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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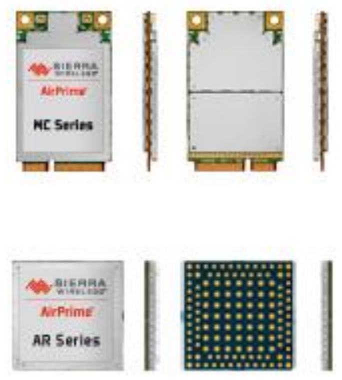

Our customers build solutions with them

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We design and build M2M modems

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

About Sierra Wireless

We want more solutions, built faster and for cheaper

- 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

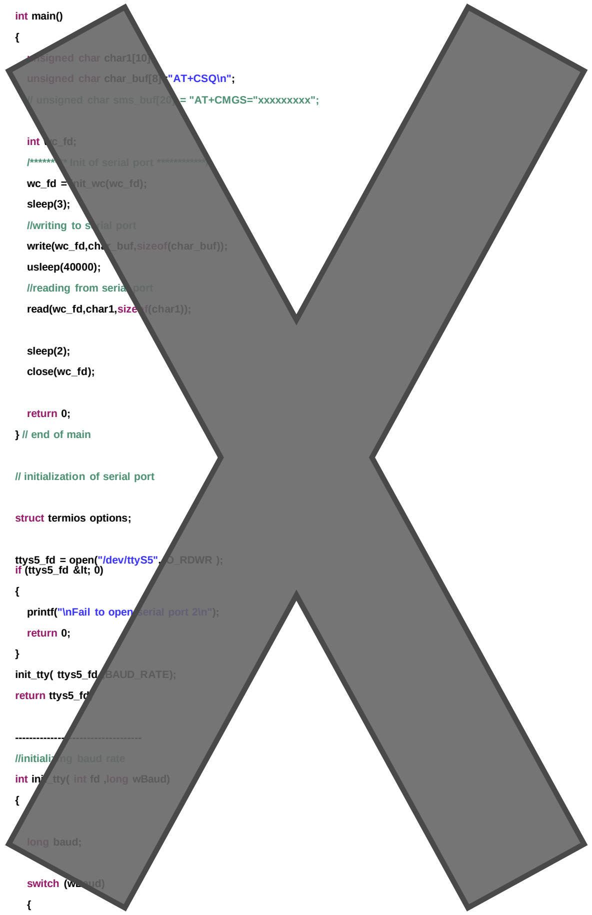
We want more solutions, built faster and for cheaper

- 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”



```
int main()
{
   unsigned char char1[10];
   unsigned char char_buf[8] ="AT+CSQ\n";
   // unsigned char sms_buf[20] = "AT+CMGS="xxxxxxxxx";

   int wc_fd;
   /********* Init of serial port ************/
   wc_fd = init_wc(wc_fd);
   sleep(3);
   //writing to serial port
   write(wc_fd,char_buf,sizeof(char_buf));
   usleep(40000);
   //reading from serial port
   read(wc_fd,char1,sizeof(char1));

   sleep(2);
   close(wc_fd);

   return 0;
} // end of main

// initialization of serial port

struct termios options;

ttys5_fd = open("/dev/ttyS5", O_RDWR );
if (ttys5_fd &lt; 0)
{
   printf("\nFail to open serial port 2\n");
   return 0;
}
init_tty( ttys5_fd ,BAUD_RATE);
return ttys5_fd;

-----------------------------------
//initializing baud rate
int init_tty( int fd ,long wBaud)
{

   long baud;

   switch (wBaud)
   {
```

```
sms.send(
  '+33612345678’,
  'My SMS’,
)
```

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.

About Sierra Wireless

We want more solutions, built faster and for cheaper

- 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

API: http://developer.sierrawireless.com/en/Resources/Resources/AirLink/ALEOS_AF/RefDoc_ALEOS_AF_API.aspx

[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 compromize**
  - **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]