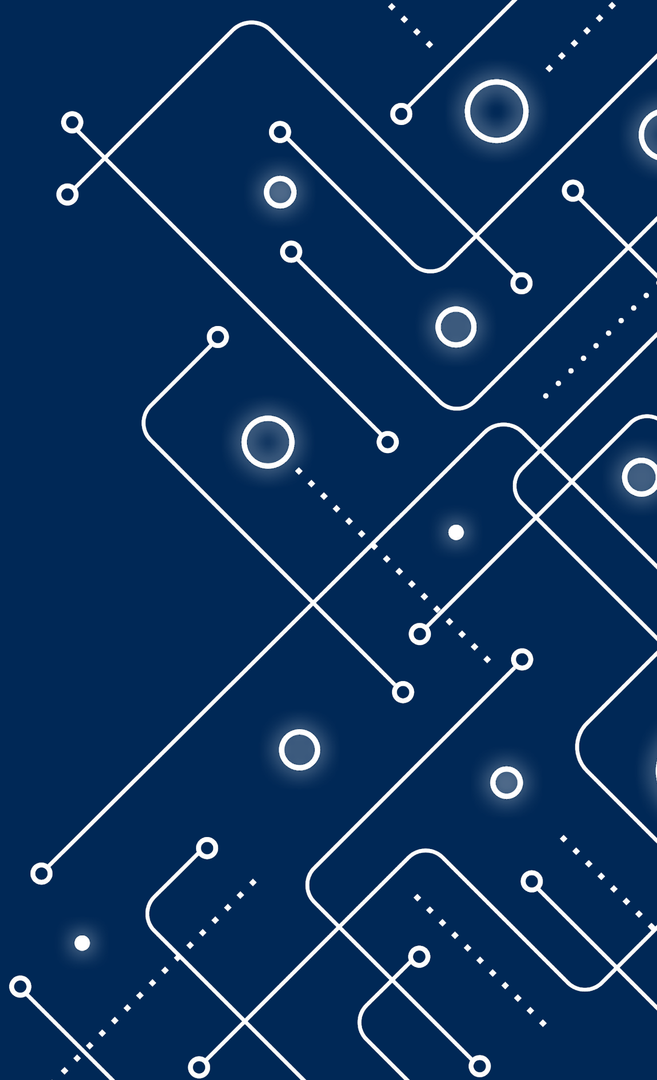
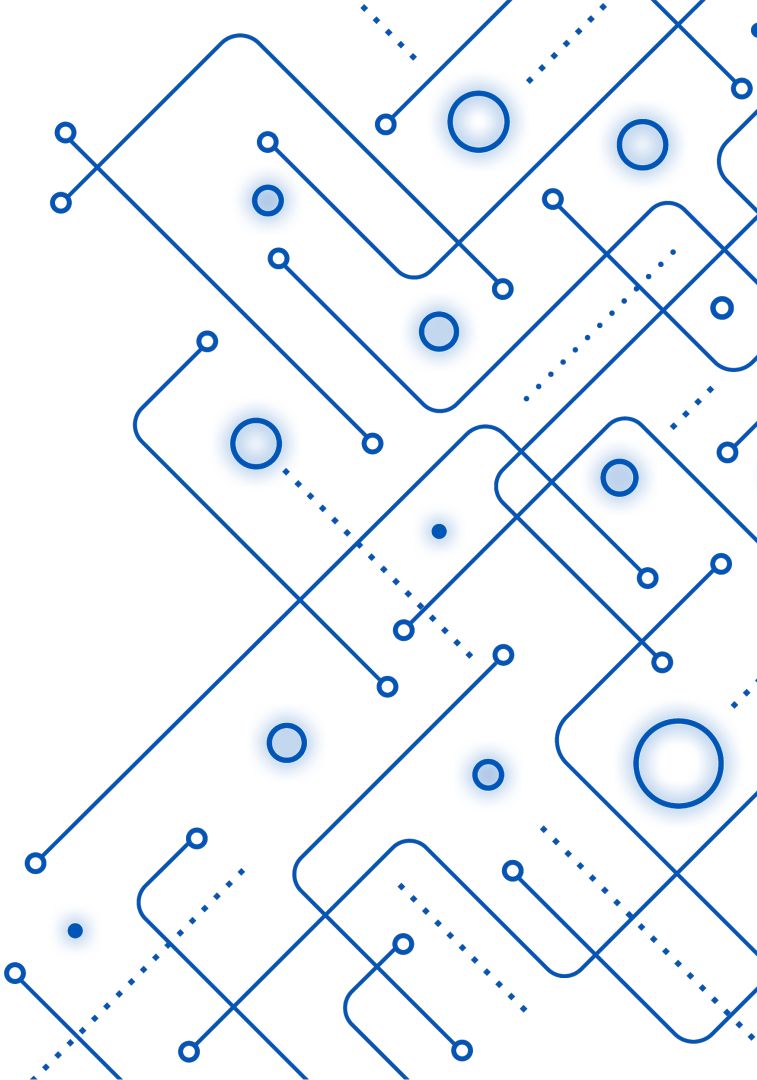
TerminusDB

Database Design



Structured, meaningful data for rapid delivery of data driven applications.

Join the data-centric revolution!



TerminusDB

A Database For The Web Age

Access structured data, in URLs, using technologies you know and trust

TerminusDB

Industrial Strength

ACID compliance and enterprise grade functionality

TerminusDB

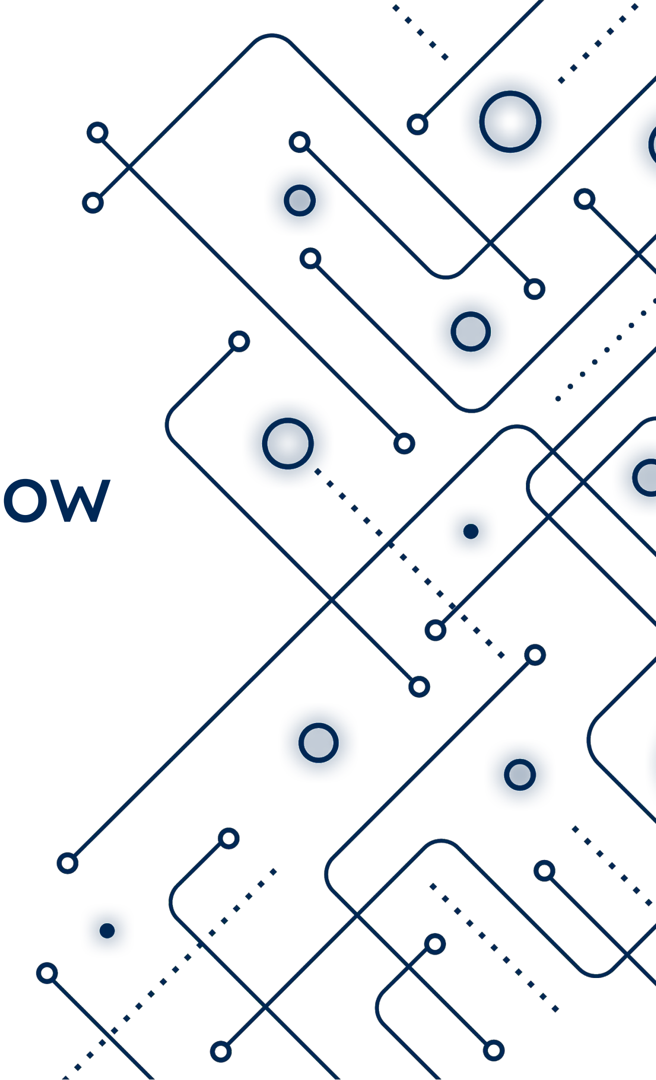
TerminusDB Provides Answers

Answer complex questions relating to time, relationships, connections and geography

TerminusDB

A Database For All

TerminusDB is open source, now and forever



TerminusDB

TerminusDB Is The Law

Control data according to real-world rules

TerminusDB

Data That Describes Itself

ACID compliance and enterprise grade functionality

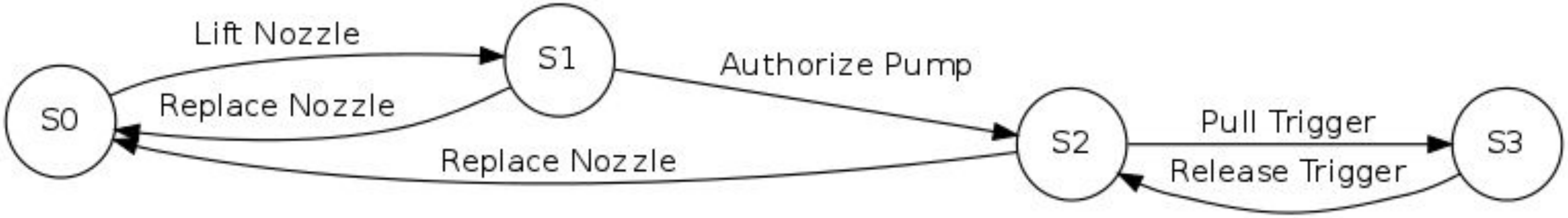
TerminusDB

TerminusDB Is A Git for Data

We allow you to branch, merge, time-travel and roll-back in your data

TerminusDB

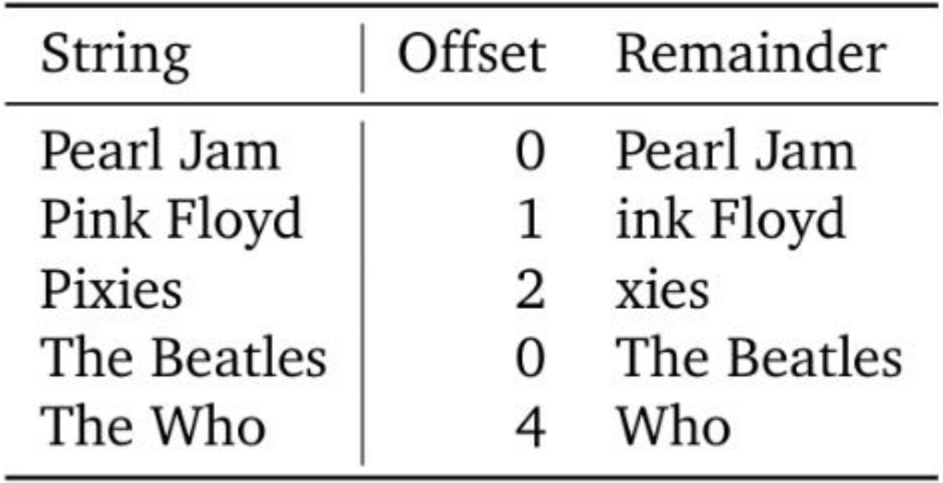
We represent data as graphs (triples)



S0 — Lift Nozzle → S1
S1 — Replace Nozzle → S0
S1 — Authorize Pump → S2
S2 — Replace Nozzle → S0
S2 — Pull Trigger → S3
S3 — Release Trigger → S2

We represent graphs with succinct data-structures

More details in: "Succinct Data Structures and Delta Encoding for Modern Databases"

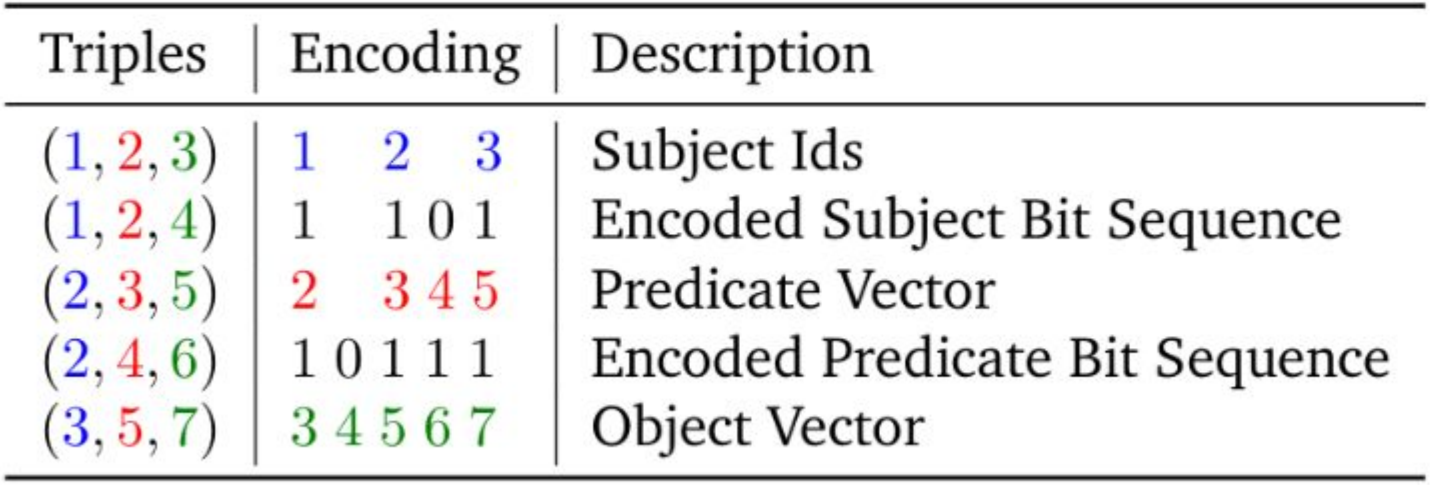


String	Offset	Remainder
Pearl Jam	0	Pearl Jam
Pink Floyd	1	ink Floyd
Pixies	2	xies
The Beatles	0	The Beatles
The Who	4	Who

Table 1: *Plain Front Coding Dictionary*

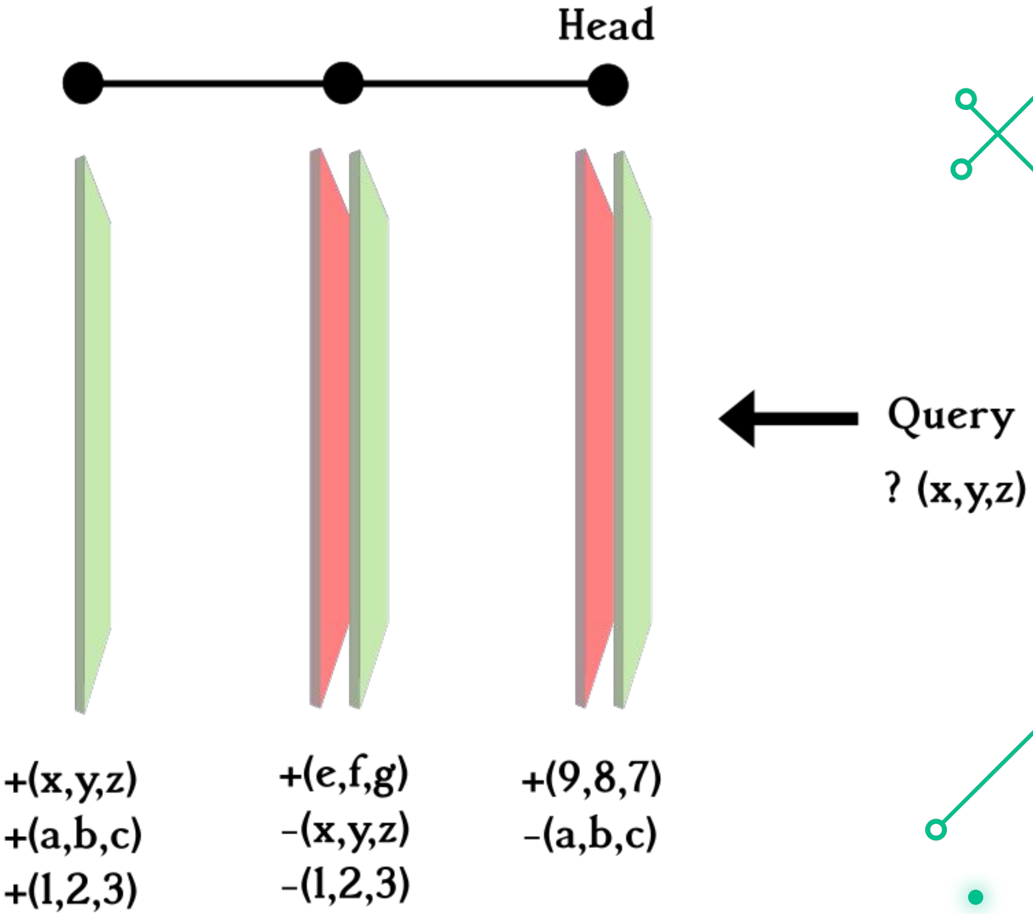
We represent graphs with succinct data-structures

More details in: "Succinct Data Structures and Delta Encoding for Modern Databases"



Triples	Encoding	Description
$(1, 2, 3)$	1 2 3	Subject Ids
$(1, 2, 4)$	1 1 0 1	Encoded Subject Bit Sequence
$(2, 3, 5)$	2 3 4 5	Predicate Vector
$(2, 4, 6)$	1 0 1 1 1	Encoded Predicate Bit Sequence
$(3, 5, 7)$	3 4 5 6 7	Object Vector

Table 2: *Succinct Graph Representation*



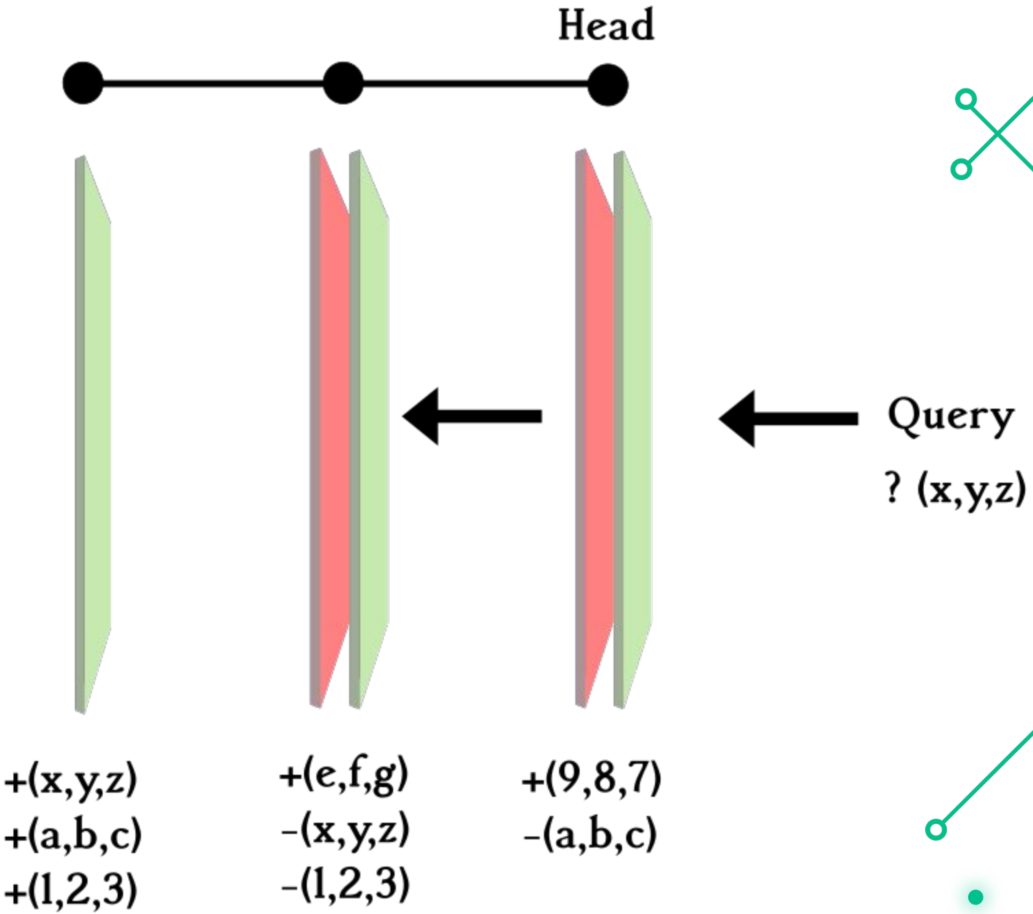
Head

+(x,y,z)
+(a,b,c)
+(1,2,3)

+(e,f,g)
-(x,y,z)
-(1,2,3)

+(9,8,7)
-(a,b,c)

Query
? (x,y,z)



Head

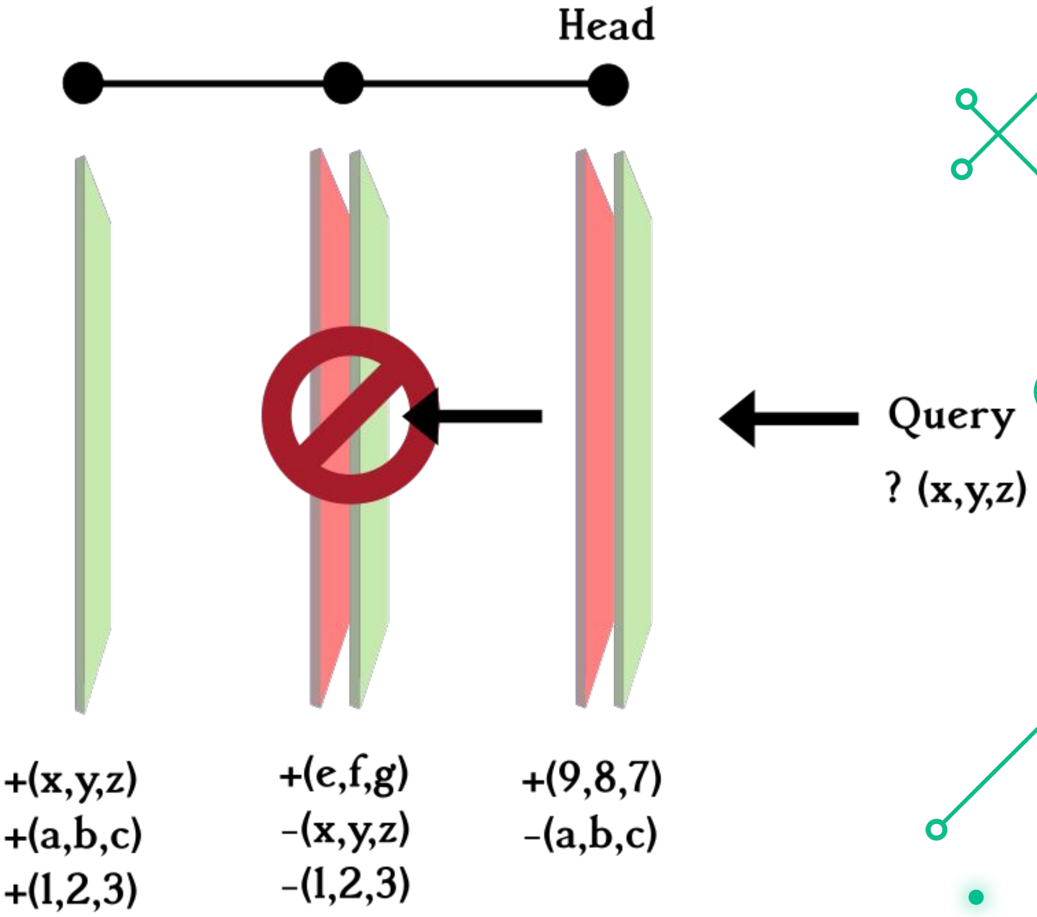
Query

? (x,y,z)

+(x,y,z)
+(a,b,c)
+(1,2,3)

+(e,f,g)
–(x,y,z)
–(1,2,3)

+(9,8,7)
–(a,b,c)



Head

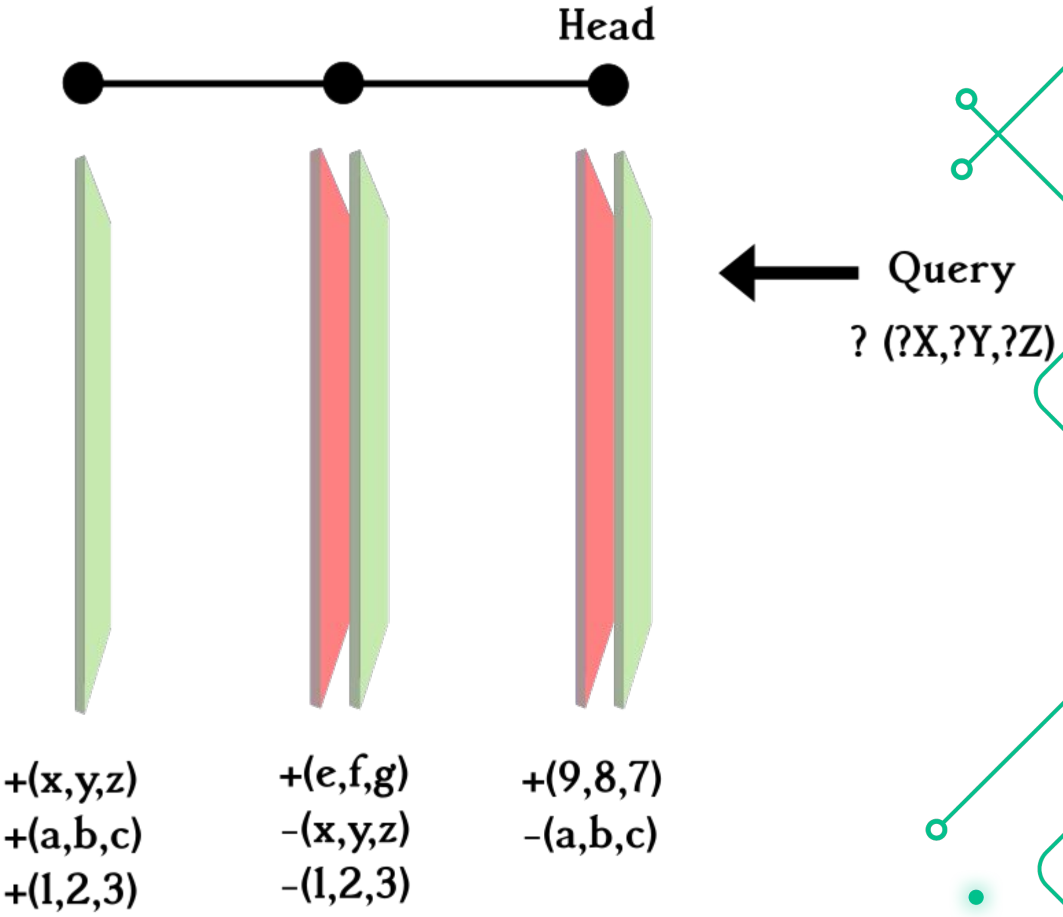
Query

? (x,y,z)

+(x,y,z)
+(a,b,c)
+(1,2,3)

+(e,f,g)
-(x,y,z)
-(1,2,3)

+(9,8,7)
-(a,b,c)



Head

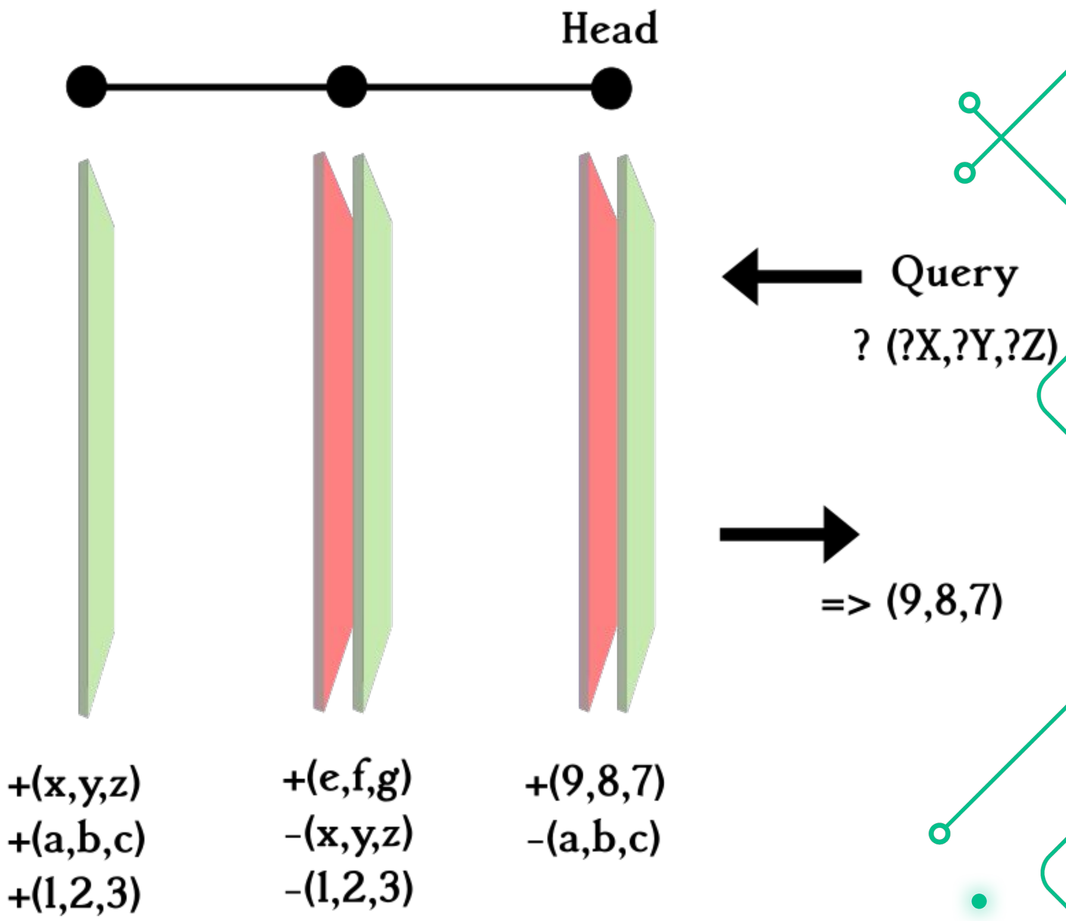
Query

? (?X,?Y,?Z)

+(x,y,z)
+(a,b,c)
+(1,2,3)

+(e,f,g)
-(x,y,z)
-(1,2,3)

+(9,8,7)
-(a,b,c)



Head

+(x,y,z)
+(a,b,c)
+(1,2,3)

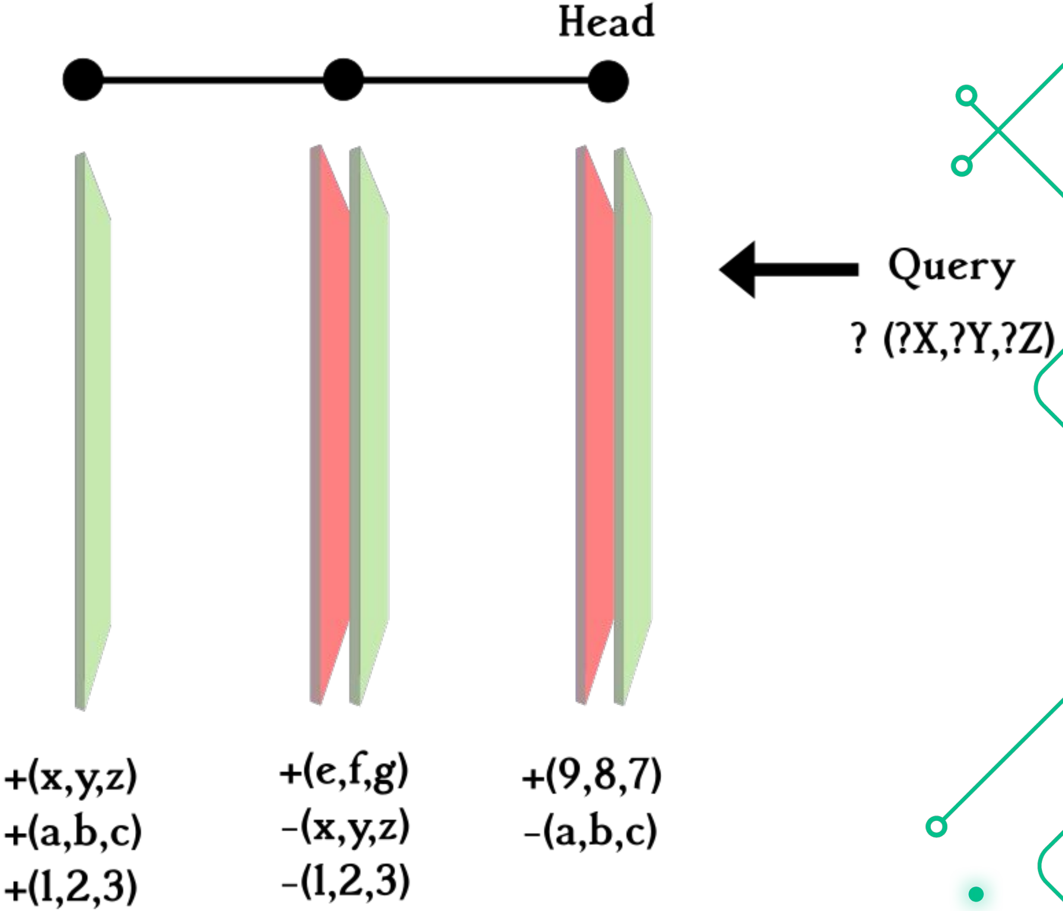
+(e,f,g)
-(x,y,z)
-(1,2,3)

+(9,8,7)
-(a,b,c)

Query

? (?X,?Y,?Z)

=> (9,8,7)



Head

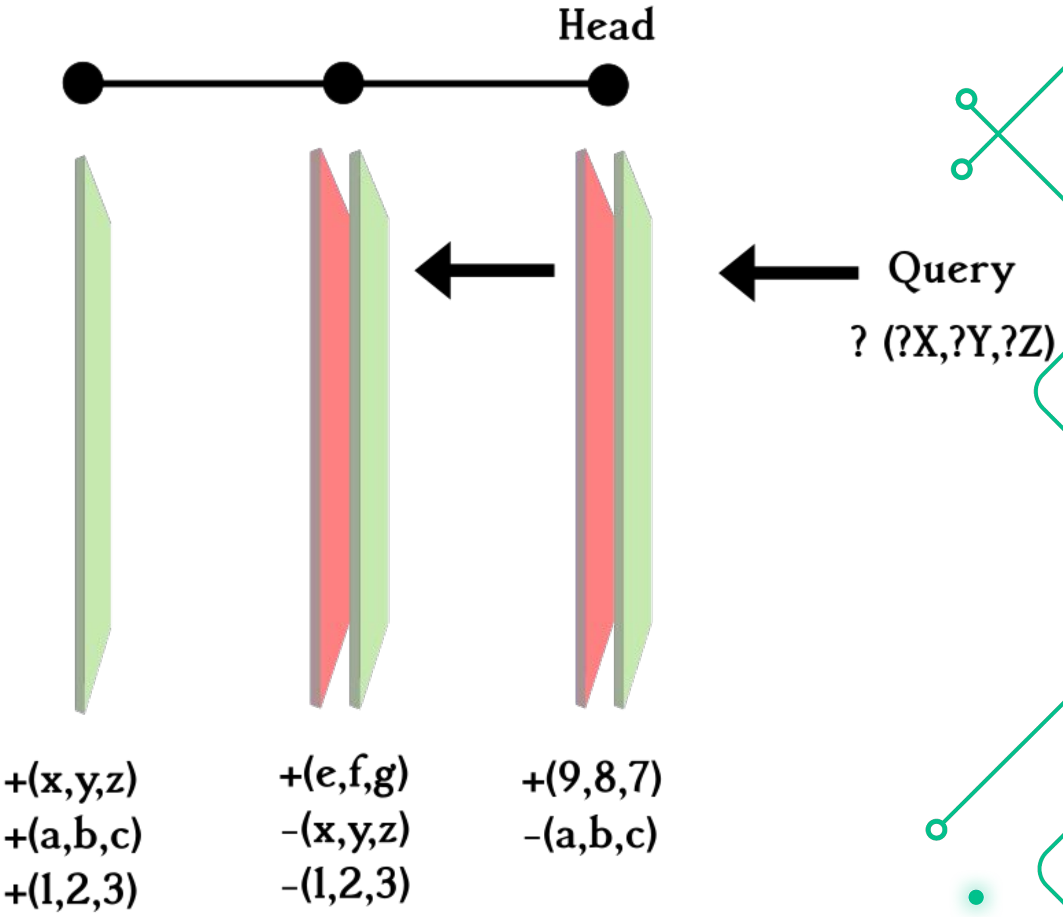
Query

? (?X,?Y,?Z)

+(x,y,z)
+(a,b,c)
+(1,2,3)

+(e,f,g)
–(x,y,z)
–(1,2,3)

+(9,8,7)
–(a,b,c)



Head

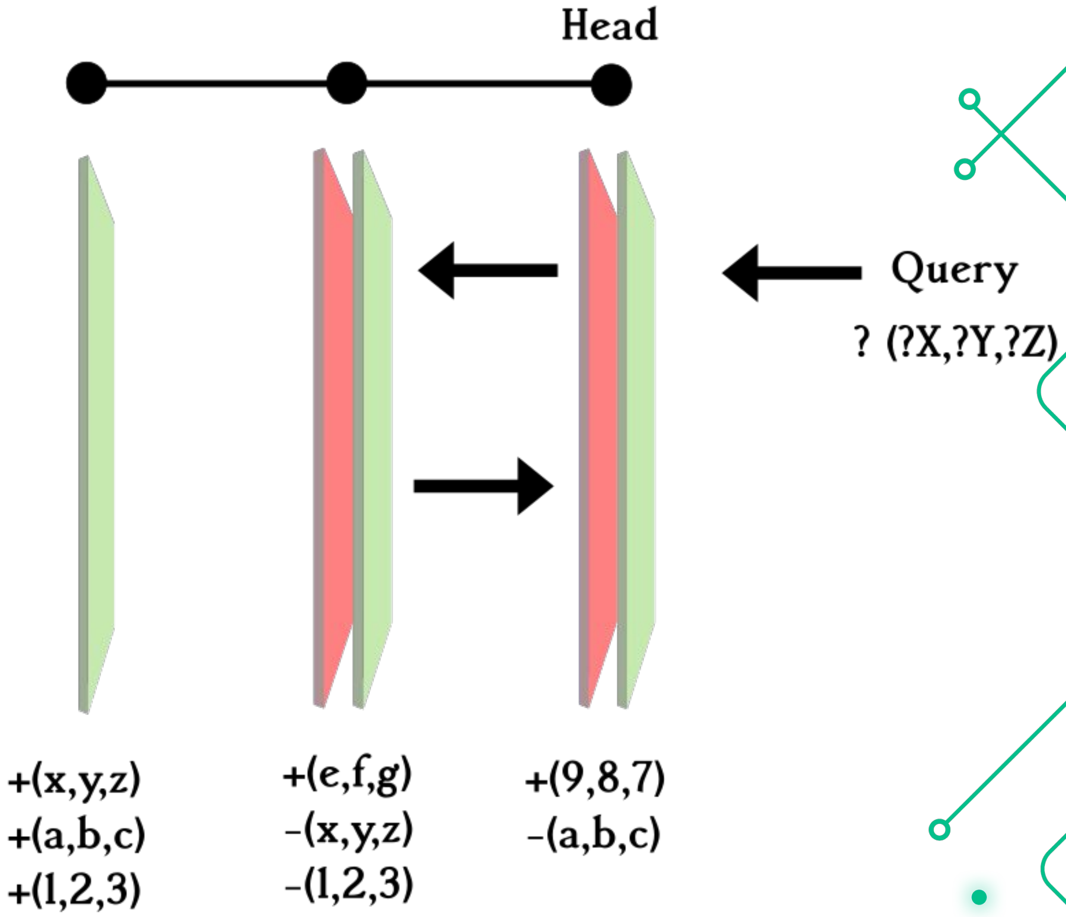
Query

? (?X,?Y,?Z)

+(x,y,z)
+(a,b,c)
+(1,2,3)

+(e,f,g)
–(x,y,z)
–(1,2,3)

+(9,8,7)
–(a,b,c)



Head

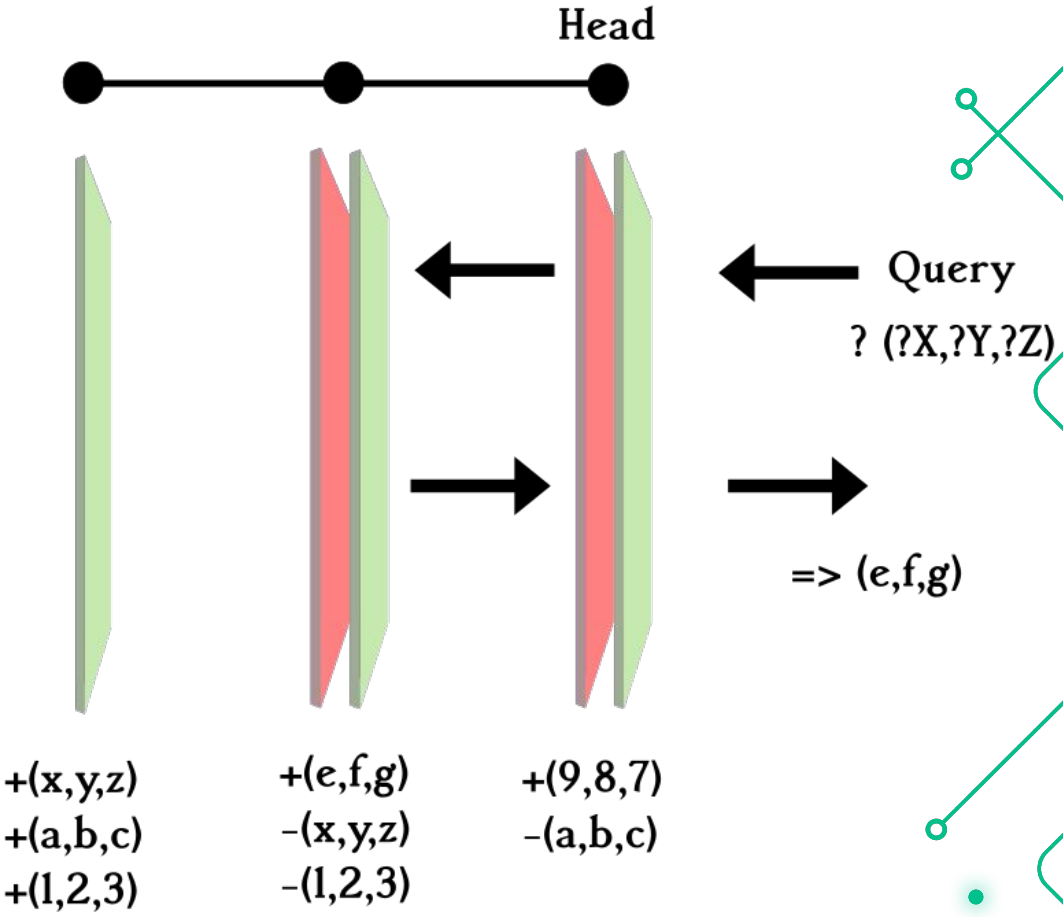
Query

? (?X,?Y,?Z)

+(x,y,z)
+(a,b,c)
+(1,2,3)

+(e,f,g)
–(x,y,z)
–(1,2,3)

+(9,8,7)
–(a,b,c)



Head

Query

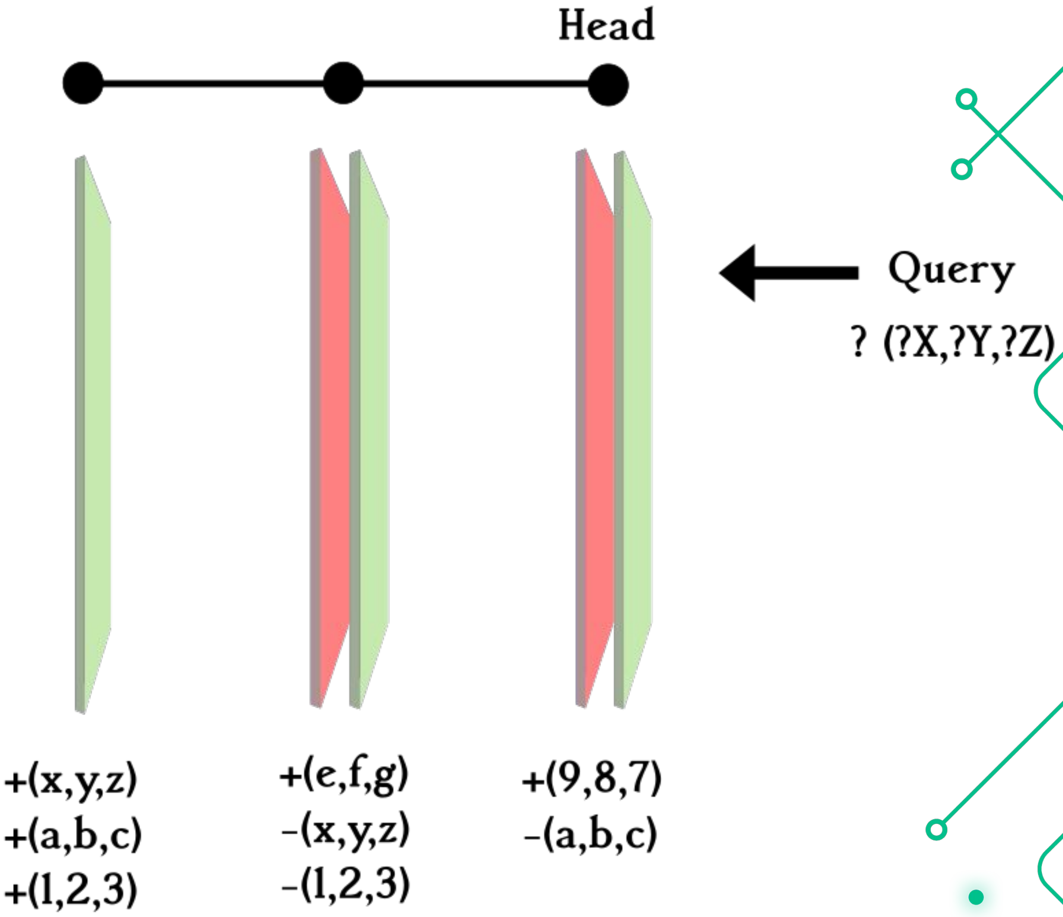
? (?X,?Y,?Z)

=> (e,f,g)

+(x,y,z)
+(a,b,c)
+(1,2,3)

+(e,f,g)
–(x,y,z)
–(1,2,3)

+(9,8,7)
–(a,b,c)



Head

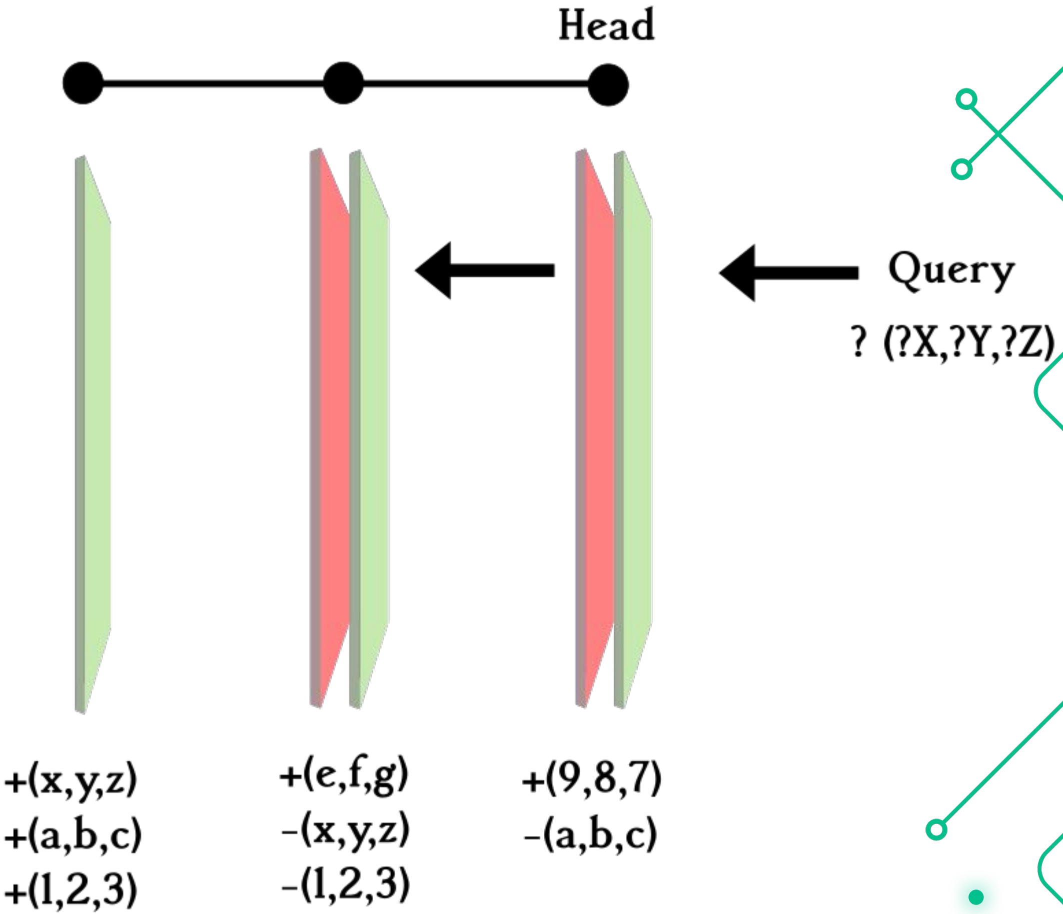
Query

? (?X,?Y,?Z)

+(x,y,z)
+(a,b,c)
+(1,2,3)

+(e,f,g)
-(x,y,z)
-(1,2,3)

+(9,8,7)
-(a,b,c)



Head

Query

? (?X,?Y,?Z)

+(x,y,z)
+(a,b,c)
+(1,2,3)

+(e,f,g)
–(x,y,z)
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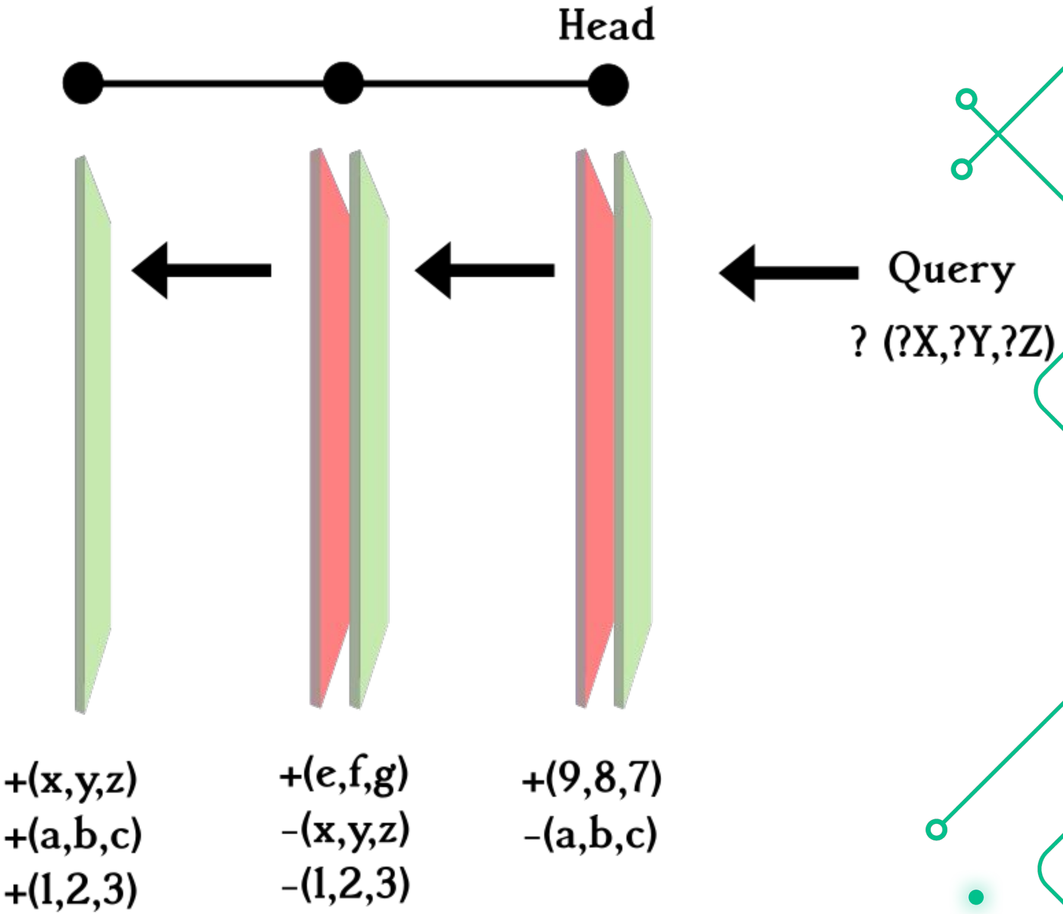

Head

Query

? (?X,?Y,?Z)

+(x,y,z)
+(a,b,c)
+(1,2,3)

+(e,f,g)
–(x,y,z)
–(1,2,3)

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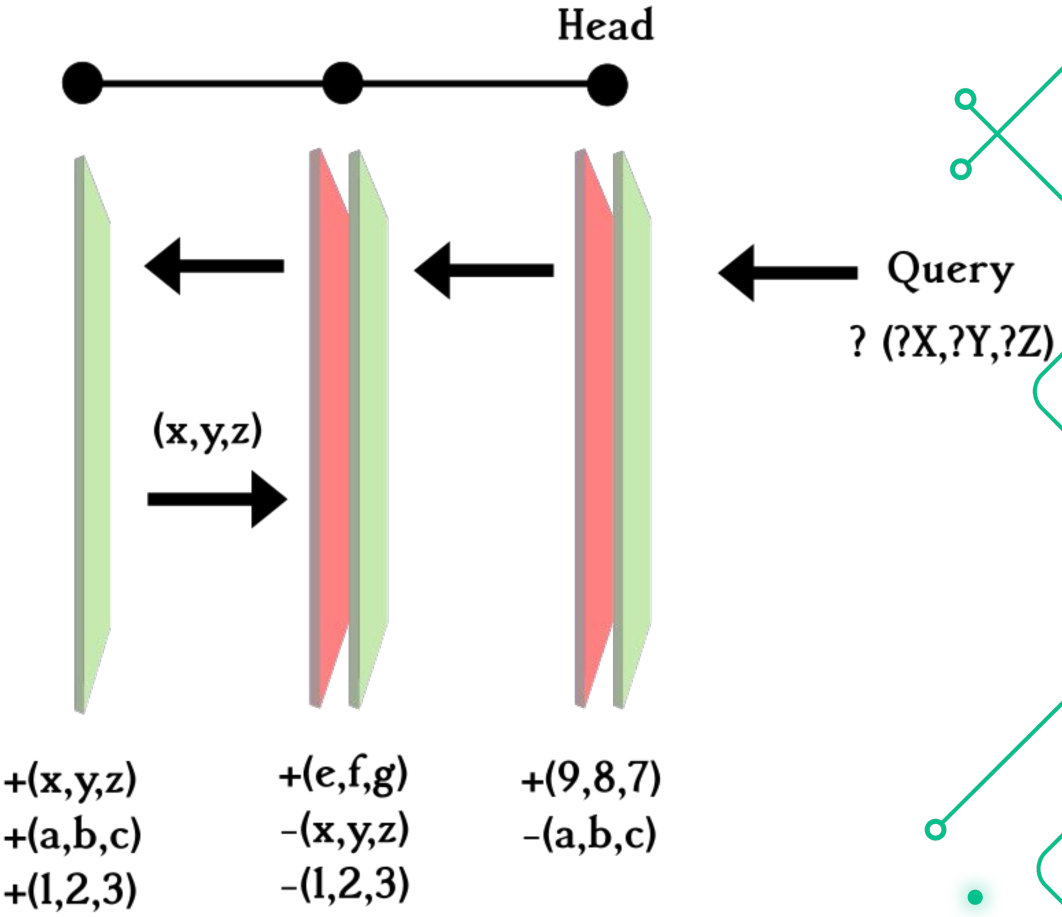
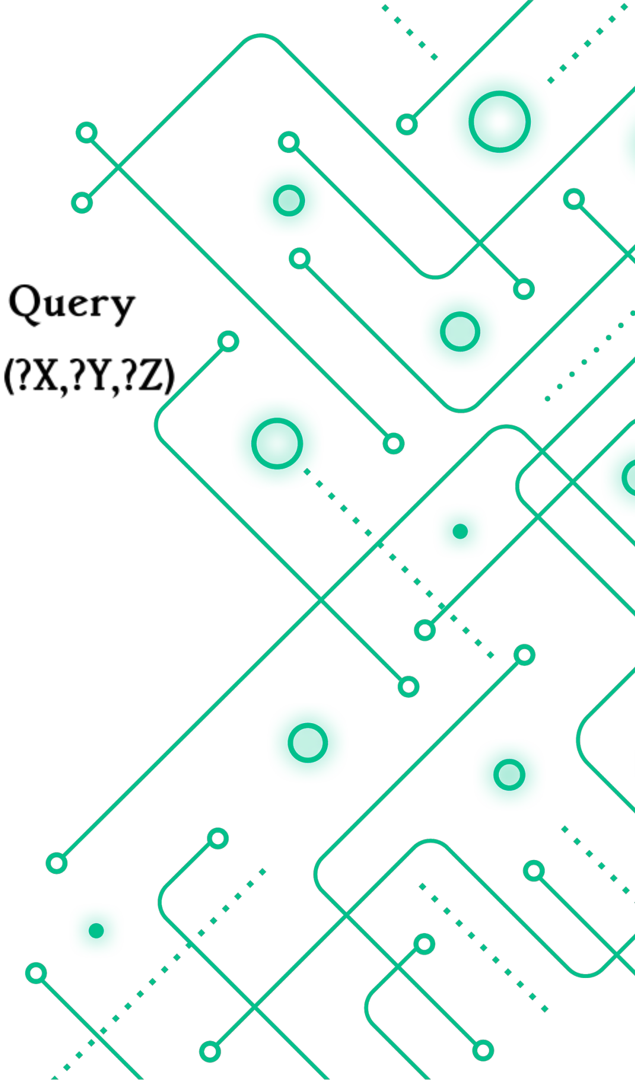
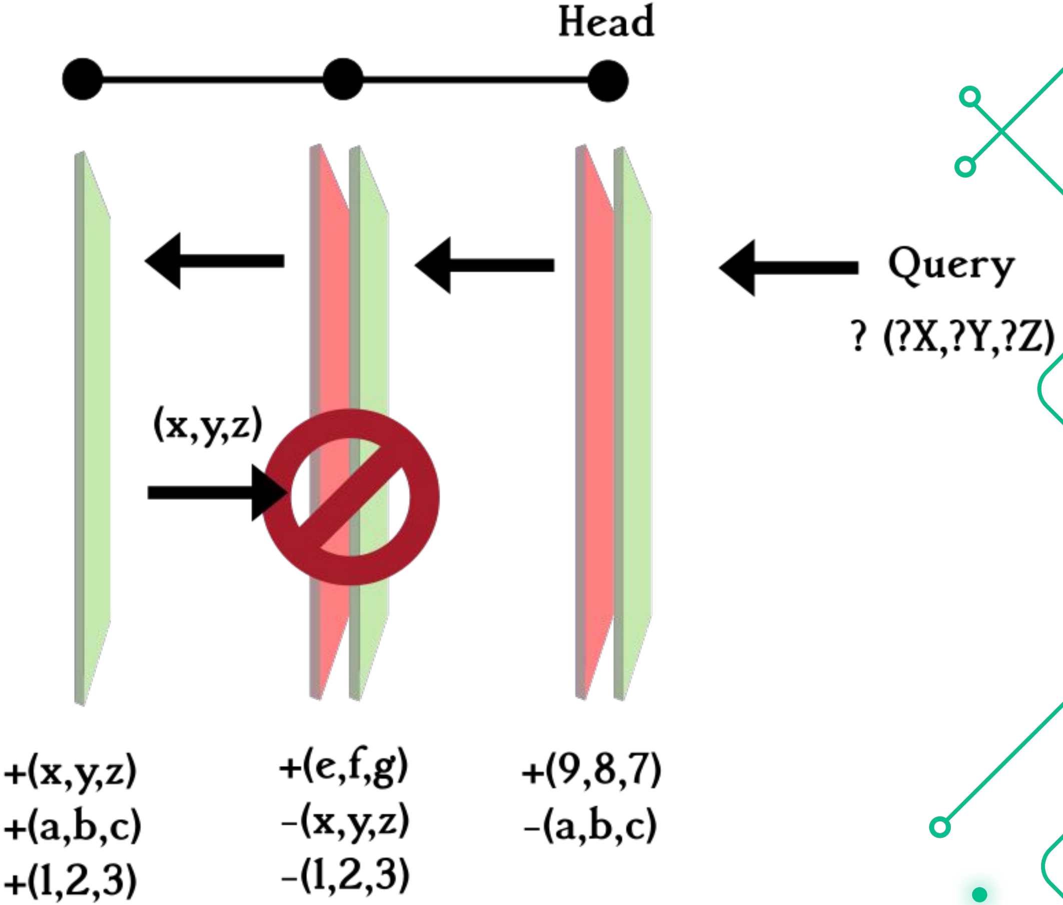

Head
Query
? (?X,?Y,?Z)
(x,y,z)
+(x,y,z)
+(a,b,c)
+(1,2,3)
+(e,f,g)
-(x,y,z)
-(1,2,3)
+(9,8,7)
-(a,b,c)





Head

Query

? (?X,?Y,?Z)

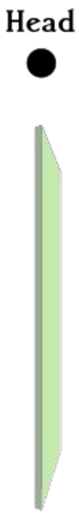
(x,y,z)

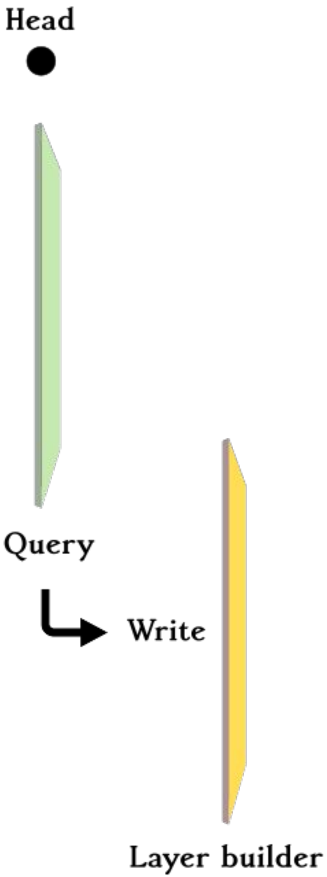
+(x,y,z)
+(a,b,c)
+(1,2,3)

+(e,f,g)
–(x,y,z)
–(1,2,3)

+(9,8,7)
–(a,b,c)

A typical write transaction....



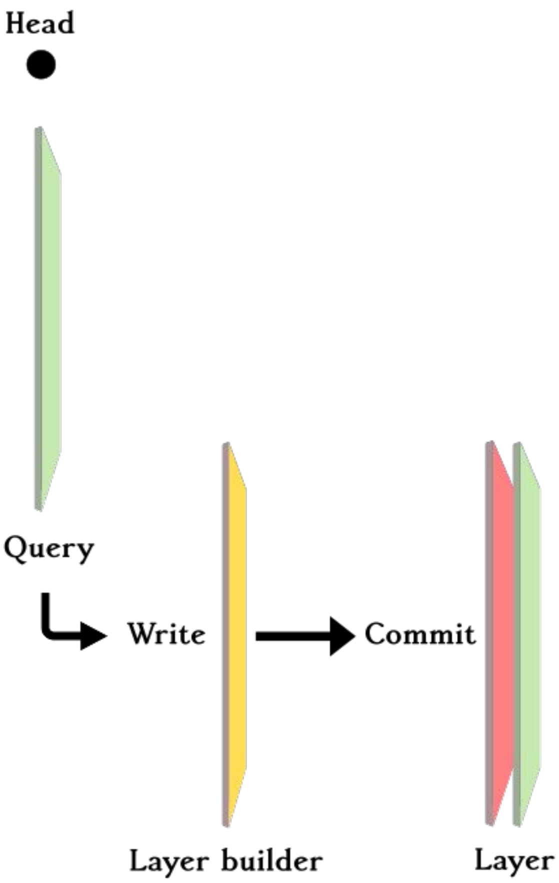


Head

Query

Write

Layer builder



Head

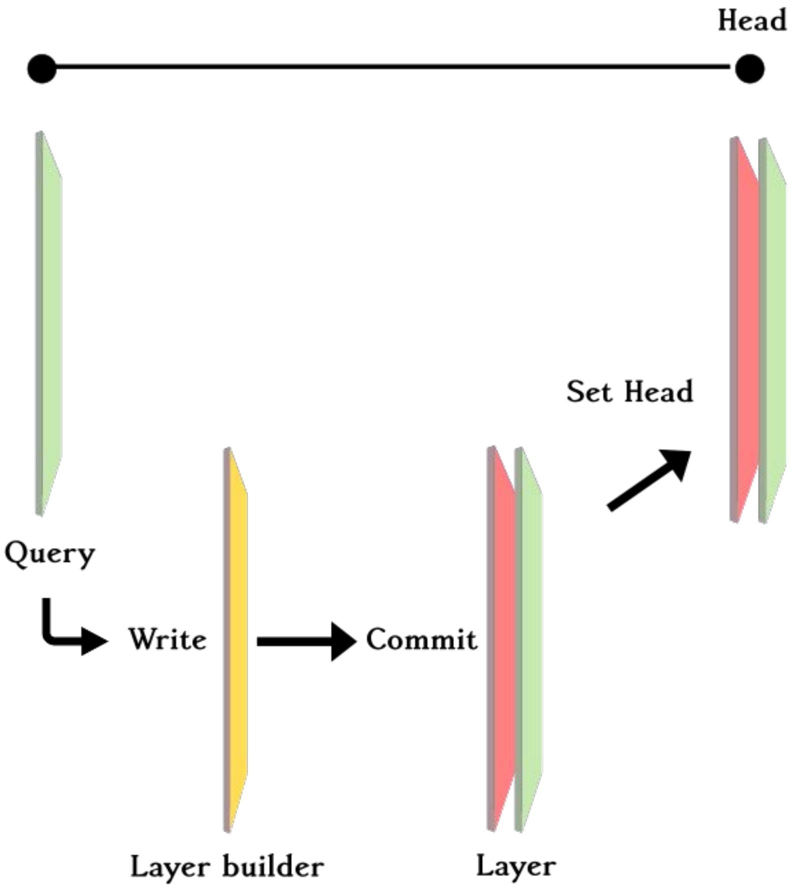
Query

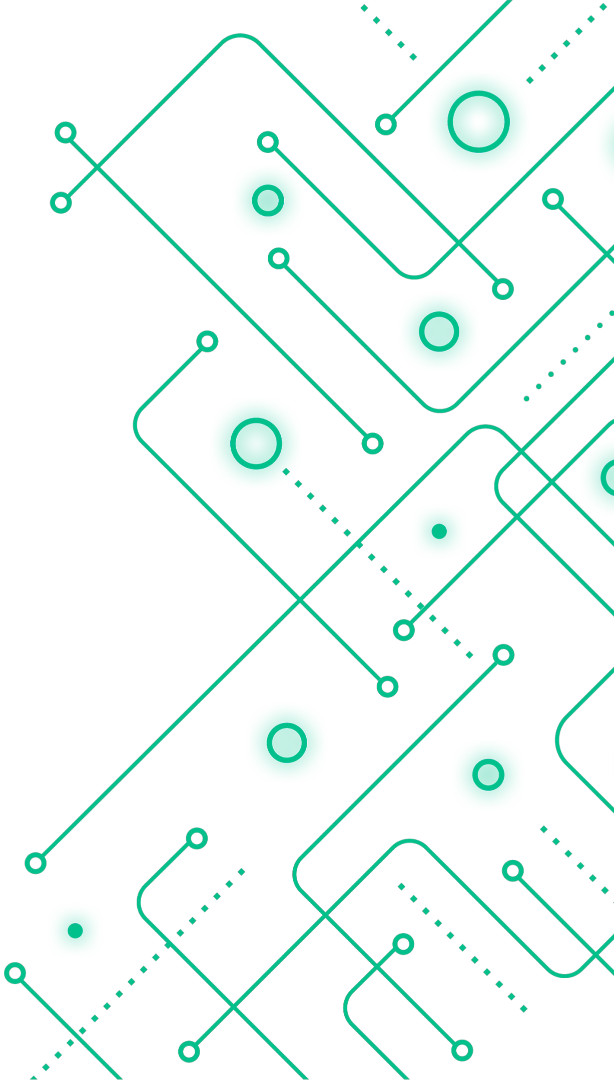
Write

Commit

Layer builder

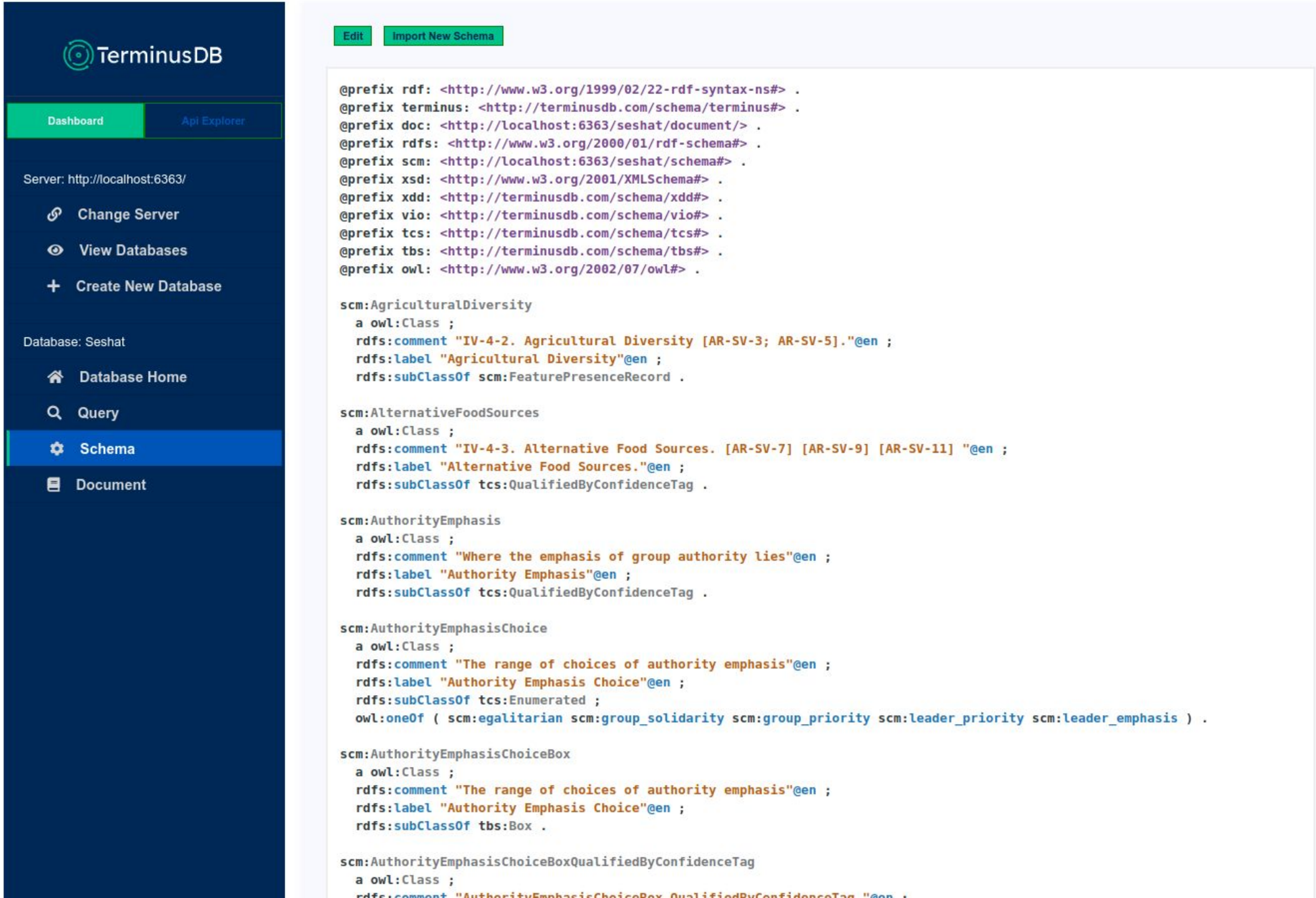
Layer


Head
Set Head
Query
Write
Commit
Layer builder
Layer



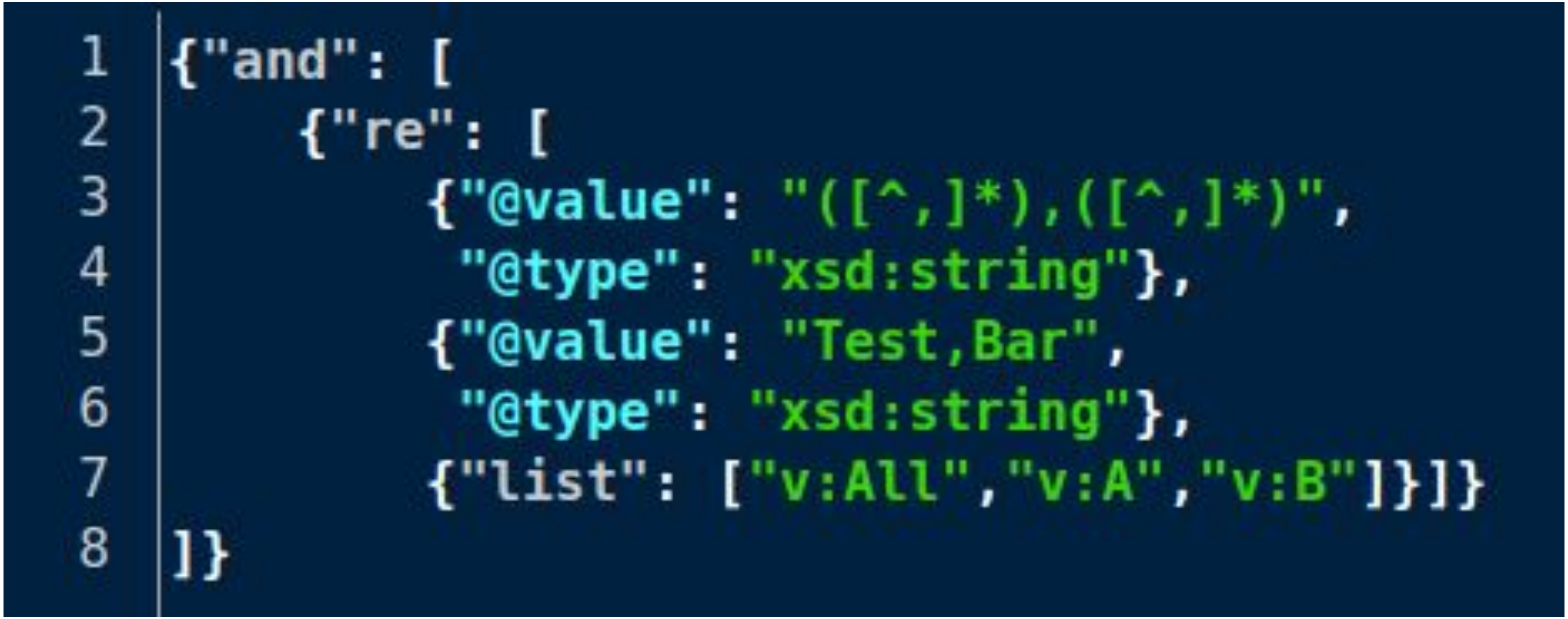
Schema driven language… (in OWL)

- Classes with multiple inheritance
- Properties with domain / range
- Restrictions (functionality, cardinality, value etc.)

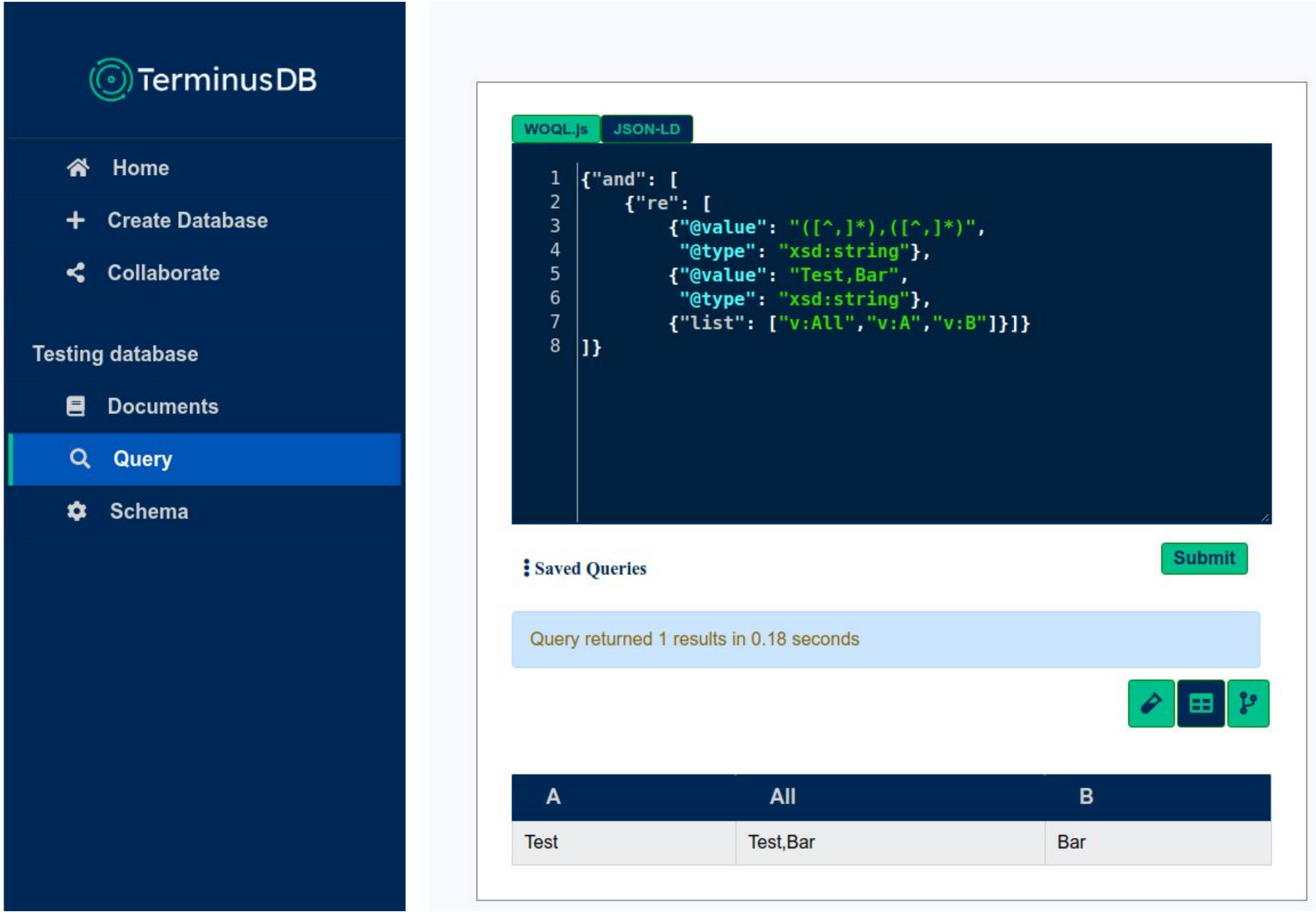


```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix terminus: <http://terminusdb.com/schema/terminus#> .
@prefix doc: <http://localhost:6363/seshat/document/> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix scm: <http://localhost:6363/seshat/schema#> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
@prefix xdd: <http://terminusdb.com/schema/xdd#> .
@prefix vio: <http://terminusdb.com/schema/vio#> .
@prefix tcs: <http://terminusdb.com/schema/tcs#> .
@prefix tbs: <http://terminusdb.com/schema/tbs#> .
@prefix owl: <http://www.w3.org/2002/07/owl#> .

scm:AgriculturalDiversity
  a owl:Class ;
  rdfs:comment "IV-4-2. Agricultural Diversity [AR-SV-3; AR-SV-5]."@en ;
  rdfs:label "Agricultural Diversity"@en ;
  rdfs:subClassOf scm:FeaturePresenceRecord .

scm:AlternativeFoodSources
  a owl:Class ;
  rdfs:comment "IV-4-3. Alternative Food Sources. [AR-SV-7] [AR-SV-9] [AR-SV-11] "@en ;
  rdfs:label "Alternative Food Sources."@en ;
  rdfs:subClassOf tcs:QualifiedByConfidenceTag .

scm:AuthorityEmphasis
  a owl:Class ;
  rdfs:comment "Where the emphasis of group authority lies"@en ;
  rdfs:label "Authority Emphasis"@en ;
  rdfs:subClassOf tcs:QualifiedByConfidenceTag .

scm:AuthorityEmphasisChoice
  a owl:Class ;
  rdfs:comment "The range of choices of authority emphasis"@en ;
  rdfs:label "Authority Emphasis Choice"@en ;
  rdfs:subClassOf tcs:Enumerated ;
  owl:oneOf ( scm:egalitarian scm:group_solidarity scm:group_priority scm:leader_priority scm:leader_emphasis ) .

scm:AuthorityEmphasisChoiceBox
  a owl:Class ;
  rdfs:comment "The range of choices of authority emphasis"@en ;
  rdfs:label "Authority Emphasis Choice"@en ;
  rdfs:subClassOf tbs:Box .

scm:AuthorityEmphasisChoiceBoxQualifiedByConfidenceTag
  a owl:Class ;
  rdfs:comment "AuthorityEmphasisChoiceBox QualifiedByConfidenceTag "@en ;
```

WOQL
(A JSON-LD Query language)



```
{"and": [
    {"re": [
        {"@value": "([^,]*),([^,]*)",
         "@type": "xsd:string"},
        {"@value": "Test,Bar",
         "@type": "xsd:string"},
        {"list": ["v:All","v:A","v:B"]}]}
]}
```

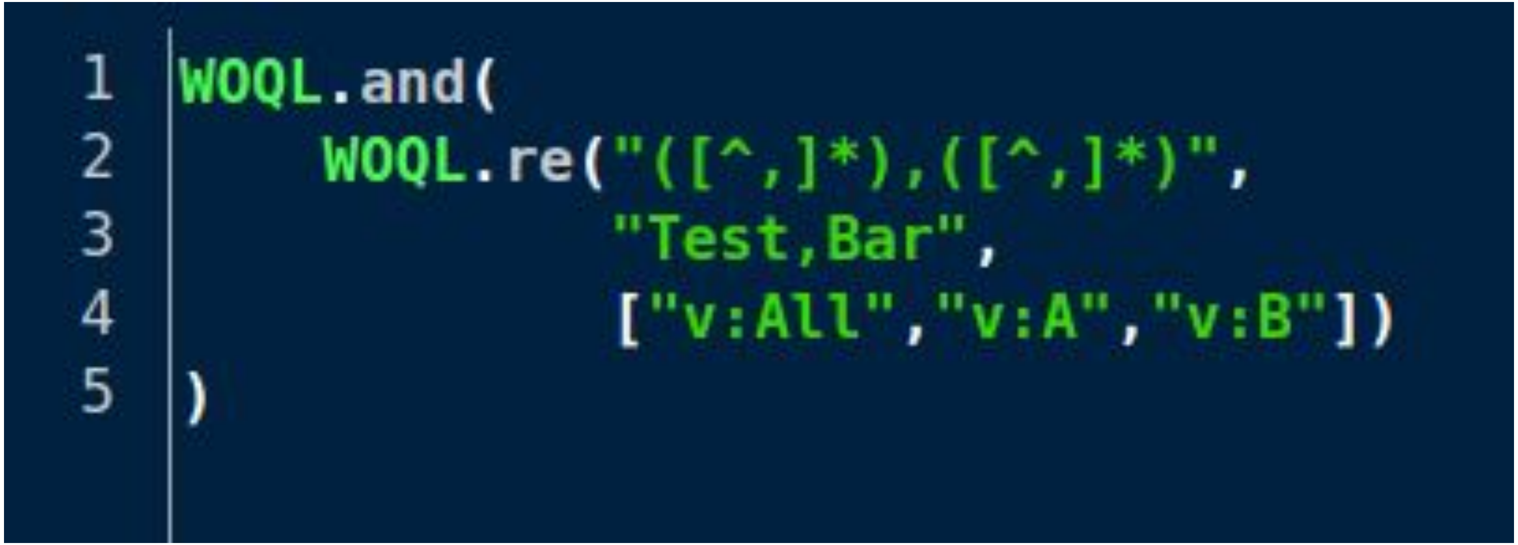


```
{"and": [
    {"re": [
        {"@value": "([^,]*),([^,]*)",
         "@type": "xsd:string"},
        {"@value": "Test,Bar",
         "@type": "xsd:string"},
        {"list": ["v:All","v:A","v:B"]}]}
]}
```

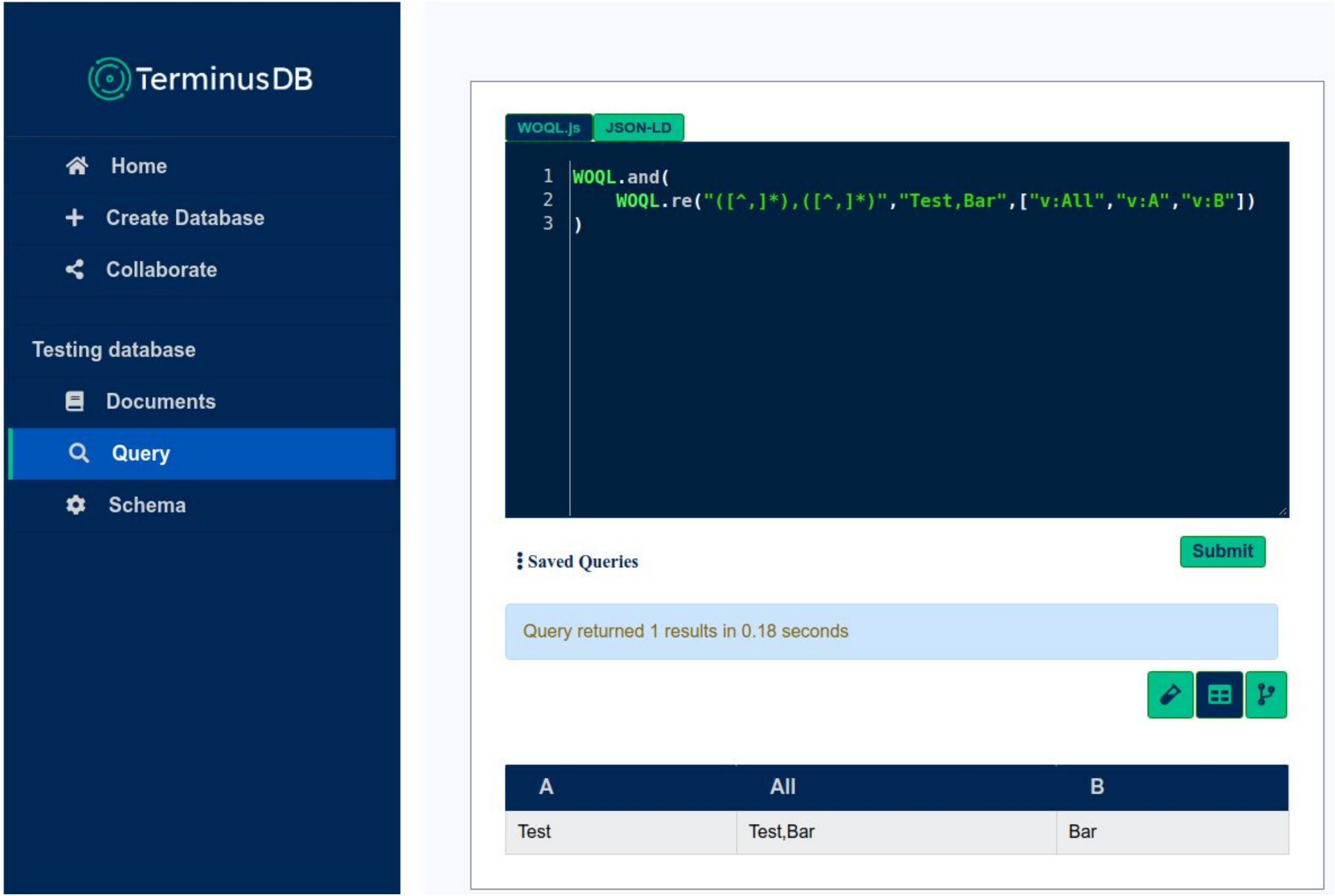
Query returned 1 results in 0.18 seconds

A	All	B
Test	Test,Bar	Bar

WOQL.js
(A fluent Query language)



```
WOQL.and(
    WOQL.re("([^,]*),([^,]*)",
            "Test,Bar",
            ["v:All","v:A","v:B"])
)
```

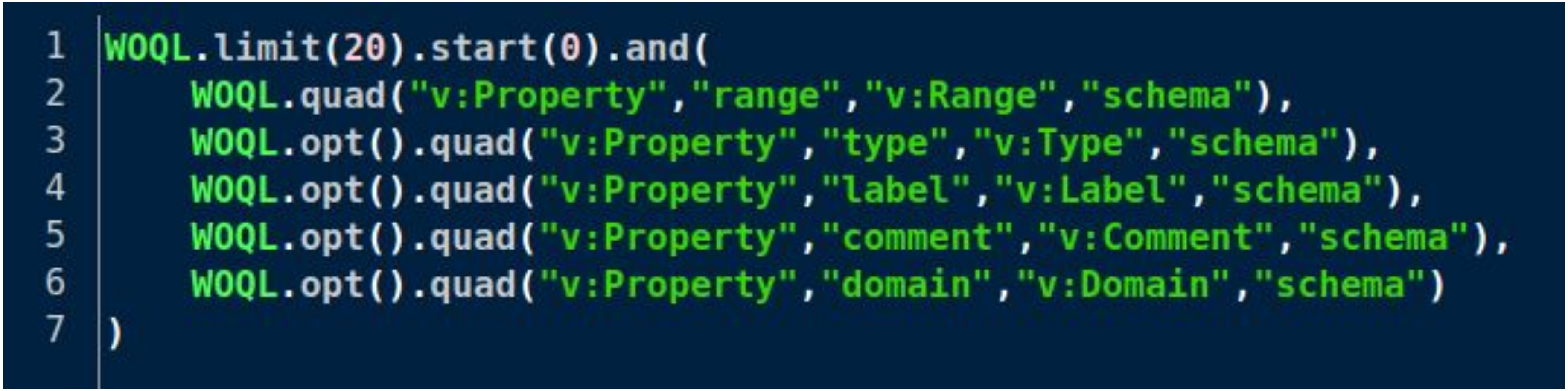


```
WOQL.and(
    WOQL.re("([^,]*),([^,]*)","Test,Bar",["v:All","v:A","v:B"])
)
```

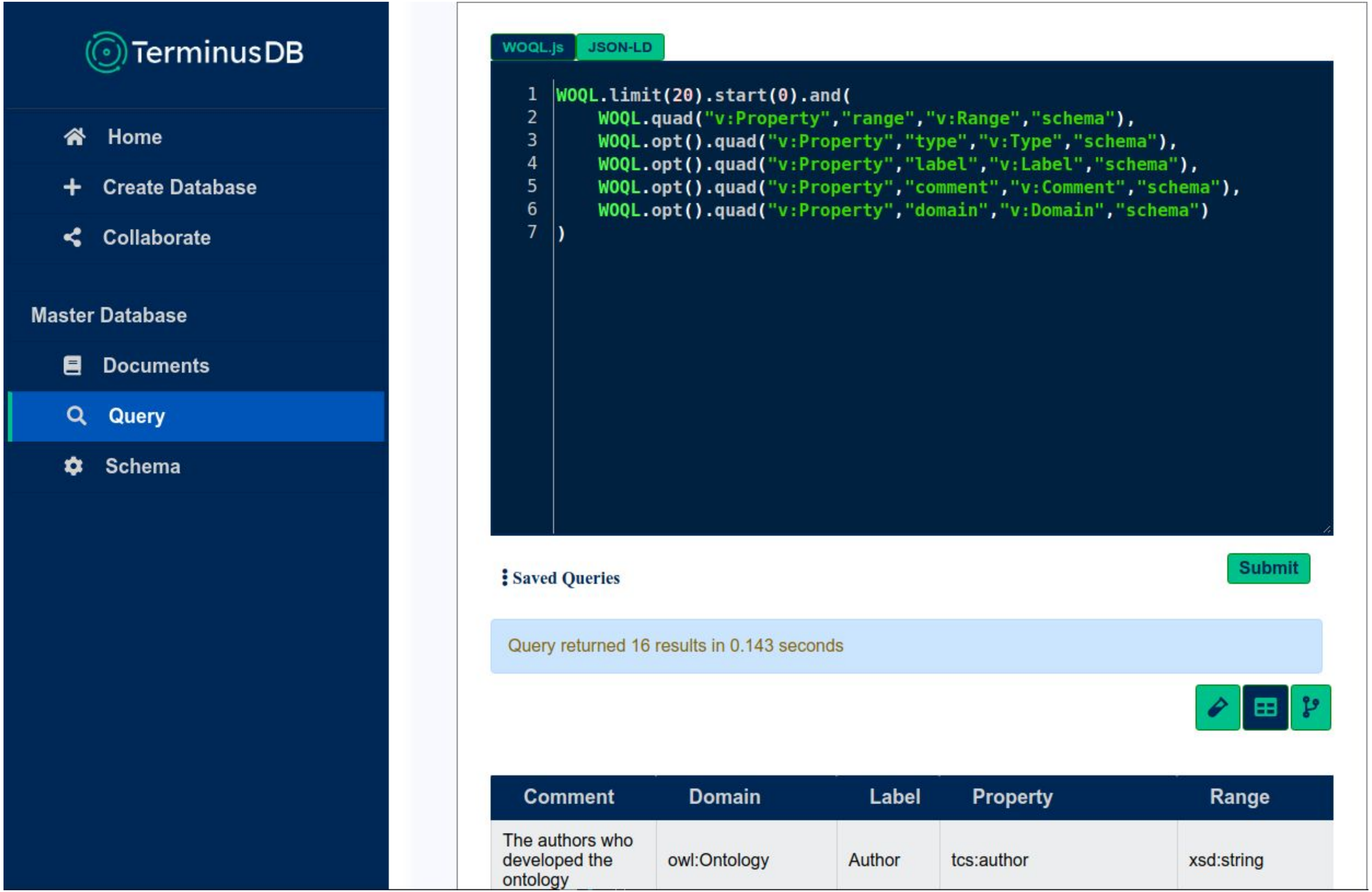
Query returned 1 results in 0.18 seconds

A	All	B
Test	Test,Bar	Bar

Reflection in WOQL



```
WOQL.limit(20).start(0).and(
    WOQL.quad("v:Property","range","v:Range","schema"),
    WOQL.opt().quad("v:Property","type","v:Type","schema"),
    WOQL.opt().quad("v:Property","label","v:Label","schema"),
    WOQL.opt().quad("v:Property","comment","v:Comment","schema"),
    WOQL.opt().quad("v:Property","domain","v:Domain","schema")
)
```

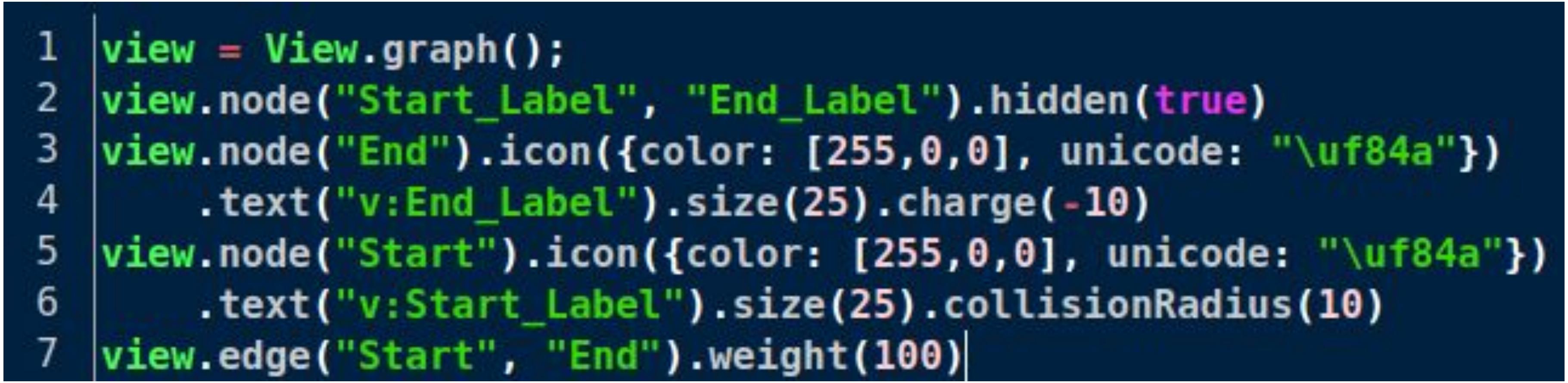


```
WOQL.limit(20).start(0).and(
    WOQL.quad("v:Property","range","v:Range","schema"),
    WOQL.opt().quad("v:Property","type","v:Type","schema"),
    WOQL.opt().quad("v:Property","label","v:Label","schema"),
    WOQL.opt().quad("v:Property","comment","v:Comment","schema"),
    WOQL.opt().quad("v:Property","domain","v:Domain","schema")
)
```

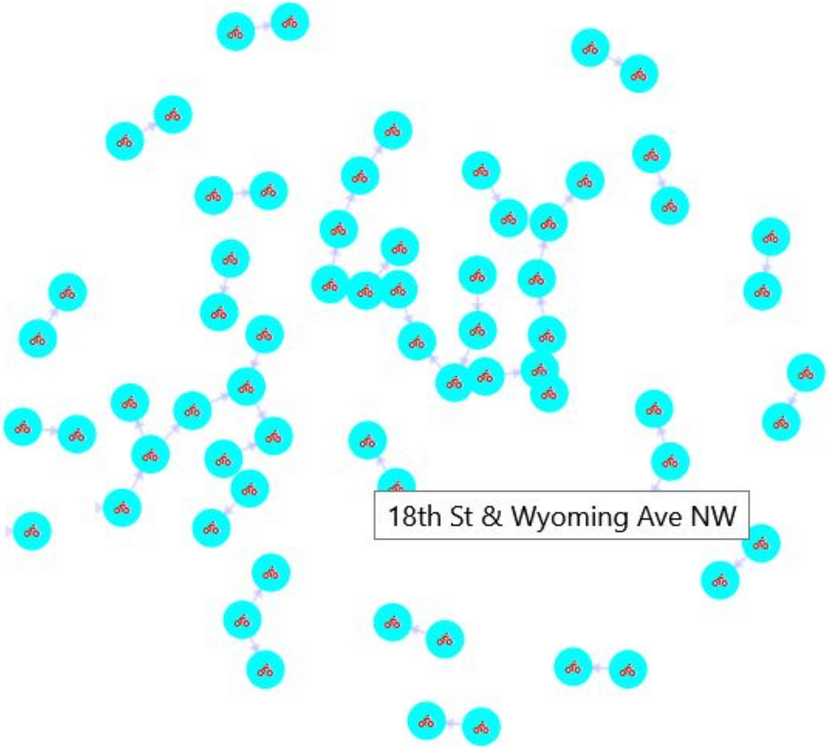
Query returned 16 results in 0.143 seconds

Comment	Domain	Label	Property	Range
The authors who developed the ontology	owl:Ontology	Author	tcs:author	xsd:string

Visualisation of Graphs



```
view = View.graph();
view.node("Start_Label", "End_Label").hidden(true)
view.node("End").icon({color: [255,0,0], unicode: "\uf84a"})
    .text("v:End_Label").size(25).charge(-10)
view.node("Start").icon({color: [255,0,0], unicode: "\uf84a"})
    .text("v:Start_Label").size(25).collisionRadius(10)
view.edge("Start", "End").weight(100)
```


18th St & Wyoming Ave NW

Next Steps

- Temporal constraint queries
- Named predicates (something like a datalog "view")
- A* search and other typical graph searches "out of the box"

Give TerminusDB a try!

Terminusdb.com

https://github.com/terminusdb/terminus-quickstart

TerminusDB