

The TinyNode Platform for Wireless Sensor Networks

February 2006 – Roger Meier



Agenda

- Shockfish SA
- Spotme™
- TinyNode Hardware and TinyOS Support
- TinyNode Kits, Products and Projects

Shockfish SA

- Founded in **1998**
by Bänz Ledin, Rémy Blank and Roger Meier
- Spin-off of the Swiss Federal Institute of Technology
- **10 Employees**
- Products & Services:
 - › **Spotme (since 2001)**
 - › **Wireless Sensor Networks (since 2004)**



spotme



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Instant Knowledge in Your Hand

Messaging,
News

Up-to-the-minute
Delegate Photos & Data

Event Schedule,
Personal Agenda

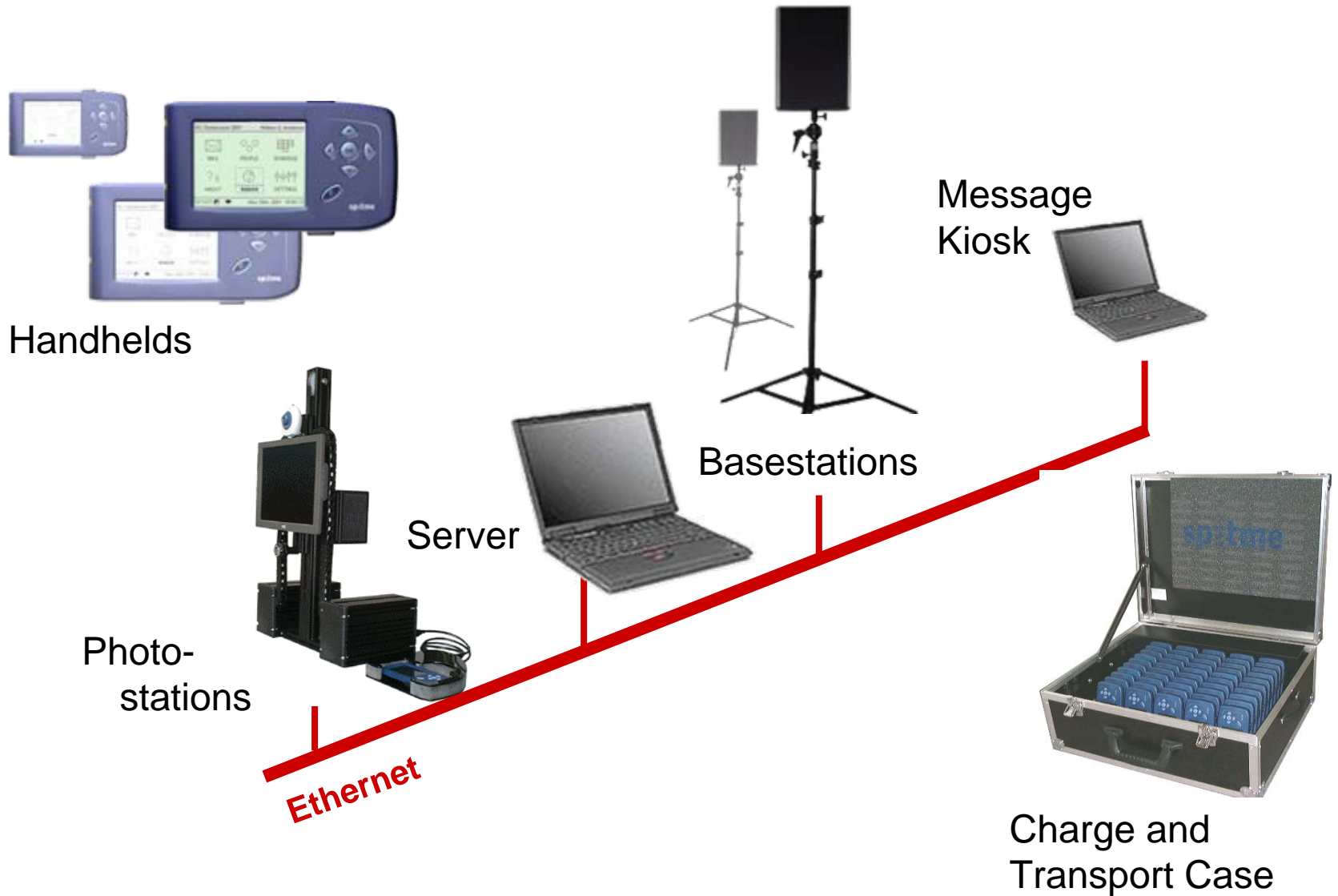


Personal Contacts,
Business Card Exchange

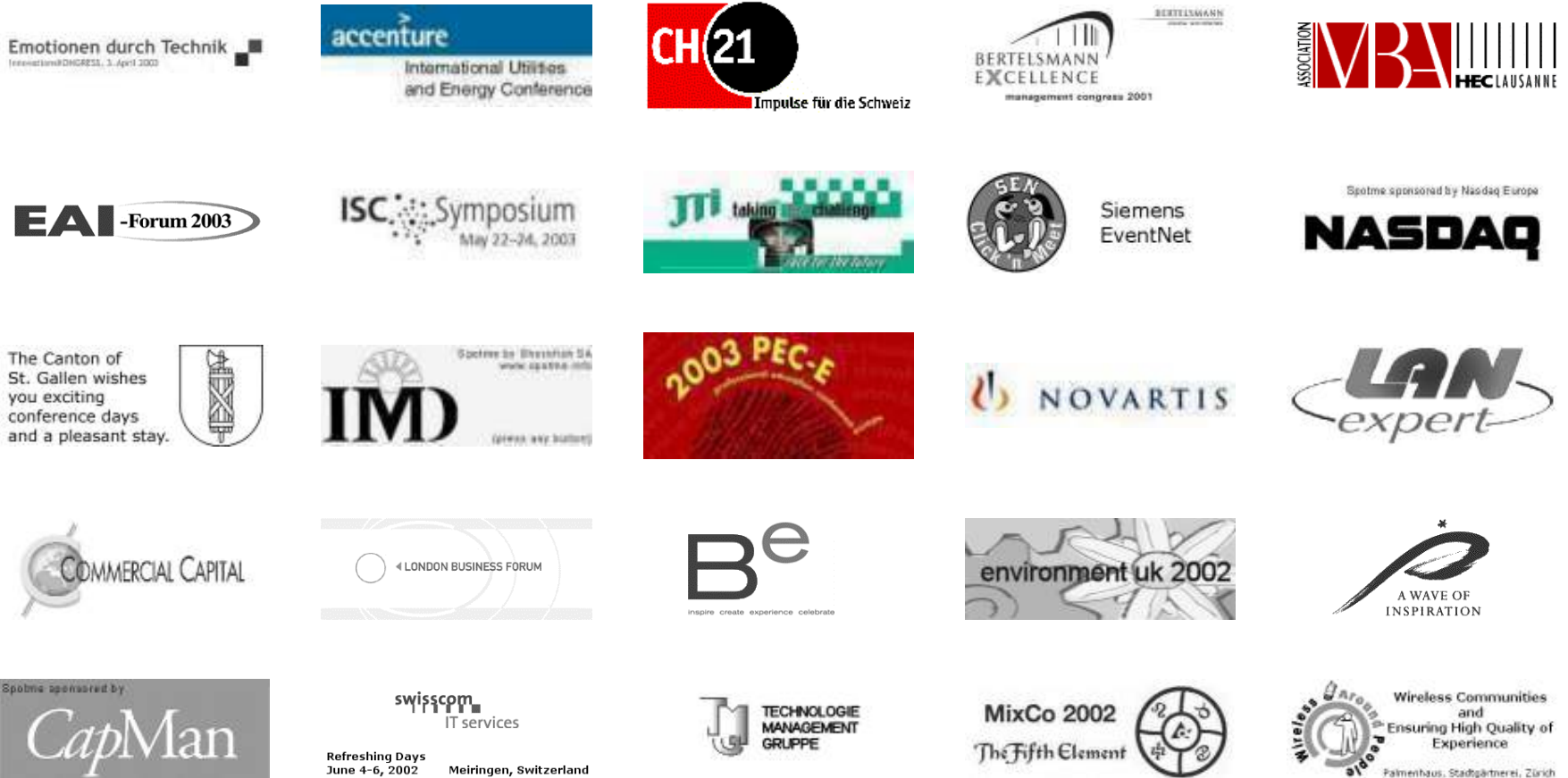
People Spotting,
Radar

Interactive Voting
On-line Surveys

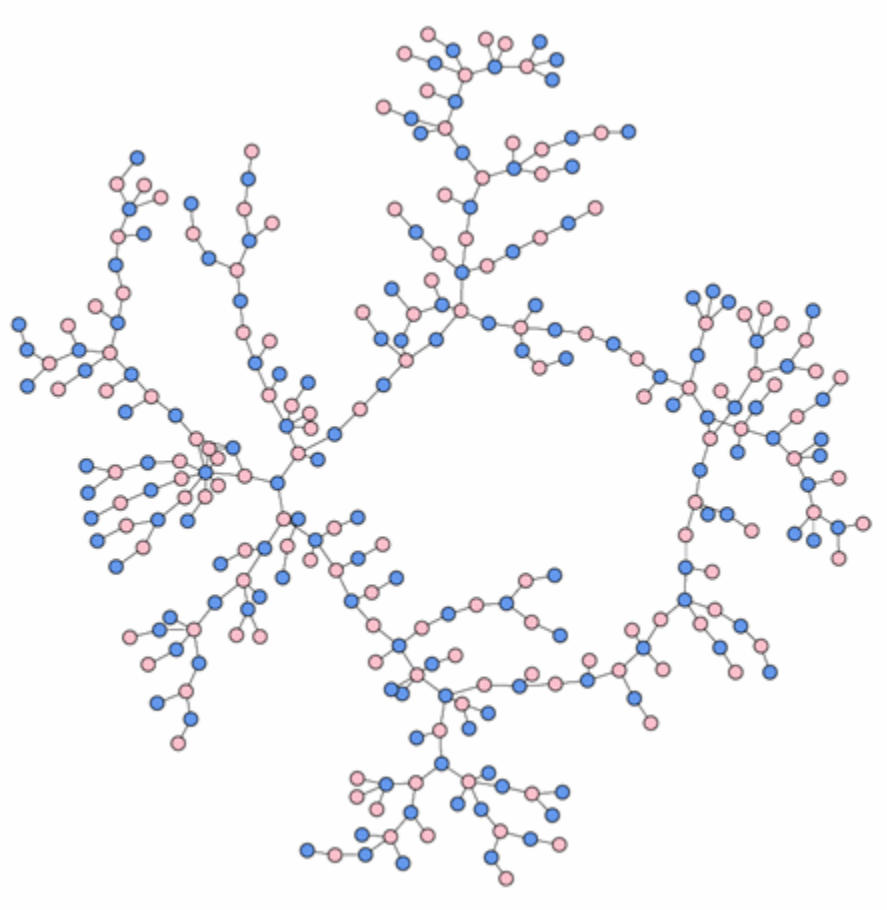
Spotme System - Wireless Communication amongst 1500 devices



Over 100 Satisfied Customers

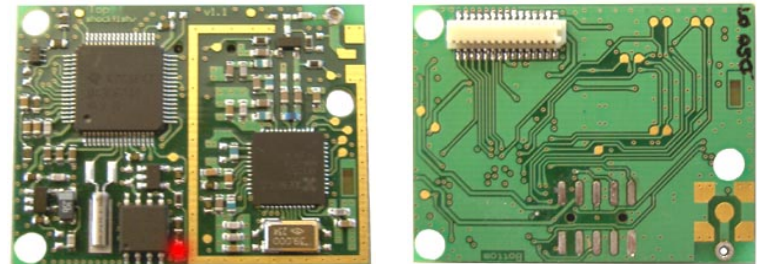


TinyNode Platform



TinyNode Design Criterias

- Modular and flexible design for doing industrial pilots efficiently
 - › Group components used in all applications (μ C, Radio)
 - › Compact module that can easily be inserted
 - › State-of-the-Art Radio with configurable data rates and bandwidth
 - › Full access to MAC layer for innovative protocols
- Highest autonomy for battery operation
 - › Low sleep current and fast wake-up cycles
 - › Very low duty cycle operation
- Highest possible range in license free frequency bands
- TinyOS compatible
- Tools for development



TinyNode Hardware Components

Extension Board

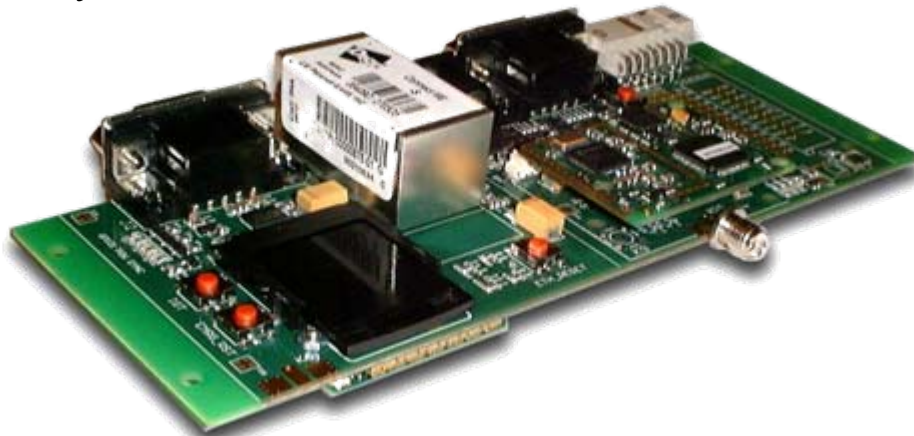
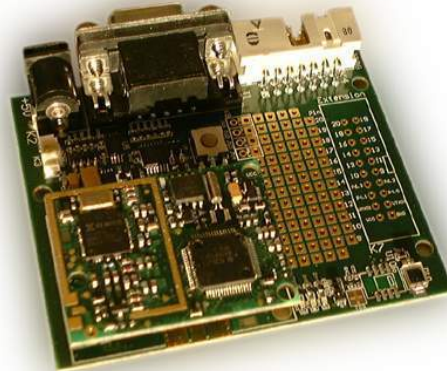
RS-232

JTAG

Light and Humidity
Sensor

Breadboard for
interface electronics

AC or Battery
powered



TinyNode 584

MSP430 μ C

XE1205 Transceiver

4Mbit Extra Flash

Power Management

V_{bat} and T Sensor

40 x 30 mm

Mama Board

Extension Board + ..

..Ethernet module

..GPRS module

..SD memory card up
to 4GB data

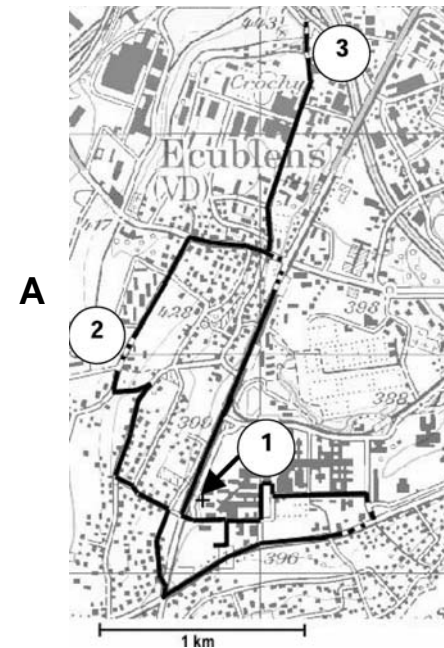
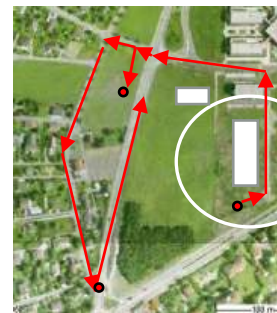
Range vs Datarate Comparision

Platform	Mica2		Telos Sky	Eyes		TinyNode	
Transceiver	CC1000		CC2420	TDA5250		XE1205	
Frequency	869 Mhz		2.4 Ghz	869 Mhz		869 Mhz	
Max. Tx Power	5dBm		0 dBm	9dBm		15dBm	
Data Rate	76.8 kbps	4.8 kbps	250 kbps	64 kbps	4.8 kbps	76.8 kbps	4.8 kbps
Sensitivity	-98 dBm	-104 dBm	-94 dBm	-96 dBm	-110 dBm	-106 dBm	-116 dBm
Link Budget	103 dB	109 dB	94 dB	105 dB	119 dB	121 dB	131 dB
Range Outdoor ¹	160m	300m	80m	200m	600m	600m	1800m

TABLE I

COMPARISON OF RADIO TRANSCEIVER CHARACTERISTICS.

- LOS Range, Outdoor with 1/4 wave monopole antennas
- Measured with TinyOS

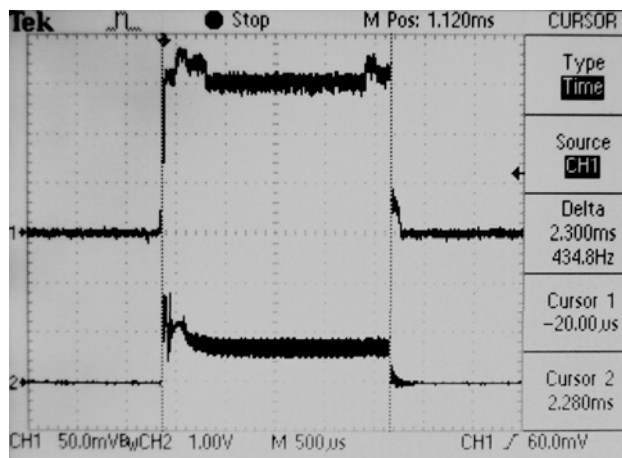


Power Consumption Comparision

	Mica2	Telos Sky	Eyes	TinyNode	
Min Voltage	2.7	1.8	2.1	2.4	V
Max Voltage	3.3	3.6	3.6	3.6	V
MCU sleep with RTC on (LPM3)	19	5.1	5.1	5.1	μA
MCU active	8	1.8	1.8	1.8	mA
MCU active, Radio RX	15.1	21.8	10.8	15.8	mA
MCU active, Radio TX at +0dBm (1mW)	25.4	19.5	13.7	25	mA
MCU active, Flash Read	9.4	4.1	5	5	mA
MCU active, Flash Write	21.6	15.1	16	16	mA
MCU wake-up latency	180	6	6	6	μs
Radio wake-up latency	1800	580	2200	1500	μs

TABLE II

CURRENT CONSUMPTION AND WAKE-UP TIMES.

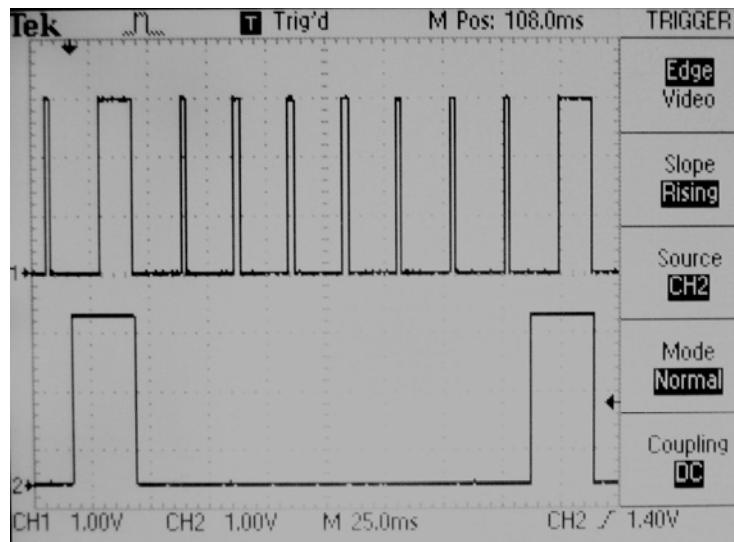


Average LPL Current Consumption

	Mica2 at 1%	TinyNode at 1%	TinyNode at 0.2%
Bit Rate	19.2 kbps	152 kbps	152kbps
Listen Time	8 ms	1.9 ms	1.9
Listen Period (Max. Latency)	1085 ms	190 ms	950 ms
Max throughput	0.89 pkts/sec	5.5 pkts/sec	1.05 pkts/sec
Average Power Consumption	509 μ W	489 μ W	104 μ W
Lifetime ² for 2 x AA alkaline cells, 2000mAh	1.3 years	1.4 years	6.6 years

TABLE III

CURRENT CONSUMPTION AND WAKE-UP TIMES.



TinyOS Support for TinyNode

- TinyOS-1.x ported by Henri Dubois-Ferrière, LCAV EPFL
- Hardware files under [tinyos-1.x\contrib\shockfish](#)
- Radio stack under [tinyos-1.x\contrib\epfl\lca](#)
- TinyOS on-line tutorials (Blink, Scope, TOSBase, ScopeRF)
- Berkley (mesh-) protocols
- Deluge 2.0 with up to 8 images
- TinyOS-2.0 port in progress by Henri Dubois-Ferrière

TinyNode Development Kit

- Install CD for Windows
- 3 TinyNodes
- 3 Extension Boards
- 3 Power Supplies
- Battery Case, RS-232 and USB
- 2h of Shockfish Support
- Price: 950 CHF, excl. VAT

