

# Introduction to the MindSet Development Tools

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June 28, 2009



The NeuroSky product families consist of hardware and software components for simple integration of this biosensor technology into consumer and industrial end-applications. All products are designed and manufactured to meet exacting consumer specifications for quality, pricing, and feature sets. NeuroSky sets itself apart by providing building-block component solutions that offer friendly synergies with related and complementary technological solutions.

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# Contents

<b>Overview</b>	<b>4</b>
<b>ThinkGear</b>	<b>5</b>
ThinkGear Connector (TGC) . . . . .	5
ThinkGear Communications Driver (TGCD) . . . . .	5
ThinkGear Communications Driver for J2ME (TGCD-J2ME) . . . . .	6
ThinkGear Stream Parser . . . . .	6
The Lowest Level . . . . .	6
<b>MDT Contents Listing</b>	<b>7</b>

# Overview

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The NeuroSky MindSet Development Tools (MDT) provides all the tools and resources necessary to create and publish games and applications capable of taking advantage of the exciting new Brain-Computer Interface (BCI) technology of NeuroSky's MindSet headset. The MDT includes drivers, sample code, and documentation describing how to develop applications for several software platforms, including PC, Symbian, and even lower level platforms such as microcontrollers like the Arduino™.

Languages directly supported include C/C++, C#, Java (through JNI), and J2ME. In addition, the MDT provides the ThinkGear Connector (TGC), a daemon-like software that runs on Windows or Mac OS X, and opens a TCP port on the user's local computer so that applications can connect to it and retrieve MindSet data. As long as the TGC is running on one of the supported platforms and connected to a MindSet, then any application written in any language that can communicate through TCP sockets (such as Flash's ActionScript3 and scripting languages in general) can connect to the TGC to read data from the MindSet.

Create exciting new games that challenge people to use the power of their mind or retrofit your existing games with a new dimension of brainwave control.

This document gives an overview of what is included in the MDT, and the platforms and languages that are supported.

# ThinkGear

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ThinkGear is the technology inside every NeuroSky product (including the MindSet), or partner product, that enables a device to interface with the wearer's brainwaves. It includes the sensor that touches the forehead, the contact and reference points located on the ear pad and the onboard chip that processes all of the data. Both the raw brainwaves and the eSense Meters (Attention and Meditation) are calculated on the ThinkGear chip.

It is with the ThinkGear technology within the MindSet that the development tools, drivers, and APIs provided in the MDT interact with.

## ThinkGear Connector (TGC)

The ThinkGear Connector (TGC) is an executable that provides a daemon-like service that manages communications with ThinkGear devices, such as the MindSet, that are connected to the computer. The TGC runs continuously in the background, and keeps an open socket on the local user's computer, allowing applications to connect to it and receive information from the connected ThinkGear devices. This means that any application in any language that can open and read from sockets (such as Flash's ActionScript3, and other scripting languages) can connect to and receive data from MindSet headsets.

The TGC is provided as an executable for the following platforms:

- Windows
- Mac OS X

The TGC, along with usage documentation and its communication protocol specification, is included as part of the MDT.

## ThinkGear Communications Driver (TGCD)

The ThinkGear Communications Driver (TGCD) is a lower-level device driver with a simple API that allows communication between an Application on a PC (or mobile device) and a ThinkGear chip/module/headset. It is available as a .dll (for x86 or ARMV4I platforms) or as a .bundle (for Mac OS X platforms).

The following languages are supported for the TGCD on the following platforms:

Language	Platform(s)	Notes
C/C++	Win32, Windows Mobile, Mac OSX	Call functions directly in the .dll or .bundle
C#	Win32, Windows Mobile	Thin C# wrapper over C/C++ interface
Java (JNI)	Win32	Thin JNI wrapper over C/C++ interface

Applications and platforms not listed above are not currently supported, but in theory, any application on any platform that can access the functions in a shared library (.dll, .bundle) could use the TGCD to communicate with MindSet headsets.

The API itself is very completely documented with parameters, return values, and detailed explanations of error codes and conditions. It is also intentionally designed to use only very basic data types (all functions take and return ints, with the exception of one function that takes a C-string, and one that returns a float), so that marshalling data types to other languages is as easy as possible. In addition, the source code for an example C program, along with a tutorial guide for using the DLL and API with Visual Studio are provided with the TGCD as part of the MDT.

## ThinkGear Communications Driver for J2ME (TGCD-J2ME)

For platforms like Symbian that cannot use the TGCD (cannot use a .dll or a .bundle), but that do support J2ME, the MDT provides a Java J2ME library for performing similar functions as the TGCD, such as connecting to a headset and reading the data.

## ThinkGear Stream Parser

For platforms where the above interfaces are not suitable, but where it is still possible to open a serial I/O stream through the platform's Bluetooth interface, the MDT provides a parsing library (as ANSI C source code) for parsing the raw byte stream from MindSet headsets. The parsing library's source code is written in vanilla ANSI C and heavily documented, making it possible for virtually any platform, all the way down to microprocessors, to be able to communicate with, and get information from, any MindSet headset. Being clean ANSI C, it is also relatively easy to port the parsing code to any other programming language that may be of interest to your project. All your application has to do is figure out how to use the serial I/O and Bluetooth API's on your platform to open and read the byte streams from the MindSet.

## The Lowest Level

At the lowest level, the MDT includes comprehensive documentation and specifications of the raw byte stream output by the MindSet itself. The MindSet sends out its raw byte stream through standard a Bluetooth Serial Port Profile (SPP), which can be opened and read on any platform in any language that can interface with that standard. All the interfaces provided in the MDT and described in the sections above were all implemented according to these specification documents.

# MDT Contents Listing

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- MDT Development Guide (pdf)
- Development Files and Documentation for:
  - Win32 (WinXP/Vista)
    - \* C/C++: .h, .lib, .dll
      - Includes API documentation in html (doxygen) format
      - Includes thinkgear\_testapp.c example
      - Includes Visual Studio 2005 guide
    - \* C#: .cs, .dll
    - \* Java (through JNI): .java, .dll
      - Includes API documentation in html (javadoc) format
  - WinMobile
    - \* C/C++: .h, .lib, .dll
    - \* C#: .cs, .dll
  - MacOSX
    - \* Documented in MDT Development Guide
  - J2ME (Symbian)
    - \* com.NeuroSky.ThinkGear.IO package libraries
    - \* com.NeuroSky.ThinkGear.Util package libraries
    - \* com.NeuroSky.Util package libraries
    - \* Includes API documentation in (html) javadoc format
  - any-platform:
    - \* C/C++: ThinkGearStreamParser header (.h) and source (.c) files
  - ThinkGear-EM API and Reference Manual
    - \* ThinkGear Data Values meanings, formats, and interpretations
    - \* ThinkGear Packet format spec, guide, and reference tables
    - \* ThinkGear Commands API and reference tables
    - \* Copy of ThinkGear-EM Connection DLL's API