

MoteView User's Manual

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Introduction to Crossbow: MoteView User's Manual

Presented by Bretny Khamphavong,

Wireless Mesh Networking Overview

- Generic name for a class of networked embedded systems that share several characteristics:
 - Multi-Hop
 - Self-Configuring
 - Self-Healing
 - Dynamic Routing
- Sensor networks become long-lived, easily deployed, and resilient to the unpredictable wireless channel

Wireless Network Deployment

Composed of three distinct software tiers:

- Client Tier
 - Visualization software and graphical interface for managing the network
- Server Tier
 - Handles translation and buffering of data from the wireless network
 - Provides bridge between the wireless motes and internet clients
- Mote Tier
 - Runs on the cloud of sensor nodes forming a mesh network

Applications and Software of Components

- Client Tier = *MoteView*
 - Free client from Crossbow
- Server Tier = *XServe* and *XOtap*
 - Run on a PC or Stargate
- Mote Tier = *XMesh*
 - Required to form a reliable communication base

MoteView Overview

- Mote Layer
 - Programmed with *XMesh* and *TinyOS*
- Server Layer
 - Provides data logging and database services
- Client Layer
 - Provides visualization, monitoring, and analysis tools to display and interpret sensor data

Framework for Deploying a Sensor Network System

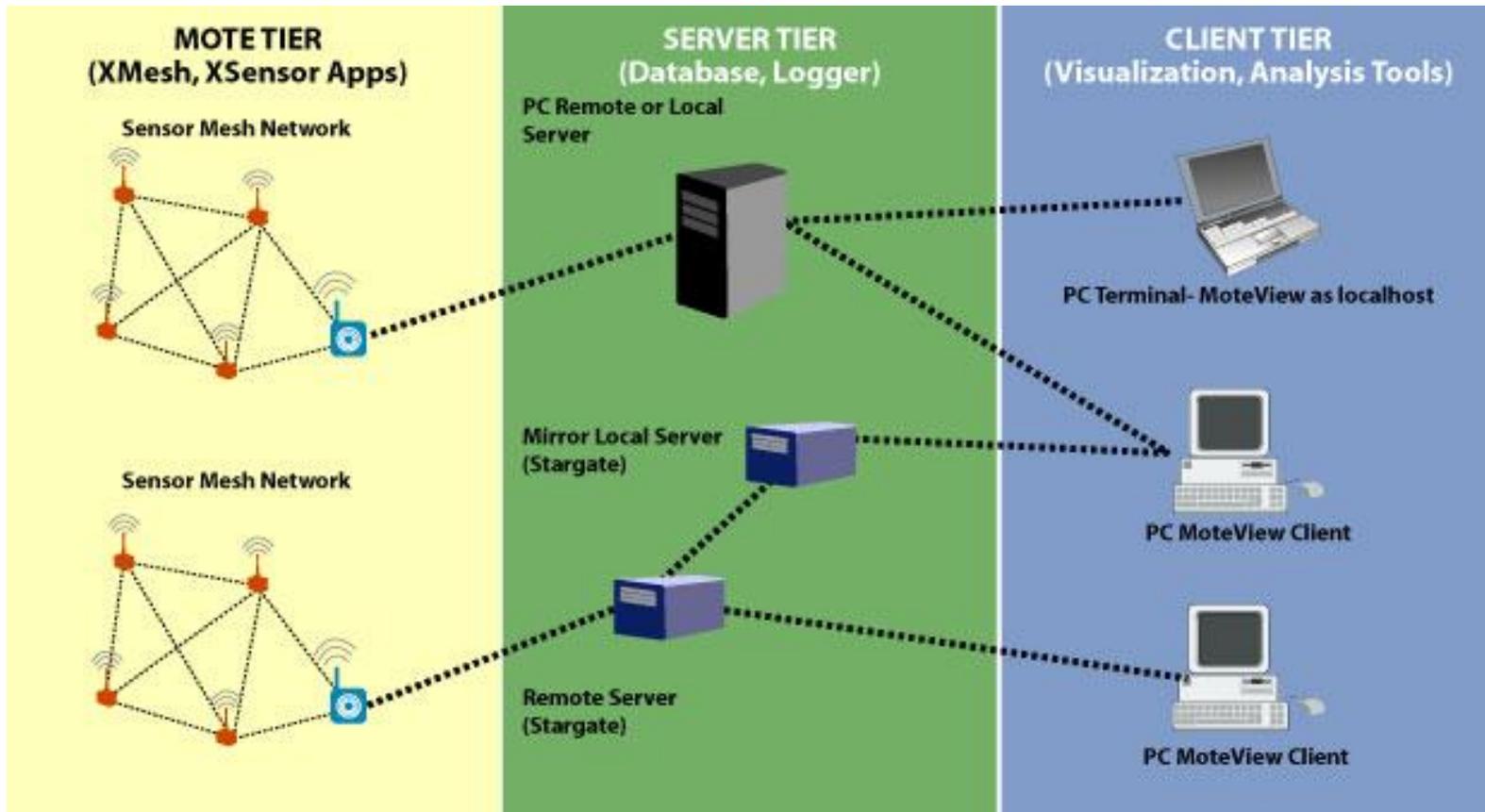


Image Source: Crossbow: MoteView User's Manual

Node List

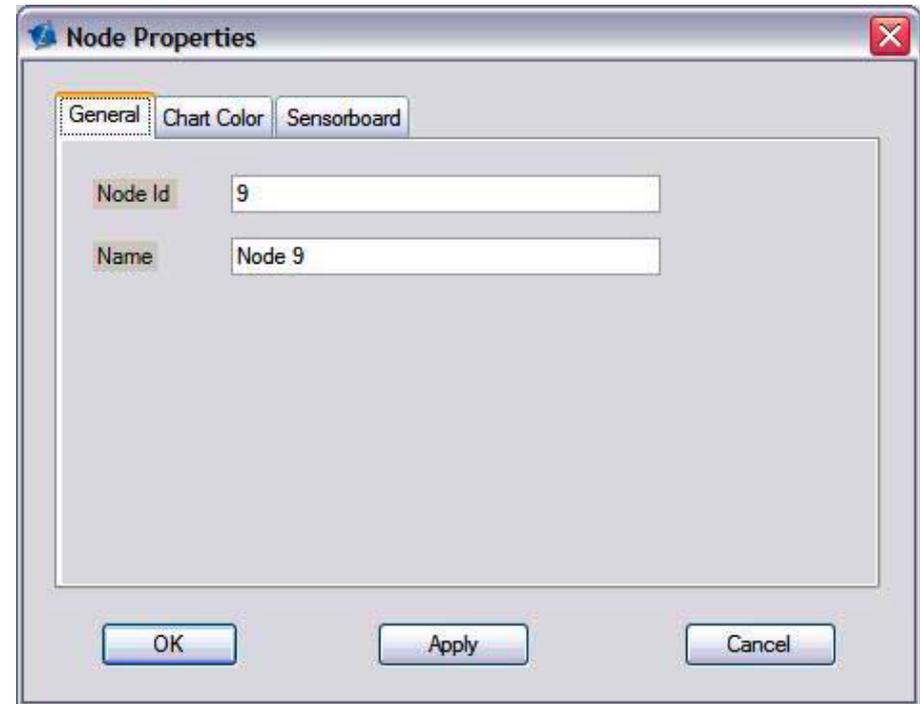
By Nancy White

About the Node List

- The node list displays all the nodes being used and allows the user to change the visualization settings.
- The nodes information can be displayed in various forms such as charts/histograms/scatter plots.

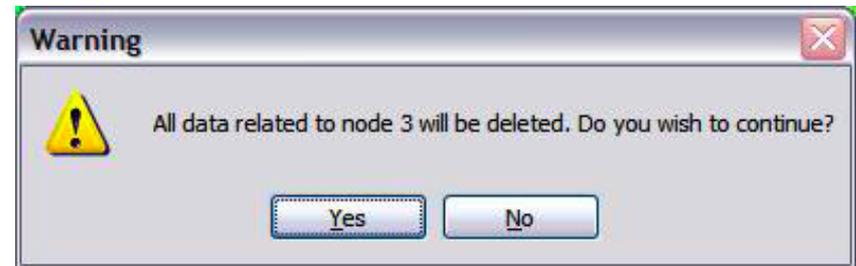
Add a Node

- To add a node the user must right click on the node list and select add node.
- The mote properties dialog box where you can create a unique node ID and name the node.



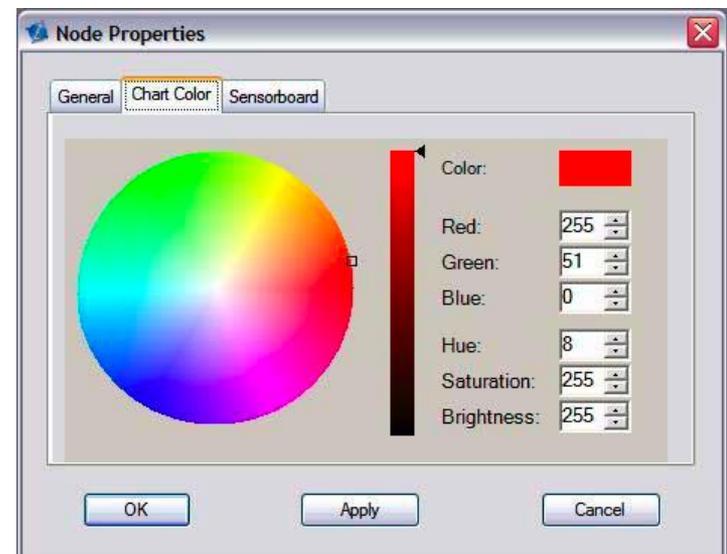
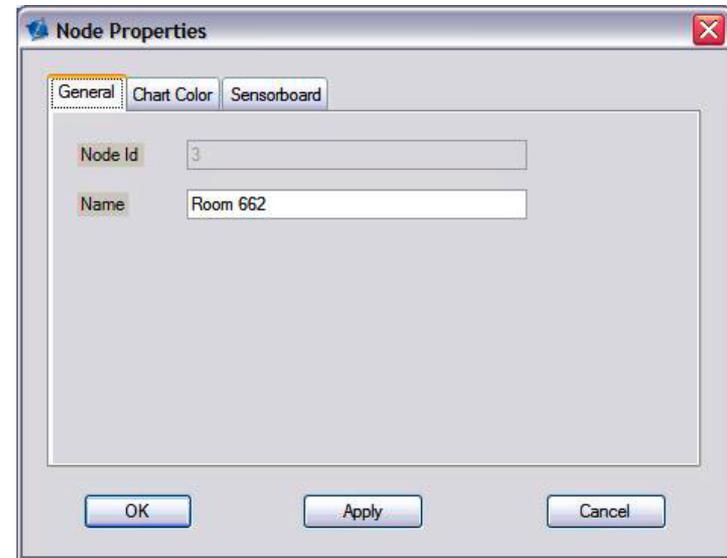
Delete a Node

- To delete a node the user must highlight the node they wish to delete and right click and select delete node.
- When a node is deleted it permanently deletes that node and all associated information to that node.



Node Properties

- The properties box allows the user to name the mote, and on the color tab the user can select different colors for charting the mote.

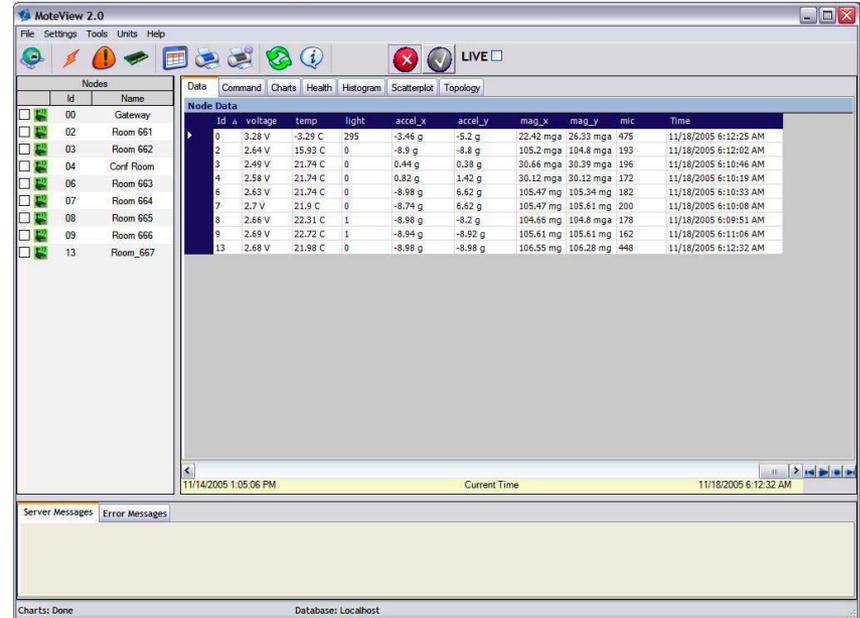


Visualization

- There are 7 different tabs for visualization including; data, command, charts, health, histogram, scatter plots, and topology which provide different ways to view the data.

Data Tab

- The data tab displays sensor readings that are received from the nodes in the connected network.
- There are columns that display information including; nodeID, server timestamp and sensor values from the sensor board firmware packet



The screenshot shows the MoteView 2.0 application window. The 'Data' tab is active, displaying a table of sensor readings for various nodes. The table has columns for Id, voltage, temp, light, accel_x, accel_y, mag_x, mag_y, mic, and Time. The data is organized into a table with 13 rows of sensor readings.

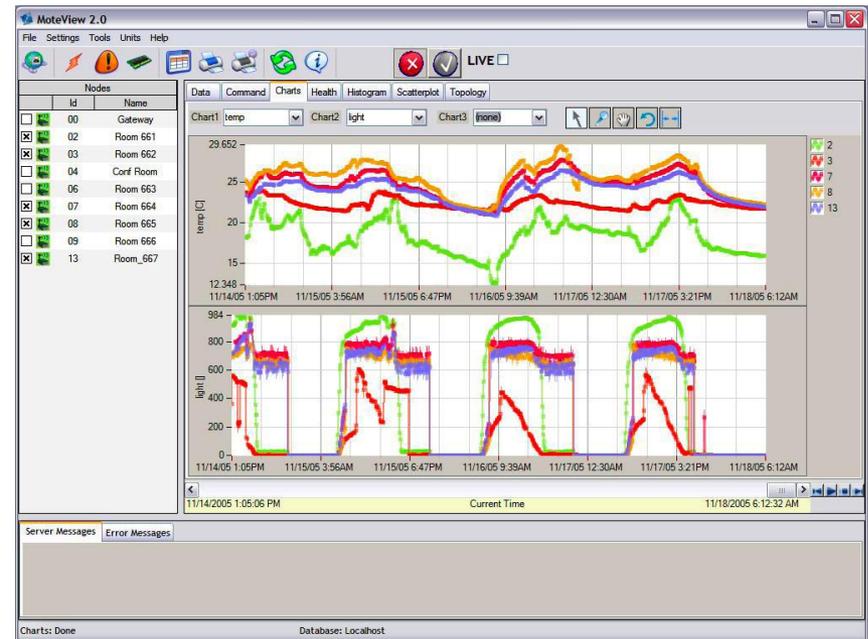
Id	voltage	temp	light	accel_x	accel_y	mag_x	mag_y	mic	Time
0	3.28 V	-3.29 C	295	-3.46 g	-5.2 g	22.42 mga	26.33 mga	475	11/18/2005 6:12:25 AM
2	2.64 V	15.93 C	0	-8.9 g	-8.8 g	105.2 mga	104.8 mga	193	11/18/2005 6:12:02 AM
3	2.49 V	21.74 C	0	0.44 g	0.38 g	30.66 mga	30.39 mga	196	11/18/2005 6:10:46 AM
4	2.58 V	21.74 C	0	0.82 g	1.42 g	30.12 mga	30.12 mga	172	11/18/2005 6:10:19 AM
6	2.63 V	21.74 C	0	-8.98 g	6.62 g	105.47 mg	105.24 mg	182	11/18/2005 6:10:33 AM
7	2.7 V	21.9 C	0	-8.74 g	6.62 g	105.47 mg	105.61 mg	200	11/18/2005 6:10:08 AM
8	2.66 V	22.31 C	1	-8.58 g	-8.2 g	104.66 mg	104.8 mg	178	11/18/2005 6:09:51 AM
9	2.69 V	22.72 C	1	-8.94 g	-8.92 g	105.61 mg	105.61 mg	162	11/18/2005 6:11:06 AM
13	2.68 V	21.98 C	0	-8.98 g	-8.98 g	106.55 mg	106.28 mg	448	11/18/2005 6:12:32 AM

Command Tab

- The command tab allows the user to change the nodes parameters wirelessly.
- The command tab can also change the LED light on the sensor to either Red, Yellow, or Green

Chart Tab

- The chart tab lets the user create graphs from the information it receives from the nodes.
- Up to 3 sensor types can be selected for plotting; therefore creating 3 different graphs.
- The x-axis on the graph displays date and time, while the y-axis shows the data collected in engineering units.

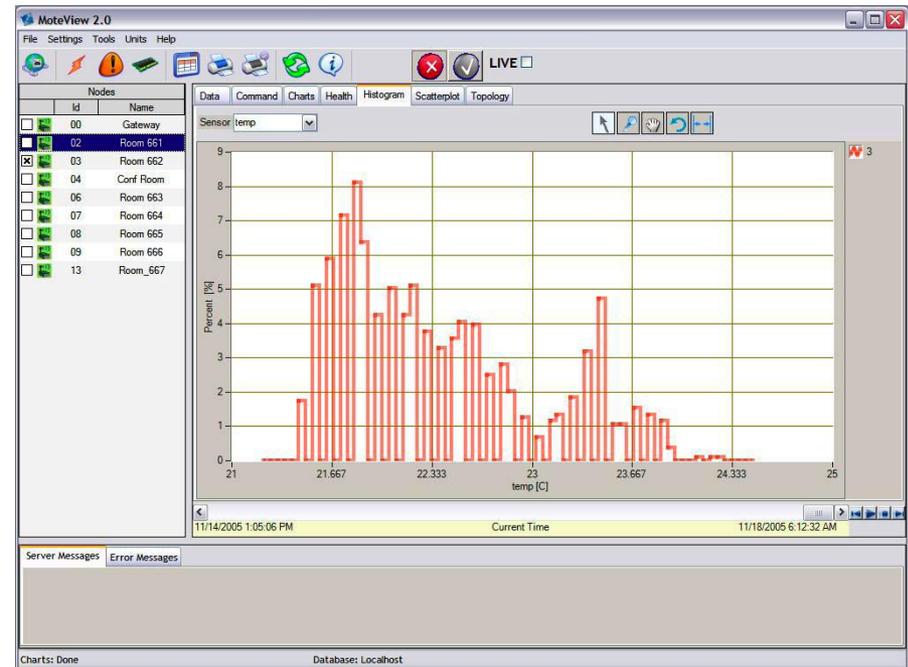


Health

- The *XMesh* application generate health packets on regular intervals, health packet encapsulate the state of the wireless mesh over time.
- The health tab displays the latest health packet reading that has been received from each node

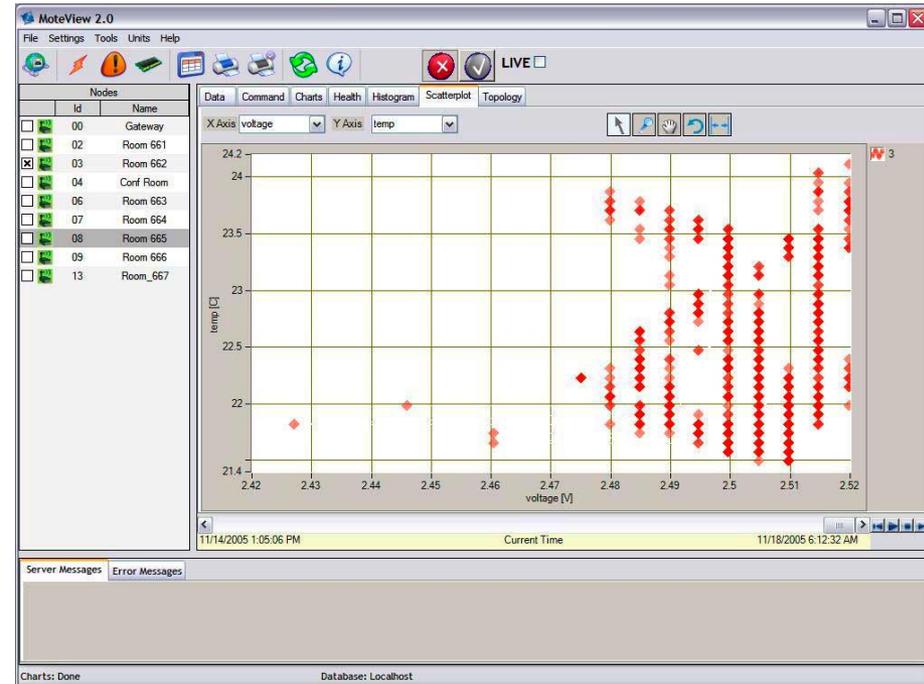
Histogram Tab

- The histogram tab displays a bar chart that summarizes the distribution of a single sensors data.
- The x-axis shows the data in engineering units and the y-axis shows % fro the instances for each sensors values.



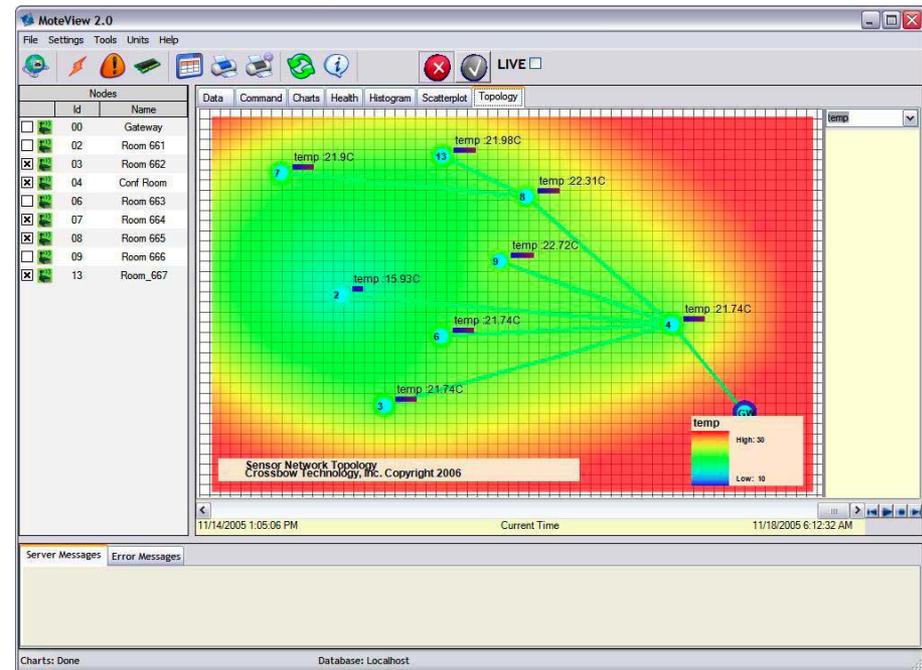
Scatterplot Tab

- The Scatter plot tab has the ability to plot 2 sensors reading against each other for a set of nodes.
- The scatter plot is a visual comparison of each sensors data fields and help to determine what kind of relationship exists between them.



Topology Tab

- The topology tab shows a mote network map with placement and parenting information, which allows users to view the topology of the modes in the network.



MoteView

Section 6
Chloe Norris

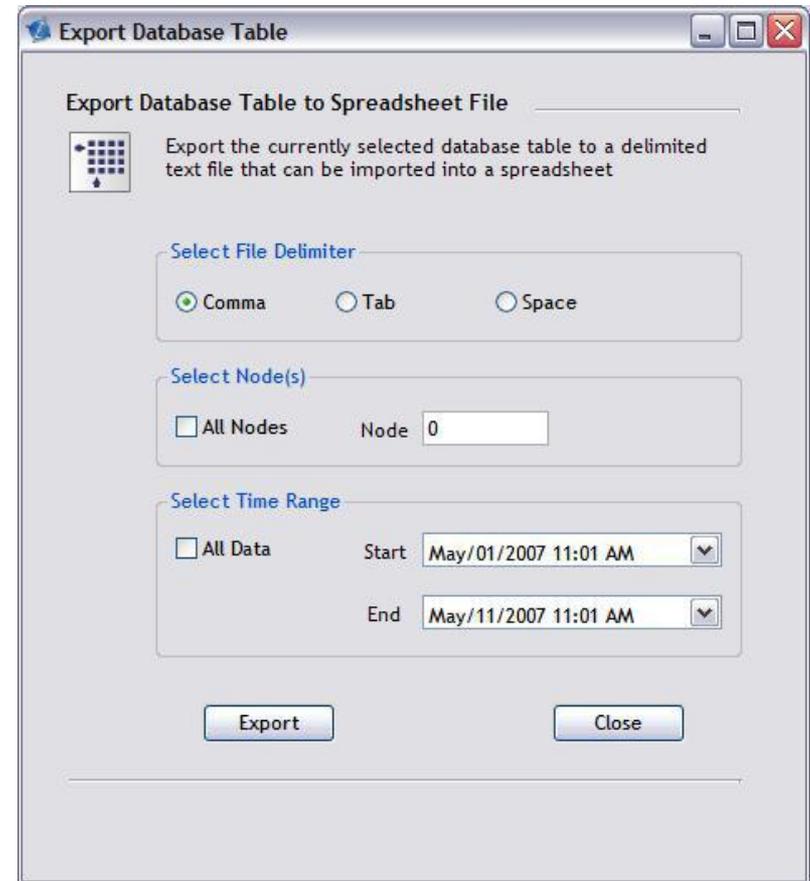
Section 6



- Details, functions, and how to use the toolbars and menus
- toolbar provides buttons for:
 - Connect to WSN wizard,
 - Program Mote
 - *Alerts Manager*
 - *MDA configuration*
 - *Export to Spreadsheet*
 - *Print, Print Preview*
 - *Refresh View*
 - *MoteView Help*
 - *Stop XServe, Start XServe*
 - *Checkbox for displaying Live (vs. historical) sensor network data*

File Tab

- Connect to the WSN
 - via the WSN wizard
- Import or export data
- print preview, print
- Exit functions

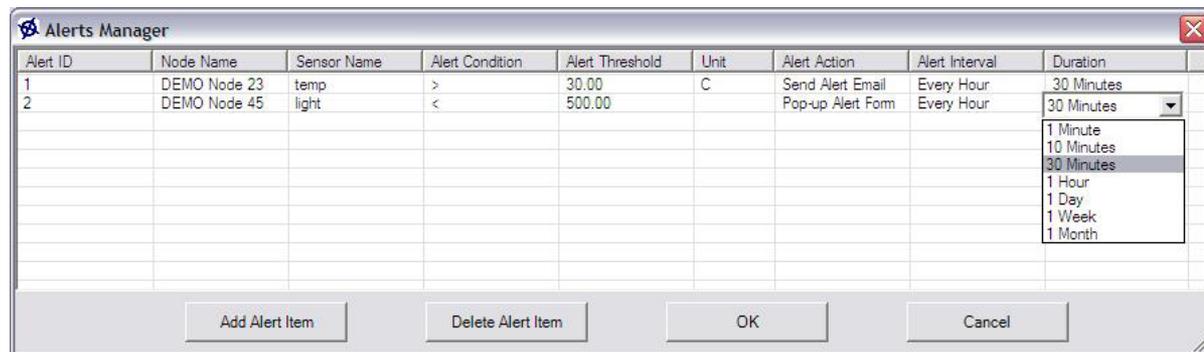


Settings Tab

- **General settings**
 - Server heartbeat, toolbar style, and playback settings
- **Node option**
 - Health status, and the properties of a selected node

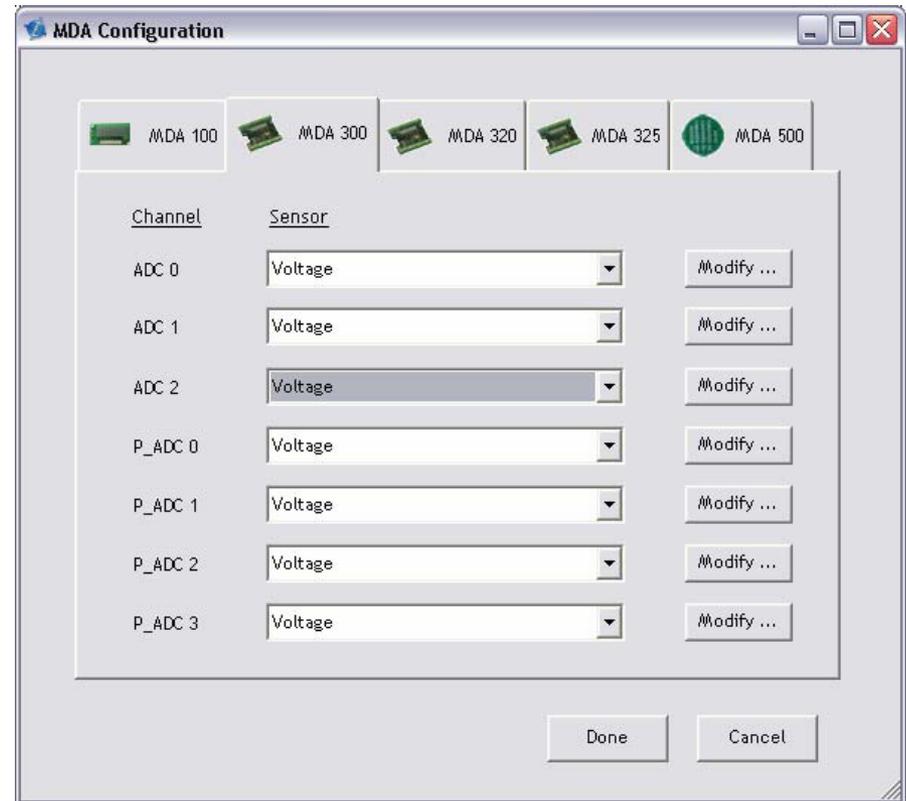
Tools Tab

- Refresh view option
 - Force a visual refresh of all visualization in software
- Add node option
- Program Mote option
- Alerts option
 - Alert conditions



MDA support (via tool tab)

- Calibration parameters
 - Convert from raw voltage into engineering units
- Define custom external sensors, conversions, and associate them with channels on a data acquisition board



Reset database option (via tool tab)

- Deletes all of the data from the local database
- reinitializes it
- not supported for remote databases

Units Tab

- User can select preferred engineering units for a given class of sensor
- Sensors will convert to the units specified by the user

Help Tab

- Users Manual
- Support option
- About option
 - displays a splash screen containing *MoteView version information*

Messages, Administration, Packets

By Catherine Greene

Server Messages

- Server Messages pane is the bottom of the MoteView window
 - displays server side messages, error messages, and general status messages as MoteView is running



```
Server Messages | Error Messages
Starting xserve:
xserve -s=COM1 -b=57600 -l -xmlfile=XmlStream.xml -xmlp -xmlport=9005

XSERVE 2.0.E: $Id: xserve.c,v 1.8.2.3 2007/02/02 17:45:01 rkapur Exp $
Warning: Converting Windows COM1 device to Cygwin device.
Using params: [db parsed] [xml parsed] [server port=9001]
Opening serial device: /dev/ttyS0 @ 57600

Charts: Done           Database: Localhost           MIB510:COM1
```

Error & Status Messages

- The Error Messages tab displays exceptions/errors reported by MoteView software
- The Status bar at the bottom displays chart query status, current database and gateway settings in a plain view
 - Left hand side: it displays the Charts query (Loading... or Done)
 - Center: it displays the Database and table name
 - Right hand side: it displays the gateway type and port settings

Server Administration

- XServe is a powerful packet parsing and data logging server preinstalled by MoteView. A user may run XServe from a Cygwin shell
 - included with the MoteWorks CD
 - Using the command line interface for XServe you must have the Cygwin shell installed on your PC. Instructions for installing Cygwin from MoteWorks InstallShield Wizard are detailed in the MoteWorks Getting Started Guide

Command Line Options

- `-?` = display help [help]
- `-r` = raw display of tos packets [raw]
- `-a` = ascii display of tos packets [ascii]
- `-p` = parsed display of tos packets [parsed]
- `-c` = converted display of tos packets [converted]
- `-xr` = raw tos packets exported to file [export raw]
- `-xp` = parsed tos packets exported to file [export parsed]
- `-xc` = converted tos packets exported to file [export converted]
- `-db` = parsed tos packets exported to db [database parsed]
- `-dbserver` = database server name (default=localhost)

More Command Line Options

- -dbport = database server port number (default=5432)
- -dbname = database name (default=MoteView db)
- -dbuser = database user (default=MoteView user)
- -dbpasswd = database user password (default=MoteView user password)
- -l = parsed tos packets exported to db
- -xmlr = raw tos packets exported to xml [xml raw]
- -xmlp = parsed tos packets exported to xml [xml parsed]
- -xmlc = converted tos packets exported to xml [xml converted]
- -xmlfile = file name to store exported xml (default=screen)
- -xmlport = port number to start the xml server

More Command Line Options

- -v = show version of all modules
- -h = display data through web server
- -m = export data using modbus
- -port = set server port <default = 9001>
- -sf = connect to unframed serial forwarder
- -fsf = connect to framed serial forwarder
- -device = connect to serial device <default = /dev/ttyS0>
- -baud = set serial baud rate <default = 57600>
- -platform = set platform. <default = mica2>
values=mica2dot|mica2|mica|telos|micaz
- -debug = set debug level. <default = DBG_WARNING>
- -alert = alert when data values are above/below specified

Database Administration

- PostgreSQL
 - An advanced relational database system included in the MoteView installer
 - The database tables that MoteView accesses can be manipulated directly by advanced users
 - Access the PostgreSQL database, from a Cygwin shell type “psql -h localhost -U tele task”
 - You can also use the psql command line interface in the Windows Command window from the C:\Program Files\PostgreSQL\8.0.0-rc1\bin folder

Database Administration

- SQL
 - SQL is the generic command language used to manipulate databases such as PostgreSQL. SQL commands can be typed in directly from the PostgreSQL command shell.
 - Some useful commands:
 - Display all readings: `select * from <tablename>;`
 - Display subset of readings: `select field, field,... from <tablename> where fieldn condition value;`
 - Delete all readings from a table: `DELETE FROM <tablename>;`
 - Deleting specific readings from table: `DELETE FROM <tablename> WHERE result_time < '2004-11-20';`
 - Delete table entirely: `Type: DROP TABLE <tablename>;`

Health Packets

- Pre-compiled XMesh applications included with MoteView generate health packets at regular intervals
 - encapsulate the state of the wireless mesh over time
- The Health tab displays the latest health packet readings received for each node in the network
- Each Mote also transmits a neighbor health packet.
- The latter is logged to the postgresSQL database but is not currently displayed by MoteView.