



NebulaGraph

Nebula Graph Database

v3.0.1

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1. Nebula Graph 3.0.1



: April 6, 2022

2.

2.1

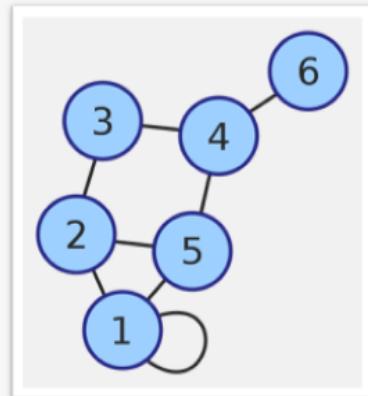
Amazon Facebook

2.1.1

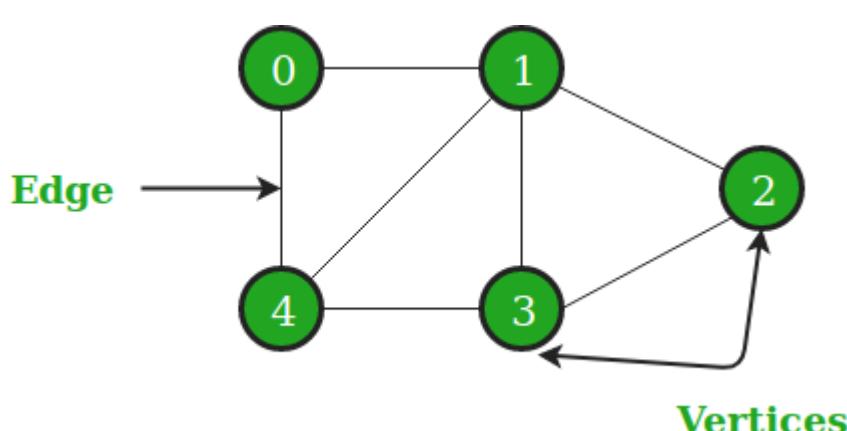
Nebula Graph GitHub

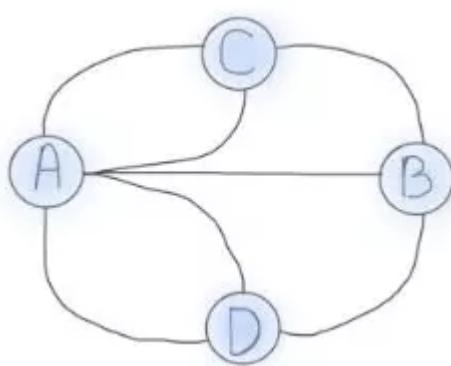
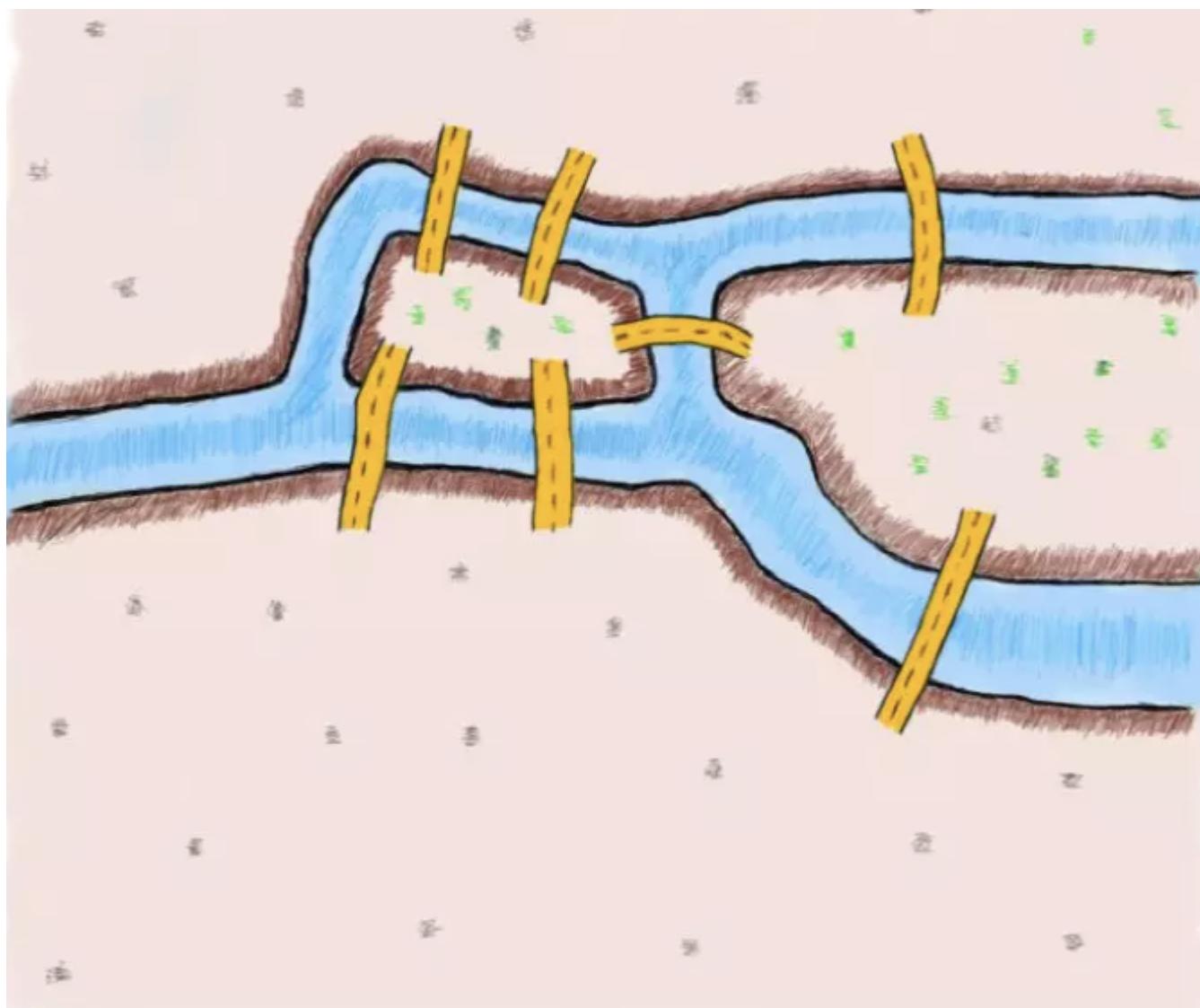


Graph: Image, Visual



Graph: Network, Connection, Linked Data

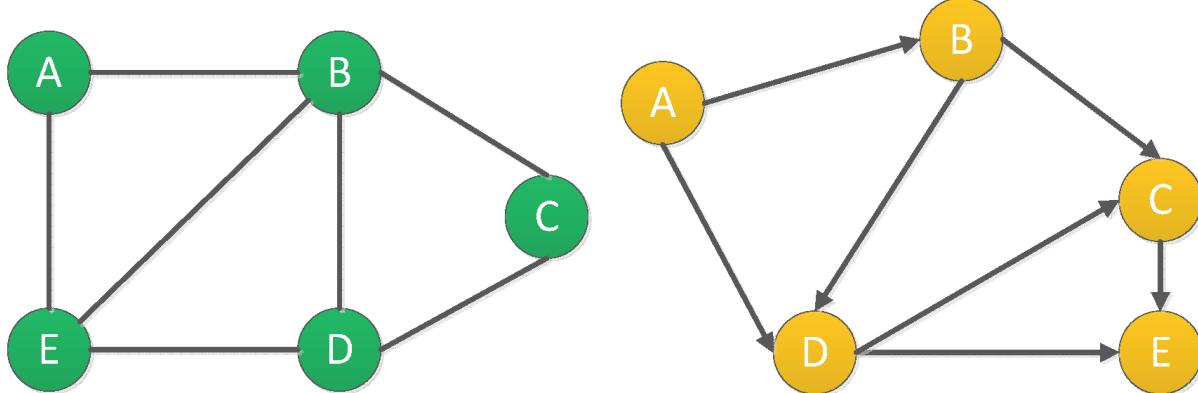




2.1.2

Vertex

Edge

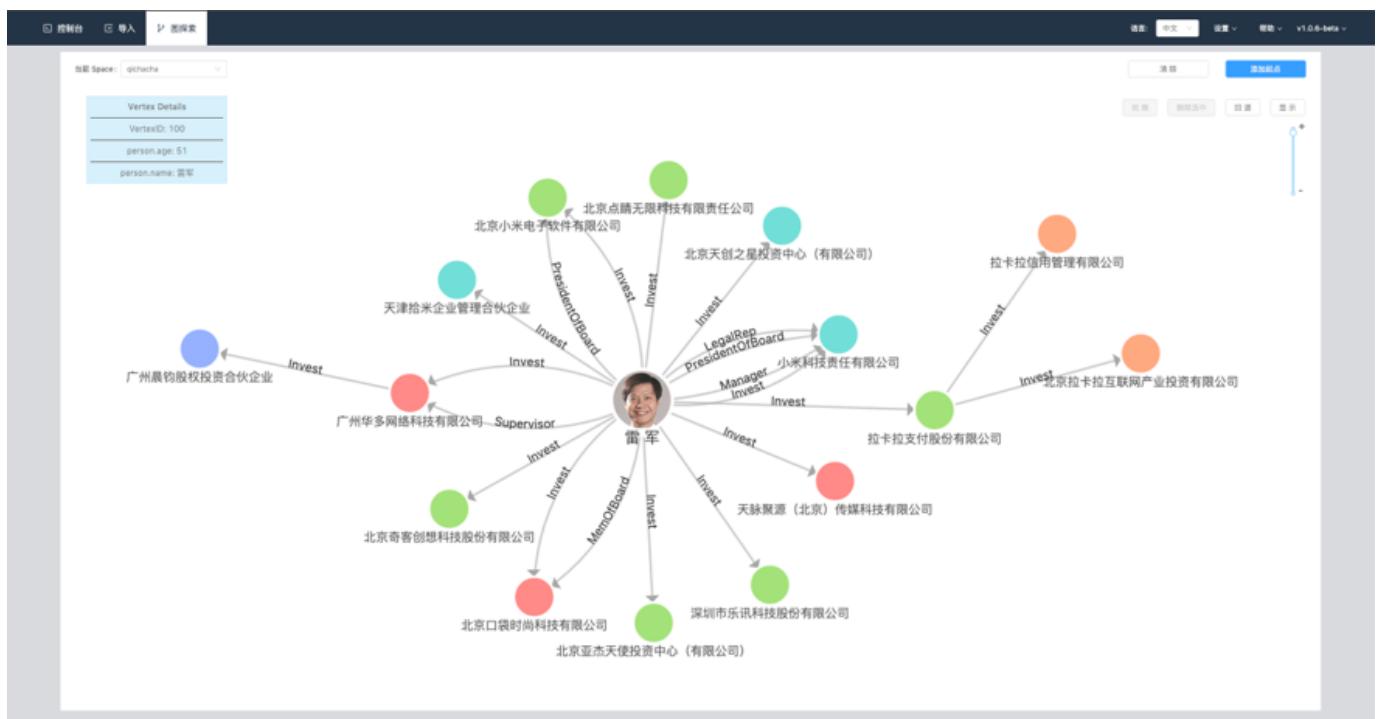


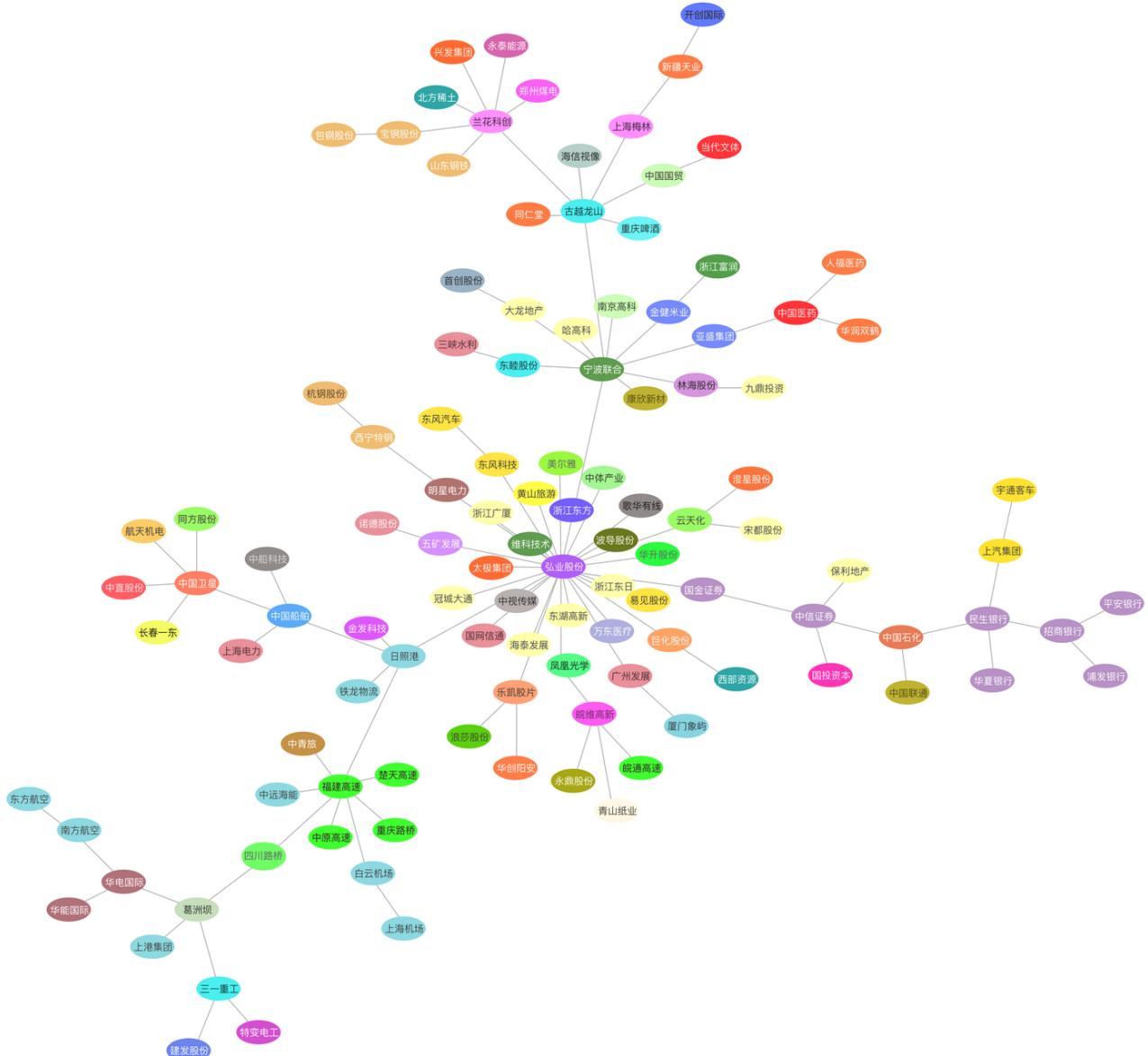
A.无向图

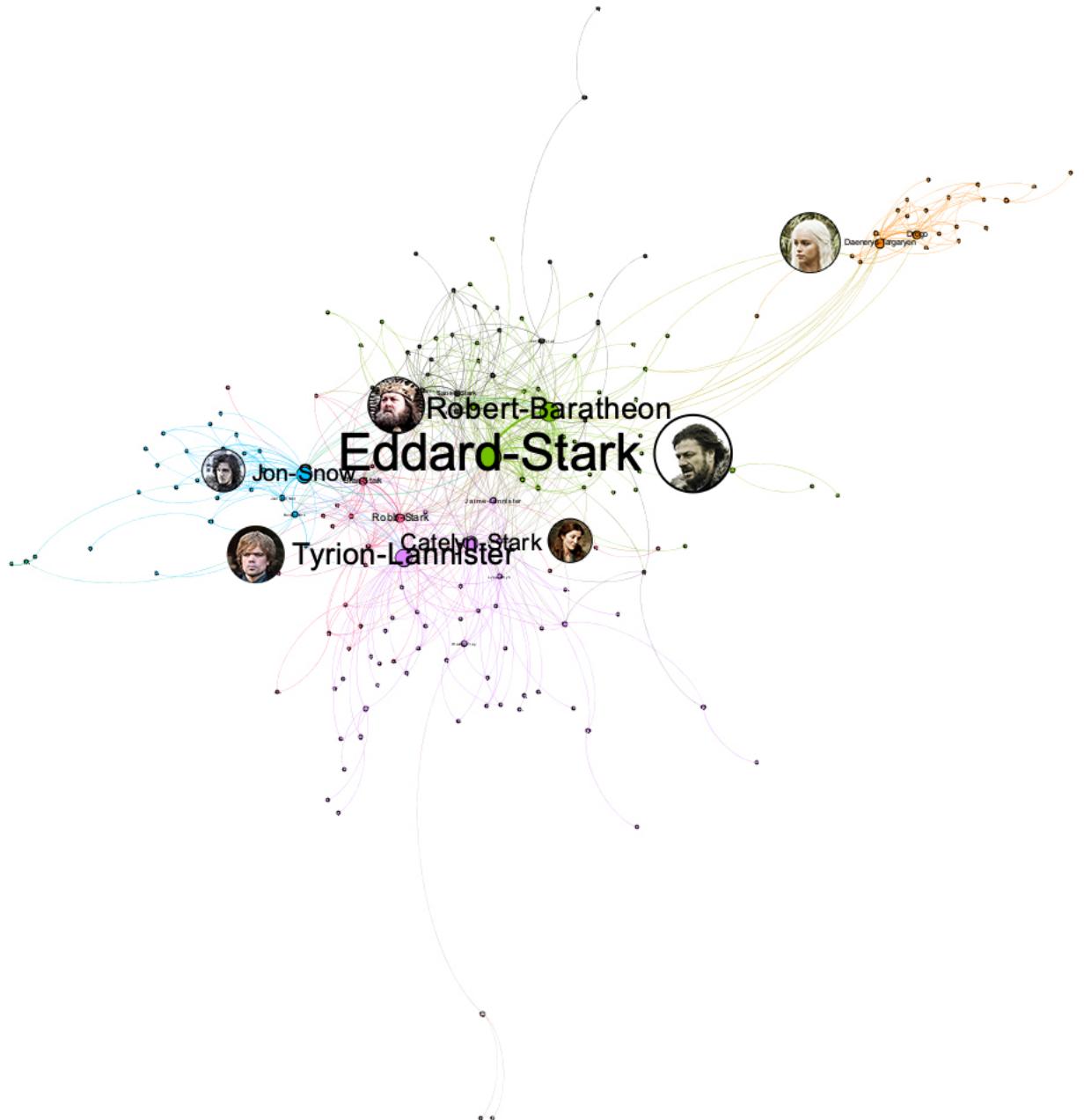
B.有向图

properties

BOSS







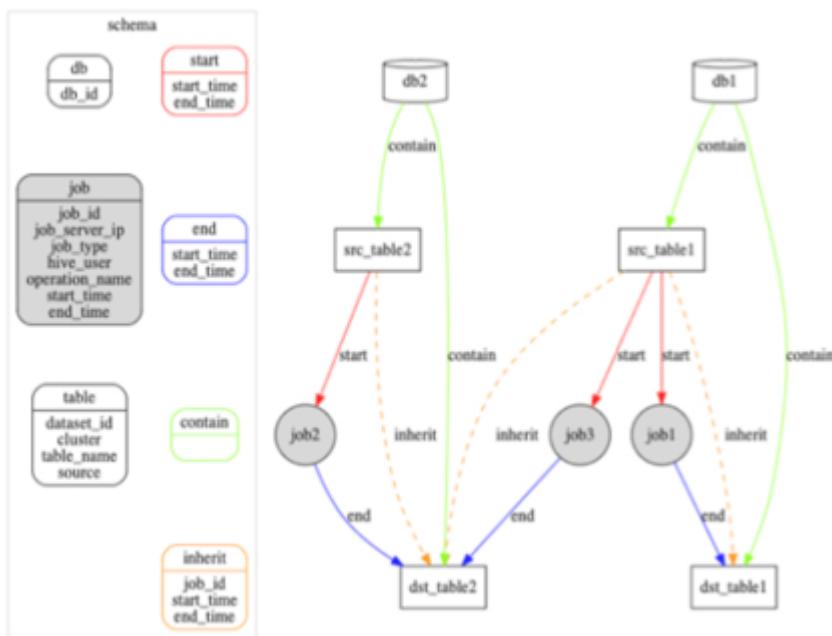
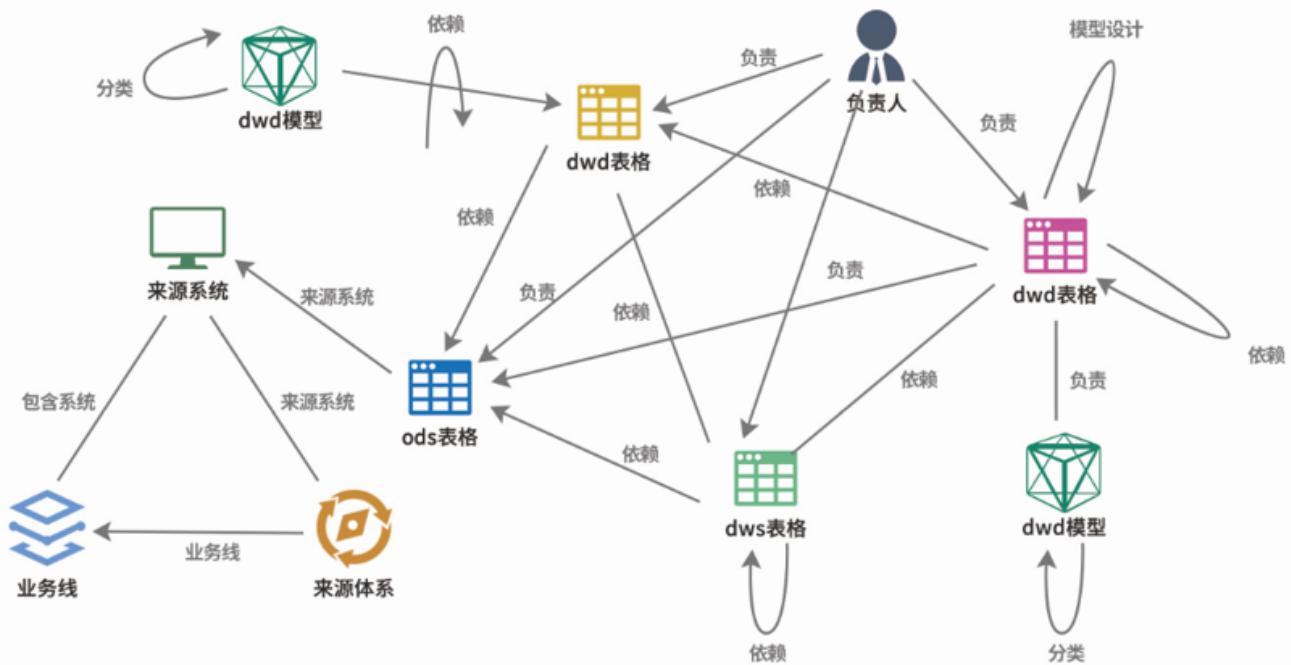
IT

Hive

Job

ETL⁵

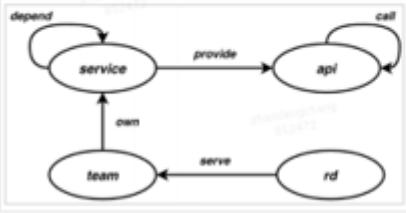
ETL



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
```



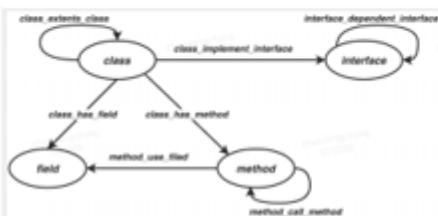
```
//查找所有java类型服务提供的API，并统计其会影响的上游API的数量，从高到低排序看影响次数大小（调用的可用率小于4个9）
LOOKUP ON service WHERE service.type=="java"
| GO FROM $-.VertexID OVER provider YIELD
provider._dst AS java_api_id
| GO FROM $-.java_api_id OVER call REVERSELY WHERE
call.availability>0 AND call.availability<1000000
YIELD call_src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

6

代码依赖分析

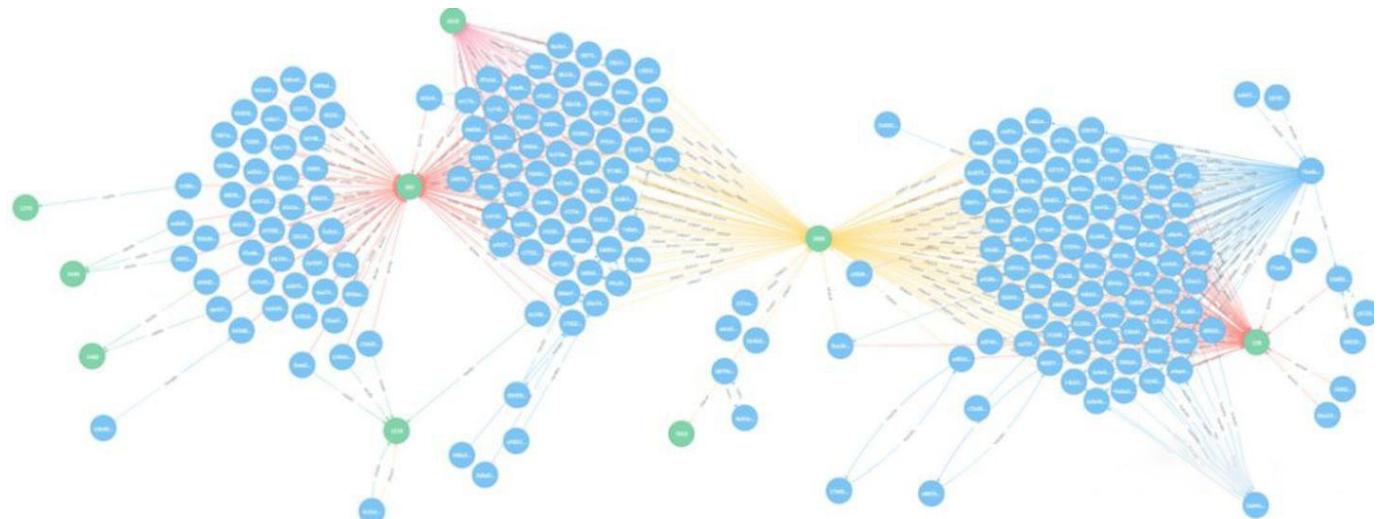
- 图谱数据
 - 将公司代码库中代码的依赖关系写入图谱
 - 包含method, field, class, interface等4类顶点，7类关系
 - 点边数量在千万级别，实时写入
 - 用于QA精准测试
 - PR向代码仓库提交PR后，能查询出所修改代码能影响到的外部接口，并展示调用路径

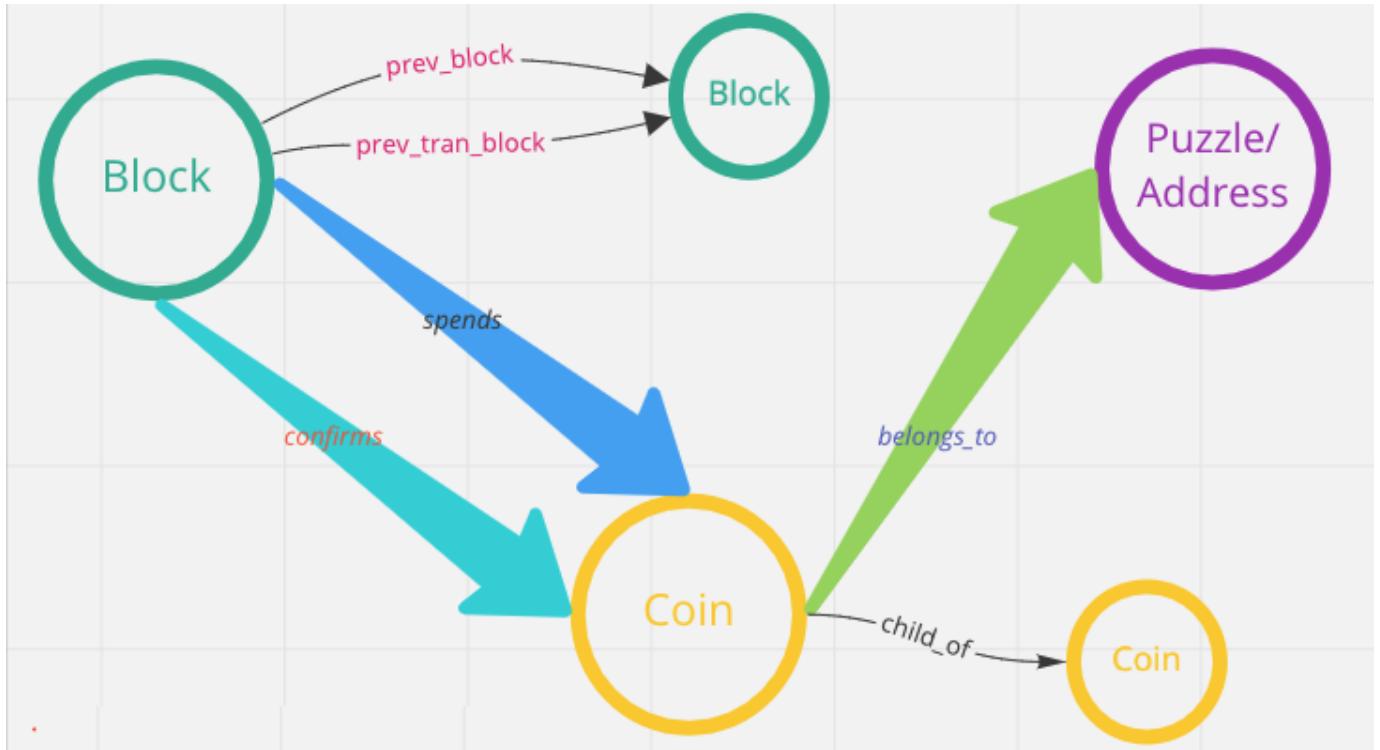
```
//查找最外层method到某个method的所有无环路径
(GO 1 to 30 STEPS FROM 2946345526231222882 OVER
method_call_method REVERSELY YIELD DISTINCT
method_call_method._dst AS id
MINUS
GO 1 to 30 STEPS FROM 2946345526231222882 OVER
method_call_method REVERSELY YIELD DISTINCT
method_call_method._src AS id )
| FIND NOLOOP path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

7

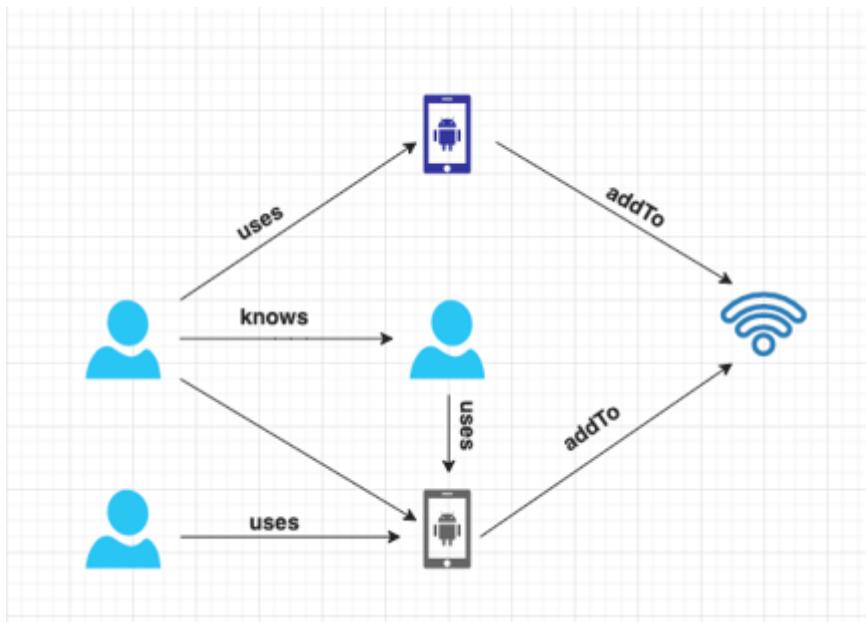




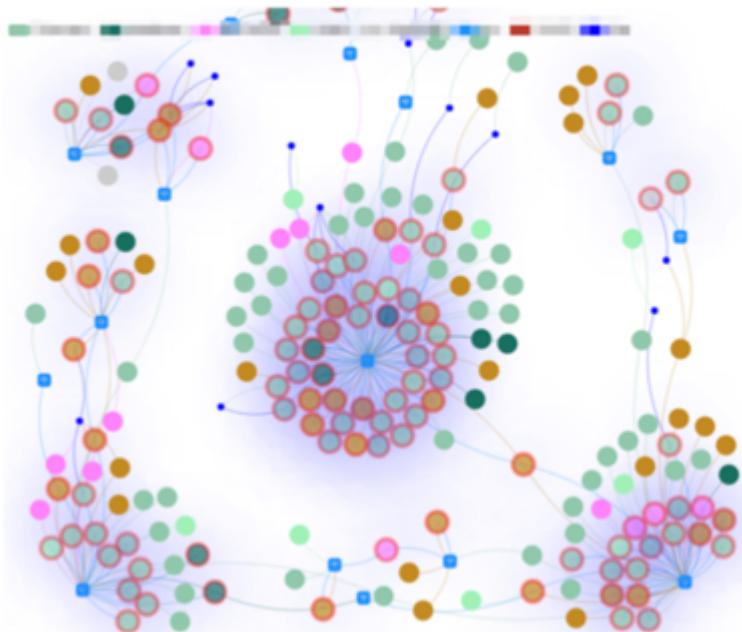
8

WIFI

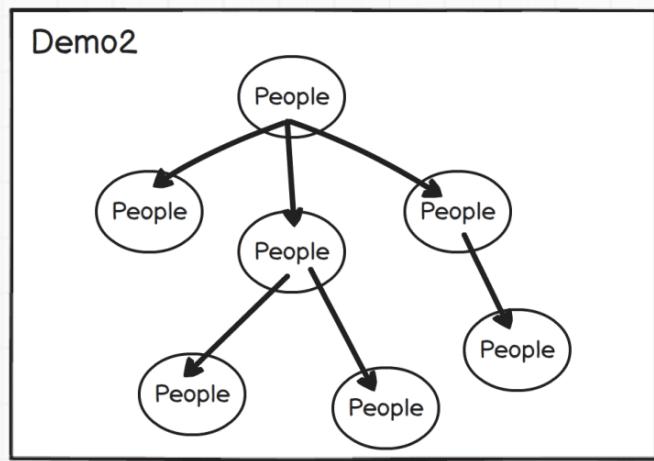
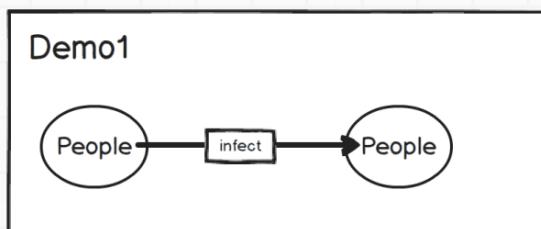
WIFI



360 8 9 10 11



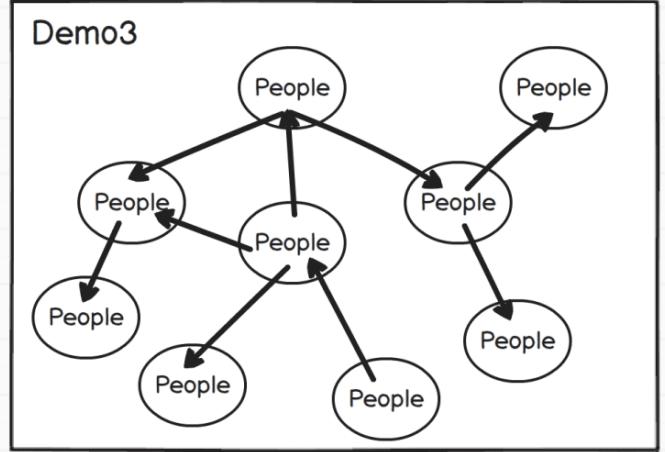
12



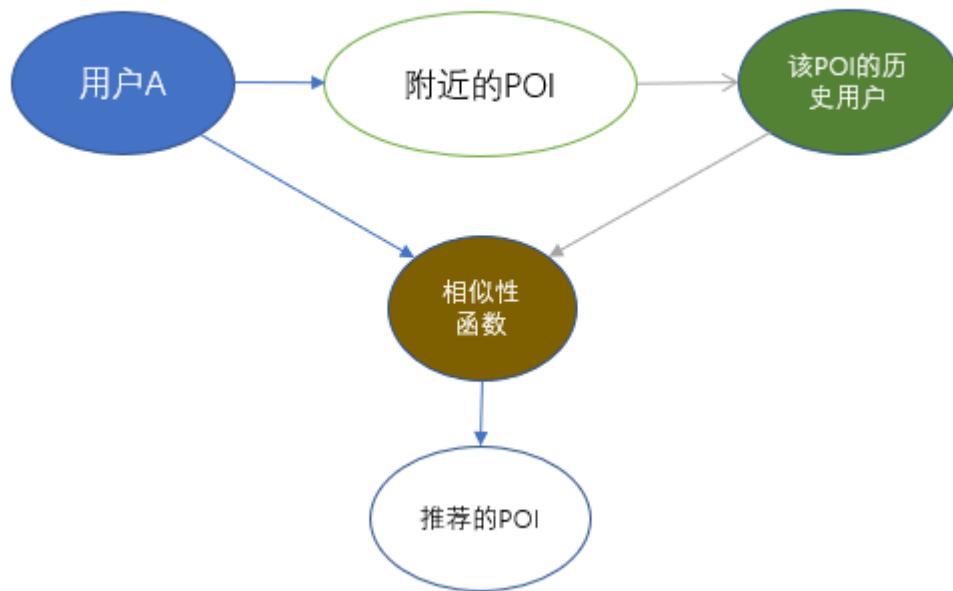
O2O

POI Point-of-Interest

13



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、得尚黑牛鱼(新荟城购物中心)、江记水煮鱼等。

Screenshot 2: 搜索结果 - 望京soho附近适合情侣约会的餐厅

- 目的地: 望京SOHO
- 望京SOHO: 望京 商务楼 1.4km
评分: 4.5/5, 2414条评价, ¥87
描述: “北京最适合情侣约会的地方”
- 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

- 目的地: 望京SOHO
- 望京SOHO: 望京 商务楼 1.4km
评分: 4.5/5, 2414条评价, ¥87
描述: “北京最适合情侣约会的地方”
- 附近餐厅: 香港汇、望京一号、七号八号·小酒小菜等。

vivo OPPO

2.1.3

XML/JSON

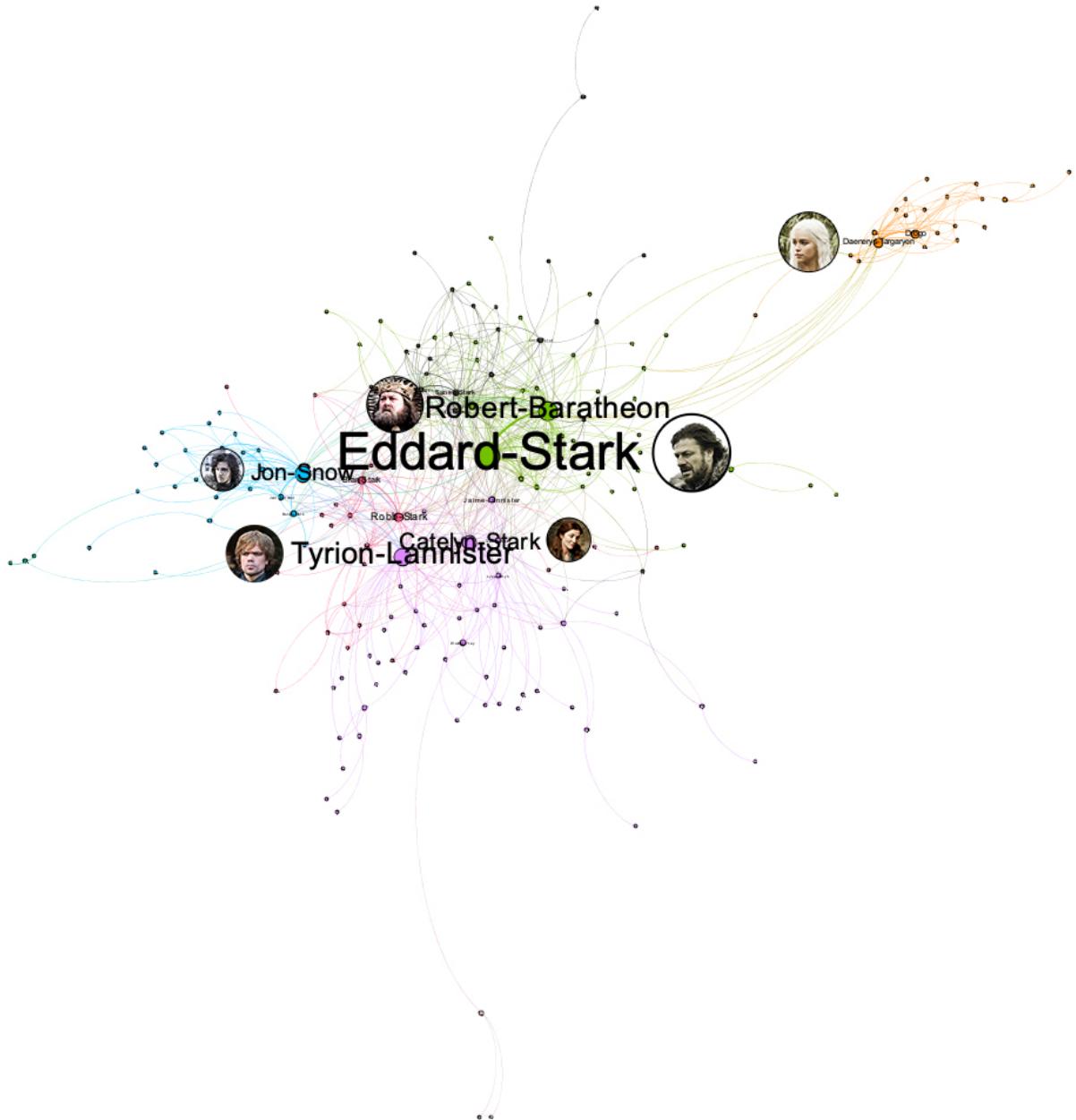
• “ ” “ ”

数据表格

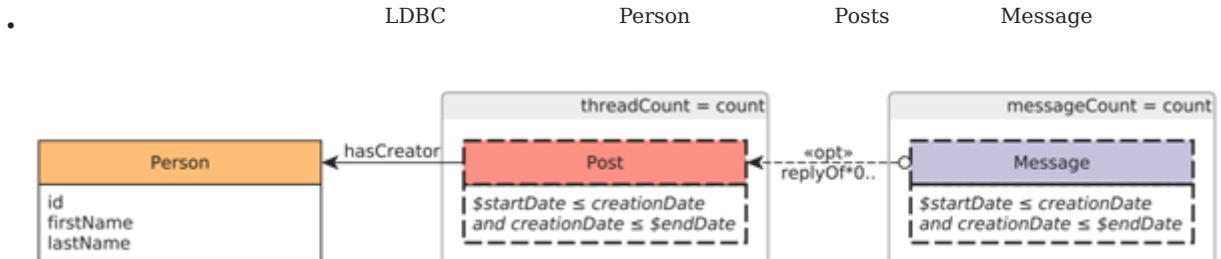
节点 边 配置 添加节点 添加边 搜索/替换 输入电子表格 输出表格 更多功能 过滤: Id

Id	Label	Interval	Modularity Class	betweenness	community
-4364237027732478972	Arya-Stark		4	0.017495	0
-4973959390558533367	Gendry		0	0.0	0
-7025436182975816947	Hallis-Mollen		5	0.0	0
8249703968876499989	Raymun-Darry		0	0.0	0
-9085767779232784107	Hobb		3	0.0	1
7505218728385384214	Randyll-Tarly		3	0.0	1
5114251854412197144	Viserys-Targaryen		7	0.002858	2
-2958304360028784612	Jonos-Bracken		2	0.0	3
-4359919586974142177	Lancel-Lannister		0	0.0	0
7195357273749773604	Robb-Stark		5	0.072984	0
1075531505424338989	Marq-Piper		4	0.006237	0
-3670573862518875597	Addam-Marbrand		2	0.0	0
3931316780000927284	Robert-Arryn		2	0.0	0
4826030504180653879	Irri		7	0.000096	2
7181995877190281794	Jommo		7	0.0	2
1787258805162148944	Eddard-Stark		0	0.269604	0
-558158798715221422	Danwell-Frey		1	0.021389	4
-2434779847791595692	Mordane		4	0.001056	0
8409318129262644314	Clydas		3	0.0	1
-1738391870688186527	Karyl-Vance		2	0.010753	5
6902668443292429674	Haggo		7	0.000068	2
95861621849685359	Mya-Stone		2	0.0	0
2025059960255100299	Porther		0	0.0	0
-1967336888960310122	Colemon		2	0.0	0
5894253429758865049	Ilyn-Payne		4	0.00032	0
-1356662602606843742	Pycelle		0	0.000321	0
382702656484230079	Gared		6	0.004328	1
1306559795724859089	Jorah-Mormont		7	0.012611	2
-96410199981447977	Cayn		0	0.000022	0
7160113306884551800	Chella		2	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	13
--	-----	------	-------	----

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

2.1.4 RDF

RDF

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

: February 25, 2022

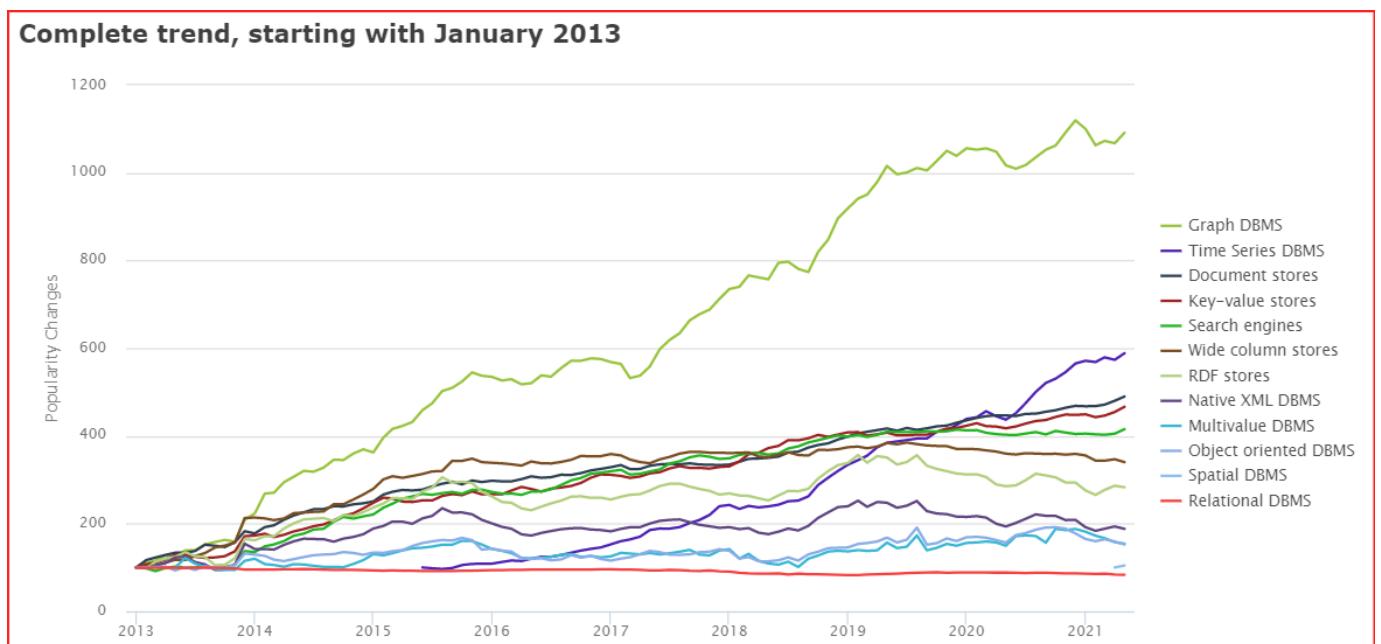
2.2

TTL UDF

2.2.1

DB-Engines

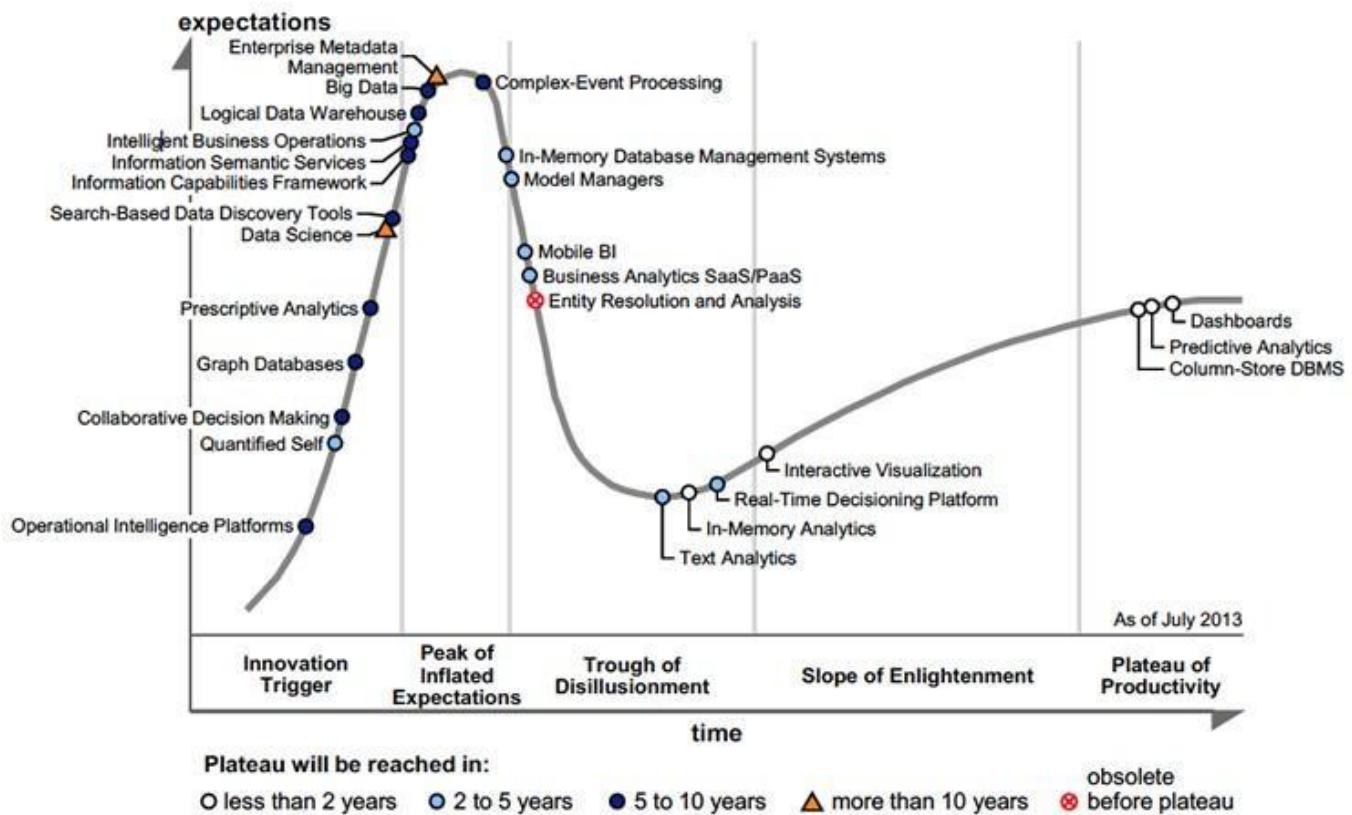
DB-Engines.com	2013	"	"	1		
Google		IT			371	12
						12



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

⑥:

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, ffnresearch⁵, marketsandmarkets⁶, gartner⁷
 (CAGR) 30-40 5-10%

2019 8 6 25%



Global Graph Database Market, 2019-2026

\$4.13

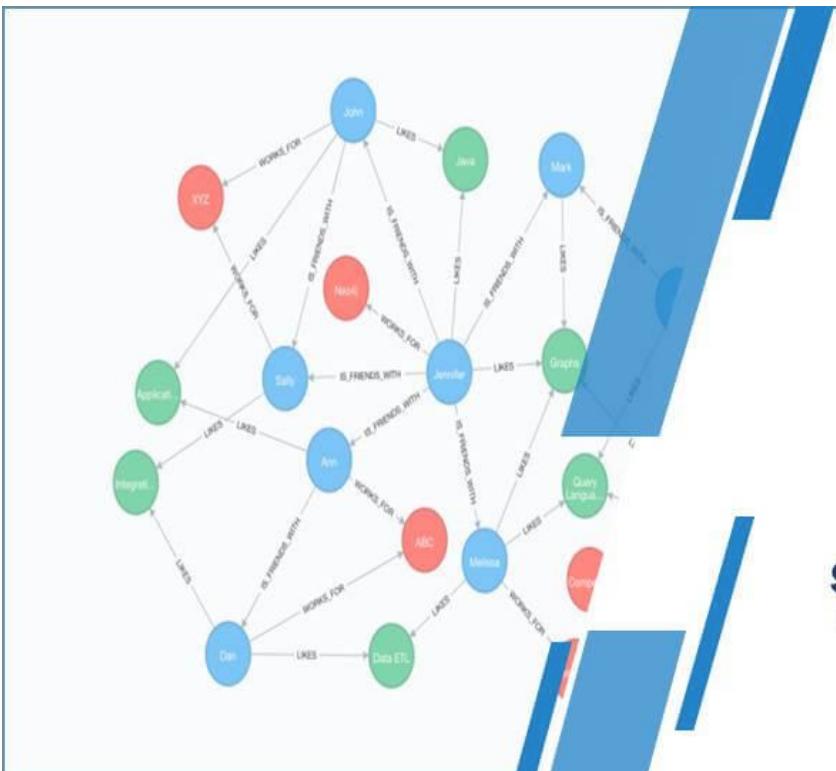
Billion by 2026

\$780.71

Million in 2018

2019 (E)

2026 (P)



2.2.2

Neo4j

1970

" "

CODASYL⁸)

G/G+⁹

" "

Neo4j ()

Neo4j
Languages^{10 9}

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	2011	Johan Svensson		Neo4j	Neo4j
structure	Neo4j 2.0	2013.12	key-value	Neo4j	search
" " " " "	" "	"	label	Neo4j	
		Neo4j		Cypher	Neo4j
2007 Neo4j		search structure			

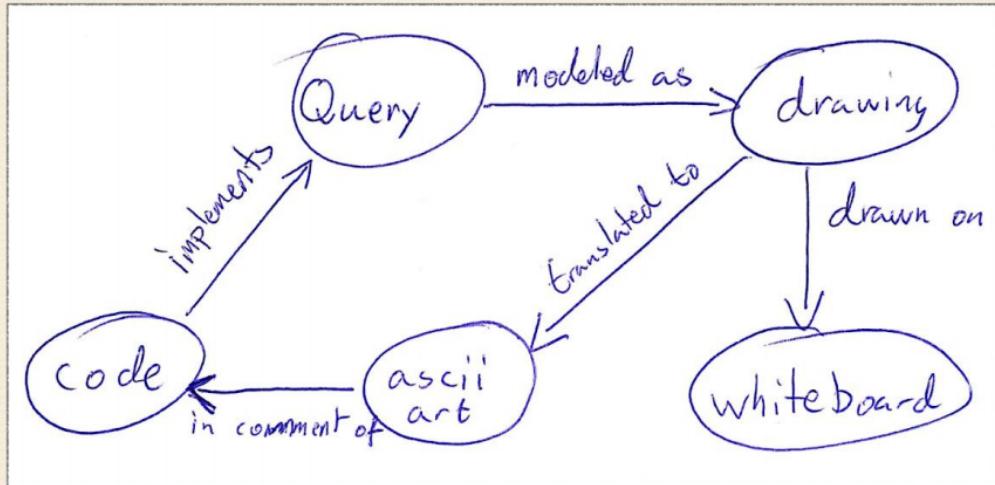
GREMLIN

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

CYPHER

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

The Origin of Cypher



The Origin of Cypher

(query) -- [MODELED_AS] --> (drawing)
 |
 [IMPLEMENTS]
 |
 |
 (code) <- [IN_COMMENT_OF] - (ascii art)

drawing
 |
 [TRANSLATED_TO]
 |
 v

```

MATCH (query)-[:MODELED_AS]->(drawing),
      (code)-[:IMPLEMENTES]->(query),
      (drawing)-[:TRANSLATED_TO]->(ascii_art)
      (ascii_art)-[:IN_COMMENT_OF]->(code)
WHERE query.id = {query_id}
RETURN code.source
  
```

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

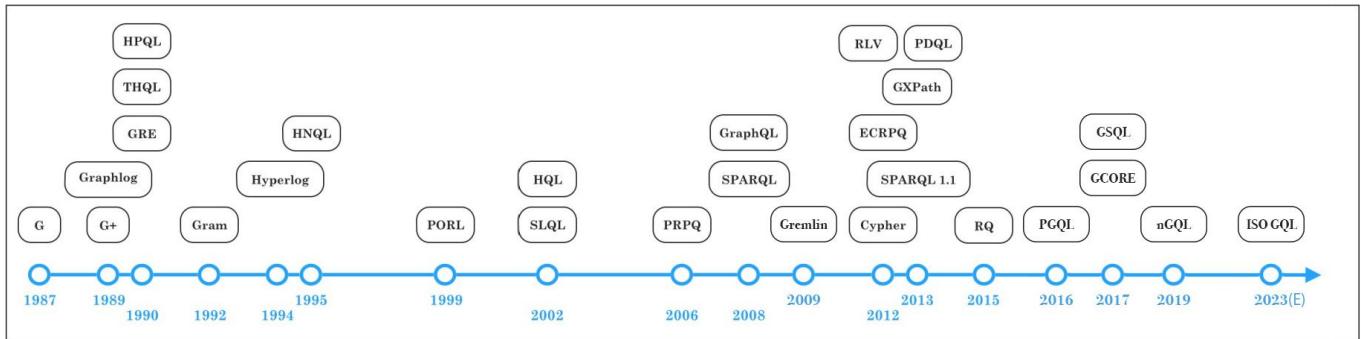
2015 Oracle PGX PGQL

2016 Linked Data Benchmarking Council, LDBC LDBC G-CORE

2018 Redis (library) RedisGraph Cypher

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

2019 Nebula Graph openCypher Nebula Graph Query Language, nGQL



2005-2010 Google " " Hadoop Cassandra

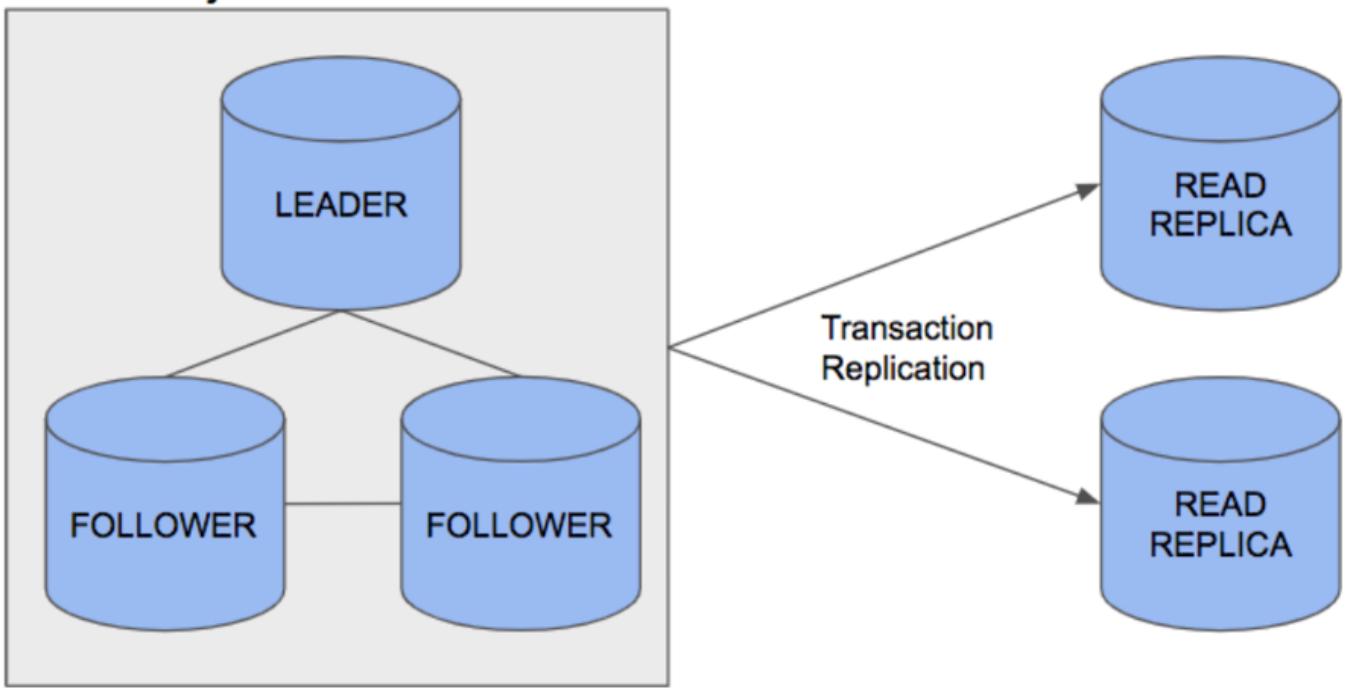
1. (Neo4j)

2.

Neo4j

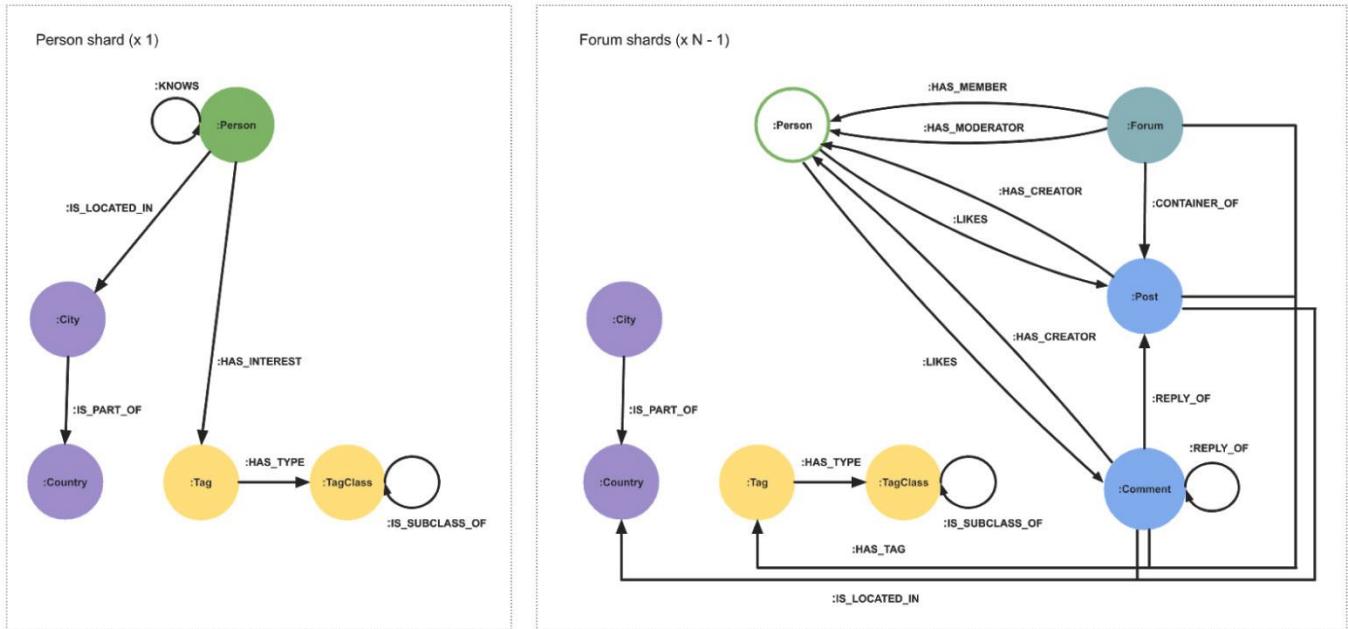
• Neo4j 3.X (Master-slave/slave)

Neo4j Causal Cluster

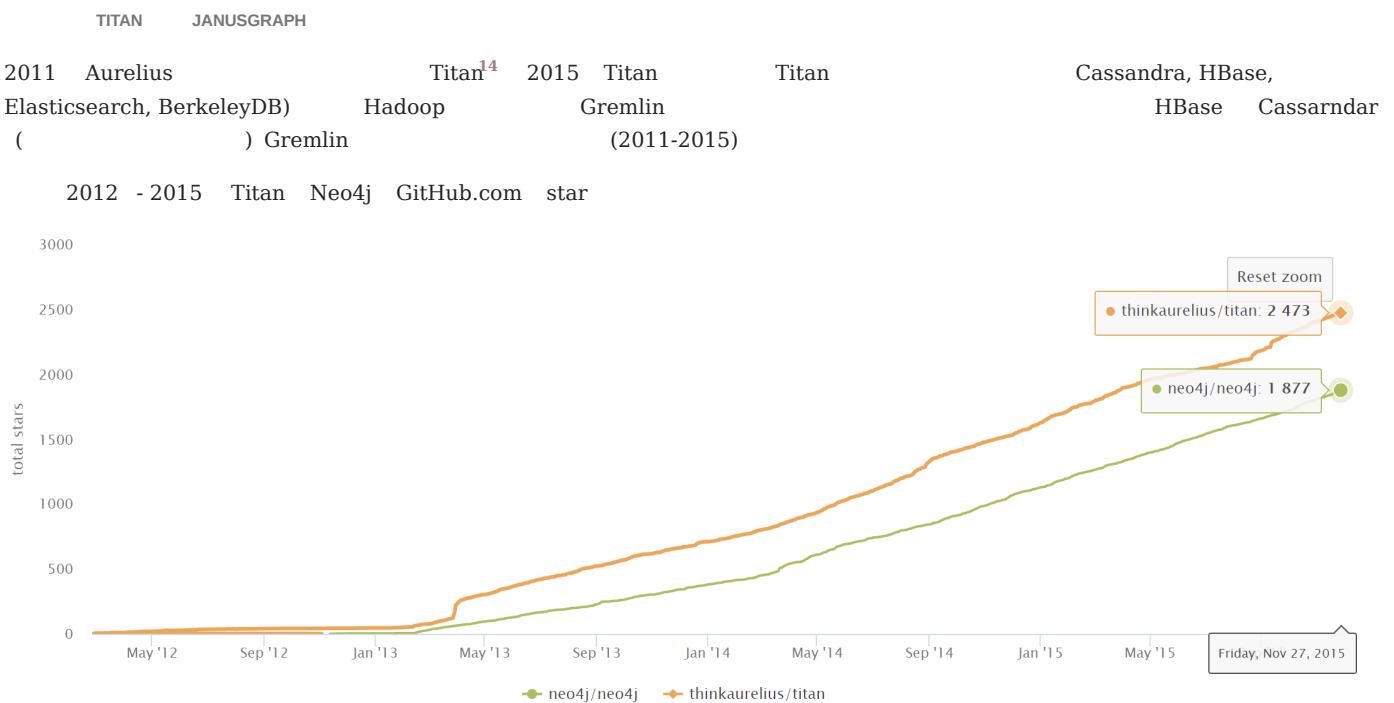
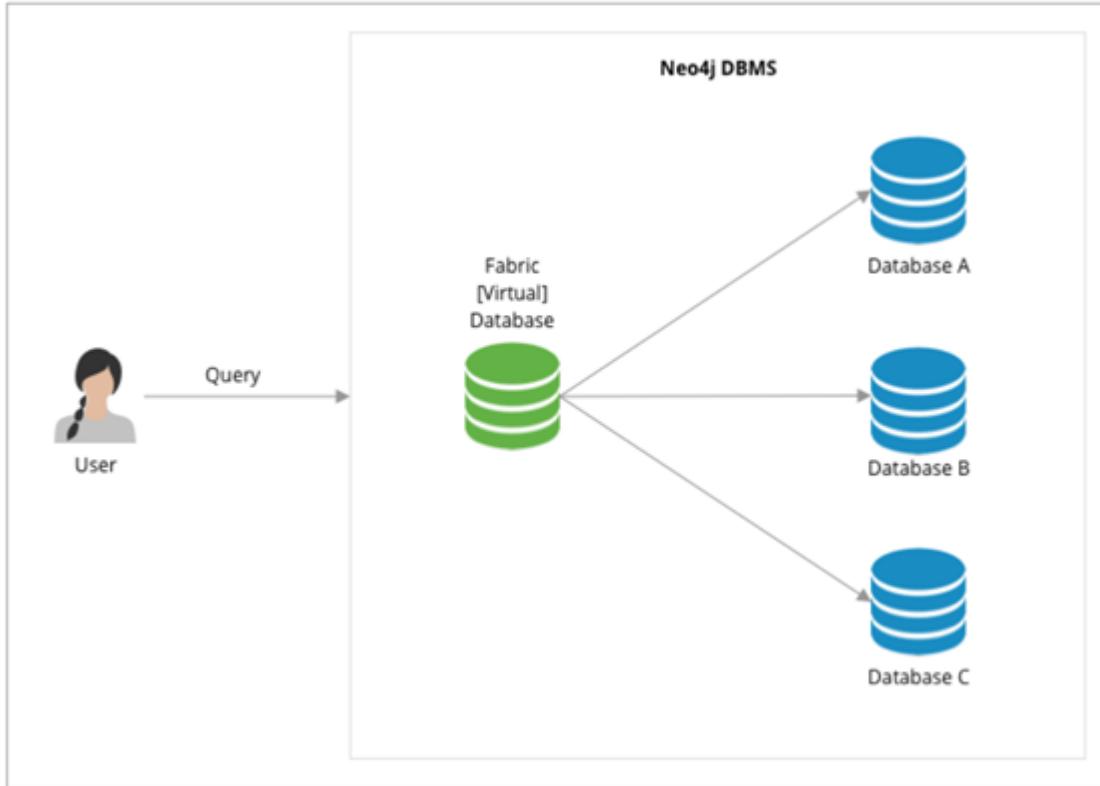


Cluster architecture

- 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)

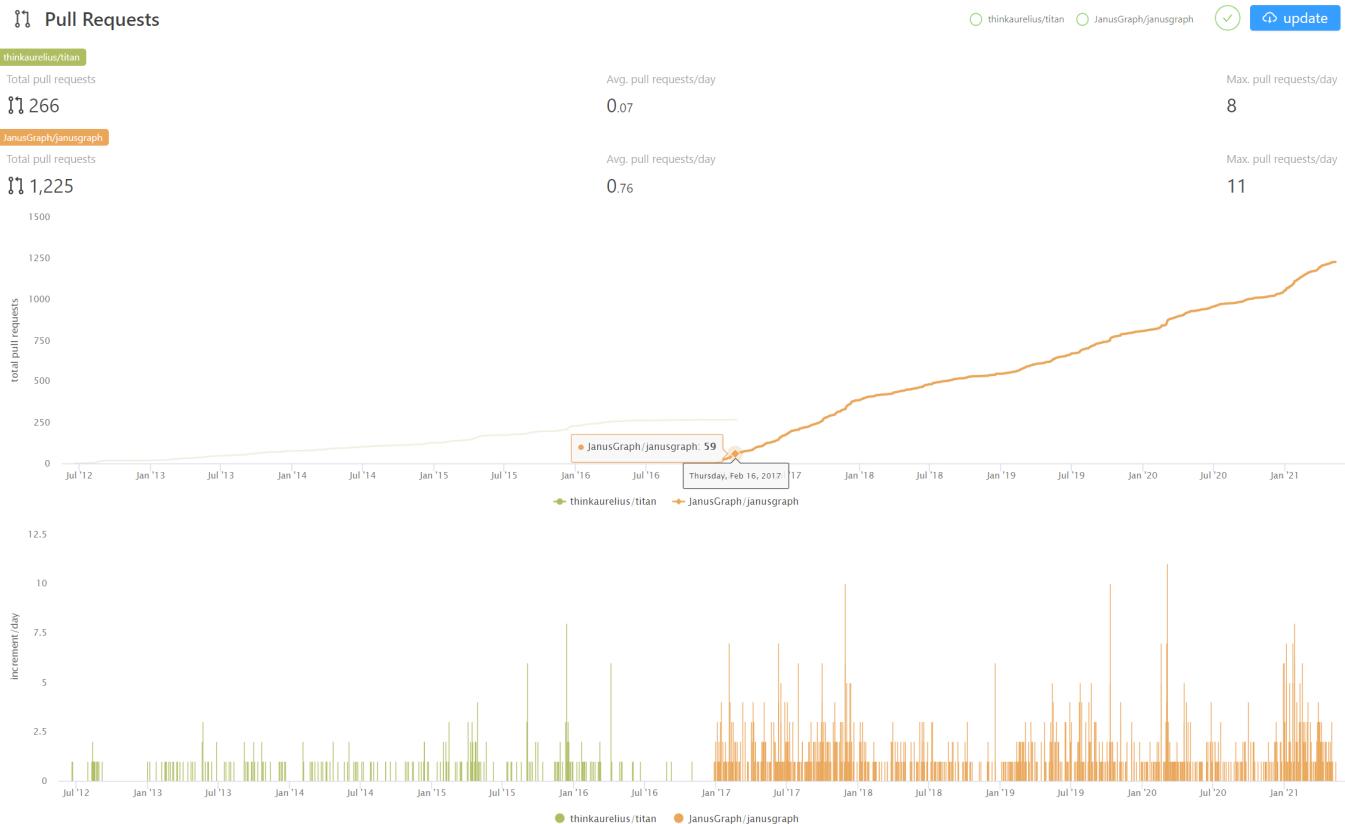
Aurelius(Titan)
Google, GRAKN.AI, Hortonworks, IBM and Amazon) 2017
JanusGraph

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 Oracle SQL key-value Amazon AWS Neptune¹⁷ AWS ,

NEBULA GRAPH

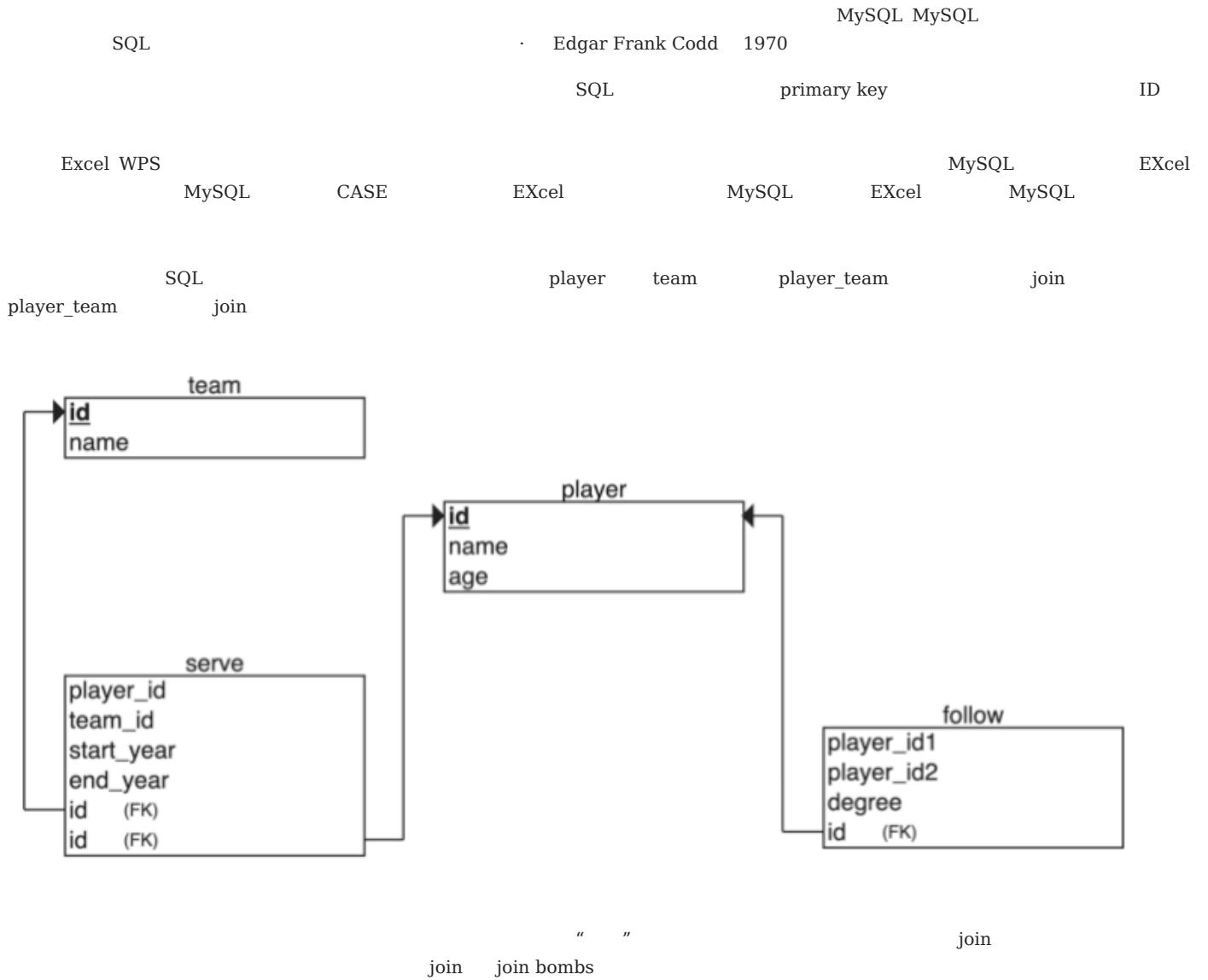
Nebula Graph

-
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/> ↵
-

: February 25, 2022

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

NoSQL NoSQL HBase Cassandra HadoopDB

NoSQL

XML JSON YAML
MongoDB CouchDB Terrastore

NoSQL Nebula Graph NoSQL NoSQL Nebula Graph Neo4j OrientDB

2.3.2

2020 ¹

Image

- ()
-
-
- ²

• K

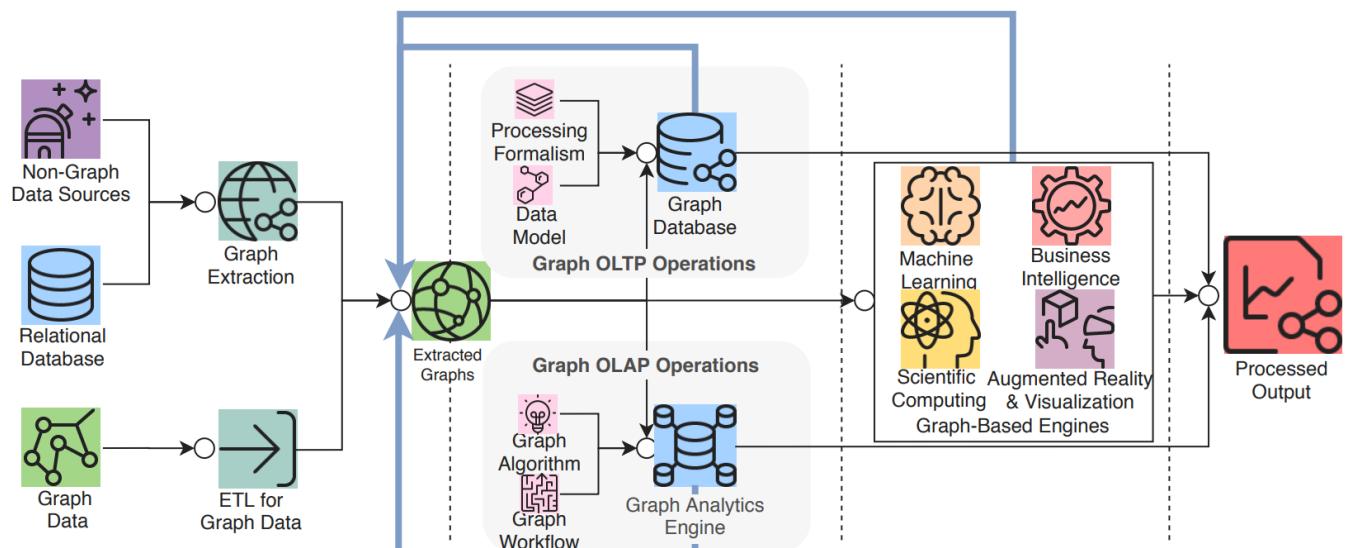
• (Pattern matching) / " (subgraph isomorphism)"—³

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

Local patterns

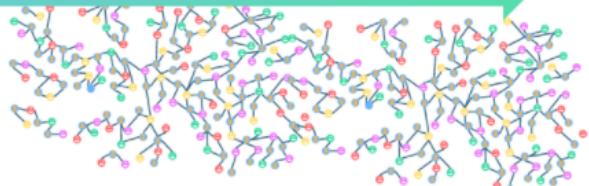


You know what you're looking
for and making a decision

Graph Algorithms libraries

Global analysis
and iterations

Global computation

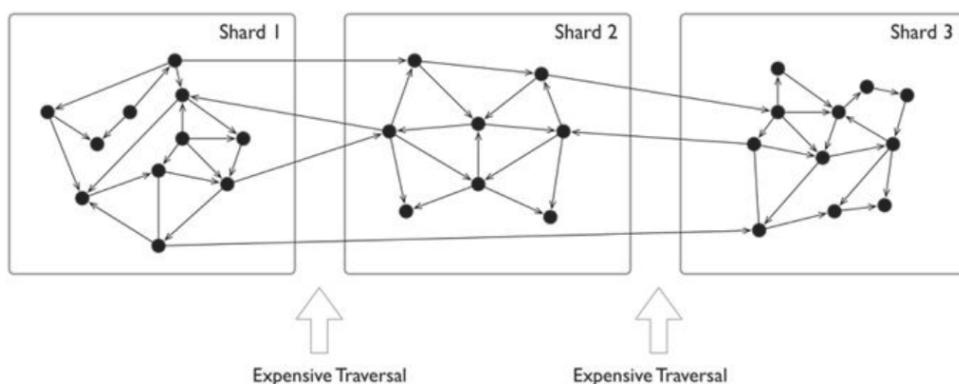


You're learning the overall structure of a
network, updating data, and predicting

6

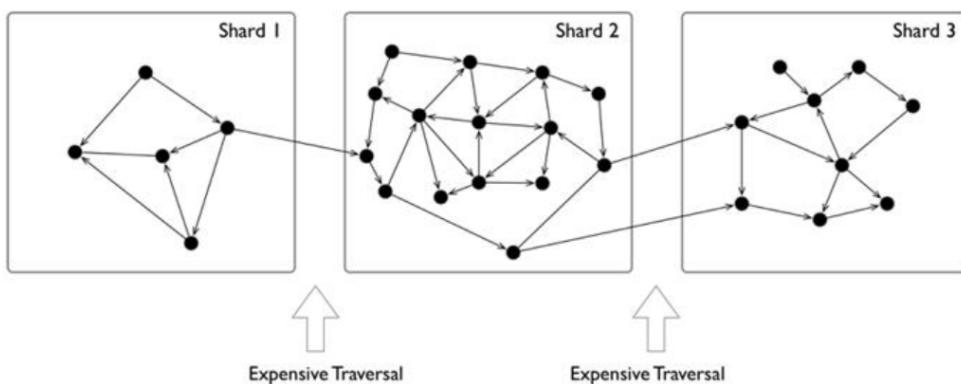
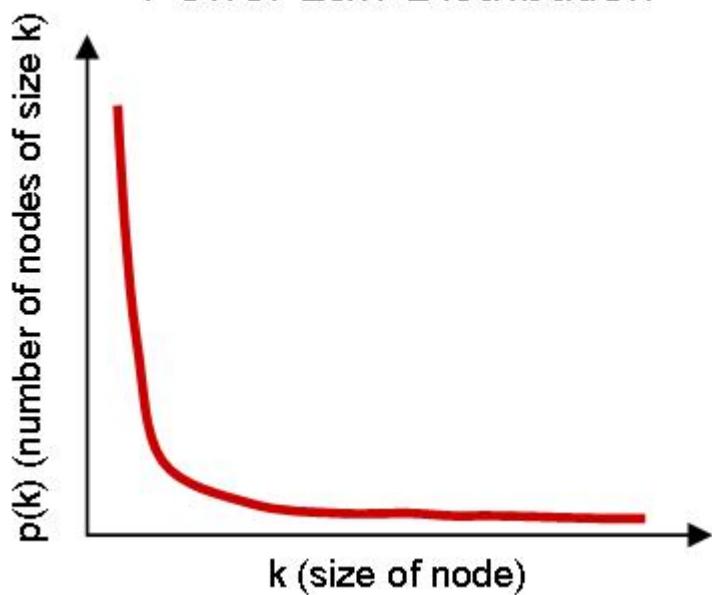
key	docID	(key-value, doc)	NoSQL	key-value
	" "	6	NP	10

()



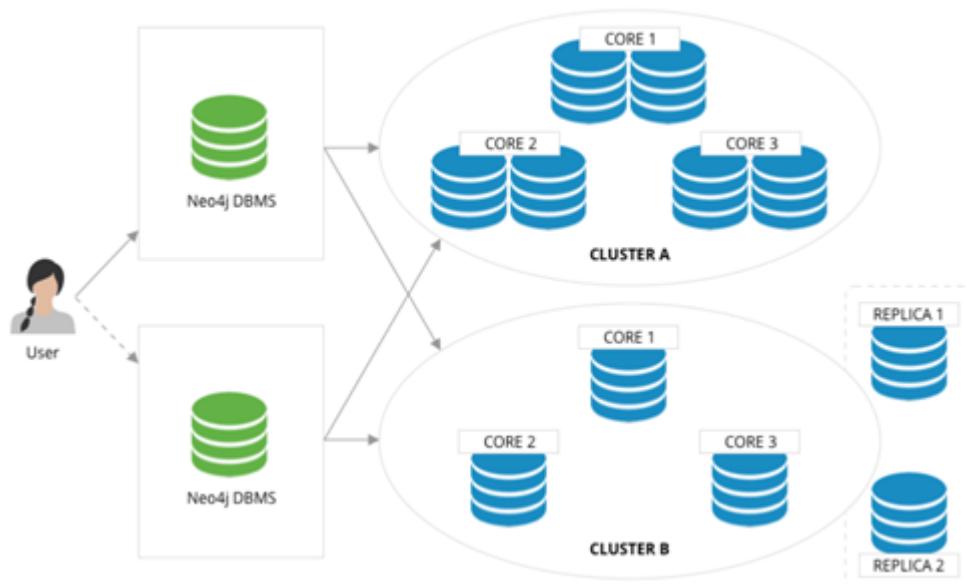
7

Power Law Distribution

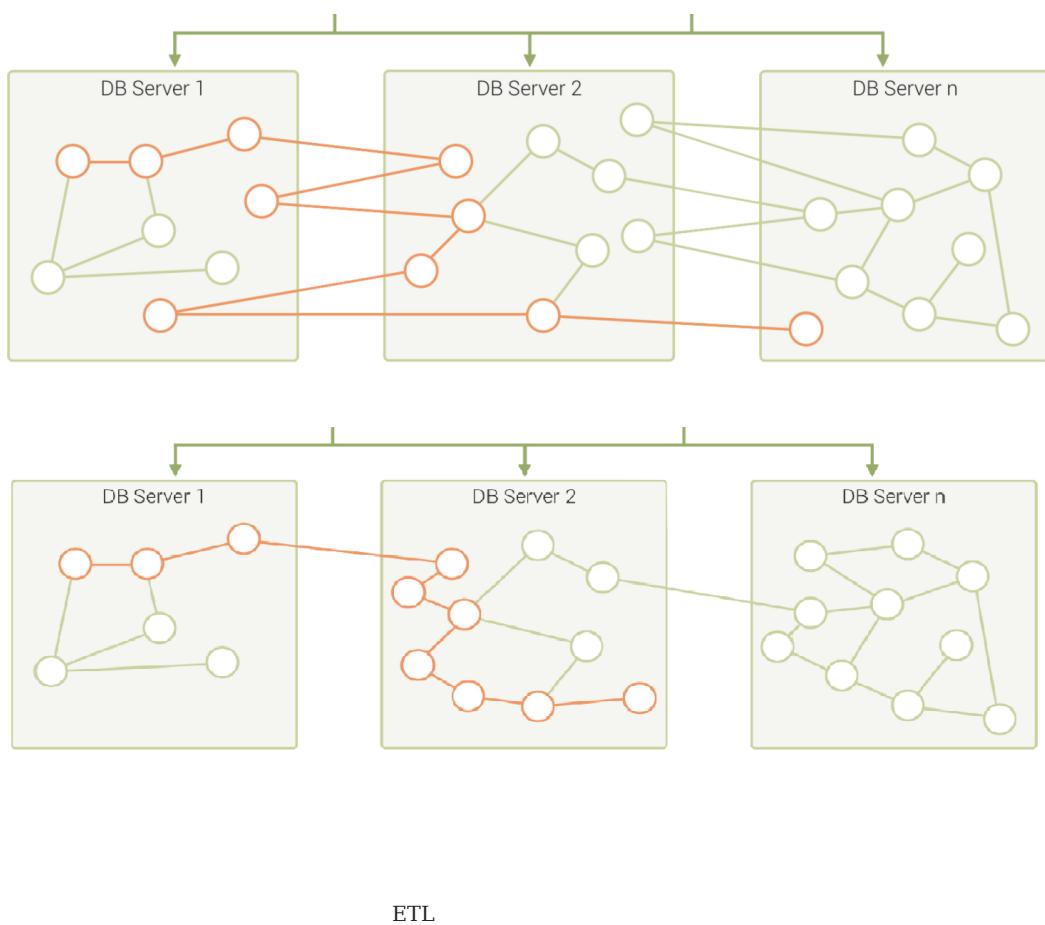


(Sharding)

Neo4j 4.x Fabric



-
- (View)
- Partition
- Sharding
- Partition
- 8



9

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

- JGraph¹⁰: Java (library)
- igraph¹¹: Library, R python C
- NetworkX¹²: python
- Cytoscape¹³:
- Gephi¹⁴:
- arrows.app¹⁵ Cypher .

Benchmark

LDBC

LDBC¹⁶ Linked Data Benchmark Council Oracle Intel Neo4j TigerGraph

SNB Social Network Benchmark
TPC-C, TPC-H SQL

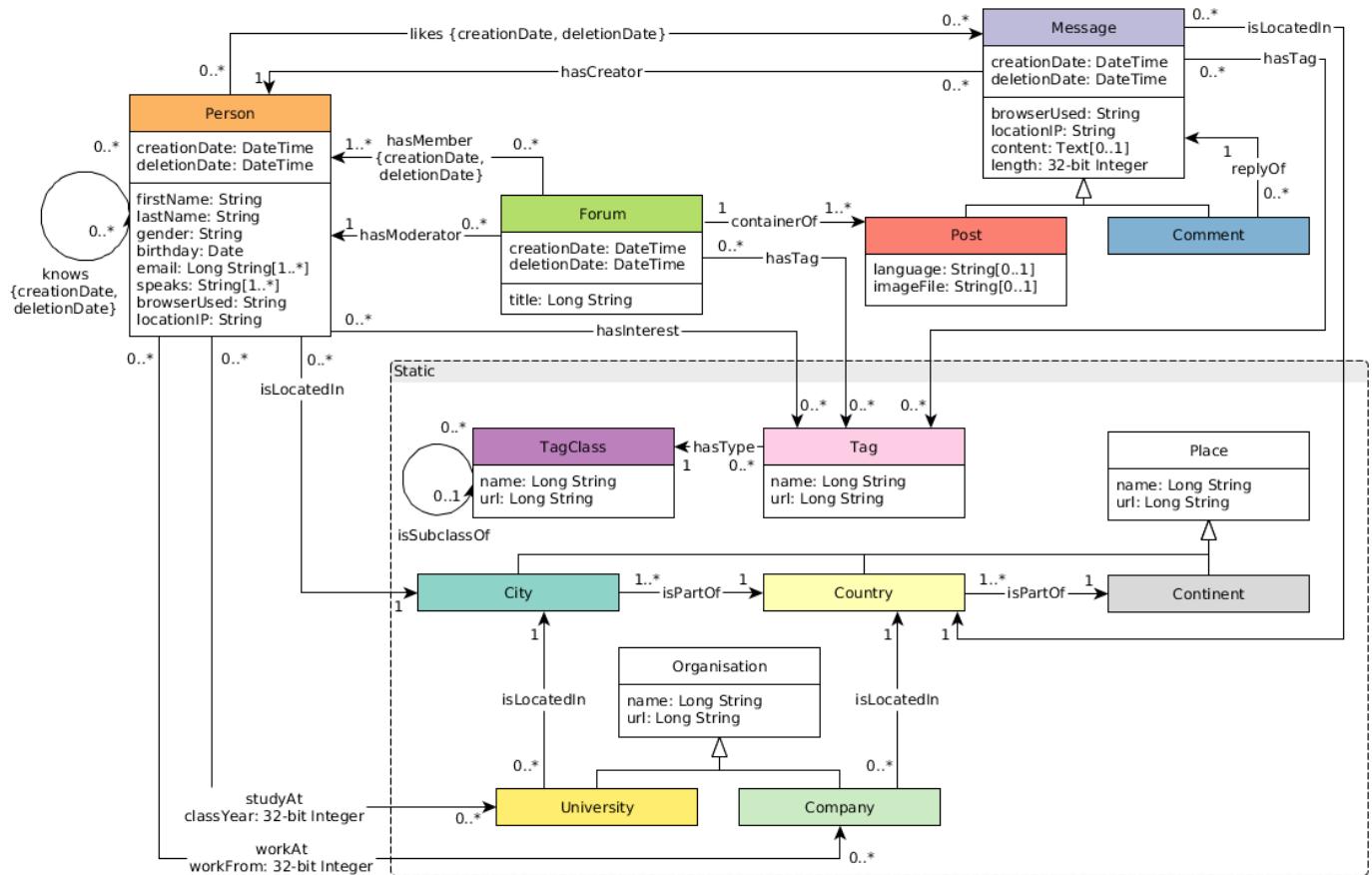
LDBC

Benchmark

Interactive

BI

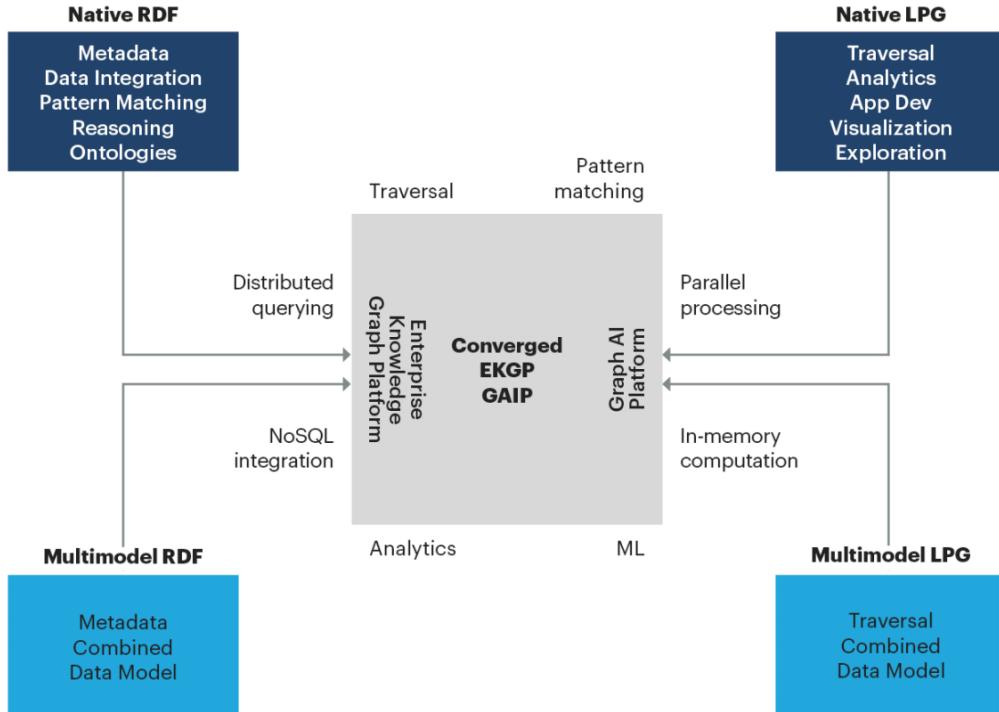
SNB



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

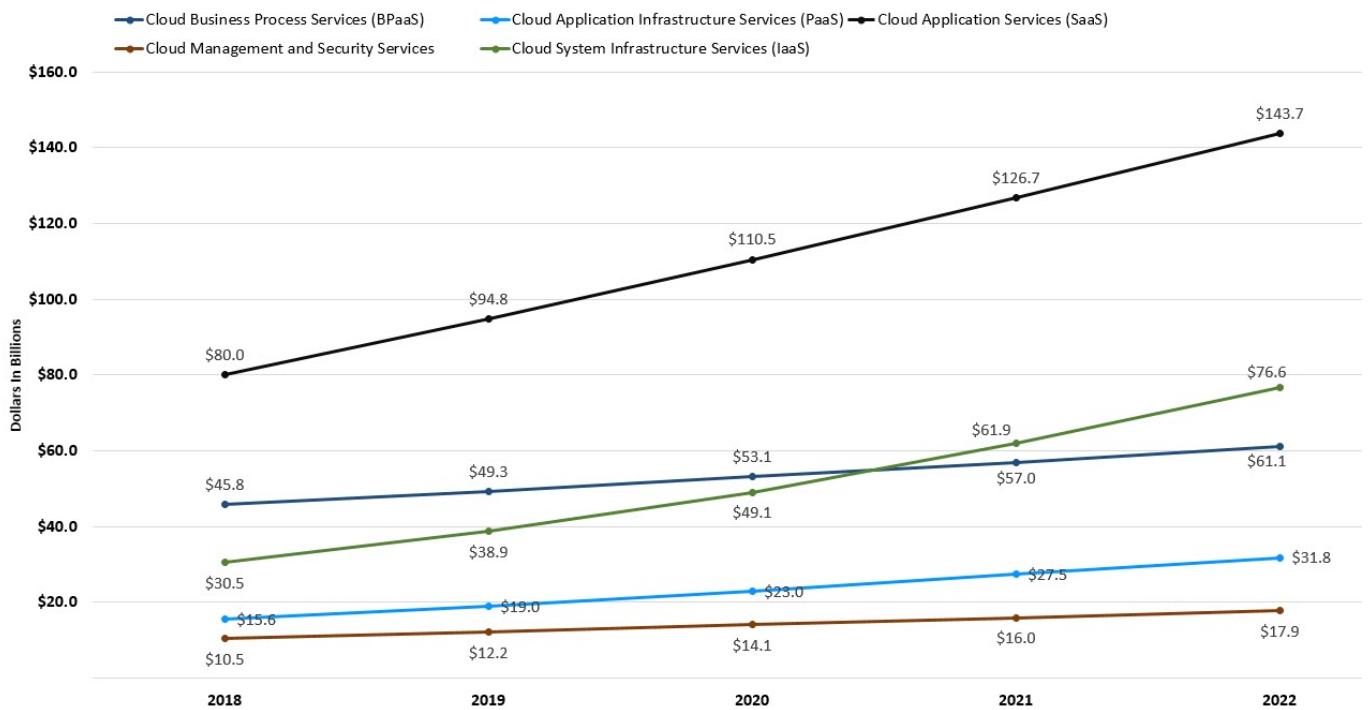
2.3.3

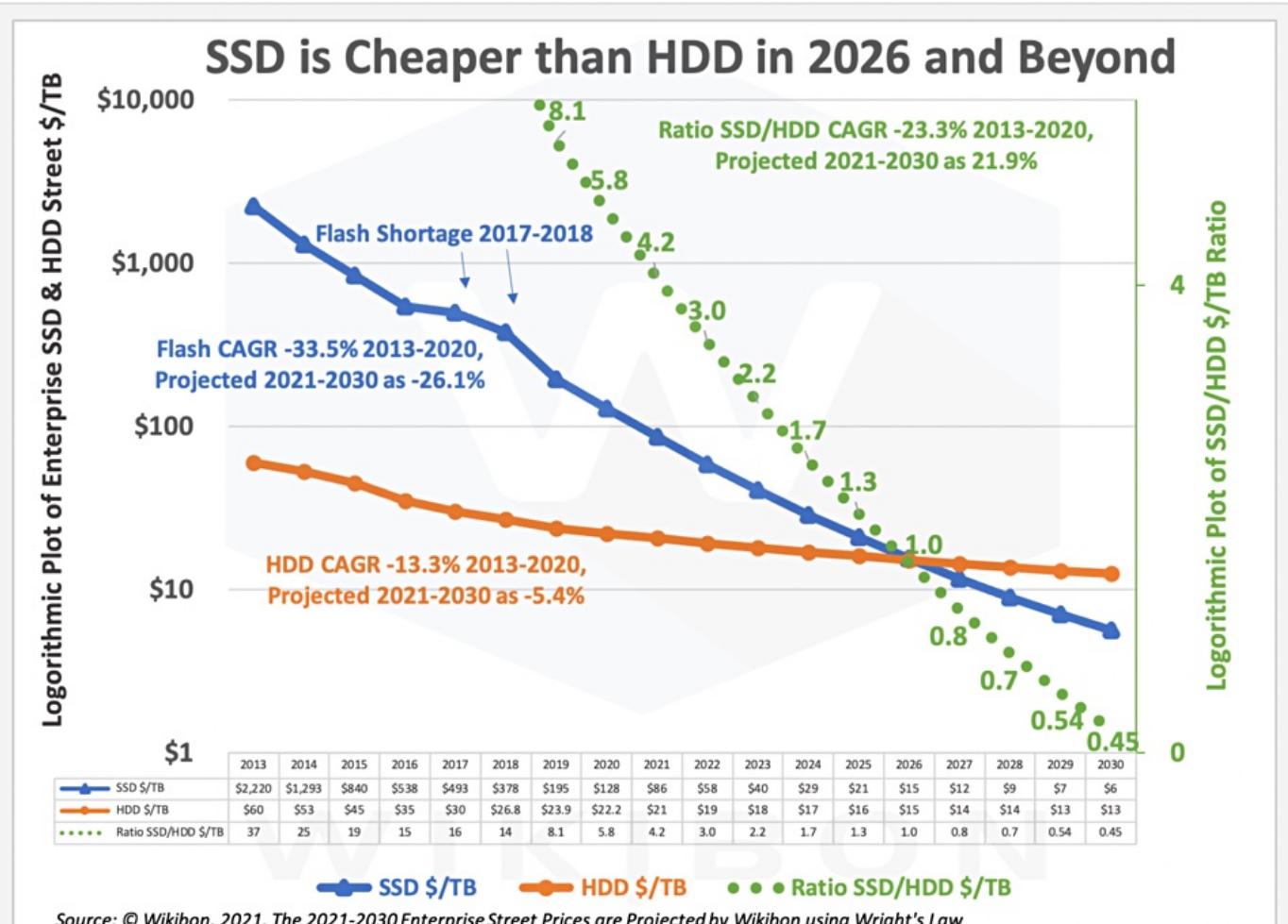
Convergence of Capabilities in the Graph DBMS Landscape

Gartner®

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**

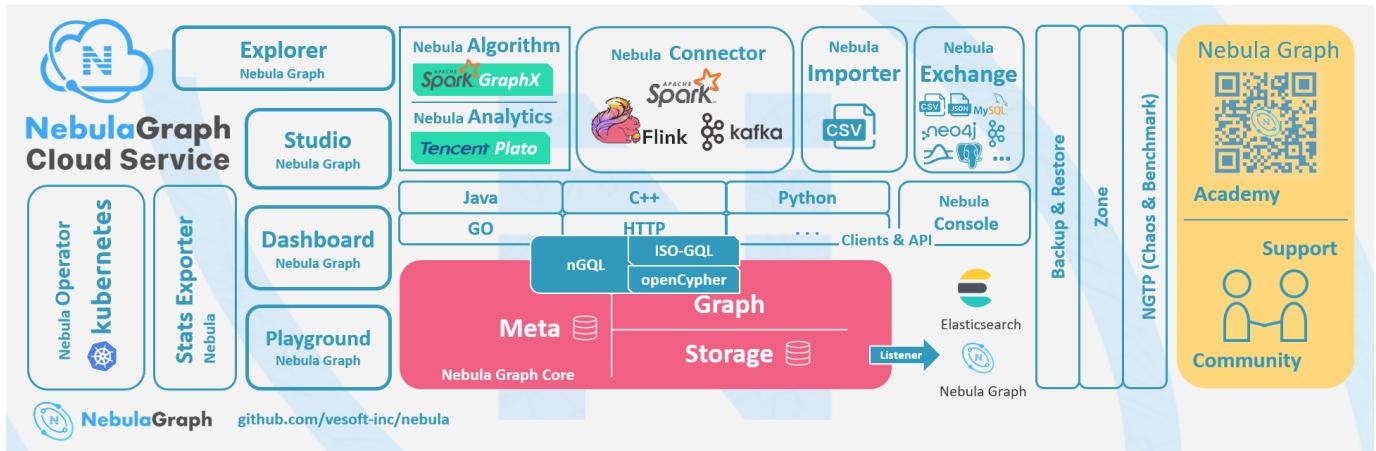
Source: © Wikibon, 2021.

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://igraph.org/> ↵
12. <https://networkx.org/> ↵
13. <https://cytoscape.org/> ↵
14. <https://gephi.org/> ↵
15. <https://arrows.app/> ↵
16. https://github.com/ldbc/ldbc_snbc_docs ↵
17. <https://cloudcomputing-news.net/news/2019/apr/15/public-cloud-soaring-to-331b-by-2022-according-to-gartner/> ↵
18. <https://blocksandfiles.com/2021/01/25/wikibon-ssds-vs-hard-drives-wrights-law/> ↵

: February 25, 2022

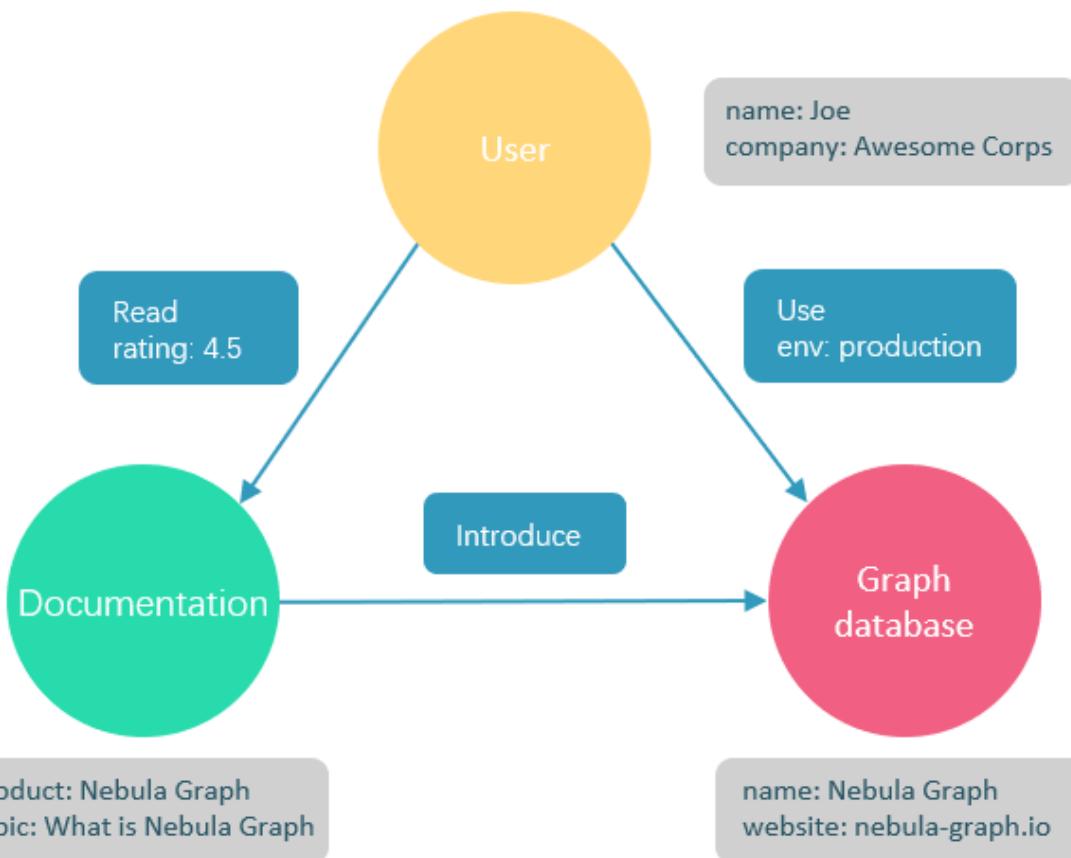
2.4 Nebula Graph

Nebula Graph



2.4.1

Vertex Edge Property



Nebula Graph

2.4.2 Nebula Graph

Nebula Graph Apache 2.0

Nebula Graph

[Nebula Graph GitHub](#)

C++ Nebula Graph
Graph benchmarking

Nebula Graph

Nebula Graph

Nebula

Nebula Graph shared-nothing

Nebula Graph Java Python C++ Go

Nebula Graph clients

Nebula Graph LDAP Lightweight Directory Access Protocol

Nebula Graph Nebula Graph Studio Nebula Console Nebula Exchange

Nebula Graph Spark Flink HBase

openCypher

Nebula Graph nGQL openCypher nGQL

Nebula Graph SSD HDD +

Nebula Graph

360

Nebula Graph

Nebula Graph

2.4.3

Nebula Graph

Nebula Graph

Nebula Graph

Nebula Graph

Nebula Graph

Nebula Graph

2.4.4

- Nebula Graph 01 39



2.4.5

2.4.6

- -
 -
 -
 - GitHub
-

: March 18, 2022

2.5

Nebula Graph

schema

2.5.1

Nebula Graph 6

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

Compatibility

Nebula Graph 2.x Tag Nebula Graph 3.0.1 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
- Properties
- Key-value pair

Note

Tag Edge type " " " "

2.5.2

Nebula Graph

	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

Nebula Graph

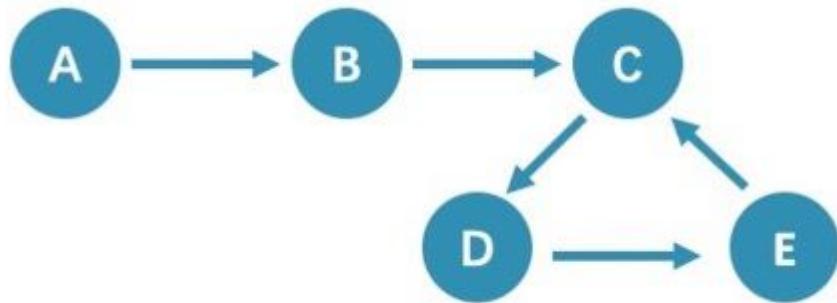
Incompatibility

Nebula Graph 3.0.1 " " " " INSERT VERTEX DELETE VERTEX INSERT EDGE
 DELETE EDGE
 openCypher MERGE

: February 8, 2022

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

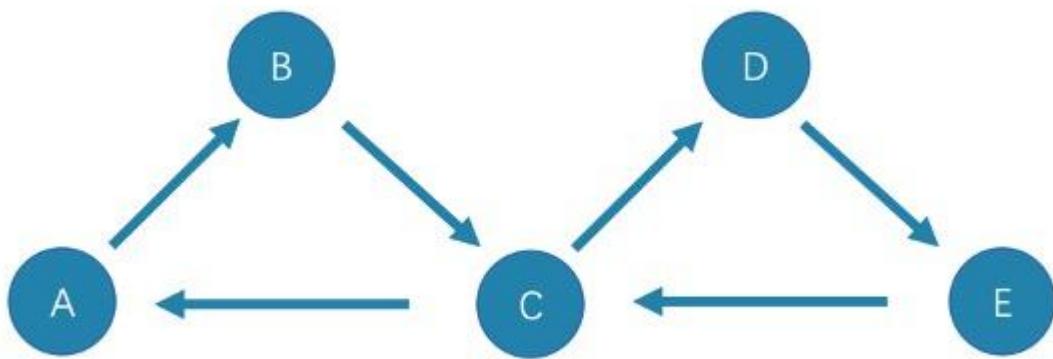
trail

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 18, 2022

2.7 VID

Nebula Graph 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

- Nebula Graph 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)"

Nebula Graph 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
```

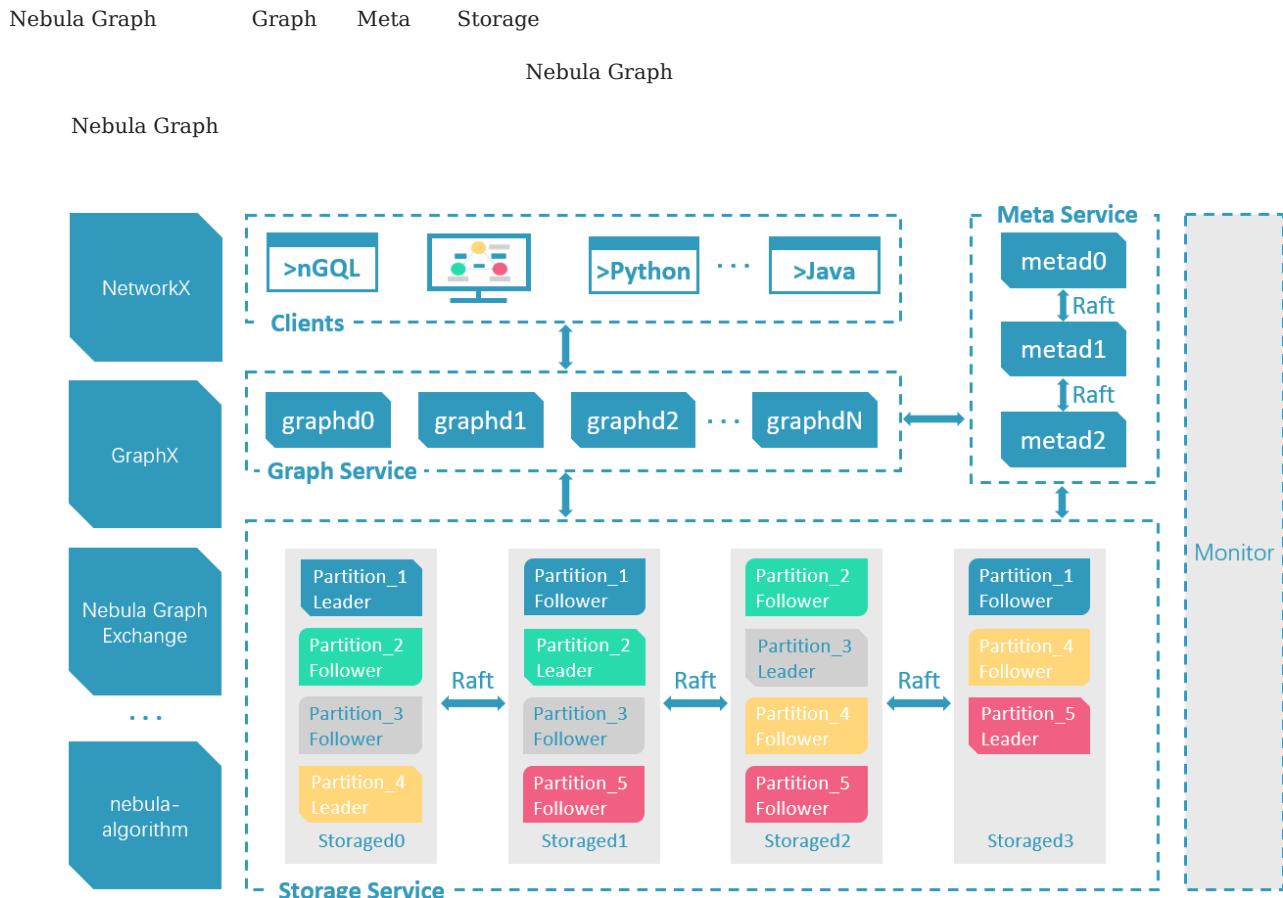
 Caution

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

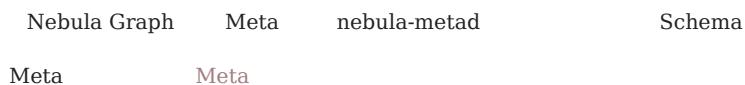
: March 11, 2022

2.8

2.8.1 Nebula Graph



Meta



Graph Storage

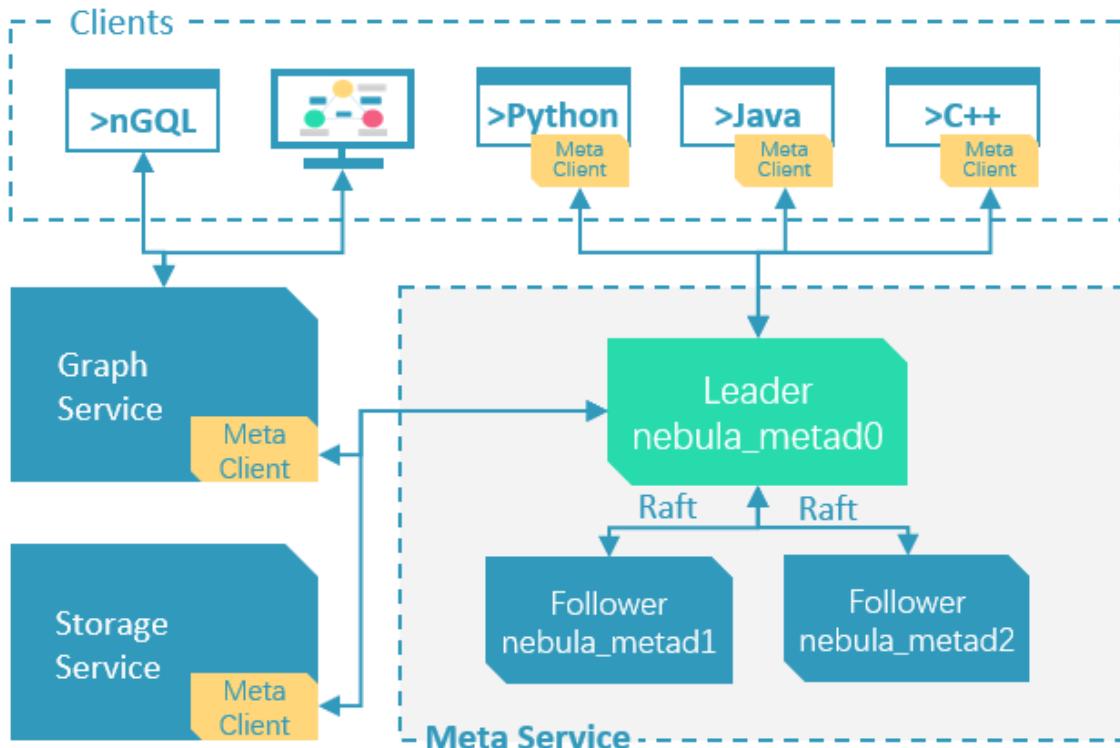
Nebula Graph	Graph	Storage	Graph	nebula-graphd	Storage	nebula-
storaged						
•						
	Graph	Storage				
•						
•						
	Graph	Storage				
			Graph	Storage		
Graph	Storage		Graph	Storage		

:January 14, 2022

2.8.2 Meta

Meta

Meta



Meta	nebula-metad		nebula-metad			
•	Nebula Graph	1	3	nebula-metad	3	1
•	Nebula Graph	3	nebula-metad			
nebula-metad	Raft		leader	follower		
leader	leader		follower	leader	follower	leader

Note

leader follower Raft leader leader Raft Storage

Meta

Meta Meta Meta
Nebula Graph

Meta

Nebula Graph Meta

SCHEMA

Nebula Graph Schema Tag Edge type Tag Edge type

Meta Schema Schema

Nebula Graph Schema

TTL

Meta

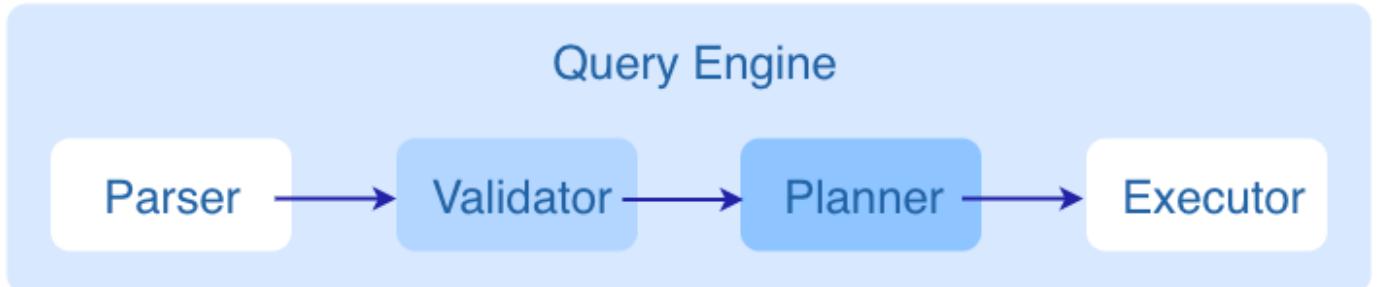
: January 14, 2022

2.8.3 Graph

Graph

Graph

Graph



Graph

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

Parser

Parser

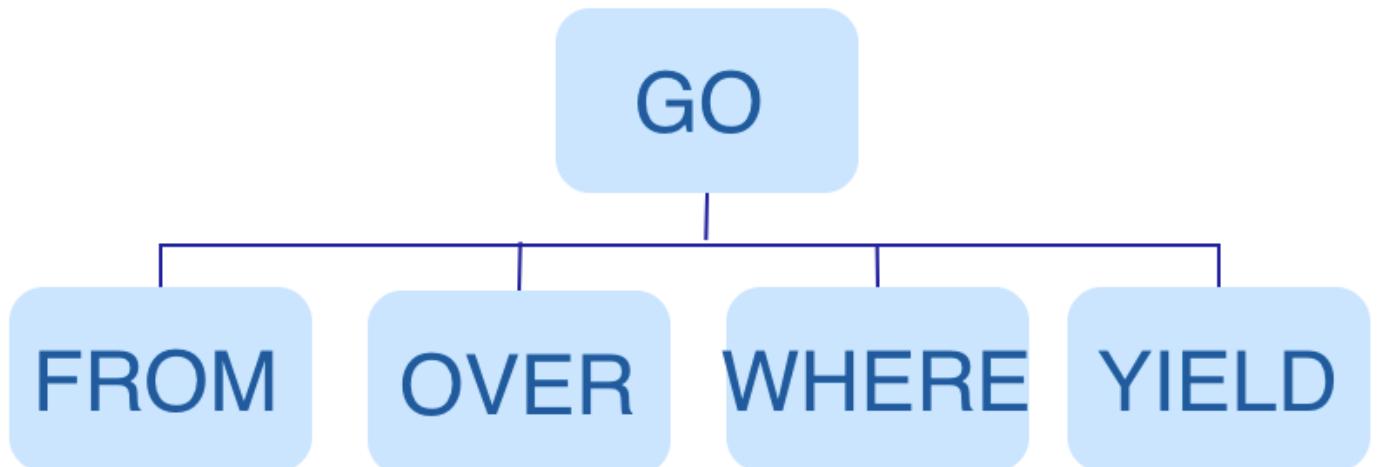
Flex

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
```

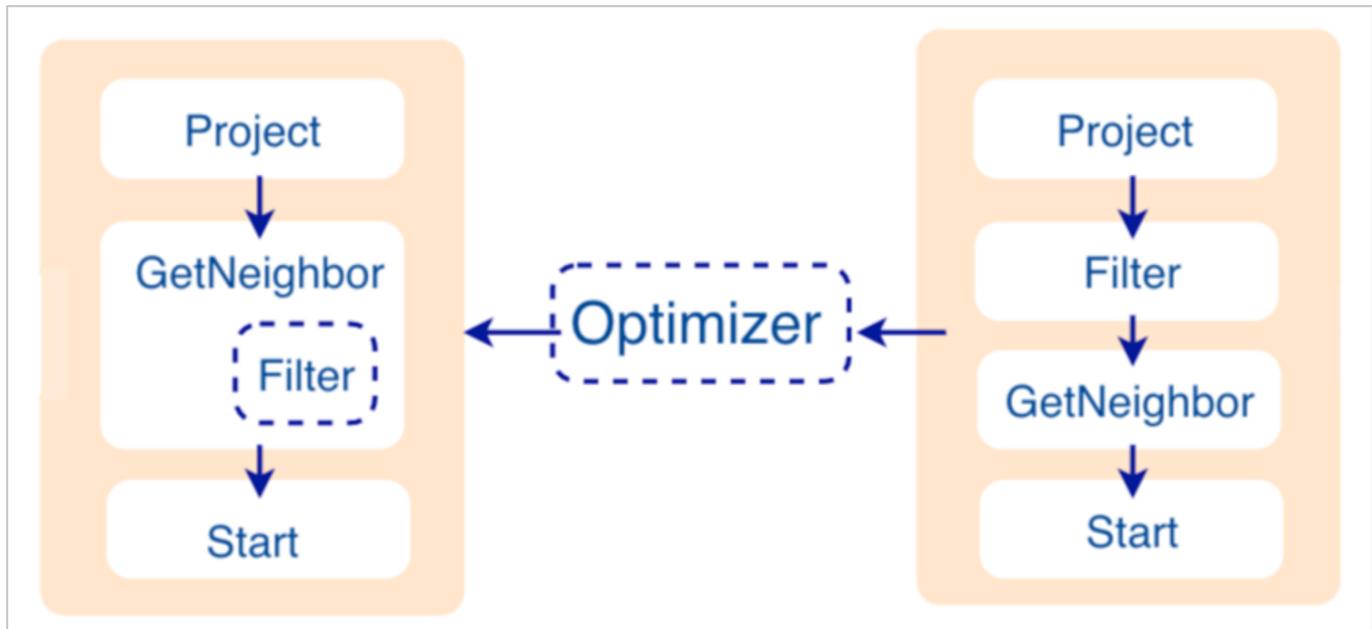
Validator

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

```



Nebula Graph

```

|--src
|   |--context    //
|   |--daemons    //
|   |--executor   //
|   |--mock       //
|   |--optimizer  //
|   |--parser     //
|   |--planner    //
|   |--scheduler  //
|   |--service    //
|   |--util       //
|   |--validator  //
|   |--visitor    //
  
```

Nebula Graph

- nMeetup Query Engine 33 30

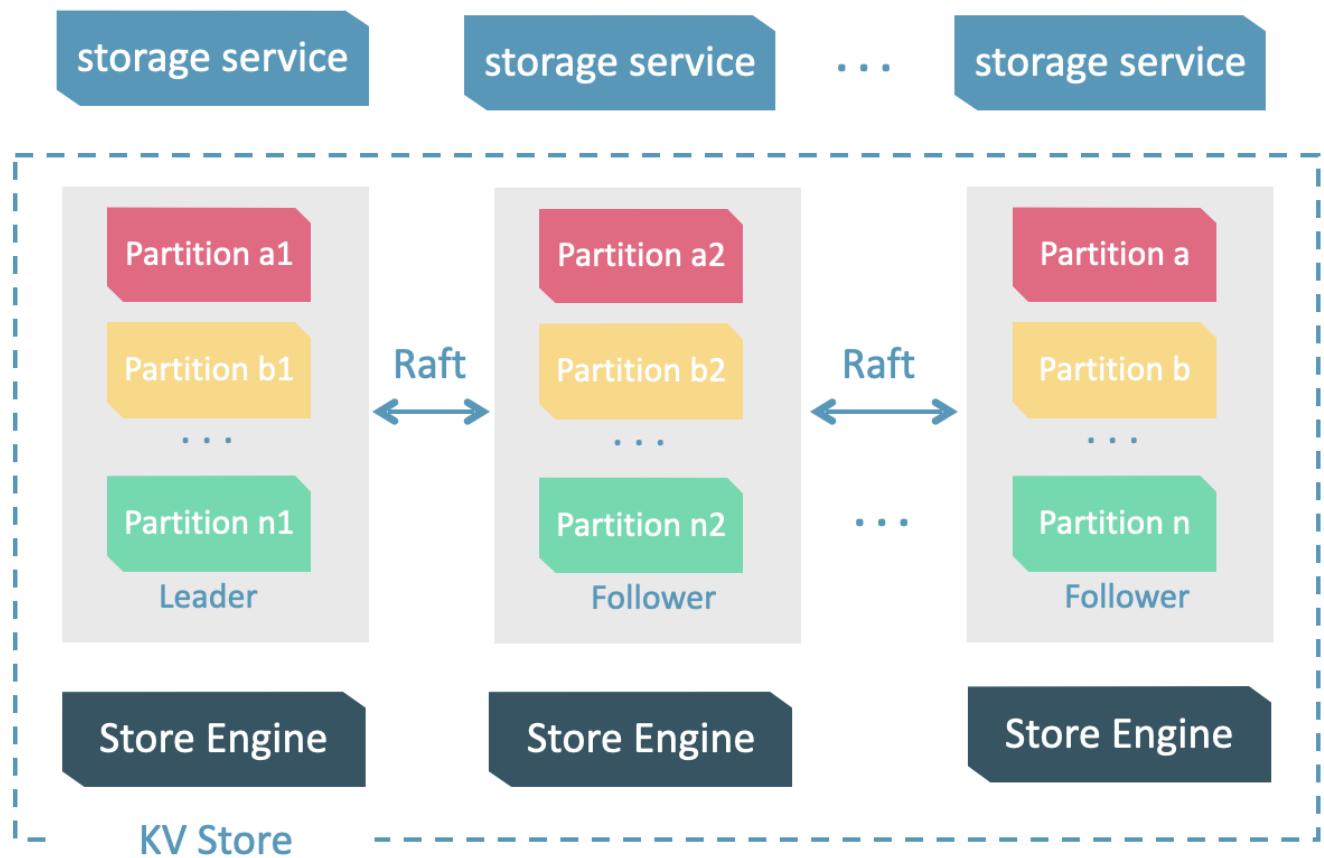
: February 23, 2022

2.8.4 Storage

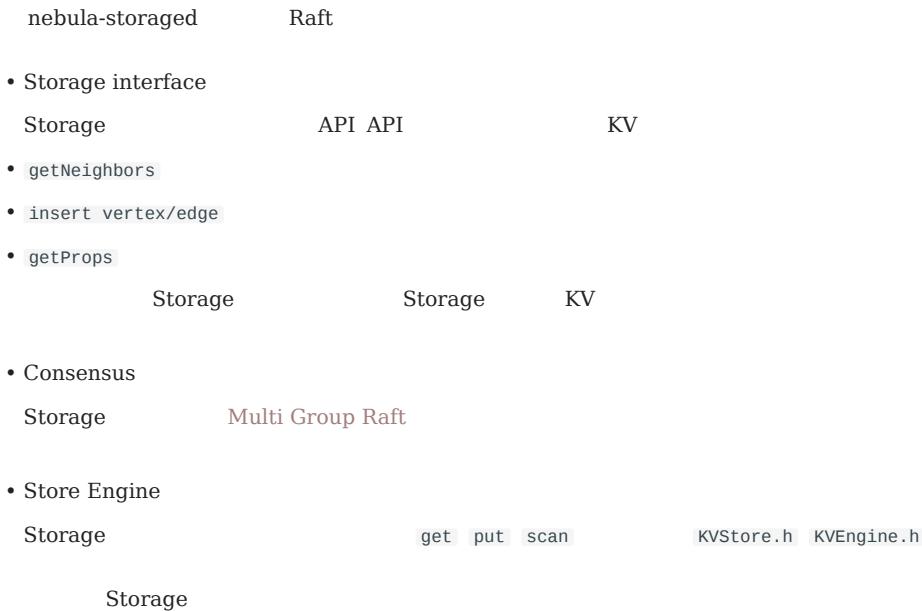
Nebula Graph Meta Meta
 Storage nebula-storaged Storage

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

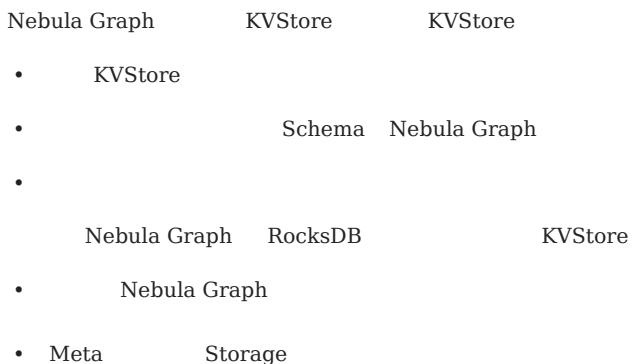
Storage



Storage nebula-storaged nebula-storaged 1 3



KVStore

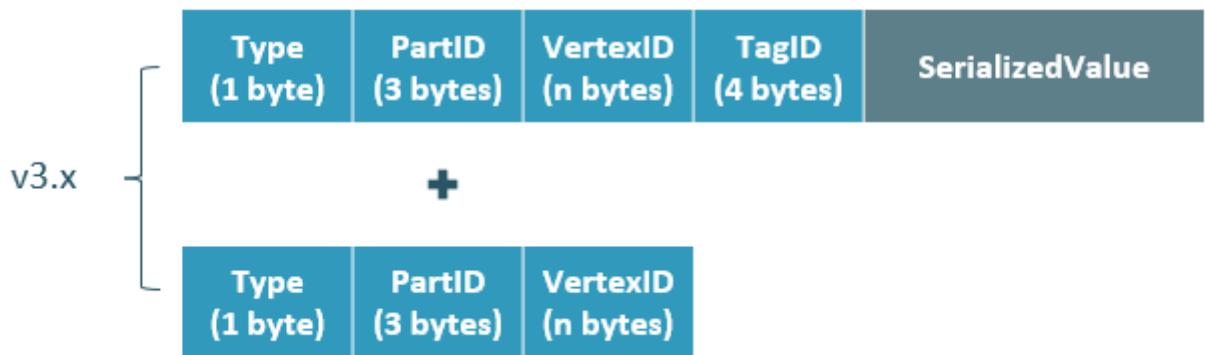


Note

- WAL (Write-Ahead Log) interacts with WAL.
- WAL interacts with WAL.

Nebula Graph key value

Nebula Graph 2.x 3.x TagID value key Tag



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

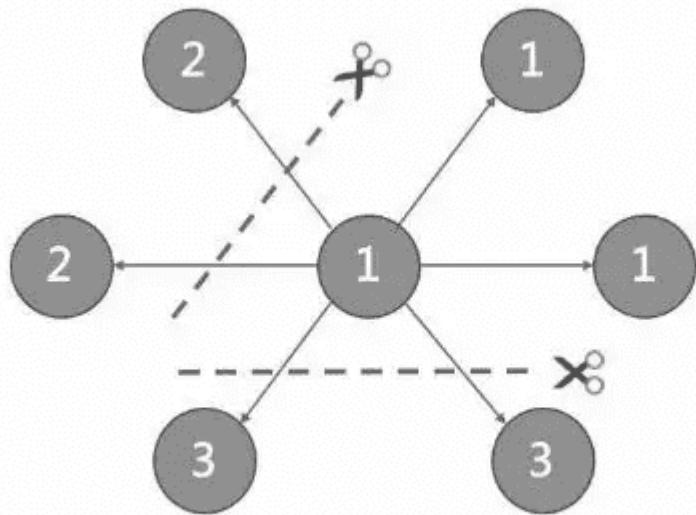
Type (1 byte)	PartID (3 bytes)	VertexID (n bytes)	EdgeType (4 bytes)	Rank (8 bytes)	VertexID (n bytes)	PlaceHolder (1 byte)	SerializedValue
------------------	---------------------	-----------------------	-----------------------	-------------------	-----------------------	-------------------------	-----------------

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					

Nebula Graph Schema

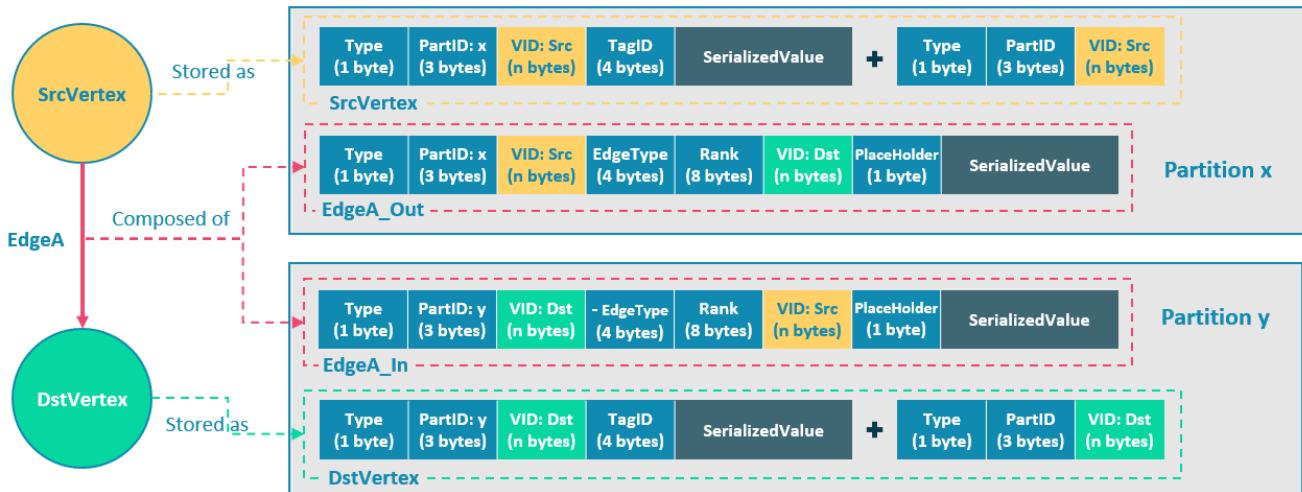
Nebula Graph Schema Meta Schema

Partition Nebula Graph



Nebula Graph

key-value pair



SrcVertex	EdgeA	DstVertex	(SrcVertex)-[EdgeA]->(DstVertex)	6
Partition x	Partition y			

EdgeA Out EdgeA In Nebula Graph key value

TOSS

Hash

VID

Tag

Note

CREATE SPACE

VID

```
//     ID      8      1.0      int64
uint64_t vid = 0;
if (id.size() == 8) {
    memcpystatic_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
		Leader Leader	Follower		Raft-wal	

Note

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

Note

Raft HDFS Raft " "

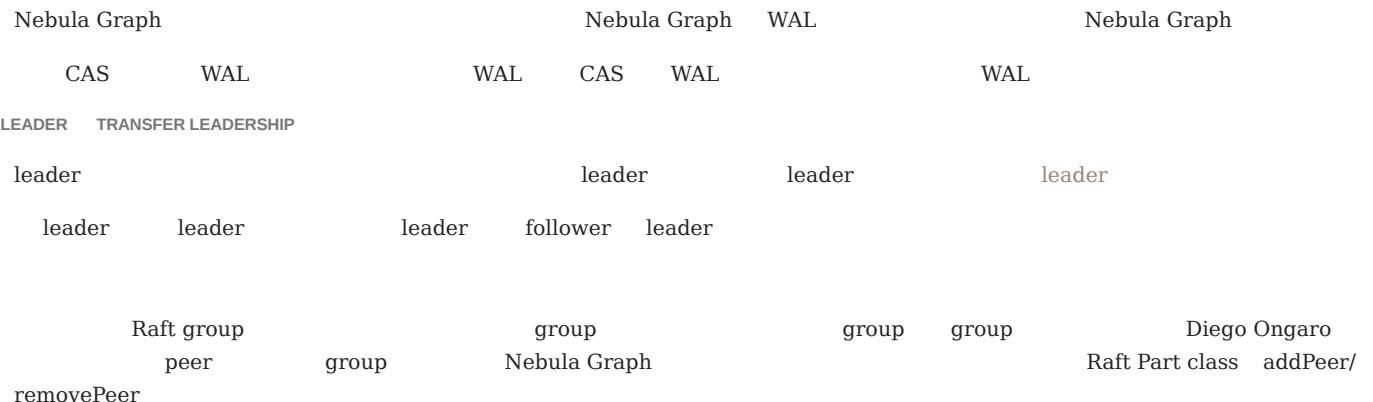
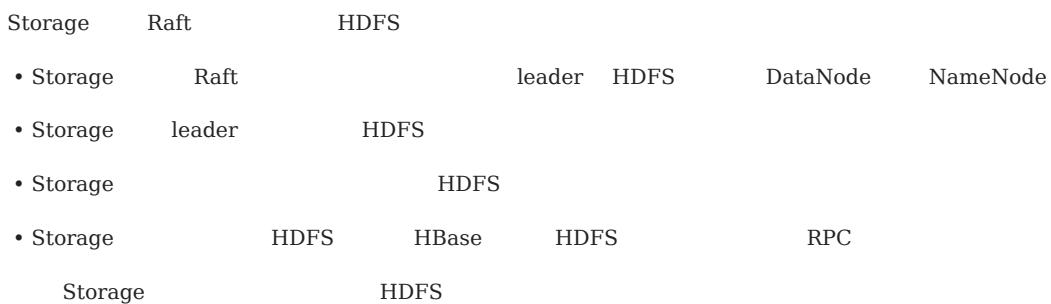
MULTI GROUP RAFT

Storage	Raft	Multi Group Raft	Raft group	leader	follower
Raft	Nebula Graph	Multi Group Raft	Nebula Graph		Raft group
WAL					

Multi Group Raft 2

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

-

BATCH**HDFS**

: February 24, 2022

3.

3.1

Nebula Graph Nebula Graph

3.1.1

Nebula Graph

1. Nebula Graph

RPM DEB Nebula Graph

2. Nebula Graph

Nebula Graph Nebula Graph

3. Nebula Graph

Nebula Graph Nebula Graph Nebula Console Nebula Graph

4. nGQL CRUD

Nebula Graph nGQL Nebula Graph Query Language

3.1.2

Nebula Graph

• Foesa ——Nebula Graph 04 20

• Foesa ——path 03 09

NG

• 08 12

• Nebula Graph 07 44

Bilibili 30 500

: February 14, 2022

3.2 1 Nebula Graph

RPM DEB Linux

RPM DEB

Nebula Graph



Nebula Graph

RPM/DEB



inquiry@vesoft.com

3.2.1

wget

3.2.2

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 3.0.1

```
wget https://oss-cdn.nebula-graph.com.cn/package/3.0.1/nebula-graph-3.0.1.el7.x86_64.rpm
wget https://oss-cdn.nebula-graph.com.cn/package/3.0.1/nebula-graph-3.0.1.el7.x86_64.rpm.sha256sum.txt
```

ubuntu 1804 3.0.1

```
wget https://oss-cdn.nebula-graph.com.cn/package/3.0.1/nebula-graph-3.0.1.ubuntu1804.amd64.deb
wget https://oss-cdn.nebula-graph.com.cn/package/3.0.1/nebula-graph-3.0.1.ubuntu1804.amd64.deb.sha256sum.txt
```

- (nightly)

Danger

- 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 18.04 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
```

3.2.3 Nebula Graph

- RPM

```
$ sudo rpm -ivh --prefix=<installation_path> <package_name>
```

--prefix Nebula Graph /usr/local/nebula/

3.0.1 RPM

```
sudo rpm -ivh nebula-graph-3.0.1.el7.x86_64.rpm
```

- DEB

```
$ sudo dpkg -i <package name>
```

Note

DEB Nebula Graph /usr/local/nebula/

3.0.1 DFB

```
do dpkg -i nebula-
```

3.2.4

- License
 - Nebula Graph
 - Nebula Graph
-

:January 14, 2022

3.3 2 Nebula Graph

```
Nebula Graph      nebula.service
nebula.service    /usr/local/nebula/scripts
```

3.3.1

```
$ 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	

3.3.2 Nebula Graph

RPM DEB Nebula Graph

```
$ 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
```

Docker Compose Nebula Graph nebula-docker-compose/

```
[nebula-docker-compose]$ docker-compose up -d
Building with native build. Learn about native build in Compose here: https://docs.docker.com/go/compose-native-build/
Creating network "nebula-docker-compose_nebula-net" with the default driver
Creating nebula-docker-compose_metad0_1 ... done
Creating nebula-docker-compose_metad2_1 ... done
Creating nebula-docker-compose_metad1_1 ... done
Creating nebula-docker-compose_storaged2_1 ... done
Creating nebula-docker-compose_graphd1_1 ... done
Creating nebula-docker-compose_storaged1_1 ... done
Creating nebula-docker-compose_storaged0_1 ... done
Creating nebula-docker-compose_graphd2_1 ... done
Creating nebula-docker-compose_graphd1_1 ... done
```

3.3.3 Nebula Graph



```
kill -9
```

Nebula Graph

```
$ 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
```

`nebula-docker-compose/`

Nebula Graph

```
[nebula-docker-compose]$ docker-compose down
Stopping nebula-docker-compose_graphd_1 ... done
Stopping nebula-docker-compose_graphd2_1 ... done
Stopping nebula-docker-compose_storaged0_1 ... done
Stopping nebula-docker-compose_storaged1_1 ... done
Stopping nebula-docker-compose_graphd1_1 ... done
Stopping nebula-docker-compose_storaged2_1 ... done
Stopping nebula-docker-compose_metad1_1 ... done
Stopping nebula-docker-compose_metad2_1 ... done
Stopping nebula-docker-compose_metad0_1 ... done
Removing nebula-docker-compose_graphd_1 ... done
Removing nebula-docker-compose_graphd2_1 ... done
Removing nebula-docker-compose_storaged0_1 ... done
Removing nebula-docker-compose_storaged1_1 ... done
Removing nebula-docker-compose_graphd1_1 ... done
Removing nebula-docker-compose_storaged2_1 ... done
Removing nebula-docker-compose_metad1_1 ... done
Removing nebula-docker-compose_metad2_1 ... done
Removing nebula-docker-compose_metad0_1 ... done
Removing network nebula-docker-compose_nebula-net
```



`docker-compose down -v`

Nebula Graph

developing nightly

3.3.4 Nebula Graph

Nebula Graph

```
$ sudo /usr/local/nebula/scripts/nebula.service status all
```

- Nebula Graph

```
[INFO] nebula-metad(02b2091): Running as 26601, Listening on 9559
[INFO] nebula-graphd(02b2091): Running as 26644, Listening on 9669
[INFO] nebula-storaged(02b2091): Running as 26709, Listening on 9779
```



Nebula Graph	nebula-storaged	nebula-storaged	nebula-metad	Storage	Storage	Storage	Ready
3.0.0	Storage	Storage	Meta	ADD HOSTS			
Storage							

- Nebula Graph Nebula Graph

```
[INFO] nebula-metad: Running as 25600, Listening on 9559
[INFO] nebula-graphd: Exited
[INFO] nebula-storaged: Running as 25646, Listening on 9779
```

Nebula Graph	Meta	Graph	Storage	etc	/usr/local/nebula/etc/
--------------	------	-------	---------	-----	------------------------

nebula-docker-compose Nebula Graph

```
[nebula-docker-compose]$ docker-compose ps
      Name          Command     State            Ports
-----+-----+-----+-----+-----+
nebula-docker-compose_graphd1_1   /usr/local/nebula/bin/nebu ... Up (healthy)    0.0.0.0:49223->19669/tcp, 0.0.0.0:49222->19670/tcp, 0.0.0.0:49224->9669/tcp
nebula-docker-compose_graphd2_1   /usr/local/nebula/bin/nebu ... Up (healthy)    0.0.0.0:49229->19669/tcp, 0.0.0.0:49228->19670/tcp, 0.0.0.0:49230->9669/tcp
nebula-docker-compose_graphd_1    /usr/local/nebula/bin/nebu ... Up (healthy)    0.0.0.0:49221->19669/tcp, 0.0.0.0:49220->19670/tcp, 0.0.0.0:9669->9669/tcp
nebula-docker-compose_metad0_1    ./bin/nebula-metad --flagf ... Up (healthy)    0.0.0.0:49212->19559/tcp, 0.0.0.0:49211->19560/tcp, 0.0.0.0:49213->9559/tcp,
                                  9560/tcp
nebula-docker-compose_metad1_1    ./bin/nebula-metad --flagf ... Up (healthy)    0.0.0.0:49209->19559/tcp, 0.0.0.0:49208->19560/tcp, 0.0.0.0:49210->9559/tcp
                                  9560/tcp
nebula-docker-compose_metad2_1    ./bin/nebula-metad --flagf ... Up (healthy)    0.0.0.0:49206->19559/tcp, 0.0.0.0:49205->19560/tcp, 0.0.0.0:49207->9559/tcp
                                  9560/tcp
nebula-docker-compose_storaged0_1  ./bin/nebula-storaged --fl ... Up (healthy)    0.0.0.0:49218->19779/tcp, 0.0.0.0:49217->19780/tcp, 9777/tcp, 9778/tcp
                                  0.0.0.0:49219->9779/tcp, 9780/tcp
nebula-docker-compose_storaged1_1  ./bin/nebula-storaged --fl ... Up (healthy)    0.0.0.0:49215->19779/tcp, 0.0.0.0:49214->19780/tcp, 9777/tcp, 9778/tcp,
                                  0.0.0.0:49216->9779/tcp, 9780/tcp
nebula-docker-compose_storaged2_1  ./bin/nebula-storaged --fl ... Up (healthy)    0.0.0.0:49226->19779/tcp, 0.0.0.0:49225->19780/tcp, 9777/tcp, 9778/tcp,
                                  0.0.0.0:49227->9779/tcp, 9780/tcp
```

nebula-docker-compose_graphd2_1 ,

docker ps	CONTAINER ID	2a6c56c405f5)
-----------	--------------	----------------

```
[nebula-docker-compose]$ docker ps
CONTAINER ID        IMAGE               COMMAND             CREATED            STATUS              NAMES
PORTS
2a6c56c405f5        vesoft/nebula-graphd:nightly   "/usr/local/nebula/b..."   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  "./bin/nebula-storag..."  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  "./bin/nebula-storag..."  36 minutes ago   Up 36 minutes (healthy)   9777-9778/tcp, 9780/tcp, 0.0.0.0:49219->9779/tcp, 9780/tcp
4dcabfe8677a        vesoft/nebula-graphd:nightly   "/usr/local/nebula/b..."  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   "/usr/local/nebula/b..."  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  "./bin/nebula-storag..."  36 minutes ago   Up 36 minutes (healthy)   9777-9778/tcp, 9780/tcp, 0.0.0.0:49216->9779/tcp, 9780/tcp
45736a32a23a        vesoft/nebula-metad:nightly    "./bin/nebula-metad ..."  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    "./bin/nebula-metad ..."  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    "./bin/nebula-metad ..."  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]#
```

3.3.5

Nebula Graph

:January 14, 2022

3.4 3 Nebula Graph

Nebula Graph

CLI GUI

Nebula Graph

CLI Nebula Console

3.4.1 Nebula Graph

Nebula Graph

3.4.2 Nebula Console Nebula Graph

- Nebula Graph
- Nebula Console Nebula Graph
- Nebula Console Nebula Graph

 Note

Nebula Console Nebula Graph
between client and server

Nebula Console Nebula Graph

incompatible version

1. Nebula Console **Assets**

 Note

2. **Assets**

3. nebula-console

 Note

Windows nebula-console.exe

4. Nebula Console nebula-console

 Note

Windows

```
$ chmod 111 nebula-console
```

5. nebula-console

6. Nebula Graph

- 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]
```

<code>-h</code>							
<code>-addr</code>	graphd	IP	127.0.0.1	Nebula Graph	Nebula Cloud	Private Link	IP
<code>-port</code>	graphd		9669				
<code>-u/-user</code>	Nebula Graph			root			
<code>-p/-password</code>							
<code>-t/-timeout</code>		120					
<code>-e/-eval</code>	nGQL						
<code>-f/-file</code>	nGQL		nGQL				
<code>./nebula-console --help</code>							

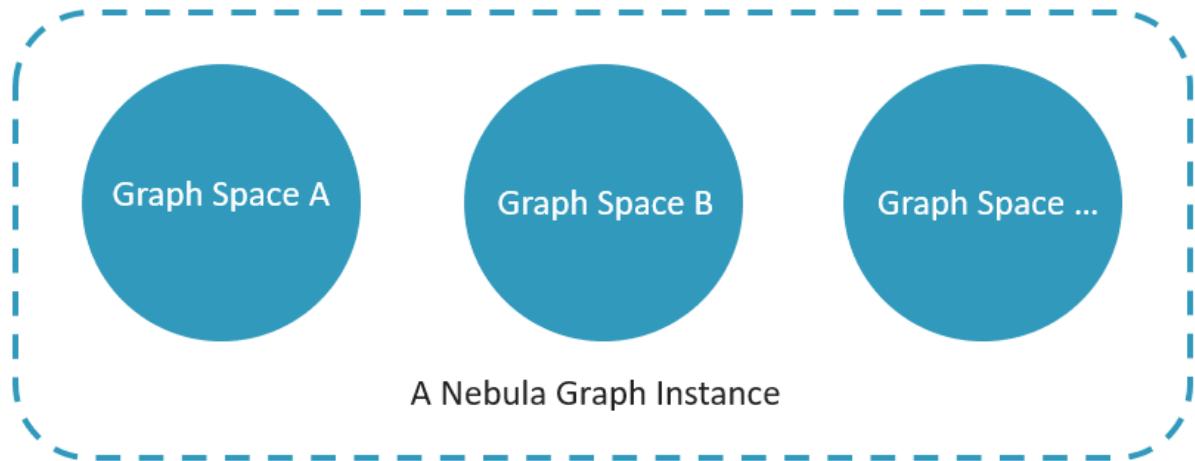
:January 14, 2022

3.5 4 nGQL CRUD

Nebula Graph Schema
nGQL

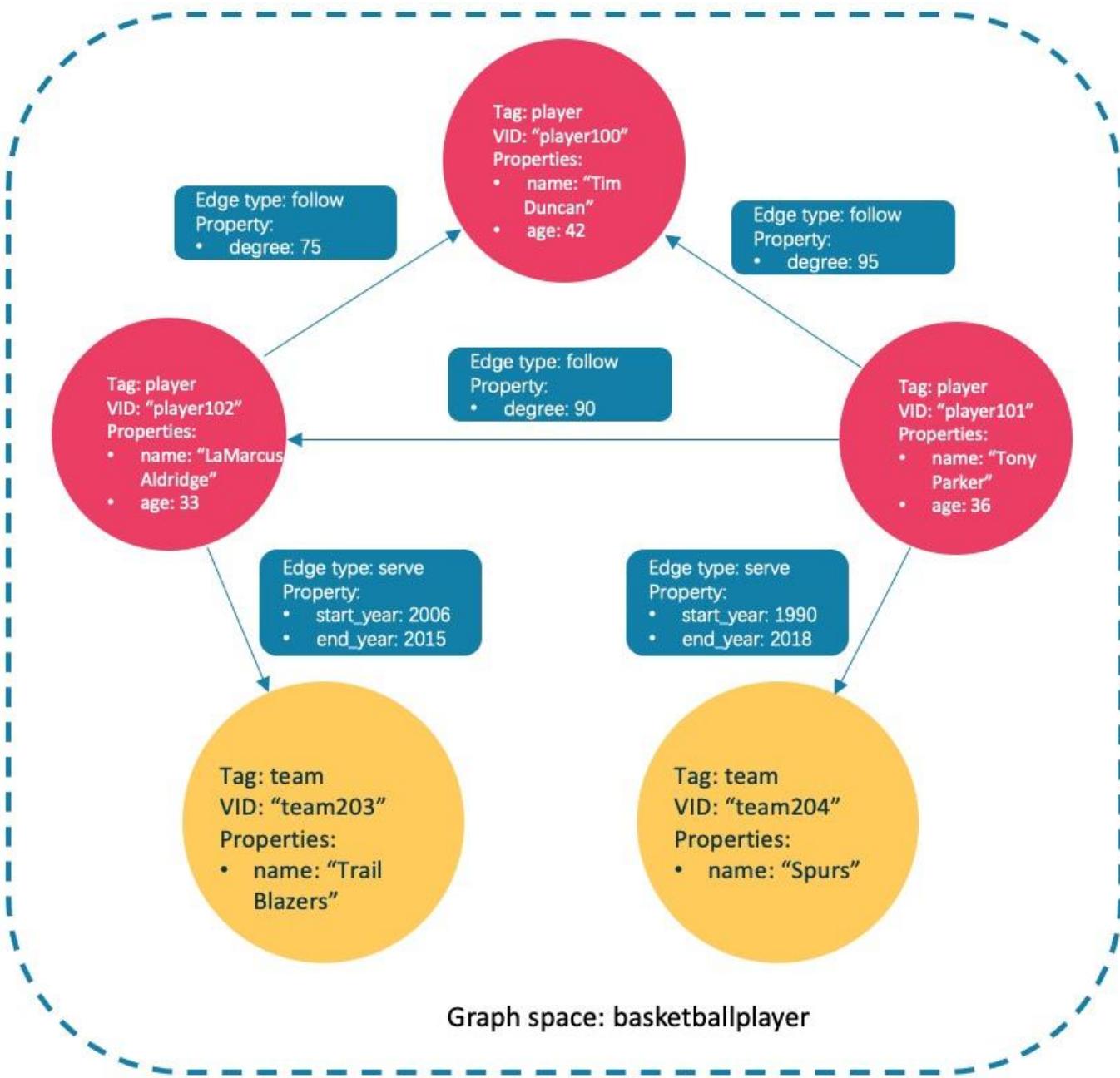
3.5.1 Schema

Nebula Graph



Schema Nebula Graph Schema

Vertex	0
Tag	
Edge	
Edge type	



3.5.2 Nebula Graph Storage

Storage Nebula Graph

Incompatibility

3.0.0

Storage

Storage

Meta

ADD HOSTS

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;

3.5.3 Nebula Graph

Storage

SHOW HOSTS

```
nebula> SHOW HOSTS;
+-----+-----+-----+-----+-----+-----+
| Host | Port | Status | Leader count | Leader distribution | Partition distribution | Version |
+-----+-----+-----+-----+-----+-----+
| "192.168.10.100" | 9779 | "ONLINE" | 0 | "No valid partition" | "No valid partition" | "3.0.1" |
| "192.168.10.101" | 9779 | "ONLINE" | 0 | "No valid partition" | "No valid partition" | "3.0.1" |
| "192.168.10.102" | 9779 | "ONLINE" | 0 | "No valid partition" | "No valid partition" | "3.0.1" |
+-----+-----+-----+-----+-----+-----+
```

Status

Storage



Nebula Graph

2 20

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



10

heartbeat_interval_secs

3.5.4

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));
```

2. SHOW HOSTS

```
nebula> SHOW HOSTS;
+-----+-----+-----+-----+-----+-----+
| Host | Port | Status | Leader count | Leader distribution | Partition distribution | Version |
+-----+-----+-----+-----+-----+-----+
| "storaged0" | 9779 | "ONLINE" | 5 | "basketballplayer:5" | "basketballplayer:5" | "3.0.1" |
| "storaged1" | 9779 | "ONLINE" | 5 | "basketballplayer:5" | "basketballplayer:5" | "3.0.1" |
| "storaged2" | 9779 | "ONLINE" | 5 | "basketballplayer:5" | "basketballplayer:5" | "3.0.1" |
+-----+-----+-----+-----+-----+-----+
```

Leader distribution

BALANCE LEADER

Storage

3. basketballplayer

```
nebula[(none)]> USE basketballplayer;
```

SHOW SPACES

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

3.5.5 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);
```

3.5.6

`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);
```

3.5.7

- `GO` `GO` `YIELD`
- `FETCH`
- `LOOKUP` `WHERE`
- `MATCH` `Nebula Graph`

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" |
```

```
| "player125" |  
+-----+  
|
```

- 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 |  
| "Manu Ginobili" | 41 |  
+-----+-----+
```

/

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 |  
+-----+-----+  
| "Spurs" | "Tim Duncan" |  
| "Trail Blazers" | "LaMarcus Aldridge" |  
| "Spurs" | "LaMarcus Aldridge" |  
| "Spurs" | "Manu Ginobili" |  
+-----+-----+
```

/

\$^

|

\$-



```
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 |  
+-----+-----+  
| "Spurs" | "Tim Duncan" |  
| "Trail Blazers" | "LaMarcus Aldridge" |  
| "Spurs" | "LaMarcus Aldridge" |  
| "Spurs" | "Manu Ginobili" |  
+-----+-----+
```

FETCH

VID player100

```
nebula> FETCH PROP ON player "player100" YIELD properties(vertex);  
+-----+  
| properties(VERTEX) |  
+-----+
```

```
| {age: 42, name: "Tim Duncan"} |
```

Note

LOOKUP MATCH

3.5.8

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 <source vid> -> <destination vid> [@rank] OF <edge_type>
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 "player101" -> "player100" OF follow 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 |
+-----+-----+
```

3.5.9

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";
```

3.5.10

CREATE INDEX Tag Edge type



MATCH LOOKUP 90%

" " 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));

//
nebula> 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"}) |
+-----+
```

: March 15, 2022

3.6 nGQL

3.6.1

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
collect()	
avg()	
count()	
max()	
min()	
std()	
sum()	
bit_and()	AND
bit_or()	OR
bit_xor()	XOR
int size()	
	[start, end] step 1

int range(int start, int end, int step)	x	x	0	0	x	-1	x	1
int sign(double x)								
double e()	e	2.718281828459045						
double pi()	π	3.141592653589793						
double radians()	radians(180)	3.141592653589793						
•								
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(string 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						
string toString()								
int hash()								
•								
int now()								
timestamp timestamp()								
date date()	UTC							
time time()	UTC							
datetime datetime()	UTC							

- Schema

- nGQL

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

- openCypher

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

`coalesce(list)`

`reduce()` reduce

- count

<code>count()</code>	count({expr *})
	count() NULL
	count(expr)
	count() size()

- collect

<code>collect()</code>	collect()
------------------------	-----------

- reduce

<code>reduce()</code>	reduce(<accumulator> = <initial>, <variable> IN <list>	reduce()
-----------------------	--	----------

- hash

<code>hash()</code>	hash()	NULL	hash()	MurmurHash2	seed
	0xc70f6907UL	MurmurHash2.h			

- concat

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

- concat_ws

concat_ws()	concat_ws()	separator
-------------	-------------	-----------

- 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

CASE	nGQL	YIELD	RETURN	CASE	ELSE
ELSE		NULL			

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

comparer	value
----------	-------

value	comparer
-------	----------

result	value	comparer	result
--------	-------	----------	--------

default	default
---------	---------

3.6.2

- 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>}
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	-->	[e]-
	MATCH (v:player{name:"Tim Duncan"})-[e]-(v2) RETURN e	<--	-
Edge type	MATCH ()-[e:follow]-() RETURN e	:<edge_type>	Edge type
	MATCH (v:player{name:"Tim Duncan"})- [e:follow{degree:95}]->(v2) RETURN e	{<prop_name>: <prop_value>}	Edge type
Edge type	MATCH (v:player{name:"Tim Duncan"})-[e:follow :serve]->(v2) RETURN e	Edge type type	[e:follow :serve]
	MATCH (v:player{name:"Tim Duncan"})-[]->(v2)<- [e:serve]-(v3) RETURN v2, v3	Edge type :	Edge type
	MATCH p=(v:player{name:"Tim Duncan"})- [e:follow*2]->(v2) RETURN DISTINCT v2 AS Friends	:<edge_type>*<hop>	hop
	MATCH p=(v:player{name:"Tim Duncan"})- [e:follow*1..3]->(v2) RETURN v2 AS Friends	minHop maxHop	1 e
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>		
	MATCH p=(v:player{name:"Tim Duncan"})-[]->(v2) 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	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

3.6.3

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>]	O 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	

3.6.4

CREATE SPACE	<code>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>']</code>	<code>CREATE SPACE my_space_1 (vid_type=FIXED_STRING(30))</code>	
CREATE SPACE	<code>CREATE SPACE <new_graph_space_name> AS <old_graph_space_name></code>	<code>CREATE SPACE my_space_4 as my_space_3</code>	Schema
USE	<code>USE <graph_space_name></code>	<code>USE space1</code>	
SHOW SPACES	<code>SHOW SPACES</code>	<code>SHOW SPACES</code>	Nebula Graph
DESCRIBE SPACE	<code>DESC[RIBE] SPACE <graph_space_name></code>	<code>DESCRIBE SPACE basketballplayer</code>	
DROP SPACE	<code>DROP SPACE [IF EXISTS] <graph_space_name></code>	<code>DROP SPACE basketballplayer</code>	

3.6.5 TAG

CREATE TAG	<code>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>'])</code>	<code>CREATE TAG woman(name string, age int, married bool, salary double, create_time timestamp) TTL_DURATION = 100, TTL_COL = "create_time"</code>	Tag
DROP TAG	<code>DROP TAG [IF EXISTS] <tag_name></code>	<code>CREATE TAG test(p1 string, p2 int)</code>	Tag
ALTER TAG	<code>ALTER TAG <tag_name> <alter_definition> [, alter_definition] ...] [ttl_definition [, ttl_definition] ...] [COMMENT = '<comment>']</code>	<code>ALTER TAG t1 ADD (p3 int, p4 string)</code>	Tag
SHOW TAGS	<code>SHOW TAGS</code>		TTL Time-To-Live)
DESCRIBE TAG	<code>DESC[RIBE] TAG <tag_name></code>	<code>DESCRIBE TAG player</code>	Tag
DELETE TAG	<code>DELETE TAG <tag_name_list> FROM <VID></code>	<code>DELETE TAG test1 FROM "test"</code>	Tag

3.6.6 Edge type

CREATE EDGE	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 = <ttl_duration>] [TTL_COL = <prop_name>] [COMMENT = '<comment>']	CREATE EDGE e1(p1 string, p2 int, p3 timestamp) TTL_DURATION = 100, TTL_COL = "p2"	Edge type
DROP EDGE	DROP EDGE [IF EXISTS] <edge_type_name>	DROP EDGE e1	Edge type
ALTER EDGE	ALTER EDGE <edge_type_name> <alter_definition> [, alter_definition] ...] [ttl_definition [, ttl_definition] ...] [COMMENT = '<comment>']	ALTER EDGE e1 ADD (p3 int, p4 string)	Edge type
SHOW EDGES	SHOW EDGES	SHOW EDGES	Edge type
DESCRIBE EDGE	DESC[RIBE] EDGE <edge_type_name>	DESCRIBE EDGE follow	Edge type

3.6.7

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

3.6.8

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>	Nebula Graph
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

3.6.9

• 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)	Nebula Graph 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	

3.6.10

GET SUBGRAPH [WITH PROP] [<step_count> STEPS] FROM {<vid>, <vid>...} [{IN OUT BOTH} <edge_type>, <edge_type>...] YIELD [VERTICES AS <vertex_alias>] [,EDGES AS <edge_alias>]	GET SUBGRAPH 1 STEPS FROM "player100" YIELD VERTICES AS nodes, EDGES AS relationships	Edge type
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>) - [:<edge_type_name>@<rank>] ->(<vertex_id>)

3.6.11

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

3.6.12

- BALANCE

BALANCE LEADER	leader	ID	
<hr/>			
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			
<hr/>			

KILL QUERY (session=<session_id>, plan=<plan_id>)	KILL QUERY(SESSION=1625553545984255, PLAN=163)
---	--

: March 14, 2022

4. nGQL

4.1 nGQL

4.1.1 nGQL

nGQL Nebula Graph Query Language Nebula Graph

nGQL

SQL

nGQL

issue

Nebula Graph

Nebula Graph 3.0

openCypher 9

nGQL

- openCypher 9

Basketballplayer

Nebula Graph

basketballplayer

Nebula Graph Console

- f

Note

ADD HOSTS

Storage

Storage

Nebula Graph 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 Nebula Graph	OpenCypher	openCypher Implementers Group
openCypher 9	nGQL	openCypher



nGQL = nGQL + openCypher



nGQL openCypher

NGQL OPENCYPHER 9



openCypher 9 DQL

nGQL	DQL match	DDL DML DCL
------	-----------	-------------

Nebula Graph Issues

incompatible

"compatibility" “ ”

NGQL OPENCYPHER 9

openCypher 9		nGQL
Schema	Schema	Schema
=	==	
^	pow(x, y)	^
Rank		@rank
-	openCypher 9 WHERE pattern	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 Blot openCypher 9

NGQL

Nebula Graph 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	Nebula Graph
------	------	-------	--------------

And	when
-----	------

@skip

tck case CI/CD

TINKERPOP GREMLIN

W3C RDF SPARQL GRAPHQL

Nebula Graph	Schema	RDF
nGQL	SPARQL	GraphQL

: February 22, 2022

4.1.2

pattern

Nebula Graph

(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 14, 2022

4.1.3

nGQL

- Nebula Graph 1.x # -- // /* * /
- Nebula Graph 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 14, 2022

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 (-8)]: 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 14, 2022

4.1.5

nGQL Schema

-
- `AND`



```
nebula> CREATE TAG TAG(name string);
[ERROR (-7)]: 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
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
```

: March 3, 2022

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.

```
go from "player100" over Follow
```

```
GO FROM "player100" OVER follow
```

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 """Nebula Graph is amazing,\\" the user says.";
```

1. ; nGQL

```
FETCH PROP ON player "player100"
```

```
FETCH PROP ON player "player100";
```

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 14, 2022

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
------	------	-----	-----	-----------	------	------	------	-------

- Nebula Graph
- 123456
- 0x1e240
- 0361100

Nebula Graph

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

- FLOAT/DDOUBLE INT
-

: January 14, 2022

4.2.2

Nebula Graph `BOOL` `true` `false`

nGQL

- - `WHERE`
-

: January 14, 2022

4.2.3

Nebula Graph

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);

- Nebula Graph
- VID Nebula Graph

• "\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 14, 2022

4.2.4

DATE TIME DATETIME TIMESTAMP DURATION

- Nebula Graph timezone_name DATE TIME DATETIME UTC



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

openCypher

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

DATE

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

TIME

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

DATETIME

DATETIME	Nebula Graph	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			

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()** string

```
#  
nebula> RETURN timestamp();  
+-----+  
| timestamp() |  
+-----+  
| 1625469277 |  
+-----+  
  
#  
nebula> RETURN timestamp("2022-01-05T06:18:43");  
+-----+  
| timestamp("2022-01-05T06:18:43") |  
+-----+  
| 1641363523 |  
+-----+
```



Nebula Graph 3.0.0 timestamp() 3.0.0 timestamp()

- **64 int**

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

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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

Nebula Graph NULL openCypher

NULL

Nebula Graph NULL openCypher

NULL

Nebula Graph 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"} |
+-----+
```

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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] |
+-----+

#
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      |
+-----+
| []   |
+-----+

#
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]

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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"} |
+-----+
```

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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 14, 2022

4.2.9

nGQL 1.0 C (type_name)expression YIELD (int)(TRUE) 1 C

nGQL 2.0 openCypher

toBoolean()
toFloat()
toInteger()
type()

```
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__      |
+-----+-----+-----+-----+

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__      |
+-----+-----+-----+-----+

nebula> MATCH (a:player)-[e]-() \
    RETURN type(e);
+-----+
| type(e) |
+-----+
| "follow" |
+-----+
| "follow" |

nebula> MATCH (a:player {name: "Tim Duncan"}) \
    WHERE toInteger(right(id(a),3)) == 100 \
    RETURN a;
+-----+
| a      |
+-----+
| ("player100" :player{age: 42, name: "Tim Duncan"}) |
+-----+

nebula> MATCH (n:player) \
    WITH n LIMIT toInteger(ceil(1.8)) \
    RETURN count(*) AS count;
+-----+
| count |
+-----+
```

	2	
+	-----	+

: February 15, 2022

4.2.10

GEOGRAPHY

Nebula Graph

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);
+-----+
| VertexID | ST_ASText(any_shape.geo) |
+-----+
| "103"   | "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);
+-----+-----+-----+
| any_shape_edge._src | any_shape_edge._dst | any_shape_edge._rank | ST_ASText(any_shape_edge.geo) |
+-----+-----+-----+
| "201"           | "302"          | 0                 | "POLYGON((0 1, 1 2, 2 3, 0 1))" |
+-----+-----+-----+-----+
```

geo geo

s2_max_level	30	S2 cell	$1 \sim 30$
s2_max_cells	8	S2 cell	$1 \sim 30$

 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);
```

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4.3

4.3.1

Nebula Graph

- opencypher
- nGQL ;
- nGQL |

OpenCypher

opencypher nGQL MATCH ... | GO ... | YIELD ...

- openCypher MATCH RETURN WITH
- nGQL FETCH GO LOOKUP



openCypher nGQL

A B C A B C



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 14, 2022

4.3.2

Nebula Graph

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 14, 2022

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



Nebula Graph 2.6.0

Schema

Nebula Graph 3.0.1

```
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);
```

Nebula Graph 3.0.1

:January 17, 2022

4.4

4.4.1

Nebula Graph

```
=
+
-
*
/
==

!=, <>

>

>=

<

<=

%

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

>

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

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

>=

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

<

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

<=

```
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__ |
+-----+-----+-----+
```

```
nebula> RETURN length(NULL), size(NULL), count(NULL), NULL IS NULL, NULL IS NOT NULL, sin(NULL), NULL + NULL, [1, NULL] IS NULL;
+-----+-----+-----+-----+-----+-----+-----+
| length(NULL) | size(NULL) | count(NULL) | NULL IS NULL | NULL IS NOT NULL | sin(NULL) | (NULL+NULL) | [1,NULL] IS NULL |
+-----+-----+-----+-----+-----+-----+-----+
| __NULL__     | __NULL__    | 0          | true        | false       | __NULL__   | __NULL__    | false      |
+-----+-----+-----+-----+-----+-----+-----+
nebula> WITH {name: null} AS map \
    RETURN map.name IS NOT NULL;
+-----+
| map.name IS NOT NULL |
+-----+
| false                |
+-----+
nebula> WITH {name: 'Mats', name2: 'Pontus'} AS map1, \
    {name: null} AS map2, {notName: 0, notName2: null } AS map3 \
    RETURN map1.name IS NULL, map2.name IS NOT NULL, map3.name IS NULL;
+-----+-----+
| map1.name IS NULL | map2.name IS NOT NULL | map3.name IS NULL |
+-----+-----+
| false            | false           | true          |
+-----+
nebula> MATCH (n:player) \
    RETURN n.player.age IS NULL, n.player.name IS NOT NULL, n.player.empty IS NULL;
+-----+-----+
| n.player.age IS NULL | n.player.name IS NOT NULL | n.player.empty IS NULL |
+-----+-----+
| false              | true             | true          |
| false              | true             | true          |
+-----+
...
```

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 14, 2022

4.4.2

Nebula Graph

AND

OR

NOT

XOR

NULL

NULL

Note

0

: March 7, 2022

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

Nebula Graph

A | B

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

:January 14, 2022

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 14, 2022

4.4.5

UNION UNION ALL INTERSECT MINUS

nGQL

Nebula Graph

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>	MINUS	<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 14, 2022

4.4.6

Nebula Graph

+

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

Nebula Graph

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

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4.4.7

Nebula Graph 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" |
+-----+
```

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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	$x < y \leq z$	$(x < y) \leq z$

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4.5

4.5.1

Nebula Graph

double abs(double x)	x
double floor(double x)	x
double ceil(double x)	x
double round(double x, int y)	x y y 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 max min 0 32 int
int rand64(int min, int max)	[min, max] 64 max min 0 64 int
collect()	
avg()	
count()	
max()	
min()	
std()	
sum()	
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 -1		
	x 1 1		
double e()	e 2.718281828459045		
double pi()	π 3.141592653589793		
double radians()	radians(180) 3.141592653589793		

Note

NULL

```
# 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 |
+-----+-----+
Got 2 rows (time spent 4739/5064 us)
```

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4.5.2

Nebula Graph

Note

SQL nGQL

1

C

0

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(string 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				
string toString()						
int hash()						

Note

NULL

```
substr() substring()  
•      0  
• pos 0  
• pos  
• pos      BAD_DATA  
• count| pos  
• count 0  
• NULL
```

↑ openCypher

```
• openCypher      a null null  
• openCypher    pos 0           count  
• openCypher    pos count null
```

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4.5.3

Nebula Graph

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

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4.5.4 Schema

Nebula Graph Schema

nGQL

Note

YIELD WHERE

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

Note

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

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

```

nebula> GO FROM "player100" OVER follow REVERSELY \
    YIELD src(edge) AS destination;
+-----+
| destination |
+-----+
| "player101" |
| "player102" |
...
nebula> LOOKUP ON player WHERE player.age > 45 YIELD id(vertex);
+-----+
| id(VERTEX) |
+-----+
| "player144" |
| "player140" |
+-----+
nebula> MATCH (a:player) WHERE id(a) == "player100" \
    RETURN tags(a), labels(a), properties(a);
+-----+-----+-----+
| tags(a) | labels(a) | properties(a) |
+-----+-----+-----+
| ["player"] | ["player"] | {age: 42, name: "Tim Duncan"} |
+-----+-----+-----+
nebula> MATCH p = (a :player {name : "Tim Duncan"})-[r:serve]-(t) \
    RETURN type(r), rank(r);
+-----+
| type(r) | rank(r) |
+-----+
| "serve" | 0 |
+-----+
nebula> MATCH p = (a :player {name : "Tim Duncan"})-[r:serve]-(t) \
    RETURN startNode(p), endNode(p);
+-----+-----+
| startNode(p) | endNode(p) |
+-----+-----+
| ("player100" :player{age: 42, name: "Tim Duncan"}) | ("team204" :team{name: "Spurs"}) |
+-----+-----+

```

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4.5.5 CASE

CASE	nGQL	YIELD	RETURN	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"    |
+-----+
```

```
CASE
WHEN <condition> THEN <result>
[WHEN ...]
```

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

condition	condition	true
result	condition	true
default		default

```
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"         | "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	<code>\$\$.player.age</code>	<code>\$\$.player.age > 35</code>	36
• <code>\$\$.player.age</code>	36	int	
• <code>\$\$.player.age > 35</code>	true	boolean	

No

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4.5.6

Nebula Graph List

List

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)		
coalesce(list)		
reduce()	reduce	



NULL

4.5.7 count

- count()
- nGQL count() GROUP BY YIELD
- openCypher count() RETURN GROUP BY

```
count({expr | *})
```

- count(*) NULL
- count(expr)
- count() size()

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

- \$-.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"}) -- (v2) \
           RETURN count(DISTINCT v2);
+-----+
| count(distinct v2) |
+-----+
| 11 |
+-----+

#      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         |
+-----+
```

:January 14, 2022

4.5.8 collect

collect()
 collect() SQL GROUP BY

```
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.player.name);
+-----+
| age | collect(n.player.name) |
+-----+
| 24 | ["Giannis Antetokounmpo"] |
| 20 | ["Luka Doncic"] |
| 25 | ["Joel Embiid", "Kyle Anderson"] |
+-----+
| ... |
```

:January 14, 2022

4.5.9 reduce

reduce()	e e	Lisp
Scala fold reduce		

openCypher

openCypher reduce() nGQL Cypher reduce()

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

accumulator

initial accumulator

variable

list

expression accumulator



```
nebula> RETURN reduce(totalNum = 10, n IN range(1, 3) | totalNum + n) AS r;
+---+
| r |
+---+
| 16 |
+---+

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

: January 14, 2022

4.5.10 hash

hash()	NULL
hash()	MurmurHash2
	seed 0xc70f6907UL

Java

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

nGQL 1.0	VID	hash	VID	nGQL 2.0	VID
----------	-----	------	-----	----------	-----

```
nebula> YIELD hash(-123);
+-----+
| hash(-(123)) |
+-----+
| -123         |
+-----+
```

```
nebula> YIELD hash("to_be_hashed");
+-----+
| hash("to_be_hashed") |
+-----+
| -1098333533029391540 |
+-----+
```

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

```
nebula> YIELD hash(true);
+-----+
| hash(true) |
+-----+
| 1          |
+-----+
nebula> YIELD hash(false);
+-----+
| hash(false) |
+-----+
| 0          |
+-----+
```

NULL

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

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

:January 17, 2022

4.5.11 concat

```
concat() concat_ws()
```

concat()

```
concat()
•
•      NULL    concat()      NULL
```

```
concat(string1,string2,...)
```

```
// 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
•      NULL    concat_ws()      NULL
•      NULL
•      NULL      NULL
```

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

```
//      +    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" |
+-----+
```

:January 14, 2022

4.5.12

true false WHERE

Nebula Graph

	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.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 14, 2022

4.5.13 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 geography_1	geography_2 True	geography_2	
ST_CoveredBy(geography_1, geography_2)	BOOL	geography_2 geography_2	geography_1 True	geography_1	
ST_DWithin(geography_1, geography_2, distance)	BOOL	geography_1 distance	geography_2 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)'')) |
+-----+
| 1568523.0187677438
+-----+
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,
1160591697722212352] |
+-----+

```

:January 14, 2022

4.5.14

openCypher

Nebula Graph 3.0.1

UDF

: January 14, 2022

4.6

4.6.1 MATCH

```
MATCH      pattern
          MATCH      Nebula Graph
          RETURN
          basketballplayer
```

```
GO  LOOKUP      MATCH      MATCH      trail
MATCH
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  WHERE  id()      VID
•           MATCH (v) RETURN v  LIMIT N      LIMIT
•     Tag      Edge Type      MATCH (v:player) RETURN v  LIMIT N      LIMIT
```

MATCH WHERE

Note

match



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

```
#  Tag player  name      Edge type follow
nebula> CREATE TAG INDEX IF NOT EXISTS name ON player(name(20));
nebula> CREATE EDGE INDEX IF NOT EXISTS follow_index on follow();
#
nebula> REBUILD TAG INDEX name;
+-----+
| 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 |
+-----+-----+-----+-----+
| 121 | "REBUILD_TAG_INDEX" | "FINISHED" | 2021-05-27T02:18:02.000000 | 2021-05-27T02:18:02.000000 |
| 0 | "storaged1" | "FINISHED" | 2021-05-27T02:18:02.000000 | 2021-05-27T02:18:02.000000 |
| 1 | "storaged0" | "FINISHED" | 2021-05-27T02:18:02.000000 | 2021-05-27T02:18:02.000000 |
| 2 | "storaged2" | "FINISHED" | 2021-05-27T02:18:02.000000 | 2021-05-27T02:18:02.000000 |
+-----+-----+-----+-----+

nebula> SHOW JOB 122;
+-----+-----+-----+-----+
| Job Id(TaskId) | Command(Dest) | Status | Start Time | Stop Time |
+-----+-----+-----+-----+
| 122 | "REBUILD_EDGE_INDEX" | "FINISHED" | 2021-05-27T02:18:11.000000 | 2021-05-27T02:18:11.000000 |
| 0 | "storaged1" | "FINISHED" | 2021-05-27T02:18:11.000000 | 2021-05-27T02:18:21.000000 |
| 1 | "storaged0" | "FINISHED" | 2021-05-27T02:18:11.000000 | 2021-05-27T02:18:21.000000 |
| 2 | "storaged2" | "FINISHED" | 2021-05-27T02:18:11.000000 | 2021-05-27T02:18:21.000000 |
+-----+-----+-----+-----+

```



Nebula Graph 3.0.0 MATCH (v) RETURN v

Nebula Graph 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



Nebula Graph 3.0.0 Tag Tag Tag Tag MATCH Nebula Graph 3.0.0 Tag
LIMIT

:<tag_name> 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 :

```

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"}) |
+-----+
```

Note

Tag

MATCH

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"}) |
+-----+
```

**↑
inCypher**

openCypher 9 = nGQL == =

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"}-[: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"})> |  
+-----+-----+
```

↑↑enCypher

nGQL @ rank openCypher rank



Nebula Graph 3.0.0

MATCH

Nebula Graph 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]-



Nebula Graph 3.0.0 Edge Type Edge type

Edge Type MATCH

Nebula Graph 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}] |  
+-----+
```

Note

Edge type MATCH

{<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

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

```
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"})
...
...
```

:<edge_type>*<hop> 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"})
+-----+
```

:<edge_type>*[minHop]..<maxHop>

minHop	minHop	1
maxHop	maxHop	

 **enCypher**

openCypher maxHop ... nGQL maxHop ...

```
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"})
...
...
```

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"

```
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> 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"}) |
+-----+-----+
```

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



Nebula Graph 3.0.1 MATCH . GO , LOOKUP , | FETCH MATCH

: March 9, 2022

4.6.2 OPTIONAL MATCH

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 17, 2022

4.6.3 LOOKUP

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

OpenCypher

nGQL

- 90%
- Explain



2.5.0

`LOOKUP`

`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>] ...];
```

- `WHERE <expression>` `AND` `OR` `WHERE`
- `YIELD` `YIELD`
- `AS`

WHERE

- `LOOKUP` `WHERE`
- `$-` `$^`
- `tagName.prop1 > tagName.prop2`
- `AliasProp`
- `XOR`
- `STARTS WITH`
-

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" @0 {degree: 90}] |
| [:follow "player118"-->"player120" @0 {degree: 90}] |
| [:follow "player118"-->"player131" @0 {degree: 90}] |
...
nebula> LOOKUP ON follow \
    WHERE follow.degree == 90 \
```

```

    YIELD properties(edge).degree;
+-----+
| properties(EDGE).degree |
+-----+
| 90 |
| 90 |
| 90 |
| ... |

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" |
| ... |

```

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



[SHOW STATS](#)

: March 28, 2022

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> ::= 
  <id> [, <id> ...]

<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 Nebula Graph
 - 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

Note

Edge type WHERE WHERE edge1.prop1 > edge2.prop2

- | | | Schema | src(edge) | dst(edge) | type(edge) |
|----------------------------------|---------------|--------|-----------|-----------|------------|
| • YIELD [DISTINCT] <return_list> | <return_list> | YIELD | | | |
| • SAMPLE <sample_list> | | SAMPLE | | | |
| • <limit_by_list_clause> | | LIMIT | | | |
| • GROUP BY | GROUP BY | YIELD | | | |
| • ORDER BY | ORDER BY | | | | |

Note

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

```

#     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($$).age AS age \
          | GROUP BY $-.dst \
          YIELD $-.dst AS dst, collect_set($-.src) AS src, collect($-.age) AS age;
+-----+-----+-----+
| dst      | src      | age      |
+-----+-----+-----+
| "player125" | ["player101"] | [41]    |
| "player100" | ["player125", "player101"] | [42, 42] |
| "player102" | ["player101"] | [33]    |
+-----+-----+-----+
#
nebula> $a = GO FROM "player100" OVER follow YIELD src(edge) AS src, dst(edge) AS dst; \
          GO 2 STEPS FROM $a.dst OVER follow \
          YIELD $a.src AS src, $a.dst, src(edge), dst(edge) \
          | ORDER BY $-.src | OFFSET 1 LIMIT 2;
+-----+-----+-----+-----+
| src      | $a.dst      | src(EDGE)   | dst(EDGE)   |
+-----+-----+-----+-----+
| "player100" | "player125" | "player100" | "player101" |
| "player100" | "player101" | "player100" | "player125" |
+-----+-----+-----+-----+
#
IS NOT EMPTY
nebula> GO FROM "player100" OVER follow WHERE properties($$).name IS NOT EMPTY YIELD dst(edge);
+-----+
| dst(EDGE) |
+-----+
| "player125" |
| "player101" |
+-----+

```

:January 17, 2022

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: 40, 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 14, 2022

4.6.6 SHOW

SHOW CHARSET

```
SHOW CHARSET
```

```
utf8  utf8mb4      utf8  Nebula Graph    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 14, 2022

SHOW COLLATION

SHOW COLLATION

- utf8 utf8_bin
- utf8mb4 utf8mb4_bin
- utf8_general_ci utf8mb4_general_ci

SHOW COLLATION;

```
nebula> SHOW COLLATION;
+-----+-----+
| Collation | Charset |
+-----+-----+
| "utf8_bin" | "utf8"  |
+-----+-----+
```

Collation

Charset

:January 14, 2022

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)) ON default" |
+-----+
```

:January 14, 2022

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 14, 2022

SHOW HOSTS

SHOW HOSTS Graph Storage Meta

SHOW HOSTS [GRAPH | STORAGE | META];



Nebula Graph

```
nebula> SHOW HOSTS;
+-----+-----+-----+-----+-----+-----+
| Host | Port | Status | Leader count | Leader distribution | Partition distribution | Version |
+-----+-----+-----+-----+-----+-----+
| "storaged0" | 9779 | "ONLINE" | 8 | "docs:5, basketballplayer:3" | "docs:5, basketballplayer:3" | "3.0.1" |
| "storaged1" | 9779 | "ONLINE" | 9 | "basketballplayer:4, docs:5" | "docs:5, basketballplayer:4" | "3.0.1" |
| "storaged2" | 9779 | "ONLINE" | 8 | "basketballplayer:3, docs:5" | "docs:5, basketballplayer:3" | "3.0.1" |
+-----+-----+-----+-----+-----+-----+

nebula> SHOW HOSTS GRAPH;
+-----+-----+-----+-----+-----+
| Host | Port | Status | Role | Git Info Sha | Version |
+-----+-----+-----+-----+-----+
| "graphd" | 9669 | "ONLINE" | "GRAPH" | "3ba41bd" | "3.0.1" |
| "graphd1" | 9669 | "ONLINE" | "GRAPH" | "3ba41bd" | "3.0.1" |
| "graphd2" | 9669 | "ONLINE" | "GRAPH" | "3ba41bd" | "3.0.1" |
+-----+-----+-----+-----+-----+-----+

nebula> SHOW HOSTS STORAGE;
+-----+-----+-----+-----+-----+
| Host | Port | Status | Role | Git Info Sha | Version |
+-----+-----+-----+-----+-----+
| "storaged0" | 9779 | "ONLINE" | "STORAGE" | "3ba41bd" | "3.0.1" |
| "storaged1" | 9779 | "ONLINE" | "STORAGE" | "3ba41bd" | "3.0.1" |
| "storaged2" | 9779 | "ONLINE" | "STORAGE" | "3ba41bd" | "3.0.1" |
+-----+-----+-----+-----+-----+-----+

nebula> SHOW HOSTS META;
+-----+-----+-----+-----+-----+
| Host | Port | Status | Role | Git Info Sha | Version |
+-----+-----+-----+-----+-----+
| "metad2" | 9559 | "ONLINE" | "META" | "3ba41bd" | "3.0.1" |
| "metad0" | 9559 | "ONLINE" | "META" | "3ba41bd" | "3.0.1" |
| "metad1" | 9559 | "ONLINE" | "META" | "3ba41bd" | "3.0.1" |
+-----+-----+-----+-----+-----+-----+
```

: March 15, 2022

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 14, 2022

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



Nebula Graph 2.0.1

SHOW TAG/EDGE INDEXES

Names

:January 14, 2022

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 14, 2022

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 14, 2022

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 14, 2022

SHOW SPACES

SHOW SPACES

CREATE SPACE

SHOW SPACES;

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

:January 14, 2022

SHOW STATS

SHOW STATS STATS

-
-
- Tag
- Edge type

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            |
+-----+-----+-----+-----+
| 98             | "STATS"       | "FINISHED" | 2021-11-01T09:33:21.000000 | 2021-11-01T09:33:21.000000 |
| 0              | "storaged2"   | "FINISHED" | 2021-11-01T09:33:21.000000 | 2021-11-01T09:33:21.000000 |
| 1              | "storaged0"   | "FINISHED" | 2021-11-01T09:33:21.000000 | 2021-11-01T09:33:21.000000 |
| 2              | "storaged1"   | "FINISHED" | 2021-11-01T09:33:21.000000 | 2021-11-01T09:33:21.000000 |
+-----+-----+-----+-----+

#
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 14, 2022

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 14, 2022

SHOW USERS

SHOW USERS

GOD root SHOW USERS

SHOW USERS;

```
nebula> SHOW USERS;
+-----+
| Account |
+-----+
| "root"  |
| "user1" |
+-----+
```

:January 14, 2022

SHOW SESSIONS

Nebula Graph

- `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 |
|-----+-----+-----+-----+-----+-----+
| 1635128818397714 | "root" | "test" | 2021-10-25T02:26:58.397714 | 2021-10-25T08:31:31.846846 | "127.0.0.1:9669" | 0 | "::ffff:
127.0.0.1" |
| 1635254859271703 | "root" | "basketballplayer" | 2021-10-26T13:27:39.271703 | 2021-10-26T13:51:38.277704 | "127.0.0.1:9669" | 0 | "::ffff:
127.0.0.1" |
| 1634871229727322 | "root" | "basketballplayer" | 2021-10-22T02:53:49.727322 | 2021-10-22T02:53:56.564001 | "127.0.0.1:9669" | 0 | "::ffff:
127.0.0.1" |
| 1635750725840229 | "root" | "basketballplayer" | 2021-11-01T07:12:05.840229 | 2021-11-01T09:42:36.883617 | "127.0.0.1:9669" | 0 | "::ffff:
127.0.0.1" |
| 1635299224732060 | "root" | "basketballplayer" | 2021-10-27T01:47:04.732060 | 2021-10-27T09:04:31.741126 | "127.0.0.1:9669" | 0 | "::ffff:
127.0.0.1" |
| 1634628999765689 | "root" | "" | 2021-10-19T07:36:39.765689 | 2021-10-19T07:36:39.768064 | "127.0.0.1:9669" | 0 | "::ffff:
127.0.0.1" |
| 1634886296595136 | "root" | "basketballplayer" | 2021-10-22T07:04:56.595136 | 2021-10-22T09:48:20.299364 | "127.0.0.1:9669" | 0 | "::ffff:
127.0.0.1" |
| 1634629179882439 | "root" | "basketballplayer" | 2021-10-19T07:39:39.882439 | 2021-10-19T09:34:52.153145 | "127.0.0.1:9669" | 0 | "::ffff:
127.0.0.1" |
| 1635246158961634 | "root" | "basketballplayer" | 2021-10-26T11:02:38.961634 | 2021-10-26T11:02:51.250897 | "127.0.0.1:9669" | 0 | "::ffff:
127.0.0.1" |
| 1634785346839017 | "root" | "basketballplayer" | 2021-10-21T03:02:26.839017 | 2021-10-21T11:07:40.911329 | "127.0.0.1:9669" | 0 | "::ffff:
127.0.0.1" |
+-----+-----+-----+-----+-----+-----+
nebula> SHOW SESSION 1635254859271703;
+-----+-----+
| VariableName | Value |
|-----+-----+
| "SessionID" | 1635254859271703 |
| "UserName" | "root" |
| "SpaceName" | "basketballplayer" |
| "CreateTime" | 2021-10-26T13:27:39.271703 |
| "UpdateTime" | 2021-10-26T13:51:38.277704 |
| "GraphAddr" | "127.0.0.1:9669" |
| "Timezone" | 0 |
+-----+-----+
```

"ClientIp" "::ffff:127.0.0.1"
+-----+-----+

SessionId	ID
UserName	
SpaceName	" "
CreateTime	timezone_name
UpdateTime	timezone_name
GraphAddr	Graph
Timezone	
ClientIp	IP

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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 14, 2022

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 14, 2022

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

```
#      player100          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()

:January 14, 2022

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

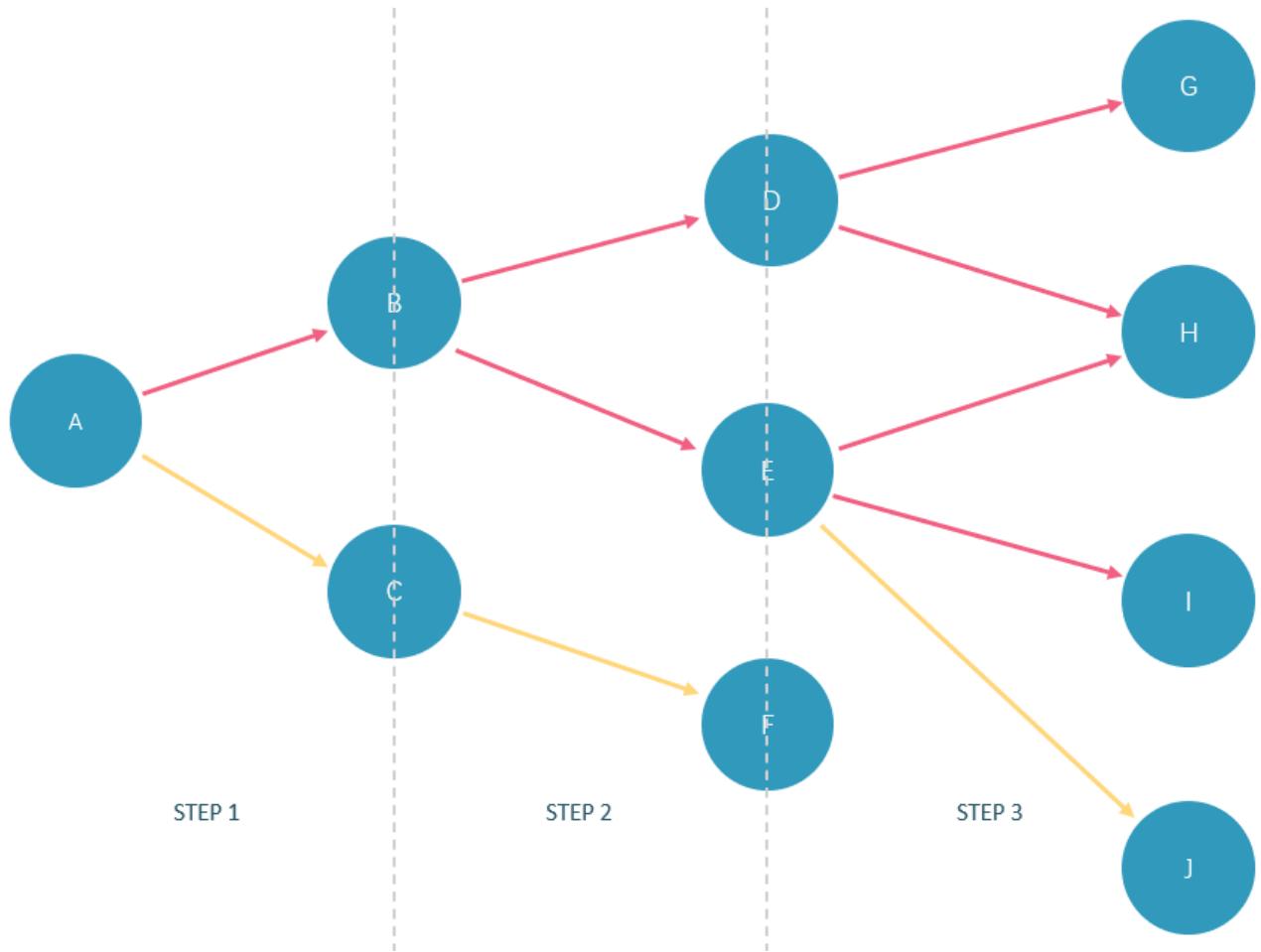
```
#              3
nebula> LOOKUP ON player YIELD id(vertex)|\
          LIMIT 3;
+-----+
| id(VERTEX)  |
+-----+
| "player100"  |
| "player101"  |
| "player102"  |
+-----+
#              2      3
nebula> GO FROM "player100" OVER follow REVERSELY \
          YIELD properties($$).name AS Friend, properties($$).age 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
      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 * \
YIELD dst(edge) \
LIMIT [rand32(5),rand32(5),rand32(5)];
+-----+
| dst(EDGE)  |
+-----+
| "team204"  |
| "team215"  |
| "player100" |
| "player102" |
+-----+
```

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

```
nebula> MATCH (v:player) RETURN v.player.name AS Name, v.player.age AS Age \
    ORDER BY Age LIMIT rand32(5);
+-----+-----+
| Name | Age |
+-----+-----+
| "Luka Doncic" | 20 |
| "Ben Simmons" | 22 |
| "Kristaps Porzingis" | 23 |
| "Giannis Antetokounmpo" | 24 |
+-----+-----+
```

SKIP**SKIP**

```
nebula> MATCH (v: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 (v: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 (v: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
-----	-----

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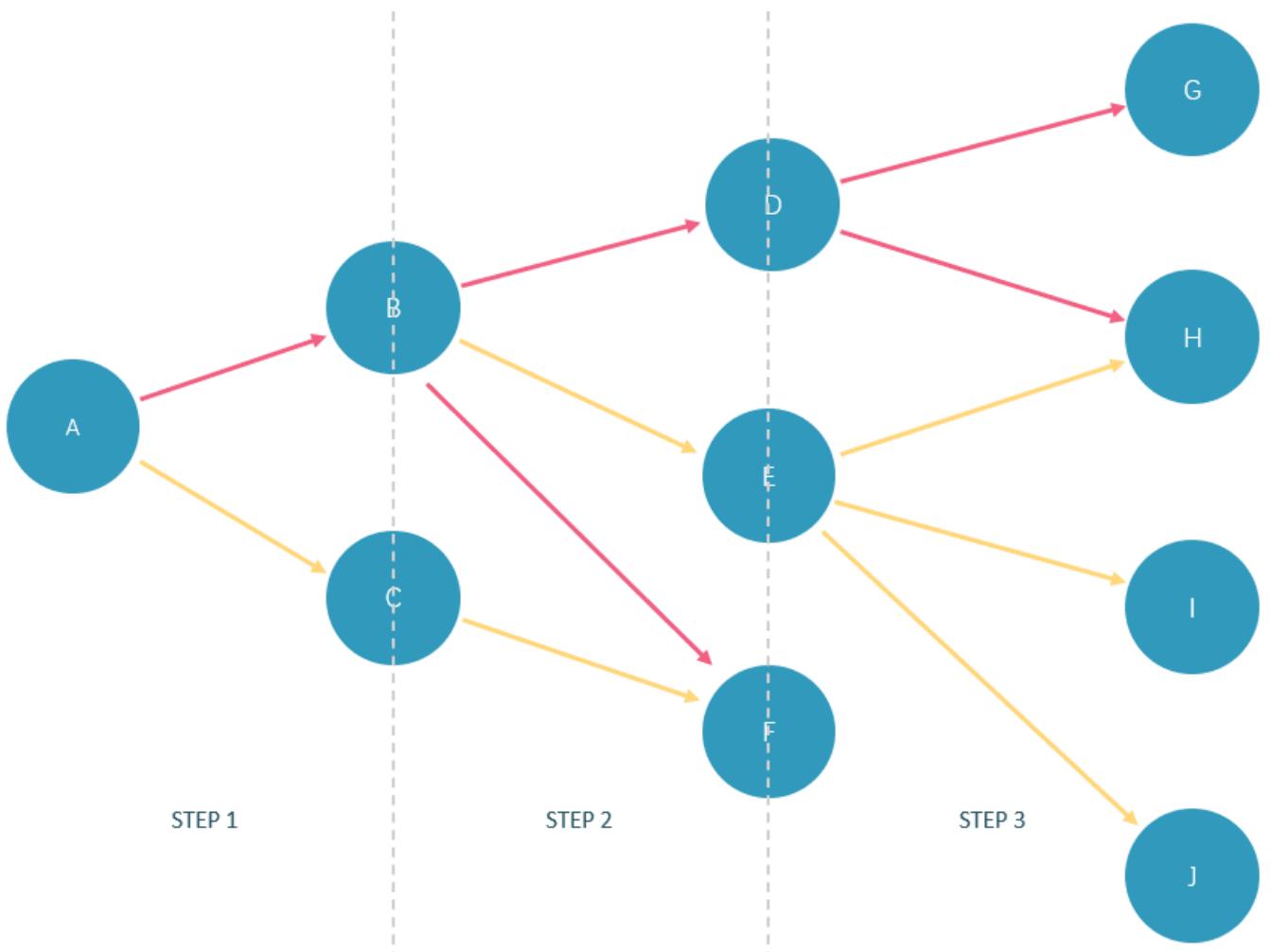
4.7.3 SAMPLE

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 4		
• GO 1 TO 3 STEPS		GO GO	GO 1 TO 3 STEPS GO 3
STEPS			



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 18, 2022

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      |
| "Spurs"     | UNKNOWN_PROP |
+-----+

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      |
+-----+
| "Spurs"   | UNKNOWN_PROP |
| "Manu Ginobili" | 41      |
| "Tony Parker" | 36      |
+-----+
```

:January 14, 2022

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" :star{} :player{age: 42, name: "Tim Duncan"}}, {"player204" :team{name: "Spurs"}}, {"player101" :player{name: "Tony Parker", age: 36}}, {"player125" :player{name: "Manu Ginobili", age: 41}}]
+-----+
```

```
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"})>
| | 1
| | |
| <("player100" :player{age: 42, name: "Tim Duncan"})-[:follow@0 {degree: 95}]->("player101" :player{age: 36, name: "Tony
Parker"})>
| | 1
| | |
| <("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 |
+-----+
```

: February 15, 2022

4.7.6 TTL

TTL Time To Live

openCypher

nGQL

- TTL Schema
- TTL INDEX
 - + Tag INDEX TTL Tag TTL
 - + TTL INDEX
- Tag
- Tag Tag Tag

Edge type

Nebula Graph

Compaction

Note

TTL Compaction

TTL

nGQL TTL

ttl_col	int timestamp
ttl_duration	64 ttl_duration 0

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;
```

: March 25, 2022

4.7.7 WHERE

WHERE

WHERE

- nGQL GO LOOKUP
- openCypher MATCH WITH

openCypher

- WHERE Pattern TODO: planning WHERE (v)-->(v2)
- 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;
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   |
+-----+-----+
```

CONTATNS

CONTATNS

```
nebula> MATCH (v:player) \
    WHERE v.player.name CONTAINS "Pa" \
    RETURN v.player.name, v.player.age;
```

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 14, 2022

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

col	col
alias	col
	AS

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 14, 2022

4.7.9 WITH

WITH

openCypher

openCypher



nGQL WITH 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 14, 2022

4.7.10 UNWIND

UNWIND

UNWIND

```
UNWIND <list> AS <alias> <RETURN clause>;
```

```
nebula> UNWIND [1,2,3] AS n RETURN n;
+---+
| n |
+---+
| 1 |
| 2 |
| 3 |
+---+
```

UNWIND WITH DISTINCT

1

1. [1,1,2,2,3,3]
- 2.
- 3.
- 4.

```
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] |
+-----+
```

2

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

```
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: "Shaquile O'Neal"}, "player105":player{age: 31, name: "Danny Green"}}, \
| {"player112":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"}}] |
+-----+
```

: January 14, 2022

4.8

4.8.1 CREATE SPACE

Nebula Graph 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>	Nebula Graph	1~4	UTF-8
--------------------	--------------	-----	-------

partition_num	5	3	15	100
---------------	---	---	----	-----

replica_factor	3	1	1
----------------	---	---	---

vid_type	ID INT64	FIXED_STRING(<N>)	INT64	INT	INT64	FIXED_STRING(<N>)	N
----------	-------------	-------------------	-------	-----	-------	-------------------	---

COMMENT	256
---------	-----

Caution

1 BALANCE Nebula Graph

Caution

VID

1. Nebula Graph 1.x VID INT64 Nebula Graph 2.x VID INT64 FIXED_STRING(<N>) VID INSERT
VID Wrong vertex id type: 1001
2. VID N The VID must be a 64-bit integer or a string fitting space vertex id length limit.



2.5.0 2.x vid_type FIXED_STRING(8)

Note

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>	Schema	Tag
`				
Edge type				

```
<old_graph_space_name>
```

```
#      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)) ON
default comment = '      '" |
+-----+
+-----+
```

Caution

2 20 heartbeat_interval_secs <5

```
nebula> SHOW HOSTS;
+-----+-----+-----+-----+-----+-----+
| Host    | Port | Status   | Leader count | Leader distribution | Partition distribution | Version |
+-----+-----+-----+-----+-----+-----+
| "storaged0" | 9779 | "ONLINE" | 8          | "basketballplayer:3, test:5" | "basketballplayer:10, test:10" | "3.0.1" |
| "storaged1" | 9779 | "ONLINE" | 9          | "basketballplayer:4, test:5"  | "basketballplayer:10, test:10" | "3.0.1" |
| "storaged2" | 9779 | "ONLINE" | 3          | "basketballplayer:3"        | "basketballplayer:10, test:10" | "3.0.1" |
+-----+-----+-----+-----+-----+-----+
```

```
nebula> BALANCE LEADER;
nebula> SHOW HOSTS;
+-----+-----+-----+-----+-----+
| Host    | Port | Status   | Leader count | Leader distribution | Partition distribution | Version |
+-----+-----+-----+-----+-----+
| "storaged0" | 9779 | "ONLINE" | 7          | "basketballplayer:3, test:4" | "basketballplayer:10, test:10" | "3.0.1" |
| "storaged1" | 9779 | "ONLINE" | 7          | "basketballplayer:4, test:3"  | "basketballplayer:10, test:10" | "3.0.1" |
+-----+-----+-----+-----+-----+
```

```
| "storaged2" | 9779 | "ONLINE" | 6           | "basketballplayer:3, test:3" | "basketballplayer:10, test:10" | "3.0.1" |
+-----+-----+-----+-----+-----+-----+-----+
```

: March 15, 2022

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 Nebula Graph

USE

Fabric Cypher

(USE +

:January 14, 2022

4.8.3 SHOW SPACES

SHOW SPACES

Nebula Graph

```
SHOW SPACES;
```

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

CREATE SPACE

:January 14, 2022

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      | Atomic Edge | Zones     | Comment |
+-----+-----+-----+-----+-----+-----+-----+
| 1  | "basketballplayer" | 10            | 1              | "utf8"  | "utf8_bin" | "FIXED_STRING(32)" | false      | "default" |           |
+-----+-----+-----+-----+-----+-----+-----+
```

: February 14, 2022

4.8.5 DROP SPACE

DROP SPACE

God

DROP SPACE

```
DROP SPACE [IF EXISTS] <graph_space_name>;
```

IF EXISTS

DROP SPACE

Storage

auto_remove_invalid_space=true

Storage

Storage

 Caution

: January 14, 2022

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 = <ttdl_duration>]
[TTL_COL = <prop_name>]
[COMMENT = '<comment>'];
```

IF NOT EXISTS	Tag	Tag	Tag
<tag_name>	Tag	Tag	Tag
<prop_name>	Tag		Tag
<data_type>			
NULL \ NOT NULL	NULL	NULL	
DEFAULT	Nebula Graph		
COMMENT	Tag	256	
TTL_DURATION			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 21, 2022

4.9.2 DROP TAG

DROP TAG	Tag	Tag	Compaction	---
• Tag	Tag	Tag	Compaction	
• Tag	Schema	Tag	Compaction	
•	DROP TAG			
• Tag	DROP TAG	[ERROR (-8)]: 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 18, 2022

4.9.3 ALTER TAG

ALTER TAG Tag

TTL Time-To-Live

- ALTER TAG
- ALTER TAG [ERROR (-8)]: 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

: February 18, 2022

4.9.4 SHOW TAGS

SHOW TAGS Tag

SHOW TAGS

SHOW TAGS;

```
nebula> SHOW TAGS;
+-----+
| Name      |
+-----+
| "player"  |
| "team"    |
+-----+
```

:January 14, 2022

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 14, 2022

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 14, 2022

4.9.7

openCypher	SET label	REMOVE label	
Nebula Graph	Tag	Tag	Tag
			DELETE TAG
			Tag
basketballplayer		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 14, 2022

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 = <ttl_duration>]
[TTL_COL = <prop_name>]
[COMMENT = '<comment>'];
```

IF NOT EXISTS	Edge type	Edge type	Edge type	Edge type	1~4	UTF-8
<edge_type_name>	Edge type	Edge type	Edge type	Edge type		
<prop_name>	Edge type		Edge type			
<data_type>						
NULL \ NOT NULL	NULL	NULL				
DEFAULT		Nebula Graph				
COMMENT	Edge type	256				
TTL_DURATION			0			
TTL_COL	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 21, 2022

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 (-8)]: 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 14, 2022

4.10.3 ALTER EDGE

ALTER EDGE Edge type TTL Time-To-Live

- `ALTER EDGE`
- `ALTER EDGE` [ERROR (-8)]: 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 14, 2022

4.10.4 SHOW EDGES

```
SHOW EDGES          Edge type
```

```
SHOW EDGES
```

```
SHOW EDGES;
```

```
nebula> SHOW EDGES;
+-----+
| Name      |
+-----+
| "follow"  |
| "serve"   |
+-----+
```

:January 14, 2022

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 14, 2022

4.11

4.11.1 INSERT VERTEX

`INSERT VERTEX` Nebula Graph

`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

Nebula Graph 3.0.1 Tag

- `property_name`
- `vid` ID Nebula Graph 3.0.1 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

```
#      Tag
nebula> INSERT VERTEX VALUES "1":();

#
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 (-1005)]: Storage Error: The not null field cannot be null.  
  
#      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 17, 2022

4.11.2 DELETE VERTEX

`DELETE VERTEX`

↑ Compatibility

Nebula Graph 2.x

Nebula Graph 3.0.1

`DELETE VERTEX`

Note

- `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;
```

Nebula Graph

Caution

-
- `nebula-graphd.conf` `--storage_client_timeout_ms`
- Nebula Graph 2 28

: March 21, 2022

4.11.3 UPDATE VERTEX

UPDATE VERTEX Tag

Nebula Graph 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 14, 2022

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 14, 2022

4.12

4.12.1 INSERT EDGE

<code>INSERT_EDGE</code>	Nebula Graph	<code>src_vid</code>	<code>dst_vid</code>
<code>INSERT_EDGE</code>	Edge type	<code>rank</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> ), ...];

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

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

```

- IF NOT EXISTS IF NOT EXISTS



- 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

```
#  
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 \
    "101" : "101"; ("101", 1), "101" : "101"; ("101", 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

- Nebula Graph 3.0.1 Dangling edge `<edgetype>._src <edgetype>._dst` VID
 -
 - edge conflict
 - `INSERT` `INSERT` `INSERT` storaged `INSERT` `INSERT` storaged `INSERT`
-

:January 25, 2022

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 18, 2022

4.12.3 UPDATE EDGE

UPDATE EDGE Edge type
 Nebula Graph 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;
+-----+-----+
| serve.start_year | serve.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 14, 2022

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 14, 2022

4.13

4.13.1

Nebula Graph

Nebula Graph

- 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 21, 2022

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



90%

Storage

256

1. Nebula Graph
- 2.
- 3.
4. LOOKUP MATCH Nebula Graph



--disable_auto_compaction = false

LOOKUP REBUILD INDEX)

2 20

can't find xxx in the space

heartbeat_interval_secs

Nebula Graph

Danger

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);
```

Caution

Tag Edge type

Note

" "

: February 28, 2022

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 18, 2022

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 18, 2022

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 14, 2022

4.13.6 REBUILD INDEX



— — — — — LOOKUP MATCH

CREATE INDEX

```
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        |
+-----+-----+-----+-----+-----+
| 31            | "REBUILD_TAG_INDEX" | "FINISHED"   | 2021-07-07T09:04:24.000 | 2021-07-07T09:04:24.000 |
| 0             | "storaged1"       | "FINISHED"   | 2021-07-07T09:04:24.000 | 2021-07-07T09:04:28.000 |
| 1             | "storaged2"       | "FINISHED"   | 2021-07-07T09:04:24.000 | 2021-07-07T09:04:28.000 |
| 2             | "storaged0"       | "FINISHED"   | 2021-07-07T09:04:24.000 | 2021-07-07T09:04:28.000 |
+-----+-----+-----+-----+-----+
```

Nebula Graph

ID SHOW JOB <job_id>

SHOW JOB

: February 15, 2022

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 14, 2022

4.13.8 DROP INDEX

```
DROP INDEX
```

```
DROP INDEX
```

```
DROP TAG INDEX  DROP EDGE INDEX
```

```
DROP {TAG | EDGE} INDEX [IF EXISTS] <index_name>;
```

```
IF NOT EXISTS
```

```
nebula> DROP TAG INDEX player_index_0;
```

:January 14, 2022

4.14

4.14.1



16

- LOOKUP
 - 256
 - Tag/Edge type Tag/Edge type
 - Tag/Edge type
 - String
 - Tag/Edge type
 -
 - NULL
 - Elastic Search
 -
 - WHERE
 -
 - Elasticsearch Nebula Graph Elasticsearch
 - ' ' \ Elasticsearch
 - Nebula Graph listener Elasticsearch
 - K8s Nebula Graph
-

:January 18, 2022

4.14.2

Nebula Graph Elasticsearch Elasticsearch listener Elasticsearch

Elasticsearch

Elasticsearch Kubernetes Elasticsearch Elasticsearch
 Elasticsearch Nebula Graph Elasticsearch
 ES 7.0

```
{
  "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;
```

: March 1, 2022

4.14.3 Raft listener

Elasticsearch	Storage	Raft listener	listener	Storage	Elasticsearch
•					
• Nebula Graph					
• Elasticsearch					
• Raft listener					
• Nebula Metad Storage Graphd listener					
• " listener " listener listener listener					
STORAGE					
listener storaged			listener	Nebula Graph	Storage
DEB Nebula Graph					RPM
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 NEBULA GRAPH

Nebula Graph 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;
```

Danger

listener listener ES

listener Elasticsearch

: January 14, 2022

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> USE basketballplayer;
//
//   listener   Nebula Graph
nebula> ADD LISTENER ELASTICSEARCH 192.168.8.5:9789;
//
//   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;
```

: March 1, 2022

4.15

4.15.1 GET SUBGRAPH

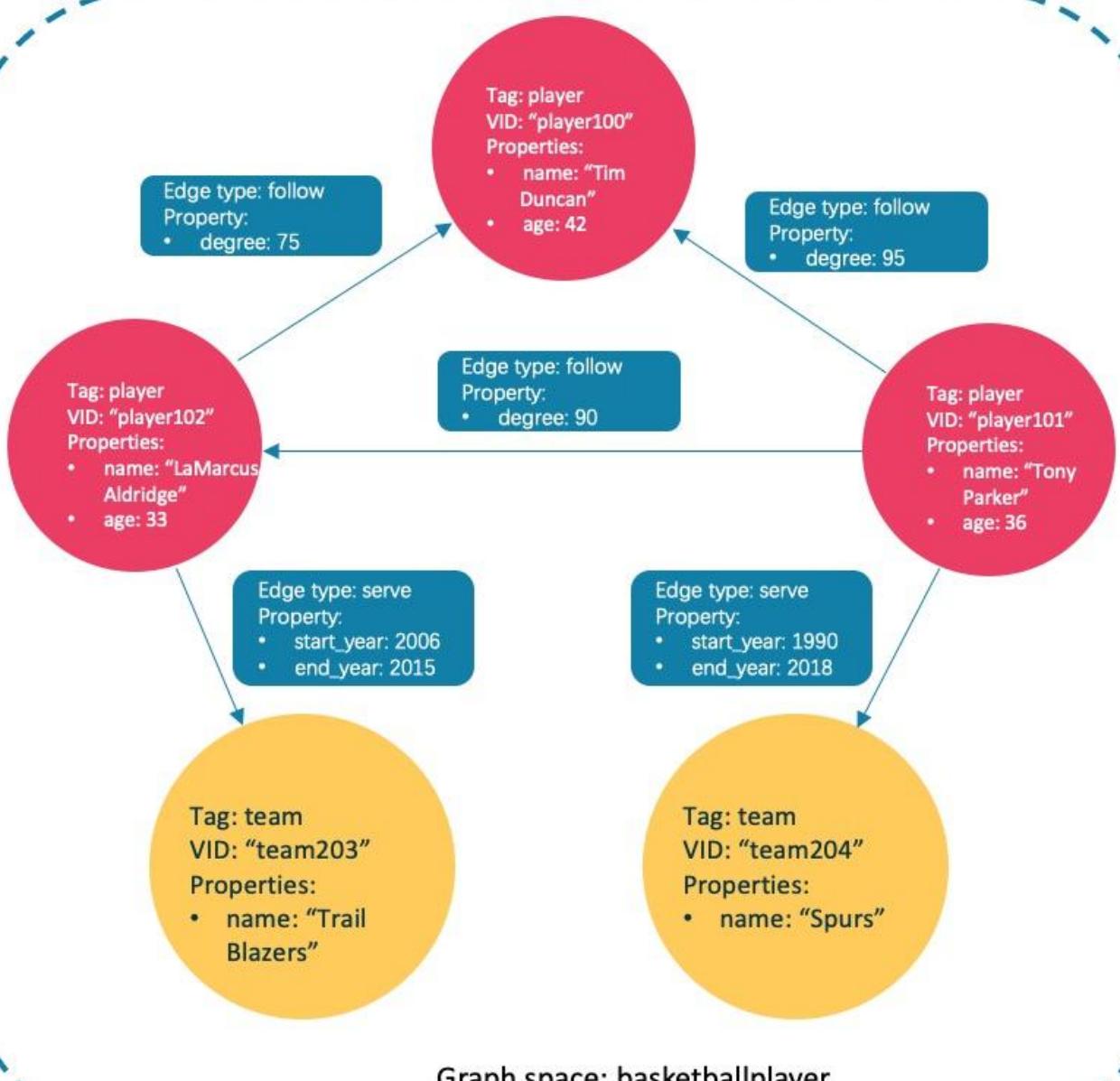
GET SUBGRAPH Edge type

```
GET SUBGRAPH [WITH PROP] [<step_count> STEPS] FROM {<vid>, <vid>...}
[{IN | OUT | BOTH} <edge_type>, <edge_type>...]
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
- YIELD

 Note

GET SUBGRAPH trail



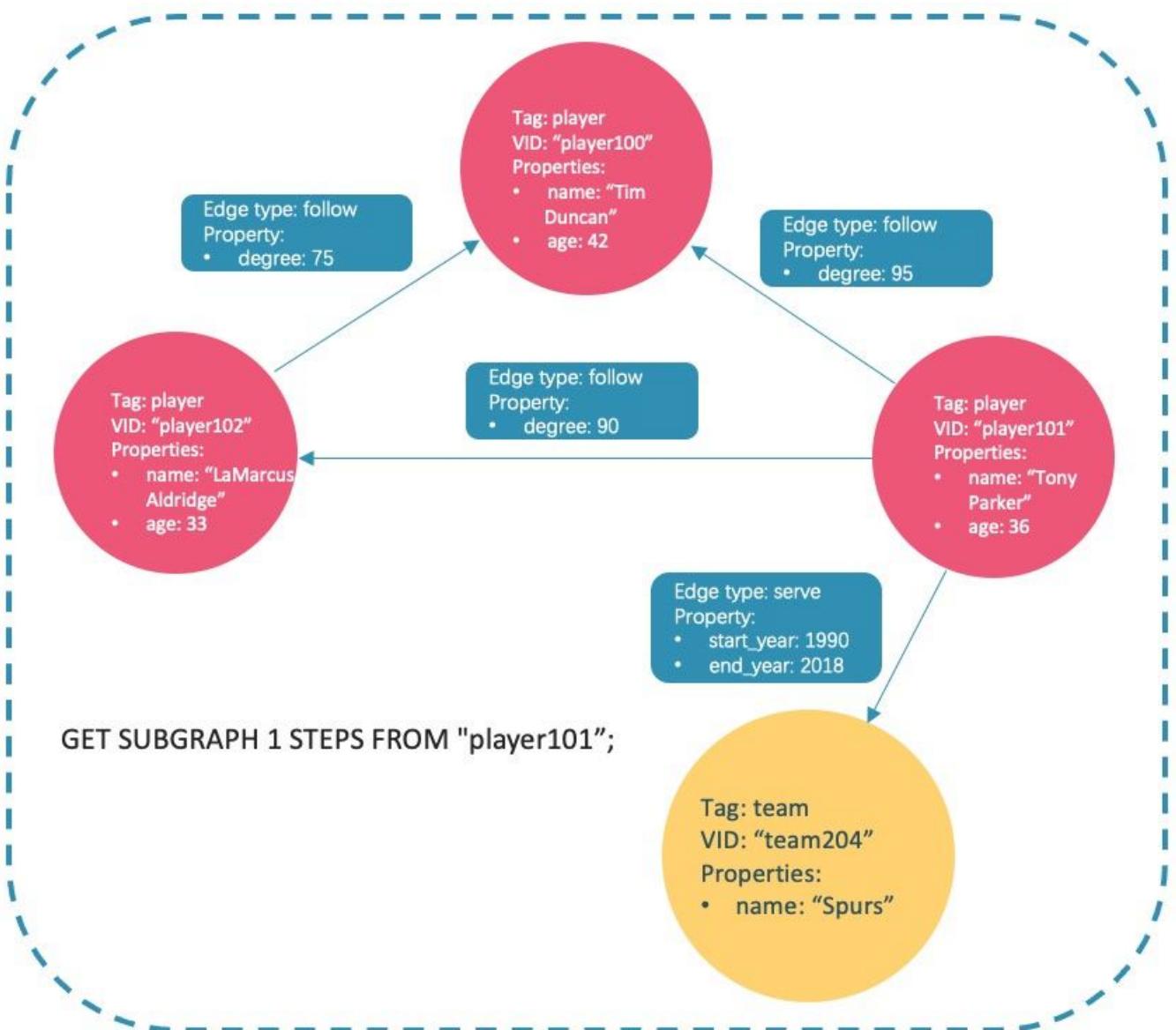
```

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{}}, {"player100":player{}}, {"team204":team{}}, {"team203":team{}}]
| [:follow "player101"->"player102" @0 {}], [:follow "player101"->"player100" @0 {}], [:serve "player101"->"team204" @0 {}], [:follow "player102"->"player100" @0 {}]
+-----+
```



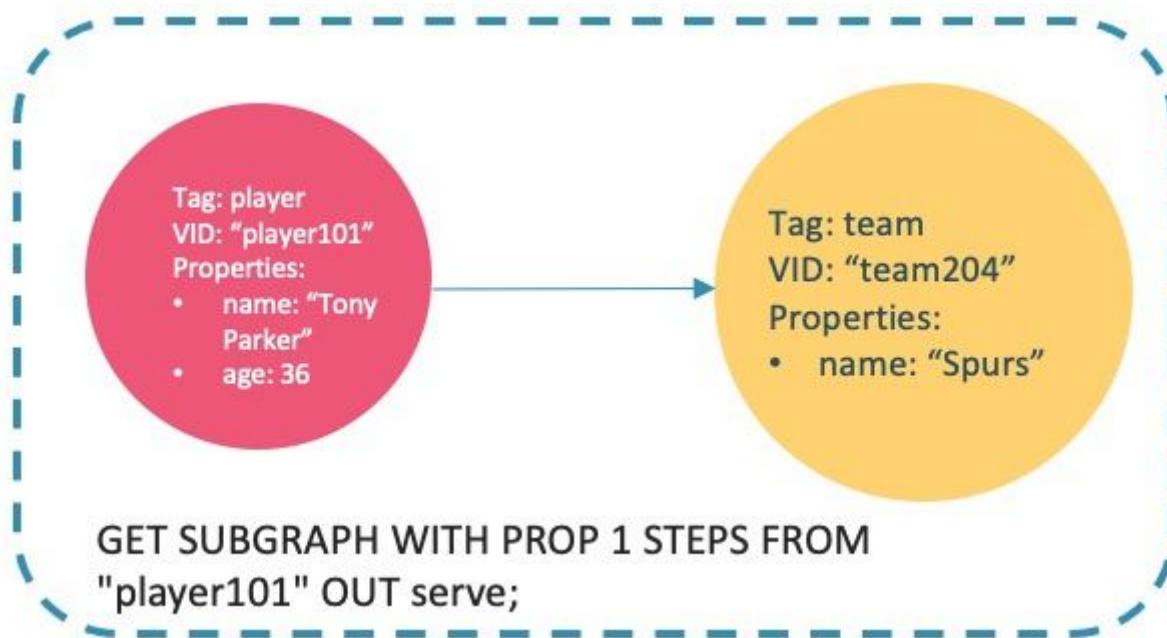
- player101 0~1 follow

```
nebula> GET SUBGRAPH 1 STEPS FROM "player101" IN follow YIELD VERTICES AS nodes, EDGES AS relationships;
+-----+-----+
| nodes | relationships |
+-----+-----+
| [{"player101":player{}}] | []
| [] | []
+-----+-----+
```

player101 follow player101

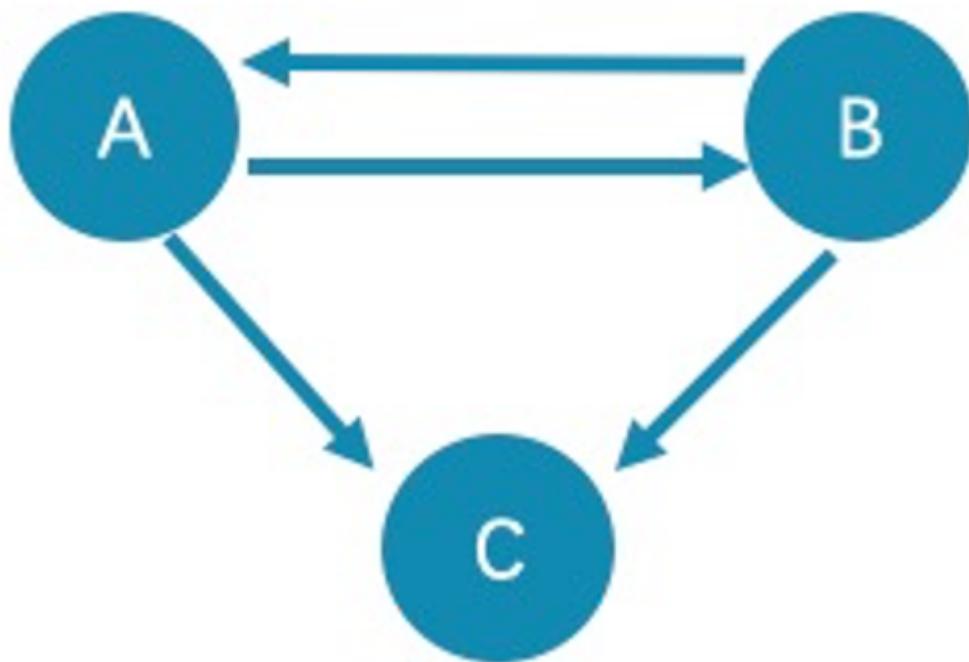
- player101 0~1 serve

```
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":@0 {end_year: 2018, start_year: 1999}}], [{"team204":team{name: "Spurs"}}, []]
+-----+-----+
```



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 id(vertex);
  
```

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 14, 2022

4.15.2 FIND PATH

FIND PATH

```
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 , * Edge type
- REVERSELY | BIDIRECT REVERSELY BIDIRECT
- <WHERE clause> WHERE
- <N> 5
- <M>



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

```
FIND ALL PATH FROM "player100" TO "team204" OVER * WHERE follow.degree is EMPTY or follow.degree >= 0;
```

:January 18, 2022

4.16

4.16.1 EXPLAIN PROFILE

```
EXPLAIN      nGQL          nGQL  
PROFILE      nGQL
```

Nebula Graph

```
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

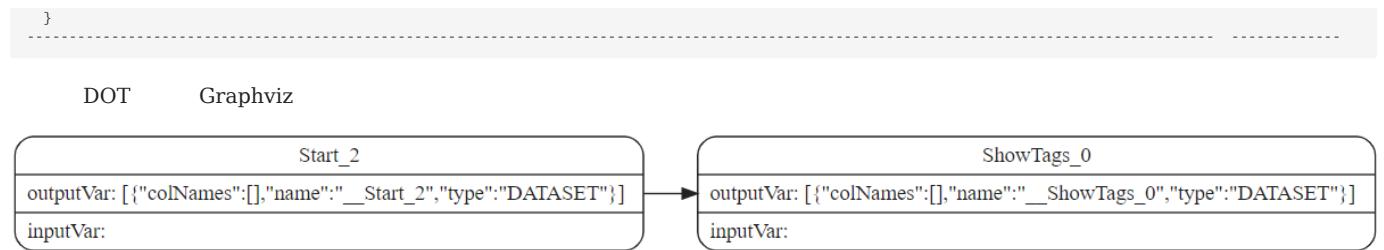
id	name	dependencies	profiling data	operator info
1	ShowTags 0		ver: 0, rows: 1, execTime: 42us, totalTime: 1177us outputVar: [{"colNames":[], "name": "__ShowTags_1", "type": "DATASET"}]	
			inputVar:	

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: \[\{"colNames":[], "name": "__ShowTags_0", "type": "DATASET"\}\]\1|inputVar:\1",    shape=Mrecord;
    "Start_2"->"ShowTags_0";
    "Start_2"[label="Start_2"]outputVar: \[\{"colNames":[], "name": "__Start_2", "type": "DATASET"\}\]\1|inputVar: \1",    shape=Mrecord;
```



:January 14, 2022

4.17

4.17.1 BALANCE



BALANCE

BALANCE LEADER Zone leader ID

:January 20, 2022

4.17.2

Storage

COMPACT FLUSH STATS



SUBMIT JOB COMPACT

SUBMIT JOB COMPACT	RocksDB	compact
compact	Storage	

```
nebula> SUBMIT JOB COMPACT;
+-----+
| New Job Id |
+-----+
| 40          |
+-----+
```

SUBMIT JOB FLUSH

SUBMIT JOB FLUSH	RocksDB memfile
------------------	-----------------

```
nebula> SUBMIT JOB FLUSH;
+-----+
| New Job Id |
+-----+
| 96          |
+-----+
```

SUBMIT JOB STATS

SUBMIT JOB STATS	SHOW STATS	SHOW STATS
------------------	------------	------------



Nebula Graph

SUBMIT JOB STATS

```
nebula> SUBMIT JOB STATS;
+-----+
| New Job Id |
+-----+
| 34          |
+-----+
```

SHOW JOB

Meta	SUBMIT JOB	nebula-storaged SHOW JOB <job_id>
job_id	SUBMIT JOB	

```
nebula> SHOW JOB 34;
+-----+-----+-----+-----+
| Job Id( taskId ) | Command(Dest) | Status | Start Time | Stop Time |
+-----+-----+-----+-----+
| 34 | "STATS" | "FINISHED" | 2021-11-01T03:32:27.000000 | 2021-11-01T03:32:27.000000 |
| 0 | "192.168.8.111" | "FINISHED" | 2021-11-01T03:32:27.000000 | 2021-11-01T03:32:41.000000 |
+-----+-----+-----+-----+
```

Job Id(taskId)	ID	ID
Command(Dest)	nebula-storaged	
Status		
Start Time		
Stop Time	FINISHED	FAILED STOPPED

QUEUE	Start Time
RUNNING	Start Time
FINISHED	Stop Time
FAILED	Stop Time
STOPPED	Stop Time
REMOVED	

```
Queue -- running -- finished -- removed
 \   \
  \   \-- failed -- /
   \   \
    \----- stopped -- /
```

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

STOP JOB

STOP JOB <job_id>

```
nebula> STOP JOB 22;
+-----+
| Result      |
+-----+
| "Job stopped" |
+-----+
```

RECOVER JOB

```
RECOVER JOB [<job_id>]          QUEUE FAILED STOPPED <job_id>
```

```
nebula> RECOVER JOB;
+-----+
| Recovered job num |
+-----+
| 5 job recovered   |
+-----+
```

FAQ

```
SUBMIT JOB      HTTP      Storage      HTTP
```

```
curl "http://{storage-ip}:19779/admin?space={space_name}&op=compact"
```

:January 20, 2022

4.17.3

KILL QUERY



KILL QUERY

```
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)]: Execution had been killed
```

: February 8, 2022

5.

5.1 Nebula Graph

Nebula Graph

5.1.1 Nebula Graph

CPU x86_64

4 GB

10 GB SSD

Linux

Nebula Graph

4.15

Linux



Linux

Nebula Graph

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
```

2. G++ CMake

```
$ g++ --version
$ cmake --version
```

3. CMake CMake

4. G++ GCC GCC

- CentOS

```
yum install centos-release-scl
yum install devtoolset-11
scl enable devtoolset-11 'bash'
```

- Ubuntu

```
add-apt-repository ppa:ubuntu-toolchain-r/test
apt install gcc-11 g++-11
```

5.1.2 Nebula Graph

CPU	x86_64
CPU	4
	8 GB
	100 GB SSD

Linux Nebula Graph 3.9 Linux

metad meta	1
storaged	≥1
graphd	≥1

1 metad 1 storaged 1 graphd

Nebula Graph

	metad	storaged	graphd
A	1	1	1
B	-	1	1
C	-	1	1

5.1.3 Nebula Graph

CPU	x86_64
CPU	48
	96 GB
	2 * 900 GB NVMe SSD

Linux Nebula Graph 3.9 Linux

Nebula Graph

Danger

metad	meta	3
storaged		≥ 3
graphd		≥ 3

3 metad metad meta

storaged

Nebula Graph

	metad	storaged	graphd
A	1	1	1
B	1	1	1
C	1	1	1
D	-	1	1
E	-	1	1

5.1.4 Nebula Graph

3 Nebula Graph

Bytes	*	* 6 * 120%	*	* 6
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 HDD 2	2~10
• 1	120%			
	20%			
• 2	RocksDB			
etc	nebula-storaged.conf --data_path		RocksDB	RocksDB

Note

```
nebula-storaged.conf --enable_partitioned_index_filter=true bloom random-seek
```

5.1.5 FAQ

Nebula Graph	NVMe SSD	SSD	IOPS	Latency
--------------	----------	-----	------	---------

- HDD IOPS
- NAS SAN HDFS Ceph
- RAID
- SSD

CPU

 **Enterpriseonly**

Nebula Graph 3.0.1	ARM	Apple Mac M1
--------------------	-----	--------------

: March 10, 2022

5.2

5.2.1 Nebula Graph

Nebula Graph



Nebula Graph

- Nebula Graph

1. Nebula Graph

- [] 3.0.1 Nebula Graph

```
$ git clone --branch v3.0.1 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. Nebula Graph



-j N \(\min(\text{CPU}, \frac{(GB)}{2})\)

```
$ make -j{N} # E.g., make -j2
```

6. Nebula Graph

```
$ sudo make install
```

7. etc/ /usr/local/nebula/etc
graph.conf nebula-metad.conf nebula-storaged.conf

master

master master Nebula Graph

1. nebula git pull upstream master
2. nebula/build make -j{N} make install

- License
- Nebula Graph

CMake

```
$ cmake -D<variable>=<value> ...
```

CMake (CMake)

CMAKE_INSTALL_PREFIX

CMAKE_INSTALL_PREFIX Nebula Graph /usr/local/nebula

ENABLE_WERROR

ON warning error OFF

ENABLE_TESTING

ON Nebula Graph OFF

ENABLE_ASAN

OFF ASan AddressSanitizer Nebula Graph ON

CMAKE_BUILD_TYPE

CMAKE_BUILD_TYPE Nebula Graph 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 18, 2022

5.2.2 RPM DEB Nebula Graph

RPM DEB Linux

RPM DEB

Nebula Graph



Nebula Graph

RPM/DEB



inquiry@vesoft.com

wget

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 3.0.1

```
wget https://oss-cdn.nebula-graph.com.cn/package/3.0.1/nebula-graph-3.0.1.el7.x86_64.rpm
wget https://oss-cdn.nebula-graph.com.cn/package/3.0.1/nebula-graph-3.0.1.el7.x86_64.rpm.sha256sum.txt
```

ubuntu 1804 3.0.1

```
wget https://oss-cdn.nebula-graph.com.cn/package/3.0.1/nebula-graph-3.0.1.ubuntu1804.amd64.deb
wget https://oss-cdn.nebula-graph.com.cn/package/3.0.1/nebula-graph-3.0.1.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
```

Nebula Graph

- RPM

```
$ sudo rpm -ivh --prefix=<installation_path> <package_name>
```

--prefix Nebula Graph /usr/local/nebula/

3.0.1 RPM

```
sudo rpm -ivh nebula-graph-3.0.1.el7.x86_64.rpm
```

- DEB

```
$ sudo dpkg -i <package_name>
```

Note

DEB Nebula Graph /usr/local/nebula/

3.0.1 DEB

```
sudo dpkg -i nebula-graph-3.0.1.ubuntu1804.amd64.deb
```

- License
 - Nebula Graph
 - Nebula Graph
-

:January 14, 2022

5.2.3 tar.gz Nebula Graph

tar.gz Nebula Graph



Nebula Graph 2.6.0 tar.gz

1. Nebula Graph 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 Nebula Graph v3.0.1 tar.gz

```
wget https://oss-cdn.nebula-graph.com.cn/package/3.0.1/nebula-graph-3.0.1.el7.x86_64.tar.gz
```

2. tar.gz Nebula Graph

```
tar -xvzf <tar.gz_file_name> -C <install_path>
```

- `tar.gz_file_name` tar.gz
- `install_path`

```
tar -xvzf nebula-graph-2.6.0.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
-----	----------------------------	---------------------------	------------------------------	----------

Nebula Graph

Nebula Graph

- License
- Nebula Graph

: January 14, 2022

5.2.4 Docker Compose Nebula Graph

Docker Compose

Nebula Graph

Nebula Graph

-

Docker

Install Docker Engine

Docker Compose

Install Docker Compose

Git

Download Git

- root Nebula Graph Docker Manage Docker as a non-root user
- Docker
- Docker Compose Nebula Graph nebula-docker-compose/data

Nebula Graph

1. Git nebula-docker-compose 3.0.1



master

```
$ git clone -b v3.0.1 https://github.com/vesoft-inc/nebula-docker-compose.git
```

2. nebula-docker-compose

```
$ cd nebula-docker-compose/
```

3. Nebula Graph



Nebula Graph Nebula Console

```
[nebula-docker-compose]$ docker-compose up -d
Creating nebula-docker-compose_metad0_1 ... done
Creating nebula-docker-compose_metad2_1 ... done
Creating nebula-docker-compose_metad1_1 ... done
Creating nebula-docker-compose_graphd2_1 ... done
Creating nebula-docker-compose_graphd1_1 ... done
Creating nebula-docker-compose_storaged0_1 ... done
Creating nebula-docker-compose_storaged2_1 ... done
Creating nebula-docker-compose_storaged1_1 ... done
```



4. Nebula Graph

a. Nebula Console Nebula Graph nebula-docker-compose_nebula-net

```
$ docker run --rm -ti --network nebula-docker-compose_nebula-net --entrypoint=/bin/sh vesoft/nebula-console:v3.0.0
```



nebula-docker-compose_nebula-net

```
$ docker network ls
NETWORK ID      NAME      DRIVER      SCOPE
a74c312b1d16    bridge    bridge      local
dbfa82505f0e    host      host       local
ed55ccf356ae   nebula-docker-compose_nebula-net  bridge      local
93ba48b4b288    none     null       local
```

b. Nebula Console Nebula Graph

```
docker> nebula-console -u <user_name> -p <password> --address=graphd --port=9669
```



root

c. nebula-storaged

```
nebula> ADD HOSTS "storaged0":9779,"storaged1":9779,"storaged2":9779;
nebula> SHOW HOSTS;
+-----+-----+-----+-----+-----+
| Host | Port | Status | Leader count | Leader distribution | Partition distribution | Version |
+-----+-----+-----+-----+-----+
| "storaged0" | 9779 | "ONLINE" | 0 | "No valid partition" | "No valid partition" | "3.0.1" |
| "storaged1" | 9779 | "ONLINE" | 0 | "No valid partition" | "No valid partition" | "3.0.1" |
| "storaged2" | 9779 | "ONLINE" | 0 | "No valid partition" | "No valid partition" | "3.0.1" |
+-----+-----+-----+-----+-----+
```



3.0 metad nebula-storaged ADD HOSTS

5. exit

Nebula Graph

docker-compose ps Nebula Graph

```
$ docker-compose ps
          Name        Command     State            Ports
-----+-----+-----+-----+
nebula-docker-compose_graphd1_1   ./bin/nebula-graphd --flag ... Up (health: starting)  13000/tcp, 13002/tcp, 0.0.0.0:33295->19669/tcp, 0.0.0.0:33291->19670/tcp,
                                         3699/tcp, 0.0.0.0:33298->9669/tcp
nebula-docker-compose_graphd2_1   ./bin/nebula-graphd --flag ... Up (health: starting)  13000/tcp, 13002/tcp, 0.0.0.0:33285->19669/tcp, 0.0.0.0:33284->19670/tcp,
                                         3699/tcp, 0.0.0.0:33286->9669/tcp
nebula-docker-compose_graphd_1    ./bin/nebula-graphd --flag ... Up (health: starting)  13000/tcp, 13002/tcp, 0.0.0.0:33288->19669/tcp, 0.0.0.0:33287->19670/tcp,
                                         3699/tcp, 0.0.0.0:9669->9669/tcp
nebula-docker-compose_metad0_1    ./bin/nebula-metad --flagf ... Up (health: starting)  11000/tcp, 11002/tcp, 0.0.0.0:33276->19559/tcp, 0.0.0.0:33275->19560/tcp,
                                         45500/tcp, 45501/tcp, 0.0.0.0:33278->9559/tcp
nebula-docker-compose_metad1_1    ./bin/nebula-metad --flagf ... Up (health: starting)  11000/tcp, 11002/tcp, 0.0.0.0:33279->19559/tcp, 0.0.0.0:33277->19560/tcp,
                                         45500/tcp, 45501/tcp, 0.0.0.0:33281->9559/tcp
nebula-docker-compose_metad2_1    ./bin/nebula-metad --flagf ... Up (health: starting)  11000/tcp, 11002/tcp, 0.0.0.0:33282->19559/tcp, 0.0.0.0:33280->19560/tcp,
                                         45500/tcp, 45501/tcp, 0.0.0.0:33283->9559/tcp
nebula-docker-compose_storaged0_1 ./bin/nebula-storaged --fl ... Up (health: starting)  12000/tcp, 12002/tcp, 0.0.0.0:33290->19779/tcp, 0.0.0.0:33289-
```

```
>19780/tcp,
nebula-docker-compose_storaged1_1 ./bin/nebula-storaged --fl ... Up (health: starting) 44500/tcp, 44501/tcp, 0.0.0.0:33294->9779/tcp
>19780/tcp,
nebula-docker-compose_storaged2_1 ./bin/nebula-storaged --fl ... Up (health: starting) 44500/tcp, 44501/tcp, 0.0.0.0:33299->9779/tcp, 0.0.0.0:33292-
>19780/tcp,
nebula-docker-compose_storaged0_1 ./bin/nebula-storaged --fl ... Up (health: starting) 44500/tcp, 44501/tcp, 0.0.0.0:33297->9779/tcp, 0.0.0.0:33293-
>19780/tcp,
```

Nebula Graph 9669 nebula-docker-compose docker-compose.yaml Nebula Graph

Nebula Graph

Nebula Graph 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
```

Nebula Graph

Nebula Graph

```
$ docker-compose down
```

```
Stopping nebula-docker-compose_graphd2_1 ... done
Stopping nebula-docker-compose_graphd1_1 ... done
Stopping nebula-docker-compose_graphd_1 ... done
Stopping nebula-docker-compose_storaged1_1 ... done
Stopping nebula-docker-compose_storaged2_1 ... done
Stopping nebula-docker-compose_storaged0_1 ... done
Stopping nebula-docker-compose_metad0_1 ... done
Stopping nebula-docker-compose_metad1_1 ... done
Stopping nebula-docker-compose_metad2_1 ... done
Removing nebula-docker-compose_graphd2_1 ... done
Removing nebula-docker-compose_graphd1_1 ... done
Removing nebula-docker-compose_graphd_1 ... done
Removing nebula-docker-compose_storaged1_1 ... done
Removing nebula-docker-compose_storaged2_1 ... done
Removing nebula-docker-compose_storaged0_1 ... done
Removing nebula-docker-compose_metad0_1 ... done
Removing nebula-docker-compose_metad1_1 ... done
Removing nebula-docker-compose_metad2_1 ... done
Removing network nebula-docker-compose_nebula-net
```



```
docker-compose down -v -v
```

nightly

Docker Compose Nebula Graph nebula-docker-compose/docker-compose.yaml

DOCKER

```
nebula-docker-compose      docker-compose.yaml      ports

graphd:
  image: vesoft/nebula-graphd:v3.0.1
  ...
  ports:
    - 9669:9669
    - 19669
    - 19670

9669:9669      9669      9669      19669      19669

/ NEBULA GRAPH  DOCKER

1. nebula-docker-compose/docker-compose.yaml      image
2. nebula-docker-compose      docker-compose pull      Graph      Storage      Meta
3. docker-compose up -d  Nebula Graph
4. Nebula Console  Nebula Graph      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

NEBULA CONSOLE

Nebula Console

```
docker pull vesoft/nebula-console:v3.0.0

NEBULA-DOCKER-COMPOSE  NEBULA GRAPH 2.0.0-RC      3699  NEBULA GRAPH

Nebula Graph 2.0.0-RC      3699  9669      9669      docker-compose.yaml

NEBULA-DOCKER-COMPOSE      2021 01 04

2021 01 04      nebula-docker-compose      docker-compose.yaml

NEBULA-DOCKER-COMPOSE      2021 01 27

2021 01 27      docker-compose down -v
```

: March 15, 2022

5.2.5 RPM/DEB Nebula Graph

Nebula Graph RPM DEB

	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

1. NEBULA GRAPH

Nebula Graph

- RPM DEB Nebula Graph
- Nebula Graph

2.

Nebula Graph

Nebula Graph 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
```

3.

- | | |
|---|-----------------------|
| A | graphd storaged metad |
| B | graphd storaged metad |
| C | graphd storaged metad |
| D | graphd storaged |
| E | graphd storaged |

Nebula Graph

```
sudo /usr/local/nebula/scripts/nebula.service start <metad|graphd|storaged|all>
```

 Note

-
- graphd storaged metad all
- /usr/local/nebula Nebula Graph

Nebula Graph

4.

CLI	Nebula 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 Nebula Graph!

> 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 | Status | Leader count | Leader distribution | Partition distribution | Version |
+-----+-----+-----+-----+-----+-----+
| "192.168.10.111" | 9779 | "ONLINE" | 0 | "No valid partition" | "No valid partition" | "3.0.1" |
| "192.168.10.112" | 9779 | "ONLINE" | 0 | "No valid partition" | "No valid partition" | "3.0.1" |
| "192.168.10.113" | 9779 | "ONLINE" | 0 | "No valid partition" | "No valid partition" | "3.0.1" |
```

```
| "192.168.10.114" | 9779 | "ONLINE" | 0 | "No valid partition" | "No valid partition" | "3.0.1" |
| "192.168.10.115" | 9779 | "ONLINE" | 0 | "No valid partition" | "No valid partition" | "3.0.1" |
+-----+-----+-----+-----+-----+-----+
```

: March 25, 2022

5.3 Nebula Graph

Nebula Graph Meta Storage Graph

Nebula Graph



Nebula Graph

5.3.1

Nebula Graph 3
1

RPC

Nebula Graph Nebula Graph 3 3

Nebula Graph

5.3.2

5.3.3

-
-

5.3.4

Nebula Graph Nebula Graph

5.3.5

Nebula Graph

Nebula Graph

CMake **makefile**

-

```
DENABLE_STANDALONE_VERSION=on  
cmake -DCMAKE_INSTALL_PREFIX=/usr/local/nebula -DENABLE_TESTING=OFF -DENABLE_STANDALONE_VERSION=on -DCMAKE_BUILD_TYPE=Release ..
```

Nebula Graph Nebula Graph

5.3.6

Nebula Graph /usr/local/nebula/etc

sudo cat nebula-standalone.conf.default

Nebula Graph

meta_port	9559	Meta
storage_port	9779	Storage
meta_data_path	data/meta	Meta

: January 14, 2022

5.4 Nebula Graph License

Nebula Graph License License

 Enterprise only

License inquiry@vesoft.com License

5.4.1

- License Nebula Graph
- License License
- License inquiry@vesoft.com
- License 3
- 7
- 3
- 3

5.4.2 License

cat License nebula.license

```
-----License Content Start-----
{
  "vendor": "Vesoft_Inc",
  "organization": "doc",
  "issuedDate": "2021-11-07T16:00:00.000Z",
  "expirationDate": "2021-11-30T15:59:59.000Z",
  "product": "nebula_graph",
  "version": ">2.6.1",
  "licenseType": "enterprise"
}
-----License Content End-----

-----License Key Start-----
coFFc0xxxxxxxxxxxxhnZgaxrQ==
-----License Key End-----
```

License

vendor	
organization	
issuedDate	License
expirationDate	License
product	Nebula Graph nebula_graph
version	
licenseType	License enterprise small_business pro individual

5.4.3 Nebula Graph License

1. inquiry@vesoft.com Nebula Graph

2. Nebula Graph RPM DEB Nebula Graph
3. inquiry@vesoft.com License nebula.license
4. License Meta Meta share/resources/



License

5.4.4

Nebula Graph

: March 11, 2022

5.5 Nebula Graph

```
Nebula Graph      nebula.service
nebula.service    /usr/local/nebula/scripts
```

5.5.1

```
$ 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 Nebula Graph

RPM DEB Nebula Graph

```
$ 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
```

Docker Compose Nebula Graph nebula-docker-compose/

```
[nebula-docker-compose]$ docker-compose up -d
Building with native build. Learn about native build in Compose here: https://docs.docker.com/go/compose-native-build/
Creating network "nebula-docker-compose_nebula-net" with the default driver
Creating nebula-docker-compose_metad0_1 ... done
Creating nebula-docker-compose_metad2_1 ... done
Creating nebula-docker-compose_metad1_1 ... done
Creating nebula-docker-compose_storaged2_1 ... done
Creating nebula-docker-compose_graphd1_1 ... done
Creating nebula-docker-compose_storaged1_1 ... done
Creating nebula-docker-compose_storaged0_1 ... done
Creating nebula-docker-compose_graphd2_1 ... done
Creating nebula-docker-compose_graphd1_1 ... done
```

5.5.3 Nebula Graph



```
kill -9
```

Nebula Graph

```
$ 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
```

`nebula-docker-compose/`

Nebula Graph

```
[nebula-docker-compose]$ docker-compose down
Stopping nebula-docker-compose_graphd_1 ... done
Stopping nebula-docker-compose_graphd2_1 ... done
Stopping nebula-docker-compose_storaged0_1 ... done
Stopping nebula-docker-compose_storaged1_1 ... done
Stopping nebula-docker-compose_graphd1_1 ... done
Stopping nebula-docker-compose_storaged2_1 ... done
Stopping nebula-docker-compose_metad1_1 ... done
Stopping nebula-docker-compose_metad2_1 ... done
Stopping nebula-docker-compose_metad0_1 ... done
Removing nebula-docker-compose_graphd_1 ... done
Removing nebula-docker-compose_graphd2_1 ... done
Removing nebula-docker-compose_storaged0_1 ... done
Removing nebula-docker-compose_storaged1_1 ... done
Removing nebula-docker-compose_graphd1_1 ... done
Removing nebula-docker-compose_storaged2_1 ... done
Removing nebula-docker-compose_metad1_1 ... done
Removing nebula-docker-compose_metad2_1 ... done
Removing nebula-docker-compose_metad0_1 ... done
Removing network nebula-docker-compose_nebula-net
```



`docker-compose down -v`

Nebula Graph

developing nightly

5.5.4 Nebula Graph

Nebula Graph

```
$ sudo /usr/local/nebula/scripts/nebula.service status all
```

- Nebula Graph

```
[INFO] nebula-metad(02b2091): Running as 26601, Listening on 9559
[INFO] nebula-graphd(02b2091): Running as 26644, Listening on 9669
[INFO] nebula-storaged(02b2091): Running as 26709, Listening on 9779
```



Nebula Graph	nebula-storaged	nebula-storaged	nebula-metad	Storage	Storage	Storage	Ready
3.0.0	Storage	Storage	Meta	ADD HOSTS			
Storage							

- Nebula Graph Nebula Graph

```
[INFO] nebula-metad: Running as 25600, Listening on 9559
[INFO] nebula-graphd: Exited
[INFO] nebula-storaged: Running as 25646, Listening on 9779
```

Nebula Graph	Meta	Graph	Storage	etc	/usr/local/nebula/etc/
--------------	------	-------	---------	-----	------------------------

nebula-docker-compose Nebula Graph

```
[nebula-docker-compose]$ docker-compose ps
      Name          Command     State            Ports
-----+-----+-----+-----+-----+
nebula-docker-compose_graphd1_1   /usr/local/nebula/bin/nebu ... Up (healthy)    0.0.0.0:49223->19669/tcp, 0.0.0.0:49222->19670/tcp, 0.0.0.0:49224->9669/tcp
nebula-docker-compose_graphd2_1   /usr/local/nebula/bin/nebu ... Up (healthy)    0.0.0.0:49229->19669/tcp, 0.0.0.0:49228->19670/tcp, 0.0.0.0:49230->9669/tcp
nebula-docker-compose_graphd_1    /usr/local/nebula/bin/nebu ... Up (healthy)    0.0.0.0:49221->19669/tcp, 0.0.0.0:49220->19670/tcp, 0.0.0.0:9669->9669/tcp
nebula-docker-compose_metad0_1    ./bin/nebula-metad --flagf ... Up (healthy)    0.0.0.0:49212->19559/tcp, 0.0.0.0:49211->19560/tcp, 0.0.0.0:49213->9559/tcp,
                                  9560/tcp
nebula-docker-compose_metad1_1    ./bin/nebula-metad --flagf ... Up (healthy)    0.0.0.0:49209->19559/tcp, 0.0.0.0:49208->19560/tcp, 0.0.0.0:49210->9559/tcp
                                  9560/tcp
nebula-docker-compose_metad2_1    ./bin/nebula-metad --flagf ... Up (healthy)    0.0.0.0:49206->19559/tcp, 0.0.0.0:49205->19560/tcp, 0.0.0.0:49207->9559/tcp
                                  9560/tcp
nebula-docker-compose_storaged0_1  ./bin/nebula-storaged --fl ... Up (healthy)    0.0.0.0:49218->19779/tcp, 0.0.0.0:49217->19780/tcp, 9777/tcp, 9778/tcp
                                  0.0.0.0:49219->9779/tcp, 9780/tcp
nebula-docker-compose_storaged1_1  ./bin/nebula-storaged --fl ... Up (healthy)    0.0.0.0:49215->19779/tcp, 0.0.0.0:49214->19780/tcp, 9777/tcp, 9778/tcp,
                                  0.0.0.0:49216->9779/tcp, 9780/tcp
nebula-docker-compose_storaged2_1  ./bin/nebula-storaged --fl ... Up (healthy)    0.0.0.0:49226->19779/tcp, 0.0.0.0:49225->19780/tcp, 9777/tcp, 9778/tcp,
                                  0.0.0.0:49227->9779/tcp, 9780/tcp
```

nebula-docker-compose_graphd2_1 ,

docker ps	CONTAINER ID	2a6c56c405f5)
-----------	--------------	----------------

```
[nebula-docker-compose]$ docker ps
CONTAINER ID        IMAGE               COMMAND             CREATED            STATUS              NAMES
PORTS
2a6c56c405f5        vesoft/nebula-graphd:nightly   "/usr/local/nebula/b..."   36 minutes ago   Up 36 minutes (healthy)   0.0.0.0:49230->9669/tcp, 0.0.0.0:49229->19669/tcp, 0.0.0.0:49222->19670/tcp
7042e0a8e83d        vesoft/nebula-storaged:nightly  "./bin/nebula-storag..."  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  "./bin/nebula-storag..."  36 minutes ago   Up 36 minutes (healthy)   9777-9778/tcp, 9780/tcp, 0.0.0.0:49219->9779/tcp, 9780/tcp
4dcabfe8677a        vesoft/nebula-graphd:nightly   "/usr/local/nebula/b..."  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   "/usr/local/nebula/b..."  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  "./bin/nebula-storag..."  36 minutes ago   Up 36 minutes (healthy)   9777-9778/tcp, 9780/tcp, 0.0.0.0:49216->19779/tcp, 9780/tcp
45736a32a23a        vesoft/nebula-metad:nightly   "./bin/nebula-metad ..."  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   "./bin/nebula-metad ..."  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   "./bin/nebula-metad ..."  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]#
```

5.5.5

Nebula Graph

:January 14, 2022

5.6 Nebula Graph

Nebula Graph

CLI GUI

Nebula Graph

CLI Nebula Console

5.6.1 Nebula Graph

Nebula Graph

5.6.2 Nebula Console Nebula Graph

- Nebula Graph
- Nebula Console Nebula Graph
- Nebula Console Nebula Graph

 **Note**

Nebula Console Nebula Graph
between client and server

Nebula Console Nebula Graph

incompatible version

1. Nebula Console **Assets**

 **Note**

2. **Assets**

3. `nebula-console`

 **Note**

Windows `nebula-console.exe`

4. Nebula Console `nebula-console`

 **Note**

Windows

```
$ chmod 111 nebula-console
```

5. `nebula-console`

6. Nebula Graph

- 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]
```

<code>-h</code>							
<code>-addr</code>	graphd	IP	127.0.0.1	Nebula Graph	Nebula Cloud	Private Link	IP
<code>-port</code>	graphd		9669				
<code>-u/-user</code>	Nebula Graph			root			
<code>-p/-password</code>							
<code>-t/-timeout</code>		120					
<code>-e/-eval</code>	nGQL						
<code>-f/-file</code>	nGQL		nGQL				
<code>./nebula-console --help</code>							

:January 14, 2022

5.7 Storage

3.0.0

Storage

Storage

Meta

ADD HOSTS

Storage

5.7.1 Storage

Storage

```
ADD HOSTS <ip>:<port> [,<ip>:<port> ...];
```

**Note**

- Storage

2 20

SHOW HOSTS

- IP

127.0.0.1:9779

5.7.2 Storage

Storage

**Note**

Storage

Storage

```
DROP HOSTS <ip>:<port> [,<ip>:<port> ...];
```

: March 10, 2022

5.8

5.8.1 Nebula Graph 2.x 3.0.1

Nebula Graph 2.6.1 3.0.1 Nebula Graph 2.x 3.x

Nebula Graph 2.0.0 2.x 3.0.1 2.0.0 1.x 2.x 3.x

Caution

2.0.0 1.x 3.0.1 3.0.1 share/resources date_time_zonespec.csv Nebula Graph
GitHub

-
-
- Docker Docker Swarm Docker Compose K8s
- IP
- dst_db_path WAL tag key
- 4 alter schema default value github known issues
-
- sudo
-
- Nebula Graph 3.x key VID 1

key	Type	1	+ Partition ID	3	+ VID	key	value	VID	1
VID	INT64		key	1	*	1 + 3 + 8 = 12	1.2 GB		
- Nebula Graph Nebula Graph 3.0.1
-
- nGQL
- YIELD
- FETCH GO LOOKUP FIND PATH GET SUBGRAPH YIELD
- MATCH Tag return v.name return v.player.name



[GitHub](#)

- Nebula Graph 3.0.1 [TAR](#) [TAR](#) [Download](#)



[RPM/DEB](#)

- Storage Meta `data_path` `nebula/data/storage` `nebula/data/meta`



-
-
- a. SUBMIT JOB STATS
- b. SHOW JOBS

1. Nebula Graph

```
<nebula_install_path>/scripts/nebula.service stop all
nebula_install_path  Nebula Graph
storaged flush      1          nebula.service status all
```



20

[GitHub](#)

2. TAR `bin` Nebula Graph `bin`



Nebula Graph

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 Nebula Graph

SHOW HOSTS meta SHOW META LEADER

Meta Meta



[GitHub](#)

5. bin db_upgrader



Storage

```
<nebula_install_path>/bin/db_upgrader \
--src_db_path=<old_storage_data_path> \
--dst_db_path=<data_backup_path> \
--upgrade_meta_server=<meta_server_ip>:<port>[, <meta_server_ip>:<port> ...] \
--upgrade_version=2:3
```

- old_storage_data_path Storage data_path
- data_backup_path
- meta_server_ip port Meta IP
- 2:3 Nebula Graph 2.x 3.x

```
<nebula_install_path>/bin/db_upgrader \
--src_db_path=/usr/local/nebula/data/storage \
--dst_db_path=/home/vesoft/nebula/data-backup \
--upgrade_meta_server=192.168.8.132:9559 \
--upgrade_version=2:3
```



[GitHub](#)

6. Graph Storage



[GitHub](#)

7. Nebula Graph

```
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;
```

3.0.1

FAQ

Q

A

Q Graph Storage

A Graph

Q Permission denied

A sudo

Q

A SUBMIT JOB STATS SHOW STATS

Q: Storage OFFLINE Leader count 0

A 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

Q SHOW JOBS Job ID Job

A Nebula Graph 2.5.0 Job Pull request 2.5.0

Q: ?

A: [Release Note](#) Incompatibility

: April 11, 2022

5.9 Nebula Graph

Nebula Graph



Caution

Nebula Graph Meta

5.9.1

Nebula Graph

Nebula Graph

5.9.2 1



Note

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

Nebula Graph

Nebula Graph

RPM Nebula Graph

1. Nebula Graph

```
$ rpm -qa | grep "nebula"
```

nebula-graph-3.0.1-1.x86_64

2. Nebula Graph

```
sudo rpm -e <nebula_version>
```

```
sudo rpm -e nebula-graph-3.0.1-1.x86_64
```

3.

DEB Nebula Graph

1. Nebula Graph

```
$ dpkg -l | grep "nebula"
```

```
ii  nebula-graph  3.0.1  amd64      Nebula Package built using CMake
```

2. Nebula Graph

```
sudo dpkg -r <nebula_version>
```

```
sudo dpkg -r nebula-graph
```

3.

Docker Compose Nebula Graph

1. nebula-docker-compose Nebula Graph

```
docker-compose down -v
```

2. nebula-docker-compose

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6.

6.1

6.1.1

Nebula Graph  flags Nebula Graph

 **Enterpriseonly**

Note

- Nebula Graph
-



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/ Nebula Graph

curl Nebula Graph

```
#     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

Nebula Graph	<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>

Caution

IP `local_ip` Nebula Graph 3 Storage 3 IP

Nebula Graph

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> true Nebula Graph			

Caution

`local_config` false Nebula Graph Meta

DOCKER COMPOSE

Docker Compose	<code><install_path>/nebula-docker-compose/docker-compose.yaml</code>	command
----------------	---	---------

: February 17, 2022

6.1.2 Meta

Meta	nebula-metad.conf.default nebula-metad.conf.production	/usr/local/nebula/etc/
------	--	------------------------



- local_config false Nebula Graph Meta
-

.default .production Meta

nebula-metad.conf.default

basics

daemonize	true			
pid_file	pids/nebula-metad.pid	ID		
timezone_name	-	Nebula Graph Specifying the Time Zone with TZ	UTC+00:00:00 --timezone_name=UTC+08:00	
license_path	share/resources/ nebula.license	License License	License	Nebula Graph



- Nebula Graph timezone_name TIMESTAMP UTC UTC
- timezone_name Nebula Graph Nebula Graph

logging

log_dir	logs	Meta						
minloglevel	0	3 FATAL	0	0 INFO	1 WARNING	2 ERROR	4 Nebula Graph	
v	0		0	1	2	3		
logbufsecs	0		0					
redirect_stdout	true							
stdout_log_file	metad- stdout.log							
stderr_log_file	metad- 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	Meta	IP	IP	nebula-metad			
port	9559	Meta Graph	RPC	Meta	9559	+1	9560	Nebula
ws_ip	0.0.0.0	HTTP	IP					
ws_http_port	19559	HTTP						
ws_h2_port	19560	HTTP2						
ws_storage_http_port	19779	HTTP	Storage	Storage	ws_http_port			
heartbeat_interval_secs	10			heartbeat_interval_secs				

Caution

IP 127.0.0.1/0.0.0.0

storage

data_path	data/meta	meta	
-----------	-----------	------	--

misc

default_parts_num	100
default_replica_factor	1

rocksdb options

rocksdb_wal_sync	true	RocksDB WAL
------------------	------	-------------

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6.1.3 Graph

Graph nebula-graphd.conf.default nebula-graphd.conf.production /usr/local/nebula/etc/

Caution

- local_config false Nebula Graph Meta
-

.default .production Graph

nebula-graphd.conf.default

basics

daemonize	true				
pid_file	pids/nebula-graphd.pid	ID			
enable_optimizer	true				
timezone_name	-	Nebula Graph the Time Zone with TZ	UTC+00:00:00 --timezone_name=UTC+08:00		Specifying
local_config	true				

Note

- Nebula Graph timezone_name TIMESTAMP UTC UTC
- timezone_name Nebula Graph Nebula Graph

logging

log_dir	logs	Graph
minloglevel	0	0 INFO 1 WARNING 2 ERROR
	3 FATAL	0 1 4 Nebula Graph
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			
ws_h2_port	19670	HTTP2			
heartbeat_interval_secs	10		heartbeat_interval_secs		
storage_client_timeout_ms	-	Graph	Storage	RPC	60000
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 password ldap cloud

memory

system_memory_high_watermark_ratio	0.8	Nebula Graph
------------------------------------	-----	--------------

metrics

enable_space_level_metrics	false	query_latency_us{space=basketballplayer}.avg.3600	curl
----------------------------	-------	---	------

experimental

enable_experimental_feature	false	true false
-----------------------------	-------	------------

EXPERIMENTAL

TOSS	TOSS Transaction on Storage Side	INSERT UPDATE UPSERT DELETE
	1	

:January 19, 2022

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	-	Nebula Graph Specifying the Time Zone with TZ		UTC+00:00:00	--timezone_name=UTC+08:00
local_config	true				

Note

- Nebula Graph timezone_name TIMESTAMP UTC UTC
- timezone_name Nebula Graph Nebula Graph

logging

log_dir	logs	Storage						
minloglevel	0		0	INFO	1	WARNING	2	ERROR
v	0	3 FATAL	0	1	4	Nebula Graph		
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	RPC	Storage	9779	9777	9778	9780
		Nebula Graph						
ws_ip	0.0.0.0	HTTP	IP					
ws_http_port	19779	HTTP						
ws_h2_port	19780	HTTP2						
heartbeat_interval_secs	10		heartbeat_interval_secs					



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

<code>data_path</code>	<code>data/storage</code>	<code>,</code>	<code> RocksDB</code>
<code>minimum_reserved_bytes</code>	<code>268435456</code>		
<code>rocksdb_batch_size</code>	<code>4096</code>		
<code>rocksdb_block_cache</code>	<code>4</code>	<code>BlockBasedTable</code>	<code> MB</code>
<code>engine_type</code>	<code>rocksdb</code>		
<code>rocksdb_compression</code>	<code>lz4</code>	<code>no snappy lz4 lz4hc zlib bzip2 zstd</code>	
<code>rocksdb_compression_per_level</code>	<code>-</code>		
<code>enable_rocksdb_statistics</code>	<code>false</code>	<code> RocksDB</code>	
<code>rocksdb_stats_level</code>	<code>kExceptHistogramOrTimers</code>	<code> RocksDB kExceptHistogramOrTimers</code>	
		<code>kExceptTimers</code>	
		<code>kExceptDetailedTimers</code>	
		<code>kExceptTimeForMutex</code>	<code>kAll</code>
<code>enable_rocksdb_prefix_filtering</code>	<code>true</code>	<code>prefix bloom filter</code>	
<code>enable_rocksdb_whole_key_filtering</code>	<code>false</code>	<code>whole key bloom filter</code>	
<code>rocksdb_filtering_prefix_length</code>	<code>12</code>	<code>key prefix 12 ID+ ID 16 ID+</code>	
		<code>ID+TagID/Edge typeID</code>	
<code>enable_partitioned_index_filter</code>	<code>-</code>	<code>true bloom</code>	<code>random-seek</code>

Key-Value separation

<code>rocksdb_enable_kv_separation</code>	<code>false</code>	<code>BlobDB KV</code>	
<code>rocksdb_kv_separation_threshold</code>	<code>100</code>	<code> RocksDB KV flush compaction</code>	<code>blob</code>
<code>rocksdb_blob_compression</code>	<code>lz4</code>	<code>BlobDB no snappy lz4 lz4hc zlib bzip2 zstd</code>	
<code>rocksdb_enable_blob_garbage_collection</code>	<code>true</code>	<code>compaction BlobDB</code>	

misc

`snapshot` Nebula Graph `snapshot` Raft leader

<code>snapshot_part_rate_limit</code>	<code>8388608</code>	<code>Raft leader Raft group</code>	<code>/</code>
<code>snapshot_batch_size</code>	<code>1048576</code>	<code>Raft leader Raft group</code>	
<code>rebuild_index_part_rate_limit</code>	<code>4194304</code>	<code>Raft leader Raft group</code>	<code>/</code>
<code>rebuild_index_batch_size</code>	<code>1048576</code>	<code>Raft leader 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

rocksdb options `{"<option_name>": "<option_value>"}`

`rocksdb_db_options` `rocksdb_column_family_options`

- `rocksdb_db_options`

```
max_total_wal_size
deleteObsolete_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

Compatibility

Nebula Graph 1.x

Nebula Graph 3.0.1

storage enable_partitioned_index_filter true RocksDB

: January 19, 2022

6.1.5 Linux

Nebula Graph 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
```

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
---------	------	------------------------------------	--------	-----------

: February 22, 2022

6.2

6.2.1

Nebula Graph glog gflags HTTP

/usr/local/nebula/logs/

Nebula Graph

- minloglevel 0 INFO 1 WARNING 2 ERROR 3 FATAL 0 1 4
Nebula Graph

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
```

Nebula Graph

RocksDB

RocksDB /usr/local/nebula/data/storage/nebula/\$id/data/LOG , \$id RocksDB

:January 14, 2022

7.

7.1 Nebula Graph

Nebula Graph

HTTP

7.1.1

Nebula Graph

. num_queries.sum.600

Nebula Graph

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

Nebula Graph

Note

```
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								

Note

Nebula Graph 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=985
```

- 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_aggregate_executors		Aggregate	
num_auth_failed_sessions_bad_username_password			
num_auth_failed_sessions_out_of_max_allowed		FLAG_OUT_OF_MAX_ALLOWED_CONNECTIONS	session
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	

Storage

add_edges_atomic_latency_us			
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			
num_get_prop		GetPropProcessor	
num_get_neighbors_errors		GetNeighborsProcessor	
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_trnx_latency_us	
<hr/>	
<hr/>	
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_oom_queries	
<hr/>	

: March 9, 2022

7.2 RocksDB

Nebula Graph RocksDB

Nebula Graph 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 14, 2022

8.

8.1

8.1.1

Nebula Graph Nebula Graph

Note

root Nebula Graph

Nebula Graph

LDAP

Nebula Graph

1. nebula-graphd.conf /usr/local/nebula/etc/
 - --enable_authorize true false
 - --failed_login_attempts Graph
 - --password_lock_time_in_secs
2. Nebula Graph

Note

God root nebula

OpenLDAP

OpenLDAP LDAP
OPENLDAP

Enterpriseonly

OpenLDAP OpenLDAP

:January 14, 2022

8.1.2

Nebula Graph

Nebula Graph

Note

- root Nebula Graph
-

CREATE USER

CREATE USER Nebula Graph **God** root CREATE USER

-

```
CREATE USER [IF NOT EXISTS] <user_name> [WITH PASSWORD '<password>'];
```

-

```
nebula> CREATE USER user1 WITH PASSWORD 'nebula';
```

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 user1 WITH PASSWORD 'nebula';
```

```
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   |
+-----+
| "test1"   |
| "test2"   |
| "test3"   |
+-----+
```

```
:January 14, 2022
```

8.1.3

Nebula Graph

- God
 - Linux root Windows administrator
- Meta
 - God root nebula



root

- God
- God God root
- Admin
- Schema data
-



ADMIN

- DBA
- Schema data
-
- User
 - Schema
 - data
- Guest
 - Schema data



-
-

	God	Admin	DBA	User	Guest	
Read space	Y	Y	Y	Y	Y	USE DESCRIBE SPACE
Read schema	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 DROP TAG DELETE TAG DROP EDGE CREATE TAG INDEX CREATE 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	GO SET PIPE MATCH ASSIGNMENT LOOKUP YIELD ORDER BY FETCH VERTICES Find FETCH EDGES FIND PATH LIMIT GROUP BY RETURN
Write data	Y	Y	Y	Y		INSERT VERTEX UPDATE VERTEX INSERT EDGE UPDATE EDGE DELETE VERTEX DELETE EDGES DELETE TAG
Show operations	Y	Y	Y	Y	Y	SHOW CHANGE PASSWORD
Job	Y	Y	Y	Y		SUBMIT JOB COMPACT SUBMIT JOB FLUSH SUBMIT JOB STATS STOP JOB RECOVER JOB BUILD TAG INDEX BUILD EDGE INDEX
Write space	Y					CREATE SPACE DROP SPACE CREATE SNAPSHOT DROP SNAPSHOT BALANCE ADMIN CONFIG INGEST DOWNLOAD

Caution

Show operations

SHOW SPACES

God

[SHOW USERS](#) [SHOW SNAPSHOTTS](#)

: March 3, 2022

8.1.4 OpenLDAP

Nebula Graph OpenLDAP OpenLDAP DN Distinguished Name

 **Enterpriseonly**

OpenLDAP Nebula Graph Nebula Graph Meta OpenLDAP DN

OpenLDAP

SIMPLEBINDAUTH

Graph OpenLDAP DN DN OpenLDAP

SEARCHBINDAUTH

Graph uid DN DN OpenLDAP

- [OpenLDAP](#)
- [OpenLDAP](#)
- [OpenLDAP](#)

OpenLDAP test2 passwdtest2

1. Nebula Graph OpenLDAP test2

```
nebula> CREATE USER test2 WITH PASSWORD '';
nebula> GRANT ROLE ADMIN ON basketballplayer TO test2;
```



Nebula Graph

2. nebula-graphd.conf /usr/local/nebula/etc/

•

```
#
--local_config=true
#
--enable_authorize=true
#      password ldap cloud
--auth_type=ldap
# OpenLDAP
--ldap_server=192.168.8.211
# OpenLDAP
--ldap_port=389
# OpenLDAP Schema
--ldap_scheme=ldap
# DN
--ldap_prefix=uid=
# DN
--ldap_suffix=,ou=it,dc=sys,dc=com
```

•

```
#
--local_config=true
#
--enable_authorize=true
#      password ldap cloud
--auth_type=ldap
# OpenLDAP
--ldap_server=192.168.8.211
# OpenLDAP
--ldap_port=389
# OpenLDAP Schema
--ldap_scheme=ldap
#      DN
--ldap_basedn=ou=it,dc=sys,dc=com
```

3. Nebula Graph

4.

```
$ ./nebula-console --addr 127.0.0.1 --port 9669 -u test2 -p passwdtest2
2021/09/08 03:49:39 [INFO] connection pool is initialized successfully
```

Welcome to Nebula Graph!



OpenLDAP root

:January 14, 2022

8.2

Nebula Graph snapshot

8.2.1

Nebula Graph

God

8.2.2

- add host drop host create space drop space balance
-
- /usr/local/nebula/data

8.2.3

Nebula Graph 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
...
```

8.2.4

CREATE SNAPSHOT

Note

```
nebula> CREATE SNAPSHOT;
```

8.2.5

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

8.2.6

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

8.2.7

shell

1. leader Meta Storage checkpoints 2 /usr/local/nebula/data/meta/
nebula@/checkpoints /usr/local/nebula/data/storage/nebula/3/checkpoints /usr/local/nebula/data/storage/nebula/4/checkpoints

```
$ ls /usr/local/nebula/data/meta/nebula@/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 14, 2022

8.3 SSL

Nebula Graph Graph Meta Storage SSL SSL

8.3.1

SSL

8.3.2

<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

8.3.3

SSL SSL Nebula Graph

- `cert_path` `key_path` `password_path`
- CA

Certificate Authority	<code>cert_path</code> <code>key_path</code> <code>ca_path</code>
-----------------------	---

8.3.4

Nebula Graph

- 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>
------	--	-------------------------------------

8.3.5

1.

2.

Graph Meta Storage

```
--cert_path=xxxxxx  
--key_path=xxxxxx  
--password_path=xxxxxx  
--enable_ssl=true
```

3.

CA

nebula-test-run.py

:January 14, 2022

9. (BR)

9.1 Backup&Restore

Backup&Restore BR CLI Nebula Graph

9.1.1

-
-
- SSD HDD
- Amazon S3 Alibaba Cloud OSS MinIO Ceph RGW
- Nebula Graph
-

9.1.2

- Nebula Graph v3.0.1
-
- metad
- Nebula Listener
- NFS
-
- DDL DML 2 5
-
-
- A B

9.1.3 BR

BR

1. BR
2. BR
3. BR

9.1.4

- Nebula Graph nebula-br 3 34



: February 25, 2022

9.2 BR

BR

BR

9.2.1

- Go 1.14.x
- make

9.2.2

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
Nebula Backup And Restore Utility Tool,V-0.6.0
  GitSha: 079e7c7
  GitRef: master
please run "help" subcommand for more infomation.
```

: February 16, 2022

9.3 BR

BR

BR

9.3.1

- BR BR BR
- Nebula Graph
- nebula-agent
- Meta Storage BR



NFS (Network File System) Meta Storage BR Alibaba Cloud OSS Amazon S3
BR

9.3.2



```
$ ./bin/br backup full --meta <ip_address> --storage <storage_path>
```

- meta 127.0.0.1:9559 /home/nebula/backup/



metad

```
$ ./bin/br backup full --meta "127.0.0.1:9559" --storage "local:///home/nebula/backup/"
```

- meta 127.0.0.1:9559 s3 br-test backup
- ```
$./bin/br backup full --meta "127.0.0.1:9559" --s3.endpoint "http://127.0.0.1:9000" --storage="s3://br-test/backup/" --s3.access_key=minioadmin --s3.secret_key=minoadmin --s3.region=default
```

```

-h, --help -
--debug -
--log string "br.log"
--meta string meta
--spaces stringArray ()
--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

```

### 9.3.3

BR               Nebula Graph               BR

---

: February 16, 2022

## 9.4 BR

---

BR Nebula Graph



### 9.4.1

- BR BR BR
- nebula-agent
- Nebula Graph
- 

### 9.4.2

1.

```
$./bin/br show --storage <ip_address>
```

```
/home/nebula/backup
```

```
$./bin/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
```

```
$./bin/br show --s3.endpoint "http://127.0.0.1:9000" --storage="s3://br-test/backup/" --s3.access_key=minioadmin --s3.secret_key=minioadmin --s3.region=default
```

|                            |        |          |                                                      |  |
|----------------------------|--------|----------|------------------------------------------------------|--|
| <code>-h, -help</code>     | -      |          |                                                      |  |
| <code>--debug</code>       | -      |          |                                                      |  |
| <code>--log</code>         | string | "br.log" |                                                      |  |
| <code>--storage</code>     | string |          | BR                    <Schema>://<PATH>              |  |
|                            |        |          | Schema        local    s3    s3        s3.access_key |  |
|                            |        |          | s3.endpoint    s3.region    s3.secret_key            |  |
|                            |        |          | PATH                                                 |  |
| <code>--</code>            | string |          |                                                      |  |
| <code>s3.access_key</code> |        |          |                                                      |  |
| <code>--s3.endpoint</code> | string |          | S3            URL    http    https                   |  |
| <code>--s3.region</code>   | string |          |                                                      |  |
| <code>--</code>            | string |          |                                                      |  |
| <code>s3.secret_key</code> |        |          |                                                      |  |

2.

```
$./bin/br restore full --meta <ip_address> --storage <storage_path> --name <backup_name>

/home/nebula/backup/ meta 127.0.0.1:9559

$./bin/br restore full --meta "127.0.0.1:9559" --storage "local:///home/nebula/backup/" --name BACKUP_2021_12_08_18_38_08

s3 br-test backup meta 127.0.0.1:9559

$./bin/br restore full --meta "127.0.0.1:9559" --s3.endpoint "http://127.0.0.1:9000" --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

|                            |        |                                                                                                                                              |
|----------------------------|--------|----------------------------------------------------------------------------------------------------------------------------------------------|
| <code>-h, -help</code>     | -      | -                                                                                                                                            |
| <code>--debug</code>       | -      |                                                                                                                                              |
| <code>--log</code>         | string | "br.log"                                                                                                                                     |
| <code>--meta</code>        | string | meta                                                                                                                                         |
| <code>--name</code>        | string |                                                                                                                                              |
| <code>--storage</code>     | string | BR                    <Schema>://<PATH><br>Schema    local    s3    s3    s3.access_key<br>s3.endpoint    s3.region    s3.secret_key<br>PATH |
| <code>--</code>            | string |                                                                                                                                              |
| <code>s3.access_key</code> |        |                                                                                                                                              |
| <code>--s3.endpoint</code> | string | S3                    URL    http    https                                                                                                   |
| <code>--s3.region</code>   | string |                                                                                                                                              |
| <code>--</code>            | string |                                                                                                                                              |
| <code>s3.secret_key</code> |        |                                                                                                                                              |

3.

```
$./bin/br cleanup --meta <ip_address> --storage <storage_path> --name <backup_name>
```

|                            |        |                                                                                                                                              |
|----------------------------|--------|----------------------------------------------------------------------------------------------------------------------------------------------|
| <code>-h, -help</code>     | -      | -                                                                                                                                            |
| <code>--debug</code>       | -      |                                                                                                                                              |
| <code>--log</code>         | string | "br.log"                                                                                                                                     |
| <code>--meta</code>        | string | meta                                                                                                                                         |
| <code>--name</code>        | string |                                                                                                                                              |
| <code>--storage</code>     | string | BR                    <Schema>://<PATH><br>Schema    local    s3    s3    s3.access_key<br>s3.endpoint    s3.region    s3.secret_key<br>PATH |
| <code>--</code>            | string |                                                                                                                                              |
| <code>s3.access_key</code> |        |                                                                                                                                              |
| <code>--s3.endpoint</code> | string | S3                    URL    http    https                                                                                                   |
| <code>--s3.region</code>   | string |                                                                                                                                              |
| <code>--</code>            | string |                                                                                                                                              |
| <code>s3.secret_key</code> |        |                                                                                                                                              |

: February 21, 2022

# 10.

---

## 10.1 Compaction

Compaction

Nebula Graph    Compaction

Compaction

Nebula Graph

Compaction

Compaction



Compaction

IO

Nebula Graph

Compaction

Compaction

Compaction

### 10.1.1 Compaction

Compaction

Compaction

Compaction

IO

### 10.1.2 Compaction

Compaction

TTL

Compaction



IO

```
nebula> USE <your_graph_space>;
nebula> SUBMIT JOB COMPACT;
```

ID

Compaction

```
nebula> SHOW JOB <job_id>;
```

### 10.1.3

Nebula Graph

- SUBMIT JOB COMPACT
- SUBMIT JOB COMPACT
- Compaction       nebula-storaged.conf

```
20MB/S
--rocksdb_rate_limit=20 (in MB/s)
```

### 10.1.4 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

: February 8, 2022

## 10.2 Storage

BALANCE

Raft leader

Storage

BALANCE



BALANCE DATA

### 10.2.1 leader

BALANCE LEADER leader

nebula&gt; BALANCE LEADER;

SHOW HOSTS

```
nebula> SHOW HOSTS;
+-----+-----+-----+-----+-----+
| Host | Port | Status | Leader count | Leader distribution | Partition distribution | Version |
+-----+-----+-----+-----+-----+
"192.168.10.100"	9779	"ONLINE"	4	"basketballplayer:3"	"basketballplayer:8"	"3.0.1"
"192.168.10.101"	9779	"ONLINE"	8	"basketballplayer:3"	"basketballplayer:8"	"3.0.1"
"192.168.10.102"	9779	"ONLINE"	3	"basketballplayer:3"	"basketballplayer:8"	"3.0.1"
"192.168.10.103"	9779	"ONLINE"	0	"basketballplayer:2"	"basketballplayer:7"	"3.0.1"
"192.168.10.104"	9779	"ONLINE"	0	"basketballplayer:2"	"basketballplayer:7"	"3.0.1"
"192.168.10.105"	9779	"ONLINE"	0	"basketballplayer:2"	"basketballplayer:7"	"3.0.1"
+-----+-----+-----+-----+-----+
```



Nebula Graph 3.0.1 Leader

Storage Error E\_RPC\_FAILURE

FAQ

: March 15, 2022

## 10.3

Nebula Graph

Note

### 10.3.1

Nebula Graph

20-80

**Tag Edge type**

Tag      Edge type

Nebula Graph

Tag      Edge type

**Tag/Edge type**

Tag      Edge type

Schema

“      ”      ”

schema-free

Nebula Graph 3.0.1   Schema

“      ”      Schema

MySQL   ALTER TABLE

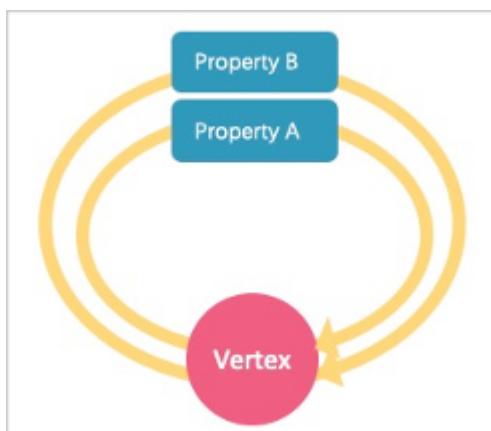
“      ”  
“      ”      Schema  
“      ”      ”      ”      ”      ”      ”      ”

Nebula Graph   Schema

ALTER TAG

List

List



```

// nebula> 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);

// nebula> 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] |
+-----+

```

- Nebula Graph

Tag      Edge type has

• “ ” ” ” (src)-[edge {P1, P2}]->(dst) edge P1, P2  
 (src)-[edge1]->(i\_node {P1, P2})-[edge2]->(dst)    Nebula Graph 3.0.1                (src)-[edge {P1, P2}]->(dst)

(dst)<-[edge]-(src)    GO FROM dst REVERSELY;

(src)-[edge]-(dst)    GO FROM src BIDIRECT ;

### Tag

Tag

VID                  90%

### VID

VID

2

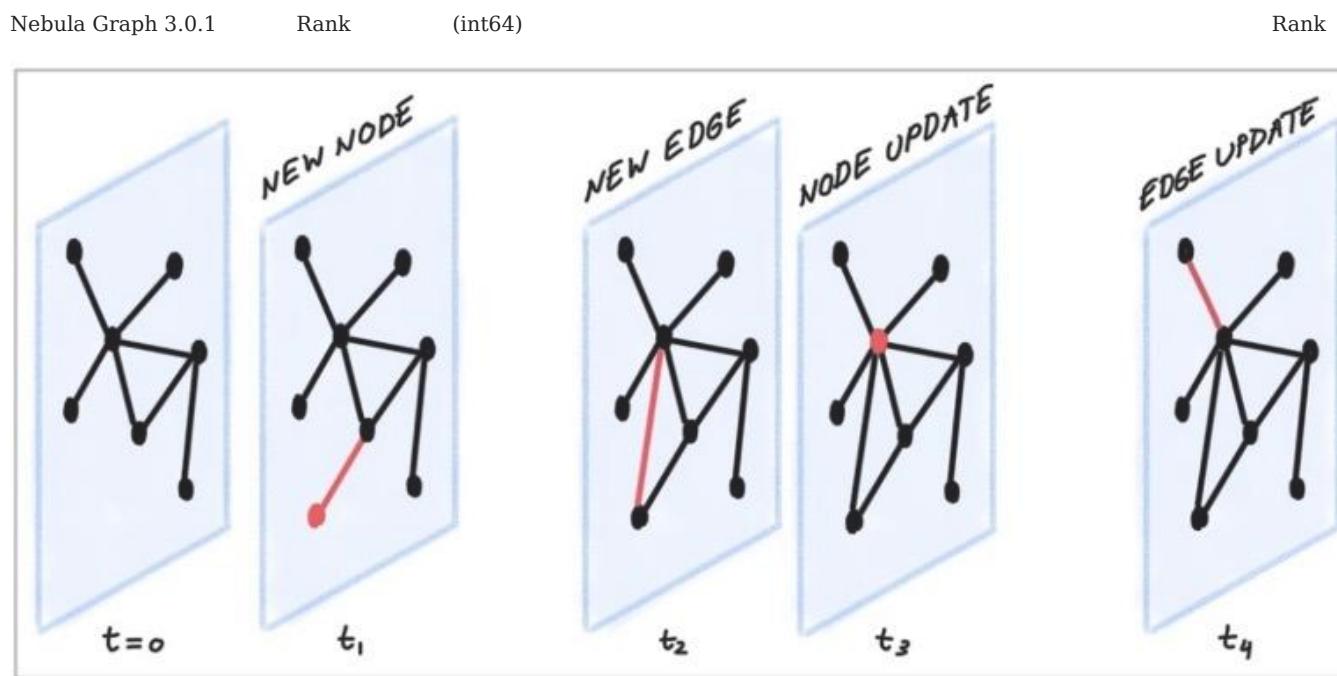
write amplification

HBase/ES

Nebula Graph

## 10.3.2

1



1. [https://blog.twitter.com/engineering/en\\_us/topics/insights/2021/temporal-graph-networks](https://blog.twitter.com/engineering/en_us/topics/insights/2021/temporal-graph-networks) ↪

: January 25, 2022

10.4

### 10.4.1 QPS

- Nebula Graph 3.0.1
  -

Nebula Algorithm

— QPS  
graphd graphd

## 10.4.2

- Nebula Graph OLTP " " OLAP " "
  - sst INSERT
  - COMPACTION BALANCE
  - Nebula Graph 3.0.1 NoSQL

### 10.4.3



: March 7, 2022

## 10.5

---

Nebula Graph 3.0.1

EXPLAIN PROFILE

---

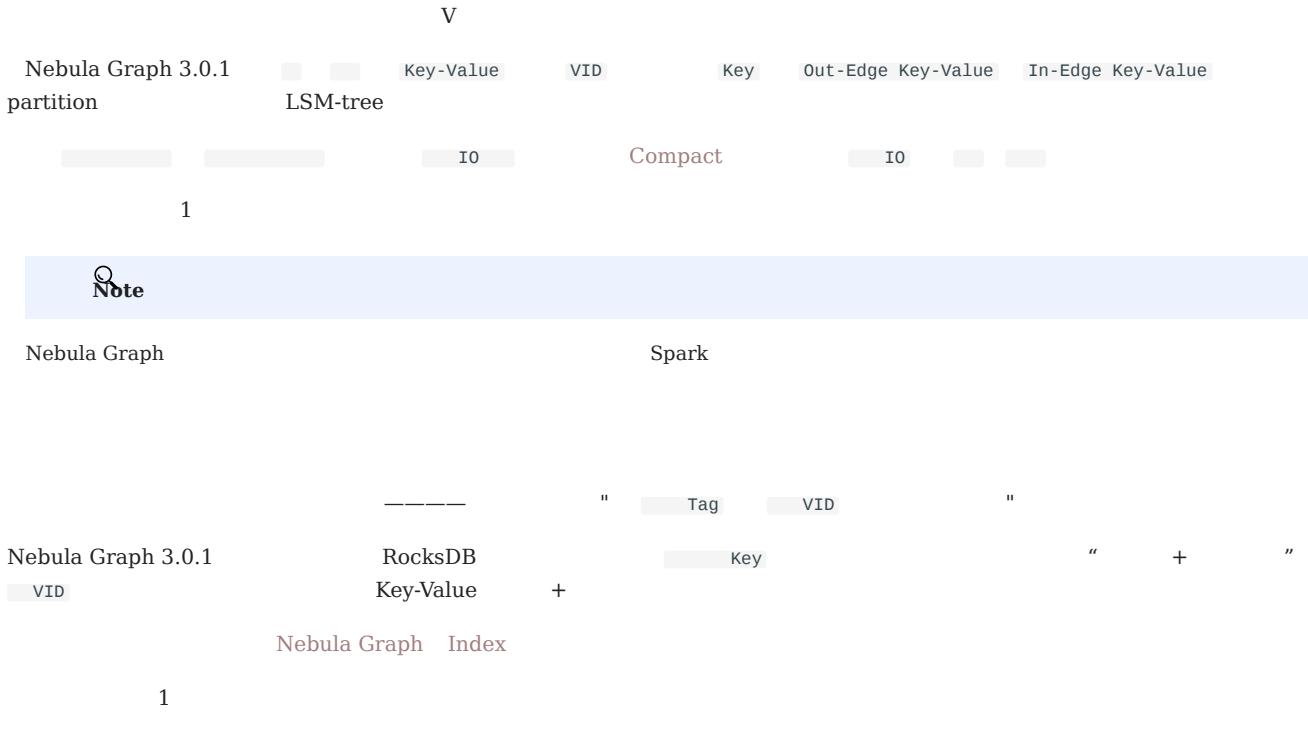
: January 14, 2022

## 10.6

---

### 10.6.1

---



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 | A |
| A1 A2 A3 |   |

A1: 1-1000, A2: 1001-10000, A3: 10000+

A

:January 14, 2022

## 10.7

---

Nebula Graph

### 10.7.1

---

- 
- 
- 

### 10.7.2

---

- MATCH Pattern
- Nebula Graph
- BDD Nebula
- BDD Nebula
- Nebula Graph
- 
- | LDBC nGQL

### 10.7.3

---

- Nebula Importer
  - Nebula 2.0 Nebula Importer
  - Nebula Graph JDBC
  - Nebula | Norm ORM
  - Nebula Graph Betweenness Centrality
  - Nebula Exchange SST
- 

:January 14, 2022

## 11.

---

### 11.1

---

Nebula Graph      Nebula Graph

- Nebula Console    CLI
- Nebula CPP C++
- Nebula Java Java
- Nebula Python Python
- Nebula Go Go



thread-safe

---

:January 18, 2022

## 11.2 Nebula Console

Nebula Console Nebula Graph

Nebula Graph

Nebula Console Nebula Graph

3 Nebula Graph

 Note

### 11.2.1

 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> =>;
```

### 11.2.2

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;
```

## 11.2.3

basketballplayer Schema SHOW

```
nebula> :play basketballplayer;
```

## 11.2.4

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)
```

## 11.2.5

N Schema Schema

```
nebula> :sleep N;
```

## 11.2.6

:EXIT :QUIT Nebula Graph Nebula Console : quit

```
nebula> :QUIT;
Bye root!
```

## 11.2.7

**Nebula Console**

Nebula Console GitHub nebula console

---

: February 17, 2022

## 11.3 Nebula CPP

Nebula CPP    C++

Nebula Graph

### 11.3.1

- C++ GCC 4.8
- 

### 11.3.2

| Nebula Graph | Nebula CPP |
|--------------|------------|
| 3.0.1        | 3.0.0      |
| 2.6.x        | 2.5.0      |
| 2.5.x        | 2.5.0      |
| 2.0.x        | 2.0.0      |

### 11.3.3 Nebula CPP

#### 1. Nebula CPP

- Nebula CPP --branch v3.0.0

```
$ git clone --branch v3.0.0 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



/usr/local/nebula -DCMAKE\_INSTALL\_PREFIX=<installation\_path>

```
$ cmake -DCMAKE_BUILD_TYPE=Release ..
```



g++ C++11 -DDISABLE\_CXX11\_ABI=ON

#### 5. Nebula CPP

-j N \(\min(\text{CPU} \frac{(GB)}{2})\)

```
$ make -j{N}
```

## 6. Nebula CPP

```
$ sudo make install
```

## 7.

```
$ sudo ldconfig
```

### 11.3.4

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 Nebula Graph                   /usr/local/nebula/lib64
- include\_folder\_path Nebula Graph                /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
```

SessionExample

: February 15, 2022

## 11.4 Nebula Java

## Nebula Java      Java      Nebula Graph

### 11.4.1

Java 8.0

## 11.4.2

| Nebula Graph | Nebula Java |
|--------------|-------------|
| 3.0.1        | 3.0.0       |
| 2.6.x        | 2.6.1       |
| 2.0.x        | 2.0.0       |
| 2.0.0-rc1    | 2.0.0-rc1   |

### 11.4.3 Nebula Java

- Nebula Java --branch v3.0.0

```
$ git clone --branch v3.0.0 https://github.com/vesoft-inc/nebula-java.git
```

- master

```
$ git clone https://github.com/vesoft-inc/nebula-java.git
```

## 11.4.4



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

## GraphClientExample

---

: February 15, 2022

## 11.5 Nebula Python

---

Nebula Python    Python

Nebula Graph

### 11.5.1

---

Python    3.6

### 11.5.2

---

<b>Nebula Graph</b>	<b>Nebula Python</b>
3.0.1	3.0.0
2.6.x	2.6.0
2.0.x	2.0.0
2.0.0-rc1	2.0.0rc1

### 11.5.3 Nebula Python

---

#### pip

```
$ pip install nebula3-python==<version>
```

#### 1. Nebula Python

- Nebula Python    --branch    v3.0.0

```
$ git clone --branch v3.0.0 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 .
```

### 11.5.4

---

#### Example

---

: February 15, 2022

## 11.6 Nebula Go

Nebula Go    Go                      Nebula Graph

### 11.6.1

Go        1.13

### 11.6.2

Nebula Graph	Nebula Go
3.0.1	3.0.0
2.6.x	2.6.0
2.0.x	2.0.0-GA

### 11.6.3 Nebula Go

- Nebula Go                  --branch                  v3.0.0

```
$ git clone --branch release-v3.0.0 https://github.com/vesoft-inc/nebula-go.git
```

- master

```
$ git clone https://github.com/vesoft-inc/nebula-go.git
```

### 11.6.4

```
$ go get -u -v github.com/vesoft-inc/nebula-go@<tag>
```

tag                      master    release-v3.0.0

### 11.6.5

graph\_client\_basic\_example    graph\_client\_goroutines\_example

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## 12. Nebula Graph Cloud

---

Nebula Graph Cloud    Cloud

Azure

Nebula Graph

Nebula Graph

2.6.2 Nebula Graph

Nebula Graph Cloud

---

: February 17, 2022

## 13. Nebula Graph Studio

---

### 13.1 Studio

---

#### 13.1.1 v3.2.3(2022.03.25)

- 
- 

#### 13.1.2 v3.2.2(2022.03.08)

- 
- 

#### 13.1.3 v3.2.1(2022.02.17)

- 
- rpm node
- csv

#### 13.1.4 v3.2.0(2022.02.15)

- 
- Nebula 3.0.x
- DEB Studio
- 
- 
- 
- 
- 
- Node Studio Node.js

---

: March 25, 2022

## 13.2 Nebula Graph Studio

### 13.2.1 Nebula Graph Studio

Nebula Graph Studio Graph GitHub	Studio	Web nebula-studio	Nebula Graph	nGQL	Nebula
-------------------------------------	--------	----------------------	--------------	------	--------

#### Studio

- Docker RPM tar DEB Studio Nebula Graph Studio
- Helm Kubernetes Helm Studio Nebula Graph Helm Nebula Graph Studio

#### Studio

- GUI Nebula Graph
- **Schema** Schema Nebula Graph
- nGQL Schema
- 
- 

#### Studio

- Docker Compose Nebula Graph Studio
- Nebula Graph GUI nGQL
- nGQL Nebula Graph Query Language GUI

Nebula Graph `root` Studio

Nebula Graph Studio Nebula Graph Nebula Graph

- Nebula Studio 3 23

: February 23, 2022

## 13.2.2

Studio

- Nebula Graph Studio      Studio      Web      Nebula Graph DBMS      nGQL
  - Nebula Graph      Graph Database Management System      Nebula Graph
- 

: February 23, 2022

### 13.2.3

Studio

#### Nebula Graph



Studio      Nebula Graph

<b>Nebula Graph</b>	<b>Studio</b>
1.x	1.x
2.0 & 2.0.1	2.x
2.5.x	3.0.0
2.6.x	3.1.0
3.0.x	3.2.0

Studio      x86\_64

Studio      CSV

CSV      CSV

#### nGQL

nGQL

- USE <space\_name>      **Space**
- nGQL

Studio

- CREATE USER
- ALTER USER
- CHANGE PASSWORD
- DROP USER
- GRANT ROLE
- REVOKE ROLE

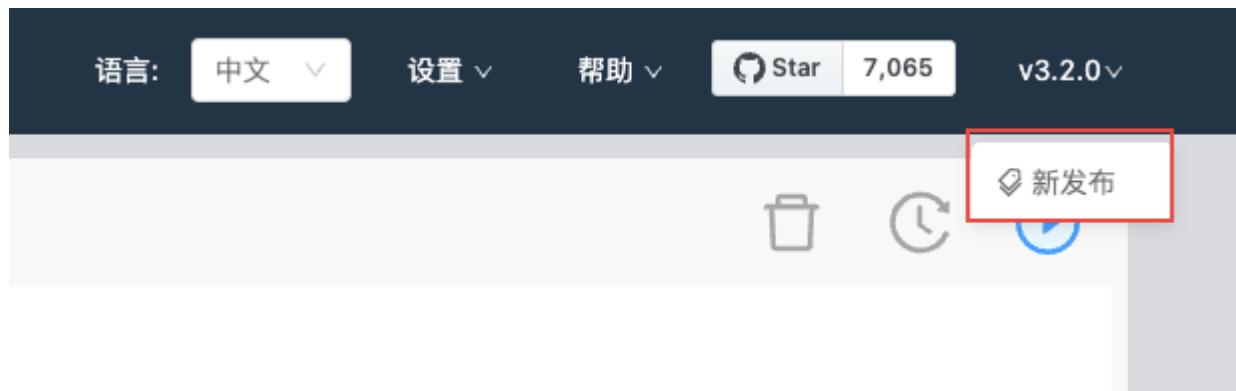
Chrome      Studio

: March 15, 2022

## 13.2.4

Studio Studio

Studio Studio



: March 8, 2022

### 13.2.5

#### Studio

nGQL Shift + Enter

Shift + +

Shift + '-'

Shift + '+'

Shift + 'l'

Shift + 'z'

Shift + 'del'

Shift + Enter

:January 14, 2022

13.3

### 13.3.1 Studio

Docker RPM DEB tar Studio



Studio

RPM Studio

RPM Studio

- Nebula Graph
  - Linux      CentOS      lsof
  -

7001

Studio web

## 1. RPM

Nebula

nebula-graph-studio-3.2.3.x86\_64.rpm nebula-graph-studio-3.2.3.x86\_64.rpm.sha256 3.0.1

2. `sudo rpm -i <rpm>` RPM

Studio 3.2.3 /usr/local/nebula-graph-studio

```
$ sudo rpm -i nebula-graph-studio-3.2.3.x86_64.rpm
```

```
$ sudo rpm -i nebula-graph-studio-3.2.3.x86_64.rpm --prefix=<path>
```

PRM Studio

Created symlink from /etc/systemd/system/multi-user.target.wants/nebula-graph-studio.service to /usr/lib/systemd/system/nebula-graph-studio.service.

3. http://ip address:7001

Studio



## 配置数据库

\* Host:

\* 用户名:

\* 密码:

**连接**

## Studio

```
$ sudo rpm -e nebula-graph-studio-3.2.3.x86_64
```

```
$ bash /usr/local/nebula-graph-studio/scripts/start.sh
```

```
$ bash /usr/local/nebula-graph-studio/scripts/stop.sh
```

ERROR: bind EADDRINUSE 0.0.0.0:7001 7001

```
$ lsof -i:7001
```

## Studio

```
// studio
$ vi config/example-config.yaml

//
web:
task_id_path:
upload_dir:
tasks_dir:
sqitedb_file_path:
ip:
port: 7001 //

//
$ systemctl restart nebula-graph-studio.service
```

**tar** **Studio**

tar Studio

- Nebula Graph [Nebula Graph](#)

•

7001

Studio web

1. tar

### Studio

nebula-graph-studio-3.2.3.x86_64.tar.gz	3.2.3
-----------------------------------------	-------

2. tar -xvf tar

```
tar -xvf nebula-graph-studio-3.2.3.x86_64.tar.gz
```

3. nebula-graph-studio

```
$ cd nebula-graph-studio
$./server
```



Studio 3.2.3

nebula-importer nebula-http-gateway

Studio v3.1.0

4.

<http://ip address:7001>

Studio



### 配置数据库

\* Host:

\* 用户名:

\* 密码:



连接

```
kill pid
```

```
$ kill $(lsof -t -i :7001) # stop nebula-graph-studio
```

## DEB Studio

DEB Studio

- Nebula Graph Nebula Graph
- Linux Ubuntu
- 

7001 Studio web

- /usr/lib/systemd/system

### 1. DEB

#### Nebula

nebula-graph-studio-3.2.3.x86_64.deb	nebula-graph-studio-3.2.3.x86_64.deb.sha256	3.0.1
--------------------------------------	---------------------------------------------	-------

### 2. sudo dpkg -i <deb> DEB

Studio 3.2.3

```
$ sudo dpkg -i nebula-graph-studio-3.2.3.x86_64.deb
```

### 3. http://ip address:7001

Studio



### 配置数据库

* Host:	<input type="text"/>
* 用户名:	<input type="text"/>
* 密码:	<input type="password"/> 
<input type="button" value="连接"/>	

Studio

```
$ sudo dpkg -r nebula-graph-studio-3.2.3.x86_64
```

Docker Studio

Docker Studio

- Nebula Graph
  - 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 Nebula Graph 2.5

#### 1. Studio

##### Nebula Graph

nebula-graph-studio-v3.2.3.tar.gz 3.0.1

#### 2. nebula-graph-studio-v3.2.3

```
mkdir nebula-graph-studio-v3.2.3 && tar -zvxf nebula-graph-studio-v3.2.3.tar.gz -C nebula-graph-studio-v3.2.3
```

#### 3. nebula-graph-studio-v3.2.3

```
cd nebula-graph-studio-v3.2.3
```

#### 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



Note

Docker Studio

ifconfig

ipconfig

IP

Studio

<http://localhost:7001>

Studio



Studio

Schema

导入

图探索

控制台

语言:

中文

设置

帮助

Star 327

##### 配置数据库

\* Host:

\* 用户名:

\* 密码:



连接

Studio

Nebula Graph

---

: March 9, 2022

### 13.3.2 Helm Studio

Kubernetes    Helm    Studio

Studio

Kubernetes     $\geq 1.14$

Helm     $\geq 3.2.0$

#### 1. Studio

```
$ git clone https://github.com/vesoft-inc/nebula-studio.git
```

#### 2. nebula-studio

```
$ cd nebula-studio
```

#### 3. Nebula Graph Studio chart    my-studio

```
$ helm upgrade --install my-studio --set service.type=NodePort --set service.port={30070} deployment/helm
```

#### 4. http://{address-of-node}:{30070}/

Studio



#### 配置数据库

* Host:	<input type="text"/>
* 用户名:	<input type="text"/>
* 密码:	<input type="password"/> 
<b>连接</b>	

```
$ helm uninstall my-studio
```

Studio

Nebula Graph

**Nebula Graph Studio 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	

: February 9, 2022

### 13.3.3

Studio      Nebula Graph      Studio      Nebula Graph

Nebula Graph

- Studio      Studio
- Nebula Graph      Graph      IP      9669
- Nebula Graph



Nebula Graph

root

Nebula Graph

## Nebula Graph

## 1. Studio

• Host Nebula Graph Graph IP ip:port 9669



Nebula Graph Studio

Host

IP

127.0.0.1

localhost

- Nebula Graph
- root
- GOD root nebula
- 

## 配置数据库

\* Host: 9669

\* 用户名: root

\* 密码: nebula



连接

## 2.

Nebula Graph



30            30

### Nebula Graph

- GOD ADMIN                                      Schema              Schema
- GOD ADMIN DBA USER                              nGQL
- GOD ADMIN DBA USER GUEST                      nGQL

: January 14, 2022

### 13.3.4

Nebula Graph

Studio

Nebula Graph

>

Studio

Nebula Graph

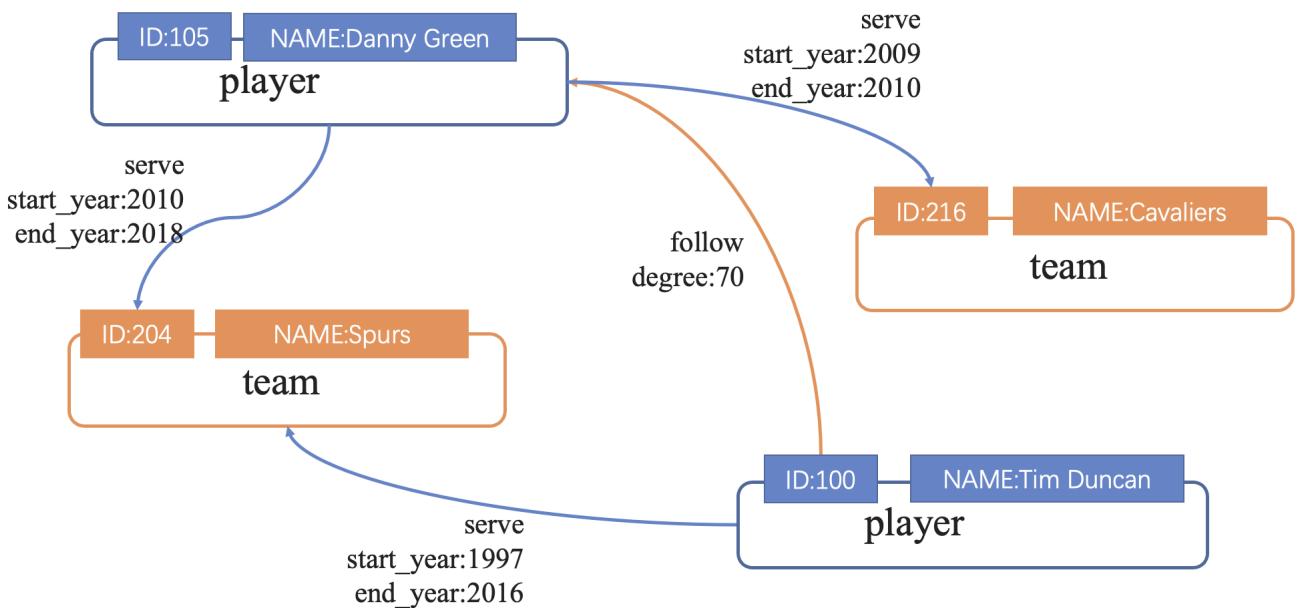
---

: January 14, 2022

## 13.4

### 13.4.1 Schema

Studio	Nebula Graph	Schema
Schema		
• Tag	Tag	
• Edge type		
Nebula Graph	basketballplayer	Schema
Schema		
Tag	<b>player</b>	- name string - age int
Tag	<b>team</b>	- name string
Edge type	<b>serve</b>	- start_year int - end_year int
Edge type	<b>follow</b>	- degree int
<b>player team serve/follow</b>		



### 13.4.2 Schema

Nebula Graph

Schema

Nebula Graph

**Schema**

Schema



nebula-console Schema

Nebula Graph

Nebula Graph

Studio Schema

- Studio Nebula Graph
- GOD ADMIN DBA Nebula Graph
- Schema
- 



GOD

**Schema**

Schema Schema

**Schema** Schema

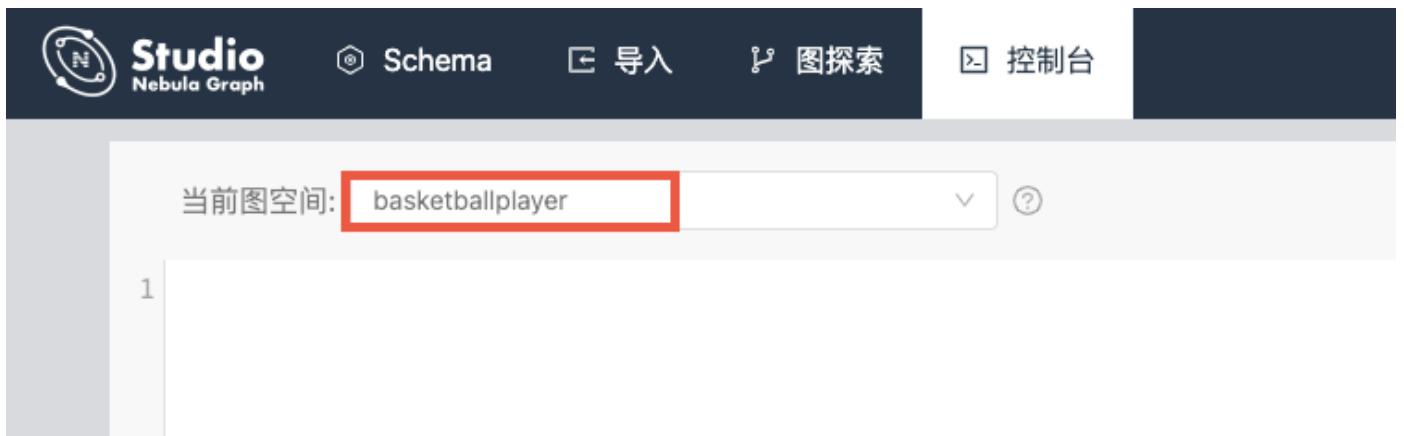
1. Tag Tag
2. Edge type Edge type

**Schema**

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

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### 13.4.3

CSV      Schema      Studio

- Studio      Nebula Graph
- Nebula Graph      Schema
- CSV      Schema
- GOD ADMIN DBA      USER



1.

**Space**

3.

CSV

edge\_serve.csv edge\_follow.csv vertex\_player.csv vertex\_team.csv



4.

5. +

vertex\_player.csv vertex\_team.csv

6. X + Tag

**7. vertexId**

a.

File: vertex\_player.csv

vertexId	对应列标
vertexId	* 选择

b.

vertex\_player.csv

VID vertex\_player.csv

playerID

Column 0

VID

TAG: player

属性	对应列标	类型
name	* 2	string
age	* 1	int

9.

Tag

5 8

10.

Tag

11.

+

edge\_follow.csv

12. Edge X

Edge type

follow

13. Edge type

edge\_follow.csv

srcId dstId

VID

srcId

VID dstId

VID rank

Edge 1 

File: edge\_follow.csv

类型: follow

属性 ①

对应列标 ①

类型 ①

srcId

\* 0

string

dstId

\* 1

string

rank

选择

int

degree

\* 2

int

14.

15.

**log****log**

2021/05/06 03:05:13 [INFO] reader.go:180: Total lines of file(/usr/local/nebula-graph-studio/tmp/upload/vertex\_team.csv) is: 30, error lines: 0

2021/05/06 03:05:13 [INFO] reader.go:64: Start to read file(2): /usr/local/nebula-graph-studio/tmp/upload/edge\_serve.csv, schema: &lt;:SRC\_VID(string),:DST\_VID(string),serve.start\_year:int,serve.end\_year:int &gt;

2021/05/06 03:05:13 [INFO] reader.go:64: Start to read file(3): /usr/local/nebula-graph-studio/tmp/upload/edge\_follow.csv, schema: &lt;:SRC\_VID(string),:DST\_VID(string),follow.degree:int &gt;

2021/05/06 03:05:13 [INFO] reader.go:180: Total lines of file(/usr/local/nebula-graph-studio/tmp/upload/edge\_follow.csv) is: 81, error lines: 0

2021/05/06 03:05:13 [INFO] reader.go:180: Total lines of file(/usr/local/nebula-graph-studio/tmp/upload/edge\_serve.csv) is: 152, error lines: 0

2021/05/06 03:05:13 [INFO] statsmgr.go:61: Done(/usr/local/nebula-graph-studio/tmp/upload/vertex\_player.csv): Time(0.03s), Finished(51), Failed(0), Latency AVG(6857us), Batches Req AVG(8667us), Rows AVG(1767.23/s)

2021/05/06 03:05:13 [INFO] statsmgr.go:61: Done(/usr/local/nebula-graph-studio/tmp/upload/vertex\_team.csv): Time(0.04s), Finished(81), Failed(0), Latency AVG(5696us), Batches Req AVG(7650us), Rows AVG(2274.78/s)

:January 14, 2022

## 13.4.4

## Note

Studio

player100 team204

- FETCH PROP ON serve "player100" -> "team204" YIELD properties(edge); Rank 0

当前图空间: basketballplayer

```
1 FETCH PROP ON serve "player100" -> "team204" YIELD properties(edge);
```

\$ FETCH PROP ON serve "player100" -> "team204" YIELD properties(edge);

serve._src	serve._dst	serve._rank	properties(EDGE)
player100	team204	0	{end_year: 2016, start_year: 1997}

共计 1 < 1 >

VID "player101"

Studio Nebula Graph Schema 导入 图探索 控制台 语言: 中文 设置 帮助 Star 791 v3.2.0

当前图空间: basketballplayer

点(1) 边(0)

vertex 1

vid : "player100"  
player.age : 42  
player.name : "Tim Duncan"

拓展条件

\* 边类型: follow, serve  
\* 方向: 流出  
\* 步数: 单步 (1)  
\* 节点颜色/图标: 按标签类型分类 (蓝色)  
结果数量限制: 100  
自定义筛选条件: + 添加条件

导出选中点CSV

: March 30, 2022

## 13.5

---

### 13.5.1 Schema

Studio      Nebula Graph

**Schema**

**Schema**

Studio v3.2.3

- Studio      Nebula Graph
- 
- Nebula Graph                  user                  password
- Nebula Graph                  root

#### **Schema**

1.      **Schema**

2.      +

3.

•              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"
```

4.

The screenshot shows the Nebula Graph Studio interface. At the top, there are tabs for 'Schema', '导入' (Import), '图探索' (Graph Exploration), and '控制台' (Console). The language is set to '中文'. On the right, there are 'Star' (659) and 'v3.0.0' buttons.

In the main area, a form is being filled out:

- 名称:** basketballplayer
- \* vid type:** FIXED\_STRING (32)
- 描述:** Statistics of basketball players
- 可选参数:**
  - partition\_num: 100
  - replica\_factor: 1
- 对应的nGQL语句:**

```
1 CREATE SPACE basketballplayer (partition_num = 100, replica_factor = 1, vid_type = FIXED_STRING(32)) COMMENT = "Statistics of basketball players"
```

A red 'Danger' warning bar is at the bottom.

## Schema

### 1. Schema



The screenshot shows the '图空间列表' (Graph Space List) page. At the top, there are tabs for 'Schema', '导入' (Import), '图探索' (Graph Exploration), and '控制台' (Console). The language is set to '中文'. On the right, there are 'Star' (659) and 'v3.0.0' buttons.

The main area displays a table of graph spaces:

序号	名称	Partition Number	Replica Factor	Charset	Collate	Vid Type	Atomic Edge	Group	Comment	操作
1	basketballplayer	15	3	utf8	utf8_bin	FIXED_STRING(30)	false	default		
2	debug	100	1	utf8	utf8_bin	FIXED_STRING(8)	false	default		
3	nba	1	1	utf8	utf8_bin	FIXED_STRING(30)	false	default		
4	soccer	100	1	utf8	utf8_bin	FIXED_STRING(10)	false	default		

3.

## Schema

- Tag
  - Edge type
  -
- 

:January 14, 2022

**Tag**

Nebula Graph

Tag

**Schema** Tag**Schema** Tag

Studio v3.2.3

Studio Tag

- Studio Nebula Graph
- 
- GOD ADMIN DBA

TAG

**Schema** Tag1. **Schema**2.  
3.  
4.  
5.

a. Tag player team

- b. Tag
- 
- Tag
- 

c. Tag TTL **TTL** TTL\_COL TTL\_DURATION TTL6. **nGQL** nGQL

7. + Tag Tag

TAG

**Schema** Tag1. **Schema**

2.



3.

4.

Tag



5.

•

•

•

•

Tag

• TTL TTL TTL TTL

• TTL TTL

• TTL TTL TTL

6. **nGQL** nGQL

TAG

Danger

Tag

**Schema** Tag1. **Schema**

2.



3.

4.

Tag



5.

Tag

: January 24, 2022

**Edge type**

Nebula Graph

Edge type

**Schema** Edge type**Schema** Edge type

Studio v3.2.3

Studio Edge type

- Studio Nebula Graph
- 
- GOD ADMIN DBA

## EDGE TYPE

**Schema** Edge type1. **Schema**

2.

3.

4.

5.

- Edge type serve
- Edge type

6. **nGQL** nGQL

**Studio Nebula Graph** Schema 导入 图探索 控制台 语言: 中文 设置 帮助 Star 659 v3.0.0 < 图空间列表

当前图空间: basketballplayer < 返回边类型列表

标签 边类型 / 列表 / 创建

边类型 索引

\* 名称: serve  
描述: Players serve the team

定义属性

属性名称	数据类型	允许空值	默认值	描述
start_year	int	<input checked="" type="checkbox"/>	请输入默认值	(-)
end_year	int	<input checked="" type="checkbox"/>	请输入默认值	(-)
teamID	string	<input checked="" type="checkbox"/>	请输入默认值	(-)
playerID	string	<input checked="" type="checkbox"/>	请输入默认值	(-)

设置TTL

✓ 对应的nGQL语句

```
1 CREATE EDGE serve (start_year int NULL , end_year int NULL , teamID string NULL , playerID string NULL) COMMENT = "Players serve the team"
```

7.



Edge type

Edge type

## EDGE TYPE

**Schema** Edge type

1. **Schema**



2.

3.

4.

Edge type



5.

•

•

•

•

•

TTL      TTL      TTL\_COL    TTL\_DURATION

•

TTL      TTL

•

TTL      TTL                    TTL

6.

**nGQL**                        nGQL

## EDGE TYPE

Danger

Edge type

**Schema** Edge type

1. **Schema**



2.

3.

4.

Edge type



5.

Edge type

: January 14, 2022

Tag Edge type      Nebula Graph      Tag Edge type  
**Schema**      **Schema**



Tag Edge type

nGQL

Studio v3.2.3

Studio

- Studio      Nebula Graph
- Tag Edge type
- GOD ADMIN DBA

## Schema

### 1. Schema

2. 

3.

4.

5.

- Tag    Edge type         Edge type
- Tag    Edge type         follow
- follow\_index
- degree



LOOKUP

nGQL

- 256                    follow\_index

### 6. nGQL

nGQL

语言: 中文  设置  帮助  Star 659  v3.0.0

当前图空间: basketballplayer

< 图空间列表

标签 索引 / 列表 / 创建

< 返回索引列表

边类型

\* 索引类型: Edge Type

索引

\* 名称: follow

\* 索引名称: follow\_index

索引属性: degree × 添加  
(可拖拽排序)

描述: index

✓ 对应的nGQL语句

```
1 CREATE EDGE INDEX follow_index on follow(degree) COMMENT = "index"
```

7. +

**Schema**1. **Schema**

2.

3.

4.

5.

**Schema**1. **Schema**

2.

3.

4.



5.

.....  
:January 14, 2022

## 13.5.2

## Studio

The screenshot shows the Nebula Graph Studio interface. At the top, there is a navigation bar with the logo, 'Schema', '导入' (Import), '图探索' (Graph Search), '控制台' (Console), language selection ('语言: 中文'), settings ('设置'), and help ('帮助'). On the right, there is a 'Star' button (7,090), a version indicator ('v3.2.0'), and a refresh icon.

**Query Editor Area:**

- 2: Current graph space: basketballplayer
- 3: Query text: `p1 => "Tim Dunc  
an"`
- 4: Query text: `MATCH (v:player{name:$p1})-[:follow]->(n) RETURN v,n;`
- 5: Delete icon
- 6: Refresh icon
- 7: Run icon
- 8: Result preview: `$ MATCH (v:player{name:$p1})-[:follow]->(n) RETURN v,n;`
- 9: Table icon
- 10: Export CSV file button
- 11: View subgraph button

**Result Table Area:**

v	n
{"player100":actor{age: 42, name: "Tim Duncan"}:player{age: 42, name: "Tim Duncan"}:t1:a: "Hello", b: 100)}	{"player125":player{age: 41, name: "Manu Ginobili")}
{"player100":actor{age: 42, name: "Tim Duncan"}:player{age: 42, name: "Tim Duncan"}:t1:a: "Hello", b: 100)}	{"player101":player{age: 36, name: "Tony Parker")}

共计 2 < 1 >

1

2

Studio

USE &lt;space\_name&gt;

3



4

nGQL



;

5



6



15

7

nGQL



8

nGQL

9

10

CSV

nGQL

CSV

CSV

11

nGQL

nGQL

Studio v3.2.3

- Studio      Nebula Graph
-



- 1.
2. **Space**                   **basketballplayer**
3. 

### Note

VID

```
nebula> GO FROM "player102" OVER serve YIELD src(edge),dst(edge);
```

```
playerId palyer102
```

```
$ GO FROM "player102" OVER serve YIELD serve._src,serve._dst;
```

 表格

导出CSV文件

导入图探索

serve._src	serve._dst
player102	team203
player102	team204

共计 2 < 1 >

4.

5.

a. **Edge type**

- b. **Edge Type**      Edge type      serve
- c. **Src ID**              VID              serve.\_src
- d. **Dst ID**              VID              serve.\_dst
- e.              Rank      Rank      Rank      0
- f.

X

点	边类型
---	-----

请选择结果中分别代表边的起点 (src\_vid)、终点 (dst\_vid) 和权重 (rank) 的列

\* Edge Type:

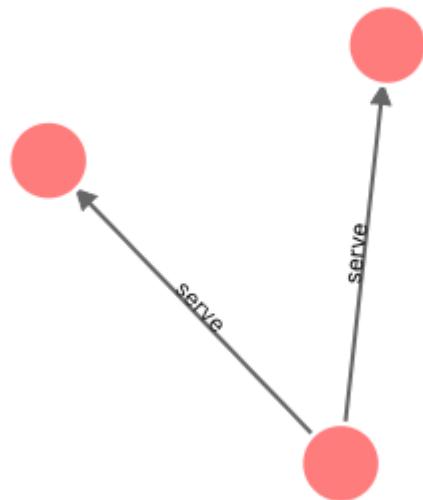
\* Src ID:

\* Dst ID:

Rank:

6.

- 
- 



- 1.
2. **Space**                   **basketballplayer**
3. 

**Note**

VID

```
nebula> FETCH PROP ON player "player100" YIELD properties(vertex).name;
```

```
playerId player100
```

```
$ FETCH PROP ON player "player100" YIELD player.name;
```

 表格

导出CSV文件

导入图探索

VertexID	player.name
player100	Tim Duncan

共计 1 &lt; 1 &gt;

4.

5.

a.

b. **Vertex ID**              VID              VertexID

c.

X

	点		边类型
--	---	--	-----

请选择表中代表点VID的列

\* vid:  ▾

**导入**

6.

- 
-

---

:January 14, 2022

Studio FIND SHORTEST | ALL PATH  
FIND SHORTEST | ALL PATH nGQL

Studio v3.2.3

FIND PATH

- Studio v3.2.3
- Studio Nebula Graph
- 

Note

Studio

FIND PATH

1.

2. Space basketballplayer

3.

FIND SHORTEST PATH FIND ALL PATH



```
nebula> FIND ALL PATH FROM "player114" to "player100" OVER follow YIELD path AS p;
```

\$ FIND ALL PATH FROM "player114" to "player100" OVER follow;

表格

导出CSV文件

查看子图

path
<"player114"-[:follow@0 {}]->"player103"-[:follow@0 {}]->"player102"-[:follow@0 {}]->"player100">
<"player114"-[:follow@0 {}]->"player103"-[:follow@0 {}]->"player102"-[:follow@0 {}]->"player101"-[:follow@0 {}]->"player100">
<"player114"-[:follow@0 {}]->"player103"-[:follow@0 {}]->"player102"-[:follow@0 {}]->"player101"-[:follow@0 {}]->"player125"-[:follow@0 {}]->"player100">
<"player114"-[:follow@0 {}]->"player103"-[:follow@0 {}]->"player102"-[:follow@0 {}]->"player101"-[:follow@0 {}]->"player102"-[:follow@0 {}]->"player100">
<"player114"-[:follow@0 {}]->"player103"-[:follow@0 {}]->"player102"-[:follow@0 {}]->"player100"-[:follow@0 {}]->"player125"-[:follow@0 {}]->"player100">
<"player114"-[:follow@0 {}]->"player103"-[:follow@0 {}]->"player102"-[:follow@0 {}]->"player100"-[:follow@0 {}]->"player101"-[:follow@0 {}]->"player100">
<"player114"-[:follow@0 {}]->"player140"-[:follow@0 {}]->"player114"-[:follow@0 {}]->"player103"-[:follow@0 {}]->"player102"-[:follow@0 {}]->"player100">

共计 7



4.

5.

•

•

icon

当前图空间: basketballplayer

点(0) 边(0)

拓展条件

\* 边类型: follow, like, serve

\* 方向: 流入

\* 步数: 单步 (selected), 范围 1

\* 节点颜色/图标: 按标签类型分类 (selected), 自定义颜色/图标

结果数量限制: 100

自定义筛选条件: + 添加条件

对应的nGQL语句

: January 14, 2022

## 13.6

---

### 13.6.1

---

Studio

1 HOST

Nebula Graph	Graph	IP	graph_server_ip	9669	Nebula Graph	Studio	IP
127.0.0.1	localhost		0.0.0.0				

2

Nebula Graph

3 NEBULA GRAPH

Nebula Graph

- Linux                  Nebula Graph          Nebula Graph
- Docker Compose      RPM      Nebula Graph      Nebula Graph

Nebula Graph          4                  Nebula Graph

 Note

`docker-compose up -d`    Nebula Graph        `docker-compose down`    Nebula Graph

4 GRAPH

Studio                  `telnet <graph_server_ip> 9669`    Nebula Graph    Graph

- Studio    Nebula Graph
- Nebula Graph

Nebula Graph          Nebula Graph

: January 14, 2022

## 13.6.2 Studio

Studio 127.0.0.1:7001 0.0.0.0:7001

1

Studio x86\_64 Studio x86\_64

2 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 nginx ...	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

Studio Studio

### Note

docker-compose up -d Studio docker-compose down 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 Nebula Graph

:January 14, 2022

### 13.6.3

---

1. Nebula Graph Docker Compose Nebula Graph `docker-compose pull && docker-compose up -d` Docker
  2. Studio
  3. GitHub nebula nebula-web-docker
  - 4.
- 

:January 14, 2022

## 14. Nebula Dashboard

---

### 14.1 Nebula Dashboard

[Nebula Dashboard](#)    [Dashboard](#)    [Nebula Graph](#)    [Dashboard](#)    [Nebula Dashboard](#)

 **Enterpriseonly**

#### 14.1.1

- CPU
- IP
- 

#### 14.1.2

[Dashboard](#)

- 
- 
- 

#### 14.1.3

- 7
- 14      14

 **Note**

[prometheus](#)

[prometheus](#)

#### 14.1.4

[Nebula Graph](#)    [Dashboard](#)

<b>Nebula Graph</b>	<b>Dashboard</b>
2.5.1~3.0.1	1.1.0
2.0.1~2.5.1	1.0.2
2.0.1~2.5.1	1.0.1

#### 14.1.5

[Release](#)

: March 15, 2022

## 14.2 Dashboard

Dashboard 5

tar

Nebula Dashboard

[GitHub nebula dashboard](#)

### 14.2.1

Dashboard

- Nebula Graph [Nebula Graph](#)

•

• 9200

• 9100

• 9090

• 8090

• 7003

- Linux CentOS v10.12.0 Node.js 1.13 Go

### 14.2.2 Dashboard

tar

**Dashboard**

**Nebula Graph**

nebula-dashboard-1.1.0.x86\_64.tar.gz

2.5.1~3.0.1

### 14.2.3

`tar -xvf nebula-dashboard-1.1.0.x86_64.tar.gz` nebula-dashboard/vendors 4

node-exporter	CPU	9100
nebula-stats-exporter	IP	9200
prometheus		9090
nebula-http-gateway	HTTP nGQL Nebula Graph	8090

4

### 14.2.4

**node-exporter**



node-exporter

node-exporter

```
$ nohup ./node-exporter --web.listen-address=:9100 &
```

&lt;IP&gt;: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 &
```

&lt;IP&gt;:9200

**prometheus****Note**

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 &
```

&lt;IP&gt;:9090

**nebula-http-gateway****Note**

nebula-dashboard      nebula-http-gateway

**nebula-http-gateway**

```
$ nohup ./nebula-htpd &
```

&lt;IP&gt;:8090

**dashboard**

1.    nebula-dashboard      config.json      Graph      IP

```
port: 7003
proxy:
 gateway:
 target: "127.0.0.1:8090" // nebula-http-gateway IP
 prometheus:
 target: "127.0.0.1:9090" // Prometheus IP
 nebulaServer:
 ip: "192.168.8.143" // Graph IP
 port: 9669 // Graph
 ...
```

2.    nebula-dashboard

```
$ nohup ./dashboard &
```

&lt;IP&gt;:7003

### 14.2.5 Dashboard

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
```

: March 15, 2022

## 14.3 Dashboard

Dashboard

Dashboard

### 14.3.1

- Dashboard
- Chrome 58

Dashboard

Chrome

### 14.3.2

1. nebula-dashboard IP <IP>:7003
2. Nebula Graph

#### Note

Nebula Graph config.json Graph IP Dashboard

- Nebula Graph
- Nebula Graph

Dashboard

root Dashboard

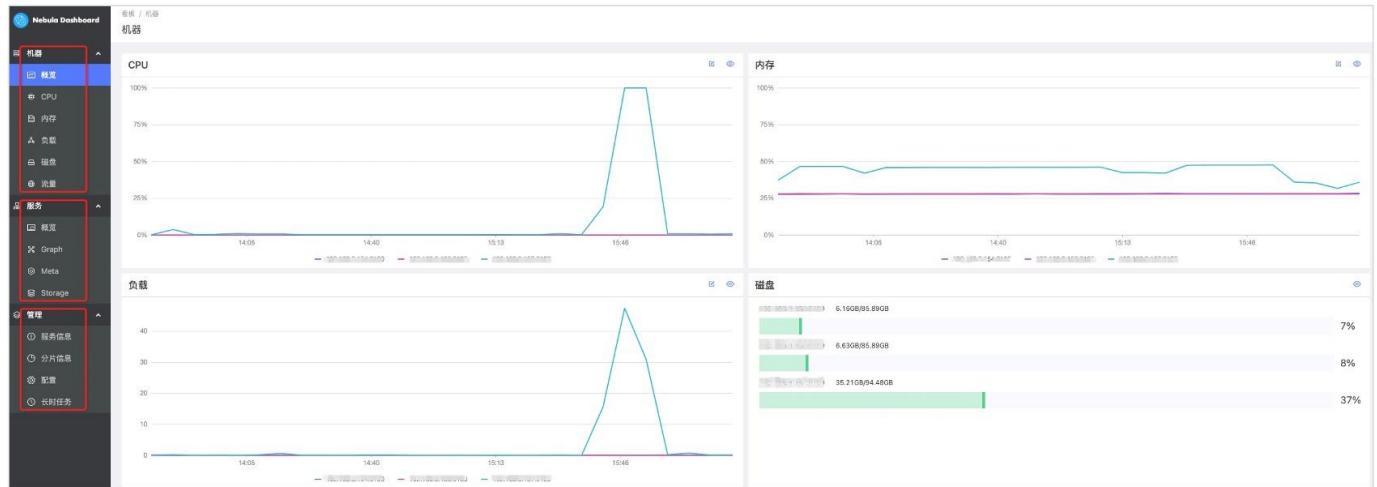


: February 11, 2022

## 14.4 Dashboard

Dashboard

### 14.4.1



#### 14.4.2

•

CPU

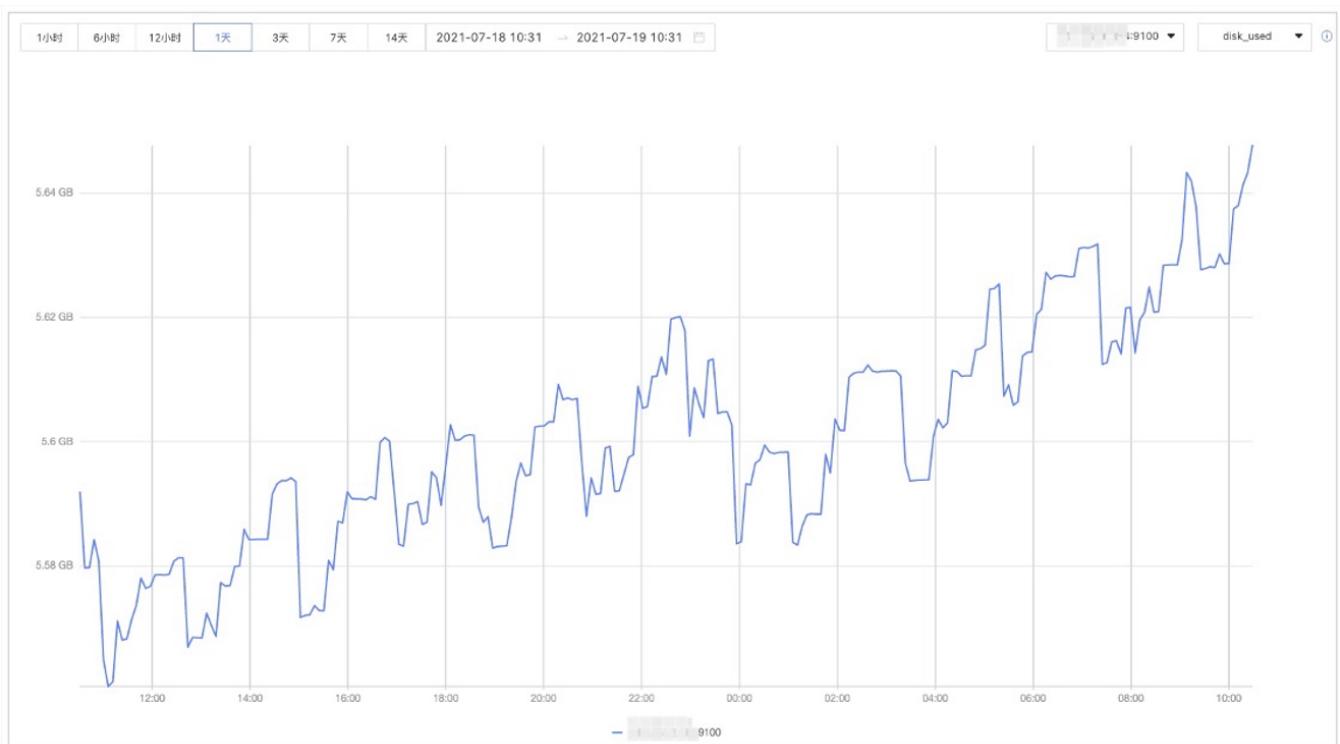


• CPU

• 14 1 6 12 1 3 7 14

•

•



#### 14.4.3



- Graph Meta Storage

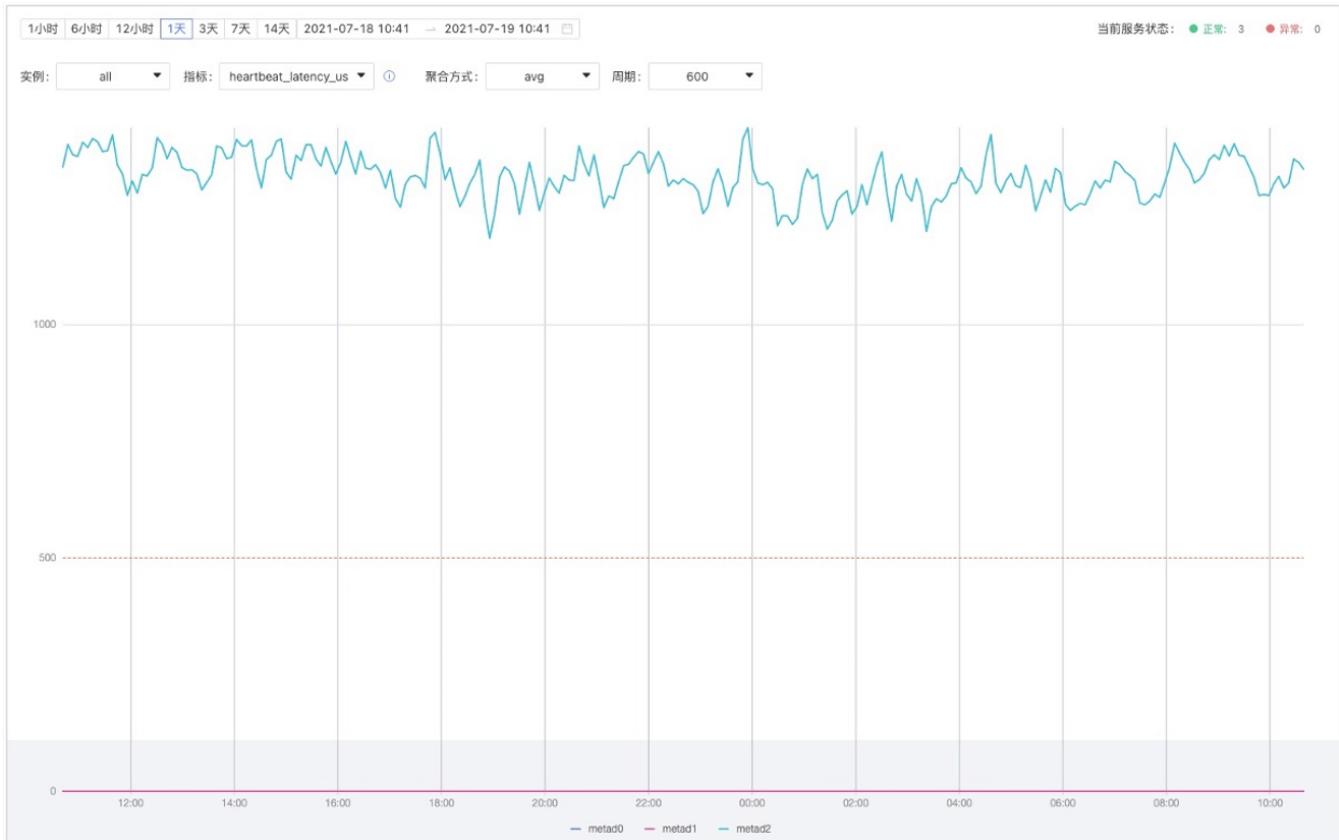
- 14                    1     6     12     1     3     7     14

- 

- Graph

- 

- 



#### 14.4.4

 Note

root

Storage                    Commit ID leader                    leader

•

Partition ID

Leader	leader	IP
Peers		IP
Losts		IP

Graph Storage

•

#### 14.4.5

- 
- 
- Dashboard
- 
- 

: February 11, 2022

## 14.5

---

[Dashboard](#)    [Nebula Graph](#)

### 14.5.1

---

#### 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	Nebula Graph CPU
cpu_system	Nebula Graph CPU

memory\_utilization

memory\_used

memory\_actual\_used

memory\_free

load_1m	1
load_5m	5
load_15m	15

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

---

#### 14.5.2

---

5    60    600    3600                5    1    10    1

rate  
sum  
avg  
P75                          75%  
P95                          95%  
P99                          99%  
P999                         99.9%

---

**Graph**

num_active_queries			
num_active_sessions			
num_aggregate_executors		Aggregate	
num_auth_failed_sessions_bad_username_password			
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			

**Meta**

commit_log_latency_us	Raft	Commit
commit_snapshot_latency_us	Raft	Commit
heartbeat_latency_us		
num_heartbeats		
num_raft_votes	Raft	
transfer_leader_latency_us	Raft	Leader

**Storage**

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			
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	

num_active_queries		
num_aggregate_executors	Aggregate	
num_indexscan_executors	IndexScan	
num_killed_queries		
num_queries		
num_query_errors_leader_changes	Leader	
num_query_errors		
num_sentences	Graphd	
num_slow_queries		
num_sort_executors	Sort	
optimizer_latency_us		
query_latency_us		

---

: January 17, 2022

## 15. Nebula Dashboard

### 15.1 Nebula Dashboard

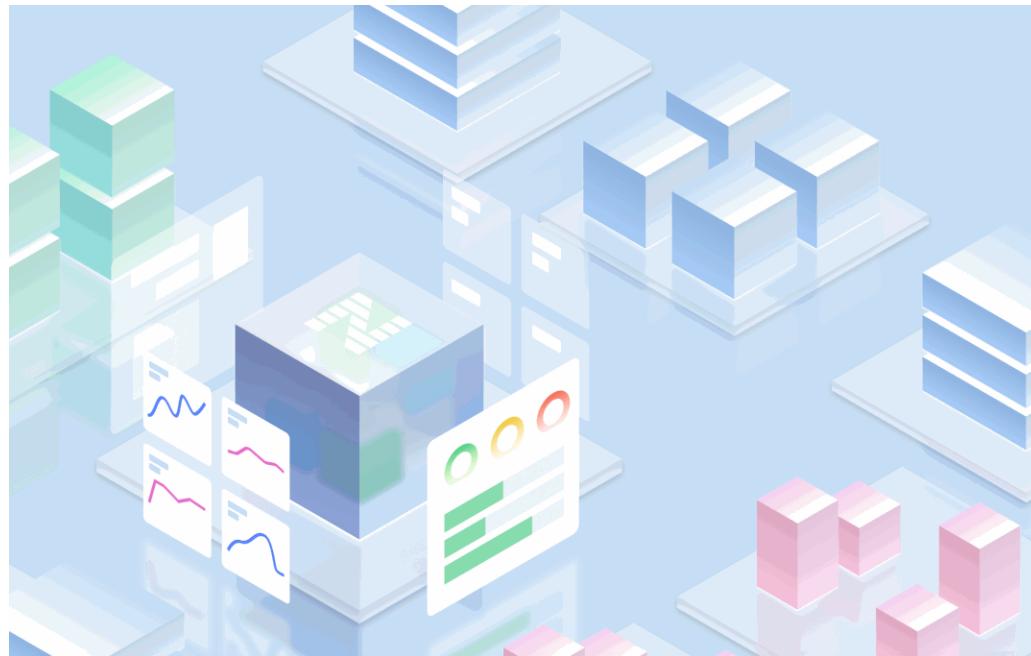
Nebula Dashboard  
Dashboard

Dashboard

Nebula Graph

Dashboard

Nebula



**Nebula Dashboard**

企业版

账户登录

LDAP

ACCOUNT

nebula

.....

登 录

#### 15.1.1

- Nebula Graph
- 
- 14
- 
- Storage Graph
- IP
- CPU
- 

#### 15.1.2

- 
- 
- 
- 

#### 15.1.3

- 7
- 14 14

- 2.5.1 Nebula Graph
- Chrome Dashboard
- 

**Note**

prometheus

prometheus

**15.1.4**

Nebula Graph Dashboard

<b>Nebula Graph</b>	<b>Dashboard</b>
2.5.1~3.0.1	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

: March 15, 2022

## 15.2 Dashboard

Dashboard

### 15.2.1

Dashboard

- Dashboard    Dashboard    Nebula Graph
- 5.7    MySQL            dashboard
- 

7005	Dashboard	web
9090	Prometheus	
9200	nebula-stats-exporter	
9093	Alertmanager	Prometheus
		Dashboard

- License

 Enterpriseonly

License      License      Nebula Dashboard

### 15.2.2

1. tar

 Enterpriseonly

Dashboard

2. tar -xzvf tar

```
$ tar -xzvf nebula-dashboard-ent-<version>.linux-amd64.tar.gz
```

```
$ tar -xzvf nebula-dashboard-ent-1.1.0.linux-amd64.tar.gz
```

3. vim config/config.yaml

```

database:
 dialect: mysql # MySQL
 host: 192.168.8.157 # MySQL IP
 port: 3306 # MySQL
 username: root # MySQL
 password: nebula # MySQL
 name: dashboard #
 autoMigrate: true # true
exporter
exporter:
 nodePort: 9100 # node-exporter
 nebulaPort: 9200 # nebula-stats-exporter

proxy:
 prometheus:
```

```

target: "127.0.0.1:9090" # prometheus IP
alertmanager:
 target: "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
 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 scripts
$ sudo ./dashboard.service start all
```

```
prometheus webserver exporter gateway Dashboard
```

```
$ cd scripts
$ sudo ./dashboard.service start prometheus # Prometheus
$ sudo ./dashboard.service start webserver # Webserver
$ sudo ./dashboard.service start exporter # Exporter
$ sudo ./dashboard.service start gateway # Gateway
```



Dashboard

scripts

dashboard.service restart all

Dashboard

#### 15.2.3 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	

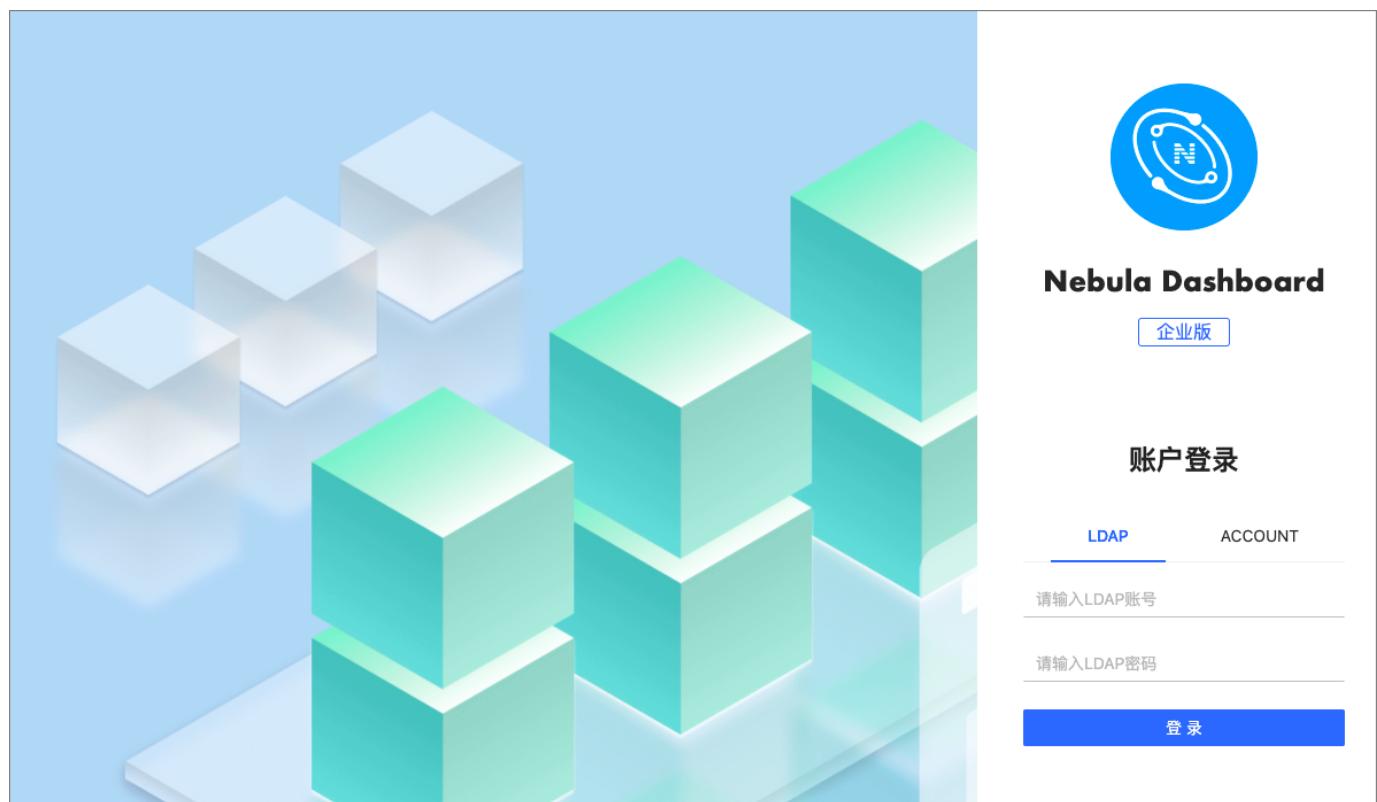
## Dashboard

```
$ 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
```

### 15.2.4 Dashboard

Dashboard [http://<ip\\_address>:7005](http://<ip_address>:7005)

Dashboard



## Note

Nebula Dashboard

[nebula](#) [nebula](#) [Dashboard](#) [Dashboard](#) [LDAP](#)

[Dashboard](#)

: February 14, 2022

## 15.3

---

### 15.3.1

---

Dashboard



- 1.
- 2.

  - 15 test\_foesa
  - Nebula Graph v2.6.1
  - 
  - a. Host IP 192.168.8.144
  - b. SSH SSH 22 vesoft SSH nebula
  - c. Nebula Graph nebula-graph-2.6.1.el7.x86\_64.rpm
  - d. .nebula/cluster
  - e. Node\_1

### 添加节点

\* Host ②: 192.168.8.144

\* SSH 端口号 ②: 22

\* SSH 用户 ②: vesoft

\* SSH 密码: .....

\* 安装包: nebula-graph-2.6.1.el7.x86\_64.rpm ▾

安装路径 ②: .nebula/cluster

节点名: Node\_1

取消
确认

- 
3. CSV
3. Nebula Graph

选择Nebula安装版本：

 Nebula Graph v2.6.1	 Nebula Graph v2.5.1	 Nebula Graph v2.0.1
----------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------

2

节点：已添加1个节点

1 [添加节点](#) [批量导入节点](#)

[自动添加服务](#) [添加 Meta](#) [添加 Graph](#) [添加Storage](#)

<input type="checkbox"/> 节点名称	节点Host	CPU(核)	内存(GB)	磁盘(GB)	安装包	服务类型	操作
<input type="checkbox"/> Node_1	192.168.8.144	4	32.78	50.33	nebula-graph-2.6.1.el7.x86_64.rpm	没有服务，请添加服务	<a href="#">编辑</a> <a href="#">删除</a>

4. meta graph storage      HTTP      HTTP2

5.

6.      installing      3-10      healthy      unhealthy

 import-2.6.1	<span>● healthy</span>	192.168.8.169	v2.6.1	1 / 1	1 / 1	1 / 1	2021-11-05 16:29:21	<a href="#">详情</a>
正在安装，过程大约需要等待3~10分钟								
 test_foesa	<span>● installing</span>	192.168.8.144	v2.6.1	0 / 1	0 / 1	0 / 1	2021-11-08 12:02:04	<a href="#">详情</a>

:January 26, 2022

## 15.3.2

Dashboard

DEB RPM

Dashboard

Docker Kubernetes



## Nebula Graph

1. <meta|graph|storage>\_server\_addrs local\_ip IP IP

2.

3. Nebula Graph

- Graphd Host < Graphd IP>:< IP>: > 192.168.8.157:9669
- Nebula Graph vesoft
- Nebula Graph nebula



Nebula Graph  
Nebula Graph

root Nebula Nebula Graph

Nebula Nebula Graph

4.

- 15 create\_1027
- SSH
- 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		<button>授权</button>
192.168.8.155				Storage Metad		<button>授权</button>
192.168.8.157	16	32.79	92.27	Storage Metad	已授权	<button>授权</button>
192.168.8.158				Storage		<button>授权</button>
127.0.0.1				Graphd		<button>授权</button>

5.

---

:January 14, 2022

15.4

## 15.4.1

## Dashboard

Dashboard

- • • •

## Graphd Stored Metadata

emergency > critical > warning



Nebula Graph Dashboard



Nebula Graph v2.5.0 v2.0.1

- **cpu**



- `query_latency_us` `slow_query_latency_us`



---

:January 14, 2022

## 15.4.2

Dashboard

Dashboard

->

CPU Memory Load Disk Network In/Out



Load

1小时 6小时 12小时 1天 3天 7天 14天

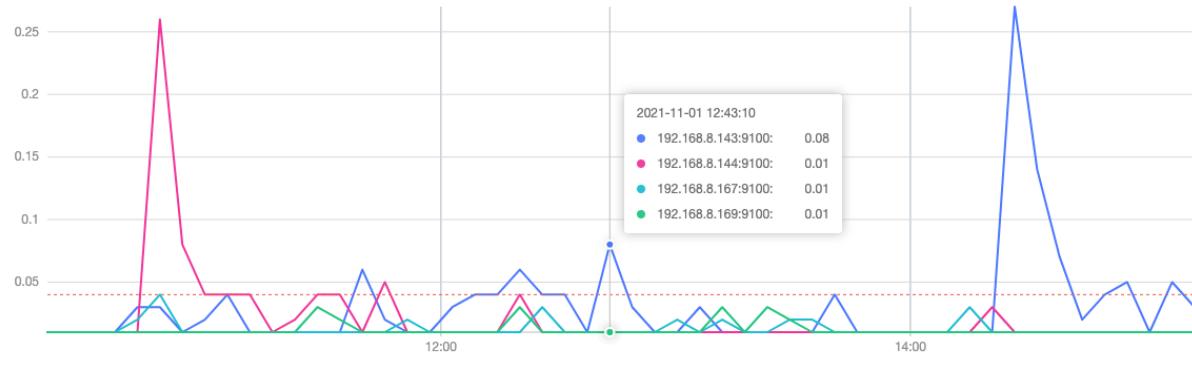
2021-10-31 15:15 → 2021-11-01 15:15

全部

load\_5m

①

基线



14

1 6 12 1 3 7 14

Dashboard

->

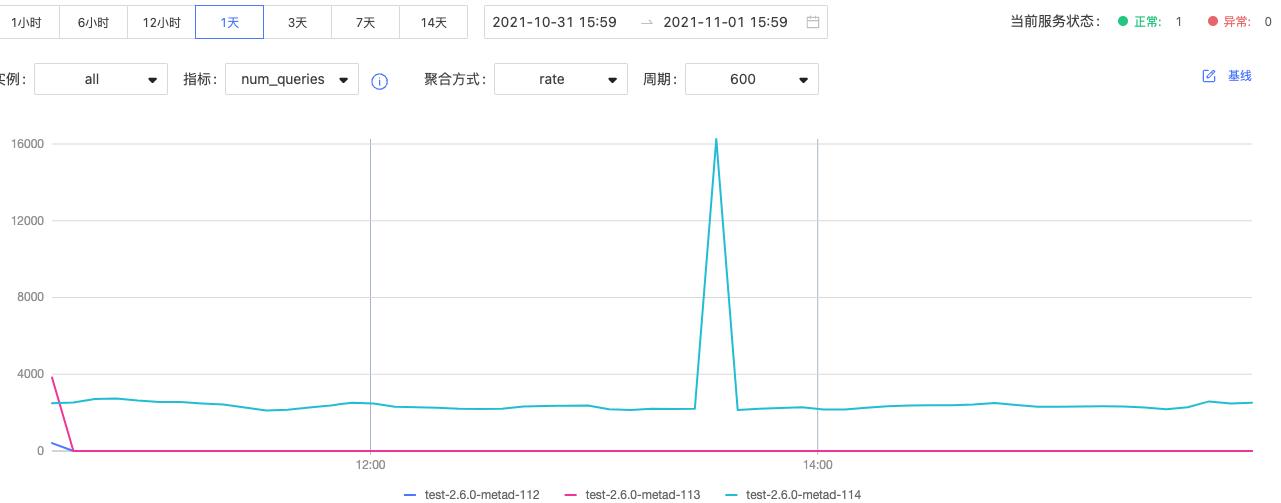
Graph Meta Storage

## Note



Graph

### Graph 指标



14 1 6 12 1 3 7 14

## Note

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

: March 8, 2022

### 15.4.3

#### Nebula Graph

&gt;

•

•

•

•

1 6 12 1 3 7 14

nebula-dashboard-ent/config/config.yaml messageStore Nebula Dashboard 90  
Dashboard

Dashboard

1. Dashboard

2. ->

3.

4.

a.

253

emergency critical warning

Min

b.

graphd storaged metad

Min

c.

Note

- 
- 
- 

**active**      **disable**



Dashboard

**active**      **disable**

Note

Webhook      Webhook      Webhook

1. Dashboard
  2. ->
  3.
    - **Mail**
    - **Webhook**,    Webhook      Webhook
- 

: February 10, 2022

## 15.4.4

Dashboard

Dashboard

- 
- Leader
- Partition
- 
- 
- 

Graph      Nebula Graph      Dashboard

Graph



Nebula Graph

Nebula Graph

Nebula

### Leader

Leader

Leader

**Balance Leader**

Nebula Graph

Leader

### Partition

Partition

Storage

Host

Port

Status

Git Info Sha

Commit ID

Leader Count

Leader

Partition Distribution

Leader Distribution

Leader

ID

Partition ID		
Leader	leader	IP
Peers		IP
Losts		IP

Job ID	ID
Command	
Status	
Start Time	
Stop Time	FINISHED FAILED STOPPED

---

:January 20, 2022

## 15.4.5

Dashboard

Host SSH CPU

• Host SSH Nebula Graph



•  
• SSH  
•

• Host / /



Danger

/

Storage Graph

Storage

Graph

Storage/Graph

•  
•

Danger

admin

user

owner

operator

Dashboard

1. Dashboard

2.

3. ->

4.

5.

- 
- 

---

:January 20, 2022

## 15.4.6

Dashboard

Dashboard

1    6    12    1    3    7    14

---

: January 14, 2022

## 15.4.7

Dashboard

Dashboard

•

• Nebula

 Note

• Nebula

 Note

---

: January 14, 2022

## 15.5

---

### Nebula Dashboard

#### 15.5.1

Dashboard	nebula	nebula	Dashboard	LDAP
-----------	--------	--------	-----------	------

##### LDAP

Dashboard	LDAP Lightweight Directory Access Protocol	Dashboard
-----------	--------------------------------------------	-----------

LDAP	LDAP
------	------

1. Dashboard      nebula-graph-dashboard-ent/nebula-dashboard-ent/config      config.yaml
2. config.yaml

```
ldap:
 server: ldap://127.0.0.1
 bindDN: cn=admin,dc=vesoft,dc=com
 bindPassword: kenshin
 baseDN: dc=vesoft,dc=com
 userFilter: "&(objectClass=*)"
 emailKey: mail
```

server	LDAP
bindDN	LDAP
bindPassword	LDAP
baseDN	
userFilter	
emailKey	LDAP

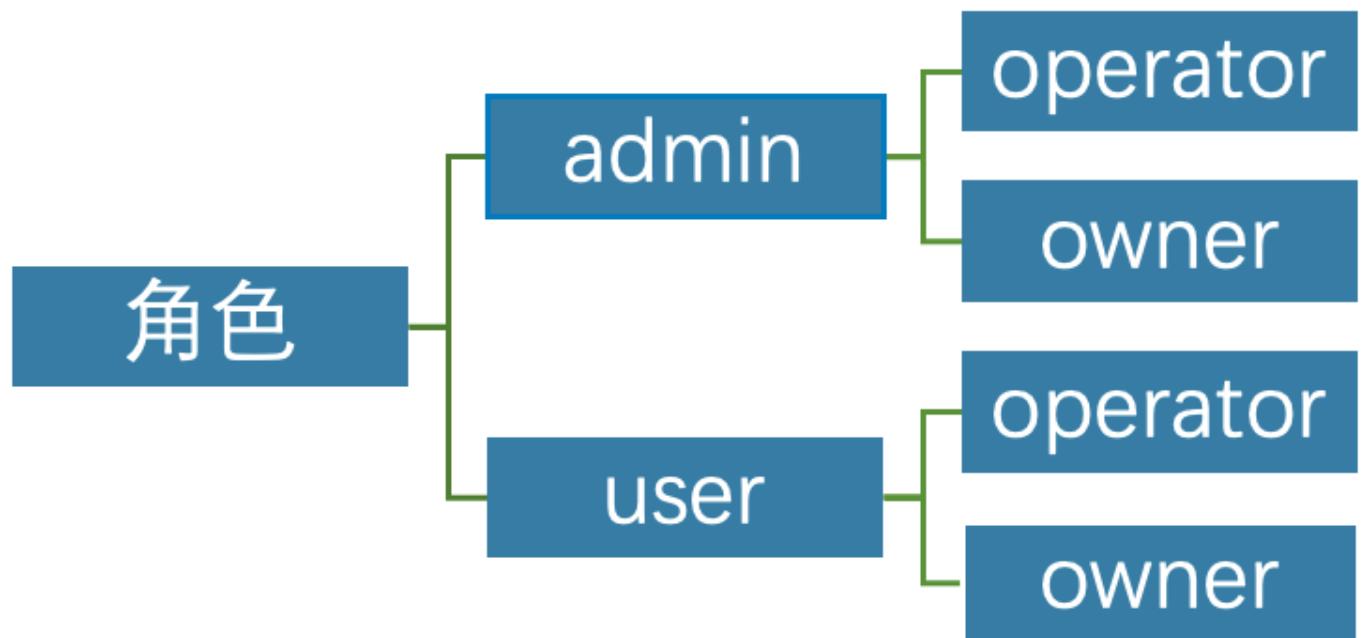
3. Dashboard

LDAP	Dashboard	nebula	nebula	Dashboard	LDAP
------	-----------	--------	--------	-----------	------

LDAP

#### 15.5.2

Dashboard	admin	user	owner	operator
-----------	-------	------	-------	----------



admin	1. 2. 3. 4.	1. admin 2. admin operator 3. owner admin admin user 4. admin
user	1. 2. admin user 3. owner	1. 2. user

operator	1. 2. 3. 4.	1. operator 2. operator
owner	1. operator 2. 3. operator 4. owner	1. 2. owner

### 15.5.3

admin

1. Dashboard

2.

- **Accept** Dashboard Dashboard



LDAP

•

### 15.5.4

- 
- **platform** **ldap** **platform** **ldap** LDAP
- **admin** **user**
- owner
- 

### 15.5.5

- A blue square icon with a white pencil and a small arrow pointing right.
- A red square icon with a white trash can symbol.

: January 14, 2022

## 15.6

Dashboard

### 15.6.1

Dashboard

Logo

- Dashboard

->

- 

SMTP	SMTP
	SMTP
Use SSL	SSL
SMTP	SMTP
SMTP	SMTP

- 

Dashboard

- **Webhook** Dashboard      Webhook

->**Webhook**

**Webhook URL**

Webhook



集群管理

1. 集群列表展示当前账号可管理的集群列表，若存在异常服务，则集群显示unhealthy状态  
 2. 创建集群，需要提前准备好节点（机器），如果已经创建好集群请点击导入集群。  
 3. 点击列表中集群名称或者管理按钮，进入管理页面。

什么是集群、节点和服务 >>  
 什么是集群的状态 >>  
 如何创建/导入集群 >>

### 15.6.2

Dashboard

Dashboard

Nebula

### 15.6.3

Dashboard

**nebula**



**Note**

LDAP

: January 14, 2022

## 15.7

---

Nebula Dashboard

Nebula Dashboard

### 15.7.1

---

- ID
- 

### 15.7.2

---

- 
- 

### 15.7.3

---

---

: January 14, 2022

15.8

## Dashboard Nebula Graph

15.8.1

Note

- | • | Linux     |      |       |        |         |
|---|-----------|------|-------|--------|---------|
| • | Byte      |      |       | 1 KB/s | Bytes/s |
| • | Dashboard | Buff | Cache |        |         |

CPU

<code>cpu_utilization</code>	CPU	
<code>cpu_idle</code>	CPU	
<code>cpu_wait</code>	IO	CPU
<code>cpu_user</code>	Nebula Graph	CPU
<code>cpu_system</code>	Nebula Graph	CPU

```
memory_utilization
memory_used
memory_actual_used
memory_free
```

load_1m	1
load_5m	5
load_15m	15

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

---

## 15.8.2

---

5    60    600    3600                5    1    10    1

rate  
sum  
avg  
P75                          75%  
P95                          95%  
P99                          99%  
P999                         99.9%

---

**Graph**

num_active_queries			
num_active_sessions			
num_aggregate_executors		Aggregate	
num_auth_failed_sessions_bad_username_password			
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			

**Meta**

commit_log_latency_us	Raft	Commit
commit_snapshot_latency_us	Raft	Commit
heartbeat_latency_us		
num_heartbeats		
num_raft_votes	Raft	
transfer_leader_latency_us	Raft	Leader

**Storage**

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			
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	

num_active_queries		
num_aggregate_executors		Aggregate
num_indexscan_executors		IndexScan
num_killed_queries		
num_queries		
num_query_errors_leader_changes		Leader
num_query_errors		
num_sentences	Graphd	
num_slow_queries		
num_sort_executors	Sort	
optimizer_latency_us		
query_latency_us		

---

: January 17, 2022

## 15.9 FAQ

## Dashboard

15.9.1

- Dashboard Nebula Graph
  - Nebula Graph
  - Nebula Metad Storage Graphd

15.9.2

- installing
  - healthy
  - unhealthy

15.9.3

SSH      Dashboard      SSH

## 15.9.4 Meta

Meta Nebula Graph Meta Meta Dashboard Meta

## 15.9.5 Dashboard

- License Dashboard sudo ./dashboard.service start all
  - License

Dashboard cat logs/webserver.log Dashboard Nebula Graph

15.9.6 Nebula Graph

[Dashboard](#) [Nebula Graph](#) [RPM](#) [DEB](#) [dashboard/download/nebula-graph](#)

15.9.7 " "

```
sudo chown -R tom:tom nebula
```

## 15.9.8 “ssh”

```
Host 127.0.0.1 Dashboard Nebula Graph "ssh" " Nebula Graph
Host IP IP
Docker "ssh" " Dashboard Docker
```

: March 8, 2022

# 16. Nebula Explorer

## 16.1 Nebula Explorer

Nebula Explorer      Explorer      Web      Nebula Graph

 **Enterprise only**

Explorer

 **Note**

Explorer

### 16.1.1

Explorer

- 
- 

### 16.1.2

- 
- nGQL
- VID Tag Subgraph
- 
- 
- 

### 16.1.3

Nebula Graph      root      Explorer

Nebula Graph      Explorer

Nebula Graph      Nebula Graph

: January 29, 2022

## 16.2

---

### 16.2.1 Explorer

RPM   TAR   Explorer

#### Nebula Graph

##### Note

Explorer      Nebula Graph

Nebula Graph	Explorer
2.5.x ~ 3.0.1	2.2.0
2.6.x	2.1.0
2.5.x	2.0.0

#### RPM

Explorer

- Nebula Graph      Nebula Graph
- 

7002      Explorer      web

##### Caution

Explorer      7002      conf/app.conf      httpport

- Linux      CentOS
- 1.13      Go
- License

##### ⑤ Enterpriseonly

License      License      Nebula Explorer

#### 1. RPM

##### ⑤ Enterpriseonly

Explorer

2. **sudo rpm -i <rpm>** RPM  
Explorer /usr/local/nebula-explorer

```
$ sudo rpm -i nebula-explorer-<version>.x86_64.rpm
```

3. License

```
$ cp -r <license> <explorer_path>
```

```
$ cp -r nebula.license /usr/local/nebula-explorer
```

4. License

```
$ systemctl stop nebula-explorer #
$ systemctl start nebula-explorer #
```

systemctl

```
$ systemctl status nebula-explorer #
$ systemctl stop nebula-explorer #
$ systemctl start nebula-explorer #
```

```
$ cd ./scripts/rpm
$ bash ./start.sh #
$ bash ./stop.sh #
```

Explorer

```
$ sudo rpm -e nebula-explorer-<version>.x86_64
```

**TAR**

Explorer

- Nebula Graph      Nebula Graph
- 

7002

Explorer    web



Explorer      7002      conf/app.conf      httpport

- Linux      CentOS
- 1.13      Go
- License



License      License      Nebula Explorer

## 1. TAR



Explorer

## 2. tar -xvf tar

\$ tar -xvf nebula-graph-explorer-&lt;version&gt;.tar.gz

## 3. License nebula-explorer

\$ cp -r &lt;license&gt; &lt;explorer\_path&gt;

\$ cp -r nebula.license /usr/local/nebula-explorer

## 4. nebula-explorer      Explorer

\$ cd nebula-explorer  
\$ ./nebula-httpd &

kill pid

\$ kill \$(lsof -t -i :7002)

[http://<ip\\_address>:7002](http://<ip_address>:7002)

### Explorer



### Note

Nebula Explorer

Explorer

Nebula Graph

: March 15, 2022

## 16.2.2

Explorer      Nebula Graph      Explorer      Nebula Graph

Nebula Graph

- Explorer      Explorer
- Nebula Graph      Graph      IP      9669
- Nebula Graph



Nebula Graph

root

Nebula Graph

Nebula Graph

### 1. Explorer

- **Host**      Nebula Graph      Graph      IP      ip:port      9669



Nebula Graph

Explorer

**Host**

IP

127.0.0.1

localhost

- Nebula Graph

root

GOD

root

nebula

2.



30

30



>

Explorer

Nebula Graph

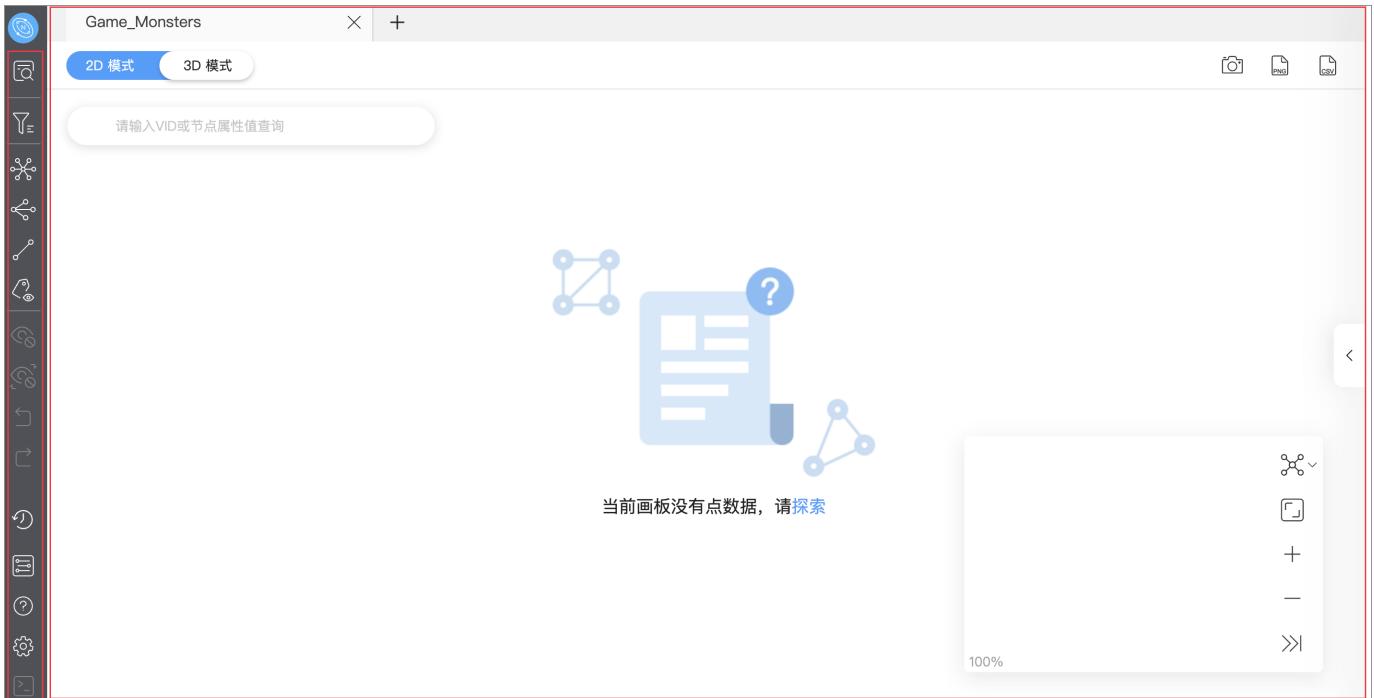
: January 29, 2022

## 16.3

Explorer

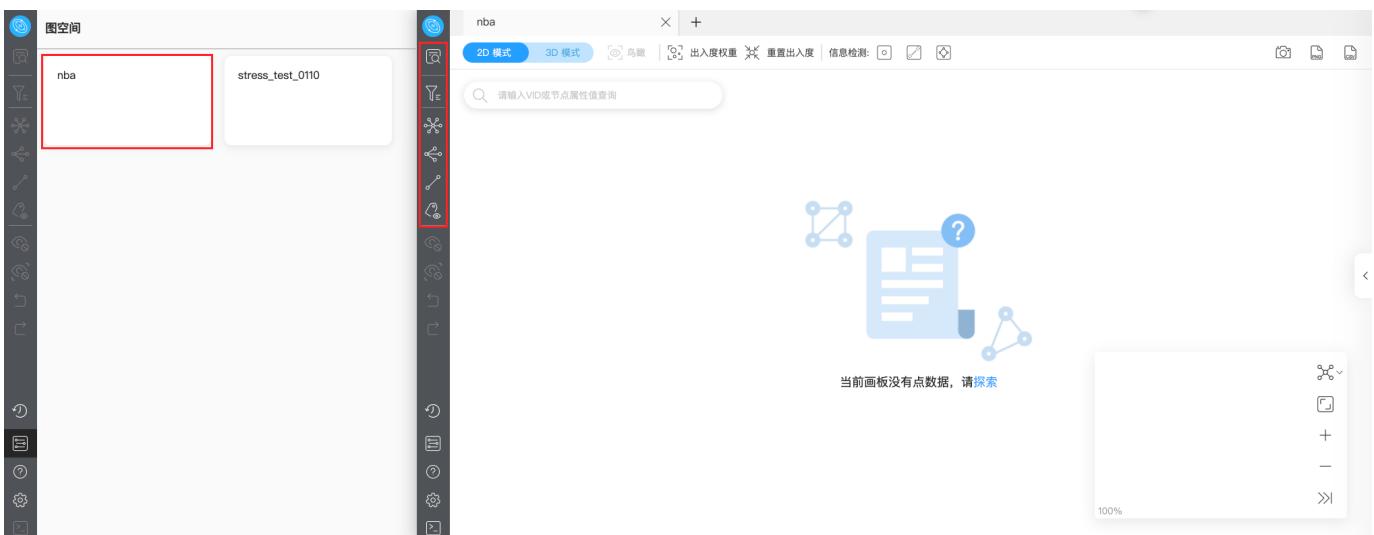
Explorer

Explorer



### Note

Explorer



### 16.3.1

Explorer



VID Tag



Explorer



Explorer



### 16.3.2

Explorer

- 
- 
- 
- 
- 
- 
-

: January 29, 2022

## 16.4

Note



3.0.0 Nebula Graph



- VID
- Tag
- 

### 16.4.1 VID

ID VID

VID

Note

- 
- VID

nba

The screenshot shows the Nebula Graph interface. On the left is a vertical toolbar with icons for search, zoom, selection, and various graph operations. The main area is titled '图空间' (Graph Space). It lists two databases: 'nba' and 'stress\_test\_0110'. The 'nba' database has a small circular icon next to its name.

### 16.4.2 Tag

Note

Tag Tag Tag

10 30 40



### 16.4.3

VID VID VID Kings Suns 2 server like

Note

VID VID Enter



: January 29, 2022

## 16.5

Tag

Note

Tag

Tag

### 16.5.1

### 16.5.2

33

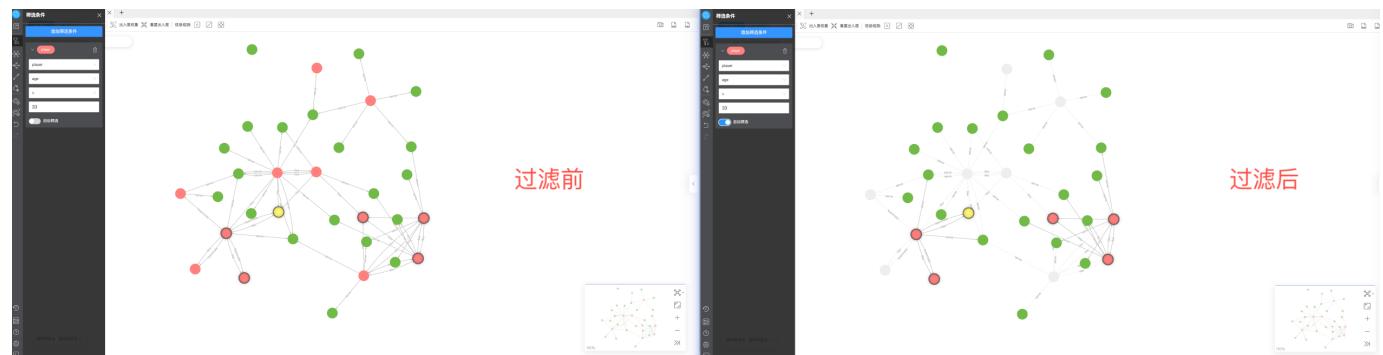
1.



2.

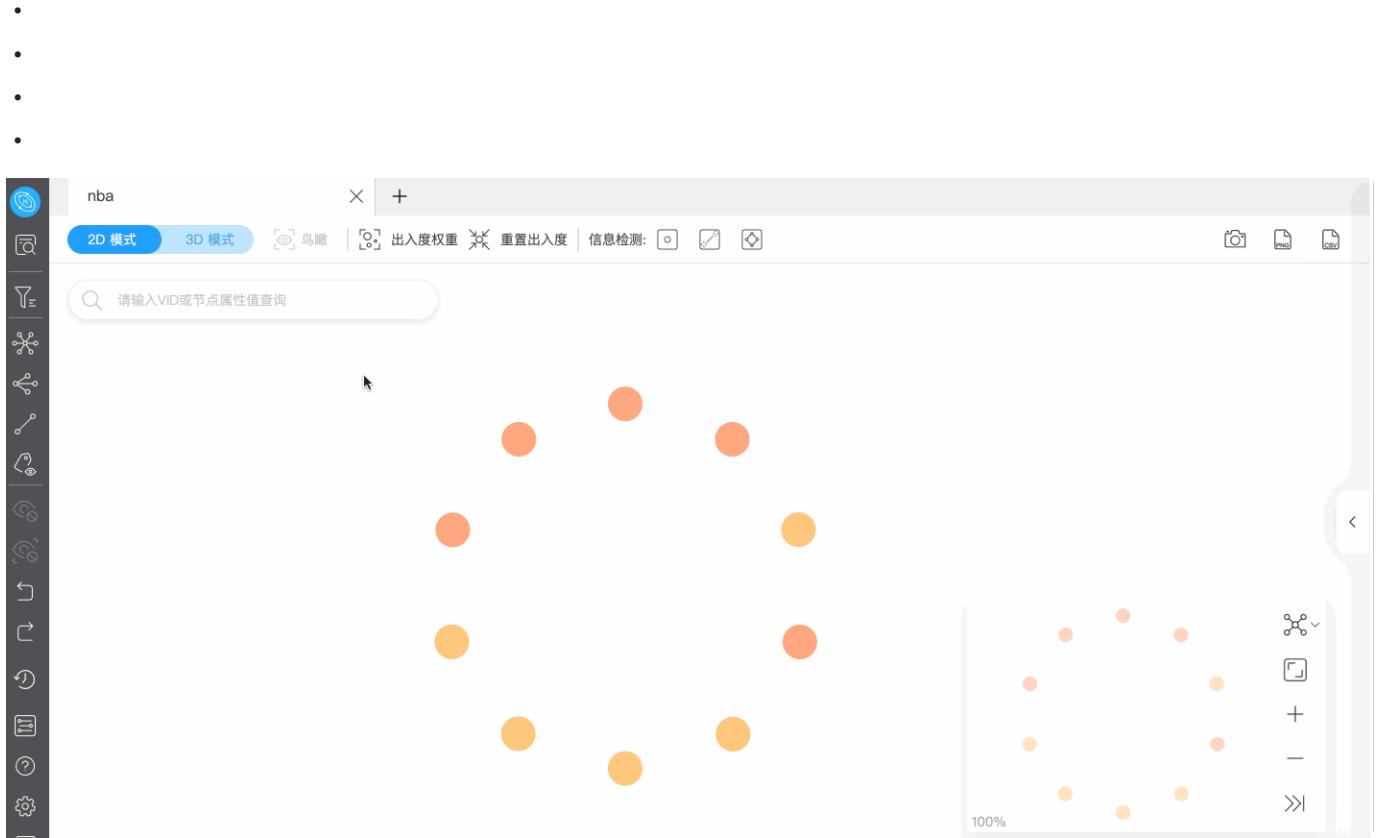
3.

4.



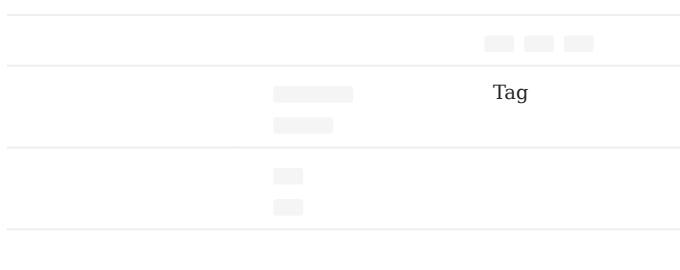
: January 29, 2022

## 16.6



### 16.6.1

### 16.6.2



Note

### 16.6.3



### 16.6.4



### 16.6.5



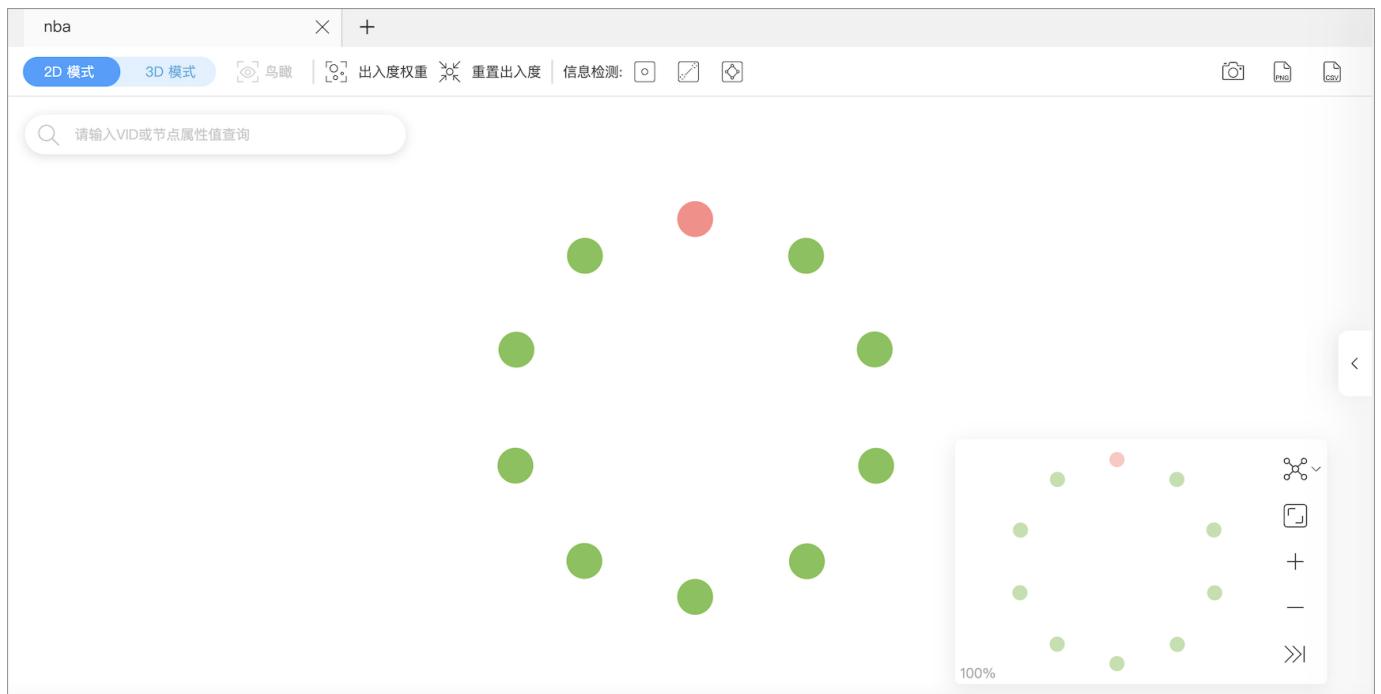
#### Note

- 90% 90%
- 100% 100%

: February 9, 2022

## 16.7

### 16.7.1



+



- 
- 

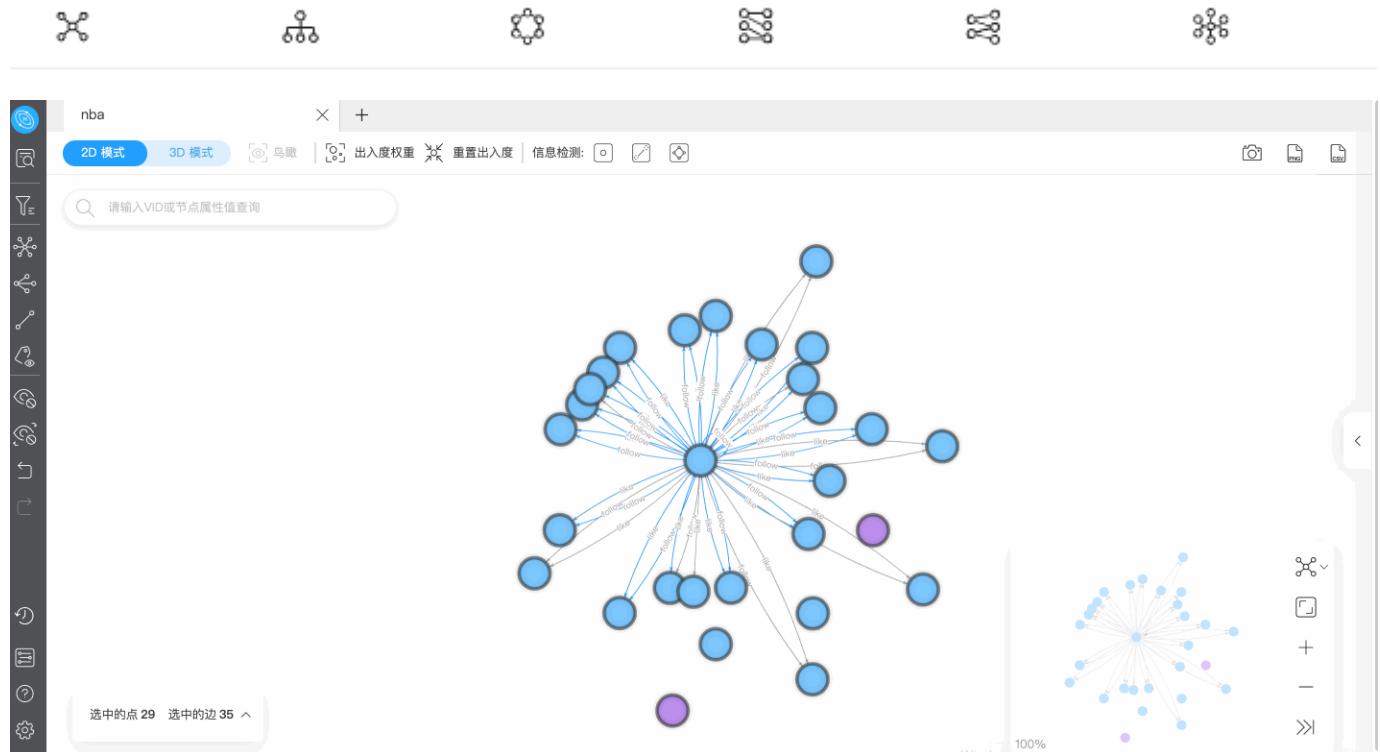
**2D**    **3D**

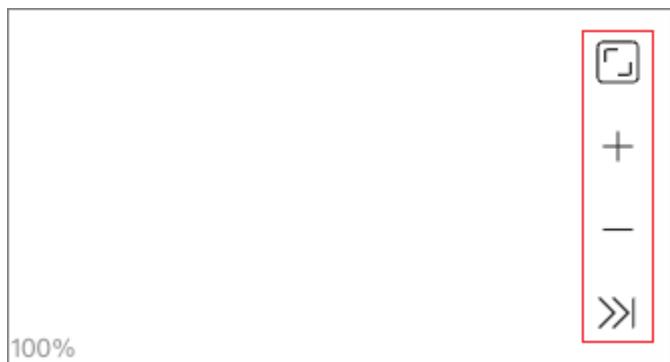
CSV

- CSV
- CSV
- CSV

VID Tag

Explorer 6





&lt;

Tag	Edge
team	1
player   team	10
bachelor   player   team	1

- Tag Edge type
- Tag Tag

### Note

Tag VID

: February 7, 2022

## 16.7.2

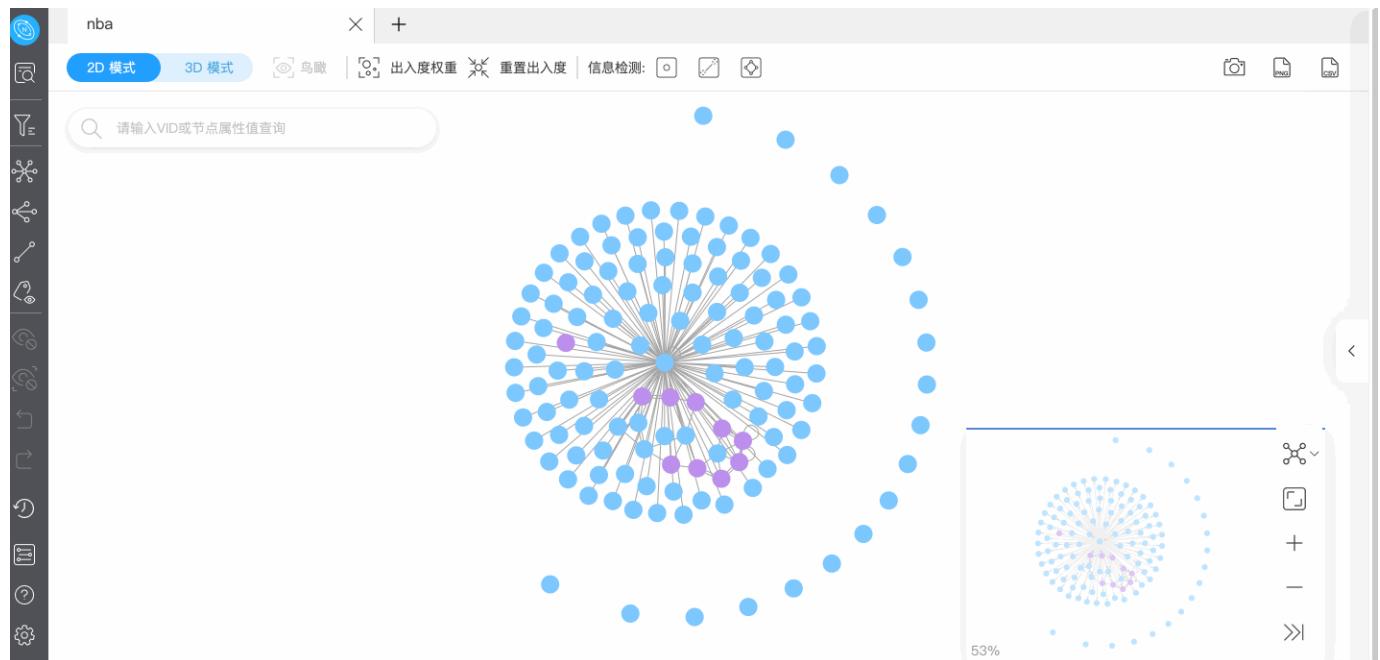
Explorer **2D** **3D**

2D

3D

**Note**

3D

**2D**

2D



1

2D

3D



3.0.0

Nebula Graph

: February 28, 2022

### 16.7.3

#### Explorer

1.



2.

3.



Explorer



- 
- JSON
- 

JSON

JSON



50

: February 23, 2022

## 16.8

Explorer

nGQL

Explorer

Note

### 16.8.1 nGQL

1. 

2. nGQL nGQL

3. 

4. 

5. 

### 16.8.2 nGQL

**CSV**

s

### 16.8.3 nGQL

- 
- 

: February 9, 2022

## 16.9

---

Explorer

### 16.9.1

---

Shift

Shift

### 16.9.2

---

Enter

Shift + '·'

Shift + '+'

Shift + 'l'

Ctrl/Cmd + 'z'

Ctrl/Cmd + Shift + 'z'

Ctrl/Cmd + 'a'

+ 'del'

+ Shift + 'del'

---

: February 8, 2022

# 17. Nebula Importer

---

## 17.1 Nebula Importer

---

Nebula Importer    Importer    Nebula Graph    CSV    Importer    CSV    Nebula Graph

### 17.1.1

---

Importer    CSV    Nebula Graph

### 17.1.2

---

- 
- CSV

### 17.1.3

---

Release

### 17.1.4

---

Nebula Importer

- Nebula Graph
- Docker Compose
- RPM/DEB
- 
- Nebula Graph      Schema      Tag    Edge type      clientSettings.postStart.commands
  - Importer      Golang      Golang

### 17.1.5

---

yaml            CSV            Nebula Graph

1. Release

2.

```
$./<binary_package_name> --config <yaml_config_file_path>
```

1.

```
$ git clone -b v3.0.0 https://github.com/vesoft-inc/nebula-importer.git
```

### Note

Nebula Graph 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 3.0.0 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

Nebula 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> Nebula Graph 3.x v3

### Note

Docker

## 17.1.6

Nebula Importer nebula-importer/examples/v2/example.yaml

Nebula Graph

/



```
version: v3
description: example
removeTempFiles: false
```

version	v3	Nebula Graph
description	example	
removeTempFiles	false	

Nebula Graph

```
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	Nebula Graph
clientSettings.channelBufferSize	128	Nebula Graph
clientSettings.space	-	Nebula Graph
clientSettings.connection.user	-	Nebula Graph
clientSettings.connection.password	-	Nebula Graph
clientSettings.connection.address	-	Graph
clientSettings.postStart.commands	-	Nebula Graph
clientSettings.postStart.afterPeriod	-	commands
clientSettings.preStop.commands	-	Nebula Graph

## Schema

```
logPath: ./err/test.log
files:
 - path: ./student_without_header.csv
 failDataPath: ./err/studenterr.csv
 batchSize: 128
 limit: 10
 inOrder: false
 type: csv
 csv:
 withHeader: false
 withLabel: false
 delimiter: ","
```

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:
 type: string
 index: 0
 tags:
 - name: student
 props:
 - name: name
 type: string
 index: 1
 - name: age
 type: int
 index: 2
 - name: gender
 type: string
 index: 3
```

files.schema.type	-	Schema	vertex	edge
files.schema.vertex.vid.type	-	ID	int	string
files.schema.vertex.vid.index	-	ID	CSV	
files.schema.vertex.tags.name	-	Tag		
files.schema.vertex.tags.props.name	-	Tag	Nebula Graph	Tag
files.schema.vertex.tags.props.type	-		bool	int float double timestamp
			string	
files.schema.vertex.tags.props.index	-	CSV		

 Note

CSV      0      0      1

•

```
schema:
 type: edge
 edge:
 name: follow
 withRanking: true
 srcVID:
 type: string
 index: 0
 dstVID:
 type: string
 index: 1
 rank:
 index: 2
 props:
 - name: degree
```

```
type: double
index: 3
```

		Schema	vertex	edge
files.schema.type	-	Edge type		
files.schema.edge.name	-	ID		
files.schema.edge.srcVID.type	-	ID	CSV	
files.schema.edge.dstVID.type	-	ID		
files.schema.edge.dstVID.index	-	ID	CSV	
files.schema.edge.rank.index	-	rank	CSV	
files.schema.edge.props.name	-	Edge type	Nebula Graph	Edge type
files.schema.edge.props.type	-	bool int float double timestamp string		
files.schema.edge.props.index	-	CSV		

## 17.1.7 CSV header

Importer CSV

- 
- 

## 17.1.8

- —Nebula Importer 3 09

: February 15, 2022

## 17.2

header CSV      withHeader true CSV



CSV      header Importer      header      Schema      yaml

### 17.2.1

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

### 17.2.2

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

### 17.2.3

```
Nebula Graph 3.x v3
version: v3

description: example

#
removeTempFiles: false

clientSettings:

nGQL
retry: 3

Nebula Graph
concurrency: 10

Nebula Graph
channelBufferSize: 128

Nebula Graph
space: student

#
connection:
 user: root
 password: nebula
 address: 192.168.11.13:9669

postStart:
 # Nebula Graph
 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:
 # Nebula Graph
 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

---

: February 15, 2022

## 17.3

---

header CSV      withHeader false CSV

### 17.3.1

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
----	----	------	--------

### 17.3.2

```
Nebula Graph 3.x v3
version: v3

description: example

#
removeTempFiles: false

clientSettings:

nGQL
retry: 3

Nebula Graph
concurrency: 10

Nebula Graph
channelBufferSize: 128

Nebula Graph
space: student

#
connection:
 user: root
 password: nebula
 address: 192.168.11.13:9669

postStart:
 # Nebula Graph
 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:
 # Nebula Graph
 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 Nebula Graph 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

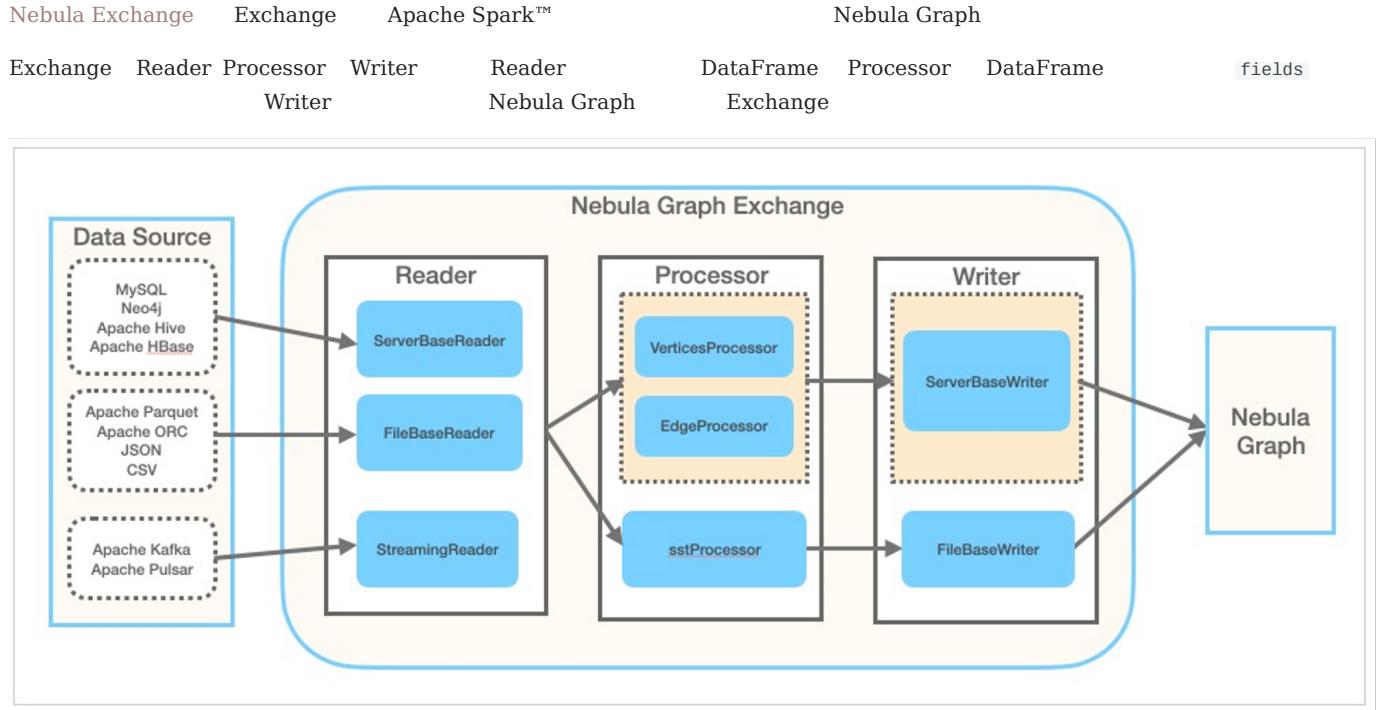
- CSV        0        0        1
  - ID        clientSettings.postStart.commands
  - index        CSV
  - ID
  - ID        ID    withRanking    true        rank
- 

: February 15, 2022

# 18. Nebula Exchange

## 18.1 Nebula Exchange

### 18.1.1 Nebula Exchange



Exchange GitHub Nebula Graph

### Exchange

- Kafka Pulsar
- MySQL HDFS Nebula Graph
- Nebula Graph SST Nebula Graph
- Nebula Graph

**⑤ enterpriseonly**

Exchange Nebula Graph

## Exchange

- Nebula Graph
- SST SST
- SSL Exchange Nebula Graph SSL
- 



Neo4j

- Graph
- Tag Edge type Tag Edge type
- Apache Spark™
- HOCON Human-Optimized Config Object Notation

## Exchange 3.0.0

Nebula Graph

nGQL

Nebula Graph

- HDFS
- Apache Parquet
- Apache ORC
- JSON
- CSV
- Apache HBase™
- 
- Hive
- MaxCompute
- Neo4j Client 2.4.5-M1
- 
- MySQL
- PostgreSQL
- ClickHouse
- Apache Kafka®
- / Apache Pulsar 2.4.5

nGQL	Exchange	SST	Console	SST
Exchange	Nebula Graph	CSV		

Release

- Nebula Graph      ——Exchange 3 08

: January 28, 2022

## 18.1.2

Exchange 3.x

Nebula Exchange JAR Nebula Graph

<b>Exchange client</b>	<b>Nebula Graph</b>
3.0-SNAPSHOT	nightly
3.0.0	3.0.1
2.6.x	2.6.x
2.5.x	2.5.x
2.1.0	2.0.0 2.0.1
2.0.1	2.0.0 2.0.1
2.0.0	2.0.0 2.0.1

JAR maven

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\_2.4-3.0.0.jar

<b>Spark 2.2</b>	<b>Spark 2.4</b>	<b>Spark 3</b>
------------------	------------------	----------------

CSV

JSON

ORC

Parquet

HBase

MySQL

PostgreSQL

ClickHouse

Neo4j

Hive

MaxCompute

Pulsar

Kafka

Nebula Graph

---

Hadoop Distributed File System (HDFS)

- HDFS
- SST

---

: February 16, 2022

## 18.2 Nebula Exchange

Nebula Exchange JAR

### 18.2.1 JAR

Exchange JAR

Exchange Nebula Graph

### 18.2.2 JAR

Exchange JAR

Exchange

 **Enterpriseonly**

Exchange Nebula Graph

- Maven
- Spark

#### 1. nebula-exchange

```
git clone -b v3.0.0 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-v3.0.0.jar x.x Spark 2.4

 Note

JAR

Nebula 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>
```

---

: February 14, 2022

## 18.3

### 18.3.1

#### Nebula Graph

- 

```
<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 JAR

 Note

yarn-cluster

```
$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=./ \
nebula-exchange-3.0.0.jar \
-c application.conf
```

--class

--master

Spark master URL master-urls

-c / --config

-h / --hive

false

Hive

-D / --dry

false

tags edges

-r / --reload

reload

Spark

Spark Configuration

: January 14, 2022

## 18.3.2

Nebula Exchange	<code>application.conf</code>
CSV	<code>csv_application.conf</code>

- Spark
- Hive
- Nebula Graph
- 
- 

### 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

<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 Graph**

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	-	Nebula Graph		
nebula.pswd	string	-			
nebula.space	string	-			
nebula.ssl.enable.graph	bool	false	Exchange true	Graph SSL	SSL Exchange
					SSL SSL
nebula.ssl.enable.meta	bool	false	Exchange true	Meta SSL	SSL Exchange
					SSL 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

<code>nebula.rate.limit</code>	<code>int</code>	<code>1024</code>
<code>nebula.rate.timeout</code>	<code>int</code>	<code>1000</code>

<code>tags.name</code>	<code>string</code>	-	Nebula Graph	Tag
<code>tags.type.source</code>	<code>string</code>	-	CSV	
<code>tags.type.sink</code>	<code>string</code>	<code>client</code>	client	SST
<code>tags.fields</code>	<code>list[string]</code>	-		CSV [_c0, _c1, _c2]
<code>tags.nebula.fields</code>	<code>list[string]</code>	-	Nebula Graph [_c1, _c2] [name, age] age	tags.fields name age
<code>tags.vertex.field</code>	<code>string</code>	-	ID	CSV _c0 ID
<code>tags.batch</code>	<code>int</code>	<code>256</code>	Nebula Graph	
<code>tags.partition</code>	<code>int</code>	<code>32</code>	Spark	

## PARQUET/JSON/ORC

<code>tags.path</code>	<code>string</code>	-	HDFS	hdfs://
CSV				
<code>tags.path</code>	<code>string</code>	-	HDFS	hdfs://
<code>tags.separator</code>	<code>string</code>	,	,	
<code>tags.header</code>	<code>bool</code>	true		

## HIVE

<code>tags.exec</code>	<code>string</code>	-	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	-	
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 basketball.team order by teamid;"

## 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

tags.path	string	-	SST
tags.repartitionWithNebula	bool	false	Nebula Graph partition DOWNLOAD INGEST SST

## NEBULA GRAPH

 Enterprise only

Nebula Graph      Nebula Graph      Exchange

tags.path	string	"hdfs://namenode:9000/path/vertex"	CSV HDFS vertex/player"	Exchange "hdfs://192.168.8.177:9000/file:///path/vertex" "file:///home/nebula/vertex/player"	Tag
tags.noField	bool	false	true	VID	false VID
tags.return.fields	list	[]	name tags.noField	age false	[ "name", "age" ]

tags edges

edges.name	string	-	Nebula Graph	Edge type
edges.type.source	string	-		csv
edges.type.sink	string	client		client SST
edges.fields	list[string]	-		CSV [_c0, _c1, _c2]
edges.nebula.fields	list[string]	-	Nebula Graph [_c2, _c3]	edges.fields [start_year, end_year]
edges.source.field	string	-		_c0
edges.target.field	string	-		_c1
edges.ranking	int	-	rank	rank 0
edges.batch	int	256	Nebula Graph	
edges.partition	int	32	Spark	

SST

edges.path	string	-	SST
edges.repartitionWithNebula	bool	false	SST Nebula Graph DOWNLOAD partition INGEST SST

## NEBULA GRAPH

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 28, 2022

## 18.4 Nebula Exchange

---

### 18.4.1 CSV

Exchange      HDFS      CSV      Nebula Graph

Nebula Graph      CSV      Nebula Importer

basketballplayer

MacOS

- 
- CPU 1.7 GHz Quad-Core Intel Core i7
- 16 GB
- Spark 2.4.7
- Hadoop 2.9.2
- Nebula Graph 3.0.1      Docker Compose
  
- Nebula Graph
- Graph      Meta      IP
- Nebula Graph
- Exchange      Exchange      Exchange 3.0.0
- Spark
- Nebula Graph      Schema      Tag      Edge type
- HDFS      Hadoop
- Nebula Graph

## 1 NEBULA GRAPH SCHEMA

CSV Nebula Graph Schema

## 1. Schema Nebula Graph 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. Nebula 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: Nebula Exchange 3.0.0
 }
 driver: {
 cores: 1
 maxResultSize: 1G
 }
 executor: {
 memory: 1G
 }
 }

 cores: {
 max: 16
 }
}
```

```

}

Nebula Graph
nebula: {
 address: {
 # Graph Meta IP
 #
 # "ip1:port", "ip2:port", "ip3:port"
 graph: ["127.0.0.1:9669"]
 meta: ["127.0.0.1:9559"]
 }
}

Nebula Graph
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
{
 # Nebula Graph Tag
 name: player
 type: {
 # CSV
 source: csv

 # Nebula Graph 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]

 # Nebula Graph
 # fields nebula.fields
 nebula.fields: [age, name]

 # VID
 # vertex fields csv.fields
 # Nebula Graph 3.0.1 VID
 vertex: {
 field_c0
 # policy:hash
 }

 #
 separator: ","
 }
}

Nebula Graph
batch: 256

Spark
partition: 32
}

Tag team
{
 # Nebula Graph Tag
 name: team
 type: {
 # CSV
 source: csv

 # Nebula Graph 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]

Nebula Graph
fields nebula.fields
nebula.fields: [name]

VID
vertex fields csv.fields
Nebula Graph 3.0.1 VID
vertex: {
 field:_c0
 # policy:hash
}

separator: ","
header: true
CSV header true
CSV header false false
header: false

Nebula Graph
batch: 256

Spark
partition: 32
}

]
#
edges: [
 # Edge type follow
{
 # Nebula Graph Edge type
 name: follow
 type: {
 # CSV
 source: csv

 # Nebula Graph 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]

Nebula Graph
fields nebula.fields
nebula.fields: [degree]

VID
vertex fields csv.fields
Nebula Graph 3.0.1 VID
source: {
 field: _c0
}
target: {
 field: _c1
}

separator: ","
rank

#ranking: rank

CSV header true
CSV header false false
header: false

Nebula Graph
batch: 256

Spark
partition: 32
}

```

```

Edge type serve
{
 # Nebula Graph Edge type
 name: serve
 type: {
 # CSV
 source: csv

 # Nebula Graph 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]

 # Nebula Graph
 # fields nebula.fields
 nebula.fields: [start_year, end_year]

 #
 # vertex fields csv.fields
 # Nebula Graph 3.0.1 VID
 source: {
 field: _c0
 }
 target: {
 field: _c1
 }

 #
 separator: ","
 #rank
 #ranking: _c5

 # CSV header true
 # CSV header false false
 header: false

 # Nebula Graph
 batch: 256

 # Spark
 partition: 32
}

]
#
}

```

#### 4 NEBULA GRAPH

CSV Nebula Graph

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange <nebula-exchange-3.0.0.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-3.0.0.jar -c /root/nebula-exchange/nebula-exchange/target/classes/csv_application.conf
```

batchSuccess.<tag\_name/edge\_name> batchSuccess.follow: 300

5

Nebula Graph Nebula Graph Studio

```
GO FROM "player100" OVER follow;
```

SHOW STATS

## Nebula Graph

---

: March 1, 2022

## 18.4.2 JSON

Exchange      HDFS      JSON      Nebula Graph

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
- Nebula Graph 3.0.1      Docker Compose

- Nebula Graph
- Graph Meta IP
- Nebula Graph
- Exchange Exchange Exchange 3.0.0
- Spark
- Nebula Graph Schema Tag Edge type
- HDFS Hadoop
- Nebula Graph

## 1 NEBULA GRAPH SCHEMA

Nebula Graph Schema

### 1. Schema Nebula Graph 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. Nebula 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: Nebula Exchange 3.0.0
 }
 driver: {
 cores: 1
 maxResultSize: 1G
 }
 executor: {
 memory:1G
 }

 cores: {
 max: 16
 }
 }

 # Nebula Graph
 nebula: {
 address:{}
 # Graph Meta IP
 # ,
 # "ip1:port","ip2:port","ip3:port"
 graph:["127.0.0.1:9669"]
 meta:["127.0.0.1:9559"]
 }

 # Nebula Graph
 user: root
 pswd: nebulax

 #
 space: basketballplayer
 connection: {
 timeout: 3000
 retry: 3
 }
 execution: {
 retry: 3
 }
 error: {
 max: 32
 output: /tmp/errors
 }
 rate: {
 limit: 1024
 timeout: 1000
 }
}

#
tags: [
 # Tag player
 {
 # Nebula Graph Tag
 name: player
 type: {
 # JSON
 source: json

 # Nebula Graph 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 Nebula Graph
 # ,
 fields: [age, name]

 # Nebula Graph
 # fields nebula.fields
 nebula.fields: [age, name]

 # VID
 # vertex JSON
 # Nebula Graph 3.0.1 VID
 vertex: {
 field:id
 }

 # Nebula Graph
 batch: 256
 }
]
```

```

Spark
partition: 32
}

Tag team
{
Nebula Graph Tag
name: team
type: {
JSON
source: json

Nebula Graph 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 Nebula Graph
,
fields: [name]

Nebula Graph
fields nebula.fields
nebula.fields: [name]

VID
vertex JSON
Nebula Graph 3.0.1 VID
vertex: {
field:id
}

Nebula Graph
batch: 256

Spark
partition: 32
}

#
]

#
edges: [
Edge type follow
{
Nebula Graph Edge type
name: follow
type: {
JSON
source: json

Nebula Graph 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 Nebula Graph
,
fields: [degree]

Nebula Graph
fields nebula.fields
nebula.fields: [degree]

rank
#ranking: rank

Nebula Graph
batch: 256

Spark
partition: 32
}

Edge type serve
{

```

```

Nebula Graph Edge type
name: serve
type: {
 # JSON
 source: json

 # Nebula Graph 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 Nebula Graph
#
#fields: [start_year,end_year]

Nebula Graph
fields nebula.fields
nebula.fields: [start_year, end_year]

#
vertex JSON
Nebula Graph 3.0.1 VID
source: {
 field: src
}
target: {
 field: dst
}

rank
#ranking: _c5

Nebula Graph
batch: 256

Spark
partition: 32
}

]
#
}

```

## 4 NEBULA GRAPH

JSON Nebula Graph

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange <nebula-exchange-3.0.0.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-3.0.0.jar -c /root/nebula-exchange/nebula-exchange/target/classes/json_application.conf
```

batchSuccess.&lt;tag\_name/edge\_name&gt; batchSuccess.follow: 300

## 5

Nebula Graph Nebula Graph Studio

```
GO FROM "player100" OVER follow;
```

SHOW STATS

## 6 NEBULA GRAPH

Nebula Graph

: March 1, 2022

### 18.4.3 ORC

Exchange      HDFS      ORC      Nebula Graph  
Nebula Graph      ORC      Nebula Importer

basketballplayer

MacOS

- 
- CPU 1.7 GHz Quad-Core Intel Core i7
- 16 GB
- Spark 2.4.7
- Hadoop 2.9.2
- Nebula Graph 3.0.1      Docker Compose
- Nebula Graph
- Graph      Meta      IP
- Nebula Graph
- Exchange      Exchange      Exchange 3.0.0
- Spark
- Nebula Graph      Schema      Tag      Edge type
- HDFS      Hadoop
- Nebula Graph

## 1 NEBULA GRAPH SCHEMA

ORC Nebula Graph Schema

## 1. Schema Nebula Graph 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. Nebula 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: Nebula Exchange 3.0.0
 }
 driver: {
 cores: 1
 maxResultSize: 1G
 }
 executor: {
 memory: 1G
 }

 cores: {
 max: 16
 }
 }

 # Nebula Graph
 nebula: {
 address: {
 # Graph Meta IP
 # "ip1:port", "ip2:port", "ip3:port"
 }
 }
}
```

```

graph:["127.0.0.1:9669"]
meta:["127.0.0.1:9559"]
}

Nebula Graph
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
 {
 # Nebula Graph Tag
 name: player
 type: {
 # ORC
 source: orc

 # Nebula Graph Client SST
 sink: client
 }
 }

 # ORC
 # HDFS hdfs:// "hdfs://ip:port/xx/xx"
 # file:// "file:///tmp/xx.orc"
 path: "hdfs://192.168.*.*:9000/data/vertex_player.orc"

 # fields ORC key value Nebula Graph
 #
 fields: [age, name]

 # Nebula Graph
 # fields nebula.fields
 nebula.fields: [age, name]

 # VID
 # vertex ORC
 # Nebula Graph 3.0.1 VID
 vertex: {
 field:id
 }

 # Nebula Graph
 batch: 256

 # Spark
 partition: 32
}

Tag team
{
 # Nebula Graph Tag
 name: team
 type: {
 # ORC
 source: orc

 # Nebula Graph Client SST
 sink: client
 }

 # ORC
 # HDFS hdfs:// "hdfs://ip:port/xx/xx"
 # file:// "file:///tmp/xx.orc"
 path: "hdfs://192.168.*.*:9000/data/vertex_team.orc"

 # fields ORC key value Nebula Graph
 #
 fields: [name]

 # Nebula Graph
 # fields nebula.fields
 nebula.fields: [name]

 # VID

```

```

vertex ORC
Nebula Graph 3.0.1 VID
vertex: {
 field:id
}

Nebula Graph
batch: 256

Spark
partition: 32
}

]

#
edges: [
Edge type follow
{
Nebula Graph Edge type
name: follow
type: {
ORC
source: orc

Nebula Graph 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 Nebula Graph
,
fields: [degree]

Nebula Graph
fields nebula.fields
nebula.fields: [degree]

#
vertex ORC
Nebula Graph 3.0.1 VID
source: {
 field: src
}
target: {
 field: dst
}

rank
#ranking: rank

Nebula Graph
batch: 256

Spark
partition: 32
}

Edge type serve
{
Nebula Graph Edge type
name: serve
type: {
ORC
source: orc

Nebula Graph 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 Nebula Graph
,
fields: [start_year,end_year]

Nebula Graph
fields nebula.fields
nebula.fields: [start_year, end_year]

#
vertex ORC
Nebula Graph 3.0.1 VID
source: {
 field: src
}
target: {
}

```

```

 field: dst
 }

rank
#ranking: _c5

Nebula Graph
batch: 256

Spark
partition: 32
}

]

#
}

```

**4 NEBULA GRAPH**

ORC Nebula Graph

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange <nebula-exchange-3.0.0.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-3.0.0.jar -c /root/nebula-exchange/nebula-exchange/target/classes/orc_application.conf
```

```
batchSuccess.<tag_name/edge_name> batchSuccess.follow: 300
```

**5**

Nebula Graph Nebula Graph Studio

```
GO FROM "player100" OVER follow;
```

```
SHOW STATS
```

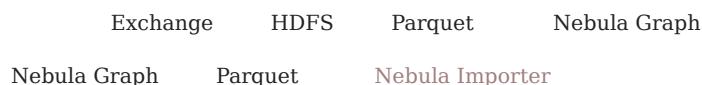
**6 NEBULA GRAPH**

Nebula Graph

---

: March 1, 2022

#### 18.4.4 Parquet



basketballplayer

MacOS

- 
- CPU 1.7 GHz Quad-Core Intel Core i7
- 16 GB
- Spark 2.4.7
- Hadoop 2.9.2
- Nebula Graph 3.0.1 Docker Compose
- Nebula Graph
- Graph Meta IP
- Nebula Graph
- Exchange Exchange Exchange 3.0.0
- Spark
- Nebula Graph Schema Tag Edge type
- HDFS Hadoop
- Nebula Graph

## 1 NEBULA GRAPH SCHEMA

Parquet Nebula Graph Schema

1. Schema Nebula Graph 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. Nebula 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: Nebula Exchange 3.0.0
 }
 driver: {
 cores: 1
 maxResultSize: 1G
 }
 executor: {
 memory: 1G
 }

 cores: {
 max: 16
 }
 }

 # Nebula Graph
 nebula: {
 address: {
 # Graph Meta IP
 #
 # "ip1:port", "ip2:port", "ip3:port"
 }
 }
}
```

```

graph:["127.0.0.1:9669"]
meta:["127.0.0.1:9559"]
}

Nebula Graph
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
 {
 # Nebula Graph Tag
 name: player
 type: {
 # Parquet
 source: parquet

 # Nebula Graph 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 Nebula Graph
 #
 fields: [age, name]

 # Nebula Graph
 # fields nebula.fields
 nebula.fields: [age, name]

 # VID
 # vertex Parquet
 # Nebula Graph 3.0.1 VID
 vertex: {
 field:id
 }

 # Nebula Graph
 batch: 256

 # Spark
 partition: 32
}

Tag team
{
 # Nebula Graph Tag
 name: team
 type: {
 # Parquet
 source: parquet

 # Nebula Graph 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 Nebula Graph
 #
 fields: [name]

 # Nebula Graph
 # fields nebula.fields
 nebula.fields: [name]

 # VID
}

```

```

vertex Parquet
Nebula Graph 3.0.1 VID
vertex: {
 field:id
}

Nebula Graph
batch: 256

Spark
partition: 32
}

]

#
edges: [
Edge type follow
{
Nebula Graph Edge type
name: follow
type: {
Parquet
source: parquet

Nebula Graph 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 Nebula Graph
,
fields: [degree]

Nebula Graph
fields nebula.fields
nebula.fields: [degree]

#
vertex Parquet
Nebula Graph 3.0.1 VID
source: {
 field: src
}
target: {
 field: dst
}

rank
#ranking: rank

Nebula Graph
batch: 256

Spark
partition: 32
}

Edge type serve
{
Nebula Graph Edge type
name: serve
type: {
Parquet
source: parquet

Nebula Graph 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 Nebula Graph
,
fields: [start_year,end_year]

Nebula Graph
fields nebula.fields
nebula.fields: [start_year, end_year]

#
vertex Parquet
Nebula Graph 3.0.1 VID
source: {
 field: src
}
target: {

```

```

 field: dst
 }

rank
#ranking: _c5

Nebula Graph
batch: 256

Spark
partition: 32
}

]

#
}

```

**4 NEBULA GRAPH**

Parquet      Nebula Graph

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange <nebula-exchange-3.0.0.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-3.0.0.jar -c /root/nebula-exchange/nebula-exchange/target/classes/parquet_application.conf
```

batchSuccess.&lt;tag\_name/edge\_name&gt;      batchSuccess.follow: 300

5

Nebula Graph      Nebula Graph Studio

```
GO FROM "player100" OVER follow;
```

SHOW STATS

6      NEBULA GRAPH

Nebula Graph

: March 1, 2022

## 18.4.5 HBase

Exchange    HBase    Nebula Graph

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
- Nebula Graph 3.0.1    Docker Compose

- Nebula Graph
- Graph Meta IP
- Nebula Graph
- Exchange Exchange Exchange 3.0.0
- Spark
- Nebula Graph Schema Tag Edge type
- Hadoop

## 1 NEBULA GRAPH SCHEMA

Nebula Graph Schema

### 1. Schema Nebula Graph 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. Nebula Graph 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: Nebula Exchange 3.0.0
 }
 driver: {
 cores: 1
 maxResultSize: 1G
 }
 }
 cores: {
```

```

 max: 16
 }

}

Nebula Graph
nebula: {
 address: {
 # Nebula Graph Graph Meta IP
 # "ip1:port", "ip2:port", "ip3:port"
 # (,)
 graph: ["127.0.0.1:9669"]
 meta: ["127.0.0.1:9559"]
 }
 # Nebula Graph
 user: root
 pswd: nebula
 # Nebula Graph
 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",
 {
 # Nebula Graph Tag
 name: player
 type: {
 # HBase
 source: hbase
 # Nebula Graph Client SST
 sink: client
 }
 host:192.168.*.*
 port:2181
 table:"player"
 columnFamily:"cf"

 # fields player value Nebula Graph
 # fields nebula.fields
 #
 fields: [age,name]
 nebula.fields: [age,name]

 # Nebula Graph VID
 # rowkey VID "rowkey"
 vertex: {
 field:rowkey
 }
 }

 # Nebula Graph
 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
{
 # Nebula Graph Edge type
 name: follow

 type: {
 #
 # HBase
 source: hbase

 #
 # Nebula Graph
 # Nebula Graph Client SST
 sink: client
 }

 host:192.168.*.*
 port:2181
 table:"follow"
 columnFamily:"cf"

 # fields follow value Nebula Graph
 # 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

 #
 # Nebula Graph
 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 NEBULA GRAPH

HBase      Nebula Graph

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange <nebula-exchange-3.0.0.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-3.0.0.jar -c /root/nebula-exchange/nebula-exchange/target/classes/hbase_application.conf
```

```
batchSuccess.<tag_name/edge_name> batchSuccess.follow: 300
```

4

Nebula Graph      Nebula Graph Studio

```
GO FROM "player100" OVER follow;
```

```
SHOW STATS
```

5      NEBULA GRAPH

Nebula Graph

---

: March 1, 2022

## 18.4.6 MySQL/PostgreSQL

## Exchange MySQL Nebula Graph PostgreSQL Nebula Graph

## basketballplayer

MySQL basketball player team follow serve

MacOS

- CPU 1.7 GHz Quad-Core Intel Core i7
  - 16 GB
  - Spark 2.4.7
  - Hadoop 2.9.2
  - MySQL 8.0.23
  - Nebula Graph 3.0.1 Docker Compose

- Nebula Graph
- Graph Meta IP
- Nebula Graph
- Exchange Exchange Exchange 3.0.0
- Spark
- Nebula Graph Schema Tag Edge type
- Hadoop

## 1 NEBULA GRAPH SCHEMA

Nebula Graph Schema

### 1. Schema Nebula Graph 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. Nebula Graph 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: Nebula Exchange 3.0.0
 }
 driver: {
 cores: 1
 maxResultSize: 1G
 }
 }
 cores: {
```

```

 max: 16
 }

}

Nebula Graph
nebula: {
 address: {
 # Nebula Graph Graph Meta IP
 # "ip1:port","ip2:port","ip3:port"
 # (,)
 graph:["127.0.0.1:9669"]
 meta:["127.0.0.1:9559"]
 }
 # Nebula Graph
 user: root
 pswd: nebula
 # Nebula Graph
 space: basketballplayer
 connection: {
 timeout: 3000
 retry: 3
 }
 execution: {
 retry: 3
 }
 error: {
 max: 32
 output: /tmp/errors
 }
 rate: {
 limit: 1024
 timeout: 1000
 }
}
#
tags: [
 # Tag player
{
 # Nebula Graph Tag
 name: player
 type: {
 # MySQL
 source: mysql
 # Nebula Graph Client SST
 sink: client
 }
}

host:192.168.*.*
port:3306
database:"basketball"
table:"player"
user:"test"
password:"123456"
sentence:"select playerid, age, name from basketball order by playerid;"

fields player value Nebula Graph
fields nebula.fields
#
fields: [age,name]
nebula.fields: [age,name]

Nebula Graph VID
vertex: {
 field:playerid
}

Nebula Graph
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 basketball order by teamid;"

fields: [name]
nebula.fields: [name]
vertex: {
 field: teamid
}
batch: 256

```

```

 partition: 32
 }

]

#
edges: [
 # Edge type follow
{
 # Nebula Graph Edge type
 name: follow

 type: {
 # MySQL
 source: mysql

 # Nebula Graph
 # Nebula Graph 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 basketball order by src_player;"

 # fields follow value Nebula Graph
 # fields nebula.fields
 #
 fields: [degree]
 nebula.fields: [degree]

 # source follow
 # target follow
 source: {
 field: src_player
 }

 target: {
 field: dst_player
 }

 # rank
 #ranking: rank

 # Nebula Graph
 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 basketball 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 NEBULA GRAPH

MySQL      Nebula Graph

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange <nebula-exchange-3.0.0.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-3.0.0.jar -c /root/nebula-exchange/nebula-exchange/target/classes/mysql_application.conf
```

```
batchSuccess.<tag_name/edge_name> batchSuccess.follow: 300
```

4

Nebula Graph Nebula Graph Studio

```
GO FROM "player100" OVER follow;
```

```
SHOW STATS
```

5 NEBULA GRAPH

Nebula Graph

---

: March 1, 2022

## 18.4.7 ClickHouse

Exchange      ClickHouse      Nebula Graph

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)
- Nebula Graph 3.0.1 Docker Compose

- Nebula Graph
- Graph      Meta      IP
- Nebula Graph
- Exchange      Exchange      Exchange 3.0.0
- Spark
- Nebula Graph      Schema      Tag    Edge type
- Hadoop

## 1 NEBULA GRAPH SCHEMA

Nebula Graph Schema

## 1. Schema Nebula Graph 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. Nebula Graph 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 3.0.0
 }
 driver: {
 cores: 1
 maxResultSize: 1G
 }
 cores: {
 max: 16
 }
 }

 # Nebula Graph
 nebula: {
 address: {
 # Nebula Graph Graph Meta IP
 # "ip1:port","ip2:port","ip3:port"
 # (,,
 graph:["127.0.0.1:9669"]
 meta:["127.0.0.1:9559"]
 }
 # Nebula Graph
 user: root
 pswd: nebula
 # Nebula Graph
 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
 # Nebula Graph 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 Nebula Graph
 # fields nebula.fields
 #
 fields: [name,age]
 nebula.fields: [name,age]
 # Nebula Graph VID
 vertex: {
 field:playerid
 # policy:hash
 }
 # Nebula Graph
 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
 {
 # Nebula Graph Edge type
 name: follow

 type: {
 # ClickHouse
 source: clickhouse
 # Nebula Graph
 # Nebula Graph 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 Nebula Graph
fields nebula.fields
#
fields: [degree]
nebula.fields: [degree]

source follow
source: {
 field:src_player
}

target follow
target: {
 field:dst_player
}

rank
#ranking: rank

Nebula Graph
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 NEBULA GRAPH

ClickHouse      Nebula Graph

```

${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange <nebula-exchange-3.0.0.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-3.0.0.jar -c /root/nebula-exchange/nebula-exchange/target/classes/clickhouse_application.conf

```

batchSuccess.<tag\_name/edge\_name>

batchSuccess.follow: 300

4

Nebula Graph

Nebula Graph Studio

```
GO FROM "player100" OVER follow;
```

```
SHOW STATS
```

5 NEBULA GRAPH

Nebula Graph

---

: March 1, 2022

### 18.4.8 Neo4j

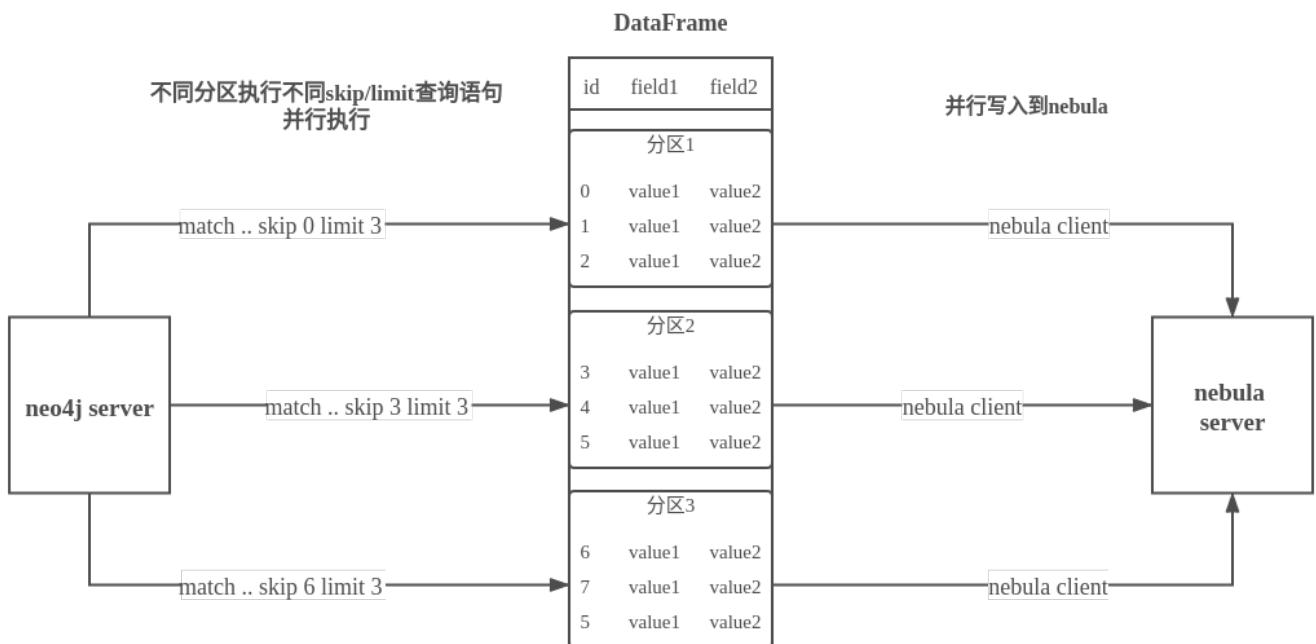
Exchange      Neo4j      Nebula Graph

Exchange	<b>Neo4j Driver 4.0.1</b>	Neo4j	label	Relationship Type	Cypher
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      Nebula Graph



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
- Nebula Graph 3.0.1 Docker Compose

- Nebula Graph
- Graph Meta IP
- Nebula Graph
- Exchange Exchange Exchange 3.0.0
- Spark
- Nebula Graph Schema Tag Edge type

## 1 NEBULA GRAPH SCHEMA

Nebula Graph Schema

## 1. Schema Nebula Graph 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. Nebula 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: Nebula Exchange 3.0.0
 }

 driver: {
 cores: 1
 maxResultSize: 1G
 }

 executor: {
 memory:1G
 }

 cores:{
 max: 16
 }
 }

 # Nebula Graph
 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
 database:neo4j
 exec: "match (n:team) return n.id as id,n.name as name"
 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
 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							
Nebula Graph	ID	Neo4j	Nebula Graph	ID	Neo4j	ID	
Nebula Graph							
Nebula Graph							
check_point_path							
partition							

## 4 NEBULA GRAPH

## Nebula Graph

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange <nebula-exchange-3.0.0.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-3.0.0.jar -c /root/nebula-exchange/nebula-exchange/target/classes/neo4j_application.conf
```

```
batchSuccess.<tag_name/edge_name> batchSuccess.follow: 300
```

5

## Nebula Graph Nebula Graph Studio

```
GO FROM "player100" OVER follow;
```

```
SHOW STATS
```

## 6 NEBULA GRAPH

## Nebula Graph

---

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## 18.4.9 Hive

Exchange      Hive      Nebula Graph

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      Nebula Graph 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
- Nebula Graph 3.0.1 Docker Compose

- Nebula Graph
- Graph Meta IP
- Nebula Graph
- Exchange Exchange Exchange 3.0.0
- Spark
- Nebula Graph Schema Tag Edge type
- Hadoop Hive Metastore MySQL

## 1 NEBULA GRAPH SCHEMA

Nebula Graph Schema

### 1. Schema Nebula Graph 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. Nebula Graph 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: Nebula Exchange 3.0.0
 }
 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"
 #}

 # Nebula Graph
 nebula: {
 address: {
 # Nebula Graph Graph Meta IP
 # "ip1:port", "ip2:port", "ip3:port"
 # (,)
 graph: ["127.0.0.1:9669"]
 meta: ["127.0.0.1:9559"]
 }
 # Nebula Graph
 user: root
 pswd: nebula
 # Nebula Graph
 space: basketballplayer
 connection: {
 timeout: 3000
 retry: 3
 }
 execution: {
 retry: 3
 }
 error: {
 max: 32
 output: /tmp/errors
 }
 rate: {
 limit: 1024
 timeout: 1000
 }
 }
 #
 tags: [
 # Tag player
 {
 # Nebula Graph Tag
 name: player
 type: {
 # hive
 source: Nebula Graph Client SST
 sink: client
 }
 # basketball player SQL
 exec: "select playerid, age, name from basketball.player"

 # fields player value Nebula Graph
 # fields nebula.fields
 #
 fields: [age, name]
 nebula.fields: [age, name]

 # Nebula Graph VID
 vertex: {
 field: playerid
 }
 }
]
}
```

```

}

Nebula Graph
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
{
 # Nebula Graph Edge type
 name: follow

 type: {
 # hive
 source: hive

 # Nebula Graph
 # Nebula Graph Client SST
 sink: client
 }

 # basketball follow SQL
 exec: "select src_player, dst_player, degree from basketball.follow"

 # fields follow value Nebula Graph
 # fields nebula.fields
 #
 fields: [degree]
 nebula.fields: [degree]

 # source follow
 # target follow
 source: {
 field: src_player
 }

 target: {
 field: dst_player
 }

 # rank
 #ranking: rank

 # Nebula Graph
 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 NEBULA GRAPH

Hive      Nebula Graph

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange <nebula-exchange-3.0.0.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-3.0.0.jar -c /root/nebula-exchange/nebula-exchange/target/classes/hive_application.conf -h
```

```
batchSuccess.<tag_name/edge_name> batchSuccess.follow: 300
```

5

Nebula Graph      Nebula Graph Studio

```
GO FROM "player100" OVER follow;
```

**SHOW STATS**

6      NEBULA GRAPH

Nebula Graph

: March 1, 2022

### 18.4.10 MaxCompute

Exchange      MaxCompute      Nebula Graph

basketballplayer

MacOS

- 
- CPU 1.7 GHz Quad-Core Intel Core i7
- 16 GB
- Spark 2.4.7
- Hadoop 2.9.2
- MaxCompute
- Nebula Graph 3.0.1      Docker Compose

- Nebula Graph

- Graph      Meta      IP
- Nebula Graph
- Exchange      Exchange      Exchange 3.0.0
- Spark
- Nebula Graph      Schema      Tag    Edge type
- Hadoop

## 1 NEBULA GRAPH SCHEMA

Nebula Graph Schema

## 1. Schema Nebula Graph 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. Nebula Graph 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: Nebula Exchange 3.0.0
 }
 driver: {
 cores: 1
 maxResultSize: 1G
 }
 cores: {
 max: 16
 }
 }

 # Nebula Graph
 nebula: {
 address: {
 # Nebula Graph Graph Meta IP
 # "ip1:port","ip2:port","ip3:port"
 # (,,
 graph:["127.0.0.1:9669"]
 meta:["127.0.0.1:9559"]
 }
 # Nebula Graph
 user: root
 pswd: nebula
 # Nebula Graph
 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
 # Nebula Graph 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 Nebula Graph
 # fields nebula.fields
 #
 fields:[name, age]
 nebula.fields:[name, age]

 # Nebula Graph VID
 vertex:{ field: playerid }

 # Nebula Graph
 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
 {
 # Nebula Graph Edge type

```

```

name: follow

type:{ MaxCompute
MaxCompute
source:maxcompute

Nebula Graph
Nebula Graph 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 Nebula Graph
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

Nebula Graph
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 NEBULA GRAPH

MaxCompute      Nebula Graph

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange <nebula-exchange-3.0.0.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-3.0.0.jar -c /root/nebula-exchange/nebula-exchange/target/classes/maxcompute_application.conf
```

```
batchSuccess.<tag_name/edge_name> batchSuccess.follow: 300
```

4

Nebula Graph      Nebula Graph Studio

```
GO FROM "player100" OVER follow;
```

SHOW STATS

5      NEBULA GRAPH

Nebula Graph

---

: March 1, 2022

### 18.4.11 Pulsar

Exchange      Pulsar      Nebula Graph

MacOS

- 
- CPU 1.7 GHz Quad-Core Intel Core i7
- 16 GB
- Spark 2.4.7
- Nebula Graph 3.0.1      Docker Compose
  
- Nebula Graph
- Graph      Meta      IP
- Nebula Graph
  
- Exchange      Exchange      Exchange 3.0.0
- Spark
- Nebula Graph      Schema      Tag      Edge type
- Pulsar

## 1 NEBULA GRAPH SCHEMA

Nebula Graph Schema

## 1. Schema Nebula Graph 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. Nebula Graph 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: Nebula Exchange 3.0.0
 }
 driver: {
 cores: 1
 maxResultSize: 1G
 }
 cores: {
 max: 16
 }
 }

 # Nebula Graph
 nebula: {
 address: {
 # Nebula Graph Graph Meta IP
 # "ip1:port", "ip2:port", "ip3:port"
 # (,)
 graph: ["127.0.0.1:9669"]
 meta: ["127.0.0.1:9559"]
 }
 # Nebula Graph
 user: root
 pswd: nebula
 # Nebula Graph
 space: basketballplayer
 connection: {
 timeout: 3000
 retry: 3
 }
 execution: {
 retry: 3
 }
 error: {
 }
```

```

 max: 32
 output: /tmp/errors
 }
 rate: {
 limit: 1024
 timeout: 1000
 }
}
#
tags: [
 # Tag player
{
 # Nebula Graph Tag
 name: player
 type: {
 # Pulsar
 source: pulsar
 # Nebula Graph 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 Nebula Graph
 # fields nebula.fields
 #
 fields: [age,name]
 nebula.fields: [age,name]

 # Nebula Graph VID
 vertex:{ field:playerid
 }

 # Nebula Graph
 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
{
 # Nebula Graph Edge type
 name: follow

 type: {
 # Pulsar
 source: pulsar

 # Nebula Graph
 # Nebula Graph 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 Nebula Graph
fields nebula.fields
#
fields: [degree]
nebula.fields: [degree]

source follow
target follow
source:{
 field:src_player
}

target:{
 field:dst_player
}

rank
#ranking: rank

Nebula Graph
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 NEBULA GRAPH

Pulsar      Nebula Graph

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange <nebula-exchange-3.0.0.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-3.0.0.jar -c /root/nebula-exchange/nebula-exchange/target/classes/pulsar_application.conf
```

batchSuccess.<tag\_name/edge\_name>      batchSuccess.follow: 300

4

Nebula Graph      Nebula Graph Studio

GO FROM "player100" OVER follow;

SHOW STATS

5 NEBULA GRAPH

Nebula Graph

: March 1, 2022

## 18.4.12 Kafka

Exchange      Kafka      Nebula Graph

MacOS

- 
- CPU 1.7 GHz Quad-Core Intel Core i7
- 16 GB
- Spark 2.4.7
- Nebula Graph 3.0.1      Docker Compose
  
- Nebula Graph
- Graph      Meta      IP
- Nebula Graph
  
- Exchange      Exchange      Exchange 3.0.0
- Spark
- Nebula Graph      Schema      Tag      Edge type
- Kafka

## 1 NEBULA GRAPH SCHEMA

Nebula Graph Schema

## 1. Schema Nebula Graph 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. Nebula Graph 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: Nebula Exchange 3.0.0
 }
 driver: {
 cores: 1
 maxResultSize: 1G
 }
 cores: {
 max: 16
 }
 }

 # Nebula Graph
 nebula: {
 address: {
 # Nebula Graph Graph Meta IP
 # "ip1:port", "ip2:port", "ip3:port"
 # (,)
 graph: ["127.0.0.1:9669"]
 meta: ["127.0.0.1:9559"]
 }
 # Nebula Graph
 user: root
 pswd: nebula
 # Nebula Graph
 space: basketballplayer
 connection: {
 timeout: 3000
 retry: 3
 }
 execution: {
 retry: 3
 }
 error: {
 }
```

```

 max: 32
 output: /tmp/errors
}
rate: {
 limit: 1024
 timeout: 1000
}
}
#
tags: [
 # Tag player
{
 # Nebula Graph Tag
 name: player
 type: {
 # Kafka
 source: kafka
 # Nebula Graph 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 Nebula Graph key value personName value Nebula Graph name personAge value age
 nebula.fields: [name, age]

 # Nebula Graph VID
 # key key key VID name
 vertex:{ field:personId
}

 # Nebula Graph
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
{
 # Nebula Graph Edge type
 name: follow

 type: {
 # Kafka
 source: kafka
 #
 Nebula Graph
 # Nebula Graph 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 Nebula Graph key value degree value Nebula Graph degree
 nebula.fields: [degree]

 # source topic
 # target topic
 source:{

}

```

```

 field:srcPersonId
 }

 target:{
 field:dstPersonId
 }

 # rank
 #ranking: rank

 # Nebula Graph
 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 NEBULA GRAPH

Kafka      Nebula Graph

```
`${SPARK_HOME}/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange <nebula-exchange-3.0.0.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-3.0.0.jar -c /root/nebula-exchange/nebula-exchange/target/classes/kafka_application.conf
```

batchSuccess.<tag\_name/edge\_name>                  batchSuccess.follow: 300

4

Nebula Graph      Nebula Graph Studio

```
GO FROM "player100" OVER follow;
```

SHOW STATS

5    NEBULA GRAPH

Nebula Graph

: March 1, 2022

### 18.4.13 SST

SST	Sorted String Table	HDFS	Nebula Graph	CSV
-----	---------------------	------	--------------	-----

- Linux SST
- Default
- Exchange 3.0.0 GEOGRAPHY SST

#### Exchange

- nGQL Nebula Graph
- SST Console SST Nebula Graph
- SST
- Schema



10

Nebula Graph	RocksDB	RocksDB	API	SST
SST		SST	Exchange Reader sstProcessor sstWriter	

#### 1. Reader

2. sstProcessor Nebula Graph Schema SST HDFS SST
3. sstWriter SST Key
4. SST RocksDB IngestExternalFile() SST Nebula Graph

```
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
- Nebula Graph 3.0.1

- Nebula Graph 3.0.1

- Graph Meta IP
- Nebula Graph
- 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 3.0.0
- Spark
- JDK 1.8 JAVA\_HOME
- Hadoop Storage

### Note

- SST
- SST Storage Hadoop
- INGEST SST Storage `--move_files=true` Nebula Graph INGEST SST `mv data --`  
`move_files false Nebula Graph cp SST`

## 1 NEBULA GRAPH SCHEMA

CSV Nebula Graph Schema

## 1. Schema Nebula Graph 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. Nebula 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: Nebula Exchange 3.0.0
 }

 master:local

 driver: {
 cores: 1
 maxResultSize: 1G
 }

 executor: {
 memory:1G
 }
 }
}
```

```

cores: {
 max: 16
}
}

Nebula Graph
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
}

RateLimiter NebulaGraph
rate: {
 # RateLimiter
 limit: 1024

 # RateLimiter
 timeout: 1000
}
}

#
tags: [
 # Tag player
{
 # Nebula Graph Tag
 name: player
 type: {
 # CSV
 source: csv

 # Nebula Graph 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]

 # Nebula Graph
 # fields nebula.fields
 nebula.fields: [age, name]

 # VID
 # vertex fields csv.fields
 # Nebula Graph 3.0.1 VID
 vertex: {
 field: _c0
 }

 #
 separator: ","
}

CSV header true
CSV header false false
header: false

Nebula Graph
batch: 256

```

```

Spark
partition: 32

SST Nebula Graph partition
repartitionWithNebula: false
}

Tag team
{
Nebula Graph Tag
name: team
type: {
CSV
source: csv

Nebula Graph 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]

Nebula Graph
fields nebula.fields
nebula.fields: [name]

VID
vertex fields csv.fields
Nebula Graph 3.0.1 VID
vertex: {
field:_c0
}

#
separator: ","
header: true
CSV header true
CSV header false false
header: false

Nebula Graph
batch: 256

Spark
partition: 32

SST Nebula Graph partition
repartitionWithNebula: false
}

#
]

#
edges: [
Edge type follow
{
Nebula Graph Edge type
name: follow
type: {
CSV
source: csv

Nebula Graph 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]

Nebula Graph
fields nebula.fields
nebula.fields: [degree]

VID
vertex fields csv.fields
Nebula Graph 3.0.1 VID
source: {
field: _c0
}
target: {
field: _c1
}

#
,
```

```

separator: ","
rank
#ranking: rank

CSV header true
CSV header false false
header: false

Nebula Graph
batch: 256

Spark
partition: 32

SST Nebula Graph partition
repartitionWithNebula: false
}

Edge type serve
{
Nebula Graph Edge type
name: serve
type: {
CSV
source: csv

Nebula Graph Client SST
sink: sst
}

CSV [_c0, _c1, _c2, ..., _cn]
CSV
fields: [_c2,_c3]

Nebula Graph
fields nebula.fields
nebula.fields: [start_year, end_year]

#
vertex fields csv.fields
Nebula Graph 3.0.1 VID
source: {
field: _c0
}
target: {
field: _c1
}

#
separator: ","
rank
#ranking: _c5

CSV header true
CSV header false false
header: false

Nebula Graph
batch: 256

Spark
partition: 32

SST Nebula Graph 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-3.0.0.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-3.0.0.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

Nebula Graph      SST

1.

```
nebula> USE basketballplayer;
```

2.      SST

```
nebula> DOWNLOAD HDFS "hdfs://<hadoop_address>:<hadoop_port>/<sst_file_path>";
```

```
nebula> DOWNLOAD HDFS "hdfs://*.**.*:9000/sst";
```

3.      SST

```
nebula> INGEST;
```

### Note

- Nebula Graph      `data/storage/nebula`      Space ID      download      SST  
download
- INGEST;

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Nebula Graph

Nebula Graph Studio

```
GO FROM "player100" OVER follow;
```

```
SHOW STATS
```

7 NEBULA GRAPH

Nebula Graph

---

: March 1, 2022

### 18.4.14 Nebula Graph

Exchange Nebula Graph CSV

 **Enterpriseonly**

Exchange Nebula Graph CSV

Linux

CPU	4 Intel(R) Xeon(R) Platinum 8260 CPU @ 2.30GHz
-----	------------------------------------------------

16G
-----

50G
-----

CentOS 7.9.2009

JDK	1.8.0
-----	-------

Hadoop	2.10.1
--------	--------

Scala	2.12.11
-------	---------

Spark	2.4.7
-------	-------

Nebula Graph	3.0.1
--------------	-------

Nebula Graph basketballplayer 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
-----------	-------	------------------------------

1. Nebula Graph Exchange JAR

2.

Exchange Nebula Graph export\_application.conf Exchange

...

```
Processing tags
```

```

There are tag config examples for different dataSources.
tags: [
 # export NebulaGraph tag data to csv, only support export to CSV for now.
 {
 name: player
 type: {
 source: Nebula
 sink: CSV
 }
 # the path to save the NebulaGrpah data, make sure the path doesn't exist.
 path:"hdfs://192.168.8.177:9000/vertex/player"
 # if no need to export any properties when export NebulaGraph tag data
 # if noField is configured true, just export vertexId
 noField:false
 # define properties to export from NebulaGraph tag data
 # if return.fields is configured as empty list, then export all properties
 return.fields:[]
 # nebula space partition number
 partition:10
 }
 ...
]

Processing edges
There are edge config examples for different dataSources.
edges: [
 # export NebulaGraph tag data to csv, only support export to CSV for now.
 {
 name: follow
 type: {
 source: Nebula
 sink: CSV
 }
 # the path to save the NebulaGrpah data, make sure the path doesn't exist.
 path:"hdfs://192.168.8.177:9000/edge/follow"
 # if no need to export any properties when export NebulaGraph edge data
 # if noField is configured true, just export src,dst,rank
 noField:false
 # define properties to export from NebulaGraph edge data
 # if return.fields is configured as empty list, then export all properties
 return.fields:[]
 # nebula space partition number
 partition:10
 }
 ...
]
}

```

### 3. Nebula Graph

```
<spark_install_path>/bin/spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange nebula-exchange-x.y.z.jar_path> -c
<export_application.conf_path>
```

```
$./spark-submit --master "local" --class com.vesoft.nebula.exchange.Exchange \
~/exchange-ent/nebula-exchange-ent-3.0.0.jar -c ~/exchange-ent/export_application.conf
```

### 4.

#### a. CSV

```
$ hadoop fs -ls /vertex/player
Found 11 items
-rw-r--r-- 3 nebula supergroup 0 2021-11-05 07:36 /vertex/player/_SUCCESS
-rw-r--r-- 3 nebula supergroup 160 2021-11-05 07:36 /vertex/player/ part-00000-17293020-ba2e-4243-b834-34495c0536b3-c000.csv
-rw-r--r-- 3 nebula supergroup 163 2021-11-05 07:36 /vertex/player/ part-00001-17293020-ba2e-4243-b834-34495c0536b3-c000.csv
-rw-r--r-- 3 nebula supergroup 172 2021-11-05 07:36 /vertex/player/ part-00002-17293020-ba2e-4243-b834-34495c0536b3-c000.csv
-rw-r--r-- 3 nebula supergroup 172 2021-11-05 07:36 /vertex/player/ part-00003-17293020-ba2e-4243-b834-34495c0536b3-c000.csv
-rw-r--r-- 3 nebula supergroup 144 2021-11-05 07:36 /vertex/player/ part-00004-17293020-ba2e-4243-b834-34495c0536b3-c000.csv
-rw-r--r-- 3 nebula supergroup 173 2021-11-05 07:36 /vertex/player/ part-00005-17293020-ba2e-4243-b834-34495c0536b3-c000.csv
-rw-r--r-- 3 nebula supergroup 160 2021-11-05 07:36 /vertex/player/ part-00006-17293020-ba2e-4243-b834-34495c0536b3-c000.csv
-rw-r--r-- 3 nebula supergroup 148 2021-11-05 07:36 /vertex/player/ part-00007-17293020-ba2e-4243-b834-34495c0536b3-c000.csv
-rw-r--r-- 3 nebula supergroup 125 2021-11-05 07:36 /vertex/player/ part-00008-17293020-ba2e-4243-b834-34495c0536b3-c000.csv
-rw-r--r-- 3 nebula supergroup 119 2021-11-05 07:36 /vertex/player/ part-00009-17293020-ba2e-4243-b834-34495c0536b3-c000.csv
```

#### b. CSV

:January 14, 2022

## 18.5 Exchange

### 18.5.1

**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>
```

### 18.5.2

**Q Yarn-Cluster**

Yarn-Cluster

```
$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 xxxx

Nebula Graph

- RPM DEB --port
  - docker docker

`nebula-docker-compose`      `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 Exception in thread "main" com.facebook.thrift.protocol.TProtocolException: The field 'code' has been assigned the invalid value -4

## Exchange Nebula Graph

## Q Hive Nebula Graph

Hive JAR

```
--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

---

18.5.3**Q**

- batch Nebula Graph nGQL

- partition Spark

- nebula.rate Nebula Graph

  - limit

  - timeout

Storage leader

---

18.5.4**Q Exchange Nebula Graph**

Exchange

**Q Exchange Spark Writer**

Exchange	Spark Writer	Spark	Nebula Graph	Exchange	Spark Writer
Exchange					
•	MySQL Neo4j Hive HBase Kafka Pulsar				
•	Spark Writer	Spark HDFS	String Nebula Graph	Schema	Exchange
	Nebula Graph	Schema	String	double Exchange	String double

**Q Exchange**

Exchange      Nebula Exchange test result

---

: February 16, 2022

## 19. Nebula Algorithm

---

Nebula Algorithm      Algorithm      GraphX      Spark      Spark      Nebula Graph  
lib      DataFrame

### 19.1

---

Nebula Algorithm      Nebula Graph

Algorithm client	Nebula Graph
3.0-SNAPSHOT	nightly
3.0.0	3.0.1
2.6.x	2.6.x
2.5.0	2.5.0 2.5.1
2.1.0	2.0.0 2.0.1

### 19.2

---

Algorithm

- Nebula Graph      Nebula Graph
- Spark      2.4.x
- Scala      2.11
- Github      Algorithm      Maven

## 19.3

---

- ID ID INT String
- String SparkSQL dense\_rank String Long
- DataFrame
- Nebula Graph Tag

pagerank	pagerank	double/string
louvain	louvain	int/string
kcore	kcore	int/string
labelpropagation	lpa	int/string
connectedcomponent	cc	int/string
stronglyconnectedcomponent	scc	int/string
betweenness	betweenness	double/string
shortestpath	shortestpath	string
degreestatic	degree,inDegree,outDegree	int/string
trianglecount	trianglecount	int/string
clusteringcoefficient	clustercoefficient	double/string
closeness	closeness	double/string
hanp	hanp	int/string
bfs	bfs	string
jaccard	jaccard	string
node2vec	node2vec	string

## 19.4

---

Nebula Algorithm

PageRank	
Louvain	
KCore	K
LabelPropagation	
Hanp	
ConnectedComponent	
StronglyConnectedComponent	
ShortestPath	
TriangleCount	
GraphTriangleCount	
BetweennessCentrality	
Closeness	
DegreeStatic	
ClusteringCoefficient	
Jaccard	
BFS	
Node2Vec	-

## 19.5

---

Nebula Algorithm

1. Nebula Spark Connector   Nebula Graph              DataFrame
2. DataFrame      GraphX
3. GraphX            PageRank              Louvain

Scala

## 19.6 Nebula Algorithm

---

### 19.6.1

---

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 -Dpgg.skip -Dmaven.javadoc.skip=true -Dmaven.test.skip=true
```

nebula-algorithm/target nebula-algorithm-3.x.x.jar

## 19.6.2 Maven

---

# 19.7

---

## 19.7.1

---

lib 10

### 1. pom.xml

```
<dependency>
 <groupId>com.vesoft</groupId>
 <artifactId>nebula-algorithm</artifactId>
 <version>3.0.0</version>
</dependency>
```

### 2. PageRank



#### Note

DataFrame                   Nebula Graph    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
----	--------	----------	----	--------	------	------	----	--------

## 19.7.2



Note

Nebula Graph

Tag

1.

```
{
 # Spark
 spark: {
 app: {
 name: LPA
 # Spark
 partitionNum:100
 }
 master:local
 }

 data: {
 # nebula csv json
 source: nebula
 # nebula csv json
 sink: nebula
 #
 hasWeight: false
 }

 # Nebula Graph
 nebula: {
 # Nebula Graph nebula.read
 read: {
 # Meta IP , "ip1:port1,ip2:port2"
 # docker-compose docker-compose
 # `docker-compose ps`

 metaAddress: "192.168.*.10:9559"
 # Nebula Graph
 space: basketballplayer
 # Nebula Graph Edge type, labels
 labels: ["serve"]
 # Nebula Graph Edge type
 weightCols: ["start_year"]
 }

 # Nebula Graph 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
 # Nebula Graph
 space:nb
 # Nebula Graph Tag Tag Tag
 # PageRank pagerank
 # Louvain louvain
 # ConnectedComponent cc
 # StronglyConnectedComponent scc
 # LabelPropagation lpa
 # ShortestPath shortestpath
 # DegreeStatic degree inDegree outDegree
 # KCore kcore
 # TriangleCount tranglecpoint
 # BetweennessCentrality betweennedss
 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
 }
}
```

```

degree static kcore stronglyconnectedcomponent trianglecount
betweenness graphtriangleCount
executeAlgo: pagerank

PageRank
pagerank: {
 maxIter: 10
 resetProb: 0.15
}

Louvain
louvain: {
 maxIter: 20
 internalIter: 10
 tol: 0.5
}

...
}

}
}
}

```

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
```

## 19.8

---

- ——Nebula Algorithm 2 36

: March 17, 2022

## 20. Nebula Analytics

---

Nebula Analytics

Nebula Graph

 **Enterprise only**

### 20.1

---

CSV

Nebula Graph

HDFS

CSV

CSV

Nebula Analytics

Nebula Graph

HDFS

CSV

### 20.2

---

Nebula Graph

### 20.3

---

Nebula Analytics

Nebula Graph

**Analytics client****Nebula Graph**

1.0.x

3.0.x

0.9.0

2.6.x

### 20.4

---

Nebula Analytics

APSP

SSSP

BFS

PageRank

KCore

K

DegreeCentrality

TriangleCount

LPA

HANP

WCC

LOUVAIN

Clustering Coefficient

## 20.5 Nebula Analytics

Nebula Analytics

SSH

```
sudo rpm -i nebula-analytics-1.0.0-centos.x86_64.rpm --prefix /home/xxx/nebula-analytics
```

20.6

---

## 1. Nebula Analytics

scripts

```
$ cd scripts
```

2.

- Nebula Graph

a. `nebula.conf` Nebula Graph

```
Nebula Graph
--retry=3
#
--space=baskeyballplayer

Nebula Graph
Nebula Graph metad
--meta_server_addrs=192.168.8.100:9559, 192.168.8.101:9559, 192.168.8.102:9559
#
--edges=LIKES
_rank
#--edge_data_fields
#
--read_batch_size=10000

Nebula Graph
Nebula Graph graphd
--graph_server_addrs=192.168.8.100:9669
Nebula Graph
--user=root
Nebula Graph
--password=nebula
Nebula Graph : insert update
--mode=insert
Nebula Graph Tag
--tag=pagerank
Nebula Graph Tag
--prop=pr
Nebula Graph Tag
--type=double
#
--write_batch_size=1000
#
--err_file=/home/xxx/analytics/err.txt
```

b. `run_pagerank.sh`

```
1 NUMA node
WNUM=3
#
WCORES=4
#
nebula.conf Nebula Graph
INPUT=${INPUT:="nebula:$PROJECT/scripts/nebula.conf"}
HDFS CSV
#INPUT=${INPUT:="$PROJECT/data/graph/v100_e2150_ua_c3.csv"}

#
Nebula Graph Nebula Graph 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
#NUM=3
#
#CORES=4
#
nebula.conf Nebula Graph
INPUT=${INPUT:="nebula:$PROJECT/scripts/nebula.conf"}
HDFS CSV
INPUT=${INPUT:="$PROJECT/data/graph/v100_e2150_ua_c3.csv"}

#
Nebula Graph Nebula Graph 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 Nebula Analytics

```
Nebula Analytics IP :
192.168.8.200:1
192.168.8.201:1
192.168.8.202:1
```

4.

```
./run_pagerank.sh
```

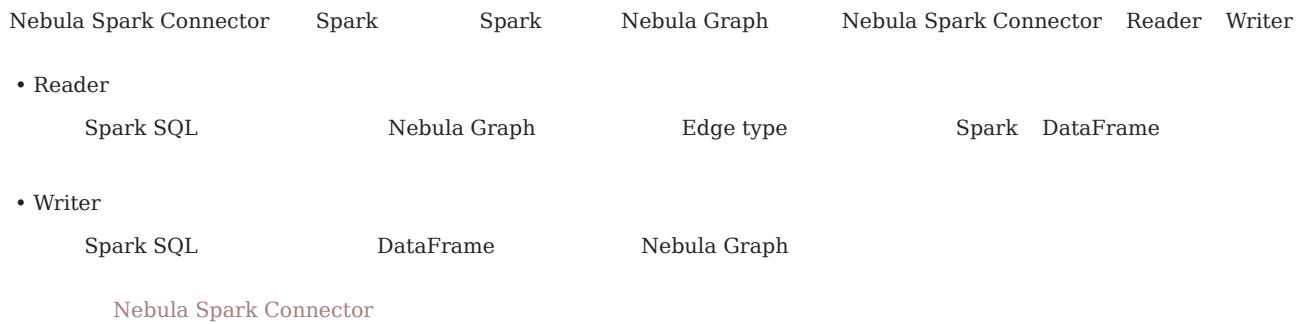
5.

- Nebula Graph nebula.conf
  - HDFS CSV CSV OUTPUT .gz
- 

: March 23, 2022

## 21. Nebula Spark Connector

---



### 21.1

---

Nebula Spark Connector

- Nebula Graph
- Nebula Graph
- Nebula Graph
- Nebula Algorithm

### 21.2

---

Nebula Spark Connector 3.0.0

- ID ID ID
- Reader
- Reader Nebula Graph Graphx VertexRDD EdgeRDD Long ID
- SparkSQL DataSourceV2 Nebula Graph
- insert update delete insert update delete
- Nebula Graph SSL

### 21.3

---

Release notes

## 21.4 Nebula Spark Connector

### 21.4.1



Spark 2.4.x

#### 1. nebula-spark-connector

```
$ git clone -b v3.0.0 https://github.com/vesoft-inc/nebula-spark-connector.git
```

#### 2. nebula-spark-connector

```
$ cd nebula-spark-connector/nebula-spark-connector
```

#### 3.

```
$ mvn clean package -Dmaven.test.skip=true -Dgpg.skip -Dmaven.javadoc.skip=true
```

```
nebula-spark-connector/nebula-spark-connector/target/ nebula-spark-connector-3.0.0-SHAPSHOT.jar
```

### 21.4.2 Maven

## 21.5

Nebula Spark Connector Nebula Graph

```
Nebula Graph
spark.read.nebula().loadVerticesToDF()
spark.read.nebula().loadEdgesToDF()

dataframe Nebula Graph
dataframe.write.nebula().writeVertices()
dataframe.write.nebula().writeEdges()

nebula()
```

### 21.5.1 Nebula Graph

```
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`    Nebula Graph

<code>withMetaAddress</code>	Meta	,	<code>ip1:port1,ip2:port2,...</code>
<code>withGraphAddress</code>			
<code>withConnectionRetry</code>	Nebula Java Client	Nebula Graph	1
<code>withExecuteRetry</code>	Nebula Java Client		1
<code>withTimeout</code>	Nebula Java Client	6000	ms

- `ReadNebulaConfig`    Nebula Graph

<code>withSpace</code>	Nebula Graph		
<code>withLabel</code>	Nebula Graph Tag Edge type		
<code>withNoColumn</code>	false	true	<code>withReturnCols</code>
<code>withReturnCols</code>	<code>List(property1,property2,...)</code>		<code>List()</code>
<code>withLimit</code>	Nebula Java Storage Client	1000	
<code>withPartitionNum</code>	Nebula Graph Spark	100	<code>partition_num</code>

## 21.5.2 Nebula Graph

### Note

DataFrame    Nebula Graph

```
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

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` Nebula Graph

<code>withMetaAddress</code>	Meta	,	ip1:port1,ip2:port2,...
<code>withGraphAddress</code>	Graph	,	ip1:port1,ip2:port2,...
<code>withConnectionRetry</code>	Nebula Java Client	Nebula Graph	1

- `WriteNebulaVertexConfig`

<code>withSpace</code>	Nebula Graph			
<code>withTag</code>	Tag			
<code>withVidField</code>	DataFrame	ID		
<code>withVidPolicy</code>	ID	Nebula Graph	HASH	
<code>withVidAsProp</code>	DataFrame	ID	false	true Tag VidField
<code>withUser</code>	Nebula Graph			
<code>withPasswd</code>	Nebula Graph			
<code>withBatch</code>	512	withWriteMode	update	512
<code>withWriteMode</code>	insert	update	insert	

- `WriteNebulaEdgeConfig`

<code>withSpace</code>	Nebula Graph			
<code>withEdge</code>	Edge type			
<code>withSrcIdField</code>	DataFrame			
<code>withSrcPolicy</code>		Nebula Graph	HASH	
<code>withDstIdField</code>	DataFrame			
<code>withDstPolicy</code>		Nebula Graph	HASH	
<code>withRankField</code>	DataFrame	rank	rank	
<code>withSrcAsProperty</code>	DataFrame	srcIdField	false	true Edge type
<code>withDstAsProperty</code>	DataFrame	dstIdField	false	true Edge type
<code>withRankAsProperty</code>	DataFrame	rank	false	true Edge type
<code>withRankField</code>				
<code>withUser</code>	Nebula Graph			
<code>withPasswd</code>	Nebula Graph			
<code>withBatch</code>	512	withWriteMode	update	512
<code>withWriteMode</code>	insert	update	insert	

### 21.5.3

---

.....  
: February 16, 2022

## 22. Nebula Flink Connector

---

Nebula Flink Connector

Flink

Nebula Graph

Nebula Graph

Nebula Graph

Nebula Flink Connector

### 22.1

---

Nebula Flink Connector

- Nebula Graph
- Nebula Graph
- Nebula Graph

### 22.2

---

Release notes

---

: January 14, 2022

## 23. Nebula Bench

---

Nebula Bench      LDBC      Nebula Graph

### 23.1

---

- Nebula Graph
- Nebula Graph

### 23.2

---

Release

Nebula Bench

---

: February 8, 2022

## 24.

---

### 24.1 Nebula Graph 3.0.1 release notes

---

#### 24.1.1 Bug fix

---

- ADD HOSTS Storage ONLINE #3950
- v2.6 Nebula Graph Graph #3942
- Tag #3920
- MATCH <node>, <node>, <path> Graph #3915

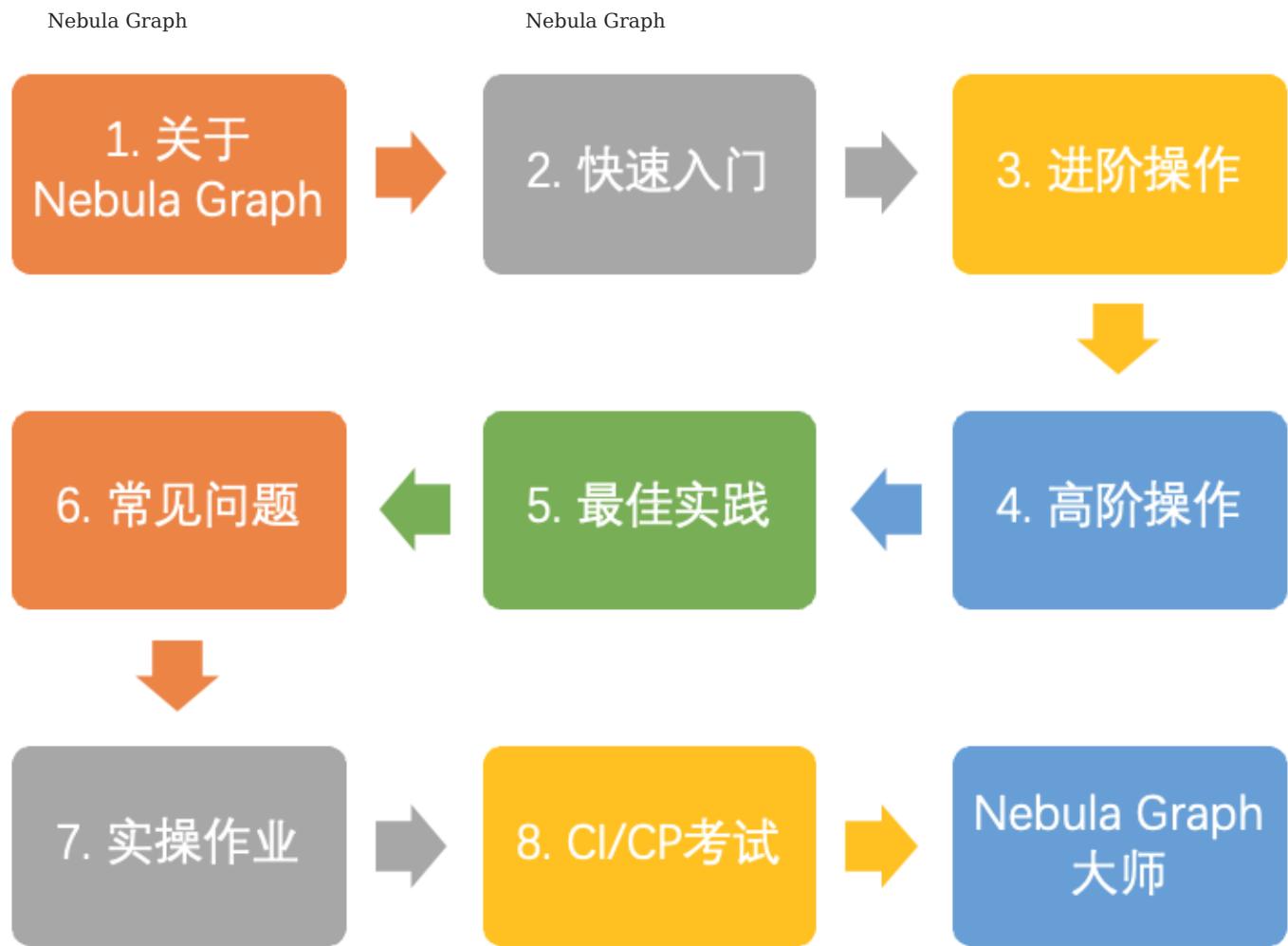
#### 24.1.2

---

: March 14, 2022

---

## 24.2 Nebula Graph



### 24.2.1. Nebula Graph

#### 1.1 Nebula Graph

Nebula Graph

Nebula Graph

Nebula Graph

#### 1.2

#### 1.3

---

**1.4**

---

**1.5**

---

Meta

Graph

Storage

---

24.2.2 2.**2.1 Nebula Graph**

---

RPM/DEB

TAR

Docker

---

Nebula Graph

---

**2.2 Nebula Graph**

---

Nebula Graph

---

**2.3 Nebula Graph**

---

Nebula Graph

---

**2.4 nGQL**

---

nGQL

---

24.2.3 3.

---

**3.1**

---

RPM/DEB      Nebula Graph

**3.2**

Nebula Graph

---

**3.3 Nebula**

Meta

---

Graph

---

Storage

---

Linux

---

**3.4****3.5**

•

---

OpenLDAP

---

---

•

---

Storage

---

•

---

Nebula

---

RocksDB

---

•

---

SSL

---

**3.6**


---

Nebula schema

---



---

Compaction

---

**3.7**


---

Nebula Graph Studio

---

Nebula Dashboard

---

Nebula Explorer

---

Nebula Studio

---

Nebula Graph Studio

---

Nebula Dashboard

---

Nebula Explorer

---



---

Nebula Importer

---

Nebula Importer

---

Nebula Spark Connector

---

-

---

Nebula Flink Connector

---

-

---

Nebula Exchange

---

Nebula Graph

---

—Exchange Exchange SST

---

Nebula Exchange

---

-

---



---

Nebula Bench

---



---

Nebula Algorithm Nebula Algorithm

---



---

Nebula Console

---

Nebula CPP

---

Nebula Java

---

Nebula Python

---

Nebula Go

---

## 24.2.4 4.

---

API & SDK

---

## 24.2.5 5.

---

&

LDBC nGQL

---

Nebula Graph Betweenness Centrality

---

Akulaku

---

Nebula Graph

---

Nebula Graph

---

Nebula Graph

---

@BOSS

---

## 24.2.6 6.

---

FAQ

---

## 24.2.7 7.

---

Nebula Graph

Nebula Graph

---

Studio Dashboard Explorer

Studio Dashboard Explorer

K6 Nebula Graph

K6 Nebula Graph

LDBC

LDBC nGQL

LDBC K

LDBC interactive-short-1.cypher

## 24.2.8 8. CI/CP

---

Nebula Graph 2

- Nebula Graph Certified Insider (NGCI)

Nebula Graph

Nebula Graph

- Nebula Graph Certified Professional (NGCP)

Nebula Graph

Nebula Graph

Nebula Graph

Nebula Graph N

: February 16, 2022

## 24.3 FAQ

---

Nebula Graph 3.0.1

[Nebula Graph](#)

[GitHub issue](#)

### 24.3.1

Nebula Graph

[issue](#) Nebula Graph

 Note

1. " "
2. Markdown "Commit changes" GitHub pull request
3. [CLA](#) 2 reviewer

### 24.3.2



Nebula Graph 3.0.1

Nebula Graph 1.x 2.x)

[Nebula Graph](#)

### 24.3.3

[nebula-storaged](#)

nebula-storaged	nebula-storaged	nebula-metad	Storage	Storage	Ready	3.0.0
Meta	Storage	Storage	Meta	ADD HOSTS	Meta	Storage
Storage						

`SemanticError: Missing yield clause.`

Nebula Graph 3.0.0

[LOOKUP](#) [GO](#) [FETCH](#) [YIELD](#)

[YIELD](#)

`Zone 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 .

`[ERROR (-1005)]: Used memory hits the high watermark(0.800000) of total system memory.`

Nebula Graph [system\\_memory\\_high\\_watermark\\_ratio](#)

0.8

Nebula Graph

- Graph      Graph      system\_memory\_high\_watermark\_ratio      0.8      0.9

**Storage Error E\_RPC\_FAILURE**

Graph      Storage      Storage

- nebula-graphd.conf      --storage\_client\_timeout\_ms      Storage client      ms      --
   
storage\_client\_timeout\_ms=60000      nebula-graphd.conf      --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

**[ERROR (-1005)]: Schema not exist: xxx**

Schema not exist

- Schema      Tag      Edge type
- Tag      Edge type

**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 (-7)]: 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-storaged.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

## 24.3.4

**time spent**

SHOW SPACES

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

```
+-----+
Got 1 rows (time spent 1235/1934 us)
```

- 1235
- 1934

### Nebula Graph

Nebula Console 2.6.0

Nebula Graph

(Dangling edge)

Nebula Graph 3.0.1                "        openCypher    MERGE                INSERT VERTEX, DELETE  
VERTEX, INSERT EDGE, DELETE EDGE

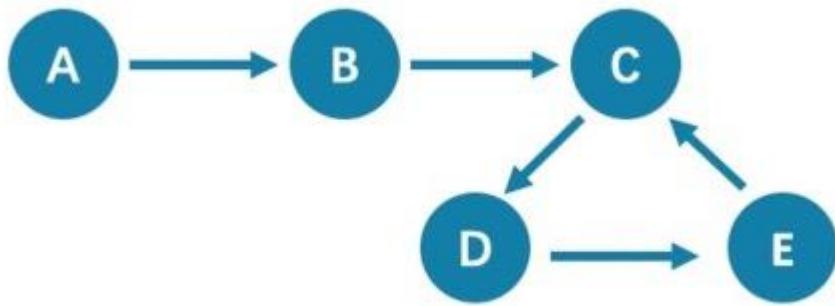
**CREATE SPACE**    **replica\_factor**                **2**

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	GO	D	A->B->C->D->E->C->D	C->D	MATCH
---	---	---	------------------	---	----	---	---------------------	------	-------

GO MATCH

MATCH

GO

D A-&gt;B-&gt;C-&gt;D-&gt;E-&gt;C-&gt;D

C-&gt;D

MATCH

**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.

Nebula 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); #
```

```
" "
```

## Nebula Algorithm

### 24.3.5

---

```
Nebula Graph /usr/local/nebula/logs/ INFO nebula-graphd.INFO, nebula-storaged.INFO, nebula-metad.INFO
 .WARNING .ERROR
```

```
Nebula Graph glog glog
```

- crontab                            Glog should delete old log files automatically
- logrotate                        logrotate                    Nebula Graph                    timestamp\_in\_logfile\_name            false

#### Nebula Graph

```
nebula-console SHOW HOSTS META SHOW HOSTS
 bin ./<binary_name> --version version GitHub commit ID
```

```
$./nebula-graphd --version
```

- Docker Compose

```
Docker Compose Nebula Graph
```

```
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	

### 24.3.6

---

Meta	9559, 9560, 19559, 19560
------	--------------------------

Graph	9669, 19669, 19670
-------	--------------------

Storage	9777 ~ 9780, 19779, 19780
---------	---------------------------

telnet

```
telnet <ip> <port>
```



telnet

telnet

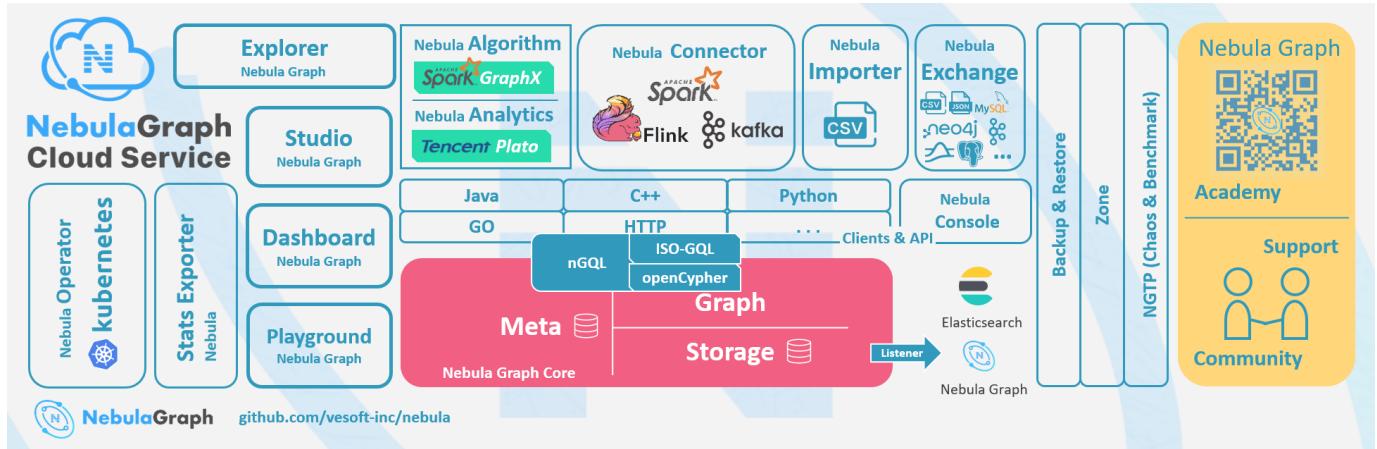
```
//
$ telnet 192.168.1.10 9669
Trying 192.168.1.10...
Connected to 192.168.1.10.
Escape character is '^]'.

//
$ telnet 192.168.1.10 9777
Trying 192.168.1.10...
telnet: connect to address 192.168.1.10: Connection refused
```

---

: March 29, 2022

24.4



Note

- |   | X.Y.Z   | X,       | Y,                  | Z     |
|---|---------|----------|---------------------|-------|
| • | Y       | 6        |                     | 3     |
| • | Y       | 3        |                     | Y     |
| • | RC      |          | (Release Candidate) | RC    |
| • | nightly | SNAPSHOT |                     |       |
| • |         | X.0.0,   |                     | X.5.0 |

## 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 Nebula Graph 3.x

## 24.4.1 Nebula Graph Studio

Nebula Graph Studio      Studio      Web      Nebula Graph DBMS      nGQL

### Note

## Studio Nebula Graph

#### 24.4.2 Nebula Dashboard

Nebula Dashboard    Dashboard    Nebula Graph

## Nebula Dashboard

#### 24.4.3 Nebula Dashboard

## Nebula Dashboard      Dashboard      Nebula Graph

Nebula

#### 24.4.4 Nebula Explorer

Nebula Explorer      Explorer      Web      Nebula Graph

#### 24.4.5 Nebula Stats Exporter

`nebula-stats-exporter` Prometheus

#### 24.4.6 Nebula Exchange

#### 24.4.7 Nebula Importer

Nebula Importer      Importer      Nebula Graph CSV      Importer      CSV      Nebula Graph

## 24.4.8 Nebula Spark Connector

Nebula Spark Connector      Spark      Spark      Nebula Graph      Nebula Spark Connector    Reader    Writer  
Nebula Spark Connector

## 24.4.9 Nebula Flink Connector

Nebula Flink Connector      Flink      Nebula Graph      Nebula Graph      Nebula Graph

Nebula Flink Connector

#### 24.4.10 Nebula Algorithm

#### 24.4.11 Nebula Analytics

Nebula Analytics Plato Plato Nebula Graph Nebula Analytics

#### 24.4.12 Nebula Console

Nebula Console   Nebula Graph   CLI   Nebula Graph

#### 24.4.13 Nebula Docker Compose

## Docker Compose Nebula Graph Docker Compose Nebula Graph

#### 24.4.14 Backup & Restore

[Backup&Restore](#)    BR    [CLI](#)    [Nebula Graph](#)

#### 24.4.15 Nebula Bench

[Nebula Bench](#)    [Nebula Graph](#)    LDBC v0.3.3

#### 24.4.16 API SDK

##### ↑ compatibility

X.Y.\*

Nebula Graph	commit id
3.0.1	C++
3.0.1	Go
3.0.1	Python
3.0.1	Java
3.0.1	HTTP

#### 24.4.17

- API
- Rust Client
- Node.js Client
- [Object Graph Mapping Library (OGM, or ORM)] Java, Python (TODO: in design)
- 
- Chaos Test

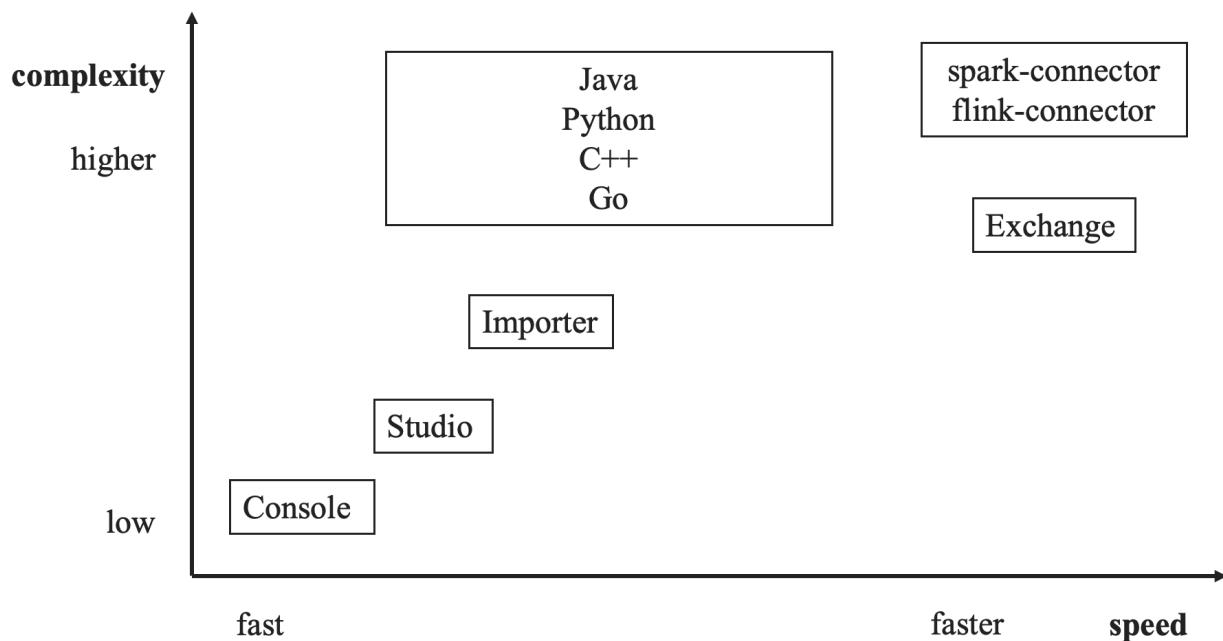
: March 7, 2022

## 24.5

---

### Nebula Graph 3.0.1

- -f nGQL
- studio csv 100 MB
- importer csv
- Exchange Neo4j, Hive, MySQL Spark
- Spark-connector/Flink-connector (Spark/Flink)
- C++/GO/Java/Python SDK



: March 1, 2022

## 24.6

---

### 24.6.1

---

#### GitHub

[GitHub](#)

[CLA](#)

[CLA](#)

[vesoft inc. Contributor License Agreement](#)

[Sign in with GitHub to agree](#)

[info@vesoft.com](mailto:info@vesoft.com)

### 24.6.2

---

[Nebula Graph](#)    [Markdown](#)

### 24.6.3

---

#### Step 1 GitHub fork

Nebula Graph                [nebula](#)

1. [github.com/vesoft-inc/nebula](https://github.com/vesoft-inc/nebula)
2. [Fork](#)                [fork nebula](#)

#### 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

Nebula Graph 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

-

Nebula Graph cpplint Google

- Bug
- Nebula Graph

### 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

## 24.6.4

How to add test cases

## 24.6.5

### Step 1

Slack      Nebula Graph      Nebula Contrib

- info@vesoft.com
- NebulaGraphbot
- Slack [Join Slack](#)

### Step 2

Nebula Graph      Nebula Contrib      ID

### Step 3

Nebula Contrib      Maintain

GitHub      Transferring a repository owned by your user account

---

: February 8, 2022

## 24.7 Nebula Graph

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 <sup>1</sup>@dangleptr



4. 2020.3 v1.0 v2.0  
5. 2020.6 v1.0.0 GA

## V1.0.0 GA

v1.0.0  
06a5db  
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

v2.0.0  
91639db  
jude-zhu released this on Mar 23  
Verified

[Compare](#)

## Nebula Graph v2.0 GA

[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

# Nebula Graph v2.5.0

 Sophie-Xie released this 4 days ago

## feature

- Support management of session. [#280](#)
- Support terminate the slow queries, know issue: there is a delay in querying and terminating the query due to the implementation. [#1152](#)
- Enhance the ability to extract the indices from expressions for `Lookup` statement. [#1188](#)
- Supports configuring machine memory watermarks to alleviate OOM issues to some extent. [#1067](#)
- Support filter the edges in `FindPath` statement. [#1091](#)
- Support return structure of a graph without properties in `Subgraph` statement. [#1134](#)
- Improve the usage of `timestamp` function. [vesoft-inc/nebula-common#515](#)
- Support for querying the version of each service. [#944](#)
- Index and TTL can be supported together. [#382](#)
- Support the creation of full-text indexes on specified properties. [#460](#)
- Support make comment when create space or schema. [#895](#)
- Support for full-text index rebuild. [#1123](#)

## bug fix

- Fixed multiple statement execution problems caused by permissions. [#1165](#)
- Fixed unwinding causing no results. [#1018](#)
- Fixed crash problems caused by aggregation functions in some scenarios. [#1015](#)
- Fixed index matching problems with OR expressions. [#1005](#)
- Fixed case sensitivity of functions. [#927](#)
- Fixed issue where query index creation information was not checked for Tag/Edge type. [#933](#)
- Fixed a bug in the Substring function. [vesoft-inc/nebula-common#491](#)
- Fixed meta not returning leader change correctly. [#423](#)
- Fixed an issue with 'LIMIT', 'ORDER', 'GROUP' statements using variables. [#1314](#)
- Fixed issue with db\_dump tool printing VID of int type. [vesoft-inc/nebula-storage#533](#)
- Fixed the issue that FAILE is still displayed after the Balance task is recovered. [vesoft-inc/nebula-storage#528](#)

## enhancement

- The Listener interface is optimized to support full data acquisition. [#465](#), [#484](#)
- The leader table of the meta is reorganized. [#439](#)
- Add a DiskManager to check disk capacity. [#461](#)
- Improve heartbeat of raft to avoid leader change. [#438](#)
- Support concurrently go/fetch/lookup in storage. [#503](#)
- Enhanced for the `EXISTS` function to the `MAP`. [#973](#)
- Enforce the use of aggregate functions, such as `COUNT(v)+AVG(v)`. [#968](#)

## change

- A little bit grammar change of Subgraph

```
Add the WITH PROP keyword to the output property
GET SUBGRAPH WITH PROP FROM <vids>

The original syntax will only output the graph structure without properties
GET SUBGRAPH FROM <vids>
```

- we must use the symbol `$-` in 'ORDER BY'. But in earlier versions, there is no need. Example:

8. 2021.10 v2.6.0

[Releases](#)

9. 2022.2 v3.0.0

[Releases](#)

---

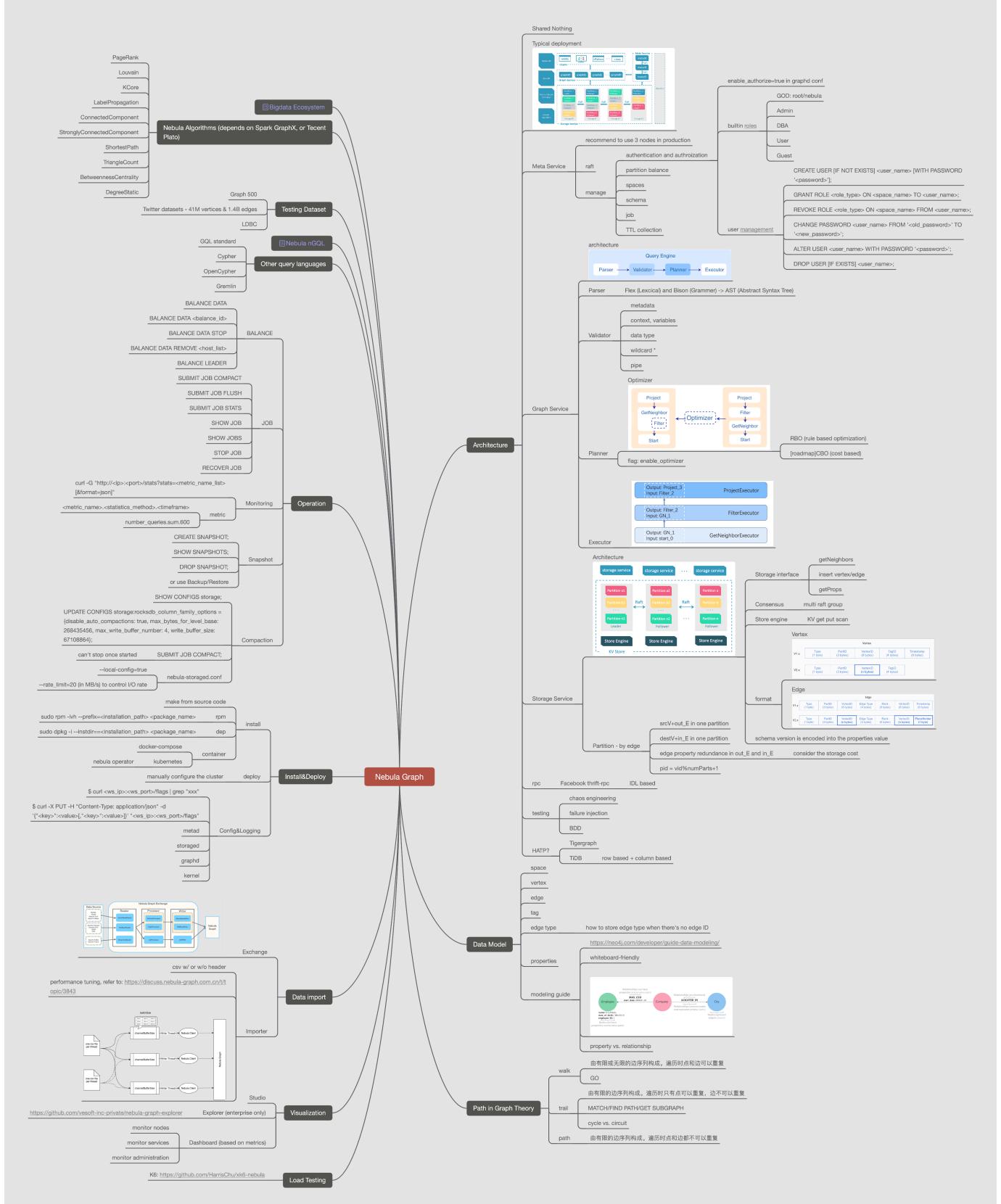
1. Nebula Graph 1.x    [RocksDB](#)    [HBase](#)    [Nebula Graph 2.x](#)    [HBase](#)   

---

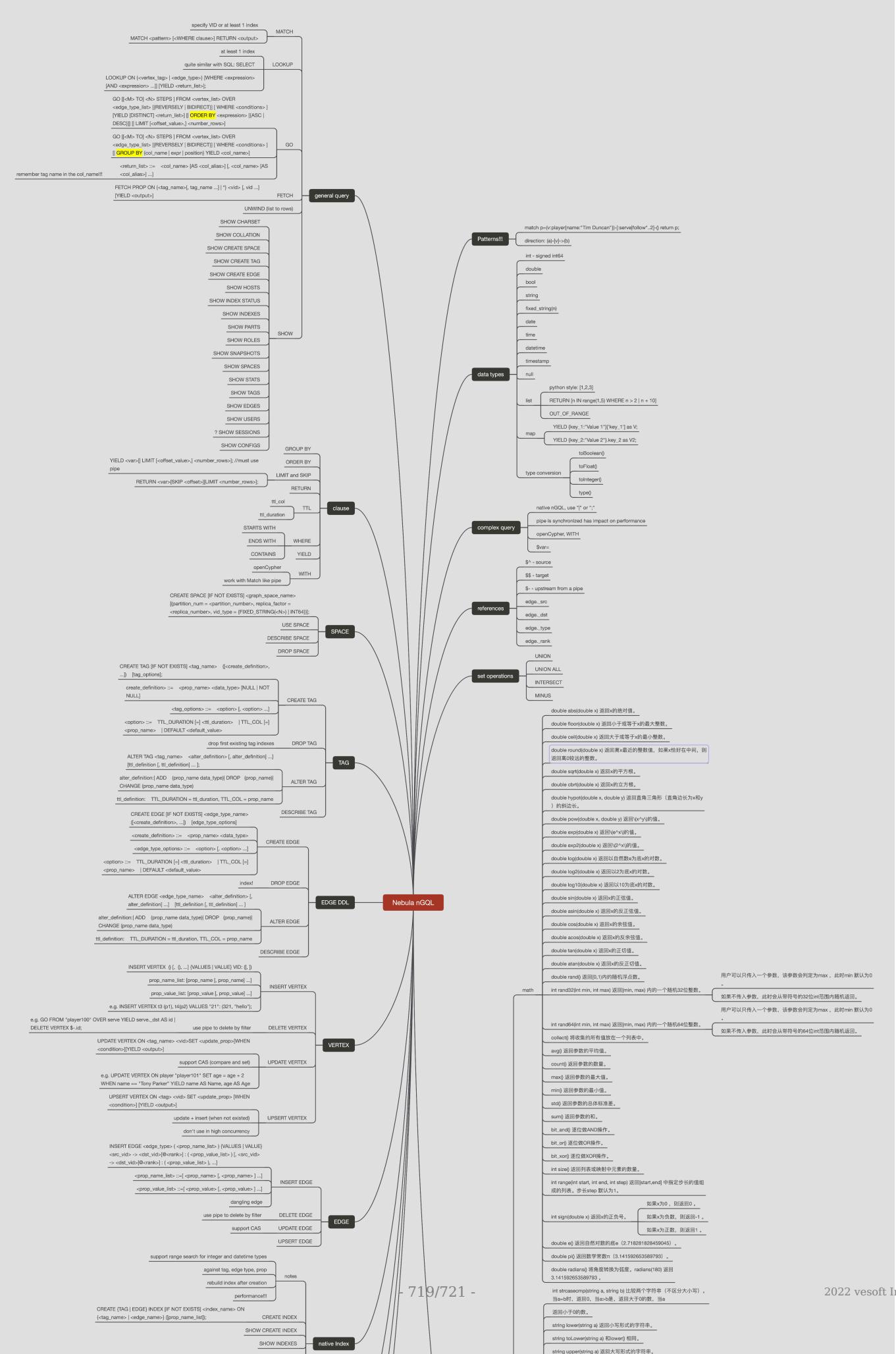
: February 25, 2022

## 24.8

### Nebula Graph



nGQL



---

:January 14, 2022



<https://docs.nebula-graph.com.cn/3.0.1>