

IPv6, Mobility, and the Ever Smarter World

Opportunities for Consumer Electronics' Internet Innovators

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Chairman, Charmed Technology

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Founder, The 4G Society

Wireless Money: The 5 M's

- **Movement: escaping the fixed place**
- **Moment: expanding the concept of time**
- **Me: extending myself and my community**
- **Money: expending financial resources**
- **Machines: empowering devices.**

Deeper Services

- **Movement: Mobility, Locality, Globality, Home Base, Positioning**
- **Moment: Plan, Postpone, Fill Time, Catch Up, Multitask, Real Time**
- **Me: Customized, Relevant, Community, Permission, Presence, Multisession (most powerful, relates to 'cool' self image)**
- **Money: M-commerce, Micropayments, M - banking, M-wallet, M-advertising, Sponsorship**
- **Machines: Telematics, Metering, Remote Access, Appliances, Robotics, Automation, Connecting with Anything and Everything**

The New World of Mobile Geolocation

ActiveCampus

Rubio's at UC 501

Roundtable

S:2 S:6

Cafe Rona

Subway Rubio's UC 50

Sarah

Hendy's UC

brad Wraps S:2

Bookstore Hok's Up UC 50

Acad. UC 411

Chancellor 104

S:2

Now Buddies Sites Maps Msg Graf >>

ActiveCampus

To: brad, 5:42pm Wanna go eat?

brad, 5:43pm Yes

Previous << 1 2 3 4 5 >> Next

Mark All Messages as Read

To: brad

can't

hi meet? eat? y n ok

Send

Now Buddies Sites Maps Msg Graf >>



Exercise Was the First Wireless Monitoring Application

POLAR.

HOME | STORE | PRODUCTS | REGISTRATION AREA | COACHES CORNER | ASK DR. ED | EVENT SCHEDULE

CONTACT US | SERVICE/REPAIR | CORPORATE | PRESS ROOM | FIND A DEALER | DEALER ACCESS

EQUIPMENT MANUFACTURER

WHO ARE YOU?

Losing Weight Comes Down to Three Things...

**Diet
Exercise
and the
m52**

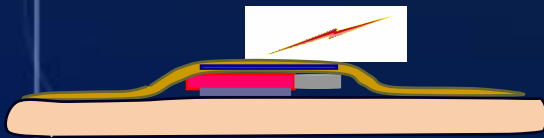
PHYSICAL EDUCATOR | MEDICAL PROFESSIONAL | EQUIPMENT MANUFACTURER | HEALTH CLUB / FITNESS PROFESSIONAL | GOVERNMENT / OCCUPATIONAL FITNESS

As Our Bodies Move On-Line Digital Medicine Will Emerge



www.givenimaging.com

- **New Sensors—Video Pill**
 - Battery, Light, & Video Camera
 - Images Transmitted to Hip Device
- **Next Step—Putting You On-Line!**
 - Wireless Internet Transmission
 - Key Metabolic and Physical Variables
 - Model -- Dozens of Processors and 60 Sensors / Actuators Inside of our Cars
- **Post-Genomic Personalized Medicine**
 - Combine Across Populations
 - Genetic Code
 - Digital Imaging
 - Body Data Flow
 - Use Powerful AI Data Mining



www.philometron.com

Current and Potential Markets for Remote Patient Monitoring

- **Wellness**
 - Fitness Monitoring
 - Obesity Epidemic
- **Ambulatory Hospital Patients**
- **Cardiac Out Patients**
- **Elder Care**
 - Global Population of People Over 65, Will Increase 88% by 2025
- **Clinical Trials**
 - New Drug Discovery
- **Emergency Response**
 - Natural Disasters
 - Homeland Security

What is a SensorNet?

- **Sensors**
 - Physical, Chemical, Biological, Imaging,...
- **Sensor Platform**
 - Computing, Power, Storage, Radios, ...
- **Telecommunications Infrastructure**
 - Wired, Wireless, Internet, ...
- **Sensor Arrays**
 - Homogeneous, Inhomogeneous, Ad Hoc, ...
- **Layered Software**
- **Backend Data Systems**

Sensor subscriptions very valuable!

- Eric Frost: 30 measures of oil extraction allows doubling, from 35% to 70%, of recoverable oil from a given reservoir.
- Will Recker: World Wide Wagon Train of 737 million to 1 billion vehicles that exchange information on the road ahead.
- John Orcutt: From Buoys to MEN (Marine Environmental Networking).
Weather prediction, climate change, government.
- Articles are on <http://www.calit2.net>. Search site for “Alex Lightman”

Multi-Sensor Data Fusion Control Rooms Will Integrate SensorNets with Legacy Data

- Common Needs for Research or Emergency Response
 - Situational Awareness
 - Common Operational Picture
 - Local Data Warehouse with Remote Data Access
 - AI Data Mining of Distributed Databases
 - Spatial Data Analysis
 - Consequences Assessment Tool Set

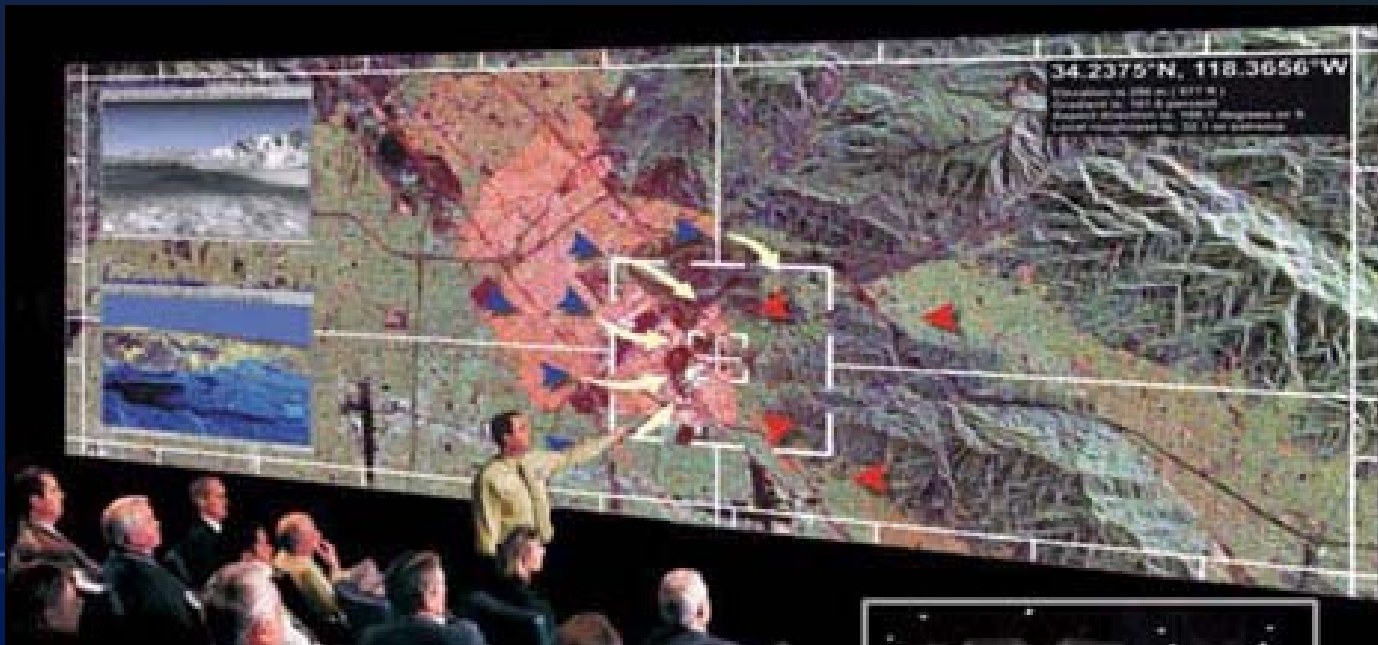


Image Source: Panoram Technologies

The New Powers of Ten

<u>Time</u>	<u>Platform(s)</u>	<u>Network Operations Model</u>	
1960-1980	Mainframe/ IBM era	10:1 people/machine ratio	<p><i>Old network management systems were single vendor solutions optimized for cost in rigid five-year preplanned networks.</i></p>
1970-1990	Minicomputer/ DEC era	1:1 people/machine ratio	
1980-	Workstation/ PC era	1:10 people/machine ratio	
1990-	Enterprise networks/ Cisco era	1:100? people/machine ratio	<p><i>New network operations systems must be designed for <u>adaptability and change</u> (new equipment, multiple vendors, new service offerings/provisioning).</i></p>
2000-	Broadband packet networks ?	1:1000? people/machine ratio	

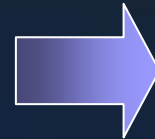
1000's of subscriptions/person

- Given Imaging's camera/sensor pill that you swallow, with data recorded onto a hiptop Personal Black Box.
- Medical Microelectronic Machines (later nanodocs) tied to NIH databases doing real-time assessment against millions of high resolution medical records, each with IP address.
- Localizers as described in Vernor Vinge's A Deepness in the Sky will link internal and external bodies.
- The value of curing cancer, heart disease approx. \$50 trillion each. Milken Institute.

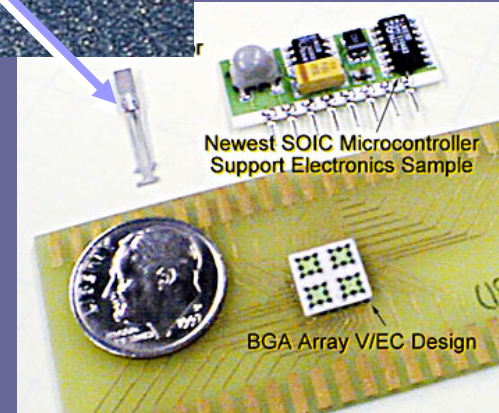
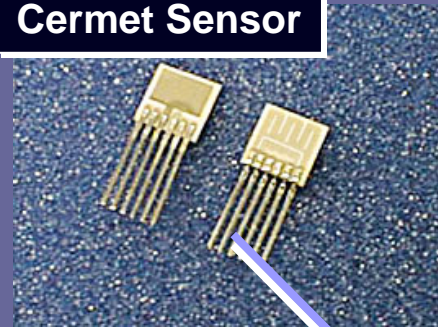
Putting Laboratories on a Chip



\$ 300,000



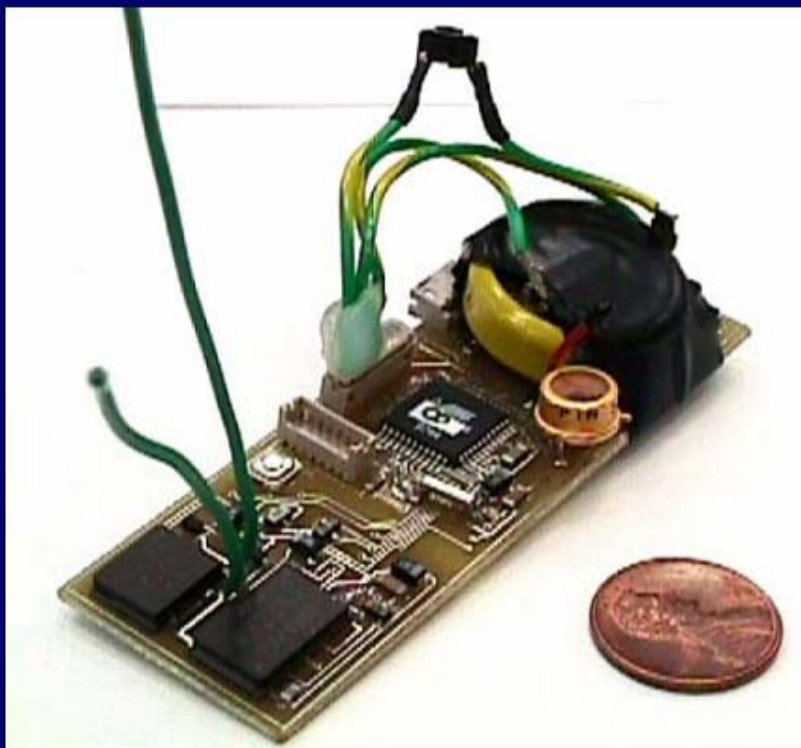
Cermet Sensor



\$ 10

COTS Dust - RF Motes

- Simple computer
- Cordless phone radio
- Up to 2 year battery life



2 Axis Magnetic Sensor



2 Axis Accelerometer



Light Intensity Sensor



Humidity Sensor

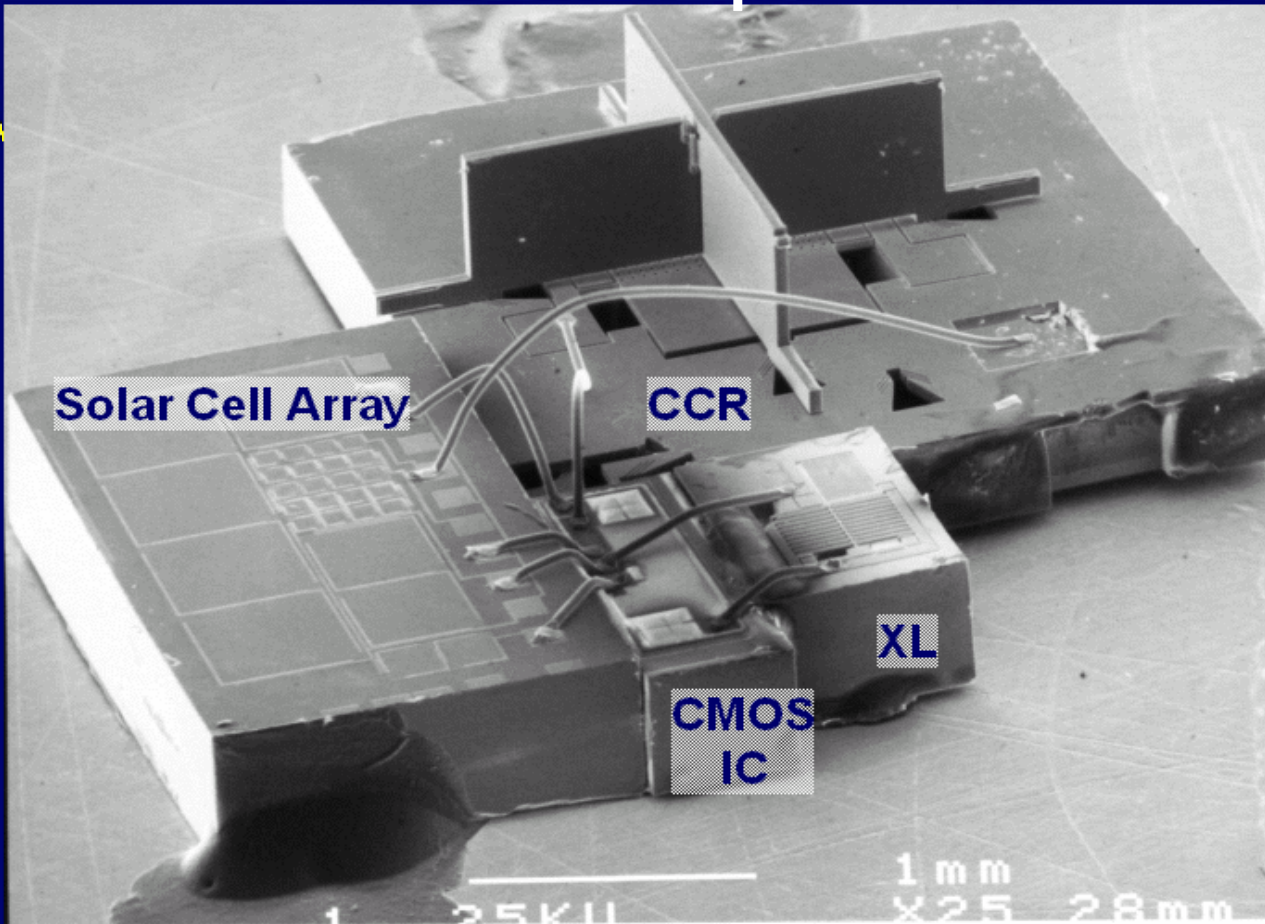


Pressure Sensor



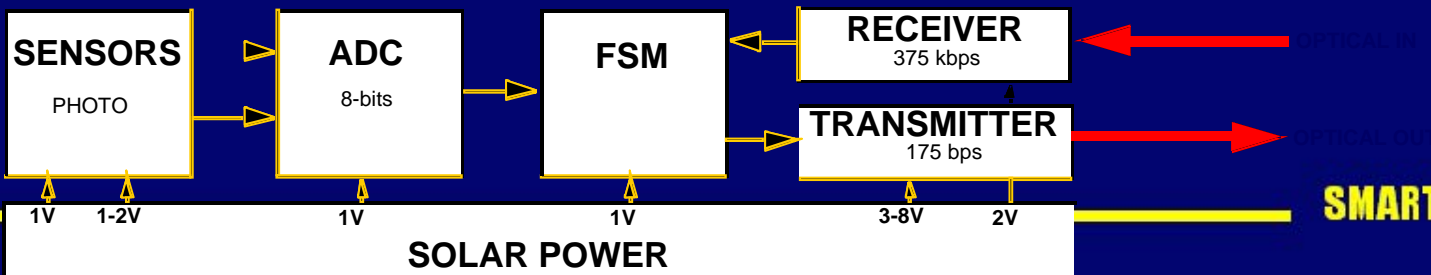
Temperature Sensor

16 mm³ total circumscribed volume
~4.8 mm³ total displaced volume



Source:
Pister,
Berkeley

CITRIS
University of California

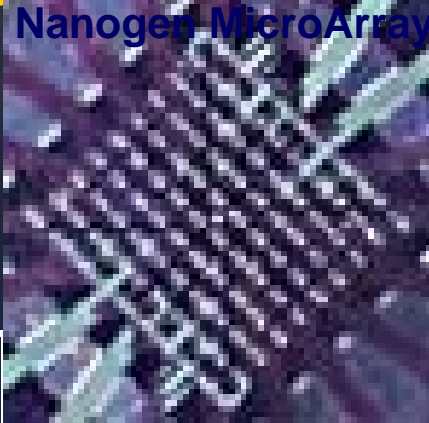


Over the Next Decade Nanobioinfoengineering Will Revolutionize SensorNets

500x
Magnification

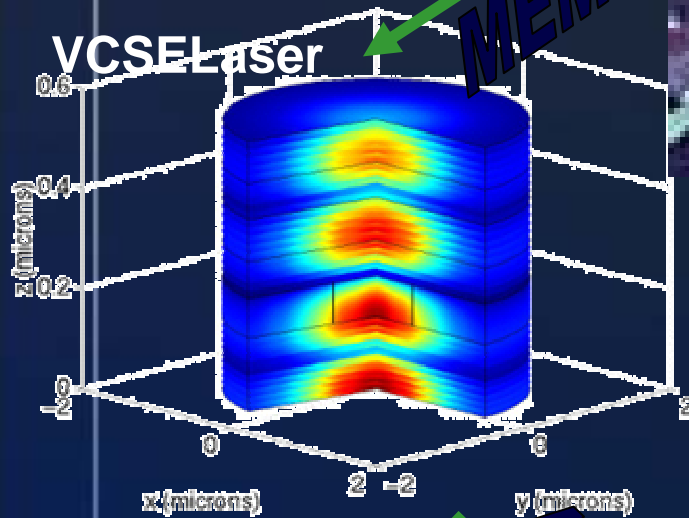
Nanogen MicroArray

2 mm



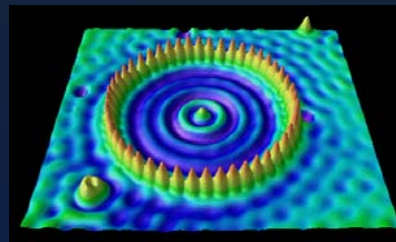
VCSEL Laser

MEMS

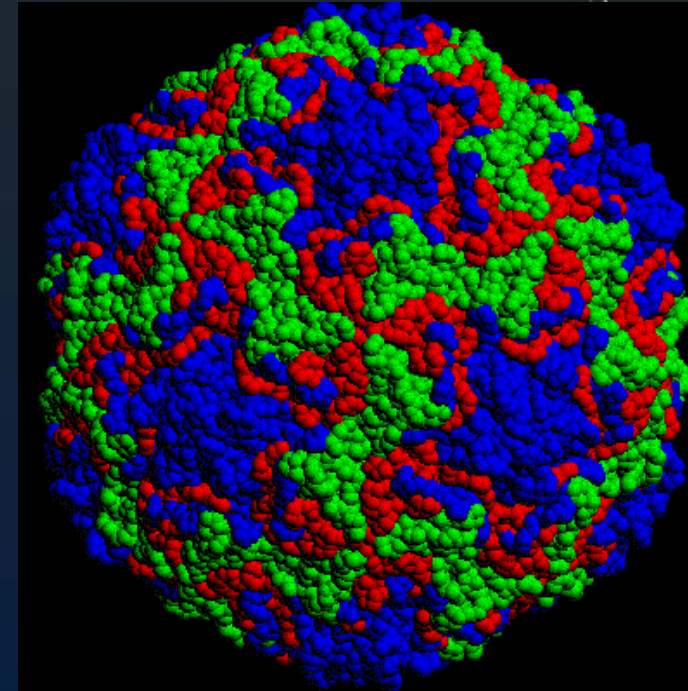


400x
Magnification

NANO



IBM Quantum Corral
Iron Atoms on Copper



Human Rhinovirus

5 nanometers

How do you manage all those tiny doctors?

■ IPv6

■ features

- ✓ 3.4×10^{38} unique addresses available
- ✓ Stateless autoconfiguration
- ✓ Security: authentication and encryption
- ✓ Mobility management

How can we secure these doctors? IPv6

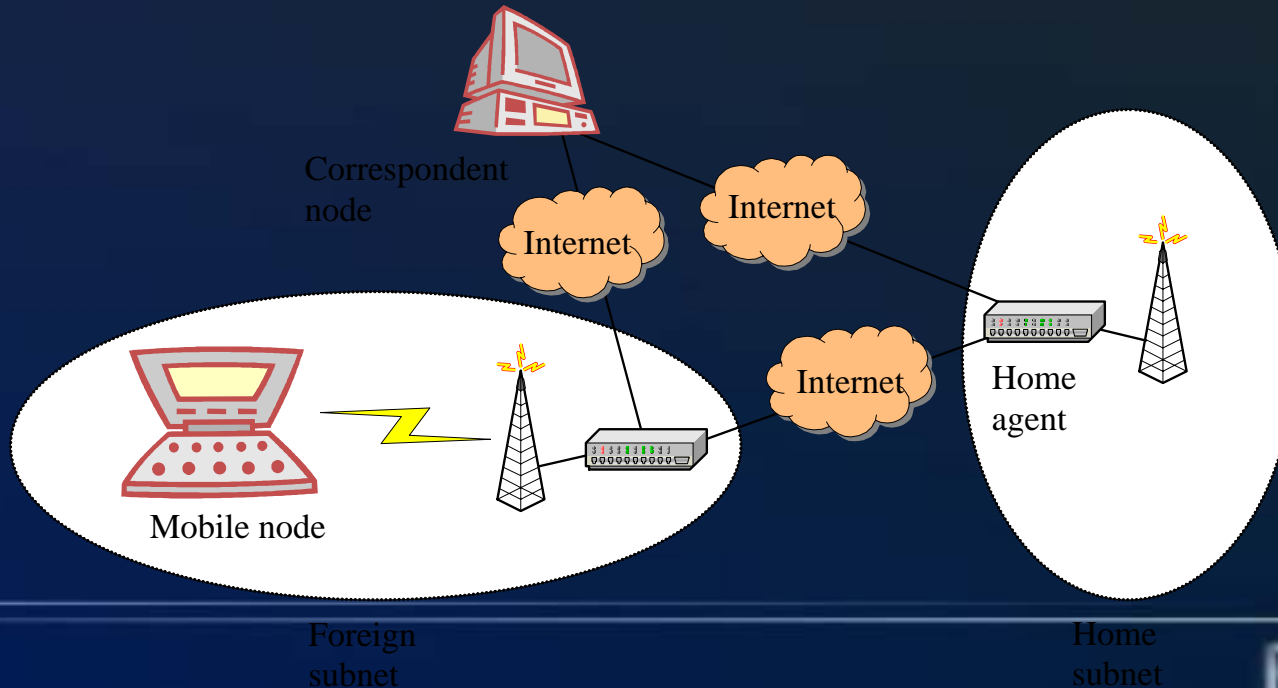
■ IPSec

- uses IPv6 extension headers
- security modes
 - authentication on IP level
 - encryption on IP level
- based on private and public key algorithms
 - manual or automatic key distribution
- allows secure end-to-end communication and Virtual Private Networks

Mobility management in IPv6

■ Goals

- transparency of mobility to higher layers
- addressability using the home address



The Gs

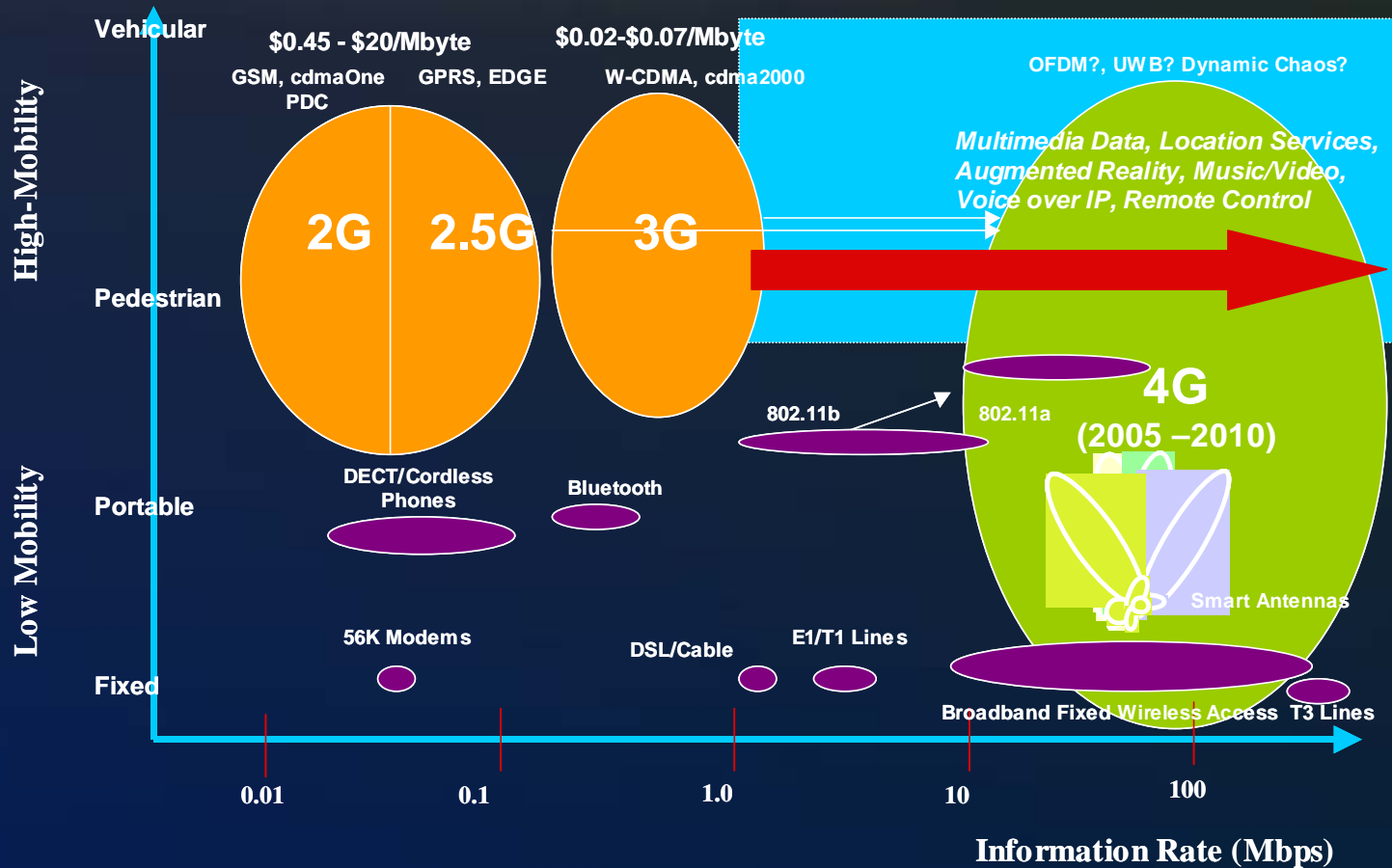
- **1G ⇒ 2G**
 - new system (GSM), same service (Voice)
- **2G ⇒ 3G**
 - new system (UMTS), new services (MM)
- **3G ⇒ 4G**
 - all systems, all services
 - ◆ integrated provision of personalised enhanced services over the most efficient/preferred networks (user profile)
 - ◆ multiple classes of terminals

Using IPv4 on 3G will create barriers:

1. Not enough IPv4 addresses to deploy large scale always-on service required for GPRS and 3G
2. Therefore no easy end-2-end security
3. No plug & ping (no ease of use, all manual and won't scale)
4. The triangular routing of Mobile IPv4 will eat up 50% of (expensive) spectrum

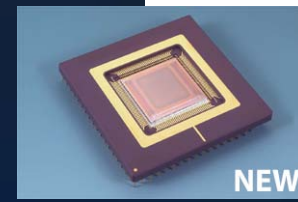
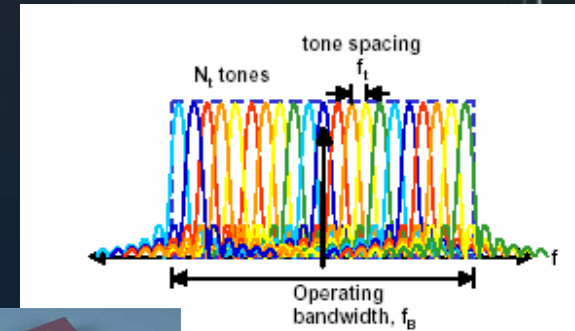
These are huge penalties to a large scale deployment of an always-on, easy to use, brand new mobile service.

The Next Logical Step In Wireless Data



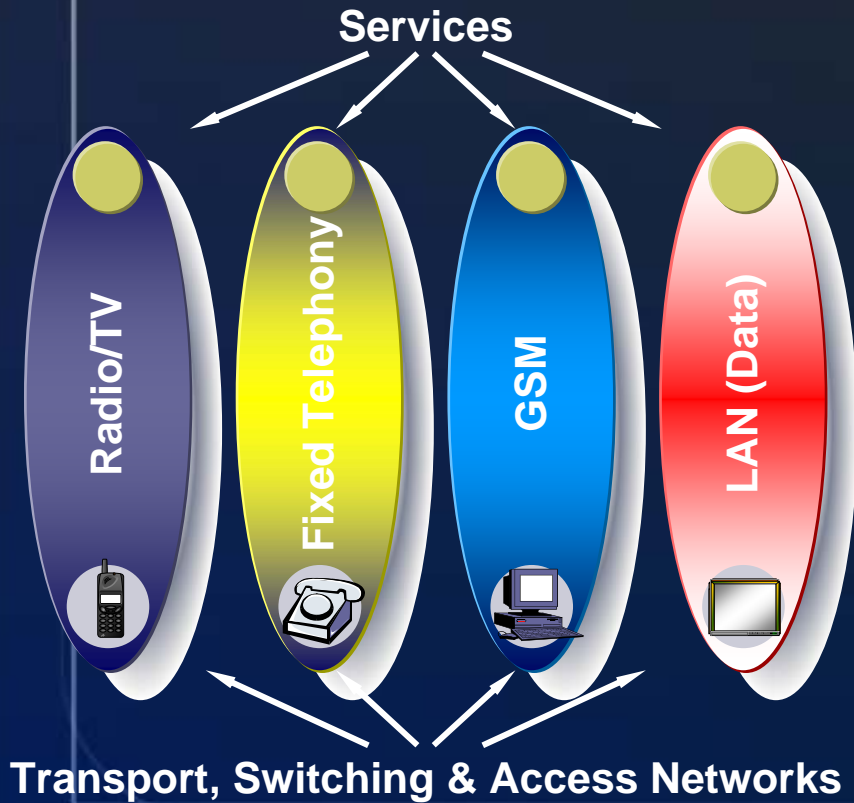
The 4G Technology Menu

- ❖ IPv6 (128-bit address space vs. today's 32-bit address space)
 - Home addresses, care-of addresses, sensors, Peer-to-Peer
- ❖ Short-Range Low-Power, Broadband Wireless Technologies
 - UWB, CDMA, Dynamic Chaos, W-LAN 802.11a,g,b
- ❖ Medium-Range, Medium-Power Nomadic/Full Mobility Broadband Wireless Technologies
 - OFDM, I-Burst [Arraycomm], OFDM+CDMA [FLARION]
- ❖ Smart Antennas and spatial processing
 - Base-stations, end user computer terminals, handsets
- ❖ Software Defined Radios [chips, boards, subsystems]
 - Amateur radio, police/public radio, military, mobile communications
- ❖ Very Low Power, High-Performance CPU embedded processors
 - Basis of software defined radios and intelligent sensors
- ❖ Wearable computer peripherals
 - Software remembrance agents, head-up displays, various input devices, wearable computer clothing



Multiservice Overlay Networks

Today Single-service networks



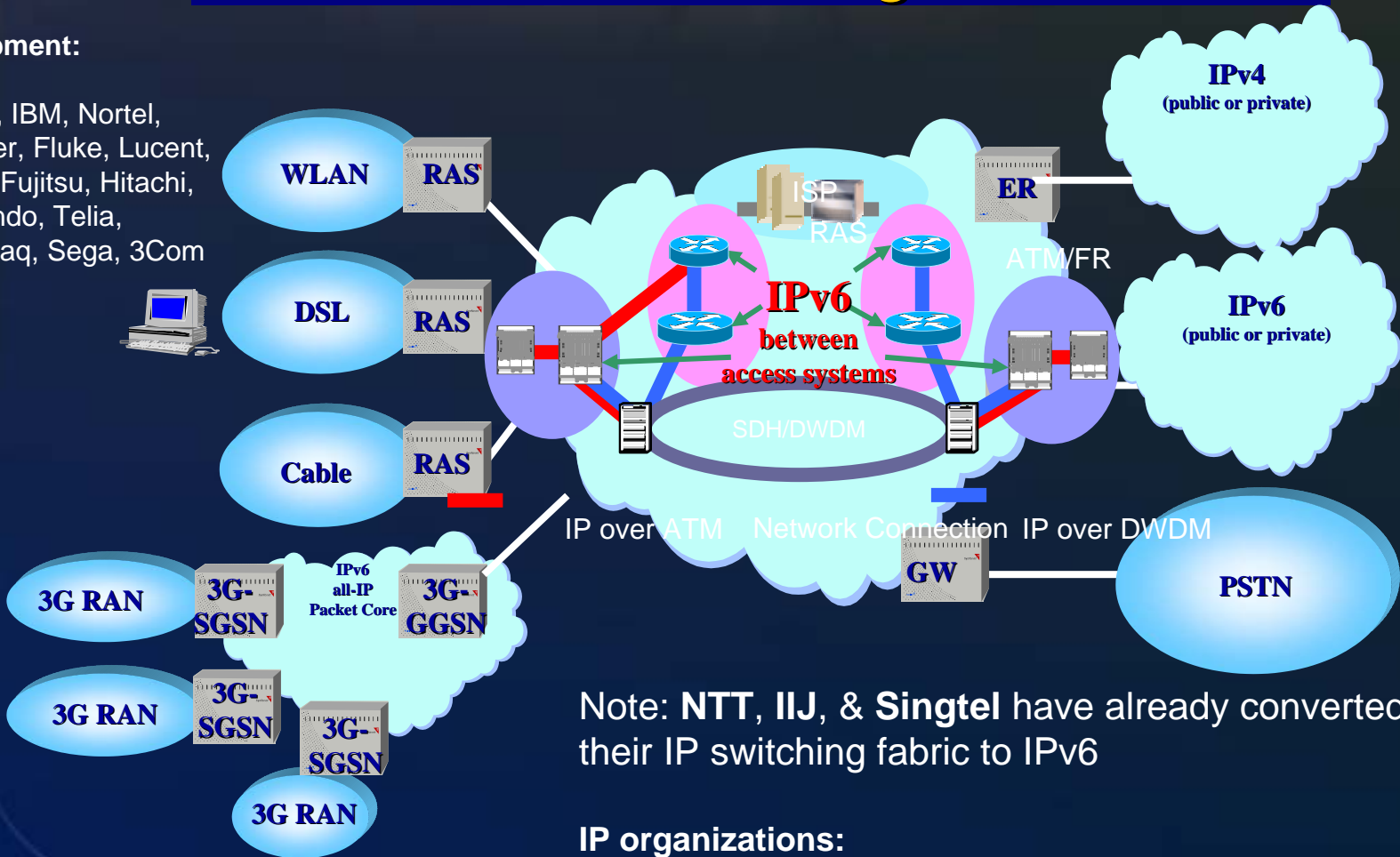
Future Multi-service networks



Potential of 4G realized as access networks migrate to IPv6

Equipment:

Cisco, IBM, Nortel, Juniper, Fluke, Lucent, NEC, Fujitsu, Hitachi, Nintendo, Telia, Compaq, Sega, 3Com



Note: NTT, IJ, & Singtel have already converted their IP switching fabric to IPv6

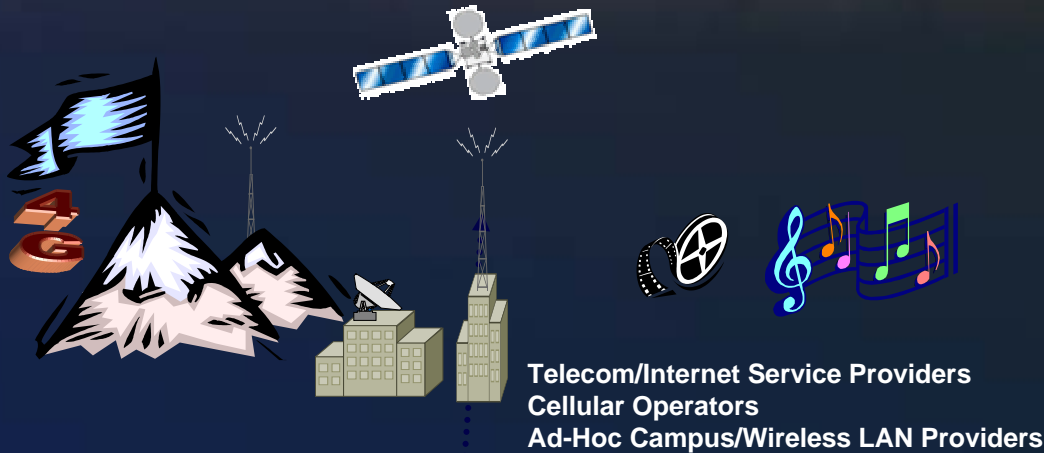
IP organizations:

www.ipv6forum.net, www.usipv6.com, www.v6pc.jp, www.ipv6.org

4G as an IPv6 integrator

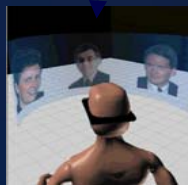
Seven Layers of 4G

7. Wireless Broadcast Layer
6. Cellular Layer
5. BFWA, W-LAN, MBWA
4. Wireless Gateway Layer
3. Wireless Personal Pico-Net Layer
2. Wireless/Wireline InfoSensor (Localizers) Layer
1. Wireline Transport Layer (Optical Fiber, DWDM, Ethernet – Fiber Hybrid Coaxial)



4G Personal Communicator

- Voice, fax, data
- MP3 Player
- PDA
- Storage
- Voice Recorder
- Language Translator
- Video Camera
- Health Monitor
- Augmented Reality(AR)
- AR Game Player



User 1

1 to 40 Mbps Radio Link

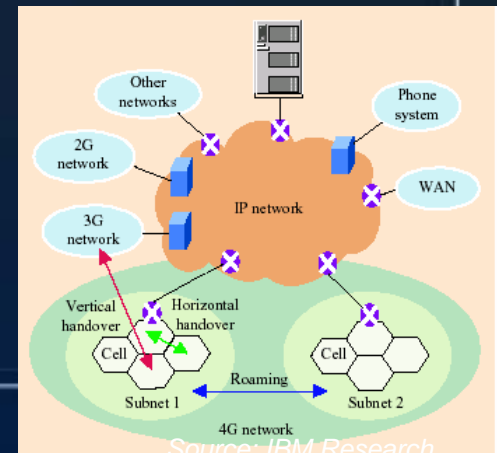


Home or Office



InfoSensors

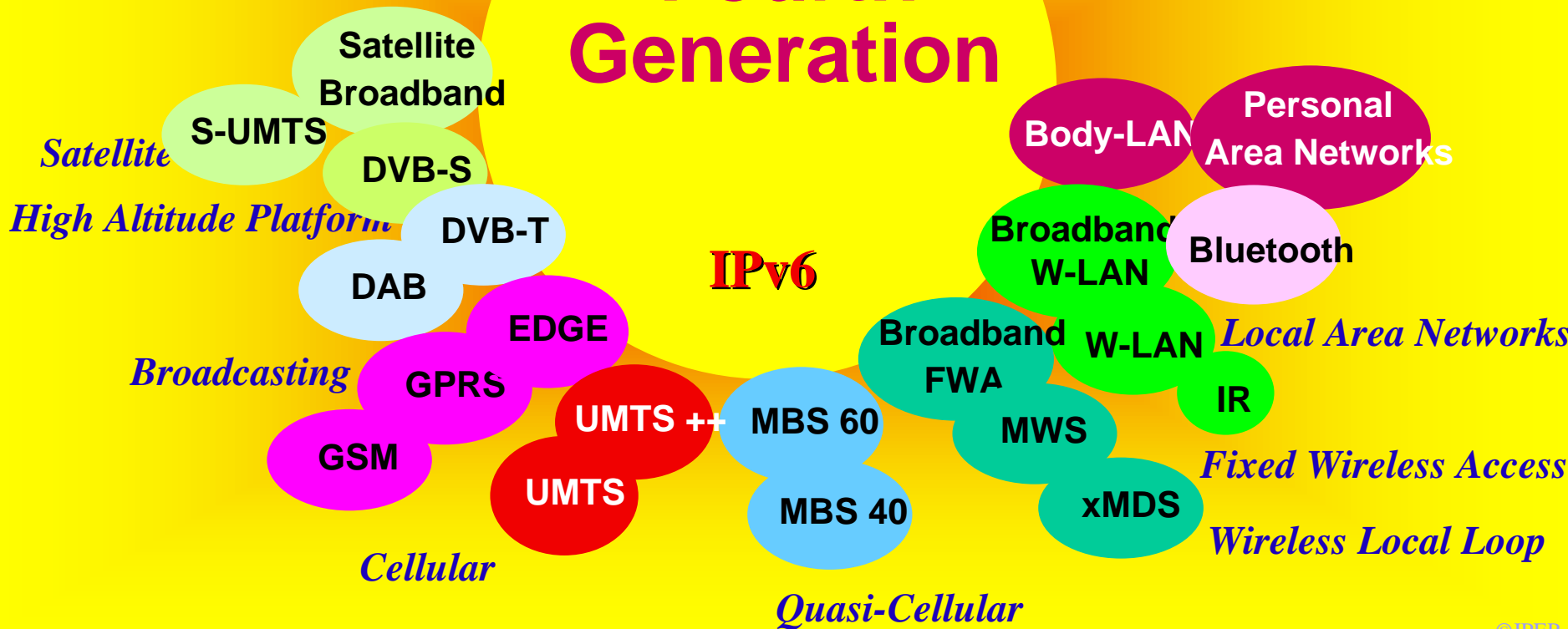
Hitachi RFID 2.4 GHZ
Chip 0.30 mm²



4G as the Integrator

Reconfigurable Radio

Fourth Generation

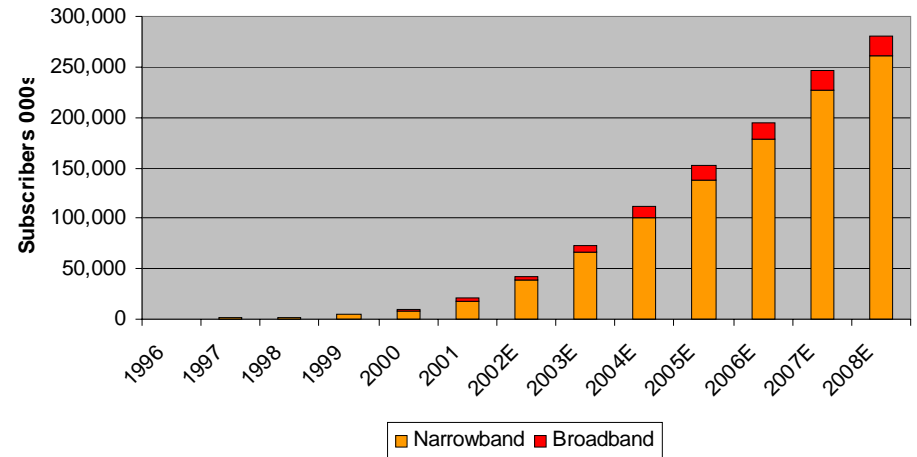


4G in China – 13 Accelerating Factors

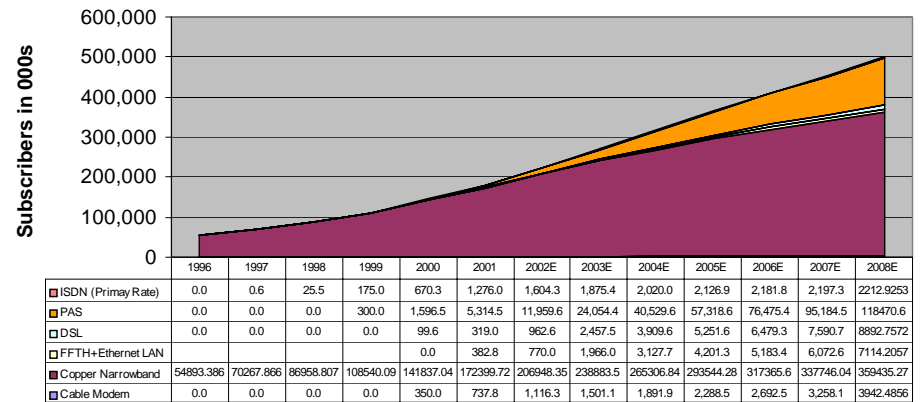
Many factors will push China into 4G faster than most planners had expected:

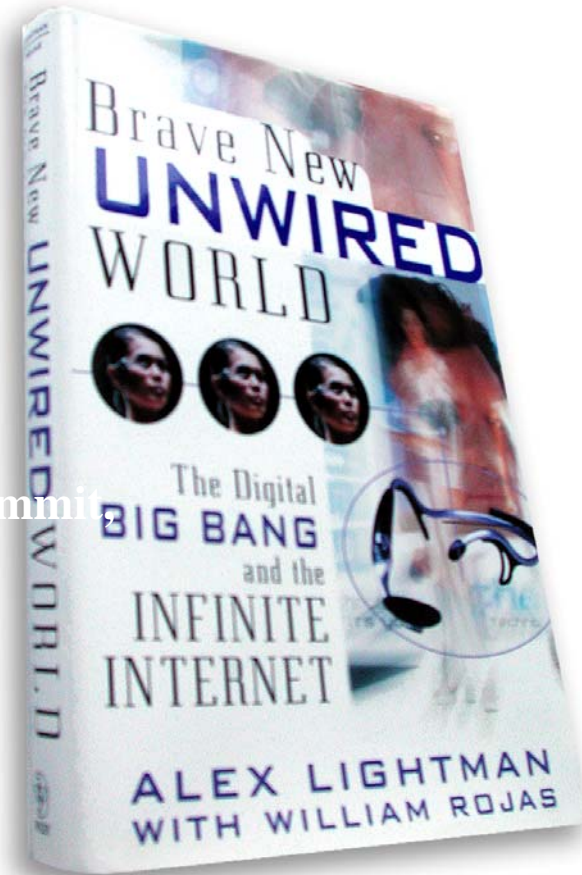
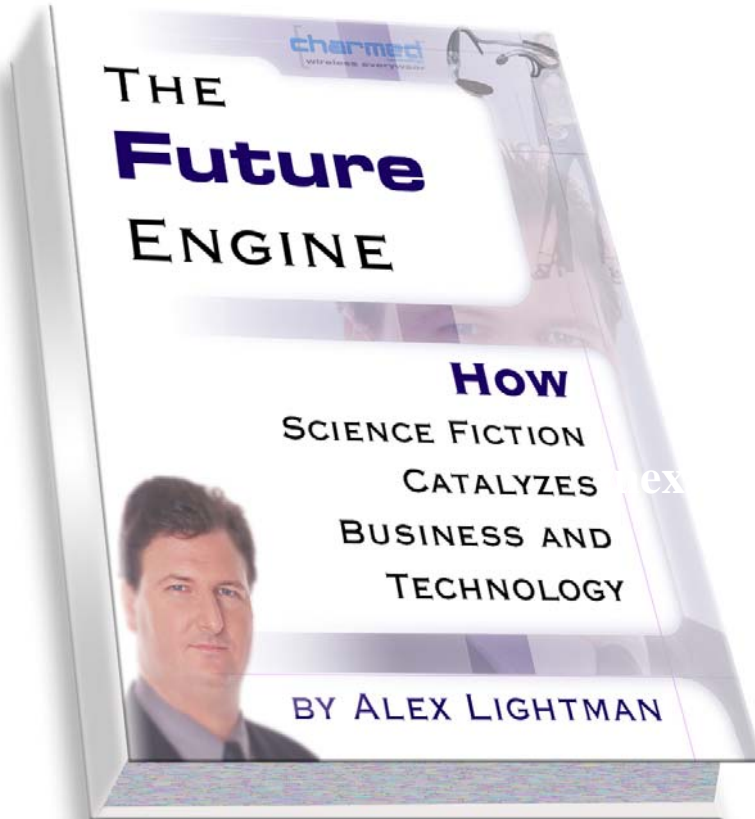
- Vast and profound implications for national security, public security and natural resource management
- National High Technology Research & Development Program (“863”) – “B3G
- Strong university research in computing, mathematics, communications, electronics, physics
- Large number of B.S., M.S. and PhD PRC students studying in the U.S., EU
- Cellular penetration growth and introduction of 2.5G services
- Growth of the internet and internet users/subscribers
- Vast fiber optic long haul and fiber optic metro networks (DWDM, Metro-ethernet, FTTx)
- W-LAN growth
- Phenomenal growth of PHS PAS services from China Telecom & Netcom
- Desire to cultivate made-in-China intellectual property in computing, communications, consumer electronics and radio electronics
- Issuance of 3.5G broadband wireless licenses
- TD-SCDMA’s affinity for smart antenna solutions
- Ministry of Science has been given the national mission of promoting 4G

China: Internet Accounts



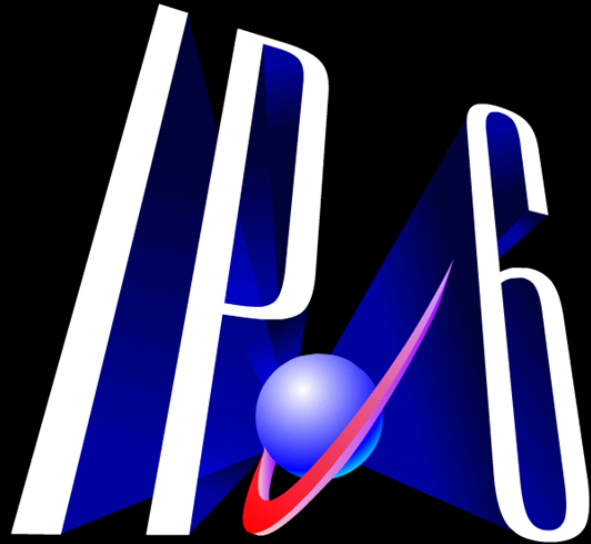
China Subscribers





Books come with 24 hour tech support, lunch, and a friendship

UNITED STATES



GLOBAL SUMMIT

Thank you!

Please stay in touch.

Alex Lightman

Alex@usipv6.com

Tel. 310 717 7745

You are invited to attend the next IPv6 Summit in
Santa Monica, CA at the Loews Resort Hotel

www.usipv6.com