



SeMI Technologies

Introduction to the Weaviate knowledge graph

@bobvanluijt



What's the problem?





```
SELECT * FROM `actors` WHERE `name` = 'Bill Murray'
```




Getty Images



A Bain & Company survey of 325 global companies found that;

1. **59% believe they lack the capabilities to generate meaningful business insights** from their data.
2. **85% said they will require substantial investments** to update their data platform.



What's the solution?

Knowledge Graphs



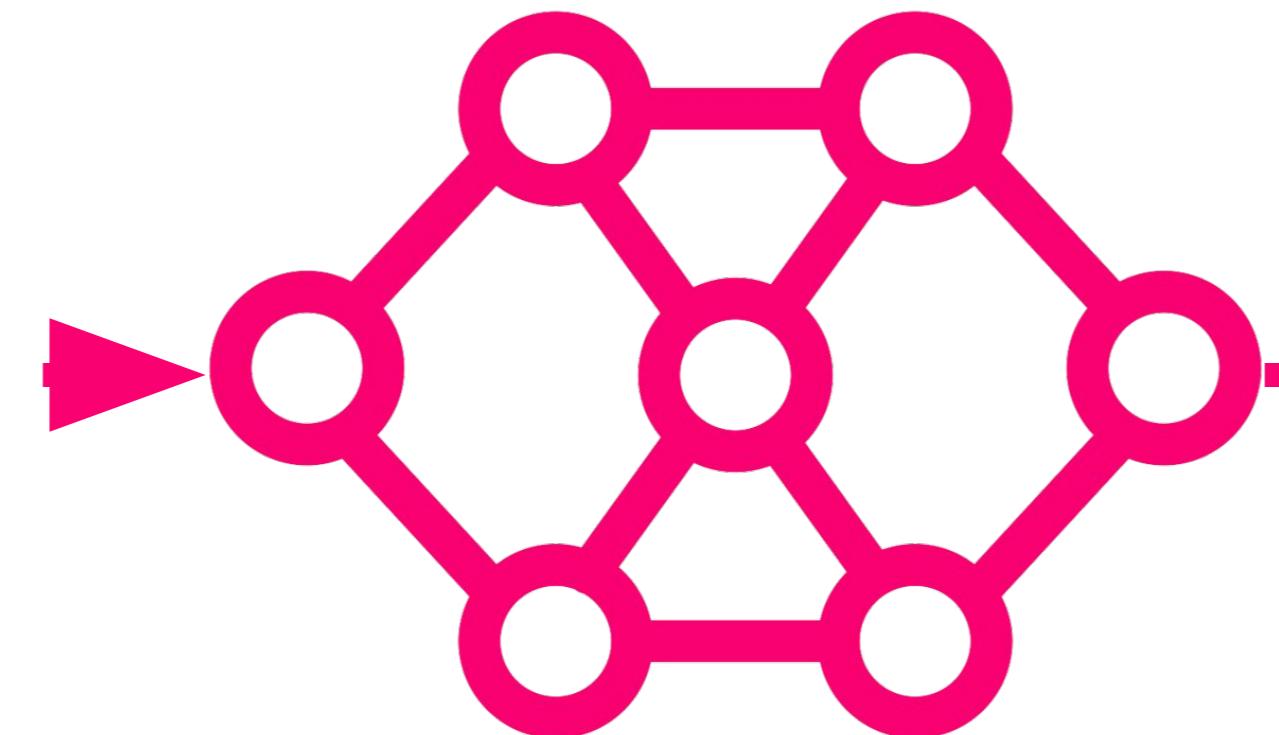
“A knowledge graph acquires and integrates information into an ontology and applies a reasoner to derive new knowledge.

Towards a Definition of Knowledge Graphs

Historically



Relational and NoSQL



Graph databases



Smart DB's



Google bill murray

All Images News Videos Maps More Settings Tools

About 232.000.000 results (0,78 seconds)

Bill Murray - Wikipedia
https://en.wikipedia.org/wiki/Bill_Murray ▾
William James Murray (born September 21, 1950) is an American actor, voice actor, comedian, filmmaker, and writer. He first rose to fame on Saturday Night ...
Family: Brian Doyle-Murray (brother); John Mu... Occupation: Actor; Voice actor; Comedian; Writ...
Years active: 1973–present Children: 6
Brian Doyle-Murray · Bill Murray & Brian Doyle ... · John Murray · Joel Murray

Bill Murray - IMDb
<https://www.imdb.com/name/nm0000195/> ▾
Bill Murray is an American actor, comedian, and writer. The fifth of nine children, he was born William James Murray in Wilmette, Illinois, to Lucille (Collins), a mailroom clerk, and Edward Joseph Murray II, who sold lumber. He is of Irish descent.
Biography · Bill Murray - Contact Info ... · Bill Murray's primary photo · Awards

Top stories

 Selena Gomez Reveals What Bill Murray Whispered In Her Ear During THAT Red Carpet Moment
Harper's BAZAAR Arabia · 2 days ago

Bill Murray

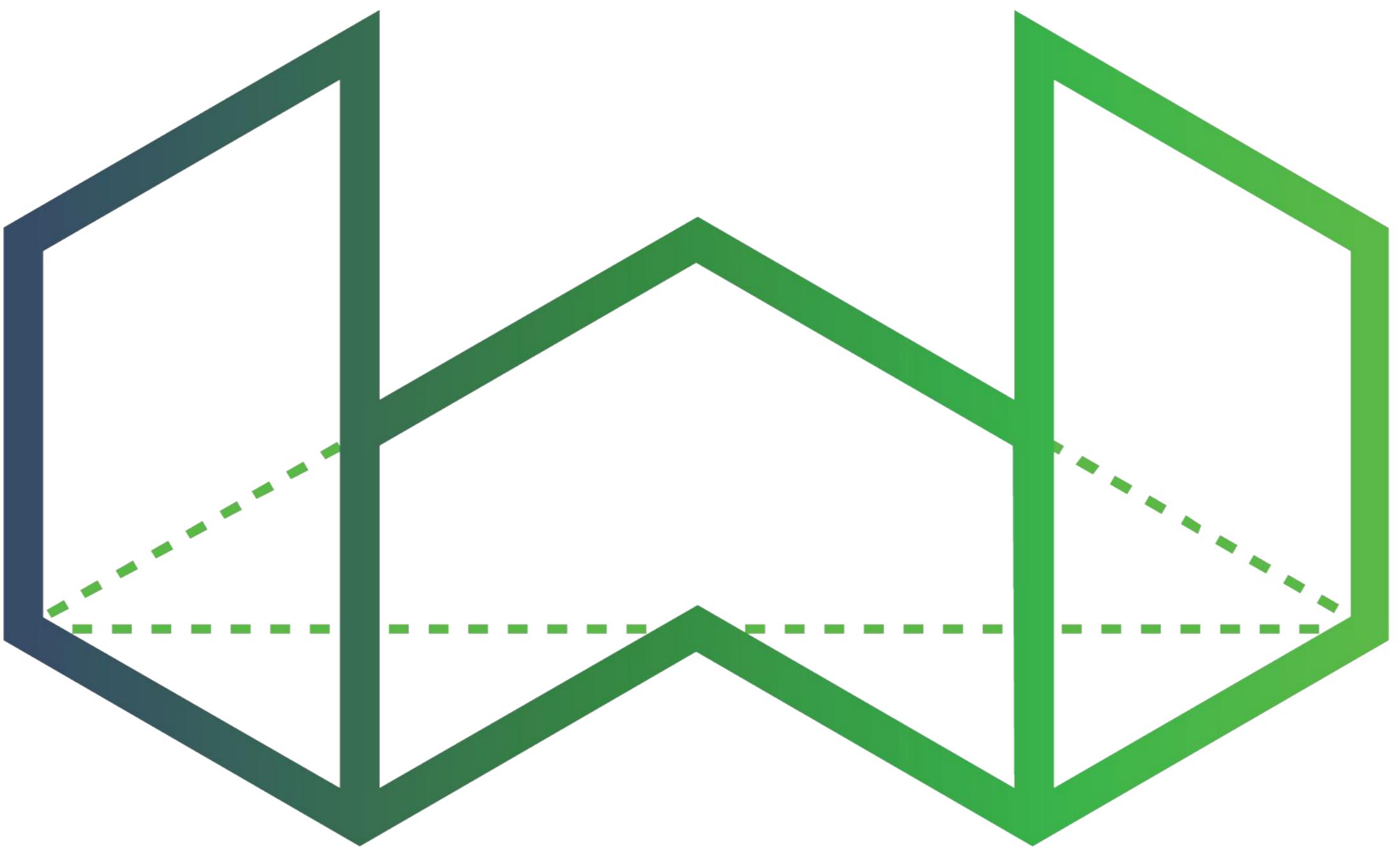
American actor

William James Murray is an American actor, voice actor, comedian, filmmaker, and writer. He first rose to fame on Saturday Night Live, a series of performances that earned him his first Emmy Award, and ... [Wikipedia](#)

Born: September 21, 1950 (age 68 years), Evanston, Illinois, United States
Children: Luke Murray, Homer Murray, Cooper Murray, Jackson Murray, Lincoln Murray, Cal Murray
TV shows: Saturday Night Live, Olive Kitteridge, MORE
Spouse: Jennifer Butler (m. 1997–2008), Margaret Kelly (m. 1981–1996)

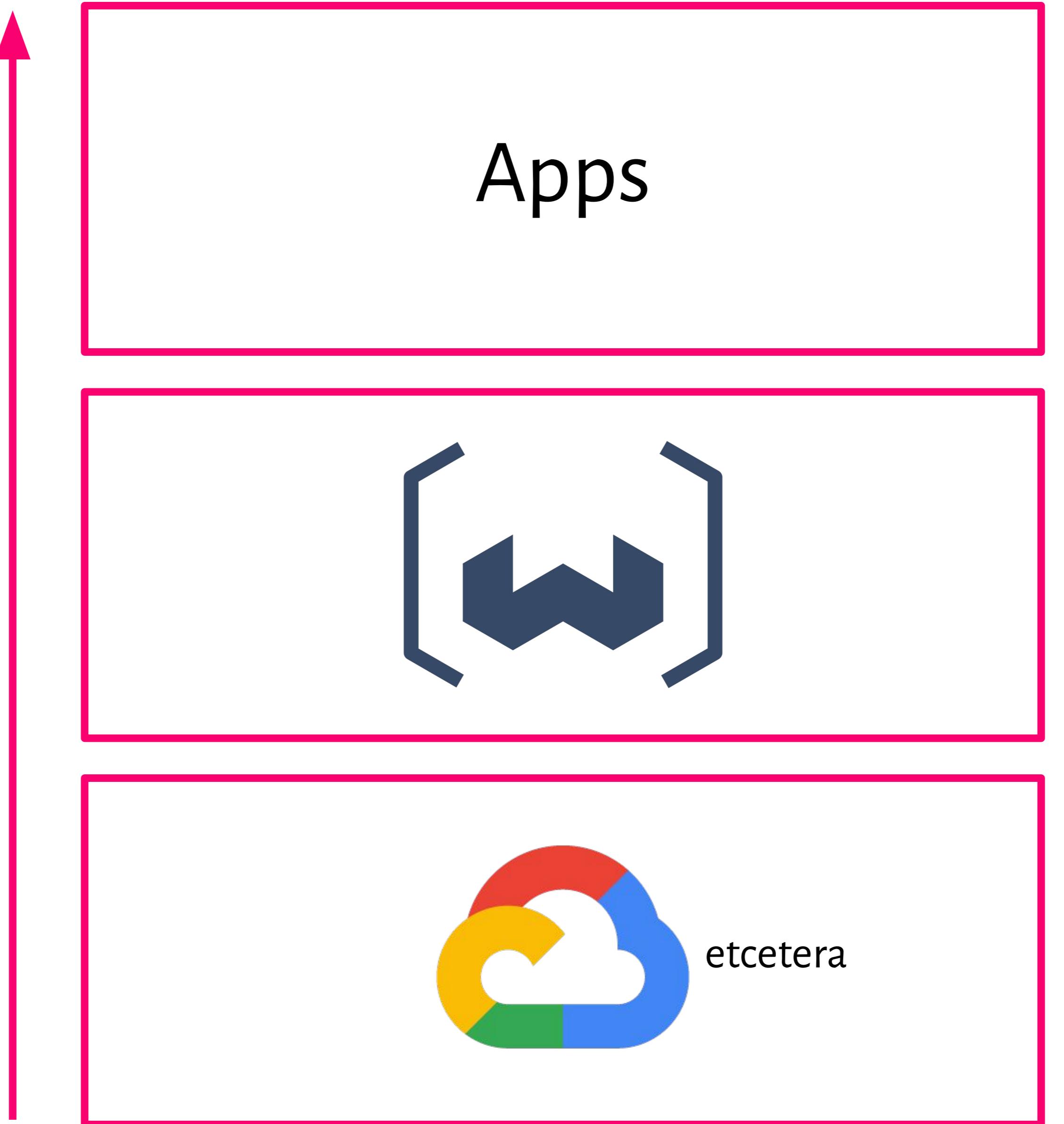


How to create your own?



weaviate

*We aim to allow anyone,
anywhere, any time to
create their own
knowledge graph or
knowledge network.*



Use Case Features



Semantic Search

Uitgelicht



Zoeken
pepsi



Zoeken

Sorteer op



BONUS (9)

Prijs

Merk

AH (3)

Bulletje (1)

Chio (1)

Nut (1)

Pepsi (1)

Strepsils (1)

Soorten



Keeltabletten (5)

Cola blikjes (6)

Pepsels (7)

Cola flessen (7)

Cola light & suikervrije blikje ...

Cola light & suikervrije flesse...

Toon meer

Dieet



Vegetarisch (19)



1.95

1,5 l

2 VOOR 2.75



Pepsi Cola max

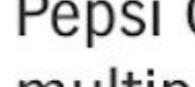


5.50

4 x 1,5 l

BONUS

Pepsi Cola max
multipack



0.50

330 ml

Pepsi Cola max
cherry



2 VOOR 2.75

1,5 l

1.95

1,5 l

Pepsi Cola max
cherry



1.95

1,5 l

2 VOOR 2.75



Pepsi Cola



1.85

1,5 l

Pepsi Cola max
lemon



2.29

4 x 0,33 l

Pepsi Cola max 4-
pack



0.59

330 ml

Pepsi Max ginger



7.70



Feedback

Cola light & suikervrije flesse...

Toon meer ▾

Zoeken
pepsi

Zoeken

Sorteer op

Dieet

- Vegetarisch (19)
- Veganistisch (17)
- Laag suiker (19)
- Laag vet (17)
- Laag zout (16)

Allergie

- Zonder eieren (23)
- Zonder gluten (16)
- Zonder lactose (17)
- Zonder melk (17)
- Zonder noten (22)
- Zonder pinda's (19)

Toon meer ▾

Filters in samenwerking
met Spoon Guru.

Lees hier meer over de
filters



0.59
330 ml

Pepsi Max lemon



0.59
330 ml

Pepsi Max
caffeinevrij



0.99
180 g

Bolletje Zoute
pepsels



0.46
200 g

AH Knabbelsticks
(zoute stokjes)



0.95
115 g

Bolletje Kaas
pepsels



0.89
200 g

Chio Party mix
original
Vanaf maandag



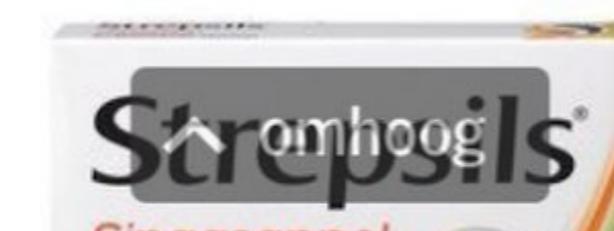
1.02
115 g

Bolletje Pinda
pepsels



0.83
250 g

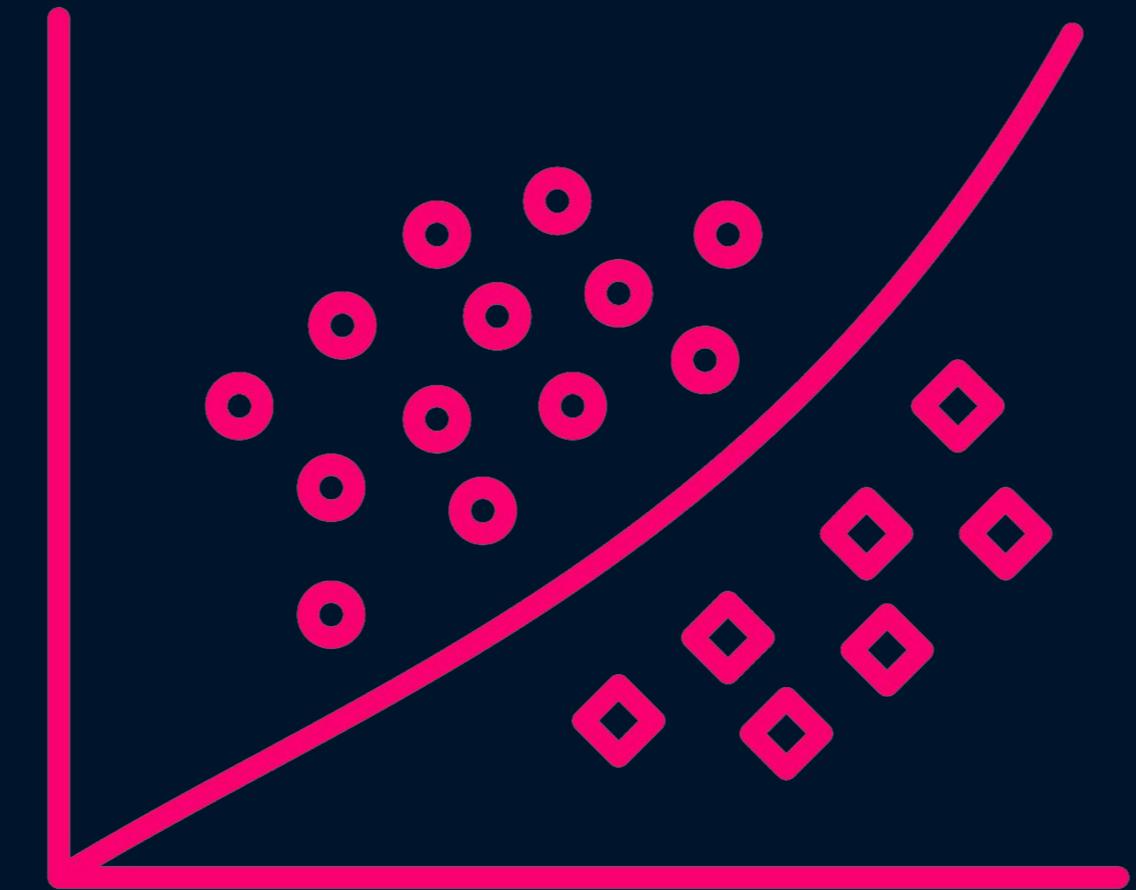
AH Mega mix



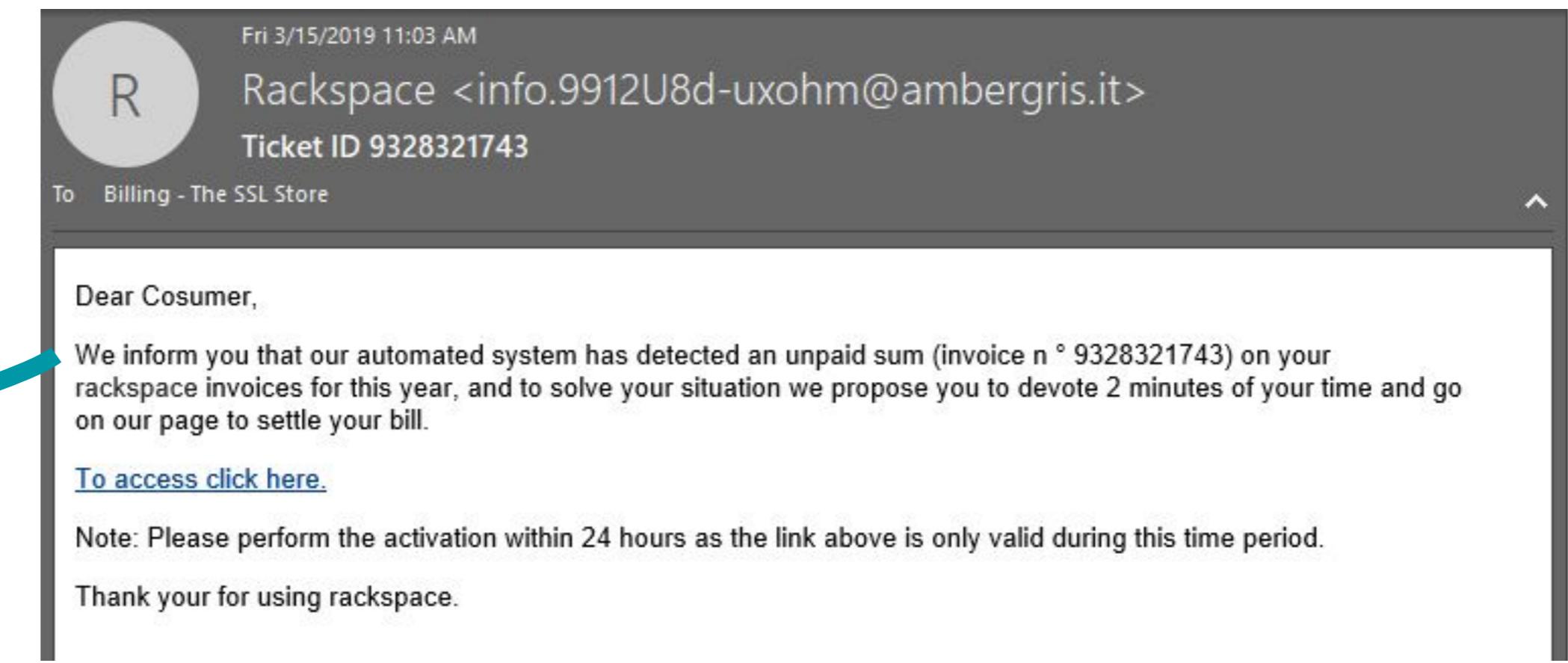
Feedback



Semantic Search



Classification

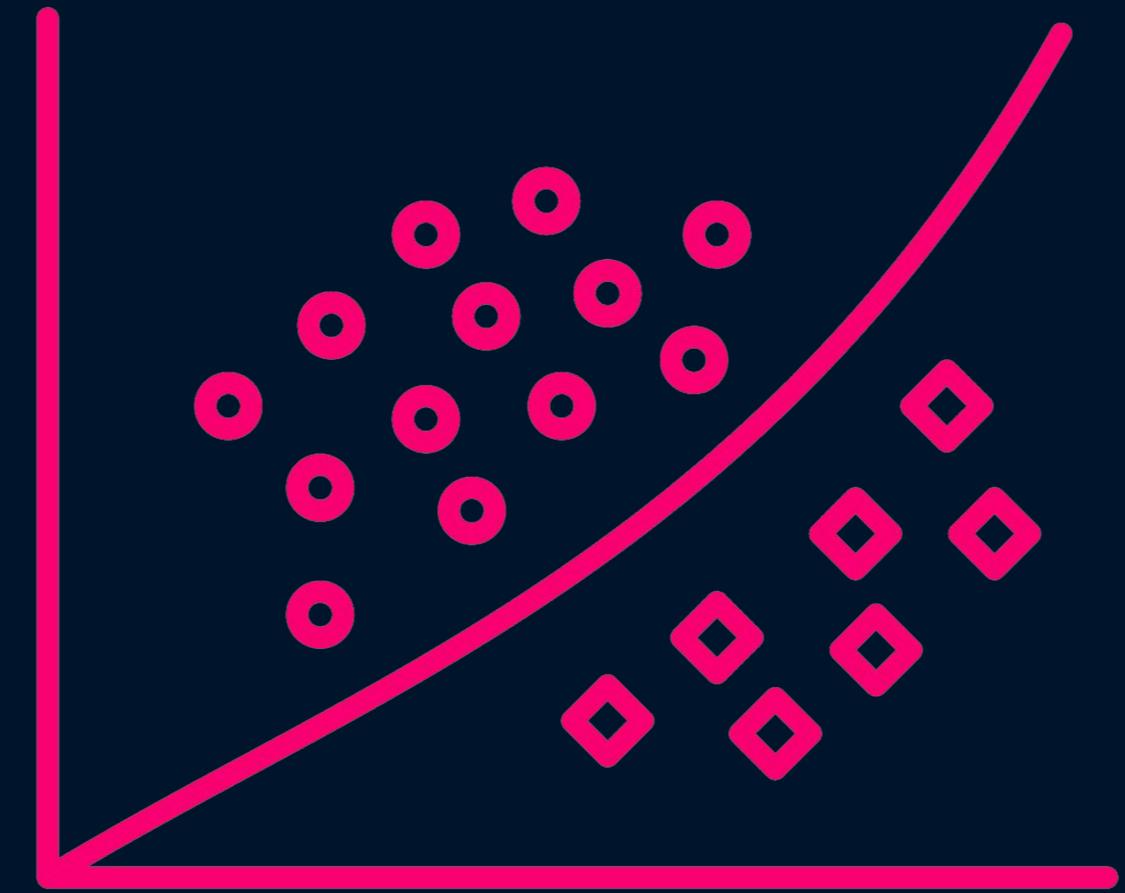


Initial Access	Execution	Persistence	Privilege Escalation	Defense Evasion	Credential Access	Discovery	Lateral Movement	Collection	Exfiltration	Command And Control
10 items	31 items	56 items	28 items	59 items	20 items	19 items	17 items	13 items	9 items	21 items
Drive-by Compromise	AppleScript	.bash_profile and .bashrc	Access Token Manipulation	Access Token Manipulation	Account Manipulation	Account Discovery	AppleScript	Audio Capture	Automated Exfiltration	Commonly Used Port
Exploit Public-Facing Application	CMSTP	Accessibility Features	Accessibility Features	Binary Padding	Bash History	Application Window Discovery	Application Deployment Software	Automated Collection	Data Compressed	Communication Through Removable Media
Hardware Additions	Command-Line Interface	AppCert DLLs	AppCert DLLs	BITS Jobs	Brute Force	Browser Bookmark Discovery	Distributed Component Object Model	Clipboard Data	Data Encrypted	Connection Proxy
Replication Through Removable Media	Control Panel Items	AppInit DLLs	AppInit DLLs	Bypass User Account Control	Credential Dumping	Credentials in Files	File and Directory	Exploitation of Remote Services	Data from Information Repositories	Data Transfer Size Limits
Spearphishing Attachment	Dynamic Data Exchange	Application Shimming	Application Shimming	Clear Command History	Credentials in Registry	File and Directory Discovery	Exploitation Over Alternative Protocol	Data from Local System	Data from Network	Custom Command and Control Protocol
Spearphishing Attachment	Execution through API	Authentication Package	CMSTP	Bypass User Account Control	Code Signing	Exploitation for Credential Access	Logon Scripts	Logon Scripts	Exfiltration Over Alternative Protocol	Custom Cryptographic Protocol
Spearphishing Link	Execution through Module Load	EVN Jobs	DLL Search Order Hijacking	Component Firmware	Forced Authentication	Network Service Scanning	Pass the Hash	Network Share	Exfiltration Over Shared Drive	Command and Control
Spearphishing via Service	Exploitation for Client Execution	Browser Extensions	DLL Hijacking	Component Object Model	Hijacking	Network Share Discovery	Pass the Ticket	Pass the Ticket	Data from Removable Media	Data Encoding
Supply Chain Compromise	Graphical User Interface	Change Default File Association	Dylib Hijacking	Control Panel Items	Forced Authentication	Network Share Discovery	Remote Desktop Protocol	Remote Desktop Protocol	Data Staged	Exfiltration Over Other Network Medium
Trusted Relationship	InstallUtil	Component Firmware	Exploitation for Privilege Escalation	DCShadow	Input Capture	>Password Policy Discovery	Peripheral Device Discovery	Remote File Copy	Email Collection	Fallback Channels
Valid Accounts	Launchctl	Component Object Model	Extra Window Memory Injection	Deobfuscate/Decode Files or Information	Input Prompt	Peripherals	Remote Services	Remote Services	Input Capture	Multi-hop Proxy
	Local Job Scheduling	Hijacking	File System Permissions Weakness	Kerberoasting	Process Discovery	Replication Through Removable Media	Replication Through Removable Media	Replication Through Removable Media	Man in the Browser	Scheduled Transfer
	LSASS Driver	Create Account	File System Permissions Weakness	Keychain	Replication Through Removable Media	Screen Capture	Screen Capture	Screen Capture	Screen Capture	Multiband Communication
	Mshta	DLL Search Order Hijacking	File System Permissions Weakness	Disabling Security Tools	Shared Webroot	Video Capture	Video Capture	Video Capture	Video Capture	Multilayer Encryption
	PowerShell	Dylib Hijacking	File System Permissions Weakness	DLL Search Order Hijacking	Process Discovery	SSH Hijacking	SSH Hijacking	SSH Hijacking	SSH Hijacking	Port Knocking
	Regsvcs/Regasm	External Remote Services	Image File Execution Options Injection	Exploitation for Defense Evasion	Private Keys	Taint Shared Content	Taint Shared Content	Taint Shared Content	Taint Shared Content	Remote Access Tools
	Regsvr32	File System Permissions Weakness	Launch Daemon	Exploitation for Defense Evasion	>Password Filter DLL	Third-party Software	Third-party Software	Third-party Software	Third-party Software	Remote File Copy
	Rundll32	New Service	Extra Window Memory Injection	Private Keys	Security Software Discovery	Windows Admin Shares	Windows Admin Shares	Windows Admin Shares	Windows Admin Shares	Standard Application Layer Protocol
	Scheduled Task	Hidden Files and Directories	Path Interception	File System Logical Offsets	Replication Through Removable Media	Windows Remote Management	Windows Remote Management	Windows Remote Management	Windows Remote Management	Standard Cryptographic Protocol
	Scripting	Hooking	Plist Modification	Gatekeeper Bypass	System Information Discovery	System Network Configuration Discovery	System Network Configuration Discovery	System Network Configuration Discovery	System Network Configuration Discovery	Third-Party Network Layer Protocol
	Service Execution	Hypervisor	Port Monitors	Hidden Files and Directories	Two-Factor Authentication Interception	System Network Connections Discovery	Incoming Network Port			
	Signed Binary Proxy Execution	Process Injection	Hidden Users	Hidden Users	System Owner/User Discovery	Web Server				
	Signed Script Proxy Execution	Signed Script Proxy Execution	Scheduled Task	HISTCONTROL	System Service Discovery	Third-Party Network Layer Protocol				
	Source	Kernel Modules and Extensions	Service Registry Permissions Weakness	Image File Execution Options Injection	System Service Discovery	Third-Party Network Layer Protocol				
	Space after Filename	Launch Agent	Setuid and Setgid	System Service Discovery	System Service Discovery	System Service Discovery	System Service Discovery	System Service Discovery	System Service Discovery	Third-Party Network Layer Protocol

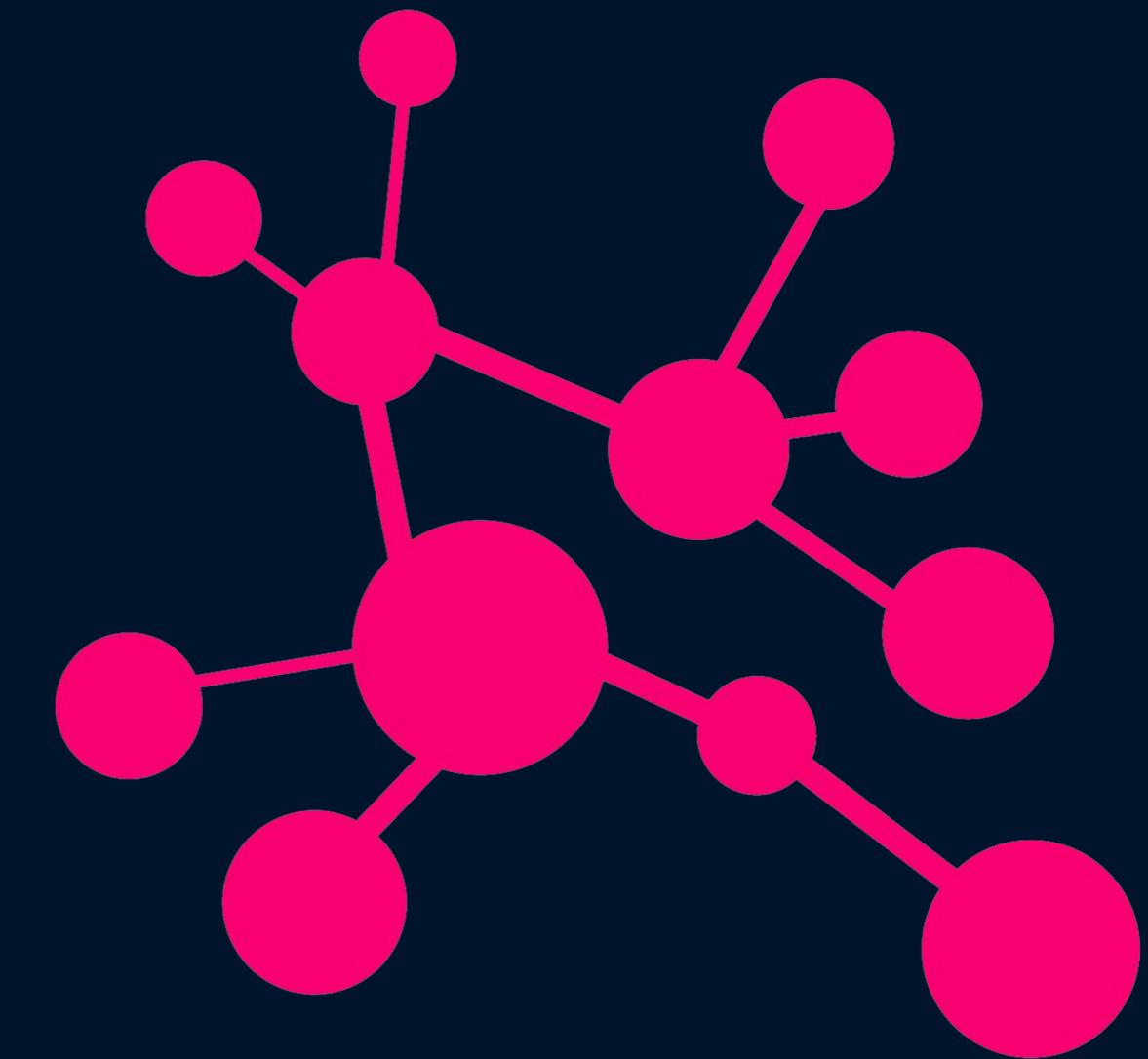
ATT&CK™



Semantic
Search



Classification



Knowledge
Representation

Search

Where is this?

Go



Relation: King's College London, Strand Campus (5747097)

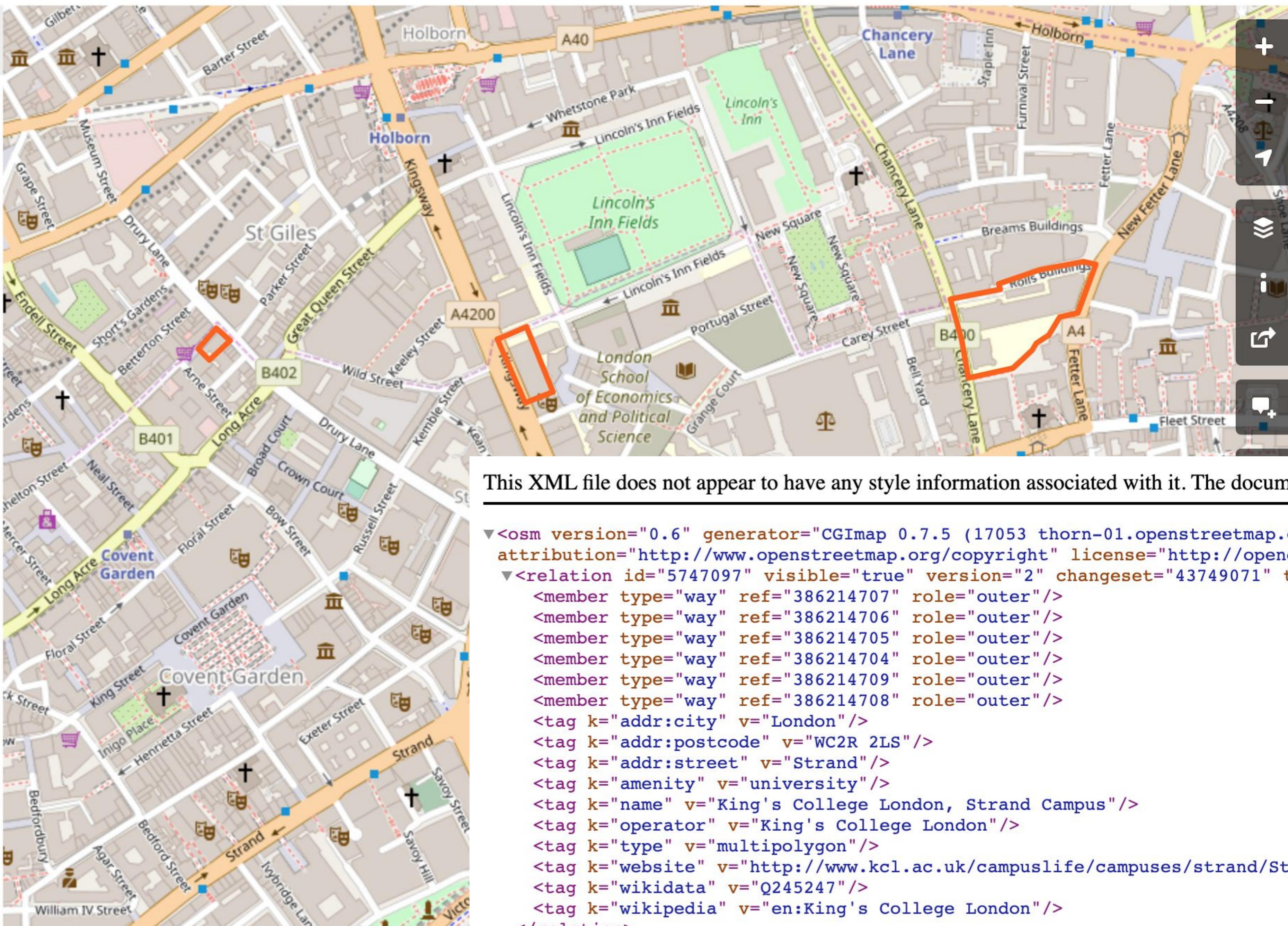
Set Wikidata ID

Edited almost 3 years ago by nyuriks

Version #2 · Changeset #43749071

Tags

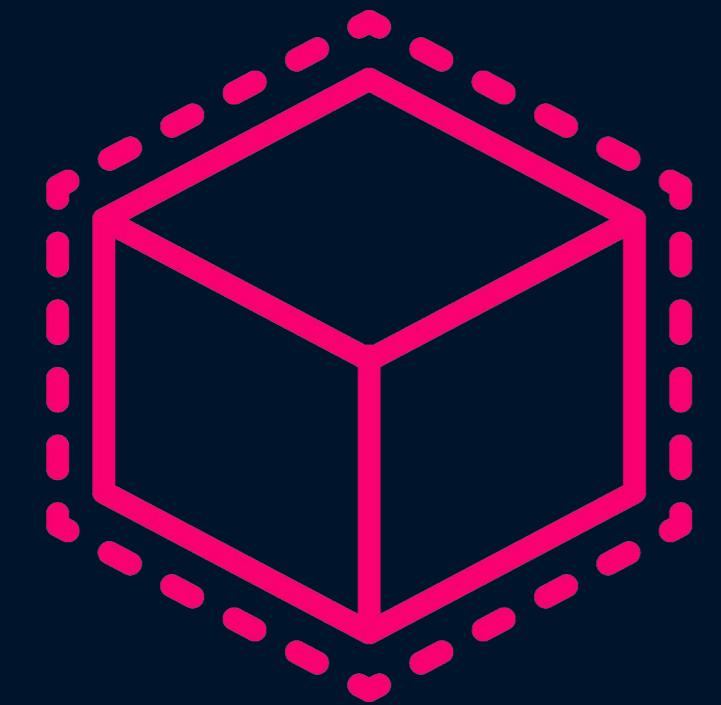
addr:city	London
addr:postcode	WC2R 2LS
addr:street	Strand
amenity	university
name	King's College London, Strand Campus
operator	King's College London
type	multipolygon
website	http://www.kcl.ac.uk/campuslife/campuses/strand/Strand.aspx
wikidata	Q245247
wikipedia	en:King's College London



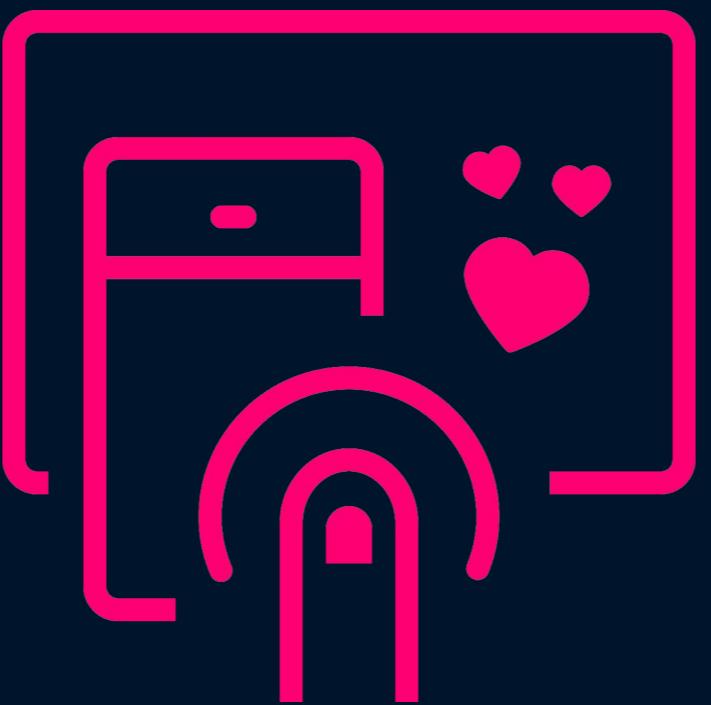
This XML file does not appear to have any style information associated with it. The document

```
▼<osm version="0.6" generator="CGImap 0.7.5 (17053 thorn-01.openstreetmap.org)" attribution="http://www.openstreetmap.org/copyright" license="http://opendatacommons.org/licenses/odbl/1.0/">▼<relation id="5747097" visible="true" version="2" changeset="43749071" type="multipolygon">
```

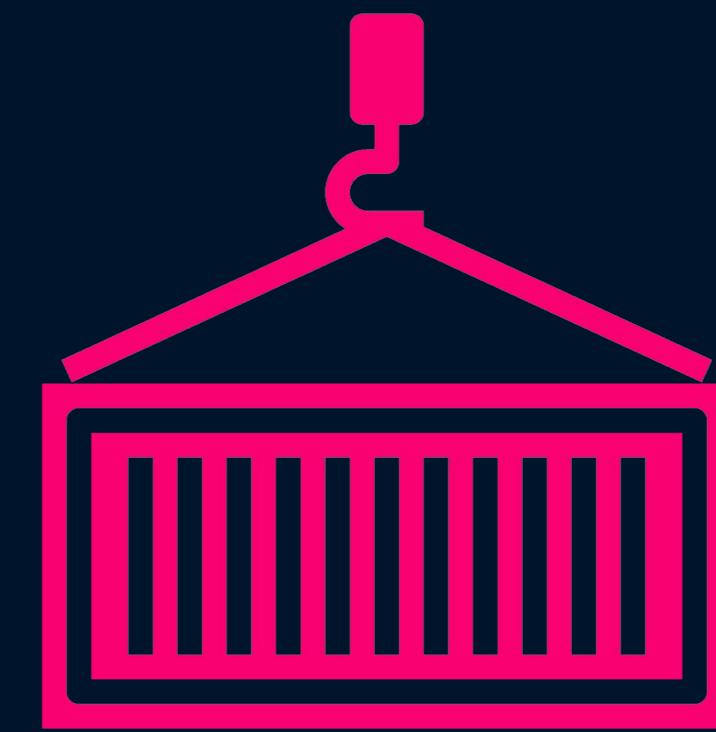
Developer Features



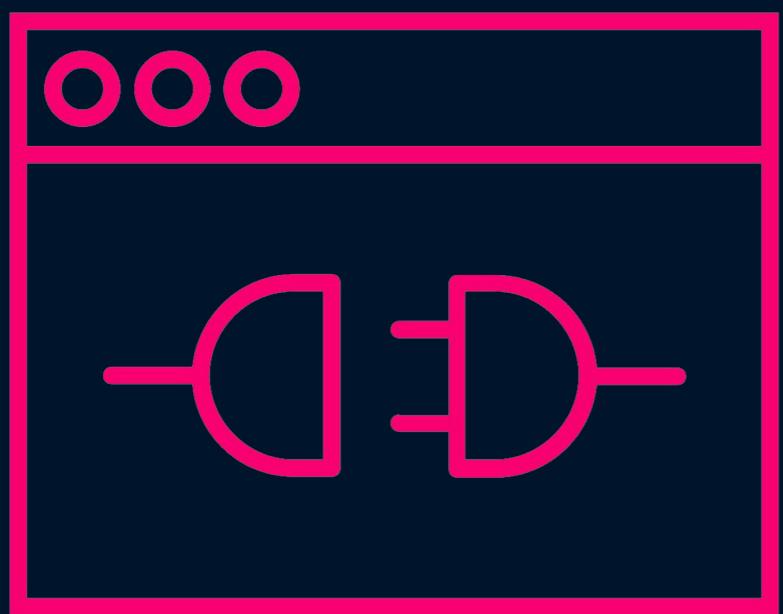
Contextuality



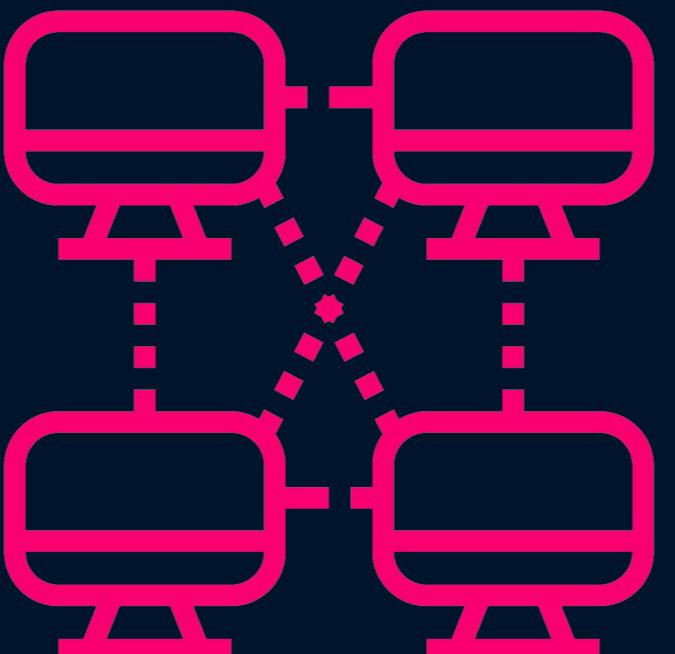
GraphQL



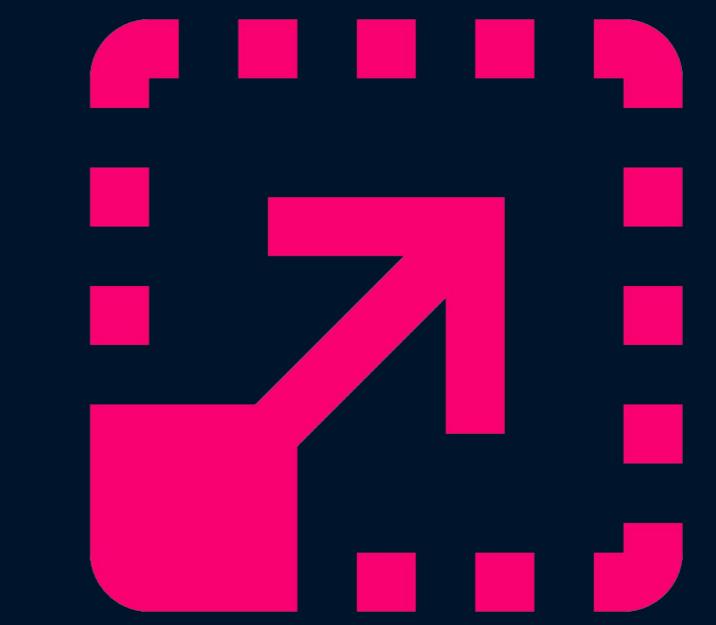
Containerized



HTTP API



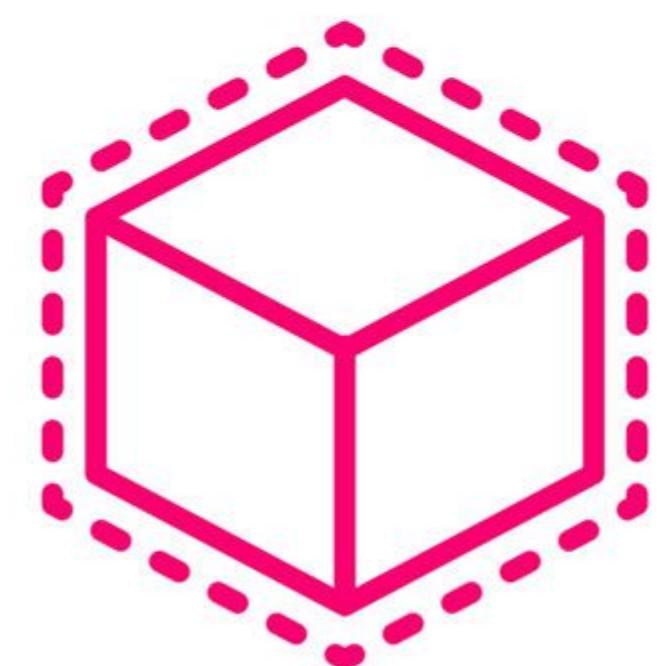
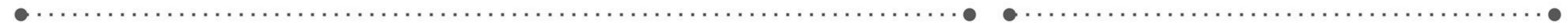
P2P Network



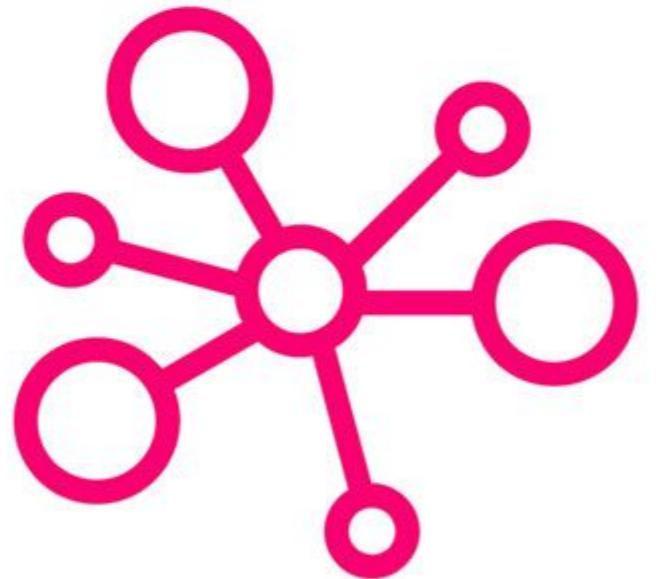
Scalable



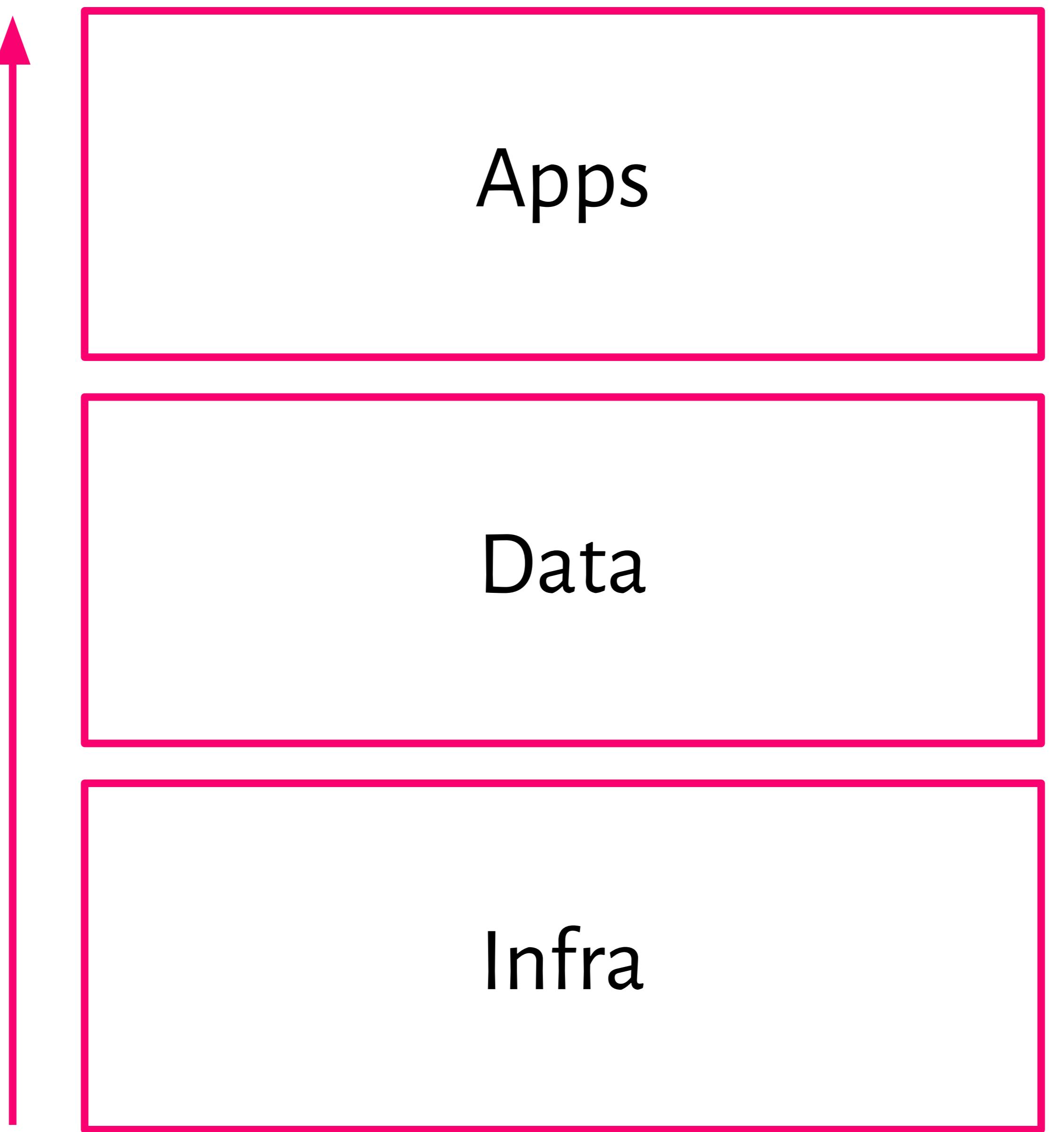
Knowledge Graph

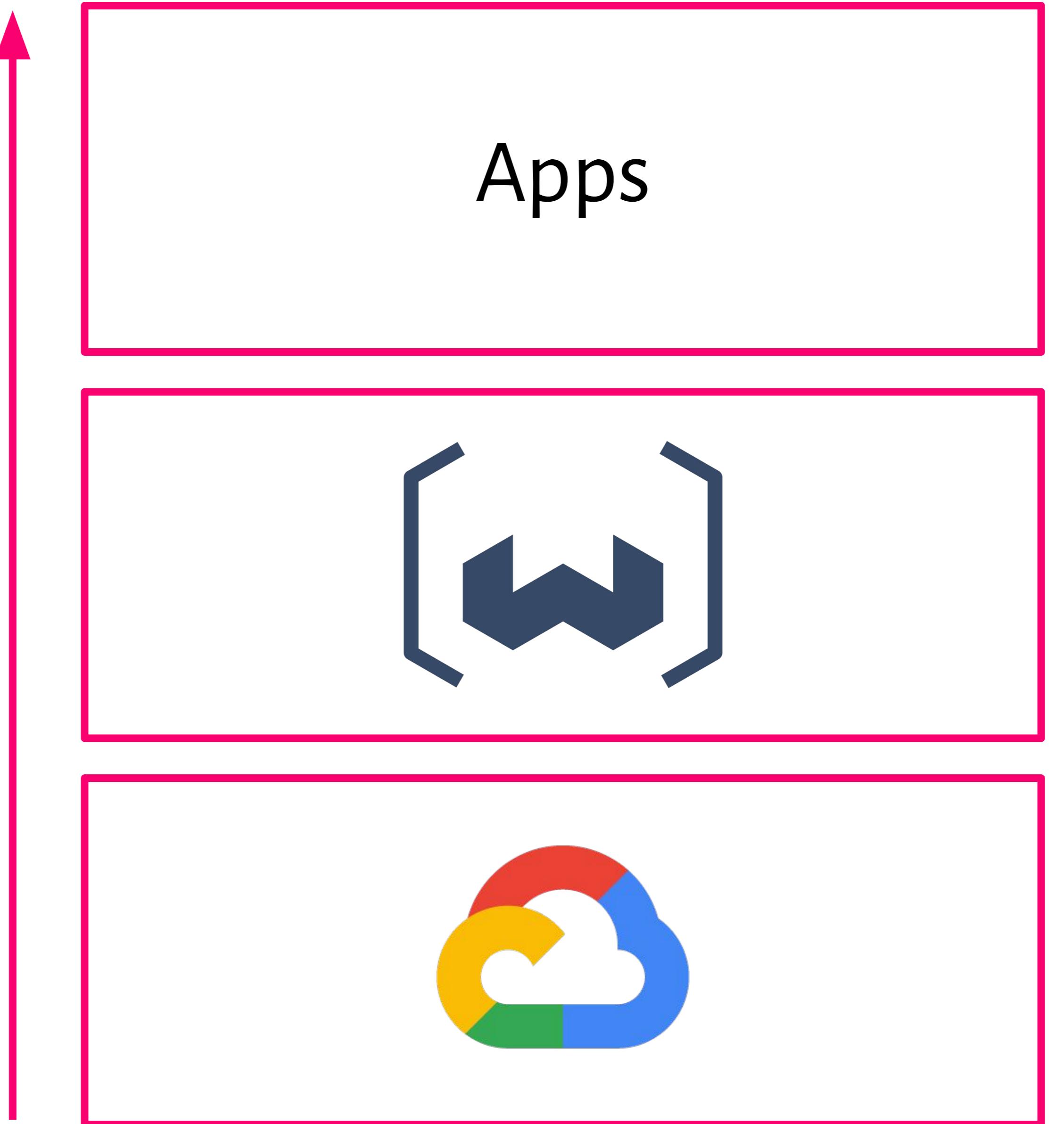


Contextionary

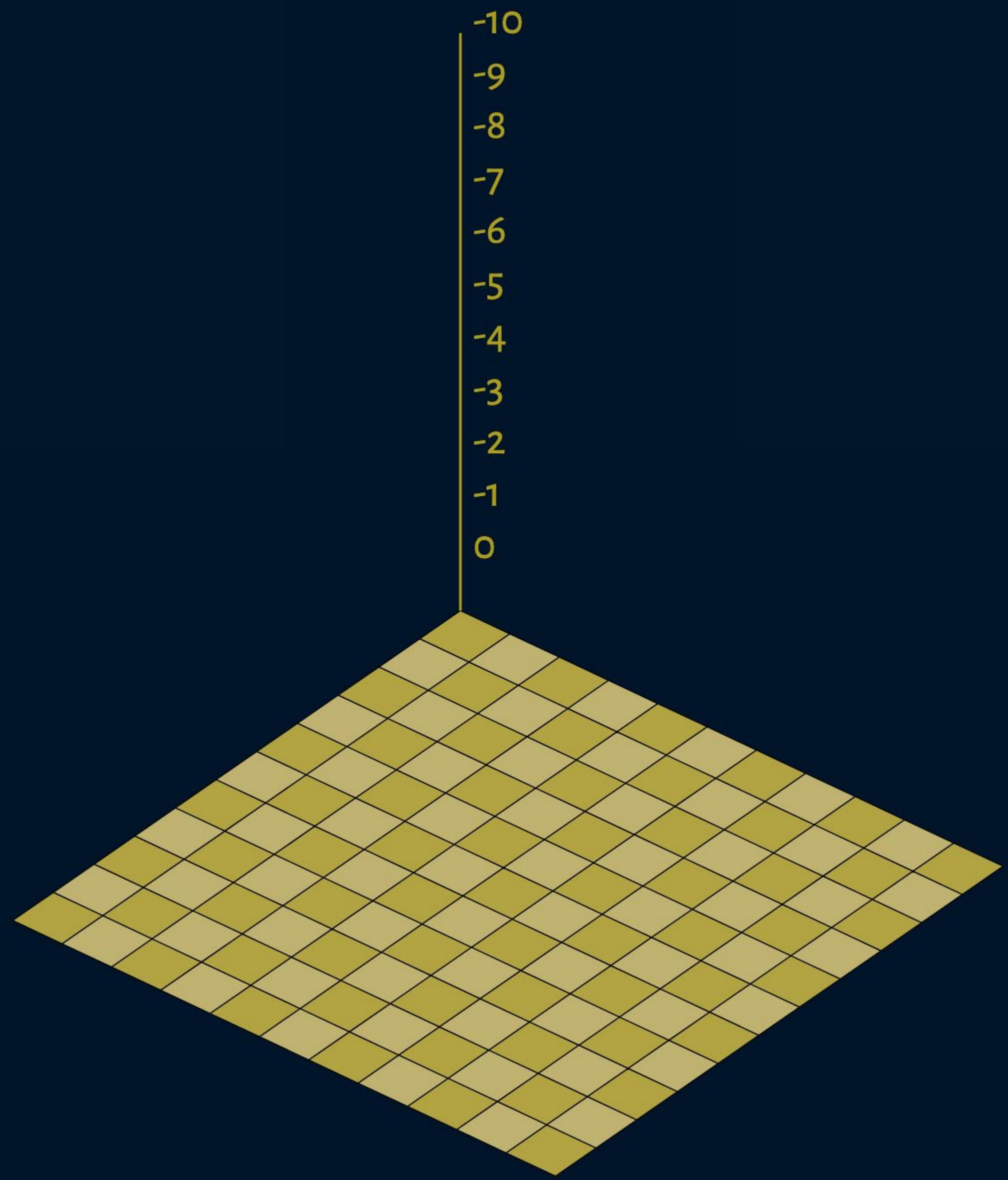


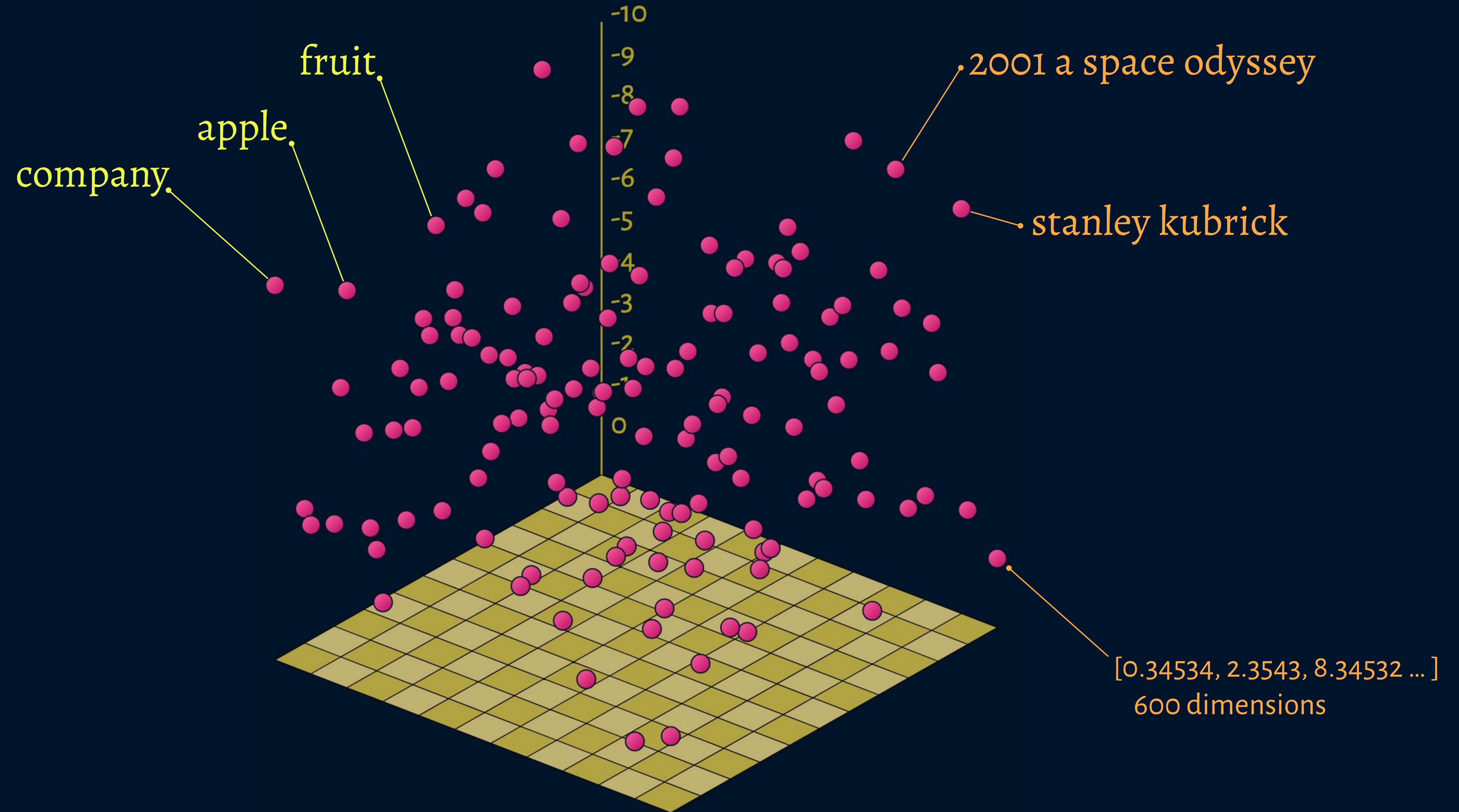
references





Weaviate's Contextionary





Company:

name: Apple

foundedIn: 1976

inCountry:

,\$cref": ...

hasCeo:

Person:

name: Tim Cook

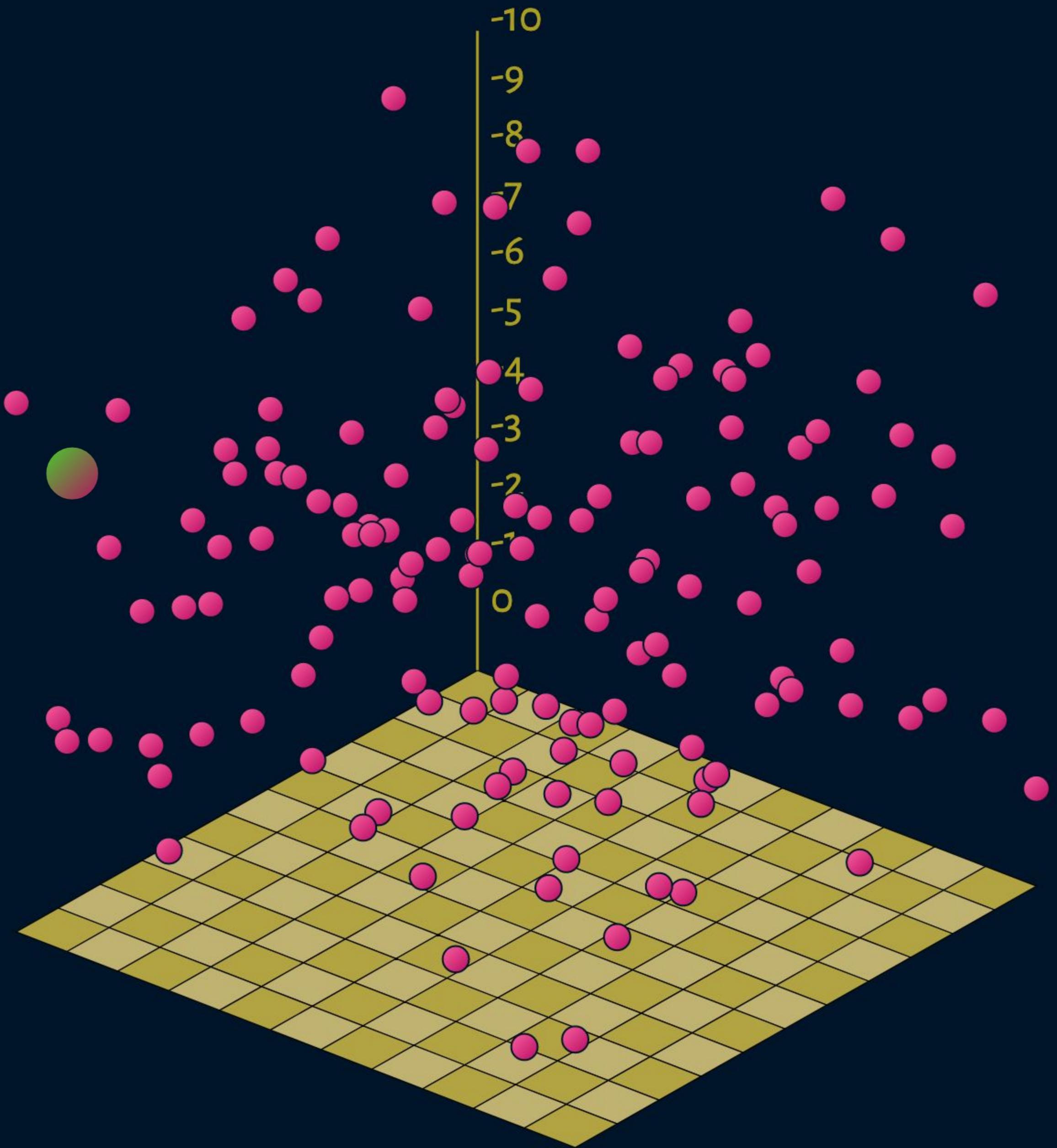


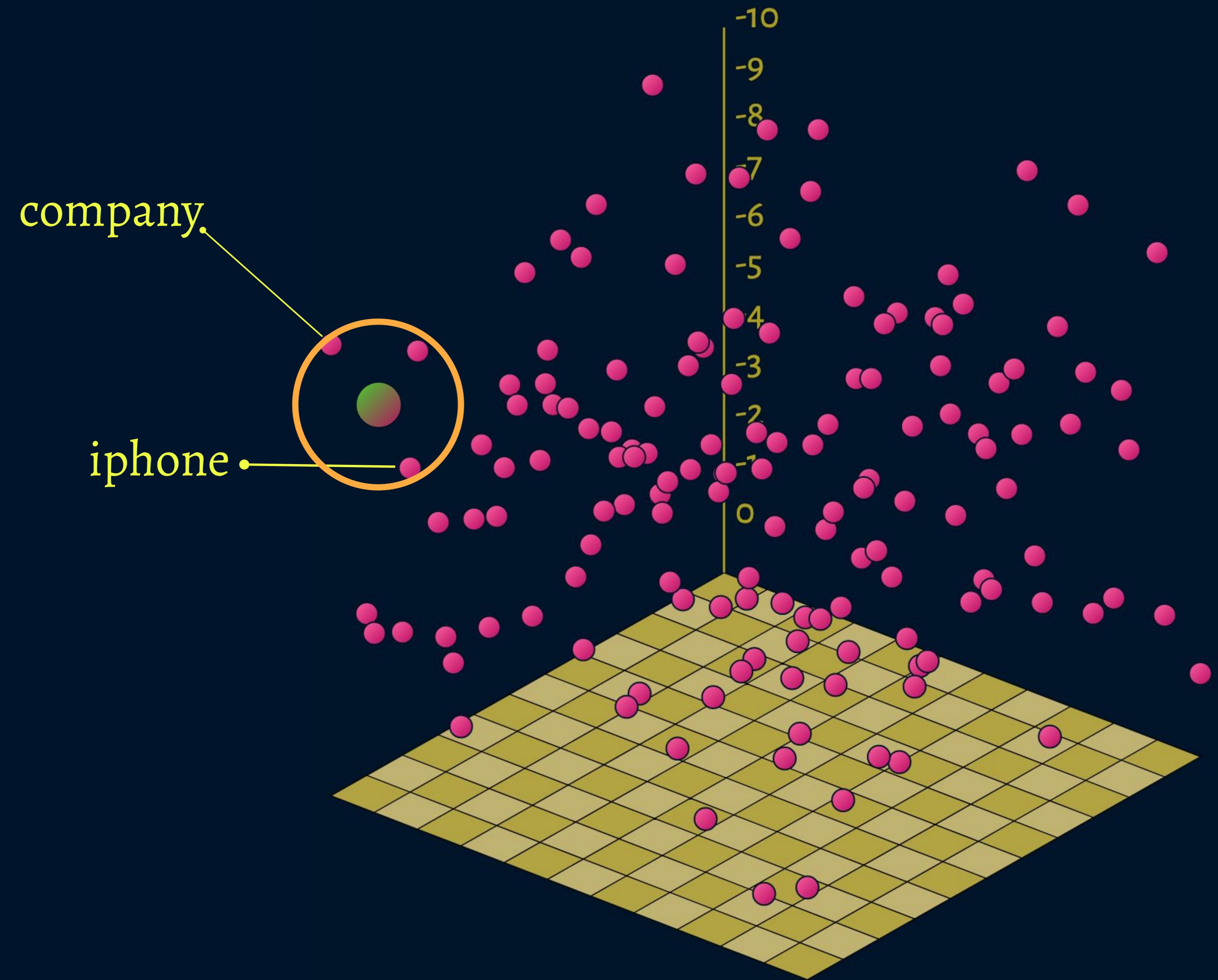
Company, name, Apple,
founded, in, 1976, in,
country, with, the, name,
United, States

Company, name, Apple,
founded, in, 1976, in,
country, with, the, name,
United, States



[0.34534, 2.3543, 8.34532 ...]





```
{  
  Get{  
    Things{  
      Company(explore:{  
        concepts: ["cola"]  
      }){  
        name  
      }  
    }  
  }  
}
```



```
{  
  "data": {  
    "Local": {  
      "Get": {  
        "Things": {  
          "Company": [  
            {  
              "name": "PepsiCo Inc."  
            },  
            {  
              "name": "Monster Beverage"  
            },  
            {  
              "name": "Coca-Cola Company"  
            }  
          ]  
        }  
      }  
    },  
    "errors": null  
  }  
}
```

```
{  
  Get{  
    Things{  
      Company(explore:{  
        concepts: ["Redmond"]  
      }){  
        name  
      }  
    }  
  }  
}
```

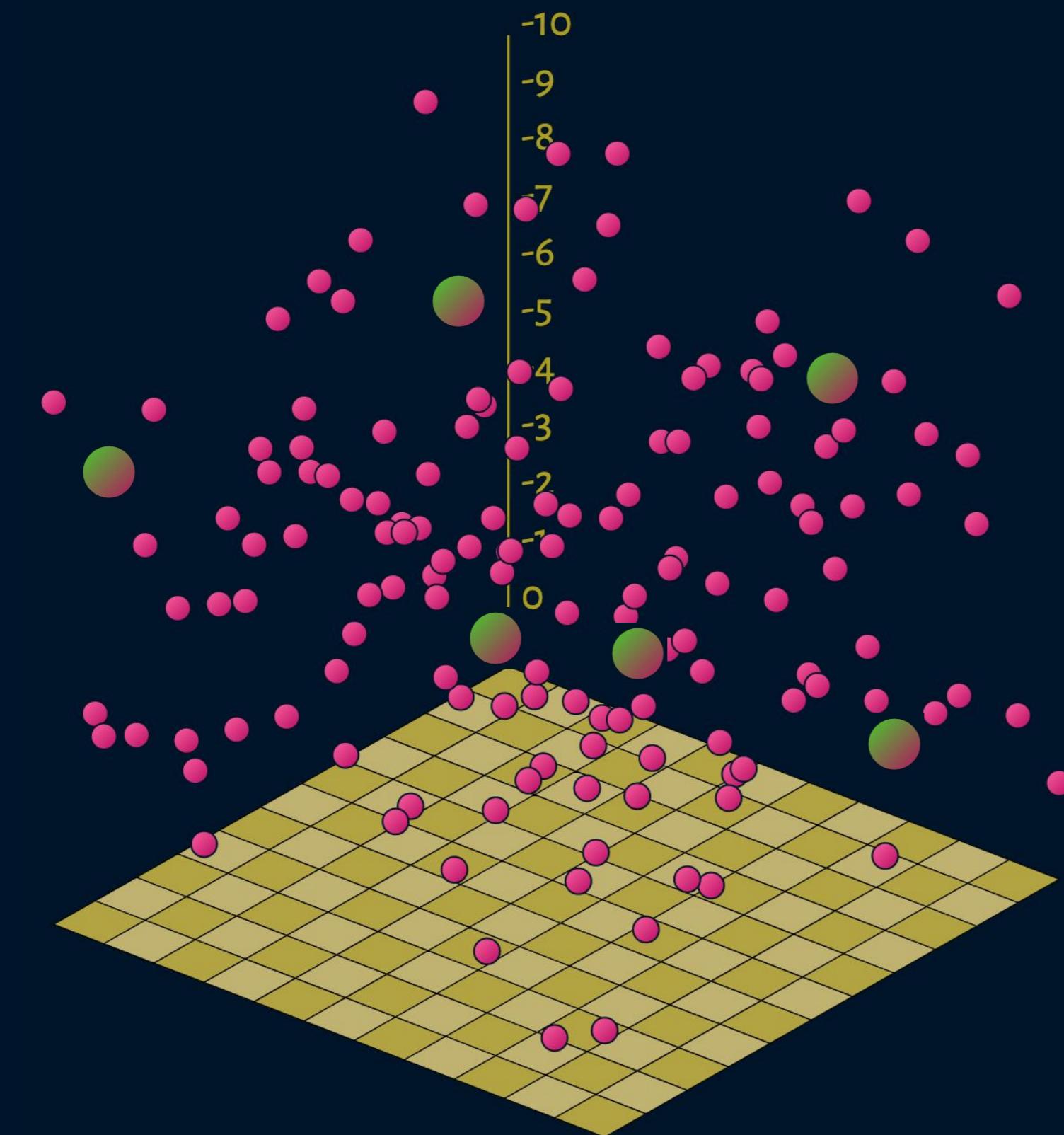


```
{  
  "data": {  
    "Get": {  
      "Things": {  
        "Company": [  
          {  
            "name": "Microsoft Corp."  
          }  
        ]  
      }  
    }  
  },  
  "errors": null  
}
```

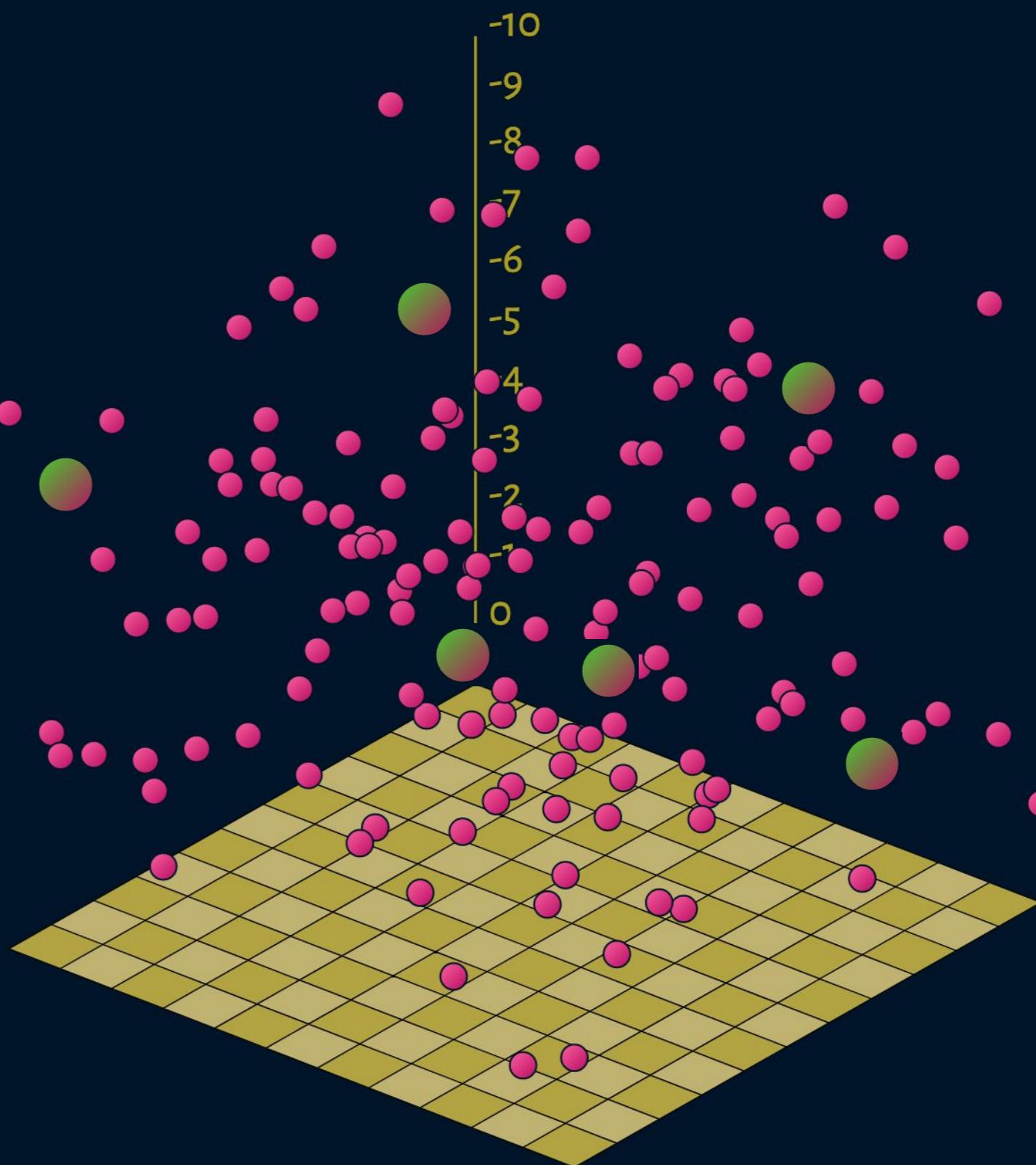
```
{  
  Explore(concepts: ["banking"]) {  
    beacon  
    certainty  
    className  
  }  
}
```

```
{  
  "data": {  
    "Local": {  
      "Explore": [  
        {  
          "beacon": "weaviate://localhost/things/742...28bd",  
          "certainty": 0.8000992,  
          "className": "Company"  
        }  
      ]  
    }  
  }  
}
```

Weaviate P2P *aka* Knowledge Networks



`weaviate://peer001.semi.network`



`weaviate://peer002.semi.network`

```
{  
  Network{  
    Explore(concepts: ["banking"]) {  
      beacon  
      certainty  
      className  
    }  
  }  
}
```

```
{  
  "data": {  
    "Network": {  
      "Explore": [  
        {  
          "beacon": "weaviate://localhost/things/742...28bd",  
          "certainty": 0.8000992,  
          "className": "Company"  
        },  
        {  
          "beacon": "weaviate://peer002.semi.network/things/f20f...225",  
          "certainty": 0.786739,  
          "className": "Business"  
        }  
      ]  
    }  
  }  
}
```

```
{  
  "data": {  
    "Network": {  
      "Explore": [  
        {  
          "beacon": "weaviate://localhost/things/742...28bd",  
          "certainty": 0.8000992,  
          "className": "Company"  
        },  
        {  
          "beacon": "weaviate://peer002.semi.network/things/f20f...225",  
          "certainty": 0.786739,  
          "className": "Business"  
        }  
      ]  
    }  
  }  
}
```

www.semi.technology

Thank you!

www.semi.technology

bob@semi.technology
@bobvanluijt