Difficulties with modularity in laboratory automation for flow synthesis

iDMT Networking Event, 8-June-2021

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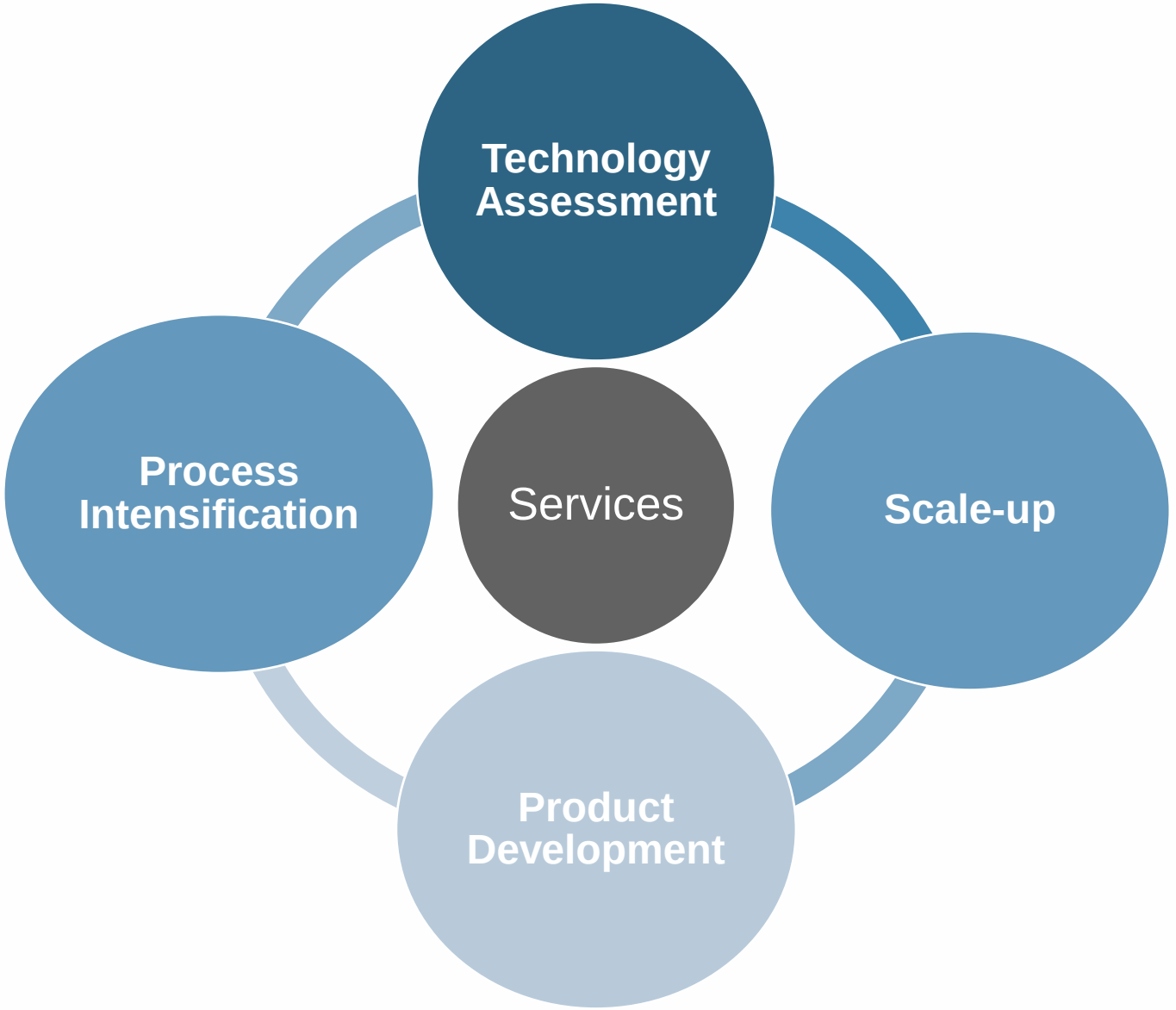
About

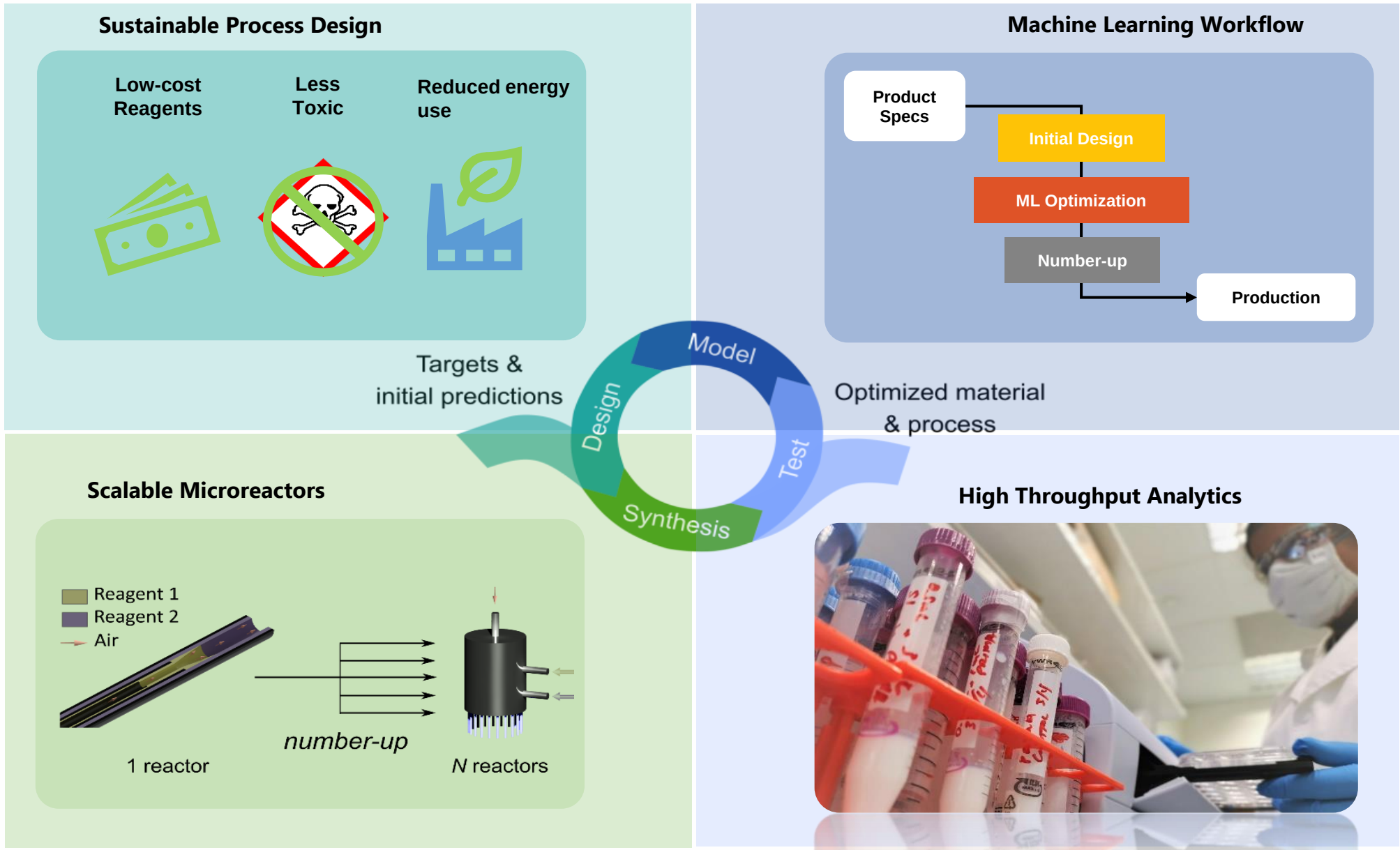
- Formed in 2020 to commercialize know-how developed from the University of Cambridge and Cambridge CARES.

- Services for rapid development and scale-up of new materials and chemicals

- Utilizing
  - Microreactor design
  - Rapid scale-up techniques
  - Machine learning workflow

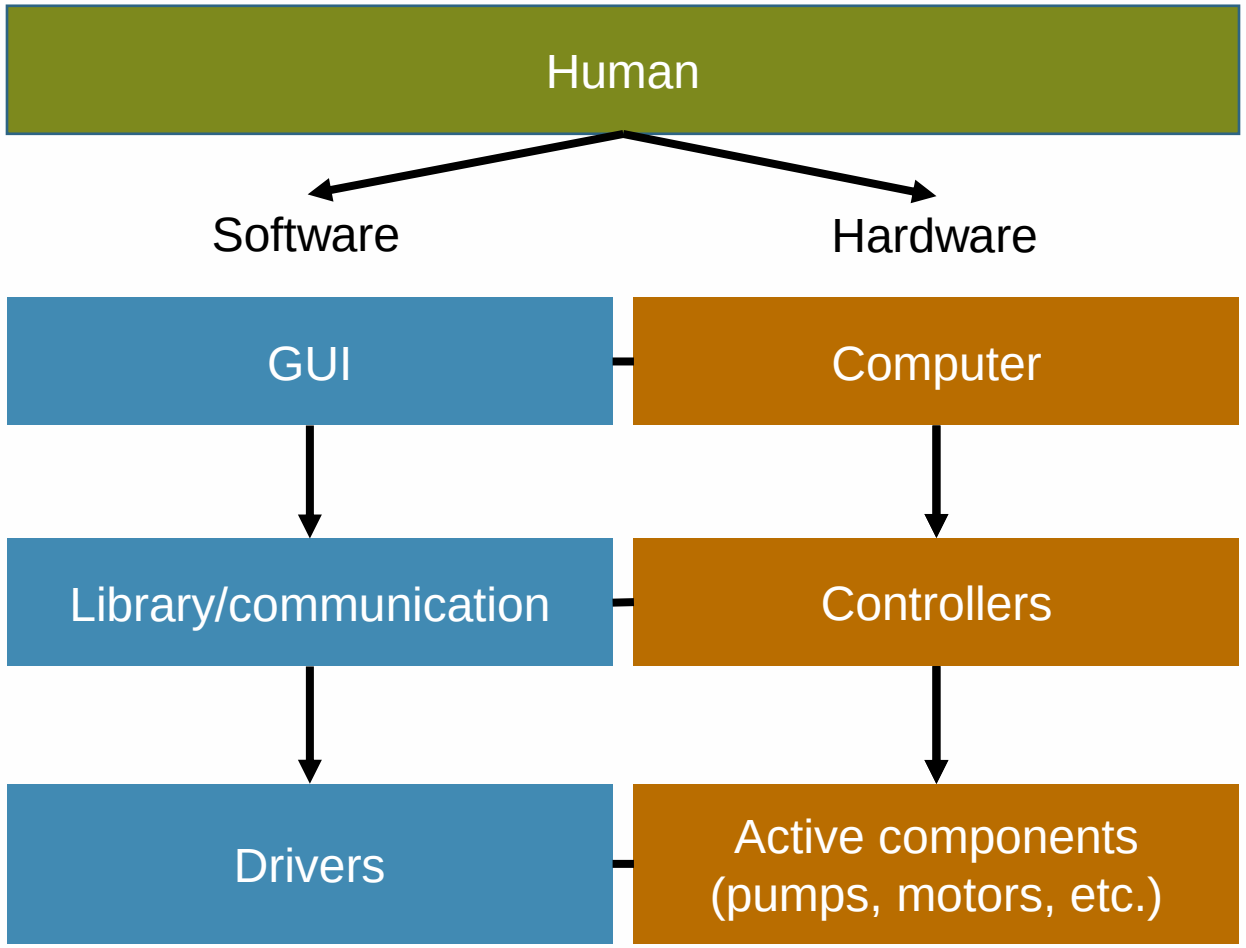


Materials development platform



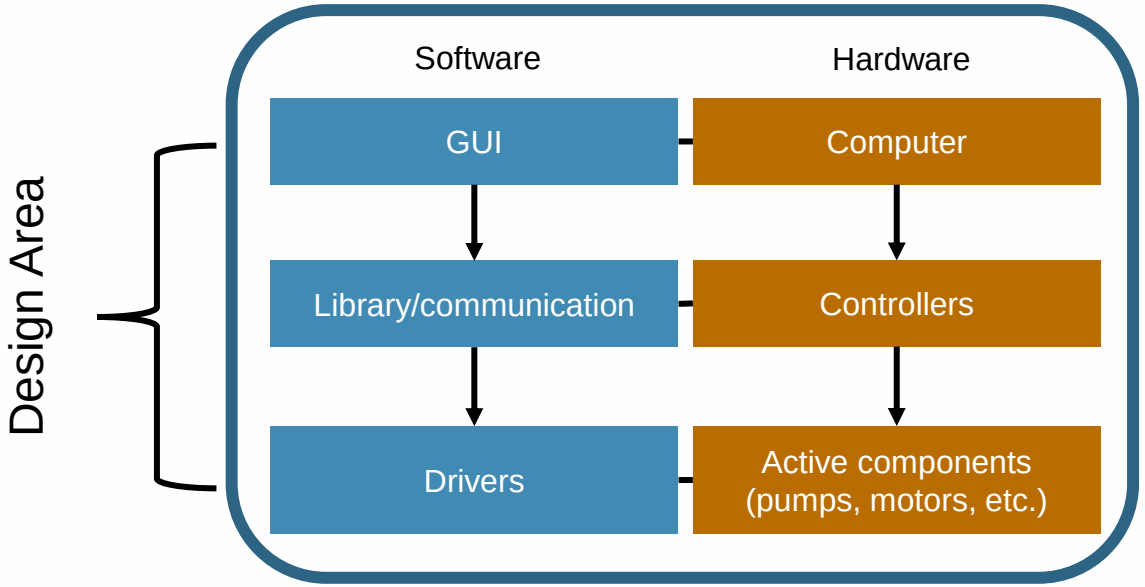
Laboratory automation

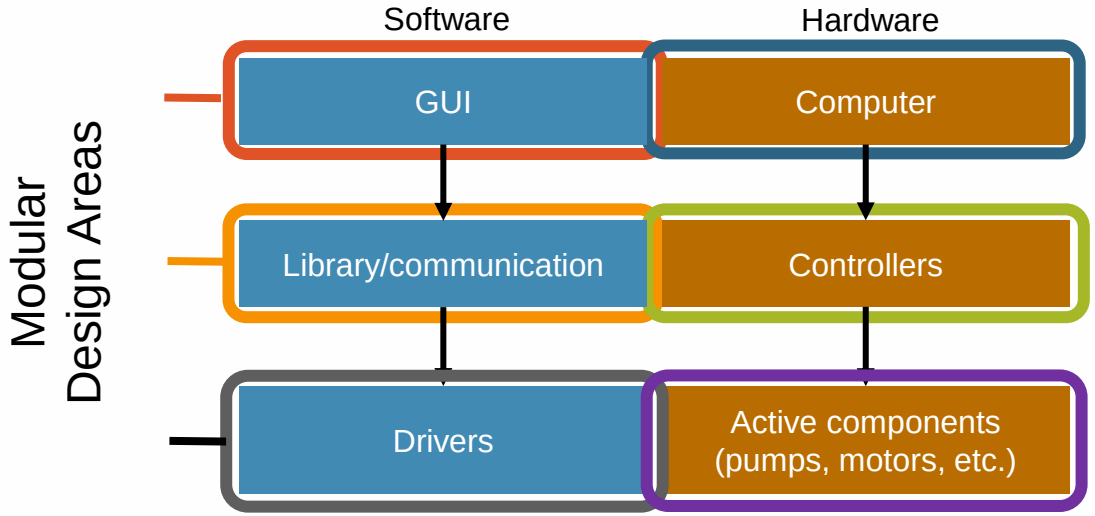
- Automation advantages
  - Fast, high quality, large datasets
- Automation tasks
  - Hardware selection
  - Software design & programing
- For iDMT
  - Linking of high throughput equipment, flow chemistry systems and analytical equipment
  - Interfacing with AI/ML algorithms



Why modularity?

- No “one-size-fits-all” solution
- New and/or difficult chemistries
- Obsoletion
- Adoption
- Improvement





Difficulties

- Equipment provider “locks”
  - No open communication

- Learning curve
  - Coding
  - hardware communication and selection
  - Labview

- Poor library availability/quality
  - Python
  - Labview
  - Arduino

- Results:
  - High cost, highly skilled labour, and large time investment required

Current strategies

- Pay equipment provider for custom solutions
  - High cost
  - Relatively inflexible for in-house modifications

- Custom build systems from OEM parts
  - Good for highly flexible systems
  - Large expertise required

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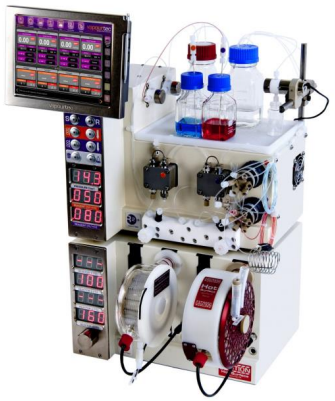
- Hybrid – OEM parts + equipment provider custom solutions
  - Less expertise and time required compared to full OEM
  - May need a good relationship with equipment provider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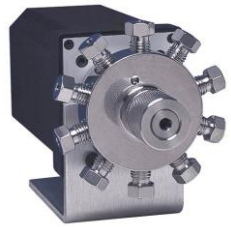

AM's strategy – mostly OEM

GUI

Experimental Protocols

Hardware Protocols

Communication Protocols

Drivers

All code

Analog

Microcontrollers

Motors, sensors

Digital

Rs232/485

Syringe pumps

Advantages:

- Equipment flexibility for different material systems
- Lower cost/open source

Disadvantages:

- Large time and expertise commitment

Potential improvements?

- Standardization and sharing
  - Communication protocols
  - Libraries
  - Custom build specifications
  - Consortium to push manufacturers towards OPC-type platforms

- Education
  - Centres/courses in automation
  - “Best practices” handbook and workshops

Thank you