

Erlang Solutions Ltd.

Erlang-Based Sensor Network Management for Heterogenous Devices



mentor and co-authors

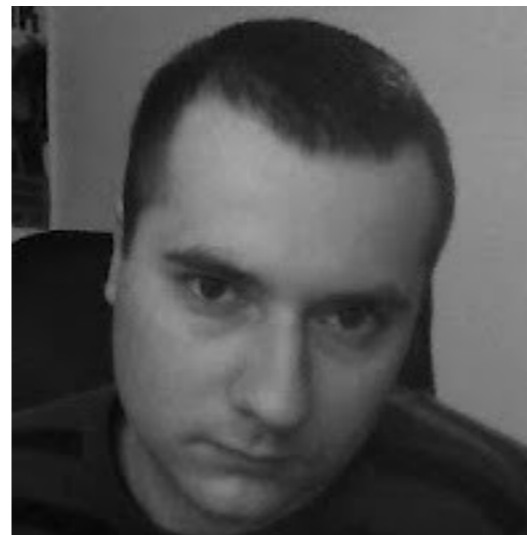
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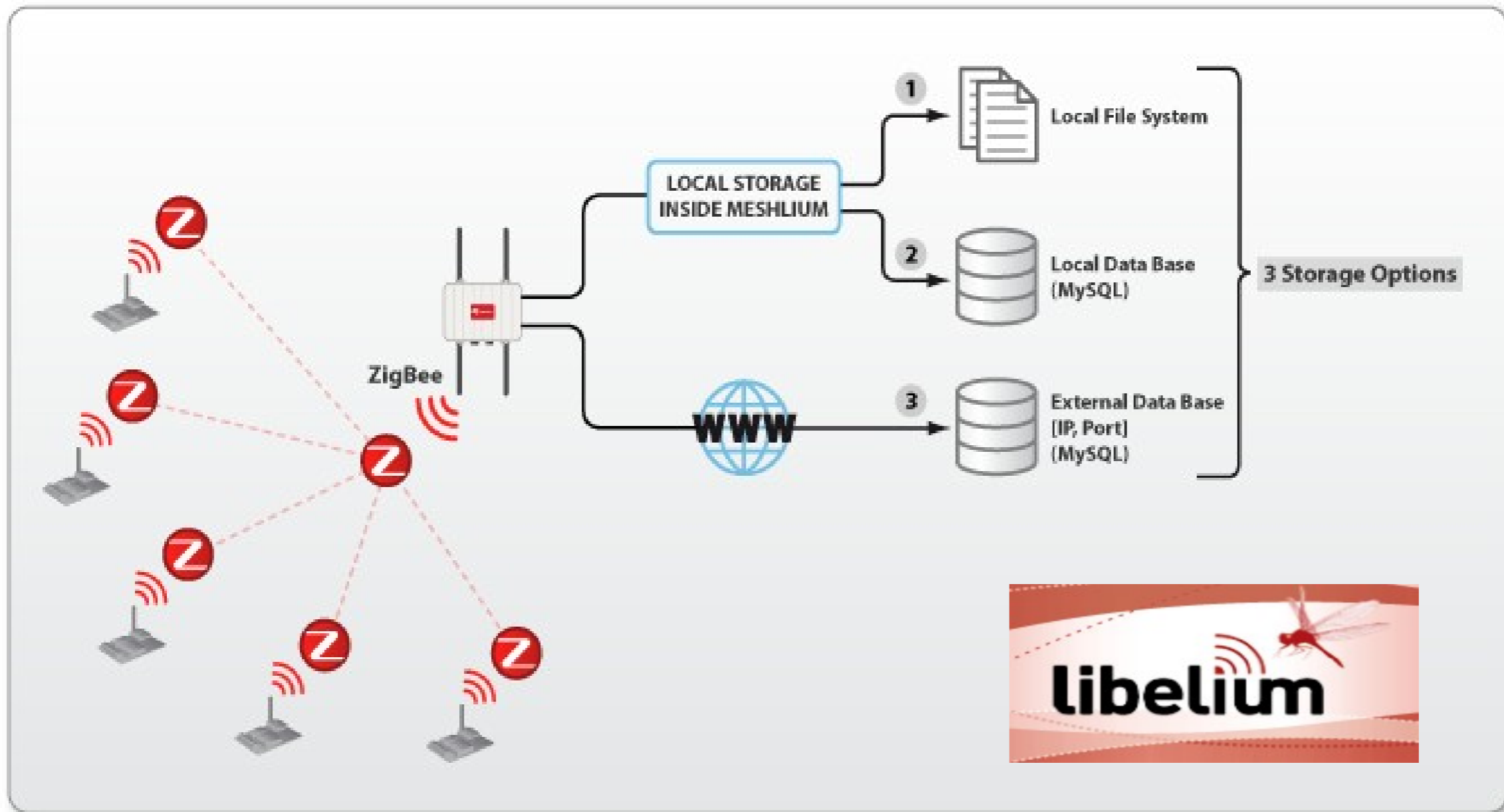
ppikula@gmail.com



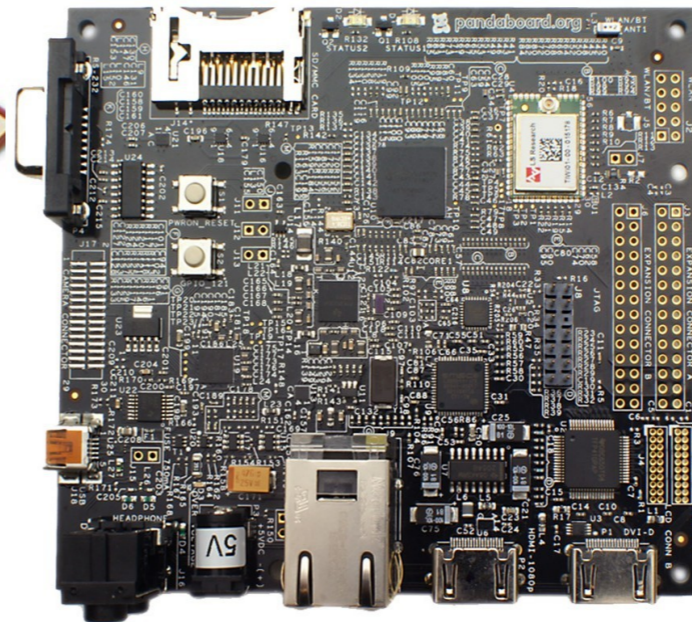
agenda

- Our system
- Why Erlang?
- Supervisors
- Communication with hardware
- HTTP REST using Webmachine
- CouchDB
- Questions

coalescense system:why?



system:hardware



- Powerful
- Popular and cheap
- USB peripherals
- Runs Linux and Erlang

system:devices







Window 1



```
sh-3.2$ export PATH=/data/local/bin:$PATH
sh-3.2$ su
sh-3.2# debdroid
Initializing chroot filesystem

Mounting proc, sysfs, dev, devpts

Setting up DNS and Networking

Setting 8.8.8.8 and 8.8.4.4 as nameservers in /etc/resolv.conf
Setting localhost and hostname "debdroid" in /etc/hosts
Debian deployed successfully, opening chroot.
bash: /usr/local/bin/mnt_home: No such file or directory
debdroid:/# erl
Erlang R15B (erts-5.9) [source] [smp:2:2] [async-threads:0] [kernel-poll:false]

Eshell V5.9 (abort with ^G)
1> halt().
debdroid:/# erl -name android@192.168.0.100 -setcookie wacek
Erlang R15B (erts-5.9) [source] [smp:2:2] [async-threads:0] [kernel-poll:false]

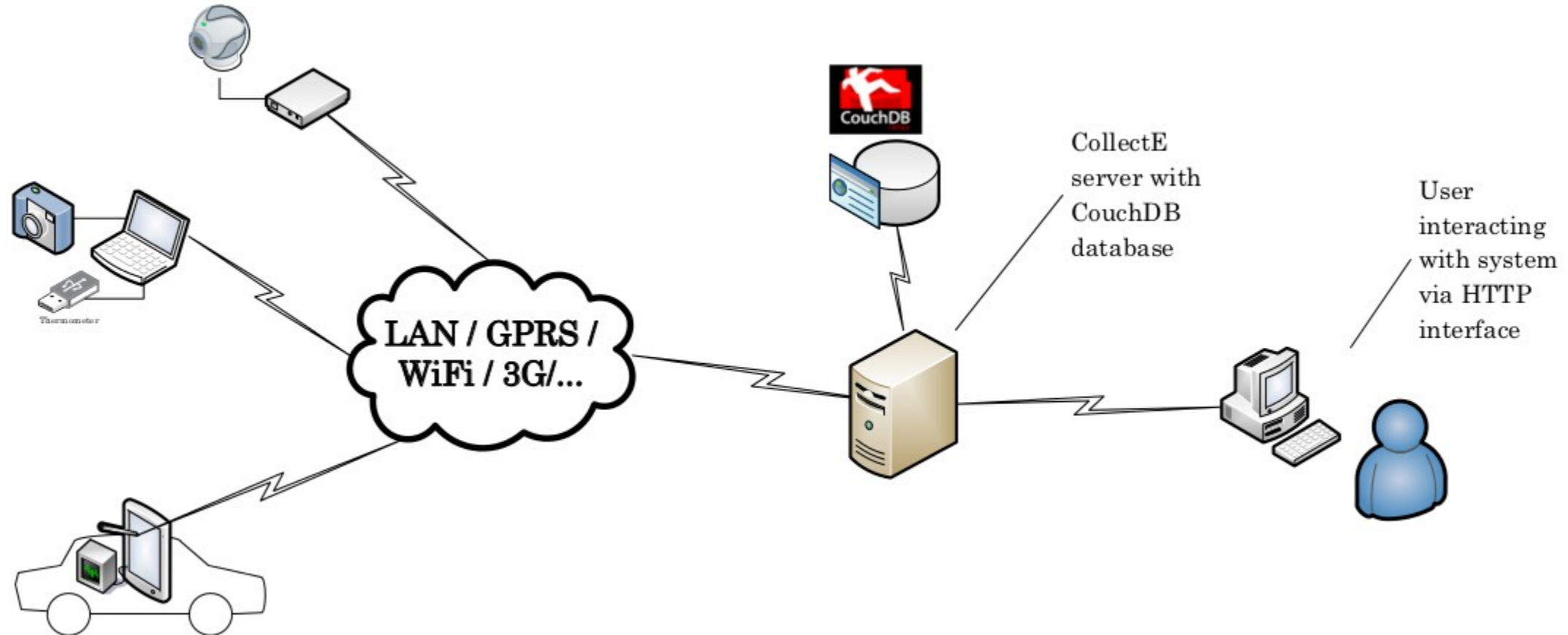
Eshell V5.9 (abort with ^G)
(android@192.168.0.100)1> nodes().
['laptop@192.168.0.102']
(android@192.168.0.100)2> █
```



20:59



system:idea



- Nodes connected via LAN, GPRS, 3G, WIFI
- Sensors analyze and classify data

- Flexible
- Easy access to data

erlang:why?

Battle-tested

designed for distributed systems

mature, stable

scalable

Cross-platform

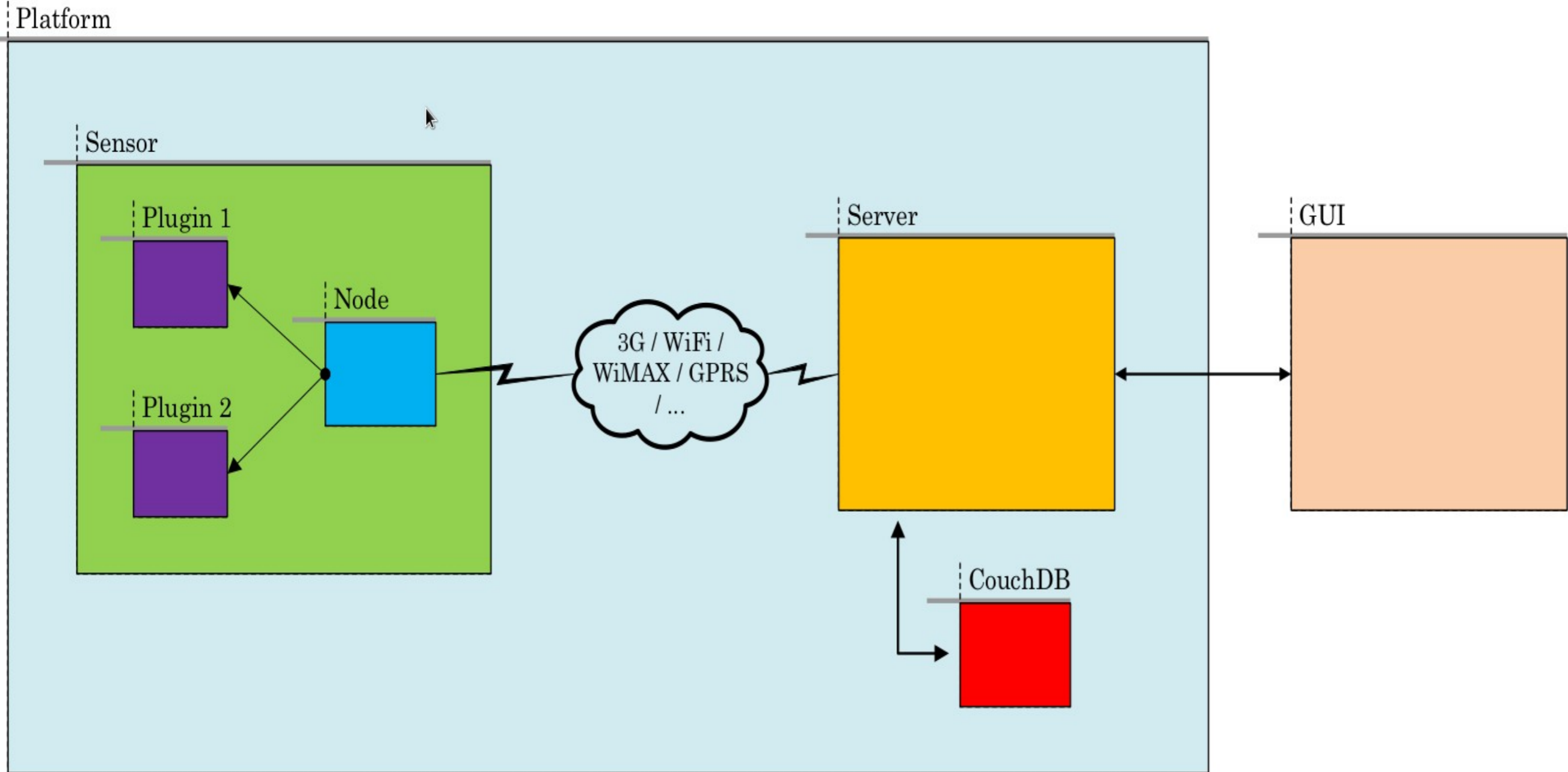
runs on Linux, BSD, Solaris, Mac OS X, Windows, VxWorks

Proper tools

OTP, webmachine, rebar...



system:architecture



supervisors:overview

Supervisors and workers

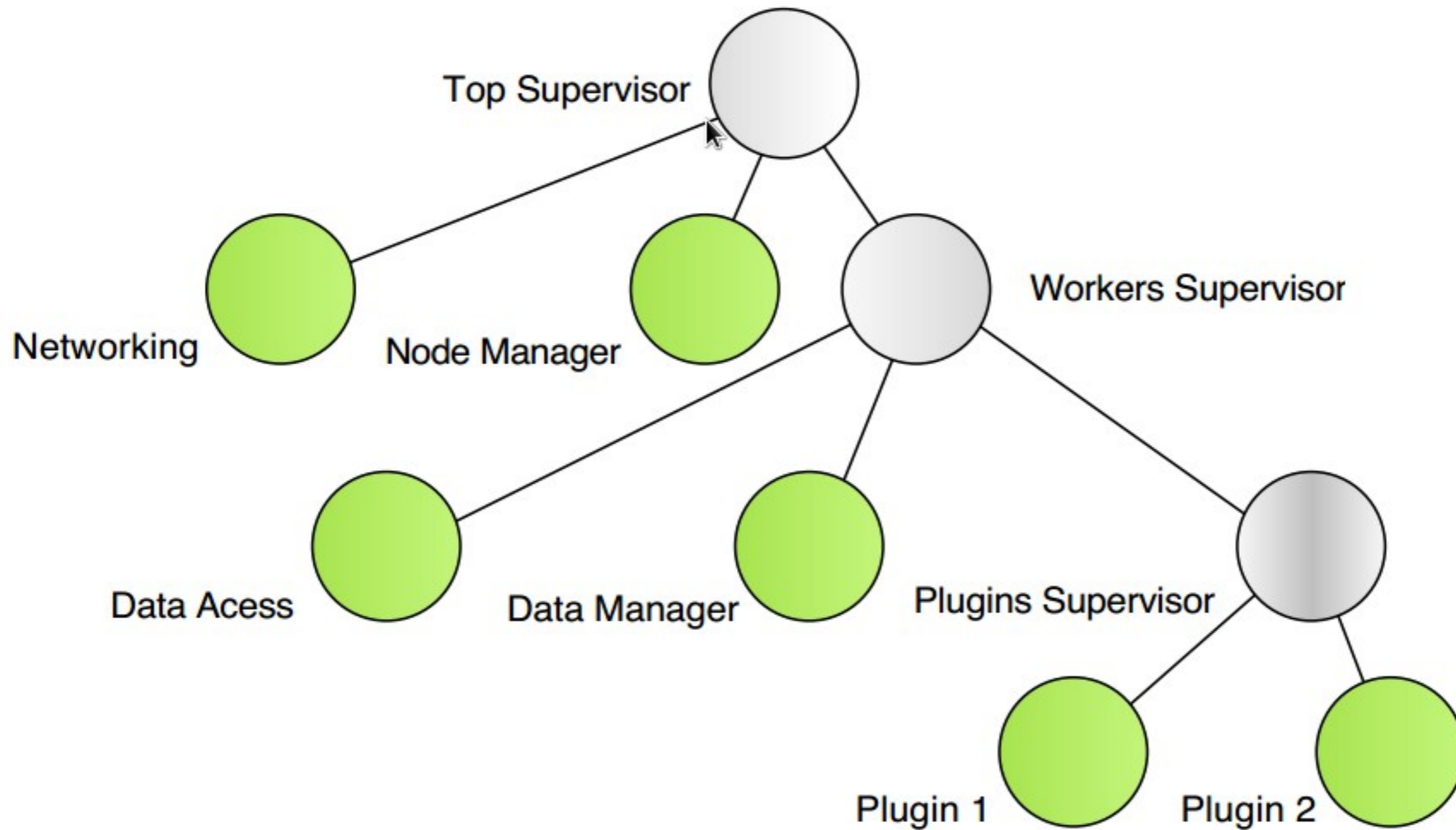
Hierarchy of processes

Error handling

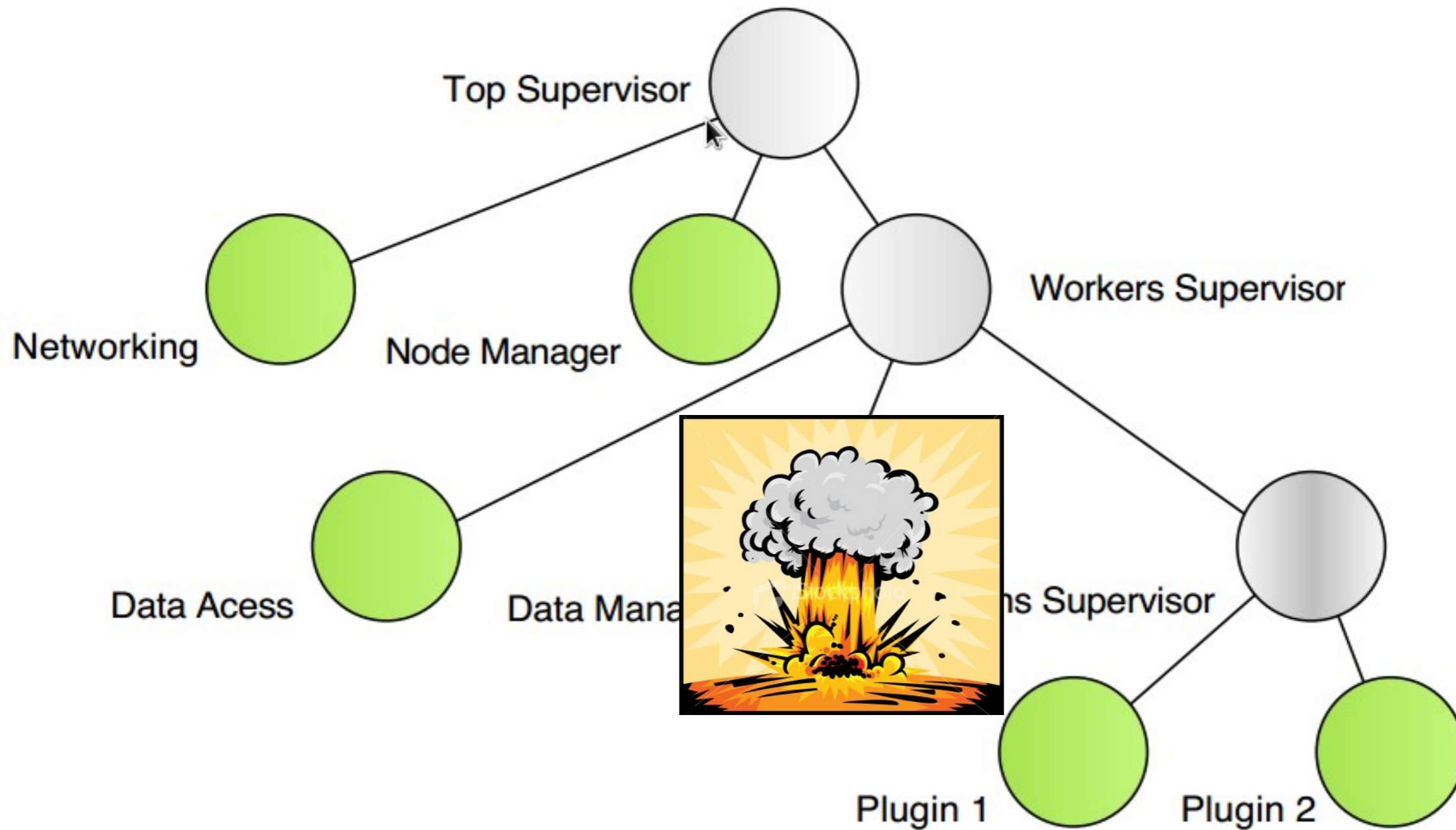
Restarting policies

Customization

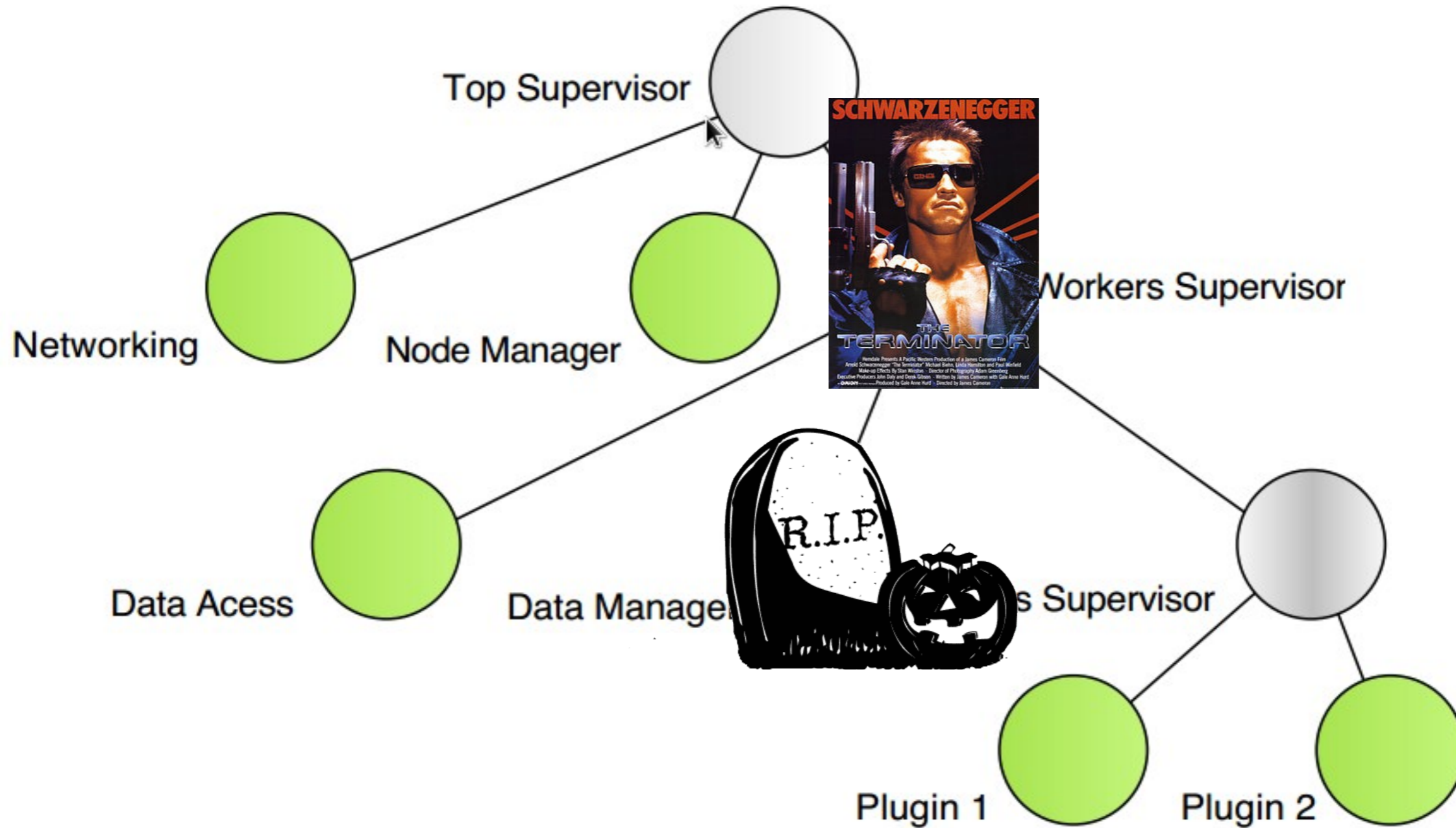
supervisors:our case



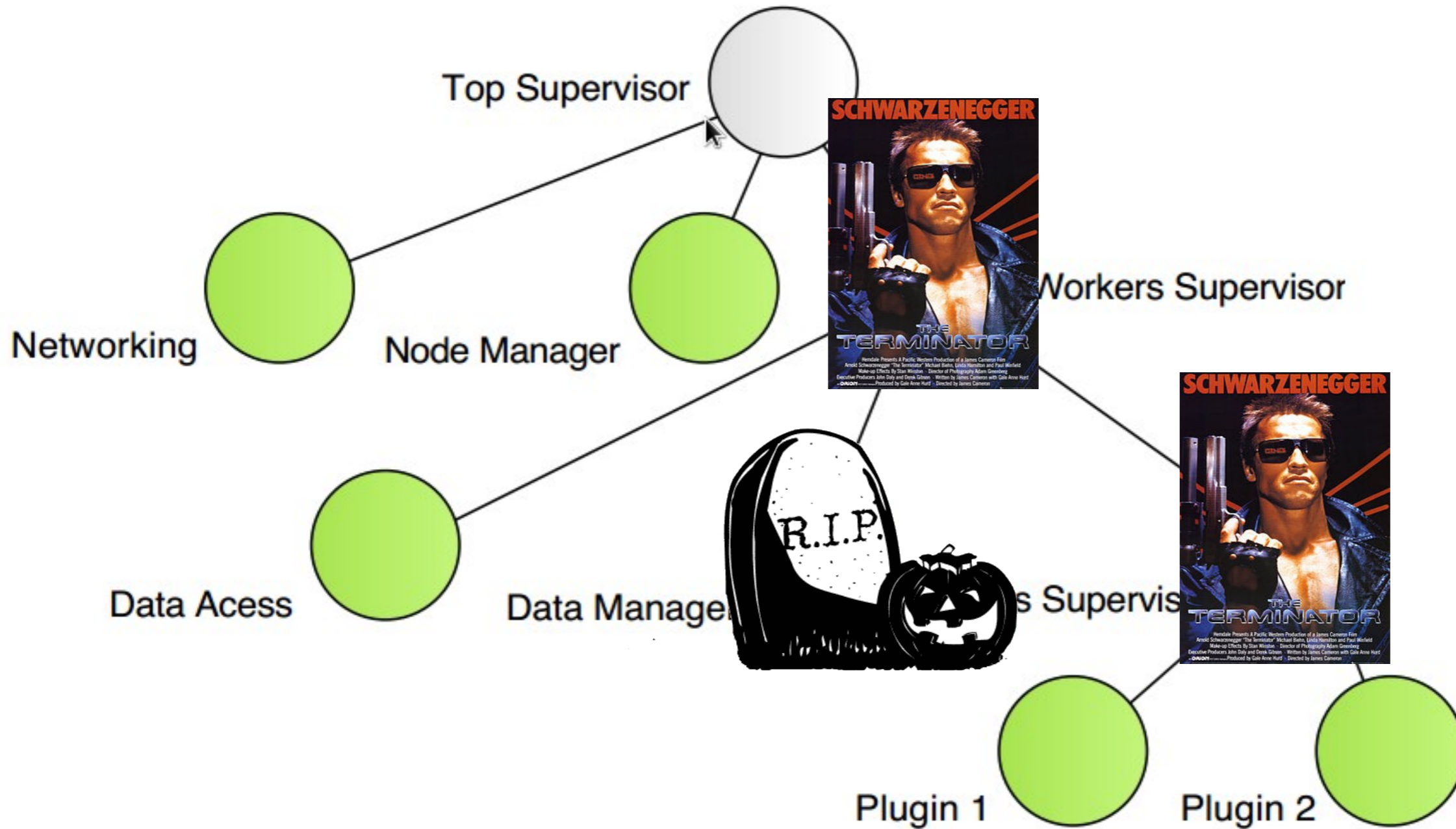
supervisors:boom



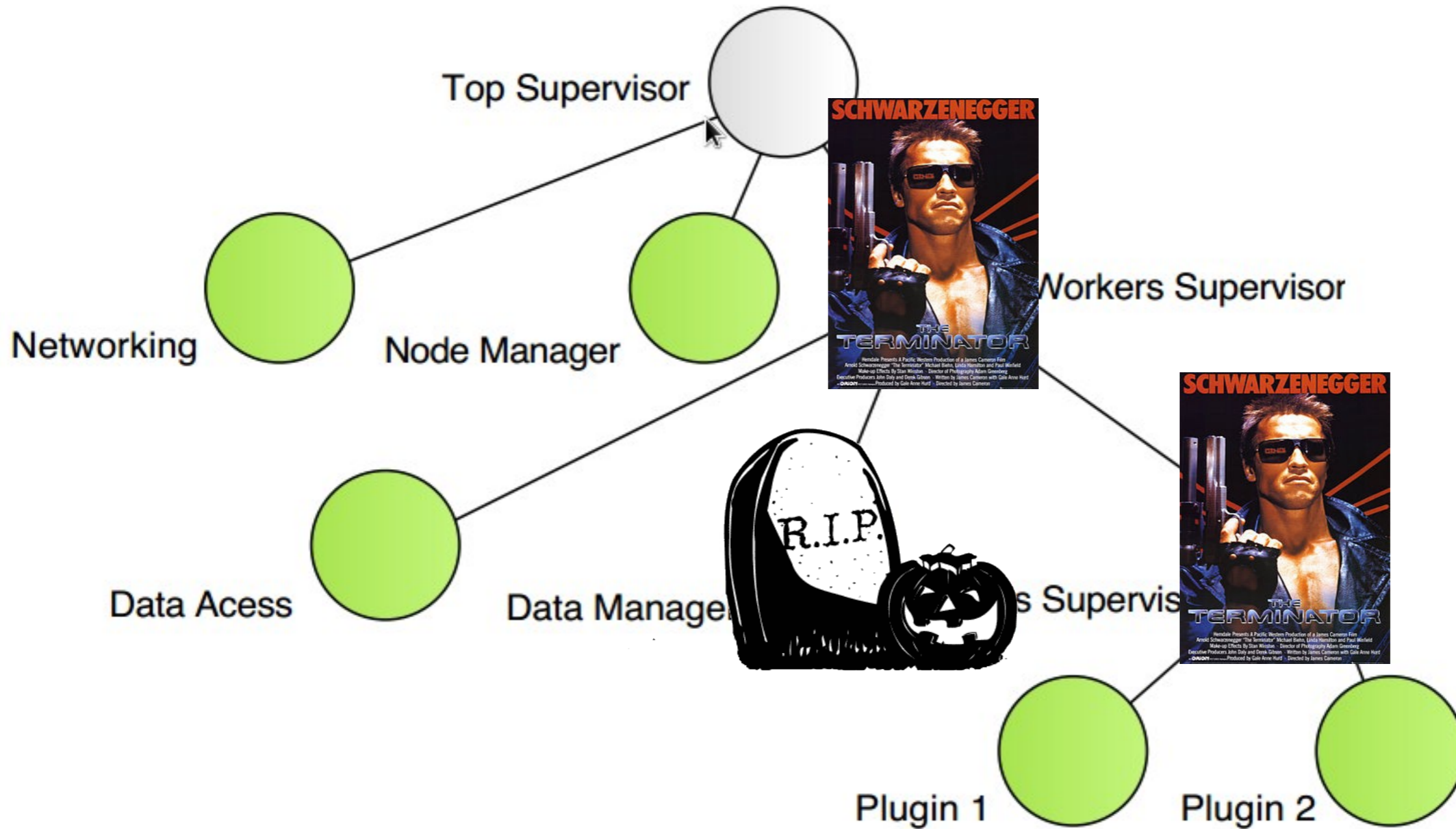
supervisors: **firefighting**



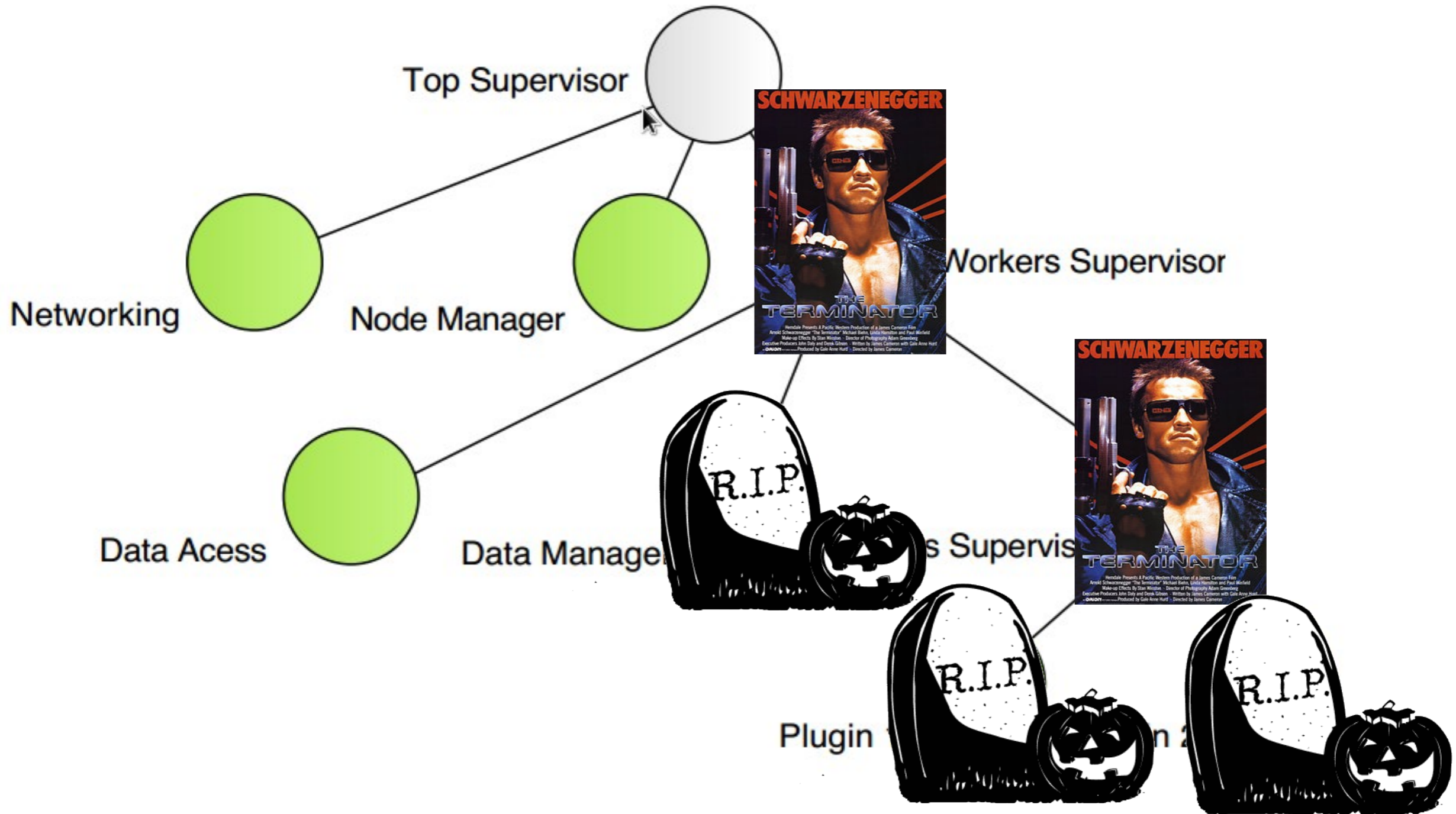
supervisors: **firefighting**



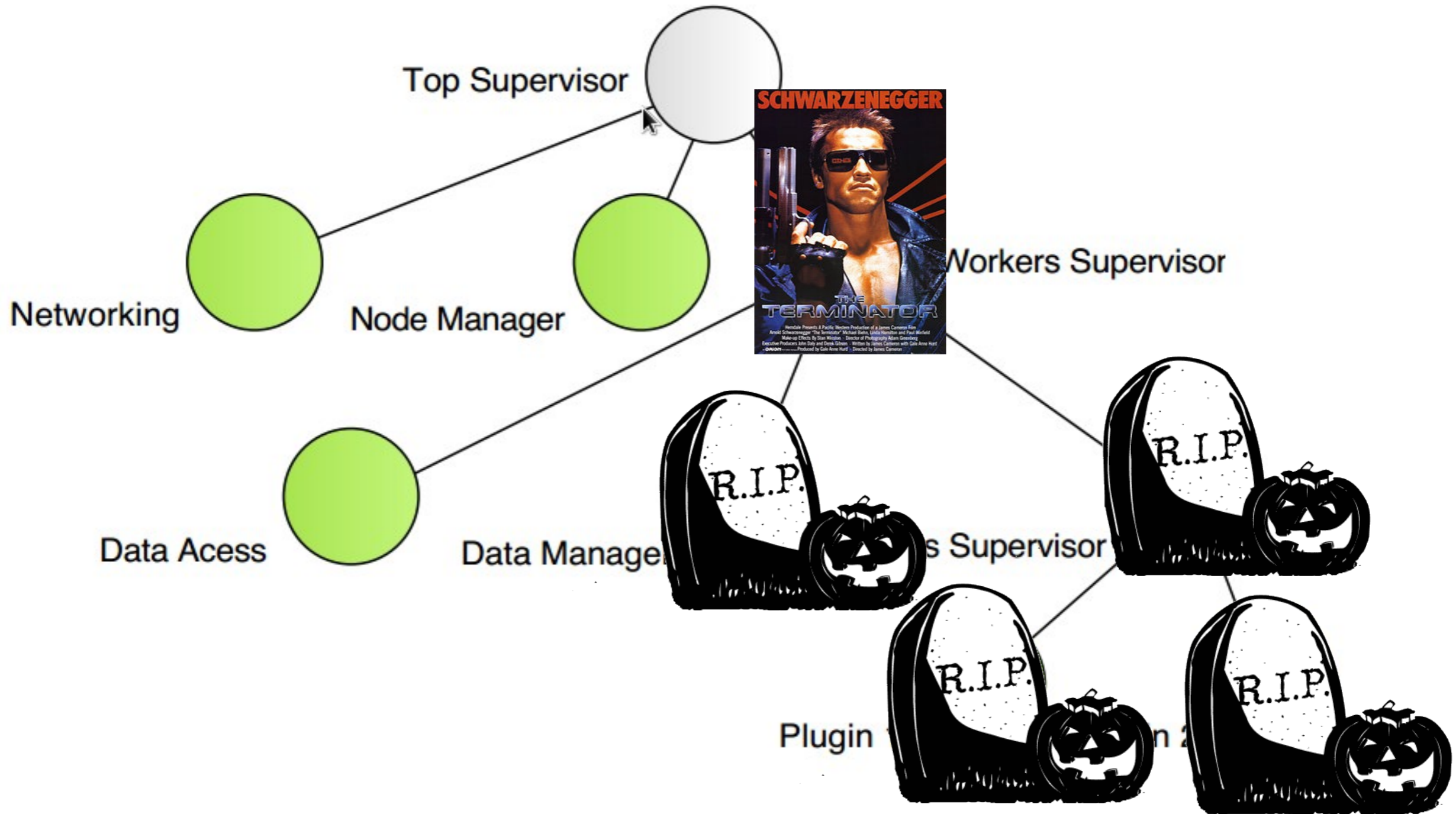
supervisors: **firefighting**



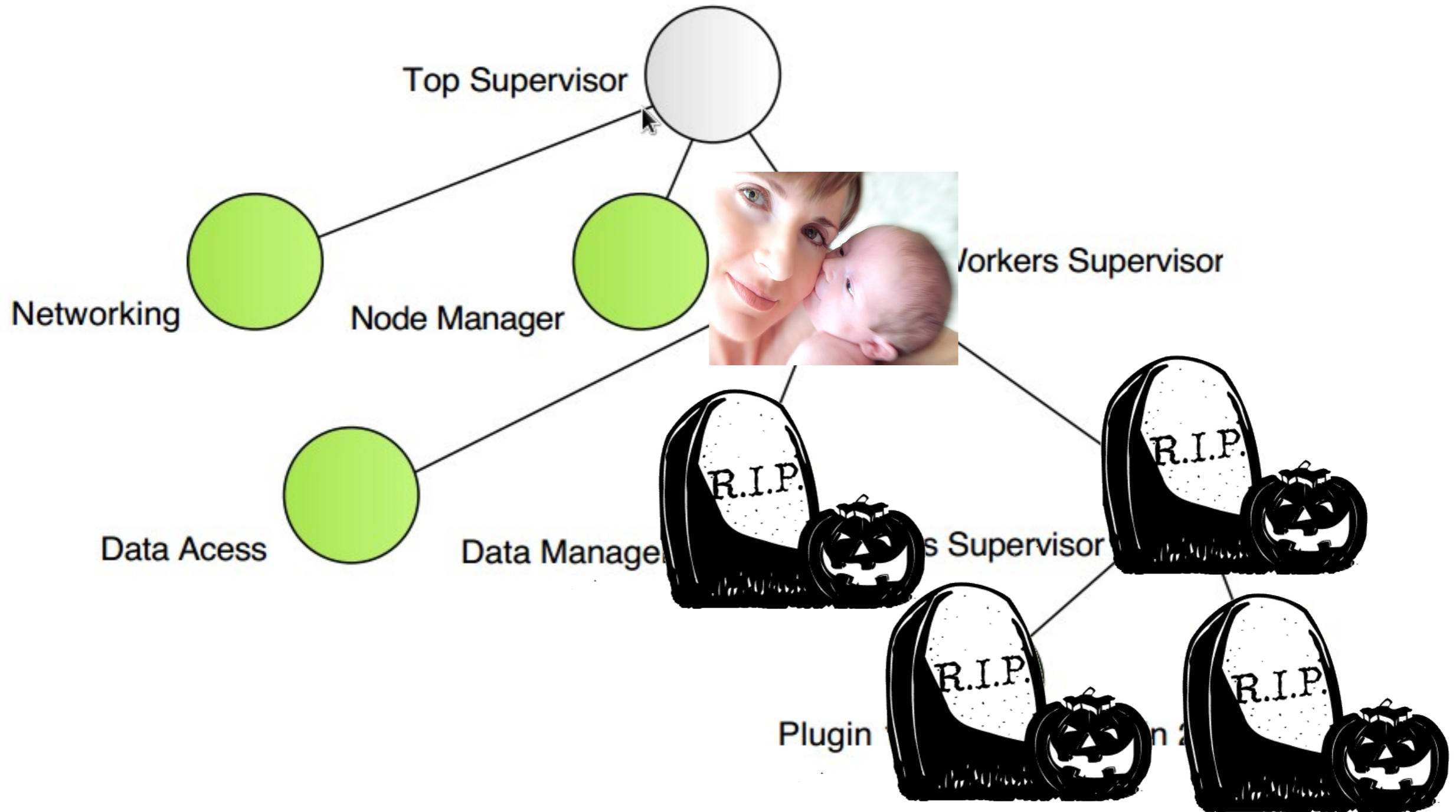
supervisors: **firefighting**



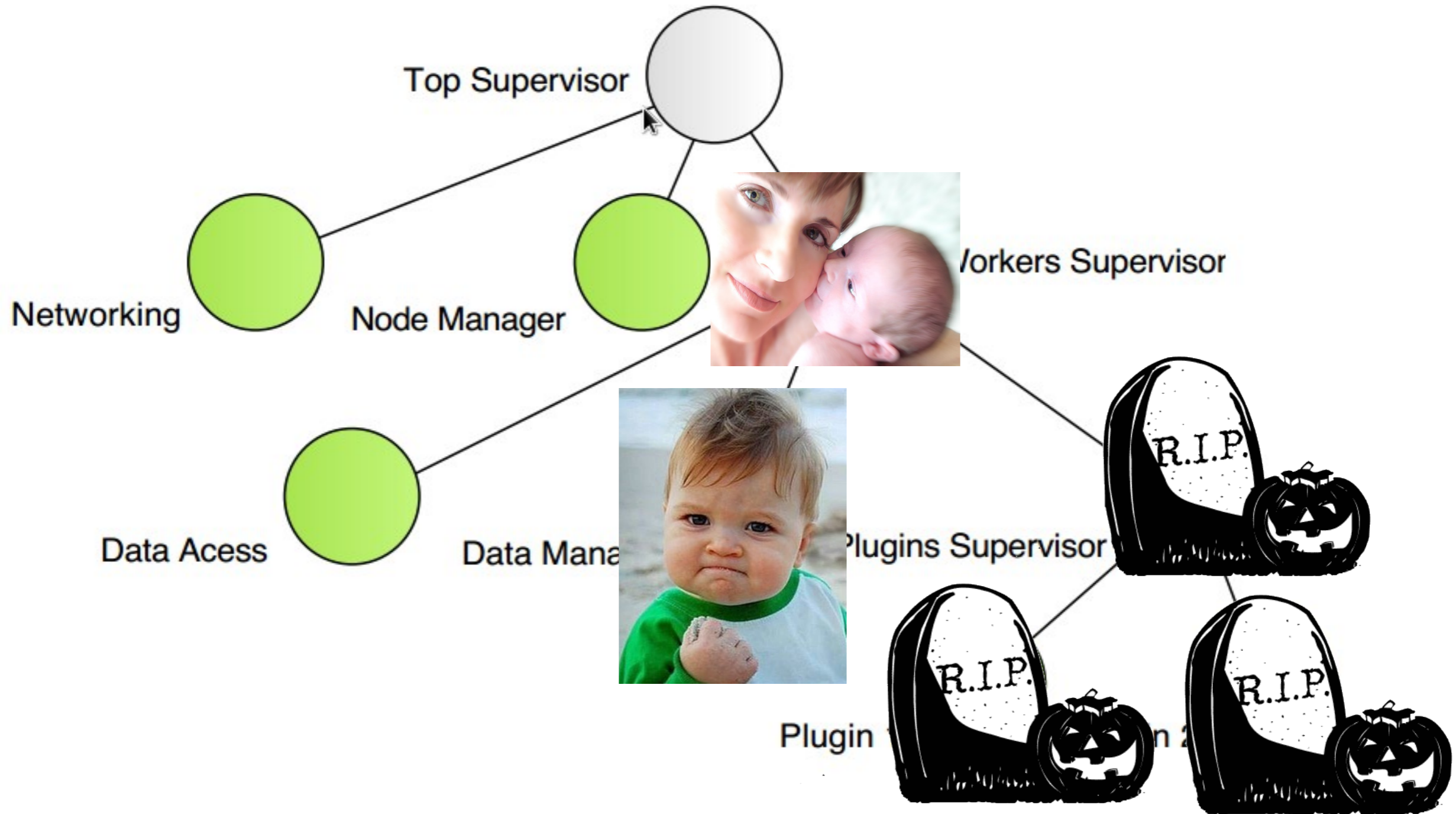
supervisors: **firefighting**



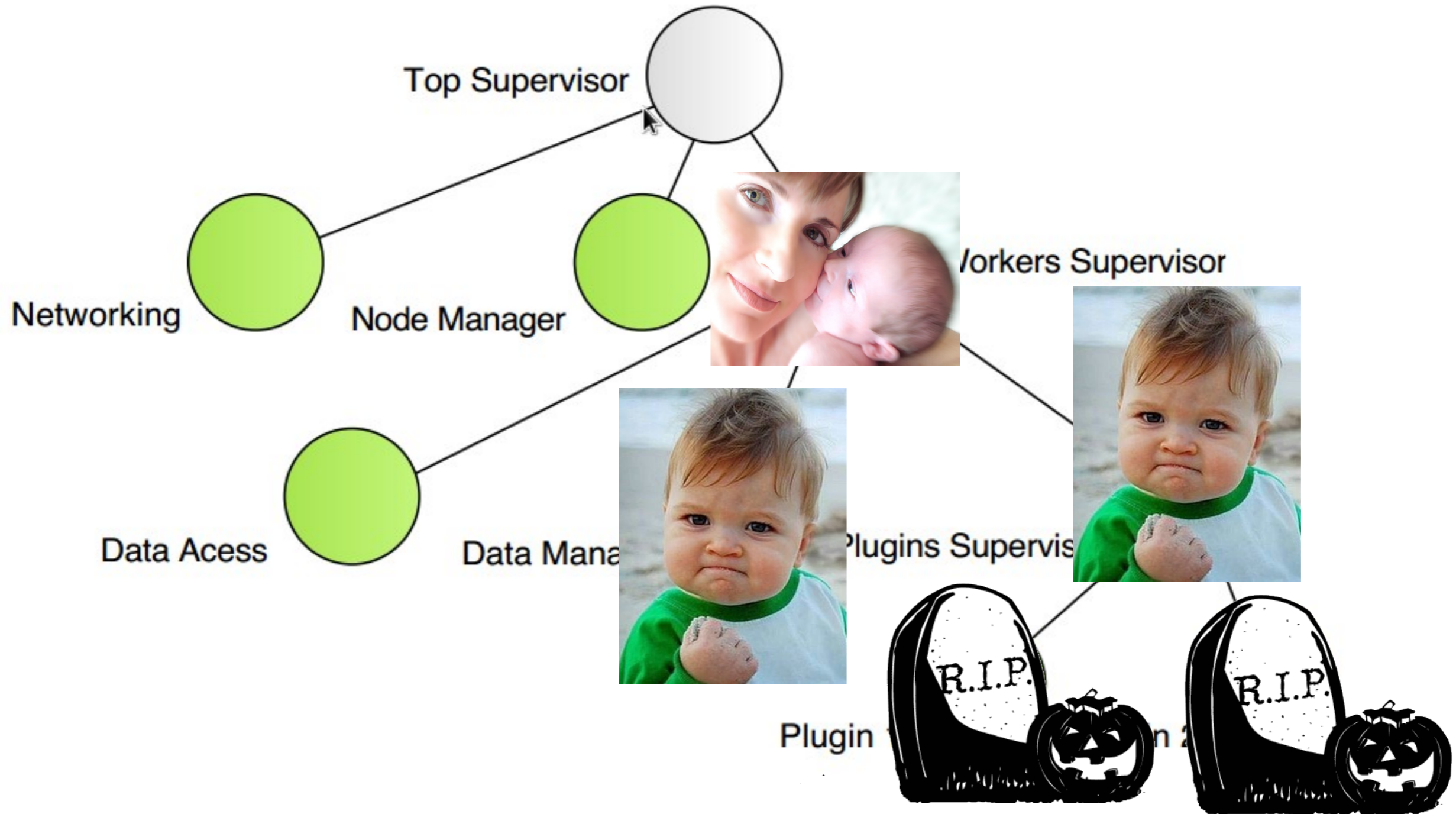
supervisors: **firefighting**



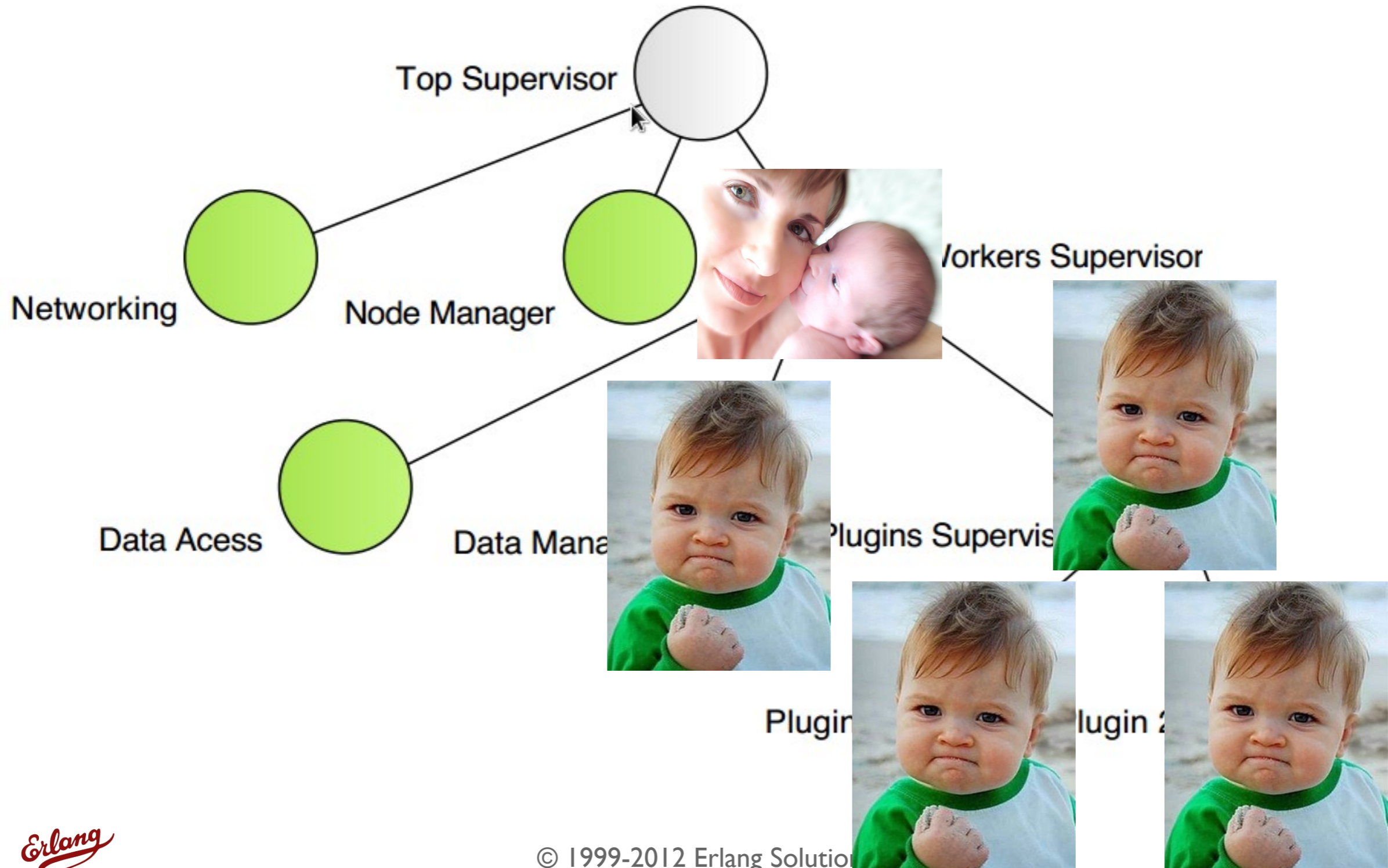
supervisors: **firefighting**



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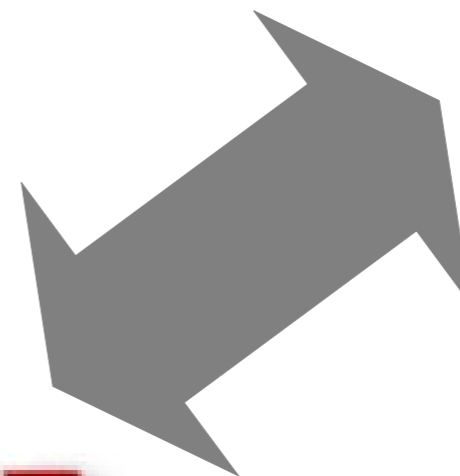


supervisors: **firefighting**

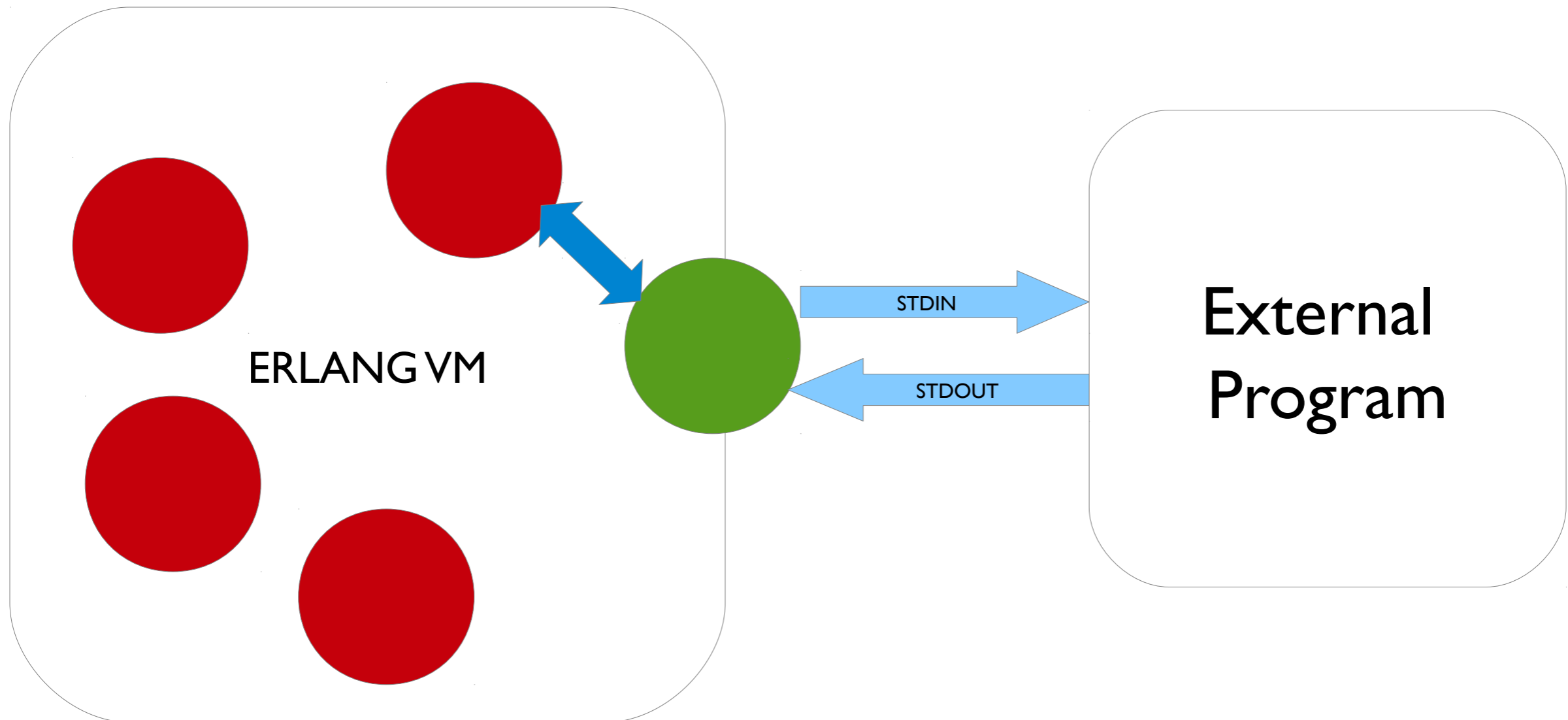


devices:erlang_interoperability

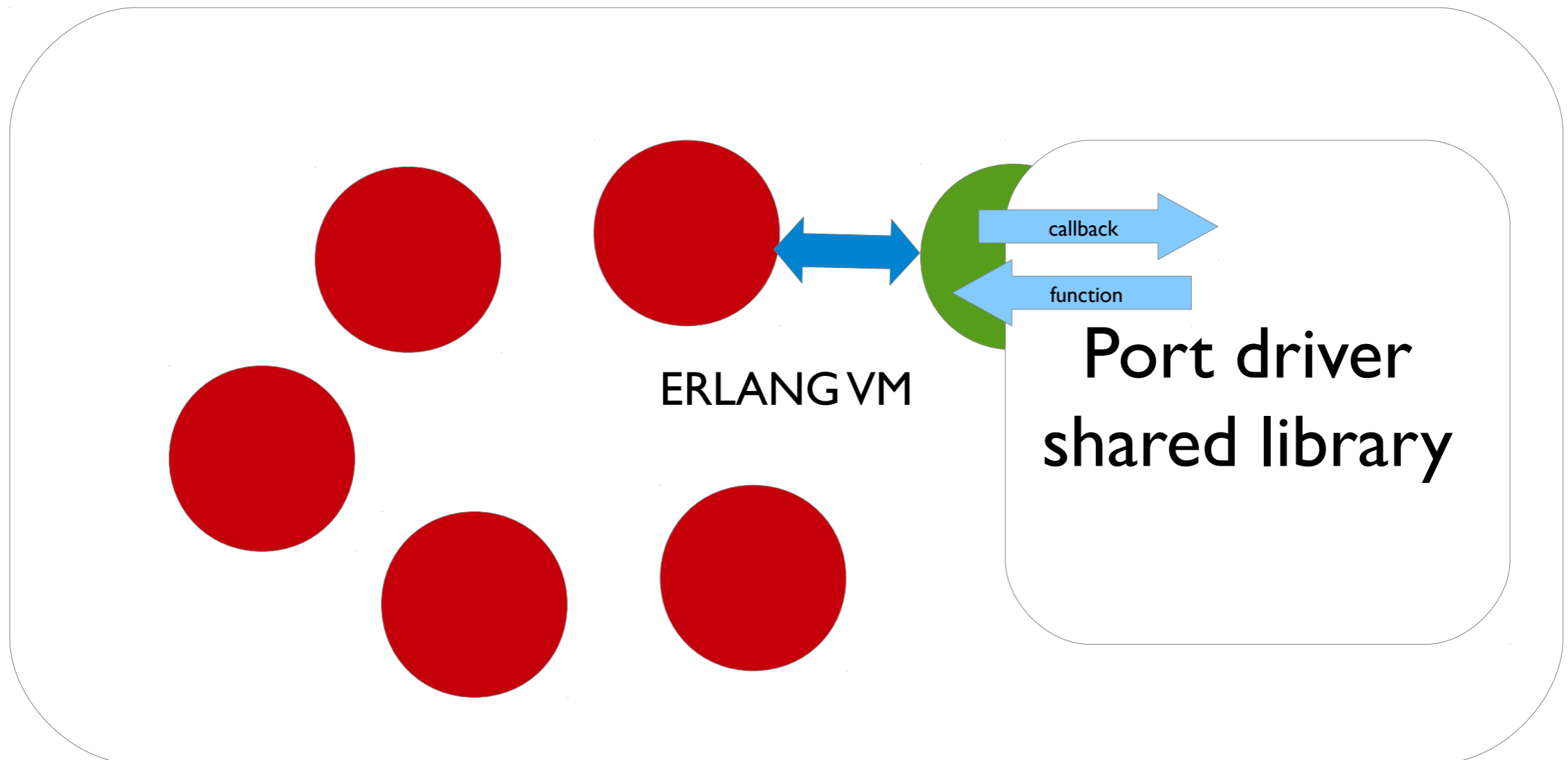
- Ports
- Port Drivers
- NIFs
- C Nodes
- JInterface



devices:ports

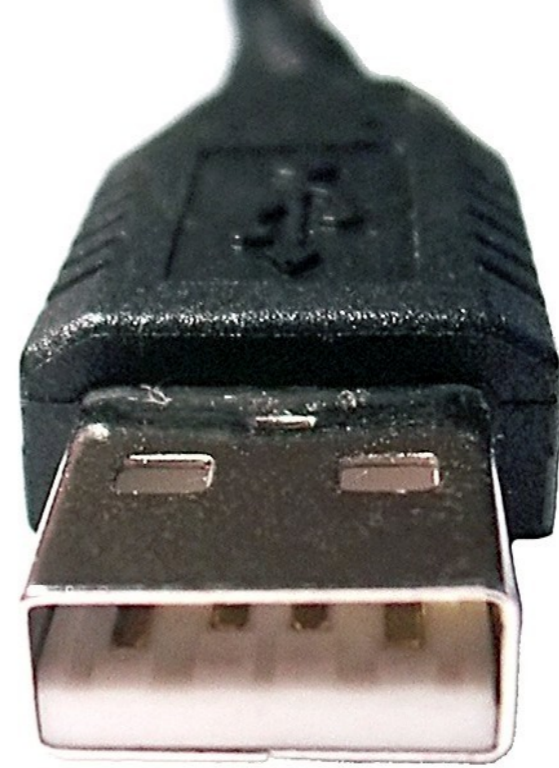


devices:port_drivers



devices:our_ports

- Serial
- Camera (motion detection)
- USB (lib usb wrapper)



webmachine:why?

- **HTTP interface for your Erlang application**
- **REST**
- **Usually no need for advanced configuration**
- **It works!**
- **Nice documentation**
- **Support for etags**

webmachine:how_to

dispach.conf:

```
{["demo", '*'], webmachine_demo_resource, []}.
```

```
{["fs", '*'], webmachine_demo_fs_resource, [{root, "/tmp/fs"}]}.
```

module:

```
-module(webmachine_demo_resource).
```

```
-export([init/1, to_html/2]).
```

```
-include_lib("webmachine/include/webmachine.hrl").
```

```
init([]) -> {ok, undefined}.
```

```
to_html(ReqData, Context) -> {"Hello, new world", ReqData, Context}.
```

couchdb:relax



couchdb:why?

- Document-orientated
- MapReduce
- RESTful API
- Replication (Multi-MASTER-MASTER)
- Futon

couchdb:attachments

- Data from cameras
- Ready to be displayed or downloaded from any webpage



couchdb:our_data

Erlang proplist

```
[  
  {temperature,10.2},  
  {location,[  
    {lng,23.123},  
    {lat,54.344}  
  ]}]
```

JSON

```
{  
  "temperature":10.2,  
  "location": {  
    "lng": 23.123,  
    "lat": 54.344  
  }  
}
```

couchdb:view_data

The screenshot shows the Apache CouchDB Futon interface. The browser tabs include 'webmachine - michalniec...', 'Basho: Webmachine Dispa...', 'Erlang Factory - Justin St...', and 'Apache CouchDB - Futon'. The address bar shows 'localhost:5984/_utils/document.html?test/98fe8e01c33fd69f01c...'. The breadcrumb navigation is 'Overview > test > 98fe8e01c33fd69f01c28764e5000d7c'. The document is displayed in a table with columns 'Field' and 'Value'. The fields are: '_id' with value '98fe8e01c33fd69f01c28764e5000d7c', '_rev' with value '1-3d075758b8d756d56b5b5b8a641d1b81', 'location' with values 'lng 23.123' and 'lat 54.344', and 'temperature' with value '10.2'. The interface also includes a sidebar with the CouchDB logo and 'relax' text, and a 'Tools' menu with options: Overview, Configuration, Replicator, Status, and Test Suite. At the bottom of the sidebar, there is a 'Recent Databases' section listing 'funga' and 'test'.

Overview > test > 98fe8e01c33fd69f01c28764e5000d7c

Save Document Add Field Upload Attachment... Delete Document...

Field	Value
_id	"98fe8e01c33fd69f01c28764e5000d7c"
_rev	"1-3d075758b8d756d56b5b5b8a641d1b81"
location	lng 23.123 lat 54.344
temperature	10.2

← Previous Version | Next Version →

CouchDB
relax

Tools

- Overview
- Configuration
- Replicator
- Status
- Test Suite

Recent Databases

- funga
- test

▼ room_cam2

5015 9459 3114 1422 7231 2095 5975 4436 9157 5966 6670 4772

Show 10 entries

TIMESTAMP	PRIORITY
2012-01-15 (Sunday) at 15:03:12 CET	urgent
Data: <ul style="list-style-type: none">m1<ul style="list-style-type: none">0.3m15<ul style="list-style-type: none">0.3m5<ul style="list-style-type: none">0.35	
2012-01-15 (Sunday) at 15:03:11 CET	urgent
2012-01-15 (Sunday) at 15:03:10 CET	urgent
2012-01-15 (Sunday) at 15:03:09 CET	urgent
2012-01-15 (Sunday) at 15:03:08 CET	urgent
2012-01-15 (Sunday) at 15:03:07 CET	urgent
2012-01-15 (Sunday) at 15:03:06 CET	urgent
2012-01-15 (Sunday) at 15:03:05 CET	urgent
2012-01-15 (Sunday) at 15:03:04 CET	urgent
2012-01-15 (Sunday) at 15:03:03 CET	urgent

Showing 1 to 10 of 833 entries

erlang:halt()

Questions?

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