Concurrent Tutorial Session

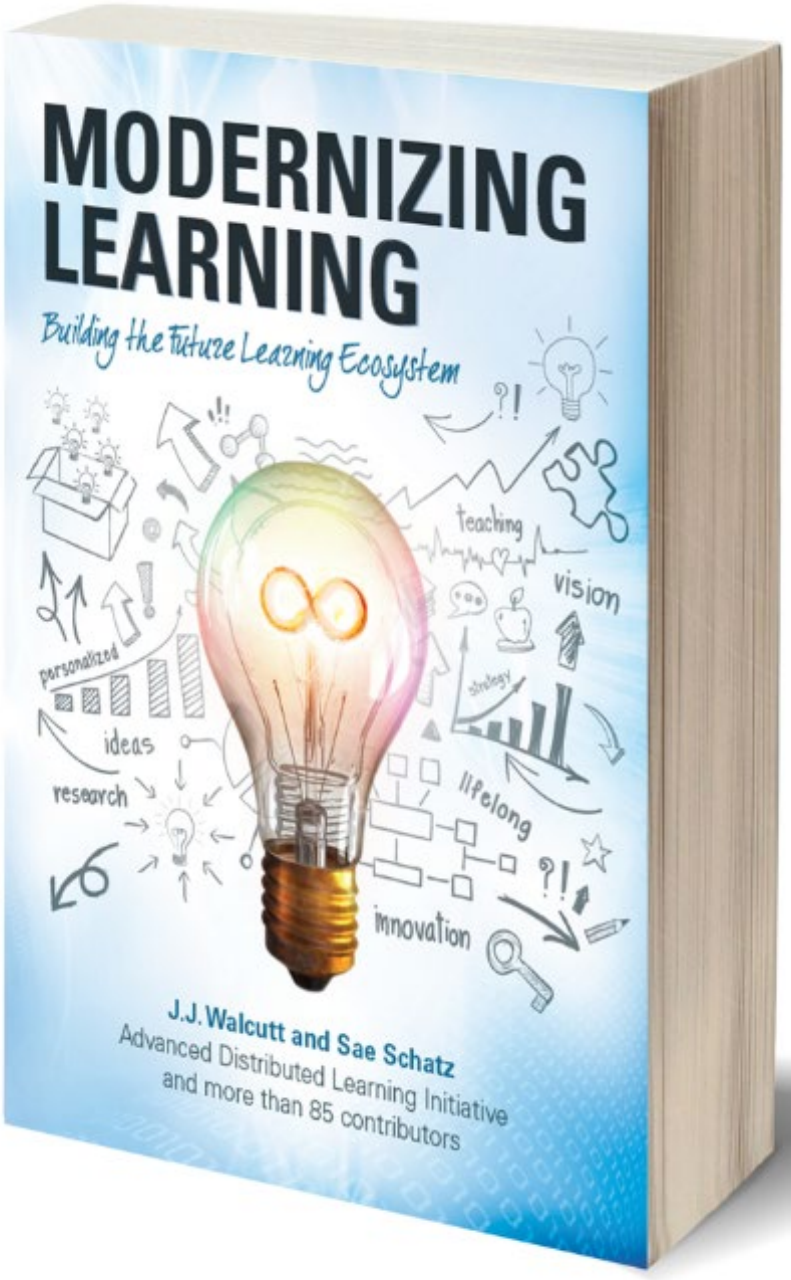
Total Learning Architecture: An Abolitionist View Of Data Stovepipes and Ongoing Modernization

Brent Smith
The ADL Initiative (Contractor)

Total Learning Architecture

An Abolitionist View of Stovepiped Data

Brent Smith, Jerry Gordon, ADL Initiative (SETA)



This Brief is not about the Why. To Learn more about the why, please read through this book

52 SME contributors from academia, education, government, military, non-profits, and industry

35 Authors

385 Pages + References

Available at the Government Publishing Office website

No cost to download

Broad allowances for reuse

https://bookstore.gpo.gov/products/modernizing-learning-building-future-learning-ecosystem

Total Learning Architecture
A Logical View

The Total Learning Architecture is a collection of **specifications** for accessing and making use of **learning-related data**.

What Does Lifelong Learning Mean to you?

Social Learning

- Online Groups
- Meetups
- YouTube

Deployment

- On the Job Training
- Performance Support
- Competencies
- Qualifications
- Evaluations
- Operational Records

BOOT CAMP

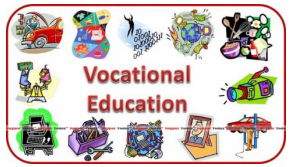
Basic Training

- Competencies
- Skills learned
- Evaluations

JOBS

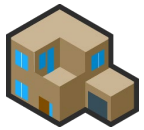
Work Experience

- Competencies
- Skills learned
- Evaluations



Public/Private K-12

- Transcripts
- Extracurricular Activities



Universities, Colleges, Trade Schools

- Registrars
- Transcripts
- Extracurricular Activities

Enterprise Systems

- Talent Development / Management
- Personnel
- Safety / Accidents Reporting
- Job Performance Tracking
- Workforce Planning

TLA - Total Learning Architecture - The Future Learning Ecosystem

The culmination of several years research:
The Total Learning Architecture
- integrates new technology:
  - cloud computing;
  - machine learning;
  - data analytics;
- **streamlines management systems,**
- leverages advances in learning science,
- removes redundancies, latencies and inefficiencies in the legacy systems, and
- integrates disparate data, services, vendors, and processes used to train and educate the force.
- This **enhances the lethality of the war-fighter** through improved training and education that is traced to and validated by **unit readiness and mission accomplishment.**

Tactics, techniques, and procedures owners and data

Platform and system developers and data

Manpower and personnel data

Readiness data

FOC Full data interoperability between T&E learning devices, data, and services as well as M&P, readiness, material, and war-fighting requirements in a Future Learning Ecosystem

Fully integrated data creates demand signals to support human capital supply chain management

Content Managers & Competency Managers

Eventually, content and competency roles split, and curriculum development becomes a function of "curation" of learning resources: activities and content

Learner-centric systems and data follow the service member throughout their career

Linking mobile learning aids, devices, and simulators and learning sites in a federation

Each Learning Command's TLA compliant computational assets, data, and services create a learning enclave

Policy, specifications, standards, and governance define the ecology

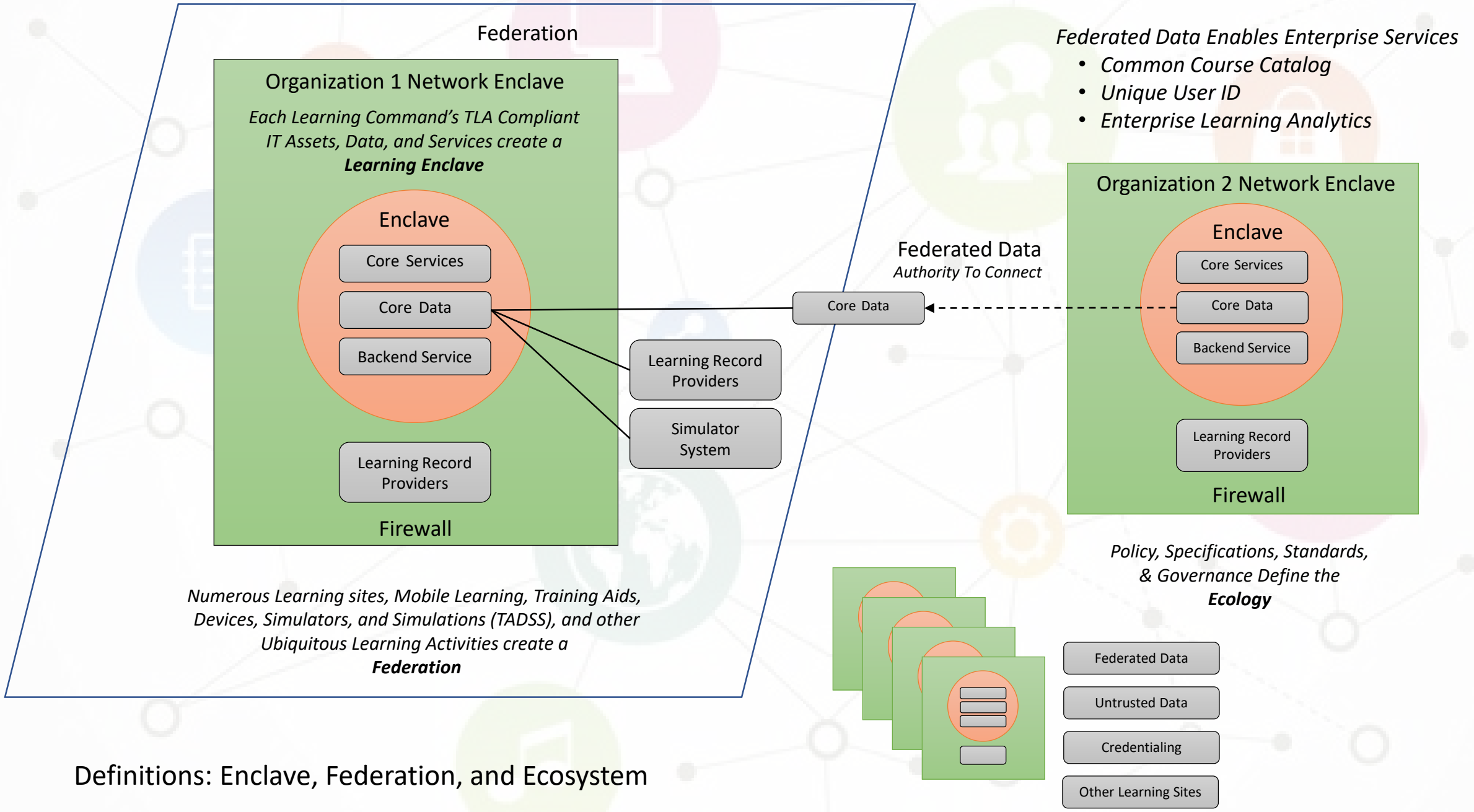
IOC Adoption of xAPI and LRS technology to remove vendor lock and provide analytics capability

Global Systems

- Enterprise Analytics
- Universal Unique ID
- Common Course Catalog
- Universal Learner Record

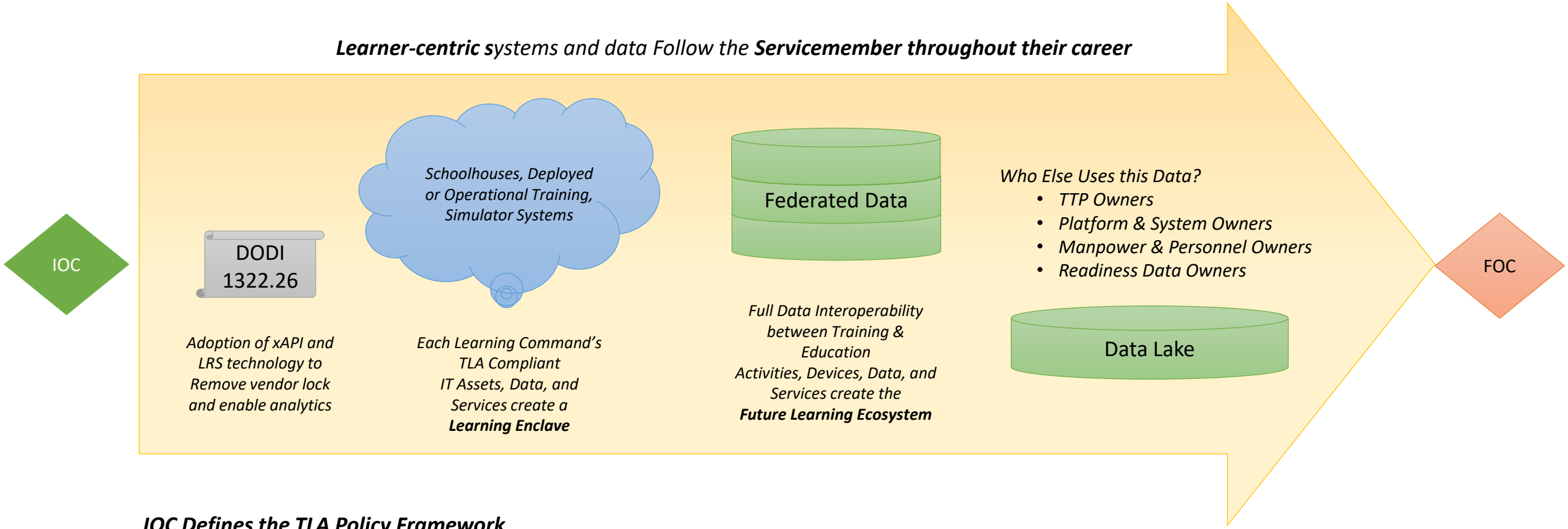
LEGEND

- Learning Command Schoolhouses
- Learning Command Deployed Units
- Learning Command Operational Units
- Required Policy and Governance
- TLA Specified Interfaces
- Native System Interfaces
- Edge Systems– Learning Record Providers
  - uLearning Devices
  - LMS/SCORM courses
  - Simulators
  - Instrumented Ranges
  - Internet of Learning Things



Definitions: Enclave, Federation, and Ecosystem

Learner-centric** systems and data Follow the **Servicemember throughout their career



IOC Defines the TLA Policy Framework

- *Training and Education Data Strategy – Federated Data*
- *Conformance Testing – Initial Technical Specifications*
- *Continuously Evolving*

FOC Matures the Tools, Technologies, and Technical Specifications to Enable:

- *Competency-based Learning*
- *Artificial Intelligence, Automation, and Meta-adaptation*
- *Big Data Analytics*

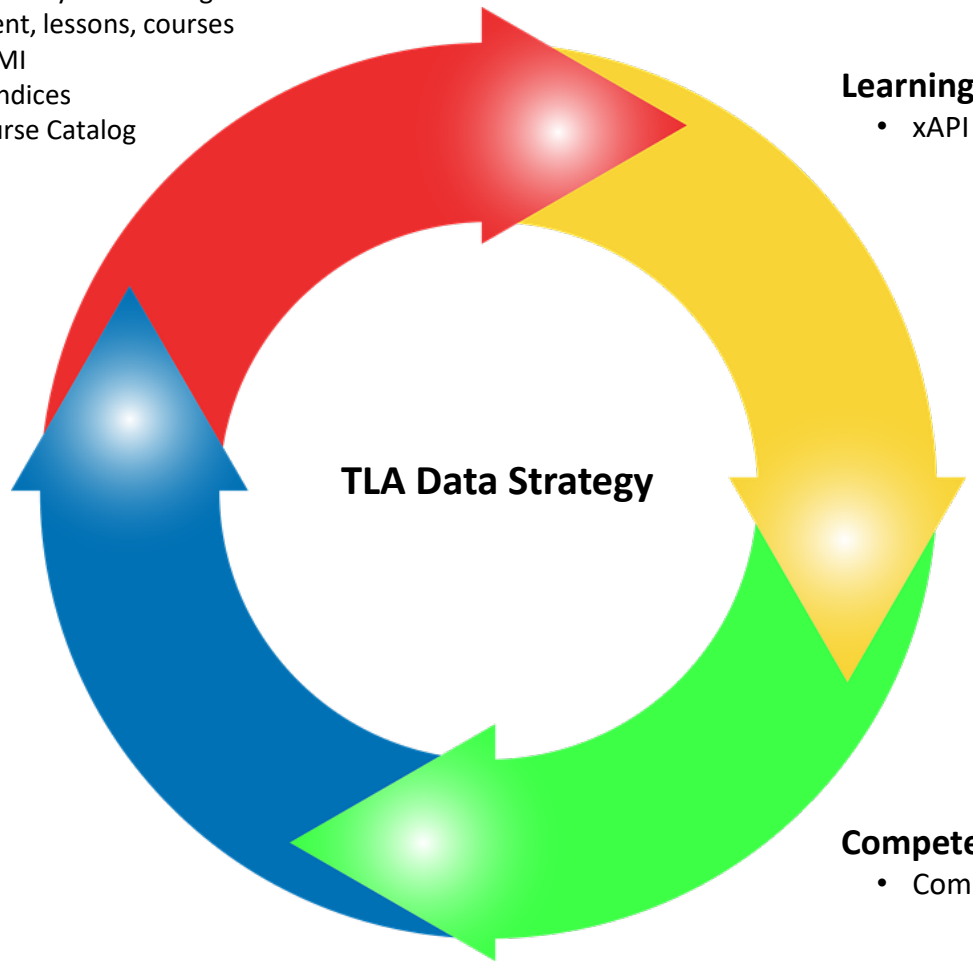
Enabling Force Education and Training as an Integral part of the ***Human Capital Supply Chain***

The TLA Policy Framework:

- Federated Data Strategy for all training and education related data.
- Derived from internationally accepted technical specifications and standards
- Portability of learning data between enclaves
- Auditability and Non-Repudiation of Competencies and Credentials
- Enterprise Analytics
- Artificial Intelligence and Automation

Activity Registry

- Experience Index
  - Metadata Repository for learning activities, content, lessons, courses
- Metadata Strategy - LRMI
- Federated Experience Indices
- Roll up to Common Course Catalog



Learning Activity Tracking

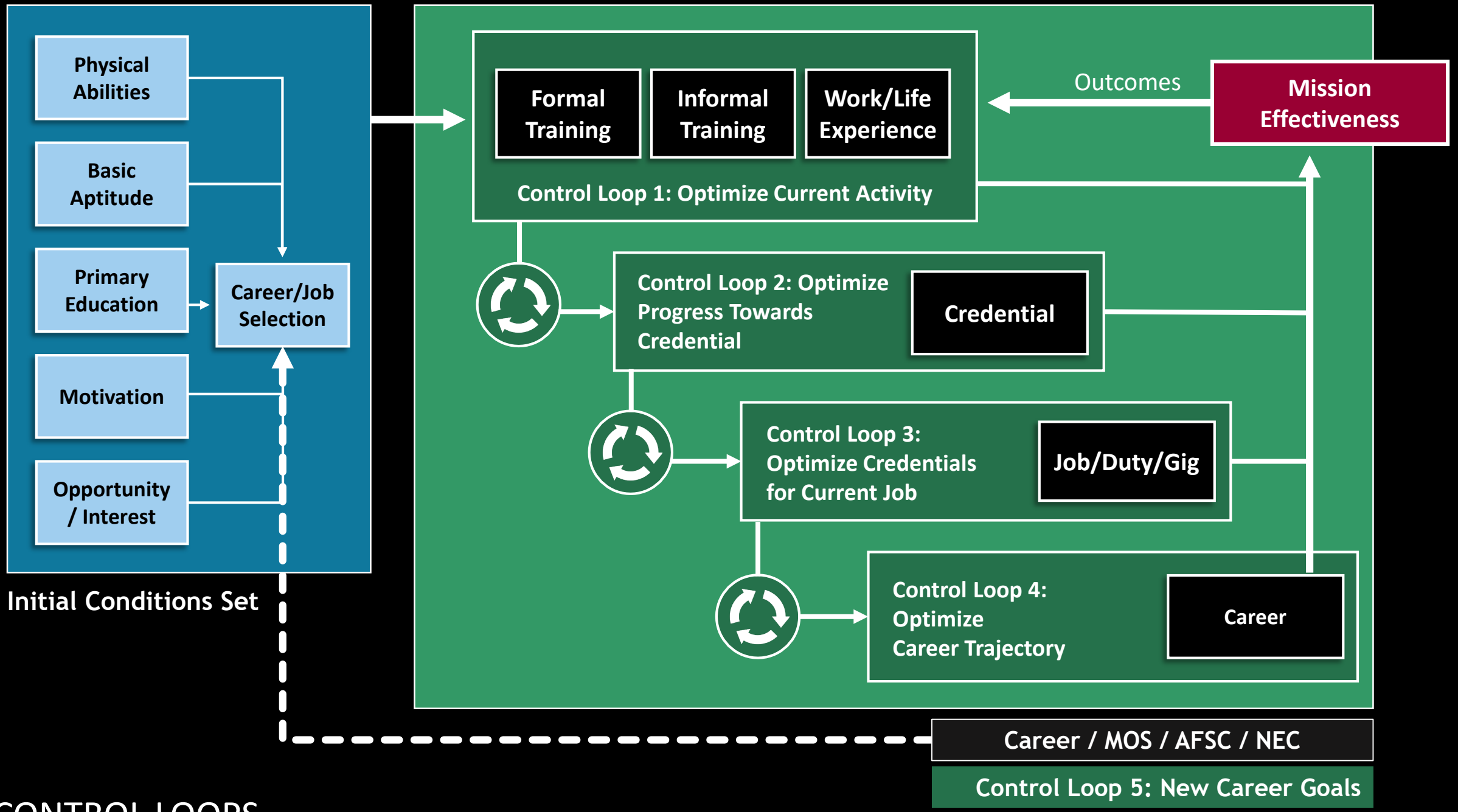
- xAPI Profiles
  - Controlled Vocabularies
  - Domain Specific Context
  - Cmi5 Specification
  - Normalized Data

Universal Learner Record

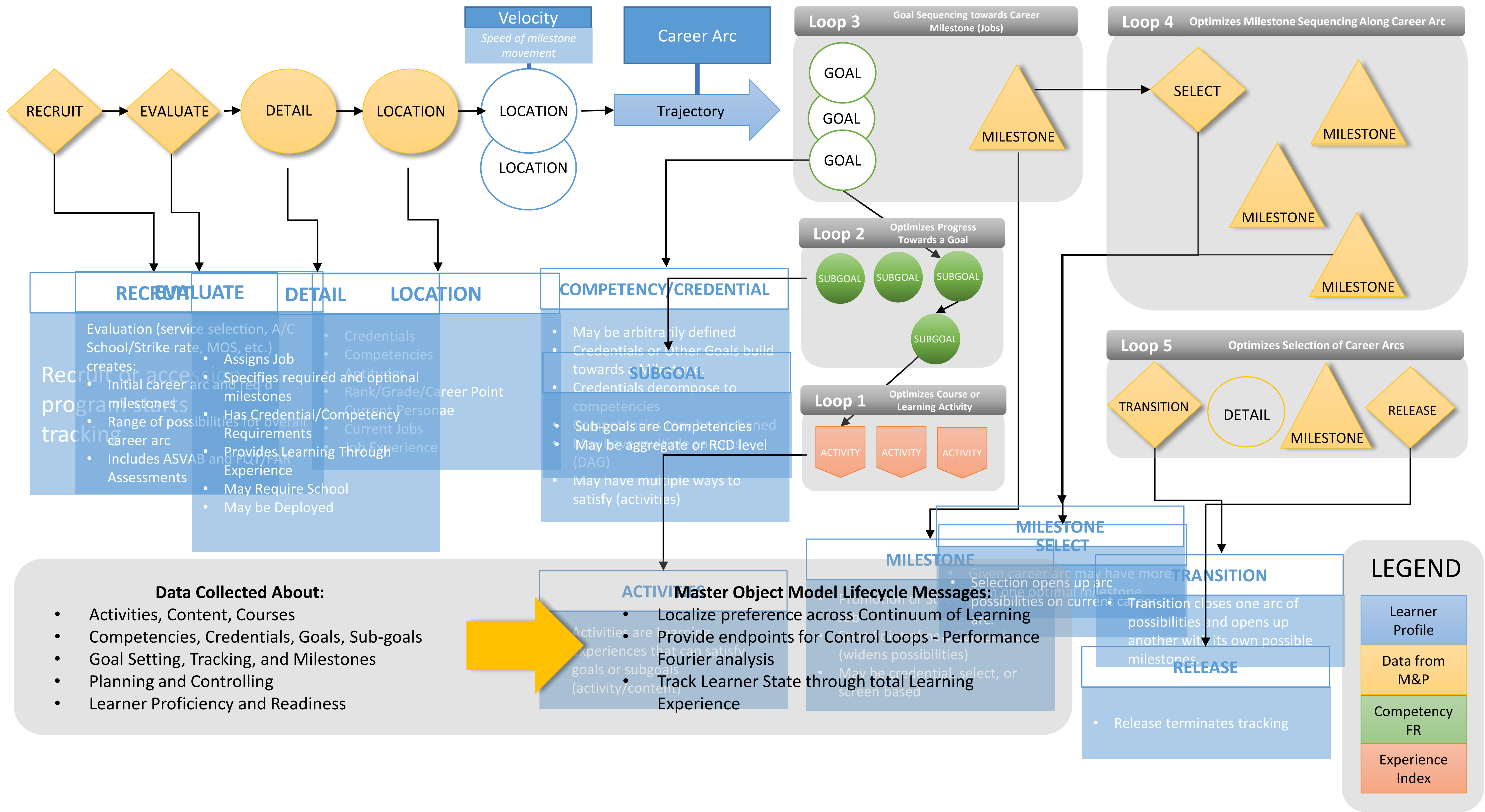
- Learner Attributes
- C&C Ledger
- Experience Ledger
- Preferences
- Career Trajectory

Competency Framework

- Competency Description
  - KSAOs
  - Tasks, Conditions, Standards
  - Environmental Factors
  - Metadata

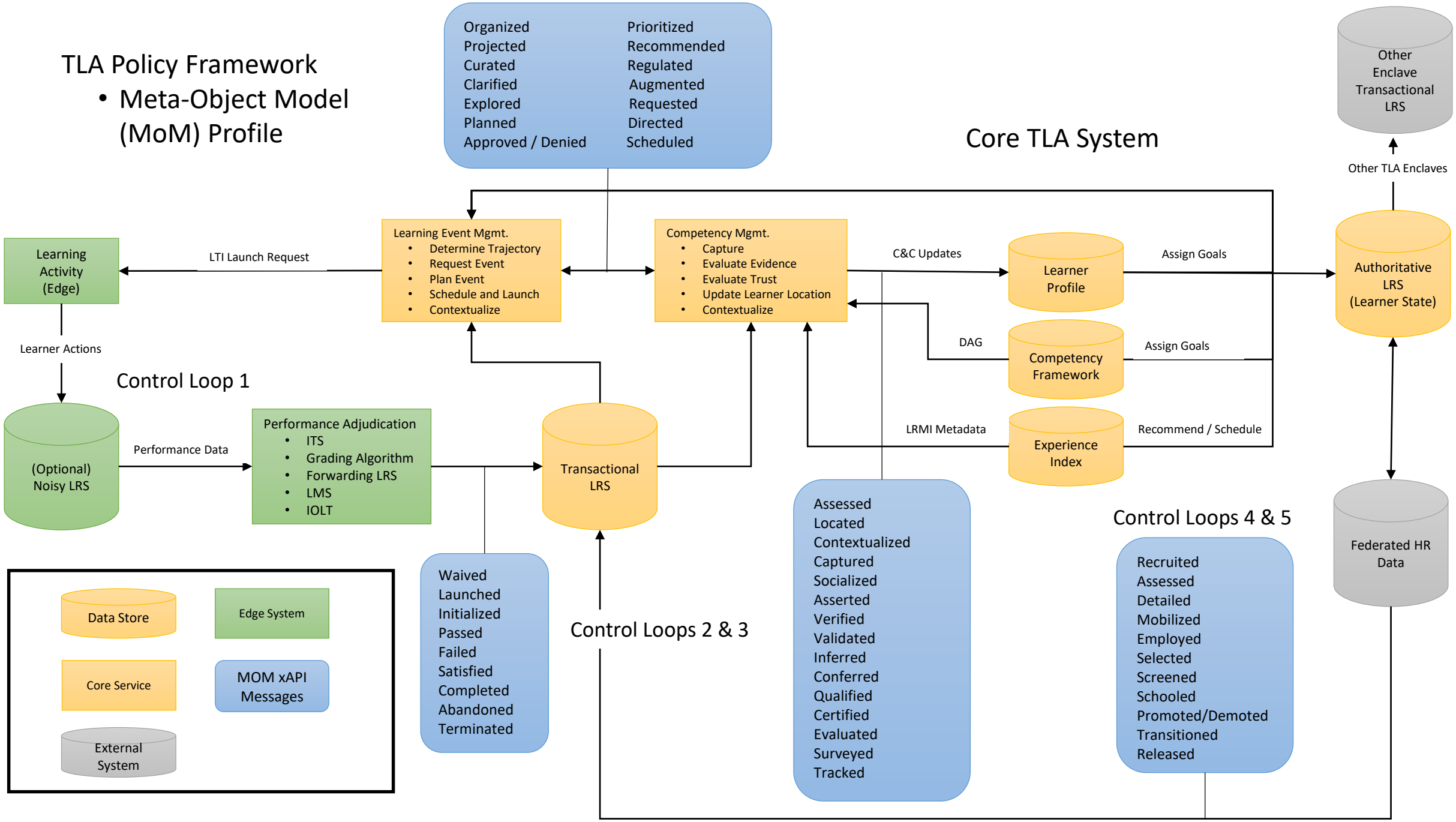


5 CONTROL LOOPS


RECRUIT
EVALUATE
DETAIL
LOCATION
LOCATION
LOCATION
Velocity
Speed of milestone movement
Career Arc
Trajectory
Loop 3
Goal Sequencing towards Career Milestone (Jobs)
GOAL
GOAL
GOAL
MILESTONE
Loop 4
Optimizes Milestone Sequencing Along Career Arc
SELECT
MILESTONE
MILESTONE
MILESTONE
Loop 2
Optimizes Progress Towards a Goal
SUBGOAL
SUBGOAL
SUBGOAL
SUBGOAL
Loop 1
Optimizes Course or Learning Activity
ACTIVITY
ACTIVITY
ACTIVITY
Loop 5
Optimizes Selection of Career Arcs
TRANSITION
DETAIL
MILESTONE
RELEASE
RECRUIT
EVALUATE
DETAIL
LOCATION
Evaluation (service selection, A/C School/Strike rate, MOS, etc.) creates:
Initial career arc and req'd milestones
Range of possibilities for overall career arc
Includes ASVAB and FQT/FAR Assessments
Recruit or accession program starts tracking
Assigns Job
Specifies required and optional milestones
Has Credential/Competency Requirements
Provides Learning Through Experience
May Require School
May be Deployed
Credentials
Competencies
Aptitudes
Rank/Grade/Career Point
Current Personae
Current Jobs
Job Experience
COMPETENCY/CREDENTIAL
May be arbitrarily defined
Credentials or Other Goals build towards a Milestone
Credentials decompose to competencies
SUBGOAL
Sub-goals are Competencies
May be aggregate or RCD level (DAG)
May have multiple ways to satisfy (activities)
MILESTONE
SELECT
MILESTONE
Selection opens up arc possibilities on current career arc
TRANSITION
Transition closes one arc of possibilities and opens up another with its own possible milestones
RELEASE
Release terminates tracking
ACTIVITIES
Activities are learning experiences that can satisfy goals or subgoals (activity/content)
May be credential, select, or screen based
Data Collected About:
Activities, Content, Courses
Competencies, Credentials, Goals, Sub-goals
Goal Setting, Tracking, and Milestones
Planning and Controlling
Learner Proficiency and Readiness
Master Object Model Lifecycle Messages:
Localize preference across Continuum of Learning
Provide endpoints for Control Loops - Performance
Fourier analysis
Track Learner State through total Learning Experience
LEGEND
Learner Profile
Data from M&P
Competency FR
Experience Index

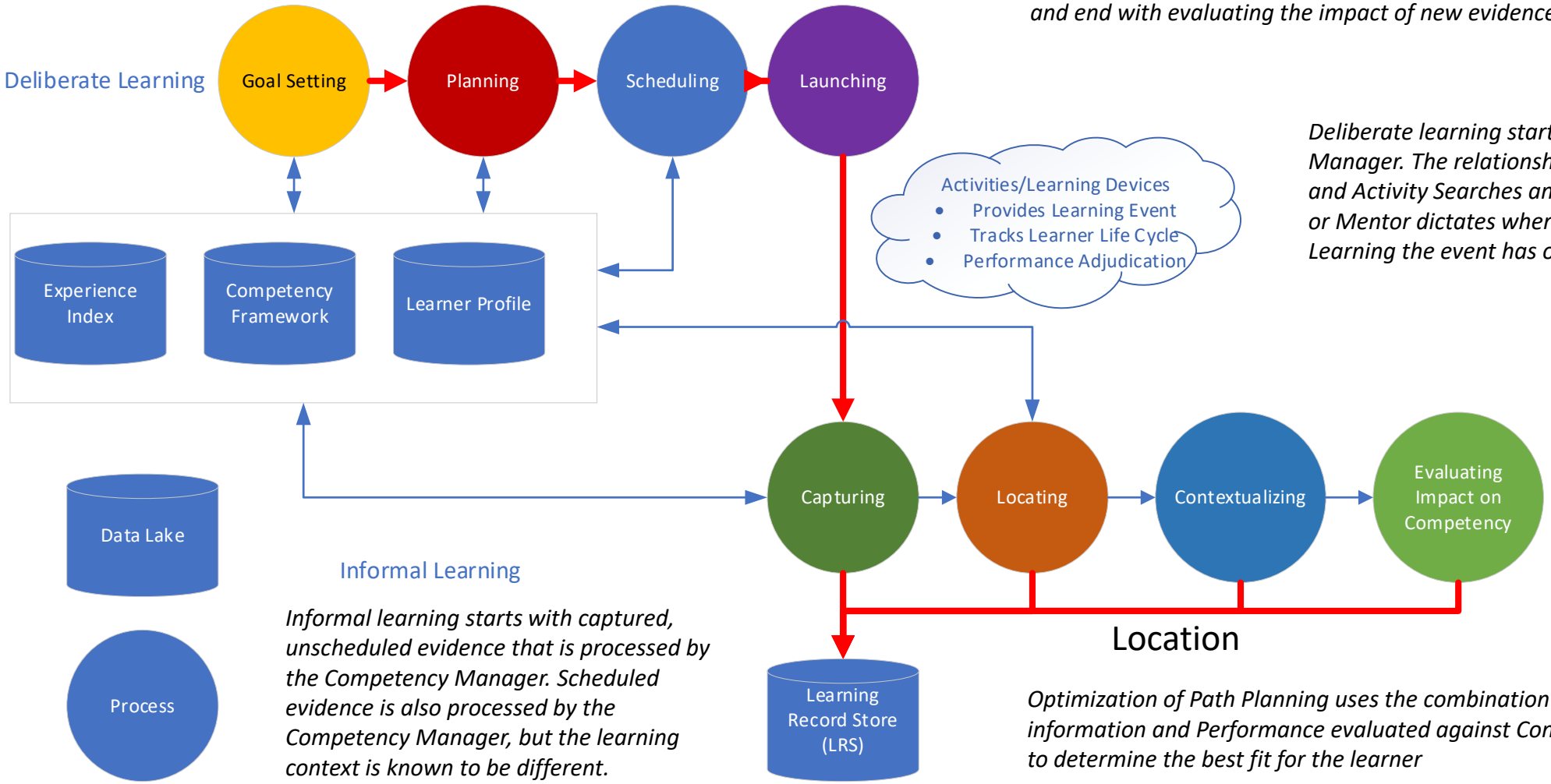
TLA Policy Framework

- Meta-Object Model (MoM) Profile



Learning Event Manager

MOM profile xAPI messages create "activity streams" that propagate between TLA Services to perform the processes of learning events, which start with goal setting and end with evaluating the impact of new evidence on competency.



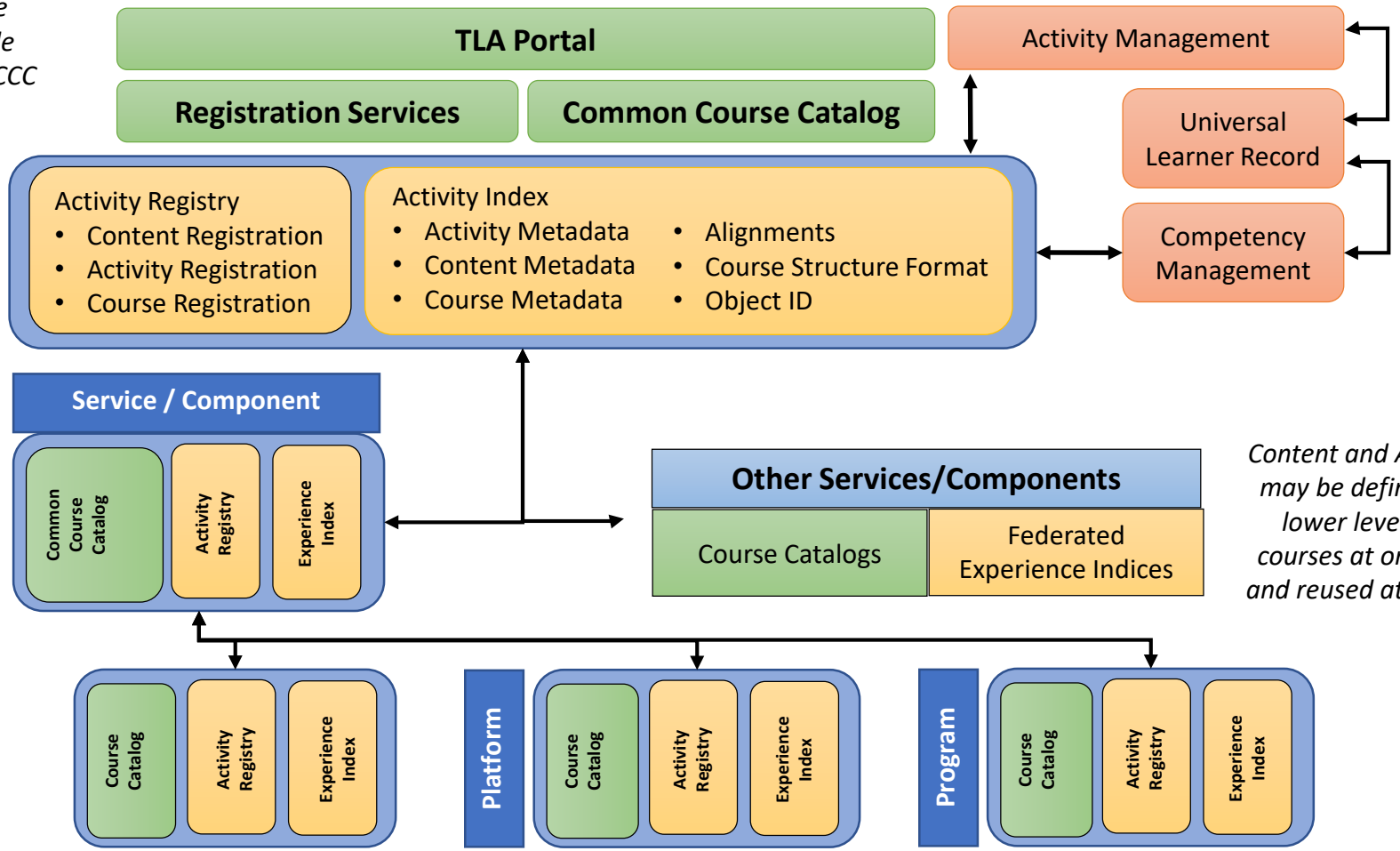
Deliberate learning starts with the Learning Event Manager. The relationship between the Competency and Activity Searches and the Presence of an Instructor or Mentor dictates where along the Continuum of Learning the event has occurred.

Informal learning starts with captured, unscheduled evidence that is processed by the Competency Manager. Scheduled evidence is also processed by the Competency Manager, but the learning context is known to be different.

Optimization of Path Planning uses the combination of location/trajectory information and Performance evaluated against Context and Activity Metadata to determine the best fit for the learner

Activity Registry is the process of listing, parametrizing, and associating the local content/activities into sets

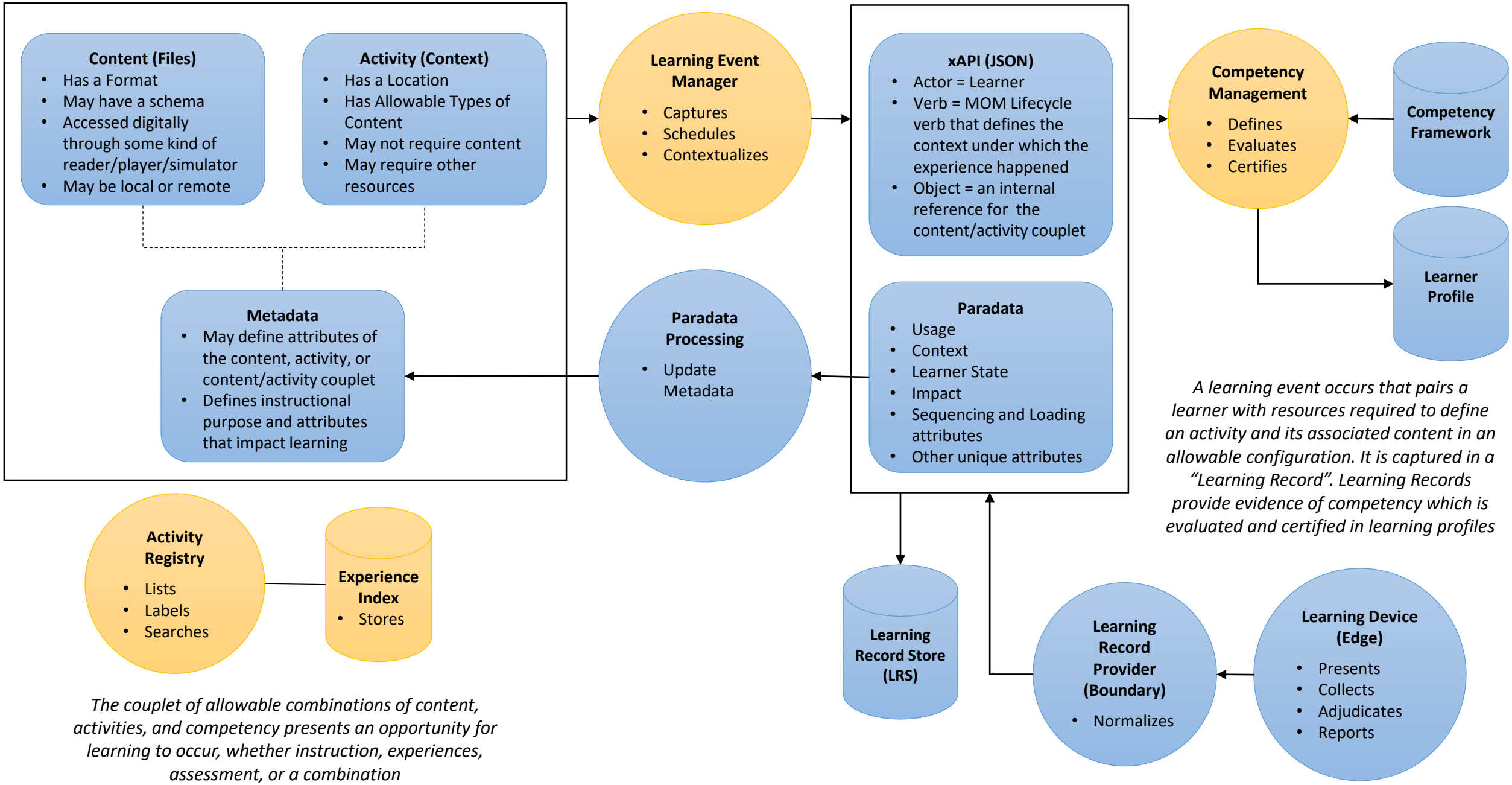
All content sets representing courses are discoverable through the CCC Service



Content and Activities may be defined at a lower level than courses at one place and reused at another

Learning Commands may have copies of Authoritative content to conduct and archive local learning. They may also register unique local activities that are not part of the CCC

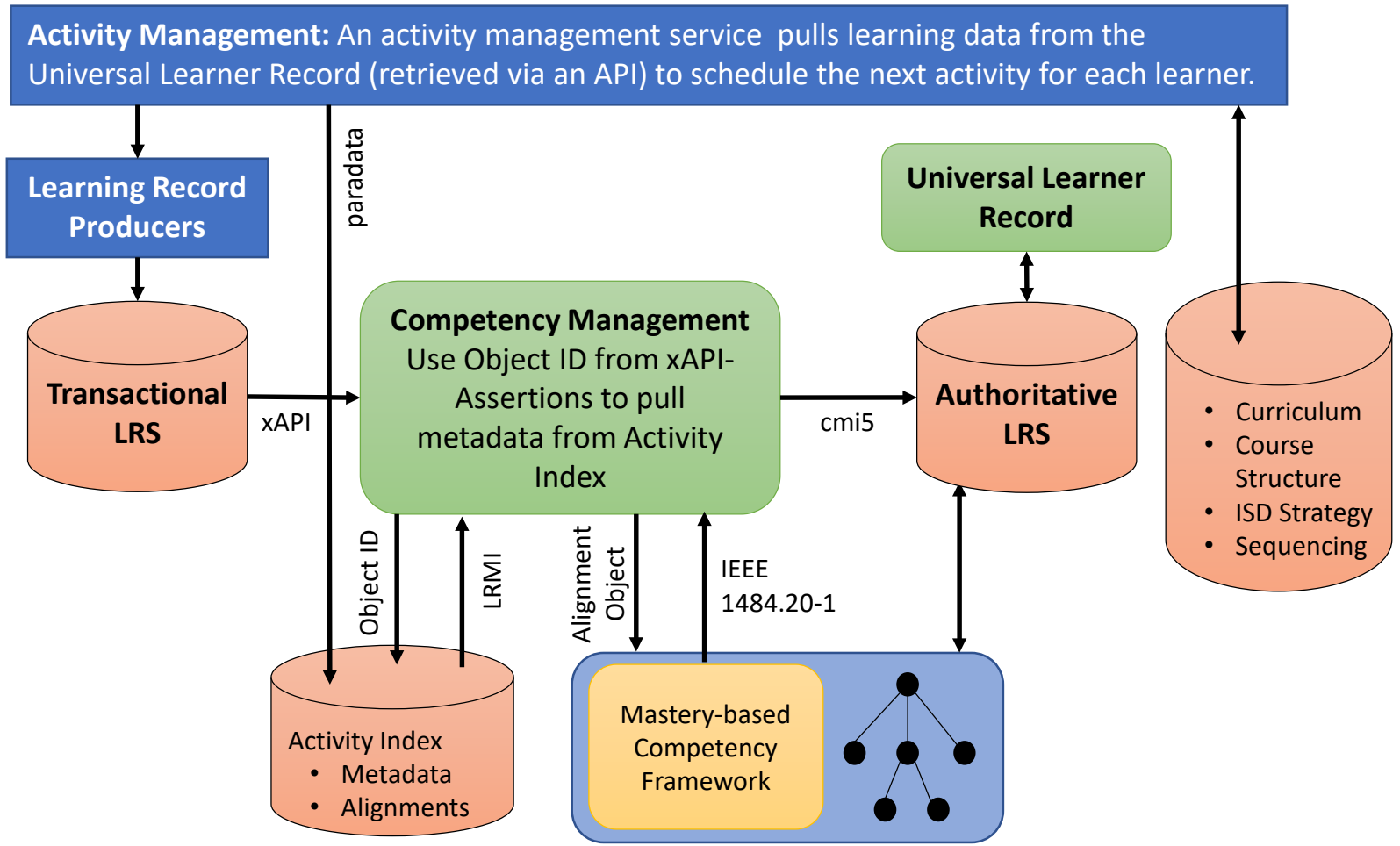
Experience Index



A learning event occurs that pairs a learner with resources required to define an activity and its associated content in an allowable configuration. It is captured in a "Learning Record". Learning Records provide evidence of competency which is evaluated and certified in learning profiles

The couplet of allowable combinations of content, activities, and competency presents an opportunity for learning to occur, whether instruction, experiences, assessment, or a combination

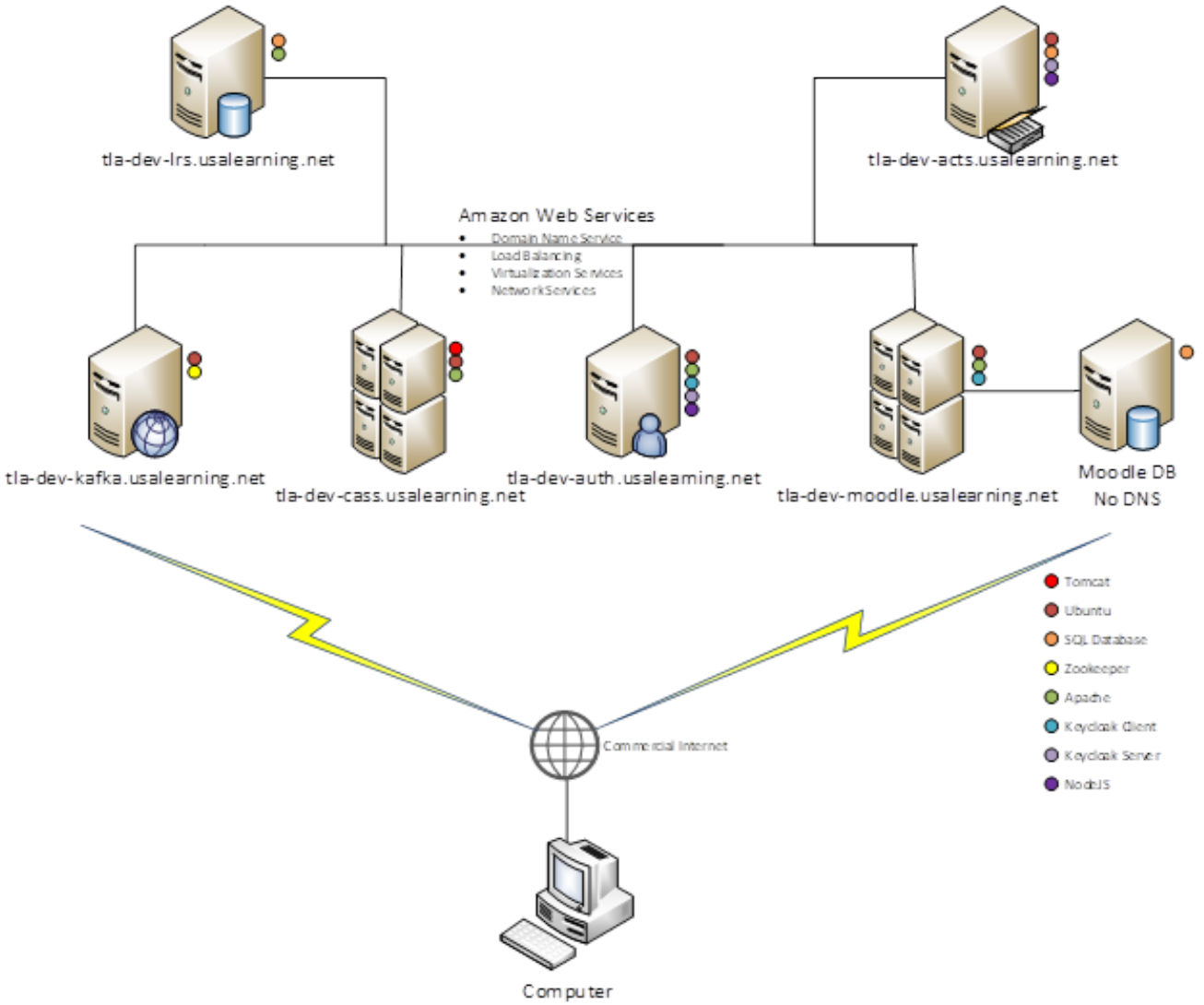
Competency Management



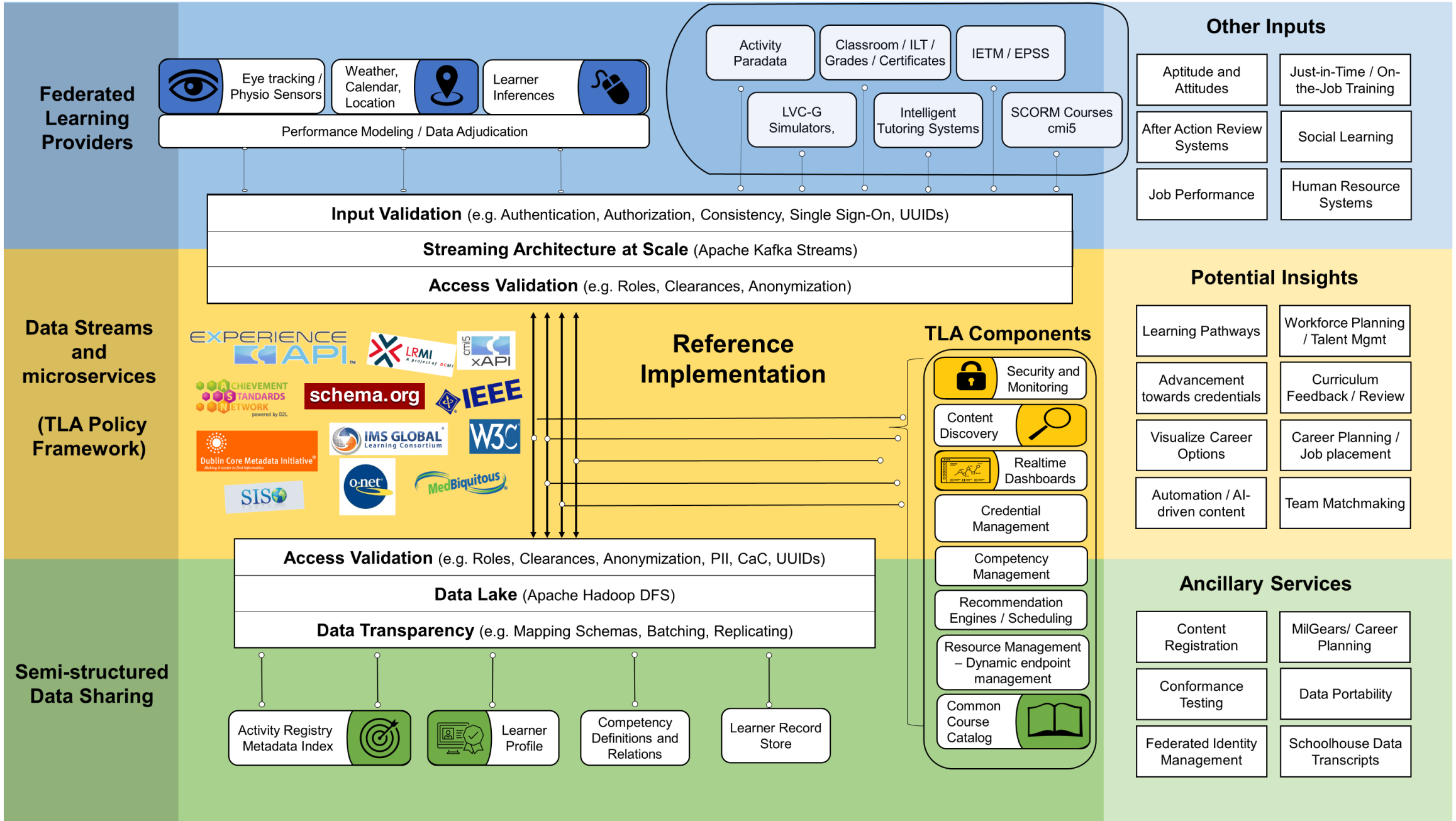
Total Learning Architecture Reference Implementation

Reference Implementation – Server Deployment

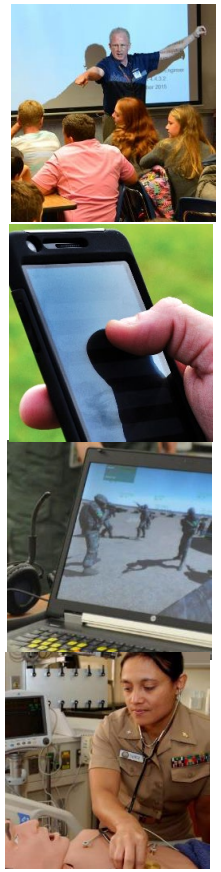
- Containerized Amazon Web Services
- Apache Kafka on multiple servers with dynamic endpoint management
- TLA Core Services and Data, along with Kafka proxy are installed on 3 containerized VM
- Web services, LMS components and content management have their own VM



Total Learning Architecture



Reference Implementation



Activity – Content – Course Metadata

Noisy LRS

xAPI

Noisy LRS

xAPI

Noisy LRS

xAPI

Noisy LRS

xAPI

Kafka Broker

Transactional LRS

Experience Index

Course Catalog

Competency Manager

Learning Event Mgr.

Authoritative LRS

Learner Record

Web Portal

Your TLA Enclave

Outside Enclave Transactional LRS

External LRS 1

External LRS 2

External LRS 3

Course Catalog

Activity Registry

Experience Index

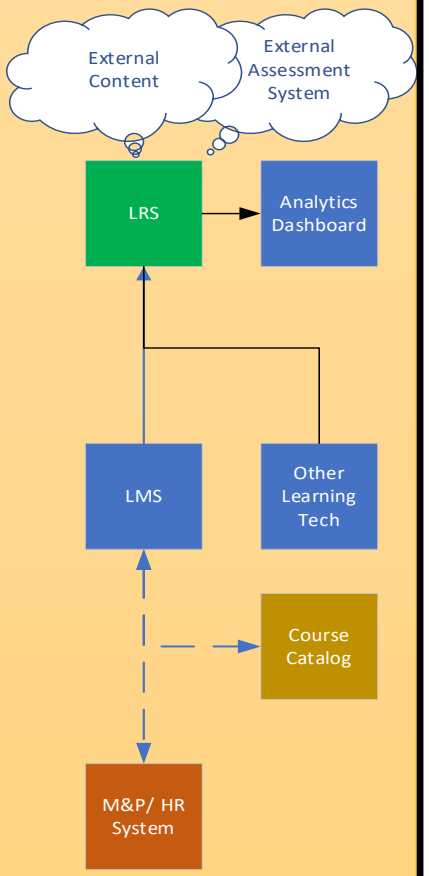
Outside Enclave Activity Index

Current TLA-related Components	TRL 4	TRL 5	TRL 6	TRL 7	TRL 8	TRL 9	TRL 10	Co-sponsors
Web Portal		x						DAU/NPS/USALearning
Apache Kafka Streaming Service					x			
Activity Registry / Experience Index	x							USALearning / DoD CMO
Competency Management System		x						AETC / USALearning
TLA Data Dictionary (MOM)			x					
Learning Event Manager	x							DAU
Identity Manager (UUID)		x						OUSD(I), AETC
xAPI Profile Server	x							USALearning
Common Course Catalogue	x							USALearning / DoD CMO
Universal Learner Record	x							AETC / USALearning
DAVE – Decision Support Templates		x						DAU / US Army STE
Conformance Test Suite - DataSim								TBD

TLA Related Specifications and Standards	TRL 4	TRL 5	TRL 6	TRL 7	TRL 8	TRL 9	TRL 10	Standards Body
xAPI						x		IEEE-LTSC
xAPI Profile				x				IEEE-LTSC
cmi5			x					IEEE-LTSC
LRMI							x	Schema.org, Dublin Core Initiative
ePUB3							x	International Digital Publishing Forum
Competency Standard (IEEE 1484.20.1)			x					IEEE-LTSC
JDX - Job Schema standard		x						US Chamber of Commerce Foundation
CTDL - Credential Transparency Description language			x					Credential Engine
SCORM							x	IEEE-LTSC
LTI							x	IMS Global
Adaptive Instructional Systems - AIS IEEE P2247.1	x							IEEE-LTSC
Learner Record - Not Available (LIP, CLR, PESC, and others not viable)								TBD

Current TLA Testing and Evaluation Opportunities	Description of Research
Defense Acquisition University FPD420 Course	DAU's xAPI Pilot course. ADL is working to assist DAU while furthering ADL Initiative research on Federated Identity, Federated LRS data stores, and SCORM to xAPI Conversion
US Army Synthetic Training Environment (STE) and the Squad Advanced Marksmanship Trainer (SAMT)	The ADL Initiative is supporting this work while exploring Federated Data strategies, approaches for Federated Identify Management, and eventually team-based competencies via the Squad Performance Model. The use of biometrics, AR/VR, and other tools provide insights into how some of these new technologies intersect with other TLA components
Defense Health Agency	The ADL Initiative is consulting to NAWCTSD who is working with DHA to create an acquisition roadmap and implement a DHA-wide Training and Education architecture to track lifelong learning
	Tactical Combat Casualty Care is being used as an educational domain for the DataSim project that will simulate large datasets of xAPI statements that represent the spectrum of training and education activities, delivery platforms, and interactions across the TC3 community
	Tactical Combat Casualty Care is being used by the PERLS development team to create an adaptive, personalized learning system for delivering a wide range of instructional content.

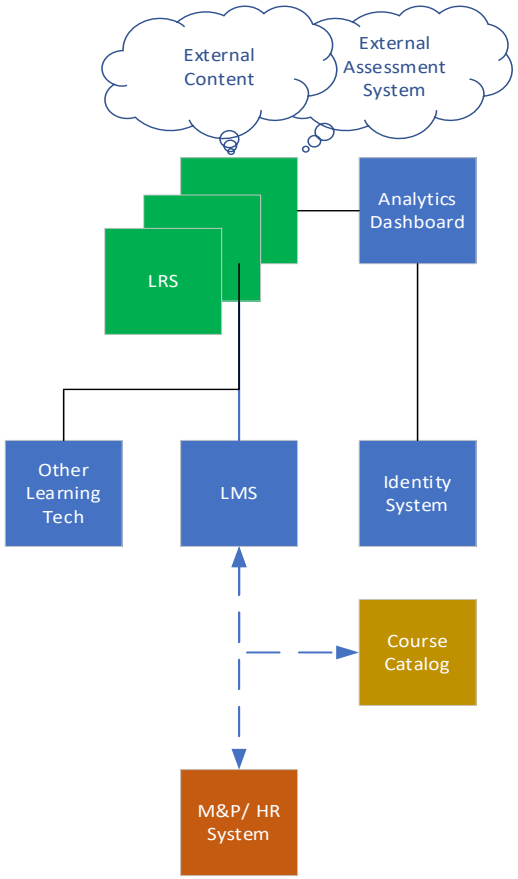
TLA Maturity Model



Level 1

Investment:
- Add LRS to decouple training records from Learning Tech
- Compile Common Courses

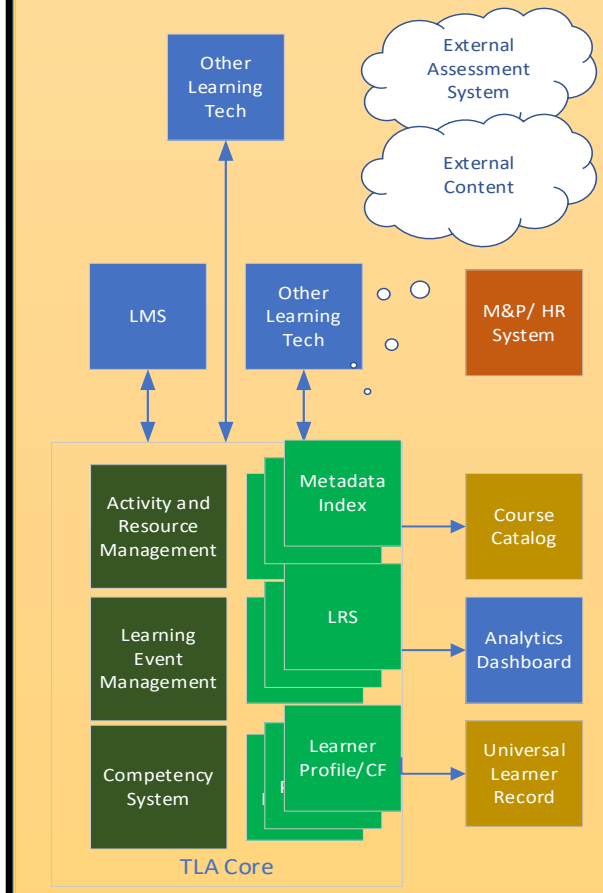
Return:
- Basic Analytics
- Support Course Reuse



Level 2

Investment:
- Globally Discoverable Metadata
- Address Globally Unique Identity Management and Privacy

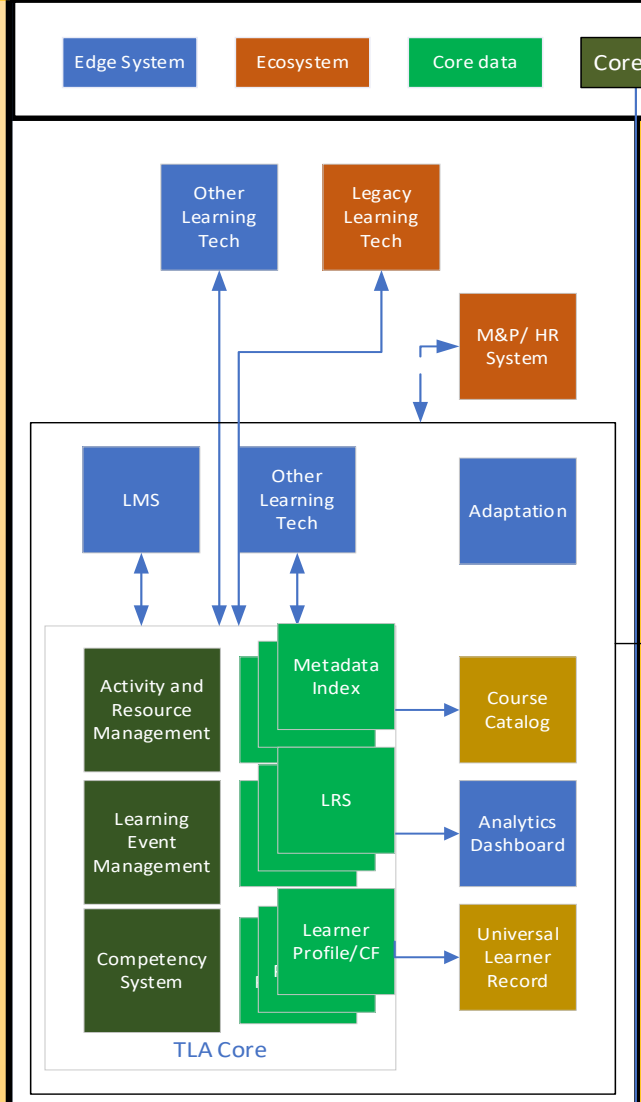
Return:
- Enterprise Analytics
- Standardize auxiliary content



Level 3

Investment:
- Migrate to service Orientation
- Enable Dynamic Federations
- Catalog driven by metadata indices

Return:
- Improve Curriculum Review Cycle
- Shift to CBL – Improved Throughput



Level 4

Investment:
- Develop Machine Learning to optimize performance
- Big Data Analytics

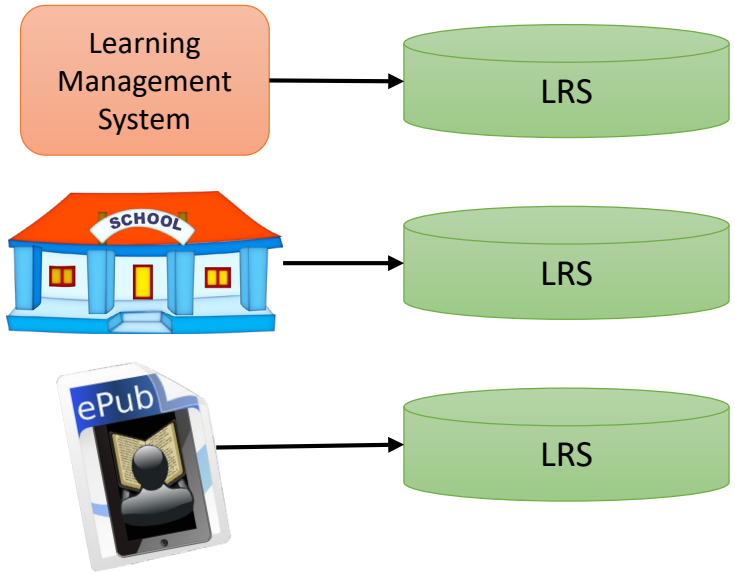
Return:
- Optimize Individual Achievement
- Support alignment of job to performer

Level 5

Investment:
- Integrate with non TLA Systems
- Human Capital SC

Return:
- Lifelong Learning
- Planning

TLA Maturity Model – Level 1

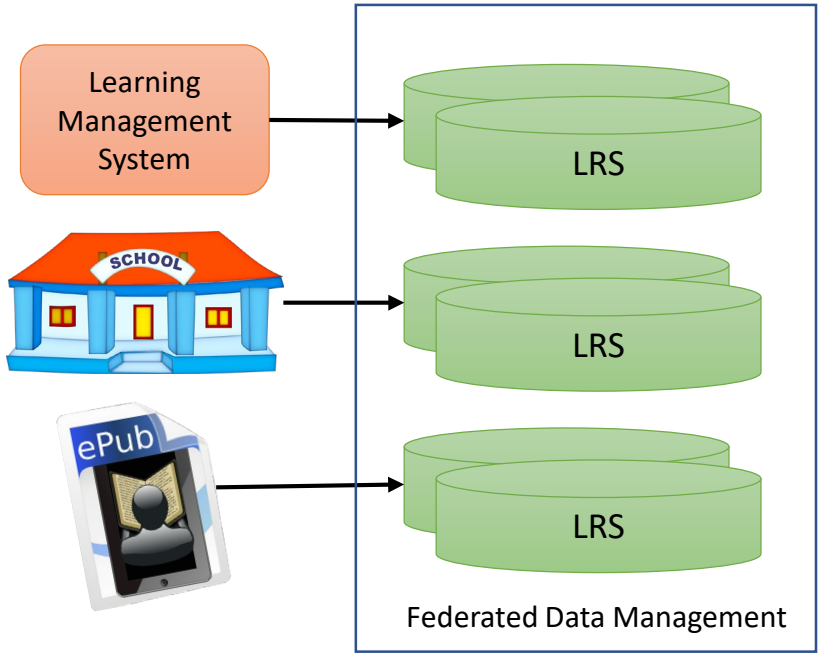


A Level 1 TLA implements the xAPI and an LRS to decouple training records from a Learning Management or Training Management System.

Learning Activity Providers instrumented with xAPI span the range of Learning Management tools, and technologies from the traditional SCORM-based LMS to modern simulation systems and beyond.

Level 1 collects data about performance inside different instructional activities (or Experiences).

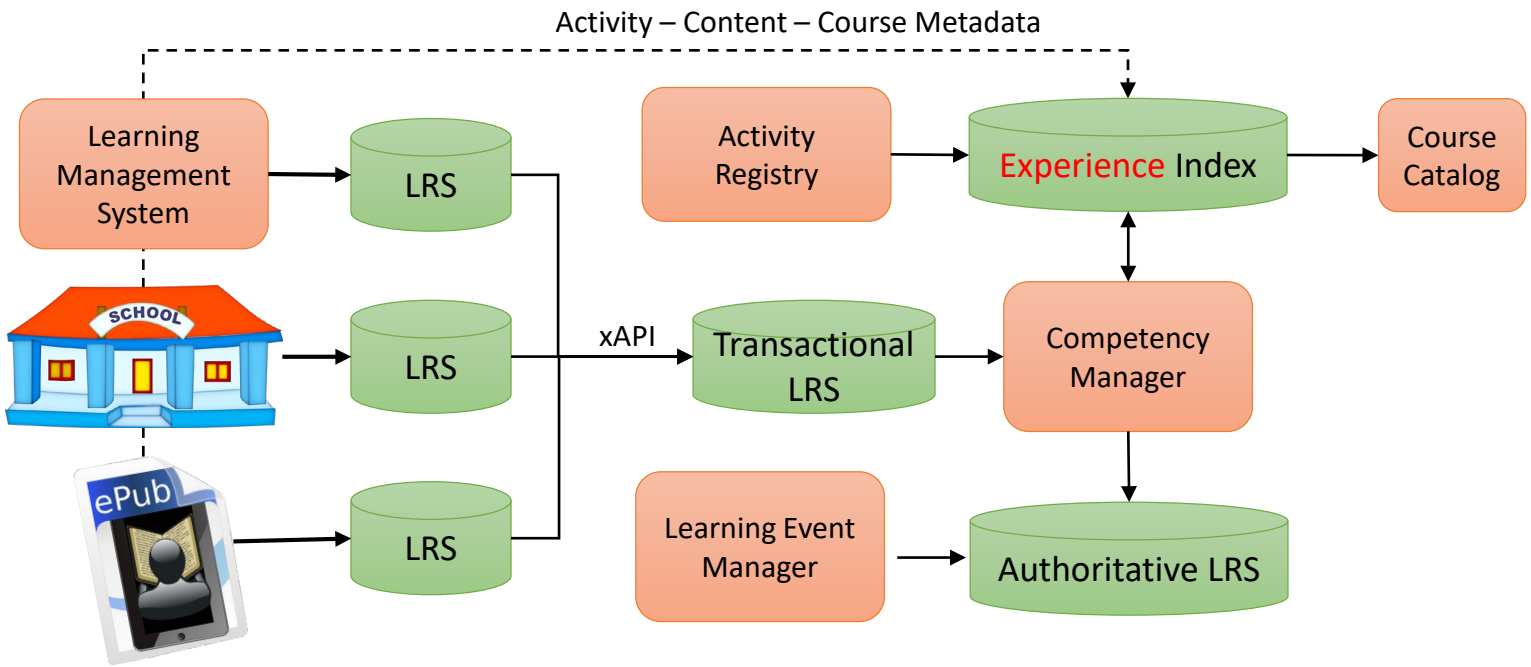
TLA Maturity Model – Level 2



A Level 2 TLA Implementation enables an aggregated approach to managing learner enterprise analytics by pulling performance data from multiple learning activities to build a more comprehensive picture of the learner

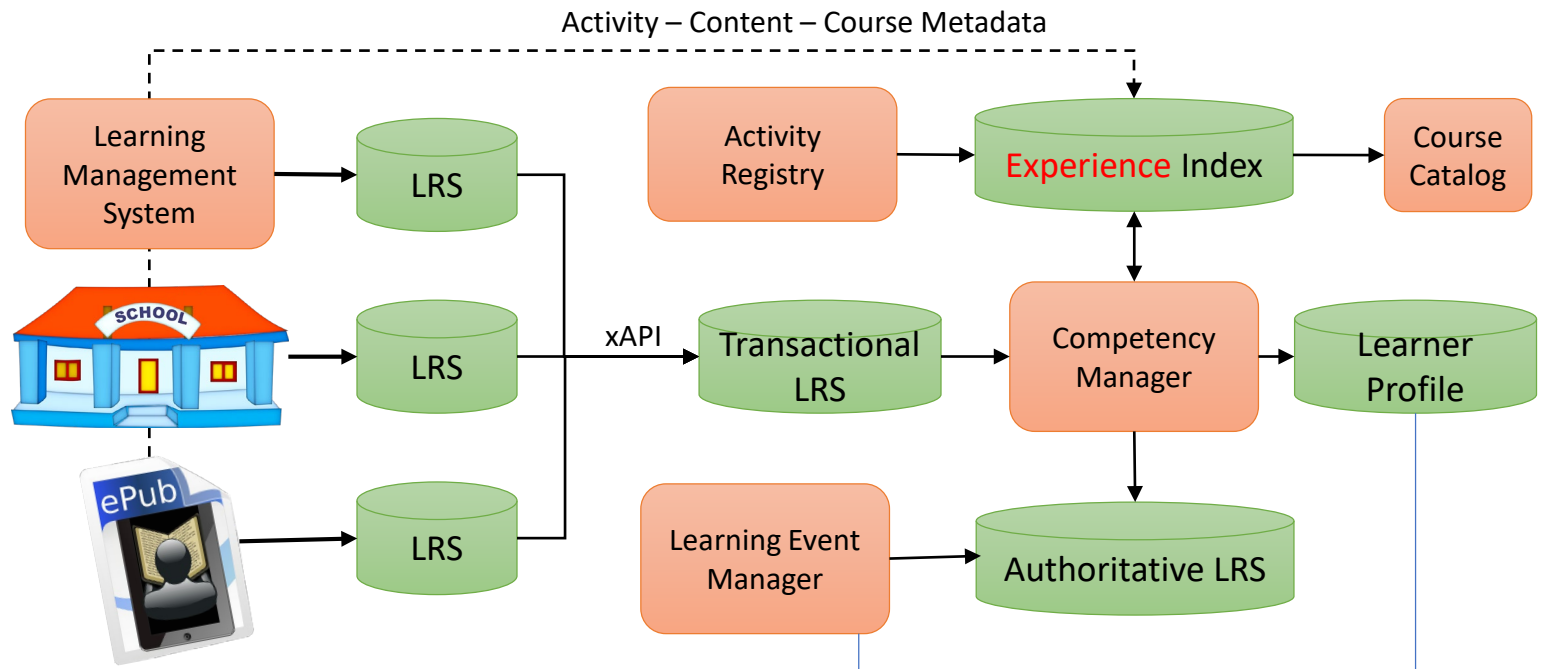
Many LRS solutions come equipped with analytics engines and dashboards that can be customized for an organization.

TLA Maturity Model – Level 3



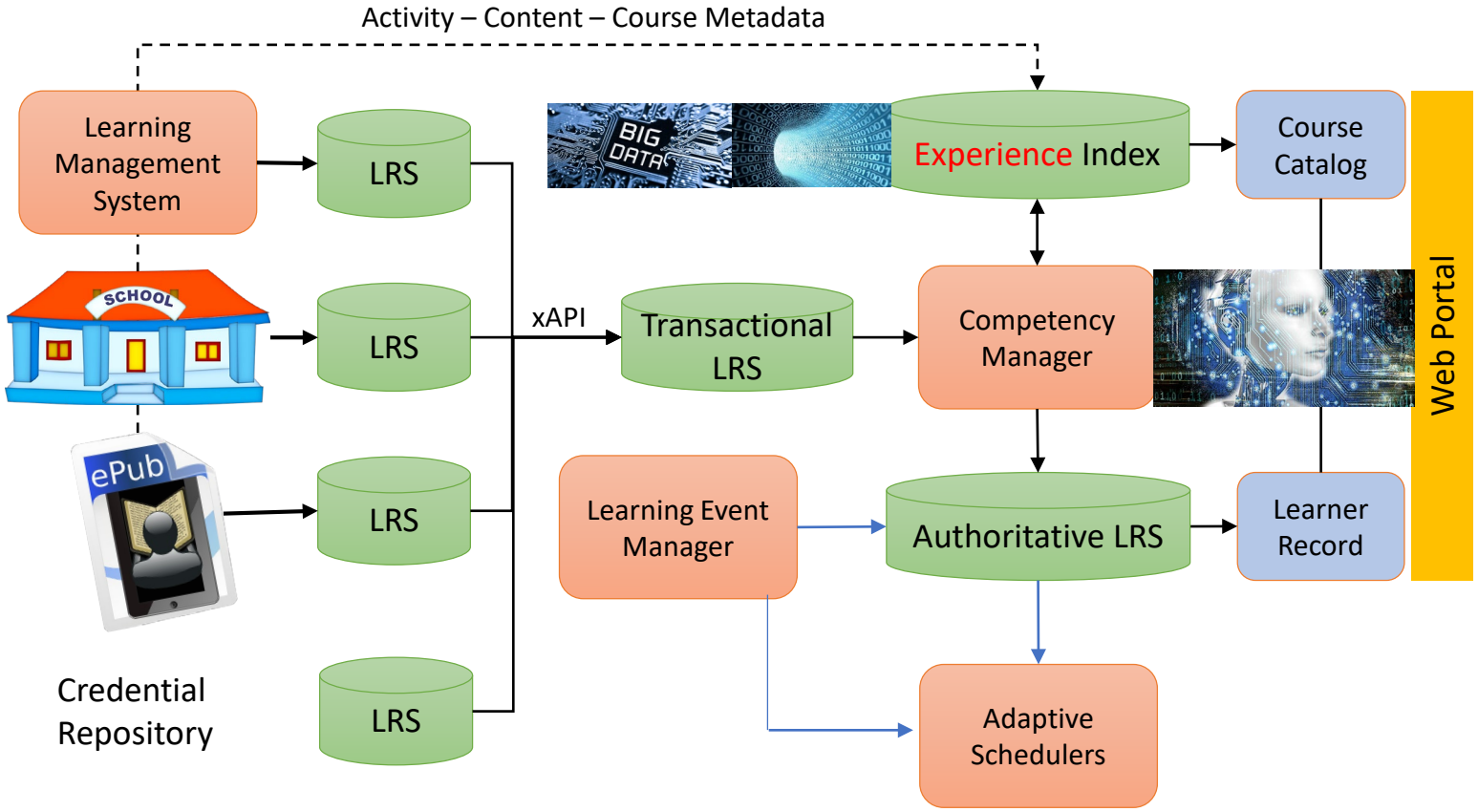
A Level 3 TLA Implementation adds Competency Management and an Experience Index that holds metadata from the various learning activities. The competency manager maps the Experience Index to align performance in an activity with one or more competencies. Learning events are scheduled or captured by an Event Manager . This level also separates the data being stored into **Noisy, Transactional, and Authoritative** LRSs and adds a controlled vocabulary through the TLA Meta Object Model

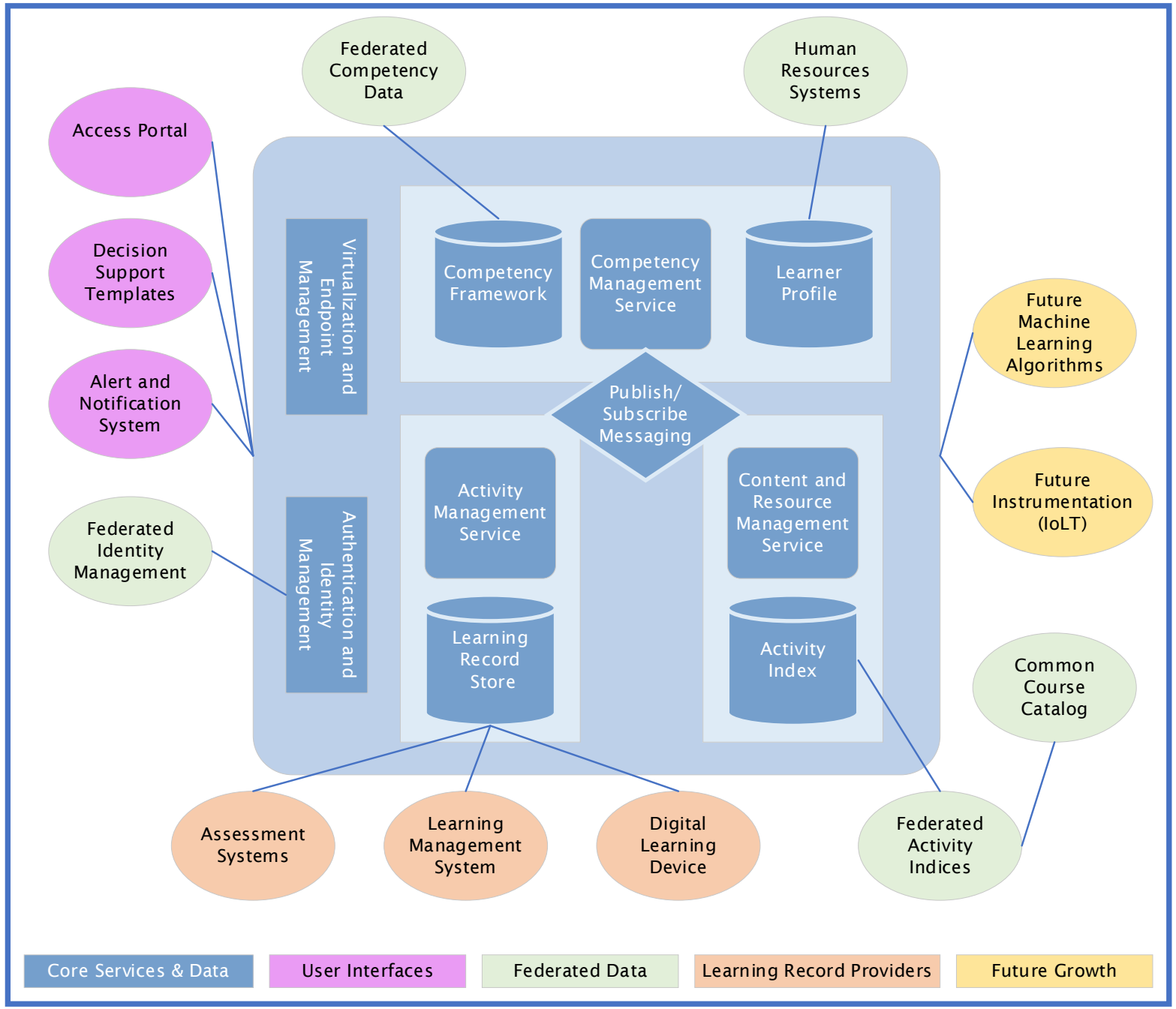
TLA Maturity Model – Level 4



A Level 4 TLA Implementation adds a Learner Record Service and an Event Manager with adaptive sequencing and scheduling services based on preset business rules and established curricula

TLA Maturity Model – Level 5




Federated Competency Data
Human Resources Systems
Access Portal
Decision Support Templates
Alert and Notification System
Federated Identity Management
Virtualization and Endpoint Management
Authentication and Identity Management
Competency Framework
Competency Management Service
Learner Profile
Publish/ Subscribe Messaging
Activity Management Service
Content and Resource Management Service
Learning Record Store
Activity Index
Future Machine Learning Algorithms
Future Instrumentation (IoLT)
Common Course Catalog
Assessment Systems
Learning Management System
Digital Learning Device
Federated Activity Indices
Core Services & Data
User Interfaces
Federated Data
Learning Record Providers
Future Growth

Outstanding Questions

For improved data and technology interoperability