AMD uProf 3.5 Release Notes
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Release Highlights

Version 3.5

The following new features are available in this release:

- **CPU Profiling GUI:**
  - Timeline for CPU Profile events and metrics
  - Profile duration filter in timeline
  - Bottom-up view of callstack samples
  - Thread level callgraph support
  - Thread level flamegraph support

- **Holistic Analysis (Linux only)** – Analyze CPU, GPU, and OS events together in GUI. Following events can be traced and analyzed using the holistic analysis view:
  - OS scheduling event
  - System calls
  - POSIX thread synchronization APIs
  - API and GPU activity tracing for heterogeneous application using HIP
  - MPI API event tracing

- **OS Tracing (Linux only)** – Operating System event analysis:
  - Requires kernel 4.7 or later, confirmed on kernel 4.15 and later.
  - Supports following analysis views in GUI:
    - Thread state analysis
    - Kernel block I/O analysis
  - Supports following event reporting in CLI:
    - Synchronization object summary
    - Kernel block I/O analysis
    - Pagefault analysis
    - Memtrace (memory alloc/dealloc) analysis
  - MPI Tracing (Linux only) – HPC Analysis:
    - Performs tracing of MPI APIs of the applications based on MPICH and derivatives
    - GUI – MPI event timeline view and MPI communication matrix view
    - CLI – Hot MPI APIs, point-to-point communication matrix, and collective APIs
  - GPU Tracing (Linux only)
    - Requires AMD ROCm 4.3 installed
    - Supports accelerators AMD Instinct™ MI100 and MI200
    - Performs HIP, ROCr, and KFD tracing
    - GUI – Offload analysis view
CLI – HIP and ROCr API and GPU activities summary

− GPU Profiling (Linux only) – GPU performance analysis:
  o Requires AMD ROCm 4.3 installed
  o Supports accelerators AMD Instinct™ MI100 and MI200
  o CLI – Performance statistics at kernel level

− AMDuProfSys – System analysis:
  o Python-based system analysis tool
  o Supported on Linux and Windows

− GUI features unavailable in this release:
  o Remote Profiling (including CLI)
  o Importing of raw data files and symbol resolution during import
  o IMIX and OpenMP Regions Detailed Analysis view
  o Save and import of Live Power profile DB and Power App analysis
  o Usability – Copy to clipboard, navigation through context menu, showing events in saved configuration details, apply global preferences on-the-fly, function search, and reporting progress bar

Version 3.4

The following features are available in this release:

• AMDuProf-3.4.494.exe addresses CVE-2021-26334
• Added new Performance Analysis type called “Cache Analysis” on Windows to identify potential false cache-line sharing performance issues
• New platform support – AMD EPYC™ “Zen3”-based processors
  − All the existing CPU Profiling features on Windows and Linux
  − All the existing Power Profiling features on Windows and Linux
  − AMD EPYC™ 3rd generation processor support was tested on the following Linux distro versions:
    o SUSE Linux Enterprise Server 15 SP2 - 5.3.18-24.49-default
    o Red Hat Enterprise Linux 8.3 (Ootpa)-64 Kernel - 4.18.0-240.10.1.el8_3.x86_64
• Virtualization support
  − Timer based profiling support for the following hypervisors and the Linux and Windows guest operating systems running on:
    o Microsoft Hyper-V
    o VMware ESXi 7.0
    o Linux KVM
  − Added Core PMC Event based profiling support for the following hypervisors and the Linux and Windows guest operating systems running on:
    o Microsoft Hyper-V + vPMU (Tested on Windows Server vNext/Fe Host and Ubuntu 18.04.5 guest VM)
- VMware ESXi 7.0
- Linux KVM

- AMDuProfPcm – System Analysis
  - Windows support
  - New platform support – AMD EPYC™ “Zen3”-based processors support all the existing features
  - Added a new option “-C” to accumulate the metric data and report it at the end of profile duration.
  - Added a new option “-A” to aggregate the metric data at various component level such as system, package, ccd, and ccx
  - Added a new option “-D” to dump the raw event count values
  - Added support to collect PCIe bandwidth metrics for AMD EPYC™ “Zen2”-based processors
  - Virtualization support
    - Microsoft Windows Server 2019, AH2020, and AH2021 with Hyper-V enabled
    - Linux and Windows guest operating systems running on:
      - Microsoft Hyper-V
      - VMware ESXi 7.0
      - Linux KVM

- Advisory Functionality
  - Confidence threshold - GUI grays out the low confidence metrics for a program unit. These are marked, if low number of samples collected for a program unit are due to multiplexing or statical sampling.
    - This is applicable to SW Timer and Core PMC based metrics.
    - This confidence threshold value can be set through “Preferences” section in SETTINGS page.
  - Issue threshold – For various program units, if the CPI metric’s value exceeds the threshold (>1.0), GUI highlights those metric values in pink as potential performance problem.

- AMDCpuTopology tool (Linux only)
  - Added a new tool AMDCpuTopology on Linux, to report the CPU topology information of AMD “Zen” architecture-based processors.

- Miscellaneous New Features
  - Included selective Callstack profiling support.
  - Enhanced Windows uProf driver to reduce the missing samples during IBS OP data collection and added an option to configure the data buffer size to use in kernel space while collecting profile data - this will reduce the missing samples due to low number of data buffers being used by uProf drivers.
  - Added option to collect and generate ASCII dump of IBS OP samples.

- Quality Improvement
Fixed data correlation issues such as wrong functions being reported as hot functions and incorrect demangling of function names.

Many more bug fixes to improve the overall quality.

Fixed Windows bug to reduce the samples being missed during IBS OP data collection.

Version 3.3

The following features are available in this release:

- Added new Performance Analysis types for HPC application analysis:
  - Profiling OpenMP applications (Linux)
  - Profiling MPI applications (Linux)
- Added new Cache Analysis to identify potential false sharing cache lines (Linux).
- Added support for System Analysis (AMDuProfPcm) on Windows.
- Support for Linux kernel profiling when kernel debug info is available.
- New platform support for AMD Ryzen™ 4000 series processors.
- GUI usability improvements:
  - Added heatmap in SOURCE view for easier navigation to hot source lines
  - Improvements to data ANALYSIS views
  - Easier locating of recently profiled configurations from Welcome page
  - Simplified Windows Symbol Server settings
- Optimizations
  - To enable to faster profile data processing
  - Simplified default report format and faster report generation
- Potential fix in AMDPowerProfiler Windows driver to avoid a BSOD.

Version 3.2

The following features are available in this release:

- New platform support for CPU Profiling - AMD EPYC™ 7002 Processor (Rome). The following Linux distro versions are supported:
  - RHEL 8.0.2 or later
  - Update 2 of RHEL 8 is requires kernel-4.18.0-80.7.1.el8 or later. For more information, refer:
    https://access.redhat.com/support/policy/amd
  - CentOS 8.0.1905 with kernel version kernel-4.18.0-80.7.1.el8 or later
  - Ubuntu 19.10
Older kernel versions may lead to the following NMI error messages on the console:

```
kernel: Uhhuh. NMI received for unknown reason 3d on CPU 1.
kerned: Do you have a strange power saving mode enabled?
kerned: Dazed and confused, but trying to continue
```

- Distros that may lead to this issue
  - SLES 15 SP1
  - RHEL 8 and older
  - CentOS 8.0.1905 and older
  - Ubuntu

- CPU Profiling
  - On Linux, performance improvements while data processing and report generation.
  - On Linux, reduction in the memory consumption during data processing and report generation.
  - Improvements in attributing callstack samples.
  - On Linux, support profiling for non-root users, when the perf_event_paranoid is not set to -1 and <=2.
  - AMDuProfCLI option changes:
    - Replaced the AMDuProfCLI report command’s --no-inline to --inline. Reporting of the inlined functions in C, C++ executables is turned off by default. Using the --inline option will report the inlined functions.
    - Added the option --show-sys-src to generate the detailed function report of the system module functions with source statements if the debug information is available for those system modules.
    - Added the option --tid to the “collect” command to profile only the given thread ID on Linux.
    - Added new AMDuProfCLI option --list to “info” command to list the supported:
      - Predefined collect profile configuration (collect-configs)
      - Report data view configurations (view-configs)
      - Raw PMC events that can be used with collect command (--pmu-events)
    - Add new options such as --collect-config, --view-config, and --pmu-event to the AMDuProfCLI’s info command.

- GUI Improvements:
  - Simplified SETTINGS page sections
    - PREFERENCE window to set the user preferences
    - SYMBOL settings window to specify the symbol paths and symbol servers
    - On Windows, use cache path mentioned with _NT_SYMBOL_PATH as default, otherwise, use uProf’s default download path
    - Persistence of the symbol paths across all the profile runs
    - Consolidated the Live Power profiler specific options in “Select Profile Type” “System-wide Power Profile (Live)” section of PROFILE page in a new collapsible pane
    - Scaling of Thread Concurrency chart to avoid horizontal scroll bar.
o Flame Graph improvements:
  ▪ Navigating to source view from Flame graph for the functions having self-samples
  ▪ Visualize Flame graph by sorting based on larger callstack
  ▪ Performance improvements while constructing the Flame graph

o Power Profiling
  ▪ Added support power profiler on 3rd Gen AMD Ryzen™ Desktop Processor without a dGPU.
  ▪ Added support package temperature counter for AMD Ryzen™ processors.
  ▪ Disabled the --histogram and --cumulative options of “timechart” command of AMDuProfCLI.
  ▪ Moved CorrelatedPower category counters to Power category for family17h processors.

o Quality and Usability improvements - Multiple bug fixes

Version 3.1

The following features are available in this release:

- New platform support for Performance and Power profiling - AMD EPYC™ 7002 processor
- Usability Improvements:
  - Easier navigation to Flame Graph window on ANALYZE page
  - By default, expand the Filters and Options collapsible pane on ANALYZE and SOURCE pages
- Quality - Bug fixes

Version 3.0

The following features are available in this release:

- Flame Graph - a callstack trace visualizer to identify hot call-paths
- Support Linux kernel profiling and kernel-space drivers
- Improved symbol discovery for Linux system libraries
- Remote Profiling support:
  - Host OS - Windows and Target OS - Linux
  - Callgraph window in GUI
- New platform support for Performance and Power profiling - 3rd Gen AMD Ryzen™ desktop processor
- GUI feature to search function names in ANALYZE page
- New OS support:
  - openSUSE Leap 15, SLES 12 and 15
  - Windows 10 (May 2019 Update) and Windows Server 2019
- Improved data translation to reduce the time taken to process the raw profile data records
• Linux Power Profiler drivers supports latest Linux kernel version
• Many bug fixes to improve the overall stability

**Supported Processors**

AMD uProf supports the following processors:

• **CPU Profiling**
  – AMD EPYC™ 7001, AMD EPYC™ 7002, and AMD EPYC™ 7003
  – AMD Ryzen™, AMD Ryzen™ PRO, AMD Ryzen™ Threadripper™, 3rd Gen AMD Ryzen™ Desktop processors
  – Processors designed for the x86-64 instruction set

• **Power Profiling**
  – AMD EPYC™ 7001, AMD EPYC™ 7002, and AMD EPYC™ 7003
  – AMD Ryzen™, AMD Ryzen™ PRO, AMD Ryzen™ Threadripper™, and 3rd Gen AMD Ryzen™ Desktop processors

• **GPU Profiling and Tracing** – AMD Instinct™ MI100 and MI200

**Supported Operating Systems**

AMD uProf supports the 64-bit version of the following operating systems:

• **Microsoft®**
  – Windows® 10 (up to 21H2)
  – Windows 11 (21H2)
  – Windows Server 2019
  – Windows Server 2022

• **Linux®**
  – Ubuntu® 16.04 and later
  – RHEL® 7.0 and later
  – openSUSE® Leap 15.0
  – SLES 12 and 15
  – CentOS 7.0 and later

• **FreeBSD®** 12.2 and later
System Requirements

AMD uProf contains a host of development features with different system requirements:

**CPU Profiling**

- Time-Based Profiling can be performed on AMD and other x86-64-compatible processors.
- The Event-Based Profiling (EBP) and Instruction-Based Sampling (IBS) session types require an AMD CPU or APU.
- CPU Profiling on Linux platforms – Limitations of Linux perf:
  - For AMD “Zen” microarchitecture processors, EBP and IBS profiling on Linux requires Linux kernel 4.9 and above.
  - Call chain analysis on Linux depends on the call chain information provided by Linux perf. This requires the profiled binaries to have stack frame pointer (that is, compiled with -fno-omit-frame-pointer).
  - For non-root users to perform EBP and System-wide profiling, `/proc/sys/kernel/perf_event_paranoid` must be set to -1.
- IBS may not be enabled by default, check BIOS setting to enable it.

**GPU Profiling and Tracing**

GPU profiling and tracing uses AMD ROCm 4.3.0. For the steps to install AMD ROCm, refer AMD uProf 3.5 user guide.

**OS Tracing**

- OS tracing (on Linux) requires BCC (BPF Compiler Collection) and eBPF, refer AMD uProf 3.5 user guide for the steps to install these dependencies.
- OS tracing requires Linux kernel 4.7 or later, it is recommended to use kernel 4.15 or later.
Known Issues

CPU Profiling

- CPU Profiling is disabled on Windows platforms if Hyper-V is enabled.
- If AMD uProf is installed in path that includes non-ASCII Unicode characters, profiling does not work.
- CPU Profiler doesn’t support profiling of Windows Store App.
- CPU Profiler report command invocation with --symbol-server & --symbol-cache-dir options crashes if Ctrl-C is pressed.
- CPU Profiler IMIX report may show ‘BAD OFFSET’ or omit instruction-name (by showing empty space) for few instructions.
- Profiling of Java apps running on 32-bit JVM on Linux platform is not supported.
- Profiling Java programs by explicitly specifying the AMD uProf’s JVMTI profile agent using Java’s -agentpath option may lead to empty source view. Users are advised to launch Java under the tool to profile Java programs.
- Profile control API's does not work with C-based applications.
- If call-stack has recursive functions, sum of samples of a function in callee table is not the same as Inclusive sample of function table for that function.
- On Linux, IBS Fetch profiling shows extremely low number of samples on AMD “Zen1 and Zen2” generation processors.
- AMDuProfCLI crashes if “Ctrl + C” pressed (to kill the profiling) during system wide profiling on RHEL 7.6. Happens 7 out of 10 times.
- Call stack info on Linux is inaccurate of the callpath includes inlined functions and FPO together using 32-bit target application.
- AMD uProf GUI doesn’t release the PDB file handle of the target application after translation, due to which the same application can’t be compiled unless AMD uProf GUI is closed.
- Segmentation fault occurs while collecting samples for FORTRAN OpenMP application compiled using icc compiler.
- OpenMP Trace data missing when application profiled in RHEL 7.6.
- On RHEL8.2, IBS and cache analysis profiles throws NMI errors.
- In Cache analysis report on AMD “Zen3” generation processor, remote catch hit(M) metric may not be reported.
- Function names are shown as empty for samples attributed to [vdso] and [uprobes].
- On Linux, the caller-callee function mapping the callgraph and flamegraph might not be accurate if frame-pointer optimized during target application compilation.
• In rare circumstances, core PMC samples may not be collected while profiling on KVM guest environment.
• ‘--inline’ CLI option is not supported for Java application profiling.
• High number of samples on ESXi guest environment is collected in comparison to applications running on bare-metal system.
• Flamegraph may show same function multiple times when profiled with FPO enabled.
• Custom profile along with IBS may not work as expected.
• GUI may crash while expanding the functions in bottom-up call chain in Function Hot-Spots.
• Function name resolution and source attribution for .NET 5 and 6 applications might not work as expected.
• Importing GPU profile DB is not supported.

**Power Profiling**

• If the profiled system goes into Sleep/Hibernate state during a Live Power Profiling session, only data collected before hibernation is displayed, and the navigation slider does not respond.
• During Live Power Profiling session, if user closes the GUI without stopping Power Profile session, crash is observed in GUI.
• Live Power Profiling does not stop even after attached target process terminates.
• On multi-socket Milan system, temperature values might not be shown correctly for second socket.
• Importing of Power App Analysis session is not supported in GUI.

**Support**

For support options, the latest documentation, and downloads refer AMD Developer Central (https://developer.amd.com/amd-uprof/).