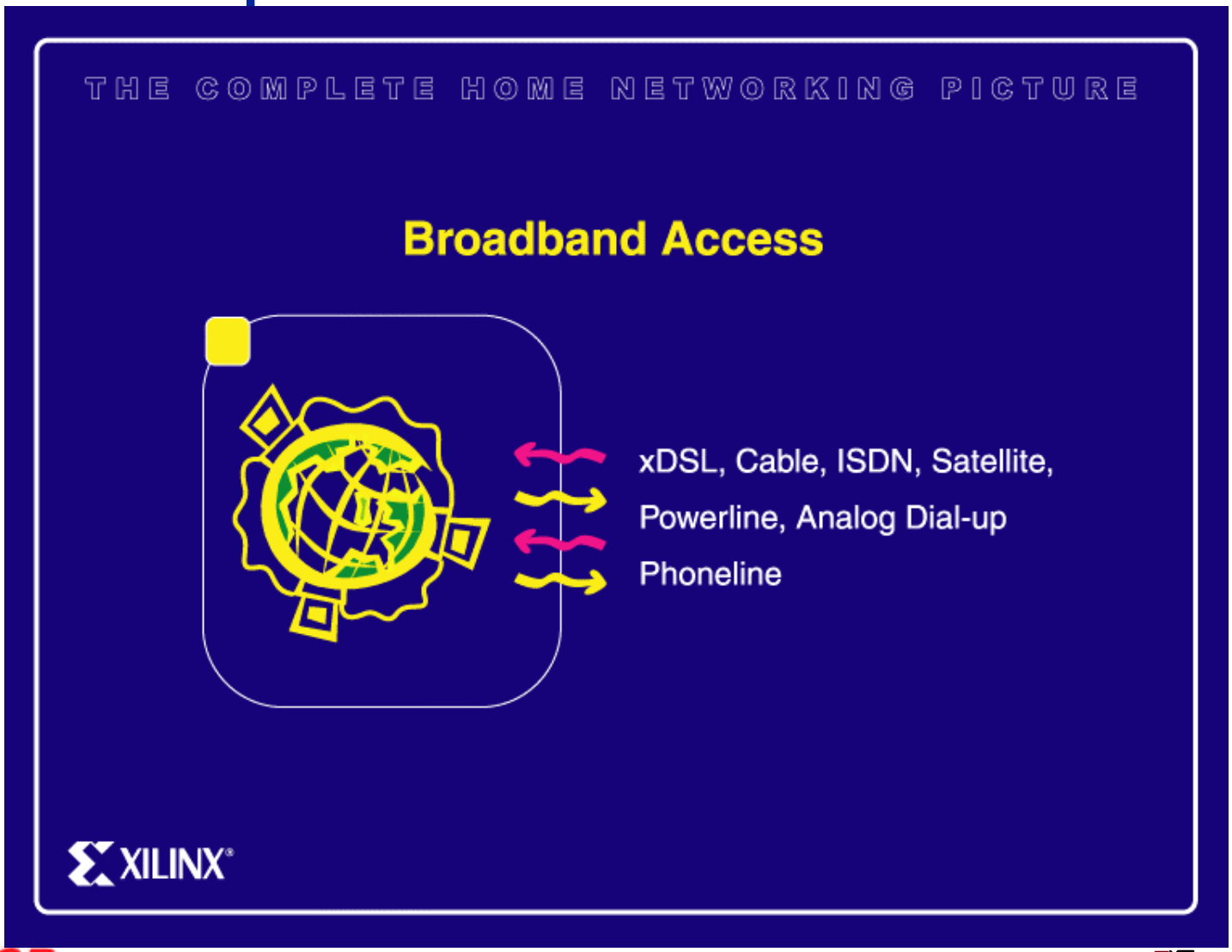
Home Networking - The Complete Solution

Vision

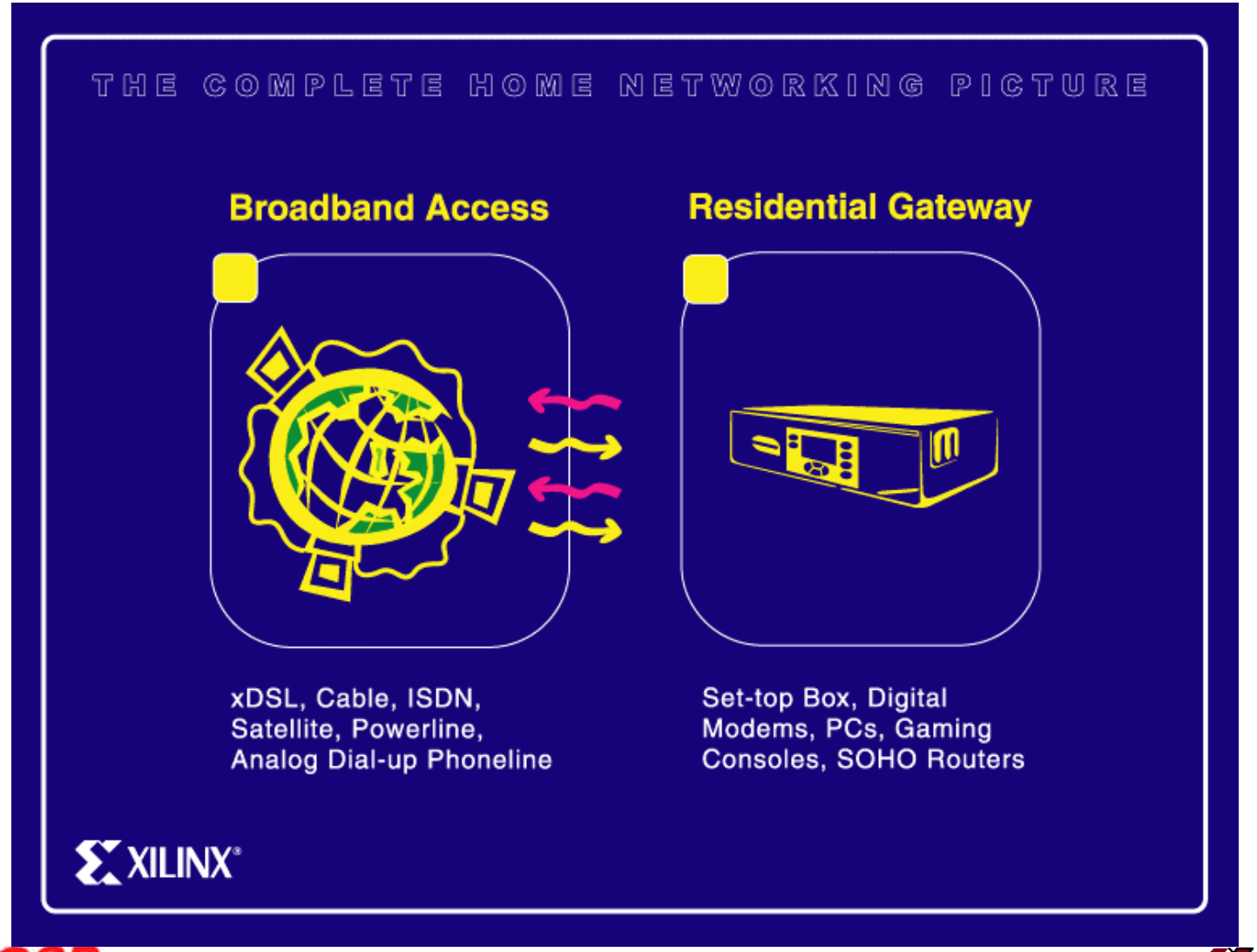
Goal of Home Networking

- Provide the ability to access information, entertainment and communicate anywhere, anytime
  - Bring the Internet to the hands of the consumer
  - Interconnect people in data, voice and video
    - Enables users to communicate & share data
  - Bring interconnectivity to intelligent devices
  - Always on, anytime, anywhere access to the home network

Four Aspects to Home Networking



Four Aspects to Home Networking



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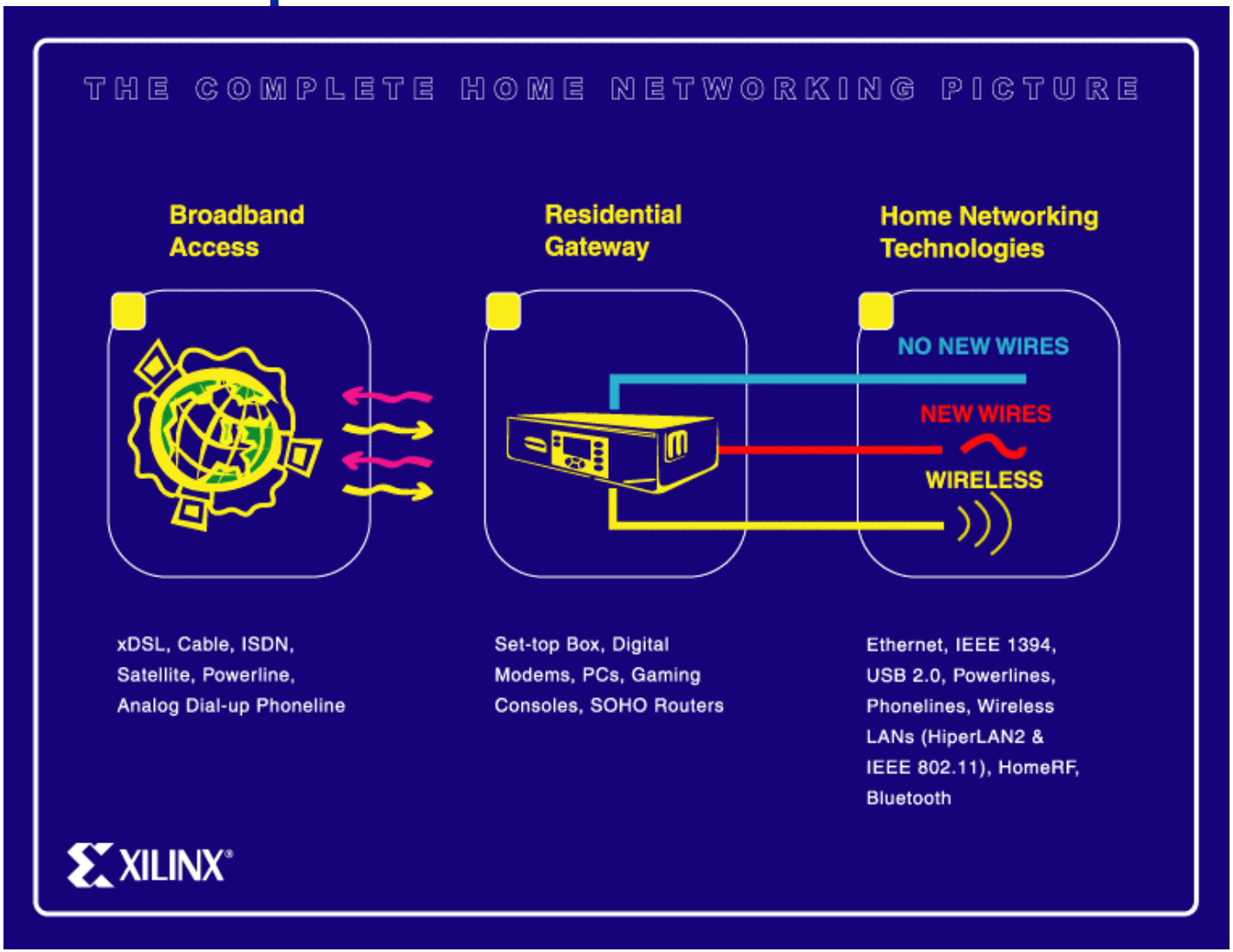

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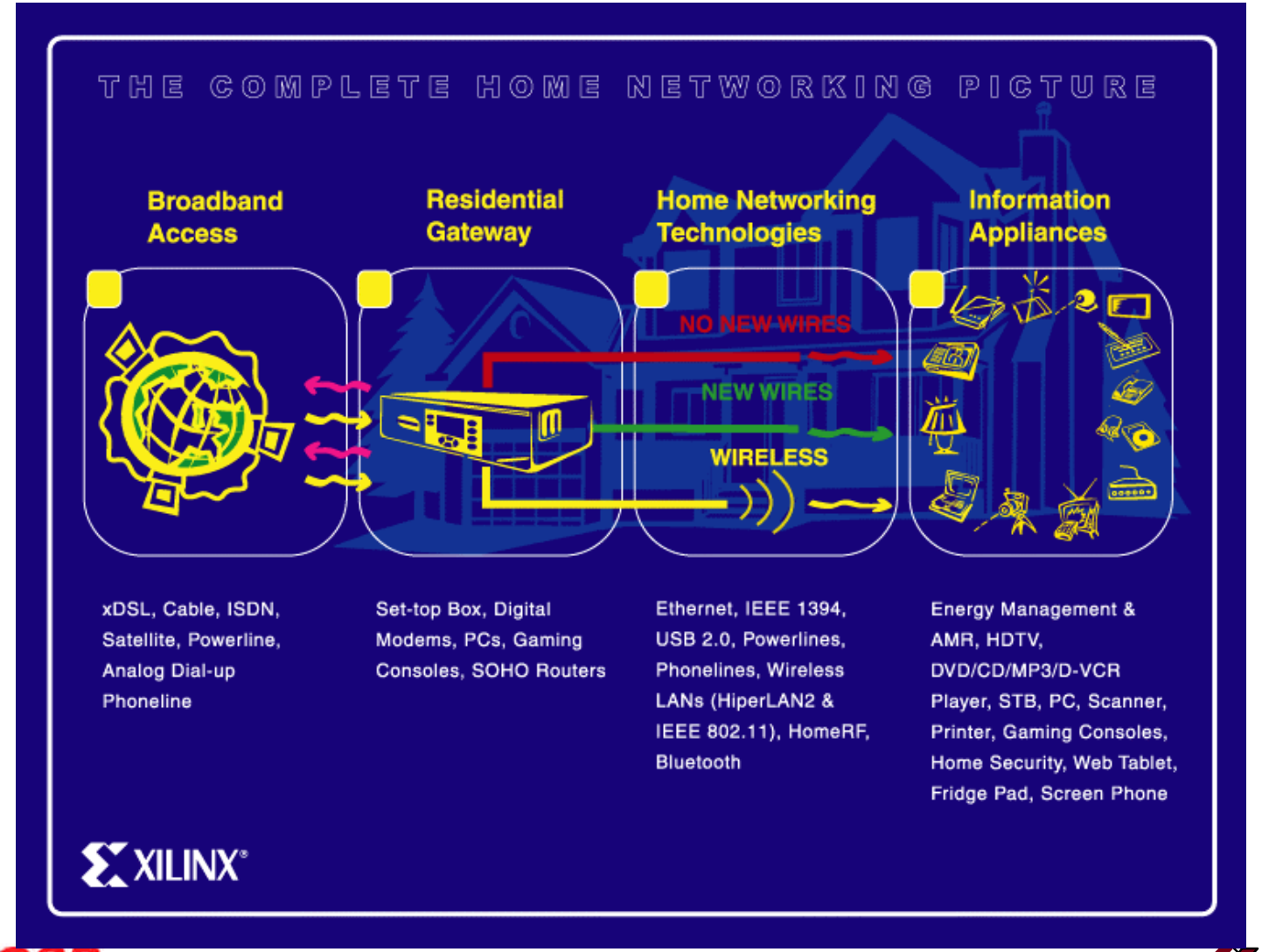


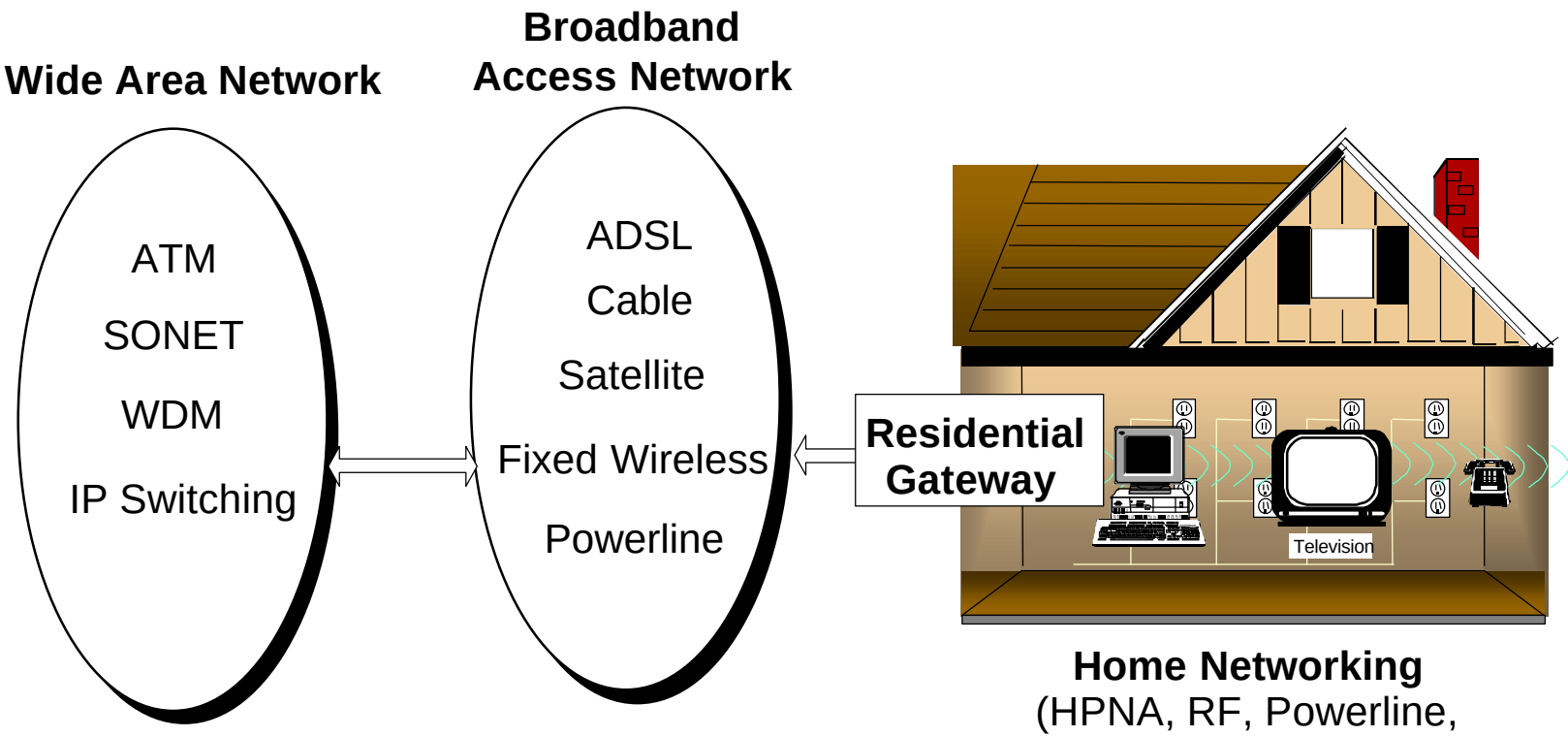
Market Requirements and Solutions Available

	Market Requirements	Solutions Available
Broadband Access	High Speed Access for Data, Voice and Video, Always on, Simultaneous Up-link &Down-link Communication, Support Simultaneous and Multi-User Access	xDSL, Cable, Powerline, Satellite, Mobile/Wireless
Residential Gateway	Provides Access into the Home, Remote Management Access Platform, Bridging between Different Networks, Firewall and Security, E-Services Capabilities	Open System Gateway initiative (OSGI), Jini, UPnP, HAVi, DVI
Home Networking Technologies	Low Cost, Speed, Mobility, Quality of Service, Security, Reliability, Ubiquity, Ease of Use	No new wires (Phonelines, Powerlines), New wires (Ethernet, 1394, USB2.0, Optic Fiber), Wireless (HomeRF, Bluetooth, Wireless LAN)
Information Application Networks	Digital electronics with advanced computational capabilities that add more value and convenience when networked	Digital TV, HDTV, set-top box, internet screen phones, digital VCR, gaming consoles, MP3 players, cordless phones, security systems, utility meters, PCs, web pads & terminals, PDAs, digital cameras, auto PCs etc.

Broadband Access

ADSL, Cable, ISDN, Satellite,
V.90 Modem/ Phonelines

RGs - The Integral Link Between Broadband Access & Home Networking



Home Networking
(HPNA, RF, Powerline, Firewire, Ethernet)

Source: Cahners In-Stat

Broadband Access Technologies

- ADSL - Asymmetrical Digital Subscriber Line
  - Comes in several forms
    - G.Lite ADSL & G.dmt ADSL
  - Always on & phone line is not tied up
  - Downstream speeds up to 8Mbps & upstream rates up to 1.5Mbps
- Cable
  - Internet access on the same cable as regular cable TV
  - Offered by cable companies
  - Subscriber requires a cable modem
  - Potential speeds up to 10Mbps
    - Number of users on the system affects speed

Broadband Access Technologies

- ISDN - Integrated Digital Services Network
  - High-speed, fully digital telephone service
  - Can operate at speeds up to 144Kbps
    - 5 or more times faster than today's analog modems
  - Widely available
- Satellite
  - Direct broadcast satellites that transmit TV programs can also provide Internet access
  - Satellite dish can deliver download speed of up to 350Kbps
  - Upload speeds are limited to ordinary analog modem speeds

Broadband Access Technologies

- V.90 Modem - Analog Phoneline
  - Modem is designed to operate with dial-up telephone lines worldwide
    - Supports high-speed analog data, high speed fax & audio/voice operation
  - Integrated modem is host controlled
    - Reduces chip count since there is no separate microcontroller
  - Data speeds up to 56Kbps from a digitally connected central site modem - V.90 enabled
  - Data can be sent upstream at speeds up to 33.6Kbps

In-Home Local Area Networks

No New Wires: Phoneline, Powerline

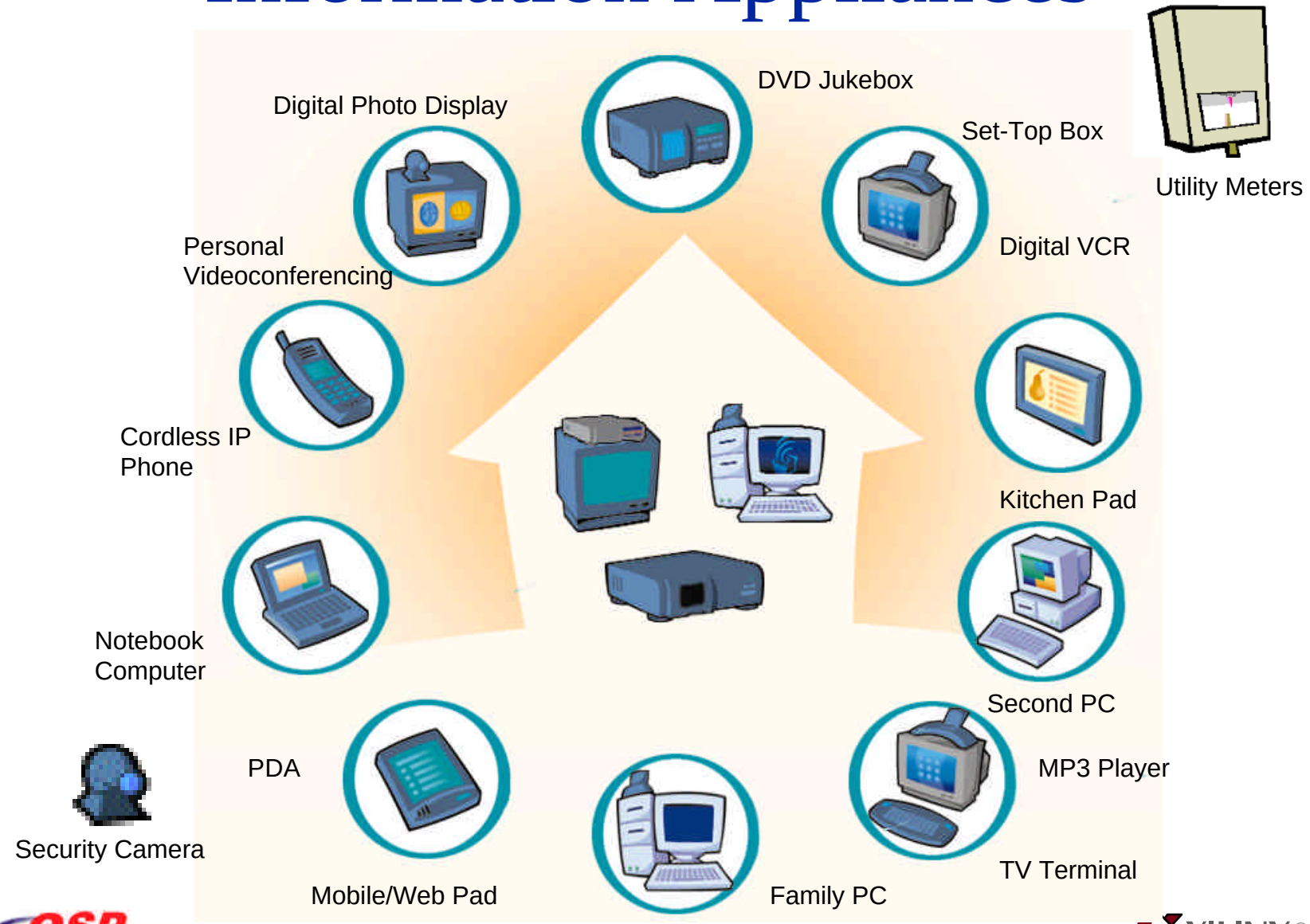
New Wires: Ethernet, IEEE-1394/Firewire

Wireless: HomeRF, Bluetooth, Wireless LANs - IEEE-802.11 & HiperLAN2

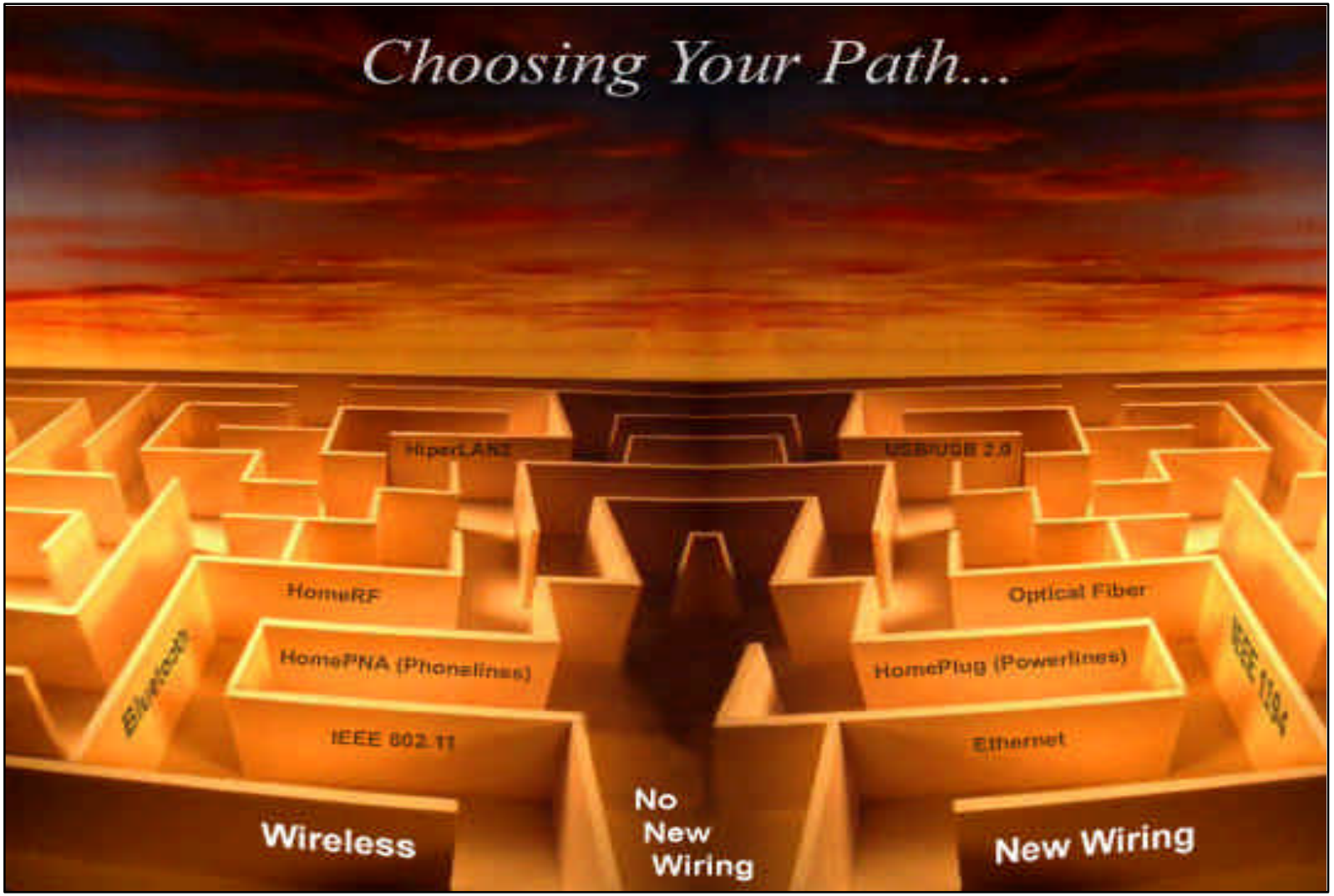
Key Information Appliances

- Digital TV
- Set-Top box
- Internet screen phones
- Interactive DVD players, Digital VCR
- Gaming devices
- MP3 players/audio Devices
- Cordless phones
- Security systems
- Utility meters
- PCs (desktop & notebook)
- Web (kitchen) pads
- Web/Email terminals
- PDAs (personal digital assistant)
- Digital Cameras
- Emerging technologies
  - Auto PCs

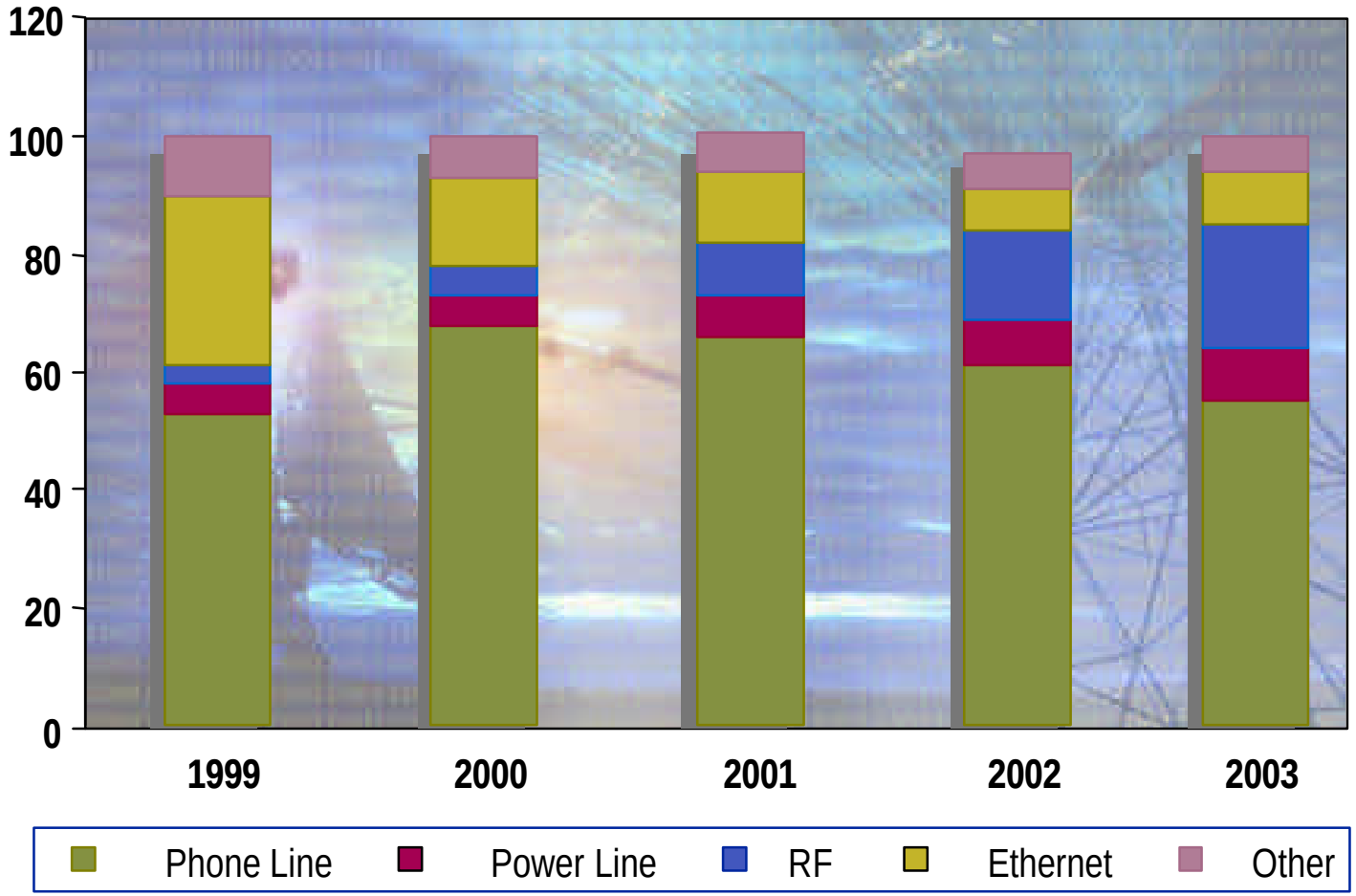
Information Appliances



Home Networking Technologies

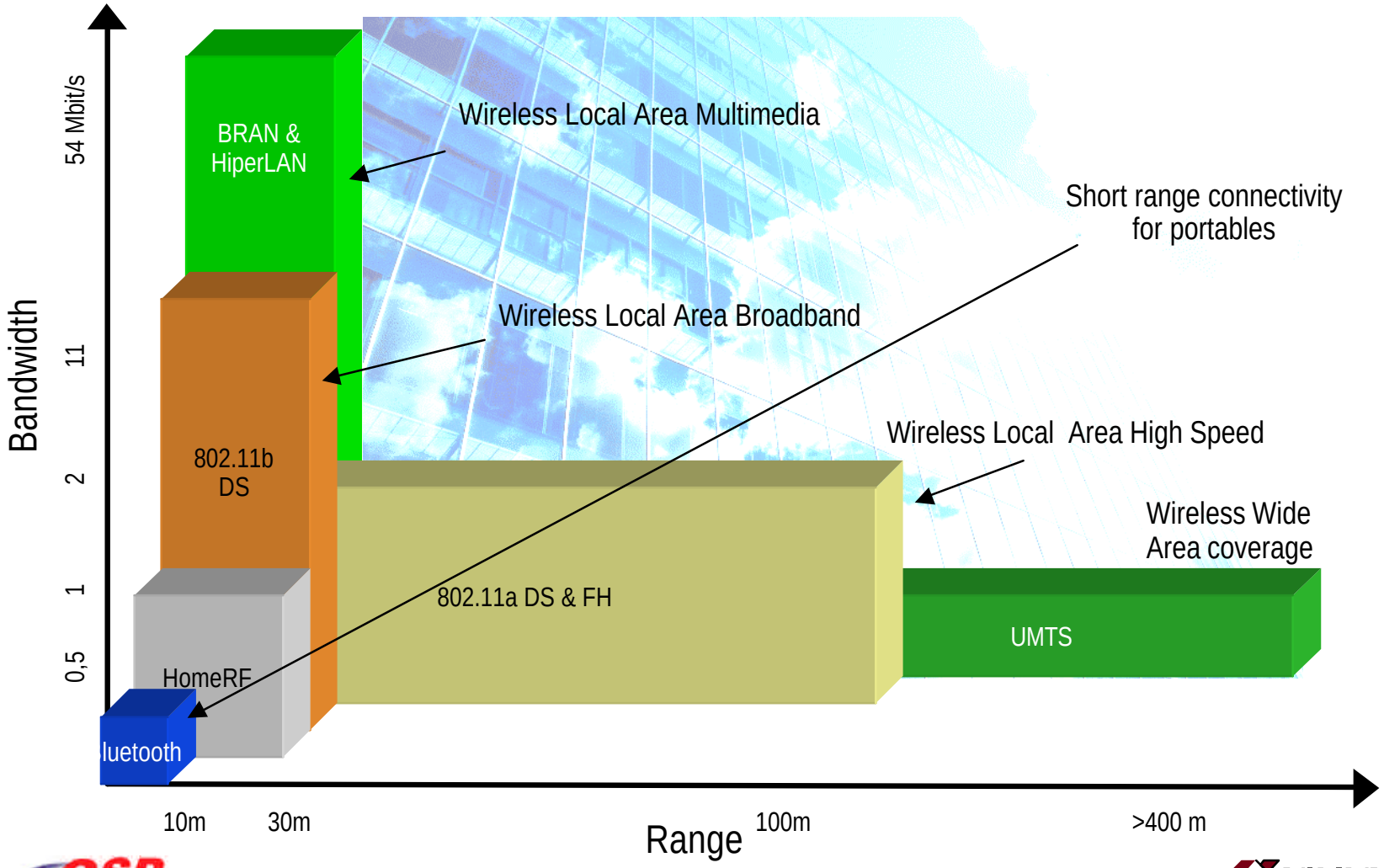


Market Acceptance



Courtesy: Dataquest

Wireless Technologies in Home Networking



Wireless In-Home Networking Technologies

- Bluetooth & IEEE 802.15
  - Personal area network for data & voice communications
- HomeRF
  - Home based data & voice transmissions
- Wireless LAN
  - High-speed wireless connectivity augmenting wired networks
  - IEEE 802.11 (a & b variations)
    - a - 5GHz standard based on OFDM
    - b - 2.4GHz standard based on Ethernet
  - HiperLAN & HiperLAN2
    - 5GHz standard based on OFDM

Bluetooth

- Short-range wireless data transmission technology - Personal Area Networks
  - Provide a simple module that will allow a wide variety of electronic devices to exchange data electronically over short ranges
- Low-cost, low power consumption methods of transmitting data without using wires
- By 2003, Bluetooth market could be worth $5 billion (SG Cowen)
- Major industry backing of Bluetooth SIG
  - Ericsson, Nokia, IBM, Intel, Toshiba, Motorola, Lucent, 3Com
  - 2000+ members today

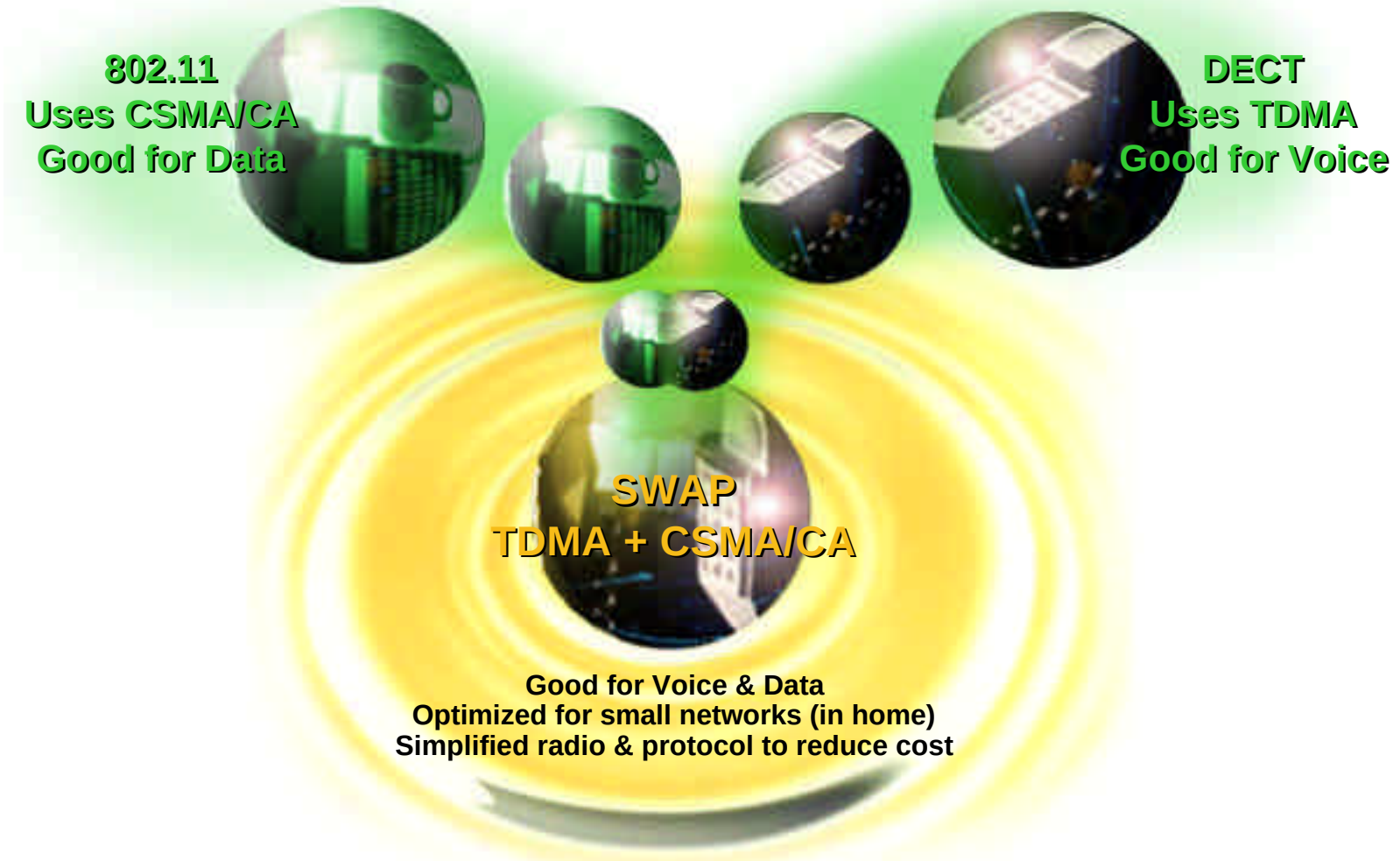
Key Characteristics & Capabilities of Bluetooth

- Transmits sound and data
- Used worldwide (standard technology)
- Ad hoc connection
- Open environment, but prevents external reception
- Compact, & able to be installed in a variety of devices
- Extremely low power consumption
- Open industry standard
- Low cost

HomeRF

- Enable broad range of interoperable consumer devices using RF anywhere in and around the house
- Led by HomeRF Working Group
- Technical
  - Low cost and voice support of DECT
  - TCP/IP support of 802.11 for data

HomeRF Origins



Both Data & Voice are Important for HomeRF

Wireless LAN

- Wireless Local Area Networks combines data connectivity with user mobility
  - Implemented as an extension to wired LAN
  - Minimizes the need for wired connections
- Radio or Infrared waves are used to transmit & receive data over the air
- Strong popularity in vertical markets for productivity gains
  - Health-care, retail, manufacturing, warehousing, academia
- Worldwide wireless LAN market
  - More than $2 billion revenues by year 2000 (Business Research Group)

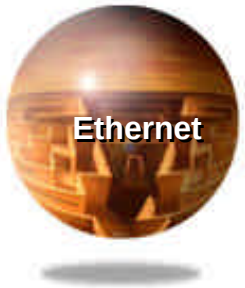
Phonelines-Based Home Networking

- In-home networking using existing phone lines
  - Connecting consumer devices such as PCs, TV, fridge, DVD/CD/MP3 players to each other and to the Internet
  - Rated up to 10Mbps
  - Supports up to 500 feet of phone wire between devices connected to RJ-11 jacks
- Phoneline home networking market outlook (by IDC)
  - In 2000, phoneline-based home networks will account for 34.4% of the installed base
  - By 2004, proportion will grow to 71.8% (a majority) of total home networking market's installed base

Powerlines-Based Home Networking

- Uses existing power & electric lines in the homes
  - Quite similar to phoneline networks
  - More AC/power sockets/outlets in a home than phone jacks
- Powerline realities - products run at 0.25 Mbps today
  - Data rates up to 10Mbps are possible, but
    - The greater amount of electrical noise on the line limits practical transmission speeds to much lower values
    - Widely varying transfer response - frequency & attenuation
    - Many different noise impairments at unpredictable times
      - RF jammers (particularly at night)
      - Time delay spread (multipath)
      - Usable bandwidth is not contiguous due to impairments or regulations
      - Channel Adaptation is required to achieve high data rates & reliability

Ethernet-Based Home Networking



- Known as IEEE 802.3
- High bandwidth
  - Data transmit rates between 10Mbps to 100Mbps
  - Computers & peripherals are linked using special & dedicated wiring
- Technology
  - CSMA/CD (Carrier Sense Multiple Access/Collision Detection)
- Components (such as NIC cards) are of lowest cost compared to other technologies
- But, requires new wiring!

IEEE 1394 Technology

The A/V Interface of Choice

- Hardware & software standard for transporting data
  - 100, 200, 400, or 800 Mbps
  - Ideal for audio and streaming video purposes
- Features
  - Digital interface
    - There is no need to convert digital data into analog and tolerate a loss of data integrity
  - Physically small
    - Thin serial cable can replace larger & more expensive interfaces
  - Easy to use
    - Does not require terminators, device IDs or elaborate set up
  - Non-proprietary - no licensing problem to use for products

FireWire/IEEE 1394 Technology

The A/V Interface of Choice

- Hot pluggable
  - Users can add or remove 1394 devices with the bus active
- Inexpensive
  - Priced for consumer products
- Scaleable architecture - may mix 100, 200, and 400 Mbps devices on a bus
- Flexible topology
  - Support of daisy chaining and branching for true peer-to-peer communication
- But
  - Requires new wiring
  - Cable length is limited to about 15 feet between devices

Different Strokes for Different Folks

	Home Automation	Entertainment	Information	Personal Communications	Communication
Devices	- Home appliances - Security/safety systems - Utility meters	- TV sets - Set-top boxes - DVD Players - Game consoles - VCRs - MP3 Players	- PCs - Screen phones - Printers - Modems - Routers - Hubs - Scanners	- Mobile phones - Smart phones - Handheld - Laptop - Pagers	- Corded/Cordless telephones - Fax machines
Content	Information on home processes, house environment, remote diagnostics and technical support	Rich multimedia content, electronic programming guides, impulse purchases	Discrete information on external world, shopping for household goods	Information used on the move or requiring instant action: travel, weather, local services, stock market	Information on how to reach people in time and space
Usage Pattern	Communal	Communal	Individual Shared	Individual Personal	Communal or Individual Shared
Connection to Outside World	- Power line - POTS	- Cable - DBS	- Cable modem - ADSL - POTS, ISDN	- GSM - Infrared	- POTS
Practical Networking Technology	- CEBus - X-10 - LONWorks	- IEEE 1394 (Fire Wire)	- HomeRF - HomePNA - Ethernet	- Infrared - Bluetooth	- POTS - DECT - 900MHz, 2.4GHz

Home appliances have different content, functionality, application, and use different interconnection technologies