

Erlang Solutions Ltd.

Erlang-Based Sensor Network Management for Heterogenous Devices



mentor and co-authors

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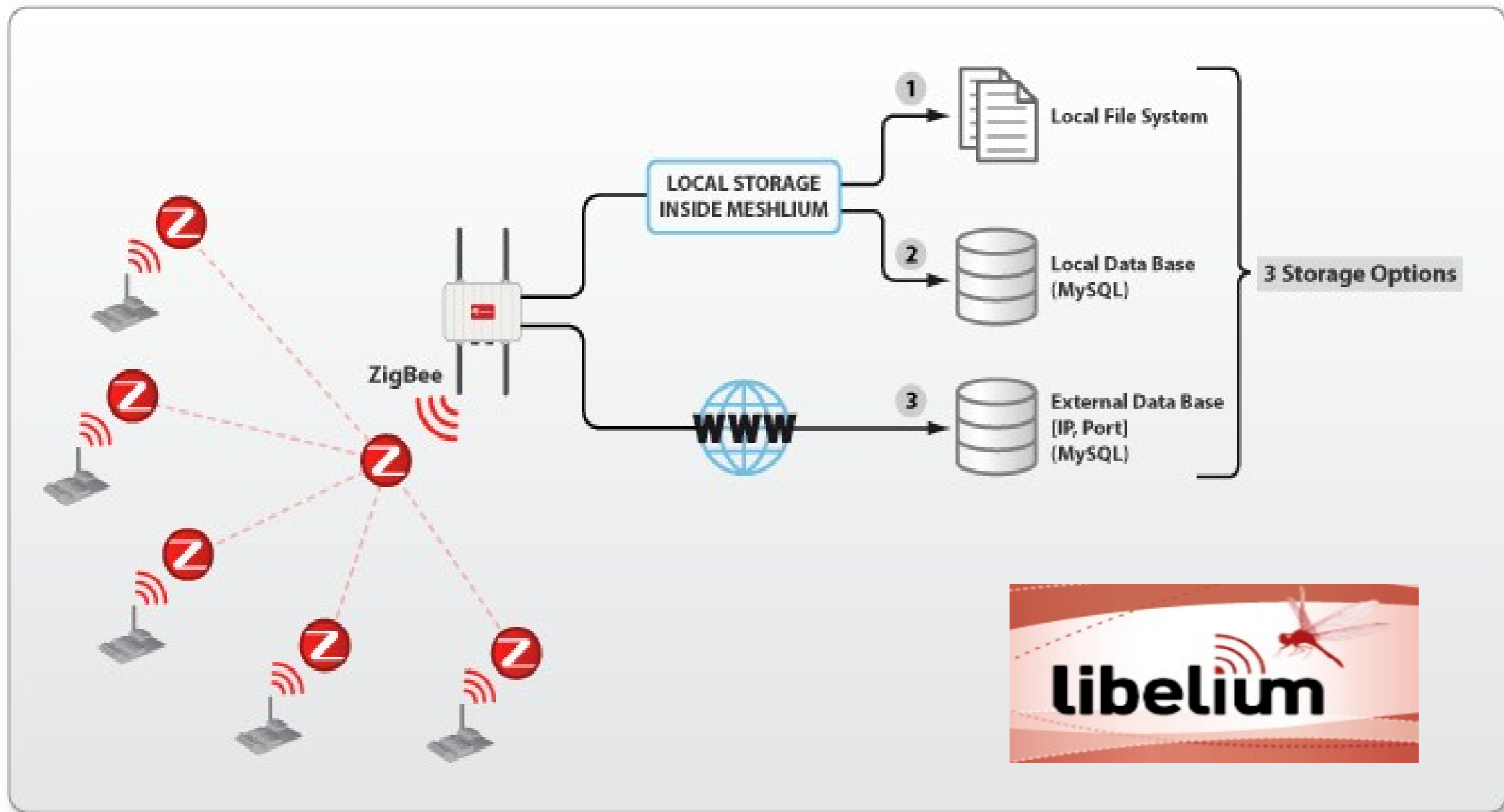
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agenda

- Our system
- Why Erlang?
- Supervisors
- Communication with hardware
- CouchDB

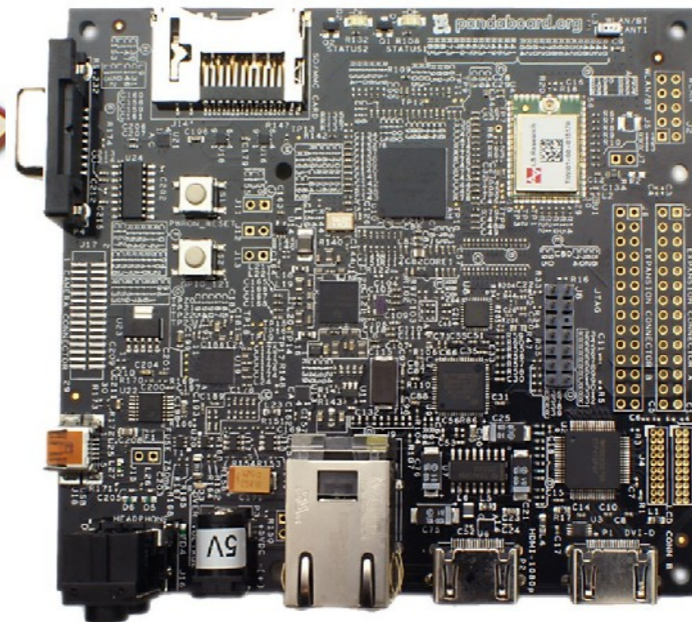
coalescesense system:why?



A Declarative Database for Sensor Networks

is Ltd.

system:hardware



- **Powerful**
- **Popular and cheap**
- **USB peripherals**
- **Run Linux and Erlang**

system:devices





CREATIVE

HOLUX

M-215

USB 2.0 PORT HUB

TEMPER
-40°C ~ +120°C

TP-LINK

TL-WN321G

54Mbps

Kingston
4GB

C4

5V



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)
```

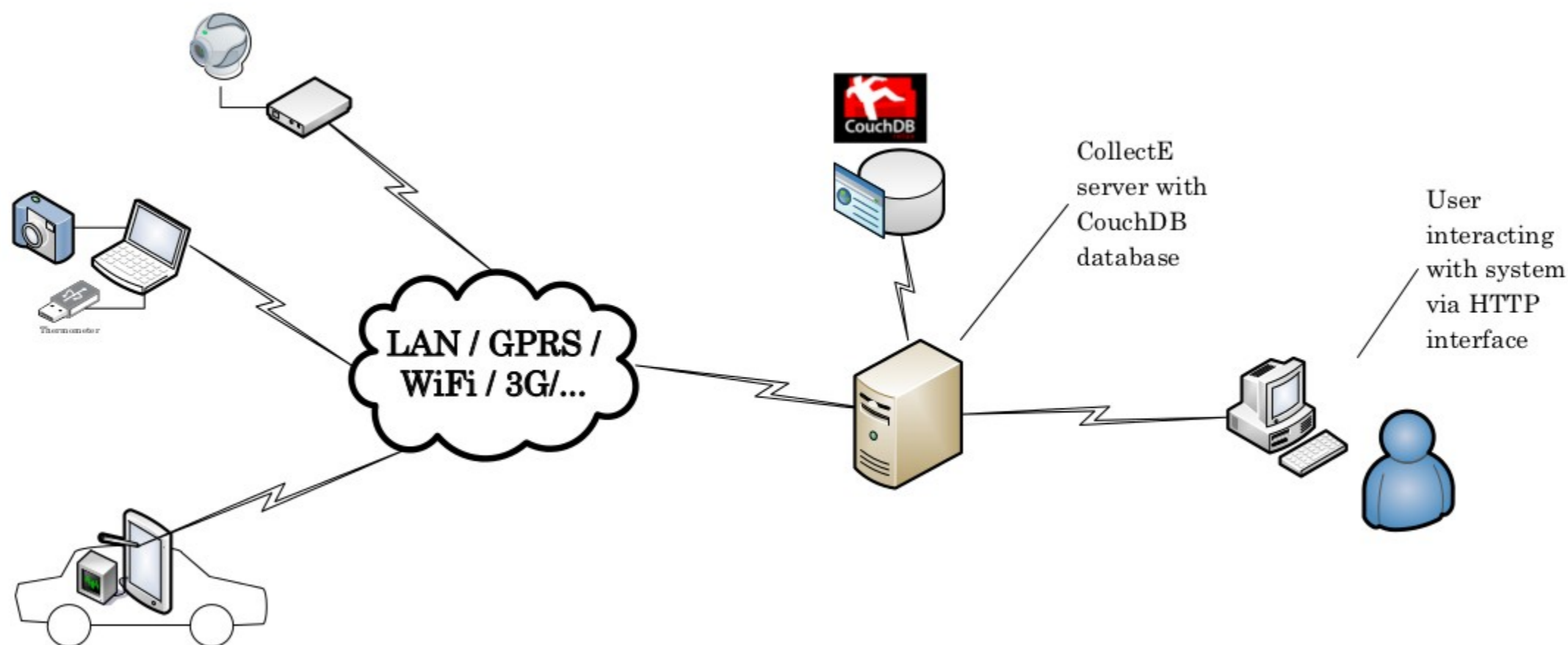
```
(android@192.168.0.100)1> nodes().
```

```
['laptop@192.168.0.102']
```

```
(android@192.168.0.100)2> █
```



system:usages



- **City pollution monitoring**
- **Meteorological data**
- **Security cameras**
- **Building automation**

- **Road surface quality measurements**
- **Traffic detection**

erlang:why?

Battle-tested

designed for distributed systems

mature, stable

scalable

Cross-platform

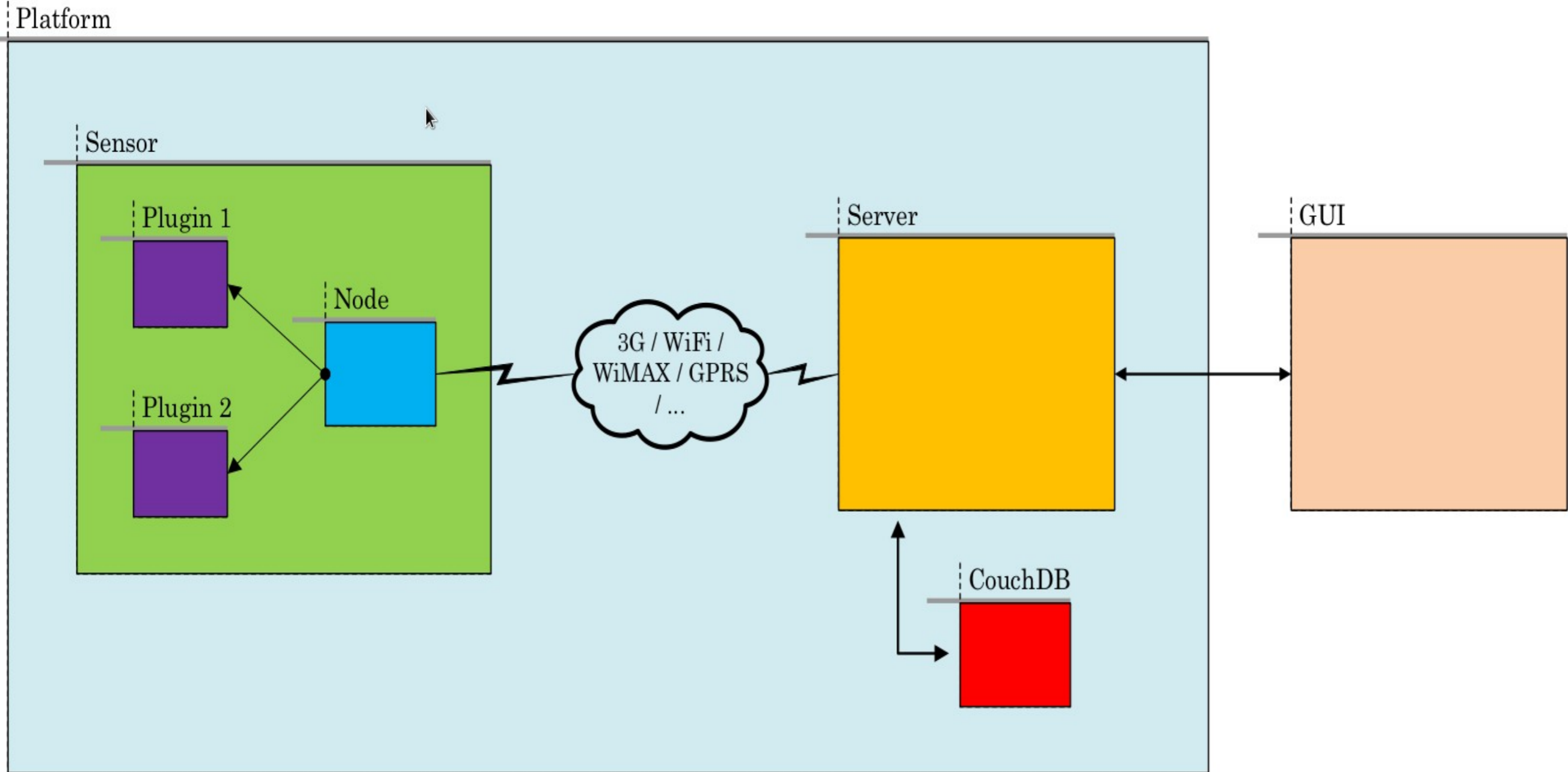
runs on Linux, BSD, Solaris, Mac OS X, Windows, VxWorks

Proper tools

OTP, webmachine, rebar...



system:architecture



supervisors:overview

Supervisors and workers

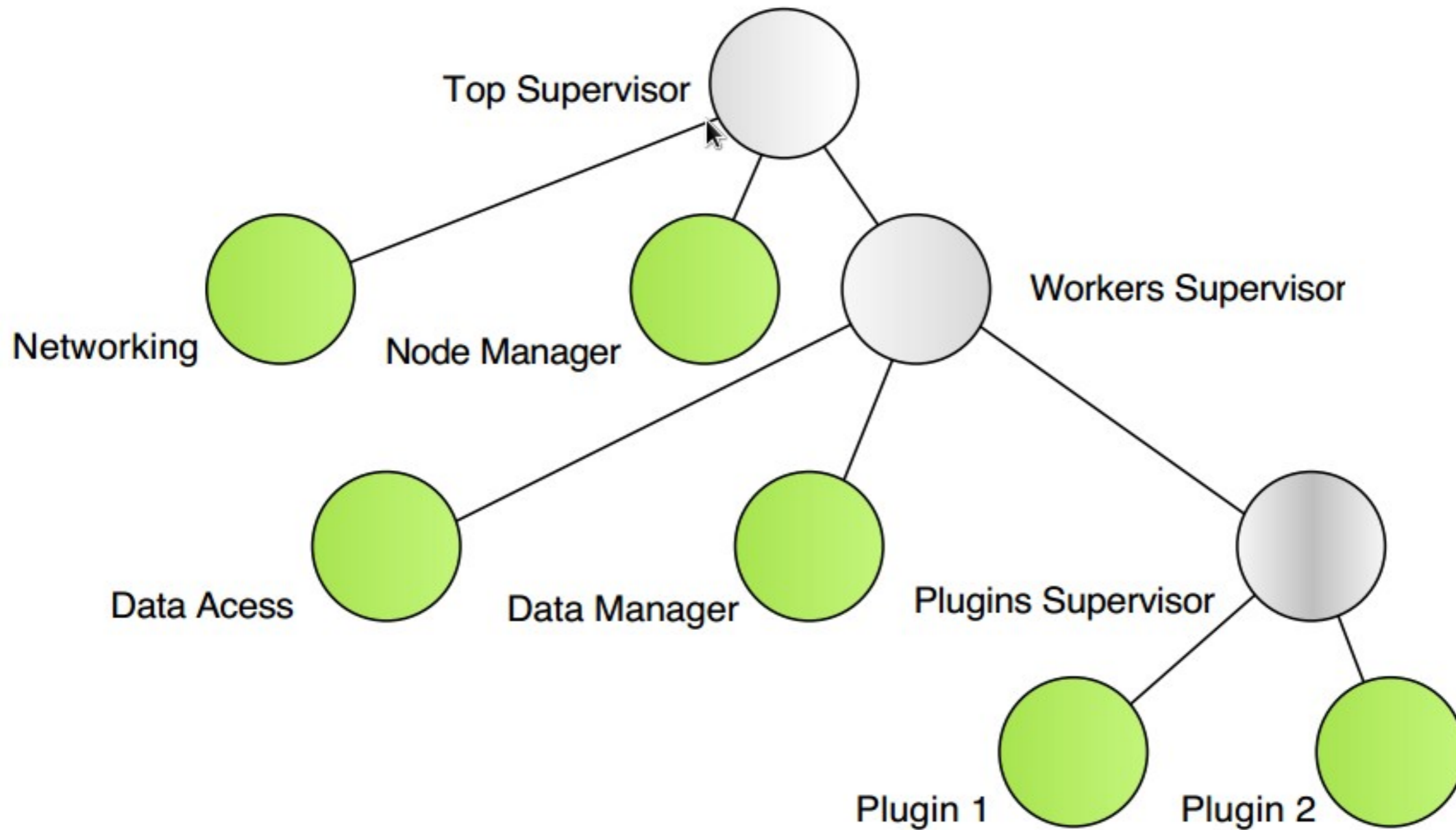
Hierarchy of processes

Error handling

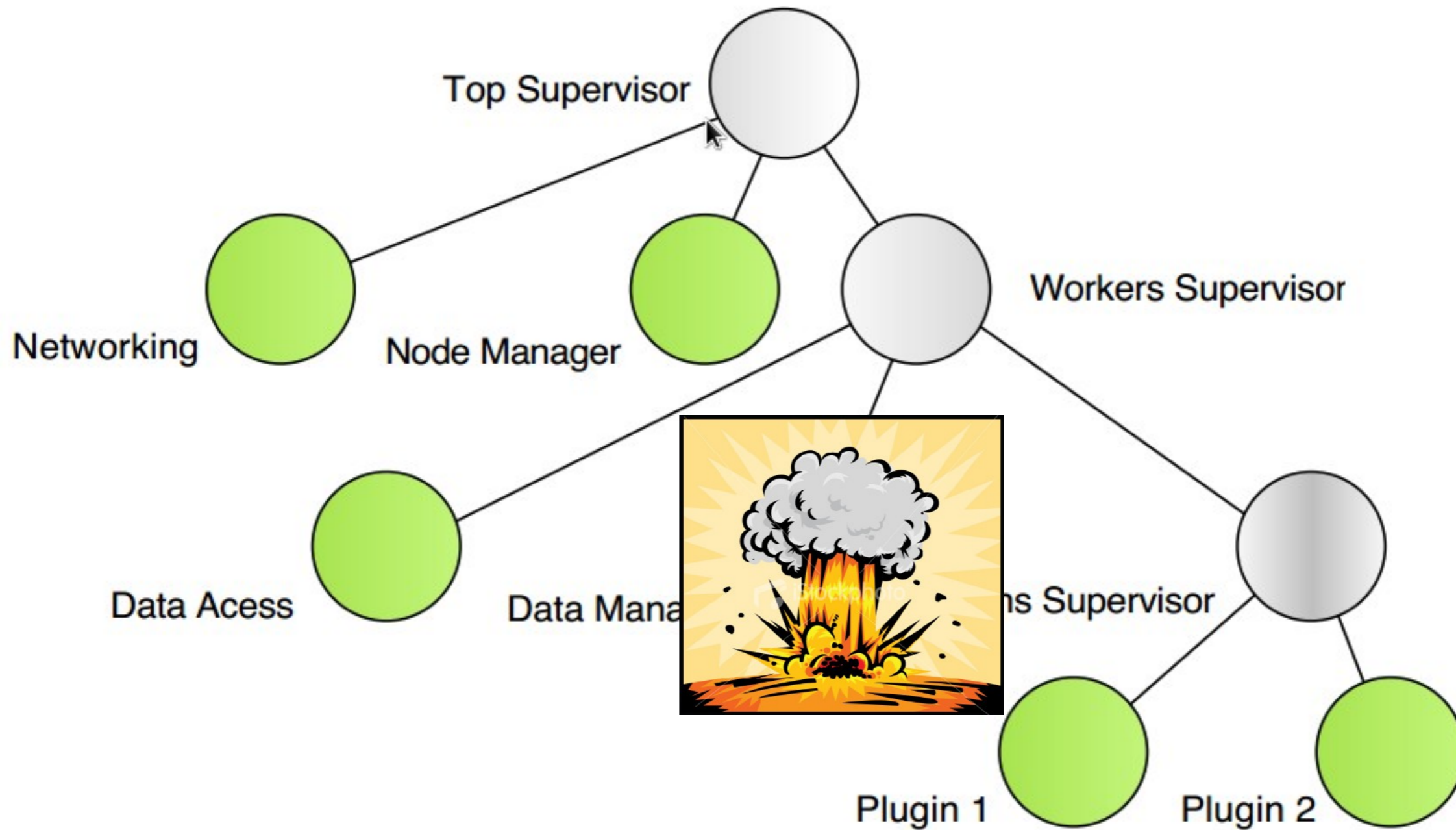
Restarting policies

Customization

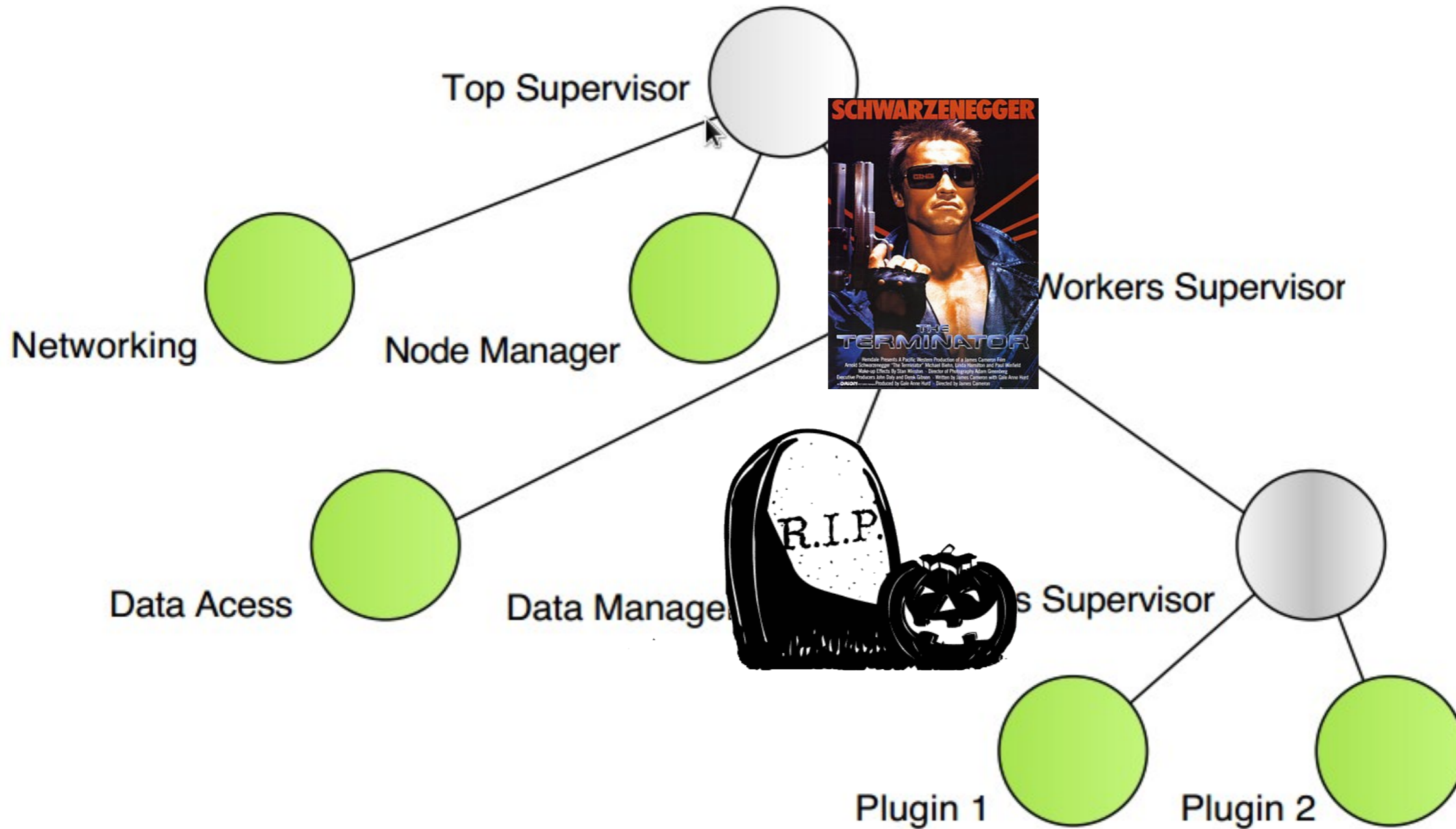
supervisors:**our** case



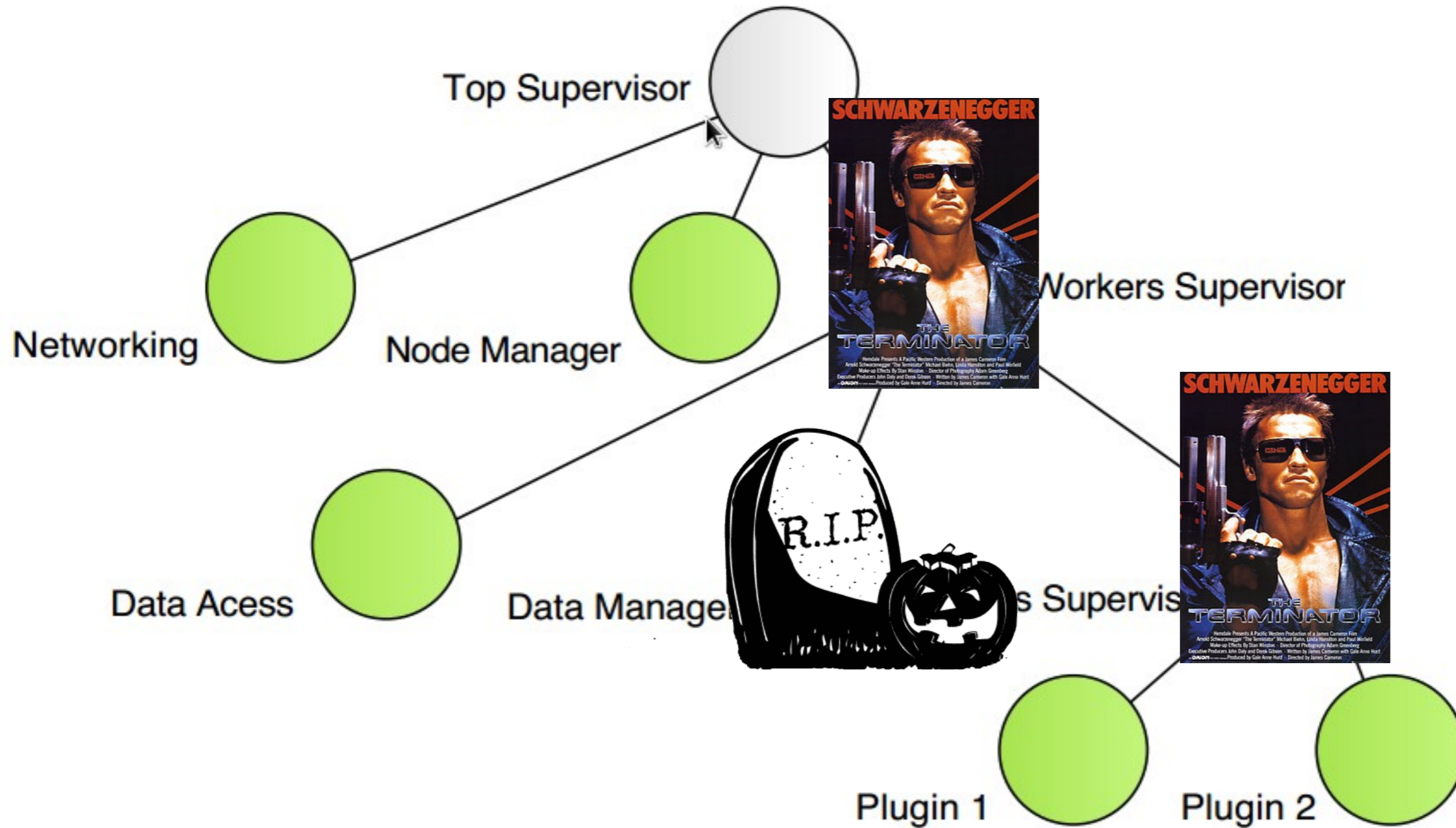
supervisors:**boom**



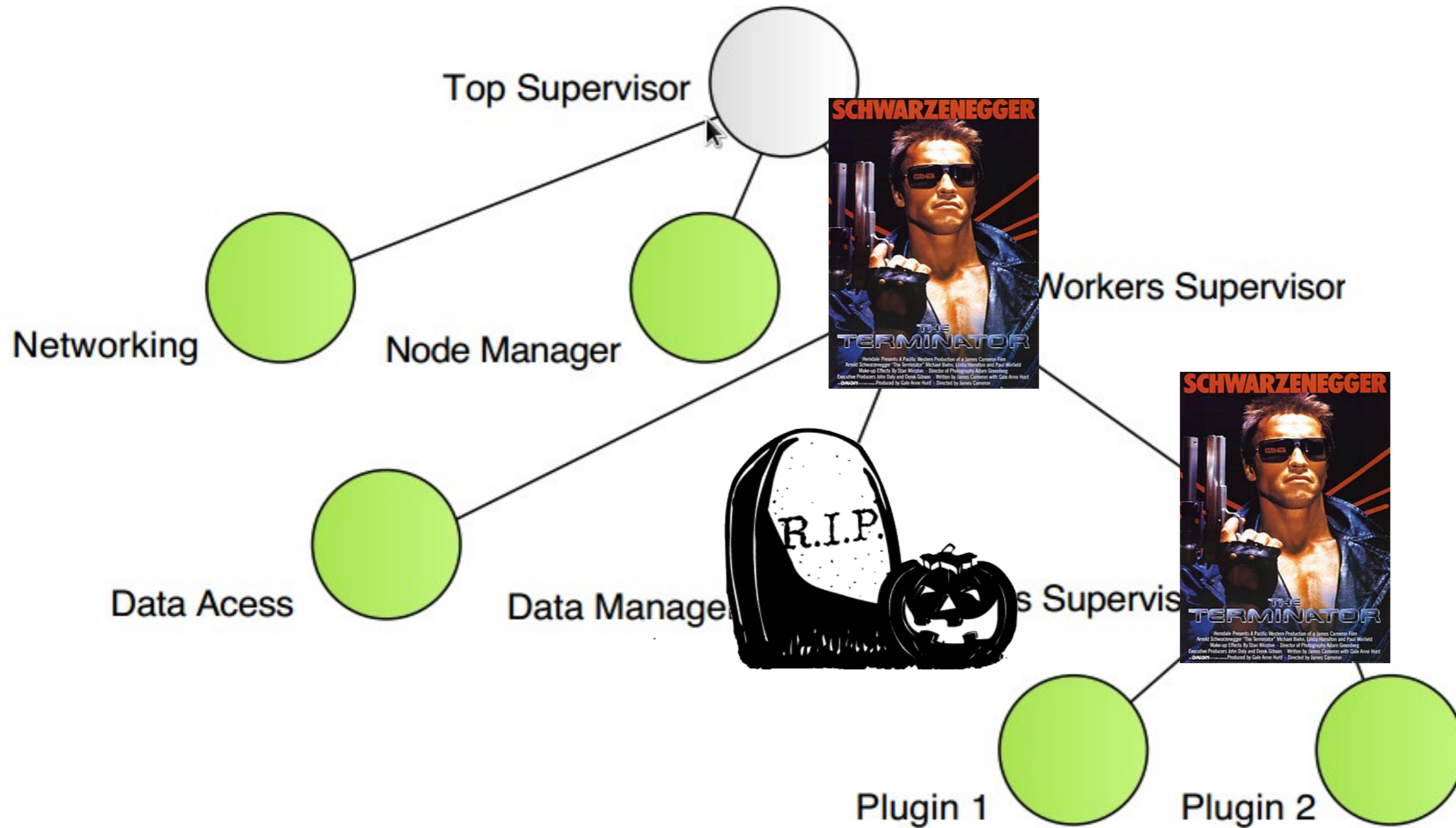
supervisors: **firefighting**



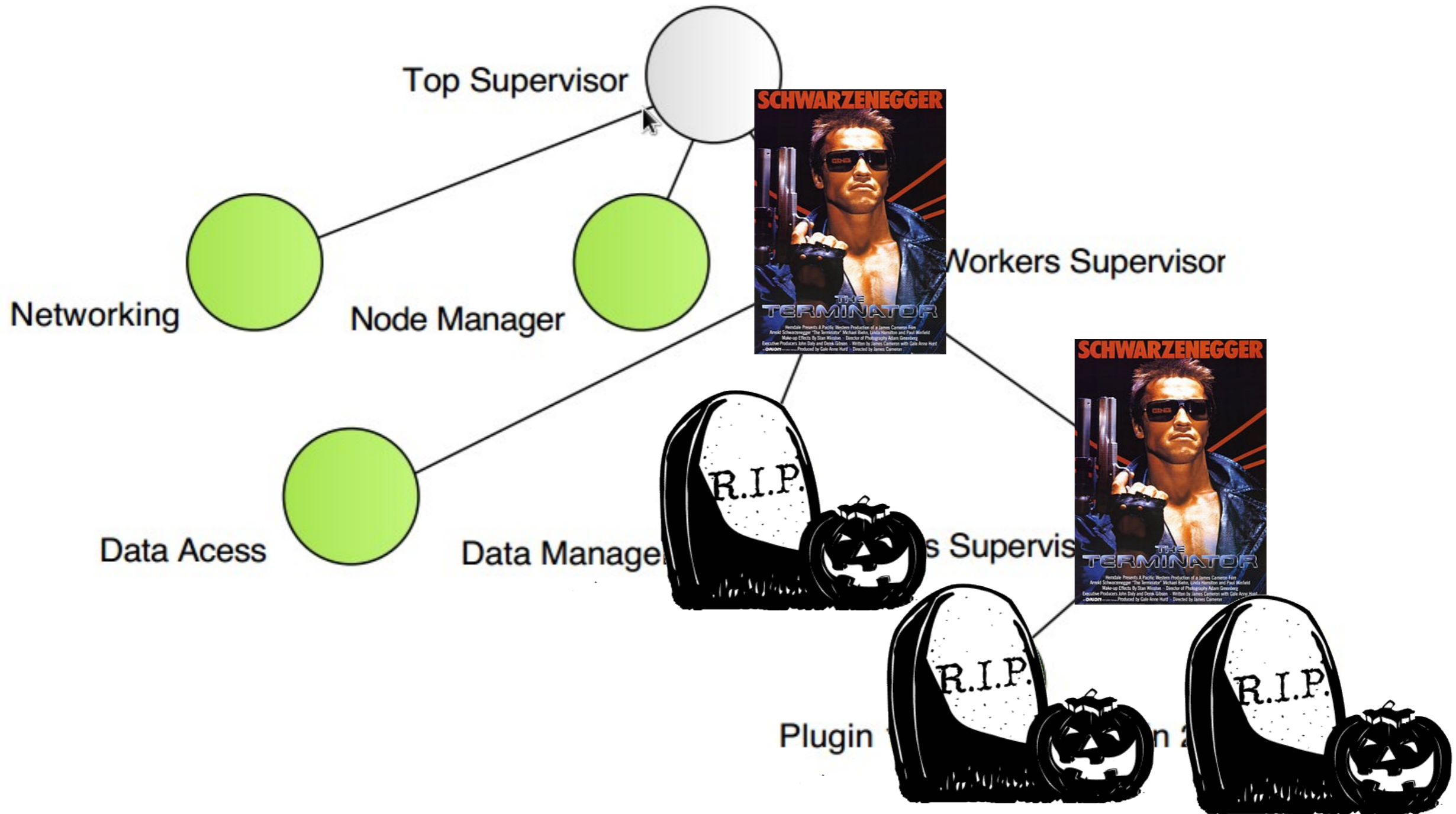
supervisors: **firefighting**



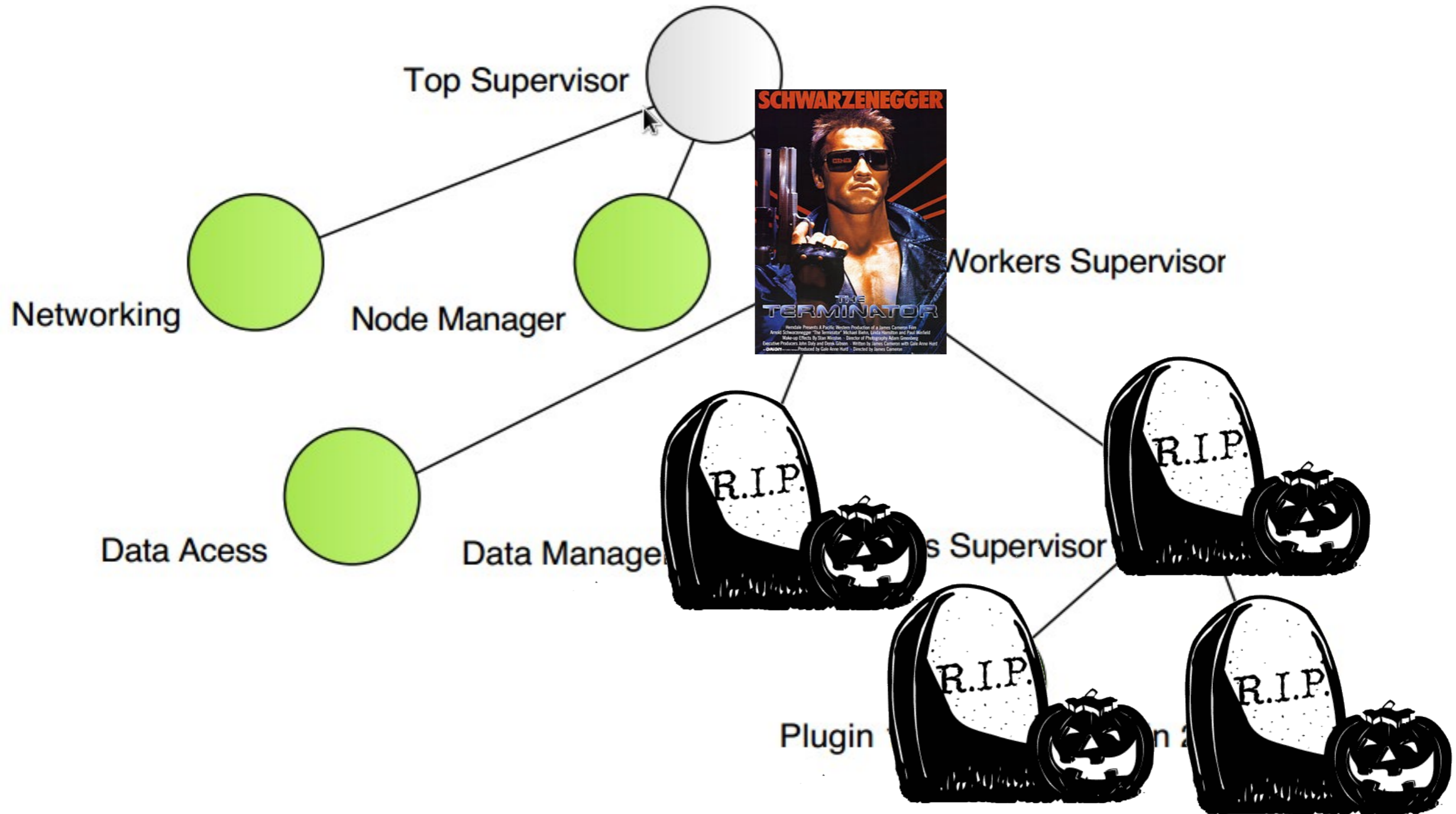
supervisors: **firefighting**



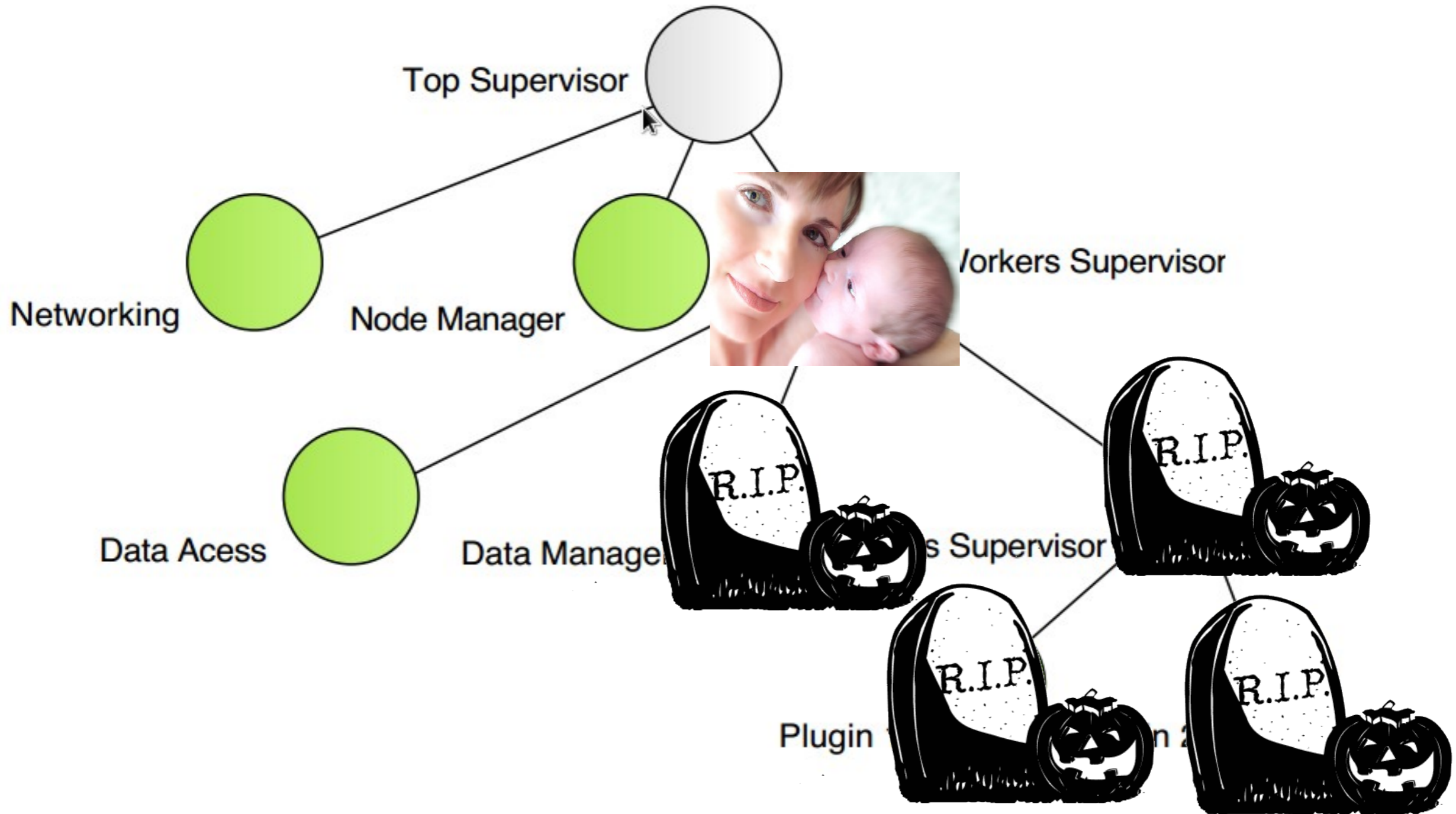
supervisors: **firefighting**



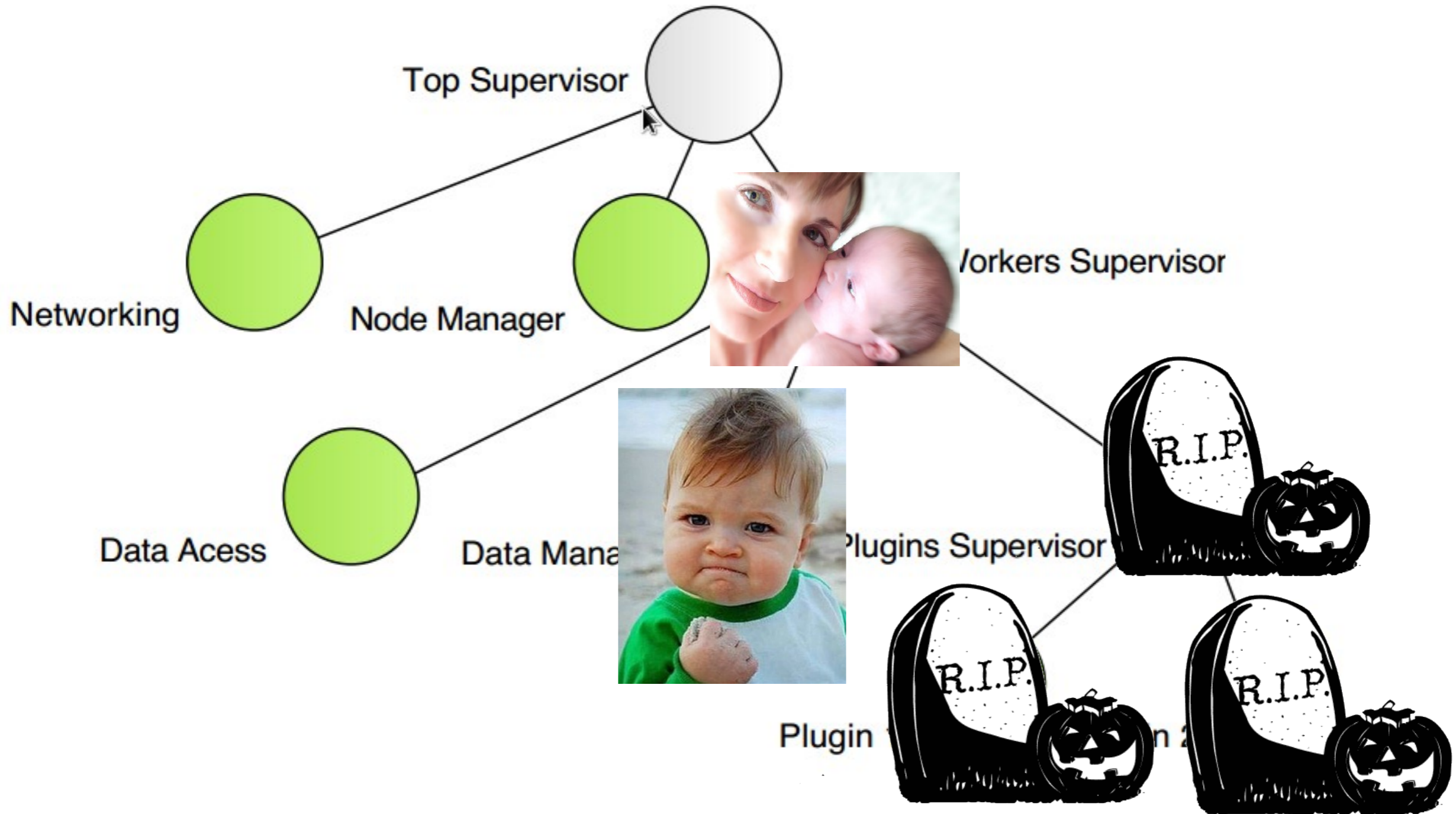
supervisors: **firefighting**



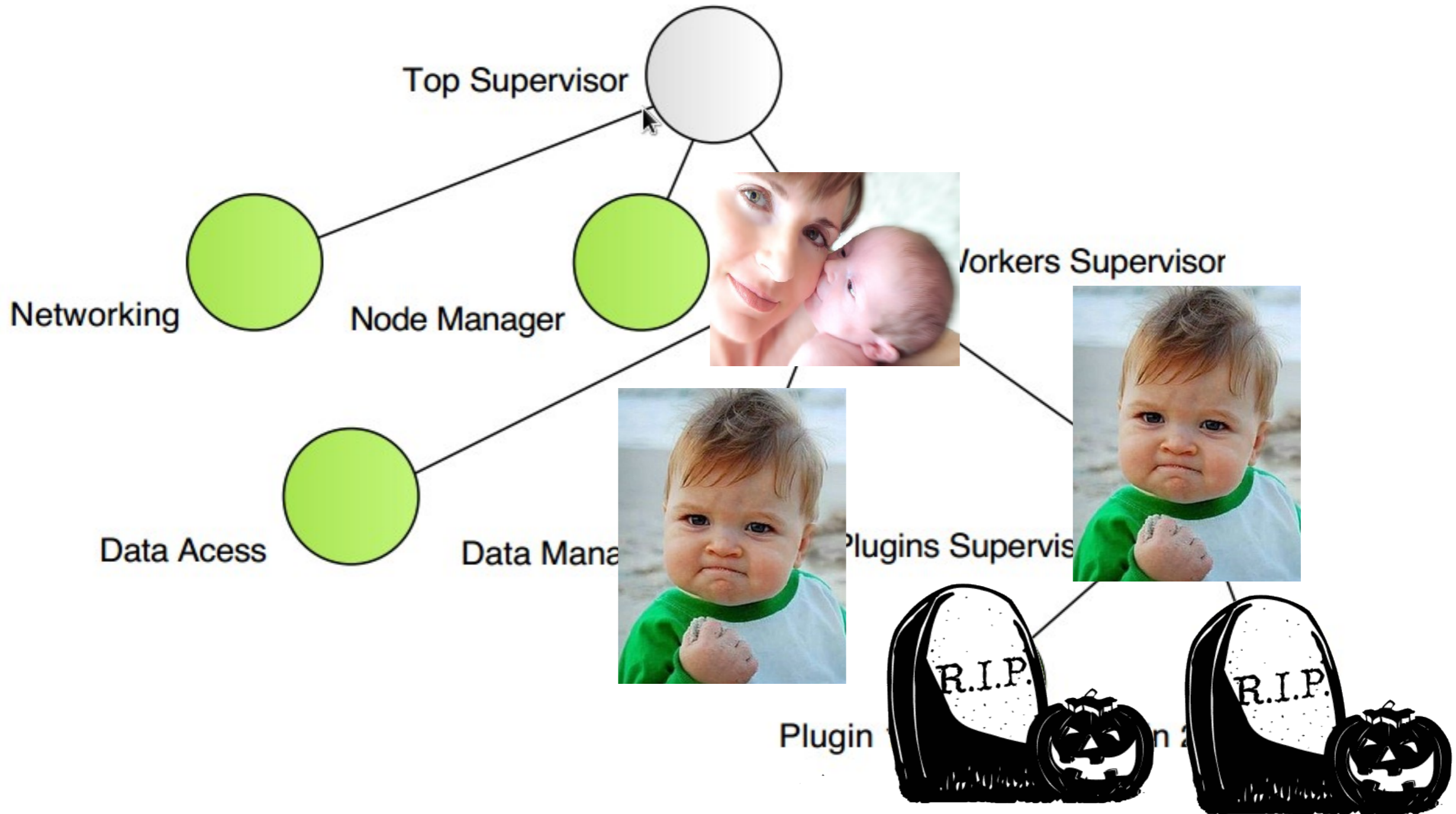
supervisors: **firefighting**



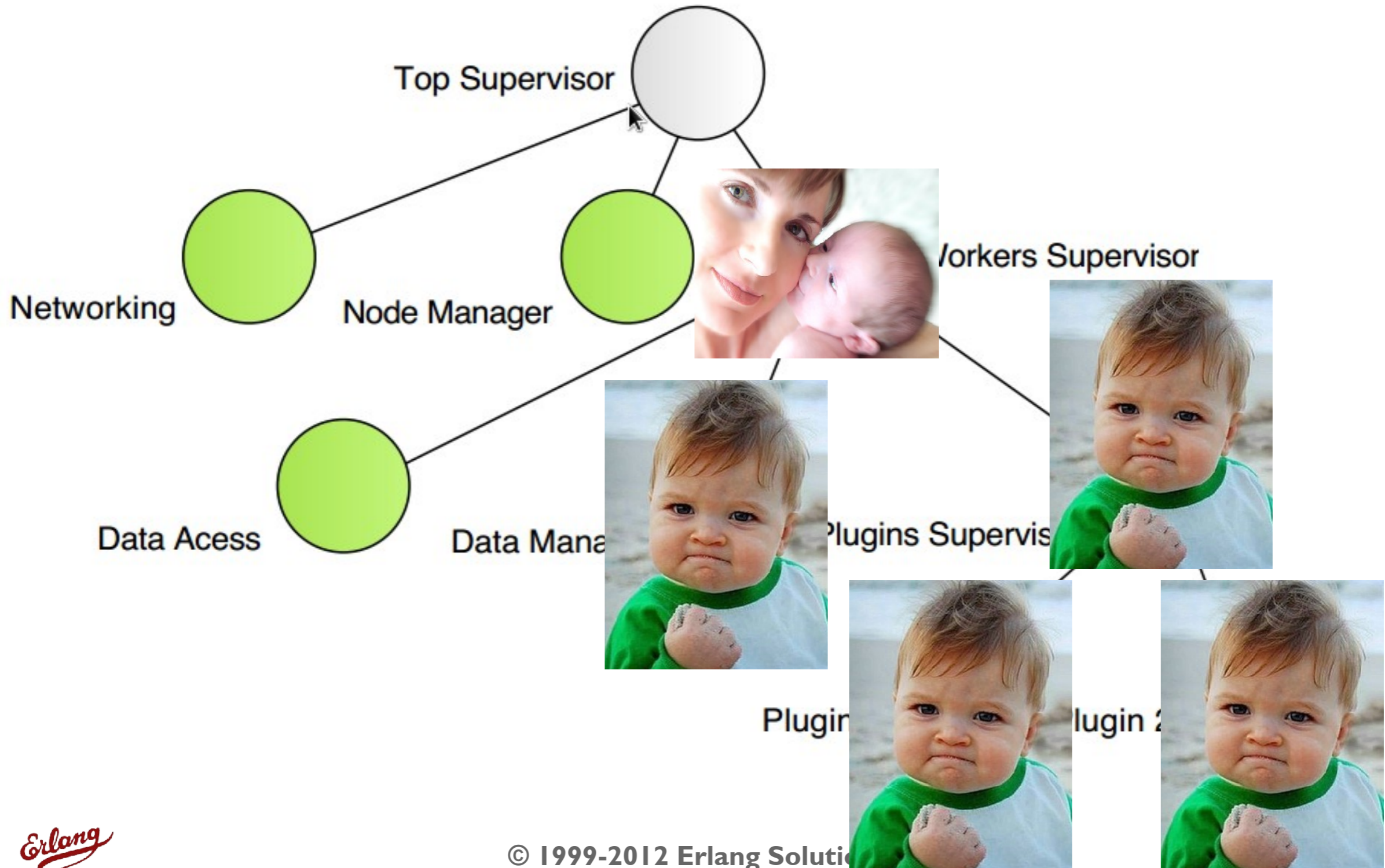
supervisors: **firefighting**



supervisors: **firefighting**

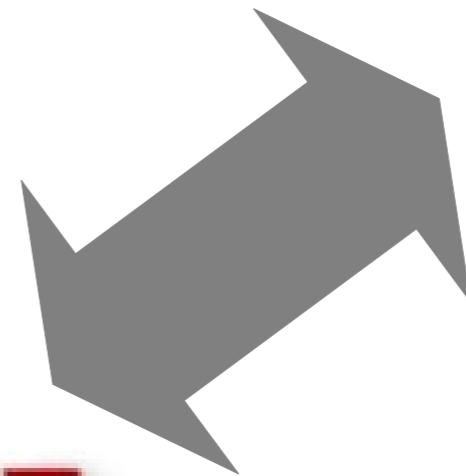


supervisors: **firefighting**

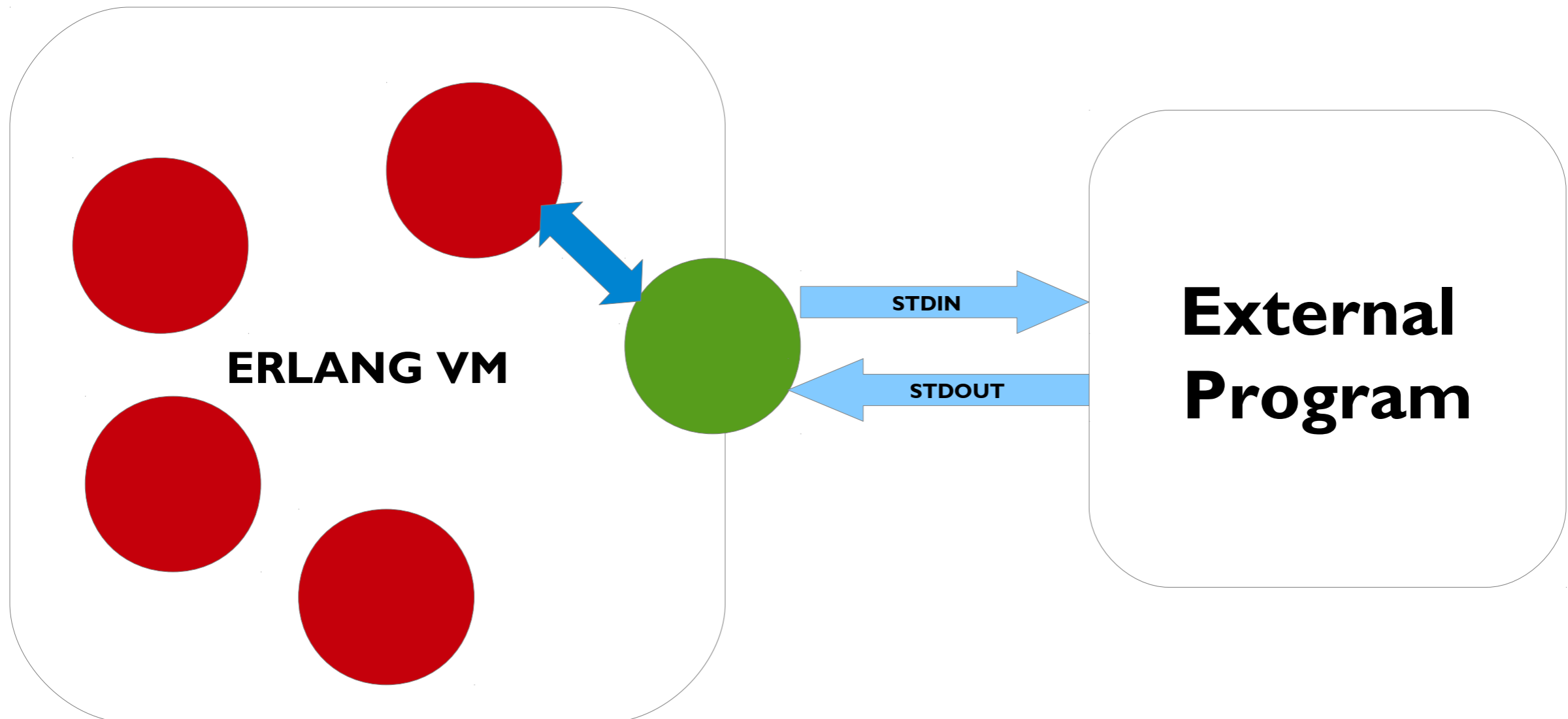


devices:erlang_interoperability

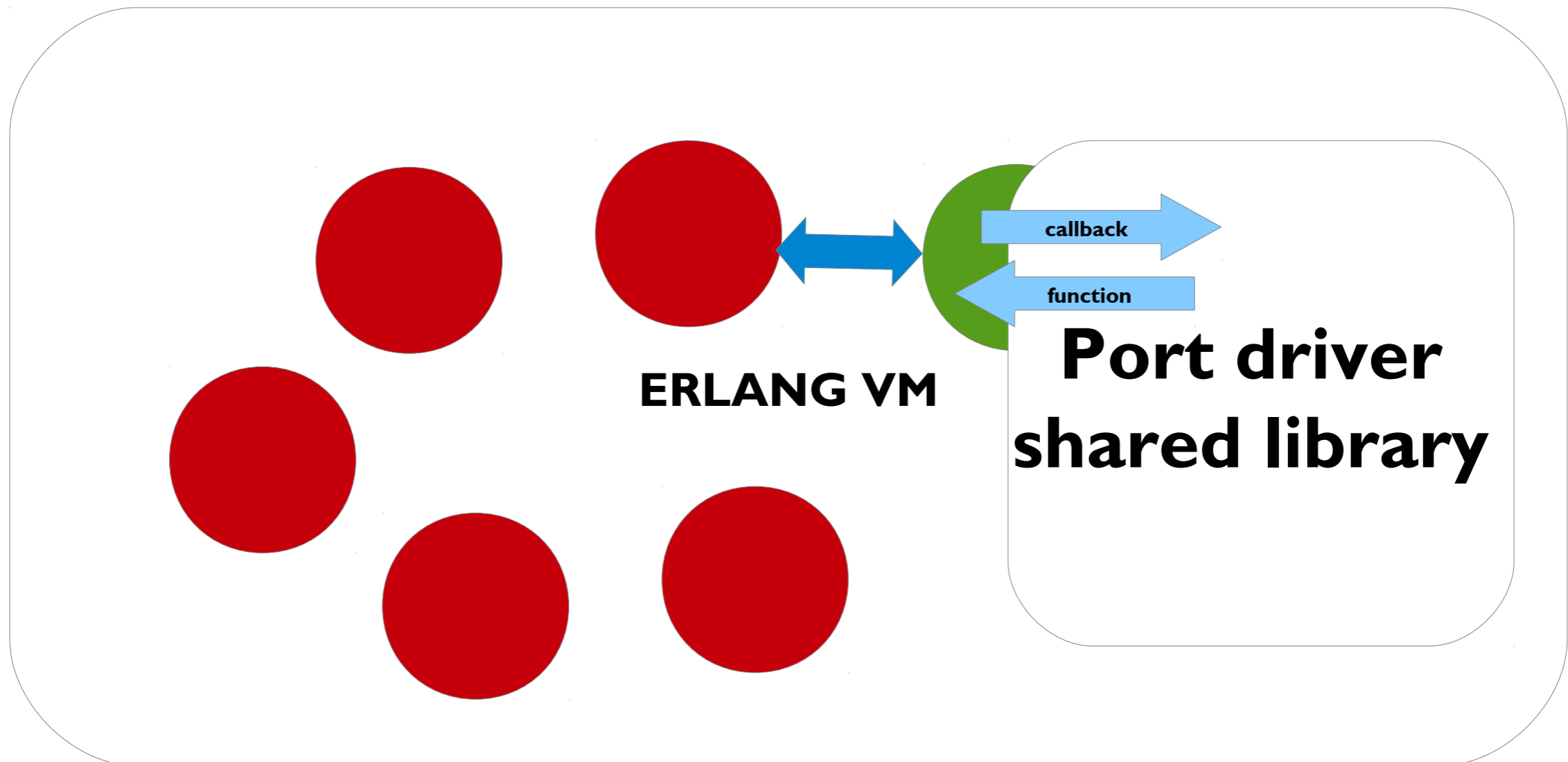
- Ports
- Port Drivers
- NIFs
- C Nodes
- JInterface



devices:ports

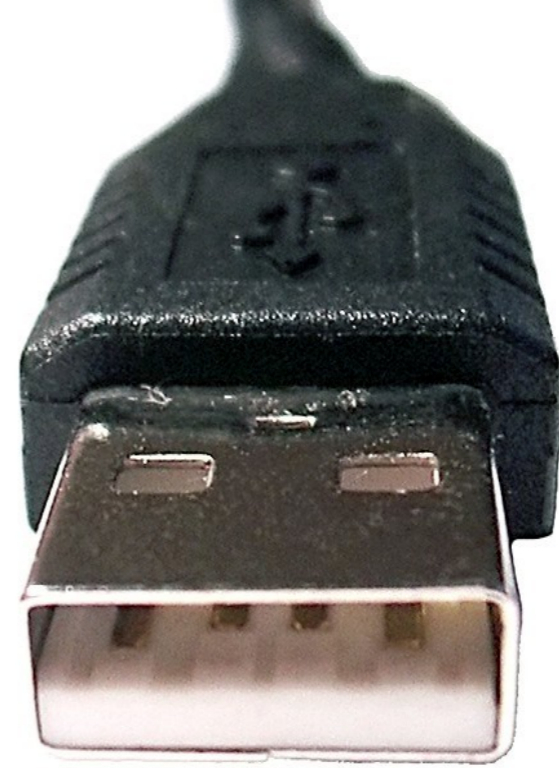


devices:port_drivers



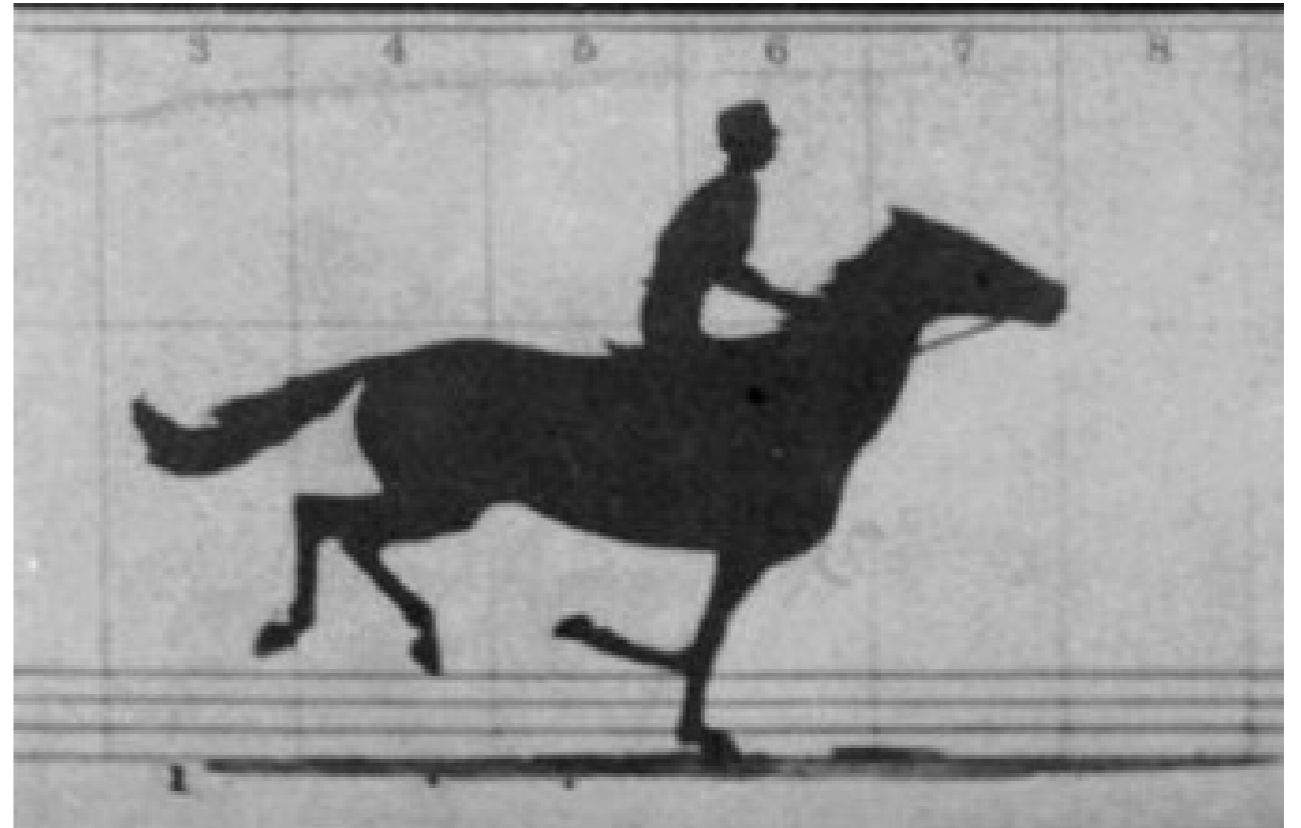
devices:our_ports

- **Serial**
- **Camera (motion detection)**
- **USB (libusb wrapper)**

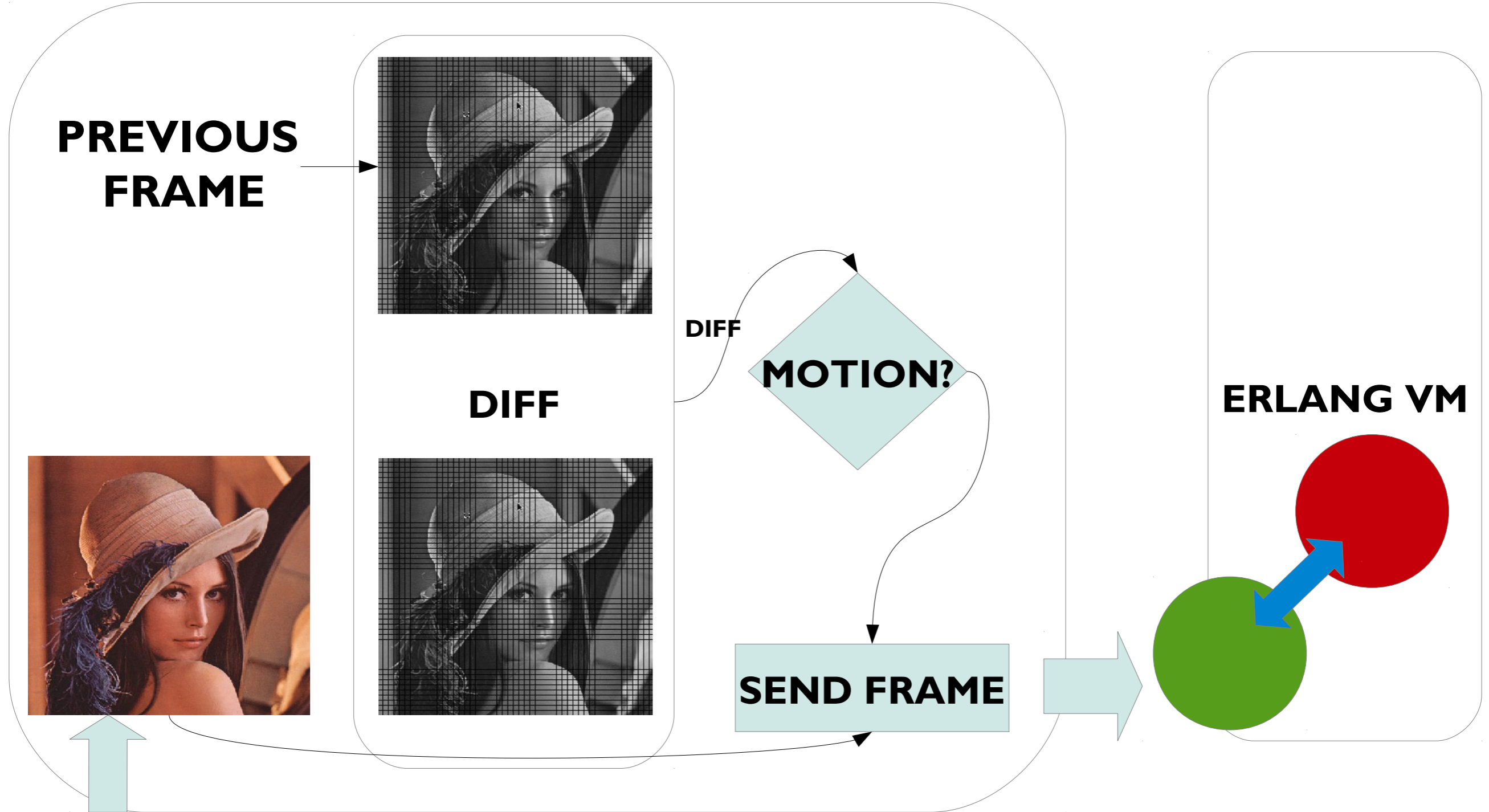


devices:motion_detect

- **Uses Video4Linux 2**
- **Creative WebCam**
- **Ports**



devices:motion_detect_2



couchdb:relax



couchdb:why?

- **Document-orientated**
- **MapReduce**
- **RESTful API**
- **Replication**
- **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

5015

9459

3114

1422

7231

2095

5975

4436

9157

5966

6670

4772

Show 10 entries

TIME STAMP

2012-01-15 (Sunday) at 15:03:12 CET

Data:

m1

└ 0.3

m15

└ 0.3

m5

└ 0.35

Attachments:

└ 912329_480s_v1.jpg

2012-01-15 (Sunday) at 15:03:11 CET

2012-01-15 (Sunday) at 15:03:10 CET

2012-01-15 (Sunday) at 15:03:09 CET

2012-01-15 (Sunday) at 15:03:08 CET

2012-01-15 (Sunday) at 15:03:07 CET

2012-01-15 (Sunday) at 15:03:06 CET

couchdb:replicate

- **Master-Master**
- **Resistant to network failures**
- **Incremental**

erlang:halt()

Questions?