EXECUTIVE SUMMARY

HOME INTERACTIVE NETWORKS
Architectures, Integration, Evolution

Dr. Richard Janow
AT&T Architecture

AT&T Bell Laboratories
Department BL041321E
Holmdel, New Jersey

Original Release: 6 July 1994
Converted to MS Word: July 1998
Version 2.02
# Table of Contents

1. BACKGROUND  
2. OPPORTUNITY  
3. ESSENTIAL HOME SYSTEM ARCHITECTURE  
4. SERVICES AND EXAMPLES  
5. STRATEGY ELEMENTS  
6. CONCLUSIONS
1. Background

Elements of the consumer multimedia "information superhighway" transition are falling into place. Major commitments to build broadband access systems are now a matter of record. Competitive futures are clearly in store for access networks and services, whether they are narrowband or broadband, wired or wireless. Ever more capable and compact consumer appliances are appearing, courtesy of the electronics revolution. The consumer multimedia market is growing dynamically, using CD-ROMs, PCs, and gaming appliances. The new communication devices that are appearing routinely integrate voice with data, offer tetherless mobility, and become integral with PCs or other platforms. Consumers will soon be deluged with new multimedia entertainment, information, and mobility services, and with competing home-based applications.

The new consumer appliances will be progressively more "brilliant", visually competent, and affordable. But, their forms and the home system architectures they will be part of are not yet determined, and they will have to work with the legacy appliance base (TVs, PCs, telephones, etc). The smart set top boxes that are emerging for Interactive TV will turn traditional TVs into low performance PCs with built-in network interfaces and video processing. But neither they nor traditional PCs are complete home systems. Most notably, they do not support control of competing access systems or support mobility, they do not fully engage usability and near-term cost issues, and they do not enhance interoperability between home appliances or systems (e.g., security with communications).

2. Opportunity

The new technology lets emerging home architectures be quite variable. Will they be integrated around home networks or collections of non-interacting appliances? Will it be access providers, or appliance providers who control home bandwidth and APIs? How can usability be assured? How will consumers be able to exploit competitive access? How can AT&T services be bonded to the customer, protected, and privileged?

AT&T can field new home consumer products to fill the hardware void. Hopefully, they will define new and innovative ground. But the AT&T stake in home systems vitally affects services also. With intelligence migrating to terminal equipment, service companies can gain or lose market clout depending on who defines home terminals and their network, user, and application interfaces. Friendly home CPE can expand the range, seamlessness, and competitiveness of service offerings, with the converse holding as well, bonding customers to the service/appliance combination. Whoever defines home architecture may gain a pivotal and survivable role in both appliance and service markets.

The changed technology, applications, and complexities will create market pull for new consumer paradigms - especially innovative user interfaces that enrapture users. Will we in telecommunications define these standards? Or, will consumer appliance or computing companies define the rules? Conditions now are reminiscent of the early 1980s, when Microsoft and Apple became important. These players recognize opportunity reborn and are aggressively investing in home systems.

Most other players lack the breadth in established business competencies that AT&T has and might coordinate if we act with speed. AT&T can potentially differentiate itself strongly by packaging more seamless, clean, end-to-end offerings than most competitors - typically narrower companies allied together loosely. But to make this happen, AT&T must unite its consumer efforts within a broad, coherent, strategic program that links CPE products with network services, and must also dramatically increase the scale of current investment.
3. Essential Home System Architecture

Home systems' value to consumers lies not only in explicit support for applications but in improved usability and control. Home systems should insulate consumers from what would otherwise be singularly more complex user and appliance interfaces accompanying the new applications, by making user interactions consistent, by supporting appliance interoperability, by centralizing control over competing access and service networks, and by integrating control over home devices of all kinds. Given time, home systems may evolve to integrated "electronic servants". In addition to these purely consumer benefits, AT&T home offerings should support strong near-term AT&T service bonding relationships, level the access playing field, and establish de facto standards that potential industry partners can rally around.

A home that fully supports these aims will be an "integrated" home, with true home narrowband and video networks. Market forces (complexity, expense, and growing demand for home-wide applications) should favor integrated architectures once the first round of digital video services reveals shortcomings in the (current) autonomous set top box architecture, and perhaps sooner.

For near- to far-term, the recommended architecture elements are:

- A modular, expandable home base station with computing capability. This key product is conceptually new and unique to home systems. It can be sold as a consumer appliance or be bundled into pricing by service providers (a potentially attractive entry strategy). The home base station can be configured as a set top smart terminal (using TVs or computer monitors) that cuts into cable boxes' evolution path by absorbing and centralizing the high level decision-making, user interfaces (keypads, speech, GUIs), and APIs. It's a low-end computer with a modular internal architecture, letting it accommodate many local and networked applications, including messaging, cordless telephony, and universal appliance control over video, home security, etc. The base station also bonds (as client) to network services that download programs or data. Many other home functions can be built into modules.

The home base station splits the expensive "information superhighway" digital set top boxes in two, moving the low level network interfaces and processing sections to "portals" - one for each access system. Cable portals can be much like today's converters augmented by compression chips and modems. Intelligent set top boxes can also be co-opted to be portals. One base station can command several portals - as modules within it or on separate platforms.

- Access control - the ability to exploit competition by selecting, managing, and signaling over several broadband, narrowband, or wireless access networks and services. Innovative new services can use access control and direct signaling to bond home CPE with network servers (bonding consumers to AT&T). One very useful home base station module is a fixed-location cellular and/or PCN communication device, providing narrowband voice, data, and signaling alternatives.

- Narrowband and video-capable home networks that share equipment and make applications available home-wide. Unwanted signals (especially video) are tuned out in the portals instead of being distributed. This "scalability" lets consumers exploit access competition, since many access sources can be connected to the home without demanding overly broad bandwidth within it. The most promising video network structure is a client/server "home bus". The home base station controls both narrowband and video home networks and unifies control over video and narrowband appliances. But portals handle actual video processing (they need not be physically collocated with the base, but can be).

- Finally, the base station ensures consistent user and appliance interfaces, including speech recognition and video GUIs, and maintains user-adaptive profiles and agents. These create the impression of an easy-to-use, seamless appliance system and can potentially enrapture and entertain users.
4. Services and Examples

AT&T home systems should bond end users to total AT&T service offerings. Home "genies" (the interim name for this differentiator) built into appliances become end users' communication servants, invisibly carrying out whatever information/communications requests have been made. The essential home "genie" capabilities are:

- Upstream direct signaling links that initiate requests to AT&T network servers, preferably via connectionless media such as a wireless digital packet service. Servers create connection-oriented or connectionless downlinks in response, possibly followed by further action. The signaling protocols include application level messages and possibly migratory agents.

- The ability to integrate access; that is, to select and coordinate connections on different access systems. For example, wireless uplinks might be answered via a shared one way cable video channel. Access services may be arbitraged based on time-sensitive tariffs, service features, etc.

- Some smart terminal capability with attractive user interfaces, and remote programmability (client mode) so that programs or data can be down linked, stored, and executed or displayed locally.

- The ability (through encryption and trusted software) to protect intellectual property.

Here are a few service elements and examples that exploit the combination:

- Direct signaling from the home "genie" to points in the AT&T network, where a process is invoked. For example, dialing a long distance call would trigger signaling to a server that places one call to the called party and another back to the calling location, reducing access charges. Direct signaling enables boundaryless home computing. For example, the home base station can hide direct signaling to a network server that seamlessly invokes application help on demand (e.g., for information look-up, high quality speech processing, email delivery, etc.).

- Client/server services. The home platform's "genie" and computing capability lets it seamlessly order, receive, and use or execute downloaded data and programs - complementary forms of boundary less service.

- Cross-access services, coordinating a network server and a home platform via different access networks. The home platform collects and routes uplink information through the chosen access system, and similarly directs inbound communications to the user terminal transparently. For example, early "genie-based" interactive digital services (e.g., games or other executables) can mimic interactive TV well before cable systems become bidirectional, using one way CATV systems and connectionless uplinks via wireless packet service or the ISDN "D" channel. Many users could share a downstream channel or two until broadband systems provide individually allocated channels.

- Outbound access arbitrage selects the optimal one of several access services or networks automatically, with the details invisible to consumers. Personalized profiles or incentive offers down linked from the AT&T network might drive the choice. Billing information can be stored and unlinked to AT&T. As one example, outbound long distance voice calls from any phone in the home can be detected and routed automatically (e.g., over Macaw cellular or a cable network) and then to an AT&T "POP" (Point of Presence).

- Incoming access arbitrage lets inbound calls or messages are intercepted at an AT&T "POP" and redirected over a favored access path (e.g., cellular/PCN or CATV) to the home. The "genie" connection makes this invisible to consumers by again redirecting the incoming communication on the alternate access system back to the same device it would normally be received on. For example, an incoming long distance voice call on the AT&T network might be rerouted from LEC to wireless or cable access at the "POP", but it would ring home phones normally once the "genie" station reroutes it back to telephone lines inside the home.

- Incoming public network cellular or PCN calls (or messages) are re-routed so that they automatically terminate on wired or wireless devices in the home instead of on the mobile devices that the caller had in mind. For example, calls to a car phone would be received on a home phone even though the sender called a cellular or PCN device.
5. **Strategy Elements**

The base station becomes the focal platform for migrating narrowband and broadband/video products and bonding services in parallel. Narrowband service customers hopefully transfer loyalty to maturing broadband applications. The following strategy elements presume effective cross-business unit partnering and a common modular home platform:

- **Preempt the interface paradigms and video control.** Consistent and innovative user interfaces unite the narrowband and video/broadband product lines with a common look and feel. The narrowband system should become the home appliance control center early on, with a mission to usurp control of video applications and set top equipment, along with APIs and UIs. Timely action could force uncoordinated “smart” set top architectures to face well-integrated, easy-to-use narrowband systems that can command the video appliances.

- **Preempt CATV/LEC offerings through bonding combinations of home “genies” with AT&T services.** Narrowband services coupled to a friendly home terminal may offset some AT&T weakness in video access. Narrowband services can move ahead aggressively without waiting for two ways digital broadband systems, possibly exploiting wireless technology. For example, narrowband “direct signaling” uplinks united with shared one way CATV channels may support interactive TV applications.

The modular, flexible home base platform can improve the probability of success. It is easier to attract initial buyers by offering alternative entry products that can all grow toward the same goal. For example, the base station can start as a communications and messaging center, or as a cordless phone and universal remote controller, or as a cellular/PCS phone and access device, or as a game deck/VCR, or as a cable converter box, or as a home video control center, etc.

6. **Conclusions**

It is important for AT&T to have a comprehensive, cross-group home systems effort focused around a flexible, irritable architecture and modular home platform. It would tie together efforts underway, including SAGE/Telecaster, set top box initiatives, wireless access, narrow and broadband services. Several AT&T groups have suggested home base station and controller concepts with subsets of the needed capability. These need to be merged. The level of home systems-related investment needs to be increased very substantially.

Competitors recognize home systems’ importance, but most industry efforts are currently still disunited. A broad AT&T program can use the strength of disparate AT&T businesses to turn out offerings that differentiate us from competitors and that encourage others to join with us and adopt standards we establish. AT&T home offerings tying together elements discussed above can effectively defend AT&T long distance revenue, and enable attractive new and near-term services.