Building a new model for Account Management

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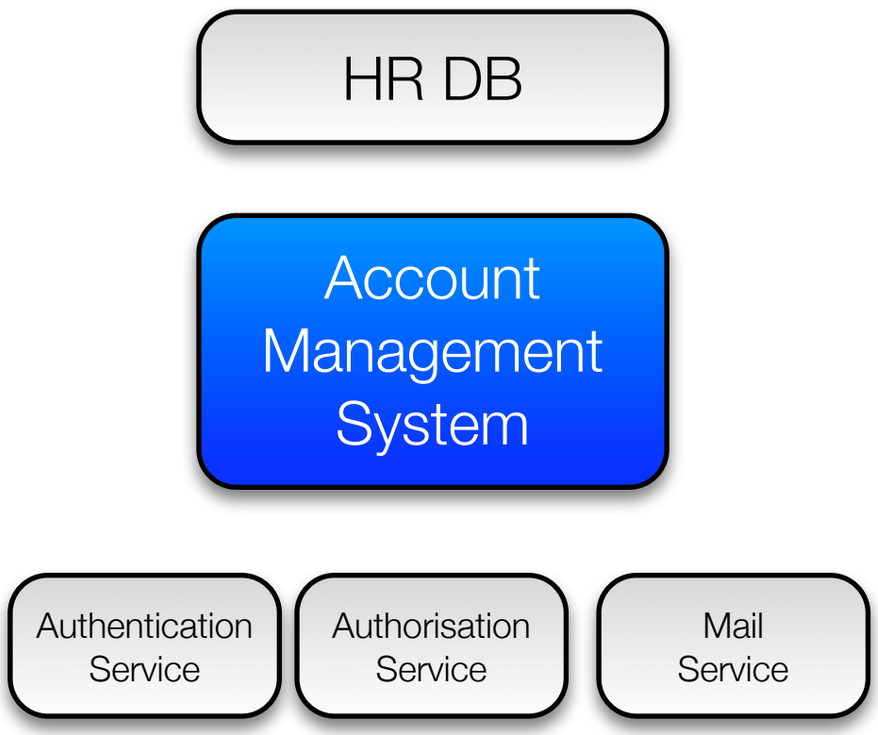
Introduction

- Background & Requirements
  - Decentralisation
  - Account types
  - Access and Identity Models
  - Auditing
- Our Implementation
  - Data Model
  - Architecture
  - Techonologies
- Conclusions

Watchu talkin' 'bout, Willis?

- What do we mean by Account/Identity* Management?



- Layer between corporate database, and your services
- Ensures that changes propogate down (*Identity Lifecycle*)
- Ensures that data in all locations matches the corporate copy

*Insert buzzword of choice

Distribution and decentralisation

- Historically, an organisation would have either
  - A central account database used by every service
  - Every service using its own database
  - (or, a mixture of the above)
- Both are untenable in a distributed, decentralised world

Account Database per Service

- No idea who your ‘users’ are
- Deletion/disabling is impossible
- Management is fragmented
- Delegated services are difficult

Centralised database for all services

- Delegated services are impossible
- Every service must interoperate with the central database
- Central database must know about every service.
- Scalability is poor, especially for systems without a strong centre

Decentralisation

- Imagine a site with hundreds of services

- Bringing up a service at the periphery shouldn’t require action at the centre

- Users have to be able to deploy their own services, which use the central account management system

- Users must be able to manage their own access control, both for these and for centrally managed services

Account spectra

- Traditionally have ‘accounts’ for institutional users

- Gulf separates those from ‘visitors’, and again from web application accounts.

- These boundaries are increasing archaic

- Accounts must be able to slide in position on the spectrum

Role Based Access Control

- Traditionally user access has been controlled via user lists or groups.

- Role based access control adds additional flexibility

- A user has one or more roles, which describes functions they perform
  - Staff
  - Student
  - Head of Department
  - System administrator

Entitlements

- Each role confers upon the user a set of *entitlements*

- Entitlements determine what they can do on the system
  - Log in to webmail
  - Log in to the compute cluster
  - Access the finance system
  - Edit the DNS

- For flexibility, we also allow roles to include other roles
  - For example, every `student` is a `person`

Identity Modelling

- Traditionally, all of a users entitlements are associated with a single identity

- The user authenticates to that identity, and then gets all of the access granted to that identity

- Doesn’t solve
  - “I want a password that can just access my webmail”
  - “I want a key that will let a process just write to this directory”
  - “I shouldn’t have admin permissions unless necessary”
  - “I should need a smartcard to login as an administrator”

Facets of Identity

- Split identity into multiple facets (or instances)
- Each instance has a subset of the base identity's entitlements
- Some instances may have additional entitlements
- Let users create instances as required, and distribute entitlements between them

Assurance

- Different levels of access require different levels of identity verification
  - Passwords
  - One-time passwords
  - Hardware tokens
- Important to be able to keep this different levels separate on the system (*can't all share a Unix UID, if they're shell sessions*)

Accounts

- Ultimately, an account is a property of a particular system
- Different systems may have different account attributes (uids, gids, shells, etc)
- Not all identities will have accounts, but some will have multiple accounts

Entities

- Machines access services too, and their accounts must be managed.
  - Not an Account Management System
  - Not an Identity Management System
  - An Entity Management System?

Distribution

- A central system doesn’t scale, either physically, or in terms of administrator effort

- Each service must be responsible for managing its local database based on the contents of the central system

- Active, regular syncronisation is vital

- Must be local to the service, rather than pushed from the centre

Auditing

- Important to regularly report on the integrity of the system
- Audit runs identify anomalies and inconsistencies between databases
- Audit reports can highlight software bugs, and operator errors
- Provided as a tool for service administrators

Delegation

- Users should be able to manage their own identity
- Users should be able to own groups and entitlements
- Users should be able to bring up services which use the central system
- A service administrator is just another user

Introducing Prometheus

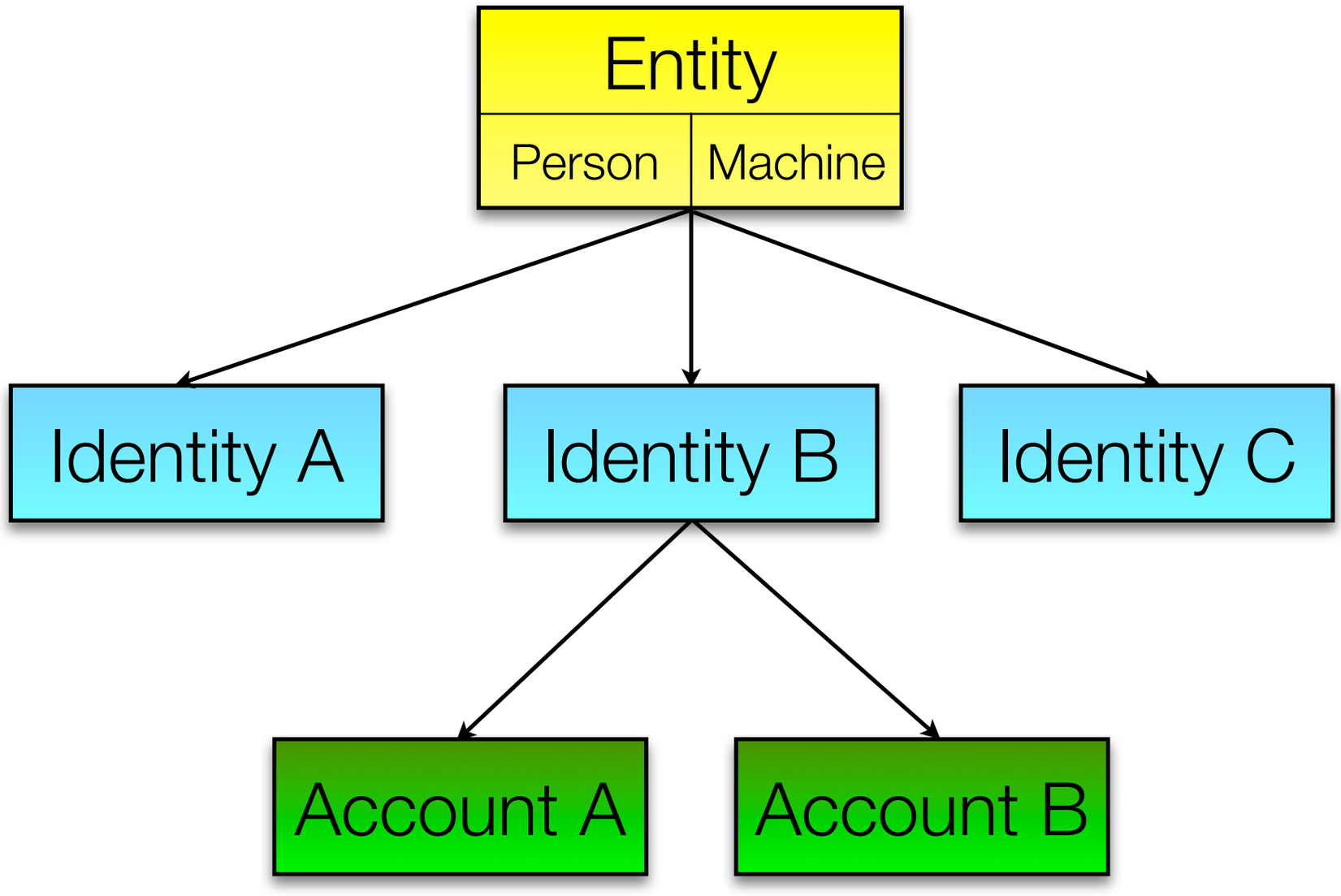
- The School of Informatics's new account management system

- Currently named *Prometheus*

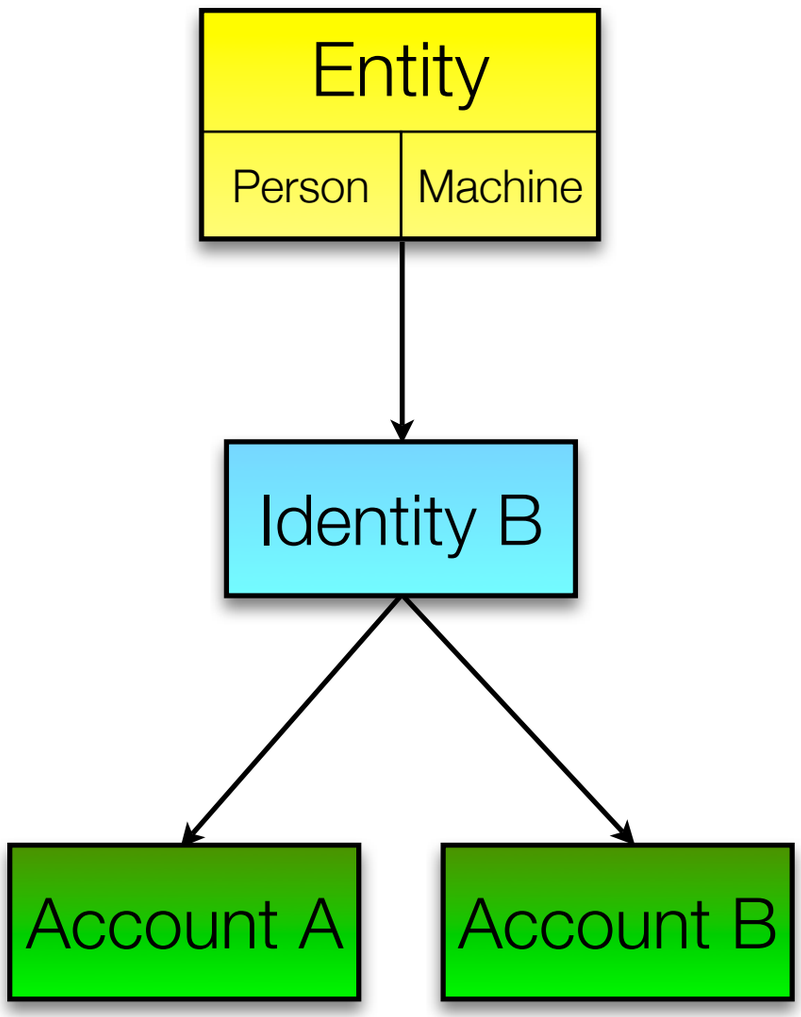
- Designed to address all of the previously discussed issues

- Very much a work in progress!

The Entity Data Model



What goes where ...



- Entities contain real-world information, plus overall role data
- Identities contain instance specific data, and authentication details
- Accounts contain OS specific data (uid, gid and the like)

Role and Entitlement data model

- A role contains
  - other roles
  - entitlements
  - negated entitlements

- An entity has both roles and explicit entitlements

- An identity may have any roles and entitlements owned by its parent entity (and must have any negated entries)

- An identity may have additional roles and entitlements

Role and Entitlement Ownership

- In order to achieve *delegation* we have to have an ownership model for roles and entitlements

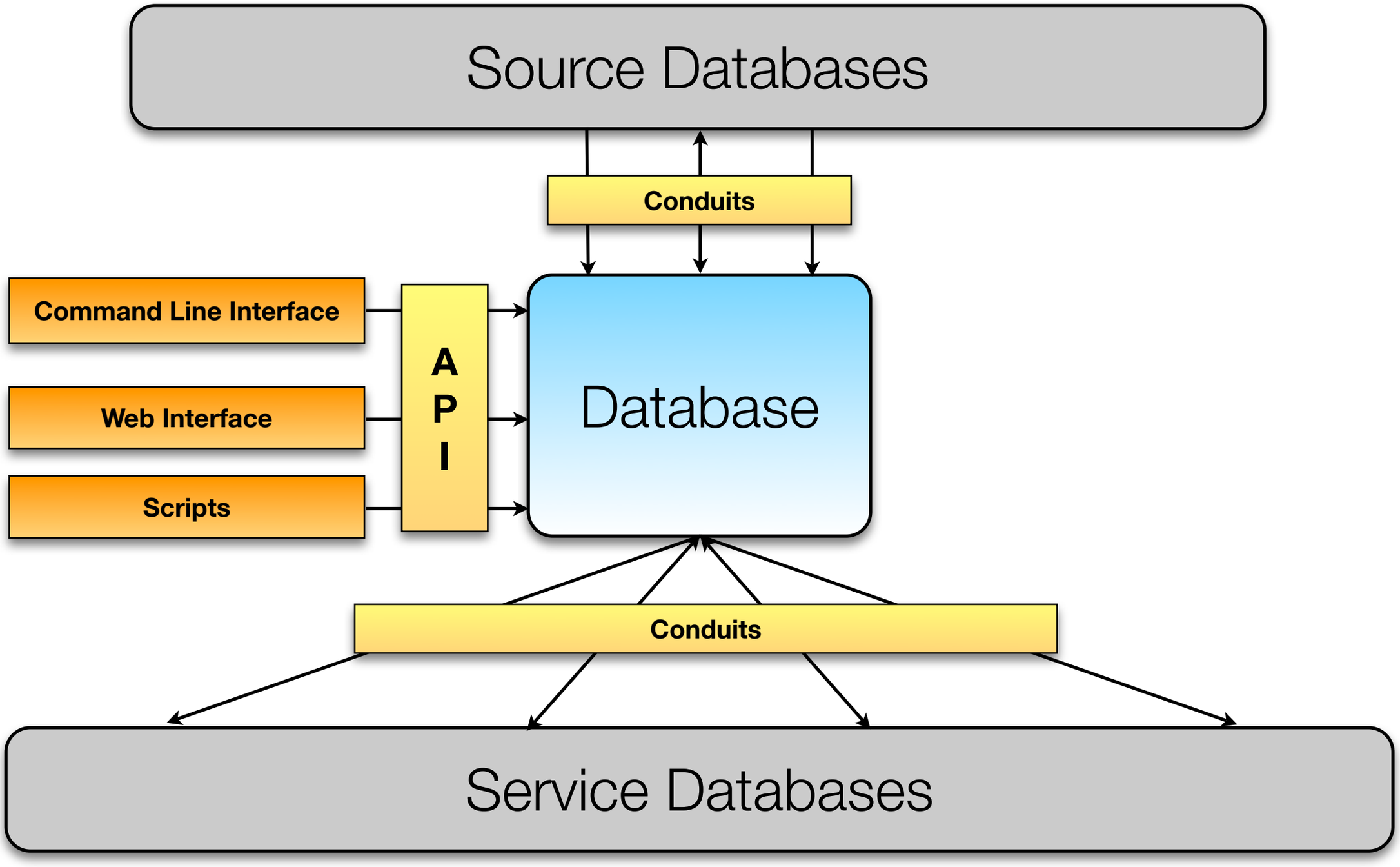
- An owner may grant that object to another role or user

- An owner may *resign (*remove) any object that they've been granted, but cannot then restore it.

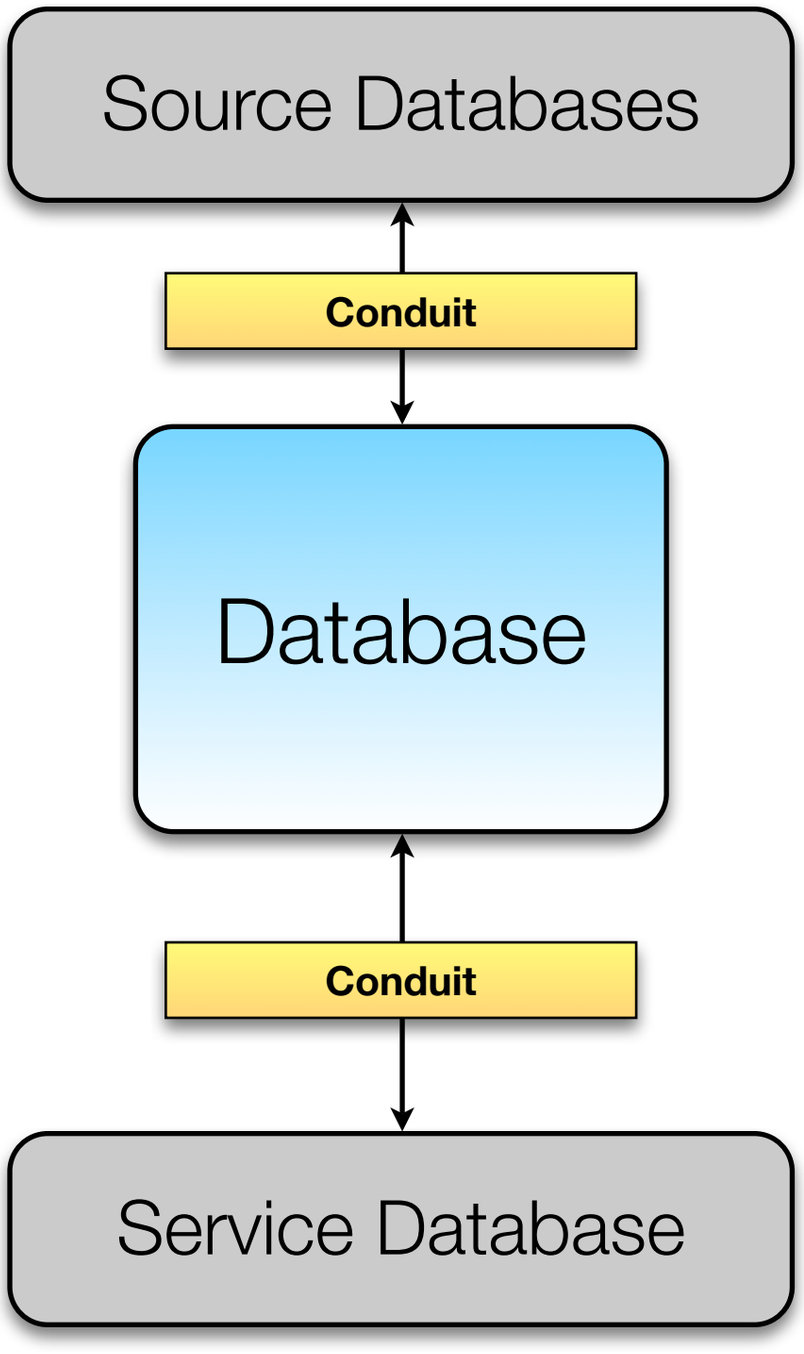
- Owners may restrict who can use an entitlement

- Owners may delegate these powers to other users

Architecture - abstract



Data flow



- Source database may be flat file, RDBMs, LDAP, whatever you like
- Import *conduit* translates from source database to abstract attribute store
- Output *conduit* translates from attribute store to service-specific database
- This can be circular!

Conduit operation

- Conduits can operate over entire data set, or be triggered by entitlements (ie `kdcentry` gives an instance a principal)

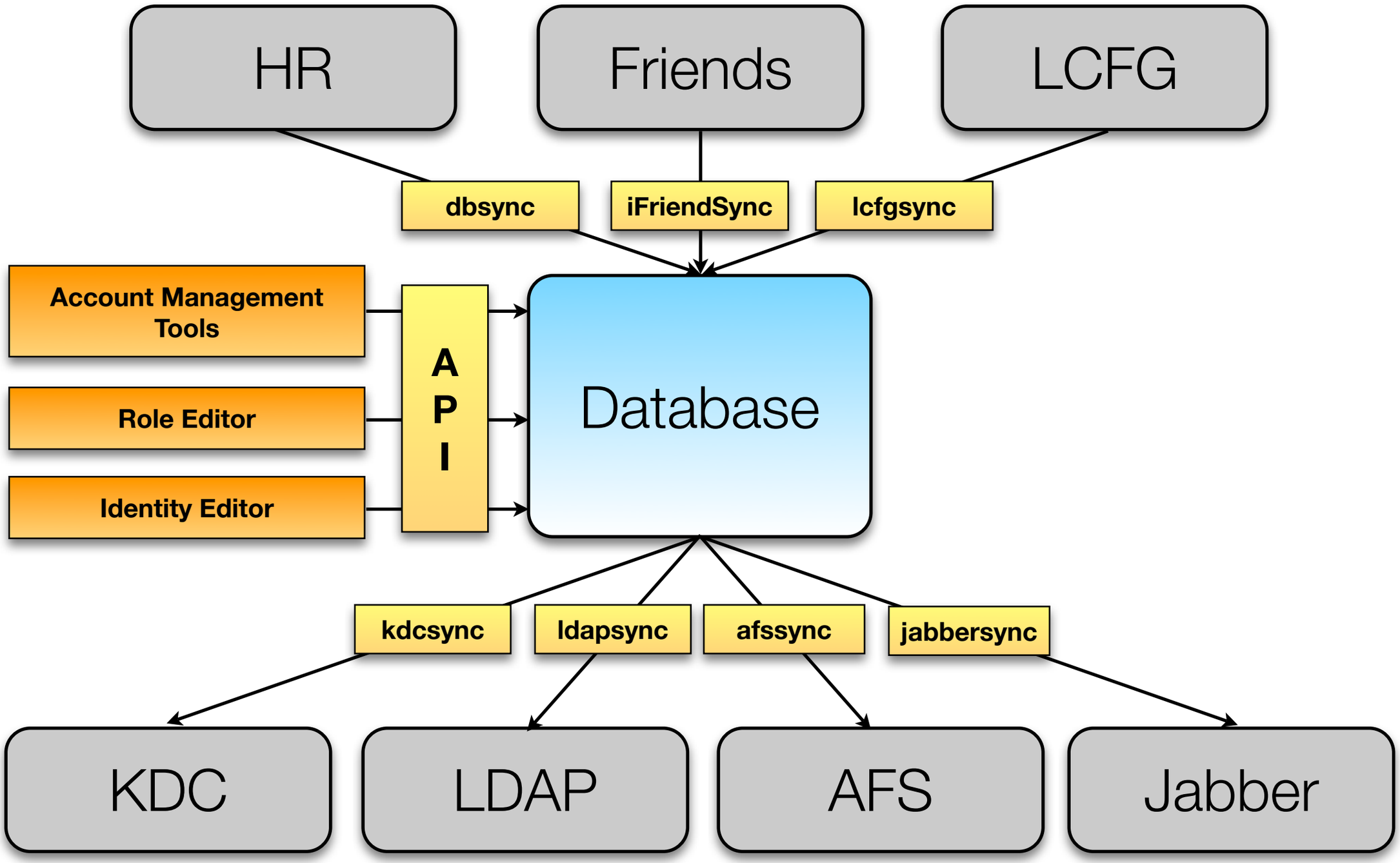
- Conduits can be pushed data or they may pull it. (support for notified pulls is planned)

- Conduits can work with deltas, or the whole database

- Audit runs are supported, and a reporting interface is provided

- Conduits may add arbitrary schema to the attribute store

Architecture - detail



Implementation

- Central database, and communication protocol LDAP based. Server implemented on top of OpenLDAP

- Advantages
  - Common, secure, well specified protocol
  - Hierarchical directory layout suits our data model
  - Straightforward, well documented, common place client API

- Disadvantages
  - Hard to express role and entitlement ownership model
  - Server data model requires external scripts, or plugins

Implementation

- Plan to provide an OpenMetaDir message bus interface to our LDAP repository

- OpenMetaDir is a framework designed for producing account management systems

- Powerful message passing, routing, and schema/*ontology* definitions

- Likely to be significantly faster than the LDAP system, but require more coding effort in the conduit

Implementation - Conduits

- Conduit simplicity is the primary goal

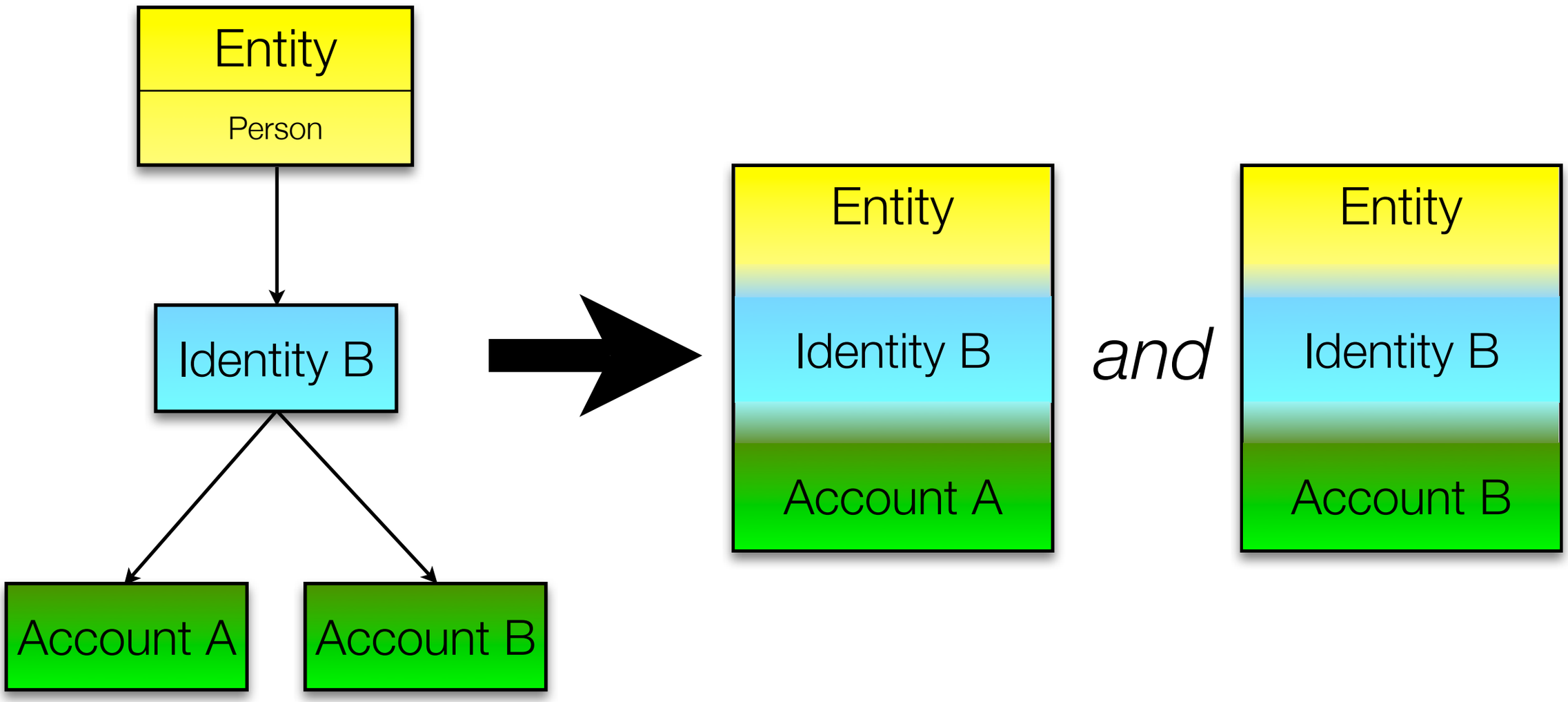
- Conduits which just want to pull information just need to
  - Register their identity, and triggering entitlement with the server
  - Perform ldapsearches with that identity

```
ldapsearch -h prometheus.inf.ed.ac.uk \
   -b “o=Prometheus,dc=inf,dc=ed,dc=ac,dc=uk” \
   (objectClass=prometheusIdentity)
```

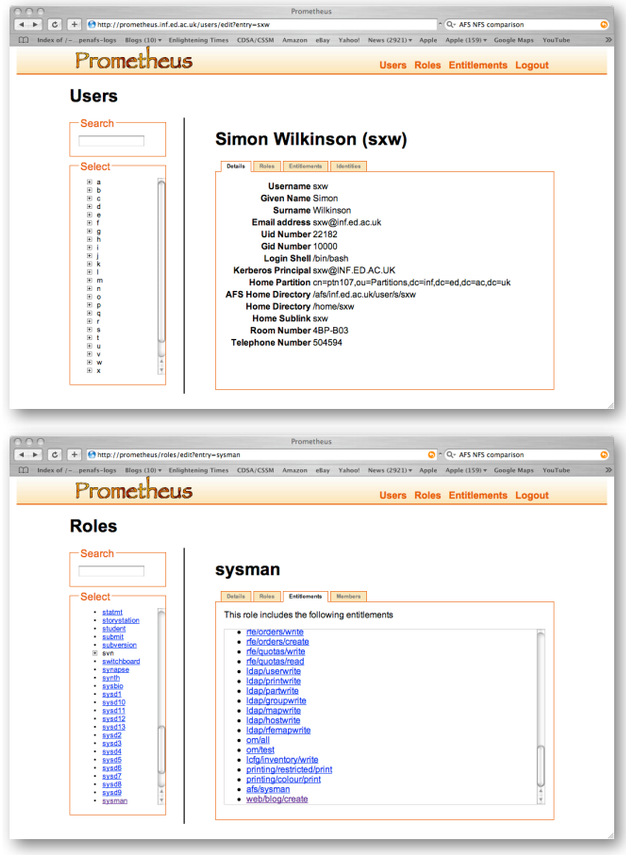
- Conduits with more complex requirements can use syncrepl (for updates) and OpenMetaDir (if their needs are specialised)

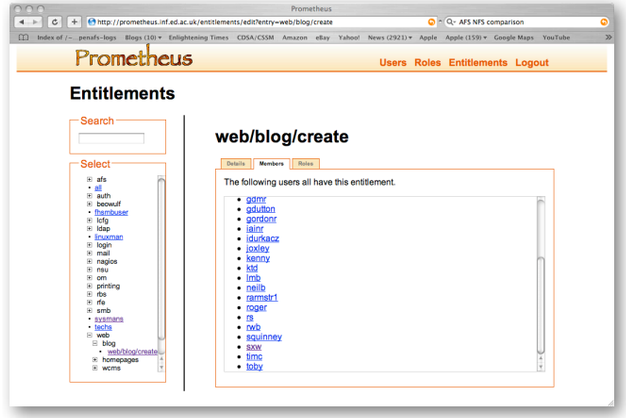
Implementation - Conduit Simplicity

- Simple conduits require the server have the ability to collapse the entity data model ...



The Web Interface





Web Interface Implementation

- Written using Catalyst - a perl MVC framework
- Uses prometheus API to communicate with LDAP server
- Uses user’s authentication tokens to secure server connection
- All authorization and access control checks performed in the server

Conclusions

- System design that meets all of our requirements
- Implementation continuing as an evolution of our existing system
- Code drops will be available shortly
- **Very** interested in talking to other sites that might be interested in any of this!

Questions?

This talk: http://www.dice.inf.ed.ac.uk/publications/

Prometheus: http://www.dice.inf.ed.ac.uk/prometheus/

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