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# 1. Query Language Reference

Quantum uses an ANTLR-based query language (BIAPIQuery.g4) for filtering, searching, and constraining data across all REST endpoints. This single, consistent syntax works everywhere: list APIs, permission rules, and access resolvers.

## 1.1. Basic Syntax

### Operators

Operator	Symbol	Example
Equals	:	name:"Widget"
Not equals	:!	status:! "DELETED"
Less than	:<	price:<##100
Greater than	:>	quantity:>#50
Less than or equal	:≤	createdAt:≤2024-12-31
Greater than or equal	:>=	updatedAt:>=2024-01-01T00:00:00Z
Field exists	:~	description:~
In list	:^	status:^["ACTIVE","PENDING"]
Not in list	:!^	status:!^["DELETED","ARCHIVED"]

### Value Types

Type	Prefix	Example
String	none or "..."	name:widget or name:"Super Widget"
Number (integer)	#	quantity:#42
Number (decimal)	##	price:##19.99
Date	none	shipDate:2024-12-25
DateTime	none	createdAt:2024-12-25T10:30:00Z
Boolean	none	active:true
Null	none	description:null
ObjectId	none	id:507f1f77bcf86cd799439011
Reference	@@	parentId:@@507f1f77bcf86cd799439011
Variable	\${...}	ownerId:\${principalId}

## Logical Operators

Operator	Symbol	Example
AND	<code>&amp;&amp;</code>	<code>active:true &amp;&amp; price:&gt;##10</code>
OR	<code>  </code>	<code>status:"ACTIVE"    status:"PENDING"</code>
NOT	<code>!!</code>	<code>!(price:&lt;##5)</code>
Grouping	<code>()</code>	<code>(active:true    featured:true) &amp;&amp; price:&gt;##0</code>

## 1.2. Common Patterns

### String Matching

```
# Exact match
name:"Super Widget"

# Wildcard matching
name:*widget*      # contains "widget"
name:widget*       # starts with "widget"
name:*widget       # ends with "widget"
name:w?dget        # single character wildcard

# Case sensitivity (depends on database collation)
name:"WIDGET"       # may or may not match "widget"
```

### Numeric Ranges

```
# Price between 10 and 100
price:>=##10 && price:<=##100

# Quantity greater than 0
quantity:>#0

# Exact count
itemCount:#5
```

### Date and Time Queries

```
# Orders from today
createdAt:>=2024-12-25

# Orders from last week
createdAt:>=2024-12-18 && createdAt:<2024-12-25

# Specific timestamp
updatedAt:2024-12-25T14:30:00Z
```

```
# Orders modified this year
updatedAt:>=2024-01-01T00:00:00Z
```

## List Membership

```
# Status in specific values (IN)
status:^[ "ACTIVE", "PENDING", "PROCESSING" ]

# Exclude statuses (NOT IN)
status:!^[ "DELETED", "ARCHIVED" ]

# User IDs from a list (IN)
ownerId:^[ "user1", "user2", "user3" ]

# Exclude specific users (NOT IN)
ownerId:!^[ "user1", "user2" ]

# ObjectId list (IN)
categoryId:^[ @507f1f77bcf86cd799439011, @507f1f77bcf86cd799439012 ]

# ObjectId list (NOT IN)
categoryId:!^[ @507f1f77bcf86cd799439011, @507f1f77bcf86cd799439012 ]

# Mixed types (coerced automatically)
priority:^[ #1, #2, #3 ]

# Using variables (CSV expansion supported by access resolvers)
customerId:!^[ ${accessibleCustomerIds} ]
```

## Null and Existence Checks

```
# Field has any value (not null)
description:~

# Field is null
description:null

# Field is not null
description:!null

# Field exists and is not empty string
description:~ && description:!""
```

## 1.3. Advanced Examples

## Complex Business Logic

```
# Active products under $50 OR featured products at any price
(active:true && price:<##50) || featured:true

# Orders needing attention: overdue OR high-value pending
(dueDate:<2024-12-25 && status!="COMPLETED") ||
(status:"PENDING" && totalAmount:>##1000)

# Products with inventory issues
(quantity:<=#5 && reorderPoint:>#5) || stockStatus:"OUT_OF_STOCK"
```

## Multi-tenant Filtering

```
# User's own records
dataDomain.ownerId:${principalId}

# Organization-wide access
dataDomain.orgRefName:${orgRefName}

# Tenant-scoped with public sharing
dataDomain.tenantId:${pTenantId} || dataDomain.orgRefName:"PUBLIC"
```

## Audit and Compliance

```
# Records modified by specific user
auditInfo.lastUpdatedBy:"john.doe"

# Changes in date range
auditInfo.lastUpdatedDate:>=2024-12-01 &&
auditInfo.lastUpdatedDate:<2024-12-31

# Created vs modified
auditInfo.createdDate:auditInfo.lastUpdatedDate # never modified
auditInfo.createdDate:!auditInfo.lastUpdatedDate # has been modified
```

## 1.4. Variables in Filters

Variables are resolved from the current security context and can be used in permission rules and access resolvers.

### Standard Variables

Variable	Description
<code>\${principalId}</code>	Current user's ID
<code>\${pTenantId}</code>	Principal's tenant ID

Variable	Description
<code>\${pAccountId}</code>	Principal's account ID
<code>\${pOrgRefName}</code>	Principal's organization
<code>\${realm}</code>	Current realm/database
<code>\${area}</code>	Current functional area
<code>\${functionalDomain}</code>	Current functional domain
<code>\${action}</code>	Current action (CREATE, UPDATE, etc.)

## Custom Variables from Access Resolvers

```
// In your AccessListResolver
@Override
public String key() {
    return "accessibleCustomerIds"; // becomes ${accessibleCustomerIds}
}

@Override
public Collection<?> resolve(...) {
    return Arrays.asList("CUST001", "CUST002", "CUST003");
}
```

```
# Use in filter
customerId:^(${accessibleCustomerIds})
```

## 1.5. Performance Tips

### Efficient Queries

```
# Good: Use indexed fields first
status:"ACTIVE" && createdAt:>=2024-01-01

# Better: Combine with specific values
status:"ACTIVE" && ownerId:${principalId} && createdAt:>=2024-01-01

# Avoid: Leading wildcards on large collections
name:*widget # can be slow on millions of records
```

### Projection for Large Objects

```
# In REST calls, limit returned fields
GET /products/list?filter=active:true&projection=+id,+name,+price,-description
```

## 1.6. Integration with REST APIs

### List Endpoints

```
# Basic filtering
GET /products/list?filter=active:true

# With sorting and pagination
GET /products/list?filter=price:>##10&sort=-createdDate&skip=20&limit=10

# Complex filter with projection
GET
/orders/list?filter=(status:"PENDING"||status:"PROCESSING")&&totalAmount:>##100&projection=+id,+status,+totalAmount,+customerName
```

### Permission Rules

```
- name: user-own-records
  priority: 300
  match:
    method: [GET]
    url: /api/**
  effect: ALLOW
  andFilterString: "dataDomain.ownerId:${principalId}"
```

### Access Resolvers

```
// Resolver returns customer IDs user can access
public Collection<?> resolve(...) {
    return customerService.getAccessibleIds(principalId);
}

// Used in permission rule
andFilterString: "customerId:^(${accessibleCustomerIds})"
```

## 1.7. Error Handling

Common syntax errors and solutions:

```
# Wrong: Missing quotes for multi-word strings
name:Super Widget
# Right:
name:"Super Widget"

# Wrong: Incorrect number prefix
price:19.99
```

```
# Right:  
price:##19.99
```

```
# Wrong: Invalid date format  
createdDate:12/25/2024
```

```
# Right:  
createdDate:2024-12-25
```

```
# Wrong: Unbalanced parentheses  
(active:true && price:>##10
```

```
# Right:  
(active:true && price:>##10)
```

## 1.8. See Also

- [REST CRUD Querying](#)
- [Permission Rules](#)
- [Access Resolvers](#)