

# Pragmatic data interoperability

Kirsty Kitto

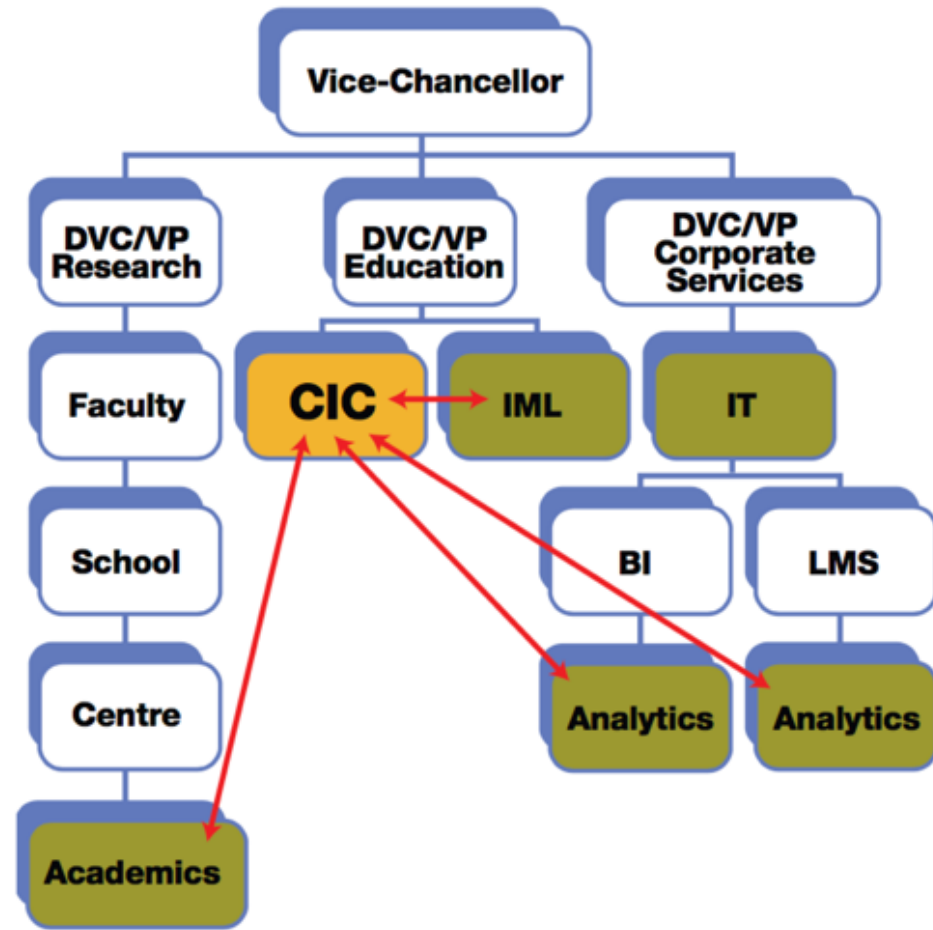
Connected Intelligence Centre

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# what is UTS:CIC?

Connected Intelligence Centre

- UTS innovation lab specialising in Learning Analytics
- provides in house data science consultancy
- academics teach data science and perform research
- trains PhDs in Learning Analytics



# some institutional context: UTS2027

## Learning for a lifetime

- “Our commitment to bringing about a transformation for society to a lifetime of learning means we must help curate and support learning and professional development for our students, whoever they may be, for their entire lives”

## Personal learning experience

- “Create a single, seamless experience learning platform. This will be a data-rich, single interface portal that dynamically adapts and supports a student’s journey.”

<https://www.uts.edu.au/about/uts-2027-strategy>

where does learning happen?



July 2018

Home

Modules

Announcements

Assignments

View Progress

Export Course Content

+ Module

+ Get started

Welcome to 36103 - Statistical Thinking for Data Science!

traditionally LA has focused upon providing analytics within the confines of specific systems built by vendors...  
(e.g. LMSs, eBooks, SIS)

Search

Settings

Don't plagiarise!

Resources, texts, and good online courses

+ Module 0: Preparing for statistical thinking

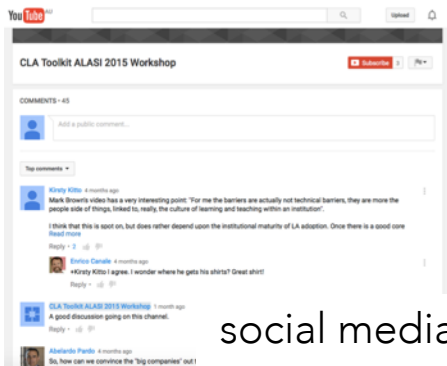
Am I ready for statistical thinking?





but learning happens everywhere!

# the connected learning analytics toolkit



social media



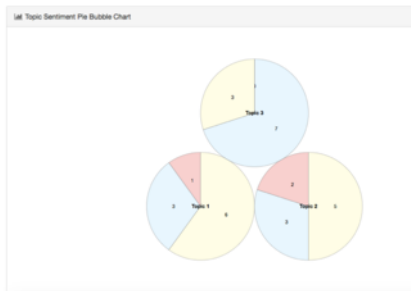
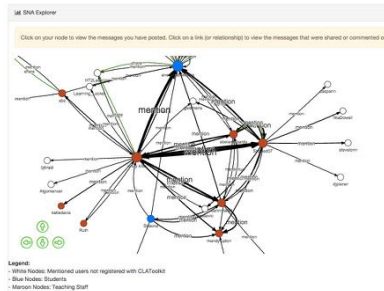
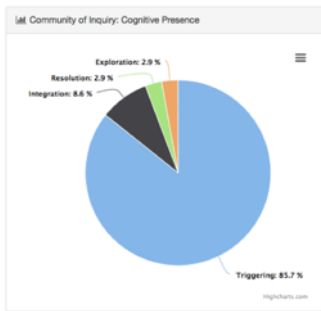
```
330 class TOPICNODEView(DefaultMixin, APView):
331
332     def get(self, request, *args, **kw):
333
334         course_code = request.GET.get('course_code', None)
335         platform = request.GET.get('platform', None)
336         start_date = request.GET.get('start_date', None)
337         end_date = request.GET.get('end_date', None)
338         num_topics = int(request.GET.get('num_topics', None))
339
340         result = json.loads(get_LDAPV350N(platform, num_topics, course_code))
341         response = Response(result, status=status.HTTP_200_OK)
342         return response
343
344 class MECLASSEFF(DefaultMixin, APView):
345
346     def get(self, request, *args, **kw):
347
348         course_code = request.GET.get('course_code', None)
349         platform = request.GET.get('platform', None)
350
351         result = classify(course_code, platform)
352         response = Response(result, status=status.HTTP_200_OK)
353         return response
354
355 class MULTAGN(DefaultMixin, APView):
356
357     def get(self, request, *args, **kw):
```

learning analytics

students

academics

admin & developers



LRS List

Title	Description	User #	Created		
Kinley's LRS		1	2019-05-09 11:00:05	✓	✗
Mandy's LRS		1	2019-05-11 23:02:19	✓	✗
Jamie's LRS		1	2019-05-11 23:02:35	✓	✗
Abelardo's LRS		1	2019-05-11 23:03:00	✓	✗
Shawn's LRS		1	2019-05-11 23:03:49	✓	✗
Grace's LRS		1	2019-05-11 23:04:23	✓	✗
Zaki's LRS		1	2019-05-11 23:05:00	✓	✗
Sam's LRS		1	2019-05-11 23:05:00	✓	✗
Simone's LRS		1	2019-05-11 23:05:35	✓	✗
Abelardo's LRS		1	2019-05-11 23:05:10	✓	✗

# I am not talking about that though!

You can read the papers if you like...

- Kitto, K., Cross, S., Waters, Z., Lupton, M. (2015). Learning Analytics beyond the LMS: the Connected Learning Analytics Toolkit. In Proceedings of the Fifth International Conference on Learning Analytics and Knowledge (LAK15). ACM, New York, NY, USA, 11-15.
- Bakharia, A., Kitto, K., Pardo, A., Gašević, D., Dawson, S. (2016), Recipe for success: lessons learnt from using xAPI within the connected learning analytics toolkit. In Proceedings of the Sixth International Conference on Learning Analytics & Knowledge (LAK16). ACM, New York, NY, USA, 378-382.
- Kitto, K., Lupton, M., Davis, K., Waters, Z. (2017). Designing for Student Facing Learning Analytics, Australasian Journal of Educational Technology, 33(5), 152-168.



# Susie's journey

Susie represents a learner growing up within this ecosystem. She has difficult decisions to make at key stages throughout her life as a learner and will need support and guidance. However, Susie will have the benefit of a lifelong learning record or e-Portfolio to assist her in making decisions. Her school, college, employers and friends will support her to maintain a valuable record and to make effective use of it throughout her life, to apply for courses and jobs as well as make informed planned decisions to ensure she leads a fulfilled career.

Sheffield Hallam: evaluating the student e-learning experience at college and university

Liverpool: exploring transition between college and university using PDP

I've kept my e-portfolio up to date

Now I can carry on adding to it, to support my voluntary work.

Finished my work based learning degree

I'm looking for a new job with skills evidenced in my e-portfolio.

Can't afford University

But can apply for a Foundation Degree using my learning plan

3 years working for the council

I'll use my City Learner Passport to apply to College and get a better job.

Leaving school  
College, travel or job?

Age 6 months

Creche

Age 16 years

Learnner Passport



Remainder exploring delivery of Foundation Degree.

Learnner Passport

Local College

Nottingham: learner data transformed from City eProgress file to University system to support wider access to higher education.

WOLU: giving students access to a lifelong learning record through a web portal.

PROGRESS: supporting online PDP for work-based learners on degree courses.

WOLU: providing nationally standardised learning for which representatives through a UK-wide network of colleges, with centrally hosted learning materials. WOLU: work to develop nationally standardised learning materials.

WOLU: sharing learner records and resources across schools and colleges.  
WOLU: monitoring and advising a small proportion of young learners' records across all publications.

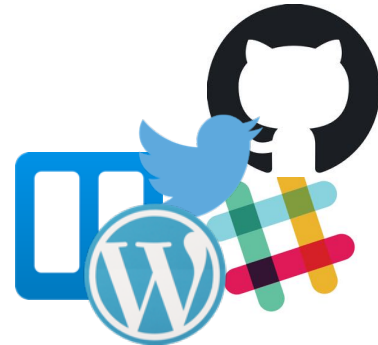
Sheffield Hallam: evaluating the student e-learning experience at college and university with young adults

London: WOLU: exploring the impact and benefits management issues relating to the concept of the lifelong learner record

learning occurs over a lifetime!

# the emerging UTS digital learning ecosystem

- LMS works as core to a decentralized system
- The core is heavily supported by other elements in the ecosystem
- Several core external tools are utilized to enrich student experience
- But many other tools are used by our academics! (how to support?)
- LA is a focus for enabling personalization (and CIC *builds* tools!)
- But student data can be generated in a wide range of tools...





so data interoperability is essential to us!

but what *type* of interoperability?

# big and comprehensive? or loose and modular?

you could ensure that *all* educational technology uses one data stack...



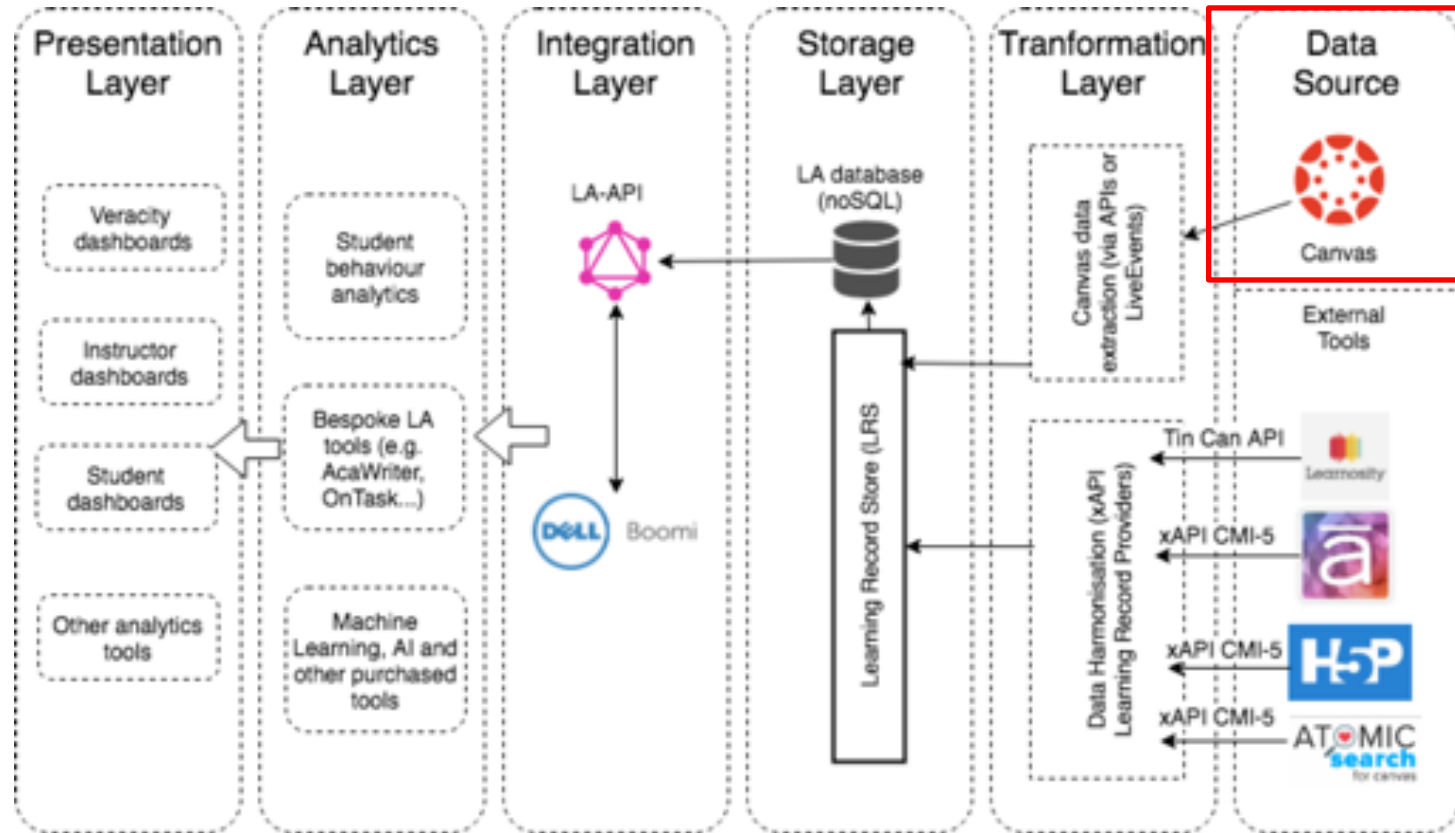
- but how long would this remain current?
- and how quickly will it evolve as new use cases arise?
- and who is control of it anyway?
- and how comprehensive can this approach actually be?

or you could try and do something that is more modular...



- where any LRP can get up and running quickly to provide data
- but then you need to ensure that there is a way to map data between different providers

we have already broken the “comprehensive” model...



# UTSCIC

## STATEMENTS

Icons		Actor		Verb		Object		Stored	
								Start Date	End Date
•	SR		Sean Pereira		created		Note	0 days ago	2020 Nov 14, 2019
•	SR		Kirsty Kitch		replied		Note	0 days ago	2020 Nov 14, 2019
•	SR		Jose Beltran Vlandy		created		Note	0 days ago	2020 Nov 14, 2019
•	SR		Archel Aguilar		replied		Note	0 days ago	2020 Nov 14, 2019
•	SR		Kirsty Kitch		created		Note	0 days ago	2020 Nov 14, 2019
•	SR		Archel Aguilar		created		Note	0 days ago	2020 Nov 14, 2019
•	SR		Archel Aguilar		replied		Note	0 days ago	2020 Nov 14, 2019
•	SR		Archel Aguilar		created		Note	0 days ago	2020 Nov 14, 2019
•	SR		Kirsty Kitch		created		Note	0 days ago	2020 Nov 14, 2019

[UTSOC Home](#)
[Analytics](#)
[xAPI Data](#)
[Statements](#)
[Activity State](#)
[Activity Profile](#)
[Agent Profile](#)
[Attachments](#)
[Management](#)
[Content](#)
[Learner Portal](#)
[Tools](#)
[Help](#)

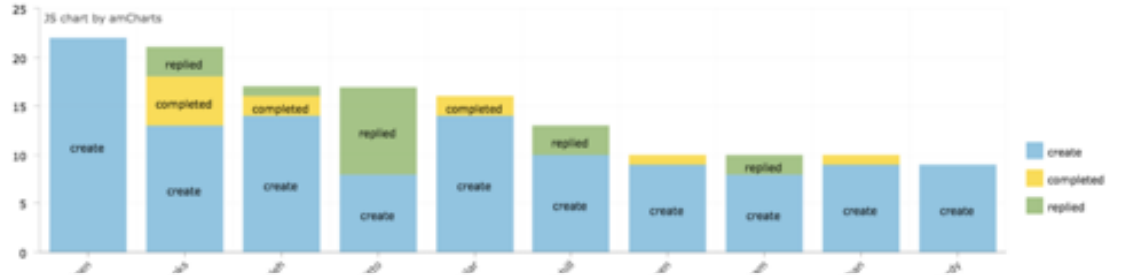


[illegible]

class activity



actor activity

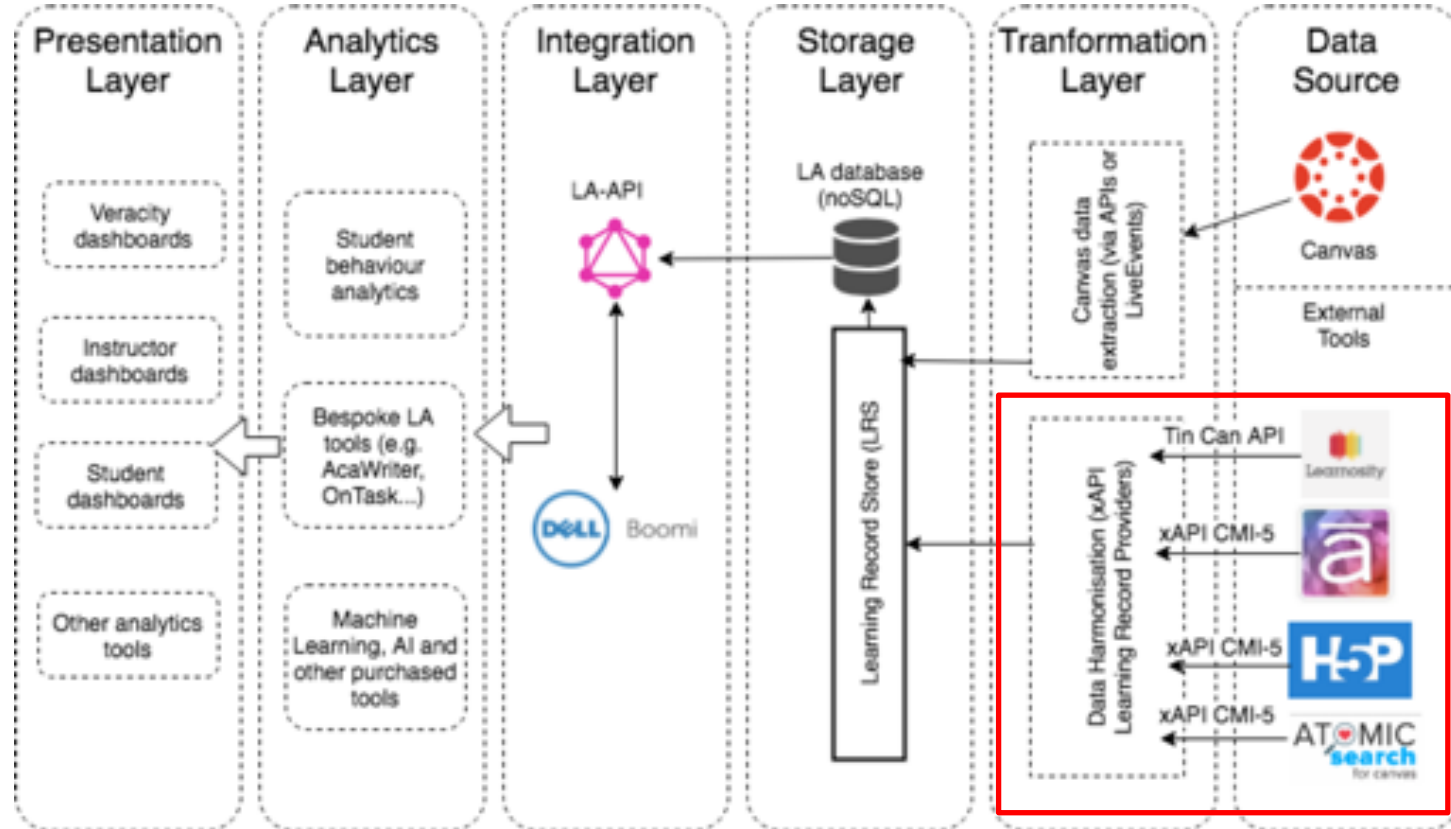


resource use



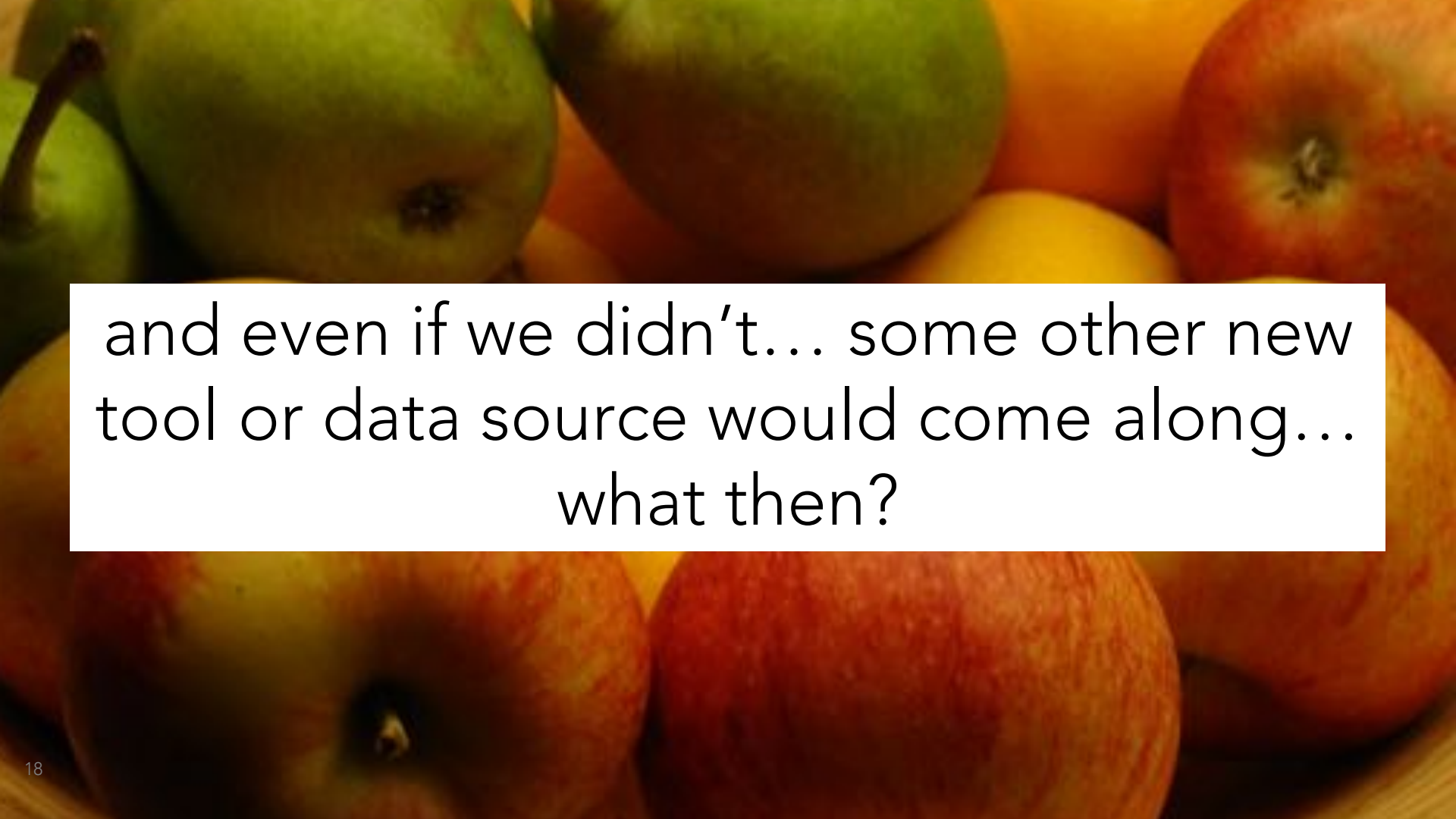
Your reflective journal	93
Adjustment	9
MDSI Pre-flight Check	7
General Discussion and shared links, R ...	7
Help me!	6
Some questions to get you thinking...	5
Regression Models: Post Class Quiz	5
Regression Models: Post Class Quiz	5
Data Fallacies	5
Help with Assessment 2!	5

Note: we have already broken the “big and comprehensive” model...

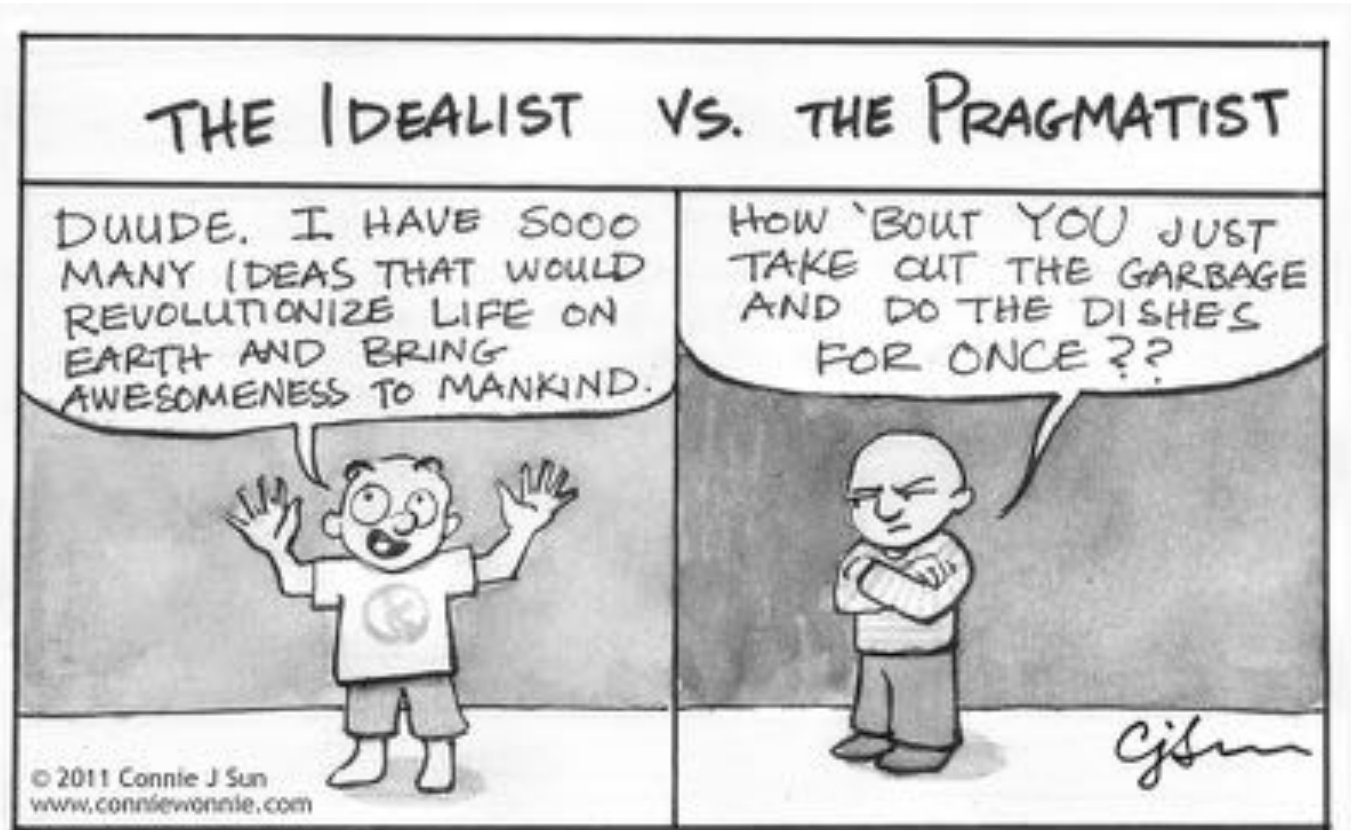


an ecosystem of data providers!

are the statements the same?

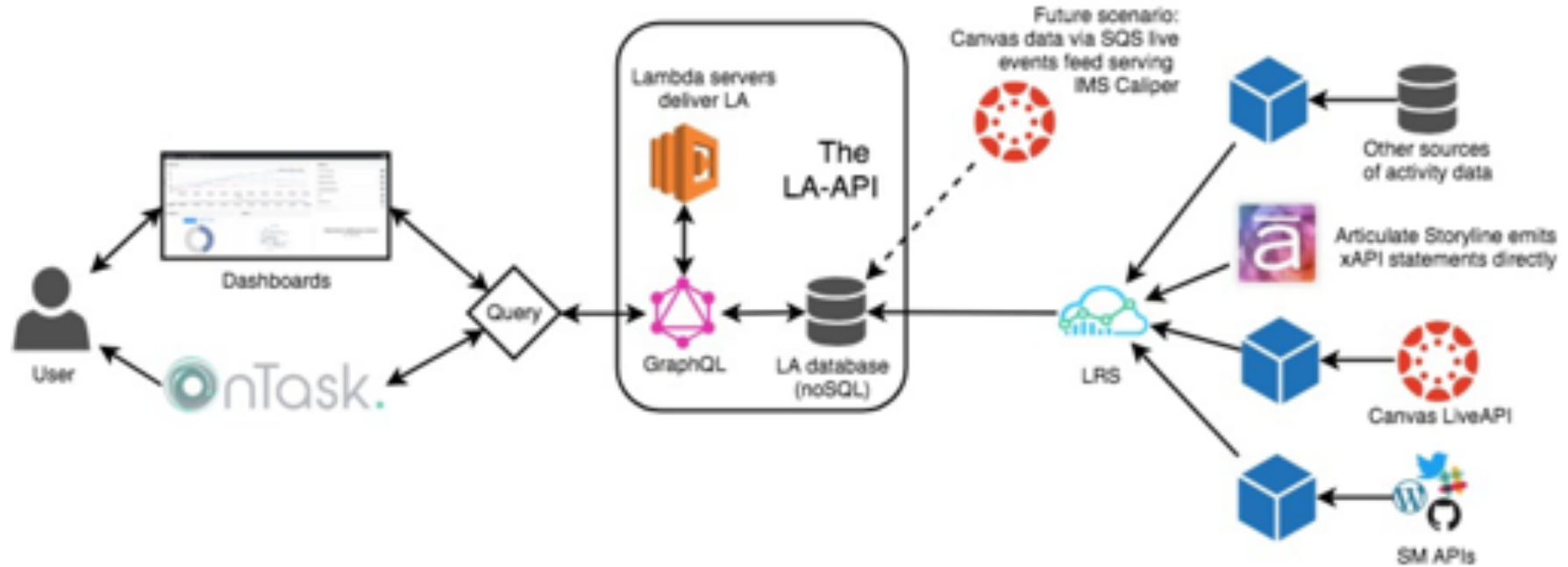


and even if we didn't... some other new  
tool or data source would come along...  
what then?



pragmatic data interoperability

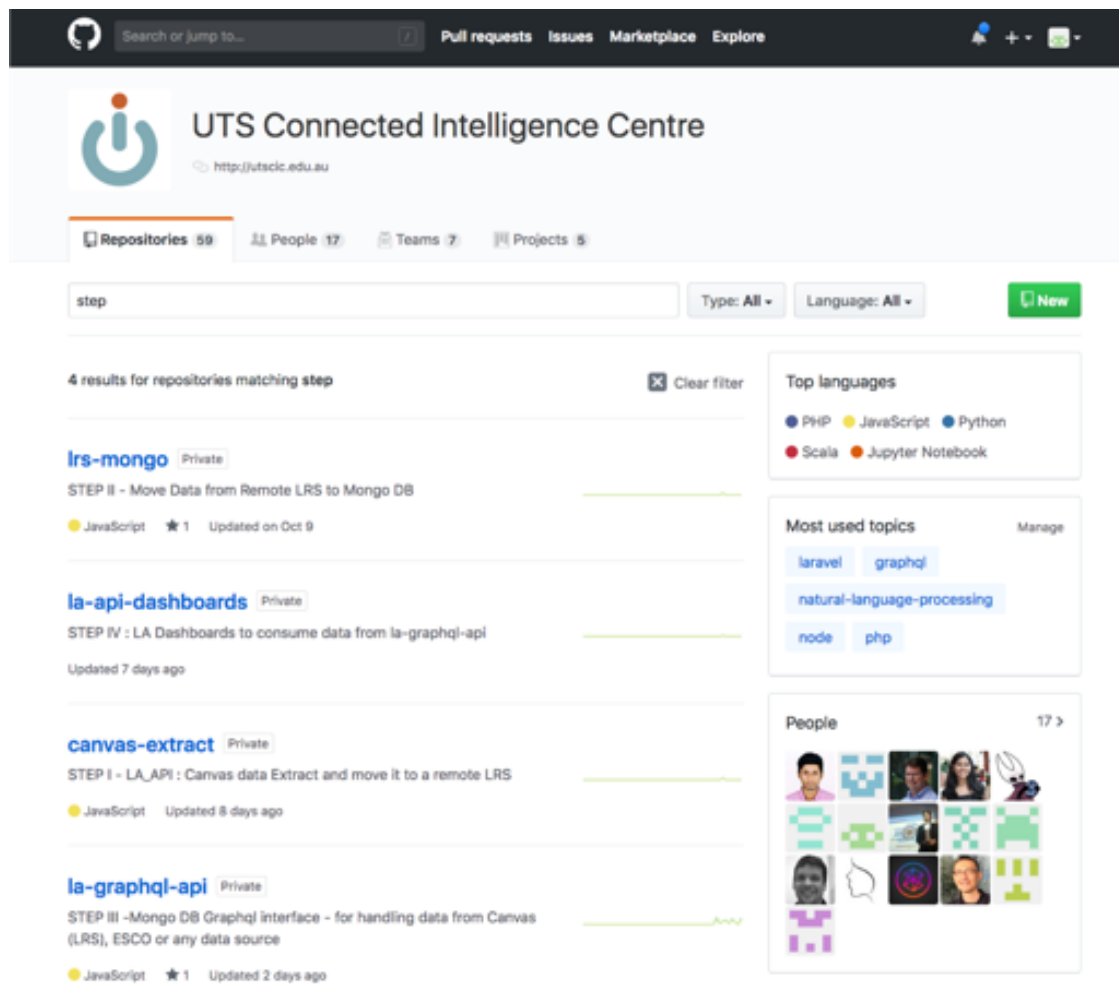
# a pilot ETL pipeline – the LA-API





# 4 related code repositories for ETL pipeline

just got permission to open source the whole data pipeline... anyone want to link up their tools or data sources?



The screenshot shows the GitHub profile of the UTS Connected Intelligence Centre. The page displays a search for repositories matching the keyword "step", resulting in 4 matches. The repositories listed are:

- lrs-mongo** (Private): STEP II - Move Data from Remote LRS to Mongo DB. JavaScript, 1 star, updated on Oct 9.
- la-api-dashboards** (Private): STEP IV : LA Dashboards to consume data from la-graphql-api. Updated 7 days ago.
- canvas-extract** (Private): STEP I - LA\_API : Canvas data Extract and move it to a remote LRS. JavaScript, 1 star, updated 8 days ago.
- la-graphql-api** (Private): STEP III -Mongo DB GraphQL interface - for handling data from Canvas (LRS), ESCO or any data source. JavaScript, 1 star, updated 2 days ago.

On the right side of the page, there are sections for "Top languages" (PHP, JavaScript, Python, Scala, Jupyter Notebook), "Most used topics" (laravel, graphql, natural-language-processing, node, php), and "People" (17 contributors).

# the GraphQL schema provides flexible data access...

What if I want counts of activity?

```
{
  searchNotes(search: email,
value:
"kirsty.kitto@uts.edu.au") {
    parentName
    createdAt
  }
}
```

What if I want to do text analysis?

```
{
  searchNotes(search: email,
value:
"kirsty.kitto@uts.edu.au") {
    verb
    parentName
    createdAt
    author{
      name
    }
    text
  }
}
```

that is... the  
GraphQL  
schema  
delivers the  
pragmatic data  
interoperability

SCHEMA

🔍 Search the schema ...

QUERIES

`getNotes(...): [Note]`

`allNotes: [Note]`

`getNotesByUser(...): [Note]`

`getNotesBySubject(...): [Note]`

`getSentiment(...): Sentiment`

`searchNotes(...): [Note]`

`getOccupations(...): [Occupation]`

`getOnTask: Ontask`

`getQuiz(...): [Quiz]`

```
getNotes(  
  platform: String!  
): [Note]
```

TYPE DETAILS

```
type Note {  
  _id: ID!  
  verb: String  
  title: String  
  text: String!  
  parentRef: String  
  parentName: String  
  groupRef: String  
  groupName: String  
  createdAt: String  
  updatedAt: String  
  platform: String  
  author: User  
  sentiment: Sentiment  
}
```

resolvers fetch  
the data from  
anywhere  
hooked up to  
the LA-API

```
async searchNotes(parent, args) {  
  let notes = [];  
  if(args.search === 'subject') {  
    let value = new RegExp(args.value, 'i');  
    notes = await Note.find({parentName : {$regex: value}});  
  }  
  if(args.search === 'email') {  
    let user = await User.find({email : args.value.toLowerCase()});  
    if(user.length === 0) return [];  
    notes = await Note.find({user: new ObjectId(user[0]._id)});  
  }  
  if(args.search === 'platform') {  
    notes = await Note.find({platform: args.value});  
  }  
  if(args.search === 'verb') {  
    notes = await Note.find({verb: args.value});  
  }  
  if(args.search === 'title') {  
    let value = new RegExp(args.value, 'i');  
    notes = await Note.find({title : {$regex: value}});  
  }  
  return notes;  
},
```

# what is the activity of a user?

The screenshot shows a GraphQL Playground interface with a query on the left and its JSON response on the right. The query is a `searchNotes` query with arguments `email` and `value`. The response is a JSON object with a `data` field containing an array of `searchNotes` results. Each result is an object with `parentName` and `createdAt` fields.

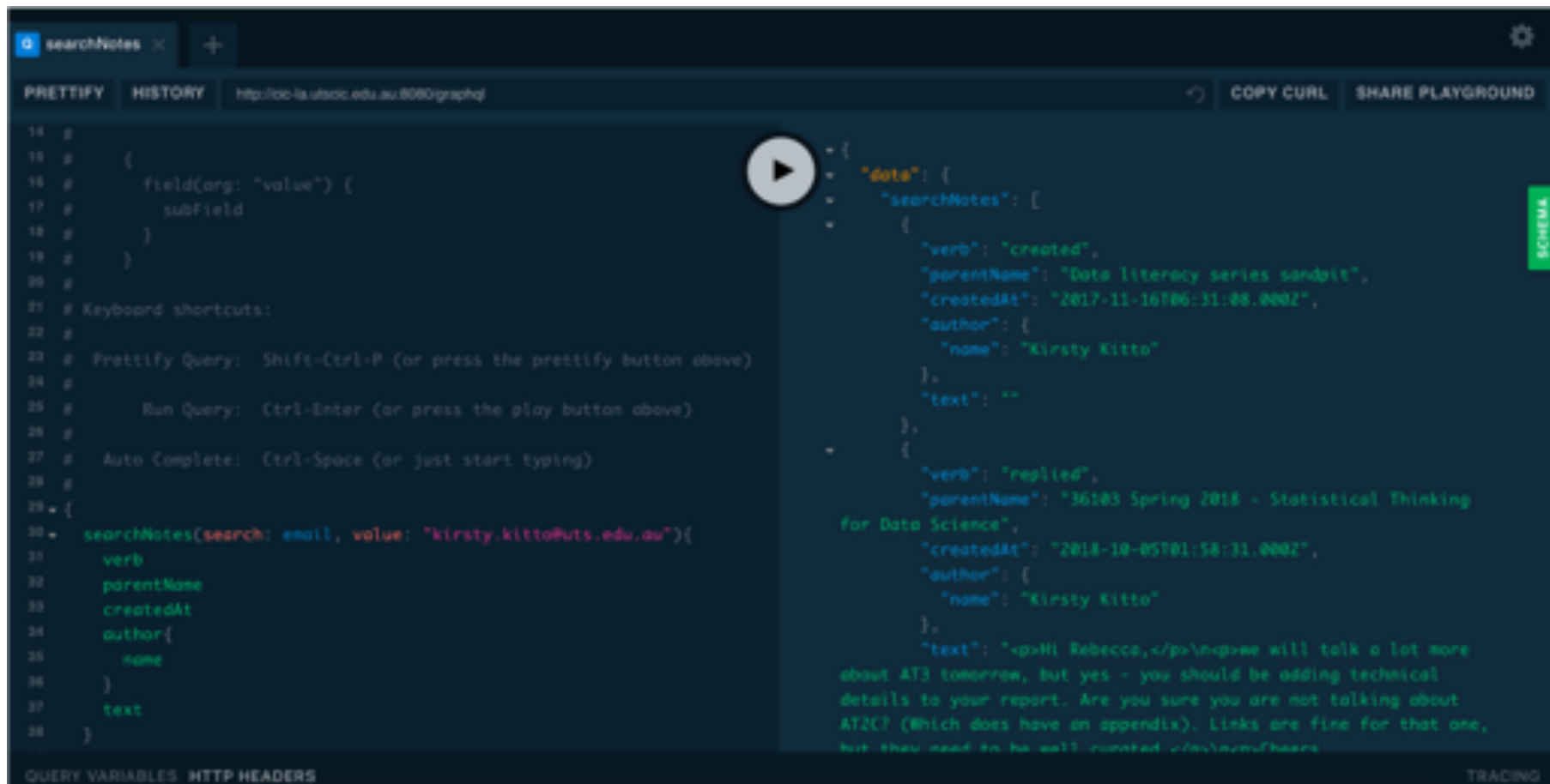
**Query:**

```
14 #
15 # {
16 #   field(arg: "value") {
17 #     subField
18 #   }
19 # }
20 #
21 # Keyboard shortcuts:
22 #
23 # Prettify Query: Shift-Ctrl-P (or press the prettify button above)
24 #
25 # Run Query: Ctrl-Enter (or press the play button above)
26 #
27 # Auto Complete: Ctrl-Space (or just start typing)
28 #
29 {
30   searchNotes(search: email, value: "kirsty.kitto@uts.edu.au"){
31     parentName
32     createdAt
33   }
34 }
35
36
```

**Response:**

```
{
  "data": {
    "searchNotes": [
      {
        "parentName": "Data literacy series sandpit",
        "createdAt": "2017-11-16T06:31:08.000Z"
      },
      {
        "parentName": "36103 Spring 2018 - Statistical Thinking for Data Science",
        "createdAt": "2018-10-05T01:58:31.000Z"
      },
      {
        "parentName": "36103 Spring 2018 - Statistical Thinking for Data Science",
        "createdAt": "2018-08-30T22:29:32.000Z"
      },
      {
        "parentName": "36103 Spring 2018 - Statistical Thinking for Data Science",
        "createdAt": "2018-09-07T10:51:52.000Z"
      },
      {
        "parentName": "36103 Spring 2018 - Statistical Thinking for Data Science"
      }
    ]
  }
}
```

# what text did they write?



The screenshot shows a GraphQL Playground interface. The left pane contains a query with line numbers 14 to 38. The right pane shows the JSON response, with a play button icon in the center. The response is a JSON object with a 'data' field containing an array of 'searchNotes'.

```
14 #
15 # {
16 #   field(arg: "value") {
17 #     subField
18 #   }
19 # }
20 #
21 # Keyboard shortcuts:
22 #
23 # Prettify Query: Shift+Ctrl-P (or press the prettify button above)
24 #
25 # Run Query: Ctrl+Enter (or press the play button above)
26 #
27 # Auto Complete: Ctrl-Space (or just start typing)
28 #
29 # {
30 #   searchNotes(search: email, value: "kirsty.kitto@uts.edu.au"){
31 #     verb
32 #     parentName
33 #     createdAt
34 #     author{
35 #       name
36 #     }
37 #     text
38 #   }
39 # }
```

```
{
  "data": {
    "searchNotes": [
      {
        "verb": "created",
        "parentName": "Data literacy series sandpit",
        "createdAt": "2017-11-16T06:31:00.000Z",
        "author": {
          "name": "Kirsty Kitto"
        },
        "text": ""
      },
      {
        "verb": "replied",
        "parentName": "36103 Spring 2018 - Statistical Thinking for Data Science",
        "createdAt": "2018-10-05T01:58:31.000Z",
        "author": {
          "name": "Kirsty Kitto"
        },
        "text": "<p>Hi Rebecca,</p>\n<p>we will talk a lot more about AT3 tomorrow, but yes - you should be adding technical details to your report. Are you sure you are not talking about AT2C? (Which does have an appendix). Links are fine for that one, but they need to be well named </p>\n\nKirsty"
      }
    ]
  }
}
```

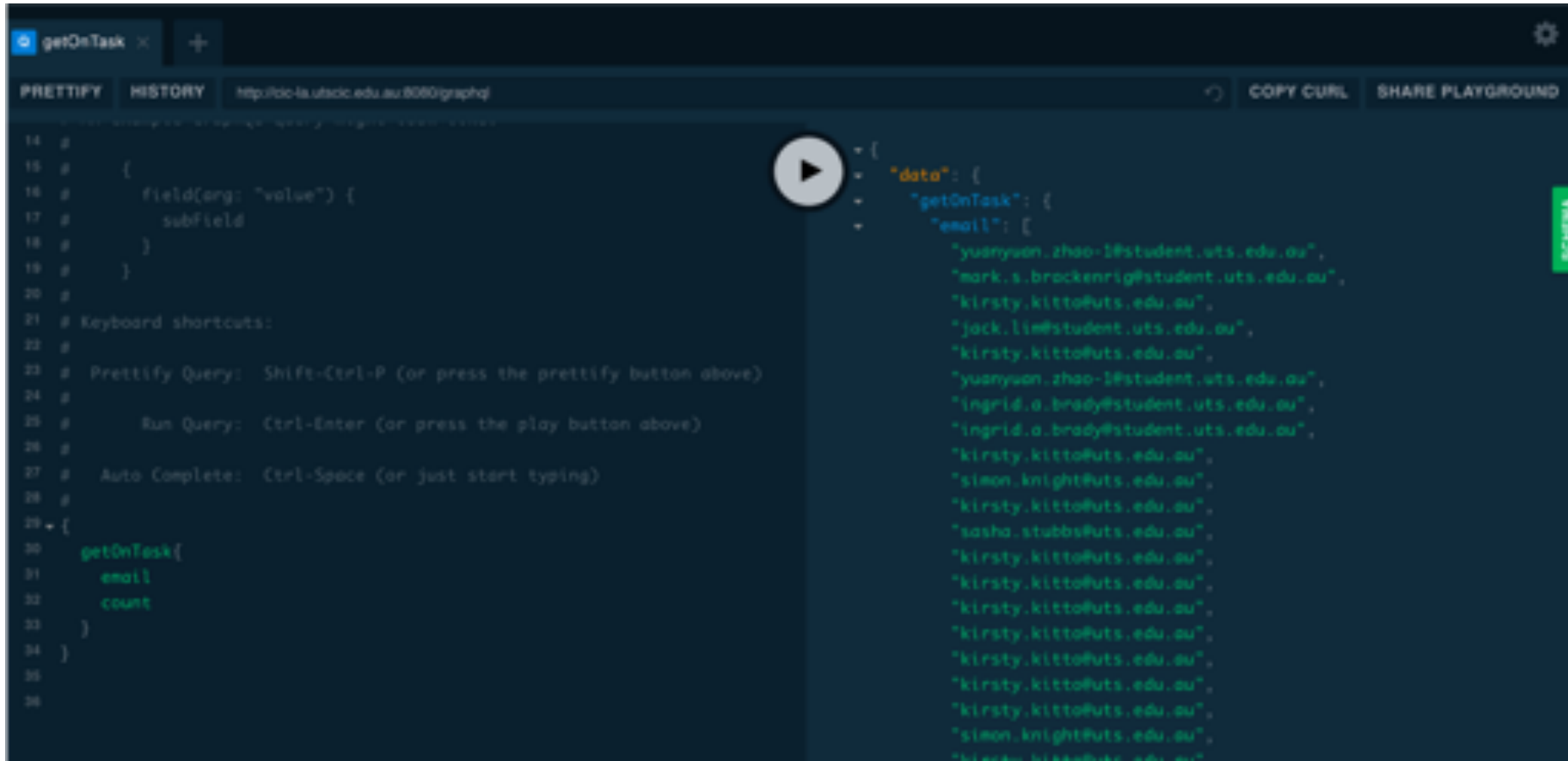
QUERY VARIABLES HTTP HEADERS

SCHEMA

TRACING



no... actually I want to send data to OnTask...



The screenshot shows a GraphQL Playground interface with a query on the left and its JSON response on the right. A play button is visible in the center.

**Query (Left Panel):**

```
14 #
15 # {
16 #   field(arg: "value") {
17 #     subfield
18 #   }
19 # }
20 #
21 # Keyboard shortcuts:
22 #
23 # Prettify Query: Shift-(Ctrl)-P (or press the prettify button above)
24 #
25 # Run Query: Ctrl-Enter (or press the play button above)
26 #
27 # Auto Complete: Ctrl-Space (or just start typing)
28 #
29 {
30   getOnTask{
31     email
32     count
33   }
34 }
35
36
```

**Response (Right Panel):**

```
{
  "data": {
    "getOnTask": {
      "email": [
        "yuanyuan.zhao-1@student.uts.edu.au",
        "mark.s.brockenrig@student.uts.edu.au",
        "kirsty.kitto@uts.edu.au",
        "jack.lin@student.uts.edu.au",
        "kirsty.kitto@uts.edu.au",
        "yuanyuan.zhao-1@student.uts.edu.au",
        "ingrid.o.brady@student.uts.edu.au",
        "ingrid.o.brady@student.uts.edu.au",
        "kirsty.kitto@uts.edu.au",
        "simon.knight@uts.edu.au",
        "kirsty.kitto@uts.edu.au",
        "sasha.stubbs@uts.edu.au",
        "kirsty.kitto@uts.edu.au",
        "kirsty.kitto@uts.edu.au",
        "kirsty.kitto@uts.edu.au",
        "kirsty.kitto@uts.edu.au",
        "kirsty.kitto@uts.edu.au",
        "kirsty.kitto@uts.edu.au",
        "simon.knight@uts.edu.au",
        "kirsty.kitto@uts.edu.au"
      ]
    }
  }
}
```

# in summary

- the LA-API provides a useable solution to the ongoing problems faced by the LA community with integrating data from multiple tools
- it provides a flexible and extensible way of moving data between LA tools
- encourages best practice use of xAPI Profiles and Caliper, as data is more likely to already be integrated (easier if you do the right thing!)
- but it still lets people integrate their other favorite (i.e. weird) tools...

Questions?