

Testing benchmarking and logging

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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	65%
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.Output.Aggregation	46%
Cardano.BM.Data.LogItem	46%
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'
  ds = map ( $\lambda(a,b) \rightarrow a - b$ ) $ zip vs (tail vs)
  (m1,s1) = updateMeanVar $ map fromInteger vs
  (m2,s2) = updateMeanVar $ map fromInteger ds
  mkBasicStats = BaseStats
    (PureI (minimum vs))
    (PureI (maximum vs))
    (fromIntegral $ length vs)
    (m1)
    (s1)
  mkDeltaStats = BaseStats
    (PureI (minimum ds))
    (PureI (maximum ds))
    (fromIntegral $ length ds)
    (m2)
    (s2)
return $ AggregatedStats (Stats
  (PureI (last vs))
  mkBasicStats
  mkDeltaStats)

```

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
    fbasic stats1 ≡ fbasic stats2 ∧
    (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) (BaseStats (−1) 0 2 (−0.5) 0.5) (BaseStats (−1) 0 1 (−1.0) 0.0))
unit_Aggregation_initial_plus_1 :: Assertion
unit_Aggregation_initial_plus_1 =
  updateAggregation 1 firstStateAggregatedStats Nothing @? = AggregatedStats (Stats 1 (BaseStats 0 1 2 0.5 0.5)
unit_Aggregation_initial_zero :: Assertion
unit_Aggregation_initial_zero =
  updateAggregation 0 firstStateAggregatedStats Nothing @? = AggregatedStats (Stats 0 (BaseStats 0 0 2 0 0) (BaseStats 0 0 0 0 0))
firstStateAggregatedStats :: Aggregated
firstStateAggregatedStats = AggregatedStats (Stats 0 (BaseStats 0 0 1 0 0) (BaseStats 0 0 0 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 (\lcase {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) o pack o 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 = [EKGViewBK, 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"
    "- EKGViewBK\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"

```

[illegible]

```

]
,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
```