The Evolution of Software-Programmable Cyber-Physical Digital Microfluidic Laboratories-on-a-Chip

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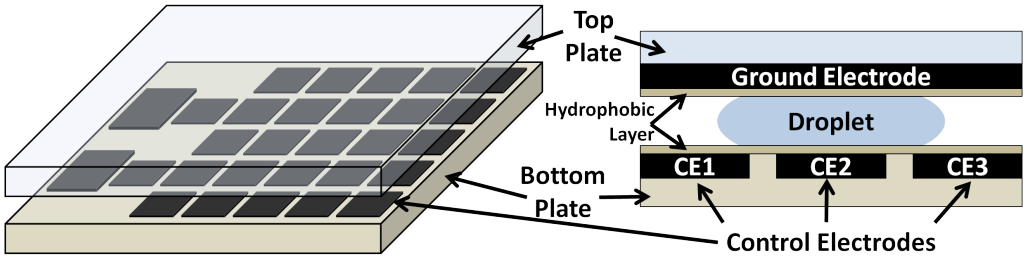
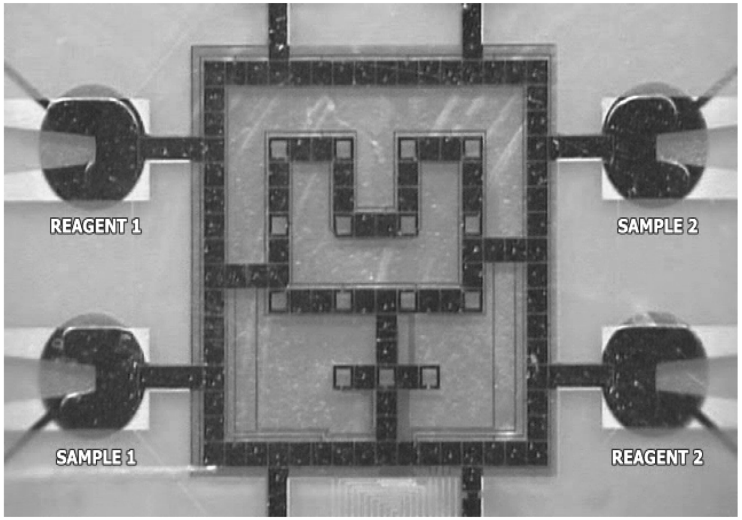
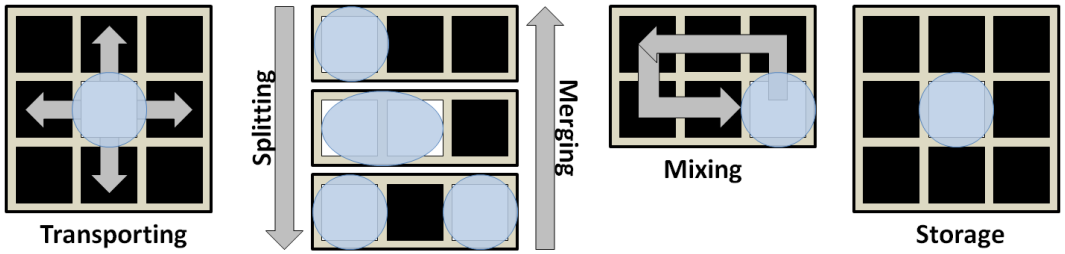
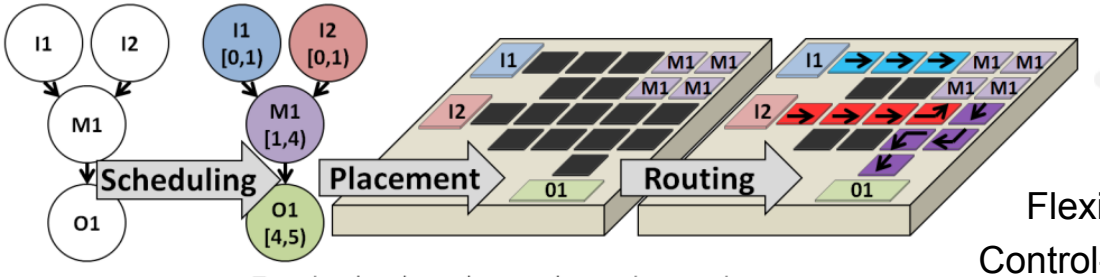
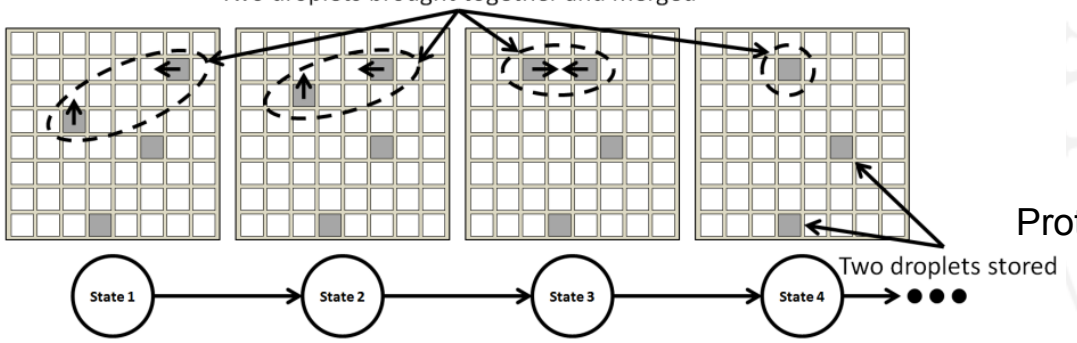
Digital Microfluidic Technology: Pre-CPS

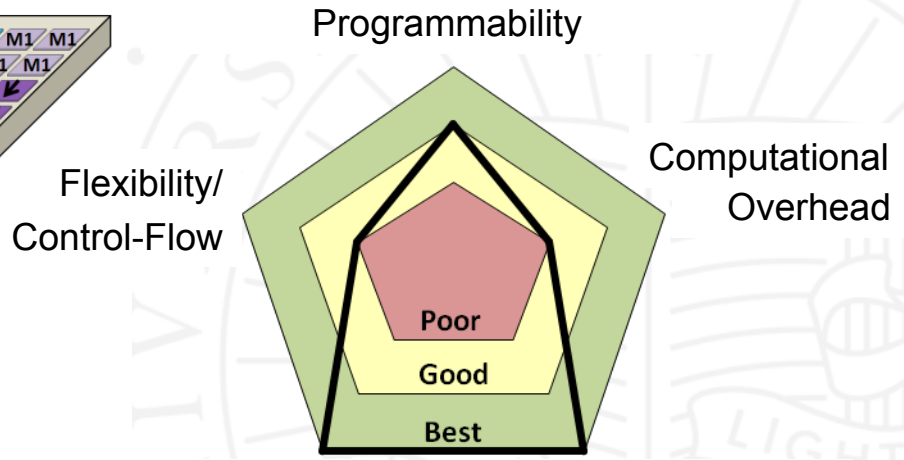






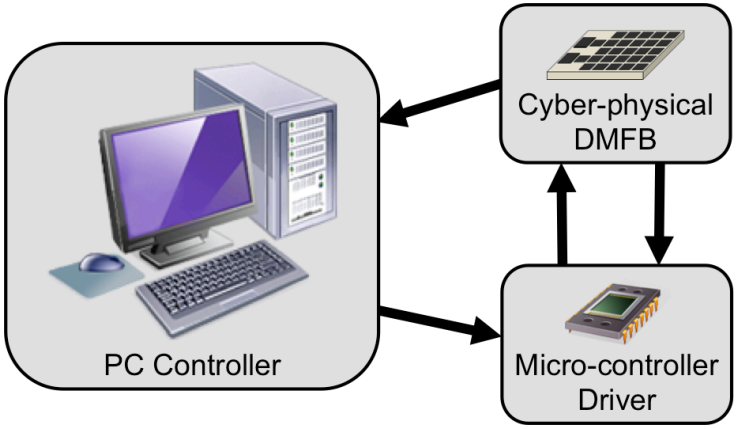


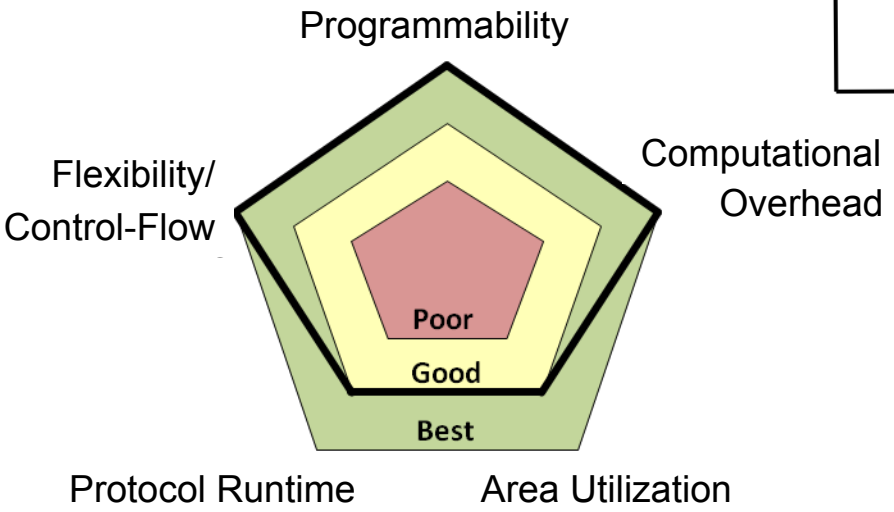


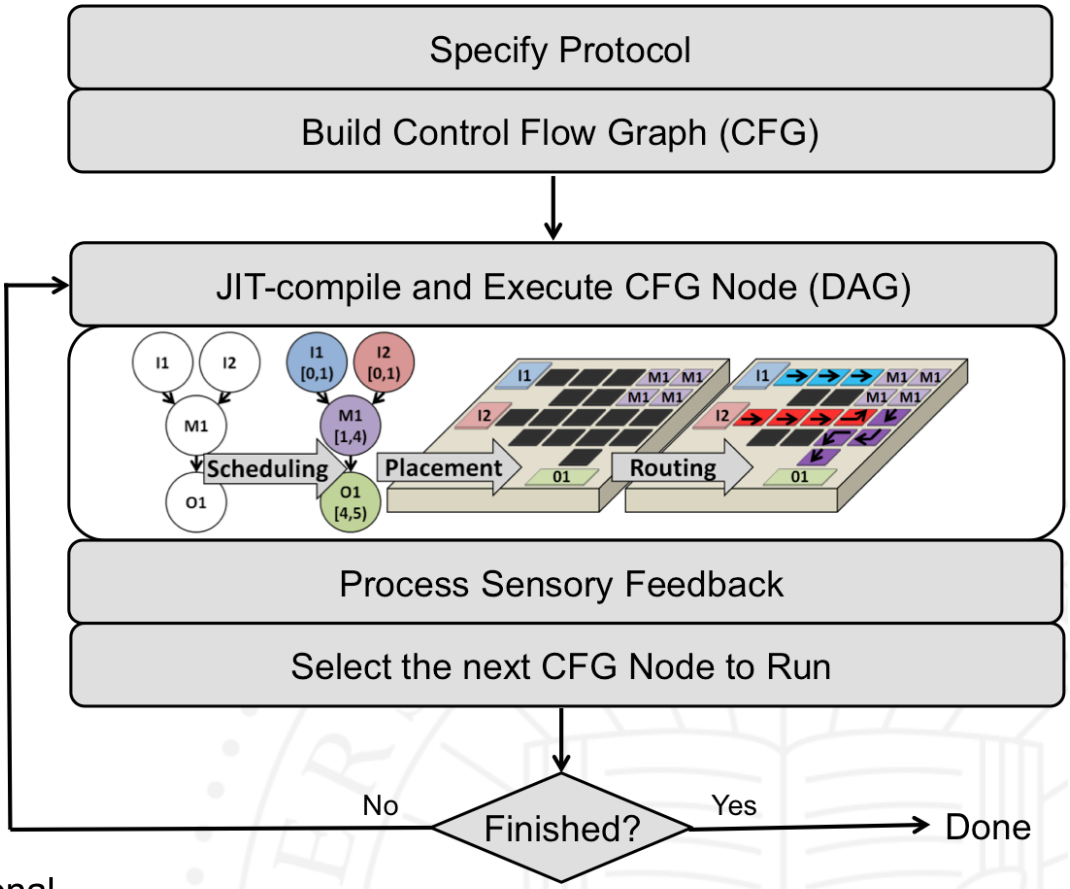


Cyber-physical Integration

NSF CPS Funding
CNS-1035603 (Brisk, UCR)
CNS-1135853 (Chakrabarty, Duke)







Contributions (CNS-1035603)

- Real-time decision-making based on sensory feedback
- Programming language support
- Fast JIT compilation flow

Future Directions

- Better domain-specific programming languages for automated biology
  - Syntax must be acceptable to biologists
  - Express timing of operations / constraints
  - Automatically extract / exploit parallelism
- Automate loading / unloading of samples
  - Robotic liquid handling
  - Off-chip fluid storage
- Distributed control over the Internet
  - Multi-site collaboration
  - Ensure timing constraints / QoS