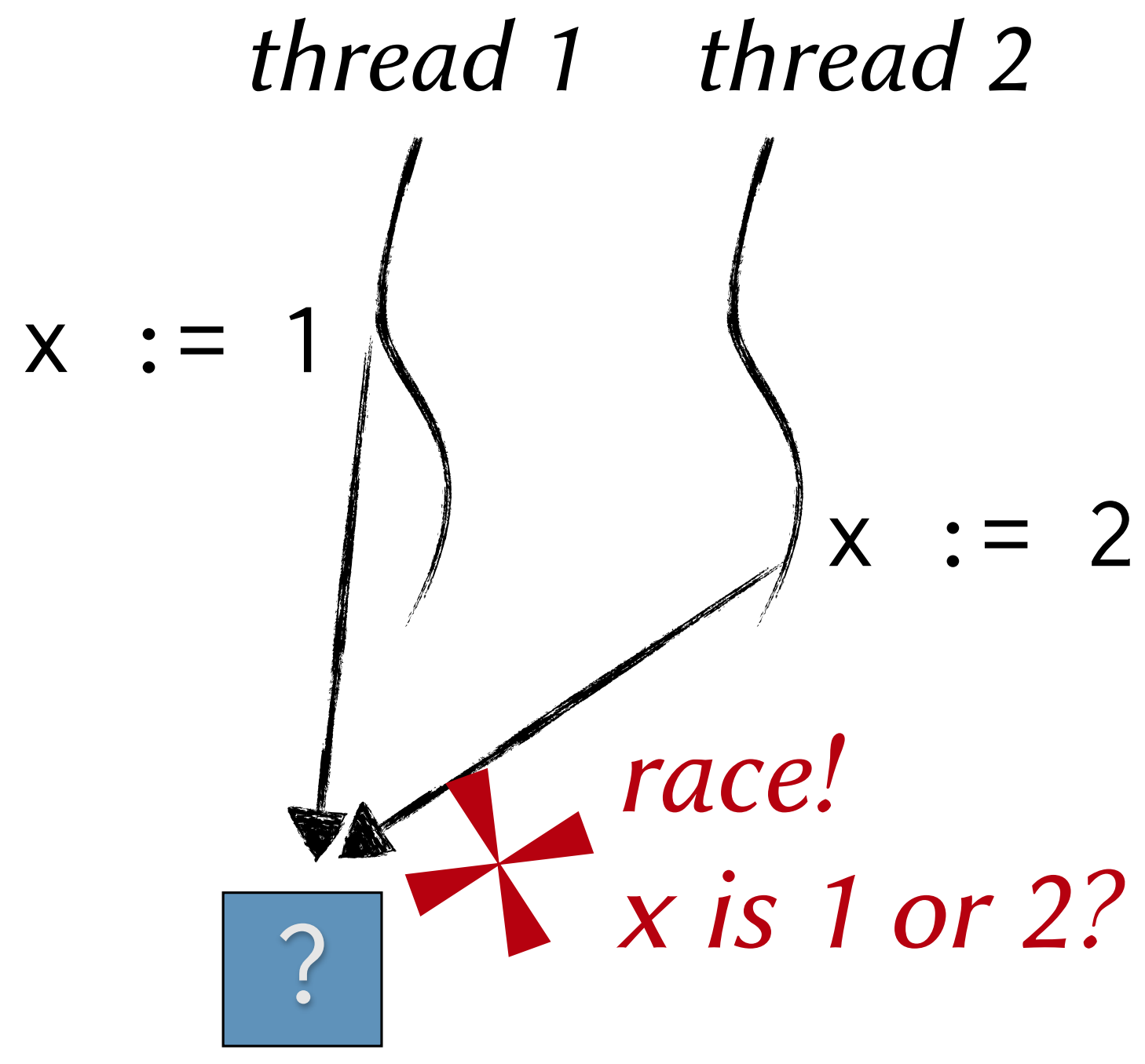




Sequential

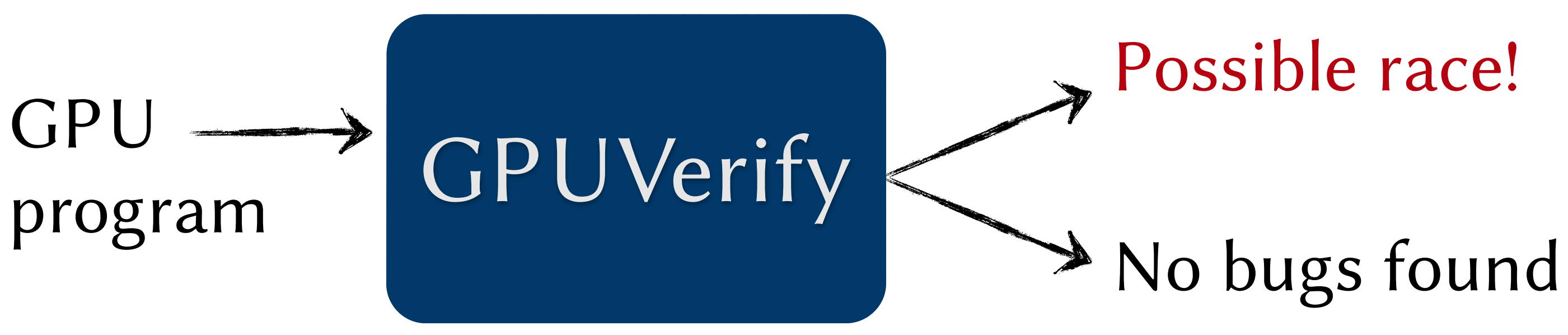
GPUs are **data-parallel**

3. GPU Bugs



Orchestrating many interacting pieces at the same time is challenging. Races introduce undefined behaviour.

4. Formal Verification for GPU Programs



*Guarantees **beyond the scope** of manual testing*

My research inside: Four top-tier publications

Key idea: transform program into logical form

GPUVerify is a static verification tool that can prove that programs are free of defects, giving valuable feedback to the programmer. GPUVerify is automatic, scalable and future-proof.

5. Technology Transfer: A Real Tool Finding Real Bugs in Real Code

NVIDIA

[About a bug found by GPUVerify] It was a real bug, and it caused real issues in the results. It took significant debugging time to find the problem. *[GPUVerify found this bug automatically]*

Lars Nyland
Senior Architect

Imagination

We think that OpenCL developers will find GPUVerify useful and we are **keen to promote and distribute the tool through our PowerVR developer program**.

Carlos Sarria
Senior Developer Technology Manager,
PowerVR Graphics

ARM

Following up on Nathan's work, we are sponsoring another *[CASE]* PhD student at Imperial College. We are keen for ARM Mali GPU developers to use the tool in their workflow, so are **exploring opportunities for integrating it with Mali OpenCL tools**.

Anton Lokhmotov
Staff Engineer,
GPU Compute Compiler Team Lead

EPSRC
Pioneering research and skills

Imperial College London

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