OMG-ATDM - 1.0

Summary: Documentation for the **OMG-ATDM** extension.

Extension ID

com.castsoftware.omg-atdm

What's new?

Please see **OMG-ATDM - 1.0 - Release Notes** for more information.

Description

ATDM (Automated Technical Debt Measure), is an OMG standard that has been submitted by the **CISQ Consortium**. This extension implements the OMG Automated Technical Debt Measure to estimate future corrective maintenance costs, i.e. the technical debt of the application in number of minutes, as described in the OMG ATDM specification 1.0, see: **https://www.omg.org/spec/ATDM/1.0/PDF**.

Note that this extension is not a replacement for the built-in **Technical Debt measures** included in CAST AIP "out-of-the box". Indeed both the existing Technical Debt measures and this extension **can be used at the same time**. In other words, the installation of this extension does not mean that the calculation of the existing Technical Debt measures will be disabled.

Compatibility

Product	Release	Supported
AIP Core	8.3.21 for 1.0.0-beta releases and 1.0.0-funcrel	✅
	8.3.24 for 1.0.1-funcrel	✅

CAST RestAPI		✅
CAST Engineering Dashboard	• 1.19 - 1.21 = beta5 • 1.22 beta6	✅
CAST Health Dashboard	-	✅
CAST Security Dashboard	1.19	✅

OMG-ATDM version

1.0 (September 2018)	✅

Dependencies with other extensions

Some CAST extensions require the presence of other CAST extensions in order to function correctly. The **OMG-ATDM** extension requires that the following other CAST extensions are also installed - these will be installed automatically when you install OMG-ATDM Index:

- **CISQ-Index (1.0.0-funcrel** when using **OMG-ATDM 1.0.1-funcrel**)

Download and installation instructions

- **Download an extension**
- **Install an extension**

Assessment Model

The extension calculates the following metrics as a **Sizing Measures**:

Release	Metric ID	Name	Description
beta3	**1062030**	OMG-ATDM: Remediation Effort ADDED	Measures the added remediation effort in number of minutes between two snapshots. Results are available at Application, Module, CISQ Business Criteria, CISQ Technical Criteria, Rule and Object level.
beta3	**1062032**	OMG-ATDM: Remediation Effort DELETED	Measures the removed remediation effort in number of minutes between two snapshots. Results are available at Application, Module, CISQ Business Criteria, CISQ Technical Criteria, Rule and Object level.
beta2	**1062010**	OMG-ATDM: Number of occurrences	An occurrence (or Pattern Occurrence) designates a single instance of a Source Code Pattern (or Pattern) representing a weakness that has been implemented in the measured software. (ASCMM, ASCRM, ASCPEM, ASCSM). This sizing measure keeps, per snapshot, the number of occurrences per object, rule, CISQ Technical Criterion and CISQ Business Criterion.
beta2	**1062011**	OMG-ATDM: Complexity	The Complexity - or Effort Complexity - of the code elements implementing an Occurrence is qualification information that is measured according to the Effort Complexity definition from the Automated Enhancement Points (AEP) specification. (AEP).
beta2	**1062012**	OMG-ATDM: Exposure	The Exposure of an Occurrence is qualification information that measures the level of connectedness of the Occurrence with the rest of the software, both directly and indirectly through call paths.
beta2	**1062013**	OMG-ATDM: Concentration	Concentration is qualification information that measures the number of Occurrences within any Code Element in the software.
beta2	**1062014**	OMG-ATDM: Technological Diversity	The Technological Diversity of an Occurrence is qualification information that measures the number of distinct programming languages in which the code elements included in a single occurrence of a source code pattern are written.
beta2	**1062015**	OMG-ATDM: Gap Size	In the context of patterns which rely on roles that model values and threshold values that are not to be exceeded, the gap between these values must be closed to remediate this weakness; the Occurrence Gap Size is the extent of the gap, measured as the difference between the values and the thresholds.
beta2	**1062016**	OMG-ATDM: Adjustment Factor	Adjustment Factor is computed based on qualification measures.

beta1	**1062020**	OMG-ATDM: Adjusted Remediation Effort	Remediation Effort designates the time required to remove an occurrence – or a set of occurrences – of a Technical Debt Item from the software. It covers the coding activity as well as unit/non-regression testing activities.

How are results calculated?

Predefined Un-Adjusted Remediation Effort

Configuration data is loaded to have the remediation effort for each CISQ Pattern. This is called **Un-Adjusted Remediation Effort**. The unit of effort is **minute**. The effort taken in to account by ATDM for each pattern is **EFFORT_DEFAULT**.

E.g.:

```
UNADJ_REMEDIATION_EFFORT
STANDARD : CISQ
PATTERN : ASCPEM-PRF-15
EFFORT_DEFAULT: 90
EFFORT_MIN: 30
EFFORT_MAX: 210
EFFORT_UNIT: MIN
```

For all violations of pattern ASCPEM-PRF-15, the **Un-Adjusted Remediation Effort** is equal to **90 minutes**.

Scope

All CAST rules mapped to the CISQ 1.0 (December 2016) standard.

- For each of the violations, the **number of occurrences** and **related objects** are collected, with **related technologies**.
- For a violation of type **Bookmark**, the **number of occurrences** corresponds to the **number of bookmarks** and the related object is the main object of the violation.
- For a violation of type **Path**, the **number of occurrences** corresponds to the **number of paths**, and the related objects are the main object of the violation, plus all related objects in the path(s)

Qualification information

Complexity

The Complexity - or Effort Complexity - of the code elements implementing an **Occurrence** is qualification information that is measured according to the Effort Complexity definition from Automated Enhancement Points:

```
EC/LowEffortComplexity
```

EC is computed by the following metrics:

- 10351: EC ADDED
- 10353: EC UPDATED
- 10354: EC UNCHANGED

LowEffortComplexity

The technology related Low Complexity column for ADDED artifacts (from COST_CONFIG). When the violation has related objects, then the average EC of all objects is taken in to account. The complexity is computed for the main object violating a rule:

```
Complexity = AVG ( Effort Complexity all objects of the violation )/ Low Complexity for the related technology
```

Concentration

Concentration is qualification information that measures the number of Occurrences within any Code Element in the software:

```
1/nb of time the object violates any rule
```

Exposure

The Exposure of an Occurrence is qualification information that measures the level of contentedness of the Occurrence with the rest of the software, both directly and indirectly through call paths:

```
1+log(nb paths)
```

Technical diversity

The Technological Diversity of an **Occurrence** measures the number of distinct technologies in which the code elements included in a single occurrence of a source code pattern are written. This is set to 1.

Gap size

In the context of patterns which rely on roles that model values and **threshold** values that are not to be exceeded, the gap between these values must be closed to re-mediate this weakness. This is set to 1.

Adjustment Factor

The adjustment factor is computed based on qualification information, as follows:

```
AVG(Complexity) X AVG(Exposure) X Count(Technological diversity) X AVG(Concentration) X Sum(Gap size)
```

Technical debt

Finally the technical debt is computed by:

```
Nb Of Occurrences X Adjustment Factor X Un-adjusted Remediation Effort
```

Result storage

In **1.0.0-beta6**, new result storage methods were implemented as described below.

Default result storage method - high level data only

By default only data aggregated at the following level is available and is stored in the Dashboard schema table **DSS_METRIC_RESULTS:**

- **Application**
- **Module**
- **Technical Criteria**
- **Business Criteria**

Detailed information at **Object** and **Rule** level can be generated and made available to the dashboard **on demand** by executing the following query against the Dashboard schema:

```
select OMG_ATDM_COMPUTE_DETAILS (SNAPSHOT_ID, OBJECT_ID, RULE_ID)
```

Where:

SNAPSHOT_ID	Is the ID of the snapshot you want to generate detailed object and rule level information for.
RULE_ID	The ID of the rule you want to generate detailed information for. Note that if **RULE_ID = -1**, detailed information will be generated for **all rules**.
OBJECT_ID	The ID of the object you want to generate detailed information for. Note that if **OBJECT_ID = -1**, detailed information will be generated for **all objects**.

When the next snapshot is generated, detailed object/rule level information will be saved in the table **OMGTD_RESULTS**.

Alternative result storage method - all data

This method is not recommended for very large Applications, since the impact on performance of generating all data for every snapshot will be significant.

It is possible to change the behaviour and choose to **always save all results** (including Object and Rule level information) for every snapshot that is generated. To do so, execute the following query against the Dashboard schema:

```
select OMG_ATDM_DETAILSALL();
```

This option will be taken in account when a new snapshot is generated and as a result all information is saved as follows:

- **Application, Module, Technical Criteria, Business Criteria** - aggregated in the table **DSS_METRIC_RESULTS**
- Details for **Object** and **Rule** levels stored in the table **OMGTD_RESULTS**

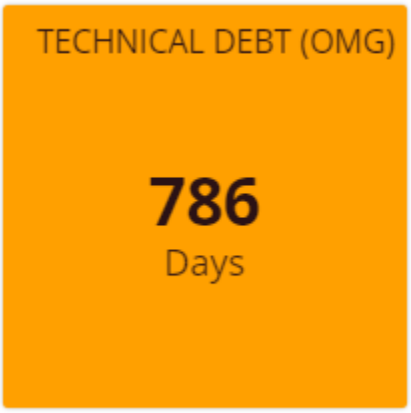
To disable the storage of all details, execute the following query against the Dashboard schema:

```
select OMG_ATDM_DETAILSONDEMAND();
```

What results can you expect?

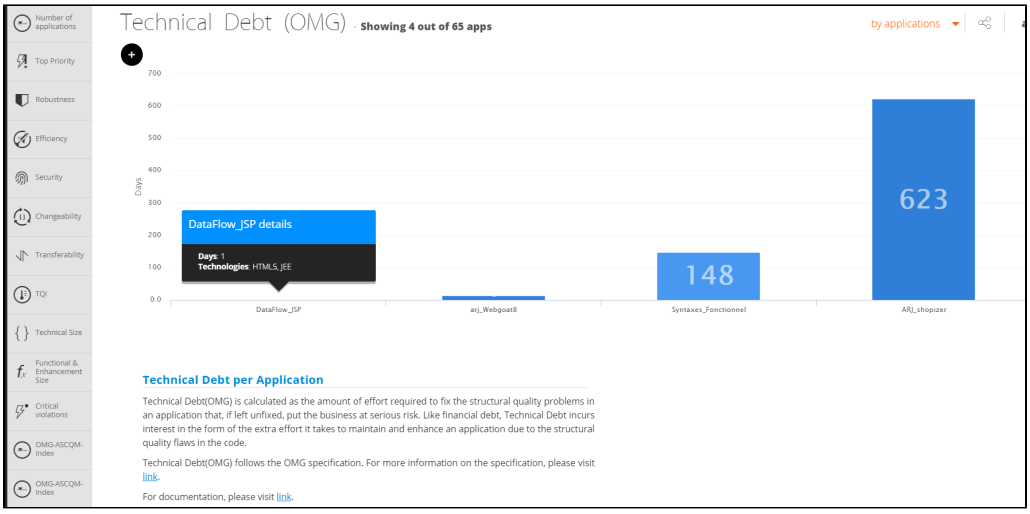
Health Dashboard tiles

Two tiles are available out of the box (in v. 1.17) in the **Overview** and **Trends** sections respectively (the tiles will display no value if the **OMG-ATDM** extens ion is not installed and no snapshot has been generated):

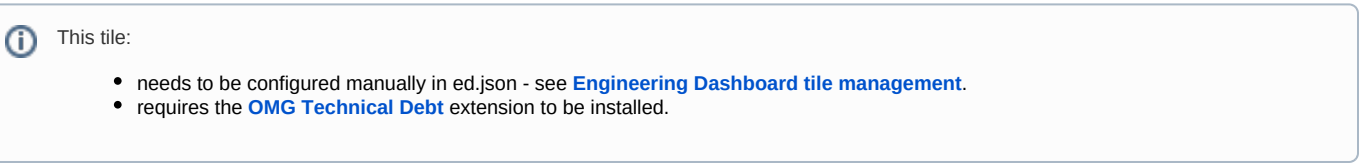


Clicking these tiles will provide more detailed information:

Click to enlarge



Engineering Dashboard tile



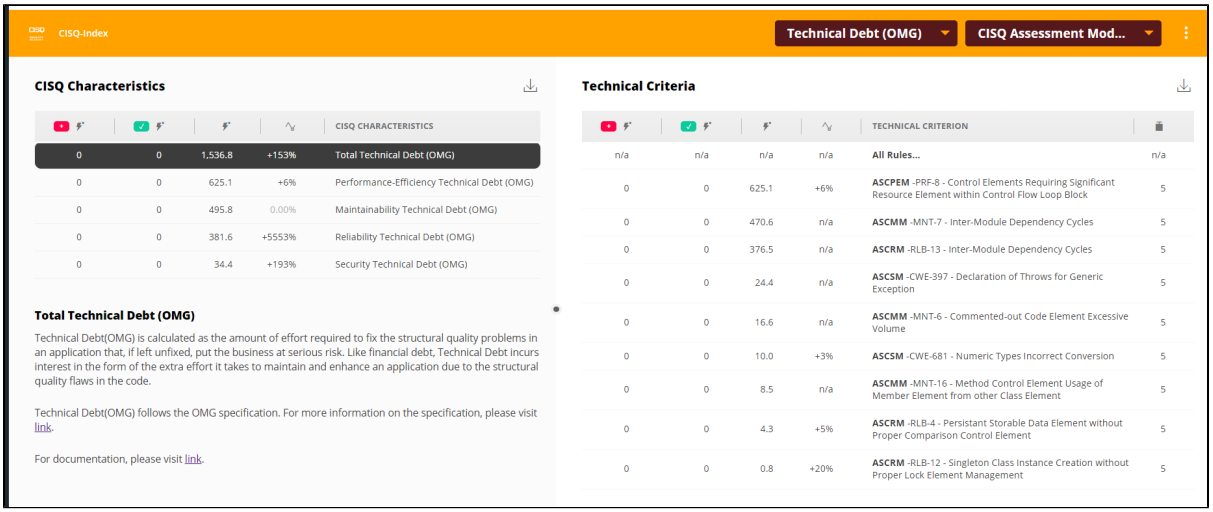
This tile:

- needs to be configured manually in ed.json - see **Engineering Dashboard tile management**.
- requires the **OMG Technical Debt** extension to be installed.

This tile displays Total Added and Removed OMG Technical Debt and the number of days taken for the same:

Clicking these tiles will provide more detailed information:

Click to enlarge



Using the RestAPI to obtain results

Total Technical Debt by Application, Module

Results can be obtained using a **RestAPI query**. For example, to obtain **technical debt** as a **remediation effort** use the metric **#1062020** (you can replace this ID with other supported Sizing Measure IDs):

```
AAD/results?metrics=1062020&modules=$all&technologies=$all
```

Example showing the technical debt for all applications, with a breakdown by technology and by module for an example Application called "shopizer8321":

```
C:>curl -H "Accept: text/csv" -u admin:cast "http://localhost:9190/CAST-RESTAPI/rest/AAD/results?
metrics=1062020&modules=$all&technologies=$all"
```

Results:

```
Application Name;Module Name;Technology;Metric Name;Metric Id;Metric Type;Critical;Snapshot Date #1;Result #1
shopizer8321;null;null;OMG-ATDM: Remediation Effort;1062020;technical-debt-statistics;N/A;2020-03-27;387350.0
shopizer8321;null;HTML5;OMG-ATDM: Remediation Effort;1062020;technical-debt-statistics;N/A;2020-03-27;770.0
shopizer8321;null;JEE;OMG-ATDM: Remediation Effort;1062020;technical-debt-statistics;N/A;2020-03-27;386580.0
shopizer8321;shopizer8321 full content;null;OMG-ATDM: Remediation Effort;1062020;technical-debt-statistics;N/A;
2020-03-27;387350.0
shopizer8321;shopizer8321 full content;HTML5;OMG-ATDM: Remediation Effort;1062020;technical-debt-statistics;N/A;
2020-03-27;770.0
shopizer8321;shopizer8321 full content;JEE;OMG-ATDM: Remediation Effort;1062020;technical-debt-statistics;N/A;
2020-03-27;386580.0
```

In other words, the "shopizer8321" application has a technical debt of **387350 minutes**, which is equivalent to **387350 ÷ 60 ÷ 8** = **806 workload days**. The remediation effort is dispatched between HTML5 code and Java Code as follows:

Technology	Remediation effort
HTML	770 minutes
JEE	386,580 minutes

Total Technical Debt by Business Criterion, Technical Criterion, Rule

With a CISQ Business Criterion ID, you can obtain the technical debt for this Quality Indicator and all related indicators (ie CISQ Measure Elements):

CISQ Business Criterion ID	Name
1062100	CISQ-Index
1062101	CISQ-Maintainability
1062102	CISQ-Performance-Efficiency
1062103	CISQ-Reliability
1062104	CISQ-Security

Example:

```
C:>curl -H "Accept: text/csv" -u admin:cast "http://localhost:9190/CAST-RESTAPI/rest/SHOPIZER/applications/3
/results?metrics=c:1062100&select=omgTechnicalDebt"

Application Name;Technical Criterion;Metric Id;Metric Type;Critical;Snapshot Date #1;Result #1;OMG Technical
Debt (Result #1);OMG Occurrences (Result #1);OMG Added Technical Debt (Result #1);OMG Removed Technical Debt
(Result #1)
shopizer8321;ASCMM-MNT-1 - Control Flow Transfer Control Element outside Switch Block;1062110;technical-
criteria;false;2020-05-15;4.0;0;2;0;0
shopizer8321;ASCMM-MNT-11 - Callable and Method Control Element Excessive Cyclomatic Complexity Value;1062112;
technical-criteria;false;2020-05-15;3.58017346587814;null;null;null;null
shopizer8321;ASCMM-MNT-12 - Named Callable and Method Control Element with Layer-skipping Call;1062113;
technical-criteria;false;2020-05-15;4.0;null;null;null;null
shopizer8321;ASCMM-MNT-13 - Callable and Method Control Element Excessive Number of Parameters;1062114;
technical-criteria;false;2020-05-15;4.0;null;null;null;null
shopizer8321;ASCMM-MNT-15 - Public Member Element;1062116;technical-criteria;false;2020-05-15;4.0;40;1;0;0
...
```

You can get also the technical debt for a single rule, as long as this rule is identified as a CISQ rule by the CISQ Index:

```
C:>curl -H "Accept: application/json" -u admin:cast "http://localhost:9190/CAST-RESTAPI/rest/SHOPIZER
/applications/3/results?metrics=8216&select=omgTechnicalDebt,violationRatio"


...
                                "result": {
                                        "grade": 4,
                                        "omgTechnicalDebt": {
                                                "total": 11040,
                                                "numberOccurrences": 176,
                                                "added": 0,
                                                "removed": 0
                                        },
                                        "violationRatio": {
                                                "totalChecks": 7411,
                                                "failedChecks": 33,
                                                "successfulChecks": 7378,
                                                "ratio": 0.9955471596275807
                                        }
                                },
```

Detailed Technical Debt for a violation

As we refer to findings from a snapshot ID, and object ID and a rule ID with URI such as:
TINY/components/568/snapshots/8/findings/8216

We can refer technical debt details in a similar Web Service:
TINY/components/568/snapshots/8/omg-technical-debt/8216

```
C:>curl -H "Accept: application/json" -u admin:cast "http://localhost:9190/CAST-RESTAPI/rest/TINY/components/568
/snapshots/8/omg-technical-debt/8216"
{
        "total": 180,
        "numberOccurrences": 3,
        "complexity": 1,
        "exposure": 1,
        "concentration": 0,
        "technologicalDiversity": 1,
        "gapSize": 1,
        "unadjustedEffort": 60,
        "added": 0,
        "removed": 0,
        "adjustmentFactor": 3
}
```

Querying the Dashboard schema for results

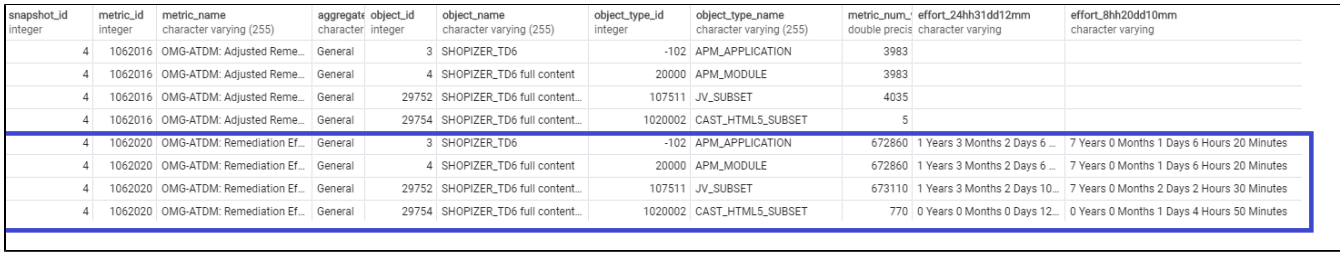
The **Dashboard schema** contains views and tables that provide information about the results generated by this extension:

View/Table	Description	Type
OMG_ATDM_RESULTS_OBJ_APP	Remediation effort and adjusted Factor aggregated at Application, Module, PATTERN level.	VIEW
OMG_ATDM_RESULTS_OBJ_RULE_APP	Remediation effort and adjusted Factor for Object Rule, aggregated at Application, Module, PATTERN level.	VIEW
OMG_ATDM_DETAILS_OBJ_RULE	Details all metrics computed for all violations.	VIEW
ATDM_SCOPE_OCCURENCES	Last scope taken in to account.	TABLE

Obtaining results at Application level for a snapshot

```
SET search_path=xxx_central;
SELECT *
FROM   omg_atdm_results_obj_app
WHERE  snapshot_id = <snapshot_id>
```

Click to enlarge



snapshot_id integer	metric_id integer	metric_name character varying (255)	aggregate character	object_id integer	object_name character varying (255)	object_type_id integer	object_type_name character varying (255)	metric_num_ double precis	effort_24hh31dd12mm character varying	effort_8hh20dd10mm character varying
4	1062016	OMG-ATDM: Adjusted Reme...	General	3	SHOPIZER_TD6	-102	APM_APPLICATION	3983		
4	1062016	OMG-ATDM: Adjusted Reme...	General	4	SHOPIZER_TD6 full content	20000	APM_MODULE	3983		
4	1062016	OMG-ATDM: Adjusted Reme...	General	29752	SHOPIZER_TD6 full content...	107511	JV_SUBSET	4035		
4	1062016	OMG-ATDM: Adjusted Reme...	General	29754	SHOPIZER_TD6 full content...	1020002	CAST_HTML5_SUBSET	5		
4	1062020	OMG-ATDM: Remediation Ef...	General	3	SHOPIZER_TD6	-102	APM_APPLICATION	672860	1 Years 3 Months 2 Days 6 ...	7 Years 0 Months 1 Days 6 Hours 20 Minutes
4	1062020	OMG-ATDM: Remediation Ef...	General	4	SHOPIZER_TD6 full content	20000	APM_MODULE	672860	1 Years 3 Months 2 Days 6 ...	7 Years 0 Months 1 Days 6 Hours 20 Minutes
4	1062020	OMG-ATDM: Remediation Ef...	General	29752	SHOPIZER_TD6 full content...	107511	JV_SUBSET	673110	1 Years 3 Months 2 Days 10...	7 Years 0 Months 2 Days 2 Hours 30 Minutes
4	1062020	OMG-ATDM: Remediation Ef...	General	29754	SHOPIZER_TD6 full content...	1020002	CAST_HTML5_SUBSET	770	0 Years 0 Months 0 Days 12...	0 Years 0 Months 1 Days 4 Hours 50 Minutes

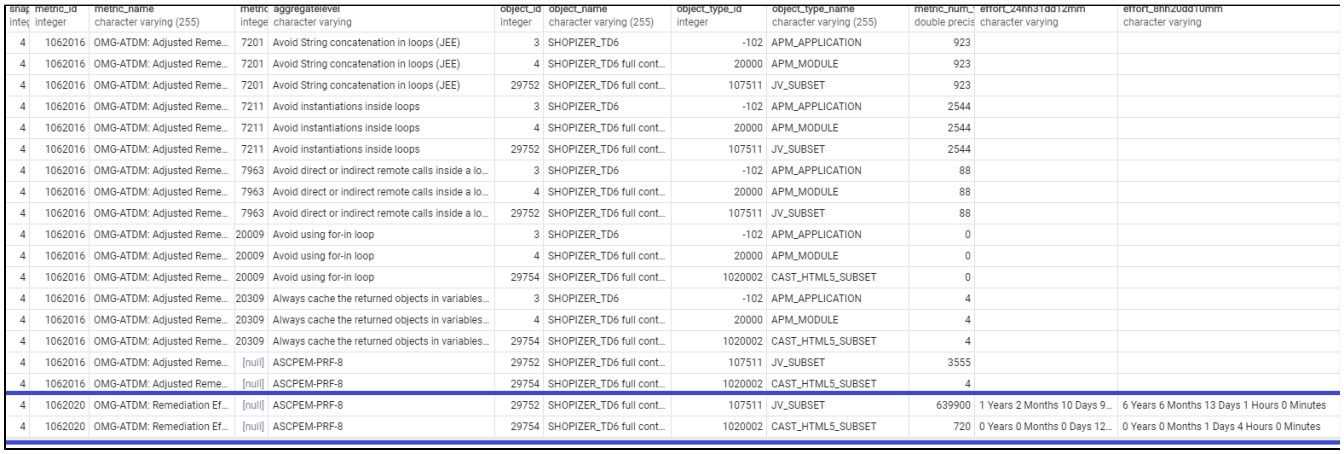
Obtaining results per CAST Rule / CISQ Pattern at the application level for a snapshot

```
SET search_path=xxx_central;
SELECT *
FROM   omg_atdm_results_obj_rule_app
WHERE  snapshot_id = <snapshot_id>
```

For example to get the results for all metrics of pattern 'ASCPEM-PRF-8':

```
SELECT *
FROM   omg_atdm_results_obj_rule_app
WHERE  snapshot_id = 4
       AND ( metric_value_index IN (SELECT T.metric_id + 1
                                    FROM   aed_metric_quality_tags T
                                    WHERE  T.tag = 'ASCPEM-PRF-8')
             OR aggregatelevel = 'ASCPEM-PRF-8' )
```

Click to enlarge



snap inte	metric_id integer	metric_name character varying (255)	metric inte	aggregatelevel character varying	object_id integer	object_name character varying (255)	object_type_id integer	object_type_name character varying (255)	metric_num_ double precis	effort_24hh31dd12mm character varying	effort_8hh20dd10mm character varying
4	1062016	OMG-ATDM: Adjusted Reme...	7201	Avoid String concatenation in loops (JEE)	3	SHOPIZER_TD6	-102	APM_APPLICATION	923		
4	1062016	OMG-ATDM: Adjusted Reme...	7201	Avoid String concatenation in loops (JEE)	4	SHOPIZER_TD6 full cont...	20000	APM_MODULE	923		
4	1062016	OMG-ATDM: Adjusted Reme...	7201	Avoid String concatenation in loops (JEE)	29752	SHOPIZER_TD6 full cont...	107511	JV_SUBSET	923		
4	1062016	OMG-ATDM: Adjusted Reme...	7211	Avoid instantiations inside loops	3	SHOPIZER_TD6	-102	APM_APPLICATION	2544		
4	1062016	OMG-ATDM: Adjusted Reme...	7211	Avoid instantiations inside loops	4	SHOPIZER_TD6 full cont...	20000	APM_MODULE	2544		
4	1062016	OMG-ATDM: Adjusted Reme...	7211	Avoid instantiations inside loops	29752	SHOPIZER_TD6 full cont...	107511	JV_SUBSET	2544		
4	1062016	OMG-ATDM: Adjusted Reme...	7963	Avoid direct or indirect remote calls inside a lo...	3	SHOPIZER_TD6	-102	APM_APPLICATION	88		
4	1062016	OMG-ATDM: Adjusted Reme...	7963	Avoid direct or indirect remote calls inside a lo...	4	SHOPIZER_TD6 full cont...	20000	APM_MODULE	88		
4	1062016	OMG-ATDM: Adjusted Reme...	7963	Avoid direct or indirect remote calls inside a lo...	29752	SHOPIZER_TD6 full cont...	107511	JV_SUBSET	88		
4	1062016	OMG-ATDM: Adjusted Reme...	20009	Avoid using for-in loop	3	SHOPIZER_TD6	-102	APM_APPLICATION	0		
4	1062016	OMG-ATDM: Adjusted Reme...	20009	Avoid using for-in loop	4	SHOPIZER_TD6 full cont...	20000	APM_MODULE	0		
4	1062016	OMG-ATDM: Adjusted Reme...	20009	Avoid using for-in loop	29754	SHOPIZER_TD6 full cont...	1020002	CAST_HTML5_SUBSET	0		
4	1062016	OMG-ATDM: Adjusted Reme...	20309	Always cache the returned objects in variables...	3	SHOPIZER_TD6	-102	APM_APPLICATION	4		
4	1062016	OMG-ATDM: Adjusted Reme...	20309	Always cache the returned objects in variables...	4	SHOPIZER_TD6 full cont...	20000	APM_MODULE	4		
4	1062016	OMG-ATDM: Adjusted Reme...	20309	Always cache the returned objects in variables...	29754	SHOPIZER_TD6 full cont...	1020002	CAST_HTML5_SUBSET	4		
4	1062016	OMG-ATDM: Adjusted Reme...	[null]	ASCPEM-PRF-8	29752	SHOPIZER_TD6 full cont...	107511	JV_SUBSET	3555		
4	1062016	OMG-ATDM: Adjusted Reme...	[null]	ASCPEM-PRF-8	29754	SHOPIZER_TD6 full cont...	1020002	CAST_HTML5_SUBSET	4		
4	1062020	OMG-ATDM: Remediation Ef...	[null]	ASCPEM-PRF-8	29752	SHOPIZER_TD6 full cont...	107511	JV_SUBSET	639900	1 Years 2 Months 10 Days 9...	6 Years 6 Months 13 Days 1 Hours 0 Minutes
4	1062020	OMG-ATDM: Remediation Ef...	[null]	ASCPEM-PRF-8	29754	SHOPIZER_TD6 full cont...	1020002	CAST_HTML5_SUBSET	720	0 Years 0 Months 0 Days 12...	0 Years 0 Months 1 Days 4 Hours 0 Minutes

To get the details of all computed metrics at object and rule level.

```
SELECT *
FROM   omg_atdm_details_obj_rule
WHERE  snapshot_id = 4
       AND object_name = 'getOrdersList'
```

Click to enlarge

snapshot_id integer	metric_id integer	metric_name character varying (255)	metric_val integer	aggregatlevel character varying	object_id integer	object_name character varying	object_ty integer	object_type_nar character varyin	metric_num_value double precision	effort_24hh31dd12mm character varying	effort_8hh20dd10mm character varying
4	1062011	OMG-ATDM: Complexity	8099	Avoid uncontrolled f...	2942	getOrdersList	102	JV_METHOD	3.33333333333333		
4	1062012	OMG-ATDM: Exposure	8099	Avoid uncontrolled f...	2942	getOrdersList	102	JV_METHOD	1.30102999566398		
4	1062013	OMG-ATDM: Concentration	8099	Avoid uncontrolled f...	2942	getOrdersList	102	JV_METHOD	0.25		
4	1062014	OMG-ATDM: Technological Diversity	8099	Avoid uncontrolled f...	2942	getOrdersList	102	JV_METHOD	1		
4	1062015	OMG-ATDM: Occurrence Gap Size	8099	Avoid uncontrolled f...	2942	getOrdersList	102	JV_METHOD	1		
4	1062016	OMG-ATDM: Adjusted Remediation Effort	8099	Avoid uncontrolled f...	2942	getOrdersList	102	JV_METHOD	2		
4	1062016	OMG-ATDM: Adjusted Remediation Effort	[null]	ASCSM-CWE-134	2942	getOrdersList	102	JV_METHOD	2		
4	1062020	OMG-ATDM: Remediation Effort	[null]	ASCSM-CWE-134	2942	getOrdersList	102	JV_METHOD	120	0 Years 0 Months 0 Days 2 Hours 0 Minutes	0 Years 0 Months 0 Days 2 Hours 0 Minutes

Note that to obtain the CISQ Pattern of a given CAST rule, you can adapt the following query. For example, to find the CISQ Pattern for the rule ID = 7201, the following query will return ASCPEM-PRF-8:

```
SELECT C.tag
FROM   aed_quality_tags_doc C
       join aed_metric_quality_tags T
         ON T.tag = C.tag
WHERE  C.standard = 'CISQ'
       AND T.metric_id + 1 = 7201
```