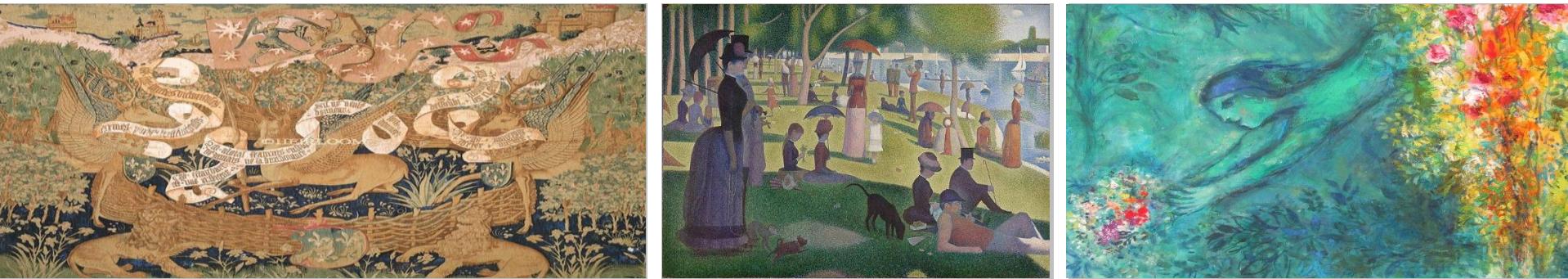


*Exceptional service in the national interest*



Total Learning Architecture (TLA) Enables  
Next-generation Learning via Meta-adaptation

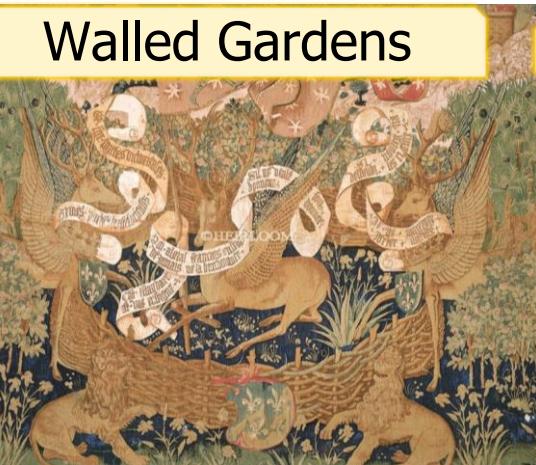
Elaine M. Raybourn

# Acknowledgements

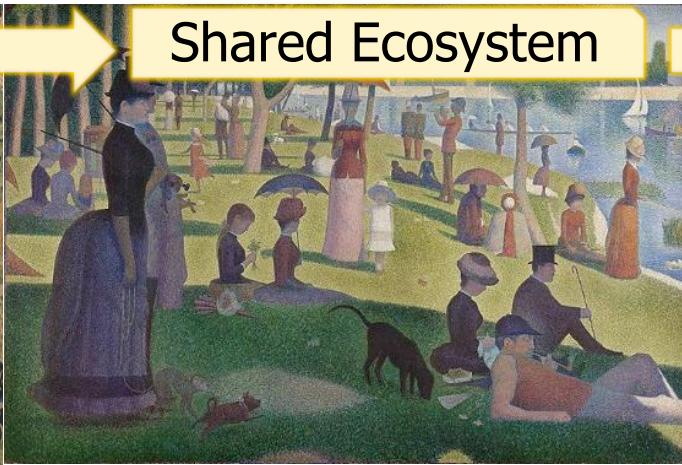
- Special thanks: this presentation based on 2016 IITSEC paper and presentation co-authored with J.T. Folsom-Kovarik, Soar Technology
- This material is based upon work supported by the Advanced Distributed Learning (ADL) Initiative under Contract No. W911QY-16-C-0019.
- Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the Advanced Distributed Learning (ADL) Initiative.
- Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC., a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

# What are we trying to do?

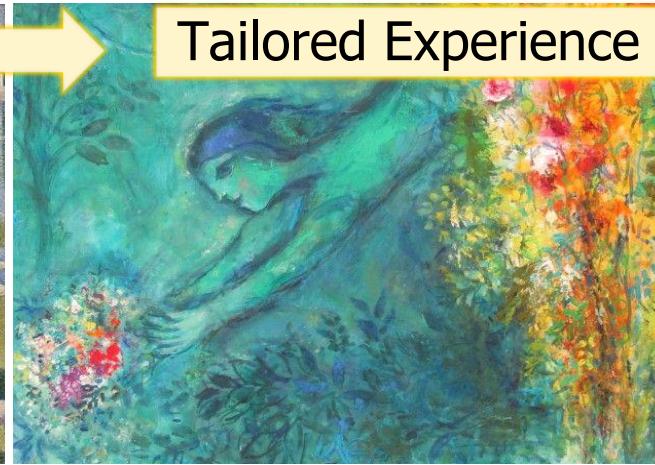
Walled Gardens



Shared Ecosystem

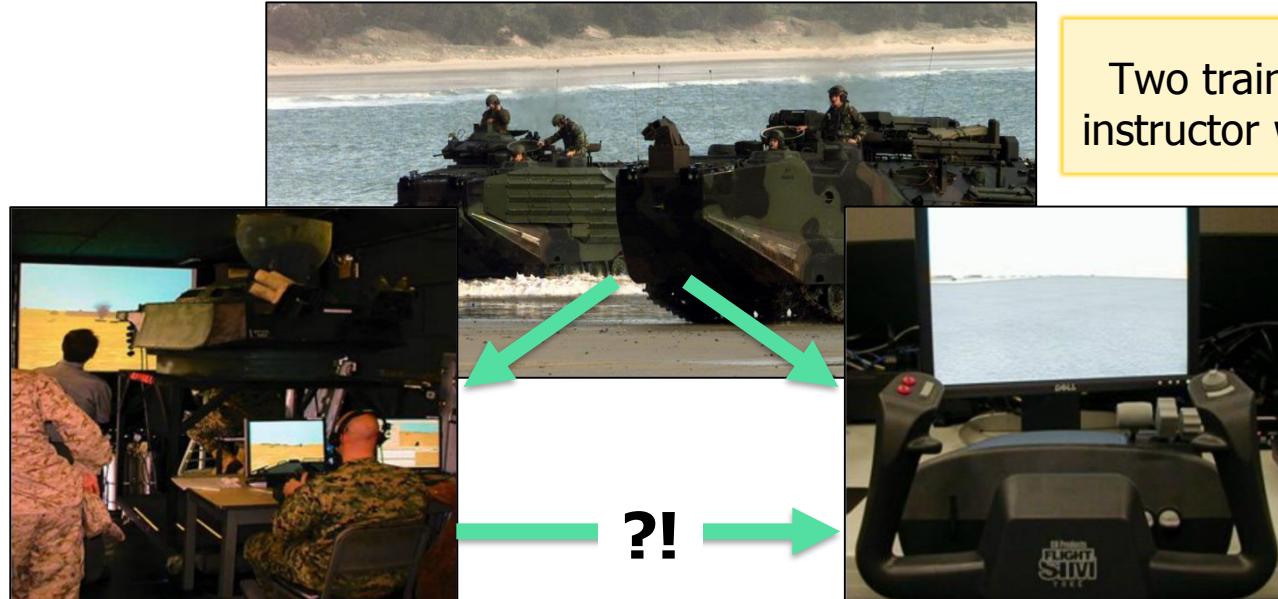


Tailored Experience



- Reduce the effort needed to make learning systems work together
- Maximize what systems can learn about a user from rich shared data
- Let every learner access just the right learning content in just the right way

# Limitations in the state of practice



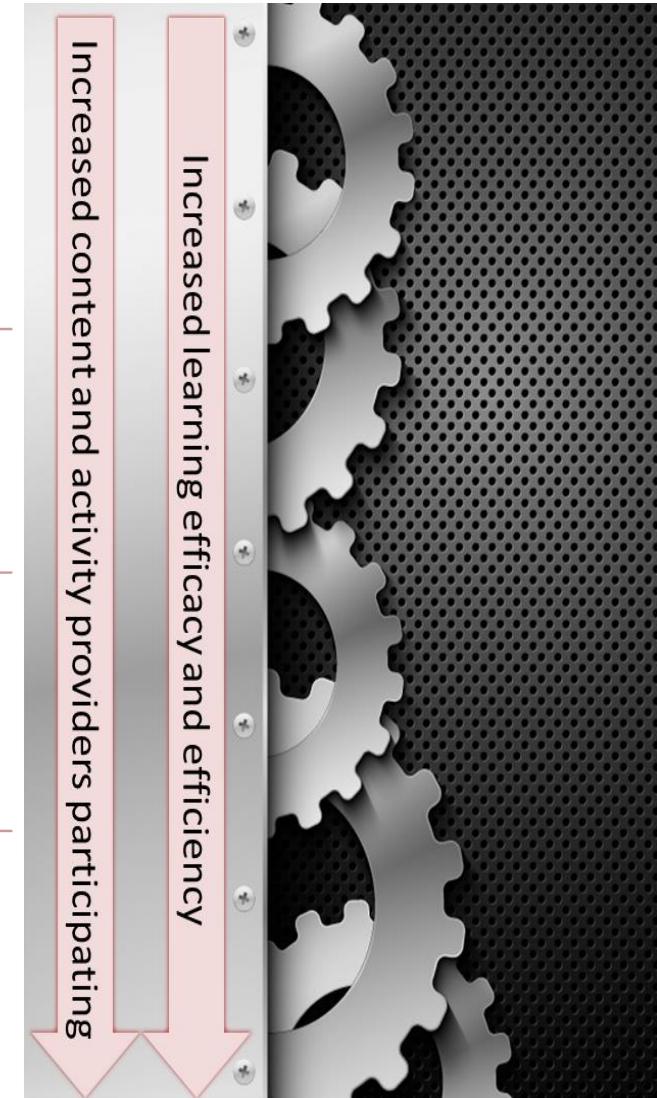
Two training sims exist, or an instructor wants to use two ITSSs

Learner progress  
is not shared  
Switching means  
starting over

- Learners transferring between vehicle types are required to repeat training
- Instructors manually transfer scores between simulators and record systems
- Instructional designers may not freely choose between simulators
- Researchers cannot compare or aggregate data collected in the two simulators

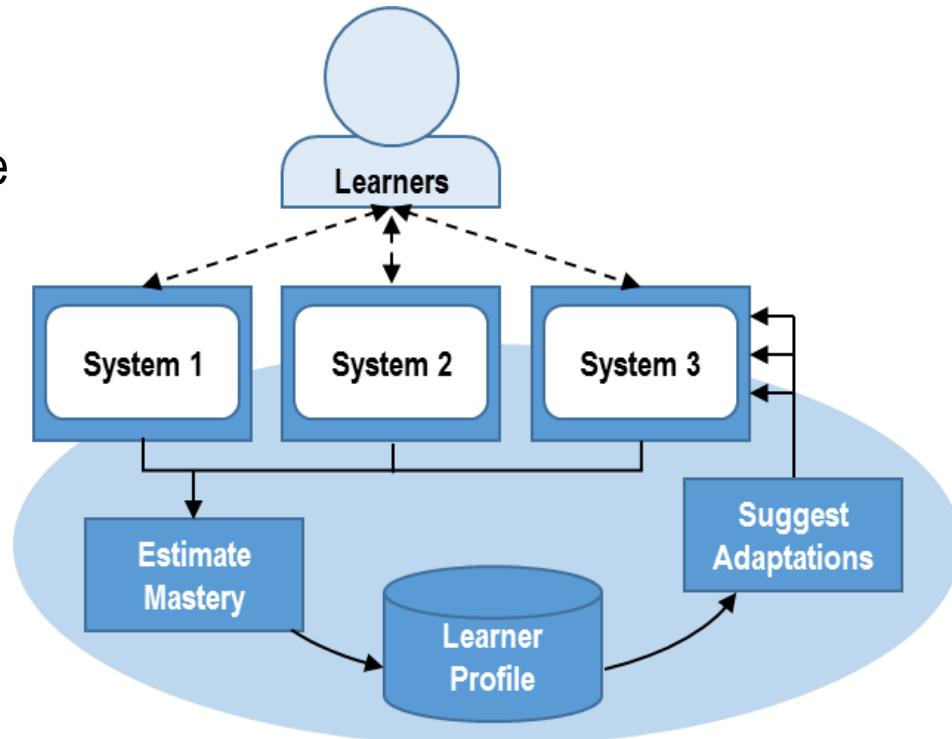
# What's new?

- 2017 = Baseline
  - ✓ Interoperability, integrated learning systems
  - ✓ Shared and fine-grained data capture
- 2018 = *Tailored pathways*
  - Learner analytics and actionable information from data
  - Leverage the data to provide new tailoring / adaptation
- 2019 = *Authored interaction*
  - Improved learner experience
  - Authoring tools, novel instructional design
- 2020 = *Hardened and robust*
  - Scalable performance
  - Commercial or acquisition pull

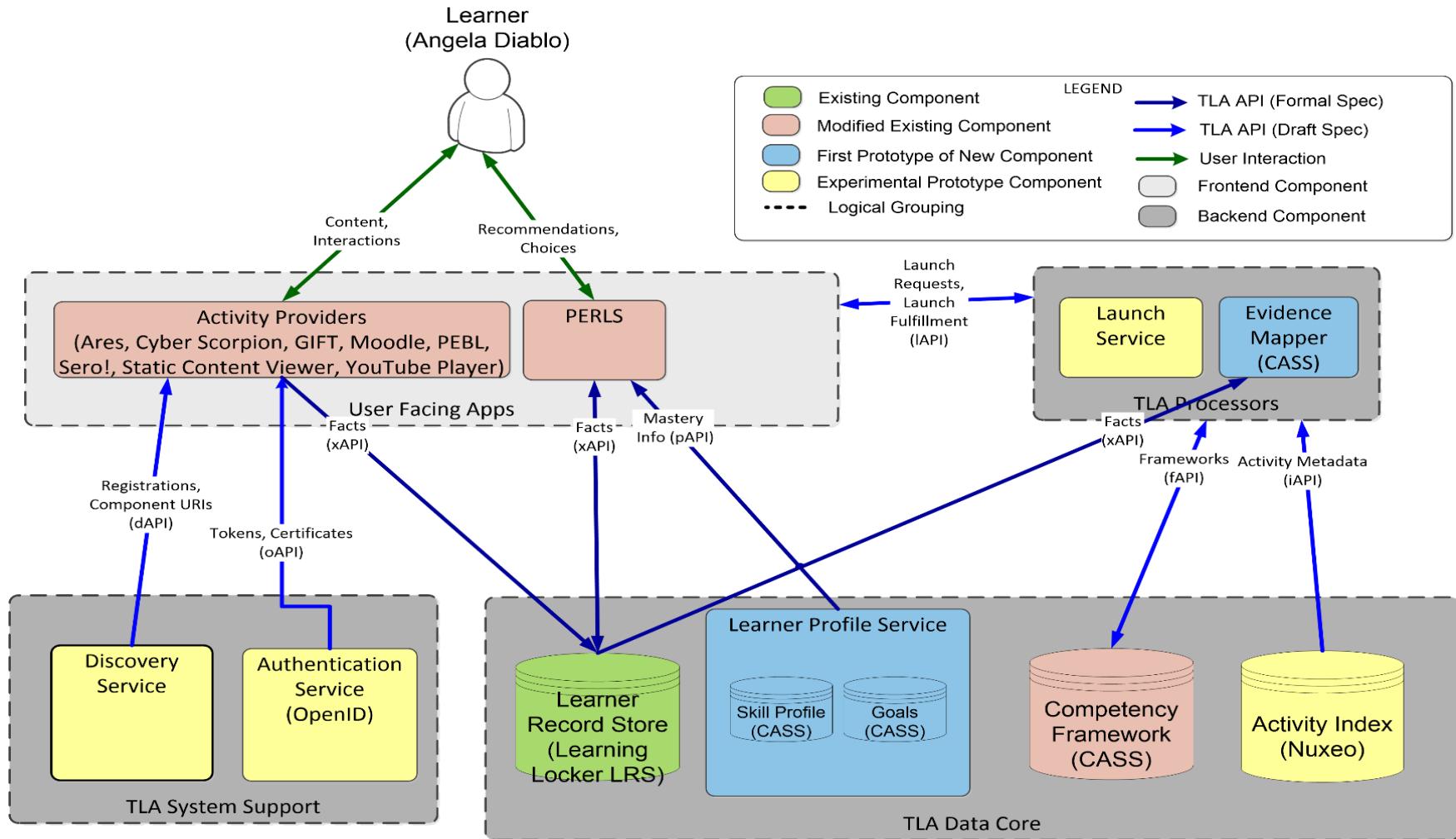


# Leverage shared and detailed data, adapt to individuals' needs, improve learning

- Sharing data builds a better understanding than each single system can have alone
  - Data from more sources
  - Synthesis of data to create new inferences
- New kinds of data not typically shared
  - Fine-grained learner experience (xAPI) is qualitatively different from rollups, estimates
  - Opportunity to broaden the definition of learning and data relevant to learning



# April 2017 Study Architecture



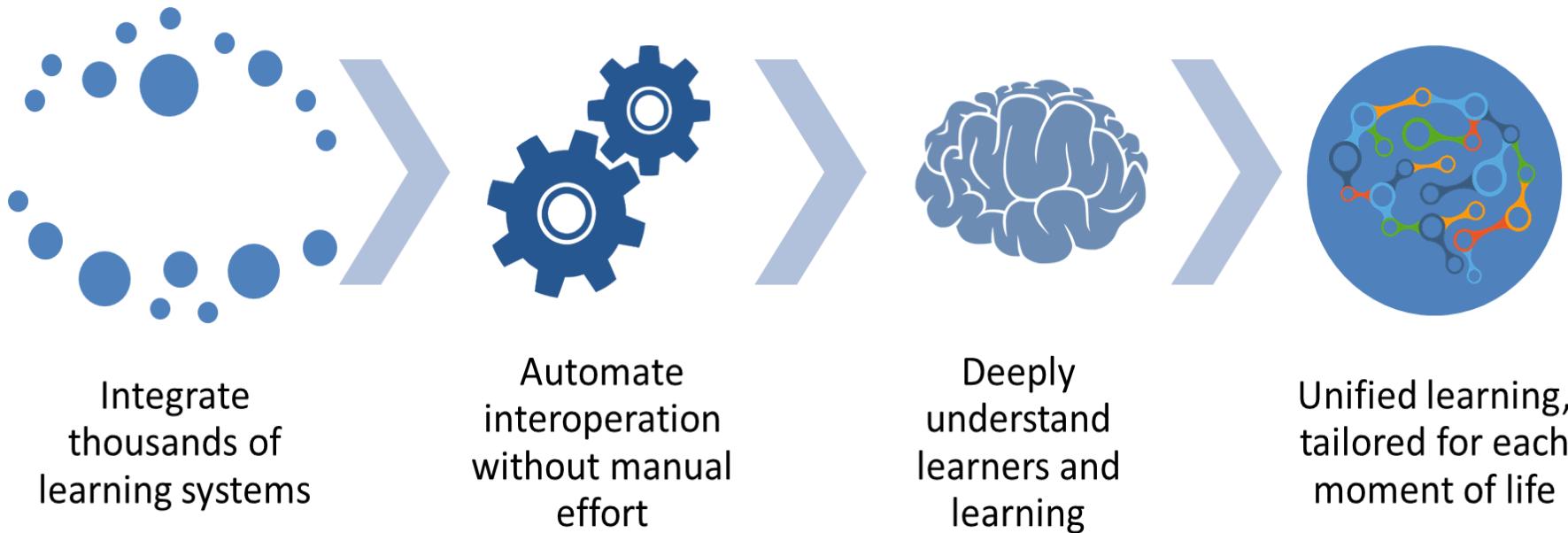
# Cyber Scorpion: Cybersecurity Use Case

- Zero-entry CTF lab environment for learner level setting via hands-on interaction
- Scalable
- Rapidly reconfigurable
- Addresses learning objectives
- Individuals and teams
- Open source
  - [Minimega.org](http://Minimega.org)



Pcap file analysis, social engineering, penetration testing, reverse engineering

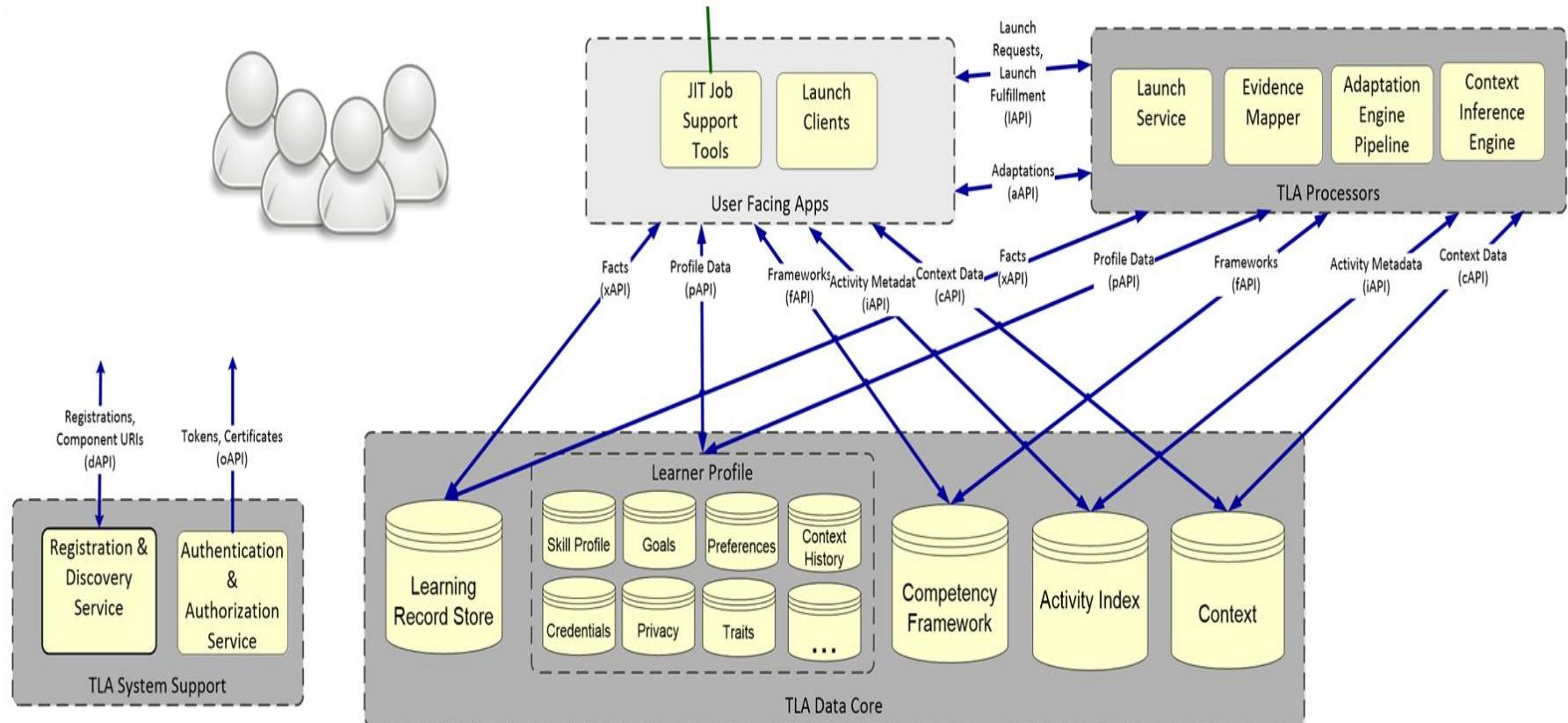
# What difference will this make?



# Future Architecture

Multiplicity of Components in every Role

Generality across Learning Use Cases



# Questions?

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