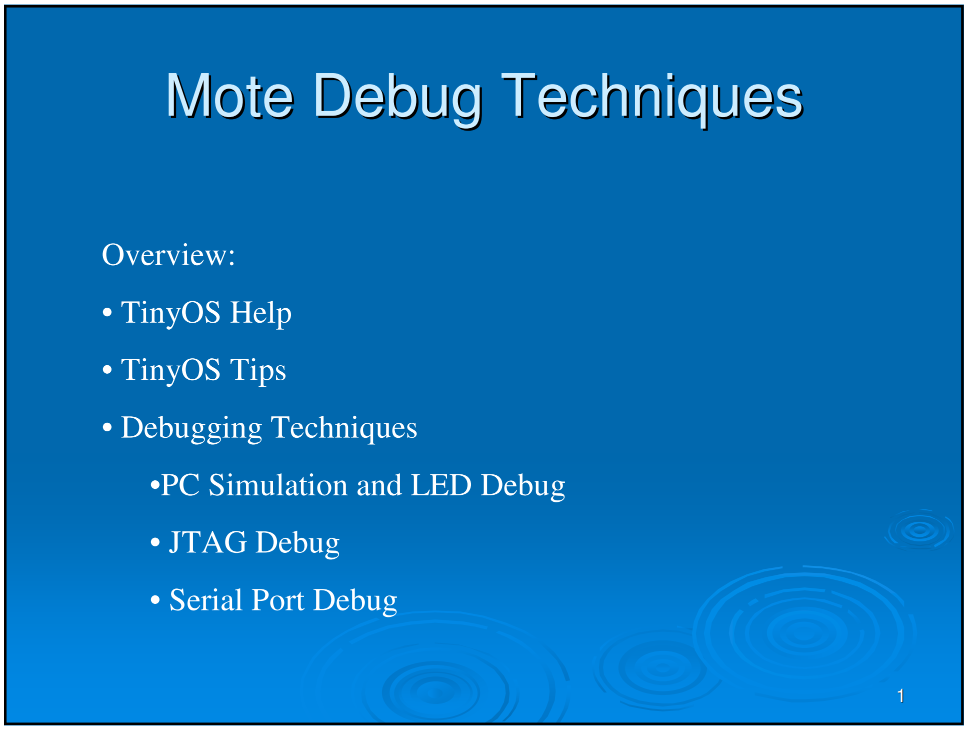

Mote Debug Techniques

Overview:

- TinyOS Help
- TinyOS Tips
- Debugging Techniques
    - PC Simulation and LED Debug
    - JTAG Debug
    - Serial Port Debug

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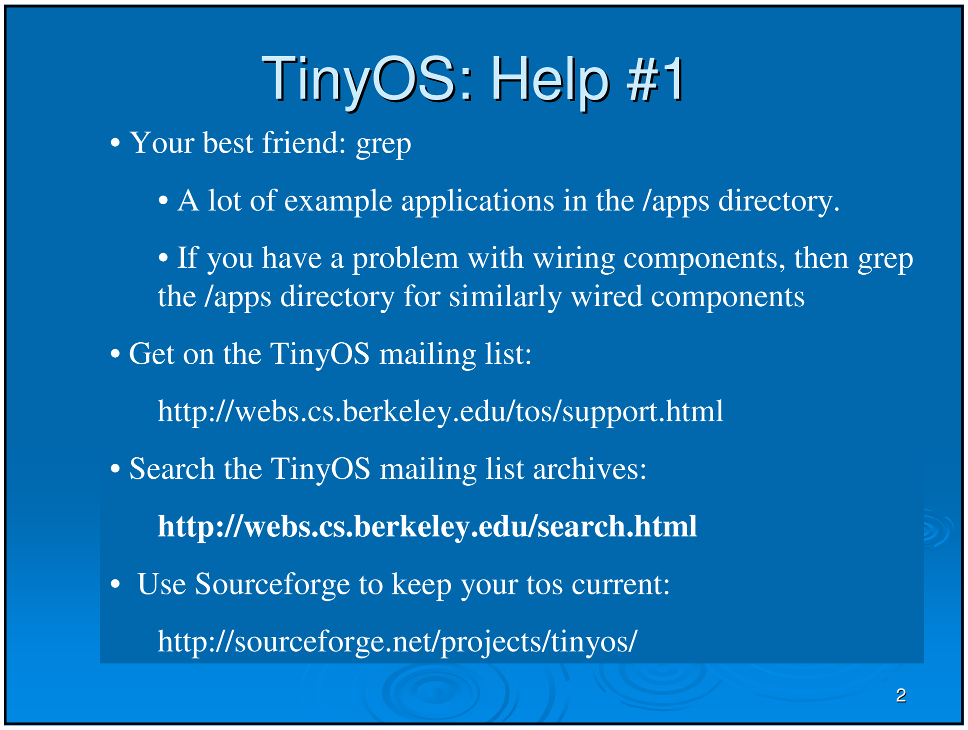

TinyOS: Help #1

- Your best friend: grep
    - A lot of example applications in the /apps directory.
    - If you have a problem with wiring components, then grep the /apps directory for similarly wired components
- Get on the TinyOS mailing list:

  http://webs.cs.berkeley.edu/tos/support.html
- Search the TinyOS mailing list archives:

  http://webs.cs.berkeley.edu/search.html
- Use Sourceforge to keep your tos current:

  http://sourceforge.net/projects/tinyos/

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TinyOS: Help #2

Use Sourceforge to update your TinyOS code and keep current:

• Before downloading; rename your present tinyos dir to keep a backup

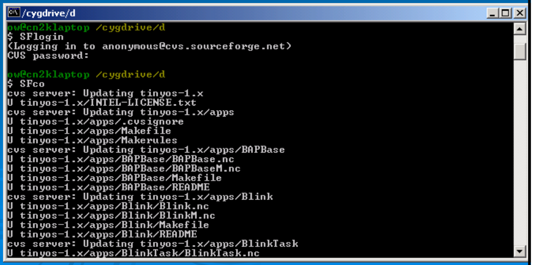
Ex (tinyos-1.x -> tinyos-1.x-rev1

• Add the following scripts to /cygwin/etc/profile:

alias SFlogin="cvs -d:pserver:anonymous@cvs.sourceforge.net:/cvsroot/tinyos login"

alias SFco="cvs -z3 -d:pserver:anonymous@cvs.sourceforge.net:/cvsroot/tinyos co tinyos-1.x"

• When Sourceforge asks for a password just hit return.



```
ow@cn2klaptop /cygdrive/d
$ SFlogin
(Logging in to anonymous@cvs.sourceforge.net)
CVS password:

ow@cn2klaptop /cygdrive/d
$ SFco
cvs server: Updating tinyos-1.x
U tinyos-1.x/INTEL-LICENSE.txt
cvs server: Updating tinyos-1.x/apps
U tinyos-1.x/apps/.cvsignore
U tinyos-1.x/apps/Makefile
U tinyos-1.x/apps/Makerules
cvs server: Updating tinyos-1.x/apps/BAPBase
U tinyos-1.x/apps/BAPBase/BAPBase.nc
U tinyos-1.x/apps/BAPBase/BAPBaseM.nc
U tinyos-1.x/apps/BAPBase/Makefile
U tinyos-1.x/apps/BAPBase/README
cvs server: Updating tinyos-1.x/apps/Blink
U tinyos-1.x/apps/Blink/Blink.nc
U tinyos-1.x/apps/Blink/BlinkM.nc
U tinyos-1.x/apps/Blink/Makefile
U tinyos-1.x/apps/Blink/README
cvs server: Updating tinyos-1.x/apps/BlinkTask
U tinyos-1.x/apps/BlinkTask/BlinkTask.nc
```

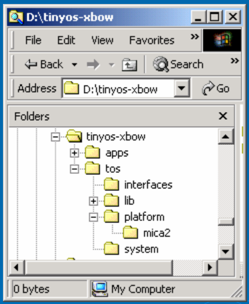
TinyOS: Help #3

• You can also do updates from Sourceforge without downloading an entire new copy of tinyos (**update –dP**). See the Sourceforge website.

•Be patient with Sourceforge. Sometimes site is too busy or upgrading. You may have to try a few times.

•Don't let Sourceforge updates or accidental deletions overwrite your application development. Develop your code in a separate directory outside of TinyOS. Ex: tinyos-xbow

- • Structure your directory like tinyos (i.e /apps, /tos,..)
- • Put modified or new tos modules in these directories, they will override the TOS modules
- • Create a Makelocal file in your /apps directory (same level as Makerules)



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TinyOS: Help #4

- Makelocal file
- Sets the path to your code modules
- Good place to set the radio frequency.
- Makelocal example:

```
BASEDIR = ../../../tinyos-1.x/tos

LOCAL_PATH += -I../../tos/platform/mica2 -I../../tos/interfaces
PFLAGS := -tosdir=$(BASEDIR) $(LOCAL_PATH) $(LOCAL_DEFINES)
$(PFLAGS)
#CFLAGS = -DCC1K_DEFAULT_FREQ=CC1K_433_002_MHZ
CFLAGS = -DCC1K_DEFAULT_FREQ=CC1K_916MHZ
```

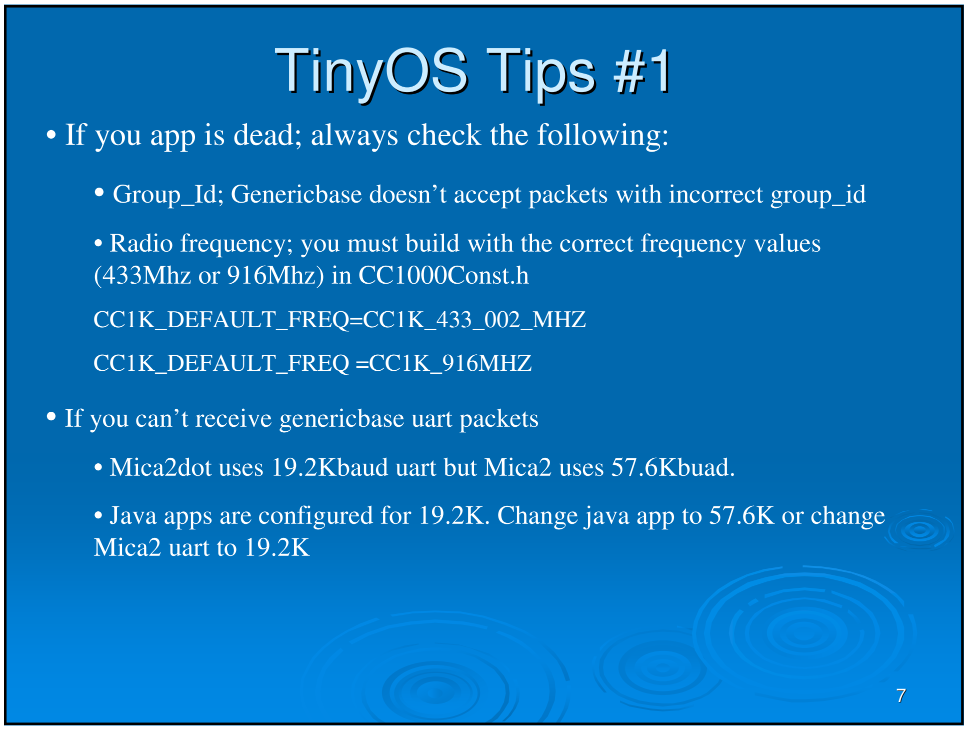
TinyOS: Help #5

- You also need to keep your Cygwin updated:

  http://www.cygwin.com/

- The Cygwin site will update your cgywin dir over the web. (I.e. use the 'update' feature.

•You do this in the lab, BAAD!!!



TinyOS Tips #1

- If you app is dead; always check the following:
  - Group_Id; Genericbase doesn’t accept packets with incorrect group_id
  - Radio frequency; you must build with the correct frequency values (433Mhz or 916Mhz) in CC1000Const.h

    CC1K_DEFAULT_FREQ=CC1K_433_002_MHZ

    CC1K_DEFAULT_FREQ =CC1K_916MHZ
- If you can’t receive genericbase uart packets
  - Mica2dot uses 19.2Kbaud uart but Mica2 uses 57.6Kbuad.
  - Java apps are configured for 19.2K. Change java app to 57.6K or change Mica2 uart to 19.2K

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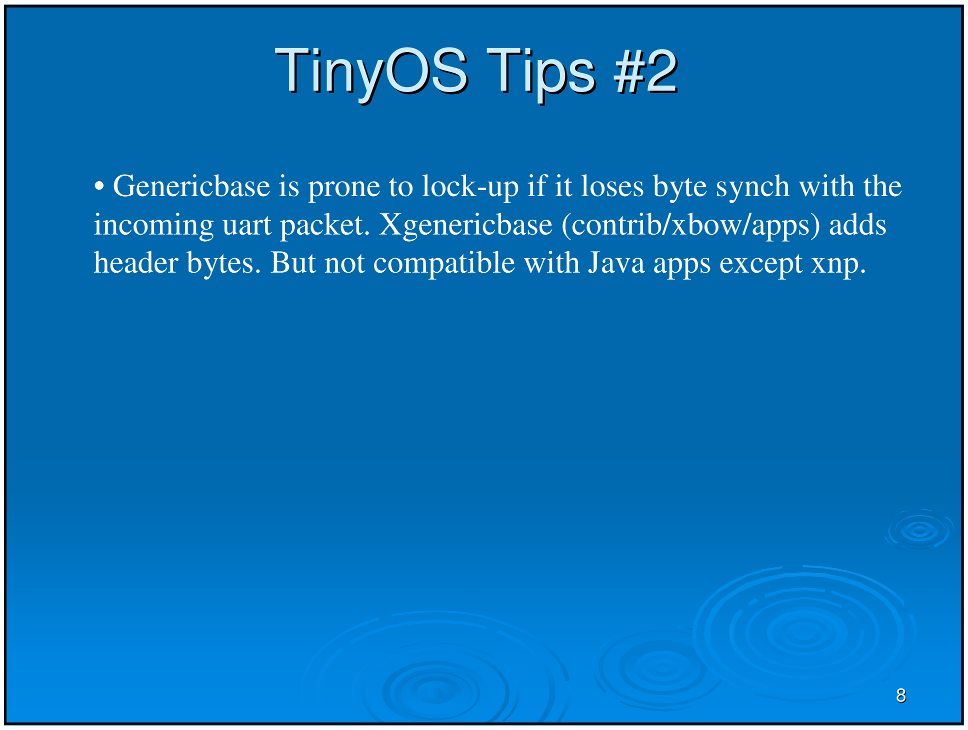

TinyOS Tips #2

- Genericbase is prone to lock-up if it loses byte synch with the incoming uart packet. Xgenericbase (contrib/xbow/apps) adds header bytes. But not compatible with Java apps except xnp.

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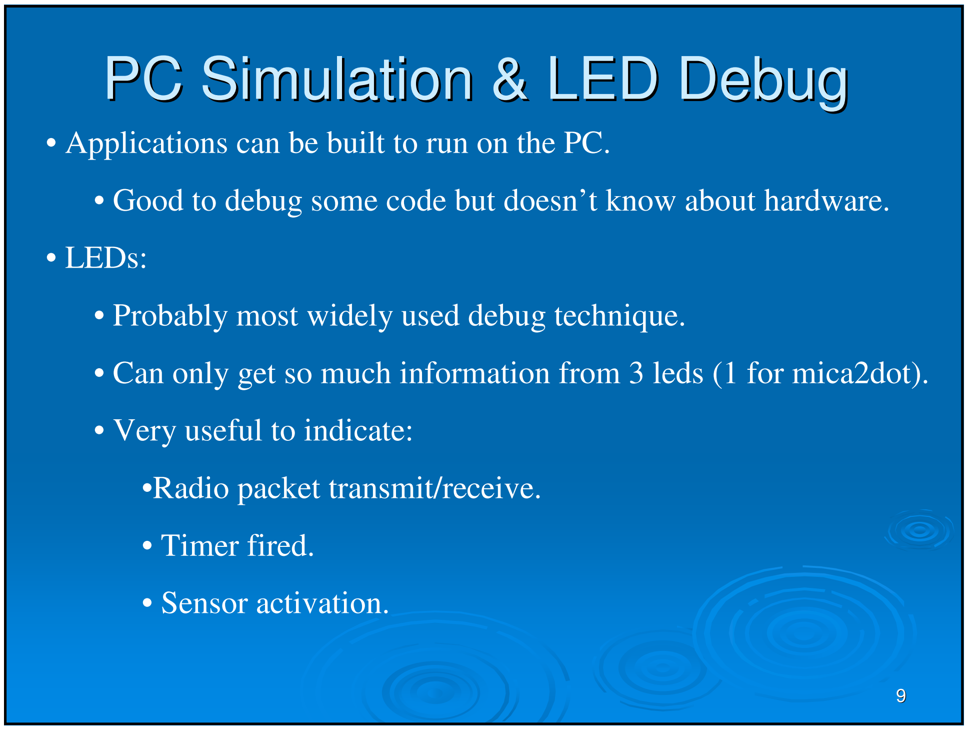

PC Simulation & LED Debug

- Applications can be built to run on the PC.
  - Good to debug some code but doesn’t know about hardware.
- LEDs:
  - Probably most widely used debug technique.
  - Can only get so much information from 3 leds (1 for mica2dot).
  - Very useful to indicate:
    - Radio packet transmit/receive.
    - Timer fired.
    - Sensor activation.

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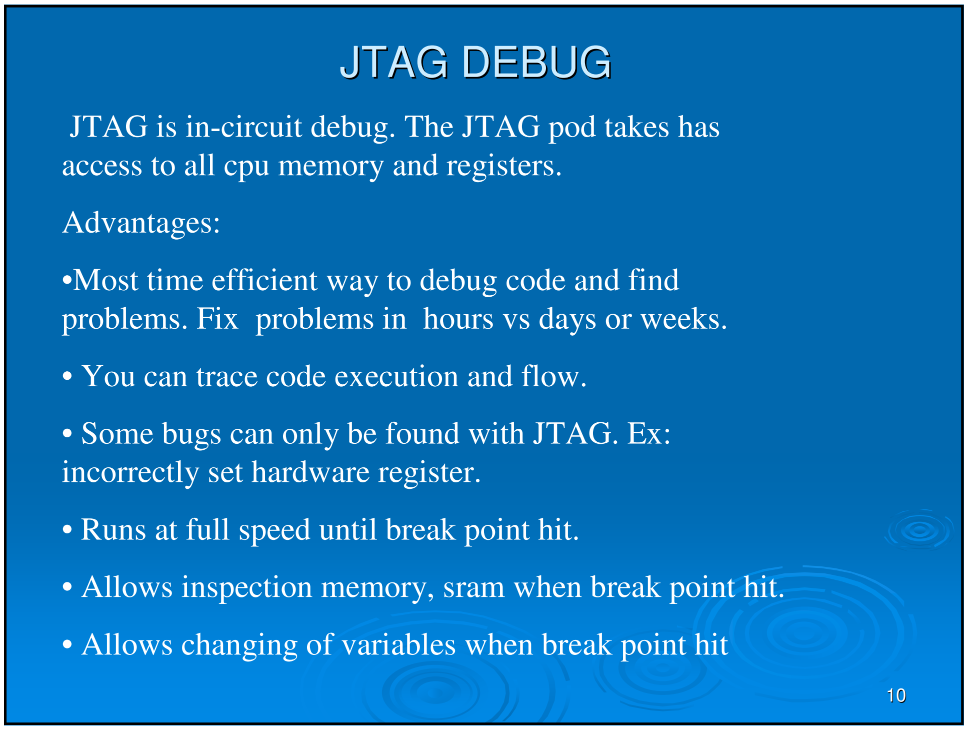

JTAG DEBUG

JTAG is in-circuit debug. The JTAG pod takes has access to all cpu memory and registers.

Advantages:

•Most time efficient way to debug code and find problems. Fix problems in hours vs days or weeks.

• You can trace code execution and flow.

• Some bugs can only be found with JTAG. Ex: incorrectly set hardware register.

• Runs at full speed until break point hit.

• Allows inspection memory, sram when break point hit.

• Allows changing of variables when break point hit

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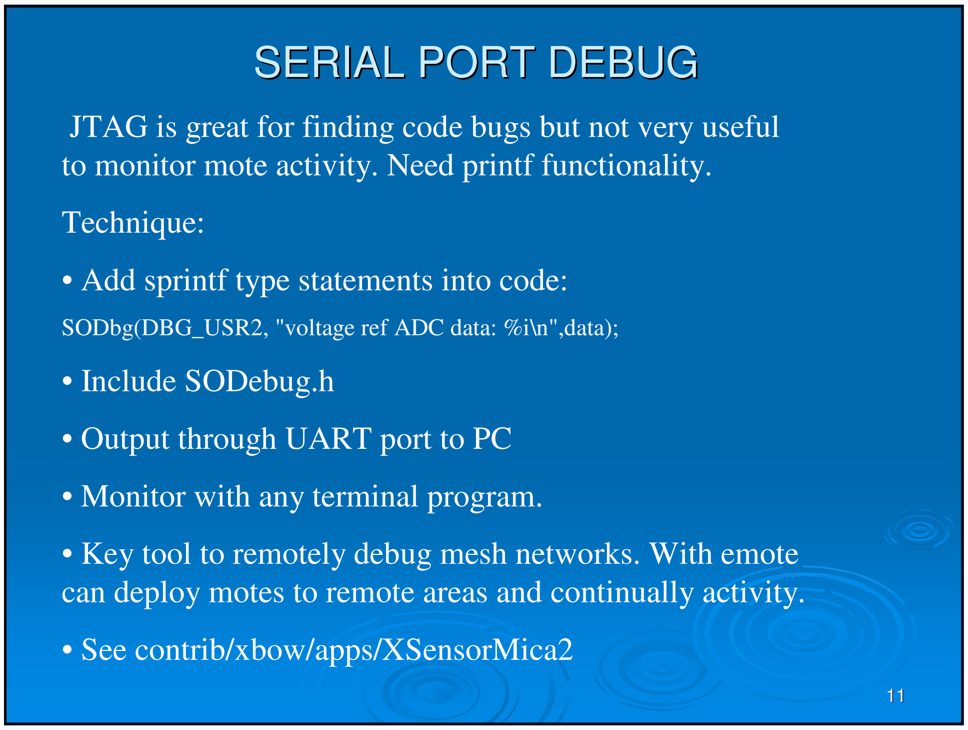

SERIAL PORT DEBUG

JTAG is great for finding code bugs but not very useful to monitor mote activity. Need printf functionality.

Technique:

• Add sprintf type statements into code:

```
SODbg(DBG_USR2, "voltage ref ADC data: %i\n",data);
```

• Include SODebug.h

• Output through UART port to PC

• Monitor with any terminal program.

• Key tool to remotely debug mesh networks. With emote can deploy motes to remote areas and continually activity.

• See contrib/xbow/apps/XSensorMica2

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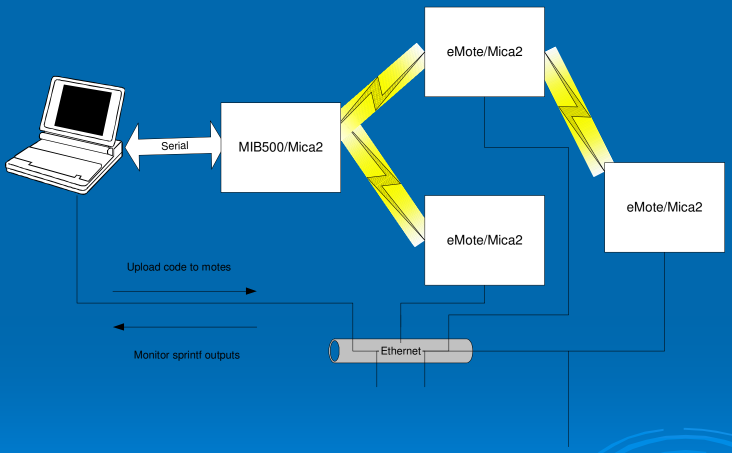
eMote DEBUG



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