



# Measuring Energy Efficiency of Selected Working Software

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Csaba Szabó and Emira Mustafa Moamer Alzeyani

DCI FEI TUKE

Csaba.Szabo@tuke.sk

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# Agenda

- What is Green Software?
- How does it fit into our research?
- The generic setup for energy consumption measurements
- Measured tool selection
- Results
- Conclusion

# What is Green Software?

- Server farm energy consumption matters (paycheck)
- Battery lifetime matters even more (navigation, sensors, IoT, healthcare)
- Greenness of hardware production and recycling is very low
- The hardware-software-user tripartite

# Intellectual output O1 part/topic “How Green Is Your Process?”

1. Setup the environment
2. Start the energy monitor
3. Develop (think, code, test, fix) for 15 minutes
4. Have a 5 minutes break (stop energy usage monitoring, set up the next one, get a coffee)
5. Finish (for this time) if there is no further idea
6. Repeat (jump to label 2)
7. Analyze collected data (energy efficiency of your development process) inside the team

# Modifications applied to the O1 “development game”

- Usage instead of development
- Longer periods of measurement
- No coffee

# Measurement setup

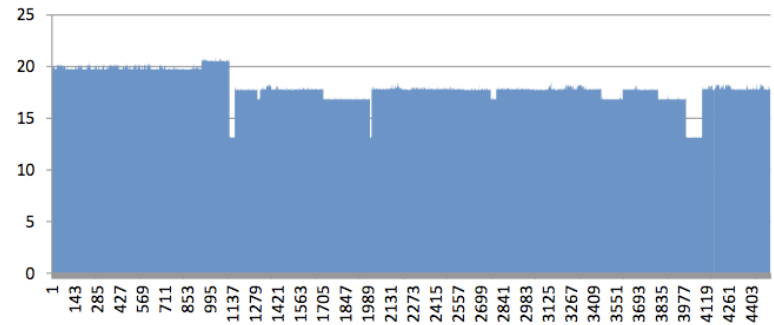
- Measurement tool:  
Intel Joulemeter (measures externally on Windows operating systems)
- Measured working software:  
Google Chrome browser
- Running web sites:
  1. IBM iNotes (e-mail client)
  2. Facebook (web interface)
  3. YouTube

# Research questions

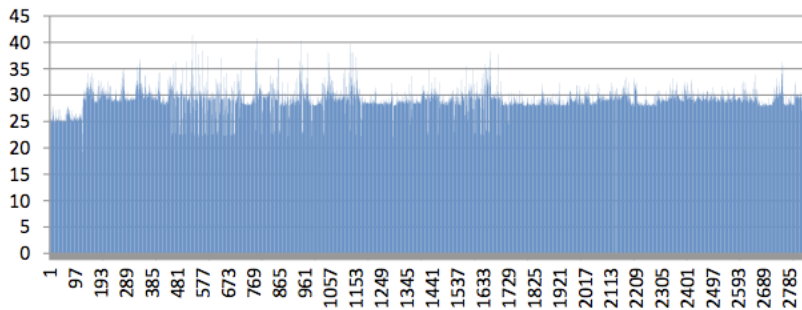
1. Is there no energy consumption when the user is idle?
2. Do the social network clients consume more energy than the e-mail client?
3. Is YouTube more efficient in video playback than Facebook (as it is more specified on that)?

# Results 1

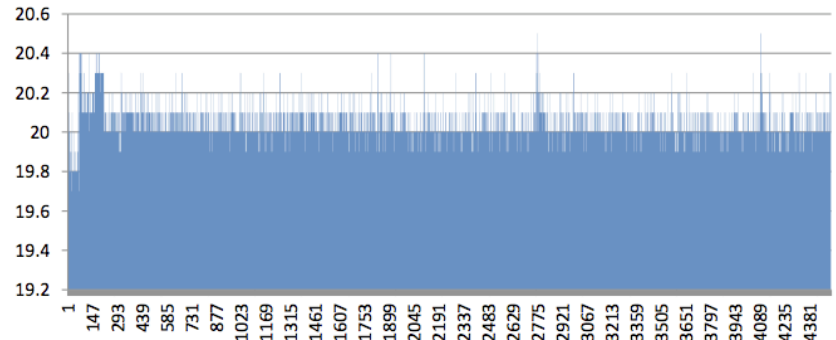
**Total Power (W)** **iNotes**



**Total Power (W)** **Facebook**



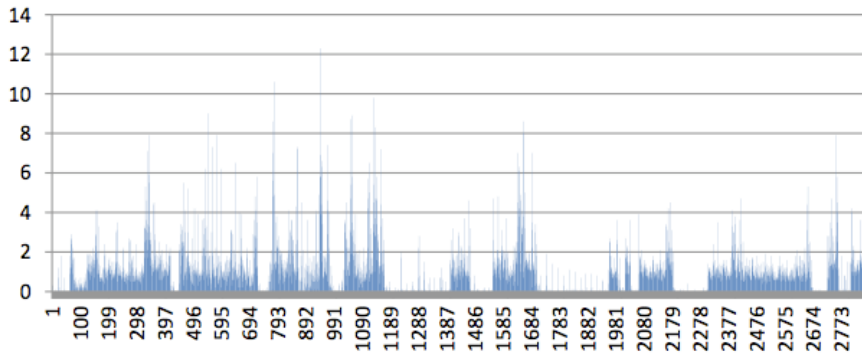
**Total Power (W)** **YouTube**



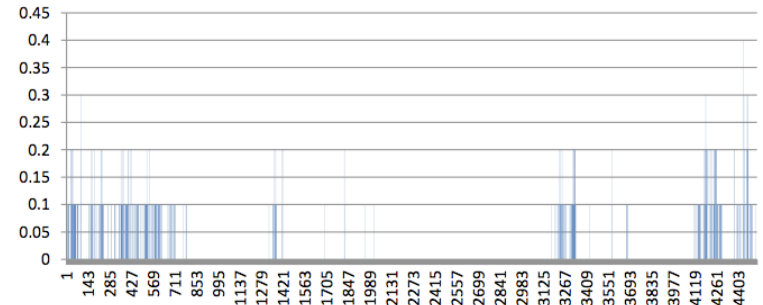


# Results 2

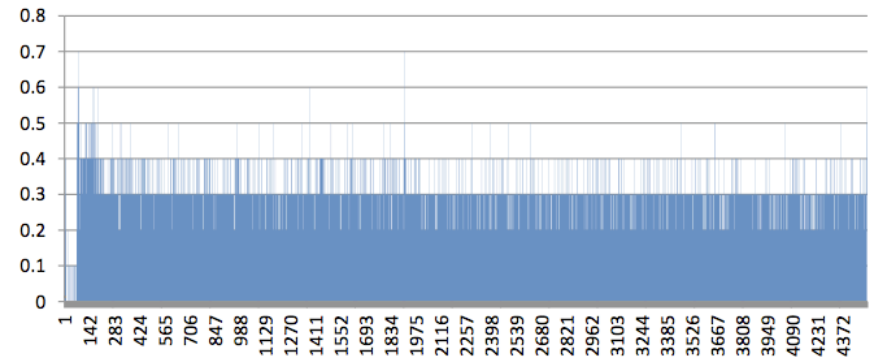
**Application (W)** **Facebook**



**Application (W)** **iNotes**



**Application (W)** **YouTube**



# Conclusion and future work

1. There is room for improvement with energy consumption in idle state
  2. E-mail client is slower responding, but there is no cost on energy for that slower response.
  3. Playback efficiency evaluation needs more study cases, using the same video (same codecs etc.)
- Re-running the measurements on mobile phone/ tablet devices as there is the effect of software more visible to end users

# Would you like to know more? Join us!

- Research cooperation in Green Software Engineering
- 2019 project multiplier events (with more results in different areas on teaching for better composable, comprehensible and more correct software) in Opatija (Croatia) and Budapest (Hungary)
- 2019 summer school in Budapest
- Further information via e-mail: [csaba.szabo@tuke.sk](mailto:csaba.szabo@tuke.sk)



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