Federated & Centralized Models

Tuesday, October 30, 2012

Facilitator: Jim Campbell (SST), Jeff Sellers (SST), Keith Brown (SST)

Panelists:

Charles McGrew, Kentucky P-20 Data Collaborative

Mimmo Parisi, National Strategic Planning & Analysis Research Center (nSPARC)

Neal Gibson, Arkansas Research Center

Aaron Schroeder, Virginia Tech

AGENDA

- Background/Overview
- Rationale for choosing a model
- Infrastructure and design
- Data Access
- Additional information

BACKGROUND/OVERVIEW

KENTUCKY

Model:

Centralized data warehouse that brings the data into a neutral location (third-party) where they are linked together then de-identified so no agency has access to any other agency's identifiable data.

VIRGINIA

Model:

Virginia is a case study in the difficulties of combining data from multiple agencies while remaining in compliance with federal and state-level privacy requirements

- Traditional Data Integration Issues
- Public Sector Specific Integration Issues
- Virginia Specific Issues

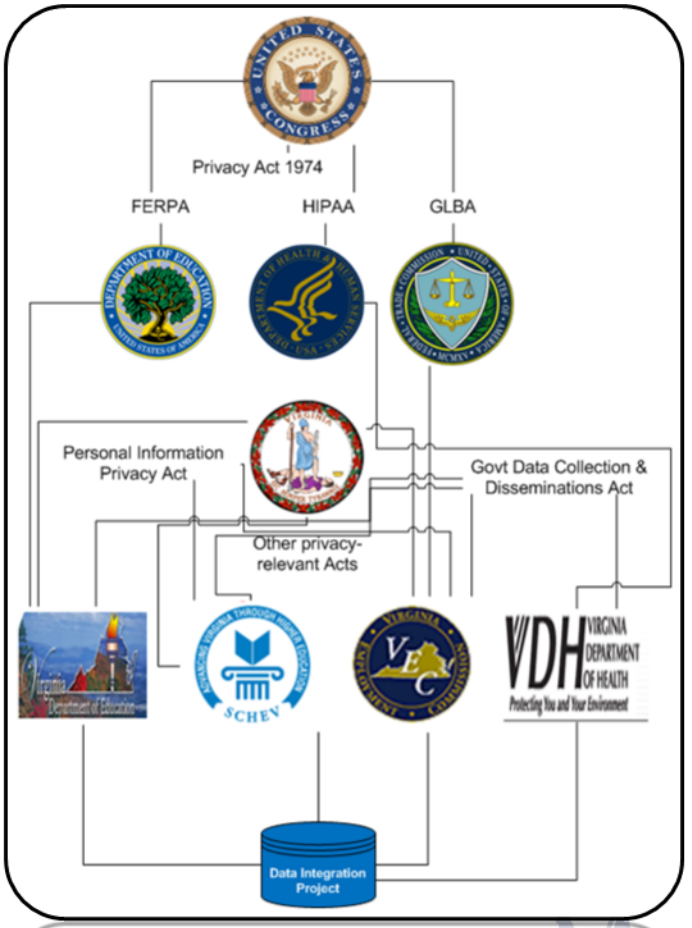
VIRGINIA

Implementation Environment Public Sector Statutory and Regulatory Heterogeneity

Multiple levels of statutory law

Multiple implementations of regulatory law at each level of statutory law

Most conservative interpretation of regulatory law becomes de facto standard



ARKANSAS

Arkansas Research Center

ARKANSAS

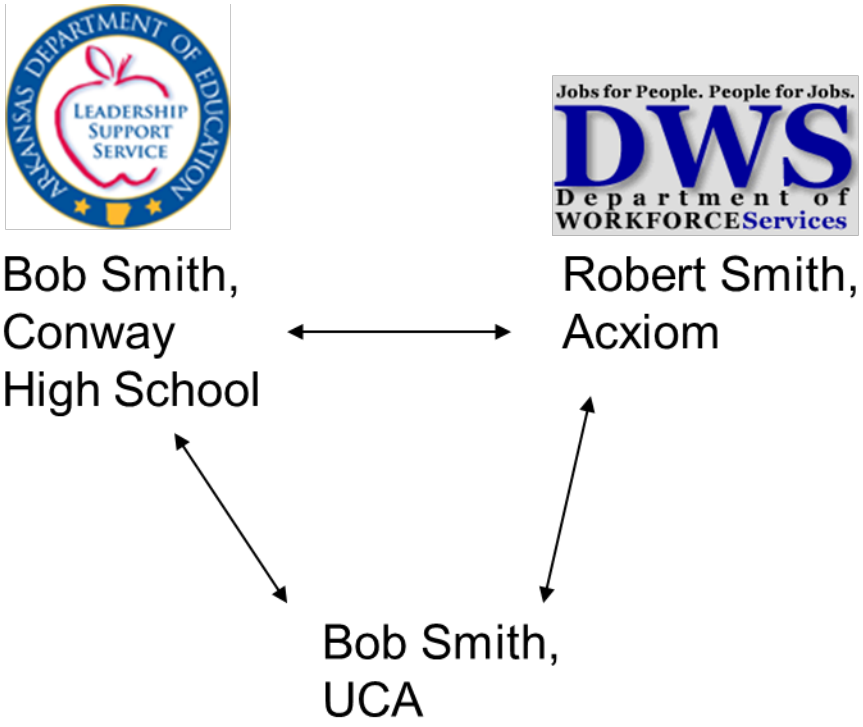
File A **File B**

Your knowledge is limited to what's in these two files ONLY

ARKANSAS

Knowledge Base Approach:

All known representations are stored to facilitate matching in the future and possibly resolve past matching errors.



Knowledge Base

Cluster	Representation
KB5765	Bob Smith, CHS
KB5765	Robert Smith, Acxiom
KB5765	Bob Smith, UCA

MISSISSIPPI

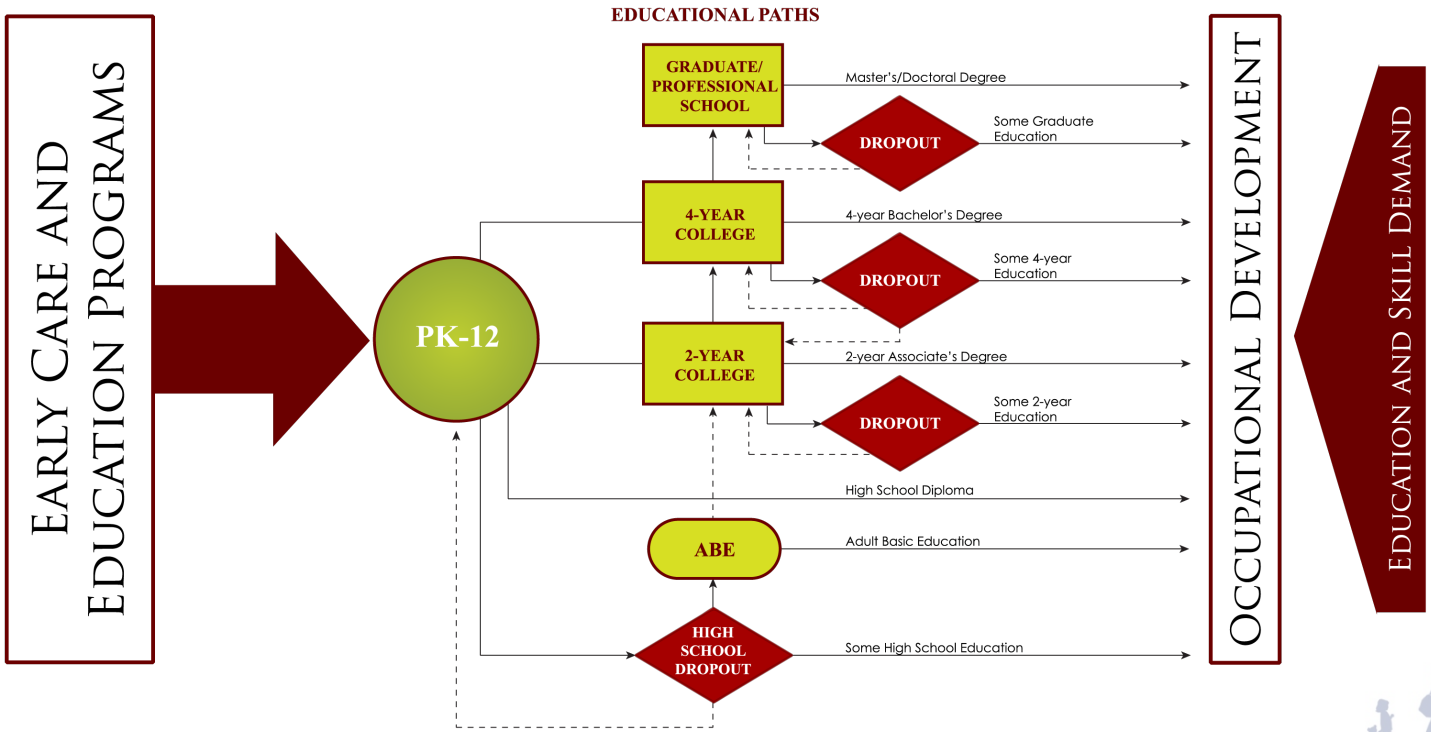
STATEWIDE LONGITUDINAL DATA SYSTEM (SLDS)

MISSISSIPPI

CULTURE OF COOPERATION	STRUCTURAL & TECHNICAL CAPACITY	PERFORMANCE-BASED MANAGEMENT

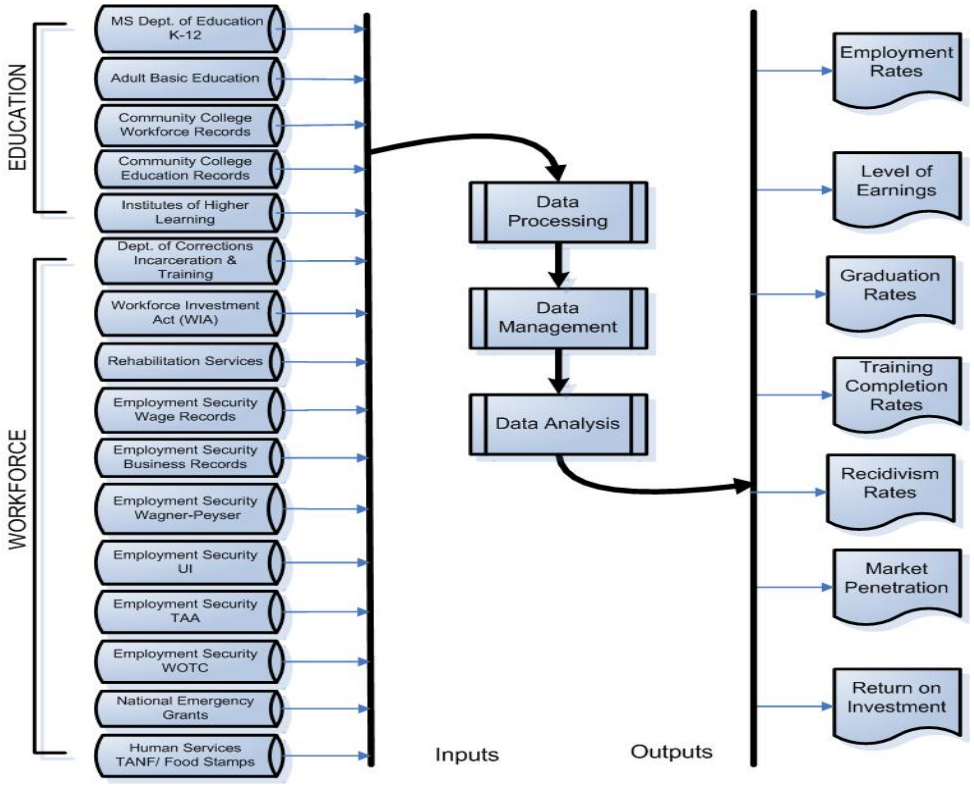
MISSISSIPPI

SLDS CONCEPTUAL MODEL



MISSISSIPPI

DATA WAREHOUSE MODEL



Rationale for Choosing a Model

KENTUCKY

- Not all agencies we want to participate have data warehouses and could participate in a federated model.
- Upgrades and infrastructure changes in participating agencies would interrupt "service".
- Political concerns about changing leadership that may allow agencies to simply stop participating.
- Centralizing data allows for shared resources and cost savings over more "silo" data systems.
- Most agencies lack research staff to utilize the system and there was a desire to centralize some analyses.
- The de-identified model satisfies agency legal concerns.
- The ability to reproduce numbers over time.

VIRGINIA

Implementation Environment and Virginia Specific Limitations:

Structural

- Decentralized authority structure in potential partner agencies (e.g. health, social services) resulting in different data systems, standards, and data collected

Legal

- VA § 2.2-3800: Government Data Collection and Dissemination Practices Act
- VA § 59.1-443.2 - Restricted use of social security numbers
- Assistant Attorneys General interpretations
  - "No one person , inside or outside a government agency, should be able to create a set of identified linked data records between partner agencies"

VIRGINIA

Consolidated Data Systems (Warehouse)

- Can be very expensive (to both build and maintain)
- Too difficult to embody (program) the multiple levels of federal and state statutory and regulatory privacy requirements – must have laws in place to allow for centralized collection
- Lack of clear data authority, per data system, between state agencies and between state and local-level agencies – participation is not compulsory

Federated Data Systems

- System that interacts with multiple data sources on the back-end and presents itself as a single data source on the front-end
- The key to linking up the different data sources is a central linking apparatus
- Allows for the maintenance of existing privacy protection rules and regulations
- Can significantly reduce application development time and cost

ARKANSAS

FERPA v. 1 Compliance

Match rates are important, especially for multi-agency data

Caleb Gibson

MISSISSIPPI

RATIONALE

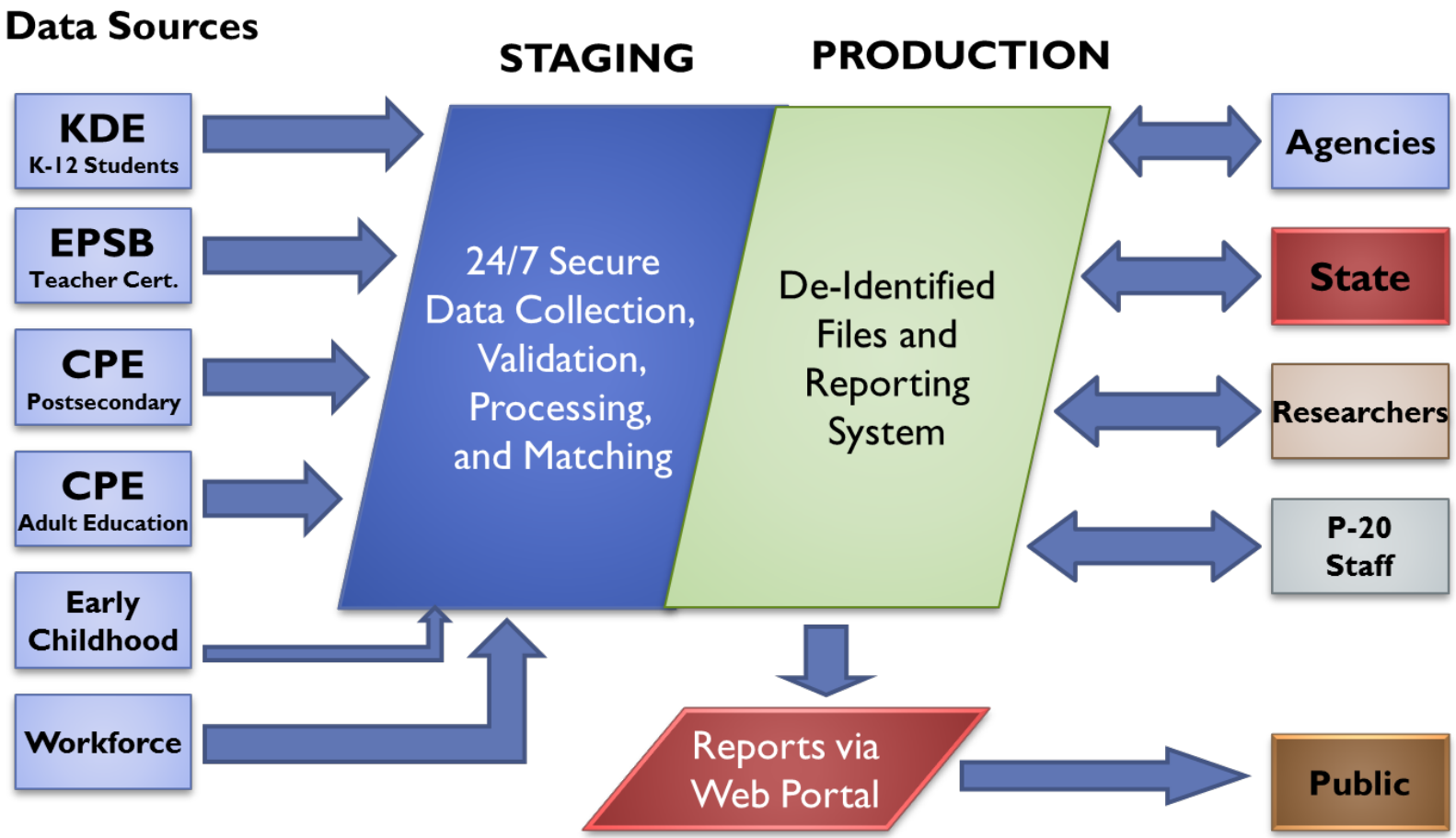
- MINIMIZE BURDEN ON DATA STAKEHOLDERS
- MINIMIZE SYSTEM CHANGES

Infrastructure and Design

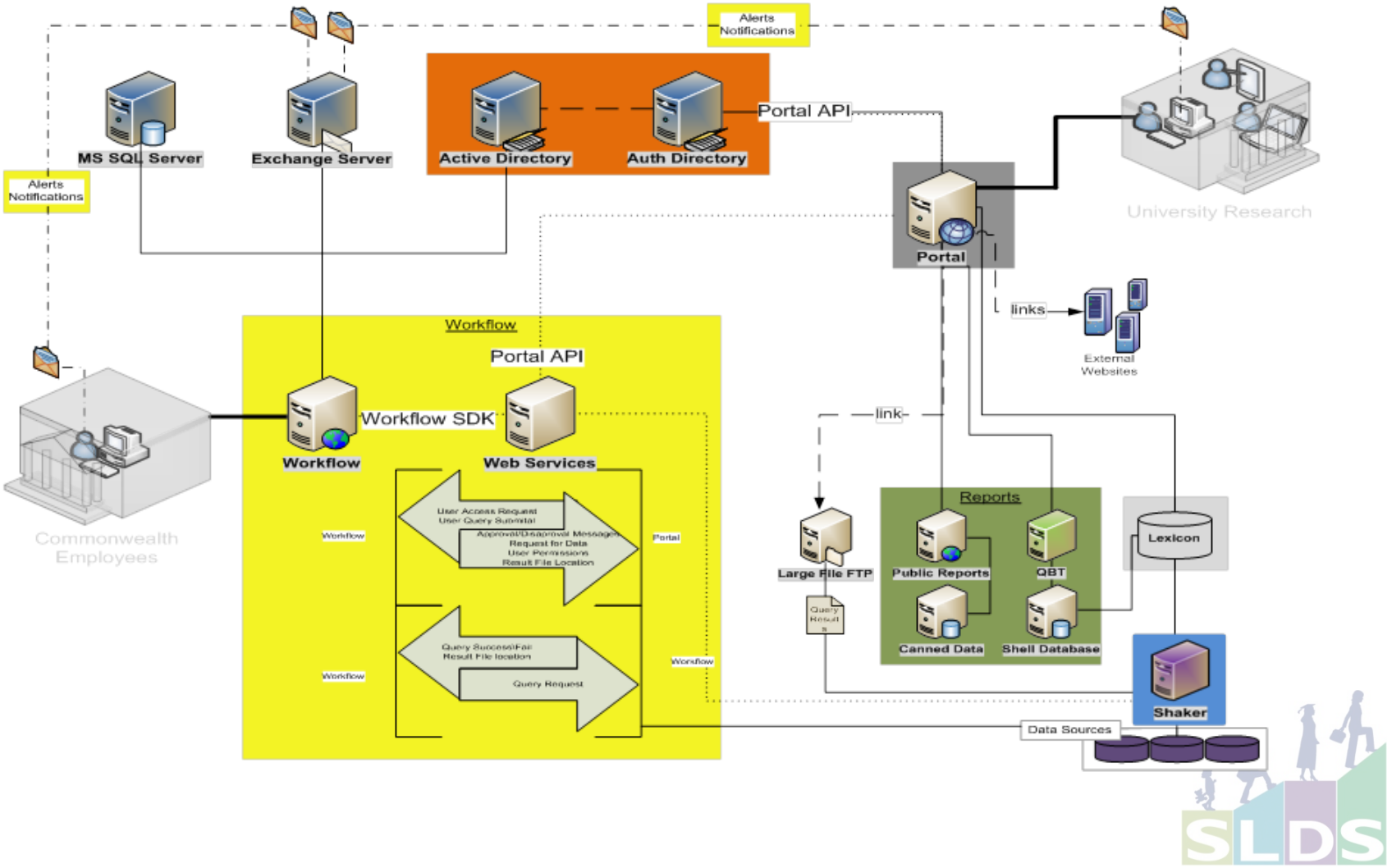
KENTUCKY

- Agencies provide data on a regular schedule and have access to the de-identified system through a standard reporting tool.
- "Master Person" record matching process that becomes "better" over time by retaining all the different versions of data for matching.
- Staging environment where data are validated and checked.

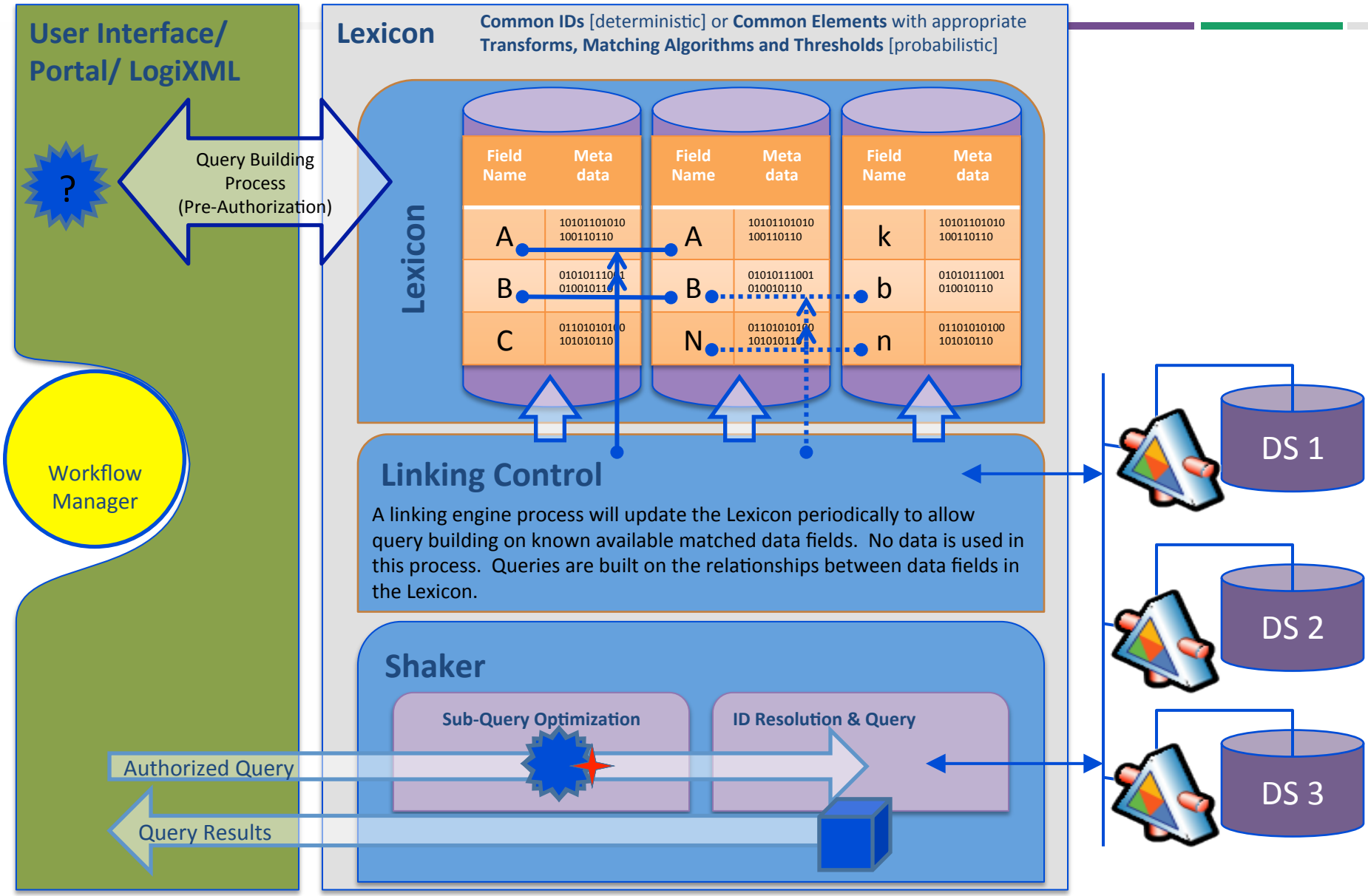
KENTUCKY


Data Sources
STAGING
PRODUCTION
KDE
K-12 Students
EPSB
Teacher Cert.
CPE
Postsecondary
CPE
Adult Education
Early Childhood
Workforce
24/7 Secure Data Collection, Validation, Processing, and Matching
De-Identified Files and Reporting System
Agencies
State
Researchers
P-20 Staff
Reports via Web Portal
Public

VIRGINIA - WORKFLOW



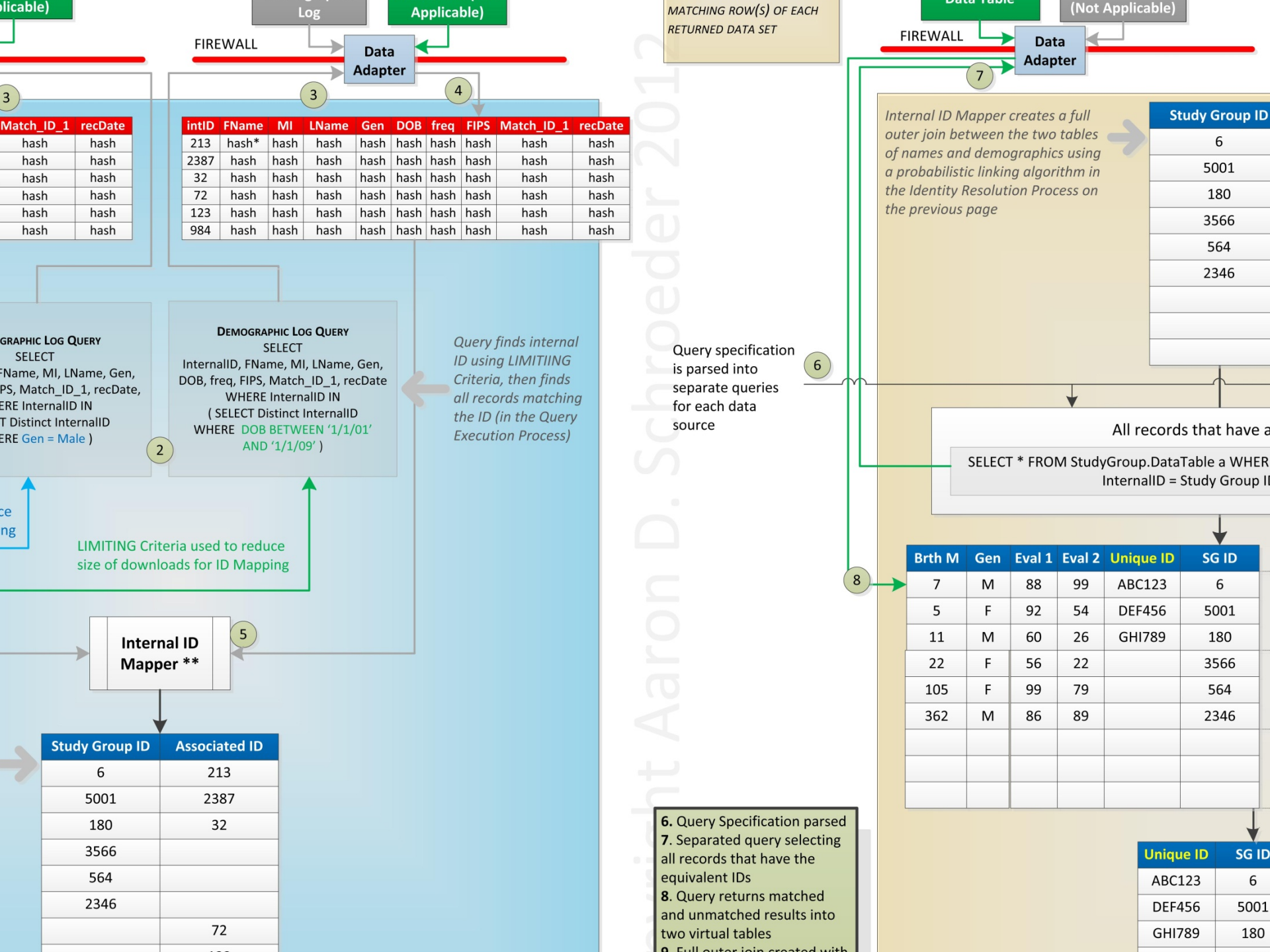
LEXICON – SHAKER PROCESS OVERVIEW



Privacy Protecting Federated query

Two Steps:

1. Identity Resolution Process
2. Query Execution Process


Applicable)
Log
Applicable)
FIREWALL
Data Adapter
3
3
4
Match_ID_1 recDate
hash hash
hash hash
hash hash
hash hash
hash hash
hash hash
intID FName MI LName Gen DOB freq FIPS Match_ID_1 recDate
213 hash* hash hash hash hash hash hash hash hash
2387 hash hash hash hash hash hash hash hash hash
32 hash hash hash hash hash hash hash hash hash
72 hash hash hash hash hash hash hash hash hash
123 hash hash hash hash hash hash hash hash hash
984 hash hash hash hash hash hash hash hash hash
GRAPHIC LOG QUERY
SELECT
FName, MI, LName, Gen,
PS, Match_ID_1, recDate,
ERE InternalID IN
T Distinct InternalID
ERE Gen = Male)
2
DEMOGRAPHIC LOG QUERY
SELECT
InternalID, FName, MI, LName, Gen,
DOB, freq, FIPS, Match_ID_1, recDate
WHERE InternalID IN
(SELECT Distinct InternalID
WHERE DOB BETWEEN '1/1/01'
AND '1/1/09')
Query finds internal ID using LIMITIING Criteria, then finds all records matching the ID (in the Query Execution Process)
LIMITING Criteria used to reduce size of downloads for ID Mapping
Internal ID Mapper **
5
Study Group ID Associated ID
6 213
5001 2387
180 32
3566
564
2346
72
MATCHING ROW(S) OF EACH RETURNED DATA SET
Data Table
(Not Applicable)
FIREWALL
Data Adapter
7
Internal ID Mapper creates a full outer join between the two tables of names and demographics using a probabilistic linking algorithm in the Identity Resolution Process on the previous page
Study Group ID
6
5001
180
3566
564
2346
Query specification is parsed into separate queries for each data source
6
All records that have a
SELECT * FROM StudyGroup.DataTable a WHER
InternalID = Study Group I
8
Brth M Gen Eval 1 Eval 2 Unique ID SG ID
7 M 88 99 ABC123 6
5 F 92 54 DEF456 5001
11 M 60 26 GHI789 180
22 F 56 22 3566
105 F 99 79 564
362 M 86 89 2346
Unique ID SG ID
ABC123 6
DEF456 5001
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6. Query Specification parsed
7. Separated query selecting all records that have the equivalent IDs
8. Query returns matched and unmatched results into two virtual tables
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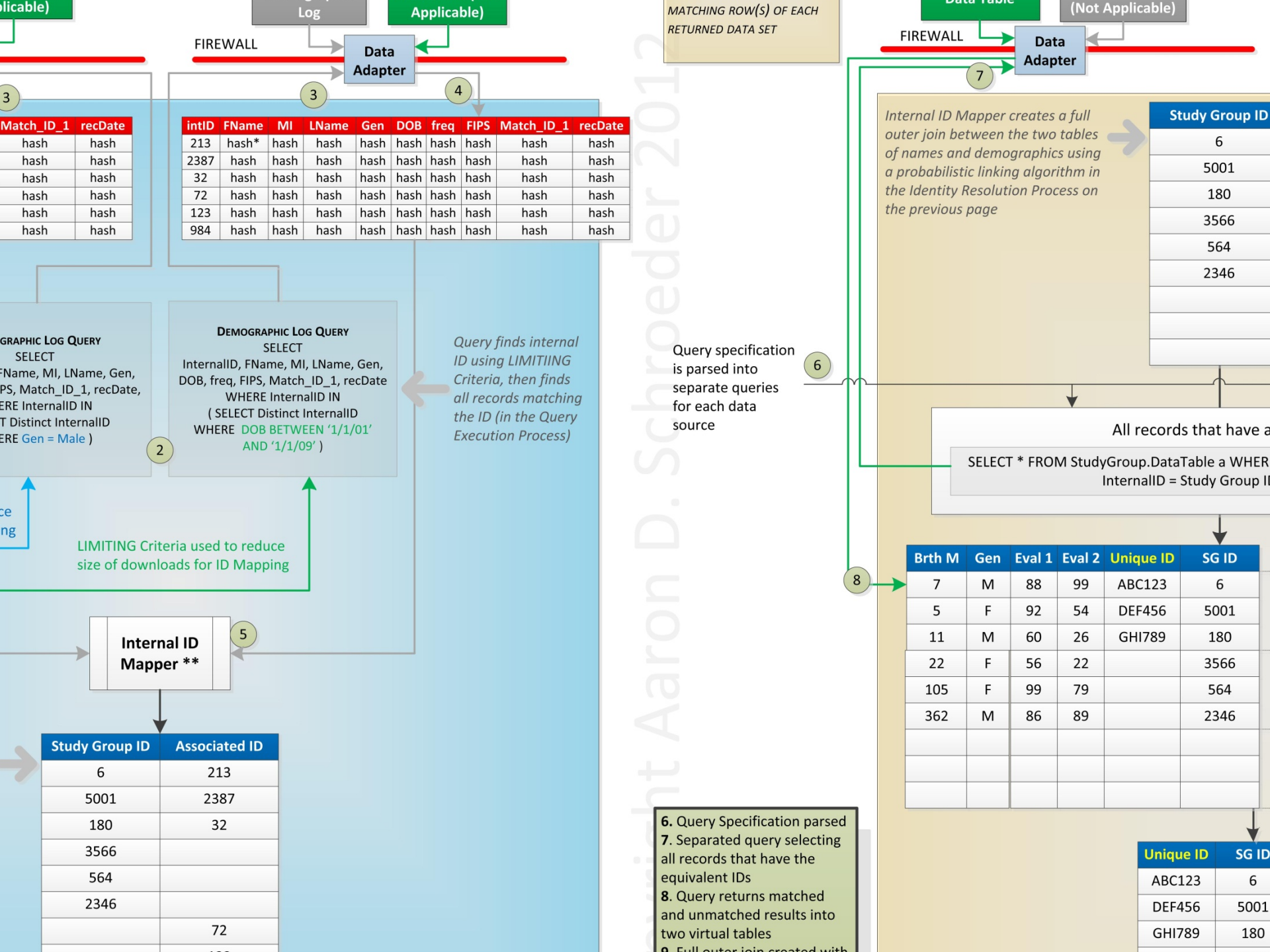
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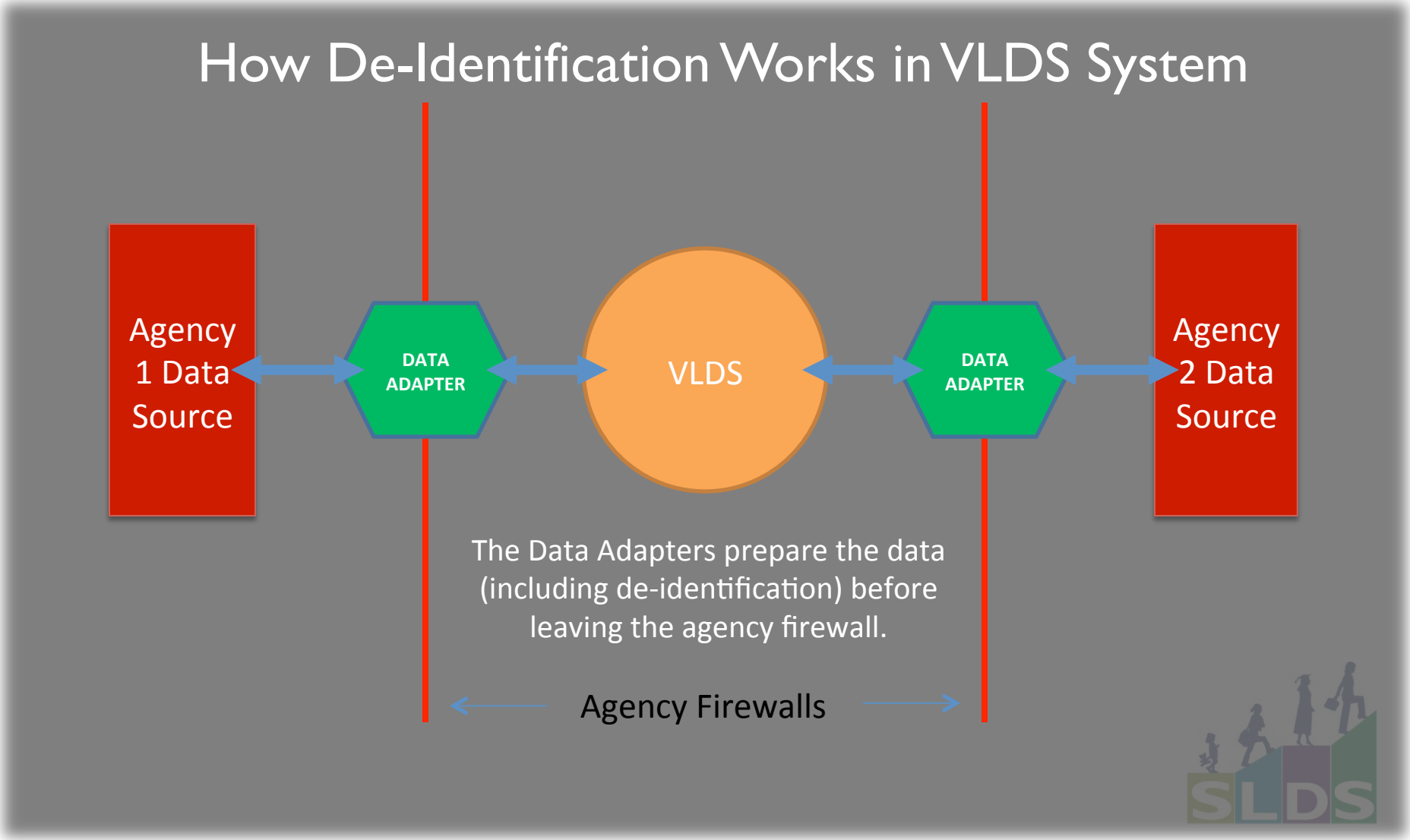
VIRGINIA


How De-Identification Works in VLDS System
Agency 1 Data Source
DATA ADAPTER
VLDS
DATA ADAPTER
Agency 2 Data Source
The Data Adapters prepare the data (including de-identification) before leaving the agency firewall.
Agency Firewalls

GETTING DATA READY FOR "DE-IDENTIFIED FEDERATION"

What the Data Adapter Does:

De'Smith-Barney IV

Remove Suffix

De'Smith-Barney

Remove Symbols

DeSmithBarney

DeSmithBarney

Substitution Alphabet – Dynamically Generated using Hashing Key (below)

YDXWKQTAGOLCNSVEFHMRJPBZUI

Substitution Cipher

Hashing Key – Dynamically Generated and sent from HANDS

b164f11d-aa37-44ca-93c3-82d3e0155061

Order Hashing

C57S78XCEBF9WECP2AA9DK59N1CO27QBES54HFD

CLEANED & ENCODED for TRANSPORT

Cleaned and Encoded Matching Data (Internal ID, First and Last Name)

INTERNAL_ID_HASHED	FIRST_NAME	LAST_NAME
044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	J11EDAV3E
044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	J11EDAV3E
044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	J11EDAV3E
044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	J11EDAV3E
044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	J11EDAV3E
044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	J11EDAV3E
044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	J11EDAV3E
044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	X11SDAK3EF86
044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	X11SDAK3EF86
044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	X11SDAK3EF86
044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	J11EDAV3E
044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	J11EDAV3E
044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	J11EDAV3E
044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	J11EDAV3E
044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	J11EDAV3E
044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	X11SDAK3EF86
044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	X11SDAK3EF86
044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	J11EDAV3E
044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	J11EDAV3E
044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	J11EDAV3E
044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	J11EDAV3E
044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	J11EDAV3E
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044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	J11EDAV3E
044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	J11EDAV3E
044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	X11SDAK3EF86
044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	X11SDAK3EF86
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044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	J11EDAV3E
044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	J11EDAV3E
044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	J11EDAV3E
044AA90CE74E2ED3B6B0B0CFE93F8ED263B73050	F11BDAE3EM86AE8	J11EDAV3E

INTERNAL_ID is the same

LAST_NAME is NOT

Many agencies DO NOT have an Index of unique individuals. There can be many representations of that individual.

What do we do?

Statistical Log Analysis and Reduction

We dynamically build a new "virtual" record made up of "most likely" demographics

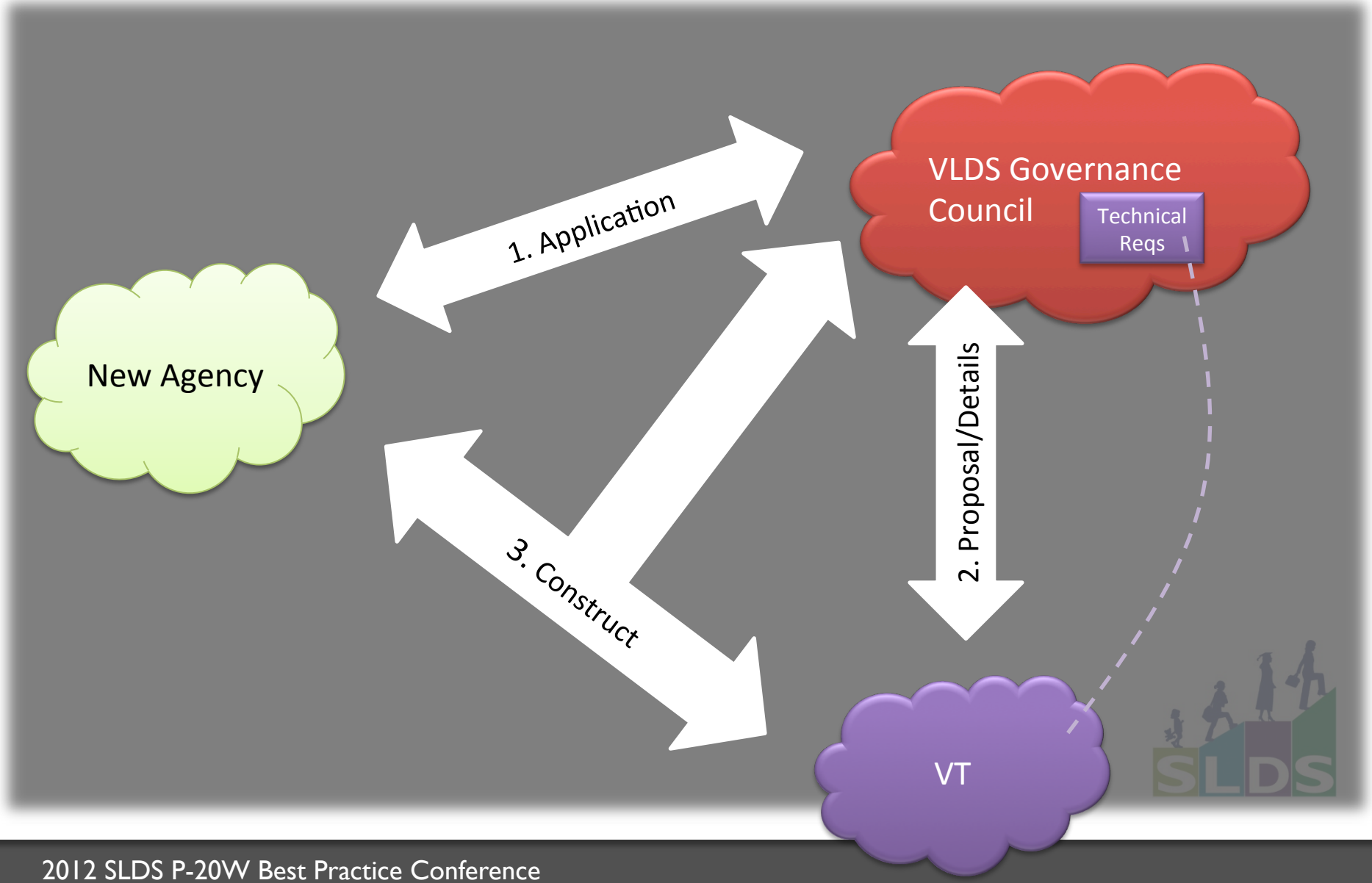
Probabilistic Linkage Process (Creating a Linking Directory)

(After we have a unique person index for each agency dataset)

- Blocking
- m and u Parameter Calculation
- Matching-Column Weight Calculations
- Match Scoring
- Linkage Determination and addition to Linking Directory

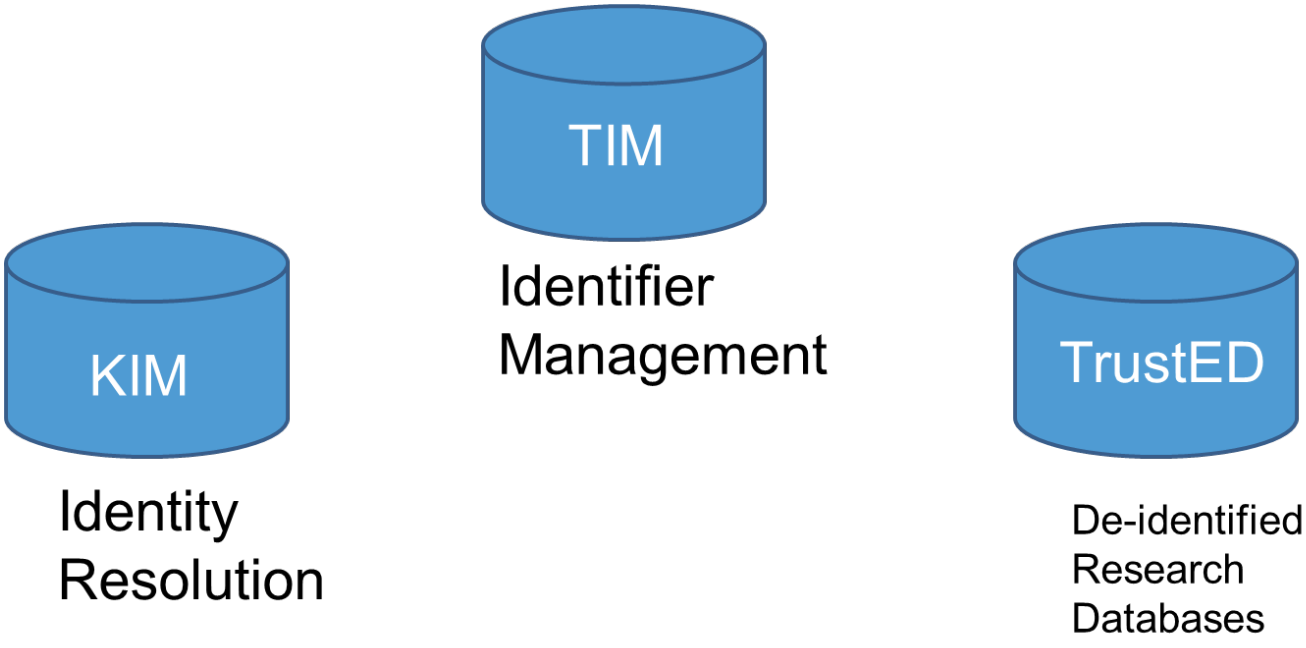
- Linkage Determination – A Cutoff score needs to be set for each blocked comparison, below which a link is not accepted as a real "link"
- The best method of establishing this cutoff is for the system operator to work with a content-area expert to determine the peculiarities of data for that content-area
- In some data sets in may be very unlikely that a birthdate was entered incorrectly, while in another, it may happen very regularly – a computer can not automatically know this
- Once these cutoffs are set, they don't need to be changed unless something drastic occurs to change the nature of the dataset

Data Partner Intake Process



ARKANSAS

TrustEd:
Knowledgebase Identity Management (KIM)
TrustEd Identifier Management (TIM)



ARKANSAS

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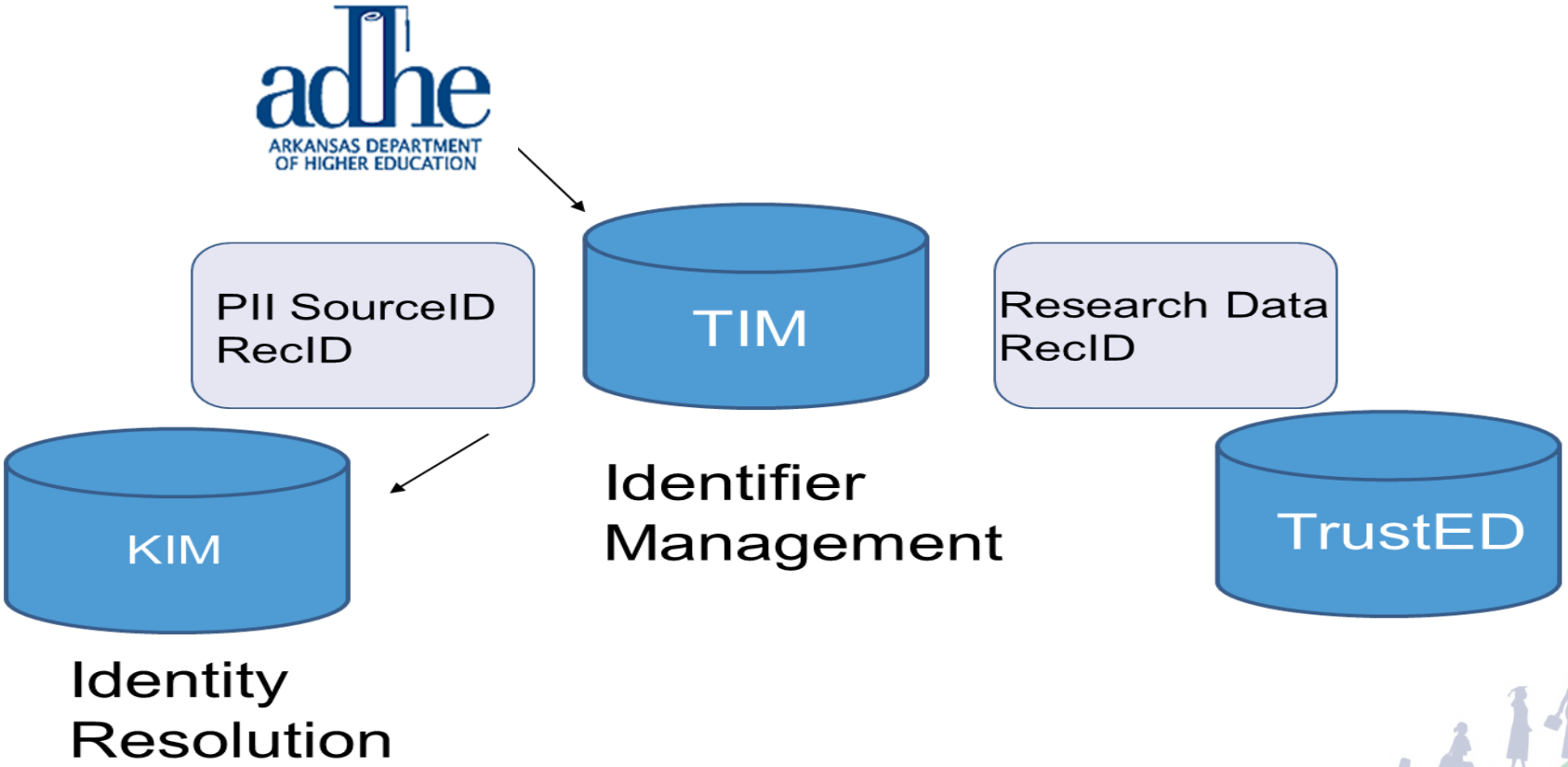

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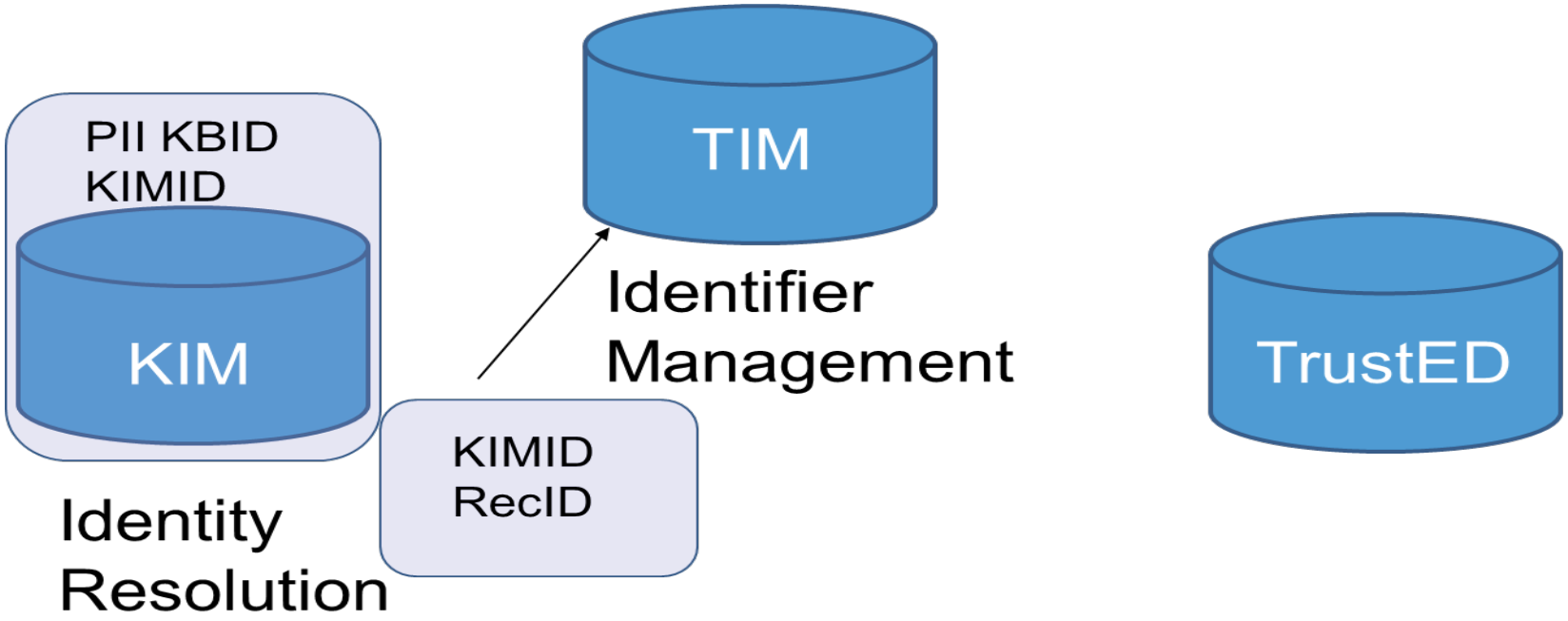

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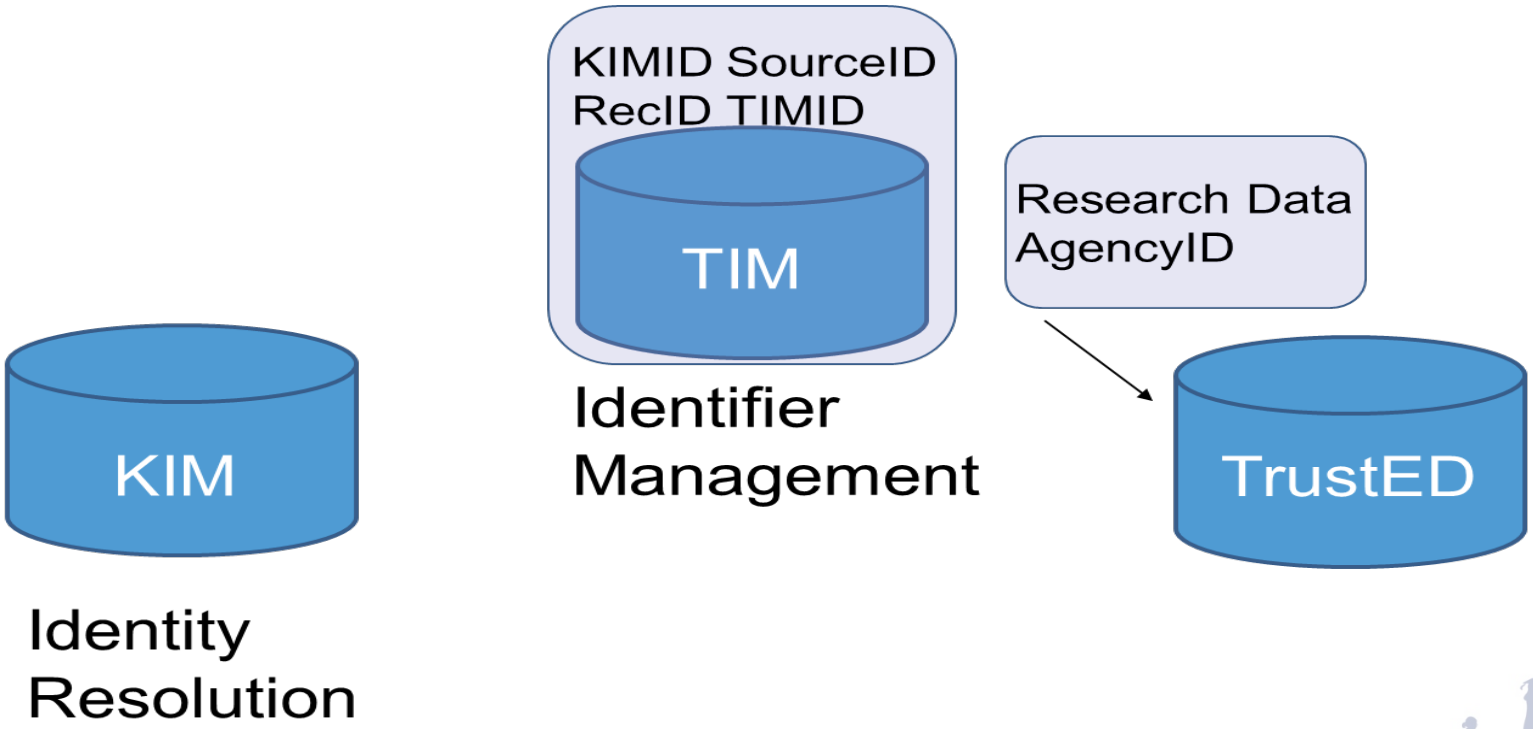

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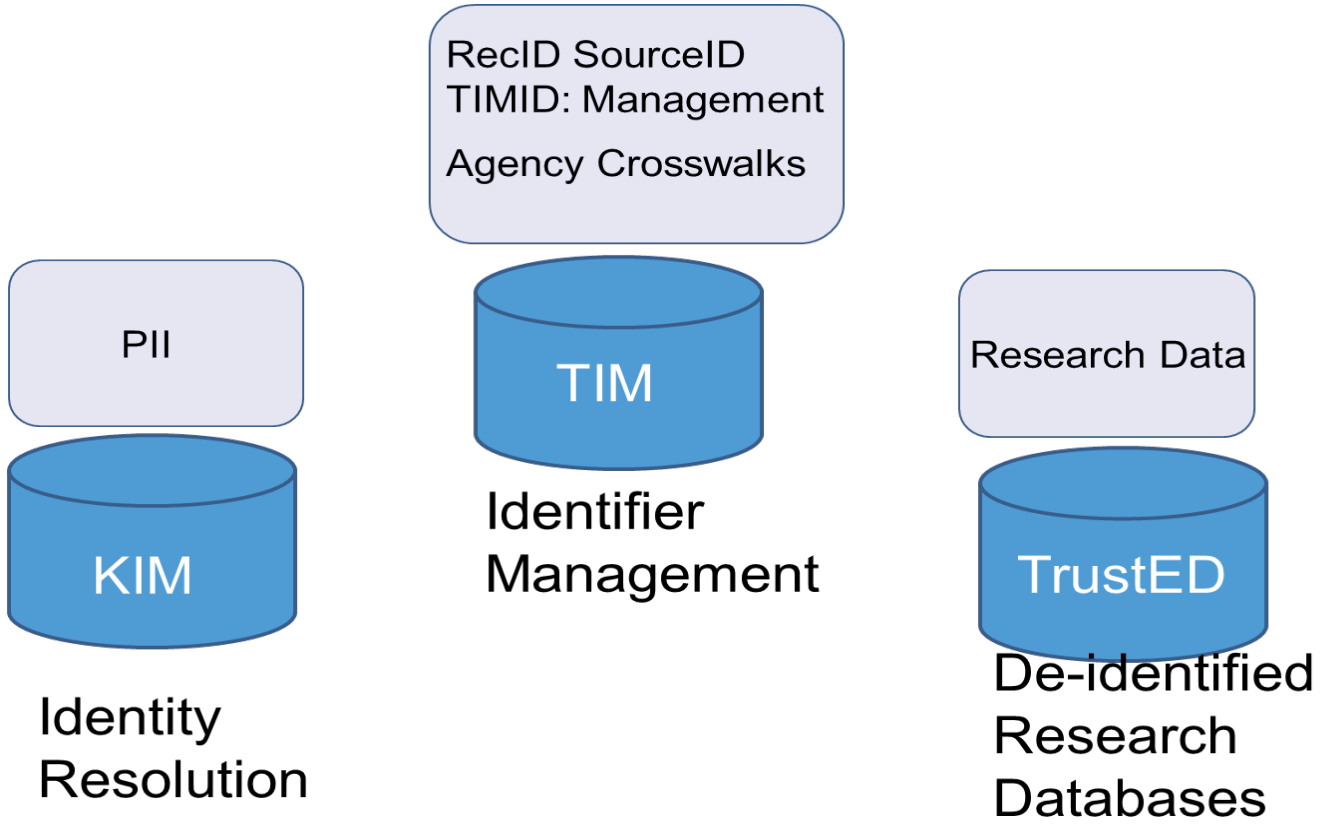


MISSISSIPPI

LOGICAL DATA MODEL

The SLDS is designed to put relevant and timely information for better decision making into the hands of appropriate stakeholders (parents, teachers, principals, superintendents, political leaders). It does so by creating an integrated data model and by framing information within the context of individuals, programs, and organizations.

MISSISSIPPI

LOGICAL DATA MODEL

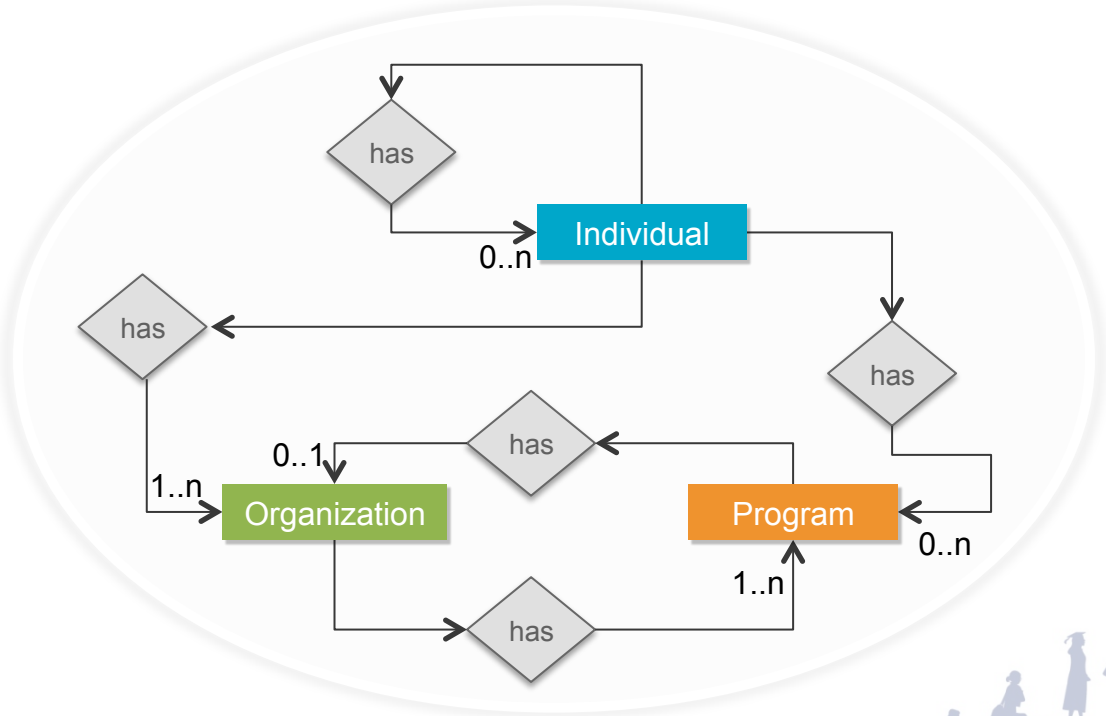
High level overview of data interaction

ORGANIZATION:

- Institution
- Pre School
- School
- Community College
- WIA Local Area
- DOL Service Center

PROGRAMS:

- K12 Enrollment Program
- Workforce Course/Training
- WIA Enrollment



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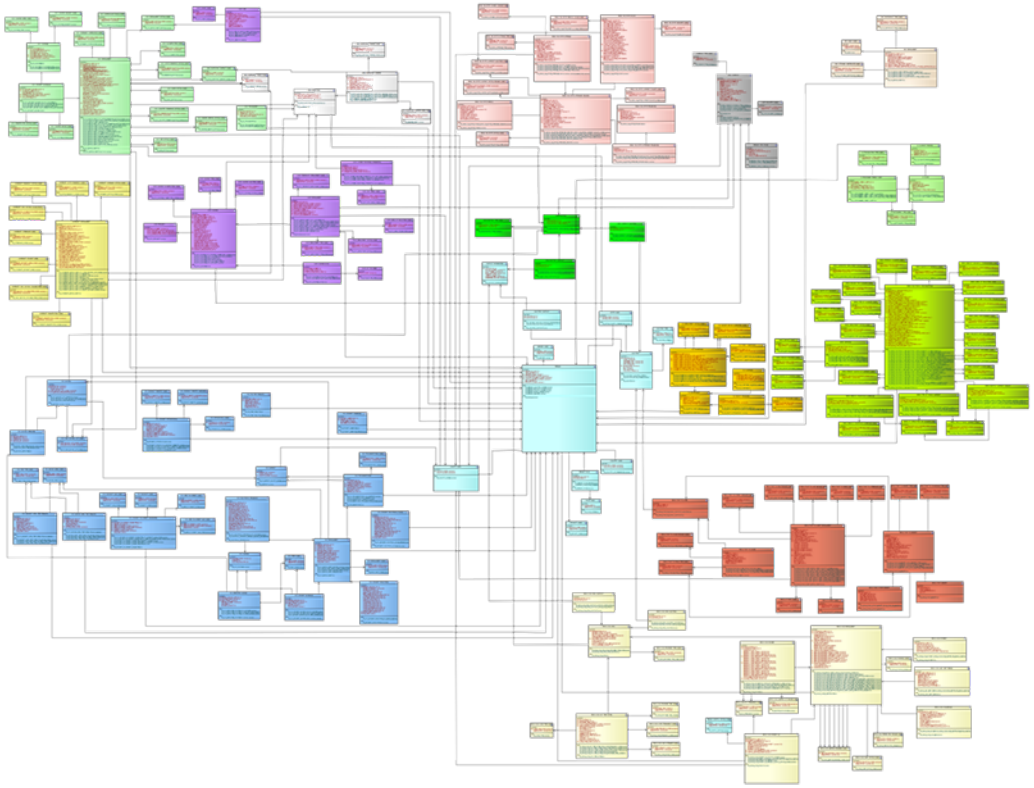
SLDS ENTITY RELATIONSHIP DIAGRAM



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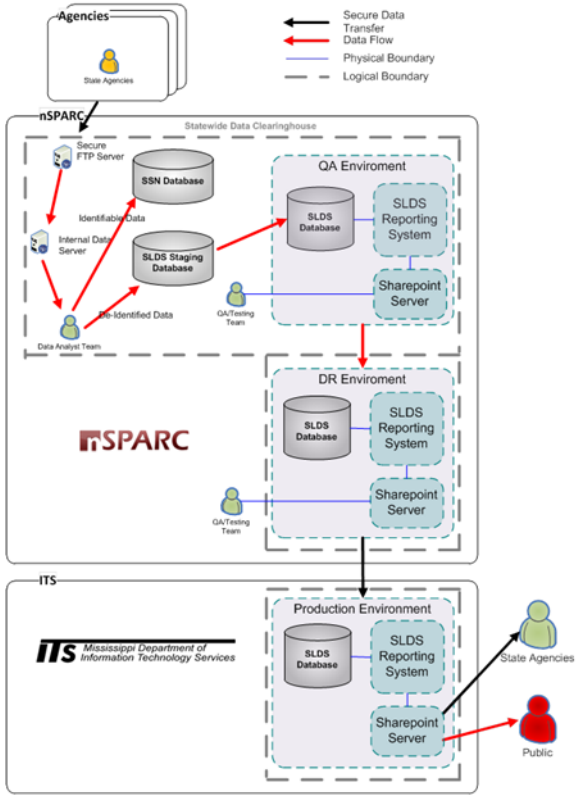
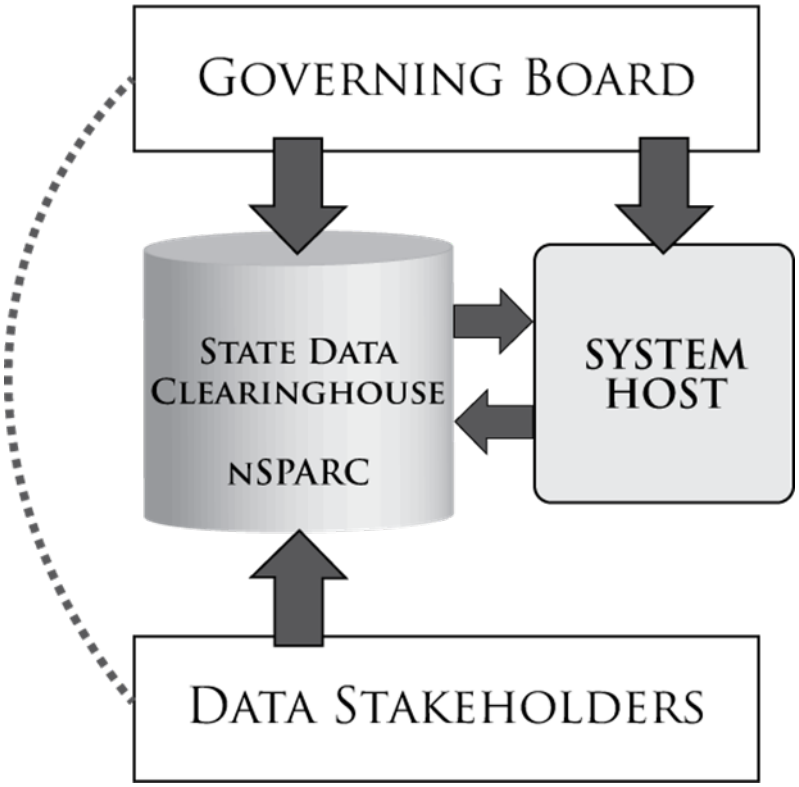
SLDS DATA FLOW ARCHITECTURE



MISSISSIPPI

GOVERNANCE STRUCTURE



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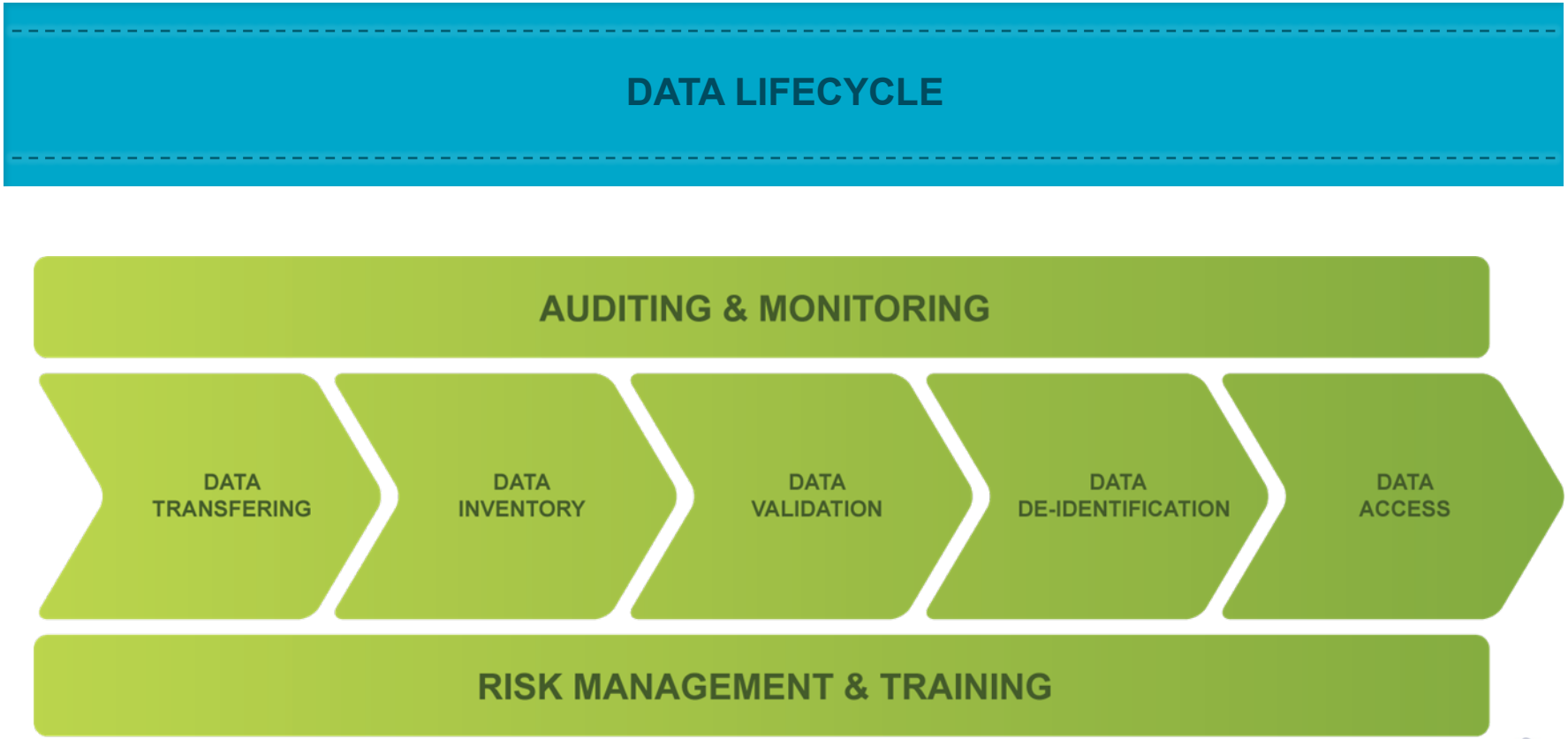


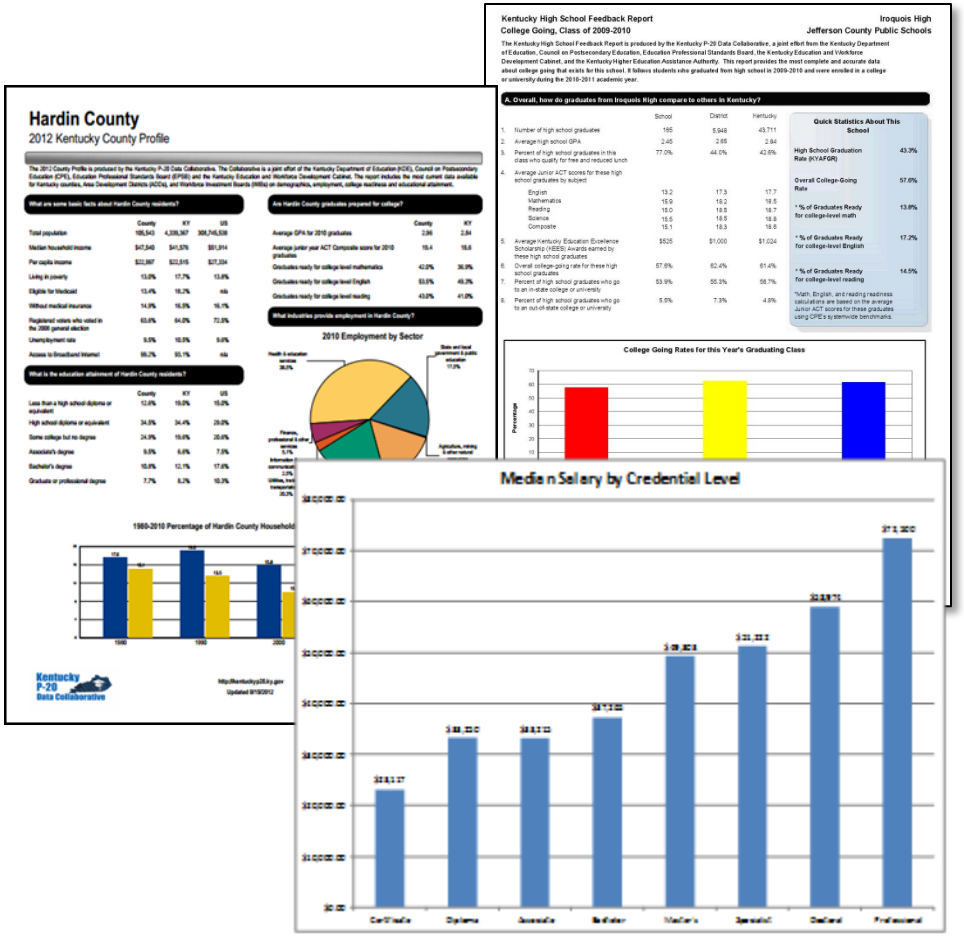
Data Access

KENTUCKY

- Agencies have access to all the identifiable data they have provided to P-20 – but not to each other's.
- Agencies and P-20 Staff have access to the de-identified production data. Shared "universes" go live in December.
- P-20 Staff respond to multi-agency data requests with vetting process to validate for accuracy.
- Access through Business Objects Web Intelligence (WebI), P-20 staff use WebI, Crystal, SSRS, SPSS, SAS, Arc-View, and other tools.
- Data retention as needed. Long-term retention to be determined.

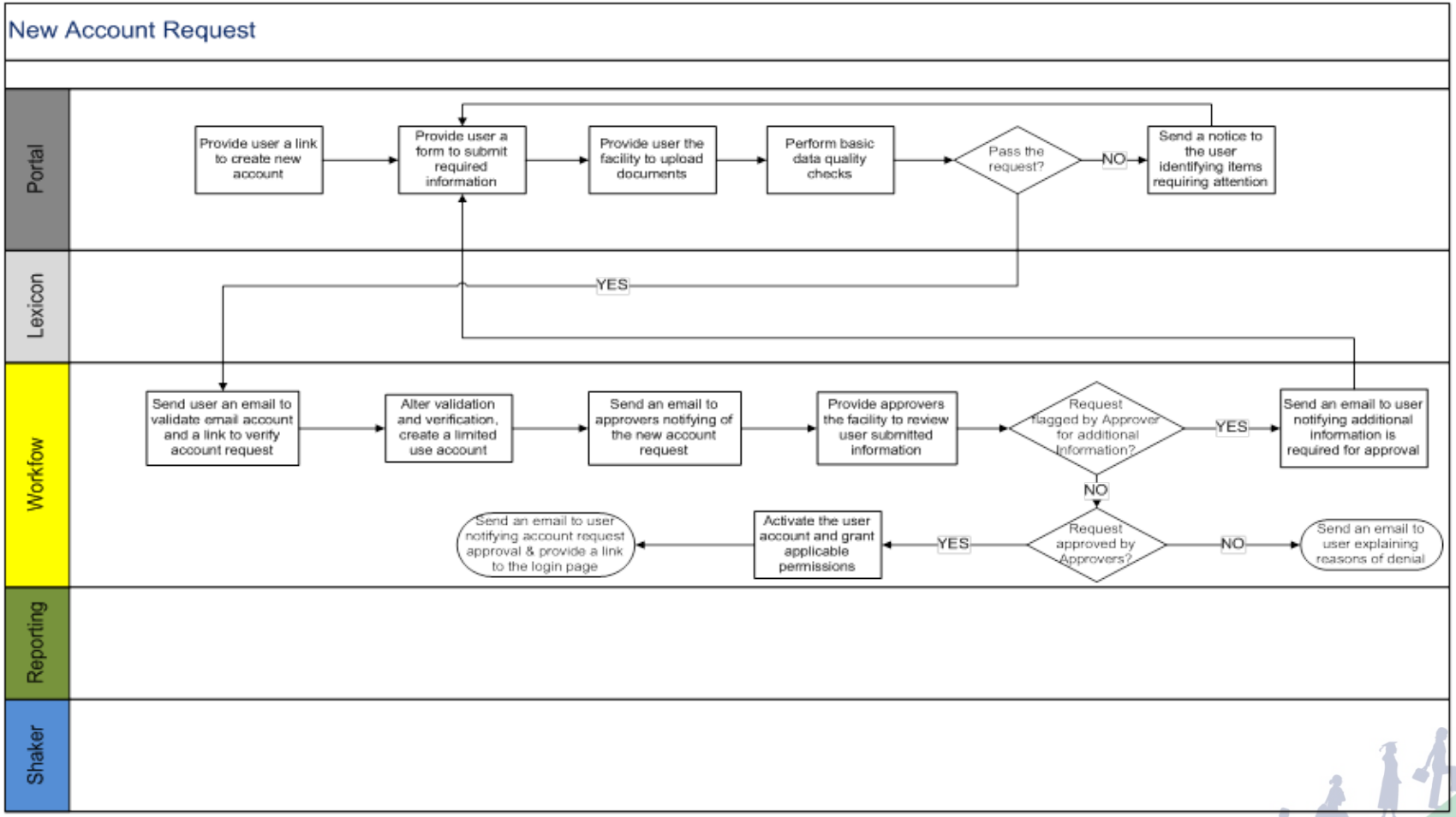
KENTUCKY

Centralized Reporting for Cross-Agency Issues

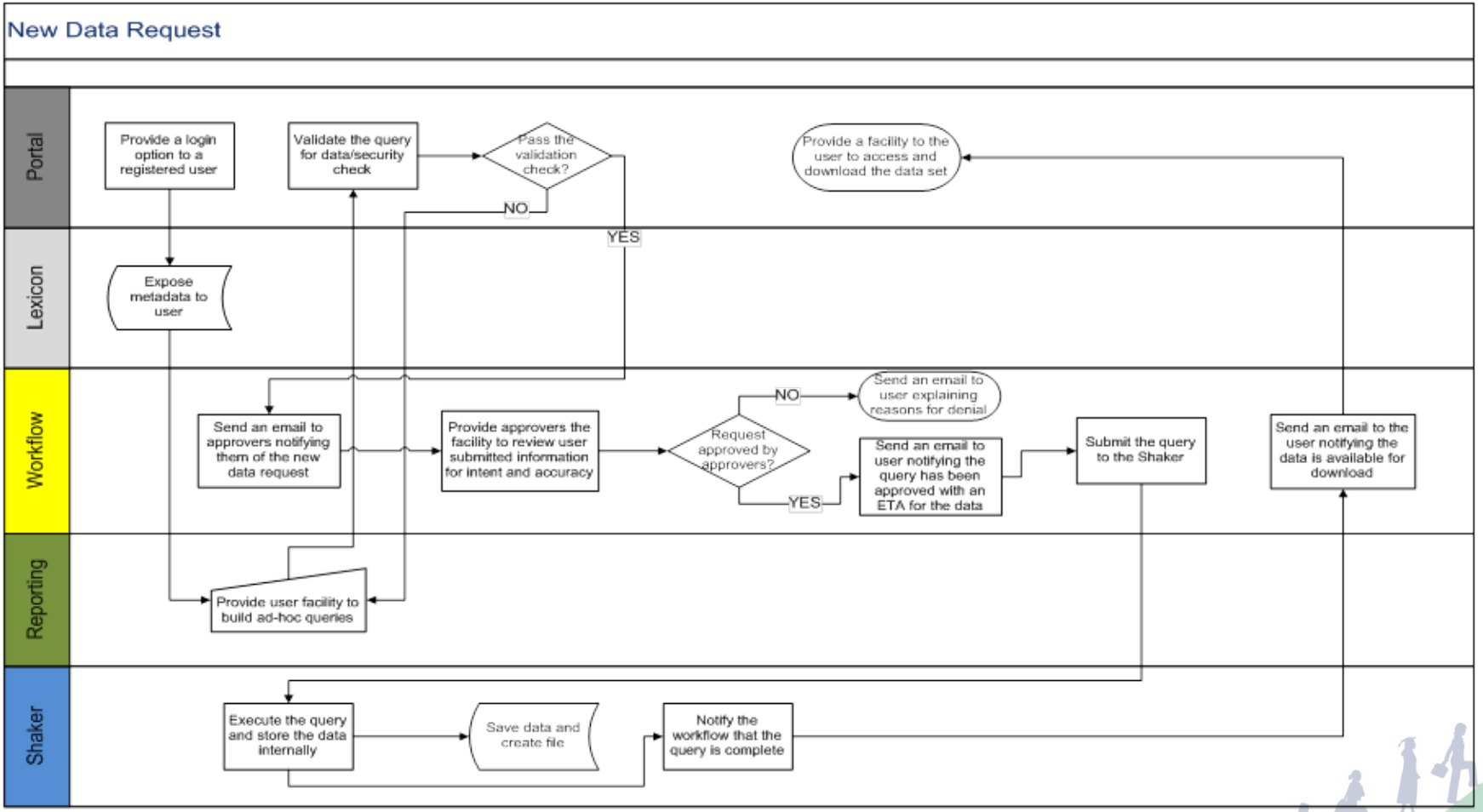


- High School Feedback
- Adult Education Feedback
- Employment Outcomes and Earnings
- County Profiles
- Workforce and Training Outcomes

VIRGINIA


New Account Request
Portal
Lexicon
Workflow
Reporting
Shaker
Provide user a link to create new account
Provide user a form to submit required information
Provide user the facility to upload documents
Perform basic data quality checks
Pass the request?
NO
Send a notice to the user identifying items requiring attention
YES
Send user an email to validate email account and a link to verify account request
Alter validation and verification, create a limited use account
Send an email to approvers notifying of the new account request
Provide approvers the facility to review user submitted information
Request flagged by Approver for additional Information?
YES
Send an email to user notifying additional information is required for approval
NO
Request approved by Approvers?
NO
Send an email to user explaining reasons of denial
YES
Activate the user account and grant applicable permissions
Send an email to user notifying account request approval & provide a link to the login page

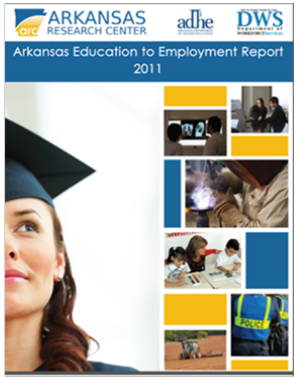
VIRGINIA


New Data Request
Portal
Lexicon
Workflow
Reporting
Shaker
Provide a login option to a registered user
Validate the query for data/security check
Pass the validation check?
NO
YES
Provide a facility to the user to access and download the data set
Expose metadata to user
Send an email to approvers notifying them of the new data request
Provide approvers the facility to review user submitted information for intent and accuracy
Request approved by approvers?
NO
Send an email to user explaining reasons for denial
YES
Send an email to user notifying the query has been approved with an ETA for the data
Submit the query to the Shaker
Send an email to the user notifying the data is available for download
Provide user facility to build ad-hoc queries
Execute the query and store the data internally
Save data and create file
Notify the workflow that the query is complete

ARKANSAS

TrustEd: KIM & TIM

Employment Report



Economic Success Measures

AIMS Report

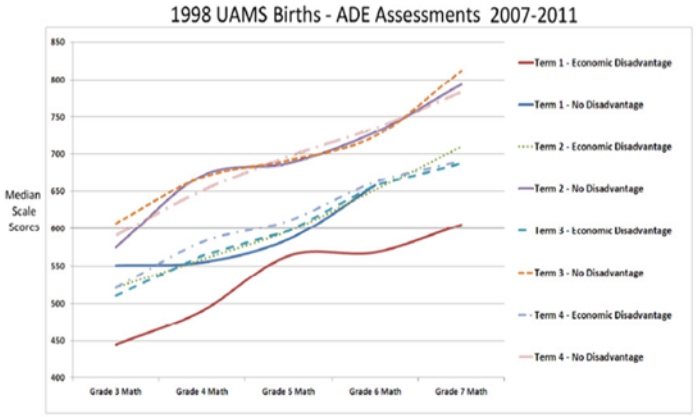
ACT	Concurrent Credit	AP Participant	Overall	On Time Bachelor's	OnTime Bach. %
17-18			2438	586	24.0%
17-18		Y	553	189	34.2%
17-18	Y		222	73	32.9%
17-18	Y	Y	54	24	44.4%
19-20			2688	855	31.8%
19-20		Y	1024	434	42.4%
19-20	Y		457	184	40.3%
19-20	Y	Y	158	82	51.9%
21-22			2185	863	39.5%
21-22		Y	1376	683	49.6%
21-22	Y		483	238	49.3%
21-22	Y	Y	228	141	61.8%
23-24			1544	665	43.1%
23-24		Y	1615	931	57.6%
23-24	Y		465	261	56.1%
23-24	Y	Y	292	182	62.3%
25-26			938	471	50.2%
25-26		Y	1618	1013	62.6%
25-26	Y		371	224	60.4%
25-26	Y	Y	338	230	68.0%
27-29			662	365	55.1%
27-29		Y	1843	1285	69.7%
27-29	Y		306	196	64.1%
27-29	Y	Y	377	283	75.1%

Early Learning Report

Evaluation of Reduced Lunch Students (non-SpecialEd) by Pre-K Program (ABC, HeadStart, and

			National Percentile Ranking (averages)				
KG Year	PreK_Summary	Students	G0_Lit	G0_Math	G0_Reading	G1_Lit	G1_Math G
2005	ABC	47	63.55	63.77	56.64	66.93	64.78
2005	HeadStart	152	57.28	60.67	51.70	61.09	59.93
2006	ABC	131	65.36	69.70	56.18	62.77	64.77
2006	HeadStart	126	61.34	60.45	55.03	54.67	60.22
2006	Voucher	18	51.50	53.94	46.39	46.88	49.19
2007	ABC	291	59.93	64.96	55.07	47.29	51.39
2007	HeadStart	108	58.41	64.77	51.47	44.73	49.57
2007	Voucher	15	47.53	43.53	44.27	48.67	50.67
2008	ABC	325		51.61	58.36	45.35	52.57
2008	HeadStart	107		50.23	57.52	43.47	47.33
2008	Voucher	25		45.96	57.40	44.96	40.32
2009	ABC	540		51.65	54.76	48.68	55.97
2009	HeadStart	129		51.71	54.78	47.95	51.72
2009	Voucher	26		47.04	49.19	37.26	46.87
2010	ABC	720		53.18	55.95	57.70	56.59
2010	HeadStart	120		49.29	52.16	56.12	54.99
2010	Voucher	33		46.12	54.55	48.48	55.87
2011	ABC	750	81.64	67.73	76.05		
2011	HeadStart	145	78.10	62.64	69.92		
2011	Voucher	44	78.82	62.16	73.30		

UAMS Neonatal Report



MISSISSIPPI

DATA ACCESS

- ON REQUEST
- ONE-STOP PORTA

MISSISSIPPI

IMPACT OF READING PROFICIENCY

- **For students not proficient in reading in 8th grade, what is their likelihood to succeed as young adults?**
  - 70 percent less likely to graduate from high school
  - 65 percent less likely to go to college
  - 3.7 times more likely to take remedial courses
  - 2.7 times more likely to receive food stamps or TANF
  - 3.7 times more likely to go to prison
- **Total Annual Average Cost to Mississippi: $143 Million**

ON REQUEST

EXAMPLES

- IMPACT OF READING PROFICIENCY
- JOB CREATION
- WORKFORCE NEEDS
- ALIGNING COLLEGE GRADS WITH WORKFORCE
- ALIGNMENT OF EDUCATION SYSTEMS
- TRACKING STUDENT OUTCOMES
- LINKING TEACHERS TO STUDENT OUTCOMES
- LINKING EARLY CHILDHOOD WITH K12

MISSISSIPPI

JOB CREATION

WORKFORCE PIPELINE

- Sector: Transportation and Logistics
- Potential Site: Desoto County
- Workforce pipeline: students enrolled in the postsecondary system graduating within a year.

	COMMUNITY COLLEGE	PUBLIC UNIVERSITY
Computer and Information Sciences and Support Services.	472	137
Transportation and Materials Moving.	19	0
Business, Management, Marketing, and Related Support Services	1,278	1,010
TOTAL...	**1,769**	**1,147**

Source: Mississippi State Longitudinal Data System, 2012

ON REQUEST

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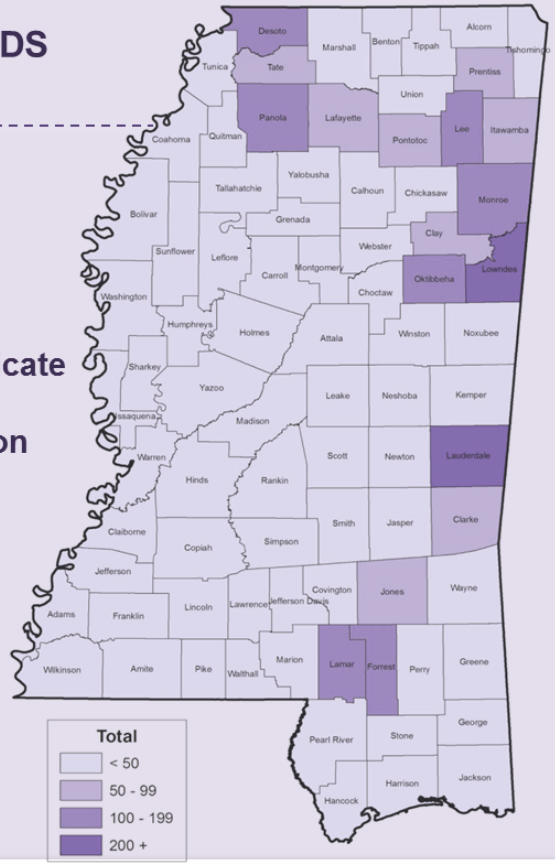
MISSISSIPPI

WORKFORCE NEEDS

Workforce Ready Communities:

Career Readiness Certificate

Gold-Level Certification



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MISSISSIPPI

ALIGNING COLLEGE GRADUATES WITH THE WORKFORCE

- 74 percent of university graduates stay and work in Mississippi
- 79 percent of community college graduates stay and work in Mississippi
- University Majors most likely to stay:
  - Education
  - Healthcare
  - Public Administration
- University Majors Most likely to leave
  - Physical Sciences
  - Math and Statistics
  - Engineering

ON REQUEST

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MISSISSIPPI

ALIGNMENT OF EDUCATION SYSTEMS

- 69 percent of all high school graduates go to college
  - 54 percent go to a community college
  - 17 percent go to a university
- 50 percent enroll in remedial math and English courses
  - 60 percent of community college students take remedial courses
  - 28 percent of university students take remedial courses

ON REQUEST

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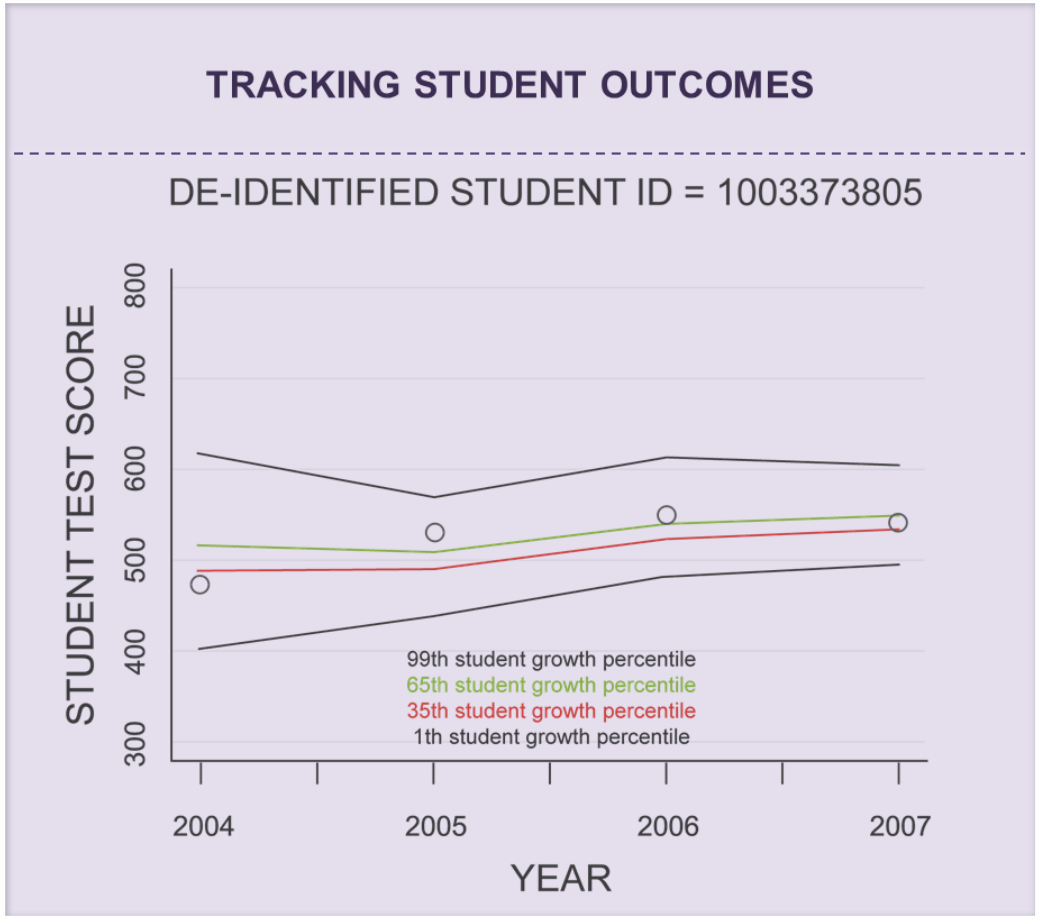

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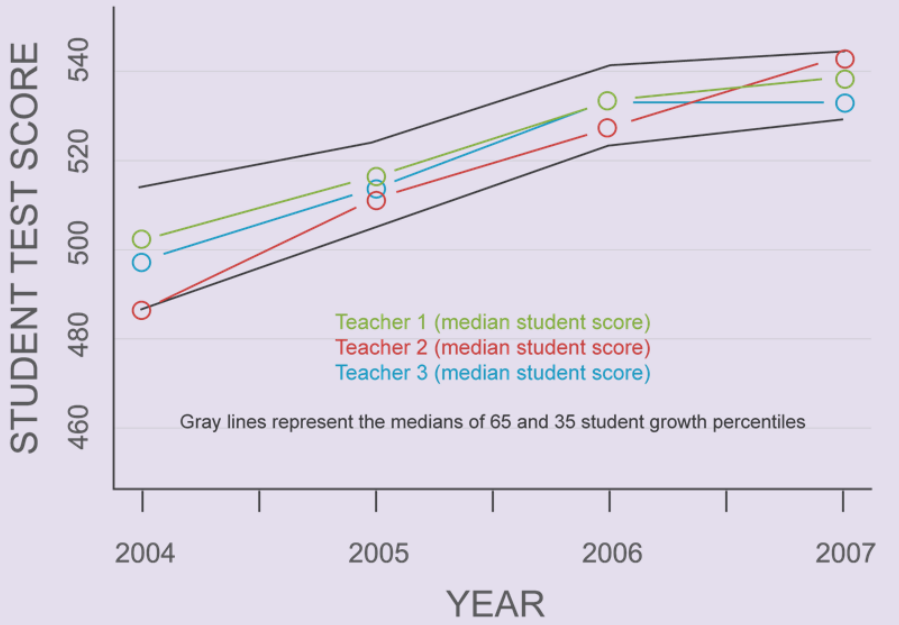
MISSISSIPPI

LINKING TEACHERS TO STUDENT OUTCOMES



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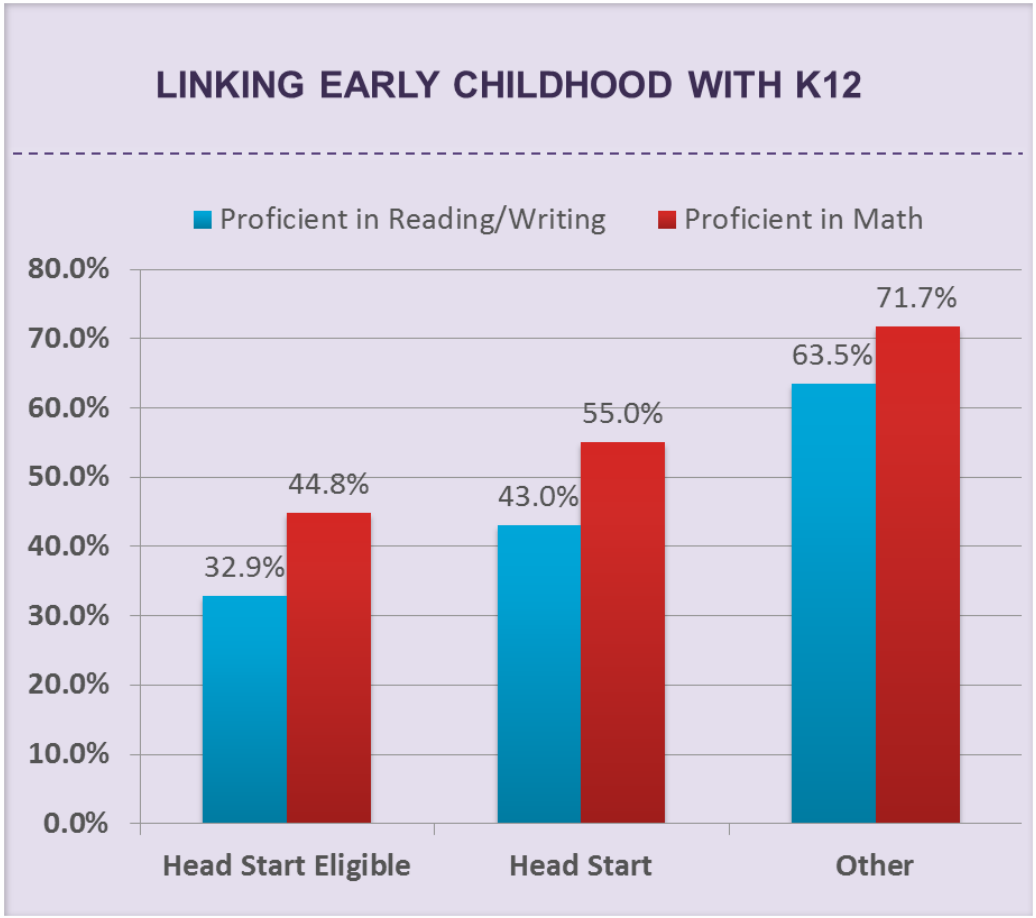

ON REQUOST

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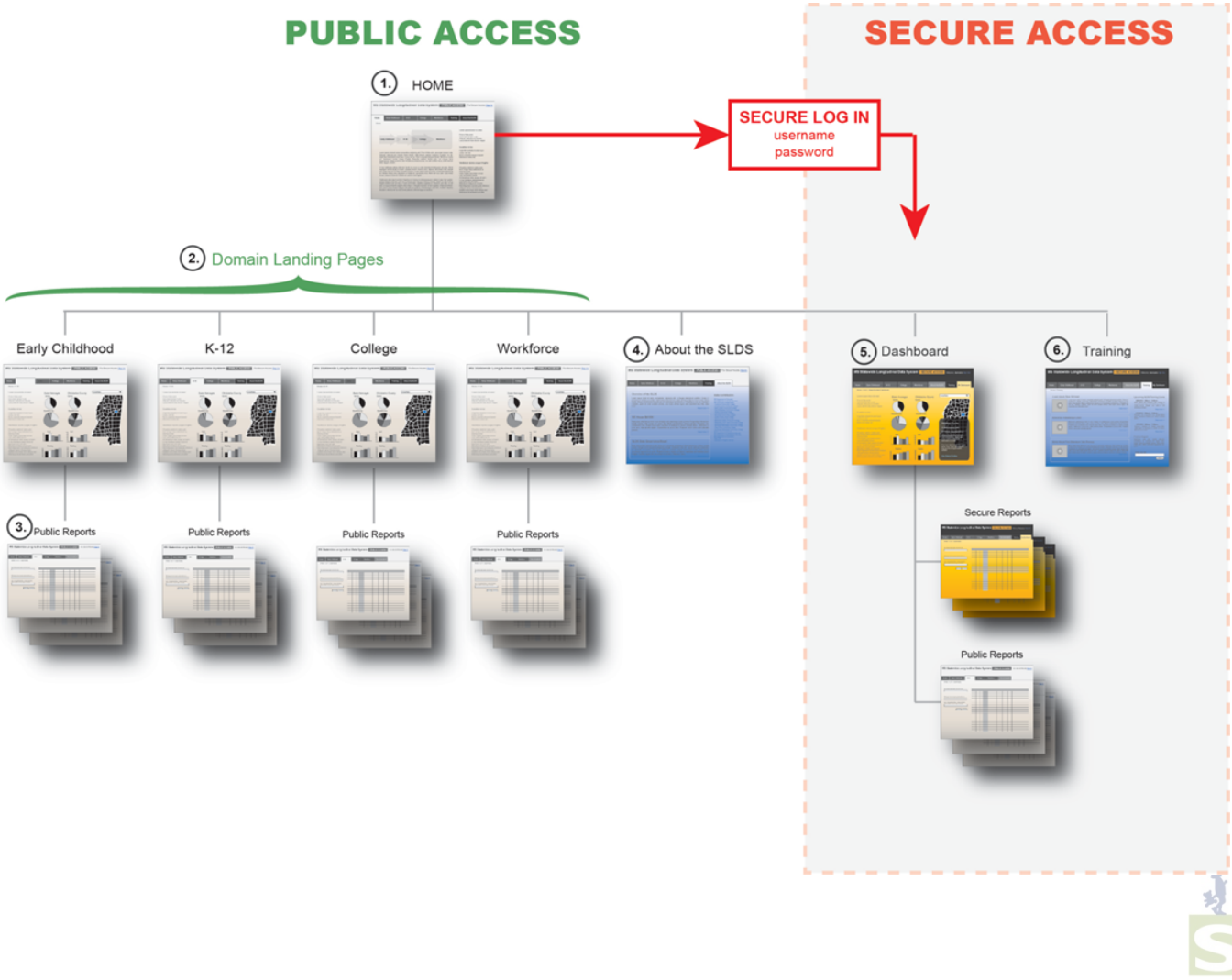

Contacts & Additional Resources

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Resources:

http://nces.ed.gov/programs/slds/pdf/federated_centralized_print.pdf