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An Example Showing the Necessity of Relationship Type Index and Related Execution Plan Optimization



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Suppose I have a large knowledge base with many relationship types, e.g., hasChild, livesIn, locatedIn, capitalOf, largestCityOf...

The number of capitalOf relationships is relatively small (say, one hundred) compared to that of all nodes and other types of relationships.

I want to fetch any capital which is also the largest city in their country by the following query:

```
MATCH city-[:capitalOf]->country, city-[:largestCityOf]->country RETURN city
```

Apparently it would be wise to take the capitalOf type as clue, scan all 100 relationship with this type and refine by [:largestCityOf]. However the current execution plan engine of neo4j would do an AllNodesScan and Expand. Why not consider add an "RelationshipByTypeScan" operator into the current query optimization engine, like what NodeByLabelScan does?

I know that I can transform relationship types to relationship properties, index it using the legacy index and manually indicate

```
START r=relationship:rels(rtype = "capitalOf")
```

to tell neo4j how to make it efficient. But for a more complicated pattern query with many relationship types but no node id/label/property to start from, it is clearly a duty of the optimization engine to decide which relationship type to start with.

I saw many questions asking the same problem but getting answers like "negative... a query TYPICALLY starts from nodes... ". I just want to use the above typical scenario to ask why once more.

Thanks!

neo4j

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asked Apr 8 at 5:08

 **inzaghi250**
1 ● 1

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A relationship is local to its start and end node - there is no global relationship dictionary. An operation like "give me globally all relationships of type x" is therefore an expensive operation - you need to go through all nodes and collect matching relationships.

There are 2 ways to deal with this:

1) use a manual index on relationships as you've sketched

2) assign labels to your nodes. Assume all the country nodes have a Country label. You can rewrite your query:

```
MATCH (city)-[:capitalOf]->(country:Country), (city)-[:largestCityOf]->(country) RET
```


The AllNodesScan is now a NodeByLabelScan. The query grabs all countries and matches to the

asked 4 months ago

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the `AddressScan` is now a `NodeByLabelScan`. The query grabs all countries and matches to the cities. Since every country does have one capital and one largest city this is efficient and scales independently of the rest of your graph.

If you put all relationships into one index and try to grab to ~100 `capitalOf` relationships that operation scales logarithmically with the *total* number of relationships in your graph.

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answered Apr 8 at 7:26
 **Stefan Armbruster**
23.1k ● 2 ● 28 ● 51

Thanks for the comments, @stefan – [inzaghi250](#) Apr 11 at 6:54

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rev 2015.8.20.694