SDSU MASTERS of HOMELAND SECURITY

GEOL600 SENSOR NETWORKS

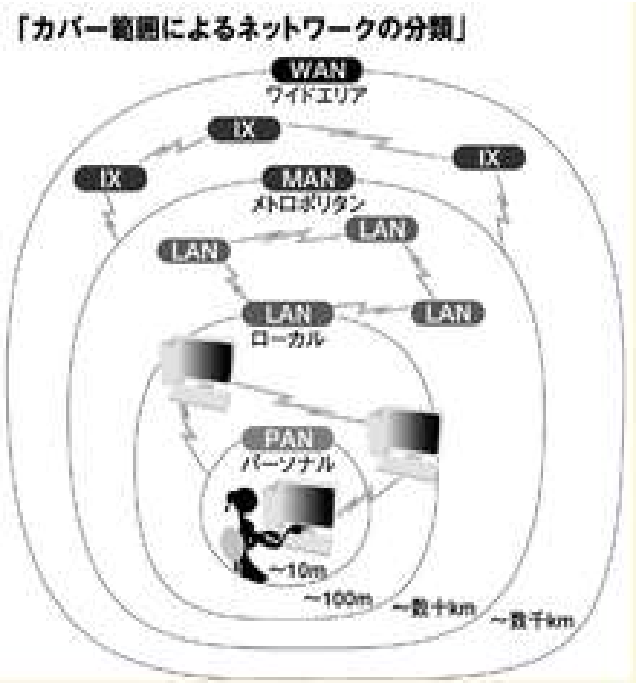
WPAN & WWAN

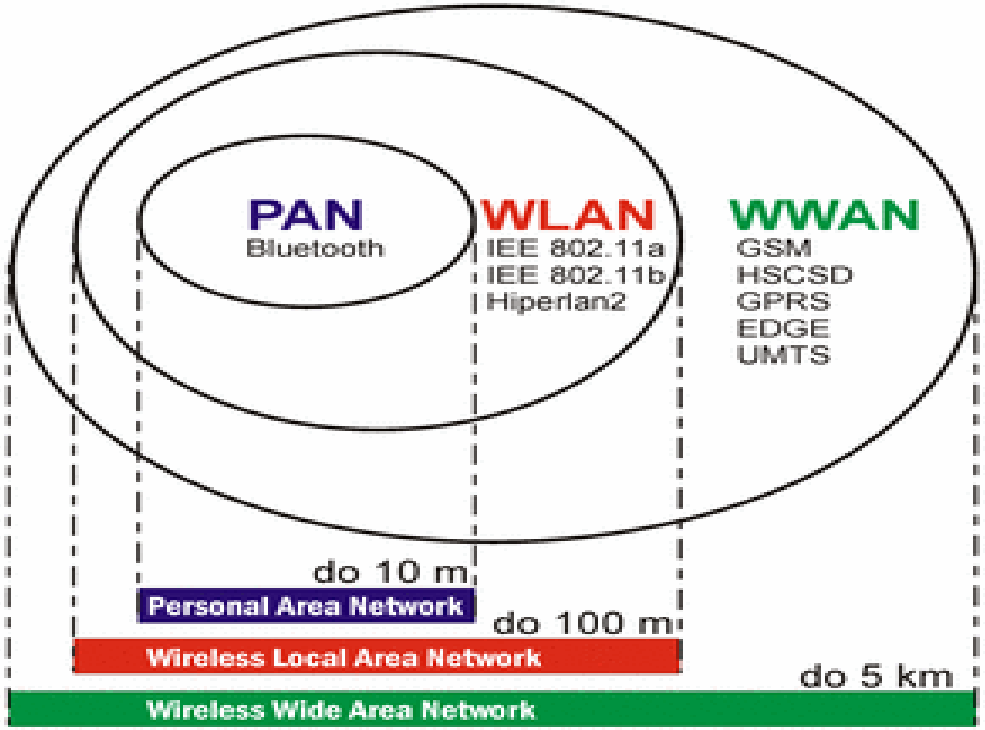
PHY: RF transmission
PAN / WPAN
802.15
802.15.1 Bluetooth
802.15.4 ZigBee
802.16 WiMAX
CELLULARNETWORKS
FDMA TDMA CDMA
0G 1G 2G
2.5G 2.75G
3G
4G
GSM

US Cell Coverage: GSM v CDMA
Cellular data networks
CDPD / GPRS / EDGE / EVDO
EVDO-coverage.com
Dual 3G
Linux EVDO
EVDO stomp box
Vehicle Tracking 1
Vehicle Tracking 2
GPS
GMRS/FRS

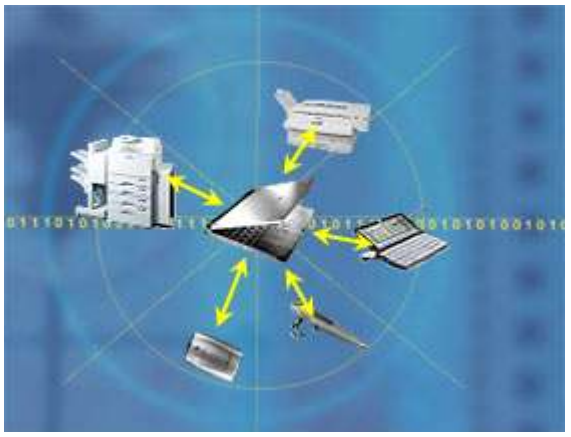
PHYSICAL LINK: RF transmission

LAN / WLAN	802.11 WiFi, HiperLAN
PAN / WPAN	802.15 BLUETOOTH, ZIGBEE
WMAN	802.16 WIMAX
CELLULAR	TDMA CDMA GSM GPRS EDGE 3G UMTS
SATELLITE	GPS





PAN / WPAN



A personal area network (PAN) is a computer network used for communication among computer devices (including telephones and personal digital assistants) close to one person. The devices may or may not belong to the person in question.
The coverage of a PAN is typically a few meters.

PANs can be used for communication among the personal devices themselves (intrapersonal communication), or for connecting to a higher level network/the Internet (uplink).

Personal area networks may be wired with computer buses (USB / Firewire). Wireless PANs can be made using technologies such as IrDA and Bluetooth.

IEEE 802.15 Wireless PAN standards work group.

It includes 4 task groups

Task group 1 (**WPAN/Bluetooth**)
Task group 2 (**Coexistence**) deals with coexistence of WPAN / WLAN (802.11)
Task group 3 (**WPAN High Rate**) & 3a (**WPAN Alternate Higher Rate**), both dealing with high-rate WPAN standards (20 Mbit/s or higher).
Task group 4 (**WPAN Low Rate**) deals with low rate but very long battery life (months or even years)

www.ieee802.org/15/

BLUETOOTH 802.15.1

www.bluetooth.org

wireless radio standard designed for low power consumption, short range (10m) and with a low-cost transceiver microchip in each device.

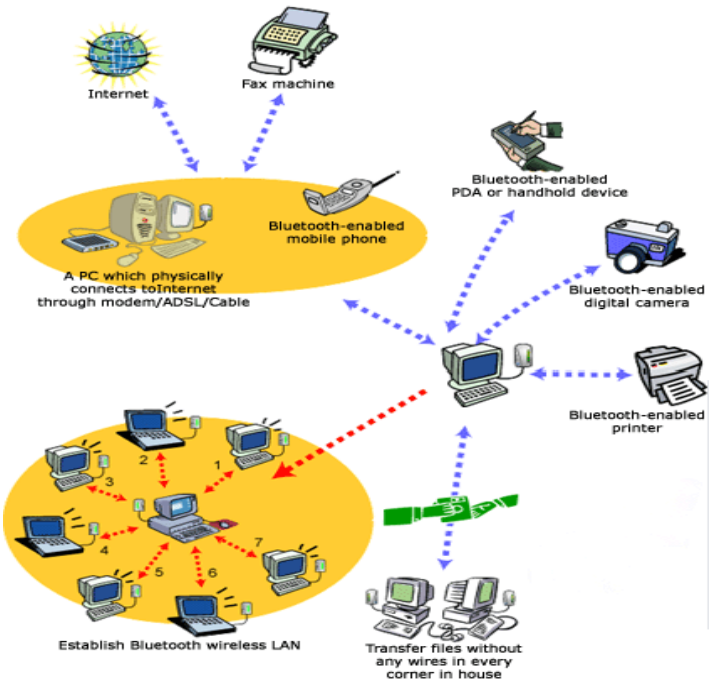
The protocol operates in ISM band at 2.45 GHz.
To avoid interfering with other protocols, Bluetooth divides the band into 79 channels (each 1 MHz wide) and frequency hops up to 1600 times per second.

Implementations with versions 1.1 and 1.2 reach speeds of 723.1 kbit/s.
Version 2.0 implementations feature Bluetooth Enhanced Data Rate (EDR), and thus reach 2.1 Mbit/s.
Technically version 2.0 devices have a higher power consumption, but the three times faster rate reduces the transmission times, effectively reducing consumption to half that of 1.x devices (assuming equal traffic load).

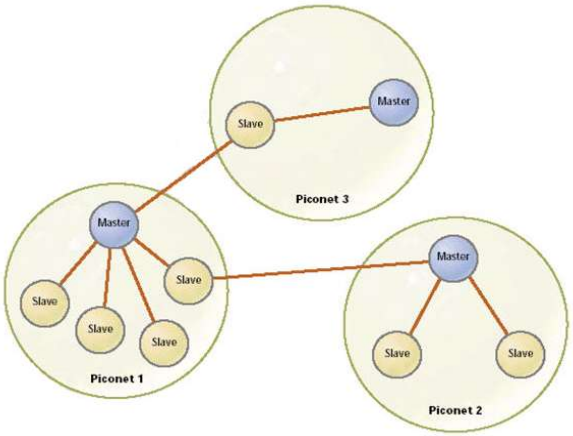
It can be used to wirelessly connect peripherals like printers or keyboards to computers, or to have PDAs communicate with other nearby PDAs or computers.

Cell phones with integrated Bluetooth technology have also been sold in large numbers, and are able to connect to computers, PDAs and handsfree devices.

The standard also includes support for more powerful, longer-range devices suitable for constructing wireless LANs.



Bluetooth PAN (**piconet**,) is composed of up to 8 active devices in a master-slave relationship (up to 255 devices can be connected in 'parked' mode). The first Bluetooth device in the piconet is the master, and all other devices are slaves that communicate with the master.
A piconet typically has a range of 10 meters, although ranges of up to 100 meters can be reached under ideal circumstances.



At any given instant in time, data can be transferred between the master and one slave; but the master switches rapidly from slave to slave in a round-robin fashion. (Simultaneous transmission from the master to multiple slaves is possible, but not used much in practice).

Two or more piconets can be joined together to form a **scatternet**, with some devices acting as a bridge by simultaneously playing the master role in one piconet and the slave role in another piconet. These devices are yet to come.

Any device may perform an "inquiry" to find other devices to which to connect, and any device can be configured to respond to such inquiries.

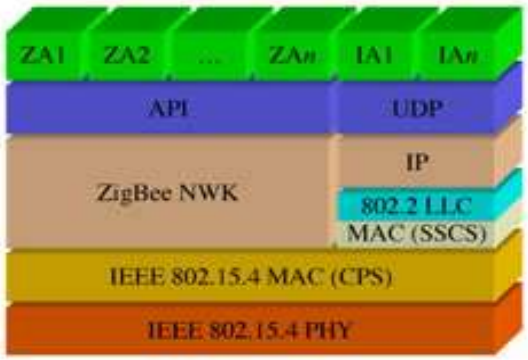
Pairs of devices may establish a trusted relationship by learning (by user input) a shared secret known as a "passkey". A device that wants to communicate only with a trusted device can cryptographically authenticate the identity of the other device. Trusted devices may also encrypt the data that they exchange over the air so that no one can listen in.

Glib summary: Bluetooth is wireless USB (wikipedia,2005)

ZIGBEE 802.15.4

www.zigbee.org

high level communication protocols designed to use small, low power digital radios based on IEEE 802.15.4 WPAN standard, ratified Dec 2004.
Relationship between IEEE 802.15.4 and ZigBee is analogous to that between IEEE 802.11 and Wi-Fi Alliance.



ZigBee has been designed to meet the primary goals of low power and low cost.

Key Features

3 licence free frequency bands :
- 2.4GHz worldwide (250 kbps),
- 868MHz Europe (20 kbps),
- 915MHz US (40 kbps)

multiple channels in 2.4GHz and 915MHz bands
up to 100m range
CSMA-CA channel access
Low power, long battery life
Resistant to interference
255 devices per network
star or peer to peer network
optional guaranteed time slot
compact protocol stack
low latency
good security (encryption and authentication)

Designed to be simpler and cheaper than other WPANs such as Bluetooth. The most capable ZigBee node type is said to require only about 10% of the software of a typical Bluetooth or Wireless Internet node, while the simplest nodes are about 2%.

ZigBee Uses

ZigBee is aimed at applications with low data rates and low power consumption. The network is designed to use very small amounts of power, so that individual devices might run for a year or two with a single alkaline battery.

ZigBee's current focus is to define a:

general-purpose,
inexpensive
self-organizing
mesh network

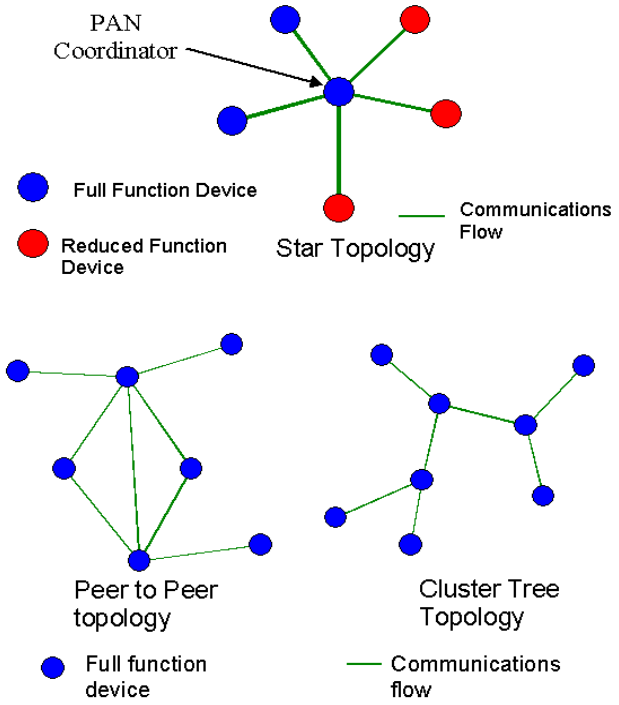
that can be shared by:
industrial controls, medical devices, smoke and intruder alarms, building-automation and home automation.

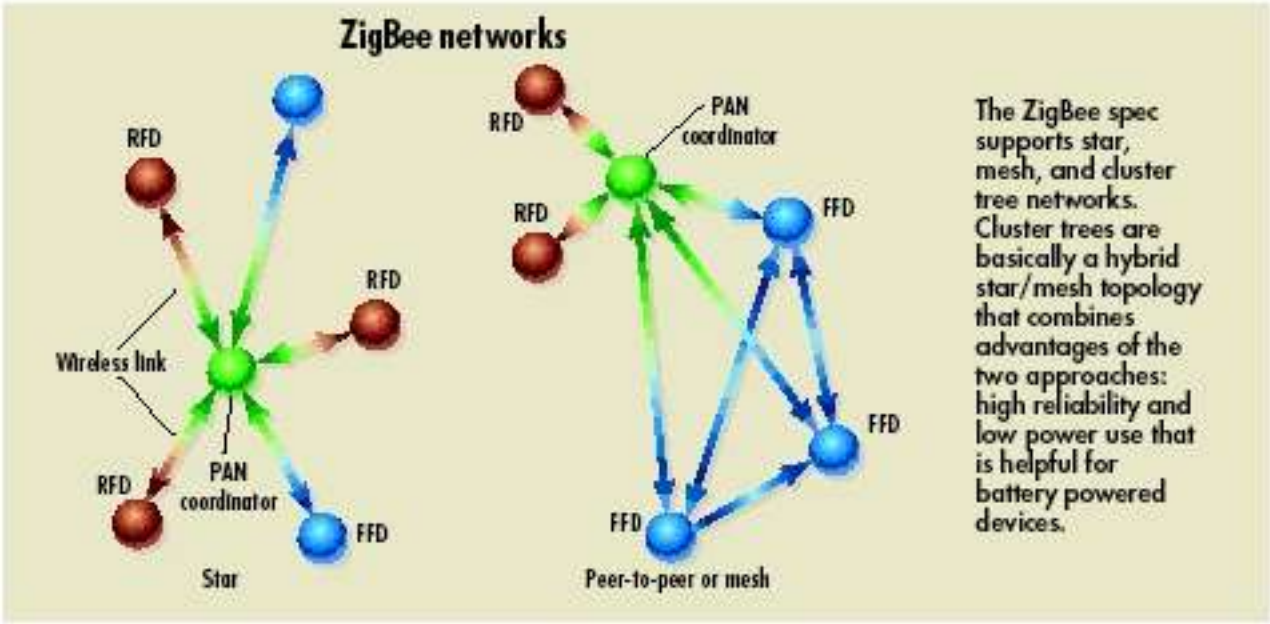
ZigBee devices: 3 different types

The most capable is a "**ZigBee coordinator**." It might bridge to other networks, and forms the root of the network tree. It is able to store information about the network. There is exactly one ZigBee coordinator in each network.

A "**full function device**" (FFD) can act as an intermediate router, passing data from other devices.

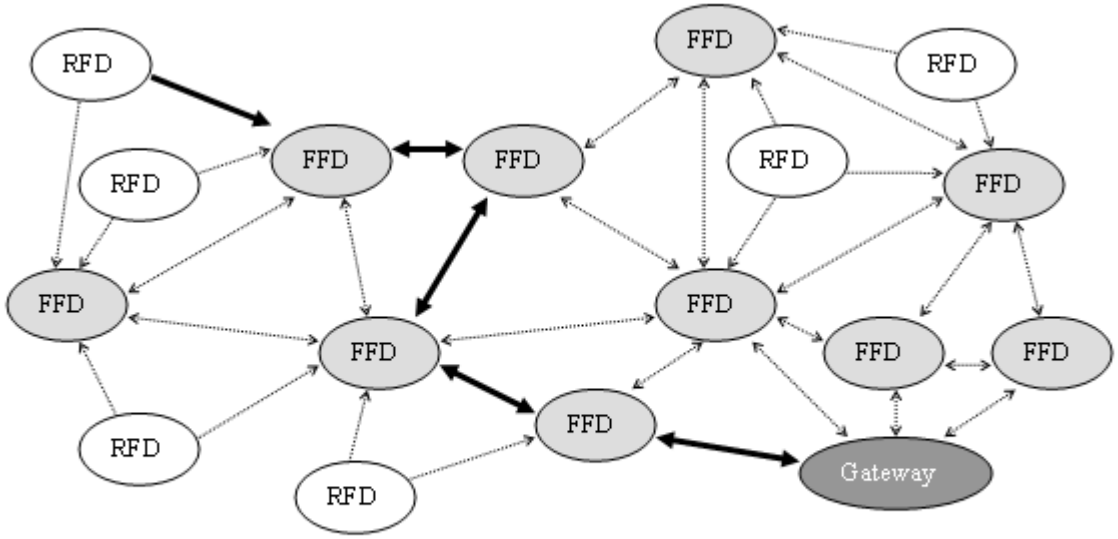
A "**reduced function device**" (RFD) is just smart enough to talk to the network; it cannot relay data from other devices. An RFD requires less memory, and therefore should be less expensive to manufacture, than an FFD.
Similarly, an FFD requires less memory, and therefore should be less expensive to manufacture, than a ZigBee coordinator.





ZigBee Protocols

The protocols build on recent algorithmic research to automatically construct a low-speed ad-hoc network of nodes. In most large cases, the network is a cluster of clusters. It can also form a mesh or a single cluster.



A mesh network showing a signal that originates at an RFD, routes though FFDs, and ends at a Gateway device. The dotted lines represent possible signal paths.

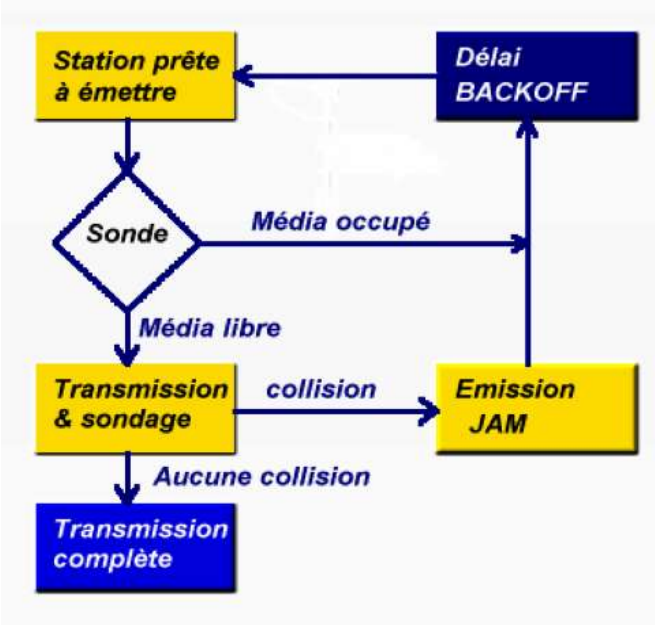
In general, the ZigBee protocols minimize the time the radio is on in order to reduce the power used by the radio.

ZigBee protocols support both beaconing and non-beaconing networks.
In **beaconing networks**, the network nodes transmit beacons to confirm their presence to other network nodes, and to allow nodes to sleep between beacons, thereby lowering their duty cycle and extending their battery life.
In **non-beaconing networks**, most devices typically have their receivers continuously active, requiring a more robust power supply; however, this enables heterogeneous networks, in which some devices receive continuously while some remain asleep, transmitting only when an external stimulus is detected.

ZigBee uses the IEEE 802.15.4 Low-Rate Wireless Personal Area Network (WPAN) standard to describe its lower protocol layers--the physical layer (PHY), and the medium access control (MAC) portion of the data link layer (DLL).
This standard specifies operation in the unlicensed 2.4 GHz, 915 MHz and 868 MHz ISM bands.
The radio uses DSSS which is managed by the digital stream into the modulator.
Conventional DSSS is employed in the 868 and 915 MHz bands, while an orthogonal signalling scheme that transmits four bits per symbol is employed in the 2.4 GHz band.
The raw, over-the-air data rate is 250 kb/s per channel in the 2.4 GHz band, 40 kb/s per channel in the 915 MHz band, and 20 kb/s in the 868 MHz band.
Transmission range is between 10 and 75 metres (33~246 feet).

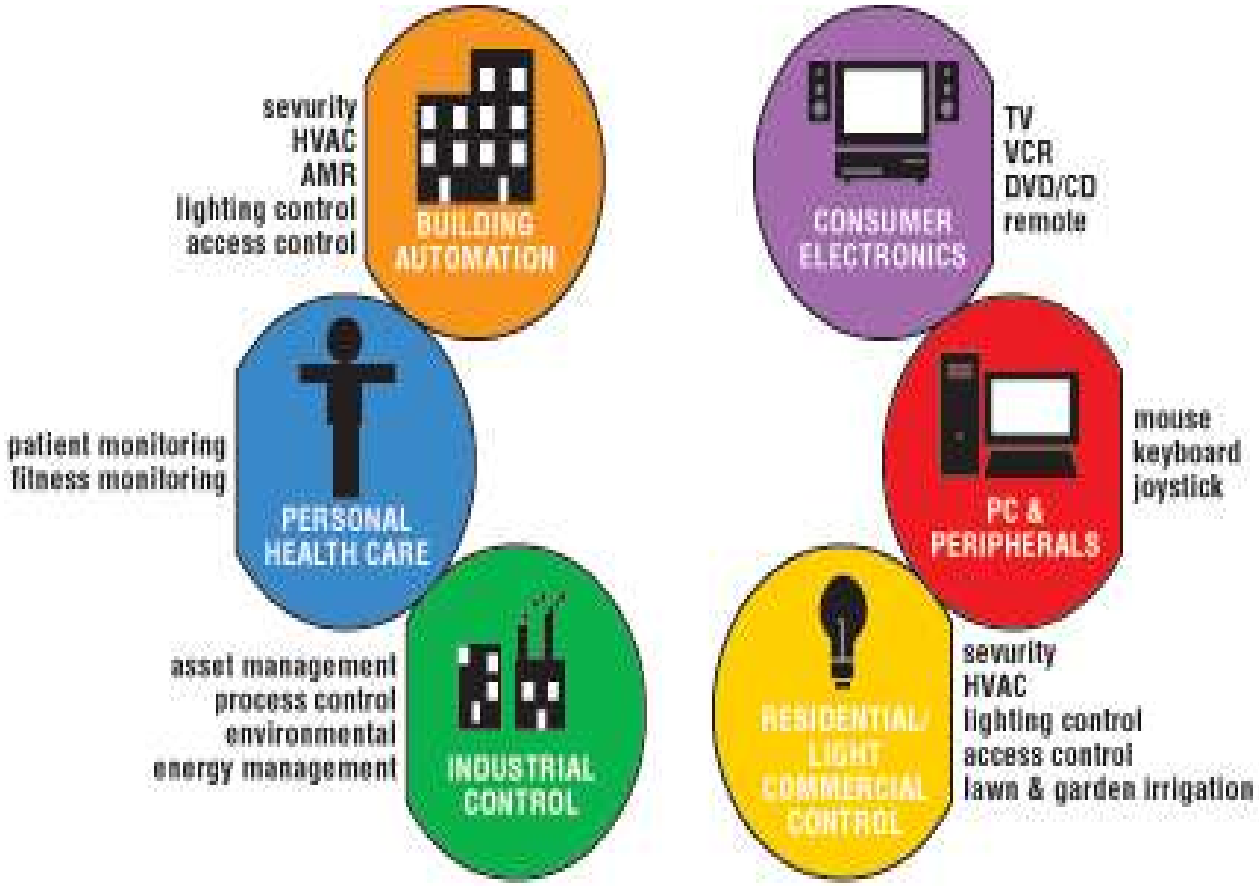
The basic mode of channel access specified by IEEE 802.15.4 is "carrier sense, multiple access" (CSMA), that is, the nodes talk in the same way that people converse--they briefly check to see that no one is talking before they start.

Beacons, however, are sent on a fixed timing schedule, and do not use CSMA. Message acknowledgements also do not use CSMA.



The typical example of a heterogeneous network is the **wireless light switch:**

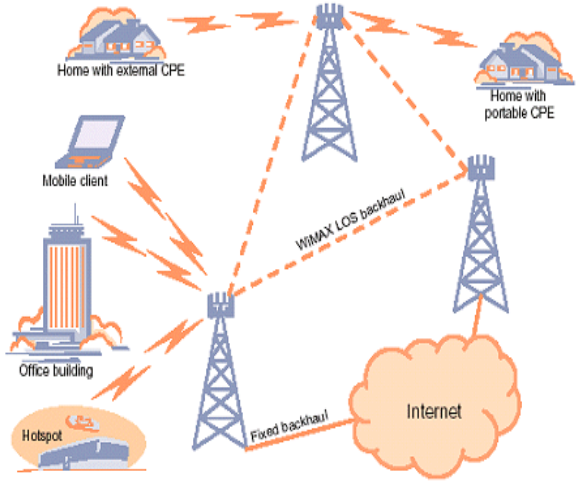
The ZigBee node at the lamp may receive constantly, since it is connected to the mains supply, while the battery-powered light switch remains asleep until the switch is thrown. The switch then wakes up, sends a command to the lamp, receives an acknowledgement, and returns to sleep. In such a network the lamp node is at least an FFD, if not the ZigBee coordinator; the switch node is typically an RFD.



IEEE 802.16 Point to multipoint broadband wireless access

WiMAX (Worldwide Interoperability for Microwave Access)

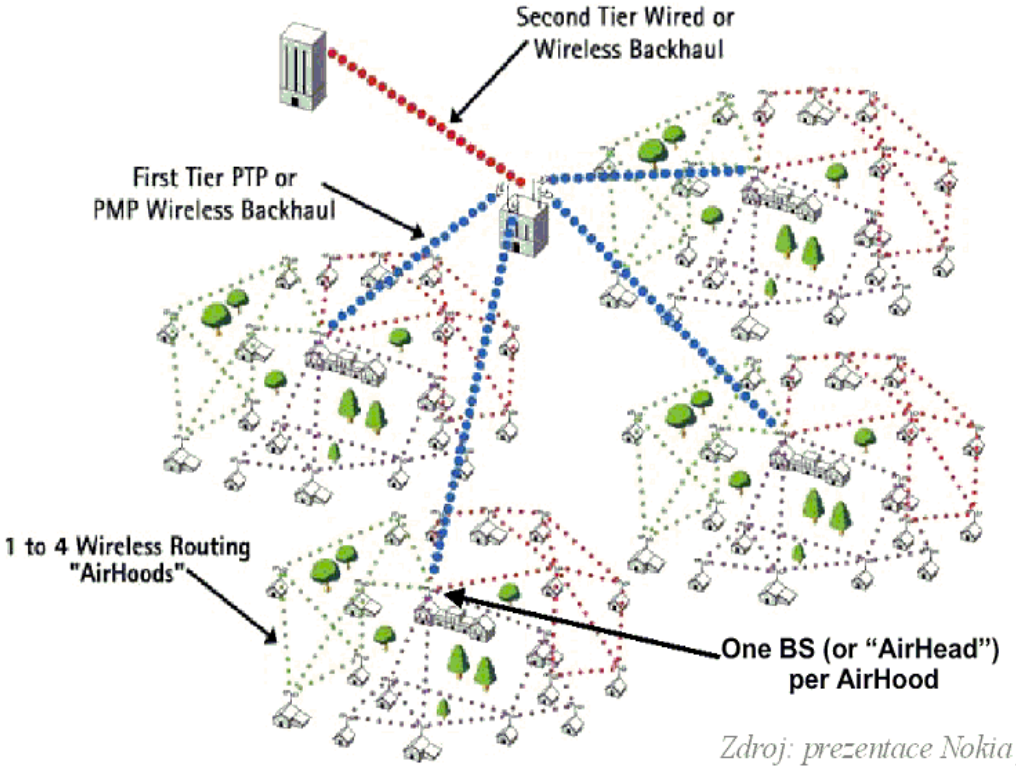
WiMAX does not conflict with WiFI, but complements it. Because IEEE 802.16 networks use the same Logical Link Controller (standardized by IEEE 802.2) as other LANs and WANs, it can be both bridged and routed to them. So the comment about complementarity to Wi-Fi also includes all flavors of wired ethernet (802.3), token ring (802.5) and non-IEEE standards that use the same LLC including FDDI and cable modem (DOCSIS).



WiMAX is a wireless metropolitan area network (MAN) technology that will connect IEEE 802.11(WiFi) hotspots to the Internet and provide a wireless extension to cable and DSL for last mile (last km) broadband access. IEEE 802.16 provides up to 50 km (31 miles) of linear service area range and allows users connectivity without a direct line of sight to a base station. Note that this should not be taken to mean that users 50 km (31 miles) away without line of sight will have connectivity. The technology also provides shared data rates up to 70 Mbit/s, which, according to WiMAX proponents, is enough bandwidth to simultaneously support more than 60 businesses with T1-type connectivity and well over a thousand homes at 1Mbit/s DSL-level connectivity.

An important aspect of the IEEE 802.16 is that it defines a MAC layer that supports multiple physical layer (PHY) specifications. This is crucial to allow equipment makers to differentiate their offerings.

The MAC is significantly different than in Wi-Fi. In WiFi, the ethernet uses contention access -- all subscriber stations wishing to pass data through an access point are competing for the AP's attention on a random basis.
By contrast, the 802.16 MAC is a scheduling MAC where the subscriber station only has to compete once (for initial entry into the network). After that it is allocated a time slot by the base station. The time slot can enlarge and constrict, but it remains assigned to the subscriber station meaning that other subscribers are not supposed to use it but take their turn.
This scheduling algorithm is stable under overload and oversubscription (unlike 802.11).and much more bandwidth efficient. The algorithm also allows the base station to control Quality of Service by balancing the assignments among the needs of the subscriber stations.



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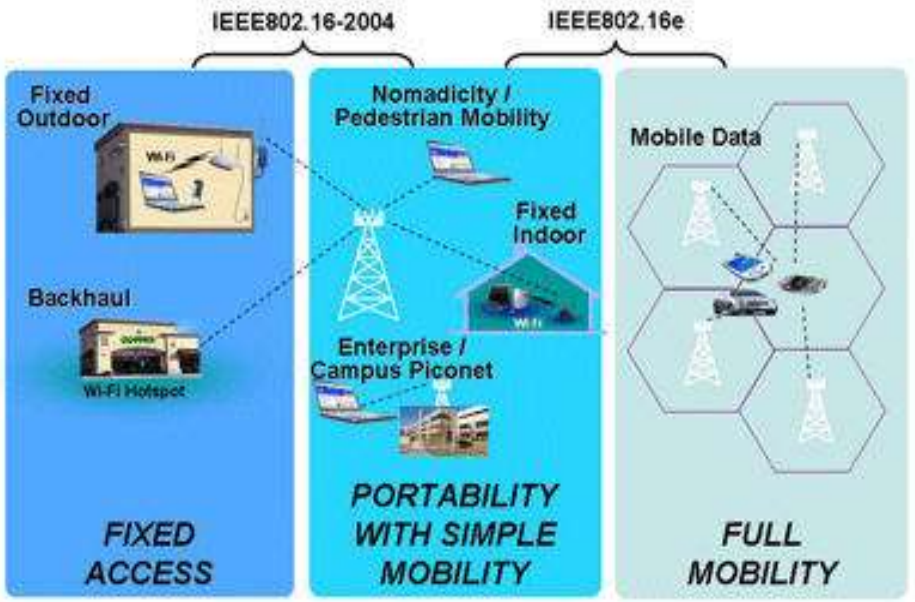
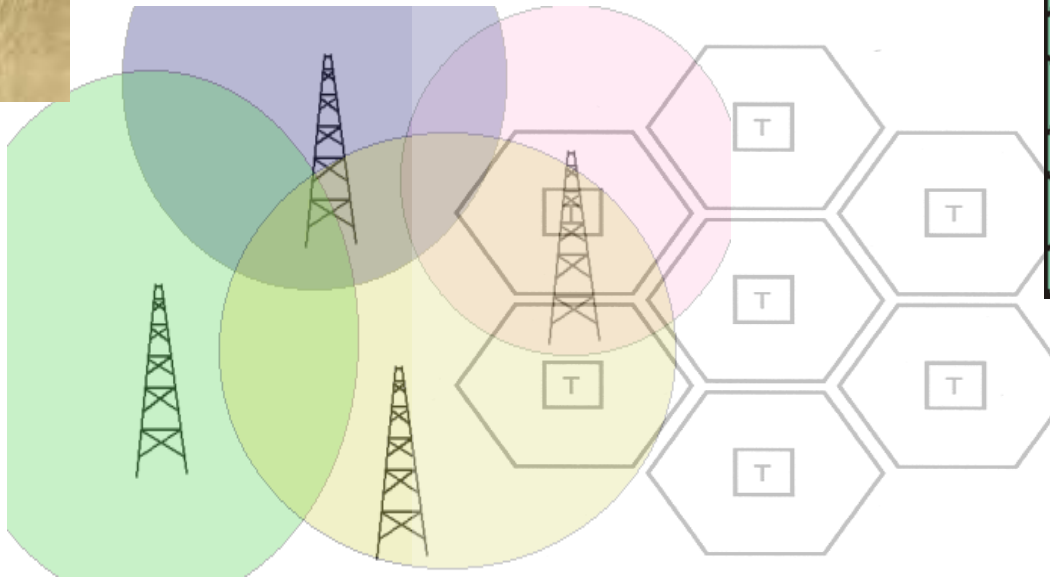
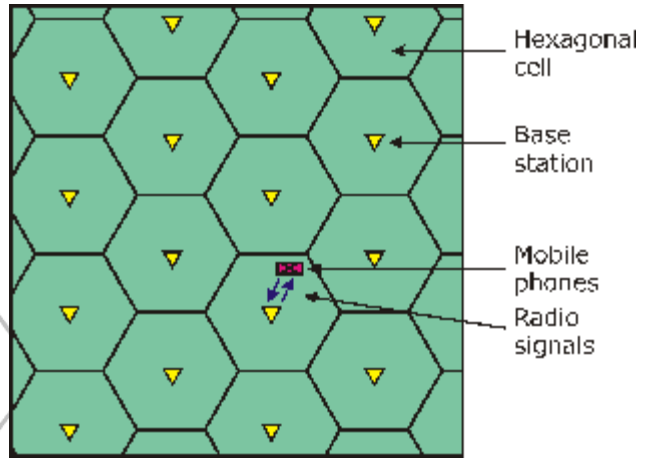
IEEE 802



CELLULAR NETWORKS

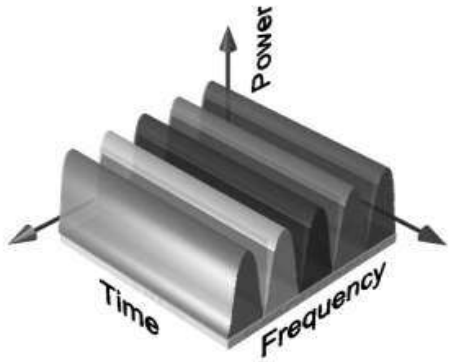




Cellular System	Year of introduction	Transmission Type	Multiple Access Technique	Channel Bandwidth	System Generation
AMPS *Advanced Mobile Phone System*	1983	Analog	FDMA	30kHz	first
NAMPS *Narrowband AMPS*	1992	Analog	FDMA	10kHz	First
USDC *U.S. Digital Cellular*	1991	Digital	TDMA	30kHz	Second
IS-95 *U.S Narrowband Spread Spectrum*	1993	Digital	CDMA	1.25MHz	Second
cdmaOne *Wideband*	2000	Digital	CDMA	-	Third

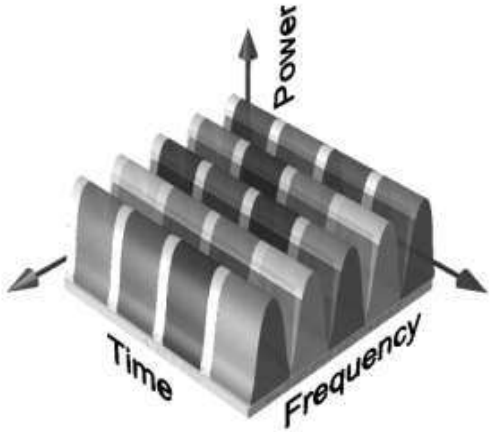
FDMA

FDMA (frequency division multiple access) is the division of the frequency band allocated for wireless cellular telephone communication into 30 channels, each of which can carry a voice conversation or, with digital service, carry digital data. With FDMA, each channel can be assigned to only one user at a time.



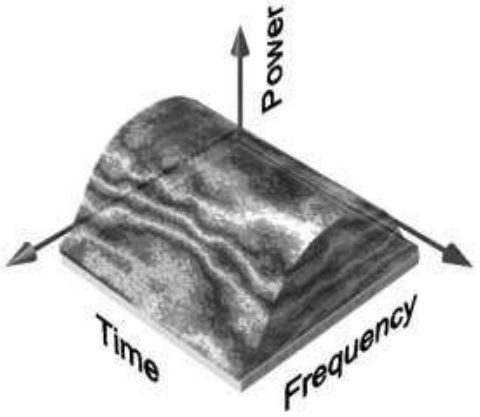
TDMA

Short for Time Division Multiple Access, a technology for delivering digital wireless service using time-division multiplexing (TDM). TDMA works by dividing a radio frequency into time slots and then allocating slots to multiple calls. In this way, a single frequency can support multiple, simultaneous data channels.
TDMA is used by the GSM digital cellular system.



CDMA

Short for Code-Division Multiple Access, a digital cellular technology that uses spread-spectrum techniques. Unlike TDMA, CDMA does not assign a specific frequency to each user. Instead, every channel uses the full available spectrum. Individual conversations are encoded with a pseudo-random digital sequence. CDMA consistently provides better capacity for voice and data communications, allowing more subscribers to connect at any given time.
CDMA is the common platform on which 3G technologies are built.



MOBILE PHONE STANDARDS

0G	1G	2G	2.5G	2.75G	3G	3.5G	4G
ARP	NMT AMPS	GSM iDEN D-AMPS cdmaOne	GPRS	EDGE	W-CDMA UMTS FOMA CDMA2000 TD-SCDMA		

0G refers to pre-cellphone mobile telephony technology, such as radio telephones that were in cars before the advent of cellphones.

1G (or 1-G) is short for first-generation wireless telephone technology, cellphones. These are the analog cellphone standards that were introduced in the 80's and continued until being replaced by 2G digital cellphones.

NMT: Nordic Mobile Telephone
AMPS: Advanced Mobile Phone System

2G (or 2-G) is short for second-generation wireless telephone technology. It cannot normally transfer data, such as email or software, other than the digital voice call itself, and other basic ancillary data such as time and date. Nevertheless, SMS messaging is also available as a form of data transmission for some standards.

-frequently referred as Personal Communications Service or PCS in the US.

-TDMA-based and CDMA-based standards depending on type of multiplexing

The main **2G** standards are:
-**GSM** (TDMA-based), originally from Europe but used worldwide
-**IDEN** (TDMA-based), proprietary network used by Nextel in US /
-**IS-136 D-AMPS**, (TDMA-based, referred as TDMA in US), used in Americas
-**IS-95 cdmaOne**, (CDMA-based, referred as CDMA in US), used in Americas Asia
-**PDC** (TDMA-based), used exclusively in Japan

2.5G is a stepping stone between 2G and 3G cellular wireless technologies.

The term "second and a half generation" is used to describe 2G-systems that have implemented a packet switched domain in addition to the circuit switched domain. It does not necessarily provide faster services because bundling of timeslots is used for circuit switched data services (HSCSD) as well.

The terms "2.5G" is not officially defined, it is used for marketing purposes only.

2.5G provides some of the benefits of 3G (e.g. it is packet-switched) and can use some of the existing 2G infrastructure in GSM and CDMA networks. The commonly known 2.5G technique is GPRS.
Some protocols, such as EDGE for GSM and CDMA2000 1x-RTT for CDMA, officially qualify as "3G" services (because they have a data rate of above 144 kbit/s), but are considered by most to be 2.5G services (or 2.75G which sounds even more sophisticated) because they are several times slower than "true" 3G services.

2.75G is the term which has been decided on for systems which don't meet the 3G requirements but are marketed as if they do (e.g. CDMA-2000 without multi-carrier) or which do, just, meet the requirements but aren't strongly marketed as such. (e.g. EDGE systems).

3G technologies are an answer to the ITU's IMT-2000 specification.
Originally, 3G was supposed to be a single, unified, worldwide standard, but in practice, the 3G world has been split into 3 camps.

UMTS (Universal Mobile Telephone System), based on **W-CDMA** technology, is the solution generally preferred by countries that used GSM, centered in Europe. UMTS is managed by the 3GPP organization, responsible for GSM, GPRS & EDGE.
FOMA, launched by Japan's NTT DoCoMo in 2001, is generally regarded as the world's first commercial 3G service. However, while based on W-CDMA, it is not generally compatible with UMTS

CDMA2000
The other significant 3G standard is CDMA2000, which is an outgrowth of the earlier 2G CDMA standard IS-95. CDMA2000's primary proponents are outside the GSM zone in the Americas, Japan and Korea. CDMA2000 is managed by 3GPP2, which is separate and independent from UMTS's 3GPP.

TD-SCDMA
A less well known standard is TD-SCDMA which is being developed in the People's Republic of China by the companies Datang and Siemens.

3.5G

High-Speed Downlink Packet Access or HSDPA: packet-based data service in W-CDMA downlink with data transmission up to 8-10 Mbit/s (and 20 Mbit/s for MIMO systems) over a 5MHz bandwidth in WCDMA downlink.
HSDPA implementations includes Adaptive Modulation and Coding (AMC), Multiple-Input Multiple-Output (MIMO), Hybrid Automatic Request (HARQ), fast cell search, and advanced receiver design.
HSDPA is beginning to reach deployment status in North America.
Cingular announced they will deploy UMTS with expansion to HSDPA in 2005.

4G (or 4-G) is short for fourth-generation the successor of 3G and is a wireless access technology. It describes two different but overlapping ideas.

High-speed mobile wireless access with a very high data transmission speed, of the same order of magnitude as a local area network connection (10 Mbits/s and up). It has been used to describe wireless LAN technologies like Wi-Fi, as well as other potential successors of the current 3G mobile telephone standards.

Pervasive networks. An amorphous and presently entirely hypothetical concept where the user can be simultaneously connected to several wireless access technologies and can seamlessly move between them (handover).

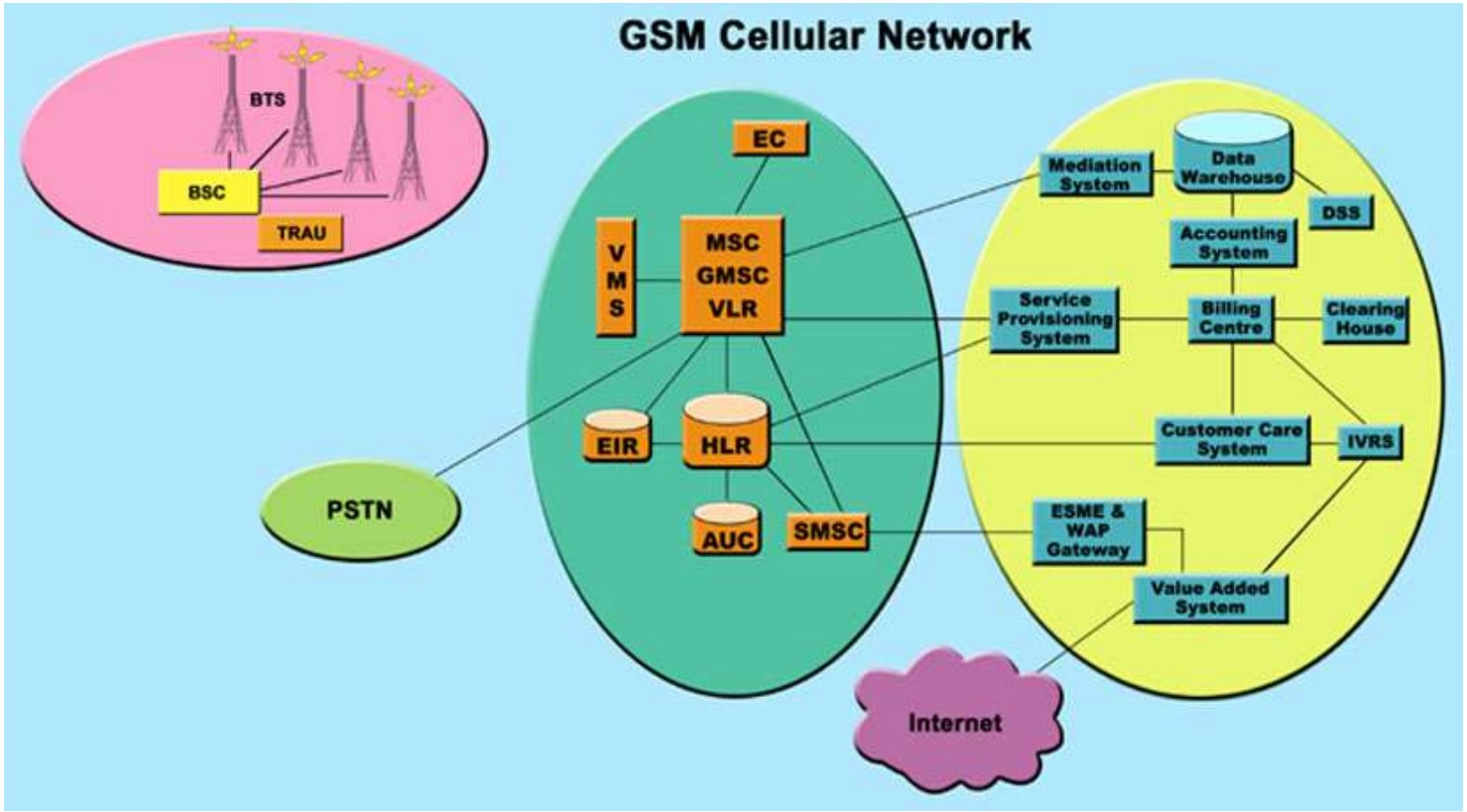
These access technologies can be Wi-Fi, UMTS, EDGE or any other future access technology. Included in this concept is also smart-radio technology to efficiently manage spectrum use and transmission power as well as the use of mesh routing protocols to create a pervasive network.

0G	1G	2G	2.5G	2.75G	3G	3.5G	4G
ARP	NMT AMPS	GSM iDEN D-AMPS cdmaOne	GPRS	EDGE	W-CDMA UMTS FOMA CDMA2000 TD-SCDMA		

GSM

Global System for Mobile Communications
World Coverage 2005
650 network operators across 210 countries & regions.
www.coveragemaps.com/gsmposter.htm

BSC: base station controller BTS: Base transceiver station
TRAU : transcoder and rate adaptation unit



EC/echo canceller VMS/voicemail system
MSC/mobile switching center, GMSC/gateway MSC VLR/visitor location register,
EIR/equipment identity register HLR/home location register
AUC/authentication center SMSC/Short Mesg Service center

US CELLULAR COVERAGE

www.cellular-news.com/coverage/usa.shtml

CDMA 800	3	
CDMA 1900	13	SprintPCS
CDMA 800/1900	3	Verizon
GSM 1900	18	ATT, Cingular, T-Mobile

Total	**37 providers**	
	(Apr 2005)	

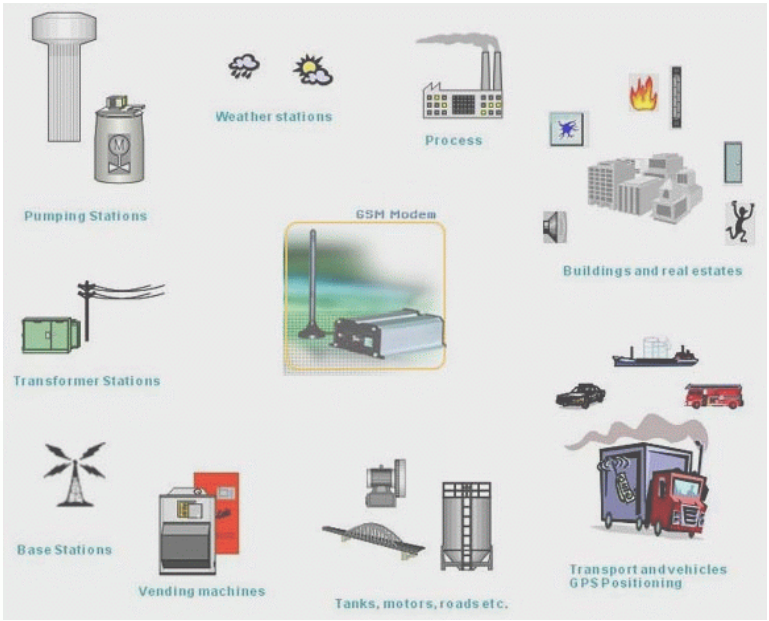
Maps show relative distribution of CDMA and GSM for above listed service providers.

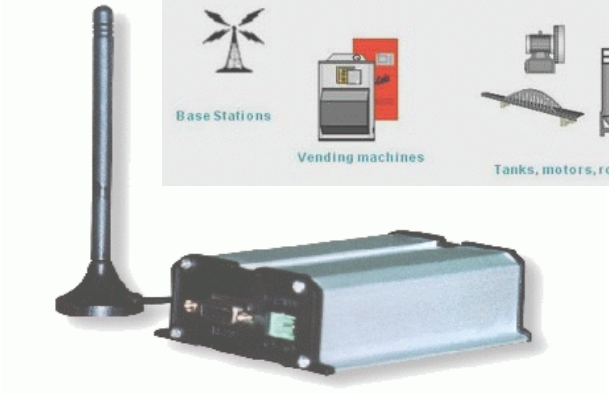
CELLULAR DATA NETWORKS

CDPD on TDMA
Cellular digital packet data,
advertised speed 19.2Kbps / real 9.6Kbps
CDPD modems manufactured by Sierra Wireless, Novatel, AirCard
CDPD ISPs include Airlink,ATT,Earthlink,Verizon

GPRS on GSM
General Packet Radio Service
specification for data transfer on
TDMA and GSM networks
advertised speed 107.2Kbps / real 20-30 Kbps

EDGE on GSM
Enhanced Data rates for GSM Evolution
will replace GPRS with advertised speeds
of 384 Kbps

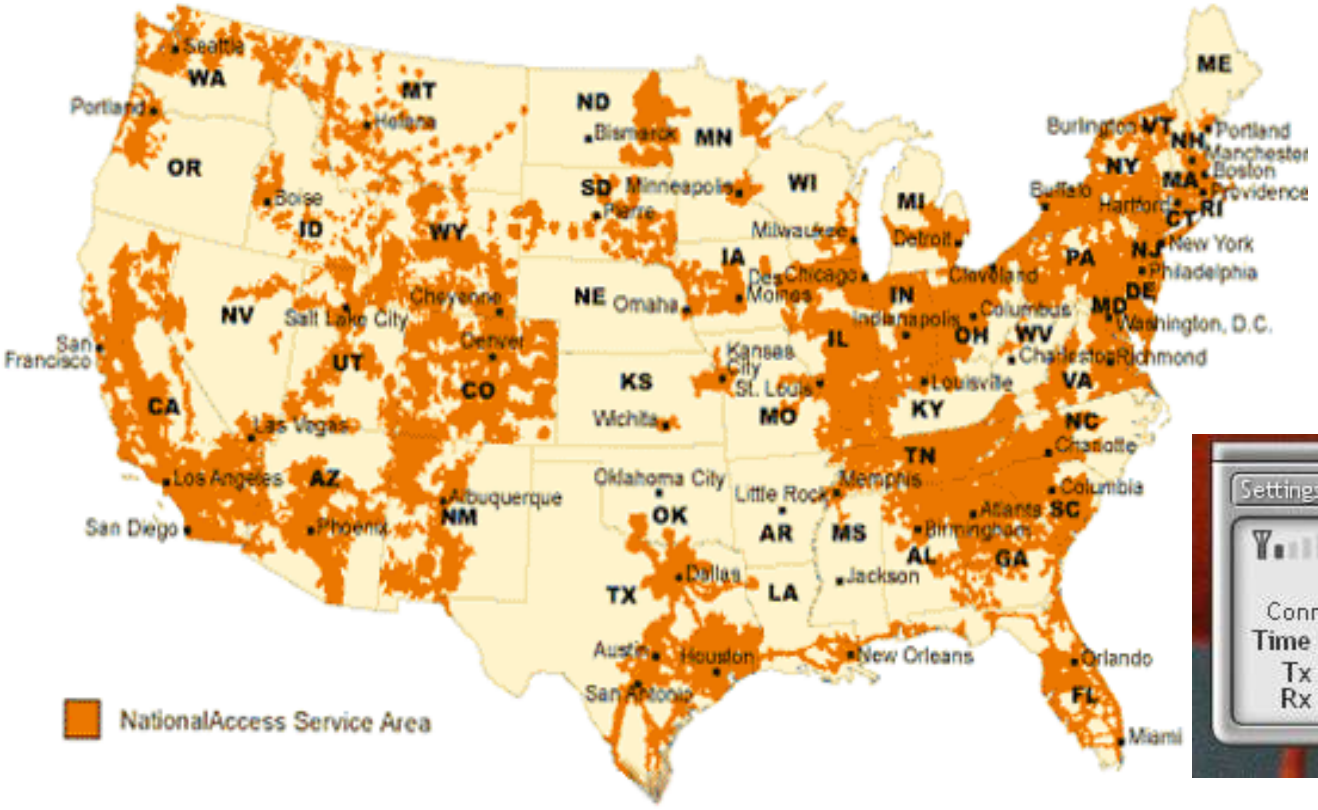


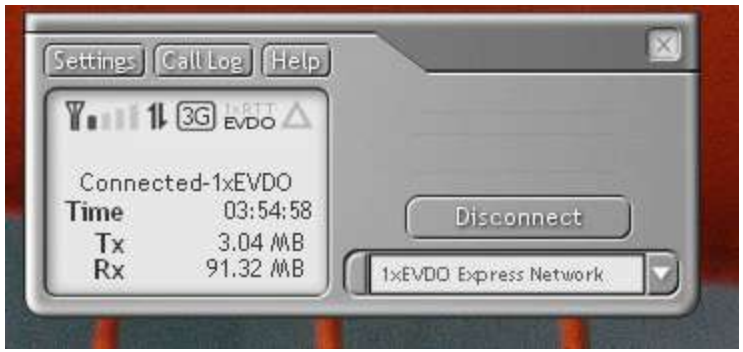


1xRTT / 1xEV-DO on CDMA

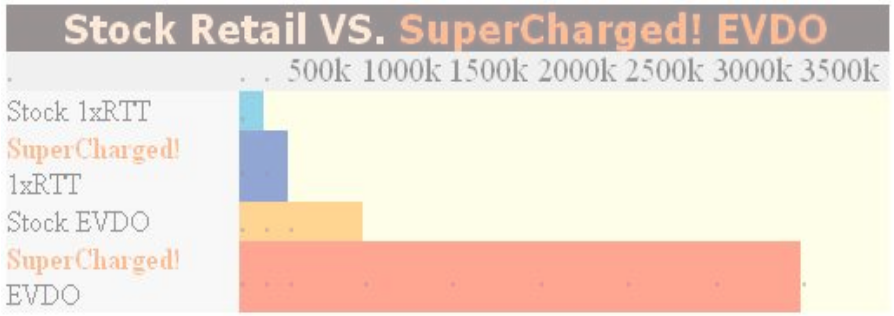
original cdma data services offered 9.6-14.4Kbps,
1xRTT advertised speeds 144 Kbps
1xEV-DO (Evolution Data Optimized) advertised speeds 2.4 Mbps down, real world 430Kbps down/120Kbps up
Sprint/Verizon operate CDMA2000-1xRTT services ,
Verizon operates 1xEVDO in 32 cities stateside.

www.tech-faq.com/





EVDO-COVERAGE.com



EVDO-HSdpa to WIFI/Cat5 Router

Wireless

WWAN

UMTS:	Novatel 530, 520
EDGE:	Sierra AC775
EVDO:	Sierra AC575, AC580
CDMA 1x:	Sierra AC555
GPRS:	Sierra AC750, Option EE828

WLAN

- 802.11b
- Transmit power: 0 ~ 30 dBm
- Receiver sensitivity: 1 Mbps BPSK, 8% PER -89 dBm

Networking

- WLAN 802.11b
- WWAN support
- Wired LAN support
- NAPT between LAN and WWAN
- DHCP Server
- MAC access control
- IP Port Forwarding
- DNS Relay
- Bridge between LAN and WLAN

MANAGEMENT

- SNMP V1/V2
- Standard and Extended MIBs
- HTTP server for web-based management
- TFTP
- Syslog
- CLI & Telnet Server for command line management
- Scan tool for upgrade management

SECURITY

- Wireless user isolation
- Access Control Table and RADIUS Authentication/Accounting
- 802.1x, TKIP support
- VPN passthrough for PPTP and UDP encapsulated IPSec
- HTTPS for Web management
- 64-bit WEP & 128-bit RC4 encryption
- Web Portal
- Password protected for web access
- Closed system

INTERFACE

Wired:	10/100Base-T (LAN)
Wireless:	WWAN WLAN IEEE 802.11b
Serial:	D-Sub RS232 connector

TOP Global
Broadening Wireless Horizons

Top Global Introduce the World's First Dual Slot EVDO and UMTS Gateway – The Universal MobileBridge™

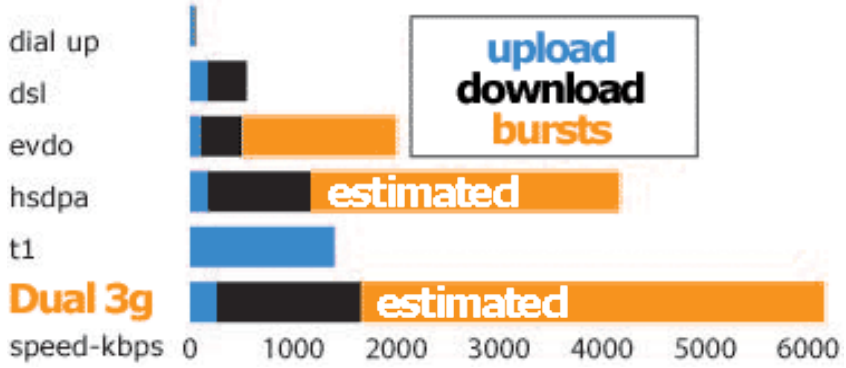
The Universal MobileBridge™ can support any of the two combinations of EVDO, CDMA 1x, EDGE, and UMTS/HSDPA networks to enable the wireless internet.

FOR RELEASE April 22, 2005

Irvine, California and China. Top Global, a leader in wireless convergence solutions, announced today the World's First Dual Slot Enterprise Class MobileBridge™ solutions that link third-generation (3G) mobile and Wi-Fi networks. Top Global's solution, called MobileBridge™, serves as a gateway/router that links 3G and Wi-Fi networks, enabling enterprises to enjoy the flexibility and convenience of broadband wireless internet including both voice and data services in truly mobile and remote environments. The Dual Slot Universal MobileBridge™ utilizes Top Global's patented MultiLink™ load balancing technology to optimise the total effective throughput, and it also utilizes Top Global's proprietary AutoSwitch™ network redundancy software.

The Universal MobileBridge™ is a standard universal gateway that supports all EVDO data cards available in the USA including PC5220/AC580, V620 and KPC650. Enterprises continue to demand for higher data throughput and for redundancy in wireless networks. With the dual slot design, we effective solve two problems at the same time. For example, enterprise customers in the USA can now use the Mobilebridge™ with both EVDO and UMTS/HSDPA networks at the same time. They not only get higher throughput but also have an automatic back up solution in case one link is down. In Europe however, customers can get two UMTS links from two independent service providers to enjoy the same benefits. The flexible systems architecture of the Universal MobileBridge™ supports any of the combinations of EVDO, CDMA 1x, EDGE, and UMTS today and can smoothly migrate to support HSDPA and EVDO Rel.A standards with firmware upgrade in the near future. The MobileBridge™ comes with a complete suite of networking software to make internet connection for multiple users or devices with LAN, WLAN, RS232 interfaces. It offers a choice of many wireless security options and can be managed through multiple management methods. It also enables flexible AAA with built-in Web Portal and Radius protocol. The dual slot Universal MobileBridge™ Gateway is a total solution for homeland security and disaster recovery applications.

"As a pioneer in Cellular/WiFi wireless convergence systems, we continuously receive feedback from our enterprise customers demanding for higher bandwidth and network redundancy. The new dual slot universal MobileBridge™ shows that we have listened to our customers and can quickly turn their requirements in new products through our superior systems architecture and unmatched creativity and experience in wireless technologies", said Top Global President & CTO, Dr. Alan Zhen Zhou.



About Top Global

Top Global is a leading wireless systems design company and a global leader in wireless technology convergence. Top Global offers total wireless solutions for Carriers, Enterprises, and Consumers. Top Global has a strong engineering and design team with many years of experience in wireless communications systems design, hardware and software design and testing, and communications protocol development. With our focus and dedication in wireless and our deep technical knowledge of wireless chipsets, drivers, firmware, and applications layer software, our goal is to become the Top Global Leader in wireless systems design. Our customers and partners can reduce investment risk and shorten time to market by OEM/ODM Top Global wireless products and solutions. We believe the future of wireless communication has just started, and that wireless broadband Internet will become as pervasive as the Internet itself. Top Global sees it as a business opportunity to give everyone easy wireless high-speed Internet access, whether at home, in the office, or in public places. This wireless horizon has just been discovered, and we will broaden the World Wide Web (WWW) to a World Without Wires (WWW). "Broadening Wireless Horizons" is our company slogan. More information about Top Global is available from its Web site at http://www.chinatopglobal.com.

For more information, reporters may contact:

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Email:tanhao@chinatopglobal.com

Linux EVD0

Using the Verizon Wireless 5220 1xEV-DO card with linux

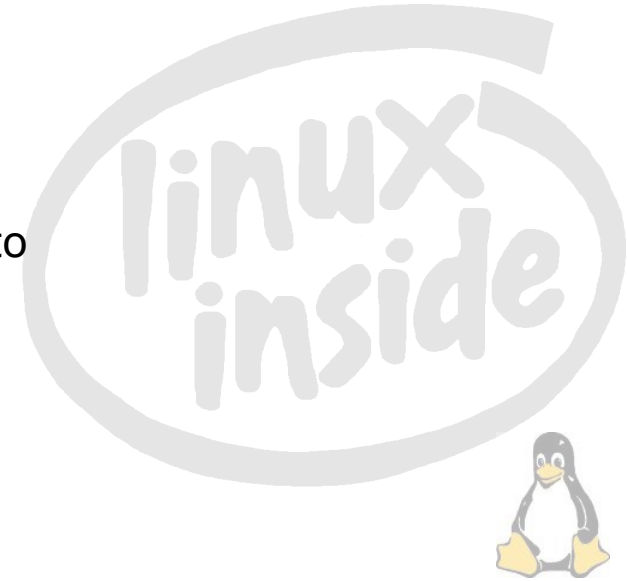
Phil Karn KA9Q

www.ka9q.net/5220.html

The 5220 card contains a Qualcomm MSM 5500 mobile station modem chip that implements the actual 1xEV-DO functionality. This chip has a native USB 1.1 interface that emulates two USB serial ports. The first provides a classic serial modem interface that accepts AT commands and PPP data. The second is reserved for diagnostics and is unused.
To package this chip in a PC Card, AirPrime added a Lucent OHCI (Compaq-style) USB 1.1 host controller and a Cardbus interface. The MSM is hardwired to the USB host controller as its only slave device.

The 5220 card cannot make voice calls. Several other features of the MSM 5500 are also unavailable.

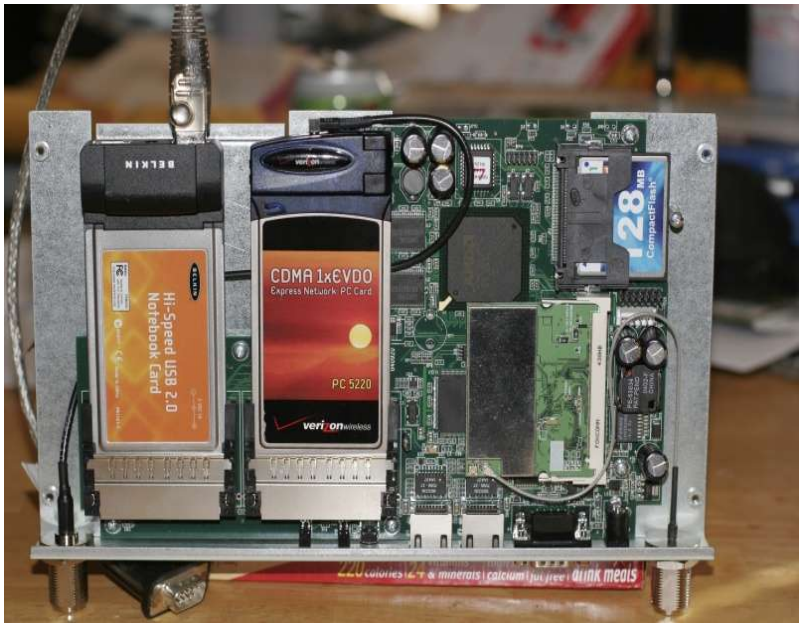
To get the card going on Linux, you must
1. install the Linux driver for the OHCI USB host adapter
2. install a Linux USB driver for the MSM itself.
3.configure Linux point-to-point protocol daemon **pppd** to place calls over the MSM's virtual serial port.

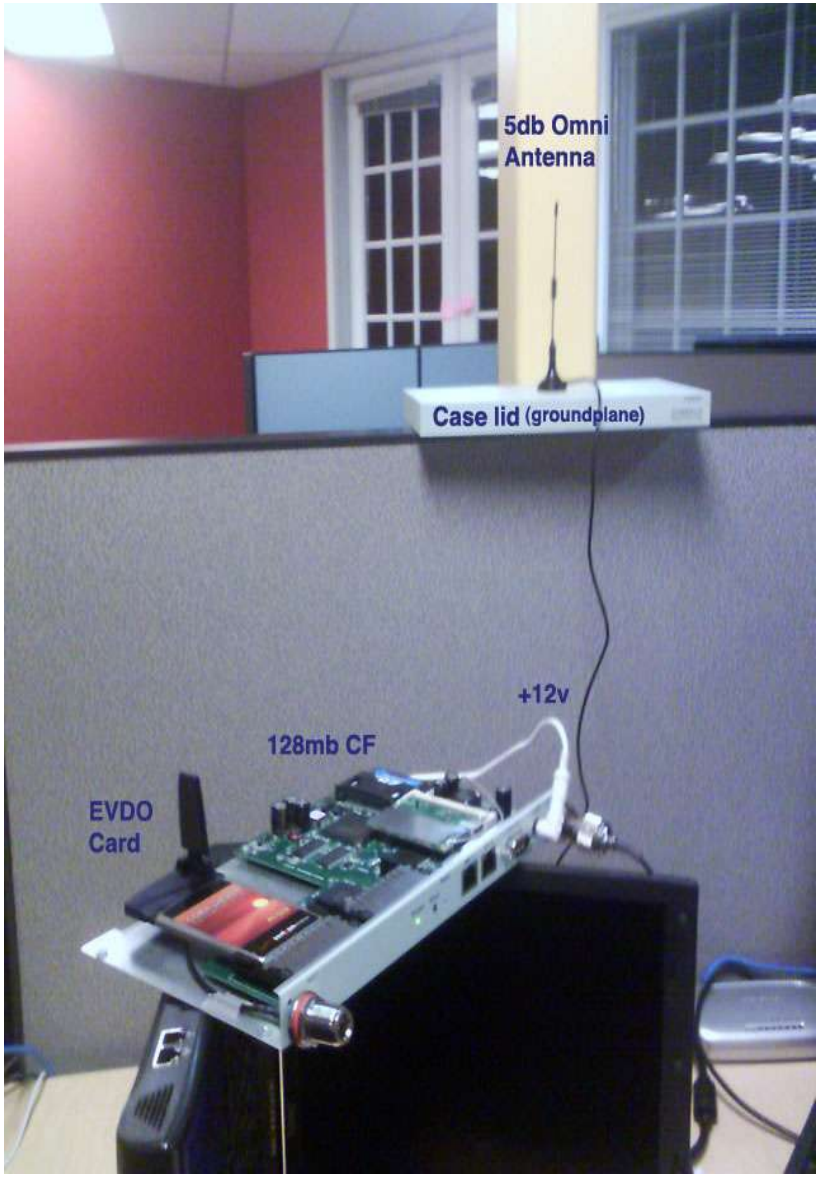


EVDO STOMP BOX
Build your own Mobile 3G/WiFi Router

moro.fbrtech.com/~tora/EVDO/index.html

Tor Amundson *and* ***Garth Minette*** *.*

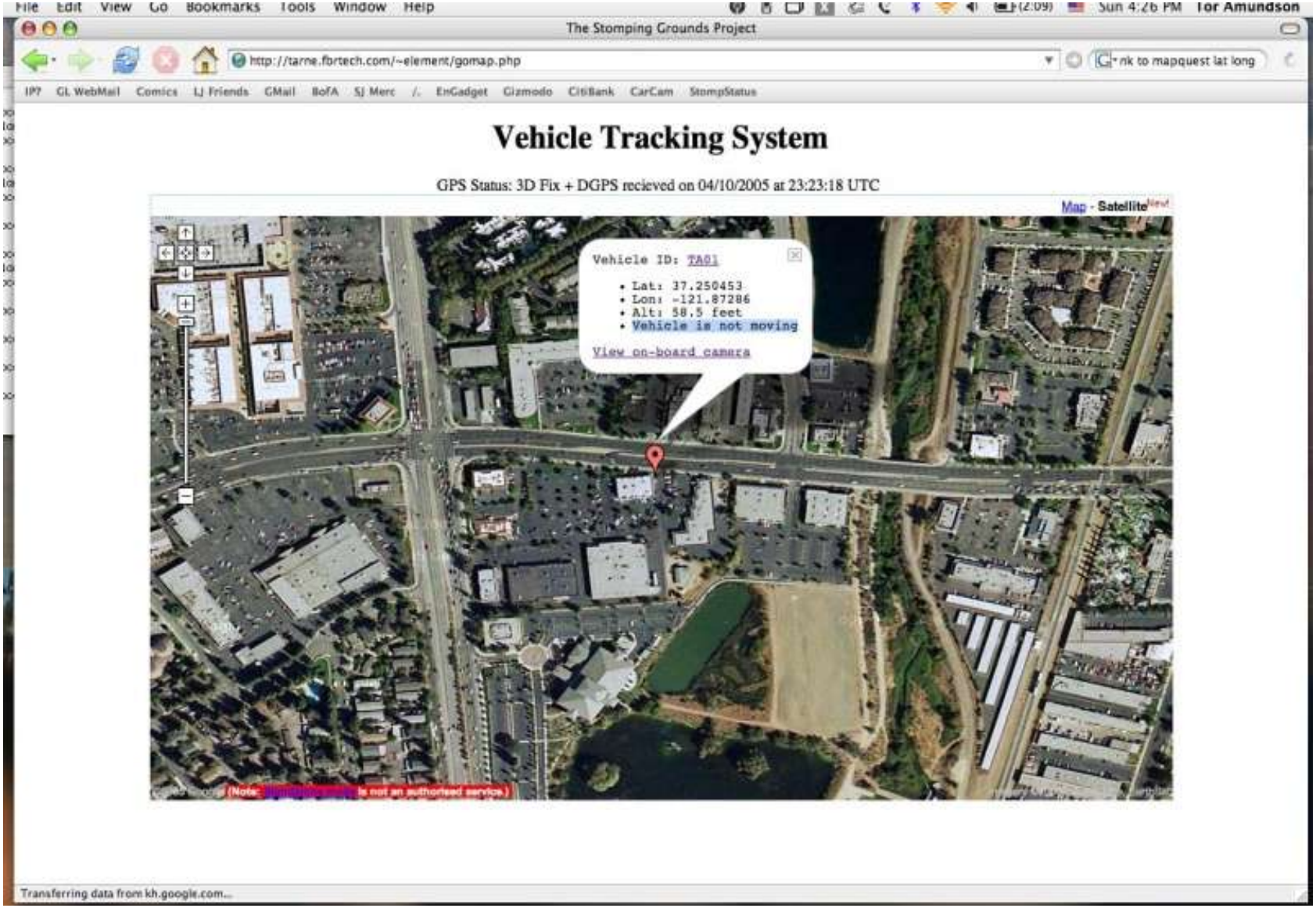




Soekris net4521
pebble linux distro
1xRTT / EV-DO pcmcia card
usb pcmcia card (for gps)
senao mini pci 200mW WiFi card

VEHICLE TRACKING SYSTEM

Tor Amundsson / Garth Minnette



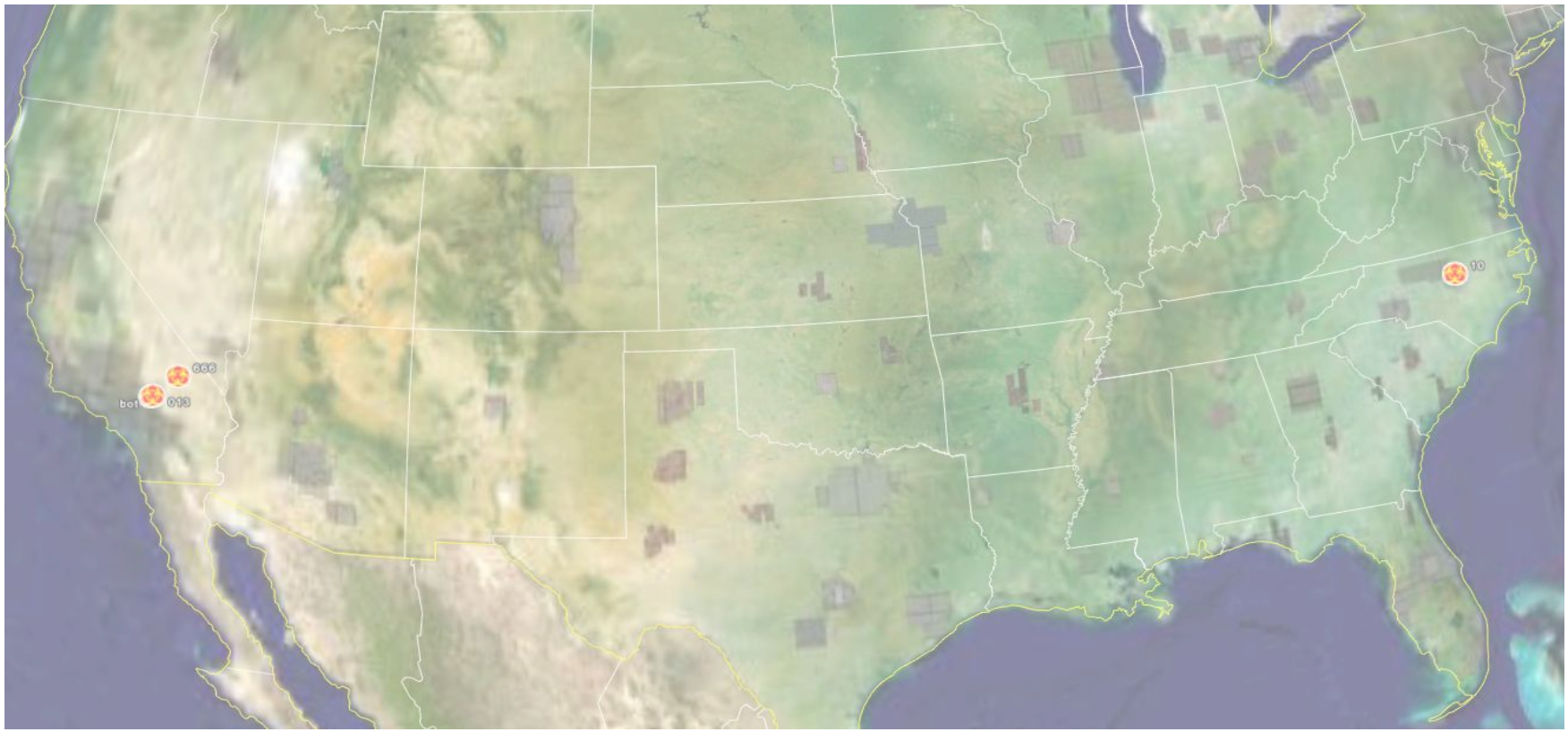
VEHICLE TRACKING SYSTEM

Tim Murphy: Autonomechs

GSM 1900 GPRS based

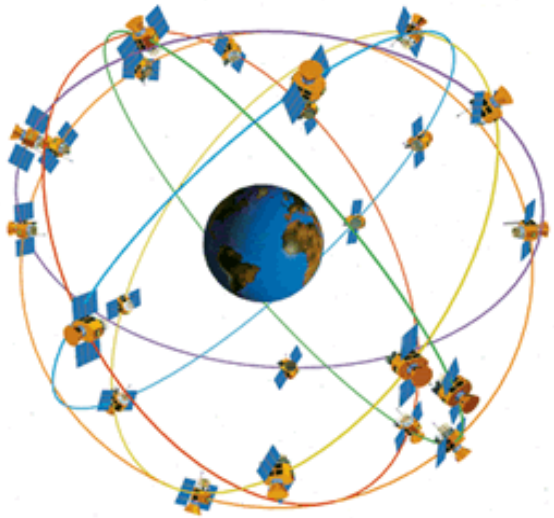
GPS

Keyhole| Google interface



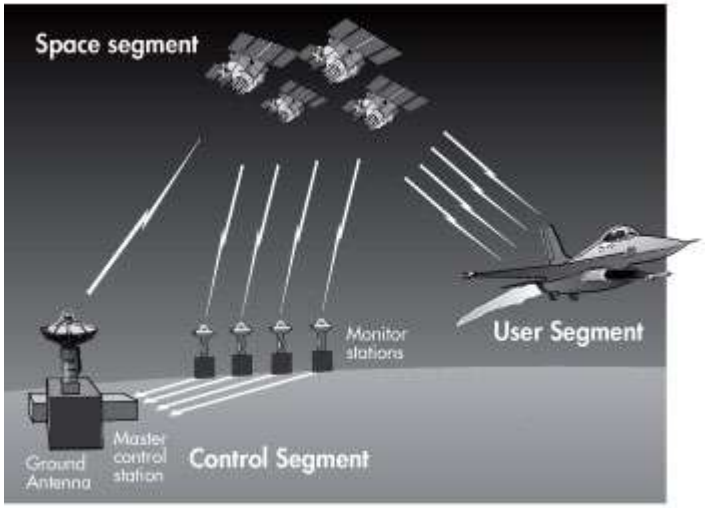
GPS
Global Positioning System

GPS can show you your exact position on Earth any time, anywhere, in any weather. The system consists of a constellation of 24 satellites (with about 6 "spares") that orbit 11,000 nautical miles above Earth's surface and continuously send signals to ground stations that monitor and control GPS operations.



GPS satellite signals can also be detected by GPS receivers, which calculate their locations anywhere on Earth within less than a meter by determining distances from at least three GPS satellites.

GPS has three parts: the space segment, the user segment, and the control segment. The space segment consists of a constellation of satellites
The user segment consists of receivers, which you can hold in your hand or mount in a vehicle
The control segment consists of ground stations (five located around the world) that make sure the satellites are working properly.
The master control station at Schriever Air Force Base runs the system.

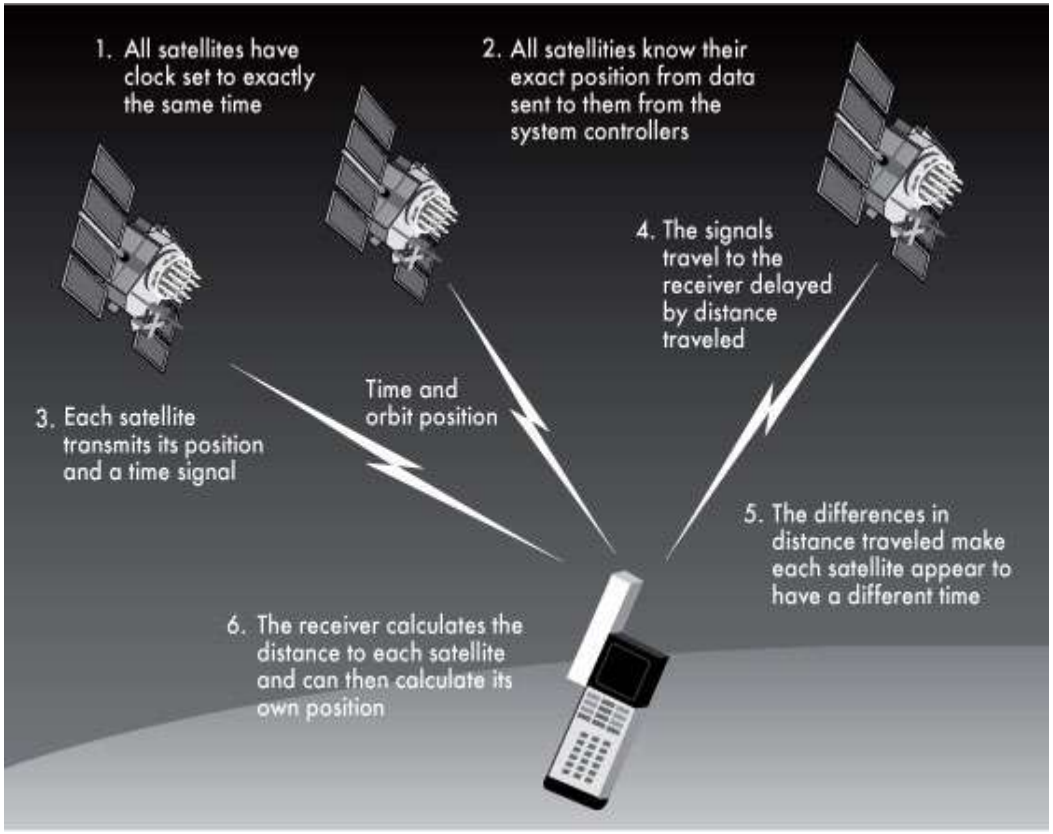


The principle behind GPS is the measurement of distance (or "range") between the satellites and the receiver. The satellites tell us exactly where they are in their orbits.

If we know our exact distance from a satellite in space, we know we are somewhere on the surface of an imaginary sphere with a radius equal to the distance to the satellite.

If we know our exact distance from two satellites, we know that we are located somewhere on the line where the two spheres intersect.

And, if we take a third and a fourth measurement from two more satellites, we can find our location.



DGPS (Differential GPS) corrects inaccuracies in the GPS system,and can yield measurements good to a couple of meters

WAAS (Wide Area Augmentation System) corrects for GPS signal errors caused by ionospheric disturbances, timing, and satellite orbit errors, WAAS consists of 25 ground reference stations positioned across the US. Two master stations collect data from the reference stations and create a GPS differential correction message, which is broadcast through one of two geostationary satellites. The information is compatible with the basic GPS signal structure, which means any WAAS-enabled GPS receiver can read the signal.

GMRS /FRS

General Mobile Radio Service / Family Radio Service

Moderate high power radios for general family/recreation communications.

GMRS (Class A CB), 462.550 – 467.725 MHz
5W – 15W fixed base stations, 50W repeaters allow for longer ranges
$75 FCC licence required

FRS ("UHF CB"), 462.5625 – 467.7125 MHz, FRS Channels 1-14
500mW max
unlicensed, no antenna modification allowed
some overlap and interoperability with GMRS frequencies

GMRS not to be confused with GPRS / GPS

GLOBAL CONNECTIVITY
PROSOCIAL GLOBAL TRANSFORMATION