



Caliper Analytics[®]

e-Learning Korea 2018

Markus Gylling
Solutions Architect | Head, IMS Europe
mgylling@imglobal.org

This session

1. Introduction to IMS Global
2. Caliper Overview & Status
3. Caliper Architecture
4. Caliper Future & Next Steps

1. Introduction to IMS Global

- **Non-profit, member-based** collaborative with a mission to improve the learning experience for students, teachers and administrators

A world map showing the global distribution of members. Numerous colored circles (blue, orange, and white) are scattered across the continents, with a high concentration in North America and Europe. A grey circular callout in the upper left contains the text '450+' and '++'.

450+
++

MEMBERS AND GROWING

Suppliers, higher education institutions, K-12 school districts, states, and government organizations.

COLLABORATION



149 HED and K-12 institutions



16 government/state education agencies

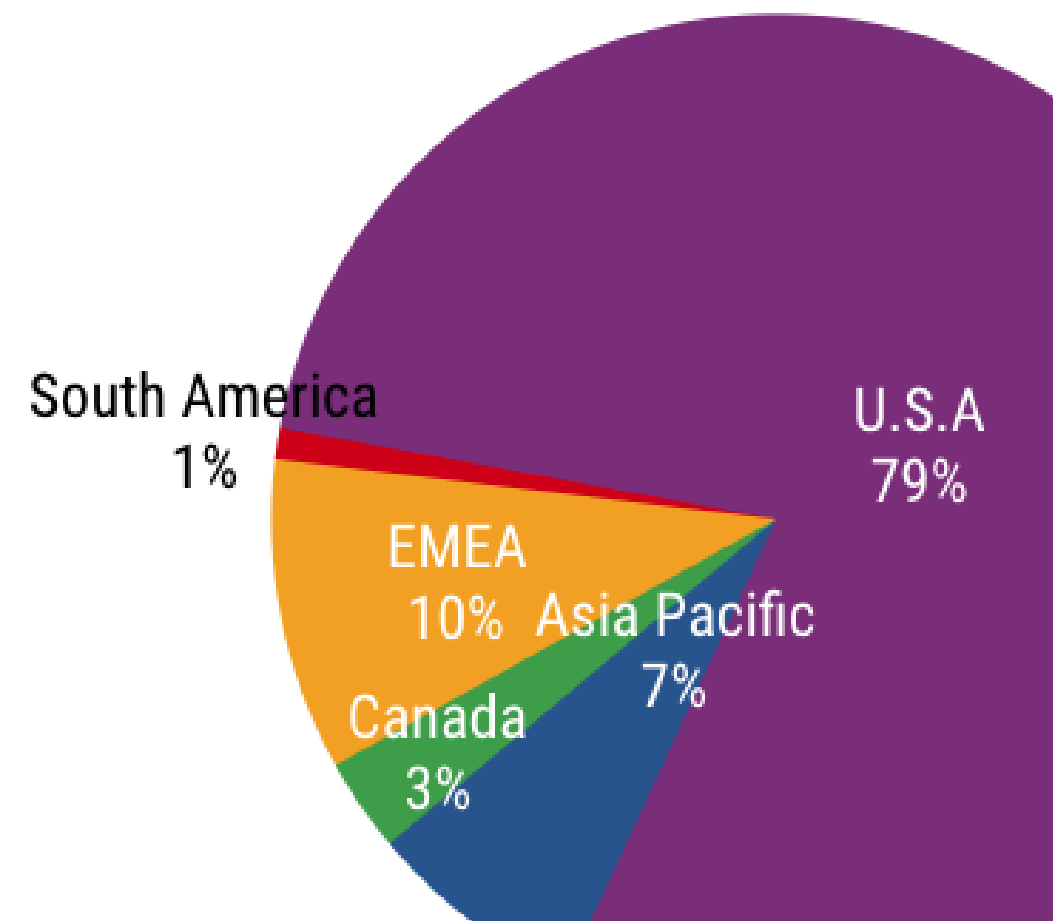


277 edtech suppliers



Members in **22** different countries

IMS Members by Region



INITIATIVES



**DIGITAL
MICRO-
CREDENTIALS**



**LEARNING DATA
&
ANALYTICS**



**INTEGRATED
ASSESSMENT**

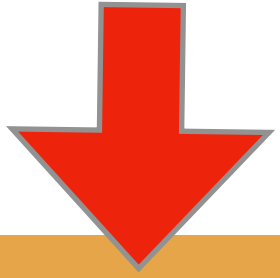


**LEARNING
PLATFORMS,
APPS & TOOLS**



**ADAPTIVE
DIGITAL
CURRICULUM**

INITIATIVES



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MICRO-
CREDENTIALS**



**LEARNING DATA
&
ANALYTICS**



**INTEGRATED
ASSESSMENT**

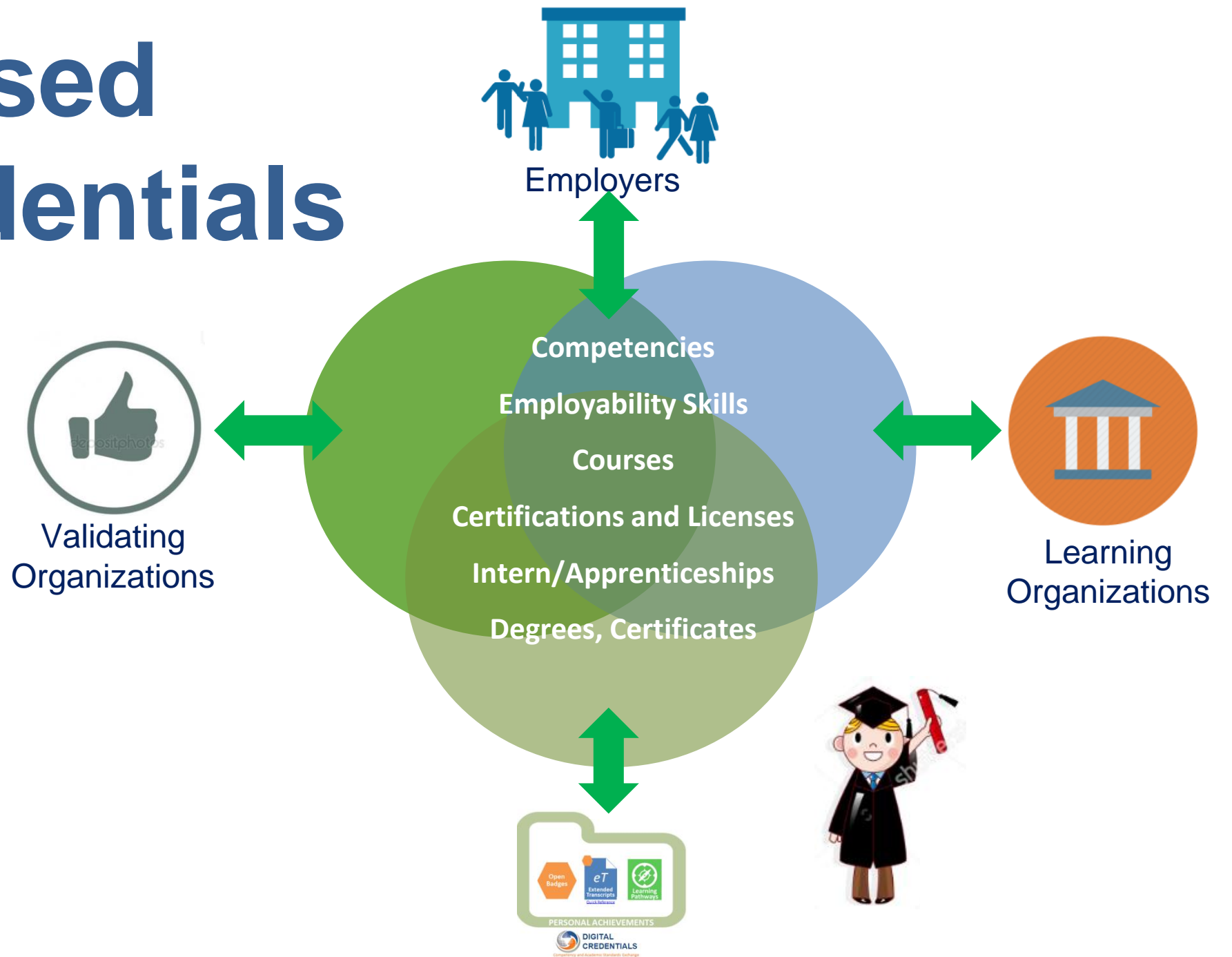


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CURRICULUM**

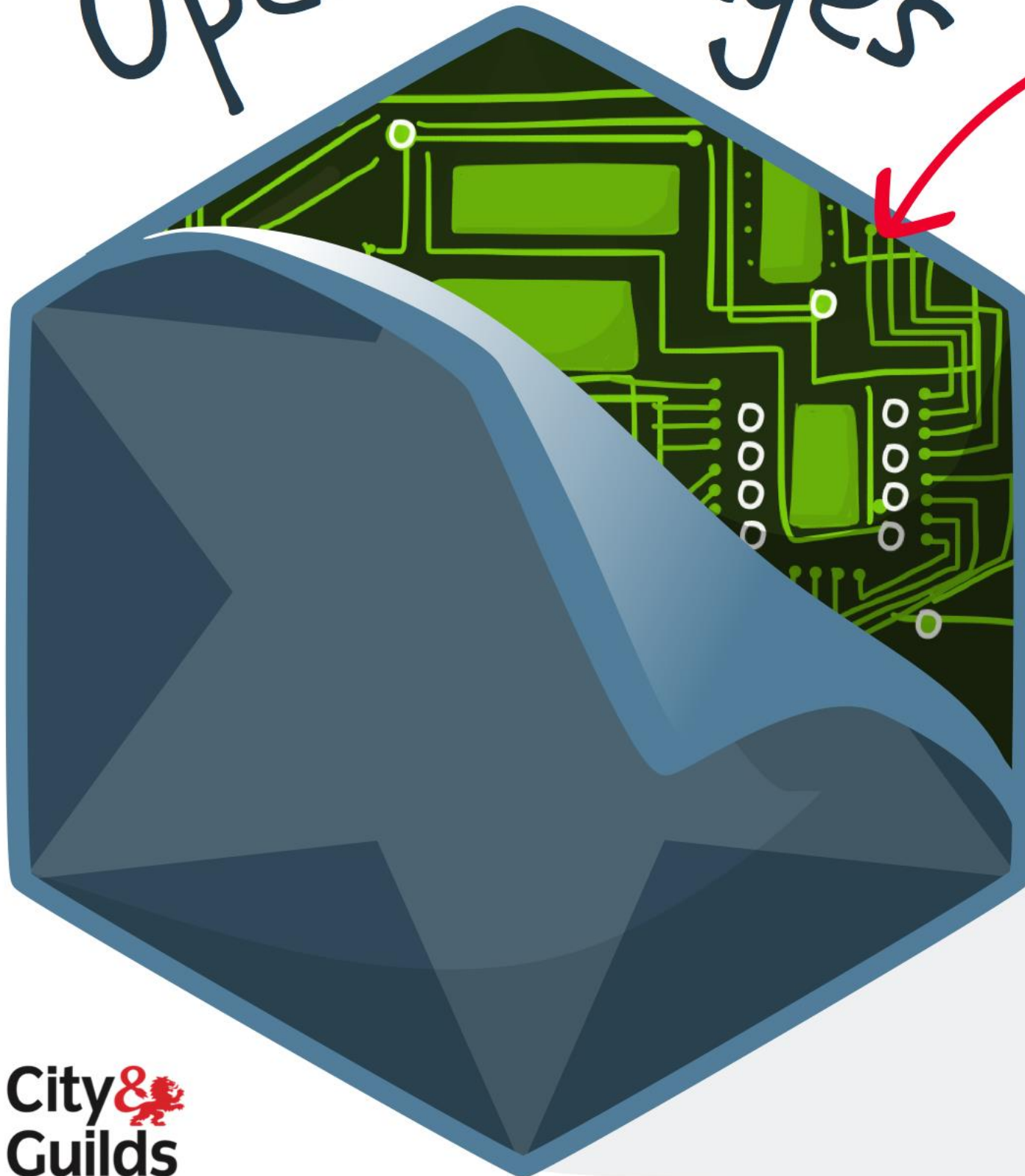
A Skills-Based Digital Credentials Ecosystem



IMS GLOBAL[®]
Learning Consortium
Better Learning From Better Learning Technology[®]

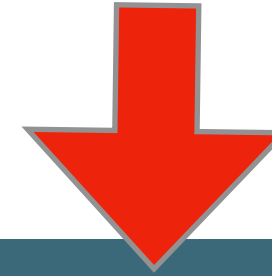
Open Badges

**THERE'S
DATA INSIDE!**



```
badge name  
badge URL (description)  
badge criteria  
badge image  
issuer  
issue date  
recipient  
tags  
alignment (standards)  
expiration date  
evidence URL
```

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&
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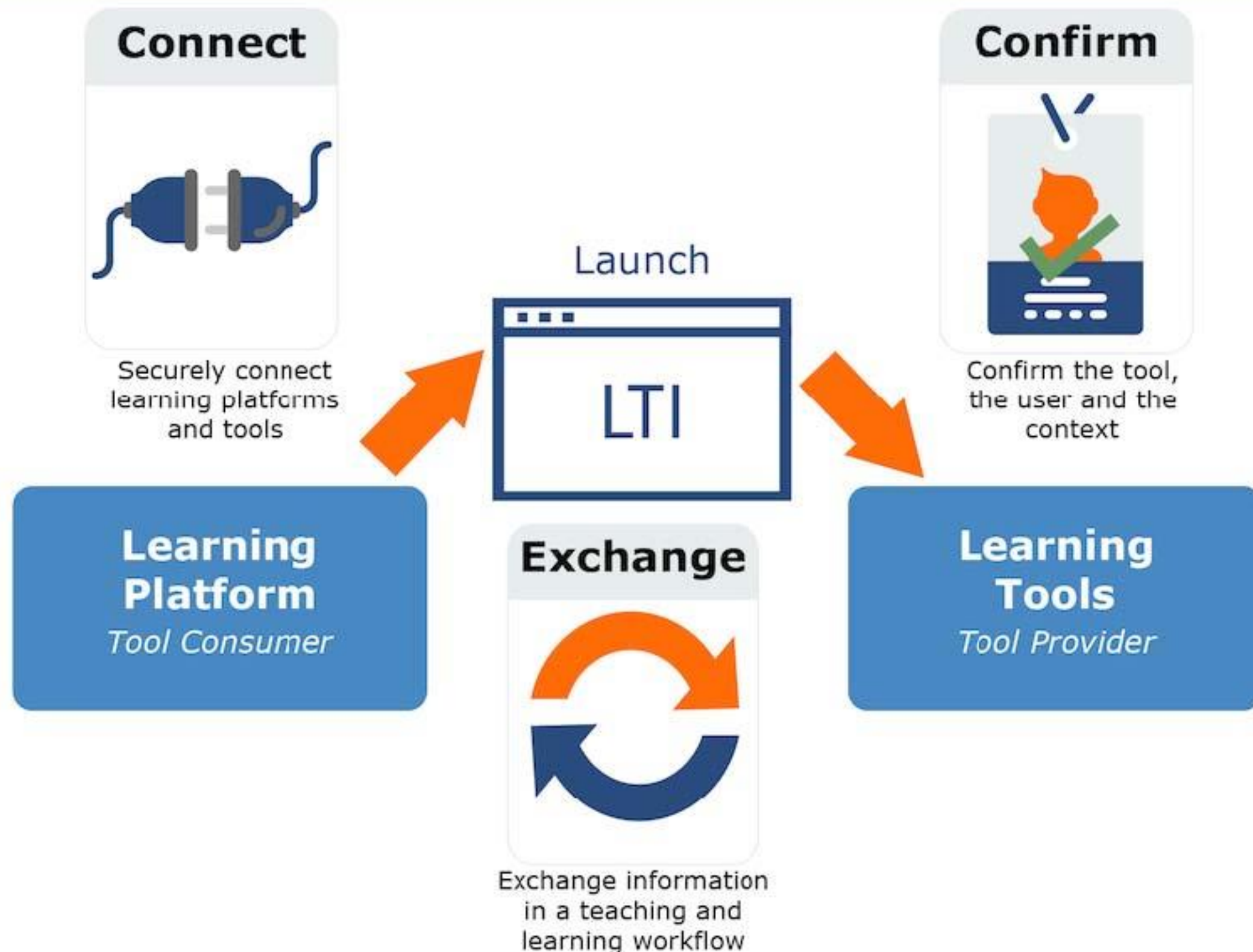


**LEARNING
PLATFORMS,
APPS & TOOLS**



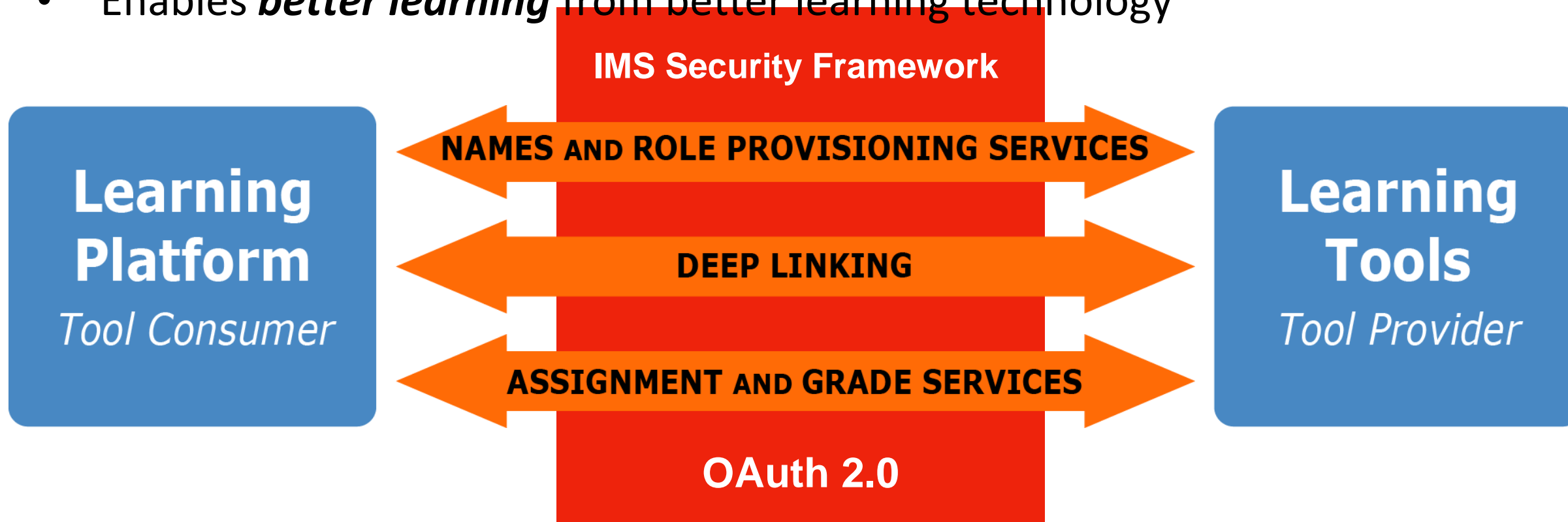
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CURRICULUM**

Essential Features of Learning Tools Interoperability® (LTI®)

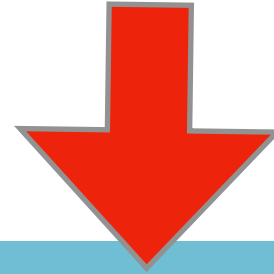


Next Generation Integrations at the Speed of Now

- LTI Advantage builds on LTI v1.3 to enable ***better and more secure integrations***
- Creates ***better user experiences***
- Enables ***better learning*** from better learning technology



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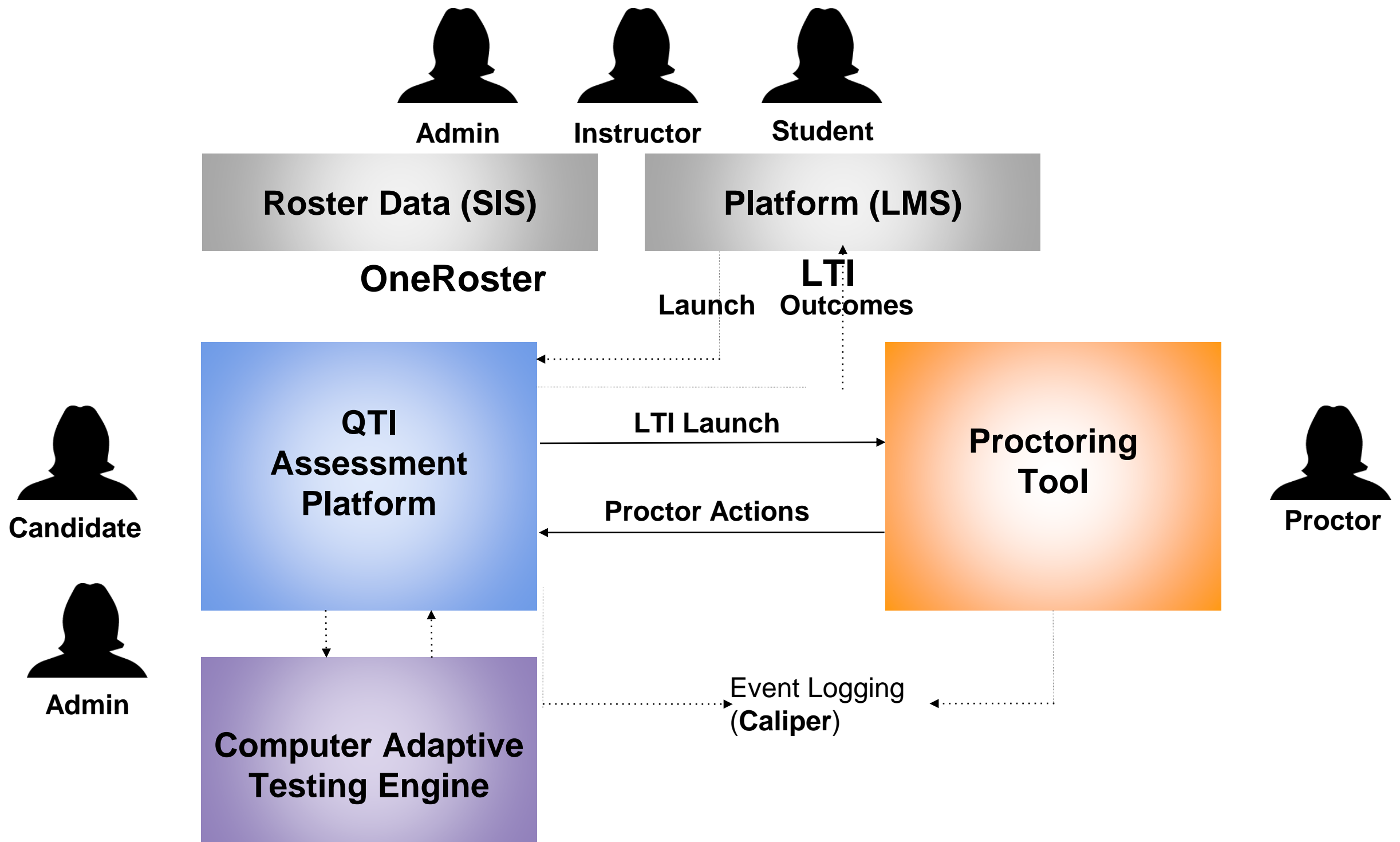
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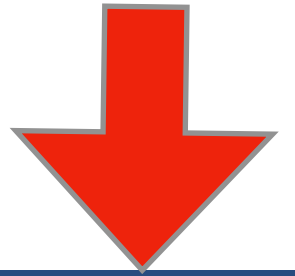
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QTI Benefits

- **Universal Design** – accessibility and accommodations for all students
- **Open Format** – ability to port test items between vendor platforms
- **Diagnostic, Formative and Summative** – applicable to all forms of assessment (paper and online)
- **Device Independent** – assessments can be delivered across a variety of devices, operating systems, and browsers
- **Ecosystem** – alignment with other edtech standards



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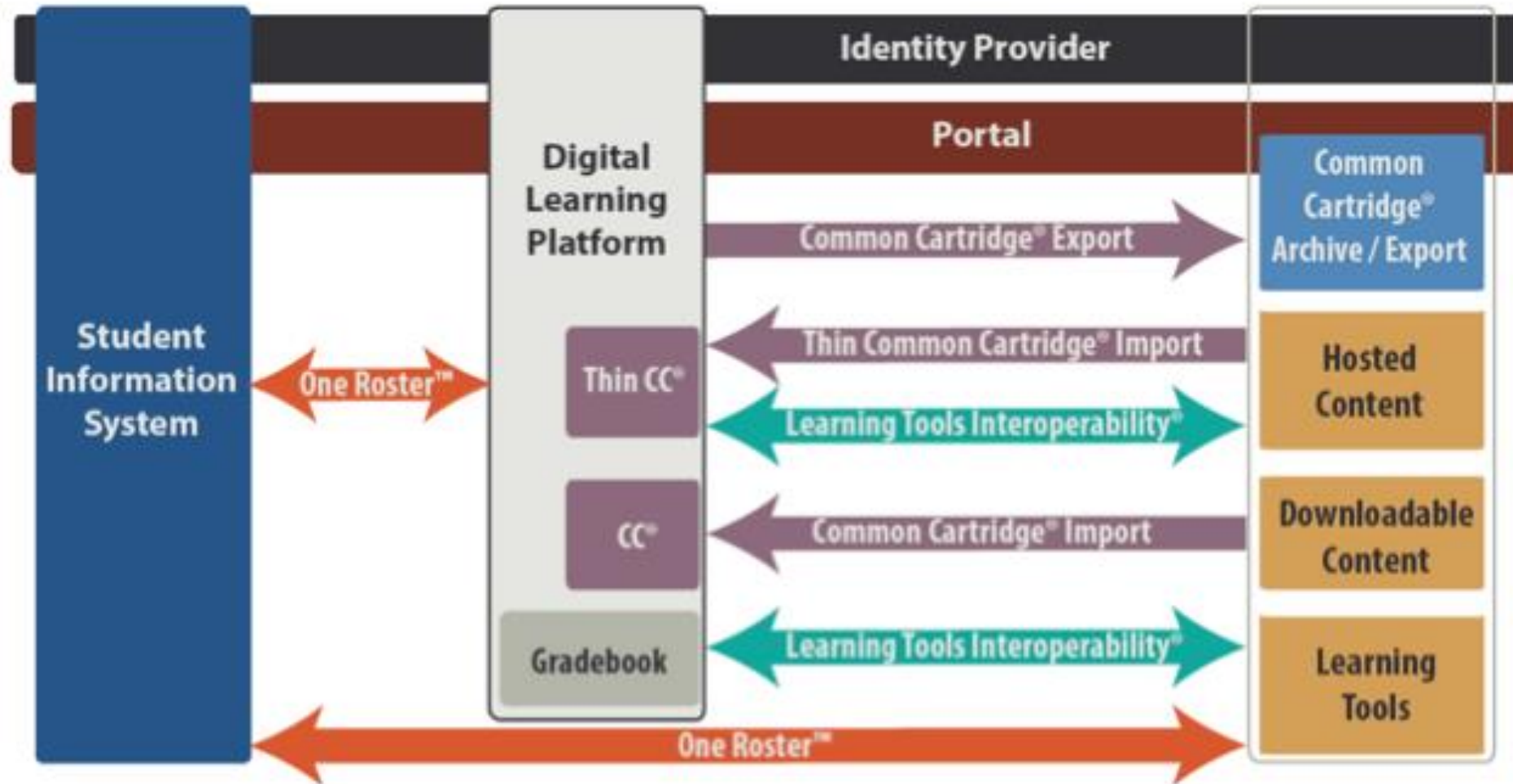


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OneRoster & Common Cartridge



	Technical Work	Technical Focus
	Accessibility	Accessibility, inclusive design, and personalization of online learning resources to meet the needs of all users/learners
	App Sharing & Integration Protocol	Peer-to-peer educational app sharing catalogs and storefronts
	Caliper Analytics	Consistently capturing and presenting measures of learning activity and defining a common language for labeling learning data, with a standard way of measuring learning activities and effectiveness enabling designers and providers of curriculum to measure, compare and improve quality
	Common Cartridge	Organization, publishing, distribution, delivery, and search of a wide variety of collections of digital learning content, applications used as the basis for or in support of online learning of any type.
	Digital Credentialing	Development of "eT," an extended transcript data standard, and creation of a Credentialing Registry
	EDUPUB	Establishing a globally interoperable, accessible, open ecosystem for e-Textbooks and other Digital Learning Materials via EPUB3, Educational Sector Standards and the Open Web Platform
	Learning Tools Interoperability	Integrating rich learning applications (often remotely hosted and provided through third-party services) with platforms like learning management systems, portals, learning object repositories, or other educational environments.
	OneRoster and Learning Information Services	Exchange and synchronization of roster information and grades which focuses on people, memberships, courses and outcomes.
	OpenVideo	Creation of video capture metadata to enable information from any video to be shared and searched
	Privacy and Security	Development of a Privacy Service which will carry privacy preferences across systems and tools
	Question and Test Interoperability/Accessible Portable Item Protocol	Exchange of item, test and results data between authoring tools, item banks, test construction tools, learning systems and assessment delivery systems, including accessible assessments.

IMS Technical Activities
see <http://www.imsglobal.org/developers>

Towards an interoperable ecosystem: modus operandi

- Technical Specifications
- Best Practices & Guidelines
- Code Libraries / Reference Implementations
- *Certification & Product Directory*

IMS Standards

Common Cartridge

LTI

IWBCFF

LIS

QTI/APIP

Caliper Analytics

OneRoster

OneRoster v1 Certified

OneRoster v1.1 Certified

CASE

OpenBadges

Product Category

Audience



D2L Corporation

Product:
Brightspace By D2L V10.7.3

OneRoster V1.1 CSV
Rostering Import Bulk,



Instructure

Product:
Canvas V2017.7.11
OneRoster V1.1 REST
Data Consumer
Rostering Core



ClassLink, Inc.

Product:
Classlink OneClick V2016.7.28
OneRoster V1.0 REST
Data Consumer,



ClassLink, Inc.

Product:
ClassLink OneRoster V3.24.2017
OneRoster V1.0 CSV
Export Bulk Only,



Classworks

Product:
Classworks V3.2017
OneRoster V1.1 CSV
Rostering Import Bulk



Clever

Product:
Clever V2017.07.06
OneRoster V1.1 CSV
Resources Export
Bulk



Clever

Product:
Clever V2016.9.16
OneRoster V1.0 CSV
Import Bulk Only,
OneRoster V1.0 REST



Authentica Solutions

Product:
DataSense Integration PaaS And Education Data



Learning Tapestry, Inc.

Product:
EASOL Ed-Fi To OneRoster Tool 1.1
OneRoster V1.0 CSV



Pearson Education

Product:
EasyBridge V4.3
OneRoster V1.0 CSV
Import Bulk Only
OneRoster V1.1 CSV



EdWire Inc.

Product:
EdGraph V2017.02.01
OneRoster V1.0 CSV
Export Bulk Only



SunGard K-12 Education

Product:
ESchool Plus V3.X
OneRoster V1.0 REST
Data Provider



ExploreLearning

Product:
ExploreLearning Gizmos
OneRoster V1.1 CSV
Rostering Import Bulk



FastBridge Learning

Product:
FAST V07152016
OneRoster V1.0 REST
Data Consumer



Instructure

Product:
Gauge V2017.7.26
OneRoster V1.1 REST
Data Consumer
Rostering Core



Gwinnett County Public Schools

Product:
GCPS OneRoster API V1.0.0
OneRoster V1.1 REST



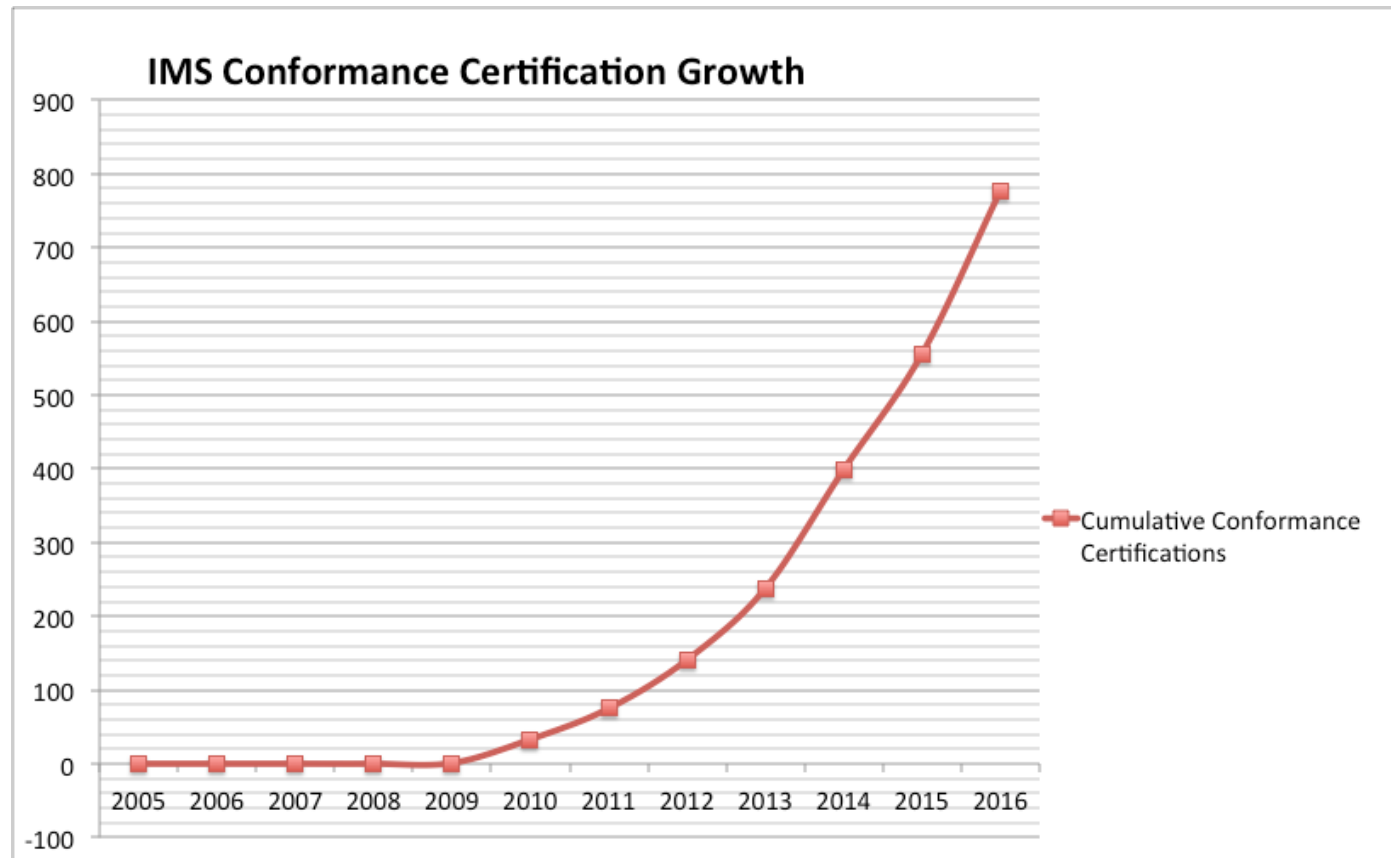
Gabbart Communications

Product:
Harmony V17.8.3
OneRoster V1.0 REST
Data Consumer



Houston Independent School District

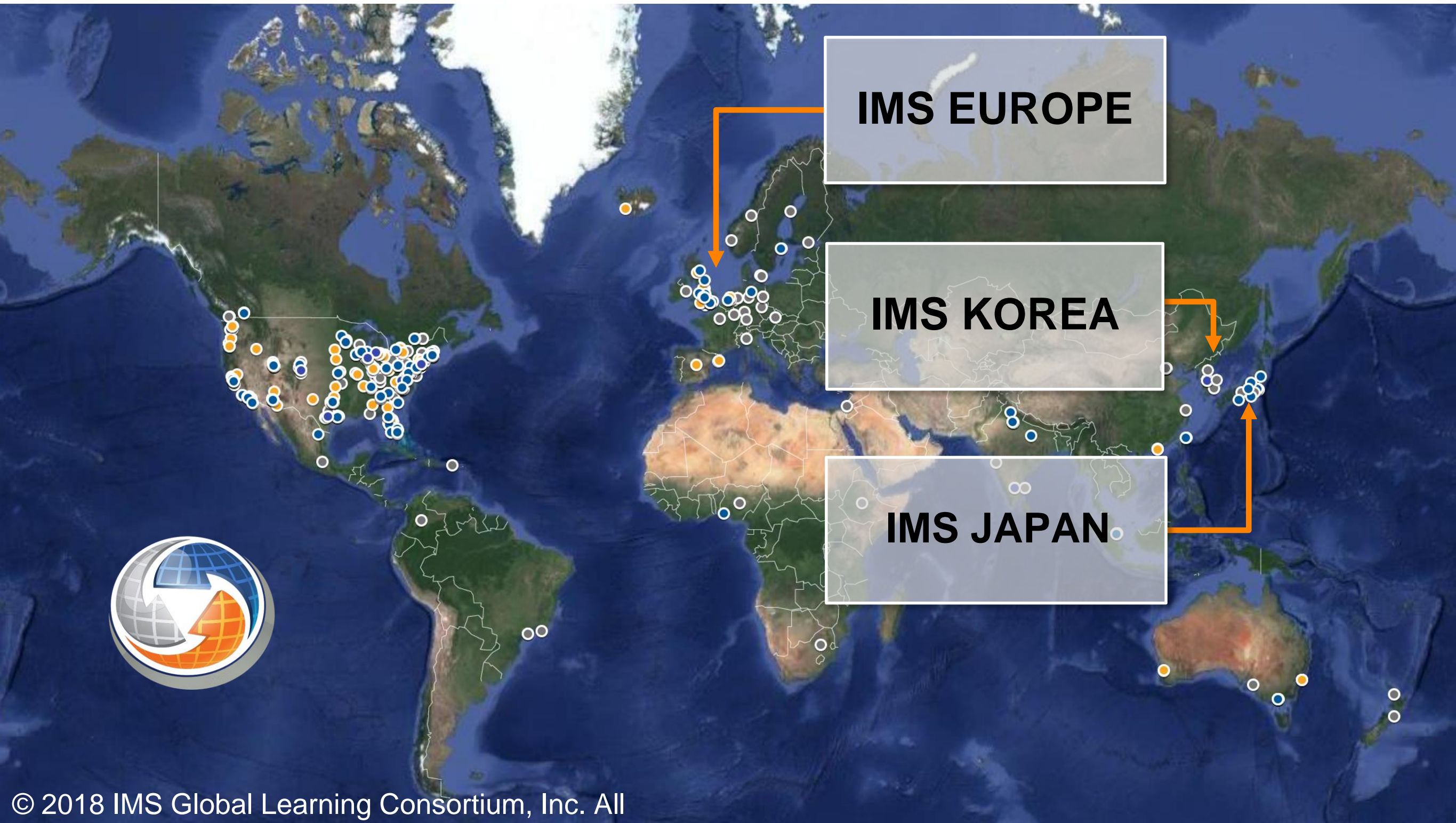
Product:
HISD Standard Roster V1.0



Adoption of certified applications/digital resources enables any application to seamlessly plug into another without requiring costly and timely custom integrations and share data to aid understanding of use of digital resources & student progress

Processes & Intellectual Property

- Formalized specification development process
 - Draft stages & TAB review approval, member vote
- IP protection policy embedded in process
- Specifications are not made available to the public until...
 - At least two interoperable implementations
 - IP review is completed



IMS EUROPE

IMS KOREA

IMS JAPAN



IMS Europe Summit November 8-9 Utrecht, Netherlands

**Includes general sessions
and LTI Advantage Bootcamp**

<https://www.imsglobal.org/event/ims-europe-summit-2018>

also coming this autumn:

- **IMS Korea & Japan tech briefings**
- September: LTI Advantage Developer Toolkit
- Expansion of train-the-trainers programme

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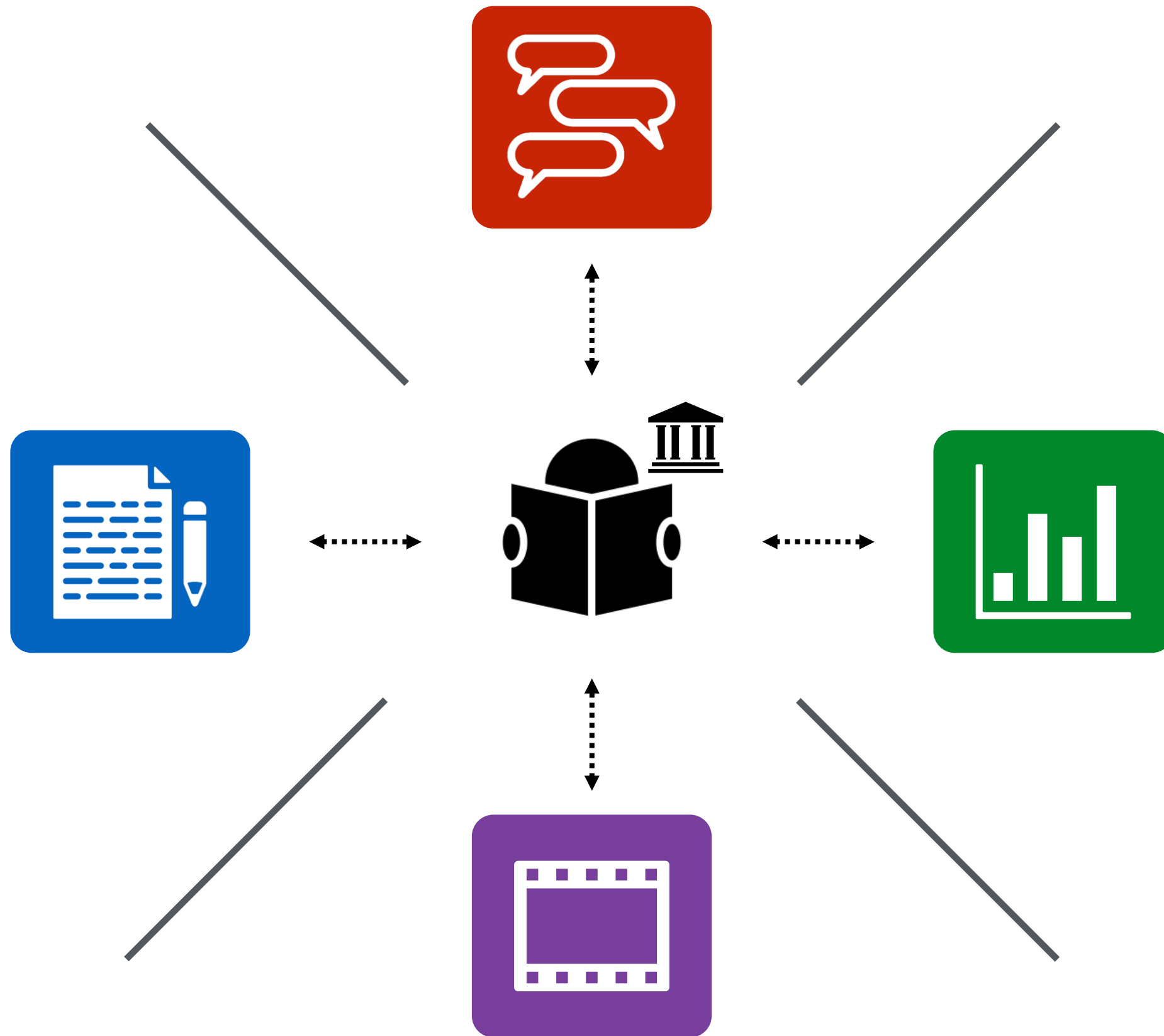
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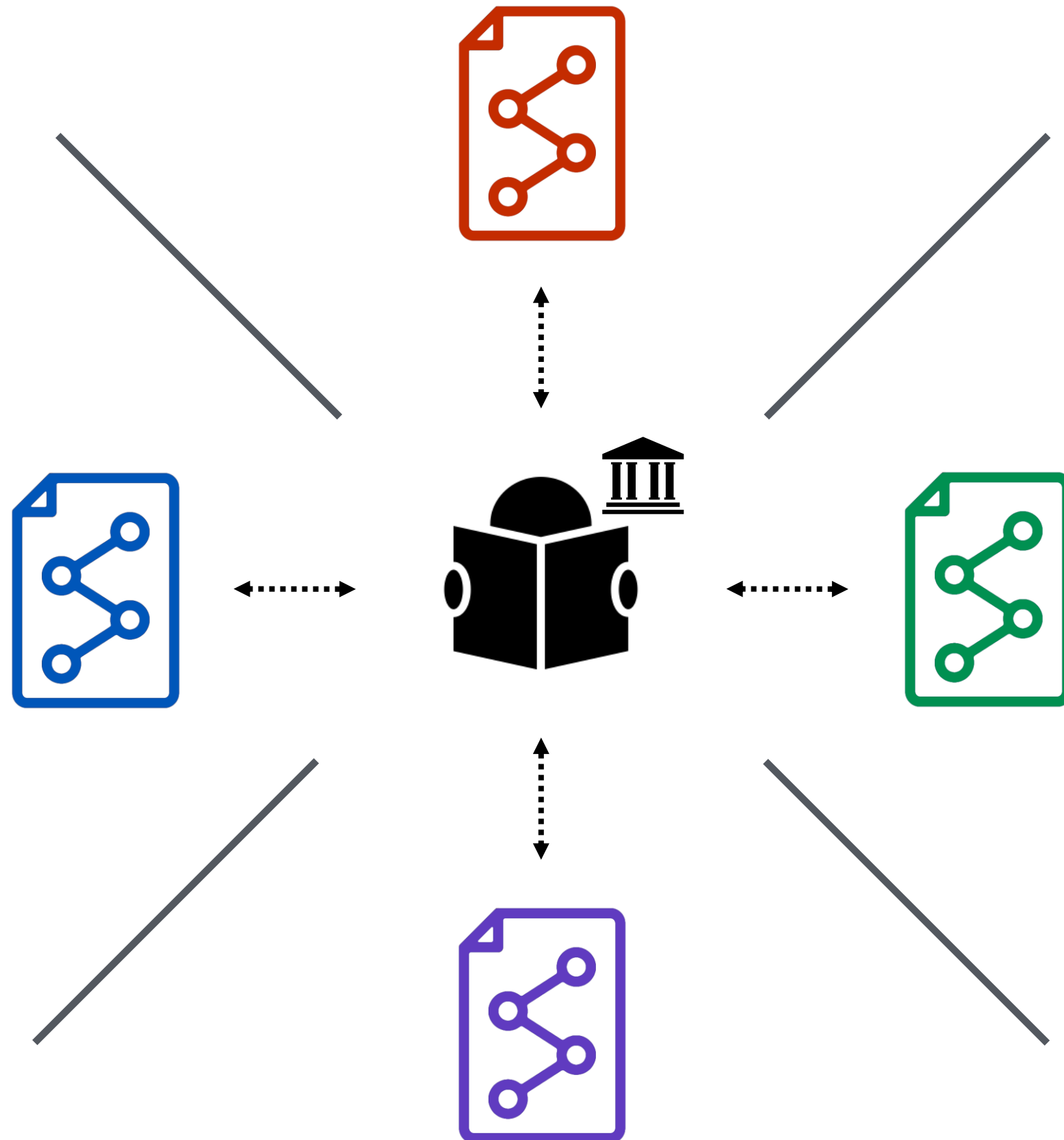
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2. Caliper Overview & Status

Challenge: a world of distributed apps



Challenge: a world of distributed data

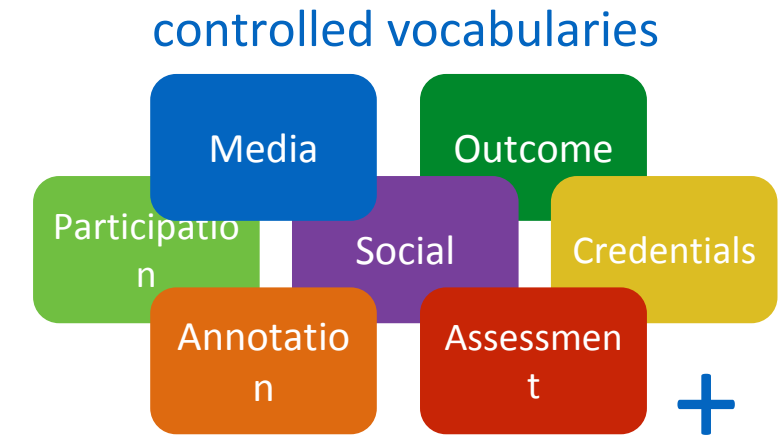


Why Caliper?

promote

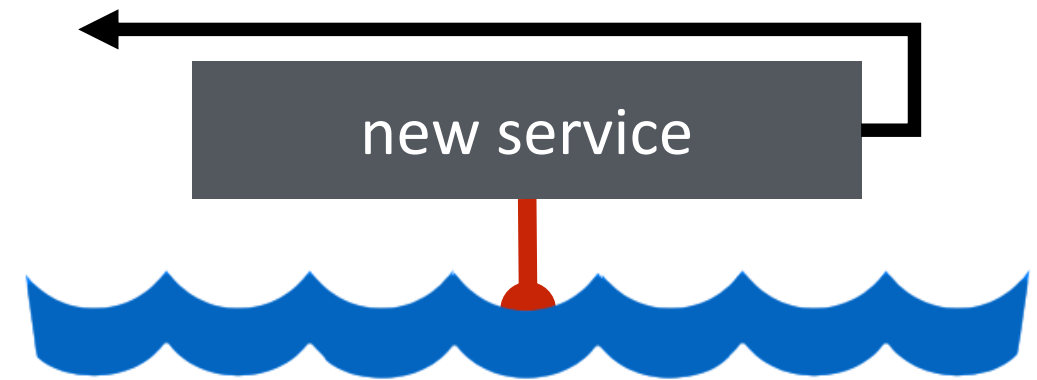
interoperability

data / semantic



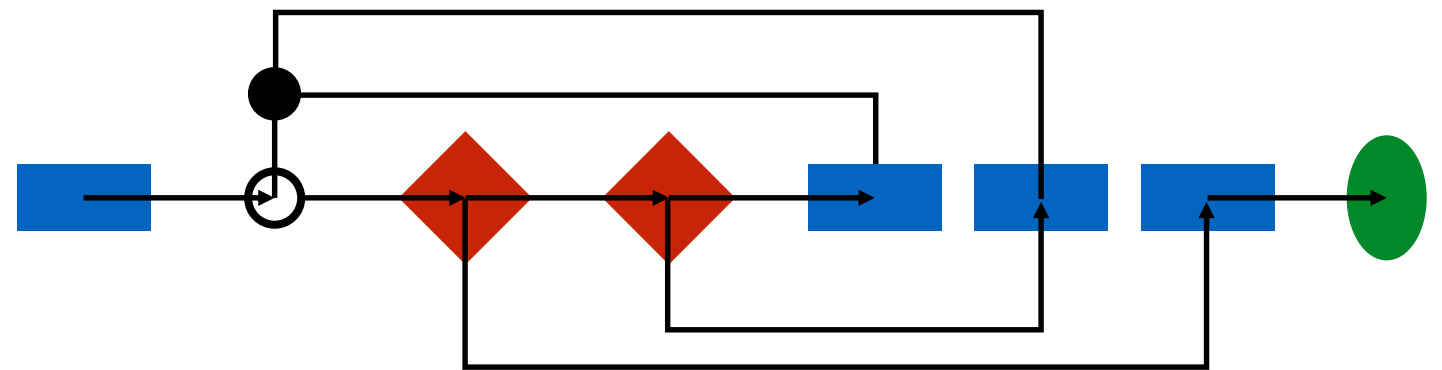
enable

innovation

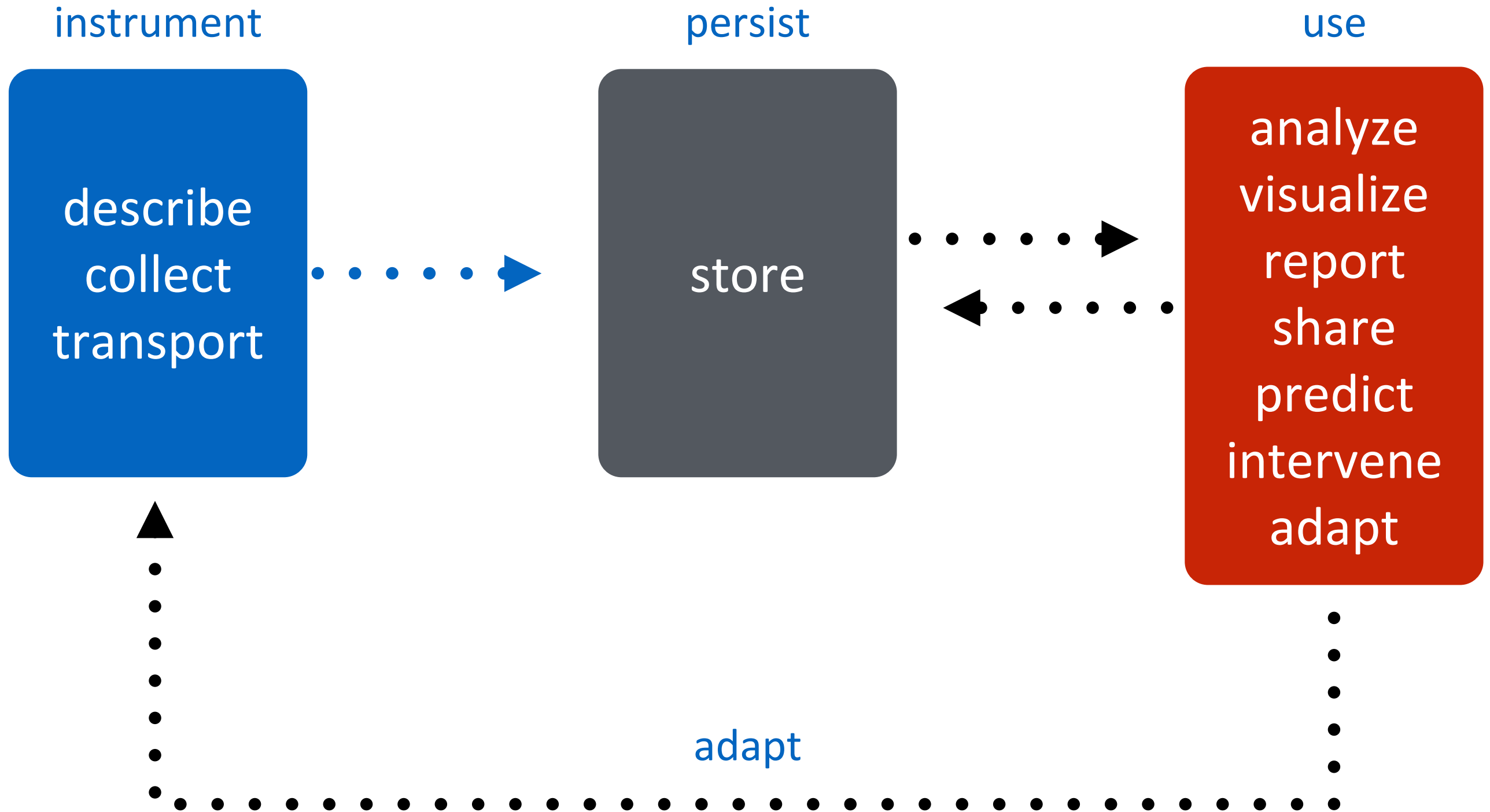


feed

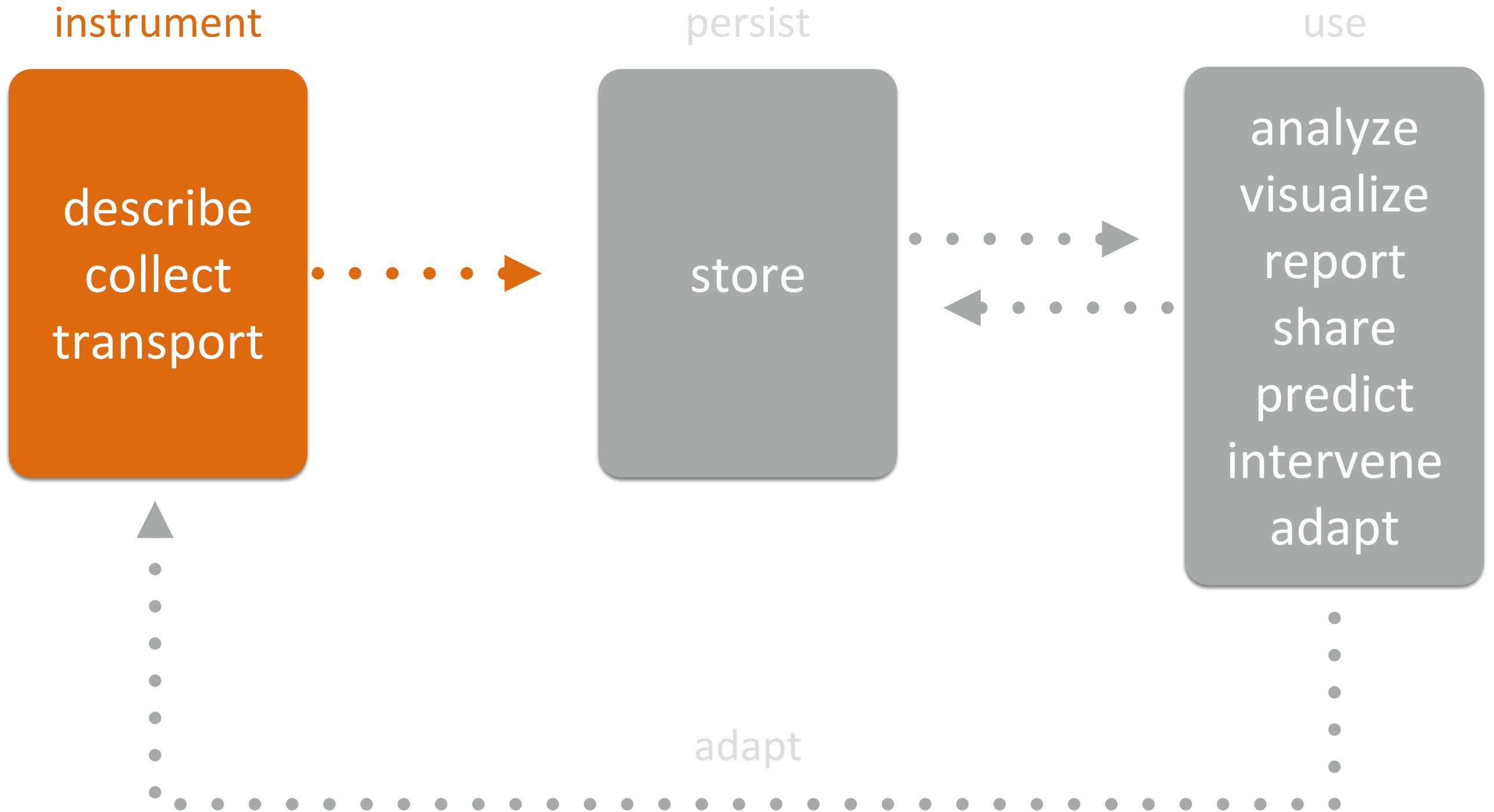
insights



Caliper 1.x scope

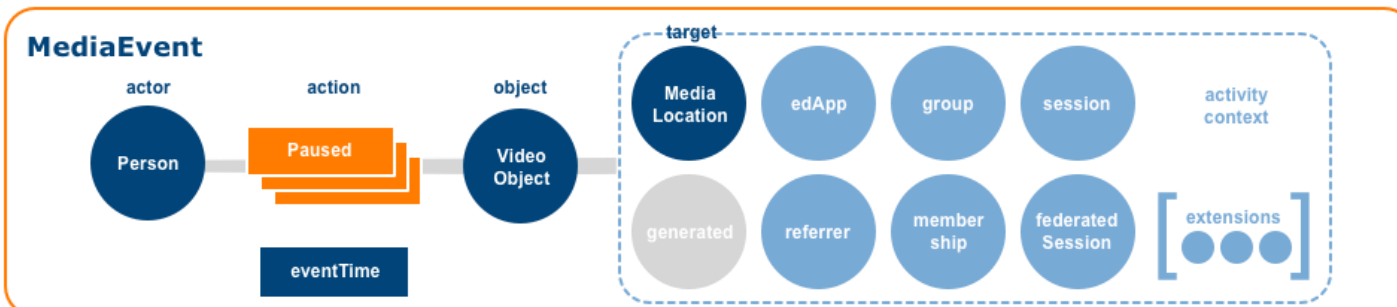
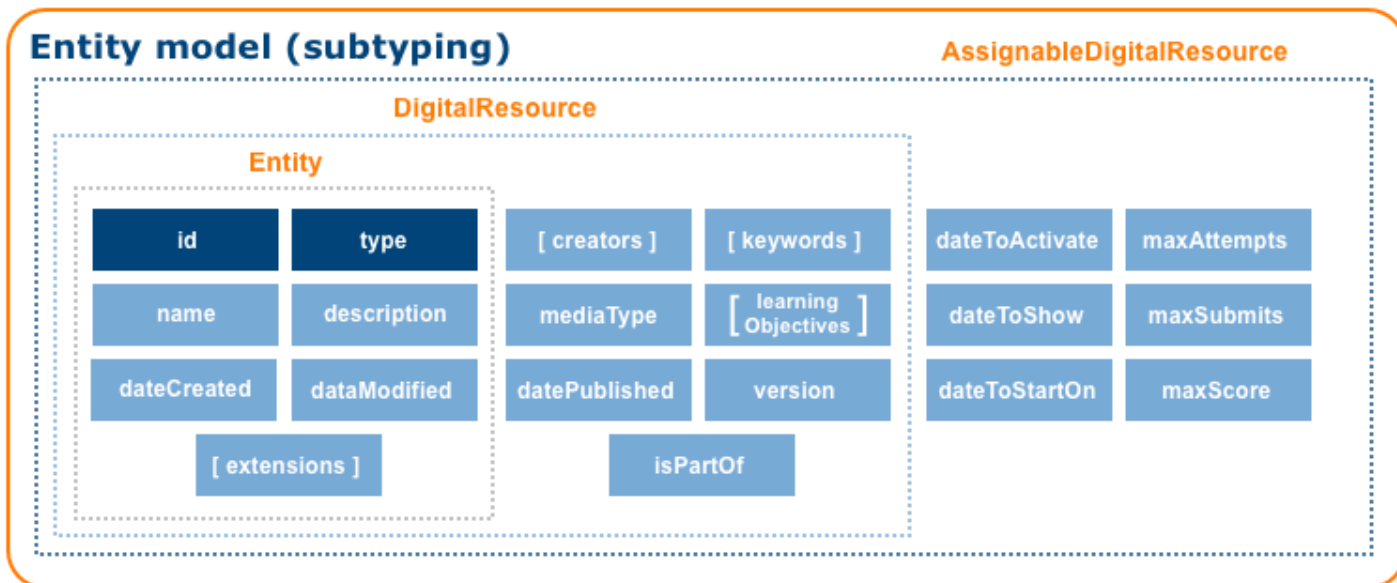
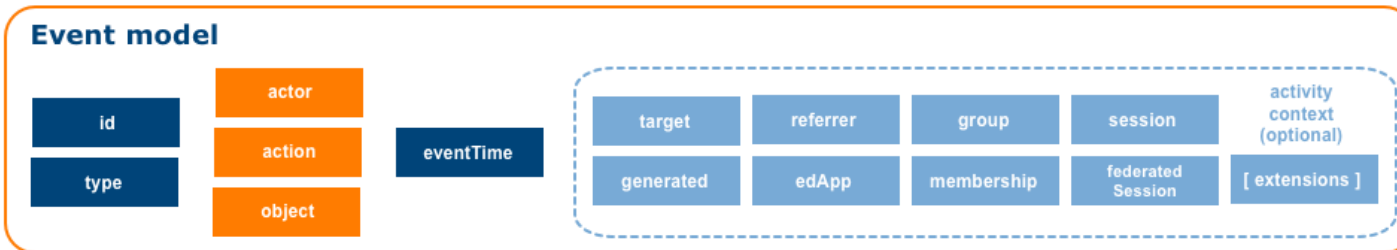
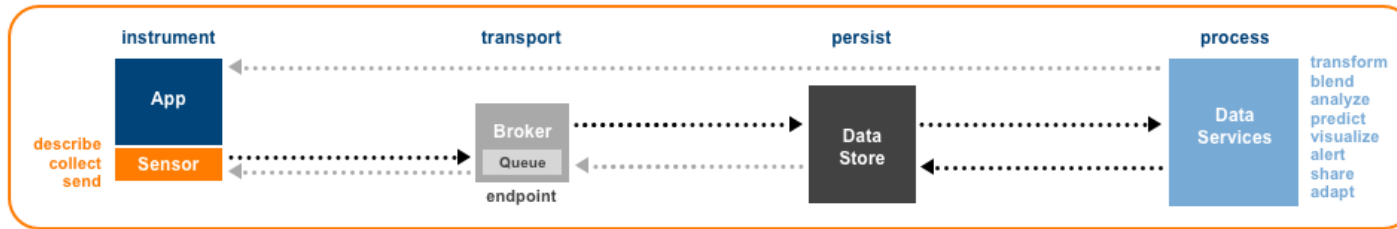


Caliper 1.x scope



Caliper 1.1 specification

<https://github.com/IMSGlobal/caliper-spec/>



Branch: master - caliper-spec / caliper-spec.md

arwhyte Clarify MediaEvent.target description. Resolves #241 c016364 on Jan 18

3 contributors

5928 lines (4968 sloc) | 468 KB

IMS GLOBAL
Learning Consortium

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Caliper Analytics® Specification, version 1.1

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 - 1.1 Status of this Document
 - 1.2 Summary of Changes
 - 1.3 Conventions
 - 1.4 Terminology



Caliper 1.1 certification

<https://github.com/IMSGlobal/caliper-cert-guide/>



Code Issues 1 Pull requests 1 Projects 0 Wiki Insights

Branch: master - caliper-cert-guide / caliper-sensor-cert-guide.md Find file Copy path

arwhyte Fix Caliper spec reference link. 08533f4 on Jan 19

1 contributor

606 lines (388 sloc) 57.8 KB Raw Blame History



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Caliper Analytics® Sensor Certification Guide, version 1.1

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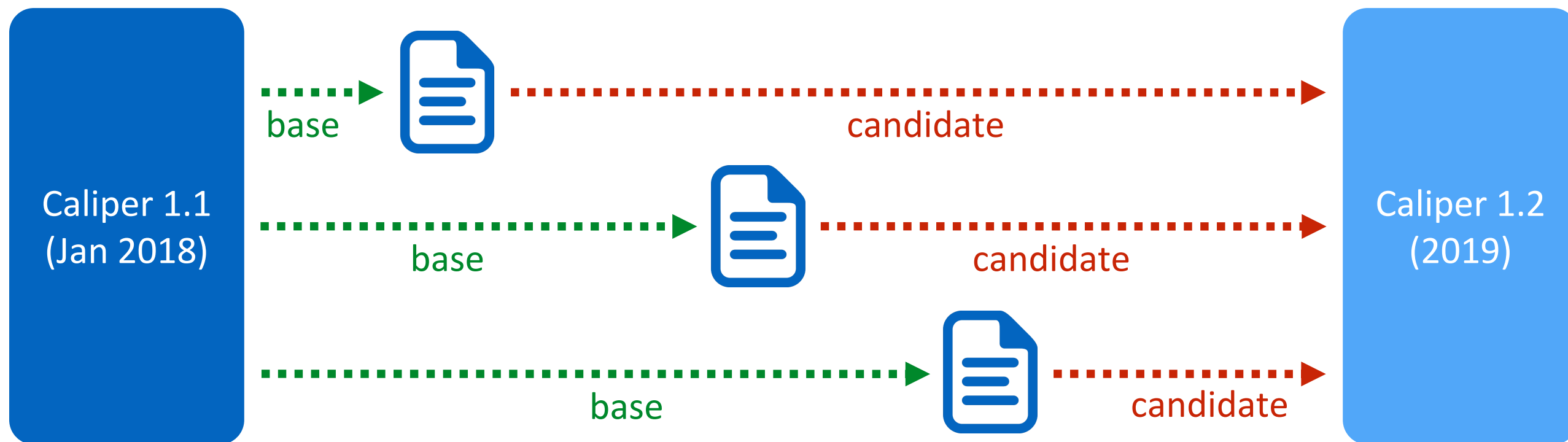
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- 2.0 Certification Prerequisites

Caliper standalone profile releases



Phase	Stability	Visibility	Contract
Base (beta)	unstable	contributing members	vocabulary additions removable at any time
Candidate	stable	public	vocabulary additions included in next point release
Final	Stable	Public	Vocabulary additions rolled into Final Vocabulary/Syntax spec.

Caliper 1.1 profiles (vocabulary)



Annotation
Profile



Assessment
Profile



Assignable
Profile



Forum
Profile



Grading
Profile



Media
Profile



Reading
Profile



Session
Profile



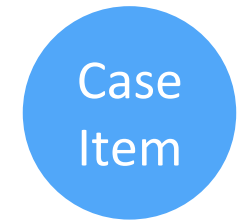
Tool Use
Profile



Basic
Profile

1.1 additions

Caliper: upcoming profiles



Tool Launch
Profile



Search
Profile



QTI
Profile



Survey
Profile



Feedback
Profile



Mastery
Profile



Badging
Profile



Participation
Profile



Resource Mgmt
Profile



Social
Profile

...

Caliper code repos (Github)

project backlog

caliper-central

docs

caliper-spec

caliper-ontology

sensors

caliper-java

caliper-js

caliper-ruby

caliper-

python

caliper-php

caliper-net

JSON-LD

caliper-contexts

caliper-common-fixtures

sample code

caliper-java-example

caliper-js-example

caliper-net-example



Caliper repositories are open to the public

Open Source Implementations

Caliper Sensors

caliper-java

caliper-js

caliper-ruby

caliper-python

caliper-php

caliper-net

<https://github.com/imsiglobal>

Caliper Endpoints

OpenLRW

<https://github.com/Aperero-Learning-Analytics-Initiative/OpenLRW>

Callisto

<https://openedinc.github.io/callisto/>



<https://github.com/purdue-tlt/Caliper-iOS>

OSS (Apache 2)



Real World Implementation Examples

Real World Implementation Examples:

Unizin



The Unizin Consortium

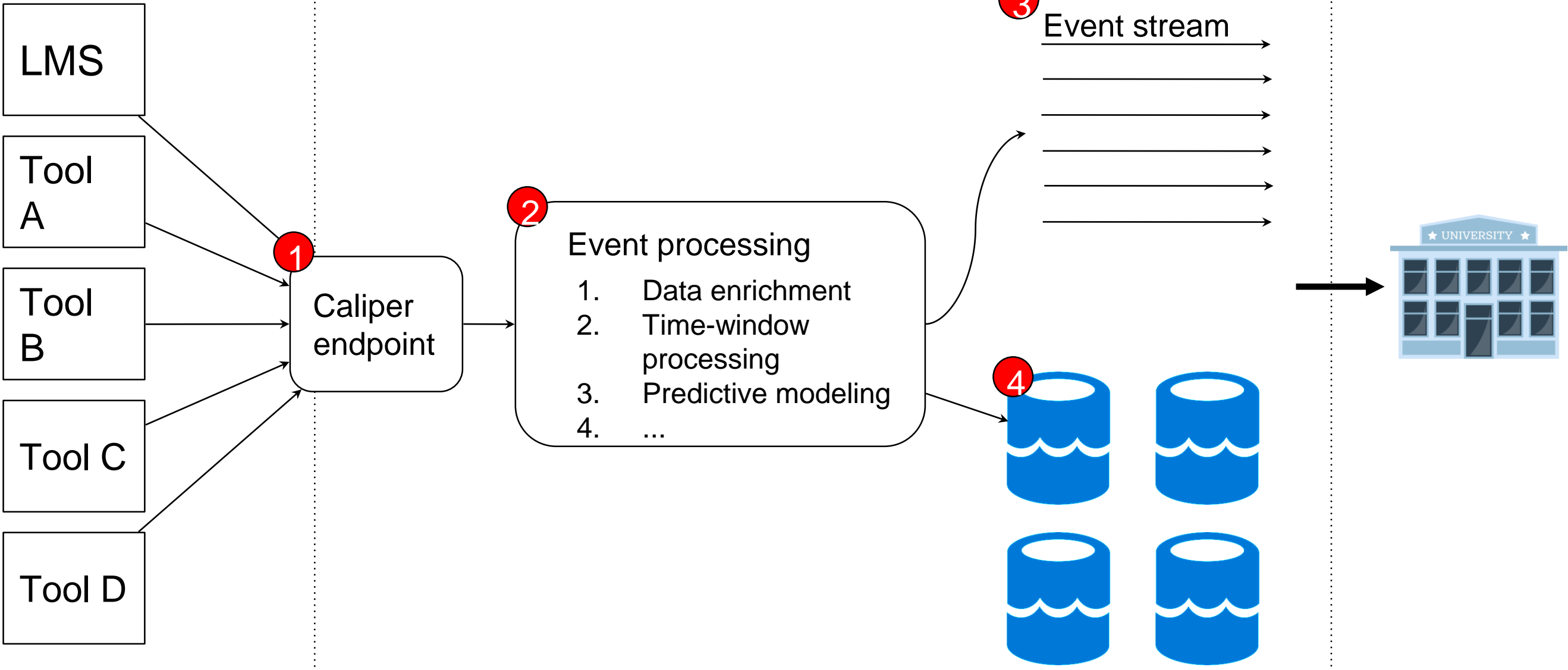


Unizin Data Platform

Three key ideas

- **A common model for all T&L data**
Unifies a representation of teaching & learning data
- **An institutional T&L data platform**
Integrate all T&L tool data and create a single, dynamic view of the learner.
- **Collaboration in data products and services**
Enable collaboration in research, analytics, reporting, tools, etc.

Unizin Data Platform



State today

- 4 running Unizin Data Platforms
- Fall 2018: 500M+ events across the consortium
- Partners: Instructure Canvas, Turnitin, Macmillan Learning,
TopHat
- Institutional tools: IU Quickcheck, UMich LectureCapture, Unizin
Engage

Data-driven teaching and learning

- **Advising.** Understanding and guiding student habits, practices, behaviors.
- **Content and course design.** Outcomes-oriented behaviors reveal efficacy of design.
- **Teaching analytics.** In-the-moment, just-in-time-teaching analytics based on interaction data.
- **Learning analytics.** Student insights into own behaviors, habits; nudging.
- **Adaptive learning.** Analytics-driven content and assessment.
- ... and many more.

Caliper endpoint

- Required component for any data ingestion
- Unizin has built one
- <https://unizin.caliper.dev.cloud.unizin.org>

Real World Implementation Examples:

Canvas

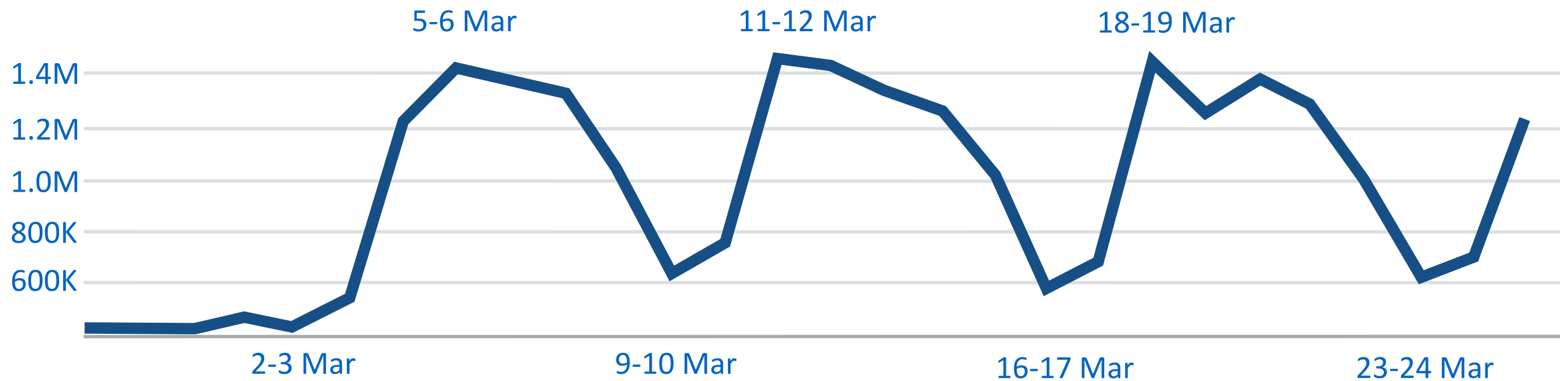
Canvas LiveEvents migration to Caliper 1.1 completed by EOY 2018

Michigan/Canvas LMS Live Events (Caliper)



Unizin UDP endpoint

Messages per day, March 2018



Peak: ~1.43M events/day



Real World Implementation Examples:

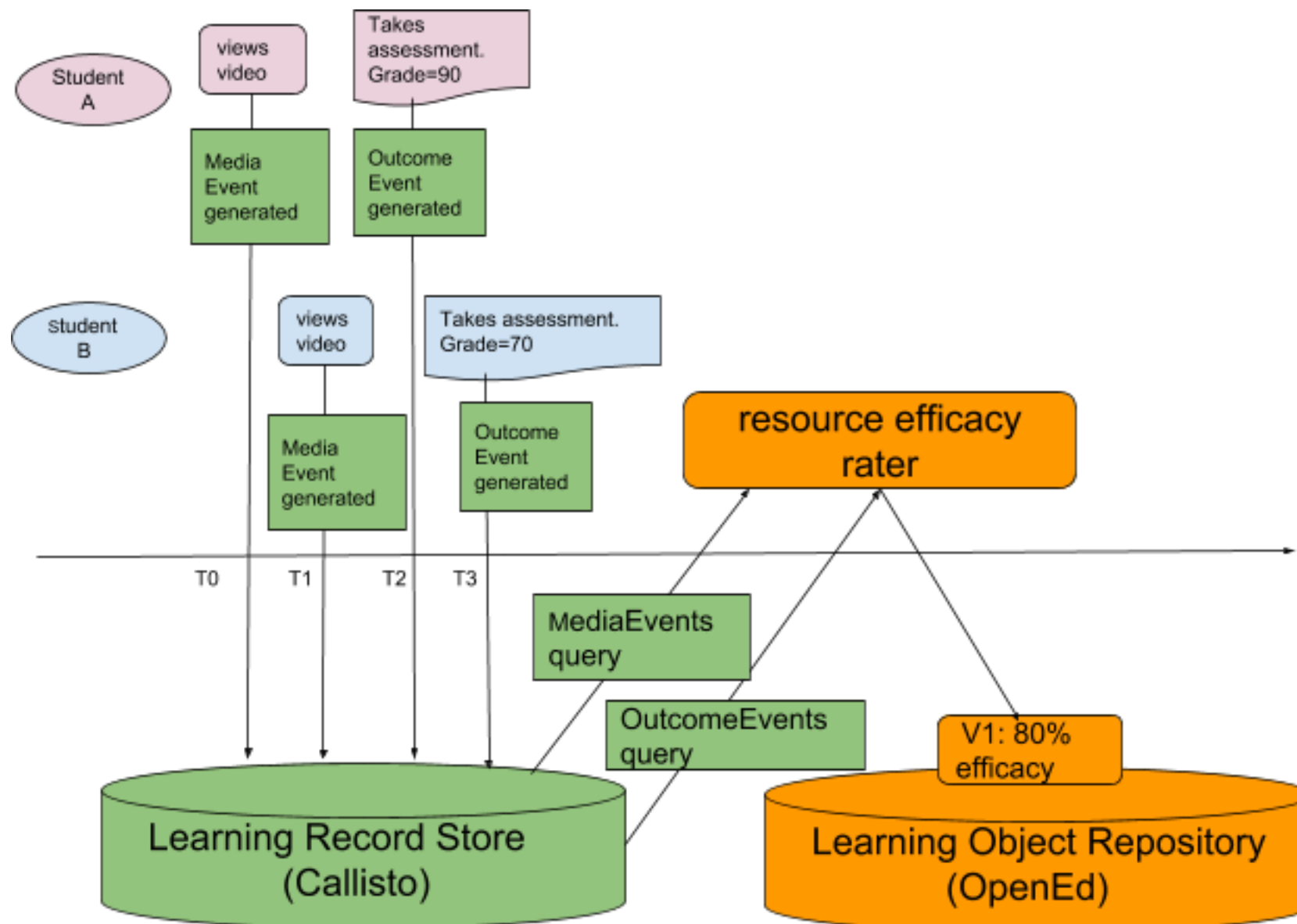
Blackboard Learn

*Migration to Caliper 1.1
currently ongoing*

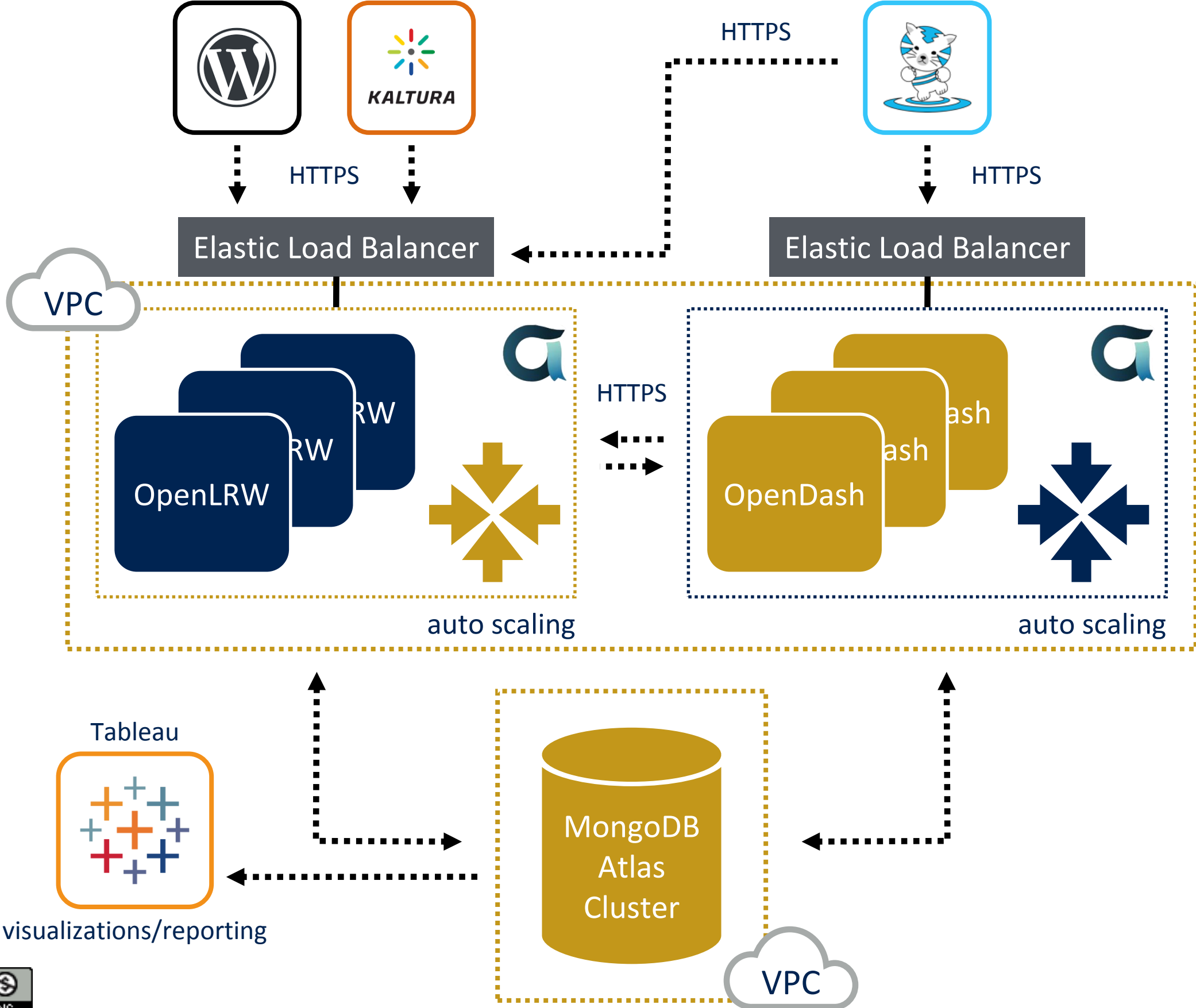


Blackboard

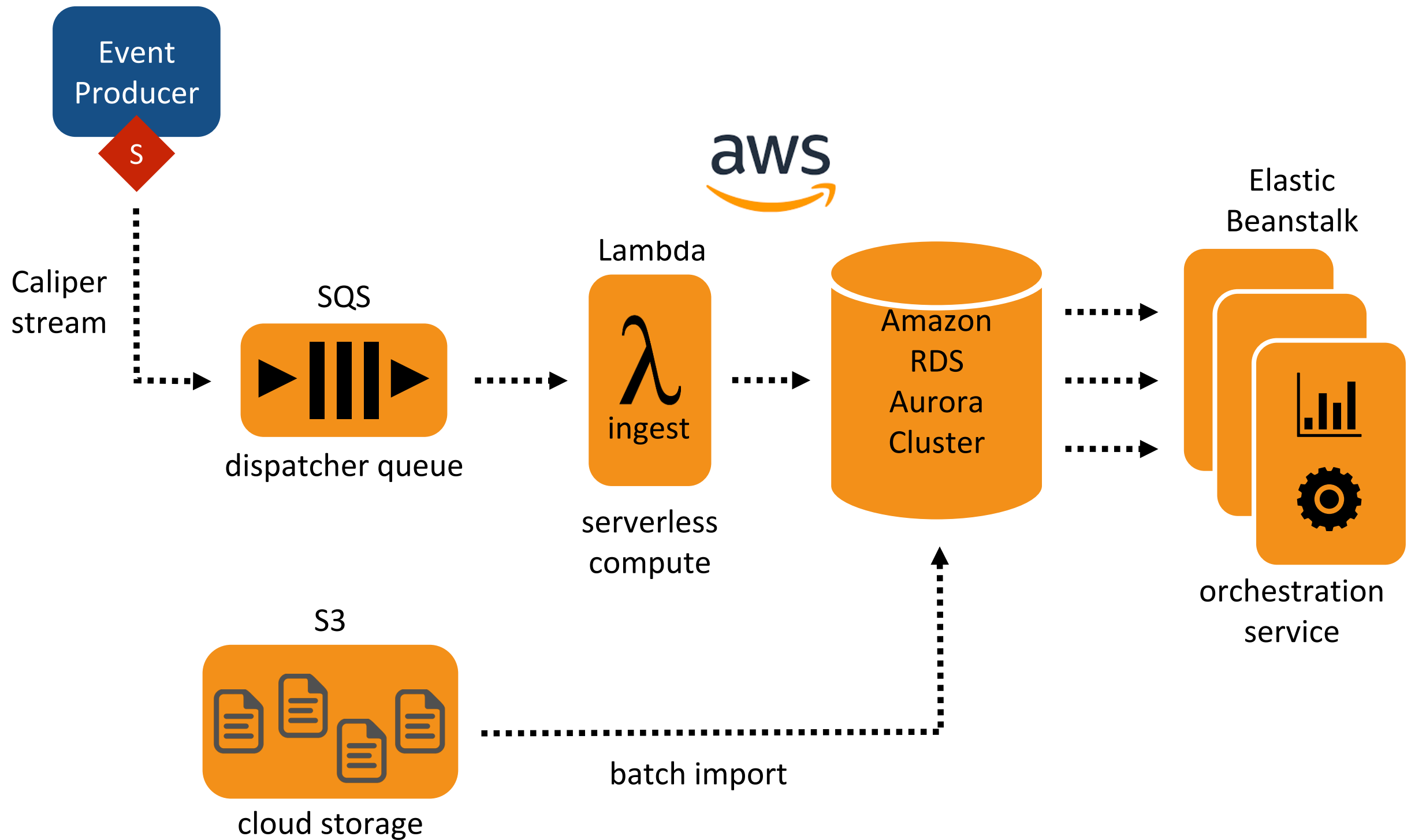
- AssessmentEvent
- AssessmentItemEvent
- AssignableEvent OutcomeEvent
- SessionEvent
- ViewEvent
- LTIEvent
- ContentEvent
- CalculatedGradeSnapshotEvent
- ForumEvent
- BlogEvent
- WikiEvent



Notre Dame: OpenLRW



UC Berkeley: CloudLRS

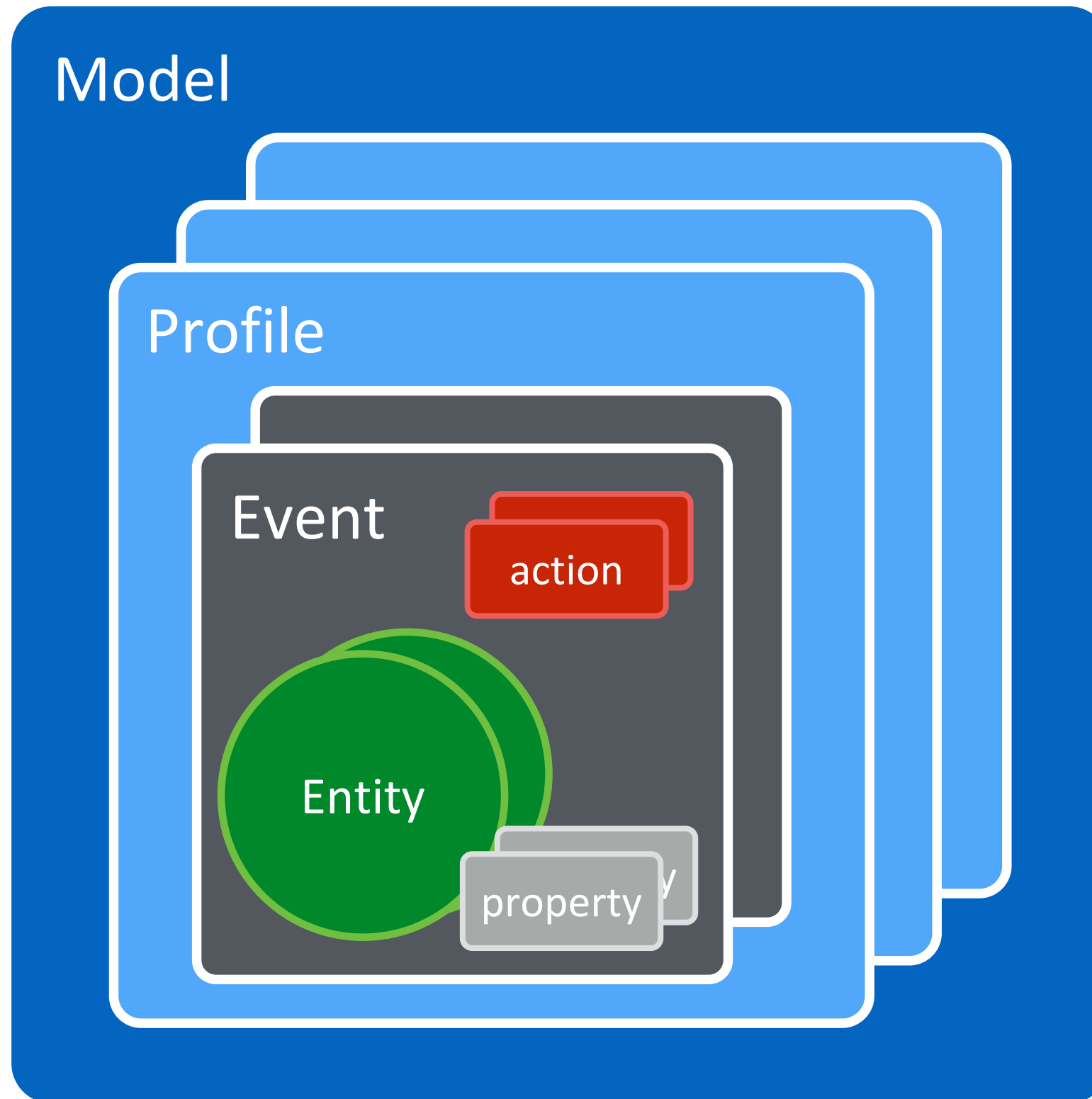


<https://aws.amazon.com/about-aws/global-infrastructure/>

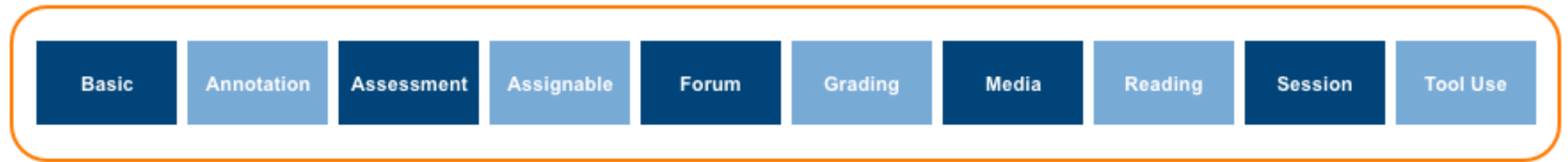


3. Caliper Architecture

Caliper model



The Caliper Profile



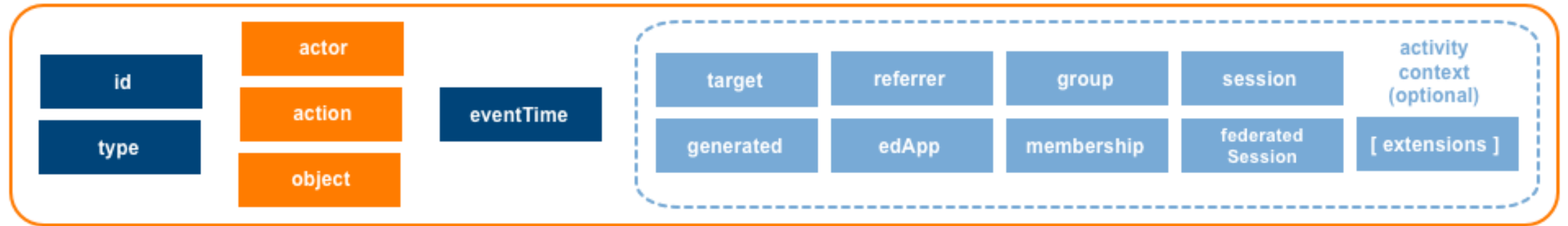
Provides a domain-specific set of terms and concepts to describe common user interactions in a consistent manner using a shared vocabulary.

- models a learning activity or a supporting activity that helps facilitate learning
- encourages vocabulary standardization and re-use among application providers

Vocabulary restrictions are outlined in each profile:


- supported events
- supported actors
- supported actions
- supported objects
- supported generated entities
- supported target entities
- other requirements

The Caliper Event



Describes the relationship established between an actor and an object, formed as a result of a purposeful action undertaken by the actor at a particular moment in time and within a given learning context.

The Caliper Event: properties

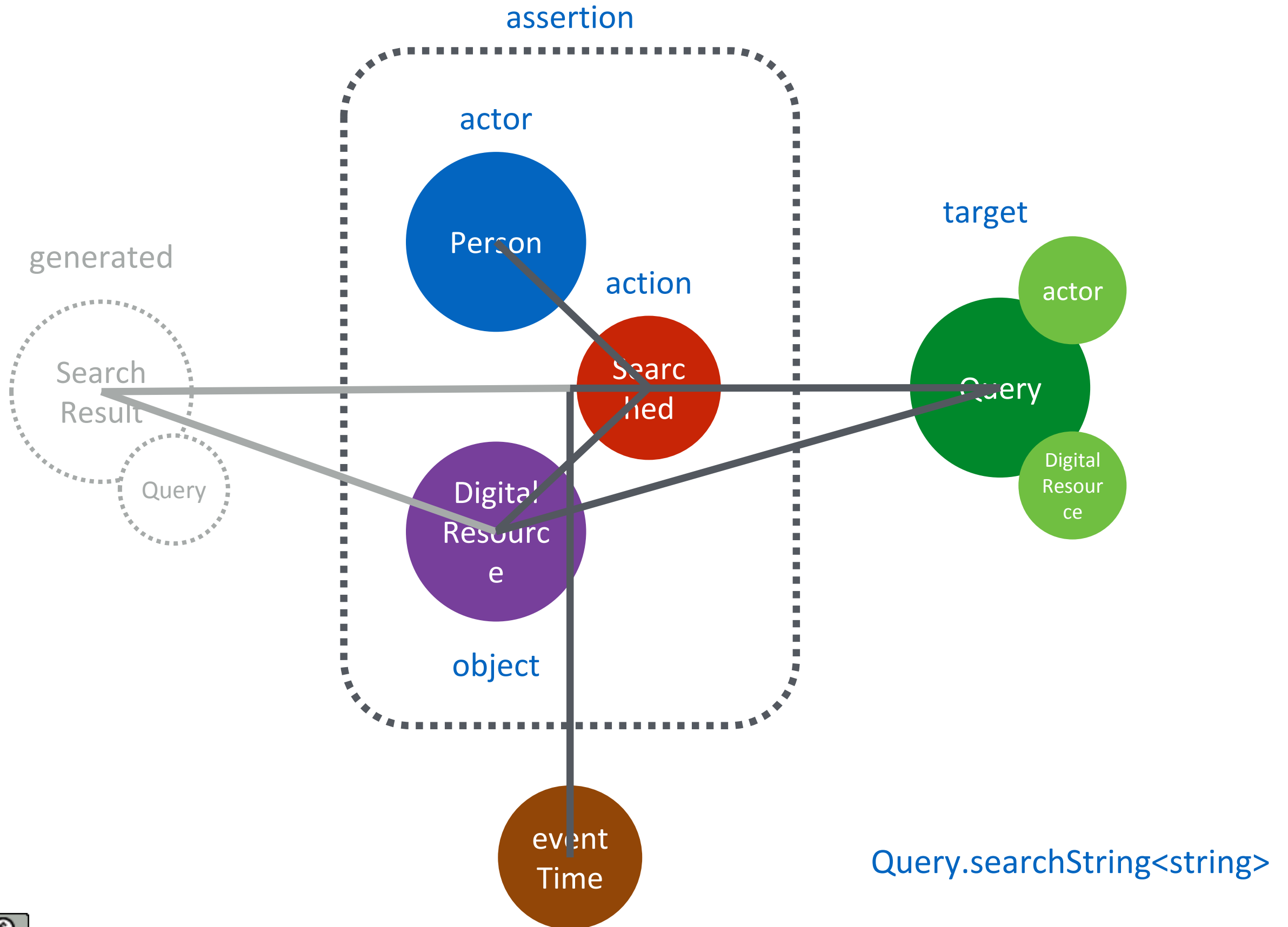
 = new 1.1



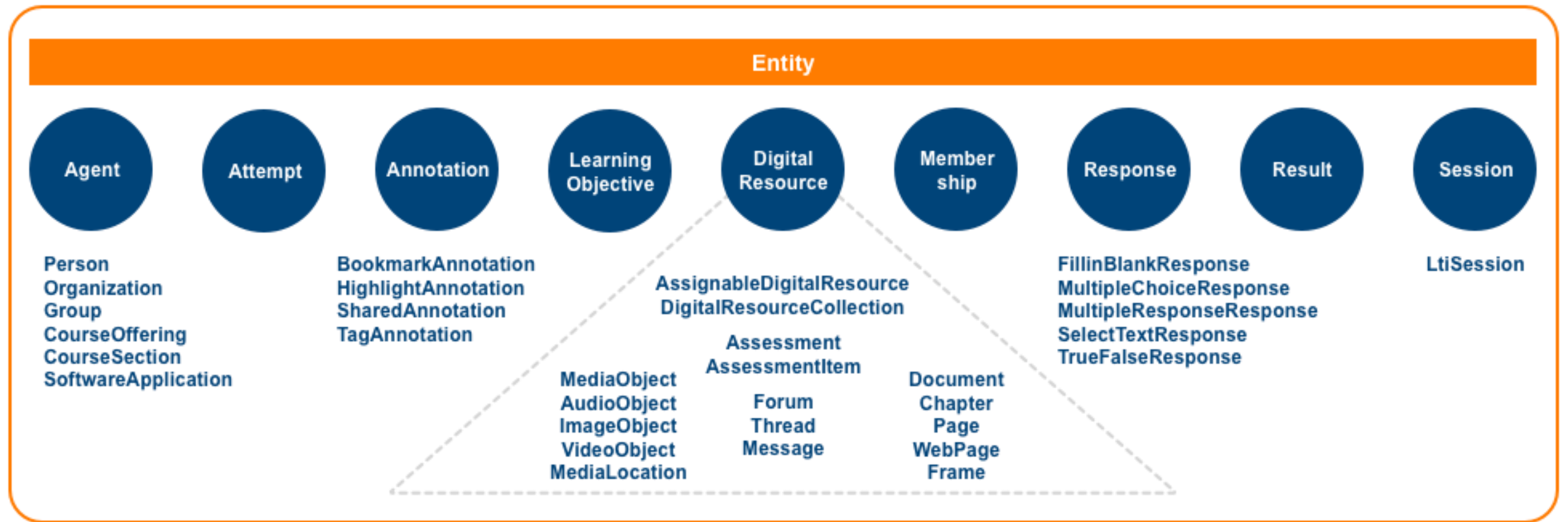
required

optional

Caliper 1.x SearchEvent (1.1 extension)



The Caliper Entity



A generic type that represents objects that participate in learning-related activities. Each

Caliper Profile: Media

MediaEvent

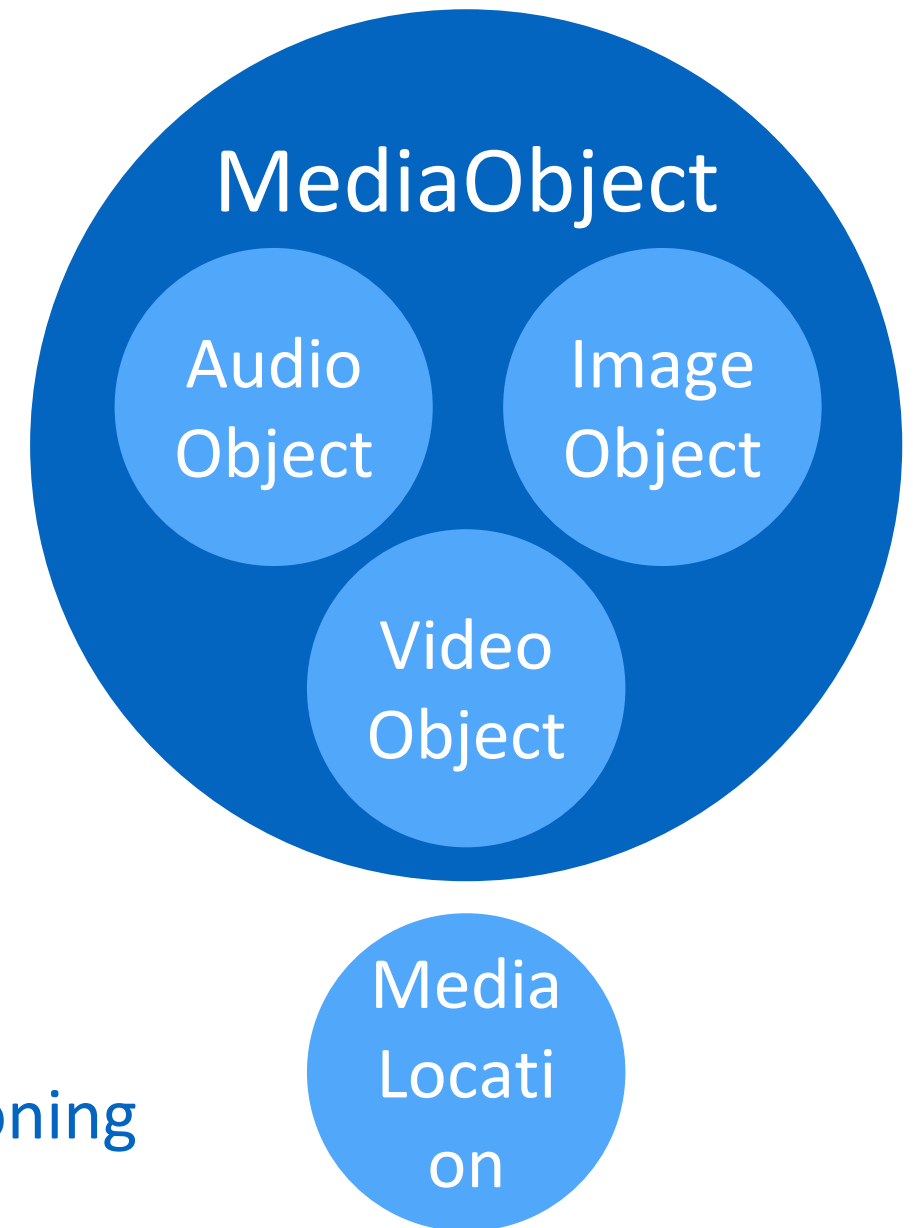
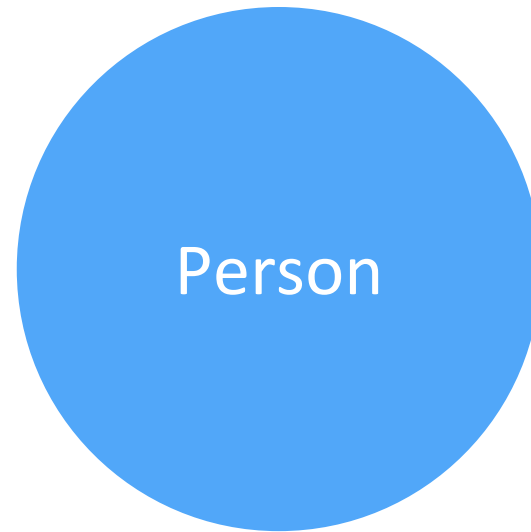
started / ended
changedSize
changedSpeed
changedResolution
changedVolume
enteredFullScreen / exitedFullScreen
forwardedTo
jumpedTo
muted / unmuted
openedPopout / closedPopout
paused / resumed
enabledClosedCaptioning / disabledClosedCaptioning

NavigationEvent

navigatedTo

ViewEvent

viewed



Caliper Media Object

id
type
name
description
creators
mediaType
keywords
learningObjectives
isPartOf
duration
dateCreated
dateModified
datePublished
version
extensions

Caliper and Linked Data

- **The basic triple: actor verb object**
- **Caliper uses JSON-LD as the serialisation**
- **JSON-LD provides context to statements**
- **Caliper also provides an ontology**
- **Caliper is designed so that JSON-LD awareness is optional**

<https://json-ld.org/primer/latest/>

Triples in Caliper and xAPI

Caliper event

@context type id

actor {} action object {}

eventTime

optional

target {} generated {} referrer {}
edApp {} group {} membership {}
session {} federatedSession {}
extensions {}

xAPI statement

actor {} verb object {}

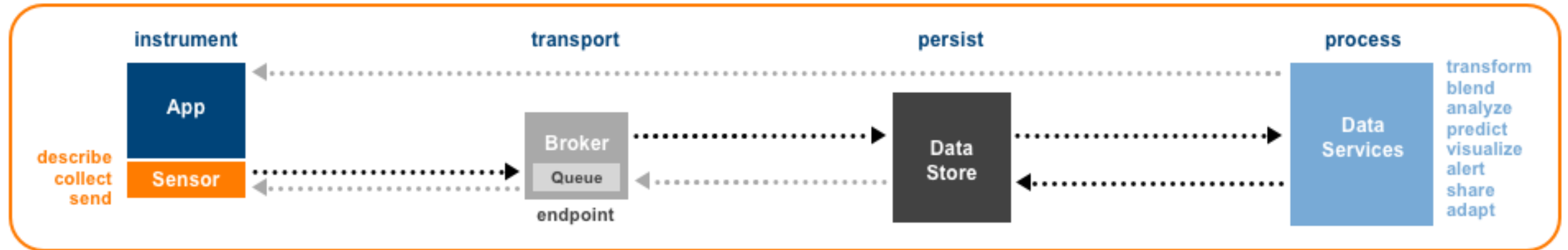
id (recommended)

stored (set by LRS)

context {} result {}
authority {} attachments []
timestamp

version (not recommended)

Serialising and sending Caliper events: the sensor API



Implementing the **Sensor** provides instrumented platforms, applications and services with a transport interface for communicating with data consumers.

A Caliper **Endpoint** **MUST** be capable of receiving Caliper data sent over HTTP by a Caliper **Sensor** using the standard POST request method. The connection **MUST** be secured with Transport Layer Security (TLS) and a valid TLS certificate provided.

The **Envelope** allows for transporting multiple events in batch mode

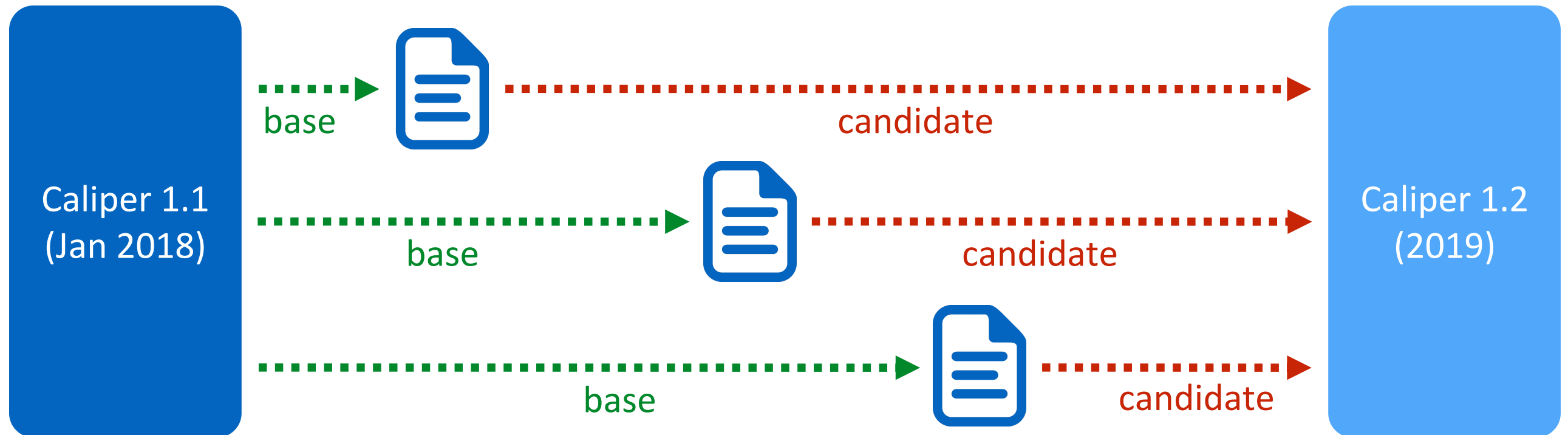
4. Caliper Future & Next Steps

Caliper 1.2

- Timeline: Spring 2018
- Endpoint behaviours and certification
- Additional semantic profiles
- Learning Tools Interoperability® (LTI®) Caliper Analytics® Endpoint Service

<https://github.com/IMSGlobal/caliper-central/issues>

Caliper standalone profile releases



Phase	Stability	Visibility	Contract
Base (beta)	unstable	contributing members	vocabulary additions removable at any time
Candidate	stable	public	vocabulary additions included in next point release
Final	Stable	Public	Vocabulary additions rolled into Final Vocabulary/Syntax spec.

Caliper: upcoming profiles



Tool Launch Profile



Search Profile



QTI Profile



Survey Profile



Feedback Profile



Mastery Profile



Badging Profile



Participation Profile



Resource Mgmt Profile



Social Profile

...

Caliper ↔ xAPI harmonisation

- IMS POV: content is king
- Data roundtrippability/vocabulary management
- Sensor / Activity Provider API
- Transport protocols, security models
- Endpoint/LRS Queries



Thank you!

Markus Gylling
Solutions Architect | Head, IMS Europe
mgylling@imglobal.org