
LeadingAgile Code Analysis Tool Data Files

1. Code Analysis Data

The Code Analysis Gather tools create and use data files that are stored as collections in a single folder. The Gather metrics tools and the Gather CLI create this folder structure. Each tool within the stuite that creates a data file will use a format specific to that tool. All of the data files are JSON and all follow a general form with some sections within the file specific to the tool at hand.

The basic format is a JSON dictionary object with the basic elements of `meta` and `data`.

The `meta` item contains process and system settings recorded at the time the last data collection that updates the file happens.

The `data` section contains the data in a form specific to the tool that created the data.

The data files are created in a folder organization to contain data for each Repository, each data run for a repository, and the data for the tools collected in the run.

Each repository analysed will have a top-level folder named after the base folder of the repository.

Within a repostiory folder will be a folder for each data run named with the run-name given at the time.

Each run folder will have a folders for the tools metrics, statistics , frequency, answers and linguist.

```
.
+-- Studios-private-test-data--Alamofire--swift
|   +-- RUN_Aug2021
|       +-- answers
|       |   +-- cognitive_complexity_reduced.json
|       +-- frequency
|       |   +-- git_frequency_data.json
|       |   +-- git_frequency_statistics.json
|       |   +-- plots
|       |       +-- git_frequency_full.png
|       |       +-- git_frequency_recent_fifty_percent.png
|       |       +-- git_frequency_recent_twenty_five_percent.png
|       +-- linguist
|       |   +-- linguist_statistics.json
|       |   +-- plots
|       |       +-- 2019-02-21_linguist.png
|       |       +-- 2019-03-07_linguist.png
|       |       +-- 2019-03-29_linguist.png
|       |       +--2019-04-06_linguist.png
|       +-- metrics
|       |   +-- javascript
|       |   |   +-- metrics_data.json
|       |   +-- swift
|       |       +-- metrics_data.json
|       +-- statistics
|           +-- javascript
|           |   +-- counts_over_limit.json
|           |   +-- statistics.json
|           |   +-- plots
|           |   |   +-- complexity.png
|           |   |   +-- counts_over_limit.png
|           |   |   +-- method_lines.png
|           |   +-- trend.json
|           +-- swift
|               +-- counts_over_limit.json
|               +-- statistics.json
|               +-- plots
|               |   +-- balance.png
|               |   +-- complexity.png
|               |   +-- counts_over_limit.png
|               |   +-- method_lines.png
|               +-- trend.json
+-- Studios-private-test-data--jif-dashboard-javascript
|   +-- RUN_Aug2021
|       +-- answers
|       |   +-- cognitive_complexity_reduced.json
|       +-- frequency
|       |   +-- git_frequency_data.json
|       |   +-- git_frequency_statistics.json
|       |   +-- plots
|       |       +-- git_frequency_full.png
```

```
|       |       +-- git_frequency_recent_fifty_percent.png
|       |       +-- git_frequency_recent_twenty_five_percent.png
|       +-- linguist
|       |   +-- linguist_statistics.json
|       |   +-- plots
|       |       +-- 2016-12-09_linguist.png
|       |       +-- 2016-12-19_linguist.png
|       |       +-- 2017-03-22_linguist.png
|       |       +-- 2018-04-16_linguist.png
|       +-- metrics
|       |   +-- javascript
|       |       +-- metrics_data.json
|       +-- output.log
|       +-- statistics
|           +-- javascript
|               +-- counts_over_limit.json
|               +-- statistics.json
|               +-- plots
|               |   +-- complexity.png
|               |   +-- counts_over_limit.png
|               |   +-- method_lines.png
|               +-- trend.json
+-- team_summary.json
```

2. Metrics Tool Data

The metrics data is where the raw static analysis data from the various collection utilities is stored.

The metrics folder under a run folder will have folders for each of the languages analysed. Each language folder will have a metrics_data.json file with the metrics collected for that language.

2.1. metrics_data.json

The metrics_data.json file contains a json dictionary object comprising elements meta and data. The meta element follows the common structure for meta data (see below).

The data element is a list of dictionaries where each item is the data from a step in the data collection. For a gather run for 52 steps (–t 52) where the steps are (roughly) a week each, there will be 52 items in the list, each a dictionary containing details the data for that week. The items in the list are stored in reverse-chronological order of the steps through the git history (i.e. starting with the most recent and going to the oldest).

Each item in the list is a dictionary object with elements:

item	description
revision_hash	the git commit hash (sha) for that step
hash_date	the commit date for that hash
extracted_data	A dictionary of items for each thing being examined (methods, modules, files, framework, e

The extracted_data item is a dictionary with items for each metric data value. The key for each item is a unique identifier for the item that the metrics are from (file, method, etc.).

The items within the extracted_data are:

item	description
location	A dictionary of items defining the file location for the metric
method_name	The name of the method for the metric (when available). Sometimes these
cyclomatic_complexity	The cyclomatic complexity of the item
method_length	
fan_out_complexity	
lines_of_code	
number_of_comments	
percentage_of_comments	
fan_in	
fan_out	
instability	
number_of_abstracts	
number_of_concretes	
abstractness	
distance_from_main_sequence	
number_of_methods	
number_of_tests	
number_of_imports	

location will always be present in some form. Each of the others optional and depend on the specifics of the underlying analysis tools used and how they apply to the particular file type (metrics vary depending on file language and options used during collection).

The location item will have as many of these as were available at the time of collection (also varies by analysis tool used):

item	description
file	the file name with path relative to the repository base folder
line	the line number within the file where the metric was collected

item	description
character	the character position for the metric, when available. This will be something close to the item bei


```
{
  "meta": {
  },
  "data": [
      {
      "revision_hash": "757478442696b302bb8f9ad16e93b30f9350d949",
      "hash_date": "2021-03-13T03:51:11-08:00",
      "extracted_data": {
        "a1d8c081f419a29dab6f871881a82b9e": {
          "location": {
            "file": "benchmarks/benchmark-runner.js",
            "line": 6,
            "character": 1
          },
          "method_length": 70,
          "method_name": "anonymous function",
          "cyclomatic_complexity": 9
        }
      }
    }
    {
      "revision_hash": "ad2aaa8c3c2a28b07c550aa99187cbd147a65962",
      "hash_date": "2021-03-06T00:54:40-06:00",
      "extracted_data": {
        "a1d8c081f419a29dab6f871881a82b9e": {
          "location": {
            "file": "benchmarks/benchmark-runner.js",
            "line": 6,
            "character": 1
          },
          "method_length": 70,
          "method_name": "anonymous function",
          "cyclomatic_complexity": 9
        },
        "17538d28cf006865a36d4fd03c5bf262": {
          "location": {
            "file":
                "benchmarks/text-editor-large-file-construction.bench.js",
            "line": 11,
            "character": 1
          },
          "method_length": 86,
          "method_name": "anonymous function",
          "cyclomatic_complexity": 4
        }
      }
    }
  ]
}
```

3. Statistics Derived from Metrics

The statistics folder will contain a folder for each langauge found during the metrics collection. Each language folder will have several data files containing statistics calulated from the metrics data. There will also be a plots folder containing basic plots of some of the metrics where the plotting can be performed and if that option was enabled during the Gather tool processing.

```
statistics
+-- javascript
|   +-- counts_over_limit.json
|   +-- statistics.json
|   +-- plots
|   |   +-- complexity.png
|   |   +-- counts_over_limit.png
|   |   +-- method_lines.png
|   +-- trend.json
```

3.1. Statistics

The statistics .json file is collection of standard statistic measures calculated from the collected data (see above). As with all the data files, this be a dictionary with a meta item and a data item.

The data item is a dictionary of items with keys that are the metric names (see above). There will be one item in the list for each metric type present in the collected data (the metrics data described above).

The value for each of these metric items is a list of dictionary items containing the calculated statistics. There will be one item in the list for each step in the collected data.

item	description
revision_hash	the git commit hash (sha) for that step
datetime	the commit date for that hash
mean	The mean calulated from the values for that step
median	The median calulated from the values for that step
mode	The mode calulated from the values for that step
min	The minimum value from the values for that step
max	The maximum value from the values for that step
stdev	The standard deviation calulated from the values for that step

In addtion to the above, the method_lines metric will contain a max_method item with a list of the methods which have a length matching the max value from the statistics.

Max Method Item elements:

item	description
name	the name of the method (from the method_name in the metrics data)
file	the file containing the method (from the location data for the item in the metrics data)


```
{
  "meta": {
  },
  "data": {
    "complexity": [
      {
        "revision_hash": "757478442696b302bb8f9ad16e93b30f9350d949",
        "datetime": "2021-03-13T03:51:11-08:00",
        "mean": 1.6269,
        "median": 1.0,
        "mode": 1,
        "min": 1,
        "max": 53,
        "stdev": 2.0188372793259095
      },
      {
        "revision_hash": "ad2aaa8c3c2a28b07c550aa99187cbd147a65962",
        "datetime": "2021-03-06T00:54:40-06:00",
        "mean": 1.6281935677787798,
        "median": 1,
        "mode": 1,
        "min": 1,
        "max": 53,
        "stdev": 2.0202190978726846
      }
    ],
    "method_lines": [
      {
        "revision_hash": "757478442696b302bb8f9ad16e93b30f9350d949",
        "datetime": "2021-03-13T03:51:11-08:00",
        "mean": 21.41608827193451,
        "median": 7.0,
        "mode": 3,
        "min": 1,
        "max": 8137,
        "stdev": 128.9954631950077,
        "max_method": [
          {
            "name": "anonymous function",
            "file": "spec/text-editor-spec.js"
          }
        ]
      },
      {
        "revision_hash": "ad2aaa8c3c2a28b07c550aa99187cbd147a65962",
        "datetime": "2021-03-06T00:54:40-06:00",
        "mean": 21.434258680710524,
        "median": 7,
        "mode": 3,
```

```
        "min": 1,
        "max": 8137,
        "stdev": 129.1774944053297,
        "max_method": [
          {
            "name": "anonymous function",
            "file": "spec/text-editor-spec.js"
          }
        ]
      }
    ]
  }
}
```

3.2. Trends Over Time

The trend.json file is structured as all the other data files with a meta object and a data object.

```
{
    "meta": {
    },
    "data": {
    }
}
```

See above for a description of meta.

The trend data is a collection of calculated data based on the metric statistics in the associated statistics .json.

This is basically the smoothing fit values and the forecast values derived using the Statistics data.

The top-level dictionary in the data object is a collection of items with keys that are the metric names (see above). There will be one item in the list for each metric type present in the collected data. This collection will exactly match the data from the source statistics json file.

The value for each of these metric items is a dictionary of items containing the calculated smooth-fit values for each statistic measure.

The data for each metric type will be a dictionary with a key for each of the statistic values:

item	description
maxs	
mins	
means	
modes	

item	description
stdevs	
medians	

Each of these items contains a dictionary that holds the caculated values for the smooth-fit curves associated with the metric data:

item	description
fit_data	An array of values of smooth-curve data fitting the actual values from the Statistics data file
forecast_data	An array of smooth-curve data extended a few steps into the future using the fit_data as the
forecast_slope	The slope of the forecase data as calculated from the first forecase point to the last.


```
{
    "meta": {},
    "data": {
        "complexity": {
            "maxs": {
                "fit_data": [
                    67.07290995034518,
                    67.03886751023525,
                    67.01018393349125,
                    66.98693630191768,
                    66.96896418606795,
                    66.955924643061,
                    66.94734344139148,
                    66.94266119245457,
                    66.94127354564931,
                    66.94256501813037,
                    66.945936377486,
                    66.95082577533196,
                    66.956724044384,
                    66.9631847255387,
                    66.96982949093588
                ],
                "forecast_data": [
                    50.48784488518306,
                    49.00608456546201,
                    47.5317330474164,
                    46.06475328703747,
                    44.6051084255365,
                    43.152761788418715,
                    41.707676884561835,
                    40.269817405299165,
                    38.83914722350737,
                    37.41563039269871
                ],
                "forecast_slope": -1.3072214492484349
            },
            "mins": {
                "fit_data": [],
                "forecast_data": [],
```

```
                "forecast_slope": 0.0
            },
            "means": {},
            "modes": {},
            "stdevs": {},
            "medians": {}
        },
        "method_lines": {}
    }
}
```

3.3. Counts Over Limit

The counts_over_limit.json file is data showing the number of items (file, methods, etc.) that exceed a defined limit for each metric at each step (week) in the data analysis.

The limit used is currently defined as MEAN + (2 * STDEV). Note that this will cause 'over the accepted limit' to sometimes be very much larger than what a fixed value would be. For instance, some might say that 10-20 lines per method is very large. However, in a codebase where say MEAN=21, MAX=8137, and STDEV=129, then the 'Acceptable Limit' used will be 279. This is much larger than anyone would consider as reasonable for a method length in any language. The purpose of this data is not necessarily to identify all the items over some measure that might be reasable, but to find the worst of the worst in the current codebase relative to the otheritems in the codebase. If you really need 'All Methods Over 10 lines', that data is in the metrics data and can be extracted fairly easily.

The data in the counts_over_limit.json has the usual meta and data objects. The data object list of objects with one element in the list for each step (week) in the gathered data from metrics. Each item in the list contains:

Step Object

item	description
revision_hash	the git commit hash (sha) for that step
datetime	the commit date for that hash
"metric name"	the name of the metric is the key that has an object has Metric Limit Information

Each metric in the statistics and metric data will have in item in the above element. The key is the metric name and the value is an object containing information about the limits and counts.

Metric Limit Information

item	description
limit	the limit value used calculated as MEAN+(2*STDEV)
count_over_limit	the number of items exeeding the limit in the named metric


```
{
    "meta": {},
    "data": [
        {
            "revision_hash":
                "757478442696b302bb8f9ad16e93b30f9350d949",
            "datetime": "2021-03-13T03:51:11-08:00",
            "complexity": {
                "limit": 5.664574558651819,
                "count_over_limit": 344
            },
            "method_lines": {
                "limit": 279.40701466194986,
                "count_over_limit": 77
            }
        },
        {
            "revision_hash":
                "3d5c83be99e1b533127e7284d9fc5559663691fe",
            "datetime": "2021-02-23T07:00:08+03:00",
            "complexity": {
                "limit": 5.668575003601831,
                "count_over_limit": 347
            },
            "method_lines": {
                "limit": 279.7393211233443,
                "count_over_limit": 76
            }
        }
    ]
}
```


4. Language Distribution

The linguist data file, linguist_statistics.json, contains information about the distribution of the programming language files found at each step (week) of the data analysis. The file content is an object with the usual meta and data objects. The data object contains a list of items where each item in an object of information about the languages in the step.

This information is collected using Github Linguist. The possible languages that it can find is a list that can include language files that other parts of Code Analysis do not analyse (e.g. "Ruby", "Scala", "Haskell", etc.).

Step Object

item	description
revision_hash	he git commit hash (sha) for that step
hash_date	the commit date for that hash
extracted_data	Language Information Object

The extracted_data object contains a dictionary of language information items with a key that is a name of the programming language. There will be one item in the extracted data object for each language-file-type found in the step (week).

Language Information Object

item	description
"Language Name"	The name of the language found
location	The file location (file name, etc.)
commits_changed_since_previous_sha	The number of commits to this file since the previous step-commit


```
{
    "meta": {
    },
    "data": [
      {
        "revision_hash": "11d518841365b85b0dca7f7a55174d12911f05a0",
        "hash_date": "2020-11-21T10:26:06-06:00",
        "extracted_data": {
          "Ruby": {
            "size": 3764,
            "percentage": "0.91"
          },
          "Swift": {
            "size": 408270,
            "percentage": "99.07"
          },
          "JavaScript": {
            "size": 77,
            "percentage": "0.02"
          }
        }
      },
      {
        "revision_hash": "ebc0f1ce8dd0e7edd491a7573ffc40f7c528967a",
        "hash_date": "2020-11-09T16:23:11-06:00",
        "extracted_data": {
          "Ruby": {
            "size": 3764,
            "percentage": "0.91"
          },
          "Swift": {
            "size": 408218,
            "percentage": "99.07"
```

```
        },
        "JavaScript": {
          "size": 77,
          "percentage": "0.02"
        }
      }
    }
  ]
}
```

5. Commit History Information

5.1. File Modification Frequency

The frequency data file,git_frequency_data.json, contains information about number of times each modified file was part of a commit between two steps (weeks) of the data analysis. The file content is an object with the usual meta and data objects. The data object contains a list of items where each item in an object of information about the files modified.

Step Object

item	description
revision_hash	he git commit hash (sha) for that step
hash_date	the commit date for that hash
extracted_data	File Change Information

The extracted_data object contains a dictionary of file information items with a key that is a unique file identifier. There will be one item in the extracted data object for each file changed in this step (week) (i.e. since the previous step-commit).

File Change Information

item	description
"File Identifier"	a unique value idenifying the file. A change recorded for this file in
location	The file location (file name, etc.)
commits_changed_since_previous_sha	The number of commits to this file since the previous step-commit

```
{
    "meta": {
    },
    "data": [
        {
```

```
            "revision_hash":
                "a607fc1c8f4a32cb1fa6fdc6bc760b3d1cc3355d",
            "hash_date": "2019-03-06T17:05:43-05:00",
            "extracted_data": {
                "d18193369129c106d3efaab6103a7b74": {
                    "location": {
                        "file": "Documentation/CONTRIBUTOR.md"
                    },
                    "commits_changed_since_previous_sha": 1
                },
                "008b9615f6f1142f7260ad4a03a62bf9": {
                    "location": {
                        "file": "Documentation/MIGRATING.md"
                    },
                    "commits_changed_since_previous_sha": 1
                },
                "2bcf996b6de98d42743b4ac18b72c5f1": {
                    "location": {
                        "file": "Documentation/images/animatorNode.png"
                    },
                    "commits_changed_since_previous_sha": 1
                }
            }
        },
        {
            "revision_hash":
                "8bb6ecfe46a148bab26963f2a359736ef6ad768a",
            "hash_date": "2019-02-12T15:20:40-08:00",
            "extracted_data": {
                "a9eca5647374360f70ae80fd19d81b80": {
                    "location": {
                        "file":
                            "lottie-ios/Classes/Private/LOTComposition.m"
                    },
                    "commits_changed_since_previous_sha": 1
                }
            }
        }
    ]
}
```


5.2. Files Most-Modified

The file git_frequency_statistics.json is an extract of information from the git_frequency_data.json to reduce to the counts for each file idenitfied. It contains the usual meta and data objects. The data object is a dictionary with objects that hold subsets of the data covering the full, the most recent half, and the most recent quarter time span out of the span of time covered by the Code Analysis run.

Data Object

item	description
full	a time span object covering the full range of time of the Analysis
recent_fifty_percent	a time span object covering the most recent 50% of time of the Analysis
recent_twenty_five_percent	a time span object covering the most recent 25% of time of the Analysis

The Time Span object which is the value of each of the above keys contains items for

Time Span Object (file set)

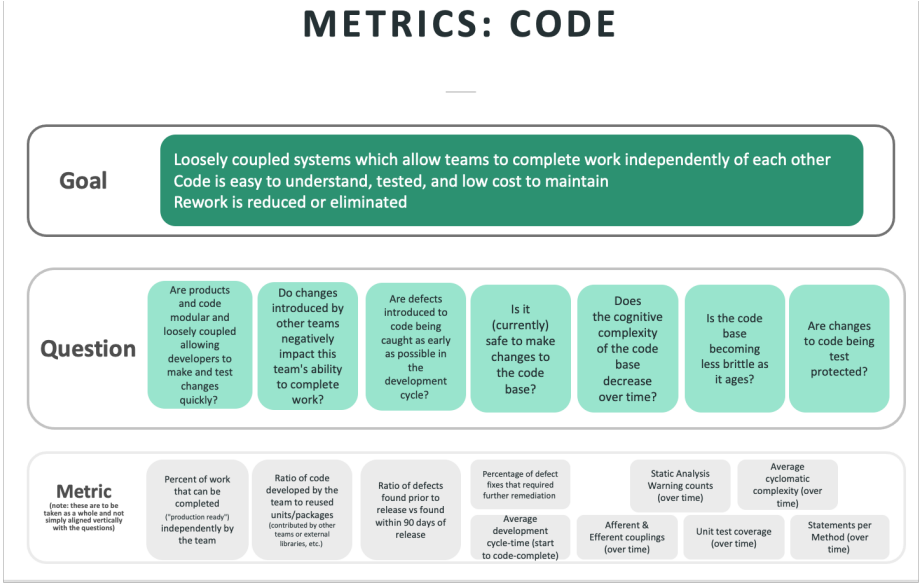
item	description
"file paths"	the path of the file relative to the repository base folder (there will one item for each file). The


```
{
    "meta": {
    },
    "data": {
      "full": {
        "lottie-ios/Classes/PublicHeaders/LOTAnimationView.h": 3,
        "lottie-ios/Classes/Private/LOTComposition.m": 3,
        "Documentation/CONTRIBUTOR.md": 4,
        "Documentation/MIGRATING.md": 4,
        "Documentation/images/animatorNode.png": 2,
        "Example/Podfile.lock": 26,
        "Example/Pods/Local Podspecs/lottie-ios.podspec.json": 22,
        "Example/Pods/Local Podspecs/lottie-swift.podspec.json": 2,
        "Example/Pods/Manifest.lock": 26,
        "Example/Pods/Pods.xcodeproj/project.pbxproj": 21,
        "Example/Pods/Target Support Files/Pods-Lottie
            Viewer/Pods-Lottie Viewer-dummy.m": 1,
        "Example/Pods/Target Support Files/Pods-Lottie
            Viewer/Pods-Lottie Viewer.modulemap": 1,
        "Example/Pods/Target Support
            Files/Pods-lottie-swift_macOS/Pods-lottie-swift_macOS-frameworks.sh":
            10,
        "Example/Pods/Target Support
            Files/Pods-lottie-swift_macOS/Pods-lottie-swift_macOS-resources.sh":
            7,
        "Example/lottie-swift/ViewController.swift": 16,
        "Example/lottie-swift_macOS/AppDelegate.swift": 1,
        "README.md": 20,
        "_Gifs/HeartButton.gif": 1,
        "lottie-ios.podspec": 24,
        "lottie-ios/Classes/.gitkeep": 1,
        "lottie-swift/src/Private/LayerContainers/CompLayers/TextCompositionLayer.swift":
            26,
        "lottie-swift/src/Private/LayerContainers/Utility/CompositionLayersInitializer.swift":
            4,
        "lottie-swift/src/Private/LayerContainers/Utility/InvertedMatteLayer.swift":
            4,
        "lottie-swift/src/Private/LayerContainers/Utility/LayerImageProvider.swift":
            2
```

```
    },
    "recent_fifty_percent": {
      "lottie-swift/src/Private/Utility/Extensions/MathKit.swift": 2,
      "lottie-swift/src/Private/NodeRenderSystem/Nodes/OutputNodes/Renderables/GradientFillRendere
          2,
      "Lottie.xcodeproj/project.pbxproj": 3,
      "lottie-swift/src/Public/DynamicProperties/ValueProviders/ColorsValueProvider.swift":
          1,
      "lottie-swift/src/Public/iOS/AnimatedControl.swift": 4,
      "lottie-swift-testing.podspec": 2,
      "_Gifs/spm-branch.png": 2,
      "README.md": 5,
      "Package.swift": 2,
      "lottie-swift/src/Public/Animation/AnimationView.swift": 20,
      "lottie-swift/src/Public/AnimationCache/LRUAnimationCache.swift":
          2
    },
    "recent_twenty_five_percent": {
      "lottie-swift/src/Public/iOS/AnimatedControl.swift": 2,
      "lottie-swift/src/Public/Animation/AnimationView.swift": 5,
      "lottie-swift/src/Private/Utility/Extensions/AnimationKeypathExtension.swift":
          1,
      "lottie-swift/src/Public/MacOS/BundleImageProvider.swift": 2,
      "lottie-swift/src/Public/iOS/BundleImageProvider.swift": 1,
      "Example/Pods/Pods.xcodeproj/project.pbxproj": 2,
      "Example/lottie-swift/ViewController.swift": 2,
      "Lottie.xcodeproj/project.pbxproj": 1,
      "lottie-swift/src/Private/LayerContainers/AnimationContainer.swift":
          1,
      "lottie-swift/src/Private/LayerContainers/CompLayers/PreCompositionLayer.swift":
          1,
      "lottie-swift/src/Private/LayerContainers/CompLayers/TextCompositionLayer.swift":
          3,
      "lottie-swift/src/Private/LayerContainers/Utility/CompositionLayersInitializer.swift":
          1,
      "lottie-swift/src/Private/LayerContainers/Utility/LayerFontProvider.swift":
          1,
      "lottie-swift/src/Private/LayerContainers/Utility/TextLayer.swift":
          5,
      "lottie-swift/src/Public/FontProvider/AnimationFontProvider.swift":
          1,
      "lottie-swift/src/Public/iOS/Compatibility/CompatibleAnimationView.swift":
          1,
      "README.md": 1
    }
  }
}
```


6. GQM Answers

The Code Analysis data is used to provide an answer, or at least some guidance, for the set of Goal-Question-Metrics questions we are asking.



In this version of Code Analysis we generate an 'answer' for the question: **Does the cognitive complexity of the code base decrease over time?**

We calculate this estimate of the answer using the trends of the metrics collected. We record an answer to the question for each language that is analysed. We also record and summary answer using the results for each language weighted by the volume of each in the repostitory (see the Linguist data above).

The Answer is determined by comparing Evaluations of the metrics used (currently: Cyclomatic Complexity and Method Length). A Metric Evalution is calculated by comparing the Average Score and Trend Score of the metrics. Scores for a metric are calculated by comparing the average (mean) of the metric result and the slope of the trend-over-time of the metric data over the time period of the full Code Analysis collection.

A metric average (mean) is 'Scored' by considering its value to some absolutes chosen based on our extensive experience in many languages. The Score for a metric level will be High, Elavated, or Low.

A metric trend is 'Scored' by considering its slope over the time of the analysis. The Score for a metric trend will be Increading, Flat, or Decreasing.

Metric Scores

	Metric Average Level			Metric Trend	
	High	Elevated	Low	Increasing	Flat
Cyclomatic complexity	>6	Between 3 & 6	<3	Slope >1	Slope Between 1 &
	Method Length >10	Between 6 & 10	<6	Slope >1	Slope Between 1

Metric Evaluation Based on Scores

		Metric Trend Level		
		If Increasing	If Flat	If Decreasing
Metric Average	If High	Real Bad	Bad	Warning
	If Elevated	Bad	Warning	Good
	If Low	Warning	Good	Great

Table 18: Cognitive Complexity from Evaluations

		Method Length				
		Real Bad	Bad	Warning	Good	Grea
Cyclomatic complexity	Real Bad		No	No	No	Inconsis
	Bad	No	No	No	Inconsistent	Inconsis
	Warning	No	No	Watch Listed	Watch Listed	Watch L
	Good	Inconsistent	Inconsistent	Watch Listed	Yes	Yes
	Great	Inconsistent	Inconsistent	Watch Listed	Yes	Yes

While we only answer the one question in this version of Code Analysis, we intend to expand this to other Questions and to expand the set of questions as we discover what is most useful to our clients.

6.1. Answers to Questions

The cognitive_complexity_reduced.json data file holds the 'answer' data for the question: **Does the cognitive complexity of the code base decrease over time?**.

This file contains an top-level object which has the usual meta and data items. The data item Repository Answer Object containing the summary and language-specific data and answers for the question for the current repository.

Repository Answer Object

item	description
summary	The Summary Answer object
"language name"	A language Answer Data object. There will be one for each language analysed.

Summary Answer Object

item	description
question	The text of the question being answered
answer	The answer generated for the question in an Answer Object as calculated from the weighted
evaluation	A dictionary of Evaluation Object items with the results of combining the weighted evaluati
scaled_weights	A dictionary with keys of the langauges used in answering the question with values of the w

Answer Object

item	description
name	The name for the answer
value	A human-language (sort of) result for the answer

Evaluation Object

item	description
”metric name”	A Metric Evaluation Object. There will be on MetricName:Evaluation pair for each metric u

Metric Evaluation Object

item	description
name	The name of the evaluation result
value	The numeric value of the evaluation result

Language Answer Object

item	description
question	The text of the question being answered
answer	The answer generated for the question in an Answer Object (see above) for the current
score	A dictionary of Score Object items with the score data for each metric. The keys for t
evaluation	A dictionary of Evaluation Object items (see above) for the current language. The key
percentage_of_repo	The percentage weight the current language has in the overall repository


```
{
    "meta": {
    },
    "data": {
      "summary": {
        "evaluation": {
          "complexity": {
            "name": "WARNING",
```

```
          "value": 3
        },
        "method_lines": {
          "name": "WARNING",
          "value": 3
        }
      },
      "question": "Does the cognitive complexity of the code base
          decrease over time?",
      "answer": {
        "name": "WATCH_LISTED",
        "value": "Better not tell you now"
      },
      "scaled_weights": {
        "swift": 99.97981632859018,
        "javascript": 0.02018367140982945
      }
    },
    "swift": {
      "score": {
        "complexity": {
          "average": {
            "name": "ELEVATED",
            "value": 2
          },
          "trend": {
            "name": "FLAT",
            "value": 2
          }
        },
        "method_lines": {
          "average": {
            "name": "ELEVATED",
            "value": 2
          },
          "trend": {
            "name": "FLAT",
            "value": 2
          }
        }
      },
      "evaluation": {
        "complexity": {
          "name": "WARNING",
          "value": 3
        },
        "method_lines": {
          "name": "WARNING",
          "value": 3
        }
      },
      "question": "Does the cognitive complexity of the code base
          decrease over time?",
      "answer": {
        "name": "WATCH_LISTED",
        "value": "Better not tell you now"
      },
```

```
        "percentage_of_repo": 99.97981632859018
      },
      "javascript": {
      }
    }
  }
```

6.2. Team Summary

The team_summary.json holds data for each **Run** which combines all of the data from the cognitive_complexity_reduced.json for each each **Repository** to generate a Team Summary Answer for the run. The Team Summary Answers for all runs are stored in this file. Note that this file is stored at the base folder of the results collection (identified as the −−output−folder when the Code Analysis tool is run.)

This file contains an top-level object which has the usual meta and data items. The data item is a dictionary whose keys are **Run Names** for objects containing the Team Sumary Object data items.

Team Summary Object

item	description
repo_answers	A dictionary of Repository Answer Object items (see above). The dictionary keys are the na
summary	A Team Summary Answer object

Team Summary Answer Object

item	description
question	The text of the question being answered
answer	The answer generated for the question in an Answer Object as calculated from the weighted answe

```
{
    "meta": {
    },
    "data": {
      "2022_Q1": {
        "repo_answers": {
          "product_client": {
            "evaluation": {
              "complexity": {
                "name": "GOOD",
                "value": 4
              },
              "method_lines": {
                "name": "GOOD",
```

```
            "value": 4
          }
        },
        "question": "Does the cognitive complexity of the code
            base decrease over time?",
        "answer": {
          "name": "YES",
          "value": "It is decidedly so"
        },
        "scaled_weights": {
          "swift": 100.00000000000001
        }
      },
      "product_library": {
      },
      "product_server": {
      }
    },
    "summary": {
      "question": "Does the cognitive complexity of the code base
          decrease over time?",
      "answer": {
        "name": "INCONSISTENT",
        "value": "Outlook not so good"
      }
    }
  },
  "2021_Annual": {
  }
 }
}
```