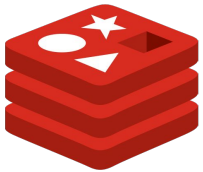
A Different Approach to Graphs
By Roi Lipman, CTO & Co-founder, FalkorDB
01/2026
FalkorDB

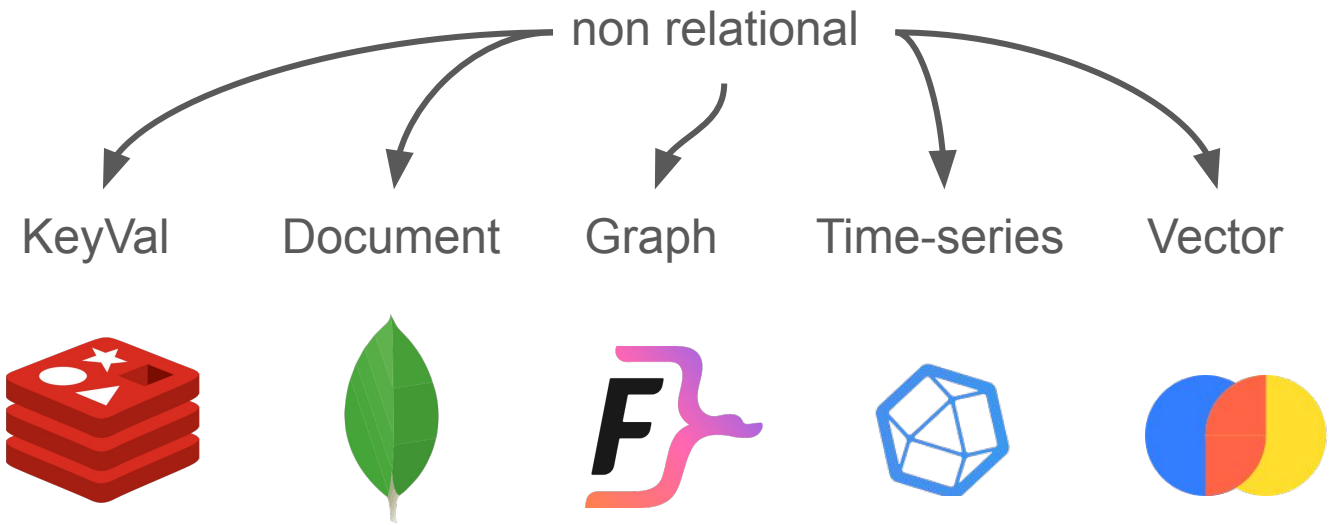
About me

2014
Created concurrent-map
4.5K starts & 550 forks

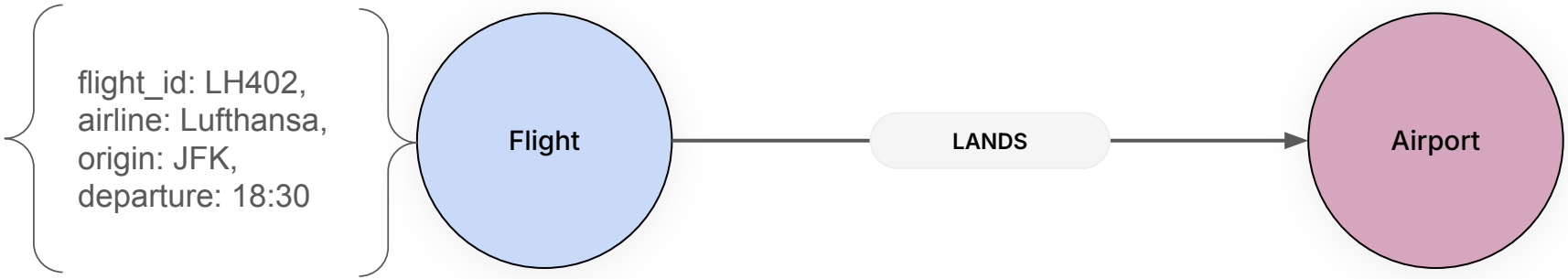


Redis [2017-2024]
Created RedisGraph

NoSQL



Graph Design



Major Players

Amazon Neptune

Neo4J *(~40% market share)*

MemGraph

Kuzu *(EOL)*

Leaderboard: DBEngine

Use Cases

Social Networks / CRMs

Fraud Detection

Identity & Access Management

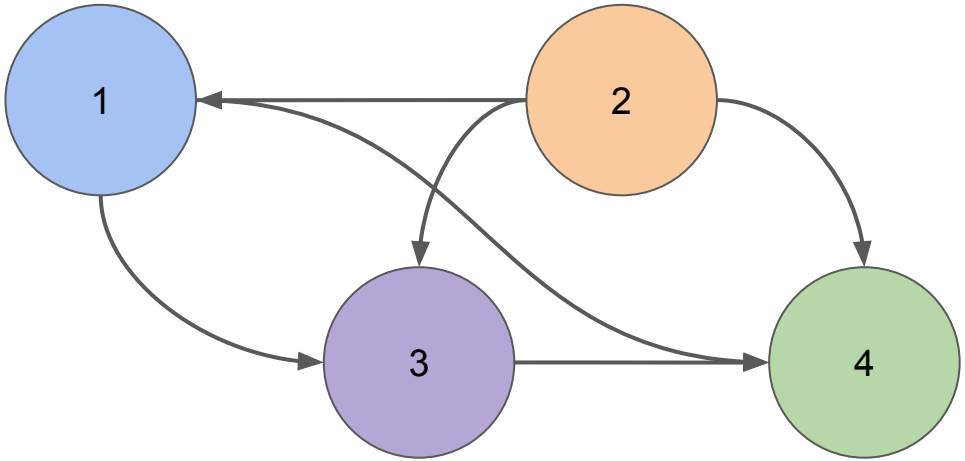
AI Agent Memory

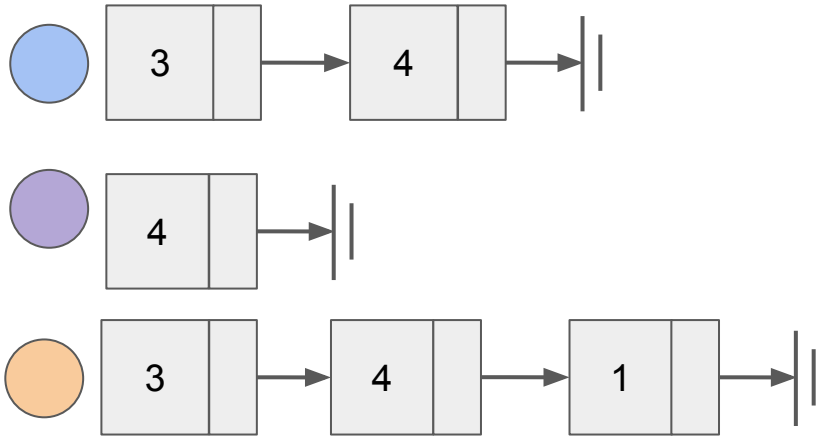
Recommendation Engines

Cloud Security

Graph Representation

Adjacency list



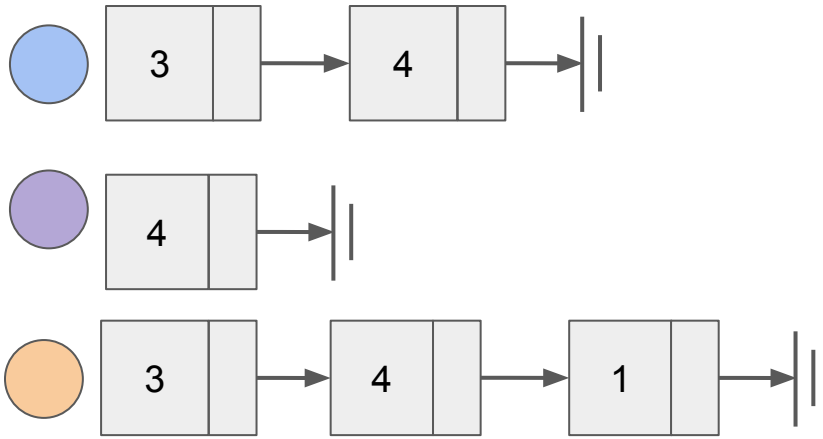


Graph Representation

Adjacency list

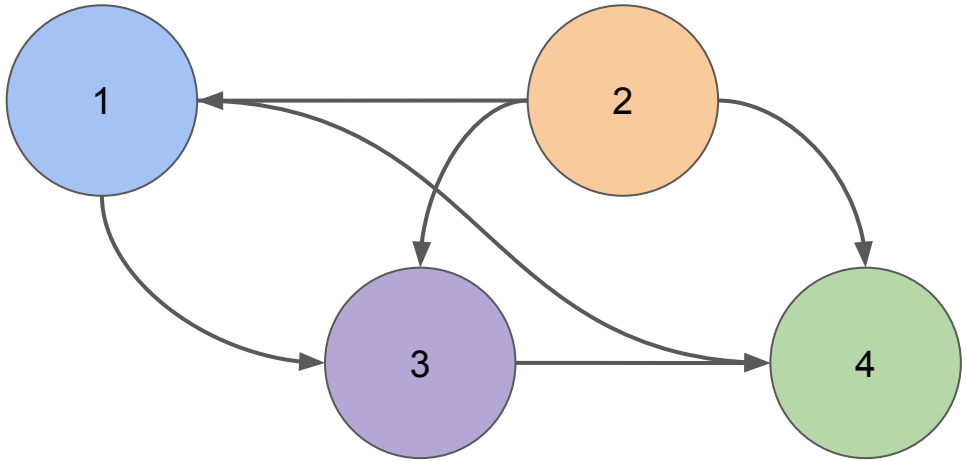
It’s SLOW!

- Node centric
- Random memory access
- Bad cache utilization
- Can’t use SIMD / AVX



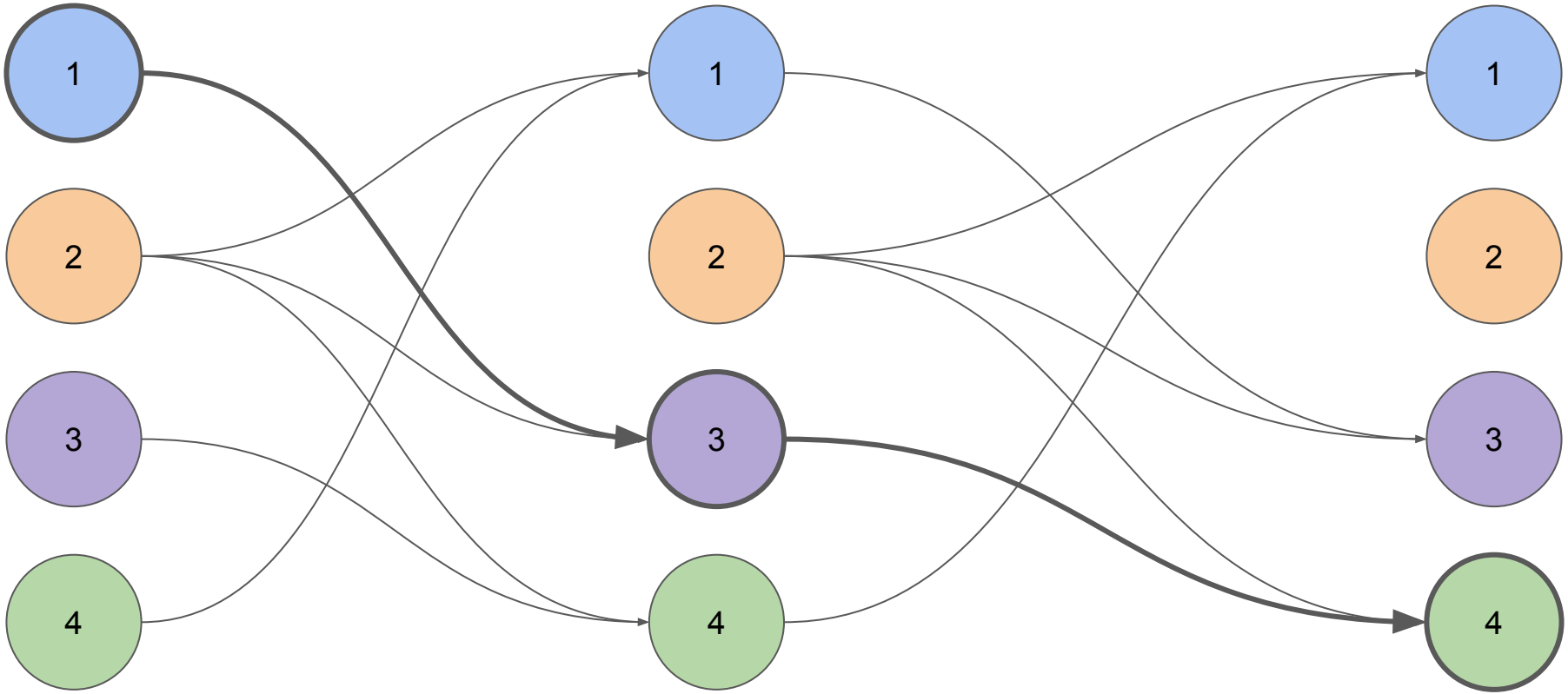
Graph Representation

Adjacency list



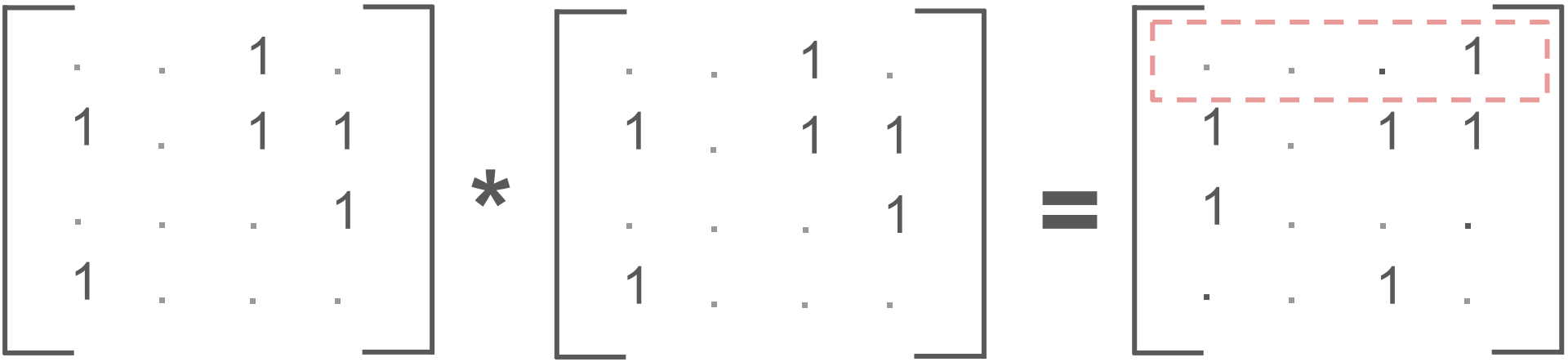
	1	2	3	4
1	.	.	1	.
2	1	.	1	1
3	.	.	.	1
4	1	.	.	.

Traversal 2 hops



Traversal 2 hops

Multi source BFS

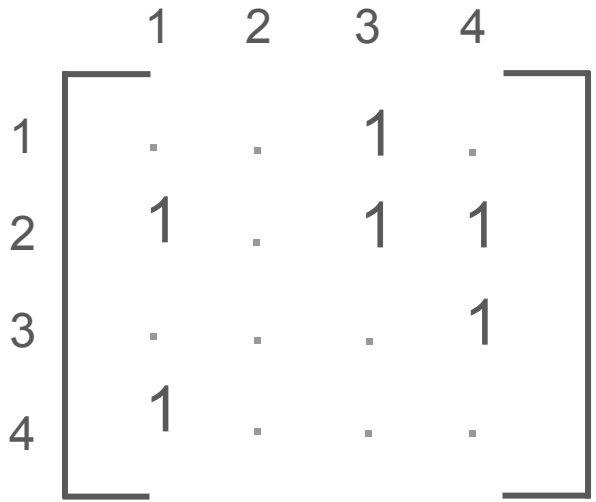


Graph Representation

Adjacency list

FAST!

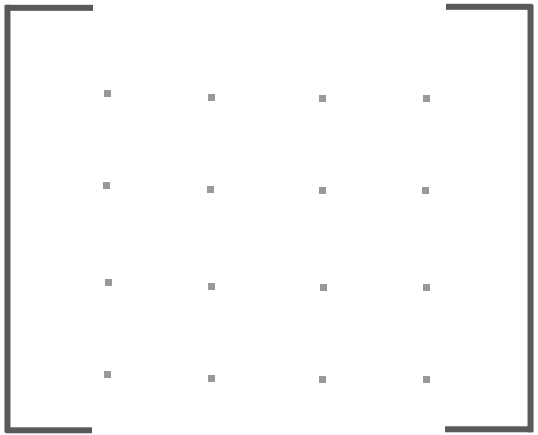
- Holistic view
- Contiguous memory
- Great cache utilization
- Enable SIMD / AVX

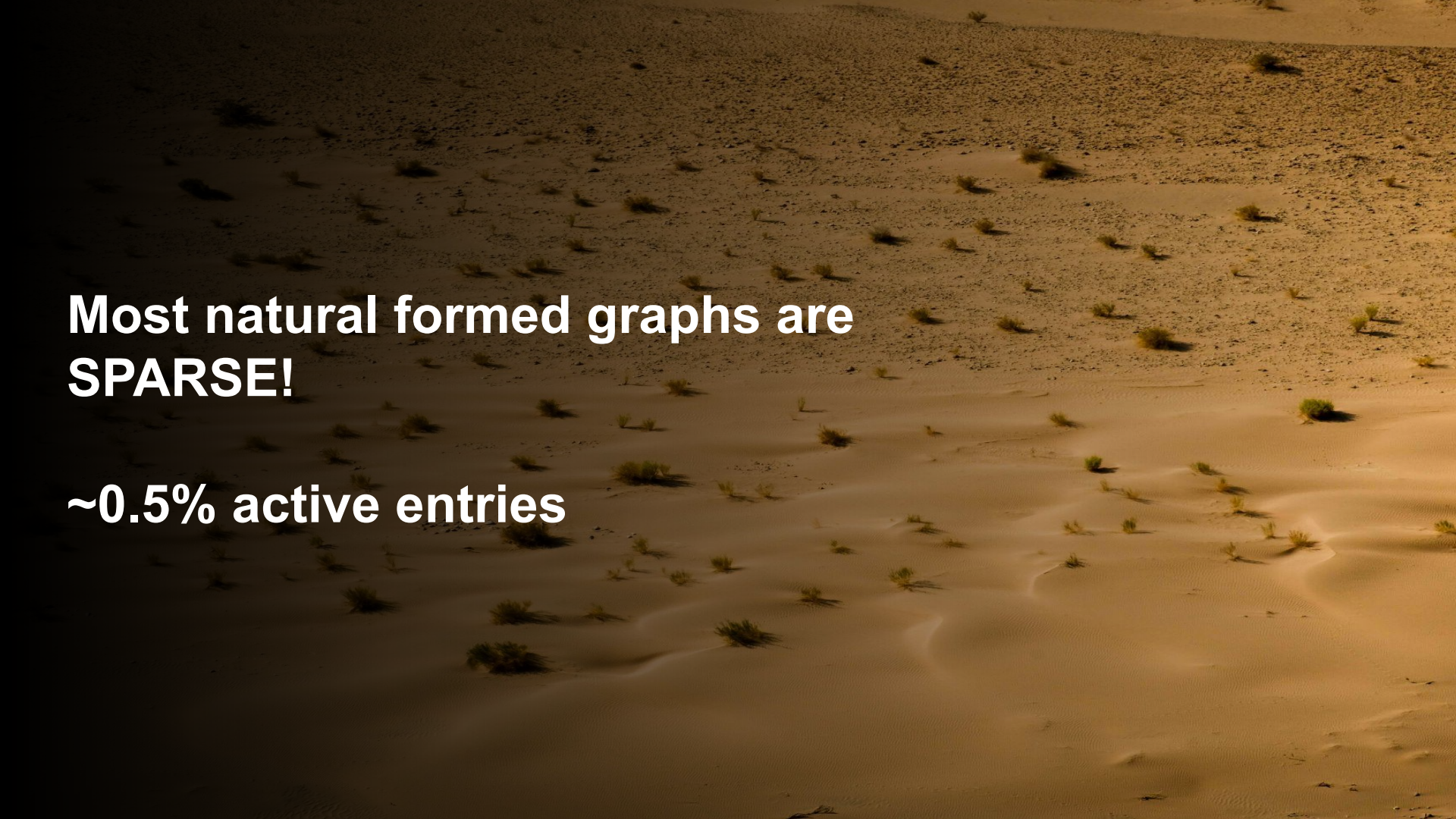


Graph Representation

Adjacency list

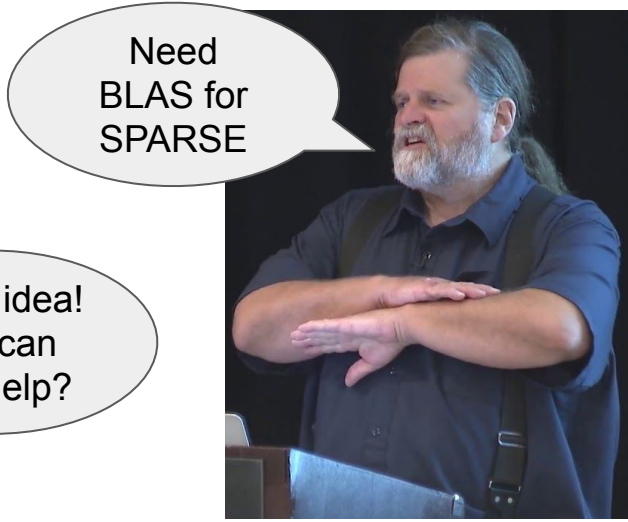
1M X 1M X 1B = 1000GB




Most natural formed graphs are SPARSE!
~0.5% active entries

~2017 GraphBLAS

BLAS - basic linear algebra subprograms



GraphBLAS

```
GrB_mxm

GrB_transpose

GrB_mxv

GrB_vxm

GrB_Matrix_apply
```

GraphBLAS

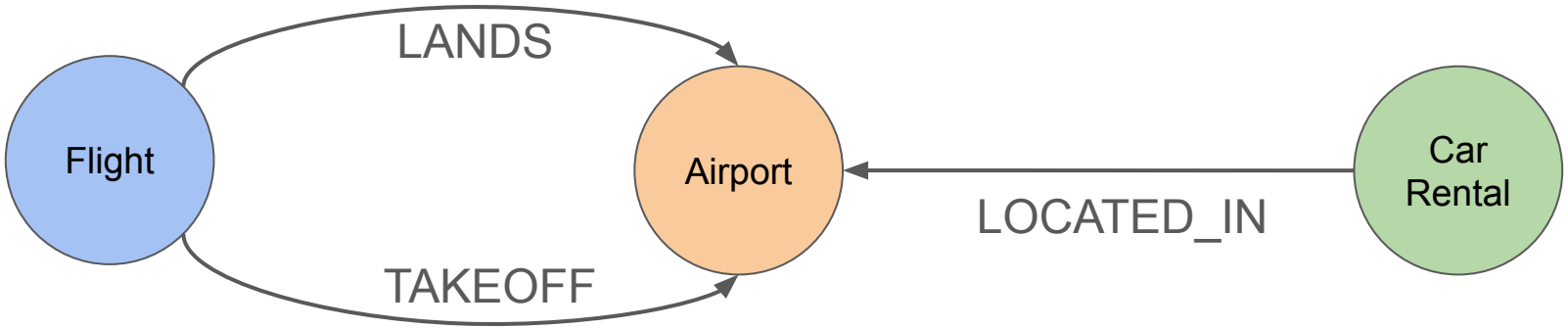
```
GrB_Info GrB_mxm                        // C<Mask> = accum (C, A*B)
(
    GrB_Matrix C,                       // input/output matrix for results
    const GrB_Matrix Mask,              // optional mask for C, unused if NULL
    const GrB_BinaryOp accum,           // optional accum for Z=accum(C,T)
    const GrB_Semiring semiring,        // defines '+' and '*' for A*B
    const GrB_Matrix A,                 // first input:  matrix A
    const GrB_Matrix B,                 // second input: matrix B
    const GrB_Descriptor desc           // descriptor for C, Mask, A, and B
) ;
```

GRAPHBLAS

FalkorDB

Cypher

```
MATCH (f:Flight)-[:LANDS|TAKEOFF]->(:Airport)<-[:LOCATED_IN]-(r:CarRental)
WHERE f.num = 'ly311'
RETURN r
```



FalkorDB

```
MATCH (f:Flight)-[:LANDS|TAKEOFF]->(:Airport)<-[:LOCATED_IN]-(r:CarRental)
WHERE f.num = 'ly311'
RETURN r
```

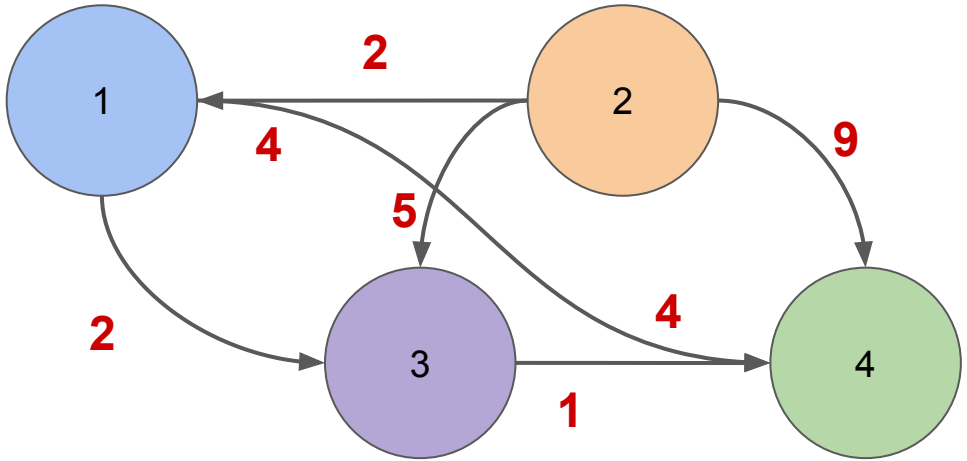
Custom semiring

1. Plus operator $\oplus$
2. Mul operator $\otimes$
3. Additive identity
4. Multiplicative identity

Trivial:

1. $\oplus \rightarrow +$
2. $\otimes \rightarrow *$
3. Additive identity $\rightarrow 0$
4. Multiplicative identity $\rightarrow 1$

Custom semiring



	1	2	3	4
1	.	.	2	.
2	2	.	5	9
3	.	.	.	1
4	4	.	.	.

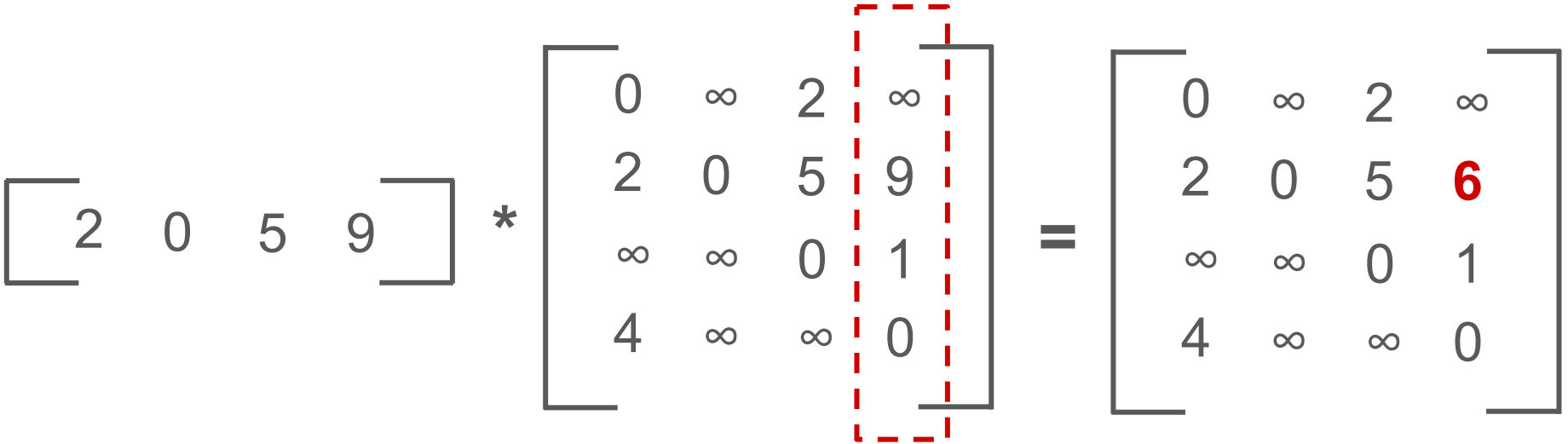
Custom semiring

Tropical semiring

1. $\oplus \rightarrow$ MIN
2. $\otimes \rightarrow +$
3. Additive identity $\rightarrow \infty$
4. Multiplicative identity $\rightarrow 0$

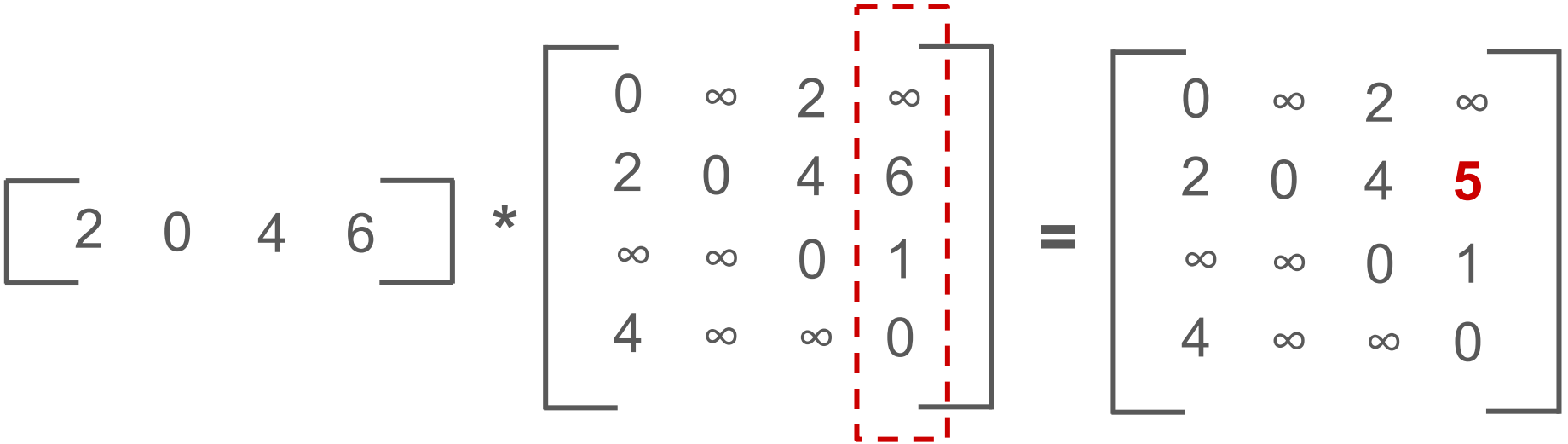
Custom semiring

A[1,3] =
Min(V[0]+A[0][3], V[1]+A[1][3], V[2]+A[2][3], V[3]+A[3][3]) =
Min(2+∞, 0+9, 5+1, 9+0) =
Min(∞,9,6,9) = 6



Custom semiring

A[1,3] =
Min(V[0]+A[0][3], V[1]+A[1][3], V[2]+A[2][3], V[3]+A[3][3]) =
Min(2+∞, 0+6, 4+1, 6+0) =
Min(∞,6,5,6) = 5

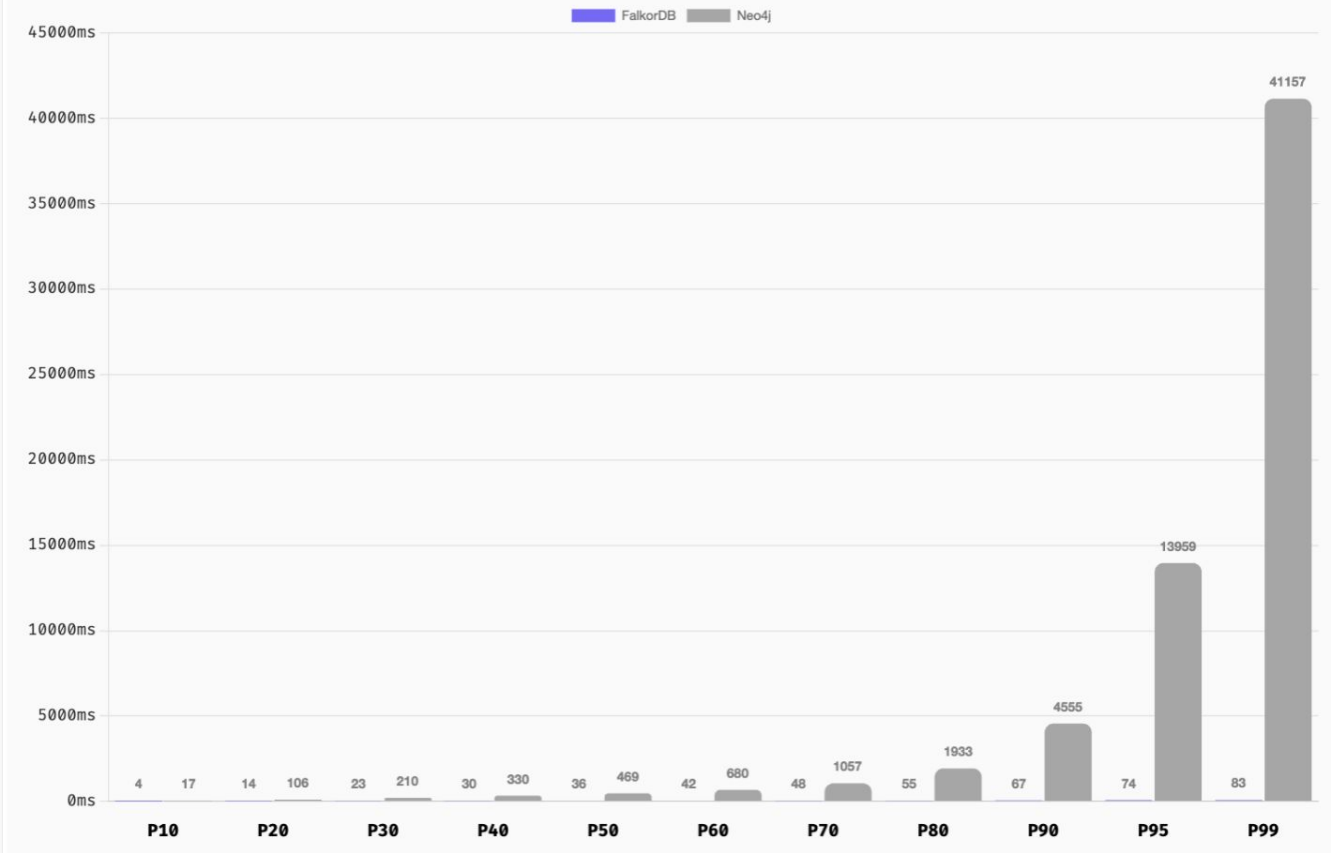


Chase every
millisecond

LATENCY

(LOWER IS BETTER)

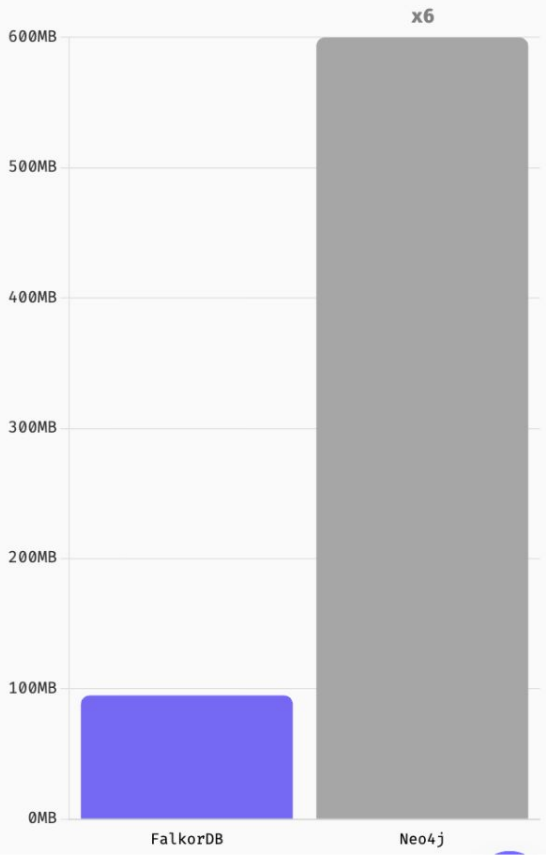
Superior Latency: 496x faster at P99



MEMORY USAGE

(LOWER IS BETTER)

6x Better performance, lower overall costs



Developing a DB

- Grammar - AST
- AST Semantic validator
- AST -> Execution Plan - Planner (probably heuristic based).
- Execution Plan Optimizer Semi rule based.
- Execution Plan Runner (hopefully vectorized, column based)
- Transaction management, supporting rollback via either UndoLog or MVCC
- Type system + Built-In functions including aggregation, procedures and UDFs.

Developing a DB

- Type system - efficient expression evaluation
- Network protocols & data layout
- Cluster support & replication (FalkorDB uses effects)
- Clients in multiple languages
- Index support: Numeric, String (Fulltext), Geo & Vector.
- Persistency for recovery
- On prem + Cloud

Developing a DB

- Security / permission management
- Algorithm suite
- Low memory footprint
- Low latency High throughput under different workloads
- Fast bulk loader for initial ingestion
- Zero crashes!

החוקרת שהייתה ההשראה ל"טהרן" גייסה עוד 60 מיליון דולר לסטארטאפ שלה

הסטארטאפ הישראלי Zafran Security מגייס עוד 60 מיליון דולר וטוען כי הכפיל את שוויו

הסטארטאפ הישראלי Vega רק הוקם בשנה שעברה וכבר מוערך ב-700 מיליון דולר

הסטארטאפ הישראלי ווגה משלים סבב גיוס נוסף, זמן קצר לאחר שנחשף, וכמעט מכפיל את שוויו

OR

יזם סדרתי ובכיר לשעבר ב-Team8 חושפים סטארטאפ חדש עם סבב Seed ענק

הסטארטאפ הישראלי Lumia Security מגייס 18 מיליון דולר מ-Team8 ו-New Era

יוצאי 8200 ומשרד ראש הממשלה חושפים "האקר AI"

הסטארטאפ הישראלי Novee הוקם בשנה שעברה וכבר רושם גיוסים של יותר מ-50 מיליון דולר

Thank you !
Questions ?
FalkorDB