Does Error Resilience Matter in the age of Approximate Computing ?

Karthik Pattabiraman,

Bo Fang, Guanpeng Li, Qining Lu,
Anna Thomas, and Jiesheng Wei
University of British Columbia (UBC)
http://blogs.ubc.ca/karthik/

What this talk is about

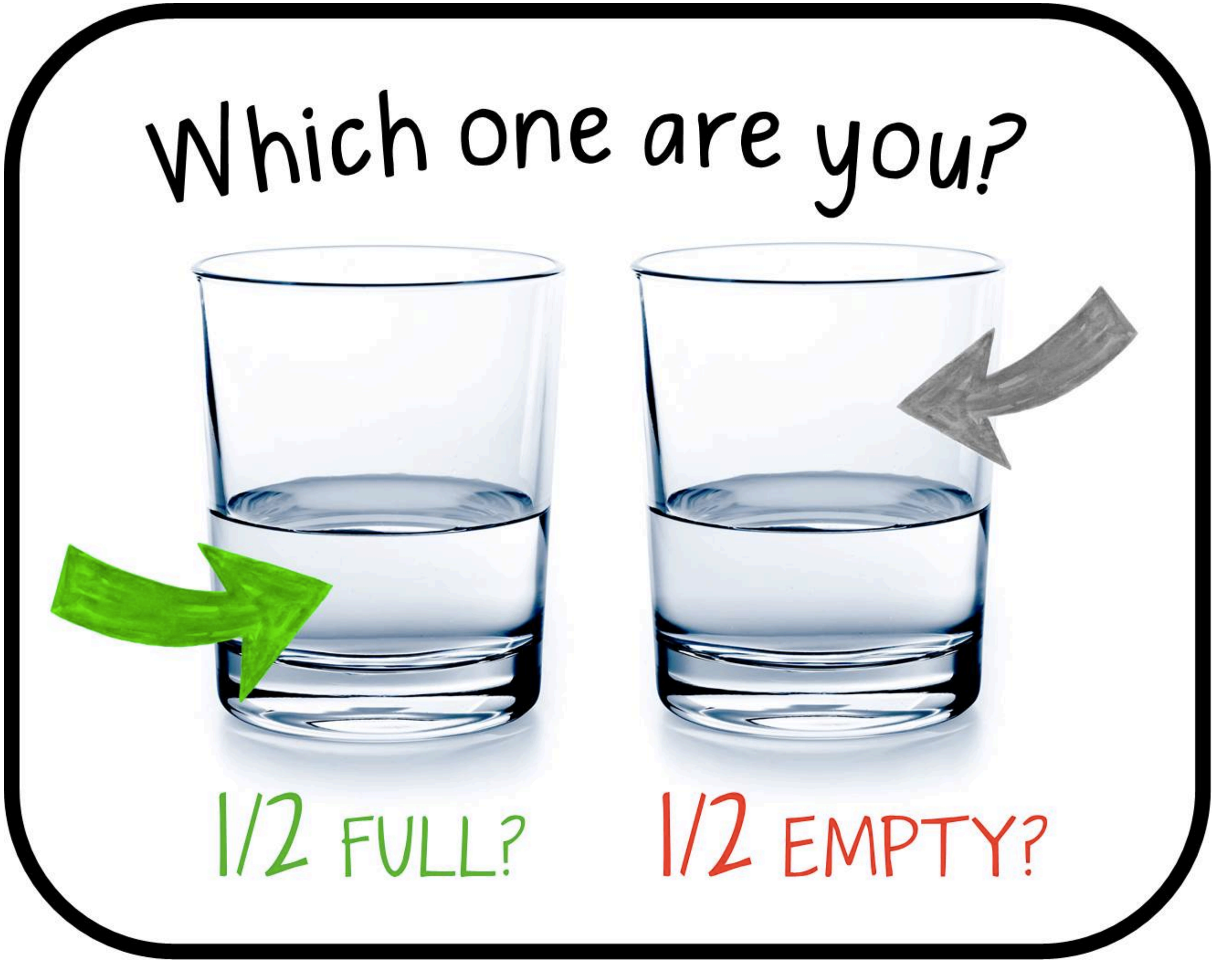
- **Approximate Computing**: Exact results don't matter (much) - compromise on correctness

- **Error-Resilient Computing**: Can we produce correct results in the presence of hardware faults ?

- **Question:** If correctness does not matter, then is it worth the trouble to build error resilient systems ?

What this talk is about

Approximate Computing



Error Resilient Computing

Approximate Computing: Myths and Reality

- **Myth 1:** Soft computing applications can tolerate almost all errors in their data
- **Myth 2**: Crashes are harmless. SDCs or output corruptions are what matter in practice.
- **Myth 3:** Programmers are good at writing correctness checks or annotations in the code

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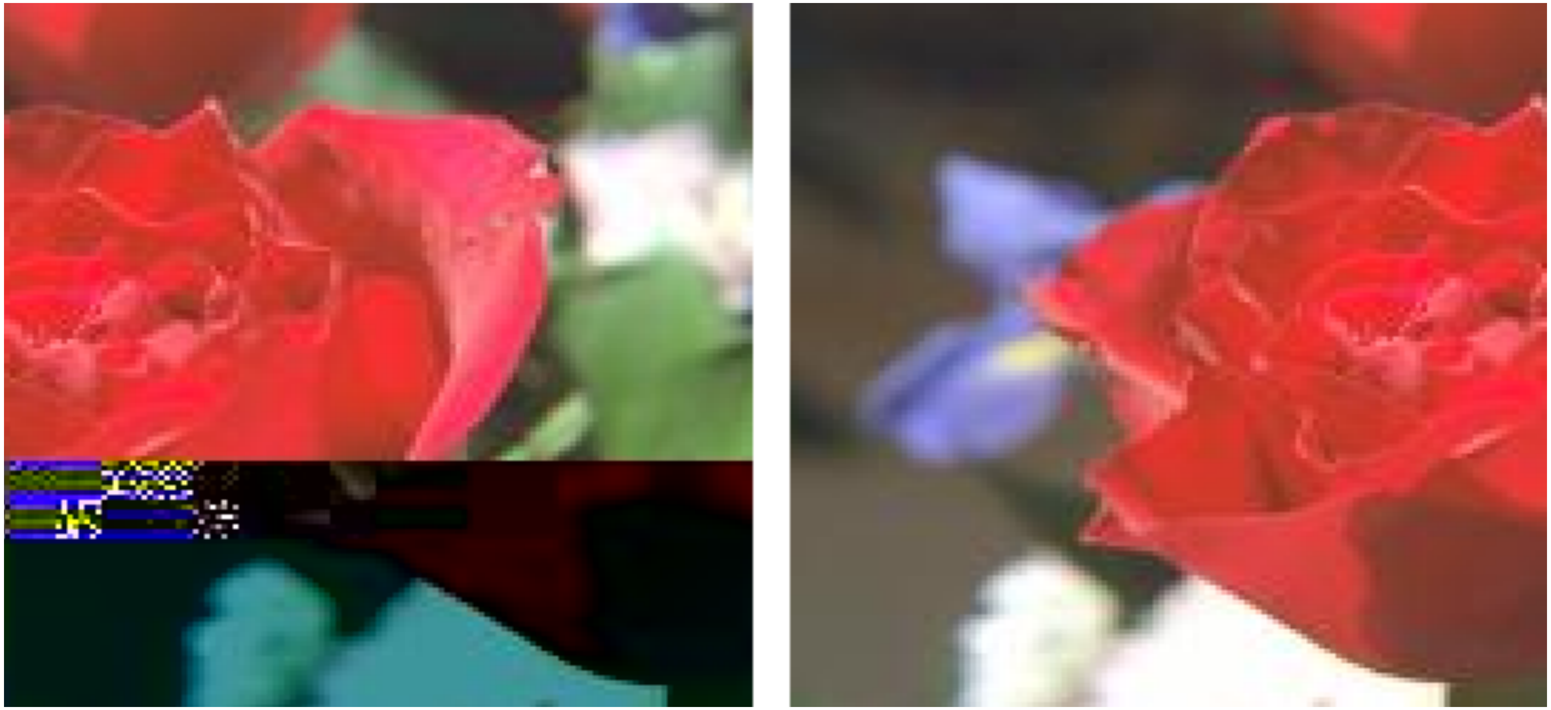
Soft Computing Applications

- Applications in machine learning, multimedia etc.

Original image (left) versus faulty image: JPEG decoder

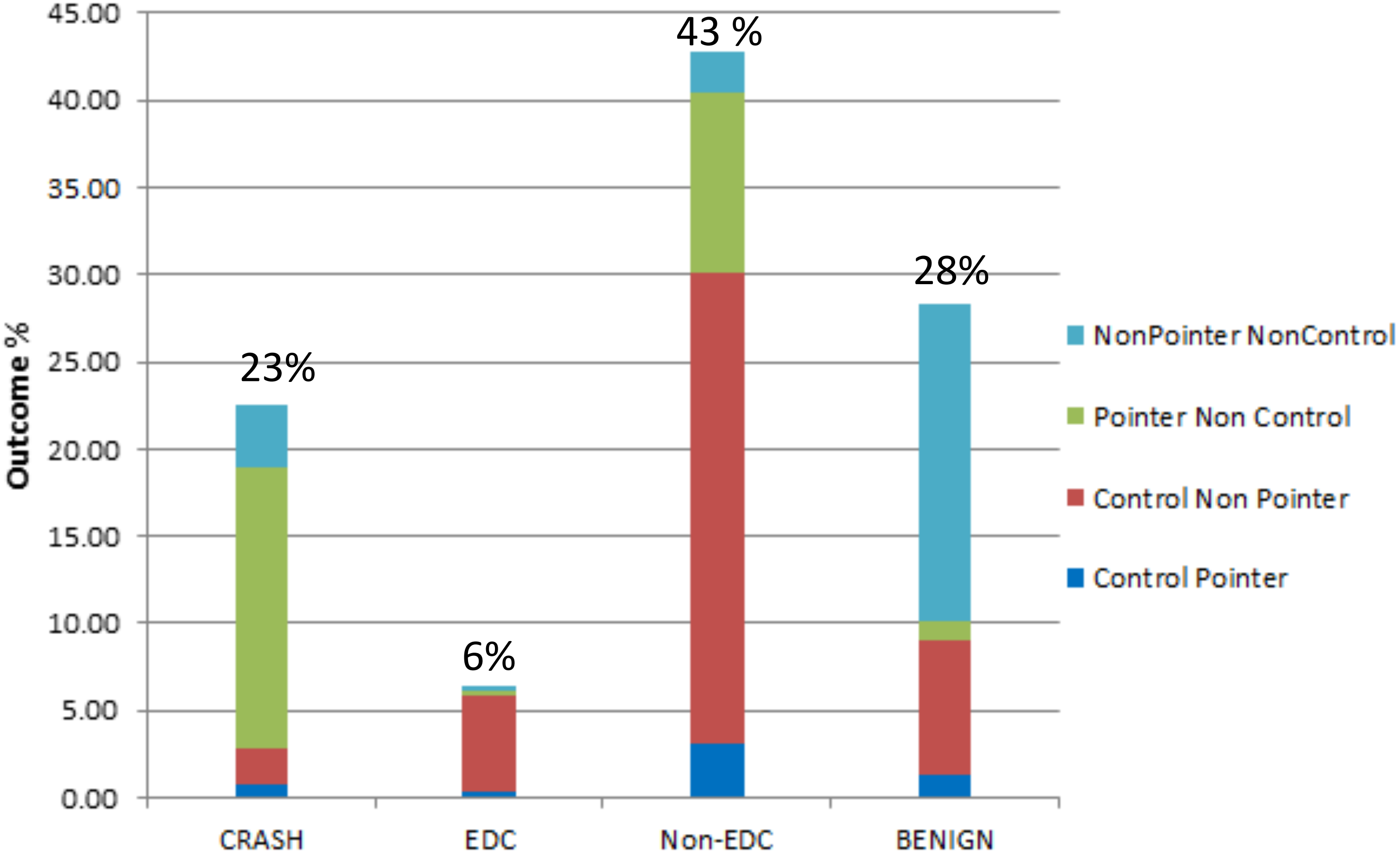
EDCs: What are they ?

- Large or unacceptable deviation in output



EDC image (PSNR 11.37) Vs. Non-EDC image (PSNR 44.79)

Error Resilience: Initial Study



References: DSN'13, SELSE'13, TECS – in press

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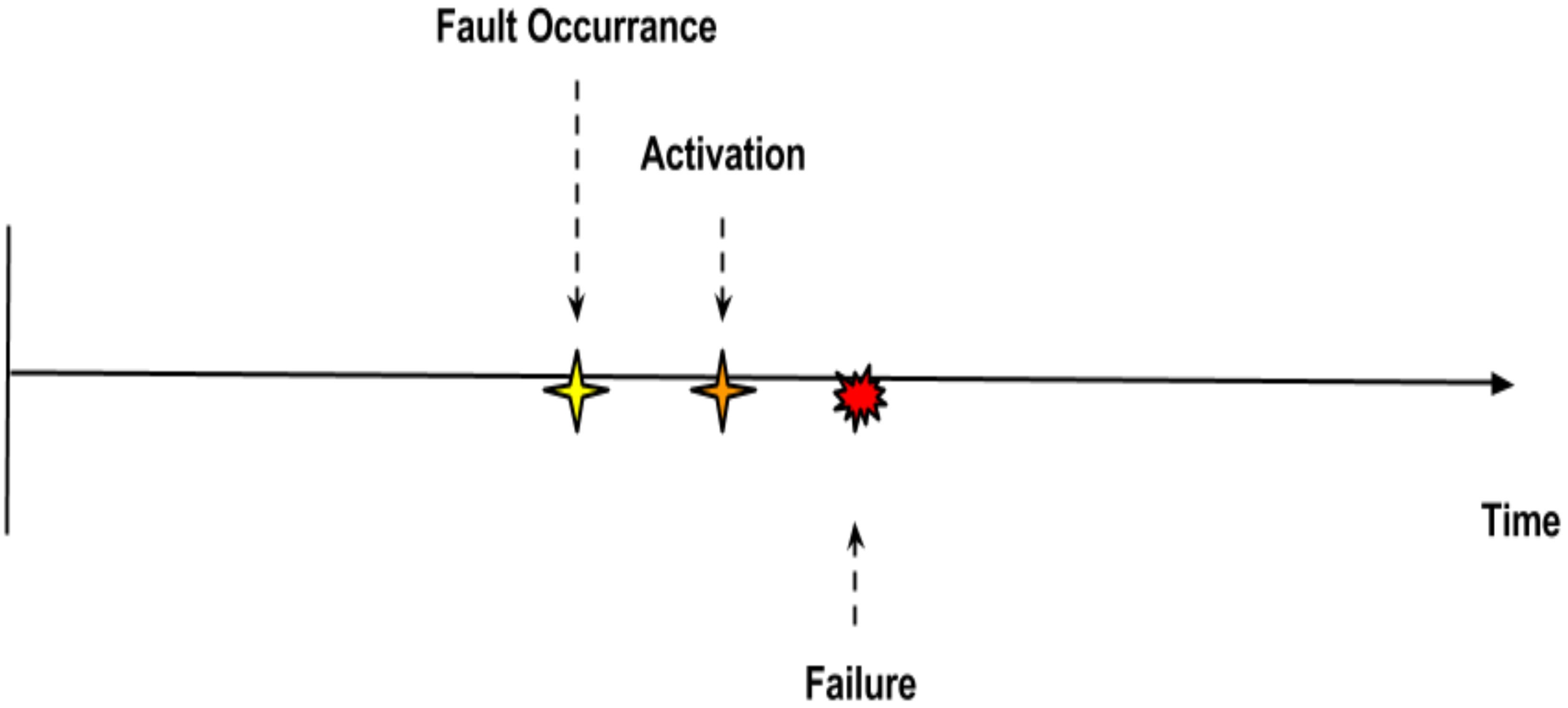
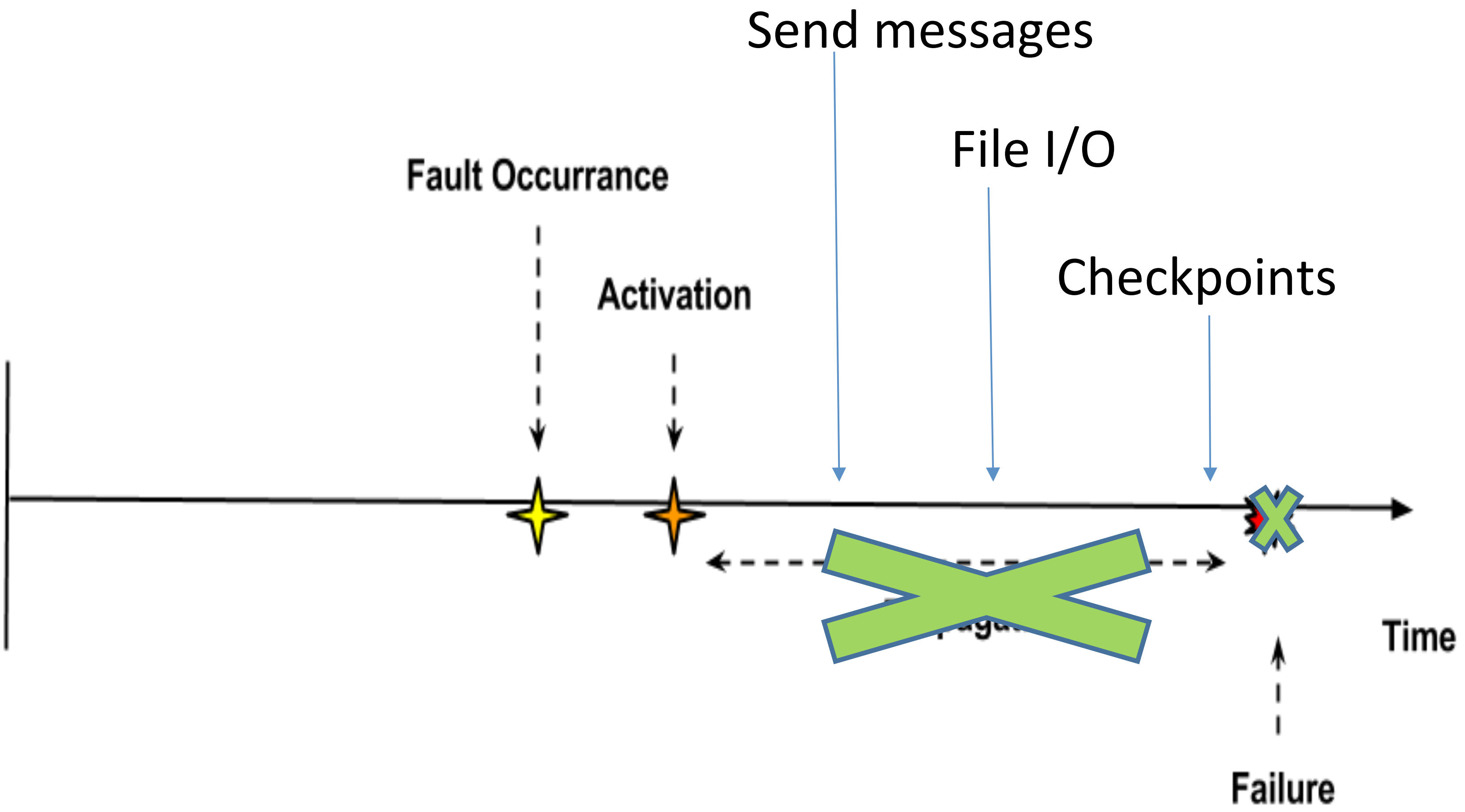
Fail-stop Assumption



Long-latency Crash

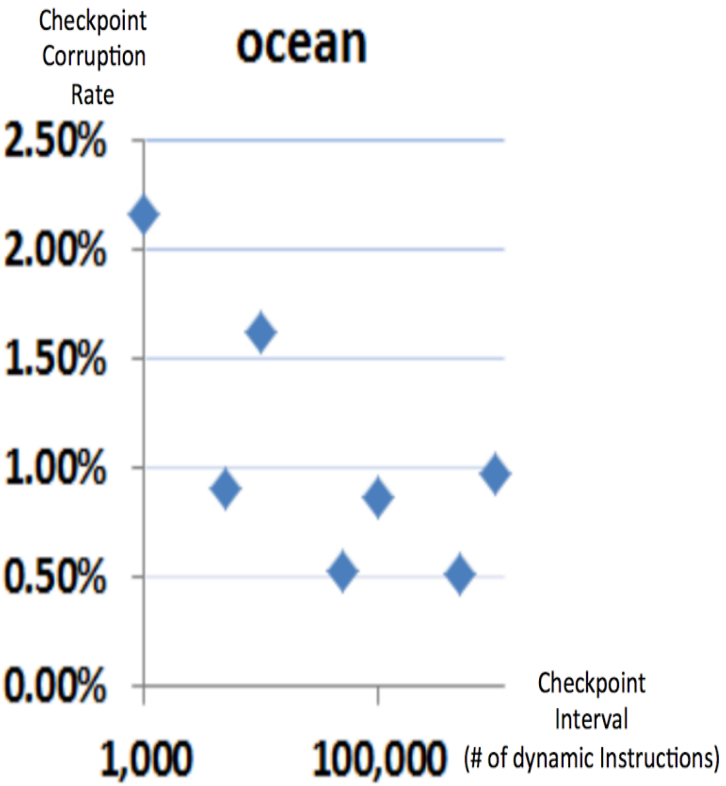


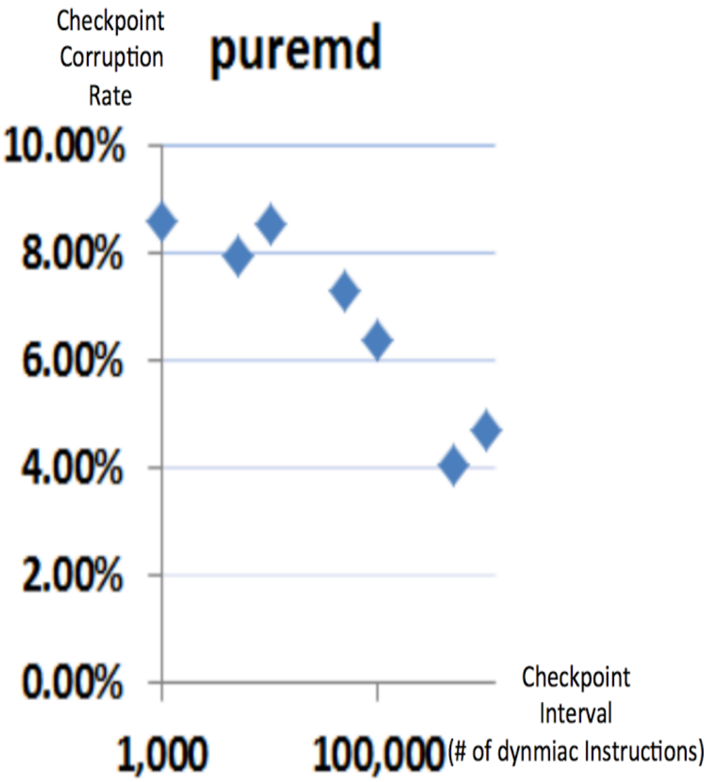
Send messages

File I/O

Checkpoints

Checkpoint Corruptions





References: DSN'15, ISSRE'15

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Programmers are busy !

- Last thing they're going to worry about is annotating data/code as critical or non-critical

- Writing good correctness checks is hard – many checks are either ineffective or wrong

- Finally, programmers tend to be conservative – Will mark everything as critical if in doubt

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Error Resilience **DOES** Matter in the age of Approximate Computing !

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