UC San Diego

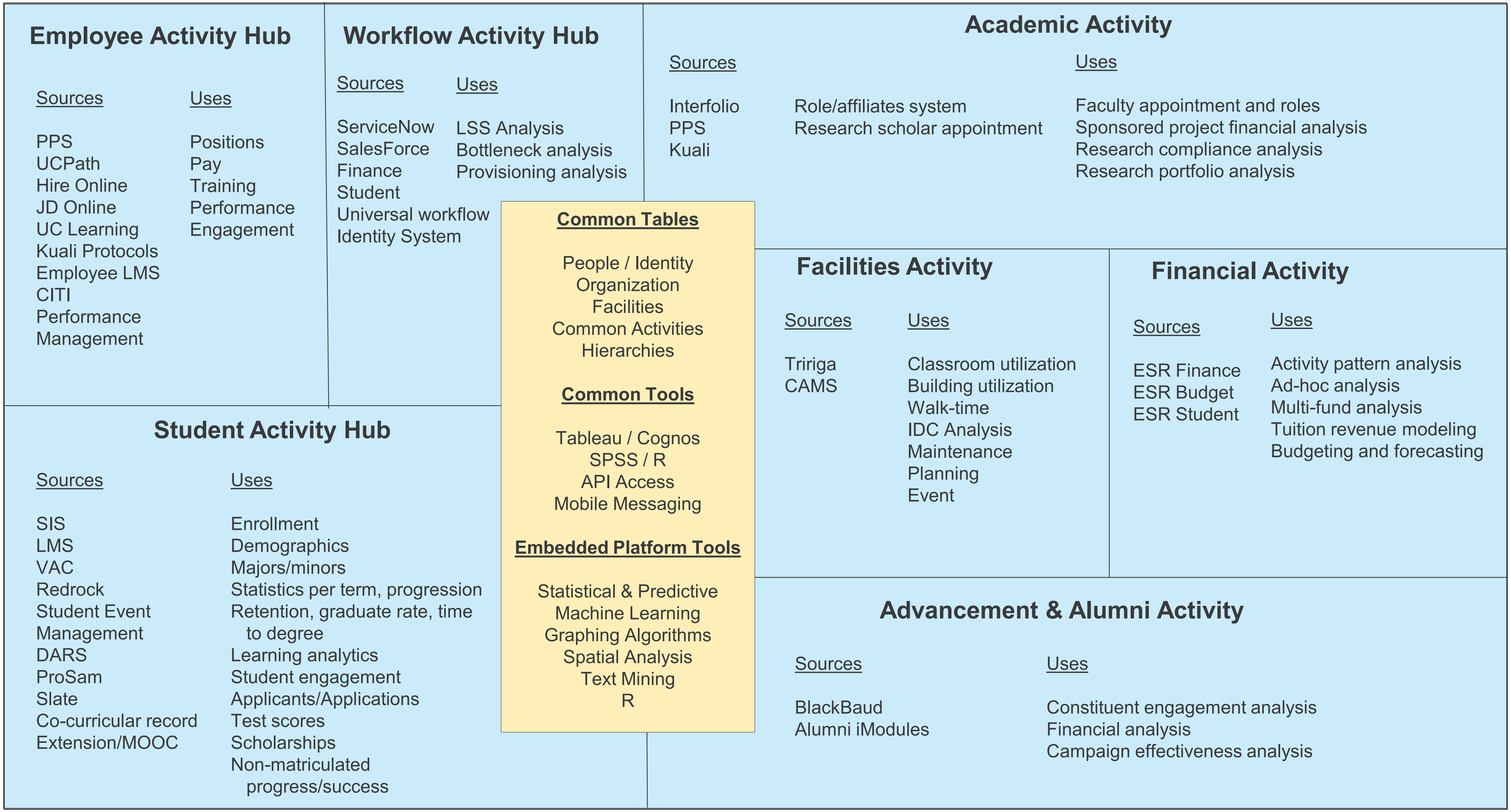
ACTIVITY HUBS

Next generation data and analytics platform for the campus

June 20, 2018

This is a living document subject to substantial revision!

Overview of the next generation data warehouse



Employee Activity Hub

Sources

PPS
UCPath
Hire Online
JD Online
UC Learning
Kuali Protocols
Employee LMS
CITI
Performance Management

Uses

Positions
Pay
Training
Performance
Engagement

Workflow Activity Hub

Sources

ServiceNow
SalesForce
Finance
Student
Universal workflow
Identity System

Uses

LSS Analysis
Bottleneck analysis
Provisioning analysis

Academic Activity

Sources

Interfolio
PPS
Kuali

Role/affiliates system
Research scholar appointment

Uses

Faculty appointment and roles
Sponsored project financial analysis
Research compliance analysis
Research portfolio analysis

Common Tables

People / Identity
Organization
Facilities
Common Activities
Hierarchies

Common Tools

Tableau / Cognos
SPSS / R
API Access
Mobile Messaging

Embedded Platform Tools

Statistical & Predictive
Machine Learning
Graphing Algorithms
Spatial Analysis
Text Mining
R

Facilities Activity

Sources

Tririga
CAMS

Uses

Classroom utilization
Building utilization
Walk-time
IDC Analysis
Maintenance
Planning
Event

Financial Activity

Sources

ESR Finance
ESR Budget
ESR Student

Uses

Activity pattern analysis
Ad-hoc analysis
Multi-fund analysis
Tuition revenue modeling
Budgeting and forecasting

Student Activity Hub

Sources

SIS
LMS
VAC
Redrock
Student Event Management
DARS
ProSam
Slate
Co-curricular record
Extension/MOOC

Uses

Enrollment
Demographics
Majors/minors
Statistics per term, progression
Retention, graduate rate, time to degree
Learning analytics
Student engagement
Applicants/Applications
Test scores
Scholarships
Non-matriculated progress/success

Advancement & Alumni Activity

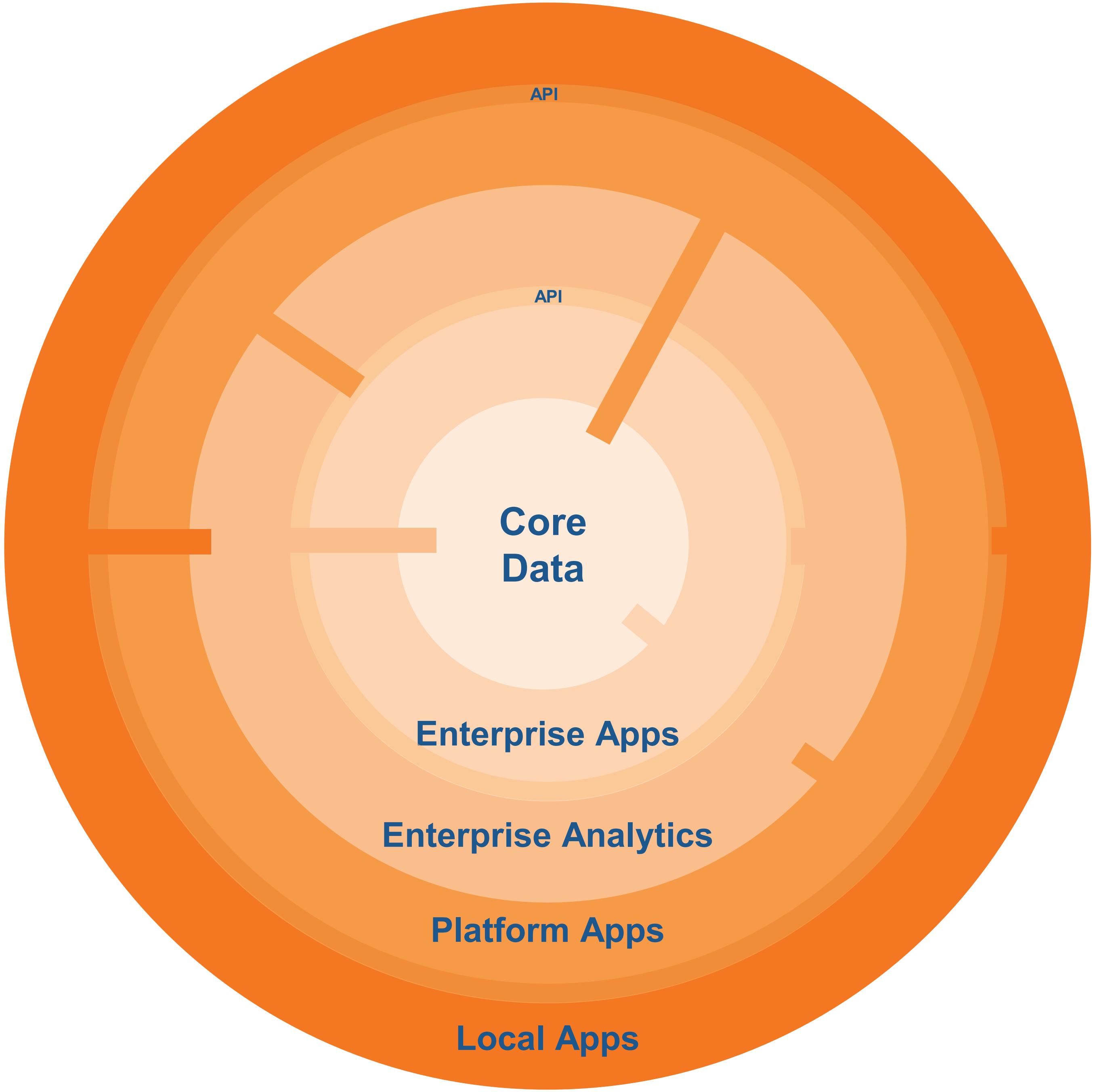
Sources

BlackBaud
Alumni iModules

Uses

Constituent engagement analysis
Financial analysis
Campaign effectiveness analysis

ESR ‘layered’ architecture



Local applications
- Support local innovations and needs, can come and go
- Access data, authenticate via APIs
- Are directly access by end users
- Can be promoted to the platform or enterprise application layer
- Need to respect scale and security standards

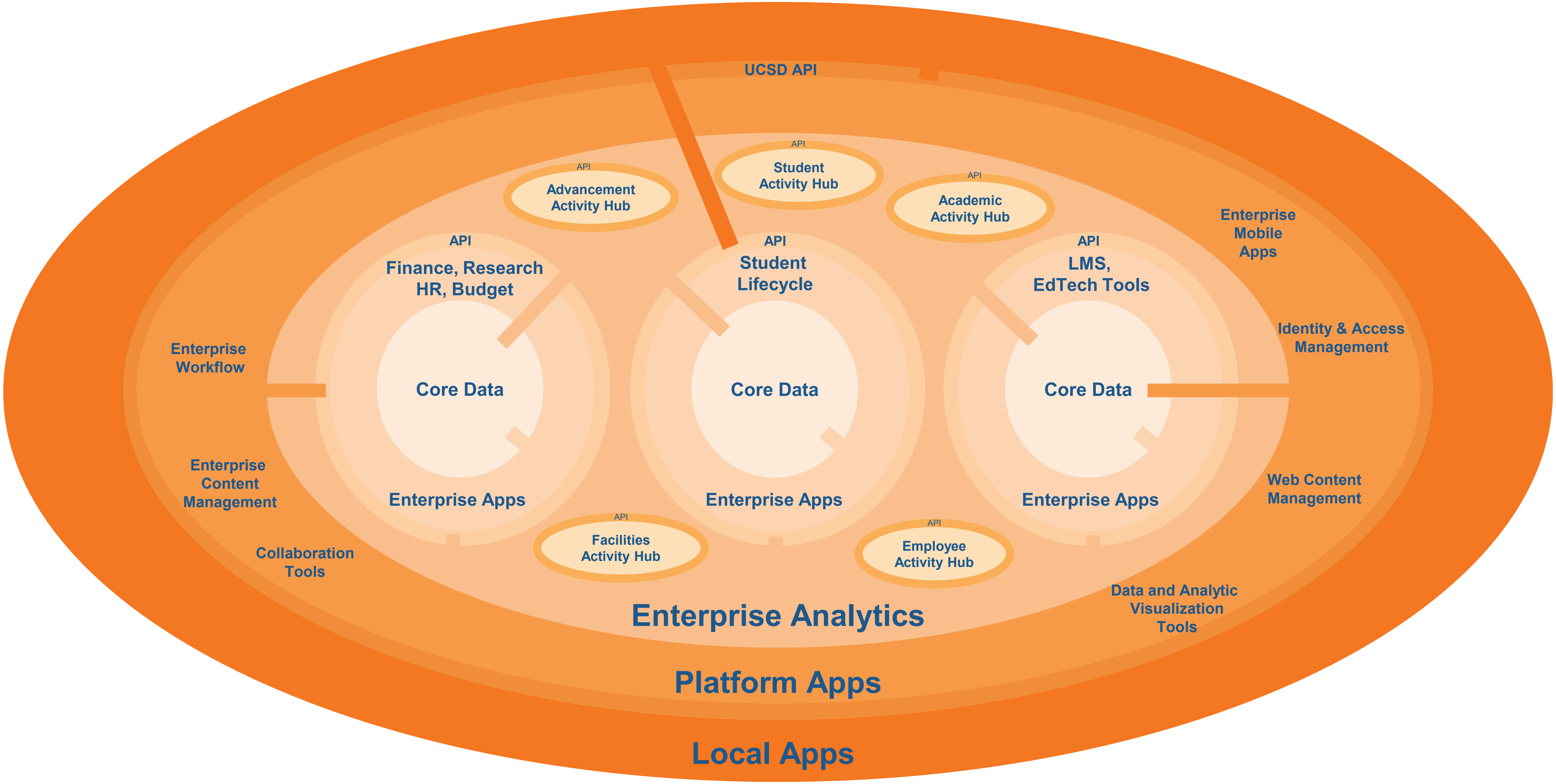
Platform applications
- Have a well-designed real-time API architecture
- APIs are used by central/distributed IT staff from local apps
- Provide access, manage workflows, content, collaboration
- Span multiple business functions
- Endure and evolve
- Enterprise content management, workflow, IAM tools, visualization

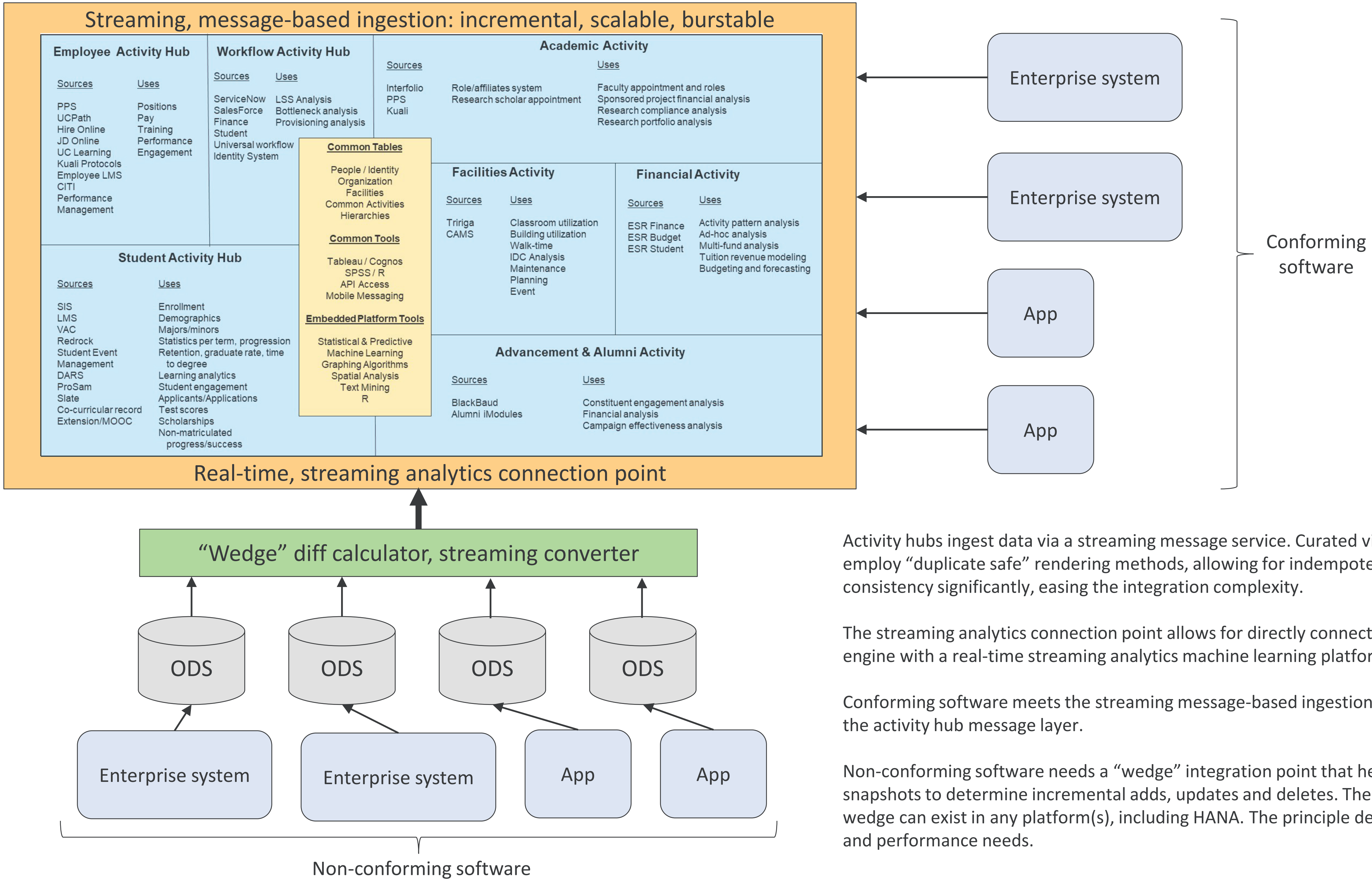
Enterprise analytics
- Are independent of enterprise applications
- Access data directly, can consume APIs
- Are directly accessed by end users
- Can be embedded in local apps
- Institutional data warehouses, data lakes

Enterprise applications
- Have a real-time transaction API layer available to upper layers
- Endure, are rarely replaced
- Manage core transactions, align with specific business functions
- Are directly access by end users
- May have analytics within and can access core data
- Finance, student information, HR, budgeting systems

Core Data
- Data essential to all layers
- Core transaction and master data
- Does not include local application data

Activity hubs and new enterprise systems





Streaming, message-based ingestion: incremental, scalable, burstable

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Real-time, streaming analytics connection point

Enterprise system

Enterprise system

App

App

Conforming software

“Wedge” diff calculator, streaming converter

ODS

ODS

ODS

ODS

Enterprise system

Enterprise system

App

App

Non-conforming software

Activity hubs ingest data via a streaming message service. Curated views and activity tables should employ “duplicate safe” rendering methods, allowing for indempotent messages. This relaxes data consistency significantly, easing the integration complexity.

The streaming analytics connection point allows for directly connecting the streaming ingestion engine with a real-time streaming analytics machine learning platform to process inbound messages

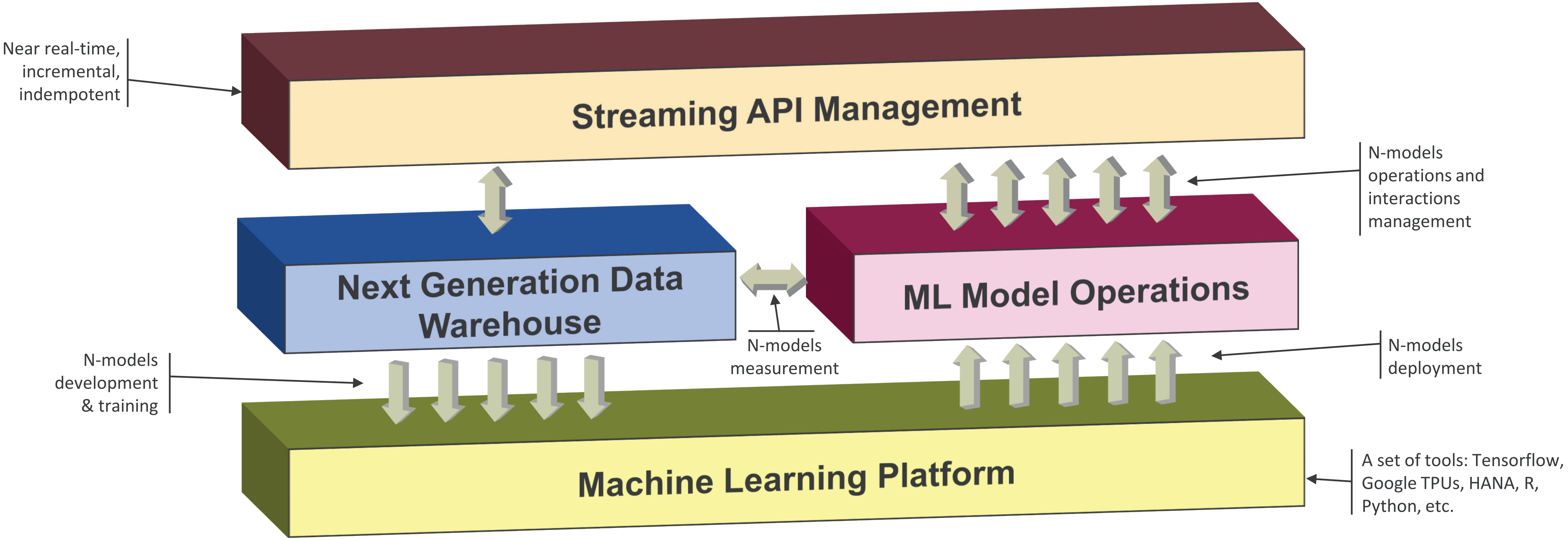
Conforming software meets the streaming message-based ingestion method and submit directly to the activity hub message layer.

Non-conforming software needs a “wedge” integration point that helps calculate differences in snapshots to determine incremental adds, updates and deletes. The ODS and other tools for this wedge can exist in any platform(s), including HANA. The principle define choice is long-term cost and performance needs.

Managing N-ML models in the next generation analytics environment

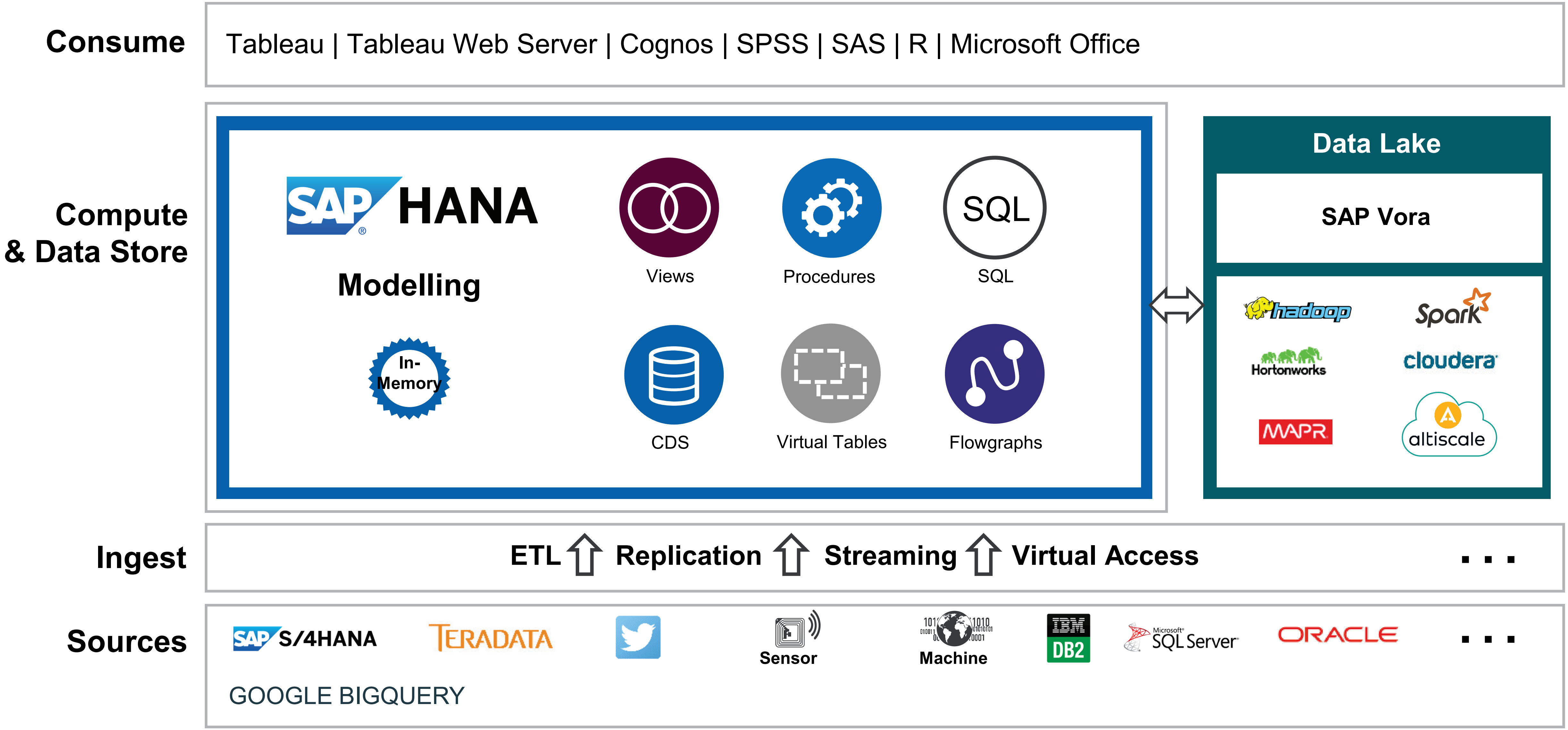
How can we use machine learning to improve administrative processes, student success?

- Multiple models may be active per each business opportunity (e.g., student learning feedback, student success intervention, financial activity fraud detection)
- Multiple models will be developed and trained based on prior streams of data
- Multiple models will be deployed to actively interact with real-time streams of data, interacting with requesting systems and users, activating workflows
- Multiple models can be managed within a single pane of glass. Operations can ensure reliability, detect anomalies, bring up and take down models
- Model measurement data feeds back into the next generation data warehouse to guide further model development



SAP HANA

Data Ingestion and Analytics modelling overview



Consume

Tableau | Tableau Web Server | Cognos | SPSS | SAS | R | Microsoft Office

Compute & Data Store

SAP HANA

Modelling

In-Memory

Views

Procedures

SQL

CDS

Virtual Tables

Flowgraphs

Data Lake

SAP Vora

hadoop

Spark

Hortonworks

cloudera

MAPR

altiscale

Ingest

ETL ⇧ **Replication** ⇧ **Streaming** ⇧ **Virtual Access** . . .

Sources

SAP S/4HANA

TERADATA

Sensor

Machine

IBM DB2

Microsoft SQL Server

ORACLE

. . .

GOOGLE BIGQUERY

Platform predictive capabilities

Classification Analysis

- CART
- C4.5 Decision Tree Analysis
- CHAID Decision Tree Analysis
- K Nearest Neighbour
- Logistic Regression Elastic Net
- Back-Propagation (Neural Network)
- Naïve Bayes
- Support Vector Machine
- Random Forests
- Gradient Boosting Decision Tree
- Linear Discriminant Analysis (LDA)
- Confusion Matrix
- Area Under Curve (AUC)
- Parameter Selection/Model Evaluation

Regression

- Multiple Linear Regression Elastic Net
- Polynomial, Exponential, Bi-Variate Geometric, Bi-Variate Logarithmic Regression
- Generalized Linear Model
- Cox Proportional Hazards Model

Cluster Analysis

- ABC Classification
- DBSCAN
- K-Means/Accelerated K-Means
- K-Medoid Clustering
- K-Medians
- Kohonen Self-Organized Maps
- Agglomerate Hierarchical
- Affinity Propagation
- Latent Dirichlet Allocation (LDA)
- Gaussian Mixture Model (GMM)
- Cluster Assignment

Time Series Analysis

- Single/Double/Brown/Triple Exponential Smoothing
- Forecast Smoothing
- Auto – ARIMA/ Seasonal ARIMA
- Croston Method
- Forecast Accuracy Measure
- Linear Regression with Damped Trend and Seasonal Adjustment
- Test for White Noise, Trend, Seasonality
- Fast Fourier Transform (FFT)
- Correlation Function

Association Analysis

- Apriori
- Apriori Lite
- FP-Growth
- KORD – Top K Rule Discovery
- Sequential Pattern Mining

Probability Distribution

- Distribution Fit/Weibull analysis
- Cumulative Distribution Function
- Quantile Function
- Kaplan-Meier Survival Analysis

Outlier Detection

- Inter-Quartile Range Test (Tukey's)
- Variance Test
- Anomaly Detection
- Grubbs Outlier Test

Recommender

- Factorized Polynomial Regression Models

Link Prediction

- Common Neighbors
- Jaccard's Coefficient
- Adamic/Adar
- Katzβ

Statistical Functions

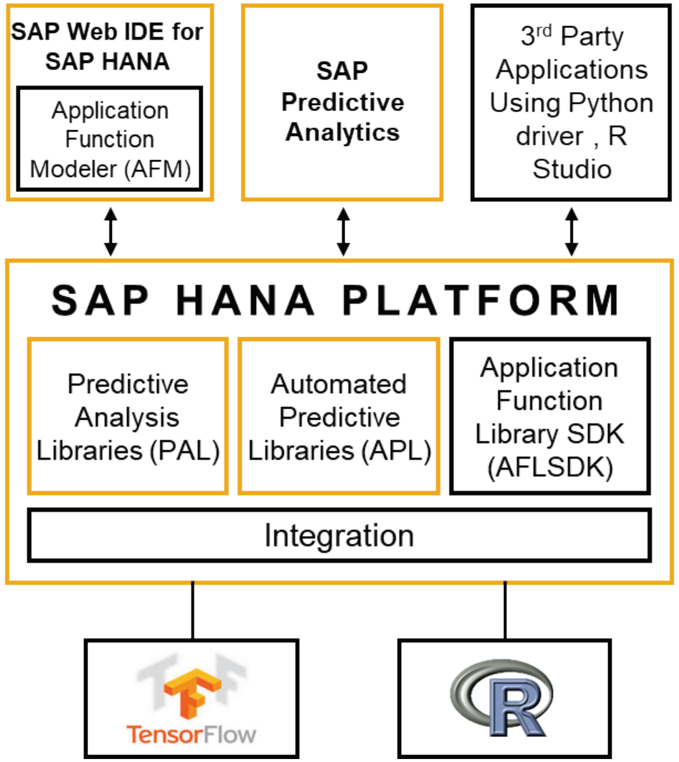
- Mean, Median, Variance, Standard Deviation, Kurtosis, Skewness
- Covariance Matrix
- Pearson Correlations Matrix
- Chi-squared Tests:
  - Test of Quality of Fit
  - Test of Independence
- F-test (variance equal test)
- Data Summary
- ANOVA
- One-sample Median Test
- T Test
- Wilcox Signed Rank Test

Data Preparation

- Sampling
- Binning
- Scaling
- Partitioning
- Principal Component Analysis (PCA)/ PCA Projection

Other

- Weighted Scores Table
- Substitute Missing Values

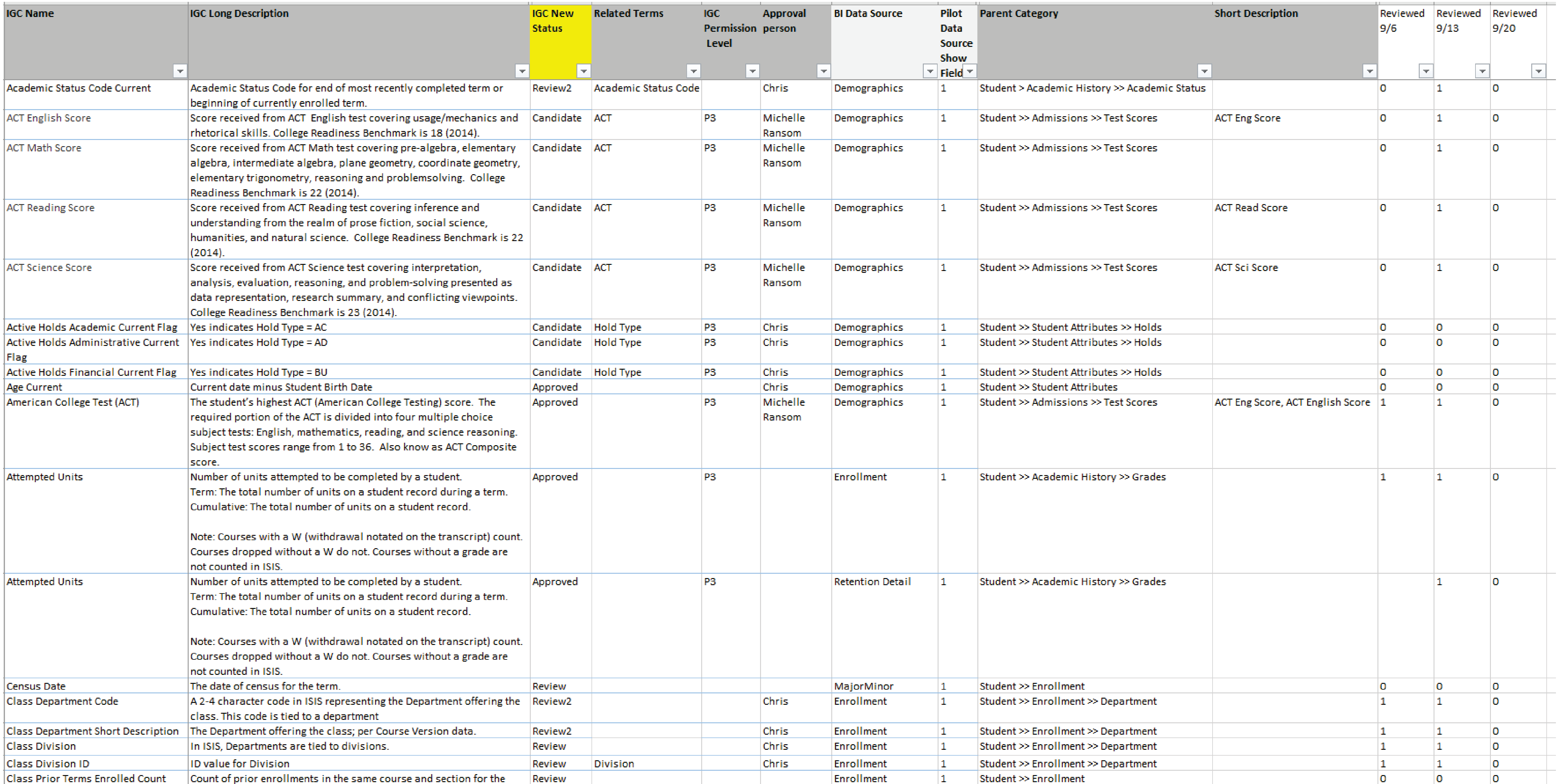

SAP Web IDE for SAP HANA
Application Function Modeler (AFM)
SAP Predictive Analytics
3rd Party Applications Using Python driver , R Studio
SAP HANA PLATFORM
Predictive Analysis Libraries (PAL)
Automated Predictive Libraries (APL)
Application Function Library SDK (AFLSDK)
Integration
TensorFlow
R

- 90+ prepackaged machine learning/predictive algorithms
- Supports association, clustering, classification, regression, time series, ...
- Supports different types of data – structured, streaming and series data
- Real-time scoring for several algorithms
- Integrated with open source machine learning libraries – TensorFlow and R

The student activity hub (SAH) will handle various needs

- Three classes of analytics
  - Institutional analytics: graduation rates, retention rates, enrollments, demographic, socio-economic, etc.
  - Academic analytics: entrance test scores, satisfactory progress, term and course grades, advising and support
  - Learning analytics: course engagement, assessments, clickstream, video views, discussion posts
- Other features of this architecture
  - HPC type performance. The system uses high-speed, in-memory techniques to handle very large data sets
  - Real-time data. A next generation learning environment will use real-time data for 'Fitbit' type analytics
  - Personalized messaging and interactions. A next generation learning environment will increasingly rely on advanced analytics to tailor degrees, content and interactions for the learner and in real-time
  - Complete data integration. All relevant systems are integrated in real-time or near real-time basis. Data interoperability standards will be important!
  - Next-generation data science. AI and ML technology can be applied to improve predictions of student success, help automate parts of summative or formative assessments, match appropriate content or other 'nudges' to learners
  - Census-driven, institutional reporting and ad-hoc analysis. The platform can provide both at the same time
  - Highly secure. Data security at multiple layers, including the database layer, the data source layer in Cognos/Tableau, within workbook creation and design, within workbook deployment in Cognos/Tableau web servers. HANA also has data anonymization built in with a real-time implementation of k-anonymity (see http://www.sap.com/data-anonymization)

SAH: Sample field list



IGC Name	IGC Long Description	IGC New Status	Related Terms	IGC Permission Level	Approval person	BI Data Source	Pilot Data Source Show Field	Parent Category	Short Description	Reviewed 9/6	Reviewed 9/13	Reviewed 9/20
Academic Status Code Current	Academic Status Code for end of most recently completed term or beginning of currently enrolled term.	Review2	Academic Status Code		Chris	Demographics	1	Student > Academic History >> Academic Status		0	1	0
ACT English Score	Score received from ACT English test covering usage/mechanics and rhetorical skills. College Readiness Benchmark is 18 (2014).	Candidate	ACT	P3	Michelle Ransom	Demographics	1	Student >> Admissions >> Test Scores	ACT Eng Score	0	1	0
ACT Math Score	Score received from ACT Math test covering pre-algebra, elementary algebra, intermediate algebra, plane geometry, coordinate geometry, elementary trigonometry, reasoning and problemsolving. College Readiness Benchmark is 22 (2014).	Candidate	ACT	P3	Michelle Ransom	Demographics	1	Student >> Admissions >> Test Scores		0	1	0
ACT Reading Score	Score received from ACT Reading test covering inference and understanding from the realm of prose fiction, social science, humanities, and natural science. College Readiness Benchmark is 22 (2014).	Candidate	ACT	P3	Michelle Ransom	Demographics	1	Student >> Admissions >> Test Scores	ACT Read Score	0	1	0
ACT Science Score	Score received from ACT Science test covering interpretation, analysis, evaluation, reasoning, and problem-solving presented as data representation, research summary, and conflicting viewpoints. College Readiness Benchmark is 23 (2014).	Candidate	ACT	P3	Michelle Ransom	Demographics	1	Student >> Admissions >> Test Scores	ACT Sci Score	0	1	0
Active Holds Academic Current Flag	Yes indicates Hold Type = AC	Candidate	Hold Type	P3	Chris	Demographics	1	Student >> Student Attributes >> Holds		0	0	0
Active Holds Administrative Current Flag	Yes indicates Hold Type = AD	Candidate	Hold Type	P3	Chris	Demographics	1	Student >> Student Attributes >> Holds		0	0	0
Active Holds Financial Current Flag	Yes indicates Hold Type = BU	Candidate	Hold Type	P3	Chris	Demographics	1	Student >> Student Attributes >> Holds		0	0	0
Age Current	Current date minus Student Birth Date	Approved			Chris	Demographics	1	Student >> Student Attributes		0	0	0
American College Test (ACT)	The student's highest ACT (American College Testing) score. The required portion of the ACT is divided into four multiple choice subject tests: English, mathematics, reading, and science reasoning. Subject test scores range from 1 to 36. Also know as ACT Composite score.	Approved		P3	Michelle Ransom	Demographics	1	Student >> Admissions >> Test Scores	ACT Eng Score, ACT English Score	1	1	0
Attempted Units	Number of units attempted to be completed by a student. Term: The total number of units on a student record during a term. Cumulative: The total number of units on a student record. Note: Courses with a W (withdrawal notated on the transcript) count. Courses dropped without a W do not. Courses without a grade are not counted in ISIS.	Approved		P3		Enrollment	1	Student >> Academic History >> Grades		1	1	0
Attempted Units	Number of units attempted to be completed by a student. Term: The total number of units on a student record during a term. Cumulative: The total number of units on a student record. Note: Courses with a W (withdrawal notated on the transcript) count. Courses dropped without a W do not. Courses without a grade are not counted in ISIS.	Approved		P3		Retention Detail	1	Student >> Academic History >> Grades			1	0
Census Date	The date of census for the term.	Review				MajorMinor	1	Student >> Enrollment		0	0	0
Class Department Code	A 2-4 character code in ISIS representing the Department offering the class. This code is tied to a department	Review2			Chris	Enrollment	1	Student >> Enrollment >> Department		1	1	0
Class Department Short Description	The Department offering the class; per Course Version data.	Review2			Chris	Enrollment	1	Student >> Enrollment >> Department		1	1	0
Class Division	In ISIS, Departments are tied to divisions.	Review			Chris	Enrollment	1	Student >> Enrollment >> Department		1	1	0
Class Division ID	ID value for Division	Review	Division		Chris	Enrollment	1	Student >> Enrollment >> Department		1	1	0
Class Prior Terms Enrolled Count	Count of prior enrollments in the same course and section for the	Review				Enrollment	1	Student >> Enrollment		0	0	0

“Curated views” of the data, de-identified

Demographics
Residency, SAT/ACT and other entrance test scores, academic status, etc.

Enrollment
Enrollment counts by class, departments, divisions/schools, colleges, including course grades

Major/Minors (wide and narrow)
Degrees, Programs, switching of majors, etc.

Student Statistics Per Term
Dozens of common student statistics, term-by-term for examining progression

Class and Section Stats Per Term
Dozens of class and section statistics, term by term for course and section planning, instructor load, etc.

Retention (wide and narrow)
Cohort, retention and graduation rates, etc.

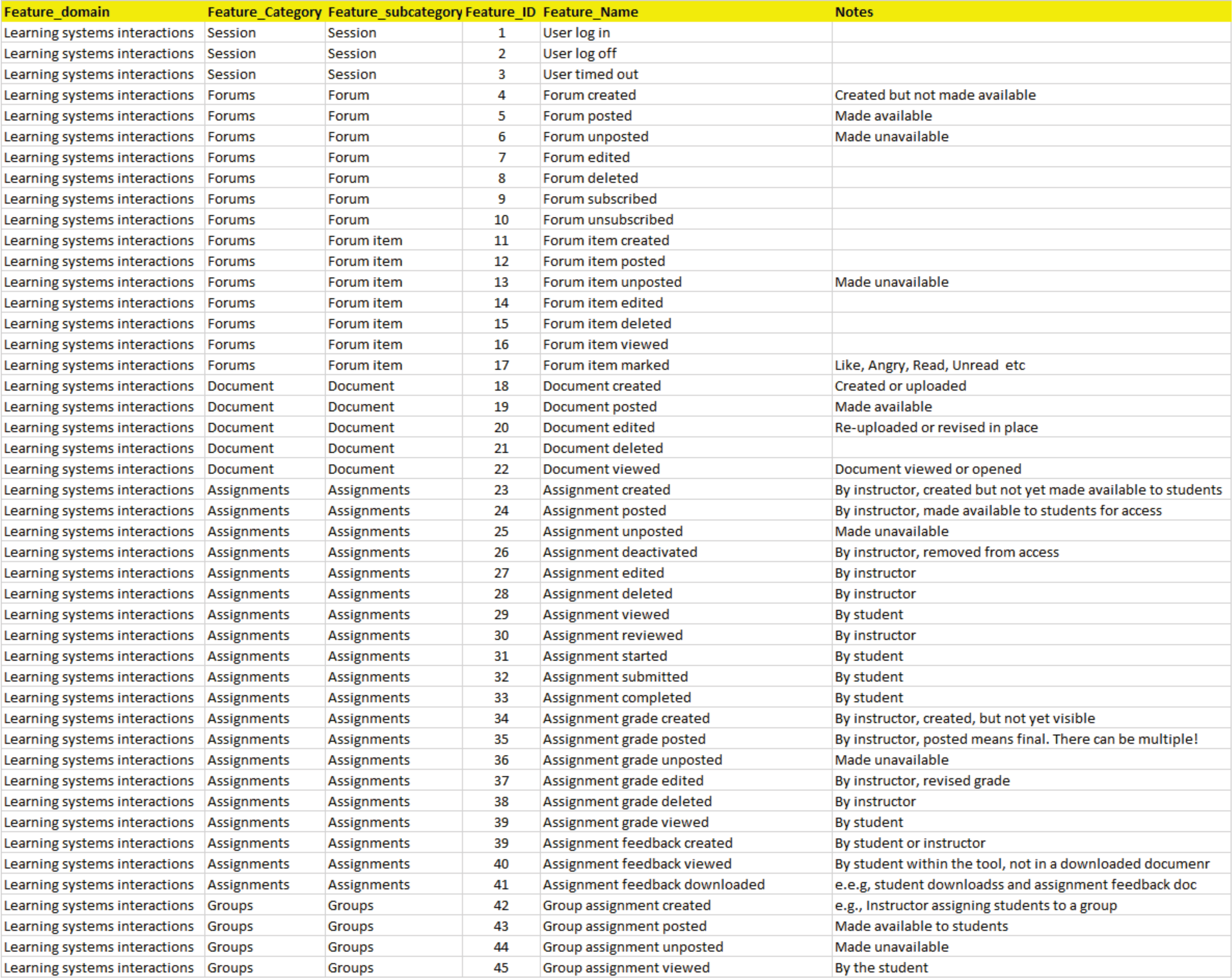
Admissions
Applicants, Applications, Test Scores, Scholarships

Continuing education students (Extension, other)
Demographics, enrollment, credentials

Learning analytics
Learning events, grading events

General student activities
Activity details, Activity stats per term

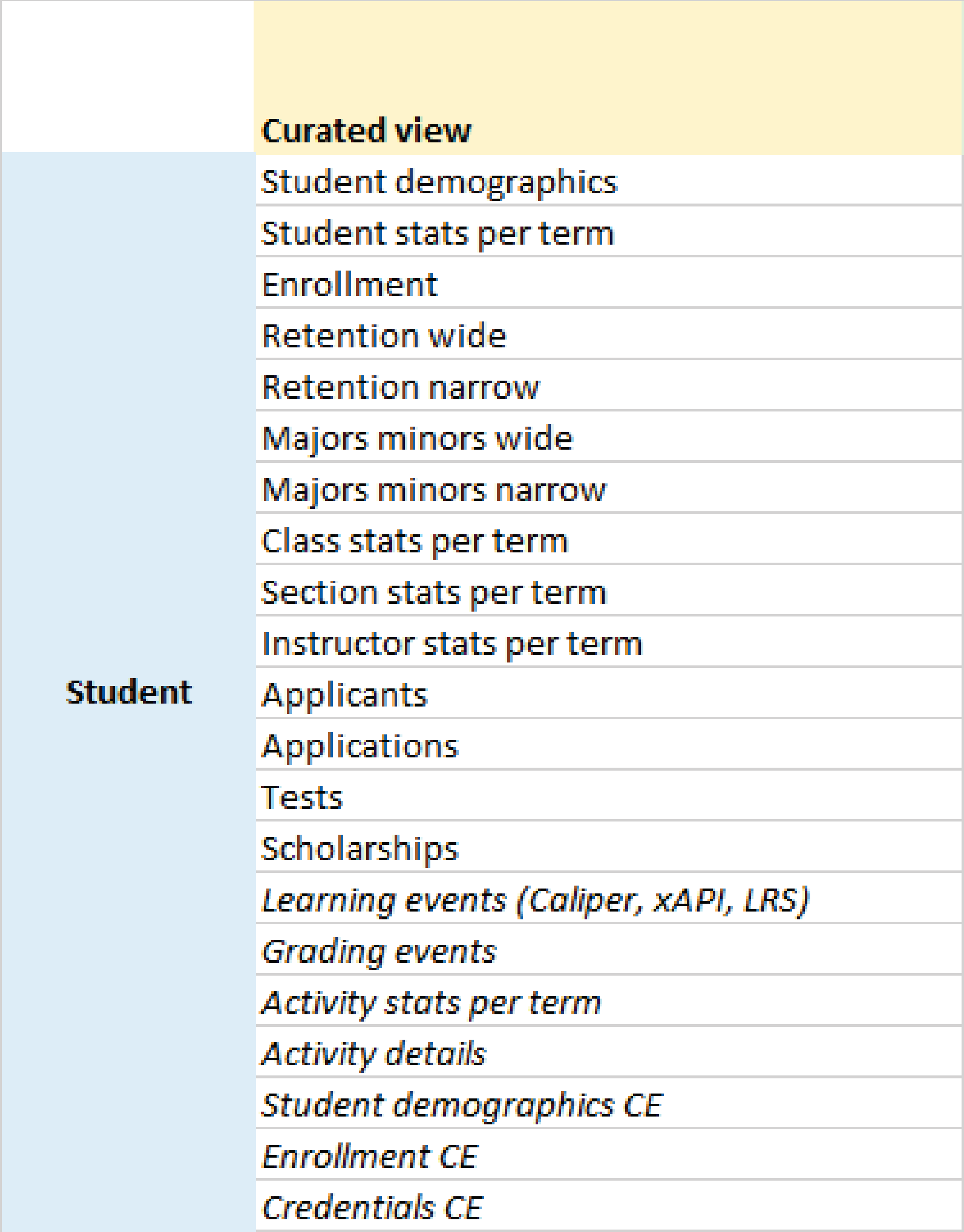
Master map of learning events



Feature_domain	Feature_Category	Feature_subcategory	Feature_ID	Feature_Name	Notes
Learning systems interactions	Session	Session	1	User log in	
Learning systems interactions	Session	Session	2	User log off	
Learning systems interactions	Session	Session	3	User timed out	
Learning systems interactions	Forums	Forum	4	Forum created	Created but not made available
Learning systems interactions	Forums	Forum	5	Forum posted	Made available
Learning systems interactions	Forums	Forum	6	Forum unposted	Made unavailable
Learning systems interactions	Forums	Forum	7	Forum edited	
Learning systems interactions	Forums	Forum	8	Forum deleted	
Learning systems interactions	Forums	Forum	9	Forum subscribed	
Learning systems interactions	Forums	Forum	10	Forum unsubscribed	
Learning systems interactions	Forums	Forum item	11	Forum item created	
Learning systems interactions	Forums	Forum item	12	Forum item posted	
Learning systems interactions	Forums	Forum item	13	Forum item unposted	Made unavailable
Learning systems interactions	Forums	Forum item	14	Forum item edited	
Learning systems interactions	Forums	Forum item	15	Forum item deleted	
Learning systems interactions	Forums	Forum item	16	Forum item viewed	
Learning systems interactions	Forums	Forum item	17	Forum item marked	Like, Angry, Read, Unread etc
Learning systems interactions	Document	Document	18	Document created	Created or uploaded
Learning systems interactions	Document	Document	19	Document posted	Made available
Learning systems interactions	Document	Document	20	Document edited	Re-uploaded or revised in place
Learning systems interactions	Document	Document	21	Document deleted	
Learning systems interactions	Document	Document	22	Document viewed	Document viewed or opened
Learning systems interactions	Assignments	Assignments	23	Assignment created	By instructor, created but not yet made available to students
Learning systems interactions	Assignments	Assignments	24	Assignment posted	By instructor, made available to students for access
Learning systems interactions	Assignments	Assignments	25	Assignment unposted	Made unavailable
Learning systems interactions	Assignments	Assignments	26	Assignment deactivated	By instructor, removed from access
Learning systems interactions	Assignments	Assignments	27	Assignment edited	By instructor
Learning systems interactions	Assignments	Assignments	28	Assignment deleted	By instructor
Learning systems interactions	Assignments	Assignments	29	Assignment viewed	By student
Learning systems interactions	Assignments	Assignments	30	Assignment reviewed	By instructor
Learning systems interactions	Assignments	Assignments	31	Assignment started	By student
Learning systems interactions	Assignments	Assignments	32	Assignment submitted	By student
Learning systems interactions	Assignments	Assignments	33	Assignment completed	By student
Learning systems interactions	Assignments	Assignments	34	Assignment grade created	By instructor, created, but not yet visible
Learning systems interactions	Assignments	Assignments	35	Assignment grade posted	By instructor, posted means final. There can be multiple!
Learning systems interactions	Assignments	Assignments	36	Assignment grade unposted	Made unavailable
Learning systems interactions	Assignments	Assignments	37	Assignment grade edited	By instructor, revised grade
Learning systems interactions	Assignments	Assignments	38	Assignment grade deleted	By instructor
Learning systems interactions	Assignments	Assignments	39	Assignment grade viewed	By student
Learning systems interactions	Assignments	Assignments	39	Assignment feedback created	By student or instructor
Learning systems interactions	Assignments	Assignments	40	Assignment feedback viewed	By student within the tool, not in a downloaded documenr
Learning systems interactions	Assignments	Assignments	41	Assignment feedback downloaded	e.e.g, student downloadss and assignment feedback doc
Learning systems interactions	Groups	Groups	42	Group assignment created	e.g., Instructor assigning students to a group
Learning systems interactions	Groups	Groups	43	Group assignment posted	Made available to students
Learning systems interactions	Groups	Groups	44	Group assignment unposted	Made unavailable
Learning systems interactions	Groups	Groups	45	Group assignment viewed	By the student

- Four level hierarchy
- At the level of granularity or lower than Caliper, xAPI
- Can map to Caliper, xAPI or future standards
- Can extend and define our learning events as needed without waiting for standards
- Can map post-hoc to standards as they evolve
- Extendible domains
  - Learning systems interactions
  - Advising interactions
  - Co-curricular interactions
  - Academic interactions
  - Advising interactions
- We are also maintaining a “Tool Hierarchy” to categorize EdTech ecosystem tools and provide a simple containership model

Full list of curated views as of June, 2018



	Curated view
Student	Student demographics
	Student stats per term
	Enrollment
	Retention wide
	Retention narrow
	Majors minors wide
	Majors minors narrow
	Class stats per term
	Section stats per term
	Instructor stats per term
	Applicants
	Applications
	Tests
	Scholarships
	Learning events (Caliper, xAPI, LRS)
	Grading events
	Activity stats per term
	Activity details
	Student demographics CE
	Enrollment CE
	Credentials CE

"In-flight" curated views

Learning analytics

Learning events (Caliper, xAPI, LRS)

Grading events

Student engagement

Activity stats per term

Activity details

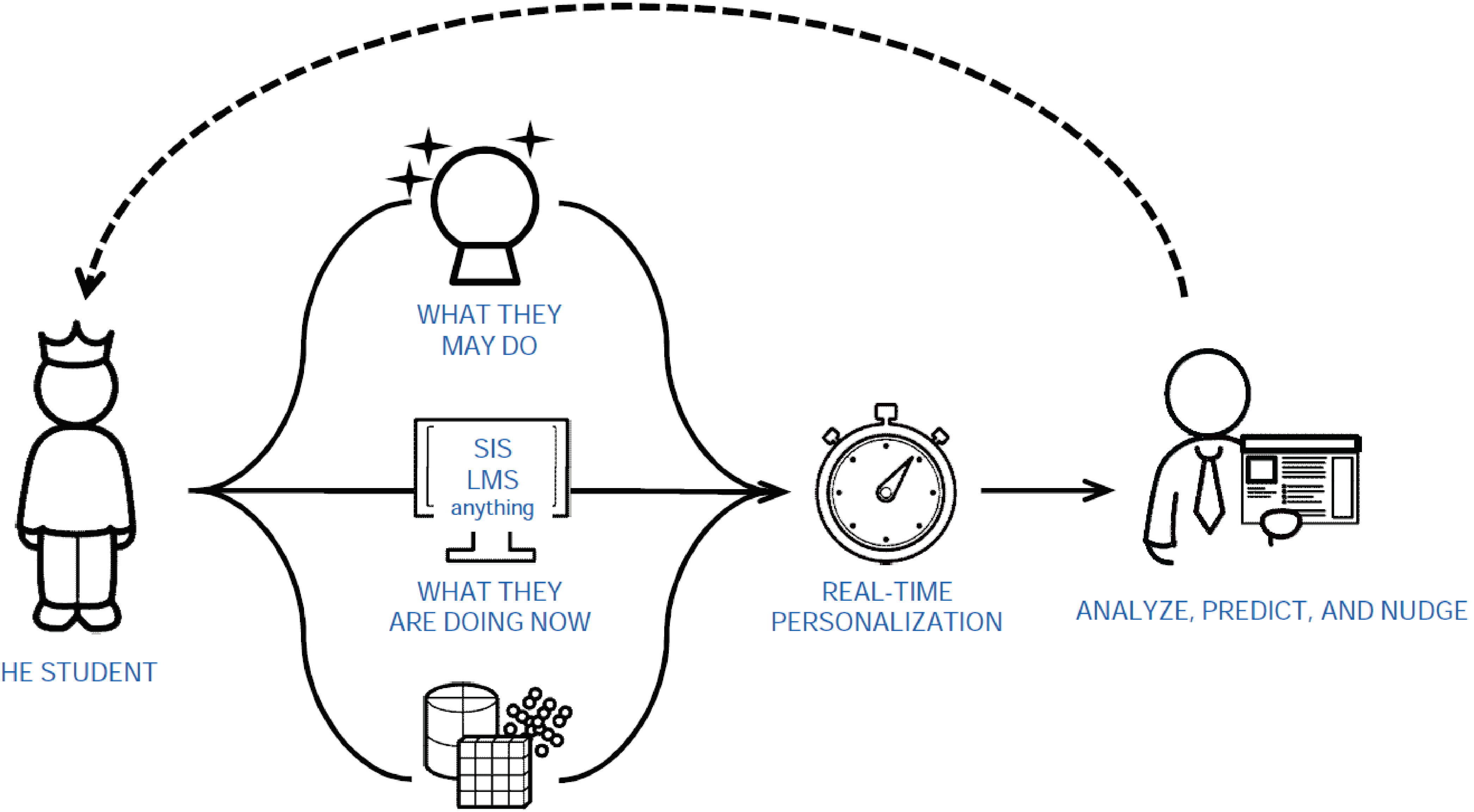
Non-matriculated, extension students

Student demographics

Enrollment

Credentials

Goals: Give analysts access to anonymized views, enable real-time mobile messaging



UC San Diego

CAMPUS MOBILE APP

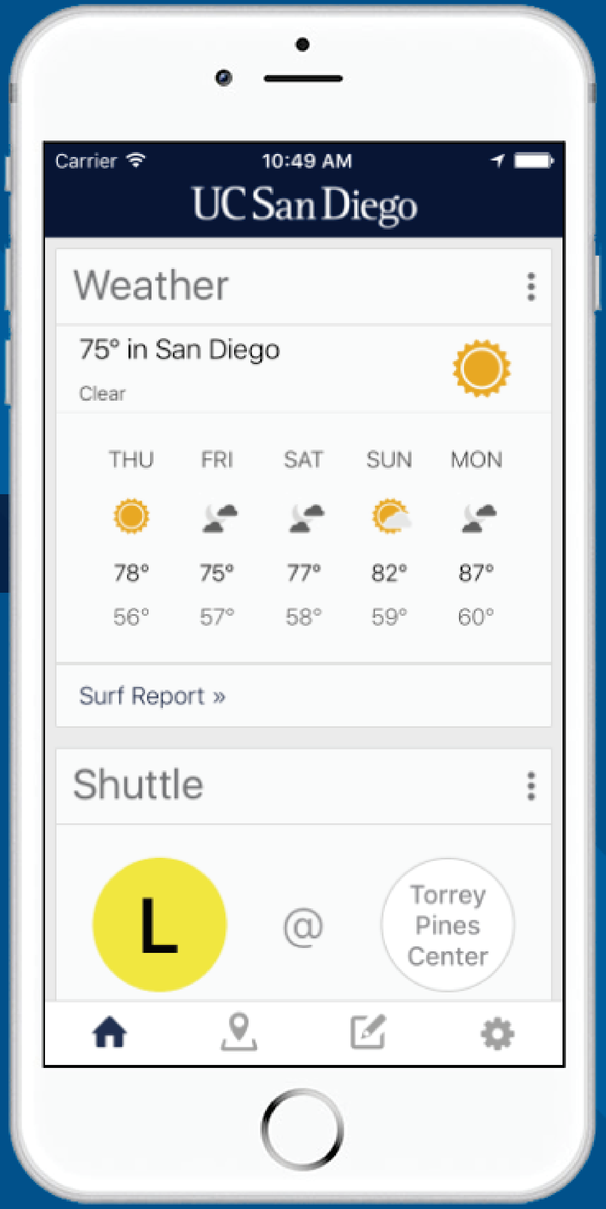
UC San Diego Campus Mobile App is a location-based mobile app that connects you to campus information such as real-time shuttles, news, events & weather.

Download on the App Store

GET IT ON Google Play

- weather and surf reports
- location based shuttle arrival information
- dining menus and locations
- events updates
- links to campus services
- real-time news updates
- directions to nearby points of interest

Got feedback? Want to contribute code or design ideas for the UC San Diego Mobile app? Contact us.



Weather

75° in San Diego

Clear

THU	FRI	SAT	SUN	MON
78°	75°	77°	82°	87°
56°	57°	58°	59°	60°

Surf Report »

Shuttle

L @ Torrey Pines Center

SAH: Group and message builder

Student group builder

Analyze student and learning activities to uncover trends

Filter and group students according to different attributes

Explore (and save) results in graphs and list format

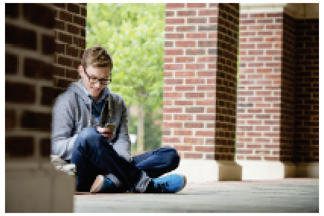
Group management

Store groups – including static and dynamic groups

Track group membership over time

Compare and analyze groups

Use groups as “attributes” in BI tools



Personalized messaging

Automatically generate user-defined messages

Use message templates and embed variables

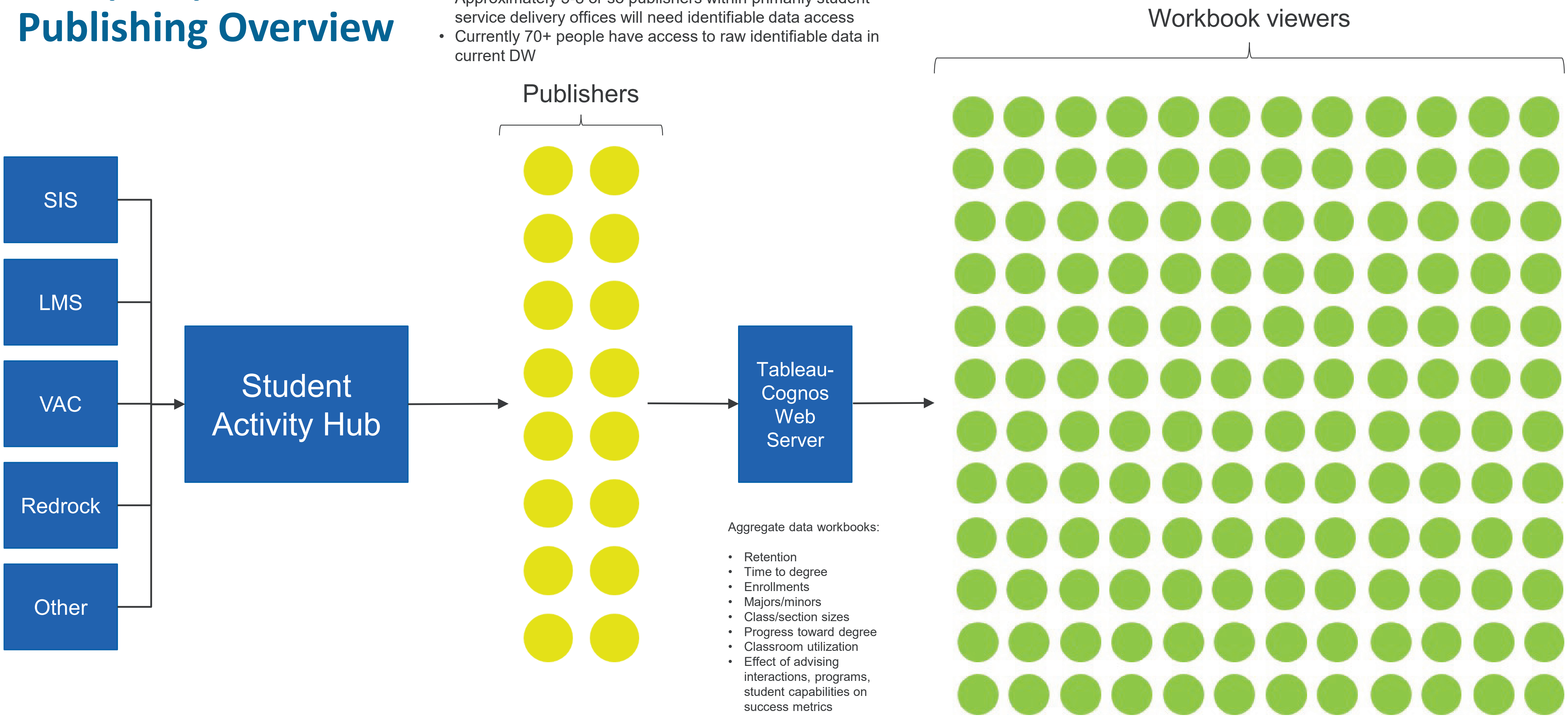
Tie message recipients to student groups

- Group builder and message builder tools interact. Group builder allows for:
- Grouping students together via any combination of fields and selection criteria (full set operations and Boolean logic)
- Changes in group membership creates events (“added to group”, “removed from group”) that can trigger messages, emails or workflow
- Groups also integrate with all analytics, allowing analysis to quickly compare and contrast different subpopulations of students. Subpopulations can be overlapping
- Groups are reusable and sharable and can be easily referenced within all workbooks and reports

EXAMPLE: Student Activity Hub (SAH) Data Publishing Overview

- Legitimate educational interest only; skilled analyst
- Using Tableau Desktop, other authoring tool, secure access
- Creates dashboards, interactive analytic screens, reports
- Access to granular, de-identified data only, control small cell size if needed
- Approximately 30-40 split between central and distributed groups
- Approximately 5-8 or so publishers within primarily student service delivery offices will need identifiable data access
- Currently 70+ people have access to raw identifiable data in current DW

- Legitimate interest only; staff, faculty with secure UCSD credentials
- Accesses published workbooks via the web
- No direct data access, no identifiable data, no downloading of data
- Can manipulate the data in the workbook only to the degree the publisher allows
- Access to identifiable data, lists of students, etc. is only through the VAC or an authorized report



Aggregate data workbooks:

- Retention
- Time to degree
- Enrollments
- Majors/minors
- Class/section sizes
- Progress toward degree
- Classroom utilization
- Effect of advising interactions, programs, student capabilities on success metrics

Hierarchy management

- Several key hierarchies need to be carefully curated so that all downstream analysis can safely aggregate and analyze data
- Hierarchy management has three components
  - **Hierarchy governance.** These are activities involving key staff who help design hierarchies, agree on publishing revised versions of hierarchies and help oversee hierarchy quality and utility. This will be included within the data and analytics governance committee
  - **Hierarchy data management.** This is a very small group of staff within the ITS Enterprise Systems team who will ensure hierarchy changes and additions are safely implemented and replicated across the subsidiary systems and activity hubs. This team can also analyze systems to determine impacts on changes to hierarchies
  - **Hierarchy data management software.** This is a software tool ITS is developing to allow the capture of key hierarchies, manage hierarchy versioning and release schedule, ensure the technical replication of hierarchy changes to subsidiary systems and allow for the mapping of different hierarchies to each other. Hierarchy mapping has interesting implications for activity hub design and use!

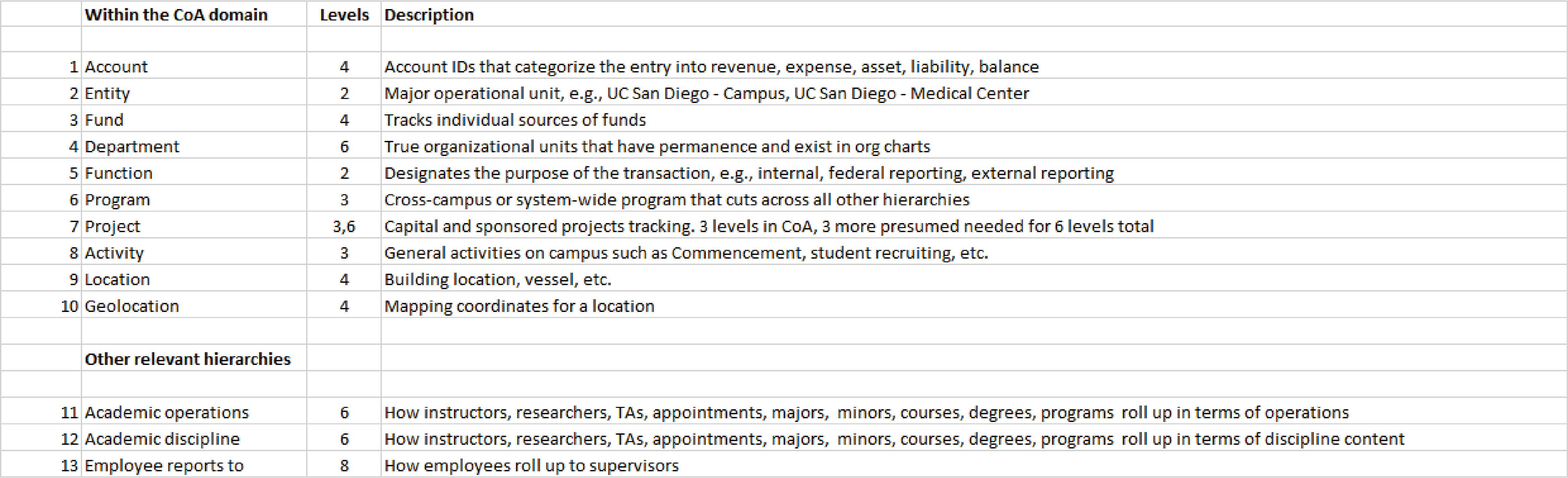
Hierarchy manager tool

- This tool will enable creating and editing hierarchies, managing different versions and mapping hierarchy versions to each other independent of any enterprise system

- Enterprise systems will subscribe to one or more hierarchies as needed via the API framework where possible. Some hierarchies may be managed within an enterprise system and replicated to the hierarchy manager

- The hierarchy manager's rendering in the Activity Hubs will enable comparing and contrasting aggregate and detailed data within the curated views across different versions of a hierarchy. Example: "Show me the enrollment totals by department for the new department hierarchy for all old data." "Show me the enrollment totals by department for the old department hierarchy for all new data." "Show me those departments that have increased or decreased enrollments because of the proposed organizational change."

- Machine learning may be used to help determine new hierarchies automatically



	Within the CoA domain	**Levels**	**Description**
1	Account	4	Account IDs that categorize the entry into revenue, expense, asset, liability, balance
2	Entity	2	Major operational unit, e.g., UC San Diego - Campus, UC San Diego - Medical Center
3	Fund	4	Tracks individual sources of funds
4	Department	6	True organizational units that have permanence and exist in org charts
5	Function	2	Designates the purpose of the transaction, e.g., internal, federal reporting, external reporting
6	Program	3	Cross-campus or system-wide program that cuts across all other hierarchies
7	Project	3,6	Capital and sponsored projects tracking. 3 levels in CoA, 3 more presumed needed for 6 levels total
8	Activity	3	General activities on campus such as Commencement, student recruiting, etc.
9	Location	4	Building location, vessel, etc.
10	Geolocation	4	Mapping coordinates for a location
	Other relevant hierarchies		
11	Academic operations	6	How instructors, researchers, TAs, appointments, majors, minors, courses, degrees, programs roll up in terms of operations
12	Academic discipline	6	How instructors, researchers, TAs, appointments, majors, minors, courses, degrees, programs roll up in terms of discipline content
13	Employee reports to	8	How employees roll up to supervisors

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