



NebulaGraph

NebulaGraph Database

v3.3.0

Table of contents

1.	NebulaGraph 3.3.0	7
1.1		7
1.2		7
1.3		7
1.4		7
1.5		8
2.		9
2.1		9
2.2		28
2.3		39
2.4	NebulaGraph	52
2.5		55
2.6		57
2.7	VID	59
2.8		61
3.		77
3.1		77
3.2		79
3.3	nGQL	93
4.	nGQL	112
4.1	nGQL	112
4.2		127
4.3		146
4.4		151
4.5		164
4.6		208
4.7		248
4.8		276
4.9	Tag	285
4.10	Edge type	293
4.11		299
4.12		306
4.13		313
4.14		324
4.15		332

4.16	339
4.17	343
5.	346
5.1	346
5.2 NebulaGraph	364
5.3	369
5.4 NebulaGraph	389
5.5 NebulaGraph	391
5.6 NebulaGraph	393
5.7 Storage	395
5.8	396
5.9 NebulaGraph	401
6.	403
6.1	403
6.2	420
7.	422
7.1 NebulaGraph	422
7.2 RocksDB	430
8.	431
8.1	431
8.2 SSL	437
9.	439
9.1 NebulaGraph BR	439
9.2	448
10.	450
10.1 BALANCE	450
11.	451
11.1 Compaction	451
11.2 Storage	453
11.3	454
11.4	458
11.5	459
11.6	460
11.7	462
12.	464
12.1	464
12.2 Nebula Console	465
12.3 NebulaGraph CPP	469

12.4 NebulaGraph Java	471
12.5 NebulaGraph Python	473
12.6 NebulaGraph Go	475
13. NebulaGraph Cloud	476
14. NebulaGraph Studio	477
14.1 NebulaGraph Studio	477
14.2	480
14.3	491
14.4	514
15. NebulaGraph Dashboard	517
15.1 NebulaGraph Dashboard	517
15.2 Dashboard	519
15.3 Dashboard	525
15.4 Dashboard	527
15.5	533
16. NebulaGraph Dashboard	541
16.1 NebulaGraph Dashboard	541
16.2 NebulaGraph Dashboard License	543
16.3 Dashboard	545
16.4 Dashboard	550
16.5	551
16.6	560
16.7	591
16.8	594
16.9	595
16.10	602
16.11 FAQ	610
17. NebulaGraph Explorer	612
17.1 NebulaGraph Explorer	612
17.2	614
17.3	624
17.4	627
17.5	639
17.6	651
17.7	656
17.8	665
17.9	688
17.10	690

17.11	FAQ	691
18.	NebulaGraph Importer	693
18.1	NebulaGraph Importer	693
18.2		699
18.3		702
19.	NebulaGraph Exchange	705
19.1	NebulaGraph Exchange	705
19.2	NebulaGraph Exchange	711
19.3		713
19.4	NebulaGraph Exchange	722
19.5	Exchange	802
20.	NebulaGraph Operator	806
20.1	NebulaGraph Operator	806
20.2		808
20.3	NebulaGraph Operator	809
20.4	NebulaGraph	814
20.5	NebulaGraph	824
20.6	NebulaGraph	829
20.7	Nebular Operator NebulaGraph	832
20.8		836
20.9		837
21.		838
21.1		838
21.2	NebulaGraph Algorithm	850
21.3	NebulaGraph Analytics	855
21.4	NebulaGraph Analytics License	861
21.5	NebulaGraph Explorer Workflow	863
22.	NebulaGraph Spark Connector	864
22.1		864
22.2		864
22.3		864
22.4	NebulaGraph Spark Connector	865
22.5		865
23.	NebulaGraph Flink Connector	870
23.1		870
23.2		870
24.	NebulaGraph Bench	871
24.1		871

24.2	871
25.	872
25.1 Release Note	872
25.2 NebulaGraph	879
25.3 FAQ	886
25.4	892
25.5	896
25.6	897
25.7 NebulaGraph	901
25.8	907
25.9	911

1. NebulaGraph 3.3.0

Note

2023-1-13 GitHub commit [0725d3dd](#) " " #C65467

↑ Compatibility

NebulaGraph 3.2 Tag NebulaGraph 3.3.0 Tag

NebulaGraph

1.1

-
- [NebulaGraph](#)
-
-
- [nGQL](#)
- [FAQ](#)
-

1.2

- [NebulaGraph 3.3.0](#)
- [NebulaGraph Studio](#)
- [NebulaGraph Dashboard](#)
- [NebulaGraph Dashboard](#)
- [NebulaGraph Explorer](#)

1.3

- [Nebula Graph](#)
-
-
-
-

1.4

Note

 **Caution**

caution

 **Danger**

danger

 **Performance** **Faq** **Compatibility**

nGQL openCypher nGQL

 **Enterpriseonly**

1.5

NebulaGraph Markdown

:January 13, 2023

2.

- 03 45



- 02 24

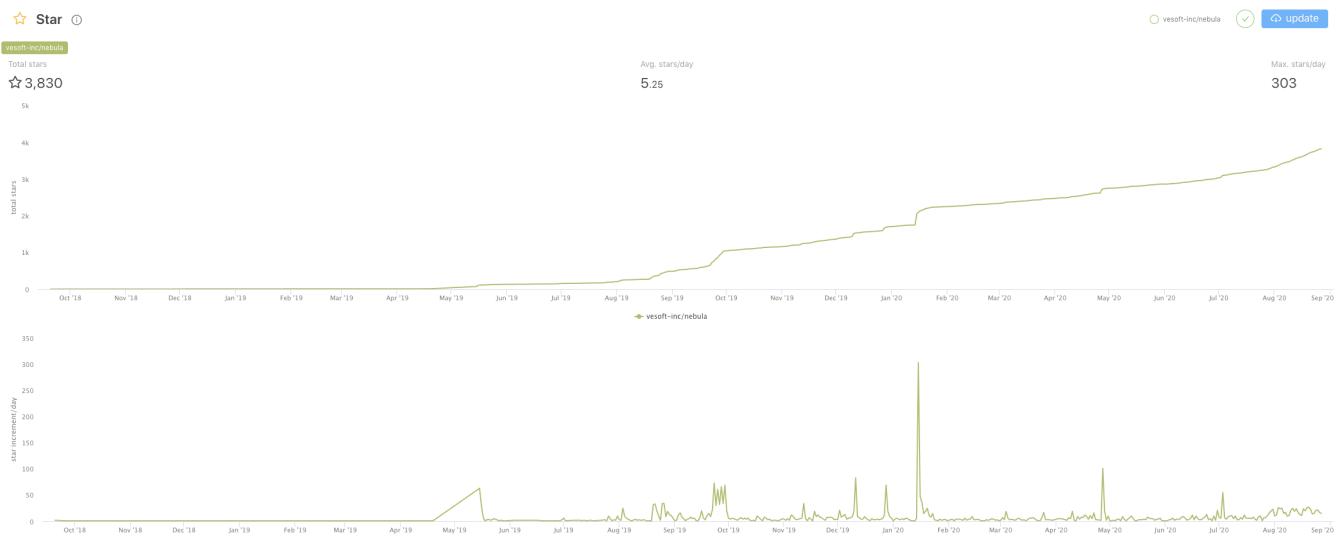


2.1

Amazon Facebook

2.1.1

NebulaGraph GitHub

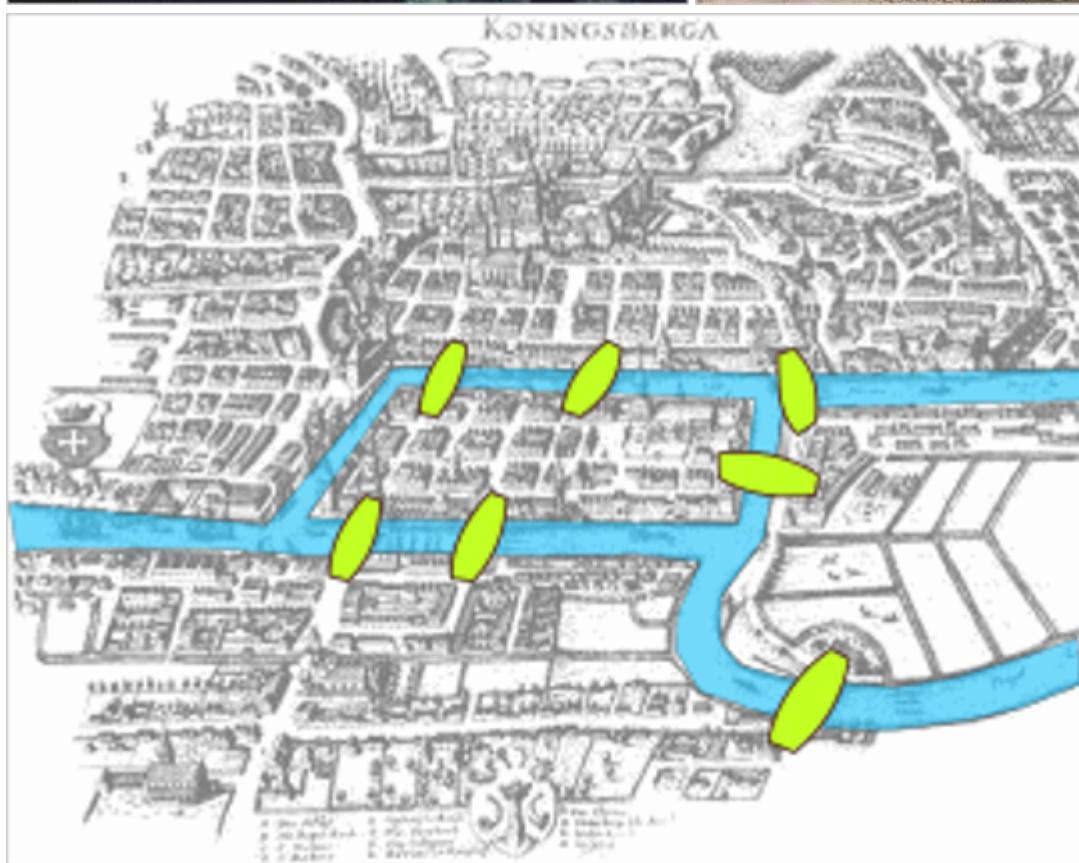




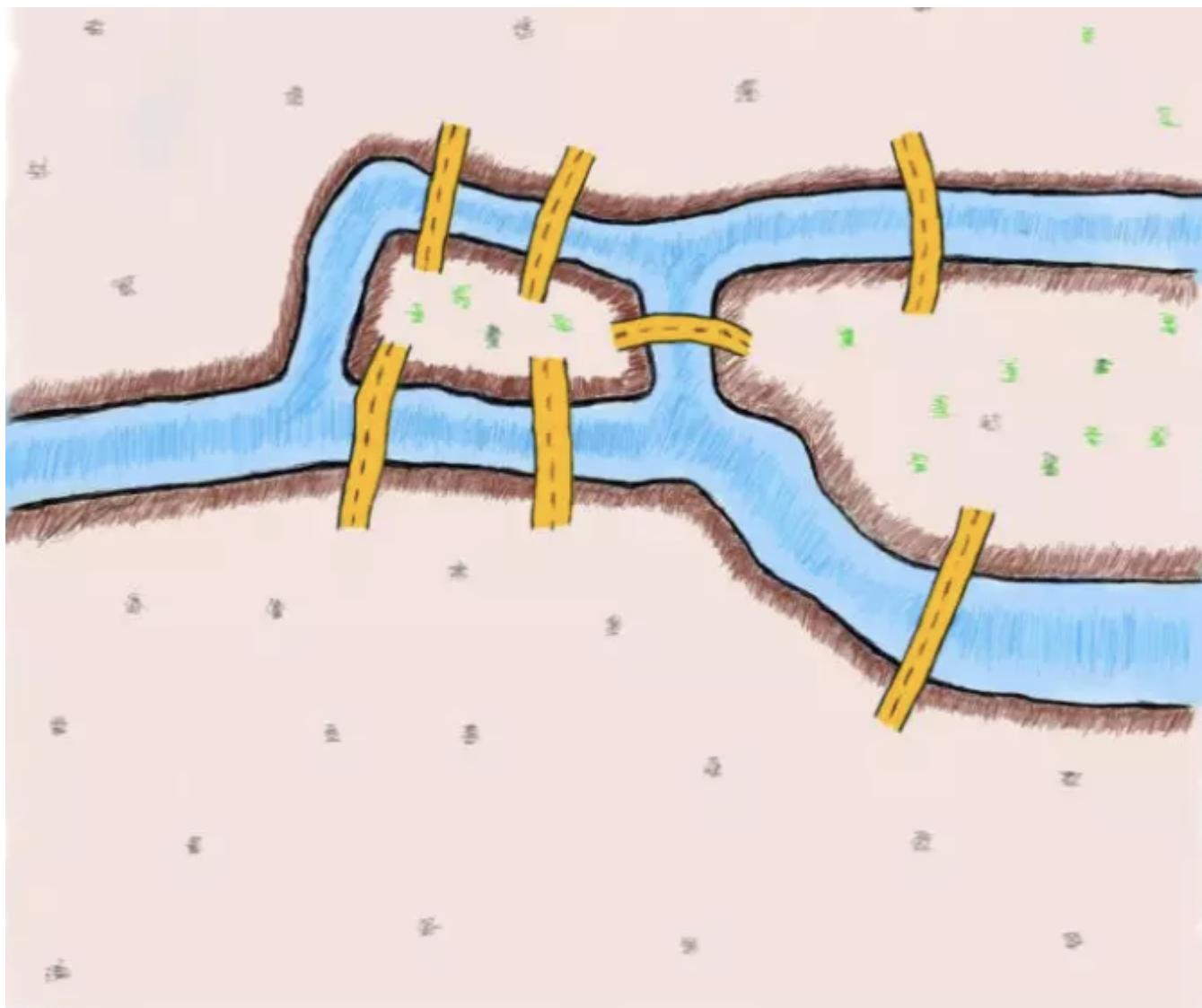
Graph: Image, Visual



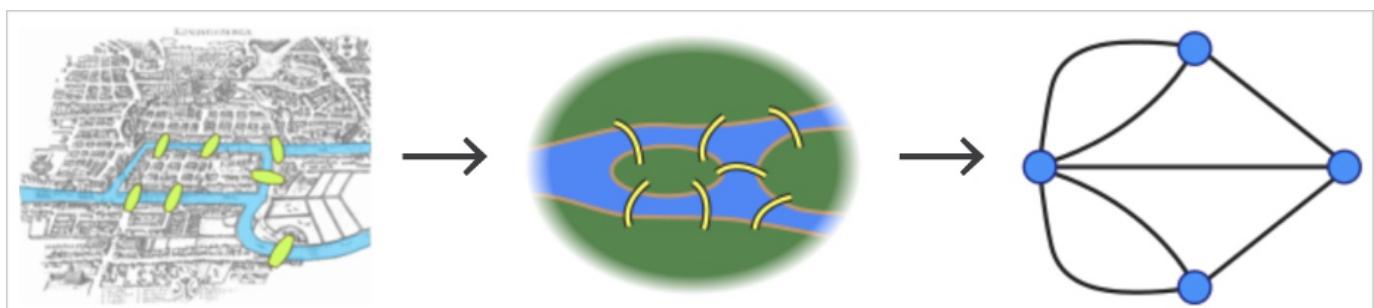
Graph: Network, Connection, Linked Data



1



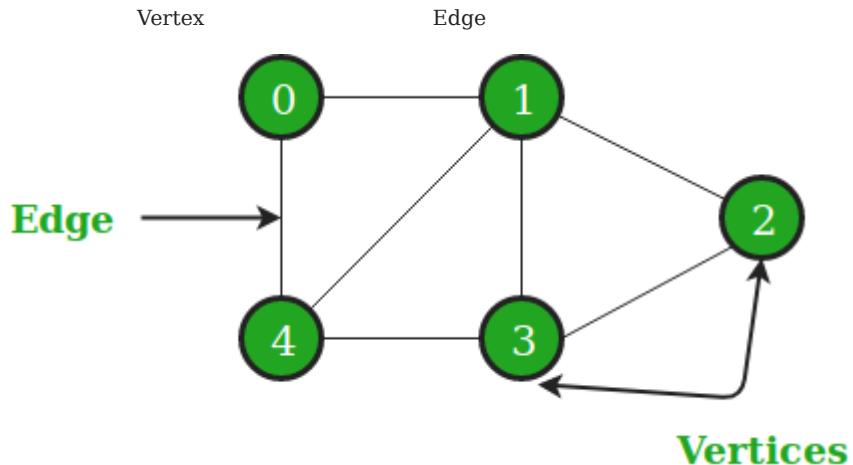
1735



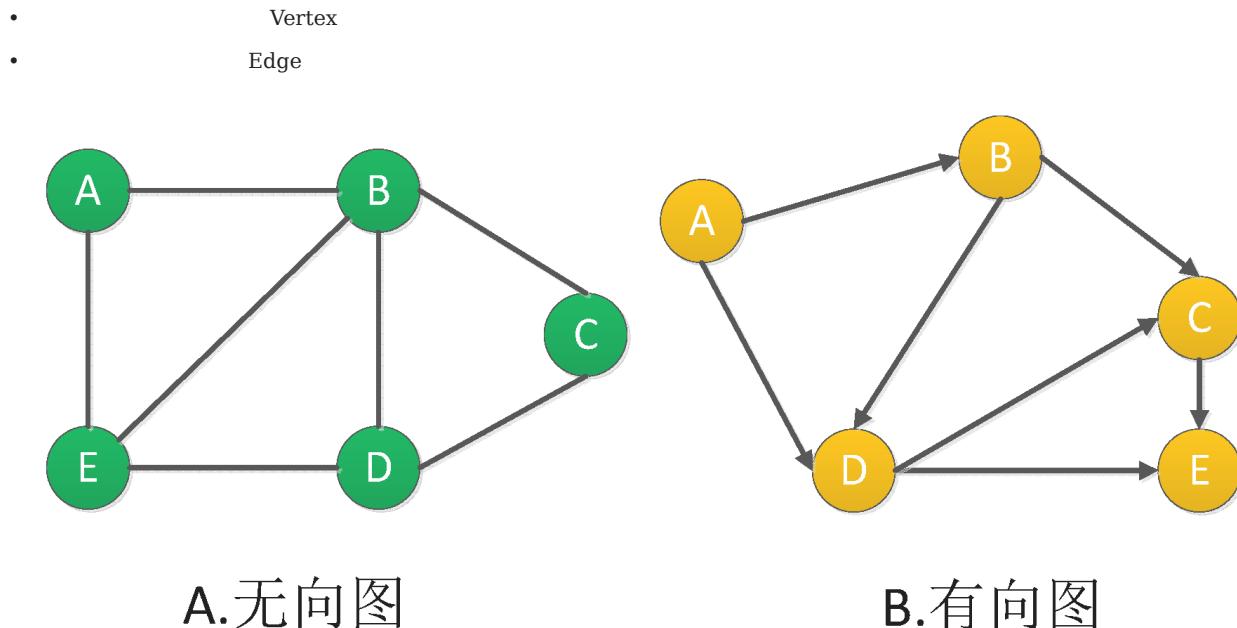
Graph

“ ” “ ”

1878

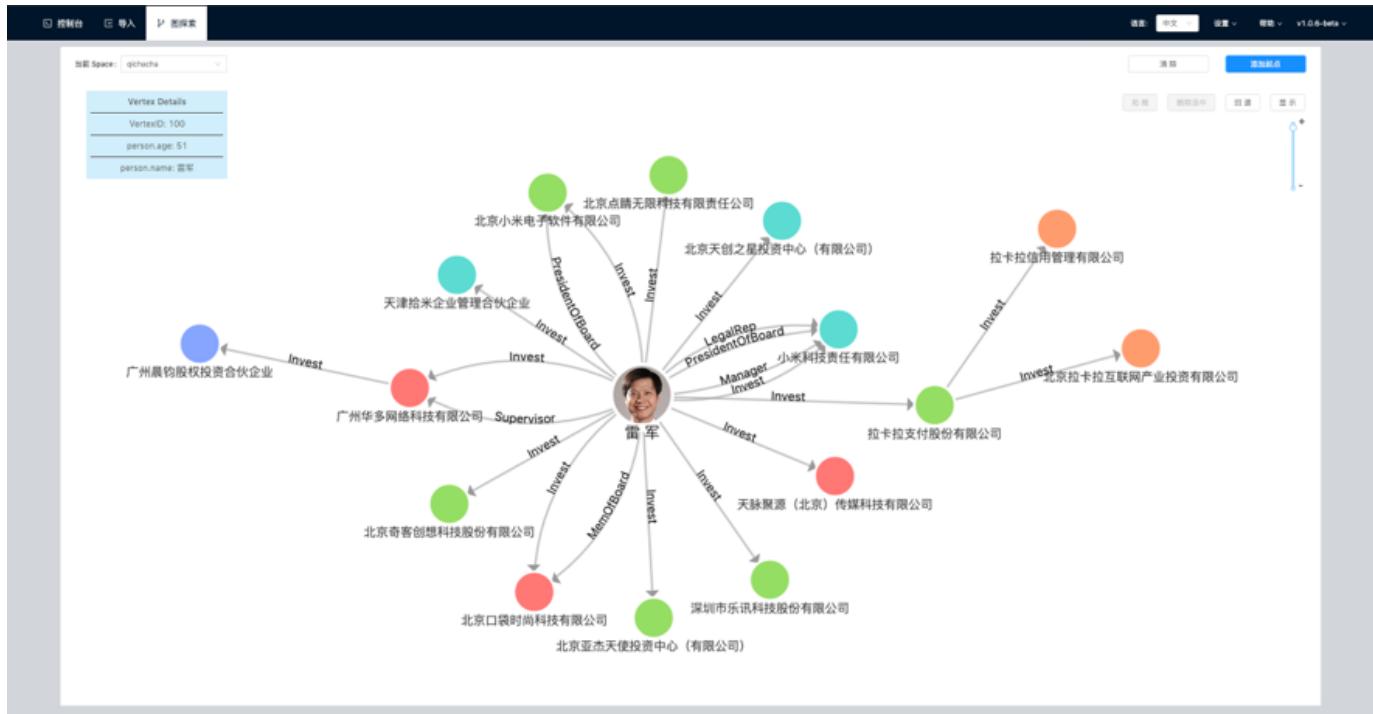


2.1.2

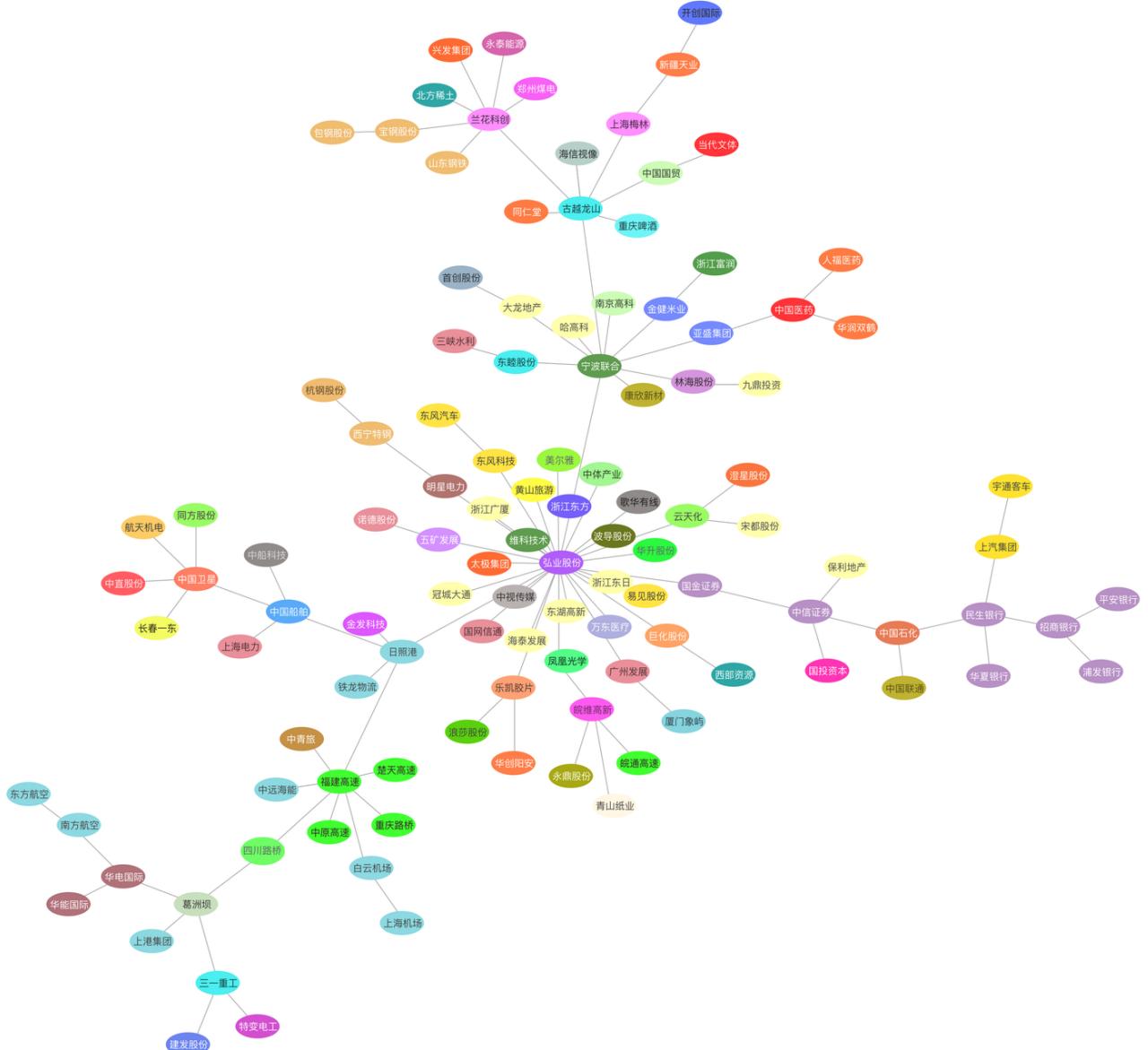


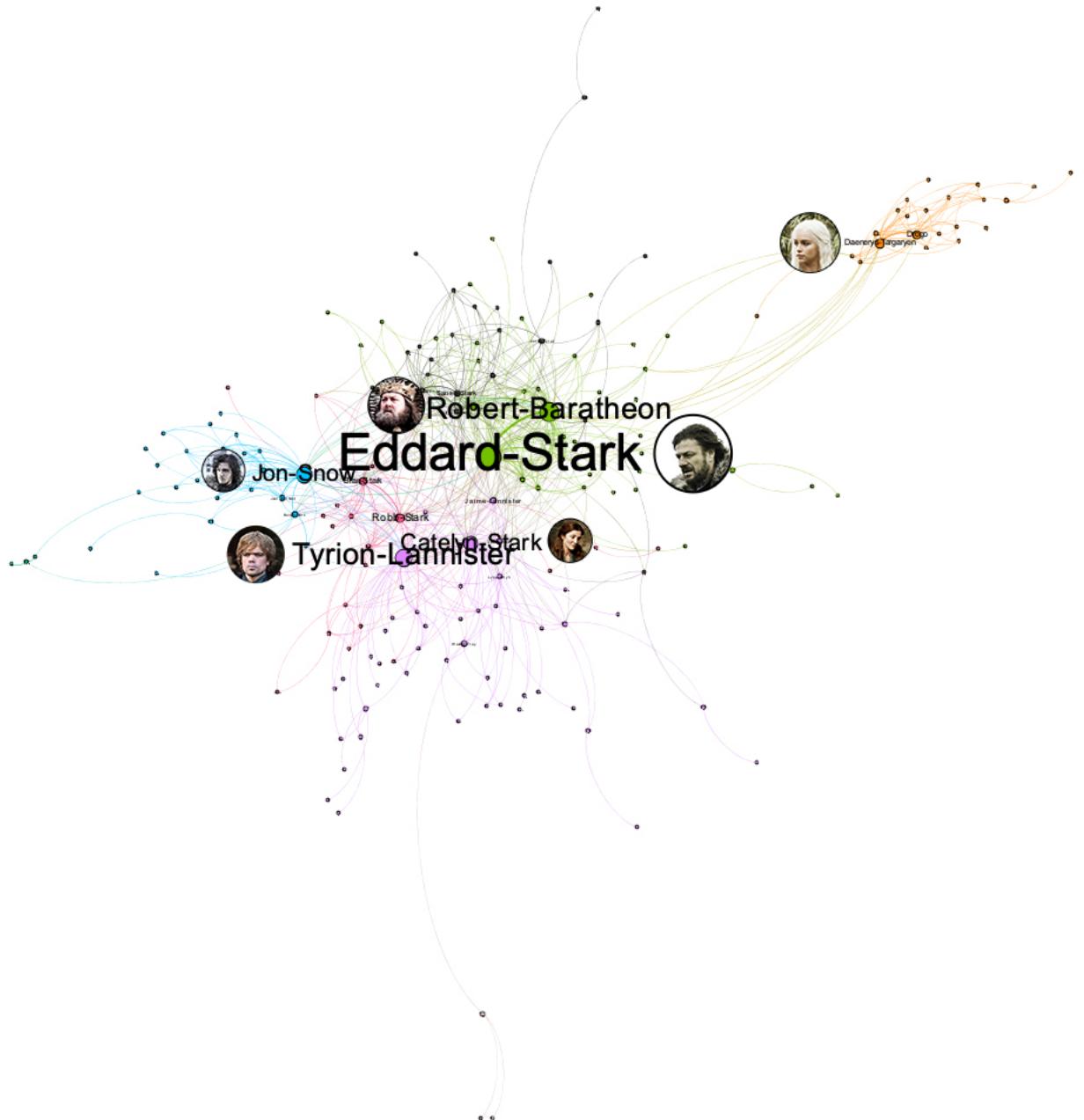
properties

BOSS



2





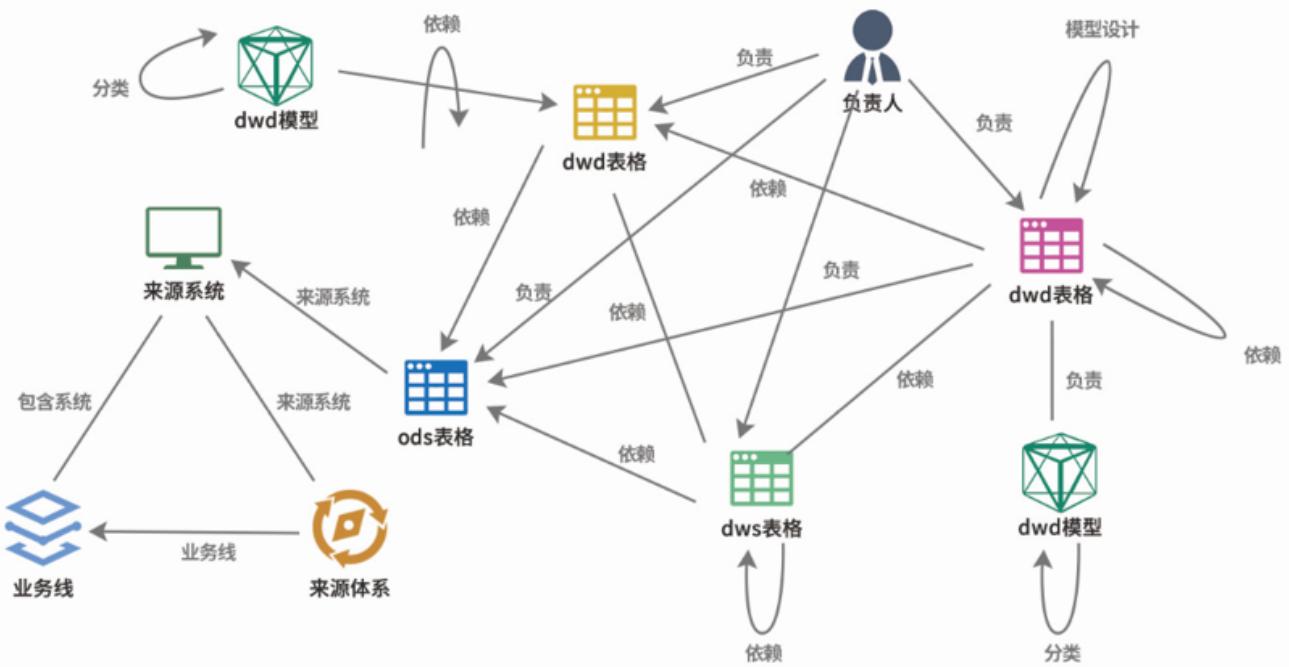
IT

Hive

Job

ETL ⁴

ETL



IT

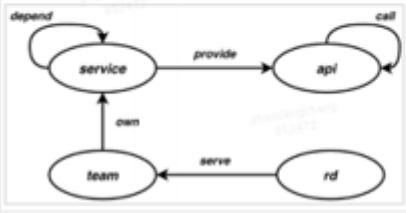
5

(99.99%)

服务治理

- 图谱数据
 - 将RPC服务调用关系写入图谱
 - 包含service、api、team等4类实体及5类关系
 - 点边数量在百万级别，实时写入
 - 用于服务链路治理和告警优化

```
//查找API com.sankuai.ia.search.api:SearchControllerV2.search过去七天可用率低于99.99%的链路的thrift调用，最大图遍历深度为10
GO 1 TO 10 STEPS FROM hash("com.sankuai.ia.search.api:SearchControllerV2.search") OVER call WHERE call.availability>0 AND call.availability<1000000 AND $$.api.type=="mthrift" YIELD call._src,call._dst
```



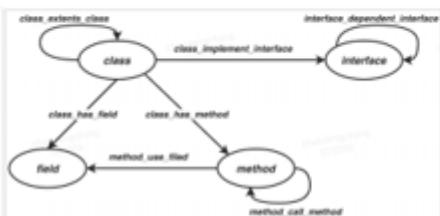
```
//查找所有java类型服务提供的API，并统计其会影响的上游API的数量，从高到低排序看影响次数大小（调用的可用率小于4个9）
LOOKUP ON service WHERE service.type=="java"
| GO FROM $-.VertexID OVER provider YIELD
provider._dst AS java_api_id
| GO FROM $-.java_api_id OVER call REVERSELY WHERE
call.availability>0 AND call.availability<1000000
YIELD call_src AS api_src, call_dst AS api_dst
| GROUP BY $-.api_src YIELD $-.api_src AS api_id,
count(1) AS call_cnt
| ORDER BY call_cnt DESC
| FETCH PROP ON api $-.api_id YIELD
api.appkey,api.method,$-.call_cnt
```

5

代码依赖分析

- 图谱数据
 - 将公司代码库中代码的依赖关系写入图谱
 - 包含method, field, class, interface等4类顶点，7类关系
 - 点边数量在千万级别，实时写入
 - 用于QA精准测试
 - PR向代码仓库提交PR后，能查询出所修改代码能影响到的外部接口，并展示调用路径

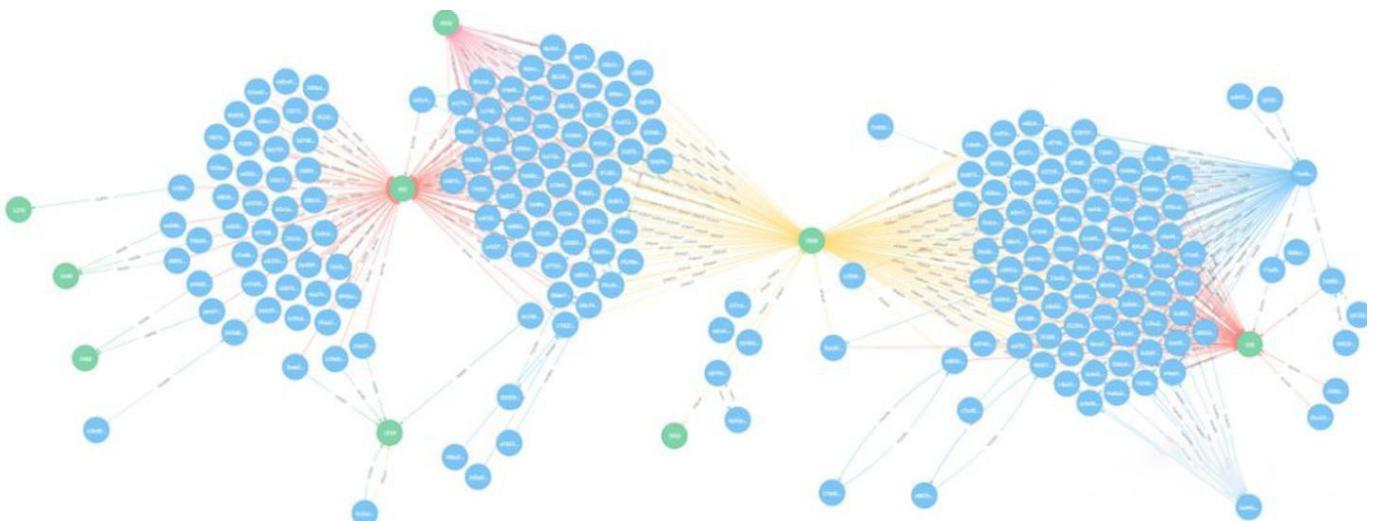
```
//查找最外层method到某个method的所有无环路径
(GO 1 to 30 STEPS FROM 2946345526231222882 OVER
method_call_method REVERSELY YIELD DISTINCT
method_call_method._dst AS id
MINUS
GO 1 to 30 STEPS FROM 2946345526231222882 OVER
method_call_method REVERSELY YIELD DISTINCT
method_call_method._src as id )
| FIND NOLOOP path FROM $-.id TO
2946345526231222882 OVER method_call_method UPTO
30 STEPS
```

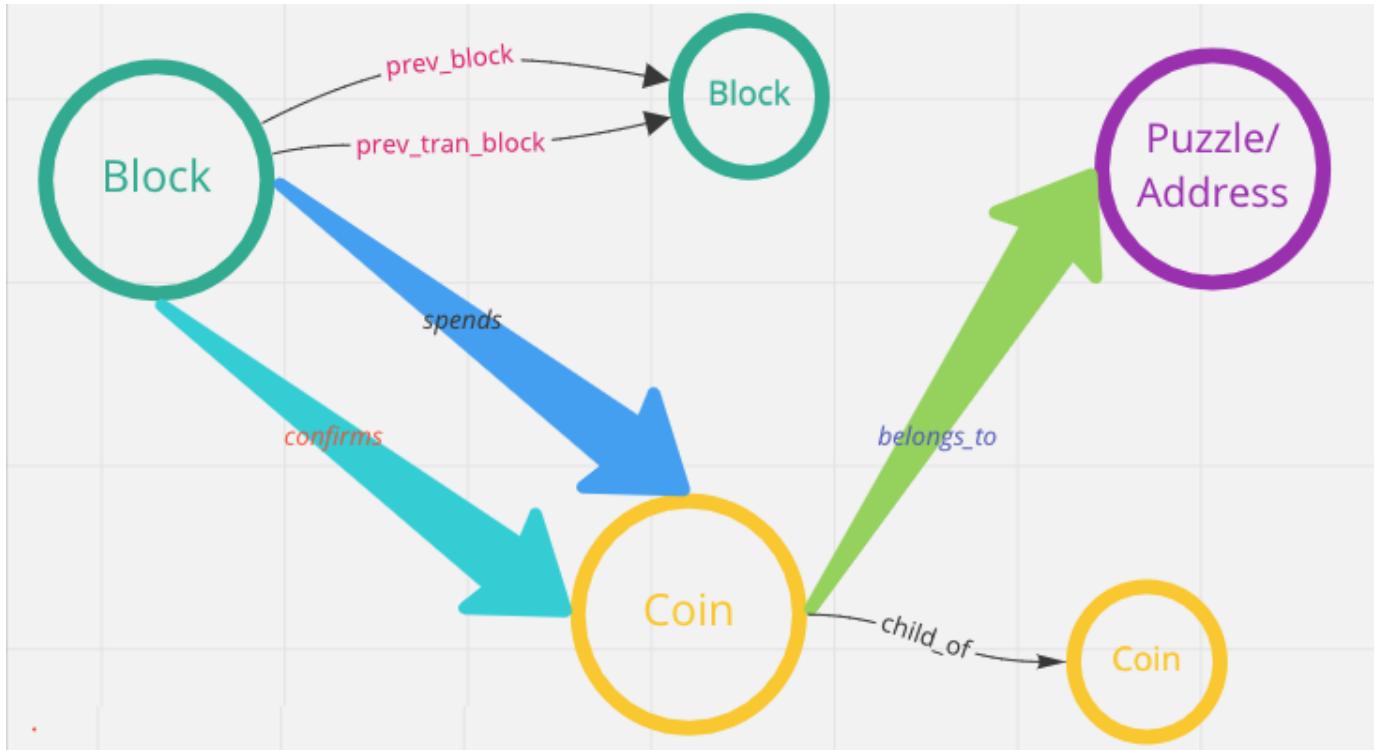


```
//确认两个method间是否有路径
FIND SINGLE SHORTEST PATH FROM hash("method1")
TO hash("method2") OVER method_call_method UPTO
30 STEPS
```

6

“ “ “ ”

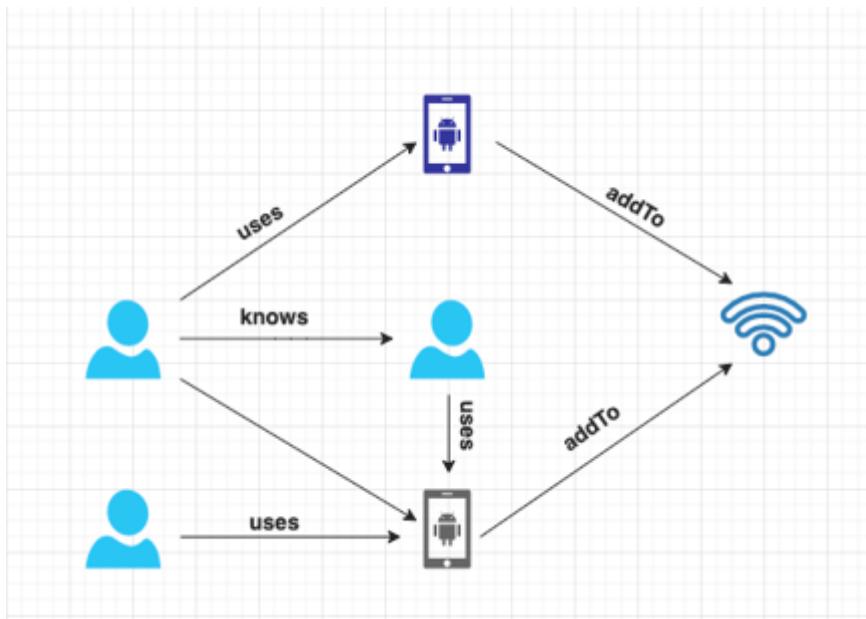




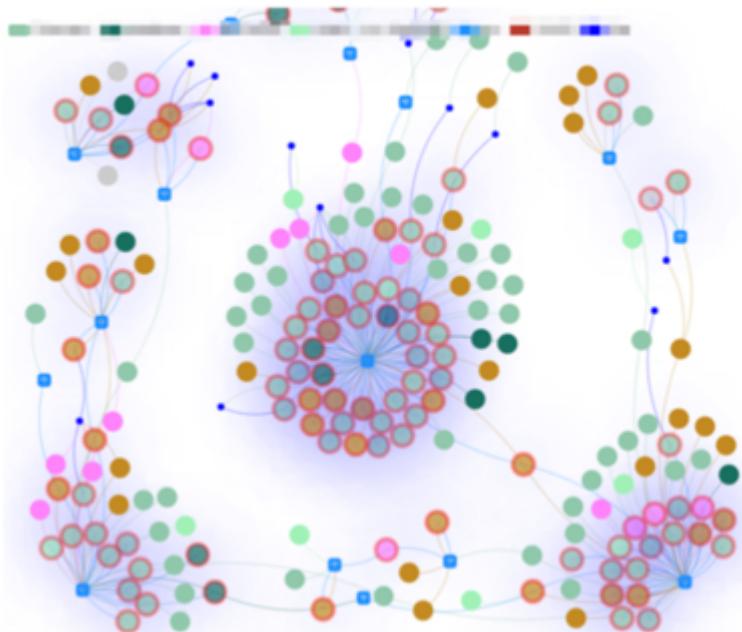
7

WIFI

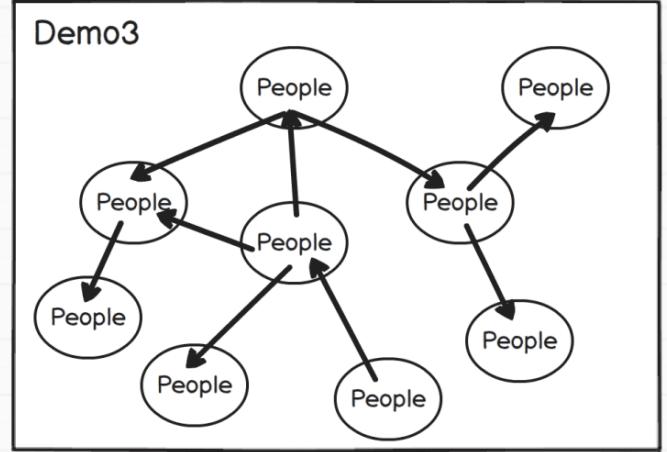
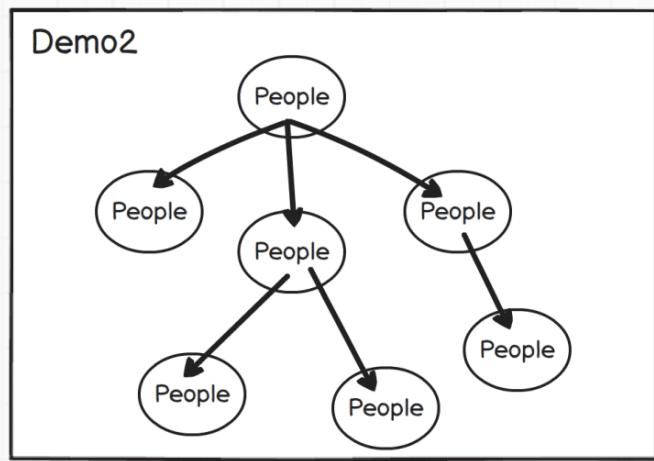
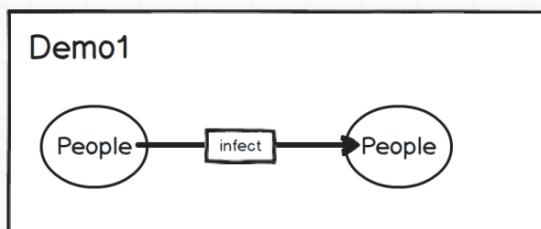
WIFI



360 7 8 9 10



11

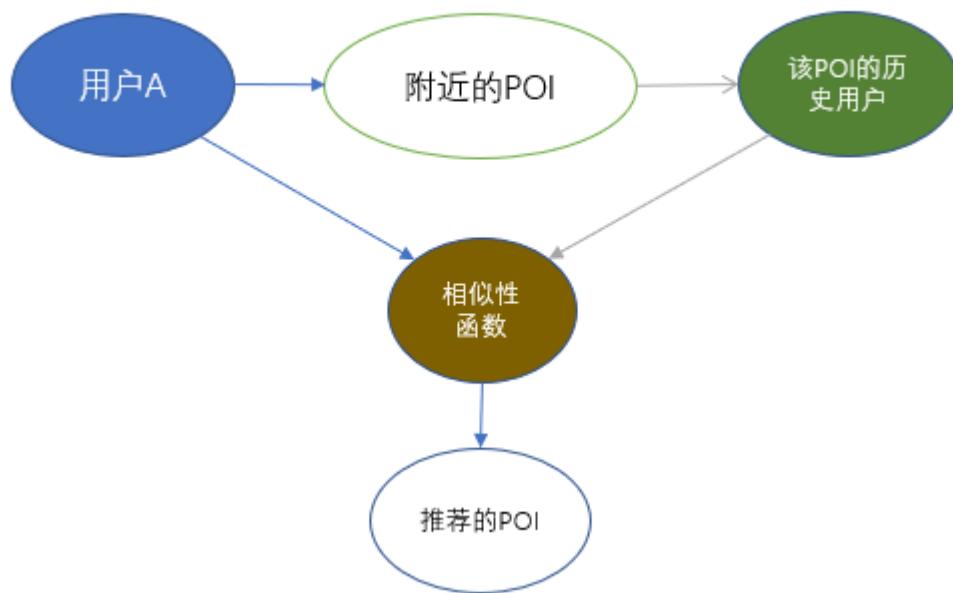


O2O

POI Point-of-Interest

12

APP



Screenshot 1: 搜索结果 - 望京 新荟城

- 目的地: 望京 新荟城
- 新荟城: 48美食 16购物 8休闲娱乐 7丽人 6亲子 648m
包含「东方饺子王」等人气美食店
- 附近商户: 海底捞火锅、尚尚涮烤鱼、江记水煮鱼等。

Screenshot 2: 搜索结果 - 望京SOHO

- 目的地: 望京SOHO
- 望京SOHO: 望京 商务楼 1.4km
评分: 4.9/5, 2414条评价, ¥87
描述: “北京最适合拍豪华夜景的地方”
- 附近餐厅: 香港汇、望京一号、七号八号·小酒小菜等。

Screenshot 3: 搜索结果 - 望京 SOHO 附近餐厅

- 目的地: 望京 SOHO 附近餐厅
- 香港汇: 望京 商务楼 1.4km
评分: 4.5/5, 2668条评价, ¥165/人
描述: “性价比高，适合商务，环境优雅”
- 望京一号: 望京 川菜馆 1.8km
评分: 4.4/5, 9083条评价, ¥105/人
描述: “真的太适合约会了”
- 七号八号·小酒小菜: 望京 川菜馆 1.8km
评分: 4.7/5, 1490条评价, ¥102/人

vivo OPPO

2.1.3

XML/JSON

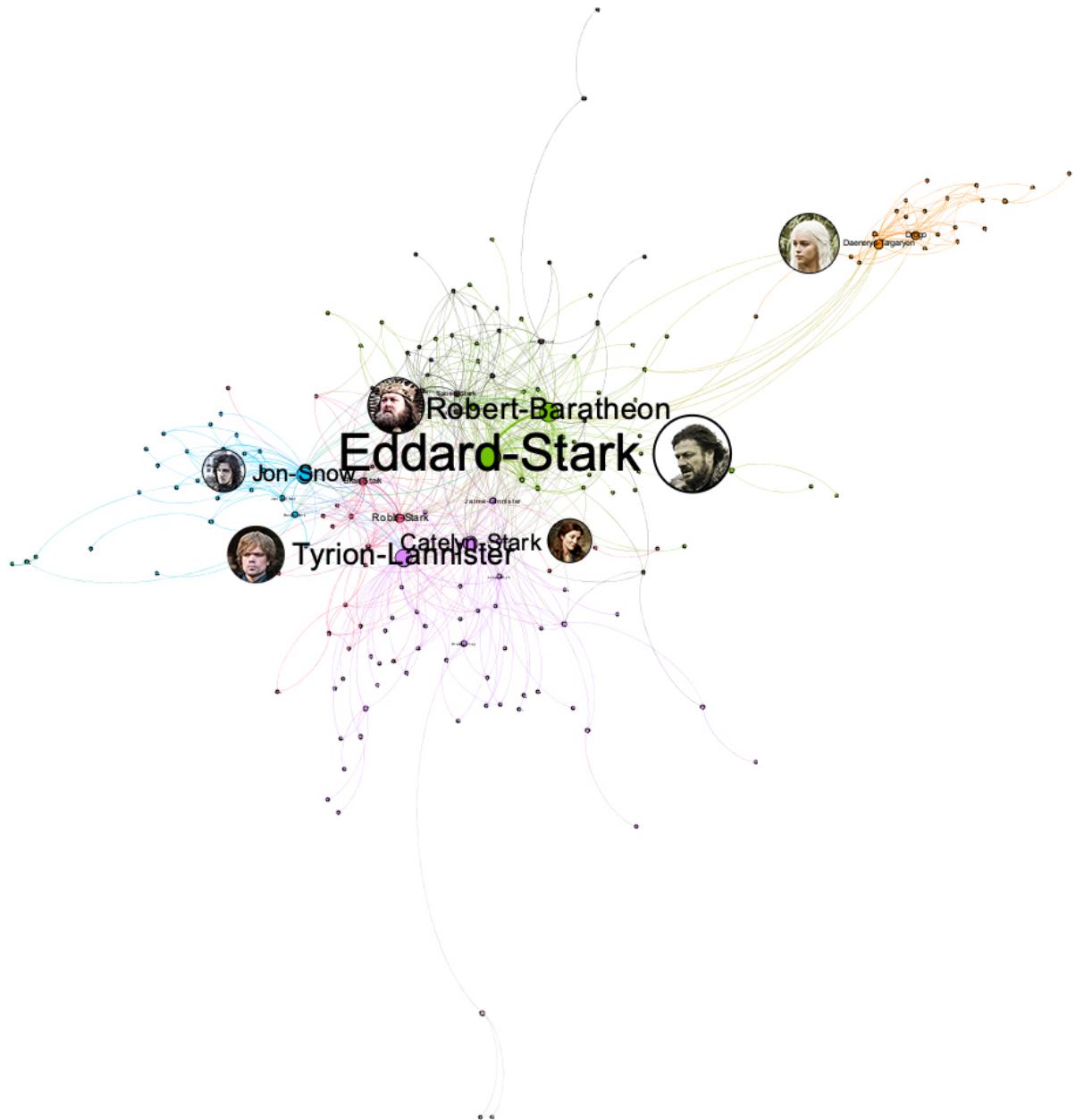
• “ ” “ ”

数据表格

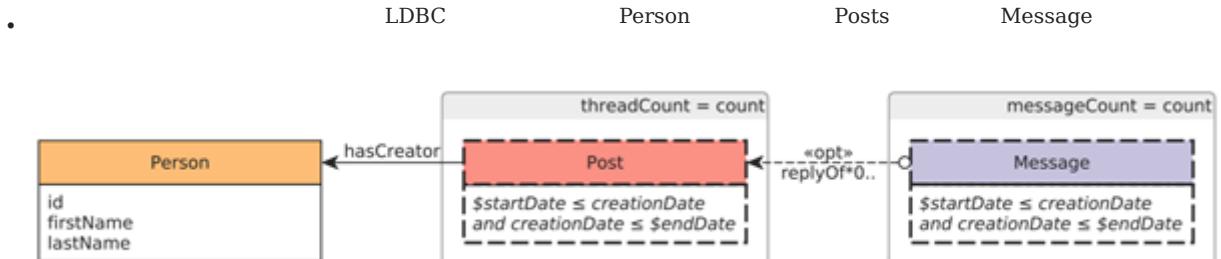
节点 边 配置 添加节点 添加边 搜索/替换 输入电子表格 输出表格 更多功能 过滤: Id

Id	Label	Interval	Modularity Class	betweenness	community	
-4364237027732478972	Arya-Stark	4	4	0.017495	0	0
-4973959390558533367	Gendry	0	0	0.0	0	0
-7025436182975816947	Hialis-Mollen	5	0	0.0	0	0
8249703968876499989	Raymun-Darry	0	0	0.0	0	0
-9085767779232784107	Hobb	3	0	0.0	1	1
7505218728385384214	Randyll-Tarly	3	0	0.0	1	1
5114251854412197144	Viserys-Targaryen	7	0	0.002858	2	2
-2958304360028784612	Jonos-Bracken	2	0	0.0	3	3
-4359919586974142177	Lancel-Lannister	0	0	0.0	0	0
7195357273749773604	Robb-Stark	5	0	0.072984	0	0
1075531505424338989	Marq-Piper	4	0	0.006237	0	0
-3670573862518875597	Addam-Marbrand	2	0	0.0	0	0
3931316780000927284	Robert-Arryn	2	0	0.0	0	0
4826030504180653879	Irri	7	0	0.000096	2	2
7181995877190281794	Jommo	7	0	0.0	2	2
1787258805162148944	Eddard-Stark	0	0	0.269604	0	0
-558158798715221422	Danwell-Frey	1	0	0.021389	4	4
-2434779847791595692	Mordane	4	0	0.001056	0	0
8409318129262644314	Clydas	3	0	0.0	1	1
-1738391870688186527	Karyl-Vance	2	0	0.010753	5	5
6902668443292429674	Haggo	7	0	0.000068	2	2
95861621849685359	Mya-Stone	2	0	0.0	0	0
2025059960255100299	Porther	0	0	0.0	0	0
-1967336888960310122	Colemon	2	0	0.0	0	0
5894253429758865049	Ilyn-Payne	4	0	0.00032	0	0
-1356662602606843742	Pycelle	0	0	0.000321	0	0
382702656484230079	Gared	6	0	0.004328	1	1
1306559795724859089	Jorah-Mormont	7	0	0.012611	2	2
-96410199981447977	Cayn	0	0	0.000022	0	0
7160113306884551800	Chella	2	0	0.0	0	0

添加列 和并列 删除列 清除列 复制数据到其它列 填写数值到列 复制列数据 从正则表达式中新建一个布尔列 新建一列 (列表或者正则表达式匹配组合) 布尔值求反 列转换为动态







PostgreSQL

```
--PostgreSQL
WITH RECURSIVE post_all(psa_threadid
, psa_thread_creatorid, psa_messageid
, psa_creationdate, psa_messagestype
) AS (
  SELECT m_messageid AS psa_threadid
  , m_creatorid AS psa_thread_creatorid
  , m_messageid AS psa_messageid
  , m_creationdate, 'Post'
  FROM message
  WHERE 1=1 AND m_c_replyof IS NULL -- post, not comment
  AND m_creationdate BETWEEN :startDate AND :endDate
UNION ALL
  SELECT psa.psa_threadid AS psa_threadid
  , psa.psa_thread_creatorid AS psa_thread_creatorid
  , m_messageid, m_creationdate, 'Comment'
  FROM message p, post_all psa
  WHERE 1=1 AND p.m_c_replyof = psa.psa_messageid
  AND m_creationdate BETWEEN :startDate AND :endDate
)
SELECT p.p_personid AS "person.id"
, p.p_firstname AS "person.firstName"
, p.p_lastname AS "person.lastName"
, count(DISTINCT psa.psa_threadid) AS threadCount
END) AS messageCount
, count(DISTINCT psa.psa_messageid) AS messageCount
FROM person p left join post_all psa on (
  1=1 AND p.p_personid = psa.psa_thread_creatorid
  AND psa_creationdate BETWEEN :startDate AND :endDate
)
GROUP BY p.p_personid, p.p_firstname, p.p_lastname
ORDER BY messageCount DESC, p.p_personid
LIMIT 100;
```

Cypher

```
--Cypher
MATCH (person:Person)-[:HAS_CREATOR]->(post:Post)-[:REPLY_OF*0..]->(reply:Message)
WHERE post.creationDate >= $startDate AND post.creationDate <= $endDate
AND reply.creationDate >= $startDate AND reply.creationDate <= $endDate
RETURN
  person.id, person.firstName, person.lastName, count(DISTINCT post) AS threadCount,
  count(DISTINCT reply) AS messageCount
ORDER BY
  messageCount DESC, person.id ASC
LIMIT 100
```

SQL join Neo4j 12

深度	关系型数据库的执行时间(s)	Neo4j的执行时间(s)	返回的记录条数
2	0.016	0.01	~2500
3	30.267	0.168	~110000
4	1543.505	1.359	~600000
5	未完成	2.132	~800000

关系数据库 vs 图数据库(多跳查询)

- IT
- 13 (IT)
- 2019 Gartner 27% 500 20%

2.1.4 RDF

RDF

1. <https://medium.freecodecamp.org/i-dont-understand-graph-theory-1c96572a1401>. ↪
 2. <https://nebula-graph.com.cn/posts/stock-interrelation-analysis-jgraphnt-nebula-graph/> ↪
 3. <https://nebula-graph.com.cn/posts/game-of-thrones-relationship-networkx-gephi-nebula-graph/> ↪
 4. <https://nebula-graph.com.cn/posts/practicing-nebula-graph-webank/> ↪
 5. <https://nebula-graph.com.cn/posts/meituan-graph-database-platform-practice/> ↪ ↪
 6. <https://zhuanlan.zhihu.com/p/90635957> ↪
 7. <https://nebula-graph.com.cn/posts/graph-database-data-connections-insight/> ↪ ↪
 8. <https://nebula-graph.com.cn/posts/kuaishou-security-intelligence-platform-with-nebula-graph/> ↪
 9. <https://nebula-graph.com.cn/posts/nebula-graph-for-social-networking/> ↪
 10. <https://mp.weixin.qq.com/s/K2QinpR5Rplw1teHpHtf4w> ↪
 11. <https://nebula-graph.com.cn/posts/detect-corona-virus-spreading-with-graph-database/> ↪
 12. <https://nebula-graph.com.cn/posts/meituan-graph-database-platform-practice/> ↪ ↪
 13. <https://arxiv.org/abs/1709.03188> ↪
-

: January 13, 2023

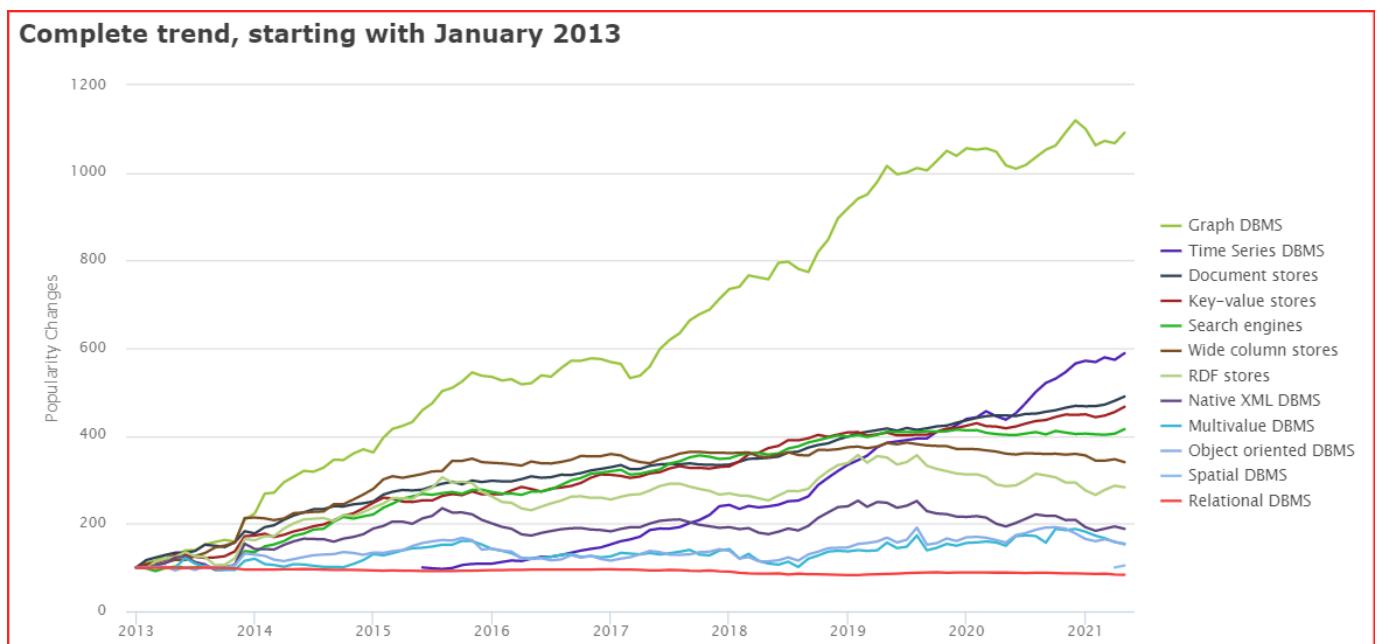
2.2

TTL UDF

2.2.1

DB-Engines

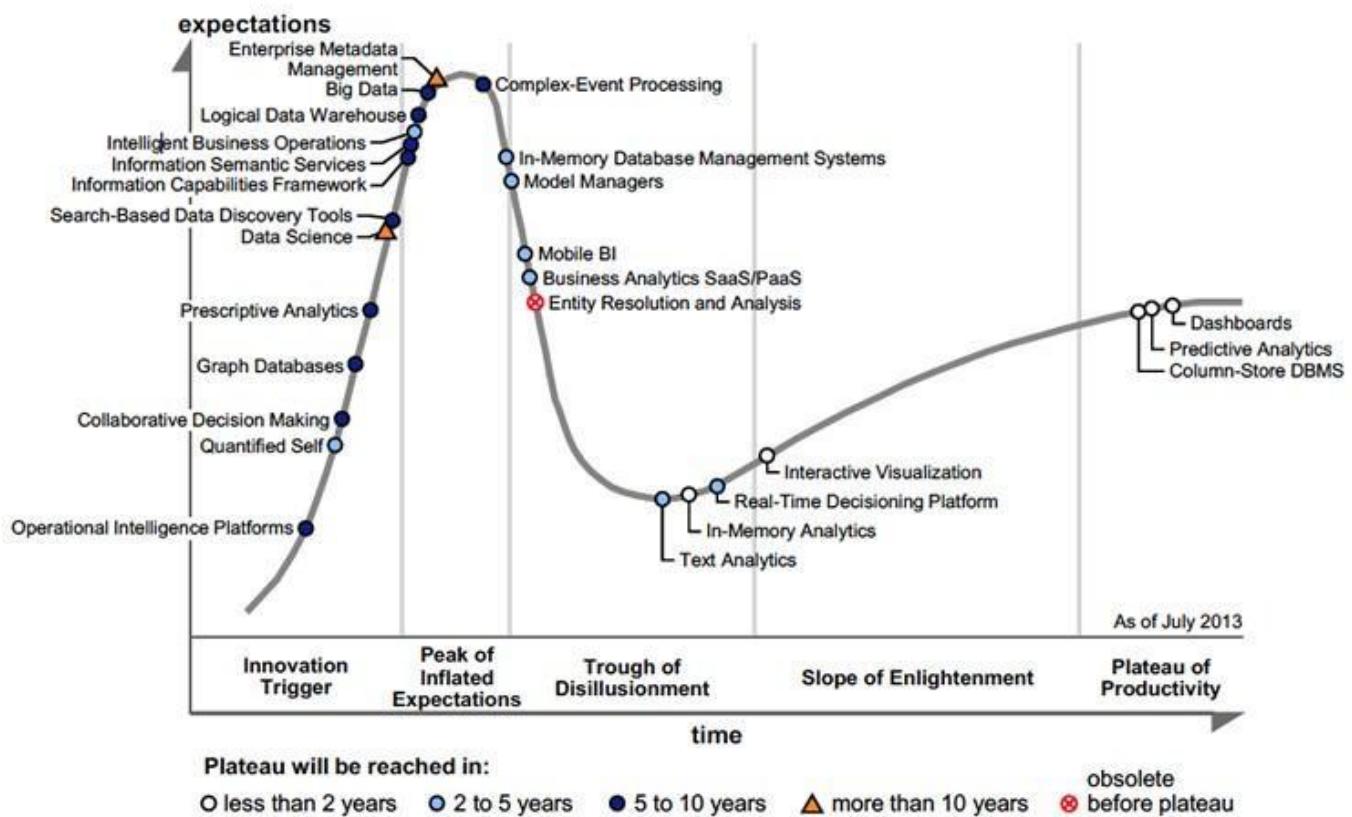
DB-Engines.com	2013	"	"	1			
		Google	IT		371	12	12



Gartner

Gartner 2013 2 " " Big Data

Figure 1. Hype Cycle for Business Intelligence and Analytics, 2013



BI = business intelligence; DBMS = database management system; SaaS = software as a service; PaaS = platform as a service

"2021

④

Gartner Top 10 Data and Analytics Trends, 2021



Accelerating Change

- 1** Smarter, Responsible, Scalable AI
- 2** Composable Data and Analytics
- 3** Data Fabric Is the Foundation
- 4** From Big to Small and Wide Data



Operationalizing Business Value

- 5** XOps
- 6** Engineering Decision Intelligence
- 7** D&A as a Core Business Function



Distributed Everything

- 8** Graph Relates Everything
- 9** The Rise of the Augmented Consumer
- 10** D&A at the Edge

gartner.com/SmarterWithGartner

Source: Gartner
© 2021 Gartner, Inc. All rights reserved. CTMKT_1164473

Gartner

"

Graph Relates Everything

Gartner 2025

2021 10% 80%

Gartner

DB-Engines

verifiedmarketresearch⁴, fnfresearch⁵, marketsandmarkets⁶, gartner⁷
 (CAGR) 30-40 5-10%

2019 8 6 25%



2.2.2

Neo4j

1970 " CODASYL⁸ G/G+⁹ " Neo4j ()

Neo4j¹⁰⁹

Cypher

ISO WG3

"An overview of the recent history of Graph Query



(Graph Query Language GQL)

SQL SQL

SQL
1989 SQL-89

—
SQL-89

(GQL) SQL

SQL-89 GQL

Neo4j Cypher (—ISO GQL-standard) Apache TinkerPop Gremlin (Declarative query language) —
 " " " " (Imperative query language)

GQL

- 2000 Neo4j network
- 2001 Neo4j
- 2007 Neo4j

- 2009 Neo4j XPath Gremlin¹¹
- 2010 Neo4j Marko Rodriguez Property Graph Neo4j Tinkerpop / Gremlin
- 2011 Neo4j 1.4; Cypher
- 2012 Neo4j 1.8 Cypher Neo4j 2.0 Cypher
- 2015 Neo4j Cypher openCypher
- 2017 ISO WG3 SQL
- 2018 12 Neo4j 3.5
- 2019 , ISO (ISO/IEC JTC 1 N 14279 ISO/IEC JTC 1/SC 32 N 3228
- 2021 Neo4j F 3.25

NEO4J

Neo4j	2000	Neo4j	schema	Neo4j	Peter Neubauer
Informix Cocoon			Neo4j	Emil Eifrem	Peter
key-value		Java API			
Neo4j	Johan Svensson			Neo4j	Neo4j
2007 Neo4j					
Neo4j structure	Neo4j 1.4 2011	Neo4j 2.0 2013.12	key-value	Neo4j	search
" " " " "	" "	"	label	Neo4j	
		Neo4j		Cypher	Neo4j
		search structure			

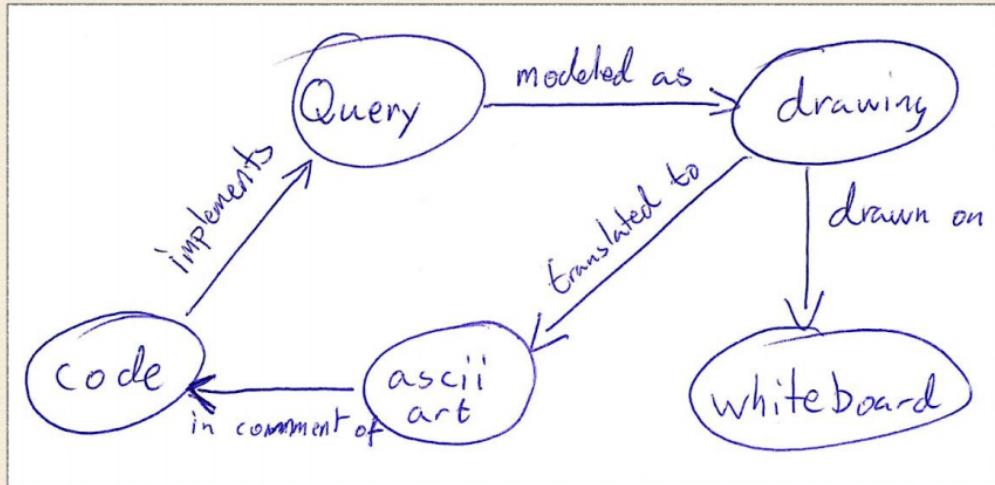
GREMLIN

Gremlin	Apache TinkerPop		Neo4j	Java API	(library)	API
NOSQL Rodriguez	NOSQL XPath	REST Groovy	Neo4j Gremlin	Tobias Lindaaker Ivarsson Peter Neubauer Marko	2009 11	
Marko	XPath Groovy	Gremlin	Groovy	DSL		

CYPHER

Gremlin	Neo4j Java API		Procedural		Gremlin	
	30	SQL	SQL	" "	"	Neo4j
2010 Andrés Taylor	Neo4j SQL			2011 Neo4j 1.4		—Cypher
Cypher	"ASCII (ASCII art)"		Neo4j			

The Origin of Cypher



The Origin of Cypher

Cypher

2012 10 Neo4j 1.8 Cypher

2013 12 Neo4j 2.0 label label

Neo4j Cypher

2015 9 Neo4j openCypher Implementors Group oCIG Cypher openCypher

Cypher

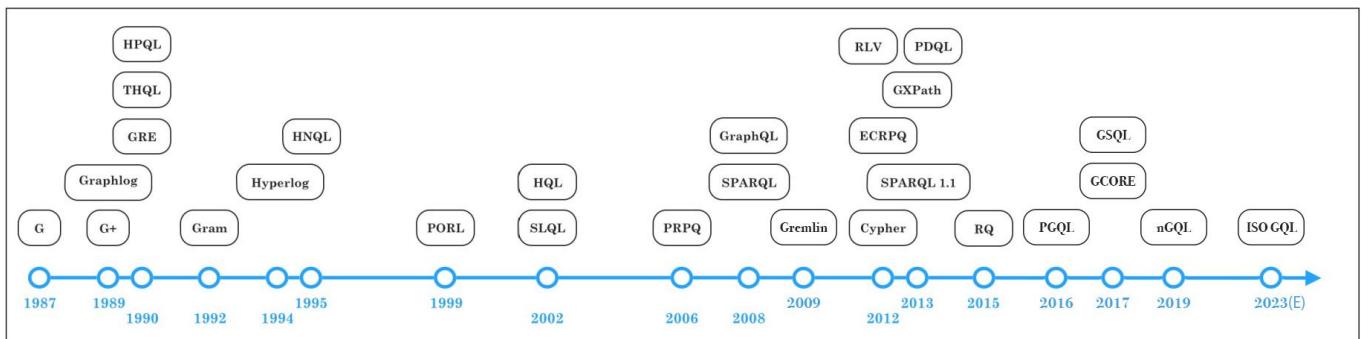
2015 Oracle PGX PGQL

2016 Linked Data Benchmarking Council, LDBC LDBC G-CORE

2018 Redis (library) RedisGraph Cypher

2019 ISO openCypher, PGQL, GSQ¹²L, and G-CORE

2019 NebulaGraph openCypher NebulaGraph Query Language, nGQL



2005-2010 Google " " Hadoop Cassandra

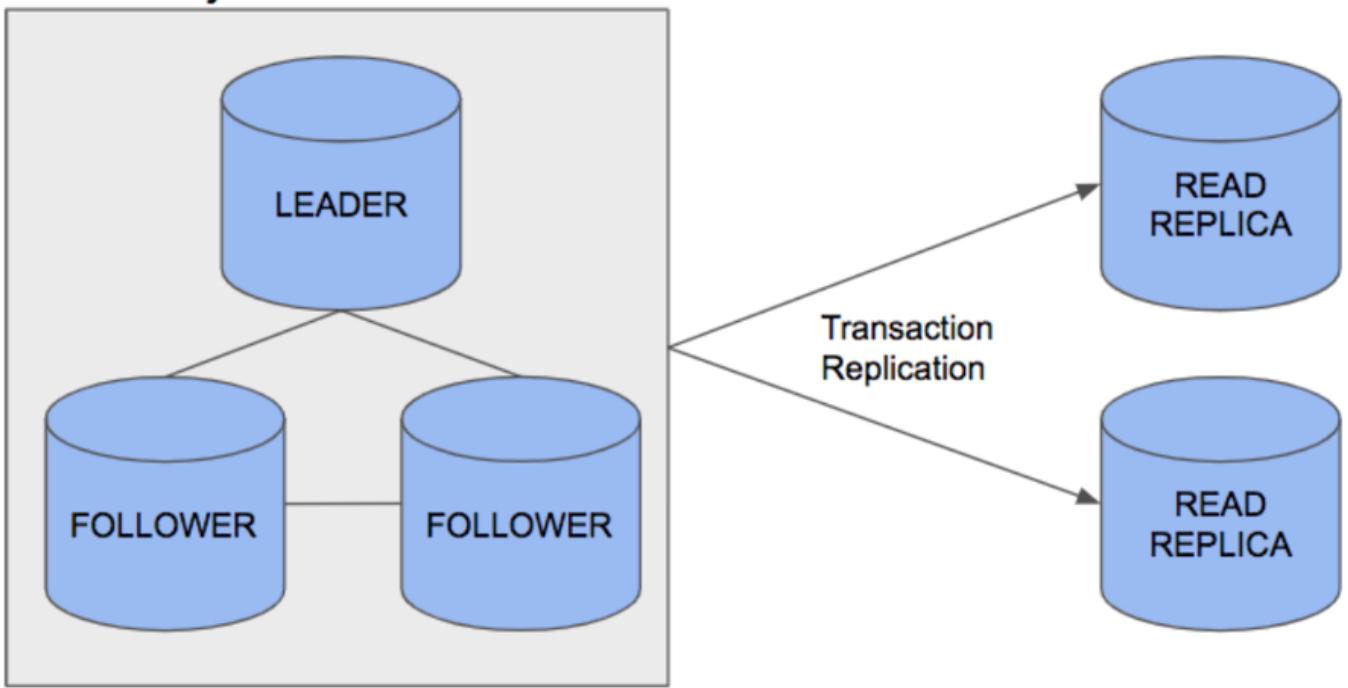
1. (Neo4j)

2.

Neo4j :

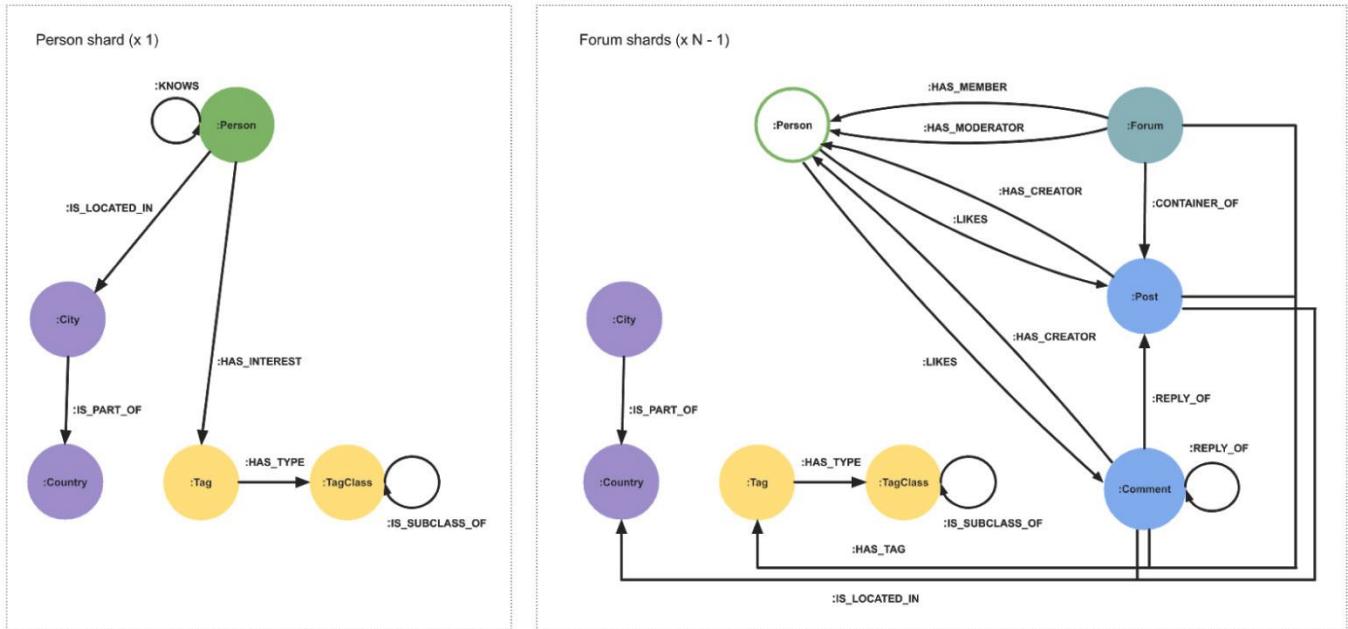
- Neo4j 3.X (Master-slave/slave)

Neo4j Causal Cluster

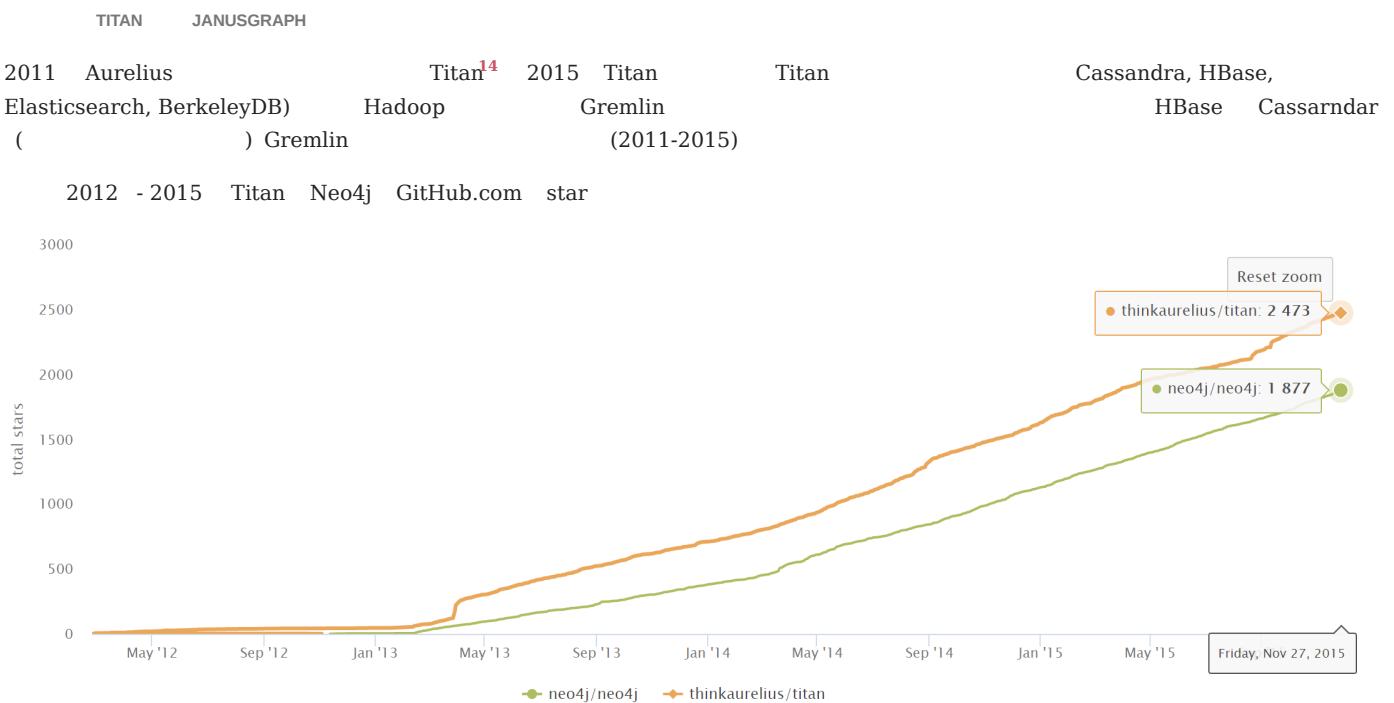
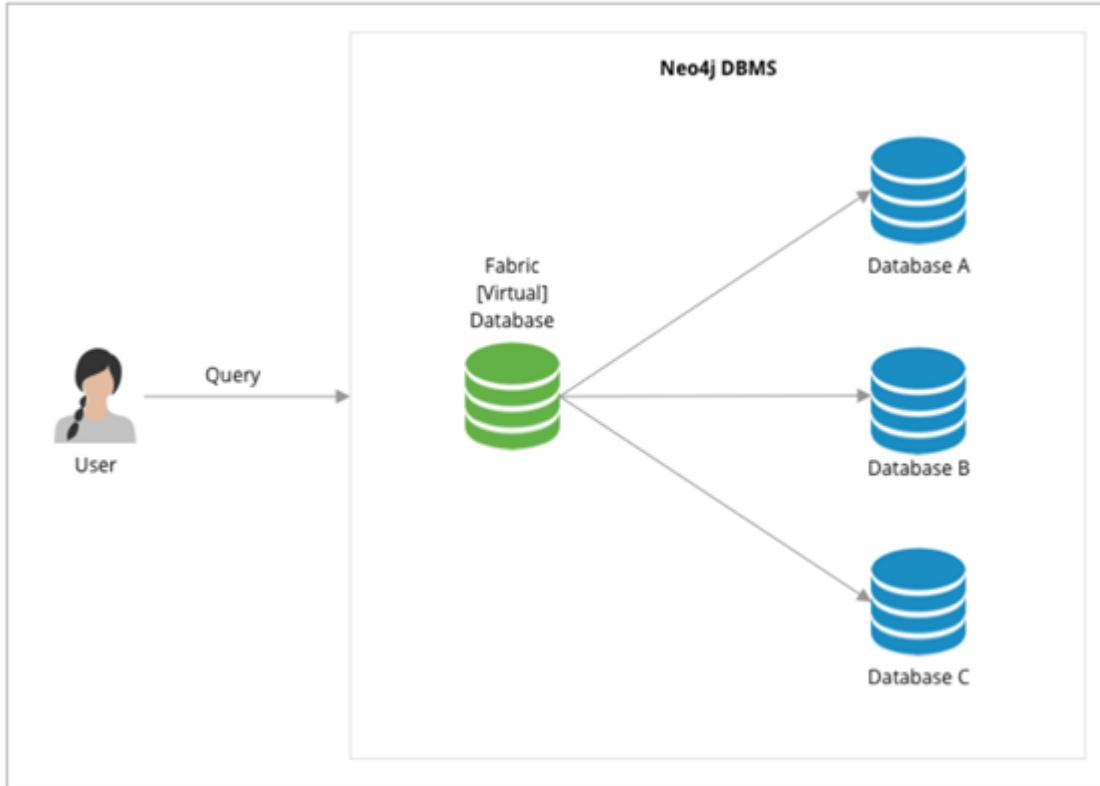


Cluster architecture

- Neo4j 4.X
- (Fabric¹³



```
USE graphA # S1.1  Shard A
MATCH (movie:Movie)
Return movie.title AS title
UNION  # S2.      Join
USE graphB # S1.2  Shard B
MATCH move:Movie)
RETURN movie.title AS title
```



2015 Aurelius(Titan) DataStax Titan (DataStax Enterprise Graph)

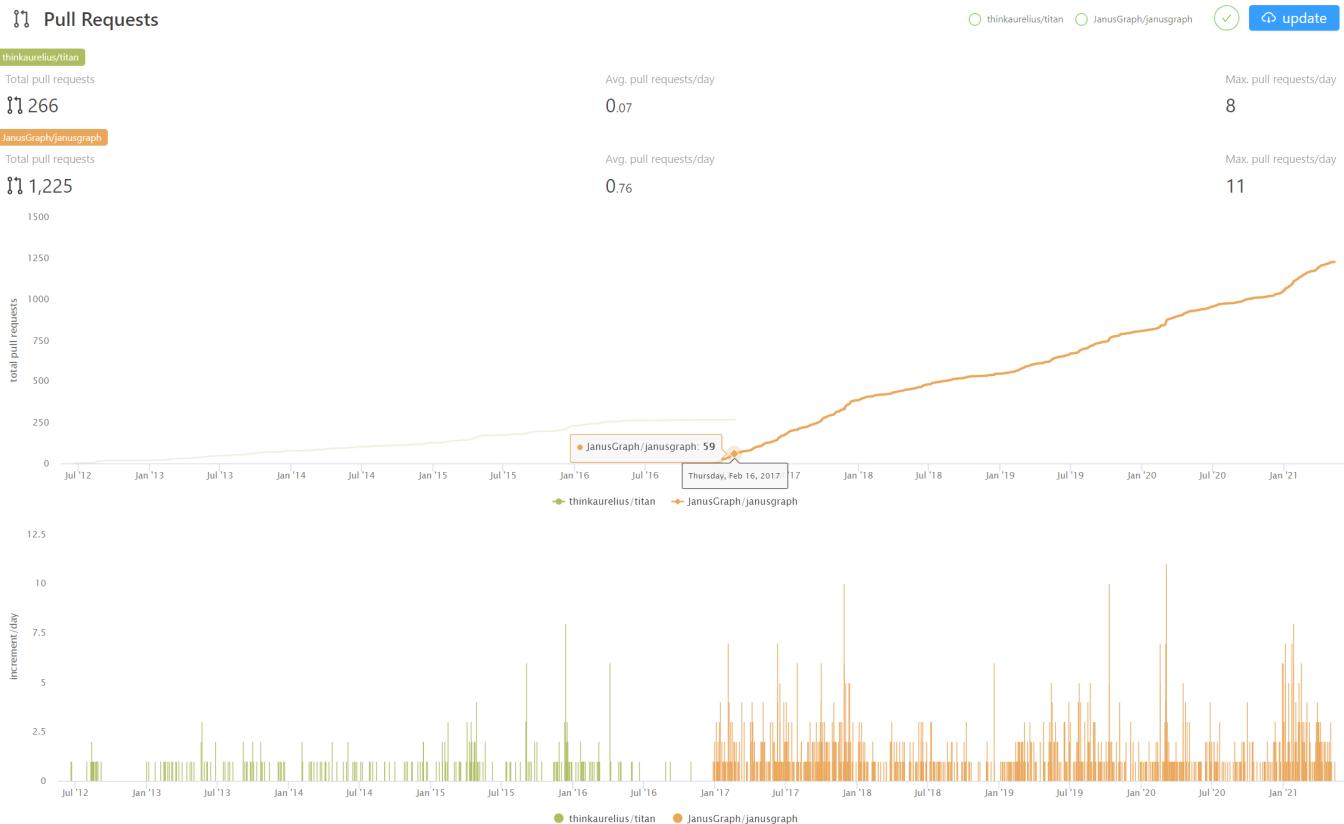
Aurelius(Titan)
Google, GRAKN.AI, Hortonworks, IBM and Amazon) 2017
JanusGraph

Linux
(fork) Titan

JanusGraph¹⁵

2012-2021 (pull request)

1. Aurelius(Titan) 2015	()
2. JanusGraph 2017 1	Titan 5 pull request



ORIENTDB, TIGERGRAPH, ARANGODB, DGRAPH

Linux JanusGraph

OrientDB LTD (2017 SAP)	2011	OrientDB	+ KV +	OrientDB SQL (SQL)
GraphQL (TigerGraph)	2012	TigerGraph	()	GraphQL (SQL)
ArangoDB GmbH	2014	ArangoDB	Apache License 2.0	AQL (, KV)
DGraph Labs	2016	DGraph	Apache Public License 2.0 + Dgraph Community License	RDF GraphQL

Microsoft Azure Cosmos DB¹⁶
RDF Oracle graph¹⁸

SQL key-value

Amazon AWS Neptune¹⁷

AWS

Oracle

NEBULAGRAPH

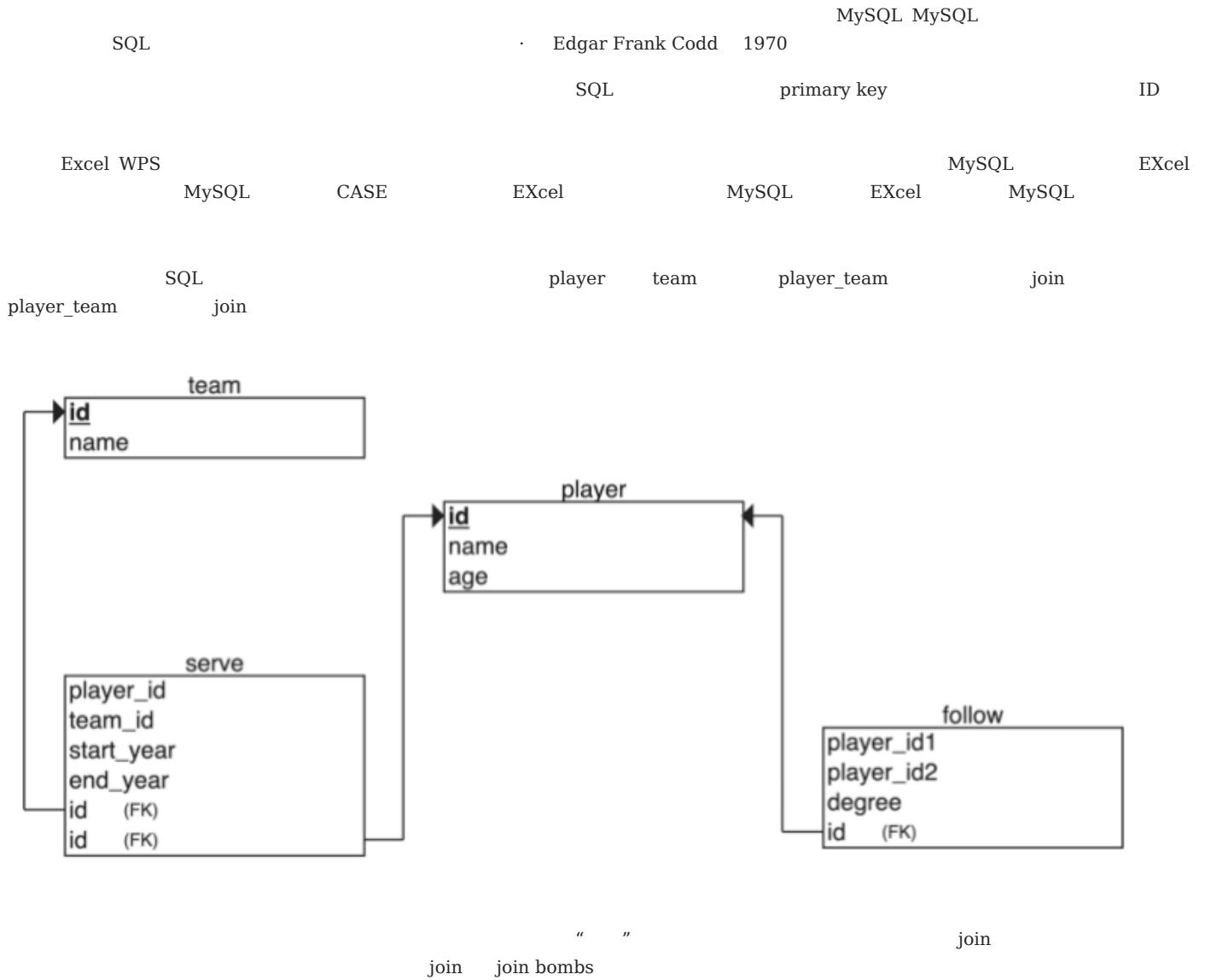
NebulaGraph

-
1. https://db-engines.com/en/ranking_categories ↵
 2. <https://www.yellowfinbi.com/blog/2014/06/yfcommunitynews-big-data-analytics-the-need-for-pragmatism-tangible-benefits-and-real-world-case-165305> ↵
 3. <https://www.gartner.com/smarterwithgartner/gartner-top-10-data-and-analytics-trends-for-2021/> ↵
 4. <https://www.verifiedmarketresearch.com/product/graph-database-market/> ↵
 5. <https://www.globenewswire.com/news-release/2021/01/28/2165742/0/en/Global-Graph-Database-Market-Size-Share-to-Exceed-USD-4-500-Million-By-2026-Facts-Factors.html> ↵
 6. <https://www.marketsandmarkets.com/Market-Reports/graph-database-market-126230231.html> ↵
 7. <https://www.gartner.com/en/newsroom/press-releases/2019-07-01-gartner-says-the-future-of-the-database-market-is-the> ↵
 8. <https://www.amazon.com/Designing-Data-Intensive-Applications-Reliable-Maintainable/dp/1449373321> ↵
 9. I. F. Cruz, A. O. Mendelzon, and P. T. Wood. A Graphical Query Language Supporting Recursion. In Proceedings of the Association for Computing Machinery Special Interest Group on Management of Data, pages 323-330. ACM Press, May 1987. ↵ ↵
 10. "An overview of the recent history of Graph Query Languages". Authors: Tobias Lindaaker, U.S. National Expert. Date: 2018-05-14 ↵
 11. Gremlin Apache TinkerPop (<https://tinkerpop.apache.org/>) ↵
 12. <https://docs.tigergraph.com/dev/gsql-ref> ↵
 13. <https://neo4j.com/fosdem20/> ↵
 14. <https://github.com/thinkaurelius/titan> ↵
 15. <https://github.com/JanusGraph/janusgraph> ↵
 16. <https://azure.microsoft.com/en-us/free/cosmos-db/> ↵
 17. <https://aws.amazon.com/cn/neptune/> ↵
 18. <https://www.oracle.com/database/graph/> ↵
-

:January 13, 2023

2.3

2.3.1



IBM . Edgar Frank Codd 1970
tuple calculus

SQL IBM R IBM . IBM Oracle

12 Codd's 12 rules

NoSQL

NoSQL	" "	NoSQL	NoSQL	90	" SQL" " SQL"
-------	-----	-------	-------	----	---------------

- key-value stores
- column-family stores
- document stores
- graph databases

SQL	web	
IT		DBA
Redis	Voldemort	Oracle BDB

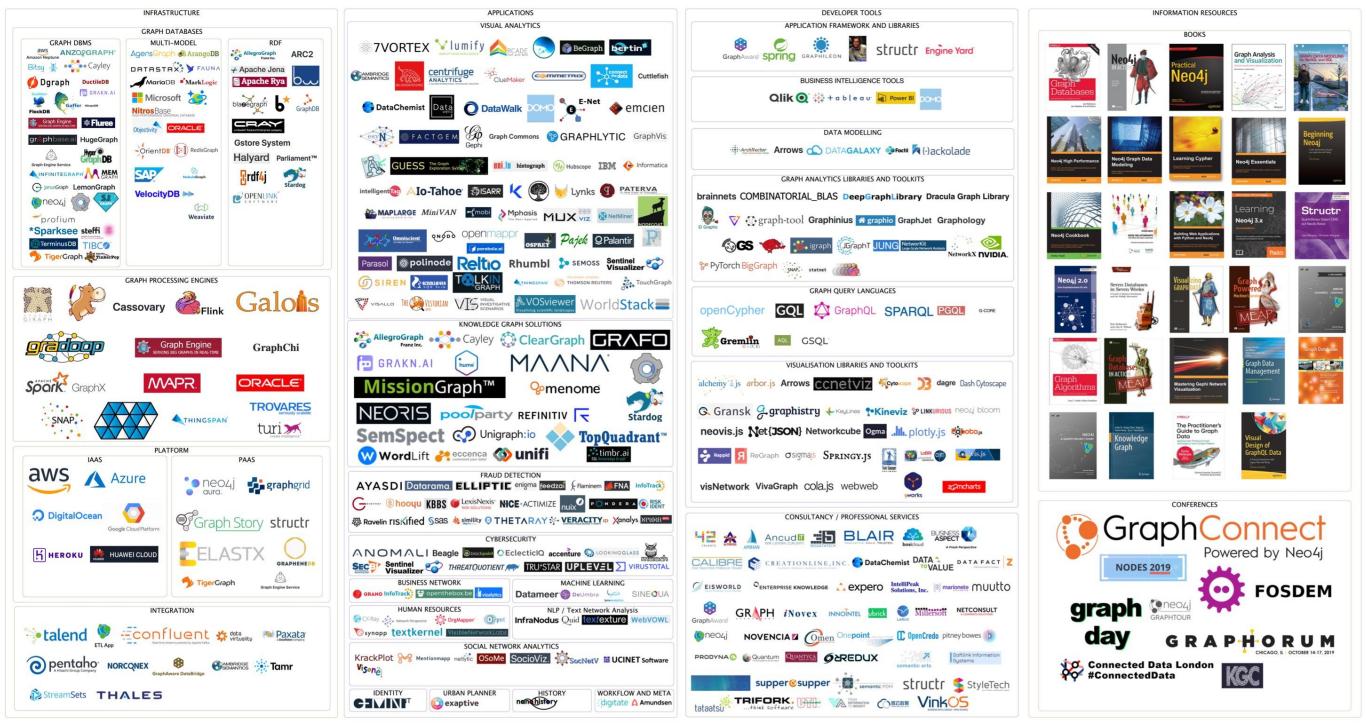
NoSQL	NoSQL	
		HBase Cassandra HadoopDB

NoSQL	XML JOSN YAML	JSON	JSON
JSON	MongoDB CouchDB Terrastore		
NoSQL	NebulaGraph	NoSQL	NoSQL
		NoSQL	NebulaGraph Neo4j OrientDB

2.3.2

2020 1

GRAPH TECHNOLOGY LANDSCAPE 2020



2020_v2

()

• K

- (Pattern matching) /

" (subgraph isomorphism)" ---

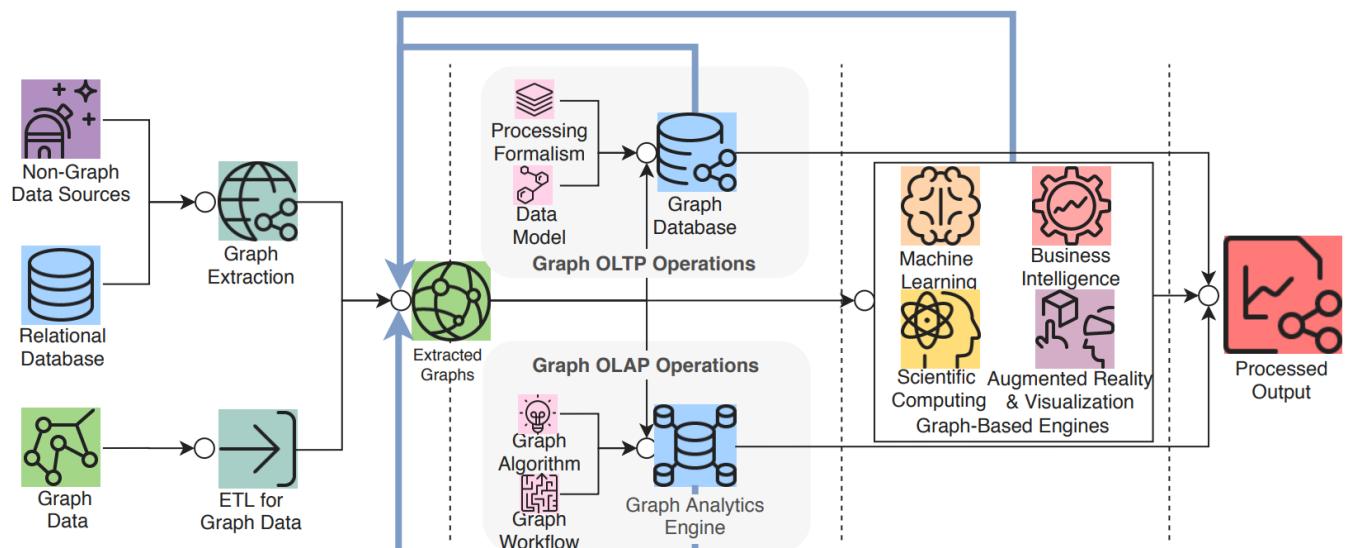
3

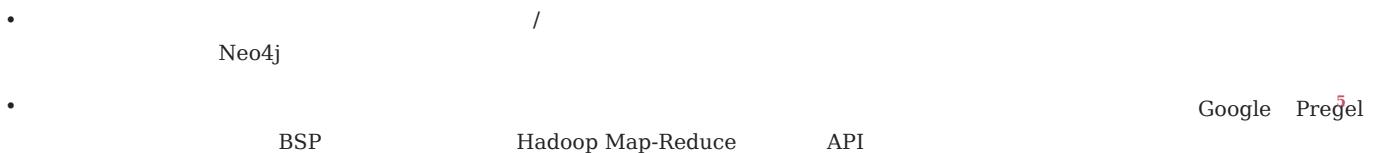
Graph G	Graph H	An isomorphism between G and H
		$f(a) = 1$ $f(b) = 6$ $f(c) = 8$ $f(d) = 3$ $f(g) = 5$ $f(h) = 2$ $f(i) = 4$ $f(j) = 7$

- (Regular Path Query) ——
- count

(Graph Database) (Graph processing)

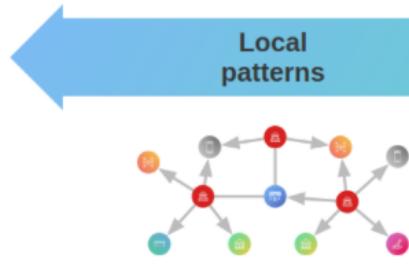
4 () () ETL (Graph OLTP) (Graph OLAP) BI





Query (e.g. Cypher/Python)

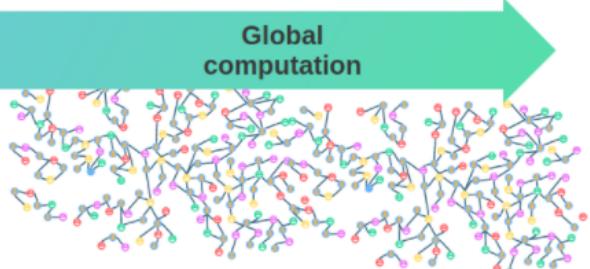
Real-time, local decisioning
and pattern matching



You know what you're looking
for and making a decision

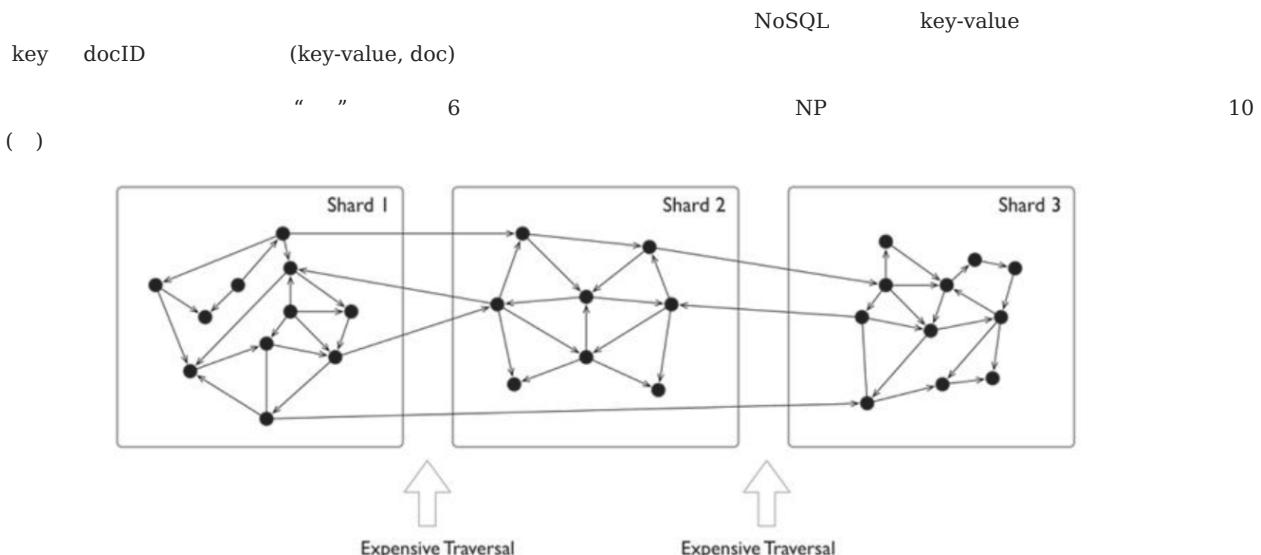
Graph Algorithms libraries

Global analysis
and iterations



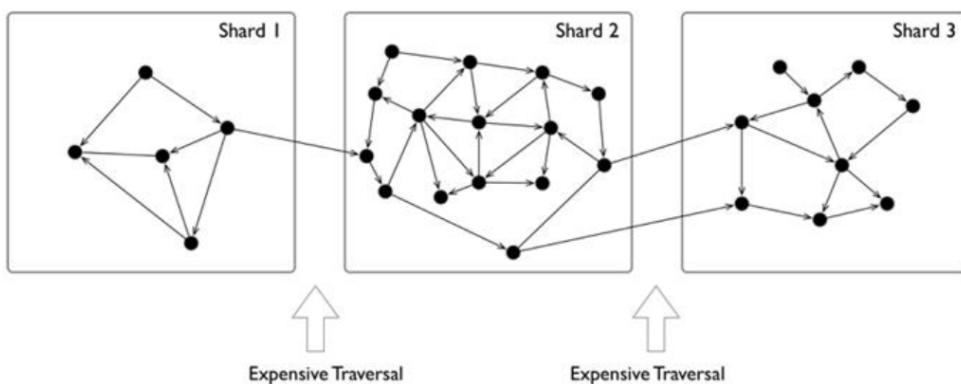
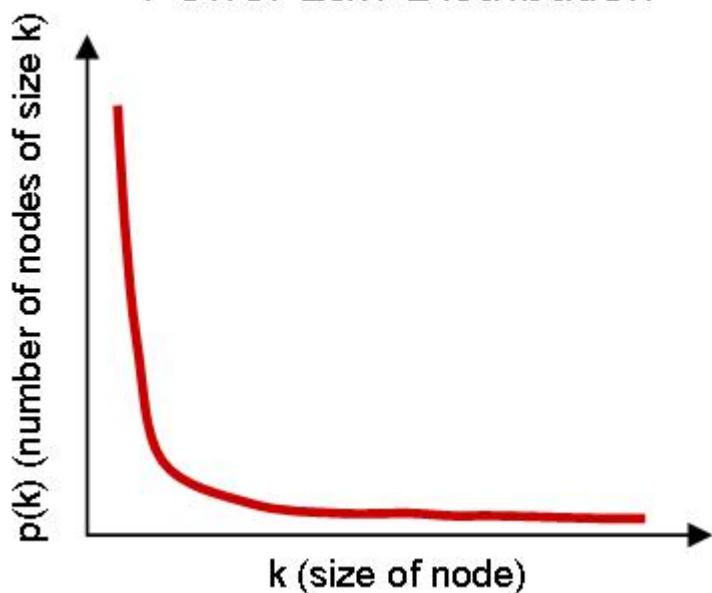
You're learning the overall structure of a
network, updating data, and predicting

6



7

Power Law Distribution

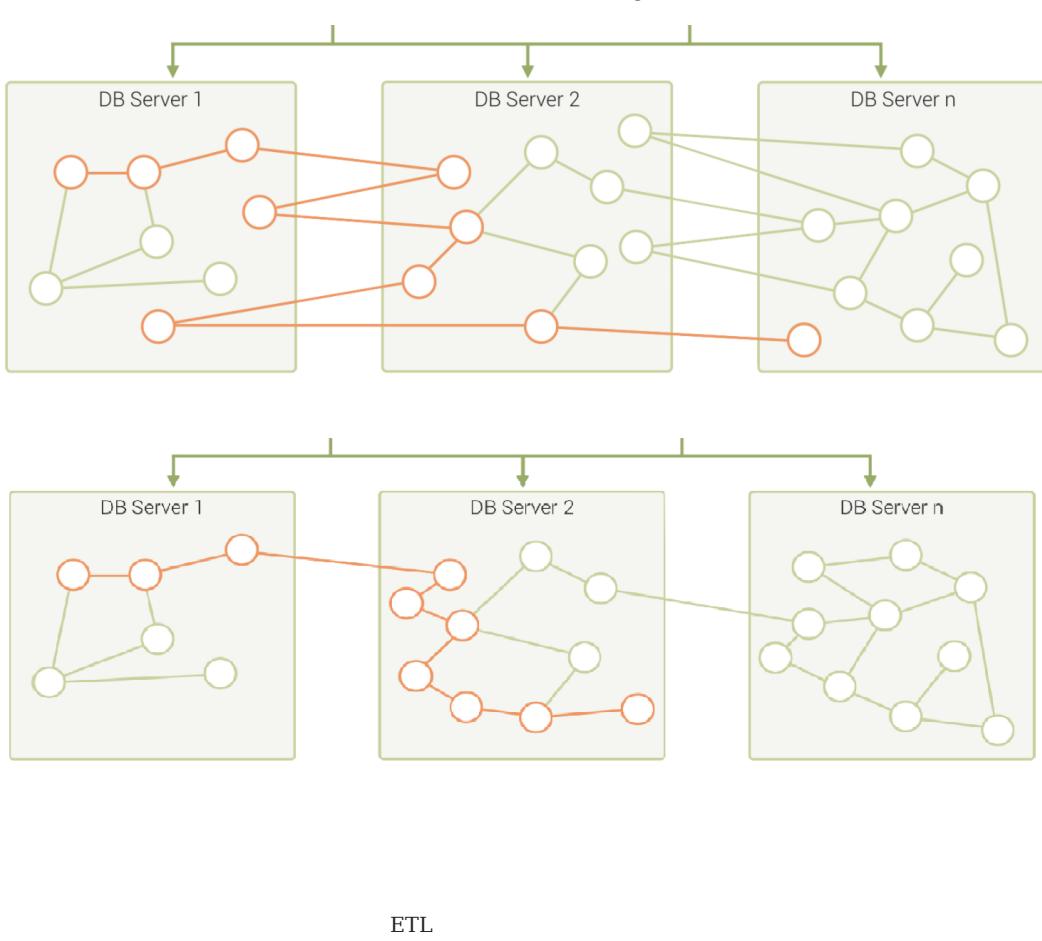


(Sharding)

Neo4j 4.x Fabric



- (View)
 - Partition Sharding) Partition



9

- ():
-
- API
-
-
-
- ETL
- Debug

SQLite Oracle

Note

- JGraphT¹⁰: Java (library)
- JUNG¹¹ BSD Java
- igraph¹²: Library, R python C
- NetworkX¹³: python
- Cytoscape¹⁴:
- Gephi¹⁵:
- arrows.app¹⁶ Cypher .

Benchmark

LDBC

LDBC¹⁷ Linked Data Benchmark Council Oracle Intel Neo4j TigerGraphSNB Social Network Benchmark
TPC-C, TPC-H SQL

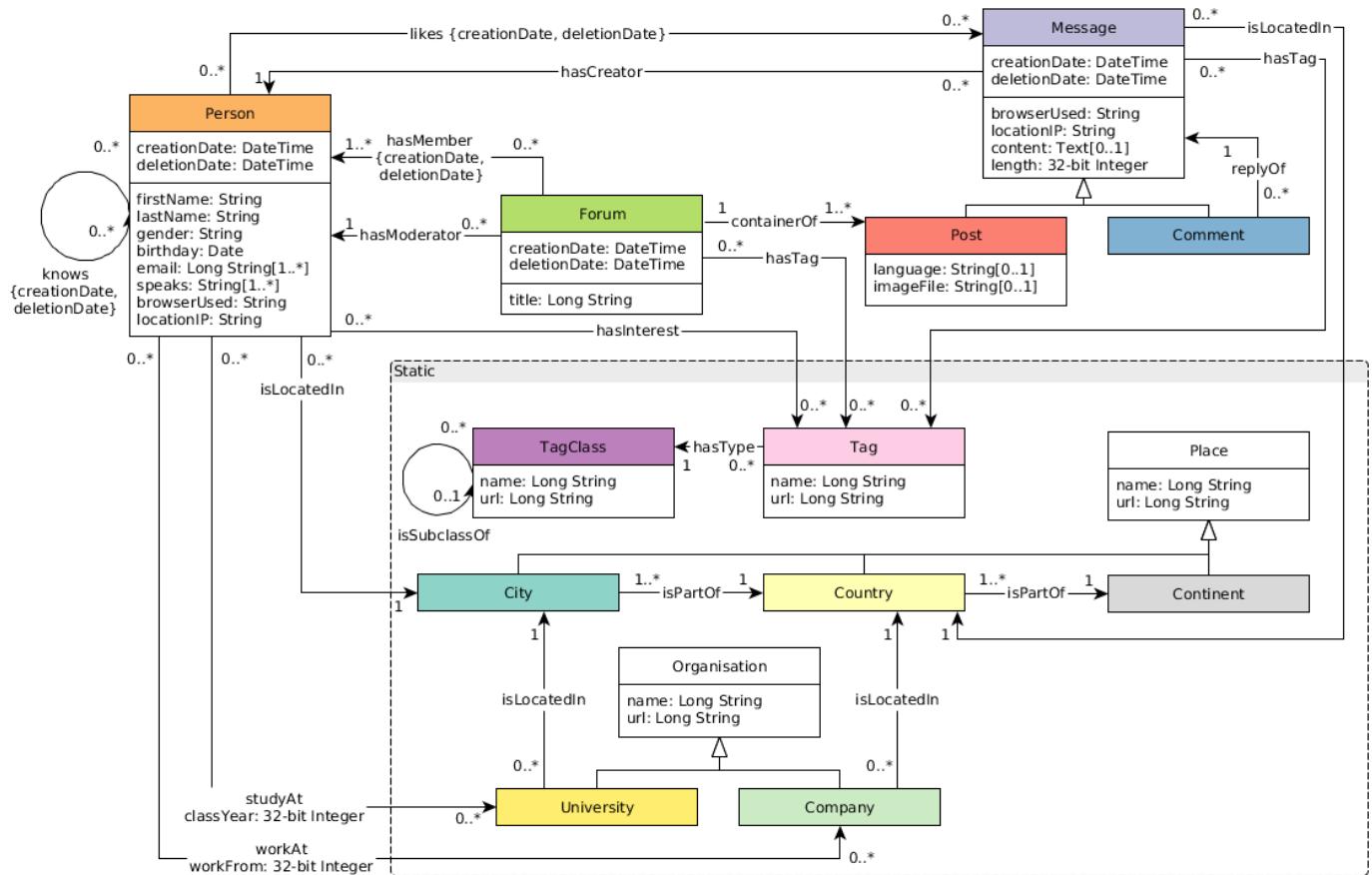
LDBC

Benchmark

Interactive

BI

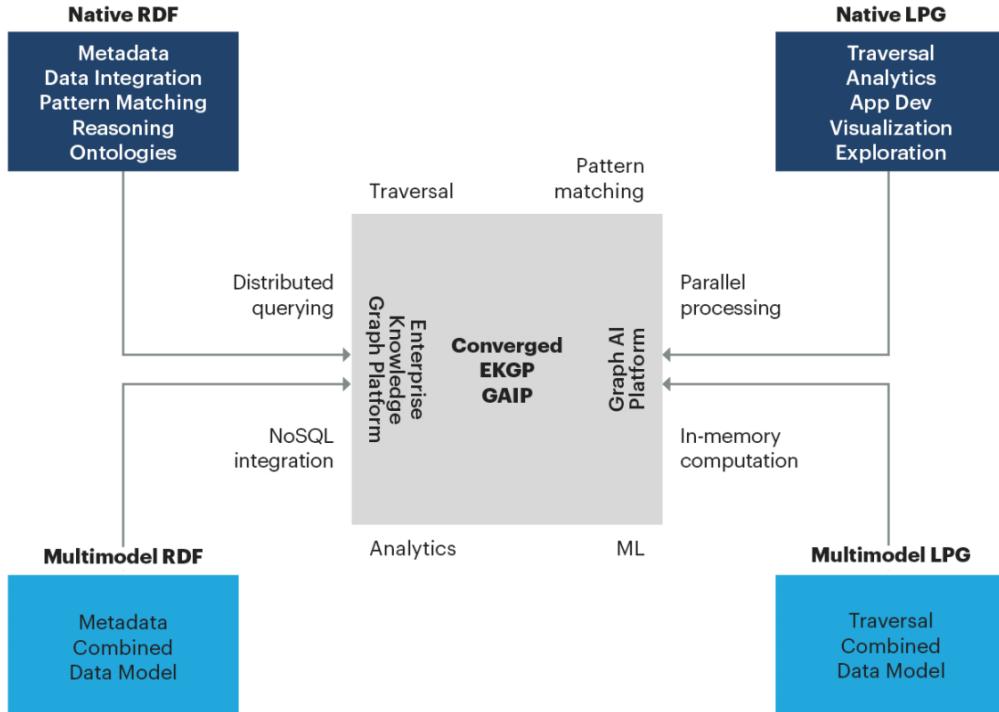
SNB



0.1 GB (scale factor 0.1) 1000 GB (sf1000) 10 TB 100 TB

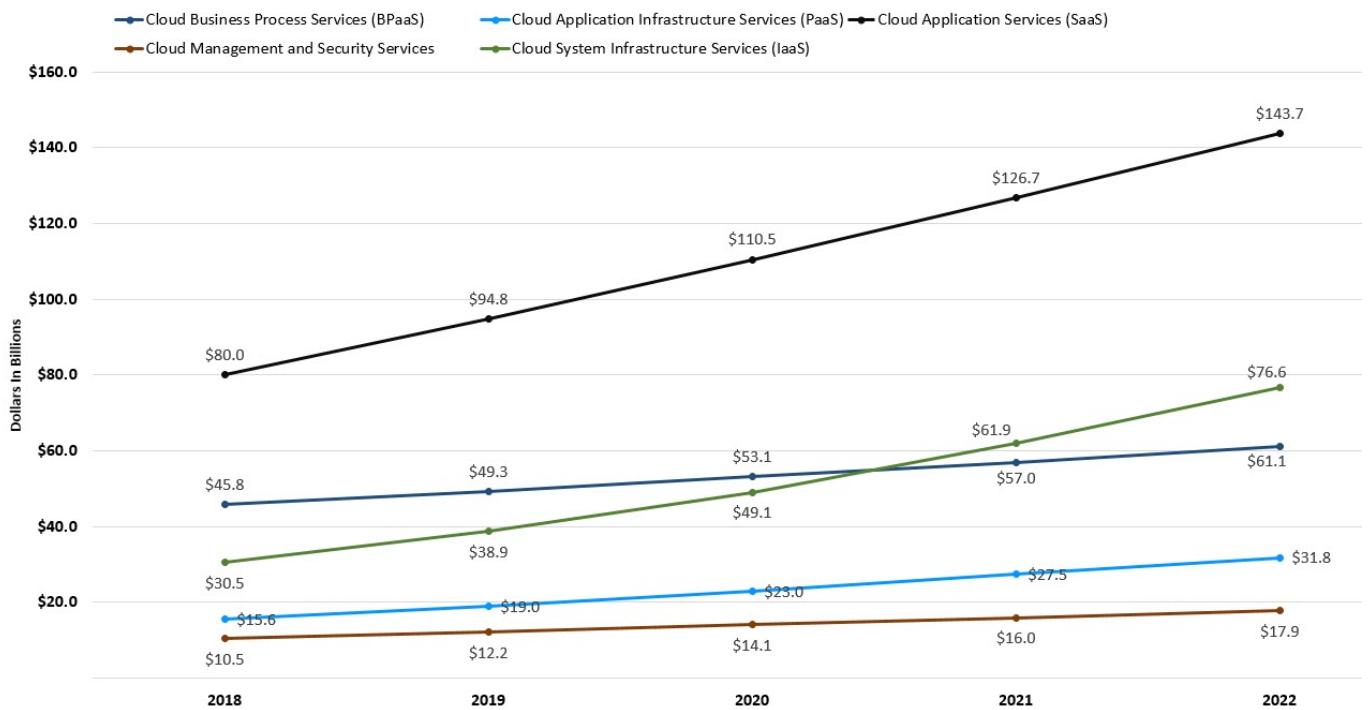
Scale Factor	0.1	0.3	1	3	10	30	100	300	1000
# of Persons	1.5K	3.5K	11K	27K	73K	182K	499K	1.25M	3.6M
# of nodes	327.6K	908K	3.2M	9.3M	30M	88.8M	282.6M	817.3M	2.7B
# of edges	1.5M	4.6M	17.3M	52.7M	176.6M	540.9M	1.8B	5.3B	17B

2.3.3

Convergence of Capabilities in the Graph DBMS Landscape

Worldwide Public Cloud Service Revenue Forecast, 2018 - 2022

(Billions of U.S. Dollars) Source: Gartner April 2, 2019



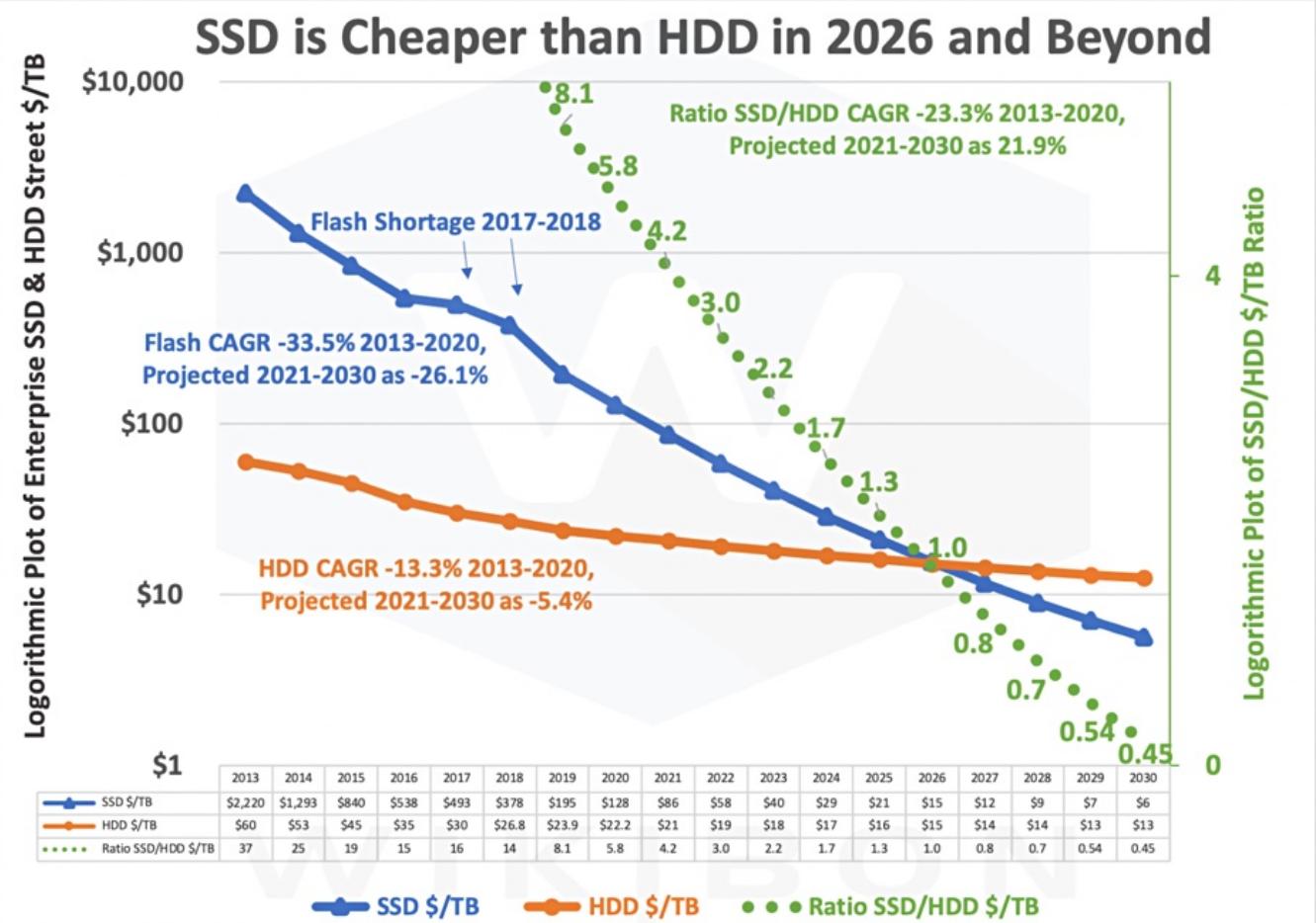


Figure 4 - SSD/HDD Pricing Ratio 2013 - 2030

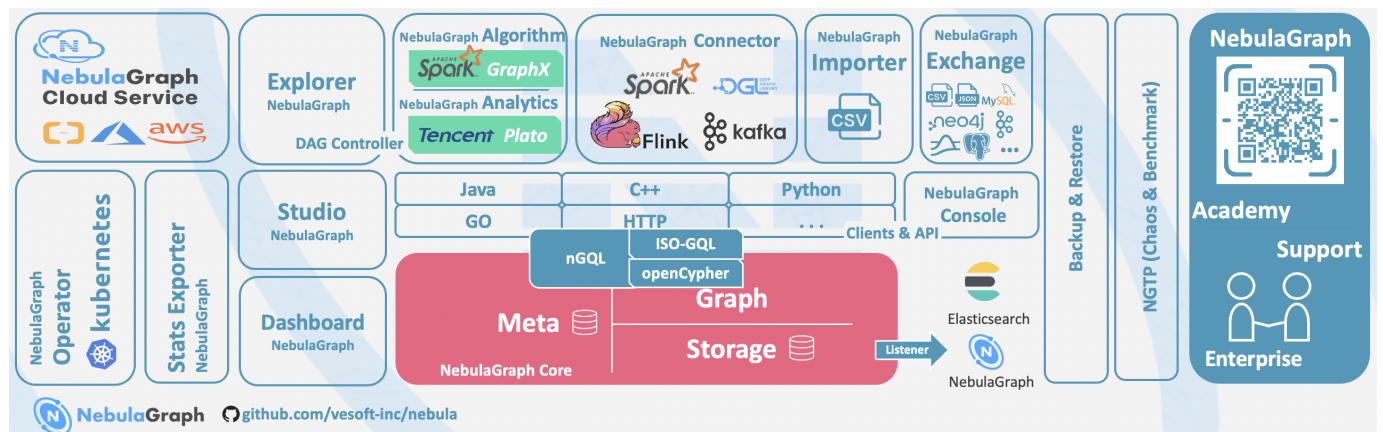
Source: © Wikibon, 2021.

-
1. <https://graphaware.com/graphaware/2020/02/17/graph-technology-landscape-2020.html> ↵
 2. () []((mailto:min.wu@vesoft.com)) ↵
 3. https://en.wikipedia.org/wiki/Graph_isomorphism ↵
 4. The Future is Big Graphs! A Community View on Graph Processing Systems. <https://arxiv.org/abs/2012.06171> ↵
 5. G. Malewicz, M. H. Austern, A. J. Bik, J. C. Dehnert, I. Horn, N. Leiser, and G. Czajkowski. Pregel: a system for large-scale graph processing. In Proceedings of the International Conference on Management of data (SIGMOD), pages 135–146, New York, NY, USA, 2010. ACM ↵
 6. <https://neo4j.com/graphacademy/training-iga-40/02-iga-40-overview-of-graph-algorithms/> ↵
 7. <https://livebook.manning.com/book/graph-powered-machine-learning/welcome/v-8/> ↵
 8. <https://www.arangodb.com/learn/graphs/using-smartgraphs-arangodb/> ↵
 9. <https://arxiv.org/abs/1709.03188> ↵
 10. <https://jgrapht.org/> ↵
 11. <https://github.com/jrtom/jung> ↵
 12. <https://igraph.org/> ↵
 13. <https://networkx.org/> ↵
 14. <https://cytoscape.org/> ↵
 15. <https://gephi.org/> ↵
 16. <https://arrows.app/> ↵
 17. https://github.com/ldbc/ldbc_snb_docs ↵
 18. <https://cloudcomputing-news.net/news/2019/apr/15/public-cloud-soaring-to-331b-by-2022-according-to-gartner/> ↵
 19. <https://blocksandfiles.com/2021/01/25/wikibon-ssds-vs-hard-drives-wrights-law/> ↵
-

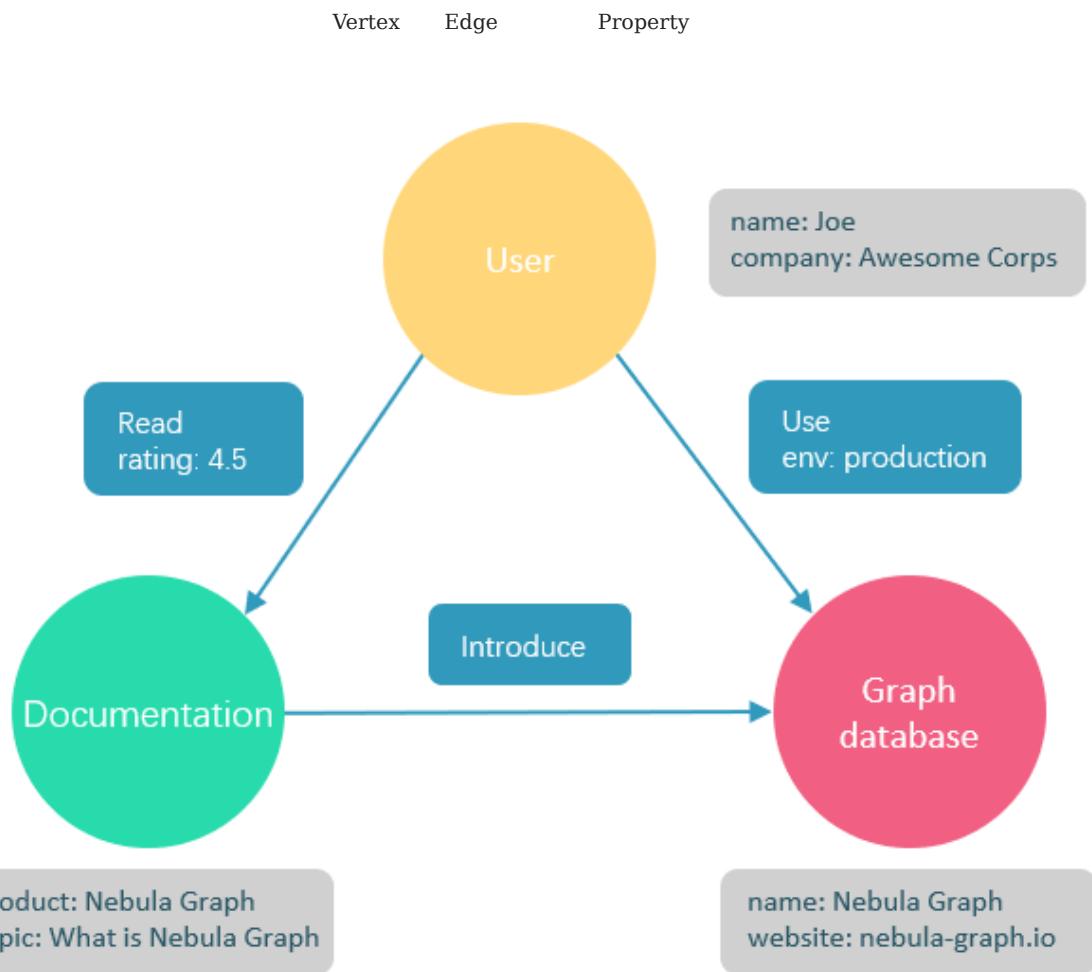
:January 13, 2023

2.4 NebulaGraph

NebulaGraph



2.4.1



NebulaGraph

2.4.2 NebulaGraph

NebulaGraph Apache 2.0

NebulaGraph

[NebulaGraph GitHub](#)

C++ NebulaGraph

[NebulaGraph benchmarking](#)

NebulaGraph

NebulaGraph

NebulaGraph shared-nothing

NebulaGraph Java Python C++ Go

[NebulaGraph clients](#)

NebulaGraph

LDAP Lightweight Directory Access Protocol

NebulaGraph

[NebulaGraph Studio](#) [NebulaGraph Console](#) [NebulaGraph Exchange](#)

NebulaGraph

Spark Flink HBase

openCypher

NebulaGraph

nGQL

openCypher

[nGQL](#)

NebulaGraph

SSD

HDD +

NebulaGraph

360

NebulaGraph

[NebulaGraph](#)

2.4.3

NebulaGraph

NebulaGraph

NebulaGraph

NebulaGraph

NebulaGraph

NebulaGraph

2.4.4

- NebulaGraph 01 39



2.4.5

2.4.6

- -
 -
 -
 - GitHub
-

:January 13, 2023

2.5

NebulaGraph

2.5.1

NebulaGraph 6

- Space
- Vertex
- VID VID VID int64 fixed_string(N)
- 0 Tag

Compatibility

NebulaGraph 2.x Tag

- Edge
-
-
- < VID Edge type (rank) VID > EID
- Edge type
- Rank int64 0



Rank Edge type
Rank
next(), pre(), head(), tail(), max(), min(), lessThan(), moreThan()

- Tag
- Tag
- Edge type
- Edge type
- Property
- Key-value pair

Note

Tag Edge type " " " "

2.5.2

NebulaGraph

player team **serve follow**

Tag	player	name (string) age int
Tag	team	name (string)
Edge type	serve	start_year (int) end_year (int)
Edge type	follow	degree (int)

Note

NebulaGraph

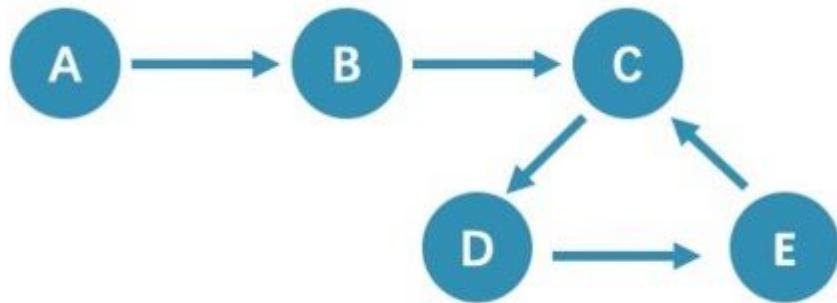
Incompatibility

NebulaGraph 3.3.0 " " " " **INSERT VERTEX** **DELETE VERTEX** **INSERT EDGE**
DELETE EDGE
openCypher MERGE

:January 13, 2023

2.6

walk trail path



2.6.1 walk

walk

C D E

A->B->C->D->E A->B->C->D->E->C A->B->C->D->E->C->D

Note

GO walk

2.6.2 trail

trail

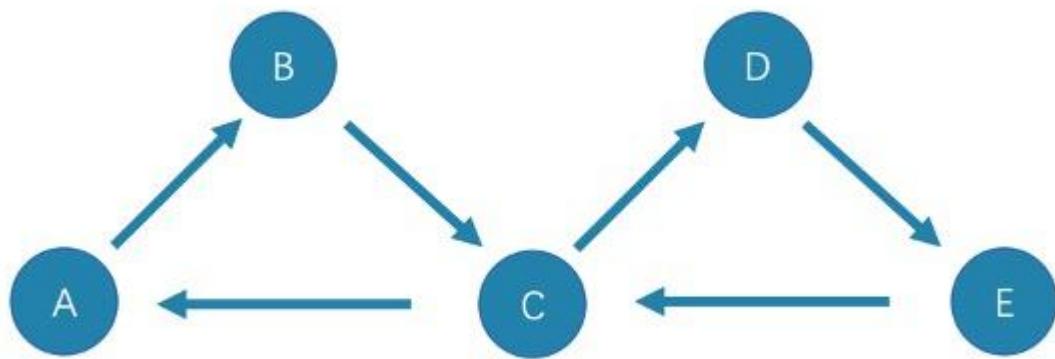
trail

5 A->B->C->D->E->C

Note

MATCH FIND PATH GET SUBGRAPH trail

trail cycle circuit



- cycle

cycle **trail**

A->B->C->A C->D->E->C .

- circuit

circuit **trail**

A->B->C->D->E->C->A

2.6.3 path

path

4 A->B->C->D->E

2.6.4

Path 03 09

:January 13, 2023

2.7 VID

NebulaGraph ID VID Vertex ID

2.7.1 VID

- VID FIXED_STRING(<N>) INT64 VID

- VID + VID

- VID ID UUID

- VID

- VID Tag " " " " Tag " " " "

- VID Tag INSERT IF NOT EXISTS INSERT

- VID TAG A TAG B INSERT TAG A TAG B

- VID LSM-tree VID

2.7.2 VID

- NebulaGraph 1.x VID INT64 2.x INT64 FIXED_STRING(<N>) CREATE SPACE vid_type VID

- id() VID

- LOOKUP MATCH VID

- VID DELETE xxx WHERE id(xxx) == "player100" GO FROM "player100" VID
LOOKUP | GO FROM \$-.ids LOOKUP |

2.7.3 VID

VID

- VID VID;

- VID

- snowflake VID

- FIXED_STRING(<N>) N BASE64 MD5 hash

- hash int64 VID 10 hash 1/10

2.7.4 VID

VID

VID

2.7.5 "(start vid)"

NebulaGraph MATCH GO LOOKUP VID start vid

```
start vid

1. GO FROM "player100" OVER      start vid  "player100"
2. LOOKUP ON player WHERE player.name == "Tony Parker"      MATCH (v:player {name:"Tony Parker"})      player.name      start
vid
```

 Caution

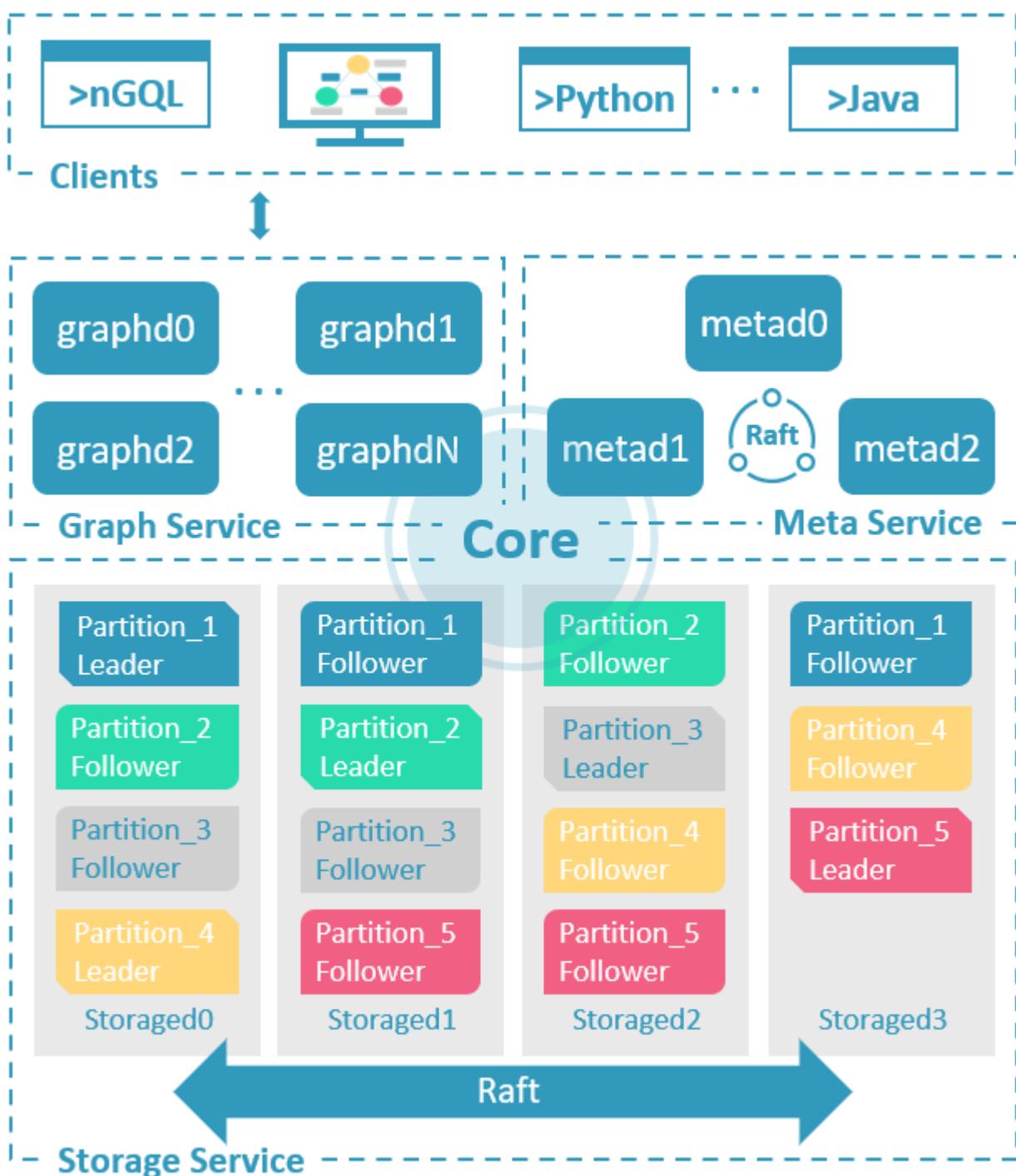
```
match (n) return n;      Scan vertices or edges need to specify a limit number, or limit number can not push down.
LIMIT
```

:January 13, 2023

2.8

2.8.1 NebulaGraph

NebulaGraph Graph Meta Storage
 NebulaGraph
 NebulaGraph



Meta

NebulaGraph Meta nebula-metad Schema

Meta

Graph Storage

NebulaGraph Graph Storage Graph nebula-graphd Storage nebula-
storaged

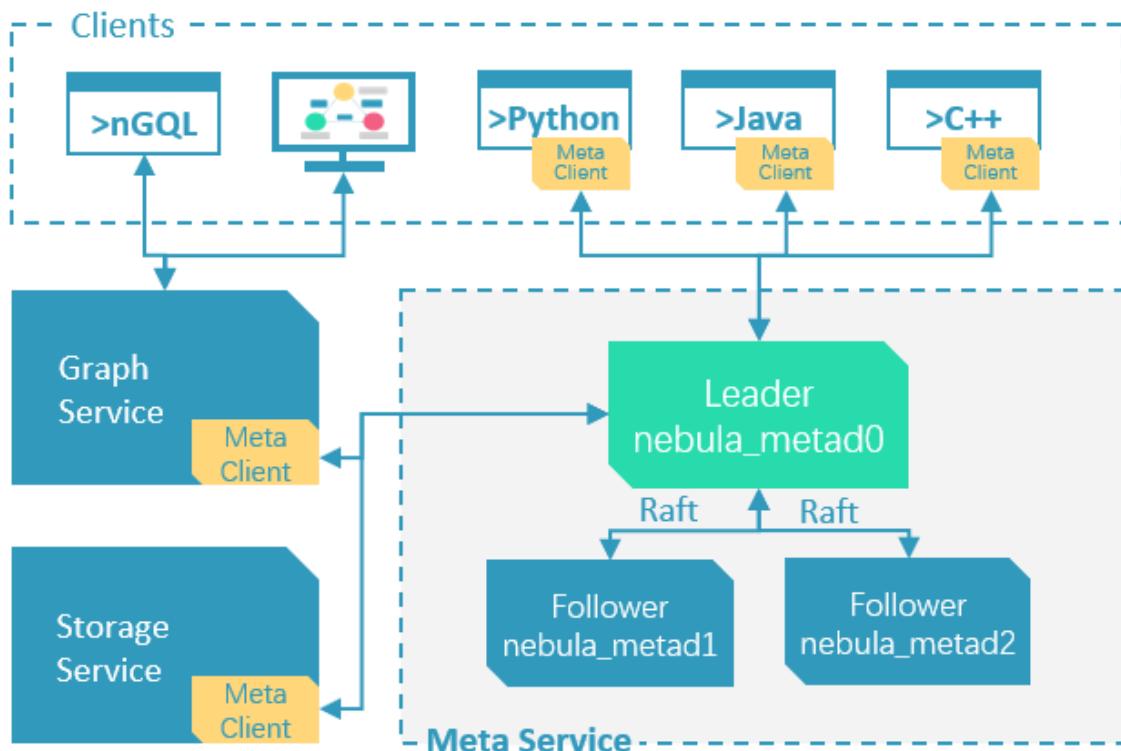
- | | | | |
|-------|---------|---------|---------|
| | Graph | Storage | |
| • | | | |
| | Graph | | Storage |
| • | | | |
| | Graph | | Storage |
| • | | | |
| | Graph | | Storage |
| Graph | Storage | Graph | Storage |

: January 13, 2023

2.8.2 Meta

Meta

Meta



Meta	nebula-metad		nebula-metad			
•	NebulaGraph	1	3	nebula-metad	3	1
•	NebulaGraph	3		nebula-metad		
	nebula-metad	Raft		leader	follower	
leader		leader		follower	leader	follower
				leader	leader	leader

Note

leader follower Raft leader leader Raft Storage

Meta

Meta		Meta	Meta
NebulaGraph			

Meta

NebulaGraph		Meta	
SCHEMA			
NebulaGraph	Schema	Tag	Edge type
Meta	Schema	Schema	Edge type
NebulaGraph	Schema		
TTL			
Meta	TTL	Time To Live	Storage

Meta

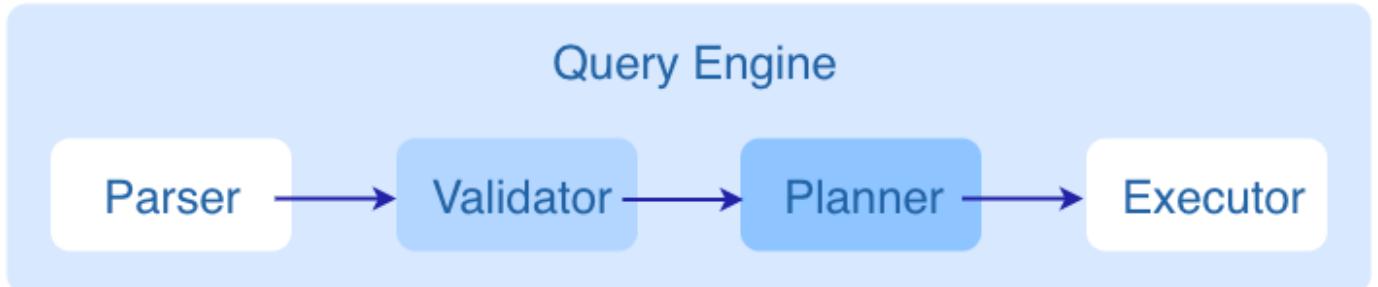
: January 13, 2023

2.8.3 Graph

Graph

Graph

Graph



Graph

1. **Parser**
2. **Validator**
3. **Planner**
4. **Executor**

Parser

Parser

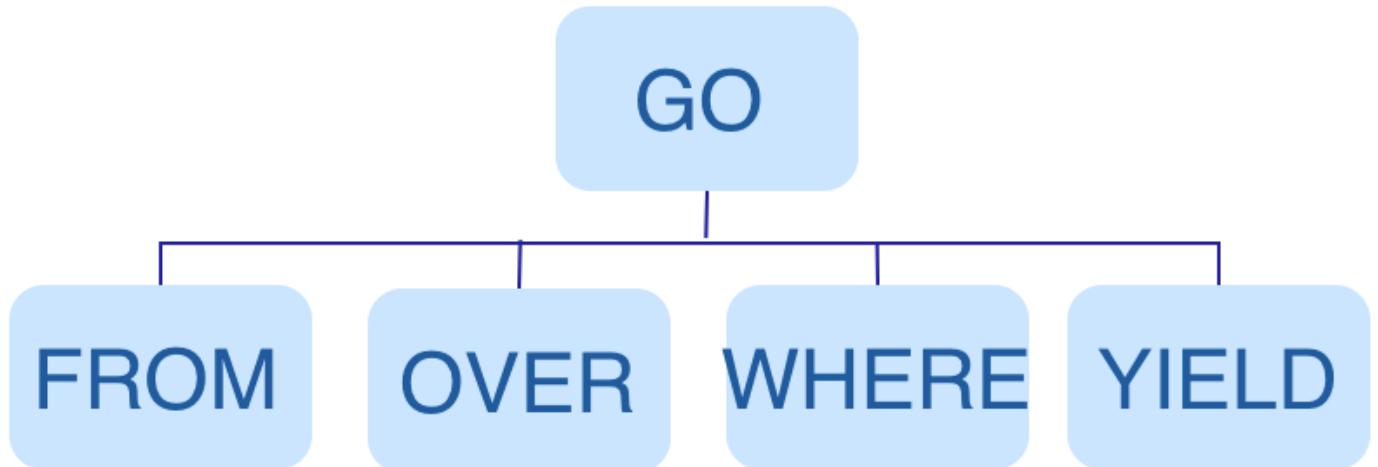
Flex

Bison

AST

```
GO FROM "Tim" OVER like WHERE properties(edge).likeness > 8.0 YIELD dst(edge)
```

AST



Validator

Validator AST

•

OVER WHERE YIELD

Schema Edge type Tag

Schema

•

```
$var = GO FROM "Tim" OVER like YIELD dst(edge) AS ID; GO FROM $var.ID OVER serve YIELD dst(edge) Validator
ID           var
```

•

WHERE bool null empty

•

* * Schema

```
GO FROM "Tim" OVER * YIELD dst(edge), properties(edge).likeness, dst(edge) OVER Edge type Edge type
like serve      GO FROM "Tim" OVER like,serve YIELD dst(edge), properties(edge).likeness, dst(edge)
```

•

|

```
GO FROM "Tim" OVER like YIELD dst(edge) AS ID | GO FROM $-.ID OVER serve YIELD dst(edge) Validator $-.ID
```

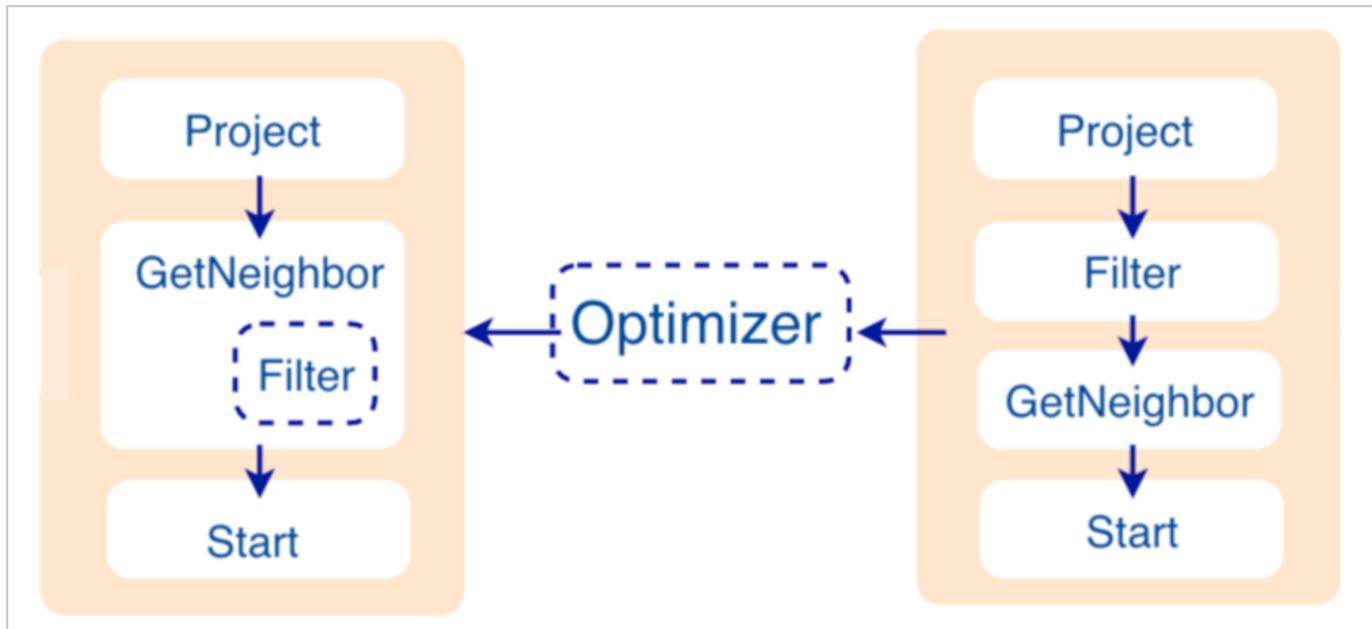
Validator

src/planner

Planner

nebula-graphd.conf enable_optimizer false Planner Validator Executor

nebula-graphd.conf enable_optimizer true Planner Validator



- ```

Project Filter Filter GetNeighbor Start
key value Start

nebula-graph src/context/ExecutionContext.cpp
ResultMap Filter ResultMap["GN1"] ResultMap["Filter2"]

```
- ```

Planner      RBO rule-based optimization      Validator      CBO cost-based optimization
nebula-graph    src/optimizer/
Project

RBO
Filter      GetNeighbor      Filter      GetNeighbor      Filter
GetNeighbor  Storage        Storage

```
- Executor**

```

Executor      Scheduler      Executor

```



NebulaGraph

```

|--src
|--graph
|--context  //
|--executor //
|--gc        //
|--optimizer //
|--planner   //
|--scheduler //
|--service   //
|--session   //
|--stats    //
|--util      //
|--validator //
|--visitor   //visitor

```

NebulaGraph

- nMeetup Query Engine 33 30

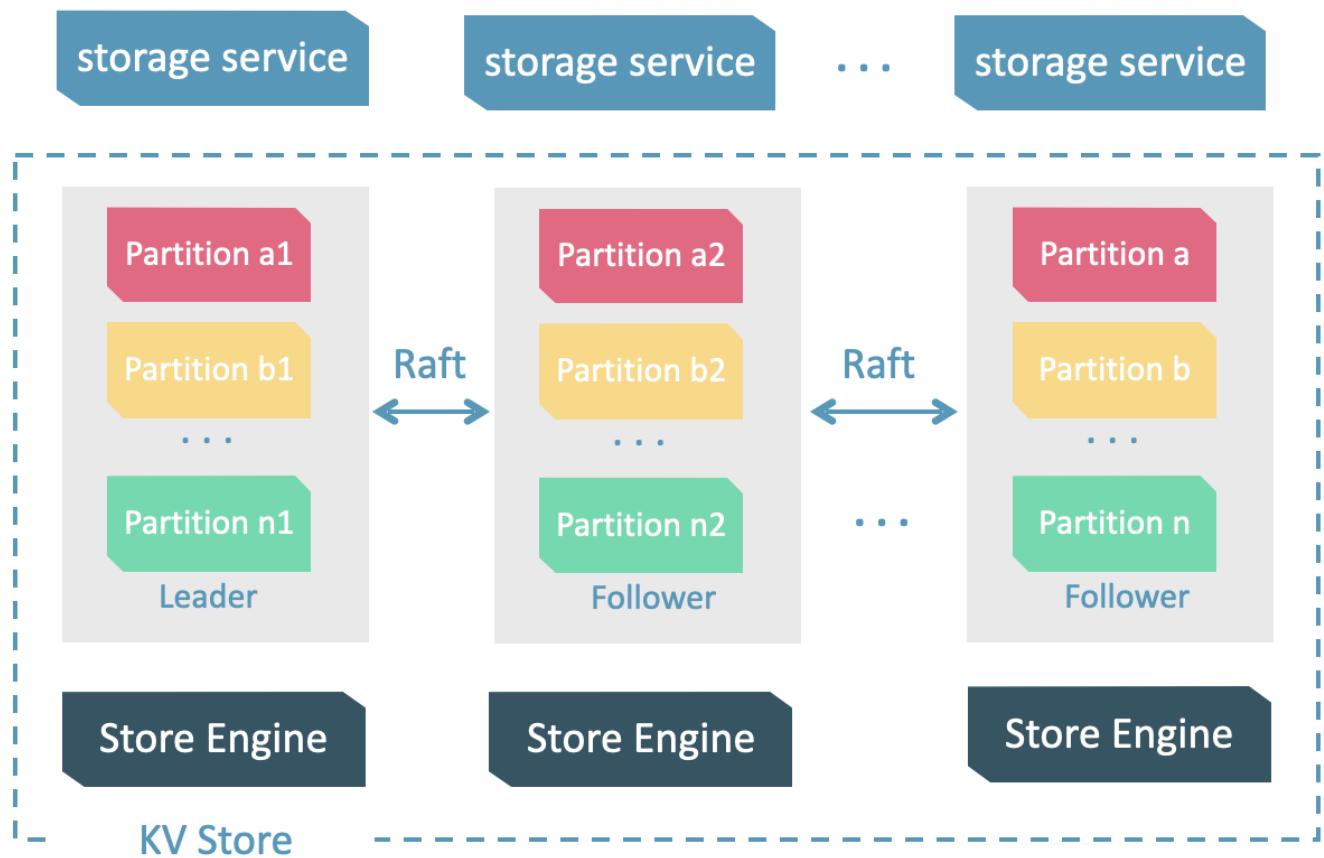
:January 13, 2023

2.8.4 Storage

NebulaGraph Meta Meta
 Storage nebula-storaged Storage

- KVStore
- Shared-nothing NAS
- Raft
- Raft
-

Storage



nebula-storaged Raft

- Storage interface

Storage API API KV

- `getNeighbors`

- `insert vertex/edge`

- `getProps`

Storage Storage KV

- Consensus

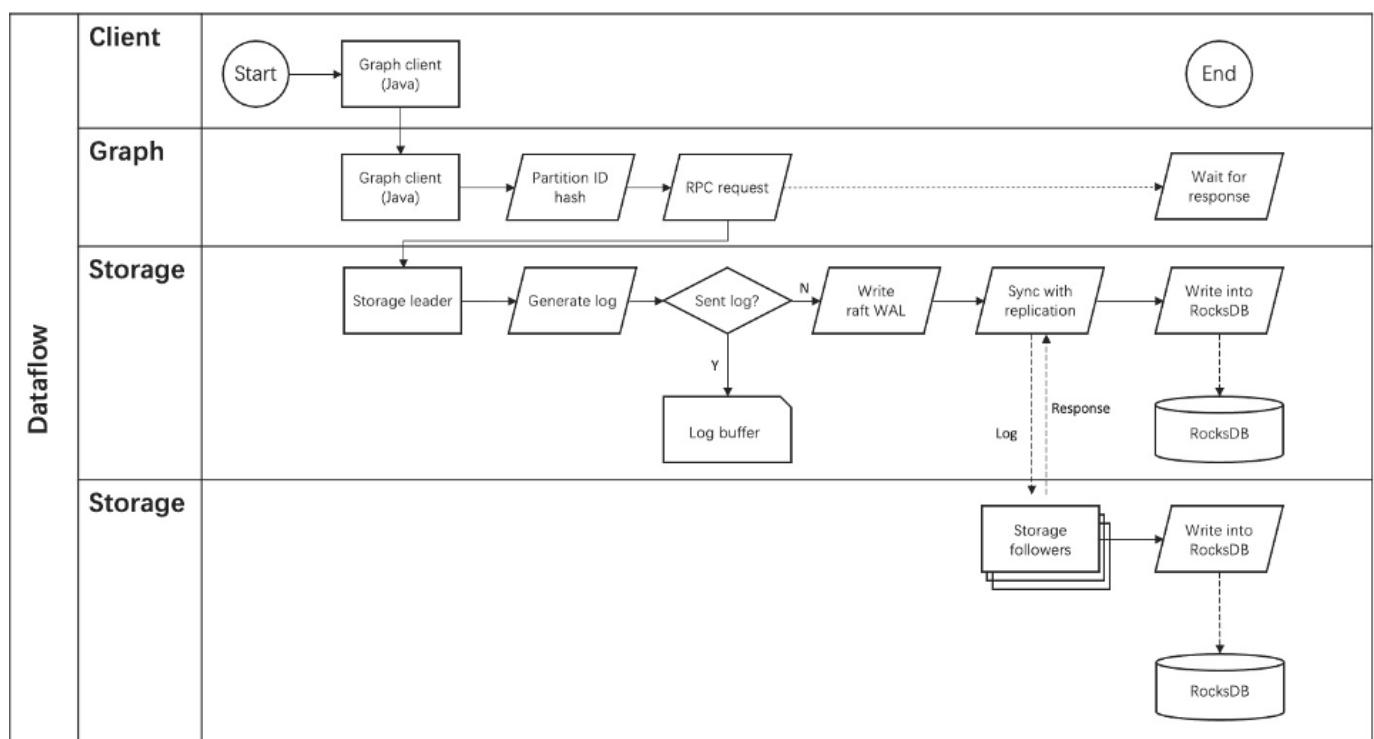
Storage Multi Group Raft

- Store Engine

Storage `get put scan` `KVStore.h KVEngine.h`

Storage

Storage



KVStore

NebulaGraph KVStore KVStore

- KVStore
- Schema NebulaGraph Schema
-

NebulaGraph RocksDB KVStore

- NebulaGraph
- Meta Storage

 Note

- WAL WAL
-

NebulaGraph

key

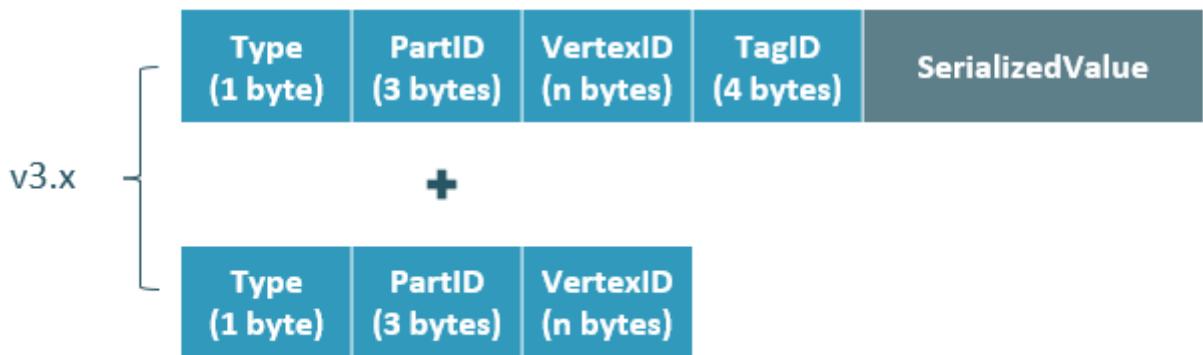
value

NebulaGraph 2.x 3.x

Tag

TagID

value key



Type	key	1					
PartID		3	Storage balance				
VertexID	ID	ID	int	8	ID	string	fixed_string
TagID		Tag ID	4				
SerializedValue	value						

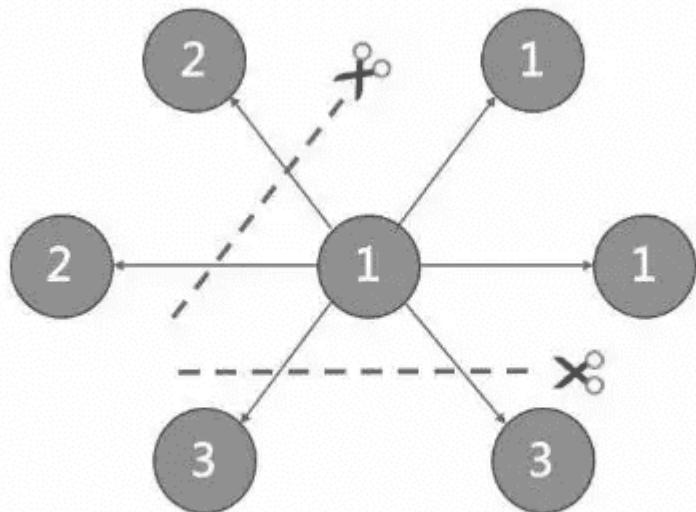
Type (1 byte)	PartID (3 bytes)	VertexID (n bytes)	EdgeType (4 bytes)	Rank (8 bytes)	VertexID (n bytes)	PlaceHolder (1 byte)	SerializedValue
------------------	---------------------	-----------------------	-----------------------	-------------------	-----------------------	-------------------------	-----------------

Type	key	1					
PartID		3	Storage	balance			
VertexID	ID	VertexID	ID	ID	VertexID	ID	ID
Edge type	0	0	4				
Rank				8			
PlaceHolder		1					
SerializedValue		value					

NebulaGraph Schema

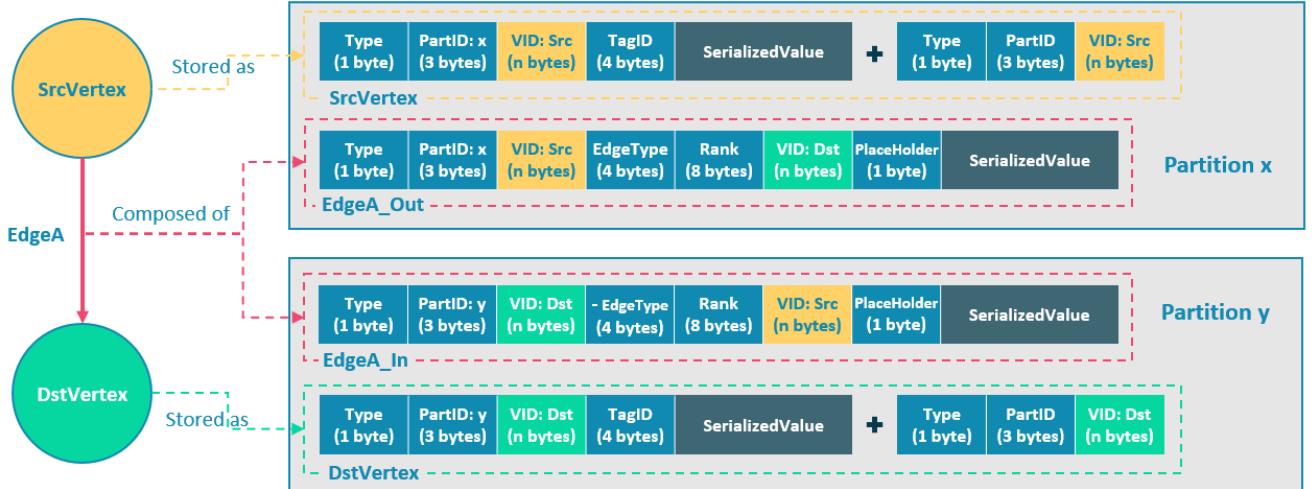
Schema NebulaGraph Schema Meta Schema

Partition NebulaGraph



NebulaGraph

key-value pair



SrcVertex	EdgeA	DstVertex	$(\text{SrcVertex}) - [\text{EdgeA}] \rightarrow (\text{DstVertex})$		6
Partition x	Partition x				
• SrcVertex	Partition x				
• EdgeA	EdgeA_Out	SrcVertex	Partition x	key	Type PartID x VID Src SrcVertex ID
EdgeType	Rank 0	VID Dst	DstVertex	ID	PlaceHolder SerializedValue Value
• DstVertex	Partition y				
• EdgeA	EdgeA_In	DstVertex	Partition y	key	Type PartID y VID Dst DstVertex ID EdgeType
Rank 0	VID Src	SrcVertex	ID	PlaceHolder SerializedValue Value	EdgeA_Out
EdgeA_Out	EdgeA_In		EdgeA	EdgeA_Out	(a) - [] -> (a) EdgeA_In
EdgeA_Out	EdgeA_In	NebulaGraph		key	value

TOSS

Hash**VID****Tag****Note**

CREATE SPACE

VID

```
// ID     8      1.0      int64
uint64_t vid = 0;
if (id.size() == 8) {
    memcpy(static_cast<void*>(&vid), id.data(), 8);
} else {
    MurmurHash2 hash;
    vid = hash(id.data());
}
PartitionID pId = vid % numParts + 1;
```

int64 int64 1

```
pId = vid % numParts + 1;

%
numParts            VID            CREATE SPACE        partition_num
pId                VID            ID

100     VID 1 101 1001            ID
```

Raft

RAFT

Raft	Raft	" "	Leader	Leader	Follower	Leader
Follower		Leader Leader	Follower		Raft-wal	

Note

Raft-wal	Raft	IO	Leader				
	Leader	Raft-wal	Follower	" "	Raft-wal		
Leader Follower							
1		Leader		2	3	3	Leader
2 Follower	Leader	Leader	Follower		2		

Note

Raft HDFS Raft " "

MULTI GROUP RAFT

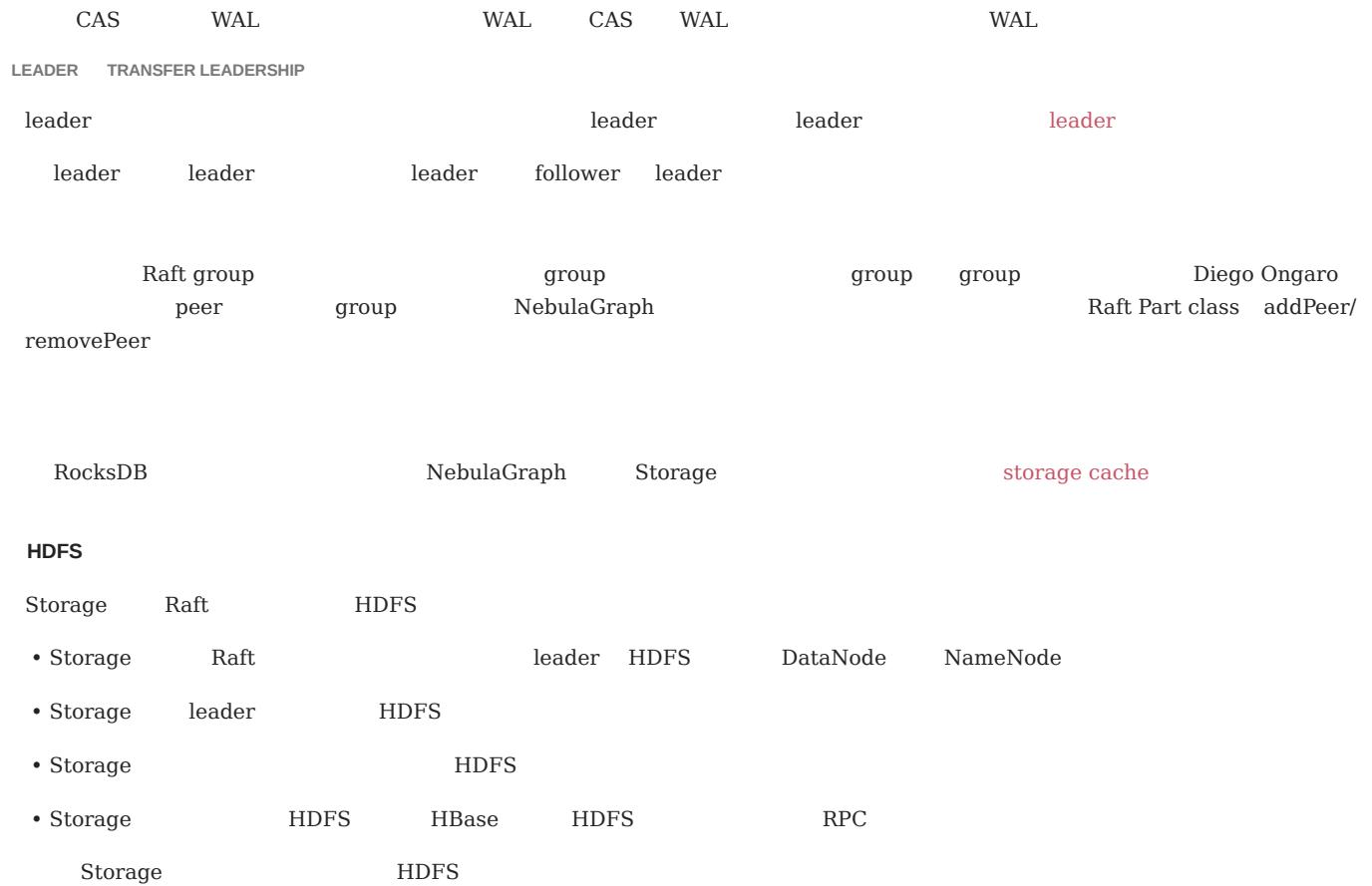
Storage	Raft	Multi Group Raft	Raft group	leader	follower
Raft					
Raft	NebulaGraph	Multi Group Raft	NebulaGraph	Raft group	
WAL					
Multi Group Raft	2				

- Transport

Raft group	peer	Transport
------------	------	-----------
-

BATCH

NebulaGraph NebulaGraph WAL NebulaGraph



: January 13, 2023

3.

3.1

NebulaGraph

NebulaGraph

NebulaGraph

3.1.1



NebulaGraph

1.

2. NebulaGraph
3. NebulaGraph

NebulaGraph Cloud

NebulaGraph Cloud

3.1.2



NebulaGraph

1. NebulaGraph
2. NebulaGraph
3. NebulaGraph
4. Storage
5. nGQL CURD

RPM DEB

NebulaGraph

NebulaGraph

3.1.3

NebulaGraph

NebulaGraph Academy

- 03 45



- 02 24



Bilibili

- Foesa ——NebulaGraph 04 20



- Foesa —— path 03 09



- Foesa —— 02 27



- Foesa —— 02 53



- Nebula Explore Demo Show 02 53



: January 13, 2023

3.2

3.2.1

NebulaGraph

NebulaGraph

NebulaGraph
Cloud

NebulaGraph

NebulaGraph Cloud

NebulaGraph

NebulaGraph



NebulaGraph Cloud

3.1.3

NebulaGraph

NebulaGraph Cloud



NebulaGraph Cloud

NebulaGraph

Nebula Graph Nebula Dashboard

Nebula Explorer

14

-
- RAM
- AliyunECSFullAccess
- AliyunVPCFullAccess
- AliyunROSFullAccess
- AliyunCloudMonitorFullAccess
- AliyunComputeNestUserFullAccess

NebulaGraph Cloud

NebulaGraph

NebulaGraph

30



NebulaGraph

ECS

1. **NebulaGraph**

2. **NebulaGraph**

3. **NebulaGraph Enterprise**

NebulaGraph

Caution

- 4.
5. ECS
 -
 -
- 6.
7. **NebulaGraph** ECS
- 8.
- a. **VPC** **ID**
 - b.
 - c. **ID**
- 9.
- 10.
- 11.
- 12.
- 13.
- 14.
15. 10



1. **NebulaGraph**

2. **NebulaGraph**

3. NebulaGraph *

4.

5.

6.

7. **NebulaGraph**

8.

9.

10.

11.

12.

13.

14.

10

Q

1. RAM

2.

3. NebulaGraph

NebulaGraph

: January 13, 2023

3.2.2 NebulaGraph

NebulaGraph

NebulaGraph Explorer

NebulaGraph

NebulaGraph Explorer NebulaGraph

- 1.
- 2.
-
-
3. **ID**
4. **nebula_private_ip explorer_portal**
5. **explorer_portal** NebulaGraph Explorer
- 6.
- **Host** nebula_private_ip :9669 192.168.98.160:9669
- root
-

 Note

NebulaGraph

NebulaGraph

:January 13, 2023

3.2.3 NebulaGraph

nGQL NebulaGraph
Nebula Graph

nGQL NebulaGraph

NebulaGraph Cloud Explorer



Explorer

NebulaGraph

nGQL

NebulaGraph

Explorer

NebulaGraph



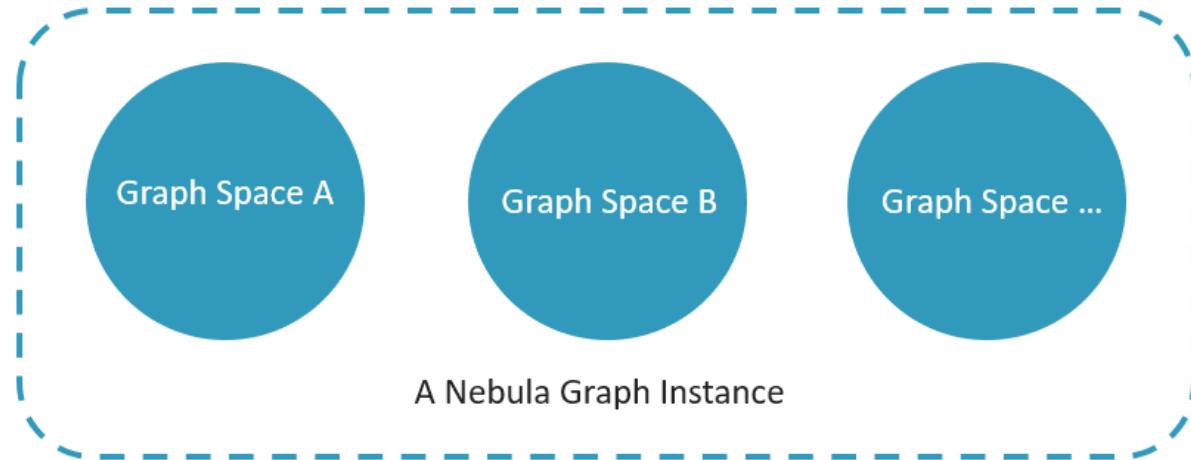
Explorer



nGQL

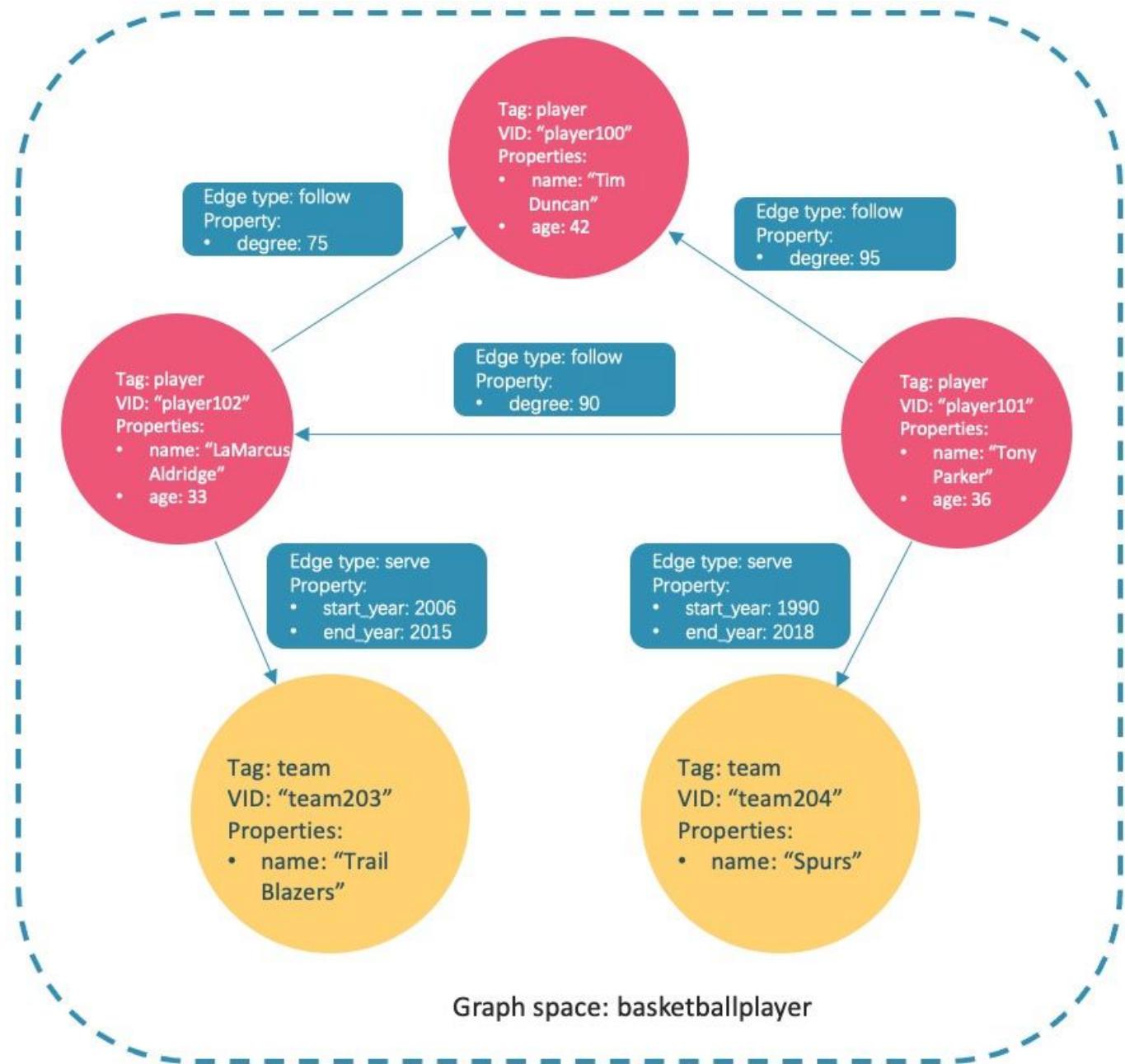
SCHEMA

NebulaGraph



Schema NebulaGraph Schema

Vertex	0
Tag	
Edge	
Edge type	



Caution

NebulaGraph

2 20

- CREATE SPACE
- CREATE TAG
- CREATE EDGE
- ALTER TAG
- ALTER EDGE
- CREATE TAG INDEX
- CREATE EDGE INDEX

Note

10 heartbeat_interval_secs

NGQL

-

```
CREATE SPACE [IF NOT EXISTS] <graph_space_name> (
[partition_num = <partition_number>,]
[replica_factor = <replica_number>,]
vid_type = {FIXED_STRING(<N>) | INT64}
)
[COMMENT = '<comment>'];
```

CREATE SPACE

-

```
nebula> SHOW SPACES;
```

-

```
USE <graph_space_name>;
```

1. basketballplayer

```
nebula> CREATE SPACE basketballplayer(partition_num=15, replica_factor=1, vid_type=fixed_string(30));
```

Note

[ERROR (-1005)]: Host not enough!

Storage

2. SHOW HOSTS

```
nebula> SHOW HOSTS;
+-----+-----+-----+-----+-----+-----+
| Host | Port | HTTP port | Status | Leader count | Leader distribution | Partition distribution | Version |
+-----+-----+-----+-----+-----+-----+
| "storaged0" | 9779 | 19669 | "ONLINE" | 5 | "basketballplayer:5" | "basketballplayer:5" | "3.1.0" |
```

```
| "storaged1" | 9779      | 19669      | "ONLINE" | 5           | "basketballplayer:5"          | "basketballplayer:5" | "3.1.0" |
| "storaged2" | 9779      | 19669      | "ONLINE" | 5           | "basketballplayer:5"          | "basketballplayer:5" | "3.1.0" |
+-----+-----+-----+-----+-----+-----+-----+-----+
```

Leader distribution

BALANCE LEADER

Storage

3. basketballplayer

nebula[(none)]> USE basketballplayer;

SHOW SPACES

```
nebula> SHOW SPACES;
+-----+
| Name      |
+-----+
| "basketballplayer" |
+-----+
```

Tag Edge type

NGQL

```
CREATE {TAG | EDGE} [IF NOT EXISTS] {<tag_name> | <edge_type_name>}
(
    <prop_name> <data_type> [NULL | NOT NULL] [DEFAULT <default_value>] [COMMENT '<comment>']
    [{, <prop_name> <data_type> [NULL | NOT NULL] [DEFAULT <default_value>] [COMMENT '<comment>']} ...]
)
[TTL_DURATION = <ttl_duration>]
[TTL_COL = <prop_name>]
[COMMENT = '<comment>'];
```

CREATE TAG CREATE EDGE

Tag: player team Edge type: follow serve

player	Tag	name (string), age (int)
team	Tag	name (string)
follow	Edge type	degree (int)
serve	Edge type	start_year (int), end_year (int)

```
nebula> CREATE TAG player(name string, age int);
nebula> CREATE TAG team(name string);
nebula> CREATE EDGE follow(degree int);
nebula> CREATE EDGE serve(start_year int, end_year int);
```

INSERT Tag**Edge type**

NGQL

```
•
INSERT VERTEX [IF NOT EXISTS] [tag_props, [tag_props] ...]
VALUES <vid>: ([prop_value_list])

tag_props:
tag_name ([prop_name_list])

prop_name_list:
[prop_name [, prop_name] ...]
```

```
prop_value_list:
  [prop_value [, prop_value] ...]
```

vid Vertex ID vid

INSERT VERTEX

•

```
INSERT EDGE [IF NOT EXISTS] <edge_type> ( <prop_name_list> ) VALUES
<src_vid> -> <dst_vid>[@<rank>] : ( <prop_value_list>
[, <src_vid> -> <dst_vid>[@<rank>] : ( <prop_value_list> ), ...];

<prop_name_list> ::= 
[ <prop_name> [, <prop_name> ] ...]

<prop_value_list> ::= 
[ <prop_value> [, <prop_value> ] ...]
```

INSERT EDGE

•

```
nebula> INSERT VERTEX player(name, age) VALUES "player100":("Tim Duncan", 42);
nebula> INSERT VERTEX player(name, age) VALUES "player101":("Tony Parker", 36);
nebula> INSERT VERTEX player(name, age) VALUES "player102":("LaMarcus Aldridge", 33);
nebula> INSERT VERTEX team(name) VALUES "team203":("Trail Blazers"), "team204":("Spurs");
```

•

```
nebula> INSERT EDGE follow(degree) VALUES "player101" -> "player100":(95);
nebula> INSERT EDGE follow(degree) VALUES "player101" -> "player102":(90);
nebula> INSERT EDGE follow(degree) VALUES "player102" -> "player100":(75);
nebula> INSERT EDGE serve(start_year, end_year) VALUES "player101" -> "team204":(1999, 2018), "player102" -> "team203":(2006, 2015);
```

• **GO**

GO

YIELD

• **FETCH**

• **LOOKUP**

WHERE

• **MATCH**

NebulaGraph

NGQL

• **GO**

```
GO [[<M> TO] <N> STEPS ] FROM <vertex_list>
OVER <edge_type_list> [{REVERSELY | BIDIRECT}]
[ WHERE <conditions> ]
YIELD [DISTINCT] <return_list>
[ { SAMPLE <sample_list> | <limit_by_list_clause> } ]
[ | GROUP BY {<col_name> | expression> | <position>} YIELD <col_name>]
```

```
[| ORDER BY <expression> [{ASC | DESC}]]  
[| LIMIT [<offset>,<number_rows>];
```

- **FETCH**

- **Tag**

```
FETCH PROP ON {<tag_name>[, tag_name ...] | *}  
<vid> [, vid ...]  
YIELD <return_list> [AS <alias>];
```

-

```
FETCH PROP ON <edge_type> <src_vid> -> <dst_vid>[@<rank>] [, <src_vid> -> <dst_vid> ...]  
YIELD <output>;
```

- **LOOKUP**

```
LOOKUP ON {<vertex_tag> | <edge_type>}  
[WHERE <expression> [AND <expression> ...]]  
YIELD <return_list> [AS <alias>];  
  
<return_list>  
  <prop_name> [AS <col_alias>] [, <prop_name> [AS <prop_alias>] ...];
```

- **MATCH**

```
MATCH <pattern> [<clause_1>] RETURN <output> [<clause_2>];
```

GO

- **VID** `player101` `follow`

```
nebula> GO FROM "player101" OVER follow YIELD id($$);  
+-----+  
| id($) |  
+-----+  
| "player100" |
```

```
| "player102" |
+-----+
```

- VID player101 follow 35

```
nebula> GO FROM "player101" OVER follow WHERE properties($$).age >= 35 \
    YIELD properties($$).name AS Teammate, properties($$).age AS Age;
+-----+-----+
| Teammate | Age |
+-----+-----+
| "Tim Duncan" | 42 |
+-----+-----+
```

/

YIELD

\$\$

\

- VID player101 follow

*

```
nebula> GO FROM "player101" OVER follow YIELD dst(edge) AS id | \
    GO FROM $.id OVER serve YIELD properties($$).name AS Team, \
    properties($^).name AS Player;
+-----+-----+
| Team | Player |
+-----+-----+
| "Trail Blazers" | "LaMarcus Aldridge" |
+-----+-----+
```

/

\$^

|

\$-

*

Note

```
nebula> $var = GO FROM "player101" OVER follow YIELD dst(edge) AS id; \
    GO FROM $var.id OVER serve YIELD properties($$).name AS Team, \
    properties($^).name AS Player;
+-----+-----+
| Team | Player |
+-----+-----+
| "Trail Blazers" | "LaMarcus Aldridge" |
+-----+-----+
```

FETCH

VID player100

```
nebula> FETCH PROP ON player "player100" YIELD properties(vertex);
+-----+
| properties(VERTEX) |
+-----+
| {age: 42, name: "Tim Duncan"} |
+-----+
```

Note

LOOKUP MATCH

UPDATE UPSERT

UPSERT UPDATE INSERT UPSERT

Note

partition UPSERT INSERT UPDATE partition

nGQL

- UPDATE

```
UPDATE VERTEX <vid> SET <properties to be updated>
[WHEN <condition>] [YIELD <columns>];
```

- UPDATE

```
UPDATE EDGE ON <edge_type> <source vid> -> <destination vid> [@rank]
SET <properties to be updated> [WHEN <condition>] [YIELD <columns to be output>];
```

- UPSERT

```
UPSERT {VERTEX <vid> | EDGE <edge_type>} SET <update_columns>
[WHEN <condition>] [YIELD <columns>];
```

- UPDATE VID player100 name FETCH

```
nebula> UPDATE VERTEX "player100" SET player.name = "Tim";
nebula> FETCH PROP ON player "player100" YIELD properties(vertex);
+-----+
| properties(VERTEX) |
+-----+
```

```
| {age: 42, name: "Tim"} |  
+-----+  
|
```

- UPDATE degree FETCH

```
nebula> UPDATE EDGE ON follow "player101" -> "player100" SET degree = 96;  
nebula> FETCH PROP ON follow "player101" -> "player100" YIELD properties(edge);  
+-----+  
| properties(EDGE) |  
+-----+  
| {degree: 96} |  
+-----+
```

- INSERT VID player111 UPSERT

```
nebula> INSERT VERTEX player(name,age) VALUES "player111":("David West", 38);  
nebula> UPSERT VERTEX "player111" SET player.name = "David", player.age = $^.player.age + 11 \  
WHEN $.player.name == "David West" AND $.player.age > 20 \  
YIELD $.player.name AS Name, $.player.age AS Age;  
+-----+-----+  
| Name | Age |  
+-----+-----+  
| "David" | 49 |  
+-----+
```

nGQL

-

```
DELETE VERTEX <vid1>[, <vid2>...]
```

-

```
DELETE EDGE <edge_type> <src_vid> -> <dst_vid>[@<rank>]  
[, <src_vid> -> <dst_vid>...]
```

-

```
nebula> DELETE VERTEX "player111", "team203";
```

-

```
nebula> DELETE EDGE follow "player101" -> "team204";
```

CREATE INDEX Tag Edge type



```
MATCH LOOKUP
```

```
" " MATCH LOOKUP
```

nGQL

-

```
CREATE {TAG | EDGE} INDEX [IF NOT EXISTS] <index_name>
ON {<tag_name> | <edge_name>} ([<prop_name_list>]) [COMMENT = '<comment>'];
```

- REBUILD {TAG | EDGE} INDEX <index_name>;

Note

utf-8

3

10

30

LOOKUP MATCH

LOOKUP MATCH

Tag player name Tony Parker

```
//      name      player_index_1
nebula> CREATE TAG INDEX IF NOT EXISTS player_index_1 ON player(name(20));
//
//      REBUILD TAG INDEX player_index_1
+-----+
| New Job Id |
+-----+
| 31          |
+-----+

//      LOOKUP
nebula> LOOKUP ON player WHERE player.name == "Tony Parker" \
    YIELD properties(vertex).name AS name, properties(vertex).age AS age;
+-----+-----+
| name      | age   |
+-----+-----+
| "Tony Parker" | 36   |
+-----+-----+

//      MATCH
nebula> MATCH (v:player{name:"Tony Parker"}) RETURN v;
+-----+
| v           |
+-----+
| ("player101" :player{age: 36, name: "Tony Parker"}) |
```

:January 13, 2023

3.3 nGQL

3.3.1

double abs(double x)	x
double floor(double x)	x
double ceil(double x)	x
double round(double x)	x x 0
double sqrt(double x)	x
double cbrt(double x)	x
double hypot(double x, double y)	x y
double pow(double x, double y)	x^y
double exp(double x)	e^x
double exp2(double x)	2^x
double log(double x)	e^x
double log2(double x)	2^x
double log10(double x)	10^x
double sin(double x)	x
double asin(double x)	x
double cos(double x)	x
double acos(double x)	x
double tan(double x)	x
double atan(double x)	x
double rand()	[0,1)
int rand32(int min, int max)	[min, max] 32 int max min 0 32
int rand64(int min, int max)	[min, max] 64 int max min 0 64
bit_and()	AND
bit_or()	OR
bit_xor()	XOR
int size()	
int range(int start, int end, int step)	[start, end] step 1
int sign(double x)	x x 0 0 x -1 x 1
double e()	e 2.718281828459045
double pi()	π 3.141592653589793
double radians()	radians(180) 3.141592653589793

avg()
count() count({expr *}) count() NULL count(expr) count() size()
max()
min()
collect() collect()
std()
sum()

int strcasecmp(string a, string b)	a=b	0	a>b	0	a<b	0
string lower(string a)						
string toLower(string a)	lower()					
string upper(string a)						
string toUpper(string a)	upper()					
int length(a)						
string trim(string a)						
string ltrim(string a)						
string rtrim(string a)						
string left(string a, int count)	count	count	a	a		
string right(string a, int count)	count	count	a	a		
string lpad(string a, int size, string letters)	a	letters	size			
string rpad(string a, int size, string letters)	a	letters	size			
string substr(string a, int pos, int count)	a	pos	pos	count		
string substring(string a, int pos, int count)	substr()					
string reverse(string)						
string replace(string a, string b, string c)	a	b	c			
list split(string a, string b)	b	a				
concat()	concat()	concat(string1, string2, ...)				
concat_ws()	concat_ws()	separator				
extract()	extract()					
json_extract()	json_extract()	JSON	map			

-

int now()		
timestamp timestamp()		
date date()	UTC	
time time()	UTC	
datetime datetime()	UTC	

- Schema

- nGQL

id(vertex)	ID	ID	
map properties(vertex)			
map properties(edge)			
string type(edge)	Edge type		
src(edge)	ID	ID	
dst(edge)	ID	ID	
int rank(edge)	rank		
vertex	ID	Tag	
edge	Edge type	ID	ID rank
vertices	GET SUBGRAPH		
edges	GET SUBGRAPH		
path	FIND PATH		

- openCypher

id(<vertex>)	ID	ID	
list tags(<vertex>)	Tag	labels()	
list labels(<vertex>)	Tag	tags()	openCypher
map properties(<vertex_or_edge>)			
string type(<edge>)	Edge type		
src(<edge>)	ID	ID	
dst(<edge>)	ID	ID	
vertex startNode(<path>)		ID	
string endNode(<path>)		ID	
int rank(<edge>)	rank		

keys(expr)

labels(vertex) Tag

nodes(path)

range(start, end [, step]) [start, end] step 1

relationships(path)

reverse(list)

tail(list)

head(list)

last(list)

reduce()

bool toBoolean()

float toFloat()

string toString()

int toInteger()

set toSet()

int hash() hash() NULL

true false WHERE

```
<predicate>(<variable> IN <list> WHERE <condition>)
```

exists() true false

any() true false

all() true false

none() true false

single() true false

CASE nGQL YIELD RETURN

CASE ELSE ELSE NULL

coalesce()

3.3.2

- MATCH

```
MATCH <pattern> [<clause_1>] RETURN <output> [<clause_2>];
```

	(v)		(v)
Tag	MATCH (v:player) RETURN v	:<tag_name>	Tag
Tag	MATCH (v:player:team) RETURN v LIMIT 10	:	Tag
	MATCH (v:player{name:"Tim Duncan"}) RETURN v	Tag	{<prop_name>: <prop_value>}
	MATCH (v) WITH v, properties(v) as props, keys(properties(v)) as kk LIMIT 10000 WHERE [i in kk where props[i] == "Tim Duncan"] RETURN v	Tag	
ID	MATCH (v) WHERE id(v) == 'player101' RETURN v	ID	id()
ID	MATCH (v:player { name: 'Tim Duncan' })--(v2) WHERE id(v2) IN ["player101", "player102"] RETURN v2	ID	WHERE id(v) IN [vid_list]
	MATCH (v:player{name:"Tim Duncan"})--(v2) RETURN v2.player.name AS Name	--	-- < >
	MATCH p=(v:player{name:"Tim Duncan"})-->(v2) RETURN p	--	
	MATCH (v:player{name:"Tim Duncan"})-[e]-(v2) RETURN e	-- --> <--	-[e]-
	MATCH ()<-[e]-() RETURN e LIMIT 3		
Edge type	MATCH ()-[e:follow]->() RETURN e LIMIT 5	:<edge_type> [e:follow]-	Edge type -
	MATCH (v:player{name:"Tim Duncan"})-[e:follow{degree:95}]->(v2) RETURN e	{<prop_name>: <prop_value>} [e:follow{likeness:95}]	Edge type Edge type
	MATCH ()-[e]->() WITH e, properties(e) as props, keys(properties(e)) as kk LIMIT 10000 WHERE [i in kk where props[i] == 90] RETURN e		
Edge type	MATCH (v:player{name:"Tim Duncan"})-[e:follow :serve]->(v2) RETURN e	Edge type Edge type [e:follow serve]	Edge type Edge type
	MATCH (v:player{name:"Tim Duncan"})-[]->(v2)<- [e:serve]-(v3) RETURN v2, v3		
	MATCH p=(v:player{name:"Tim Duncan"})-[e:follow*2]->(v2) >(v2) RETURN DISTINCT v2 AS Friends	:<edge_type>*<hop> e	hop
	MATCH p=(v:player{name:"Tim Duncan"})-[e:follow*1..3]->(v2) RETURN v2 AS Friends	minHop maxHop	minHop maxHop
Edge type	MATCH p=(v:player{name:"Tim Duncan"})-[e:follow serve*2]->(v2) RETURN DISTINCT v2	Edge type Edge type	hop minHop maxHop e
	MATCH (v:player{name:"Tim Duncan"}) RETURN v MATCH (v:player{name:"Tim Duncan"})-[e]->(v2) RETURN e	RETURN {<vertex_name> <edge_name>}	
ID	MATCH (v:player{name:"Tim Duncan"}) RETURN id(v)	id()	ID
Tag	MATCH (v:player{name:"Tim Duncan"}) RETURN labels(v)	labels() labels(v)	Tag N labels(v)[n-1]

	MATCH (v:player{name:"Tim Duncan"}) RETURN v.player.age	RETURN {<vertex_name> <edge_name>}.<property> AS
	MATCH p=(v:player{name:"Tim Duncan"})-[]-(v2) RETURN properties(v2)	properties()
Edge type	MATCH p=(v:player{name:"Tim Duncan"})-[e]->() RETURN DISTINCT type(e)	type() Edge type
	MATCH p=(v:player{name:"Tim Duncan"})-[*3]->()	RETURN <path_name>
	RETURN nodes(p)	nodes()
	MATCH p=(v:player{name:"Tim Duncan"})-[]-(v2) RETURN relationships(p)	relationships()
	MATCH p=(v:player{name:"Tim Duncan"})-[*..2]->(v2) RETURN p AS Paths, length(p) AS Length	length()

- OPTIONAL MATCH

```
MATCH (m)-[]-(n) WHERE id(m)=="player100" OPTIONAL MATCH (n)-[]-(l) WHERE id(n)=="player125" RETURN id(m),id(n),id(l) NULL
```

- LOOKUP

```
LOOKUP ON {<vertex_tag> | <edge_type>} [WHERE <expression> [AND <expression> ...]] YIELD <return_list> [AS <alias>]
```

	LOOKUP ON player WHERE player.name == "Tony Parker" YIELD player.name AS name, player.age AS age	Tag player name Tony Parker
	LOOKUP ON follow WHERE follow.degree == 90 YIELD follow.degree	Edge type follow degree 90
Tag	LOOKUP ON player YIELD properties(vertex),id(vertex)	Tag player VID
Edge type	LOOKUP ON like YIELD edge AS e	Edge type like
	LOOKUP ON player YIELD id(vertex) YIELD COUNT(*) AS Player_Count	Tag player
	LOOKUP ON like YIELD id(vertex) YIELD COUNT(*) AS Like_Count	Edge type like

- GO

```
GO [[<M> TO] <N> STEPS ] FROM <vertex_list>
OVER <edge_type_list> [{REVERSELY | BIDIRECT}]
[ WHERE <conditions> ]
YIELD [DISTINCT] <return_list>
[ {SAMPLE <sample_list> | LIMIT <limit_list>} ]
[| GROUP BY {col_name | expr | position} YIELD <col_name>]
[| ORDER BY <expression> [{ASC | DESC}]]
[| LIMIT [<offset_value>,] <number_rows>]
```

GO FROM "player102" OVER serve YIELD dst(edge)	player102
GO 2 STEPS FROM "player102" OVER follow YIELD dst(edge)	player102
GO FROM "player100", "player102" OVER serve WHERE properties(edge).start_year > 1995 YIELD DISTINCT properties(\$\$).name AS team_name, properties(edge).start_year AS start_year, properties(\$^).name AS player_name	
GO FROM "player100" OVER follow, serve YIELD properties(edge).degree, properties(edge).start_year	Edge type UNKNOWN_PROP
GO FROM "player100" OVER follow REVERSELY YIELD src(edge) AS destination	player100
GO FROM "player100" OVER follow REVERSELY YIELD src(edge) AS id GO FROM \$-.id OVER serve WHERE properties(\$^).age > 20 YIELD properties(\$^).name AS FriendOf, properties(\$\$).name AS Team	player100
GO FROM "player102" OVER follow YIELD dst(edge) AS both	player102
GO 2 STEPS FROM "player100" OVER follow YIELD src(edge) AS src, dst(edge) AS dst, properties(\$ \$).age AS age GROUP BY \$-.dst YIELD \$-.dst AS dst, collect_set(\$-.src) AS src, collect(\$-.age) AS age	

- **FETCH**

```
FETCH PROP ON {<tag_name>[, tag_name ...] | *}
<vid> [, vid ...]
YIELD <return_list> [AS <alias>]
```

FETCH PROP ON player "player100" YIELD properties(vertex)	FETCH	Tag	
FETCH PROP ON player "player100" YIELD player.name AS name	YIELD		
FETCH PROP ON player "player101", "player102", "player103" YIELD properties(vertex)	ID	,	
FETCH PROP ON player, t1 "player100", "player103" YIELD properties(vertex)	FETCH	Tag	Tag
FETCH PROP ON * "player100", "player106", "team200" YIELD properties(vertex)	FETCH	*	

```
FETCH PROP ON <edge_type> <src_vid> -> <dst_vid>[@<rank>] [, <src_vid> -> <dst_vid> ...]
YIELD <output>;
```

FETCH PROP ON serve "player100" -> "team204" YIELD properties(edge)	player100	team204	serve
FETCH PROP ON serve "player100" -> "team204" YIELD serve.start_year	YIELD		
FETCH PROP ON serve "player100" -> "team204", "player133" -> "team202" YIELD properties(edge)	(<src_vid> -> <dst_vid>[@<rank>])	,	
FETCH PROP ON serve "player100" -> "team204"@1 YIELD properties(edge)	rank	0	FETCH
GO FROM "player101" OVER follow YIELD follow._src AS s, follow._dst AS d	player101	follow	degree
FETCH PROP ON follow \$-.s -> \$-.d YIELD follow.degree			
\$var = GO FROM "player101" OVER follow YIELD follow._src AS s, follow._dst AS d; FETCH PROP ON follow \$var.s -> \$var.d YIELD follow.degree			

- SHOW

SHOW CHARSET	SHOW CHARSET	SHOW CHARSET	
SHOW COLLATION	SHOW COLLATION	SHOW COLLATION	
SHOW CREATE SPACE	SHOW CREATE SPACE <space_name>	SHOW CREATE SPACE basketballplayer	
SHOW CREATE TAG/EDGE	SHOW CREATE {TAG <tag_name> EDGE <edge_name>}	SHOW CREATE TAG player	Tag/Edge type
SHOW HOSTS	SHOW HOSTS [GRAPH STORAGE META]	SHOW HOSTS SHOW HOSTS GRAPH	Graph Storage Meta
SHOW INDEX STATUS	SHOW {TAG EDGE} INDEX STATUS	SHOW TAG INDEX STATUS	
SHOW INDEXES	SHOW {TAG EDGE} INDEXES	SHOW TAG INDEXES	Tag Edge type
SHOW PARTS	SHOW PARTS [<part_id>]	SHOW PARTS	
SHOW ROLES	SHOW ROLES IN <space_name>	SHOW ROLES in basketballplayer	
SHOW SNAPSHOTS	SHOW SNAPSHOTS	SHOW SNAPSHOTS	
SHOW SPACES	SHOW SPACES	SHOW SPACES	
SHOW STATS	SHOW STATS	SHOW STATS	STATS
SHOW TAGS/EDGES	SHOW TAGS EDGES	SHOW TAGS SHOW EDGES	Tag/Edge type
SHOW USERS	SHOW USERS	SHOW USERS	
SHOW SESSIONS	SHOW SESSIONS	SHOW SESSIONS	
SHOW SESSIONS	SHOW SESSION <Session_Id>	SHOW SESSION 1623304491050858	ID
SHOW QUERIES	SHOW [ALL] QUERIES	SHOW QUERIES	Session
SHOW META LEADER	SHOW META LEADER	SHOW META LEADER	Meta leader

3.3.3

GROUP BY	GROUP BY <var> YIELD <var>, <aggregation_function(var)>	GO FROM "player100" OVER follow BIDIRECT YIELD \$\$.player.name as Name GROUP BY \$-.Name YIELD \$-.Name as Player, count(*) AS Name_Count	player100
LIMIT	YIELD <var> [LIMIT [<offset_value>, <number_rows>]	GO FROM "player100" OVER follow REVERSELY YIELD \$\$.player.name AS Friend, \$\$.player.age AS Age ORDER BY \$-.Age, \$-.Friend LIMIT 1, 3	2 3
SKIP	RETURN <var> [SKIP <offset>] [LIMIT <number_rows>]	MATCH (v:player{name:"Tim Duncan"}) --> (v2) RETURN v2.player.name AS Name, v2.player.age AS Age ORDER BY Age DESC SKIP 1	SKIP <offset> LIMIT <number_rows>
SAMPLE	<go_statement> SAMPLE <sample_list>;	GO 3 STEPS FROM "player100" OVER * YIELD properties(\$\$).name AS NAME, properties(\$\$).age AS Age SAMPLE [1,2,3];	
ORDER BY	<YIELD clause> ORDER BY <expression> [ASC DESC] [, <expression> [ASC DESC] ...]	FETCH PROP ON player "player100", "player101", "player102", "player103" YIELD player.age AS age, player.name AS name ORDER BY \$-.age ASC, \$-.name DESC	ORDER BY
RETURN	RETURN {<vertex_name> <edge_name> <vertex_name>.<property> <edge_name>.<property> ...}	MATCH (v:player) RETURN v.player.name, v.player.age LIMIT 3	name age
TTL	CREATE TAG <tag_name>(<property_name_1> <property_value_1>, <property_name_2> <property_value_2>, ...) ttl_duration= <value_int>, ttl_col = <property_name>	CREATE TAG t2(a int, b int, c string) ttl_duration= 100, ttl_col = "a"	Tag TTL
WHERE	WHERE {<vertex> edge_alias>.<property_name> {> = < ...} <value>...}	MATCH (v:player) WHERE v.player.name == "Tim Duncan" XOR (v.player.age < 30 AND v.player.name == "Yao Ming") OR NOT (v.player.name == "Yao Ming" OR v.player.name == "Tim Duncan") RETURN v.player.name, v.player.age	WHERE GO LOOKUP MATCH WITH
YIELD	YIELD [DISTINCT] <col> [AS <alias>] [, <col> [AS <alias>] ...] [WHERE <conditions>];	GO FROM "player100" OVER follow YIELD dst(edge) AS ID FETCH PROP ON player \$-.ID YIELD player.age AS Age YIELD AVG(\$-.Age) as Avg_age, count(*)as Num_friends	player100 player
WITH	MATCH \$expressions WITH {nodes() labels() ...}	MATCH p=(v:player{name:"Tim Duncan"})--() WITH nodes(p) AS n UNWIND n AS n1 RETURN DISTINCT n1	WITH
UNWIND	UNWIND <list> AS <alias> <RETURN clause>	UNWIND [1,2,3] AS n RETURN n	

3.3.4

CREATE SPACE	CREATE SPACE [IF NOT EXISTS] <graph_space_name> ([partition_num = <partition_number>,] [replica_factor = <replica_number>,] vid_type = {FIXED_STRING(<N>) INT[64]}) [COMMENT = '<comment>']	CREATE SPACE my_space_1 (vid_type=FIXED_STRING(30))	
CREATE SPACE	CREATE SPACE <new_graph_space_name> AS <old_graph_space_name>	CREATE SPACE my_space_4 as my_space_3	Schema
USE	USE <graph_space_name>	USE space1	
SHOW SPACES	SHOW SPACES	SHOW SPACES	NebulaGraph
DESCRIBE SPACE	DESC[RIBE] SPACE <graph_space_name>	DESCRIBE SPACE basketballplayer	
CLEAR SPACE	CLEAR SPACE [IF EXISTS] <graph_space_name>		Schema
DROP SPACE	DROP SPACE [IF EXISTS] <graph_space_name>	DROP SPACE basketballplayer	

3.3.5 TAG

CREATE TAG	CREATE TAG [IF NOT EXISTS] <tag_name> (<prop_name> <data_type> [NULL NOT NULL] [DEFAULT <default_value>] [COMMENT '<comment>'] [{, <prop_name> <data_type> [NULL NOT NULL] [DEFAULT <default_value>] [COMMENT '<comment>'] } ...] [TTL_DURATION = <ttl_duration>] [TTL_COL = <prop_name>] [COMMENT = '<comment>']	CREATE TAG woman(name string, age int, married bool, salary double, create_time timestamp) TTL_DURATION = 100, TTL_COL = "create_time"	Tag
DROP TAG	DROP TAG [IF EXISTS] <tag_name>	DROP TAG test;	Tag
ALTER TAG	ALTER TAG <tag_name> <alter_definition> [, alter_definition] ...] [ttl_definition [, ttl_definition] ...] [COMMENT = '<comment>']	ALTER TAG t1 ADD (p3 int, p4 string)	Tag
			TTL Time-To- Live)
SHOW TAGS	SHOW TAGS	SHOW TAGS	Tag
DESCRIBE TAG	DESC[RIBE] TAG <tag_name>	DESCRIBE TAG player	Tag
DELETE TAG	DELETE TAG <tag_name_list> FROM <VID>	DELETE TAG test1 FROM "test"	Tag

3.3.6 Edge type

CREATE EDGE	<code>CREATE EDGE [IF NOT EXISTS] <edge_type_name> (<prop_name> <data_type> [NULL NOT NULL] [DEFAULT <default_value>] [COMMENT '<comment>'] [{, <prop_name> <data_type> [NULL NOT NULL] [DEFAULT <default_value>] [COMMENT '<comment>']}] ...) [TTL_DURATION = <ttx_duration>] [TTL_COL = <prop_name>] [COMMENT = '<comment>']</code>	<code>CREATE EDGE e1(p1 string, p2 int, p3 timestamp) TTL_DURATION = 100, TTL_COL = "p2"</code>	Edge type
DROP EDGE	<code>DROP EDGE [IF EXISTS] <edge_type_name></code>	<code>DROP EDGE e1</code>	Edge type
ALTER EDGE	<code>ALTER EDGE <edge_type_name> <alter_definition> [, alter_definition] ... [ttl_definition [, ttl_definition] ...] [COMMENT = '<comment>']</code>	<code>ALTER EDGE e1 ADD (p3 int, p4 string)</code>	Edge type
SHOW EDGES	<code>SHOW EDGES</code>	<code>SHOW EDGES</code>	Edge type
DESCRIBE EDGE	<code>DESC[RIBE] EDGE <edge_type_name></code>	<code>DESCRIBE EDGE follow</code>	Edge type

3.3.7

INSERT VERTEX	<code>INSERT VERTEX [IF NOT EXISTS] [tag_props, [tag_props] ...] VALUES <vid>: ([prop_value_list])</code>	<code>INSERT VERTEX t2 (name, age) VALUES "13":("n3", 12), "14":("n4", 8)</code>	NebulaGraph
DELETE VERTEX	<code>DELETE VERTEX <vid> [, <vid> ...]</code>	<code>DELETE VERTEX "team1"</code>	
UPDATE VERTEX	<code>UPDATE VERTEX ON <tag_name> <vid> SET <update_prop> [WHEN <condition>] [YIELD <output>]</code>	<code>UPDATE VERTEX ON player "player101" SET age = age + 2</code>	Tag
UPSERT VERTEX	<code>UPSERT VERTEX ON <tag> <vid> SET <update_prop> [WHEN <condition>] [YIELD <output>]</code>	<code>UPSERT VERTEX ON player "player667" SET age = 31</code>	UPDATE INSERT

3.3.8

INSERT EDGE	<code>INSERT EDGE [IF NOT EXISTS] <edge_type> (<prop_name_list>) VALUES <src_vid> -> <dst_vid>[@<rank>] : (<prop_value_list>) [, <src_vid> -> <dst_vid>[@<rank>] : (<prop_value_list>), ...]</code>	<code>INSERT EDGE e2 (name, age) VALUES "11"- >"13":("n1", 1)</code>	NebulaGraph
DELETE EDGE	<code>DELETE EDGE <edge_type> <src_vid> -> <dst_vid>[@<rank>] [, <src_vid> -> <dst_vid>[@<rank>] ...]</code>	<code>DELETE EDGE serve "player100" -> "team204"@0</code>	
UPDATE EDGE	<code>UPDATE EDGE ON <edge_type> <src_vid> -> <dst_vid> [@<rank>] SET <update_prop> [WHEN <condition>] [YIELD <output>]</code>	<code>UPDATE EDGE ON serve "player100" -> "team204"@0 SET start_year = start_year + 1</code>	Edge type
UPsert EDGE	<code>UPSERT EDGE ON <edge_type> <src_vid> -> <dst_vid> [@rank] SET <update_prop> [WHEN <condition>] [YIELD <properties>]</code>	<code>UPSERT EDGE on serve "player666" -> "team200"@0 SET end_year = 2021</code>	UPDATE INSERT

3.3.9

• LOOKUP MATCH

CREATE INDEX	CREATE {TAG EDGE} INDEX [IF NOT EXISTS] <index_name> ON {<tag_name> <edge_name>} ([<prop_name_list>]) [COMMENT = '<comment>']	CREATE TAG INDEX player_index on player()	Tag EdgeType
SHOW CREATE INDEX	SHOW CREATE {TAG EDGE} INDEX <index_name>	show create tag index index_2	Tag Edge type nGQL
SHOW INDEXES	SHOW {TAG EDGE} INDEXES	SHOW TAG INDEXES	Tag Edge type
DESCRIBE INDEX	DESCRIBE {TAG EDGE} INDEX <index_name>	DESCRIBE TAG INDEX player_index_0	Field Type
REBUILD INDEX	REBUILD {TAG EDGE} INDEX [<index_name_list>]	REBUILD TAG INDEX single_person_index	
SHOW INDEX STATUS	SHOW {TAG EDGE} INDEX STATUS	SHOW TAG INDEX STATUS	
DROP INDEX	DROP {TAG EDGE} INDEX [IF EXISTS] <index_name>	DROP TAG INDEX player_index_0	

SIGN IN TEXT SERVICE [(<elastic_ip:port> [,<username>, <password>]), (<elastic_ip:port>), ...]	SIGN IN TEXT SERVICE (127.0.0.1:9200)	NebulaGraph Elasticsearch SIGN IN Elasticsearch
SHOW TEXT SEARCH CLIENTS	SHOW TEXT SEARCH CLIENTS	
SIGN OUT TEXT SERVICE	SIGN OUT TEXT SERVICE	
CREATE FULLTEXT {TAG EDGE} INDEX <index_name> ON {<tag_name> <edge_name>} ([<prop_name_list>])	CREATE FULLTEXT TAG INDEX nebula_index_1 ON player(name)	
SHOW FULLTEXT INDEXES	SHOW FULLTEXT INDEXES	
REBUILD FULLTEXT INDEX	REBUILD FULLTEXT INDEX	
DROP FULLTEXT INDEX <index_name>	DROP FULLTEXT INDEX nebula_index_1	
LOOKUP ON {<tag> <edge_type>} WHERE <expression> [YIELD <return_list>]	LOOKUP ON player WHERE FUZZY(player.name, "Tim Dunncan", AUTO, OR) YIELD player.name	

3.3.10

GET SUBGRAPH [WITH PROP] [<step_count> STEPS]	GET SUBGRAPH 1 STEPS	Edge type
FROM {<vid>, <vid>...} [{IN OUT BOTH}]	FROM "player100" YIELD	
<edge_type>, <edge_type>... YIELD [VERTICES AS <vertex_alias> [, EDGES AS <edge_alias>]]	VERTICES AS nodes,	
FIND { SHORTEST ALL NOLOOP } PATH [WITH PROP] FROM <vertex_id_list> TO <vertex_id_list> OVER <edge_type_list> [REVERSELY BIDIRECT] [<WHERE clause>] [UPTO <N> STEPS] YIELD path as <alias> [ORDER BY \$-.path] [LIMIT <M>]	FIND SHORTEST PATH FROM "player102" TO "team204" OVER * YIELD path as p	(<vertex_id>) ->(<vertex_id>)

3.3.11

EXPLAIN	EXPLAIN [format="row" "dot"] <your_nGQL_statement>	EXPLAIN format="row" SHOW TAGS	nGQL
PROFILE	PROFILE [format="row" "dot"] <your_nGQL_statement>	PROFILE format="row" SHOW TAGS	nGQL

3.3.12

- BALANCE

BALANCE LEADER	leader	ID	
•			
SUBMIT JOB COMPACT	RocksDB	compact	
SUBMIT JOB FLUSH	RocksDB	memfile	
SUBMIT JOB STATS		SHOW STATS	
SHOW JOB <job_id>	Meta	SUBMIT JOB	nebula-storaged
SHOW JOBS			
STOP JOB			
RECOVER JOB			
•			
KILL QUERY (session=<session_id>, plan=<plan_id>)	KILL	QUERY(SESSION=1625553545984255, PLAN=163)	

: January 13, 2023

4. nGQL

4.1 nGQL

4.1.1 nGQL

nGQL NebulaGraph Query Language NebulaGraph

nGQL

SQL

nGQL

issue

NebulaGraph

NebulaGraph 3.0

openCypher

9

nGQL

-
-
-
-
-
-
-
-
- openCypher 9

Basketballplayer

NebulaGraph

basketballplayer

NebulaGraph Console

- f

Note

ADD HOSTS

Storage

Storage

NebulaGraph nGQL

- (Draft) ISO/IEC JTC1 N14279 SC 32 - Database_Languages - GQL
- (Draft) ISO/IEC JTC1 SC32 N3228 - SQL_Property_Graph_Queries - SQLPGQ
- OpenCypher 9

nGQL

< >

:

[]

{ }

|

...

nGQL

```
INSERT VERTEX [IF NOT EXISTS] [tag_props, [tag_props] ...]
VALUES <vid>: ([prop_value_list])

tag_props:
  tag_name ([prop_name_list])

prop_name_list:
  [prop_name [, prop_name] ...]

prop_value_list:
  [prop_value [, prop_value] ...]
```

```
nebula> CREATE TAG IF NOT EXISTS player(name string, age int);
```

openCypher

NGQL OPENCYPHER

nGQL NebulaGraph	openCypher	openCypher Implementers Group	openCypher 9
nGQL openCypher	openCypher		



nGQL = nGQL + openCypher

NGQL OPENCYPHER 9



nGQL DQL (match, optional match, with)

DDL DML DCL

Bolt

APOC GDS

"compatibility" " "

NebulaGraph Issues

incompatible

NGQL OPENCYPHER 9

openCypher 9		nGQL
Schema	Schema	Schema
=	==	
^	pow(x, y)	^
Rank	@rank	
-	openCypher 9 OPTIONAL MATCH	DML CREATE MERGE DCL MATCH , \ +
Label Tag	Label	Tag

↑ Compatibility

openCypher 9 Cypher

1. Cypher Cypher " " openCypher nGQL
2. Cypher constraints Unique node property constraints Node property existence constraints Relationship property existence constraints Node key constraints OpenCypher nGQL Schema Schema NOT NULL
" " UNIQUE constraint
3. Cypher APoC openCypher 9 APoC Cypher Bolt openCypher 9

NGQL

NebulaGraph GitHub [features](#) 2500 nGQL

features features nGQL

```
Feature: Basic match

Background:
Given a graph with space named "basketballplayer"

Scenario: Single node
When executing query:
"""
MATCH (v:player {name: "Yao Ming"}) RETURN v;
"""

Then the result should be, in any order, with relax comparison:
| v
| ("player133" :player{age: 38, name: "Yao Ming"}) |
```

```
Scenario: One step
When executing query:
"""
MATCH (v1:player{name: "LeBron James"}) -[r]-> (v2)
RETURN type(r) AS Type, v2.player.name AS Name
"""

Then the result should be, in any order:
```

Type	Name
"follow"	"Ray Allen"
"serve"	"Lakers"
"serve"	"Heat"
"serve"	"Cavaliers"

Feature: Comparison of where clause

```
Background:
Given a graph with space named "basketballplayer"
```

```
Scenario: push edge props filter down
When profiling query:
"""
GO FROM "player100" OVER follow
```

```

WHERE properties(edge).degree IN [v IN [95,99] WHERE v > 0]
YIELD dst(edge), properties(edge).degree
"""

Then the result should be, in any order:
| follow_dst | follow.degree |
| "player101" | 95           |
| "player125" | 95           |

And the execution plan should be:
| id | name      | dependencies | operator info |
| 0  | Project    | 1            |                   |
| 1  | GetNeighbors | 2          | {"filter": "(properties(edge).degree IN [v IN [95,99] WHERE (v>0)])")} |
| 2  | Start      |             |                   |

```

Feature**Background****Given****Scenario** @skip**When** nGQL executing query profiling query**Then** when issue NebulaGraph**And** when

@skip

tck case CI/CD

TINKERPOP GREMLIN

W3C RDF SPARQL GRAPHQL

NebulaGraph	Schema	RDF
nGQL	SPARQL	GraphQL

:January 13, 2023

4.1.2

pattern

NebulaGraph

(a)

a

(a)-[]->(b)

a b

a b

(a)-[]->(b)<-[]-(c)

 path

Tag

 Note

nGQL Tag openCypher Label

Tag Tag

Tag

(a:User)-[]->(b)

Tag

(a:User :Admin)-[] ->(b)

nGQL

(a {name: 'Andres', sport: 'Brazilian Ju-Jitsu'})

(a)-[{blocked: false}]->(b)

(a)-[]-(b)

(a)-[r]->(b)

Tag

(a)-[r:REL_TYPE]->(b)

Tag

Edge type

Edge type

|

(a)-[r:TYPE1|TYPE2]->(b)

(a)-[:REL_TYPE]->(b)

3 2

2

(a)-[]->()-[]->(b)

variable-length edges

(a)-[*3..5]->(b)

*3..5 3 5

4 3 5 4 6 5

(a)-[*..5]->(b)

Note

(a)-[*3..]->(b) (a)-[*]->(b)

nGQL

p = (a)-[*3..5]->(b)

MATCH

:January 13, 2023

4.1.3

nGQL



- NebulaGraph 1.x `#` `--` `//` `/* */`
- NebulaGraph 2.x `--`

Examples

```
nebula> #  
nebula> RETURN 1+1;      #  
nebula> RETURN 1+1;      //  
nebula> RETURN 1 /*      */ + 1 == 2;  
nebula> RETURN 11 +  
/*           \  
   \           \  
*/ 12;
```

nGQL `\`

OpenCypher

- nGQL `\` `/* */`
- openCypher

```
/* openCypher  
  
 */  
MATCH (n:label)  
RETURN n;
```

```
/*  nGQL  \  
   \  \  
 */  \  
MATCH (n:tag) \  
RETURN n;
```

:January 13, 2023

4.1.4

```
my_space MY_SPACE
```

```
nebula> CREATE SPACE IF NOT EXISTS my_space (vid_type=FIXED_STRING(30));
nebula> use MY_SPACE;
[ERROR (-1005)]: SpaceNotFound:
```

```
show spaces
```

```
nebula> show spaces;
nebula> SHOW SPACES;
nebula> SHOW spaces;
nebula> show SPACES;
```

```
count() COUNT() couNT()
```

```
nebula> WITH [NULL, 1, 1, 2, 2] As a \
    UNWIND a AS b \
    RETURN count(b), COUNT(*), couNT(DISTINCT b);
+-----+-----+-----+
| count(b) | COUNT(*) | couNT(DISTINCT b) |
+-----+-----+-----+
| 4       | 5       | 2       |
+-----+-----+-----+
```

:January 13, 2023

4.1.5

nGQL Schema

-
- `AND`



```
nebula> CREATE TAG TAG(name string);
[ERROR (-1004)]: SyntaxError: syntax error near 'TAG'

nebula> CREATE TAG `TAG` (name string);
Execution succeeded

nebula> CREATE TAG SPACE(name string);
Execution succeeded

nebula> CREATE TAG  (  string);
Execution succeeded

nebula> CREATE TAG ` %      &*+-*/` (`q-      =  wer` string);
Execution succeeded
```

```
ACROSS
ADD
ALTER
AND
AS
ASC
ASCENDING
BALANCE
BOOL
BY
CASE
CHANGE
COMPACT
CREATE
DATE
DATETIME
DELETE
DESC
DESCENDING
DESCRIBE
DISTINCT
DOUBLE
DOWNLOAD
DROP
EDGE
EDGES
EXISTS
EXPLAIN
FETCH
FIND
FIXED_STRING
FLOAT
FLUSH
FORMAT
FROM
GET
GO
GRANT
IF
IGNORE_EXISTED_INDEX
IN
INDEX
INDEXES
INGEST
INSERT
INT
INT16
INT32
INT64
```

```

INT8
INTERSECT
IS
LIMIT
LIST
LOOKUP
MAP
MATCH
MINUS
NO
NOT
NOT_IN
NULL
OF
OFFSET
ON
OR
ORDER
OVER
OVERWRITE
PROFILE
PROP
REBUILD
RECOVER
REMOVE
RESTART
RETURN
REVERSELY
REVOKE
SET
SHOW
STEP
STEPS
STOP
STRING
SUBMIT
TAG
TAGS
TIME
TIMESTAMP
TO
UNION
UPDATE
UPSERT
UPTO
USE
VERTEX
VERTICES
WHEN
WHERE
WITH
XOR
YIELD

```

```

ACCOUNT
ADMIN
ALL
ANY
ATOMIC_EDGE
AUTO
BIDIRECT
BOTH
CHARSET
CLIENTS
COLLATE
COLLATION
COMMENT
CONFIGS
CONTAINS
DATA
DBA
DEFAULT
ELASTICSEARCH
ELSE
END
ENDS
ENDS_WITH
FORCE
FULLTEXT
FUZZY
GOD
GRAPH
GROUP
GROUPS
GUEST
HDFS
HOST
HOSTS
INTO

```

```
IS_EMPTY
IS_NOT_EMPTY
IS_NOT_NULL
IS_NULL
JOB
JOBS
KILL
LEADER
LISTENER
META
NOLOOP
NONE
NOT_CONTAINS
NOT_ENDS_WITH
NOT_STARTS_WITH
OPTIONAL
OUT
PART
PARTITION_NUM
PARTS
PASSWORD
PATH
PLAN
PREFIX
QUERIES
QUERY
REDUCE
REGEXP
REPLICA_FACTOR
RESET
ROLE
ROLES
SAMPLE
SEARCH
SERVICE
SESSION
SESSIONS
SHORTEST
SIGN
SINGLE
SKIP
SNAPSHOT
SNAPSHOTS
SPACE
SPACES
STARTS
STARTS_WITH
STATS
STATUS
STORAGE
SUBGRAPH
TEXT
TEXT_SEARCH
THEN
TOP
TTL_COL
TTL_DURATION
UNWIND
USER
USERS
UUID
VALUE
VALUES
VID_TYPE
WILDCARD
ZONE
ZONES
FALSE
TRUE
```

:January 13, 2023

4.1.6 nGQL

nGQL

nGQL

nGQL

nGQL

Compatibility

nGQL Cypher Style Guide

1.

```
GO FROM "player100" OVER follow REVERSELY YIELD src(edge) AS id;
```

```
GO FROM "player100" \
OVER follow REVERSELY \
YIELD src(edge) AS id;
```

2.

```
GO FROM "player100" OVER follow REVERSELY YIELD src(edge) AS id | GO FROM $-.id \
OVER serve WHERE properties($^).age > 20 YIELD properties($^).name AS FriendOf, properties($$).name AS Team;
```

```
GO FROM "player100" \
OVER follow REVERSELY \
YIELD src(edge) AS id | \
GO FROM $-.id OVER serve \
WHERE properties($^).age > 20 \
YIELD properties($^).name AS FriendOf, properties($$).name AS Team;
```

3. 80

```
MATCH (v:player{name:"Tim Duncan"})-[e]->(v2) \
WHERE (v2.player.name STARTS WITH "Y" AND v2.player.age > 35 AND v2.player.age < v.player.age) OR (v2.player.name STARTS WITH "T" AND v2.player.age < 45 AND \
v2.player.age > v.player.age) \
RETURN v2;
```

```
MATCH (v:player{name:"Tim Duncan"})-[e]->(v2) \
WHERE (v2.player.name STARTS WITH "Y" AND v2.player.age > 35 AND v2.player.age < v.player.age) \
OR (v2.player.name STARTS WITH "T" AND v2.player.age < 45 AND v2.player.age > v.player.age) \
RETURN v2;
```

Note

80

nGQL

1. Tag Edge type

```
MATCH p=(v:players)-[e:are_following]-(v2) \
RETURN nodes(p);
```

```
MATCH p=(v:player)-[e:follow]-(v2) \
RETURN nodes(p);
```

2. -

```
MATCH (v:basketballTeam) \
RETURN v;
```

```
MATCH (v:basketball_team) \
RETURN v;
```

3.

```
match (v:player) return v limit 5;
```

```
MATCH (v:player) RETURN v LIMIT 5;
```

Pattern

1. Pattern

```
MATCH (v:player{name: "Tim Duncan", age: 42}) \
-[e:follow]->()-[e2:serve]->()<--(v2) \
RETURN v, e, v2;
```

```
MATCH (v:player{name: "Tim Duncan", age: 42})-[e:follow]-> \
()-[e2:serve]->()<--(v2) \
RETURN v, e, v2;
```

2.

```
MATCH (v:player)-[e:follow]->(v2) \
RETURN v;
```

```
MATCH (v:player)-[:follow]->() \
RETURN v;
```

3.

```
MATCH ()-[:follow]->(v) \
RETURN v;
```

```
MATCH (v)<-[ :follow ] -() \
RETURN v;
```

```
RETURN 'Hello Nebula!';
```

```
RETURN "Hello Nebula!"\\'123\\'"
```

Note

\

```
RETURN "\\\"NebulaGraph is amazing,\\\" the user says.";
```

1. ; nGQL

```
FETCH PROP ON player "player100" YIELD properties(vertex);
```

```
FETCH PROP ON player "player100" YIELD properties(vertex);
```

2. |

```
GO FROM "player100" \
OVER follow \
YIELD dst(edge) AS id; | \
GO FROM $-.id \
OVER serve \
YIELD properties($$).name AS Team, properties($^).name AS Player;
```

```
GO FROM "player100" \
OVER follow \
YIELD dst(edge) AS id | \
GO FROM $-.id \
OVER serve \
YIELD properties($$).name AS Team, properties($^).name AS Player;
```

3.

```
$var = GO FROM "player100" \
OVER follow \
YIELD dst(edge) AS id \
GO FROM $var.id \
OVER serve \
YIELD properties($$).name AS Team, properties($^).name AS Player;
```

```
$var = GO FROM "player100" \
OVER follow \
YIELD dst(edge) AS id | \
GO FROM $var.id \
OVER serve \
YIELD properties($$).name AS Team, properties($^).name AS Player;
```

```
$var = GO FROM "player100" \
OVER follow \
YIELD dst(edge) AS id; \
GO FROM $var.id \
OVER serve \
YIELD properties($$).name AS Team, properties($^).name AS Player;
```

:January 13, 2023

4.2

4.2.1

nGQL

nGQL	64	INT64	32	INT32	16	INT16	8	INT8
------	----	-------	----	-------	----	-------	---	------

INT64	INT64	INT	-9,223,372,036,854,775,808 ~ 9,223,372,036,854,775,807
INT32	INT32		-2,147,483,648 ~ 2,147,483,647
INT16	INT16		-32,768 ~ 32,767
INT8	INT8		-128 ~ 127

nGQL	FLOAT	DOUBLE
------	-------	--------

FLOAT	FLOAT	3.4E +/- 38	6~7
DOUBLE	DOUBLE	1.7E +/- 308	15~16

nGQL	1e2	1.1e2	.3e4	1.e4	-1234E-10
------	-----	-------	------	------	-----------

Note

MySQL DECIMAL

nGQL

VID

INT64	INT64
INT32	INT64
INT16	INT64
INT8	INT64
FLOAT	DOUBLE
DOUBLE	DOUBLE

nGQL	INT8	VID	TAG	Edge type	INT8	nGQL	INT8	INT64
------	------	-----	-----	-----------	------	------	------	-------

- NebulaGraph

- 123456

- 0x1e240

- 0361100

NebulaGraph

score	INT	INSERT	0xb	FETCH	11	0xb
-------	-----	--------	-----	-------	----	-----

- FLOAT/DDOUBLE INT
-

:January 13, 2023

4.2.2

NebulaGraph BOOL true false

nGQL

-
- WHERE

: January 13, 2023

4.2.3

NebulaGraph

nGQL

- STRING
- FIXED_STRING(<length>) <length> FIXED_STRING(32)
"Hello, Cooper" 'Hello, Cooper'

nGQL

- VID
- Schema Tag Edge type
-

•

```
nebula> CREATE TAG IF NOT EXISTS t1 (p1 FIXED_STRING(10));
```

•

```
nebula> CREATE TAG IF NOT EXISTS t2 (p2 STRING);
```

- NebulaGraph
- VID NebulaGraph

• "\n\t\r\b\f"

• "\110ello world"

OpenCypher

openCypher Cypher nGQL openCypher

```
# File: Literals.feature
Feature: Literals

Background:
  Given any graph
Scenario: Return a single-quoted string
  When executing query:
    """
      RETURN '' AS literal
    """
  Then the result should be, in any order:
    | literal |
    | '' | # Note: it should return single-quotes as openCypher required.
And no side effects
```

Cypher nGQL Cypher

```
nebula > YIELD '' AS quote1, "" AS quote2, """ AS quote3, ''' AS quote4
+-----+-----+-----+
| quote1 | quote2 | quote3 | quote4 |
+-----+-----+-----+
| ""     | ""     | """   | '''   |
+-----+-----+-----+
```

:January 13, 2023

4.2.4

DATE TIME DATETIME TIMESTAMP DURATION

- NebulaGraph timezone_name DATE TIME DATETIME UTC

Note

timezone_name

- date() time() datetime() datetime("2017-03-04 22:30:40.003000+08:00")
datetime("2017-03-04T22:30:40.003000[Asia/Shanghai]")
- date() time() datetime() timestamp()
- date() time() datetime() duration() date().month time("02:59:40").minute

Note

Map

openCypher

- localdatetime()
- YYYY-MM-DDThh:mm:ss YYYY-MM-DD hh:mm:ss
- time("1:1:1")

DATE

DATE	NebulaGraph	DATE	YYYY-MM-DD	-32768-01-01	32767-12-31
date()	year month day date()	YYYY	YYYY-MM	YYYY-MM-DD	01

```
nebula> RETURN DATE({year:-123, month:12, day:3});
+-----+
| date({year:-(123),month:12,day:3}) |
+-----+
| -123-12-03 |
+-----+
nebula> RETURN DATE("23333");
+-----+
| date("23333") |
+-----+
| 23333-01-01 |
+-----+
```

TIME

TIME	NebulaGraph	TIME	hh:mm:ss.msmsmsususus	00:00:00.000000	23:59:59.999999
time()	hour minute second				

DATETIME

```
DATETIME      NebulaGraph      DATETIME      YYYY-MM-DDThh:mm:ss.msmsmsususus      -32768-01-01T00:00:00.000000
32767-12-31T23:59:59.999999
```

- `datetime()` `year month day hour minute second`
- `datetime()` `TIMESTAMP` `DATETIME` `TIMESTAMP` `0~9223372036`
- `datetime()` `int` `int`

```
#
nebula> RETURN datetime();
+-----+
| datetime() |
+-----+
| 2022-08-29T06:37:08.933000 |
+-----+

#
nebula> RETURN datetime().hour;
+-----+
| datetime().hour |
+-----+
| 6 |
+-----+

#      DATETIME
nebula> RETURN datetime(timestamp(1625469277));
+-----+
| datetime(timestamp(1625469277)) |
+-----+
| 2021-07-05T07:14:37.000000 |
+-----+

nebula> RETURN datetime(1625469277);
+-----+
| datetime(1625469277) |
+-----+
| 2021-07-05T07:14:37.000000 |
+-----+
```

TIMESTAMP

```
TIMESTAMP      UTC      1970-01-01T00:00:01  2262-04-11T23:47:16
```

```
TIMESTAMP
```

- `1615974839` `2021-03-17T17:53:59`
- `TIMESTAMP` `timestamp()`
- `TIMESTAMP` `timestamp()` `now()`
- `timestamp()` `0~9223372036`
- `timestamp()` `DATETIME` `TIMESTAMP` `DATETIME` `string`
- **64 int**

```
#
nebula> RETURN timestamp();
+-----+
| timestamp() |
+-----+
| 1625469277 |
+-----+

#
nebula> RETURN timestamp("2022-01-05T06:18:43");
+-----+
| timestamp("2022-01-05T06:18:43") |
+-----+
| 1641363523 |
+-----+

#      datetime()
nebula> RETURN timestamp(datetime("2022-08-29T07:53:10.939000"));
+-----+
| timestamp(datetime("2022-08-29T07:53:10.939000")) |
+-----+
```

```
+-----+
| 1661759590
+-----+
```

Note

`timestamp()` `timestamp(datetime())`

DURATION

`DURATION` `years months days hours minutes seconds` `Key` `Map` `duration({years: 12, months: 5, days: 14, hours: 16, minutes: 12, seconds: 70})`

`DURATION`

- `DURATION`
-

1. Tag date1 DATE TIME DATETIME

```
nebula> CREATE TAG IF NOT EXISTS date1(p1 date, p2 time, p3 datetime);
```

2. test1

```
nebula> INSERT VERTEX date1(p1, p2, p3) VALUES "test1":(date("2021-03-17"), time("17:53:59"), datetime("2017-03-04T22:30:40.003000[Asia/Shanghai]"));
```

3. test1 p1

```
nebula> CREATE TAG INDEX IF NOT EXISTS date1_index ON date1(p1);
nebula> REBUILD TAG INDEX date1_index;
nebula> MATCH (v:date1) RETURN v.date1.p1.month;
+-----+
| v.date1.p1.month |
+-----+
| 3 |
+-----+
```

4. Tag school TIMESTAMP

```
nebula> CREATE TAG IF NOT EXISTS school(name string, found_time timestamp);
```

5. DUT "1988-03-01T08:00:00"

```
# 1988-03-01T08:00:00      573177600      UTC      573206400
nebula> INSERT VERTEX school(name, found_time) VALUES "DUT":("DUT", 573206400);

#
nebula> INSERT VERTEX school(name, found_time) VALUES "DUT":("DUT", timestamp("1988-03-01T08:00:00"));
```

6. dut now() timestamp()

```
# now()
nebula> INSERT VERTEX school(name, found_time) VALUES "dut":("dut", now());

# timestamp()
nebula> INSERT VERTEX school(name, found_time) VALUES "dut":("dut", timestamp());
```

WITH

```
nebula> WITH time({hour: 12, minute: 31, second: 14, millisecond:111, microsecond: 222}) AS d RETURN d;
+-----+
| d |
+-----+
| 12:31:14.111222 |
+-----+

nebula> WITH date({year: 1984, month: 10, day: 11}) AS x RETURN x + 1;
```

```
+-----+
| (x+1)      |
+-----+
| 1984-10-12 |
+-----+  
nebula> WITH date('1984-10-11') as x, duration({years: 12, days: 14, hours: 99, minutes: 12}) as d \
    RETURN x + d AS sum, x - d AS diff;
+-----+-----+
| sum      | diff      |
+-----+-----+
| 1996-10-29 | 1972-09-23 |
+-----+-----+
```

:January 13, 2023

4.2.5 NULL

NULL NOT NULL

NULL

AND OR XOR NOT

a	b	a AND b	a OR b	a XOR b	NOT a
false	false	false	false	false	true
false	null	false	null	null	true
false	true	false	true	true	true
true	false	false	true	true	false
true	null	null	true	null	false
true	true	true	true	false	false
null	false	false	null	null	null
null	null	null	null	null	null
null	true	null	true	null	null

OpenCypher

NebulaGraph NULL openCypher

NULL

NebulaGraph NULL openCypher

NULL

NebulaGraph NULL openCypher

NOT NULL

Tag player name NOT NULL

```
nebula> CREATE TAG IF NOT EXISTS player(name string NOT NULL, age int);
```

SHOW Tag name NOT NULL age NULL

```
nebula> SHOW CREATE TAG player;
+-----+-----+
| Tag | Create Tag |
+-----+-----+
| "student" | "CREATE TAG `player` (
| | `name` string NOT NULL,
| | `age` int64 NULL
| | ) ttl_duration = 0, ttl_col = """
+-----+-----+
```

Kobe age NULL

```
nebula> INSERT VERTEX player(name, age) VALUES "Kobe":("Kobe",null);
```

NOT NULL

Tag player age NOT NULL

```
nebula> CREATE TAG IF NOT EXISTS player(name string, age int NOT NULL DEFAULT 18);
```

```
Kobe      name
```

```
nebula> INSERT VERTEX player(name) VALUES "Kobe":("Kobe");
```

```
Kobe      age      18
```

```
nebula> FETCH PROP ON player "Kobe" YIELD properties(vertex);
+-----+
| properties(VERTEX) |
+-----+
| {age: 18, name: "Kobe"} |
+-----+
```

:January 13, 2023

4.2.6

List

[] ,

OpenCypher

List Set Map

[M]
[M..N]
[M..]
[..N]

nGQL	0	0	1	-1	-1	-2
• [M]	M					
• [M..N]	M ≤	N	N 0			
• [M..]	M ≤					
• [..N]		N	N 0			

Note

-
- M ≥ N
- M null BAD_TYPE M N null null

```
#      [1,2,3]
nebula> RETURN list[1, 2, 3] AS a;
+-----+
| a      |
+-----+
| [1, 2, 3] |
+-----+

#      [1,2,3,4,5]      3          0          4
nebula> RETURN range(1,5)[3];
+-----+
| range(1,5)[3] |
+-----+
| 4           |
+-----+

#      [1,2,3,4,5]      -2         -1      -2          4
nebula> RETURN range(1,5)[-2];
+-----+
| range(1,5)[-2] |
+-----+
| 4           |
+-----+

#      [1,2,3,4,5]      0   3   3
nebula> RETURN range(1,5)[0..3];
+-----+
| range(1,5)[0..3] |
+-----+
| [1, 2, 3] |
+-----+

#      [1,2,3,4,5]      2

```

```

nebula> RETURN range(1,5)[3..] AS a;
+-----+
| a      |
+-----+
| [4, 5] |
+-----+

#      3
nebula> WITH list[1, 2, 3, 4, 5] AS a \
    RETURN a[..3] AS r;
+-----+
| r      |
+-----+
| [1, 2, 3] |
+-----+

#      [1,2,3,4,5]      2
nebula> RETURN [n IN range(1,5) WHERE n > 2 | n + 10] AS a;
+-----+
| a      |
+-----+
| [13, 14, 15] |
+-----+

#
nebula> YIELD list[1, 2, 3][0..-1] AS a;
+-----+
| a      |
+-----+
| [1, 2] |
+-----+

#
nebula> YIELD list[1, 2, 3, 4, 5][-3..-1] AS a;
+-----+
| a      |
+-----+
| [3, 4] |
+-----+

#
      1 2
nebula> $var = YIELD 1 AS f, 3 AS t; \
    YIELD list[1, 2, 3][$var.f..$var.t] AS a;
+-----+
| a      |
+-----+
| [2, 3] |
+-----+

#
nebula> RETURN list[1, 2, 3, 4, 5] [0..10] AS a;
+-----+
| a      |
+-----+
| [1, 2, 3, 4, 5] |
+-----+

nebula> RETURN list[1, 2, 3] [-5..5] AS a;
+-----+
| a      |
+-----+
| [1, 2, 3] |
+-----+

# [0..0]
nebula> RETURN list[1, 2, 3, 4, 5] [0..0] AS a;
+-----+
| a      |
+-----+
| []   |
+-----+

# M ≥ N
nebula> RETURN list[1, 2, 3, 4, 5] [3..1] AS a;
+-----+
| a      |
+-----+
| []   |
+-----+

#
      null      null
nebula> WITH list[1,2,3] AS a \
    RETURN a[0..null] as r;
+-----+
| r      |
+-----+
| __NULL__ |
+-----+

#      [1,2,3,4,5]
nebula> RETURN tail([n IN range(1, 5) | 2 * n - 10]) AS a;
+-----+
| a      |
+-----+

```

```

| [-6, -4, -2, 0] |
+-----+
#      [1,2,3]
nebula> RETURN [n IN range(1, 3) WHERE true | n] AS r;
+-----+
| r      |
+-----+
| [1, 2, 3] |
+-----+

#      [1,2,3]
nebula> RETURN size(list[1,2,3]);
+-----+
| size([1,2,3]) |
+-----+
| 3            |
+-----+

#      [92,90]      where
nebula> GO FROM "player100" OVER follow WHERE properties(edge).degree NOT IN [x IN [92, 90] | x + $$.player.age] \
    YIELD dst(edge) AS id, properties(edge).degree AS degree;
+-----+-----+
| id      | degree |
+-----+-----+
| "player101" | 95   |
| "player102" | 90   |
+-----+-----+

#  MATCH
nebula> MATCH p = (n:player{name:"Tim Duncan"})-[:follow]->(m) \
    RETURN [n IN nodes(p) | n.age + 100] AS r;
+-----+
| r      |
+-----+
| [142, 136] |
| [142, 133] |
+-----+

```

OpenCypher

- openCypher null nGQL OUT_OF_RANGE

```

nebula> RETURN range(0,5)[-12];
+-----+
| range(0,5)[-12] |
+-----+
| OUT_OF_RANGE     |
+-----+

```

- set map list
- Rank
- List pattern [(src)-[]->(m) | m.name]

:January 13, 2023

4.2.7

Set

```
{ } ,
```

List

OpenCypher

- List Set Map
- OpenCypher nGQL

```
# {1,2,3}
nebula> RETURN set{1, 2, 3} AS a;
+-----+
| a   |
+-----+
| {3, 2, 1} |
+-----+  
  

# {1,2,1}           {1,2}
nebula> RETURN set{1, 2, 1} AS a;
+-----+
| a   |
+-----+
| {2, 1} |
+-----+  
  

#           1
nebula> RETURN 1 IN set{1, 2} AS a;
+-----+
| a   |
+-----+
| true |
+-----+  
  

#
nebula> YIELD size(set{1, 2, 1}) AS a;
+---+
| a |
+---+
| 2 |
+---+  
  

#
nebula> GO FROM "player100" OVER follow \
    YIELD set{properties($$).name, properties($$).age} as a;
+-----+
| a   |
+-----+
| {36, "Tony Parker"} |
| {41, "Manu Ginobili"} |
+-----+
```

:January 13, 2023

4.2.8

Map	Key-Value	Key	Value	map['<key>']
{ }	,			

OpenCypher

- List Set Map
- map projection

```

#
nebula> YIELD map{key1: 'Value1', Key2: 'Value2'} as a;
+-----+
| a |
+-----+
| {Key2: "Value2", key1: "Value1"} |
+-----+

#
nebula> YIELD map{listKey: [{inner: 'Map1'}, {inner: 'Map2'}]} as a;
+-----+
| a |
+-----+
| {listKey: [{inner: "Map1"}, {inner: "Map2"}]} |
+-----+

#
nebula> RETURN map{a: LIST[1,2], b: SET{1,2,1}, c: "hee"} as a;
+-----+
| a |
+-----+
| {a: [1, 2], b: {2, 1}, c: "hee"} |
+-----+

#
nebula> RETURN map{a: LIST[1,2], b: SET{1,2,1}, c: "hee"}["b"] AS b;
+-----+
| b |
+-----+
| {2, 1} |
+-----+

#      key      value
nebula> RETURN "a" IN MAP{a:1, b:2} AS a;
+-----+
| a |
+-----+
| true |
+-----+

```

:January 13, 2023

4.2.9

NebulaGraph

```
nebula> UNWIND [true, false, 'true', 'false', NULL] AS b \
    RETURN toBoolean(b) AS b;
+-----+
| b      |
+-----+
| true   |
+-----+
| false  |
+-----+
| true   |
+-----+
| false  |
+-----+
| __NULL__ |
+-----+  
  
nebula> RETURNtoFloat(1), toFloat('1.3'), toFloat('1e3'), toFloat('not a number');
+-----+-----+-----+-----+
| toFloat(1) | toFloat("1.3") | toFloat("1e3") | toFloat("not a number") |
+-----+-----+-----+-----+
| 1.0       | 1.3        | 1000.0     | __NULL__      |
+-----+-----+-----+-----+
```

:January 13, 2023

4.2.10

GEOGRAPHY

NebulaGraph

Point LineString Polygon

SQL-MM 3

geo

GEOGRAPHY

GEOGRAPHY

"POINT(3 8)" 3° 8°

Point "POINT(3 8)"

LineString "LINESTRING(3 8, 4.7 73.23)"

Polygon "POLYGON((0 1, 1 2, 2 3, 0 1))"

geo geo

```
// Tag
nebula> CREATE TAG IF NOT EXISTS any_shape(geo geography);

// Tag
nebula> CREATE TAG IF NOT EXISTS only_point(geo geography(point));

// Tag
nebula> CREATE TAG IF NOT EXISTS only_linestring(geo geography(linestring));

// Tag
nebula> CREATE TAG IF NOT EXISTS only_polygon(geo geography(polygon));

// Edge type
nebula> CREATE EDGE IF NOT EXISTS any_shape_edge(geo geography);

//
nebula> INSERT VERTEX any_shape(geo) VALUES "103":(ST_GeogFromText("POLYGON((0 1, 1 2, 2 3, 0 1))"));

//
nebula> INSERT EDGE any_shape_edge(geo) VALUES "201"->"302":(ST_GeogFromText("POLYGON((0 1, 1 2, 2 3, 0 1))"));

// 103 geo
nebula> FETCH PROP ON any_shape "103" YIELD ST_ASText(any_shape.geo);
+-----+
| ST_ASText(any_shape.geo) |
+-----+
| "POLYGON((0 1, 1 2, 2 3, 0 1))" |
+-----+

// 201->302 geo
nebula> FETCH PROP ON any_shape_edge "201"->"302" YIELD ST_ASText(any_shape_edge.geo);
+-----+
| ST_ASText(any_shape_edge.geo) |
+-----+
| "POLYGON((0 1, 1 2, 2 3, 0 1))" |
+-----+

// geo LOOKUP
nebula> CREATE TAG INDEX IF NOT EXISTS any_shape_geo_index ON any_shape(geo);
nebula> REBUILD TAG INDEX any_shape_geo_index;
nebula> LOOKUP ON any_shape YIELD ST_ASText(any_shape.geo);
+-----+
| ST_ASText(any_shape.geo) |
+-----+
| "POLYGON((0 1, 1 2, 2 3, 0 1))" |
+-----+
```

geo geo

s2_max_level	30	S2 cell	1 ~ 30
s2_max_cells	8	S2 cell	1 ~ 30

Note

Point Point s2_max_level 30

```
nebula> CREATE TAG INDEX IF NOT EXISTS any_shape_geo_index ON any_shape(geo) with (s2_max_level=30, s2_max_cells=8);
```

:January 13, 2023

4.3

4.3.1

NebulaGraph

- opencypher
- nGQL ;
- nGQL |

OpenCypher

- ```
opencypher nGQL MATCH ... | GO ... | YIELD ...
• openCypher MATCH RETURN WITH
• nGQL FETCH GO LOOKUP
```

A B C     A        B        C

#### Note

#### openCypher

- opencypher

```

nebula> MATCH p=(v:player{name:"Tim Duncan"})--() \
WITH nodes(p) AS n \
UNWIND n AS n1 \
RETURN DISTINCT n1;
```

- nGQL

```

nebula> SHOW TAGS; SHOW EDGES;

nebula> INSERT VERTEX player(name, age) VALUES "player100":("Tim Duncan", 42); \
INSERT VERTEX player(name, age) VALUES "player101":("Tony Parker", 36); \
INSERT VERTEX player(name, age) VALUES "player102":("LaMarcus Aldridge", 33);
```

- nGQL

```

nebula> GO FROM "player100" OVER follow YIELD dst(edge) AS id | \
GO FROM $.id OVER serve YIELD properties($$).name AS Team, \
properties($^).name AS Player;
+-----+-----+
| Team | Player |
+-----+-----+
"Spurs"	"Tony Parker"
"Hornets"	"Tony Parker"
"Spurs"	"Manu Ginobili"
+-----+-----+
```

---

:January 13, 2023

### 4.3.2

NebulaGraph

#### OpenCypher

```
nebula> MATCH (v:player{name:"Tim Duncan"}) RETURN v;
+-----+
| v
+-----+
| ("player100" :player{name: "Tim Duncan", age: 42}) |
+-----+
```

v

#### nGQL

|      |                       |         |
|------|-----------------------|---------|
| nGQL | \$var_name   var_name | —       |
|      |                       | session |

#### Note

```
nebula> $var = GO FROM "player100" OVER follow YIELD dst(edge) AS id; \
 GO FROM $var.id OVER serve YIELD properties($$).name AS Team, \
 properties($^).name AS Player;
+-----+-----+
| Team | Player |
+-----+-----+
"Spurs"	"Tony Parker"
"Hornets"	"Tony Parker"
"Spurs"	"Manu Ginobili"
+-----+-----+
```

:January 13, 2023

### 4.3.3

WHERE | YIELD

#### Note

nGQL GO

\$^.<tag\_name>.<prop\_name>

\$^

tag\_name Tag

prop\_name Tag

\$.<tag\_name>.<prop\_name>

\$\$

tag\_name Tag

prop\_name Tag

<edge\_type>.<prop\_name>

edge\_type Edge type

prop\_name Edge type

\_src

\_dst

\_type

\_rank rank

```
Tag player name Tag player age
nebula> GO FROM "player100" OVER follow YIELD $^.player.name AS startName, $$.player.age AS endAge;
+-----+-----+
| startName | endAge |
+-----+-----+
| "Tim Duncan" | 36 |
| "Tim Duncan" | 41 |
+-----+-----+

Edge type follow degree
nebula> GO FROM "player100" OVER follow YIELD follow.degree;
+-----+
| follow.degree |
+-----+
| 95 |
+-----+

EdgeType follow VID VID EdgeType rank
nebula> GO FROM "player100" OVER follow YIELD follow._src, follow._dst, follow._type, follow._rank;
+-----+-----+-----+-----+
| follow._src | follow._dst | follow._type | follow._rank |
+-----+-----+-----+
| "player100" | "player101" | 17 | 0 |
| "player100" | "player125" | 17 | 0 |
+-----+-----+-----+-----+
```



NebulaGraph 2.6.0

[Schema](#)

NebulaGraph 3.3.0

```
GO FROM "player100" OVER follow YIELD properties($^).name AS startName, properties($$).age AS endAge;
GO FROM "player100" OVER follow YIELD properties(edge).degree;
GO FROM "player100" OVER follow YIELD src(edge), dst(edge), type(edge), rank(edge);
```

NebulaGraph 3.3.0

:January 13, 2023

## 4.4

---

### 4.4.1

NebulaGraph

```
=
+
-
*
/
==

!=, <>

>

>=

<

<=

%

-
IS NULL NULL
IS NOT NULL NULL
IS EMPTY
IS NOT EMPTY

true false
```

 Note

- NULL
- EMPTY GROUP BY count() sum() max() hash() collect() + \*

### OpenCypher

openCypher EMPTY MATCH EMPTY

==

## Note

nGQL      == openCypher      =

```
nebula> RETURN 'A' == 'a', toUpper('A') == toUpper('a'), toLower('A') == toLower('a');
+-----+
| ("A"=="a") | (toUpper("A")==toUpper("a")) | (toLower("A")==toLower("a")) |
+-----+-----+-----+
| false | true | true |
+-----+-----+-----+
```

```
nebula> RETURN '2' == 2, toInteger('2') == 2;
+-----+
| ("2"==2) | (toInteger("2")==2) |
+-----+-----+
| false | true |
+-----+-----+
```

&gt;

```
nebula> RETURN 3 > 2;
+-----+
| (3>2) |
+-----+
| true |
+-----+
```

```
nebula> WITH 4 AS one, 3 AS two \
 RETURN one > two AS result;
+-----+
| result |
+-----+
| true |
+-----+
```

&gt;=

```
nebula> RETURN 2 >= "2", 2 >= 2;
+-----+
| (2>="2") | (2>=2) |
+-----+-----+
| __NULL__ | true |
+-----+-----+
```

&lt;

```
nebula> YIELD 2.0 < 1.9;
+-----+
| (2<1.9) |
+-----+
| false |
+-----+
```

&lt;=

```
nebula> YIELD 0.11 <= 0.11;
+-----+
| (0.11<=0.11) |
+-----+
| true |
+-----+
```

!=

```
nebula> YIELD 1 != '1';
+-----+
| (1!="1") |
+-----+
| true |
+-----+
```

IS [NOT] NULL

```
nebula> RETURN null IS NULL AS value1, null == null AS value2, null != null AS value3;
+-----+-----+
| value1 | value2 | value3 |
+-----+-----+-----+
| true | __NULL__ | __NULL__ |
+-----+-----+-----+
```

**IS [NOT] EMPTY**

```
nebula> RETURN null IS EMPTY;
+-----+
| NULL IS EMPTY |
+-----+
| false |
+-----+

nebula> RETURN "a" IS NOT EMPTY;
+-----+
| "a" IS NOT EMPTY |
+-----+
| true |
+-----+

nebula> GO FROM "player100" OVER * WHERE properties($$).name IS NOT EMPTY YIELD dst(edge);
+-----+
| dst(EDGE) |
+-----+
| "team204" |
| "player101" |
| "player125" |
+-----+
```

: January 13, 2023

#### 4.4.2

NebulaGraph

AND

OR

NOT

XOR

NULL

NULL

Note

0

: January 13, 2023

#### 4.4.3

nGQL |

##### openCypher

nGQL

nGQL SQL

- SQL
- nGQL shell |

```
nebula> GO FROM "player100" OVER follow \
 YIELD dst(edge) AS dstid, properties($$).name AS Name | \
 GO FROM $-.dstid OVER follow YIELD dst(edge);

+-----+
| dst(EDGE) |
+-----+
| "player100" |
| "player102" |
| "player125" |
| "player100" |
+-----+
```

| YIELD | YIELD | ID        |
|-------|-------|-----------|
|       | \$-   | \$-.dstid |

NebulaGraph A | B

1. A
  - 2.
  3. A |
- a. A
- b.
- c. graphd
- d. graphd B
- graphd A | B

:January 13, 2023

#### 4.4.4

---

nGQL      WHERE    YIELD

##### openCypher

nGQL

\$^

\$\$

\$-

```
nebula> GO FROM "player100" OVER follow YIELD properties($^).age AS SrcAge, properties($$).age AS DestAge;
+-----+-----+
| SrcAge | DestAge |
+-----+-----+
| 42 | 36 |
| 42 | 41 |
+-----+-----+

player100 player
nebula> GO FROM "player100" OVER follow \
 YIELD dst(edge) AS id | \
 GO FROM $-.id OVER serve \
 YIELD properties($^).name AS Player, properties($$).name AS Team;
+-----+-----+
| Player | Team |
+-----+-----+
"Tony Parker"	"Spurs"
"Tony Parker"	"Hornets"
"Manu Ginobili"	"Spurs"
+-----+-----+
```

:January 13, 2023

#### 4.4.5

UNION UNION ALL INTERSECT MINUS

nGQL

NebulaGraph

##### openCypher

nGQL

##### UNION UNION DISTINCT UNION ALL

```
<left> UNION [DISTINCT | ALL] <right> [UNION [DISTINCT | ALL] <right> ...]
```

- UNION DISTINCT      UNION      A    B
- UNION ALL      A    B
- left right

```

nebula> GO FROM "player102" OVER follow YIELD dst(edge) \
UNION \
GO FROM "player100" OVER follow YIELD dst(edge);
+-----+
| dst(EDGE) |
+-----+
| "player100" |
| "player101" |
| "player125" |
+-----+

nebula> GO FROM "player102" OVER follow YIELD dst(edge) \
UNION ALL \
GO FROM "player100" OVER follow YIELD dst(edge);
+-----+
| dst(EDGE) |
+-----+
| "player100" |
| "player101" |
| "player101" |
| "player125" |
+-----+

UNION YIELD
nebula> GO FROM "player102" OVER follow \
YIELD dst(edge) AS id, properties(edge).degree AS Degree, properties($$).age AS Age \
UNION /* DISTINCT */ \
GO FROM "player100" OVER follow \
YIELD dst(edge) AS id, properties(edge).degree AS Degree, properties($$).age AS Age;
+-----+-----+-----+
| id | Degree | Age |
+-----+-----+-----+
"player100"	75	42
"player101"	75	36
"player101"	95	36
"player125"	95	41
+-----+-----+-----+
```

##### INTERSECT

```
<left> INTERSECT <right>
```

- INTERSECT      A    B
- left right

```
nebula> GO FROM "player102" OVER follow \
YIELD dst(edge) AS id, properties(edge).degree AS Degree, properties($$).age AS Age \
INTERSECT \
+-----+-----+-----+
```

```
GO FROM "player100" OVER follow \
YIELD dst(edge) AS id, properties(edge).degree AS Degree, properties($$).age AS Age;
+-----+
| id | Degree | Age |
+-----+
+-----+
```

**MINUS**

|        |              |         |            |     |   |   |
|--------|--------------|---------|------------|-----|---|---|
| <left> | <b>MINUS</b> | <right> |            |     |   |   |
| MINUS  | A B          | A-B     | left right | A-B | A | B |

```
nebula> GO FROM "player100" OVER follow YIELD dst(edge) \
MINUS \
GO FROM "player102" OVER follow YIELD dst(edge);
+-----+
| dst(EDGE) |
+-----+
| "player125" |
+-----+
```

```
nebula> GO FROM "player102" OVER follow YIELD dst(edge) \
MINUS \
GO FROM "player100" OVER follow YIELD dst(edge);
+-----+
| dst(EDGE) |
+-----+
| "player100" |
+-----+
```

| GO FROM 1 UNION GO FROM 2 | GO FROM 3 | GO FROM 1 UNION (GO FROM 2 | GO FROM 3)

```
nebula> GO FROM "player102" OVER follow \
YIELD dst(edge) AS play_dst \
UNION \
GO FROM "team200" OVER serve REVERSELY \
YIELD src(edge) AS play_src \
| GO FROM $-.play_src OVER follow YIELD dst(edge) AS play_dst;

+-----+
| play_dst |
+-----+
| "player100" |
| "player101" |
| "player117" |
| "player105" |
+-----+
```

```
nebula> GO FROM "player102" OVER follow YIELD follow._dst AS play_dst \
UNION \
GO FROM "team200" OVER serve REVERSELY YIELD serve._dst AS play_dst \
| GO FROM $-.play_dst OVER follow YIELD follow._dst AS play_dst;
```

UNION

```
nebula> (GO FROM "player102" OVER follow \
YIELD dst(edge) AS play_dst \
UNION \
GO FROM "team200" OVER serve REVERSELY \
YIELD src(edge) AS play_dst) \
| GO FROM $-.play_dst OVER follow YIELD dst(edge) AS play_dst;
```

UNION

: January 13, 2023

#### 4.4.6

##### NebulaGraph

+

CONTAINS

(NOT) IN

(NOT) STARTS WITH

(NOT) ENDS WITH



+

```
nebula> RETURN 'a' + 'b';
+-----+
| ("a"+ "b") |
+-----+
| "ab" |
+-----+
nebula> UNWIND 'a' AS a UNWIND 'b' AS b RETURN a + b;
+-----+
| (a+b) |
+-----+
| "ab" |
+-----+
```

CONTAINS

CONTAINS

```
nebula> MATCH (s:player)-[e:serve]->(t:team) WHERE id(s) == "player101" \
 AND t.team.name CONTAINS "ets" RETURN s.player.name, e.start_year, e.end_year, t.team.name;
+-----+-----+-----+
| s.player.name | e.start_year | e.end_year | t.team.name |
+-----+-----+-----+
| "Tony Parker" | 2018 | 2019 | "Hornets" |

nebula> GO FROM "player101" OVER serve WHERE (STRING)properties(edge).start_year CONTAINS "19" AND \
 properties($^).name CONTAINS "ny" \
 YIELD properties($^).name, properties(edge).start_year, properties(edge).end_year, properties($$).name;
+-----+-----+-----+
| properties($^).name | properties(EDGE).start_year | properties(EDGE).end_year | properties($$).name |
+-----+-----+-----+
| "Tony Parker" | 1999 | 2018 | "Spurs" |

nebula> GO FROM "player101" OVER serve WHERE !(properties($$).name CONTAINS "ets") \
 YIELD properties($^).name, properties(edge).start_year, properties(edge).end_year, properties($$).name;
+-----+-----+-----+
| properties($^).name | properties(EDGE).start_year | properties(EDGE).end_year | properties($$).name |
+-----+-----+-----+
| "Tony Parker" | 1999 | 2018 | "Spurs" |
```

(NOT) IN

```
nebula> RETURN 1 IN [1,2,3], "Yao" NOT IN ["Yi", "Tim", "Kobe"], NULL IN ["Yi", "Tim", "Kobe"];
+-----+-----+
| (1 IN [1,2,3]) | ("Yao" NOT IN ["Yi", "Tim", "Kobe"]) | (NULL IN ["Yi", "Tim", "Kobe"]) |
+-----+-----+-----+
```

```
| true | true | __NULL__ |
+-----+-----+-----+
|
```

## (NOT) STARTS WITH

```
nebula> RETURN 'apple' STARTS WITH 'app', 'apple' STARTS WITH 'a', 'apple' STARTS WITH toUpper('a');
+-----+-----+-----+
| ("apple" STARTS WITH "app") | ("apple" STARTS WITH "a") | ("apple" STARTS WITH toUpper("a")) |
+-----+-----+-----+
| true | true | false |
+-----+-----+-----+
```

```
nebula> RETURN 'apple' STARTS WITH 'b','apple' NOT STARTS WITH 'app';
+-----+-----+
| ("apple" STARTS WITH "b") | ("apple" NOT STARTS WITH "app") |
+-----+-----+
| false | false |
+-----+-----+
```

## (NOT) ENDS WITH

```
nebula> RETURN 'apple' ENDS WITH 'app', 'apple' ENDS WITH 'e', 'apple' ENDS WITH 'E', 'apple' ENDS WITH 'b';
+-----+-----+-----+-----+
| ("apple" ENDS WITH "app") | ("apple" ENDS WITH "e") | ("apple" ENDS WITH "E") | ("apple" ENDS WITH "b") |
+-----+-----+-----+-----+
| false | true | false | false |
+-----+-----+-----+-----+
```

## Note

openCypher      MATCH    WITH      nGQL      FETCH    GO    LOOKUP

NebulaGraph

std::regex

`=~ '<regexp>'`

```
nebula> RETURN "384748.39" =~ "\\\d+(\\.\\\\d{2})?";
+-----+
| ("384748.39"=~"\d+(\.\d{2})?") |
+-----+
| true |
+-----+
```

```
nebula> MATCH (v:player) WHERE v.player.name =~ 'Tony.*' RETURN v.player.name;
+-----+
| v.player.name |
+-----+
| "Tony Parker" |
+-----+
```

:January 13, 2023

## 4.4.7

NebulaGraph List

+

IN

[]

```

nebula> YIELD [1,2,3,4,5]+[6,7] AS myList;
+-----+
| myList |
+-----+
| [1, 2, 3, 4, 5, 6, 7] |
+-----+

nebula> RETURN size([NULL, 1, 2]);
+-----+
| size([NULL,1,2]) |
+-----+
| 3 |
+-----+

nebula> RETURN NULL IN [NULL, 1];
+-----+
| (NULL IN [NULL,1]) |
+-----+
| __NULL__ |
+-----+

nebula> WITH [2, 3, 4, 5] AS numberlist \
 UNWIND numberlist AS number \
 WITH number \
 WHERE number IN [2, 3, 8] \
 RETURN number;
+-----+
| number |
+-----+
| 2 |
| 3 |
+-----+

nebula> WITH ['Anne', 'John', 'Bill', 'Diane', 'Eve'] AS names RETURN names[1] AS result;
+-----+
| result |
+-----+
| "John" |
+-----+

```

:January 13, 2023

#### 4.4.8

##### nGQL

- -
- ! NOT
- \* / %
- - +
- == >= > <= < <> !=
- AND
- OR XOR
- =

```
nebula> RETURN 2+3*5;
+-----+
| (2+(3*5)) |
+-----+
| 17 |
+-----+

nebula> RETURN (2+3)*5;
+-----+
| ((2+3)*5) |
+-----+
| 25 |
+-----+
```

##### openCypher

|            |                |                               |
|------------|----------------|-------------------------------|
| openCypher | $x < y \leq z$ | $x < y \text{ AND } y \leq z$ |
| nGQL       | $x < y \leq z$ | $(x < y) \leq z$              |

---

:January 13, 2023

## 4.5

---

### 4.5.1

NebulaGraph

#### **abs()**

abs()

abs(<expression>)

- expression      double
- double

```
nebula> RETURN abs(-10);
+-----+
| abs(-(10)) |
+-----+
| 10 |
+-----+
nebula> RETURN abs(5-6);
+-----+
| abs((5-6)) |
+-----+
| 1 |
+-----+
```

#### **floor()**

floor()

floor(<expression>)

- expression      double
- double

```
nebula> RETURN floor(9.9);
+-----+
| floor(9.9) |
+-----+
| 9.0 |
+-----+
```

#### **ceil()**

ceil()

ceil(<expression>)

- expression      double
- double

```
nebula> RETURN ceil(9.1);
+-----+
| ceil(9.1) |
+-----+
```

```
| 10.0 |
+-----+
```

**round()****round()****round(<expression>, <digit>)**

- **expression**      **double**
- **digit**            **0**                  **int**
- **double**

```
nebula> RETURN round(314.15926, 2);
+-----+
| round(314.15926,2) |
+-----+
| 314.16 |
+-----+

nebula> RETURN round(314.15926, -1);
+-----+
| round(314.15926,-(1)) |
+-----+
| 310.0 |
+-----+
```

**sqrt()****sqrt()****sqrt(<expression>)**

- **expression**      **double**
- **double**

```
nebula> RETURN sqrt(9);
+-----+
| sqrt(9) |
+-----+
| 3.0 |
+-----+
```

**cbrt()****cbrt()****cbrt(<expression>)**

- **expression**      **double**
- **double**

```
nebula> RETURN cbrt(8);
+-----+
| cbrt(8) |
+-----+
| 2.0 |
+-----+
```

**hypot()**

hypot()

hypot(&lt;expression\_x&gt;, &lt;expression\_y&gt;)

- expression\_x    expression\_y              double                        x    y
- double

```
nebula> RETURN hypot(3,2*2);
+-----+
| hypot(3,(2*2)) |
+-----+
| 5.0 |
+-----+
```

**pow()**pow()              x<sup>y</sup>

pow(&lt;expression\_x&gt;, &lt;expression\_y&gt;, )

- expression\_x              double              x
- expression\_y              double              y
- double

```
nebula> RETURN pow(3,3);
+-----+
| pow(3,3) |
+-----+
| 27 |
+-----+
```

**exp()**exp()              e      e<sup>x</sup>

exp(&lt;expression&gt;)

- expression              double              x
- double

```
nebula> RETURN exp(2);
+-----+
| exp(2) |
+-----+
| 7.38905609893065 |
+-----+
```

**exp2()**exp2()    2      2<sup>x</sup>

exp2(&lt;expression&gt;)

- expression              double              x
- double

```
nebula> RETURN exp2(3);
+-----+
| exp2(3) |
+-----+
| 8.0 |
+-----+
```

**log()**

```
log() e \(\log_e\{N\}\)

log(<expression>)

• expression double N
```

- double

```
nebula> RETURN log(8);
+-----+
| log(8) |
+-----+
| 2.0794415416798357 |
+-----+
```

**log2()**

```
log2() 2 \(\log_2\{N\}\)

log2(<expression>)

• expression double N
```

- double

```
nebula> RETURN log2(8);
+-----+
| log2(8) |
+-----+
| 3.0 |
+-----+
```

**log10()**

```
log10() 10 \(\log_{10}\{N\}\)

log10(<expression>)

• expression double N
```

- double

```
nebula> RETURN log10(100);
+-----+
| log10(100) |
+-----+
| 2.0 |
+-----+
```

**sin()**

```
sin() radians()
```

`sin(<expression>)`

- `expression`      `double`
- `double`

```
nebula> RETURN sin(3);
+-----+
| sin(3) |
+-----+
| 0.1411200080598672 |
+-----+
```

### `asin()`

`asin()`      `radians()`

`asin(<expression>)`

- `expression`      `double`
- `double`

```
nebula> RETURN asin(0.5);
+-----+
| asin(0.5) |
+-----+
| 0.5235987755982989 |
+-----+
```

### `cos()`

`cos()`      `radians()`

`cos(<expression>)`

- `expression`      `double`
- `double`

```
nebula> RETURN cos(0.5);
+-----+
| cos(0.5) |
+-----+
| 0.8775825618903728 |
+-----+
```

### `acos()`

`acos()`      `radians()`

`acos(<expression>)`

- `expression`      `double`
- `double`

```
nebula> RETURN acos(0.5);
+-----+
| acos(0.5) |
+-----+
```

```
| 1.0471975511965979 |
+-----+
```

**tan()**

**tan()** radians()

tan(<expression>)

- expression double
- double

```
nebula> RETURN tan(0.5);
+-----+
| tan(0.5) |
+-----+
| 0.5463024898437905 |
+-----+
```

**atan()**

**atan()** radians()

atan(<expression>)

- expression double
- double

```
nebula> RETURN atan(0.5);
+-----+
| atan(0.5) |
+-----+
| 0.4636476090008061 |
+-----+
```

**rand()**

**rand()** [0,1)

rand()

- double

```
nebula> RETURN rand();
+-----+
| rand() |
+-----+
| 0.6545837172298736 |
+-----+
```

**rand32()**

**rand32()** [min, max] 32

rand32(<expression\_min>,<expression\_max>)

- expression\_min int min
- expression\_max int max
- int
- max min 0 32 int

```
nebula> RETURN rand32(1,100);
+-----+
| rand32(1,100) |
+-----+
| 63 |
+-----+
```

### rand64()

rand64() [min, max] 64

rand64(<expression\_min>,<expression\_max>)

- expression\_min int min
- expression\_max int max
- int
- max min 0 64 int

```
nebula> RETURN rand64(1,100);
+-----+
| rand64(1,100) |
+-----+
| 34 |
+-----+
```

### bit\_and()

bit\_and() AND

bit\_and(<expression\_1>,<expression\_2>)

- expression\_1 expression\_2 int
- int

```
nebula> RETURN bit_and(5,6);
+-----+
| bit_and(5,6) |
+-----+
| 4 |
+-----+
```

### bit\_or()

bit\_or() OR

```
bit_or(<expression_1>,<expression_2>)
```

- expression\_1 expression\_2 int
- int

```
nebula> RETURN bit_or(5,6);
+-----+
| bit_or(5,6) |
+-----+
| 7 |
+-----+
```

### bit\_xor()

```
bit_xor() XOR
```

```
bit_xor(<expression_1>,<expression_2>)
```

- expression\_1 expression\_2 int
- int

```
nebula> RETURN bit_xor(5,6);
+-----+
| bit_xor(5,6) |
+-----+
| 3 |
+-----+
```

### size()

```
size()
```

```
size({<expression>|<string>})
```

- expression
- string
- int

```
nebula> RETURN size([1,2,3,4]);
+-----+
| size([1,2,3,4]) |
+-----+
| 4 |
+-----+
```

```
nebula> RETURN size("basketballplayer") as size;
+----+
| size |
+----+
| 16 |
+----+
```

### range()

```
range() [start,end]
```

```
range(<expression_start>,<expression_end>[,<expression_step>])
```

- expression\_start      int      start
- expression\_end      int      end
- expression\_step      int      step      1
- list

```
nebula> RETURN range(1,(3*3),2);
+-----+
| range(1,(3*3),2) |
+-----+
| [1, 3, 5, 7, 9] |
+-----+
```

## sign()

- ```
sign()      0      0      -1      1
```
- ```
sign(<expression>)
```
- expression      double
  - int

```
nebula> RETURN sign(10);
+-----+
| sign(10) |
+-----+
| 1 |
+-----+
```

## e()

- ```
e()      e 2.718281828459045
```
- ```
e()
```
- double

```
nebula> RETURN e();
+-----+
| e() |
+-----+
| 2.718281828459045 |
+-----+
```

## pi()

- ```
pi()      π 3.141592653589793
```
- ```
pi()
```
- double

```
nebula> RETURN pi();
+-----+
| pi() |
+-----+
```

```
| 3.141592653589793 |
+-----+
```

## radians()

```
radians()

radians(<angle>)

• double
```

```
nebula> RETURN radians(180);
+-----+
| radians(180) |
+-----+
| 3.141592653589793 |
+-----+
```

---

:January 13, 2023

## 4.5.2

### NebulaGraph

#### avg()

avg()

```
avg(<expression>)
```

- double

```
nebula> MATCH (v:player) RETURN avg(v.player.age);
+-----+
| avg(v.player.age) |
+-----+
| 33.294117647058826 |
+-----+
```

#### count()

count()

- nGQL            count()    GROUP BY            YIELD
- openCypher        count()        RETURN        GROUP BY  
count({<expression> | \*})
- count(\*)        NULL
- int

```
nebula> WITH [NULL, 1, 1, 2, 2] As a UNWIND a AS b \
 RETURN count(b), count(*), count(DISTINCT b);
+-----+-----+-----+
| count(b) | count(*) | count(distinct b) |
+-----+-----+-----+
| 4 | 5 | 2 |
+-----+-----+-----+
```

```
player101 follow follow player101
`count()` ``GROUP BY``

nebula> GO FROM "player101" OVER follow BIDIRECT \
 YIELD properties($$).name AS Name \
 | GROUP BY $-.Name YIELD $-.Name, count(*);
+-----+-----+
| $-.Name | count(*) |
+-----+-----+
"LaMarcus Aldridge"	2
"Tim Duncan"	2
"Marco Belinelli"	1
"Manu Ginobili"	1
"Boris Diaw"	1
"Dejounte Murray"	1
+-----+-----+

`count()` ``

nebula> MATCH (v1:player)-[:follow]-(v2:player) \
 WHERE id(v1) == "player101" \
 RETURN v2.player.name AS Name, count(*) as cnt ORDER BY cnt DESC;
+-----+-----+
| Name | cnt |
+-----+-----+
"LaMarcus Aldridge"	2
"Tim Duncan"	2
"Boris Diaw"	1
"Manu Ginobili"	1
"Dejounte Murray"	1
"Marco Belinelli"	1
+-----+-----+
```

- `$-.Name`

- `count(*)`

```
basketballplayer count(*) 2 player101 follow
```

```

nebula> LOOKUP ON player \
 YIELD player.age AS playerage \
 | GROUP BY $-.playerage \
 YIELD $-.playerage AS age, count(*) AS number \
 | ORDER BY $-.number DESC, $-.age DESC;
```

| age | number |
|-----|--------|
| 34  | 4      |
| 33  | 4      |
| 30  | 4      |
| 29  | 4      |
| 38  | 3      |

...

```

nebula> MATCH (n:player) \
 RETURN n.player.age AS age, count(*) AS number \
 ORDER BY number DESC, age DESC;
```

| age | number |
|-----|--------|
| 34  | 4      |
| 33  | 4      |
| 30  | 4      |
| 29  | 4      |
| 38  | 3      |

...

```
Tim Duncan
nebula> MATCH (v:player{name:"Tim Duncan"}) -[e]- (v2) \
 RETURN count(e);
```

| count(e) |
|----------|
| 13       |

```
Tim Duncan
nebula> MATCH (n:player {name : "Tim Duncan"})-[]->(friend:player)-[]->(fof:player) \
 RETURN count(fof), count(DISTINCT fof);
```

| count(fof) | count(distinct fof) |
|------------|---------------------|
| 4          | 3                   |

## max()

### max()

```
max(<expression>)
```

- 

```
nebula> MATCH (v:player) RETURN max(v.player.age);
+-----+
| max(v.player.age) |
+-----+
| 47 |
+-----+
```

## min()

### min()

`min(<expression>)`

```
nebula> MATCH (v:player) RETURN min(v.player.age);
+-----+
| min(v.player.age) |
+-----+
| 20 |
+-----+
```

## collect()

`collect()`

`collect(<expression>)`

- list

```
nebula> UNWIND [1, 2, 1] AS a \
 RETURN a;
+---+
| a |
+---+
| 1 |
| 2 |
| 1 |
+---+

nebula> UNWIND [1, 2, 1] AS a \
 RETURN collect(a);
+-----+
| collect(a) |
+-----+
| [1, 2, 1] |
+-----+

nebula> UNWIND [1, 2, 1] AS a \
 RETURN a, collect(a), size(collect(a));
+-----+-----+
| a | collect(a) | size(collect(a)) |
+-----+-----+
| 2 | [2] | 1 |
| 1 | [1, 1] | 2 |
+-----+-----+

3
nebula> UNWIND ["c", "b", "a", "d"] AS p \
 WITH p AS q \
 ORDER BY q DESC LIMIT 3 \
 RETURN collect(q);
+-----+
| collect(q) |
+-----+
| ["d", "c", "b"] |
+-----+

nebula> WITH [1, 1, 2, 2] AS coll \
 UNWIND coll AS x \
 WITH DISTINCT x \
 RETURN collect(x) AS ss;
+-----+
| ss |
+-----+
| [1, 2] |
+-----+

nebula> MATCH (n:player) \
 RETURN collect(n.player.age);
+-----+
| collect(n.player.age) |
+-----+
| [32, 32, 34, 29, 41, 40, 33, 25, 40, 37, ...
...

nebula> MATCH (n:player) \
 RETURN n.player.age AS age, collect(n.p...
```

```

| 20 | ["Luka Doncic"] |
| 25 | ["Joel Embiid", "Kyle Anderson"] |
+-----+
...
nebula> GO FROM "player100" OVER serve \
 YIELD properties($$).name AS name \
 | GROUP BY $-.name \
 YIELD collect($-.name) AS name;
+-----+
| name |
+-----+
| ["Spurs"] |
+-----+
nebula> LOOKUP ON player \
 YIELD player.age AS playerage \
 | GROUP BY $-.playerage \
 YIELD collect($-.playerage) AS playerage;
+-----+
| playerage |
+-----+
| [22] |
| [47] |
| [43] |
| [25, 25] |
+-----+
...

```

**std()**

std()

std(&lt;expression&gt;)

- double

```

nebula> MATCH (v:player) RETURN std(v.player.age);
+-----+
| std(v.player.age) |
+-----+
| 6.423895701687502 |
+-----+

```

**sum()**

sum()

sum(&lt;expression&gt;)

- 

```

nebula> MATCH (v:player) RETURN sum(v.player.age);
+-----+
| sum(v.player.age) |
+-----+
| 1698 |
+-----+

```

```

nebula> GO FROM "player100" OVER follow YIELD dst(edge) AS dst, properties($$).age AS age \
 | GROUP BY $-.dst \
 YIELD \
 $-.dst AS dst, \
 toInteger((sum($-.age)/count($-.age)))+avg(distinct $-.age+1)+1 AS statistics;
+-----+
| dst | statistics |
+-----+
| "player125" | 84.0 |
| "player101" | 74.0 |
+-----+

```

: January 13, 2023

### 4.5.3

NebulaGraph

- SQL nGQL 1 C 0

#### **strcasecmp()**

strcasecmp()

```
strcasecmp(<string_a>,<string_b>)

• string_a string_b
• int
• string_a = string_b 0 string_a > string_b 0 string_a < string_b 0
```

```
nebula> RETURN strcasecmp("a","aa");
+-----+
| strcasecmp("a","aa") |
+-----+
| -97
+-----+
```

#### **lower() toLower()**

lower() toLower()

```
lower(<string>) | toLower(<string>)

• string
• string
```

```
nebula> RETURN lower("Basketball_Player");
+-----+
| lower("Basketball_Player") |
+-----+
| "basketball_player" |
+-----+
```

#### **upper() toUpper()**

upper() toUpper()

```
upper(<string>) | toUpper(<string>)

• string
• string
```

```
nebula> RETURN upper("Basketball_Player");
+-----+
| upper("Basketball_Player") |
+-----+
```

```
| "BASKETBALL_PLAYER" |
+-----+
|
```

**length()**

```
length() -
```

```
length({<string>}|<path>)
```

- string
- path
- int

```
nebula> RETURN length("basketball");
+-----+
| length("basketball") |
+-----+
| 10
+-----+
```

```
nebula> MATCH p=(v:player{name:"Tim Duncan"})-->(v2) return length(p);
+-----+
| length(p) |
+-----+
| 1
| 1
| 1
+-----+
```

**trim()**

```
trim()
```

```
trim(<string>)
```

- string
- string

```
nebula> RETURN trim(" basketball player ");
+-----+
| trim(" basketball player ") |
+-----+
| "basketball player" |
+-----+
```

**ltrim()**

```
ltrim()
```

```
ltrim(<string>)
```

- string
- string

```
nebula> RETURN ltrim(" basketball player ");
+-----+
| ltrim(" basketball player ") |
+-----+
| "basketball player" |
+-----+
```

**rtrim()**

rtrim()

`rtrim(<string>)`

- `string`
- `string`

```
nebula> RETURN rtrim(" basketball player ");
+-----+
| rtrim(" basketball player ") |
+-----+
| " basketball player" |
+-----+
```

**left()**

left()

`left(<string>,<count>)`

- `string`
- `count` `count`
- `string`

```
nebula> RETURN left("basketball_player",6);
+-----+
| left("basketball_player",6) |
+-----+
| "basket" |
+-----+
```

**right()**

right()

`right(<string>,<count>)`

- `string`
- `count` `count`
- `string`

```
nebula> RETURN right("basketball_player",6);
+-----+
| right("basketball_player",6) |
+-----+
| "player" |
+-----+
```

**lpad()**

lpad()

`lpad(<string>,<count>,<letters>)`

- `string`
- `count`                    `count`    `string`                    `string`                    `count`
- `letters`
- `string`

```
nebula> RETURN lpad("abcd",10,"b");
+-----+
| lpad("abcd",10,"b") |
+-----+
| "bbbbbbabcd" |
+-----+

nebula> RETURN lpad("abcd",3,"b");
+-----+
| lpad("abcd",3,"b") |
+-----+
| "abc" |
+-----+
```

## rpad()

`rpad()`

`rpad(<string>,<count>,<letters>)`

- `string`
- `count`                    `count`    `string`                    `string`                    `count`
- `letters`
- `string`

```
nebula> RETURN rpad("abcd",10,"b");
+-----+
| rpad("abcd",10,"b") |
+-----+
| "abcd#####" |
+-----+

nebula> RETURN rpad("abcd",3,"b");
+-----+
| rpad("abcd",3,"b") |
+-----+
| "abc" |
+-----+
```

## substr()  substring()

`substr()`  `substring()`

`substr(<string>,<pos>,<count>)`  `substring(<string>,<pos>,<count>)`

- `string`
- `pos`                    `int`
- `count`
- `string`

**SUBSTR() | SUBSTRING()**

- pos 0
- pos
- pos BAD\_DATA
- count pos
- count 0
- NULL

 **enCypher**

openCypher a null null

```
nebula> RETURN substr("abcdefg",2,4);
+-----+
| substr("abcdefg",2,4) |
+-----+
| "cdef" |
+-----+

nebula> RETURN substr("abcdefg",0,4);
+-----+
| substr("abcdefg",0,4) |
+-----+
| "abcd" |
+-----+

nebula> RETURN substr("abcdefg",2);
+-----+
| substr("abcdefg",2) |
+-----+
| "cdefg" |
+-----+
```

**reverse()**

reverse()

reverse(<string>)

- string
- string

```
nebula> RETURN reverse("abcdefg");
+-----+
| reverse("abcdefg") |
+-----+
| "gfedcba" |
+-----+
```

**replace()**

replace() a b

```
replace(<string>,<substr_a>,<string_b>)
```

- string
- substr\_a a
- string\_b b
- string

```
nebula> RETURN replace("abcdefg","cd","AAAAAA");
+-----+
| replace("abcdefg","cd","AAAAAA") |
+-----+
| "abAAAAAefg" |
+-----+
```

## split()

```
split() b

split(<string>,<substr>)

• string

• substr b

• list
```

```
nebula> RETURN split("basketballplayer","a");
+-----+
| split("basketballplayer","a") |
+-----+
| ["b", "sketb", "llp1", "yer"] |
+-----+
```

## concat()

```
concat()

concat(<string1>,<string2>,...)

•

• NULL concat() NULL

• string
```

```
// 1 2 3
nebula> RETURN concat("1","2","3") AS r;
+-----+
| r |
+-----+
| "123" |
+-----+

// NULL
nebula> RETURN concat("1","2",NULL) AS r;
+-----+
| r |
+-----+
| __NULL__ |
+-----+

nebula> GO FROM "player100" over follow \
 YIELD concat(src(edge), properties($^).age, properties($$).name, properties(edge).degree) AS A;
+-----+
| A |
+-----+
```

```
+-----+
| "player10042Tony Parker95" |
| "player10042Manu Ginobili95" |
+-----+
```

**concat\_ws()**

```
concat_ws() separator

concat_ws(<separator>, <string1>, <string2>, ...)
```

- 
- NULL    concat\_ws()       NULL
- NULL
- NULL    NULL

```
// + a b c
nebula> RETURN concat_ws("+", "a", "b", "c") AS r;
+-----+
| r |
+-----+
| "a+b+c" |
+-----+

// NULL
nebula> RETURN concat_ws(NULL, "a", "b", "c") AS r;
+-----+
| r |
+-----+
| __NULL__ |
+-----+

// + NULL
nebula> RETURN concat_ws("+", "a", NULL, "b", "c") AS r;
+-----+
| r |
+-----+
| "a+b+c" |
+-----+

// +
nebula> RETURN concat_ws("+", "a") AS r;
+-----+
| r |
+-----+
| "a" |
+-----+

nebula> GO FROM "player100" over follow \
 YIELD concat_ws(" ", src(edge), properties($^).age, properties($$).name, properties(edge).degree) AS A;
+-----+
| A |
+-----+
| "player100 42 Tony Parker 95" |
| "player100 42 Manu Ginobili 95" |
+-----+
```

**extract()**

```
extract()

extract(<string>, "<regular_expression>")

• string
• regular_expression
• list
```

```
nebula> MATCH (a:player)-[b:serve]-(c:team{name: "Lakers"}) \
 WHERE a.player.age > 45 \
 RETURN extract(a.player.name, "\w+") AS result;
+-----+
```

```
| result |
+-----+
| ["Shaquille", "O", "Neal"] |
+-----+

nebula> MATCH (a:player)-[b:serve]-(c:team{name: "Lakers"}) \
 WHERE a.player.age > 45 \
 RETURN extract(a.player.name, "hello") AS result;
+-----+
| result |
+-----+
| [] |
+-----+
```

**json\_extract()**

json\_extract()    JSON        map

extract(<string>)

- string            JSON
- map

**Caution**

- Bool Double Int String NULL
- 1 Map            2

```
nebula> YIELD json_extract('{"a": 1, "b": {}, "c": {"d": true}}') AS result;
+-----+
| result |
+-----+
| {a: 1, b: {}, c: {d: true}} |
+-----+
```

---

:January 13, 2023

#### 4.5.4

##### NebulaGraph

```
int now()
timestamp timestamp()
date date() UTC
time time() UTC
datetime datetime() UTC
map duration()
```

```
nebula> RETURN now(), timestamp(), date(), time(), datetime();
+-----+-----+-----+-----+-----+
| now() | timestamp() | date() | time() | datetime() |
+-----+-----+-----+-----+-----+
| 1640057560 | 1640057560 | 2021-12-21 | 03:32:40.351000 | 2021-12-21T03:32:40.351000 |
+-----+-----+-----+-----+-----+
```

:January 13, 2023

#### 4.5.5 Schema

NebulaGraph Schema

## Schema

- nGQL
  - openCypher

nGQL

nGQL YIELD WHERE



```
vertex edge vertices edges path AS <alias> GO FROM "player100" OVER follow YIELD edge AS e;
```

### ID(VERTEX)

**id(vertex)** ID

`id(vertex)`

- ID

```
nebula> LOOKUP ON player WHERE player.age > 45 YIELD id(vertex);
+-----+
| id(VERTEX) |
+-----+
| "player144" |
| "player140" |
+-----+
```

## PROPERTIES(VERTEX)

properties(vertex)

`properties(vertex)`

- map

```
nebula> LOOKUP ON player WHERE player.age > 45 \
 YIELD properties(vertex);
+-----+
| properties(VERTEX) |
+-----+
| {age: 47, name: "Shaquille O'Neal"} |
| {age: 46, name: "Grant Hill"} |
+-----+
```

#### PROPERTIES(EDGE)

`properties(edge)`

`properties(edge)`

- map

```
nebula> GO FROM "player100" OVER follow \
 YIELD properties(edge);
+-----+
| properties(EDGE) |
```

```
+-----+
| {degree: 95} |
| {degree: 95} |
+-----+
```

## TYPE(EDGE)

type(edge) Edge type

type(edge)

- string

```
nebula> GO FROM "player100" OVER follow \
 YIELD src(edge), dst(edge), type(edge), rank(edge);
+-----+-----+-----+-----+
| src(EDGE) | dst(EDGE) | type(EDGE) | rank(EDGE) |
+-----+-----+-----+-----+
| "player100" | "player101" | "follow" | 0 |
| "player100" | "player125" | "follow" | 0 |
+-----+-----+-----+-----+
```

## SRC(EDGE)

src(edge) ID

src(edge)

- ID

```
nebula> GO FROM "player100" OVER follow \
 YIELD src(edge), dst(edge);
+-----+-----+
| src(EDGE) | dst(EDGE) |
+-----+-----+
| "player100" | "player101" |
| "player100" | "player125" |
+-----+-----+
```

## Note

src(edge) properties(\$^)

src(edge)

ID properties(\$^)

GO FROM "player100" player100

## DST(EDGE)

dst(edge) ID

dst(edge)

- ID

```
nebula> GO FROM "player100" OVER follow \
 YIELD src(edge), dst(edge);
+-----+-----+
| src(EDGE) | dst(EDGE) |
+-----+-----+
| "player100" | "player101" |
| "player100" | "player125" |
+-----+-----+
```

## Note

dst(edge) ID

**RANK(EDGE)**

rank(edge) rank

rank(edge)

- int

```
nebula> GO FROM "player100" OVER follow \
 YIELD src(edge), dst(edge), rank(edge);
+-----+-----+-----+
| src(EDGE) | dst(EDGE) | rank(EDGE) |
+-----+-----+-----+
| "player100" | "player101" | 0
| "player100" | "player125" | 0
+-----+-----+
```

**VERTEX**

vertex ID Tag AS <alias>

vertex

```
nebula> LOOKUP ON player WHERE player.age > 45 YIELD vertex AS v;
+-----+
| v |
+-----+
| ("player144" :player{age: 47, name: "Shaquille O'Neal"}) |
| ("player140" :player{age: 46, name: "Grant Hill"}) |
+-----+
```

**EDGE**

edge Edge type ID ID rank AS <alias>

edge

```
nebula> GO FROM "player100" OVER follow YIELD edge AS e;
+-----+
| e |
+-----+
| [:follow "player100"->"player101" @0 {degree: 95}] |
| [:follow "player100"->"player125" @0 {degree: 95}] |
+-----+
```

**VERTICES**

vertices GET SUBGRAPH

**EDGES**

edges GET SUBGRAPH

**PATH**

path FIND PATH

**openCypher**

openCypher RETURN WHERE

ID()

id() ID

id(<vertex>)

- ID

```
nebula> MATCH (v:player) RETURN id(v);
+-----+
| id(v) |
+-----+
| "player129" |
| "player115" |
| "player106" |
| "player102" |
...
```

## TAGS()

tags() labels() Tag

```
tags(<vertex>) labels(<vertex>)
```

- list

```
nebula> MATCH (v) WHERE id(v) == "player100" \
 RETURN tags(v);
+-----+
| tags(v) |
+-----+
| ["player"] |
+-----+
```

## PROPERTIES()

properties()

```
properties(<vertex_or_edge>)
```

- map

```
nebula> MATCH (v:player)-[e:follow]-() RETURN properties(v),properties(e);
+-----+-----+
| properties(v) | properties(e) |
+-----+-----+
{age: 31, name: "Stephen Curry"}	{degree: 90}
{age: 47, name: "Shaquille O'Neal"}	{degree: 100}
{age: 34, name: "LeBron James"}	{degree: 13}
...
```

## TYPE()

type() Edge type

```
type(<edge>)
```

- string

```
nebula> MATCH (v:player{name:"Tim Duncan"})-[e]->() \
 RETURN type(e);
+-----+
| type(e) |
+-----+
| "serve" |
| "follow" |
| "follow" |
+-----+
```

## SRC()

src() ID

```
src(<edge>)
```

- ID

```
nebula> MATCH ()-[e]->(v:player{name:"Tim Duncan"}) \
 RETURN src(e);
+-----+
| src(e) |
+-----+
| "player125" |
| "player113" |
| "player102" |
...
```

## DST()

|       |             |
|-------|-------------|
| dst() | ID          |
|       | dst(<edge>) |

- ID

```
nebula> MATCH (v:player{name:"Tim Duncan"})-[e]->() \
 RETURN dst(e);
+-----+
| dst(e) |
+-----+
| "team204" |
| "player101" |
| "player125" |
+-----+
```

## STARTNODE()

|             |                   |
|-------------|-------------------|
| startNode() | ID Tag            |
|             | startNode(<path>) |

```
nebula> MATCH p = (a :player {name : "Tim Duncan"})-[r:serve]-(t) \
 RETURN startNode(p);
+-----+
| startNode(p) |
+-----+
| ("player100" :player{age: 42, name: "Tim Duncan"}) |
+-----+
```

## ENDNODE()

|           |                 |
|-----------|-----------------|
| endNode() | ID Tag          |
|           | endNode(<path>) |

```
nebula> MATCH p = (a :player {name : "Tim Duncan"})-[r:serve]-(t) \
 RETURN endNode(p);
+-----+
| endNode(p) |
+-----+
| ("team204" :team{name: "Spurs"}) |
+-----+
```

## RANK()

|        |              |
|--------|--------------|
| rank() | rank         |
|        | rank(<edge>) |

- int

```
nebula> MATCH (v:player{name:"Tim Duncan"})-[e]->() \
 RETURN rank(e);
+-----+
```

```
| rank(e) |
+-----+
| 0 |
| 0 |
| 0 |
+-----+
```

---

:January 13, 2023

## 4.5.6

NebulaGraph      List      nGQL      openCypher

• SQL    nGQL      1      C      0

### RANGE()

```
range() [start, end]
range(start, end [, step])
• step 1
• list
```

```
nebula> RETURN range(1,9,2);
+-----+
| range(1,9,2) |
+-----+
| [1, 3, 5, 7, 9] |
+-----+
```

### REVERSE()

```
reverse()
reverse(<list>)
• list
```

```
nebula> WITH [NULL, 4923, 'abc', 521, 487] AS ids \
 RETURN reverse(ids);
+-----+
| reverse(ids) |
+-----+
| [487, 521, "abc", 4923, __NULL__] |
+-----+
```

### TAIL()

```
tail()
tail(<list>)
• list
```

```
nebula> WITH [NULL, 4923, 'abc', 521, 487] AS ids \
 RETURN tail(ids);
+-----+
| tail(ids) |
+-----+
| [4923, "abc", 521, 487] |
+-----+
```

### HEAD()

```
head()
```

head(<list>)

•

```
nebula> WITH [NULL, 4923, 'abc', 521, 487] AS ids \
 RETURN head(ids);
+-----+
| head(ids) |
+-----+
| __NULL__ |
+-----+
```

LAST()

last()

last(<list>)

•

```
nebula> WITH [NULL, 4923, 'abc', 521, 487] AS ids \
 RETURN last(ids);
+-----+
| last(ids) |
+-----+
| 487 |
+-----+
```

REDUCE()

reduce()

e e

Lisp

Scala fold reduce



openCypher reduce() nGQL Cypher reduce()

reduce(<accumulator> = <initial>, <variable> IN <list> | <expression>)

- accumulator
- initial accumulator
- variable
- list
- expression accumulator
- 

```
nebula> RETURN reduce(totalNum = -4 * 5, n IN [1, 2] | totalNum + n * 2) AS r;
```

```
+-----+
| r |
+-----+
| -14 |
+-----+
```

```
nebula> MATCH p = (n:player{name:"LeBron James"})->[:follow]-(m) \
 RETURN nodes(p)[0].age AS src1, nodes(p)[1].age AS dst2, \
 reduce(totalAge = 100, n IN nodes(p) | totalAge + n.age) AS sum;
+-----+-----+-----+
| src1 | dst2 | sum |
+-----+-----+-----+
34	31	165
34	29	163
34	33	167
34	26	160
```

```
| 34 | 34 | 168 |
| 34 | 37 | 171 |
+-----+-----+-----+
nebula> LOOKUP ON player WHERE player.name == "Tony Parker" YIELD id(vertex) AS VertexID \
 | GO FROM $-.VertexID over follow \
 WHERE properties(edge).degree != reduce(totalNum = 5, n IN range(1, 3) | properties($$).age + totalNum + n) \
 YIELD properties($$).name AS id, properties($$).age AS age, properties(edge).degree AS degree;
+-----+-----+-----+
| id | age | degree |
+-----+-----+-----+
"Tim Duncan"	42	95
"LaMarcus Aldridge"	33	90
"Manu Ginobili"	41	95
+-----+-----+-----+
```

## nGQL

KEYS()

keys()

```
keys({vertex | edge})
```

- list

```
+-----+
nebula> LOOKUP ON player \
 WHERE player.age > 45 \
 YIELD keys(vertex);
+-----+
| keys(VERTEX) |
+-----+
| ["age", "name"] |
| ["age", "name"] |
+-----+
```

LABELS()

labels() Tag

```
labels(vertex)
```

- list

```
+-----+
nebula> FETCH PROP ON * "player101", "player102", "team204" \
 YIELD labels(vertex);
+-----+
| labels(VERTEX) |
+-----+
| ["player"] |
| ["player"] |
| ["team"] |
+-----+
```

## openCypher

KEYS()

keys()

```
keys(<vertex_or_edge>)
```

- list

```
+-----+
nebula> MATCH (v:player{name:"Tim Duncan"})-[e]->() \
 RETURN keys(e);
+-----+
| keys(e) |
+-----+
| ["end_year", "start_year"] |
| ["degree"] |
+-----+
```

```
| ["degree"] |
+-----+
|
```

**LABELS()**

**labels()** Tag

```
labels(<vertex>)
```

- list

```
nebula> MATCH (v)-[e:serve]->() \
 WHERE id(v)=="player100" \
 RETURN labels(v);
+-----+
| labels(v) |
+-----+
| ["player"] |
+-----+
```

**NODES()**

**nodes()** ID Tag

```
nodes(<path>)
```

- list

```
nebula> MATCH p=(v:player{name:"Tim Duncan"})-->(v2) \
 RETURN nodes(p);
+-----+
| nodes(p) |
+-----+
| [{"player100":player{age: 42, name: "Tim Duncan"}, "team204":team{name: "Spurs"}}, {"player101":player{age: 36, name: "Tony Parker"}}, {"player125":player{age: 41, name: "Manu Ginobili"}}] |
+-----+
```

**RELATIONSHIPS()**

**relationships()**

```
relationships(<path>)
```

- list

```
nebula> MATCH p=(v:player{name:"Tim Duncan"})-->(v2) \
 RETURN relationships(p);
+-----+
| relationships(p) |
+-----+
| [{:serve "player100"->"team204" @0 {end_year: 2016, start_year: 1997}}, {:follow "player100"->"player101" @0 {degree: 95}}, {:follow "player100"->"player125" @0 {degree: 95}}] |
+-----+
```

---

:January 13, 2023

## 4.5.7

NebulaGraph

### **toBoolean()**

toBoolean()

```
toBoolean(<value>)
```

- bool

```
nebula> UNWIND [true, false, 'true', 'false', NULL] AS b \
 RETURN toBoolean(b) AS b;
+-----+
| b |
+-----+
| true |
| false|
| true |
| false|
| __NULL__ |
+-----+
```

### **toFloat()**

toFloat()

```
toFloat(<value>)
```

- float

```
nebula> RETURN toFloat(1), toFloat('1.3'), toFloat('1e3'), toFloat('not a number');
+-----+-----+-----+-----+
| toFloat(1) | toFloat("1.3") | toFloat("1e3") | toFloat("not a number") |
+-----+-----+-----+-----+
| 1.0 | 1.3 | 1000.0 | __NULL__ |
+-----+-----+-----+-----+
```

### **toString()**

toString()

```
toString(<value>)
```

- string

```
nebula> RETURN toString(9669) AS int2str, toString(null) AS null2str;
+-----+-----+
| int2str | null2str |
+-----+-----+
| "9669" | __NULL__ |
+-----+-----+
```

### **toInteger()**

toInteger()

```
toInteger(<value>)
```

- int

```
nebula> RETURN toInteger(1), toInteger('1'), toInteger('1e3'), toInteger('not a number');
+-----+-----+-----+-----+
| toInteger(1) | toInteger("1") | toInteger("1e3") | toInteger("not a number") |
+-----+-----+-----+-----+
| 1 | 1 | 1000 | __NULL__ |
+-----+-----+-----+-----+
```

**toSet()****toSet()****toSet(<value>)**

- **set**

```
nebula> RETURN toSet(list[1,2,3,1,2]) AS list2set;
+-----+
| list2set |
+-----+
| {3, 1, 2} |
+-----+
```

**hash()****hash()** NULL**hash()** MurmurHash2 seed 0xc70f6907UL [MurmurHash2.h](#)**Java**

```
MurmurHash2.hash64("to_be_hashed".getBytes(),"to_be_hashed".getBytes().length, 0xc70f6907)
```

**hash(<string>)**

- **int**

```
nebula> RETURN hash("abcde");
+-----+
| hash("abcde") |
+-----+
| 811036730794841393 |
+-----+

nebula> YIELD hash([1,2,3]);
+-----+
| hash([1,2,3]) |
+-----+
| 11093822460243 |
+-----+

nebula> YIELD hash(NULL);
+-----+
| hash(NULL) |
+-----+
| -1 |
+-----+

nebula> YIELD hash(toLower("HELLO NEBULA"));
+-----+
| hash(toLower("HELLO NEBULA")) |
+-----+
| -8481157362655072082 |
+-----+
```

:January 13, 2023

## 4.5.8

NebulaGraph

### CASE

|      |            |      |      |      |
|------|------------|------|------|------|
| CASE | openCypher | nGQL | CASE |      |
| CASE |            |      | ELSE | ELSE |
|      |            |      |      | NULL |

•

```
CASE <comparer>
WHEN <value> THEN <result>
[WHEN ...]
[ELSE <default>]
END
```



CASE      END

| comparer | value                       |
|----------|-----------------------------|
| value    | comparer                    |
| result   | value    comparer    result |
| default  | default                     |

•

```
nebula> RETURN \
CASE 2+3 \
WHEN 4 THEN 0 \
WHEN 5 THEN 1 \
ELSE -1 \
END \
AS result;
```

```
+-----+
| result |
+-----+
| 1 |
+-----+
```

```
nebula> GO FROM "player100" OVER follow \
YIELD properties($$).name AS Name, \
CASE properties($$).age > 35 \
WHEN true THEN "Yes" \
WHEN false THEN "No" \
ELSE "Nah" \
END \
AS Age_above_35;
```

```
+-----+
| Name | Age_above_35 |
+-----+
| "Tony Parker" | "Yes" |
| "Manu Ginobili" | "Yes" |
+-----+
```

```
[ELSE <default>]
END
```

|           |           |        |
|-----------|-----------|--------|
| condition | condition | true   |
| result    | condition | true   |
| default   |           | result |

•

```
nebula> YIELD \
CASE WHEN 4 > 5 THEN 0 \
WHEN 3+4==7 THEN 1 \
ELSE 2 \
END \
AS result;
+-----+
| result |
+-----+
| 1 |
+-----+
```

```
nebula> MATCH (v:player) WHERE v.player.age > 30 \
RETURN v.player.name AS Name, \
CASE \
WHEN v.player.name STARTS WITH "T" THEN "Yes" \
ELSE "No" \
END \
AS Starts_with_T;
+-----+-----+
| Name | Starts_with_T |
+-----+-----+
"Tim Duncan"	"Yes"
"LaMarcus Aldridge"	"No"
"Tony Parker"	"Yes"
+-----+-----+
```

```
nebula> GO FROM "player100" OVER follow \
YIELD properties($$).name AS Name, properties($$).age AS Age, \
CASE properties($$).age \
WHEN properties($$).age > 35 THEN "Yes" \
ELSE "No" \
END \
AS Age_above_35;
+-----+-----+-----+
| Name | Age | Age_above_35 |
+-----+-----+-----+
| "Tony Parker" | 36 | "No" |
| "Manu Ginobili" | 41 | "No" |
+-----+-----+-----+
```

|      |                  |                       |    |
|------|------------------|-----------------------|----|
| 35   | Yes              | 36                    | No |
| CASE | \$\$ .player.age | \$\$ .player.age > 35 | 36 |

- $\$\$.player.age$     36    int

- $\$\$.player.age > 35$     true    boolean

No

## coalesce()

coalesce()

```
coalesce(<expression_1>[,<expression_2>...])
```

•

```
nebula> RETURN coalesce(null,[1,2,3]) as result;
+-----+
| result |
+-----+
| [1, 2, 3] |
+-----+

nebula> RETURN coalesce(null) as result;
+-----+
| result |
+-----+
| __NULL__ |
+-----+
```

:January 13, 2023

## 4.5.9

true false WHERE

NebulaGraph

|          | true | false |
|----------|------|-------|
| exists() | true | false |
| any()    | true | false |
| all()    | true | false |
| none()   | true | false |
| single() | true | false |

### Note

NULL

### Incompatibility

openCypher exists()

<predicate>(<variable> IN <list> WHERE <condition>)

```
nebula> RETURN any(n IN [1, 2, 3, 4, 5, NULL] \
 WHERE n > 2) AS r;
+-----+
| r |
+-----+
| true |
+-----+

nebula> RETURN single(n IN range(1, 5) \
 WHERE n == 3) AS r;
+-----+
| r |
+-----+
| true |
+-----+

nebula> RETURN none(n IN range(1, 3) \
 WHERE n == 0) AS r;
+-----+
| r |
+-----+
| true |
+-----+

nebula> WITH [1, 2, 3, 4, 5, NULL] AS a \
 RETURN any(n IN a WHERE n > 2);
+-----+
| any(n IN a WHERE (n>2)) |
+-----+
| true |
+-----+

nebula> MATCH p = (n:player{name:"LeBron James"})->[:follow]-(m) \
 RETURN nodes(p)[0].name AS n1, nodes(p)[1].name AS n2, \
 all(n IN nodes(p) WHERE n.name NOT STARTS WITH "D") AS b;
+-----+-----+-----+
| n1 | n2 | b |
+-----+-----+-----+
| "LeBron James" | "Danny Green" | false |
```

```

"LeBron James"	"Dejounte Murray"	false
"LeBron James"	"Chris Paul"	true
"LeBron James"	"Kyrie Irving"	true
"LeBron James"	"Carmelo Anthony"	true
"LeBron James"	"Dwyane Wade"	false
+-----+-----+-----+
nebula> MATCH p = (n:player{name:"LeBron James"})-[:follow]->(m) \
 RETURN single(n IN nodes(p) WHERE n.age > 40) AS b;
+----+
| b |
+----+
| true |
+----+
nebula> MATCH (n:player) \
 RETURN exists(n.player.id), n IS NOT NULL;
+-----+-----+
| exists(n.player.id) | n IS NOT NULL |
+-----+-----+
| false | true |
...
nebula> MATCH (n:player) \
 WHERE exists(n['name']) \
 RETURN n;
+-----+
| n |
+-----+
| {"player105":player{age: 31, name: "Danny Green"}}, {"player109":player{age: 34, name: "Tiago Splitter"}}, {"player111":player{age: 38, name: "David West"}}, ...
...

```

:January 13, 2023

## 4.5.10 geo

geo                    GEOGRAPHY

|                                                   |              |                            |                     |             |           |
|---------------------------------------------------|--------------|----------------------------|---------------------|-------------|-----------|
| ST_Point(longitude, latitude)                     | GEOGRAPHY    |                            |                     |             |           |
| ST_GeogFromText(wkt_string)                       | GEOGRAPHY    | WKT                        | GEOGRAPHY           |             |           |
| ST_ASText(geography)                              | STRING       |                            | GEOGRAPHY           | WKT         |           |
| ST_Centroid(geography)                            | GEOGRAPHY    |                            | GEOGRAPHY           |             | GEOGRAPHY |
| ST_ISValid(geography)                             | BOOL         |                            | GEOGRAPHY           |             |           |
| ST_Intersects(geography_1, geography_2)           | BOOL         |                            | GEOGRAPHY           |             |           |
| ST_Covers(geography_1, geography_2)               | BOOL         | geography_1<br>geography_1 | geography_2<br>True | geography_2 |           |
| ST_CoveredBy(geography_1, geography_2)            | BOOL         | geography_2<br>geography_2 | geography_1<br>True | geography_1 |           |
| ST_DWithin(geography_1, geography_2,<br>distance) | BOOL         | geography_1<br>distance    | geography_2<br>True | geography_2 |           |
| ST_Distance(geography_1, geography_2)             | FLOAT        |                            | GEOGRAPHY           |             |           |
| S2_CellIdFromPoint(point_geography)               | INT          |                            | GEOGRAPHY           | S2          | ID        |
| S2_CoveringCellIds(geography)                     | ARRAY<INT64> |                            | GEOGRAPHY           | S2          | ID        |

```

nebula> RETURN ST_ASText(ST_Point(1,1));
+-----+
| ST_ASText(ST_Point(1,1)) |
+-----+
| "POINT(1 1)" |
+-----+

nebula> RETURN ST_ASText(ST_GeogFromText("POINT(3 8)"));
+-----+
| ST_ASText(ST_GeogFromText("POINT(3 8)")) |
+-----+
| "POINT(3 8)" |
+-----+

nebula> RETURN ST_ASTEXT(ST_Centroid(ST_GeogFromText("LineString(0 1,1 0)")));
+-----+
| ST_ASTEXT(ST_Centroid(ST_GeogFromText("LineString(0 1,1 0)"))) |
+-----+
| "POINT(0.5000380800773782 0.5000190382261059)" |
+-----+

nebula> RETURN ST_ISValid(ST_GeogFromText("POINT(3 8)"));
+-----+
| ST_ISValid(ST_GeogFromText("POINT(3 8)")) |
+-----+
| true |
+-----+

nebula> RETURN ST_Intersects(ST_GeogFromText("LineString(0 1,1 0)'),ST_GeogFromText("LineString(0 0,1 1)'));
+-----+
| ST_Intersects(ST_GeogFromText("LineString(0 1,1 0)'),ST_GeogFromText("LineString(0 0,1 1)')) |
+-----+
| true |
+-----+

nebula> RETURN ST_Covers(ST_GeogFromText("POLYGON((0 0,10 0,10 10,0 10,0 0))"),ST_Point(1,2));
+-----+

```

```

| ST_Covers(ST_GeogFromText("POLYGON((0 0,10 0,10 10,0 10,0 0))"),ST_Point(1,2)) |
+-----+
| true
+-----+
nebula> RETURN ST_CoveredBy(ST_Point(1,2),ST_GeogFromText("POLYGON((0 0,10 0,10 10,0 10,0 0))"));
+-----+
| ST_CoveredBy(ST_Point(1,2),ST_GeogFromText("POLYGON((0 0,10 0,10 10,0 10,0 0))")) |
+-----+
| true
+-----+
nebula> RETURN ST_dwithin(ST_GeogFromText("Point(0 0)"),ST_GeogFromText("Point(10 10)'),2000000000.0);
+-----+
| ST_dwithin(ST_GeogFromText("Point(0 0)"),ST_GeogFromText("Point(10 10)'),2000000000) |
+-----+
| true
+-----+
nebula> RETURN ST_Distance(ST_GeogFromText("Point(0 0)'),ST_GeogFromText("Point(10 10)')));
+-----+
| ST_Distance(ST_GeogFromText("Point(0 0)'),ST_GeogFromText("Point(10 10)')) |
+-----+
| 1.5685230187677438e+06
+-----+
nebula> RETURN S2_CellIdFromPoint(ST_GeogFromText("Point(1 1)'));
+-----+
| S2_CellIdFromPoint(ST_GeogFromText("Point(1 1)')) |
+-----+
| 1153277837650709461
+-----+
nebula> RETURN S2_CoveringCellIds(ST_GeogFromText("POLYGON((0 1, 1 2, 2 3, 0 1))"));
+-----+
| S2_CoveringCellIds(ST_GeogFromText("POLYGON((0 1, 1 2, 2 3, 0
1))"))
+-----+
| [1152391494368201343, 1153466862374223872, 1153554823304445952, 1153836298281156608, 1153959443583467520, 1154240918560178176, 1160503736791990272,
116059169772212352] |
+-----+

```

:January 13, 2023

## 4.5.11

### **openCypher**

NebulaGraph 3.3.0

UDF

---

: January 13, 2023

## 4.6

### 4.6.1 MATCH

```
MATCH pattern
 MATCH NebulaGraph RETURN
 basketballplayer
```

GO LOOKUP MATCH MATCH trail

```
MATCH <pattern> [<clause_1>] RETURN <output> [<clause_2>];
```

- pattern pattern MATCH , , (a)-[]->(b),(c)-[]->(d)
- clause\_1 WHERE WITH UNWIND OPTIONAL MATCH MATCH
- output AS
- clause\_2 ORDER BY LIMIT

```
MATCH MATCH
 MATCH id() VID
 MATCH (v) RETURN v LIMIT N MATCH ()-[e]->() RETURN e LIMIT N
 Tag MATCH (v:player) RETURN v LIMIT N
 Edge Type MATCH ()-[e:follow]->() RETURN e LIMIT N
```

#### Note

- MATCH
- Tag Edge Type MATCH (v:player)-[e:follow]->() RETURN e LIMIT N



```
3.0.0 Tag Tag RETURN < >.< > RETURN < >.<Tag >.< >
```

```
Tag player name Edge type follow
nebula> CREATE TAG INDEX IF NOT EXISTS player_index_1 ON player(name(20));
nebula> CREATE EDGE INDEX IF NOT EXISTS follow_index on follow();

#
nebula> REBUILD TAG INDEX player_index_1;
+-----+
| New Job Id |
+-----+
```

```
| 121 |
+-----+
nebula> REBUILD EDGE INDEX follow_index;
+-----+
| New Job Id |
+-----+
| 122 |
+-----+
#
nebula> SHOW JOB 121;
+-----+-----+-----+-----+-----+
| Job Id(TaskId) | Command(Dest) | Status | Start Time | Stop Time | Error Code |
+-----+-----+-----+-----+-----+
121	"REBUILD_TAG_INDEX"	"FINISHED"	2021-05-27T02:18:02.000000	2021-05-27T02:18:02.000000	"SUCCEEDED"
0	"storaged1"	"FINISHED"	2021-05-27T02:18:02.000000	2021-05-27T02:18:02.000000	"SUCCEEDED"
1	"storaged0"	"FINISHED"	2021-05-27T02:18:02.000000	2021-05-27T02:18:02.000000	"SUCCEEDED"
2	"storaged2"	"FINISHED"	2021-05-27T02:18:02.000000	2021-05-27T02:18:02.000000	"SUCCEEDED"
"Total:3"	"Succeeded:3"	"Failed:0"	"In Progress:0"	""	""
+-----+-----+-----+-----+-----+					
nebula> SHOW JOB 122;					
+-----+-----+-----+-----+-----+					
Job Id(TaskId)	Command(Dest)	Status	Start Time	Stop Time	Error Code
+-----+-----+-----+-----+-----+					
122	"REBUILD_EDGE_INDEX"	"FINISHED"	2021-05-27T02:18:11.000000	2021-05-27T02:18:11.000000	"SUCCEEDED"
0	"storaged1"	"FINISHED"	2021-05-27T02:18:11.000000	2021-05-27T02:18:21.000000	"SUCCEEDED"
1	"storaged0"	"FINISHED"	2021-05-27T02:18:11.000000	2021-05-27T02:18:21.000000	"SUCCEEDED"
2	"storaged2"	"FINISHED"	2021-05-27T02:18:11.000000	2021-05-27T02:18:21.000000	"SUCCEEDED"
"Total:3"	"Succeeded:3"	"Failed:0"	"In Progress:0"	""	""
+-----+-----+-----+-----+-----+
```



NebulaGraph 3.0.0

MATCH (v) RETURN v LIMIT n ; LIMIT

MATCH (v) RETURN v

(v)

```
nebula> MATCH (v) \
 RETURN v \
 LIMIT 3;
+-----+
| v |
+-----+
| ("player102" :player{age: 33, name: "LaMarcus Aldridge"}) |
| ("player106" :player{age: 25, name: "Kyle Anderson"}) |
| ("player115" :player{age: 40, name: "Kobe Bryant"}) |
+-----+
```

TAG



NebulaGraph 3.0.0

Tag Tag Tag

Tag MATCH NebulaGraph 3.0.0 Tag

LIMIT

:&lt;tag\_name&gt; Tag

```
nebula> MATCH (v:player) \
 RETURN v \
 LIMIT 3;
+-----+
| v |
+-----+
| ("player102" :player{age: 33, name: "LaMarcus Aldridge"}) |
| ("player106" :player{age: 25, name: "Kyle Anderson"}) |
| ("player115" :player{age: 40, name: "Kobe Bryant"}) |
+-----+
...
```

Tag :

## Note

Tag

```
match (v1:player:team) where v1.player.name=="Tim Duncan" return v1 limit 10;
```

```
nebula> CREATE TAG actor (name string, age int);
nebula> INSERT VERTEX actor(name, age) VALUES "player100":("Tim Duncan", 42);
nebula> MATCH (v:player:actor) \
 RETURN v \
 LIMIT 10;
+-----+
| v |
+-----+
| {"player100" :actor{age: 42, name: "Tim Duncan"} :player{age: 42, name: "Tim Duncan"}) |
+-----+
```

Tag {<prop\_name>: <prop\_value>}

```
name
nebula> MATCH (v:player{name:"Tim Duncan"}) \
 RETURN v;
+-----+
| v |
+-----+
| {"player100" :player{age: 42, name: "Tim Duncan"}) |
+-----+
```

WHERE

```
nebula> MATCH (v:player) \
 WHERE v.player.name == "Tim Duncan" \
 RETURN v;
+-----+
| v |
+-----+
| {"player100" :player{age: 42, name: "Tim Duncan"}) |
+-----+
```

## ↑enCypher

openCypher 9 = nGQL == =

Tag

```
nebula> MATCH (v) \
 WITH v, properties(v) as props, keys(properties(v)) as kk \
 LIMIT 10000 WHERE [i in kk where props[i] == "Tim Duncan"] \
 RETURN v;
+-----+
| v |
+-----+
| {"player100" :player{age: 42, name: "Tim Duncan"}) |
+-----+
```

ID

ID id() ID

```
nebula> MATCH (v) \
 WHERE id(v) == 'player101' \
 RETURN v;
+-----+
| v |
+-----+
| {"player101" :player{age: 36, name: "Tony Parker"}) |
+-----+
```

ID WHERE id(v) IN [vid\_list]

```
nebula> MATCH (v:player { name: 'Tim Duncan' })--(v2) \
 WHERE id(v2) IN ["player101", "player102"] \
```

```
RETURN v2;
+-----+
| v2
+-----+
| ("player101" :player{age: 36, name: "Tony Parker"}) |
| ("player101" :player{age: 36, name: "Tony Parker"}) |
| ("player102" :player{age: 33, name: "LaMarcus Aldridge"}) |
+-----+
```



nGQL 1.x

nGQL 2.x

```
nebula> MATCH (v:player{name:"Tim Duncan"})--(v2:player) \
 RETURN v2.player.name AS Name;
+-----+
| Name
+-----+
| "Manu Ginobili"
| "Manu Ginobili"
| "Dejounte Murray"
...
```



```
--> v v2 v v2
nebula> MATCH (v:player{name:"Tim Duncan"})-->(v2:player) \
 RETURN v2.player.name AS Name;
+-----+
| Name
+-----+
| "Tony Parker"
| "Manu Ginobili"
...
```

## CASE

```
nebula> MATCH (v:player{name:"Tim Duncan"})--(v2) \
 RETURN \
 CASE WHEN v2.team.name IS NOT NULL \
 THEN v2.team.name \
 WHEN v2.player.name IS NOT NULL \
 THEN v2.player.name END AS Name;
+-----+
| Name
+-----+
| "Manu Ginobili"
| "Manu Ginobili"
| "Spurs"
| "Dejounte Murray"
...
```

```
nebula> MATCH (v:player{name:"Tim Duncan"})-->(v2)<--(v3) \
 RETURN v3.player.name AS Name;
+-----+
| Name
+-----+
| "Dejounte Murray"
| "LaMarcus Aldridge"
| "Marco Belinelli"
...
```

```
nebula> MATCH (v:player{name:"Tim Duncan"})-->()<--(v3) \
 RETURN v3.player.name AS Name;
+-----+
| Name
+-----+
| "Dejounte Murray"
| "LaMarcus Aldridge"
...
```

```
| "Marco Belinelli" |
...
```

```
nebula> MATCH p=(v:player{name:"Tim Duncan"})-->(v2) \
 RETURN p;
+-----+
| p |
+-----+
| <"player100" :player{age: 42, name: "Tim Duncan"}->("team204" :team{name: "Spurs"})> |
| <"player100" :player{age: 42, name: "Tim Duncan"}->("player101" :player{age: 36, name: "Tony Parker"})> |
| <"player100" :player{age: 42, name: "Tim Duncan"}->("player125" :player{age: 41, name: "Manu Ginobili"})> |
+-----+
```



nGQL @ rank openCypher rank



NebulaGraph 3.0.0

MATCH

NebulaGraph 3.0.0

LIMIT

```
nebula> MATCH ()<-[e]-() \
 RETURN e \
 LIMIT 3;
+-----+
| e |
+-----+
| [:follow "player101"->"player102" @0 {degree: 90}] |
| [:follow "player103"->"player102" @0 {degree: 70}] |
| [:follow "player135"->"player102" @0 {degree: 80}] |
+-----+
```

EDGE TYPE

:<edge\_type> Edge type -[e:follow]-



NebulaGraph 3.0.0 Edge Type

Edge type

Edge Type

MATCH

NebulaGraph 3.0.0

Edge

Type

LIMIT

```
nebula> MATCH ()-[e:follow]->() \
 RETURN e \
 limit 3;
+-----+
| e |
+-----+
| [:follow "player102"->"player100" @0 {degree: 75}] |
| [:follow "player102"->"player101" @0 {degree: 75}] |
| [:follow "player129"->"player116" @0 {degree: 90}] |
+-----+
```

{<prop\_name>: <prop\_value>} Edge type [e:follow{likeness:95}]

```
nebula> MATCH (v:player{name:"Tim Duncan"})-[e:follow{degree:95}]->(v2) \
 RETURN e;
+-----+
| e |
+-----+
| [:follow "player100"->"player101" @0 {degree: 95}] |
| [:follow "player100"->"player125" @0 {degree: 95}] |
+-----+
```

## Edge type

```
nebula> MATCH ()-[e]->() \
 WITH e, properties(e) as props, keys(properties(e)) as kk \
 LIMIT 10000 WHERE [i in kk where props[i] == 90] \
 RETURN e;
+-----+
| e |
+-----+
| [:follow "player125"->"player100" @0 {degree: 90}] |
| [:follow "player140"->"player114" @0 {degree: 90}] |
| [:follow "player133"->"player144" @0 {degree: 90}] |
| [:follow "player133"->"player114" @0 {degree: 90}] |
...
+-----+
```

## EDGE TYPE

|  |           |                   |           |   |           |                  |
|--|-----------|-------------------|-----------|---|-----------|------------------|
|  | Edge type | [e:follow :serve] | Edge type | : | Edge type | [e:follow serve] |
|--|-----------|-------------------|-----------|---|-----------|------------------|



Tag Edge type

```
MATCH (v)-[e:follow|serve]->(v2) where v.player.name=="Tim Duncan" RETURN e limit 10; (v) Tag
```

```
nebula> MATCH (v:player{name:"Tim Duncan"})-[e:follow|:serve]->(v2) \
 RETURN e;
+-----+
| e |
+-----+
| [:follow "player100"->"player101" @0 {degree: 95}] |
| [:follow "player100"->"player125" @0 {degree: 95}] |
| [:serve "player100"->"team204" @0 {end_year: 2016, start_year: 1997}] |
+-----+
```

```
nebula> MATCH (v:player{name:"Tim Duncan"})-[]->(v2)<-[:serve]->(v3) \
 RETURN v2, v3;
+-----+-----+
| v2 | v3 |
+-----+-----+
("team204" :team{name: "Spurs"})	("player104" :player{age: 32, name: "Marco Belinelli"})
("team204" :team{name: "Spurs"})	("player101" :player{age: 36, name: "Tony Parker"})
("team204" :team{name: "Spurs"})	("player102" :player{age: 33, name: "LaMarcus Aldridge"})
...
+-----+-----+
```

:&lt;edge\_type&gt;\*&lt;hop&gt; hop

```
nebula> MATCH p=(v:player{name:"Tim Duncan"})-[e:follow*2]->(v2) \
 RETURN DISTINCT v2 AS Friends;
+-----+
| Friends |
+-----+
| ("player100" :player{age: 42, name: "Tim Duncan"}) |
| ("player125" :player{age: 41, name: "Manu Ginobili"}) |
| ("player102" :player{age: 33, name: "LaMarcus Aldridge"}) |
+-----+
```

hop 0

```
nebula> MATCH (v:player{name:"Tim Duncan"}) -[*0]-> (v2) \
 RETURN v2;
+-----+
| v2 |
+-----+
| ("player100" :player{age: 42, name: "Tim Duncan"}) |
+-----+
```

## Note

```
-[e:follow*2]-> e .degree
nebula> MATCH p=(v:player{name:"Tim Duncan"})-[e:follow*2]->(v2) \
 WHERE e.degree > 1 \
 RETURN DISTINCT v2 AS Friends;
```

```
nebula> MATCH p=(v:player{name:"Tim Duncan"})-[e:follow*2]->(v2) \
 WHERE ALL(e_ in e WHERE e_.degree > 0) \
 RETURN DISTINCT v2 AS Friends;
```

```
nebula> MATCH p=(v:player{name:"Tim Duncan"})-[e:follow*2]->(v2) \
 WHERE e[0].degree > 98 \
 RETURN DISTINCT v2 AS Friends;
```

:<edge\_type>\*[minHop..maxHop]

## Caution

maxHop graph OOM

| minHop | minHop | 1 |
|--------|--------|---|
|--------|--------|---|

| maxHop | maxHop |
|--------|--------|
|--------|--------|

minHop maxHop :<edge\_type>\*

```
nebula> MATCH p=(v:player{name:"Tim Duncan"})-[e:follow*]->(v2) \
 RETURN v2 AS Friends;
+-----+
| Friends |
+-----+
| {"player125" :player{age: 41, name: "Manu Ginobili"}) |
| {"player101" :player{age: 36, name: "Tony Parker"}) |
...
```

```
nebula> MATCH p=(v:player{name:"Tim Duncan"})-[e:follow*1..3]->(v2) \
 RETURN v2 AS Friends;
+-----+
| Friends |
+-----+
| {"player101" :player{age: 36, name: "Tony Parker"}) |
| {"player125" :player{age: 41, name: "Manu Ginobili"}) |
| {"player100" :player{age: 42, name: "Tim Duncan"}) |
...
```

```
nebula> MATCH p=(v:player{name:"Tim Duncan"})-[e:follow*1..]->(v2) \
 RETURN v2 AS Friends;
+-----+
| Friends |
+-----+
| {"player125" :player{age: 41, name: "Manu Ginobili"}) |
| {"player101" :player{age: 36, name: "Tony Parker"}) |
| {"player100" :player{age: 42, name: "Tim Duncan"}) |
...
```

DISTINCT

```
nebula> MATCH p=(v:player{name:"Tim Duncan"})-[e:follow*1..3]->(v2:player) \
 RETURN DISTINCT v2 AS Friends, count(v2);
+-----+-----+
| Friends | count(v2) |
+-----+-----+
{"player102" :player{age: 33, name: "LaMarcus Aldridge"})	1
{"player100" :player{age: 42, name: "Tim Duncan"})	4
{"player101" :player{age: 36, name: "Tony Parker"})	3

```

```
| ("player125" :player{age: 41, name: "Manu Ginobili"}) | 3 |
```

| minHop | 0 | minHop | 0 | "Tim Duncan" | 5 |
|--------|---|--------|---|--------------|---|
|--------|---|--------|---|--------------|---|

```
nebula> MATCH p=(v:player{name:"Tim Duncan"})-[e:follow*0..3]->(v2:player) \
 RETURN DISTINCT v2 AS Friends, count(v2);
+-----+-----+
| Friends | count(v2) |
+-----+-----+
("player102" :player{age: 33, name: "LaMarcus Aldridge"})	1
("player100" :player{age: 42, name: "Tim Duncan"})	5
("player125" :player{age: 41, name: "Manu Ginobili"})	3
("player101" :player{age: 36, name: "Tony Parker"})	3
+-----+-----+
```

**EDGE TYPE**

| Edge type | hop | minHop | maxHop | Edge type |
|-----------|-----|--------|--------|-----------|
|-----------|-----|--------|--------|-----------|

```
nebula> MATCH p=(v:player{name:"Tim Duncan"})-[e:follow|serve*2]->(v2) \
 RETURN DISTINCT v2;
+-----+
| v2 |
+-----+
| ("team204" :team{name: "Spurs"}) |
| ("player100" :player{age: 42, name: "Tim Duncan"}) |
| ("team215" :team{name: "Hornets"}) |
| ("player125" :player{age: 41, name: "Manu Ginobili"}) |
| ("player102" :player{age: 33, name: "LaMarcus Aldridge"}) |
+-----+
```

```
nebula> CREATE TAG INDEX IF NOT EXISTS team_index ON team(name(20));
nebula> REBUILD TAG INDEX team_index;
nebula> MATCH (v1:player{name:"Tim Duncan"}), (v2:team{name:"Spurs"}) \
 RETURN v1,v2;
+-----+-----+
| v1 | v2 |
+-----+
| ("player100" :player{age: 42, name: "Tim Duncan"}) | ("team204" :team{name: "Spurs"}) |
+-----+
```

**shortestPath**

```
nebula> MATCH p = shortestPath((a:player)-[e:follow*..2]-(b:player))\
 WHERE a.player.age > 45 AND b.player.age < 30 \
 RETURN p;
+-----+
| |
| p |
| |
+-----+
| <"player144" :player{age: 47, name: "Shaquille O'Neal"}-[:follow@0 {degree: 80}]->("player100" :player{age: 42, name: "Tim Duncan"})<-[:follow@0 {degree: 99}]-("player113" :player{age: 29, name: "Dejounte Murray"})> |
+-----+
|
```

**MATCH****MATCH**

```
nebula> MATCH (m)-[]->(n) WHERE id(m)=="player100" \
 MATCH (n)-[]->(l) WHERE id(n)=="player125" \
 RETURN id(m),id(n),id(l);
+-----+-----+-----+
| id(m) | id(n) | id(l) |
+-----+-----+-----+
| "player100" | "player125" | "team204" |
| "player100" | "player125" | "player100" |
+-----+-----+-----+
```

## OPTIONAL MATCH

OPTIONAL MATCH



NebulaGraph 3.3.0 MATCH . GO , LOOKUP , | FETCH MATCH

---

:January 13, 2023

## 4.6.2 OPTIONAL MATCH



OPTIONAL MATCH Beta

|                |       |       |      |
|----------------|-------|-------|------|
| OPTIONAL MATCH | MATCH | MATCH | NULL |
|----------------|-------|-------|------|

### openCypher

nGQL openCypher

|       |                |
|-------|----------------|
| MATCH | OPTIONAL MATCH |
|-------|----------------|

```
nebula> MATCH (m)-[]->(n) WHERE id(m)=="player100" \
 OPTIONAL MATCH (n)-[]->(l) WHERE id(n)=="player125" \
 RETURN id(m),id(n),id(l);
+-----+-----+-----+
| id(m) | id(n) | id(l) |
+-----+-----+-----+
"player100"	"team204"	____NULL____
"player100"	"player101"	____NULL____
"player100"	"player125"	"team204"
"player100"	"player125"	"player100"
+-----+-----+-----+
```

|       |                |
|-------|----------------|
| MATCH | OPTIONAL MATCH |
|-------|----------------|

```
nebula> MATCH (m)-[]->(n) WHERE id(m)=="player100" \
 MATCH (n)-[]->(l) WHERE id(n)=="player125" \
 RETURN id(m),id(n),id(l);
+-----+-----+-----+
| id(m) | id(n) | id(l) |
+-----+-----+-----+
| "player100" | "player125" | "team204" |
| "player100" | "player125" | "player100" |
+-----+-----+-----+
```

:January 13, 2023

### 4.6.3 LOOKUP

- `LOOKUP`
- `LOOKUP`
- `WHERE`
- `Tag`      `Tag`      `ID`
- `Edge type`      `Edge type`      `rank`
- `Tag`      `Edge type`

#### OpenCypher

nGQL

- 
- `Explain`



2.5.0

`LOOKUP`

`LOOKUP`

```
LOOKUP ON {<vertex_tag> | <edge_type>}
[WHERE <expression> [AND <expression> ...]]
YIELD <return_list> [AS <alias>]
[<clause>];

<return_list>
 <prop_name> [AS <col_alias>] [, <prop_name> [AS <prop_alias>] ...];
```

- `WHERE <expression>`      `AND`    `OR`      `WHERE`
- `YIELD`      `YIELD`
- `AS`
- `clause`      `ORDER BY`      `LIMIT`

**WHERE**

LOOKUP WHERE

- \$- \$^
- tagName.prop1 > tagName.prop2
- AliasProp
- XOR
- STARTS WITH
- rank()
- .

Tag player name Tony Parker

```
nebula> CREATE TAG INDEX IF NOT EXISTS index_player ON player(name(30), age);

nebula> REBUILD TAG INDEX index_player;
+-----+
| New Job Id |
+-----+
| 15 |
+-----+

nebula> LOOKUP ON player \
 WHERE player.name == "Tony Parker" \
 YIELD id(vertex);
+-----+
| id(VERTEX) |
+-----+
| "player101" |
+-----+

nebula> LOOKUP ON player \
 WHERE player.name == "Tony Parker" \
 YIELD properties(vertex).name AS name, properties(vertex).age AS age;
+-----+-----+
| name | age |
+-----+-----+
| "Tony Parker" | 36 |
+-----+-----+

nebula> LOOKUP ON player \
 WHERE player.age > 45 \
 YIELD id(vertex);
+-----+
| id(VERTEX) |
+-----+
| "player144" |
| "player140" |
+-----+

nebula> LOOKUP ON player \
 WHERE player.name STARTS WITH "B" \
 AND player.age IN [22,30] \
 YIELD properties(vertex).name, properties(vertex).age;
+-----+-----+
| properties(VERTEX).name | properties(VERTEX).age |
+-----+-----+
| "Ben Simmons" | 22 |
| "Blake Griffin" | 30 |
+-----+-----+

nebula> LOOKUP ON player \
 WHERE player.name == "Kobe Bryant" \
 YIELD id(vertex) AS VertexID, properties(vertex).name AS name | \
 GO FROM $-.VertexID OVER serve \
 YIELD $-.name, properties(edge).start_year, properties(edge).end_year, properties($$).name;
+-----+-----+-----+-----+
| $-.name | properties(EDGE).start_year | properties(EDGE).end_year | properties($$).name |
+-----+-----+-----+-----+
| "Kobe Bryant" | 1996 | 2016 | "Lakers" |
+-----+-----+-----+-----+
```

Edge type follow degree 90

```

nebula> CREATE EDGE INDEX IF NOT EXISTS index_follow ON follow(degree);

nebula> REBUILD EDGE INDEX index_follow;
+-----+
| New Job Id |
+-----+
| 62 |
+-----+

nebula> LOOKUP ON follow \
 WHERE follow.degree == 90 YIELD edge AS e;
+-----+
| e |
+-----+
| [:follow "player109"->"player125" @ {degree: 90}] |
| [:follow "player118"->"player120" @ {degree: 90}] |
| [:follow "player118"->"player131" @ {degree: 90}] |
...
| ...

nebula> LOOKUP ON follow \
 WHERE follow.degree == 90 \
 YIELD properties(edge).degree;
+-----+
| properties(EDGE).degree |
+-----+
| 90 |
| 90 |
...
| ...

nebula> LOOKUP ON follow \
 YIELD properties(edge).degree as degree \
 | ORDER BY $-.degree \
 | LIMIT 10;
+-----+
| degree |
+-----+
| -1 |
| -1 |
| 9 |
| 10 |
| 13 |
| 50 |
| 55 |
| 60 |
| 70 |
| 70 |
+-----+

nebula> LOOKUP ON follow \
 WHERE follow.degree == 60 \
 YIELD dst(edge) AS DstVID, properties(edge).degree AS Degree \
 GO FROM $.DstVID OVER serve \
 YIELD $.DstVID, properties(edge).start_year, properties(edge).end_year, properties($$).name;
+-----+-----+-----+-----+
| $.DstVID | properties(EDGE).start_year | properties(EDGE).end_year | properties($$).name |
+-----+-----+-----+-----+
"player105"	2010	2018	"Spurs"
"player105"	2009	2010	"Cavaliers"
"player105"	2018	2019	"Raptors"
+-----+-----+-----+-----+

```

### Tag / Edge type

Tag                      Edge type              Tag    Edge type

Tag player name age

Tag player ID Tag player name age

- Tag player VID

```
nebula> CREATE TAG IF NOT EXISTS player(name string,age int);
nebula> CREATE TAG INDEX IF NOT EXISTS player_index on player();

nebula> REBUILD TAG INDEX player_index;
+-----+
| New Job Id |
+-----+
| 66 |
+-----+

nebula> INSERT VERTEX player(name,age) \
VALUES "player100":("Tim Duncan", 42), "player101":("Tony Parker", 36);

player MATCH (n:player) RETURN id(n) /*, n */

nebula> LOOKUP ON player YIELD id(vertex);
+-----+
| id(VERTEX) |
+-----+
| "player100" |
| "player101" |
| ... |
+-----+

4
nebula> LOOKUP ON player YIELD id(vertex) | LIMIT 4;
+-----+
| id(VERTEX) |
+-----+
| "player105" |
| "player109" |
| "player111" |
| "player118" |
+-----+
```

- Edge type follow

```
nebula> CREATE EDGE IF NOT EXISTS follow(degree int);
nebula> CREATE EDGE INDEX IF NOT EXISTS follow_index on follow();

nebula> REBUILD EDGE INDEX follow_index;
+-----+
| New Job Id |
+-----+
| 88 |
+-----+

nebula> INSERT EDGE follow(degree) \
VALUES "player100"->"player101":(95);

follow MATCH (s)-[e:follow]->(d) RETURN id(s), rank(e), id(d) /*, type(e) */

nebula> LOOKUP ON follow YIELD edge AS e;
+-----+
| e |
+-----+
| [:follow "player105"->"player100" @0 {degree: 70}] |
| [:follow "player105"->"player116" @0 {degree: 80}] |
| [:follow "player109"->"player100" @0 {degree: 80}] |
| ... |
+-----+
```

Tag player Edge type follow

```
nebula> LOOKUP ON player YIELD id(vertex)|\
YIELD COUNT(*) AS Player_Number;
+-----+
| Player_Number |
+-----+
| 51 |
+-----+

nebula> LOOKUP ON follow YIELD edge AS e| \
YIELD COUNT(*) AS Follow_Number;
+-----+
| Follow_Number |
+-----+
| 81 |
+-----+
```

 Note[SHOW STATS](#)

---

: January 13, 2023

#### 4.6.4 GO

GO                  GO                  walk

##### openCypher

nGQL

```
GO [[<M> TO] <N> STEPS] FROM <vertex_list>
OVER <edge_type_list> [{REVERSELY | BIDIRECT}]
[WHERE <conditions>]
YIELD [DISTINCT] <return_list>
[{ SAMPLE <sample_list> | <limit_by_list_clause> }]
[| GROUP BY {<col_name> | expression} | <position> } YIELD <col_name>]
[| ORDER BY <expression> [{ASC | DESC}]]
[| LIMIT [<offset>,] <number_rows>];

<vertex_list> ::=
<vid> [, <vid> ...]

<edge_type_list> ::=
<edge_type> [, <edge_type> ...]
| *
```

- ```
<return_list> ::= 
  <col_name> [AS <col_alias>] [, <col_name> [AS <col_alias>] ...]
```
- <N> STEPS N 1 N 0 NebulaGraph
 - M TO N STEPS M-N M 0 M 1 GO 0 TO 2 GO 1 TO 2
 - <vertex_list> ID \$-.id
 - <edge_type_list> Edge type
 - REVERSELY | BIDIRECT <vertex_list> REVERSELY BIDIRECT <edge_type>._type
 - WHERE <conditions> WHERE AND OR NOT XOR WHERE

 Note

- Edge type WHERE WHERE edge1.prop1 > edge2.prop2
- GO
- YIELD [DISTINCT] <return_list> <return_list> Schema src(edge) dst(edge) type(edge)
- SAMPLE <sample_list> SAMPLE
- <limit_by_list_clause> LIMIT
- GROUP BY GROUP BY YIELD
- ORDER BY ORDER BY

 Note

- LIMIT [<offset>,] <number_rows> LIMIT

```
#     player102
nebula> GO FROM "player102" OVER serve YIELD dst(edge);
+-----+
| dst(EDGE) |
+-----+
| "team203" |
| "team204" |
+-----+
```

```
#     player102
nebula> GO 2 STEPS FROM "player102" OVER follow YIELD dst(edge);
+-----+
| dst(EDGE) |
+-----+
| "player101" |
| "player125" |
| "player100" |
| "player102" |
| "player125" |
+-----+
```

```
# 
nebula> GO FROM "player100", "player102" OVER serve \
      WHERE properties(edge).start_year > 1995 \
      YIELD DISTINCT properties($$).name AS team_name, properties(edge).start_year AS start_year, properties($^).name AS player_name;
```

```

| team_name      | start_year | player_name      |
+-----+-----+-----+
| "Spurs"       | 1997      | "Tim Duncan"    |
| "Trail Blazers" | 2006      | "LaMarcus Aldridge" |
| "Spurs"       | 2015      | "LaMarcus Aldridge" |
+-----+-----+-----+


#     Edge type      UNKNOWN_PROP
nebula> GO FROM "player100" OVER follow, serve \
          YIELD properties(edge).degree, properties(edge).start_year;
+-----+-----+
| properties(EDGE).degree | properties(EDGE).start_year |
+-----+-----+
| 95           | UNKNOWN_PROP        |
| 95           | UNKNOWN_PROP        |
| UNKNOWN_PROP  | 1997              |
+-----+-----+


#     player100
nebula> GO FROM "player100" OVER follow REVERSELY \
          YIELD src(edge) AS destination;
+-----+
| destination |
+-----+
| "player101" |
| "player102" |
...
#     MATCH      GO
nebula> MATCH (v)-[e:follow]->(v2) WHERE id(v) == 'player100' \
          RETURN id(v2) AS destination;
+-----+
| destination |
+-----+
| "player101" |
| "player102" |
...
...


#     player100
nebula> GO FROM "player100" OVER follow REVERSELY \
          YIELD src(edge) AS id | \
          GO FROM $-.id OVER serve \
          WHERE properties($^).age > 20 \
          YIELD properties($^).name AS FriendOf, properties($$).name AS Team;
+-----+-----+
| FriendOf   | Team      |
+-----+-----+
| "Boris Diaw" | "Spurs"   |
| "Boris Diaw" | "Jazz"    |
| "Boris Diaw" | "Suns"    |
...
#     MATCH      GO
nebula> MATCH (v)-[e:follow]->(v2)-[e2:serve]->(v3) \
          WHERE id(v) == 'player100' \
          RETURN v2.player.name AS FriendOf, v3.team.name AS Team;
+-----+-----+
| FriendOf   | Team      |
+-----+-----+
| "Boris Diaw" | "Spurs"   |
| "Boris Diaw" | "Jazz"    |
| "Boris Diaw" | "Suns"    |
...
...


#     player100 1~2
nebula> GO 1 TO 2 STEPS FROM "player100" OVER follow \
          YIELD dst(edge) AS destination;
+-----+
| destination |
+-----+
| "player101" |
| "player125" |
...
#     MATCH      GO
nebula> MATCH (v) -[e:follow*1..2]->(v2) \
          WHERE id(v) == "player100" \
          RETURN id(v2) AS destination;
+-----+
| destination |
+-----+
| "player100" |
| "player102" |
...
...


#
nebula> GO 2 STEPS FROM "player100" OVER follow \
          YIELD src(edge) AS src, dst(edge) AS dst, properties($$).age AS age \
          | GROUP BY $-.dst \
          YIELD $-.dst AS dst, collect_set($-.src) AS src, collect($-.age) AS age;

```

: January 13, 2023

4.6.5 FETCH

FETCH

openCypher

nGQL

```
FETCH PROP ON {<tag_name>[, tag_name ...] | *}
<vid> [, vid ...]
YIELD <return_list> [AS <alias>];
```

tag_name	Tag
*	Tag
vid	ID
YIELD	YIELD
AS	

TAG

FETCH Tag

```
nebula> FETCH PROP ON player "player100" YIELD properties(vertex);
+-----+
| properties(VERTEX) |
+-----+
| {age: 42, name: "Tim Duncan"} |
+-----+
```

YIELD

```
nebula> FETCH PROP ON player "player100" \
          YIELD properties(vertex).name AS name;
+-----+
| name      |
+-----+
| "Tim Duncan" |
+-----+
```

ID

,

```
nebula> FETCH PROP ON player "player101", "player102", "player103" YIELD properties(vertex);
+-----+
| properties(VERTEX) |
+-----+
| {age: 33, name: "LaMarcus Aldridge"} |
| {age: 36, name: "Tony Parker"} |
| {age: 32, name: "Rudy Gay"} |
+-----+
```

TAG

FETCH Tag Tag ,

```
#   Tag t1
nebula> CREATE TAG IF NOT EXISTS t1(a string, b int);
```

```
#    player100  Tag t1
nebula> INSERT VERTEX t1(a, b) VALUES "player100":("Hello", 100);

#    Tag player  t1    player100
nebula> FETCH PROP ON player, t1 "player100" YIELD vertex AS v;
+-----+
| v
+-----+
| {"player100" :player{age: 42, name: "Tim Duncan"} :t1{a: "Hello", b: 100}} |
+-----+
```

FETCH Tag

```
nebula> FETCH PROP ON player, t1 "player100", "player103" YIELD vertex AS v;
+-----+
| v
+-----+
| {"player100" :player{age: 42, name: "Tim Duncan"} :t1{a: "Hello", b: 100}} |
| {"player103" :player{age: 32, name: "Rudy Gay"}) |
+-----+
```

FETCH *

```
nebula> FETCH PROP ON * "player100", "player106", "team200" YIELD vertex AS v;
+-----+
| v
+-----+
| {"player100" :player{age: 42, name: "Tim Duncan"} :t1{a: "Hello", b: 100}} |
| {"player106" :player{age: 25, name: "Kyle Anderson"} |
| {"team200" :team{name: "Warriors"}) |
+-----+
```

```
FETCH PROP ON <edge_type> <src_vid> -> <dst_vid>[@<rank>] [, <src_vid> -> <dst_vid> ...]
YIELD <output>;
```

edge_type	Edge type
src_vid	ID
dst_vid	ID
rank	rank
	0
	Edge type
	rank
YIELD	YIELD

```
#    player100  team204  serve
nebula> FETCH PROP ON serve "player100" -> "team204" YIELD properties(edge);
+-----+
| properties(EDGE)           |
+-----+
| {end_year: 2016, start_year: 1997} |
+-----+
```

YIELD

```
nebula> FETCH PROP ON serve "player100" -> "team204" \
      YIELD properties(edge).start_year;
+-----+
| properties(EDGE).start_year |
+-----+
| 1997                         |
+-----+
```

```
(<src_vid> -> <dst_vid>[@<rank>]) ,
```

```
nebula> FETCH PROP ON serve "player100" -> "team204", "player133" -> "team202" YIELD edge AS e;
+-----+
| e
+-----+
| [:serve "player100"->"team204" @0 {end_year: 2016, start_year: 1997}] |
| [:serve "player133"->"team202" @0 {end_year: 2011, start_year: 2002}] |
+-----+
```

RANK

Edge type	rank
-----------	------

```
#      rank
nebula> insert edge serve(start_year,end_year) \
values "player100"->"team204"@1:(1998, 2017);

nebula> insert edge serve(start_year,end_year) \
values "player100"->"team204"@2:(1990, 2018);

#      rank 0      FETCH      rank
#      rank 0      FETCH      rank
nebula> FETCH PROP ON serve "player100" -> "team204" YIELD edge AS e;
+-----+
| e
+-----+
| [:serve "player100"->"team204" @0 {end_year: 2016, start_year: 1997}] |
+-----+
```

rank 0 FETCH rank
nebula> FETCH PROP ON serve "player100" -> "team204"@1 YIELD edge AS e;
+-----+
| e
+-----+
| [:serve "player100"->"team204" @1 {end_year: 2017, start_year: 1998}] |
+-----+

FETCH

FETCH	nGQL	GO
-------	------	----

```
#      player101      follow      degree
nebula> GO FROM "player101" OVER follow \
YIELD src(edge) AS s, dst(edge) AS d \
| FETCH PROP ON follow $-.s -> $-.d \
YIELD properties(edge).degree;
+-----+
| properties(EDGE).degree |
+-----+
| 95
| 90
| 95
+-----+
```

```
nebula> $var = GO FROM "player101" OVER follow \
YIELD src(edge) AS s, dst(edge) AS d; \
FETCH PROP ON follow $var.s -> $var.d \
YIELD properties(edge).degree;
+-----+
| properties(EDGE).degree |
+-----+
| 95
| 90
| 95
+-----+
```

:January 13, 2023

4.6.6 SHOW

SHOW CHARSET

```
SHOW CHARSET
```

```
utf8  utf8mb4      utf8  NebulaGraph  uft8      utf8  utf8mb4
```

```
SHOW CHARSET;
```

```
nebula> SHOW CHARSET;
+-----+-----+-----+
| Charset | Description      | Default collation | Maxlen |
+-----+-----+-----+
| "utf8"  | "UTF-8 Unicode"  | "utf8_bin"        | 4       |
+-----+-----+-----+
```

Charset

Description

Default collation

Maxlen

:January 13, 2023

SHOW COLLATION

SHOW COLLATION

```
    utf8_bin  utf8mb4_bin
•      utf8      utf8_bin
•      utf8mb4   utf8mb4_bin
```

SHOW COLLATION;

```
nebula> SHOW COLLATION;
+-----+-----+
| Collation | Charset |
+-----+-----+
| "utf8_bin" | "utf8"  |
+-----+-----+
```

Collation

Charset

:January 13, 2023

SHOW CREATE SPACE

SHOW CREATE SPACE

CREATE SPACE

SHOW CREATE SPACE <space_name>;

```
nebula> SHOW CREATE SPACE basketballplayer;
+-----+
+-----+
| Space          | Create
Space           |
+-----+
+-----+
| "basketballplayer" | "CREATE SPACE `basketballplayer` (partition_num = 10, replica_factor = 1, charset = utf8, collate = utf8_bin, vid_type =
FIXED_STRING(32), atomic_edge = false)" |
+-----+
+-----+
```

:January 13, 2023

SHOW CREATE TAG/EDGE

SHOW CREATE TAG	Tag	Tag	CREATE TAG
SHOW CREATE EDGE	Edge type	Edge type	CREATE EDGE

```
SHOW CREATE {TAG <tag_name> | EDGE <edge_name>};
```

```
nebula> SHOW CREATE TAG player;
+-----+-----+
| Tag   | Create Tag
+-----+-----+
| "player" | "CREATE TAG `player` (
|           |   `name` string NULL,
|           |   `age` int64 NULL
|           | ) ttl_duration = 0, ttl_col = """
+-----+-----+

nebula> SHOW CREATE EDGE follow;
+-----+-----+
| Edge  | Create Edge
+-----+-----+
| "follow" | "CREATE EDGE `follow` (
|           |   `degree` int64 NULL
|           | ) ttl_duration = 0, ttl_col = """"
+-----+-----+
```

:January 13, 2023

SHOW HOSTS

SHOW HOSTS	leader	Graph Storage Meta
------------	--------	--------------------

```
SHOW HOSTS [GRAPH | STORAGE | META];
```



NebulaGraph

```
nebula> SHOW HOSTS;
+-----+-----+-----+-----+-----+-----+-----+
| Host | Port | HTTP port | Status | Leader count | Leader distribution | Partition distribution | Version |
+-----+-----+-----+-----+-----+-----+-----+
| "storaged0" | 9779 | 19779 | "ONLINE" | 8 | "docs:5, basketballplayer:3" | "docs:5, basketballplayer:3" | "3.3.0" |
| "storaged1" | 9779 | 19779 | "ONLINE" | 9 | "basketballplayer:4, docs:5" | "docs:5, basketballplayer:4" | "3.3.0" |
| "storaged2" | 9779 | 19779 | "ONLINE" | 8 | "basketballplayer:3, docs:5" | "docs:5, basketballplayer:3" | "3.3.0" |
+-----+-----+-----+-----+-----+-----+-----+

nebula> SHOW HOSTS GRAPH;
+-----+-----+-----+-----+-----+
| Host | Port | Status | Role | Git Info Sha | Version |
+-----+-----+-----+-----+-----+
| "graphd" | 9669 | "ONLINE" | "GRAPH" | "3ba41bd" | "3.3.0" |
| "graphd1" | 9669 | "ONLINE" | "GRAPH" | "3ba41bd" | "3.3.0" |
| "graphd2" | 9669 | "ONLINE" | "GRAPH" | "3ba41bd" | "3.3.0" |
+-----+-----+-----+-----+-----+-----

nebula> SHOW HOSTS STORAGE;
+-----+-----+-----+-----+-----+
| Host | Port | Status | Role | Git Info Sha | Version |
+-----+-----+-----+-----+-----+
| "storaged0" | 9779 | "ONLINE" | "STORAGE" | "3ba41bd" | "3.3.0" |
| "storaged1" | 9779 | "ONLINE" | "STORAGE" | "3ba41bd" | "3.3.0" |
| "storaged2" | 9779 | "ONLINE" | "STORAGE" | "3ba41bd" | "3.3.0" |
+-----+-----+-----+-----+-----+-----

nebula> SHOW HOSTS META;
+-----+-----+-----+-----+-----+
| Host | Port | Status | Role | Git Info Sha | Version |
+-----+-----+-----+-----+-----+
| "metad2" | 9559 | "ONLINE" | "META" | "3ba41bd" | "3.3.0" |
| "metad0" | 9559 | "ONLINE" | "META" | "3ba41bd" | "3.3.0" |
| "metad1" | 9559 | "ONLINE" | "META" | "3ba41bd" | "3.3.0" |
+-----+-----+-----+-----+-----+
```

:January 13, 2023

SHOW INDEX STATUS

```
SHOW INDEX STATUS
```

```
SHOW {TAG | EDGE} INDEX STATUS;
```

```
nebula> SHOW TAG INDEX STATUS;
+-----+-----+
| Name          | Index Status |
+-----+-----+
| "date1_index" | "FINISHED"   |
| "basketballplayer_all_tag_indexes" | "FINISHED"   |
| "any_shape_geo_index" | "FINISHED"   |
+-----+-----+

nebula> SHOW EDGE INDEX STATUS;
+-----+-----+
| Name          | Index Status |
+-----+-----+
| "follow_index" | "FINISHED"   |
+-----+-----+
```

- REBUILD NATIVE INDEX

:January 13, 2023

SHOW INDEXES

SHOW INDEXES Tag Edge type

SHOW {TAG | EDGE} INDEXES;

```
nebula> SHOW TAG INDEXES;
+-----+-----+-----+
| Index Name | By Tag | Columns |
+-----+-----+-----+
| "player_index_0" | "player" | []      |
| "player_index_1" | "player" | ["name"] |
+-----+-----+-----+

nebula> SHOW EDGE INDEXES;
+-----+-----+-----+
| Index Name | By Edge | Columns |
+-----+-----+-----+
| "follow_index" | "follow" | []      |
+-----+-----+-----+
```



NebulaGraph 2.0.1 SHOW TAG/EDGE INDEXES Names

:January 13, 2023

SHOW PARTS

SHOW PARTS

SHOW PARTS [<part_id>];

```
nebula> SHOW PARTS;
+-----+-----+-----+
| Partition ID | Leader | Peers | Losts |
+-----+-----+-----+
| 1 | "192.168.2.1:9779" | "192.168.2.1:9779" | "" |
| 2 | "192.168.2.2:9779" | "192.168.2.2:9779" | "" |
| 3 | "192.168.2.3:9779" | "192.168.2.3:9779" | "" |
| 4 | "192.168.2.1:9779" | "192.168.2.1:9779" | "" |
| 5 | "192.168.2.2:9779" | "192.168.2.2:9779" | "" |
| 6 | "192.168.2.3:9779" | "192.168.2.3:9779" | "" |
| 7 | "192.168.2.1:9779" | "192.168.2.1:9779" | "" |
| 8 | "192.168.2.2:9779" | "192.168.2.2:9779" | "" |
| 9 | "192.168.2.3:9779" | "192.168.2.3:9779" | "" |
| 10 | "192.168.2.1:9779" | "192.168.2.1:9779" | "" |
+-----+-----+-----+
```

```
nebula> SHOW PARTS 1;
+-----+-----+-----+
| Partition ID | Leader | Peers | Losts |
+-----+-----+-----+
| 1 | "192.168.2.1:9779" | "192.168.2.1:9779" | "" |
+-----+-----+-----+
```

Partition ID		ID		
Leader	Raft leader	IP		
Peers	leader	follower	IP	
Losts			IP	

:January 13, 2023

SHOW ROLES

SHOW ROLES

- GOD ADMIN GOD
- DBA USER GUEST
-

SHOW ROLES IN <space_name>;

```
nebula> SHOW ROLES in basketballplayer;
+-----+-----+
| Account | Role Type |
+-----+-----+
| "user1" | "ADMIN"   |
+-----+-----+
```

:January 13, 2023

SHOW SNAPSHOTS

SHOW SNAPSHOTS

GOD root SHOW SNAPSHOTS

SHOW SNAPSHOTS;

```
nebula> SHOW SNAPSHOTS;
+-----+-----+-----+
| Name      | Status | Hosts
+-----+-----+-----+
| "SNAPSHOT_2020_12_16_11_13_55" | "VALID" | "storaged0:9779, storaged1:9779, storaged2:9779" |
| "SNAPSHOT_2020_12_16_11_14_10" | "VALID" | "storaged0:9779, storaged1:9779, storaged2:9779" |
+-----+-----+-----+
```

:January 13, 2023

SHOW SPACES

SHOW SPACES

CREATE SPACE

SHOW SPACES;

```
nebula> SHOW SPACES;
+-----+
| Name      |
+-----+
| "docs"    |
| "basketballplayer" |
+-----+
```

:January 13, 2023

SHOW STATS

[SHOW STATS](#) [SUBMIT JOB STATS](#)

-
-
- Tag
- Edge type



[SHOW STATS](#) [SUBMIT JOB STATS](#) [TTL](#) [Compaction](#)

[SUBMIT JOB STATS](#)

[SUBMIT JOB STATS](#)



[SHOW STATS](#) [SUBMIT JOB STATS](#) [SUBMIT JOB STATS](#)

SHOW STATS;

```
#  
nebula> USE basketballplayer;  
  
#     SUBMIT JOB STATS  
nebula> SUBMIT JOB STATS;  
+-----+  
| New Job Id |  
+-----+  
| 98          |  
+-----+  
  
#  
nebula> SHOW JOB 98;  
+-----+-----+-----+-----+-----+-----+  
| Job Id( taskId ) | Command(Dest) | Status      | Start Time           | Stop Time            | Error Code |  
+-----+-----+-----+-----+-----+-----+  
| 98             | "STATS"       | "FINISHED"  | 2021-11-01T09:33:21.000000 | 2021-11-01T09:33:21.000000 | "SUCCEEDED" |  
| 0              | "storaged2"   | "FINISHED"  | 2021-11-01T09:33:21.000000 | 2021-11-01T09:33:21.000000 | "SUCCEEDED" |  
| 1              | "storaged0"   | "FINISHED"  | 2021-11-01T09:33:21.000000 | 2021-11-01T09:33:21.000000 | "SUCCEEDED" |  
| 2              | "storaged1"   | "FINISHED"  | 2021-11-01T09:33:21.000000 | 2021-11-01T09:33:21.000000 | "SUCCEEDED" |  
| "Total:3"      | "Succeeded:3" | "Failed:0"   | "In Progress:0"        | ""                | "  
+-----+-----+-----+-----+-----+-----+  
  
#  
nebula> SHOW STATS;  
+-----+-----+-----+  
| Type    | Name      | Count |  
+-----+-----+-----+  
| "Tag"   | "player"  | 51   |  
| "Tag"   | "team"    | 30   |  
| "Edge"  | "follow"  | 81   |  
| "Edge"  | "serve"   | 152  |  
| "Space" | "vertices" | 81   |  
| "Space" | "edges"   | 233  |  
+-----+-----+-----+
```

: January 13, 2023

SHOW TAGS/EDGES

SHOW TAGS	Tag
SHOW EDGES	Edge type

```
SHOW {TAGS | EDGES};
```

```
nebula> SHOW TAGS;
+-----+
| Name   |
+-----+
| "player" |
| "star"   |
| "team"   |
+-----+

nebula> SHOW EDGES;
+-----+
| Name   |
+-----+
| "follow" |
| "serve"  |
+-----+
```

:January 13, 2023

SHOW USERS

SHOW USERS

GOD root SHOW USERS

SHOW USERS;

```
nebula> SHOW USERS;
+-----+-----+
| Account | IP Whitelist |
+-----+-----+
| "root" | ""           |
| "user1" | ""           |
| "user2" | "192.168.10.10" |
+-----+-----+
```

:January 13, 2023

SHOW SESSIONS

NebulaGraph

- `exit` API release `nebula-graphd.conf` `session_idle_timeout_secs`
(TODO: coding)
- `SHOW SESSIONS` Graph
- `SHOW LOCAL SESSIONS` Graph Graph
- `SHOW SESSION <Session_Id>` Session ID

```
SHOW [LOCAL] SESSIONS;
SHOW SESSION <Session_Id>;
```

```
nebula> SHOW SESSIONS;
+-----+-----+-----+-----+-----+-----+
| SessionId | UserName | SpaceName | CreateTime | UpdateTime | GraphAddr | Timezone |
| ClientIp  |           |           |           |           |           |           |
+-----+-----+-----+-----+-----+-----+
| 1651220858102296 | "root" | "basketballplayer" | 2022-04-29T08:27:38.102296 | 2022-04-29T08:50:46.282921 | "127.0.0.1:9669" | 0 | "::ffff:
127.0.0.1" |
| 165119930300991 | "root" | "basketballplayer" | 2022-04-29T02:28:50.300991 | 2022-04-29T08:16:28.339038 | "127.0.0.1:9669" | 0 | "::ffff:
127.0.0.1" |
| 1651112899847744 | "root" | "basketballplayer" | 2022-04-28T02:28:19.847744 | 2022-04-28T08:17:44.470210 | "127.0.0.1:9669" | 0 | "::ffff:
127.0.0.1" |
| 1651041092662100 | "root" | "basketballplayer" | 2022-04-27T06:31:32.662100 | 2022-04-27T07:01:25.200978 | "127.0.0.1:9669" | 0 | "::ffff:
127.0.0.1" |
| 1650959429593975 | "root" | "basketballplayer" | 2022-04-26T07:50:29.593975 | 2022-04-26T07:51:47.184810 | "127.0.0.1:9669" | 0 | "::ffff:
127.0.0.1" |
| 1650958897679595 | "root" | "" | 2022-04-26T07:41:37.679595 | 2022-04-26T07:41:37.683802 | "127.0.0.1:9669" | 0 | "::ffff:
127.0.0.1" |
+-----+-----+-----+-----+-----+-----+
nebula> SHOW SESSION 1635254859271703;
+-----+-----+-----+-----+-----+
| SessionId | UserName | SpaceName | CreateTime | UpdateTime | GraphAddr | Timezone |
| ClientIp  |           |           |           |           |           |           |
+-----+-----+-----+-----+-----+
| 1651220858102296 | "root" | "basketballplayer" | 2022-04-29T08:27:38.102296 | 2022-04-29T08:50:54.254384 | "127.0.0.1:9669" | 0 | "::ffff:
127.0.0.1" |
+-----+-----+-----+-----+-----+
```

SessionId	ID
UserName	
SpaceName	" "
CreateTime	timezone_name
UpdateTime	timezone_name
GraphAddr	Graph
Timezone	
ClientIp	IP

: January 13, 2023

SHOW QUERIES

SHOW QUERIES

Session



- SHOW LOCAL QUERIES Session
 - SHOW QUERIES Meta Session session_reclaim_interval_secs Meta

SHOW [LOCAL] QUERIES;

SessionID	ID
ExecutionPlanID	ID
User	
Host	
StartTime	
DurationInUSec	
Status	
Query	

: January 13, 2023

SHOW META LEADER

```
SHOW META LEADER      Meta    leader  
Meta      Meta
```

```
SHOW META LEADER;
```

```
nebula> SHOW META LEADER;  
+-----+-----+  
| Meta Leader | secs from last heart beat |  
+-----+-----+  
| "127.0.0.1:9559" | 3 |  
+-----+-----+
```

Meta Leader	Meta	leader	leader	IP
secs from last heart beat				

:January 13, 2023

4.7

4.7.1 GROUP BY

GROUP BY

openCypher

nGQL

openCypher count()

```
nebula> MATCH (v:player)<-[:follow]-(:player) RETURN v.player.name AS Name, count(*) as cnt ORDER BY cnt DESC;
+-----+-----+
| Name | cnt |
+-----+-----+
| "Tim Duncan" | 10 |
| "LeBron James" | 6 |
| "Tony Parker" | 5 |
| "Chris Paul" | 4 |
| "Manu Ginobili" | 4 |
+-----+-----+
...
```

GROUP BY

GROUP BY | YIELD

| GROUP BY <var> YIELD <var>, <aggregation_function(var)>

aggregation_function() avg() sum() max() min() count() collect() std()

```
#      player100
nebula> GO FROM "player100" OVER follow BIDIRECT \
    YIELD properties($$).name as Name \
    | GROUP BY $-.Name \
    YIELD $-.Name as Player, count(*) AS Name_Count;
+-----+-----+
| Player | Name_Count |
+-----+-----+
| "Shaquille O'Neal" | 1 |
| "Tiago Splitter" | 1 |
| "Manu Ginobili" | 2 |
| "Boris Diaw" | 1 |
| "LaMarcus Aldridge" | 1 |
| "Tony Parker" | 2 |
| "Marco Belinelli" | 1 |
| "Dejounte Murray" | 1 |
| "Danny Green" | 1 |
| "Aron Baynes" | 1 |
+-----+-----+
```

```
#      degree
nebula> GO FROM "player100" OVER follow \
    YIELD src(edge) AS player, properties(edge).degree AS degree \
    | GROUP BY $-.player \
    YIELD sum($-.degree);
+-----+
| sum($-.degree) |
+-----+
| 190 |
+-----+
```

sum()

nGQL GROUP BY GROUP BY openCypher GROUP BY GROUP BY nGQL
 GROUP BY openCypher GROUP BY nGQL openCypher GROUP BY GROUP BY how-to-
make-group-by-in-a-cypher-query

34

```
nebula> LOOKUP ON player WHERE player.age > 34 YIELD id(vertex) AS v | \
  GO FROM $-v OVER serve YIELD serve.start_year AS start_year, serve.end_year AS end_year | \
  YIELD $-.start_year, $-.end_year, count(*) AS count | \
  ORDER BY $-.count DESC | LIMIT 5;
+-----+-----+-----+
| $-.start_year | $-.end_year | count |
+-----+-----+-----+
| 2018          | 2019          | 3    |
| 1998          | 2004          | 2    |
| 2012          | 2013          | 2    |
| 2007          | 2012          | 2    |
| 2010          | 2011          | 2    |
+-----+-----+-----+
```

:January 13, 2023

4.7.2 LIMIT

LIMIT LIMIT nGQL openCypher

- nGQL LIMIT LIMIT
- openCypher LIMIT SKIP



nGQL openCypher LIMIT ORDER BY

nGQL LIMIT

nGQL LIMIT GO

NGQL LIMIT

nGQL LIMIT SQL LIMIT LIMIT

```
... | LIMIT [<offset>,] <number_rows>;
```

offset	0	0
--------	---	---

number_rows

```
#              3
nebula> LOOKUP ON player YIELD id(vertex)|\
          LIMIT 3;
+-----+
| id(VERTEX)  |
+-----+
| "player100"  |
| "player101"  |
| "player102"  |
+-----+
#              2      3
nebula> GO FROM "player100" OVER follow REVERSELY \
          YIELD properties($$).name AS Friend, properties($$).age AS Age \
          | ORDER BY $-.Age, $-.Friend \
          | LIMIT 1, 3;
+-----+
| Friend      | Age |
+-----+-----+
| "Danny Green"  | 31  |
| "Aron Baynes"  | 32  |
| "Marco Belinelli"  | 32  |
+-----+-----+
```

GO LIMIT

GO LIMIT nGQL

```
<go_statement> LIMIT <limit_list>;
```

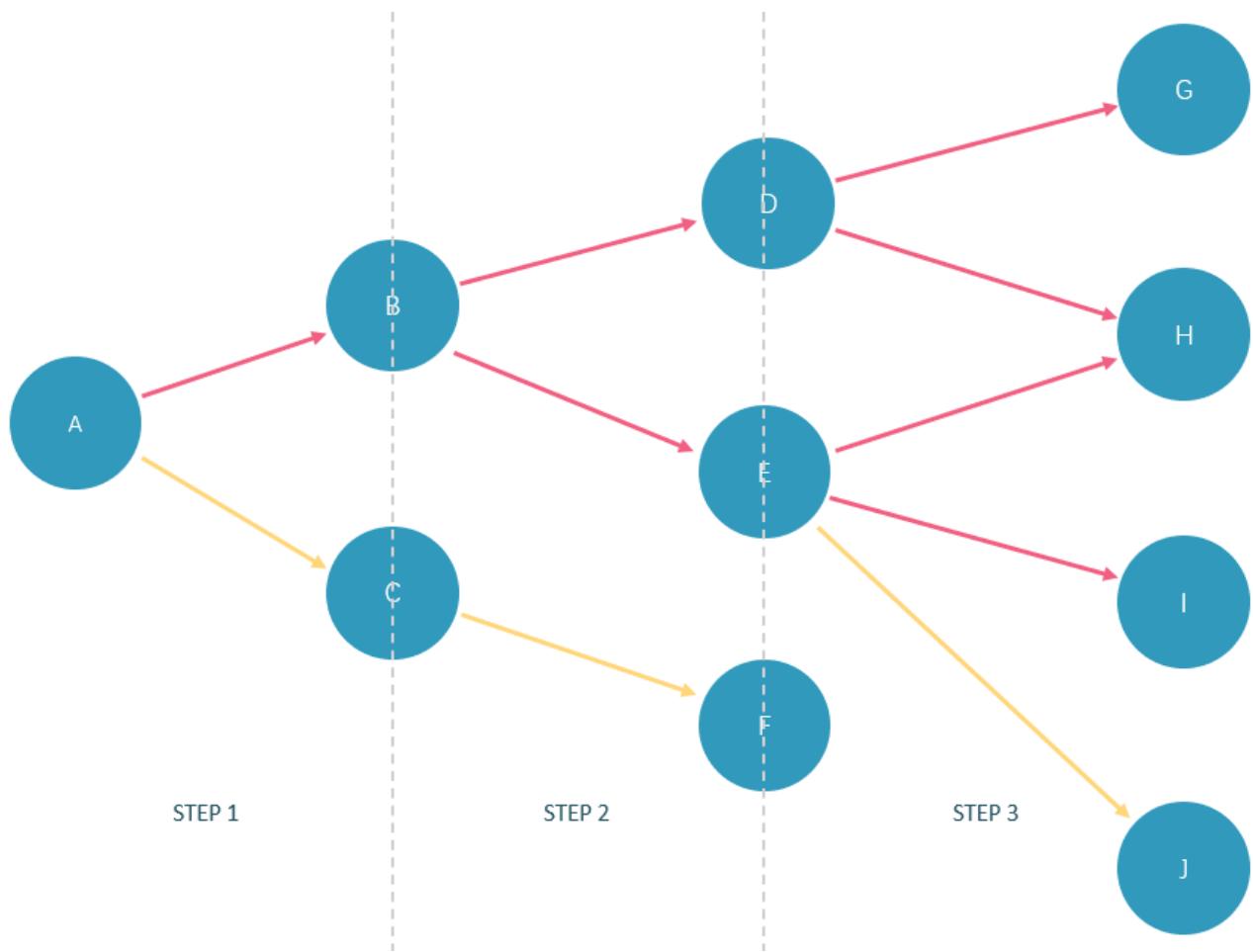
limit_list

GO STEPS

GO 1 TO 3 STEPS FROM "A" OVER * LIMIT <limit_list>

LIMIT

- limit_list 3 GO 1 TO 3 STEPS FROM "A" OVER * LIMIT [1,2,4]
 - LIMIT [1,2,4] 1 1 2 2 4 4
 - GO 1 TO 3 STEPS GO
- STEPS



basketballplayer

```
nebula> GO 3 STEPS FROM "player100" \
OVER * \
YIELD properties($$).name AS NAME, properties($$).age AS Age \
LIMIT [3,3,3];
+-----+-----+
| NAME | Age |
+-----+-----+
| "Spurs" | UNKNOWN_PROP |
| "Tony Parker" | 36 |
| "Manu Ginobili" | 41 |
+-----+-----+

nebula> GO 3 STEPS FROM "player102" OVER * BIDIRECT \
YIELD dst(edge) \
LIMIT [rand32(5),rand32(5),rand32(5)];
+-----+
| dst(EDGE) |
+-----+
| "player100" |
| "player100" |
+-----+
```

openCypher **LIMIT**

```
MATCH openCypher      LIMIT
```

```
... [SKIP <offset>] [LIMIT <number_rows>];
```

offset	0	0
--------	---	---

number_rows

offset number_rows



8/6 1

LIMIT

LIMIT

```
nebula> MATCH (v:player) RETURN v.player.name AS Name, v.player.age AS Age \
    ORDER BY Age LIMIT 5;
+-----+-----+
| Name | Age |
+-----+-----+
| "Luka Doncic" | 20 |
| "Ben Simmons" | 22 |
| "Kristaps Porzingis" | 23 |
| "Giannis Antetokounmpo" | 24 |
| "Kyle Anderson" | 25 |
+-----+-----+
```

SKIP

SKIP

```
nebula> MATCH (:player{name:"Tim Duncan"}) --> (v2) \
    RETURN v2.player.name AS Name, v2.player.age AS Age \
    ORDER BY Age DESC SKIP 1;
+-----+-----+
| Name | Age |
+-----+-----+
| "Manu Ginobili" | 41 |
| "Tony Parker" | 36 |
+-----+-----+
```



```
nebula> MATCH (:player{name:"Tim Duncan"}) --> (v2) \
    RETURN v2.player.name AS Name, v2.player.age AS Age \
    ORDER BY Age DESC SKIP 1+1;
+-----+-----+
| Name | Age |
+-----+-----+
| "Tony Parker" | 36 |
+-----+-----+
```

SKIP LIMIT

SKIP LIMIT

```
nebula> MATCH (:player{name:"Tim Duncan"}) --> (v2) \
    RETURN v2.player.name AS Name, v2.player.age AS Age \
    ORDER BY Age DESC SKIP 1 LIMIT 1;
+-----+-----+
| Name | Age |
+-----+-----+
| "Manu Ginobili" | 41 |
+-----+-----+
```

:January 13, 2023

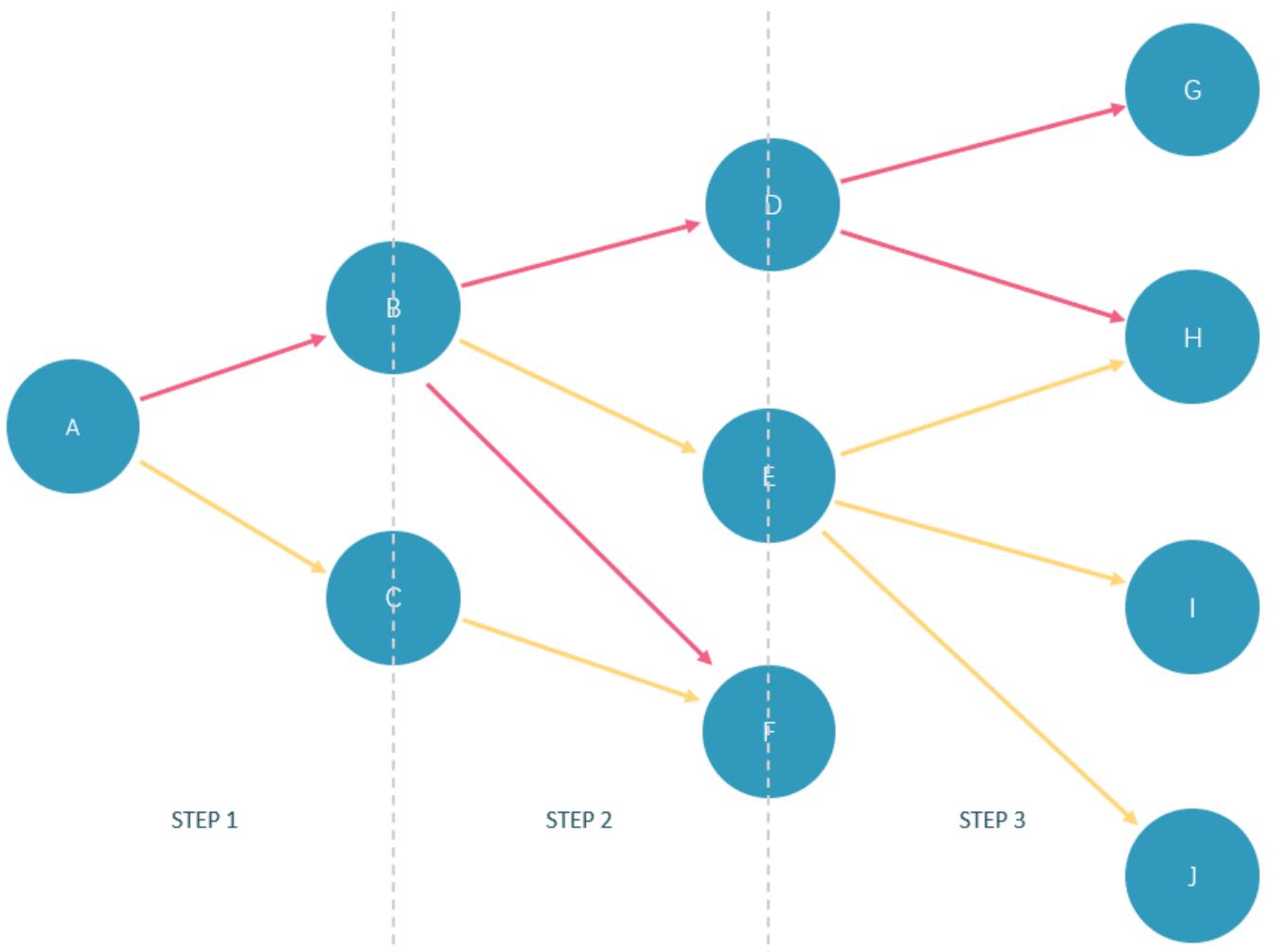
4.7.3 SAMPLE

SAMPLE

SAMPLE GO

```
<go_statement> SAMPLE <sample_list>;
```

sample_list	GO	STEPS	GO 1 TO 3 STEPS FROM "A" OVER * SAMPLE <sample_list>	SAMPLE
• sample_list 3			GO 1 TO 3 STEPS FROM "A" OVER * SAMPLE [1,2,4]	
• SAMPLE [1,2,4] 1	1	2	2	4
• GO 1 TO 3 STEPS			GO	GO
STEPS				GO 1 TO 3 STEPS GO 3



basketballplayer

```
nebula> GO 3 STEPS FROM "player100" \
OVER * \
YIELD properties($$).name AS NAME, properties($$).age AS Age \
SAMPLE [1,2,3];
+-----+
| NAME      | Age      |
+-----+-----+
| "Spurs"   | UNKNOWN_PROP |
| "Tony Parker" | 36    |
| "Manu Ginobili" | 41    |
+-----+
```

```
nebula> GO 1 TO 3 STEPS FROM "player100" \
OVER * \
YIELD properties($$).name AS NAME, properties($$).age AS Age \
SAMPLE [2,2,2];
+-----+-----+
| NAME | Age |
+-----+-----+
| "Manu Ginobili" | 41 |
| "Tony Parker" | 36 |
| "Tim Duncan" | 42 |
| "LaMarcus Aldridge" | 33 |
| "Tony Parker" | 36 |
| "Tim Duncan" | 42 |
+-----+-----+
```

:January 13, 2023

4.7.4 ORDER BY

ORDER BY

- nGQL YIELD | ORDER BY
- openCypher RETURN ORDER BY
- ASC :
• DESC :

nGQL

```
<YIELD clause>
ORDER BY <expression> [ASC | DESC] [, <expression> [ASC | DESC] ...];
```

Compatibility

nGQL ORDER BY \$-. 2.5.0

```
nebula> FETCH PROP ON player "player100", "player101", "player102", "player103" \
    YIELD properties(vertex).age AS age, properties(vertex).name AS name \
    | ORDER BY $-.age ASC, $-.name DESC;
+-----+
| age | name
+-----+
| 32 | "Rudy Gay"
| 33 | "LaMarcus Aldridge"
| 36 | "Tony Parker"
| 42 | "Tim Duncan"
+-----+
nebula> $var = GO FROM "player100" OVER follow \
    YIELD dst(edge) AS dst; \
    ORDER BY $var.dst DESC;
+-----+
| dst
+-----+
| "player125"
| "player101"
+-----+
```

OpenCypher

```
<RETURN clause>
ORDER BY <expression> [ASC | DESC] [, <expression> [ASC | DESC] ...];
```

```
nebula> MATCH (v:player) RETURN v.player.name AS Name, v.player.age AS Age \
    ORDER BY Name DESC;
+-----+
| Name      | Age |
+-----+
| "Yao Ming" | 38 |
| "Vince Carter" | 42 |
| "Tracy McGrady" | 39 |
| "Tony Parker" | 36 |
| "Tim Duncan" | 42 |
+-----+
...
#
nebula> MATCH (v:player) RETURN v.player.age AS Age, v.player.name AS Name \
    ORDER BY Age DESC, Name ASC;
+-----+
| Age | Name
+-----+
| 47 | "Shaquille O'Neal"
```

```
| 46 | "Grant Hill"      |
| 45 | "Jason Kidd"      |
| 45 | "Steve Nash"      |
+-----+
...
```

NULL

NULL NULL

```
nebula> MATCH (v:player{name:"Tim Duncan"}) --> (v2) \
    RETURN v2.player.name AS Name, v2.player.age AS Age \
    ORDER BY Age;
+-----+
| Name      | Age      |
+-----+
| "Tony Parker" | 36      |
| "Manu Ginobili" | 41      |
| __NULL__ | __NULL__ |
+-----+

nebula> MATCH (v:player{name:"Tim Duncan"}) --> (v2) \
    RETURN v2.player.name AS Name, v2.player.age AS Age \
    ORDER BY Age DESC;
+-----+
| Name      | Age      |
+-----+
| __NULL__ | __NULL__ |
| "Manu Ginobili" | 41      |
| "Tony Parker" | 36      |
+-----+
```

:January 13, 2023

4.7.5 RETURN

```
RETURN      nGQL      ,  
RETURN  
• RETURN      nGQL      openCypher      MATCH  UNWIND  
• RETURN
```

openCypher

```
nGQL      openCypher      nGQL      YIELD
```

```
RETURN      openCypher
```

```
•
```

```
MATCH (`_1`:player) \  
RETURN `_1`;
```

```
•
```

```
MATCH (v:player) \  
RETURN (v)-[e]->(v2);
```

- nGQL 1.x RETURN nGQL RETURN <var_ref> IF <var_ref> IS NOT NULL
- nGQL 2.0 RETURN nGQL

Map

```
RETURN      Map      Key
```

```
nebula> RETURN {age: 32, name: "Marco Belinelli"};  
+-----+  
| {age:32,name:"Marco Belinelli"} |  
+-----+  
| {age: 32, name: "Marco Belinelli"} |  
+-----+  
  
nebula> RETURN {zage: 32, name: "Marco Belinelli"};  
+-----+  
| {zage:32,name:"Marco Belinelli"} |  
+-----+  
| {name: "Marco Belinelli", zage: 32} |  
+-----+
```

```
RETURN {<vertex_name> | <edge_name>}
```

```
//  
nebula> MATCH (v:player) \  
RETURN v;  
+-----+  
| v |  
+-----+  
| ("player104" :player{age: 32, name: "Marco Belinelli"}) |  
| ("player107" :player{age: 32, name: "Aron Baynes"}) |  
| ("player116" :player{age: 34, name: "LeBron James"}) |  
| ("player120" :player{age: 29, name: "James Harden"}) |  
| ("player125" :player{age: 41, name: "Manu Ginobili"}) |  
+-----+  
...
```

```
//
nebula> MATCH (v:player)-[e]->() \
    RETURN e;
+-----+
| e |
+-----+
| [:follow "player104"->"player100" @0 {degree: 55}] |
| [:follow "player104"->"player101" @0 {degree: 50}] |
| [:follow "player104"->"player105" @0 {degree: 60}] |
| [:serve "player104"->"team200" @0 {end_year: 2009, start_year: 2007}] |
| [:serve "player104"->"team208" @0 {end_year: 2016, start_year: 2015}] |
+-----+
...
```

ID

id() ID

```
nebula> MATCH (v:player{name:"Tim Duncan"}) \
    RETURN id(v);
+-----+
| id(v) |
+-----+
| "player100" |
+-----+
```

Tag

labels() Tag

```
nebula> MATCH (v:player{name:"Tim Duncan"}) \
    RETURN labels(v);
+-----+
| labels(v) |
+-----+
| ["player"] |
+-----+
labels(v) N labels(v)[n-1] labels(v)[0]
```

```
nebula> MATCH (v:player{name:"Tim Duncan"}) \
    RETURN labels(v)[0];
+-----+
| labels(v)[0] |
+-----+
| "player" |
+-----+
```

{<vertex_name>|<edge_name>}.<property>

```
nebula> MATCH (v:player) \
    RETURN v.player.name, v.player.age \
    LIMIT 3;
+-----+-----+
| v.player.name | v.player.age |
+-----+-----+
| "Danny Green" | 31 |
| "Tiago Splitter" | 34 |
| "David West" | 38 |
+-----+-----+
```

properties()

```
nebula> MATCH p=(v:player{name:"Tim Duncan"})-[]->(v2) \
    RETURN properties(v2);
+-----+
| properties(v2) |
+-----+
| {name: "Spurs"} |
| {age: 36, name: "Tony Parker"} |
| {age: 41, name: "Manu Ginobili"} |
+-----+
```

Edge type

type() Edge type

```
nebula> MATCH p=(v:player{name:"Tim Duncan"})-[e]->() \
    RETURN DISTINCT type(e);
+-----+
| type(e) |
+-----+
| "serve" |
| "follow" |
+-----+
```

RETURN <path_name>

```
nebula> MATCH p=(v:player{name:"Tim Duncan"})-[*3]->() \
    RETURN p;
+-----+
| |
| p |
| +
| +-----+
| | <("player100" :player{age: 42, name: "Tim Duncan"})-[:follow@0 {degree: 95}]->("player101" :player{age: 36, name: "Tony Parker"})-[:follow@0 {degree: 90}]->("player102" :player{age: 33, name: "LaMarcus Aldridge"})-[:serve@0 {end_year: 2019, start_year: 2015}]->("team204" :team{name: "Spurs"})> |
| | <("player100" :player{age: 42, name: "Tim Duncan"})-[:follow@0 {degree: 95}]->("player101" :player{age: 36, name: "Tony Parker"})-[:follow@0 {degree: 90}]->("player102" :player{age: 33, name: "LaMarcus Aldridge"})-[:serve@0 {end_year: 2015, start_year: 2006}]->("team203" :team{name: "Trail Blazers"})> |
| | <("player100" :player{age: 42, name: "Tim Duncan"})-[:follow@0 {degree: 95}]->("player101" :player{age: 36, name: "Tony Parker"})-[:follow@0 {degree: 90}]->("player102" :player{age: 33, name: "LaMarcus Aldridge"})-[:follow@0 {degree: 75}]->("player101" :player{age: 36, name: "Tony Parker"})> |
| +-----+
| ...
+-----+
```

nodes()

```
nebula> MATCH p=(v:player{name:"Tim Duncan"})-[]->(v2) \
    RETURN nodes(p);
+-----+
| nodes(p) |
+-----+
| [{"player100" :player{age: 42, name: "Tim Duncan"}, "team204" :team{name: "Spurs"}}, |
| [{"player100" :player{age: 42, name: "Tim Duncan"}, "player101" :player{age: 36, name: "Tony Parker"}}, |
| [{"player100" :player{age: 42, name: "Tim Duncan"}, "player125" :player{age: 41, name: "Manu Ginobili"}}, |
+-----+
```

relationships()

```
nebula> MATCH p=(v:player{name:"Tim Duncan"})-[]->(v2) \
    RETURN relationships(p);
+-----+
| relationships(p) |
+-----+
| [[:serve "player100"-->"team204" @0 {end_year: 2016, start_year: 1997}]] |
| [[:follow "player100"-->"player101" @0 {degree: 95}]] |
| [[:follow "player100"-->"player125" @0 {degree: 95}]] |
+-----+
```

length()

```
nebula> MATCH p=(v:player{name:"Tim Duncan"})-[*..2]->(v2) \
    RETURN p AS Paths, length(p) AS Length;
+-----+
| Paths |
| Length |
+-----+
| <("player100" :player{age: 42, name: "Tim Duncan"})-[:serve@0 {end_year: 2016, start_year: 1997}]->("team204" :team{name: "Spurs"})> |
| <("player100" :player{age: 42, name: "Tim Duncan"})-[:follow@0 {degree: 95}]->("player101" :player{age: 36, name: "Tony Parker"})> |
| <("player100" :player{age: 42, name: "Tim Duncan"})-[:follow@0 {degree: 95}]->("player125" :player{age: 41, name: "Manu
```

```

Ginobili"})>                                | 1   |
| <("player100" :player{age: 42, name: "Tim Duncan"})-[:follow@0 {degree: 95}]->("player101" :player{age: 36, name: "Tony Parker"})-[:serve@0 {end_year: 2018,
start_year: 1999}]->("team204" :team{name: "Spurs"})>    | 2   |
| <("player100" :player{age: 42, name: "Tim Duncan"})-[:follow@0 {degree: 95}]->("player101" :player{age: 36, name: "Tony Parker"})-[:serve@0 {end_year: 2019,
start_year: 2018}]->("team215" :team{name: "Hornets"})>    | 2   |
| <("player100" :player{age: 42, name: "Tim Duncan"})-[:follow@0 {degree: 95}]->("player101" :player{age: 36, name: "Tony Parker"})-[:follow@0 {degree: 95}]->("player100" :player{age: 42, name: "Tim Duncan"})>    | 2   |
| <("player100" :player{age: 42, name: "Tim Duncan"})-[:follow@0 {degree: 95}]->("player101" :player{age: 36, name: "Tony Parker"})-[:follow@0 {degree: 90}]->("player102" :player{age: 33, name: "LaMarcus Aldridge"})> | 2   |
| <("player100" :player{age: 42, name: "Tim Duncan"})-[:follow@0 {degree: 95}]->("player101" :player{age: 36, name: "Tony Parker"})-[:follow@0 {degree: 95}]->("player125" :player{age: 41, name: "Manu Ginobili"})>    | 2   |
| <("player100" :player{age: 42, name: "Tim Duncan"})-[:follow@0 {degree: 95}]->("player125" :player{age: 41, name: "Manu Ginobili"})-[:serve@0 {end_year:
2018, start_year: 2002}]->("team204" :team{name: "Spurs"})> | 2   |
| <("player100" :player{age: 42, name: "Tim Duncan"})-[:follow@0 {degree: 95}]->("player125" :player{age: 41, name: "Manu Ginobili"})-[:follow@0 {degree:
90}]->("player100" :player{age: 42, name: "Tim Duncan"})> | 2   |
+-----+
+-----+

```

*

```

nebula> MATCH (v:player{name:"Tim Duncan"}) \
    RETURN *;
+-----+
| v
+-----+
| ("player100" :player{age: 42, name: "Tim Duncan"}) |
+-----+
nebula> MATCH (v:player{name:"Tim Duncan"})-[e]->(v2) \
    RETURN *;
+-----+
+-----+
| v           | e
v2          |
+-----+
+-----+
| ("player100" :player{age: 42, name: "Tim Duncan"}) | [:follow "player100"-->"player101" @0 {degree: 95}] | ("player101" :player{age: 36,
name: "Tony Parker"}) |
| ("player100" :player{age: 42, name: "Tim Duncan"}) | [:follow "player100"-->"player125" @0 {degree: 95}] | ("player125" :player{age: 41,
name: "Manu Ginobili"}) |
| ("player100" :player{age: 42, name: "Tim Duncan"}) | [:serve "player100"-->"team204" @0 {end_year: 2016, start_year: 1997}] | ("team204" :team{name:
"Spurs"}) |
+-----+
+-----+

```

AS <alias>

```

nebula> MATCH (v:player{name:"Tim Duncan"})-[:serve]->(v2) \
    RETURN v2.team.name AS Team;
+-----+
| Team   |
+-----+
| "Spurs" |
+-----+
nebula> RETURN "Amber" AS Name;
+-----+
| Name   |
+-----+
| "Amber" |
+-----+

```

NULL

```

nebula> MATCH (v:player{name:"Tim Duncan"})-[e]->(v2) \
    RETURN v2.player.name, type(e), v2.player.age;
+-----+-----+-----+
| v2.player.name | type(e) | v2.player.age |
+-----+-----+-----+
| "Manu Ginobili" | "follow" | 41      |
| __NULL__       | "serve"  | __NULL__ |
| "Tony Parker"  | "follow" | 36      |
+-----+-----+-----+

```

RETURN

```

nebula> MATCH (v:player{name:"Tony Parker"})-->(v2:player) \
    RETURN DISTINCT v2.player.name, "Hello"+" graphs!", v2.player.age > 35;
+-----+-----+-----+
| v2.player.name | ("Hello"+" graphs!") | (v2.player.age>35) |
+-----+-----+-----+
| "LaMarcus Aldridge" | "Hello graphs!" | false |
| "Tim Duncan" | "Hello graphs!" | true |
| "Manu Ginobili" | "Hello graphs!" | true |
+-----+-----+-----+

nebula> RETURN 1+1;
+-----+
| (1+1) |
+-----+
| 2 |
+-----+

nebula> RETURN 3 > 1;
+-----+
| (3>1) |
+-----+
| true |
+-----+

nebula> RETURN 1+1, rand32(1, 5);
+-----+
| (1+1) | rand32(1,5) |
+-----+
| 2 | 1 |
+-----+

```

DISTINCT

```

#      DISTINCT
nebula> MATCH (v:player{name:"Tony Parker"})--(v2:player) \
    RETURN v2.player.name, v2.player.age;
+-----+-----+
| v2.name | v2.age |
+-----+-----+
| "Tim Duncan" | 42 |
| "LaMarcus Aldridge" | 33 |
| "Marco Belinelli" | 32 |
| "Boris Diaw" | 36 |
| "Dejounte Murray" | 29 |
| "Tim Duncan" | 42 |
| "LaMarcus Aldridge" | 33 |
| "Manu Ginobili" | 41 |
+-----+-----+

#      DISTINCT
nebula> MATCH (v:player{name:"Tony Parker"})--(v2:player) \
    RETURN DISTINCT v2.player.name, v2.player.age;
+-----+-----+
| v2.name | v2.age |
+-----+-----+
| "Tim Duncan" | 42 |
| "LaMarcus Aldridge" | 33 |
| "Marco Belinelli" | 32 |
| "Boris Diaw" | 36 |
| "Dejounte Murray" | 29 |
| "Manu Ginobili" | 41 |
+-----+-----+

```

:January 13, 2023

4.7.6 TTL

TTL Time To Live

openCypher

nGQL

- TTL Schema
- TTL INDEX
- Tag/Edge type INDEX TTL Tag TTL
- TTL INDEX

- Tag
- Tag Tag

Edge type

NebulaGraph

Compaction

Note

TTL Compaction

TTL

nGQL TTL

ttl_col	int timestamp
ttl_duration	64 ttl_duration 0

Note

NULL TTL TTL

TTL

TAG EDGE TYPE

Tag Edge type ALTER Tag Edge type

```
#     Tag
nebula> CREATE TAG IF NOT EXISTS t1 (a timestamp);

# ALTER   Tag    TTL
nebula> ALTER TAG t1 TTL_COL = "a", TTL_DURATION = 5;

#           5
nebula> INSERT VERTEX t1(a) VALUES "101":(now());
```

TAG EDGE TYPE

Tag Edge type TTL CREATE TAG CREATE EDGE

```
#     Tag      TTL
nebula> CREATE TAG IF NOT EXISTS t2(a int, b int, c string) TTL_DURATION= 100, TTL_COL = "a";

#           1648197238 1648197138 + 100
nebula> INSERT VERTEX t2(a, b, c) VALUES "102":(1648197138, 30, "Hello");
```

•

```
nebula> ALTER TAG t1 DROP (a);
```

• ttl_col

```
nebula> ALTER TAG t1 TTL_COL = "";
```

• ttl_duration 0 TTL Schema

```
nebula> ALTER TAG t1 TTL_DURATION = 0;
```

:January 13, 2023

4.7.7 WHERE

WHERE

WHERE

- nGQL GO LOOKUP
- openCypher MATCH WITH

openCypher

Rank	nGQL	openCypher	Rank	rank()	MATCH (:player)-[e:follow]->() RETURN rank(e);
------	------	------------	------	--------	--



\$\$ \$^

WHERE NOT AND OR XOR

```
nebula> MATCH (v:player) \
  WHERE v.player.name == "Tim Duncan" \
  XOR (v.player.age < 30 AND v.player.name == "Yao Ming") \
  OR NOT (v.player.name == "Yao Ming" OR v.player.name == "Tim Duncan") \
  RETURN v.player.name, v.player.age;
+-----+-----+
| v.player.name | v.player.age |
+-----+-----+
| "Danny Green" | 31      |
| "Tiago Splitter" | 34      |
| "David West" | 38      |
...
...
```

```
nebula> GO FROM "player100" \
  OVER follow \
  WHERE properties(edge).degree > 90 \
  OR properties($$).age != 33 \
  AND properties($$).name != "Tony Parker" \
  YIELD properties($$);
+-----+
| properties($$) |
+-----+
| {age: 41, name: "Manu Ginobili"} |
+-----+
```

WHERE

- ```
nebula> MATCH (v:player)-[e]-(v2) \
 WHERE v2.player.age < 25 \
 RETURN v2.player.name, v2.player.age;
+-----+-----+
| v2.player.name | v2.player.age |
+-----+-----+
"Ben Simmons"	22
"Luka Doncic"	20
"Kristaps Porzingis"	23
+-----+-----+
```
- ```
nebula> GO FROM "player100" OVER follow \
    WHERE $^.player.age >= 42 \
    YIELD dst(edge);
+-----+
| dst(EDGE) |
+-----+
| "player101" |
| "player125" |
+-----+
```
- ```
nebula> MATCH (v:player)-[e]->() \
 WHERE e.start_year < 2000 \
 RETURN DISTINCT v.player.name, v.player.age;
+-----+-----+
| v.player.name | v.player.age |
+-----+-----+
"Tony Parker"	36
"Tim Duncan"	42
"Grant Hill"	46
...
+-----+
```
- ```
nebula> GO FROM "player100" OVER follow \
    WHERE follow.degree > 90 \
    YIELD dst(edge);
+-----+
| dst(EDGE) |
+-----+
| "player101" |
| "player125" |
+-----+
```
- ```
nebula> MATCH (v:player) \
 WHERE v[tolower("AGE")] < 21 \
 RETURN v.player.name, v.player.age;
+-----+-----+
| v.name | v.age |
+-----+-----+
| "Luka Doncic" | 20 |
+-----+-----+
```
- ```
nebula> MATCH (v:player) \
    WHERE exists(v.player.age) \
    RETURN v.player.name, v.player.age;
+-----+-----+
| v.player.name | v.player.age |
+-----+-----+
| "Danny Green" | 31 |
| "Tiago Splitter" | 34 |
| "David West" | 38 |
...
+-----+
```

RANK

nGQL	rank	WHERE	rank

```
#  
nebula> CREATE SPACE IF NOT EXISTS test (vid_type=FIXED_STRING(30));  
nebula> USE test;  
nebula> CREATE EDGE IF NOT EXISTS e1(p1 int);
```

```

nebula> CREATE TAG IF NOT EXISTS person(p1 int);
nebula> INSERT VERTEX person(p1) VALUES "1":(1);
nebula> INSERT VERTEX person(p1) VALUES "2":(2);
nebula> INSERT EDGE e1(p1) VALUES "1"->"2">@0:(10);
nebula> INSERT EDGE e1(p1) VALUES "1"->"2"@1:(11);
nebula> INSERT EDGE e1(p1) VALUES "1"->"2">@2:(12);
nebula> INSERT EDGE e1(p1) VALUES "1"->"2">@3:(13);
nebula> INSERT EDGE e1(p1) VALUES "1"->"2">@4:(14);
nebula> INSERT EDGE e1(p1) VALUES "1"->"2">@5:(15);
nebula> INSERT EDGE e1(p1) VALUES "1"->"2">@6:(16);

#      rank      rank      2
nebula> GO FROM "1" \
    OVER e1 \
    WHERE rank(edge) > 2 \
    YIELD src(edge), dst(edge), rank(edge) AS Rank, properties(edge).p1 | \
        ORDER BY $-.Rank DESC;
+-----+-----+-----+-----+
| src(EDGE) | dst(EDGE) | Rank | properties(EDGE).p1 |
+-----+-----+-----+-----+
| "1"      | "2"       | 6   | 16          |
| "1"      | "2"       | 5   | 15          |
| "1"      | "2"       | 4   | 14          |
| "1"      | "2"       | 3   | 13          |
+-----+-----+-----+-----+

```

WHERE STARTS WITH ENDS WITH CONTAINS

STARTS WITH

STARTS WITH

```
#          T      player
nebula> MATCH (v:player) \
      WHERE v.player.name STARTS WITH "T" \
      RETURN v.player.name, v.player.age;
+-----+-----+
| v.player.name | v.player.age |
+-----+-----+
| "Tony Parker" | 36   |
| "Tiago Splitter" | 34   |
| "Tim Duncan" | 42   |
| "Tracy McGrady" | 39   |
+-----+-----+
```

t STARTS WITH "t"

```
nebula> MATCH (v:player) \
      WHERE v.player.name STARTS WITH "t" \
      RETURN v.player.name, v.player.age;
+-----+-----+
| v.player.name | v.player.age |
+-----+-----+
+-----+-----+
Empty set (time spent 5080/6474 us)
```

ENDS WITH

ENDS WITH

```
nebula> MATCH (v:player) \
    WHERE v.player.name ENDS WITH "r" \
    RETURN v.player.name, v.player.age;
```

v.player.name	v.player.age
"Tony Parker"	36
"Tiago Splitter"	34
"Vince Carter"	42

CONTAINS

CONTAINS

```
nebula> MATCH (v:player) \
    WHERE v.player.name CONTAINS "Pa" \
    RETURN v.player.name, v.player.age;
```

```
+-----+
| "Paul George" | 28      |
| "Tony Parker" | 36      |
| "Paul Gasol"  | 38      |
| "Chris Paul"  | 33      |
+-----+
```

NOT

NOT

```
nebula> MATCH (v:player) \
    WHERE NOT v.player.name ENDS WITH "R" \
    RETURN v.player.name, v.player.age;
+-----+
| v.player.name | v.player.age |
+-----+
| "Danny Green" | 31      |
| "Tiago Splitter" | 34      |
| "David West" | 38      |
| "Russell Westbrook" | 30      |
...
```

IN

```
nebula> MATCH (v:player) \
    WHERE v.player.age IN range(20,25) \
    RETURN v.player.name, v.player.age;
+-----+
| v.player.name | v.player.age |
+-----+
| "Ben Simmons" | 22      |
| "Giannis Antetokounmpo" | 24      |
| "Kyle Anderson" | 25      |
| "Joel Embiid" | 25      |
| "Kristaps Porzingis" | 23      |
| "Luka Doncic" | 20      |
+-----+

nebula> LOOKUP ON player \
    WHERE player.age IN [25,28] \
    YIELD properties(vertex).name, properties(vertex).age;
+-----+
| properties(VERTEX).name | properties(VERTEX).age |
+-----+
| "Kyle Anderson" | 25      |
| "Damian Lillard" | 28      |
| "Joel Embiid" | 25      |
| "Paul George" | 28      |
| "Ricky Rubio" | 28      |
+-----+
```

NOT

```
nebula> MATCH (v:player) \
    WHERE v.player.age NOT IN range(20,25) \
    RETURN v.player.name AS Name, v.player.age AS Age \
    ORDER BY Age;
+-----+
| Name      | Age   |
+-----+
| "Kyrie Irving" | 26 |
| "Cory Joseph" | 27 |
| "Damian Lillard" | 28 |
| "Paul George" | 28 |
| "Ricky Rubio" | 28 |
...
```

:January 13, 2023

4.7.8 YIELD

`YIELD` nGQL

`YIELD`

- `YIELD` nGQL `GO` `FETCH` `LOOKUP` `YIELD`
- `YIELD`

openCypher

nGQL openCypher `RETURN`

`YIELD` nGQL openCypher

- `openCypher` `YIELD` `CALL[...YIELD]`

 Note

nGQL `CALL[...YIELD]`

- nGQL `YIELD` openCypher `RETURN`

 Note

`$$` `$-`

YIELD

`YIELD [DISTINCT] <col> [AS <alias>] [, <col> [AS <alias>] ...];`

`DISTINCT`

<code>col</code>	<code>col</code>
<code>alias</code>	<code>col</code>
	<code>AS</code>

`YIELD`

- `GO` `YIELD`

```
nebula> GO FROM "player100" OVER follow \
    YIELD properties($$).name AS Friend, properties($$).age AS Age;
+-----+---+
| Friend | Age |
+-----+---+
| "Tony Parker" | 36 |
```

```
| "Manu Ginobili" | 41 |
+-----+-----+
```

- **FETCH** **YIELD**

```
nebula> FETCH PROP ON player "player100" \
          YIELD properties(vertex).name;
+-----+
| properties(VERTEX).name |
+-----+
| "Tim Duncan"           |
+-----+
```

- **LOOKUP** **YIELD**

```
nebula> LOOKUP ON player WHERE player.name == "Tony Parker" \
          YIELD properties(vertex).name, properties(vertex).age;
+-----+-----+
| properties(VERTEX).name | properties(VERTEX).age |
+-----+-----+
| "Tony Parker"          | 36                  |
+-----+-----+
```

YIELD

```
YIELD [DISTINCT] <col> [AS <alias>] [, <col> [AS <alias>] ...]
[WHERE <conditions>];
```

DISTINCT

col	col	
alias	col	AS
conditions	WHERE	WHERE

YIELD

YIELD

```
#   player100      player
nebula> GO FROM "player100" OVER follow \
          YIELD dst(edge) AS ID \
          | FETCH PROP ON player $-.ID \
          YIELD properties(vertex).age AS Age \
          | YIELD AVG($-.Age) as Avg_age, count(*)as Num_friends;
+-----+
| Avg_age | Num_friends |
+-----+-----+
| 38.5    | 2            |
+-----+-----+
```

```
#   player101      player      degree  90  player
nebula> $var1 = GO FROM "player101" OVER follow \
          YIELD properties(edge).degree AS Degree, dst(edge) as ID; \
          YIELD $var1.ID AS ID WHERE $var1.Degree > 90;
+-----+
| ID      |
+-----+
| "player100" |
| "player125" |
+-----+
```

YIELD

YIELD

```
nebula> YIELD rand32(1, 6);
+-----+
| rand32(1,6) |
+-----+
| 3           |
+-----+
```

```
+-----+
nebula> YIELD "Hel" + "\tlo" AS string1, ", World!" AS string2;
+-----+
| string1      | string2      |
+-----+-----+
| "Hel      lo" | ", World!" |
+-----+-----+

nebula> YIELD hash("Tim") % 100;
+-----+
| (hash("Tim")%100) |
+-----+
| 42               |
+-----+

nebula> YIELD \
    CASE 2+3 \
    WHEN 4 THEN 0 \
    WHEN 5 THEN 1 \
    ELSE -1 \
    END \
    AS result;
+-----+
| result |
+-----+
| 1      |
+-----+
```

:January 13, 2023

4.7.9 WITH

WITH

openCypher

openCypher



openCypher

nGQL WITH

WITH

1

- 1.
2. nodes()
- 3.
- 4.

```
nebula> MATCH p=(v:player{name:"Tim Duncan"})--() \
    WITH nodes(p) AS n \
    UNWIND n AS n1 \
    RETURN DISTINCT n1;
+-----+
| n1 |
+-----+
| {"player100":player{age: 42, name: "Tim Duncan"}}, \
| {"player101":player{age: 36, name: "Tony Parker"}}, \
| {"team204":team{name: "Spurs"}}, \
| {"player102":player{age: 33, name: "LaMarcus Aldridge"}}, \
| {"player125":player{age: 41, name: "Manu Ginobili"}}, \
| {"player104":player{age: 32, name: "Marco Belinelli"}}, \
| {"player144":player{age: 47, name: "Shaquille O'Neal"}}, \
| {"player105":player{age: 31, name: "Danny Green"}}, \
| {"player113":player{age: 29, name: "Dejounte Murray"}}, \
| {"player107":player{age: 32, name: "Aron Baynes"}}, \
| {"player109":player{age: 34, name: "Tiago Splitter"}}, \
| {"player108":player{age: 36, name: "Boris Diaw"}}, \
+-----+
```

2

1. ID player100
2. labels() Tag
- 3.
- 4.

```
nebula> MATCH (v) \
    WHERE id(v)="player100" \
    WITH labels(v) AS tags_unf \
    UNWIND tags_unf AS tags_f \
    RETURN tags_f;
+-----+
| tags_f |
+-----+
| "player" |
+-----+
```

WITH

```
nebula> MATCH (v:player)-->(v2:player) \
    WITH DISTINCT v2 AS v2, v2.player.age AS Age \
    ORDER BY Age \
    WHERE Age<25 \
    RETURN v2.player.name AS Name, Age;
+-----+-----+
| Name | Age |
+-----+-----+
| "Luka Doncic" | 20 |
| "Ben Simmons" | 22 |
| "Kristaps Porzingis" | 23 |
+-----+-----+
```

collect()

```
collect()           WITH
```

```
nebula> MATCH (v:player) \
    WITH v.player.name AS Name \
    ORDER BY Name DESC \
    LIMIT 3 \
    RETURN collect(Name);
+-----+
| collect(Name) |
+-----+
| ["Yao Ming", "Vince Carter", "Tracy McGrady"] |
+-----+
```

RETURN

```
WITH           RETURN
```

```
nebula> WITH [1, 2, 3] AS `list` RETURN 3 IN `list` AS r;
+-----+
| r   |
+-----+
| true |
+-----+
```



```
nebula> WITH 4 AS one, 3 AS two RETURN one > two AS result;
+-----+
| result |
+-----+
| true   |
+-----+
```

:January 13, 2023

4.7.10 UNWIND

UNWIND

UNWIND

UNWIND

```
UNWIND <list> AS <alias> <RETURN clause>;
```

-

```
nebula> UNWIND [1,2,3] AS n RETURN n;
+---+
| n |
+---+
| 1 |
| 2 |
| 3 |
+---+
```

UNWIND

- nGQL UNWIND



Note

nGQL UNWIND | \$- UNWIND | \$-

```
<statement> | UNWIND $-.<var> AS <alias> <|> <clause>;
```

- openCypher UNWIND

```
<statement> UNWIND <list> AS <alias> <RETURN clause>
```

- UNWIND WITH DISTINCT



Note

nGQL WITH DISTINCT

```
//      `'[1,1,2,2,3,3]`'
nebula> WITH [1,1,2,2,3,3] AS n \
    UNWIND n AS r \
    WITH DISTINCT r AS r \
    ORDER BY r \
    RETURN collect(r);
+-----+
| collect(r) |
+-----+
```

```
| [1, 2, 3] |
```

- MATCH UNWIND

```
//
nebula> MATCH p=(v:player{name:"Tim Duncan"})--(v2) \
    WITH nodes(p) AS n \
    UNWIND n AS r \
    WITH DISTINCT r AS r \
    RETURN collect(r);
+-----+
| collect(r)
+-----+
| [{"player100": {"player": {"age": 42, "name": "Tim Duncan"}, "player101": {"player": {"age": 36, "name": "Tony Parker"}}, "team204": {"team": {"name": "Spurs"}}, "player102": {"player": {"age": 33, "name": "LaMarcus Aldridge"}}, "player125": {"player": {"age": 41, "name": "Manu Ginobili"}}, "player104": {"player": {"age": 32, "name": "Marco Belinelli"}}, "player144": {"player": {"age": 47, "name": "Shaqoule O'Neal"}}, "player105": {"player": {"age": 31, "name": "Danny Green"}}, "player113": {"player": {"age": 29, "name": "Dejounte Murray"}}, "player107": {"player": {"age": 32, "name": "Aron Baynes"}}, "player109": {"player": {"age": 34, "name": "Tiago Splitter"}}, "player108": {"player": {"age": 36, "name": "Boris Diaw"}}}]
+-----+
```

- GO UNWIND

```
//
nebula> YIELD ['player101', 'player100'] AS a | UNWIND $-.a AS b | GO FROM $-.b OVER follow YIELD edge AS e;
+-----+
| e
+-----+
| [:follow "player101" -> "player100" @0 {degree: 95}] |
| [:follow "player101" -> "player102" @0 {degree: 90}] |
| [:follow "player101" -> "player125" @0 {degree: 95}] |
| [:follow "player100" -> "player101" @0 {degree: 95}] |
| [:follow "player100" -> "player125" @0 {degree: 95}] |
+-----+
```

- LOOKUP UNWIND

```
//
nebula> LOOKUP ON player \
    WHERE player.age > 46 \
    YIELD DISTINCT keys(vertex) as p | UNWIND $-.p as a | YIELD $-.a AS a;
+-----+
| a
+-----+
| "age"
| "name"
+-----+
```

- FETCH UNWIND

```
// player101      Tag
nebula> CREATE TAG hero(like string, height int);
INSERT VERTEX hero(like, height) VALUES "player101":("deep", 182);
FETCH PROP ON * "player101" \
YIELD tags(vertex) as t | UNWIND $-.t as a | YIELD $-.a AS a;
+-----+
| a
+-----+
| "hero"
| "player"
+-----+
```

- GET SUBGRAPH UNWIND

```
//    player100  0-2  serve
nebula> GET SUBGRAPH 2 STEPS FROM "player100" BOTH serve \
    YIELD edges as e | UNWIND $-.e as a | YIELD $-.a AS a;
+-----+
| a
+-----+
| [:serve "player100"->"team204" @0 {}]
| [:serve "player101"->"team204" @0 {}]
| [:serve "player102"->"team204" @0 {}]
| [:serve "player103"->"team204" @0 {}]
| [:serve "player105"->"team204" @0 {}]
| [:serve "player106"->"team204" @0 {}]
| [:serve "player107"->"team204" @0 {}]
| [:serve "player108"->"team204" @0 {}]
| [:serve "player109"->"team204" @0 {}]
| [:serve "player110"->"team204" @0 {}]
| [:serve "player111"->"team204" @0 {}]
| [:serve "player112"->"team204" @0 {}]
| [:serve "player113"->"team204" @0 {}]
| [:serve "player114"->"team204" @0 {}]
| [:serve "player125"->"team204" @0 {}]
| [:serve "player138"->"team204" @0 {}]
| [:serve "player104"->"team204" @20132015 {}]
| [:serve "player104"->"team204" @20182019 {}]
+-----+
```

- FIND PATH UNWIND

```
//    player101  team204  serve
nebula> FIND SHORTEST PATH FROM "player101" TO "team204" OVER serve \
    YIELD path as p | YIELD nodes($-.p) AS nodes | UNWIND $-.nodes AS a | YIELD $-.a AS a;
+-----+
| a
+-----+
| ("player101")
| ("team204")
+-----+
```

:January 13, 2023

4.8

4.8.1 CREATE SPACE

NebulaGraph MySQL database CREATE SPACE Schema

God CREATE SPACE

```
CREATE SPACE [IF NOT EXISTS] <graph_space_name> (
    [partition_num = <partition_number>],
    [replica_factor = <replica_number>],
    vid_type = {FIXED_STRING(<N>) | INT[64]}
)
[COMMENT = '<comment>'];
```

IF NOT EXISTS

<graph_space_name>	NebulaGraph	1~4	UTF-8
--------------------	-------------	-----	-------

partition_num	20	HDD	2	3	60	100
---------------	----	-----	---	---	----	-----

replica_factor	3	1		1		
----------------	---	---	--	---	--	--

vid_type	ID FIXED_STRING(<N>)	INT64	INT	INT64 N	UTF-8	N 12	vid_type 4
----------	-------------------------	-------	-----	------------	-------	------	------------

INT64

COMMENT	256
---------	-----

Caution

- 1 BALANCE NebulaGraph

- VID

- NebulaGraph 1.x VID INT64 NebulaGraph 2.x VID INT64 FIXED_STRING(<N>) VID INSERT
VID Wrong vertex id type: 1001

- VID N The VID must be a 64-bit integer or a string fitting space vertex id length limit.

- Host not enough! Storage Host replica_factor SHOW HOSTS

- Storage Host replica_factor Storage Host

- Storage Host ADD HOSTS Console SHOW HOSTS Storage Host ADD HOSTS
Online Storage Host

- Storage Host Online



2.5.0 2.x vid_type FIXED_STRING(8)



graph_space_name, partition_num, replica_factor, vid_type, comment [DROP SPACE](#) [CREATE SPACE](#)

```
CREATE SPACE <new_graph_space_name> AS <old_graph_space_name>;
```

<new_graph_space_name>	1~4 UTF-8
`	<old_graph_space_name>
Edge type	Schema
<old_graph_space_name>	Tag

```
#      VID
nebula> CREATE SPACE IF NOT EXISTS my_space_1 (vid_type=FIXED_STRING(30));

#      VID
nebula> CREATE SPACE IF NOT EXISTS my_space_2 (partition_num=15, replica_factor=1, vid_type=FIXED_STRING(30));

#      VID
nebula> CREATE SPACE IF NOT EXISTS my_space_3 (partition_num=15, replica_factor=1, vid_type=FIXED_STRING(30)) comment="      ";

#
nebula> CREATE SPACE IF NOT EXISTS my_space_4 as my_space_3;
nebula> SHOW CREATE SPACE my_space_4;
+-----+
+-----+
| Space      | Create
Space
|
+-----+
+-----+
| "my_space_4" | "CREATE SPACE `my_space_4` (partition_num = 15, replica_factor = 1, charset = utf8, collate = utf8_bin, vid_type = FIXED_STRING(30),
atomic_edge = false) ON default_zone_127.0.0.1_9779 comment = '      '" |
+-----+
+-----+
+
```



2 20 heartbeat_interval_secs <5

```
nebula> SHOW HOSTS;
+-----+-----+-----+-----+-----+-----+-----+
| Host    | Port | HTTP port | Status   | Leader count | Leader distribution          | Partition distribution | Version |
+-----+-----+-----+-----+-----+-----+-----+
| "storaged0" | 9779 | 19779    | "ONLINE" | 8           | "basketballplayer:3, test:5" | "basketballplayer:10, test:10" | "3.1.0" |
| "storaged1" | 9779 | 19779    | "ONLINE" | 9           | "basketballplayer:4, test:5"  | "basketballplayer:10, test:10" | "3.1.0" |
| "storaged2" | 9779 | 19779    | "ONLINE" | 3           | "basketballplayer:3"         | "basketballplayer:10, test:10" | "3.1.0" |
+-----+-----+-----+-----+-----+-----+-----+
```

```
nebula> BALANCE LEADER;
nebula> SHOW HOSTS;
+-----+-----+-----+-----+-----+-----+-----+
| Host | Port | HTTP port | Status | Leader count | Leader distribution | Partition distribution | Version |
+-----+-----+-----+-----+-----+-----+-----+
| "storaged0" | 9779 | 19779 | "ONLINE" | 7 | "basketballplayer:3, test:4" | "basketballplayer:10, test:10" | "3.1.0" |
| "storaged1" | 9779 | 19779 | "ONLINE" | 7 | "basketballplayer:4, test:3" | "basketballplayer:10, test:10" | "3.1.0" |
| "storaged2" | 9779 | 19779 | "ONLINE" | 6 | "basketballplayer:3, test:3" | "basketballplayer:10, test:10" | "3.1.0" |
+-----+-----+-----+-----+-----+-----+-----+
```

:January 13, 2023

4.8.2 USE

USE

USE

```
USE <graph_space_name>;
```

```
#  
nebula> CREATE SPACE IF NOT EXISTS space1 (vid_type=FIXED_STRING(30));  
nebula> CREATE SPACE IF NOT EXISTS space2 (vid_type=FIXED_STRING(30));  
  
#      space1  
nebula> USE space1;  
  
#      space2      space1  
nebula> USE space2;
```



Fabric Cypher NebulaGraph

USE

Fabric Cypher

(USE +

:January 13, 2023

4.8.3 SHOW SPACES

SHOW SPACES NebulaGraph

```
SHOW SPACES;
```

```
nebula> SHOW SPACES;
+-----+
| Name      |
+-----+
| "cba"     |
| "basketballplayer" |
+-----+
```

CREATE SPACE

:January 13, 2023

4.8.4 DESCRIBE SPACE

DESCRIBE SPACE

DESC DESCRIPTIVE

```
DESC[RIBE] SPACE <graph_space_name>;
```

```
nebula> DESCRIBE SPACE basketballplayer;
+-----+-----+-----+-----+-----+
| ID | Name          | Partition Number | Replica Factor | Charset | Collate      | Vid Type       | Comment |
+-----+-----+-----+-----+-----+
| 1  | "basketballplayer" | 10            | 1              | "utf8"   | "utf8_bin"    | "FIXED_STRING(32)" |           |
+-----+-----+-----+-----+-----+
```

:January 13, 2023

4.8.5 CLEAR SPACE

CLEAR SPACE

Schema

God

CLEAR SPACE

-
- CLEAR SPACE
- CLEAR SPACE CLEAR SPACE Graph storage_client_timeout_ms
- CLEAR SPACE CLEAR SPACE



- NebulaGraph CLEAR SPACE

```
CLEAR SPACE [IF EXISTS] <space_name>;
```

/

IF EXISTS

CLEAR SPACE

space_name

```
CLEAR SPACE basketballplayer;
```

CLEAR SPACE

- Tag
- Edge type
-

CLEAR SPACE

```
#      basketballplayer
nebula[(none)]> use basketballplayer;
Execution succeeded

#      Tag      Edge type
nebula[basketballplayer]> SHOW TAGS;
+-----+
| Name   |
+-----+
| "player" |
| "team"  |
+-----+
Got 2 rows

nebula[basketballplayer]> SHOW EDGES;
+-----+
```

```

| Name      |
+-----+
| "follow" |
| "serve"  |
+-----+
Got 2 rows

#
nebula[basketballplayer]> SUBMIT JOB STATS;
+-----+
| New Job Id |
+-----+
| 4          |
+-----+
Got 1 rows

#
nebula[basketballplayer]> SHOW STATS;
+-----+-----+-----+
| Type    | Name      | Count   |
+-----+-----+-----+
| "Tag"   | "player"  | 51      |
| "Tag"   | "team"    | 30      |
| "Edge"  | "follow"  | 81      |
| "Edge"  | "serve"   | 152     |
| "Space" | "vertices" | 81      |
| "Space" | "edges"   | 233     |
+-----+-----+-----+
Got 6 rows

# Tag
nebula[basketballplayer]> SHOW TAG INDEXES;
+-----+-----+-----+
| Index Name | By Tag   | Columns |
+-----+-----+-----+
| "player_index_0" | "player" | []       |
| "player_index_1" | "player" | ["name"] |
+-----+-----+-----+
Got 2 rows

# ----- CLEAR SPACE -----
# CLEAR SPACE      basketballplayer
nebula[basketballplayer]> CLEAR SPACE basketballplayer;
Execution succeeded

#
nebula[basketballplayer]> SUBMIT JOB STATS;
+-----+
| New Job Id |
+-----+
| 5          |
+-----+
Got 1 rows

# Tag Edge type
nebula[basketballplayer]> SHOW STATS;
+-----+-----+-----+
| Type    | Name      | Count   |
+-----+-----+-----+
| "Tag"   | "player"  | 0       |
| "Tag"   | "team"    | 0       |
| "Edge"  | "follow"  | 0       |
| "Edge"  | "serve"   | 0       |
| "Space" | "vertices" | 0       |
| "Space" | "edges"   | 0       |
+-----+-----+-----+
Got 6 rows

# Tag
nebula[basketballplayer]> SHOW TAG INDEXES;
+-----+-----+-----+
| Index Name | By Tag   | Columns |
+-----+-----+-----+
| "player_index_0" | "player" | []       |
| "player_index_1" | "player" | ["name"] |
+-----+-----+-----+
Got 2 rows (time spent 523/978 us)

```

:January 13, 2023

4.8.6 DROP SPACE

DROP SPACE



DROP SPACE Storage auto_remove_invalid_space auto_remove_invalid_space true
auto_remove_invalid_space false Storage

God DROP SPACE

DROP SPACE [IF EXISTS] <graph_space_name>;

IF EXISTS



NebulaGraph 3.1.0 DROP SPACE



FAQ

DROP SPACE

3.1.0 NebulaGraph, DROP SPACE
<nebula_graph_install_path>/data/storage/nebula/<space_id> <space_id> DESCRIBE SPACE {space_name}

:January 13, 2023

4.9 Tag

4.9.1 CREATE TAG

`CREATE TAG`

Tag

OpenCypher

nGQL Tag openCypher Label

- openCypher Label `CREATE`
- nGQL Tag `CREATE TAG` Tag MySQL

`CREATE TAG`

Tag

Tag USE

```
CREATE TAG [IF NOT EXISTS] <tag_name>
(
  <prop_name> <data_type> [NULL | NOT NULL] [DEFAULT <default_value>] [COMMENT '<comment>']
  [{, <prop_name> <data_type> [NULL | NOT NULL] [DEFAULT <default_value>] [COMMENT '<comment>']} ...]
)
[TTL_DURATION = <ttxl_duration>]
[TTL_COL = <prop_name>]
[COMMENT = '<comment>'];
```

IF NOT EXISTS

Tag

Tag Tag

<tag_name>

1 Tag

2 Tag

3 Tag 1~4 UTF-8

.

<prop_name>

Tag

Tag

<data_type>

NULL \| NOT

NULL

NULL

DEFAULT

NebulaGraph

COMMENT

Tag

256

TTL_DURATION

64

0

TTL_COL

int timestamp Tag

TTL_COL

TTL

TTL

```
nebula> CREATE TAG IF NOT EXISTS player(name string, age int);

#      Tag
nebula> CREATE TAG IF NOT EXISTS no_property();

#      Tag
nebula> CREATE TAG IF NOT EXISTS player_with_default(name string, age int DEFAULT 20);

#      create_time    TTL    100
nebula> CREATE TAG IF NOT EXISTS woman(name string, age int, \
```

```
married bool, salary double, create_time timestamp) \  
TTL_DURATION = 100, TTL_COL = "create_time";
```

Tag

Tag	2	20
-----	---	----

```
heartbeat_interval_secs
```

:January 13, 2023

4.9.2 DROP TAG

```
DROP TAG           Tag
                  Tag
•      Tag      Tag      Compaction      --
•      Tag      Tag      Tag
Tag      Schema      Compaction

↑↑↑compatibility
```

NebulaGraph 3.3.0 Tag Tag Graph nebula-graphd.conf --graph_use_vertex_key=true
Storage nebula-storaged.conf --use_vertex_key=true

- DROP TAG
- Tag DROP TAG [ERROR (-1005)]: Conflict! drop index

```
DROP TAG [IF EXISTS] <tag_name>;
```

- IF EXISTS Tag Tag
- tag_name Tag Tag

```
nebula> CREATE TAG IF NOT EXISTS test(p1 string, p2 int);
nebula> DROP TAG test;
```

:January 13, 2023

4.9.3 ALTER TAG

ALTER TAG Tag

TTL Time-To-Live

- **ALTER TAG**
- **ALTER TAG** [ERROR (-1005)]: Conflict! drop index

```
ALTER TAG <tag_name>
  <alter_definition> [[, alter_definition] ...]
  [ttl_definition [, ttl_definition] ... ]
  [COMMENT = '<comment>'];

alter_definition:
| ADD   (prop_name data_type [NULL | NOT NULL] [DEFAULT <default_value>] [COMMENT '<comment>'])
| DROP  (prop_name)
| CHANGE (prop_name data_type [NULL | NOT NULL] [DEFAULT <default_value>] [COMMENT '<comment>'])

ttl_definition:
  TTL_DURATION = ttl_duration, TTL_COL = prop_name
```

- **tag_name** Tag Tag Tag
- **ALTER TAG** ADD DROP CHANGE ,

```
nebula> CREATE TAG IF NOT EXISTS t1 (p1 string, p2 int);
nebula> ALTER TAG t1 ADD (p3 int, p4 string);
nebula> ALTER TAG t1 TTL_DURATION = 2, TTL_COL = "p2";
nebula> ALTER TAG t1 COMMENT = 'test1';
nebula> ALTER TAG t1 ADD (p5 double NOT NULL DEFAULT 0.4 COMMENT 'p5') COMMENT='test2';
```

Tag

Tag 2 20

heartbeat_interval_secs

:January 13, 2023

4.9.4 SHOW TAGS

SHOW TAGS Tag

SHOW TAGS

SHOW TAGS;

```
nebula> SHOW TAGS;
+-----+
| Name      |
+-----+
| "player"  |
| "team"    |
+-----+
```

:January 13, 2023

4.9.5 DESCRIBE TAG

DESCRIBE TAG Tag

DESCRIBE TAG

```
DESC[RIBE] TAG <tag_name>;
```

DESCRIBE DESC

```
nebula> DESCRIBE TAG player;
+-----+-----+-----+-----+
| Field | Type   | Null  | Default | Comment |
+-----+-----+-----+-----+
| "name" | "string" | "YES" |         |          |
| "age"  | "int64"  | "YES" |         |          |
+-----+-----+-----+-----+
```

: January 13, 2023

4.9.6 DELETE TAG

DELETE TAG

Tag

DELETE TAG

```
DELETE TAG <tag_name_list> FROM <VID>;
```

- **tag_name_list** Tag Tag , * Tag
- **VID** Tag ID

```
nebula> CREATE TAG IF NOT EXISTS test1(p1 string, p2 int);
nebula> CREATE TAG IF NOT EXISTS test2(p3 string, p4 int);
nebula> INSERT VERTEX test1(p1, p2),test2(p3, p4) VALUES "test":("123", 1, "456", 2);
nebula> FETCH PROP ON * "test" YIELD vertex AS v;
+-----+
| v |
+-----+
| {"test" :test1{p1: "123", p2: 1} :test2{p3: "456", p4: 2}} |
+-----+
```



```
nebula> DELETE TAG test1 FROM "test";
nebula> FETCH PROP ON * "test" YIELD vertex AS v;
+-----+
| v |
+-----+
| {"test" :test2{p3: "456", p4: 2}} |
+-----+
```



```
nebula> DELETE TAG * FROM "test";
nebula> FETCH PROP ON * "test" YIELD vertex AS v;
+---+
| v |
+---+
+---+
```

↑ Compatibility

- openCypher REMOVE v:LABEL v LABEL
- nGQL DELETE TAG

:January 13, 2023

4.9.7

openCypher	SET label	REMOVE label	
NebulaGraph	Tag	Tag	Tag
			DELETE TAG
			Tag
		Tag shareholder	
			DELETE TAG
			Tag

```

//      Tag
nebula> CREATE TAG IF NOT EXISTS shareholder();
nebula> CREATE TAG INDEX IF NOT EXISTS shareholder_tag on shareholder();

//      Tag
nebula> INSERT VERTEX shareholder() VALUES "player100":();
nebula> INSERT VERTEX shareholder() VALUES "player101":();

//
nebula> MATCH (v:shareholder) RETURN v;
+-----+
| v |
+-----+
| ("player100" :player{age: 42, name: "Tim Duncan"} :shareholder{}) |
| ("player101" :player{age: 36, name: "Tony Parker"} :shareholder{}) |
+-----+
nebula> LOOKUP ON shareholder YIELD id(vertex);
+-----+
| id(VERTEX) |
+-----+
| "player100" |
| "player101" |
+-----+

//  player100
nebula> DELETE TAG shareholder FROM "player100";
nebula> LOOKUP ON shareholder YIELD id(vertex);
+-----+
| id(VERTEX) |
+-----+
| "player101" |
+-----+

```



REBUILD TAG INDEX <index_name_list>;

:January 13, 2023

4.10 Edge type

4.10.1 CREATE EDGE

`CREATE EDGE` Edge type

OpenCypher

nGQL Edge type openCypher

- openCypher CREATE
- nGQL Edge type CREATE EDGE Edge type MySQL

`CREATE EDGE` Edge type

Edge type USE

```
CREATE EDGE [IF NOT EXISTS] <edge_type_name>
(
    <prop_name> <data_type> [NULL | NOT NULL] [DEFAULT <default_value>] [COMMENT '<comment>']
    [{, <prop_name> <data_type> [NULL | NOT NULL] [DEFAULT <default_value>] [COMMENT '<comment>']} ...]
)
[TTL_DURATION = <ttxl_duration>]
[TTL_COL = <prop_name>]
[COMMENT = '<comment>'];
```

IF NOT EXISTS	Edge type	Edge type	Edge type	Edge type	1~4	UTF-8
<code><edge_type_name></code>	Edge type	Edge type	Edge type	Edge type		
<code><prop_name></code>	Edge type		Edge type			
<code><data_type></code>						
<code>NULL \ NOT NULL</code>	NULL	NULL				
<code>DEFAULT</code>		NebulaGraph				
<code>COMMENT</code>	Edge type	256				
<code>TTL_DURATION</code>	64		0			
<code>TTL_COL</code>	int timestamp	Edge type	TTL_COL TTL	TTL		

```
nebula> CREATE EDGE IF NOT EXISTS follow(degree int);
#           Edge type
nebula> CREATE EDGE IF NOT EXISTS no_property();

#           Edge type
nebula> CREATE EDGE IF NOT EXISTS follow_with_default(degree int DEFAULT 20);

#      p2      TTL   100
nebula> CREATE EDGE IF NOT EXISTS e1(p1 string, p2 int, p3 timestamp) \
TTL_DURATION = 100, TTL_COL = "p2";
```

: January 13, 2023

4.10.2 DROP EDGE

DROP EDGE	Edge type	
Edge type	Edge type	Compaction
Edge type	Schema	Compaction

- DROP EDGE
- Edge type DROP EDGE [ERROR (-1005)]: Conflict! drop index

```
DROP EDGE [IF EXISTS] <edge_type_name>
```

- IF EXISTS Edge type Edge type
- edge_type_name Edge type Edge type

```
nebula> CREATE EDGE IF NOT EXISTS e1(p1 string, p2 int);
nebula> DROP EDGE e1;
```

:January 13, 2023

4.10.3 ALTER EDGE

ALTER EDGE Edge type TTL Time-To-Live

- ALTER EDGE
- ALTER EDGE [ERROR (-1005)]: Conflict! drop index

```
ALTER EDGE <edge_type_name>
  <alter_definition> [, alter_definition] ...
  [ttl_definition [, ttl_definition] ... ]
  [COMMENT = '<comment>'];

alter_definition:
| ADD   (prop_name data_type)
| DROP  (prop_name)
| CHANGE (prop_name data_type)

ttl_definition:
  TTL_DURATION = ttl_duration, TTL_COL = prop_name
```

- edge_type_name Edge type Edge type Edge type
- ALTER EDGE ADD | DROP | CHANGE ,

```
nebula> CREATE EDGE IF NOT EXISTS e1(p1 string, p2 int);
nebula> ALTER EDGE e1 ADD (p3 int, p4 string);
nebula> ALTER EDGE e1 TTL_DURATION = 2, TTL_COL = "p2";
nebula> ALTER EDGE e1 COMMENT = 'edge1';
```

Edge type

Edge type 2 20

heartbeat_interval_secs

:January 13, 2023

4.10.4 SHOW EDGES

SHOW EDGES Edge type

SHOW EDGES

SHOW EDGES;

```
nebula> SHOW EDGES;
+-----+
| Name      |
+-----+
| "follow"  |
| "serve"   |
+-----+
```

:January 13, 2023

4.10.5 DESCRIBE EDGE

```
DESCRIBE EDGE      Edge type
```

```
DESCRIBE EDGE
```

```
DESC[RIBE] EDGE <edge_type_name>
```

```
DESCRIBE      DESC
```

```
nebula> DESCRIBE EDGE follow;
+-----+-----+-----+-----+
| Field | Type  | Null | Default | Comment |
+-----+-----+-----+-----+
| "degree" | "int64" | "YES" |          |
+-----+-----+-----+-----+
```

:January 13, 2023

4.11

4.11.1 INSERT VERTEX

`INSERT VERTEX` NebulaGraph

`INSERT VERTEX`

```
INSERT VERTEX [IF NOT EXISTS] [tag_props, [tag_props] ...]
VALUES VID: ([prop_value_list])

tag_props:
  tag_name ([prop_name_list])

prop_name_list:
  [prop_name [, prop_name] ...]

prop_value_list:
  [prop_value [, prop_value] ...]
```

- `IF NOT EXISTS` VID



Note

- `IF NOT EXISTS` VID + Tag
- `IF NOT EXISTS`

- `tag_name` Tag Tag **CREATE TAG**



Caution

NebulaGraph 3.3.0 Tag Tag Graph nebula-graphd.conf --graph_use_vertex_key=true
Storage nebula-storaged.conf --use_vertex_key=true Tag INSERT VERTEX VALUES "1":();

- `property_name`

- `vid` ID NebulaGraph 3.3.0 **CREATE SPACE**

- `property_value` `prop_name_list` Tag NOT NULL **CREATE TAG**



`INSERT VERTEX openCypher CREATE`

- `INSERT VERTEX` NoSQL(key-value) `INSERT` SQL `UPSERT (UPDATE OR INSERT)`
- `VID TAG` `IF NOT EXISTS`
- `VID TAG` TAG

```

#
nebula> CREATE TAG IF NOT EXISTS t1();
nebula> INSERT VERTEX t1() VALUES "10":();

nebula> CREATE TAG IF NOT EXISTS t2 (name string, age int);
nebula> INSERT VERTEX t2 (name, age) VALUES "11":("n1", 12);

#      "a13"    int
nebula> INSERT VERTEX t2 (name, age) VALUES "12":("n1", "a13");

#      2
nebula> INSERT VERTEX t2 (name, age) VALUES "13":("n3", 12), "14":("n4", 8);

nebula> CREATE TAG IF NOT EXISTS t3(p1 int);
nebula> CREATE TAG IF NOT EXISTS t4(p2 string);

#      Tag
nebula> INSERT VERTEX t3 (p1), t4(p2) VALUES "21": (321, "hello");

```

```

#
nebula> INSERT VERTEX t2 (name, age) VALUES "11":("n2", 13);
nebula> INSERT VERTEX t2 (name, age) VALUES "11":("n3", 14);
nebula> INSERT VERTEX t2 (name, age) VALUES "11":("n4", 15);
nebula> FETCH PROP ON t2 "11" YIELD properties(vertex);
+-----+
| properties(VERTEX)   |
+-----+
| {age: 15, name: "n4"} |
+-----+

```

```

nebula> CREATE TAG IF NOT EXISTS t5(p1 fixed_string(5) NOT NULL, p2 int, p3 int DEFAULT NULL);
nebula> INSERT VERTEX t5(p1, p2, p3) VALUES "001":("Abe", 2, 3);

#      p1      NULL
nebula> INSERT VERTEX t5(p1, p2, p3) VALUES "002":(NULL, 4, 5);
[ERROR (-1009)]: SemanticError: No schema found for `t5'

#      p3      NULL
nebula> INSERT VERTEX t5(p1, p2) VALUES "003":("cd", 5);
nebula> FETCH PROP ON t5 "003" YIELD properties(vertex);
+-----+
| properties(VERTEX)   |
+-----+
| {p1: "cd", p2: 5, p3: __NULL__} |
+-----+

#      p1      5
nebula> INSERT VERTEX t5(p1, p2) VALUES "004":("shalalalala", 4);
nebula> FETCH PROP ON t5 "004" YIELD properties(vertex);
+-----+
| properties(VERTEX)   |
+-----+
| {p1: "shala", p2: 4, p3: __NULL__} |
+-----+

```

IF NOT EXISTS

```

#      1
nebula> INSERT VERTEX t2 (name, age) VALUES "1":("n2", 13);

#      IF NOT EXISTS    1    1
nebula> INSERT VERTEX IF NOT EXISTS t2 (name, age) VALUES "1":("n3", 14);
nebula> FETCH PROP ON t2 "1" YIELD properties(vertex);
+-----+
| properties(VERTEX)   |
+-----+
| {age: 13, name: "n2"} |
+-----+

```

:January 13, 2023

4.11.2 DELETE VERTEX

`DELETE VERTEX`



NebulaGraph 2.x

NebulaGraph 3.3.0

`DELETE VERTEX`



- `DELETE VERTEX`

- `DELETE TAG` Tag

```
DELETE VERTEX <vid> [ , <vid> ... ] [WITH EDGE];
```

- `WITH EDGE` :

```
#     VID  `team1`  
nebula> DELETE VERTEX "team1";  
  
#     VID  `team1`  
nebula> DELETE VERTEX "team1" WITH EDGE;
```

```
#  
nebula> GO FROM "player100" OVER serve WHERE properties(edge).start_year == "2021" YIELD dst(edge) AS id | DELETE VERTEX $-.id;
```

NebulaGraph



-
- `nebula-graphd.conf` `--storage_client_timeout_ms`
- [NebulaGraph](#) 2 28

:January 13, 2023

4.11.3 UPDATE VERTEX

UPDATE VERTEX Tag

NebulaGraph CAS compare and set



Tag

```
UPDATE VERTEX ON <tag_name> <vid>
SET <update_prop>
[WHEN <condition>]
[YIELD <output>]
```

ON <tag_name>	Tag	Tag	ON player
<vid>	ID		"player100"
SET <update_prop>			SET age = age +1
WHEN <condition>	<condition>	false SET	WHEN name == "Tim"
YIELD <output>			YIELD name AS Name

```
//    "player101"
nebula> FETCH PROP ON player "player101" YIELD properties(vertex);
+-----+
| properties(VERTEX)           |
+-----+
| {age: 36, name: "Tony Parker"} |
+-----+

//    age      name      age
nebula> UPDATE VERTEX ON player "player101" \
          SET age = age + 2 \
          WHEN name == "Tony Parker" \
          YIELD name AS Name, age AS Age;
+-----+-----+
| Name        | Age   |
+-----+-----+
| "Tony Parker" | 38   |
+-----+-----+
```

:January 13, 2023

4.11.4 UPSERT VERTEX

UPSERT VERTEX UPDATE INSERT



UPSERT VERTEX Tag

UPSERT VERTEX INSERT UPSERT



UPSERT UPDATE INSERT

```
UPSERT VERTEX ON <tag> <vid>
SET <update_prop>
[WHEN <condition>]
[YIELD <output>]
```

ON <tag>	Tag	Tag	ON player
<vid>	ID	"player100"	
SET <update_prop>		SET age = age +1	
WHEN <condition>		WHEN name == "Tim"	
YIELD <output>		YIELD name AS Name	

WHEN SET

- SET
-
- Tag player name age
- SET age=30

WHEN	name	age
		30
	NULL	30
		30
	NULL	30

```

// "Empty set"
nebula> FETCH PROP ON * "player666", "player667", "player668" YIELD properties(vertex);
+-----+
| properties(VERTEX) |
+-----+
+-----+
Empty set

nebula> UPSERT VERTEX ON player "player666" \
    SET age = 30 \
    WHEN name == "Joe" \
    YIELD name AS Name, age AS Age;
+-----+-----+
| Name      | Age      |
+-----+-----+
| __NULL__ | 30      |
+-----+-----+

nebula> UPSERT VERTEX ON player "player666" \
    SET age = 31 \
    WHEN name == "Joe" \
    YIELD name AS Name, age AS Age;
+-----+-----+
| Name      | Age      |
+-----+-----+
| __NULL__ | 30      |
+-----+-----+

nebula> UPSERT VERTEX ON player "player667" \
    SET age = 31 \
    YIELD name AS Name, age AS Age;
+-----+-----+
| Name      | Age      |
+-----+-----+
| __NULL__ | 31      |
+-----+-----+

nebula> UPSERT VERTEX ON player "player668" \
    SET name = "Amber", age = age + 1 \
    YIELD name AS Name, age AS Age;
+-----+-----+
| Name      | Age      |
+-----+-----+
| "Amber"   | __NULL__ |
+-----+-----+

```

age age NULL age = age + 1 NULL age age = age + 1

```
nebula> CREATE TAG IF NOT EXISTS player_with_default(name string, age int DEFAULT 20);
Execution succeeded
```

```
nebula> UPSERT VERTEX ON player_with_default "player101" \
    SET age = age + 1 \
    YIELD name AS Name, age AS Age;

+-----+-----+
| Name      | Age   |
+-----+-----+
| __NULL__ | 21   |
+-----+-----+
```

WHEN

```

nebula> FETCH PROP ON player "player101" YIELD properties(vertex);
+-----+
| properties(VERTEX)      |
+-----+
| {age: 36, name: "Tony Parker"} |
+-----+


nebula> UPSERT VERTEX ON player "player101" \
    SET age = age + 2 \
    WHEN name == "Tony Parker" \
    YIELD name AS Name, age AS Age;
+-----+-----+
| Name        | Age   |
+-----+-----+
| "Tony Parker" | 38   |
+-----+-----+

```

WHEN

```
nebula> FETCH PROP ON player "player101" YIELD properties(vertex);
```

```
| properties(VERTEX)      |
+-----+
| {age: 38, name: "Tony Parker"} |
+-----+

nebula> UPSERT VERTEX ON player "player101" \
    SET age = age + 2 \
    WHEN name == "Someone else" \
    YIELD name AS Name, age AS Age;
+-----+-----+
| Name      | Age   |
+-----+-----+
| "Tony Parker" | 38  |
+-----+-----+
```

:January 13, 2023

4.12

4.12.1 INSERT EDGE

`INSERT EDGE` NebulaGraph `src_vid` `dst_vid`

`INSERT EDGE` Edge type `rank`

```
INSERT EDGE [IF NOT EXISTS] <edge_type> ( <prop_name_list> ) VALUES
<src_vid> -> <dst_vid>[@<rank>] : ( <prop_value_list> )
[ , <src_vid> -> <dst_vid>[@<rank>] : ( <prop_value_list> ), ... ];

<prop_name_list> ::= 
[ <prop_name> [, <prop_name> ] ...]

<prop_value_list> ::= 
[ <prop_value> [, <prop_value> ] ...]
```

- `IF NOT EXISTS` IF NOT EXISTS



Note

- `IF NOT EXISTS` <rank>
- `IF NOT EXISTS`

- `<edge_type>` Edge type Edge type Edge type CREATE EDGE

- `<prop_name_list>`

- `src_vid` ID

- `dst_vid` ID

- `rank` rank 0



openCypher rank

- `<prop_value_list>` prop_name_list Edge type Edge type NOT NULL
CREATE EDGE

```
# 
nebula> CREATE EDGE IF NOT EXISTS e1();
nebula> INSERT EDGE e1 () VALUES "10"->"11":();

#      rank 1
nebula> INSERT EDGE e1 () VALUES "10"->"11"@1:();
```

```
nebula> CREATE EDGE IF NOT EXISTS e2 (name string, age int);
nebula> INSERT EDGE e2 (name, age) VALUES "11"->"13":("n1", 1);

#      2
nebula> INSERT EDGE e2 (name, age) VALUES \
"12"->"13":("n1", 1), "13"->"14":("n2", 2);
```

```
#      "a13"    int
nebula> INSERT EDGE e2 (name, age) VALUES "11"->"13":("n1", "a13");
```

```
#  
nebula> INSERT EDGE e2 (name, age) VALUES "11"->"13":("n1", 12);  
nebula> INSERT EDGE e2 (name, age) VALUES "11"->"13":("n1", 13);  
nebula> INSERT EDGE e2 (name, age) VALUES "11"->"13":("n1", 14);  
nebula> FETCH PROP ON e2 "11"->"13" YIELD edge AS e;  
+-----+  
| e |  
+-----+  
| [:e2 "11"->"13" @0 {age: 14, name: "n1"}] |  
+-----+
```

IF NOT EXISTS

```
#  
nebula> INSERT EDGE e2 (name, age) VALUES "14"->"15">@1:(n1", 12);  
# IF NOT EXISTS  
nebula> INSERT EDGE IF NOT EXISTS e2 (name, age) VALUES "14"->"15">@1:(n2", 13);  
nebula> FETCH PROP ON e2 "14"->"15">@1 YIELD edge AS e;  
+-----+  
| e |  
+-----+  
| [:e2 "14"->"15" @1 {age: 12, name: "n1"}] |  
+-----+
```

Note

- NebulaGraph 3.3.0 Dangling edge <edgetype>._src <edgetype>._dst VID
 -
 - edge conflict
 - INSERT INSERT INSERT storaged INSERT storaged INSERT
-

:January 13, 2023

4.12.2 DELETE EDGE

DELETE EDGE

DELETE VERTEX

```
DELETE EDGE <edge_type> <src_vid> -> <dst_vid>[@<rank>] [, <src_vid> -> <dst_vid>[@<rank>] ...]
```



rank rank 0 rank

```
nebula> DELETE EDGE serve "player100" -> "team204"@0;
```

```
#           rank
nebula> GO FROM "player100" OVER follow \
    WHERE dst(edge) == "team204" \
    YIELD src(edge) AS src, dst(edge) AS dst, rank(edge) AS rank \
    | DELETE EDGE follow $-.src -> $-.dst @ $-.rank;
```

:January 13, 2023

4.12.3 UPDATE EDGE

UPDATE EDGE Edge type

NebulaGraph CAS compare and swap

```
UPDATE EDGE ON <edge_type>
<src_vid> -> <dst_vid> [@<rank>]
SET <update_prop>
[WHEN <condition>]
[YIELD <output>]
```

ON <edge_type>	Edge type	Edge type	ON serve
<src_vid>	ID		"player100"
<dst_vid>	ID		"team204"
<rank>	rank		10
SET <update_prop>			SET start_year = start_year +1
WHEN <condition>	<condition>	false SET	WHEN end_year < 2010
YIELD <output>			YIELD start_year AS Start_Year

```
// GO
nebula> GO FROM "player100" \
OVER serve \
YIELD properties(edge).start_year, properties(edge).end_year;
+-----+-----+
| properties(EDGE).start_year | properties(EDGE).end_year |
+-----+-----+
| 1997 | 2016 |
+-----+-----+

// start_year    end_year    start_year

nebula> UPDATE EDGE ON serve "player100" -> "team204" @0 \
SET start_year = start_year + 1 \
WHEN end_year > 2010 \
YIELD start_year, end_year;
+-----+-----+
| start_year | end_year |
+-----+-----+
| 1998 | 2016 |
+-----+-----+
```

:January 13, 2023

4.12.4 UPSERT EDGE

UPSERT EDGE UPDATE | INSERT

UPSERT EDGE INSERT UPSERT



UPSERT UPDATE | INSERT

```
UPSERT EDGE ON <edge_type>
<src_vid> -> <dst_vid> [<rank>]
SET <update_prop>
[WHEN <condition>]
[YIELD <properties>]
```

ON <edge_type>	Edge type	Edge type	ON serve
<src_vid>	ID		"player100"
<dst_vid>	ID		"team204"
<rank>	rank		10
SET <update_prop>			SET start_year = start_year +1
WHEN <condition>			WHEN end_year < 2010
YIELD <output>			YIELD start_year AS Start_Year

WHEN SET

- SET
-
-

- Edge type serve start_year end_year
- SET end_year = 2021

WHEN	start_year	end_year
		2021
	NULL	2021
		2021
	NULL	2021

```
//      serve      "Empty set"      serve
nebula> GO FROM "player666", "player667", "player668" \
OVER serve \
```

```

    YIELD properties(edge).start_year, properties(edge).end_year;
+-----+
| properties(EDGE).start_year | properties(EDGE).end_year |
+-----+
+-----+
Empty set

nebula> UPSERT EDGE on serve \
    "player666" -> "team200"@0 \
    SET end_year = 2021 \
    WHEN end_year == 2010 \
    YIELD start_year, end_year;
+-----+
| start_year | end_year |
+-----+
| __NULL__ | 2021 |
+-----+

nebula> UPSERT EDGE on serve \
    "player666" -> "team200"@0 \
    SET end_year = 2022 \
    WHEN end_year == 2010 \
    YIELD start_year, end_year;
+-----+
| start_year | end_year |
+-----+
| __NULL__ | 2021 |
+-----+

nebula> UPSERT EDGE on serve \
    "player667" -> "team200"@0 \
    SET end_year = 2022 \
    YIELD start_year, end_year;
+-----+
| start_year | end_year |
+-----+
| __NULL__ | 2022 |
+-----+

nebula> UPSERT EDGE on serve \
    "player668" -> "team200"@0 \
    SET start_year = 2000, end_year = end_year + 1 \
    YIELD start_year, end_year;
+-----+
| start_year | end_year |
+-----+
| 2000 | __NULL__ |
+-----+

```

end_year	end_year	NULL	end_year = end_year + 1	NULL	end_year	end_year = end_year + 1
----------	----------	------	-------------------------	------	----------	-------------------------

```

nebula> CREATE EDGE IF NOT EXISTS serve_with_default(start_year int, end_year int DEFAULT 2010);
Execution succeeded

nebula> UPSERT EDGE on serve_with_default \
    "player668" -> "team200" \
    SET end_year = end_year + 1 \
    YIELD start_year, end_year;
+-----+
| start_year | end_year |
+-----+
| __NULL__ | 2011 |
+-----+

```

WHEN

```

nebula> MATCH (v:player{name:"Ben Simmons"})-[e:serve]-(v2) \
    RETURN e;
+-----+
| e |
+-----+
| [:serve "player149"->"team219" @0 {end_year: 2019, start_year: 2016}] |
+-----+

nebula> UPSERT EDGE on serve \
    "player149" -> "team219" \
    SET end_year = end_year + 1 \
    WHEN start_year == 2016 \
    YIELD start_year, end_year;
+-----+
| start_year | end_year |
+-----+
| 2016 | 2020 |
+-----+

```

WHEN

```
nebula> MATCH (v:player{name:"Ben Simmons"})-[e:serve]-(v2) \
    RETURN e;
+-----+
| e |
+-----+
| [:serve "player149"->"team219" @0 {end_year: 2020, start_year: 2016}] |
+-----+  
  
nebula> UPSERT EDGE on serve \
    "player149" -> "team219" \
    SET end_year = end_year + 1 \
    WHEN start_year != 2016 \
    YIELD start_year, end_year;
+-----+-----+
| start_year | end_year |
+-----+-----+
| 2016       | 2020       |
+-----+-----+
```

:January 13, 2023

4.13

4.13.1

NebulaGraph

NebulaGraph

- Tag Edge type
- REBUILD INDEX
- Tag Edge type Tag Edge type
- CREATE INDEX
- SHOW CREATE INDEX
- SHOW INDEXES
- DESCRIBE INDEX
- REBUILD INDEX
- SHOW INDEX STATUS
- DROP INDEX
- LOOKUP
- MATCH

Elastic Search

-
- 256
- AND OR NOT

 Note

listener

Elasticsearch

Elasticsearch

NULL

NULL

Cypher

Constrains

MySQL

nGQL

:January 13, 2023

4.13.2 CREATE INDEX

Tag Edge type Tag Edge type **CREATE TAG** **CREATE EDGE**

LOOKUP MATCH

CREATE INDEX Tag EdgeType "Tag" "Edge type" "

- Tag Edge type Tag Edge type LOOKUP Tag player

- " " age age == 19

Tag T A i_TA Edge type

- i_TA i_T

- MATCH i_T i_TA

- LOOKUP i_T i_TA



LOOKUP Tag Edge type



Storage

256

1. NebulaGraph
- 2.
- 3.
4. **LOOKUP** **MATCH** NebulaGraph



--disable_auto_compaction = false

LOOKUP REBUILD INDEX)

2 20

can't find xxx in the space

heartbeat_interval_secs

NebulaGraph



REBUILD INDEX MATCH LOOKUP

```
CREATE {TAG | EDGE} INDEX [IF NOT EXISTS] <index_name> ON {<tag_name> | <edge_name>} ([<prop_name_list>]) [COMMENT '<comment>'];
```

TAG | EDGE

IF NOT EXISTS

<index_name>	iTagName_propName	1~4	UTF-8
--------------	-------------------	-----	-------

<tag_name>	Tag	Edge
<edge_name>		

<prop_name_list>	prop_name(length)	Tag	Edge type	<prop_name_list>
------------------	-------------------	-----	-----------	------------------

COMMENT	256
---------	-----

Tag/Edge type

```
nebula> CREATE TAG INDEX player_index on player();
```

```
nebula> CREATE EDGE INDEX follow_index on follow();
```

Tag	Edge type	LOOKUP	Tag	VID	VID	VID	rank	LOOKUP
-----	-----------	--------	-----	-----	-----	-----	------	--------

```
nebula> CREATE TAG INDEX IF NOT EXISTS player_index_0 on player(name(10));
```

Tag	player	name	10	name	10
-----	--------	------	----	------	----

```
#  
nebula> CREATE TAG IF NOT EXISTS var_string(p1 string);  
nebula> CREATE TAG INDEX IF NOT EXISTS var ON var_string(p1(10));  
  
#  
nebula> CREATE TAG IF NOT EXISTS fix_string(p1 FIXED_STRING(10));  
nebula> CREATE TAG INDEX IF NOT EXISTS fix ON fix_string(p1);
```

```
nebula> CREATE EDGE INDEX IF NOT EXISTS follow_index_0 on follow(degree);
```

Tag	Edge type)
-----	------------

```
nebula> CREATE TAG INDEX IF NOT EXISTS player_index_1 on player(name(10), age);
```



Tag Edge type

Note

.. ..

: January 13, 2023

4.13.3 SHOW INDEXES

```
SHOW INDEXES          Tag    Edge type
```

```
SHOW {TAG | EDGE} INDEXES;
```

```
nebula> SHOW TAG INDEXES;
+-----+-----+-----+
| Index Name | By Tag   | Columns      |
+-----+-----+-----+
| "fix"       | "fix_string" | ["p1"]        |
| "player_index_0" | "player" | ["name"]      |
| "player_index_1" | "player" | ["name", "age"] |
| "var"        | "var_string" | ["p1"]        |
+-----+-----+-----+

nebula> SHOW EDGE INDEXES;
+-----+-----+-----+
| Index Name | By Edge  | Columns      |
+-----+-----+-----+
| "follow_index" | "follow" | []           |
+-----+-----+-----+
```

:January 13, 2023

4.13.4 SHOW CREATE INDEX

SHOW CREATE INDEX Tag Edge type nGQL

```
SHOW CREATE {TAG | EDGE} INDEX <index_name>;
```

SHOW TAG INDEXES Tag SHOW CREATE TAG INDEX

```
nebula> SHOW TAG INDEXES;
+-----+-----+-----+
| Index Name | By Tag | Columns |
+-----+-----+-----+
| "player_index_0" | "player" | [] |
| "player_index_1" | "player" | ["name"] |
+-----+-----+-----+
nebula> SHOW CREATE TAG INDEX player_index_1;
+-----+-----+
| Tag Index Name | Create Tag Index |
+-----+-----+
| "player_index_1" | "CREATE TAG INDEX `player_index_1` ON `player` ( | | |
| | | `name`(20) | |
| | | )" | |
+-----+-----+
```

Edge type

```
nebula> SHOW EDGE INDEXES;
+-----+-----+-----+
| Index Name | By Edge | Columns |
+-----+-----+-----+
| "follow_index" | "follow" | [] |
+-----+-----+-----+
nebula> SHOW CREATE EDGE INDEX follow_index;
+-----+-----+
| Edge Index Name | Create Edge Index |
+-----+-----+
| "follow_index" | "CREATE EDGE INDEX `follow_index` ON `follow` ( | |
| | | ")" | |
+-----+-----+
```

:January 13, 2023

4.13.5 DESCRIBE INDEX

DESCRIBE INDEX	Field	Type
----------------	-------	------

```
DESCRIBE {TAG | EDGE} INDEX <index_name>;
```

```
nebula> DESCRIBE TAG INDEX player_index_0;
+-----+
| Field | Type      |
+-----+
| "name" | "fixed_string(30)" |
+-----+

nebula> DESCRIBE TAG INDEX player_index_1;
+-----+
| Field | Type      |
+-----+
| "name" | "fixed_string(10)" |
| "age"  | "int64"   |
+-----+
```

:January 13, 2023

4.13.6 REBUILD INDEX



- **—** **LOOKUP** **MATCH**
-

CREATE INDEX



`rebuild_index_part_rate_limit` `rebuild_index_batch_size`

Storage

```
REBUILD {TAG | EDGE} INDEX [<index_name_list>];

<index_name_list>::=
    [index_name [, index_name] ...]
```

- ,
- **SHOW {TAG | EDGE} INDEX STATUS** **SHOW INDEX STATUS**

```
nebula> CREATE TAG IF NOT EXISTS person(name string, age int, gender string, email string);
nebula> CREATE TAG INDEX IF NOT EXISTS single_person_index ON person(name(10));

#      ID
nebula> REBUILD TAG INDEX single_person_index;
+-----+
| New Job Id |
+-----+
| 31          |
+-----+

#
nebula> SHOW TAG INDEX STATUS;
+-----+-----+
| Name           | Index Status |
+-----+-----+
| "single_person_index" | "FINISHED"   |
+-----+-----+

#      SHOW JOB <job_id>
nebula> SHOW JOB 31;
+-----+-----+-----+-----+-----+-----+
| Job Id(TaskId) | Command(Dest)     | Status       | Start Time        | Stop Time        | Error Code   |
+-----+-----+-----+-----+-----+-----+
| 31            | "REBUILD_TAG_INDEX" | "FINISHED"   | 2021-07-07T09:04:24.000 | 2021-07-07T09:04:24.000 | "SUCCEEDED" |
| 0            | "storaged1"       | "FINISHED"   | 2021-07-07T09:04:24.000 | 2021-07-07T09:04:28.000 | "SUCCEEDED" |
| 1            | "storaged2"       | "FINISHED"   | 2021-07-07T09:04:24.000 | 2021-07-07T09:04:28.000 | "SUCCEEDED" |
| 2            | "storaged0"       | "FINISHED"   | 2021-07-07T09:04:24.000 | 2021-07-07T09:04:28.000 | "SUCCEEDED" |
| "Total:3"    | "Succeeded:3"     | "Failed:0"    | "In Progress:0"      | ""              | ""          |
+-----+-----+-----+-----+-----+-----+
```

NebulaGraph

ID **SHOW JOB <job_id>**

SHOW JOB

:January 13, 2023

4.13.7 SHOW INDEX STATUS

```
SHOW INDEX STATUS
```

- QUEUE
- RUNNING
- FINISHED
- FAILED
- STOPPED
- INVALID



CREATE INDEX

```
SHOW {TAG | EDGE} INDEX STATUS;
```

```
nebula> SHOW TAG INDEX STATUS;
+-----+-----+
| Name      | Index Status |
+-----+-----+
| "player_index_0"    | "FINISHED"   |
| "player_index_1"    | "FINISHED"   |
+-----+-----+
```

:January 13, 2023

4.13.8 DROP INDEX

DROP INDEX

DROP INDEX

DROP TAG INDEX DROP EDGE INDEX

```
DROP {TAG | EDGE} INDEX [IF EXISTS] <index_name>;
```

IF EXISTS

```
nebula> DROP TAG INDEX player_index_0;
```

:January 13, 2023

4.14

4.14.1



16

- LOOKUP
 -
 - 256
 - Tag/Edge type
 - Tag/Edge type Tag/Edge type
 - Tag/Edge type
 - String
 - Tag/Edge type
 -
 - NULL
 - Elasticsearch NebulaGraph text search not found
 - Elasticsearch
 -
 - WHERE
 -
 - Elasticsearch NebulaGraph Elasticsearch
 - ' \ Elasticsearch
 - NebulaGraph listener Elasticsearch
 - K8s NebulaGraph
-

:January 13, 2023

4.14.2

NebulaGraph

Elasticsearch

Elasticsearch

listener

Elasticsearch

Elasticsearch

Elasticsearch

Kubernetes

Elasticsearch

Elasticsearch

Elasticsearch

NebulaGraph



ES 7.8 ES

Elasticsearch

ES

```
{
  "template": "nebula*",
  "settings": {
    "index": {
      "number_of_shards": 3,
      "number_of_replicas": 1
    }
  },
  "mappings": {
    "properties" : {
      "tag_id" : { "type" : "long" },
      "column_id" : { "type" : "text" },
      "value" :{ "type" : "keyword"}
    }
  }
}
```

```
"template": "nebula*"
"tag_id" : { "type" : "long" },
"column_id" : { "type" : "text" },
"value" :{ "type" : "keyword"}
```



nebula

```
curl -H "Content-Type: application/json; charset=utf-8" -XPUT http://127.0.0.1:9200/_template/nebula_index_template -d '
{
  "template": "nebula*",
  "settings": {
    "index": {
      "number_of_shards": 3,
      "number_of_replicas": 1
    }
  },
  "mappings": {
    "properties" : {
      "tag_id" : { "type" : "long" },
      "column_id" : { "type" : "text" },
      "value" :{ "type" : "keyword"}
    }
  }
}'
```

Elasticsearch

Elasticsearch

Elasticsearch

Elasticsearch

SIGN IN

Elasticsearch

Elasticsearch

IP

elastic_ip:port

```
SIGN IN TEXT SERVICE (<elastic_ip:port>, {HTTP | HTTPS} [, "<username>", "<password>"] [, (<elastic_ip:port>, ...)];
```

```
nebula> SIGN IN TEXT SERVICE (127.0.0.1:9200, HTTP);
```



Elasticsearch

SIGN IN

```
SHOW TEXT SEARCH CLIENTS
```

```
SHOW TEXT SEARCH CLIENTS;
```

```
nebula> SHOW TEXT SEARCH CLIENTS;
+-----+-----+
| Host      | Port |
+-----+-----+
| "127.0.0.1" | 9200 |
+-----+-----+
```

```
SIGN OUT TEXT SERVICE
```

```
SIGN OUT TEXT SERVICE;
```

```
nebula> SIGN OUT TEXT SERVICE;
```

:January 13, 2023

4.14.3 Raft listener

Elasticsearch	Storage	Raft listener	listener	Storage	Elasticsearch
•					
• NebulaGraph					
• Elasticsearch					
• Raft listener					
• NebulaGraph Metad Storage Graphd listener					
• " listener " listener listener listener					
STORAGE					
listener storaged		listener	NebulaGraph	Storage	RPM
DEB NebulaGraph					
LISTENER					
listener	nebula-storaged-listener.conf		etc		.production
Storage					
daemonize	true				
pid_file	pids_listener/nebula-storaged.pid	ID			
meta_server_addrs	-	Meta	IP	Meta	,
local_ip	-	listener	IP		
port	-	listener	RPC		
heartbeat_interval_secs	10	Meta	s		
listener_path	data/listener	listener	WAL		
data_path	data		data		
part_man_type	memory	memory	meta		
rocksdb_batch_size	4096				
rocksdb_block_cache	4	BlockBasedTable	MB		
engine_type	rocksdb	rocksdb	memory		
part_type	simple	simple	consensus		

Note

listener IP 127.0.0.1

LISTENER

listener

```
./bin/nebula-storaged --flagfile <listener_config_path>/nebula-storaged-listener.conf
```

listener_config_path listener

LISTENER NEBULAGRAPH

NebulaGraph USE <space> listener

```
ADD LISTENER ELASTICSEARCH <listener_ip:port> [<listener_ip:port>, ...]
```

Warning

listener IP

listener

```
nebula> ADD LISTENER ELASTICSEARCH 192.168.8.5:9789,192.168.8.6:9789;
```

listener

SHOW LISTENER listener

```
nebula> SHOW LISTENER;
+-----+-----+-----+
| PartId | Type      | Host          | Status   |
+-----+-----+-----+
| 1      | "ELASTICSEARCH" | "[192.168.8.5:46780]" | "ONLINE" |
| 2      | "ELASTICSEARCH" | "[192.168.8.5:46780]" | "ONLINE" |
| 3      | "ELASTICSEARCH" | "[192.168.8.5:46780]" | "ONLINE" |
+-----+-----+-----+
```

listener

REMOVE LISTENER ELASTICSEARCH listener

```
nebula> REMOVE LISTENER ELASTICSEARCH;
```

listener Elasticsearch

:January 13, 2023

4.14.4

LOOKUP WHERE

listener

```
Durant Tim Duncan David Beckham      player.name      LOOKUP ON player WHERE PREFIX(player.name,"d");
```

```
CREATE FULLTEXT {TAG | EDGE} INDEX <index_name> ON {<tag_name> | <edge_name>} ([<prop_name_list>]);
```

```
SHOW FULLTEXT INDEXES;
```

REBUILD FULLTEXT INDEX;

```
DROP FULLTEXT INDEX <index_name>;
```

```
LOOKUP ON {<tag> | <edge_type>} WHERE <expression> [YIELD <return_list>];
```

```
<expression> ::=  
    PREFIX | WILDCARD | REGEXP | FUZZY
```

```
<return_list>
  <prop_name> [AS <prop_alias>] [, <prop_name> [AS <prop_alias>] ...]
```

- PREFIX(schema_name.prop_name, prefix_string, row_limit, timeout)
 - WILDCARD(schema_name.prop_name, wildcard_string, row_limit, timeout)
 - REGEXP(schema_name.prop_name, regexp_string, row_limit, timeout)
 - FUZZY(schema_name.prop_name, fuzzy_string, fuzziness, operator, row_limit, timeout)
 - fuzziness AUTO Elasticsearch
 - operator OR and
 - row_limit 100
 - timeout ms 200

```

// nebula> CREATE SPACE IF NOT EXISTS basketballplayer (partition_num=3,replica_factor=1, vid_type=fixed_string(30));
//
// nebula> SIGN IN TEXT SERVICE (127.0.0.1:9200, HTTP);
//
// nebula> SHOW TEXT SEARCH CLIENTS;
//
// nebula> USE basketballplayer;
//
//   listener    NebulaGraph
nebula> ADD LISTENER ELASTICSEARCH 192.168.8.5:9789;
//
//   listener    Online
nebula> SHOW LISTENER;
//
//   Tag
nebula> CREATE TAG IF NOT EXISTS player(name string, age int);
//
// nebula> CREATE TAG INDEX IF NOT EXISTS name ON player(name(20));
//
// nebula> REBUILD TAG INDEX;
//
//           `nebula`
nebula> CREATE FULLTEXT TAG INDEX nebula_index_1 ON player(name);
//
// nebula> REBUILD FULLTEXT INDEX;
//
// nebula> SHOW FULLTEXT INDEXES;
+-----+-----+-----+-----+
| Name      | Schema Type | Schema Name | Fields |
+-----+-----+-----+-----+
| "nebula_index_1" | "Tag"      | "player"     | "name"  |
+-----+-----+-----+-----+
//
nebula> INSERT VERTEX player(name, age) VALUES \
  "Russell Westbrook": ("Russell Westbrook", 30), \
  "Chris Paul": ("Chris Paul", 33), \
  "Boris Diaw": ("Boris Diaw", 36), \
  "David West": ("David West", 38), \
  "Danny Green": ("Danny Green", 31), \
  "Tim Duncan": ("Tim Duncan", 42), \
  "James Harden": ("James Harden", 29), \
  "Tony Parker": ("Tony Parker", 36), \
  "Aron Baynes": ("Aron Baynes", 32), \
  "Ben Simmons": ("Ben Simmons", 22), \
  "Blake Griffin": ("Blake Griffin", 30);

//
nebula> LOOKUP ON player WHERE PREFIX(player.name, "B") YIELD id(vertex);
+-----+
| id(VERTEX) |
+-----+
| "Boris Diaw" |
| "Ben Simmons" |
| "Blake Griffin" |
+-----+

nebula> LOOKUP ON player WHERE WILDCARD(player.name, "*ri*") YIELD player.name, player.age;
+-----+-----+
| name      | age |
+-----+-----+
| "Chris Paul" | 33 |
| "Boris Diaw" | 36 |
| "Blake Griffin" | 30 |
+-----+-----+

nebula> LOOKUP ON player WHERE WILDCARD(player.name, "*ri*") | YIELD count();
+-----+
| count(*) |
+-----+
| 3         |
+-----+-----+

nebula> LOOKUP ON player WHERE REGEXP(player.name, "R.*") YIELD player.name, player.age;
+-----+-----+
| name      | age |
+-----+-----+
| "Russell Westbrook" | 30 |
+-----+-----+

nebula> LOOKUP ON player WHERE REGEXP(player.name, ".*") YIELD id(vertex);
+-----+
| id(VERTEX) |
+-----+

```

```
+-----+
| "Danny Green"      |
| "David West"       |
| "Russell Westbrook" |
+-----+
...
nebula> LOOKUP ON player WHERE FUZZY(player.name, "Tim Dunncan", AUTO, OR) YIELD player.name;
+-----+
| name      |
+-----+
| "Tim Duncan" |
+-----+
//  
nebula> DROP FULLTEXT INDEX nebula_index_1;
```

:January 13, 2023

4.15

4.15.1 GET SUBGRAPH

GET SUBGRAPH

GET SUBGRAPH

```
GET SUBGRAPH [WITH PROP] [<step_count> STEPS] FROM {<vid>, <vid>...}
[{:IN | :OUT | BOTH} <edge_type>, <edge_type>...]
[WHERE <expression> [AND <expression> ...]]
YIELD [VERTICES AS <vertex_alias>] [, EDGES AS <edge_alias>];
```

- WITH PROP
- step_count 0 step_count 1
- vid ID
- edge_type Edge type IN OUT BOTH Edge type BOTH
- WHERE AND
- YIELD

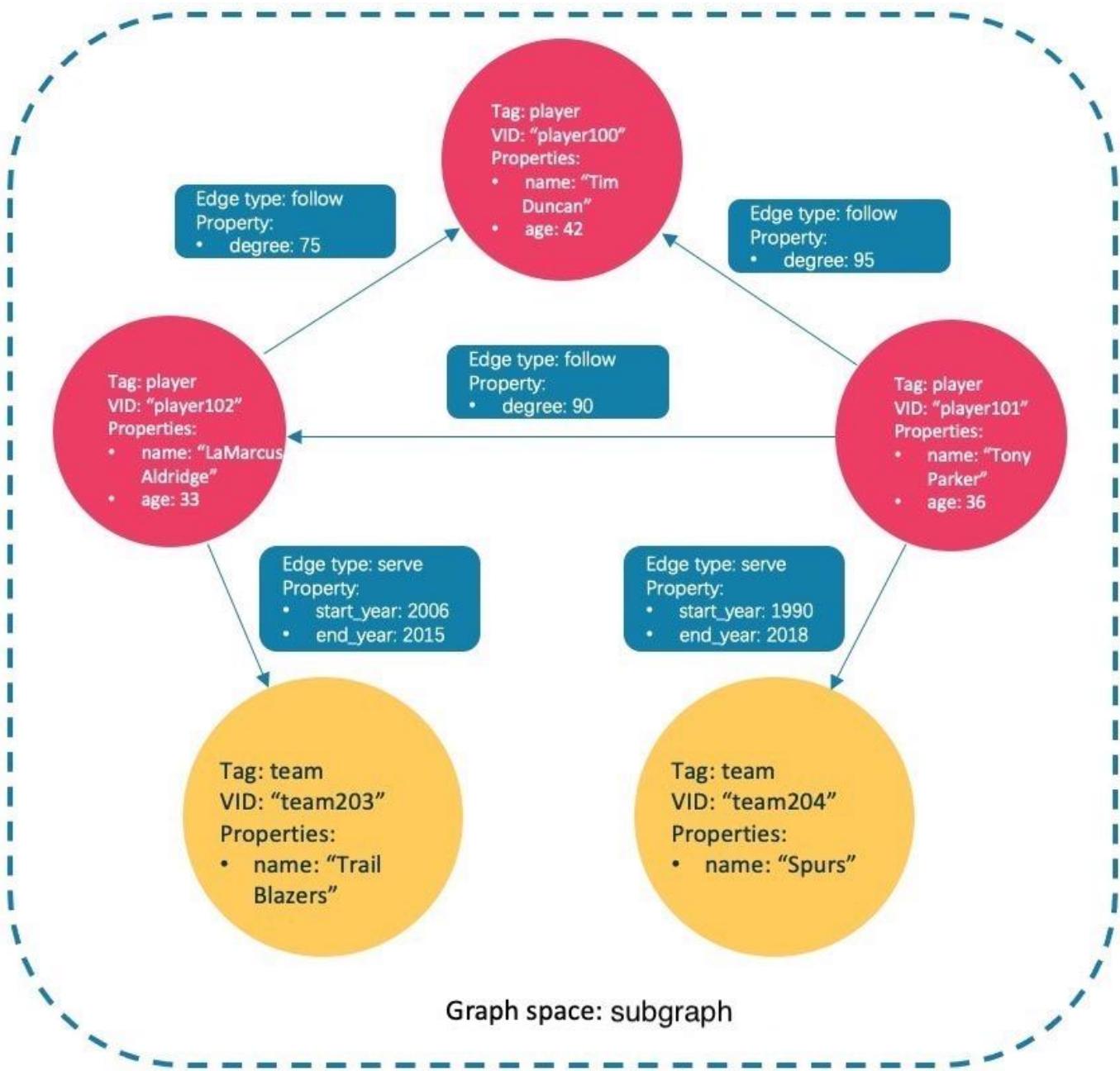


GET SUBGRAPH trail

WHERE

GET SUBGRAPH WHERE

- AND
- \$\$.tagName.propName
- edge_type.propName
-
- Schema geo



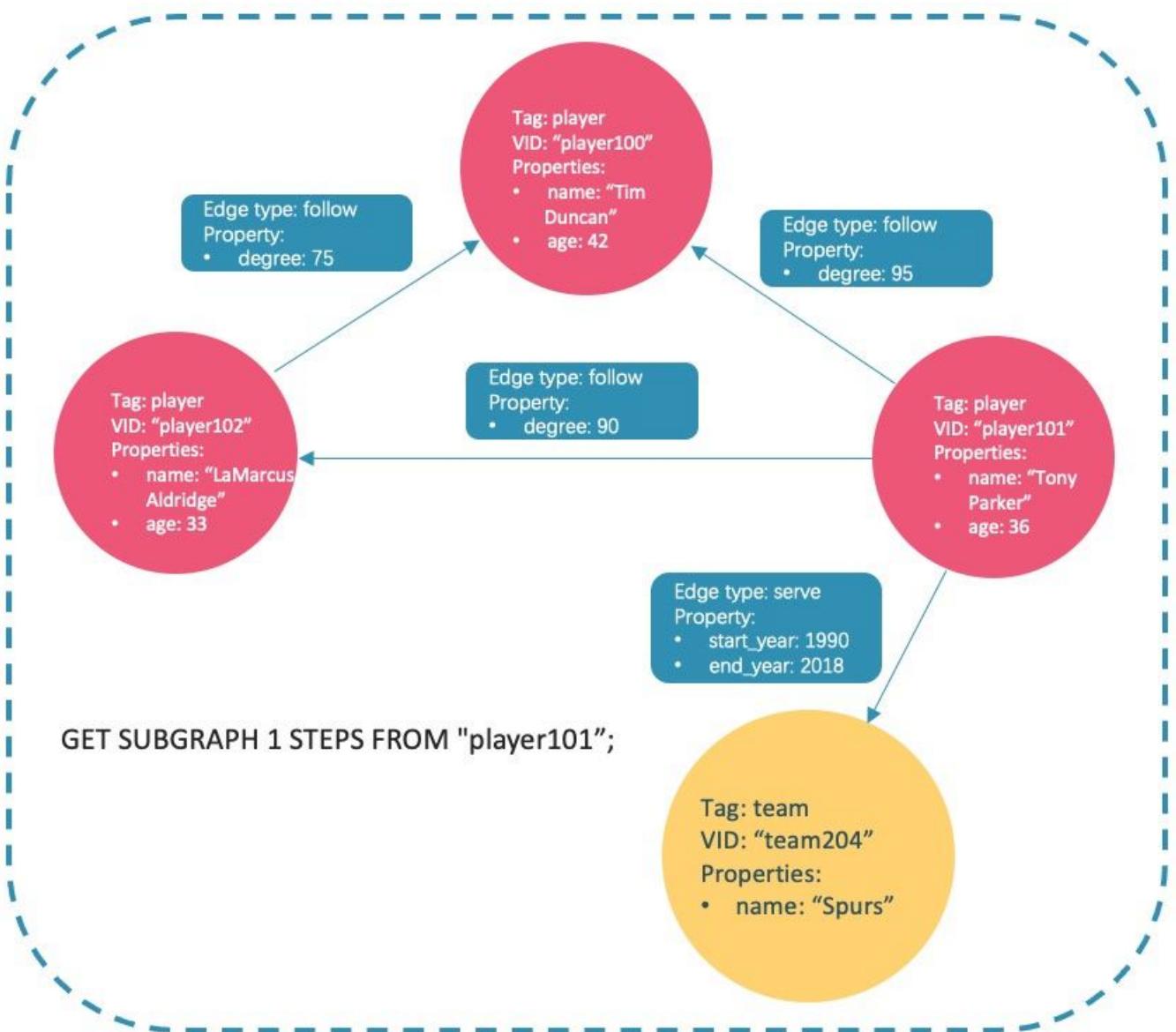
```

nebula> CREATE SPACE IF NOT EXISTS subgraph(partition_num=15, replica_factor=1, vid_type=fixed_string(30));
nebula> USE subgraph;
nebula> CREATE TAG IF NOT EXISTS player(name string, age int);
nebula> CREATE TAG IF NOT EXISTS team(name string);
nebula> CREATE EDGE IF NOT EXISTS follow(degree int);
nebula> CREATE EDGE IF NOT EXISTS serve(start_year int, end_year int);
nebula> INSERT VERTEX player(name, age) VALUES "player100":("Tim Duncan", 42);
nebula> INSERT VERTEX player(name, age) VALUES "player101":("Tony Parker", 36);
nebula> INSERT VERTEX player(name, age) VALUES "player102":("LaMarcus Aldridge", 33);
nebula> INSERT VERTEX team(name) VALUES "team203":("Trail Blazers"), "team204":("Spurs");
nebula> INSERT EDGE follow(degree) VALUES "player101" -> "player100":(95);
nebula> INSERT EDGE follow(degree) VALUES "player101" -> "player102":(90);
  
```

```
nebula> INSERT EDGE follow(degree) VALUES "player102" -> "player100":(75);
nebula> INSERT EDGE serve(start_year, end_year) VALUES "player101" -> "team204":(1999, 2018), "player102" -> "team203":(2006, 2015);
```

- player101 0~1 Edge type

```
nebula> GET SUBGRAPH 1 STEPS FROM "player101" YIELD VERTICES AS nodes, EDGES AS relationships;
+-----+
| nodes
relationships
+-----+
| [{"player101":player{}}, {"player102":player{}}, {"team204":team{}}, {"player100":player{}}, {"player101":player{}}, {"team203":team{}}, {"player102":player{}}, {"player100":player{}}]
| [:follow "player101"->"player102" @0 {}], [:serve "player101"->"team204" @0 {}], [:follow "player101"->"player100" @0 {}], [:follow "player102"->"player100" @0 {}]
| -----+
+-----+
```



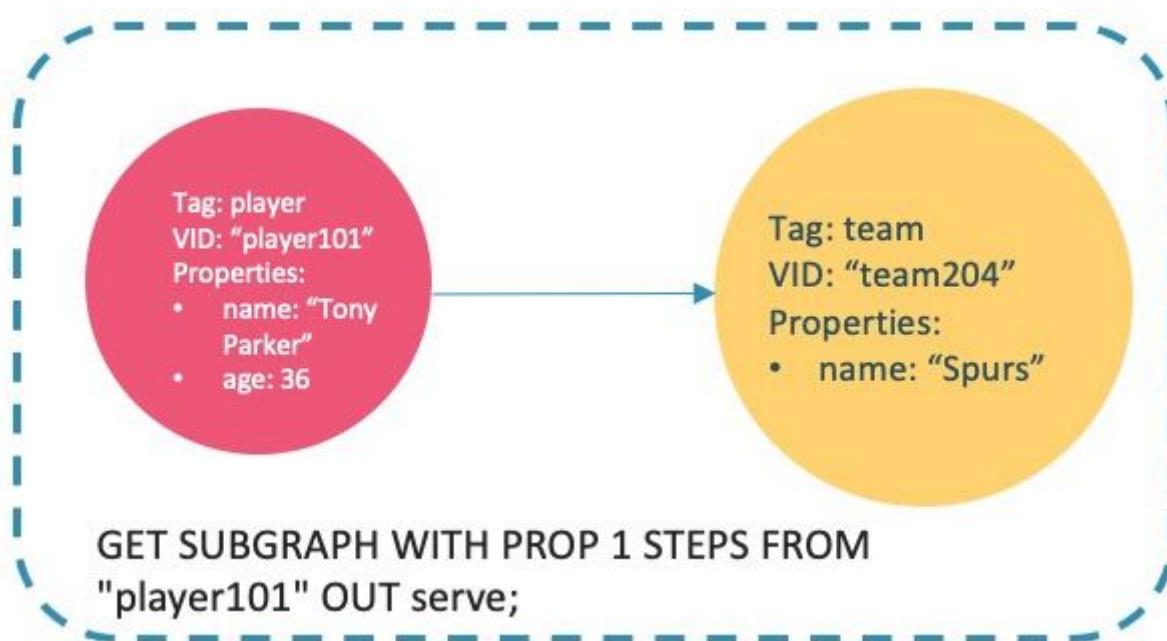
- player101 0~1 follow

```
nebula> GET SUBGRAPH 1 STEPS FROM "player101" IN follow YIELD VERTICES AS nodes, EDGES AS relationships;
+-----+-----+
| nodes | relationships |
+-----+-----+
| [{"player101":player{}}] | [] |
```

player101 follow player101

- player101 0~1 serve

```
nebula> GET SUBGRAPH WITH PROP 1 STEPS FROM "player101" OUT serve YIELD VERTICES AS nodes, EDGES AS relationships;
+-----+-----+
| nodes | relationships |
+-----+-----+
| [{"player101":player{age: 36, name: "Tony Parker"}}, [{"serve": "player101->team204"}], [{"team204":team{name: "Spurs"}}, []]] |
```

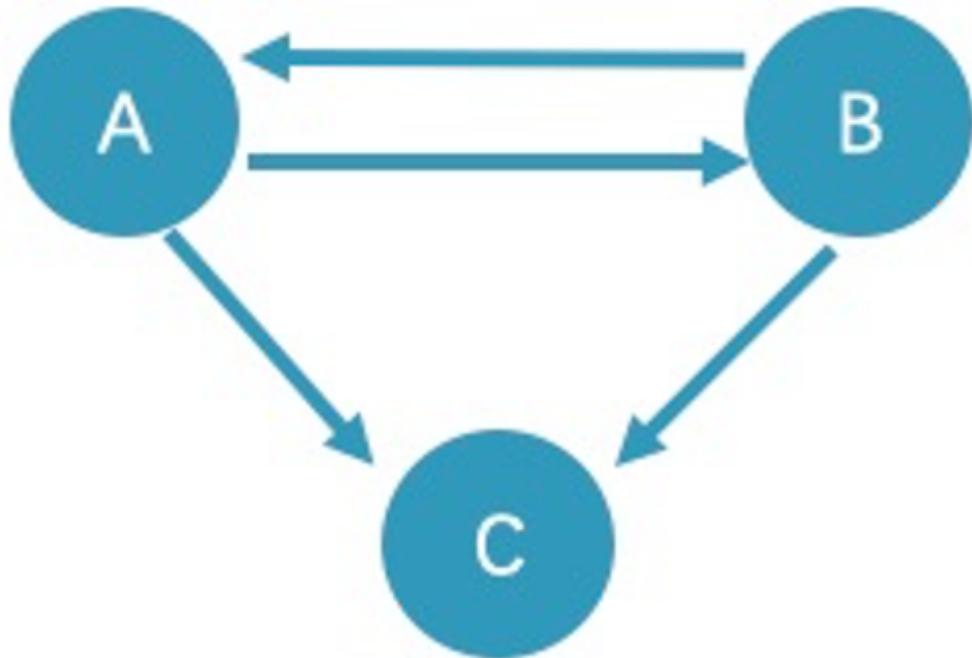


- player101 0~2 follow degree 90 30

```
nebula> GET SUBGRAPH WITH PROP 2 STEPS FROM "player101" \
    WHERE follow.degree > 90 AND $$ .player.age > 30 \
    YIELD VERTICES AS nodes, EDGES AS relationships;
+-----+-----+
| nodes | relationships |
|-----+-----|
| [{"player101":player{age: 36, name: "Tony Parker"}}, [{"follow": "player101->player125"}, [{"follow": "player101->player100"}], [{"follow": "player100->player101"}, {"player100":player{age: 42, name: "Tim Duncan"}], [{"follow": "player100->player125"}], [{"follow": "player125->player101"}, {"player125":player{age: 41, name: "Manu Ginobili"}]}] |
```

FAQ

STEP_COUNT



- GET SUBGRAPH 1 STEPS FROM "A"; A->B B->A A->C B->C
 - GET SUBGRAPH 1 STEPS FROM "A" IN follow; B->A A->B

MATCH GO

```
nebula> MATCH p= (v:player) -- (v2) WHERE id(v)=="A" RETURN p;  
nebula> GO 1 STEPS FROM "A" OVER follow YIELD src(edge),dst(edge);
```

STEP COUNT

```
nebula> GET SUBGRAPH 100 STEPS FROM "player101" OUT follow YIELD VERTICES AS nodes, EDGES AS relationships;
+-----+-----+
| nodes | relationships |
+-----+-----+
| [ {"player101" :player{}} ] | [ [:follow "player101"->"player100" @ 0 {}], [:follow "player101"->"player102" @ 0 {}] ] |
| [ {"player100" :player{}}, {"player102" :player{}} ] | [ [:follow "player102"->"player100" @ 0 {}] ] |
+-----+-----+
```

: January 13, 2023

4.15.2 FIND PATH

FIND PATH

Note

nebula-graphd.conf	num_operator_threads	FIND PATH	num_operator_threads	2 ~ 10	Graph	CPU
Graph	CPU	Graph				

```

FIND { SHORTEST | ALL | NOLOOP } PATH [WITH PROP] FROM <vertex_id_list> TO <vertex_id_list>
OVER <edge_type_list> [REVERSELY | BIDIRECT]
[<WHERE clause>] [UPTO <N> STEPS]
YIELD path as <alias>
[| ORDER BY $-.path] [| LIMIT <M>];

<vertex_id_list> ::= 
    [vertex_id [, vertex_id] ...]

```

- SHORTEST
- ALL
- NOLOOP
- WITH PROP
- <vertex_id_list> ID , \$- \$var
- <edge_type_list> Edge type , * Edge type
- REVERSELY | BIDIRECT REVERSELY BIDIRECT
- <WHERE clause> WHERE
- <N> 5
- <M>

Note

FIND PATH trail

-
-
- WHERE
- graphd

```
(<vertex_id>)-[:<edge_type_name>@<rank>]->(<vertex_id>)
```

```

nebula> FIND SHORTEST PATH FROM "player102" TO "team204" OVER * YIELD path AS p;
+-----+
| p |
+-----+

```

```

| <("player102")-[:serve@0 {}]->("team204")> |
+-----+
nebula> FIND SHORTEST PATH WITH PROP FROM "team204" TO "player100" OVER * REVERSELY YIELD path AS p;
+-----+
| p |
+-----+
| <("team204" :team{name: "Spurs"})-<[:serve@0 {end_year: 2016, start_year: 1997}]-("player100" :player{age: 42, name: "Tim Duncan"})> |
+-----+



nebula> FIND ALL PATH FROM "player100" TO "team204" OVER * WHERE follow.degree is EMPTY or follow.degree >=0 YIELD path AS p;
+-----+
| p |
+-----+
| <"player100"-[:serve@0 {}]->("team204")> |
| <"player100"-[:follow@0 {}]->("player125")-[:serve@0 {}]->("team204")> |
| <"player100"-[:follow@0 {}]->("player101")-[:serve@0 {}]->("team204")> |
| ... |
+-----+



nebula> FIND NOLOOP PATH FROM "player100" TO "team204" OVER * YIELD path AS p;
+-----+
| p |
+-----+
| <("player100")-[:serve@0 {}]->("team204")> |
| <("player100")-[:follow@0 {}]->("player125")-[:serve@0 {}]->("team204")> |
| <("player100")-[:follow@0 {}]->("player101")-[:serve@0 {}]->("team204")> |
| <("player100")-[:follow@0 {}]->("player101")-[:follow@0 {}]->("player125")-[:serve@0 {}]->("team204")> |
| <("player100")-[:follow@0 {}]->("player101")-[:follow@0 {}]->("player102")-[:serve@0 {}]->("team204")> |
| ... |
+-----+

```

FAQ

WHERE

WHERE

WHERE follow.degree is EMPTY or follow.degree >= 0

:January 13, 2023

4.16

4.16.1 EXPLAIN PROFILE

```
EXPLAIN      nGQL          nGQL  
PROFILE      nGQL
```

NebulaGraph

```
nGQL      action  action          action          action      operator  
SHOW TAGS    action  operator  Start  ShowTags    GO        10      action
```

- EXPLAIN

```
EXPLAIN [format= {"row" | "dot"}] <your_nGQL_statement>;
```

- PROFILE

```
PROFILE [format= {"row" | "dot"}] <your_nGQL_statement>;
```

```
EXPLAIN PROFILE      row      dot      format
```

row**row**

- EXPLAIN

```
nebula> EXPLAIN format="row" SHOW TAGS;
Execution succeeded (time spent 327/892 us)
```

Execution Plan

id name	dependencies	profiling data	operator info	
1 ShowTags 0			outputVar: [{"colNames":[], "name": "__ShowTags_1", "type": "DATASET"}]	
			inputVar:	

id name	dependencies	profiling data	operator info	
0 Start 0			outputVar: [{"colNames":[], "name": "__Start_0", "type": "DATASET"}]	
			inputVar:	

- PROFILE

```
nebula> PROFILE format="row" SHOW TAGS;
+-----+
| Name |
+-----+
| player |
| team |
+-----+
Got 2 rows (time spent 2038/2728 us)
```

Execution Plan

id name	dependencies	profiling data	operator info	
1 ShowTags 0		ver: 0, rows: 1, execTime: 42us, totalTime: 1177us	outputVar: [{"colNames":[], "name": "__ShowTags_1", "type": "DATASET"}]	
			inputVar:	

id name	dependencies	profiling data	operator info	
0 Start 0		ver: 0, rows: 0, execTime: 1us, totalTime: 57us	outputVar: [{"colNames":[], "name": "__Start_0", "type": "DATASET"}]	
			inputVar:	

id	operator	ID
----	----------	----

name	operator
------	----------

dependencies	operator	operator	ID
--------------	----------	----------	----

profiling data	ver	operator	rows	operator	execTime	action	totalTime	action
----------------	-----	----------	------	----------	----------	--------	-----------	--------

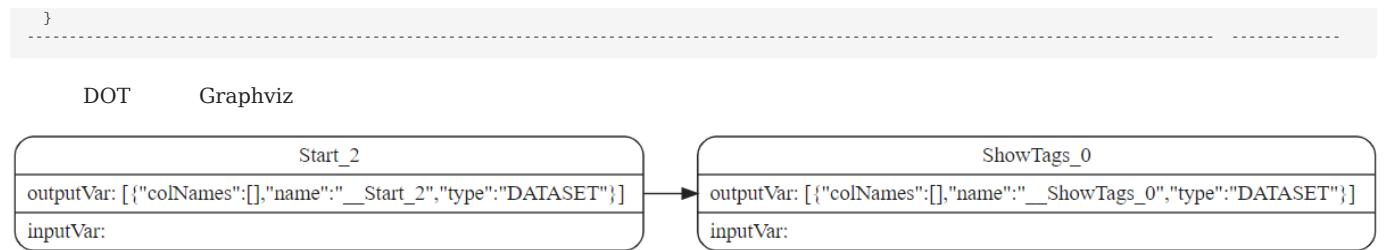
operator info	operator
---------------	----------

dot**dot****Graphviz****Graphviz****DOT****Graphviz****DOT****SVG****JSON****Graphviz Online**

```
nebula> EXPLAIN format="dot" SHOW TAGS;
Execution succeeded (time spent 161/665 us)
Execution Plan
```

```
plan
```

```
digraph exec_plan {
    rankdir=LR;
    "ShowTags_0"[label="ShowTags_0"]outputVar: \[\{"colNames":[], "name": "__ShowTags_0", "type": "DATASET"\}\]\|inputVar:\1,    shape=Mrecord];
    "Start_2"->"ShowTags_0";
    "Start_2"[label="Start_2"]outputVar: \[\{"colNames":[], "name": "__Start_2", "type": "DATASET"\}\]\|inputVar: \1,    shape=Mrecord];
```



:January 13, 2023

4.16.2

KILL QUERY



God

```
KILL QUERY (session=<session_id>, plan=<plan_id>);
```

- session_id ID
- plan_id ID

ID ID SHOW QUERIES

```
nebula> KILL QUERY(SESSION=1625553545984255,PLAN=163);
```

```
[ERROR (-1005)]: ExecutionPlanId[1001] does not exist in current Session.
```

:January 13, 2023

4.17

Storage

COMPACT FLUSH STATS



Note

4.17.1 SUBMIT JOB COMPACT

SUBMIT JOB COMPACT RocksDB compact

compact Storage

```
nebula> SUBMIT JOB COMPACT;
+-----+
| New Job Id |
+-----+
| 40          |
+-----+
```

4.17.2 SUBMIT JOB FLUSH

SUBMIT JOB FLUSH RocksDB memfile

```
nebula> SUBMIT JOB FLUSH;
+-----+
| New Job Id |
+-----+
| 96          |
+-----+
```

4.17.3 SUBMIT JOB STATS

SUBMIT JOB STATS SHOW STATS SHOW STATS



NebulaGraph

SUBMIT JOB STATS

```
nebula> SUBMIT JOB STATS;
+-----+
| New Job Id |
+-----+
| 9           |
+-----+
```

4.17.4 SUBMIT JOB DOWNLOAD/INGEST

SUBMIT JOB DOWNLOAD HDFS SUBMIT JOB INGEST SST NebulaGraph SST

SUBMIT JOB DOWNLOAD HDFS HDFS SST

SUBMIT JOB INGEST SST

```
nebula> SUBMIT JOB DOWNLOAD HDFS "hdfs://192.168.10.100:9000/sst";
+-----+
| New Job Id |
+-----+
| 10          |
+-----+

nebula> SUBMIT JOB INGEST;
+-----+
| New Job Id |
+-----+
| 11          |
+-----+
```

4.17.5 SHOW JOB

Meta	SUBMIT JOB	nebula-storaged SHOW JOB <job_id>
		job_id SUBMIT JOB

```
nebula> SHOW JOB 9;
+-----+-----+-----+-----+-----+-----+
| Job Id( taskId ) | Command(Dest) | Status | Start Time | Stop Time | Error Code |
+-----+-----+-----+-----+-----+-----+
| 8           | "STATS"    | "FINISHED" | 2022-10-18T08:14:45.000000 | 2022-10-18T08:14:45.000000 | "SUCCEEDED" |
| 0           | "192.168.8.129" | "FINISHED" | 2022-10-18T08:14:45.000000 | 2022-10-18T08:15:13.000000 | "SUCCEEDED" |
| "Total:1"   | "Succeeded:1" | "Failed:0"  | "In Progress:0"           | ""                   | ""           |
+-----+-----+-----+-----+-----+-----+
```

Job Id(taskId)	ID	ID
Command(Dest)	nebula-storaged	
Status		
Start Time		
Stop Time	FINISHED	FAILED STOPPED
Error Code		

QUEUE	Start Time
RUNNING	Start Time
FINISHED	Stop Time
FAILED	Stop Time
STOPPED	Stop Time
REMOVED	

```
Queue -- running -- finished -- removed
 \     \
  \     \ -- failed -- /
   \     \
    \ ----- stopped -- /
```

4.17.6 SHOW JOBS

`SHOW JOBS`

Meta	job_expired_secs	Meta
------	------------------	------

```
nebula> SHOW JOBS;
+-----+-----+-----+-----+
| Job Id | Command      | Status    | Start Time          | Stop Time          |
+-----+-----+-----+-----+
| 34     | "STATS"       | "FINISHED" | 2021-11-01T03:32:27.000000 | 2021-11-01T03:32:27.000000 |
| 33     | "FLUSH"        | "FINISHED" | 2021-11-01T03:32:15.000000 | 2021-11-01T03:32:15.000000 |
| 32     | "COMPACT"      | "FINISHED" | 2021-11-01T03:32:06.000000 | 2021-11-01T03:32:06.000000 |
| 31     | "REBUILD_TAG_INDEX" | "FINISHED" | 2021-10-29T05:39:16.000000 | 2021-10-29T05:39:17.000000 |
| 10     | "COMPACT"      | "FINISHED" | 2021-10-26T02:27:05.000000 | 2021-10-26T02:27:05.000000 |
+-----+-----+-----+-----+
```

4.17.7 STOP JOB

`STOP JOB <job_id>`

```
nebula> STOP JOB 22;
+-----+
| Result      |
+-----+
| "Job stopped" |
+-----+
```

4.17.8 RECOVER JOB

RECOVER JOB [<job_id>]	FAILED	STOPPED	<job_id>
------------------------	--------	---------	----------

```
nebula> RECOVER JOB;
+-----+
| Recovered job num |
+-----+
| 5 job recovered   |
+-----+
```

4.17.9 FAQ

SUBMIT JOB	HTTP	Storage	HTTP
------------	------	---------	------

```
curl "http://{storaged-ip}:19779/admin?space={space_name}&op=compact"
```

:January 13, 2023

5.

5.1

5.1.1 1 NebulaGraph

RPM DEB Linux RPM DEB NebulaGraph



NebulaGraph

RPM/DEB

wget



- Linux NebulaGraph CentOS 7.x CentOS 8.x Ubuntu 16.04 Ubuntu 18.04 Ubuntu 20.04
- Linux NebulaGraph

OSS

- release

URL

```
//Centos 7
https://oss-cdn.nebula-graph.com.cn/package/<release_version>/nebula-graph-<release_version>.el7.x86_64.rpm

//Centos 8
https://oss-cdn.nebula-graph.com.cn/package/<release_version>/nebula-graph-<release_version>.el8.x86_64.rpm

//Ubuntu 1604
https://oss-cdn.nebula-graph.com.cn/package/<release_version>/nebula-graph-<release_version>.ubuntu1604.amd64.deb

//Ubuntu 1804
https://oss-cdn.nebula-graph.com.cn/package/<release_version>/nebula-graph-<release_version>.ubuntu1804.amd64.deb

//Ubuntu 2004
https://oss-cdn.nebula-graph.com.cn/package/<release_version>/nebula-graph-<release_version>.ubuntu2004.amd64.deb
```

Centos 7.5 3.3.0

```
wget https://oss-cdn.nebula-graph.com.cn/package/3.3.0/nebula-graph-3.3.0.el7.x86_64.rpm
wget https://oss-cdn.nebula-graph.com.cn/package/3.3.0/nebula-graph-3.3.0.el7.x86_64.rpm.sha256sum.txt
```

ubuntu 1804 3.3.0

```
wget https://oss-cdn.nebula-graph.com.cn/package/3.3.0/nebula-graph-3.3.0.ubuntu1804.amd64.deb
wget https://oss-cdn.nebula-graph.com.cn/package/3.3.0/nebula-graph-3.3.0.ubuntu1804.amd64.deb.sha256sum.txt
```

- (nightly)

Danger

- nightly nightly
- nightly

URL

```
//Centos 7
https://oss-cdn.nebula-graph.com.cn/package/nightly/<yyyy.mm.dd>/nebula-graph-<yyyy.mm.dd>-nightly.el7.x86_64.rpm

//Centos 8
https://oss-cdn.nebula-graph.com.cn/package/nightly/<yyyy.mm.dd>/nebula-graph-<yyyy.mm.dd>-nightly.el8.x86_64.rpm

//Ubuntu 1604
https://oss-cdn.nebula-graph.com.cn/package/nightly/<yyyy.mm.dd>/nebula-graph-<yyyy.mm.dd>-nightly.ubuntu1604.amd64.deb

//Ubuntu 1804
https://oss-cdn.nebula-graph.com.cn/package/nightly/<yyyy.mm.dd>/nebula-graph-<yyyy.mm.dd>-nightly.ubuntu1804.amd64.deb

//Ubuntu 2004
https://oss-cdn.nebula-graph.com.cn/package/nightly/<yyyy.mm.dd>/nebula-graph-<yyyy.mm.dd>-nightly.ubuntu2004.amd64.deb
```

2021.11.24 Centos 7.5 2.x

```
wget https://oss-cdn.nebula-graph.com.cn/package/nightly/2021.11.24/nebula-graph-2021.11.24-nightly.el7.x86_64.rpm
wget https://oss-cdn.nebula-graph.com.cn/package/nightly/2021.11.24/nebula-graph-2021.11.24-nightly.el7.x86_64.rpm.sha256sum.txt
```

2021.11.24 Ubuntu 1804 2.x

```
wget https://oss-cdn.nebula-graph.com.cn/package/nightly/2021.11.24/nebula-graph-2021.11.24-nightly.ubuntu1804.amd64.deb
wget https://oss-cdn.nebula-graph.com.cn/package/nightly/2021.11.24/nebula-graph-2021.11.24-nightly.ubuntu1804.amd64.deb.sha256sum.txt
```

NebulaGraph

- RPM

```
$ sudo rpm -ivh --prefix=<installation_path> <package_name>
```

--prefix NebulaGraph /usr/local/nebula/

3.3.0 RPM

```
sudo rpm -ivh nebula-graph-3.3.0.el7.x86_64.rpm
```

- DEB

```
$ sudo dpkg -i <package_name>
```

Note

DEB NebulaGraph

/usr/local/nebula/

3.3.0 DEB

```
sudo dpkg -i nebula-graph-3.3.0.ubuntu1804.amd64.deb
```

- NebulaGraph

- [NebulaGraph](#)
-

: January 13, 2023

5.1.2 2 NebulaGraph

NebulaGraph

```
nebula.service
```



```
nebula.service      /usr/local/nebula/scripts
```

```
$ sudo /usr/local/nebula/scripts/nebula.service
[-v] [-c <config_file_path>]
<start | stop | restart | kill | status>
<metad | graphd | storaged | all>
```

```
-v
```

```
-c          /usr/local/nebula/etc/
```

```
start
```

```
stop
```

```
restart
```

```
kill
```

```
status
```

```
metad          Meta
```

```
graphd         Graph
```

```
storaged       Storage
```

```
all
```

NebulaGraph

```
$ sudo /usr/local/nebula/scripts/nebula.service start all
[INFO] Starting nebula-metad...
[INFO] Done
[INFO] Starting nebula-graphd...
[INFO] Done
[INFO] Starting nebula-storaged...
[INFO] Done
```

NebulaGraph



```
kill -9
```

NebulaGraph

```
$ sudo /usr/local/nebula/scripts/nebula.service stop all
[INFO] Stopping nebula-metad...
[INFO] Done
[INFO] Stopping nebula-graphd...
[INFO] Done
[INFO] Stopping nebula-storaged...
[INFO] Done
```

NebulaGraph

NebulaGraph

```
$ sudo /usr/local/nebula/scripts/nebula.service status all
```

- NebulaGraph

```
[INFO] nebula-metad(33fd35e): Running as 29020, Listening on 9559
[INFO] nebula-graphd(33fd35e): Running as 29095, Listening on 9669
[WARN] nebula-storaged after v3.0.0 will not start service until it is added to cluster.
[WARN] See Manage Storage hosts:ADD HOSTS in https://docs.nebula-graph.io/
[INFO] nebula-storaged(33fd35e): Running as 29147, Listening on 9779
```



Note

NebulaGraph	nebula-storaged	nebula-storaged	nebula-metad	Storage	Storage	Storage	Ready
3.0.0	Storage	Storage	Meta	ADD HOSTS			
Storage							

- NebulaGraph NebulaGraph

```
[INFO] nebula-metad: Running as 25600, Listening on 9559
[INFO] nebula-graphd: Exited
[INFO] nebula-storaged: Running as 25646, Listening on 9779
```

NebulaGraph	Meta	Graph	Storage	etc	/usr/local/nebula/etc/
-------------	------	-------	---------	-----	------------------------

-
- NebulaGraph

:January 13, 2023

5.1.3 3 NebulaGraph

Nebula Console NebulaGraph



NebulaGraph

Storage

NebulaGraph

- NebulaGraph
- Nebula Console NebulaGraph
- Nebula Console NebulaGraph



Nebula Console NebulaGraph

Nebula Console NebulaGraph

incompatible version

between client and server

1. Nebula Console

Assets



2. **Assets**

3. nebula-console



Windows

nebula-console.exe

4. Nebula Console nebula-console



Windows

```
$ chmod 111 nebula-console
```

5. nebula-console

6. NebulaGraph

- Linux macOS

```
$ ./nebula-console -addr <ip> -port <port> -u <username> -p <password>
[-t 120] [-e "nGQL_statement" | -f filename.nGQL]
```

- Windows

```
> nebula-console.exe -addr <ip> -port <port> -u <username> -p <password>
[-t 120] [-e "nGQL_statement" | -f filename.nGQL]
```

-h/-help		
-addr/-address	Graph	IP 127.0.0.1
-P/-port	Graph	9669
-u/-user	NebulaGraph	root
-p/-password		
-t/-timeout		120
-e/-eval		nGQL
-f/-file	nGQL	nGQL
-enable_ssl	NebulaGraph	SSL
-ssl_root_ca_path		CA
-ssl_cert_path		CRT
-ssl_private_key_path		

: January 13, 2023

5.1.4 Storage

NebulaGraph Storage



NebulaGraph 3.0.0 ADD HOSTS Storage

NebulaGraph

1. Storage

```
ADD HOSTS <ip>:<port> [,<ip>:<port> ...];
```

```
nebula> ADD HOSTS 192.168.10.100:9779, 192.168.10.101:9779, 192.168.10.102:9779;
```



IP nebula-storaged.conf local_ip IP Storage

2.

```
nebula> SHOW HOSTS;
+-----+-----+-----+-----+-----+-----+-----+
| Host | Port | HTTP port | Status | Leader count | Leader distribution | Partition distribution | Version |
+-----+-----+-----+-----+-----+-----+-----+
| "192.168.10.100" | 9779 | 19669 | "ONLINE" | 0 | "No valid partition" | "No valid partition" | "3.1.0" |
| "192.168.10.101" | 9779 | 19669 | "ONLINE" | 0 | "No valid partition" | "No valid partition" | "3.1.0" |
| "192.168.10.102" | 9779 | 19669 | "ONLINE" | 0 | "No valid partition" | "No valid partition" | "3.1.0" |
+-----+-----+-----+-----+-----+-----+-----+
```

Status Storage

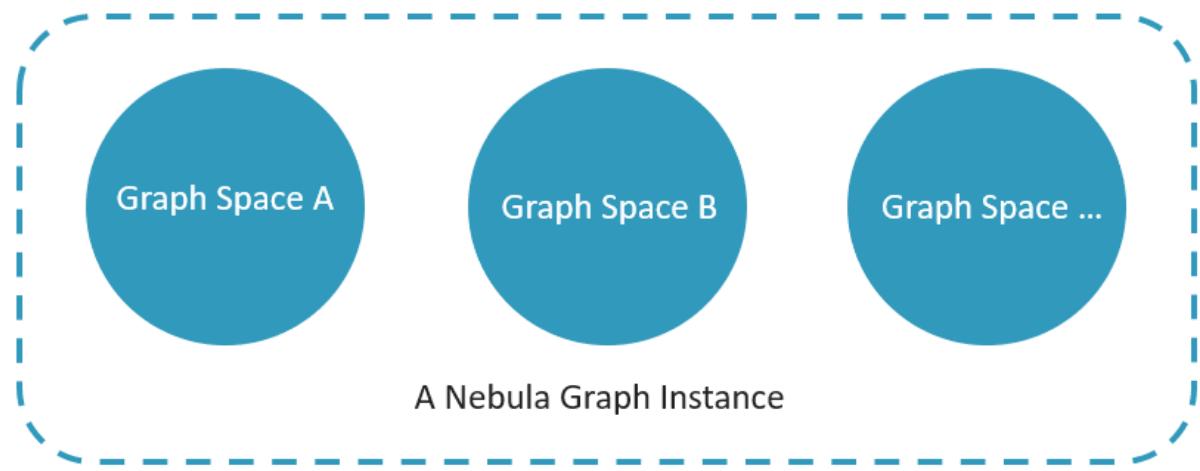
: January 13, 2023

5.1.5 4 nGQL CRUD

NebulaGraph Schema
nGQL

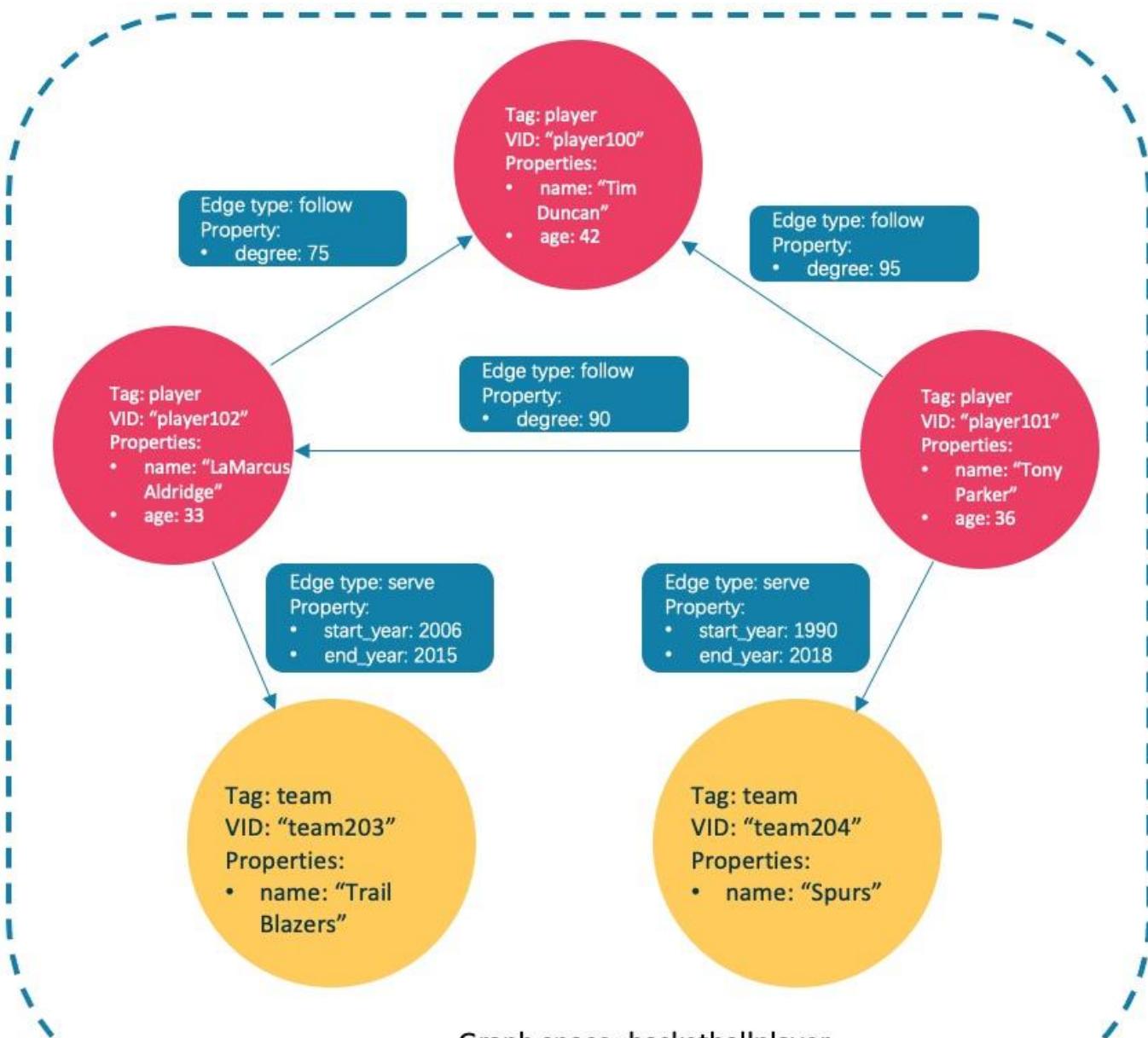
SCHEMA

NebulaGraph



Schema NebulaGraph Schema

Vertex	0
Tag	
Edge	
Edge type	



Caution

NebulaGraph

2 20

- CREATE SPACE
- CREATE TAG
- CREATE EDGE
- ALTER TAG
- ALTER EDGE
- CREATE TAG INDEX
- CREATE EDGE INDEX

Note

10 heartbeat_interval_secs

NGQL

```
CREATE SPACE [IF NOT EXISTS] <graph_space_name> (
[partition_num = <partition_number>,
[replica_factor = <replica_number>,
vid_type = {FIXED_STRING(<N>) | INT64}
)

[COMMENT = '<comment>'];
```

CREATE SPACE

```
nebula> SHOW SPACES;
```

```
USE <graph_space_name>;
```

1. basketballplayer

```
nebula> CREATE SPACE basketballplayer(partition_num=15, replica_factor=1, vid_type=fixed_string(30));
```

Note

[ERROR (-1005)]: Host not enough!

Storage

2. SHOW HOSTS

```
nebula> SHOW HOSTS;
+-----+-----+-----+-----+-----+-----+
| Host | Port | HTTP port | Status | Leader count | Leader distribution | Partition distribution | Version |
+-----+-----+-----+-----+-----+-----+
| "storaged0" | 9779 | 19669 | "ONLINE" | 5 | "basketballplayer:5" | "basketballplayer:5" | "3.1.0" |
| "storaged1" | 9779 | 19669 | "ONLINE" | 5 | "basketballplayer:5" | "basketballplayer:5" | "3.1.0" |
| "storaged2" | 9779 | 19669 | "ONLINE" | 5 | "basketballplayer:5" | "basketballplayer:5" | "3.1.0" |
+-----+-----+-----+-----+-----+-----+
```

Leader distribution

BALANCE LEADER

Storage

3. basketballplayer

```
nebula[(none)]> USE basketballplayer;
```

SHOW SPACES

```
nebula> SHOW SPACES;
+-----+
| Name |
+-----+
| "basketballplayer" |
+-----+
```

Tag Edge type

NGQL

```
CREATE {TAG | EDGE} [IF NOT EXISTS] {<tag_name> | <edge_type_name>}
(
  <prop_name> <data_type> [NULL | NOT NULL] [DEFAULT <default_value>] [COMMENT '<comment>']
  [{, <prop_name> <data_type> [NULL | NOT NULL] [DEFAULT <default_value>] [COMMENT '<comment>']} ...]
)
[TTL_DURATION = <ttl_duration>]
[TTL_COL = <prop_name>]
[COMMENT = '<comment>'];
```

CREATE TAG CREATE EDGE

Tag: player team Edge type: follow serve

player	Tag	name (string), age (int)
team	Tag	name (string)
follow	Edge type	degree (int)
serve	Edge type	start_year (int), end_year (int)

```
nebula> CREATE TAG player(name string, age int);
nebula> CREATE TAG team(name string);
nebula> CREATE EDGE follow(degree int);
nebula> CREATE EDGE serve(start_year int, end_year int);
```

INSERT Tag Edge type

NGQL

```
INSERT VERTEX [IF NOT EXISTS] [tag_props, [tag_props] ...]
VALUES <vid>: ([prop_value_list])

tag_props:
  tag_name ([prop_name_list])

prop_name_list:
  [prop_name [, prop_name] ...]

prop_value_list:
  [prop_value [, prop_value] ...]
```

vid Vertex ID vid INSERT VERTEX

```
INSERT EDGE [IF NOT EXISTS] <edge_type> ( <prop_name_list> ) VALUES
<src_vid> -> <dst_vid>[@<rank>] : ( <prop_value_list> )
[, <src_vid> -> <dst_vid>[@<rank>] : ( <prop_value_list> ), ...];

<prop_name_list> ::= 
[ <prop_name> [, <prop_name>] ...]

<prop_value_list> ::= 
[ <prop_value> [, <prop_value>] ...]
```

INSERT EDGE

- ```
nebula> INSERT VERTEX player(name, age) VALUES "player100":("Tim Duncan", 42);
nebula> INSERT VERTEX player(name, age) VALUES "player101":("Tony Parker", 36);
nebula> INSERT VERTEX player(name, age) VALUES "player102":("LaMarcus Aldridge", 33);
nebula> INSERT VERTEX team(name) VALUES "team203":("Trail Blazers"), "team204":("Spurs");
```
- ```
nebula> INSERT EDGE follow(degree) VALUES "player101" -> "player100":(95);
nebula> INSERT EDGE follow(degree) VALUES "player101" -> "player102":(90);
nebula> INSERT EDGE follow(degree) VALUES "player102" -> "player100":(75);
nebula> INSERT EDGE serve(start_year, end_year) VALUES "player101" -> "team204":(1999, 2018), "player102" -> "team203":(2006, 2015);
```

- GO GO YIELD
- FETCH
- LOOKUP WHERE
- MATCH NebulaGraph

NGQL

- GO

```
GO [[<M> TO] <N> STEPS ] FROM <vertex_list>
OVER <edge_type_list> [{REVERSELY | BIDIRECT}]
[ WHERE <conditions> ]
YIELD [DISTINCT] <return_list>
[ { SAMPLE <sample_list> | <limit_by_list_clause> } ]
[ | GROUP BY {<col_name> | expression> | <position>} YIELD <col_name>]
```

```
[| ORDER BY <expression> [{ASC | DESC}]]  
[| LIMIT [<offset>,<number_rows>];
```

- **FETCH**

- **Tag**

```
FETCH PROP ON {<tag_name>[, tag_name ...] | *}  
<vid> [, vid ...]  
YIELD <return_list> [AS <alias>];
```

-

```
FETCH PROP ON <edge_type> <src_vid> -> <dst_vid>[@<rank>] [, <src_vid> -> <dst_vid> ...]  
YIELD <output>;
```

- **LOOKUP**

```
LOOKUP ON {<vertex_tag> | <edge_type>}  
[WHERE <expression> [AND <expression> ...]]  
YIELD <return_list> [AS <alias>];  
  
<return_list>  
  <prop_name> [AS <col_alias>] [, <prop_name> [AS <prop_alias>] ...];
```

- **MATCH**

```
MATCH <pattern> [<clause_1>] RETURN <output> [<clause_2>];
```

GO

- VID `player101` follow

```
nebula> GO FROM "player101" OVER follow YIELD id($$);  
+-----+  
| id($) |  
+-----+  
| "player100" |
```

```
| "player102" |
+-----+
```

- VID player101 follow 35

```
nebula> GO FROM "player101" OVER follow WHERE properties($$).age >= 35 \
    YIELD properties($$).name AS Teammate, properties($$).age AS Age;
+-----+-----+
| Teammate | Age |
+-----+-----+
| "Tim Duncan" | 42 |
+-----+-----+
```

/

YIELD

\$\$

\

- VID player101 follow

*

```
nebula> GO FROM "player101" OVER follow YIELD dst(edge) AS id | \
    GO FROM $.id OVER serve YIELD properties($$).name AS Team, \
    properties($^).name AS Player;
+-----+-----+
| Team | Player |
+-----+-----+
| "Trail Blazers" | "LaMarcus Aldridge" |
+-----+-----+
```

/

\$^

|

\$-

*

Note

```
nebula> $var = GO FROM "player101" OVER follow YIELD dst(edge) AS id; \
    GO FROM $var.id OVER serve YIELD properties($$).name AS Team, \
    properties($^).name AS Player;
+-----+-----+
| Team | Player |
+-----+-----+
| "Trail Blazers" | "LaMarcus Aldridge" |
+-----+-----+
```

FETCH

VID player100

```
nebula> FETCH PROP ON player "player100" YIELD properties(vertex);
+-----+
| properties(VERTEX) |
+-----+
| {age: 42, name: "Tim Duncan"} |
+-----+
```

Note

LOOKUP MATCH

UPDATE UPSERT

UPSERT UPDATE INSERT UPSERT

Note

partition UPSERT INSERT UPDATE partition

nGQL

- UPDATE

```
UPDATE VERTEX <vid> SET <properties to be updated>
[WHEN <condition>] [YIELD <columns>];
```

- UPDATE

```
UPDATE EDGE ON <edge_type> <source vid> -> <destination vid> [@rank]
SET <properties to be updated> [WHEN <condition>] [YIELD <columns to be output>];
```

- UPSERT

```
UPSERT {VERTEX <vid> | EDGE <edge_type>} SET <update_columns>
[WHEN <condition>] [YIELD <columns>];
```

- UPDATE VID player100 name FETCH

```
nebula> UPDATE VERTEX "player100" SET player.name = "Tim";
nebula> FETCH PROP ON player "player100" YIELD properties(vertex);
+-----+
| properties(VERTEX) |
+-----+
```

```
| {age: 42, name: "Tim"} |  
+-----+  
|
```

- UPDATE degree FETCH

```
nebula> UPDATE EDGE ON follow "player101" -> "player100" SET degree = 96;  
nebula> FETCH PROP ON follow "player101" -> "player100" YIELD properties(edge);  
+-----+  
| properties(EDGE) |  
+-----+  
| {degree: 96} |  
+-----+
```

- INSERT VID player111 UPSERT

```
nebula> INSERT VERTEX player(name,age) VALUES "player111":("David West", 38);  
nebula> UPSERT VERTEX "player111" SET player.name = "David", player.age = $^.player.age + 11 \  
WHEN $.player.name == "David West" AND $.player.age > 20 \  
YIELD $.player.name AS Name, $.player.age AS Age;  
+-----+-----+  
| Name | Age |  
+-----+-----+  
| "David" | 49 |  
+-----+
```

nGQL

- ```
DELETE VERTEX <vid1>[, <vid2>...]
```
- ```
DELETE EDGE <edge_type> <src_vid> -> <dst_vid>[@<rank>]  
[, <src_vid> -> <dst_vid>...]
```
- ```
nebula> DELETE VERTEX "player111", "team203";
```
- ```
nebula> DELETE EDGE follow "player101" -> "team204";
```

CREATE INDEX Tag Edge type



```
MATCH LOOKUP  
" " MATCH LOOKUP
```

nGQL

-

```
CREATE {TAG | EDGE} INDEX [IF NOT EXISTS] <index_name>
ON {<tag_name> | <edge_name>} ([<prop_name_list>]) [COMMENT = '<comment>'];
```

- REBUILD {TAG | EDGE} INDEX <index_name>;

Note

utf-8

3

10

30

LOOKUP MATCH

LOOKUP MATCH

Tag player name Tony Parker

```
//      name      player_index_1
nebula> CREATE TAG INDEX IF NOT EXISTS player_index_1 ON player(name(20));
//
//      REBUILD TAG INDEX player_index_1
+-----+
| New Job Id |
+-----+
| 31          |
+-----+

//      LOOKUP
nebula> LOOKUP ON player WHERE player.name == "Tony Parker" \
      YIELD properties(vertex).name AS name, properties(vertex).age AS age;
+-----+-----+
| name      | age   |
+-----+-----+
| "Tony Parker" | 36   |
+-----+-----+

//      MATCH
nebula> MATCH (v:player{name:"Tony Parker"}) RETURN v;
+-----+
| v           |
+-----+
| ("player101" :player{age: 36, name: "Tony Parker"}) |
```

:January 13, 2023

5.2 NebulaGraph

NebulaGraph

5.2.1

NebulaGraph NVMe SSD SSD IOPS Latency

- HDD IOPS
- NAS SAN HDFS Ceph
- RAID
- SSD AWS Provisioned IOPS SSD

5.2.2 CPU



3.0.2 NebulaGraph Docker Hub Docker ARM64 ARM macOS Docker Desktop ARM Linux Server
NebulaGraph

5.2.3

CPU	x86_64
	4 GB
	10 GB SSD

Linux NebulaGraph 4.15 Linux



Linux NebulaGraph RPM DEB TAR

glibc	2.17	ldd --version
make	-	
m4	-	
git	-	
wget	-	
unzip	-	
xz	-	
readline-devel	-	
ncurses-devel	-	
zlib-devel	-	
g++	8.5.0	g++ -v
cmake	3.14.0	cmake --version
curl	-	
redhat-lsb-core	-	
libstdc++-static		CentOS 8+ RedHat 8+ Fedora
libasan		CentOS 8+ RedHat 8+ Fedora
bzip2	-	
cmake	build	

1.

- CentOS RedHat Fedora

```
$ yum update
$ yum install -y make \
    m4 \
    git \
    wget \
    unzip \
    xz \
    readline-devel \
    ncurses-devel \
    zlib-devel \
    gcc \
    gcc-c++ \
    cmake \
    curl \
    redhat-lsb-core \
    bzip2
//  CentOS 8+ RedHat 8+ Fedora      libstdc++-static  libasan
$ yum install -y libstdc++-static libasan
```

- Debian Ubuntu

```
$ apt-get update
$ apt-get install -y make \
    m4 \
    git \
    wget \
    unzip \
    xz-utils \
    curl \
    lsb-core \
    build-essential \
    libreadline-dev \
    ncurses-dev \
    cmake \
    bzip2
```

2. G++ CMake

```
$ g++ --version
$ cmake --version
```

3. CMake g++

5.2.4

CPU	x86_64
CPU	4
	8 GB
	100 GB SSD

Linux NebulaGraph 3.9 Linux

metad meta	1
storaged	≥ 1
graphd	≥ 1

1 metad 1 storaged 1 graphd

NebulaGraph

	metad	storaged	graphd
A	1	1	1
B	-	1	1
C	-	1	1

5.2.5

CPU	x86_64
CPU	48
	256 GB
	2 * 1.6 TB NVMe SSD

Linux NebulaGraph 3.9 Linux

NebulaGraph



metad meta	3	
storaged	≥ 3	
graphd	≥ 3	
3 metad	metad	meta
storaged		

	metad	storaged	graphd
A	1	1	1
B	1	1	1
C	1	1	1
D	-	1	1
E	-	1	1

5.2.6 NebulaGraph

3 NebulaGraph

Bytes	*	* 7.5 * 120%	*	* 7.5
Bytes	[* 16 + RocksDB * (write_buffer_size * max_write_buffer_number + *)] * 120%		* 16 BloomFilter max_write_buffer_number RocksDB MemTable	write_buffer_size Memory usage in RocksDB
-	*		disk_partition_num_multiplier	2~20 SSD 20 HDD 2
• 1	7.5		16	* 50
csv		2.5		
• 2	120%			
20%				
• 3	RocksDB			
NebulaGraph	=	*	RocksDB --data_path etc nebula-storaged.conf	RocksDB
RocksDB			NebulaGraph RocksDB	

Note

nebula-storaged.conf --enable_partitioned_index_filter=true bloom random-seek

: January 13, 2023

5.3

5.3.1 NebulaGraph

NebulaGraph

-



NebulaGraph

- NebulaGraph

1. NebulaGraph

- [] 3.3.0 NebulaGraph

```
$ git clone --branch release-3.3 https://github.com/vesoft-inc/nebula.git
```

- master

```
$ git clone https://github.com/vesoft-inc/nebula.git
```

2. nebula

```
$ cd nebula
```

3. build

```
$ mkdir build && cd build
```

4. CMake makefile



/usr/local/nebula

-DCMAKE_INSTALL_PREFIX=<installation_path>

CMake CMake

```
$ cmake -DCMAKE_INSTALL_PREFIX=/usr/local/nebula -DENABLE_TESTING=OFF -DCMAKE_BUILD_TYPE=Release ..
```

5. NebulaGraph



-j N \(\min(\text{CPU}, \frac{(\text{GB})}{2})\)

```
$ make -j{N} # E.g., make -j2
```

6. NebulaGraph

```
$ sudo make install
```

7. etc/ /usr/local/nebula/etc script nebula-

```
graph.conf nebula-metad.conf nebula-storaged.conf
```

master

master	master	NebulaGraph
--------	--------	-------------

1. nebula git pull upstream master
2. nebula/build make -j{N} make install

- NebulaGraph

CMake

```
$ cmake -D<variable>=<value> ...
```

CMake (CMake)

CMAKE_INSTALL_PREFIX

```
CMAKE_INSTALL_PREFIX NebulaGraph /usr/local/nebula
```

ENABLE_WERROR

```
ON warning error OFF
```

ENABLE_TESTING

```
ON NebulaGraph OFF
```

ENABLE_ASAN

```
OFF ASan AddressSanitizer NebulaGraph ON
```

CMAKE_BUILD_TYPE

```
CMAKE_BUILD_TYPE NebulaGraph build
```

- Debug

```
CMAKE_BUILD_TYPE build debug
```

- Release

```
build debug
```

- RelWithDebInfo

```
build debug
```

- MinSizeRel

```
build debug
```

```
ENABLE_INCLUDE_WHAT_YOU_USE
```

```
OFF      ON      include-what-you-use      makefile
```

```
NEBULA_USE_LINKER
```

- bfd ld.bfd
- lld , lld ld.lld
- gold gold ld.gold

```
CMAKE_C_COMPILER/CMAKE_CXX_COMPILER
```

```
CMake      C/C++
```

```
$ cmake -DCMAKE_C_COMPILER=<path_to_gcc/bin/gcc> -DCMAKE_CXX_COMPILER=<path_to_gcc/bin/g++> ..
$ cmake -DCMAKE_C_COMPILER=<path_to_clang/bin/clang> -DCMAKE_CXX_COMPILER=<path_to_clang/bin/clang++> ..
```

```
ENABLE_CCACHE
```

```
ENABLE_CCACHE ON      Ccache compiler cache
```

```
ccache      ENABLE_CCACHE=OFF      ccache      export CCACHE_DISABLE=true      ~/.ccache/
ccache.conf  disable=true      ccache official documentation
```

```
NEBULA_THIRDPARTY_ROOT
```

```
NEBULA_THIRDPARTY_ROOT      /opt/vesoft/third-party
```

1.

2. [third-party](#)

3. `make -j1`

: January 13, 2023

5.3.2 RPM DEB NebulaGraph

RPM DEB Linux

RPM DEB

NebulaGraph



NebulaGraph

RPM/DEB

wget



- Linux NebulaGraph CentOS 7.x CentOS 8.x Ubuntu 16.04 Ubuntu 18.04 Ubuntu 20.04
- Linux NebulaGraph

OSS

- release

URL

```
//Centos 7
https://oss-cdn.nebula-graph.com.cn/package/<release_version>/nebula-graph-<release_version>.el7.x86_64.rpm

//Centos 8
https://oss-cdn.nebula-graph.com.cn/package/<release_version>/nebula-graph-<release_version>.el8.x86_64.rpm

//Ubuntu 1604
https://oss-cdn.nebula-graph.com.cn/package/<release_version>/nebula-graph-<release_version>.ubuntu1604.amd64.deb

//Ubuntu 1804
https://oss-cdn.nebula-graph.com.cn/package/<release_version>/nebula-graph-<release_version>.ubuntu1804.amd64.deb

//Ubuntu 2004
https://oss-cdn.nebula-graph.com.cn/package/<release_version>/nebula-graph-<release_version>.ubuntu2004.amd64.deb
```

Centos 7.5 3.3.0

```
wget https://oss-cdn.nebula-graph.com.cn/package/3.3.0/nebula-graph-3.3.0.el7.x86_64.rpm
wget https://oss-cdn.nebula-graph.com.cn/package/3.3.0/nebula-graph-3.3.0.el7.x86_64.rpm.sha256sum.txt
```

ubuntu 1804 3.3.0

```
wget https://oss-cdn.nebula-graph.com.cn/package/3.3.0/nebula-graph-3.3.0.ubuntu1804.amd64.deb
wget https://oss-cdn.nebula-graph.com.cn/package/3.3.0/nebula-graph-3.3.0.ubuntu1804.amd64.deb.sha256sum.txt
```

- (nightly)

Danger

- nightly nightly
- nightly

URL

```
//Centos 7
https://oss-cdn.nebula-graph.com.cn/package/nightly/<yyyy.mm.dd>/nebula-graph-<yyyy.mm.dd>-nightly.el7.x86_64.rpm

//Centos 8
https://oss-cdn.nebula-graph.com.cn/package/nightly/<yyyy.mm.dd>/nebula-graph-<yyyy.mm.dd>-nightly.el8.x86_64.rpm

//Ubuntu 1604
https://oss-cdn.nebula-graph.com.cn/package/nightly/<yyyy.mm.dd>/nebula-graph-<yyyy.mm.dd>-nightly.ubuntu1604.amd64.deb

//Ubuntu 1804
https://oss-cdn.nebula-graph.com.cn/package/nightly/<yyyy.mm.dd>/nebula-graph-<yyyy.mm.dd>-nightly.ubuntu1804.amd64.deb

//Ubuntu 2004
https://oss-cdn.nebula-graph.com.cn/package/nightly/<yyyy.mm.dd>/nebula-graph-<yyyy.mm.dd>-nightly.ubuntu2004.amd64.deb
```

2021.11.24 Centos 7.5 2.x

```
wget https://oss-cdn.nebula-graph.com.cn/package/nightly/2021.11.24/nebula-graph-2021.11.24-nightly.el7.x86_64.rpm
wget https://oss-cdn.nebula-graph.com.cn/package/nightly/2021.11.24/nebula-graph-2021.11.24-nightly.el7.x86_64.rpm.sha256sum.txt
```

2021.11.24 Ubuntu 1804 2.x

```
wget https://oss-cdn.nebula-graph.com.cn/package/nightly/2021.11.24/nebula-graph-2021.11.24-nightly.ubuntu1804.amd64.deb
wget https://oss-cdn.nebula-graph.com.cn/package/nightly/2021.11.24/nebula-graph-2021.11.24-nightly.ubuntu1804.amd64.deb.sha256sum.txt
```

NebulaGraph

- RPM

```
$ sudo rpm -ivh --prefix=<installation_path> <package_name>
```

--prefix NebulaGraph /usr/local/nebula/

3.3.0 RPM

```
sudo rpm -ivh nebula-graph-3.3.0.el7.x86_64.rpm
```

- DEB

```
$ sudo dpkg -i <package_name>
```

Note

DEB NebulaGraph

/usr/local/nebula/

3.3.0 DEB

```
sudo dpkg -i nebula-graph-3.3.0.ubuntu1804.amd64.deb
```

- NebulaGraph

- [NebulaGraph](#)
-

: January 13, 2023

5.3.3 tar.gz NebulaGraph

tar.gz NebulaGraph

Note

- NebulaGraph 2.6.0 tar.gz
- Linux NebulaGraph CentOS 7.x CentOS 8.x Ubuntu 16.04 Ubuntu 18.04 Ubuntu 20.04
- Linux NebulaGraph

1. NebulaGraph tar.gz

```
<release_version>

//Centos 7
https://oss-cdn.nebula-graph.com.cn/package/<release_version>/nebula-graph-<release_version>.el7.x86_64.tar.gz
//Checksum
https://oss-cdn.nebula-graph.com.cn/package/<release_version>/nebula-graph-<release_version>.el7.x86_64.tar.gz.sha256sum.txt

//Centos 8
https://oss-cdn.nebula-graph.com.cn/package/<release_version>/nebula-graph-<release_version>.el8.x86_64.tar.gz
//Checksum
https://oss-cdn.nebula-graph.com.cn/package/<release_version>/nebula-graph-<release_version>.el8.x86_64.tar.gz.sha256sum.txt

//Ubuntu 1604
https://oss-cdn.nebula-graph.com.cn/package/<release_version>/nebula-graph-<release_version>.ubuntu1604.amd64.tar.gz
//Checksum
https://oss-cdn.nebula-graph.com.cn/package/<release_version>/nebula-graph-<release_version>.ubuntu1604.amd64.tar.gz.sha256sum.txt

//Ubuntu 1804
https://oss-cdn.nebula-graph.com.cn/package/<release_version>/nebula-graph-<release_version>.ubuntu1804.amd64.tar.gz
//Checksum
https://oss-cdn.nebula-graph.com.cn/package/<release_version>/nebula-graph-<release_version>.ubuntu1804.amd64.tar.gz.sha256sum.txt

//Ubuntu 2004
https://oss-cdn.nebula-graph.com.cn/package/<release_version>/nebula-graph-<release_version>.ubuntu2004.amd64.tar.gz
//Checksum
https://oss-cdn.nebula-graph.com.cn/package/<release_version>/nebula-graph-<release_version>.ubuntu2004.amd64.tar.gz.sha256sum.txt
```

CentOS 7.5 NebulaGraph release-3.3 tar.gz

```
wget https://oss-cdn.nebula-graph.com.cn/package/3.3.0/nebula-graph-3.3.0.el7.x86_64.tar.gz
```

2. tar.gz NebulaGraph

```
tar -xvzf <tar.gz_file_name> -C <install_path>
```

- tar.gz_file_name tar.gz
- install_path

```
tar -xvzf nebula-graph-3.3.0.el7.x86_64.tar.gz -C /home/joe/nebula/install
```

3.

```
etc nebula-graphd.conf.default nebula-metad.conf.default nebula-storaged.conf.default .default
NebulaGraph
```

NebulaGraph

- NebulaGraph

: January 13, 2023

5.3.4 Docker Compose NebulaGraph

Docker Compose NebulaGraph NebulaGraph

-

Docker

[Install Docker Engine](#)

Docker Compose

[Install Docker Compose](#)

Git

[Download Git](#)

- root NebulaGraph Docker [Manage Docker as a non-root user](#)
- Docker
- Docker Compose NebulaGraph `nebula-docker-compose/data`

NebulaGraph

1. Git `nebula-docker-compose 3.3.0`

 **Danger**

master

```
$ git clone -b release-3.3 https://github.com/vesoft-inc/nebula-docker-compose.git
```

 **Note**

Docker Compose `x.y` `x.y` `z` Docker Compose `z` `z`

2. `nebula-docker-compose`

```
$ cd nebula-docker-compose/
```

3. NebulaGraph

 **Note**

NebulaGraph NebulaGraph Console

```
[nebula-docker-compose]$ docker-compose up -d
Creating nebuladockercompose_metad0_1 ... done
Creating nebuladockercompose_metad2_1 ... done
Creating nebuladockercompose_metad1_1 ... done
Creating nebuladockercompose_graphd2_1 ... done
Creating nebuladockercompose_graphd1_1 ... done
Creating nebuladockercompose_graphd1_1 ... done
Creating nebuladockercompose_storaged0_1 ... done
Creating nebuladockercompose_storaged2_1 ... done
Creating nebuladockercompose_storaged1_1 ... done
```

↑ Compatibility

3.1 Docker-compose NebulaGraph Console Storage ADD HOSTS

Note

NebulaGraph

NebulaGraph

- Nebula Console Graph 9669 NebulaGraph
- NebulaGraph Console Graph

1. docker-compose ps NebulaGraph Console

```
$ docker-compose ps
  Name          Command     State    Ports
-----+-----+-----+-----+
nebuladockercompose_console_1   sh -c sleep 3 && nebula-co ...
.....
```

2. NebulaGraph Console

```
$ docker exec -it nebuladockercompose_console_1 /bin/sh
/ #
```

3. NebulaGraph Console NebulaGraph

```
/ # ./usr/local/bin/nebula-console -u <user_name> -p <password> --address=graphd --port=9669
```

Note

root

4.

```
nebula> SHOW HOSTS;
+-----+-----+-----+-----+-----+-----+-----+
| Host | Port | HTTP port | Status | Leader count | Leader distribution | Partition distribution | Version |
+-----+-----+-----+-----+-----+-----+-----+
| "storaged0" | 9779 | 19779 | "ONLINE" | 0 | "No valid partition" | "No valid partition" | "x.x.x" |
| "storaged1" | 9779 | 19779 | "ONLINE" | 0 | "No valid partition" | "No valid partition" | "x.x.x" |
| "storaged2" | 9779 | 19779 | "ONLINE" | 0 | "No valid partition" | "No valid partition" | "x.x.x" |
+-----+-----+-----+-----+-----+-----+-----+
```

exit

NebulaGraph

docker-compose ps NebulaGraph

Note

NebulaGraph 9669 nebula-docker-compose docker-compose.yaml NebulaGraph

```
$ docker-compose ps
nebuladockercompose_console_1   sh -c sleep 3 &&
```

```

nebuladockercompose_graphd1_1    /usr/local/nebula/bin/nebu ... Up   0.0.0.0:49174->19669/tcp,:::49174->19669/tcp, 0.0.0.0:49171->19670/tcp,:::49171->19670/tcp, 0.0.0.0:49177->9669/tcp,:::49177->9669/tcp
nebuladockercompose_graphd2_1    /usr/local/nebula/bin/nebu ... Up   0.0.0.0:49175->19669/tcp,:::49175->19669/tcp, 0.0.0.0:49172->19670/tcp,:::49172->19670/tcp, 0.0.0.0:49178->9669/tcp,:::49178->9669/tcp
nebuladockercompose_graphd_1     /usr/local/nebula/bin/nebu ... Up   0.0.0.0:49180->19669/tcp,:::49180->19669/tcp, 0.0.0.0:49179->19670/tcp,:::49179->19670/tcp, 0.0.0.0:49169->9669/tcp,:::49169->9669/tcp
nebuladockercompose_metad0_1    /usr/local/nebula/bin/nebu ... Up   0.0.0.0:49157->19559/tcp,:::49157->19559/tcp, 0.0.0.0:49154->19560/tcp,:::49154->19560/tcp, 0.0.0.0:49160->9559/tcp,:::49160->9559/tcp, 9560/tcp
nebuladockercompose_metad1_1    /usr/local/nebula/bin/nebu ... Up   0.0.0.0:49156->19559/tcp,:::49156->19559/tcp, 0.0.0.0:49153->19560/tcp,:::49153->19560/tcp, 0.0.0.0:49159->9559/tcp,:::49159->9559/tcp, 9560/tcp
nebuladockercompose_metad2_1    /usr/local/nebula/bin/nebu ... Up   0.0.0.0:49158->19559/tcp,:::49158->19559/tcp, 0.0.0.0:49155->19560/tcp,:::49155->19560/tcp, 0.0.0.0:49161->9559/tcp,:::49161->9559/tcp, 9560/tcp
nebuladockercompose_storaged0_1  /usr/local/nebula/bin/nebu ... Up   0.0.0.0:49166->19779/tcp,:::49166->19779/tcp, 0.0.0.0:49163->19780/tcp,:::49163->19780/tcp, 9777/tcp, 9778/tcp, 0.0.0.0:49169->9779/tcp,:::49169->9779/tcp, 9780/tcp
nebuladockercompose_storaged1_1  /usr/local/nebula/bin/nebu ... Up   0.0.0.0:49165->19779/tcp,:::49165->19779/tcp, 0.0.0.0:49162->19780/tcp,:::49162->19780/tcp, 9777/tcp, 9778/tcp, 0.0.0.0:49168->9779/tcp,:::49168->9779/tcp, 9780/tcp
nebuladockercompose_storaged2_1  /usr/local/nebula/bin/nebu ... Up   0.0.0.0:49167->19779/tcp,:::49167->19779/tcp, 0.0.0.0:49164->19780/tcp,:::49164->19780/tcp, 9777/tcp, 9778/tcp, 0.0.0.0:49170->9779/tcp,:::49170->9779/tcp, 9780/tcp

```

```
nebuladockercompose_graphd2_1 ,
```

```
docker ps      CONTAINER ID      2a6c56c405f5 )
```

CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS	NAMES
2a6c56c405f5	vesoft/nebula-graphd:nightly	" <code>/usr/local/nebula/b...</code> "	36 minutes ago	Up 36 minutes (healthy)	0.0.0.0:49230->9669/tcp, 0.0.0.0:49229->19669/tcp, 0.0.0.0:49228->19670/tcp
7042e0a8e83d	vesoft/nebula-storaged:nightly	" <code>./bin/nebula-storag...</code> "	36 minutes ago	Up 36 minutes (healthy)	9777-9778/tcp, 9780/tcp, 0.0.0.0:49227->9779/tcp, 0.0.0.0:49226->19779/tcp, 0.0.0.0:49225->19780/tcp
18e3ea63ad65	vesoft/nebula-storaged:nightly	" <code>./bin/nebula-storag...</code> "	36 minutes ago	Up 36 minutes (healthy)	9777-9778/tcp, 9780/tcp, 0.0.0.0:49219->9779/tcp, 0.0.0.0:49218->19779/tcp, 0.0.0.0:49217->19780/tcp
4dcabfe8677a	vesoft/nebula-graphd:nightly	" <code>/usr/local/nebula/b...</code> "	36 minutes ago	Up 36 minutes (healthy)	0.0.0.0:49224->9669/tcp, 0.0.0.0:49223->19669/tcp, 0.0.0.0:49222->19670/tcp
a74054c6ae25	vesoft/nebula-graphd:nightly	" <code>/usr/local/nebula/b...</code> "	36 minutes ago	Up 36 minutes (healthy)	0.0.0.0:9669->9669/tcp, 0.0.0.0:49221->19669/tcp, 0.0.0.0:49220->19670/tcp
880025a3858c	vesoft/nebula-storaged:nightly	" <code>./bin/nebula-storag...</code> "	36 minutes ago	Up 36 minutes (healthy)	9777-9778/tcp, 9780/tcp, 0.0.0.0:49216->9779/tcp, 0.0.0.0:49215->19779/tcp, 0.0.0.0:49214->19780/tcp
45736a32a23a	vesoft/nebula-metad:nightly	" <code>./bin/nebula-metad...</code> "	36 minutes ago	Up 36 minutes (healthy)	9560/tcp, 0.0.0.0:49213->9559/tcp, 0.0.0.0:49212->19559/tcp, 0.0.0.0:49211->19560/tcp
3b2c90eb073e	vesoft/nebula-metad:nightly	" <code>./bin/nebula-metad...</code> "	36 minutes ago	Up 36 minutes (healthy)	9560/tcp, 0.0.0.0:49207->9559/tcp, 0.0.0.0:49206->19559/tcp, 0.0.0.0:49205->19560/tcp
7bb31b7a5b3f	vesoft/nebula-metad:nightly	" <code>./bin/nebula-metad...</code> "	36 minutes ago	Up 36 minutes (healthy)	9560/tcp, 0.0.0.0:49210->9559/tcp, 0.0.0.0:49209->19559/tcp, 0.0.0.0:49208->19560/tcp

```
[nebula-docker-compose]$ docker exec -it 2a6c56c405f5 bash
[root@2a6c56c405f5 nebula]#
```

NebulaGraph

```
NebulaGraph      nebula-docker-compose/data  nebula-docker-compose/logs
```

```

nebula-docker-compose/
|-- docker-compose.yaml
|-- data
|   |-- meta0
|   |-- meta1
|   |-- meta2
|   |-- storage0
|   |-- storage1
|   |-- storage2
`-- logs
    |-- graph
    |-- graph1
    |-- graph2
    |-- meta0
    |-- meta1
    |-- meta2
    |-- storage0
    |-- storage1
    |-- storage2

```

NebulaGraph

NebulaGraph

```
$ docker-compose down
```

```
Stopping nebuladockercompose_console_1 ... done
Stopping nebuladockercompose_graphd1_1 ... done
Stopping nebuladockercompose_graphd_1 ... done
Stopping nebuladockercompose_graphd2_1 ... done
Stopping nebuladockercompose_storaged1_1 ... done
Stopping nebuladockercompose_storaged0_1 ... done
Stopping nebuladockercompose_storaged2_1 ... done
Stopping nebuladockercompose_metad2_1 ... done
Stopping nebuladockercompose_metad0_1 ... done
Stopping nebuladockercompose_metad1_1 ... done
Removing nebuladockercompose_console_1 ... done
Removing nebuladockercompose_graphd1_1 ... done
Removing nebuladockercompose_graphd_1 ... done
Removing nebuladockercompose_graphd2_1 ... done
Removing nebuladockercompose_storaged1_1 ... done
Removing nebuladockercompose_storaged0_1 ... done
Removing nebuladockercompose_storaged2_1 ... done
Removing nebuladockercompose_metad2_1 ... done
Removing nebuladockercompose_metad0_1 ... done
Removing nebuladockercompose_metad1_1 ... done
Removing network nebuladockercompose_nebula-net
```



docker-compose down -v -v nightly

Docker Compose NebulaGraph nebula-docker-compose/docker-compose.yaml

DOCKER

nebula-docker-compose docker-compose.yaml ports

```
graphd:
  image: vesoft/nebula-graphd:release-3.3
  ...
  ports:
    - 9669:9669
    - 19669
    - 19670
```

9669:9669 9669 9669 19669 19669

/ NEBULAGRAPH DOCKER

1. nebula-docker-compose/docker-compose.yaml image
2. nebula-docker-compose docker-compose pull Graph Storage Meta NebulaGraph Console
3. docker-compose up -d NebulaGraph
4. NebulaGraph Console NebulaGraph SHOW HOSTS GRAPH SHOW HOSTS STORAGE SHOW HOSTS META

DOCKER-COMPOSE PULL ERROR: TOOMANYREQUESTS

ERROR: toomanyrequests: You have reached your pull rate limit. You may increase the limit by authenticating and upgrading:
<https://www.docker.com/increase-rate-limit>

Docker Hub

[Understanding Docker Hub Rate Limiting](#)

NEBULAGRAPH CONSOLE

```
docker-compose pull      NebulaGraph      NebulaGraph Console
```

:January 13, 2023

5.3.5 RPM/DEB NebulaGraph

RPM DEB

Note

NebulaGraph

	IP	graphd	storaged	metad
A	192.168.10.111	1	1	1
B	192.168.10.112	1	1	1
C	192.168.10.113	1	1	1
D	192.168.10.114	1	1	-
E	192.168.10.115	1	1	-

- 5
- NTP

NEBULAGRAPH

NebulaGraph

- RPM DEB NebulaGraph
- NebulaGraph

NebulaGraph

NebulaGraph etc nebula-graphd.conf nebula-metad.conf nebula-storaged.conf

A	nebula-graphd.conf	nebula-storaged.conf	nebula-metad.conf
B	nebula-graphd.conf	nebula-storaged.conf	nebula-metad.conf
C	nebula-graphd.conf	nebula-storaged.conf	nebula-metad.conf
D	nebula-graphd.conf	nebula-storaged.conf	
E	nebula-graphd.conf	nebula-storaged.conf	

Note

meta_server_addrs	Meta IP	local_ip	IP
-------------------	---------	----------	----

- Meta
- Graph
- Storage
- A
- nebula-graphd.conf

```
##### networking #####
# Comma separated Meta Server Addresses
--meta_server_addrs=192.168.10.111:9559,192.168.10.112:9559,192.168.10.113:9559
# Local IP used to identify the nebula-graphd process.
# Change it to an address other than loopback if the service is distributed or
# will be accessed remotely.
--local_ip=192.168.10.111
# Network device to listen on
--listen_netdev=any
# Port to listen on
--port=9669
```

- nebula-storaged.conf

```
##### networking #####
# Comma separated Meta server addresses
--meta_server_addrs=192.168.10.111:9559,192.168.10.112:9559,192.168.10.113:9559
# Local IP used to identify the nebula-storaged process.
# Change it to an address other than loopback if the service is distributed or
# will be accessed remotely.
--local_ip=192.168.10.111
# Storage daemon listening port
--port=9779
```

- nebula-metad.conf

```
##### networking #####
# Comma separated Meta Server addresses
--meta_server_addrs=192.168.10.111:9559,192.168.10.112:9559,192.168.10.113:9559
# Local IP used to identify the nebula-metad process.
# Change it to an address other than loopback if the service is distributed or
# will be accessed remotely.
--local_ip=192.168.10.111
# Meta daemon listening port
--port=9559
```

- B

- **nebula-graphd.conf**

```
#####
# networking #####
# Comma separated Meta Server Addresses
--meta_server_addrs=192.168.10.111:9559,192.168.10.112:9559,192.168.10.113:9559
# Local IP used to identify the nebula-graphd process.
# Change it to an address other than loopback if the service is distributed or
# will be accessed remotely.
--local_ip=192.168.10.112
# Network device to listen on
--listen_netdev=any
# Port to listen on
--port=9669
```

- **nebula-storaged.conf**

```
#####
# networking #####
# Comma separated Meta server addresses
--meta_server_addrs=192.168.10.111:9559,192.168.10.112:9559,192.168.10.113:9559
# Local IP used to identify the nebula-storaged process.
# Change it to an address other than loopback if the service is distributed or
# will be accessed remotely.
--local_ip=192.168.10.112
# Storage daemon listening port
--port=9779
```

- **nebula-metad.conf**

```
#####
# networking #####
# Comma separated Meta Server addresses
--meta_server_addrs=192.168.10.111:9559,192.168.10.112:9559,192.168.10.113:9559
# Local IP used to identify the nebula-metad process.
# Change it to an address other than loopback if the service is distributed or
# will be accessed remotely.
--local_ip=192.168.10.112
# Meta daemon listening port
--port=9559
```

- C

- nebula-graphd.conf

```
#####
# networking #####
# Comma separated Meta Server Addresses
--meta_server_addrs=192.168.10.111:9559,192.168.10.112:9559,192.168.10.113:9559
# Local IP used to identify the nebula-graphd process.
# Change it to an address other than loopback if the service is distributed or
# will be accessed remotely.
--local_ip=192.168.10.113
# Network device to listen on
--listen_netdev=any
# Port to listen on
--port=9669
```

- nebula-storaged.conf

```
#####
# networking #####
# Comma separated Meta server addresses
--meta_server_addrs=192.168.10.111:9559,192.168.10.112:9559,192.168.10.113:9559
# Local IP used to identify the nebula-storaged process.
# Change it to an address other than loopback if the service is distributed or
# will be accessed remotely.
--local_ip=192.168.10.113
# Storage daemon listening port
--port=9779
```

- nebula-metad.conf

```
#####
# networking #####
# Comma separated Meta Server addresses
--meta_server_addrs=192.168.10.111:9559,192.168.10.112:9559,192.168.10.113:9559
# Local IP used to identify the nebula-metad process.
# Change it to an address other than loopback if the service is distributed or
# will be accessed remotely.
--local_ip=192.168.10.113
# Meta daemon listening port
--port=9559
```

- D

- nebula-graphd.conf

```
#####
# networking #####
# Comma separated Meta Server Addresses
--meta_server_addrs=192.168.10.111:9559,192.168.10.112:9559,192.168.10.113:9559
# Local IP used to identify the nebula-graphd process.
# Change it to an address other than loopback if the service is distributed or
# will be accessed remotely.
--local_ip=192.168.10.114
# Network device to listen on
--listen_netdev=any
# Port to listen on
--port=9669
```

- nebula-storaged.conf

```
#####
# networking #####
# Comma separated Meta server addresses
--meta_server_addrs=192.168.10.111:9559,192.168.10.112:9559,192.168.10.113:9559
# Local IP used to identify the nebula-storaged process.
# Change it to an address other than loopback if the service is distributed or
# will be accessed remotely.
--local_ip=192.168.10.114
# Storage daemon listening port
--port=9779
```

- E

- nebula-graphd.conf

```
#####
# networking #####
# Comma separated Meta Server Addresses
--meta_server_addrs=192.168.10.111:9559,192.168.10.112:9559,192.168.10.113:9559
# Local IP used to identify the nebula-graphd process.
# Change it to an address other than loopback if the service is distributed or
# will be accessed remotely.
--local_ip=192.168.10.115
# Network device to listen on
--listen_netdev=any
# Port to listen on
--port=9669
```

- nebula-storaged.conf

```
#####
# networking #####
# Comma separated Meta server addresses
--meta_server_addrs=192.168.10.111:9559,192.168.10.112:9559,192.168.10.113:9559
# Local IP used to identify the nebula-storaged process.
# Change it to an address other than loopback if the service is distributed or
# will be accessed remotely.
--local_ip=192.168.10.115
# Storage daemon listening port
--port=9779
```

A	graphd storaged metad
B	graphd storaged metad
C	graphd storaged metad
D	graphd storaged
E	graphd storaged

NebulaGraph

```
sudo /usr/local/nebula/scripts/nebula.service start <metad|graphd|storaged|all>
```

 Note

- graphd storaged metad all
- /usr/local/nebula NebulaGraph

NebulaGraph

CLI NebulaGraph Console

graphd

Storage

SHOW HOSTS

```
$ ./nebula-console --addr 192.168.10.111 --port 9669 -u root -p nebula
2021/05/25 01:41:19 [INFO] connection pool is initialized successfully
Welcome to NebulaGraph!

> ADD HOSTS 192.168.10.111:9779, 192.168.10.112:9779, 192.168.10.113:9779, 192.168.10.114:9779, 192.168.10.115:9779;
> SHOW HOSTS;
+-----+-----+-----+-----+-----+-----+-----+
| Host | Port | HTTP port | Status | Leader count | Leader distribution | Partition distribution | Version |
+-----+-----+-----+-----+-----+-----+-----+
| "192.168.10.111" | 9779 | 19779 | "ONLINE" | 0 | "No valid partition" | "No valid partition" | "3.1.0" |
| "192.168.10.112" | 9779 | 19779 | "ONLINE" | 0 | "No valid partition" | "No valid partition" | "3.1.0" |
| "192.168.10.113" | 9779 | 19779 | "ONLINE" | 0 | "No valid partition" | "No valid partition" | "3.1.0" |
```

```
| "192.168.10.114" | 9779 | 19779 | "ONLINE" | 0 | "No valid partition" | "No valid partition" | "3.1.0" |
| "192.168.10.115" | 9779 | 19779 | "ONLINE" | 0 | "No valid partition" | "No valid partition" | "3.1.0" |
+-----+-----+-----+-----+-----+-----+-----+
```

:January 13, 2023

5.3.6 NebulaGraph

NebulaGraph

- NebulaGraph Operator

- **NebulaGraph Operator** NebulaGraph Kubectl NebulaGraph Helm NebulaGraph
-

: January 13, 2023

5.4 NebulaGraph

NebulaGraph Meta Storage Graph

NebulaGraph



NebulaGraph

5.4.1

NebulaGraph 3

RPC

NebulaGraph NebulaGraph 3 3 1

NebulaGraph

5.4.2

5.4.3

-
-

5.4.4

NebulaGraph NebulaGraph

5.4.5

NebulaGraph

NebulaGraph

CMake **makefile**

-

```
DENABLE_STANDALONE_VERSION=on  
cmake -DCMAKE_INSTALL_PREFIX=/usr/local/nebula -DENABLE_TESTING=OFF -DENABLE_STANDALONE_VERSION=on -DCMAKE_BUILD_TYPE=Release ..
```

NebulaGraph NebulaGraph

5.4.6

NebulaGraph /usr/local/nebula/etc

sudo cat nebula-standalone.conf.default

NebulaGraph

meta_port	9559	Meta
storage_port	9779	Storage
meta_data_path	data/meta	Meta

: January 13, 2023

5.5 NebulaGraph

NebulaGraph

5.5.1

`nebula.service`



`nebula.service` `/usr/local/nebula/scripts`

```
$ sudo /usr/local/nebula/scripts/nebula.service
[-v] [-c <config_file_path>]
<start | stop | restart | kill | status>
<metad | graphd | storaged | all>
```

-v

-c `/usr/local/nebula/etc/`

start

stop

restart

kill

status

metad Meta

graphd Graph

storaged Storage

all

5.5.2 NebulaGraph

```
$ sudo /usr/local/nebula/scripts/nebula.service start all
[INFO] Starting nebula-metad...
[INFO] Done
[INFO] Starting nebula-graphd...
[INFO] Done
[INFO] Starting nebula-storaged...
[INFO] Done
```

5.5.3 NebulaGraph



`kill -9`

NebulaGraph

```
$ sudo /usr/local/nebula/scripts/nebula.service stop all
[INFO] Stopping nebula-metad...
[INFO] Done
[INFO] Stopping nebula-graphd...
[INFO] Done
[INFO] Stopping nebula-storaged...
[INFO] Done
```

5.5.4 NebulaGraph

NebulaGraph

```
$ sudo /usr/local/nebula/scripts/nebula.service status all
```

- NebulaGraph

```
[INFO] nebula-metad(33fd35e): Running as 29020, Listening on 9559
[INFO] nebula-graphd(33fd35e): Running as 29095, Listening on 9669
[WARN] nebula-storaged after v3.0.0 will not start service until it is added to cluster.
[WARN] See Manage Storage hosts:ADD HOSTS in https://docs.nebula-graph.io/
[INFO] nebula-storaged(33fd35e): Running as 29147, Listening on 9779
```



NebulaGraph	nebula-storaged	nebula-storaged	nebula-metad	Storage	Storage	Ready
3.0.0	Storage	Storage	Meta	ADD HOSTS	Storage	Storage
Storage						

- NebulaGraph

NebulaGraph

```
[INFO] nebula-metad: Running as 25600, Listening on 9559  
[INFO] nebula-graphd: Exited  
[INFO] nebula-storaged: Running as 25646, Listening on 9779
```

NebulaGraph Meta Graph Storage

etc /usr/local/nebula/etc/

5.5.5

- NebulaGraph

: January 13, 2023

5.6 NebulaGraph

Nebula Console NebulaGraph



NebulaGraph

Storage

NebulaGraph

5.6.1

- NebulaGraph
- Nebula Console NebulaGraph
- Nebula Console NebulaGraph



Nebula Console NebulaGraph

Nebula Console NebulaGraph

incompatible version

between client and server

5.6.2

1. Nebula Console **Assets**



2. **Assets**

3. nebula-console



Windows nebula-console.exe

4. Nebula Console nebula-console



Windows

```
$ chmod 111 nebula-console
```

5. nebula-console

6. NebulaGraph

- Linux macOS

```
$ ./nebula-console -addr <ip> -port <port> -u <username> -p <password>
[-t 120] [-e "nGQL_statement" | -f filename.nGQL]
```

- Windows

```
> nebula-console.exe -addr <ip> -port <port> -u <username> -p <password>
[-t 120] [-e "nGQL_statement" | -f filename.nGQL]
```

-h/-help		
-addr/-address	Graph	IP 127.0.0.1
-P/-port	Graph	9669
-u/-user	NebulaGraph	root
-p/-password		
-t/-timeout		120
-e/-eval		nGQL
-f/-file	nGQL	nGQL
-enable_ssl	NebulaGraph	SSL
-ssl_root_ca_path		CA
-ssl_cert_path		CRT
-ssl_private_key_path		

: January 13, 2023

5.7 Storage

3.0.0

Storage

Storage

Meta

ADD HOSTS

Storage

5.7.1 Storage

Storage

```
ADD HOSTS <ip>:<port> [,<ip>:<port> ...];
ADD HOSTS "<hostname>:<port> [, "<hostname>:<port> ...];
```



- Storage 2 20 SHOW HOSTS
- IP 127.0.0.1:9779
- ADD HOSTS "foo-bar":9779
- Storage Storage

5.7.2 Storage

Storage



Storage Storage

```
DROP HOSTS <ip>:<port> [,<ip>:<port> ...];
DROP HOSTS "<hostname>:<port> [, "<hostname>:<port> ...];
```

:January 13, 2023

5.8

5.8.1 NebulaGraph 2.x 3.3.0

NebulaGraph 2.6.1 3.3.0 NebulaGraph 2.x 3.x

NebulaGraph 2.0.0 2.x 3.3.0 2.0.0 1.x 2.x 2.x
3.x

 **Caution**

2.0.0 1.x 3.3.0 3.3.0 share/resources date_time_zonespec.csv NebulaGraph
[GitHub](#)

-
-
- Docker Docker Swarm Docker Compose K8s
- IP
- 4 alter schema default value [github known issues](#)
-
- sudo

NebulaGraph NebulaGraph 3.3.0

-
- nGQL
- YIELD
- FETCH GO LOOKUP FIND PATH GET SUBGRAPH YIELD
- MATCH Tag return v.name return v.player.name

 **Caution**

[GitHub](#)

- NebulaGraph 3.3.0 TAR [Download](#)

Note

RPM/DEB

- Storage Meta data_path nebula/data/storage nebula/data/meta

Danger

-
-
- a. SUBMIT JOB STATS
- b. SHOW JOBS

1. NebulaGraph

```
<nebula_install_path>/scripts/nebula.service stop all
```

```
nebula_install_path NebulaGraph
storaged flush 1 nebula.service status all
```

Note

20

[GitHub](#)

2. TAR bin NebulaGraph bin

Note

NebulaGraph

3. Graph

- session_idle_timeout_secs [1,604800] 28800
- client_idle_timeout_secs [1,604800] 28800

2.x

[Graph](#)

4. Meta

```
<nebula_install_path>/scripts/nebula-metad.service start
```

Meta leader

Graph NebulaGraph

[SHOW HOSTS meta](#) [SHOW META LEADER](#)

Meta Meta

Note[GitHub](#)

5. Graph Storage

Note[GitHub](#)

6. NebulaGraph

```
nebula> SHOW HOSTS;
nebula> SHOW HOSTS storage;
nebula> SHOW SPACES;
nebula> USE <space_name>
nebula> SHOW PARTS;
nebula> SUBMIT JOB STATS;
nebula> SHOW STATS;
nebula> MATCH (v) RETURN v LIMIT 5;
```

3.3.0

FAQ

```
SPACE 0 NOT FOUND
Space 0 not found
Space ID 0      <nebula_storagepath>/data/storage/nebula/0
Space 0      Storage
GRAPH      STORAGE
Graph
PERMISSION DENIED
sudo
```

```
SUBMIT JOB STATS  SHOW STATS
STORAGE OFFLINE  LEADER COUNT 0
```

Storage

```
ADD HOSTS <ip>:<port>[, <ip>:<port> ...];
```

```
ADD HOSTS 192.168.10.100:9779, 192.168.10.101:9779, 192.168.10.102:9779;
```

Meta

ADD HOSTS

Storage

heartbeat_interval_secs

Storage GitHub

SHOW JOBS JOB ID JOB

NebulaGraph 2.5.0 Job Pull request 2.5.0

?

A: [Release Note](#) Incompatibility

: January 13, 2023

5.8.2 NebulaGraph v3.x v3.3.0

NebulaGraph v3.x v3.3.0 v3.3.0 RPM/DEB v3.3.0

RPM/DEB

1. [RPM/DEB](#)
2. NebulaGraph [NebulaGraph](#)



Caution

Tag	Graph	nebula-graphd.conf	--graph_use_vertex_key=true	Storage	nebula-storaged.conf
--use_vertex_key=true					

3.

- RPM

```
$ sudo rpm -Uvh <package_name>
```

```
$ sudo rpm -Uvh --prefix=<installation_path> <package_name>
```

- DEB

```
$ sudo dpkg -i <package_name>
```

4. [NebulaGraph](#)

1. NebulaGraph etc
2. NebulaGraph



Note

Docker Compose



Docker Compose NebulaGraph

:January 13, 2023

5.9 NebulaGraph

NebulaGraph



NebulaGraph

Meta

5.9.1

NebulaGraph

NebulaGraph

5.9.2 1



Storage Meta

1. Storage disk

```
##### Disk #####
# Root data path. Split by comma. e.g. --data_path=/disk1/path1/,/disk2/path2/
# One path per Rocksdb instance.
--data_path=/nebula/data/storage
```

2. metad

3.

5.9.3 2



cluster.id

--prefix /usr/local/nebula

NebulaGraph

NebulaGraph

RPM **NebulaGraph**

1. NebulaGraph

```
$ rpm -qa | grep "nebula"
```

nebula-graph-3.3.0-1.x86_64

2. NebulaGraph

```
sudo rpm -e <nebula_version>
```

```
sudo rpm -e nebula-graph-3.3.0-1.x86_64
```

3.

DEB NebulaGraph

1. NebulaGraph

```
$ dpkg -l | grep "nebula"
```

```
ii  nebula-graph  3.3.0  amd64      NebulaGraph Package built using CMake
```

2. NebulaGraph

```
sudo dpkg -r <nebula_version>
```

```
sudo dpkg -r nebula-graph
```

3.

Docker Compose NebulaGraph

1. nebula-docker-compose NebulaGraph

```
docker-compose down -v
```

2. nebula-docker-compose

:January 13, 2023

6.

6.1

6.1.1

NebulaGraph **gflags** flags NebulaGraph

Note

- NebulaGraph
-



1.x CONFIGS

2.x CONFIGS

<binary> --help

```
#     Meta
$ /usr/local/nebula/bin/nebula-metad --help

#     Graph
$ /usr/local/nebula/bin/nebula-graphd --help

#     Storage
$ /usr/local/nebula/bin/nebula-storaged --help
```

/usr/local/nebula/bin/ NebulaGraph

curl

NebulaGraph

```
#     Meta
curl 127.0.0.1:19559/flags

#     Graph
curl 127.0.0.1:19669/flags

#     Storage
curl 127.0.0.1:19779/flags
```

Note

IP 127.0.0.1

RPM/DEB TAR

NebulaGraph	<code><service_name>.conf.default</code>	<code><service_name>.conf.production</code>	RPM/DEB
<code>/usr/local/nebula/etc/</code>	TAR	<code><install_path>/<tar_package_directory>/etc</code>	TAR
		<code>.default</code>	<code>.production</code>



IP	<code>local_ip</code>	NebulaGraph	3	Storage	3	IP
----	-----------------------	-------------	---	---------	---	----

NebulaGraph

Meta	<code>nebula-metad.conf.default</code>	<code>nebula-metad.conf.production</code>	Meta
Graph	<code>nebula-graphd.conf.default</code>	<code>nebula-graphd.conf.production</code>	Graph
Storage	<code>nebula-storaged.conf.default</code>	<code>nebula-storaged.conf.production</code>	Storage

<code>local_config</code>	<code>true</code>	NebulaGraph
---------------------------	-------------------	-------------



<code>local_config</code>	<code>false</code>	NebulaGraph	Meta
---------------------------	--------------------	-------------	------

DOCKER COMPOSE

Docker Compose	<code><install_path>/nebula-docker-compose/docker-compose.yaml</code>	command
----------------	---	---------

NEBULAGRAPH OPERATOR

NebulaGraph Operator	Kubectl	YAML	<code>spec.{graphd storaged metad}.config</code>
----------------------	---------	------	--



Helm

NebulaGraph	NebulaGraph Config
-------------	--------------------

NebulaGraph

- RPM/DEB TAR
 - a.
 - b. NebulaGraph
 - Docker Compose
 - a. <install_path>/nebula-docker-compose/docker-compose.yaml
 - b. `nebula-docker-compose docker-compose up -d`
 - Kubectl
-

:January 13, 2023

6.1.2 Meta

Meta	<code>nebula-metad.conf.default</code>	<code>nebula-metad.conf.production</code>	/usr/local/nebula/etc/
------	--	---	------------------------

 **Caution**

- `local_config false` NebulaGraph Meta
-

`.default .production Meta`

`nebula-metad.conf.default`

basics

<code>daemonize</code>	<code>true</code>			
<code>pid_file</code>	<code>pids/nebula-metad.pid</code>	ID		
<code>timezone_name</code>	-	NebulaGraph the Time Zone with TZ	<code>UTC+00:00:00</code> <code>--timezone_name=UTC+08:00</code>	Specifying

 **Note**

- NebulaGraph `timezone_name` TIMESTAMP UTC UTC
- `timezone_name` NebulaGraph NebulaGraph

logging

<code>log_dir</code>	<code>logs</code>	<code>Meta</code>							
<code>minloglevel</code>	<code>0</code>			<code>0</code>	<code>INFO</code>	<code>1</code>	<code>WARNING</code>	<code>2</code>	<code>ERROR</code>
		<code>FATAL</code>		<code>0</code>		<code>1</code>		<code>4</code>	<code>NebulaGraph</code>
<code>v</code>	<code>0</code>			<code>0</code>	<code>1</code>	<code>2</code>	<code>3</code>		
<code>logbufsecs</code>	<code>0</code>			<code>0</code>					
<code>redirect_stdout</code>	<code>true</code>								
<code>stdout_log_file</code>	<code>metad-</code> <code>stdout.log</code>								
<code>stderr_log_file</code>	<code>metad-</code> <code>stderr.log</code>								
<code>stderrthreshold</code>	<code>2</code>			<code>minloglevel</code>					
<code>timestamp_in_logfile_name</code>	<code>true</code>			<code>true</code>		<code>false</code>			

networking

<code>meta_server_addrs</code>	<code>127.0.0.1:9559</code>	<code>Meta</code>	<code>IP</code>	<code>Meta</code>	,				
<code>local_ip</code>	<code>127.0.0.1</code>	<code>Meta</code>	<code>IP</code>	<code>IP</code>	<code>nebula-metad</code>				
<code>port</code>	<code>9559</code>	<code>Meta</code>	<code>RPC</code>	<code>Meta</code>	<code>9559</code>	<code>+1</code>	<code>9560</code>		
<code>NebulaGraph</code>									
<code>ws_ip</code>	<code>0.0.0.0</code>	<code>HTTP</code>	<code>IP</code>						
<code>ws_http_port</code>	<code>19559</code>	<code>HTTP</code>							
<code>ws_storage_http_port</code>	<code>19779</code>	<code>HTTP</code>	<code>Storage</code>	<code>Storage</code>	<code>Storage</code>		<code>ws_http_port</code>		
			<code>NebulaGraph</code>						
<code>heartbeat_interval_secs</code>	<code>10</code>			<code>heartbeat_interval_secs</code>					

CautionIP `127.0.0.1/0.0.0.0`**storage**

<code>data_path</code>	<code>data/meta</code>	<code>meta</code>
------------------------	------------------------	-------------------

misc

<code>default_parts_num</code>	<code>100</code>
<code>default_replica_factor</code>	<code>1</code>

rocksdb options

rocksdb_wal_sync	true	RocksDB WAL
------------------	------	-------------

:January 13, 2023

6.1.3 Graph

Graph	<code>nebula-graphd.conf.default</code>	<code>nebula-graphd.conf.production</code>	<code>/usr/local/nebula/etc/</code>
-------	---	--	-------------------------------------

 **Caution**

- `local_config` `false` `NebulaGraph` `Meta`
-

`.default` `.production` `Graph`

`nebula-graphd.conf.default`

basics

<code>daemonize</code>	<code>true</code>				
<code>pid_file</code>	<code>pids/nebula-</code>	<code>ID</code>			
	<code>graphd.pid</code>				
<code>enable_optimizer</code>	<code>true</code>				
<code>timezone_name</code>	-	<code>NebulaGraph</code>	<code>UTC+00:00:00</code>	<code>--timezone_name=UTC+08:00</code>	Specifying the Time Zone with TZ
<code>local_config</code>	<code>true</code>				

 **Note**

- `NebulaGraph` `timezone_name` `TIMESTAMP` `UTC` `UTC`
- `timezone_name` `NebulaGraph` `NebulaGraph`

logging

log_dir	logs	Graph
minloglevel	0	0 INFO 1 WARNING 2 ERROR 3 FATAL 0 1 4 NebulaGraph
v	0	0 1 2 3
logbufsecs	0	0
redirect_stdout	true	
stdout_log_file	graphd- stdout.log	
stderr_log_file	graphd- stderr.log	
stderrthreshold	2	minloglevel
timestamp_in_logfile_name	true	true false

query

accept_partial_success	false
session_reclaim_interval_secs	10
max_allowed_query_size	4194304 4MB

networking

meta_server_addrs	127.0.0.1:9559	Meta	IP	Meta	,
local_ip	127.0.0.1	Graph	IP	IP	nebula-graphd
listen_netdev	any				
port	9669	Graph	RPC		
reuse_port	false		SO_REUSEPORT		
listen_backlog	1024	socket			net.core.somaxconn
client_idle_timeout_secs	28800		8	0	
session_idle_timeout_secs	28800		1~604800	8	
num_accept_threads	1				
num_netio_threads	0	IO	0	CPU	
num_worker_threads	0		0	CPU	
ws_ip	0.0.0.0	HTTP	IP		
ws_http_port	19669	HTTP			
heartbeat_interval_secs	10		heartbeat_interval_secs		
storage_client_timeout_ms	-	Graph	Storage	RPC	60000
slow_query_threshold_us	200000				
ws_meta_http_port	19559	HTTP	Meta	Meta	ws_http_port



IP 127.0.0.1/0.0.0.0

charset and collate

default_charset	utf8
default_collate	utf8_bin

authorization

enable_authorize	false
auth_type	password

memory

system_memory_high_watermark_ratio	0.8	NebulaGraph
------------------------------------	-----	-------------

metrics

enable_space_level_metrics	false	query_latency_us{space=basketballplayer}.avg.3600	curl
----------------------------	-------	---	------

session

max_sessions_per_ip_per_user	300	IP
------------------------------	-----	----

experimental

enable_experimental_feature	false	true false		
enable_toss	false	TOSS TOSS Transaction on Storage Side UPINSERT DELETE enable_experimental_feature true	INSERT UPDATE	1
enable_data_balance	true	enable_experimental_feature true		

:January 13, 2023

6.1.4 Storage

Storage nebula-storaged.conf.default nebula-storaged.conf.production /usr/local/nebula/etc/

Caution

- local_config false Storage Meta
-

.default .production Storage

nebula-storaged.conf.default nebula-
storaged.conf.production

Note

Raft Listener Storage Raft listener

basics

daemonize	true				
pid_file	pids/nebula-storaged.pid	ID			
timezone_name	-	NebulaGraph the Time Zone with TZ	UTC+00:00:00 --timezone_name=UTC+08:00		Specifying
local_config	true				

Note

- NebulaGraph timezone_name TIMESTAMP UTC UTC
- timezone_name NebulaGraph NebulaGraph

logging

log_dir	logs	Storage						
minloglevel	0	FATAL	0	0 INFO	1 WARNING	2 ERROR	3	4 NebulaGraph
v	0		0	0 1 2 3				
logbufsecs	0		0					
redirect_stdout	true							
stdout_log_file	storaged- stdout.log							
stderr_log_file	storaged- stderr.log							
stderrthreshold	2		minloglevel					
timestamp_in_logfile_name	true		true false					

networking

meta_server_addrs	127.0.0.1:9559	Meta	IP	Meta	,			
local_ip	127.0.0.1	Storage	IP	IP	nebula-storaged			
port	9779	Storage NebulaGraph	RPC	Storage	9779	9777	9778	9780
ws_ip	0.0.0.0	HTTP	IP					
ws_http_port	19779	HTTP						
heartbeat_interval_secs	10		heartbeat_interval_secs					

Caution

IP 127.0.0.1/0.0.0.0

raft

raft_heartbeat_interval_secs	30	Raft	
raft_rpc_timeout_ms	500	Raft	RPC
wal_ttl	14400	Raft WAL	

disk

data_path	data/storage	,	RocksDB
minimum_reserved_bytes	268435456		
rocksdb_batch_size	4096		
rocksdb_block_cache	4	BlockBasedTable	
disable_page_cache	false	NebulaGraph cache true NebulaGraph block cache	false page page cache
engine_type	rocksdb		
rocksdb_compression	lz4	no snappy lz4 lz4hc zlib bzip2 zstd	
rocksdb_compression_per_level	-		
enable_rocksdb_statistics	false	RocksDB	
rocksdb_stats_level	kExceptHistogramOrTimers	RocksDB kExceptTimers kExceptDetailedTimers kExceptTimeForMutex	kAll
enable_rocksdb_prefix_filtering	true	prefix bloom filter	
enable_rocksdb_whole_key_filtering	false	whole key bloom filter	
rocksdb_filtering_prefix_length	12	key prefix 12 ID+ ID 16 ID+ ID+TagID/Edge typeID	
enable_partitioned_index_filter	-	true bloom	random-seek

Key-Value separation

rocksdb_enable_kv_separation	false	BlobDB KV	
rocksdb_kv_separation_threshold	100	RocksDB KV flush compaction	blob
rocksdb_blob_compression	lz4	BlobDB no snappy lz4 lz4hc zlib bzip2 zstd	
rocksdb_enable_blob_garbage_collection	true	compaction	BlobDB

misc

`snapshot NebulaGraph` `snapshot Raft` `leader`

<code>auto_remove_invalid_space</code>	<code>true</code>	<code>DROP SPACE</code>	<code>true</code>
<code>num_io_threads</code>	<code>16</code>	<code>I/O</code>	<code>RPC</code>
<code>num_worker_threads</code>	<code>32</code>	<code>Storage</code>	<code>RPC</code>
<code>max_concurrent_subtasks</code>	<code>10</code>	<code>TaskManager</code>	
<code>snapshot_part_rate_limit</code>	<code>10485760</code>	<code>Raft leader</code>	<code>Raft group</code>
<code>snapshot_batch_size</code>	<code>1048576</code>	<code>Raft leader</code>	<code>Raft group</code>
<code>rebuild_index_part_rate_limit</code>	<code>4194304</code>	<code>Raft leader</code>	<code>Raft group</code>
<code>rebuild_index_batch_size</code>	<code>1048576</code>	<code>Raft leader</code>	<code>Raft group</code>

rocksdb options

<code>rocksdb_db_options</code>	<code>{}</code>	RocksDB database
<code>rocksdb_column_family_options</code>	<code>{"write_buffer_size":"67108864", "max_write_buffer_number":"4", "max_bytes_for_level_base":"268435456"}</code>	RocksDB column family
<code>rocksdb_block_based_table_options</code>	<code>{"block_size":"8192"}</code>	RocksDB block based table
<code>rocksdb options</code>	<code>{"<option_name>": "<option_value>"}</code>	,

rocksdb_db_options | rocksdb_column_family_options• **rocksdb_db_options**

```
max_total_wal_size
delete_obsolete_files_period_micros
max_background_jobs
stats_dump_period_sec
compaction_readahead_size
writable_file_max_buffer_size
bytes_per_sync
wal_bytes_per_sync
delayed_write_rate
avoid_flush_during_shutdown
max_open_files
stats_persist_period_sec
stats_history_buffer_size
strict_bytes_per_sync
enable_rocksdb_prefix_filtering
enable_rocksdb_whole_key_filtering
rocksdb_filtering_prefix_length
num_compaction_threads
rate_limit
```

• **rocksdb_column_family_options**

```
write_buffer_size
max_write_buffer_number
level0_file_num_compaction_trigger
level0_slowdown_writes_trigger
level0_stop_writes_trigger
target_file_size_base
target_file_size_multiplier
max_bytes_for_level_base
max_bytes_for_level_multiplier
disable_auto_compactions
```

RocksDB

max_edge_returned_per_vertex	space
------------------------------	-------

max_edge_returned_per_vertex	2147483647
------------------------------	------------

Warning

300 MB

storage	enable_partitioned_index_filter	true	rocksdb_block_cache	RocksDB
OOM				

:January 13, 2023

6.1.5 Linux

NebulaGraph Linux

ULIMIT

```
ulimit      shell
• ulimit
•
•          sudo
•          /etc/security/limits.conf
```

ULIMIT -C

```
ulimit -c    core      unlimited
```

```
ulimit -c unlimited
```

ULIMIT -N

```
ulimit -n      10
```

```
ulimit -n 130000
```

VM.SWAPPINESS

vm.swappiness	swap	swap	0	0	swap
---------------	------	------	---	---	------

VM.MIN_FREE_KBYTES

vm.min_free_kbytes	Linux	128 GB	vm.min_free_kbytes	5 GB
--------------------	-------	--------	--------------------	------

VM.MAX_MAP_COUNT

vm.max_map_count	VMA	65530
------------------	-----	-------

VM.DIRTY_*

vm.dirty_*

TRANSPARENT HUGE PAGE

THP transparent huge page

```
root# echo never > /sys/kernel/mm/transparent_hugepage/enabled
root# echo never > /sys/kernel/mm/transparent_hugepage/defrag
root# swapoff -a && swapon -a
```

GRUB	/etc/rc.local
------	---------------

THP

NET.IPV4.TCP_SLOW_START_AFTER_IDLE

net.ipv4.tcp_slow_start_after_idle	1	0
------------------------------------	---	---

NET.CORE.SOMAXCONN

net.core.somaxconn	socket	128	1024
--------------------	--------	-----	------

NET.IPV4.TCP_MAX_SYN_BACKLOG

net.ipv4.tcp_max_syn_backlog	SYN_RECV	TCP	128	1024
------------------------------	----------	-----	-----	------

NET.CORE.NETDEV_MAX_BACKLOG

net.core.netdev_max_backlog	1000	10000
-----------------------------	------	-------

NET.IPV4.TCP_KEEPALIVE_*

net.ipv4.tcp_keepalive_*	TCP	tcp_keepalive_time	tcp_keepalive_intvl
--------------------------	-----	--------------------	---------------------

NET.IPV4.TCP_WMEM/RMEM

TCP	/	(GB)	*	(ms)
-----	---	------	---	------

SCHEDULER

SSD	scheduler	noop	none	/sys/block/DEV_NAME/queue/scheduler
-----	-----------	------	------	-------------------------------------

KERNEL.CORE_PATTERN

core	kernel.core_uses_pid	1
------	----------------------	---

SYSCTL

- sysctl <conf_name>

- sysctl -w <conf_name>=<value>

- sysctl -p [<file_path>]

Linux /etc/sysctl.conf

PRLIMIT

prlimit	sudo	prlimit --nofile=140000 --pid=\$\$	140000	RedHat 7u
---------	------	------------------------------------	--------	-----------

:January 13, 2023

6.2

6.2.1

DBA DBA
 NebulaGraph **glog** **gflags** HTTP

`/usr/local/nebula/logs/`

NebulaGraph

• **minloglevel** 0 INFO 1 WARNING 2 ERROR 3 FATAL 0 1 4
 NebulaGraph

• **v** 0 1 2 3

Meta Graph Storage `/usr/local/nebula/etc/`

gflags

```
$ curl <ws_ip>:<ws_port>/flags
```

ws_ip	HTTP	IP	127.0.0.1
ws_port	HTTP	19559	Meta 19669 Graph 19779 Storage

- Meta

```
$ curl 127.0.0.1:19559/flags | grep 'minloglevel'
```

- Storage

```
$ curl 127.0.0.1:19779/flags | grep -w 'v'
```

```
$ curl -X PUT -H "Content-Type: application/json" -d '{"<key>:<value>[,<key>:<value>]}' "<ws_ip>:<ws_port>/flags"
```

key			
value			
ws_ip	HTTP	IP	127.0.0.1
ws_port	HTTP	19559	Meta 19669 Graph 19779 Storage

```
$ curl -X PUT -H "Content-Type: application/json" -d '{"minloglevel":0,"v":3}' "127.0.0.1:19779/flags" # storaged
$ curl -X PUT -H "Content-Type: application/json" -d '{"minloglevel":0,"v":3}' "127.0.0.1:19669/flags" # graphd
$ curl -X PUT -H "Content-Type: application/json" -d '{"minloglevel":0,"v":3}' "127.0.0.1:19559/flags" # metad
```

NebulaGraph

RocksDB

RocksDB	/usr/local/nebula/data/storage/nebula/\$id/data/LOG ,	\$id	RocksDB
---------	---	------	---------

:January 13, 2023

7.

7.1 NebulaGraph

NebulaGraph

HTTP

7.1.1

NebulaGraph

num_queries.sum.600 NebulaGraph

num_queries										
	sum	SUM	AVG	RATE	P	P75	P95	P99	P999	
	600		5	60	600	3600	5	1	10	1

Graph

Space Level Metrics

Graph enable_space_level_metrics true NebulaGraph



```
curl -G "http://192.168.8.40:19559/stats" {space=space_name}
num_active_queries{space=basketballplayer}.sum.5=0
```

7.1.2 HTTP

```
curl -G "http://<ip>:<port>/stats?stats=<metric_name_list> [&format=json]"
```

ip	IP						
port	HTTP	Meta	19559	Graph	19669	Storage	19779
metric_name_list	,						
&format=json	JSON						



NebulaGraph docker-compose ps

Graph 10

```
$ curl -G "http://192.168.8.40:19669/stats?stats=num_queries.sum.600"
num_queries.sum.600=400
```

-

Meta	1	10	P99	1%
------	---	----	-----	----

```
$ curl -G "http://192.168.8.40:19559/stats?stats=heartbeat_latency_us.avg.60,heartbeat_latency_us.p99.600"
heartbeat_latency_us.avg.60=281
heartbeat_latency_us.p99.600=965
```

- JSON

Storage	10	JSON
---------	----	------

```
$ curl -G "http://192.168.8.40:19779/stats?stats=num_add_vertices.sum.600&format=json"
[{"value":1,"name":"num_add_vertices.sum.600"}]
```

-

```
$ curl -G "http://192.168.8.40:19559/stats"
heartbeat_latency_us.avg.5=304
heartbeat_latency_us.avg.60=308
heartbeat_latency_us.avg.600=299
heartbeat_latency_us.avg.3600=285
heartbeat_latency_us.p75.5=652
heartbeat_latency_us.p75.60=669
heartbeat_latency_us.p75.600=651
heartbeat_latency_us.p75.3600=642
heartbeat_latency_us.p95.5=930
heartbeat_latency_us.p95.60=963
heartbeat_latency_us.p95.600=933
heartbeat_latency_us.p95.3600=929
heartbeat_latency_us.p99.5=986
heartbeat_latency_us.p99.60=1409
heartbeat_latency_us.p99.600=989
heartbeat_latency_us.p99.3600=986
num_heartbeats.rate.5=0
num_heartbeats.rate.60=0
num_heartbeats.rate.600=0
num_heartbeats.rate.3600=0
num_heartbeats.sum.5=2
num_heartbeats.sum.60=40
num_heartbeats.sum.600=394
num_heartbeats.sum.3600=2364
...
```

7.1.3

Graph

num_active_queries							
num_active_sessions							
	num_active_sessions.sum.5	5	10	30			-20
10-30							
num_aggregate_executors	Aggregate						
num_auth_failed_sessions_bad_username_password							
num_auth_failed_sessions_out_of_max_allowed	FLAG_OUT_OF_MAX_ALLOWED_CONNECTIONS						
num_auth_failed_sessions							
num_indexscan_executors	IndexScan						
num_killed_queries							
num_opened_sessions							
num_queries							
num_query_errors_leader_changes	Leader						
num_query_errors							
num_reclaimed_expired_sessions							
num_rpc_sent_to_metad_failed	Graphd	Metad	RPC				
num_rpc_sent_to_metad	Graphd	Metad	RPC				
num_rpc_sent_to_storaged_failed	Graphd	Storaged	RPC				
num_rpc_sent_to_storaged	Graphd	Storaged	RPC				
num_sentences	Graphd						
num_slow_queries							
num_sort_executors	Sort						
optimizer_latency_us							
query_latency_us							
slow_query_latency_us							
num_queries_hit_memory_watermark							

Meta

commit_log_latency_us	Raft	Commit
commit_snapshot_latency_us	Raft	Commit
<hr/>		
heartbeat_latency_us		
<hr/>		
num_heartbeats		
num_raft_votes	Raft	
transfer_leader_latency_us	Raft	Leader
num_agent_heartbeats		AgentHBProcessor
agent_heartbeat_latency_us		AgentHBProcessor
replicate_log_latency_us	Raft	
num_send_snapshot	Raft	
append_log_latency_us	Raft	
append_wal_latency_us	Raft	WAL
num_grant_votes	Raft	
num_start_elect	Raft	

Storage

add_edges_atomic_latency_us	TOSS
add_edges_latency_us	
add_vertices_latency_us	
commit_log_latency_us	Raft Commit
commit_snapshot_latency_us	Raft Commit
delete_edges_latency_us	
delete_vertices_latency_us	
get_neighbors_latency_us	
get_dst_by_src_latency_us	
num_get_prop	GetPropProcessor
num_get_neighbors_errors	GetNeighborsProcessor
num_get_dst_by_src_errors	GetDstBySrcProcessor
get_prop_latency_us	GetPropProcessor
num_edges_deleted	
num_edges_inserted	
num_raft_votes	Raft
num_rpc_sent_to_metad_failed	Storage Metad RPC
num_rpc_sent_to_metad	Storage Metad RPC
num_tags_deleted	Tag
num_vertices_deleted	
num_vertices_inserted	
transfer_leader_latency_us	Raft Leader
lookup_latency_us	LookupProcessor
num_lookup_errors	LookupProcessor
num_scan_vertex	ScanVertexProcessor
num_scan_vertex_errors	ScanVertexProcessor
update_edge_latency_us	UpdateEdgeProcessor
num_update_vertex	UpdateVertexProcessor
num_update_vertex_errors	UpdateVertexProcessor
kv_get_latency_us	Getprocessor
kv_put_latency_us	PutProcessor
kv_remove_latency_us	RemoveProcessor
num_kv_get_errors	GetProcessor
num_kv_get	GetProcessor
num_kv_put_errors	PutProcessor

num_kv_put	PutProcessor
num_kv_remove_errors	RemoveProcessor
num_kv_remove	RemoveProcessor
forward_tranx_latency_us	
scan_edge_latency_us	ScanEdgeProcessor
num_scan_edge_errors	ScanEdgeProcessor
num_scan_edge	ScanEdgeProcessor
scan_vertex_latency_us	ScanVertexProcessor
num_add_edges	
num_add_edges_errors	
num_add_vertices	
num_start_elect	Raft
num_add_vertices_errors	
num_delete_vertices_errors	
append_log_latency_us	Raft
num_grant_votes	Raft
replicate_log_latency_us	Raft
num_delete_tags	Tag
num_delete_tags_errors	Tag
num_delete_edges	
num_delete_edges_errors	
num_send_snapshot	
update_vertex_latency_us	UpdateVertexProcessor
append_wal_latency_us	Raft WAL
num_update_edge	UpdateEdgeProcessor
delete_tags_latency_us	Tag
num_update_edge_errors	UpdateEdgeProcessor
num_get_neighbors	GetNeighborsProcessor
num_get_dst_by_src	GetDstBySrcProcessor
num_get_prop_errors	GetPropProcessor
num_delete_vertices	
num_lookup	LookupProcessor
num_sync_data	Storage Drainer
num_sync_data_errors	Storage Drainer
sync_data_latency_us	Storage Drainer

Note

num_active_queries				
num_queries				
num_sentences		Graphd		
optimizer_latency_us				
query_latency_us				
num_slow_queries				
num_query_errors				
num_query_errors_leader_changes		Leader		
num_killed_queries				
num_aggregate_executors		Aggregate		
num_sort_executors		Sort		
num_indexscan_executors		IndexScan		
num_auth_failed_sessions_bad_username_password				
num_auth_failed_sessions				
num_opened_sessions				
num_queries_hit_memory_watermark				
num_reclaimed_expired_sessions				
num_rpc_sent_to_metad_failed	Graphd	Metad	RPC	
num_rpc_sent_to_metad	Graphd	Metad	RPC	
num_rpc_sent_to_storaged_failed	Graphd	Storaged	RPC	
num_rpc_sent_to_storaged	Graphd	Storaged	RPC	
slow_query_latency_us				

:January 13, 2023

7.2 RocksDB

NebulaGraph RocksDB

NebulaGraph RocksDB

7.2.1 RocksDB

RocksDB RocksDB

```
1. nebula-storaged.conf -enable_rocksdb_statistics true /use/local/nebula/etc
2.
```

7.2.2 RocksDB

HTTP JSON

-
-

7.2.3

RocksDB

```
curl -L "http://${storage_ip}:${port}/rocksdb_stats"
```

```
curl -L "http://172.28.2.1:19779/rocksdb_stats"
rocksdb.blobdb.blob.file.bytes.read=0
rocksdb.blobdb.blob.file.bytes.written=0
rocksdb.blobdb.blob.file.bytes.synced=0
...
```

RocksDB

```
curl -L "http://${storage_ip}:${port}/rocksdb_stats?stats=${stats_name}"
```

```
rocksdb.bytes.read    rocksdb.block.cache.add
```

```
curl -L "http://172.28.2.1:19779/rocksdb_stats?stats=rocksdb.bytes.read,rocksdb.block.cache.add"
rocksdb.block.cache.add=14
rocksdb.bytes.read=1632
```

JSON RocksDB

```
curl -L "http://${storage_ip}:${port}/rocksdb_stats?stats=${stats_name}&format=json"
```

```
rocksdb.bytes.read    rocksdb.block.cache.add         JSON
```

```
curl -L "http://172.28.2.1:19779/rocksdb_stats?stats=rocksdb.bytes.read,rocksdb.block.cache.add&format=json"
[
  {
    "rocksdb.block.cache.add": 1
  },
  {
    "rocksdb.bytes.read": 160
  }
]
```

:January 13, 2023

8.

8.1

8.1.1

NebulaGraph NebulaGraph

NebulaGraph LDAP

NebulaGraph

1. nebula-graphd.conf /usr/local/nebula/etc/

- --enable_authorize true false

 **Note**

- root NebulaGraph
- God root nebula

• --failed_login_attempts Graph Graph *

• --password_lock_time_in_secs

2. NebulaGraph

:January 13, 2023

8.1.2

NebulaGraph

NebulaGraph



- root NebulaGraph
-

CREATE USER

CREATE USER NebulaGraph **God** root CREATE USER

-

```
CREATE USER [IF NOT EXISTS] <user_name> [WITH PASSWORD '<password>'];
```

- IF NOT EXISTS
- user_name
- password

-

```
nebula> CREATE USER user1 WITH PASSWORD 'nebula';
nebula> SHOW USERS;
+-----+-----+
| Account | IP Whitelist |
+-----+-----+
| "root" | ""           |
| "user1" | ""           |
+-----+-----+
```

GRANT ROLE

GRANT ROLE **God** **Admin** GRANT ROLE

-

```
GRANT ROLE <role_type> ON <space_name> TO <user_name>;
```

-

```
nebula> GRANT ROLE USER ON basketballplayer TO user1;
```

REVOKE ROLE

REVOKE ROLE

God**Admin**

REVOKE ROLE

REVOKE ROLE <role_type> ON <space_name> FROM <user_name>;

nebula> REVOKE ROLE USER ON basketballplayer FROM user1;

DESCRIBE USER

DESCRIBE USER

DESCRIBE USER <user_name>;
DESC USER <user_name>;nebula> DESCRIBE USER user1;
+-----+-----+
| role | space |
+-----+-----+
| "ADMIN" | "basketballplayer" |
+-----+-----+**SHOW ROLES**

SHOW ROLES

root

SHOW ROLES IN <space_name>;

nebula> SHOW ROLES IN basketballplayer;
+-----+-----+
| Account | Role Type |
+-----+-----+
| "user1" | "ADMIN" |
+-----+-----+**CHANGE PASSWORD**

CHANGE PASSWORD

CHANGE PASSWORD <user_name> FROM '<old_password>' TO '<new_password>';

nebula> CHANGE PASSWORD user1 FROM 'nebula' TO 'nebula123';

ALTER USER

ALTER USER

God

root

ALTER USER

ALTER USER <user_name> WITH PASSWORD '<password>';

```
nebula> ALTER USER user2 WITH PASSWORD 'nebula';
nebula> SHOW USERS;
+-----+-----+
| Account | IP Whitelist |
+-----+-----+
| "root" | ""           |
| "user1" | ""           |
| "user2" | ""           |
+-----+-----+
```

DROP USER

DROP USER

God

DROP USER



DROP USER [IF EXISTS] <user_name>;

nebula> DROP USER user1;

SHOW USERS

SHOW USERS

God

SHOW USERS

SHOW USERS;

```
nebula> SHOW USERS;
+-----+-----+
| Account | IP Whitelist |
+-----+-----+
| "root" | ""           |
| "user1" | ""           |
| "user2" | "192.168.10.10" |
+-----+-----+
```

:January 13, 2023

8.1.3

NebulaGraph

- God
 - Linux root Windows administrator
- Meta
 - God root nebula



root

- nebula-graphd.conf /usr/local/nebula/etc/ --enable_authorize true
- God
- God God root
- Admin
- Schema data
-



ADMIN

- DBA
- Schema data
-
- User
- Schema
- data
- Guest
- Schema data



-
-

	God	Admin	DBA	User	Guest	Basic	
Read space	Y	Y	Y	Y	Y	Y	USE DESCRIBE SPACE
Read schema	Y	Y	Y	Y	Y	Y	DESCRIBE TAG DESCRIBE EDGE DESCRIBE TAG INDEX DESCRIBE EDGE INDEX
Write schema	Y	Y	Y				CREATE TAG ALTER TAG CREATE EDGE ALTER EDGE TAG DELETE TAG DROP EDGE CREATE TAG INDEX EDGE INDEX DROP TAG INDEX DROP EDGE INDEX
Write user	Y						CREATE USER DROP USER ALTER USER
Write role	Y	Y					GRANT REVOKE
Read data	Y	Y	Y	Y	Y	C	GO SET PIPE MATCH ASSIGNMENT LOOKUP YIELD ORDER BY FETCH VERTICES Find FETCH EDGES PATH LIMIT GROUP BY RETURN
Write data	Y	Y	Y	Y		C	INSERT VERTEX UPDATE VERTEX INSERT EDGE EDGE DELETE VERTEX DELETE EDGES DELETE TAG
Show operations	Y	Y	Y	Y	Y	Y	SHOW CHANGE PASSWORD
Job	Y	Y	Y	Y			SUBMIT JOB COMPACT SUBMIT JOB FLUSH SUBMIT STATS STOP JOB RECOVER JOB BUILD TAG INDEX EDGE INDEX INGEST DOWNLOAD
Write space		Y					CREATE SPACE DROP SPACE CREATE SNAPSHOT SNAPSHOT BALANCE CONFIG

 **Enterpriseonly**

Basic (Tag/Edge type)

 **Caution**

Show operations

SHOW SPACES

God

SHOW USERS SHOW SNAPSHOTS

:January 13, 2023

8.2 SSL

NebulaGraph Graph Meta Storage SSL SSL

8.2.1

SSL

8.2.2

<code>cert_path</code>	-	PEM
<code>key_path</code>	-	
<code>password_path</code>	-	
<code>ca_path</code>	-	CA
<code>enable_ssl</code>	<code>false</code>	SSL
<code>enable_graph_ssl</code>	<code>false</code>	Graph SSL
<code>enable_meta_ssl</code>	<code>false</code>	Meta SSL

8.2.3

SSL SSL NebulaGraph

- `cert_path` `key_path` `password_path`
- CA

Certificate Authority	<code>cert_path</code> <code>key_path</code> <code>ca_path</code>
-----------------------	---

8.2.4

NebulaGraph

- Graph Meta Storage

<code>nebula-graphd.conf</code> <code>nebula-metad.conf</code> <code>nebula-storaged.conf</code>	<code>enable_ssl = true</code>
--	--------------------------------
- Graph

Graph	<code>nebula-graphd.conf</code>	<code>enable_graph_ssl = true</code>
-------	---------------------------------	--------------------------------------
- Meta

meta	<code>nebula-graphd.conf</code> <code>nebula-metad.conf</code> <code>nebula-storaged.conf</code>	<code>enable_meta_ssl = true</code>
------	--	-------------------------------------

8.2.5

1.

2.

Graph Meta Storage

```
--cert_path=xxxxxx  
--key_path=xxxxxx  
--password_path=xxxxxx  
--enable_ssl=true
```

3.

CA

nebula-test-run.py

: January 13, 2023

9.

9.1 NebulaGraph BR

9.1.1 Backup&Restore

Backup&Restore BR CLI NebulaGraph

- -
 - SSD HDD
 - Amazon S3 Alibaba Cloud OSS MinIO Ceph RGW
 - NebulaGraph
 -

- NebulaGraph v3.3.0
 -
 - NebulaGraph Listener
 - NFS
 - Storage IP
 - DDL DML 2 5
 -
 - NebulaGraph BR

BR

BR

1. BR
 2. BR
 3. BR

- NebulaGraph nebula-br 3 34

: January 13, 2023

9.1.2 BR

BR

BR	NebulaGraph	NebulaGraph Agent	Agent	NebulaGraph	BR	Agent
----	-------------	-------------------	-------	-------------	----	-------

NebulaGraph	BR	Agent
3.3.0	3.3.0	0.2.0
3.0.x ~ 3.2.x	0.6.1	0.1.0 ~ 0.2.0

BR

1. BR

```
wget https://github.com/vesoft-inc/nebula-br/releases/download/v3.3.0/br-3.3.0-linux-amd64
```

2. br

```
sudo mv br-3.3.0-linux-amd64 br
```

3. BR

```
sudo chmod +x br
```

4. ./br version BR

```
[nebula-br]$ ./br version
Nebula Backup And Restore Utility Tool,V-3.3.0
```

BR

- Go 1.14.x
- make

1. nebula-br

```
git clone https://github.com/vesoft-inc/nebula-br.git
```

2. br

```
cd nebula-br
```

3. BR

```
make
```

```
bin/br version
```

```
[nebula-br]$ bin/br version
NebulaGraph Backup And Restore Utility Tool,V-3.3.0
```

Agent

NebulaGraph Agent RPC BR

1. Agent

```
wget https://github.com/vesoft-inc/nebula-agent/releases/download/v0.2.0/agent-0.2.0-linux-amd64
```

2. Agent agent

```
sudo mv agent-0.2.0-linux-amd64 agent
```

3. Agent

```
sudo chmod +x agent
```

4. Agent



Agent Meta Agent NebulaGraph

```
sudo nohup ./nebula_agent --agent=<agent_node_ip>:8888 --meta=<metad_node_ip>:9559 > nebula_agent.log 2>&1 &
```

- `--agent` Agent IP
- `--meta` Meta IP
- `--ratelimit` Bytes

```
sudo nohup ./nebula_agent --agent="192.168.8.129:8888" --meta="192.168.8.129:9559" --ratelimit=1048576 > nebula_agent.log 2>&1 &
```



--agent IP Meta Storage IP 127.0.0.1 Agent

5. Agent

```
nebula> SHOW HOSTS AGENT;
+-----+-----+-----+-----+-----+
| Host | Port | Status | Role | Git Info Sha | Version |
+-----+-----+-----+-----+-----+
| "192.168.8.129" | 8888 | "ONLINE" | "AGENT" | "96646b8" |      |
+-----+-----+-----+-----+-----+
```

E_LIST_CLUSTER_NO_AGENT_FAILURE

<code>E_LIST_CLUSTER_NO_AGENT_FAILURE</code>	Agent	Agent	Meta	<code>SHOW HOSTS AGENT</code>	Agent
OFFLINE	Agent	Agent	--meta		

:January 13, 2023

9.1.3 BR

BR

BR

- BR Agent Agent
- NebulaGraph
- Meta Storage BR

 Note

NFS (Network File System)	Meta	Storage	BR	Alibaba Cloud OSS	Amazon S3
			BR		

BR

`./bin/br`

 Note

```
$ ./br backup full --meta <ip_address> --storage <storage_path>
```

- meta 192.168.8.129:9559 /home/nebula/backup/

 Caution

metad

 Caution

leader metad	metad	leader metad	<storage_path>/meta	follower meadt
--------------	-------	--------------	---------------------	----------------

```
$ ./br backup full --meta "192.168.8.129:9559" --storage "local:///home/nebula/backup/"
```

- meta 192.168.8.129:9559 s3 br-test backup

```
$ ./br backup full --meta "192.168.8.129:9559" --s3.endpoint "http://192.168.8.129:9000" --storage="s3://br-test/backup/" --s3.access_key=minioadmin --s3.secret_key=minioadmin --s3.region=default
```

-h, --help	-					
--debug	-					
--log	string	"br.log"				
--meta	string		meta			
--spaces	stringArray			--spaces nba_01 --spaces nba_02		
--storage	string		BR	<Schema>://<PATH>		
			Schema	local s3 s3	s3.access_key	
			s3.endpoint	s3.region s3.secret_key		
				PATH		
--	string					
s3.access_key						
--s3.endpoint	string		S3	URL http https		
--s3.region	string					
--	string					
s3.secret_key						

BR

NebulaGraph

BR

: January 13, 2023

9.1.4 BR

BR NebulaGraph



- BR Agent Agent
- NebulaGraph
-

BR

./bin/br

1.

```
$ ./br show --storage <storage_path>
```

```
/home/nebula/backup
```

```
$ ./br show --storage "local:///home/nebula/backup"
```

NAME	CREATE TIME	SPACES	FULL BACKUP	ALL SPACES
BACKUP_2022_02_10_07_40_41	2022-02-10 07:40:41	basketballplayer	true	true
BACKUP_2022_02_11_08_26_43	2022-02-11 08:26:47	basketballplayer,foesa	true	true

```
s3      br-test      backup
```

```
$ ./br show --s3.endpoint "http://192.168.8.129:9000" --storage="s3://br-test/backup/" --s3.access_key=minioadmin --s3.secret_key=minioadmin --s3.region=default
```

-h, -help	-
--debug	-
--log	string "br.log"
--storage	string
	BR <Schema>://<PATH>
	Schema local s3 s3 s3.access_key
	s3.endpoint s3.region s3.secret_key
	PATH
--	string
s3.access_key	
--s3.endpoint	string S3 URL http https
--s3.region	string
--	string
s3.secret_key	

2.

```
$ ./br restore full --meta <ip_address> --storage <storage_path> --name <backup_name>
```

```
/home/nebula/backup/ meta 192.168.8.129:9559
```

```
$ ./br restore full --meta "192.168.8.129:9559" --storage "local:///home/nebula/backup/" --name BACKUP_2021_12_08_18_38_08
```

```
s3      br-test      backup      meta      192.168.8.129:9559
```

```
$ ./br restore full --meta "192.168.8.129:9559" --s3.endpoint "http://192.168.8.129:9000" --storage="s3://br-test/backup/" --s3.access_key=minioadmin --s3.secret_key=minioadmin --s3.region="default" --name BACKUP_2021_12_08_18_38_08
```

Restore succeed.

Caution

IP

add host

Storage

-h, -help	-	-
--debug	-	
--log	string	"br.log"
--meta	string	meta
--name	string	
--storage	string	BR <Schema>://<PATH> Schema local s3 s3 s3.access_key s3.endpoint s3.region s3.secret_key PATH
--	string	
s3.access_key		
--s3.endpoint	string	S3 URL http https
--s3.region	string	
--	string	
s3.secret_key		

3.

```
$ ./br cleanup --meta <ip_address> --storage <storage_path> --name <backup_name>
```

-h, -help	-	-
--debug	-	
--log	string	"br.log"
--meta	string	meta
--name	string	
--storage	string	BR <Schema>://<PATH> Schema local s3 s3 s3.access_key s3.endpoint s3.region s3.secret_key PATH
--	string	
s3.access_key		
--s3.endpoint	string	S3 URL http https
--s3.region	string	
--	string	
s3.secret_key		

:January 13, 2023

9.2

NebulaGraph snapshot

9.2.1

NebulaGraph

God

9.2.2

- add host drop host create space drop space balance
-
- /usr/local/nebula/data

9.2.3

NebulaGraph SNAPSHOT_2021_03_09_08_43_12 2021_03_09_08_43_12 UTC

leader Meta Storage checkpoints

Linux find

```
$ find |grep 'SNAPSHOT_2021_03_09_08_43_12'
./data/meta2/nebula/0/checkpoints/SNAPSHOT_2021_03_09_08_43_12
./data/meta2/nebula/0/checkpoints/SNAPSHOT_2021_03_09_08_43_12/data
./data/meta2/nebula/0/checkpoints/SNAPSHOT_2021_03_09_08_43_12/data/000081.sst
...
```

9.2.4

CREATE SNAPSHOT

 Note

```
nebula> CREATE SNAPSHOT;
```

9.2.5

SHOW SNAPSHOTS

```
nebula> SHOW SNAPSHOTS;
+-----+-----+-----+
| Name      | Status | Hosts   |
+-----+-----+-----+
| "SNAPSHOT_2021_03_09_08_43_12" | "VALID" | "127.0.0.1:9779" |
| "SNAPSHOT_2021_03_09_09_10_52" | "VALID" | "127.0.0.1:9779" |
+-----+-----+-----+
```

Name	Snapshot	UTC
Status	VALID	INVALID
Hosts	Storage	IP

9.2.6

DROP Snapshot

```
DROP SNAPSHOT <snapshot_name>;
```

```
nebula> DROP SNAPSHOT SNAPSHOT_2021_03_09_08_43_12;
nebula> SHOW SNAPSHTS;
+-----+-----+-----+
| Name | Status | Hosts |
+-----+-----+-----+
| "SNAPSHOT_2021_03_09_09_10_52" | "VALID" | "127.0.0.1:9779" |
+-----+-----+-----+
```

9.2.7

shell

1. leader Meta Storage checkpoints 2 /usr/local/nebula/data/meta/
nebula/0/checkpoints /usr/local/nebula/data/storage/nebula/3/checkpoints /usr/local/nebula/data/storage/nebula/4/checkpoints

```
$ ls /usr/local/nebula/data/meta/nebula/0/checkpoints/
SNAPSHOT_2021_03_09_09_10_52
$ ls /usr/local/nebula/data/storage/nebula/3/checkpoints/
SNAPSHOT_2021_03_09_09_10_52
$ ls /usr/local/nebula/data/storage/nebula/4/checkpoints/
SNAPSHOT_2021_03_09_09_10_52
```

2. data wal checkpoints data wal



Meta data wal Meta leader Meta leader Meta

:January 13, 2023

10.

10.1 BALANCE

BALANCE	NebulaGraph	Storage	BALANCE	Storage	Storage
BALANCE					
BALANCE	LEADER		leader	ID	job_id

: January 13, 2023

11.

11.1 Compaction

Compaction

NebulaGraph Compaction

Compaction

NebulaGraph

Compaction

Compaction



Compaction

IO

NebulaGraph

Compaction

Compaction

Compaction

11.1.1 Compaction

Compaction

Compaction

Compaction

IO

11.1.2 Compaction

Compaction

TTL

Compaction



IO

```
nebula> USE <your_graph_space>;
nebula> SUBMIT JOB COMPACT;
```

ID

Compaction

```
nebula> SHOW JOB <job_id>;
```

11.1.3

NebulaGraph

- SUBMIT JOB COMPACT
- SUBMIT JOB COMPACT
- Compaction nebula-storaged.conf Compaction

```
#                  20MB/S
--rocksdb_rate_limit=20 (in MB/s)
```

11.1.4 FAQ

Compaction

/usr/local/nebula/data/storage/nebula/{1}/data/

LOG

LOG.old.1625797988509303

```
** Compaction Stats [default] **
Level   Files   Size   Score   Read(GB)   Rn(GB)   Rnp1(GB)   Write(GB)   Wnew(GB)   Moved(GB)   W-Amp   Rd(MB/s)   Wr(MB/s)   Comp(sec)   CompMergeCPU(sec)   Comp(cnt)   Avg(sec)
```

KeyIn	KeyDrop																
L0	2/0	2.46 KB	0.5	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.53	0.51	2		
0.264	0	0															
Sum	2/0	2.46 KB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.53	0.51	2		
0.264	0	0															
Int	0/0	0.00 KB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0		
0.000	0	0															

L0 compaction

Compaction

IO

Compaction

rocksdb_rate_limit 20MB/S /rocksdb_rate_limit 50MB/S

rocksdb_rate_limit

Compaction

RocksDB

:January 13, 2023

11.2 Storage

BALANCE

Raft leader

Storage

BALANCE



BALANCE

IP

11.2.1 leader

BALANCE LEADER leader

nebula> BALANCE LEADER;

SHOW HOSTS

```
nebula> SHOW HOSTS;
+-----+-----+-----+-----+-----+-----+
| Host | Port | HTTP port | Status | Leader count | Leader distribution | Partition distribution | Version |
+-----+-----+-----+-----+-----+-----+
| "192.168.10.100" | 9779 | 19779 | "ONLINE" | 4 | "basketballplayer:3" | "basketballplayer:8" | "3.1.0" |
| "192.168.10.101" | 9779 | 19779 | "ONLINE" | 8 | "basketballplayer:3" | "basketballplayer:8" | "3.1.0" |
| "192.168.10.102" | 9779 | 19779 | "ONLINE" | 3 | "basketballplayer:3" | "basketballplayer:8" | "3.1.0" |
| "192.168.10.103" | 9779 | 19779 | "ONLINE" | 0 | "basketballplayer:2" | "basketballplayer:7" | "3.1.0" |
| "192.168.10.104" | 9779 | 19779 | "ONLINE" | 0 | "basketballplayer:2" | "basketballplayer:7" | "3.1.0" |
| "192.168.10.105" | 9779 | 19779 | "ONLINE" | 0 | "basketballplayer:2" | "basketballplayer:7" | "3.1.0" |
+-----+-----+-----+-----+-----+-----+
```



NebulaGraph 3.3.0 Leader

Storage Error E_RPC_FAILURE

FAQ

:January 13, 2023

11.3

NebulaGraph

Note

11.3.1

NebulaGraph

20-80

VID
NebulaGraph

VID

Tag Edge type

Tag Edge type

NebulaGraph

Tag Edge type

Tag/Edge type

Tag Edge type

Schema

" " "

schema-free

NebulaGraph 3.3.0 Schema

" " Schema

MySQL - ALTER TABLE

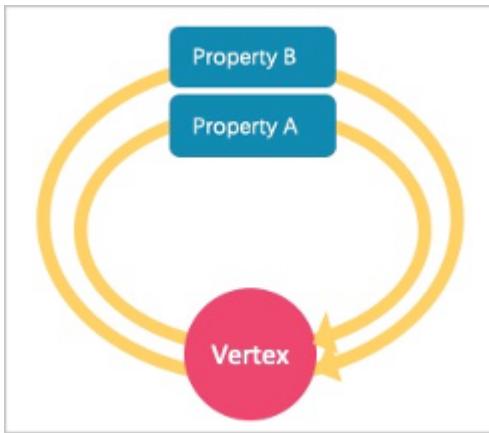
" " Schema

NebulaGraph Schema

ALTER TAG

List

List



```

// CREATE EDGE IF NOT EXISTS temp(tmp int);
nebula> INSERT EDGE temp(tmp) VALUES "player100"->"player100"@1:(1);
nebula> INSERT EDGE temp(tmp) VALUES "player100"->"player100"@2:(2);
nebula> INSERT EDGE temp(tmp) VALUES "player100"->"player100"@3:(3);

// GO FROM "player100" OVER temp YIELD properties(edge).tmp;
+-----+
| properties(EDGE).tmp |
+-----+
| 1 |
| 2 |
| 3 |
+-----+

// List
nebula> MATCH (v1:player)-[e:temp]->() return collect(e.tmp);
+-----+
| collect(e.tmp) |
+-----+
| [1, 2, 3] |
+-----+

```

- NebulaGraph 2 54

(Dangling edge)

NebulaGraph 3.3.0

INSERT EDGE

DELETE VERTEX

WITH EDGE

NebulaGraph 3.3.0
MATCH

GO LOOKUP

```

//      "11"    "13"
nebula> CREATE EDGE IF NOT EXISTS e1 (name string, age int);
nebula> INSERT EDGE e1 (name, age) VALUES "11"->"13":("n1", 1);

// GO
nebula> GO FROM "11" over e1 YIELD properties(edge);
+-----+
| properties(EDGE) |
+-----+
| {age: 1, name: "n1"} |

```

```
+-----+
//    LOOKUP
nebula> LOOKUP ON e1 YIELD EDGE AS r;
+-----+
| r |
+-----+
| [:e2 "11"-->"13" @0 {age: 1, name: "n1"}] |
+-----+

//    MATCH
nebula> MATCH ()-[e:e1]->() RETURN e LIMIT 100;
+---+
| e |
+---+
Empty set (time spent 3153/3573 us)
```

- NebulaGraph 2 28

|

- NebulaGraph

Tag Edge type has

• “ ” ” ” (src)-[edge {P1, P2}]->(dst) edge P1, P2
 (src)-[edge1]->(i_node {P1, P2})-[edge2]->(dst) NebulaGraph 3.3.0 (src)-[edge {P1, P2}]->(dst)

(dst)<-[edge]-(src) GO FROM dst REVERSELY;
 (src)-[edge]-(dst) GO FROM src BIDIRECT;

Tag

Tag

VID

VID

VID

2

write amplification

HBase/ES

NebulaGraph

11.3.2

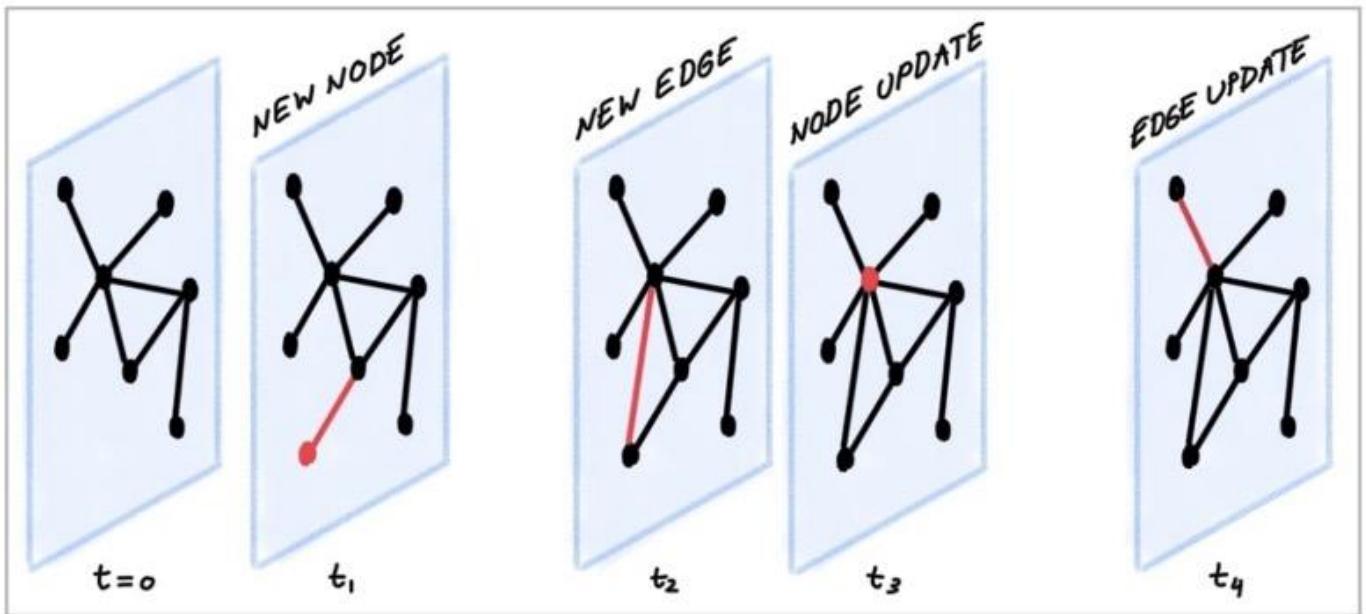
1

NebulaGraph 3.3.0

Rank

(int64)

Rank



11.3.3

[arrows.app](#)

-
1. https://blog.twitter.com/engineering/en_us/topics/insights/2021/temporal-graph-networks ↪
-

: January 13, 2023

11.4

11.4.1 QPS

- NebulaGraph 3.3.0 — —QPS
- graphd graphd

NebulaGraph Algorithm

11.4.2

- NebulaGraph OLTP “ ” OLAP “ ”
- sst INSERT
- COMPACTON BALANCE
- NebulaGraph 3.3.0 NoSQL

11.4.3

- Graphd
- Storaged RocksDB LSM-tree BloomFilter
- Storaged (LRU) Cache

: January 13, 2023

11.5

NebulaGraph 3.3.0

EXPLAIN PROFILE

:January 13, 2023

11.6

11.6.1

V



Note

NebulaGraph Spark



NebulaGraph Index

1

1. :

2. Compact RocksDB

- A)-[]-> B) AB A) B)

" " "

- <- [depart] ->

depart Edge type Edge type depart_ceair, depart_csair

- -[]-> A

A A1 A2 A3,

```
1)-[ ]-> A1), 2)-[ ]-> A2), 2)-[ ]-> A3);
A1)-[ ]-> A), A2)-[ ]-> A), A3)-[ ]-> A).
```

A1 A2 A3	A1: 1-1000, A2: 1001-10000, A3: 10000+	A
A1 A2 A3		

:January 13, 2023

11.7

NebulaGraph

11.7.1

-
-
-

11.7.2

- MATCH Pattern
- NebulaGraph
- BDD NebulaGraph
- BDD NebulaGraph
- NebulaGraph
-
- | LDBC nGQL

11.7.3

- NebulaGraph Importer
- NebulaGraph 3.0
- NebulaGraph JDBC
- Nebula- | Norm ORM
- NebulaGraph Betweenness Centrality
- NebulaGraph Exchange SST
- logrotate NebulaGraph

##

- Nebula schema by 51 30



- 21 53



- Nebula Akulaku 40 03



- NebulaGraph 09 34



- 14 36

- 21 33
- 39 06
- OPPO 43 09
- NebulaGraph 47 40
- BIGO 53 47
- NebulaGraph Demo 39 54
- NebulaGraph Demo 1 01 55
- NebulaGraph 29 06

:January 13, 2023

12.

12.1

NebulaGraph NebulaGraph

- [NebulaGraph Console](#) CLI
- [NebulaGraph CPP](#) C++
- [NebulaGraph Java](#) Java
- [NebulaGraph Python](#) Python
- [NebulaGraph Go](#) Go



NebulaGraph Java thread-safe



NebulaGraph

- [NebulaGraph PHP](#)
- [NebulaGraph Node](#)
- [NebulaGraph .net](#)
- [NebulaGraph JDBC](#)
- [NebulaGraph Carina](#) Python ORM
- [NORM](#) Golang ORM
- [Graph-Ocean](#) Java ORM
- [NebulaGraph Ngbatis](#) MyBatis Java ORM

: January 13, 2023

12.2 Nebula Console

Nebula Console NebulaGraph

NebulaGraph

12.2.1 Nebula Console

Nebula Console

- [GitHub](#)
- [Install from source code](#)

12.2.2

NebulaGraph

nebula-console NebulaGraph

```
<path_of_console> -addr <ip> -port <port> -u <username> -p <password>
```

path_of_console Nebula Console

-h/-help			
-addr/-address	Graph	IP	127.0.0.1
-P/-port	Graph		9669
-u/-user	NebulaGraph		root
-p/-password			
-t/-timeout		120	
-e/-eval	nGQL		
-f/-file	nGQL	nGQL	
-enable_ssl	NebulaGraph	SSL	
-ssl_root_ca_path	CA		
-ssl_cert_path	CRT		
-ssl_private_key_path			

192.168.10.8 Graph

```
./nebula-console -addr 192.168.10.8 -port 9669 -u Joe -p Joespassword
```

Nebula Console

Note

- VID

- SAMPLE

-

-

```
nebula> :param <param_name> => <param_value>;
```

```
nebula> :param p1 => "Tim Duncan";
nebula> MATCH (v:player{name:$p1})-[:follow]->(n)  RETURN v,n;
+-----+-----+
| v   | n   |
+-----+-----+
| ("player100" :player{age: 42, name: "Tim Duncan"}) | ("player125" :player{age: 41, name: "Manu Ginobili"}) |
| ("player100" :player{age: 42, name: "Tim Duncan"}) | ("player101" :player{age: 36, name: "Tony Parker"}) |
+-----+-----+
```

```
nebula> :param p2 => {"a":3,"b":false,"c":"Tim Duncan"};
nebula> RETURN $p2.b AS b;
+-----+
| b   |
+-----+
| false |
+-----+
```

-

```
nebula> :params;
```

-

```
nebula> :params <param_name>;
```

-

```
nebula> :param <param_name> =>;
```

CSV DOT

Note

- Linux pwd
-
- DOT [GraphvizOnline](#)
- CSV

```
nebula> :CSV <file_name.csv>;
```

- DOT

```
nebula> :dot <file_name.dot>;
```

```
nebula> :dot a.dot;
nebula> PROFILE FORMAT="dot" GO FROM "player100" OVER follow;
```

basketballplayer Schema SHOW

```
nebula> :play basketballplayer;
```

N

```
nebula> :repeat N;
```

```
nebula> :repeat 3;
nebula> GO FROM "player100" OVER follow YIELD dst(edge);
+-----+
| dst(EDGE) |
+-----+
| "player101" |
| "player125" |
+-----+
Got 2 rows (time spent 2602/3214 us)
```

Fri, 20 Aug 2021 06:36:05 UTC

```
+-----+
| dst(EDGE) |
+-----+
| "player101" |
| "player125" |
+-----+
Got 2 rows (time spent 583/849 us)
```

Fri, 20 Aug 2021 06:36:05 UTC

```
+-----+
| dst(EDGE) |
+-----+
| "player101" |
| "player125" |
+-----+
Got 2 rows (time spent 496/671 us)
```

Fri, 20 Aug 2021 06:36:05 UTC

Executed 3 times, (total time spent 3681/4734 us), (average time spent 1227/1578 us)

N Schema Schema

```
nebula> :sleep N;
```

:EXIT :QUIT NebulaGraph Nebula Console : quit

```
nebula> :QUIT;  
Bye root!
```

.....
:January 13, 2023

12.3 NebulaGraph CPP

[NebulaGraph CPP](#) [C++](#)

NebulaGraph

12.3.1

C++ GCC 4.8

12.3.2

NebulaGraph	NebulaGraph CPP
3.3.0	3.3.0
3.1.0 ~ 3.2.x	3.0.2
3.0.0	3.0.0
2.6.x	2.5.0
2.5.x	2.5.0
2.0.x	2.0.0

12.3.3 NebulaGraph CPP

NebulaGraph CPP

- C++ GCC {10.1.0 | 9.3.0 | 9.2.0 | 9.1.0 | 8.3.0 | 7.5.0 | 7.1.0} [gcc_preset_versions](#)

1. NebulaGraph CPP

- NebulaGraph CPP [--branch](#) v3.3.0

```
$ git clone --branch release-3.3 https://github.com/vesoft-inc/nebula-cpp.git
```

- [master](#)

```
$ git clone https://github.com/vesoft-inc/nebula-cpp.git
```

2. nebula-cpp

```
$ cd nebula-cpp
```

3. build

```
$ mkdir build && cd build
```

4. CMake makefile

Note

```
/usr/local/nebula -DCMAKE_INSTALL_PREFIX=<installation_path>
```

```
$ cmake -DCMAKE_BUILD_TYPE=Release ..
```

Note

```
g++ C++11 -DDISABLE_CXX11_ABI=ON
```

5. NebulaGraph CPP

```
-j N \(\min(\text{CPU} \ \ \frac{\text{GB}}{2})\)
```

```
$ make -j{N}
```

6. NebulaGraph CPP

```
$ sudo make install
```

7.

```
$ sudo ldconfig
```

12.3.4

CPP SessionExample.cpp

1. SessionExample.cpp

2.

```
$ LIBRARY_PATH=<library_folder_path>:$LIBRARY_PATH g++ -std=c++11 SessionExample.cpp -I<include_folder_path> -lnebula_graph_client -o session_example
```

- library_folder_path NebulaGraph /usr/local/nebula/lib64
- include_folder_path NebulaGraph /usr/local/nebula/include

```
$ LIBRARY_PATH=/usr/local/nebula/lib64:$LIBRARY_PATH g++ -std=c++11 SessionExample.cpp -I/usr/local/nebula/include -lnebula_graph_client -o session_example
```

12.3.5

NebulaGraph CPP Session Pool Connection Pool NebulaGraph Connection Pool Session

- Session Pool

[SessionPoolExample](#)

- Connection Pool

[SessionExample](#)

:January 13, 2023

12.4 NebulaGraph Java

[NebulaGraph Java](#) [Java](#) [NebulaGraph](#)

12.4.1

Java 8.0

12.4.2

NebulaGraph	NebulaGraph Java
3.3.0	3.3.0
3.0.0 ~ 3.2.0	3.0.0
2.6.x	2.6.1
2.0.x	2.0.0
2.0.0-rc1	2.0.0-rc1

12.4.3 NebulaGraph Java

- NebulaGraph Java --branch v3.3.0

```
$ git clone --branch release-3.3 https://github.com/vesoft-inc/nebula-java.git
```

- master

```
$ git clone https://github.com/vesoft-inc/nebula-java.git
```

12.4.4



IDEA Maven pom.xml



3.0.0-SNAPSHOT release 3.0.0-SNAPSHOT

```
<dependency>
  <groupId>com.vesoft</groupId>
  <artifactId>client</artifactId>
  <version>3.0.0-SNAPSHOT</version>
</dependency>
```

pom.xml release

```
<repositories>
  <repository>
    <id>snapshots</id>
    <url>https://oss.sonatype.org/content/repositories/snapshots/</url>
```

```
</repository>
</repositories>
```

Maven

JAR

NebulaGraph Java

Connection Pool Session Pool

Connection Pool

Session

- Session Pool

[GraphSessionPoolExample](#)

- Connection Pool

[GraphClientExample](#)

12.4.5 Java

- [java-jdbc](#)
 - [java-orm](#)
 - [java-springboot demo](#)
 - [ngbatis](#)
-

: January 13, 2023

12.5 NebulaGraph Python

NebulaGraph Python Python NebulaGraph

12.5.1

Python 3.6

12.5.2

NebulaGraph	NebulaGraph Python
3.3.0	3.3.0
3.1.0 ~ 3.2.x	3.1.0
3.0.0 ~ 3.0.2	3.0.0
2.6.x	2.6.0
2.0.x	2.0.0
2.0.0-rc1	2.0.0rc1

12.5.3 NebulaGraph Python

pip

```
$ pip install nebula3-python==<version>
```

1. NebulaGraph Python

- NebulaGraph Python --branch v3.3.0

```
$ git clone --branch release-3.3 https://github.com/vesoft-inc/nebula-python.git
```

- master

```
$ git clone https://github.com/vesoft-inc/nebula-python.git
```

2. nebula-python

```
$ cd nebula-python
```

3.

```
$ pip install .
```

12.5.4

NebulaGraph Python

Connection Pool Session Pool

Connection Pool

Session

- Session Pool

[SessinPoolExample.py](#)

Example of using session pool

- Connection Pool

[Example](#)

:January 13, 2023

12.6 NebulaGraph Go

NebulaGraph Go Go NebulaGraph

12.6.1

Go 1.13

12.6.2

NebulaGraph	NebulaGraph Go
3.3.0	3.3.0
3.2.x	3.2.0
3.1.0	3.1.0
3.0.0 ~ 3.0.2	3.0.0
2.6.x	2.6.0
2.0.x	2.0.0-GA

12.6.3 NebulaGraph Go

- NebulaGraph Go --branch v3.3.0

```
$ git clone --branch release-3.3 https://github.com/vesoft-inc/nebula-go.git
```

- master

```
$ git clone https://github.com/vesoft-inc/nebula-go.git
```

12.6.4

```
$ go get -u -v github.com/vesoft-inc/nebula-go@<tag>
```

tag master release-3.3

12.6.5

NebulaGraph GO Connection Pool Session Pool Connection Pool Session

- Session Pool

[session_pool_example.go](#)

[Usage example](#)

- Connection Pool

[graph_client_basic_example](#) [graph_client_goroutines_example](#)

:January 13, 2023

13. NebulaGraph Cloud

NebulaGraph Cloud Cloud NebulaGraph

NebulaGraph

Cloud

- NebulaGraph Cloud
- AWS NebulaGraph Cloud AWS
- Azure NebulaGraph Cloud Azure



Cloud 3.3.0 Cloud **NebulaGraph Cloud**

: January 13, 2023

14. NebulaGraph Studio

14.1 NebulaGraph Studio

14.1.1 NebulaGraph Studio

NebulaGraph Studio Studio Web **NebulaGraph** nGQL NebulaGraph
GitHub [nebula-studio](#)



Studio

RPM DEB tar Docker Studio Kubernetes Helm Studio Studio

Studio

Studio NebulaGraph

- | • Schema | Tag | Edge Type | NebulaGraph |
|----------|------|-----------|-------------|
| • | | | |
| • | nGQL | Schema | |

Studio

- NebulaGraph GUI Schema nGQL
 - nGQL NebulaGraph Query Language GUI

NebulaGraph

root

Studio

NebulaGraph

Studio

NebulaGraph

Note

Studio NebulaGraph

NebulaGraph	Studio
3.3.0	3.5.0
3.0.0 3.2.x	3.4.1 3.4.0
3.1.0	3.3.2
3.0.0	3.2.x
2.6.x	3.1.x
2.6.x	3.1.x
2.0 & 2.0.1	2.x
1.x	1.x

Studio Studio

The screenshot shows the Nebula Studio interface with the following details:

- Header:** Nebula Studio, Schema (highlighted in blue), 导入 (Import), 控制台 (Console).
- Top Right:** Update Log (更新日志) button (highlighted with a red box), Logout (登出) button, Version v3.3.0-beta.
- Section Header:** 图空间列表 (Graph Space List).
- Buttons:** + 创建图空间 (Create Graph Space) button.
- Table:** A list of graph spaces with the following columns: 序号 (Index), 名称 (Name), Partition Number, Replica Factor, Charset, Collate, Vid Type, Atomic Edge, Group, Comment, 操作 (Operations). The table contains three entries:

序号	名称	Partition Number	Replica Factor	Charset	Collate	Vid Type	Atomic Edge	Group	Comment	操作
1	basketball...	10	1	utf8	utf8_bin	FIXED_ST RING(32)	false	_EMPTY_	Schema	...
2	hello_test	100	1	utf8	utf8_bin	INT64	false	_EMPTY_	Schema	...
3	test	15	1	utf8	utf8_bin	FIXED_ST RING(30)	false	_EMPTY_	Schema	...

- Pagination:** Navigation buttons <, 1, >.

:January 13, 2023

14.1.2

Studio

Studio x86_64

Studio CSV

CSV

nGQL

nGQL

- USE <space_name> **Space**
- nGQL

Chrome Studio

: January 13, 2023

14.2

14.2.1 Studio

RPM DEB tar Docker Studio

RPM Studio

RPM Studio

- NebulaGraph NebulaGraph
- Linux CentOS lsosf
-

7001 Studio web

1. RPM

NebulaGraph

nebula-graph-studio-3.5.0.x86_64.rpm	nebula-graph-studio-3.5.0.x86_64.rpm.sha256	3.3.0
--------------------------------------	---	-------

2. `sudo rpm -i <rpm_name>` RPM

Studio 3.5.0 /usr/local/nebula-graph-studio

```
$ sudo rpm -i nebula-graph-studio-3.5.0.x86_64.rpm
```

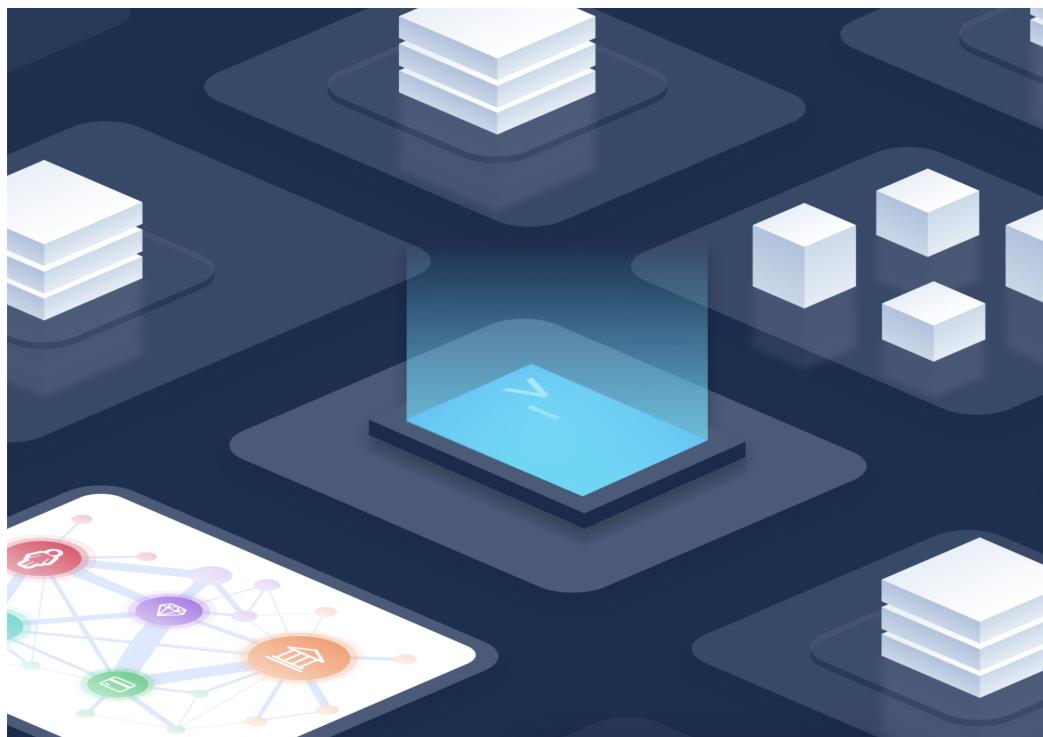
```
$ sudo rpm -i nebula-graph-studio-3.5.0.x86_64.rpm --prefix=<path>
```

PRM Studio

```
Start installing NebulaGraph Studio now...
NebulaGraph Studio has been installed.
NebulaGraph Studio started automatically.
```

3. `http://<ip address>:7001`

Studio



Nebula Studio

配置数据库

Host

用户名

密码

连接

版本: v3.3.0-beta 简体中文

Studio

```
$ sudo rpm -e nebula-graph-studio-3.5.0.x86_64
```

PRM Studio

```
NebulaGraph Studio removed, bye-
```

```
$ bash /usr/local/nebula-graph-studio/scripts/rpm/start.sh
```

```
$ bash /usr/local/nebula-graph-studio/scripts/rpm/stop.sh
```

```
ERROR: bind EADDRINUSE 0.0.0.0:7001 7001
```

```
$ lsof -i:7001
```

Studio

```
// studio
$ vi etc/studio-api.yaml

// Port: 7001 //

// $ systemctl restart nebula-graph-studio.service
```

DEB Studio

DEB Studio

- NebulaGraph NebulaGraph
- Linux Ubuntu
-

7001 Studio web

- /usr/lib/systemd/system

1. DEB

NebulaGraph

nebula-graph-studio-3.5.0.x86_64.deb	nebula-graph-studio-3.5.0.x86_64.deb.sha256	3.3.0
--------------------------------------	---	-------

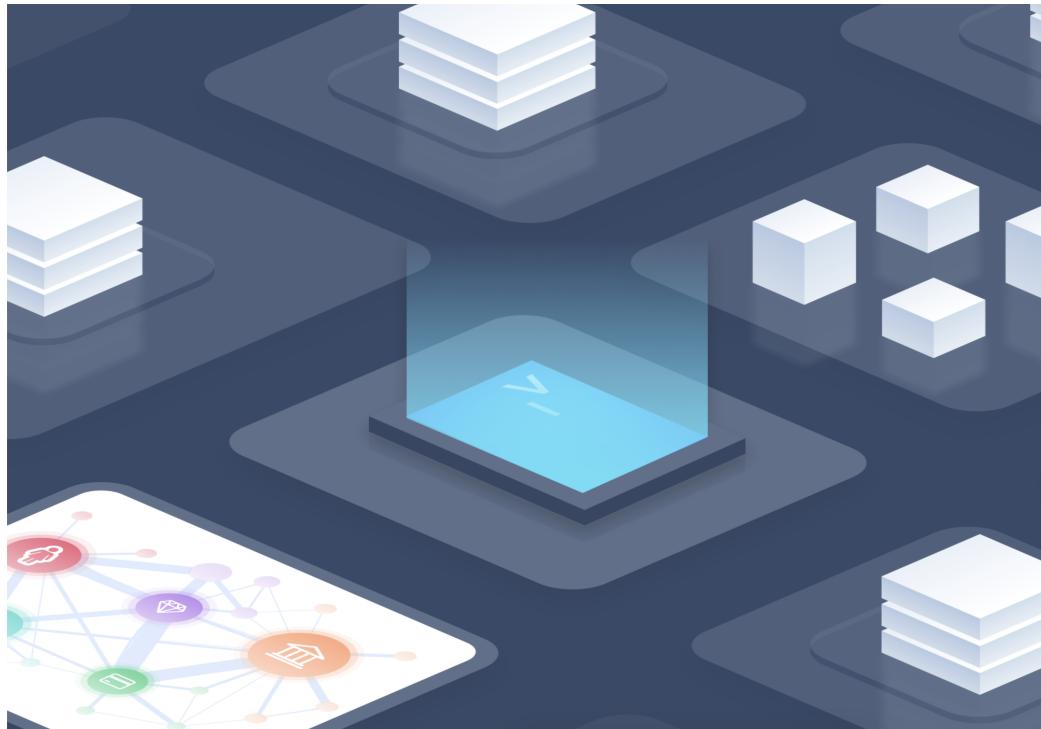
2. sudo dpkg -i <deb_name> DEB

Studio 3.5.0

```
$ sudo dpkg -i nebula-graph-studio-3.5.0.x86_64.deb
```

3. http://<ip address>:7001

Studio



Nebula Studio

配置数据库

Host

用户名

密码

连接

版本: v3.3.0-beta @ 中文 ▾

Studio

```
$ sudo dpkg -r nebula-graph-studio
```

tar Studio

tar Studio

- NebulaGraph **NebulaGraph**
-

7001

Studio web

1. tar

Studio	NebulaGraph
---------------	--------------------

nebula-graph-studio-3.5.0.x86_64.tar.gz	3.5.0	3.3.0
--	-------	-------

2. tar

```
tar -xvf nebula-graph-studio-3.5.0.x86_64.tar.gz
```

3. nebula-graph-studio

```
$ cd nebula-graph-studio
$ ./server
```

4. <http://<ip address>:7001>

Studio



Nebula Studio

配置数据库

Host	<input type="text"/>
用户名	<input type="text"/>
密码	<input type="password"/> <input checked="" type="checkbox"/>
连接	
版本: v3.3.0-beta @ 中文 ▾	

```
kill <pid>
```

```
$ kill $(lsof -t -i :7001) # stop nebula-graph-studio
```

Docker Studio

Docker Studio

- NebulaGraph [NebulaGraph](#)
- Docker Studio [Docker Compose](#) [Docker Compose](#)
-

7001

Studio web

- Docker Hub Docker [registry-mirrors](#) Docker

[registry-mirrors](#)

```
{  
  "registry-mirrors": [  
    "https://registry.docker-cn.com",  
    "http://hub-mirror.c.163.com",  
    "https://docker.mirrors.ustc.edu.cn"  
  ]  
}
```

/ Docker Desktop

Docker Daemon

Docker Studio NebulaGraph 3.3.0

1. Studio

NebulaGraph

[nebula-graph-studio-3.5.0.tar.gz](#) 3.3.0

2. nebula-graph-studio-3.5.0

```
mkdir nebula-graph-studio-3.5.0 && tar -zxvf nebula-graph-studio-3.5.0.tar.gz -C nebula-graph-studio-3.5.0
```

3. nebula-graph-studio-3.5.0

```
cd nebula-graph-studio-3.5.0
```

4. Studio Docker

```
docker-compose pull
```

5. Studio -d

```
docker-compose up -d
```

Docker Studio

```
Creating docker_web_1 ... done
```

6. http://<ip address>:7001



Docker Studio

[ifconfig](#)

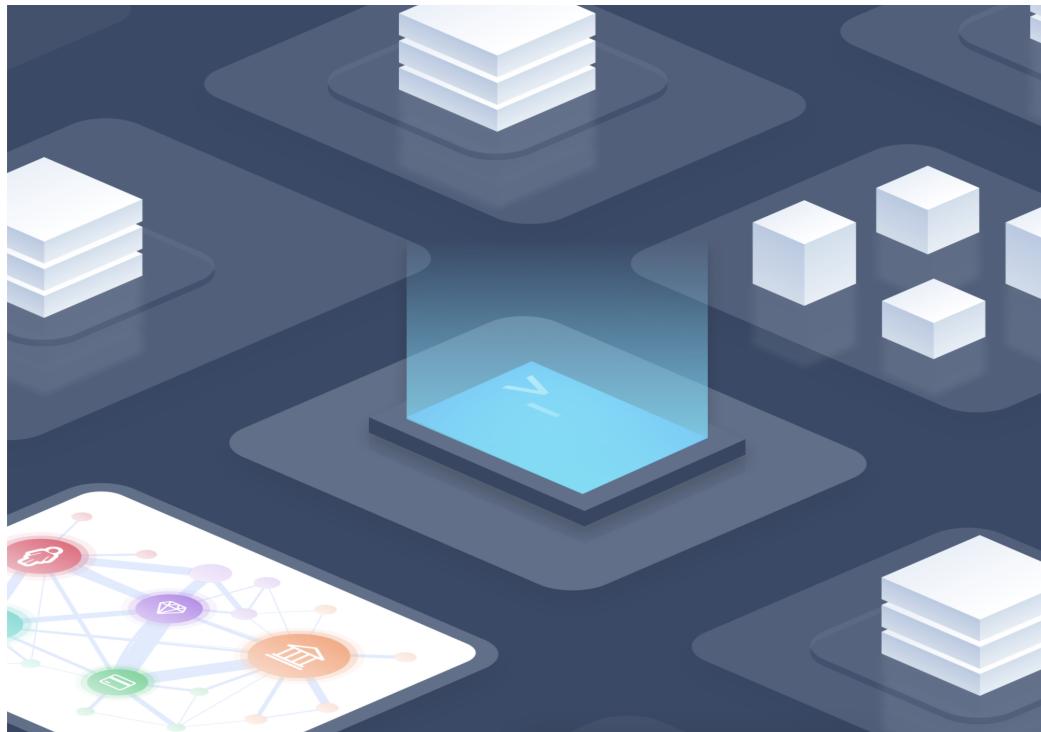
[ipconfig](#)

IP

Studio

<http://localhost:7001>

Studio



Nebula Studio

配置数据库

Host

用户名

密码

连接

版本: v3.3.0-beta @ 中文 ▾

Helm Studio

Kubernetes Helm Studio

Studio

Kubernetes ≥ 1.14

Helm $\geq 3.2.0$

1. Studio

```
$ git clone https://github.com/vesoft-inc/nebula-studio.git
```

2. nebula-studio

```
$ cd nebula-studio
```

3. Helm Chart my-studio

```
$ helm upgrade --install my-studio --set service.type=NodePort --set service.port={30070} deployment/helm
```

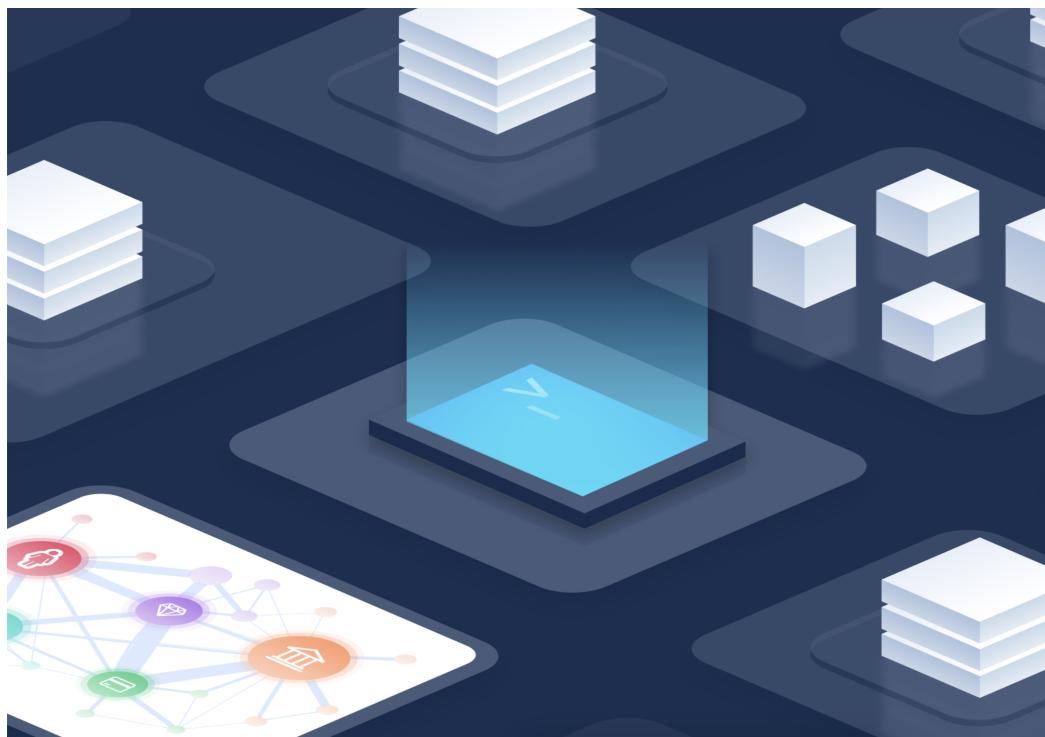
Helm Chart

replicaCount	0	Deployment				
image.nebulaStudio.name	vesoft/nebula-graph-studio	nebula-graph-studio				
image.nebulaStudio.version	v3.2.0	nebula-graph-studio				
service.type	ClusterIP	NodePort	ClusterIP	LoadBalancer		
service.port	7001	nebula-graph-studio web				
service.nodePort	32701	Kubernetes	nebula-studio			
resources.nebulaStudio	{}	nebula-studio	/			
persistent.storageClassName	""	storageClass				
persistent.size	5Gi					

4.

http://<node_address>:30070

Studio



Nebula Studio

配置数据库

Host

用户名

密码

连接

版本: v3.3.0-beta 简体中文

```
$ helm uninstall my-studio
```

Studio

NebulaGraph

:January 13, 2023

14.2.2

Studio NebulaGraph Studio NebulaGraph

NebulaGraph

- Studio [Studio](#)
- NebulaGraph Graph IP 9669
- NebulaGraph



NebulaGraph

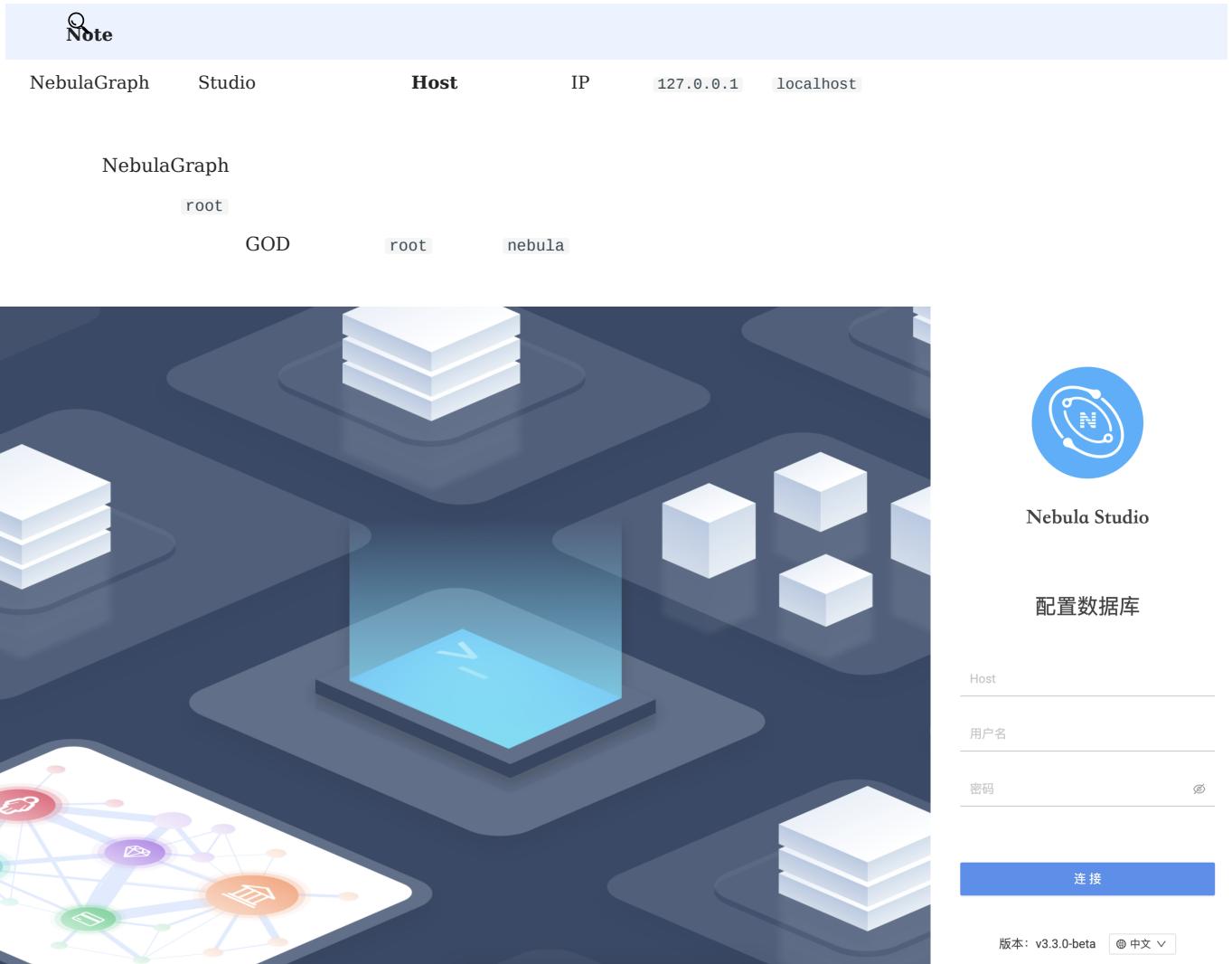
root

[NebulaGraph](#)

NebulaGraph

1. Studio

- **Host** NebulaGraph Graph IP ip:port 9669



2.

30 30

NebulaGraph

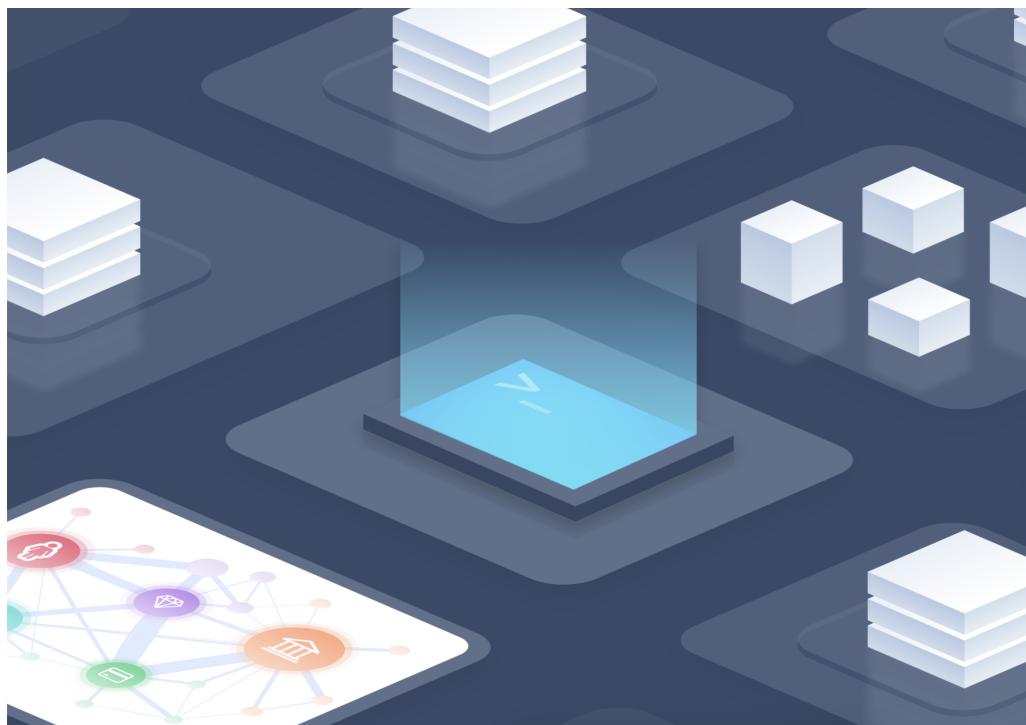
- **Schema** Schema
-
- nGQL
- **Schema** Schema

Note

NebulaGraph

Studio

NebulaGraph



Nebula Studio

配置数据库

Host

用户名

密码

连接

版本: v3.3.0-beta

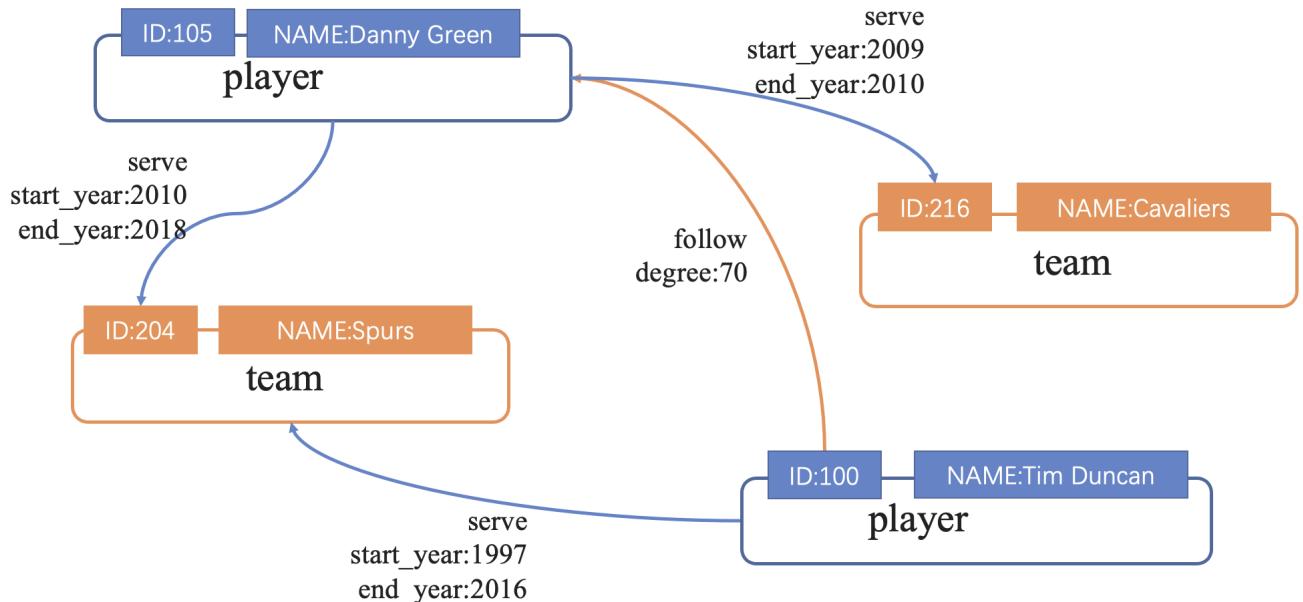
: January 13, 2023

14.3

14.3.1 Schema

Studio	NebulaGraph	Schema
Schema		
• Tag	Tag	
• Edge type		
NebulaGraph	basketballplayer	Schema
Schema		
Tag	player	- name string - age int
Tag	team	- name string
Edge type	serve	- start_year int - end_year int
Edge type	follow	- degree int

player team serve/follow



14.3.2 Schema

NebulaGraph Schema NebulaGraph **Schema** Schema

Note

- nebula-console Schema **NebulaGraph** **NebulaGraph**
- Schema Schema **Schema**

Studio Schema

- Studio **NebulaGraph**
- GOD ADMIN DBA **NebulaGraph**
- Schema
-

Note

GOD **Schema**

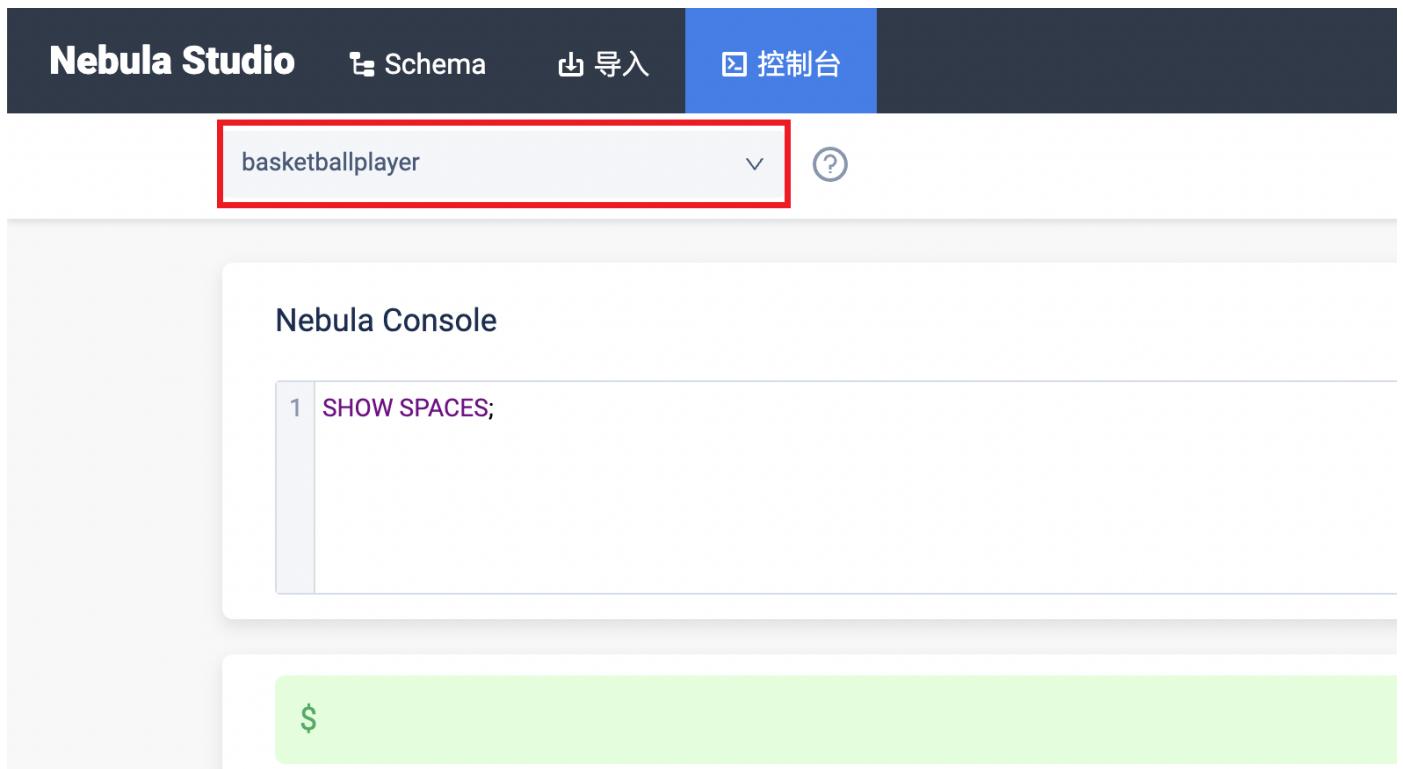
Schema Schema

Schema Schema

1. Tag **Tag**
2. Edge type **Edge type**

Schema

- 1.
2. **Space** **basketballplayer**



3.

```
// Tag player 2
CREATE TAG player(name string, age int);

// Tag team 1
CREATE TAG team(name string);

// Edge type follow 1
CREATE EDGE follow(degree int);

// Edge type serve 2
CREATE EDGE serve(start_year int, end_year int);
```

Schema Tag Edge type

```
// Tag
SHOW TAGS;

// Edge type
SHOW EDGES;

// Tag Edge type
DESCRIBE TAG player;
DESCRIBE TAG team;
DESCRIBE EDGE follow;
DESCRIBE EDGE serve;
```

Schema

:January 13, 2023

14.3.3

CSV Schema Studio

- Studio NebulaGraph
- NebulaGraph Schema
- CSV Schema
- GOD ADMIN DBA USER

1.

2. CSV edge_serve.csv edge_follow.csv vertex_player.csv vertex_team.csv

Note

CSV CSV Schema

3.



Nebula Studio Schema 导入 控制台

上传文件 导入数据

+ 上传文件

文件列表

文件名	头字段	大小	操作
edge-宝可梦-database.csv	<input type="checkbox"/>	4.0	
edge_follow.csv	<input type="checkbox"/>	1.9	
edge_serve.csv	<input type="checkbox"/>	4.41 KB	
vertex-宝可梦-database.csv	<input type="checkbox"/>	20.86 KB	
vertex_player.csv	<input type="checkbox"/>	1.40 KB	
vertex_team.csv	<input type="checkbox"/>	472 B	

Column 0	Column 1	Column 2	Column 3
player100	team204	1997	2016
player101	team204	1999	2018
player101	team215	2018	2019

- 1.
- 2.
3. +

Caution

example.yaml NebulaGraph Importer CSV

•

•

•

• + vertex_player.csv

vertices 1 verteID Select CSV Index vertexID

+ Tag player name Column 2 string age Column

1 int

+ edge_follow.csv

edge 1 Edge Type

Edge type edge_follow.csv srcId dstId Schema VID srcId

VID dstId VID rank

Nebula Studio Schema 导入 控制台

← 任务列表 / 创建导入任务

* 图空间 basketballplayer * 任务名称 test_import

批处理量 60

* 关联点 + 绑定数据源

vertices 1 vertex_player.csv

vertexID: Column 0

Tag: player

属性	对应列标	类型
name	* Column 2	string
age	* Column 1	int

+ 添加 Tag

* 关联边 + 绑定数据源

edge 1 edge_follow.csv

Edge Type: follow

属性	对应列标	类型
srcId	* Column 0	string
dstId	* Column 1	string
rank	选择	int
degree	* Column 2	int

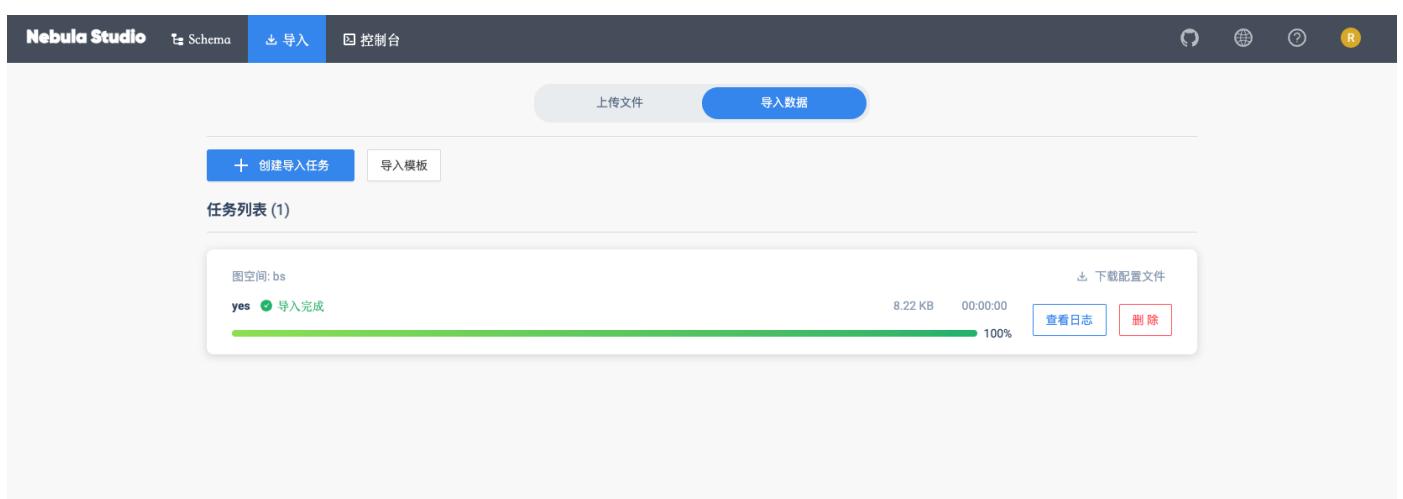
取消 导入

4.

5. NebulaGraph



6.



: January 13, 2023

14.3.4

Studio

Nebula Studio Schema 导入 控制台 控制台

2 basketballplayer 3 ☆ 4 ⌚ 5 □ 6 ▶ 运行

7 p1 8 1 MATCH (v:player) RETURN v LIMIT 3 9 \$ MATCH (v:player) RETURN v LIMIT 3 10 ☆ 11 ↑ 12 ^ 13 ×

14 表格 15 可视化

表格

\$ MATCH (v:player) RETURN v LIMIT 3

执行时间消耗 0.00302 (s)

可视化

\$ MATCH (v:player) RETURN v LIMIT 3

v

(“player102” :player{age: 33, name: “LaMarcus Aldridge”})
 (“player106” :player{age: 25, name: “Kyle Anderson”})
 (“player115” :player{age: 40, name: “Kobe Bryant”})

共计 3 < 1 >

1

2

Studio

USE <space_name>

3



4



15

5



6

nGQL



7



8

nGQL



; //

9

nGQL

10



11

CSV PNG

nGQL
CSV PNG

CSV



12

/



nGQL



nGQL

.

13



nGQL

14

15



:January 13, 2023

14.3.5 Schema

Studio NebulaGraph

Schema

Schema

- Studio NebulaGraph
- NebulaGraph user
- NebulaGraph root

1. Schema

2. +

- basketballplayer

• vid type	ID VID	FIXED_STRING(<N>)	INT64	FIXED_STRING(32)	VID
•	256	Statistics of basketball players			
•	partition_num replica_factor	100	1	CREATE SPACE	

nGQL nGQL

```
CREATE SPACE basketballplayer (partition_num = 100, replica_factor = 1, vid_type = FIXED_STRING(32)) COMMENT = "Statistics of basketball players"
```

3.

The screenshot shows the Nebula Studio interface with the 'Schema' tab selected. A modal dialog is open for creating a new graph space. The 'Name' field contains 'basketballplayer'. The 'Vid Type' dropdown is set to 'FIXED_STRING' with a length of 32. The 'Description' field contains 'Statistics of basketball players'. Under 'Partition_num' (optional), the value '100' is entered. Under 'Replica_factor' (optional), the value '1' is entered. Below the form, a section titled '对应的nGQL语句' (The corresponding nGQL statement) displays the generated nGQL code: 'CREATE SPACE `basketballplayer` (partition_num = 100, replica_factor = 1, vid_type = FIXED_STRING(32)) COMMENT = "Statistics of basketball players"'. At the bottom of the dialog are two buttons: '取消' (Cancel) and a blue '创建' (Create) button.



1. Schema

2.

The screenshot shows the Nebula Studio interface with the 'Schema' tab selected. The main area displays a table titled '图空间列表' (Graph Space List) with the following data:

序号	名称	Partition Number	Replica Factor	Charset	Collate	Vid Type	Atomic Edge	Group	Comment	操作
1	basketball...	10	1	utf8	utf8_bin	FIXED_ST RING(32)	false	_EMPTY_	Schema	更多
2	hello_test	100	1	utf8	utf8_bin	INT64	false	_EMPTY_	Schema	删除图空间
3	test	15	1	utf8	utf8_bin	FIXED_ST RING(30)	false	_EMPTY_	Schema	更多

Below the table, there are navigation buttons: '<' (left), '1' (center), and '>' (right). A red box highlights the '删除图空间' (Delete Graph Space) button for the second row.

3.

Schema

- Tag
- Edge type
-

: January 13, 2023

Tag

NebulaGraph

Tag

Schema

Tag

Schema

Tag

Studio Tag

• Studio NebulaGraph

•

• GOD ADMIN DBA

TAG

1. **Schema**2. **Schema**

3.

4. +

5.

a. Tag player

b. Tag

c. Tag +

•

•

•

•

d. **TTL** Tag TTL TTL **TTL_COL** **TTL_DURATION** **TTL**6. **nGQL** nGQL

Nebula Studio Schema 导入 控制台

← 图空间列表 / 标签列表 / 创建标签 当前图空间: basketballplayer

* 名称: player 描述:

定义属性

* 属性名称	* 数据类型	允许空值	默认值	描述
age	int	<input checked="" type="checkbox"/>		<input type="button" value="删除"/>
name	fixed_string	<input checked="" type="checkbox"/>		<input type="button" value="删除"/>

设置TTL (存活时间)

TTL_COL	TTL_DURATION
	请输入时间(s)

对应的nGQL语句:

```
1 CREATE tag `player` (`age` int NULL , `name` fixed_string(64) NULL )
```

取消

7.

Tag Tag

TAG

1. Schema
2. Schema
- 3.
- 4.



Tag

- 5.
-
-
-
- + Tag
- TTL TTL TTL
- TTL TTL TTL TTL
- TTL TTL TTL TTL_COL TTL_DURATION TTL

Note

TTL TTL

TAG

Danger

Tag

1. **Schema**
2. **Schema**
- 3.
4. Tag 
- 5.

Tag

:January 13, 2023

Edge type

NebulaGraph

Edge type

Schema Edge type**Schema** Edge type

Studio Edge type

- Studio NebulaGraph

-

- GOD ADMIN DBA

1. **Schema****Schema**

3.

4. +

5.

a. Edge type serve

b. Edge type

c. Edge type +

-

-

-

-

-

d. **TTL** Edge type TTL TTL **TTL_COL** **TTL_DURATION** **TTL**6. **nGQL** nGQL

The screenshot shows the Nebula Studio Schema interface. The top navigation bar includes tabs for Nebula Studio, Schema, Import, and Control Panel. The current view is under the Schema tab, specifically in the basketballplayer graph space, creating a new edge type named 'serve'. The 'serve' edge type has four properties defined: start_year (int), end_year (int), teamID (string), and playerID (string). The TTL section is collapsed. The generated nGQL code for creating the edge type is shown in the bottom panel.

* 属性名称	* 数据类型	允许空值	默认值	描述
start_year	int	<input checked="" type="checkbox"/>		
end_year	int	<input checked="" type="checkbox"/>		
teamID	string	<input checked="" type="checkbox"/>		
playerID	string	<input checked="" type="checkbox"/>		

```

1 CREATE edge `serve` (`start_year` int NULL , `end_year` int NULL , `teamID` string NULL , `playerID` string NULL )
  
```

7.

Edge Type

Edge type

EDGE TYPE

Schema Edge type

1. **Schema**

Schema

3.

4.



Edge Type

5.

•

•

•

•

+

• TTL

TTL

TTL

•

TTL

TTL

TTL

•

Note

TTL

TTL

EDGE TYPE

Danger

Edge type

1. **Schema**

Schema

3.

4.

Edge type



Edge type

: January 13, 2023

Tag Edge type

Schema

Schema



Tag Edge type

Studio

- Studio NebulaGraph
- Tag Edge type
- GOD ADMIN DBA

1. **Schema**

Schema

3.

4. +

5.

a. **Tag Edge type Edge type**

b. Tag Edge type **follow**

follow_index

d.

e. +

degree



LOOKUP

LOOKUP

6.

nGQL

nGQL

* 索引类型
Edge Type

* 关联 edge 名称
follow

* 索引名称
follow_index

描述
follow_index

索引属性(可拖拽排序)
+ 添加属性

`degree` X

✓ 对应的nGQL语句

```
1 CREATE EDGE INDEX `follow_index` ON `follow`(`degree`) COMMENT "follow_index"
```

取消 创建

7.

1. Schema

Schema

2.

3.

4.

5.

1. Schema

Schema

2.

3.

4.

5.



REBUILD INDEX

1. Schema

Schema

2.

- 3.
 - 4.
 5. 
 - 6.
-

:January 13, 2023

14.3.6 Schema

Studio Schema Schema Schema

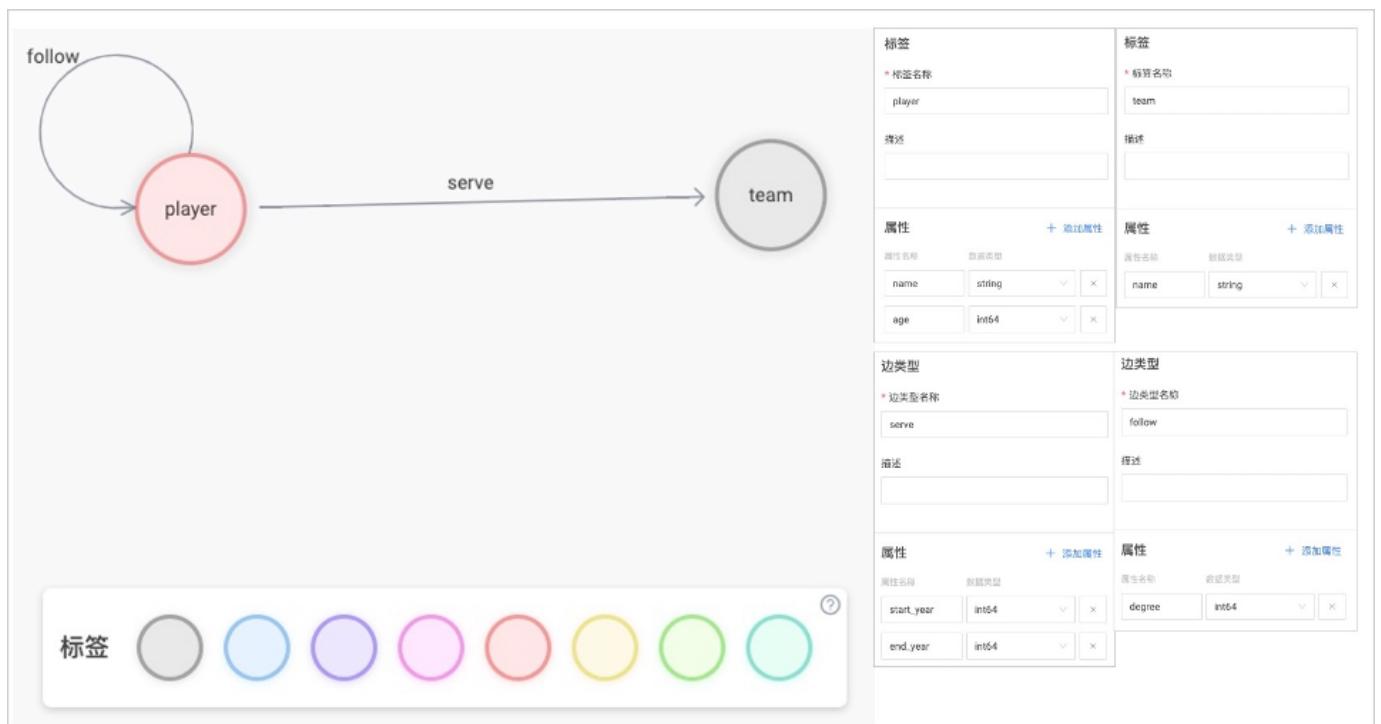
- Schema
- Schema
- Schema PNG



Schema

basketballplayer Schema Schema

- 1.
2. Tag Tag
3. Tag player name age
4. Tag team name
5. Tag player Tag team serve start_year end_year
6. Tag player follow degree
- 7.



Schema

1. Schema

2. Schema

Note

- CREATE SPACE
- Schema

Schema

Schema

**Note**

Schema

Schema

Schema

**Schema**

Schema PNG

: January 13, 2023

14.4

14.4.1

Studio

1 HOST

NebulaGraph	Graph	IP	graph_server_ip	9669	NebulaGraph	Studio	IP
127.0.0.1	localhost	0.0.0.0					

2

NebulaGraph

3 NEBULAGRAPH

NebulaGraph

- Linux NebulaGraph NebulaGraph
- Docker Compose RPM NebulaGraph NebulaGraph

NebulaGraph 4 NebulaGraph

 Note

docker-compose up -d NebulaGraph docker-compose down NebulaGraph

4 GRAPH

Studio telnet <graph_server_ip> 9669 NebulaGraph Graph

- Studio NebulaGraph
- NebulaGraph

NebulaGraph NebulaGraph

: January 13, 2023

14.4.2 Studio

Studio 127.0.0.1:7001 0.0.0.0:7001

1.

Studio x86_64 Studio x86_64

2. STUDIO

- RPM DEB Studio systemctl status nebula-graph-studio
- tar Studio sudo lsof -i:7001
- Docker-compose Studio docker-compose ps

State Up

Name	Command	State	Ports
nebula-web-docker_client_1	./nebula-go-api	Up	0.0.0.0:32782->8080/tcp
nebula-web-docker_importer_1	nebula-importer --port=569 ...	Up	0.0.0.0:32783->5699/tcp
nebula-web-docker_nginx_1	/docker-entrypoint.sh ngn ...	Up	0.0.0.0:7001->7001/tcp, 80/tcp
nebula-web-docker_web_1	docker-entrypoint.sh npm r ...	Up	0.0.0.0:32784->7001/tcp



docker-compose up -d Studio docker-compose down Studio

Studio Studio

3.

Studio localhost:7001 127.0.0.1:7001 0.0.0.0:7001 Studio
<studio_server_ip>:7001 studio_server_ip Studio IP

4.

curl <studio_server_ip>:7001 -I HTTP/1.1 200 OK

- Studio
- Studio

Studio NebulaGraph

:January 13, 2023

14.4.3

1. NebulaGraph Docker Compose NebulaGraph `docker-compose pull && docker-compose up -d` Docker
 2. Studio
 3. GitHub [nebula](#) [nebula-web-docker](#)
 - 4.
-

:January 13, 2023

15. NebulaGraph Dashboard

15.1 NebulaGraph Dashboard

NebulaGraph Dashboard Dashboard NebulaGraph Dashboard **NebulaGraph**
Dashboard

 **Enterpriseonly**

15.1.1

- CPU
- IP
-
-

15.1.2

Dashboard

-
-
-

15.1.3

14 14

 **Note**

prometheus **prometheus**

15.1.4

NebulaGraph Dashboard

NebulaGraph	Dashboard
3.3.0	3.2.0
2.5.0 ~ 3.2.0	3.1.0
2.5.x ~ 3.1.0	1.1.1
2.0.1 ~ 2.5.1	1.0.2
2.0.1 ~ 2.5.1	1.0.1

15.1.5

Release

15.1.6

NebulaGraph Dashboard Demo v3.0 2 57

: January 13, 2023

15.2 Dashboard

Dashboard 5

TAR

NebulaGraph Dashboard

[GitHub NebulaGraph dashboard](#)

15.2.1

Dashboard

- NebulaGraph [NebulaGraph](#)
- 9200
- 9100
- 9090
- 8090
- 7003

• Linux CentOS v10.12.0 Node.js 1.13 Go

15.2.2 Dashboard

TAR [nebula-dashboard-3.2.0.x86_64.tar.gz](#)

15.2.3

```
tar -xvf nebula-dashboard-3.2.0.x86_64.tar.gz      nebula-dashboard/vendors      4
```

node-exporter	CPU	9100
nebula-stats-exporter	IP	9200
prometheus		9090
nebula-http-gateway	HTTP nGQL	NebulaGraph 8090

15.2.4 Docker Compose Dashboard

Docker Compose Dashboard

Dashboard

Docker

1. NebulaGraph [nebula-dashboard](#) [vendors/node-exporter](#) [node-exporter](#)

```
nohup ./node-exporter --web.listen-address=:9100 &
```



[node-exporter](#)

2. Dashboard nebula-dashboard Dashboard

a. vendors/nebula-stats-exporter config.yaml NebulaGraph HTTP IP

```

clusters:
  - name: nebula
    instances:
      - name: metad0
        endpointIP: 192.168.8.157
        endpointPort: 19559
        componentType: metad
      - name: metad1
        endpointIP: 192.168.8.155
        endpointPort: 19559
        componentType: metad
      - name: metad2
        endpointIP: 192.168.8.154
        endpointPort: 19559
        componentType: metad
      - name: graphd0
        endpointIP: 192.168.8.157
        endpointPort: 19669
        componentType: graphd
      - name: graphd1
        endpointIP: 192.168.8.155
        endpointPort: 19669
        componentType: graphd
      - name: graphd2
        endpointIP: 192.168.8.154
        endpointPort: 19669
        componentType: graphd
      - name: storaged0
        endpointIP: 192.168.8.157
        endpointPort: 19779
        componentType: storaged
      - name: storaged1
        endpointIP: 192.168.8.155
        endpointPort: 19779
        componentType: storaged
      - name: storaged2
        endpointIP: 192.168.8.154
        endpointPort: 19779
        componentType: storaged

```

b. vendors/prometheus prometheus.yaml node-exporter nebula-stats-exporter

```

global:
  scrape_interval: 5s # 1
  evaluation_interval: 5s # 1
scrape_configs:
  - job_name: 'node-exporter'
    static_configs:
      - targets: [
        '192.168.8.154:9100',
        '192.168.8.155:9100',
        '192.168.8.157:9100' # node-exporter IP
      ]
  - job_name: 'nebula-stats-exporter'
    static_configs:
      - targets: [
        'nebula-stats-exporter:9200', # nebula-stats-exporter
      ]

```

c. nebula-dashboard config.json

```
{
  "port": 7003,
  "proxy": {
    "gateway": {
      "target": "nebula-http-gateway:8090" # nebula-http-gateway
    },
    "prometheus": {
      "target": "prometheus:9090" # Prometheus
    },
    "graph": {
      "target": "graphd:19669" # Graph
    },
    "storage": {
      "target": "graphd:19779" # Storage
    }
  },
  "nebulaServer": {
    "ip": "192.168.8.131", # Graph IP
    "port": 9669 # Graph
  }
}
```

3. Dashboard

```
docker network create nebula-net
```

4. nebula-dashboard Dashboard

```
docker-compose -f docker-compose.yaml up -d
```

```
docker-compose.yaml
```

5. docker ps

- <IP>:9200 nebula-stats-exporter
- <IP>:9100 node-exporter
- <IP>:9090 prometheus
- <IP>:8090 nebula-http-gateway
- <IP>:7003 dashboard

15.2.5 Dashboard

`node-exporter`



`node-exporter`

`node-exporter`

```
$ nohup ./node-exporter --web.listen-address=:9100 &
```

<IP>:9100

nebula-stats-exporter



nebula-dashboard nebula-stats-exporter

1. nebula-stats-exporter config.yaml HTTP

```
clusters:
  - name: nebula
    instances:
      - name: metad0
        endpointIP: 192.168.8.157
        endpointPort: 19559
        componentType: metad
      - name: metad1
        endpointIP: 192.168.8.155
        endpointPort: 19559
        componentType: metad
      - name: metad2
        endpointIP: 192.168.8.154
        endpointPort: 19559
        componentType: metad
      - name: graphd0
        endpointIP: 192.168.8.157
        endpointPort: 19669
        componentType: graphd
      - name: graphd1
        endpointIP: 192.168.8.155
        endpointPort: 19669
        componentType: graphd
      - name: graphd2
        endpointIP: 192.168.8.154
        endpointPort: 19669
        componentType: graphd
      - name: storaged0
        endpointIP: 192.168.8.157
        endpointPort: 19779
        componentType: storaged
      - name: storaged1
        endpointIP: 192.168.8.155
        endpointPort: 19779
        componentType: storaged
      - name: storaged2
        endpointIP: 192.168.8.154
        endpointPort: 19779
        componentType: storaged
```

2.

```
$ nohup ./nebula-stats-exporter --listen-address=:9200 --bare-metal --bare-metal-config=./config.yaml &
```

<IP>:9200

prometheus

nebula-dashboard prometheus

1. prometheus prometheus.yaml node-exporter nebula-stats-exporter IP

```
global:
  scrape_interval:      5s
  evaluation_interval: 5s
scrape_configs:
- job_name: 'nebula-stats-exporter'
  static_configs:
    - targets: [
        '192.168.xx.100:9200' # nebula-stats-exporter     IP
    ]
- job_name: 'node-exporter'
  static_configs:
    - targets: [
        '192.168.xx.100:9100', # node-exporter     IP
        '192.168.xx.101:9100'
    ]
```

- scrape_interval 1
- evaluation_interval 1

2.

```
$ nohup ./prometheus --config.file=../prometheus.yaml &
```

<IP>:9090

nebula-http-gateway

nebula-dashboard nebula-http-gateway

nebula-http-gateway

```
$ nohup ./nebula-htpd &
```

<IP>:8090

dashboard

1. nebula-dashboard config.json

```
port: 7003
proxy:
  gateway:
    target: "127.0.0.1:8090" // nebula-http-gateway     IP
  prometheus:
    target: "127.0.0.1:9090" // Prometheus     IP
  graph:
    target: "127.0.0.1:19669" //     Graph
  storage:
    target: "127.0.0.1:19779" //     Storage
  nebulaServer:
    ip: "192.168.8.143" // Graph     IP
    port: 9669 // Graph
  ...
```

2. nebula-dashboard

```
$ nohup ./dashboard &
```

<IP>:7003

15.2.6 Dashboard

- Docker Compose Dashboard docker-compose stop
- Dashboard kill <pid>

```
$ kill $(lsof -t -i :9100) # node-exporter
$ kill $(lsof -t -i :9200) # nebula-stats-exporter
$ kill $(lsof -t -i :9090) # prometheus
$ kill $(lsof -t -i :8090) # nebula-http-gateway
$ kill $(lsof -t -i :7003) # dashboard
```

15.2.7

Dashboard

15.2.8 Mac node-exporter

- Mac 'brew install node_exporter' node-exporter
- 'brew services start node_exporter' node-exporter
- http://localhost:9100/

: January 13, 2023

15.3 Dashboard

Dashboard

Dashboard

15.3.1

- Dashboard [Dashboard](#)
- Chrome 89 [Chrome](#)

15.3.2

1. `nebula-dashboard` IP [`<IP>:7003`](#)
2. NebulaGraph

Note

NebulaGraph [config.json](#) [Graph](#) [IP](#) [Dashboard](#)

- NebulaGraph [Dashboard](#)
 - NebulaGraph [root](#) [Dashboard](#)
3. NebulaGraph

Note

[config.json](#) [NebulaGraph](#) , [Dashboard](#)



4.

: January 13, 2023

15.4 Dashboard

Dashboard

15.4.1



15.4.2

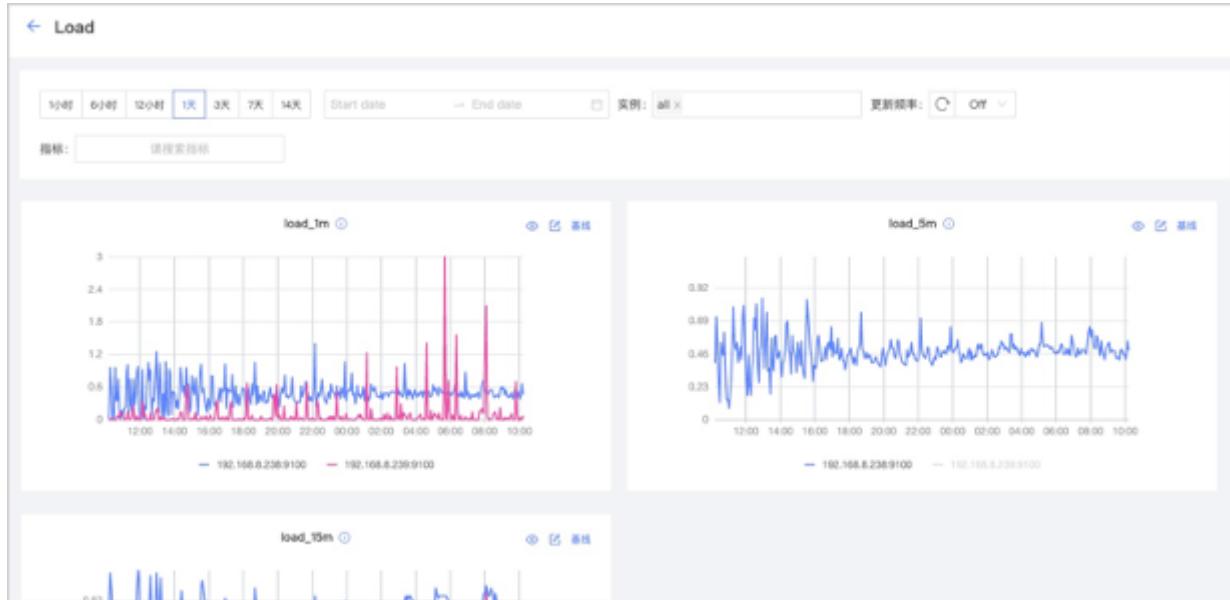
->

CPU Memory Load Disk Network In/Out

- 14 1 6 12 1 3 7 14



Load



15.4.3

->

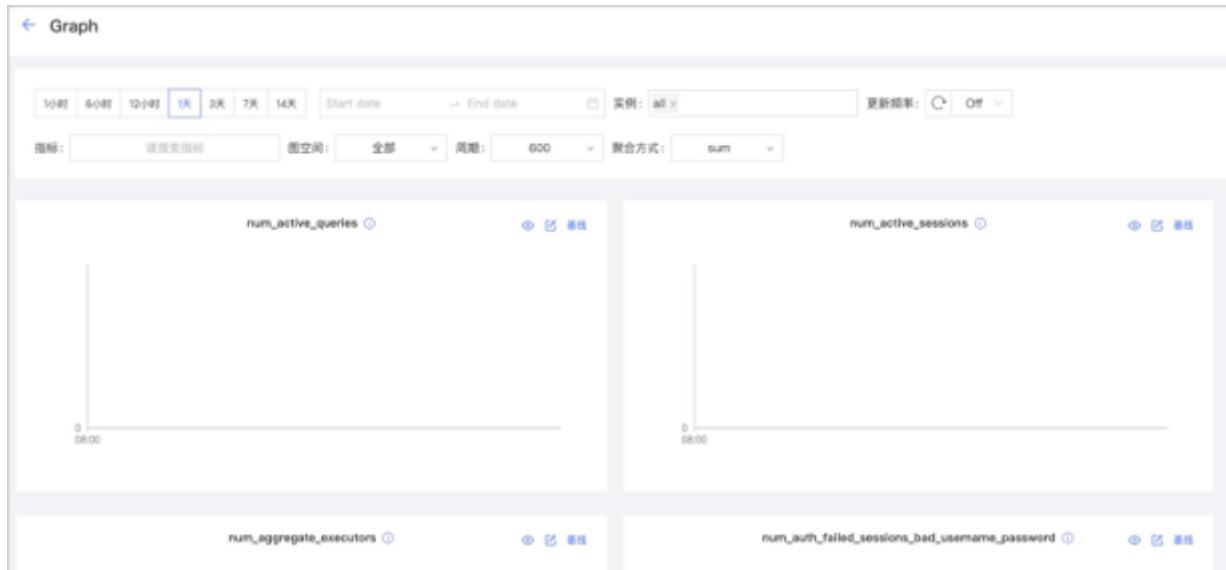
Graph Meta Storage

Note

- 14 1 6 12 1 3 7 14



Graph



- Graph

Caution

Graph enable_space_level_metrics true Graph



Graph

Dashboard

查询条件 X

周期: ▼

指标: ▼ (i)

图空间: ▼

聚合方式: ▼

基线:

取消 确认

15.4.4

[NebulaGraph](#)[Storage](#)[Storage Leader](#)[NebulaGraph](#)

集群管理 / 信息总览

[← 信息总览](#)

Storage Leader 分布

		服务	Leader 数量	Leader 分布
●	192.168.8.129	192.168.8.129	0	No valid partition

服务信息

Host	Port	Status	Git Info Sha	Leader Count	Partition Distribution	Leader Distribution
192.168.8.129	9779	ONLINE	cfa65a1	0	No valid partition	No valid partition

请选择图空间

Partition 分布

服务	分片数
	没有数据
	No Data

分片信息

版本

服务	版本
Graph Service	3.1.0-ent
Storage Service	3.1.0-ent
Meta Service	3.1.0-ent

STORAGE LEADER

Leader Leader

- **Balance Leader** NebulaGraph Leader Leader Storage
- Leader

NebulaGraph

Storage

Host	
Port	
Status	
Git Info Sha	Commit ID
Leader Count	Leader
Partition Distribution	
Leader Distribution	Leader

PARTITION

Storage IP Storage

Partition ID	
Leader	leader IP
Peers	IP
Losts	IP

ID

Graph Storage

15.4.5

-
-
- Dashboard
-
-

:January 13, 2023

15.5

Dashboard NebulaGraph

15.5.1

Note

- Linux
- Byte 1 KB/s Bytes/s
- v1.0.2 Dashboard Buff Cache

CPU

cpu_utilization	CPU	
cpu_idle	CPU	
cpu_wait	IO	CPU
cpu_user	NebulaGraph	CPU
cpu_system	NebulaGraph	CPU

memory_utilization
memory_used
memory_free

load_1m	1
load_5m	5
load_15m	15

disk_used_percentage
 disk_used
 disk_free
 disk_readbytes
 disk_writebytes
 disk_readiops
 disk_writeiops
 inode_utilization inode

network_in_rate
 network_out_rate
 network_in_errs
 network_out_errs
 network_in_packets
 network_out_packets

15.5.2

5 60 600 3600 5 1 10 1

rate
 sum
 avg
 P75 75%
 P95 95%
 P99 99%
 P999 99.9%

Note

[Dashboard](#)

[Dashboard](#)

Graph

num_active_queries								
num_active_sessions								
	num_active_sessions.sum.5	5	10	30				-20
	10-30							
num_aggregate_executors	Aggregate							
num_auth_failed_sessions_bad_username_password								
num_auth_failed_sessions_out_of_max_allowed	FLAG_OUT_OF_MAX_ALLOWED_CONNECTIONS							
num_auth_failed_sessions								
num_indexscan_executors	IndexScan							
num_killed_queries								
num_opened_sessions								
num_queries								
num_query_errors_leader_changes	Leader							
num_query_errors								
num_reclaimed_expired_sessions								
num_rpc_sent_to_metad_failed	Graphd	Metad	RPC					
num_rpc_sent_to_metad	Graphd	Metad	RPC					
num_rpc_sent_to_storaged_failed	Graphd	Storaged	RPC					
num_rpc_sent_to_storaged	Graphd	Storaged	RPC					
num_sentences	Graphd							
num_slow_queries								
num_sort_executors	Sort							
optimizer_latency_us								
query_latency_us								
slow_query_latency_us								
num_queries_hit_memory_watermark								

Meta

commit_log_latency_us	Raft	Commit
commit_snapshot_latency_us	Raft	Commit
<hr/>		
heartbeat_latency_us		
<hr/>		
num_heartbeats	Raft	
num_raft_votes	Raft	
transfer_leader_latency_us	Raft	Leader
num_agent_heartbeats	AgentHBProcessor	
agent_heartbeat_latency_us	AgentHBProcessor	
replicate_log_latency_us	Raft	
num_send_snapshot	Raft	
append_log_latency_us	Raft	
append_wal_latency_us	Raft	WAL
num_grant_votes	Raft	
num_start_elect	Raft	

Storage

add_edges_atomic_latency_us	TOSS
add_edges_latency_us	
add_vertices_latency_us	
commit_log_latency_us	Raft Commit
commit_snapshot_latency_us	Raft Commit
delete_edges_latency_us	
delete_vertices_latency_us	
get_neighbors_latency_us	
get_dst_by_src_latency_us	
num_get_prop	GetPropProcessor
num_get_neighbors_errors	GetNeighborsProcessor
num_get_dst_by_src_errors	GetDstBySrcProcessor
get_prop_latency_us	GetPropProcessor
num_edges_deleted	
num_edges_inserted	
num_raft_votes	Raft
num_rpc_sent_to_metad_failed	Storage Metad RPC
num_rpc_sent_to_metad	Storage Metad RPC
num_tags_deleted	Tag
num_vertices_deleted	
num_vertices_inserted	
transfer_leader_latency_us	Raft Leader
lookup_latency_us	LookupProcessor
num_lookup_errors	LookupProcessor
num_scan_vertex	ScanVertexProcessor
num_scan_vertex_errors	ScanVertexProcessor
update_edge_latency_us	UpdateEdgeProcessor
num_update_vertex	UpdateVertexProcessor
num_update_vertex_errors	UpdateVertexProcessor
kv_get_latency_us	Getprocessor
kv_put_latency_us	PutProcessor
kv_remove_latency_us	RemoveProcessor
num_kv_get_errors	GetProcessor
num_kv_get	GetProcessor
num_kv_put_errors	PutProcessor

num_kv_put	PutProcessor
num_kv_remove_errors	RemoveProcessor
num_kv_remove	RemoveProcessor
forward_tranx_latency_us	
scan_edge_latency_us	ScanEdgeProcessor
num_scan_edge_errors	ScanEdgeProcessor
num_scan_edge	ScanEdgeProcessor
scan_vertex_latency_us	ScanVertexProcessor
num_add_edges	
num_add_edges_errors	
num_add_vertices	
num_start_elect	Raft
num_add_vertices_errors	
num_delete_vertices_errors	
append_log_latency_us	Raft
num_grant_votes	Raft
replicate_log_latency_us	Raft
num_delete_tags	Tag
num_delete_tags_errors	Tag
num_delete_edges	
num_delete_edges_errors	
num_send_snapshot	
update_vertex_latency_us	UpdateVertexProcessor
append_wal_latency_us	Raft WAL
num_update_edge	UpdateEdgeProcessor
delete_tags_latency_us	Tag
num_update_edge_errors	UpdateEdgeProcessor
num_get_neighbors	GetNeighborsProcessor
num_get_dst_by_src	GetDstBySrcProcessor
num_get_prop_errors	GetPropProcessor
num_delete_vertices	
num_lookup	LookupProcessor
num_sync_data	Storage Drainer
num_sync_data_errors	Storage Drainer
sync_data_latency_us	Storage Drainer

Note

num_active_queries				
num_queries				
num_sentences	Graphd			
optimizer_latency_us				
query_latency_us				
num_slow_queries				
num_query_errors				
num_query_errors_leader_changes	Leader			
num_killed_queries				
num_aggregate_executors	Aggregate			
num_sort_executors	Sort			
num_indexscan_executors	IndexScan			
num_auth_failed_sessions_bad_username_password				
num_auth_failed_sessions				
num_opened_sessions				
num_queries_hit_memory_watermark				
num_reclaimed_expired_sessions				
num_rpc_sent_to_metad_failed	Graphd	Metad	RPC	
num_rpc_sent_to_metad	Graphd	Metad	RPC	
num_rpc_sent_to_storaged_failed	Graphd	Storaged	RPC	
num_rpc_sent_to_storaged	Graphd	Storaged	RPC	
slow_query_latency_us				

:January 13, 2023

16. NebulaGraph Dashboard

16.1 NebulaGraph Dashboard

NebulaGraph Dashboard Dashboard NebulaGraph Dashboard
NebulaGraph Dashboard

The screenshot shows the NebulaGraph Dashboard interface. On the left is a dark sidebar with navigation links like 'Nebula Dashboard' (selected), '集群管理', '权限管理', '任务中心', '平台设置', '帮助中心', and 'nebula'. The main content area has several sections:

- 集群总览**: Shows '当前集群: explorer131' and a '集群总览' card with service counts (运行服务 1, 异常服务 0).
- 集群监控**: Includes '节点监控' (CPU usage chart) and '服务监控' (line charts for 'num_queries' and 'num_slow_queries').
- 告警**: Shows a message '没有数据'.
- 集群信息**: Displays cluster details: '集群名称: explorer131', '创建时间: 2022-06-30 11:53:00', '过期时间: 2023-06-28 23:59:59', '创建用户: nebula', and '版本: 企业版 v3.2.0'.
- 状态列表**: Shows a 'Graph 服务' status card with '运行服务 1' (green dot) and '异常服务 0'.

16.1.1

- NebulaGraph
-
- 14
-
- Storage Graph
-
- IP
- CPU
-
-

16.1.2

-
-

-
-

16.1.3

- 14 14
- 2.5.0 NebulaGraph
- Chrome Dashboard
-

 Note

prometheus

prometheus

16.1.4

NebulaGraph Dashboard

NebulaGraph	Dashboard
3.3.0	3.2.4 3.2.3 3.2.2 3.2.1 3.2.0
2.5.0 ~ 3.2.0	3.1.2 3.1.1 3.1.0
2.5.x ~ 3.1.0	3.0.4
2.5.1 ~ 3.0.0	1.1.0
2.0.1 ~ 2.6.1	1.0.2
2.0.1 ~ 2.6.1	1.0.1
2.0.1 ~ 2.6.1	1.0.0

16.1.5

- NebulaGraph Dashboard Demo v3.0 2 57

: January 13, 2023

16.2 NebulaGraph Dashboard License

License Dashboard	NebulaGraph Dashboard License	License	NebulaGraph Dashboard	NebulaGraph
----------------------	----------------------------------	---------	-----------------------	-------------

16.2.1

- License NebulaGraph Dashboard
- License License
- License
- License 14
- 30
- 14
- 14

16.2.2

NebulaGraph Dashboard License



NebulaGraph Dashboard 30 License

16.2.3 NebulaGraph Dashboard License

NebulaGraph Dashboard License nebula.license

```
-----License Content Start-----
{
  "vendor": "vesoft",
  "organization": "doc",
  "issuedate": "2022-06-06T16:00:00.000Z",
  "expirationDate": "2023-05-31T15:59:59.000Z",
  "product": "nebula_graph_dashboard",
  "version": ">=3.2.0",
  "licenseType": "enterprise",
  "gracePeriod": 14,
  "clusterCode": "BAIAEAiAQAAG"
}
-----License Content End-----

-----License Key Start-----
Rrjip5cxXXXXXXXXXXXX5zKoQ==
-----License Key End-----
```

License

vendor			
organization			
issuedDate	License		
expirationDate	License		
product	NebulaGraph Dashboard	nebula_graph_dashboard	
version			
licenseType	License	enterprise samll_bussiness pro individual	
gracePeriod		License	0
clusterCode		License	

16.2.4

NebulaGraph Dashboard License **Dashboard**

16.2.5

NebulaGraph Dashboard License

1. NebulaGraph Dashboard License nebula.license
2. NebulaGraph Dashboard /usr/local/nebula-dashboard-ent License License

Note

NebulaGraph Dashboard License Dashboard License

:January 13, 2023

16.3 Dashboard

Dashboard

16.3.1

Dashboard

- Dashboard Dashboard NebulaGraph
- Dashboard SQLite MySQL Dashboard MySQL 5.7 MySQL dashboard utf8

 Note

SQLite Dashboard SQLite

•

7005	Dashboard	web
------	-----------	-----

9090	Prometheus
------	------------

9200	nebula-stats-exporter
------	-----------------------

9093	Alertmanager	Prometheus	Dashboard
------	--------------	------------	-----------

9100	node-exporter	CPU
------	---------------	-----

- License

 Enterpriseonly

License License **NebulaGraph Dashboard**

16.3.2 TAR

1. TAR

 Enterpriseonly

Dashboard

2. tar -xzvf TAR

```
$ tar -xzvf nebula-dashboard-ent-<version>.linux-amd64.tar.gz -C <install_path>
```

```
$ tar -xzvf nebula-dashboard-ent-3.2.4.linux-amd64.tar.gz -C /usr/local/
```

3. vim /usr/local/nebula-dashboard-ent/etc/config.yaml

```

Name: dashboard-api
Host: 0.0.0.0 # Dashboard
Port: 7005 # Dashboard
MaxBytes: 1073741824 # Http ContentLength 1048576 0 ~ 8388608
Timeout: 15000 #
Debug: # Debug
Enable: false
Log: # Dashboard
KeepDays: 7 #
Mode: console #
Database:
  Dialect: sqlite # SQLite MySQL SQLite
  AutoMigrate: true # true
  Host: 127.0.0.1 # MySQL IP
  Port: 3306 # MySQL
  Username: root # MySQL
  Password: nebula # MySQL
  Name: dashboard #

# exporter
Exporter:
  NodePort: 9100 # node-exporter
  NebulaPort: 9200 # nebula-stats-exporter

#
Proxy:
  PrometheusAddr: 127.0.0.1:9090 # prometheus IP
  AlertmanagerAddr: 127.0.0.1:9093 # alertmanager IP

# LDAP
Mail:
  Host: smtp.office365.com # SMTP
  Port: 587 # SMTP
  Username: "" # SMTP
  Password: "" # SMTP

#
System:
  WebAddress: http://127.0.0.1:7005 # Dashboard Dashboard
  MessageStore: 90 # 90

# LDAP
LDAP:
  Server: ldap://127.0.0.1 # LDAP
  BindDN: cn=admin,dc=vesoft,dc=com # LDAP
  BindPassword: "" # LDAP
  BaseDN: dc=vesoft,dc=com #
  UserFilter: "&(objectClass=*)" #
  EmailKey: mail # LDAP

```

4. License nebula-dashboard-ent

```
$ cp -r <license> <dashboard_path>
```

```
$ cp -r nebula.license /usr/local/nebula-dashboard-ent
```

5. Dashboard

Dashboard

```
$ cd /usr/local/nebula-dashboard-ent/scripts
$ sudo ./dashboard.service start all
```

```
Prometheus nebula-dashboard-server nebula-stats-exporter Alertmanager Dashboard
```

```
$ cd scripts
$ sudo ./dashboard.service start prometheus # Prometheus
$ sudo ./dashboard.service start webserver # nebula-dashboard-server
$ sudo ./dashboard.service start exporter # nebula-stats-exporter
$ sudo ./dashboard.service start alertmanager # Alertmanager
```



Dashboard

scripts

dashboard.service restart all

Dashboard

Dashboard

Dashboard dashboard.service

```
$ sudo <dashboard_path>/dashboard/scripts/dashboard.service
[-v] [-h]
<start|stop|status> <prometheus|webserver|exporter|gateway|all>
```

dashboard_path	Dashboard
-v	
-h	
start	
stop	
status	
prometheus	prometheus
webserver	webserver
exporter	exporter
gateway	gateway
all	

Dashboard

```
$ sudo /dashboard/scripts/dashboard.service start all # Dashboard
$ sudo /dashboard/scripts/dashboard.service stop all # Dashboard
$ sudo /dashboard/scripts/dashboard.service status all # Dashboard
$ sudo /dashboard/scripts/dashboard.service restart all # Dashboard
```

16.3.3 RPM

1. RPM

 **Enterpriseonly**

Dashboard

2. sudo rpm -ivh <package_name> RPM

Dashboard /usr/local/nebula-dashboard-ent

```
sudo rpm -ivh nebula-dashboard-ent-<version>.x86_64.rpm
```

```
sudo rpm -ivh nebula-dashboard-ent-xxx.rpm --prefix=<path>
```

3. License nebula-dashboard-ent

```
$ cp -r <license> <dashboard_path>
```

```
$ cp -r nebula.license /usr/local/nebula-dashboard-ent
```

4.

```
sudo systemctl list-dependencies nebula-dashboard.target #
sudo systemctl start nebula-dashboard.target #
```

```
sudo systemctl {status|stop|start} {nbd-prometheus.service|nbd-alert-manager.service|nbd-stats-exporter.service|nbd-webserver.service}
```

5. LDAP vim /usr/local/nebula-dashboard-ent/etc/config.yaml

```
# LDAP
mail:
  host: smtp.office365.com # SMTP
  port: 587 # SMTP
  username: "" # SMTP
  password: "" # SMTP
#
system:
  webAddress: http://127.0.0.1:7005 # Dashboard
  messageStore: 90 # 90
# LDAP
ldap:
  server: ldap://127.0.0.1 # LDAP
  bindDN: cn=admin,dc=vesoft,dc=com # LDAP
  bindPassword: "" # LDAP
  baseDN: dc=vesoft,dc=com #
  userFilter: "&(objectClass=*)" #
  emailKey: mail # LDAP
```

/var/log/messages Dashboard

```
sudo cat /var/log/messages
```

Dashboard

```
journalctl -u {nbd-prometheus.service|nbd-alert-manager.service|nbd-stats-exporter.service|nbd-webserver.service} -b
```

Prometheus

```
journalctl -u nbd-prometheus.service -b
```

RPM Dashboard

```
sudo rpm -e <package_name>
```

16.3.4 DEB

1. DEB

 Enterpriseonly

Dashboard

2. sudo dpkg -i <package_name> DEB

Dashboard /usr/local/nebula-dashboard-ent

```
sudo dpkg -i nebula-dashboard-ent-3.2.4.ubuntu1804.amd64.deb
```



DEB Dashboard

3. License nebula-dashboard-ent

```
$ cp -r <license> <dashboard_path>
```

```
$ cp -r nebula.license /usr/local/nebula-dashboard-ent
```

4.

```
sudo systemctl list-dependencies nebula-dashboard.target #
sudo systemctl start nebula-dashboard.target #
```

```
sudo {systemctl status|stop|start} {nbd-prometheus.service|nbd-alert-manager.service|nbd-stats-exporter.service|nbd-webserver.service}
```

5. LDAP OAuth2.0

vim /usr/local/nebula-dashboard-ent/etc/config.yaml

```
# LDAP OAuth2.0
mail:
  host: smtp.office365.com # SMTP
  port: 587 # SMTP
  username: "" # SMTP
  password: "" # SMTP
#
system:
  webAddress: http://127.0.0.1:7005 # Dashboard
  messageStore: 90 # 90
```

/var/log/syslog Dashboard

```
sudo cat /var/log/syslog
```

Dashboard

```
journalctl -u {nbd-prometheus.service|nbd-alert-manager.service|nbd-stats-exporter.service|nbd-webserver.service} -b
```

Prometheus

```
journalctl -u nbd-prometheus.service -b
```

DEB Dashboard

```
sudo dpkg -r <package_name>
```

:January 13, 2023

16.4 Dashboard

Dashboard

Dashboard

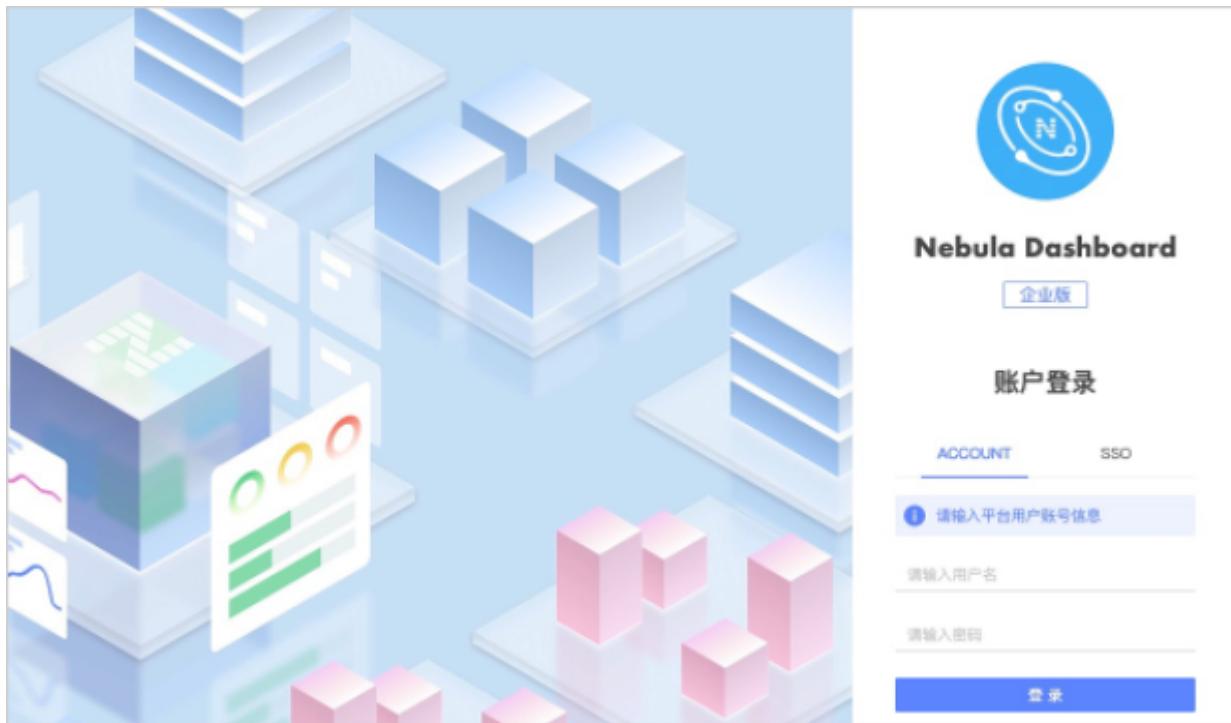
16.4.1

- Dashboard [Dashboard](#)
- Chrome 89 [Chrome](#)

16.4.2

1. Dashboard IP http://<ip_address>:7005

Dashboard



NebulaGraph Dashboard

2. nebula nebula Dashboard



Dashboard LDAP OAuth2.0

Dashboard

: January 13, 2023

16.5

16.5.1

Dashboard

1. Dashboard
- 2.

3.
• 15
• NebulaGraph

 **Note**

[Dashboard](#) [NebulaGraph](#) [NebulaGraph](#)

•

 **Note**

[NebulaGraph](#) [License](#)

- Host SSH SSH

- SSH SSH

- SSH Dashboard passphrase

添加节点

* Host ?: 192.168.8.129

* SSH 端口号 ?: 22

* SSH 用户 ?: vesoft

* 认证方式: SSH密码 SSH密钥

* SSH 密码: *****

* 安装包: nebula-graph-ent-3.1.2.el7.x86_64.rpm ▾

安装路径 ?: .nebula/cluster

节点名: node1

[取消](#) [确认](#)

CSV

4. 3 NebulaGraph

节点: 已添加1个节点

操作		服务类型						自动添加服务				添加 Meta			添加 Graph			添加Storage		
1	节点名称	节点Host	CPU(核)	内存(GB)	磁盘(GB)	安装包														
<input checked="" type="checkbox"/>	Node_1	192.168.8.129	4	8.01	52.43	nebula-graph-ent-3.1.0-ent.el7.x86_64.rpm	没有服务, 请添加服务						编辑	删除						

5. Meta Graph Storage HTTP

6.

7. installing 3-10 healthy unhealthy

:January 13, 2023

16.5.2

[Dashboard](#)

[DEB](#) [RPM](#)

[Dashboard](#)

[Docker](#) [Kubernetes](#)

Caution

NebulaGraph

1. <meta|graph|storage>_server_addrs local_ip IP IP

- 2.
3. NebulaGraph
 - Graphd Host < Graphd IP>:< IP>: 192.168.8.157:9669
 - NebulaGraph vesoft
 - NebulaGraph nebula

Note

NebulaGraph root NebulaGraph NebulaGraph NebulaGraph NebulaGraph

- 4.
- 15 create_1027
- SSH sudo

Notice

- SSH NebulaGraph sudo **sudo**
- CSV CSV
 -

集群名称:

节点: 已添加5个 未授权4个 已授权1个 **批量授权**

节点Host	CPU(核)	内存(GB)	磁盘(GB)	服务类型	状态	操作
192.168.8.154				Storage	Metad	授权
192.168.8.155				Storage	Metad	授权
192.168.8.157	16	32.79	92.27	Storage	Metad	已授权
192.168.8.158				Storage		授权
127.0.0.1				Graphd		授权

5.

:January 13, 2023

16.6

16.6.1

Dashboard

Dashboard

Dashboard

-
-
-
-
-
-

Graphd Storaged Metad

emergency > critical > warning 5

- NebulaGraph
- NebulaGraph
- NebulaGraph License

 **Enterpriseonly**

NebulaGraph

- NebulaGraph Dashboard
- NebulaGraph



- CPU





- `query_latency_us` `slow_query_latency_us`



:January 13, 2023

16.6.2

Dashboard

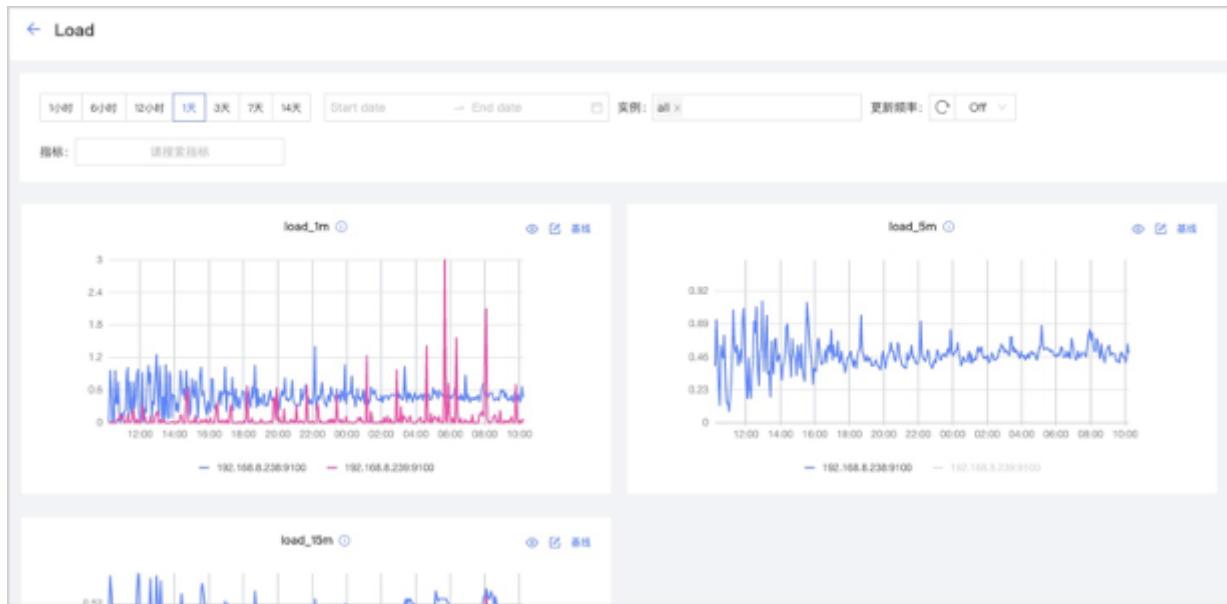
Dashboard

-> ->

CPU Memory Load Disk Network In/Out

- 14 1 6 12 1 3 7 14
-
-
- 
- 
- 

Load



-
-
-
- 

-> ->

Graph Meta Storage

Note

- 14 1 6 12 1 3 7 14



Graph



-
-
-
-



- Graph

Caution

Graph enable_space_level_metrics true



Graph

Dashboard

查询条件 X

周期: ▼

指标: ▼ i

图空间: ▼

聚合方式: ▼

基线:

取消 确认

Dashboard

->



1. Note

2.

3. CPU

4. emergency>critical>warning

5

4 Graph

1. num_active_sessions
2. num_slow_queries
3. num_active_queries
4. num_query_errors

1. QPS (Query Per Second)

2. Storage add_edges_latency_us add_vertices_latency_us

1. cpu_utilization
2. memory_utilization
3. load_1m
4. disk_readbytes
5. disk_writebytes

Note

- 100 13
 - $100 \geq 80 \geq 60 \geq 60$
 - $(1 - /) * 100\%$
 - emergency 40 emergency 10
-

: January 13, 2023

16.6.3

NebulaGraph

Dashboard

告警信息	告警名称	严重级别	指标类型	Target	触发时间	状态	更新状态
eteadfad	eteadfad	emergency	node	192.168.8.243:9100	2022-02-09 11:12:26	Unsolved	<button>去处理</button> <button>已解决</button>

- >
- 2

- 1 6 12 1 3 7 14
- unsolved

nebula-dashboard-ent/config/config.yaml messageStore NebulaGraph Dashboard 90
[Dashboard](#)

Dashboard

1. Dashboard

2. ->

3.

4.

a.

253

emergency critical warning

Min

b.

graphd storaged metad

AND

Min

c.

d.



-
-
-

active **disable**



Dashboard

active **disable**



Webhook Webhook Webhook

1. Dashboard
 2. ->
 3.
 - **Mail**
 - **Webhook**, Webhook Webhook
-

: January 13, 2023

16.6.4

NebulaGraph Storage Storage Leader NebulaGraph

1. Dashboard

2.

3. ->



Graph NebulaGraph Dashboard

集群管理 / 信息总览
← 信息总览

Storage Leader 分布

服务	Leader 数量	Leader 分布
192.168.8.129	0	No valid partition

服务信息

Host	Port	Status	Git Info Sha	Leader Count	Partition Distribution	Leader Distribution
192.168.8.129	9779	ONLINE	cfa5a1	0	No valid partition	No valid partition

Partition 分布

服务	分片数
没有数据	No Data

版本

- Graph Service**: 服务 192.168.8.129:9669, 版本 3.1.0-ent
- Storage Service**: 服务 192.168.8.129:9779, 版本 3.1.0-ent
- Meta Service**: 服务 192.168.8.129:9559, 版本 3.1.0-ent

分区信息

STORAGE LEADER

Leader	Leader			
• Balance Leader	NebulaGraph	Leader	Leader	Storage
•	Leader			

NebulaGraph

Storage

Host			
Port			
Status			
Git Info Sha	Commit ID		
Leader Count	Leader		
Partition Distribution			
Leader Distribution	Leader		

PARTITION

•	Storage	IP	Storage		
• Balance Data					
• Balance Data Remove	Storage		Storage	Storage	IP

Partition ID			
Leader	leader	IP	
Peers		IP	
Losses		IP	

ID

: January 13, 2023

-
- Session
-

1. Dashboard

2.

3. ->

1.

1 6 12 1 3 7 14



2.

[集群管理 / 集群诊断](#)

[← 集群诊断](#)

创建诊断报告:

2022-04-10 11:42	→	2022-04-11 11:42	自定义	<input type="button" value="1小时"/>	<input type="button" value="6小时"/>	<input type="button" value="12小时"/>	<input checked="" type="button" value="1天"/>	<input type="button" value="3天"/>	<input type="button" value="7天"/>	<input type="button" value="14天"/>	<input type="button" value="开始诊断"/>
------------------	---	------------------	-----	------------------------------------	------------------------------------	-------------------------------------	--	-----------------------------------	-----------------------------------	------------------------------------	-------------------------------------

报告ID	诊断时间	诊断区间	状态	操作
2	2022-04-11 11:42:13	2022-04-10 10:05:44-2022-04-11 10:05:44	success	详情

3. generating success

PDF

-
-
-
- Network
- Session
-
-

num_queries_hit_memory_watermark	nGQL
graphd_down	Graph
storaged_down	Storage
metad_down	Meta
node-exporter down	

基本信息

诊断区间

START_TIME	END_TIME
2022-03-30 03:12:29	2022-03-30 03:12:29

节点信息

HOST	INSTANCE	CPU (Core)	MEMORY (GB)	DISK (GB)
192.168.8.129	metad*1 graphd*1 storaged*1	4	8.01	52.43

服务信息

NAME	TYPE	HOST	PORT	HTTP_PORT	STATUS
192.168.8.129-metad	metad	192.168.8.129	9559	19559	running
192.168.8.129-graphd	graphd	192.168.8.129	9669	19669	running
192.168.8.129-storaged	storaged	192.168.8.129	9779	19779	running

Leader分布

Storage Service	Number of Leaders	Leader Distribution
192.168.8.129:9779	0	

-

- CPU

HOST	IP
INSTANCE	metad*1 graphd*1 storaged*1
CPU	CPU Core
MEMORY	GB
DISK	GB

- NebulaGraph IP HTTP

- **Leader** Storage Leader

Storage Service	Storage	
Number of Leaders	Storage	Leader
Leader Distribution	Storage	Leader

负载

CPU使用率

Node	Avg	Max	Min
192.168.8.129:9100	0.30%	0.30%	0.30%

内存使用率

Node	Avg	Max	Min
192.168.8.129:9100	11.62%	11.62%	11.62%

磁盘使用率

Disk	Avg	Max	Min
▼ 192.168.8.129:9100	67.56%	67.56%	67.56%
-- /dev/sda1	67.56%	67.56%	67.56%

AVG MAX MIN

- %
- **CPU** CPU %
- %

Network

Network

NetworkOut

Node	Avg (Bytes/s)	Max (Bytes/s)	Min (Bytes/s)
▼ 192.168.8.129:9100	11882.18	11882.18	11882.18
-- eth0	11882.18	11882.18	11882.18

NetworkIn

Node	Avg (Bytes/s)	Max (Bytes/s)	Min (Bytes/s)
▼ 192.168.8.129:9100	8208.09	8208.09	8208.09
-- eth0	8208.09	8208.09	8208.09

AVG MAX MIN

- **NetworkOut** Bytes/s
- **NetworkIn** Bytes/s

Session**Session**

Sessions	Total
num_opened_sessions	
num_auth_failed_sessions	
num_active_sessions	
num_reclaimed_expired_sessions	

[Graph](#) [Session](#)[num_opened_sessions](#)[num_auth_failed_sessions](#)[num_active_sessions](#)[num_reclaimed_expired_sessions](#)

• Graph

Graph

该表显示的是 Graph 服务稳定性相关指标。TOTAL为总数，ERROR为发生错误的个数，P75周期内响应耗时从小到大排列，顺序处于 75% 位置的分位数值。P95周期内响应耗时从小到大排列，顺序处于 95% 位置的分位数值。P99周期内响应耗时从小到大排列，顺序处于 99% 位置的分位数值。P999周期内响应耗时从小到大排列，顺序处于 99.9% 位置的分位数值。

METRIC_NAME	TOTAL	ERROR	P75	P95	P99	P999
slow_queries	0		-2147.483648s	-2147.483648s	-2147.483648s	-2147.483648s
num_killed_queries	0					
num_queries_hit_memory_watermark	0					
num_rpc_sent_to_metad	0	0				
query	0	0	-2147.483648s	-2147.483648s	-2147.483648s	-2147.483648s

METRIC_NAME	query			
	slow_queries			
	num_killed_queries			
	num_queries_hit_memory_watermark	nGQL		
	num_rpc_sent_to_metad	Graphd	Metad	RPC

• Meta

Meta

该表显示的是 Meta 服务稳定性相关指标。TOTAL为总数，ERROR为发生错误的个数，P75周期内响应耗时从小到大排列，顺序处于 75% 位置的分位数值。P95周期内响应耗时从小到大排列，顺序处于 95% 位置的分位数值。P99周期内响应耗时从小到大排列，顺序处于 99% 位置的分位数值。P999周期内响应耗时从小到大排列，顺序处于 99.9% 位置的分位数值。

METRIC_NAME	TOTAL	P75	P95	P99
heartbeat	0	-2147.483648s	-2147.483648s	-2147.483648s

METRIC_NAME	heartbeat
-------------	-----------

• Storage

Storage

该表显示的是 Storage 服务 稳定性相关指标。TOTAL为总数，ERROR为发生错误的个数，P75周期内响应耗时从小到大排列，顺序处于 75% 位置的分位数值。P95周期内响应耗时从小到大排列，顺序处于 95% 位置的分位数值。P99周期内响应耗时从小到大排列，顺序处于 99% 位置的分位数值。P999周期内响应耗时从小到大排列，顺序处于 99.9% 位置的分位数值。

METRIC_NAME	TOTAL	ERROR	P75	P95	P99
delete_edges	0	0	-2147.483648s	-2147.483648s	-2147.483648s
delete_tags	0	0	-2147.483648s	-2147.483648s	-2147.483648s
num_rpc_sent_to_metad	0	0			
delete_vertices	0	0	-2147.483648s	-2147.483648s	-2147.483648s

METRIC_NAME	delete_vertices			
	delete_edges			
	delete_tags	Tag		
	num_rpc_sent_to_metad	Storaged	Metad	RPC

TOTAL		
<hr/>		
ERROR		
P75	P75	75%
P95	P95	95%
P99	P99	99%
P999	P999	99.9%

Graph Meta Storage

: January 13, 2023

16.6.5

Host SSH CPU

1. Dashboard
 - 2.
 3. ->

Host SSH SSH



Balance Data Balance Leader



- 10

: January 13, 2023

Host / /

1. Dashboard

2.

3. ->

 Danger

/

•



: January 13, 2023

Storage Graph

1. Dashboard
- 2.
3. ->

-
-



- Storage/Graph
- Storage Graph

: January 13, 2023

owner owner operator

1. Dashboard

2.

3. ->

•

 Note

Dashboard

•



• owner owner

: January 13, 2023

[Dashboard](#)[NebulaGraph](#)**Caution**

-
-
-

**Note**

- **3.0.0** NebulaGraph **3.2.1** **3.3.0**
-
- License
-

1. Dashboard
- 2.
3. ->
4. **NebulaGraph**

**Note**

1.

2. **NebulaGraph** **NebulaGraph**
version update

:January 13, 2023

NebulaGraph Dashboard**NebulaGraph**

UI

NebulaGraph Backup & Restore BR
NebulaGraph Dashboard NebulaGraph

NebulaGraph Dashboard

BR

- S3 OSS MinIO Ceph RGW

**Note**

-
-
-
-
-

- **Dashboard** **NebulaGraph**
- S3

1. NebulaGraph Dashboard
- 2.
3. ->

- 1.
2. **S3**
- 3.

s3.access_key	Access Key ID	AKIAI44QH8DHBxxxx
s3.endpoint	URL	https://s3.us-east-2.amazonaws.com {bucket_name}.s3.us-west-2.amazonaws.com
s3.region	us-east-1	
s3.secret_key	Access Key Secret	je7MtGbClwBF/2Zp9Utk/h3yCoxxxx
storage path	s3	s3://br-test/backup/

OSS Amazon S3

- Amazon S3

* s3.access_key:	LTAI5tEwhrcm[REDACTED]
* s3.endpoint:	https://s3.us-west-2.amazonaws.com/
* s3.region:	us-west-2
* s3.secret_key:	MfjNFKNf56Y[REDACTED]
* storage path:	s3://nebula-br-test/

- OSS

* s3.access_key:	LTAI5tK[REDACTED]
* s3.endpoint:	https://oss-cn-hangzhou.aliyuncs.com
* s3.region:	oss-cn-hangzhou
* s3.secret_key:	7dl9l9ll[REDACTED]
* storage path:	s3://nebula-br-test/

Caution

OSS oss s3 oss://nebula-br-test/ s3://nebula-br-test/

4.
5.

- NebulaGraph
-
- QPS 0 QPS 0



NebulaGraph

6.

备份列表		恢复列表				S3配置	创建备份		
<input type="text"/> 请输入备份名称		SUCCESS ▾ 1小时 6小时 1天 30天		2022-05-28 14:07 → 2022-06-27 14:07					
备份名称	备份时间	状态	备份图空间	备份方式	存储路径	操作			
BACKUP_2022_06_24_09_48_46	2022-06-24 17:48:46	success	nba	s3	s3://nebula-br-test/	<button>恢复</button>	<button>恢复历史</button>	<button>查看日志</button>	<button>删除</button>
BACKUP_2022_06_24_03_18_31	2022-06-24 11:18:31	success	nba	s3	s3://nebula-br-test/	<button>恢复</button>	<button>恢复历史</button>	<button>查看日志</button>	<button>删除</button>

- 30
- running success failed
-
-



7.

s3://nebula-br-test

- Amazon S3:

Amazon S3 > Buckets > nebula-br-test

nebula-br-test Info

Objects (46)

Objects are the fundamental entities stored in Amazon S3. You can use [Amazon S3 inventory](#) to get a list of all objects in your bucket. For others to access your objects, you'll need to explicitly grant them permissions. [Learn more](#)

[Copy S3 URI](#) [Copy URL](#) [Download](#) [Open](#) [Delete](#) [Actions](#) [Create folder](#) [Upload](#)

BACKUP_2022_06_20_03_ × 3 matches

Name	Type	Last modified	Size	Storage class
meta/	Folder	-	-	-
data/	Folder	-	-	-
BACKUP_2022_06_20_03_16_11.meta	meta	June 20, 2022, 11:17:23 (UTC+08:00)	3.2 KB	Standard

- OSS:

oss://nebula-br-test/

上传 创建目录 全选 下载 复制 更多 ▾

按名称前缀过滤 1 ? 区域: oss-chn-hangzhou

名称	类型 / 大小	最后修改时间	操作
BACKUP_2022_06_21_14_35_58	目录		下载 删除

 **Danger**

 **Caution**

- 1.
- 2.
- 3.

- NebulaGraph

-
-

- 4.

备份列表		恢复列表						S3配置
恢复记录ID		备份名称	状态	恢复时间	恢复的图空间	存储路径	操作人	操作
31		BACKUP_2022_06_24_03_18_31	success	2022-06-27 14:23:13	nba	s3://nebula-br-test/	nebula	查看日志
16		BACKUP_2022_06_20_06_05_00	success	2022-06-27 14:23:13	nba	s3://nebula-br-test/	nebula	查看日志

-
- 30
- ID
- `running success failed`

 **Note**

:January 13, 2023

16.6.6

Dashboard

Dashboard

1 6 12 1 3 7 14

: January 13, 2023

16.6.7

Dashboard

Dashboard

•

• NebulaGraph

 Note

•

NebulaGraph

 Note

: January 13, 2023

16.7

NebulaGraph Dashboard

 Note

LDAP OAuth2.0

16.7.1

Dashboard

nebula nebula

Dashboard

LDAP OAuth2.0

LDAP

Dashboard

LDAP Lightweight Directory Access Protocol

Dashboard

OAuth2.0

Dashboard

OAuth2.0 access_token

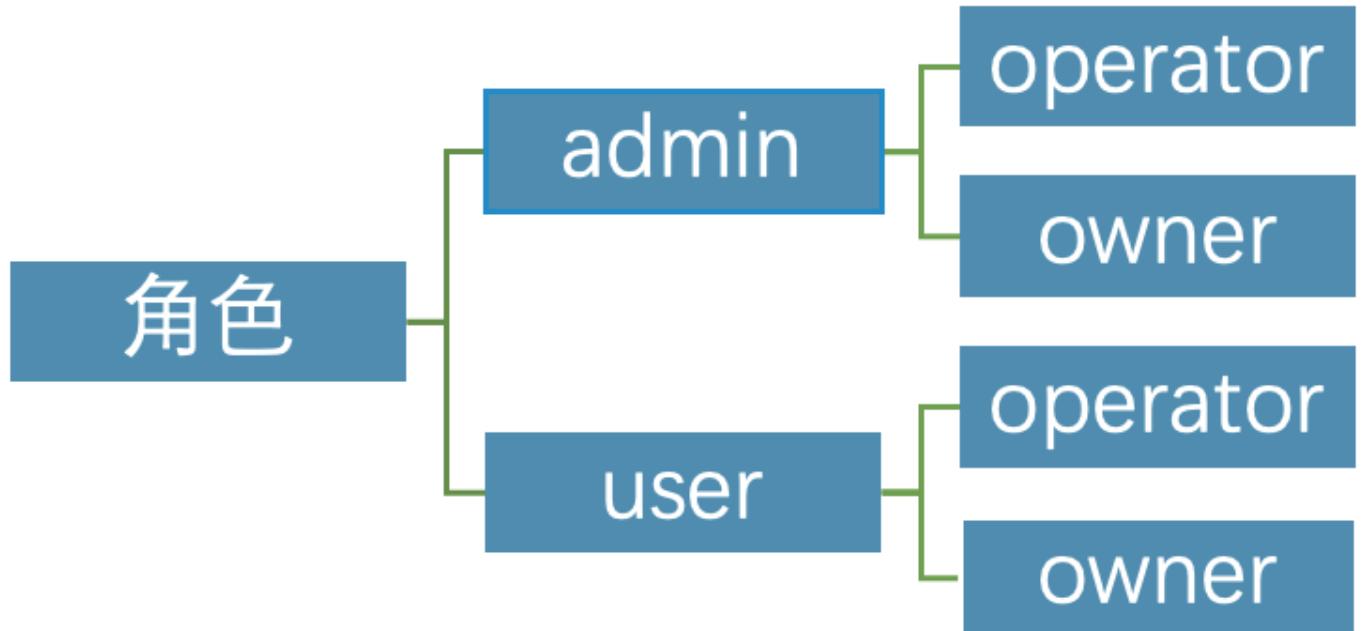
Dashboard

16.7.2

Dashboard

admin user

owner operator



admin	1.	1.	admin
	2.	2.	admin operator
	3.	3.	admin user operator
	4.	4.	owner admin admin user
			admin
user	1.	1.	
	2. admin user	2.	user
	3. owner		
operator	1.	1.	
	2.	2.	operator
	3.		
	4.		
owner	1. operator	1.	
	2.	2.	owner
	3. operator		
	4. owner		

16.7.3

- admin
1. Dashboard
 - 2.
 - LDAP OAuth2.0 **Accept** Dashboard
 - Dashboard
 -

16.7.4

-
- **ldap oauth2.0 platform platform**
- **admin user**
- owner
-

16.7.5

- 
 - 
-

:January 13, 2023

16.8

NebulaGraph Dashboard

NebulaGraph Dashboard

16.8.1

- ID
-

16.8.2

-
-

16.8.3

: January 13, 2023

16.9

16.9.1

Logo

1. Dashboard

2.

Logo

:January 13, 2023

16.9.2

Webhook

1. Dashboard

2.

Dashboard

•

SMTP	SMTP
	SMTP
Use SSL	SSL
SMTP	SMTP
SMTP	SMTP

•

Dashboard

WEBHOOK

Dashboard Webhook

->**Webhook**

Webhook URL

Webhook

: January 13, 2023

16.9.3

NebulaGraph Dashboard

LDAP

OAuth2.0

Dashboard

LDAP

OAuth2.0

Note

-
- LDAP OAuth2.0

LDAP

1. Dashboard

2. ->**LDAP**

LDAP Server Address	ldap://192.168.10.100	LDAP
Bind DN	cn=admin,dc=vesoft,dc=com	LDAP
Password	123456	LDAP
Base DN	dc=vesoft,dc=com	
User Filter	&(objectClass=*)	
Email Key	mail	LDAP

OAuth2.0

1. Dashboard

2. ->**OAuth2.0**

ClientId	4953xxx- mmnoge13xx.apps.googleusercontent.com	ClientId
ClientSecret	GOCxxx-xaytomFexxx	ClientSecret
RedirectURL	http://dashboard.vesoft-inc.com/login	Dashboard URL
AuthURL	https://accounts.google.com/o/oauth2/auth	URL
TokenURL	https://oauth2.googleapis.com/token	access_token URL
UserInfoURL	https://www.googleapis.com/oauth2/v1/ userinfo	URL
Username Key	email	
Organization	vesoft company	
OAuth	email	OAuth scope
		OAuth2.0 scope
		Username Key

:January 13, 2023

16.9.4

NebulaGraph Dashboard

NebulaGraph

- admin
-

1. Dashboard

2.

平台设置 /

← 安装包管理

操作	创建时间	大小	版本	安装包名称
<button>删除</button>	2022-06-07 10:36:25	64.40MB	社区版-v2.6.2	nebula-graph-2.6.2.el7.x86_64.rpm
<button>删除</button>	2022-06-07 10:36:26	83.57MB	社区版-v2.6.2	nebula-graph-2.6.2.ubuntu1804.amd64.deb
<button>删除</button>	2022-03-29 10:18:03	69.58MB	社区版-v3.0.2	nebula-graph-3.0.2.el7.x86_64.rpm
<button>删除</button>	2022-06-07 11:03:04	70.53MB	社区版-v3.1.0	nebula-graph-3.1.0.el7.x86_64.rpm
<button>删除</button>	2022-06-07 10:36:29	92.60MB	社区版-v3.1.0	nebula-graph-3.1.0.ubuntu1804.amd64.deb

1.



- v2.5
- CentOS 7/8 Ubuntu 1604/1804/2004
- RPM DEB tar.gz

2.

package download success

RPM DEB tar.gz

package upload success

REQUEST ENTITY TOO LARGE

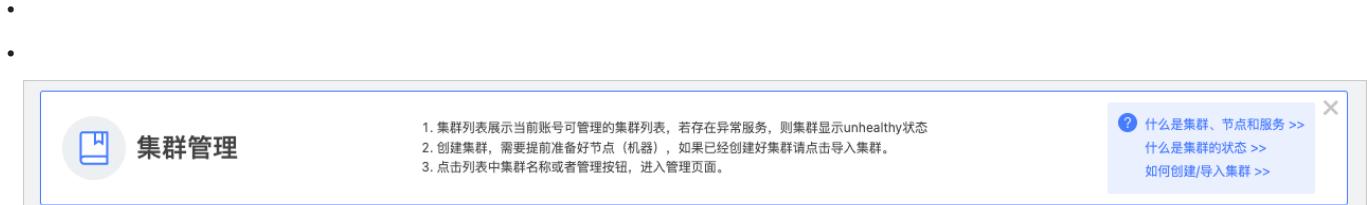
Nginx 1 MB nginx.conf http{} client_max_body_size 200m; 200 MB

: January 13, 2023

16.9.5

1. Dashboard

2.



: January 13, 2023

16.10

Dashboard NebulaGraph

16.10.1



- Linux
- Byte 1 KB/s Bytes/s
- Dashboard Buff Cache

CPU

cpu_utilization	CPU
cpu_idle	CPU
cpu_wait	IO CPU
cpu_user	NebulaGraph CPU
cpu_system	NebulaGraph CPU

memory_utilization
memory_used
memory_free

load_1m	1
load_5m	5
load_15m	15

disk_used_percentage
 disk_used
 disk_free
 disk_readbytes
 disk_writebytes
 disk_readiops
 disk_writeiops
 inode_utilization inode

network_in_rate
 network_out_rate
 network_in_errs
 network_out_errs
 network_in_packets
 network_out_packets

16.10.2

5 60 600 3600 5 1 10 1

rate
 sum
 avg
 P75 75%
 P95 95%
 P99 99%
 P999 99.9%

Note

[Dashboard](#)

[Dashboard](#)

Graph

num_active_queries								
num_active_sessions								
	num_active_sessions.sum.5	5	10	30				-20
	10-30							
num_aggregate_executors	Aggregate							
num_auth_failed_sessions_bad_username_password								
num_auth_failed_sessions_out_of_max_allowed	FLAG_OUT_OF_MAX_ALLOWED_CONNECTIONS							
num_auth_failed_sessions								
num_indexscan_executors	IndexScan							
num_killed_queries								
num_opened_sessions								
num_queries								
num_query_errors_leader_changes	Leader							
num_query_errors								
num_reclaimed_expired_sessions								
num_rpc_sent_to_metad_failed	Graphd	Metad	RPC					
num_rpc_sent_to_metad	Graphd	Metad	RPC					
num_rpc_sent_to_storaged_failed	Graphd	Storaged	RPC					
num_rpc_sent_to_storaged	Graphd	Storaged	RPC					
num_sentences	Graphd							
num_slow_queries								
num_sort_executors	Sort							
optimizer_latency_us								
query_latency_us								
slow_query_latency_us								
num_queries_hit_memory_watermark								

Meta

commit_log_latency_us	Raft	Commit
commit_snapshot_latency_us	Raft	Commit
<hr/>		
heartbeat_latency_us		
<hr/>		
num_heartbeats	Raft	
num_raft_votes	Raft	
transfer_leader_latency_us	Raft	Leader
num_agent_heartbeats	AgentHBProcessor	
agent_heartbeat_latency_us	AgentHBProcessor	
replicate_log_latency_us	Raft	
num_send_snapshot	Raft	
append_log_latency_us	Raft	
append_wal_latency_us	Raft	WAL
num_grant_votes	Raft	
num_start_elect	Raft	

Storage

add_edges_atomic_latency_us	TOSS
add_edges_latency_us	
add_vertices_latency_us	
commit_log_latency_us	Raft Commit
commit_snapshot_latency_us	Raft Commit
delete_edges_latency_us	
delete_vertices_latency_us	
get_neighbors_latency_us	
get_dst_by_src_latency_us	
num_get_prop	GetPropProcessor
num_get_neighbors_errors	GetNeighborsProcessor
num_get_dst_by_src_errors	GetDstBySrcProcessor
get_prop_latency_us	GetPropProcessor
num_edges_deleted	
num_edges_inserted	
num_raft_votes	Raft
num_rpc_sent_to_metad_failed	Storage Metad RPC
num_rpc_sent_to_metad	Storage Metad RPC
num_tags_deleted	Tag
num_vertices_deleted	
num_vertices_inserted	
transfer_leader_latency_us	Raft Leader
lookup_latency_us	LookupProcessor
num_lookup_errors	LookupProcessor
num_scan_vertex	ScanVertexProcessor
num_scan_vertex_errors	ScanVertexProcessor
update_edge_latency_us	UpdateEdgeProcessor
num_update_vertex	UpdateVertexProcessor
num_update_vertex_errors	UpdateVertexProcessor
kv_get_latency_us	Getprocessor
kv_put_latency_us	PutProcessor
kv_remove_latency_us	RemoveProcessor
num_kv_get_errors	GetProcessor
num_kv_get	GetProcessor
num_kv_put_errors	PutProcessor

num_kv_put	PutProcessor
num_kv_remove_errors	RemoveProcessor
num_kv_remove	RemoveProcessor
forward_tranx_latency_us	
scan_edge_latency_us	ScanEdgeProcessor
num_scan_edge_errors	ScanEdgeProcessor
num_scan_edge	ScanEdgeProcessor
scan_vertex_latency_us	ScanVertexProcessor
num_add_edges	
num_add_edges_errors	
num_add_vertices	
num_start_elect	Raft
num_add_vertices_errors	
num_delete_vertices_errors	
append_log_latency_us	Raft
num_grant_votes	Raft
replicate_log_latency_us	Raft
num_delete_tags	Tag
num_delete_tags_errors	Tag
num_delete_edges	
num_delete_edges_errors	
num_send_snapshot	
update_vertex_latency_us	UpdateVertexProcessor
append_wal_latency_us	Raft WAL
num_update_edge	UpdateEdgeProcessor
delete_tags_latency_us	Tag
num_update_edge_errors	UpdateEdgeProcessor
num_get_neighbors	GetNeighborsProcessor
num_get_dst_by_src	GetDstBySrcProcessor
num_get_prop_errors	GetPropProcessor
num_delete_vertices	
num_lookup	LookupProcessor
num_sync_data	Storage Drainer
num_sync_data_errors	Storage Drainer
sync_data_latency_us	Storage Drainer

Note

num_active_queries				
num_queries				
num_sentences	Graphd			
optimizer_latency_us				
query_latency_us				
num_slow_queries				
num_query_errors				
num_query_errors_leader_changes	Leader			
num_killed_queries				
num_aggregate_executors	Aggregate			
num_sort_executors	Sort			
num_indexscan_executors	IndexScan			
num_auth_failed_sessions_bad_username_password				
num_auth_failed_sessions				
num_opened_sessions				
num_queries_hit_memory_watermark				
num_reclaimed_expired_sessions				
num_rpc_sent_to_metad_failed	Graphd	Metad	RPC	
num_rpc_sent_to_metad	Graphd	Metad	RPC	
num_rpc_sent_to_storaged_failed	Graphd	Storaged	RPC	
num_rpc_sent_to_storaged	Graphd	Storaged	RPC	
slow_query_latency_us				

:January 13, 2023

16.11 FAQ

Dashboard

16.11.1

- Dashboard NebulaGraph
- NebulaGraph
- NebulaGraph Metad Storage Graphd

16.11.2

- installing 3 10
- healthy
- unhealthy

16.11.3

SSH Dashboard SSH

16.11.4

NebulaGraph Dashboard Storage Graph Metad

16.11.5 Meta

Meta NebulaGraph Meta Meta Dashboard Meta

16.11.6

- Storage Dashboard Storage -> Storage Leader Partition
Balance Leader Balance Data
- Storage Storage -> Partition Balance Data Remove Storage
Storage
- Graph

16.11.7 Dashboard

- License Dashboard sudo ./dashboard.service start all
- License

Dashboard cat logs/webserver.log Dashboard NebulaGraph

16.11.8 NebulaGraph

Dashboard NebulaGraph RPM DEB nebula-dashboard-ent/download/nebula-graph

16.11.9	"ssh "
Host	127.0.0.1 Dashboard NebulaGraph
Host IP	IP
Docker	"ssh " Dashboard Docker

:January 13, 2023

17. NebulaGraph Explorer

17.1 NebulaGraph Explorer

NebulaGraph Explorer Explorer Web NebulaGraph

 **Enterpriseonly**

- Nebula Explorer
-  30 Explorer

17.1.1

Explorer

-
-

17.1.2

-
- nGQL
- VID Tag Subgraph
-
-
-
- Explorer

17.1.3

NebulaGraph  Explorer

NebulaGraph Explorer

NebulaGraph **NebulaGraph**

17.1.4

NebulaGraph Explorer

NebulaGraph	Explorer
3.3.0	3.2.1 3.2.0
3.1.0 ~ 3.2.x	3.1.0
3.0.0 ~ 3.1.0	3.0.0
2.5.x ~ 3.0.0	2.2.0
2.6.x	2.1.0
2.5.x	2.0.0

17.1.5

- NebulaGraph Explore Demo Show 2 54

:January 13, 2023

17.2

17.2.1 Explorer

RPM DEB TAR Explorer

Explorer

- NebulaGraph [NebulaGraph](#)

•

7002

Explorer web

 **Caution**

Explorer 7002 conf/app.conf httpport

- Linux CentOS
- License

 **Enterpriseonly**

License License [Nebula Explorer](#)

- HDFS namenode 8020 datanode 50010

 **Caution**

HDFS

Explorer 3.2.0 Dag Controller Dag Controller Dag Controller Explorer
Workflow

RPM

1. RPM

 **Enterpriseonly**

Explorer

2. sudo rpm -i <rpm> RPM

Explorer /usr/local/nebula-explorer

sudo rpm -i nebula-explorer-<version>.x86_64.rpm

--prefix

sudo rpm -i nebula-explorer-<version>.x86_64.rpm --prefix=<path>

3. License

sudo cp -r <license> <explorer_path>

sudo cp -r nebula.license /usr/local/nebula-explorer

4. Dag Controller

Dag Controller

5. nebula-explorer

```
cd nebula-explorer
#   Explorer
sudo ./scripts/start.sh
#   Dag Controller
sudo ./dag-ctrl/scripts/start.sh
```

systemctl

```
systemctl status nebula-explorer #
systemctl stop nebula-explorer #
systemctl start nebula-explorer #
```

```
sudo ./scripts/start.sh #   Explorer
sudo ./scripts/stop.sh #   Explorer
sudo ./dag-ctrl/scripts/start.sh #   Dag Controller
sudo ./dag-ctrl/scripts/stop.sh #   Dag Controller
```

Explorer

sudo rpm -e nebula-explorer-<version>.x86_64

DEB**⑤ enterpriseonly**

Explorer

1. DEB

2. sudo dpkg -i <package_name> DEB

Explorer /usr/local/nebula-explorer

sudo dpkg -i nebula-explorer-3.2.1.x86_64.deb

 **Note**

DEB Explorer

3. License nebula-explorer

```
sudo cp -r <license> <explorer_path>
```

```
sudo cp -r nebula.license /usr/local/nebula-explorer
```

4. Dag Controller **Dag Controller**

5. nebula-explorer

```
cd nebula-explorer
#   Explorer
sudo ./lib/start.sh

#       Dag Controller
sudo ./dag-ctrl/scripts/start.sh
```

```
sudo systemctl status nebula-explorer.service
```

```
sudo systemctl stop nebula-explorer.service
```

Explorer

```
sudo dpkg -r nebula-explorer
```

TAR

1. TAR

 **Enterpriseonly**

Explorer

2. tar -xvf tar

```
tar -xvf nebula-explorer-<version>.tar.gz
```

3. License nebula-explorer

```
cp -r <license> <explorer_path>
```

```
cp -r nebula.license /usr/local/nebula-explorer
```

4. Dag Controller **Dag Controller**

5. nebula-explorer

```
cd nebula-explorer
```

```
#     Explorer    Dag Controller
sudo ./scripts/start.sh

#     Explorer
sudo nohup ./nebula-explorer-server > explorer.log 2>&1 &
```

```
kill pid
```

```
kill $(lsof -t -i :7002)
```

Dag Controller

Dag Controller	DAG	DAG	NebulaGraph Analytics
Dag Controller	NebulaGraph Analytics	Dag Controller	NebulaGraph Analytics
Analytics	NebulaGraph	HDFS	NebulaGraph
	Dag Controller		Dag Controller

1. Dag Controller SSH NebulaGraph Analytics NebulaGraph Analytics SSH
- A Dag Controller SSH NebulaGraph Analytics B B-1 A

```
//
$ ssh-keygen -t rsa

//      A          B-1          A          B-1
$ ssh-copy-id -i ~/.ssh/id_rsa.pub <B_user>@<B_IP>
```

A B-2 B-3 B

2. Dag Controller eval \$(ssh-agent) ssh-agent ssh-add ~/.ssh/id_rsa ssh-agent

Note

ssh-agent SSH

3. dag-ctrl-api.yaml dag-ctrl/etc/dag-ctrl-api.yaml NebulaGraph Analytics

```
#
Name: task-api

Host: 0.0.0.0      # Dag Controller    IP
Port: 9002        # Dag Controller
Timeout: 60000     # HTTP

Log:             #           https://go-zero.dev/cn/docs/blog/tool/logx/
  Mode: file      #
  KeepDays: 7     #
  Path: logs      #
  Level: info     #
  Compress: false  #

# NebulaGraph Analytics      SSH
SSH:
  UserName: vesoft
  Port: 22

#
JobPool:
  Sleep: 3      # 3
  Size: 3       #      3
TaskPool:
  CheckStatusSleep: 1   # 1
  Size: 10      #      10
Dag:
  VarDataListMaxSize: 100    #      HDFS      100

#
Debug:
  Enable: false  #      Debug

# Explorer    Dag Controller
RsaPriKey: |
  -----BEGIN RSA PRIVATE KEY-----
  MIICXAIBAAKBgQDcR0keIMmmV...
```

```
-----END RSA PRIVATE KEY-----
RsaPubKey: |
-----BEGIN RSA PUBLIC KEY-----
MIGJAQBNXHSR4gyaZ7uet7...
-----END RSA PUBLIC KEY-----
```

4. tasks.yaml dag-ctrl/etc/tasks.yaml exec_file exec_file run_algo.sh



Note

- NebulaGraph Analytics scripts
-
-

```
exec_file: /home/xxx/nebula-analytics/scripts/run_algo.sh
```

http://<ip_address>:7002

Explorer



 Note

Nebula Explorer

Explorer

NebulaGraph

: January 13, 2023

17.2.2

Explorer NebulaGraph OAuth2.0

NebulaGraph

- Explorer [Explorer](#)
- NebulaGraph Graph IP 9669
- NebulaGraph

OAuth2.0

Caution

OAuth2.0 Beta

Note

OAuth2.0 Explorer config/app-config.yaml

OAuth

Enable	false	OAuth2.0
ClientId	4953xxx- mmnoge13xx.apps.googleusercontent.com	ClientId
ClientSecret	GOCxxx-xaytomFexxx	ClientSecret
RedirectURL	http://dashboard.vesoft-inc.com/login	Dashboard URL
AuthURL	https://accounts.google.com/o/oauth2/auth	URL
TokenURL	https://oauth2.googleapis.com/token	access_token URL
UserInfoURL	https://www.googleapis.com/oauth2/v1/ userinfo	URL
UsernameKey	email	
Organization	vesoft company	
TokenName	oauth_token	Cookie Token
Scope	email	OAuth scope OAuth2.0 scope UsernameKey
AvatarKey	picture	Avatar Key

Explorer OAuth

NebulaGraph

1. Explorer

• **Host** NebulaGraph Graph IP ip:port 9669



- NebulaGraph Explorer Host IP 127.0.0.1 localhost
- NebulaGraph NebulaGraph
- NebulaGraph
- root
- GOD root nebula
-

2.



30 30



>

Explorer NebulaGraph

: January 13, 2023

17.2.3 NebulaGraph Explorer License

NebulaGraph Explorer License

- License NebulaGraph Explorer
- License License
- License
- License 14
- 30
- 14
- 14

NebulaGraph Explorer License



NebulaGraph Explorer License

30 License

NebulaGraph Explorer License

NebulaGraph Explorer License nebula.license

```
-----License Content Start-----
{
  "vendor": "vesoft",
  "organization": "doc",
  "issuedDate": "2022-06-06T16:00:00.000Z",
  "expirationDate": "2023-05-31T15:59:59.000Z",
  "product": "nebula_graph_explorer",
  "version": ">=3.2.0",
  "licenseType": "enterprise",
  "gracePeriod": 14,
  "clusterCode": "BAIAEAiAQAAAG"
}
-----License Content End-----

-----License Key Start-----
Rrjip5cxxxxxxxxxxxx52kQ==
```

License

vendor	
organization	
issuedDate	License
expirationDate	License
product	NebulaGraph Explorer
	nebula_graph_explorer
version	
licenseType	License
	enterprise samll_bussiness pro individual
gracePeriod	License 0
clusterCode	License

NebulaGraph Explorer [NebulaGraph Explorer](#)

NebulaGraph Explorer License

1. NebulaGraph Explorer License nebula.license
2. NebulaGraph Explorer /usr/local/nebula-explorer License License

Note

NebulaGraph Explorer license Explorer License

:January 13, 2023

17.3

NebulaGraph Explorer

NebulaGraph Explorer

NebulaGraph Explorer



17.3.1

/

Explorer

Visual Query

Workflow



Schema

Schema



NebulaGraph

Schema



NebulaGraph



NebulaGraph

nGQL



nGQL



NebulaGraph Explorer



NebulaGraph



17.3.2

Note

Explorer

Explorer



VID Tag



Explorer



17.3.3

Note

Explorer

Explorer

- -
 -
 -
 -
 -
 -
 -
-

:January 13, 2023

17.4

17.4.1 Schema

Explorer Schema

Schema

Schema

- Schema
- Schema
- Schema PNG

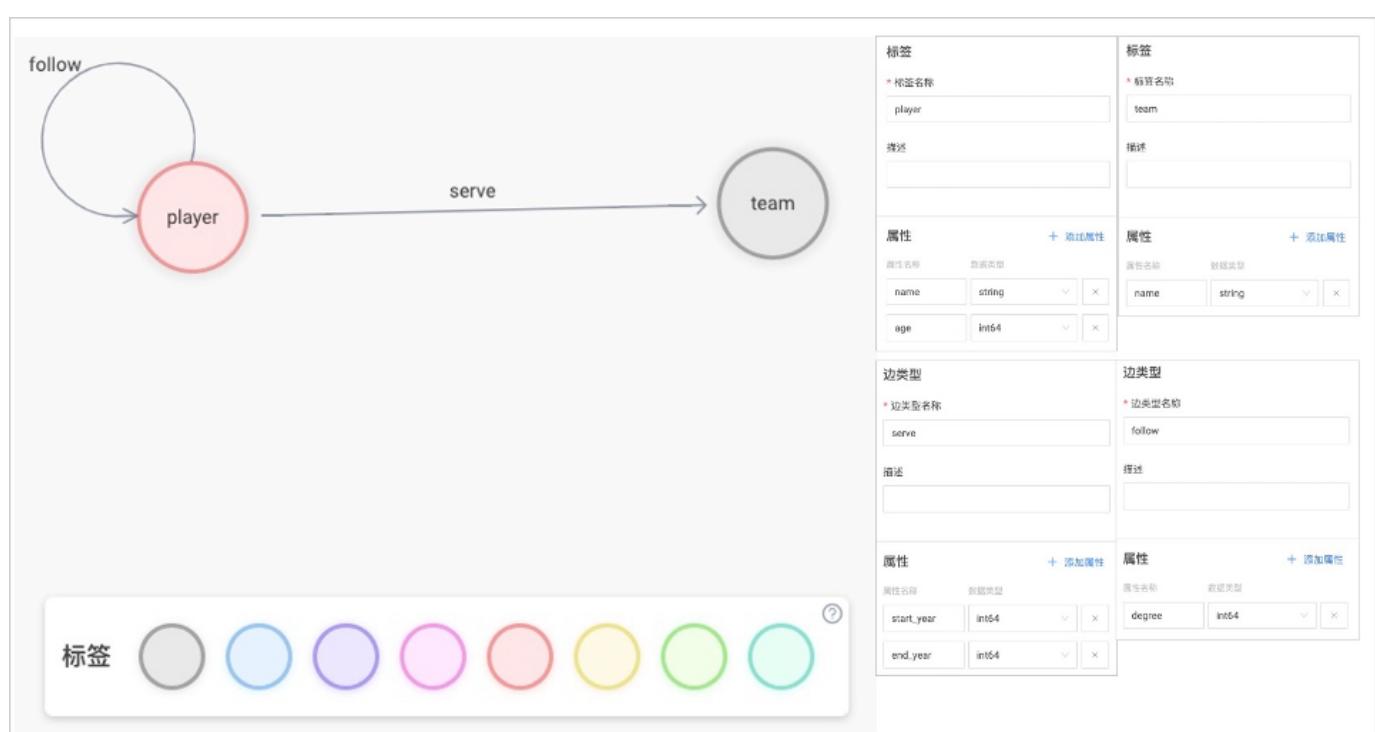


Schema

basketballplayer Schema

Schema

- 1.
2. Tag Tag
3. Tag player name age
4. Tag team name
5. Tag player Tag team serve start_year end_year
6. Tag player follow degree
- 7.



Schema

1. Schema
2. Schema



CREATE SPACE

- Schema

Schema

Schema



Schema

Schema

Schema

**Schema**

Schema PNG

: January 13, 2023

17.4.2 Schema

Explorer Schema

Note

- Schema Schema Schema
 - nGQL Schema
-
- GOD ADMIN DBA NebulaGraph
 - Schema

Note

GOD Schema



- 1.
2. CREATE SPACE
- 3.

/

1. Schema
- 2.
3. CREATE TAG CREATE EDGE

Note

TTL TTL

- 4.

Note

- Tag Edge type
-

1.

Schema

2.

3. **CREATE INDEX****Note**

LOOKUP

LOOKUP

4.

1.

Schema

2.

Schema

1.

Schema2. **Schema****Schema**

: January 13, 2023

17.4.3

Explorer CSV NebulaGraph

- NebulaGraph Schema
- CSV Schema
- GOD ADMIN DBA **NebulaGraph**



1. CSV



CSV

2. A blue eye icon with a magnifying glass symbol over it.

1.

Caution

example.yaml

NebulaGraph Importer

CSV

-
-
-
-
- **vertices 1** `vertexID` **Select CSV Index** VID
- **Tag** **Tag** Tag
-

[← 任务列表 / 创建导入任务](#)

* 图空间
basketballplayer

* 任务名称
test_import

批处理量
60

* 关联点

+ 固定数据源

vertices 1 vertex_player.csv

属性	对应列	类型
name	* Column 2	string
age	* Column 1	int

+ 添加 Tag

* 关联边

+ 固定数据源

edge 1 edge_follow.csv

Edge Type	对应列	类型
srcId	* Column 0	string
dstId	* Column 1	string
rank	选择	int
degree	* Column 2	int

取消

导入

2. , NebulaGraph

:January 13, 2023

17.4.4

Explorer

nGQL

The screenshot shows the Nebula Graph nGQL console interface. At the top, there is a search bar with the text "basketballplayer" and a dropdown arrow icon. Below the search bar are several buttons: a red circle with the number 1, a dropdown arrow, a question mark, a save as template button (red circle with 6), and a run button (blue background with white play icon). To the right of the run button are five small icons: a star, a refresh, a clipboard, and a blue circle with the number 5.

The main area contains a code editor with the following query:

```
1 MATCH (v:player) RETURN v LIMIT 10;
```

This query is highlighted with a green background. To the right of the code editor are four small icons: a star, an up arrow, a down arrow, and a close button. Below the code editor, the results are displayed in a table format. A sidebar on the left shows a "表格" (Table) icon (red circle with 14) and a "可视化" (Visualization) icon (red circle with 15).

v
("player102" :player{age: 33, name: "LaMarcus Aldridge"})
("player106" :player{age: 25, name: "Kyle Anderson"})
("player115" :player{age: 40, name: "Kobe Bryant"})
("player129" :player{age: 37, name: "Dwyane Wade"})
("player138" :player{age: 38, name: "Paul Gasol"})
("player108" :player{age: 36, name: "Boris Diaw"})
("player122" :player{age: 30, name: "DeAndre Jordan"})
("player123" :player{age: 28, name: "Ricky Rubio"})
("player139" :player{age: 34, name: "Marc Gasol"})
("player142" :player{age: 29, name: "Klay Thompson"})

At the bottom of the results table, there are navigation buttons for "共计 10" (Total 10), page numbers (1, 2, 3, 4, 5), and arrows. Below the table, the text "执行时间消耗 0.002957 (s)" (Execution time consumption 0.002957 (s)) is displayed. At the very bottom right, there are two buttons: "保存为模板" (Save as template) and "导入图探索" (Import graph exploration).

1	nGQL	USE <space_name>
2		
3		15
4		
5	nGQL	
6	nGQL	
7	nGQL	;
8		//
9	nGQL	
10		
11	CSV	PNG
	nGQL	
	CSV	PNG
12	/	nGQL
13		nGQL
14		
15		

:January 13, 2023

17.4.5

NebulaGraph Explorer

nGQL

nGQL

NebulaGraph

Schema



1. +

编辑模板

* 模板名称: * 图空间:

描述:

* 查詢模版:

输入:

参数名称	示例	描述	操作
name	Tim Duncan	指定球员姓名	删除

test

basketballplayer

```
MATCH (v:player{name:"${name}"})--(v2:player)
RETURN v2.player.name AS Name;
```

nGQL
{name}

+
Tim Duncan

\$



Note

+

2.

- 
 - 
 - 
 -
 -
 -
 - 
-

: January 13, 2023

17.4.6

NebulaGraph Explorer

Explorer God Admin



用户列表 授权

+ 创建用户

请输入关键字搜索

账号	IP 白名单	操作
root		查看 修改密码
test11		查看 修改密码 剔除用户



root

1.

IP IP NebulaGraph IP , NebulaGraph



2.

1.

root

2.

root	Admin
------	-------

3.

Note

root

-
-
- root
-
-
-
-
-
-
-

**Note**

:January 13, 2023

17.5

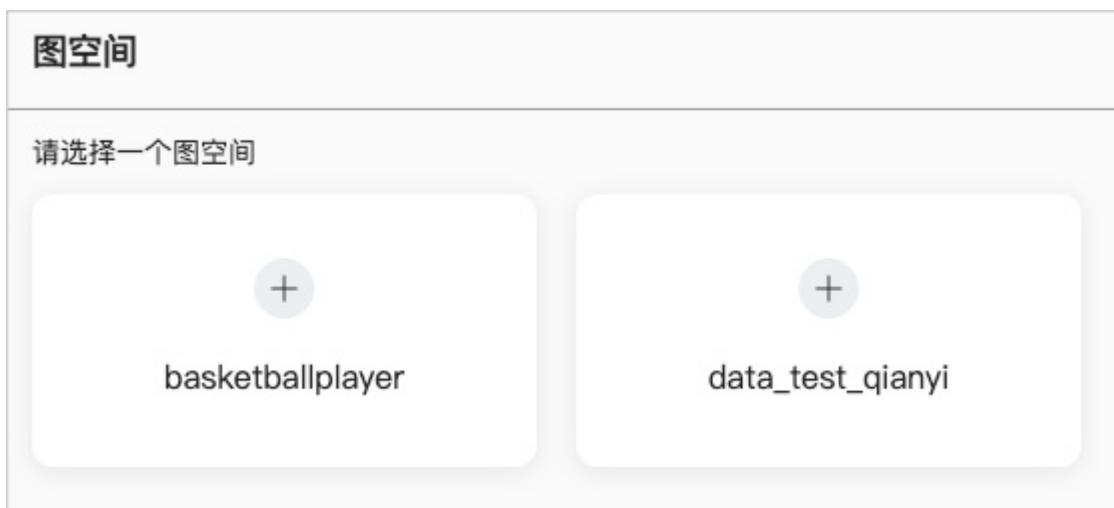
17.5.1

Explorer

Explorer

Explorer

Explorer



1.
Explorer



2.

Note

: January 13, 2023

17.5.2



3.0.0 NebulaGraph

Explorer

- VID
- Tag
-
-

VID

ID VID

VID

Note

VID

basketballplayer

Nebula Explorer **Explorer** Visual Query

basketballplayer

2D 模式 3D 模式 鸟瞰: | 出入度权重: | 信息检测: | 编辑:

当前画板没有点数据, 请[快速开始 \(随机导入数据\)](#)

101%

TAG

Tag

Note

Tag

Tag

10 30 40

Tag 查询

2D 模式 3D 模式

* Tag:

结果数量限制:

* 选择索引:

筛选条件

字段	运算符	值
age	>	30
<hr/> AND <hr/>		
age	!=	40

VID

VID

1

Note

VID VID Enter

VID Kings Suns 2 server like





:January 13, 2023

17.5.3

Tag

- **Tag**
 - Tag
 - Tag Tag
 - Tag Tag
 - Tag
 - Tag Tag Tag
 - Tag Tag
 - Tag

1 TAG PLAYER

1.

2. player

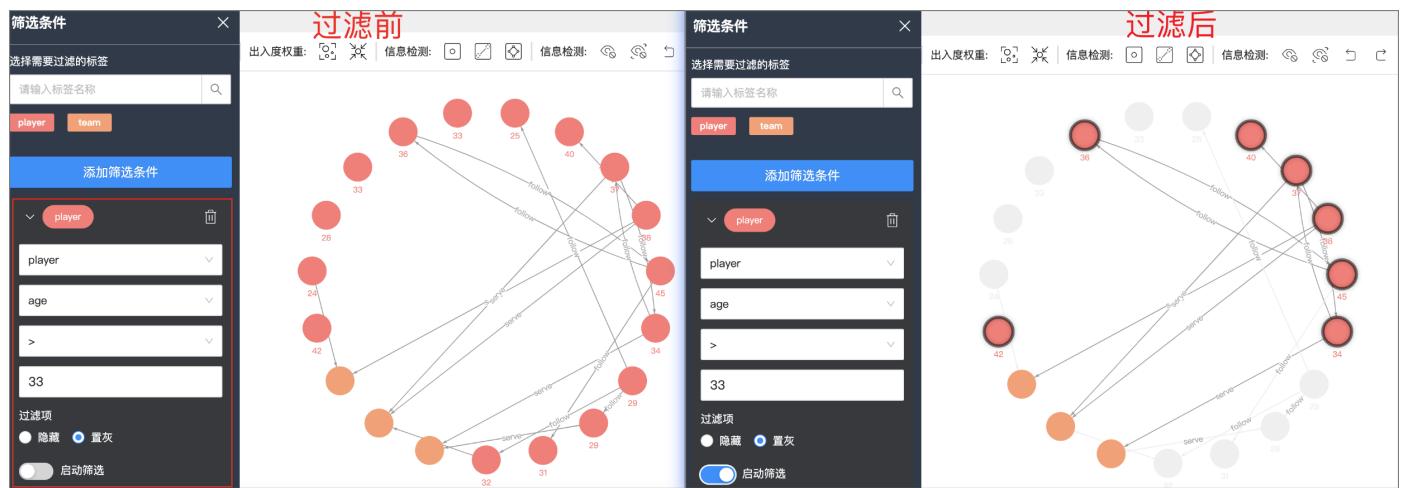
3. Tag team



33

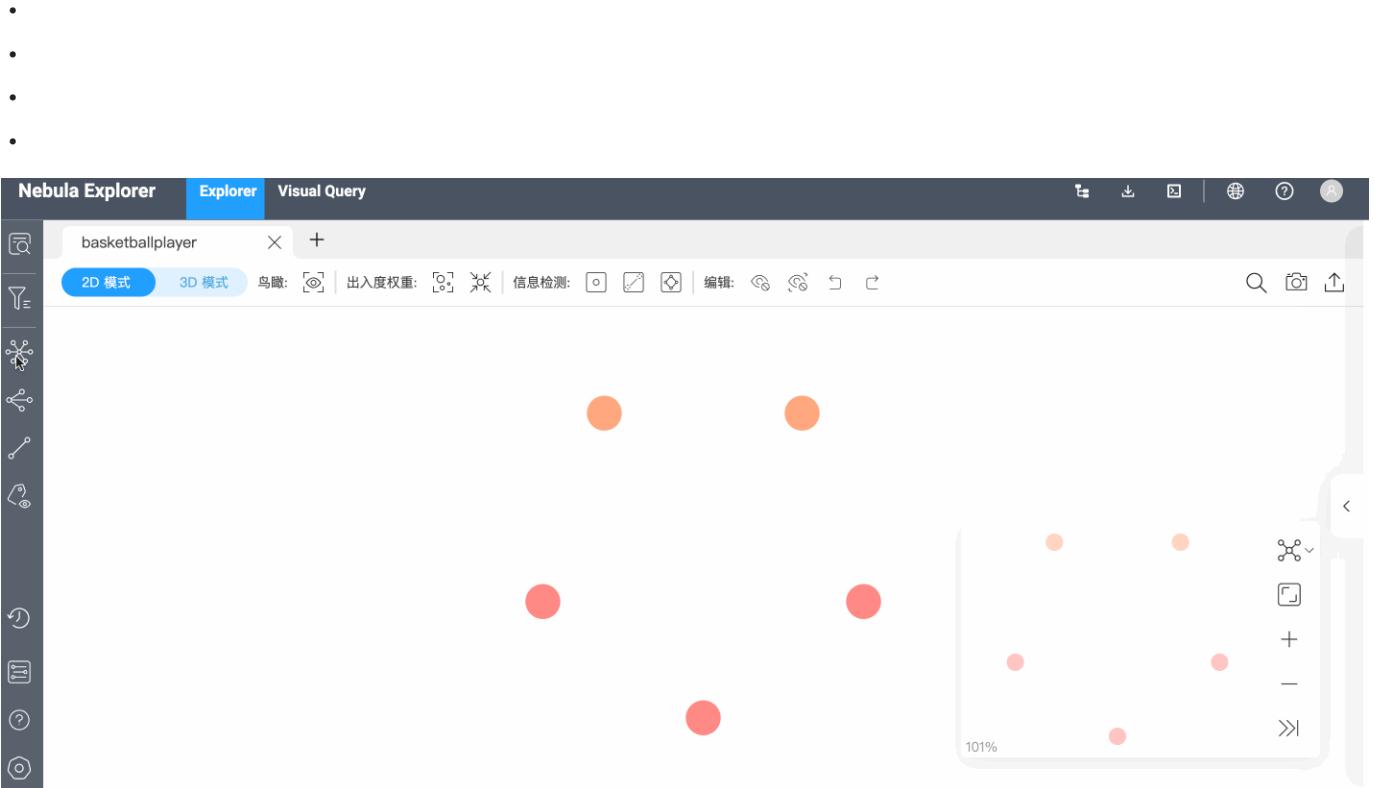
1.

2. player age > 33
3.
4.



: January 13, 2023

17.5.4



1.



Tag

2.

Shift

Note



Shift

1.



2. Shift



Note

- 90% 90%
 - 100% 100%
-

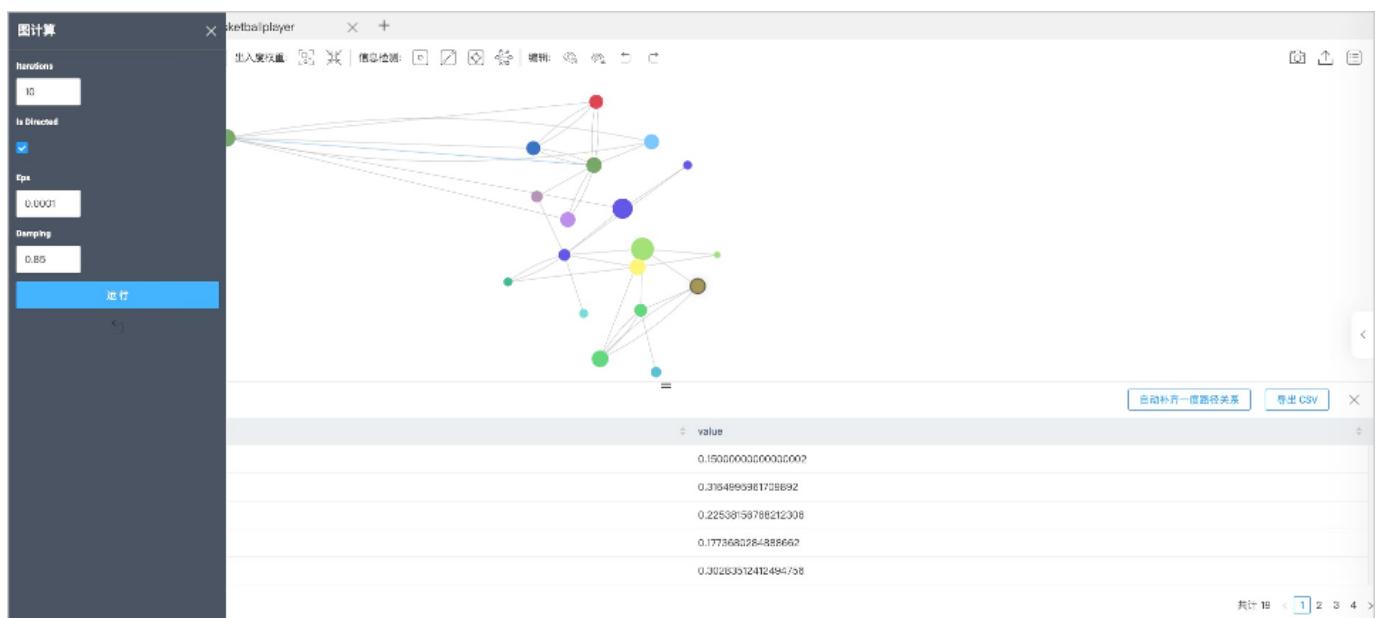
:January 13, 2023

17.5.5

Note

Workflow

1. 
- 2.
- 3.
- 4.
-
- CSV CSV



: January 13, 2023

17.5.6

-
- INT
- Edge type
-
-

1

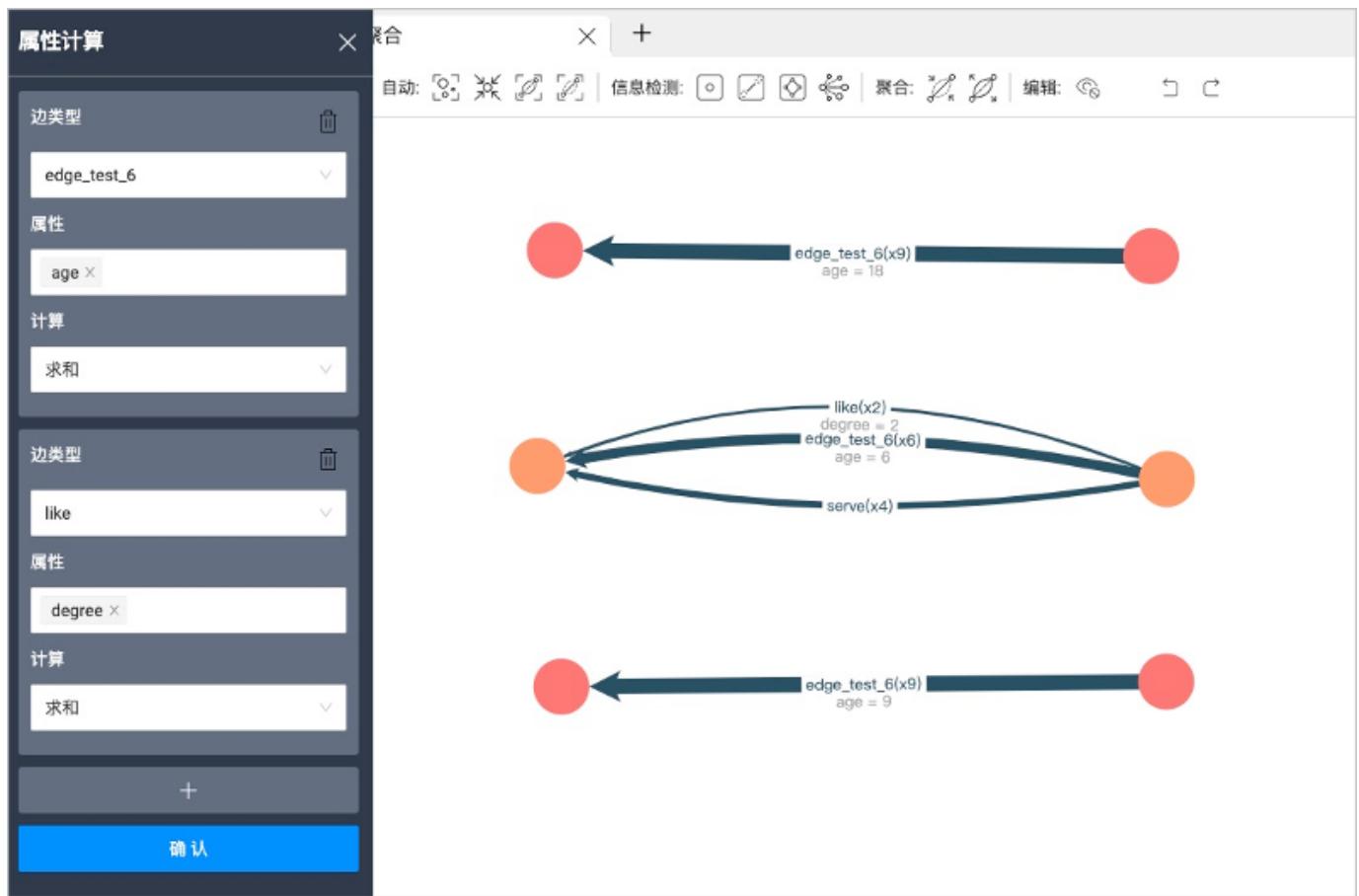
1.



2. +

3.

+ Edge type



2

- 1.
- 2.
- 3.

: January 13, 2023

17.6

↑ Compatibility

3.0.0 NebulaGraph

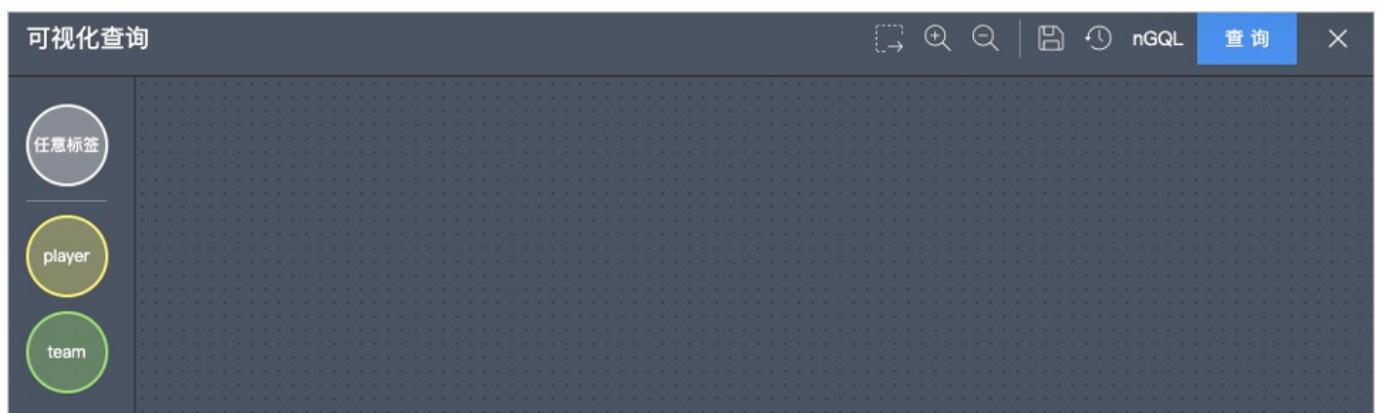
Note

Explorer

17.6.1

-
- MATCH

17.6.2



Explorer

Visual Query

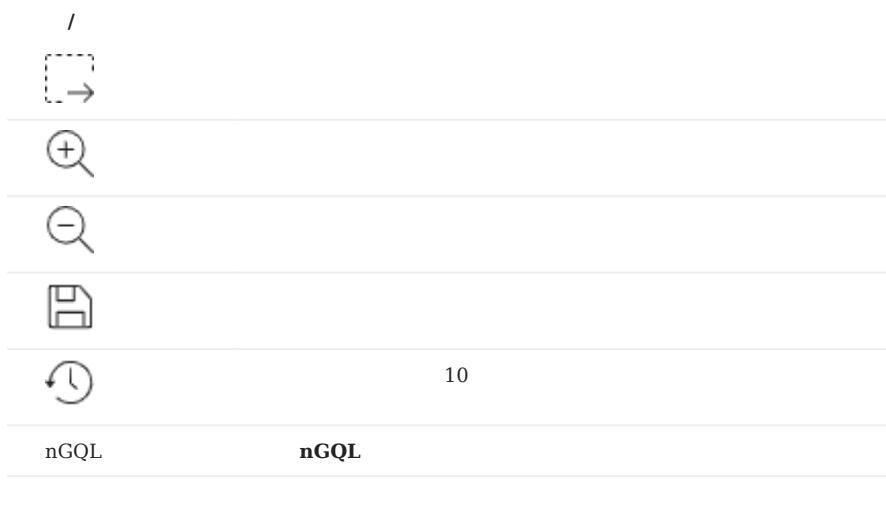
Tag (player team)

Tag

Note

Tag

Tag



17.6.3

1. Tag Tag
- 2.
- 3.

▼ 点

标签名

player X team X

▼ 筛选条件 ② +

字段	运算符	值
player.age	==	30

• Tag

Note

0 Tag

- 0 Tag Tag
- Tag Tag
- Tag Tag

Note

Tag

4.



• Edge Type

Note

Edge Type

- Edge Type Edge Type
- Edge Type Edge Type

Note

Edge Type

5. ()  RETURN
- 6.

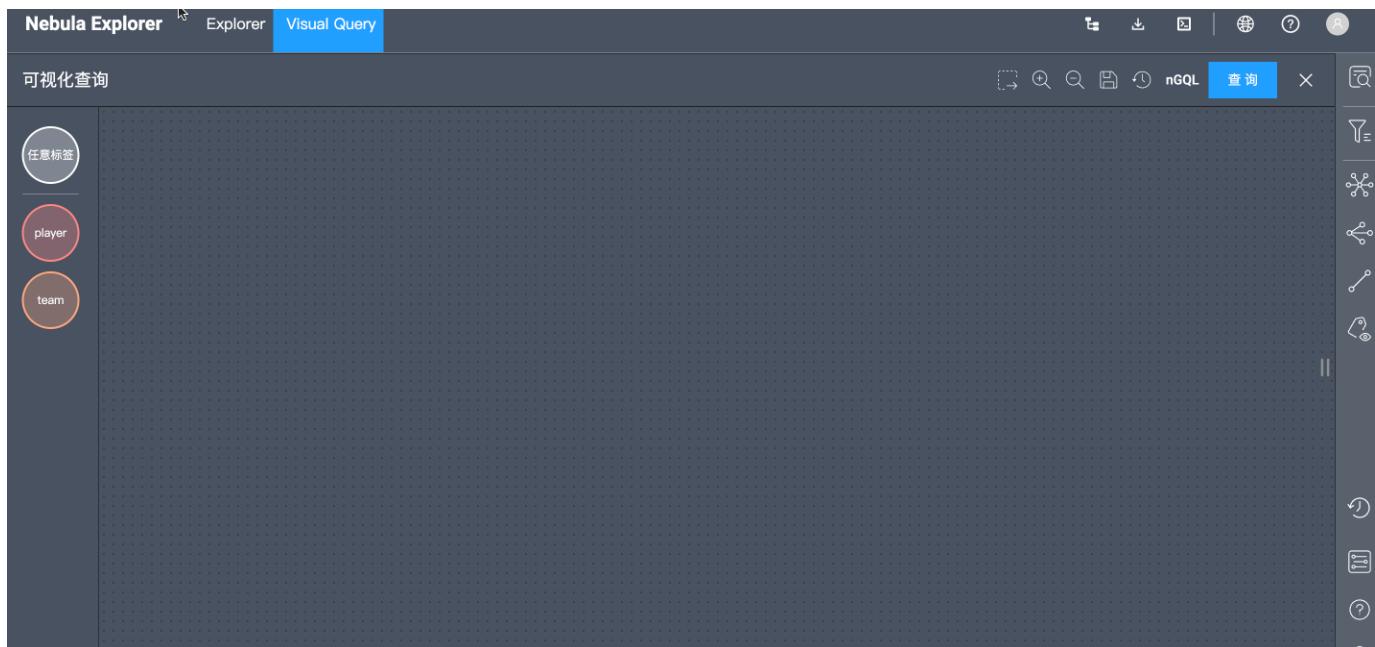
17.6.4

1

Yao Ming

35

6



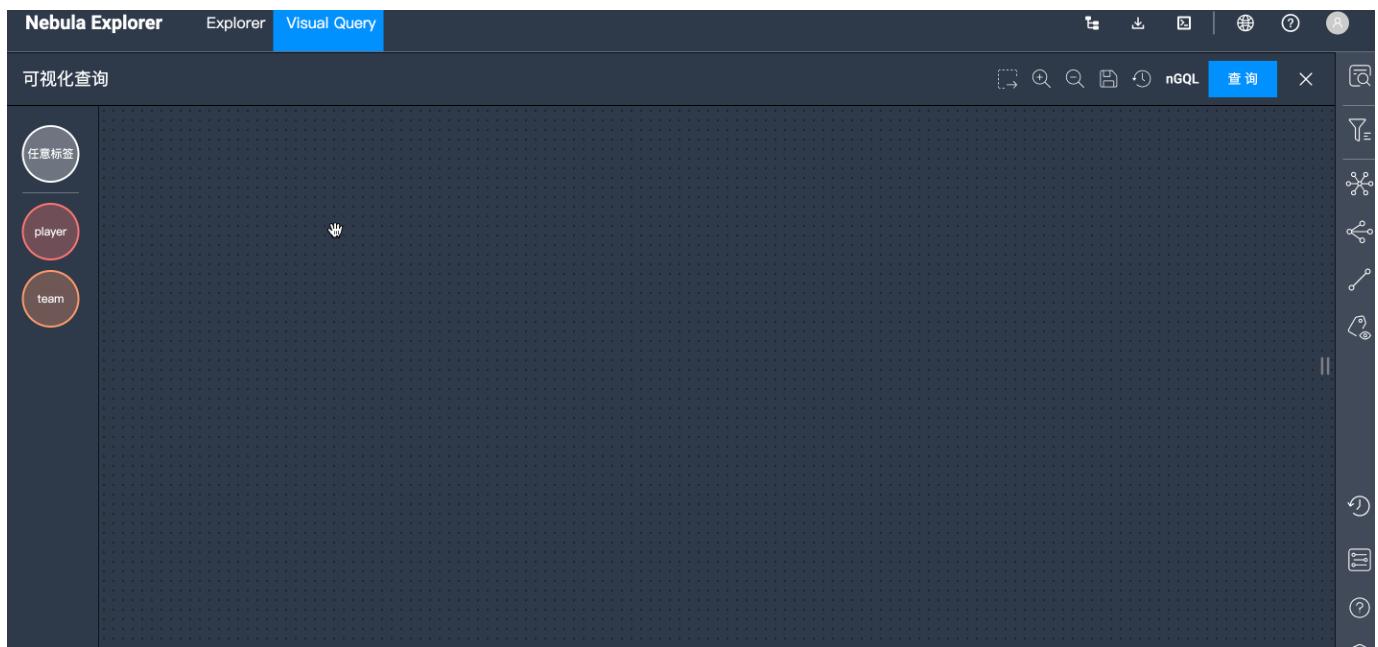
1. Tag 2. player 1. team
- 2.

 - a. player.name == Yao Ming
 - b. follow 1
 - c. player.age > 35
 - d. serve 1
 - e.  serve
 - f. 6

3. 6

2

30

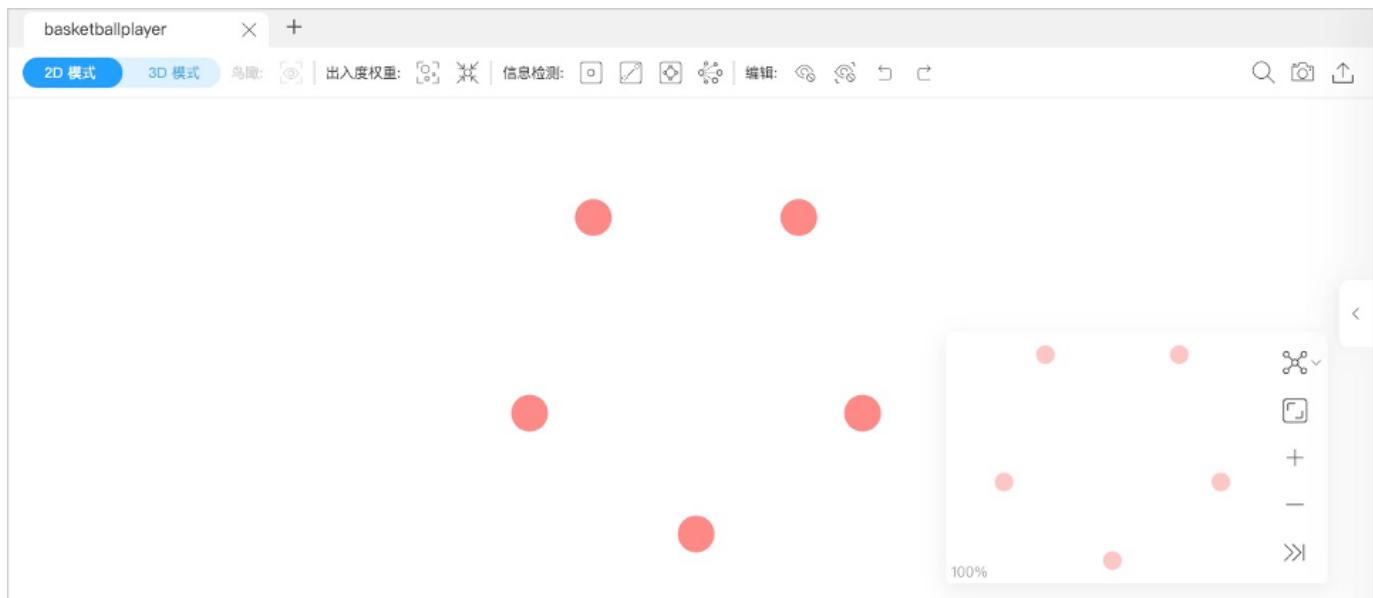


1. Tag 3 player 1 team
2.
 - a. follow 1
 - b. serve 1
 - c. serve 1
- d. player.age > 30
- e. serve 1
- f.  serve
- 3.

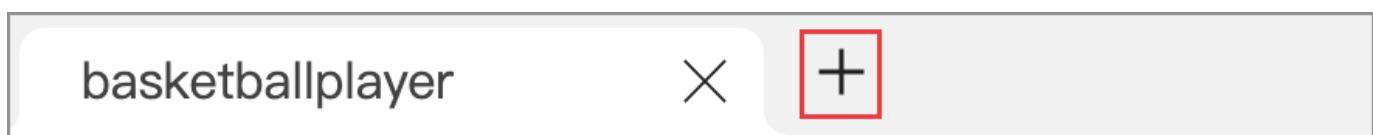
:January 13, 2023

17.7

17.7.1



+



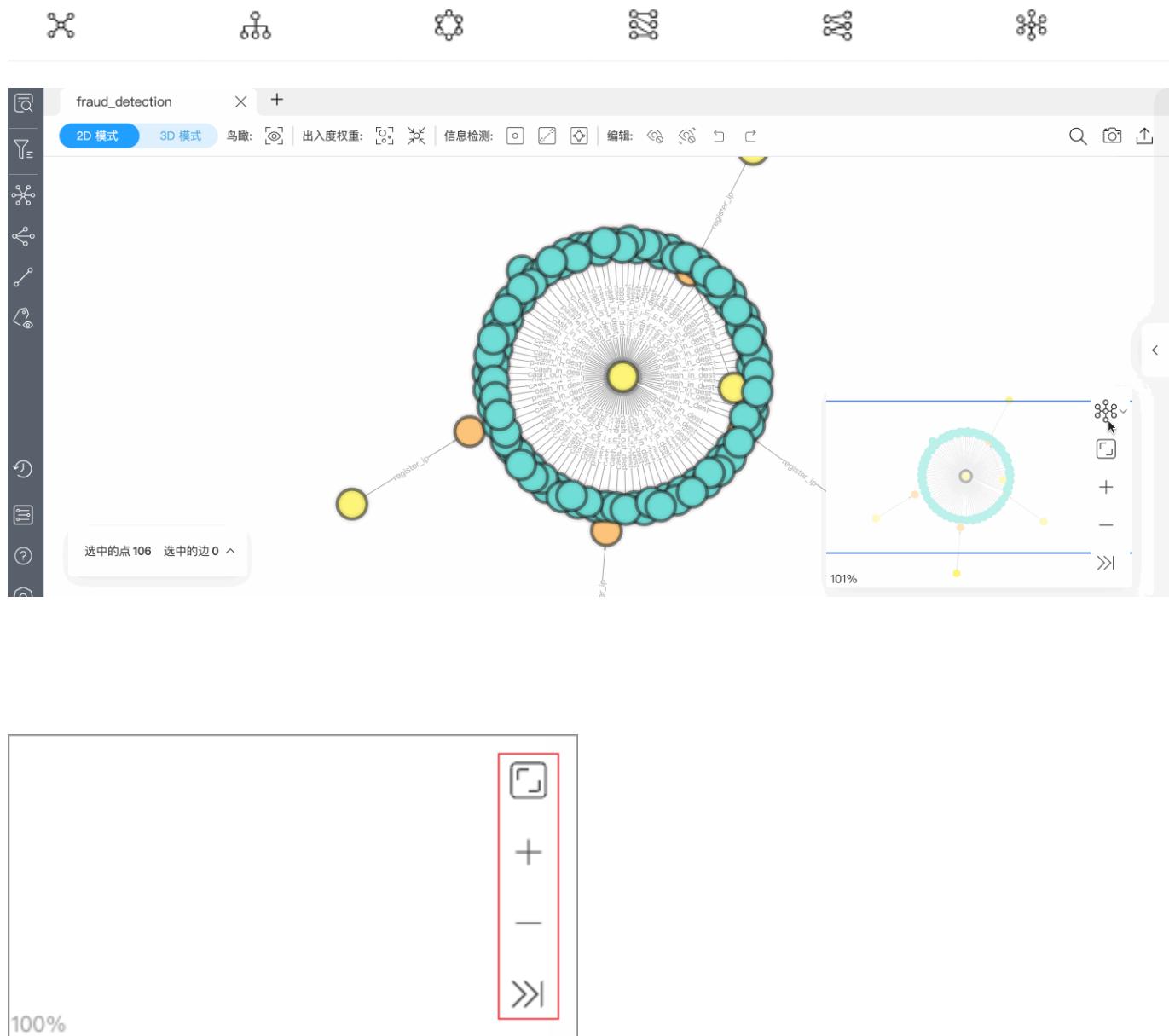
2D 3D

CSV

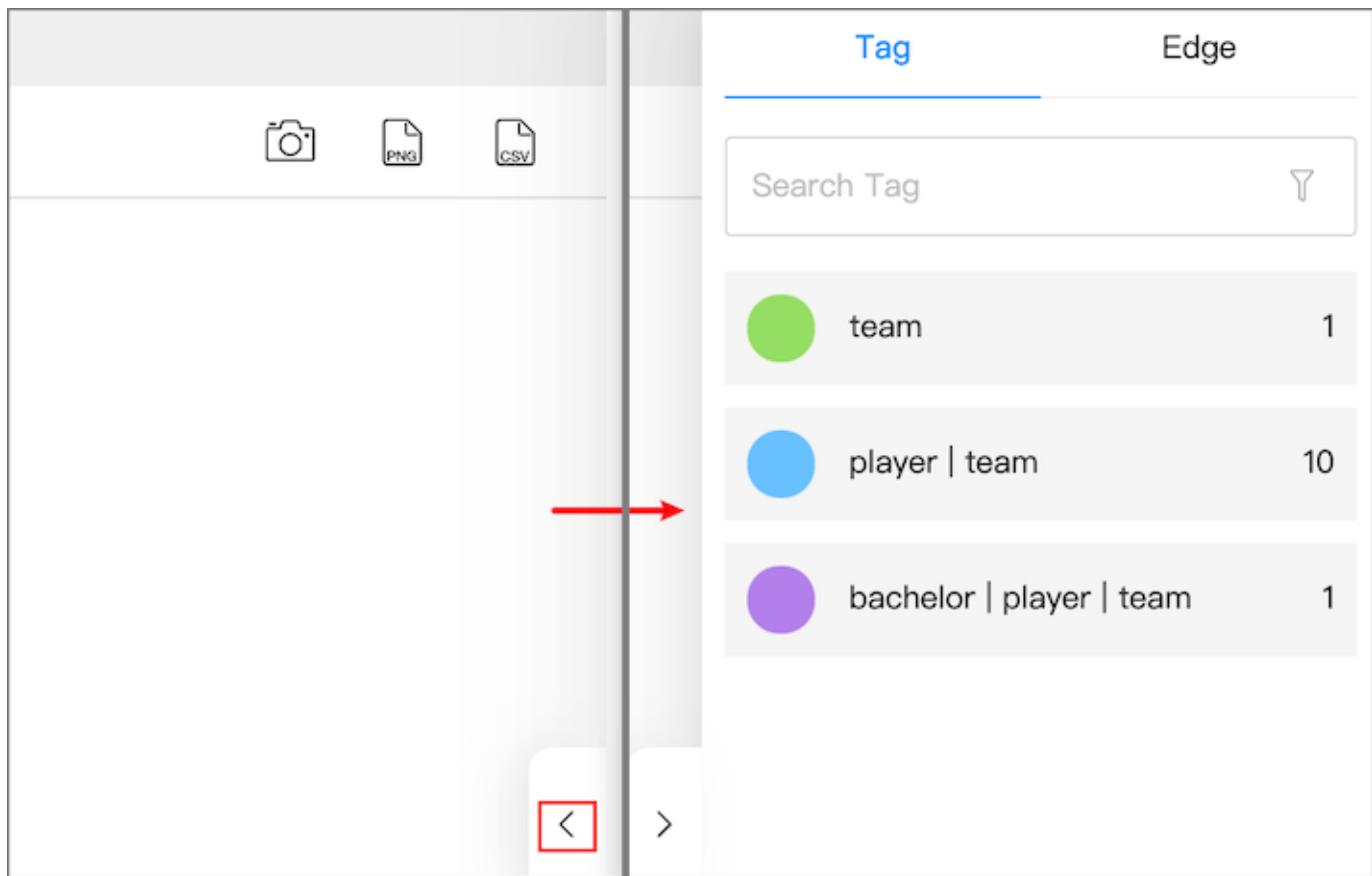
- 
 -  CSV CSV
 -  PNG

VID Tag

Explorer 6



<



- Tag Edge type
- Tag Edge type Tag

Note

		player	5
--	---	--------	---

颜色 尺寸 图标 [图片](#)

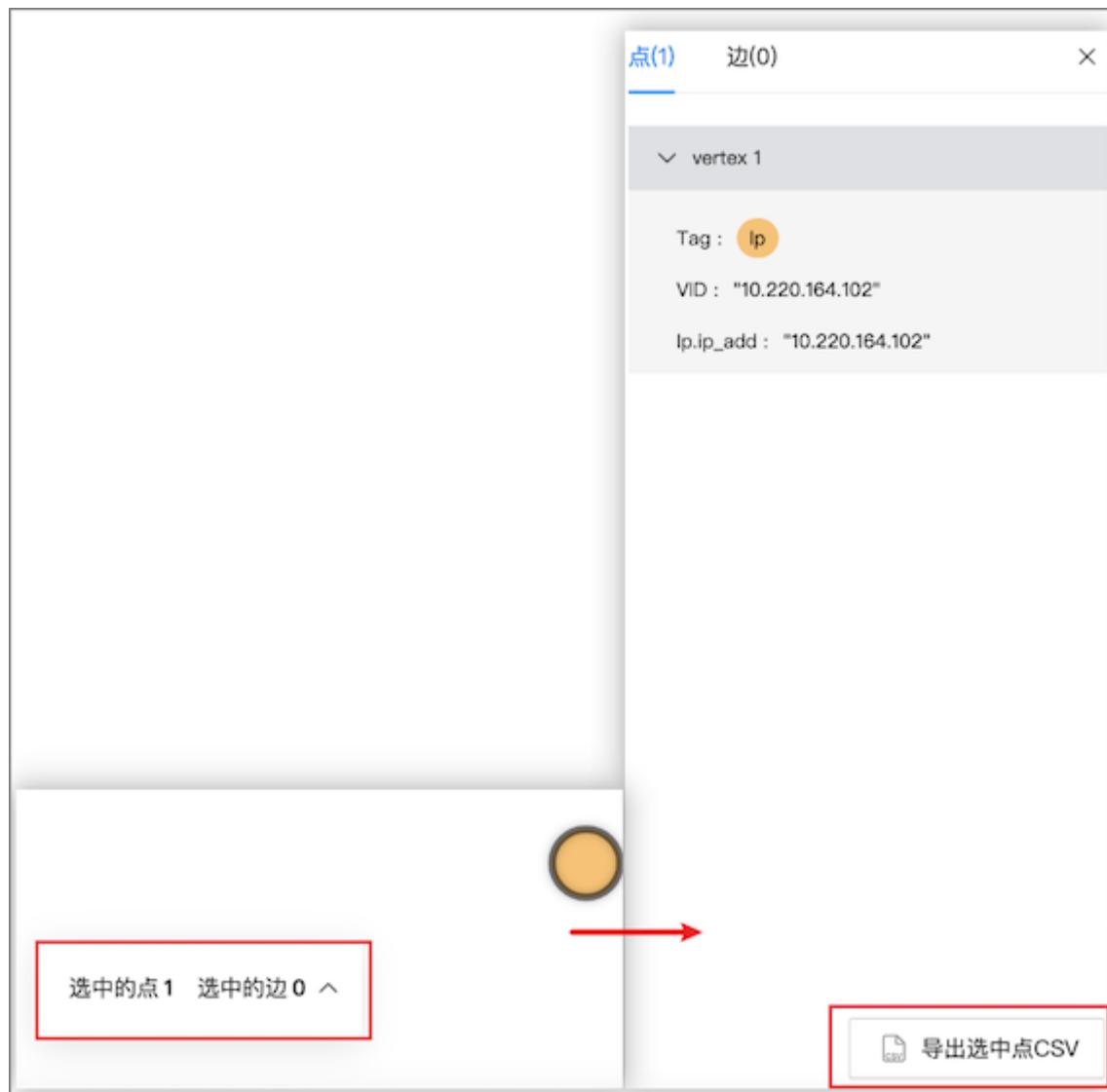
Please upload a picture with size less than 200px * 200px

{number}

{number}

CSV



: January 13, 2023

17.7.2

Explorer **2D** **3D**

2D

3D

Note

3D

**2D**

2D



1

N

Note

2D 5000

2D

-
-
-
-

3D

2D 模式

3D 模式

鸟瞰:  ▾

画质: 普通

重新受力



3D

3D

2D

2D

20000 2000



3.0.0 NebulaGraph

: January 13, 2023

17.7.3

Explorer

1.



2.

3.



- 50

•

Explorer



- A blue downward-pointing arrow icon.
- JSON A blue edit icon with a pencil and a document.
- A blue trash bin icon.

JSON

JSON

: January 13, 2023

17.8

17.8.1

Nebula Explorer

Nebula Explorer Component
Workflow

Dag Controller



Task

Job

Explorer

Nebula Analytics

-
-
-
-

• Dag Controller Nebula Analytics [NebulaGraph Analytics](#) Explorer

•

HDFS

• NebulaGraph HDFS

•

HDFS NebulaGraph

NebulaGraph

HDFS

17.8.2

NebulaGraph HDFS NebulaGraph Analytics

- 3.3.0 NebulaGraph Analytics [NebulaGraph Analytics](#)
- Dag Controller [Explorer](#)

1. Explorer

Workflow

2.

3.

配置

Nebula Graph 配置

Graphd	Graphd Timeout(ms)
192.168.8.131:9669	60000
Metad Timeout(ms)	Storage Timeout(ms)
60000	60000

HDFS 配置

+ 添加

hdfs1	X
hdfs://192.168.8.100:9000/t...	
root	
hdfs2	X
hdfs://192.168.8.101:9000/t...	
root	

Nebula Analytics 节点配置

+ 添加

192.168.8.131	X
192.168.8.132	X
192.168.8.133	X

取消 **确认**

NebulaGraph	Graph	Explorer	Graph				
HDFS	HDFS 192.168.8.100:9000/test	HDFS Analytics	fs.defaultFS HDFS	HDFS	HDFS	HDFS	hdfs://
NebulaGraph Analytics	NebulaGraph Analytics						

4.

:January 13, 2023

17.8.3

- NebulaGraph HDFS CSV
-

```
MATCH    MATCH (v1:player)--(v2)    RETURN id(v1), id(v2);      PageRank
```

1. Explorer
- 2.
3. ->**Query**

Workflow

query_1

▼ 查询语言

basketballplayer

```
1 MATCH (v1:player)--(v2) RETURN id(v1), id(v2);
```

解析参数

▶ 输入

▼ 输出 [+ 添加参数](#)

output0:	id(v1)		
output1:	id(v2)		

▶ 结果

Query

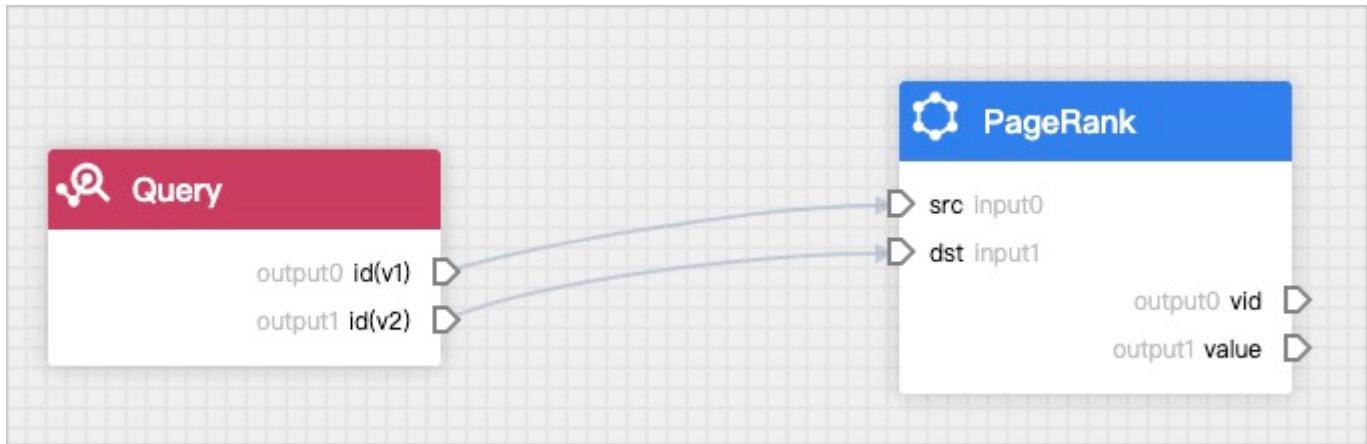
nGQL nGQL

AS

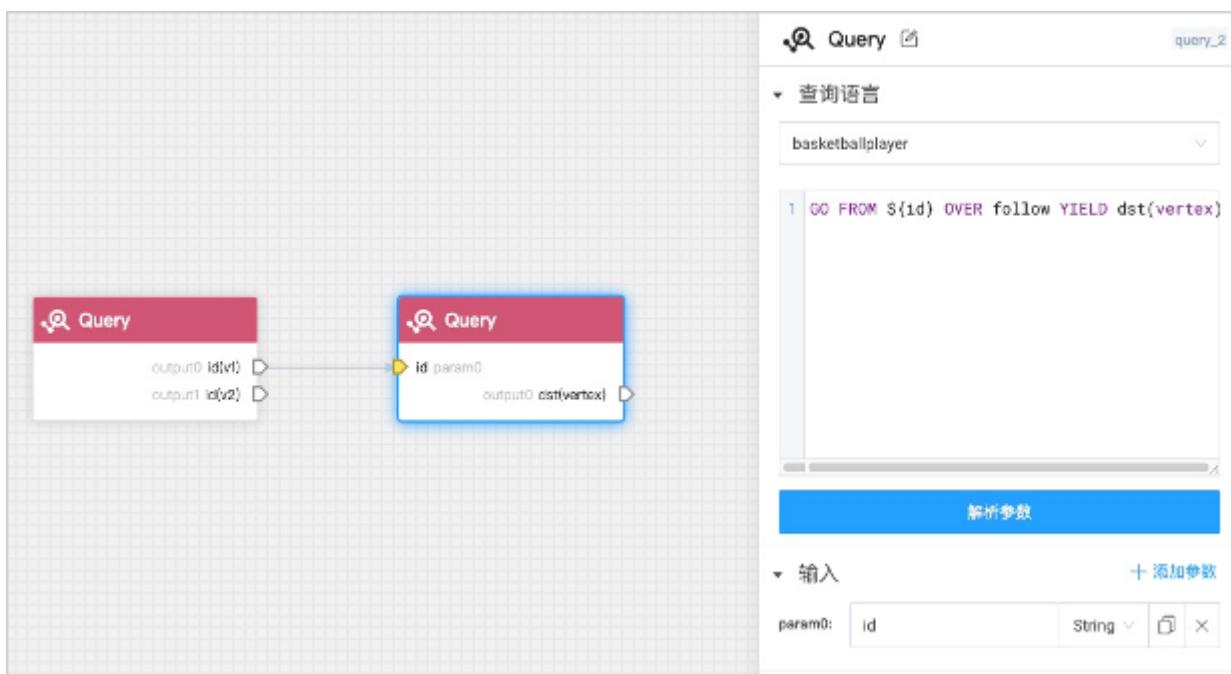
HDFS

Note

4. ->**PageRank** output0 input0 output1 input1



```
GO FROM ${id} OVER follow YIELD dst(vertex) ${id}
```



5.

PageRank

输入

Nebula Graph	Dependence	HDFS
src:	Query.id(v1)	v
dst:	Query.id(v2)	v

参数配置

Iterations:	10
Is Directed:	<input checked="" type="checkbox"/>
Eps:	0.0001
Damping:	0.85

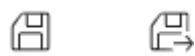
输出

执行配置

结果

PageRank		NebulaGraph	Dependence	HDFS	HDFS
		HDFS	NebulaGraph	ID	
		HDFS	HDFS	Tag	Tag
		NebulaGraph			
		HDFS			

6. 

 Note

Backspace

: January 13, 2023

17.8.4

1. Explorer

Workflow

2.

•

•

•

•

•



•

•



: January 13, 2023

17.8.5

1. Explorer **Workflow**

2. ID

-
-
-
-

• **Explorer** CSV

-
-

: January 13, 2023

17.8.6 API

API

API

```
api-open/v1/workflows/<workflow_id>/jobs
<workflow_id> ID
```

<code>workflow_id</code>	number	-	<code>4216617528</code>	ID
				ID

Headers

<code>Content-Type</code>	string	-	application/ json	
<code>explorer_token</code>	string	-	<code>eyJhbxxx</code>	Token

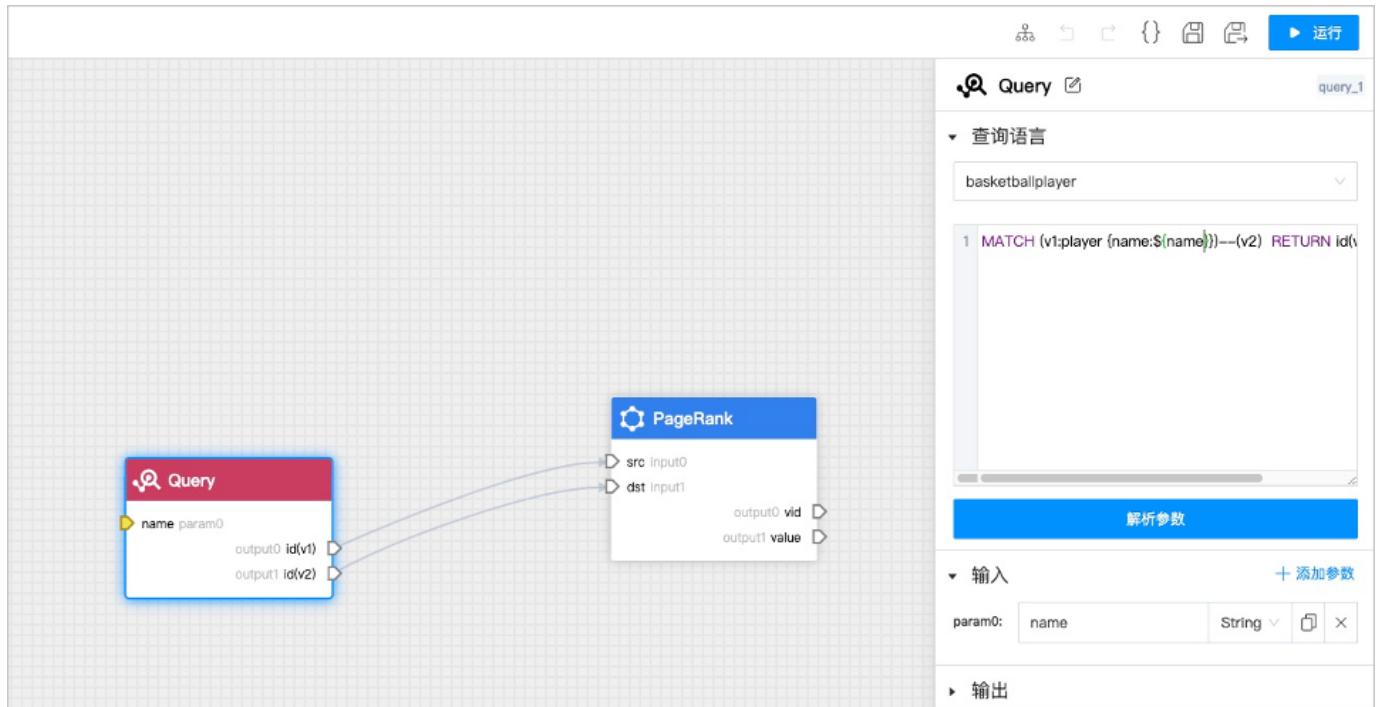
Token [API](#)

Body



<code>input</code>	object	-	-	
- <code>task_id</code>	object	-	<code>query_1</code>	ID
- <code>param_name:</code> <code>param_value</code>	string: {string number}	-	<code>param0:</code> <code>player100</code>	<code>param_name</code> <code>param_value</code>

nGQL name Tim Duncan



```
curl -i -X POST -H "Content-Type: application/json" -H "Cookie: explorer_token=eyJhb...x" -d '{"input":{"query_1":{"name":"Tim Duncan"}}}' http://192.168.8.145:7002/api-open/v1/workflows/4216617528/jobs
```

code	number	0	0	API
message	string	Success		
data	object	-		
- id	string	107	ID	

```
{
  "cookie": [],
  "Content-Type": "application/json",
  "Traceparent": "00-1ba128615cdc2226c921973a689e9f1b-7630b12963494672-00",
  "Date": "Fri, 15 Jul 2022 07:19:25 GMT",
  "Content-Length": "48"
}

{
  "code": 0,
  "data": {
    "id": 107
  },
  "message": "Success"
}
```

: January 13, 2023

API

API

api-open/v1/jobs

Headers

Content-Type	string	-	application/json
explorer_token	string	-	eyJhbxxx Token Token API

Body

filter	object	-	-
- name	string	-	workflow_q745a_20220715092236
- status	number	-	2 API
- fromCreateTime	number	-	1657848036000
- toCreateTime	number	-	1657848157000
orderByCreateTime	string	desc	- desc asc
pageSize	number	10	-
page	number	1	-

Note

jobs? Body filter URL { "status": 2, "orderByCreateTime": "asc"}

```
curl -i -X GET -H "Content-Type: application/json" -H "Cookie: explorer_token=eyJhbxxx" http://192.168.8.145:7002/api-open/v1/jobs?filter=%7B%20%22status%22%3A%202%2C%20%22orderByCreateTime%22%3A%20%22asc%22%7D&pageSize=10&page=1
```

code	number	0	0	API
message	string	Success		
data	object	-		
- total	number	2		
- Page	number	1		
- PageSize	number	10		
- items	object	-		
- id	number	105	ID	
- name	string	workflow_q745a_20220715090915		
- workflowId	string	4216617528	ID	
-	string	workflow_q745a		
workflowName				
- status	number	2	API	
-	number	1657847358000		
runBeginTime				
- runEndTime	number	1657847364000		
- createTime	number	1657847355906		

```
{
  "cookie": [],
  "Content-Type": "application/json",
  "Traceparent": "00-d3a1943f5baf46771e9afc629e0b5d40-920db2f06142f5ff-00",
  "Date": "Fri, 15 Jul 2022 06:17:21 GMT",
  "Content-Length": "512"
}

{
  "code": 0,
  "data": {
    "items": [
      {
        "id": 105,
        "name": "workflow_q745a_20220715090915",
        "workflowId": "4216617528",
        "workflowName": "workflow_q745a",
        "status": 2,
        "runBeginTime": 1657847358000,
        "runEndTime": 1657847364000,
        "createTime": 1657847355906
      },
      {
        "id": 106,
        "name": "workflow_q745a_20220715092236",
        "workflowId": "4216617528",
        "workflowName": "workflow_q745a",
        "status": 2,
        "runBeginTime": 1657848157000,
        "runEndTime": 1657848163000,
        "createTime": 1657848156290
      }
    ],
    "total": 2,
    "Page": 1,
    "PageSize": 10
  },
  "message": "Success"
}
```

: January 13, 2023

API

API

api-open/v1/workflows/<workflow_id>/jobs

<workflow_id> ID

workflow_id	number	-	4216617528	ID
-------------	--------	---	------------	----

Headers

Content-Type	string	-	application/json	
explorer_token	string	-	eyJhbxxx	Token

Token API

Body

filter	object	-	-	
- name	string	-	workflow_q745a_20220715092236	
- status	number	-	2	API
- fromCreateTime	number	-	1657848036000	
- toCreateTime	number	-	1657848157000	
-	string	desc	-	desc
orderByCreateTime				asc
pageSize	number	10	-	
page	number	1	-	

Note

jobs? Body filter URL {"status": 2, "fromCreateTime": 1657874100000}

```
curl -i -X GET -H "Content-Type: application/json" -H "Cookie: explorer_token=eyJhbxxx" http://192.168.8.145:7002/api-open/v1/workflows/4216617528/jobs?filter=%7B%22status%22%3A%202%2C%20%20%22fromCreateTime%22%3A%201657874100000%7D&pageSize=10&page=1
```

code	number	0	0	API
message	string	Success		
data	object	-		
- total	number	2		
- Page	number	1		
- PageSize	number	10		
- items	object	-		
- id	number	105	ID	
- name	string	workflow_q745a_20220715090915		
- workflowId	string	4216617528	ID	
-	string	workflow_q745a		
workflowName				
- status	number	2	API	
-	number	1657847358000		
runBeginTime				
- runEndTime	number	1657847364000		
- createTime	number	1657847355906		

```
{
  "cookie": [],
  "Content-Type": "application/json",
  "Traceparent": "00-008c3056686dd3f3be38b8eda42a917e-b5616e30434cb803-00",
  "Date": "Fri, 15 Jul 2022 08:44:06 GMT",
  "Content-Length": "297"
}
{
  "code": 0,
  "data": {
    "items": [
      {
        "id": 115,
        "name": "workflow_q745a_20220715163650",
        "workflowId": "4216617528",
        "workflowName": "workflow_q745a",
        "status": 2,
        "runBeginTime": 1657874212000,
        "runEndTime": 1657874218000,
        "createTime": 1657874210088
      }
    ],
    "total": 1,
    "Page": 1,
    "PageSize": 10
  },
  "message": "Success"
}
```

:January 13, 2023

API

API

```
api-open/v1/jobs/<job_id>
```

<job_id> ID

job_id	number	-	1964	ID	API
--------	--------	---	------	----	-----

Headers

Content-Type	string	-	application/ json		
explorer_token	string	-	eyJhbxxx	Token	API

Body

```
curl -i -X GET -H "Content-Type: application/json" -H "Cookie: "explorer_token=eyJhbxxx"" http://192.168.8.145:7002/api-open/v1/jobs/1964
```

code	number	0	0	API
message	string	Success		
data	object	-		
- id	number	1964	ID	
- name	string	workflow_xkkjf_20220712103332		
- workflowId	string	3992429968	ID	
- workflowName	string	workflow_xkkjf		
- status	number	2		API
- tasks	object	-		
- id	string	f93dea90fc3a11ecac7e6da0662c195b	ID	
- name	string	BFS		
-	datetime	2022-07-12T10:33:35+08:00		
runBeginTime				
- runEndTime	datetime	2022-07-12T10:33:38+08:00		
- status	number	2		API

```
{
  "cookie": [],
  "Content-Type": "application/json",
  "Traceparent": "00-3db17c9fd9e0a4c3824973471523d214-4384705e523dce83-00",
  "Date": "Fri, 15 Jul 2022 09:08:20 GMT",
  "Content-Length": "400"
}
{
  "code": 0,
  "data": {
    "id": 1964,
    "name": "workflow_xkkjf_20220712103332",
    "workflowId": "3992429968",
    "workflowName": "workflow_xkkjf",
    "status": 2,
    "tasks": [
      {
        "id": "f93dea90fc3a11ecac7e6da0662c195b",
        "name": "BFS",
        "runBeginTime": "2022-07-12T10:33:35+08:00",
        "runEndTime": "2022-07-12T10:33:38+08:00",
        "status": 2
      }
    ],
    "runBeginTime": 1657593215000,
    "runEndTime": 1657593218000,
    "createTime": 1657593212505
  },
  "message": "Success"
}
```

:January 13, 2023

API

API

```
api-open/v1/jobs/<job_id>/cancel
```

<job_id> ID

job_id	number	-	1964	ID	API
--------	--------	---	------	----	-----

Headers

Content-Type	string	-	application/x-www-form-urlencoded		
explorer_token	string	-	eyJhbxxx	Token	API

Body

```
curl -i -X PUT -H "Content-Type: application/x-www-form-urlencoded" -H "Cookie: \"explorer_token=eyJhbxxx\"" http://192.168.8.145:7002/api-open/v1/jobs/30600/cancel
```

code	number	0	0	API
message	string	Success		
data	object	-		
- success	bool	true		

```
{
  "cookie": [],
  "Content-Type": "application/json",
  "Traceparent": "00-8b4b47413a211d9b5e0839aadcc712052-4a98bae37fe5948a-00",
  "Date": "Mon, 18 Jul 2022 01:45:08 GMT",
  "Content-Length": "54"
}
{
  "code": 0,
  "data": {
    "success": true
  },
  "message": "Success"
}
```

:January 13, 2023

API

API

```
api-open/v1/jobs/<job_id>/tasks/<task_id>/sample_result
```

- <job_id> ID
- <task_id> ID

job_id	number	-	29987	ID	API
task_id	number	-	8c171f70fb6f11ecac7e6da0662c195b	ID	API

Headers

Content-Type	string	-	application/x-www-form-urlencoded		
explorer_token	string	-	eyJhbxxx	Token	API

Body

limit	number	10	-		
-------	--------	----	---	--	--

```
curl -i -X GET -H "Content-Type: application/x-www-form-urlencoded" -H "Cookie: "explorer_token=eyJhbxxx"" http://192.168.8.145:7002/api-open/v1/jobs/29987/tasks/8c171f70fb6f11ecac7e6da0662c195b/sample_result?limit=1000
```

code	number	0	0	API
message	string	Success		
data	object	-		
- items	list	-		
- result	string	"player110","0.150000"	2 3	

```
{
  "cookie": [],
  "Content-Type": "application/json",
  "Traceparent": "00-14047b04b6810be06be22e010f500506-4c310a844b824a7f-00",
  "Date": "Fri, 15 Jul 2022 09:36:56 GMT",
  "Content-Length": "2014"
}
```

```
{  
    "code": 0,  
    "data": {  
        "items": [  
            [ "player110",  
              "0.150000"  
            ],  
            [ "team219",  
              "0.452126"  
            ],  
            ....  
            [ "player121",  
              "0.262148"  
            ]  
        },  
        "message": "Success"  
    }  
}
```

: January 13, 2023

17.9

NebulaGraph Explorer iframe

17.9.1

Explorer

17.9.2

- Explorer
-

17.9.3

1. Explorer config/app-config.yaml

```
#   CertFile  KeyFile
CertFile: "./config/NebulaGraphExplorer.crt"
KeyFile: "./config/NebulaGraphExplorer.key"

#   IframeMode.Enable  true
IframeMode:
  Enable: true
#   URI
# Origins:
# - "http://192.168.8.8"
```

2. config openssl

```
openssl req -newkey rsa:4096 -x509 -sha512 -days 365 -nodes -subj "/CN=NebulaGraphExplorer.com" -out NebulaGraphExplorer.crt -keyout NebulaGraphExplorer.key
```

- -newkey
- -x509
- -sha512
- -days -x509
- -nodes
- -subj
- -out
- -keyout

3. iframe Explorer

4. postMessage

```
{ type: 'NebulaGraphExploreLogin',
  data: {
    authorization: 'WyJyb290IiwibmVidWxhIl0=',
    host: '192.168.8.240:9669',
    space: 'basketballplayer'
  }
}
```

- type NebulaGraphExploreLogin
- data
- authorization NebulaGraph Base64 [' ', ' '] ['root', 'nebula'] WyJyb290IiwibmVidWxhIl0=
- host NebulaGraph Graph
- space

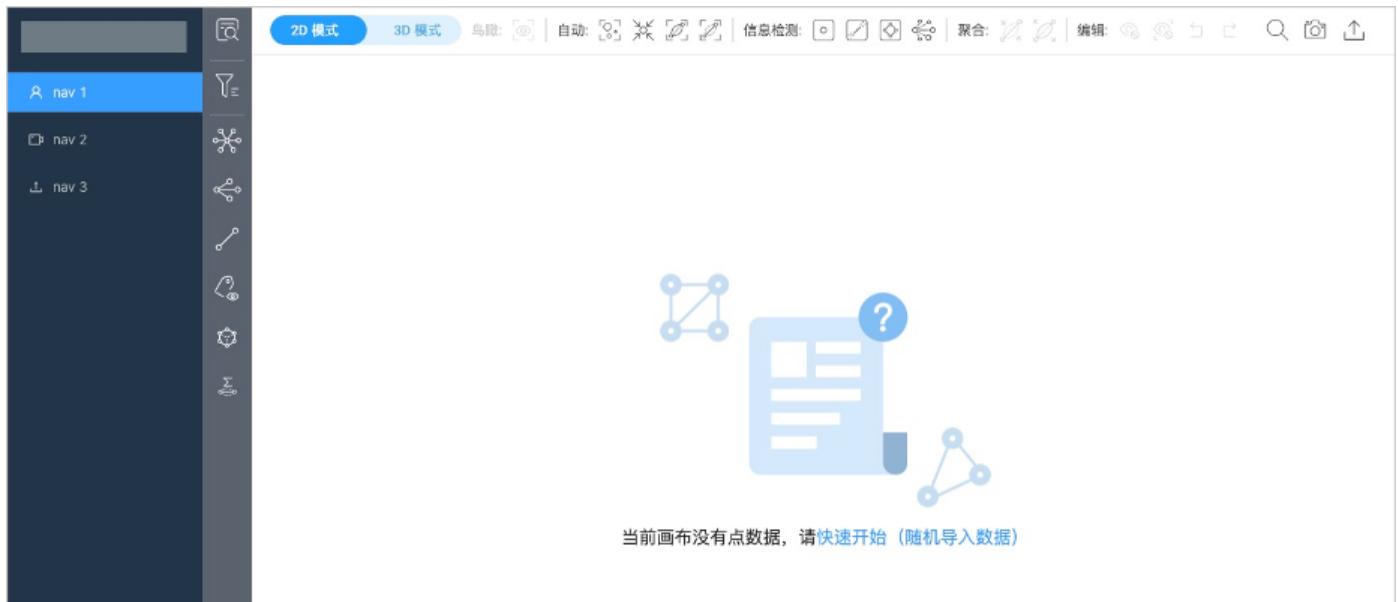
5. Explorer

NoteRPM/DEB Explorer `sudo ./nebula-explorer-server &``./scripts/start.sh`

6.

Explorer

basketballplayer



:January 13, 2023

17.10

Explorer

17.10.1

Shift

Shift

17.10.2

Enter

Shift + '.'

Shift + '+'

Shift + 'l'

Ctrl/Cmd + 'z'

Ctrl/Cmd + Shift + 'z'

Ctrl/Cmd + 'a'

+ 'del'

+ Shift + 'del'

: January 13, 2023

17.11 FAQ

Explorer

17.11.1 Graph

Dag Controller

Dag Controller

NebulaGraph Analytics

HDFS

NebulaGraph

17.11.2

17.11.3

Dag Controller

Graph

Graph

NebulaGraph Analytics

17.11.4 HDFS

running

HDFS

```
<configuration>
<property>
    <name>ipc.client.connect.timeout</name>
    <value>3000</value>
</property>

<property>
    <name>ipc.client.connect.max.retries.on.timeouts</name>
    <value>3</value>
</property>
</configuration>
```

17.11.5 Err:dial unix: missing address

dag-ctrl/etc/dag-ctrl-api.yaml SSH UserName

17.11.6 bash: /home/xxx/nebula-analytics/scripts/run_algo.sh: No such file or directory

dag-ctrl/etc/tasks.yaml exec_file

17.11.7 /lib64/libm.so.6: version 'GLIBC_2.29' not found (required by /home/vesoft/jdk-18.0.1/jre/lib/amd64/server/libjvm.so)

JDK18 YUM GLIBC_2.29 JDK1.8 nebula-analytics/scripts/set_env.sh JDK

17.11.8 handshake failed: ssh: unable to authenticate, attempted methods [none publickey], no supported methods remain

.ssh .ssh/authorized_keys .ssh 744 .ssh/authorized_keys 600

17.11.9

There are 0 NebulaGraph Analytics available. clusterSize should be less than or equal to it

17.11.9

There are 0 NebulaGraph Analytics available. clusterSize should be less than or equal to it

1. SSH

Dag Controller

ssh <user_name>@<node_ip>



Dag Controller Analytics

2. Dag Controller

- etc/dag-ctrl-api.yaml SSH Dag Controller SSH
- etc/tasks.yaml
- scripts/set_env.sh Hadoop Java

3. Dag Controller

17.11.10

no available namenodes: dial tcp xx.xx.xx.xx:8020: connect: connection timed out

HDFS namenode 8020

17.11.11

org.apache.hadoop.net.ConnectTimeoutException: 60000 millis timeout

HDFS datanode 50010

- Check failed: false close hdfs-file failed
- org.apache.hadoop.ipc.RemoteException(java.io.IOException): File /analytics/xx/tasks/analytics_xxx/xxx.csv could only be replicated to 0 nodes instead of minReplication

17.11.12

broadcast.hpp:193] Check failed: (size_t)recv_bytes >= sizeof(chunk_tail_t) recv message too small: 0

clusterSize processes

:January 13, 2023

18. NebulaGraph Importer

18.1 NebulaGraph Importer

NebulaGraph Importer Importer **NebulaGraph** CSV Importer CSV NebulaGraph

18.1.1

Importer CSV NebulaGraph

18.1.2

-
- CSV

18.1.3

[Release notes](#)

18.1.4

NebulaGraph Importer

- NebulaGraph
- [Docker Compose](#)
- [RPM/DEB](#)
-
- NebulaGraph Schema Tag Edge type `clientSettings.postStart.commands`
- Importer Golang [Golang](#)

18.1.5

yaml CSV NebulaGraph

1. [Release](#)

2.

```
$ ./<binary_package_name> --config <yaml_config_file_path>
```

1.

```
$ git clone -b release-3.1 https://github.com/vesoft-inc/nebula-importer.git
```

Note

NebulaGraph 2.x 3.x rpc

2. nebula-importer

```
$ cd nebula-importer
```

3.

```
$ make build
```

4.

```
$ ./nebula-importer --config <yaml_config_file_path>
```

Note

yaml

1.

```
$ git clone -b release-3.1 https://github.com/vesoft-inc/nebula-importer.git
```

2.

```
$ cd nebula-importer
$ go mod vendor
$ cd .. && tar -zcvf nebula-importer.tar.gz nebula-importer
```

3.

4.

```
$ tar -zxf nebula-importer.tar.gz
$ cd nebula-importer
$ go build -mod vendor cmd/importer.go
```

Docker

Docker

Go

NebulaGraph Importer

CSV

```
$ docker run --rm -ti \
--network=host \
-v <config_file>:<config_file> \
-v <csv_data_dir>:<csv_data_dir> \
vesoft/nebula-importer:<version>
--config <config_file>
```

- <config_file> yaml
- <csv_data_dir> CSV
- <version> NebulaGraph 3.x v3

Note

Docker

18.1.6

NebulaGraph Importer nebula-importer/examples/v2/example.yaml

NebulaGraph

/



```
version: v2
description: example
removeTempFiles: false
```

version	v2
description	example
removeTempFiles	false

NebulaGraph

```
clientSettings:
  retry: 3
  concurrency: 10
  channelBufferSize: 128
  space: test
  connection:
    user: user
    password: password
    address: 192.168.11.13:9669,192.168.11.14:9669
    # # local_config false           UPDATE CONFIGS
    # postStart:
    #   commands: |
    #     UPDATE CONFIGS storage:wal_ttl=3600;
    #     UPDATE CONFIGS storage:rocksdb_column_family_options = { disable_auto_compactions = true };
    #   afterPeriod: 8s
    # preStop:
    #   commands: |
```

```
#     UPDATE CONFIGS storage:wal_ttl=86400;
#     UPDATE CONFIGS storage:rocksdb_column_family_options = { disable_auto_compactions = false };
```

clientSettings.retry	3	nGQL
clientSettings.concurrency	10	NebulaGraph
clientSettings.channelBufferSize	128	NebulaGraph
clientSettings.space	-	NebulaGraph
clientSettings.connection.user	-	NebulaGraph
clientSettings.connection.password	-	NebulaGraph
clientSettings.connection.address	-	Graph
clientSettings.postStart.commands	-	NebulaGraph
clientSettings.postStart.afterPeriod	-	commands
clientSettings.preStop.commands	-	NebulaGraph

Schema

```
workingDir: ./data/
logPath: ./err/test.log
files:
  - path: ./student.csv
    failDataPath: ./err/student.csv
    batchSize: 128
    limit: 10
    inorder: false
    type: csv
    csv:
      withHeader: false
      withLabel: false
      delimiter: ","
```

workingDir	-	path	failDataPath
		./data/student.csv	./data/err/student.csv
logPath	-		
files.path	-		*
files.failDataPath	-		
files.batchSize	128		
files.limit	-		
files.inOrder	-	false	
files.type	-		
files.csv.withHeader	false	CSV	
files.csv.withLabel	false	LABEL	
files.csv.delimiter	","	CSV	

SCHEMA

Schema Meta Schema

```

schema:
  type: vertex
  vertex:
    vid:
      index: 1
      function: hash
      prefix: abc
    tags:
      - name: student
        props:
          - name: age
            type: int
            index: 2
          - name: name
            type: string
            index: 1
          - name: gender
            type: string
  
```

files.schema.type	-	Schema	vertex	edge
files.schema.vertex.vid.index	-	ID	CSV	
files.schema.vertex.vid.function	-	VID	hash	
files.schema.vertex.vid.type	-	ID	int string	
files.schema.vertex.vid.prefix	-	vid	function , VID	prefix , function VID
files.schema.vertex.tags.name	-	Tag		
files.schema.vertex.tags.props.name	-	Tag	NebulaGraph	Tag
files.schema.vertex.tags.props.type	-		bool int float double string time timestamp date datetime geography(linestring) geography(polygon)	
files.schema.vertex.tags.props.index	-	CSV		

Note

CSV 0 0 1

```

schema:
  type: edge
  edge:
    name: follow
    srcVID:
      index: 0
      function: hash
    dstVID:
      index: 1
      function:
    rank:
      index: 2
    props:
      - name: grade
  
```

```
type: int
index: 3
```

		Schema	vertex	edge
files.schema.type	-	Edge type		
files.schema.edge.name	-	ID	CSV	
files.schema.edge.srcVID.index	-	VID		hash
files.schema.edge.srcVID.function	-	ID	CSV	
files.schema.edge.dstVID.index	-	VID		hash
files.schema.edge.dstVID.function	-	rank	CSV	
files.schema.edge.rank.index	-	Edge type	NebulaGraph	Edge type
files.schema.edge.props.name	-	bool	int	float double timestamp string
files.schema.edge.props.type	-	geo		
files.schema.edge.props.index	-	CSV		

18.1.7 CSV header

Importer CSV

-
-

18.1.8

- [—NebulaGraph Importer](#) 3 09

:January 13, 2023

18.2

header CSV withHeader true CSV



CSV header Importer header Schema yaml

18.2.1

CSV

•

`student_with_header.csv`

```
:VID(string),student.name:string,student.age:int,student.gender:string
student100,Monica,16,female
student101,Mike,18,male
student102,Jane,17,female
```

ID name age gender

•

`follow_with_header.csv`

```
:SRC_VID(string),:DST_VID(string),:RANK,follow.degree:double
student100,student101,0,92.5
student101,student100,1,85.6
student101,student102,2,93.2
student100,student102,1,96.2
```

ID ID rank degree

18.2.2

rank

- :VID ID :VID(type) :VID(string) :VID(int)
- :SRC_VID ID :SRC_VID(type)
- :DST_VID ID :DST_VID(type)
- :RANK rank
- :IGNORE
- :LABEL + -

```
:LABEL,
+,
```



:LABEL CSV header

Tag Edge type <tag_name/edge_name>.<prop_name>:<prop_type>

- <tag_name/edge_name> Tag Edge type
- <prop_name>
- <prop_type> bool int float double timestamp string string

student.name:string follow.degree:double

18.2.3

```
#     NebulaGraph      3.x      v3
version: v3

description: example

#
removeTempFiles: false

clientSettings:

# nGQL
retry: 3

# NebulaGraph
concurrency: 10

#     NebulaGraph
channelBufferSize: 128

#             NebulaGraph
space: student

#
connection:
  user: root
  password: nebula
  address: 192.168.11.13:9669

postStart:
  #     NebulaGraph
  commands: |
    DROP SPACE IF EXISTS student;
    CREATE SPACE IF NOT EXISTS student(partition_num=5, replica_factor=1, vid_type=FIXED_STRING(20));
    USE student;
    CREATE TAG student(name string, age int, gender string);
    CREATE EDGE follow(degree int);

  #
  afterPeriod: 15s

preStop:
  #     NebulaGraph
  commands: |

#
logPath: ./err/test.log

# CSV
files:

  #
  - path: ./student_with_header.csv

  #
  failDataPath: ./err/studenterr.csv

  #
batchSize: 10

  #
  limit: 10

  #
  inOrder: true

  #             CSV
  type: csv

csv:
  #
  withHeader: true

  #
  withLabel: false

  #
  CSV
```

```
delimiter: ","

schema:
  # Schema      vertex   edge
  type: vertex

#
- path: ./follow_with_header.csv
  failDataPath: ./err/followerr.csv
  batchSize: 10
  limit: 10
  inOrder: true
  type: csv
  csv:
    withHeader: true
    withLabel: false
  schema:
    # Schema      edge
    type: edge
  edge:
    # Edge type
    name: follow

  #
  #      rank
  withRanking: true
```

Note

ID clientSettings.postStart.commands

: January 13, 2023

18.3

header CSV withHeader false CSV

18.3.1

CSV

•

`student_without_header.csv`

```
student100,Monica,16,female
student101,Mike,18,male
student102,Jane,17,female
```

ID	name	age	gender
----	------	-----	--------

•

`follow_without_header.csv`

```
student100,student101,0,92.5
student101,student100,1,85.6
student101,student102,2,93.2
student100,student102,1,96.2
```

ID	ID	rank	degree
----	----	------	--------

18.3.2

```
#     NebulaGraph      3.x      v3
version: v3

description: example

#
removeTempFiles: false

clientSettings:

# nGQL
retry: 3

# NebulaGraph
concurrency: 10

#     NebulaGraph
channelBufferSize: 128

#     NebulaGraph
space: student

#
connection:
  user: root
  password: nebula
  address: 192.168.11.13:9669

postStart:
  #     NebulaGraph
  commands: |
    DROP SPACE IF EXISTS student;
    CREATE SPACE IF NOT EXISTS student(partition_num=5, replica_factor=1, vid_type=FIXED_STRING(20));
    USE student;
    CREATE TAG student(name string, age int, gender string);
    CREATE EDGE follow(degree int);

#
afterPeriod: 15s

preStop:
  #     NebulaGraph
  commands: |

#
logPath: ./err/test.log
```

```

# CSV
files:
  #
  - path: ./student_without_header.csv

  #
  failDataPath: ./err/studentterr.csv

  #
  batchSize: 10

  #
  limit: 10

  #
  inOrder: false
  type: csv

  csv:
    #
    withHeader: false

    #
    withLabel: false

    #
    delimiter: ","

schema:
  # Schema      vertex   edge
  type: vertex

vertex:
  #
  ID
  vid:
    # ID      CSV      CSV      0
    index: 0

    # ID      int     string   NebulaGraph   INT64   FIXED_STRING
    type: string

  # Tag
  tags:
    # Tag
    - name: student

    # Tag
    props:
      #
      - name: name

      #
      type: string

      #
      CSV
      index: 1

      - name: age
      type: int
      index: 2
      - name: gender
      type: string
      index: 3

  #
  - path: ./follow_without_header.csv
  failDataPath: ./err/followerr.csv
  batchSize: 10
  limit: 10
  inOrder: true
  type: csv
  csv:
    withHeader: false
    withLabel: false
  schema:
    # Schema      edge
    type: edge
  edge:
    # Edge type
    name: follow

    #
    rank
    withRanking: true

    #
    ID
    srcVID:
      #
      type: string

```

```

#      ID      CSV
index: 0

#      ID
dstVID:
  type: string
index: 1

# rank
rank:
  # rank      CSV           index      rank
  index: 2

# Edge type
props:
  #
  - name: degree

  #
  type: double

#      CSV
index: 3

```

Note

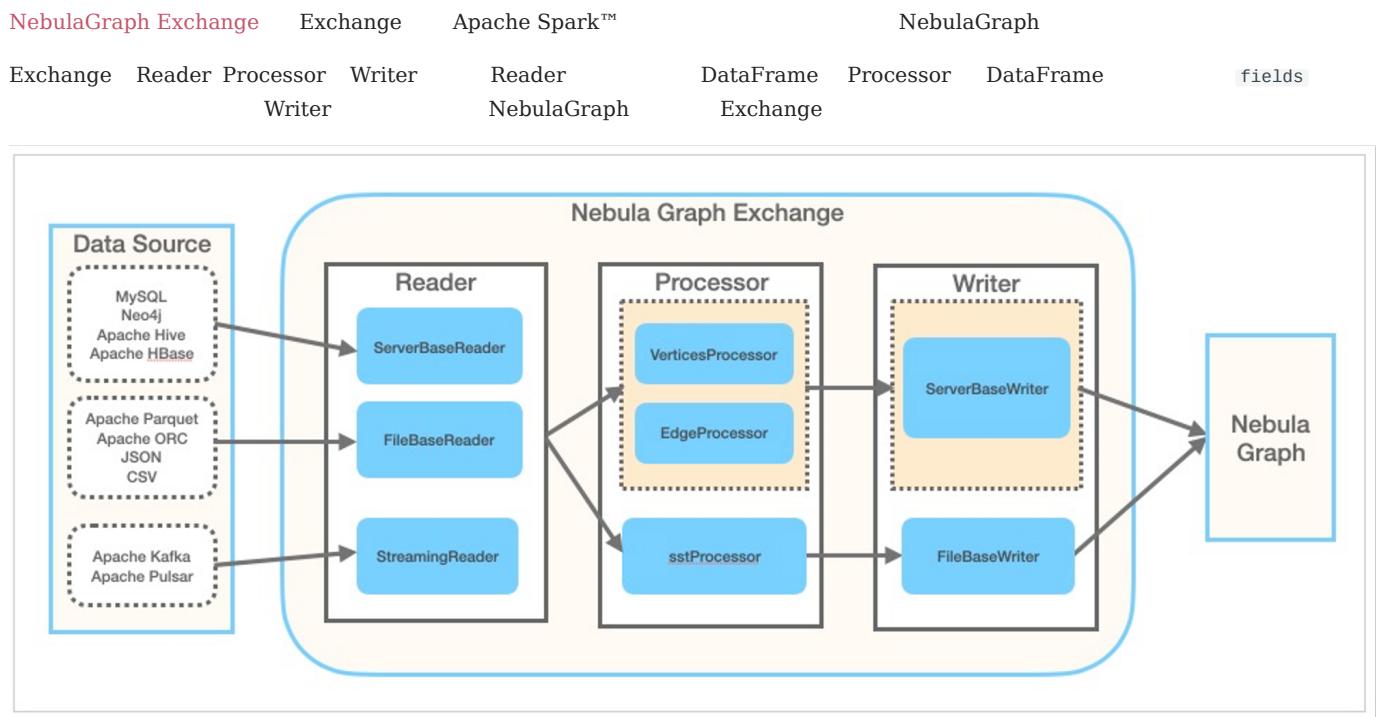
- CSV 0 0 1
 - ID clientSettings.postStart.commands
 - index CSV
 - ID
 - ID ID withRanking true rank
-

:January 13, 2023

19. NebulaGraph Exchange

19.1 NebulaGraph Exchange

19.1.1 NebulaGraph Exchange



Exchange GitHub NebulaGraph

Exchange

- Kafka Pulsar NebulaGraph
- MySQL HDFS NebulaGraph
- NebulaGraph SST NebulaGraph
- NebulaGraph

Enterpriseonly

Exchange NebulaGraph

Exchange

- NebulaGraph
- SST SST
- SSL Exchange NebulaGraph SSL
-



Neo4j

- Graph
- Tag Edge type Tag Edge type
- Apache Spark™
- HOCON Human-Optimized Config Object Notation

NebulaGraph Exchange JAR NebulaGraph Spark

Exchange	NebulaGraph	Spark
nebula-exchange_spark_3.0-3.0-SNAPSHOT.jar	nightly	3.3.x 3.2.x 3.1.x 3.0.x
nebula-exchange_spark_2.4-3.0-SNAPSHOT.jar	nightly	2.4.x
nebula-exchange_spark_2.2-3.0-SNAPSHOT.jar	nightly	2.2.x
nebula-exchange_spark_3.0-3.3.0.jar	3.x.x	3.3.x 3.2.x 3.1.x 3.0.x
nebula-exchange_spark_2.4-3.3.0.jar	3.x.x	2.4.x
nebula-exchange_spark_2.2-3.3.0.jar	3.x.x	2.2.x
nebula-exchange_spark_3.0-3.0.0.jar	3.x.x	3.3.x 3.2.x 3.1.x 3.0.x
nebula-exchange_spark_2.4-3.0.0.jar	3.x.x	2.4.x
nebula-exchange_spark_2.2-3.0.0.jar	3.x.x	2.2.x
nebula-exchange-2.6.3.jar	2.6.1 2.6.0	2.4.x
nebula-exchange-2.6.2.jar	2.6.1 2.6.0	2.4.x
nebula-exchange-2.6.1.jar	2.6.1 2.6.0	2.4.x
nebula-exchange-2.6.0.jar	2.6.1 2.6.0	2.4.x
nebula-exchange-2.5.2.jar	2.5.1 2.5.0	2.4.x
nebula-exchange-2.5.1.jar	2.5.1 2.5.0	2.4.x
nebula-exchange-2.5.0.jar	2.5.1 2.5.0	2.4.x
nebula-exchange-2.1.0.jar	2.0.1 2.0.0	2.4.x
nebula-exchange-2.0.1.jar	2.0.1 2.0.0	2.4.x
nebula-exchange-2.0.0.jar	2.0.1 2.0.0	2.4.x

JAR maven

Exchange 3.3.0

NebulaGraph

nGQL

NebulaGraph

- HDFS
- Apache Parquet
- Apache ORC
- JSON
- CSV
- Apache HBase™
-
- Hive
- MaxCompute

- Neo4j Client 2.4.5-M1
-
- MySQL
- PostgreSQL
- Oracle
- ClickHouse
- Apache Kafka®
- / Apache Pulsar 2.4.5
- JDBC

nGQL

Exchange

SST

Console SST

Release

- NebulaGraph ——Exchange 3 08

:January 13, 2023

19.1.2

Exchange 3.3.0

Exchange 3.x

- CentOS 7
- macOS

Exchange

- Java 1.8
- Scala 2.10.7 2.11.12 2.12.10
- Apache Spark Exchange Spark

Note

Exchange Spark JAR Spark 2.4 nebula-exchange_spark_2.4-3.3.0.jar

Spark 2.2

Spark 2.4

Spark 3

CSV

JSON

ORC

Parquet

HBase

MySQL

PostgreSQL

Oracle

ClickHouse

Neo4j

Hive

MaxCompute

Pulsar

Kafka

NebulaGraph

Hadoop Distributed File System (HDFS)

- HDFS
- SST

: January 13, 2023

19.2 NebulaGraph Exchange

NebulaGraph Exchange JAR

19.2.1 JAR

Exchange JAR

Exchange NebulaGraph

19.2.2 JAR

Exchange JAR

Exchange

 **Enterpriseonly**

Exchange NebulaGraph

- [Maven](#)
- [Spark](#) [Spark](#)

1. nebula-exchange

```
git clone -b release-3.3 https://github.com/vesoft-inc/nebula-exchange.git
```

2. nebula-exchange

```
cd nebula-exchange
```

3. Exchange Spark Exchange

- [Spark 2.2](#)

```
mvn clean package -Dmaven.test.skip=true -Dgpg.skip -Dmaven.javadoc.skip=true \
-p1 nebula-exchange_spark_2.2 -am -Pscala-2.11 -Pspark-2.2
```

- [Spark 2.4](#)

```
mvn clean package -Dmaven.test.skip=true -Dgpg.skip -Dmaven.javadoc.skip=true \
-p1 nebula-exchange_spark_2.4 -am -Pscala-2.11 -Pspark-2.4
```

- [Spark 3.0](#)

```
mvn clean package -Dmaven.test.skip=true -Dgpg.skip -Dmaven.javadoc.skip=true \
-p1 nebula-exchange_spark_3.0 -am -Pscala-2.12 -Pspark-3.0
```

nebula-exchange_spark_x.x/target/ nebula-exchange_spark_x.x-release-3.3.jar x.x Spark 2.4

 **Note**

JAR

NebulaGraph Java Client

[Releases](#)

target/classes/application.conf

- Maven libexec/conf/settings.xml mirror

```
<mirror>
<id>alimaven</id>
<mirrorOf>central</mirrorOf>
<name>aliyun maven</name>
<url>http://maven.aliyun.com/nexus/content/repositories/central/</url>
</mirror>
```

:January 13, 2023

19.3

19.3.1

NebulaGraph

```
<spark_install_path>/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange <nebula-exchange-2.x.y.jar_path> -c <application.conf_path>
```

- reload

reload -r reload

```
<spark_install_path>/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange <nebula-exchange-2.x.y.jar_path> -c <application.conf_path> -r "<reload_file_path>"
```

Note

JAR

FAQ

yarn-cluster --conf

```
$SPARK_HOME/bin/spark-submit --master yarn-cluster \
--class com.vesoft.nebula.exchange.Exchange \
--files application.conf \
--conf spark.driver.extraClassPath=./ \
--conf spark.executor.extraClassPath=./ \
--name nebula-exchange-3.3.0.jar \
--c application.conf
```

--class

--master

Spark master URL:

master-urls

-c / --config

Hive

-D / --dry

-1 / --Reload

Reload

Spark

: January 13, 2023

19.3.2

NebulaGraph Exchange `application.conf`
 CSV `csv_application.conf`

- Spark

- Hive

- NebulaGraph

-

-

Spark

Spark

<code>spark.app.name</code>	string	-	Spark
<code>spark.driver.cores</code>	int	1	CPU
<code>spark.driver.maxResultSize</code>	string	1G 1M 0	Spark collect
<code>spark.executor.memory</code>	string	1G	Spark 512M 1G
<code>spark.cores.max</code>	int	16	" " Mesos CPU Spark <code>spark.deploy.defaultCores</code> Mesos infinite

Hive

Spark Hive

Hive

<code>hive.warehouse</code>	string	-	HDFS warehouse <code>hdfs://</code>
<code>hive.connectionURL</code>	string	-	JDBC URL " <code>jdbc:mysql://127.0.0.1:3306/hive_spark?characterEncoding=UTF-8</code> "
<code>hive.connectionDriverName</code>	string	" <code>com.mysql.jdbc.Driver</code> "	
<code>hive.connectionUserName</code>	list[string]	-	
<code>hive.connectionPassword</code>	list[string]	-	

nebula.address.graph	list[string]	["127.0.0.1:9669"]	Graph	IP	,
					["ip1:port1","ip2:port2","ip3:port3"]
nebula.address.meta	list[string]	["127.0.0.1:9559"]	Meta	IP	,
					["ip1:port1","ip2:port2","ip3:port3"]
nebula.user	string	-	NebulaGraph		
nebula.pswd	string	-			
nebula.space	string	-			
nebula.ssl.enable.graph	bool	false	Exchange	Graph	SSL
			true	SSL	Exchange
				SSL	
nebula.ssl.enable.meta	bool	false	Exchange	Meta	SSL
			true	SSL	Exchange
				SSL	
nebula.ssl.sign	string	ca	ca	CA	self
nebula.ssl.ca.param.caCrtFilePath	string	"/path/caCrtFilePath"	nebula.ssl.sign	ca	CA
nebula.ssl.ca.param.crtFilePath	string	"/path/crtFilePath"	nebula.ssl.sign	ca	CRT
nebula.ssl.ca.param.keyFilePath	string	"/path/keyFilePath"	nebula.ssl.sign	ca	
nebula.ssl.self.param.crtFilePath	string	"/path/crtFilePath"	nebula.ssl.sign	self	CRT
nebula.ssl.self.param.keyFilePath	string	"/path/keyFilePath"	nebula.ssl.sign	self	
nebula.ssl.self.param.password	string	"nebula"	nebula.ssl.sign	self	
nebula.path.local	string	"/tmp"	SST	SST	
nebula.path.remote	string	"/sst"	SST	SST	
nebula.path.hdfs.namenode	string	"hdfs://name_node:9000"	SST	HDFS	namenode
nebula.connection.timeout	int	3000	Thrift	ms	
nebula.connection.retry	int	3	Thrift		
nebula.execution.retry	int	3	nGQL		
nebula.error.max	int	32			Spark
nebula.error.output	string	/tmp/errors			nGQL

nebula.rate.limit	int	1024
nebula.rate.timeout	int	1000

Note

NebulaGraph	Tag	Tag	Tag	Exchange	nebula.enableTagless	true
-------------	-----	-----	-----	----------	----------------------	------

```
nebula: {
    address: {
        graph: ["127.0.0.1:9669"]
        meta: ["127.0.0.1:9559"]
    }
    user: root
    pswd: nebula
    space: test
    enableTagless: true
    .....
}
```

tags.name	string	-	NebulaGraph	Tag
tags.type.source	string	-		csv
tags.type.sink	string	client		client SST
tags.fields	list[string]	-		CSV [_c0, _c1, _c2]
tags.nebula.fields	list[string]	-	NebulaGraph	tags.fields [_c1, _c2] [name, age] name age
tags.vertex.field	string	-	ID	CSV _c0 ID
tags.batch	int	256		NebulaGraph
tags.partition	int	32		Spark

PARQUET/JSON/ORC

tags.path	string	-	HDFS	hdfs://
CSV				
tags.path	string	-	HDFS	hdfs://
tags.separator	string	,	,	,
tags.header	bool	true		

HIVE

tags.exec	string	-	select name,age from mooc.users
-----------	--------	---	---------------------------------

MAXCOMPUTE

tags.table	string	-	MaxCompute
tags.project	string	-	MaxCompute
tags.odpsUrl	string	-	MaxCompute odpsUrl
tags.tunnelUrl	string	-	MaxCompute tunnelUrl
tags.accessKeyId	string	-	MaxCompute accessKeyId
tags.accessKeySecret	string	-	MaxCompute accessKeySecret
tags.partitionSpec	string	-	MaxCompute
tags.numPartitions	int	1	MaxCompute Spark MaxCompute
tags.sentence	string	-	SQL table

NEO4J

tags.exec	string	-	match (n:label) return n.neo4j-field-0
tags.server	string	"bolt://127.0.0.1:7687"	Neo4j
tags.user	string	-	Neo4j
tags.password	string	-	Neo4j
tags.database	string	-	Neo4j
tags.check_point_path	string	/tmp/test	

MYSQL/POSTGRESQL

tags.host	string	-	MySQL/PostgreSQL
tags.port	string	-	MySQL/PostgreSQL
tags.database	string	-	
tags.table	string	-	
tags.user	string	-	MySQL/PostgreSQL
tags.password	string	-	
tags.sentence	string	-	"select teamid, name from team order by teamid"

ORACLE

tags.url	string	-	Oracle
tags.driver	string	-	Oracle
tags.user	string	-	Oracle
tags.password	string	-	
tags.table	string	-	
tags.sentence	string	-	"select playerid, name, age from player"

CLICKHOUSE

tags.url	string	-	ClickHouse JDBC URL
tags.user	string	-	ClickHouse
tags.password	string	-	
tags.numPartition	string	-	ClickHouse
tags.sentence	string	-	

HBASE

tags.host	string	127.0.0.1	Hbase
tags.port	string	2181	Hbase
tags.table	string	-	
tags.columnFamily	string	-	column family

PULSAR

tags.service	string	"pulsar://localhost:6650"	Pulsar
tags.admin	string	"http://localhost:8081"	pulsar admin.url
tags.options.<topic\ topics\ \ topicsPattern>	string	-	Pulsar topic topics topicsPattern
tags.interval.seconds	int	10	

KAFKA

tags.service	string	-	Kafka
tags.topic	string	-	
tags.interval.seconds	int	10	

SST

<code>tags.path</code>	string	-	SST		
<code>tags.repartitionWithNebula</code>	bool	true	SST	NebulaGraph DOWNLOAD	partition INGEST SST

tags edges

<code>edges.name</code>	string	-	NebulaGraph	Edge type
<code>edges.type.source</code>	string	-		csv
<code>edges.type.sink</code>	string	client		client SST
<code>edges.fields</code>	list[string]	-		CSV [_c0, _c1, _c2]
<code>edges.nebula.fields</code>	list[string]	-	NebulaGraph [_c2, _c3]	edges.fields [start_year, end_year]
<code>edges.source.field</code>	string	-		_c0
<code>edges.target.field</code>	string	-		_c1
<code>edges.ranking</code>	int	-	rank	rank 0
<code>edges.batch</code>	int	256	NebulaGraph	
<code>edges.partition</code>	int	32	Spark	

SST

<code>edges.path</code>	string	-	SST		
<code>edges.repartitionWithNebula</code>	bool	true	SST	NebulaGraph DOWNLOAD	partition INGEST SST

NEBULAGRAPH

edges.path	string	"hdfs://namenode:9000/path/edge"	CSV	Exchange	HDFS
			"follow"	"file:///path/edge"	"file:///home/nebula/edge/follow"
			Edge	Edge	
edges.noField	bool	false	true VID VID	VID VID	Rank Rank
edges.return.fields	list	[]		start_year ["start_year", "end_year"]	end_year edges.noField false

:January 13, 2023

19.4 NebulaGraph Exchange

19.4.1 CSV

Exchange HDFS CSV NebulaGraph
NebulaGraph CSV **NebulaGraph Importer**

basketballplayer

MacOS

-
- CPU 1.7 GHz Quad-Core Intel Core i7
- 16 GB
- Spark 2.4.7
- Hadoop 2.9.2
- NebulaGraph 3.3.0 **Docker Compose**

- **NebulaGraph**
- Graph Meta IP
- NebulaGraph
- Exchange **Exchange** Exchange 3.3.0
- Spark
- NebulaGraph Schema Tag Edge type
- HDFS Hadoop
- NebulaGraph

1 NEBULAGRAPH SCHEMA

CSV NebulaGraph Schema

1. Schema NebulaGraph Schema

Tag	player	name string, age int
Tag	team	name string
Edge Type	follow	degree int
Edge Type	serve	start_year int, end_year int

2. NebulaGraph Console basketballplayer Schema

```
## nebula> CREATE SPACE basketballplayer \
    (partition_num = 10, \
     replica_factor = 1, \
     vid_type = FIXED_STRING(30));

##      basketballplayer
nebula> USE basketballplayer;

##      Tag player
nebula> CREATE TAG player(name string, age int);

##      Tag team
nebula> CREATE TAG team(name string);

##      Edge type follow
nebula> CREATE EDGE follow(degree int);

##      Edge type serve
nebula> CREATE EDGE serve(start_year int, end_year int);
```

2 CSV

1. CSV Schema



Exchange CSV

2. CSV

3

Exchange target/classes/application.conf CSV csv_application.conf

```
{
  # Spark
  spark: {
    app: {
      name: NebulaGraph Exchange 3.3.0
    }
    driver: {
      cores: 1
      maxResultSize: 1G
    }
    executor: {
      memory:1G
    }
  }

  cores: {
    max: 16
  }
}
```

```

}

# NebulaGraph
nebula: {
  address: {
    # Graph     Meta     IP
    #
    # "ip1:port", "ip2:port", "ip3:port"
    graph: ["127.0.0.1:9669"]
    meta: ["127.0.0.1:9559"]
  }
}

#      NebulaGraph
user: root
pswd: nebula

#
space: basketballplayer
connection: {
  timeout: 3000
  retry: 3
}
execution: {
  retry: 3
}
error: {
  max: 32
  output: /tmp/errors
}
rate: {
  limit: 1024
  timeout: 1000
}
}

#
tags: [
  # Tag player
{
  # NebulaGraph     Tag
  name: player
  type: {
    # CSV
    source: csv

      # NebulaGraph Client   SST
      sink: client
  }

  # CSV
  # HDFS           hdfs://  "hdfs://ip:port/xx/xx"
  # file://        "file:///tmp/xx.csv"
  path: "hdfs://192.168.*.*:9000/data/vertex_player.csv"

  # CSV          [_c0, _c1, _c2, ..., _cn]
  # CSV
  fields: [_c1, _c2]

  # NebulaGraph
  # fields  nebula.fields
  nebula.fields: [age, name]

  # VID
  # vertex      fields   csv.fields
  # NebulaGraph 3.3.0      VID
  vertex: {
    field_c0
    # policy:hash
  }

  #
  separator: ","
}

#      CSV
header: true
# CSV      header  false   false
header: false

#      NebulaGraph
batch: 256

#      Spark
partition: 32
}

# Tag team
{
  # NebulaGraph     Tag
  name: team
  type: {
    # CSV
    source: csv

      # NebulaGraph Client   SST
      sink: client
}

```

```

}

#   CSV
#       HDFS          hdfs://      "hdfs://ip:port/xx/xx"
#           file://      "file:///tmp/xx.csv"
path: "hdfs://192.168.*.*:9000/data/vertex_team.csv"

#   CSV      [_c0, _c1, _c2, ..., _cn]
#   CSV
fields: [_c1]

#   NebulaGraph
# fields  nebula.fields
nebula.fields: [name]

#       VID
# vertex      fields  csv.fields
# NebulaGraph 3.3.0          VID
vertex: {
    field:_c0
    # policy:hash
}

# separator: ","
header: false

#   CSV      header  true
#   CSV      header  false   false
#       NebulaGraph
batch: 256

#   Spark
partition: 32
}

# ]
edges: [
    # Edge type follow
{
    #   NebulaGraph      Edge type
    name: follow
    type: {
        #   CSV
        source: csv

        #       NebulaGraph Client  SST
        sink: client
    }

    #   CSV
    #       HDFS          hdfs://      "hdfs://ip:port/xx/xx"
    #           file://      "file:///tmp/xx.csv"
path: "hdfs://192.168.*.*:9000/data/edge_follow.csv"

#   CSV      [_c0, _c1, _c2, ..., _cn]
#   CSV
fields: [_c2]

#   NebulaGraph
# fields  nebula.fields
nebula.fields: [degree]

#       VID
# vertex      fields  csv.fields
# NebulaGraph 3.3.0          VID
source: {
    field: _c0
}
target: {
    field: _c1
}

# separator: ","
#       rank
#ranking: rank

#   CSV      header  true
#   CSV      header  false   false
#       NebulaGraph
batch: 256

#   Spark
partition: 32
}

```

```

#   Edge type serve
{
  #   NebulaGraph      Edge type
  name: serve
  type: {
    #           CSV
    source: csv

    #           NebulaGraph Client  SST
    sink: client
  }

  #   CSV
  #   HDFS          hdfs://      "hdfs://ip:port/xx/xx"
  #           file:///      "file:///tmp/xx.csv"
  path: "hdfs://192.168.*.*:9000/data/edge_serve.csv"

  #   CSV          [_c0, _c1, _c2, ..., _cn]
  #   CSV
  fields: [_c2,_c3]

  #   NebulaGraph
  # fields  nebula.fields
  nebula.fields: [start_year, end_year]

  #
  # vertex      fields  csv.fields
  #   NebulaGraph 3.3.0      VID
  source: {
    field: _c0
  }
  target: {
    field: _c1
  }

  #
  separator: ","
  #rank
  #ranking: _c5

  #   CSV      header  true
  #   CSV      header  false   false
  header: false

  #   NebulaGraph
  batch: 256

  #   Spark
  partition: 32
}

]
#
}

```

4 NEBULAGRAPH

CSV NebulaGraph

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange <nebula-exchange-3.3.0.jar_path> -c <csv_application.conf_path>
```

Note

JAR

maven

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange /root/nebula-exchange/nebula-exchange/target/nebula-exchange-3.3.0.jar -c /root/nebula-exchange/nebula-exchange/target/classes/csv_application.conf
```

batchSuccess.<tag_name/edge_name> batchSuccess.follow: 300

5

NebulaGraph NebulaGraph Studio

```
GO FROM "player100" OVER follow;
```

SHOW STATS

NebulaGraph

:January 13, 2023

19.4.2 JSON

Exchange HDFS JSON NebulaGraph

basketballplayer

- player

```
{"id": "player100", "age": 42, "name": "Tim Duncan"}  
{"id": "player101", "age": 36, "name": "Tony Parker"}  
{"id": "player102", "age": 33, "name": "LaMarcus Aldridge"}  
{"id": "player103", "age": 32, "name": "Rudy Gay"}  
...
```

- team

```
{"id": "team200", "name": "Warriors"}  
{"id": "team201", "name": "Nuggets"}  
...
```

- follow

```
{"src": "player100", "dst": "player101", "degree": 95}  
{"src": "player101", "dst": "player102", "degree": 90}  
...
```

- serve

```
{"src": "player100", "dst": "team204", "start_year": "1997", "end_year": "2016"}  
{"src": "player101", "dst": "team204", "start_year": "1999", "end_year": "2018"}  
...
```

MacOS

-
- CPU 1.7 GHz Quad-Core Intel Core i7
 - 16 GB
- Spark 2.3.0
- Hadoop 2.9.2
- NebulaGraph 3.3.0 [Docker Compose](#)

- **NebulaGraph**
- Graph Meta IP
- NebulaGraph
- Exchange Exchange Exchange 3.3.0
- Spark
- NebulaGraph Schema Tag Edge type
- HDFS Hadoop
- NebulaGraph

1 NEBULAGRAPH SCHEMA

NebulaGraph Schema

1. Schema NebulaGraph Schema

Tag	player	name string, age int
Tag	team	name string
Edge Type	follow	degree int
Edge Type	serve	start_year int, end_year int

2. NebulaGraph Console basketballplayer Schema

```
## nebula> CREATE SPACE basketballplayer \
  (partition_num = 10, \
  replica_factor = 1, \
  vid_type = FIXED_STRING(30));

##     basketballplayer
nebula> USE basketballplayer;

##     Tag player
nebula> CREATE TAG player(name string, age int);

##     Tag team
nebula> CREATE TAG team(name string);

##     Edge type follow
nebula> CREATE EDGE follow(degree int);

##     Edge type serve
nebula> CREATE EDGE serve(start_year int, end_year int);
```

2 JSON

1. JSON Schema
2. JSON

3.

Exchange	target/classes/application.conf	JSON	json_application.conf
----------	---------------------------------	------	-----------------------

```
{
  # Spark
  spark: {
    app: {
      name: NebulaGraph Exchange 3.3.0
    }
    driver: {
      cores: 1
      maxResultSize: 1G
    }
    executor: {
      memory:1G
    }

    cores: {
      max: 16
    }
  }

  # NebulaGraph
  nebula: {
    address:{ 
      # Graph     Meta     IP
      # ,
      # "ip1:port","ip2:port","ip3:port"
      graph:["127.0.0.1:9669"]
      meta:["127.0.0.1:9559"]
    }
  }

  # NebulaGraph
  user: root
  pswd: nebula

  #
  space: basketballplayer
  connection: {
    timeout: 3000
    retry: 3
  }
  execution: {
    retry: 3
  }
  error: {
    max: 32
    output: /tmp/errors
  }
  rate: {
    limit: 1024
    timeout: 1000
  }
}

#
tags: [
  # Tag player
  {
    # NebulaGraph     Tag
    name: player
    type: {
      # JSON
      source: json

      # NebulaGraph Client   SST
      sink: client
    }

    # JSON
    # HDFS           hdfs://      "hdfs://ip:port/xx/xx"
    # file://        "file:///tmp/xx.json"
    path: "hdfs://192.168.*.*:9000/data/vertex_player.json"

    # fields   JSON   key       value   NebulaGraph
    # ,
    fields: [age,name]

    # NebulaGraph
    # fields   nebula.fields
    nebula.fields: [age, name]

    # VID
    # vertex   JSON
    # NebulaGraph 3.3.0          VID
    vertex: {
      field:id
    }

    # NebulaGraph
    batch: 256
  }
]
```

```

#   Spark
partition: 32
}

#   Tag team
{
#     NebulaGraph      Tag
name: team
type: {
#       JSON
source: json

#           NebulaGraph Client  SST
sink: client
}

#   JSON
#       HDFS          hdfs://    "hdfs://ip:port/xx/xx"
#           file://    "file:///tmp/xx.json"
path: "hdfs://192.168.*.*:9000/data/vertex_team.json"

#   fields  JSON   key        value    NebulaGraph
#   ,
fields: [name]

#   NebulaGraph
# fields  nebula.fields
nebula.fields: [name]

#   VID
# vertex   JSON
#   NebulaGraph 3.3.0          VID
vertex: {
field:id
}

#           NebulaGraph
batch: 256

#   Spark
partition: 32
}

#
]

#
edges: [
#   Edge type follow
{
#     NebulaGraph      Edge type
name: follow
type: {
#       JSON
source: json

#           NebulaGraph Client  SST
sink: client
}

#   JSON
#       HDFS          hdfs://    "hdfs://ip:port/xx/xx"
#           file://    "file:///tmp/xx.json"
path: "hdfs://192.168.*.*:9000/data/edge_follow.json"

#   fields  JSON   key        value    NebulaGraph
#   ,
fields: [degree]

#   NebulaGraph
# fields  nebula.fields
nebula.fields: [degree]

#
# vertex   JSON
#   NebulaGraph 3.3.0          VID
source: {
field: src
}
target: {
field: dst
}

#   rank
#ranking: rank

#           NebulaGraph
batch: 256

#   Spark
partition: 32
}

#   Edge type serve
{

```

```

#   NebulaGraph      Edge type
name: serve
type: {
    #           JSON
    source: json

    #           NebulaGraph Client  SST
    sink: client
}

#   JSON
#   HDFS          hdfs://      "hdfs://ip:port/xx/xx"
#   file://        "file:///tmp/xx.json"
path: "hdfs://192.168.*.*:9000/data/edge_serve.json"

#   fields      JSON     key       value      NebulaGraph
#
#fields: [start_year,end_year]

#   NebulaGraph
# fields  nebula.fields
nebula.fields: [start_year, end_year]

#
# vertex      JSON
# NebulaGraph 3.3.0      VID
source: {
    field: src
}
target: {
    field: dst
}

#   rank
#ranking: _c5

#   NebulaGraph
batch: 256

#   Spark
partition: 32
}

]
#
}

```

4 NEBULAGRAPH

JSON NebulaGraph

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange <nebula-exchange-3.3.0.jar_path> -c <json_application.conf_path>
```



JAR maven

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange /root/nebula-exchange/nebula-exchange/target/nebula-exchange-3.3.0.jar -c /root/nebula-exchange/nebula-exchange/target/classes/json_application.conf
```

batchSuccess.<tag_name/edge_name> batchSuccess.follow: 300

5

NebulaGraph NebulaGraph Studio

```
GO FROM "player100" OVER follow;
```

[SHOW STATS](#)

6 NEBULAGRAPH

NebulaGraph

:January 13, 2023

19.4.3 ORC

Exchange HDFS ORC NebulaGraph
NebulaGraph ORC **NebulaGraph Importer**

basketballplayer

MacOS

-
- CPU 1.7 GHz Quad-Core Intel Core i7
- 16 GB
- Spark 2.4.7
- Hadoop 2.9.2
- NebulaGraph 3.3.0 **Docker Compose**

- **NebulaGraph**
- Graph Meta IP
- NebulaGraph
- Exchange **Exchange** Exchange 3.3.0
- Spark
- NebulaGraph Schema Tag Edge type
- HDFS Hadoop
- NebulaGraph

1 NEBULAGRAPH SCHEMA

ORC NebulaGraph Schema

1. Schema NebulaGraph Schema

Tag	player	name string, age int
Tag	team	name string
Edge Type	follow	degree int
Edge Type	serve	start_year int, end_year int

2. NebulaGraph Console basketballplayer Schema

```
## nebula> CREATE SPACE basketballplayer \
    (partition_num = 10, \
     replica_factor = 1, \
     vid_type = FIXED_STRING(30));

##      basketballplayer
nebula> USE basketballplayer;

##      Tag player
nebula> CREATE TAG player(name string, age int);

##      Tag team
nebula> CREATE TAG team(name string);

##      Edge type follow
nebula> CREATE EDGE follow(degree int);

##      Edge type serve
nebula> CREATE EDGE serve(start_year int, end_year int);
```

2 ORC

1. ORC Schema

2. ORC

3

Exchange target/classes/application.conf ORC orc_application.conf

```
{
  # Spark
  spark: {
    app: {
      name: NebulaGraph Exchange 3.3.0
    }
    driver: {
      cores: 1
      maxResultSize: 1G
    }
    executor: {
      memory: 1G
    }

    cores: {
      max: 16
    }
  }

  # NebulaGraph
  nebula: {
    address: {
      # Graph     Meta     IP
      #           ,
      #       "ip1:port", "ip2:port", "ip3:port"
    }
  }
}
```

```

graph:["127.0.0.1:9669"]
meta:["127.0.0.1:9559"]
}

#      NebulaGraph
user: root
pswd: nebula

#
space: basketballplayer
connection: {
    timeout: 3000
    retry: 3
}
execution: {
    retry: 3
}
error: {
    max: 32
    output: /tmp/errors
}
rate: {
    limit: 1024
    timeout: 1000
}
}

#
tags: [
    #      Tag player
{
    #      NebulaGraph      Tag
    name: player
    type: {
        #          ORC
        source: orc

        #      NebulaGraph Client  SST
        sink: client
    }
}

#      ORC
#      HDFS          hdf://      "hdfs://ip:port/xx/xx"
#      file://      "file:///tmp/xx.orc"
path: "hdfs://192.168.*.*:9000/data/vertex_player.orc"

# fields      ORC      key      value      NebulaGraph
#
fields: [age, name]

#      NebulaGraph
# fields  nebula.fields
nebula.fields: [age, name]

#      VID
# vertex      ORC
#      NebulaGraph 3.3.0      VID
vertex: {
    field:id
}

#      NebulaGraph
batch: 256

#      Spark
partition: 32
}

#      Tag team
{
    #      NebulaGraph      Tag
    name: team
    type: {
        #          ORC
        source: orc

        #      NebulaGraph Client  SST
        sink: client
    }

#      ORC
#      HDFS          hdf://      "hdfs://ip:port/xx/xx"
#      file://      "file:///tmp/xx.orc"
path: "hdfs://192.168.*.*:9000/data/vertex_team.orc"

# fields      ORC      key      value      NebulaGraph
#
fields: [name]

#      NebulaGraph
# fields  nebula.fields
nebula.fields: [name]

#      VID

```

```

# vertex      ORC
#   NebulaGraph 3.3.0          VID
vertex: {
  field:id
}

#       NebulaGraph
batch: 256

#       Spark
partition: 32
}

# 
]

#
edges: [
#   Edge type follow
{
#   NebulaGraph      Edge type
name: follow
type: {
#       ORC
source: orc

#       NebulaGraph Client  SST
sink: client
}

#   ORC
#   HDFS           hdfs://    "hdfs://ip:port/xx/xx"
#   file://        "file:///tmp/xx.orc"
path: "hdfs://192.168.*.*:9000/data/edge_follow.orc"

#   fields      ORC      key      value      NebulaGraph
#   ,
fields: [degree]

#   NebulaGraph
# fields  nebula.fields
nebula.fields: [degree]

#
# vertex      ORC
#   NebulaGraph 3.3.0          VID
source: {
  field: src
}
target: {
  field: dst
}

#       rank
#ranking: rank

#       NebulaGraph
batch: 256

#       Spark
partition: 32
}

#   Edge type serve
{
#   NebulaGraph      Edge type
name: serve
type: {
#       ORC
source: orc

#       NebulaGraph Client  SST
sink: client
}

#   ORC
#   HDFS           hdfs://    "hdfs://ip:port/xx/xx"
#   file://        "file:///tmp/xx.orc"
path: "hdfs://192.168.*.*:9000/data/edge_serve.orc"

#   fields      ORC      key      value      NebulaGraph
#   ,
fields: [start_year,end_year]

#   NebulaGraph
# fields  nebula.fields
nebula.fields: [start_year, end_year]

#
# vertex      ORC
#   NebulaGraph 3.3.0          VID
source: {
  field: src
}
target: {
}

```

```

        field: dst
    }

    #          rank
    #ranking: _c5

    #          NebulaGraph
    batch: 256

    #          Spark
    partition: 32
}

]

#
}

```

4 NEBULAGRAPH

ORC NebulaGraph

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange <nebula-exchange-3.3.0.jar_path> -c <orc_application.conf_path>
```



JAR maven

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange /root/nebula-exchange/nebula-exchange/target/nebula-exchange-3.3.0.jar -c /root/nebula-exchange/nebula-exchange/target/classes/orc_application.conf
```

```
batchSuccess.<tag_name/edge_name>           batchSuccess.follow: 300
```

5

NebulaGraph NebulaGraph Studio

```
GO FROM "player100" OVER follow;
```

SHOW STATS

6 NEBULAGRAPH

NebulaGraph

: January 13, 2023

19.4.4 Parquet



basketballplayer

MacOS

- CPU 1.7 GHz Quad-Core Intel Core i7
- 16 GB
- Spark 2.4.7
- Hadoop 2.9.2
- NebulaGraph 3.3.0 Docker Compose

- NebulaGraph

- Graph Meta IP
- NebulaGraph
- Exchange Exchange Exchange 3.3.0
- Spark
- NebulaGraph Schema Tag Edge type
- HDFS Hadoop
- NebulaGraph

1 NEBULAGRAPH SCHEMA

Parquet NebulaGraph Schema

1. Schema NebulaGraph Schema

Tag	player	name string, age int
Tag	team	name string
Edge Type	follow	degree int
Edge Type	serve	start_year int, end_year int

2. NebulaGraph Console basketballplayer Schema

```
## nebula> CREATE SPACE basketballplayer \
    (partition_num = 10, \
     replica_factor = 1, \
     vid_type = FIXED_STRING(30));

##      basketballplayer
nebula> USE basketballplayer;

##      Tag player
nebula> CREATE TAG player(name string, age int);

##      Tag team
nebula> CREATE TAG team(name string);

##      Edge type follow
nebula> CREATE EDGE follow(degree int);

##      Edge type serve
nebula> CREATE EDGE serve(start_year int, end_year int);
```

2 PARQUET

1. Parquet Schema

2. Parquet

3

Exchange target/classes/application.conf Parquet parquet_application.conf

```
{
  # Spark
  spark: {
    app: {
      name: NebulaGraph Exchange 3.3.0
    }
    driver: {
      cores: 1
      maxResultSize: 1G
    }
    executor: {
      memory: 1G
    }

    cores: {
      max: 16
    }
  }

  # NebulaGraph
  nebula: {
    address: {
      # Graph Meta IP
      #
      # "ip1:port", "ip2:port", "ip3:port"
    }
  }
}
```

```

graph:["127.0.0.1:9669"]
meta:["127.0.0.1:9559"]
}

#      NebulaGraph
user: root
pswd: nebula

#
space: basketballplayer
connection: {
  timeout: 3000
  retry: 3
}
execution: {
  retry: 3
}
error: {
  max: 32
  output: /tmp/errors
}
rate: {
  limit: 1024
  timeout: 1000
}
}

#
tags: [
  #      Tag player
  {
    #      NebulaGraph      Tag
    name: player
    type: {
      #          Parquet
      source: parquet

      #      NebulaGraph Client  SST
      sink: client
    }
  }

  #      Parquet
  #      HDFS           hdfs://      "hdfs://ip:port/xx/xx"
  #      file://         "file:///tmp/xx.csv"
  path: "hdfs://192.168.11.139000/data/vertex_player.parquet"

  # fields   Parquet   key       value   NebulaGraph
  #
  fields: [age, name]

  #      NebulaGraph
  # fields  nebula.fields
  nebula.fields: [age, name]

  #      VID
  # vertex  Parquet
  #      NebulaGraph 3.3.0      VID
  vertex: {
    field:id
  }

  #      NebulaGraph
  batch: 256

  #      Spark
  partition: 32
}

#      Tag team
{
  #      NebulaGraph      Tag
  name: team
  type: {
    #          Parquet
    source: parquet

    #      NebulaGraph Client  SST
    sink: client
  }

  #      Parquet
  #      HDFS           hdfs://      "hdfs://ip:port/xx/xx"
  #      file://         "file:///tmp/xx.csv"
  path: "hdfs://192.168.11.13:9000/data/vertex_team.parquet"

  # fields   Parquet   key       value   NebulaGraph
  #
  fields: [name]

  #      NebulaGraph
  # fields  nebula.fields
  nebula.fields: [name]

  #      VID
}

```

```

# vertex      Parquet
#   NebulaGraph 3.3.0          VID
vertex: {
  field:id
}

#       NebulaGraph
batch: 256

#       Spark
partition: 32
}

# 
]

#
edges: [
#   Edge type follow
{
#   NebulaGraph      Edge type
name: follow
type: {
#       Parquet
source: parquet

#       NebulaGraph Client  SST
sink: client
}

#   Parquet
#       HDFS           hdfs://    "hdfs://ip:port/xx/xx"
#       file://        "file:///tmp/xx.csv"
path: "hdfs://192.168.11.13:9000/data/edge_follow.parquet"

#   fields      Parquet     key         value      NebulaGraph
#   ,
fields: [degree]

#   NebulaGraph
# fields  nebula.fields
nebula.fields: [degree]

#
# vertex      Parquet
#   NebulaGraph 3.3.0          VID
source: {
  field: src
}
target: {
  field: dst
}

#       rank
#ranking: rank

#       NebulaGraph
batch: 256

#       Spark
partition: 32
}

#   Edge type serve
{
#   NebulaGraph      Edge type
name: serve
type: {
#       Parquet
source: parquet

#       NebulaGraph Client  SST
sink: client
}

#   Parquet
#       HDFS           hdfs://    "hdfs://ip:port/xx/xx"
#       file://        "file:///tmp/xx.csv"
path: "hdfs://192.168.11.13:9000/data/edge_serve.parquet"

#   fields      Parquet     key         value      NebulaGraph
#   ,
fields: [start_year,end_year]

#   NebulaGraph
# fields  nebula.fields
nebula.fields: [start_year, end_year]

#
# vertex      Parquet
#   NebulaGraph 3.3.0          VID
source: {
  field: src
}
target: {
}

```

```

        field: dst
    }

#           rank
#ranking: _c5

#           NebulaGraph
batch: 256

#           Spark
partition: 32
}

]

#
}

```

4 NEBULAGRAPH

Parquet NebulaGraph

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange <nebula-exchange-3.3.0.jar_path> -c <parquet_application.conf_path>
```



JAR maven

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange /root/nebula-exchange/nebula-exchange/target/nebula-exchange-3.3.0.jar -c /root/nebula-exchange/nebula-exchange/target/classes/parquet_application.conf
```

batchSuccess.<tag_name/edge_name> batchSuccess.follow: 300

5

NebulaGraph NebulaGraph Studio

```
GO FROM "player100" OVER follow;
```

SHOW STATS

6 NEBULAGRAPH

NebulaGraph

:January 13, 2023

19.4.5 HBase

Exchange HBase NebulaGraph

basketballplayer

HBase player team follow serve

```

hbase(main):002:0> scan "player"
ROW                               COLUMN+CELL
player100                          column=cf:age, timestamp=1618881347530, value=42
player100                          column=cf:name, timestamp=1618881354604, value=Tim Duncan
player101                          column=cf:age, timestamp=1618881369124, value=36
player101                          column=cf:name, timestamp=1618881379102, value=Tony Parker
player102                          column=cf:age, timestamp=1618881386987, value=33
player102                          column=cf:name, timestamp=1618881393370, value=LaMarcus Aldridge
player103                          column=cf:age, timestamp=1618881402002, value=32
player103                          column=cf:name, timestamp=1618881407882, value=Rudy Gay
...
hbase(main):003:0> scan "team"
ROW                               COLUMN+CELL
team200                           column=cf:name, timestamp=1618881445563, value=Warriors
team201                           column=cf:name, timestamp=1618881453636, value=Nuggets
...
hbase(main):004:0> scan "follow"
ROW                               COLUMN+CELL
player100                          column=cf:degree, timestamp=1618881804853, value=95
player100                          column=cf:dst_player, timestamp=1618881791522, value=player101
player101                          column=cf:degree, timestamp=1618881824685, value=90
player101                          column=cf:dst_player, timestamp=1618881816042, value=player102
...
hbase(main):005:0> scan "serve"
ROW                               COLUMN+CELL
player100                          column=cf:end_year, timestamp=1618881899333, value=2016
player100                          column=cf:start_year, timestamp=1618881890117, value=1997
player100                          column=cf:teamid, timestamp=1618881875739, value=team204
...

```

MacOS

-
- CPU 1.7 GHz Quad-Core Intel Core i7
- 16 GB
- Spark 2.4.7
- Hadoop 2.9.2
- HBase 2.2.7
- NebulaGraph 3.3.0 Docker Compose

- **NebulaGraph**
- Graph Meta IP
- NebulaGraph
- Exchange Exchange Exchange 3.3.0
- Spark
- NebulaGraph Schema Tag Edge type
- Hadoop

1 NEBULAGRAPH SCHEMA

NebulaGraph Schema

1. Schema NebulaGraph Schema

Tag	player	name string, age int
Tag	team	name string
Edge Type	follow	degree int
Edge Type	serve	start_year int, end_year int

2. NebulaGraph basketballplayer Schema

```
##  
nebula> CREATE SPACE basketballplayer \  
  (partition_num = 10, \  
   replica_factor = 1, \  
   vid_type = FIXED_STRING(30));  
  
##      basketballplayer  
nebula> USE basketballplayer;  
  
##      Tag player  
nebula> CREATE TAG player(name string, age int);  
  
##      Tag team  
nebula> CREATE TAG team(name string);  
  
##      Edge type follow  
nebula> CREATE EDGE follow(degree int);  
  
##      Edge type serve  
nebula> CREATE EDGE serve(start_year int, end_year int);
```

2

Exchange target/classes/application.conf HBase hbase_application.conf

```
{
  # Spark
  spark: {
    app: {
      name: NebulaGraph Exchange 3.3.0
    }
    driver: {
      cores: 1
      maxResultSize: 1G
    }
  }
  cores: {
```

```

        max: 16
    }
}

# NebulaGraph
nebula: {
    address: {
        # NebulaGraph Graph Meta IP
        #           "ip1:port", "ip2:port", "ip3:port"
        #           (, )
        graph: ["127.0.0.1:9669"]
        meta: ["127.0.0.1:9559"]
    }
    # NebulaGraph
    user: root
    pswd: nebula
    # NebulaGraph
    space: basketballplayer
    connection: {
        timeout: 3000
        retry: 3
    }
    execution: {
        retry: 3
    }
    error: {
        max: 32
        output: /tmp/errors
    }
    rate: {
        limit: 1024
        timeout: 1000
    }
}
#
tags: [
    # Tag player
    # rowkey      "rowkey",
{
    # NebulaGraph Tag
    name: player
    type: {
        # HBase
        source: hbase
        # NebulaGraph Client SST
        sink: client
    }
    host:192.168.*.*
    port:2181
    table:"player"
    columnFamily:"cf"

    # fields     player         value   NebulaGraph
    # fields   nebula.fields
    #
    fields: [age,name]
    nebula.fields: [age,name]

    # NebulaGraph VID
    # rowkey    VID      "rowkey"
    vertex: {
        field:rowkey
    }

    # NebulaGraph
    batch: 256

    # Spark
    partition: 32
}
# Tag team
{
    name: team
    type: {
        source: hbase
        sink: client
    }
    host:192.168.*.*
    port:2181
    table:"team"
    columnFamily:"cf"
    fields: [name]
    nebula.fields: [name]
    vertex: {
        field:rowkey
    }
    batch: 256
    partition: 32
}
]

#
edges: [

```

```

#   Edge type follow
{
  # NebulaGraph      Edge type
  name: follow

  type: {
    #
    #          HBase
    source: hbase

    #
    #          NebulaGraph Client  SST
    sink: client
  }

  host:192.168.*.*
  port:2181
  table:"follow"
  columnFamily:"cf"

  #   fields      follow      value      NebulaGraph
  # fields    nebula.fields
  #
  fields: [degree]
  nebula.fields: [degree]

  #   source      follow      rowkey
  #   target      follow      dst_player
  source:{ field:rowkey
  }

  target:{ field:dst_player
  }

  #
  #rank
  #ranking: rank

  #
  #          NebulaGraph
  batch: 256

  #
  # Spark
  partition: 32
}

#   Edge type serve
{
  name: serve
  type: {
    source: hbase
    sink: client
  }
  host:192.168.*.*
  port:2181
  table:"serve"
  columnFamily:"cf"

  fields: [start_year,end_year]
  nebula.fields: [start_year,end_year]
  source:{ field:rowkey
  }

  target:{ field:teamid
  }

  #
  #rank
  #ranking: rank

  batch: 256
  partition: 32
}
]
}

```

3 NEBULAGRAPH

HBase NebulaGraph

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange <nebula-exchange-3.3.0.jar_path> -c <hbase_application.conf_path>
```



JAR

maven

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange /root/nebula-exchange/nebula-exchange/target/nebula-exchange-3.3.0.jar -c /root/nebula-exchange/nebula-exchange/target/classes/hbase_application.conf
```

```
batchSuccess.<tag_name/edge_name>          batchSuccess.follow: 300
```

4

NebulaGraph NebulaGraph Studio

```
GO FROM "player100" OVER follow;
```

```
SHOW STATS
```

5 NEBULAGRAPH

NebulaGraph

:January 13, 2023

19.4.6 MySQL/PostgreSQL

Exchange MySQL NebulaGraph PostgreSQL NebulaGraph

basketballplayer

MySQL basketball player team follow serve

```
mysql> desc player;
+-----+-----+-----+-----+-----+-----+
| Field | Type   | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| playerid | varchar(30) | YES |   | NULL    |   |
| age      | int     | YES |   | NULL    |   |
| name     | varchar(30) | YES |   | NULL    |   |
+-----+-----+-----+-----+-----+-----+



mysql> desc team;
+-----+-----+-----+-----+-----+
| Field | Type   | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+
| teamid | varchar(30) | YES |   | NULL    |   |
| name    | varchar(30) | YES |   | NULL    |   |
+-----+-----+-----+-----+-----+



mysql> desc follow;
+-----+-----+-----+-----+-----+
| Field | Type   | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+
| src_player | varchar(30) | YES |   | NULL    |   |
| dst_player | varchar(30) | YES |   | NULL    |   |
| degree     | int     | YES |   | NULL    |   |
+-----+-----+-----+-----+-----+



mysql> desc serve;
+-----+-----+-----+-----+-----+
| Field | Type   | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+
| playerid | varchar(30) | YES |   | NULL    |   |
| teamid   | varchar(30) | YES |   | NULL    |   |
| start_year | int     | YES |   | NULL    |   |
| end_year  | int     | YES |   | NULL    |   |
+-----+-----+-----+-----+-----+
```

MacOS

- CPU 1.7 GHz Quad-Core Intel Core i7
 - 16 GB
 - Spark 2.4.7
 - Hadoop 2.9.2
 - MySQL 8.0.23
 - NebulaGraph 3.3.0 Docker Compose

- **NebulaGraph**
- Graph Meta IP
- NebulaGraph
- Exchange Exchange Exchange 3.3.0
- Spark
- NebulaGraph Schema Tag Edge type
- Hadoop

1 NEBULAGRAPH SCHEMA

NebulaGraph Schema

1. Schema NebulaGraph Schema

Tag	player	name string, age int
Tag	team	name string
Edge Type	follow	degree int
Edge Type	serve	start_year int, end_year int

2. NebulaGraph basketballplayer Schema

```
##  
nebula> CREATE SPACE basketballplayer \  
  (partition_num = 10, \  
   replica_factor = 1, \  
   vid_type = FIXED_STRING(30));  
  
##      basketballplayer  
nebula> USE basketballplayer;  
  
##      Tag player  
nebula> CREATE TAG player(name string, age int);  
  
##      Tag team  
nebula> CREATE TAG team(name string);  
  
##      Edge type follow  
nebula> CREATE EDGE follow(degree int);  
  
##      Edge type serve  
nebula> CREATE EDGE serve(start_year int, end_year int);
```

2

Exchange target/classes/application.conf MySQL mysql_application.conf

```
{
  # Spark
  spark: {
    app: {
      name: NebulaGraph Exchange 3.3.0
    }
    driver: {
      cores: 1
      maxResultSize: 1G
    }
  }
  cores: {
```

```

        max: 16
    }

}

# NebulaGraph
nebula: {
    address: {
        #      NebulaGraph  Graph   Meta      IP
        #          "ip1:port","ip2:port","ip3:port"
        #          (,)

        graph:["127.0.0.1:9669"]
        meta:["127.0.0.1:9559"]
    }
    #      NebulaGraph
    user: root
    pswd: nebula
    #      NebulaGraph
    space: basketballplayer
    connection: {
        timeout: 3000
        retry: 3
    }
    execution: {
        retry: 3
    }
    error: {
        max: 32
        output: /tmp/errors
    }
    rate: {
        limit: 1024
        timeout: 1000
    }
}
#
tags: [
    # Tag player
    {
        # NebulaGraph      Tag
        name: player
        type: {
            #           MySQL
            source: mysql
            #           NebulaGraph Client  SST
            sink: client
        }
    }

    host:192.168.*.*
    port:3306
    database:"basketball"
    table:"player"
    user:"test"
    password:"123456"
    sentence:"select playerid, age, name from player order by playerid"

    # fields     player         value     NebulaGraph
    # fields     nebula.fields
    #
    fields: [age,name]
    nebula.fields: [age,name]

    #      NebulaGraph    VID
    vertex: {
        field:playerid
    }

    #      NebulaGraph
    batch: 256

    # Spark
    partition: 32
}
# Tag team
{
    name: team
    type: {
        source: mysql
        sink: client
    }
}

host:192.168.*.*
port:3306
database:"basketball"
table:"team"
user:"test"
password:"123456"
sentence:"select teamid, name from team order by teamid"

fields: [name]
nebula.fields: [name]
vertex: {
    field: teamid
}
batch: 256

```

```

        partition: 32
    }

]

#
edges: [
    #   Edge type follow
{
    # NebulaGraph      Edge type
    name: follow

    type: {
        #           MySQL
        source: mysql

        #           NebulaGraph
        #           NebulaGraph Client  SST
        sink: client
    }

    host:192.168.*.*
    port:3306
    database:"basketball"
    table:"follow"
    user:"test"
    password:"123456"
    sentence:"select src_player,dst_player,degree from follow order by src_player"

    #   fields      follow      value      NebulaGraph
    # fields  nebula.fields
    #
    fields: [degree]
    nebula.fields: [degree]

    #   source      follow
    #   target      follow
    source: {
        field: src_player
    }

    target: {
        field: dst_player
    }

    #       rank
    #ranking: rank

    #           NebulaGraph
    batch: 256

    # Spark
    partition: 32
}

#   Edge type serve
{
    name: serve
    type: {
        source: mysql
        sink: client
    }

    host:192.168.*.*
    port:3306
    database:"basketball"
    table:"serve"
    user:"test"
    password:"123456"
    sentence:"select playerid,teamid,start_year,end_year from serve order by playerid"
    fields: [start_year,end_year]
    nebula.fields: [start_year,end_year]
    source: {
        field: playerid
    }
    target: {
        field: teamid
    }

    #       rank
    #ranking: rank

    batch: 256
    partition: 32
}
]
}

```

3 NEBULAGRAPH

MySQL NebulaGraph

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange <nebula-exchange-3.3.0.jar_path> -c <mysql_application.conf_path>
```

Note

JAR maven

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange /root/nebula-exchange/nebula-exchange/target/nebula-exchange-3.3.0.jar -c /root/nebula-exchange/nebula-exchange/target/classes/mysql_application.conf
```

```
batchSuccess.<tag_name/edge_name>           batchSuccess.follow: 300
```

4

NebulaGraph NebulaGraph Studio

```
GO FROM "player100" OVER follow;
```

```
SHOW STATS
```

5 NEBULAGRAPH

NebulaGraph

:January 13, 2023

19.4.7 Oracle

Exchange Oracle NebulaGraph

basketballplayer

Oracle basketball player team follow serve

```
oracle> desc player;
+-----+-----+-----+
| Column | Null | Type |
+-----+-----+-----+
| PLAYERID | - | VARCHAR2(30) |
| NAME | - | VARCHAR2(30) |
| AGE | - | NUMBER |
+-----+-----+-----+

oracle> desc team;
+-----+-----+-----+
| Column | Null | Type |
+-----+-----+-----+
| TEAMID | - | VARCHAR2(30) |
| NAME | - | VARCHAR2(30) |
+-----+-----+-----+

oracle> desc follow;
+-----+-----+-----+
| Column | Null | Type |
+-----+-----+-----+
| SRC_PLAYER | - | VARCHAR2(30) |
| DST_PLAYER | - | VARCHAR2(30) |
| DEGREE | - | NUMBER |
+-----+-----+-----+

oracle> desc serve;
+-----+-----+-----+
| Column | Null | Type |
+-----+-----+-----+
| PLAYERID | - | VARCHAR2(30) |
| TEAMID | - | VARCHAR2(30) |
| START_YEAR | - | NUMBER |
| END_YEAR | - | NUMBER |
+-----+-----+-----+
```

MacOS

-
- CPU 1.7 GHz Quad-Core Intel Core i7
- 16 GB
- Spark 2.4.7
- Hadoop 2.9.2
- NebulaGraph 3.3.0 Docker Compose

- **NebulaGraph**
- Graph Meta IP
- NebulaGraph
- Exchange Exchange Exchange 3.3.0
- Spark
- NebulaGraph Schema Tag Edge type
- Hadoop

1 NEBULAGRAPH SCHEMA

NebulaGraph Schema

1. Schema NebulaGraph Schema

Tag	player	name string, age int
Tag	team	name string
Edge Type	follow	degree int
Edge Type	serve	start_year int, end_year int

2. NebulaGraph basketballplayer Schema

```
##  
nebula> CREATE SPACE basketballplayer \  
  (partition_num = 10, \  
   replica_factor = 1, \  
   vid_type = FIXED_STRING(30));  
  
##      basketballplayer  
nebula> USE basketballplayer;  
  
##      Tag player  
nebula> CREATE TAG player(name string, age int);  
  
##      Tag team  
nebula> CREATE TAG team(name string);  
  
##      Edge type follow  
nebula> CREATE EDGE follow(degree int);  
  
##      Edge type serve  
nebula> CREATE EDGE serve(start_year int, end_year int);
```

2

Exchange target/classes/application.conf Oracle oracle_application.conf

```
{
  # Spark
  spark: {
    app: {
      name: NebulaGraph Exchange 3.3.0
    }
    driver: {
      cores: 1
      maxResultSize: 1G
    }
  }
  cores: {
```

```

        max: 16
    }

}

# NebulaGraph
nebula: {
    address: {
        #      NebulaGraph   Graph     Meta      IP
        #          "ip1:port","ip2:port","ip3:port"
        #          (,
        graph:["127.0.0.1:9669"]
        meta:["127.0.0.1:9559"]
    }
    #      NebulaGraph
    user: root
    pswd: nebula
    #      NebulaGraph
    space: basketballplayer
    connection: {
        timeout: 3000
        retry: 3
    }
    execution: {
        retry: 3
    }
    error: {
        max: 32
        output: /tmp/errors
    }
    rate: {
        limit: 1024
        timeout: 1000
    }
}
#
tags: [
{
    # NebulaGraph      Tag
    name: player
    type: {
        #          Oracle
        source: oracle
        #      NebulaGraph Client   SST
        sink: client
    }
}

url:"jdbc:oracle:thin:@host:1521:db"
driver: "oracle.jdbc.driver.OracleDriver"
user: "root"
password: "123456"
table: "basketball.player"
sentence: "select playerid, name, age from player"

# fields      player           value      NebulaGraph
# fields      nebula.fields
#
fields: [age,name]
nebula.fields: [age,name]

#      NebulaGraph      VID
vertex: {
    field:playerid
}

#      NebulaGraph
batch: 256

# Spark
partition: 32
}
#  Tag team
{
    name: team
    type: {
        source: oracle
        sink: client
    }
}

url:"jdbc:oracle:thin:@host:1521:db"
driver: "oracle.jdbc.driver.OracleDriver"
user: "root"
password: "123456"
table: "basketball.team"
sentence: "select teamid, name from team"

fields: [name]
nebula.fields: [name]
vertex: {
    field: teamid
}
batch: 256
partition: 32
}

```

```

]

#
edges: [
  #   Edge type follow
  {
    # NebulaGraph      Edge type
    name: follow

    type: {
      #          Oracle
      source: oracle

      #      NebulaGraph
      #      NebulaGraph Client  SST
      sink: client
    }

    url:"jdbc:oracle:thin:@host:1521:db"
    driver: "oracle.jdbc.driver.OracleDriver"
    user: "root"
    password: "123456"
    table: "basketball.follow"
    sentence: "select src_player, dst_player, degree from follow"

    #   fields      follow      value      NebulaGraph
    # fields  nebula.fields
    #
    fields: [degree]
    nebula.fields: [degree]

    #   source      follow
    # target      follow
    source: {
      field: src_player
    }

    target: {
      field: dst_player
    }

    #       rank
    #ranking: rank

    #      NebulaGraph
    batch: 256

    # Spark
    partition: 32
  }

  #   Edge type serve
  {
    name: serve
    type: {
      source: oracle
      sink: client
    }

    url:"jdbc:oracle:thin:@host:1521:db"
    driver: "oracle.jdbc.driver.OracleDriver"
    user: "root"
    password: "123456"
    table: "basketball.serve"
    sentence: "select playerid, teamid, start_year, end_year from serve"

    fields: [start_year,end_year]
    nebula.fields: [start_year,end_year]
    source: {
      field: playerid
    }
    target: {
      field: teamid
    }

    #       rank
    #ranking: rank

    batch: 256
    partition: 32
  }
]
}

```

3 NEBULAGRAPH

Oracle NebulaGraph

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange <nebula-exchange-3.3.0.jar_path> -c <oracle_application.conf_path>
```

Note

JAR maven

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange /root/nebula-exchange/nebula-exchange/target/nebula-exchange-3.3.0.jar -c /root/nebula-exchange/nebula-exchange/target/classes/oracle_application.conf
```

```
batchSuccess.<tag_name/edge_name>           batchSuccess.follow: 300
```

4

NebulaGraph NebulaGraph Studio

```
GO FROM "player100" OVER follow;
```

SHOW STATS

5 NEBULAGRAPH

NebulaGraph

:January 13, 2023

19.4.8 ClickHouse

Exchange ClickHouse NebulaGraph

basketballplayer

MacOS

- CPU 1.7 GHz Quad-Core Intel Core i7
- 16 GB
- Spark 2.4.7
- Hadoop 2.9.2
- ClickHouse docker yandex/clickhouse-server tag: latest(2021.07.01)
- NebulaGraph 3.3.0 [Docker Compose](#)

- [NebulaGraph](#)

- Graph Meta IP
- NebulaGraph
- Exchange [Exchange](#) Exchange 3.3.0
- Spark
- NebulaGraph Schema Tag Edge type
- Hadoop

1 NEBULAGRAPH SCHEMA

NebulaGraph Schema

1. Schema NebulaGraph Schema

Tag	player	name string, age int
Tag	team	name string
Edge Type	follow	degree int
Edge Type	serve	start_year int, end_year int

2. NebulaGraph basketballplayer Schema

```
## nebula> CREATE SPACE basketballplayer \
    (partition_num = 10, \
     replica_factor = 1, \
     vid_type = FIXED_STRING(30));

##      basketballplayer
nebula> USE basketballplayer;

##      Tag player
nebula> CREATE TAG player(name string, age int);

##      Tag team
nebula> CREATE TAG team(name string);

##      Edge type follow
nebula> CREATE EDGE follow(degree int);

##      Edge type serve
nebula> CREATE EDGE serve(start_year int, end_year int);
```

2

Exchange target/classes/application.conf ClickHouse clickhouse_application.conf

```
{
  # Spark
  spark: {
    app: {
      name: Nebula Exchange 3.3.0
    }
    driver: {
      cores: 1
      maxResultSize: 1G
    }
    cores: {
      max: 16
    }
  }

  # NebulaGraph
  nebula: {
    address: {
      # NebulaGraph Graph Meta IP
      #           "ip1:port","ip2:port","ip3:port"
      #           (,,
      graph:["127.0.0.1:9669"]
      meta:["127.0.0.1:9559"]
    }
    # NebulaGraph
    user: root
    pswd: nebula
    # NebulaGraph
    space: basketballplayer
    connection: {
      timeout: 3000
      retry: 3
    }
    execution: {
      retry: 3
    }
  }
}
```

```

}
error: {
  max: 32
  output: /tmp/errors
}
rate: {
  limit: 1024
  timeout: 1000
}
#
tags: [
  # Tag player
  {
    name: player
    type: {
      # ClickHouse
      source: clickhouse
      # NebulaGraph Client SST
      sink: client
    }
  }
  # ClickHouse JDBC URL
  url:"jdbc:clickhouse://192.168.*.*:8123/basketballplayer"
  user:"user"
  password:"123456"
  # ClickHouse
  numPartition:"5"
  table:"player"
  sentence:"select * from player"
  # fields      player          value      NebulaGraph
  # fields      nebula.fields
  #
  fields: [name,age]
  nebula.fields: [name,age]
  # NebulaGraph VID
  vertex: {
    field:playerid
    # policy:hash
  }
  # NebulaGraph
  batch: 256
  # Spark
  partition: 32
}

# Tag team
{
  name: team
  type: {
    source: clickhouse
    sink: client
  }
  url:"jdbc:clickhouse://192.168.*.*:8123/basketballplayer"
  user:"user"
  password:"123456"
  numPartition:"5"
  table:"team"
  sentence:"select * from team"
  fields: [name]
  nebula.fields: [name]
  vertex: {
    field:teamid
  }
  batch: 256
  partition: 32
}
]

#
edges: [
  # Edge type follow
  {
    # NebulaGraph     Edge type
    name: follow

    type: {
      # ClickHouse
      source: clickhouse
      # NebulaGraph
      # NebulaGraph Client SST
      sink: client
    }
  }
  # ClickHouse JDBC URL
  url:"jdbc:clickhouse://192.168.*.*:8123/basketballplayer"
]

```

```

user:"user"
password:"123456"

# ClickHouse
numPartition:"5"

table:"follow"
sentence:"select * from follow"

#   fields      follow      value    NebulaGraph
#   fields      nebula.fields
#
fields: [degree]
nebula.fields: [degree]

#   source      follow
source: {
  field:src_player
}

#   target      follow
target: {
  field:dst_player
}

#       rank
#ranking: rank

#       NebulaGraph
batch: 256

# Spark
partition: 32
}

#   Edge type serve
{
  name: serve
  type: {
    source: clickhouse
    sink: client
  }
  url:"jdbc:clickhouse://192.168.*.*:8123/basketballplayer"
  user:"user"
  password:"123456"
  numPartition:"5"
  sentence:"select * from serve"
  fields: [start_year,end_year]
  nebula.fields: [start_year,end_year]
  source: {
    field:playerid
  }
  target: {
    field:teamid
  }

#       rank
#ranking: rank

batch: 256
partition: 32
}
]
}

```

3 NEBULAGRAPH

ClickHouse NebulaGraph

```

${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange <nebula-exchange-3.3.0.jar_path> -c
<clickhouse_application.conf_path>

```



JAR maven

```

${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange /root/nebula-exchange/nebula-exchange/target/nebula-
exchange-3.3.0.jar -c /root/nebula-exchange/nebula-exchange/target/classes/clickhouse_application.conf

```

batchSuccess.<tag_name/edge_name> batchSuccess.follow: 300

4

NebulaGraph NebulaGraph Studio

GO FROM "player100" OVER follow;

[SHOW STATS](#)

5 NEBULAGRAPH

NebulaGraph

:January 13, 2023

19.4.9 Neo4j

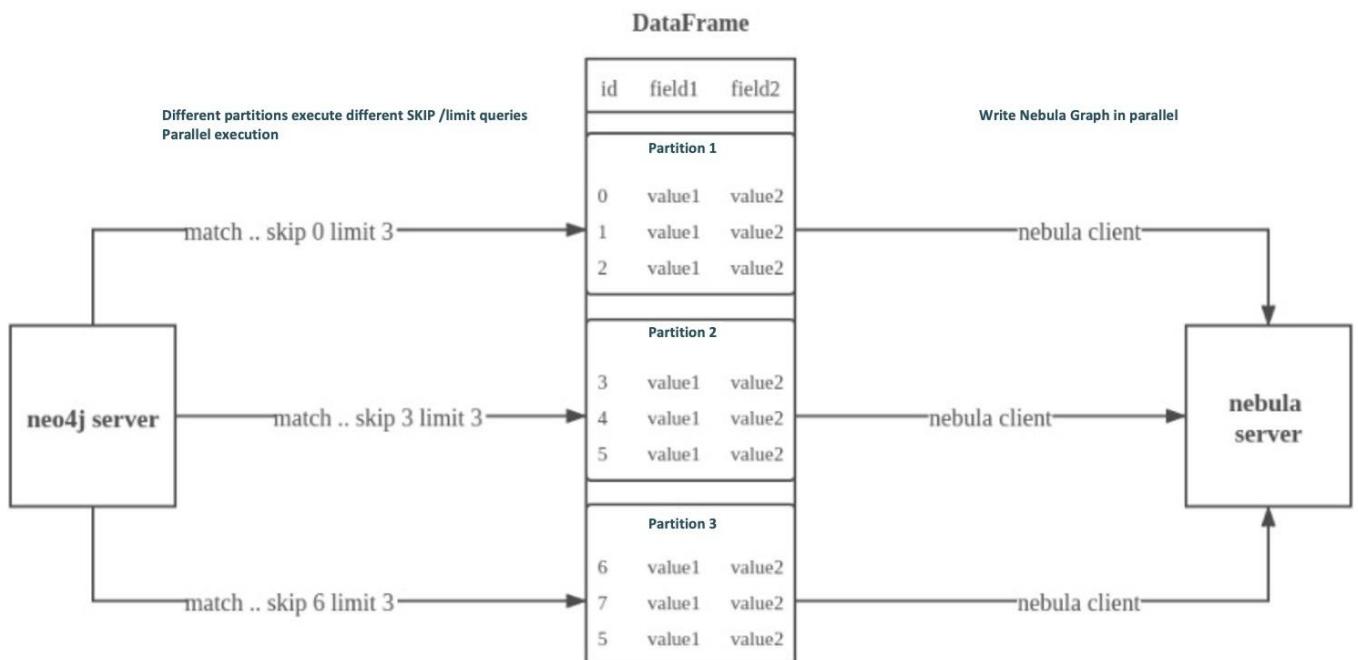
Exchange Neo4j NebulaGraph

Exchange **Neo4j Driver 4.0.1** Neo4j
Spark

Exchange Neo4j

1. Exchange Reader exec Cypher RETURN COUNT(*) Spark
2. check_point_path Reader Reader Spark
3. Spark Exchange Reader Cypher SKIP LIMIT Neo4j Driver Spark
4. Reader DataFrame

Exchange Neo4j NebulaGraph



basketballplayer

MacOS

- CPU Intel(R) Xeon(R) CPU E5-2697 v3 @ 2.60GHz
- CPU 14
- 251 GB
- Spark 2.4.6 pre-build for Hadoop 2.7
- Neo4j 3.5.20 Community Edition
- NebulaGraph 3.3.0 [Docker Compose](#)

- [NebulaGraph](#)
- Graph Meta IP
- NebulaGraph
- Exchange [Exchange](#) Exchange 3.3.0
- Spark
- NebulaGraph Schema Tag Edge type

1 NEBULAGRAPH SCHEMA

NebulaGraph Schema

1. Schema NebulaGraph Schema

Tag	player	name string, age int
Tag	team	name string
Edge Type	follow	degree int
Edge Type	serve	start_year int, end_year int

2. NebulaGraph Console basketballplayer Schema

```
## nebula> CREATE SPACE basketballplayer \
    (partition_num = 10, \
     replica_factor = 1, \
     vid_type = FIXED_STRING(30));

##      basketballplayer
nebula> USE basketballplayer;

##      Tag player
nebula> CREATE TAG player(name string, age int);

##      Tag team
nebula> CREATE TAG team(name string);

##      Edge type follow
nebula> CREATE EDGE follow(degree int);

##      Edge type serve
nebula> CREATE EDGE serve(start_year int, end_year int);
```

2

Neo4j Neo4j Neo4j

3

Exchange target/classes/application.conf neo4j_application.conf

```
{
  # Spark
  spark: {
    app: {
      name: NebulaGraph Exchange 3.3.0
    }

    driver: {
      cores: 1
      maxResultSize: 1G
    }

    executor: {
      memory:1G
    }

    cores:{ 
      max: 16
    }
  }

  # NebulaGraph
  nebula: {
    address:{ 
      graph:["127.0.0.1:9669"]
      meta:["127.0.0.1:9559"]
    }
    user: root
    pswd: nebula
    space: basketballplayer
  }
}
```

```

connection: {
    timeout: 3000
    retry: 3
}

execution: {
    retry: 3
}

error: {
    max: 32
    output: /tmp/errors
}

rate: {
    limit: 1024
    timeout: 1000
}
}

#
tags: [
    # Tag player
{
    name: player
    type: {
        source: neo4j
        sink: client
    }
    server: "bolt://192.168.*.*:7687"
    user: neo4j
    password:neo4j
    database:neo4j
    exec: "match (n:player) return n.id as id, n.age as age, n.name as name"
    fields: [age,name]
    nebula.fields: [age,name]
    vertex: {
        field:id
    }
    partition: 10
    batch: 1000
    check_point_path: /tmp/test
}
# Tag team
{
    name: team
    type: {
        source: neo4j
        sink: client
    }
    server: "bolt://192.168.*.*:7687"
    user: neo4j
    password:neo4j
    # bolt 3 does not support `select database`, please do not config database
    # database:neo4j
    exec: "match (n:team) return n.id as id,n.name as name order by id(n)"
    fields: [name]
    nebula.fields: [name]
    vertex: {
        field:id
    }
    partition: 10
    batch: 1000
    check_point_path: /tmp/test
}
]

#
edges: [
    # Edge type follow
{
    name: follow
    type: {
        source: neo4j
        sink: client
    }
    server: "bolt://192.168.*.*:7687"
    user: neo4j
    password:neo4j
    database:neo4j
    exec: "match (a:player)-[r:follow]-(b:player) return a.id as src, b.id as dst, r.degree as degree order by id(r)"
    fields: [degree]
    nebula.fields: [degree]
    source: {
        field: src
    }
    target: {
        field: dst
    }
    #ranking: rank
    partition: 10
    batch: 1000
    check_point_path: /tmp/test
}
]

```

```

}
#   Edge type serve
{
  name: serve
  type: {
    source: neo4j
    sink: client
  }
  server: "bolt://192.168.*.*:7687"
  user: neo4j
  password:neo4j
  # bolt 3 does not support `select database`, please do not config database
  #database:neo4j
  exec: "match (a:player)-[r:serve]-(b:team) return a.id as src, b.id as dst, r.start_year as start_year, r.end_year as end_year order by id(r)"
  fields: [start_year,end_year]
  nebula.fields: [start_year,end_year]
  source: {
    field: src
  }
  target: {
    field: dst
  }
  #ranking: rank
  partition: 10
  batch: 1000
  check_point_path: /tmp/test
}
]
}

```

exec

tags.exec	edges.exec	Cypher	Cypher	ORDER BY		
			ID	partition		
ORDER BY						
Exchange	Spark	SKIP LIMIT Cypher	tags.exec	edges.exec	Cypher	SKIP LIMIT
tags.vertex	edges.vertex					
NebulaGraph	ID		Neo4j	NebulaGraph	ID	Neo4j
NebulaGraph			NebulaGraph		Neo4j	
check_point_path						
partition						

4 NEBULAGRAPH

NebulaGraph

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange <nebula-exchange-3.3.0.jar_path> -c <neo4j_application.conf_path>
```



JAR

maven

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange /root/nebula-exchange/nebula-exchange/target/nebula-exchange-3.3.0.jar -c /root/nebula-exchange/nebula-exchange/target/classes/neo4j_application.conf
```

batchSuccess.<tag_name/edge_name> batchSuccess.follow: 300

5

NebulaGraph NebulaGraph Studio

```
GO FROM "player100" OVER follow;
```

SHOW STATS

NebulaGraph

:January 13, 2023

19.4.10 Hive

Exchange Hive NebulaGraph

basketballplayer

Hive basketball player team follow serve

```
scala> spark.sql("describe basketball.player").show
+-----+-----+-----+
|col_name|data_type|comment|
+-----+-----+-----+
|playerid| string| null|
| age| bigint| null|
| name| string| null|
+-----+-----+-----+

scala> spark.sql("describe basketball.team").show
+-----+-----+-----+
| col_name|data_type|comment|
+-----+-----+-----+
| teamid| string| null|
| name| string| null|
+-----+-----+-----+

scala> spark.sql("describe basketball.follow").show
+-----+-----+-----+
| col_name|data_type|comment|
+-----+-----+-----+
|src_player| string| null|
|dst_player| string| null|
| degree| bigint| null|
+-----+-----+-----+

scala> spark.sql("describe basketball.serve").show
+-----+-----+-----+
| col_name|data_type|comment|
+-----+-----+-----+
| playerid| string| null|
| teamid| string| null|
|start_year| bigint| null|
| end_year| bigint| null|
+-----+-----+-----+
```

Hive bigint NebulaGraph int

MacOS

-
- CPU 1.7 GHz Quad-Core Intel Core i7
- 16 GB
- Spark 2.4.7
- Hadoop 2.9.2
- Hive 2.3.7 Hive Metastore MySQL 8.0.22
- NebulaGraph 3.3.0 [Docker Compose](#)

- **NebulaGraph**
- Graph Meta IP
- NebulaGraph
- Exchange Exchange Exchange 3.3.0
- Spark
- NebulaGraph Schema Tag Edge type
- Hadoop Hive Metastore MySQL

1 NEBULAGRAPH SCHEMA

NebulaGraph Schema

1. Schema NebulaGraph Schema

Tag	player	name string, age int
Tag	team	name string
Edge Type	follow	degree int
Edge Type	serve	start_year int, end_year int

2. NebulaGraph basketballplayer Schema

```
##  
nebula> CREATE SPACE basketballplayer \  
  (partition_num = 10, \  
   replica_factor = 1, \  
   vid_type = FIXED_STRING(30));  
  
##      basketballplayer  
nebula> USE basketballplayer;  
  
##      Tag player  
nebula> CREATE TAG player(name string, age int);  
  
##      Tag team  
nebula> CREATE TAG team(name string);  
  
##      Edge type follow  
nebula> CREATE EDGE follow(degree int);  
  
##      Edge type serve  
nebula> CREATE EDGE serve(start_year int, end_year int);
```

2 SPARK SQL HIVE SQL

spark-shell Spark Hive

```
scala> sql("select playerid, age, name from basketball.player").show  
scala> sql("select teamid, name from basketball.team").show  
scala> sql("select src_player, dst_player, degree from basketball.follow").show  
scala> sql("select playerid, teamid, start_year, end_year from basketball.serve").show
```

basketball.player

playerid	age	name
----------	-----	------

```
+-----+-----+
|player100| 42|      Tim Duncan|
|player101| 36|      Tony Parker|
|player102| 33|LaMarcus Aldridge|
|player103| 32|      Rudy Gay|
|player104| 32| Marco Belinelli|
+-----+-----+
...
```

3

Exchange target/classes/application.conf Hive [hive_application.conf](#)

```
{
  # Spark
  spark: {
    app: {
      name: NebulaGraph Exchange 3.3.0
    }
    driver: {
      cores: 1
      maxResultSize: 1G
    }
    cores: {
      max: 16
    }
  }

  #   Spark   Hive
  #hive: {
  #  waredir: "hdfs://NAMENODE_IP:9000/apps/svr/hive-xxx/warehouse/"
  #  connectionURL: "jdbc:mysql://your_ip:3306/hive_spark?characterEncoding=UTF-8"
  #  connectionDriverName: "com.mysql.jdbc.Driver"
  #  connectionUserName: "user"
  #  connectionPassword: "password"
  #}

  # NebulaGraph
  nebula: {
    address: {
      # NebulaGraph Graph Meta IP
      #           "ip1:port", "ip2:port", "ip3:port"
      #           (, )
      graph: ["127.0.0.1:9669"]
      meta: ["127.0.0.1:9559"]
    }
    #       NebulaGraph
    user: root
    pswd: nebula
    #   NebulaGraph
    space: basketballplayer
    connection: {
      timeout: 3000
      retry: 3
    }
    execution: {
      retry: 3
    }
    error: {
      max: 32
      output: /tmp/errors
    }
    rate: {
      limit: 1024
      timeout: 1000
    }
  }
  #
  tags: [
    #   Tag player
    {
      # NebulaGraph     Tag
      name: player
      type: {
        #           hive
        source: NebulaGraph Client SST
        sink: client
      }
      #       basketball   player     SQL
      exec: "select playerid, age, name from basketball.player"

      #   fields     player     value     NebulaGraph
      # fields   nebula.fields
      #
      fields: [age, name]
      nebula.fields: [age, name]

      #       NebulaGraph     VID
      vertex: {
        field: playerid
      }
    }
  ]
}
```

```

}

#      NebulaGraph
batch: 256

# Spark
partition: 32
}
# Tag team
{
  name: team
  type: {
    source: hive
    sink: client
  }
  exec: "select teamid, name from basketball.team"
  fields: [name]
  nebula.fields: [name]
  vertex: {
    field: teamid
  }
  batch: 256
  partition: 32
}

]

# edges: [
#   Edge type follow
{
  # NebulaGraph      Edge type
  name: follow

  type: {
    #          hive
    source: hive

    #      NebulaGraph
    #      NebulaGraph Client  SST
    sink: client
  }

  #      basketball  follow      SQL
  exec: "select src_player, dst_player, degree from basketball.follow"

  # fields      follow      value      NebulaGraph
  # fields      nebula.fields
  #
  fields: [degree]
  nebula.fields: [degree]

  # source      follow
  # target      follow
  source: {
    field: src_player
  }

  target: {
    field: dst_player
  }

  #      rank
  #ranking: rank

  #      NebulaGraph
  batch: 256

  # Spark
  partition: 32
}

#   Edge type serve
{
  name: serve
  type: {
    source: hive
    sink: client
  }
  exec: "select playerid, teamid, start_year, end_year from basketball.serve"
  fields: [start_year,end_year]
  nebula.fields: [start_year,end_year]
  source: {
    field: playerid
  }
  target: {
    field: teamid
  }

  #      rank
  #ranking: rank

  batch: 256
  partition: 32
}

```

```

    }
]
}
}
```

4 NEBULAGRAPH

Hive NebulaGraph

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange <nebula-exchange-3.3.0.jar_path> -c <hive_application.conf_path> -h
```



JAR

maven

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange /root/nebula-exchange/nebula-exchange/target/nebula-exchange-3.3.0.jar -c /root/nebula-exchange/nebula-exchange/target/classes/hive_application.conf -h
```

```
batchSuccess.<tag_name/edge_name>                    batchSuccess.follow: 300
```

5

NebulaGraph NebulaGraph Studio

```
GO FROM "player100" OVER follow;
```

[SHOW STATS](#)

6 NEBULAGRAPH

NebulaGraph

: January 13, 2023

19.4.11 MaxCompute

Exchange MaxCompute NebulaGraph

basketballplayer

MacOS

- CPU 1.7 GHz Quad-Core Intel Core i7
- 16 GB
- Spark 2.4.7
- Hadoop 2.9.2
- MaxCompute
- NebulaGraph 3.3.0 Docker Compose

- NebulaGraph

- Graph Meta IP
- NebulaGraph
- Exchange Exchange Exchange 3.3.0
- Spark
- NebulaGraph Schema Tag Edge type
- Hadoop

1 NEBULAGRAPH SCHEMA

NebulaGraph Schema

1. Schema NebulaGraph Schema

Tag	player	name string, age int
Tag	team	name string
Edge Type	follow	degree int
Edge Type	serve	start_year int, end_year int

2. NebulaGraph basketballplayer Schema

```
## nebula> CREATE SPACE basketballplayer \
    (partition_num = 10, \
     replica_factor = 1, \
     vid_type = FIXED_STRING(30));

##      basketballplayer
nebula> USE basketballplayer;

##      Tag player
nebula> CREATE TAG player(name string, age int);

##      Tag team
nebula> CREATE TAG team(name string);

##      Edge type follow
nebula> CREATE EDGE follow(degree int);

##      Edge type serve
nebula> CREATE EDGE serve(start_year int, end_year int);
```

2

Exchange target/classes/application.conf MaxCompute

maxcompute_application.conf

```
{
  # Spark
  spark: {
    app: {
      name: NebulaGraph Exchange 3.3.0
    }
    driver: {
      cores: 1
      maxResultSize: 1G
    }
    cores: {
      max: 16
    }
  }

  # NebulaGraph
  nebula: {
    address: {
      # NebulaGraph Graph Meta IP
      #           "ip1:port","ip2:port","ip3:port"
      #           (,,
      graph:["127.0.0.1:9669"]
      meta:["127.0.0.1:9559"]
    }
    # NebulaGraph
    user: root
    pswd: nebula
    # NebulaGraph
    space: basketballplayer
    connection: {
      timeout: 3000
      retry: 3
    }
    execution: {
      retry: 3
    }
  }
}
```

```

}
error: {
  max: 32
  output: /tmp/errors
}
rate: {
  limit: 1024
  timeout: 1000
}
#
tags: [
  # Tag player
  {
    name: player
    type: {
      # MaxCompute
      source: maxcompute
      # NebulaGraph Client SST
      sink: client
    }
  }
  # MaxCompute
  table:player

  # MaxCompute
  project:project

  # MaxCompute odpsUrl tunnelUrl
  # https://help.aliyun.com/document_detail/34951.html
  odpsUrl:"http://service.cn-hangzhou.maxcompute.aliyun.com/api"
  tunnelUrl:"http://dt.cn-hangzhou.maxcompute.aliyun.com"

  # MaxCompute accessKeyId accessKeySecret
  accessKeyId:xxx
  accessKeySecret:xxx

  # MaxCompute
  partitionSpec:"dt='partition1'"

  # MaxCompute Spark MaxCompute 1
  numPartitions:100

  # SQL table
  sentence:"select id, name, age, playerid from player where id < 10"

  # fields player value NebulaGraph
  # fields nebula.fields
  #
  fields:[name, age]
  nebula.fields:[name, age]

  # NebulaGraph VID
  vertex:{ field: playerid }

  # NebulaGraph
  batch: 256

  # Spark
  partition: 32
}

# Tag team
{
  name: team
  type: {
    source: maxcompute
    sink: client
  }
  table:team
  project:project
  odpsUrl:"http://service.cn-hangzhou.maxcompute.aliyun.com/api"
  tunnelUrl:"http://dt.cn-hangzhou.maxcompute.aliyun.com"
  accessKeyId:xxx
  accessKeySecret:xxx
  partitionSpec:"dt='partition1'"
  sentence:"select id, name, teamid from team where id < 10"
  fields:[name]
  nebula.fields:[name]
  vertex:{ field: teamid }
  batch: 256
  partition: 32
}
]

#
edges: [
  # Edge type follow
  {
    # NebulaGraph Edge type

```

```

name: follow

type:{          MaxCompute
#           MaxCompute
source:maxcompute

#       NebulaGraph
#       NebulaGraph Client   SST
sink:client
}

# MaxCompute
table:follow

# MaxCompute
project:project

# MaxCompute      odpsUrl    tunnelUrl
#      https://help.aliyun.com/document_detail/34951.html
odpsUrl:"http://service.cn-hangzhou.maxcompute.aliyun.com/api"
tunnelUrl:"http://dt.cn-hangzhou.maxcompute.aliyun.com"

# MaxCompute      accessKeyId    accessKeySecret
accessKeyId:xxx
accessKeySecret:xxx

# MaxCompute
partitionSpec:"dt='partition1'"


#   SQL          table
sentence:"select * from follow"

#   fields      follow        value      NebulaGraph
#   fields      nebula.fields
#
fields:[degree]
nebula.fields:[degree]

#   source      follow
source:{      field: src_player
}

#   target      follow
target:{      field: dst_player
}

#   rank
#ranking: rank

# Spark
partition:10

#       NebulaGraph
batch:10
}

#   Edge type serve
{
name: serve
type:{      source:maxcompute
           sink:client
}
table:serve
project:project
odpsUrl:"http://service.cn-hangzhou.maxcompute.aliyun.com/api"
tunnelUrl:"http://dt.cn-hangzhou.maxcompute.aliyun.com"
accessKeyId:xxx
accessKeySecret:xxx
partitionSpec:"dt='partition1'"
sentence:"select * from serve"
fields:[start_year,end_year]
nebula.fields:[start_year,end_year]
source:{      field: playerid
}
target:{      field: teamid
}

#   rank
#ranking: rank

partition:10
batch:10
}
]
}

```

3 NEBULAGRAPH

MaxCompute NebulaGraph

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange <nebula-exchange-3.3.0.jar_path> -c <maxcompute_application.conf_path>
```



JAR maven

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange /root/nebula-exchange/nebula-exchange/target/nebula-exchange-3.3.0.jar -c /root/nebula-exchange/nebula-exchange/target/classes/maxcompute_application.conf
```

batchSuccess.<tag_name/edge_name> batchSuccess.follow: 300

4

NebulaGraph NebulaGraph Studio

```
GO FROM "player100" OVER follow;
```

SHOW STATS

5 NEBULAGRAPH

NebulaGraph

:January 13, 2023

19.4.12 Pulsar

Exchange Pulsar NebulaGraph

MacOS

-
- CPU 1.7 GHz Quad-Core Intel Core i7
- 16 GB
- Spark 2.4.7
- NebulaGraph 3.3.0 [Docker Compose](#)
- [NebulaGraph](#)
- Graph Meta IP
- NebulaGraph
- Exchange [Exchange](#) Exchange 3.3.0
- Spark
- NebulaGraph Schema Tag Edge type
- Pulsar

1 NEBULAGRAPH SCHEMA

NebulaGraph Schema

1. Schema NebulaGraph Schema

Tag	player	name string, age int
Tag	team	name string
Edge Type	follow	degree int
Edge Type	serve	start_year int, end_year int

2. NebulaGraph basketballplayer Schema

```
## nebula> CREATE SPACE basketballplayer \
    (partition_num = 10, \
     replica_factor = 1, \
     vid_type = FIXED_STRING(30));

##      basketballplayer
nebula> USE basketballplayer;

##      Tag player
nebula> CREATE TAG player(name string, age int);

##      Tag team
nebula> CREATE TAG team(name string);

##      Edge type follow
nebula> CREATE EDGE follow(degree int);

##      Edge type serve
nebula> CREATE EDGE serve(start_year int, end_year int);
```

2

Exchange target/classes/application.conf Pulsar pulsar_application.conf

```
{
  # Spark
  spark: {
    app: {
      name: NebulaGraph Exchange 3.3.0
    }
    driver: {
      cores: 1
      maxResultSize: 1G
    }
    cores: {
      max: 16
    }
  }

  # NebulaGraph
  nebula: {
    address: {
      # NebulaGraph Graph Meta IP
      # "ip1:port", "ip2:port", "ip3:port"
      # (, )
      graph: ["127.0.0.1:9669"]
      meta: ["127.0.0.1:9559"]
    }
    # NebulaGraph
    user: root
    pswd: nebula
    # NebulaGraph
    space: basketballplayer
    connection: {
      timeout: 3000
      retry: 3
    }
    execution: {
      retry: 3
    }
    error: {
  }
```

```

    max: 32
    output: /tmp/errors
}
rate: {
    limit: 1024
    timeout: 1000
}
}
#
tags: [
    # Tag player
{
    # NebulaGraph      Tag
    name: player
    type: {
        #                  Pulsar
        source: pulsar
        # NebulaGraph Client  SST
        sink: client
    }
    # Pulsar
    service: "pulsar://127.0.0.1:6650"
    # pulsar admin.url
    admin: "http://127.0.0.1:8081"
    # Pulsar      topic topics  topicsPattern
    options: {
        topics: "topic1,topic2"
    }

    # fields     player      value      NebulaGraph
    # fields    nebula.fields
    #
    fields: [age,name]
    nebula.fields: [age,name]

    #          NebulaGraph  VID
    vertex:{ field:playerid
}

    #      NebulaGraph
batch: 10

    # Spark
partition: 10
#
interval.seconds: 10
}
# Tag team
{
    name: team
    type: {
        source: pulsar
        sink: client
    }
    service: "pulsar://127.0.0.1:6650"
    admin: "http://127.0.0.1:8081"
    options: {
        topics: "topic1,topic2"
    }
    fields: [name]
    nebula.fields: [name]
    vertex:{ field:teamid
}
batch: 10
partition: 10
interval.seconds: 10
}
]

#
edges: [
    # Edge type follow
{
    # NebulaGraph      Edge type
    name: follow

    type: {
        #                  Pulsar
        source: pulsar
        # NebulaGraph Client  SST
        sink: client
    }
    # Pulsar
    service: "pulsar://127.0.0.1:6650"
    # pulsar admin.url
    admin: "http://127.0.0.1:8081"
    # Pulsar      topic topics  topicsPattern
    options: {

```

```

    topics: "topic1,topic2"
}

#   fields      follow      value     NebulaGraph
# fields  nebula.fields
#
fields: [degree]
nebula.fields: [degree]

#   source      follow
#   target      follow
source:{ 
    field:src_player
}

target:{ 
    field:dst_player
}

#       rank
#ranking: rank

#       NebulaGraph
batch: 10

# Spark
partition: 10

#
interval.seconds: 10
}

#   Edge type serve
{
name: serve
type: {
    source: Pulsar
    sink: client
}
service: "pulsar://127.0.0.1:6650"
admin: "http://127.0.0.1:8081"
options: {
    topics: "topic1,topic2"
}

fields: [start_year,end_year]
nebula.fields: [start_year,end_year]
source:{ 
    field:playerid
}

target:{ 
    field:teamid
}

#       rank
#ranking: rank

batch: 10
partition: 10
interval.seconds: 10
}
}
}

```

3 NEBULAGRAPH

Pulsar NebulaGraph

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange <nebula-exchange-3.3.0.jar_path> -c <pulsar_application.conf_path>
```



JAR maven

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange /root/nebula-exchange/nebula-exchange/target/nebula-exchange-3.3.0.jar -c /root/nebula-exchange/nebula-exchange/target/classes/pulsar_application.conf
```

batchSuccess.<tag_name/edge_name> batchSuccess.follow: 300

4

NebulaGraph NebulaGraph Studio

GO FROM "player100" OVER follow;

[SHOW STATS](#)

5 NEBULAGRAPH

NebulaGraph

:January 13, 2023

19.4.13 Kafka

Exchange Kafka NebulaGraph

MacOS

-
- CPU 1.7 GHz Quad-Core Intel Core i7
- 16 GB
- Spark 2.4.7
- NebulaGraph 3.3.0 [Docker Compose](#)

- [NebulaGraph](#)
- Graph Meta IP
- NebulaGraph
- Exchange [Exchange](#) Exchange 3.3.0
- Spark
- NebulaGraph Schema Tag Edge type
- Kafka

1 NEBULAGRAPH SCHEMA

NebulaGraph Schema

1. Schema NebulaGraph Schema

Tag	player	name string, age int
Tag	team	name string
Edge Type	follow	degree int
Edge Type	serve	start_year int, end_year int

2. NebulaGraph basketballplayer Schema

```
## nebula> CREATE SPACE basketballplayer \
    (partition_num = 10, \
     replica_factor = 1, \
     vid_type = FIXED_STRING(30));

##      basketballplayer
nebula> USE basketballplayer;

##      Tag player
nebula> CREATE TAG player(name string, age int);

##      Tag team
nebula> CREATE TAG team(name string);

##      Edge type follow
nebula> CREATE EDGE follow(degree int);

##      Edge type serve
nebula> CREATE EDGE serve(start_year int, end_year int);
```

2

Exchange target/classes/application.conf Kafka kafka_application.conf

```
{
  # Spark
  spark: {
    app: {
      name: NebulaGraph Exchange 3.3.0
    }
    driver: {
      cores: 1
      maxResultSize: 1G
    }
    cores: {
      max: 16
    }
  }

  # NebulaGraph
  nebula: {
    address: {
      # NebulaGraph Graph Meta IP
      # "ip1:port", "ip2:port", "ip3:port"
      # (, )
      graph: ["127.0.0.1:9669"]
      meta: ["127.0.0.1:9559"]
    }
    # NebulaGraph
    user: root
    pswd: nebula
    # NebulaGraph
    space: basketballplayer
    connection: {
      timeout: 3000
      retry: 3
    }
    execution: {
      retry: 3
    }
    error: {
  }
```

```

    max: 32
    output: /tmp/errors
}
rate: {
    limit: 1024
    timeout: 1000
}
}
#
tags: [
    # Tag player
{
    # NebulaGraph      Tag
    name: player
    type: {
        #           Kafka
        source: kafka
        #           NebulaGraph Client  SST
        sink: client
    }
    # Kafka
    service: "127.0.0.1:9092"
    #
    topic: "topic_name1"

    #   fields      Kafka value          ,   Spark Structured Streaming   Kafka      JSON      value      fields      JSON      key
    fields: [personName, personAge]
    #   fields      key     NebulaGraph      key   value          personName  value  NebulaGraph  name  personAge  value  age
    nebula.fields: [name, age]

    #           NebulaGraph      VID
    #   key      key      key      VID      name
    vertex:{ field:personId
}

    #           NebulaGraph
batch: 10

    # Spark
partition: 10
#
interval.seconds: 10
}
# Tag team
{
    name: team
    type: {
        source: kafka
        sink: client
    }
    service: "127.0.0.1:9092"
    topic: "topic_name2"
    fields: [key]
    nebula.fields: [name]
    vertex:{ field:teamId
}
batch: 10
partition: 10
interval.seconds: 10
}

]

#
edges: [
    # Edge type follow
{
    # NebulaGraph      Edge type
    name: follow

    type: {
        #           Kafka
        source: kafka

        #           NebulaGraph
        #           NebulaGraph Client  SST
        sink: client
    }

    # Kafka
    service: "127.0.0.1:9092"
    #
    topic: "topic_name3"

    #   fields      Kafka value          ,   Spark Structured Streaming   Kafka      JSON      value      fields      JSON      key
    fields: [degree]
    #   fields      key     NebulaGraph      key   value          degree  value  NebulaGraph  degree
    nebula.fields: [degree]

    #   source      topic
    #   target      topic
    source:{

}

```

```

        field:srcPersonId
    }

    target:{
        field:dstPersonId
    }

    #      rank
    #ranking: rank

    #      NebulaGraph
    batch: 10

    # Spark
    partition: 10

    #
    interval.seconds: 10
}

#   Edge type serve
{
    name: serve
    type: {
        source: kafka
        sink: client
    }
    service: "127.0.0.1:9092"
    topic: "topic_name4"

    fields: [startYear,endYear]
    nebula.fields: [start_year,end_year]
    source:{
        field:personId
    }

    target:{
        field:teamId
    }

    #      rank
    #ranking: rank

    batch: 10
    partition: 10
    interval.seconds: 10
}
]
```

3 NEBULAGRAPH

Kafka NebulaGraph

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange <nebula-exchange-3.3.0.jar_path> -c <kafka_application.conf_path>
```



JAR maven

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange /root/nebula-exchange/nebula-exchange/target/nebula-exchange-3.3.0.jar -c /root/nebula-exchange/nebula-exchange/target/classes/kafka_application.conf
```

batchSuccess.<tag_name/edge_name> batchSuccess.follow: 300

4

NebulaGraph NebulaGraph Studio

```
GO FROM "player100" OVER follow;
```

SHOW STATS

5 NEBULAGRAPH

NebulaGraph

: January 13, 2023

19.4.14 JDBC

JDBC JDBC MySQL Exchange JDBC NebulaGraph

basketballplayer

MySQL basketball player team follow serve

MacOS

- CPU 1.7 GHz Quad-Core Intel Core i7
 - 16 GB
 - Spark 2.3.0
 - Hadoop 2.9.2
 - NebulaGraph 3.3.0 Docker Compose

- **NebulaGraph**
- Graph Meta IP
- NebulaGraph
- Exchange Exchange Exchange 3.3.0
- Spark
- NebulaGraph Schema Tag Edge type
- HDFS Hadoop
- NebulaGraph

1 NEBULAGRAPH SCHEMA

NebulaGraph Schema

1. Schema NebulaGraph Schema

Tag	player	name string, age int
Tag	team	name string
Edge Type	follow	degree int
Edge Type	serve	start_year int, end_year int

2. NebulaGraph Console basketballplayer Schema

```
## nebula> CREATE SPACE basketballplayer \
  (partition_num = 10, \
  replica_factor = 1, \
  vid_type = FIXED_STRING(30));

##     basketballplayer
nebula> USE basketballplayer;

##     Tag player
nebula> CREATE TAG player(name string, age int);

##     Tag team
nebula> CREATE TAG team(name string);

##     Edge type follow
nebula> CREATE EDGE follow(degree int);

##     Edge type serve
nebula> CREATE EDGE serve(start_year int, end_year int);
```

2.

Exchange target/classes/application.conf JDBC

jdbc_application.conf

```
{
# Spark
spark: {
  app: {
    name: NebulaGraph Exchange 3.3.0
  }
  driver: {
    cores: 1
  }
}
```

```

        maxResultSize: 1G
    }
    executor: {
        memory:1G
    }

    cores: {
        max: 16
    }
}

# NebulaGraph
nebula: {
    address: {
        # Graph      Meta      IP
        #
        # "ip1:port","ip2:port","ip3:port"
        graph:["127.0.0.1:9669"]
        meta:["127.0.0.1:9559"]
    }
}

#      NebulaGraph
user: root
pswd: nebula

#
space: basketballplayer
connection: {
    timeout: 3000
    retry: 3
}
execution: {
    retry: 3
}
error: {
    max: 32
    output: /tmp/errors
}
rate: {
    limit: 1024
    timeout: 1000
}
}

tags: [
    # Tag player
    {
        # NebulaGraph      Tag
        name: player
        type: {
            # JDBC
            source: jdbc

            # NebulaGraph Client  SST
            sink: client
        }
    }
]

# JDBC      URL      MySql
url:"jdbc:mysql://127.0.0.1:3306/basketball?useUnicode=true&characterEncoding=utf-8"

# JDBC
driver:"com.mysql.cj.jdbc.Driver"

#
user:root
password:"12345"

table:player
sentence:"select playerid, age, name from player order by playerid"

#          https://spark.apache.org/docs/latest/sql-data-sources-jdbc.html
partitionColumn:playerid   #
lowerBound:1                #
upperBound:5                #
numPartitions:5             #

fetchSize:2                 #

#   fields      player      value      NebulaGraph
#   fields      nebula.fields
#
fields: [age,name]           '
nebula.fields: [age,name]

#      NebulaGraph      VID
vertex: {
    field:playerid
}

#      NebulaGraph
batch: 256

```

```

# Spark
partition: 32
}
#   Tag team
{
  name: team
  type: {
    source: jdbc
    sink: client
  }

  url:"jdbc:mysql://127.0.0.1:3306/basketball?useUnicode=true&characterEncoding=utf-8"
  driver:"com.mysql.cj.jdbc.Driver"
  user:root
  password:"12345"
  table:team
  sentence:"select teamid, name from team order by teamid"
  partitionColumn:teamid
  lowerBound:1
  upperBound:5
  numPartitions:5
  fetchSize:2

  fields: [name]
  nebula.fields: [name]
  vertex: {
    field: teamid
  }
  batch: 256
  partition: 32
}

]

#
edges: [
  #   Edge type follow
  {
    # NebulaGraph      Edge type
    name: follow

    type: {
      #           JDBC
      source: jdbc

      #           NebulaGraph
      #           NebulaGraph Client   SST
      sink: client
    }

    url:"jdbc:mysql://127.0.0.1:3306/basketball?useUnicode=true&characterEncoding=utf-8"
    driver:"com.mysql.cj.jdbc.Driver"
    user:root
    password:"12345"
    table:follow
    sentence:"select src_player,dst_player,degree from follow order by src_player"
    partitionColumn:src_player
    lowerBound:1
    upperBound:5
    numPartitions:5
    fetchSize:2

    #   fields      follow      value      NebulaGraph
    #   fields      nebula.fields
    #           ,
    fields: [degree]
    nebula.fields: [degree]

    #   source      follow
    #   target      follow
    source: {
      field: src_player
    }

    target: {
      field: dst_player
    }

    #           rank
    #ranking: rank

    #           NebulaGraph
    batch: 256

    # Spark
    partition: 32
  }

  #   Edge type serve
  {
    name: serve
    type: {
      source: jdbc
    }
  }
]

```

```

    sink: client
}

url:"jdbc:mysql://127.0.0.1:3306/basketball?useUnicode=true&characterEncoding=utf-8"
driver:"com.mysql.cj.jdbc.Driver"
user:root
password:"12345"
table:serve
sentence:"select playerid,teamid,start_year,end_year from serve order by playerid"
partitionColumn:playerid
lowerBound:1
upperBound:5
numPartitions:5
fetchSize:2

fields: [start_year,end_year]
nebula.fields: [start_year,end_year]
source: {
  field: playerid
}
target: {
  field: teamid
}

# rank
#ranking: rank

batch: 256
partition: 32
}
]
}
}

```

4 NEBULAGRAPH

JDBC NebulaGraph

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange <nebula-exchange-3.3.0.jar_path> -c <jdbc_application.conf_path>
```



JAR maven

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange /root/nebula-exchange/nebula-exchange/target/nebula-exchange-3.3.0.jar -c /root/nebula-exchange/nebula-exchange/target/classes/jdbc_application.conf
```

batchSuccess.<tag_name/edge_name> batchSuccess.follow: 300

5

NebulaGraph NebulaGraph Studio

```
GO FROM "player100" OVER follow;
```

SHOW STATS

6 NEBULAGRAPH

NebulaGraph

:January 13, 2023

19.4.15 SST

SST	Sorted String Table	HDFS	NebulaGraph	CSV
-----	---------------------	------	-------------	-----

- Linux SST
- Default
- Exchange 3.3.0 GEOGRAPHY SST

Exchange

- nGQL NebulaGraph
- SST Console SST NebulaGraph
SST



10

NebulaGraph RocksDB RocksDB API SST
SST SST Exchange Reader sstProcessor sstWriter

1. Reader

2. sstProcessor NebulaGraph Schema SST HDFS SST
3. sstWriter SST Key
4. SST RocksDB IngestExternalFile() SST NebulaGraph

```
IngestExternalFileOptions info;
#     SST
Status s = db_->IngestExternalFile({"home/usr/file1.sst", "home/usr/file2.sst"}, info);
if (!s.ok()) {
    printf("Error while adding file %s and %s, Error %s\n",
        file_path1.c_str(), file_path2.c_str(), s.ToString().c_str());
    return 1;
}
```

IngestExternalFile()	RocksDB	RocksDB	SST	Memtable	Memtable	flush
SST	LSM					

basketballplayer

MacOS

- CPU 1.7 GHz Quad-Core Intel Core i7
- 16 GB
- Spark 2.4.7
- Hadoop 2.9.2
- NebulaGraph 3.3.0

- **NebulaGraph 3.3.0**

- Graph Meta IP
 - NebulaGraph
- Meta `--ws_storage_http_port` Storage `--ws_http_port` 19779
- Graph `--ws_meta_http_port` Meta `--ws_http_port` 19559
- Schema Tag Edge type
- Exchange jar Exchange 3.3.0
- Spark
- JDK 1.8 JAVA_HOME
- Hadoop Storage

 **Note**

- SST
- SST Storage Hadoop
- INGEST SST Storage `--move_files=true` NebulaGraph INGEST SST `mv` data `--`
 - `move_files` false NebulaGraph `cp` SST

1 NEBULAGRAPH SCHEMA

CSV NebulaGraph Schema

1. Schema NebulaGraph Schema

Tag	player	name string, age int
Tag	team	name string
Edge Type	follow	degree int
Edge Type	serve	start_year int, end_year int

2. NebulaGraph Console basketballplayer Schema

```
## nebula> CREATE SPACE basketballplayer \
    (partition_num = 10, \
     replica_factor = 1, \
     vid_type = FIXED_STRING(30));

##      basketballplayer
nebula> USE basketballplayer;

##      Tag player
nebula> CREATE TAG player(name string, age int);

##      Tag team
nebula> CREATE TAG team(name string);

##      Edge type follow
nebula> CREATE EDGE follow(degree int);

##      Edge type serve
nebula> CREATE EDGE serve(start_year int, end_year int);
```

2 CSV

1. CSV Schema



CSV

2. CSV

3

Exchange target/classes/application.conf sst_application.conf

```
{
  # Spark
  spark: {
    app: {
      name: NebulaGraph Exchange 3.3.0
    }

    master:local

    driver: {
      cores: 1
      maxResultSize: 1G
    }

    executor: {
      memory:1G
    }
  }
}
```

```

cores: {
    max: 16
}
}

# NebulaGraph
nebula: {
    address: {
        graph: ["127.0.0.1:9669"]
        meta: ["127.0.0.1:9559"]
    }
    user: root
    pswd: nebula
    space: basketballplayer
}

# SST
path:{ 
    #           SST
    local:"/tmp"

    # SST      HDFS
    remote:"/sst"

    # HDFS  NameNode
    hdfs.namenode: "hdfs://*.**.*:9000"
}

#
connection: {
    # socket
    timeout: 30000
}

error: {
    #
    max: 32
    #
    output: /tmp/errors
}

# Google Guava RateLimiter      NebulaGraph
rate: {
    # RateLimiter
    limit: 1024

    # RateLimiter
    timeout: 1000
}
}

#
tags: [
    # Tag player
{
    #   NebulaGraph      Tag
    name: player
    type: {
        #           CSV
        source: csv

        #           NebulaGraph Client  SST
        sink: sst
    }

    #           CSV
    #           HDFS          hdfs://      "hdfs://ip:port/xx/xx.csv"
    path: "hdfs://*.**.*:9000/dataset/vertex_player.csv"

    #           CSV          [ _c0, _c1, _c2, ..., _cn ]
    #           CSV
    fields: [ _c1, _c2 ]

    #   NebulaGraph
    # fields  nebula.fields
    nebula.fields: [age, name]

    #           VID
    # vertex      fields  csv.fields
    # NebulaGraph 3.3.0          VID
    vertex: {
        field: _c0
    }

    #
    separator: ","
}

#           CSV      header  true
#           CSV      header  false   false
header: false

#           NebulaGraph
batch: 256

```

```

#   Spark
partition: 32

#   SST      NebulaGraph      partition
repartitionWithNebula: false
}

#   Tag team
{
#   NebulaGraph      Tag
name: team
type: {
#       CSV
source: csv

#       NebulaGraph Client  SST
sink: sst
}

#   CSV
#   HDFS          hdf://      "hdfs://ip:port/xx/xx.csv"
path: "hdfs://*.*.*:9000/dataset/vertex_team.csv"

#   CSV          [_c0, _c1, _c2, ..., _cn]
#   CSV
fields: [_c1]

#   NebulaGraph
# fields  nebula.fields
nebula.fields: [name]

#       VID
# vertex      fields  csv.fields
# NebulaGraph 3.3.0          VID
vertex: {
field:_c0
}

#
separator: ","
'

#   CSV      header  true
#   CSV      header  false   false
header: false

#       NebulaGraph
batch: 256

#   Spark
partition: 32

#   SST      NebulaGraph      partition
repartitionWithNebula: false
}

#
]

#
edges: [
#   Edge type follow
{
#   NebulaGraph      Edge type
name: follow
type: {
#       CSV
source: csv

#       NebulaGraph Client  SST
sink: sst
}

#   CSV
#   HDFS          hdf://      "hdfs://ip:port/xx/xx.csv"
path: "hdfs://*.*.*:9000/dataset/edge_follow.csv"

#   CSV          [_c0, _c1, _c2, ..., _cn]
#   CSV
fields: [_c2]

#   NebulaGraph
# fields  nebula.fields
nebula.fields: [degree]

#       VID
# vertex      fields  csv.fields
# NebulaGraph 3.3.0          VID
source: {
field: _c0
}
target: {
field: _c1
}

#
,

```

```

separator: ","
#      rank
#ranking: rank

#   CSV      header  true
#   CSV      header  false   false
header: false

#      NebulaGraph
batch: 256

#      Spark
partition: 32

#   SST      NebulaGraph      partition
repartitionWithNebula: false
}

#   Edge type serve
{
#   NebulaGraph      Edge type
name: serve
type: {
#   CSV
source: csv

#      NebulaGraph Client  SST
sink: sst
}

#   CSV          [_c0, _c1, _c2, ..., _cn]
#   CSV
fields: [_c2,_c3]

#   NebulaGraph
# fields  nebula.fields
nebula.fields: [start_year, end_year]

#
# vertex      fields  csv.fields
# NebulaGraph 3.3.0      VID
source: {
field: _c0
}
target: {
field: _c1
}

#
separator: ","
#      rank
#ranking: _c5

#   CSV      header  true
#   CSV      header  false   false
header: false

#      NebulaGraph
batch: 256

#      Spark
partition: 32

#   SST      NebulaGraph      partition
repartitionWithNebula: false
}

]
#
}

```

4 SST

CSV SST

```
`${SPARK_HOME}/bin/spark-submit --master "local" --conf spark.sql.shuffle.partitions=<shuffle_concurrency> --class com.vesoft.nebula.exchange.Exchange <nebula-exchange-3.3.0.jar_path> -c <sst_application.conf_path>
```

Note

SST Spark shuffle `spark.sql.shuffle.partitions`

Note

JAR maven

```
`${SPARK_HOME}/bin/spark-submit --master "local" --conf spark.sql.shuffle.partitions=200 --class com.vesoft.nebula.exchange.Exchange /root/nebula-exchange/nebula-exchange/target/nebula-exchange-3.3.0.jar -c /root/nebula-exchange/nebula-exchange/target/classes/sst_application.conf
```

HDFS /sst nebula.path.remote SST

Note

Schema Tag Edge type SST SST Space ID Tag ID Edge ID

5 SST

Note

- Storage Hadoop HADOOP_HOME JAVA_HOME
- Meta `--ws_storage_http_port` Storage `--ws_http_port` 19779
- Graph `--ws_meta_http_port` Meta `--ws_http_port` 19559

NebulaGraph SST

1.

```
nebula> USE basketballplayer;
```

2. SST

```
nebula> SUBMIT JOB DOWNLOAD HDFS "hdfs://<hadoop_address>:<hadoop_port>/<sst_file_path>";
```

```
nebula> SUBMIT JOB DOWNLOAD HDFS "hdfs://*.**.*:9000/sst";
```

3. SST

```
nebula> SUBMIT JOB INGEST;
```

Note

- NebulaGraph `data/storage/nebula` Space ID download SST
download
- SUBMIT JOB INGEST;

6

NebulaGraph NebulaGraph Studio

GO FROM "player100" OVER follow;

[SHOW STATS](#)

7 NEBULAGRAPH

NebulaGraph

:January 13, 2023

19.5 Exchange

19.5.1

Q central Could not resolve dependencies for project xxx

```
Maven libexec/conf/settings.xml mirror

<mirror>
  <id>alimaven</id>
  <mirrorOf>central</mirrorOf>
  <name>aliyun maven</name>
  <url>http://maven.aliyun.com/nexus/content/repositories/central/</url>
</mirror>

mirrorOf * central *,!SparkPackagesRepo,!bintray-streamnative-maven
```

Exchange pom.xml	Maven central pom.xml	maven	mirrorOf *
central			

Q Exchange SNAPSHOT

Could not find artifact com.vesoft:client:jar:xxx-SNAPSHOT

maven	SNAPSHOT	maven	central	SNAPSHOT
maven	setting.xml	profiles		

```
<profile>
  <activation>
    <activeByDefault>true</activeByDefault>
  </activation>
  <repositories>
    <repository>
      <id>snapshots</id>
      <url>https://oss.sonatype.org/content/repositories/snapshots/</url>
      <snapshots>
        <enabled>true</enabled>
      </snapshots>
    </repository>
  </repositories>
</profile>
```

19.5.2

Q java.lang.ClassNotFoundException: com.vesoft.nebula.exchange.Exchange

Yarn-Cluster	--conf

```
$SPARK_HOME/bin/spark-submit --class com.vesoft.nebula.exchange.Exchange \
--master yarn-cluster \
--files application.conf \
--conf spark.driver.extraClassPath=./ \
--conf spark.executor.extraClassPath=./ \
nebula-exchange-3.0.0.jar \
-c application.conf
```

Q method name xxx not found

Meta	Graph	Storage

Q NoSuchMethod MethodNotFound Exception in thread "main" java.lang.NoSuchMethodError

JAR	Exchange	Spark	Scala	Hive

Q Exchange Hive `Exception in thread "main" org.apache.spark.sql.AnalysisException: Table or view not found`

```
exchange           -h   table  database      spark-sql      exec      exec
```

Q com.facebook.thrift.protocol.TProtocolException: Expected protocol id xxx

NebulaGraph

- RPM DEB -port

- docker docker

```
nebula-docker-compose    docker-compose ps
```

```
$ docker-compose ps
      Name          Command     State            Ports
-----+-----+-----+-----+-----+
nebula-docker-compose_graphd_1 /usr/local/nebula/bin/nebu ... Up (healthy)  0.0.0.0:33205->19669/tcp, 0.0.0.0:33204->19670/tcp, 0.0.0.0:9669->9669/tcp
nebula-docker-compose_metad0_1 ./bin/nebula-metad --flagf ... Up (healthy)  0.0.0.0:33165->19559/tcp, 0.0.0.0:33162->19560/tcp, 0.0.0.0:33167->9559/tcp, 9560/tcp
nebula-docker-compose_metad1_1 ./bin/nebula-metad --flagf ... Up (healthy)  0.0.0.0:33166->19559/tcp, 0.0.0.0:33163->19560/tcp, 0.0.0.0:33168->9559/tcp, 9560/tcp
nebula-docker-compose_metad2_1 ./bin/nebula-metad --flagf ... Up (healthy)  0.0.0.0:33161->19559/tcp, 0.0.0.0:33160->19560/tcp, 0.0.0.0:33164->9559/tcp, 9560/tcp
nebula-docker-compose_storaged0_1 ./bin/nebula-storaged --fl ... Up (healthy)  0.0.0.0:33180->19779/tcp, 0.0.0.0:33178->19780/tcp, 9777/tcp, 9778/tcp, 0.0.0.0:33183->9779/tcp, 9780/tcp
nebula-docker-compose_storaged1_1 ./bin/nebula-storaged --fl ... Up (healthy)  0.0.0.0:33175->19779/tcp, 0.0.0.0:33172->19780/tcp, 9777/tcp, 9778/tcp, 0.0.0.0:33177->9779/tcp, 9780/tcp
nebula-docker-compose_storaged2_1 ./bin/nebula-storaged --fl ... Up (healthy)  0.0.0.0:33184->19779/tcp, 0.0.0.0:33181->19780/tcp, 9777/tcp, 9778/tcp, 0.0.0.0:33185->9779/tcp, 9780/tcp
```

Ports docker

- Graph	9669
- Meta	33167 33168 33164
- Storage	33183 33177 33185

Q com.facebook.thrift.protocol.TProtocolException: The field 'code' has been assigned the invalid value -4

Exchange NebulaGraph

Q Hive NebulaGraph

Hive JAR

```
--conf spark.driver.extraJavaOptions=-Dfile.encoding=utf-8
--conf spark.executor.extraJavaOptions=-Dfile.encoding=utf-8
```

```
<spark_install_path>/bin/spark-submit --master "local" \
--conf spark.driver.extraJavaOptions=-Dfile.encoding=utf-8 \
--conf spark.executor.extraJavaOptions=-Dfile.encoding=utf-8 \
--class com.vesoft.nebula.exchange.Exchange \
<nebula-exchange-3.x.y.jar_path> -c <application.conf_path>
```

YARN

```
<spark_install_path>/bin/spark-submit \
--class com.vesoft.nebula.exchange.Exchange \
--master yarn-cluster \
--files <application.conf_path> \
--conf spark.driver.extraClassPath=./ \
--conf spark.executor.extraClassPath=./ \
--conf spark.driver.extraJavaOptions=-Dfile.encoding=utf-8 \
--conf spark.executor.extraJavaOptions=-Dfile.encoding=utf-8 \
<nebula-exchange-3.x.y.jar_path> \
-c application.conf
```

Q Hive schema

Spark Hive Schema version 1.2.0 does not match metastore's schema version 2.1.0 Metastore is not upgraded or corrupt
 Hive metastore schema Spark metastore

1. Hive Hive metastore MySQL version Spark metastore

Hive MySQL metastore hive hive.VERSION version

```
update hive.VERSION set SCHEMA_VERSION="2.1.0" where VER_ID=1
```

2. Hive hive-site.xml

```
<property>
<name>hive.metastore.schema.verification</name>
<value>false</value>
</property>
```

3. Hive

Q: SST org.rocksdb.RocksDBException: While open a file for appending: /path/sst/1-xxx.sst: No such file or directory

1. /path

2. Spark /path

19.5.3**Q**

- batch NebulaGraph nGQL
- partition Spark
- nebula.rate NebulaGraph
 - limit
 - timeout

Storage leader

19.5.4**Q Exchange NebulaGraph**

Exchange

Q Exchange Spark Writer

Exchange	Spark Writer	Spark	NebulaGraph	Exchange	Spark Writer
Exchange					
•	MySQL Neo4j Hive HBase Kafka Pulsar				
•	Spark Writer	Spark HDFS	String NebulaGraph Schema Exchange		
	NebulaGraph	Schema	String double Exchange String		double

Q Exchange

Exchange

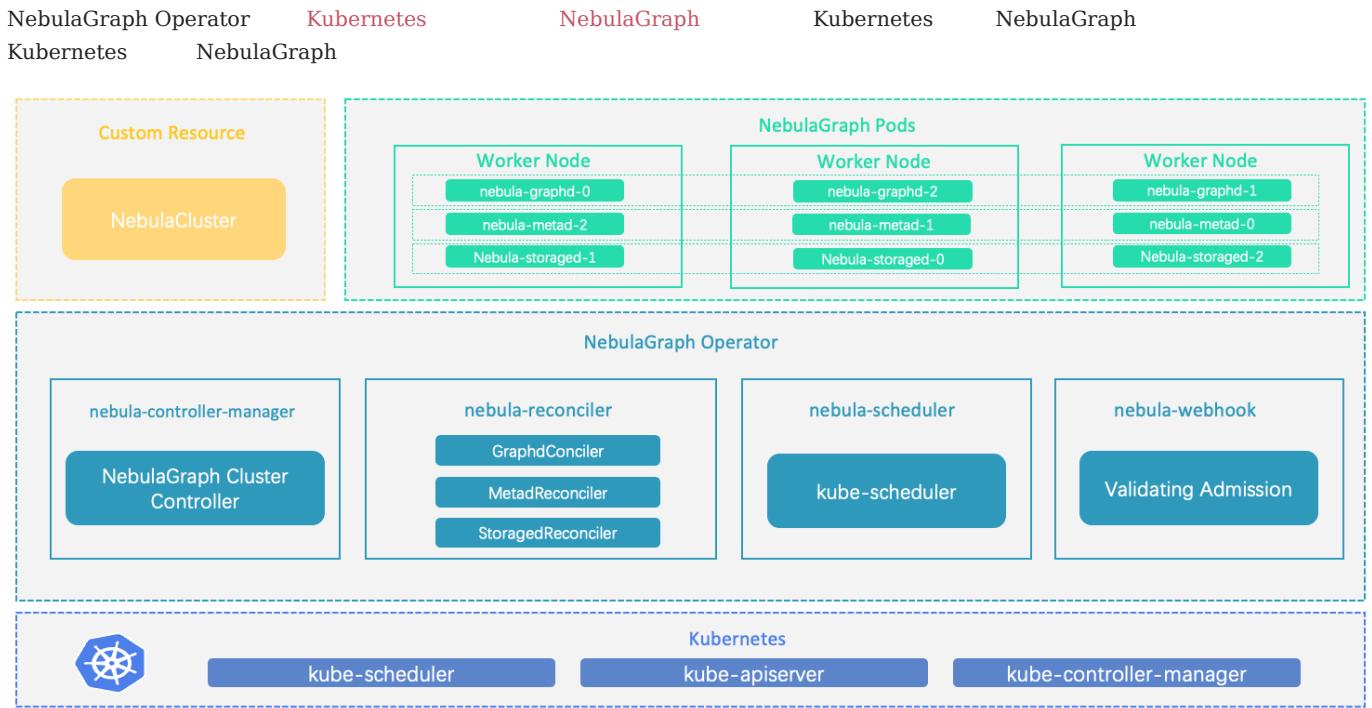
NebulaGraph Exchange test result

:January 13, 2023

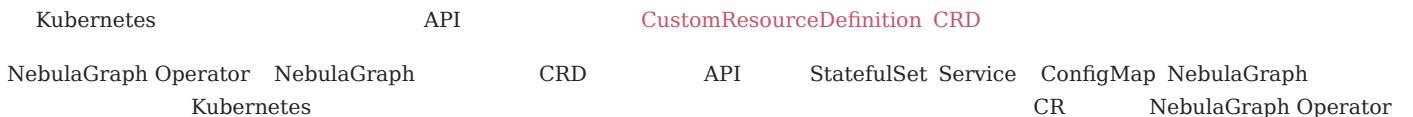
20. NebulaGraph Operator

20.1 NebulaGraph Operator

20.1.1



20.1.2



20.1.3

NebulaGraph Operator

- NebulaGraph Operator
Kubectl NebulaGraph Helm NebulaGraph
CR NebulaGraph Operator NebulaGraph
- NebulaGraph
Kubectl Helm
NebulaGraph NebulaGraph NebulaGraph Operator
YAML
- 3.0.0 NebulaGraph 3.3.x
- NebulaGraph Operator NebulaGraph
NebulaGraph Operator
- NebulaGraph Operator
Pods NebulaGraph

20.1.4

NebulaGraph Operator v1.x NebulaGraph NebulaGraph

NebulaGraph	NebulaGraph Operator
3.0.0 ~ 3.3.x	1.3.0
3.0.0 ~ 3.3.x	1.0.0 1.1.0 1.2.0
2.5.x ~ 2.6.x	0.9.0
2.5.x	0.8.0



- 1.x NebulaGraph Operator 3.x NebulaGraph.
- 0.9.0 NebulaGraph Operator 0.9.0 NebulaGraph Operator 0.8.0 2.5.x NebulaGraph
2.5.x NebulaGraph 0.9.0 Operator 2.6.x

NebulaGraph Operator NebulaGraph NebulaGraph Operator NebulaGraph

20.1.5

[Release](#)

: January 13, 2023

20.2

NebulaGraph Operator NebulaGraph

1. NebulaGraph Operator
 2. NebulaGraph
 - Kubectl NebulaGraph Helm NebulaGraph
 3. NebulaGraph
-

:January 13, 2023

20.3 NebulaGraph Operator

Helm NebulaGraph Operator

20.3.1

NebulaGraph Operator NebulaGraph NebulaGraph

20.3.2

NebulaGraph Operator NebulaGraph Operator

Kubernetes ≥ 1.16

Helm $\geq 3.2.0$

CoreDNS $\geq 1.6.0$



- RBAC
- CoreDNS DNS Pods DNS NebulaGraph DNS `x.default.svc.cluster.local`

20.3.3

NebulaGraph Operator

1. NebulaGraph Operator chart Helm

```
helm repo add nebula-operator https://vesoft-inc.github.io/nebula-operator/charts
```

2. Helm

```
helm repo update
```

3. NebulaGraph Operator

```
helm install nebula-operator nebula-operator/nebula-operator --namespace=<namespace_name> --version=${chart_version}
```

1.3.0 Operator

```
helm install nebula-operator nebula-operator/nebula-operator --namespace=nebula-operator-system --version=1.3.0
```

- nebula-operator-system `kubectl create namespace nebula-operator-system`
- 1.3.0 NebulaGraph Operator chart Chart `helm search repo -l nebula-operator Chart`
NebulaGraph Operator chart **Chart**

Chart

```
helm show values [CHART] [flags]
```

```
[abby@master ~]$ helm show values nebula-operator/nebula-operator
image:
  nebulaOperator:
    image: vesoft/nebula-operator:v1.3.0
    imagePullPolicy: Always
  kubeRBACProxy:
    image: gcr.io/kubebuilder/kube-rbac-proxy:v0.8.0
    imagePullPolicy: Always
  kubeScheduler:
    image: k8s.gcr.io/kube-scheduler:v1.18.8
    imagePullPolicy: Always

  imagePullSecrets: []
  kubernetesClusterDomain: ""

controllerManager:
  create: true
  replicas: 2
  env: []
  resources:
    limits:
      cpu: 200m
      memory: 200Mi
    requests:
      cpu: 100m
      memory: 100Mi

admissionWebhook:
  create: true

scheduler:
  create: true
  schedulerName: nebula-scheduler
  replicas: 2
  env: []
  resources:
    limits:
      cpu: 200m
      memory: 200Mi
    requests:
      cpu: 100m
      memory: 100Mi
...
...
```

image.nebulaOperator.image	vesoft/nebula-operator:v1.3.0	NebulaGraph Operator	1.3.0
image.nebulaOperator.imagePullPolicy	IfNotPresent		
imagePullSecrets	-		
kubernetesClusterDomain	cluster.local		
controllerManager.create	true	controller-manager	
controllerManager.replicas	2	controller-manager	
admissionWebhook.create	true	Admission Webhook	
shceduler.create	true	Scheduler	
shceduler.schedulerName	nebula-scheduler		
shceduler.replicas	2	nebula-scheduler	

<code>helm install [NAME] [CHART] [flags]</code>	Chart	Chart	Chart
NebulaGraph Operator	NebulaGraph Operator	AdmissionWebhook	AdmissionWebhook

```
helm install nebula-operator nebula-operator/nebula-operator --namespace=<nebula-operator-system> --set admissionWebhook.create=false
```

Helm `helm install`

NebulaGraph Operator

1. Helm

```
helm repo update
```

2. --set --values NebulaGraph Operator

- --set
- --values (-f) YAML

Chart

NebulaGraph Operator AdmissionWebhook

AdmissionWebhook

```
helm upgrade nebula-operator nebula-operator/nebula-operator --namespace=nebula-operator-system --version=1.3.0 --set admissionWebhook.create=false
```

Helm

NebulaGraph Operator



- 0.9.0 NebulaGraph Operator 1.x
- 1.x NebulaGraph Operator 3.x NebulaGraph

1. Helm

```
helm repo update
```

2. NebulaGraph Operator 1.3.0

```
helm upgrade nebula-operator nebula-operator/nebula-operator --namespace=<namespace_name> --version=1.3.0
```

```
helm upgrade nebula-operator nebula-operator/nebula-operator --namespace=nebula-operator-system --version=1.3.0
```

```
Release "nebula-operator" has been upgraded. Happy Helming!
NAME: nebula-operator
LAST DEPLOYED: Tue Nov 16 02:21:08 2021
NAMESPACE: nebula-operator-system
STATUS: deployed
REVISION: 3
TEST SUITE: None
NOTES:
NebulaGraph Operator installed!
```

3. CRD



Operator CRD NebulaGraph CRD [apps.nebula-graph.io_nebulaclusters.yaml](#)

a. NebulaGraph Operator chart

```
helm pull nebula-operator/nebula-operator --version=1.3.0
```

- --version :

b. tar -zxvf

```
1.3.0 chart /tmp
```

```
tar -zxvf nebula-operator-1.3.0.tgz -C /tmp
```

- -C /tmp :

4. nebula-operator CRD

```
kubectl apply -f crds/nebulacluster.yaml
```

```
customresourcedefinition.apiextensions.k8s.io/nebulaclusters.apps.nebula-graph.io configured
```

NebulaGraph Operator

1. NebulaGraph Operator chart

```
helm uninstall nebula-operator --namespace=<nebula-operator-system>
```

2. CRD

```
kubectl delete crd nebulaclusters.apps.nebula-graph.io
```

20.3.4

NebulaGraph Operator

NebulaGraph

Kubectl

NebulaGraph

Helm

NebulaGraph

: January 13, 2023

20.4 NebulaGraph

20.4.1 Kubectl NebulaGraph



1.x NebulaGraph Operator 3.x NebulaGraph

- [NebulaGraph Operator](#)

nebula

NebulaGraph

1.

- apps_v1alpha1_nebulacluster.yaml

```

apiVersion: apps.nebula-graph.io/v1alpha1
kind: NebulaCluster
metadata:
  name: nebula
spec:
  graphd:
    resources:
      requests:
        cpu: "500m"
        memory: "500Mi"
    limits:
      cpu: "1"
      memory: "1Gi"
    replicas: 1
    image: vesoft/nebula-graphd
    version: v3.3.0
    logVolumeClaim:
      resources:
        requests:
          storage: 2Gi
      storageClassName: fast-disks
  metad:
    resources:
      requests:
        cpu: "500m"
        memory: "500Mi"
    limits:
      cpu: "1"
      memory: "1Gi"
    replicas: 1
    image: vesoft/nebula-metad
    version: v3.3.0
    logVolumeClaim:
      resources:
        requests:
          storage: 2Gi
      storageClassName: fast-disks
  dataVolumeClaim:
    resources:
      requests:
        storage: 2Gi
      storageClassName: fast-disks
  storaged:
    resources:
      requests:
        cpu: "500m"
        memory: "500Mi"
    limits:
      cpu: "1"
      memory: "1Gi"
    replicas: 1
    image: vesoft/nebula-storaged
    version: v3.3.0
    logVolumeClaim:
      resources:
        requests:
          storage: 2Gi
      storageClassName: fast-disks
  dataVolumeClaims: # Operator 1.3.0
  - resources:
      requests:
        storage: 2Gi
      storageClassName: fast-disks
  - resources:
      requests:
        storage: 2Gi
      storageClassName: fast-disks
  enableAutoBalance: true
reference:
  name: statefulsets.apps
  version: v1
schedulerName: default-scheduler
nodeSelector:
  nebula: cloud
imagePullPolicy: Always
unsatisfiableAction: ScheduleAnyway

```

metadata.name	-	NebulaGraph
spec.graphd.replicas	1	Graphd
spec.graphd.images	vesoft/nebula-graphd	Graphd
spec.graphd.version	v3.3.0	Graphd
spec.graphd.service	-	Graphd Service
spec.graphd.logVolumeClaim.storageClassName	-	Graphd
spec.metad.replicas	1	Metad
spec.metad.images	vesoft/nebula-metad	Metad
spec.metad.version	v3.3.0	Metad
spec.metad.dataVolumeClaim.storageClassName	-	Metad
spec.metad.logVolumeClaim.storageClassName	-	Metad
spec.storaged.replicas	3	Storaged
spec.storaged.images	vesoft/nebula-storaged	Storaged
spec.storaged.version	v3.3.0	Storaged
spec.storaged.dataVolumeClaims.resources.requests.storage	-	Storaged /usr/local/nebula/ data1 /usr/local/nebula/data2
spec.storaged.dataVolumeClaims.resources.storageClassName	-	Storaged
spec.storaged.logVolumeClaim.storageClassName	-	Storaged
spec.storaged.enableAutoBalance	true	
spec.reference.name	-	
spec.schedulerName	-	
spec.imagePullPolicy	NebulaGraph Image pull policy	

2. NebulaGraph

```
kubectl create -f apps_vialpha1_nebulacluster.yaml
```

```
nebulacluster.apps.nebula-graph.io/nebula created
```

3. NebulaGraph

```
kubectl get nebulaclusters.apps.nebula-graph.io nebula
```

NAME	GRAPHD-DESIRED	GRAPHD-READY	METAD-DESIRED	METAD-READY	STORAGED-DESIRED	STORAGED-READY	AGE
nebula	1	1	1	1	3	3	86s

- NebulaGraph

Kubectl NebulaGraph

```
kubectl delete -f apps_v1alpha1_nebulacluster.yaml
```

NebulaGraph

:January 13, 2023

20.4.2 Helm NebulaGraph



1.x NebulaGraph Operator 3.x NebulaGraph

- [NebulaGraph Operator](#)

NebulaGraph

1. NebulaGraph Operator chart Helm 1 2 3

```
helm repo add nebula-operator https://vesoft-inc.github.io/nebula-operator/charts
```

2. Helm

```
helm repo update
```

3. Helm

```
export NEBULA_CLUSTER_NAME=nebula      # NebulaGraph
export NEBULA_CLUSTER_NAMESPACE=nebula # NebulaGraph
export STORAGE_CLASS_NAME=fast-disks   # NebulaGraph     StorageClass
```

4. NebulaGraph

```
kubectl create namespace "${NEBULA_CLUSTER_NAMESPACE}"
```

5. NebulaGraph

```
helm install "${NEBULA_CLUSTER_NAME}" nebula-operator/nebula-cluster \
--namespace="${NEBULA_CLUSTER_NAMESPACE}" \
--set nameOverride=${NEBULA_CLUSTER_NAME} \
--set nebula.storageClassName="${STORAGE_CLASS_NAME}"
```

6. NebulaGraph

```
kubectl -n "${NEBULA_CLUSTER_NAMESPACE}" get pod -l "app.kubernetes.io/cluster=${NEBULA_CLUSTER_NAME}"
```

NAME	READY	STATUS	RESTARTS	AGE
nebula-graphd-0	1/1	Running	0	5m34s
nebula-graphd-1	1/1	Running	0	5m34s
nebula-metad-0	1/1	Running	0	5m34s
nebula-metad-1	1/1	Running	0	5m34s
nebula-metad-2	1/1	Running	0	5m34s
nebula-storaged-0	1/1	Running	0	5m34s
nebula-storaged-1	1/1	Running	0	5m34s
nebula-storaged-2	1/1	Running	0	5m34s

- [NebulaGraph](#)

Helm

```
helm uninstall "${NEBULA_CLUSTER_NAME}" --namespace="${NEBULA_CLUSTER_NAMESPACE}"
```

```
helm uninstall nebula --namespace=nebula
```

NebulaGraph

NebulaGraph Chart

nameOverride	nil	Chart
nebula.version	v3.3.0	NebulaGraph
nebula.imagePullPolicy	IfNotPresent	NebulaGraph Image pull policy
nebula.storageClassName	nil	StorageClass
nebula.schedulerName	default-scheduler	NebulaGraph
nebula.reference	{"name": "statefulsets.apps", "version": "v1"}	NebulaGraph
nebula.graphd.image	vesoft/nebula-graphd	Graphd nebula.version
nebula.graphd.replicas	2	Graphd
nebula.graphd.env	[]	Graphd
nebula.graphd.resources	{"resources": {"requests": {"cpu": "500m", "memory": "500Mi"}, "limits": {"cpu": "1", "memory": "1Gi"}}}	Graphd
nebula.graphd.logStorage	500Mi	Graphd
nebula.graphd.podLabels	{}	Graphd Pod
nebula.graphd.podAnnotations	{}	Graphd Pod
nebula.graphd.nodeSelector	{}	Graphd pod
nebula.graphd.tolerations	{}	Graphd pod
nebula.graphd.affinity	{}	Graphd pod
nebula.graphd.readinessProbe	{}	Graphd pod
nebula.graphd.sidecarContainers	{}	Graphd pod Sidecar Containers
nebula.graphd.sidecarVolumes	{}	Graphd pod Sidecar Volumes
nebula.metad.image	vesoft/nebula-metad	Metad nebula.version
nebula.metad.replicas	3	Metad
nebula.metad.env	[]	Metad
nebula.metad.resources	{"resources": {"requests": {"cpu": "500m", "memory": "500Mi"}, "limits": {"cpu": "1", "memory": "1Gi"}}}	Metad
nebula.metad.logStorage	500Mi	Metad
nebula.metad.dataStorage	1Gi	Metad
nebula.metad.license	{}	NebulaGraph License
nebula.metad.podLabels	{}	Metad Pod

nebula.metad.podAnnotations	{}	Metad	Pod
nebula.metad.nodeSelector	{}	Metad	pod
nebula.metad.tolerations	{}	Metad	pod
nebula.metad.affinity	{}	Metad	pod
nebula.metad.readinessProbe	{}	Metad	pod
nebula.metad.sidecarContainers	{}	Metad pod	Sidecar Containers
nebula.metad.sidecarVolumes	{}	Metad pod	Sidecar Volumes
nebula.storaged.image	vesoft/nebula-storaged	Storaged	nebula.version
nebula.storaged.replicas	3	Storaged	
nebula.storaged.env	[]	Storaged	
nebula.storaged.resources	{"resources": {"requests": {"cpu": "500m", "memory": "500Mi"}, "limits": {"cpu": "1", "memory": "1Gi"}}}	Storaged	
nebula.storaged.logStorage	500Mi	Storaged	
nebula.storaged.dataStorage	1Gi	Storaged	
nebula.storaged.podLabels	{}	Storaged	Pod
nebula.storaged.podAnnotations	{}	Storaged	Pod
nebula.storaged.nodeSelector	{}	Storaged	pod
nebula.storaged.tolerations	{}	Storaged	pod
nebula.storaged.affinity	{}	Storaged	pod
nebula.storaged.readinessProbe	{}	Storaged	pod
nebula.storaged.sidecarContainers	{}	Storaged pod	Sidecar Containers
nebula.storaged.sidecarVolumes	{}	Storaged Pod	Sidecar Volumes
imagePullSecrets	[]	Secret	

: January 13, 2023

20.5 NebulaGraph

20.5.1 NebulaGraph

NebulaGraph Meta Storage Graph CR NebulaGraph YAML config config
ConfigMap



Helm NebulaGraph

config

```
Config map[string]string `json:"config,omitempty"`
```

K8s

Kubectl NebulaGraph

nebula nebula_cluster.yaml YAML

Graph config

1. nebula

```
kubectl edit nebulaclusters.apps.nebula-graph.io nebula
```

2. YAML spec.graphd.config enable_authorize auth_type

```
apiVersion: apps.nebula-graph.io/v1alpha1
kind: NebulaCluster
metadata:
  name: nebula
  namespace: default
spec:
  graphd:
    resources:
      requests:
        cpu: "500m"
        memory: "500Mi"
      limits:
        cpu: "1"
        memory: "1Gi"
    replicas: 1
    image: vesoft/nebula-graphd
    version: v3.3.0
    storageClaim:
      resources:
        requests:
          storage: 2Gi
      storageClassName: fast-disks
    config: // Graph
    "enable_authorize": "true"
    "auth_type": "password"
...
```

3. kubectl apply -f nebula_cluster.yaml

enable_authorize auth_type Graph ConfigMap nebula-graphd

Meta Storage Graph

: January 13, 2023

20.5.2 PV

NebulaGraph Operator	PV Persistent Volume	PVC Persistent Volume Claim	NebulaGraph
PV	PVC		
CR	enablePVReclaim	PV	
		NebulaGraph	enablePVReclaim true
K8s	Kubectl	NebulaGraph	

`nebula` `nebula_cluster.yaml` YAML `enablePVReclaim`

1. nebula

```
kubectl edit nebulaclusters.apps.nebula-graph.io nebula
```

```
2. YAML spec enablePVReclaim true
```

```
apiVersion: apps.nebula-graph.io/v1alpha1
kind: NebulaCluster
metadata:
  name: nebula
spec:
  enablePVRClaim: true //      true
graphd:
  image: vesoft/nebula-graphd
  logVolumeClaim:
    resources:
      requests:
        storage: 2Gi
  storageClassName: fast-disks
replicas: 1
resources:
  limits:
    cpu: "1"
    memory: 1Gi
  requests:
    cpu: 500m
    memory: 500Mi
version: v3.3.0
imagePullPolicy: IfNotPresent
metad:
  dataVolumeClaim:
    resources:
      requests:
        storage: 2Gi
  storageClassName: fast-disks
image: vesoft/nebula-metad
logVolumeClaim:
  resources:
    requests:
      storage: 2Gi
  storageClassName: fast-disks
replicas: 1
resources:
  limits:
    cpu: "1"
    memory: 1Gi
  requests:
    cpu: 500m
    memory: 500Mi
version: v3.3.0
nodeSelector:
  nebula: cloud
reference:
  name: statefulsets.apps
  version: v1
schedulerName: default-scheduler
storageD:
  dataVolumeClaims:
    - resources:
        requests:
          storage: 2Gi
  storageClassName: fast-disks
  - resources:
        requests:
          storage: 2Gi
  storageClassName: fast-disks
image: vesoft/nebula-storaged
logVolumeClaim:
  resources:
    requests:
      storage: 2Gi
  storageClassName: fast-disks
replicas: 3
resources:
  limits:
    cpu: "1"
    memory: 1Gi
  requests:
    cpu: 500m
    memory: 500Mi
version: v3.3.0
```

```
3. kubectl apply -f nebula cluster.yaml
```

:January 13, 2023

20.6 NebulaGraph

NebulaGraph Operator NebulaGraph



1.x NebulaGraph Operator 3.x NebulaGraph

20.6.1

- NebulaGraph Operator NebulaGraph
- NebulaGraph 3.0.0 3.3.x

20.6.2 Kubectl NebulaGraph

NebulaGraph Kubectl NebulaGraph

NebulaGraph 3.0.0 YAML apps_v1alpha1_nebulacluster.yaml

1.

```
kubectl get pods -l app.kubernetes.io/cluster=nebula -o jsonpath=".items[*].spec.containers[*].image" | tr -s '[:space:]' '\n' | sort | uniq -c
```

```
1 vesoft/nebula-graphd:v3.0.0
1 vesoft/nebula-metad:v3.0.0
3 vesoft/nebula-storaged:v3.0.0
```

2. apps_v1alpha1_nebulacluster.yaml version 3.0.0 v3.3.0

YAML

```
apiVersion: apps.nebula-graph.io/v1alpha1
kind: NebulaCluster
metadata:
  name: nebula
spec:
  graphd:
    resources:
      requests:
        cpu: "500m"
        memory: "500Mi"
      limits:
        cpu: "1"
        memory: "1Gi"
    replicas: 1
    image: vesoft/nebula-graphd
    version: v3.3.0 // 3.0.0 v3.3.0
    service:
      type: NodePort
      externalTrafficPolicy: Local
    logVolumeClaim:
      resources:
        requests:
          storage: 2Gi
          storageClassName: fast-disks
  metad:
    resources:
      requests:
        cpu: "500m"
        memory: "500Mi"
      limits:
        cpu: "1"
        memory: "1Gi"
    replicas: 1
```

```

image: vesoft/nebula-metad
version: v3.3.0 // 3.0.0 v3.3.0
dataVolumeClaim:
  resources:
    requests:
      storage: 2Gi
      storageClassName: fast-disks
logVolumeClaim:
  resources:
    requests:
      storage: 2Gi
      storageClassName: fast-disks
storaged:
  resources:
    requests:
      cpu: "500m"
      memory: "500Mi"
    limits:
      cpu: "1"
      memory: "1Gi"
replicas: 3
image: vesoft/nebula-storaged
version: v3.3.0 // 3.0.0 v3.3.0
dataVolumeClaims:
- resources:
  - requests:
    storage: 2Gi
    storageClassName: fast-disks
- resources:
  - requests:
    storage: 2Gi
    storageClassName: fast-disks
logVolumeClaim:
  resources:
    requests:
      storage: 2Gi
      storageClassName: fast-disks
reference:
  name: statefulsets.apps
  version: v1
schedulerName: default-scheduler
imagePullPolicy: Always

```

3. CR

```
kubectl apply -f apps_vialpha1_nebulacluster.yaml
```

4. 2 v3.3.0

```
kubectl get pods -l app.kubernetes.io/cluster=nebula -o jsonpath=".items[*].spec.containers[*].image" | tr -s '[[:space:]]' '\n' | sort |uniq -c
```

```

1 vesoft/nebula-graphd:v3.3.0
1 vesoft/nebula-metad:v3.3.0
3 vesoft/nebula-storaged:v3.3.0

```

20.6.3 Helm NebulaGraph

NebulaGraph

Helm NebulaGraph

1. Helm

```
helm repo update
```

2. Helm

```

export NEBULA_CLUSTER_NAME=nebula      # NebulaGraph
export NEBULA_CLUSTER_NAMESPACE=nebula  # NebulaGraph

```

3. NebulaGraph

v3.3.0 NebulaGraph

```
helm upgrade "${NEBULA_CLUSTER_NAME}" nebula-operator/nebula-cluster \
--namespace="${NEBULA_CLUSTER_NAMESPACE}" \
--set nameOverride=${NEBULA_CLUSTER_NAME} \
--set nebula.version=v3.3.0
```

--set nebula.version

4.

```
$ kubectl -n "${NEBULA_CLUSTER_NAMESPACE}" get pod -l "app.kubernetes.io/cluster=${NEBULA_CLUSTER_NAME}"
NAME        READY   STATUS    RESTARTS   AGE
nebula-graphd-0  1/1    Running   0          2m
nebula-graphd-1  1/1    Running   0          2m
nebula-metad-0   1/1    Running   0          2m
nebula-metad-1   1/1    Running   0          2m
nebula-metad-2   1/1    Running   0          2m
nebula-storaged-0 1/1    Running   0          2m
nebula-storaged-1 1/1    Running   0          2m
nebula-storaged-2 1/1    Running   0          2m
```

```
$ kubectl get pods -l app.kubernetes.io/cluster=nebula -o jsonpath=".items[*].spec.containers[*].image" | tr -s '[[:space:]]' '\n' | sort |uniq -c
1 vesoft/nebula-graphd:v3.3.0
1 vesoft/nebula-metad:v3.3.0
3 vesoft/nebula-storaged:v3.3.0
```

:January 13, 2023

20.7 Nebular Operator NebulaGraph

NebulaGraph Operator NebulaGraph NebulaGraph NebulaGraph NebulaGraph

20.7.1

NebulaGraph Operator NebulaGraph Kubectl NebulaGraph Helm NebulaGraph

20.7.2 NebulaGraph NebulaGraph

NebulaGraph Operator	NebulaGraph	NebulaGraph Operator	<code><cluster-name>-graphd-svc</code>	ClusterIP
Service	Service IP	NebulaGraph		

1. Service

```
$ kubectl get service -l app.kubernetes.io/cluster=<nebula> #<nebula>
NAME          TYPE        CLUSTER-IP   EXTERNAL-IP  PORT(S)           AGE
nebula-graphd-svc   ClusterIP  10.98.213.34 <none>      9669/TCP,19669/TCP,19670/TCP   23h
nebula-metad-headless   ClusterIP  None         <none>      9559/TCP,19559/TCP,19560/TCP   23h
nebula-storaged-headless   ClusterIP  None         <none>      9779/TCP,19779/TCP,19780/TCP,9778/TCP   23h
```

ClusterIP	Service	ClusterIP
-----------	---------	-----------

2. `<cluster-name>-graphd-svc` Service IP NebulaGraph

```
kubectl run -ti --image vesoft/nebula-console:v3.3.1 --restart=Never -- <nebula_console_name> -addr <cluster_ip> -port <service_port> -u <username> -p <password>
```

```
kubectl run -ti --image vesoft/nebula-console:v3.3.1 --restart=Never -- nebula-console -addr 10.98.213.34 -port 9669 -u root -p vesoft
```

- `--image` NebulaGraph NebulaGraph Console
- `<nebula-console>` Pod
- `-addr` Graphd IP ClusterIP Service IP
- `-port` Graphd 9669
- `-u` NebulaGraph root
- `-p`

If you don't see a command prompt, try pressing enter.

```
(root@nebula) [(none)]>
```

FQDN `<cluster-name>-graphd.<cluster-namespace>.svc.<CLUSTER_DOMAIN>`

```
kubectl run -ti --image vesoft/nebula-console:v3.3.1 --restart=Never -- <nebula_console_name> -addr <cluster_name>-graphd-svc.default.svc.cluster.local -port <service_port> -u <username> -p <password>
```

CLUSTER_DOMAIN cluster.local

20.7.3 NodePort NebulaGraph NebulaGraph

NodePort	Service	IP	Azure AWS	Service	LoadBalancer
NodePort	Service	spec.selector	app.kubernetes.io/cluster: <cluster-name>	app.kubernetes.io/component:	
graphd	Graphd	pod			

1. graphd-nodeport-service.yaml YAML

```
apiVersion: v1
kind: Service
metadata:
  labels:
    app.kubernetes.io/cluster: nebula
    app.kubernetes.io/component: graphd
    app.kubernetes.io/managed-by: nebula-operator
    app.kubernetes.io/name: nebula-graph
  name: nebula-graphd-svc-nodeport
  namespace: default
spec:
  externalTrafficPolicy: Local
  ports:
    - name: thrift
      port: 9669
      protocol: TCP
      targetPort: 9669
    - name: http
      port: 19669
      protocol: TCP
      targetPort: 19669
  selector:
    app.kubernetes.io/cluster: nebula
    app.kubernetes.io/component: graphd
    app.kubernetes.io/managed-by: nebula-operator
    app.kubernetes.io/name: nebula-graph
  type: NodePort
```

- NebulaGraph 9669 19669 Graph

- targetPort Pod

2. Service

```
kubectl create -f graphd-nodeport-service.yaml
```

3. Service NebulaGraph

```
kubectl get services
```

NAME	TYPE	CLUSTER-IP	EXTERNAL-IP	PORT(S)	AGE
nebula-graphd-svc	ClusterIP	10.98.213.34	<none>	9669/TCP,19669/TCP,19670/TCP	23h
nebula-graphd-svc-nodeport	NodePort	10.107.153.129	<none>	9669:32236/TCP,19669:31674/TCP,19670:31057/TCP	24h
nebula-metad-headless	ClusterIP	None	<none>	9559/TCP,19559/TCP,19560/TCP	23h
nebula-storaged-headless	ClusterIP	None	<none>	9779/TCP,19779/TCP,19780/TCP,9778/TCP	23h

NodePort	Service	32236
----------	---------	-------

4. IP NebulaGraph

```
kubectl run -ti --image vesoft/nebula-console:v3.3.1 --restart=Never -- <nebula_console_name> -addr <node_ip> -port <node_port> -u <username> -p <password>
```

```
kubectl run -ti --image vesoft/nebula-console:v3.3.1 --restart=Never -- nebula-console2 -addr 192.168.8.24 -port 32236 -u root -p vesoft
If you don't see a command prompt, try pressing enter.
```

```
(root@nebula) [(none)]>
```

- --image NebulaGraph NebulaGraph Console
- <nebula-console> Pod nebula-console2
- -addr NebulaGraph IP 192.168.8.24
- -port NebulaGraph 32236
- -u NebulaGraph root
- -p

20.7.4 Ingress NebulaGraph

Nginx Ingress Kubernetes Ingress NebulaGraph

Nginx 7

HostNetwork DaemonSet Nginx Ingress NebulaGraph

HostNetwork Nginx Ingress Pod Nginx Ingress Nginx Ingress

DaemonSet

Ingress TCP UDP nginx-ingress-controller --tcp-services-configmap --udp-services-configmap ConfigMap

ConfigMap

tcp-services ConfigMap

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: tcp-services
  namespace: nginx-ingress
data:
  # update
  9769: "default/nebula-graphd-svc:9669"
```

1. `nginx-ingress-daemonset-hostnetwork.yaml`

`nginx-ingress-daemonset-hostnetwork.yaml` YAML



YAML

nginx-ingress

`kubectl create namespace nginx-ingress`

2. worker2 IP 192.168.8.160

YAML

`nginx-ingress-controller` DaemonSet

`kubectl label node worker2 nginx-ingress=true`

3. Nginx Ingress

`kubectl create -f nginx-ingress-daemonset-hostnetwork.yaml`

```
configmap/nginx-ingress-controller created
configmap/tcp-services created
serviceaccount/nginx-ingress created
serviceaccount/nginx-ingress-backend created
clusterrole.rbac.authorization.k8s.io/nginx-ingress created
clusterrolebinding.rbac.authorization.k8s.io/nginx-ingress created
role.rbac.authorization.k8s.io/nginx-ingress created
rolebinding.rbac.authorization.k8s.io/nginx-ingress created
service/nginx-ingress-controller-metrics created
service/nginx-ingress-default-backend created
service/nginx-ingress-proxy-tcp created
daemonset.apps/nginx-ingress-controller created
```

Nginx Ingress	Nginx Ingress	hostNetwork	Nginx Ingress	IP 192.168.8.160	9769
NebulaGraph					

4. NebulaGraph Console IP 192.168.8.160 NebulaGraph

`kubectl run -ti --image vesoft/nebula-console:v3.3.1 --restart=Never -- <nebula_console_name> -addr <host_ip> -port <external_port> -u <username> -p <password>`

`kubectl run -ti --image vesoft/nebula-console:v3.3.1 --restart=Never -- nebula-console -addr 192.168.8.160 -port 9769 -u root -p vesoft`

- `--image` NebulaGraph NebulaGraph Console
- `<nebula-console>` Pod nebula-console
- `-addr` Nginx Ingress IP 192.168.8.160
- `-port` 9769
- `-u` NebulaGraph root
- `-p`

If you don't see a command prompt, try pressing enter.

(root@nebula) [(none)]>

:January 13, 2023

20.8

NebulaGraph Operator	NebulaGraph	NebulaGraph
NebulaGraph	1 Storage Pod	Nebular Operator

20.8.1

NebulaGraph Operator

20.8.2

1. NebulaGraph Kubectl NebulaGraph Helm NebulaGraph
2. Pods Running <cluster_name>-storaged-2 Pod

```
kubectl delete pod <cluster-name>-storaged-2 --now
```

<cluster_name> NebulaGraph

3. NebulaGraph Operator <cluster-name>-storaged-2 Pod

```
kubectl get pods   <cluster-name>-storaged-2 Pod
```

```
...
nebula-cluster-storaged-1    1/1    Running        0        5d23h
nebula-cluster-storaged-2    0/1    ContainerCreating   0        1s
...
```

```
...
nebula-cluster-storaged-1    1/1    Running        0        5d23h
nebula-cluster-storaged-2    1/1    Running        0        4m2s
...
```

```
<cluster-name>-storaged-2    ContainerCreating   Running
```

:January 13, 2023

20.9

20.9.1 NebulaGraph Operator v1.x NebulaGraph

v1.x NebulaGraph DNS NebulaGraph Operator DNS

20.9.2

Pod NebulaGraph Operator

20.9.3

20.9.4 Operator replica NebulaGraph replica

Operator replica K8s Pod replica NebulaGraph

.....

:January 13, 2023

21.

21.1

Note

NebulaGraph Analytics NebulaGraph Algorithm

Note

	PageRank	DegreeWithTime	SSSP	APSP	LPA	HANP	Louvain	weight
--	----------	----------------	------	------	-----	------	---------	--------

- HDFS CSV src dst weight
- NebulaGraph src dst weight

21.1.1

PageRank

PageRank	PageRank	PageRank	PageRank
----------	----------	----------	----------

- NebulaGraph Analytics

-

ITERATIONS	10	
IS_DIRECTED	true	false
EPS	0.0001	
DAMPING	0.85	

-

VID	vid_type	ID
VALUE	double	PageRank

KCore

KCore	K
-------	---

- NebulaGraph Analytics

-

TYPE	vertex	vertex	subgraph	vertex	subgraph
KMIN	1		K	TYPE = subgraph	
KMAX	1000000		K	TYPE = subgraph	

- TYPE=vertex

VID	vid_type	ID
VALUE	int	

- TYPE=subgraph

VID	vid_type	ID
VALUE	VID	

DegreeCentrality NStepDegree

DegreeCentrality



NebulaGraph Analytics

- NebulaGraph Analytics

-

STEP	3	-1
BITS	6	hyperloglog
TYPE	both	in out both

- TYPE=both

VID	vid_type	ID
BOTH_DEGREE	int	
OUT_DEGREE	int	
IN_DEGREE	int	

- TYPE=out

VID	vid_type	ID
OUT_DEGREE	int	

- TYPE=in

VID	vid_type	ID
IN_DEGREE	int	

DegreeWithTime

DegreeWithTime



NebulaGraph Analytics

-

TYPE	both	in out both
BEGIN_TIME	-	yyyy-MM-dd HH:mm:ss.SSS
END_TIME	-	yyyy-MM-dd HH:mm:ss.SSS

- TYPE=both

VID	vid_type	ID
BOTH_DEGREE	int	
OUT_DEGREE	int	
IN_DEGREE	int	

- TYPE=out

VID	vid_type	ID
OUT_DEGREE	int	

- TYPE=in

VID	vid_type	ID
IN_DEGREE	int	

BetweennessCentrality

BetweennessCentrality

- NebulaGraph Analytics

-

ITERATIONS	10	
IS_DIRECTED	true	false
CHOSEN	-1	ID -1
CONSTANT	2	

-

VID	vid_type	ID
VALUE	double	

ClosenessCentrality

ClosenessCentrality

- NebulaGraph Analytics

-

IS_DIRECTED	true	false
NUM_SAMPLES	10	

-

VID	vid_type	ID
VALUE	double	

21.1.2

APSP

APSP



NebulaGraph Analytics

-

VID1	vid_type	ID
VID2	vid_type	ID
DISTANCE	double	VID1 VID2

SSSP

SSSP

- NebulaGraph Analytics

-

ROOT	-	VID
•		
VID	vid_type	ID
DISTANCE	double	ROOT VID

BFS

BFS

- NebulaGraph Analytics

-

IS_DIRECTED	true	false
ROOT	-	VID
•		
ROOT	vid_type	ID
VISITED	int	ROOT

ShortestPath

ShortestPath

- NebulaGraph Analytics

-

src	"100"
dst	"200"
•	
VALUE	
list	src, vid1,vid2...dst

21.1.3**LPA**

LPA

- NebulaGraph Analytics

-

ITERATIONS	10
IS_DIRECTED	true
IS_CALC_MODULARITY	false
•	
VID	
vid_type	ID
LABEL	VID
ID	

HANP

HANP Hop Attenuation & Node Preference LPA

- NebulaGraph Analytics

-

ITERATIONS	10	
IS_DIRECTED	true	false
PREFERENCE	1.0	m>0 m<0 m=0
HOP_ATT	0.1	0 ~ 1

-

VID	vid_type	ID
LABEL	VID	ID

ConnectedComponent

ConnectedComponent	strongly connected component	weakly
connected component		



NebulaGraph Analytics

- NebulaGraph Analytics

-

IS_DIRECTED	true	false
IS_CALC_MODULARITY	false	

-

VID	vid_type	ID
LABEL	VID	ID

Louvain

Louvain

- NebulaGraph Analytics

-

IS_DIRECTED	true	false
OUTER_ITERATION	20	
INNER_ITERATION	10	
IS_CALC_MODULARITY	false	

-

VID	vid_type	ID
LABEL	VID	ID

InfoMap

InfoMap PageRank



NebulaGraph Analytics

- NebulaGraph Analytics

-

pagerank_iter	10	PageRank
pagerank_threshold	0.0001	PageRank
teleport_prob	0.15	
inner_iter	3	
outer_iter	2	
comm_info_num	100	

-

VID	vid_type	ID
LABEL	VID	ID

21.1.4

TriangleCount

TriangleCount

- NebulaGraph Analytics

-

OPT	3	1	2	3
REMOVED_DUPLICATION_EDGE	true			
REMOVED_SELF_EDGE	true			

- OPT=1

COUNT	int
-------	-----

- OPT=2

VID	vid_type	ID
COUNT	int	

- OPT=3

VID1	VID	A	ID
VID2	VID	B	ID
VID3	VID	C	ID

Node2Vec

Node2Vec	DeepWalk	SGD	D
	DeepWalk		

- NebulaGraph Analytics

-

is_weighted	false
p	1.0
q	0.5
epoch	1
step	10
rate	0.02

-

Tree_stat

Tree_stat

Note

NebulaGraph Analytics

- NebulaGraph Analytics

-

root	100	VID
stat	width, depth	

-

VALUE	list	stat
-------	------	------

HyperANF

HyperANF

Note

NebulaGraph Analytics

- NebulaGraph Analytics

-

bits	6	HyperLogLog	bit	6~16
------	---	-------------	-----	------

-

VALUE	double
-------	--------

21.1.5**ClusteringCoefficient**

ClusteringCoefficient

- NebulaGraph Analytics

-

TYPE	local	local	global
REMOVED_DUPLICATION_EDGE	true		
REMOVED_SELF_EDGE	true		

- TYPE=local

VID	vid_type	ID
VALUE	double	

- TYPE=global

VID	vid_type	ID
VALUE	double	

21.1.6

Jaccard

Jaccard

- NebulaGraph Analytics

-

IDS1	-	VID	A	VID	,
IDS2	-	VID	B	VID	,
REMOVED_SELF_EDGE	true				

-

VID1	vid_type	ID
VID2	vid_type	ID
VALUE	double	VID1 VID2

: January 13, 2023

21.2 NebulaGraph Algorithm

NebulaGraph Algorithm	Algorithm	GraphX	Spark	Spark	NebulaGraph
lib	DataFrame				

21.2.1

NebulaGraph Algorithm	NebulaGraph
-----------------------	-------------

NebulaGraph	NebulaGraph Algorithm
nightly	3.0-SNAPSHOT
3.0.0 ~ 3.3.x	3.0.0
2.6.x	2.6.x
2.5.0 2.5.1	2.5.0
2.0.0 2.0.1	2.1.0

21.2.2

Algorithm

- NebulaGraph [NebulaGraph](#)
- Spark 2.4.x
- Scala 2.11
- Github Algorithm [Maven](#)

21.2.3

- ID ID INT String
- String SparkSQL dense_rank String Long
- DataFrame

21.2.4

NebulaGraph Algorithm

PageRank		pagerank	double/string
Louvain		louvain	int/string
KCore	K	kcore	int/string
LabelPropagation		lpa	int/string
Hanp		hanp	int/string
ConnectedComponent		cc	int/string
StronglyConnectedComponent		scc	int/string
ShortestPath		shortestpath	string
TriangleCount		trianglecount	int/string
GraphTriangleCount		count	int
BetweennessCentrality		betweenness	double/string
ClosenessCentrality		closeness	double/string
DegreeStatic		degree,inDegree,outDegree	int/string
ClusteringCoefficient		clustercoefficient	double/string
Jaccard		jaccard	string
BFS		bfs	string
Node2Vec	-	node2vec	string

Note

NebulaGraph Tag

21.2.5

NebulaGraph Algorithm

1. NebulaGraph Spark Connector NebulaGraph DataFrame
2. DataFrame GraphX
3. GraphX PageRank Louvain

Scala

21.2.6 NebulaGraph Algorithm

1. nebula-algorithm

```
$ git clone -b v3.0.0 https://github.com/vesoft-inc/nebula-algorithm.git
```

2. nebula-algorithm

```
$ cd nebula-algorithm
```

3.

```
$ mvn clean package -Dpgp.skip -Dmaven.javadoc.skip=true -Dmaven.test.skip=true
```

nebula-algorithm/target nebula-algorithm-3.x.x.jar

Maven

21.2.7

lib 10

1. pom.xml

```
<dependency>
  <groupId>com.vesoft</groupId>
  <artifactId>nebula-algorithm</artifactId>
  <version>3.0.0</version>
</dependency>
```

2. PageRank



DataFrame

NebulaGraph Rank

```
val prConfig = new PRConfig(5, 1.0)
val louvainResult = PageRankAlgo.apply(spark, data, prConfig, false)
```

ID	String	PageRank	ID	String	Long	Long	ID	String
----	--------	----------	----	--------	------	------	----	--------

1.

```
{
  # Spark
  spark: {
    app: {
      name: LPA
      # Spark
      partitionNum:100
    }
    master:local
  }

  data: {
    # nebula csv json
    source: nebula
    # nebula csv json
    sink: nebula
    #
    hasWeight: false
  }

  # NebulaGraph
  nebula: {
    # NebulaGraph
    nebula.read
    read: {
      # Meta IP , "ip1:port1,ip2:port2"
    }
  }
}
```

```

#      docker-compose          docker-compose
#      `docker-compose ps`      metaAddress: "192.168.*.10:9559"
# NebulaGraph
space:basketballplayer
# NebulaGraph Edge type,    labels
labels: ["serve"]
# NebulaGraph   Edge type
weightCols: ["start_year"]           Edge type
}

#             NebulaGraph  nebula.write
write:{

# Graph      IP                  ,          "ip1:port1,ip2:port2"
# docker-compose          docker-compose
# `docker-compose ps`      graphAddress: "192.168.*.11:9669"
# Meta       IP                  ,          "ip1:port1,ip2:port2"
# docker-compose          docker-compose
# `docker-compose ps`      metaAddress: "192.168.*.12:9559"
user:root
pswd:nebula
#                      Tag
# NebulaGraph Tag
space:nb
# NebulaGraph Tag      Tag Tag
# PageRank pagerank
# Louvain louvain
# ConnectedComponent cc
# StronglyConnectedComponent scc
# LabelPropagation lpa
# ShortestPath shortestpath
# DegreeStatic degree inDegree outDegree
# KCore kcore
# TriangleCount trianglecount
# BetweennessCentrality betweenness
tag:pagerank
}

}

local: {
#             csv      json      local.read
read:{

filePath: "hdfs://127.0.0.1:9000/edge/work_for.csv"
#      CSV      [ _c0, _c1, _c2, ..., _cn]      json
#      ID
srcId:"_c0"
#      ID
dstId:"_c1"
#
weight: "_c2"
#      CSV
header: false
#      CSV
delimiter:","
}

}

#             csv      text      local.write
write:{

resultPath:/tmp/
}

algorithm: {

# pagerank louvain connectedcomponent labelpropagation shortestpaths
# degreestatic kcore stronglyconnectedcomponent trianglecount
# betweenness graphtriangleCount
executeAlgo: pagerank

# PageRank
pagerank: {
    maxIter: 10
    resetProb: 0.15
}

# Louvain
louvain: {
    maxIter: 20
    internalIter: 10
    tol: 0.5
}

# ...
}
}

```

 Note

sink: nebula NebulaGraph TAG

2.

```
`${SPARK_HOME}/bin/spark-submit --master <mode> --class com.vesoft.nebula.algorithm.Main <nebula-algorithm-3.0.0.jar_path> -p <application.conf_path>
```

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.algorithm.Main /root/nebula-algorithm/target/nebula-algorithm-3.0-SNAPSHOT.jar -p /root/nebula-algorithm/src/main/resources/application.conf
```

21.2.8

- [—NebulaGraph Algorithm](#) 2 36

:January 13, 2023

21.3 NebulaGraph Analytics

NebulaGraph Analytics

NebulaGraph

21.3.1

- Nebula Analytics
- [Nebula Analytics License](#)
- 2.2.x [HDFS](#)
- 1.8 JDK

21.3.2

NebulaGraph CSV	HDFS	CSV	CSV	NebulaGraph Analytics	NebulaGraph	HDFS	CSV
--------------------	------	-----	-----	-----------------------	-------------	------	-----

21.3.3

NebulaGraph

21.3.4

NebulaGraph Analytics NebulaGraph

NebulaGraph	NebulaGraph Analytics
3.3.0	3.3.0
3.1.0 ~ 3.2.x	3.2.0
3.0.x	1.0.x
2.6.x	0.9.0

21.3.5

NebulaGraph Analytics

APSP

SSSP

BFS

ShortestPath

PageRank

KCore

K

DegreeCentrality

DegreeWithTime

BetweennessCentrality

ClosenessCentrality

TriangleCount

Node2Vec

Tree_stat

HyperANF

LPA

HANP

WCC

LOUVAIN

InfoMap

Clustering Coefficient

Jaccard

21.3.6 NebulaGraph Analytics

1. NebulaGraph Analytics

```
$ sudo rpm -ivh <analytics_package_name> --prefix <install_path>
$ sudo chown <user>:<user> -R <install path>
```

```
$ sudo rpm -ivh nebula-analytics-3.3.0-centos.x86_64.rpm --prefix=/home/vesoft/nebula-analytics
$ sudo chown vesoft:vesoft -R /home/vesoft/nebula-analytics
```

2. set_env.sh nebula-analytics/scripts/set_env.sh Hadoop JDK

```
export HADOOP_HOME=<hadoop_path>
export JAVA_HOME=<java_path>
```

3. License NebulaGraph Analytics scripts

21.3.7

1. NebulaGraph Analytics

scripts

```
$ cd scripts
```

2.

- NebulaGraph

a. nebula.conf NebulaGraph

```
#      NebulaGraph
--retry=3
#
--space=baskeyballplayer

#      NebulaGraph
#
--edges=LIKES
#           _rank
##--edge_data_fields
#
--read_batch_size=10000

#      NebulaGraph
# NebulaGraph graphd
--graph_server_addrs=192.168.8.100:9669
# NebulaGraph
--user=root
# NebulaGraph
--password=nebula
# NebulaGraph : insert update
--mode=insert
# NebulaGraph Tag
--tag=pagerank
# NebulaGraph Tag
--prop=pr
# NebulaGraph Tag
--type=double
#
--write_batch_size=1000
#
--err_file=/home/xxx/analytics/err.txt

#
#
--graphd_timeout=60000
--metad_timeout=60000
--storaged_timeout=60000
```

b. run_pagerank.sh

```
#          1     NUMA     node
WNUM=3
#
WCORES=4
#
#      nebula.conf     NebulaGraph
INPUT=${INPUT:="nebula:$PROJECT/scripts/nebula.conf"}
#      HDFS     CSV
# #INPUT=${INPUT:="$PROJECT/data/graph/v100_e2150_ua_c3.csv"}

#
#      NebulaGraph     NebulaGraph     nebula.conf
OUTPUT=${OUTPUT:="nebula:$PROJECT/scripts/nebula.conf"}
#      HDFS     CSV
# OUTPUT=${OUTPUT:='hdfs://192.168.8.100:9000/_test/output'}

# true     false
IS_DIRECTED=${IS_DIRECTED:=true}
#      ID
NEED_ENCODE=${NEED_ENCODE:=true}
#      ID     string int32 int64
VTYPE=${VTYPE:=int32}
#      distributed     ID     single     ID
ENCODER=${ENCODER:="distributed"}
# PageRank
EPS=${EPS:=0.0001}
DAMPING=${DAMPING:=0.85}
#
ITERATIONS=${ITERATIONS:=100}
```

- HDFS CSV

```
run_pagerank.sh
```

```
#          1     NUMA     node
WNUM=3
#
WCORES=4
#
#      nebula.conf    NebulaGraph
# INPUT=${INPUT:="nebula:$PROJECT/scripts/nebula.conf"}
#      HDFS    CSV
INPUT=${INPUT:="$PROJECT/data/graph/v100_e2150_ua_c3.csv"}

#
#      NebulaGraph      NebulaGraph      nebula.conf
# OUTPUT=${OUTPUT:="nebula:$PROJECT/scripts/nebula.conf"}
#      HDFS    CSV
OUTPUT=${OUTPUT:='hdfs://192.168.8.100:9000/_test/output'}

# true    false
IS_DIRECTED=${IS_DIRECTED:=true}
#      ID
NEED_ENCODE=${NEED_ENCODE:=true}
#      ID      string int32 int64
VTYPE=${VTYPE:=int32}
#      distributed   ID      single      ID
ENCODER=${ENCODER:="distributed"}
# PageRank
EPS=${EPS:=0.0001}
DAMPING=${DAMPING:=0.85}
#
ITERATIONS=${ITERATIONS:=100}
```

3. cluster NebulaGraph Analytics

```
# NebulaGraph Analytics      IP  :
192.168.8.200:1
192.168.8.201:1
192.168.8.202:1
```

4.

```
./run_pagerank.sh
```

5.

- NebulaGraph nebula.conf
- HDFS CSV CSV OUTPUT .gz

:January 13, 2023

21.4 NebulaGraph Analytics License

License License	NebulaGraph Analytics	License	NebulaGraph Analytics	NebulaGraph Analytics
--------------------	-----------------------	---------	-----------------------	-----------------------

21.4.1

- License NebulaGraph Analytics
- License License
- License
- License 14
- 30
- 14
- 14

21.4.2

NebulaGraph Analytics License



NebulaGraph Analytics

30

License

21.4.3 NebulaGraph Analytics License

NebulaGraph Analytics License nebula.license

```
-----License Content Start-----
{
  "vendor": "vesoft",
  "organization": "vesoft",
  "issuedate": "2022-11-01T16:00:00.000Z",
  "expirationDate": "2023-11-01T15:59:59.000Z",
  "product": "nebula_graph_analytics",
  "version": ">3.0.0",
  "licenseType": "enterprise",
  "gracePeriod": 14,
  "analytics": {
    "nodes": 3,
    "vcpu": 3
  }
}
-----License Content End-----

-----License Key Start-----
Rrjip5c+xxxxxxxxxxxxxk5Yg==
-----License Key End-----
```

License

vendor					
organization					
issuedDate	License				
expirationDate	License				
product	NebulaGraph Analytics		nebula_graph_analytics		
version					
licenseType	License	enterprise	small_business	pro	individual
gracePeriod		License		0	
nodes	Analytics				
vcpu	Analytics				
clusterCode		License			

21.4.4

NebulaGraph Analytics License [NebulaGraph Analytics](#)

21.4.5

NebulaGraph Analytics License

1. NebulaGraph Analytics License `nebula.license`
2. NebulaGraph Analytics `/usr/local/nebula-analytics/scripts/` License License

Note

NebulaGraph Analytics License Analytics License

: January 13, 2023

21.5 NebulaGraph Explorer Workflow

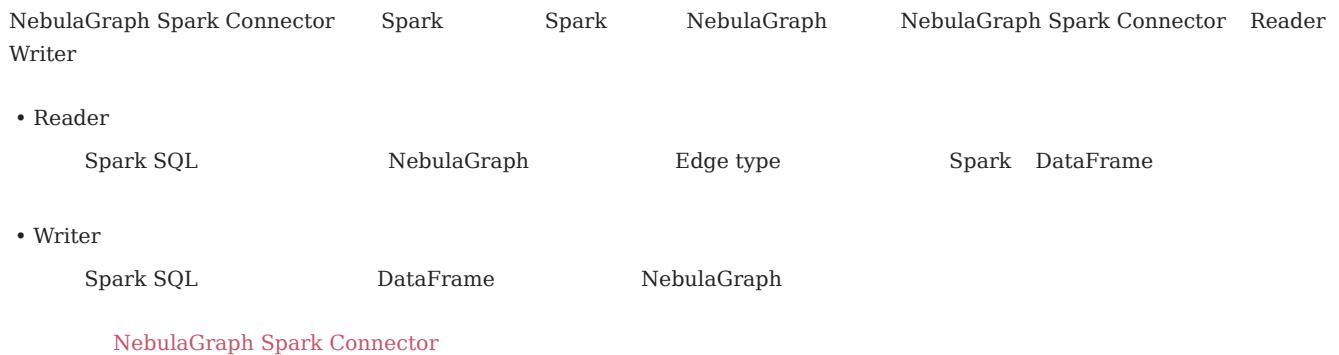
NebulaGraph Explorer Workflow

 **Enterpriseonly**

Nebula Explorer

: January 13, 2023

22. NebulaGraph Spark Connector



22.1

NebulaGraph Spark Connector

- NebulaGraph
- NebulaGraph
- NebulaGraph
- NebulaGraph Algorithm

22.2

NebulaGraph Spark Connector 3.3.0

- ID ID ID
- Reader
- Reader NebulaGraph Graphx VertexRDD EdgeRDD Long ID
- SparkSQL DataSourceV2 NebulaGraph
- insert update delete insert update delete
- NebulaGraph SSL

22.3

[Release notes](#)

22.4 NebulaGraph Spark Connector

22.4.1



Spark 2.4.x 2.2.x

1. nebula-spark-connector

```
$ git clone -b release-3.3 https://github.com/vesoft-inc/nebula-spark-connector.git
```

2. Spark

- Spark 2.4.x

a. nebula-spark-connector

```
cd nebula-spark-connector/nebula-spark-connector
```

b.

```
$ mvn clean package -Dmaven.test.skip=true -Dgpg.skip -Dmaven.javadoc.skip=true
```

- Spark 2.2.x

a. nebula-spark-connector_2.2

```
cd nebula-spark-connector/nebula-spark-connector_2.2
```

b.

```
$ mvn clean package -Dmaven.test.skip=true -Dgpg.skip -Dmaven.javadoc.skip=true
```

target nebula-spark-connector-3.3.0-SNAPSHOT.jar

22.4.2 Maven

22.5

NebulaGraph Spark Connector NebulaGraph

```
# NebulaGraph
spark.read.nebula().loadVerticesToDF()
spark.read.nebula().loadEdgesToDF()

# dataframe NebulaGraph
dataframe.write.nebula().writeVertices()
dataframe.write.nebula().writeEdges()

nebula()
```

22.5.1 NebulaGraph

```
val config = NebulaConnectionConfig
  .builder()
  .withMetaAddress("127.0.0.1:9559")
  .withConenctionRetry(2)
  .withExecuteRetry(2)
  .withTimeout(6000)
```

```

.build()

val nebulaReadVertexConfig: ReadNebulaConfig = ReadNebulaConfig
    .builder()
    .withSpace("test")
    .withLabel("person")
    .withNoColumn(false)
    .withReturnCols(List("birthday"))
    .withLimit(10)
    .withPartitionNum(10)
    .build()
val vertex = spark.read.nebula(config, nebulaReadVertexConfig).loadVerticesToDF()

val nebulaReadEdgeConfig: ReadNebulaConfig = ReadNebulaConfig
    .builder()
    .withSpace("test")
    .withLabel("knows")
    .withNoColumn(false)
    .withReturnCols(List("degree"))
    .withLimit(10)
    .withPartitionNum(10)
    .build()
val edge = spark.read.nebula(config, nebulaReadEdgeConfig).loadEdgesToDF()

```

- `NebulaConnectionConfig` `NebulaGraph`

<code>withMetaAddress</code>	<code>Meta</code>	<code>,</code>	<code>ip1:port1,ip2:port2,...</code>
	<code>withGraphAddress</code>		
<code>withConnectionRetry</code>	<code>NebulaGraph Java Client</code>	<code>NebulaGraph</code>	<code>1</code>
<code>withExecuteRetry</code>	<code>NebulaGraph Java Client</code>		<code>1</code>
<code>withTimeout</code>	<code>NebulaGraph Java Client</code>	<code>6000</code>	<code>ms</code>

- `ReadNebulaConfig` `NebulaGraph`

<code>withSpace</code>	<code>NebulaGraph</code>			
<code>withLabel</code>	<code>NebulaGraph</code>	<code>Tag</code>	<code>Edge type</code>	
<code>withNoColumn</code>		<code>false</code>	<code>true</code>	<code>withReturnCols</code>
<code>withReturnCols</code>			<code>List(property1,property2,...)</code>	<code>List()</code>
<code>withLimit</code>		<code>NebulaGraph Java Storage Client</code>		<code>1000</code>
<code>withPartitionNum</code>	<code>NebulaGraph</code>	<code>Spark</code>	<code>100</code>	<code>partition_num</code>

22.5.2 NebulaGraph



`DataFrame` `NebulaGraph`

```

val config = NebulaConnectionConfig
    .builder()
    .withMetaAddress("127.0.0.1:9559")
    .withGraphAddress("127.0.0.1:9669")
    .withConenctionRetry(2)
    .build()

val nebulaWriteVertexConfig: WriteNebulaVertexConfig = WriteNebulaVertexConfig
    .builder()
    .withSpace("test")
    .withTag("person")
    .withVidField("id")
    .withVidPolicy("hash")
    .withVidAsProp(true)
    .withUser("root")
    .withPasswd("nebula")
    .withBatch(512)

```

```
.build()
df.write.nebula(config, nebulaWriteVertexConfig).writeVertices()

val nebulaWriteEdgeConfig: WriteNebulaEdgeConfig = WriteNebulaEdgeConfig
  .builder()
  .withSpace("test")
  .withEdge("friend")
  .withSrcIdField("src")
  .withSrcPolicy(null)
  .withDstIdField("dst")
  .withDstPolicy(null)
  .withRankField("degree")
  .withSrcAsProperty(true)
  .withDstAsProperty(true)
  .withRankAsProperty(true)
  .withUser("root")
  .withPasswd("nebula")
  .withBatch(512)
  .build()
df.write.nebula(config, nebulaWriteEdgeConfig).writeEdges()
```

insert withWriteMode update delete

```
val config = NebulaConnectionConfig
  .builder()
  .withMetaAddress("127.0.0.1:9559")
  .withGraphAddress("127.0.0.1:9669")
  .build()

val nebulaWriteVertexConfig = WriteNebulaVertexConfig
  .builder()
  .withSpace("test")
  .withTag("person")
  .withVidField("id")
  .withVidAsProp(true)
  .withBatch(512)
  .withWriteMode(WriteMode.UPDATE)
```

```
.build()
df.write.nebula(config, nebulaWriteVertexConfig).writeVertices()
```

- `NebulaConnectionConfig` `NebulaGraph`

<code>withMetaAddress</code>	<code>Meta</code>	,	<code>ip1:port1,ip2:port2,...</code>
<code>withGraphAddress</code>	<code>Graph</code>	,	<code>ip1:port1,ip2:port2,...</code>
<code>withConnectionRetry</code>	<code>NebulaGraph Java Client</code>	<code>NebulaGraph</code>	<code>1</code>

- `WriteNebulaVertexConfig`

<code>withSpace</code>	<code>NebulaGraph</code>						
<code>withTag</code>	<code>Tag</code>						
<code>withVidField</code>	<code>DataFrame</code>	<code>ID</code>					
<code>withVidPolicy</code>	<code>ID</code>	<code>NebulaGraph</code>	<code>HASH</code>				
<code>withVidAsProp</code>	<code>DataFrame</code>	<code>ID</code>		<code>false</code>	<code>true</code>	<code>Tag</code>	<code>VidField</code>
<code>withUser</code>	<code>NebulaGraph</code>						
<code>withPasswd</code>	<code>NebulaGraph</code>						
<code>withBatch</code>		<code>512</code>	<code>withWriteMode</code>	<code>update</code>		<code>512</code>	
<code>withWriteMode</code>			<code>insert</code>	<code>update</code>	<code>delete</code>		<code>insert</code>
<code>withDeleteEdge</code>			<code>false</code>	<code>withWriteMode</code>	<code>delete</code>		

- `WriteNebulaEdgeConfig`

<code>withSpace</code>	<code>NebulaGraph</code>				
<code>withEdge</code>	<code>Edge type</code>				
<code>withSrcIdField</code>	<code>DataFrame</code>				
<code>withSrcPolicy</code>		<code>NebulaGraph</code>	<code>HASH</code>		
<code>withDstIdField</code>	<code>DataFrame</code>				
<code>withDstPolicy</code>		<code>NebulaGraph</code>	<code>HASH</code>		
<code>withRankField</code>	<code>DataFrame</code>	<code>rank</code>	<code>rank</code>		
<code>withSrcAsProperty</code>	<code>DataFrame</code> <code>SrcIdField</code>		<code>false</code>	<code>true</code>	<code>Edge type</code>
<code>withDstAsProperty</code>	<code>DataFrame</code> <code>DstIdField</code>		<code>false</code>	<code>true</code>	<code>Edge type</code>
<code>withRankAsProperty</code>	<code>DataFrame</code> <code>RankField</code>	<code>rank</code>		<code>false</code>	<code>true</code>
<code>withUser</code>	<code>NebulaGraph</code>				
<code>withPasswd</code>	<code>NebulaGraph</code>				
<code>withBatch</code>		<code>512</code>	<code>withWriteMode</code>	<code>update</code>	<code>512</code>
<code>withWriteMode</code>		<code>insert</code>	<code>update</code>	<code>delete</code>	<code>insert</code>

22.5.3

: January 13, 2023

23. NebulaGraph Flink Connector

NebulaGraph Flink Connector

Flink

NebulaGraph

NebulaGraph

NebulaGraph

[NebulaGraph Flink Connector](#)

23.1

NebulaGraph Flink Connector

- NebulaGraph
- NebulaGraph
- NebulaGraph

23.2

[Release notes](#)

: January 13, 2023

24. NebulaGraph Bench

NebulaGraph Bench LDBC NebulaGraph

24.1

- NebulaGraph
- NebulaGraph

24.2

Release

NebulaGraph Bench

:January 13, 2023

25.

25.1 Release Note

25.1.1 NebulaGraph 3.3.0 release notes

- k-hop #4560 #4736 #4566 #4582 #4558 #4556 #4555 #4516 #4531 #4522 #4754 #4762
- GO JOIN #4599 #4750
- GET SUBGRAPH #4357
- GetNeighbors #4671
- FIND SHORTEST PATH #4672
- #4626
- #4498
- job manager #4446 #4442 #4444 #4460 #4500 #4633 #4654 #4663 #4722 #4742
- flag TOSS enable_toss BALANCE DATA enable_data_balance #4728
- #4550
- JSON_EXTRACT #4743

- `#4724`
- `MATCH #4780`
- `#4706`
- `OPTIONAL MATCH OPTIONAL MATCH WHERE MATCH #4670`
- `LOOKUP #4664`
- `LOOKUP YIELD DISTINCT #4651`
- `ColumnExpression #4413`
- `GO id($$) #4768`
- `MATCH IN #4748`
- `MATCH #4771`
- `MATCH pattern #4778`
- `Tag Edge Tag Edge #4616`
 - `#4524`
- `datetime #4448`
- `enable_breakpad #4623`
- `metad #4610`
 - `#4409`
- `ENABLE_CCACHE #4648`
- `#4628`
- `COUNT(DISTINCT *) #4553`
- `Tag #4629`

:January 13, 2023

25.1.2 NebulaGraph Studio

v3.5.0

- - Schema Schema
 -
 - demo
 - //
 -
 -
 -
 -
 -
 - Int8/16/32 fixed_string
-

:January 13, 2023

25.1.3 NebulaGraph Dashboard

v3.2.0

- -
 - Storage
 -
 -
-

:January 13, 2023

25.1.4 NebulaGraph Dashboard

v3.2.4

-
- NebulaGraph 3.1.3 3.4

v3.2.3

-
- NebulaGraph 3.3.0

v3.2.2

-
-
-
- RPM DEB Dashboard

v3.2.1

-
- NebulaGraph 3.3.0
-
- NebulaGraph 3.3.0 BR

v3.2.0

- -
 - OAuth2.0
 -
 -
 -
 -
 - Storage
 -
 -
 -
 -
 - SSH
 -
 - Dashboard NebulaGraph
 -
 - prometheus alertmanager
 -
 -
 -
 -
 -
-

:January 13, 2023

25.1.5 NebulaGraph Explorer

v3.2.1

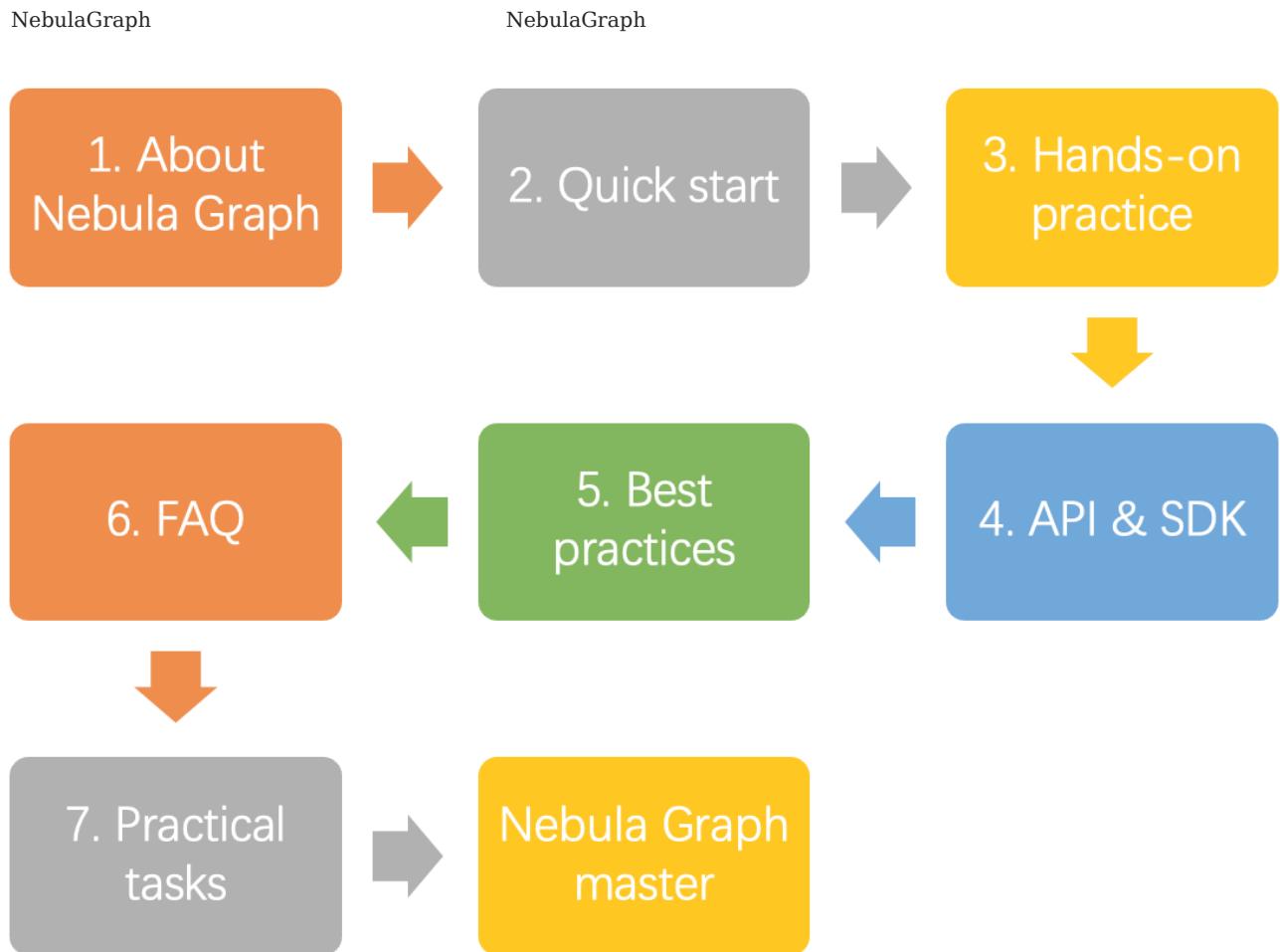
-
- HTTP 500
-

v3.2.0

-
-
- Schema Schema
- iFrame
- OAuth 2.0 OAuth2.0 Explorer
- Explorer
- nGQL
-
- node2vec
-
- Dag Controller
- demo
-
- //
-
-
-
-
-
-
-
-
- 3D
- Int8/16/32 fixed_string

: January 13, 2023

25.2 NebulaGraph



NebulaGraph

CI/CP

25.2.1 1. NebulaGraph

1.1 NebulaGraph

PPT

NebulaGraph

NebulaGraph

NebulaGraph

NebulaGraph 3

1.2

1.3

1.4

1.5

Meta

Graph

Storage

25.2.2 2.

2.1 NebulaGraph

RPM/DEB

TAR

Docker

NebulaGraph

2.2 NebulaGraph

NebulaGraph

2.3 NebulaGraph

NebulaGraph

2.4 nGQL

nGQL

25.2.3 3.

3.1

RPM/DEB NebulaGraph

3.2

NebulaGraph

3.3 Nebula

Meta

Graph

Storage

Linux

3.4

3.5

•

OpenLDAP

•

Storage

•

Nebula

RocksDB

•

• SSL

SSL

3.6

Nebula schema

-

Compaction

-

3.7

Nebula Studio	Nebula Studio	Nebula Studio
Nebula Dashboard	Nebula Dashboard	Nebula Dashboard
Nebula Explorer		Nebula Explorer

Nebula Importer	Nebula Importer
Nebula Spark Connector	-
Nebula Flink Connector	-
Nebula Exchange	NebulaGraph ---Exchange Exchange SST
Nebula Exchange	-

Nebula BR NebulaGraph nebula-br

Nebula Bench

Nebula Operator

Nebula Algorithm

Nebula Console

Nebula CPP

Nebula Java

Nebula Python

Nebula Go

25.2.4 4.

API & SDK

25.2.5 5.

&

LDBC nGQL

NebulaGraph Betweenness Centrality

Akulaku

NebulaGraph

NebulaGraph

NebulaGraph

@BOSS

25.2.6 6.

FAQ

25.2.7 7.

NebulaGraph

NebulaGraph

Studio Dashboard Explorer

Studio Dashboard Explorer

K6 NebulaGraph

K6 NebulaGraph

LDBC

LDBC nGQL

LDBC K

LDBC interactive-short-1.cypher

25.2.8 8. CI/CP

NebulaGraph 2

- NebulaGraph Certified Insider (NGCI)

NebulaGraph

NebulaGraph

- NebulaGraph Certified Professional (NGCP)

NebulaGraph

NebulaGraph

NebulaGraph

NebulaGraph

25.2.9

- NebulaGraph
 - NebulaGraph 2.4
 - NebulaGraph 2.8
-

: January 13, 2023

25.3 FAQ

NebulaGraph 3.3.0

[NebulaGraph](#)

[GitHub issue](#)

25.3.1

NebulaGraph

[issue](#) NebulaGraph



1. " "
2. Markdown "Commit changes" GitHub pull request
3. [CLA](#) 2 reviewer

25.3.2



NebulaGraph 3.3.0

NebulaGraph 1.x 2.x

[NebulaGraph](#)

25.3.3

SemanticError: Missing yield clause.

NebulaGraph 3.0.0

LOOKUP GO FETCH YIELD

[YIELD](#)

Host not enough!

3.0.0

Storage

Storage

Meta

ADD HOSTS

Storage

Storage

To get the property of the vertex in 'v.age', should use the format 'var.tag.prop'

3.0.0

pattern

Tag

Tag

RETURN .

RETURN .Tag .

Storage Error E_RPC_FAILURE

Graph Storage

Storage

- nebula-graphd.conf --storage_client_timeout_ms storage_client_timeout_ms=60000 nebula-graphd.conf Storage client ms -- --local_config=true
- LIMIT GO MATCH
- Storaged OOM (dmesg |grep nebula)
- Storage SSD
-

```
The leader has changed. Try again later
```

```
1-N (N==partition      meta client   leader    1-2
```

```
NebulaGraph      df -h
```

Exchange Connectors Algorithm SNAPSHOT

```
Could not find artifact com.vesoft:client:jar:xxx-SNAPSHOT
```

```
maven      SNAPSHOT maven central      SNAPSHOT
maven setting.xml profiles
```

```
<profile>
<activation>
  <activeByDefault>true</activeByDefault>
</activation>
<repositories>
  <repository>
    <id>snapshots</id>
    <url>https://oss.sonatype.org/content/repositories/snapshots/</url>
    <snapshots>
      <enabled>true</enabled>
    </snapshots>
  </repository>
</repositories>
</profile>
```

```
[ERROR (-1004)]: SyntaxError: syntax error near
```

```
YIELD RETURN
```

```
can't solve the start vids from the sentence
```

```
VID      VID
```

```
> GO FROM ${vids} ...
> MATCH (src) WHERE id(src) == ${vids}
#      VID
```

```
# CREATE TAG INDEX IF NOT EXISTS i_player ON player(name(20));
# REBUILD TAG INDEX i_player;

> LOOKUP ON player WHERE player.name == "abc" | ... YIELD ...
> MATCH (src) WHERE src.name == "abc" ...
#      name      VID
```

```
can't solve the start vids from the sentence
```

```
Wrong vertex id type: 1001
```

```
VID      create space    INT64  FIXED_STRING(N)      create space
```

```
The VID must be a 64-bit integer or a string fitting space vertex id length limit.
```

```
VID      create space
```

```
edge conflict  vertex conflict
```

Storage

```

RPC failure in MetaClient: Connection refused

metad      metad  graphd

• metad      metad      metad

• telnet meta-ip:port

•



nebula-graph.INFO      StorageClientBase.inl:214] Request to "x.x.x.x":9779 failed:
N6apache6thrift9transport19TTransportExceptionE: Timed Out

storaged

• compaction

• Graph   Storage   RPC      nebula-graphd.conf      --storage_client_timeout_ms      ms      60000

nebula-storaged.INFO      MetaClient.cpp:65] Heartbeat failed, status:Wrong cluster!      nebula-metad.INFO
HBProcessor.cpp:54] Reject wrong cluster host "x.x.x.x":9771!

metad ip      storage

storage      /usr/local/nebula      cluster.id      storaged

Storage Error: More than one request trying to add/update/delete one edge/vertex at the same time.

```

25.3.4

time spent

SHOW SPACES

```

nebula> SHOW SPACES;
+-----+
| Name      |
+-----+
| "basketballplayer" |
+-----+
Got 1 rows (time spent 1235/1934 us)

```

- 1235
- 1934

NebulaGraph nebula-storaged

nebula-storaged	nebula-storaged	nebula-metad	Storage	Storage	Ready	3.0.0
Meta	Storage	Storage	Meta	ADD HOSTS	Meta	Storage
Storage						

NebulaGraph

NebulaGraph Console 2.6.0 NebulaGraph

(Dangling edge)

NebulaGraph 3.3.0 " " openCypher MERGE
 VERTEX, INSERT EDGE, DELETE EDGE INSERT VERTEX, DELETE

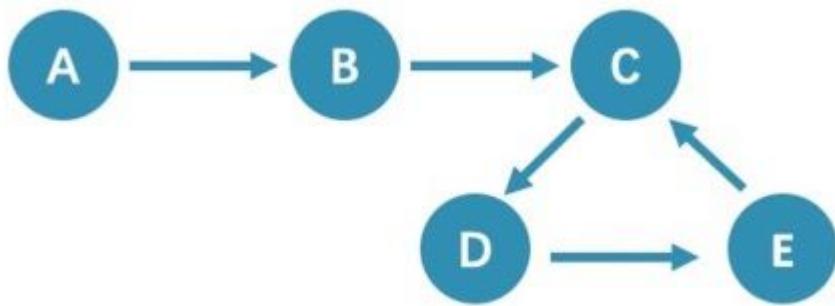
CREATE SPACE `replica_factor` 2

Storage Raft

```
1  replica_factor    1
    replica_factor=2          replica_factor=4          replica_factor=3
replica_factor
    replica_factor=3          replica_factor=1
```

GO MATCH

- GO
- RETURN
- Storage `max_edge_returned_per_vertex`
-
- GO walk
- MATCH openCypher trail



A 5	C A->B->C->D->E->C 6	D A->B->C->D->E->C->D 6	C->D	MATCH
GO MATCH	MATCH	GO		

Tag Edge type

show-stats

Tag Edge type

1.

```
> CREATE TAG INDEX IF NOT EXISTS i_player ON player();
> REBUILD TAG INDEX i_player;
```

2. LOOKUP MATCH

```
> LOOKUP ON player;
> MATCH (n:player) RETURN n;
```

INDEX LOOKUP MATCH

Tag/EdgeType

nGQL

Tag/EdgeType LIMIT

MATCH (n) RETURN (n). Scan vertices or edges need to specify a limit number, or limit number can not push down.

NebulaGraph Algorithm

Tag/Edge Type Union

Tag Edge type

?

" " "

```
nebula > MATCH (s)-[e]->() WHERE id(s) == "given" RETURN count(e); #
nebula > MATCH (s)<-[e]-() WHERE id(s) == "given" RETURN count(e); #
```

OOM

" "

NebulaGraph Algorithm

25.3.5

NebulaGraph /usr/local/nebula/logs/ INFO nebula-graphd.INFO, nebula-storaged.INFO, nebula-metad.INFO
.WARNING .ERROR

NebulaGraph glog glog

- crontab Glog should delete old log files automatically
- logrotate logrotate NebulaGraph timestamp_in_logfile_name false

NebulaGraph

nebula-console SHOW HOSTS META SHOW HOSTS

bin	./<binary_name> --version	version	GitHub	commit ID
-----	---------------------------	---------	--------	-----------

```
$ ./nebula-graphd --version
```

- Docker Compose

Docker Compose NebulaGraph

```
docker exec -it nebula-docker-compose_graphd_1 bash
cd bin/
./nebula-graphd --version
```

- RPM/DEB

```
rpm -qa |grep nebula
```

Host	Host	OFFLINE
------	------	---------

OFFLINE	Host
---------	------

25.3.6

Meta	9559, 9560, 19559
------	-------------------

Graph	9669, 19669
-------	-------------

Storage	9777 ~ 9780, 19779
---------	--------------------

telnet

```
telnet <ip> <port>
```



telnet

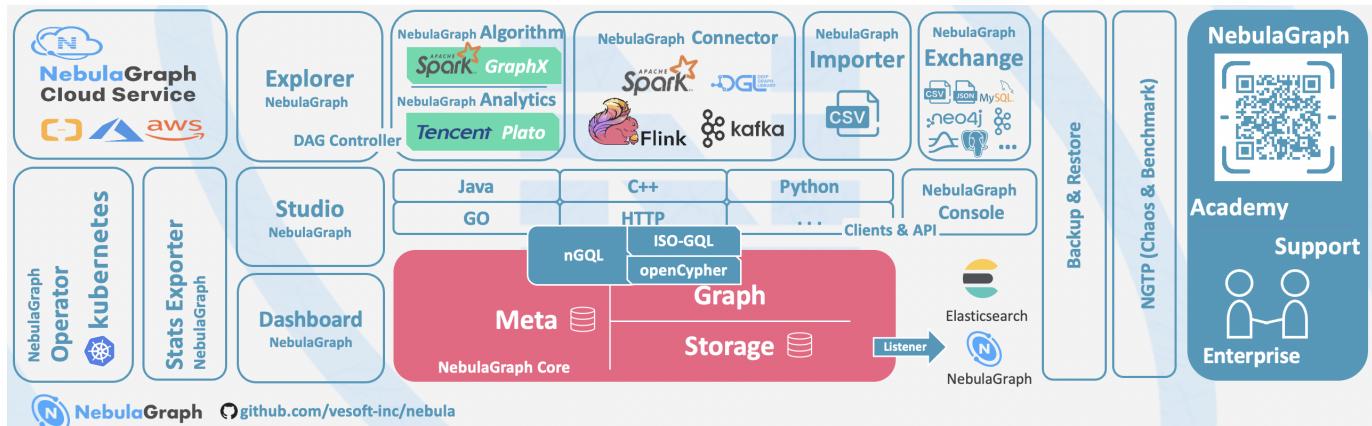
telnet

```
//
$ telnet 192.168.1.10 9669
Trying 192.168.1.10...
Connected to 192.168.1.10.
Escape character is '^}'.

//
$ telnet 192.168.1.10 9777
Trying 192.168.1.10...
telnet: connect to address 192.168.1.10: Connection refused
```

:January 13, 2023

25.4



Note

- | | X.Y.Z | X, | Y, | Z |
|---|---------|----------|---------------------|----|
| • | Y | 6 | | 3 |
| • | Y | 3 | | Y |
| • | RC | | (Release Candidate) | RC |
| • | nightly | SNAPSHOT | | |
| • | | | | |

Incompatibility

- X.Y.Z1 X.Y.Z2 : bugfix
 - X.Y1.* X.Y2.* : API X.Y2.*
 - X1.*.* X2.*.* : API
 - X.Y.Z2 X.Y.Z1
 - 2.x NebulaGraph 3.x

25.4.1 NebulaGraph Studio

NebulaGraph Studio Studio Web NebulaGraph DBMS nGQL

Note

Studio NebulaGraph

NebulaGraph

Studio

v3.3.0

v3.5.0

25.4.2 NebulaGraph Dashboard

NebulaGraph Dashboard	Dashboard	NebulaGraph	NebulaGraph Dashboard
NebulaGraph	Dashboard		
v3.3.0	v3.2.0		

25.4.3 NebulaGraph Dashboard

NebulaGraph Dashboard	Dashboard	NebulaGraph
NebulaGraph Dashboard		
NebulaGraph	Dashboard	
v3.3.0	v3.2.4	

25.4.4 NebulaGraph Explorer

NebulaGraph Explorer	Explorer	Web	NebulaGraph
NebulaGraph Explorer			
NebulaGraph	Explorer		
v3.3.0	v3.2.1		

25.4.5 NebulaGraph Stats Exporter

nebula-stats-exporter	Prometheus
NebulaGraph Stats Exporter	
NebulaGraph	Stats Exporter

25.4.6 NebulaGraph Exchange

NebulaGraph Exchange	Exchange	Apache Spark™	NebulaGraph
NebulaGraph Exchange			
NebulaGraph	Exchange	Exchange	
v3.3.0	v3.3.0	v3.0.0	

25.4.7 NebulaGraph Operator

NebulaGraph Operator	Operator	Kubernetes	NebulaGraph	Kubernetes	NebulaGraph
Kubernetes	NebulaGraph		NebulaGraph Operator		
NebulaGraph	Operator				

25.4.8 NebulaGraph Importer

NebulaGraph Importer	Importer	NebulaGraph	CSV	Importer	CSV	NebulaGraph
NebulaGraph Importer						
NebulaGraph	Importer					
v3.3.0	v3.1.0					

25.4.9 NebulaGraph Spark Connector

NebulaGraph Spark Connector	Spark	Spark	NebulaGraph	NebulaGraph Spark Connector	Reader
Writer					
NebulaGraph	Spark Connector				
v3.3.0	v3.3.0				

25.4.10 NebulaGraph Flink Connector

NebulaGraph Flink Connector	Flink	NebulaGraph	NebulaGraph	NebulaGraph
NebulaGraph Flink Connector				
NebulaGraph	Flink Connector			
v3.3.0	v3.3.0			

25.4.11 NebulaGraph Algorithm

NebulaGraph Algorithm	Algorithm	GraphX	Spark	Spark	NebulaGraph
lib	DataFrame	NebulaGraph Algorithm			
NebulaGraph	Algorithm				
v3.3.0	v3.0.0				

25.4.12 NebulaGraph Analytics

NebulaGraph Analytics	Plato	Plato	NebulaGraph	NebulaGraph Analytics
NebulaGraph Analytics				
NebulaGraph	Analytics			
v3.3.0	v3.3.0			

25.4.13 NebulaGraph Console

NebulaGraph Console	NebulaGraph	CLI	NebulaGraph
NebulaGraph Console			
NebulaGraph	Console		
v3.3.0	v3.3.1		

25.4.14 NebulaGraph Docker Compose

Docker Compose	NebulaGraph	Docker Compose	NebulaGraph
NebulaGraph Docker Compose			
NebulaGraph	Docker Compose		
v3.3.0	v3.3.0		

25.4.15 Backup & Restore

Backup&Restore	BR	CLI	NebulaGraph
------------------------------------	----	-----	-------------

NebulaGraph	BR
--------------------	-----------

v3.3.0	v3.3.0
--------	--------

25.4.16 NebulaGraph Bench

NebulaGraph Bench	NebulaGraph	LDBC v0.3.3
-----------------------------------	-------------	-------------

NebulaGraph	Bench
--------------------	--------------

v3.3.0	v1.2.0
--------	--------

25.4.17 API SDK

↑ Compatibility

X.Y.*

NebulaGraph	commit id
--------------------	------------------

v3.3.0	C++
--------	-----

v3.3.0	Go
--------	----

v3.3.0	Python
--------	--------

v3.3.0	Java
--------	------

v3.3.0	HTTP
--------	------

25.4.18

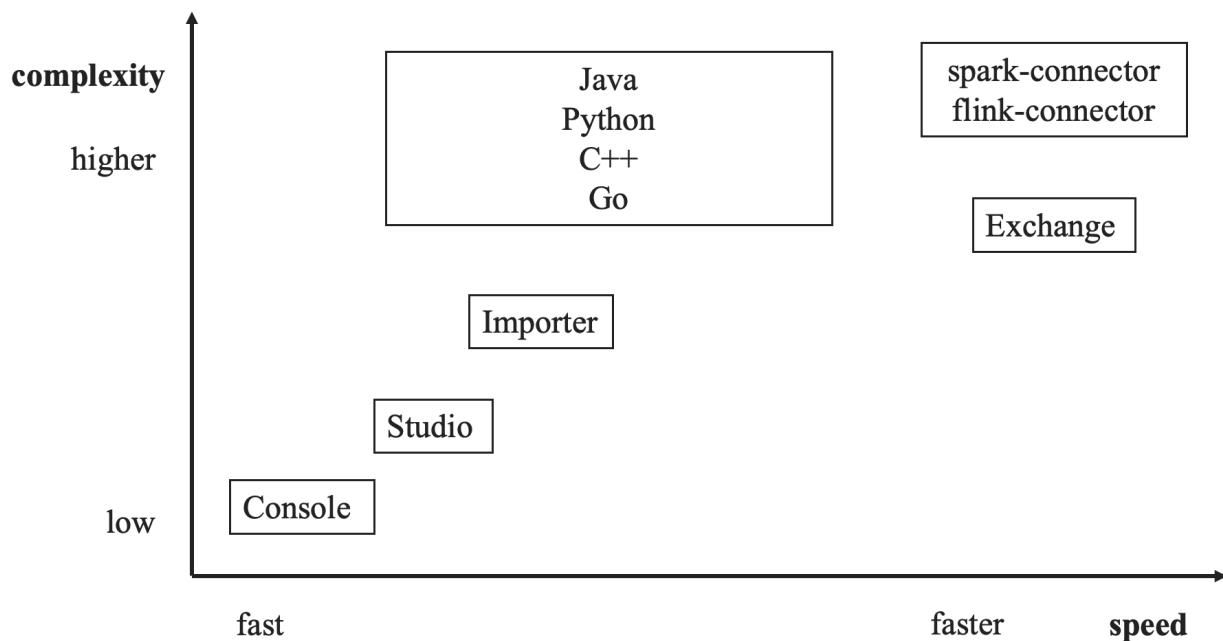
- [Rust Client](#)
- [Node.js Client](#)
- Object Graph Mapping Library (OGM, or ORM)
-

:January 13, 2023

25.5

NebulaGraph 3.3.0

- -f nGQL
- studio csv
- importer csv
- Exchange Neo4j, Hive, MySQL Spark
- Spark-connector/Flink-connector (Spark/Flink)
- C++/GO/Java/Python SDK



: January 13, 2023

25.6

25.6.1

GitHub

[GitHub](#)

[CLA](#)

[CLA](#)

[vesoft inc. Contributor License Agreement](#)

[Sign in with GitHub to agree](#)

info@vesoft.com

25.6.2

NebulaGraph [Markdown](#)

25.6.3

Step 1 GitHub fork

NebulaGraph [NebulaGraph](#)

1. github.com/vesoft-inc/nebula
2. [Fork](#) fork NebulaGraph

Step 2

- 1.

```
#  
working_dir=$HOME/Workspace
```

2. user GitHub

```
user={GitHub }
```

- 3.

```
mkdir -p $working_dir  
cd $working_dir  
git clone https://github.com/$user/nebula.git  
# git clone git@github.com:$user/nebula.git  
  
cd $working_dir/nebula  
git remote add upstream https://github.com/vesoft-inc/nebula.git  
# git remote add upstream git@github.com:vesoft-inc/nebula.git  
  
#  
git remote set-url --push upstream no_push  
  
#  
#  
# origin git@github.com:$(user)/nebula.git (fetch)  
# origin git@github.com:$(user)/nebula.git (push)
```

```
# upstream https://github.com/vesoft-inc/nebula (fetch)
# upstream no_push (push)
git remote -v
```

4. pre-commit hook

NebulaGraph pre-commit hook .git

hook commit

```
cd $working_dir/nebula/.git/hooks
ln -s $working_dir/nebula/.linters/cpp/hooks/pre-commit.sh .
```

pre-commit hook

```
cd $working_dir/nebula/.git/hooks
chmod +x pre-commit
```

Step 3

1.

```
cd $working_dir/nebula
git fetch upstream
git checkout master
git rebase upstream/master
```

2.

```
git checkout -b myfeature
```

Note

PR	commits	upstream/master	commits	squash	commit	origin/master	upstream/
		commits	origin/master				
master	hard reset						

```
git fetch upstream
git checkout master
git reset --hard upstream/master
git push --force origin master
```

Step 4

-

NebulaGraph cpplint Google

- Bug
- NebulaGraph

Note

```
-DENABLE_TESTING = ON
```

- nebula

```
cd nebula/build
ctest -j$(nproc)
```

Step 5

```
#      myfeature
git fetch upstream
git rebase upstream/master
```

PR

head

Step 6 Commit

```
git commit -a
```

```
--amend
```

Step 7 Push

push GitHub

```
git push origin myfeature
```

Step 8 pull request

1. fork [https://github.com/\\$user/nebula](https://github.com/$user/nebula) \$user)
2. myfeature Compare & pull request

Step 9

pull request

25.6.4

[How to add test cases](#)

25.6.5

Step 1

Slack NebulaGraph

NebulaGraph Contrib

- info@vesoft.com
- NebulaGraphbot
- Slack [Join Slack](#)

Step 2

NebulaGraph NebulaGraph Contrib ID

Step 3

NebulaGraph Contrib Maintain

GitHub [Transferring a repository owned by your user account](#)

:January 13, 2023

25.7 NebulaGraph

1. 2018.9.5 @dutor

[Feature] Added some concurrent utilities, GenericThreadPool, etc.

 dutor merged 2 commits into `vesoft-inc:master` from `dutor:master`  on Sep 5, 2018

 Conversation 21  Commits 2  Checks 0  Files changed 24

 dutor commented on Sep 4, 2018 • edited  Member  ...

This PR adds several utilities such as `GenericThreadPool`, `GenericWorker`, `Barrier`, `Latch`, `ThreadLocalPtr` and some other convenience things.

2. 2019.5 v0.1.0 alpha ,



v1.0.0-beta, v1.0.0-rc1, v1.0.0-rc2, v1.0.0-rc3, v1.0.0-rc4

[Pre-release](#) v0.1.0
-O b0d817f[Compare ▾](#)

Nebula Graph v0.1.0

darionyaphet released this on May 14, 2019 · 1075 commits to master since this release

This is the first release of *Nebula Graph*, a brand new, fast and distributed graph database.

Available Features

- Physical data isolation with Graph Space
- Strongly typed schema support
- Vertices and edges insertion
- Graph traversal(the `GO` statement)
- Variable definition and reference
- Piping query result between statements
- Client API in C++, Golang and Java

Features Coming Soon

- Raft support
- Query based on secondary index(the `LOOKUP` statement)
- Sub-graph retrieval(the `MATCH` statement)
- User defined function call
- User management

Try Out

A Docker image is available for trial purpose. You can get it by following the guide [here](#).

▼ Assets 2

[Source code \(zip\)](#) [Source code \(tar.gz\)](#)

3. 2019.7 HBaseCon ¹@dangleptr



4. 2020.3 v1.0 v2.0

5. 2020.6 v1.0.0 GA

V1.0.0 GA

v1.0.0
06a5db4
Verified

jude-zhu released this on Jun 10, 2020 · 146 commits to master since this release

[Compare](#)

Basic Features

- Online DDL & DML. Support updating schemas and data without stopping or affecting your ongoing operations.
- Graph traversal. `go` statement supports forward/reverse and bidirectional graph traversal. `GO minHops TO maxHops` is supported to get variable hops relationships.
- Aggregate. Support aggregation functions such as `GROUP BY`, `ORDER BY`, and `LIMIT`.
- Composite query. Support composite clauses: `UNION`, `UNION DISTINCT`, `INTERSECT`, and `MINUS`.
- PIPE statements. The result yielded from the previous statement could be piped to the next statement as input.
- Use defined variables. Support user-defined variables to pass the result of a query to another.
- Index. Both the single-property index and composite index are supported to make searches of related data more efficient. `LOOKUP ON` statement is to query on the index.

Advanced Features

- Privilege Management. Support user authentication and role-based access control. Nebula Graph can easily integrate with third-party authentication systems. There are five built-in roles in Nebula Graph: `GO0`, `ADMIN`, `DBA`, `USER`, and `GUEST`. Each role has its corresponding privileges.
- Support Reservoir Sampling, which will retrieve k elements randomly for the sampling of the supernode at the complexity of $O(n)$.
- Cluster snapshot. Support creating snapshots for the cluster as an online backup strategy.
- TTL. Support TTL to expire items after a certain amount of time automatically.
- Operation & Maintenance
 - Scale in/out. Support online scale in/out and load balance for storage
 - `HOSTS` clause to manage storage hosts
 - `CONFIGS` clause to manage configuration options
- Job Manager & Scheduler. A tool for job managing and scheduling. Currently, `COMPACT` and `FLUSH` jobs are supported.
- Graph Algorithms. Support finding the full path and the shortest path between vertices.
- Provide OLAP interfaces to integrate with third-party graph analytics platforms.
- Support multiple character sets and collations. The default `CHARSET` and `COLLATE` are `utf8` and `utf8_bin`.

Clients

- Java Client. Support source code building and downloading from the MVN repository, see [Java Client](#) for more details.
- Python Client. Support source code building and installation with pip, see [Python Client](#) for more details.
- Golang Client. Install the client with the command `go get -u -v github.com/vesoft-inc/nebula-go`, see [Go Client](#) for more details.

Nebula Graph Studio

A graphical user interface for working with Nebula Graph. Support querying, designing schema, data loading, and graph exploring. See [Nebula Graph Studio](#) for more details.

6. 2021.3

v2.0 GA

Nebula Graph v2.0 GA

jude-zhu released this on Mar 23

Verified

Compare

New Features

- `vertexID` supports both `Integer` and `String`.
- New data types:
 - `NULL`: the property can be set to `NULL`. `NOT NULL` constraint is also supported
 - Composite types: `LIST`, `SET`, and `MAP`(Cannot be set as property types)
 - Temporal types: `DATE` and `DATETIME`
 - `FIXED_STRING`: a fixed size `String`
- Full-text indexes are supported to do prefix, wildcard, regex, and fuzzy search on a string property.
- Explain & Profile outputs the execution plan of an nGQL statement and execution profile.
- Subgraph to retrieve vertices and edges reachable from the start vertices.
- Support to collect statistics of the graph space.
- OpenCypher compatibility
 - Partially support the `MATCH` clause
 - Support `RETURN`, `WITH`, `UNWIND`, `LIMIT` & `SKIP` clauses
- More built-in functions
 - Predicate functions
 - Scalar functions
 - List functions
 - Aggregating functions
 - Mathematical functions
 - String functions
 - Temporal functions

Improvements

- Optimize the performance of inserting, updating, and deleting data with indexes.
- `LOOKUP ON` filtering data supports `OR` and `AND` operators.
- `FIND PATH` supports finding paths with or without regard to direction, and also supports excluding cycles in paths.
- `SHOW HOSTS graph/meta/storage` supports to retrieve the basic information of graphd/metad/storage hosts.

Changelog

- The data type of `vertexID` must be specified when creating a graph space.
- `FETCH PROP ON` returns a composite object if not specify the result set.
- Changed the default port numbers of `metad`, `graphd`, and `storage`.
- Refactor metrics counters.

Nebula-graph Console

Supports local commands mode. `:set csv` outputs the query results to the console and the specified CSV file. For more information, please refer to <https://github.com/vesoft-inc/nebula-console>.

Clients

Support connection pool and load balance.

- cpp client <https://github.com/vesoft-inc/nebula-cpp>
- java client <https://github.com/vesoft-inc/nebula-java>
- python client <https://github.com/vesoft-inc/nebula-python>
- go client <https://github.com/vesoft-inc/nebula-go>

Nebula Graph Studio

With Studio, you can create a graph schema, load data, execute nGQL statements, and explore graphs in one stop. For more information, please refer to <https://github.com/vesoft-inc/nebula-web-docker>.

Known Issues

- #860

7. 2021.8 v2.5.0

8. 2021.10 v2.6.0

9. 2022.2 v3.0.0

10. 2022.4 v3.1.0

1. NebulaGraph 1.x

RocksDB HBase

NebulaGraph 2.x

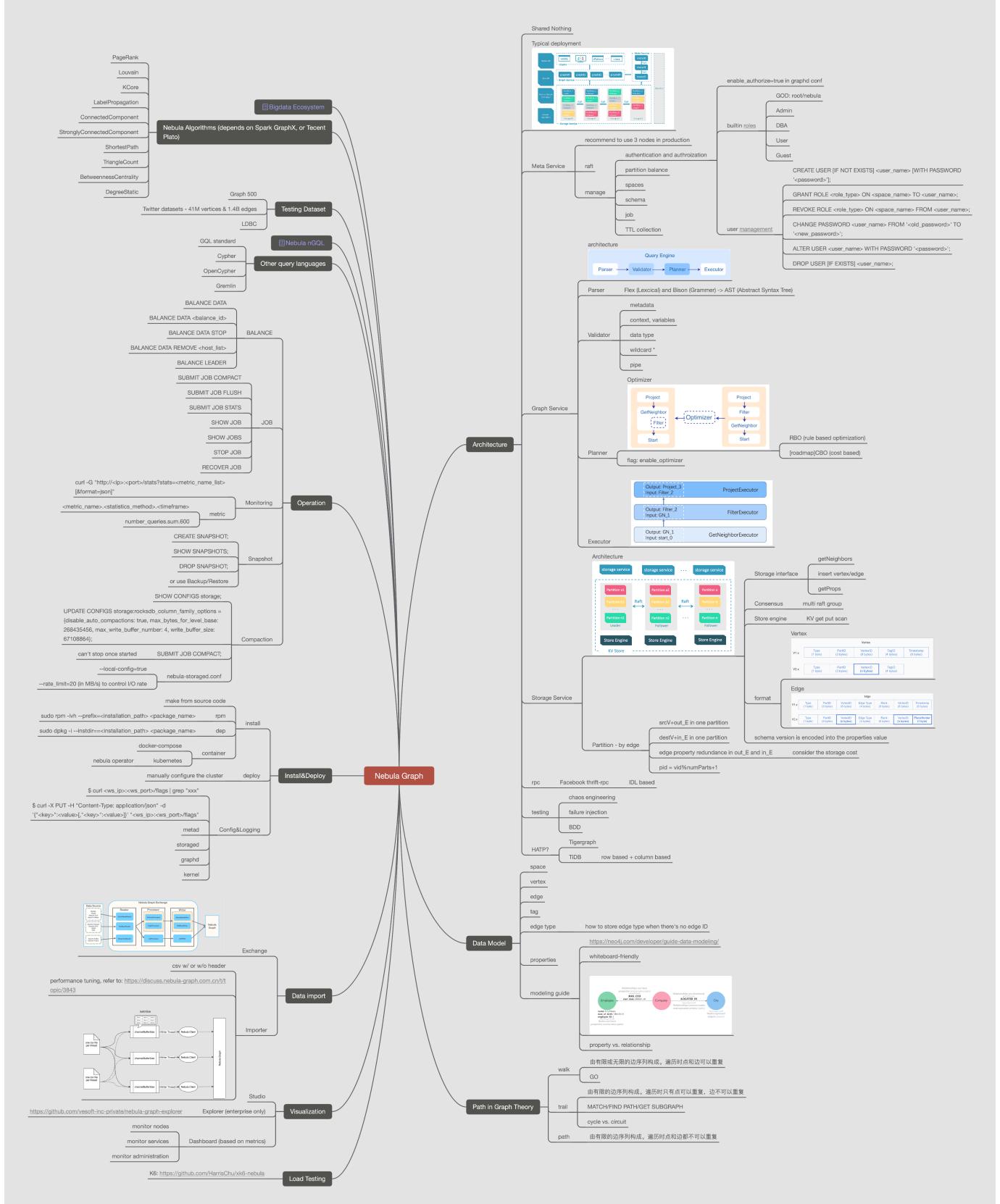
HBase



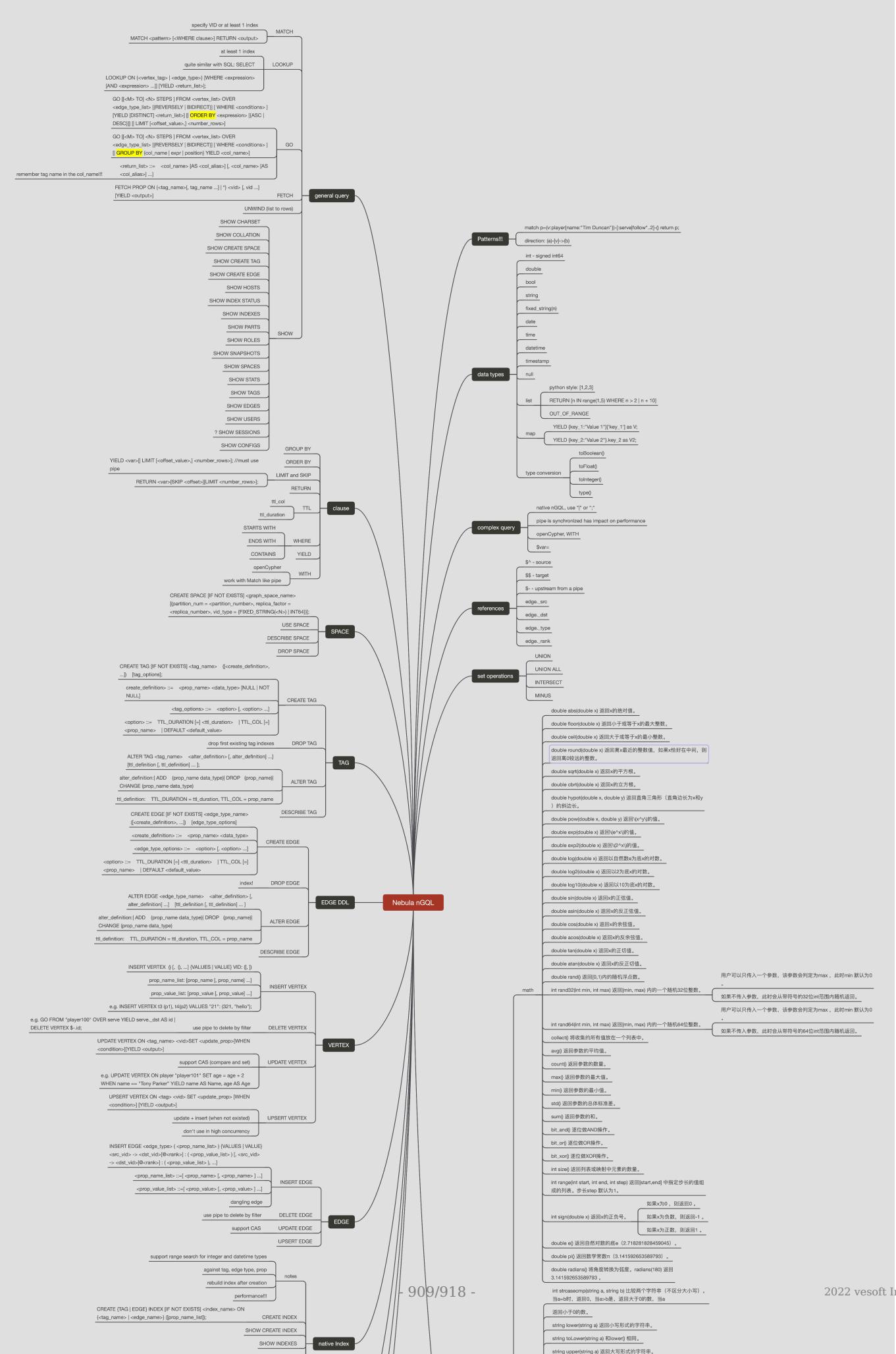
: January 13, 2023

25.8

NebulaGraph



nGQL



:January 13, 2023

25.9

NebulaGraph

 Note

- GitHub
- 0

E_DISCONNECTED	-1	
E_FAIL_TO_CONNECT	-2	
E_RPC_FAILURE	-3	RPC
E_LEADER_CHANGED	-4	Raft leader
E_SPACE_NOT_FOUND	-5	
E_TAG_NOT_FOUND	-6	Tag
E_EDGE_NOT_FOUND	-7	Edge type
E_INDEX_NOT_FOUND	-8	
E_EDGE_PROP_NOT_FOUND	-9	
E_TAG_PROP_NOT_FOUND	-10	Tag
E_ROLE_NOT_FOUND	-11	
E_CONFIG_NOT_FOUND	-12	
E_MACHINE_NOT_FOUND	-13	
E_LISTENER_NOT_FOUND	-15	listener
E_PART_NOT_FOUND	-16	
E_KEY_NOT_FOUND	-17	key
E_USER_NOT_FOUND	-18	
E_STATS_NOT_FOUND	-19	
E_SERVICE_NOT_FOUND	-20	
E_BACKUP_FAILED	-24	
E_BACKUP_EMPTY_TABLE	-25	
E_BACKUP_TABLE_FAILED	-26	
E_PARTIAL_RESULT	-27	multiget
E_REBUILD_INDEX_FAILED	-28	
E_INVALID_PASSWORD	-29	
E_FAILED_GET_ABS_PATH	-30	
E_BAD_USERNAME_PASSWORD	-1001	
E_SESSION_INVALID	-1002	
E_SESSION_TIMEOUT	-1003	
E_SYNTAX_ERROR	-1004	
E_EXECUTION_ERROR	-1005	
E_STATEMENT_EMPTY	-1006	
E_BAD_PERMISSION	-1008	
E_SEMANTIC_ERROR	-1009	
E_TOO_MANY_CONNECTIONS	-1010	

E_PARTIAL_SUCCEEDED	-1011	
E_NO_HOSTS	-2001	
E_EXISTED	-2002	
E_INVALID_HOST	-2003	
E_UNSUPPORTED	-2004	
E_NOT_DROP	-2005	
E_CONFIG_IMMUTABLE	-2007	
E_CONFLICT	-2008	meta
E_INVALID_PARM	-2009	
E_WRONGCLUSTER	-2010	
E_ZONE_NOT_ENOUGH	-2011	listener
E_ZONE_IS_EMPTY	-2012	
E_SCHEMA_NAME_EXISTS	-2013	Schema
E RELATED INDEX EXISTS	-2014	Tag Edge Type
E RELATED SPACE EXISTS	-2015	
E_STORE_FAILURE	-2021	
E_STORE_SEGMENT_ILLEGAL	-2022	
E_BAD_BALANCE_PLAN	-2023	
E_BALANCED	-2024	
E_NO_RUNNING_BALANCE_PLAN	-2025	
E_NO_VALID_HOST	-2026	
E_CORRUPTED_BALANCE_PLAN	-2027	
E_IMPROPER_ROLE	-2030	
E_INVALID_PARTITION_NUM	-2031	
E_INVALID_REPLICA_FACTOR	-2032	
E_INVALID_CHARSET	-2033	
E_INVALID_COLLATE	-2034	
E_CHARSET_COLLATE_NOT_MATCH	-2035	
E_SNAPSHOT_FAILURE	-2040	
E_BLOCK_WRITE_FAILURE	-2041	
E_ADD_JOB_FAILURE	-2044	
E_STOP_JOB_FAILURE	-2045	
E_SAVE_JOB_FAILURE	-2046	
E_BALANCER_FAILURE	-2047	
E_JOB_NOT_FINISHED	-2048	

E_TASK_REPORT_OUT_DATE	-2049	
E_JOB_NOT_IN_SPACE	-2050	
E_JOB_NEED_RECOVER	-2051	
E_JOB_ALREADY_FINISH	-2052	
E_JOB_SUBMITTED	-2053	
E_JOB_NOT_STOPPABLE	-2054	
E_JOB_HAS_NO_TARGET_STORAGE	-2055	leader
E_INVALID_JOB	-2065	
E_BACKUP_BUILDING_INDEX	-2066	
E_BACKUP_SPACE_NOT_FOUND	-2067	
E_RESTORE_FAILURE	-2068	
E_SESSION_NOT_FOUND	-2069	
E_LIST_CLUSTER_FAILURE	-2070	
E_LIST_CLUSTER_GET_ABS_PATH_FAILURE	-2071	
E_LIST_CLUSTER_NO_AGENT_FAILURE	-2072	agent
E_QUERY_NOT_FOUND	-2073	query
E_AGENT_HB_FAILURE	-2074	agent
E_CONSENSUS_ERROR	-3001	
E_KEY_HAS_EXISTS	-3002	key
E_DATA_TYPE_MISMATCH	-3003	
E_INVALID_FIELD_VALUE	-3004	
E_INVALID_OPERATION	-3005	
E_NOT_NULLABLE	-3006	
E_FIELD_UNSET	-3007	
E_OUT_OF_RANGE	-3008	
E_DATA_CONFLICT_ERROR	-3010	
E_WRITE_STALLED	-3011	
E_IMPROPER_DATA_TYPE	-3021	
E_INVALID_SPACEVIDLEN	-3022	VID
E_INVALID_FILTER	-3031	
E_INVALID_UPDATER	-3032	
E_INVALID_STORE	-3033	KV
E_INVALID_PEER	-3034	peer
E_RETRY_EXHAUSTED	-3035	
E_TRANSFER_LEADER_FAILED	-3036	leader

E_INVALID_STAT_TYPE	-3037		
E_INVALID_VID	-3038	VID	
E_LOAD_META_FAILED	-3040		
E_FAILED_TO_CHECKPOINT	-3041	checkpoint	
E_CHECKPOINT_BLOCKED	-3042	checkpoint	
E_FILTER_OUT	-3043		
E_INVALID_DATA	-3044		
E_MUTATE_EDGE_CONFLICT	-3045		
E_MUTATE_TAG_CONFLICT	-3046		
E_OUTDATED_LOCK	-3047		
E_INVALID_TASK_PARA	-3051		
E_USER_CANCEL	-3052		
E_TASK_EXECUTION_FAILED	-3053		
E_PLAN_IS_KILLED	-3060		
E_NO_TERM	-3070		
E_OUTDATED_TERM	-3071	leader	leader
E_WRITE_WRITE_CONFLICT	-3073		
E_RAFT_UNKNOWN_PART	-3500		
E_RAFT_LOG_GAP	-3501	raft	
E_RAFT_LOG_STALE	-3502	raft	
E_RAFT_TERM_OUT_OF_DATE	-3503		
E_RAFT_UNKNOWN_APPEND_LOG	-3504		
E_RAFT_WAITING_SNAPSHOT	-3511		
E_RAFT_SENDING_SNAPSHOT	-3512		
E_RAFT_INVALID_PEER	-3513		
E_RAFT_NOT_READY	-3514	Raft	
E_RAFT_STOPPED	-3515	Raft	
E_RAFT_BAD_ROLE	-3516		
E_RAFT_WAL_FAIL	-3521	WAL	
E_RAFT_HOST_STOPPED	-3522		
E_RAFT_TOO_MANY_REQUESTS	-3523		
E_RAFT_PERSIST_SNAPSHOT_FAILED	-3524		
E_RAFT_RPC_EXCEPTION	-3525	RPC	
E_RAFT_NO_WAL_FOUND	-3526	WAL	
E_RAFT_HOST_PAUSED	-3527		

E_RAFT_WRITE_BLOCKED	-3528	
E_RAFT_BUFFER_OVERFLOW	-3529	
E_RAFT_ATOMIC_OP_FAILED	-3530	
E_LEADERLEASE FAILED	-3531	leader
E_RAFT_CAUGHT_UP	-3532	Raft

:January 13, 2023



<https://docs.nebula-graph.com.cn/3.3.0>