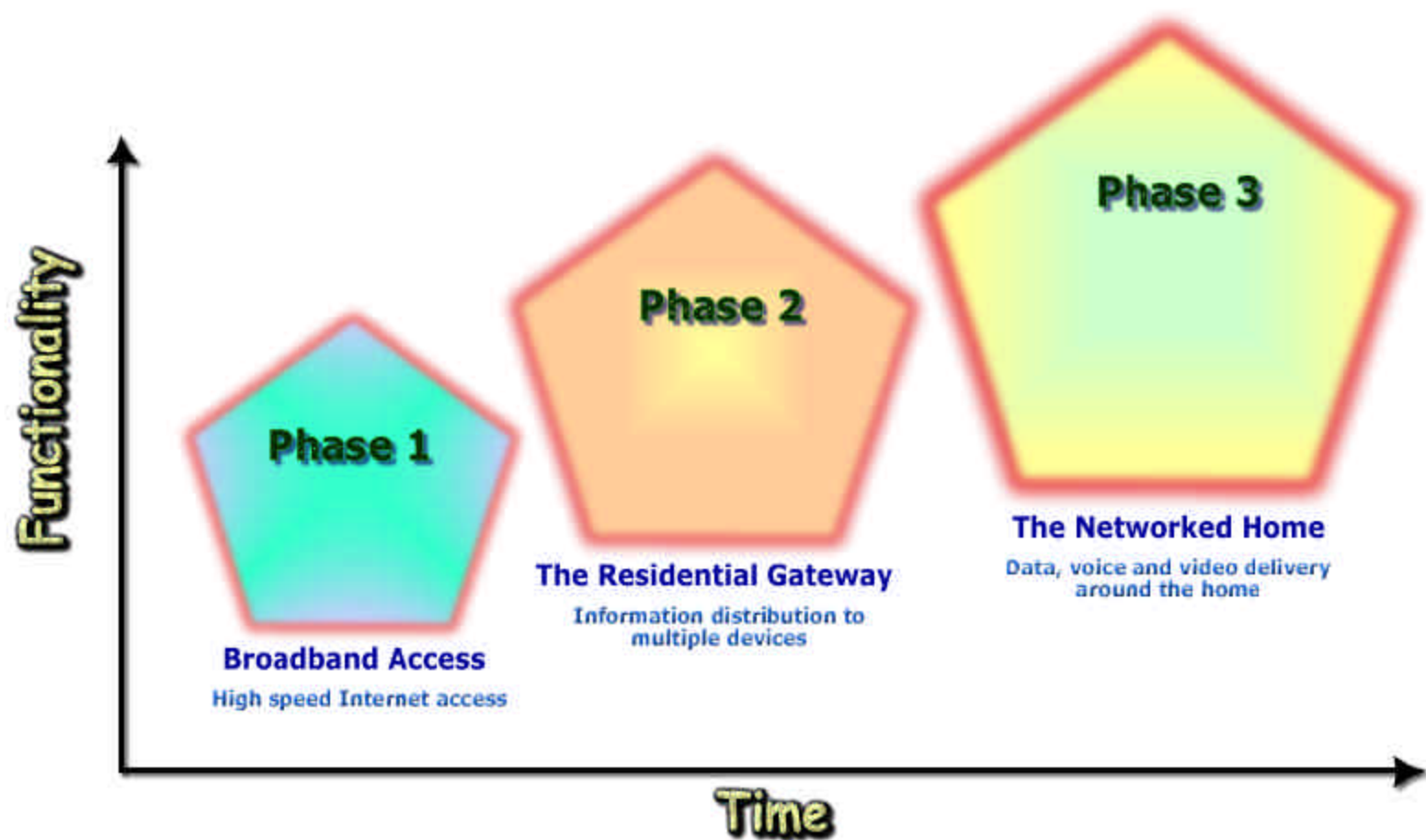




Phased Deployment of RGs

RG Deployment - The Incremental Change



First Generation RGs

- ◆ These are not IP based devices & have low bandwidth
- ◆ Digital set-top box RGs
 - Broadcast TV into the home
- ◆ Utility-centric RGs
 - Enable automated meter reading (AMR), energy optimization, management & monitoring
- ◆ PCs
- ◆ Gaming consoles

Second Generation RGs

- ◆ Devices that bridge one WAN pipe to one LAN connection
- ◆ Configurations are 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

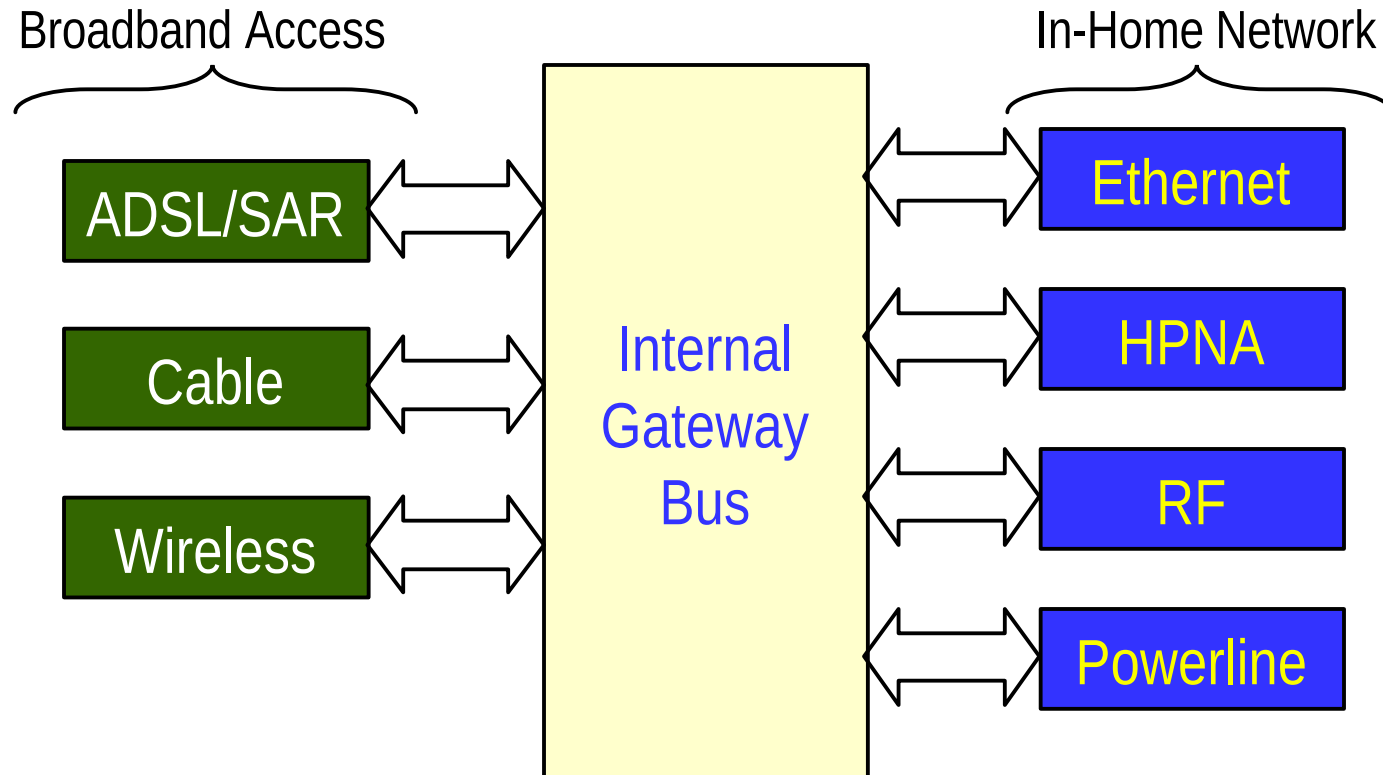
Second Generation RGs

- ◆ 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
- ◆ These devices are targeted by service providers & equipment OEMs for wide scale deployment as RGs in the next 2-3 years

Third Generation RGs

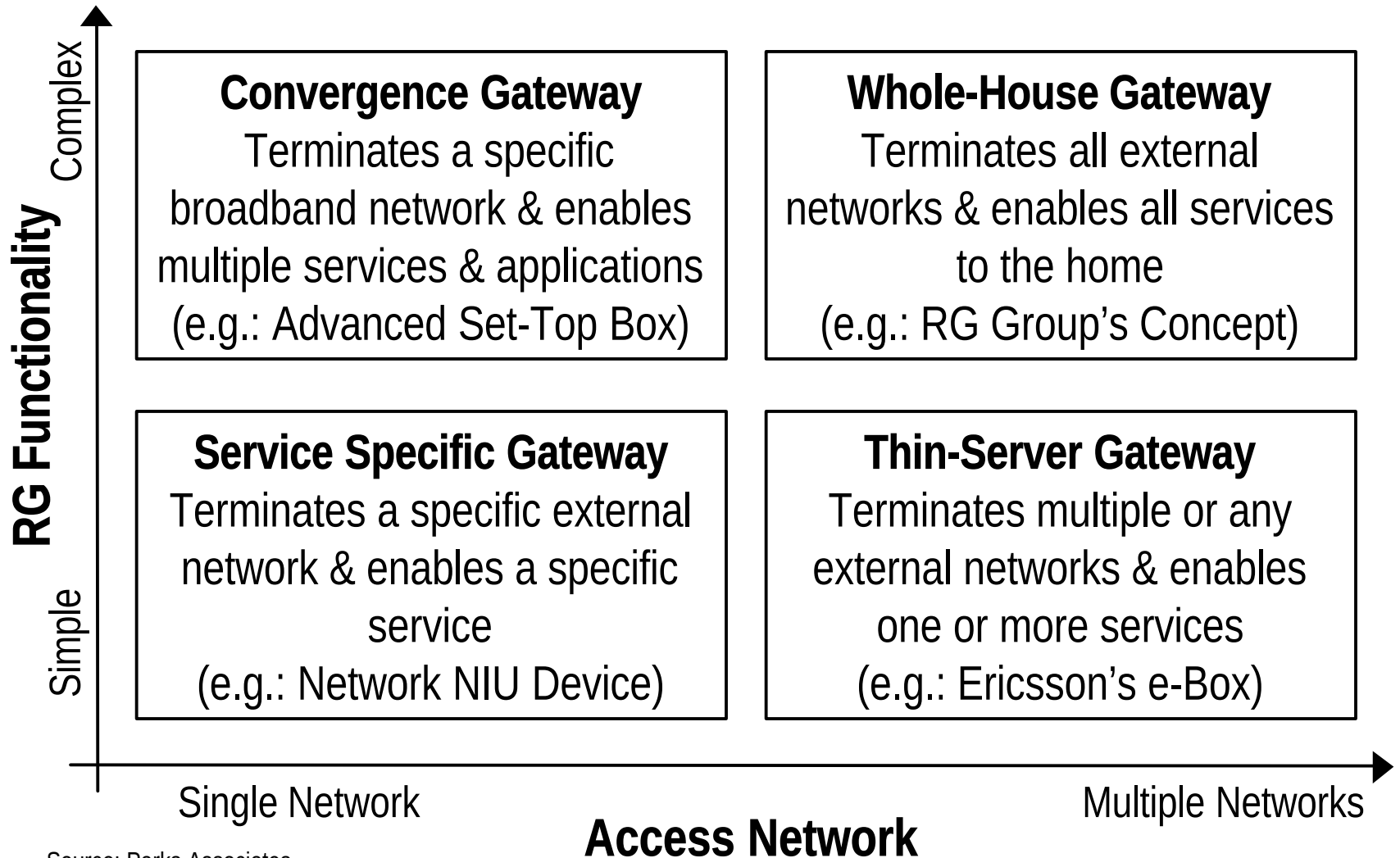
- ◆ Will have capabilities to terminate several LAN & WAN types
 - Multiple types of WAN connections (wireless, DSL, cable)
 - Multiple LAN connections (Ethernet, RF, HPNA, powerline)
- ◆ More expensive given the high degree of modularity
- ◆ Will be owned by the consumer
 - Service providers do not inherently share CPE equipment
 - Unless channel & pricing model changes this is not realistic
- ◆ Example
 - Sharegate's RG

Third Generation RGs



Conceptual 3rd Generation RG Supporting
Multiple WAN & LAN Interface

RG - Classification Model



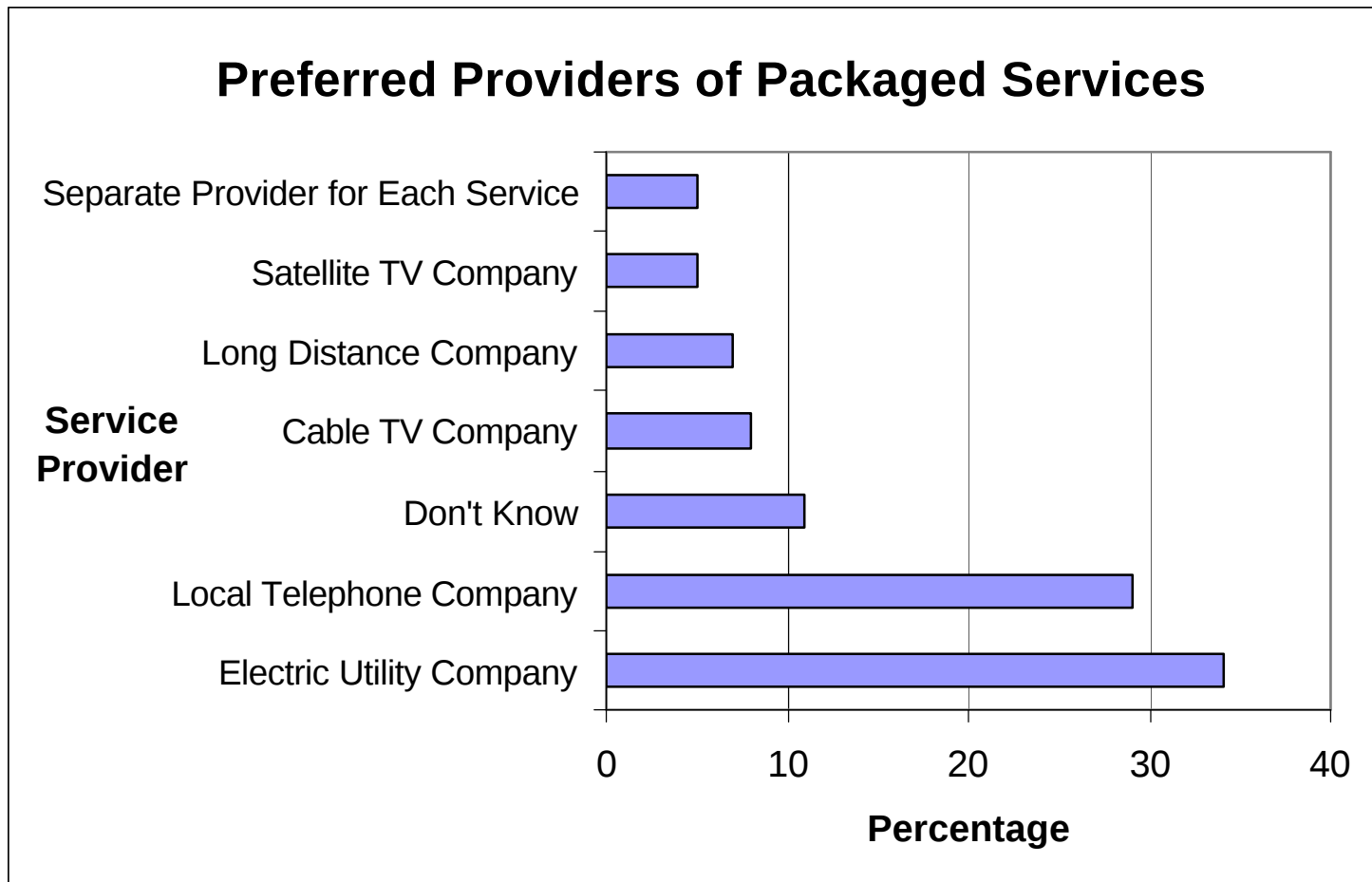
Source: Parks Associates



Early Products

- ◆ First generation products are already shipping
 - Products available from IBM, 2Wire, Panja
 - Began shipping in late 1999
 - Distribute broadband connectivity throughout the home via phoneline, RF & powerline
- ◆ Initial focus
 - Connecting & sharing high-speed Internet, phone services & networking among PCs and computer peripherals

Preferred Provider for Bundled Services



Source: Parks Associates



Drivers to RG Deployment

- ◆ Service providers expanding into integrated services
 - Voice, cable & wireless industries are moving to expand their market opportunity beyond their traditional service model
 - Providing multiple services over one broadband connection
 - RG provides the ability to enable multiple services
 - Providing non-native services through the access network
- ◆ Internet
 - Massive influence on business & consumers
 - IP bits will one day flow around the house in applications such as entertainment, home automation, security
 - RG will be the device controlling the flow of the bits between the home networking nodes & Internet

Drivers to RG Deployment

- ◆ New market opportunity for hardware equipment & silicon vendors
- ◆ Smart home construction
 - Incorporating structured wiring into the homes makes them smarter homes
 - Requires an RG that manages the network & controls the access to devices for the external network
- ◆ Low cost PCs
 - Leveraging one Internet connection for multiple PCs

Drivers to RG Deployment

- ◆ Widespread deployment of home networking
- ◆ Always-on broadband connection
 - Necessary for security & home automation services
 - Transforms the Internet into a viable broadcast advertising medium
- ◆ New entertainment options/applications
 - Interactive TV or intermingling of Internet & TV broadcasting will result in new entertainment & advertising models
 - Digital TV roll out will result in the demand for new specialized broadcasts & increase in channel capacity
- ◆ Remote monitoring

Hurdles to RG Deployment

- ◆ Unclear ownership/economic model
 - Standards
 - Cost
- ◆ Current services are reliable & cheap
 - Service providers must compete against their legacy services and brands
 - POTS, cable & satellite service is reliable & cheap
- ◆ Support issues
 - Service providers need to enable remote support & diagnosis
 - Limit the end-user interaction

Hurdles to RG Deployment

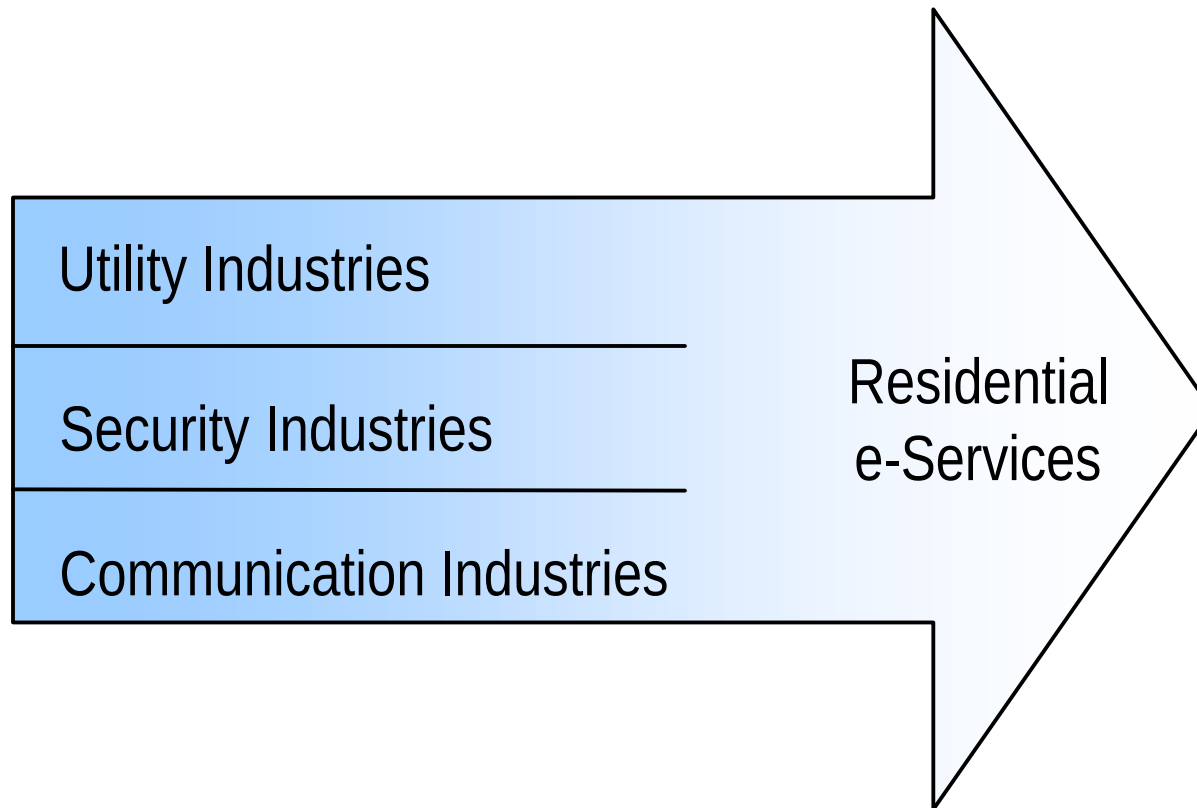
- ◆ Immature technology
 - Different home networking technologies are in different stages of maturity
 - Phoneline networking is most widespread
 - Lot of work needs to be done at the physical connection layer & above
 - Microsoft, Sun & others continue to create separate software & APIs to simplify connectivity
 - VoDSL & Voice over cable are still immature compared to the reliable switched voice



Enabling Electronic Services

Services Gateway - Concept is being enabled
by network operators or service providers (SP)
such as telephone operators, ISP, cable TV
operators, utilities

Convergence of Residential Service Industries



Drivers of the e-Services Market

- ◆ Opportunities are being created for network operators to provide e-Services to residential users
 - The networked home allows incumbent & new players to provide a range of advanced value added services
 - Differentiate themselves from the competition
 - Managing customer relationships
 - Shift from owning & maintaining infrastructures
- ◆ Technology & industry deregulation
 - Rapidly changes the way companies addressing the residential market define & conduct their business

Emerging e-Services

Business opportunity for service providers - Bundling of the following e-Services types such as communication, entertainment, security services, energy service, home automation & home care

- ◆ Communication & entertainment
 - Shared Internet access
 - PC, TV, Web phones, gaming consoles
 - Ability to network multiple devices in the home
 - New telephony services such as IP telephony
- ◆ Security services, home automation & control
 - Facilitate new & more advanced services
 - Remote monitoring & control through standard Internet browser or mobile phone

Emerging e-Services

- ◆ Energy services
 - Key drivers - Deregulation in the energy industry
 - e-Services create new revenues as prices & margins fall
 - Secure customer loyalty on a huge new market
 - Prevent new entrants from highly competitive industries like banking & retail to develop customer relationships
 - Automatic meter reading (AMR)
 - Customers in the same local distribution network start buying energy from different suppliers
 - Need arises to measure hourly consumption by consumer
 - Benefits in network optimization, load balancing & outage detection for distribution companies

Emerging e-Services

- ◆ Home automation
 - Ease of use & penetration of network-enabled devices
- ◆ Home care
 - Key drivers
 - Aging population in developed countries around the world
 - Desire to bridge increasing geographical distances
 - Providing elderly & physically challenged persons with security & monitoring services
 - Providing communication services such as home shopping & video telephony

Requirements of an e-Services Infrastructure

- ◆ New e-service infrastructure must use existing technologies & standards
 - Complement & build upon current solutions
- ◆ Flexible, open & modular infrastructure
 - Accommodation of a range of communication protocols
 - Allow individual components rather than entire solutions to be replaced as new technologies are introduced
- ◆ Consumers should not have to administer any part of the infrastructure
 - Professional & remote system management for operation & maintenance

Requirements of an e-Services Infrastructure

- ◆ Edge servers should bridge the public & local networks
 - Run local applications, store information, control & protect devices
- ◆ Services should be implemented as distributed applications
 - Using extremely powerful & complex edge servers can be avoided by executing complex services over several infrastructure nodes
 - Increases technical life & reduces cost of edge servers

Requirements of an e-Services Infrastructure

- ◆ Consumers should be able to access services & information through different kinds of client
 - Edge server should adapt presentation of information to type of client terminal in use
 - “Fat” clients
 - Workstations & PCs
 - “Thin” clients
 - Mobile phones, PDAs, pagers

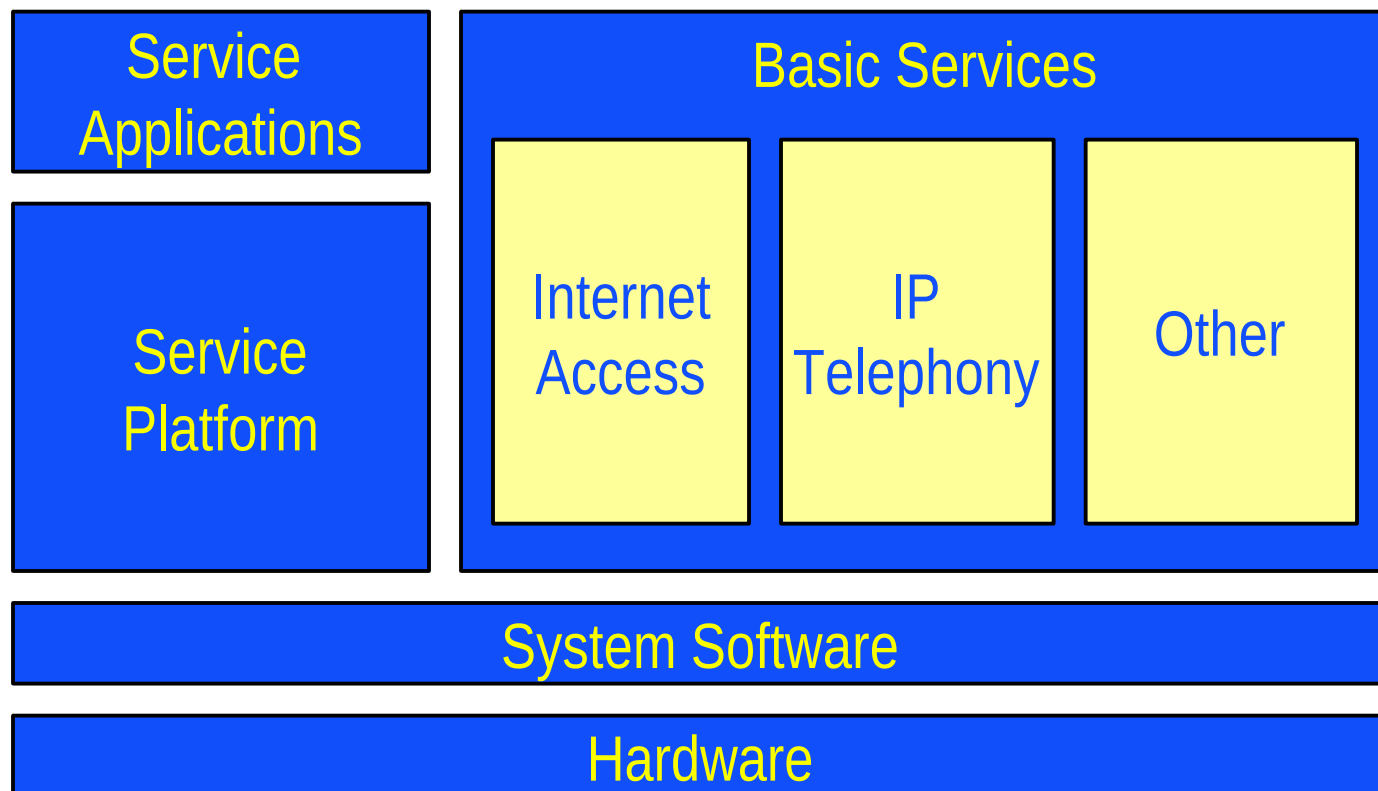
Consumer Requirements of e-Services

- ◆ Reliability
 - Mission-critical services such as security & energy management require higher reliability
 - Unlike PC crashing is tolerable by most people
- ◆ Security
 - Consumers do not tolerate invasion of privacy or hacking into mission-critical services by strangers or neighbors
- ◆ Simplicity
 - Services must be simple to install & intuitive to learn & use
- ◆ Utility
 - Home services must provide an obvious consumer value

Service Provider (SP) Requirements

- ◆ Integrity
 - Infrastructure must allow different SPs to share infrastructure without adversely affecting each others services
- ◆ SPs must have flexibility in defining their business model
 - While being able to derive cost synergies from sharing the infrastructure
- ◆ Future proof
 - Easy to modify & upgrade services on existing infrastructure & require minimal consumer involvement
- ◆ Reliability
 - Consumers expect same levels of reliability for critical services as the telephone system

Services Gateway - Architecture



Services Gateway - Architecture

◆ Hardware

- 32-bit CPU
- DRAM, Flash memory, SRAM
- External interfaces: RS232, IEEE 1394
- I/O card slots
 - Support to 10BaseT Ethernet, xDSL modem, 56K modem

◆ System software

- OS
- Drivers for external & local network access
- Server components
 - Web servers, WAP (wireless application protocol) servers, DNS (domain name servers)
- Java virtual machine (JVM)

Services Gateway - Architecture

- ◆ Basic services
 - Services that are basic in the business model & offers technical advantage both in performance & cost
 - Internet access
 - IP telephony
- ◆ Service platform
 - Applications that implement services which can be downloaded, installed or removed
 - Permits remote life-cycle management of service applications
 - Typically fulfills the role of a gateway between servers in the external network & devices in the local network

RG - A New Paradigm in Service Provision

- ◆ The world of the 'Service Provider' has traditionally ended at the edge of the house
- ◆ Service providers envision RGs to be
 - Delivering traditional & new value-added services to the home
 - Creating the desire to do more, but also bearing the burden of doing more
- ◆ New issues
 - Who owns the gateway?
 - Who pays for the gateway?
 - Who installs & maintains the gateway?