

# DomainContext, RuleContext, and DataDomain

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Quantum enforces multi-tenant isolation and sharing through contextual data carried on models and evaluated at runtime.

# Chapter 1. DataDomain

Every persisted model includes a DataDomain that describes ownership and scope, commonly including fields such as:

- `tenantId`: Identifies the tenant
- `orgRefName`: Organization unit reference within a tenant
- `ownerId`: Owning user or system entity
- `realm`: Optional runtime override for partitioning

These fields enable filtering, authorization, and controlled sharing of data between tenants or org units.

# Chapter 2. DomainContext

DomainContext represents the current execution context for a request or operation, typically capturing:

- current tenant/org/user identity
- functional area / functional domain
- the action being executed (e.g., CREATE, UPDATE, VIEW, DELETE, ARCHIVE)

It feeds downstream components (repositories, resources) to consistently apply filtering and policy decisions.

# Chapter 3. RuleContext

RuleContext encapsulates policy evaluation. It can:

- Enforce whether an action is allowed for a given model and DataDomain
- Produce additional filters and projections used by repositories
- Grant cross-tenant read access for specific functional areas (e.g., shared catalogs) while keeping others strictly isolated

# Chapter 4. End-to-End Flow

1. A REST request enters a BaseResource-derived endpoint.
2. The resource builds a DomainContext from the security principal and request parameters.
3. RuleContext evaluates permissions and returns effective filters.
4. Repository applies filters (DataDomain-aware) to find/get/list/update/delete.
5. The model's UIActionList can be computed to reflect what the caller can do next.

This pattern ensures consistent enforcement across all CRUD operations, independent of the specific model or repository.

# Chapter 5. Resolvers and Variables in Rule Filters

RuleContext can attach FILTERs (not only ALLOW/DENY) to repository queries using rule fields and filter strings. Variables inside those filter strings are populated from:

- PrincipalContext and ResourceContext standard variables: principalId, pAccountId, pTenantId, ownerId, orgRefName, resourceId, action, functionalDomain, area
- AccessListResolver SPI implementations: per-request computed Collections (e.g., customer IDs the caller can access)

Implementation highlights: - AccessListResolver has methods key(), supports(...), resolve(...). Resolvers are injected and invoked for each request; results are published as variables by key. - MorphiaUtils.VariableBundle carries both string variables and object variables (including collections) to the query listener. - The QueryToFilterListener supports IN clauses using a single \${var} inside brackets, expanding Collections/arrays and coercing types (ObjectId, numbers, booleans, dates).

Authoring examples: - Constrain by principal domain:

+

```
orgRefName:${orgRefName} && dataDomain.tenantId:${pTenantId}
```

- Access list resolver for customer visibility:

```
customerId:^([${accessibleCustomerIds}])
```

For the complete query language reference, see [Query Language](#).

# Chapter 6. Concrete example: building and using a resolver

This section shows how to implement a resolver that restricts access to orders by the set of customerIds the current user is allowed to see.

## 6.1. 1) Implement the SPI

Create a CDI bean that implements `AccessListResolver`. It decides when it applies and returns a Collection of values. The collection can be `ObjectId`, `String`, numbers, etc.

```
import com.e2eq.framework.securityrules.AccessListResolver;
import com.e2eq.framework.model.persistent.base.UnversionedBaseModel;
import com.e2eq.framework.model.securityrules.PrincipalContext;
import com.e2eq.framework.model.securityrules.ResourceContext;
import jakarta.enterprise.context.ApplicationScoped;
import jakarta.inject.Inject;
import org.bson.types.ObjectId;
import java.util.*;

@ApplicationScoped
public class CustomerAccessResolver implements AccessListResolver {

    @Inject CustomerAccessService service; // your app-specific service

    @Override
    public String key() {
        // This becomes the variable name available to rules: ${accessibleCustomerIds}
        return "accessibleCustomerIds";
    }

    @Override
    public boolean supports(PrincipalContext pctx, ResourceContext rctx,
                           Class<? extends UnversionedBaseModel> modelClass) {
        // Optionally narrow by area/domain/action/model
        return rctx != null && "sales".equalsIgnoreCase(rctx.getArea())
            && "order".equalsIgnoreCase(rctx.getFunctionalDomain());
    }

    @Override
    public Collection<?> resolve(PrincipalContext pctx, ResourceContext rctx,
                                Class<? extends UnversionedBaseModel> modelClass) {
        // Return the set of customer ids for this user; could be ObjectId or String.
        // Example returns strings; the query listener will coerce 24-hex to ObjectId.
        return service.findCustomerIdsForUser(pctx.getUserId());
    }
}
```

Notes: - You can return `List<ObjectId>` directly if you prefer; no coercion needed then. - The resolver runs per request. Cache internally if the computation is expensive.

## 6.2. 2) How RuleContext uses resolvers

At query time, `RuleContext` discovers all `AccessListResolver` beans and calls `supports(...)`. For those that apply, it invokes `resolve(...)` and publishes the result into the variable bundle under the provided key(). Variables are available to the BI-API query via `${...}`.

Internally this uses `MorphiaUtils.VariableBundle` and `QueryToFilterListener` to carry both strings and typed objects/collections. Starting with this release you can reuse the exact same variable bundle for custom evaluation paths. The `RuleContext.resolveVariableBundle(...)` helper runs all matching `AccessListResolver` beans and returns the maps you can feed directly into `QueryPredicates` (for in-memory rules) or any other component that understands `${var}` tokens.

```
PrincipalContext pc = ...; // build from request
ResourceContext rc = ...;

MorphiaUtils.VariableBundle vars = ruleContext.resolveVariableBundle(pc, rc,
    UserProfile.class);

Predicate<JsonNode> predicate = QueryPredicates.compilePredicate(
    "customerId^[${accessibleCustomerIds}]",
    vars.strings,
    vars.objects
);

JsonNode order = QueryPredicates.toJsonNode(Map.of("customerId",
    "5f1e1a5e5e5e5e5e5e5e5e51"));
boolean allowed = predicate.test(order); // true when resolver returned that ObjectId
```

This allows the same resolver outputs to drive Morphia queries and client-side predicate checks without duplicating resolver logic.

## 6.3. 3) Author a rule that consumes the variable

Given the resolver above, a rule can attach an IN filter to constrain queries:

```
// andFilterString (example)
customerId^[${accessibleCustomerIds}]
```

When executed: - If `accessibleCustomerIds` is a Collection/array, each element is type-coerced (`ObjectId`, number, date, boolean, or string) and used in `$in`. - If `accessibleCustomerIds` is a comma-separated string, it is split and each token is coerced similarly. - An empty collection results in an empty `$in` (matches none), effectively denying access via filtering, not via ALLOW/DENY.

## 6.4. 4) End-to-end behavior

- SecurityFilter sets ResourceContext (area/domain/action) per request.
- RuleContext evaluates rules for the principal and resource and gathers resolvers.
- The repository composes filters including the rule-provided IN clause with the access list.
- Only documents whose customerId is in the caller's resolved set are returned.

## 6.5. String literals vs. typed values in resolver variables

When an `AccessListResolver` returns a list of values that will be used in an `IN` clause (for example, `field:^[${var}]`), the engine attempts to coerce each element to an appropriate type so Mongo/Morphia filters are typed correctly:

- 24-hex string → `ObjectId`
- `true/false` → `Boolean`
- integer → `Long`
- decimal → `Double`
- ISO-8601 datetime → `java.util.Date`
- `yyyy-MM-dd` → `java.time.LocalDate`
- otherwise → `String`

This works well when your target field is an `ObjectId`, number, or date. However, string fields can contain values that look like other types (for example, a 24-hex string that resembles an `ObjectId`). In those cases you must force "treat as plain string" so no coercion occurs.

To do this, the framework provides a small wrapper type `StringLiteral`. If a resolver returns `StringLiteral` instances, the listener unwraps them to plain `String` values and skips coercion entirely.

### 6.5.1. Example A: Resolver returns ObjectIds (typed)

```
@ApplicationScoped
public class CustomerAccessResolver implements AccessListResolver {
    public static final ObjectId ID1 = new ObjectId("5f1e1a5e5e5e5e5e5e51");
    public static final ObjectId ID2 = new ObjectId("5f1e1a5e5e5e5e5e5e52");

    @Override public String key() { return "accessibleCustomerIds"; }
    @Override public boolean supports(PrincipalContext p, ResourceContext r, Class<?
extends UnversionedBaseModel> m) {
        return r != null && "sales".equalsIgnoreCase(r.getArea()) && "order"
.equalsIgnoreCase(r.getFunctionalDomain()) && "view".equalsIgnoreCase(r.getAction());
    }
    @Override public Collection<?> resolve(PrincipalContext p, ResourceContext r,
```

```

Class<? extends UnversionedBaseModel> m) {
    return java.util.List.of(ID1, ID2); // typed values pass through as-is
}

```

Rule:

```
customerId:^(#{accessibleCustomerIds})
```

Result: `$in` with `List<ObjectId>` on `customerId`.

### 6.5.2. Example B: Resolver returns String literals (force raw strings)

```

@ApplicationScoped
public class CustomerCodeResolver implements AccessListResolver {
    @Override public String key() { return "accessibleCustomerCodes"; }
    @Override public boolean supports(PrincipalContext p, ResourceContext r, Class<?
extends UnversionedBaseModel> m) {
        return r != null && "sales".equalsIgnoreCase(r.getArea()) && "order"
.equalsIgnoreCase(r.getFunctionalDomain()) && "view".equalsIgnoreCase(r.getAction());
    }
    @Override public Collection<?> resolve(PrincipalContext p, ResourceContext r,
Class<? extends UnversionedBaseModel> m) {
        return java.util.List.of(
            com.e2eq.framework.model.persistent.morphia.StringLiteral.of(
                "5f1e1a5e5e5e5e5e5e5e5e51"),
            com.e2eq.framework.model.persistent.morphia.StringLiteral.of("CUST-42")
        );
    }
}

```

Rule:

```
customerCode:^(#{accessibleCustomerCodes})
```

Result: `$in` with `List<String>` on `customerCode` (even for hex-like strings).

### 6.5.3. Other types supported

Resolvers can also return numbers, booleans, and dates/datetimes. Already-typed elements (Number, Boolean, java.util.Date, java.time.LocalDate, ObjectId) are preserved. String elements are heuristically parsed into those types unless wrapped with `StringLiteral`.

Authoring tips:

- Prefer returning already-typed values when you know the target field type.

- Use `StringLiteral` when a value might be misinterpreted (for example, 24-hex or numeric-looking strings).
- For CSV strings published under a variable, the engine splits by comma and applies the same per-element coercion.

## 6.6. Using AccessListResolver with Ontology (optional)

When ontology is enabled, an `AccessListResolver` can compute ID lists from semantic edges (materialized in Mongo) and publish them as variables for use in rule filters.

Example resolver (conceptual)

```
@ApplicationScoped
public class OrdersByOrgResolver implements AccessListResolver {
    @Inject EdgeDao edgeDao; // from quantum-ontology-mongo
    @Override public String key() { return "idsByPlacedInOrg"; }
    @Override public boolean supports(PrincipalContext p, ResourceContext r, Class<?
extends UnversionedBaseModel> model) {
        return model.getSimpleName().equals("Order");
    }
    @Override public Collection<?> resolve(PrincipalContext p, ResourceContext r, Class
<? extends UnversionedBaseModel> model) {
        String tenantId = p.getDataDomain().getTenantId();
        String org = p.getDataDomain().getOrgRefName();
        return edgeDao.srcIdsByDst(tenantId, "placedInOrg", org);
    }
}
```

Rule filter usage

```
id:^{idsByPlacedInOrg}
```

Notes

- Always scope by `tenantId` from `RuleContext/PrincipalContext`.
- This is optional and only active if you wire ontology components. For a deeper integration path, see [Integrating Ontology](#).