Recent advances in computer hardware architecture: The opportunities and challenges for provenance

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Why hardware advances?

Fine-grained capture

Precision & Accuracy

Completeness
Areas of hardware advances

1. Processors
2. Heterogeneous computing
3. Network architecture
1. Processor technology

Overlap of functionality

Hardware support

Intel PT, TraceHub

ARM Coresight ETM
Intel PT

Complete control flow
  - Direct branches (taken/not taken)
  - Indirect branches (target IP)

Ring Buffer in memory

Recreate program execution
Intel Trace Hub
Applicability

Debugging

Data flow reconstruction

Feed-forward computation
Challenges

Processing

Storage

Too low level
2. Heterogeneous Computing

Near Data Processing

- Programmable SSDs

Accelerators/Co-processors

- GPU, Intel MIC etc.
Programmable SSDs

Firmware proprietary

New interfaces

Offload computations
Applicability:
Completeness

Challenges:
Limited processing power
Overheads
Accelerators

High parallelism

Offload computations

Results copied
Applicability:
Completeness

Challenges:
Negate performance benefits
3. Network architecture

Lack of visibility

Specialised hardware

Network Function Virtualisation

Software Defined Networking
Applicability:
Easy integration and capture
Completeness

Challenges:
Emerging technologies
Coordination across hosts
Future research directions

Leverage Intel PT and TraceHub

Retrospective data flow analysis
Summary

Hardware advances

Precision and Accuracy

Completeness
Thank You

For more info visit:
http://www.cl.cam.ac.uk/research/dtg/fresco/