KETS Technical Environment Information – Combined Documents

Last Reviewed: April 30, 2017

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The information contained within this Appendix is the current state for the respective Kentucky Educational Technology System (KETS) technical environments. Some environments refer to current or future project related work that may result in changes that impact the information contained within these documents. Where possible, that information is included. However, these documents are for high level planning purposes only.

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KETS Technical Environment Information Document

Active Directory

Section 001

Last Reviewed: 08/30/2016

Last Updated: 12/11/2014

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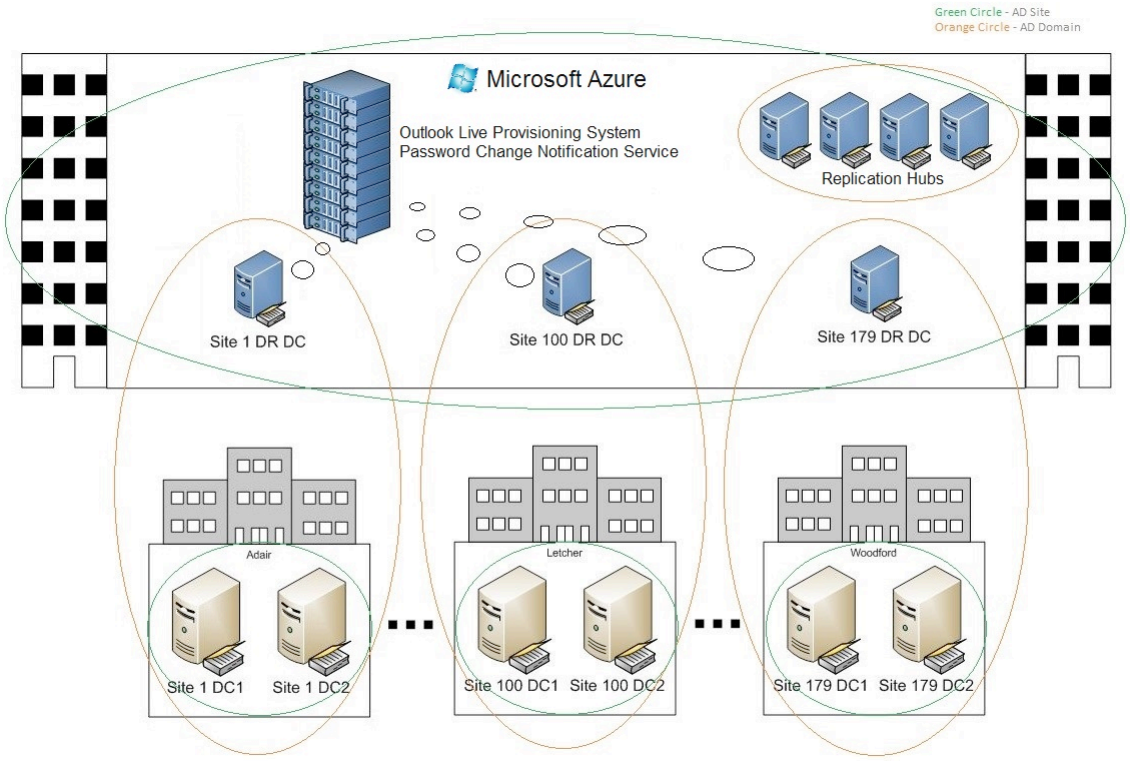
Summary

The KETS Active Directory provides authorization and authentication services for nearly 1,000,000 user objects and 500,000 computers and servers. It provides a directory structure for easier management of the user and computer objects throughout the KETS environment. Microsoft Active Directory services provide DHCP, DNS, WINS, Group Policies for object management, as well as normal directory services like authentication and authorization.

Visual Representation

This is a diagram of the KETS Active Directory structure. The green circles represent AD Sites for replication and the orange circles designate domains. One of the two district-located DCs is also a Global Catalog server. Though there are only three domains shown these represent 180 domains, and one empty root domain (181 total AD Domains). All Active Directory Domain Controllers are virtualized with the exception of the two root domain controllers located in Frankfort (GC/DC).



Description

The KETS Active Directory is a native mode Windows 2012 R2 single forest with 181 domains, averaging 3,500 users per domain. The smallest domain has approximately 500 users while the largest has nearly 125,000. The forest consists of a root domain, one domain each for the Department of Education, KY School for the Deaf (KSD), KY School for the Blind (KSB), a research and development domain as well as one domain for each of our 173 school districts. There are also three additional domains that are used for piloting updates. Each domain has a minimum of three domain controllers with one acting as a global catalog server. One DC for each domain is located in Microsoft Azure 'in the cloud'. This provides off-site redundancy from a district perspective. Generally, each district is also a single site within the directory structure. Replication within the forest is a hub and spoke model with replication hub servers hosted in Microsoft Azure and site links created between each domain and the hub site. AT&T's Netbond VPN solution as well as Microsoft EtherExpress allow for a reliable network connection between the KETS on premise network and the cloud subnet.

Windows 2012 R2 DNS and WINS provide naming services throughout the internal network. DHCP provides IP addresses to workstations while servers use static addressing.

Organizational units have been created for Students, Staff, Leadership, Workstations, and Local Servers. These top-level organizational units cannot be deleted or have their permissions modified. Key district technical staff have been delegated permissions to create/modify child organizational units for each school in the district as prescribed in the KETS OU Naming Standards document (available upon request).

Management and Support Strategy

The KETS Active Directory is monitored using Microsoft System Center Operations Manager. The KETS Messaging and Directory Services Team and the other operation service teams provide management of sites, site links, replication, domain controllers' hardware, and all naming services. The KETS Messaging and Directory Services Team manages all infrastructure and enterprise functions of Active Directory. District technical staff manage user account creation/modification, computer account creation/modification, and some group policy creation/modification within specified organizational units. Permissions have been delegated to a named group within each domain for these functions. When districts have issues they have the ability to call a technical service desk employed by KDE. Some issues are escalated to the KETS Messaging and Directory Service Team and potentially on to Microsoft through a Premier Support engagement.

KETS Technical Environment Information Document

Internet Content Management System
(Previously: Application and Content Caching)
Section 002

Created: June 23, 2005
Last Reviewed: 08/30/2016
Last Updated: 01/25/2016

Prepared By: Paul Shoemaker
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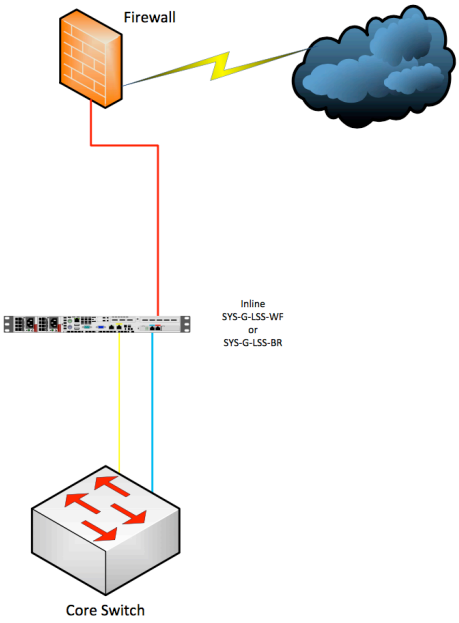
Summary

This document describes the design and use of Internet Content Management Systems within the KETS or Kentucky Education Technology Systems network and within the districts.

Visual Representation



Description

The Kentucky Educational Technology System (KETS) utilizes an MPLS connection to the Internet. The districts and KDE the Agency have independent connectivity to the Internet through the MPLS cloud. KDE the Agency has their own independent Internet Management System based on the Lightspeed Rocket product. Access and tracking are based on Active Directory authentication, IP addressing or client installation on the end-user system. This is an inline solution and all Internet bound traffic passes through the Lightspeed system. The Lightspeed system can be used in multiple configurations, captive portal being the most common configuration. Lightspeed is contracted to service KDE and district systems.

Districts are allowed to request a waiver from the Lightspeed product and select their own Internet filtration device, so long as it meets the requirements documented in KAR 701-5:120, CIPA and other regulatory guidelines or statutes. A baseline configuration is provided to all districts that may be used as a guide with the Lightspeed system. Districts

may alter that configuration to reflect any additional policies or restrictions they practice. Districts may employ a caching solution at their discretion.

Management Strategy

The Office of Educational Technology (OET) provides the Lightspeed solution and a baseline configuration for all districts. Lightspeed provide direct support for this product for districts and KDE. Each district is responsible for their maintenance and configurations beyond the baseline provided. If a district has requested a waiver for a different product, the district is responsible for all support and configurations and is expected to arrange for support from the providing vendor.

KETS Technical Environment Information Document

Database Environment
Section 003

Created: 2/24/2009
Last Reviewed: 1/30/2017
Last Updated: 1/30/2017

Prepared By: Martin Herbener
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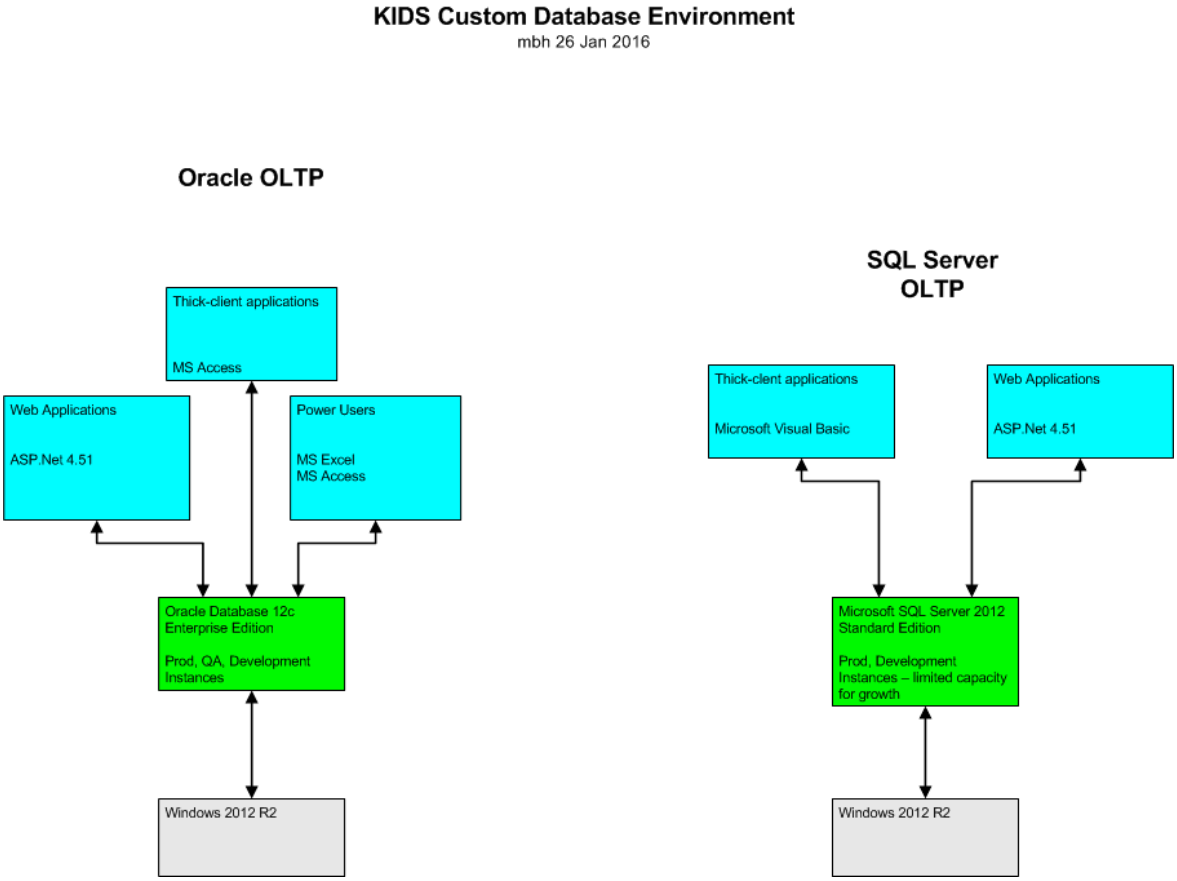
Summary

This document describes the custom database environment built and/or maintained by the Office of Education Technology. This document does not cover custom databases maintained by other offices of KDE, nor does it cover databases dedicated to supporting packaged applications and maintained as part of managing those applications.

Visual Representation



Description

The KIDS custom database environment includes the following parts:

- Oracle OLTP environment, with Development, QA and Production instances running Oracle Database 12c Enterprise Edition on Windows 2012 R2. This environment supports web applications, fat-client applications, and power users with desktop data access tools. Web and fat-client applications generally connect to the database using a dedicated per-application userid, while power users use database userids or Active Directory-based authentication. The production database is about 20 GB in size and contains about 500 tables, mostly in third-normal form.

- Microsoft SQL Server environment, with Development and Production instances running SQL Server 2012 Enterprise Edition on Windows 2012 R2. This environment supports fat-client applications, generally connecting with dedicated application userids. The production database is around 2 GB in size and contains around 60 tables.

Management Strategy

The custom database environment is centrally managed by the Database Administration team, which is responsible for database object creation and cutovers as well as routine administration. The DBA team meets needs for new instances by working with the application development group to determine needs and infrastructure groups to implement new hardware.

KETS Technical Environment Information Document

Application Support
Section 004

Created 2/24/2009
Last Reviewed: 1/30/2017
Last Updated: 1/30/2017

Prepared By Martin Herbener
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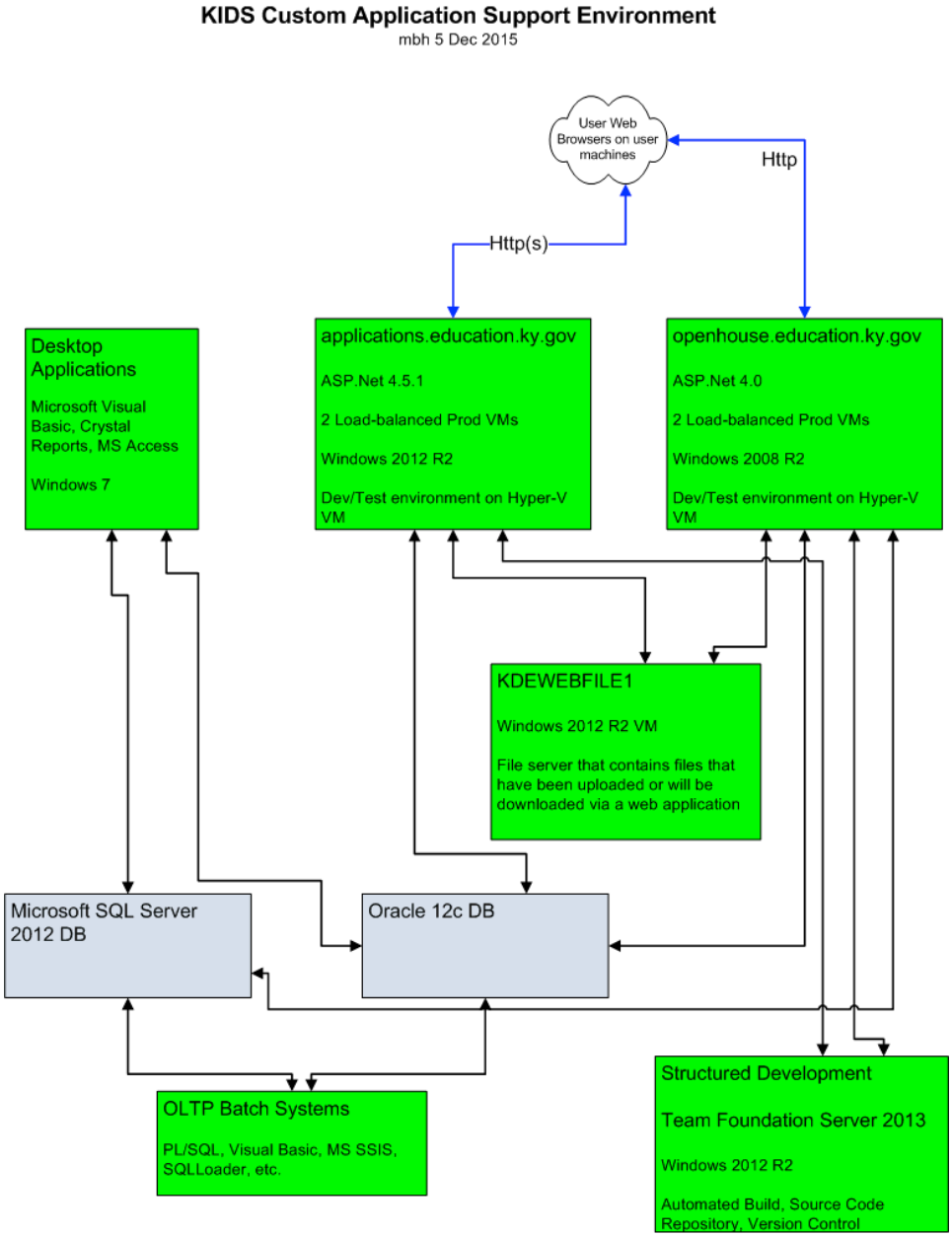
Summary

This document describes the Custom Application Support environment maintained by the Office of Knowledge, Information and Data Systems. This document does not cover Application Support carried out by other offices of KDE or Application Support carried out by outside vendors on behalf of KDE.

Visual Representation



Description

The KIDS Application Support environment includes the following parts:

- A current web application environment based on Microsoft ASP.NET 4.5.1, with Test and Production systems running on Windows 2012 R2. This environment supports about 30 data maintenance and reporting applications, some with login security using a shared, in-house user authentication/authorization system, with users from KDE, school districts and the general public. The Production system contains two servers with load-balancing and failover handled by network hardware. In most cases significant business logic is implemented in database stored procedures/packages. These applications were developed using XHTML, CSS and DHTML to improve functionality and maintainability. Standards support the major browsers on both Windows and Macintosh clients. Maintenance is managed and source code maintained in a Microsoft Team Foundation Server 2013 installation.
- Desktop application environment based on Microsoft Visual Basic, Crystal Reports, and Microsoft Access running on Windows 7. This environment is made up of a few systems for which desktop applications were more appropriate than web-based applications; user security is handled in a variety of ways. The users of these applications are all within KDE.
- OLTP batch loading environment using multiple products. Depending on individual need, batch load programs have been developed using Oracle SQL Loader, Microsoft Visual Basic, Microsoft SQL Server Integration Services, Oracle PL/SQL blocks, procedures and packages, Microsoft Transact-SQL Stored Procedures, and Oracle Warehouse Builder. Most of these programs are executed by development team members as needed, though a few are scheduled using Windows Scheduler or invoked by end users.
- Web file storage on a dedicated file server. This file server is used to store files, in formats such as Acrobat, Excel or CSV, which have either been uploaded from districts or are published through the website. This single file server stores files for all web application servers.

Management Strategy

Developers and administrators within a Development team carry out application maintenance and also manage the application server environments. Analysts within the same team are responsible for business requirements collection, analysis and system design.

KETS Technical Environment Information Document

Electronic Mail
Section 005

Last Reviewed: 08/30/2016
Last Updated: 4/1/2014

Prepared by John Logan
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Summary

This document describes the electronic messaging application used by the Kentucky Department of Education, KSB, KSD, and the 173 Kentucky school districts. The Office of Education Technology maintains this system. The solution also provides other services which are described in this document.

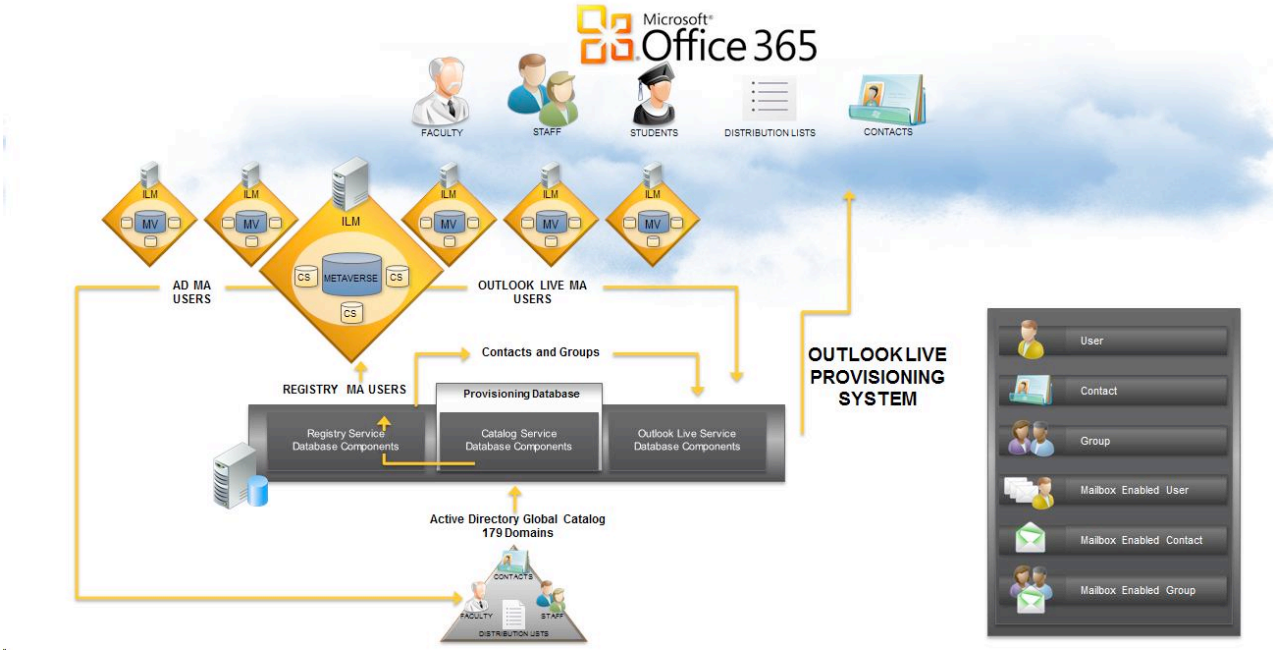
The Kentucky Department of Education (KDE) provides collaboration technologies to all Kentucky Public Schools. This comprises nearly 900,000 user mailboxes (faculty, staff and students). KDE has chosen Microsoft's cloud collaborative suite named Office 365. Office 365 is a collection of tools for messaging, web-conferencing, document sharing and its Office suite of applications.

Office 365 users, groups, etc. are created by a provisioning solution customized by Microsoft which pulls information from our Microsoft Active Directory environment. This solution, called OLPS, is a collection of Microsoft FIM servers, SQL, PowerShell, PCNS for password synchronization and custom code.

Visual Representation

Visual representation of the Office 365 suite. All users who are provisioned an Office 365 account get Exchange Online, Lync Online and a OneDrive 'mysite' for storage and document sharing. Office Professional Plus is currently not licensed for any users.

View of the provisioning infrastructure between Active Directory and Office 365. This allows us to utilize Active Directory for user management instead of using Office 365 directly for account creations, etc.



Description

The Office 365 solution is Microsoft's cloud collaboration offering provided out of Microsoft's datacenters. It is comprised of the following:

- Exchange Online – Microsoft's electronic messaging solution.
- Lync Online – Microsoft's web-conferencing solution.
- SharePoint Online – Microsoft's solution for securely storing, organizing, sharing and accessing your information.
- Office Professional Plus – Microsoft's cloud-deployed Office suite. This allows users to install and update the Office suite of tools on up to five devices from the Internet. Currently we do not utilize this offering for any users.

Management Strategy

The KETS Messaging and Directory Services Team centrally manages the Active Directory and provisioning solution responsible for CRUD (creates, updates, deletes) between AD and Office 365. The messaging infrastructure itself is managed by Microsoft. When districts have issues they have the ability to call a technical service desk employed by KDE. Some issues are escalated to the KETS Messaging and Directory Service Team and potentially on to Microsoft through a Premier Support engagement.

KETS Technical Environment Information Document

KETS Service Desk
Section 006

Created: 6/24/2005
Last Reviewed: 08/30/2016
Last Updated: 10/14/2010

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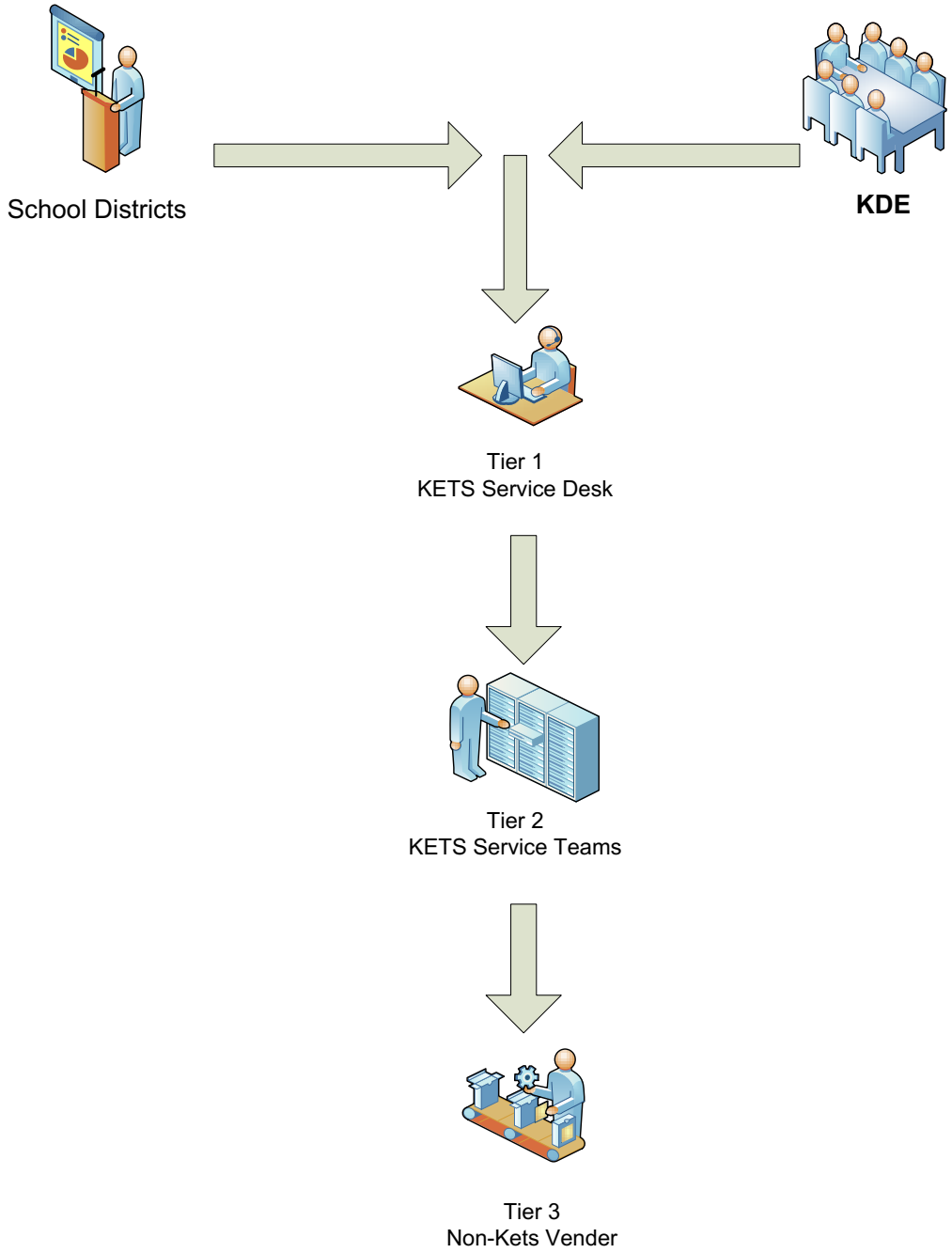
Summary

This document provides an overview of the KETS Service Desk Services provided by the Office of Educational Technology.

Visual Representation



Description

The KETS Service Desk provides support to both internal and external KETS customers. Internal customers are defined as the Kentucky Department of Education (KDE) including the Kentucky School for the Blind (KSB) and the Kentucky School for the Deaf (KSD) as well as districts (173) and schools (1,250) throughout the state of Kentucky. The KETS Service Desk also supports external customers defined as the general public who need assistance with any public facing technology that KDE provides such as web applications.

The KETS Service Desk resolves technical issues and answers questions on the following platforms and services: messaging, network connectivity, public facing web applications, internal desktop support (KDE the agency only), Active Directory, and network security. Issues are generally resolved within 20 minutes, though more complex issues may take longer. Resolution may entail working directly with a Service Desk analyst for a short time (Tier 1), escalation of an issue to another team within KETS (Tier 2), or by escalation to another non-KETS resource (Tier 3). Examples of a Tier 3 resource may include vendor partners such as Nortel, Microsoft, and McAfee.

Support provided to KDE the agency is often the first level of triage meaning that the Service Desk encounters a wide range of issues varying between simple password resets all the way to workstation reimages. Support provided to the school districts is often more technical in nature as the issues escalated to the KETS Service Desk have already gone through layers of technical support within the school district. However, this varies from district to district depending on the size and availability of IT staff. Issues escalated to the KETS Service Desk by school districts are either issues that can't be solved in the district or issues where the district staff may not have the rights to change something such as DNS entries or firewall configurations.

Management Strategy

The KETS Service Desk is a process-driven entity and allows for seamless operation with KETS Service Teams. The KETS Service Desk is staffed each business day 7:30 AM – 5 PM Eastern. The KETS Service Desk is the central hub and entry point for accessing technical support for all KETS provided technology.

KETS Technical Environment Information Document

MUNIS

Section 007

Created: June 20, 2005
Last Reviewed: 1/30/2017
Last Updated: 1/30/2017

Prepared By Martin Herbener
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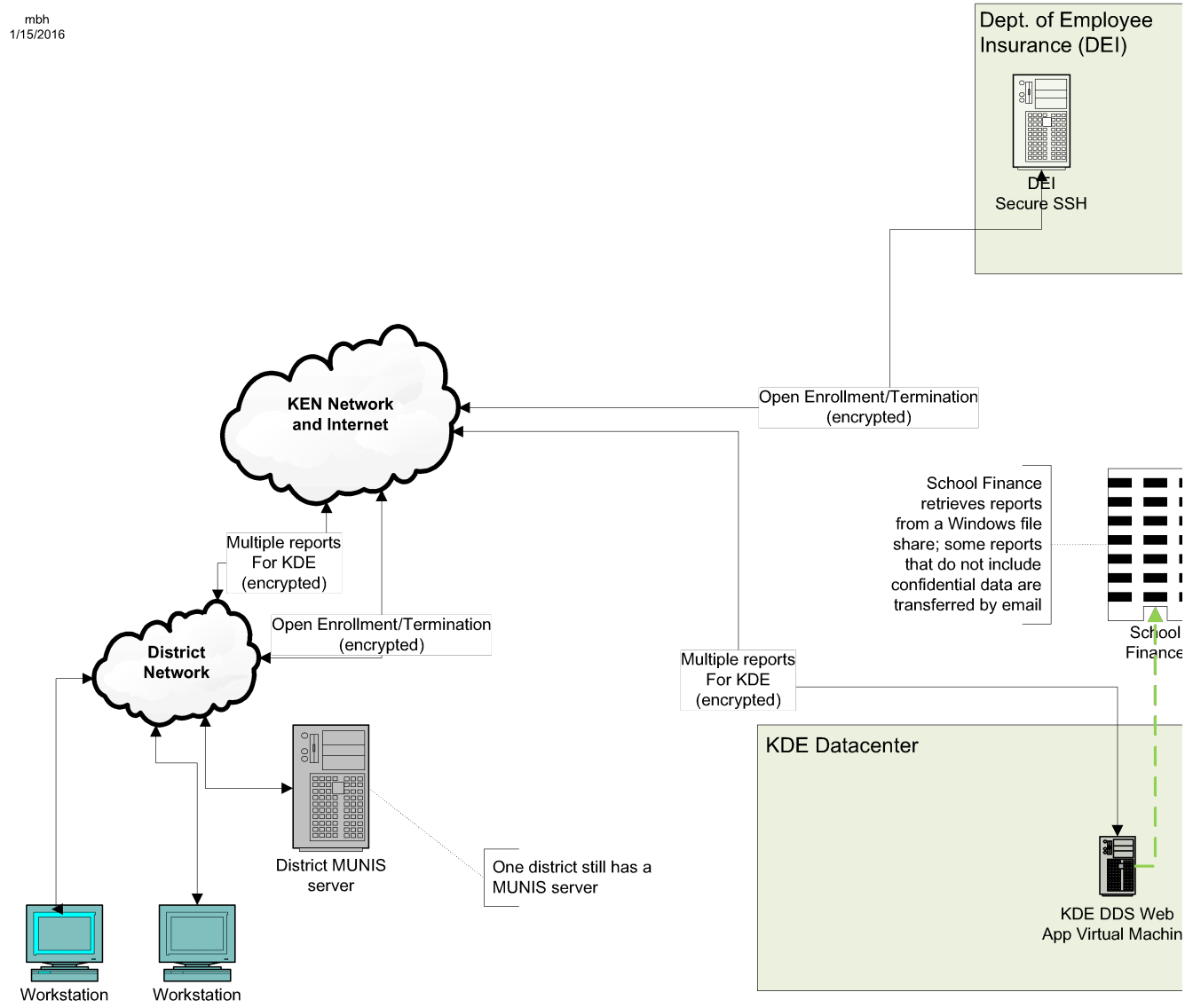
Summary

This document covers MUNIS, KETS's financial software.

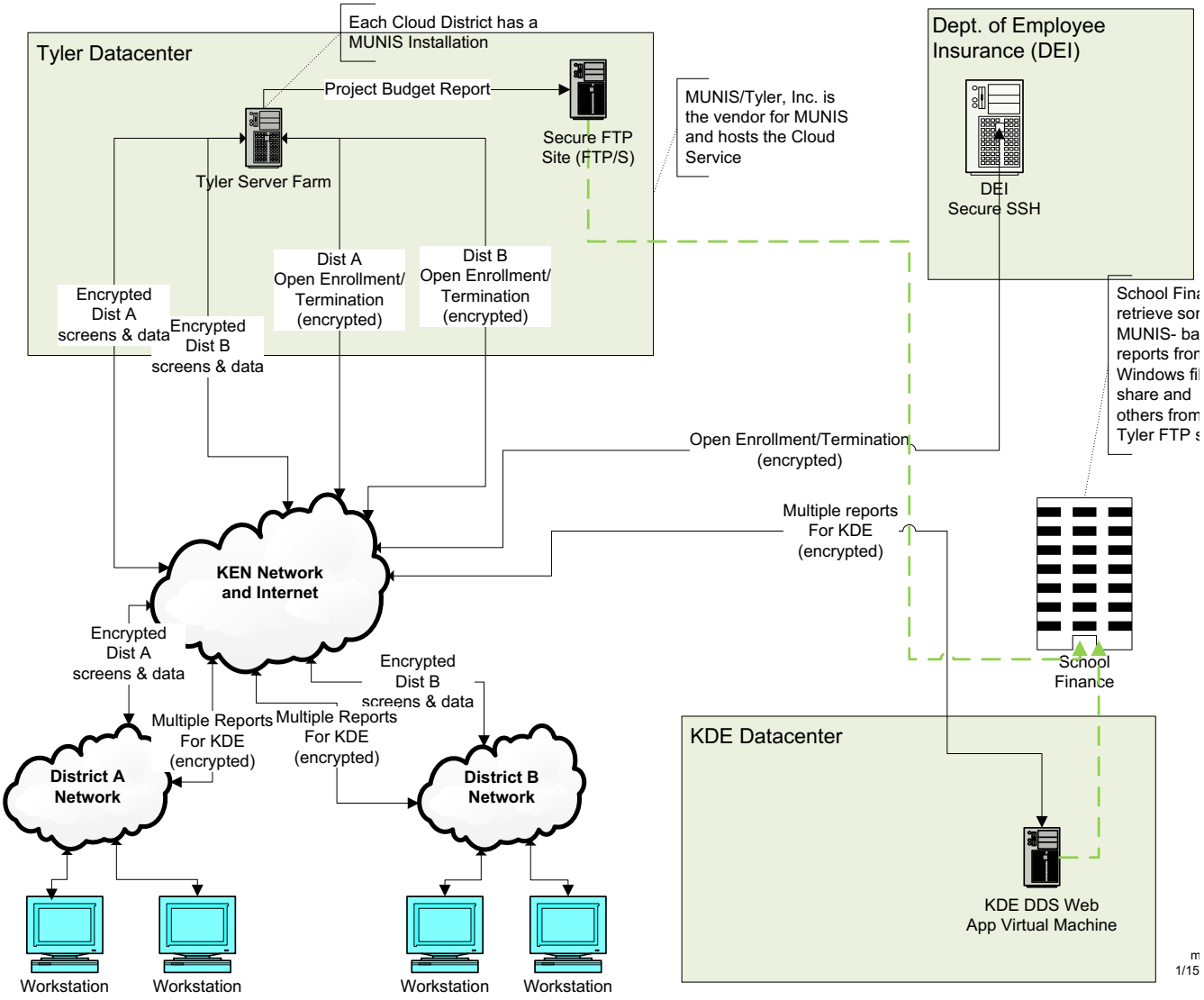
172 districts use a Cloud Service implementation; one district uses on-premise equipment. This document describes both implementations where applicable.

Visual Representation

On-Premise File/Data Transfers



Cloud Service File/Data Transfers



Description

MUNIS (Municipal Information System), from Tyler Technologies, is KETS's financial system. For both the single remaining on-premise district and all Cloud districts it runs on Windows servers. MUNIS performs the following functions for school districts:

- The MUNIS application is the primary General Ledger system.
- The MUNIS application is the primary budgeting system.
- The MUNIS application is the primary purchasing system.
- The MUNIS application is the primary payroll system.
- The MUNIS application is the primary benefits system.
- The MUNIS application is the primary billing system.
- The MUNIS application is the primary accounts payable system.
- The MUNIS application is the primary fixed asset system.
- Sends insurance information to the state and to carriers
- Submits 1099 and W2s to the federal government, the local government, and to employees.
- Submits reports for Kentucky teacher retirement
- Provides reporting for grants
- Tracks and reports asset information
- Submits statistics to the state to allow calculation of funding per district
- Provides information on food service funding
- Provides transportation information

Management Strategy

The remaining on-premise district in Kentucky has a MUNIS server. Users, printers, security and operating system design are managed by the district with Tyler support.

Each of the cloud districts has a Tyler VPN device used to make a secure connection between the district network and the Tyler datacenter. Users and printers are managed locally, while application updates, databases, security and the operating system are managed by Tyler.

KETS Technical Environment Information Document

The KEN Network (Kentucky Education Network)
Section 008

Created:
Last Reviewed 08/30/2016
Last Updated: 01/25/2016

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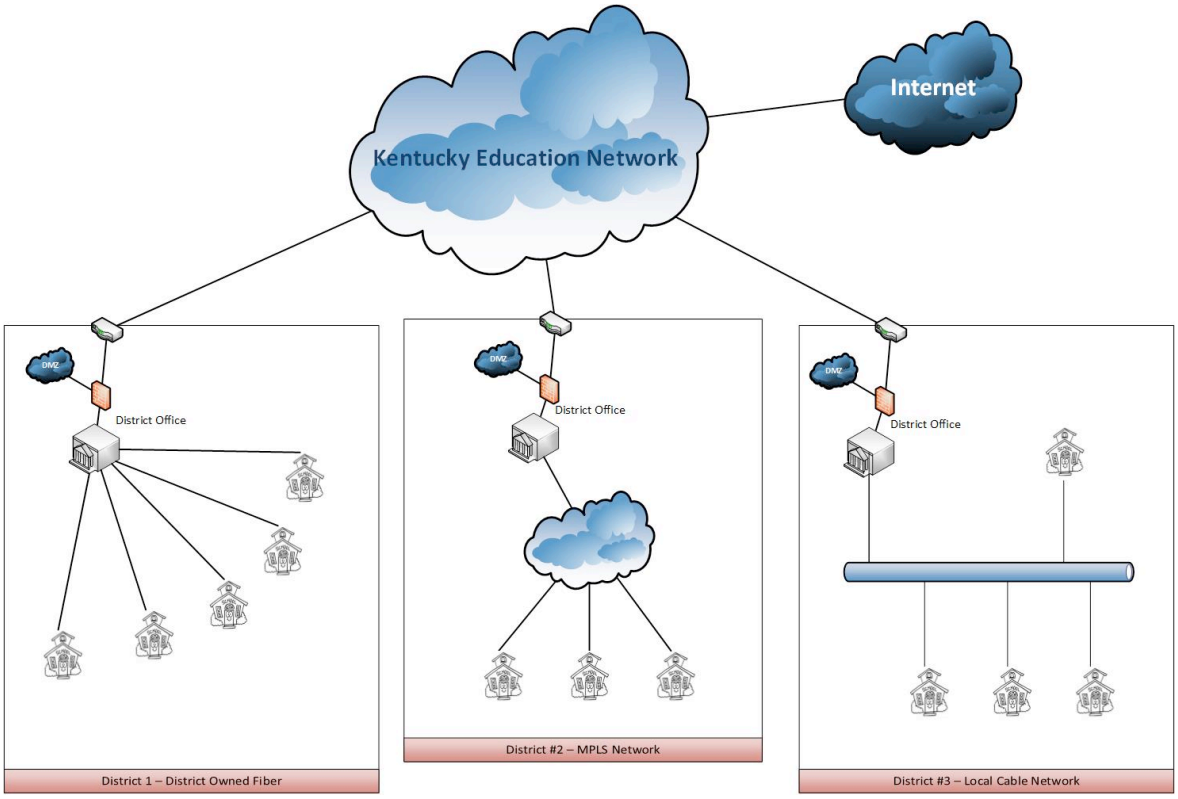
Summary

This document provides a brief, high-level view of the layout of the Kentucky Educational Technology System (KETS) networking environment throughout the Commonwealth of Kentucky. This document does not provide vendor-specific information with regard to network components, nor does it provide component level configuration information.

Visual Representation



Description

The Kentucky Educational Technology System (KETS) network consists of 1200+ schools in 173 districts. There are about 350,000 workstations and servers serviced by the Kentucky Educational Technology System network. Approximately 100,000 staff members and 650,000 students are consumers of the services of the network.

The current Kentucky Education Network consists of an MPLS backbone supplied by AT&T (KIH3 contract). The school districts have direct Internet connection via this MPLS

backbone. Only services housed at a state level require connection to the Kentucky Department of Education. Each district connects to the backbone via an Ethernet hand off with lines speeds from 100Mb/s to 10Gb/s. At this district level the Kentucky Department of Education supplies a managed firewall, traffic management device, and shared services switch solution. This is the demarcation point between the services supplied by the Kentucky Department of Education and district owned and managed services. In most cases the district connects to the managed firewall via a layer 3 switch or routing device. The buildings that make up the district connect to the districts hub site by any direct method that is available to them for that location. It cannot be assumed that all buildings in a district contain classrooms. Some examples of buildings with alternative uses are bus garages, athletic complexes, as well as technology and maintenance centers. The variety of connections can include methods such as District owned fiber or Managed Ethernet Services with line speeds from 100Mb/s to 10Gb/s. Inside each building there is at least one wiring distribution frame where the Ethernet switches, Phone system, and usually a video distribution system is located. Classroom wiring is completed as homeruns back to these wiring distribution frames. Wiring between distribution frames inside a building is generally completed by the use of multi-mode fiber optic cable. If wiring is needed between buildings on a campus it is encouraged that it be done with the use of single mode fiber optic cable.

Management Strategy

The Office of Educational Technology supports and maintains all centralized KETS shared service level and distributed components, including Firewalls, VPN servers, Traffic Management devices, etc. for all 173 school districts. Additionally, all hardware components, Leased-Line connectivity, and configuration management for connectivity between the school district's hub site and the state is funded and managed by OET. OET sets standards for all other network-related components and negotiates contracts on behalf of the school districts with approved vendors. OET also provides design and configuration assistance to school districts on an as-needed basis. School districts are responsible for all networking components and their configuration and management within their own LANs on their side of the KETS DMZ.

KETS Technical Environment Information Document

Security
Section 009

Created: June 22, 2005
Last Reviewed: 08/30/2016
Last Updated: 01/25/2016

Prepared By Paul Shoemaker
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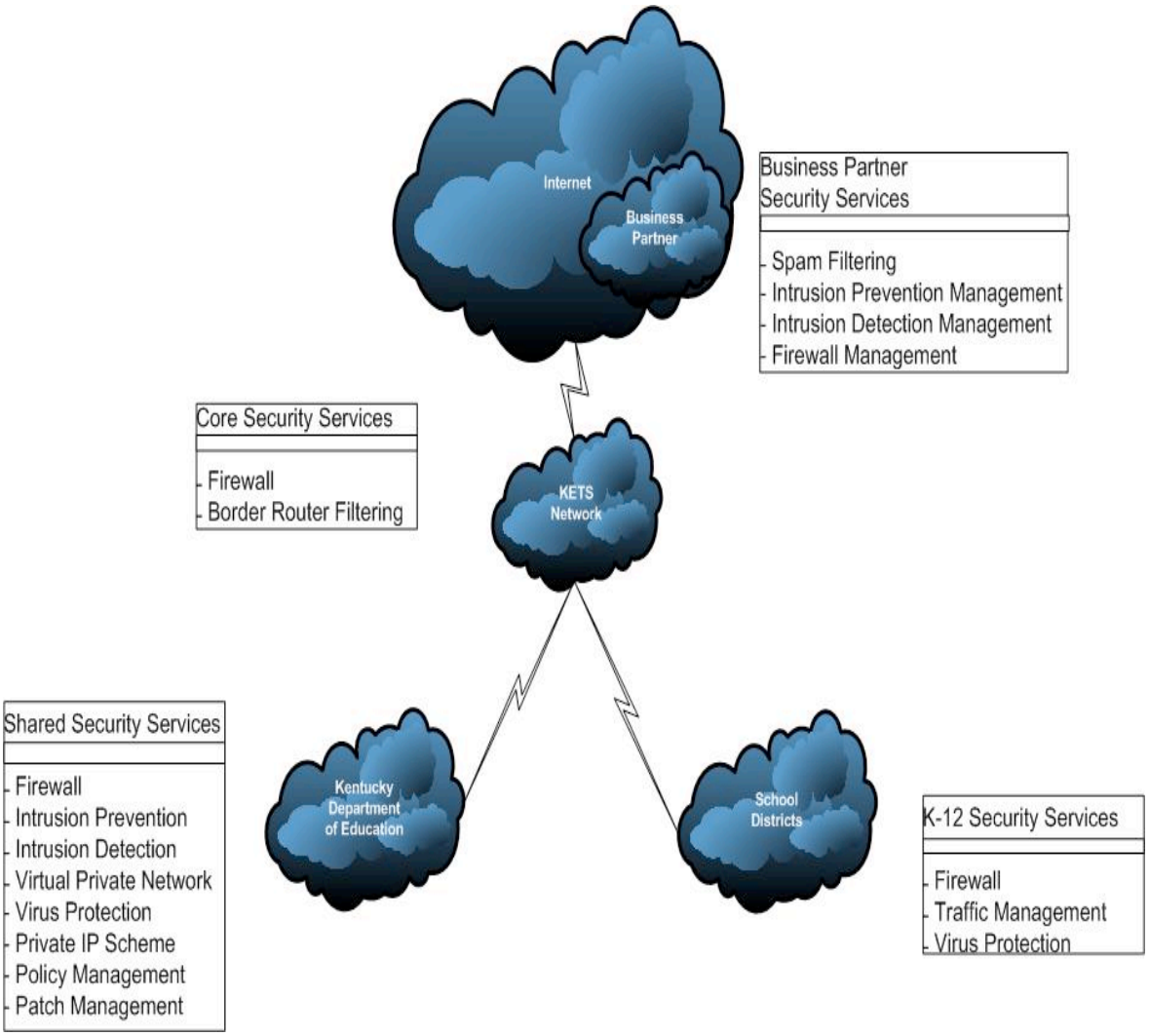
Summary

This document provides an overview of the Network Security Services provided by the Office of Educational Technology (OET) for the Kentucky Educational Technology System (KETS). This document only covers core security services supported by the OET Network Security Team, Contracted Network Management Services (SDGBlue), and AT&T Network Services.

Visual Representation



Description

Core Network Security Services include the following:

1. Intrusion Detection – Systems that passively monitor and detect harmful network traffic or attacks
2. Border Router Filtering – Basic filters placed on border routers which filter out common “noise” before it hits security devices
3. Firewall Services – Systems that provide security of outward facing network connections.
4. SPAM Filtering – Systems that monitor and remove unwanted e-mail sent to the KETS network
5. Intrusion Prevention – Systems that actively look for harmful network traffic or attacks and reset connections as needed
6. Virtual Private Networking – Systems that allow secured access to the KETS Network from outside networks
7. Virus Protection – Virus detection and removal software that is loaded on all workstations and servers in the KETS network
8. Traffic Management – Systems that can either guarantee or limit the amount of traffic of any specific type on the network
9. Certificate Services (Internal usage only) – A root certificate authority tied to the KETS AD forest will be established at KDE. Districts wanting to implement certificate services will stand up their own subordinate certificate server to be used for wireless authentication and other certificate related authentication practices required in the district.

Management Strategy

Intrusion Detection, Firewall Services, SPAM Filtering, Intrusion Prevention, Traffic Management, and Virtual Private Networking are all managed by a combination of the OET Network Security Team, Microsoft Office365 and Contracted Network Management Services (SDGBlue). Border Router Filtering is cooperatively managed by the OET Network Security Team and AT&T Network Services. Contracted Network Management Services (SDGBlue) and AT&T Network Services handle daily maintenance and updates while the OET Network Security Team handles defining policies. Virus Protection is supported by both the Network Security Team and local district support. Certificate services will be granted to districts subordinate certificate servers through KDE. Districts will issue, expire and reclaim certificates to their end users through their own support local support services.

KETS Technical Environment Information Document

Infinite Campus Student Information System
Section 010

Created: February 23, 2009
Last Reviewed: 08/30/2016
Last Updated: 01/25/2016

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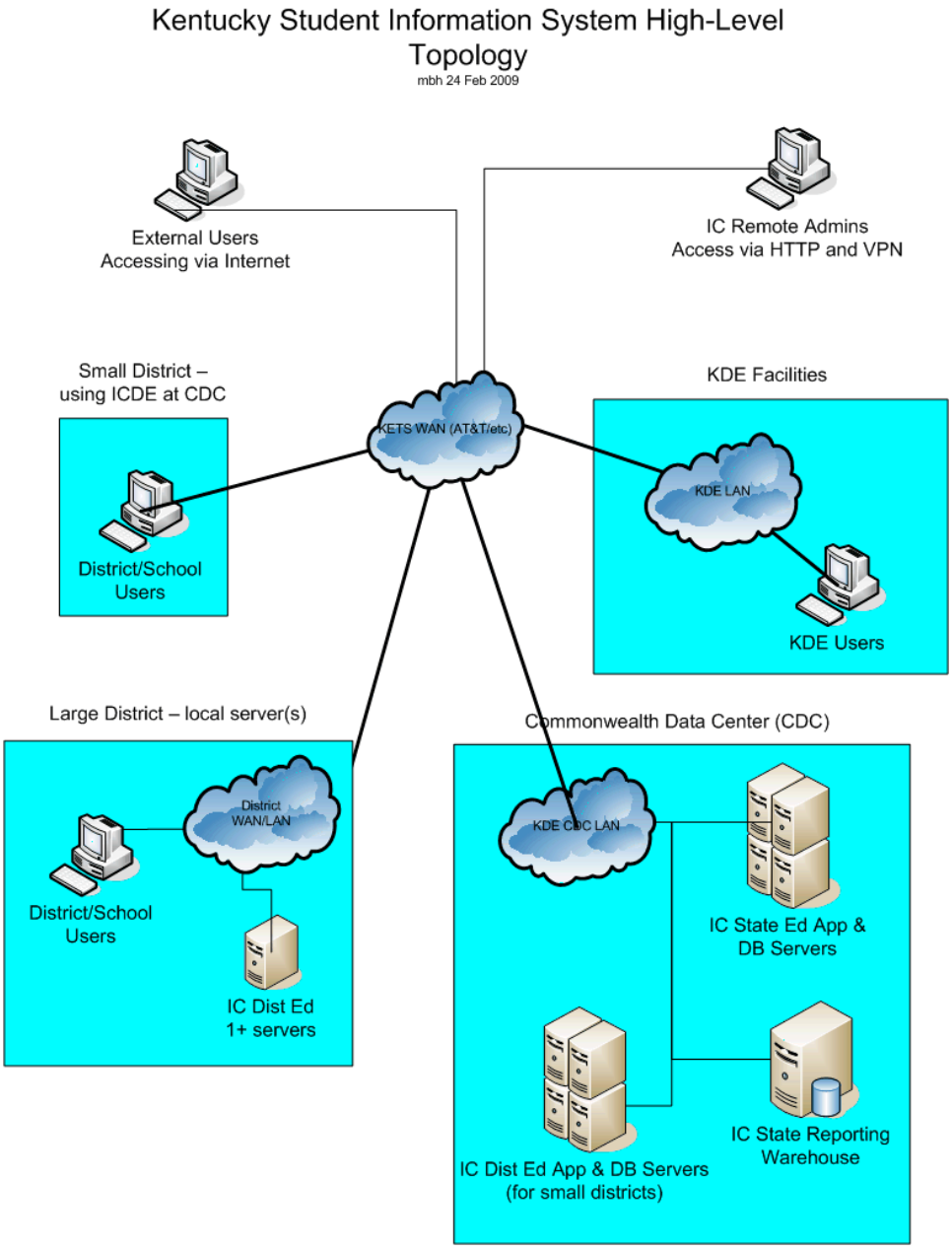
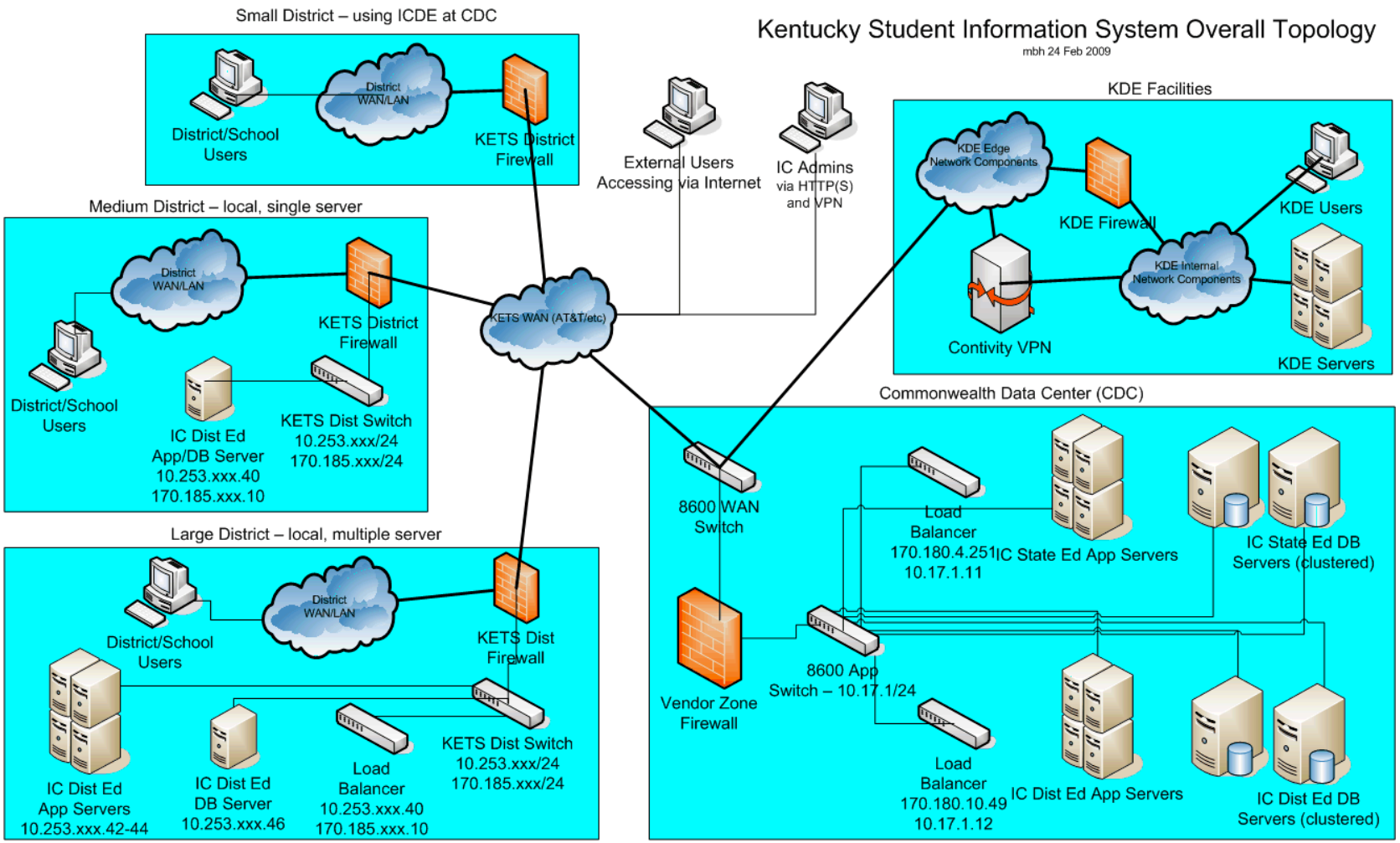
Summary

The Infinite Campus Student Information System gathers student information from districts across Kentucky and allows KDE to create reports for decision-making purposes. Implementation began in summer of 2007 and was completed by April 2009, at which time the previous statewide Student Information System was decommissioned.

Visual Representation



Detailed Diagram



Description

Infinite Campus provides KETS's student information system. This system includes three main components:

- Infinite Campus District Edition – locally and centrally hosted
- Infinite Campus State Edition
- Statewide Reporting Warehouse

Plus two optional (per-district) components:

- Food Service
- Messenger with Voice

Infinite Campus District Edition is the application used by school and district staff – teachers, administrators, and support staff. It tracks data such as attendance, grades, behavior, student demographics, schedules, fees, instructional plans, and health. It produces numerous reports and constantly synchronizes certain data elements with the centralized Infinite Campus State Edition installation. As a web-based application it is accessible anywhere in the district and, with the districts' approval, from the general Internet as well. It includes an interface for students and parents to use.

Infinite Campus State Edition is the application used by KDE and other state-level staff. It automatically receives certain data elements from each District Edition installation for reporting purposes. It is also used to manage district, school, and in rare cases (such as duplicate student ID cleanup) student records.

The **State Reporting Warehouse** is a single SQL Server database instance which contains copies of all the Infinite Campus District Edition databases which are no more than 1 week old. This database is used as the source for reports that required detailed data which are not synchronized to the Infinite Campus State Edition application.

Infinite Campus Food Service is an optional module that manages cafeteria menus and links with Point of Sale devices to process food service transactions.

Infinite Campus Messenger with Voice is an optional module that places voice phone calls to staff, students and/or parents based on triggers (such as absences) or manual input (such as to announce special events).

Management Strategy

The Kentucky Student Information System based on Infinite Campus is treated as a service provided by Infinite Campus. Districts with an ADA (Average Daily Attendance) of 3000 or larger have local equipment which is provided and owned by Infinite Campus and located in the KETS Distributed Service rack that also houses KDE-owned wide area networking equipment. Districts with a smaller ADA use a central server farm of equipment that is provided and owned by Infinite Campus and located in the Commonwealth Data Center in Frankfort. Infinite Campus remotely monitors and

administers all this equipment via the KETS VPN service and the KETS Wide Area Network. KDE is responsible for the required network infrastructure, while districts and the Commonwealth Data Center are responsible for the environmental infrastructure (power, cooling, physical security).

KETS Technical Environment Information Document

Schoolnet Instructional Management and Educator Development System

Section 011

Created: February 27, 2015
Last Updated: 1/30/2017
Last Reviewed: 1/30/2017

Prepared By Martin Herbener
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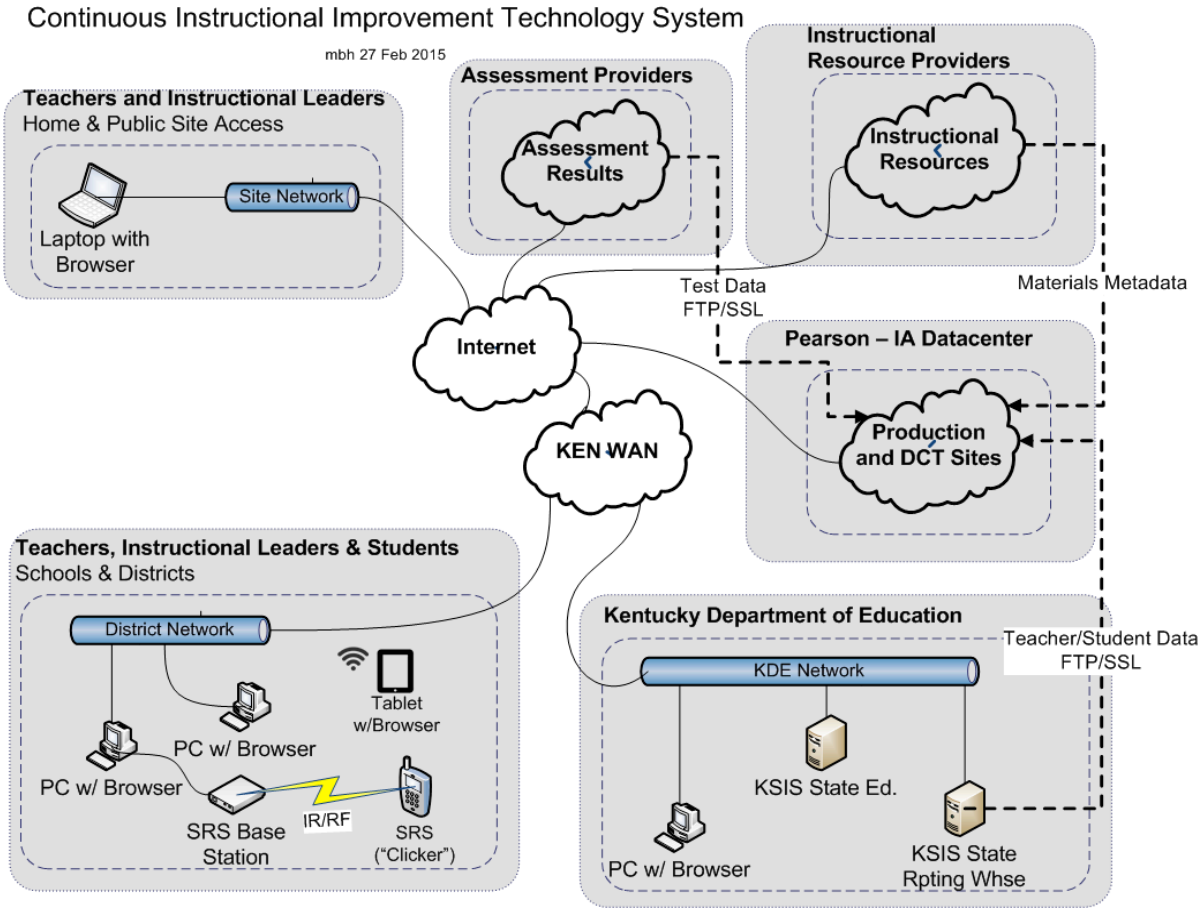
Summary

The Schoolnet Instructional Management and Educator Development System, knowns as CIITS (Continuous Instructional Improvement Technology System), is used by teachers and administrators across Kentucky to find instructional resources, plan instruction, view and analyze student data, create and delivery formative and benchmark assessments, engage in professional learning, and carry out educator evaluation. Implementation began in spring of 2011 and the first significant release with student data was in the fall of 2011. Major enhancements, especially related to professional learning and educator evaluation, are still in progress.

Visual Representation



Description

Pearson, Inc. provides CIITS based on the IMS (Instructional Management System) and EDS (Educator Development Suite) modules of its Schoolnet product.

The Schoolnet system is browser-based, supporting recent versions of the major browsers. Data are stored in SQL Server databases. Pearson provides documented file layouts for the student, educator, course, assessment, and other data to be loaded.

The IMS module includes the following components:

- A searchable repository of educational standards and aligned instructional materials; this includes interfaces to integrate materials hosted and managed by other providers such as Discovery Education, SAS Curriculum Pathways and PBS LearningMedia
- A tool to create, schedule and manage lesson plans, units and curricula
- Tools to create, manage, share, administer, and report results of assessments; this includes web-based access for students to respond to assessments and integration with student response systems ("clickers")
- A repository of student data visible in dashboard and reports, including courses, grades, assessment results, and demographics

The EDS module includes the following components:

- Tools and reports for educator evaluation, including aspects such as Professional Growth Plans, Observations, Student Growth Goals, Student Voice, Self-Reflection, and summary evaluation
- A searchable and district-maintainable repository of professional learning resources and courses
- Tools and reports to record and monitor educator attendance at courses and use of resources

Most Schoolnet installations are for a single district (albeit for some very large school districts). The Kentucky installation is a single tenant serving all KY school districts. Therefore, some configuration settings are applied statewide, and district staff have limited abilities to administer users or customize the system.

User authentication and authorization (application of roles/perrmissions) are implemented by the Schoolnet system. However, user identity (usernames, email addresses) and role assignments are based on data recorded in the KSIS (Kentucky Student Information System) and transferred to Schoolnet as part of the weekly and nightly ETL process described below.

Management Strategy

Schoolnet is hosted, maintained, supported and operated (from a technology perspective) by Pearson staff using a Software as a Service model. The primary data center supporting CIITS is located in Iowa, with a backup data center in the New York City area.

KDE is responsible for providing data to be loaded into the system on a daily and weekly basis. Most of the data are extracted from the Kentucky Student Information System, using both the IC Standard Edition and the IC Reporting Warehouse. Extract logic is coded using SQL Server capabilities such as stored procedures and SQL Server Integration Services. KDE uploads data to a secure FTP site maintained by Pearson

Pearson has arrangements with several providers of instructional materials and benchmark/interim assessments such that those provides send data and content directly to Pearson (with district approval when needed).

Pearson provides end-user support by email and phone; a Kentucky-specific subgroup of the general Schoolnet support team responds to requests. Certain issues or questions are referred back to district or KDE staff as documented in the Support Plan.