Account Matching - How to Know Who's Who
(or Will the Real John Smith Please Stand Up?)

IAM Online

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What is Identity Matching?

- Not the same as identity linking, but one can lead to the other
- Answers the question: are A and B the same person?
- Useful for on-boarding or later if identity information is changed
- Harder today than it used to be with information being more sensitive

Why Bother With Identity Matching?

- Prevent someone from having multiple identities
- For users with multiple roles, it can be important for everything to be under one identity
- Fewer passwords and MFA tokens to juggle
- Better experience than waiting for the user to contact the help desk to ask for a merge
- But be careful: a false match can create a tangled mess!

Matching Overview & History
Benn Oshrin, Spherical Cow Group

First, Some Background

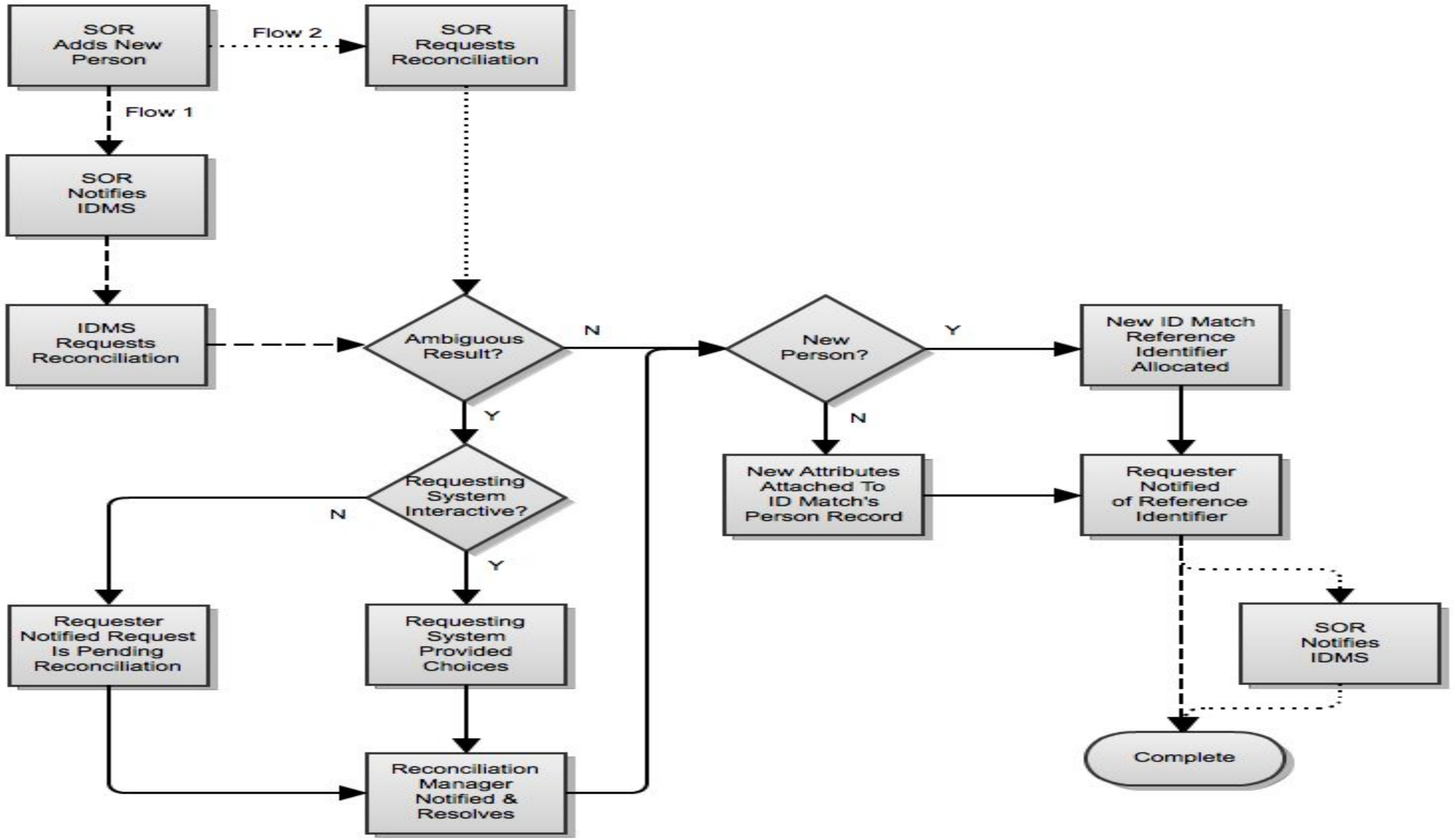
- This problem has been around for a while
  - Way, way back (in the mid-90s) campuses started to set up email for everyone
    - (Similar problem for ID badges, etc)
  - Problem: Who is everyone?
    - HR knows employees
    - Registrar knows students
  - Multiple Systems of Record (SORs) Make Higher Ed Special*
    - *For identity management purposes, anyway

Today, It's Basically The Same Problem

- Typical Higher Ed Scenarios
  - Students apply via commercial application
  - Students enroll via Registrar
  - Students become alumni and are tracked via Alumni Relations
  - Employees are hired through HR
    - But only after some early onboarding process
  - Guests and affiliates come from everywhere
  - And what about the Hospital?
- Need a single identity to properly manage access to resources

Multiple Approaches, Common Themes

- Variation 1: Match at Registry
  - Absent other considerations, probably the recommended approach
- Variation 2: Match at SOR ("Standalone")
- Variation 3: Match before SOR
  - Enrollee obtains unique ID before approaching SOR
- Regardless of variation, similar considerations
  - Quality of inbound attributes
  - Handling ambiguous ("fuzzy", "potential") matches


SOR Adds New Person
Flow 2
SOR Requests Reconciliation
Flow 1
SOR Notifies IDMS
IDMS Requests Reconciliation
Ambiguous Result?
N
Y
New Person?
Y
N
New ID Match Reference Identifier Allocated
Requesting System Interactive?
N
Y
New Attributes Attached To ID Match's Person Record
Requester Notified of Reference Identifier
SOR Notifies IDMS
Requester Notified Request Is Pending Reconciliation
Requesting System Provided Choices
Reconciliation Manager Notified & Resolves
Complete

Solutions (?)

- Lots of custom (legacy) code
- Some commercial products
  - Expensive
  - Some better than others
- Not much in the way of Open Source
  - Maybe you can hack something together from MDM solutions
  - … Until now (well, soon) …

Two Parts To A Solution

1. ID Match API
   - Defines how match requests and responses are exchanged
     1. Match Request
     2. Match Response (exact, potential)
     3. Pending Matches (for review and resolution)
     4. Update Match Attributes
   - Design preference: JSON + REST
   - Goal: Assign a "Reference Identifier"
     1. Unique identifier for a person, as defined by the Match Engine
   - (More later…)

Two Parts To A Solution

2. Match Engine
   - Implements rules for performing searches
     1. Define attribute characteristics
     2. "Canonical" vs "Potential" rules
        1. Canonical: Can uniquely identify a person, processing stops if exact match found
        2. Potential: Can suggest ambiguous or fuzzy matches, processing does not stop even if a single match is found
   - Maintains match state
     1. Implies a need for attribute updates (such as name changes) to be reported to the Match Engine

Matching: A Community Timeline

- 2011: Initial ID Match Strawman drafted
- 2012: "CIFER" Strawman API drafted
- 2013: UCB develops Java-based in memory solution
- 2014: UCB develops Postgres-based solution (PoC)
- 2015: UCB internal implementation
- Nov 2017: TIER project funding allocated
- Summer 2018: Initial TIER component releases
    - Code being developed under the COmanage Project
    - API being formalized by TIER API/Reg Working Group

Matching @ UC Berkeley

Summer Scanlan, University of California, Berkeley

Identity Matching at UC Berkeley

System Elements

- Berkeley Person Registry (BPR)
- Systems of Record (SOR)
- Primary Key
- UID
- Raw data (sorObject)
- Match Engine
- Canonical Match Rules
- Potential Match Rules
- Partial Match Table

Record Provisioning and Auto Matching in BPR

- Data arrives from SORs each morning or via message queue
- Incoming new and update records are checked for an existing primary key
  - If the primary key matches an existing record, the existing record is updated
  - If the primary key does not already exist, a new sorObject is created, which is then sent through the match engine

Example of Auto Match

Incoming record:
Robert Jones
SSN: 12345
DOB: 01/01/2000
EID: 011223345
Role: Employee

Existing record:
Robert Jones
SSN: 12345
DOB: 01/01/2000
SID: 3031231231
Role: Student

Matched Record:
Robert Jones
SSN: 12345
DOB: 01/01/2000
EID: 011223345
SID: 3031231231
Roles: Employee, Student

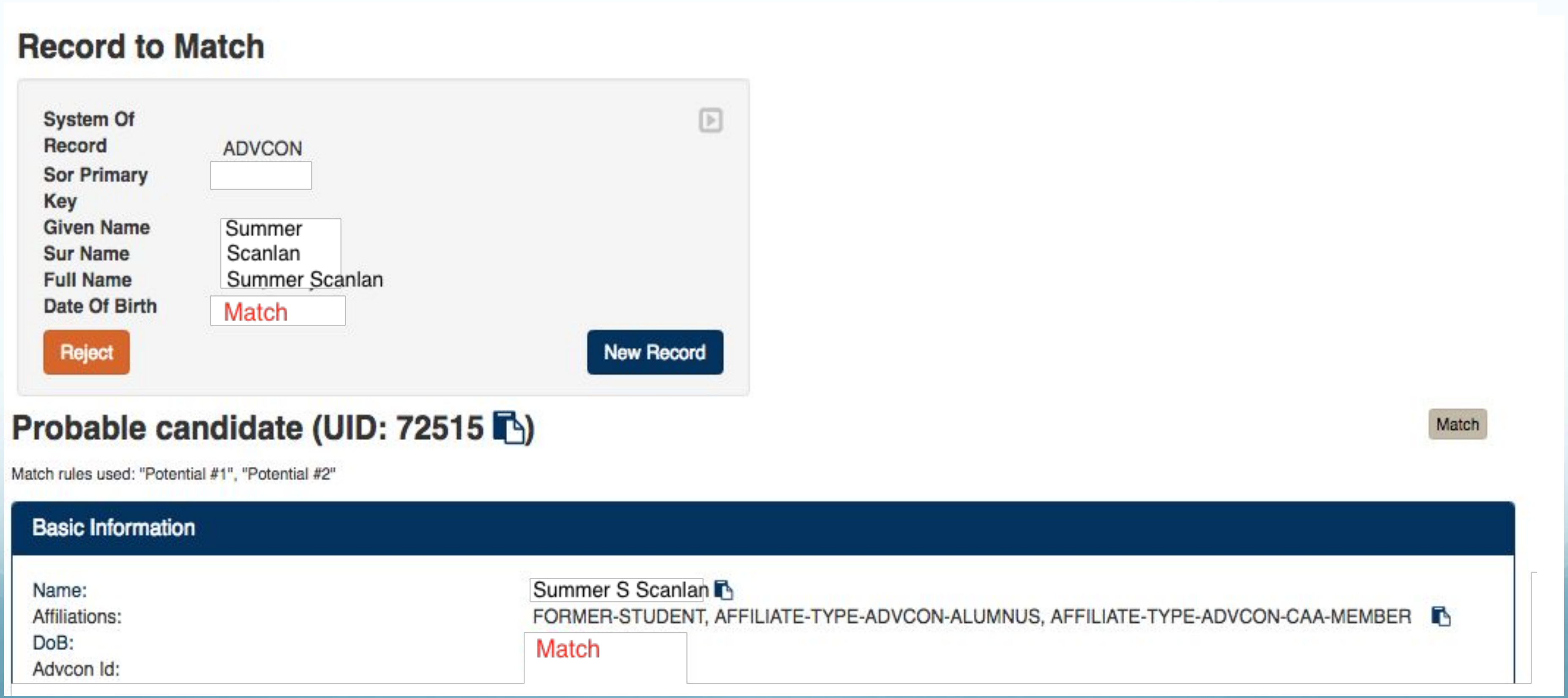
Match Engine

- Matchable elements are extracted from the sorObject
- Rest call is made to the match service
- Match engine goes through matching rules, starting with canonical rules
- Records that meet canonical criteria are matched, and UID is reprovisioned with updated identity data

Partial Match Table

- Records go through the potential match rules after canonical rules
- Records that are a potential match are sent to the partial match table for human review
- CalNet staff reviews raw data for additional matching data elements
  - Although the match engine is really quite helpful, human review is sometimes still required -- matching is hard!
- If no canonical or potential match is made, a new UID is provisioned

Example of Partial Match Table



Record to Match

System Of Record	ADVCON
Sor Primary Key	
Given Name	Summer
Sur Name	Scanlan
Full Name	Summer Scanlan
Date Of Birth	Match

Probable candidate (UID: 72515)

Match rules used: "Potential #1", "Potential #2"

Basic Information

Name:	Summer S Scanlan
Affiliations:	FORMER-STUDENT, AFFILIATE-TYPE-ADVCON-ALUMNUS, AFFILIATE-TYPE-ADVCON-CAA-MEMBER
DoB:	Match
Advcon Id:	

Match Rules Improvement

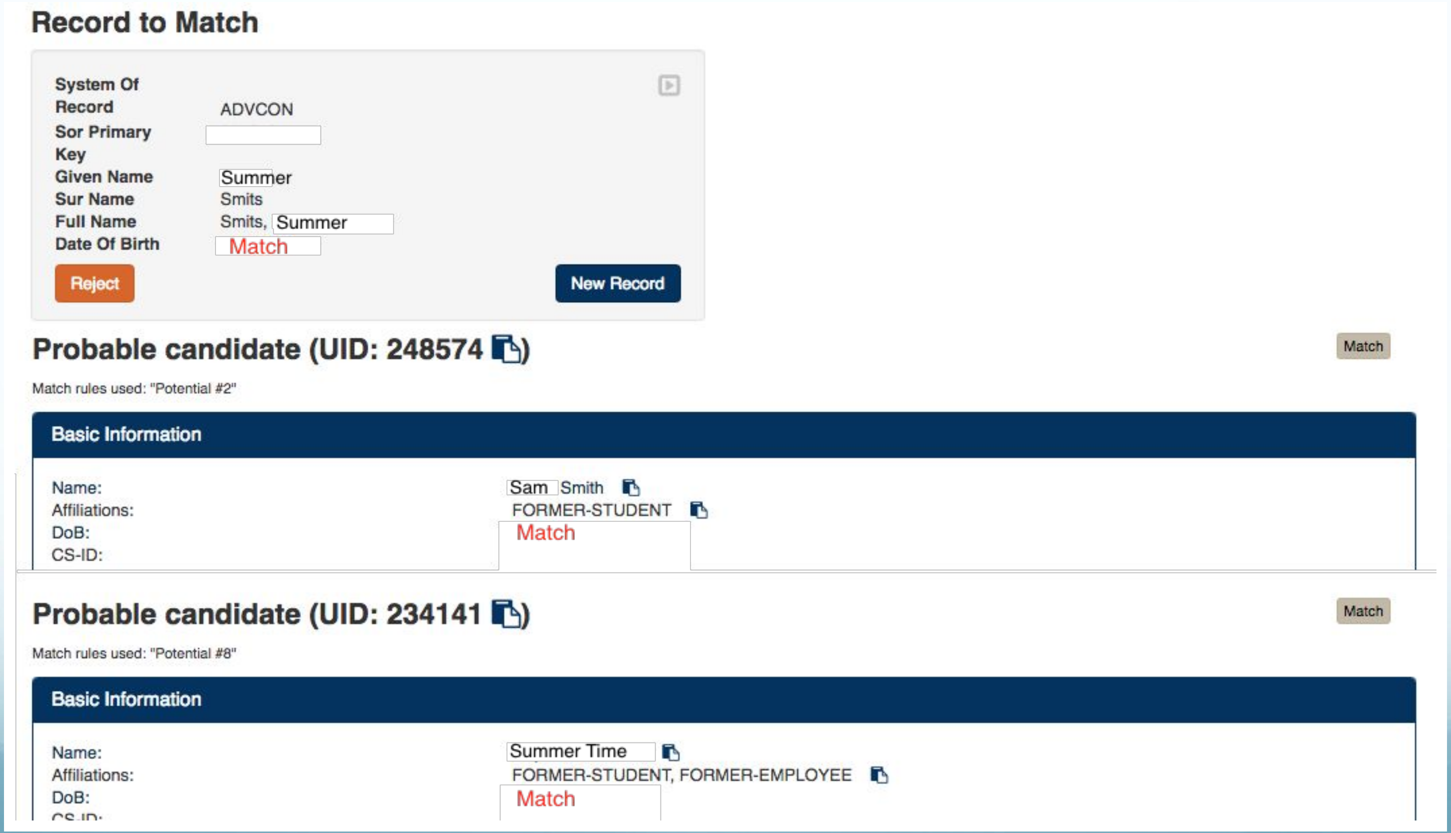
- After implementation, we analyzed the partial match table and duplicate records to find additional possible match rules
- Updating rules requires a developer to update the configuration inside the match engine
- We regularly review our systems in the hopes of continuously improving them

Gotchas!

Examples:

- Potential Match Rule - arguably a “bad” rule
- Canonical Match Rule - a “good” rule that occasionally results in identity collision

Example of Potential Match Rule



Record to Match

System Of Record	ADVCON
Sor Primary Key	
Given Name	Summer
Sur Name	Smits
Full Name	Smits, Summer
Date Of Birth	Match

Reject   New Record

Probable candidate (UID: 248574)   Match

Match rules used: "Potential #2"

Basic Information

Name:	Sam Smith
Affiliations:	FORMER-STUDENT
DoB:	Match
CS-ID:	

Probable candidate (UID: 234141)   Match

Match rules used: "Potential #8"

Basic Information

Name:	Summer Time
Affiliations:	FORMER-STUDENT, FORMER-EMPLOYEE
DoB:	Match
CS-ID:	

Example - Potential Match Rule

potential givenName: SUBSTRING, surName: DISTANCE, dateOfBirth: EXACT

- Matches are difficult for records that have multiple first or last names
- This rule was meant to capture such cases
- The actual result of implementation is hundreds of non matching records hitting the partial match table each month, and having to be manually reviewed and provisioned
- It often feels like a bad rule, but it also finds matches that would otherwise be provisioned as duplicates!

Gotcha #2: Canonical Rule

canonical givenName: SUBSTRING, surName: EXACT, socialSecurityNumber: EXACT, socialSecurityNumberType: FIXED_VALUE

- Records matching on first, last, and last five of SSN are considered a canonical match
- This rule resulted in 3 identity collisions last year (out of 50,000 records provisioned)
- Luckily, these are found right easily repaired

Summary

- Matching is not easy
- Having a match engine is definitely helpful
- Analyzing your potential matches and cases of identity collision makes for a better match engine

TIER Match API & Component
Benn Oshrin, Spherical Cow Group

The ID Match API

- RESTful design
- Goal: Obtain a *Reference Identifier*
- Can operate synchronously or asynchronously
  - ie: interactive fuzzy resolution, or queue for an admin
- Can be placed behind a Registry or as a standalone service
- Can be used to transition legacy systems

ID Match API Status

- Strawman stable for quite some time
- Effort starting to "formalize" specification
    - eduPerson style, not as an RFC/etc
        - Goal: Ready for TechEx
    - Long term home TBD
    - Attribute names may change slightly from the examples

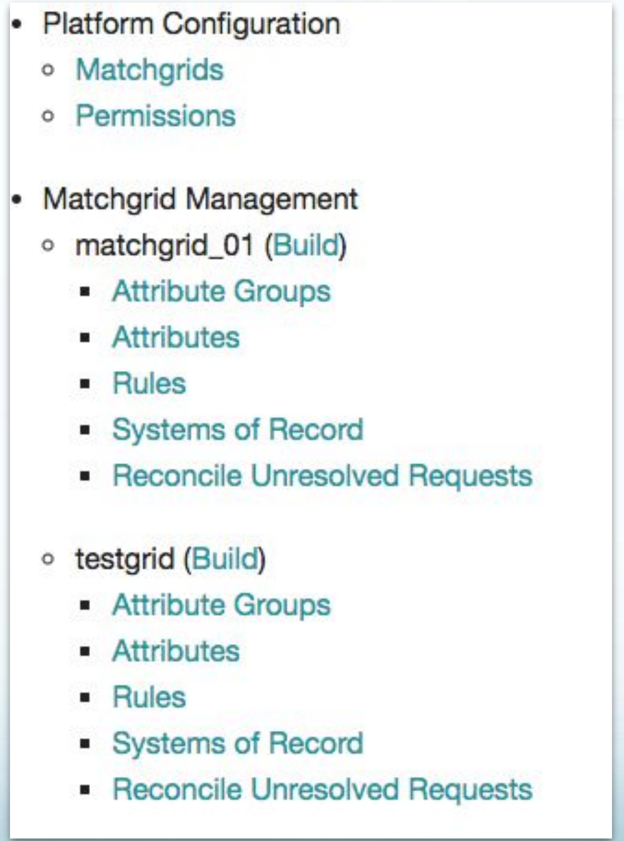
ID Match Component Initial Scoping

- UI Driven Configuration
  - Includes ambiguous match resolution
- ID Match API Support
- Postgres Only
  - Possible MySQL/MariaDB support later
- Multi-tenant
- Distance and Substring Matching
  - Dictionary and others later

TIER ID Match Component Status

- Being developed as part of COmanage Project
  - Does not require COmanage Registry
- Initial coding complete
  - Early access releases RSN
  - v1.0.0 by TechEx
- Documentation underway
- Up next:
  - UI
  - Packaging

Match Engine Configuration



- Platform Configuration
  - Matchgrids
  - Permissions

- Matchgrid Management
  - matchgrid_01 (Build)
    - Attribute Groups
    - Attributes
    - Rules
    - Systems of Record
    - Reconcile Unresolved Requests

  - testgrid (Build)
    - Attribute Groups
    - Attributes
    - Rules
    - Systems of Record
    - Reconcile Unresolved Requests

Matchgrid Configuration

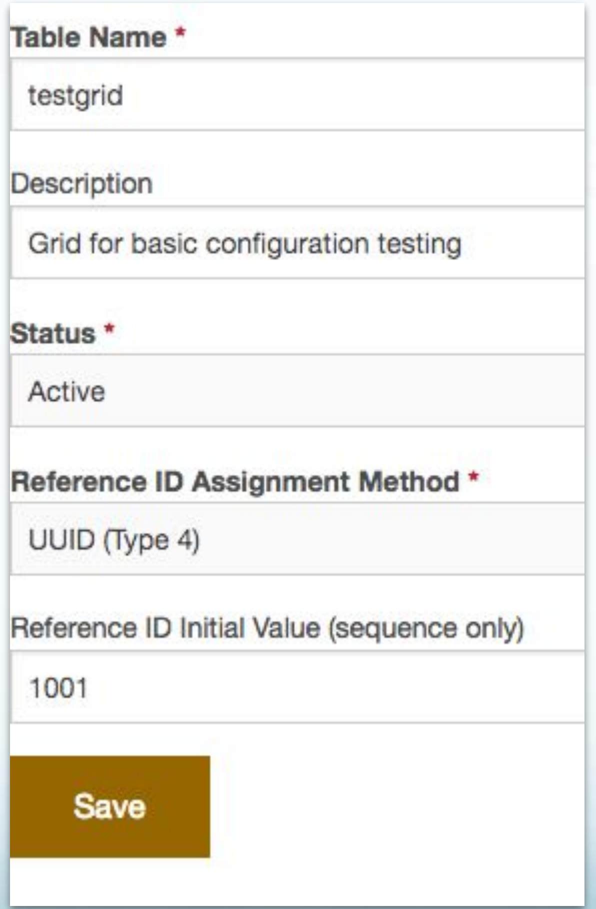


Table Name *

testgrid

Description

Grid for basic configuration testing

Status *

Active

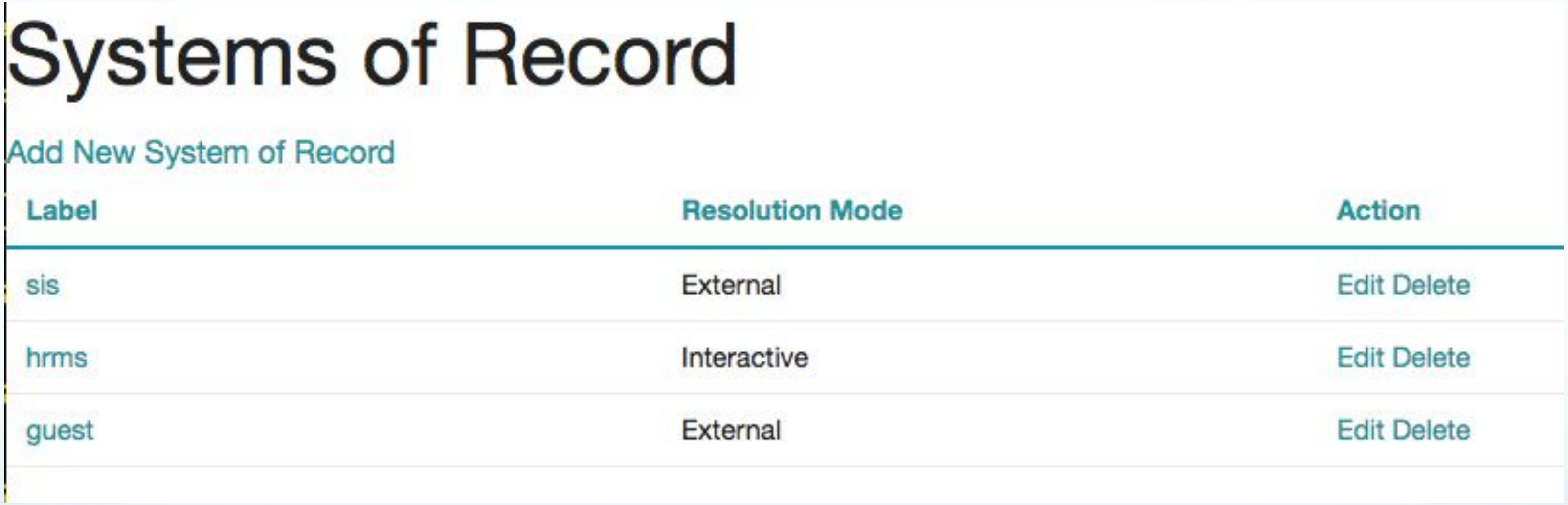
Reference ID Assignment Method *

UUID (Type 4)

Reference ID Initial Value (sequence only)

1001

SoR Configuration

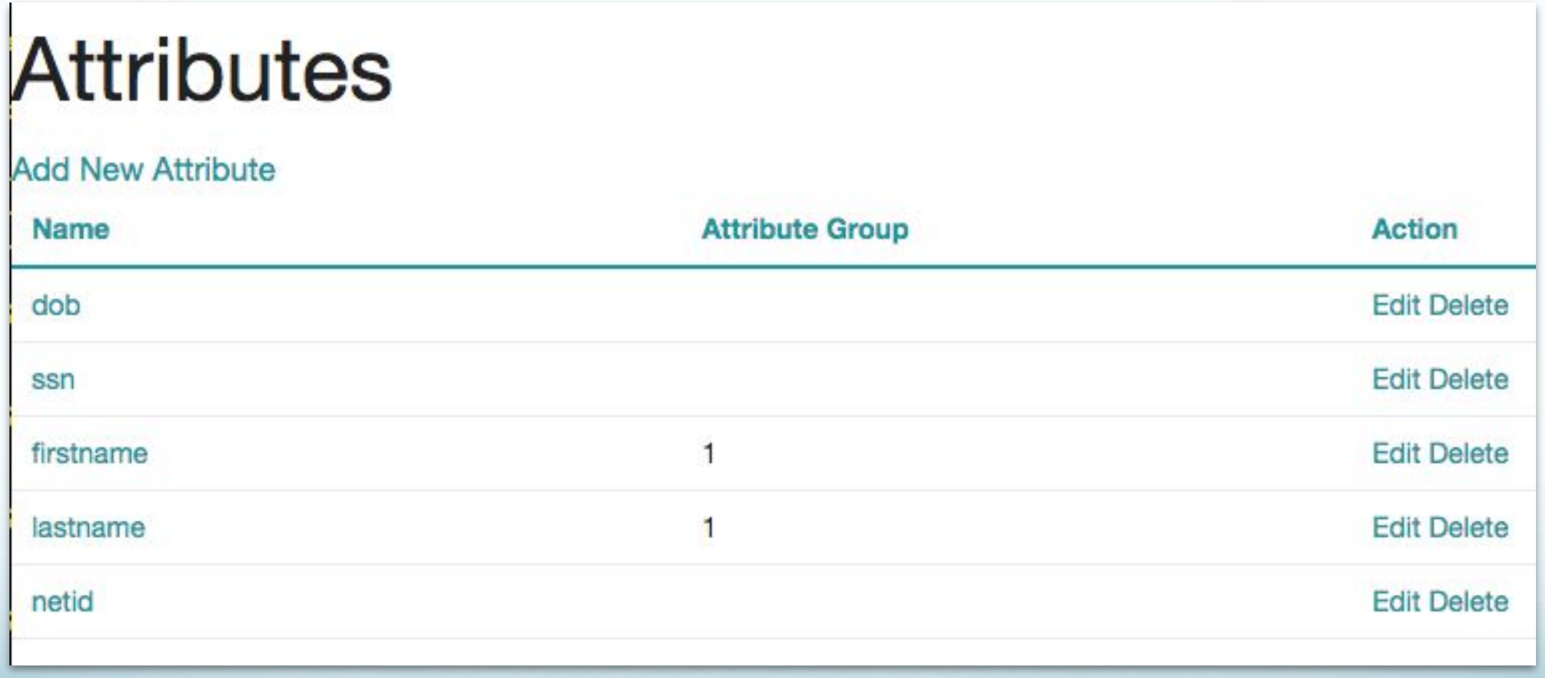


Systems of Record

Add New System of Record

Label	Resolution Mode	Action
sis	External	Edit Delete
hrms	Interactive	Edit Delete
guest	External	Edit Delete

Match Attributes

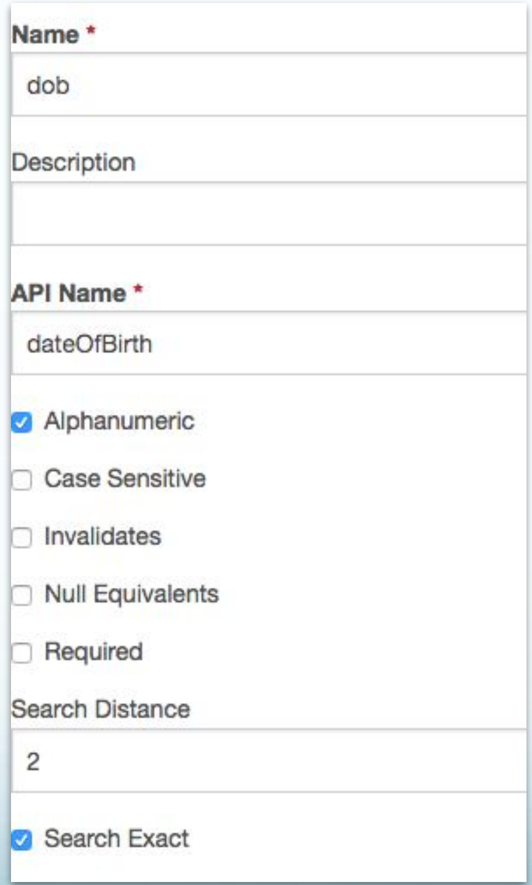


Attributes

Add New Attribute

Name	Attribute Group	Action
dob		Edit Delete
ssn		Edit Delete
firstname	1	Edit Delete
lastname	1	Edit Delete
netid		Edit Delete

Date of Birth Configuration



Name *

dob

Description

API Name *

dateOfBirth

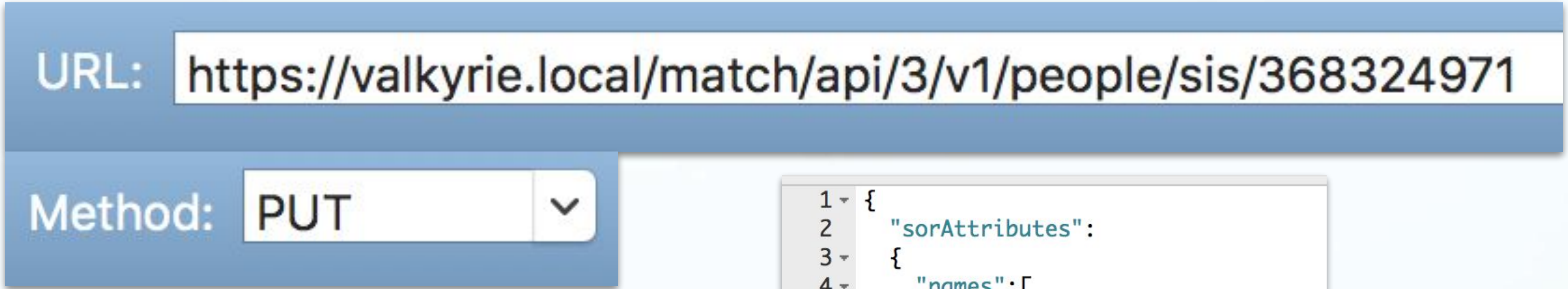
- [✓] Alphanumeric
- [ ] Case Sensitive
- [ ] Invalidates
- [ ] Null Equivalents
- [ ] Required

Search Distance

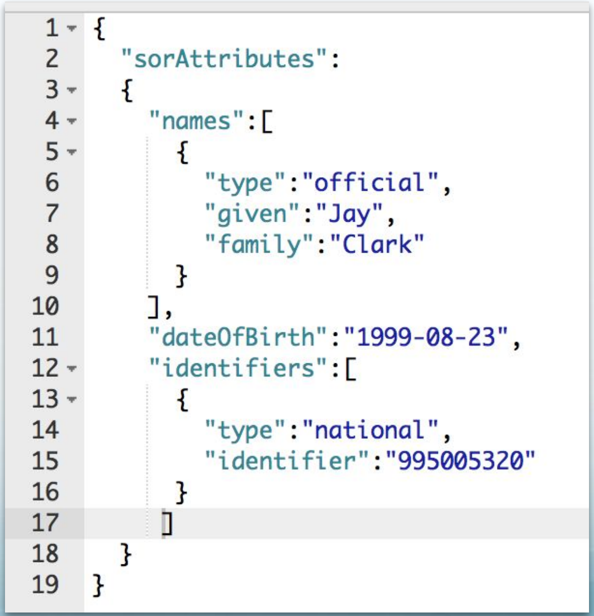
2

- [✓] Search Exact

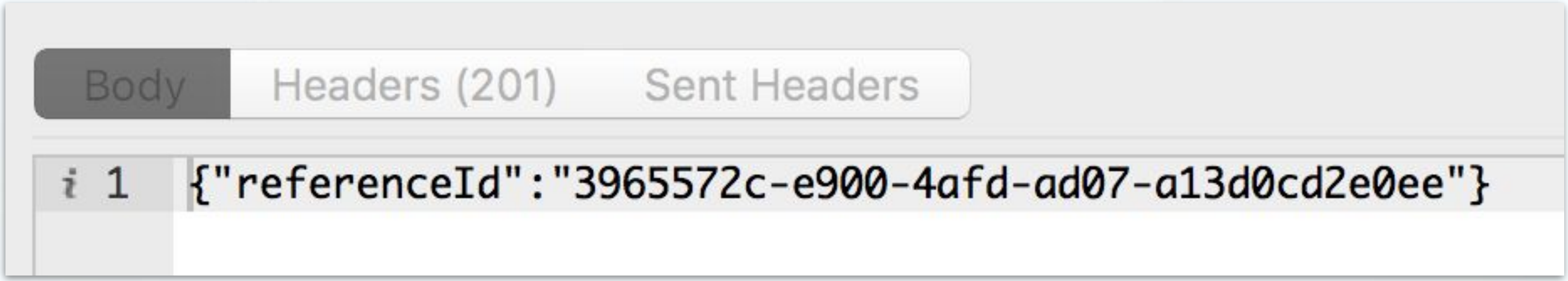
New Match Request (SIS)


URL: https://valkyrie.local/match/api/3/v1/people/sis/368324971

Method: PUT


```
{
  "sorAttributes":
  {
    "names":[
      {
        "type":"official",
        "given":"Jay",
        "family":"Clark"
      }
    ],
    "dateOfBirth":"1999-08-23",
    "identifiers":[
      {
        "type":"national",
        "identifier":"995005320"
      }
    ]
  }
}
```

Match Result (SIS)

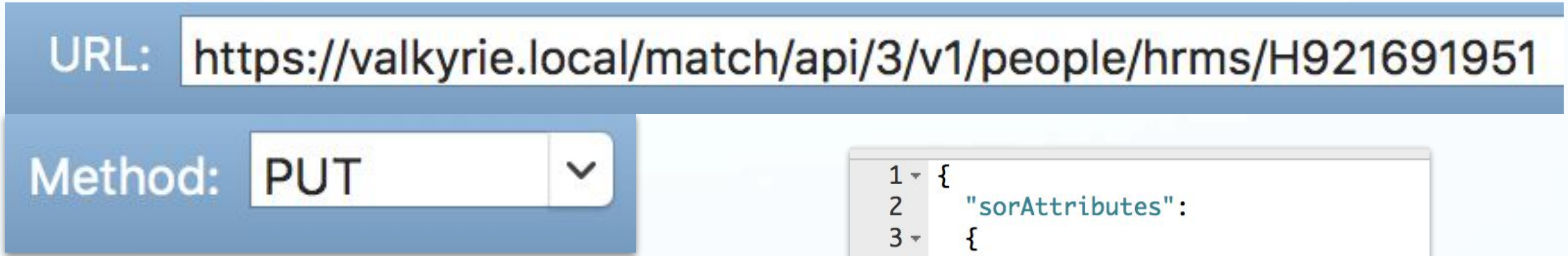


```
{"referenceId":"3965572c-e900-4afd-ad07-a13d0cd2e0ee"}
```

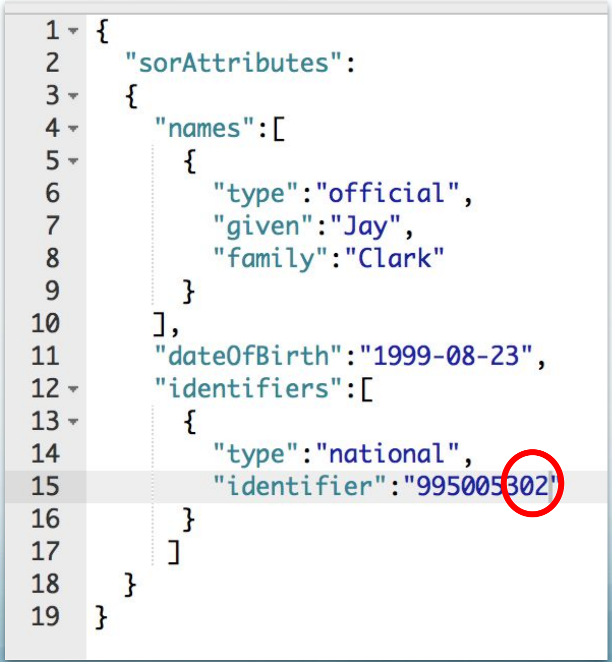
Demo Match Rules

	Rule C1	Rule C2	Rule P1	Rule P2
DoB	Exact	Exact	Distance (2)	Exact
SSN	Exact	Skip	Distance (2)	Skip
First	Substring (1,3)	Skip	Substring (1,3)	Substring (1,3)
Last	Exact	Exact	Distance (2)	Distance (2)
NetID	Skip	Exact	Skip	Exact

New Match Request (HRMS)


URL: https://valkyrie.local/match/api/3/v1/people/hrms/H921691951

Method: PUT


```
{
  "sorAttributes":
  {
    "names":[
      {
        "type":"official",
        "given":"Jay",
        "family":"Clark"
      }
    ],
    "dateOfBirth":"1999-08-23",
    "identifiers":[
      {
        "type":"national",
        "identifier":"995005302"
      }
    ]
  }
}
```

Fuzzy Match (300) Result (HRMS)

```
{ "candidates": [ {
  "referenceId": "3965572c-e900-4afd-ad07-a13d0cd2e0ee",
    "attributes": [ {
      "matchRequest": 21,
      "sor": "sis",
      "identifiers": [ {
        "type": "sor", "identifier": "368324971" }, {
        "type": "national", "identifier": "995005320", } ],
      "dateOfBirth": "1999-08-23",
      "names": [ {
        "family": "Clark",
        "given": "Jay",
        "type": "official"
} ] } ] } ] }
```

Fuzzy Match Result

- Because the SoR is "interactive", there is no pending request for the Match Administrator to review
    - Option 1: Notice correct identifier and resubmit
    - Option 2: Submit "Forced Reconciliation Request" with appropriate Reference Identifier

Performance Considerations

- Search times vary according to
  - Configured attributes
  - Quantity and complexity of confidence rules
  - Number of records in the database
- Exact ~= (Exact + Fuzzy) < Fuzzy
  - Exact matches can partition the search space for fuzzy matches
- Need to optimize for initial load of already-matched data

More Info

- ID Match Strawman API: https://spaces.at.internet2.edu/x/2QL5AQ
    - Will move to https://github.internet2.edu soon
- ID Match Component: https://spaces.at.internet2.edu/x/qwW6Bw
    - (In progress, content coming soon)

Please evaluate today’s session

https://www.surveymonkey.com/r/IAMOnline-Aug2018

2018 Internet2 Technology Exchange (TechEx)
October 15-19, 2018 - Orlando, Florida

https://meetings.internet2.edu/2018-technology-exchange/

- Two full tracks for Trust and Identity topics
- Advance CAMP (ACAMP)
- Pre-meeting tutorials

Next IAM Online

Wednesday, September 12, 2018

2 pm ET | 1 pm CT | Noon MT | 11 am PT

Grouper 2.4 and the Grouper Deployment Guide

- Features of the latest Grouper release (2.4)
- The Grouper Deployment Guide, NIST 800-162, access models, and how that comes together in a TIER based architecture.