

ENTERPRISE-WIDE TECHNICAL ARCHITECTURE

Introduction

An enterprise-wide technical architecture (EWTA) is an operational statement of the current technologies utilized and supported by the central computing organization.

The elements of the EWTA are:

1. Desktop Client Platforms
2. Desktop Applications
3. Email/GroupWare
4. Servers
5. Network and Communications Protocols
6. Operational Software
7. Database, Data Interfaces
8. Security
9. Middleware
10. Application Development Tools
11. Mobile/Remote Platforms
12. Voice Communication
13. E-Commerce
14. Transaction Security
15. ADA Compliance
16. Interfaces to ERP Data
17. Learning Management System
18. Content Management System
19. Software as a Service

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1. Desktop Client Platforms

The client-server desktop platform is described by IT Services' hardware, operating system and client software.

Hardware

The supported client desktop is Dell Optiplex, Dell Precision, and Apple iMac. The University's preferred vendor is Dell and Apple. Current purchases are:

<p>Dell OptiPlex 7040 MT Desktop:</p> <p>Intel® Core™ i7-6700 Processor (Quad Core, 8MB, 8T, 3.4GHz, 65W) 8GB (1x8G) 2133MHz DDR4 Memory 2.5 inch 1TB 5400rpm Solid State Hybrid Drive w/8GB Flash AMD Radeon™ R5 340X (2GB DP/DVI-I) 20-inch Flat Panel Monitor</p>	<p>Dell Precision Desktop 3620 (High-End):</p> <p>6th Gen Intel® Core™ i7-6700 (Quad Core 3.40GHz, 4.0Ghz Turbo, 8MB, w/ HD Graphics 530) 500GB 3.5inch Serial ATA (7200 Rpm) Hard Drive 16GB (2x8GB) 2133MHz DDR4 Non-ECC NVIDIA® Quadro® K620 2GB (DP, DL-DVI-I) (1 DP to SL-DVI adapter) 24-inch Flat Panel Monitor</p>
<p>21.5 inch iMac Desktop (Campus Standard):</p> <p>2.8GHz Quad-core Intel Core i5, Turbo Boost up to 3.3GHz" 8GB 1867MHz LPDDR3 SDRAM - 2x4GB 1TB Serial ATA Drive @ 5400 rpm Intel Iris Pro Graphics 6200 21.5" Full HD 1080p Display</p>	<p>21.5 inch iMac Desktop (High-End):</p> <p>3.1GHz Quad-core Intel Core i5, Turbo Boost up to 3.6GHz 16GB 1867MHz LPDDR3 SDRAM - 2x8GB 1TB Serial ATA Drive @ 5400 rpm Intel Iris Pro Graphics 6200 21.5" Retina with 4K Display</p>

The supported client laptops are the Dell Latitude E5000 and E7000 series, Apple MacBook Air and Macbook Pro, and Lenovo ThinkPads. Complete a Tech Purchases webform found at <http://uits.kennesaw.edu/support/formspurchases.php> for specific laptop configurations.

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Kennesaw State University leverages Virtual Desktop Infrastructure (VDI) as a preferred solution utilizing PCoIP monitors as the preferred lab interface. All VDI images are based on the campus standard image.

Operating System (OS)

Enterprise-wide client-server applications will be required to be compatible with Microsoft Windows 7 Enterprise Edition 64-Bit Service Pack 1 and/or OSX 10.10 (update needed)

Client Applications

A client application is a software program that connects the desktop computer to its corresponding server based component. Client applications by themselves provide no or minimal functionality. They require a connection to their “application server”. The server and client components must be in sync (i.e. compatible versions) for all functions to work correctly. The table below is an alphabetical list of supported clients. Additional version information is available upon request.

Client Application	Function
Abila Sage	Finance/ Accounting System
ADP Ev5	HR/Payroll
AIM	Facilities and Asset Management
Appointment Plus	Online Scheduling System
BankMobile	Refunds
Banner INB & Web Self-Service 8.x	Student Information System
Blackbaud Financial Edge	Accounting and Fundraising System
Blackbaud Raiser’s Edge	Alumni & Development System
Bomgar	Remote Assistance
ChangeGear	Service Request and Change Mgt
College Scheduler	Student Registration Planner
CollegiateLink	Student Events Management Tool
ComplianceAssist	Report Tool –Student performance assessment
Concur Travel	Travel authorization, booking, and expense reports
Crystal Reports	IT-Centric Reporting Tool
DegreeWorks	Degree Auditing System
Digital Measures Course Response and Activity	Electronic Course Evaluation System and Faculty Activity and Portfolio

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Insight	Portal
EAB SSC Campus	Advising, Tutoring, Student Success Services
ECSI	Student Loan System
Endeavor	Library System
ECSI	Incident Management System
Events Management System (EMS)	Client for accessing EMS Enterprise
Fusion	Recreation Facility Management
Firefox	Web Browser
Hobsons	Customer Relationship Management
Internet Explorer	Web Browser
iStrategy	Budgetary Reporting System
IronKey	Encrypted Hard-Drives
JCA Answers	Business Intelligence Software
JumpForward	Athletics Management System
Lenel	Door/gate access
Maximus	Effort Reporting System
Microsoft Application Virtualization	Virtual application delivery
Missouri Book Systems	Bookstore POS System
Nelnet	e-Cashier flexible payment portal
Nolij Transfer	Data Load System
Nolij Web	Document Imaging System
OnityTesa	Door/gate access
Oracle Application Server/ Portal 10giAS	ESS Development, report & application deployment
Oracle Java Version 6/7	Oracle Forms Client Access
Oracle Networking	Oracle Database Access
Oracle SQL*Net	Oracle Database Access
OrgSync	Student Organization Management
Peachtree Accounting	Accounting Software
PeopleAdmin	Faculty Hiring System
PeopleSoft Financials 9.2	Purchasing/Accounting/GL
Pharos Gold	Network Print Mgmt
Red Canyon	Recreation Facility Management System
Remote Assistance	Remote Server Access
Runner Tech Clean Address	USPS/ Global Address Validator
SALTO	Door/gate access
SAS Enterprise Guide	Reporting and Analytics Tool

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and Web Report Studio 9.2	
Smart Grants	Grants Management
SmarterMeasures	Student Assessment Tool
StarRez	Student Housing Management
Team Dynamix	Project Management Portal
Touchnet	Payment Portal
VMware Fusion	Desktop Virtualization
WebCheckout	AudioVisual checkout system
Zimbra 7.1.1	Email & Calendar

2. Desktop Applications

A desktop application can be completely installed on the desktop computer's hard drive and does not require a network connection to a corresponding "server application" to provide its functionality. This is in sharp contrast to client applications, which provide no functionality unless connected to its corresponding server component (see "Section 1, Desktop Client Platforms").

Desktop applications do, like client applications, depend upon the underlying desktop operating system. Currently, Windows and Apple applications are supported.

Below are the specific products for which both technical and user support is available.

<i>Type</i>	<i>Software Application</i>	<i>Version</i>	<i>Description</i>
General Productivity	MS Office Suite	2016	Includes a word processor (Word), spreadsheet (Excel), database (Access), presentation tool (PowerPoint)
	MS Visio	2016	Flowchart creation tool
	Adobe	Creative Cloud	Document, Multimedia and graphic creation/editing
	Respondus	Respondus Editor, Repondus Lock Down Browser, Respondus Monitor	Quiz creator, Browser Lock, Quiz monitor
	Kaltura	MediaSpace	Video storage

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	Bb	Collaborate/Ultra	Lecture Capture
Utilities	Skillsoft	Owltrain	Online training and workshop registration
	Microsoft System Center Endpoint Protection	Client Version 4.5	Anti-virus and proactive threat protection
	Adobe Acrobat	DC	PDF file editor

3. Email/Zimbra

Zimbra is a genre of software that facilitates collaboration through integrated functions and shared resources. Zimbra products integrate email, contacts, and calendars.

KSU uses Zimbra messaging, which is IMAP compliant. KSU does not support POP.

The table below shows the supported solutions and their respective components.

<i>Category</i>	<i>Protocol</i>	<i>Platform</i>	<i>Client</i>
Email	IMAP	Microsoft	Outlook
	IMAP	OSX	Mail
	HTTP	Zimbra	Web Browser
Calendar	IMAP	Microsoft	Outlook
	IMAP	OSX	iCalendar
	HTTP	Zimbra	Web Browser

4. Servers

Servers are categorized by the following:

- Administrative servers, generally housing enterprise-wide administrative applications
- Research Servers are used to support academic research conducted on the High Performance Computing Cluster managed by UITS.
- File/print servers, used for desktop application delivery and “infrastructure applications” such as e-mail. Infrastructure applications are defined as applications that are primarily used as data transport.
- Web servers, both Internal (Intranet) and External
- Enterprise servers, generally housing, technical applications that affect the operation of the entire network; including functions such as DNS/DHCP and firewalls.
- Small application servers, generally housing single, tactical applications

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- Servers must be located and managed in accordance with USG and KSU policy requirements.

The standards for these servers include both the hardware and operating system:

Server Category	Vendor & Hardware	Operating System
Administrative Servers	HP Blade Center	Redhat Linux 5.x, 6.x
Research Servers	IBM 3650, 3850, Flex Chassis	Redhat Linux 7.x
File/Print Servers	IBM Xseries and HP Blade Center Technologies leveraging VMWare 5.x	Windows 2008 R2/2012
Operational servers	Sun SPARC	Solaris / Apache
Small Application Servers	Dell Intel-based, HP Blade Center technologies, & IBM Intel-based Servers	Windows 2008 R2/2012
Web Servers – Internet or Extranet	Sun SPARC HP 9000, HP Integrity	Solaris / Apache HP-UX 11.x, Apache, Oracle 10giAS, and Oracle Weblogic FMW 11g, Linux
Enterprise Servers	IBM Blades and Xseries, Dell Intel based, and HP Blade Center technologies	Linux, Windows 2008 R2/2012, VMWare VSphere 5.x

Clearly, applications often drive hardware and operating system choices. The table above represents “best attempt” guidelines. Deviation from the standards should be for clear necessity, not simply for optimization.

5. Network and Communications Protocols

Network hardware, as well as communications protocols, is included in this section.

Physical Equipment

Any purchases of equipment, routers, hubs, switches must be compatible with the existing Cisco, Enterasys, and Aptran infrastructure, as well as IPv6 compliant.

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Wiring (Physical layer)

Currently installed campus network wiring is “Category 6” as well as “Category 5e” to the desktop, and fiber between wiring closets and buildings.

Wireless

Wireless utilizes WPA2enterprise and WPA2 with a AES cipher. These connections are authenticated via the Identity Management System. Full access to all network resources will require authentication via 802.1x.

Network (Network layer)

The network is switched Ethernet for all on-campus connections. POE is available to 98% of all data ports around campus.

Protocol (Internet layer)

Although many protocols will work successfully within a single subnet, the only ones that will be “routed” or passed between buildings or subnets, are IP (Internet Protocol). **We do not route non-IP protocols.**

6. Operational Software

Operational software is software that is used, primarily, by computing personnel as adjuncts to the operating system to provide a comprehensive computing framework.

The following software is preferred:

Category	Preferred Solution
Backups (Windows)	CommVault Simpana 10
Backups (Unix)	CommVault Simpana 10
Batch scheduler	UC4/Appworx /Automic and IBM Platform Computing LSF Scheduler
DNS/DHCP	ISC Bind, DNCPd, Bluecat
Email list management	Listserv, Joomla, Sympa
Firewall	PaloAlto
Print management	Windows 2012
Web server	Apache, Oracle 10giAS Portal, Oracle WebLogic FMW 11g, and IIS
LDAP Authentication (administrative, Oracle users)	Oracle Internet Directory (OID) 10.x

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Identity Management (centralized Username Password)	IBM Directory Services (LDAP) – Preferred Authentication Method for Applications; Active Directory – Preferred Authentication Method for Desktops and Infrastructure
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7. Database, Data Interfaces

A Data Base Management System (DBMS) consists of a collection of programs that enables you to store, modify, and extract information from a database. From a technical standpoint, DBMSs can differ widely. The terms relational (RDBMS), network, flat, and hierarchical all refer to the way a DBMS organizes information internally.

The three supported enterprise level DBMSs are:

- Oracle 10g Enterprise Edition (10.x) & Oracle 11g Enterprise Edition (11.x), Oracle 12c Enterprise Edition (12.x)
- Microsoft SQL Server 2008, 2012, 2014
- MySQL

Desktop and shared, small database needs can be met via Microsoft's Access RDBMS and its Open Data Base Connectivity (ODBC) standard. Client and technical support is available for Access, ODBC, and the middleware listed Section 9. Direct Oracle connectivity is available through Oracle Networking 10g/11g or SQL*Net as well as JDBC thin client.

8. Security

Organization

While information security is the responsibility of all KSU employees, it is managed centrally by University Information Technology Services. System and application administrators are a critical component of information security on campus and work closely with IT Services to ensure the confidentiality, availability, and integrity of data at KSU.

Life safety and emergency planning are managed centrally by the Department of Strategic Security and Safety and KSU Public Safety.

Network/System Security

Network Firewall security for all of campus is maintained with an enterprise Firewall at the demarcation point to the Internet. Individual

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servers are scanned prior to production status and maintain local security through a variety of technologies including; local firewalls/IDS, IP filtering rules, IPSec, etc. Scheduled scans of the KSU network ensure that systems are cataloged and remain hardened as services evolve.

Identity and Access Control

As previously mentioned, user accounts at KSU are managed via enterprise directory services, with authentication available via LDAP, Active Directory, and CAS. ***All proposed systems are strongly encouraged to conform to this standard.*** Accounts are audited for use and password age regularly based on user classification and service access. The maximum age of the password of any NetID account is 365 days; passwords expire and accounts lock after that time period.

Enterprise Information Technology is the sole provider of Two-Factor Authentication for University resources.

Proximity Authentication

Usage of RFID technologies on campus that support a changeable key are centrally managed and stored by the Information Security Office. The primary technology for Proximity Authentication is MIFARE. The cards supported are MIFARE Classic 4k. Changes to sectors or keys must be coordinated to ensure that compatibility is maintained. A complete list of sectors that can be utilized can be obtained by request from the Information Security Office.

IP Surveillance Cameras

Purchase and installation of IP Video Cameras must be approved by the Department of Public Safety. Contact information can be found at <http://www.kennesaw.edu/police/>.

Disaster Recovery

Disaster Recovery is another component of a complete security infrastructure. In terms of disaster recovery:

- All KSU critical servers are backed up at a consistent point in time
- Full backups are done weekly; incremental backups are done daily
- We have 7x24 coverage on all critical servers/components
- Off-site storage is used for all “mission critical” information.

Proposed systems are evaluated for disaster recovery intersections during their implementation, and safeguards introduced as necessary. Server Disaster Recovery documents are maintained as part of KSU Business Continuity Documentation.

9. Middleware

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Middleware is the software between the application programs we use and the operating system of our computers. Kennesaw State adheres to the National Middleware Initiative – Enterprise Desktop Integration Technologies (NMI-EDIT), now managed by InCommon, standards for academic side processes.

Middleware products that are currently supported:

- Oracle Networking and/or SQL*Net provides applications the interfaces needed to communicate with Oracle databases, i.e. native database drivers
- OLE DB/ODBC provides applications with standard interfaces to communicate with databases from many vendors, i.e. non-native database drivers
- Oracle HTTP Server (i.e., Apache) included with Oracle 10giAS and Oracle WebLogic FMW 11g are being used as the application server. Application delivery is done with MODPLSQL module (for PL/SQL) and the Oracle Components for Java (OC4J) for JSP, Java applets, and Java Servlets.
- Oracle10g iAS Portal is employed for application development including reporting as well as a deployment and delivery platform to end-users.
- Oracle Internet Directory (OID) 10.x is being used for LDAP authentication for Oracle 10.x Portal and network names resolution.
- SAS Data Integration Studio is employed as a middleware ETL tool for data integration and secure movement of data between databases.
- Enterprise directory functionality provides authentication, authorization, and auditing for all user accounts including Banner, Oracle/PeopleSoft Financials, and ADP Ev5.

10. Application Development Tools

Application Development

The following application development languages/tools are supported to develop and/or modify enterprise-wide systems including Banner and PeopleSoft:

- SQL
- PL/SQL
- Java
- PHP
- SAS
- JQuery
- XML
- Classic ASP

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- Java Script
- Perl

Production of SQL and PL/SQL is done via Dell Software's SQL Navigator and TOAD.

Data, Information, and Analytics Reporting

SAS Business Intelligence Platform

(including Web Report Studio, Enterprise Guide, and Enterprise Miner), Crystal Reports, and Oracle BI technologies (Oracle Portal) are supported tools for reporting from enterprise-wide systems.

Web Application Development

The following application development tools are supported to develop/modify enterprise-wide web applications:

- Java
- JavaScript
- Java Server Pages (JSP)
- HTML5
- SQL
- PL/SQL
- Perl
- PHP
- AJAX
- ASP
- VBScript
- MS .NET Platform
- T-SQL
- CSS

11. Mobile/Remote Platforms

Kennesaw State University uses both mobile and remote access for its computing needs. This ranges from mobile device and laptops in terms of hardware and Wide Area Networked file storage (WebDAV based) and web based access to groupware in terms of software. Secure Roaming Wireless (802.11) access is deployed across the campus. In addition, synchronization software for handhelds is supported.

Remote Computing

Virtual Private Networking (VPN) is in use for secure off site access to internal services. VPN access, or equivalent secure tunneling technology, is required for remote administration.

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12. Voice Communication

The following telecommunications vendors provide voice communication services:

- Primary dial tone to KSU is provided by the Unify Enterprise VoIP system. Life Safety devices at the Kennesaw campus, will retain the Analog 5ESS Centrex line services as provided under state contract with AT&T.
- Long Distance, int'l and toll-free services are provided through Unify Enterprise VoIP system. Long distance and int'l are billable at a per minute/per country rate and will be charged back to the respective department based on the ext utilized to place the call.
- The voice mail system is provided as part of the Unify Enterprise VoIP system.
- Cellular Telephone services are tailored per departmental needs.
- KSU Central IT provides secondary support for Residential Student Services
- UITs supports the following headsets and connection cabling for use with the Unify Enterprise VoIP system:

Plantronics Savi W740 Convertible Headset 83542-01
Plantronics APS-11 EHS cable Savi/CS500 37818-11
Plantronics CS540 Convertible Headset 84693-01
Plantronics APS-11 EHS cable Savi/CS500 37818-11
Plantronics HW251N NC Mono Headset 64338-31
Plantronics A10-16 Direct Connect Cable 66268-02
Plantronics EncorePro HW710 Mono Headset 78712-01
Plantronics A10-16 Direct Connect Cable 66268-02
Plantronics EncorePro HW720 Stereo Headset 78714-101
Plantronics A10-16 Direct Connect Cable 66268-02

13. E-Commerce

Our preferred solution is that all personal financial information be requested and processed by Touchnet (a Board of Regents chosen vendor).

The following requirements must be met by e-commerce systems:

- Must be compliant over SSL version3, Secure FTP or SSH. P2PE devices strongly preferred.
- NOTE: Telnet and FTP protocols are not used on campus and are blocked at the firewall.
- Must be compliant with Industry, Federal, State, BOR, and KSU policies regarding credit card transactions and security.

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14. Transaction Security

KSU requires all applications which allow transactions to be routed on public networks (including the university backbone) meet or exceed all applicable government and industry standards for security including, but not limited to:

- All Federal, State, and Local Laws
- Family Educational Rights and Privacy Act (FERPA)
- Payment Card Industry (PCI)
- Health Insurance Portability and Accountability Act (HIPAA)

15. ADA Compliance

KSU prefers that systems deployed for campus users meet ADA Tier-1 Compliance. The purpose of this requirement is to ensure that the needs of system users are met through reasonable accommodation in the IT products and services provided.

16. Interfaces to ERP Data

KSU maintains information on the campus community (students, faculty, staff, visitors, etc.) including education records and courses and finances in supported ERP systems. Any ancillary system implemented for campus that requires data maintained in any operational enterprise system, must be able to synchronize data with the source ERP system(s). The preferred synchronization method is via an ancillary system function that processes updates from the ERP system(s). Occasionally, ancillary systems are granted read-only access to operational ERP systems.

17. Learning Management System

The campus standard Learning Management System (LMS) is Desire2Learn Brightspace (D2L). The D2L system is hosted by the University System of Georgia and administered by local KSU personnel, with authentication provided by KSU systems. Any systems that communicate directly with, or extend, the standard LMS must go through an approval and testing process that involves both KSU and the University System.

18. Content Management System

The campus standard Content Management System for web sites is OmniUpdate OU Campus. KSU operates OU Campus as Software as a Service through the vendor OmniUpdate with users authenticating into the system through CAS. All production websites are hosted on a

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high-availability Linux cluster. The system is configured to allow for multiple websites, varying level of user permissions, and user workflows. OU Campus allows for web forms with submissions being stored in a back-end database that is accessible to internal users through the system.

19. Software as a Service

All Software as a Service (SaaS) purchases must conform to the Technology Purchasing, Relocation, and Surplus Policy found at policy.kenneaw.edu.