

TESTBED @ WASAL

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<http://wasal.epfl.ch>

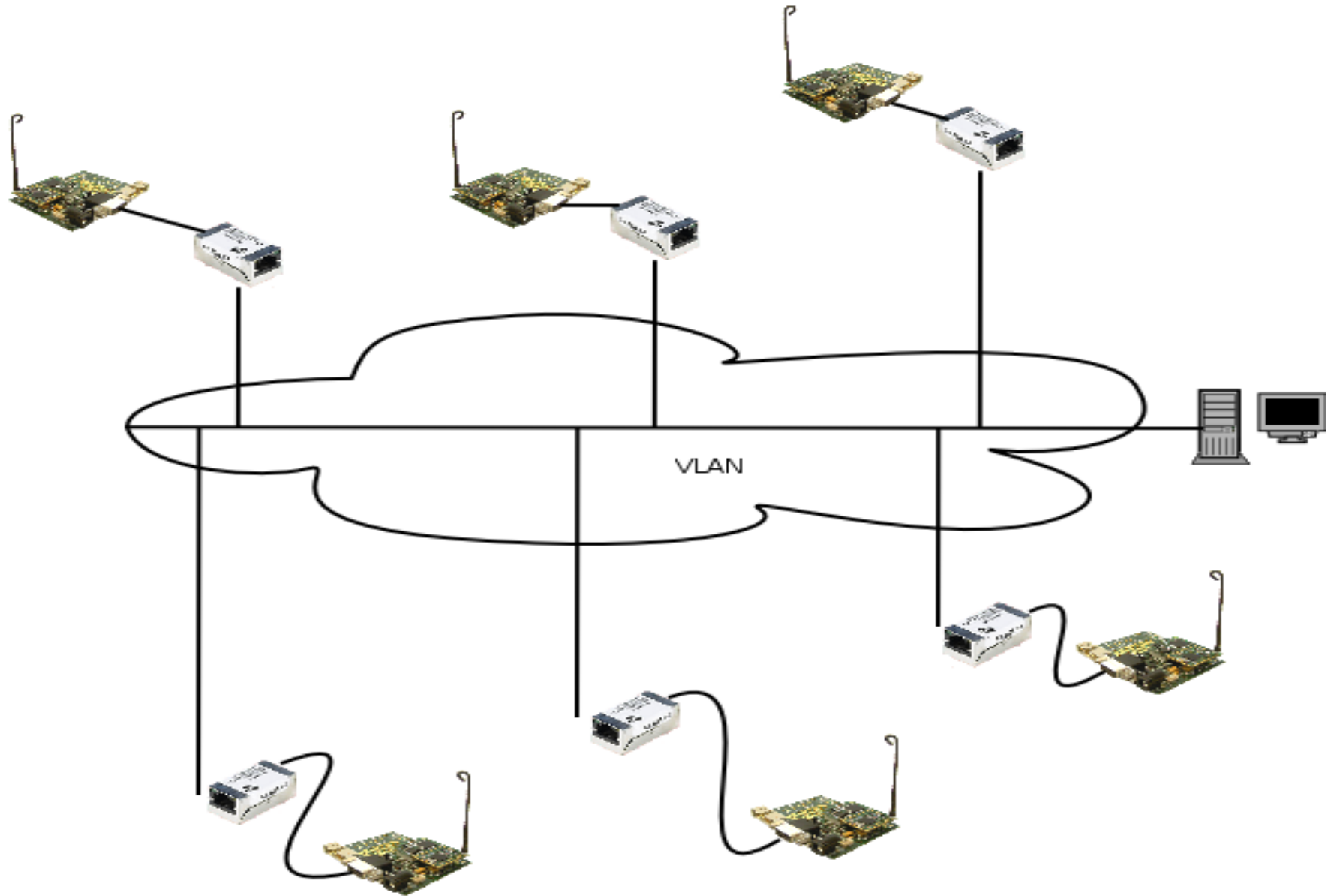
Motivation

- Imperfection of simulation tools
- Lack of proper monitoring of many real-world conditions for WSANs of realistic size
- Need of appropriate tools and methods for systematic testing and management of WSANs
- Need of demonstration platform for applications supported by WSANs

Goals

- Provide research infrastructure of networked sensors and actuators for the MICS Center at EPFL
- Real-time, Robust, Reliable -> Testbed should:
 - support multiple applications simultaneously
 - provide wired feedback channel for management/logging,
 - allow public data retrieval in real-time

HW Architecture



Idea: Full control capability provided by wired feedback channel

Approach: Use the existing LAN infrastructure

WASAdmin - Introduction

- WASAdmin: WASAL's SW Management Tool
- Approach:
 - concurrent execution of shell instance per target node, and script parsing.
- Configuration:
 - XML file `nodes.conf` includes:
 - all node-specific parameters: port, name, location etc.
 - all <shortcuts> that map needed information to a one-letter shortcut, e.g. 'I' -> IPv4 Address

WASAdmin - Configuration

```
<WASAL>
  <shortcuts>
    <!--
    Hardcoded shortcuts :
    'I' : IPv4 Address
    'H' : Fully Qualified Domain Name (ex: wasal-node01.vlan.epfl.ch)
    'h' : Custom defined hostname (ex: wasal-node01) -->
    <key value="p">TTY-port</key>
    <key value="l">location</key>
    <key value="R">RJ45-plug</key>
    <key value="r">RealPort-ID</key>
    <key value="C">COM-ID</key>
    <key value="P">TTY-port-alias</key>
    <key value="i">Node-id</key>
  </shortcuts>
  <node>
    <mac-address>00:40:9D:26:B7:8A</mac-address>
    <DNS-hostname>wasal-node01</DNS-hostname>
    <IPv4-address>192.168.52.1</IPv4-address>
    <location>BC 247</location>
    <RJ45-plug>806.01ab</RJ45-plug>
    <RealPort-ID>aa</RealPort-ID>
    <TTY-port>/dev/ttyaa00</TTY-port>
    <TTY-port-alias>/dev/ttyS1</TTY-port-alias>
    <COM-ID>COM1</COM-ID>
    <Node-id>1</Node-id>
  </node>
</WASAL>
```

WASAdmin Example

The screenshot shows the WASAdmin application window. On the left, there is a list of nodes from wasal-node01 to wasal-node21. Each node is listed with its name, a status of 'Unknown', and a right-facing parenthesis. The node 'wasal-node04' is highlighted in blue. On the right side of the window, the 'Node properties' for the selected node are displayed:

```
Node properties:  
hostname: wasal-node04  
MAC Address: 00:40:9d:26:b7:be  
IPv4 Address: 192.168.52.4  
COM-ID: COM4  
RealPort-ID: ad  
Node-id: 4  
RJ45-plug: 803.06ab  
TTY-port: /dev/ttyad00  
location: BC 241  
TTY-port-alias: /dev/tty54
```

WASAdmin - Scripts

Examples:

Mote Alive

```
ping -q -c 1 %I  
exit
```

Mote Programming

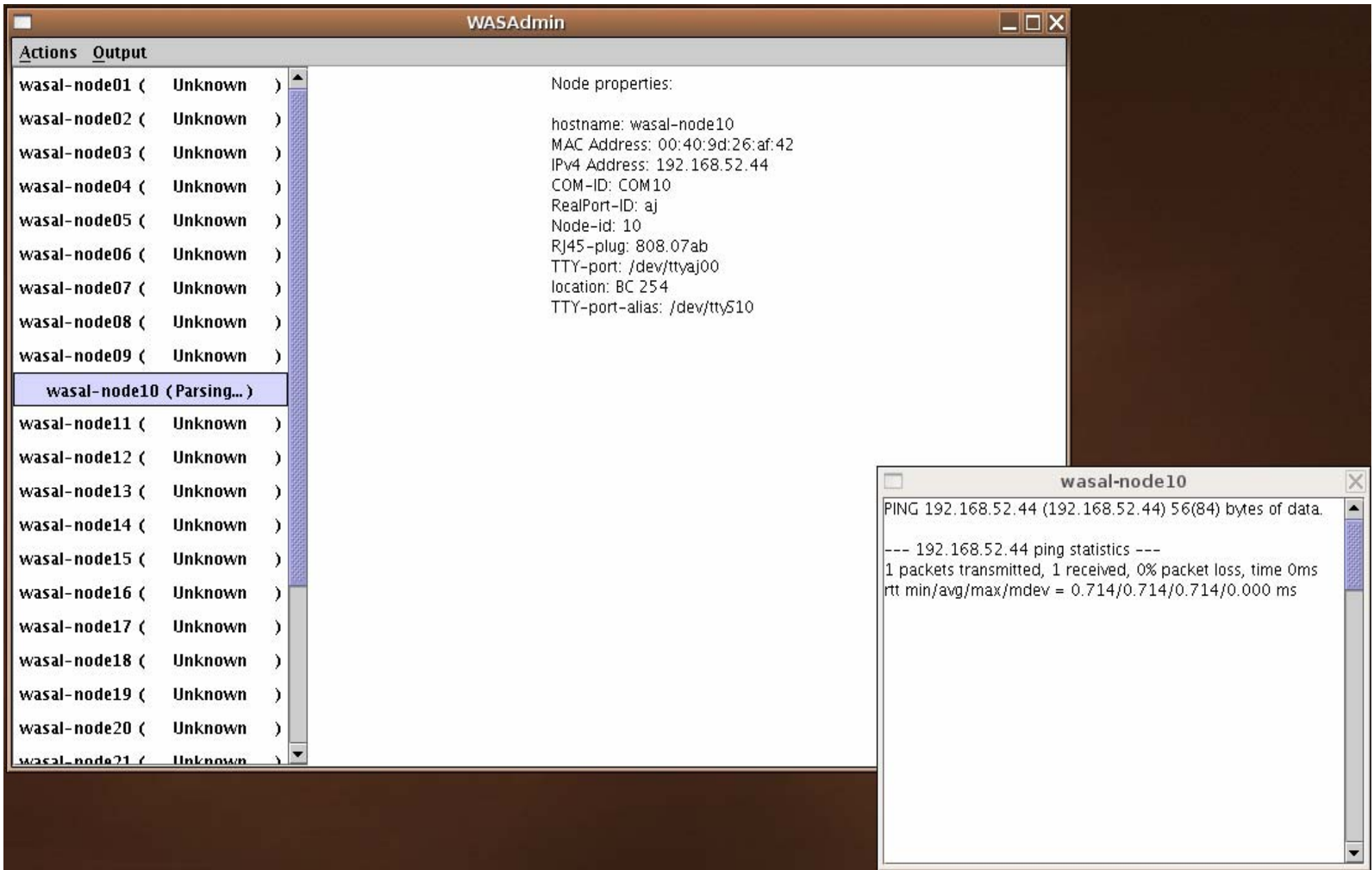
```
make -C $TOSROOT/contrib/shockfish/apps/OscilloscopeTOS tinynode reinstall digi bsl,%p  
exit
```

Feedback Channel

```
export MOTECOM=serial@%P:57600  
java -cp $TOSROOT/tools/java net.tinyos.tools.Listen
```

Each sequence %x is replaced by parameter whose shortcut 'x' is taken from nodes.conf file

WASAdmin – Mote Alive



The screenshot displays the WASAdmin application window. On the left, a list of nodes is shown, with 'wasal-node10 (Parsing...)' selected. The main area displays the node properties for 'wasal-node10'.

Node properties:

- hostname: wasal-node10
- MAC Address: 00:40:9d:26:af:42
- IPv4 Address: 192.168.52.44
- COM-ID: COM10
- RealPort-ID: aj
- Node-id: 10
- RJ45-plug: 808.07ab
- TTY-port: /dev/ttyaj00
- location: BC 254
- TTY-port-alias: /dev/tty510

A terminal window titled 'wasal-node10' is open in the foreground, showing the output of a ping command:

```
PING 192.168.52.44 (192.168.52.44) 56(84) bytes of data:
--- 192.168.52.44 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 0.714/0.714/0.714/0.000 ms
```

WASAdmin – Mote Programming

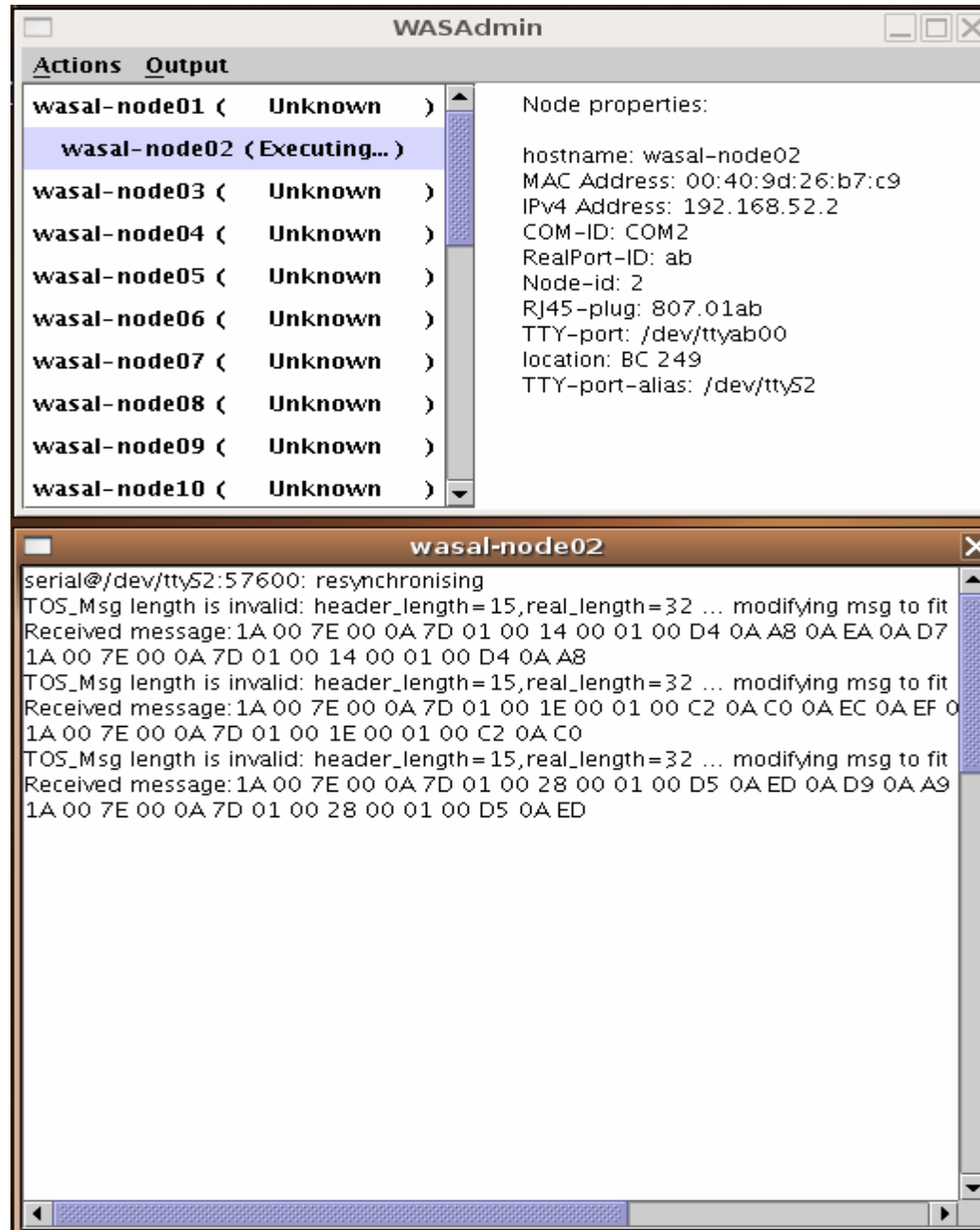
The screenshot shows the WASAdmin interface. On the left, a list of nodes is displayed, with 'wasal-node10' selected and marked as '(Returned 0)'. The main area shows the 'Node properties' for 'wasal-node10':

```
Node properties:  
hostname: wasal-node10  
MAC Address: 00:40:9d:26:af:42  
IPv4 Address: 192.168.52.44  
COM-ID: COM10  
RealPort-ID: aj  
Node-id: 10  
RJ45-plug: 808.07ab  
TTY-port: /dev/ttyaj00  
location: BC 254  
TTY-port-alias: /dev/ttyS10
```

An inset terminal window titled 'wasal-node10' shows the output of a programming command:

```
Program starting at 0x0700, 224 bytes ...  
Program starting at 0x6840, 224 bytes ...  
Program starting at 0x6920, 224 bytes ...  
Program starting at 0x6a00, 224 bytes ...  
Program starting at 0x6ae0, 224 bytes ...  
Program starting at 0x6bc0, 224 bytes ...  
Program starting at 0x6ca0, 224 bytes ...  
Program starting at 0x6d80, 224 bytes ...  
Program starting at 0x6e60, 224 bytes ...  
Program starting at 0x6f40, 224 bytes ...  
Program starting at 0x7020, 224 bytes ...  
Program starting at 0x7100, 224 bytes ...  
Program starting at 0x71e0, 224 bytes ...  
Program starting at 0x72c0, 224 bytes ...  
Program starting at 0x73a0, 224 bytes ...  
Program starting at 0x7480, 224 bytes ...  
Program starting at 0x7560, 224 bytes ...  
Program starting at 0x7640, 224 bytes ...  
Program starting at 0x7720, 224 bytes ...  
Program starting at 0x7800, 224 bytes ...  
Program starting at 0x78e0, 224 bytes ...  
Program starting at 0x79c0, 224 bytes ...  
Program starting at 0x7aa0, 224 bytes ...  
Program starting at 0x7b80, 224 bytes ...  
Program starting at 0x7c60, 224 bytes ...  
Program starting at 0x7d40, 224 bytes ...  
Program starting at 0x7e20, 224 bytes ...  
Program starting at 0x7f00, 224 bytes ...  
Program starting at 0x7fe0, 190 bytes ...  
Program starting at 0xffe0, 32 bytes ...  
16574 bytes programmed.  
Reset device ...  
rm -f build/tinynode/main.exe.out build/tinynode/main.ihex.out  
make[1]: Leaving directory `~/opt/tinyos-1.x/contrib/shockfish/apps/Oscill...
```

WASAdmin - Feedback Channel



Test Scenarios

- Indoor RSSI measurements
- Deluge 2.0 Testing
- Mobile Sink Testing
- Full-Fledge Demo for SmartPark
- ...

Future Work

- Merge testbeds from BC building at EPFL
- Mobile Testbed -> Digi Connect Wi-ME
- Extend WASAdmin's functionality