

Webinar to Present On-Mode Computer Testing Software (Lot 3)

20 September 2022

15h30 – 17h30 Brussels

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CLASP improves the energy and environmental performance of the appliances & equipment we use every day, accelerating our transition to a more sustainable world.

Meeting Agenda



Time	Topic	Organisation
15:30	Welcome, Introduction and Context	CLASP Europe
15:40	Motivation and Task	DG Energy
15:50	Lot 3 On-Mode Software Testing Suite <ul style="list-style-type: none">● Overview● Architecture● Setup● Procedure● Worklets	GTD GmbH
17:00	Questions, Answers and Discussion	All
17:30	Closing and Thank You	

House Keeping

- Please mute your microphone
- Please do not run your video
- Please edit your name so it includes your organisation like this: Michael Scholand, CLASP
- Comments and questions can be submitted in writing in the chat box (not the Q&A box)
- This presentation is being recorded
- A copy of the slides and link to the recording will be shared with all registered participants



What are we speaking about today?



- A **software tool** for measuring the energy consumption and performance of personal computers (Lot 3) in active mode
- CLASP and GTD GmbH have been working together since January 2020 on this software tool which is designed to:
 1. Accurately assess the energy use and performance of the computer when executing tasks;
 2. Be agnostic of operating system, architecture and configuration;
 3. Be low cost and easy to use for manufacturers and Market Surveillance Authorities (MSAs); and
 4. Open source, to become an independently reviewed and updated software.

Acknowledgements



- CLASP and GTD wish to thank:
 - **DIGITALEUROPE** and their members for their on-going reviews and comments on the software tool (over 2 years...)
 - **UNITY**, and **Underwriters Laboratories (UL)** for their support in providing high-quality content to be utilised within the software

Request for data

- **Software tool and manual** can be found here:
<https://www.clasp.ngo/tools/on-mode-computer-testing-tool/>
- Participants and stakeholders are invited to conduct testing of computers and share the test results / data in support of the Impact Assessment





Ecodesign and Energy Labelling:

Computers (Lot 3) Setting the scene

Prep study (2016-2018)

- Extremely complex to assess compliance in current ED Regulation (EU) 617/2013:
 - 4 Computer categories, several allowances/adjustments (memory, storage, audio/graphics cards...)
 - Need of opening the computer...(warranty?)
- Assessing energy efficiency/consumption in IDLE not relevant anymore, but no usable solution proposed
- Work frozen (limited resources)

A light at end of the tunnel

- CLASP/GTD offered support to fill the gap
- 1° meeting in Commission premises (January 2020) with engineers of major manufacturers participating
- Long development, demonstrations, reiterative testing with Digital Europe members
- From 46 worklets down to approximately 22 worklets

Timeline (tentative)

- **October 2022:** start of study update & Impact Assessment
- **Q2 2023:** Consultation Forum meeting
- **Summer 2023:**
 - Drafting transitional methods / standardisation mandate
 - IA Board, Inter Services Consultation, WTO, Regulatory Committee...
- Start of application: **end 2024**

Thank you for your attention

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SOFTWARE TEST-SUITE FOR COMPUTER ENERGY EFFICIENCY MEASUREMENT

WEBINAR

Andoni Arregui, Thomas Wucher, and Joan Roig

2022-09-20

GTD GmbH

TABLE OF CONTENTS

1. Testing Tool Architecture
2. Test Setup and Procedure
3. Test Worklet Analysis

Who we are and what we do:

- We are a software company in the south of Germany
- Part of the European group GTD with headquarters in Barcelona, founded in 1987

We mainly work for:

- European Space Agency (ESA)
- German Aerospace Center (DLR)
- German federal institutions (UBA, BAM)

Since 2019 we have our software in space

TESTING TOOL ARCHITECTURE

The main characteristics of the Test Suite developed by GTD are:

- It is based on the **open-source** Phoronix Test Suite
- It runs a **series** of **worklets**¹
- It executes **native binaries** in Microsoft Windows, MacOSX, and Linux (incl. ChromeOS)
- Measuring power **does not alter** the **performance** or the **power demand**
- All the results are fused together in a **single meta-efficiency metric** value

¹A *worklet* is a set of tasks, placed in a *workflow*, that is, in a sequence of activities that can be easily reproduced on a regular basis.



Phoronix Test Suite² is an open-source framework for automated benchmarking:

- Runs on Microsoft Windows, Linux, MacOSX (written in PHP)
- Automates the whole testing process from dependency installation to test results aggregation
- Has a huge collection of predefined test-profiles (i.e., worklets)
- Easily extensible for our use-case (e.g., new worklets)
- Results can be visualized by Phoronix Result-Viewer or exported to CSV
- Support for power measurement devices
- No external connection is required to execute the worklets

²<https://www.phoronix-test-suite.com/>

Several changes were necessary to make Phoronix Test Suite work for our purpose:

- Support merging power data after running all tests
- Define and implement support for calculating efficiency for lower is better result units
- Support power measurements on Windows
- Support the result viewer on Windows
- Make the installation of PHP more robust on Windows
- Add better CSV exports
- Other small bug fixes and optimizations

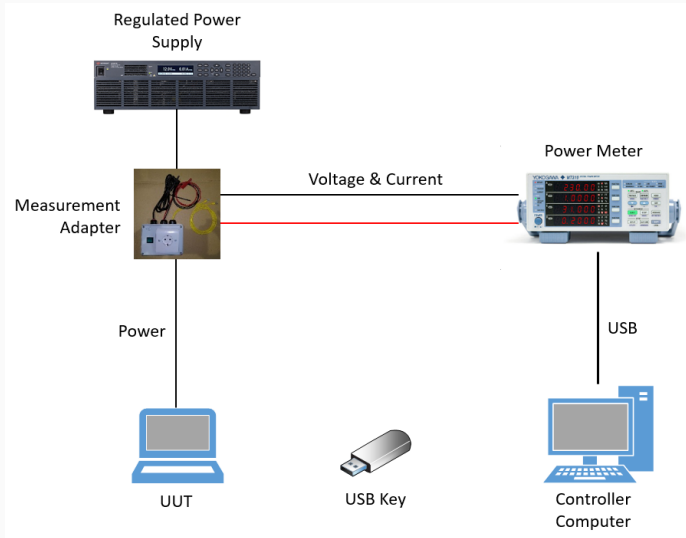
Each worklet consists of the following parts:

- Test definition
- Results definition
- Downloads definition
- Installation script
- Run script

Definition files are written in XML, scripts are shell scripts.

A test suite defines:

- Series of worklets to be run
- Configuration options for each worklet



Reading data from power meters is done by using *sigrok*, an open-source signal analysis software suite.

- sigrok is cross-platform, supporting Windows, MacOSX, Linux
- sigrok is vendor-independant, supporting devices from different manufacturers
- We added support for
 - Yokogawa WT310(E), WT333, WT500
 - Hioki PW3335, 3332

Power meters connected via GPIB are read using a specifically created Python application using librevisa.

On the controller the following pieces of software are installed:

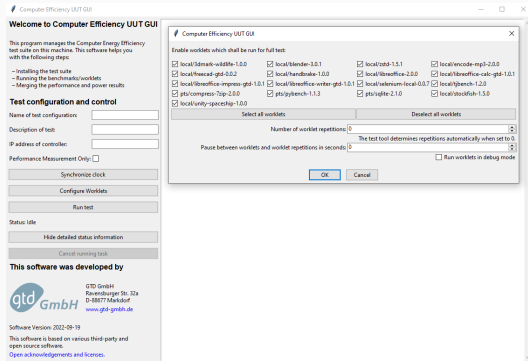
- PHP (and its dependency, the Visual C++ redistributable package)
- Driver for USB-connected power meters
- NTP server (for time synchronization)
- Phoronix Test Suite configuration (e.g. to configure the result viewer)

On the EUT the following pieces of software are installed:

- PHP (and its dependency, the Visual C++ redistributable package)
- NTP client (for time synchronization)
- Third party applications used for testing (Libreoffice, FreeCAD, Blender, ...)
- Cygwin (to run the worklet scripts, only on MS Windows)
- Phoronix Test Suite configuration
- Phoronix Test Suite
- All relevant worklets according to their definition files

The GUI of the test software is

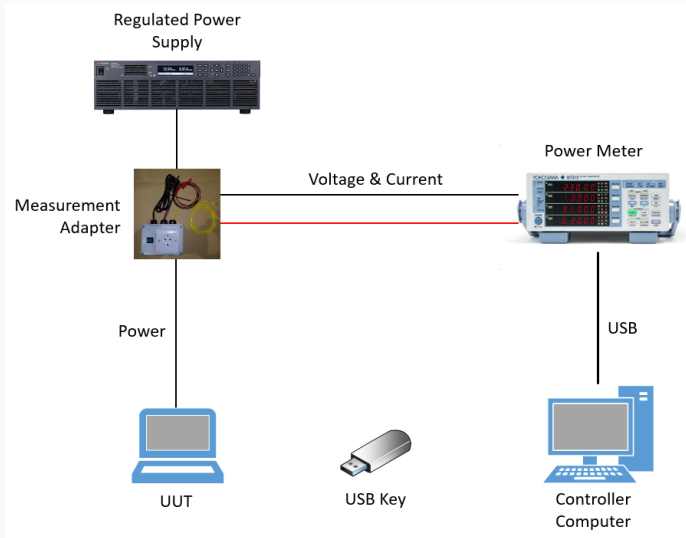
- written in Python and packaged with pyinstaller
- developed using the tkinter widget toolkit
- only a frontend to various shell and batch scripts



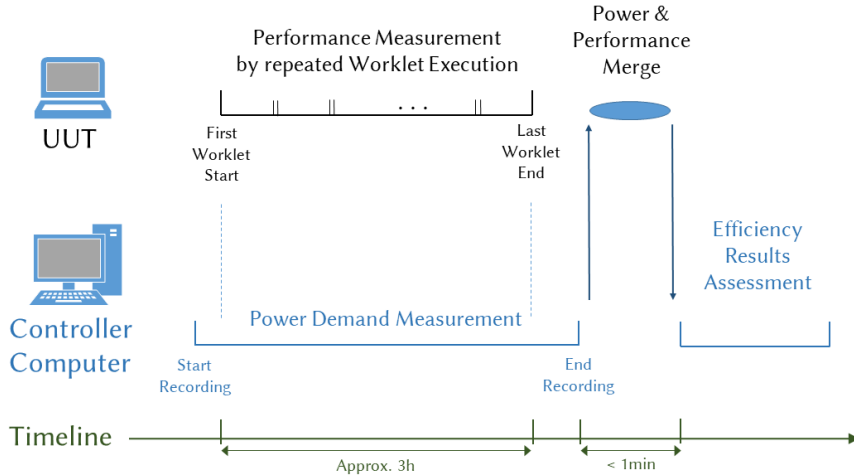
The CLI is implemented through scripts for each operating system to

- Install the controller software
- Install the EUT software
- Check connection to the power meter
- Run the full benchmark
- Run the result viewer
- Start acquiring power measurements
- Start the NTP time server
- Synchronize the time to a given timeserver
- Uninstall the software
- Update an existing USB key to the latest version
- Run arbitrary PTS commands (development and debugging)

TEST SETUP AND PROCEDURE



TEST SUITE EXECUTION WORKFLOW



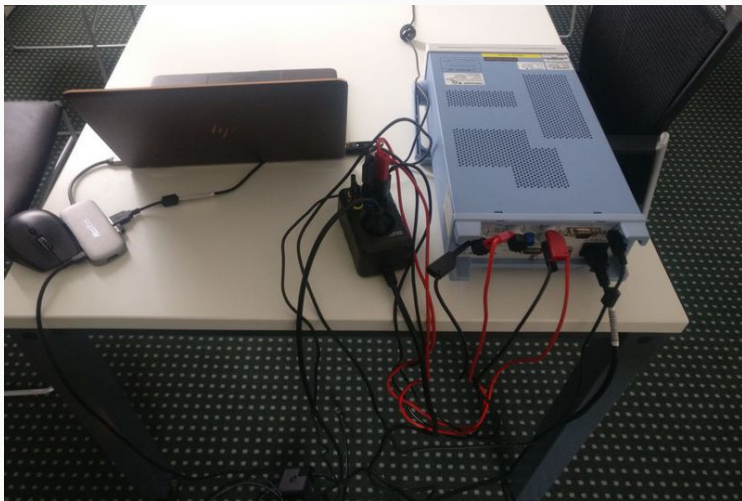
In a live demo we will show the following steps:

- Installation on the EUT
- Installation on the Controller
- Starting the software on Controller and EUT
- Synchronize the time
- Run a few selected worklets
- Merge the power and performance data
- Display the test results
- Uninstall the software

DEMO SETUP



DEMO SETUP



TEST WORKLET ANALYSIS

- Re-using existing benchmark software
- Re-using existing real world applications
- Testing all relevant use cases for a computer
- Simple test setup (i.e. no complicated network setup needed)
- Open architecture for framework and worklets

CRITERIA FOR AN EXISTING WORKLET TO BE CONSIDERED

- Supported on all relevant operating systems
- Free and Open-Source (exception possible)
- Actively maintained
- Simulates workloads of typical users
- Automation possible
- No additional testing setup needed
- Performance and power results are consistent and repeatable

- Add support for missing operating systems
- Allow worklets to run offline
- Include as many dependencies as possible for offline install
- Automate the (un)installation as much as possible
- Check that all worklets run on all expected computer configurations

WHAT WORKLETS ARE AVAILABLE? (RENDERING AND CAD)

Blender

- Popular 3D modelling and video editing application
- Different 3D models available for testing
- Can render only on the CPU or via OpenCL, CUDA
- Result in seconds needed for the rendering

FreeCAD

- Newly developed worklet to simulate CAD usage profiles
- Uses an unmodified version of FreeCAD
- Creates a CAD model via FreeCAD's API
- Result in seconds needed for creating the CAD model

WHAT WORKLETS ARE AVAILABLE? (COMPRESSION)

7-Zip Compression

- Compresses a file with the 7-Zip compression tool
- Result in million instructions per second (MIPS)

Zstd Compression and Decompression

- Compresses a file with the zstd compression algorithm
- Zstd is a more modern algorithm than used in other worklets
- Multi-threaded
- Result in MB per second of compression throughput

WHAT WORKLETS ARE AVAILABLE? (OFFICE TASKS)

LibreOffice PDF conversion

- Converts several LibreOffice documents to PDF format
- Uses an unmodified version of LibreOffice
- Result in seconds needed for converting 20 documents

LibreOffice Spreadsheet/Presentation/Writer

- Newly developed worklet to measure spreadsheet performance
- Creates documents with various numbers, formulas, graphs, images, text
- Uses an unmodified version of LibreOffice
- Result in seconds needed for creating a spreadsheet/presentation/text document

Selenium

- Selenium is a browser automation tool, often used for testing websites
- Automates Google Chrome to measure Browser performance
- Runs the JavaScript benchmark Kraken
- Result in milliseconds for the average benchmark task

WHAT WORKLETS ARE AVAILABLE? (ARTIFICIAL INTELLIGENCE)

Stockfish

- Open Source Chess Engine
- Plays several chess games using its neural network based AI
- Result in nodes per second

WHAT WORKLETS ARE AVAILABLE? (IMAGE AND AUDIO/VIDEO PROCESSING)

tjbench

- JPEG compression/decompression benchmark part of libjpeg-turbo
- Measure performance of reading and writing images in JPEG format
- Result in megapixels per second

MP3 Encoding

- Encoding a file to MP3 format using lame encoder
- Result in seconds needed for encoding the test file

Handbrake

- Hardware accelerated video transcoding
- AMD, Apple, Intel and NVidia accelerators supported, with software encoding fallback
- Transcodes a H.264 encoded video to H.265
- Result in seconds needed for encoding the test file

WHAT WORKLETS ARE AVAILABLE? (DATABASE)

SQLite

- Implements a simple file database
- Measures the performance of creating and querying a test database
- Can be configured to run with different amounts of threads
- Result in seconds needed for running a defined set of queries

WHAT WORKLETS ARE AVAILABLE? (PROGRAMMING LANGUAGES)

PyBench

- Benchmark written in Python language
- Measures the performance of the Python interpreter on the system
- Average time needed for the test in milliseconds

WHAT WORKLETS ARE AVAILABLE? (3D GRAPHICS)

3DMark Wildlife Extreme

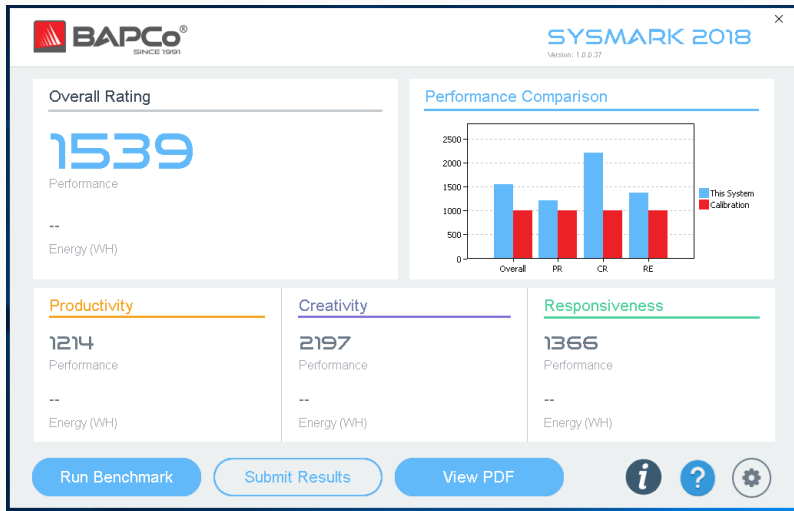
- Graphics benchmark as known from the 3DMark benchmarks
- Renders several realistic scenes in 4K UHD resolution
- Result in average frames per second

Unity Spaceship

- Graphics benchmark provided by Unity
- Renders several realistic scenes using the Unity engine
- Result in average frames per second

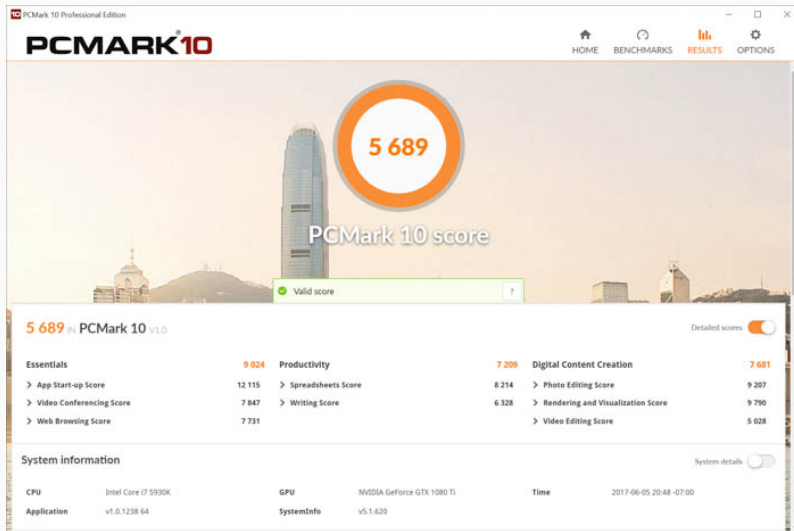
- SysMark benchmarks unmodified real-world applications
- Different scenarios for different usage profiles
- Focused on office and productivity workloads, e.g. no gaming
- Approximate run time is 1 hour
- Measures energy consumption
- Proprietary test framework and worklets
- Supports Windows only

SYSMARK RESULTS

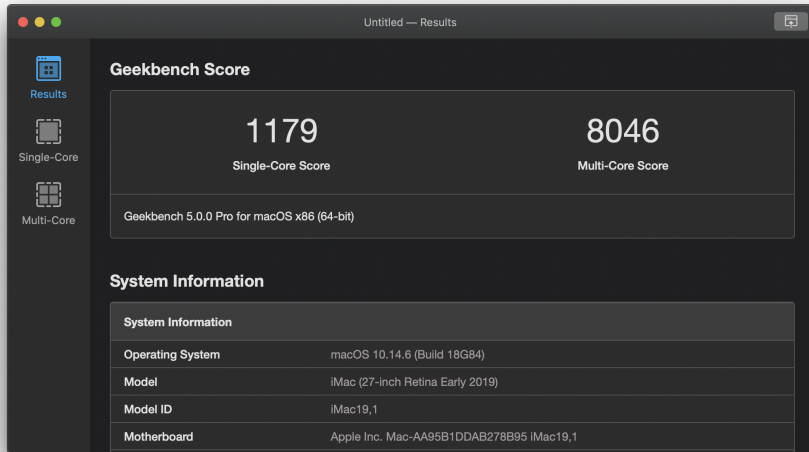


- PCMark does use some real-world applications but also synthetic workloads
- Different scenarios for different usage profiles
- Focused on office, productivity workloads
- Gaming workloads only in extended version
- Approximate run time is 30 minutes for the extended version
- Has a profile to measure battery life in hours for different scenarios
- Proprietary test framework and worklets
- Supports Windows only

PCMark10 RESULTS



- Geekbench does not use real-world applications but claims to be simulating common tasks
- No different scenarios, only single core and multi core benchmarks
- Does not measure any energy consumption
- Proprietary test framework and worklets
- Supports Windows, MacOSX, Linux, Android, iOS



The test software, test procedure, this presentation and other resources are available via the following website:

gtd-gmbh.de/computer-energy-efficiency-tool

clasp.ngo/tools/on-mode-computer-testing-tool

