

Network structure

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Illustrate a typical MADS network structure and its requirements.

Table of contents

Architecture	1
The broker	2
The agents	3
Layout and requirements	3
How to develop a plugin	5
How to deal with time	5

Architecture

The typical architecture of a MADS network can be represented as:

! Important

Remember that the above schematic represent *processes*, regardless the physical machine on which they are being executed.

For example, the whole network could run on a single workstation, or it could be conversely distributed over multiple devices connected to the same IP network, each device running a single process/node.

In the figure Figure 1, the solid lines represent a [ZeroMQ](#) connection over TCP/IP, which uses compressed JSON as a data encoding protocol. Compression is preformed with the [snappy](#)

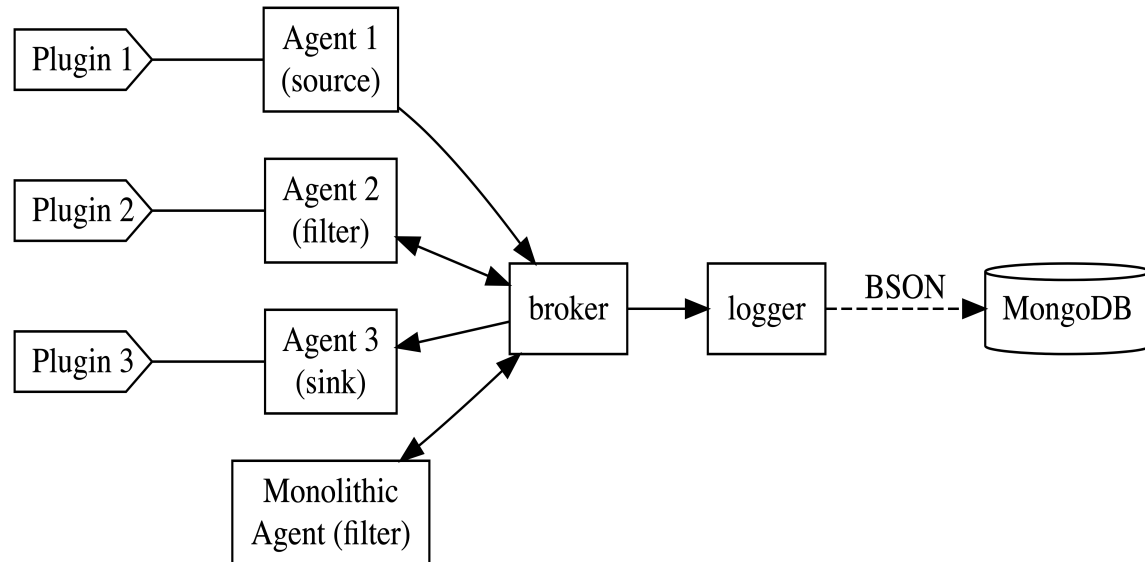


Figure 1: MADS Network

library. The dashed line, conversely, represents the proprietary MongoDB protocol, with data serialized as BSON (Binary-JSON).

The broker

What is the broker purpose?

The broker solves the issue of knowing multiple network addresses when you have a number of devices participating to the same distributed system.

With the aid of the broker, any separate device partaking to the MADS network only needs to know a single hostname/IP address: that of the machine running the broker.

⚠ Warning

There can only be a single broker per network.

Running the broker is quite simple:

```
mads broker
```

The agents

Agents can be:

- **monolithic**: implemented as a single executable inheriting the `Mads::Agent` C++ class.
- **plug-in**: a single executable that on runtime loads a proper plug-in (i.e. a dynamically loaded library)

Regardless the type, agent can have three different behaviors:

- **source**: they provide information to the network (e.g. by reading sensors)
- **filter**: they operate and transform received information
- **sink**: they consume information received from the network (e.g. to store or visualize)

The MADS installer provides three general purpose agents, aptly named **source**, **filter**, and **sink**, that are designed to load proper plugins. The command `mads plugin` can be used to generate a suitable template for a new plugin to be developed.

Layout and requirements

At the bare minimum, a MADS network requires:

- the broker
- the MongoDB database
- the logger agent

The MADS installers provide broker and logger, but MongoDB must be installed separately. The easiest route is to do it via Docker.

Ideally, broker, logger and database should run on a single machine, having enough resources to store the data flow on the database, while agents can be distributed over multiple devices.

Note

According to our testing, Linux is the best choice for running MADS broker and logger in terms of performance.

Any other agent can be run on the same machine or on a separate machine. In the latter case, it must be started with the `-s` option stating the broker address, e.g.: `-s tcp://<hostname>:9092`, where `<hostname>` shall be replaced with the proper host name, if available, or with the machine IP address. This is the only address that any agent needs to know in order to connect to the MADS network.

To help you find out the proper address, you can use the `-n list` broker option:

```

> mads broker -n list
Reading settings from /Users/p4010/usr/local/etc/mads.ini [broker]
Using network interface list
Available network adapters:
[      lo0] - 127.0.0.1
[      en0] - 192.168.1.220
[ bridge100] - 198.19.249.3
Binding broker frontend (XSUB) at tcp://*:9090
Binding broker backend (XPUB) at tcp://*:9091
Binding broker shared settings (REP) at tcp://*:9092
Timecode FPS: 25
Settings are provided via tcp://127.0.0.1:9092
CTRL-C to immediate exit
Type P to pause, R to resume, I for information, Q to clean quit, X to restart and reload settings

```

This shows that the host has three network interfaces. The public one is probably `en0` (your names may vary). Now quit the broker and relaunch it as:

```

> mads broker -n en0
Reading settings from /Users/p4010/usr/local/etc/mads.ini [broker]
Using network interface en0
Binding broker frontend (XSUB) at tcp://*:9090
Binding broker backend (XPUB) at tcp://*:9091
Binding broker shared settings (REP) at tcp://*:9092
Timecode FPS: 25
Settings are provided via tcp://192.168.1.220:9092
CTRL-C to immediate exit
Type P to pause, R to resume, I for information, Q to clean quit, X to restart and reload settings

```

Look at the line `Settings are provided via tcp://192.168.1.220:9092`: that is the address that you must use to start any agent in the network, e.g.:

```
mads feedback -s tcp://192.168.1.220:9092
```

! Important

The `-n` command line option **has no effect** on how the broker operates. Its only purpose is to help you find out the proper address to use when starting agents that run on different machines or devices.

How to develop a plugin

i Note

To be done.

How to deal with time

i Note

To be done.