

# Testing benchmarking and logging

Alexander Diemand

Andreas Triantafyllos

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## **Abstract**

abstract ...

# Chapter 1

## Test coverage

### 1.1 Coverage

Test coverage is calculated as the fraction of functions which are called from test routines. This percentage is calculated by the tool *hpc* with a call to

```
cabal new-test
```

Add to a local `cabal.project.local` file these lines:

```
tests:           True
coverage:        True
library-coverage: True
```

Cardano.BM.Data.Trace	100%
Cardano.BM.Counters.Dummy	100%
Cardano.BM.Counters.Common	100%
Cardano.BM.Counters	100%
Cardano.BM.Configuration	100%
Cardano.BM.Output.Switchboard	90%
Cardano.BM.Data.Configuration	83%
Cardano.BM.BaseTrace	80%
Cardano.BM.Configuration.Model	79%
Cardano.BM.Setup	75%
Cardano.BM.Observer.Monadic	75%
Cardano.BM.Output.Log	66%
Cardano.BM.Data.Aggregated	61%
Cardano.BM.Data.Counter	56%
Cardano.BM.Data.Severity	54%
Cardano.BM.Data.Output	50%
Cardano.BM.Data.BackendKind	50%
Cardano.BM.Data.Backend	50%
Cardano.BM.Configuration.Static	50%
Cardano.BM.Data.LogItem	46%
Cardano.BM.Output.Aggregation	42%
Cardano.BM.Observer.STM	33%
Cardano.BM.Data.AggregatedKind	33%
Cardano.BM.Trace	31%
Cardano.BM.Data.Observable	20%
Cardano.BM.Data.SubTrace	10%
Cardano.BM.Data.Rotation	10%
Cardano.BM.Output.EKGView	0%
Paths_iohk_monitoring	0%
	50%

Figure 1.1: Test coverage of modules in percent as computed by the tool 'hpc'

# Chapter 2

## Testing

### 2.1 Test main entry point

```
module Main
(
    main
) where
import Test.Tasty
import qualified Cardano.BM.Test.Agregated (tests)
import qualified Cardano.BM.Test.STM (tests)
import qualified Cardano.BM.Test.Trace (tests)
import qualified Cardano.BM.Test.Configuration (tests)
import qualified Cardano.BM.Test.Routing (tests)
main :: IO ()
main = defaultMain tests
tests :: TestTree
tests =
    testGroup "iohk-monitoring"
    [ Cardano.BM.Test ◦ Aggregated.tests
    , Cardano.BM.Test ◦ STM.tests
    , Cardano.BM.Test ◦ Trace.tests
    , Cardano.BM.Test ◦ Configuration.tests
    , Cardano.BM.Test ◦ Routing.tests
    ]
```

#### 2.1.1 instance Arbitrary Aggregated

We define an instance of *Arbitrary* for an *Aggregated* which lets *QuickCheck* generate arbitrary instances of *Aggregated*. For this an arbitrary list of *Integer* is generated and this list is aggregated into a structure of *Aggregated*.

```
instance Arbitrary Aggregated where
    arbitrary = do
        vs' ← arbitrary :: Gen [Integer]
```

```

let vs = 42 : 17 : vs'
  (m,s) = updateMeanVar $ map fromInteger vs
return $ AggregatedStats (Stats
  (PureI (last vs))
  (PureI (minimum vs))
  (PureI (maximum vs))
  (fromIntegral $ length vs)
  (m)
  (s)
  )

```

Estimators for mean and variance must be updated the same way as in the code.

```

updateMeanVar :: [Double] → (Double, Double)
updateMeanVar [] = (0, 0)
updateMeanVar (val : vals) = updateMeanVar' (val, 0) 1 vals
where
  updateMeanVar' (m, s) _ [] = (m, s)
  updateMeanVar' (m, s) cnt (a : r) =
    let delta = a - m
        newcount = cnt + 1
        m' = m + (delta / newcount)
        s' = s + (delta * (a - m'))
    in
      updateMeanVar' (m', s') newcount r

```

### 2.1.2 Testing aggregation

```

tests :: TestTree
tests = testGroup "aggregation measurements" [
  property_tests
, unit_tests
]

property_tests :: TestTree
property_tests = testGroup "Properties" [
  testProperty "minimal" prop_Aggregation_minimal
, testProperty "commutative" prop_Aggregation_comm
]

unit_tests :: TestTree
unit_tests = testGroup "Unit tests" [
  testCase "initial_minus_1" unit_Aggregation_initial_minus_1
, testCase "initial_plus_1" unit_Aggregation_initial_plus_1
, testCase "initial_0" unit_Aggregation_initial_zero
]

prop_Aggregation_minimal :: Bool
prop_Aggregation_minimal = True

```

```

prop_Aggregation_comm :: Integer → Integer → Aggregated → Bool
prop_Aggregation_comm v1 v2 ag =
  let AggregatedStats stats1 = updateAggregation (PureI v1) (updateAggregation (PureI v2) ag Nothing) Nothing
      AggregatedStats stats2 = updateAggregation (PureI v2) (updateAggregation (PureI v1) ag Nothing) Nothing
  in
    fmin stats1 ≡ fmin stats2 ∧
    fmax stats1 ≡ fmax stats2 ∧
    fcount stats1 ≡ fcount stats2 ∧
    abs (fsum_A stats1 - fsum_A stats2) < 1.0e-4 ∧
    abs (fsum_B stats1 - fsum_B stats2) < 1.0e-4 ∧
    (v1 ≡ v2) 'implies' (flast stats1 ≡ flast stats2)
-- implication: if p1 is true, then return p2; otherwise true
implies :: Bool → Bool → Bool
implies p1 p2 = (¬ p1) ∨ p2
unit_Aggregation_initial_minus_1 :: Assertion
unit_Aggregation_initial_minus_1 =
  updateAggregation (-1) firstStateAggregatedStats Nothing @? =
    AggregatedStats (Stats (-1) (-1) 0 2 (-0.5) 0.5)
unit_Aggregation_initial_plus_1 :: Assertion
unit_Aggregation_initial_plus_1 =
  updateAggregation 1 firstStateAggregatedStats Nothing @? = AggregatedStats (Stats 1 0 1 2 0.5 0.5)
unit_Aggregation_initial_zero :: Assertion
unit_Aggregation_initial_zero =
  updateAggregation 0 firstStateAggregatedStats Nothing @? = AggregatedStats (Stats 0 0 0 2 0 0)
firstStateAggregatedStats :: Aggregated
firstStateAggregatedStats = AggregatedStats (Stats 0 0 0 1 0 0)

```

### 2.1.3 STM

```

module Cardano.BM.Test.STM (
  tests
) where
import Test.Tasty
import Test.Tasty.QuickCheck
tests :: TestTree
tests = testGroup "observing STM actions" [
  testProperty "minimal" prop_STM_observer
]
prop_STM_observer :: Bool
prop_STM_observer = True

```

### 2.1.4 Trace

```

tests :: TestTree
tests = testGroup "testing Trace" [

```



```

    unit_tests
  ,testCase "forked traces stress testing" stress_trace_in_fork
  ,testCase "stress testing: ObservableTrace vs. NoTrace" timing_Observable_vs_Untimed
  ,testCaseInfo "demonstrating nested named context logging" example_with_named_contexts
  ]
unit_tests :: TestTree
unit_tests = testGroup "Unit tests" [
  testCase "opening messages should not be traced" unit_noOpening_Trace
  ,testCase "hierarchy of traces" unit_hierarchy
  ,testCase "forked traces" unit_trace_in_fork
  ,testCase "hierarchy of traces with NoTrace" $
    unit_hierarchy' [Neutral, NoTrace, (ObservableTrace observablesSet)]
    onlyLevelOneMessage
  ,testCase "hierarchy of traces with DropOpening" $
    unit_hierarchy' [Neutral, DropOpening, (ObservableTrace observablesSet)]
    notObserveOpen
  ,testCase "hierarchy of traces with UntimedTrace" $
    unit_hierarchy' [Neutral, UntimedTrace, UntimedTrace]
    observeNoMeasures
  ,testCase "changing the minimum severity of a trace at runtime"
    unit_trace_min_severity
  ,testCase "changing the minimum severity of a named context at runtime"
    unit_named_min_severity
  ,testCase "appending names should not exceed 80 chars" unit_append_name
  ,testCase "creat subtrace which duplicates messages" unit_trace_duplicate
  ,testCase "testing name filtering" unit_name_filtering
  ,testCase "testing throwing of exceptions" unit_exception_throwing
  ,testCase "NoTrace: check lazy evaluation" unit_test_lazy_evaluation
  ]
where
  observablesSet = [MonotonicClock, MemoryStats]
  notObserveOpen :: [LogObject] → Bool
  notObserveOpen = all (λcase {LogObject _ (ObserveOpen _) → False; _ → True})
  notObserveClose :: [LogObject] → Bool
  notObserveClose = all (λcase {LogObject _ (ObserveClose _) → False; _ → True})
  notObserveDiff :: [LogObject] → Bool
  notObserveDiff = all (λcase {LogObject _ (ObserveDiff _) → False; _ → True})
  onlyLevelOneMessage :: [LogObject] → Bool
  onlyLevelOneMessage = λcase
    [LogObject _ (LogMessage (LogItem _ _ "Message from level 1."))] → True
    _ → False
  observeNoMeasures :: [LogObject] → Bool
  observeNoMeasures obs = notObserveOpen obs ∧ notObserveClose obs ∧ notObserveDiff obs

```

## Helper routines

```
data TraceConfiguration = TraceConfiguration
```

```

{tcOutputKind :: OutputKind
,tcName       :: LoggerName
,tcSubTrace   :: SubTrace
,tcSeverity   :: Severity
}

setupTrace :: TraceConfiguration → IO (Trace IO)
setupTrace (TraceConfiguration outk name subTr sev) = do
  c ← liftIO $ Cardano.BM.Configuration ∘ Model.empty
  mockSwitchboard ← newMVar $ error "Switchboard uninitialized."
  ctx ← liftIO $ newContext name c sev $ Switchboard mockSwitchboard
  let logTrace0 = case outk of
    TVarList tvar → BaseTrace.natTrace liftIO $ traceInTVarIO tvar
    TVarListNamed tvar → BaseTrace.natTrace liftIO $ traceNamedInTVarIO tvar
  setSubTrace (configuration ctx) name (Just subTr)
  logTrace' ← subTrace "" (ctx, logTrace0)
  return logTrace'

setTransformer_ :: Trace IO → LoggerName → Maybe SubTrace → IO ()
setTransformer_ (ctx, _) name subtr = do
  let c = configuration ctx
  n = (loggerName ctx) <> "." <> name
  setSubTrace c n subtr

```

### Example of using named contexts with *Trace*

```

example_with_named_contexts :: IO String
example_with_named_contexts = do
  cfg ← defaultConfigTesting
  logTrace ← Setup.setupTrace (Right cfg) "test"
  putStrLn "\n"
  logInfo logTrace "entering"
  logTrace0 ← appendName "simple-work-0" logTrace
  work0 ← complexWork0 logTrace0 "0"
  logTrace1 ← appendName "complex-work-1" logTrace
  work1 ← complexWork1 logTrace1 "42"
  Async.wait work0
  Async.wait work1
  -- the named context will include "complex" in the logged message
  logInfo logTrace "done."
  threadDelay 1000
  return ""
where
  complexWork0 tr msg = Async.async $ logInfo tr ("let's see (0): " `append` msg)
  complexWork1 tr msg = Async.async $ do
    logInfo tr ("let's see (1): " `append` msg)
    trInner@(ctx, _) ← appendName "inner-work-1" tr
    let observablesSet = [MonotonicClock]

```

```

setSubTrace (configuration ctx) "test.complex-work-1.inner-work-1.STM-action" $
  Just $ ObservableTrace observablesSet
_ ← STMObserver.bracketObserveIO trInner "STM-action" setVar_
logInfo trInner "let's see: done."
-- logInfo logTrace' "let's see: done."

```

### Show effect of turning off observables

```

run_timed_action :: Trace IO → Int → IO Measurable
run_timed_action logTrace reps = do
  runid ← newUnique
  t0 ← getMonoClock
  forM_ [1 :: Int]..reps $ const $ observeAction logTrace
  t1 ← getMonoClock
  return $ diffTimeObserved (CounterState runid t0) (CounterState runid t1)
where
  observeAction trace = do
    _ ← MonadicObserver.bracketObserveIO trace "" action
    return ()
  action = return $ forM [1 :: Int..100] $ \x → [x] ++ (init $ reverse [1 :: Int..10000])

timing_Observable_vs_Untimed :: Assertion
timing_Observable_vs_Untimed = do
  msgs1 ← STM.newTVarIO []
  traceObservable ← setupTrace $ TraceConfiguration
    (TVarList msgs1)
    "observables"
    (ObservableTrace observablesSet)
    Debug
  msgs2 ← STM.newTVarIO []
  traceUntimed ← setupTrace $ TraceConfiguration
    (TVarList msgs2)
    "no timing"
    UntimedTrace
    Debug
  msgs3 ← STM.newTVarIO []
  traceNoTrace ← setupTrace $ TraceConfiguration
    (TVarList msgs3)
    "no trace"
    NoTrace
    Debug
  t_observable ← run_timed_action traceObservable 100
  t_untimed ← run_timed_action traceUntimed 100
  t_notrace ← run_timed_action traceNoTrace 100
  assertBool
    ("Untimed consumed more time than ObservableTrace " ++ (show [t_untimed,t_observable]))
    (t_untimed < t_observable)

```

```

    assertBool
      ("NoTrace consumed more time than ObservableTrace" ++ (show [t_notrace, t_observable]))
      (t_notrace < t_observable)
    assertBool
      ("NoTrace consumed more time than Untimed" ++ (show [t_notrace, t_untimed]))
      True
  where
    observablesSet = [MonotonicClock, GhcRtsStats, MemoryStats]

```

### Control tracing in a hierarchy of *Traces*

We can lay out traces in a hierarchical manner, that the children forward traced items to the parent *Trace*. A *NoTrace* introduced in this hierarchy will cut off a branch from messaging to the root.

```

unit_hierarchy :: Assertion
unit_hierarchy = do
  msgs ← STM.newTVarIO []
  trace0 ← setupTrace $ TraceConfiguration (TVarList msgs) "test" Neutral Debug
  logInfo trace0 "This should have been displayed!"
  -- subtrace of trace which traces nothing
  setTransformer_trace0 "inner" (Just NoTrace)
  trace1 ← subTrace "inner" trace0
  logInfo trace1 "This should NOT have been displayed!"
  setTransformer_trace1 "innermost" (Just Neutral)
  trace2 ← subTrace "innermost" trace1
  logInfo trace2 "This should NOT have been displayed also due to the trace one level above!"
  -- acquire the traced objects
  res ← STM.readTVarIO msgs
  -- only the first message should have been traced
  assertBool
    ("Found more or less messages than expected: " ++ show res)
    (length res == 1)

```

### Change a trace's minimum severity

A trace is configured with a minimum severity and filters out messages that are labelled with a lower severity. This minimum severity of the current trace can be changed.

```

unit_trace_min_severity :: Assertion
unit_trace_min_severity = do
  msgs ← STM.newTVarIO []
  trace@(ctx, _) ← setupTrace $ TraceConfiguration (TVarList msgs) "test min severity" Neutral Debug
  logInfo trace "Message #1"
  -- raise the minimum severity to Warning
  setMinSeverity (configuration ctx) Warning

```

```

msev ← Cardano.BM.Configuration.minSeverity (configuration ctx)
assertBool ("min severity should be Warning, but is " ++ (show msev))
  (msev ≡ Warning)
-- this message will not be traced
logInfo trace "Message #2"
-- lower the minimum severity to Info
setMinSeverity (configuration ctx) Info
-- this message is traced
logInfo trace "Message #3"
-- acquire the traced objects
res ← STM.readTVarIO msgs
-- only the first and last messages should have been traced
assertBool
  ("Found more or less messages than expected: " ++ show res)
  (length res ≡ 2)
assertBool
  ("Found Info message when Warning was minimum severity: " ++ show res)
  (all (λcase {LogObject _ (LogMessage (LogItem _ Info "Message #2")) → False; _ → True}) res)

```

### Define a subtrace's behaviour to duplicate all messages

The *SubTrace* will duplicate all messages that pass through it. Each message will be in its own named context.

```

unit_trace_duplicate :: Assertion
unit_trace_duplicate = do
  msgs ← STM.newTVarIO []
  trace0@(ctx, _) ← setupTrace $ TraceConfiguration (TVarList msgs) "test duplicate" Neutral Debug
  logInfo trace0 "Message #1"
  -- create a subtrace which duplicates all messages
  setSubTrace (configuration ctx) "test duplicate.orig" $ Just (TeeTrace "dup")
  trace ← subTrace "orig" trace0
  -- this message will be duplicated
  logInfo trace "You will see me twice!"
  -- acquire the traced objects
  res ← STM.readTVarIO msgs
  -- only the first and last messages should have been traced
  assertBool
    ("Found more or less messages than expected: " ++ show res)
    (length res ≡ 3)

```

### Change the minimum severity of a named context

A trace of a named context can be configured with a minimum severity, such that the trace will filter out messages that are labelled with a lower severity.

```

unit_named_min_severity :: Assertion
unit_named_min_severity = do
  msgs ← STM.newTVarIO []
  trace0 ← setupTrace $ TraceConfiguration (TVarList msgs) "test named severity" Neutral Debug
  trace@(ctx, _) ← appendName "sev-change" trace0
  logInfo trace "Message #1"
  -- raise the minimum severity to Warning
  setSeverity (configuration ctx) (loggerName ctx) (Just Warning)
  msev ← Cardano.BM.Configuration.inspectSeverity (configuration ctx) (loggerName ctx)
  assertBool ("min severity should be Warning, but is " ++ (show msev))
    (msev ≡ Just Warning)
  -- this message will not be traced
  logInfo trace "Message #2"
  -- lower the minimum severity to Info
  setSeverity (configuration ctx) (loggerName ctx) (Just Info)
  -- this message is traced
  logInfo trace "Message #3"
  -- acquire the traced objects
  res ← STM.readTVarIO msgs
  -- only the first and last messages should have been traced
  assertBool
    ("Found more or less messages than expected: " ++ show res)
    (length res ≡ 2)
  assertBool
    ("Found Info message when Warning was minimum severity: " ++ show res)
    (all (\case {LogObject _ (LogMessage (LogItem _ Info "Message #2")) → False; _ → True}) res)

unit_hierarchy' :: [SubTrace] → ([LogObject] → Bool) → Assertion
unit_hierarchy' subtraces f = do
  let (t1 : t2 : t3 : _) = cycle subtraces
  msgs ← STM.newTVarIO []
  -- create trace of type 1
  trace1 ← setupTrace $ TraceConfiguration (TVarList msgs) "test" t1 Debug
  logInfo trace1 "Message from level 1."
  -- subtrace of type 2
  setTransformer_trace1 "inner" (Just t2)
  trace2 ← subTrace "inner" trace1
  logInfo trace2 "Message from level 2."
  -- subsubtrace of type 3
  setTransformer_trace2 "innermost" (Just t3)
  _ ← STMObserver.bracketObserveIO trace2 "innermost" setVar_
  logInfo trace2 "Message from level 3."
  -- acquire the traced objects
  res ← STM.readTVarIO msgs
  -- only the first message should have been traced
  assertBool

```

```

("Found more or less messages than expected: " ++ show res)
(f res)

```

### Logging in parallel

```

unit_trace_in_fork :: Assertion
unit_trace_in_fork = do
  msgs ← STM.newTVarIO []
  trace ← setupTrace $ TraceConfiguration (TVarListNamed msgs) "test" Neutral Debug
  trace0 ← appendName "work0" trace
  trace1 ← appendName "work1" trace
  work0 ← work trace0
  threadDelay 5000
  work1 ← work trace1
  Async.wait $ work0
  Async.wait $ work1
  res ← STM.readTVarIO msgs
  let names@(_:namesTail) = map lnName res
  -- each trace should have its own name and log right after the other
  assertBool
    ("Consecutive loggernames are not different: " ++ show names)
    (and $ zipWith (≠) names namesTail)
where
  work :: Trace IO → IO (Async.Async ())
  work trace = Async.async $ do
    logInfoDelay trace "1"
    logInfoDelay trace "2"
    logInfoDelay trace "3"
  logInfoDelay :: Trace IO → Text → IO ()
  logInfoDelay trace msg =
    logInfo trace msg >>
    threadDelay 10000

```

### Stress testing parallel logging

```

stress_trace_in_fork :: Assertion
stress_trace_in_fork = do
  msgs ← STM.newTVarIO []
  trace ← setupTrace $ TraceConfiguration (TVarListNamed msgs) "test" Neutral Debug
  let names = map (λa → ("work-" <> pack (show a))) [1..(10::Int)]
  ts ← forM names $ λname → do
    trace' ← appendName name trace
    work trace'
  forM_ ts Async.wait
  res ← STM.readTVarIO msgs

```

```

let resNames = map lnName res
let frequencyMap = fromListWith (+) [(x,1) | x ← resNames]
-- each trace should have traced 'totalMessages' messages
assertBool
  ("Frequencies of logged messages according to logername: " ++ show frequencyMap)
  (all (λname → (lookup ("test." <> name) frequencyMap) ≡ Just totalMessages) names)
where
  work :: Trace IO → IO (Async.Async ())
  work trace = Async.async $ forM_ [1..totalMessages] $ (logInfo trace) ∘ pack ∘ show
  totalMessages :: Int
  totalMessages = 10

```

### Dropping ObserveOpen messages in a subtrace

```

unit_noOpening.Trace :: Assertion
unit_noOpening.Trace = do
  msgs ← STM.newTVarIO []
  logTrace ← setupTrace $ TraceConfiguration (TVarList msgs) "test" DropOpening Debug
  _ ← STMObserver.bracketObserveIO logTrace "setTVar" setVar_
  res ← STM.readTVarIO msgs
  assertBool
    ("Found non-expected ObserveOpen message: " ++ show res)
    (all (λcase {LogObject _ (ObserveOpen _) → False; _ → True}) res)

```

### Assert maximum length of log context name

The name of the log context cannot grow beyond a maximum number of characters, currently the limit is set to 80.

```

unit_append_name :: Assertion
unit_append_name = do
  cfg ← defaultConfigTesting
  trace0 ← Setup.setupTrace (Right cfg) "test"
  trace1 ← appendName bigName trace0
  (ctx2, _) ← appendName bigName trace1
  assertBool
    ("Found logger name with more than 80 chars: " ++ show (loggerName ctx2))
    (T.length (loggerName ctx2) ≤ 80)
where
  bigName = T.replicate 30 "abcdefghijklmnopqrstuvwxy"

```

```

setVar_ :: STM.STM Integer
setVar_ = do
  t ← STM.newTVar 0
  STM.writeTVar t 42
  res ← STM.readTVar t
  return res

```



## Testing log context name filters

```

unit_name_filtering :: Assertion
unit_name_filtering = do
  let contextName = "test.sub.1"
  let lname = "sum"-- would be part of a "LogValue lname 42"
  let filter1 = [(Drop (Exact "test.sub.1"), Unhide [ ])]
  assertBool ("Dropping a specific name should filter it out and thus return False")
    (False == evalFilters filter1 contextName)
  let filter2 = [(Drop (EndsWith ".1"), Unhide [ ])]
  assertBool ("Dropping a name ending with a specific text should filter out the context name")
    (False == evalFilters filter2 contextName)
  let filter3 = [(Drop (StartsWith "test."), Unhide [ ])]
  assertBool ("Dropping a name starting with a specific text should filter out the context name")
    (False == evalFilters filter3 contextName)
  let filter4 = [(Drop (Contains ".sub."), Unhide [ ])]
  assertBool ("Dropping a name starting containing a specific text should filter out the context name")
    (False == evalFilters filter4 contextName)
  let filter5 = [(Drop (StartsWith "test."),
    Unhide [(Exact "test.sub.1")])]
  assertBool ("Dropping all and unhiding a specific name should the context name allow passing")
    (True == evalFilters filter5 contextName)
  let filter6 = [(Drop (StartsWith "test."),
    Unhide [(EndsWith ".sum"),
    (EndsWith ".other")])]
  assertBool ("Dropping all and unhiding some names, the LogObject should pass the filter")
    (True == evalFilters filter6 (contextName <> "." <> lname))
  let filter7 = [(Drop (StartsWith "test."),
    Unhide [(EndsWith ".product")])]
  assertBool ("Dropping all and unhiding an inexistant named value, the LogObject should not pass")
    (False == evalFilters filter7 (contextName <> "." <> lname))
  let filter8 = [(Drop (StartsWith "test."),
    Unhide [(Exact "test.sub.1")]),
    (Drop (StartsWith "something.else."),
    Unhide [(EndsWith ".this")])]
  assertBool ("Disjunction of filters that should pass")
    (True == evalFilters filter8 contextName)
  let filter9 = [(Drop (StartsWith "test."),
    Unhide [(Exact ".that")]),
    (Drop (StartsWith "something.else."),
    Unhide [(EndsWith ".this")])]
  assertBool ("Disjunction of filters that should not pass")
    (False == evalFilters filter9 contextName)

```

## Exception throwing

Exceptions encountered should be thrown.

```

unit_exception_throwing :: Assertion
unit_exception_throwing = do
    action ← work msg
    res ← Async.waitCatch action
    assertBool
        ("Exception should have been rethrown")
        (isLeft res)
where
    msg :: Text
    msg = error "faulty message"
    work :: Text → IO (Async.Async ())
    work message = Async.async $ do
        cfg ← defaultConfigTesting
        trace ← Setup.setupTrace (Right cfg) "test"
        logInfo trace message
        threadDelay 1000

```

### Check lazy evaluation of trace

Exception should not be thrown when type of *Trace* is *NoTrace*.

```

unit_test_lazy_evaluation :: Assertion
unit_test_lazy_evaluation = do
    action ← work msg
    res ← Async.waitCatch action
    assertBool
        ("Exception should not have been rethrown when type of Trace is NoTrace")
        (isRight res)
where
    msg :: Text
    msg = error "faulty message"
    work :: Text → IO (Async.Async ())
    work message = Async.async $ do
        cfg ← defaultConfigTesting
        trace0@(ctx, _) ← Setup.setupTrace (Right cfg) "test"
        setSubTrace (configuration ctx) "test.work" (Just NoTrace)
        trace ← subTrace "work" trace0
        logInfo trace message
        threadDelay 1000

```

### 2.1.5 Testing configuration

#### Test declarations

```

tests :: TestTree
tests = testGroup "config tests" [

```

```

    property_tests
  , unit_tests
]

property_tests :: TestTree
property_tests = testGroup "Properties" [
  testProperty "minimal" prop_Configuration_minimal
]

unit_tests :: TestTree
unit_tests = testGroup "Unit tests" [
  testCase "static_representation" unit_Configuration_static_representation
  , testCase "parsed_representation" unit_Configuration_parsed_representation
  , testCase "parsed_configuration" unit_Configuration_parsed
  , testCase "include_EKG_if_defined" unit_Configuration_check_EKG_positive
  , testCase "not_include_EKG_if_ndef" unit_Configuration_check_EKG_negative
  , testCase "check_scribe_caching" unit_Configuration_check_scribe_cache
]

```

### Property tests

```

prop_Configuration_minimal :: Bool
prop_Configuration_minimal = True

```

### Unit tests

The configuration file only indicates that EKG is listening on port nnnnn. Infer that *EKGViewBK* needs to be started as a backend.

```

unit_Configuration_check_EKG_positive :: Assertion
unit_Configuration_check_EKG_positive = do
  let c = ["rotation:"
    , "  rpLogLimitBytes: 5000000"
    , "  rpKeepFilesNum: 10"
    , "  rpMaxAgeHours: 24"
    , "minSeverity: Info"
    , "defaultBackends:"
    , "  - KatipBK"
    , "setupBackends:"
    , "  - KatipBK"
    , "defaultScribes:"
    , "  - StdoutSK"
    , "  - stdout"
    , "setupScribes:"
    , "  - scName: stdout"
    , "  scRotation: null"
    , "  scKind: StdoutSK"
    , "hasEKG: 18321"

```

```

    , "options:"
    , "  test:"
    , "    value: nothing"
  ]
  fp = "/tmp/test_ekgv_config.yaml"
  writeFile fp $unlines c
  repr ← parseRepresentation fp
  assertBool "expecting EKGViewBK to be setup" $
    EKGViewBK ∈ (setupBackends repr)

```

If there is no port defined for EKG, then do not start it even if present in the config.

```

unit_Configuration_check_EKG_negative :: Assertion
unit_Configuration_check_EKG_negative = do
  let c = [ "rotation:"
    , "  rpLogLimitBytes: 5000000"
    , "  rpKeepFilesNum: 10"
    , "  rpMaxAgeHours: 24"
    , "minSeverity: Info"
    , "defaultBackends:"
    , "  - KatipBK"
    , "  - EKGViewBK"
    , "setupBackends:"
    , "  - KatipBK"
    , "  - EKGViewBK"
    , "defaultScribes:"
    , "- - StdoutSK"
    , "  - stdout"
    , "setupScribes:"
    , "- scName: stdout"
    , "  scRotation: null"
    , "  scKind: StdoutSK"
    , "###hasEKG: 18321"
    , "options:"
    , "  test:"
    , "    value: nothing"
  ]
  fp = "/tmp/test_ekgv_config.yaml"
  writeFile fp $unlines c
  repr ← parseRepresentation fp
  assertBool "EKGViewBK shall not be setup" $
    ¬ $ EKGViewBK ∈ (setupBackends repr)
  assertBool "EKGViewBK shall not receive messages" $
    ¬ $ EKGViewBK ∈ (defaultBackends repr)

unit_Configuration_static_representation :: Assertion
unit_Configuration_static_representation =

```

```

let r = Representation
  {minSeverity = Info
  ,rotation = RotationParameters 5000000 24 10
  ,setupScribes =
    [ScribeDefinition {scName = "stdout"
                      ,scKind = StdoutSK
                      ,scRotation = Nothing}
    ]
  ,defaultScribes = [(StdoutSK, "stdout")]
  ,setupBackends = [EKGVViewBK, KatipBK]
  ,defaultBackends = [KatipBK]
  ,hasGUI = Just 12789
  ,hasEKG = Just 18321
  ,options =
    HM.fromList [("test1", (HM.singleton "value" "object1"))
                ,("test2", (HM.singleton "value" "object2")))]
}

in
  encode r @? = "
rotation:\n"
"  rpLogLimitBytes: 5000000\n"
"  rpKeepFilesNum: 10\n"
"  rpMaxAgeHours: 24\n"
"defaultBackends:\n"
"- KatipBK\n"
"setupBackends:\n"
"- EKGVViewBK\n"
"- KatipBK\n"
"hasGUI: 12789\n"
"defaultScribes:\n"
"- - StdoutSK\n"
"  - stdout\n"
"options:\n"
"  test2:\n"
"    value: object2\n"
"  test1:\n"
"    value: object1\n"
"setupScribes:\n"
"- scName: stdout\n"
"  scRotation: null\n"
"  scKind: StdoutSK\n"
"hasEKG: 18321\n"
"minSeverity: Info\n"
unit_Configuration_parsed_representation :: Assertion
unit_Configuration_parsed_representation = do
  repr ← parseRepresentation "test/config.yaml"
  encode repr @? = "

```

```

"rotation:\n"
"  rpLogLimitBytes: 5000000\n"
"  rpKeepFilesNum: 10\n"
"  rpMaxAgeHours: 24\n"
"defaultBackends:\n"
"- KatipBK\n"
"setupBackends:\n"
"- AggregationBK\n"
"- EKGViewBK\n"
"- KatipBK\n"
"hasGUI: null\n"
"defaultScribes:\n"
"- - StdoutSK\n"
"  - stdout\n"
"options:\n"
"  mapSubtrace:\n"
"    iohk.benchmarking:\n"
"      tag: ObservableTrace\n"
"      contents:\n"
"        - GhcRtsStats\n"
"        - MonotonicClock\n"
"    iohk.deadend: NoTrace\n"
"  mapSeverity:\n"
"    iohk.startup: Debug\n"
"    iohk.background.process: Error\n"
"    iohk.testing.uncritical: Warning\n"
"  mapAggregatedkinds:\n"
"    iohk.interesting.value: EwmaAK {alpha = 0.75}\n"
"    iohk.background.process: StatsAK\n"
"  cfokey:\n"
"    value: Release-1.0.0\n"
"  mapScribes:\n"
"    iohk.interesting.value:\n"
"      - StdoutSK::stdout\n"
"      - FileTextSK::testlog\n"
"    iohk.background.process: FileTextSK::testlog\n"
"  mapBackends:\n"
"    iohk.interesting.value:\n"
"      - EKGViewBK\n"
"      - AggregationBK\n"
"setupScribes:\n"
"- scName: testlog\n"
"  scRotation:\n"
"    rpLogLimitBytes: 25000000\n"
"    rpKeepFilesNum: 3\n"
"    rpMaxAgeHours: 24\n"
"  scKind: FileTextSK\n"
"- scName: stdout\n"

```

```

"  scRotation: null\n"
"  scKind: StdoutSK\n"
"hasEKG: 12789\n"
"minSeverity: Info\n"
unit_Configuration_parsed :: Assertion
unit_Configuration_parsed = do
  cfg ← setup "test/config.yaml"
  cfgInternal ← readMVar $ getCG cfg
  cfgInternal @? = ConfigurationInternal
    {cgMinSeverity      = Info
    ,cgMapSeverity      = HM.fromList [("iohk.startup", Debug)
                                       ,("iohk.background.process", Error)
                                       ,("iohk.testing.uncritical", Warning)
                                       ]
    ,cgMapSubtrace      = HM.fromList [("iohk.benchmarking",
                                       ObservableTrace [GhcRtsStats, MonotonicClock])
                                       ,("iohk.deadend", NoTrace)
                                       ]
    ,cgOptions          = HM.fromList
      [ ("mapSubtrace",
        HM.fromList [("iohk.benchmarking",
                      Object (HM.fromList [("tag", String "ObservableTrace")
                                             ,("contents", Array $ V.fromList
                                               [String "GhcRtsStats"
                                                ,String "MonotonicClock" ])))
                      ,("iohk.deadend", String "NoTrace")])
      , ("mapSeverity", HM.fromList [("iohk.startup", String "Debug")
                                     ,("iohk.background.process", String "Error")
                                     ,("iohk.testing.uncritical", String "Warning")])
      , ("mapAggregatedkinds", HM.fromList [("iohk.interesting.value",
                                              String "EwmaAK {alpha = 0.75}")
                                              ,("iohk.background.process",
                                              String "StatsAK")])
      , ("cfokey", HM.fromList [("value", String "Release-1.0.0")])
      , ("mapScribes", HM.fromList [("iohk.interesting.value",
                                     Array $ V.fromList [String "StdoutSK::stdout"
                                                           ,String "FileTextSK::testlog" ])
                                     ,("iohk.background.process", String "FileTextSK::testlog")])
      , ("mapBackends", HM.fromList [("iohk.interesting.value",
                                     Array $ V.fromList [String "EKGViewBK"
                                                           ,String "AggregationBK" ]))
      ]
    ,cgMapBackend        = HM.fromList [("iohk.interesting.value", [EKGViewBK, AggregationBK])
    ,cgDefBackendKs      = [KatipBK]
    ,cgSetupBackends     = [AggregationBK, EKGViewBK, KatipBK]
    ,cgMapScribe         = HM.fromList [("iohk.interesting.value",
                                       ["StdoutSK::stdout", "FileTextSK::testlog"])

```

```

        ,("iohk.background.process",["FileTextSK::testlog"])
      ]
    ,cgMapScribeCache = HM.fromList [("iohk.interesting.value",
      ["StdoutSK::stdout","FileTextSK::testlog"])
      ,("iohk.background.process",["FileTextSK::testlog"])
    ]
    ,cgDefScribes      = ["StdoutSK::stdout"]
    ,cgSetupScribes    = [ScribeDefinition
      {scKind = FileTextSK
      ,scName = "testlog"
      ,scRotation = Just $ RotationParameters
        {rpLogLimitBytes = 25000000
        ,rpMaxAgeHours = 24
        ,rpKeepFilesNum = 3
        }
      }
      ,ScribeDefinition
      {scKind = StdoutSK
      ,scName = "stdout"
      ,scRotation = Nothing
      }
    ]
    ,cgMapAggregatedKind = HM.fromList [("iohk.interesting.value",EwmaAK {alpha = 0.75})
      ,("iohk.background.process",StatsAK)
    ]
    ,cgDefAggregatedKind = StatsAK
    ,cgPortEKG           = 12789
    ,cgPortGUI           = 0
  }

```

Test caching and inheritance of Scribes.

```

unit_Configuration_check_scribe_cache :: Assertion
unit_Configuration_check_scribe_cache = do
  configuration ← empty
  let defScribes = ["FileTextSK::node.log"]
  setDefaultScribes configuration defScribes
  let scribes12 = ["StdoutSK::stdout","FileTextSK::out.txt"]
  setScribes configuration "name1.name2" $ Just scribes12
  scribes1234 ← getScribes configuration "name1.name2.name3.name4"
  scribes1 ← getScribes configuration "name1"
  scribes1234cached ← getCachedScribes configuration "name1.name2.name3.name4"
  scribesXcached ← getCachedScribes configuration "nameX"
  assertBool "Scribes for name1.name2.name3.name4 must be the same as name1.name2"$
    scribes1234 == scribes12
  assertBool "Scribes for name1 must be the default ones"$
    scribes1 == defScribes

```



```
assertBool "Scribes for name1.name2.name3.name4 must have been cached" $  
  scribes1234cached ≡ Just scribes1234  
assertBool "Scribes for nameX must not have been cached since getScribes was not called" $  
  scribesXcached ≡ Nothing
```