Check MIB

<draft-nunzi-check-mib-00.txt>

Giorgio Nunzi, Juergen Quittek,
Marcus Brunner, Thomas Dietz
{nunzi|quittek|brunner|dietz}@netlab.nec.de

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General Problem Statement

- DISMAN has developed standards for distributed management including
  - Script MIB
  - Schedule MIB
  - Expression MIB
  - Event MIB
  - . . .
- The standards are designed to cover rather general problem spaces
- They may not fit well for one or the other specific problem
- Making them general also made them more heavy-weight
  - This is particularly relevant if you want to delegate simple functions to a large set of very light-weight devices

Specific Problem Statement

- Our concrete problem was managing several hundreds of base stations (NodeBs) in IP-based 3G and 4G mobile access networks
  - Applies also to ADSL and cable modem management
- These devices need to undergo regular health checks (with different significance)
  - connectivity in control layer
  - configuration of radio frequencies per attached antenna
  - load statistics, radio link error statistics
  - . . .
- The NMS should be informed immediately about failed health checks.
- Doing this by checking managed objects at all managed nodes from a central NMS does not scale sufficiently.

Investigates Approaches

- Management by Delegation:
  - divide the number of managed nodes into groups with reasonable size
  - create a management mid-level
  - have a mid-level manager for each group
  - --> this did not match well the existing management infrastructure
- Highly distributed management
  - delegate all health check to the managed nodes
  - perform health checks locally
  - --> our choice

Local Health Check

- Options
  - Script MIB
  - Expression MIB combined with Event MIB
  - partially hard coded health check
  - completely hard coded health check
- Script Mib definitely too heavy-weight
- Hard coding not flexible enough
- Expression/Event MIB still not really light-weight
- Our choice: non-standard, partially hard coded health check

Partially Hard Coded

- Supporting only two kinds of operations
  - compare object values with constants
  - logical and operation on results of compare operations
- Added a set of useful features
  - severity of failed comparison
  - max severity of all failed comparisons
  - notification on max severity threshold
  - health checks performed on demand (polling) or regularly (given interval)
  - number of failed comparisons
  - list of failed comparisons

Rule Table

- Defines compare operations per OID
- First part of index is checkResultName
- Single entry apllies to a single columnar or non-columnar object
  - **checkRuleName -- index** **SnmpAdminString**
  - **checkRuleOid** **OBJECT IDENTIFIER**
  - **checkRuleValue -- octet string** **RuleValue**
  - **checkRuleOperation** **INTEGER {**
    - **noOperation(0),**
    - **unequal(1), equal(2),**
    - **less(3), lessOrEqual(4),**
    - **greater(5), greaterOrEqual(6),**
    - **delta(7) }**
  - **checkRuleSeverity** **SeverityConfigured**
  - **checkRuleRowStatus** **RowStatus**

Result Table

- Defines results of health checks
- Single entry apllies to a single columnar or non-columnar object

```
◆ checkResultName                  SnmpAdminString,
  -- index
◆ checkResultSeverity              SeverityReturned,
  -- max severity of all failed rules
◆ checkResultSize                  Unsigned32,
  -- number of failed rules
◆ checkResultTime                  TimeStamp,
◆ checkResultInterval              TimeInterval,
◆ checkResultSeverityThreshold     SeverityConfigured,
  -- triggering a notification if severity exceeds
◆ checkResultStorageType           StorageType,
◆ checkResultRowStatus             RowStatus
```

Failure Table

- Provides list of failed rules
- Indexed by
  - **`checkResultName,`**
  - **`checkFailureSeverity,`**
  - **`checkRuleName`**
- Just two objects per entry:
  - **`checkFailureSeverity    SeverityReturned,`**
  - **`checkFailureOid         OBJECT IDENTIFIER`**

Scalar Capability and Control Objects

- Capability objects
  - `checkCapabMinCheckInterval TimeTicks`
  - `checkCapabMaxResults       Unsigned32`
  - `checkCapabMaxRules         Unsigned32`
- Control objects
  - `checkCtrlAdminStatus       INTEGER {`
    - `up(1),       -- performing checks`
    - `silent(2),   -- no notifications sent`
    - `down(3)   }  -- all checks disabled`
  - `checkCtrlOperStatus INTEGER {`
    - `up(1),       -- performing checks`
    - `silent(2),   -- no notifications sent`
    - `down(3),     -- all checks disabled`
    - `flushing(4)} -- finishing checks already started`

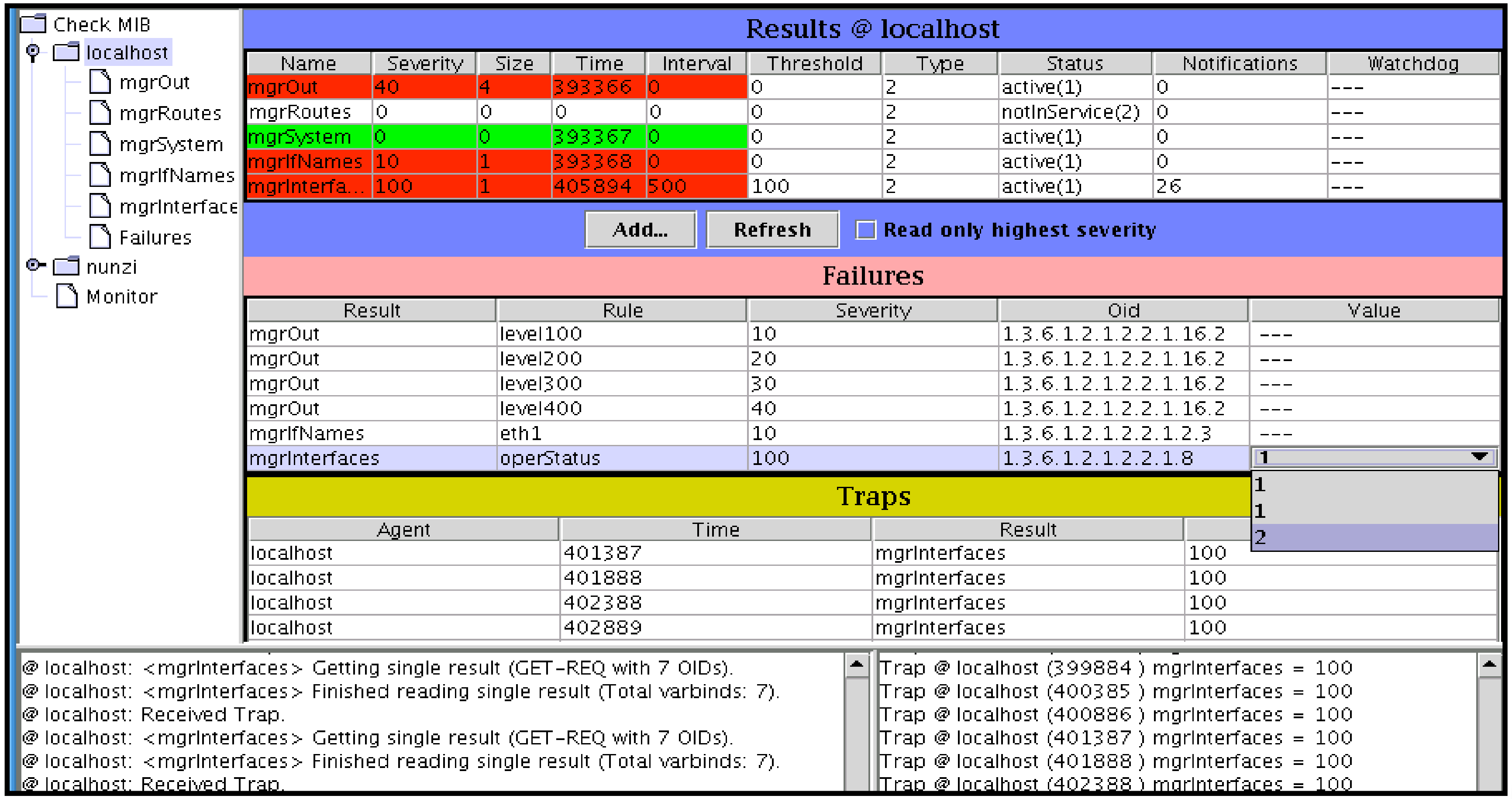
Check MIB Status

- Submitted as draft-nunzi-check-mib-00.txt
- Linux implementation using NET-SNMP
- GUI implementation in Java, integrated into HP-OpenView
- Product implementation in wireless access points planned for 2005

Conclusion

- We had a problem clearly related to the disman problem space.
- We were not satisfied with existing standards.
- We developed a more problem specific solution.
- The solution is still flexible within the narrowed problem space of health checking.
- We consider two options:
  - If there is interest to jointly improve and standardize this work, the disman WG could accept it as work item.
  - Otherwise, we intend to submit it individually to the IESG.

Monitoring an agent (1)



Results @ localhost

Name	Severity	Size	Time	Interval	Threshold	Type	Status	Notifications	Watchdog
mgrOut	40	4	393366	0	0	2	active(1)	0	---
mgrRoutes	0	0	0	0	0	2	notInService(2)	0	---
mgrSystem	0	0	393367	0	0	2	active(1)	0	---
mgrIfNames	10	1	393368	0	0	2	active(1)	0	---
mgrInterfa...	100	1	405894	500	100	2	active(1)	26	---

Failures

Result	Rule	Severity	Oid	Value
mgrOut	level100	10	1.3.6.1.2.1.2.2.1.16.2	---
mgrOut	level200	20	1.3.6.1.2.1.2.2.1.16.2	---
mgrOut	level300	30	1.3.6.1.2.1.2.2.1.16.2	---
mgrOut	level400	40	1.3.6.1.2.1.2.2.1.16.2	---
mgrIfNames	eth1	10	1.3.6.1.2.1.2.2.1.2.3	---
mgrInterfaces	operStatus	100	1.3.6.1.2.1.2.2.1.8	1

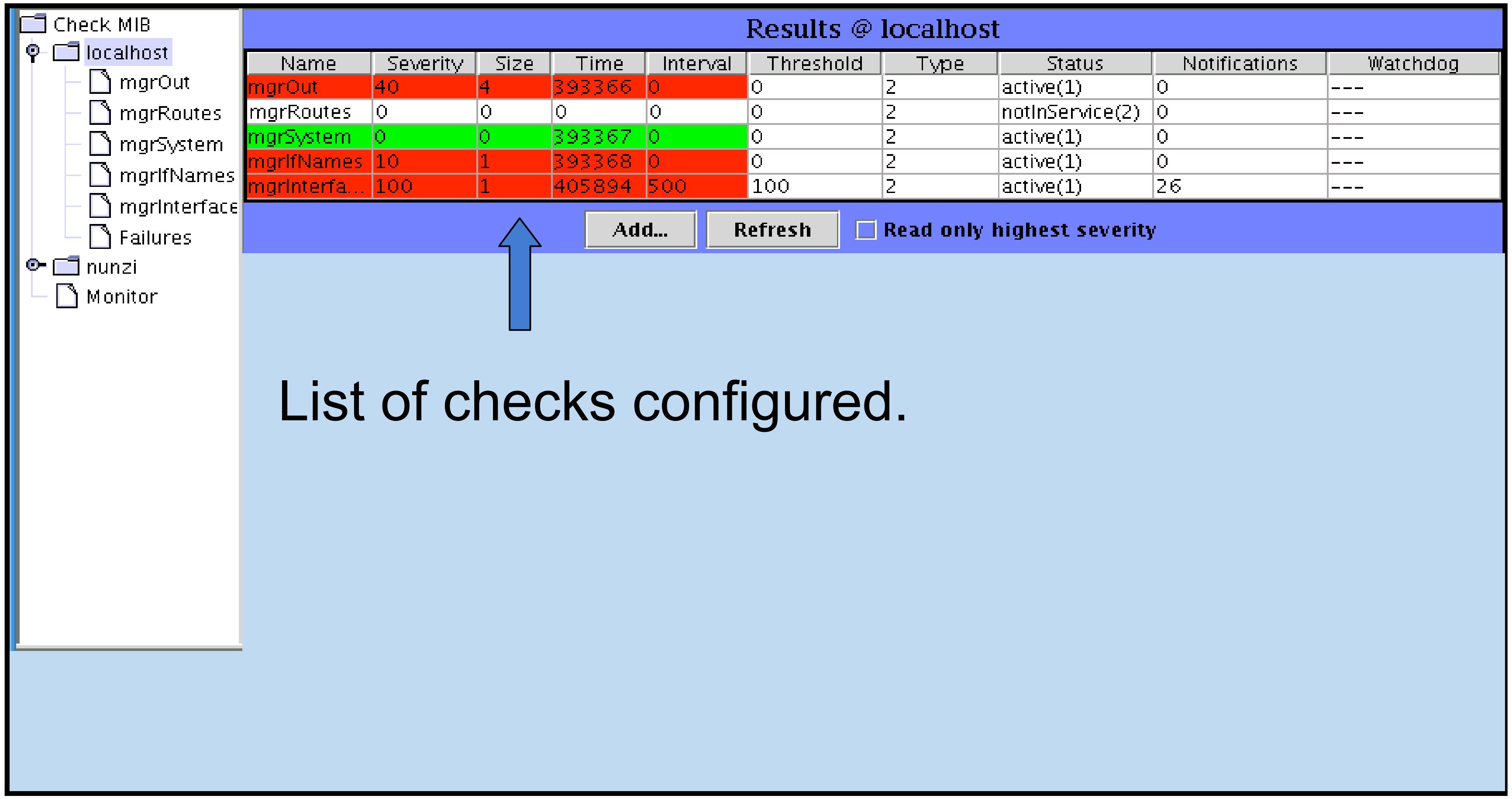
Traps

Agent	Time	Result	
localhost	401387	mgrInterfaces	100
localhost	401888	mgrInterfaces	100
localhost	402388	mgrInterfaces	100
localhost	402889	mgrInterfaces	100

```
@ localhost: <mgrInterfaces> Getting single result (GET-REQ with 7 OIDs).
@ localhost: <mgrInterfaces> Finished reading single result (Total varbinds: 7).
@ localhost: Received Trap.
@ localhost: <mgrInterfaces> Getting single result (GET-REQ with 7 OIDs).
@ localhost: <mgrInterfaces> Finished reading single result (Total varbinds: 7).
@ localhost: Received Trap.
```

```
Trap @ localhost (399884 ) mgrInterfaces = 100
Trap @ localhost (400385 ) mgrInterfaces = 100
Trap @ localhost (400886 ) mgrInterfaces = 100
Trap @ localhost (401387 ) mgrInterfaces = 100
Trap @ localhost (401888 ) mgrInterfaces = 100
Trap @ localhost (402388 ) mgrInterfaces = 100
```

Monitoring an agent (2)

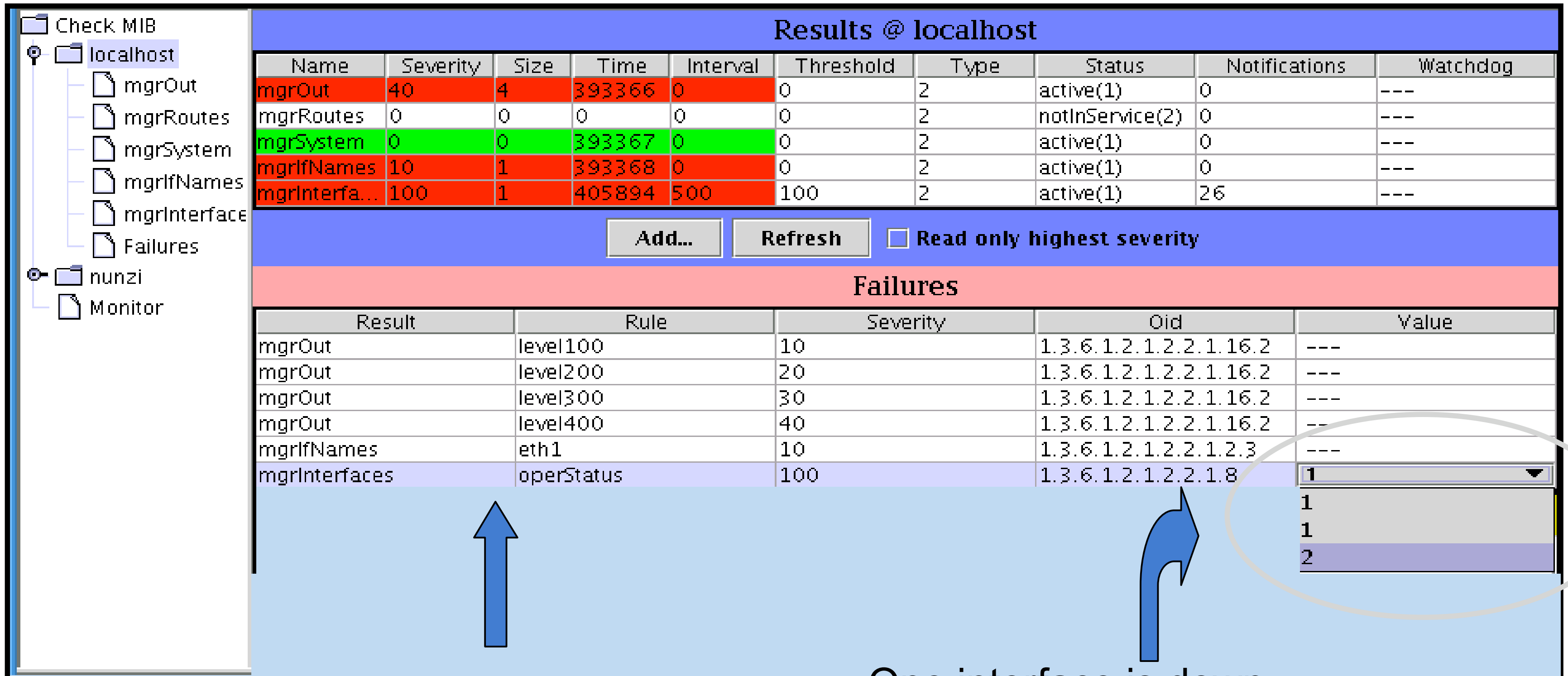


Results @ localhost

Name	Severity	Size	Time	Interval	Threshold	Type	Status	Notifications	Watchdog
mgrOut	40	4	393366	0	0	2	active(1)	0	---
mgrRoutes	0	0	0	0	0	2	notInService(2)	0	---
mgrSystem	0	0	393367	0	0	2	active(1)	0	---
mgrIfNames	10	1	393368	0	0	2	active(1)	0	---
mgrInterfa...	100	1	405894	500	100	2	active(1)	26	---

List of checks configured.

Monitoring an agent (3)



Results @ localhost

Name	Severity	Size	Time	Interval	Threshold	Type	Status	Notifications	Watchdog
mgrOut	40	4	393366	0	0	2	active(1)	0	---
mgrRoutes	0	0	0	0	0	2	notInService(2)	0	---
mgrSystem	0	0	393367	0	0	2	active(1)	0	---
mgrIfNames	10	1	393368	0	0	2	active(1)	0	---
mgrInterfa...	100	1	405894	500	100	2	active(1)	26	---

Failures

Result	Rule	Severity	Oid	Value
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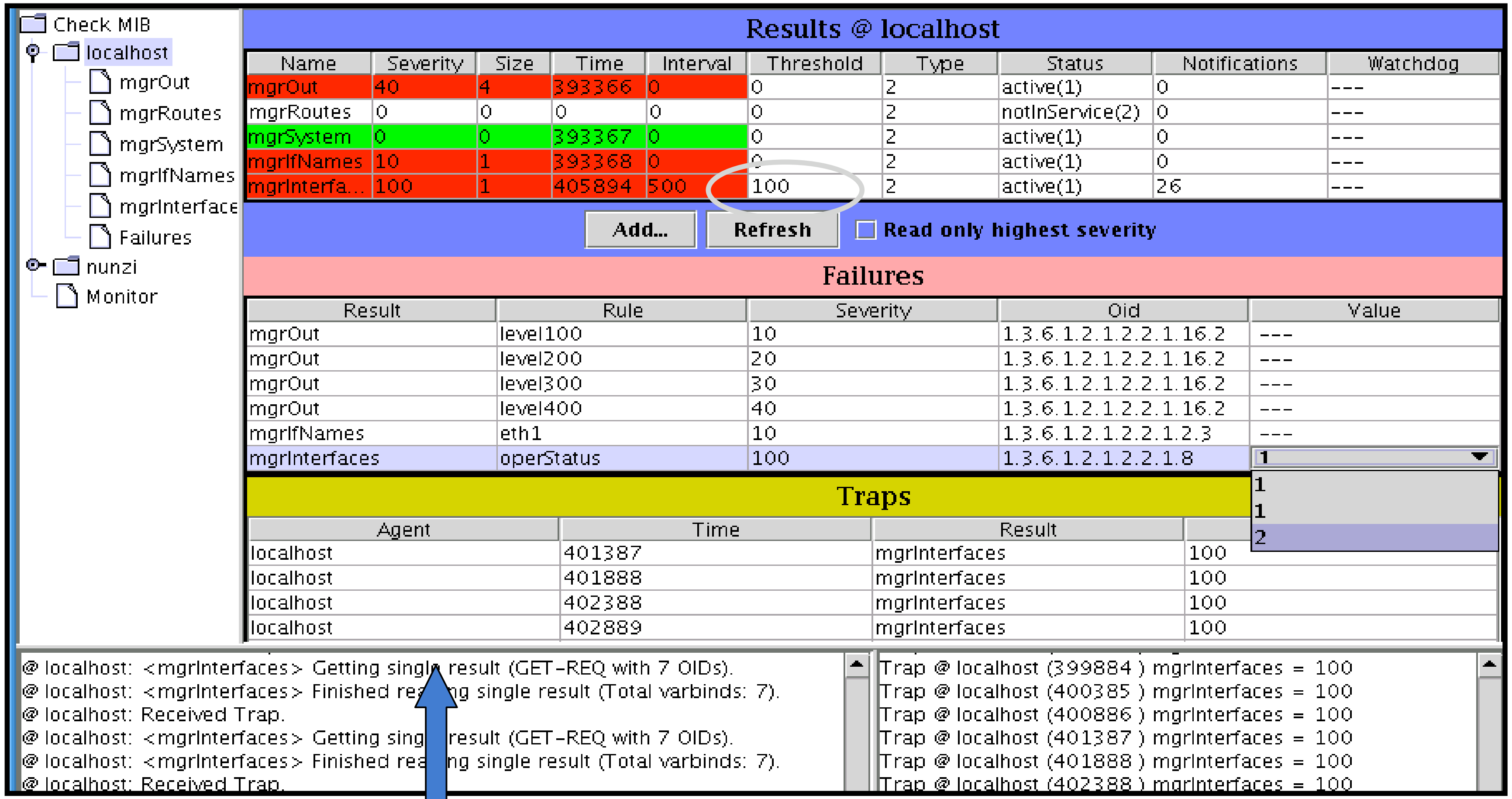
mgrOut	level300	30	1.3.6.1.2.1.2.2.1.16.2	---
mgrOut	level400	40	1.3.6.1.2.1.2.2.1.16.2	--
mgrIfNames	eth1	10	1.3.6.1.2.1.2.2.1.2.3	---
mgrInterfaces	operStatus	100	1.3.6.1.2.1.2.2.1.8	1

1
1
2

FailuresTable: red results are described.

One interface is down (these values are read by the NMS, not by the CheckMIB!)

Monitoring an agent (4)



Results @ localhost

Name	Severity	Size	Time	Interval	Threshold	Type	Status	Notifications	Watchdog
mgrOut	40	4	393366	0	0	2	active(1)	0	---
mgrRoutes	0	0	0	0	0	2	notInService(2)	0	---
mgrSystem	0	0	393367	0	0	2	active(1)	0	---
mgrIfNames	10	1	393368	0	0	2	active(1)	0	---
mgrInterfa...	100	1	405894	500	100	2	active(1)	26	---

Failures

Result	Rule	Severity	Oid	Value
mgrOut	level100	10	1.3.6.1.2.1.2.2.1.16.2	---
mgrOut	level200	20	1.3.6.1.2.1.2.2.1.16.2	---
mgrOut	level300	30	1.3.6.1.2.1.2.2.1.16.2	---
mgrOut	level400	40	1.3.6.1.2.1.2.2.1.16.2	---
mgrIfNames	eth1	10	1.3.6.1.2.1.2.2.1.2.3	---
mgrInterfaces	operStatus	100	1.3.6.1.2.1.2.2.1.8	1

```
1
1
2
```

Traps

Agent	Time	Result	
localhost	401387	mgrInterfaces	100
localhost	401888	mgrInterfaces	100
localhost	402388	mgrInterfaces	100
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```
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Trap @ localhost (400886 ) mgrInterfaces = 100
Trap @ localhost (401387 ) mgrInterfaces = 100
Trap @ localhost (401888 ) mgrInterfaces = 100
Trap @ localhost (402388 ) mgrInterfaces = 100
```
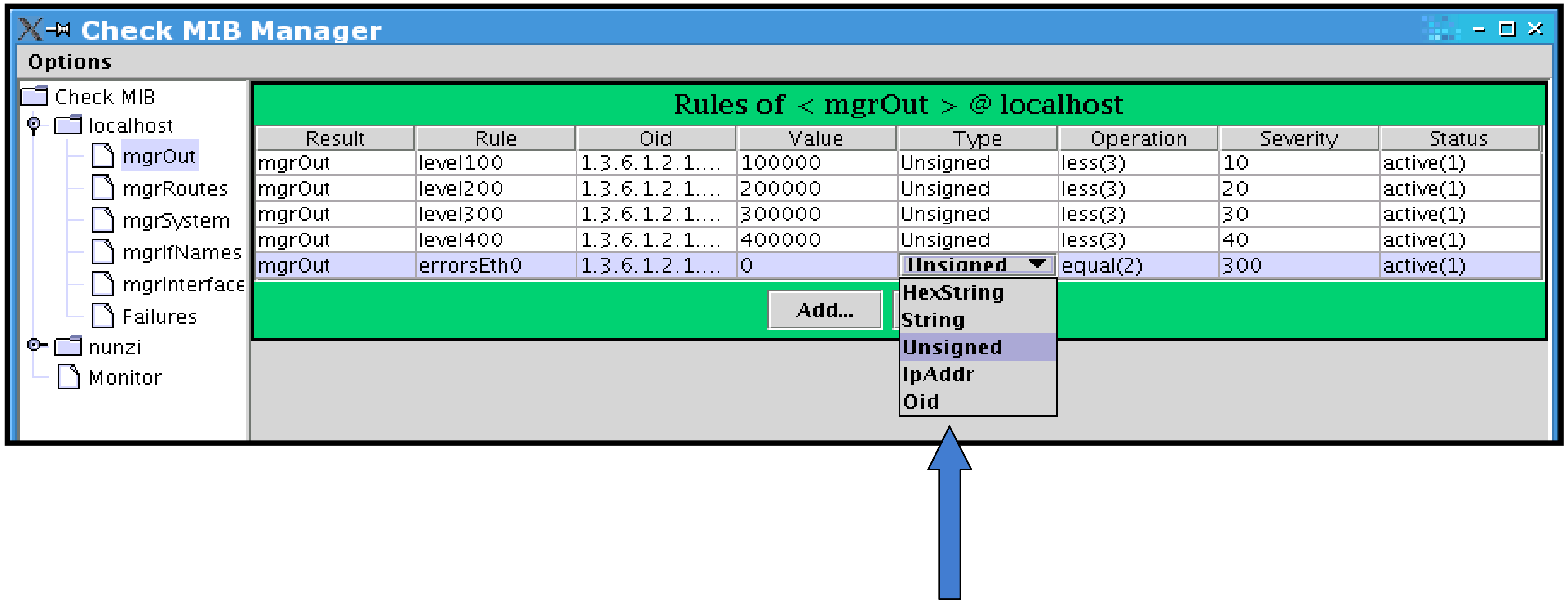

Notifications of the check failed

Configuring checks

A result is defined trough a set of comparisons on managed objects.



Check MIB Manager

Options

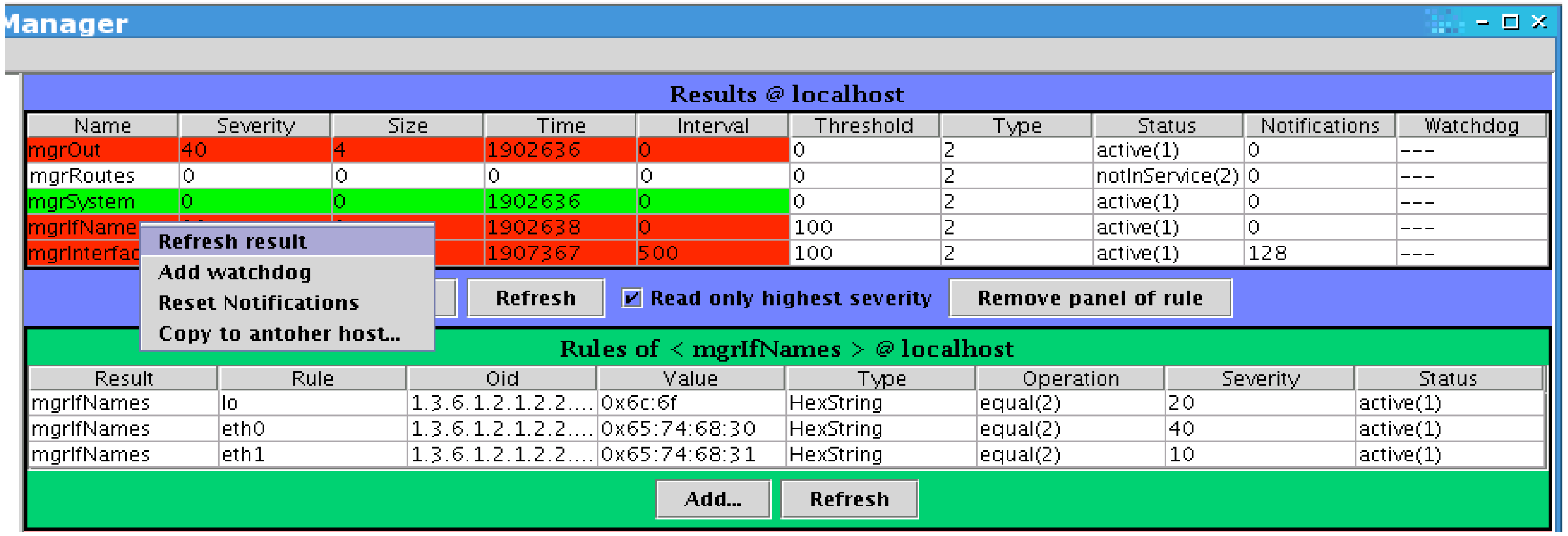
- Check MIB
  - localhost
    - mgrOut
    - mgrRoutes
    - mgrSystem
    - mgrIfNames
    - mgrInterface
    - Failures
  - nunzi
  - Monitor

Rules of < mgrOut > @ localhost

Result	Rule	Oid	Value	Type	Operation	Severity	Status
mgrOut	level100	1.3.6.1.2.1....	100000	Unsigned	less(3)	10	active(1)
mgrOut	level200	1.3.6.1.2.1....	200000	Unsigned	less(3)	20	active(1)
mgrOut	level300	1.3.6.1.2.1....	300000	Unsigned	less(3)	30	active(1)
mgrOut	level400	1.3.6.1.2.1....	400000	Unsigned	less(3)	40	active(1)
mgrOut	errorsEth0	1.3.6.1.2.1....	0	Unsigned	equal(2)	300	active(1)

Value is encoded into an OCTECT STRING.

Copy&Paste of checks



Results @ localhost

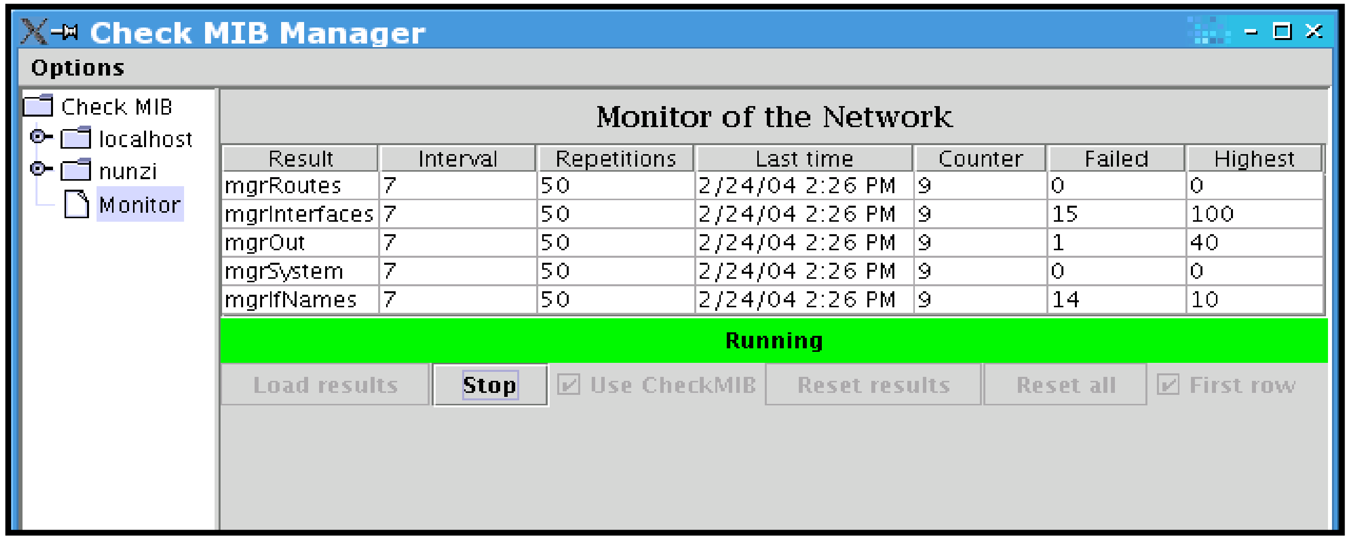
Name	Severity	Size	Time	Interval	Threshold	Type	Status	Notifications	Watchdog
mgrOut	40	4	1902636	0	0	2	active(1)	0	---
mgrRoutes	0	0	0	0	0	2	notInService(2)	0	---
mgrSystem	0	0	1902636	0	0	2	active(1)	0	---
mgrIfName			1902638	0	100	2	active(1)	0	---
mgrInterfac			1907367	500	100	2	active(1)	128	---

Rules of < mgrIfNames > @ localhost

Result	Rule	Oid	Value	Type	Operation	Severity	Status
mgrIfNames	lo	1.3.6.1.2.1.2.2....	0x6c:6f	HexString	equal(2)	20	active(1)
mgrIfNames	eth0	1.3.6.1.2.1.2.2....	0x65:74:68:30	HexString	equal(2)	40	active(1)
mgrIfNames	eth1	1.3.6.1.2.1.2.2....	0x65:74:68:31	HexString	equal(2)	10	active(1)

- A check can be copied to another host (all the rules included are copied).
- A single rule can be copied to another check.

Monitoring the network



Monitor of the Network

Result	Interval	Repetitions	Last time	Counter	Failed	Highest
mgrRoutes	7	50	2/24/04 2:26 PM	9	0	0
mgrInterfaces	7	50	2/24/04 2:26 PM	9	15	100
mgrOut	7	50	2/24/04 2:26 PM	9	1	40
mgrSystem	7	50	2/24/04 2:26 PM	9	0	0
mgrIfNames	7	50	2/24/04 2:26 PM	9	14	10

Running

Checks are read from all agents.