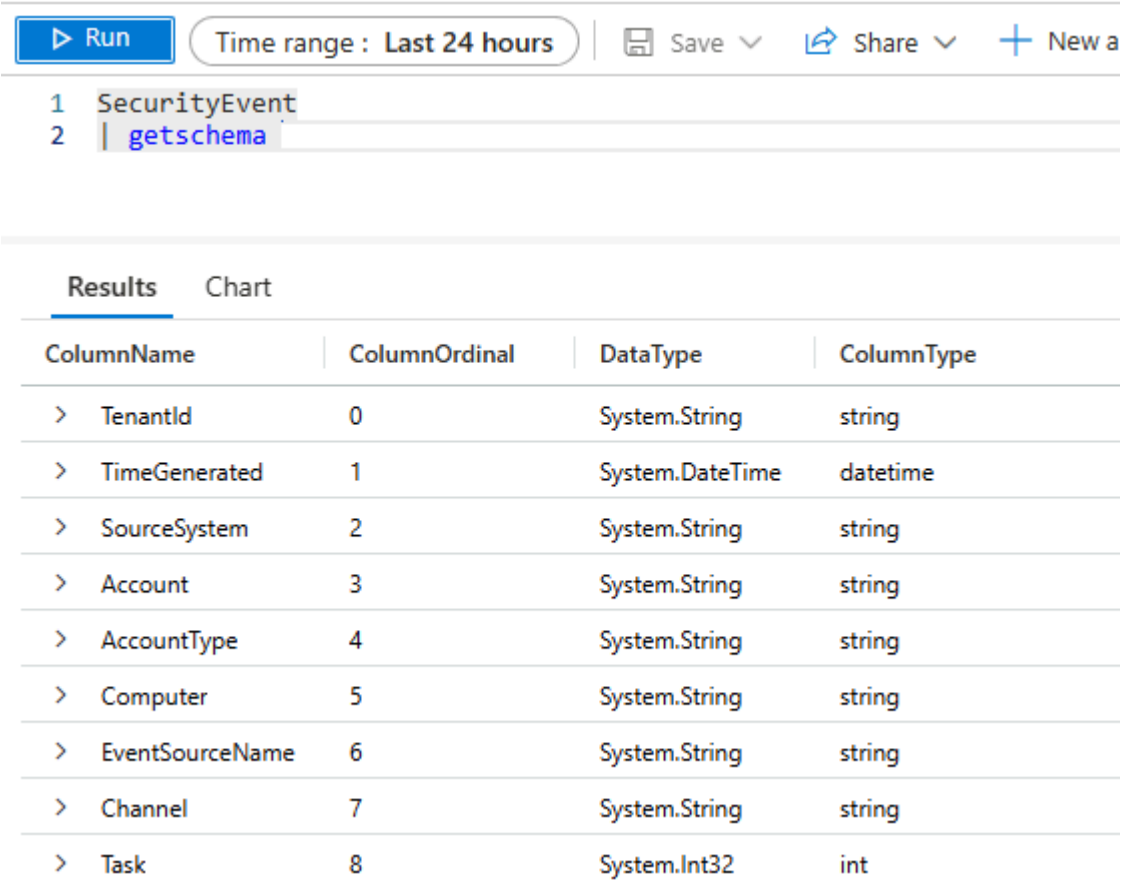
KQL Intermediate Training

Data Types	Summarize	Arg / Min	Rounding	union
Variables (let)	Bin / Floor	Arg / max	Null/Empty values	join
Rendering Graphs and Charts				

Data Types:

getschema operator : Produce a table that represents a tabular schema of the input. You can list the data type of each column of the table.



ColumnName	ColumnOrdinal	DataType	ColumnType
TenantId	0	System.String	string
TimeGenerated	1	System.DateTime	datetime
SourceSystem	2	System.String	string
Account	3	System.String	string
AccountType	4	System.String	string
Computer	5	System.String	string
EventSourceName	6	System.String	string
Channel	7	System.String	string
Task	8	System.Int32	int

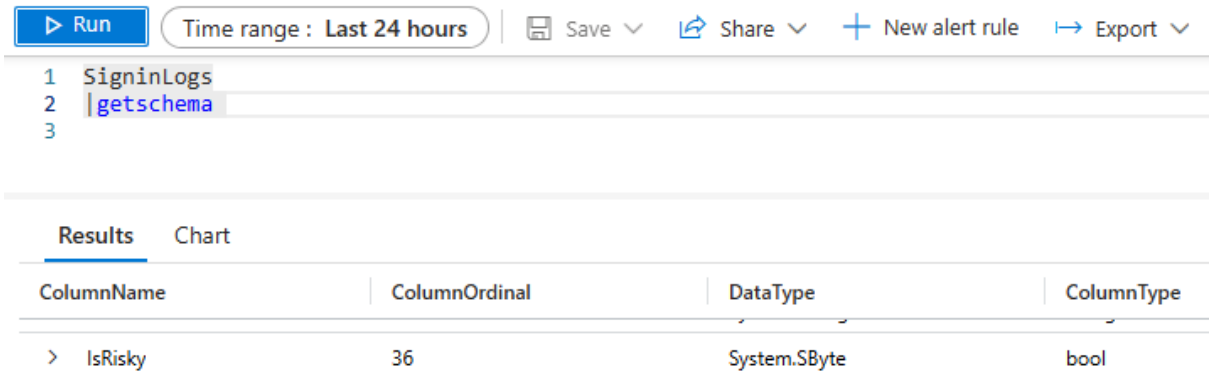
KQL Data Types

Bool	Dynamic	Int	Real	Timespan
Datetime	Guid	Long	String	Decimal

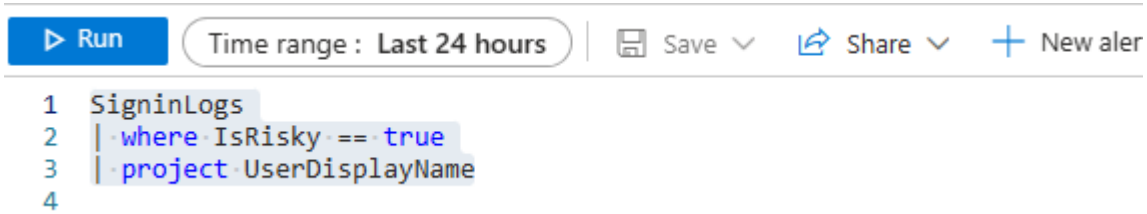
The bool data type

- The `bool` data type can be: `true` (`1`), `false` (`0`), or null.
- The `bool` and `boolean` data types are equivalent.
- The `bool` data type supports all of the logical operators: equality (`==`), inequality (`!=`), logical-and (`and`), and logical-or (`or`).

IsRisky - bool



List the user who performed risky logins



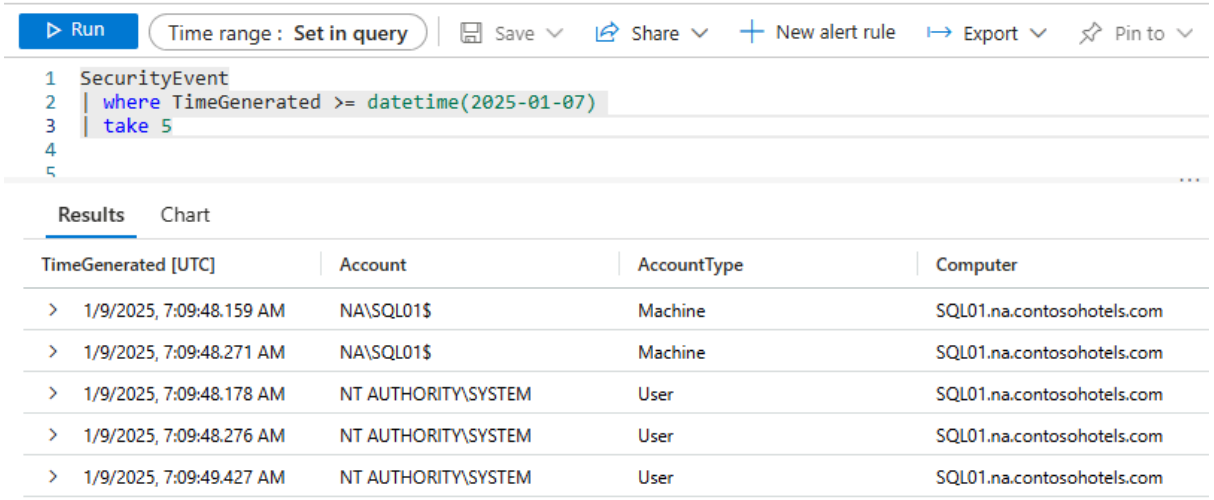
The datetime data type

The `datetime` data type represents an instant in time, typically expressed as a date and time of day. Values range from 00:00:00 (midnight), January 1, 0001 Anno Domini (Common Era) through 11:59:59 P.M., December 31, 9999 A.D. (C.E.) in the Gregorian calendar.

Time values are measured in 100-nanosecond units called ticks, and a particular date is the number of ticks since 12:00 midnight, January 1, 0001 A.D. (C.E.) in the GregorianCalendar calendar (excluding ticks that would be added by leap seconds). For example, a ticks value of 31241376000000000 represents the date, Friday, January 01, 0100 12:00:00 midnight. This is sometimes called "a moment in linear time".

The `datetime` and `date` data types are equivalent.

Note: A `datetime` value in Kusto is always in the UTC time zone. If displaying `datetime` values in other time zones is required, use datetime_utc_to_local() or datetime_local_to_utc().



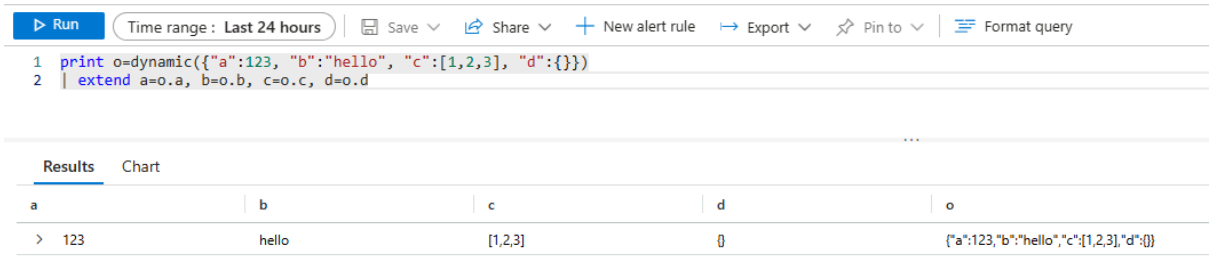
The decimal data type

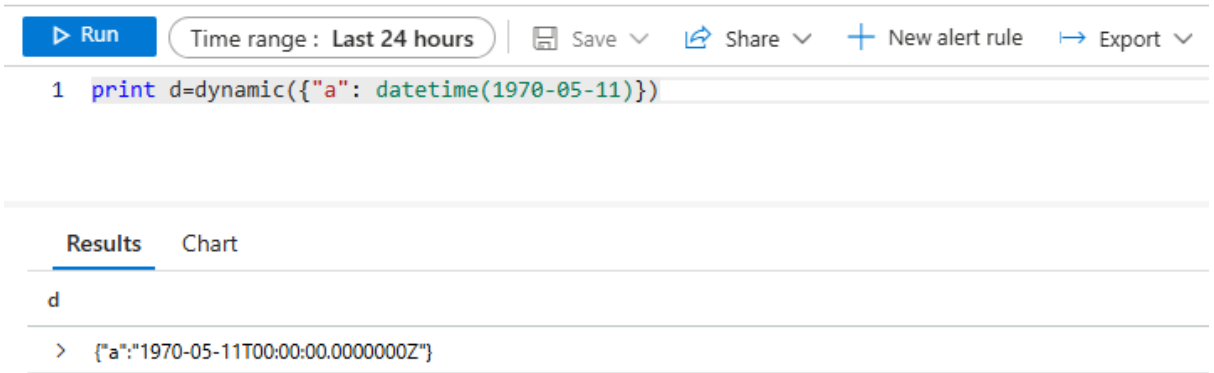
The `decimal` data type represents a 128-bit wide, decimal number.

Caution: Arithmetic operations involving `decimal` values are significantly slower than operations on real data type. If your use case doesn't require very high precision, we recommend using `real`.

The dynamic data type

https://learn.microsoft.com/en-us/kusto/query/scalar-data-types/dynamic?view=microsoft-fabric





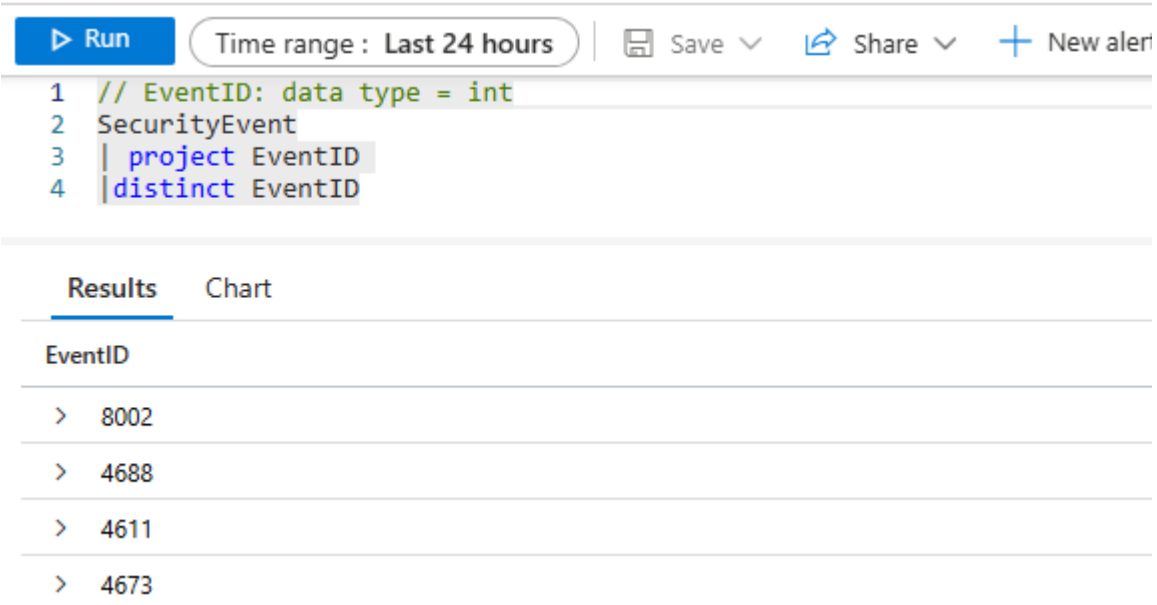
The guid data type

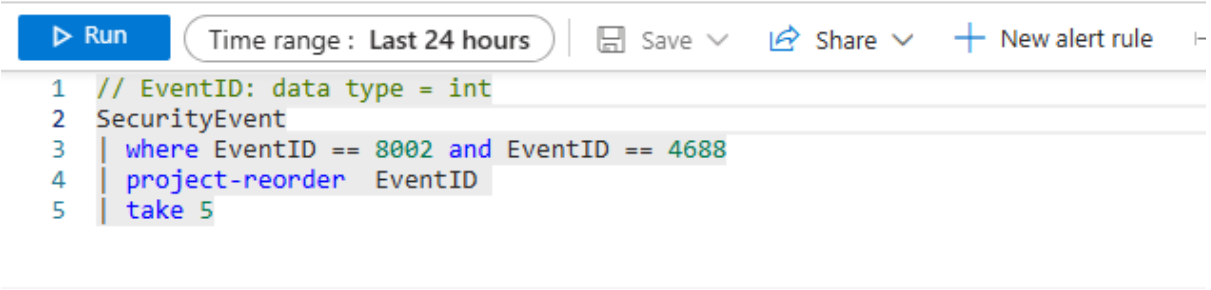
The `guid` data type represents a 128-bit globally unique value. The `guid`, `uuid`, and `uniqueid` data types are equivalent.

guid : 68fg45er-2l5t-67h9-h875-fr0h443g4543

The int data type

The `int` data type represents a signed, 32-bit wide, integer.





The long data type

The `long` data type represents a signed, 64-bit wide, integer. By default, integers and integers represented with hexadecimal syntax are of type `long`.

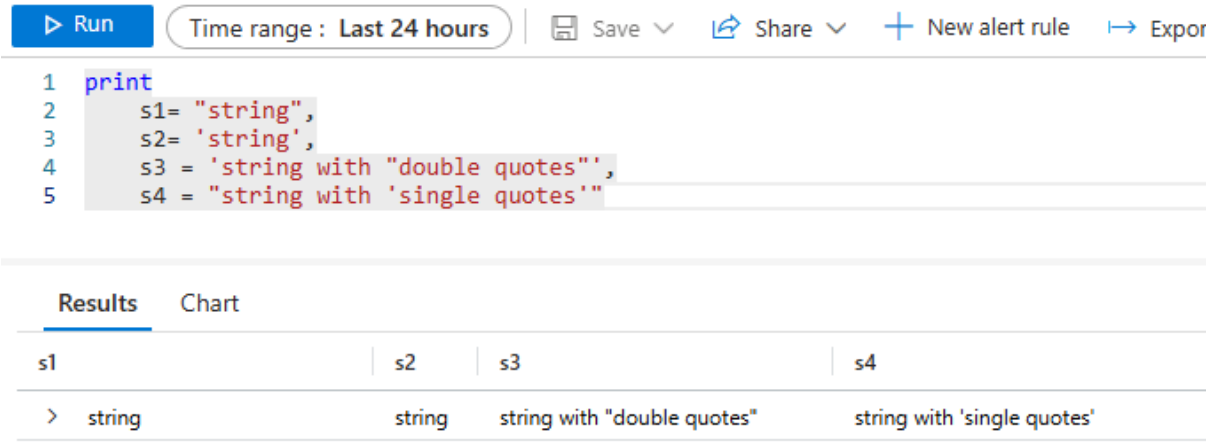
The real data type

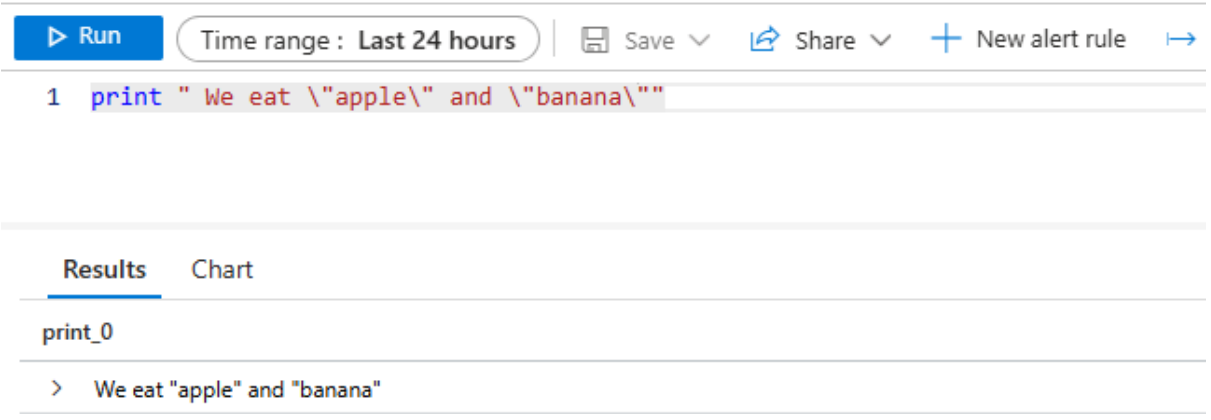
The `real` data type represents a 64-bit wide, double-precision, floating-point number. By default, decimal numbers and numbers represented with scientific notation are of type `real`.

The string data type

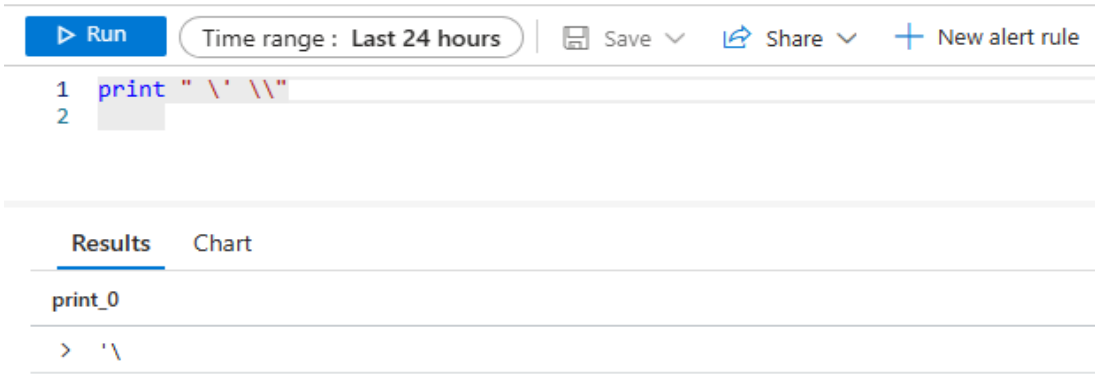
The `string` data type represents a sequence of zero or more Unicode characters.

String literal with quotes

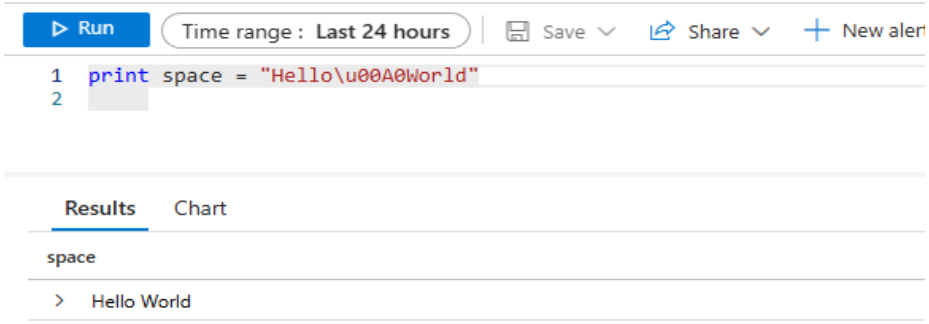




String literal with backslash escaping



String literal with Unicode



Verbatim string literal

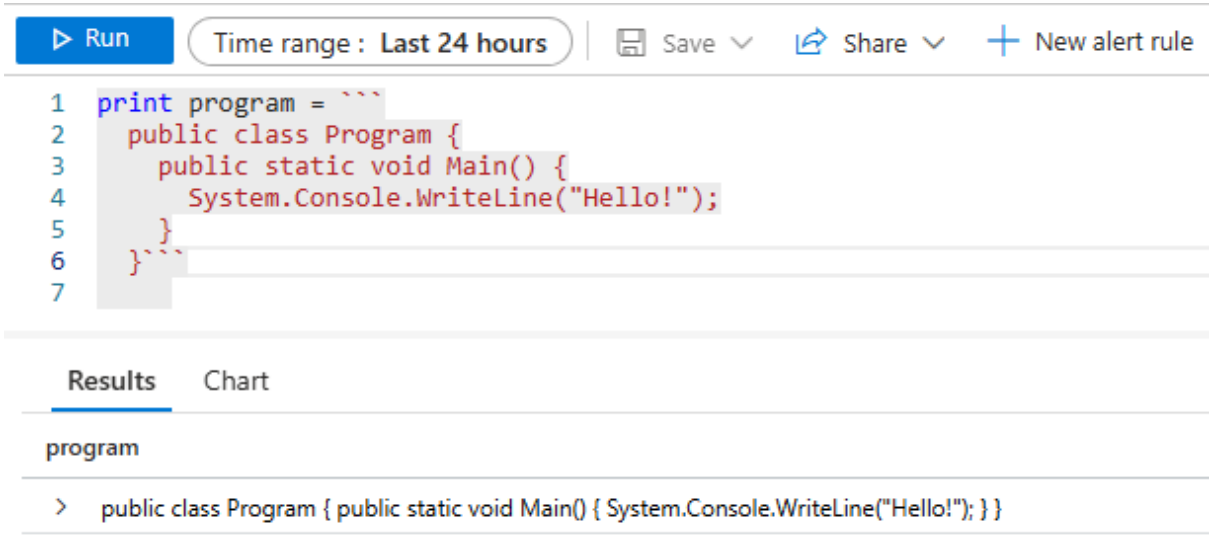
The following example creates a path in which the backslashes are part of the path instead of escape characters. To do this, the string `@` sign is prepended to the string, creating a verbatim string literal.

```
print myPath = @'C:\Folder\filename.txt'
```

myPath
C:\Folder\filename.txt

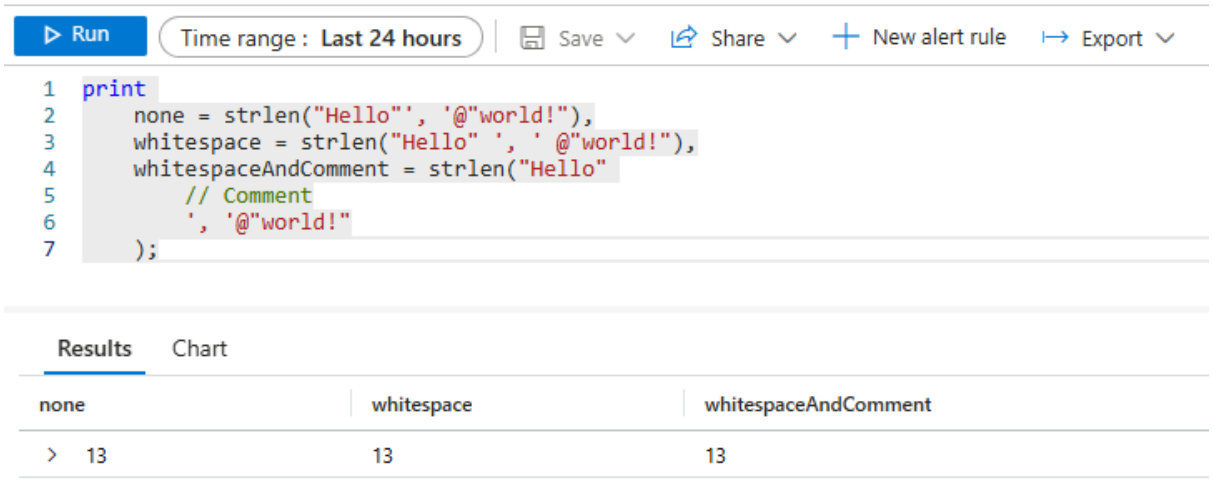
Multi-line string literal

The following example shows the syntax for a multi-line string literal, which uses newlines and tabs to style a code block. For more information, see Multi-line string literals.



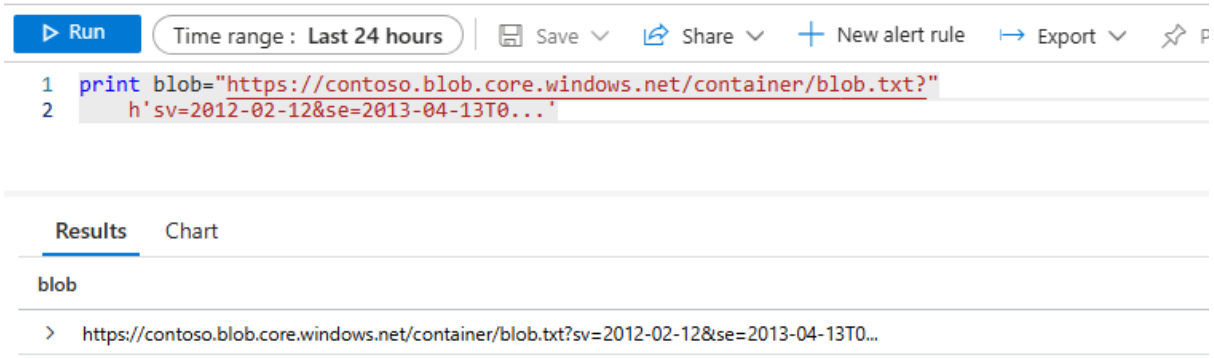
Concatenated string literals

The following expressions all yield a string of length 13. For more information, see Concatenation of separated string literals.



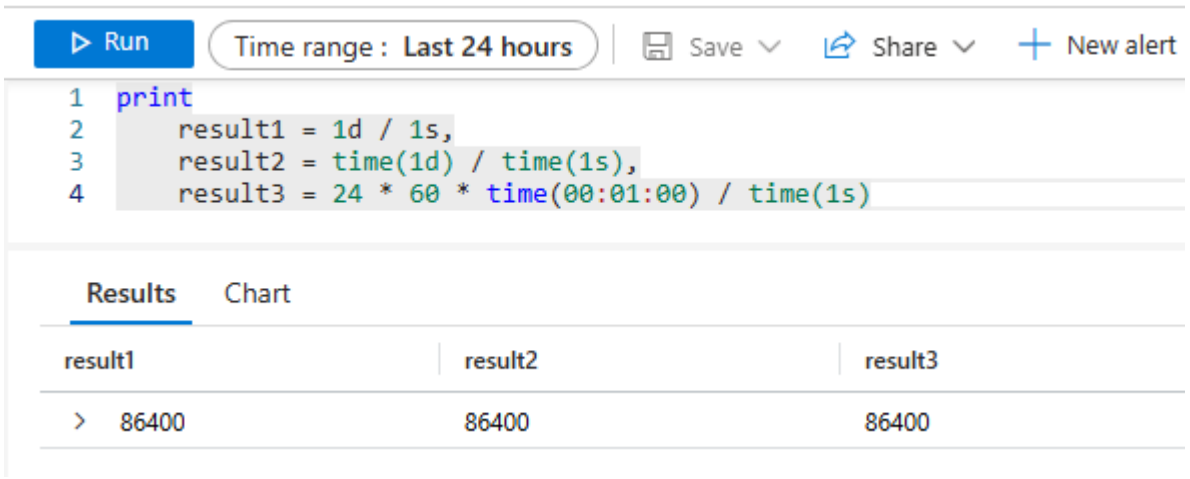
Obfuscated string literal

In the following query output, the `h` string is visible in your results. However, in tracing or telemetry, the `h` string is stored in an obfuscated form and substituted with asterisks in the log. For more information, see Obfuscated string literals.



The timespan data type

The `timespan` data type represents a time interval. The `timespan` and `time` data types are equivalent.



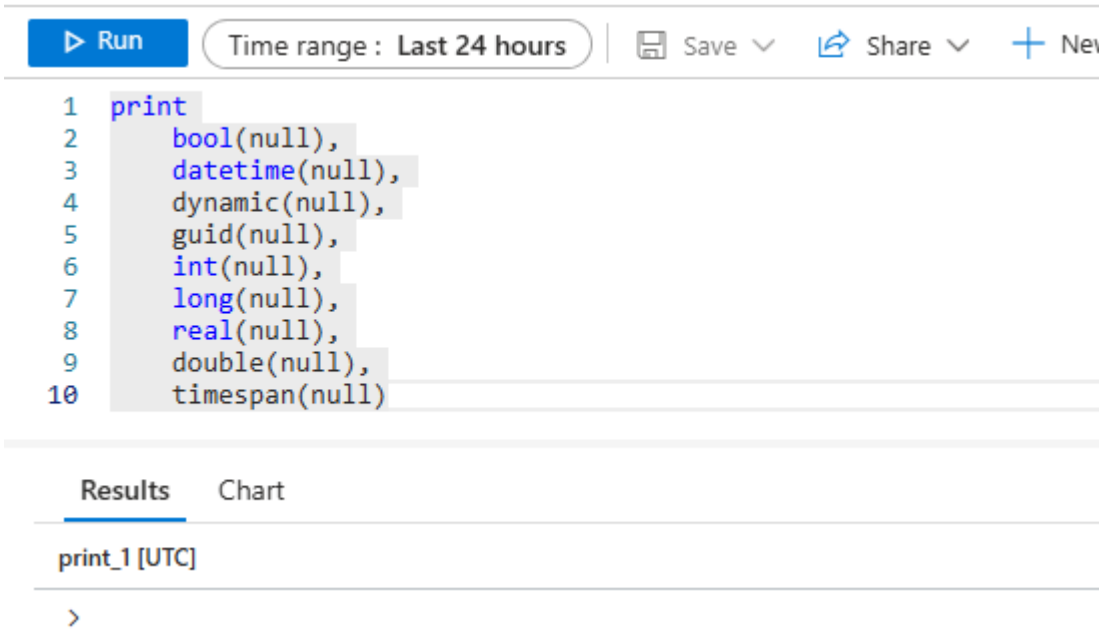
Null values

All scalar data types in Kusto have a special value that represents a missing value. This value is called the *null value*, or *null*.

Note: The `string` data type doesn't support null values.

String = empty
Others = null

Null literals



Predicates on null values

The scalar function isnull() can be used to determine if a scalar value is the null value. The corresponding function isnotnull() can be used to determine if a scalar value isn't the null value.

Note: Because the `string` type doesn't support null values, we recommend using the isempty() and the isnotempty() functions.

Equality and inequality of null values

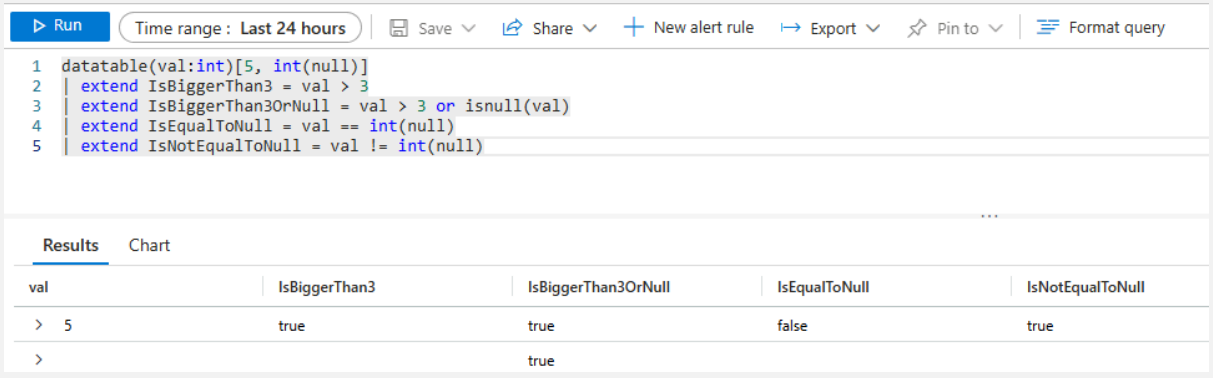
Equality (==): Applying the equality operator to two null values yields `bool(null)`. Applying the equality operator to a null value and a non-null value yields `bool(false)`.

Inequality (!=): Applying the inequality operator to two null values yields `bool(null)`. Applying the inequality operator to a null value and a non-null value yields `bool(true)`.

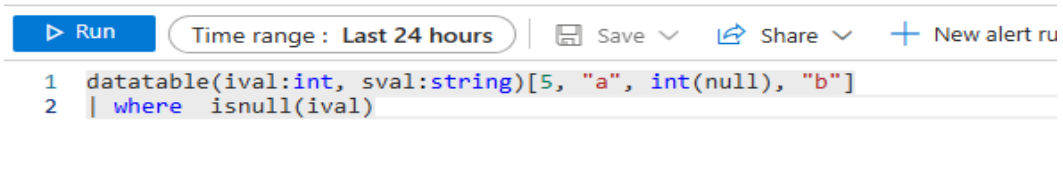
For example:

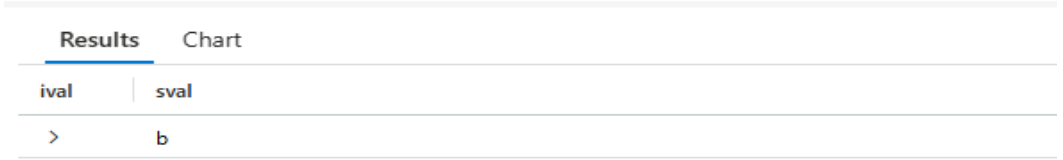
```
datatable(val:int)[5, int(null)]
| extend IsBiggerThan3 = val > 3
| extend IsBiggerThan3OrNull = val > 3 or isnull(val)
| extend IsEqualToNull = val == int(null)
| extend IsNotEqualToNull = val != int(null)
```

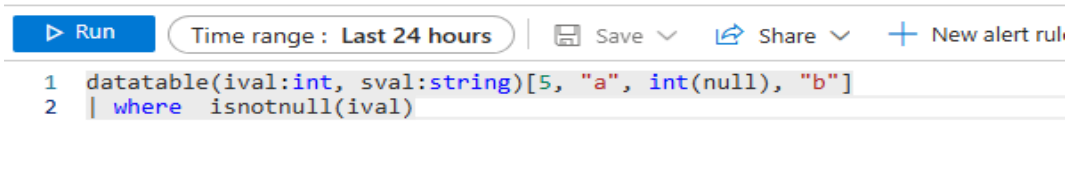
val	IsBiggerThan3	IsBiggerThan3OrNull	IsEqualToNull	IsNotEqualToNull
5	true	true	false	true
null	null	true	null	null

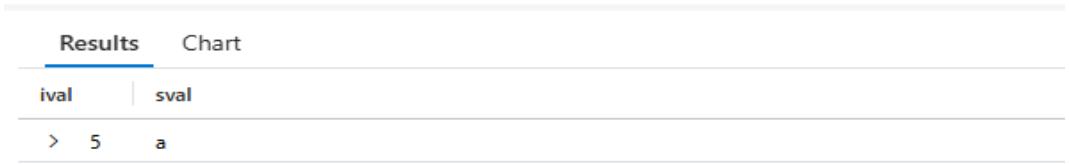


Null values and the where operator









Null values and binary operators

Exceptions to this rule

- For the equality (==) and inequality (`!=`) operators, if one of the values is null and the other value isn't null, then the result is either `bool(false)` or `bool(true)`, respectively.
- For the logical AND (&&) operator, if one of the values is `bool(false)`, the result is also `bool(false)`.
- For the logical OR (`||`) operator, if one of the values is `bool(true)`, the result is also `bool(true)`.

For example:

```
datatable(val:int)[5, int(null)]
| extend Add = val + 10
| extend Multiply = val * 10
```

val	Add	Multiply
5	15	50
null	null	null

Null values and the logical NOT (!) operator

The logical NOT operator not() yields the value `bool(null)` if the argument is the null value.

Null values and the in operator

- The in operator behaves like a logical OR of equality comparisons.
- The `!in` operator behaves like a logical `AND` of inequality comparisons.

Null values and data ingestion

For most data types, a missing value in the data source produces a null value in the corresponding table cell. However, columns of type `string` and CSV (or CSV-like) data formats are an exception to this rule, and a missing value produces an empty string.

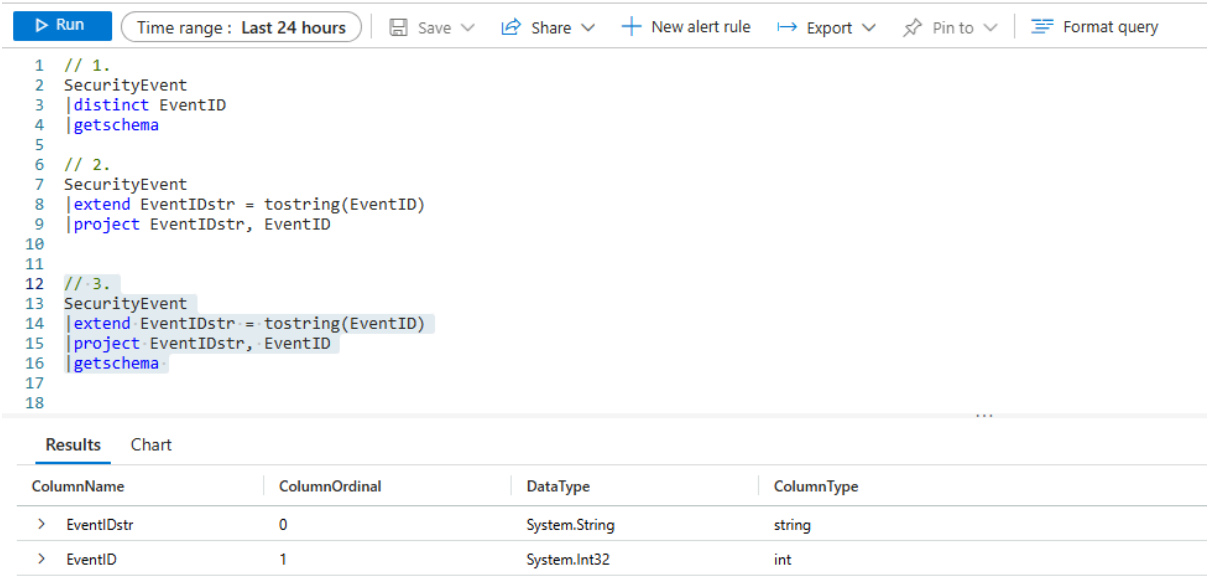
Kusto

```
.create table T(a:string, b:int)

.ingest inline into table T
[,]
[ , ]
[a,1]

T
| project a, b, isnull_a=isnull(a), isempty_a=isempty(a), stlen_a=strlen(a), isnull_b=isnull(b)
```

a	b	isnull_a	isempty_a	strlen_a	isnull_b
		false	true	0	true
		false	false	1	true
a	1	false	false	1	false

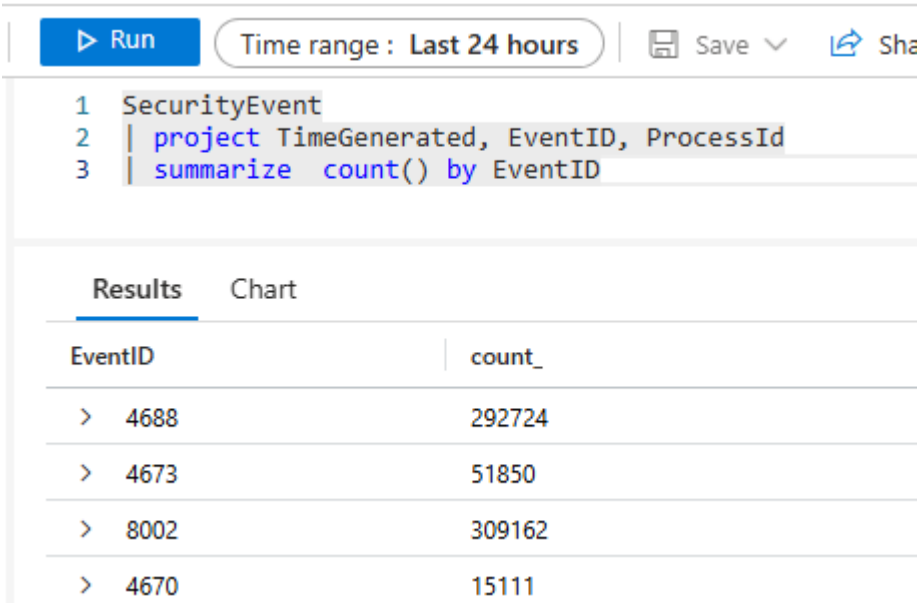
Exercise: LA Demo Environment , SecurityEvent

1- Identify datatype of EventID field
2- Cast EventID field to String
3- Verify the change by checking the schema.

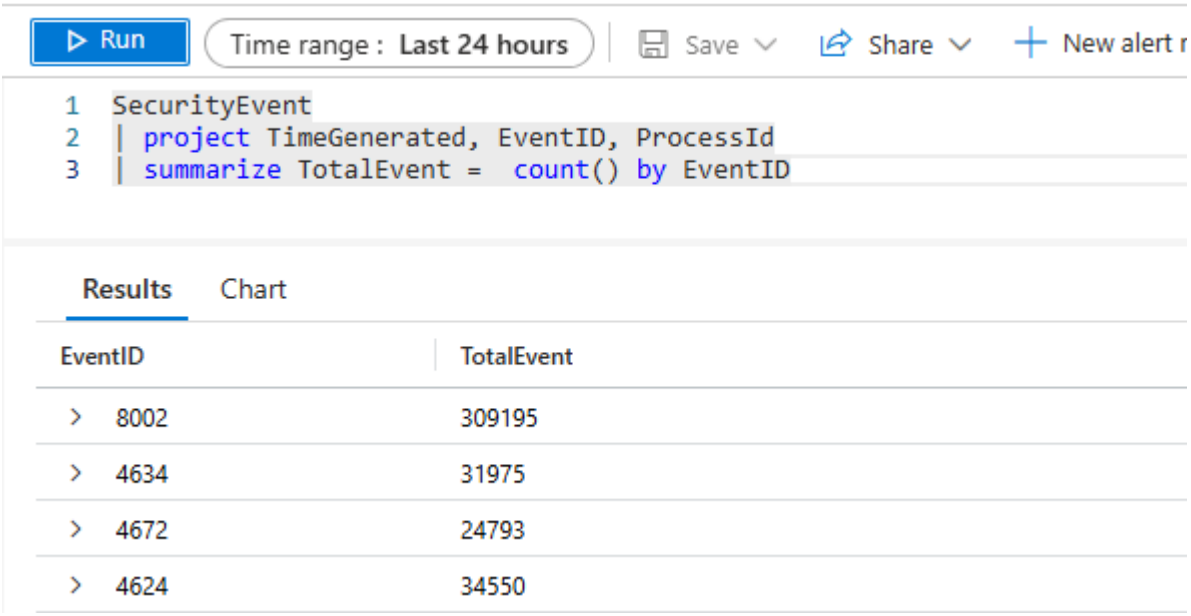


summarize(): Produces a table that aggregates the content of the input table.

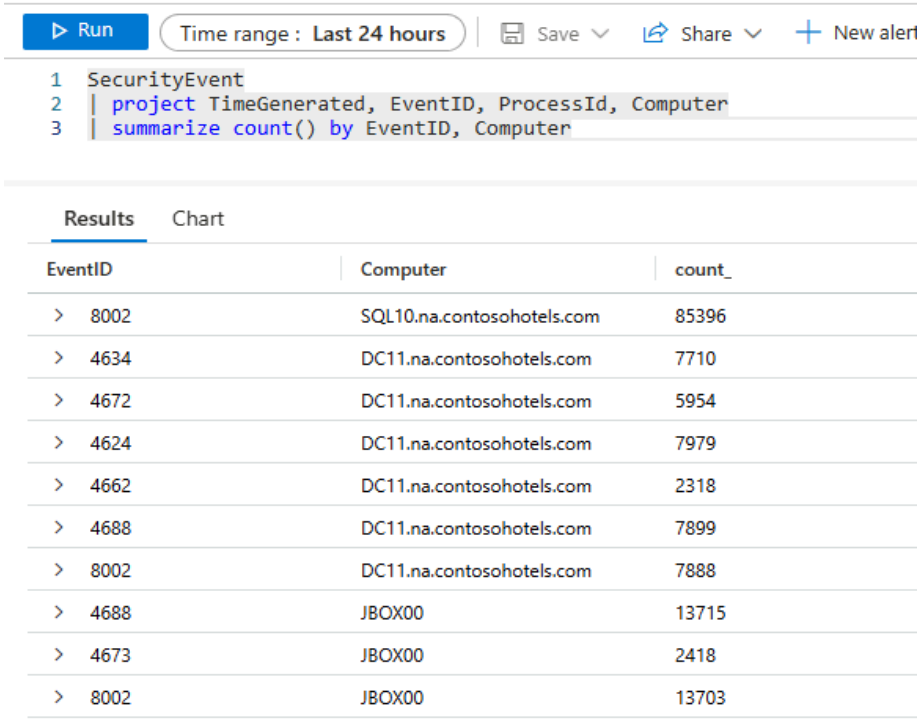
summarize by counting SecurityEvents by EventID



You can give a name to count result

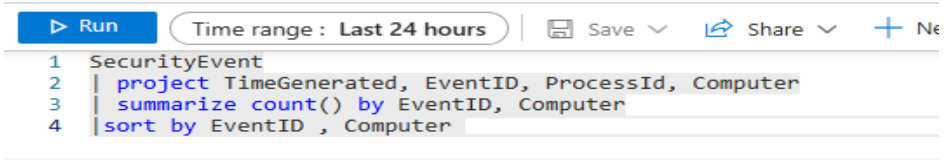


summarize by counting SecurityEvents by EventID and Computer



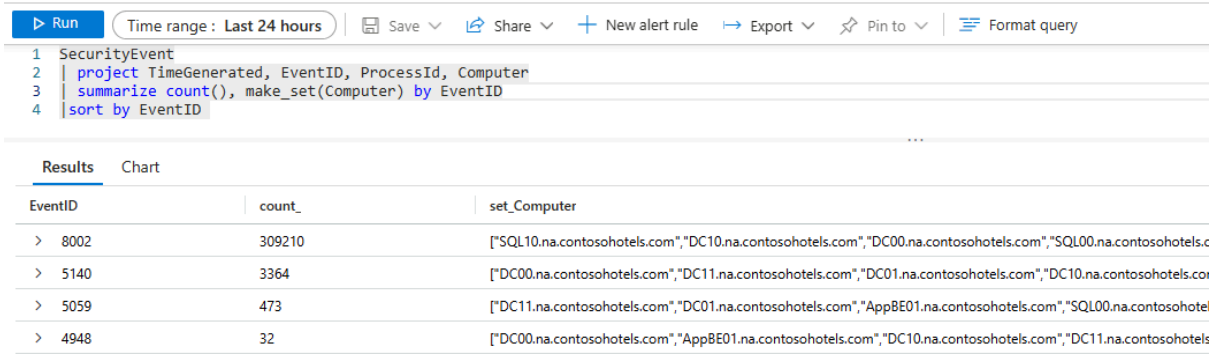
EventID	Computer	count_
8002	SQL10.na.contosohotels.com	85396
4634	DC11.na.contosohotels.com	7710
4672	DC11.na.contosohotels.com	5954
4624	DC11.na.contosohotels.com	7979
4662	DC11.na.contosohotels.com	2318
4688	DC11.na.contosohotels.com	7899
8002	DC11.na.contosohotels.com	7888
4688	JBOX00	13715
4673	JBOX00	2418
8002	JBOX00	13703

Add sort by to query



EventID	Computer	count_
8002	SQL10.na.contosohotels.com	85381
8002	SQL01.na.contosohotels.com	77587
8002	SQL00.na.contosohotels.com	77014
8002	JBOX10	12425
8002	JBOX00	13694
8002	DC11.na.contosohotels.com	7861
8002	DC10.na.contosohotels.com	7763
8002	DC01.na.contosohotels.com	9975
8002	DC00.na.contosohotels.com	9099
8002	AppBE01.na.contosohotels.com	8344
5140	DC11.na.contosohotels.com	729
5140	DC10.na.contosohotels.com	1076
5140	DC01.na.contosohotels.com	758
5140	DC00.na.contosohotels.com	804

How can we combine computers into one set? (Computer, make_set(Computer))

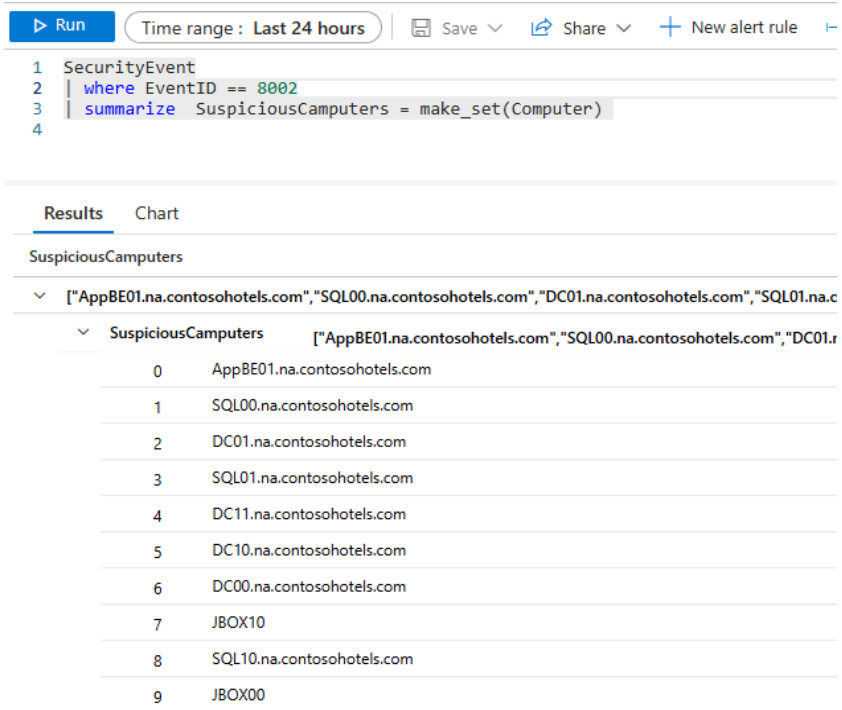


```
SecurityEvent
| project TimeGenerated, EventID, ProcessId, Computer
| summarize count(), make_set(Computer) by EventID
|sort by EventID
```

Results | Chart

EventID	count_	set_Computer
8002	309210	["SQL10.na.contosohotels.com","DC10.na.contosohotels.com","DC00.na.contosohotels.com","SQL00.na.contosohotels.c
5140	3364	["DC00.na.contosohotels.com","DC11.na.contosohotels.com","DC01.na.contosohotels.com","DC10.na.contosohotels.co
5059	473	["DC11.na.contosohotels.com","DC01.na.contosohotels.com","AppBE01.na.contosohotels.com","SQL00.na.contosohotel
4948	32	["DC00.na.contosohotels.com","AppBE01.na.contosohotels.com","DC10.na.contosohotels.com","DC11.na.contosohotels

Let's assume that Event ID 8002 indicates malicious activity. How can you find all the Computers where this malicious activity is happening**?**

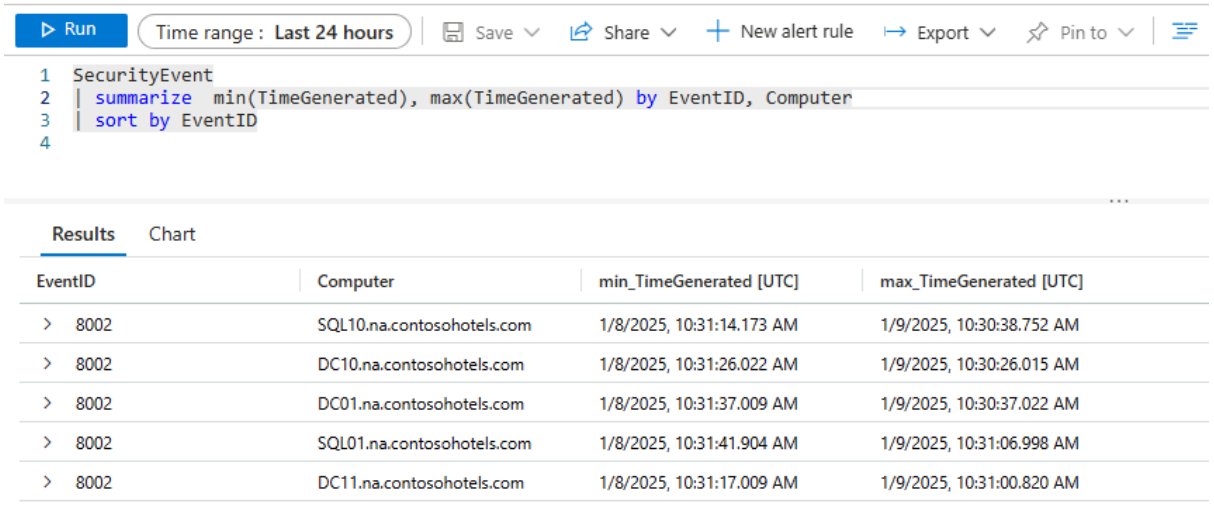


```
SecurityEvent
| where EventID == 8002
| summarize  SuspiciousCamputers = make_set(Computer)

```

Results | Chart

SuspiciousCamputers	
["AppBE01.na.contosohotels.com","SQL00.na.contosohotels.com","DC01.na.contosohotels.com","SQL01.na.c	
SuspiciousCamputers	["AppBE01.na.contosohotels.com","SQL00.na.contosohotels.com","DC01.r
0	AppBE01.na.contosohotels.com
1	SQL00.na.contosohotels.com
2	DC01.na.contosohotels.com
3	SQL01.na.contosohotels.com
4	DC11.na.contosohotels.com
5	DC10.na.contosohotels.com
6	DC00.na.contosohotels.com
7	JBOX10
8	SQL10.na.contosohotels.com
9	JBOX00

min() and max()

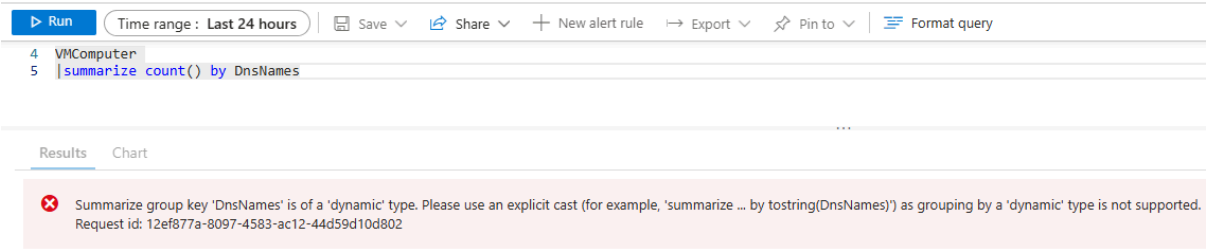


```
SecurityEvent
| summarize  min(TimeGenerated), max(TimeGenerated) by EventID, Computer
| sort by EventID

```

Results | Chart

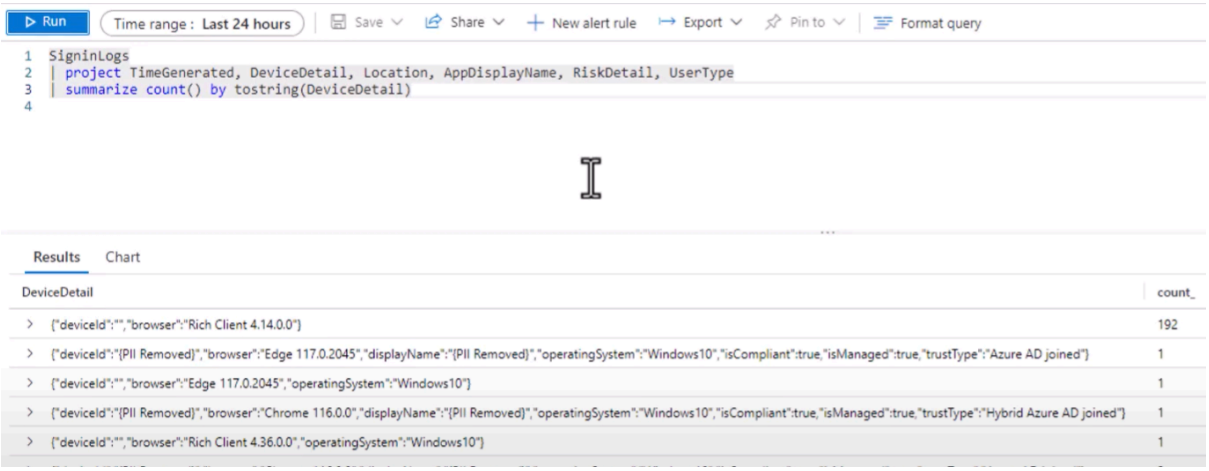
EventID	Computer	min_TimeGenerated [UTC]	max_TimeGenerated [UTC]
8002	SQL10.na.contosohotels.com	1/8/2025, 10:31:14.173 AM	1/9/2025, 10:30:38.752 AM
8002	DC10.na.contosohotels.com	1/8/2025, 10:31:26.022 AM	1/9/2025, 10:30:26.015 AM
8002	DC01.na.contosohotels.com	1/8/2025, 10:31:37.009 AM	1/9/2025, 10:30:37.022 AM
8002	SQL01.na.contosohotels.com	1/8/2025, 10:31:41.904 AM	1/9/2025, 10:31:06.998 AM
8002	DC11.na.contosohotels.com	1/8/2025, 10:31:17.009 AM	1/9/2025, 10:31:00.820 AM

Try to summarize DnsNames, Ipv4Addresses, MacAddresses

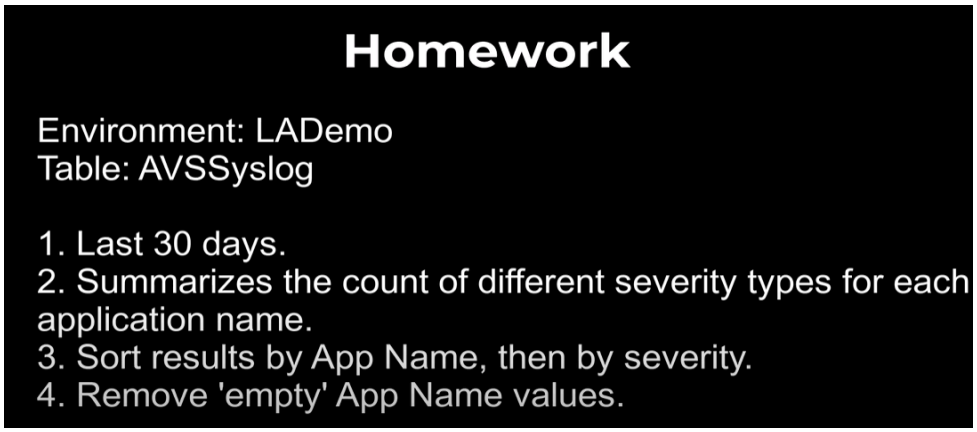


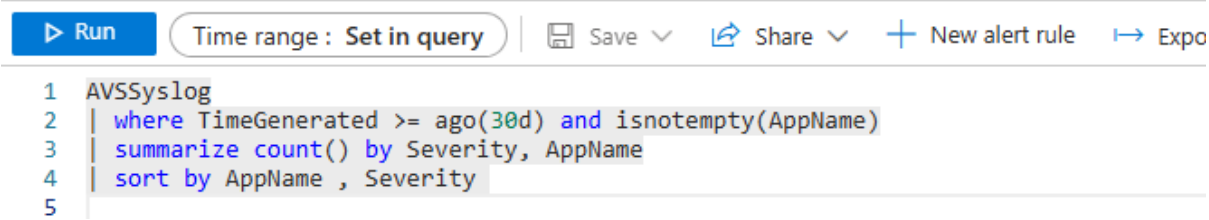
Note: You can not use dynamic data types with summarize.

You can cast it into a string type , if it does your work.



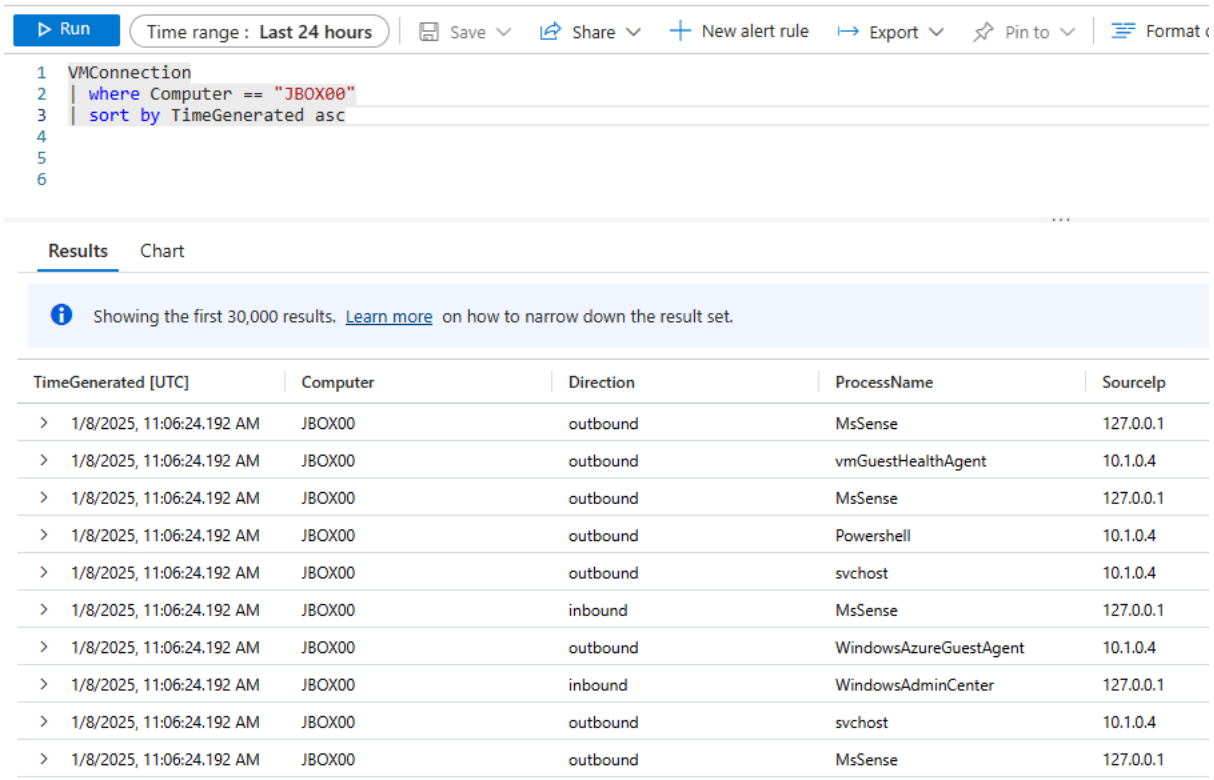
Note: Homework is taken from “Ten Minute KQL” YouTube channel.





summarize, bin, dcount, countif

VMConnections for Computer “JBOX00”



TimeGenerated [UTC]	Computer	Direction	ProcessName	SourceIp
1/8/2025, 11:06:24.192 AM	JBOX00	outbound	MsSense	127.0.0.1
1/8/2025, 11:06:24.192 AM	JBOX00	outbound	vmGuestHealthAgent	10.1.0.4
1/8/2025, 11:06:24.192 AM	JBOX00	outbound	MsSense	127.0.0.1
1/8/2025, 11:06:24.192 AM	JBOX00	outbound	Powershell	10.1.0.4
1/8/2025, 11:06:24.192 AM	JBOX00	outbound	svchost	10.1.0.4
1/8/2025, 11:06:24.192 AM	JBOX00	inbound	MsSense	127.0.0.1
1/8/2025, 11:06:24.192 AM	JBOX00	outbound	WindowsAzureGuestAgent	10.1.0.4
1/8/2025, 11:06:24.192 AM	JBOX00	inbound	WindowsAdminCenter	127.0.0.1
1/8/2025, 11:06:24.192 AM	JBOX00	outbound	svchost	10.1.0.4
1/8/2025, 11:06:24.192 AM	JBOX00	outbound	MsSense	127.0.0.1

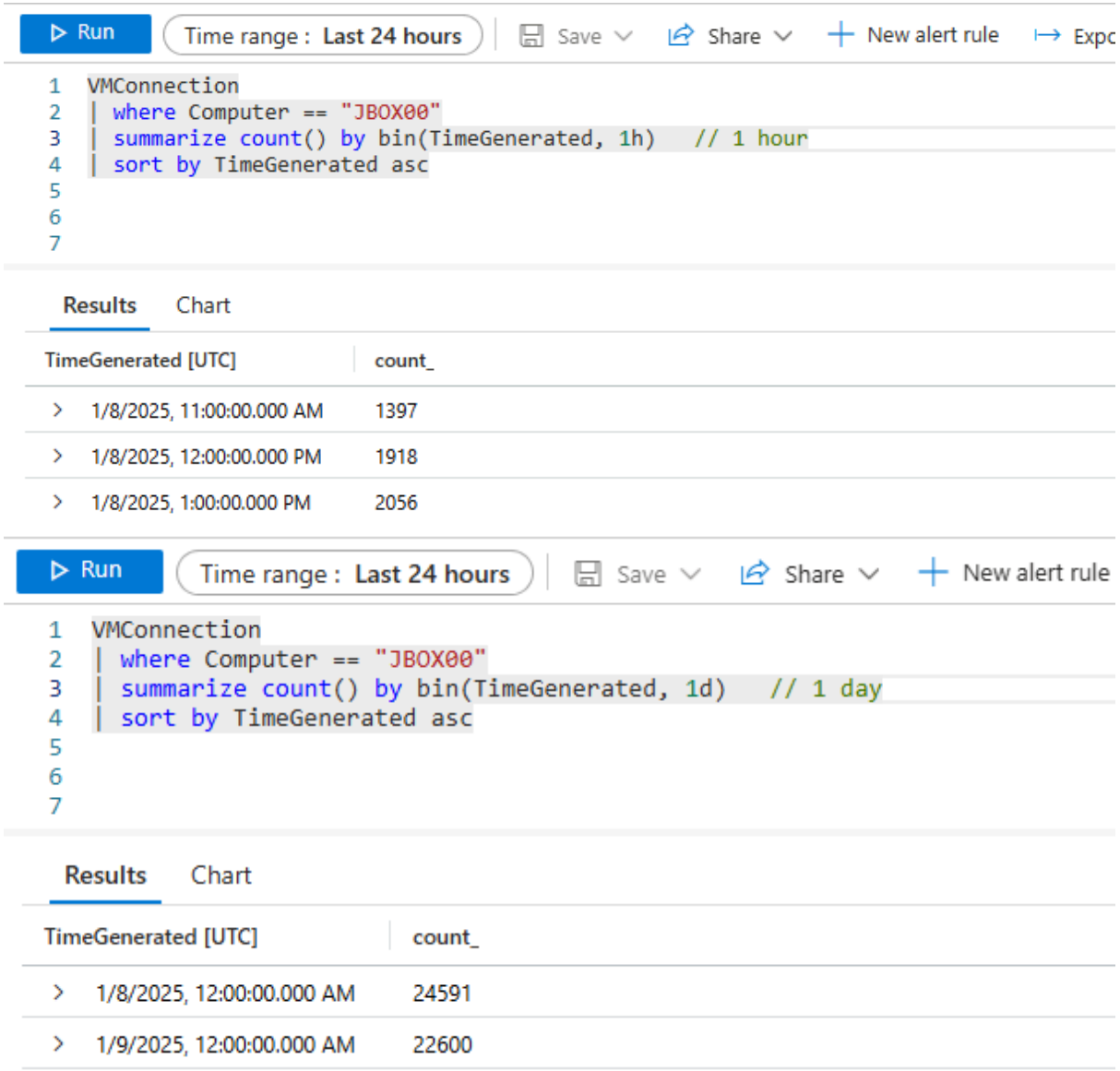
Let’s summarize that by bin

TimeGenerated [UTC]	count_
1/8/2025, 11:11:00.000 AM	36
1/8/2025, 11:12:00.000 AM	28
1/8/2025, 11:13:00.000 AM	28

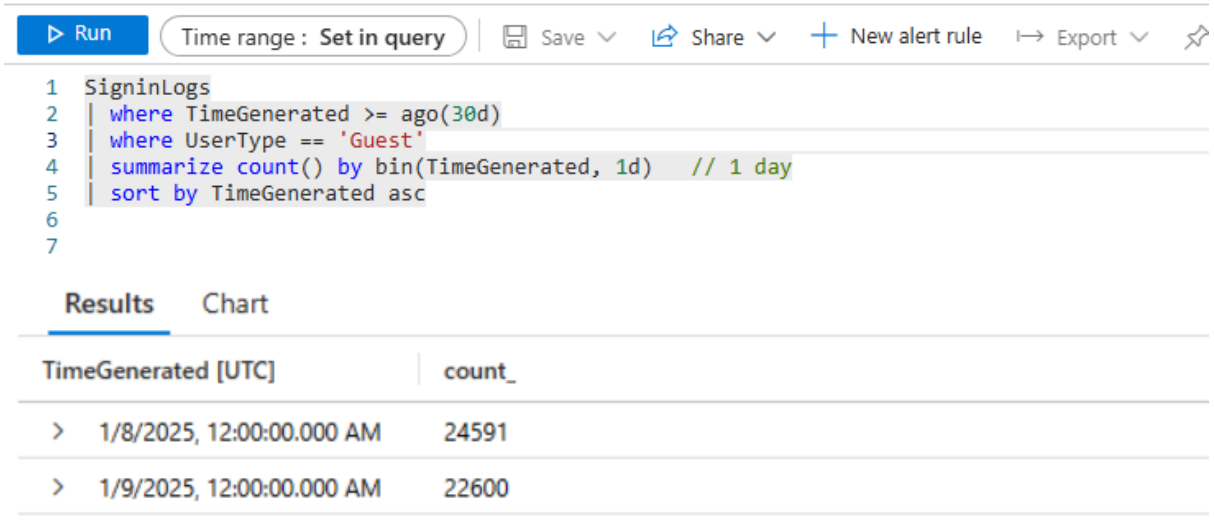
`bin()` : Rounds values down to an integer multiple of a given bin size.

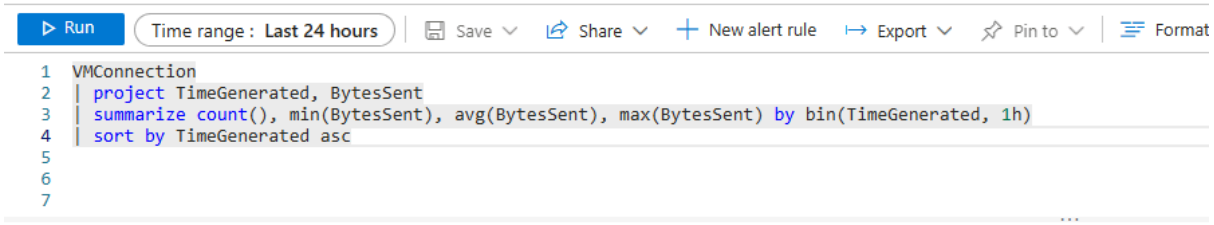
Used frequently in combination with summarize by .... If you have a scattered set of values, they'll be grouped into a smaller set of specific values.

The `bin()` and `floor()` functions are equivalent



How many Guests logged into your system daily in the last month?



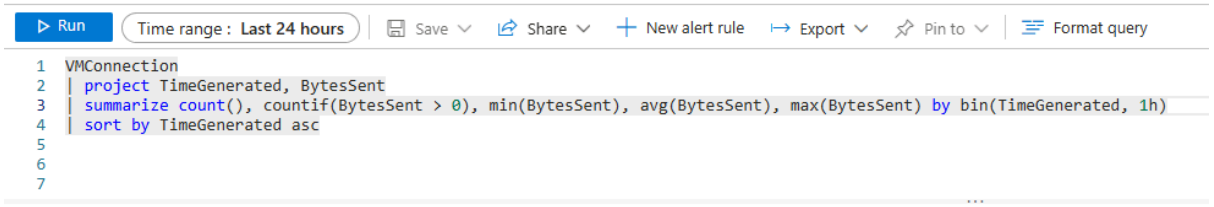



```
VMConnection
| project TimeGenerated, BytesSent
| summarize count(), min(BytesSent), avg(BytesSent), max(BytesSent) by bin(TimeGenerated, 1h)
| sort by TimeGenerated asc
```

Results | Chart

TimeGenerated [UTC]	count_	min_BytesSent	avg_BytesSent	max_BytesSent
1/8/2025, 11:00:00.000 AM	15367	0	59479.00338387454	33106835
1/8/2025, 12:00:00.000 PM	25982	0	69261.1486413671	281155523
1/8/2025, 1:00:00.000 PM	26223	0	70157.25462380353	287623079

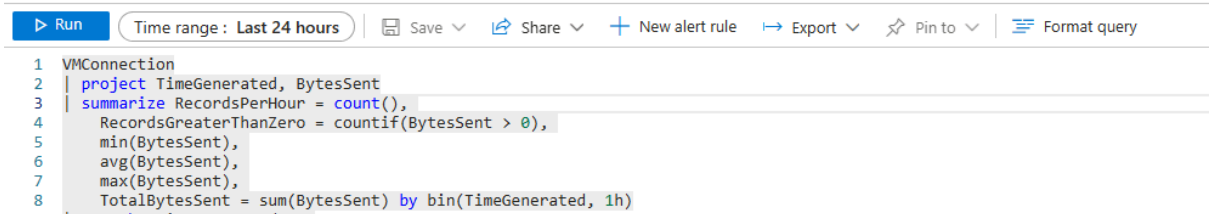
countif - counts only ByteSent is bigger than 0.




```
VMConnection
| project TimeGenerated, BytesSent
| summarize count(), countif(BytesSent > 0), min(BytesSent), avg(BytesSent), max(BytesSent) by bin(TimeGenerated, 1h)
| sort by TimeGenerated asc
```

Results | Chart

TimeGenerated [UTC]	count_	countif_	min_BytesSent	avg_BytesSent	max_BytesSent
1/8/2025, 11:00:00.000 AM	13436	9466	0	60609.92691277166	33106835
1/8/2025, 12:00:00.000 PM	25982	18240	0	69261.1486413671	281155523
1/8/2025, 1:00:00.000 PM	26223	18296	0	70157.25462380353	287623079

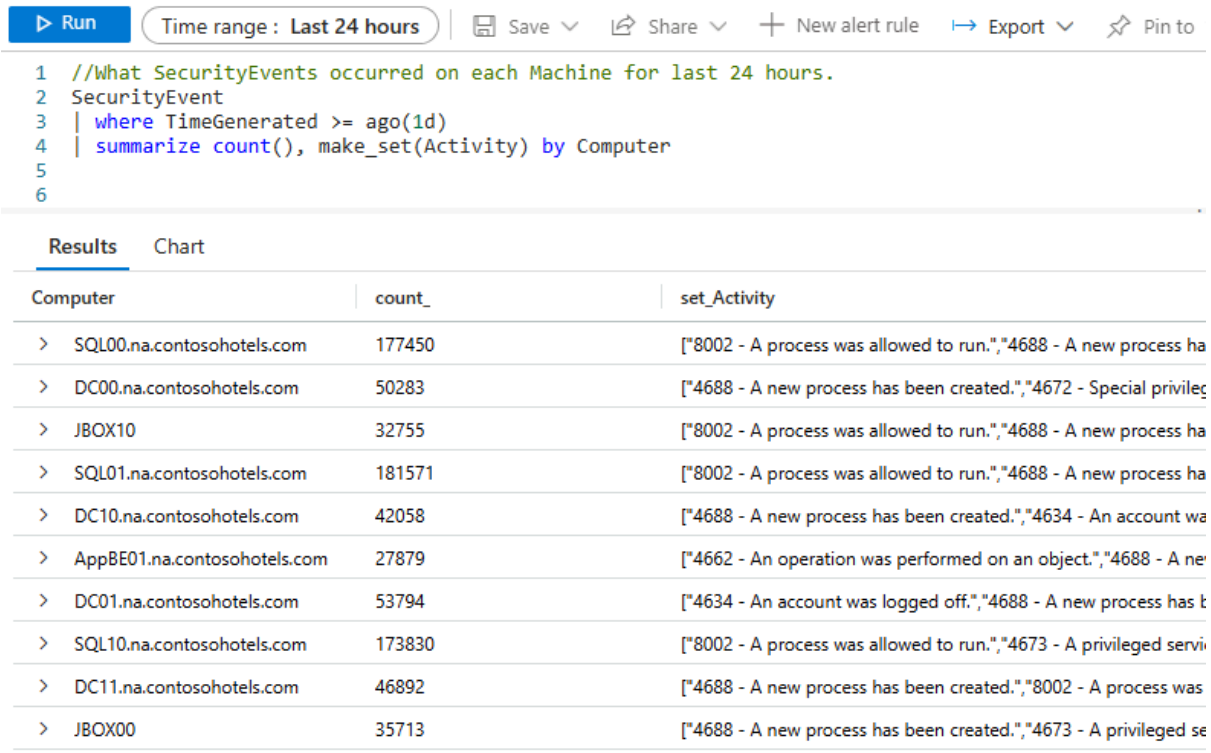



```
VMConnection
| project TimeGenerated, BytesSent
| summarize RecordsPerHour = count(),
    RecordsGreaterThanZero = countif(BytesSent > 0),
    min(BytesSent),
    avg(BytesSent),
    max(BytesSent),
    TotalBytesSent = sum(BytesSent) by bin(TimeGenerated, 1h)
| sort by TimeGenerated asc
```

Results | Chart

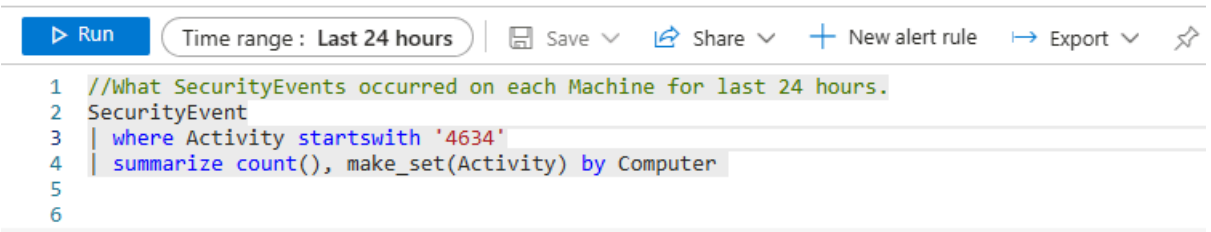
TimeGenerated [UTC]	RecordsPerHour	RecordsGreaterThanZ...	min_BytesSent	avg_BytesSent	max_BytesS...	TotalBytesSent
1/8/2025, 11:00:00.000 AM	9767	6882	0	59127.97184396437	23900836	577502901
1/8/2025, 12:00:00.000 PM	25982	18240	0	69261.1486413671	281155523	1799543164
1/8/2025, 1:00:00.000 PM	26223	18296	0	70157.25462380353	287623079	1839733688
1/8/2025, 2:00:00.000 PM	26688	18611	0	67712.7573441247	206953038	1807118068
1/8/2025, 3:00:00.000 PM	26007	18203	0	71084.10081901027	195273389	1848684210
1/8/2025, 4:00:00.000 PM	26279	18385	0	69156.61147684463	286906786	1817366593

What SecurityEvents occurred on each Machine for last 24 hours.



Computer	count_	set_Activity
SQL00.na.contosohotels.com	177450	["8002 - A process was allowed to run.","4688 - A new process ha
DC00.na.contosohotels.com	50283	["4688 - A new process has been created.","4672 - Special privileg
JBOX10	32755	["8002 - A process was allowed to run.","4688 - A new process ha
SQL01.na.contosohotels.com	181571	["8002 - A process was allowed to run.","4688 - A new process ha
DC10.na.contosohotels.com	42058	["4688 - A new process has been created.","4634 - An account wa
AppBE01.na.contosohotels.com	27879	["4662 - An operation was performed on an object.","4688 - A ne
DC01.na.contosohotels.com	53794	["4634 - An account was logged off.","4688 - A new process has b
SQL10.na.contosohotels.com	173830	["8002 - A process was allowed to run.","4673 - A privileged servi
DC11.na.contosohotels.com	46892	["4688 - A new process has been created.","8002 - A process was
JBOX00	35713	["4688 - A new process has been created.","4673 - A privileged se

Let's assume that you are searching for Activity - 4634. How to narrow down your result.



Computer	count_	set_Activity
DC11.na.contosohotels.com	7652	["4634 - An account was logged off."]
SQL01.na.contosohotels.com	1114	["4634 - An account was logged off."]
DC00.na.contosohotels.com	7911	["4634 - An account was logged off."]
DC10.na.contosohotels.com	6768	["4634 - An account was logged off."]
DC01.na.contosohotels.com	7943	["4634 - An account was logged off."]
SQL10.na.contosohotels.com	628	["4634 - An account was logged off."]
SQL00.na.contosohotels.com	105	["4634 - An account was logged off."]
AppBE01.na.contosohotels.com	16	["4634 - An account was logged off."]

How many 4662 SecurityEvent occurred by Computer, every hour, last 24 hours.

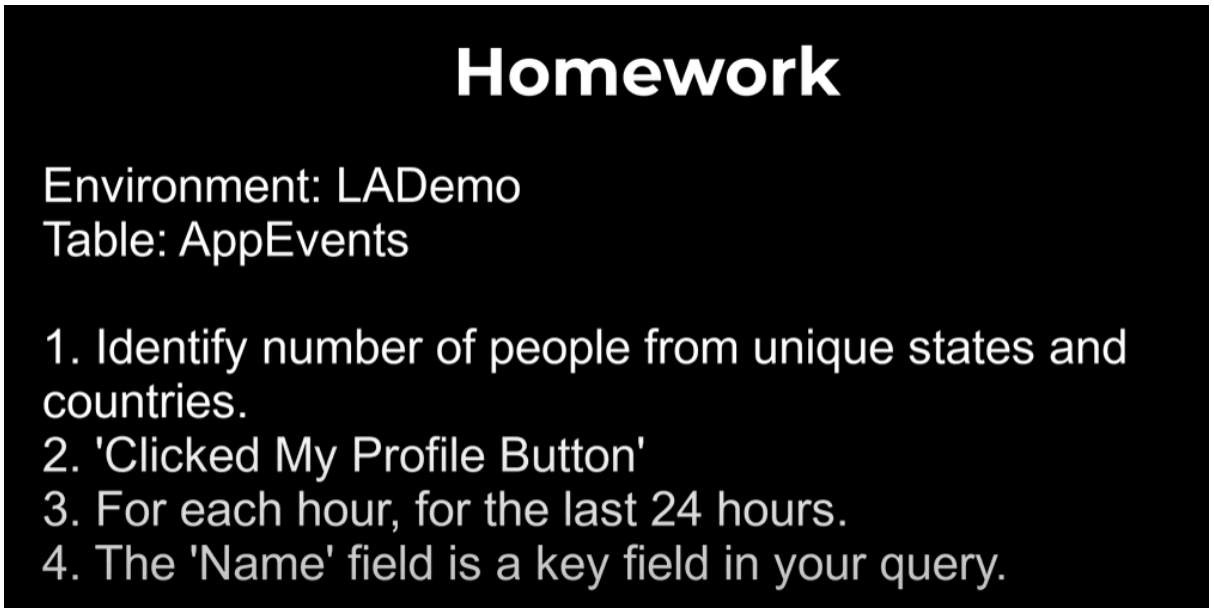
Run | Time range : Last 24 hours | Save | Share | New alert rule | Export

```
1  //How many 4662 SecurityEvent occurred by Computer, every hour, last 24 hours
2  SecurityEvent
3  | where Activity startswith '4662'
4  | summarize count() by Computer, bin(TimeGenerated, 1h), Activity
5
6
```

Results | Chart

Computer	TimeGenerated [UTC]	Activity	count_
DC11.na.contosohotels.com	1/9/2025, 11:00:00.000 AM	4662 - An operation was perfor...	70
DC10.na.contosohotels.com	1/9/2025, 11:00:00.000 AM	4662 - An operation was perfor...	88
SQL10.na.contosohotels.com	1/9/2025, 11:00:00.000 AM	4662 - An operation was perfor...	23
SQL00.na.contosohotels.com	1/9/2025, 11:00:00.000 AM	4662 - An operation was perfor...	70
AppBE01.na.contosohotels.com	1/9/2025, 11:00:00.000 AM	4662 - An operation was perfor...	213
DC01.na.contosohotels.com	1/9/2025, 11:00:00.000 AM	4662 - An operation was perfor...	97
SQL01.na.contosohotels.com	1/9/2025, 11:00:00.000 AM	4662 - An operation was perfor...	100
JBOX00	1/9/2025, 11:00:00.000 AM	4662 - An operation was perfor...	15
JBOX10	1/9/2025, 11:00:00.000 AM	4662 - An operation was perfor...	15
DC00.na.contosohotels.com	1/9/2025, 11:00:00.000 AM	4662 - An operation was perfor...	34

Taken from “Ten Minute KQL”



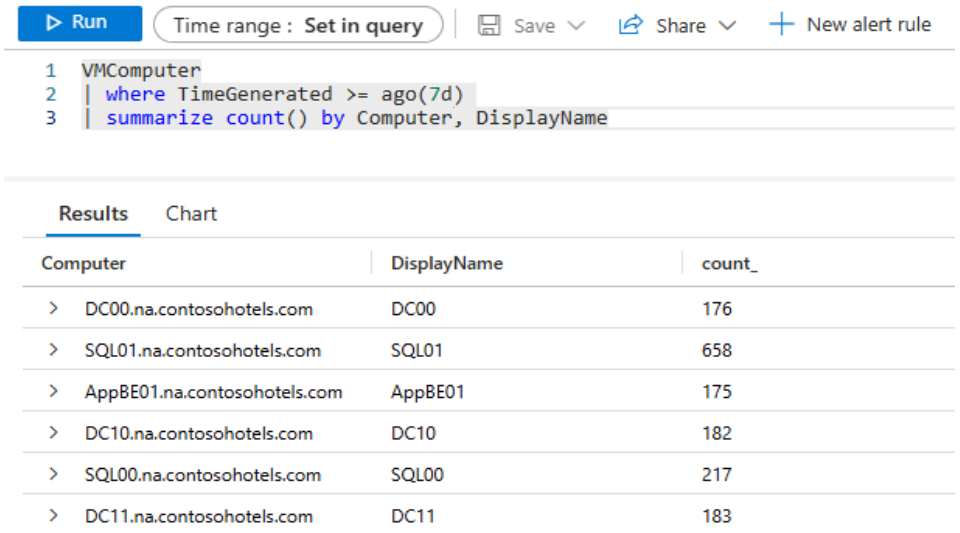
Solution:

Run | Time range : Set in query | Save | Share | New alert rule | Export | Pin to

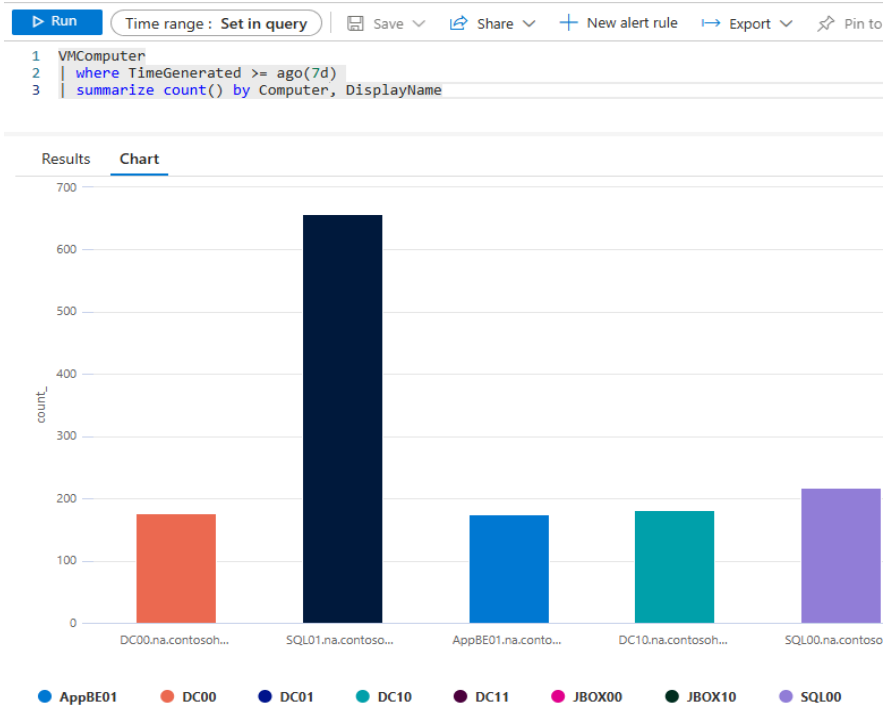
```
1  AppEvents
2  | where TimeGenerated >= ago(24h)
3  | where Name == "Clicked My Profile Button"
4  | summarize count() by bin(TimeGenerated, 1h), ClientStateOrProvince, ClientCountryOrRegion
5  | sort by TimeGenerated asc
6
```

render, timechart, areachart, barchart

Results:



When you click to Chart

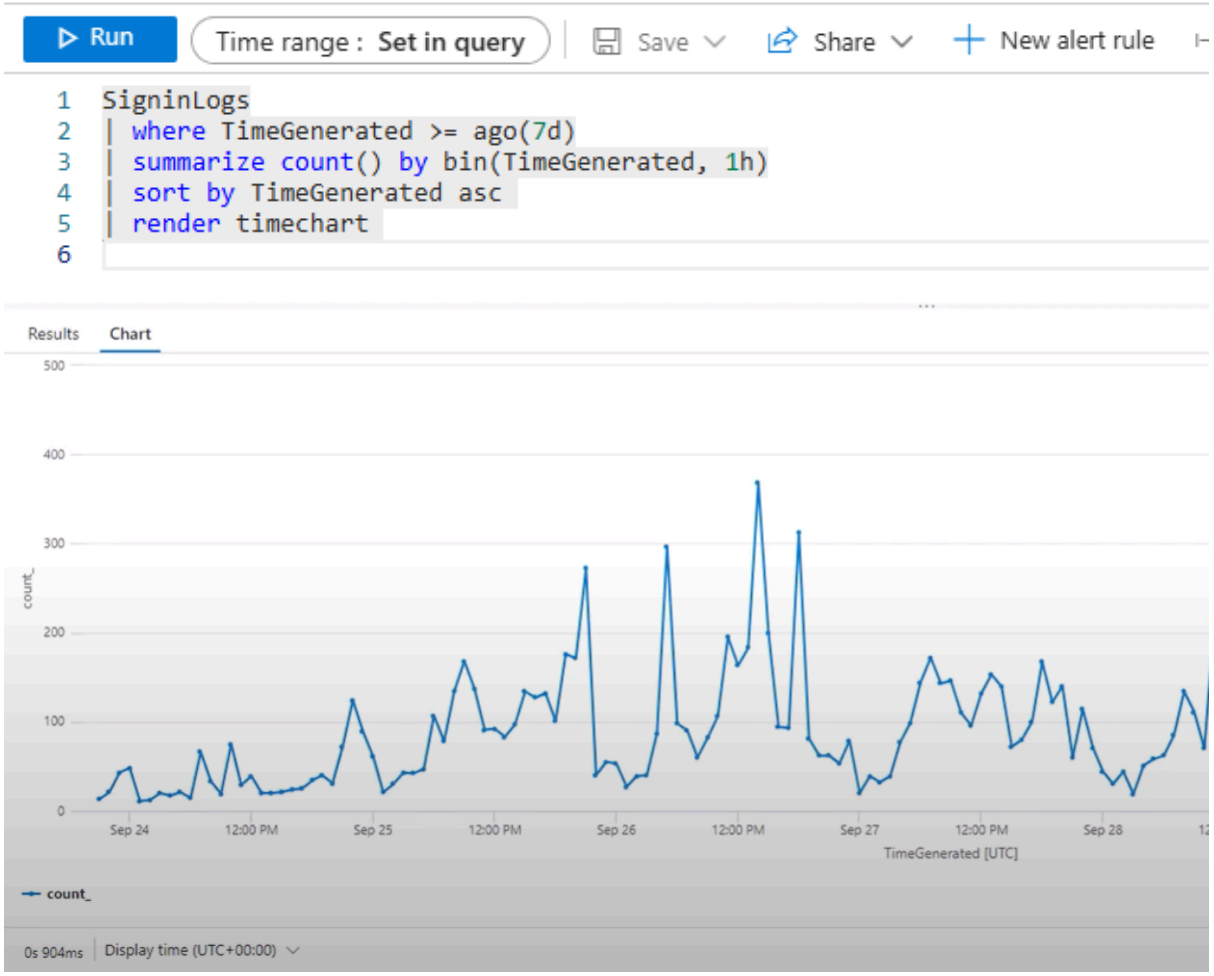


render operator: Instructs the user agent to render a visualization of the query results. The render operator **must be the last operator** in the query, and can only be used with queries that produce **a single tabular data stream result**. The render operator **doesn't modify** data. It injects an annotation ("Visualization") into the result's extended properties. The annotation contains the information provided by the operator in the query. The interpretation of the visualization information is done by the user agent. Different agents, such as Kusto.Explorer or Azure Data Explorer web UI, may support different visualizations.

Time Chart

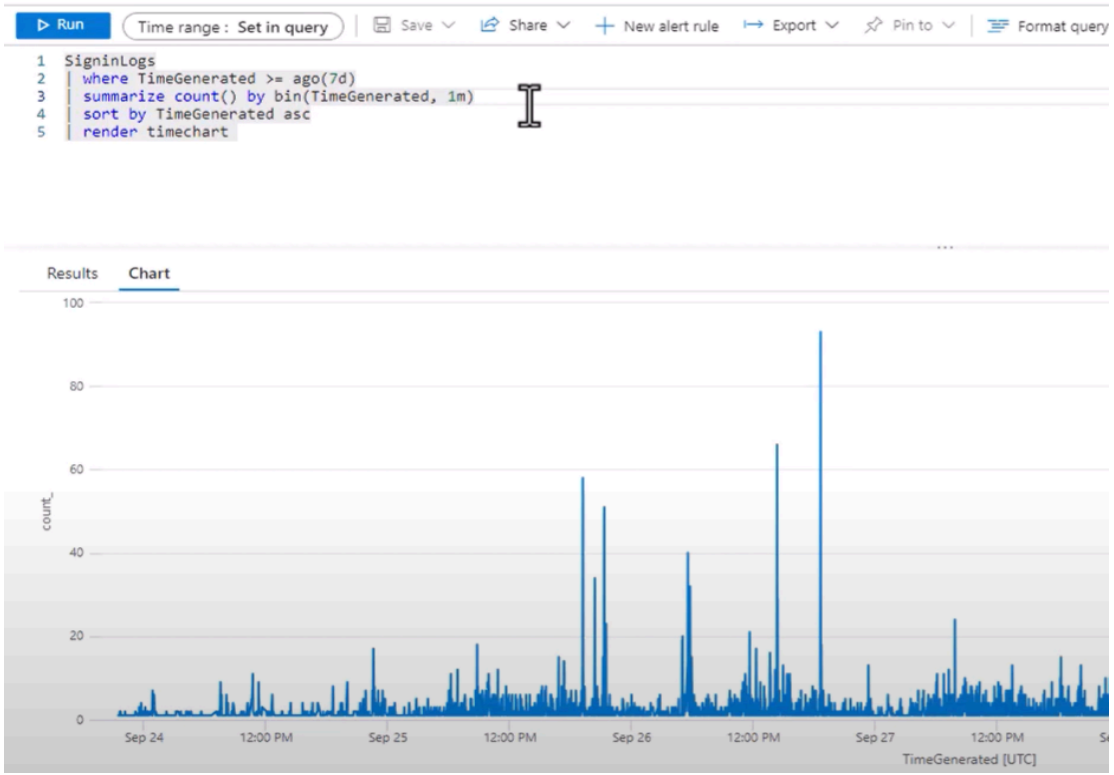
A time chart visual is a type of line graph. The first column of the query is the x-axis, and should be a datetime. Other numeric columns are y-axes. One string column values are used to group the numeric columns and create different lines in the chart. Other string columns are ignored. The time chart visual is like a line chart except the x-axis is always time.

How do we display logins from the last week in a graph as hourly buckets?



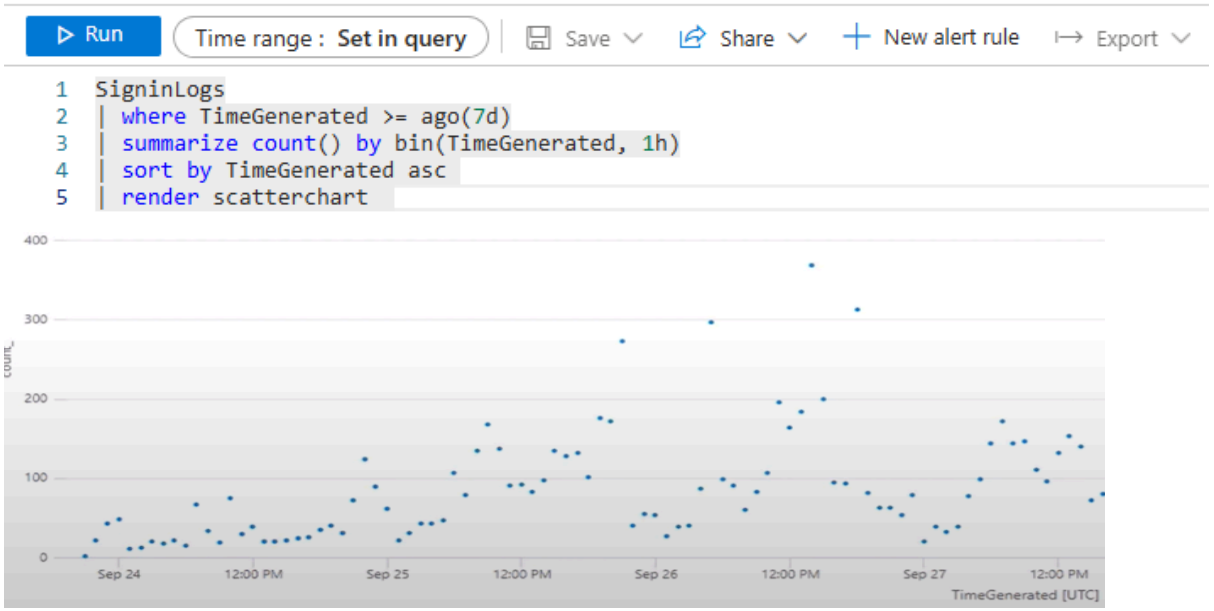
Try for 30 minutes, 6 hours, 12 hours, 1 day and examine the results.

bin(TimeGenerated, 1m)



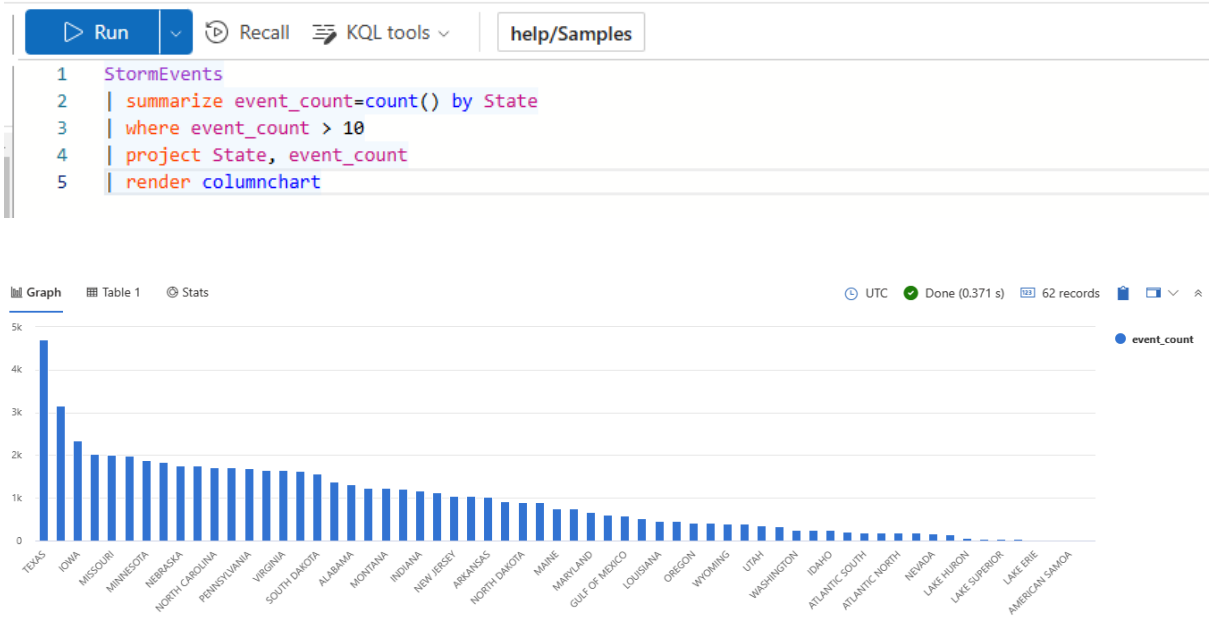
Focus on the spikes, what they are telling us. In some cases those spikes can be very meaningful for us. In some cases, these spikes can be very meaningful to us. Visualization makes the result set easier to read.

Scatter Chart: In a scatter chart visual, the first column is the x-axis and should be a numeric column. Other numeric columns are y-axes. Scatter plots are used to observe relationships between variables. The scatter chart visual can also be used in the context of Geospatial visualizations.



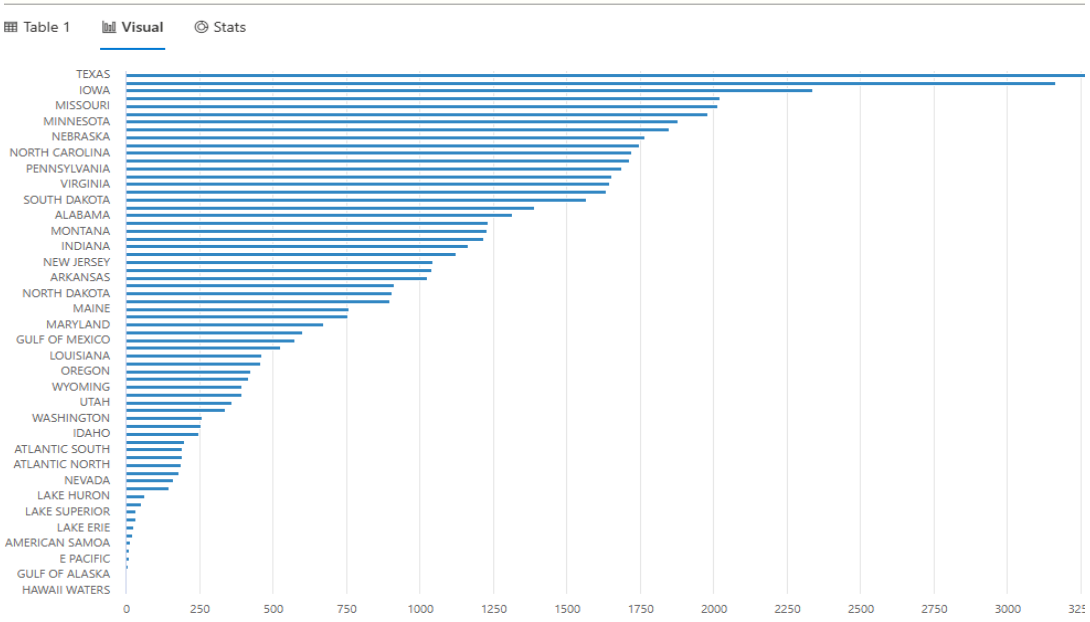
column chart: The column chart visual needs a minimum of two columns in the query result. By default, the first column is used as the x-axis. This column can contain text, datetime, or numeric data types. The other columns are used as the y-axis and contain numeric data types to be displayed as vertical lines. Column charts are used for comparing specific subcategory items in a main category range, where the length of each line represents its value.

ADX - Azure Data Explorer



barchart: The bar chart visual needs a minimum of two columns in the query result. By default, the first column is used as the y-axis. This column can contain text, datetime, or numeric data types. The other columns are used as the x-axis and contain numeric data types to be displayed as horizontal lines. Bar charts are used mainly for comparing numeric and nominal discrete values, where the length of each line represents its value.

```
1  StormEvents
2  | summarize event_count=count() by State
3  | project State, event_count
4  | render barchart
```



piechart: The pie chart visual needs a minimum of two columns in the query result. By default, the first column is used as the color axis. This column can contain text, datetime, or numeric data types. Other columns will be used to determine the size of each slice and contain numeric data types. Pie charts are used for presenting a composition of categories and their proportions out of a total.

Two columns data perfect for piechart

Run | Recall | KQL tools | help/Samples

```
1  StormEvents
2  | summarize statecount=count() by State
3  | sort by statecount
4  | limit 10
5  | render piechart with(title="Storm Events by State")
```

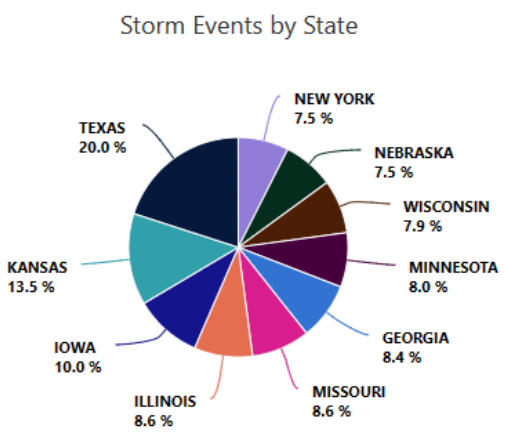
Table 1 | Visual | Stats

State	event_count
TEXAS	4 701
KANSAS	3 166
IOWA	2 337
ILLINOIS	2 022
MISSOURI	2 016
GEORGIA	1 983

Run | Recall | KQL tools | help/Samples

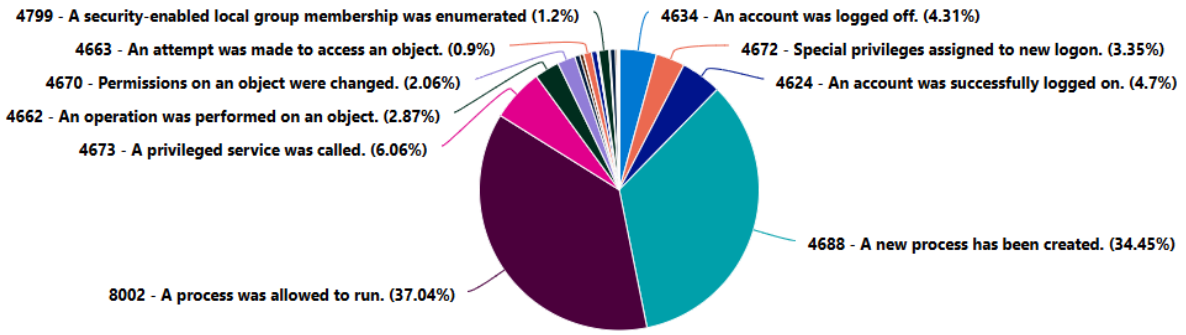
```
1  StormEvents
2  | summarize statecount=count() by State
3  | sort by statecount
4  | limit 10
5  | render piechart with(title="Storm Events by State")
```

Graph | Table 1 | Stats | UTC | Done (1.003 s) | 10 records



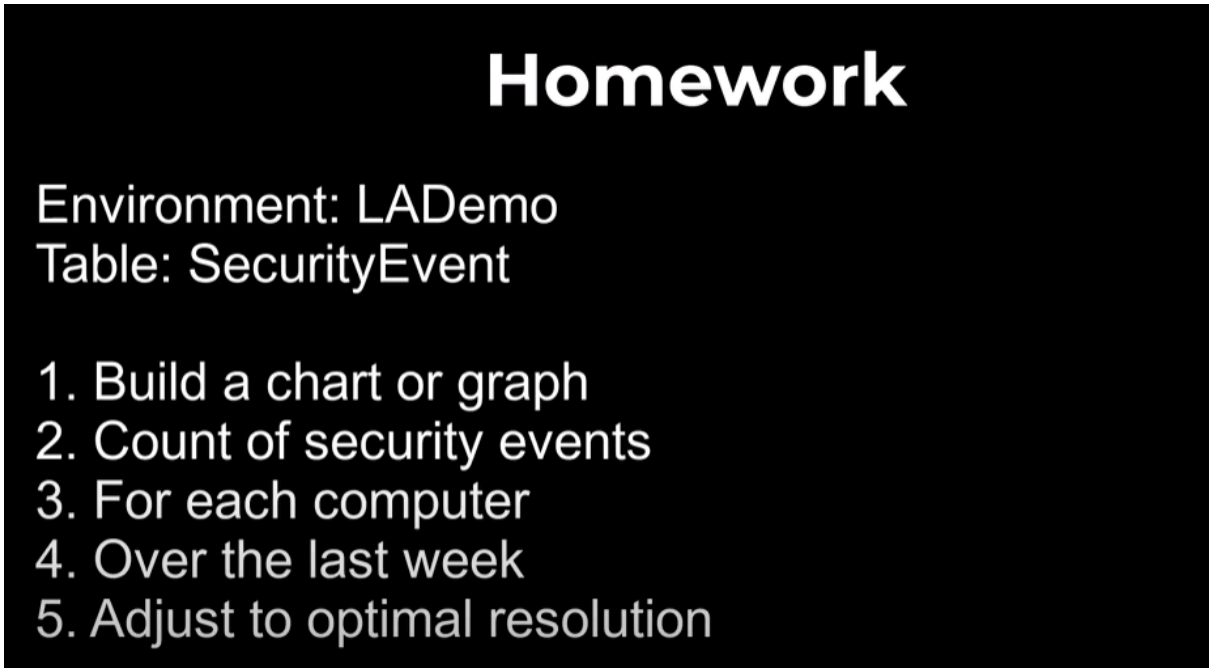
Run | Time range : Set in query | Save | Share | New alert rule

```
1  SecurityEvent
2  | where TimeGenerated >= ago(7d)
3  | summarize Count=count() by Activity
4  | render piechart
5
```

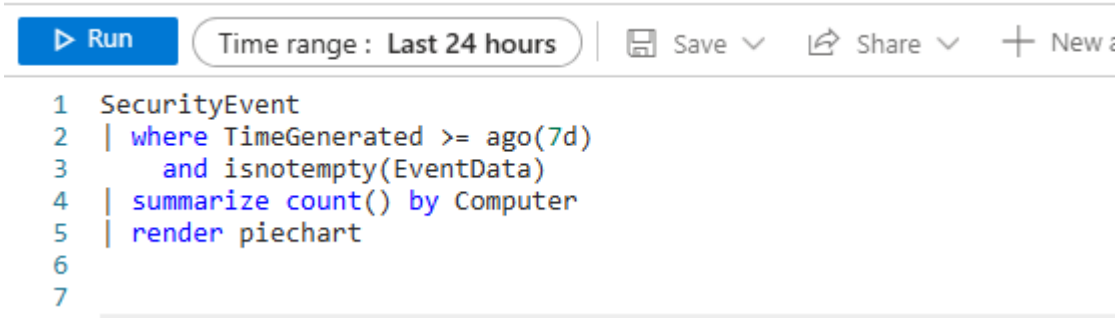


areachart: The area chart visual shows a time-series relationship. The first column of the query should be numeric and is used as the x-axis. Other numeric columns are the y-axes. Unlike line charts, area charts also visually represent volume. Area charts are ideal for indicating the change among different datasets.

Ten Minute KQL:



Solution:

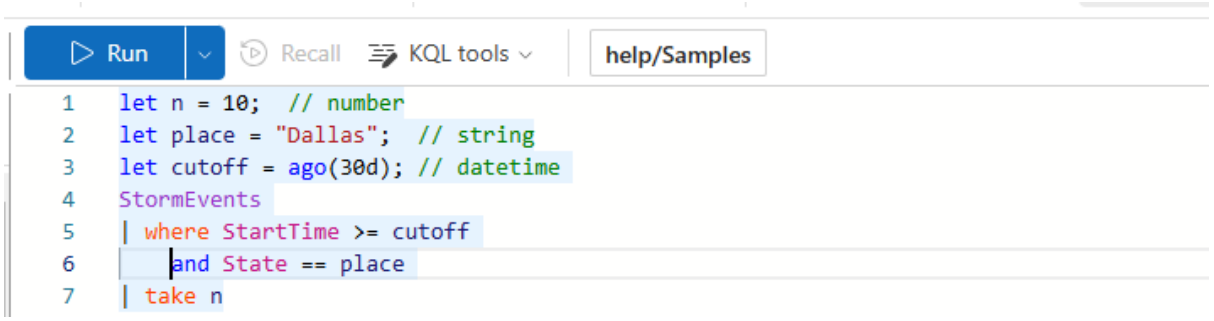


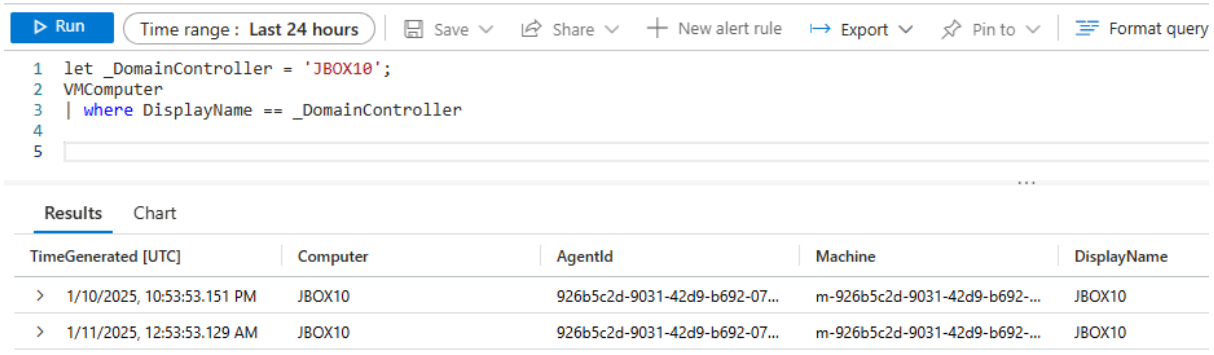
Variables, let, pack_array, has_any

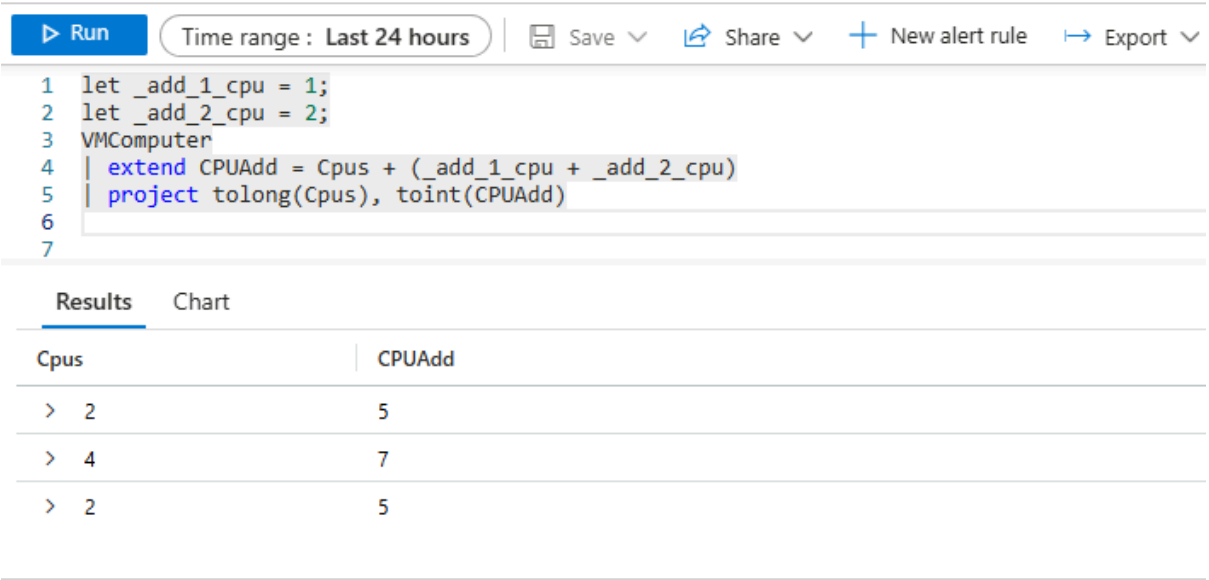
let statement: A `let` statement is used to set a variable name equal to an expression or a function, or to create views.
`let` statements are useful for:

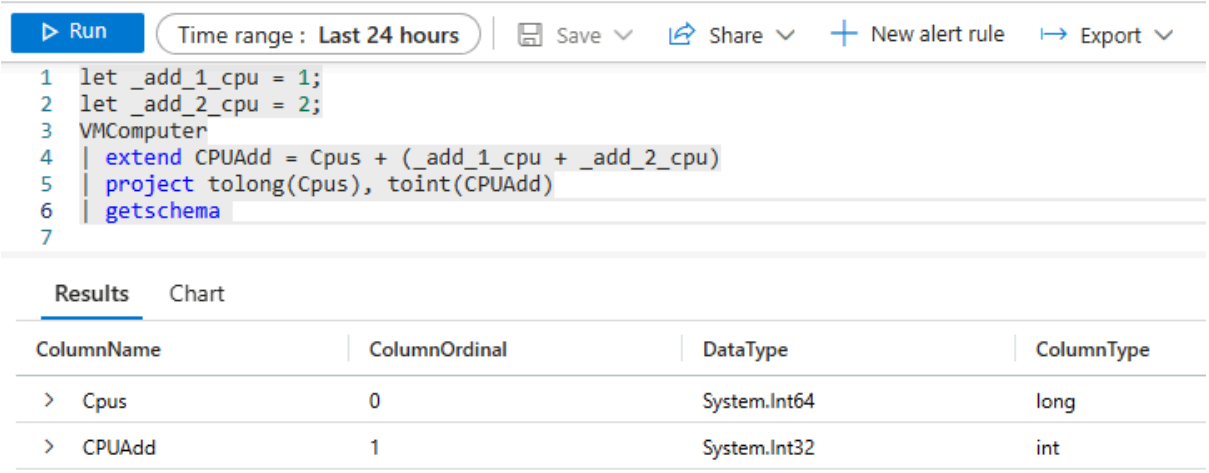
- Breaking up a complex expression into multiple parts, each represented by a variable.
- Defining constants outside of the query body for readability.
- Defining a variable once and using it multiple times within a query.

If the variable previously represented another value, for example in nested statements, the innermost `let` statement applies.









pack_array: Packs all input values into a dynamic array.

```
range x from 1 to 3 step 1
| extend y = x * 2
| extend z = y * 2
| project pack_array(x, y, z)
```

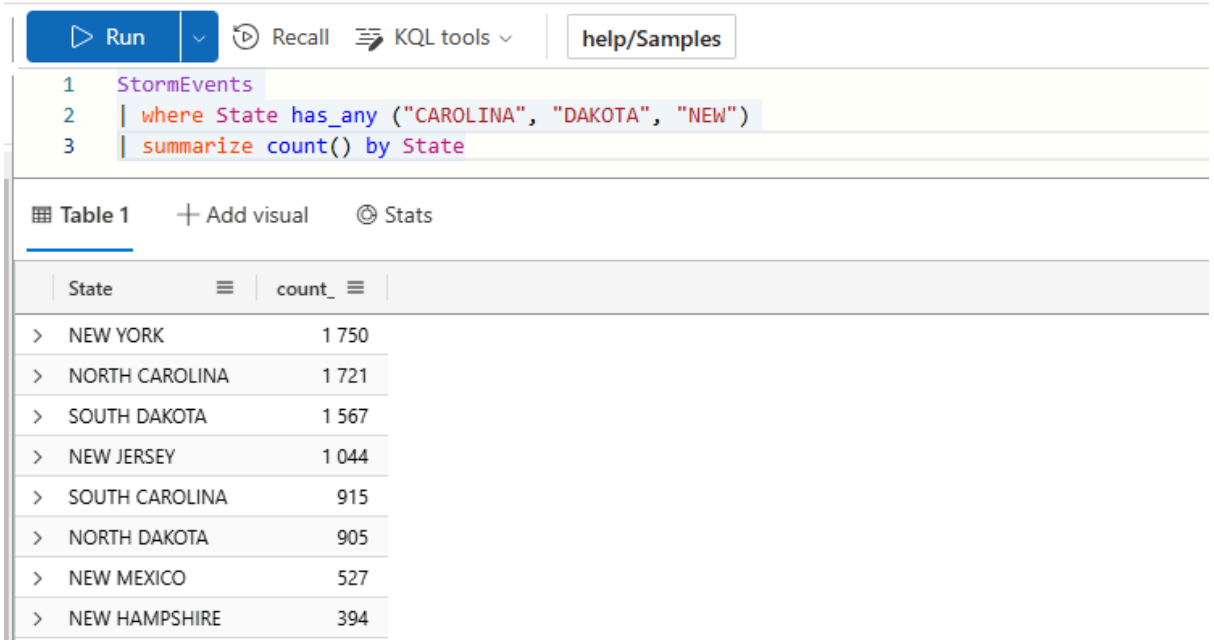
Column1
[1,2,4]
[2,4,8]
[3,6,12]

```
range x from 1 to 3 step 1
| extend y = tostring(x * 2)
| extend z = (x * 2) * 1s
| project pack_array(x, y, z)
```

Column1
[1,"2","00:00:02"]
[2,"4","00:00:04"]
[3,"6","00:00:06"]

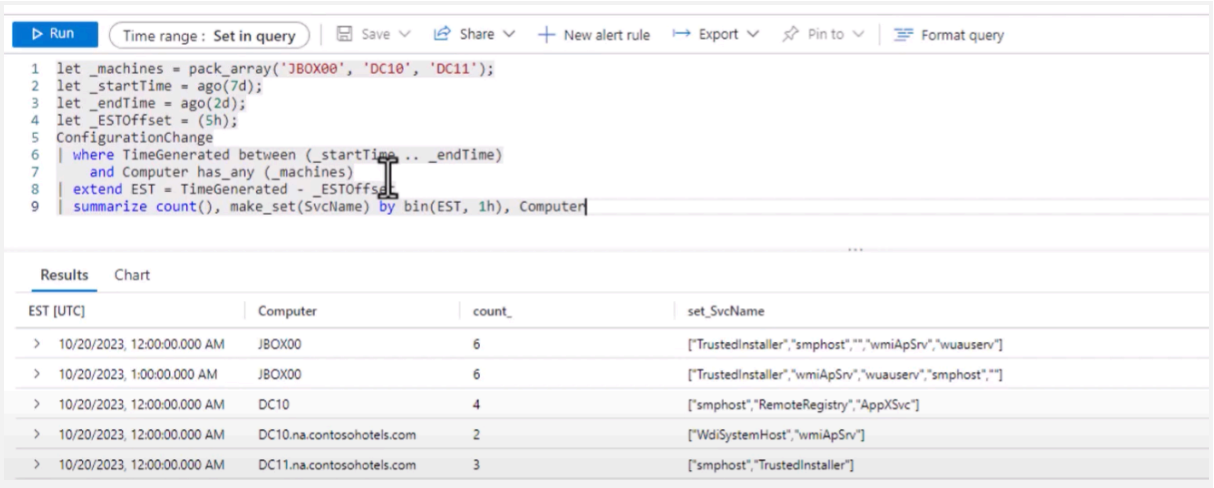
has_any: Filters a record set for data with any set of case-insensitive strings. `has_any` searches for indexed terms, where an indexed term is three or more characters. If your term is fewer than three characters, the query scans the values in the column, which is slower than looking up the term in the term index.

For more information about other operators and to determine which operator is most appropriate for your query, see datatype string operators.




```
// The following query shows how to use has_any with a dynamic array.
StormEvents
| where State has_any (dynamic(['south', 'north']))
| summarize count() by State
```

```
//The same query can also be written with a let statement.
let areas = dynamic(['south', 'north']);
StormEvents
| where State has_any (areas)
| summarize count() by State

//The following query shows how to use has_any with an inline tabular expression. Notice that an inline tabular expression must be enclosed with double parentheses.
StormEvents
| where State has_any ((PopulationData | where Population > 5000000 | project State))
| summarize count() by State

let large_states = PopulationData | where Population > 5000000 | project State;
StormEvents
| where State has_any (large_states)
| summarize count() by State
```



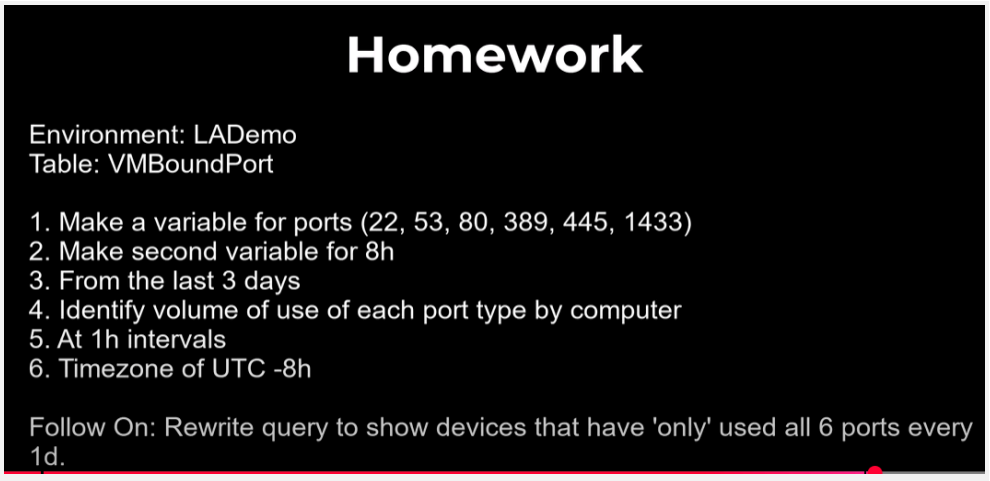
Run | Time range : Set in query | Save | Share | New alert rule | Export | Pin to | Format query

```
let _suspiciousActivities = pack_array(" 4688 - A new process has been created.",
                                       "4670 - Permissions on an object were changed.",
                                       "4672 - Special privileges assigned to new logon.");
SecurityEvent
| where TimeGenerated >= ago(7d)
        and Activity has_any (_suspiciousActivities)
| summarize make_set(Activity) by Computer
```

Results | Chart

Computer	set_Activity
DC11.na.contosohotels.com	["4670 - Permissions on an object were changed.","4672 - Special privileges assigned to new logon."]
DC10.na.contosohotels.com	["4672 - Special privileges assigned to new logon.","4670 - Permissions on an object were changed."]
DC00.na.contosohotels.com	["4672 - Special privileges assigned to new logon.","4670 - Permissions on an object were changed."]
DC01.na.contosohotels.com	["4672 - Special privileges assigned to new logon.","4670 - Permissions on an object were changed."]
JBOX00	["4670 - Permissions on an object were changed.","4672 - Special privileges assigned to new logon."]
JBOX10	["4672 - Special privileges assigned to new logon.","4670 - Permissions on an object were changed."]
SQL01.na.contosohotels.com	["4672 - Special privileges assigned to new logon.","4670 - Permissions on an object were changed."]
SQL10.na.contosohotels.com	["4670 - Permissions on an object were changed.","4672 - Special privileges assigned to new logon."]
SQL00.na.contosohotels.com	["4670 - Permissions on an object were changed.","4672 - Special privileges assigned to new logon."]
AppBE01.na.contosohotels.com	["4672 - Special privileges assigned to new logon.","4670 - Permissions on an object were changed."]

Taken from Ten Minute KQL YouTube Channel



Solution:

Run | Time range : Set in query | Save | Share | New alert rule | Export

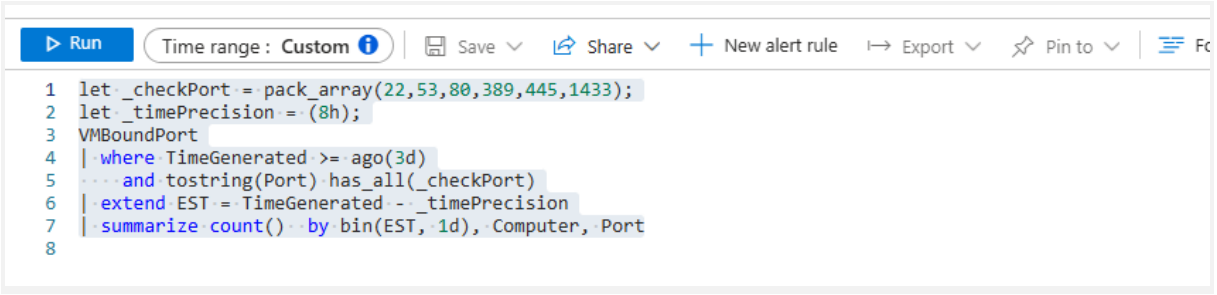
```
let _checkPort = pack_array(22,53,80,389,445,1433);
let _timePrecision = (8h);
VMBoundPort
| where TimeGenerated >= ago(3d)
    and tostring(Port) has_any(_checkPort)
| extend EST = TimeGenerated - _timePrecision
| summarize count()  by bin(EST, 1h), Computer, Port
```

Results | Chart

EST [UTC]	Computer	Port	count_
1/10/2025, 11:00:00.000 PM	JBOX00	445	60
1/10/2025, 11:00:00.000 PM	DC11.na.contosohotels.com	389	97
1/10/2025, 11:00:00.000 PM	DC11.na.contosohotels.com	53	240

Follow On: Rewrite query to show devices that have 'only' used all 6 ports every 1d.

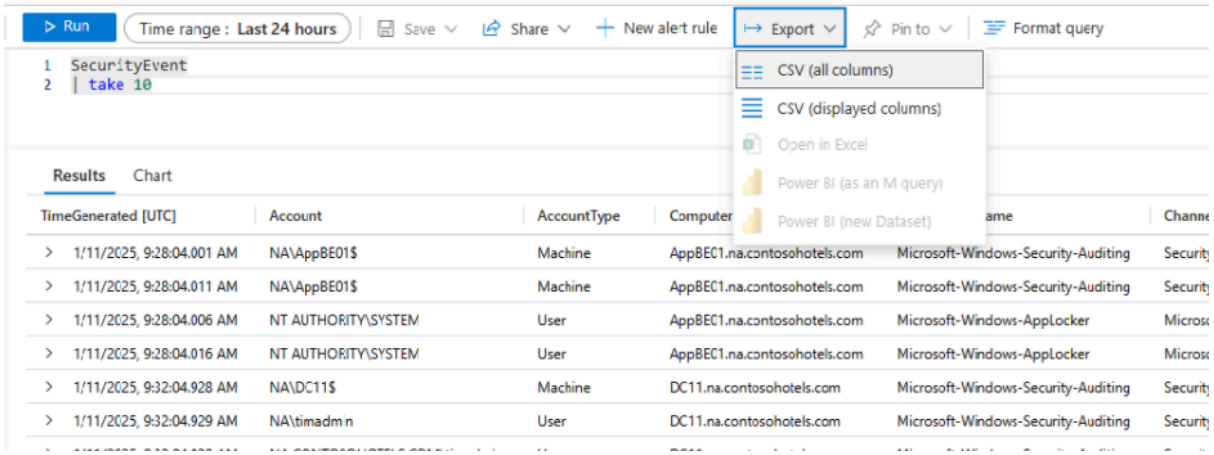
Solution:



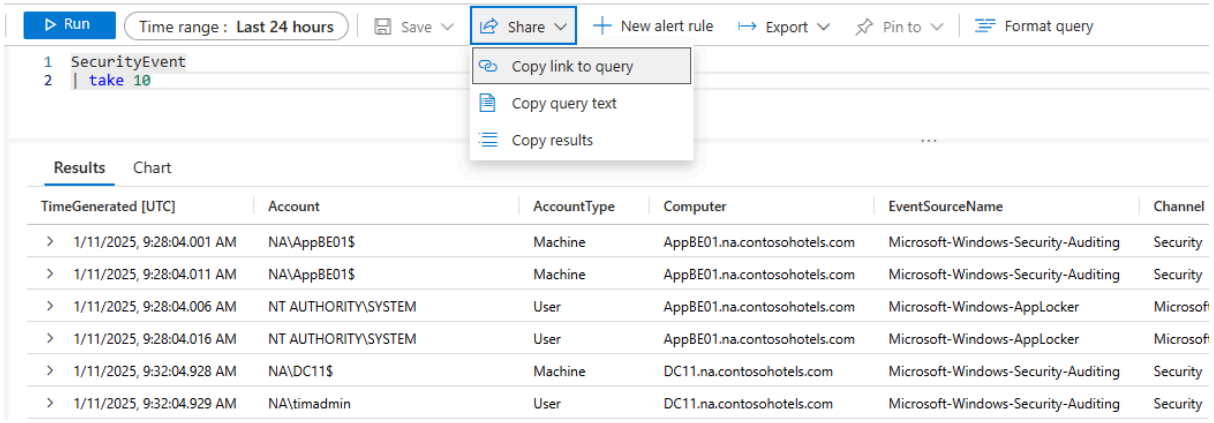
externaldata operator: The `externaldata` operator returns a table whose schema is defined in the query itself, and whose data is read from an external storage artifact, such as a blob in Azure Blob Storage or a file in Azure Data Lake Storage.

How to export data csv, excel or PowerBI file?

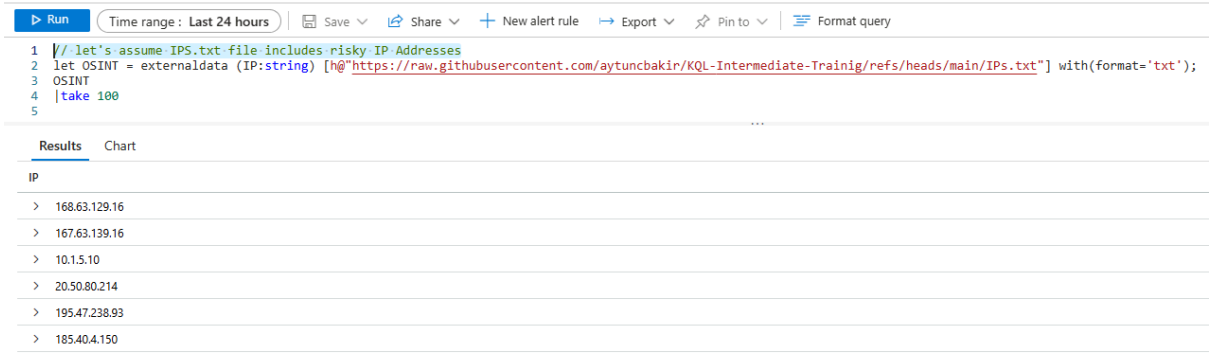
You can use the export feature.



How to share your Query?
You can use the share feature.



Let's assume IPS.txt file includes risky IP Addresses

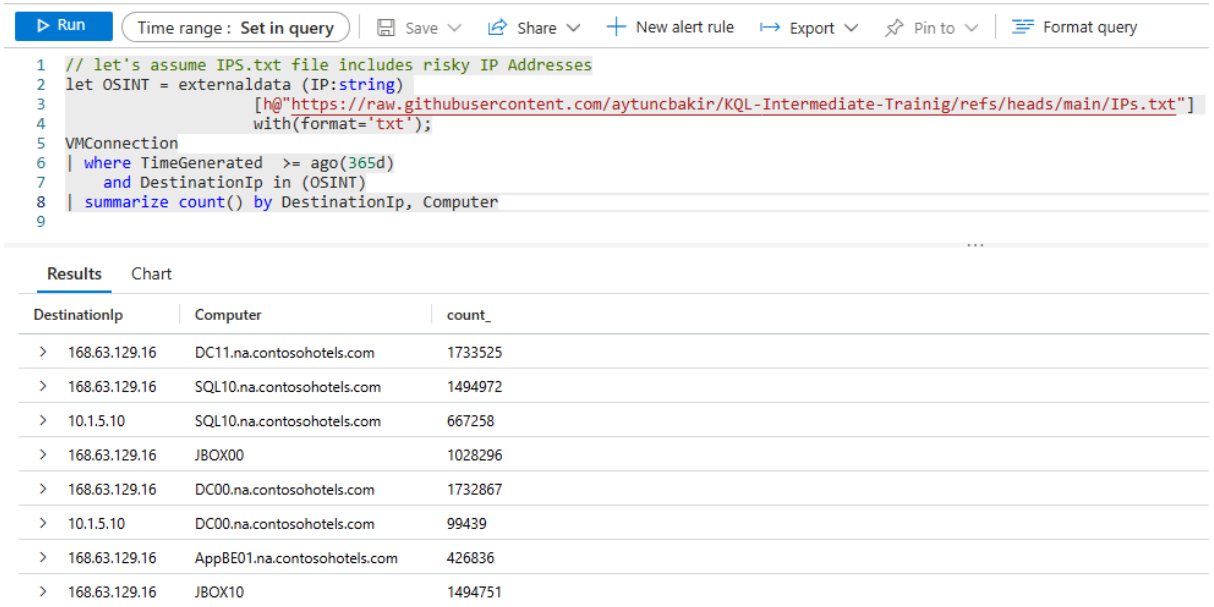


```
// let's assume IPS.txt file includes risky IP Addresses
let OSINT = externaldata (IP:string) [h@"https://raw.githubusercontent.com/aytuncbakir/KQL-Intermediate-Trainig/refs/heads/main/IPs.txt"] with(format='txt');
OSINT
|take 100
```

Results | Chart

IP
168.63.129.16
167.63.139.16
10.1.5.10
20.50.80.214
195.47.238.93
185.40.4.150

Check if it was connected to those IPS by your VMs.

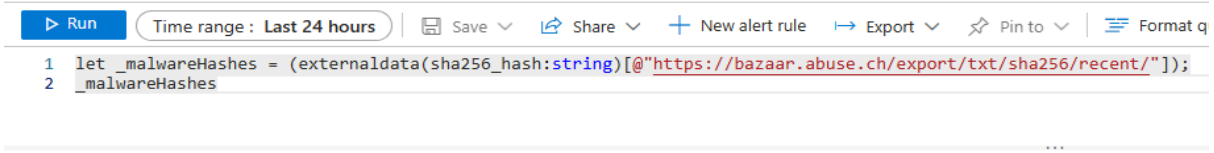


```
// let's assume IPS.txt file includes risky IP Addresses
let OSINT = externaldata (IP:string)
                    [h@"https://raw.githubusercontent.com/aytuncbakir/KQL-Intermediate-Trainig/refs/heads/main/IPs.txt"]
                    with(format='txt');
VMConnection
| where TimeGenerated  >= ago(365d)
    and DestinationIp in (OSINT)
| summarize count() by DestinationIp, Computer
```

Results | Chart

DestinationIp	Computer	count_
168.63.129.16	DC11.na.contosohotels.com	1733525
168.63.129.16	SQL10.na.contosohotels.com	1494972
10.1.5.10	SQL10.na.contosohotels.com	667258
168.63.129.16	JBOX00	1028296
168.63.129.16	DC00.na.contosohotels.com	1732867
10.1.5.10	DC00.na.contosohotels.com	99439
168.63.129.16	AppBE01.na.contosohotels.com	426836
168.63.129.16	JBOX10	1494751

Let’s read malicious hashes from bazar.abuse

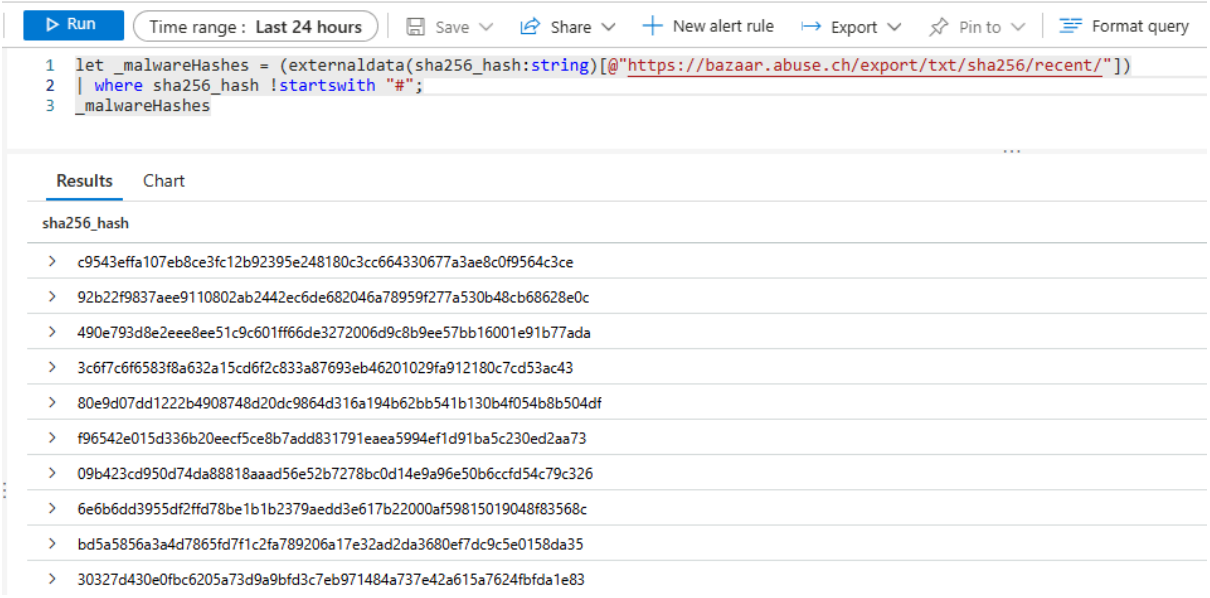


```
let _malwareHashes = (externaldata(sha256_hash:string)[@"https://bazaar.abuse.ch/export/txt/sha256/recent/"]);
_malwareHashes
```

Results | Chart

sha256_hash
##
MalwareBazaar recent malware samples (SHA256 hashes)
Last updated: 2025-01-11 10:06:25 UTC
# #
Terms Of Use: https://bazaar.abuse.ch/faq/#tos
For questions please contact bazaar [at] abuse.ch
##
#
sha256_hash
c9543effa107eb8ce3fc12b92395e248180c3cc664330677a3ae8c0f9564c3ce
92b22f9837aee9110802ab2442ec6de682046a78959f277a530b48cb68628e0c

Let’s drop the lines start with “#”

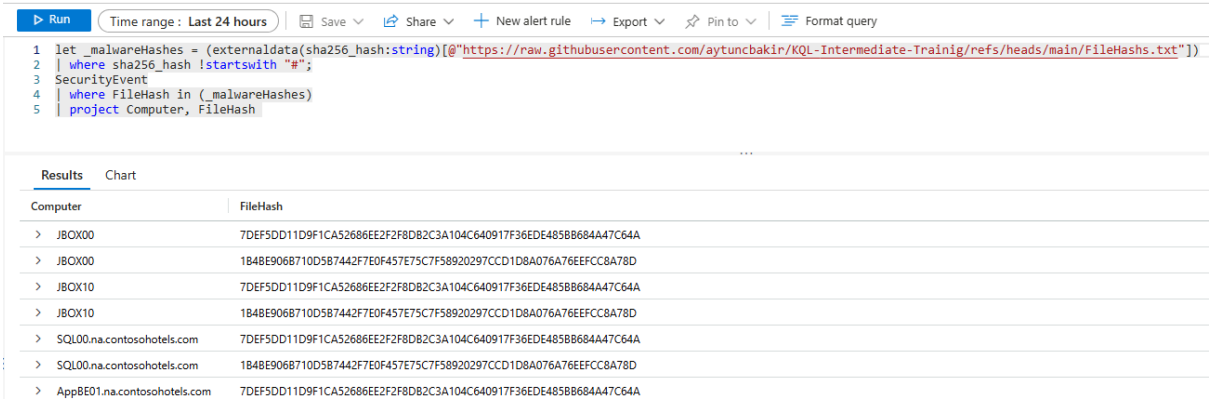


Homework

Environment: LA Demo
SecurityEvent
You have malicious FileHases at:

https://raw.githubusercontent.com/aytuncbakir/KQL-Intermediate-Trainig/refs/heads/main/FileHashs.txt

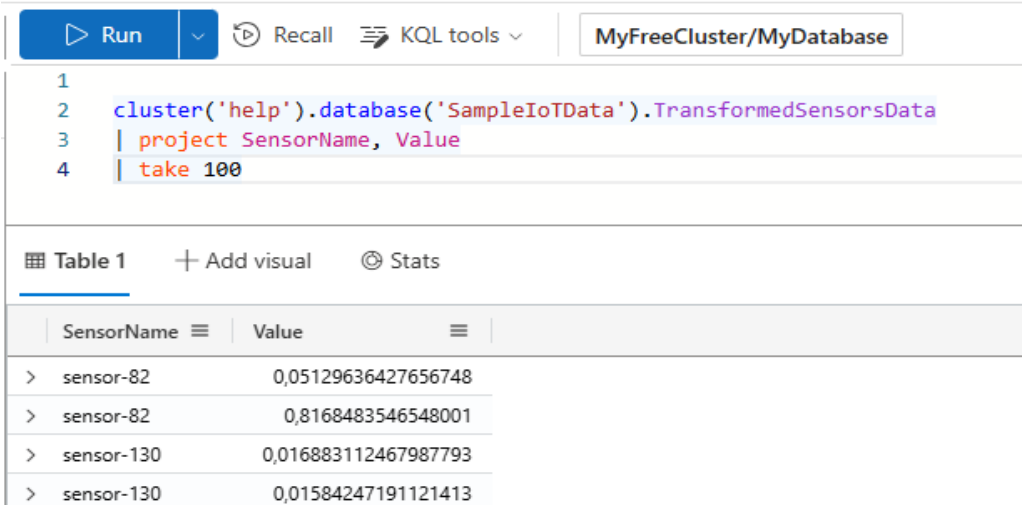
Hunt those given FileHashes by using KQL.

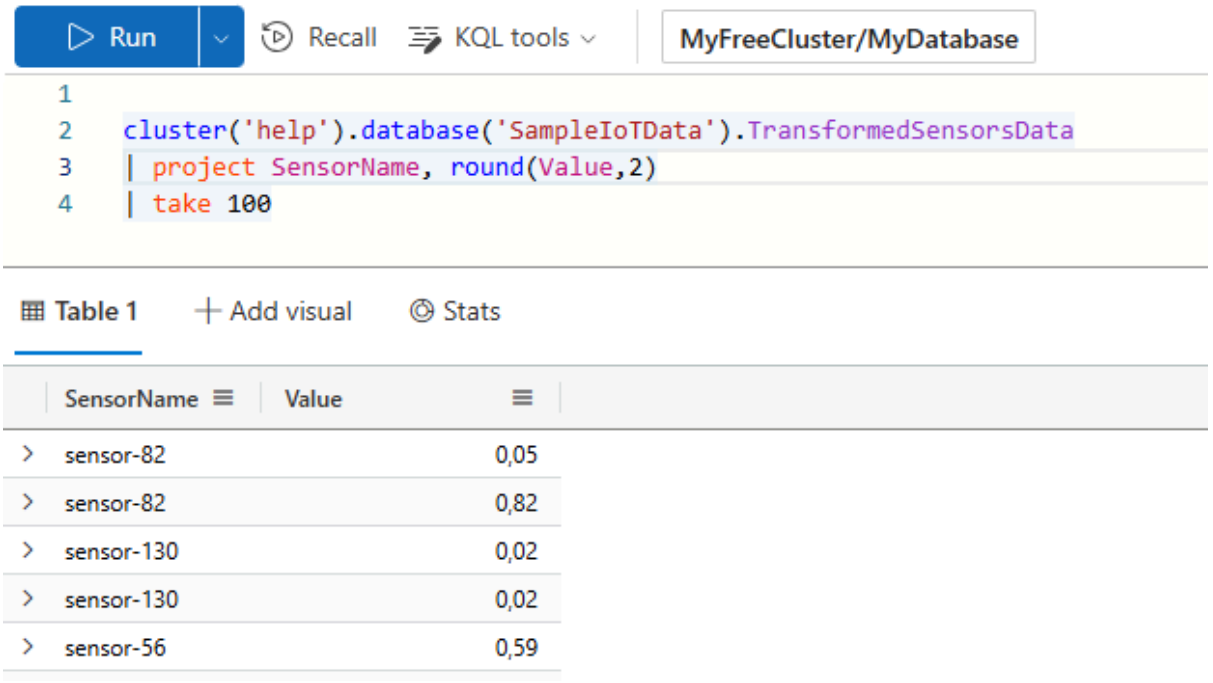


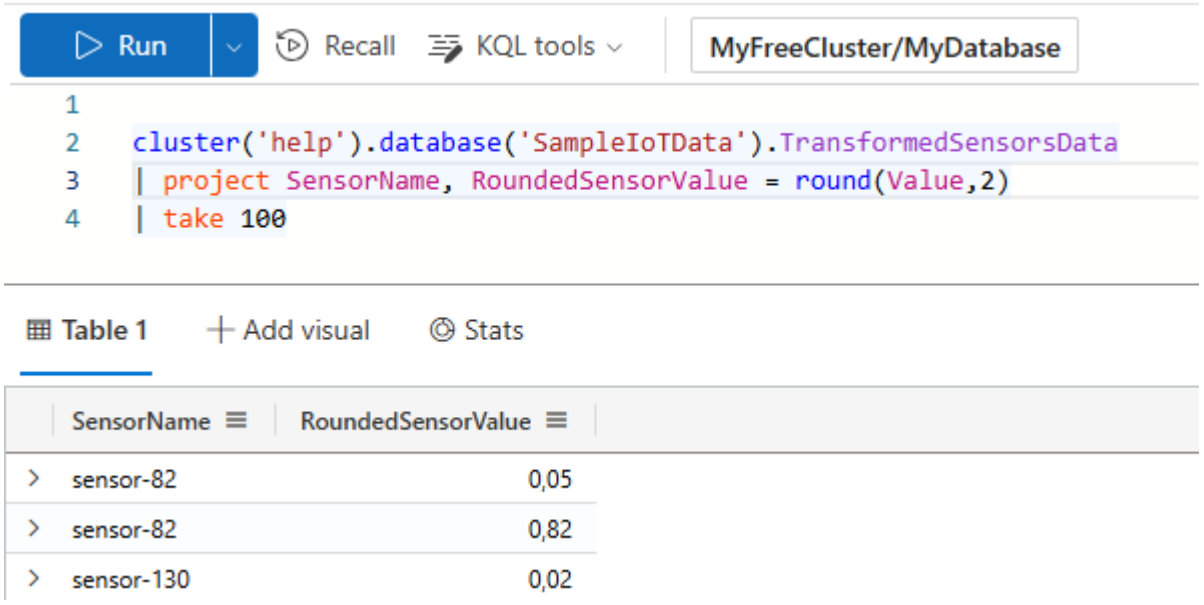
round(), arg_max(), union

round(): Returns the rounded number to the specified precision. The rounded number to the specified precision. Round is different from the bin() function in that the `round()` function rounds a number to a specific number of digits while the `bin()` function rounds the value to an integer multiple of a given bin size. For example, `round(2.15, 1)` returns 2.2 while `bin(2.15, 1)` returns 2.

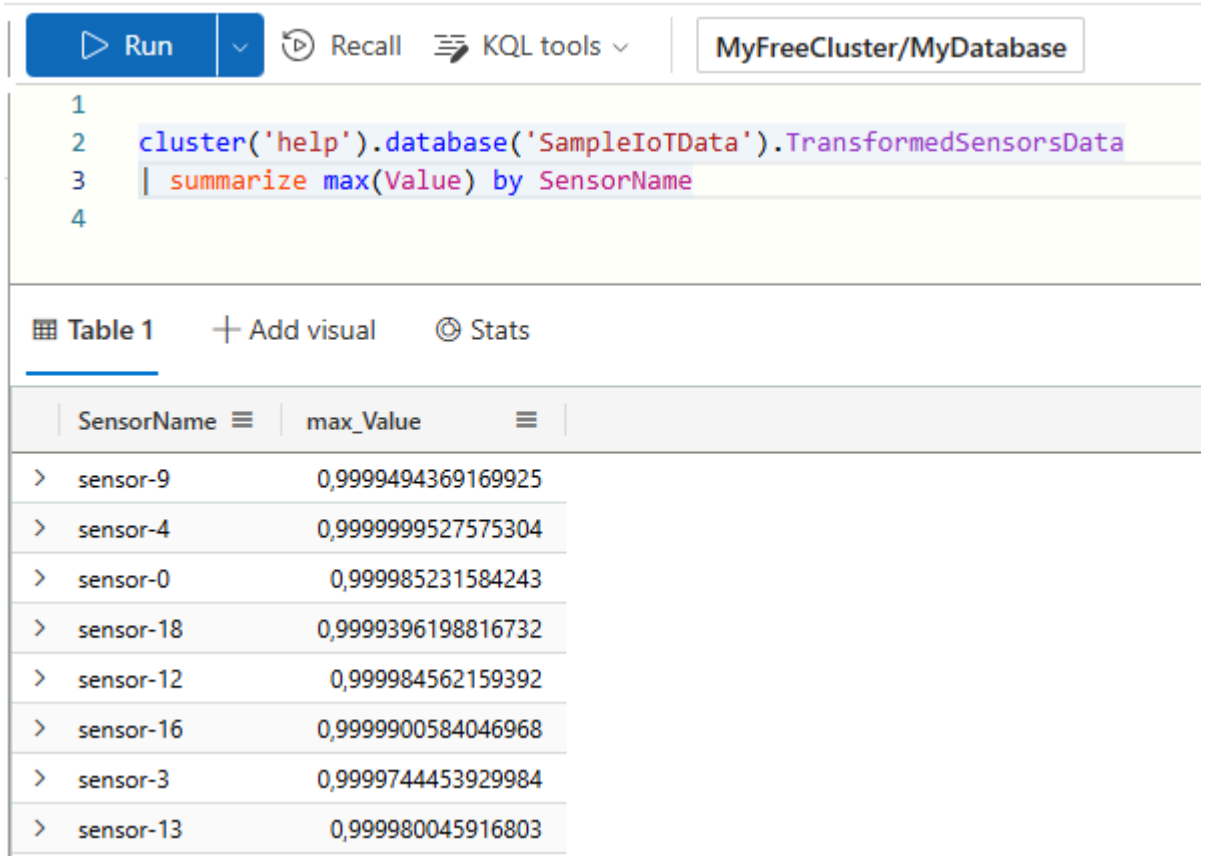
```
round(2.98765, 3)    // 2.988
round(2.15, 1)       // 2.2
round(2.15)          // 2 // equivalent to round(2.15, 0)
round(-50.55, -2)    // -100
round(21.5, -1)      // 20
```



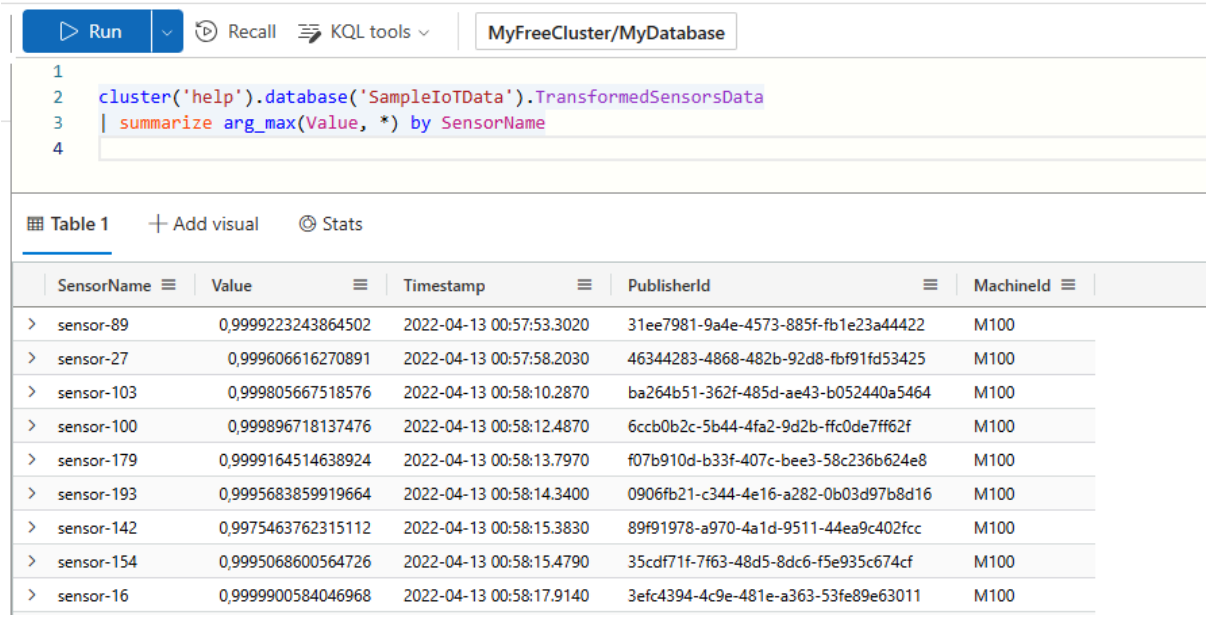




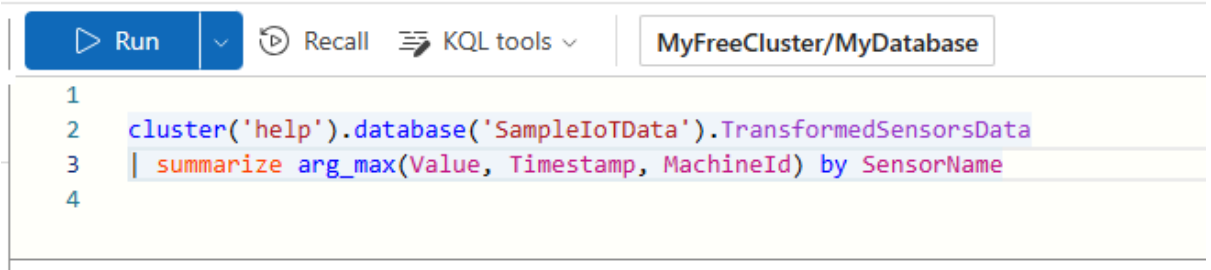
max():



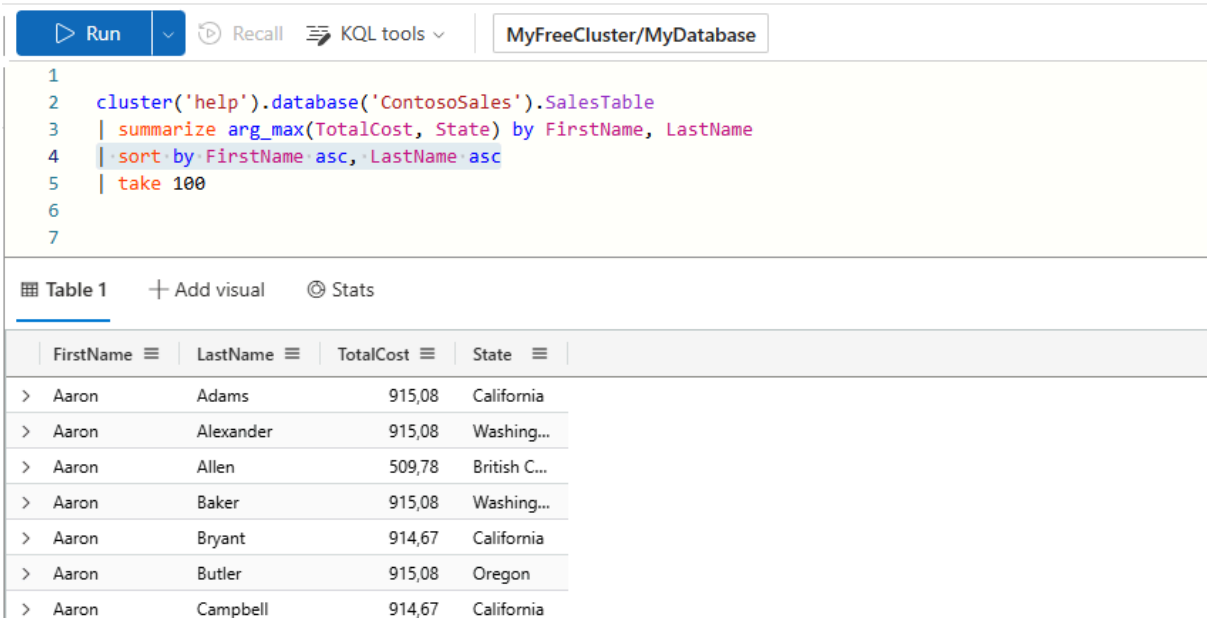
The arg_max() function differs from the max() function. The arg_max() function allows you to return additional columns along with the maximum value, and max() only returns the maximum value itself.



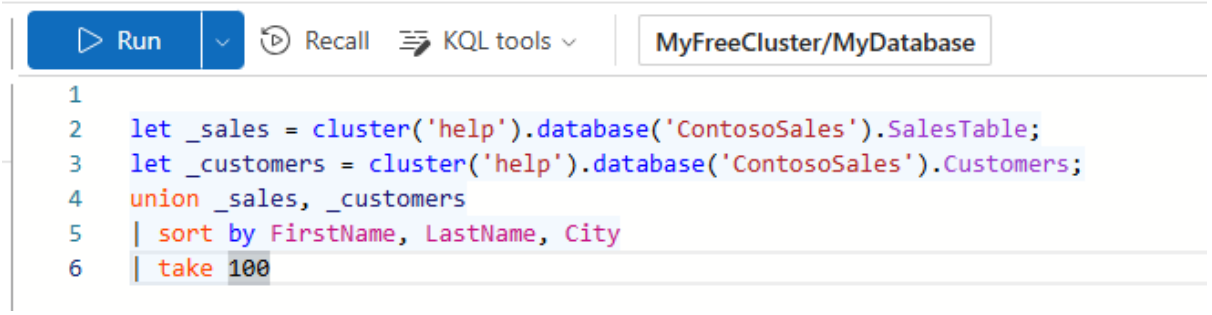
SensorName	Value	Timestamp	PublisherId	MachineId
sensor-89	0,9999223243864502	2022-04-13 00:57:53.3020	31ee7981-9a4e-4573-885f-fb1e23a44422	M100
sensor-27	0,999606616270891	2022-04-13 00:57:58.2030	46344283-4868-482b-92d8-fbf91fd53425	M100
sensor-103	0,999805667518576	2022-04-13 00:58:10.2870	ba264b51-362f-485d-ae43-b052440a5464	M100
sensor-100	0,999896718137476	2022-04-13 00:58:12.4870	6ccb0b2c-5b44-4fa2-9d2b-ffc0de7ff62f	M100
sensor-179	0,9999164514638924	2022-04-13 00:58:13.7970	f07b910d-b33f-407c-bee3-58c236b624e8	M100
sensor-193	0,9995683859919664	2022-04-13 00:58:14.3400	0906fb21-c344-4e16-a282-0b03d97b8d16	M100
sensor-142	0,9975463762315112	2022-04-13 00:58:15.3830	89f91978-a970-4a1d-9511-44ea9c402fcc	M100
sensor-154	0,9995068600564726	2022-04-13 00:58:15.4790	35cdf71f-7f63-48d5-8dc6-f5e935c674cf	M100
sensor-16	0,9999900584046968	2022-04-13 00:58:17.9140	3efc4394-4c9e-481e-a363-53fe89e63011	M100



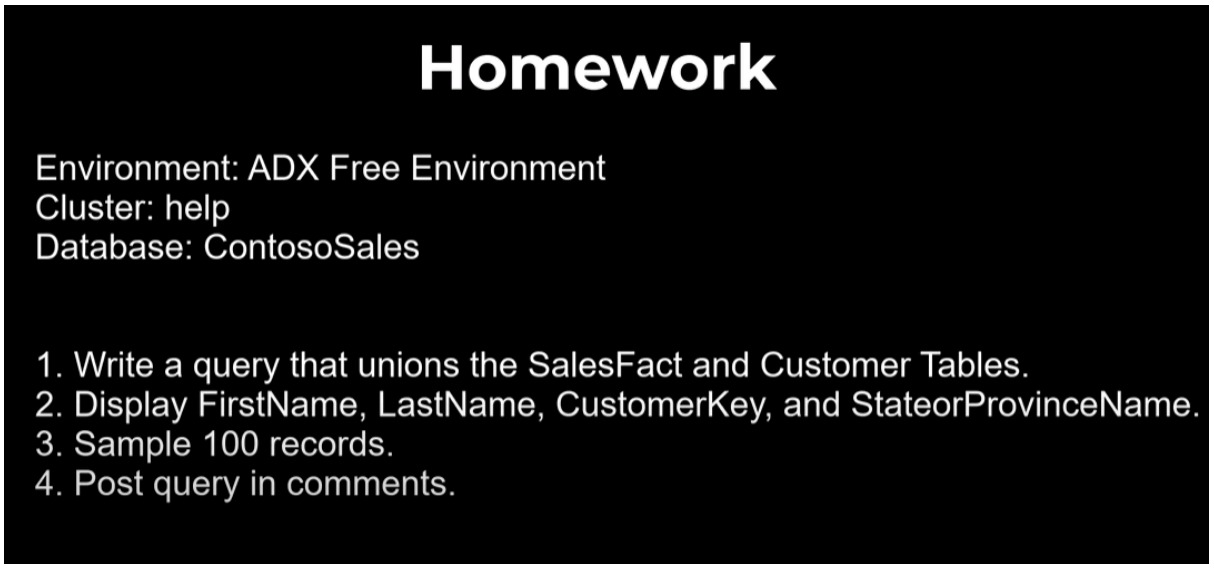
SensorName	Value	Timestamp	MachineId
sensor-89	0,9999223243864502	2022-04-13 00:57:53.3020	M100
sensor-27	0,999606616270891	2022-04-13 00:57:58.2030	M100
sensor-103	0,999805667518576	2022-04-13 00:58:10.2870	M100
sensor-100	0,999896718137476	2022-04-13 00:58:12.4870	M100
sensor-179	0,9999164514638924	2022-04-13 00:58:13.7970	M100
sensor-193	0,9995683859919664	2022-04-13 00:58:14.3400	M100



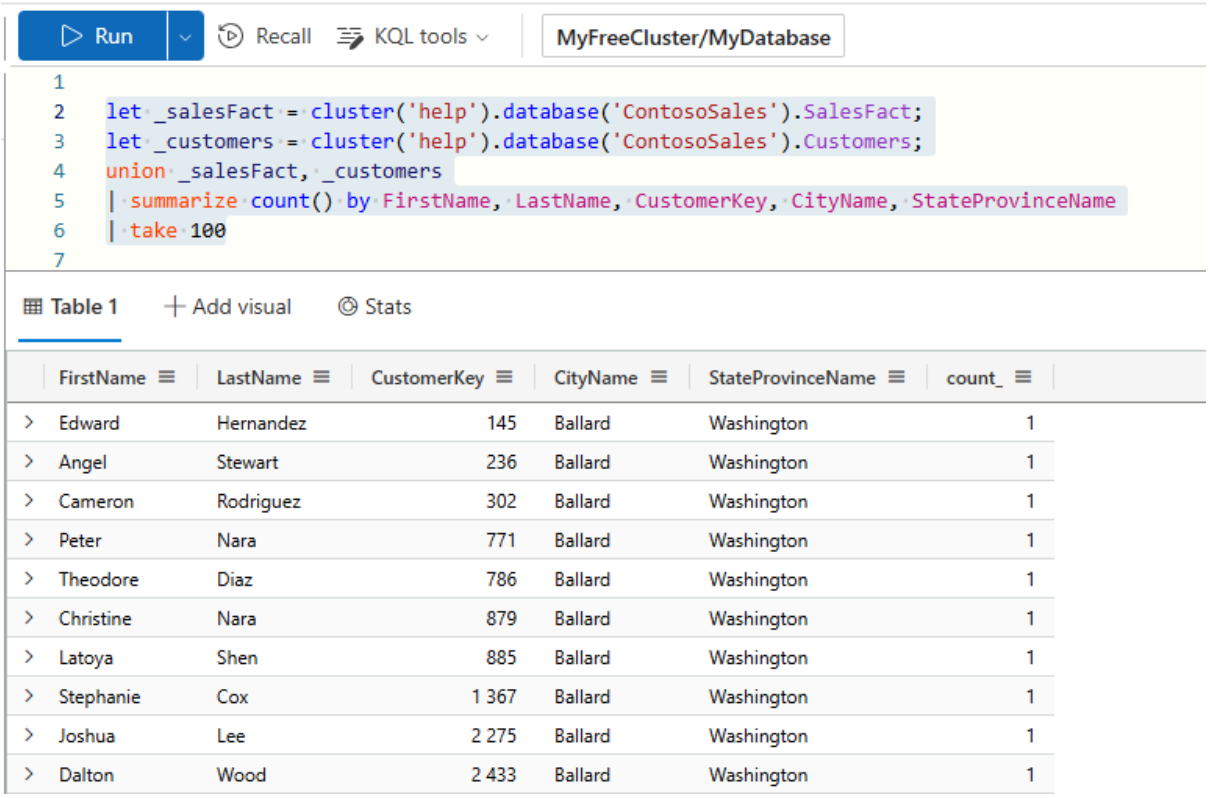
union operator: Takes two or more tables and returns the rows of all of them.



Taken from Ten Minute KQL YouTube Channel.



Solution:

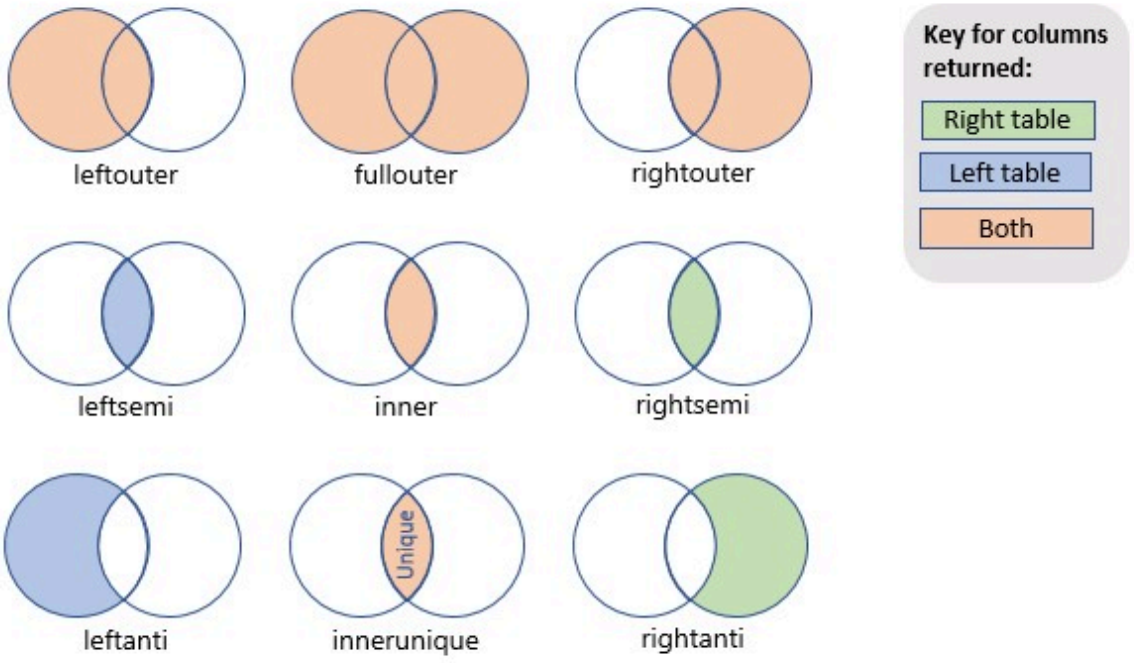

Run
Recall
KQL tools
MyFreeCluster/MyDatabase
let _salesFact = cluster('help').database('ContosoSales').SalesFact;
let _customers = cluster('help').database('ContosoSales').Customers;
union _salesFact, _customers
| summarize count() by FirstName, LastName, CustomerKey, CityName, StateProvinceName
| take 100
Table 1
Add visual
Stats
FirstName LastName CustomerKey CityName StateProvinceName count_
Edward Hernandez 145 Ballard Washington 1
Angel Stewart 236 Ballard Washington 1
Cameron Rodriguez 302 Ballard Washington 1
Peter Nara 771 Ballard Washington 1
Theodore Diaz 786 Ballard Washington 1
Christine Nara 879 Ballard Washington 1
Latoya Shen 885 Ballard Washington 1
Stephanie Cox 1 367 Ballard Washington 1
Joshua Lee 2 275 Ballard Washington 1
Dalton Wood 2 433 Ballard Washington 1

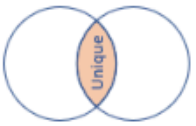
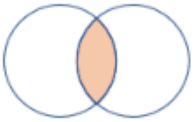
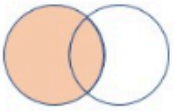
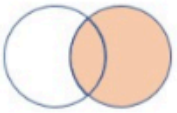
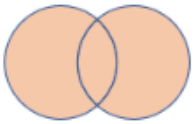
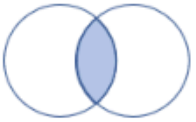
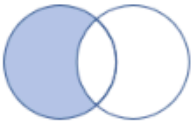
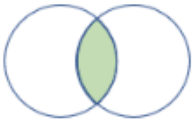
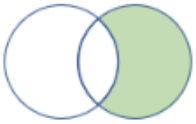
Join

Merge the rows of two tables to form a new table by matching values of the specified columns from each table.

Kusto Query Language (KQL) offers many kinds of joins that each affect the schema and rows in the resultant table in different ways. For example, if you use an `inner` join, the table has the same columns as the left table, plus the columns from the right table. For best performance, if one table is always smaller than the other, use it as the left side of the `join` operator.

The following image provides a visual representation of the operation performed by each join. The color of the shading represents the columns returned, and the areas shaded represent the rows returned.



Join flavor	Returns	Illustration
innerunique (default)	Inner join with left side deduplication **Schema:** All columns from both tables, including the matching keys **Rows:** All deduplicated rows from the left table that match rows from the right table	
inner	Standard inner join **Schema:** All columns from both tables, including the matching keys **Rows:** Only matching rows from both tables	
leftouter	Left outer join **Schema:** All columns from both tables, including the matching keys **Rows:** All records from the left table and only matching rows from the right table	
rightouter	Right outer join **Schema:** All columns from both tables, including the matching keys **Rows:** All records from the right table and only matching rows from the left table	
fullouter	Full outer join **Schema:** All columns from both tables, including the matching keys **Rows:** All records from both tables with unmatched cells populated with null	
leftsemi	Left semi join **Schema:** All columns from the left table **Rows:** All records from the left table that match records from the right table	
leftanti, anti, leftantisemi	Left anti join and semi variant **Schema:** All columns from the left table **Rows:** All records from the left table that don't match records from the right table	
rightsemi	Right semi join **Schema:** All columns from the right table **Rows:** All records from the right table that match records from the left table	
rightanti, rightantisemi	Right anti join and semi variant **Schema:** All columns from the right table **Rows:** All records from the right table that don't match records from the left table	

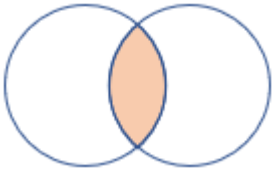
Let's create tables for practice:

```
let leftTable = datatable(id:int, value:string)
[
    0,"Hello",
    0,"Hola",
    1,"Salut",
    1,"Ciao",
    2,"Hei"
];
let rightTable = datatable(id:int, value:string)
[
    0,"World",
    0,"Mundo",
    1,"Monde",
    1,"Mondo",
    2,"Mailmaa"
];
```

	id	value
>	0	Hello
>	0	Hola
>	1	Salut
>	1	Ciao
>	2	Hei

	id	value
>	0	World
>	0	Mundo
>	1	Monde
>	1	Mondo
>	2	Mailmaa

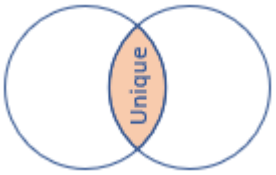
`inner join:` The `inner` join flavor is like the standard inner join from the SQL world. An output record is produced whenever a record on the left side has the same join key as the record on the right side.



```
leftTable
| join kind=inner rightTable on id
```

	id	value	id1	value1
>	0	Hola	0	World
>	0	Hello	0	World
>	0	Hola	0	Mundo
>	0	Hello	0	Mundo
>	1	Ciao	1	Monde
>	1	Salut	1	Monde
>	1	Ciao	1	Mondo
>	1	Salut	1	Mondo
>	2	Hei	2	Mailmaa

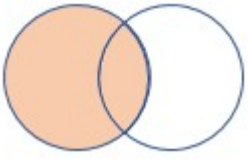
`innerunique join:` The `innerunique` join flavor removes duplicate keys from the left side. This behavior ensures that the output contains a row for every combination of unique left and right keys. By default, the `innerunique` join flavor is used if the `kind` parameter isn't specified. This default implementation is useful in log/trace analysis scenarios, where you aim to correlate two events based on a shared correlation ID. It allows you to retrieve all instances of the phenomenon while disregarding duplicate trace records that contribute to the correlation.




```
leftTable
| join kind=innerunique rightTable on id
```

	id	value	id1	value1
>	0	Hello	0	World
>	0	Hello	0	Mundo
>	1	Salut	1	Monde
>	1	Salut	1	Mondo
>	2	Hei	2	Mailmaa

`leftouter join:` The `leftouter` join flavor returns all the records from the left side table and only matching records from the right side table.



```
let leftTable = datatable(id:int, value:string)
[
    0,"Hello",
    0,"Hola",
    1,"Salut",
    1,"Ciao",
    2,"Hei",
    3,"Moi"
];
let rightTable = datatable(id:int, value:string)
[
    0,"World",
    0,"Mundo",
    1,"Monde",
    1,"Mondo",
    2,"Mailmaa",
    4,"Lume"
];
```

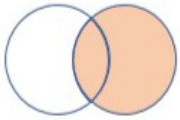
id	value
0	Hello
0	Hola
1	Salut
1	Ciao
2	Hei
3	Moi

id	value
0	World
0	Mundo
1	Monde
1	Mondo
2	Mailmaa
4	Lume

```
leftTable
| join kind=leftouter rightTable on id
```

id	value	id1	value1
0	Hola	0	World
0	Hello	0	World
0	Hola	0	Mundo
0	Hello	0	Mundo
1	Ciao	1	Monde
1	Salut	1	Monde
1	Ciao	1	Mondo
1	Salut	1	Mondo
2	Hei	2	Mailmaa
3	Moi		

rightjoin: The `rightouter` join flavor returns all the records from the right side and only matching records from the left side. This join flavor resembles the leftouter join flavor, but the treatment of the tables is reversed.



```
let leftTable = datatable(id:int, value:string)
[
    0,"Hello",
    0,"Hola",
    1,"Salut",
    1,"Ciao",
    2,"Hei",
    3,"Moi"
];
let rightTable = datatable(id:int, value:string)
[
    0,"World",
    0,"Mundo",
    1,"Monde",
    1,"Mondo",
    2,"Mailmaa",
    4,"Lume"
];
```

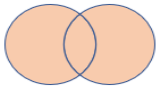
	id	value
>	0	Hello
>	0	Hola
>	1	Salut
>	1	Ciao
>	2	Hei
>	3	Moi

	id	value
>	0	World
>	0	Mundo
>	1	Monde
>	1	Mondo
>	2	Mailmaa
>	4	Lume

```
leftTable
| join kind=rightouter  rightTable on id
```

	id	value	id1	value1
>	0	Hola	0	World
>	0	Hello	0	World
>	0	Hola	0	Mundo
>	0	Hello	0	Mundo
>	1	Ciao	1	Monde
>	1	Salut	1	Monde
>	1	Ciao	1	Mondo
>	1	Salut	1	Mondo
>	2	Hei	2	Mailmaa
>			4	Lume

`fullouter join:` A `fullouter` join combines the effect of applying both left and right outer-joins. For columns of the table that lack a matching row, the result set contains `null` values. For those records that do match, a single row is produced in the result set containing fields populated from both tables.



```
let leftTable = datatable(id:int, value:string)
[
    0,"Hello",
    0,"Hola",
    1,"Salut",
    1,"Ciao",
    2,"Hei",
    3,"Moi"
];
let rightTable = datatable(id:int, value:string)
[
    0,"World",
    0,"Mundo",
    1,"Monde",
    1,"Mondo",
    2,"Mailmaa",
    4,"Lume"
];
```

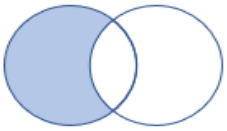
id	value
0	Hello
0	Hola
1	Salut
1	Ciao
2	Hei
3	Moi

id	value
0	World
0	Mundo
1	Monde
1	Mondo
2	Mailmaa
4	Lume

```
leftTable
| join kind=fullouter rightTable on id
```

id	value	id1	value1
0	Hola	0	World
0	Hello	0	World
0	Hola	0	Mundo
0	Hello	0	Mundo
1	Ciao	1	Monde
1	Salut	1	Monde
1	Ciao	1	Mondo
1	Salut	1	Mondo
2	Hei	2	Mailmaa
		4	Lume
3	Moi		

`leftsemi join:` The `leftsemi` join flavor returns all records from the left side that match a record from the right side. Only columns from the left side are returned.



```
let leftTable = datatable(id:int, value:string)
[
    0,"Hello",
    0,"Hola",
    1,"Salut",
    1,"Ciao",
    2,"Hei",
    3,"Moi"
];
let rightTable = datatable(id:int, value:string)
[
    0,"World",
    0,"Mundo",
    1,"Monde",
    1,"Mondo",
    2,"Mailmaa",
    4,"Lume"
];
```

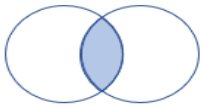
id	value
0	Hello
0	Hola
1	Salut
1	Ciao
2	Hei
3	Moi

id	value
0	World
0	Mundo
1	Monde
1	Mondo
2	Mailmaa
4	Lume

```
leftTable
| join kind=leftsemi rightTable on id
```

id	value
2	Hei
1	Ciao
1	Salut
0	Hola
0	Hello

`leftanti join:` The `leftanti` join flavor returns all records from the left side that don't match any record from the right side. The anti join models the "NOT IN" query.



```
let leftTable = datatable(id:int, value:string)
[
    0,"Hello",
    0,"Hola",
    1,"Salut",
    1,"Ciao",
    2,"Hei",
    3,"Moi"
];
let rightTable = datatable(id:int, value:string)
[
    0,"World",
    0,"Mundo",
    1,"Monde",
    1,"Mondo",
    2,"Mailmaa",
    4,"Lume"
];
```

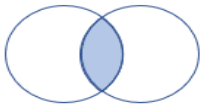
id	value
0	Hello
0	Hola
1	Salut
1	Ciao
2	Hei
3	Moi

id	value
0	World
0	Mundo
1	Monde
1	Mondo
2	Mailmaa
4	Lume

```
leftTable
| join kind=leftsemi rightTable on id
```

id	value
3	Moi

`rightsemi join:` The `rightsemi` join flavor returns all records from the right side that match a record from the left side. Only columns from the right side are returned.



```
let leftTable = datatable(id:int, value:string)
[
    0,"Hello",
    0,"Hola",
    1,"Salut",
    1,"Ciao",
    2,"Hei",
    3,"Moi"
];
let rightTable = datatable(id:int, value:string)
[
    0,"World",
    0,"Mundo",
    1,"Monde",
    1,"Mondo",
    2,"Mailmaa",
    4,"Lume"
];
```

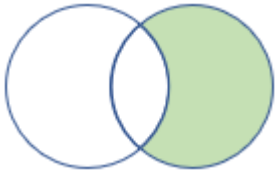
id	value
0	Hello
0	Hola
1	Salut
1	Ciao
2	Hei
3	Moi

id	value
0	World
0	Mundo
1	Monde
1	Mondo
2	Mailmaa
4	Lume

```
leftTable
| join kind=rightsemi rightTable on id
```

id	value
0	World
0	Mundo
1	Monde
1	Mondo
2	Mailmaa

`rightanti join:` The `rightanti` join flavor returns all records from the right side that don't match any record from the left side. The anti join models the "NOT IN" query.



```
let leftTable = datatable(id:int, value:string)
[
    0,"Hello",
    0,"Hola",
    1,"Salut",
    1,"Ciao",
    2,"Hei",
    3,"Moi"
];
let rightTable = datatable(id:int, value:string)
[
    0,"World",
    0,"Mundo",
    1,"Monde",
    1,"Mondo",
    2,"Mailmaa",
    4,"Lume"
];
```

id	value
0	Hello
0	Hola
1	Salut
1	Ciao
2	Hei
3	Moi

id	value
0	World
0	Mundo
1	Monde
1	Mondo
2	Mailmaa
4	Lume

```
leftTable
| join kind=rightanti rightTable on id
```

id	value
4	Lume