The Digital Modem Evolves Into The Residential Gateways

Home Networking using a Digital Modem

New Dimensions to Home Internet Access

- ◆ Internet revolution
  - — New ways to communicate, entertain & educate
  - — Millions of users rushing to Gain Internet access

- ◆ Applications & services are fueling demand for high-speed Internet access
  - — E-mail, instant messaging, shopping, games, research

- ◆ Home users are embracing a variety of new services
  - — Broadband access will evolve to bring new dimensions to the Internet experience

Convergence Is Happening!

- ◆ Invisible computing embedded within everyday devices
  - — Increasing intelligence of everyday appliances

- ◆ Digital revolution
  - — Infrastructure: Circuit-switched to IP-based networks
  - — Analog TV to Digital TV

- ◆ Internet is ubiquitous
  - — Being deployed within commercial channels
    - – Business-to-Business commerce, secure transaction processing, banking

- ◆ Deregulation of global infrastructure
  - — Multiple industries such as telecom, cable and utilities

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The Push for Home Networking

- ◆ Rapid growth in multiple-PC household penetration
  - — PC penetration exceeds 50% in US households
  - — Multi-PC/household growth (U.S.): 15M (1998) to 26M(2003) *

- ◆ Increasing Internet usage
  - — Internet usage growth (U.S.): 20% (1997) to 47% (2001) **

- ◆ Demand for Broadband
  - — Broadband penetration growth (U.S.): less than 1M (1998) to more than 15M (2002) ***

- ◆ Info-appliance Invasion
  - — Increased Sharing of digital content inside the home

* - Dataquest, ** - Yankee Group, *** - Forrester Research

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History Repeats Itself Again...

- ◆ Television
  - — There was a time when one television set per home was considered a luxury
  - — Today 76% of US households have two or more television sets
  - — Three factors contributed to multiple TV ownership
    - – Purchase of newer/bigger/ better television
    - – Additional television to reduce conflicts over TV use
    - – Television in bedroom / kitchen
  - — Replace the word "TV" with "PC" and history repeats itself again!

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Worldwide Home Network & Residential Gateway Forecast

Worldwide Home Network and Residential Gateway Forecast (US $M)
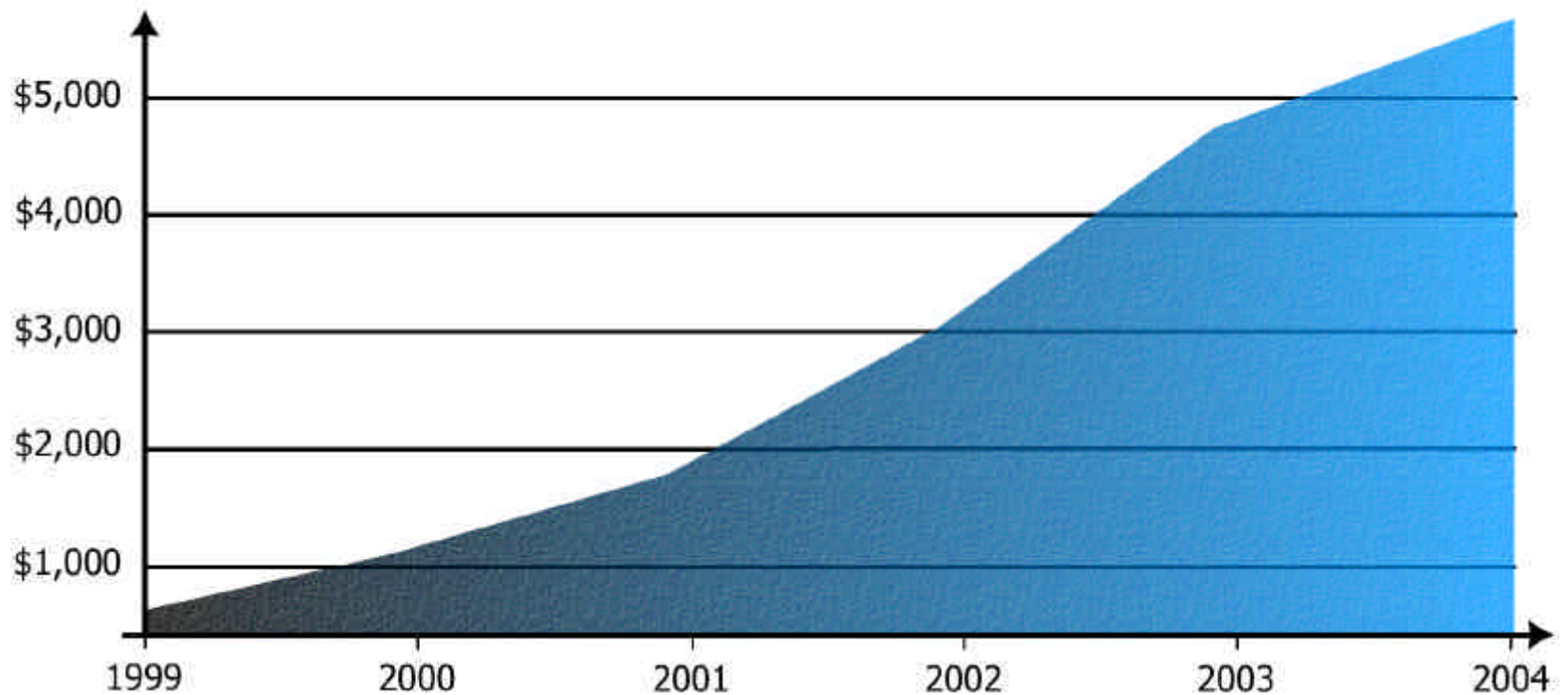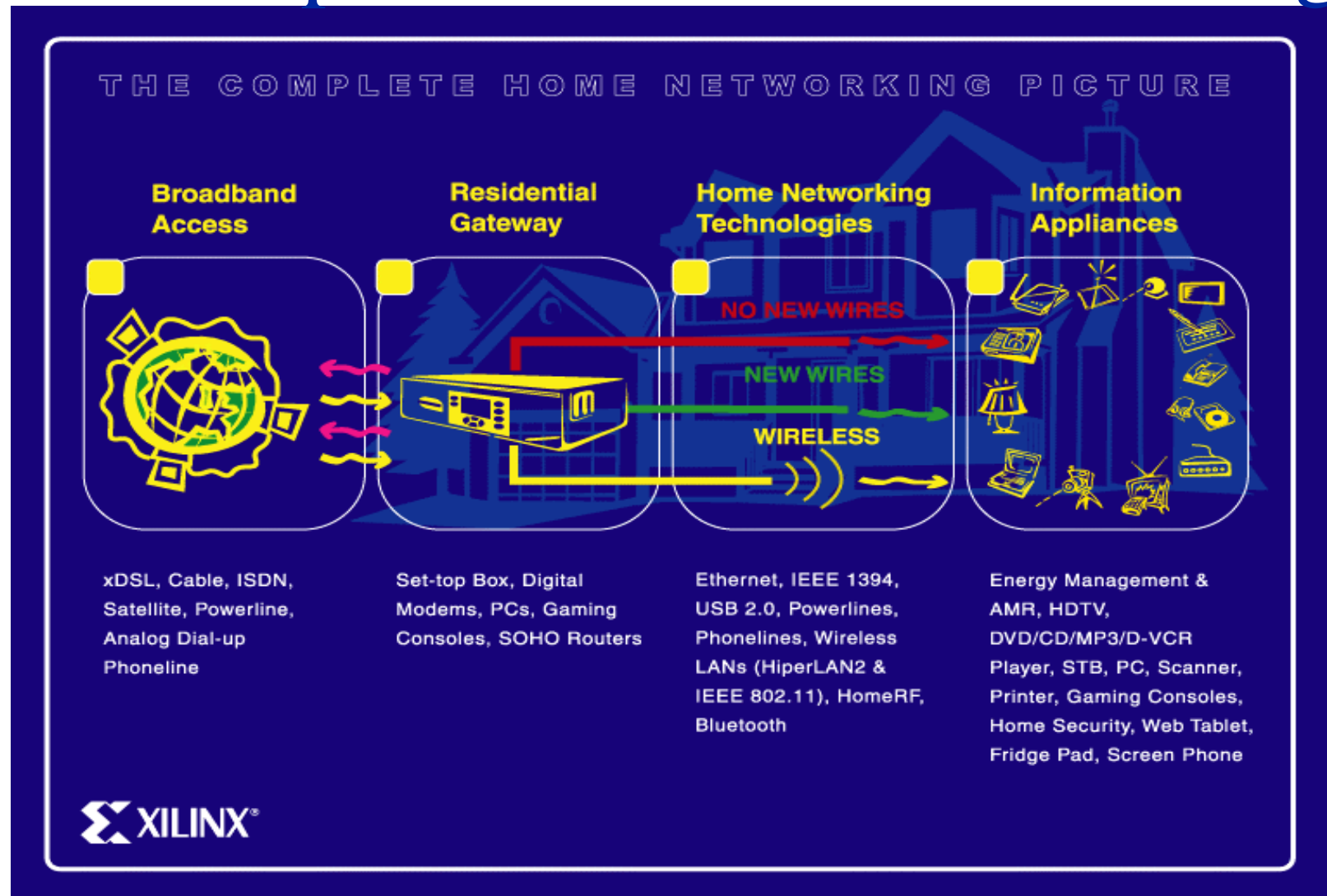

Source: Cahners In-Stat Group

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Residential Gateway
The Key Ingredient For Home Networking

- ◆ RGs provide integration of different broadband access types & different home networking solutions
  - — Broadband access
    - – ISDN, satellite, xDSL & cable modems
  - — Home networking solutions
    - – No new wires
      - – HomePNA, HomePlug
    - – Wireless
      - – Bluetooth, HomeRF, wireless LANs (IEEE802.11 & HiperLAN2)
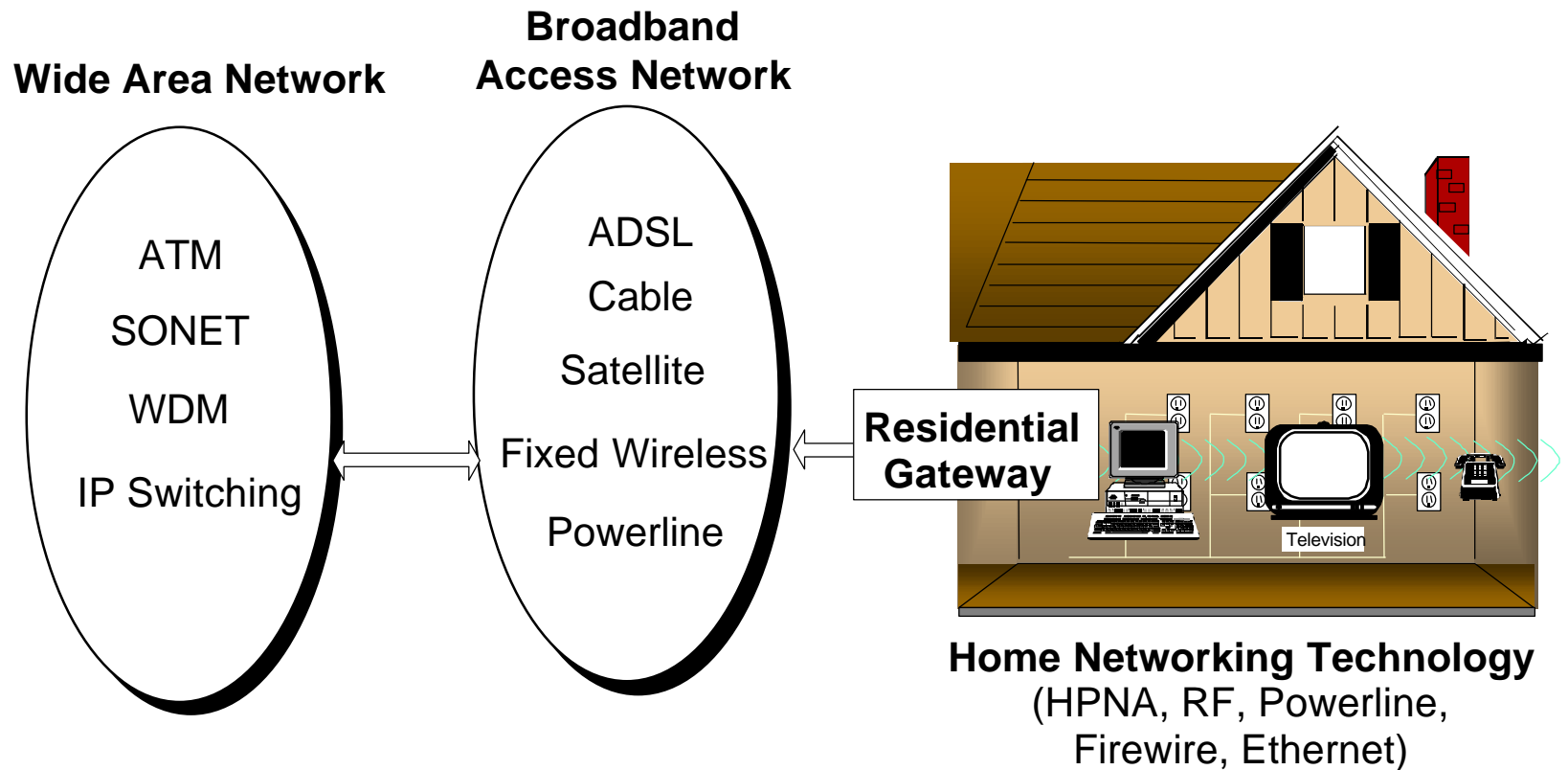   - – New wires
      - – Ethernet, IEEE 1394

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Four Aspects to Home Networking

THE COMPLETE HOME NETWORKING PICTURE

Broadband Access

Residential Gateway

Home Networking Technologies

NO NEW WIRES

NEW WIRES

WIRELESS

Information Appliances

xDSL, Cable, ISDN, Satellite, Powerline, Analog Dial-up Phoneline

Set-top Box, Digital Modems, PCs, Gaming Consoles, SOHO Routers

Ethernet, IEEE 1394, USB 2.0, Powerlines, Phonelines, Wireless LANs (HiperLAN2 & IEEE 802.11), HomeRF, Bluetooth

Energy Management & AMR, HDTV, DVD/CD/MP3/D-VCR Player, STB, PC, Scanner, Printer, Gaming Consoles, Home Security, Web Tablet, Fridge Pad, Screen Phone

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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.

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RGs - An Integral Part of Broadband Access & Home Networking

Wide Area Network

Broadband Access Network

ATM

SONET

WDM

IP Switching

ADSL

Cable

Satellite

Fixed Wireless

Powerline

Residential Gateway

Television

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

Source: Cahners In-Stat

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Broadband Based or Digital Modems RGs

◆ Broadband termination device that has incorporated the necessary routing functions within one device

◆ ADSL or cable termination device with routing capabilities

◆ Digital modem that has evolved to incorporate the necessary functionality to be a RG

◆ Gateway is sold in conjunction with DSL services
   — Can be partially or completely subsidized
   — Consumer installs the gateway
      – The service provider saves the cost of a truck roll

◆ Not dependent upon a PC

Broadband Centric or Digital Modems RGs

◆ Built to support one specific home networking technology
— HomePNA, Ethernet, USB or wireless
— Future technology advancements require buying another gateway & reconfiguration of the home network

◆ Examples
— 2Wire Inc. - Product: HomePortal
  – Provides support for both HomePNA & HomeRF solutions
  – Platform for PC networking, communications convergence & distributed entertainment content
  – Remotely manageable
— Cayman ADSL 3220H router/RG
— Cisco uBR924 Cable router/RG

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RG - An Incremental Deployment
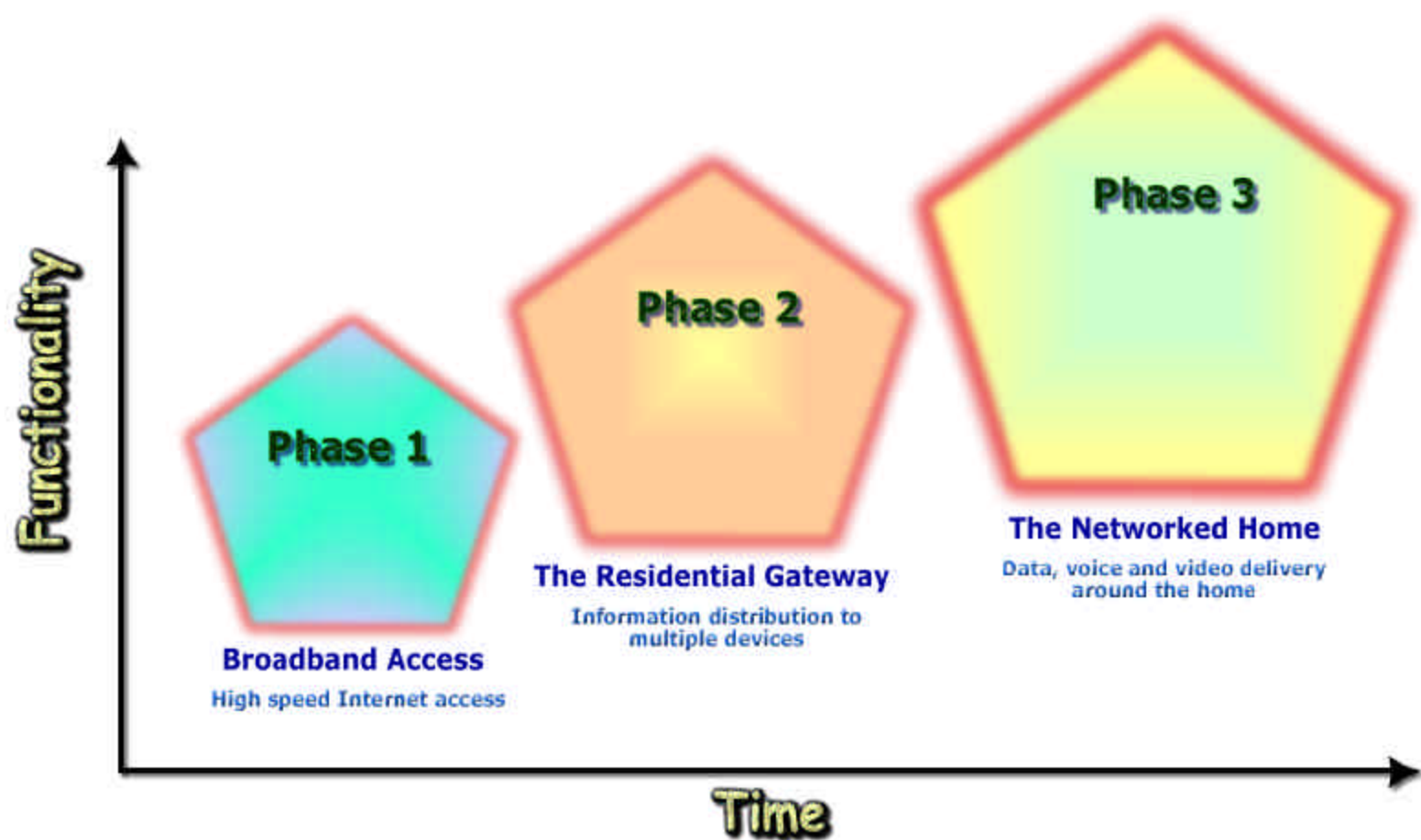
From Digital Modems to Residential Gateway

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Home Networking is Here!
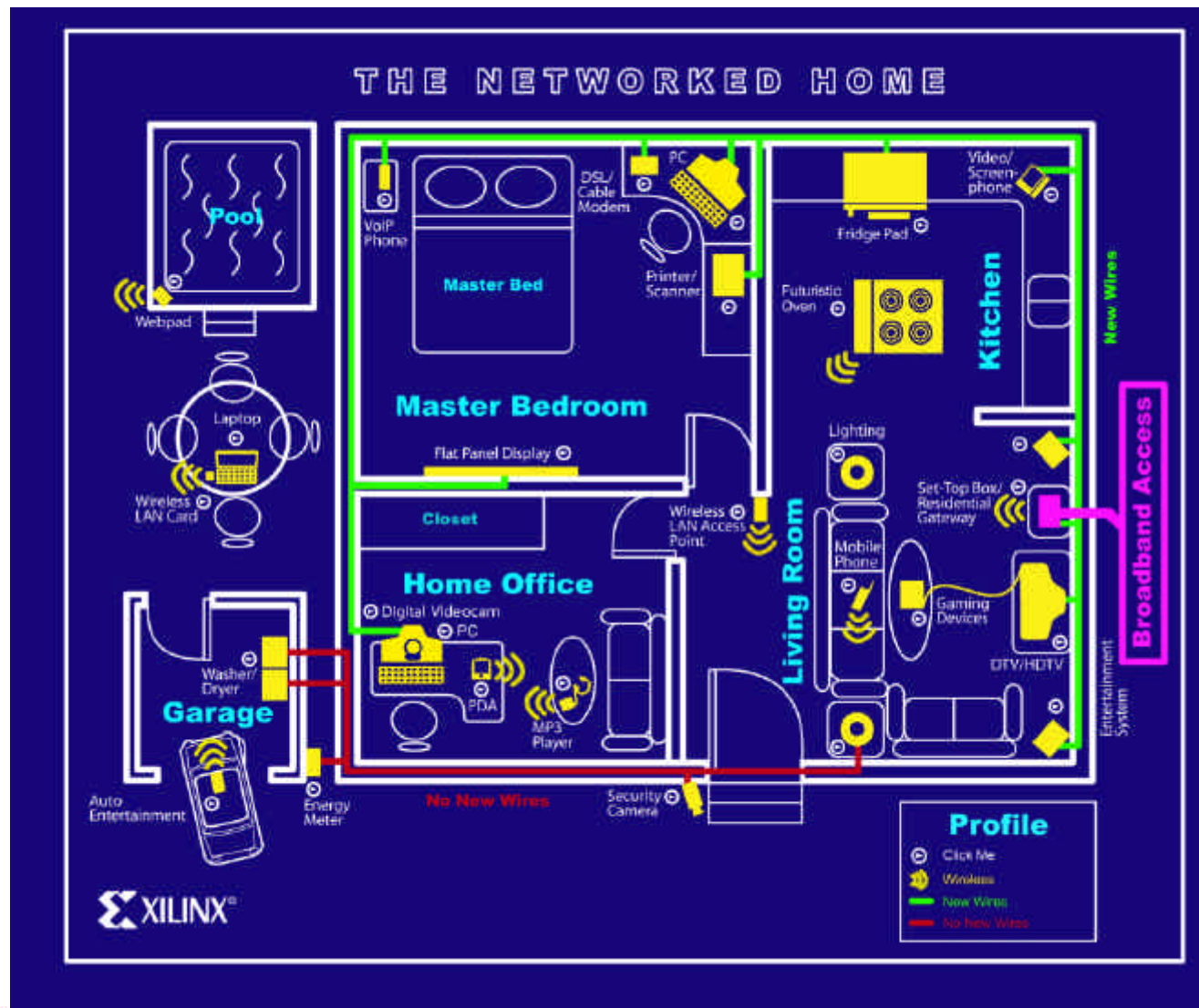
First Generation RGs

- ◆ Not IP based devices & have low bandwidth

- ◆ Types
  - — Digital set-top box RGs
    - – Broadcast TV into the home
  - — Utility-centric RGs
    - – Enable automated meter reading (AMR), energy optimization, home automation, management & monitoring
  - — PCs
  - — Gaming consoles

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Second Generation RGs

- Devices that bridge one WAN pipe to one LAN connection

- Configurations include
  - Digital modems connected to a PC
  - Or, stand alone devices with the intelligence to handle all of these functions without the aid of a PC

- Conduct majority of routing functions & IP address mgmt

- Broadband access termination devices with integrated LAN hubbing routing functionality
  - Example: Cayman's ADSL 3220H router/RG
  - Example: General Instruments-Motorola's DCT 5000+ Advanced Interactive Digital Consumer Terminal

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Second Generation RGs

- PC-based architecture RG
  - Example: Ericsson's E-Box

- Set-top box RG
  - Has the necessary home routing functionality
  - Example: Next level Communications N3 RG

- Smart phones
  - Example: Global Converging Technologies or Home Wireless Networks, Cisco, Alcatel, Nokia, Nortel, Ericsson

- Targeted by service providers & equipment OEMs for wide scale deployment as RGs in the next 2-3 years

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Third Generation

◆ Multi-service home gateways

◆ Have capabilities to terminate
   — Multiple types of WAN connections (wireless, DSL, cable)
   — Multiple LAN connections (Ethernet, RF, HPNA, powerline)

◆ More expensive given the high degree of modularity

◆ Will be owned by the consumer
   — Service providers do not inherently share CPE equipment
   — Unless channel & pricing model changes this is not realistic

◆ Example
   — Sharegate's RG

Third Generation

◆ These devices do not exist today but will evolve based on products available today

◆ Features
  — Modular in design
  — Multiple WAN termination of media types such as wireless, xDSL or cable supported
  — Multiple LAN/home networking technologies supported
    – Less apt to becoming obsolete with future technology changes
  — Deliver telephony/voice services
  — Easier to set up
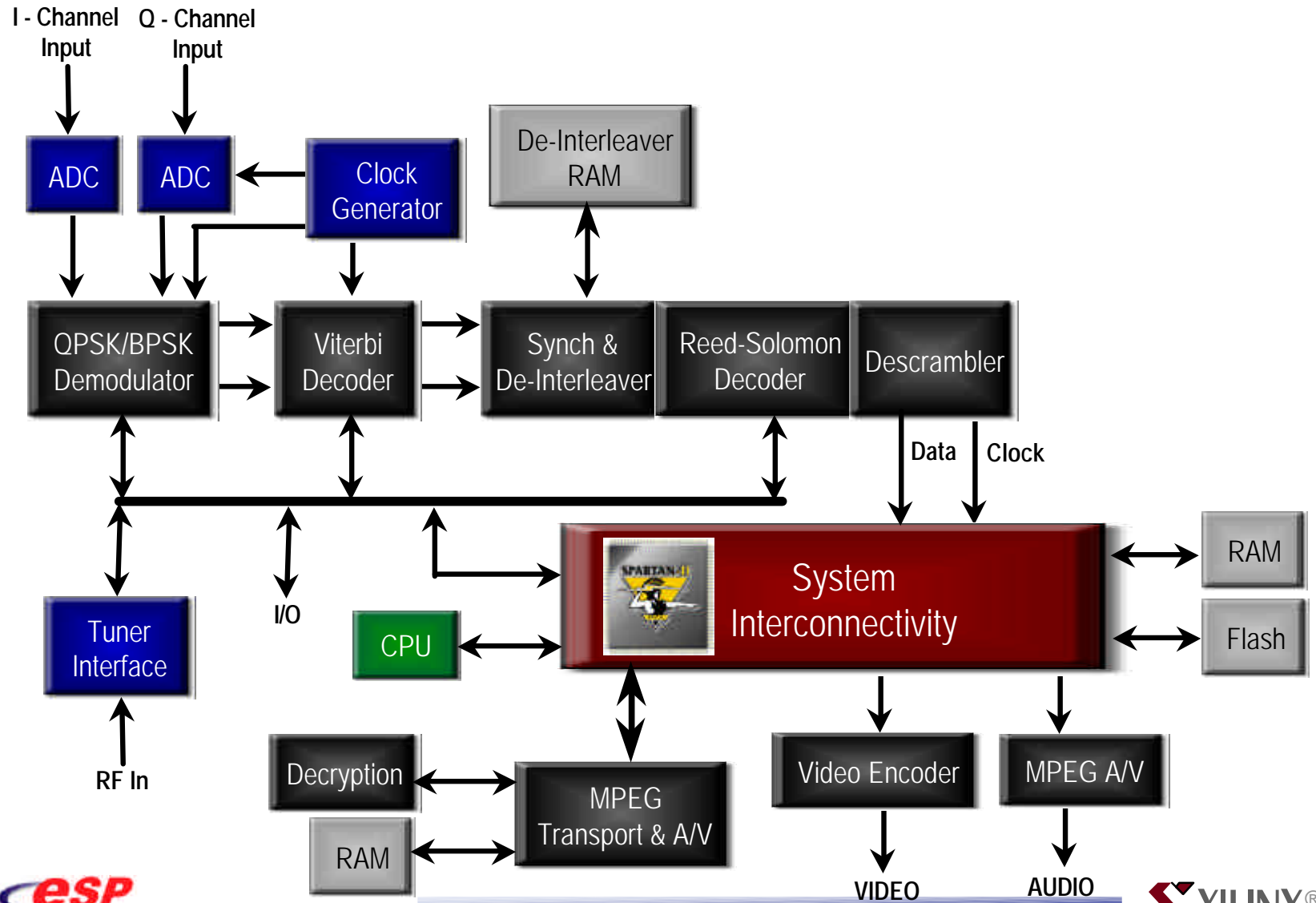 — Remote management is possible

Possibilities Within The Gateway

♦ Different combinations are available to suit different particular home networking needs

— Depends on broadband access technologies

– xDSL, cable, ISDN, satellite, mobile/cellular phones, analog phonelines

— Depends on in-home network technologies

– Phoneline, powerline, Ethernet, IEEE-1394/Firewire, HomeRF, Bluetooth, wireless LANs (IEEE-802.11 & HiperLAN2)
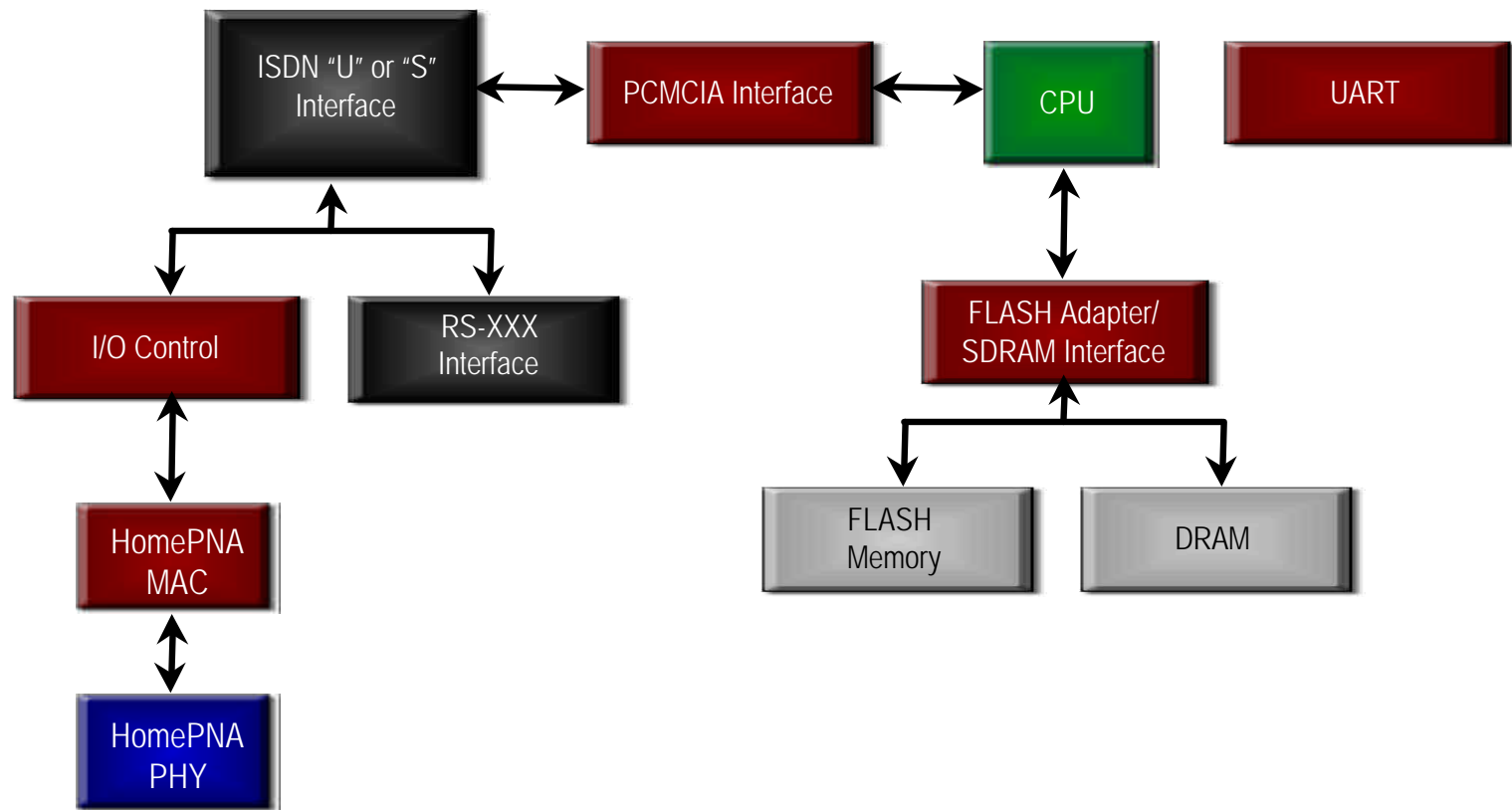
Xilinx Envisioned Gateway Model

- ◆ Single "small" box

- ◆ Enable high-speed, two-way Internet, voice & video communication
  - — Distribution of broadband services within the house/small office
  - — Seamless connection & simultaneous operational capabilities

- ◆ Multiple digital phone (VoDSL) lines
  - — Separate telephone & data lines

- ◆ Allow secure access
  - — From any Internet-accessible remote location via any standard Web browser

- ◆ Firewall security protection

- ◆ Affordable price points

- ◆ Minimize truck rolls
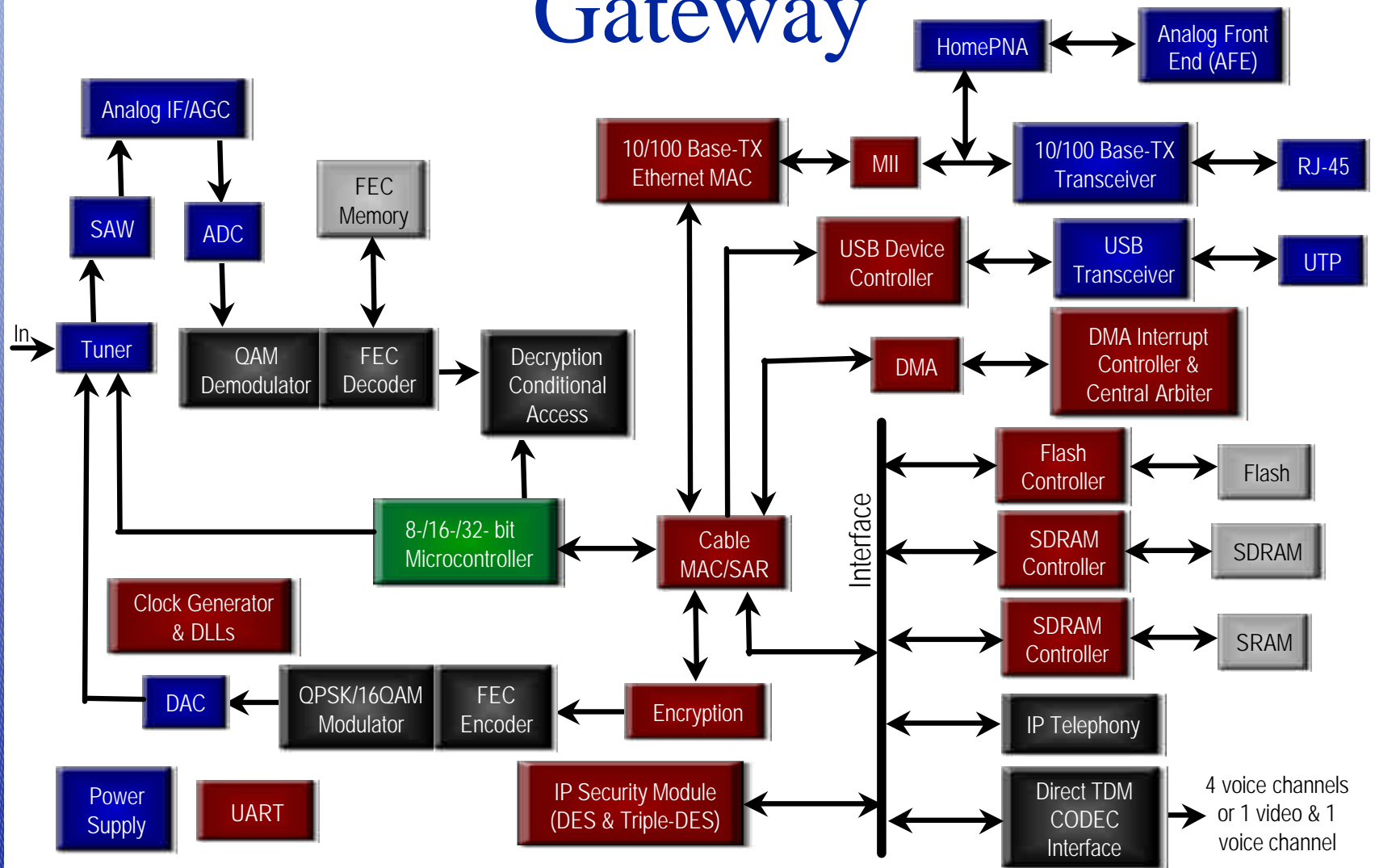 - — Management software for remote provisioning, service management, diagnostics, software upgrades

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Satellite Modems

Quadrature Data from Tuner

I - Channel Input

Q - Channel Input

ADC

ADC

Clock Generator

De-Interleaver RAM

QPSK/BPSK Demodulator

Viterbi Decoder

Synch & De-Interleaver

Reed-Solomon Decoder

Descrambler

Data   Clock

Tuner Interface

I/O

CPU

System Interconnectivity

RAM

Flash

RF In

Decryption

RAM

MPEG Transport & A/V

Video Encoder

MPEG A/V

VIDEO

AUDIO

eSP
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ISDN Modems

Cable Modem Residential Gateway

ADSL Broadcast Solution

Satellite, cable
or terrestrial

Descrambler

Broadcast Translator

Scrambler → IP Router & ATM Switch → DSLAM →→ POTS Splitter → ADSL Modem CPE → PC

Set-top box, hard disk & TV

VoD Server & Software

Internet Proxy

Telephone

Smart Card

ADSL Central Office

Home

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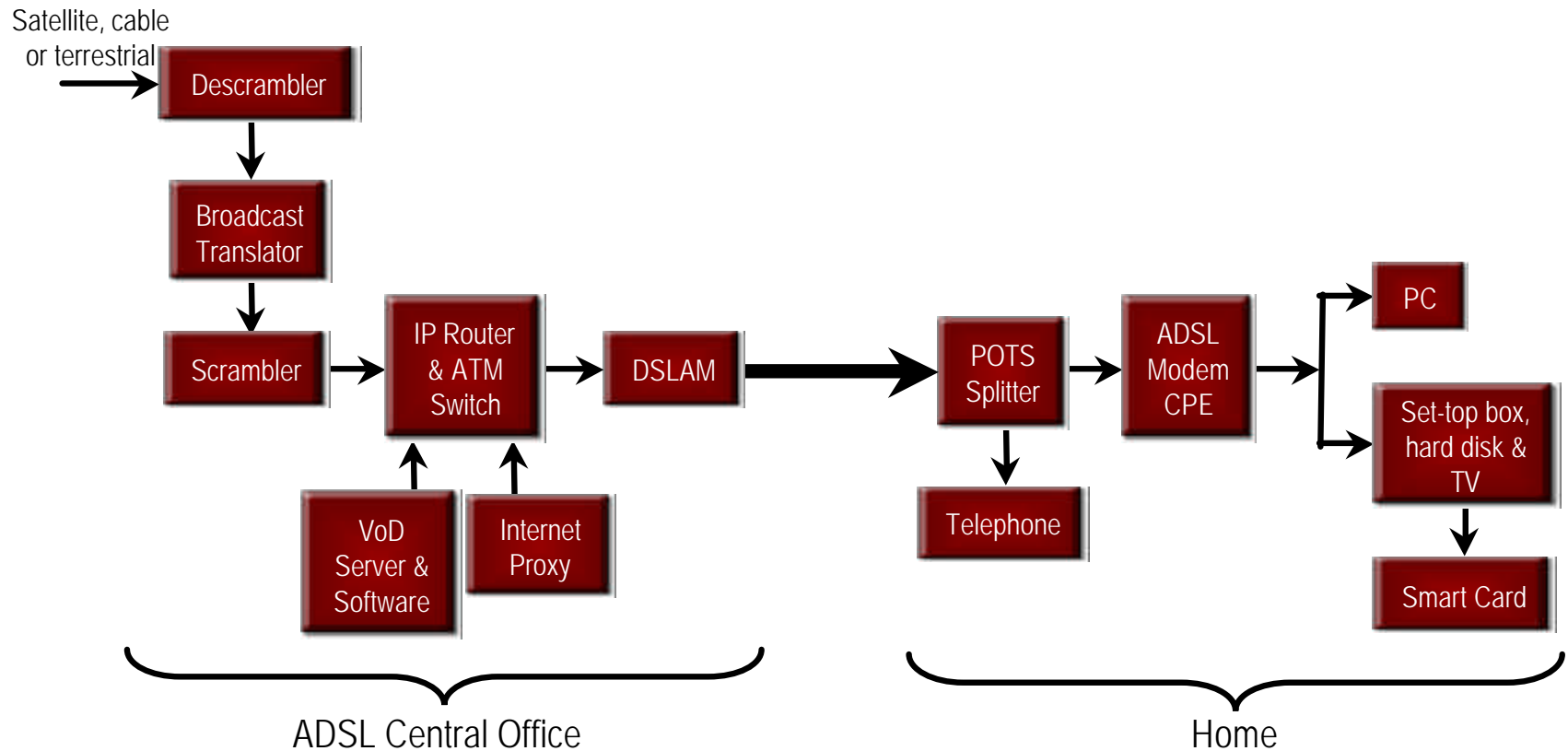
DSL Modem Home Gateway
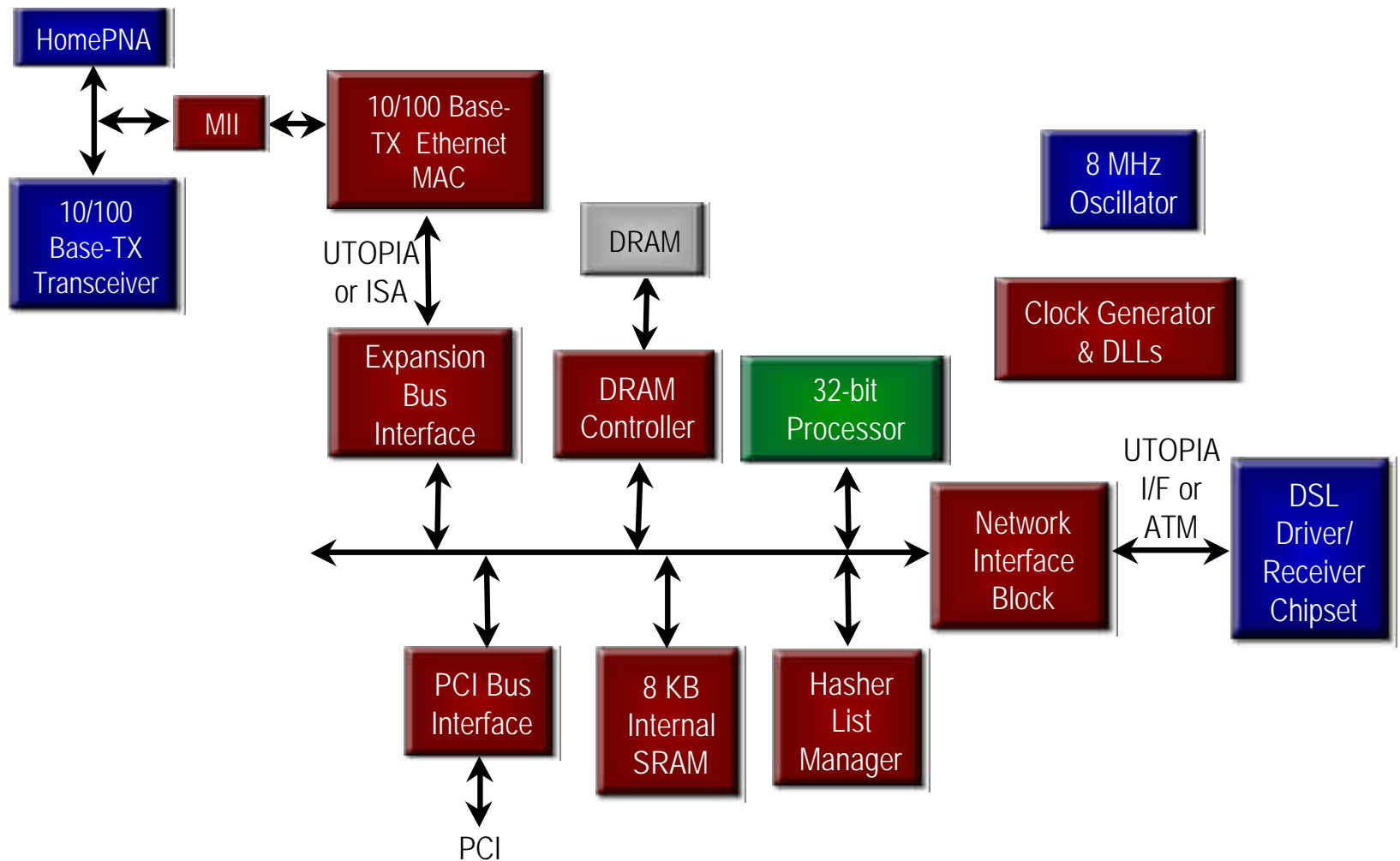
DSL CPE
(Customer Premise Equipment)

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