Make your own M2M application, in ½ hour, with Lua

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Lua Workshop ’12
Sierra Wireless @ Lua workshop

Last year, we talked about our Lua based M2M SDK http://www.lua.org/wshop11/m2m-embedded-development-with-lua.pdf

Today, we’ll actually demonstrate it; sources available on github: http://github.com/fab13n/wshop12

But we’ll inflict you some more talking first, for those who missed or forgot last year’s talk!

We promised to open source it, we partially did: https://github.com/SierraWireless/luasched

We’ll do more: http://www.eclipse.org/mihini
What’s M2M?

M2M == Machine-to-Machine [communications]
(The latest fashionable name for M2M is “IoT”, i.e. “Internet of Things”)

M2M is networking for embedded devices, with some twists:

• Hardware is disseminated over vast areas
• Access primarily happens through GSM / CDMA / 3G networks
• There's no skilled operator / maintainer on site
• Fleets are often large and heterogeneous
About Sierra Wireless

We design and build M2M modems

Our customers build solutions with them

We want more solutions, built faster and for cheaper
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Our customers build solutions with them:

• Energy (windmill, solar panels)
• Dispensers: ATM, vending machines, charging stations
• Specialized engines: compressors, water plants, coffee machines
• Mobile assets: vehicle fleets, shipping containers
• Utility meters

We want more solutions, built faster and for cheaper
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- A solution involves:
  - Embedded hardware
  - Embedded Software
  - IP Networking
  - Wireless networking
  - Radio issues
  - Protocols
  - Back-end server software
  - Database
  - Front-end server software
  - ERP integration
  - Telecom operators integration
About Sierra Wireless

We want more solutions, built faster and for cheaper

• A solution involves [many domains].
• None of this is rocket science, but very few organizations are competent in all of these domains simultaneously.

Billions of M2M devices are forecast in the next decade

• That’s quite a bubble
• It cannot be only manned by embedded specialists. The market will belong to those who enable generalist developers.
“Embedded expertize”

```c
int main()
{
    unsigned char char1[10];
    unsigned char char_buf[8] = "AT+CSQ\n";
    int sfd;

    // writing to serial port
    write(sfd, char_buf, sizeof(char_buf));
    usleep(40000);
    // reading from serial port
    read(sfd, char1, sizeof(char1));
    sleep(2);
    close(sfd);
    return 0;
}
```

It’s **not OK** for a simple, core operation such as sending an SMS to take pages of error-prone code. Yet it’s still the norm in the embedded world.

```c
sms.send('+33612345678', 'My SMS', )
```
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• A solution involves *many domains*
  […]
• The market will belong to those who enable generalist developers.

Sierra Wireless provides:

• Embedded hardware
• SIM / Subscription / Airtime billing management
• Embedded SDK (in Lua): API, runtime, IDE
• Back-end servers
• REST access to servers
• Generic UI, designed for large fleet management
Demo time

DIY-friendly hardware:
• Raspberry Pi
• Arduino Uno (representative of distributed architectures)
• Plugs Arduino shield (to avoid any soldering)
• Cheap, generic sensors, wired straight to GPIOs

<$100, available on the net, accessible to all developers. Enables fun projects: domotics, automated greenhouse, RC models…
Demo time

1. Simplest possible application: telnet server + scheduler
2. Getting data: modbus
3. Making data physically meaningful
4. Publishing with MQTT
5. Controlling through http://m2mop.net

Sources: http://www.github.com/fab13n/wshop12
[Demo: basic modbus, data processing, MQTT connection]
Embedded Agent services

Embedded devices need to perform:

- Data acquisition / consolidation / reporting
- Locally managed actions
- Server-initiated actions
- Over-The-Air software and firmware updates
Embedded Agent services

Embedded devices need to perform:

• Data acquisition / consolidation / reporting
  • access to local I/O: serial buses, GPIO, ADC/DAC, LAN…
  • local storage
  • optionally persisted
  • efficient encoding of time series
  • customizable precision/bandwidth compromise
  • standard consolidation methods (min, max, mean…)
  • remotely customizable reporting policies
• Locally managed actions
• Server-initiated actions
• Over-The-Air software and firmware updates
Embedded Agent services

Embedded devices need to perform:

• Data acquisition / consolidation / reporting
• Locally managed actions
  • get / set / notify API for system state
  • full Lua programming language, with I/O APIs
• Server-initiated actions
• Over-The-Air software and firmware updates
Embedded Agent services

Embedded devices need to perform:

• Data acquisition / consolidation / reporting
• Locally managed actions
• Server-initiated actions
  • get / set / notify API for server-controlled data
  • standard encoding of commands and handlers
  • can be sent to / acknowledged by large batches of devices
• Over-The-Air software and firmware updates
Embedded Agent services

Embedded devices need to perform:

- Data acquisition / consolidation / reporting
- Locally managed actions
- Server-initiated actions
- Over-The-Air software and firmware updates
  - Firmware and software authentication
  - Management by arbitrary batches
  - Monitoring of success / failure
  - Auto-recovery in case of failure
- Update forwarding to other embedded CPUs
[Demo: Embedded Agent+m2mop.net, reporting, setting, command]