WHAT DO GRAPH TABLES BRING TO THE TABLE

Hasan Savran (He/him)

Owner
SavranWeb Consulting

- MS Data Platform MVP
- Azure Cosmos DB SME
- From Cleveland, USA
- 15+ years Web Development
- 8+ years Business Intelligence

https://h-savran.blogspot.com/

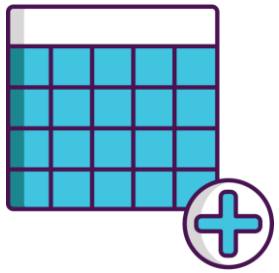
hasansavran

@savranweb

Microsoft® MVP Most Valuable Professional

SELECTING CORRECT DATA MODEL

Business Change



Data/Schema Change

Entertainment

New Vehicles

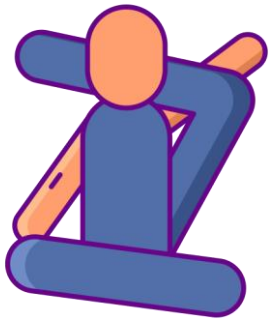
IOT

Healthcare

SELECTING CORRECT DATA MODEL

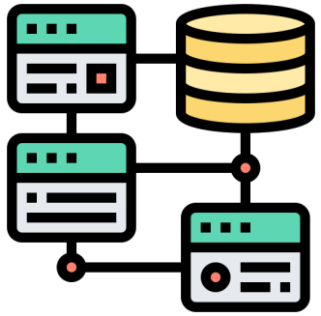
Evolve

Business evolves



Flexible

Schema changes

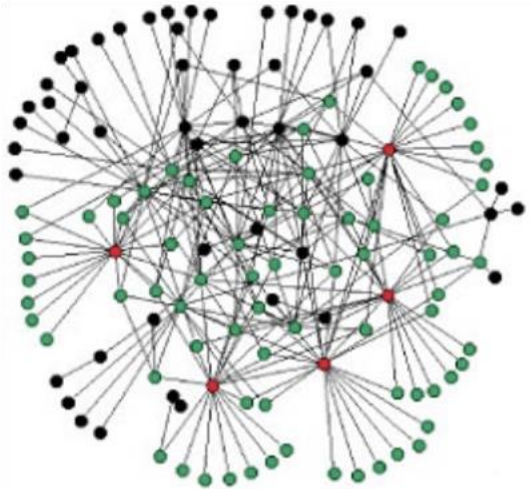


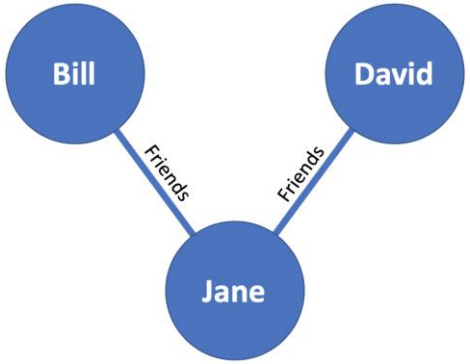
Relational?

Key Value
Wide Column
Graph

WHICH DATABASE ENGINES SUPPORT IT?

WHO USES GRAPH DATABASES?





GRAPH DATABASES IN SQL SERVER


Introduced in 2017

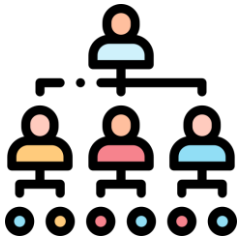

No need to learn a new language


No need to buy different servers

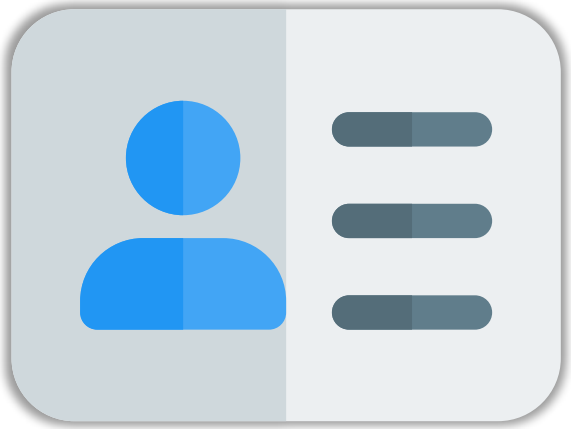

You can join to other tables

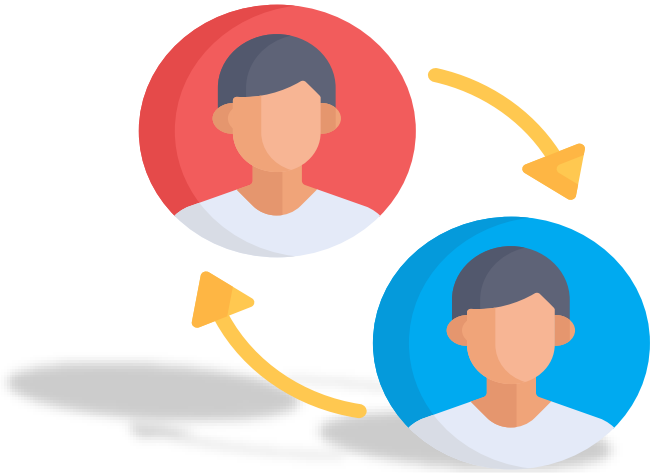

Fully integrated to SQL Server Engine

GRAPH DATABASES IN SQL SERVER

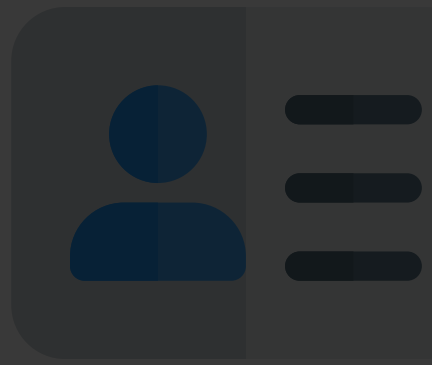


HIERARCHYID	GRAPH DATABASE TABLES
Highly Structured Data	No fixed boundaries
Multiple Parents are not allowed	Multiple parents are possible
You can have only one root	Root doesn't exist
One to Many Relationships	Many to Many Relationships
Indexable	Indexable
CLR Functions to find data	MATCH Clause
SQL Server 2008+	SQL Server 2017+





NODE TABLES	EDGE TABLES
Keep Entity Data	Keep Relation Data
$nodeId is the identity of an Entity	$edgeId is the identity of a relation
They can have any type of columns	They can have any type of columns
	$from_id and $to_id controls the relation
	Relations can not be updated
	Directions are important.



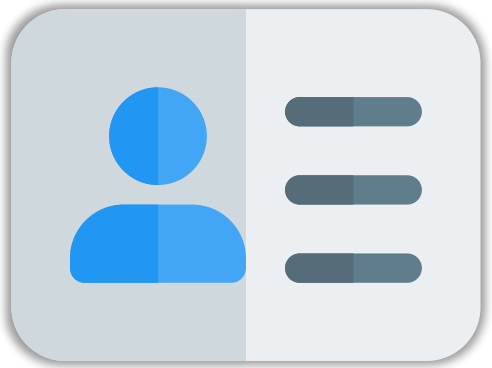
NODE TABLE

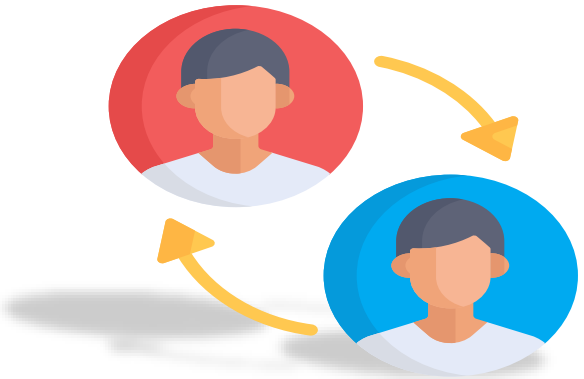
GE TABLES

```
CREATE TABLE Products (
  ProductId int,
  ProductName varchar(50)
  ProductCat tinyint
) AS NODE
```

```
AlikeProduct (
etime default GetDate()
```

- Graphs
  - Database Diagrams
  - Tables
    - System Tables
    - FileTables
    - External Tables
    - Graph Tables
      - dbo.AlikeProduct
      - dbo.HR
      - dbo.inprocess
      - dbo.instock
      - dbo.Products
      - dbo.ReportsTo
      - dbo.Users
      - dbo.warehouses
      - dbo.Wished
    - dbo.DistanceDemo
    - dbo.Employees (System-Versioned)
    - dbo.Grocery_UPC_Database
  - Views



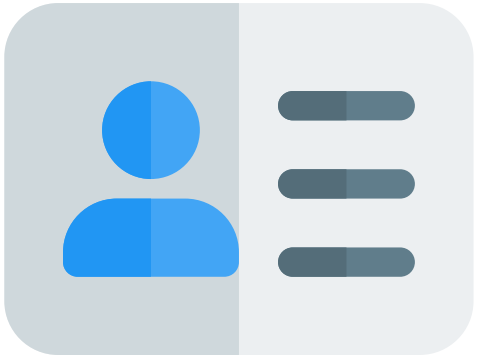


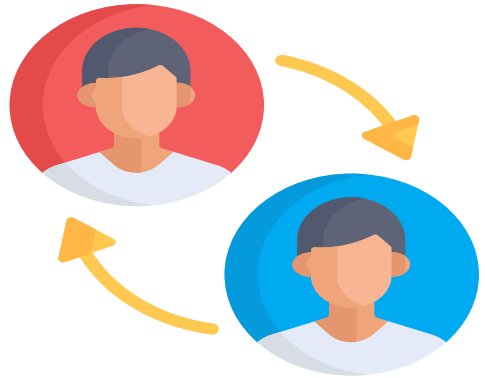
NODE TABLES

```
INSERT INTO Products (Brand, ProductName,
InStock, InvoicePrice, RetailPrice, Active,
Rating)
VALUES
('Amazon','Kindle Fire 7',1,30,49,1,4),
('Amazon','Kindle Fire HD 8',1,50,79,1,5),
('Amazon','Kindle Fire 7 Kids',1,55,99,1,4)
```

EDGE TABLES

```
INSERT INTO AlikeProduct VALUES(
(SELECT $node_id FROM Products WHERE Id = 1),
(SELECT $node_id FROM Products WHERE Id = 2),
GetDate())
```





NODE TABLES

```
UPDATE Products
SET InStock = 0
WHERE ProductId = 1
```

EDGE TABLES

```
UPDATE AlikeProduct
SET CreatedDt = GETDATE() -1
FROM Products p1, AlikeProduct ap, Products p2
WHERE MATCH(p1-(ap)->p2) and p1.ProductId =1
```

YOU CANNOT UPDATE RELATIONS
$FROM_ID or $TO_ID

NODE TABLES

Results | Messages

	$node_id_6ACA178D479F4B5FBB88C806CB64C7AF	ProductId	Brand	ProductName	InStock	InvoicePrice	RetailPrice	Active	Rating
1	{"type":"node","schema":"dbo","table":"Products","id":...	1	Amazon	Kindle Fire 7	1	30.00	49.00	1	4
2	{"type":"node","schema":"dbo","table":"Products","id":...	2	Amazon	Kindle Fire HD 8	1	50.00	79.00	1	5
3	{"type":"node","schema":"dbo","table":"Products","id":...	3	Amazon	Kindle Fire 7 Kids	1	55.00	99.00	1	4
4	{"type":"node","schema":"dbo","table":"Products","id":...	4	Amazon	Kindle PaperWhite	1	87.00	120.00	1	4
5	{"type":"node","schema":"dbo","table":"Products","id":...	5	Amazon	Kindle Fire HD 10	1	99.00	149.00	1	5

EDGE TABLES

Results | Messages

	$edge_id_AD5111F3447F4...	$from_id_6E22AE584BB6428A831ED3BEFCB84CF0	$to_id_22754BBCE410471B99F8EBCFA83D5A97	CreatedDt
1	{"type":"edge","schema":"...	{"type":"node","schema":"dbo","table":"Products","id":0}	{"type":"node","schema":"dbo","table":"Products","id":1}	2020-10-15 10:23:17.603
2	{"type":"edge","schema":"...	{"type":"node","schema":"dbo","table":"Products","id":1}	{"type":"node","schema":"dbo","table":"Products","id":5}	2020-10-15 10:23:17.603
3	{"type":"edge","schema":"...	{"type":"node","schema":"dbo","table":"Products","id":6}	{"type":"node","schema":"dbo","table":"Products","id":7}	2020-10-15 10:23:17.603
4	{"type":"edge","schema":"...	{"type":"node","schema":"dbo","table":"Products","id":6}	{"type":"node","schema":"dbo","table":"Products","id":8}	2020-10-15 10:23:17.603

MATCH(graph_search_pattern)

- Specifies the pattern to search
- Pattern needs to go from one entity to another using a relationship
- Arrow character specifies the direction.
- Parenthesis remarks the relationships

```
SELECT U.Name, W.CreatedDT, P.ProductId, P.Brand, P.ProductName
FROM Products P,  Wished W,  Users U
WHERE MATCH(U-(W)->P) and U.UserId = 1
```

Fire 7 tablet (7" display, 16 GB) - Black

Brand: Amazon

4.5 out of 5 stars 104,134 ratings | 1000+ answered questions

Amazon's Choice for "kindle fire"

Best Deal

Price: $49.99 prime FREE One-Day
or 5 monthly payments of $10.00

In Stock.

FREE delivery: **Tomorrow**
Order within 5 hrs and 7 mins Details

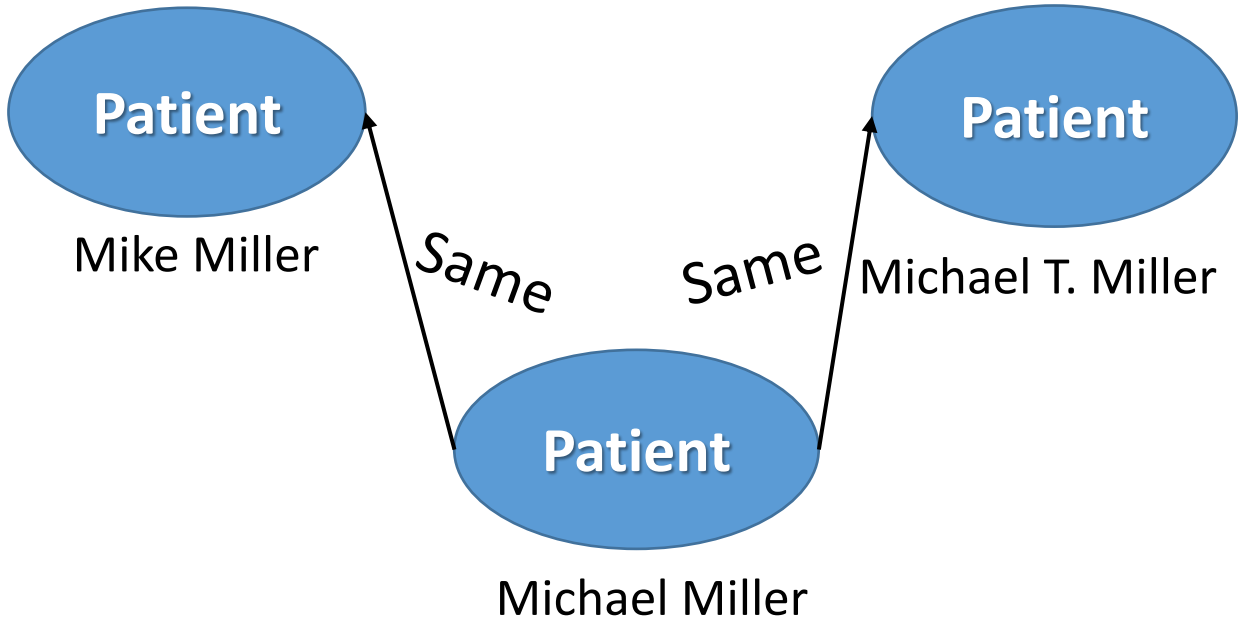
Ships from and sold by Amazon.com Services LLC.

Digital Storage Capacity: **16 GB**

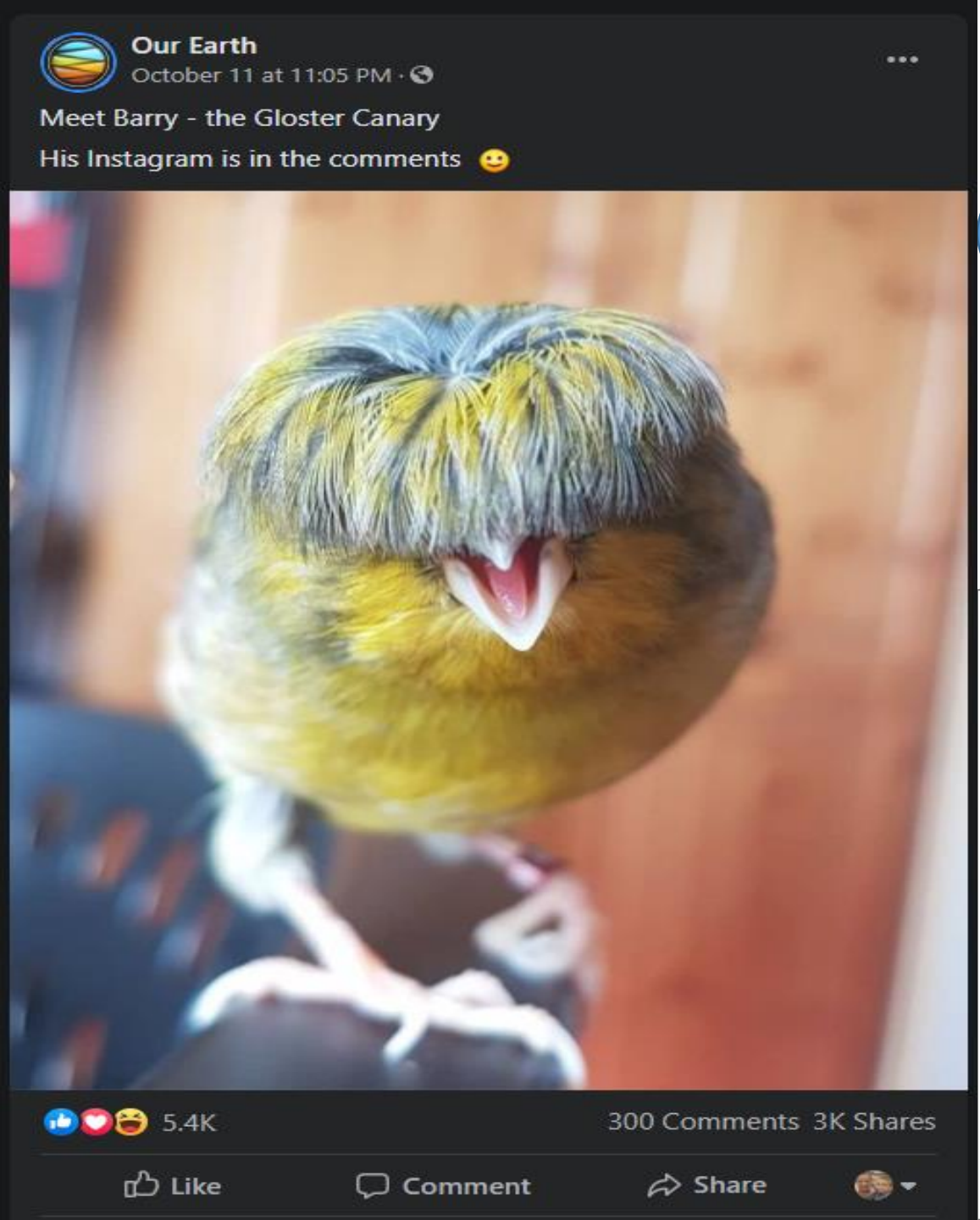
16 GB | 32 GB

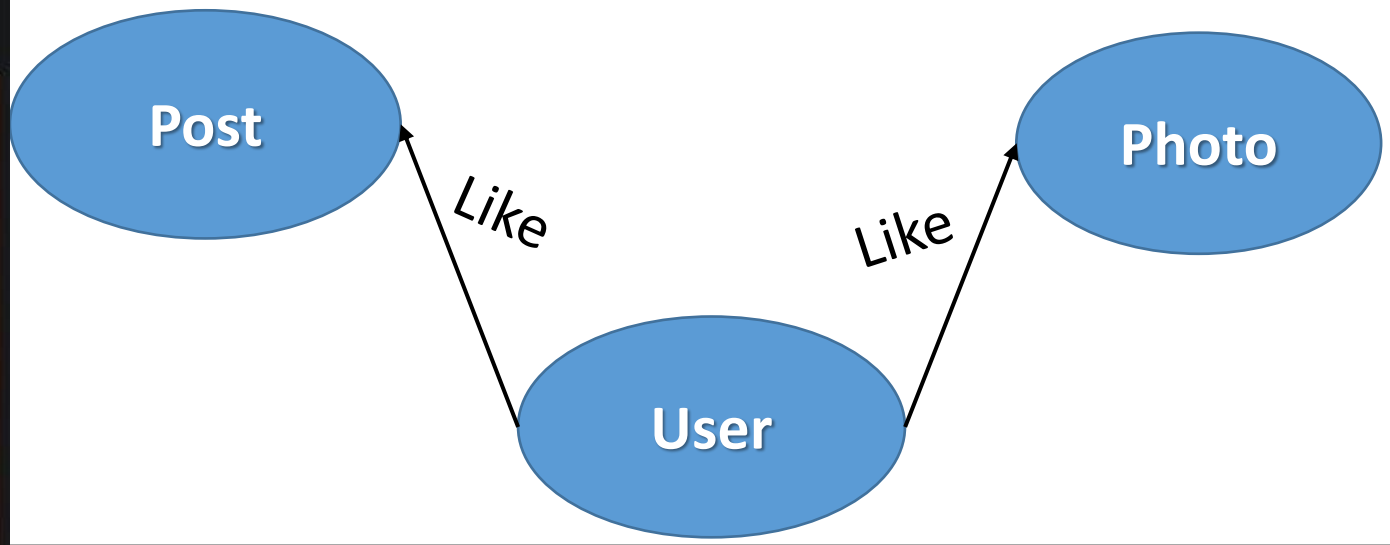
Offer Type: **Ad-Supported**

```
SELECT P.Name, P.Desc, P.Price, P2.Name, P2.Price, P2.Desc
FROM Products P,  Alike A,  Products P2
WHERE MATCH(P-(A)->P2) AND P.Id = 1
```



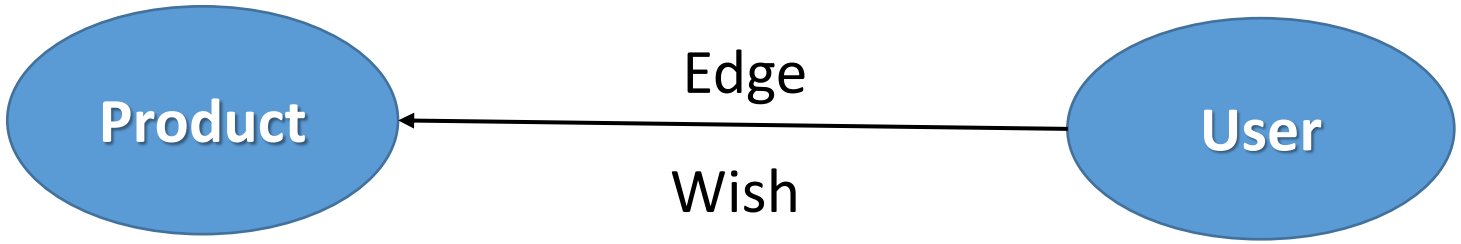

```
SELECT P1.Name, P1.MRN, P2.Name,
P2.MRN
FROM Patient P1, Same S,
Patient P2
WHERE MATCH(P1-(S)->P2)
and P1.Id= 1
```






```
SELECT U.Name, L.OccuredDt, P.Id,
P.Text
FROM Users U,  Like L,  Posts P
WHERE MATCH(U-(L)->P) AND P.Id = 1
```

EDGE CONSTRAINTS



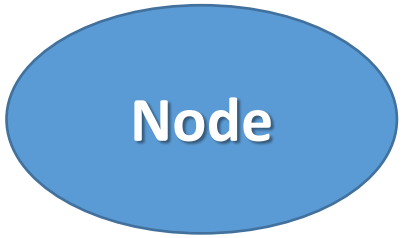

```
ALTER TABLE Wished ADD CONSTRAINT EC_Wish
CONNECTION (Users TO Products)
```

```
ALTER TABLE Wished ADD CONSTRAINT EC_Wish
CONNECTION (Users TO Products, Guests TO Products)
```

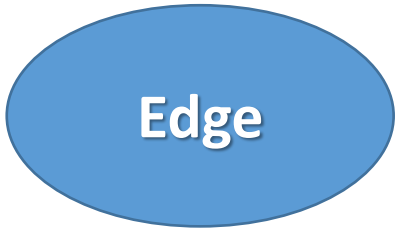
```
ALTER TABLE Wished ADD CONSTRAINT EC_Wish
CONNECTION (Users TO Products) ON DELETE CASCADE
```

```
ALTER TABLE Wished ADD CONSTRAINT EC_Wish
CONNECTION (Users TO Products) ON DELETE NO ACTION
```

INDEXING GRAPH DATABASE



$node_id

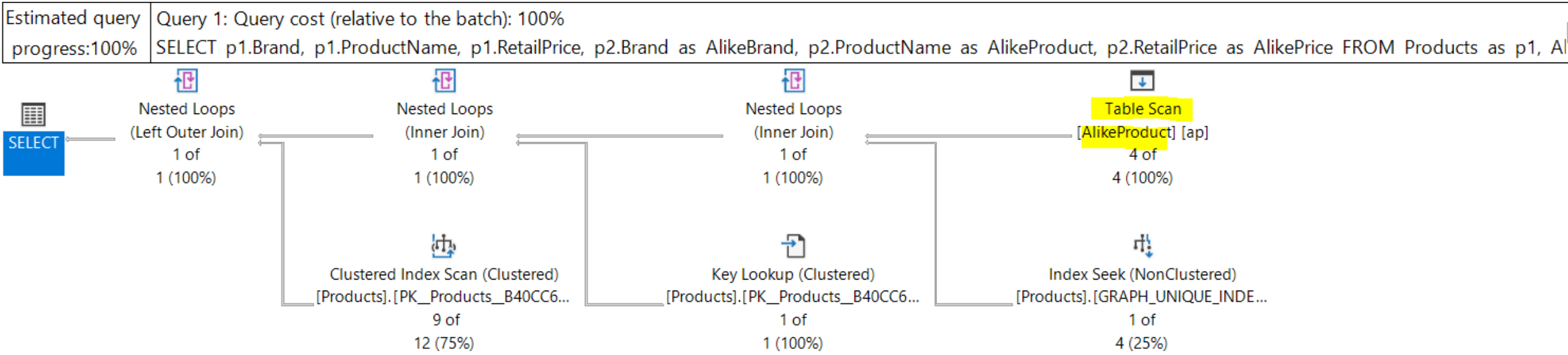


$edge_id
$from_id
$to_id

```
SELECT p1.Brand, p1.ProductName, p1.RetailPrice, p2.Brand as
AlikeBrand, p2.ProductName as AlikeProduct, p2.RetailPrice as
AlikePrice
FROM Products as p1, AlikeProduct as ap, Products p2
WHERE MATCH(p1-(ap)->p2)
AND p1.ProductId = 1
```

INDEXING GRAPH DATABASE

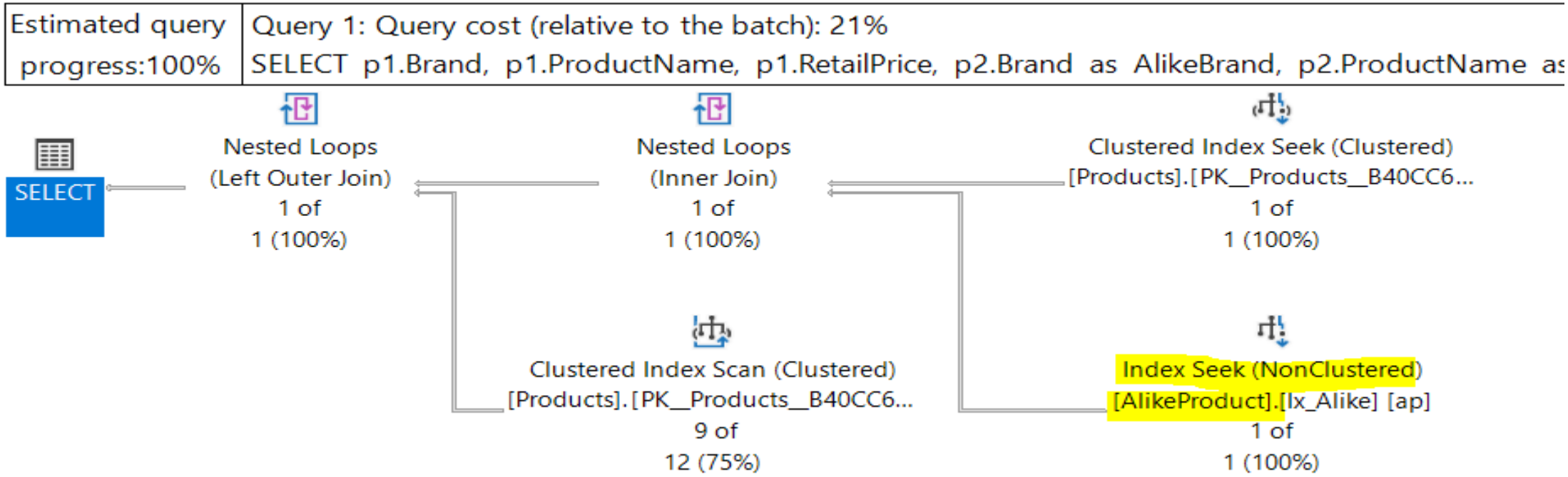
```
SELECT p1.Brand, p1.ProductName, p1.RetailPrice, p2.Brand as
AlikeBrand, p2.ProductName as AlikeProduct, p2.RetailPrice as
AlikePrice
FROM Products as p1, AlikeProduct as ap, Products p2
WHERE MATCH(p1-(ap)->p2)
AND p1.ProductId = 1
```



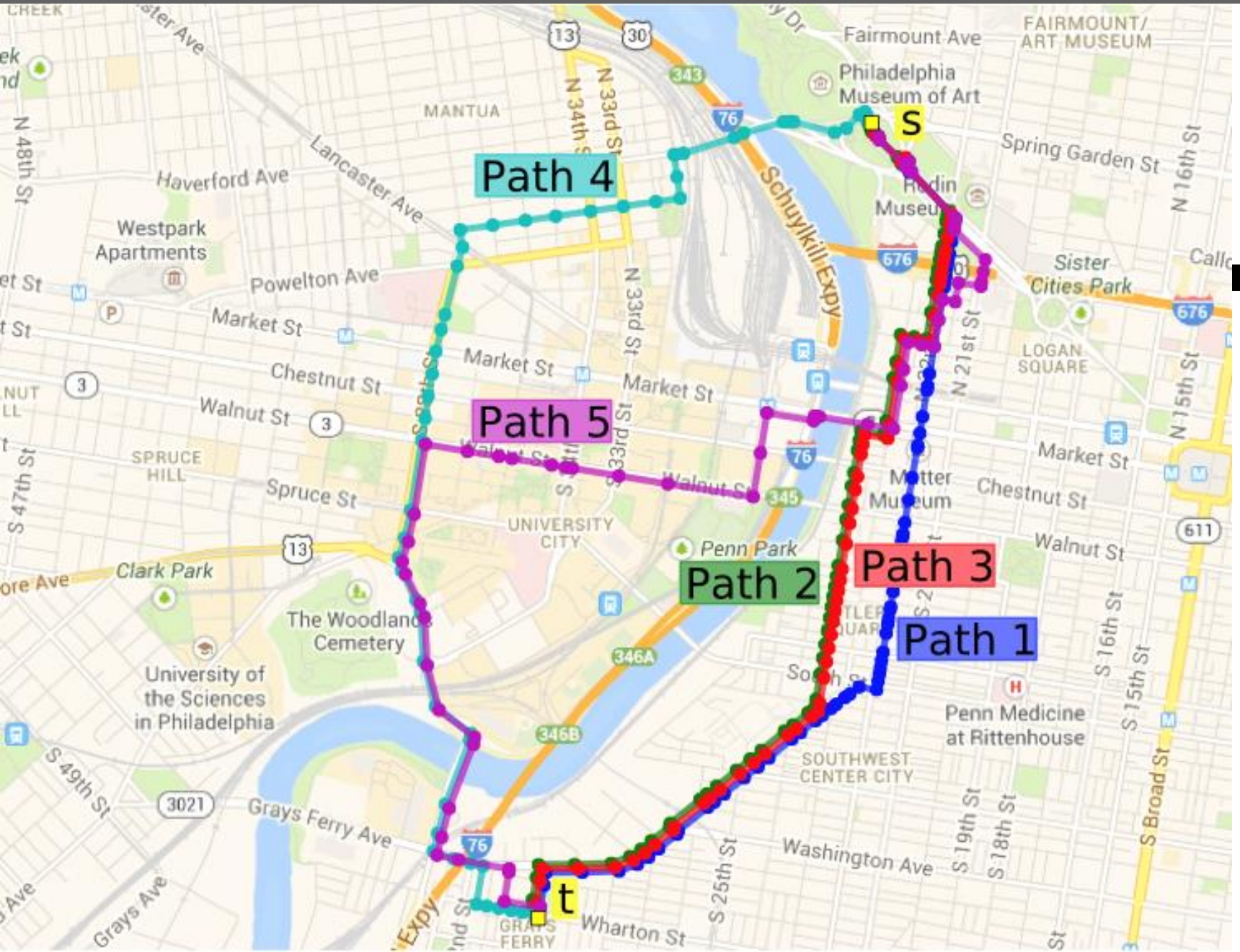
INDEXING GRAPH DATABASE

```
CREATE UNIQUE NONCLUSTERED INDEX Ix_Alike on AlikeProduct($From_Id, $To_Id)
CREATE UNIQUE NONCLUSTERED INDEX Ix_Wished on Wished ($From_id, $To_id)
```

```
SELECT p1.Brand, p1.ProductName, p1.RetailPrice, p2.Brand as AlikeBrand,
p2.ProductName as AlikeProduct, p2.RetailPrice as AlikePrice
FROM Products as p1, AlikeProduct as ap, Products p2
WHERE MATCH(p1-(ap)->p2)
AND p1.ProductId = 1
```



QUERYING GRAPH DATABASE TABLES <SHORTEST PATH>



- Finds shortest path between two entities.
- Use in MATCH Clause.

SELECT {**Graph Path Agg Functions**}
FROM {**FOR PATH**}
WHERE MATCH(){**Arbitrary Length**}

QUERYING GRAPH DATABASE TABLES <SHORTEST PATH>

SELECT GRAPH PATH AGG FUNCTION WITHIN ORDER CLAUSE

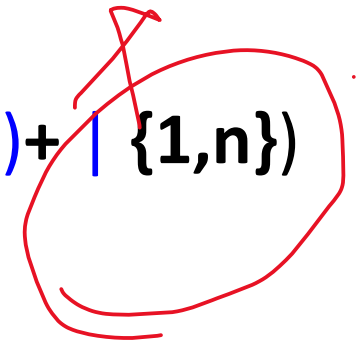
STRING_AGG()
LAST_VALUE()
SUM()
COUNT()
AVG()
MIN()
MAX()

GROUP (GRAPH PATH)

+ : Repeat 1 or more times
{1,n}: Repeat the pattern 1 to n times

FROM Node Or Edge Tables FOR PATH

WHERE MATCH(SHORTEST_PATH(graph search pattern)**+** | **{1,n}**)




DEBUG

Thank you!

You can reach me on the following platforms.

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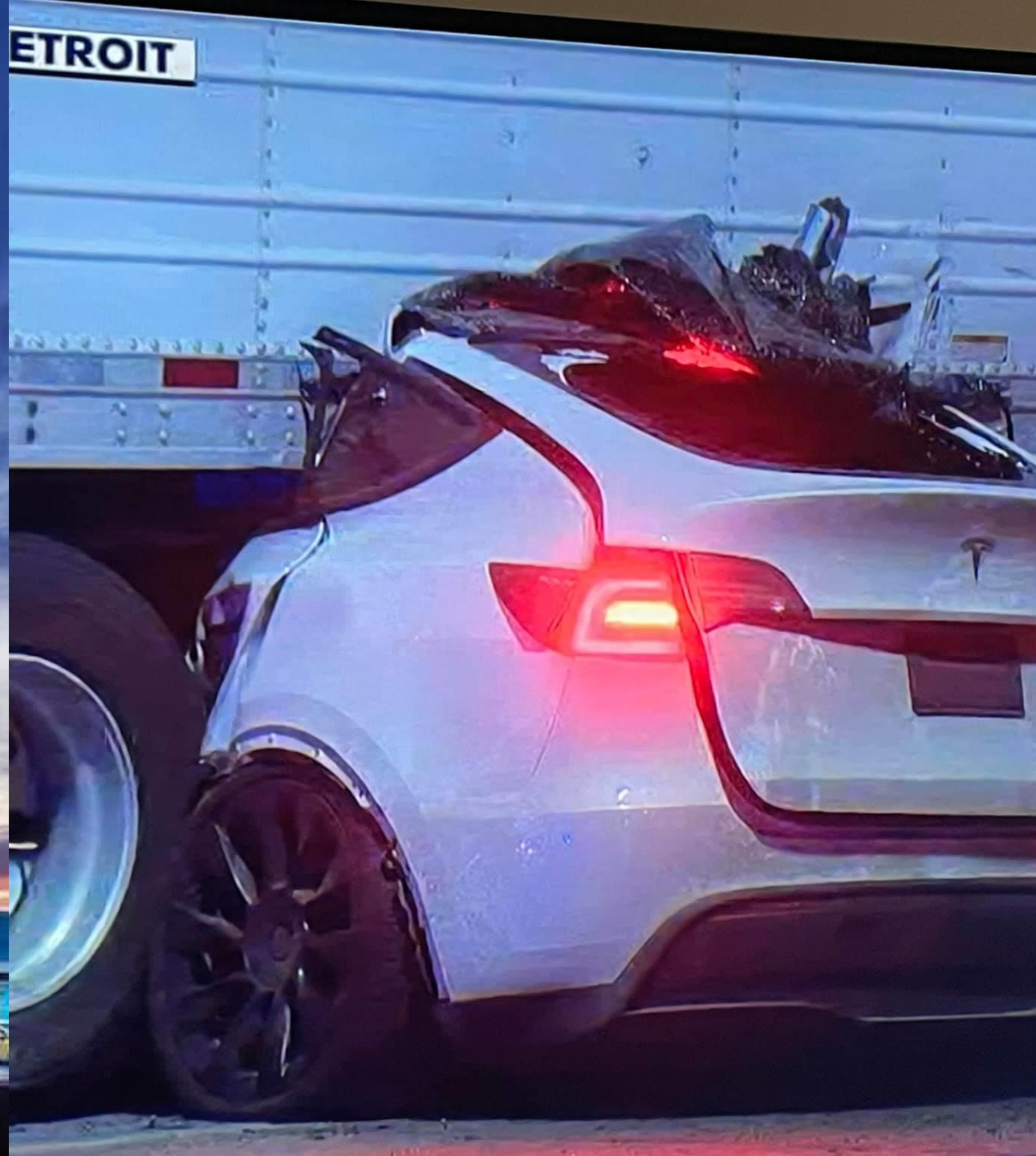
FIVE NITES
2 for $1
FIVE NITES


CARVANA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