Live Demonstration: A platform for autonomous sensor characterization and generation of provenance-aware datasets for IoT applications

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WHAT?

1

NEW: Automated Data Acquisition and Digital Curation Toolset → *eGor*

- browser-based mobile access to automated measurement on multiple workbenches
- remote scheduling, execution and monitoring of measurement processes with precise timing
- production and curation of meta-rich datasets with user annotation

WHY?

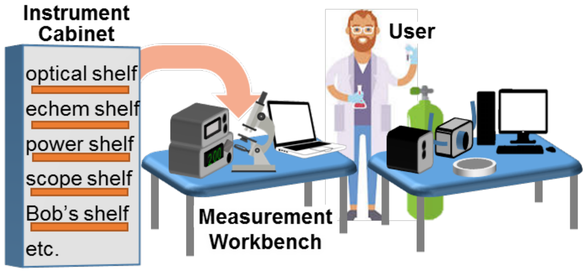
2

Traditional Measurement Environment

Pitfalls

- labor intensive; requires user presence before, during and after the experiment
- permits excessive user-generated errors i.e. time precision of manual controls, etc
- limited parallel activity; low utilization of instruments
- no tracking of instruments with datasets; low visibility of instrument or systematic errors

→ **poor precision, productivity and reproducibility**

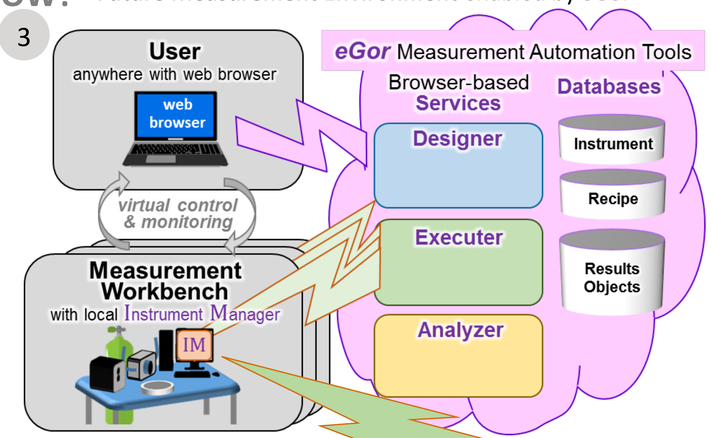


Traditional measurement environment where user must be in room with instruments and workbenches

HOW?

3

Future Measurement Environment enabled by ***eGor***



eGore: A highly flexible mobile software platform for virtual design of measurement processes, real-time execution of automated data acquisition, production of result objects with data provenance and curation of datasets throughout the data life cycle.

Improvements

- design and execute experiments from anywhere
- schedule jobs any time to maximize productivity
- archive and share designs to reduce development time
- automate execution of measurement recipes for precise timing and coordination of events
- produce meta-rich measurement results objects with instrument details and user annotations to support reproducibility and deep error analysis
- apply custom filters on raw datasets online and offline

→ **enhances data acquisition precision, user productivity and measurement reproducibility**

4 WORKBENCH

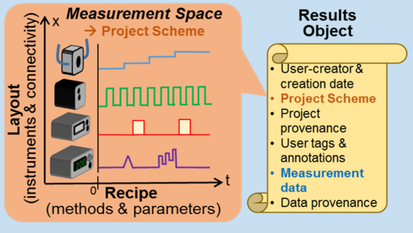
Instrument Manager

- Runs on local measurement workbench to control and automate instruments
- Executes **instrument command set** defined by *Designer* tool
- Utilizes custom instrument drivers with action recipes compiled by *Designer* tool

Virtual Instrument

- make/model/SN
- user-defined ID; instance number
- method options (eg square or sign wave)
- control parameters (eg freq or amplitude)

User-defined job-specific configurations are compiled into **executable instrument command sets**



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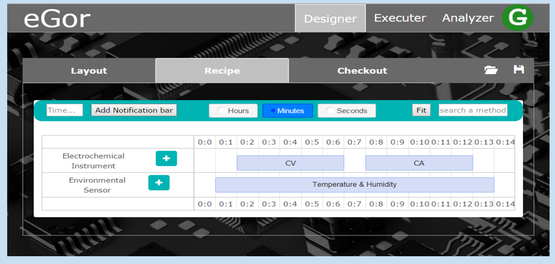
5 SERVICES: browser-based micro-services for mobile/remote interaction

Designer

- Manage **virtual instrument** cabinets and user-defined shelves via Instrument database
- Capture **measurement space** through user-defined instrument layout and recipe
  - Layout: select all instruments and define interconnections
  - Recipe: configure methods and parameters over time; align events between instruments
- Archive Recipes and Layout for future use and share templates with other users.
  - Track design provenance for error analysis
- Compile user-defined design elements into an **executable instrument command set** to run on the *Instrument Manager* tool

Tool Development

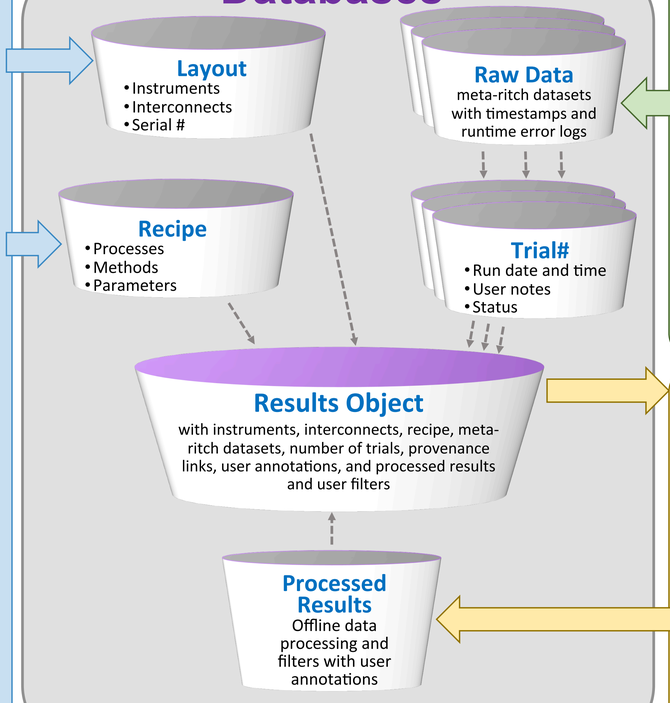
- Schematic tool to layout the interconnects between devices
- Timeline tool to design processes for each instrument



eGor Designer panel showing recipe over time of a design with two instruments

Executable Instrument Command Set

Databases



eGor utilize the flexibility of document-based NoSQL database to produce a Results Object (RO)

Executer

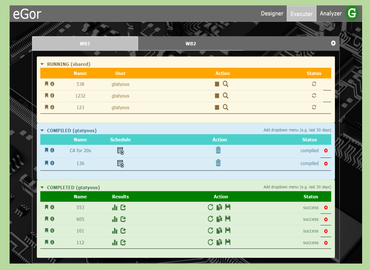
- Scan Design database for **executable instrument command set**s created by *Designer* tool
- Check physical workbench configuration through local *Instrument Manager* tool
- Run or schedule automated measurement jobs that match workbench configuration

Raw Data

[LIVE][aMEASUREV2m][2017-05-25][13:40:19.028275]
[{'data': ['255', '139', '0', '2'], 'name': 'DATA'}
[LIVE][FLUKE][2017-05-25][13:42:23.139275]
9.178E-3 ADC
[LIVE][RHTS][2017-05-25][13:40:18.107275]
43.3 %RH

- Monitor results and job status in real time
- Generate measurement results and runtime errors
- Archive to Results database

eGor Executer panel showing status of several completed and running automation jobs



Analyzer

- Search Results database and view/plot measurement results
- Review and analyze design meta-data; add user annotations
- Apply DSP filters such as down-sample and low pass filter
- Adjust sampling rates to compare datasets
- Apply use-defined analysis algorithms
  - Archive and share analysis algorithms to expand *Analyzer* tool
- Archive all generated datasets with provenance and user annotations in Processed Results database

eGor Analyzer panel showing results of completed jobs and providing the user with downloadable files and plotting tools