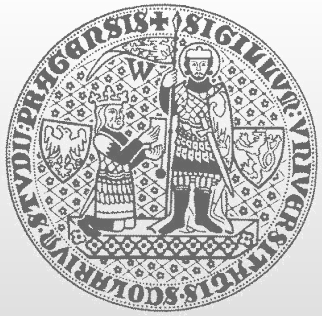
Course Agenda

Crash Dump Analysis 2015/2016



CHARLES UNIVERSITY IN PRAGUE

faculty of mathematics and physics

Department of Distributed and Dependable Systems

ORACLE

SUSE

redhat

Motivation

- **Goal**
  - Explain what is the right debugging tool when an application or the kernel crashes
- **Observation**
  - `printf()` is usually not the right tool

Motivation (2)

- **More observations**
  - System can crash even in production
    - We cannot alter the binary and run it again
    - We have to investigate post mortem
      - Using the record of the memory layout in the time of the crash (crash dump)
  - It is not wise to reinvent the wheel
    - We will see some well-proven tools and best practices
    - Some degree of low-level programming knowledge is required

Course Outline

- **Basic low-level programming**
  - Processor architectures, assembler, stack, ABI
  - IA-32, AMD64, SPARC V9
- **Basic system debugging tools**
  - Solaris, Linux, Windows
  - mdb, gdb, crash, WinDbg
- **Core files, crash dumps**
  - How to analyze them

Course Outline (2)

- **Common causes of crashes**
  - Memory corruption
  - Deadlock
  - Lockup
- **Dynamic tracing tools**
  - DTrace, SystemTap
- **System diagnostics tools**
  - ABRT

Expected Knowledge

- **Basic C language**
  - *Programming in C++* course should be more than sufficient
- **Basic low-level programming**
  - *Principles of Computers* course should be more than sufficient
- **User-level UNIX knowledge**
  - *Introduction to UNIX* course should be more than sufficient
- **Basic technical English**
  - For the slides, literature, tools and manuals

Practical

- **Lectures**
  - Thursdays 10:40 – 12:10 in lecture hall S9
- **Tutorials / Labs**
  - Thursdays 12:20 – 15:30 in lab SU1
    - Physical capacity is limited to about 15 students
      - Make sure your u-lab account is working
      - Or you can bring your own laptop
        - Make sure you have Internet connection

Practical (2)

- **Current lecturers**
  - Martin Děcký – martin.decky@d3s.mff.cuni.cz
  - Jiří Svoboda – jiri.svoboda@oracle.com
  - Tomáš Jedlička – tomas.jedlicka@oracle.com
  - Petr Muller – muller@redhat.com
  - Martin Čermák – mcermak@redhat.com
  - Jakub Filák – jfilak@redhat.com
  - Vlastimil Babka – vbabka@suse.cz
  - Michal Hocko – mhocko@suse.cz
- **Past contributors**
  - Jakub Jermář (Oracle/Avast)
  - Vítězslav Bátrla (Oracle)
  - Vineeth Pillai (Oracle)

Practical (3)

- **Web**
  - Slides, practical information, news
  - http://d3s.mff.cuni.cz/cda

Grading

- **Labs credit**
  - No lab attendance required
    - But strongly recommended
  - Passing a practical test
    - Typical assignment: Identify a root cause of a crash from a crash dump
    - At the end of the semester (2 tries)
- **Exam**
  - Passing a written test
    - Questions available on the web (3 terms)

Resources

- **Lectures and labs**
  - Most important hands-on experience
  - Note: The slides serve just as an outline
- **Literature**
  - **Frank Hofmann:** *The Solaris Operating System on x86 Platforms, Crashdump Analysis, Operating System Internals*
    - http://d3s.mff.cuni.cz/cda/ref/book.pdf

Resources (2)

- **Literature (cont.)**
  - **Igor Ljubuncic:** *Linux Kernel Crash Book*
    - Link
  - **Chris Drake, Kimberley Brown:** *PANIC! UNIX System Crash Dump Analysis Handbook*
    - Useful general reference

Resources (3)

- **Literature (cont.)**
  - **Richard McDougall, Jim Mauro, Brendan Gregg:** *Solaris Performance and Tools: DTrace and MDB Techniques for Solaris 10 and OpenSolaris*
    - Dynamic tracing and core dump analysis using mdb

Resources (4)

- **References**
  - *Intel® 64 and IA-32 Architectures Software Developer's Manual, Volume 2*
    - IA-32 and AMD64 instruction set reference
    - Link
  - *SPARC Assembly Language Reference Manual, Appendix E SPARC-V9 Instruction Set*
    - SPARC V9 instruction set reference
    - Link

Disclaimer

- **Your mileage may vary**
  - Different operating systems have different levels of support for crash dump analysis and observability
    - This course tries to explain the general principles
    - But sometimes we just need to demonstrate those principles in action
      - Therefore we primarily use Solaris and Fedora (on IA-32, AMD64 and SPARC V9)
      - It is up to you to translate the general principles and concrete examples to your favorite platform
      - We welcome any constructive suggestions