

Illinois Pilot Project Description (NCSA & IlliniCloud)

1. *Target constituents and scope*

The IlliniCloud is a cooperative formed by three principle public school districts, its core mission is to provide high-value cloud services that are owned and operated to its member organizations. The service verticals include:

- Managed business-continuity services to assure high-value access to “disaster and recovery” tools and resource as well as access to other virtual and physical computing resources available to members.
- Managed data-service supporting data-validation rule evaluations during ingestion as part of the centrally implemented School Interchange Framework (SIF) data-model and Zone Integration Service (ZIS) service as well as alternative facilitation tools.
- Managed identity-service tools supporting (minimally,) web-browser based Single Sign On (SSO) capacity implemented as a passive centralized orchestration conductor enabling, delegated authentication and authorization interrogation for school district users.
- Managed app-service (portal) to provide school districts tenants with customizable visual characteristics and content filtering rules over application tiles based on dynamic evaluations of identity attributes of a given user.

The first vertical listed above has been a model “high-value” asset for member school districts of the IlliniCloud that emphasizes, how strategic centralization of resource and tools not only makes economic sense, but further empowers individual school districts to leverage the service as they desire. Secondly, the providers and the clients in this operational scenario are all constituents of the K12 community allowing for the mantra, “**By K12 for K12**”.

Each of the other three verticals listed were services were being designed and implemented under the timeframe and scope of the Quilt/InC K12 Pilot collaboration. Substantial progress has been achieved and helps to demonstrate a positive case for streamlining operational requirements to support existing and operating enterprises with minimal thresholds of adoption. The initial population of school districts targeted included the Illinois’ Race to the Top, round 3 participants, approximately 32 of the more than 800 districts in the State. The expectation was that some number of these would become the adopters of one or more of the central services.

2. *Initial goal*

As stated back on Nov of 2013 in context of the InC-Quilt-Federation Home for the pilot projects:

1) **Key functional goals** include three federated service integration point options:

- Data Service – interface district’s “source systems” to produce School Interchange Format (SIF) data-model used to transform and propagate an appropriately populated EdFi data-model at inBloom;
- K12 IAM – interface district’s directory services as the authoritative authentication for their affiliated user population and the administrative interfaces to manage meta-data, roles, and groups associated with federated applications and services; and
- K12 AppPortal – interface to support adaptation of Single Sign-On (SSO) for federated service providers and applications including both inBloom and InCommons.

2) **Key operational objectives** are to implement a sustainable model that enables a community of school districts to adopt federated applications and services using interfaces and implementation strategies supporting local systems and private/public cloud services focused on enhancing and enabling school districts to embrace the challenges of delivering personalized learning.

The overall evolution of the influences in the K12 education ecosystem impact school districts more often than not, in negative ways when the faculty, staff, and students are expected to manage disparate identity related requirements for independent applications. The application sprawl and managing the business-cases around personally identifiable information related to individual educators and the groups of students they are lead.

- Each student similarly, has a group of educators they have pedagogical relationships with. Some age brackets of students require parental consent for applications.
- Each school district has a wide-range of applications and business processes in place to manage the day-to-day progression of their annual service cycle.
- Each application imposes requirements for school district to use the application, often includes lists of schools, teachers, students, and the course binds for these lists.

An example of an environmental influence was the inBloom life-cycle on an overlapping timeline to this project. The experience was informative, inspirational, and failed predictable as the core-

challenge did not address the requirement to provide access to their vision with a minimal threshold of adoption that is focused on “business as usual” for those school districts. Our project space was materially engaged and working with inBloom from their inception as the Illinois State Pilot with two of our school district participants. The Illinois participation in this implementation effort evolved and inspired collaboration with inBloom to explore development of an “Operator Model”, where an operation instances of the “Secure Data Service” would established and operated by regional service providers. This evolutionary mutation would have empowered individual school districts or cooperatives or school districts to host and operate the service in a private or hybrid cloud under their exclusive control. The operator-model discussion and project materialization transpired during the final three-quarters of inBloom’s corporate life-cycle. As a result of these efforts, inBloom generously provide IlliniCloud the opportunity to directly interface with and leverage their human resources to transfer knowledge and digital assets to enable further evolution of the vision represented in the body of work.

3. *Post pilot longer term goals*

Establish a reference implementation of a federated service stack that provides an “Operator” the core essentials to manage identity and data requirements by empowering school districts leverage high-value tools that augment their capacity to account for and manage relationships with vendors and agencies. The philosophical goals are to normalize measure and observations into predominate expressive data-models, instrument common data-model activities using administrative interfaces, and empower school districts to manage federated identity services that protect and enable the enterprise users to safe use applications offered by service providers. Our case presumes that the reference operational model would be deployable by one school district or a collection of school districts resulting in a community of operators that support like operational constructs. This will lead to a federation of K12 institutions working together to improve and enhance their capacity to satisfy agency needs and vendor requirements with tools that favor school districts, improve their data accuracy, and provide string identity/privacy protection, vendor relationship accountability, and administrative management control for these services.

4. *Federation model selected*

“*Federation-to-Federation*”: where an “Operator” or a collection of them, would inter-federate with InCommon or other academic federations offering services and digital resource for K12.

5. Targeted applications or services

In context, the Illinois project pre-dates the Quilt/InCommon K12 pilot program where previous and concurrent work had established an initial central data-service and on-going collaboration, the Illinois Shared Learning Environment project which included:

- Southern Illinois University's Career and Workforce Development Center located on the campus of Lincoln Land Community College in Springfield, IL, where the Illinois Open Education Resources (IOER) application was conceived, constructed, and is supported. This tool implements a Learning Registry (LR) node that participates in the nation network of replicating nodes and has worked to extend the Learning Registry Metadata Infrastructure to include workforce classifications and encoding standards to better support adult-learners and K12 students that are on a non-academic track beyond their high school experience.
- Northern Illinois University's organization known as the Illinois Interactive Report Card (IIRC) which has a long history of working with K12 school districts to normalize a wide variety assessment results to produce comparable charts and graphs for administrators and agencies. This group undertook the task to design, develop, and implement a more robust teacher facing dashboard application modeled on a custom application previously developed by two IlliniCloud school districts in collaboration. This application service specifically implements functional and informational interfaces designed for teachers and the pedagogical administrators and leaders of a school district.
- IlliniCloud's "Three Pillars of Support" (data, identity, and presentation services) as previously described.

The vision for the Illinois project was that K12 school districts would be able to economically leverage InCommon Net+ services. The breath of opportunity is abundant, however the cost and functional requirements for many of the K12 organizations, are simply out-reach. There are some providers that are potentially high-value for the community, but it seemed apparent to empower school districts, the general operator-model was a prerequisite for success.

6. InCommon Affiliate assistance/role in pilot, if applicable

Perhaps it is best to start by providing the Illinois visionary objectives through services and software resource acquired from the InCommon Affiliates utilized by the Illinois project in the

scope germane to the Quilt/InC K12 pilot project. First, as described in the previous section the Illinois project scope was ambitious and included external partners that would leverage the central services established in the course of the overall project space. Through active and constant inquiring participation, the Illinois team members were educated and made aware of the options, previous experiences, and expert knowledge shared by other pilot projects and community leaders. Through this process the Illinois objectives and goals to be fulfilled with the aid of commercial providers included the following conceptual areas:

- Centralized IDP/Proxy implementation based on a rock solid and scalable model, which at the time seemed best served by using the Shibboleth IDP to achieve the objective of a multiple tenant deployment model. This conceptually could be thought of as an IDP condominium where the “Operator” is the management service that takes care of all the “common-areas” and provides for general property management liabilities of the physical service asset. School district organizations are the condo occupants that enjoy the conveniences and luxuries of condominium life, allowing them to focus on the business of delivering curriculum to their students.
- Centralized App-Launcher presentation service provided by the “Operator” leveraging a similar multiple tenant ideology where school districts are empowered to manage visual characteristics of their unique tenancy in the portal and further to centrally enable them to provide their user-populations with access to application that are relevant to given segments of the population. For example, early childhood teachers and students use different applications and have different requirements than those of the elementary, middle, or high school population segments. The objective was to establish a model implementation the fully realized the functional potential represented by reasonably expressive authorization attributes supplied by the identity service.
- Centralized Administrative Interfaces for the “Operator”, IDP tenants (school districts), and App-Launcher tenants. This focus area was primarily concerned with implementation of a set of business process workflows that encompasses: 1) the IDP and school district functions like delegated authentication and authorization attribute interrogation; 2) the IDP and Service Provider functions that provides a minimal set of attributes while enabling application specific requirements to be declared; and 3) allows school districts to select registered providers that will be serviced by the central IDP.
- Resources and services produced by or on behalf of IlliniCloud would be open licensed and made freely available to the community of K12 school districts and K12 Federation Operators to promote community adoption and continued development into the future.

Bearing in mind the conceptual visionary goals above the following outline provides a high-level accounting of the engagements IlliniCloud has under taken during the course of the K12 Pilot project with InCommon Affiliates:

- **Unicon**

- First engagement: provide ISLE project partners with an assessment of the overall work requirements necessary to deploy, implement, and sustain the portal and identity service components.
- Second engagement: prepare and deliver 2-hour recorded knowledge sharing sessions for the ISLE partners over the course of 4 weeks. Each session is approximately 2 hours, slides and session recordings as follows
 - [Session 01 - Basic Portal 101.pdf](#)
 - [Session 02 - uPortal -- Basic Application 101.pdf](#)
 - [Session 03 - uPortal - How to frame and present stand-alone applications.pdf](#)
 - [Session 04 - uPortal - How are user and application sessions managed-.pdf](#)
 - [Session 05 - uPortal - How are the Portal Look and Feel Managed.pdf](#)
 - [Session 07 - IAM - IAM Basics.pdf](#)
 - [Session 08 - PM Concepts.pdf](#)
 - [Unicon IlliniCloud Session 1 0.flv](#)
 - [Unicon IlliniCloud Session 2 0.flv](#)
 - [Unicon IlliniCloud Sessions 3 0.flv](#)
 - [Unicon IlliniCloud Sessions 4 0.flv](#)
 - [Unicon IlliniCloud Sessions 5 0.flv](#)
 - [Unicon IlliniCloud Session 6 0.flv](#)
 - [Unicon IlliniCloud Session 7 0.flv](#)
 - [Unicon IlliniCloud Session 9 10.flv](#)
- Third engagement: uPortal, Shibboleth SP, and Shibboleth IDP initial configuration, deployment on IC private cloud, and establish shared development support service. This scope of work was scheduled and organized to ensure that both Unicon and Aegis contributors would be on-site together with the ISLE partner team contributors.
 - uPortal
 - Multiple tenant constructs and Operator administrative features
 - Initial deployment model: Apache HTTP, Shibboleth SP, and database service. Other developer resources included GitLab, Atlassian's Confluence and Jira service.
 - Shibboleth IDP
 - Initial deployment model and configuration of the uPortal's Shibboleth SP.
 - Assist ISLE project partners with Shibboleth SP deployment and configuration for interoperation
- Two additional engagement extensions were concluded, these coincided with similar development extensions with Aegis Identity
 - Code-name: project "Blue Box", knowledge and digital asset acquisition related to inBloom dissolution. Acquisition, analysis, and assessment were the primary objective for this aspect of the project work.
 - Post "Blue Box" engagement primarily focused on uPortal enhancements and features to target users based on eduPerson values from the IDP.

- ***Aegis Identity***

- Purchased perpetual license covering Trident for any IlliniCloud members
- First engagement: coinciding with Unicon's third engagement focused on implementing Trident services
 - Establish multiple-tenant and logical "Operator" within the operational context of Trident.
 - Use Trident to augment Shibboleth IDP with two functional capacities
 - Provide IDP with connectivity demographics for logical tenants in real-time during an authentication request cycle
 - Just-in-Time provisioning of session users demographics using Trident synchronization service to populate a common database table for the single user in real-time. The database table is used by the Shibboleth IDP to resolve and filter SAML attributes for the session. Provisioned demographics are persistently stored and authoritative for only the life-cycle of the logical session they represent.
- Second engagement: project "Blue Box"
 - Together with IlliniCloud and Unicon the knowledge transfer and digital asset acquisition project work was concluded
 - During this engagement, the Australian Access Federation Registry project was adopted to serve as a foundation to implement a series of administrative user interfaces for IDP tenants and Service Providers.
- Third engagement: post "Blue Box", two primary focal areas
 - Continued development of the administrative interfaces for the LEA and SP operational partners of the IDP/Proxy service with concentration on standardizing configuration and deployment for tenants.
 - LEA on-boarding and engagement focused directly on contacts and refining the human user experience using the "self-service" interfaces.

As indicated in the above affiliate outlines, it is clear that the Illinois K12 Pilot project is multifaceted but keenly focused on establishing services that would enable an "Operator" like IlliniCloud to provide federated services to a collection of K12 school districts. The fundamental objectives include the easy-of-use, sustainability, and administrative autonomy for school district tenants of the data, identity, and portal service stack. The three major engagement sequences each represents approximately 6 month cycles.

7. **Outcomes**

- Challenges encountered and how were they addressed

The list of challenges is extensive when it includes the considerations related to managing large scale project vision funded by a public agency, with fiduciary oversight provided by multiple public agency representatives, and cohorts of competing motivations ranging from political posturing to aggressive go-to-market profiteering. This spectrum of human factors has the ability to derail and negatively impact the even well orchestrated projects and the Illinois K12 Pilot project was confronted with a cornucopia of these kind challenges. The technical challenges seem trivial in contrast however they are the most germane here with some of the most important high-level ones outlined below:

- Identity and Data service are closely bound together

Let us consider the color-spectrum of vendor requirements that are imposed onto school districts to used applications without considerations related to SSO capability of the applications. There are multiple tiers of data requirement types in the world of K12 just make most applications operational, these are: identity information (accounts), “roster” information which generally includes teacher, student, school, and course relationships, and “performance” information which includes intimate details related to scores, interventions, and holistic meters for educators, students and K12 institutions.

A real-world example of how an application may be brought into a classroom for use by an educator and their students could start with the educator self-registering with an application vendor online. This action provides them with an account for that application where they would normally enter demographic details about their students so that they will be able to use the content managed by the educator. Obviously, the day-to-day management of student demographics would fall onto the educator when new students enter or existing students leave which is not an uncommon circumstances.

In worst cases, these data-transactions happen with no institutional knowledge or oversight which can result in a lack of accountability for personally identifiable information in the custody of a third-party indirectly provided by the K12 organization the educator is associated with. In the best of cases the data-transactions are delegated and/or managed by a business process complement with some level of automation tools

to schedule, account for, and/or monitor institutional provide informational resource to external service providers. The IlliniCloud data service and identity service are explicitly bound minimally with the burden to ensure that user's authentication and the resulting session characteristics can be mapped to SIS users for cases where "roster" data-sets are used by applications to recognize the service features that should be provided to the user based on their identity and "roster" characteristics.

In other words, from the IDP/Proxy perspective, SPs may only desire to receive a single value that will map the session to their own pre-populated database of users. The IDP/Proxy may deliver login-identifier used, or derivatives like a persistent-Id, transient-Id, eduPersonPrincipalName or any other agreed upon value construct that enables the required matching of session-user and database-user-record(s) after a successfully satisfying an authentication challenge. This is the simplest IDP/Proxy case.

- The IDP Operations and General Purpose Attributes

In contrast the K12 App-Launcher does not pre-populate any LEA "roster" data-values. Rather, it interrogates the collection of "general purpose" attributes that include a small subset of eduPerson schema components. The portal recognizes when a session is unauthenticated and responds with a public viewable presentation associated with the "Operator", IlliniCloud in our case. When the session is authenticated the portal can detect the user's organizational association (either IlliniCloud or one of the tenant-LEAs using the portal) using the eduPersonOrgDN variable. Similarly, IDP operational partners utilize eduPersonAffiliation along with tiny refines to the definitions of 4 of the fixed-vocabulary terms available to make them more useful and precise for the K12 case:

- *Faculty* is "Teacher of Record", the one who sits before and lead one or more groups of students, this user should authorized to work with identifiable student data.
- *Staff* is anyone that is authorized to work with identifiable student data that is not a *Faculty*. It could be an office secretary or the LEA's Superintendent.
- *Employee* is anyone that is authorized to authenticate but has no authorization to work with identifiable student data.
- *Student* is hopefully candidates are self-explanatory and should be authorized to view their own data

We assert that the above four values are mutually exclusive and will be presented along with the value Member in eduPersonAffiliation for users that meet the criteria defined by the LEA. The term “Affiliate” has also been adopted to indicate when present an expectation that an eduPersonEntitlement would exist to better delineate this user’s type. For example, we have adopted the convention to present values in this variable as URLs in the form show in the first bullet followed by two more examples:

- <http://district-identifier/sp-identifier/custom-variable/variable-value>
- <http://district87.illinicloud.org/app.illinicloud.org/Affiliate/Parent>
- <http://dist428.illinicloud.org/app.illinicloud.org/Affiliate/Mentor>

The App-Launcher is engineered to dynamically consume eduPersonAffiliation, eduPersonOrgDN, and eduPersonOrgUnitDN (school building assignment(s)) and present app-tiles based on the constraint combinations defined by the portal LEA tenant administrator. One more easily consumable example: Consider a school district composed of several elementary schools, some middle schools, and one or more high schools. In this case the content defined in the App-Launcher could be organized such that, all Elementary Teachers see content for them and their students. Elementary students see only content for them. Similarly, content for the middle and high school populations could be constrained to NOT expose elementary content to them. This construct enable LEA portal administrators to leverage the course granularity of Affiliation and Location values to refine “who sees what” within their portal tenancy.

- The IDP Operation Partners (LEAs and SPs) and Federation Registry

The relationship between the identity service and LEA authoritative source systems are intimate and sensitive requiring a series of technical details to be exchanged to enable the operational partnerships. The strategic approach adopted the AAF Federation Registry, a grails application, to act as the basis for “Self-Service Administrative Interfaces” that would allow IDP Operational Partners to establish and manage their relationship with the identity service. The workflow in general, involves an organization application which may be for an LEA or SP organization. These result in a single organization entity administrative account that is empowered to manage their IDP relationship. The most important operational observation is that the IDP/Proxy does not persist or retain LEA user demographic details beyond the life-cycle of a given session

context. This means that the IDP/Proxy delegate authentication to the authoritative source system in real-time as they occur and when successful, the service interrogates the defined systems to satisfy the general purpose attributes and any application specific requirements declared.

The federation registry adaptation implements hybrid version of the logical IDP object model to capture connectivity details for authoritative source systems for LEAs with the expectation that the general purpose attributes can be properly handled. The SP registration has similarly adopted to capture application specific attribute requirements and includes considerations to capture variable level terms-of-use and life-cycle-manage statements. LEA Administrators are empowered to select registered SPs and provide resolution rules for any application specific requirements. Documentation and video clips have been created and published on the project wiki-site. These documents and resource are weighted heavily toward LEA enrollment as shown in the following:

- [IDP Operational Partners](#)
 - [Organization Registration](#)
 - [IDP Operational Partner “Service Registration”](#)
 - [LEA Operational Partner Connectivity](#)
 - [LEA Operational Partner Attribute Resolution](#)
 - [LEA-IDP-SP Relationships](#)
- The IDP Operations between Operators, State and Regional Ed Authorities

There have been several circumstances that have not yet been addressed related to organizations that may have an important role to play in the K12 Federated Services. We have received multiple organization registration applications for Learning Technology Centers in Illinois. The current hurdle is to determine how these organizations can use the central services or how they may be leveraged enroll or manage aspects of the business process flow used to enroll partners. These types of tangential organizations are a systemic component of the ecosystem and should have a participatory role to play. It is currently assumed that a “virtual organization” construct will be implemented to accommodate these types of organizational entities. However, this is an open consideration for now.

- The Impact of External Entities on the ISLE Project

At approximately the timeframe that the ISLE project was being ignited, The Council of Chief State School Officers (CCSSO)¹ in collaboration with the Gates Foundation and the Carnegie Mellon Foundation funded efforts started as the Shared Learning Initiative (SLI) was coming into being. This effort evolved into the Shared Learning Collaborative (SLC) and finally took shape as the Atlanta based non-profit organization known as inBloom. The impact and influence of this externally driven effort on the ISLE project leadership cannot be over emphasized, assumptions were adopted that effectively dictated dependencies to engineer resources for the purpose of supporting exclusive integration with inBloom as a primary objective despite the many early warning signs and symptoms exhibited by the effort in terms of materially supporting tools and services that were usable by K12 organizations. The Illinois school districts directly engaged with this effort were consistently challenged to minimally meet the operational requirements

The inBloom technology requirements included direct integration of identity and data resources from local school district, student information systems into the centrally service constructs operated by them. These requirements combined two distinct authentication and authorization approaches: 1) SAML2 based Single-Sign-On (SSO) integration for school districts with the inBloom services; and 2) an OAuth2 implementation to authenticate and authorize application to access API methods and features. The technologies and protocols set the threshold of adoption fairly high for most school district entities with limited supportive services to ease the overall liability to manage the on-going responsibility. These considerations encouraged the IlliniCloud to participate in the Quilt/InCommon K12 Pilot project which was focused on addressing the question: “How can Higher Education focused and developed Federated Service Concepts and practices be provided to the K12 and Community College community. This participation was profound benefit for IlliniCloud in terms of providing access to expertise and a community of interest seeking to address similar challenges for their local communities.

The directional strategies and influences championed inBloom had both positive and negative impacts on both the first and second phases of the ISLE project.

¹ www.ccsso.org

1. IlliniCloud, as the primary supportive agent for the Illinois inBloom pilot school districts, made every effort to work with inBloom to identify opportunities to make integration and adoption viable. For example, during latter 2013, an IlliniCloud team visited the inBloom offices for the purpose of exploring potential business models. The result of these sessions was introduction of an “Operator” model that would enable organizations like IlliniCloud (, a cooperative of local school districts,) to own and operate a technology infrastructure that could be operationally integrated with the inBloom while retaining local control and custody of all data resources while meeting the centralized data-model specification.

The discussion continued to mature into a joint exploratory effort to deploy a locally held example of the proposed integration. This collaboration produced the capacity to demonstrate the inBloom technology in a single virtual machine and/or a collection of virtual machines running on IlliniCloud infrastructure resources. Through the first Quarter of 2014, the relationship with inBloom was taking shape with a focus on developing business terms and contract language that would enable formalized continued development and implementation of the “Operator” model with IlliniCloud. In April of 2014, inBloom formally announced that it would be shutting down its operations after the climax of litigations that changed the game in New York, making it impossible for an external or third party provider to house and hold the scope and spectrum of data elements defined by inBloom’s Secure Data Service.

As a result of this advent, IlliniCloud was offered the opportunity to directly engage with the inBloom team prior to formal disillusion of the organization in Atlanta. This challenge was met by extending professional service contracts with existing development resources (both, Unicon and Aegis) to help IlliniCloud take physical possession of digital resources, documentation, and source code that composed the logical services that composed the inBloom platform. Upon conclusion and during the course of the acquisition engagement it became apparent that several systemic issues existed in the implementation that would require significant decomposition and refitting to better address the implementation of security related logic and segregation of personally identifiable data attributes from other data attributes.

2. Another area of directional influence was the adoption and implementation of a “Learning Registry” (LR)² server node that participates in a national data-replication scheme to sharing content resources and metadata with all other nodes in the LR network of nodes. This service has played a significant role, specifically in conjunction with the Learning Registry Metadata Infrastructure (LRMI)³ which focuses on the implementation of encoding tags that describe learning content reflective of national and local learning objectives. The ISLE partner Southern Illinois University (SIU)⁴, Career Workforce Development (CWD) center located on the campus of Lincoln Land Community College, in Springfield, Illinois adopted these technologies and developed the Illinois Open Education Resources (IOER)⁵ application. This application enables user to search and find content, apply meaningful tags to describe the content, to develop personalized libraries of content, and to share content with others using the application. The IOER contribution and work in these areas have helped to identify and to start addressing significant gaps in taxonomies and descriptive tags related to workforce development focal areas for which they have become nationally recognized valuable-contributor.
3. The grand vision marketed by the inBloom organization is that with the Secure Data Service, the API, and the platform, was the notion that the commercial vendor community serving K12 institutions would cheerfully provide the new applications and integrate existing applications with these technology services to provide Curriculum Maps and student-facing Learning Maps. Intoxicated by the vision and thirst for easy-wins, the ISLE Phase 2, leadership choose to go down a path to create a set of functional requirements that would be used to solicit vendor bids to adopt and/or create software resources to address those requirements.

The proposition seemed reasonable on the surface, however the context materialized an effective joint-venture with an assessment authoring vendor to supply application services for the RttT-3 participants and to effect the development of the Learning Map concepts within context of their proprietary

² learningregistry.org

³ www.lrmi.net

⁴ <http://cwd.siu.edu/>

⁵ <http://ioer.ilsharedlearning.org/>

application. This approach was met with a high degree of friction as it became apparent that the commercial interest and appetite of the vendor organization awarded the contract were not well aligned with the goals and objectives of the partners to develop and implement application components that would seamlessly interoperate. The overall relationship and approach violated a primary covenant that bound the original ISLE partners together to collectively work toward manifesting reusable and sustainable resources for the community of interest, P20 educators and learners. The effort and the investment incurred on this path were concluded with no tangible deliverables realized for or by the RttT-3 school districts.

To the benefit of IlliniCloud, the Quilt/InCommon K12 Pilot project provided opportunities to learn, collaborate, and network with other similar project focuses. Through the regular conference calls and discussions significant contributions were realized helping to ensure that the K12 community represented by IlliniCloud, would be served with the knowledge and practical capacity to formulate a sustainable and operational federation of K12 “Operators”. Identity is an important and considerable component of the equation, however it generally must be coupled with some-level data-exchange (roster: as previously mentioned). The federated operator model attempts to provide for the concept of “self-service” administrative user-interfaces for: a) the operator; b) the school district or districts serviced by the operator; and c) application service providers.

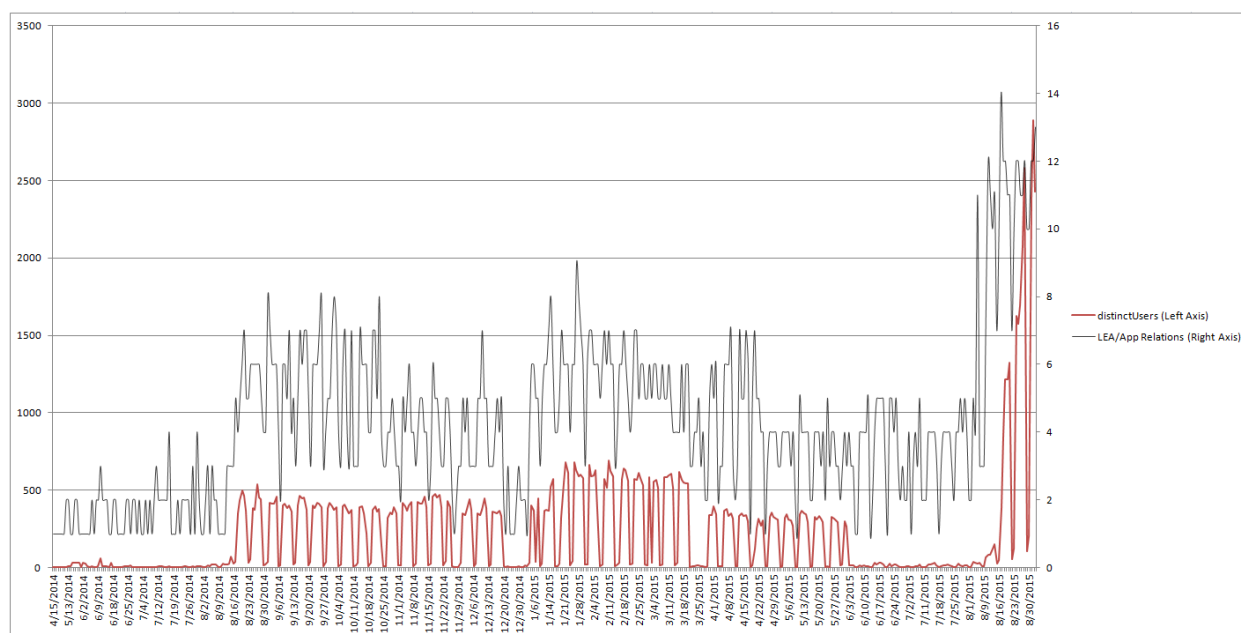
This approach enables the IDP/Proxy relationship with school districts can be established in complete segregation from the actions needed to enable application service providers. In essence, the administrative interfaces are declarative by both LEAs (school districts) and SPs (application service providers). The degree of completion achieved thus far on a path to provide automated real-time configuration modification, is that they capture connectivity requirements from LEAs as well as attribute resolution rules for the core general purpose attributes the IDP service desires. SPs entities use them to declare their application requirements by selecting from the general purpose collection or defining application specific variables. LEAs select and complete any additional resolution rules for custom application-specific attributes and/or satisfy roster requirements. These actions alert the operator to enable the configuration to facilitate connecting the two preconfigured entities.

The course of development leveraging the Federation Registry⁶ as a foundation to defined data-collection requirements from IDP-Operational Partners⁷ was conceived and inspired during the inBloom knowledge transfer and digital asset acquisition work completed during 2014. This work was primarily preformed using the professional service contract with one of our inCommon Affiliates. This work reached a functional level of maturity enabling IlliniCloud to use them to on-board a collection of additional school districts that are using the identity services for the 2015-2016 school year.

- Successes/Benefits for K12 users

As a frame of reference the following graph is provided to show successful SSO authentication events at the IDP/Proxy since being placed into service. The darker line represents the number of unique lea/app relationships (scale on right) that occurred on a given date and the red line represents the number of distinct end-users observed on a given date. This graph shows a fairly consistent utilization during the course of the previous school year (2014-2015) which also represents the first operational deployment. The production services were primarily used by two school districts during this time period: Bloomington SD87 and McClain County SD Unit5.

Graph#1: Authentication Events and User Counts, all LEAs and SPs using SSO

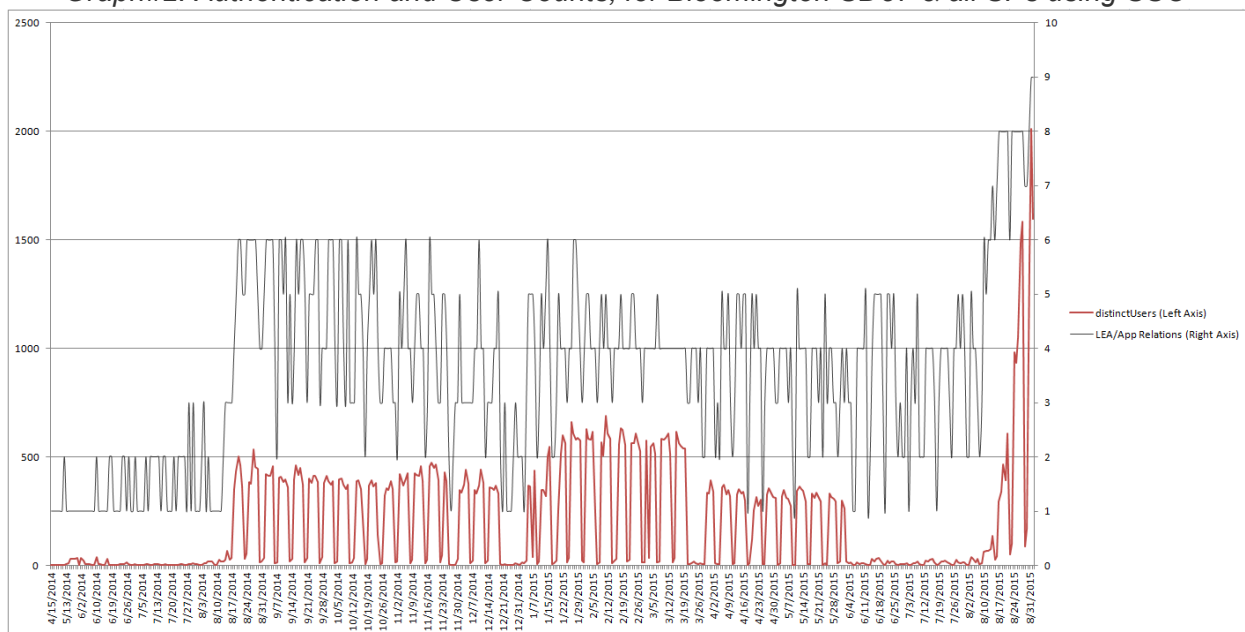


⁶ <http://wiki.aaf.edu.au/federationregistry/>

⁷ <http://confluence.illinicloud.org:8090/display/TP/IDPOperationalPartners>

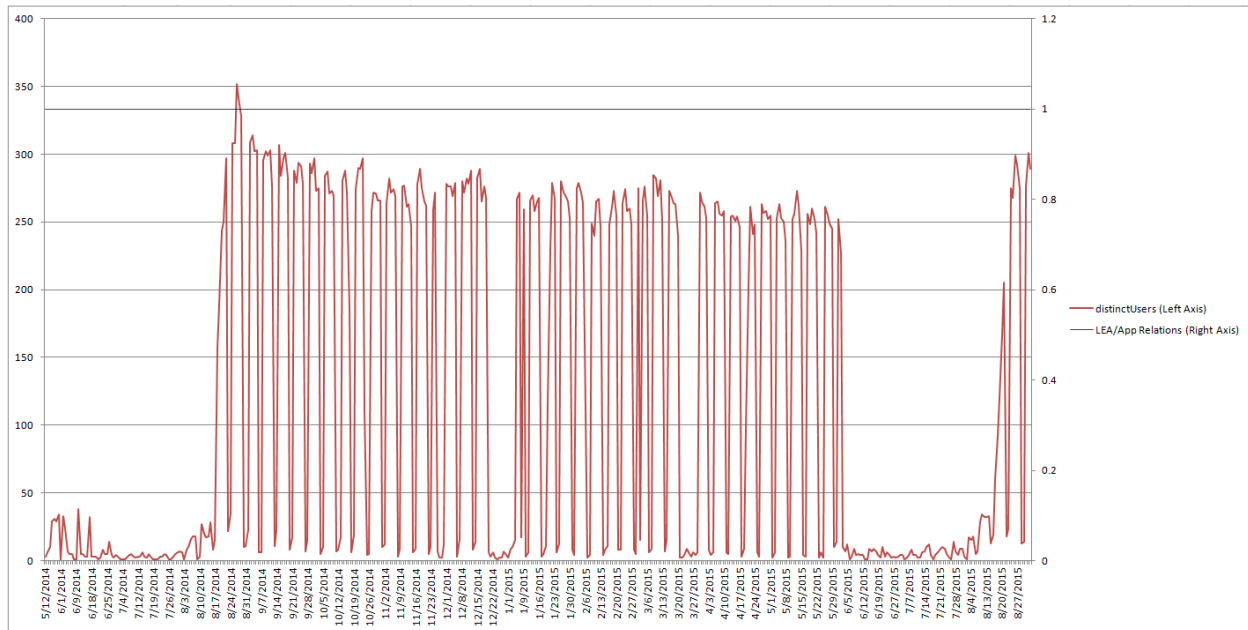
To better interrupt the above visualization it may be helpful to be aware that the production roll-out of functionality and features in the app-launcher portal and identity systems focused on both the priorities of IlliniCloud as the sustaining service provider to community of consumers and their role in the ISLE project. In this capacity, a strong concentration of collaboration with ISLE development teams enabled them to quickly implement SAML compliance within context of their individual application services. Similarly, IlliniCloud seized an opportunity to enlist high-value vendors used by the pilot LEAs to adopt and leverage the identity service. Graph#2 shows a similar presentation as the previous graph, but is limited to data-points that belong to Bloomington District 87 and shows the growth of SSO enabled applications (in production) as well as the number id distinct users observed for them.

Graph#2: Authentication and User Counts, for Bloomington SD87 & all SPs using SSO

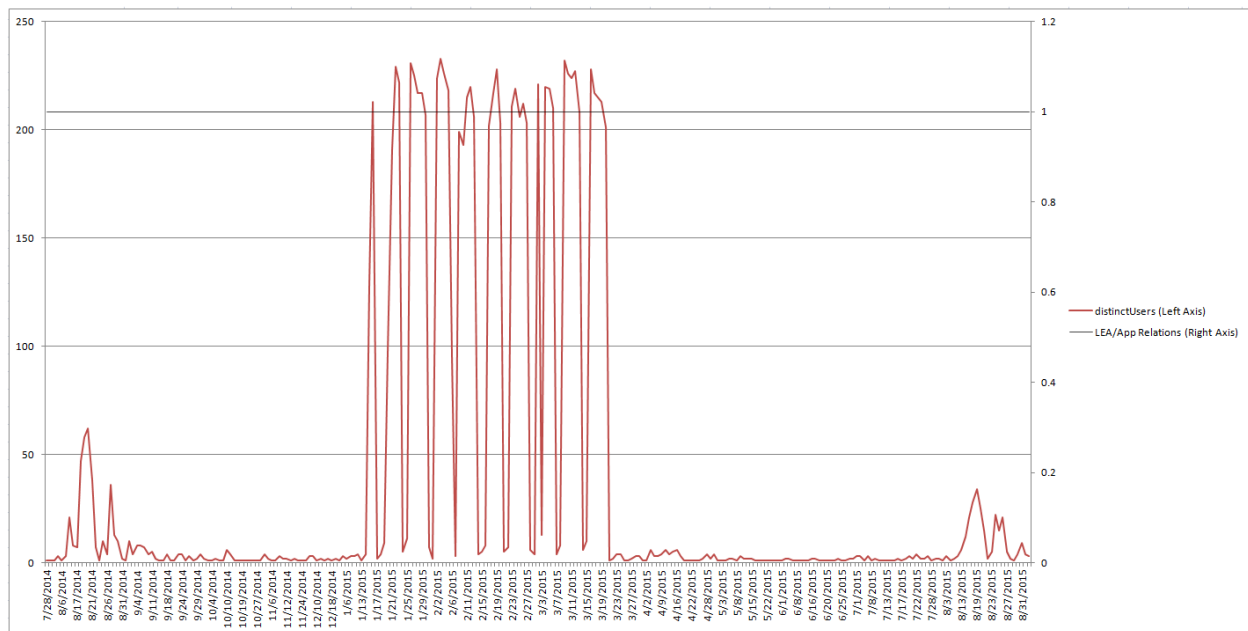


The Educator Dashboard application and the IOER Application as SSO enabled applications are shown below. It is important to recognize that the Educator Dashboard application is an Educator facing application and does provide service to students. Bearing this fact in mind, the distinctUsers (Red) line in Graph#3 reflects strongly on Educators (and some other delegated Staff members) that used the application as an IDP authenticated user.

Graph#3: Authentication and User Counts, for Bloomington SD87 & NIU's Educator Dashboard

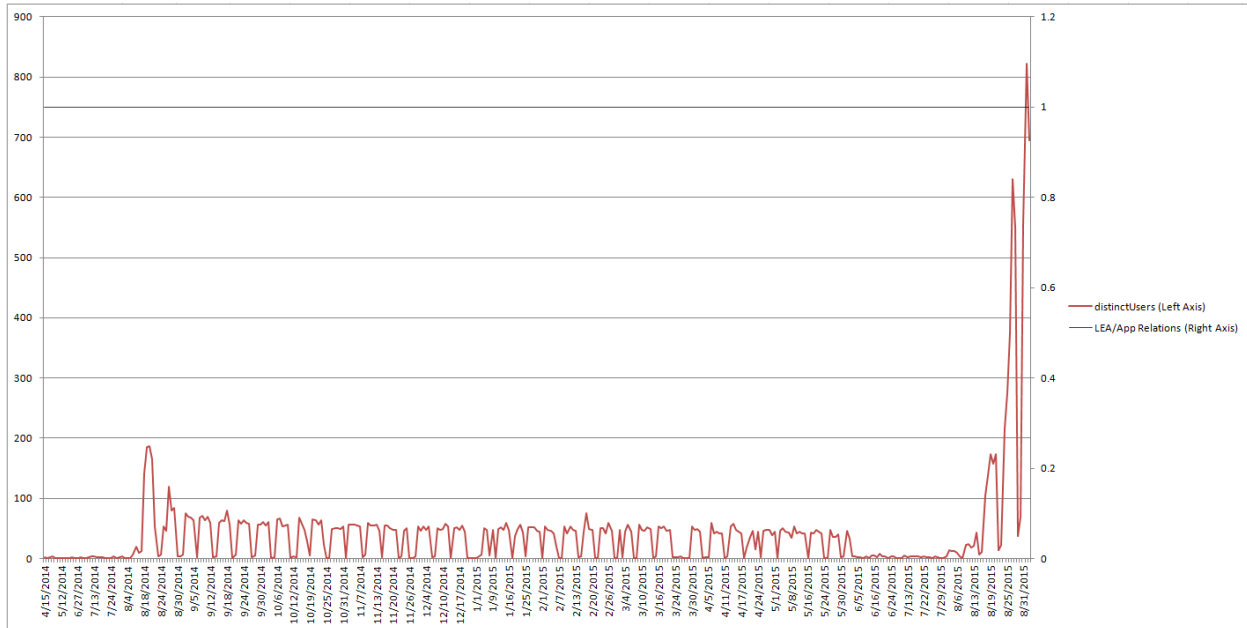


Graph#4: Authentication and User Counts, for Bloomington SD87 & SIU's IOER Application

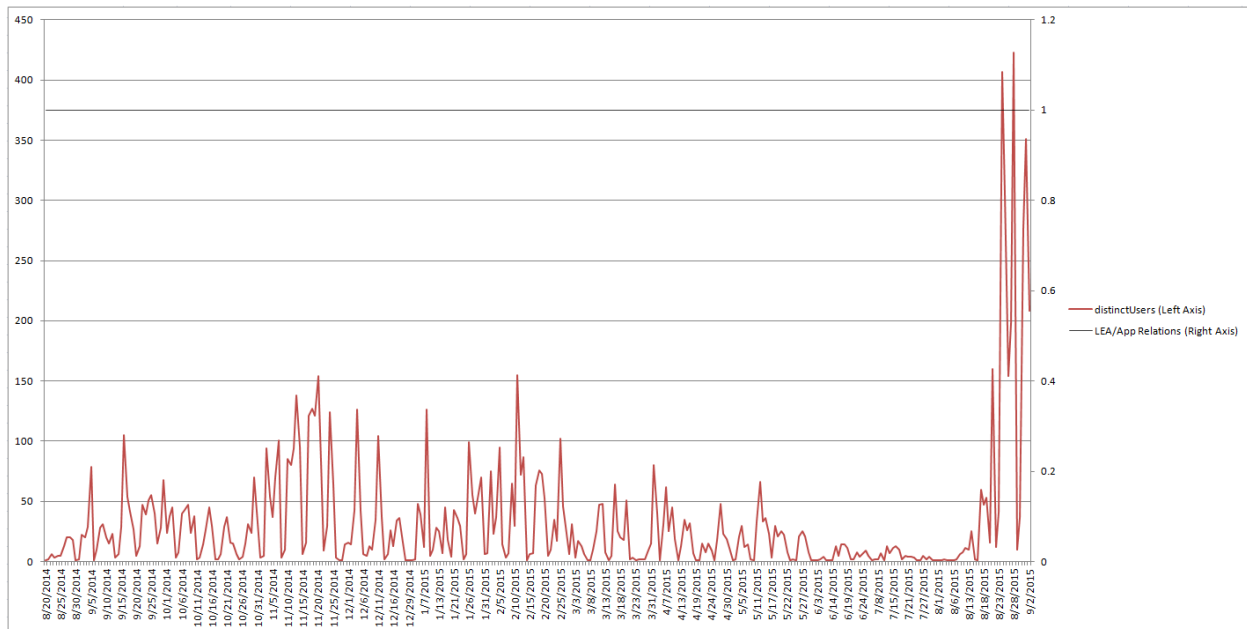


The two previous graphs show some utilization spikes that stand out from the general utilization pattern indicated over the time-window shown. These may represent professional development sessions, conference workshops, developers, and/or other community engagement activities.

Graph#5: Authentication and User Counts, for Bloomington SD87 & App-Launcher Portal



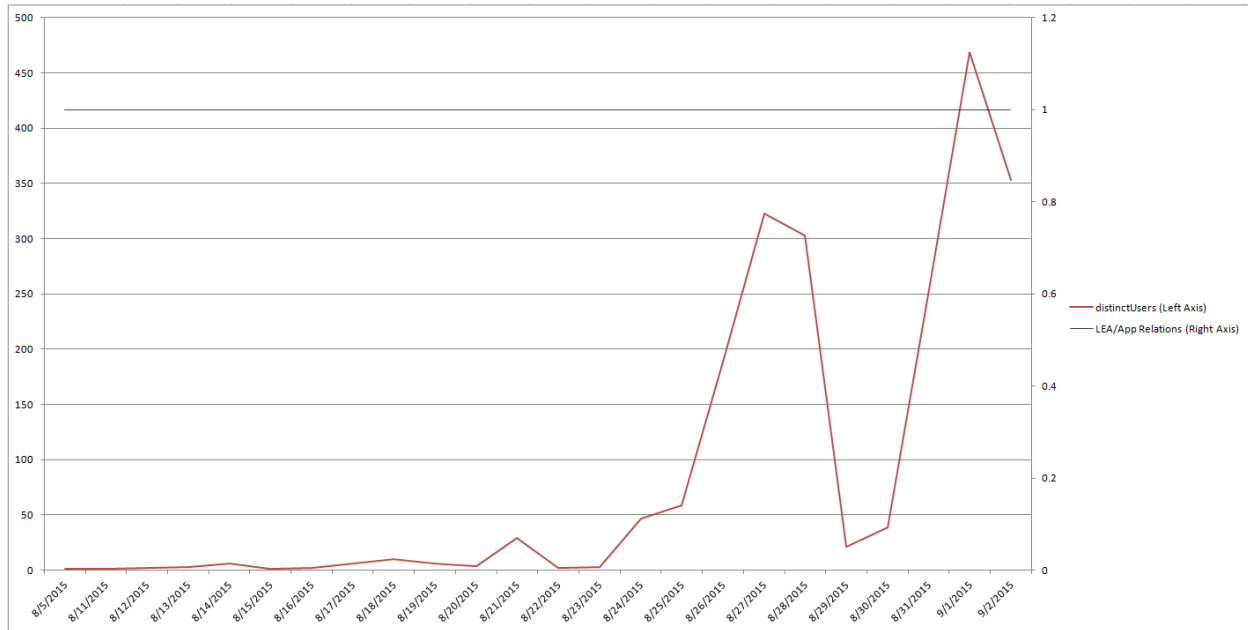
Graph#6: Authentication and User Counts, for Bloomington SD87 & Moodle (lms.district87.org)



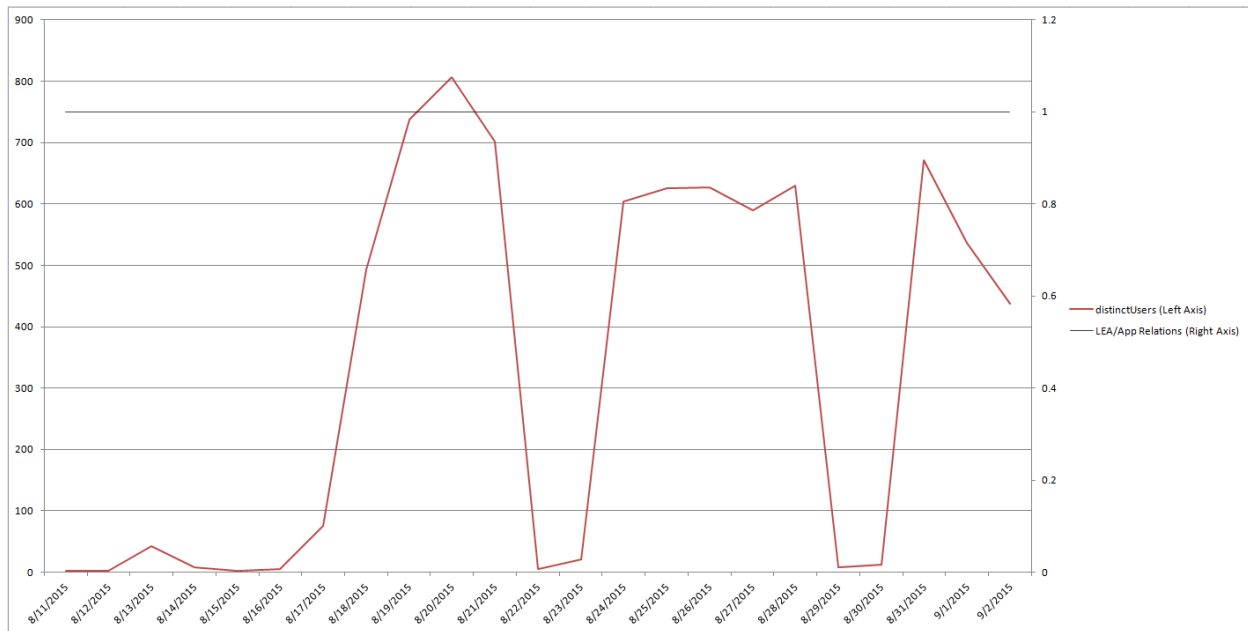
The obvious spike in utilization this school term versus the previous one at Bloomington SD87 is directly related to a roll-out of the App-Launcher to the full population and being fitted with the application-tiles that represent the applications the teachers in the district use. The some

applications are SSO enabled and some are not. It has been clearly heard from the user-community that their preference is to have more applications that work with the SSO feature.

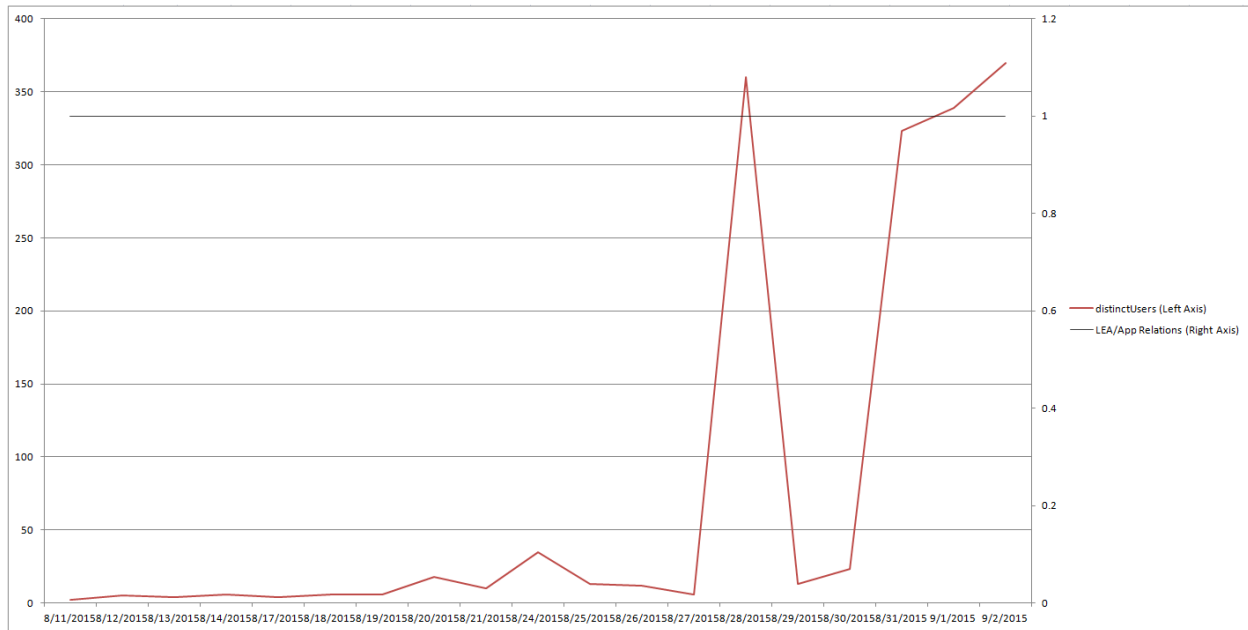
Graph#7: Authentication and User Counts, for Bloomington SD87 & Pearson EasyBridge



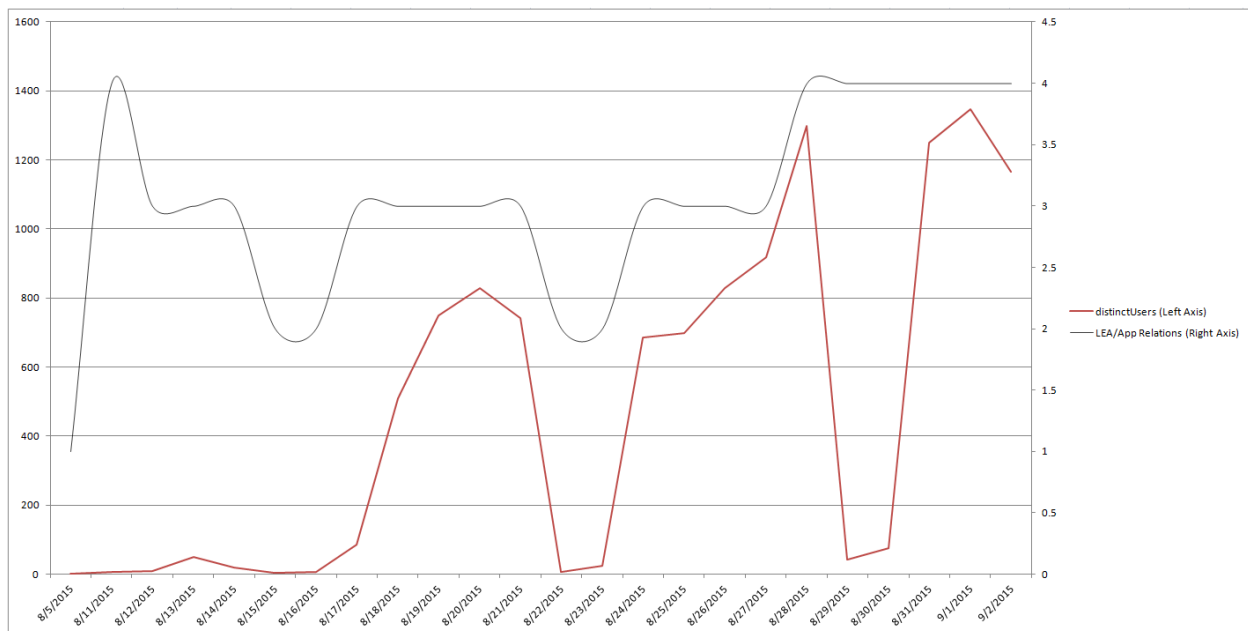
Graph#7: Authentication and User Counts, for Woodstock CUSD200 & Pearson EasyBridge



Graph#8: Authentication and User Counts, for Dekalb SD428 & Pearson EasyBridge



Graph#9: Authentication and User Counts, for All LEAs & Pearson EasyBridge



The four previous graphs focus on some of the Pearson EasyBridge integration with the last one showing the cumulative summary across the LEAs using the service. In each of the LEA cases, an incremental roll-out is planned to include a more broad range of students. The significance of

this application's graphs is that the users are predominately students in the elementary and middle school levels. The Moodle graph is also mostly representative of student-users.

8. ***Moving Forward***

- **Lessons learned and recommendations to others**

Support your local K12 school district(s) and recognize that the community of practice is the expert-authority to define what is needed and secondly to be humble enough to take the time needed to ensure that the community voice is the driver of the change they must own and operate into future even after we are all gone. There will be new students each and every year and the LEAs will evolve and adopt the most cost effective, beneficial components and technologies they can facilitate on limited budgets and human time.

Improving learning outcomes starts in the classroom with a teacher and the students they mentor through the regiment of curriculum. Improving the daily life of the educator with technology revolves concentrically around the business processes that dictate the complexity or simplicity of establishing learning-resource relationships to serve their students. Save time, automated general data-handling to reduce friction and improve accountability for data-assets that may be exchange with service providers.

K12 improvement programs are characteristically top-down driven, short-sighted with short life-cycles, and more often than not are designed more to generate metrics to visualize trends in cost, educator and student performance, population demographic, and other special purpose considerations, specially special needs management. These are all important and necessary inquiries to inform executive leadership at every administrative-level as an aid to the decision making process. These types of programs rarely provide any immediate benefit to the practitioners or learners; instead it is likely imposes additional human time-load requirements at the local-level. Idealistically, school improvement begins at the school and should enable agility, tools, and protocols that empower the school to use data to improve local decision making and can be used to inform the educational administrative oversight hierarchy.

The Q/InC wiki-page, “Working with vendors”⁸ highlights challenges, observations, and recommendations with a focus on professional services, open-source development, and proprietary products.

- Plans for scaling beyond current scope

The IlliniCloud service scope will be improved and be deployed across multiple data-centers in Illinois. This project trajectory has been seeded with the enrollment of core founding cooperative school districts that operate the IlliniCloud data-centers. Beyond this objective the longer term goal is continue to engage and drive toward a standardization of operational requirements for regional K12 federation operators to collectively interoperate and collaborate to advance the entire community of practice.

- Next Steps

Our collaborations began like many others, surfacing naturally over the years, as we discussed ways in which we could work together to meet shared challenges. Nebraska and Illinois participated in the Quilt inCommons Project, and found we were on similar paths. We began meeting weekly via phone conference, which resulted in mutual visits, shared presentations and a formal agreement between our organizations to work together on the development of federated services.

As we attended national conferences, we met with other regional, state and large district operators. K12 operators from around the country attended our weekly calls to share their project spaces and opportunities for collaboration.

The Clark County School District was one of these, seeking to contribute their security project work, and their interest in federated identity services. Mutual site visits and discussions led to a pending formal agreement to collaborate.

Our growing collaboration of operators became aware of the work in New York around their data hub during the CoSN Conference in Atlanta. As the technical leads shared out information on our weekly calls, we became very interested in leveraging their work, and continue to seek opportunities for sharing and formal collaboration.

This group of operators developed core understandings:

- as operators, we have our own project spaces for serving districts
- we have identified common threads within our independent projects
- we have identified a series of federated services as a common goal
- we believe that collaboration is crucial to the success of our common goal
- we have an interest in pooling resources for the greater good
- we have an interest in developing standards-based, open-source resources for K12 operators

⁸ <https://spaces.internet2.edu/display/InCQuiltFed/Working+with+Vendors+for+K12+Federation>

- we have an interest in creating an organization of K12 operators and governance that provides a structure for shared and federated services
- we have an interest in having an open door for other operators to participate and contribute
- we have an interest in sustaining our shared and federated services indefinitely

A notable example of a success was the development of identity and portal services between Illinois and Nebraska. IlliniCloud was funded under a state project to develop and implement data, identity and portal services for school districts. The Illinois contributions to the uPortal development included multi-tenancy and the development of the App Launcher. As Illinois project funding came to an end, the Nebraska team picked up the development to further enhance additional operator functionality. Similarly, the multi-tenancy enhancement have stimulated considerable interest and contribution from other members of the Apereo community. These continuously improve the functional capacity of the uPortal foundation and enables IlliniCloud to leverage community contributions.

During Apereo 2015 Annual Conference in Baltimore, a meeting with the Executive Director, Ian Dolphin, to introduce IlliniCloud, the K12 operator concept, and to determine if/how they could help steward communal digital-assets and lead an effort to implement the organizational structure for K12 operators.

In July of 2015, we assembled the teams from IlliniCloud, Nebraska, Clark County, and Ian Dolphin of Apereo at a statewide CTO event in Illinois. We conducted a panel keynote session sharing the concept of the K12 Federation – a series of operators collaborating in the development of the federated service stack for K12 operators.

It is these efforts that we intend to continue to develop and nurture. The grand objective is the establishment of an operational collection of K12 organizations collaborating and contributing to a common set of foundational open-source components. The organizational requirements and minimal governance necessary to coordinate strategic support for K12 federated operators working collectively together to help normalize the business of making application, digital assets, and resources available to students and teachers in the classroom with the lowest threshold for adoption. To achieve this objective, IlliniCloud will continue to champion the evolution of a grass-roots community of practice that seeds development of a K12 Federation and components that empower operators to sustainably provide support for one or more K12 organizations using open-source, vendor neutral components, built for and by the community of practice.

The collaborative expectation is to seed the foundational components for K12 organizational entities to implement a common-set of practices empowered by technologies to improve access to digital resources for teachers and students. To achieve this objective, the collaboration initiative fosters establishment of sustainable communal entity empowering custodianship and stewardship for digital resources and intellectual property assets for the benefit of K12 community. We are already committed to this path, and understand the catalyst for supplanting availability for a team of operators, outsourcing foundational development, establishing the shared organization and governance, and the management of a self sustaining model is necessary. K12 federated operators working collaboratively can drive systemic evolutionary change that favors K12 organizations providing opportunities, access, and accountability.