

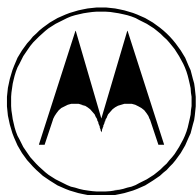


**Closing the Personal Digital Divide
Visioneering White Paper
“Your World, Your Stuff, All the time”**



By

**Guy Bieber
Lead Architect
Openwings**



MOTOROLA



1. Introduction

This document presents a vision of the future digital world of consumers. Consumers today have a wide variety of personal electronics devices and services available to them (see Figure 1). These devices operate independently and typically in isolation.



Figure 1: Digitization on the Individual

At home the user has another array of digital devices and services (see figure 2). Some of the services are hosted on home PCs, some are on the Internet, and others are sprinkled throughout the devices in our homes. The Internet provides many provocative services: internet telephony, location based information (weather, maps), telephone directories, music, audio streams, video streams, auctions, file sharing, instant messaging, email, etc.

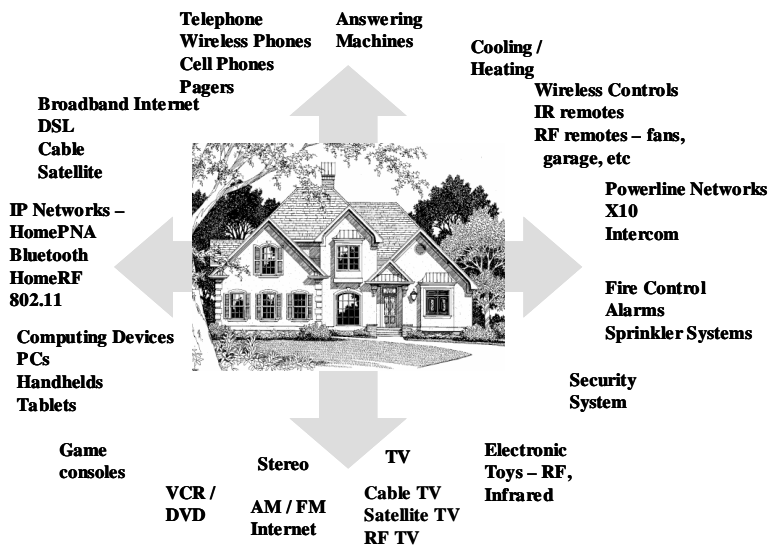


Figure 2: Digitization in the Home

At the office there is yet another set of devices and services. We lead many separate digital lives.

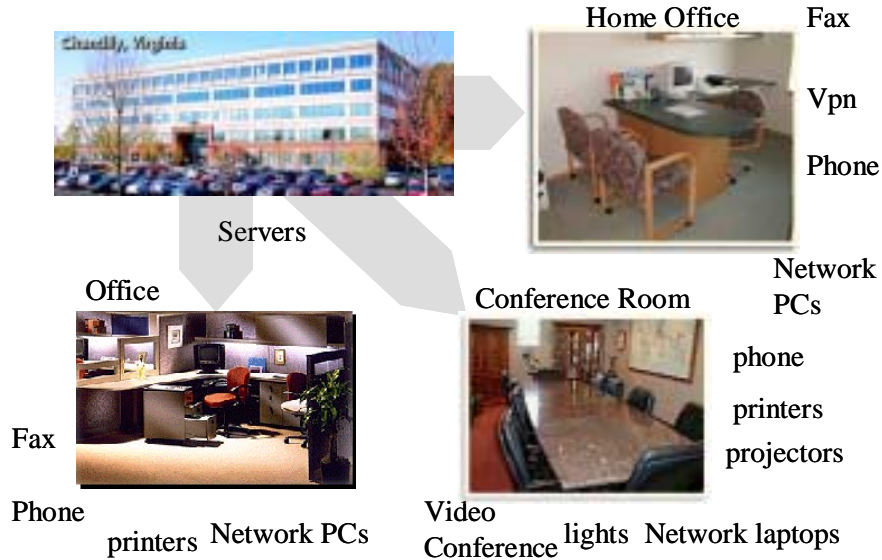


Figure 3: Digitization in the Office

These devices are all great, if you have the right one with you. Three technologies are poised to dramatically change how we interact with our digital and physical worlds: broadband Internet technologies, wireless ad-hoc networking technologies, and discovery technologies.

2. The Problem

So what exactly is the problem, we like our toys? Well, there has been a lot of talk recently over the “digital divide”. How parts of society are digitally enabled and others are not. However, we all have a personal part in the battle, the personal digital divide. Even those that enjoy the benefits of the computer age, have their digital world divided into many isolated islands of information and services. The information and programs on your computer at home aren’t accessible from work. The contacts are all different on your cell phone, PDA, work PC, and home PC. The price comparison information that is at your fingertips on the Web, is unavailable when you are actually out shopping. Directions to the piano teacher on your home computer are useless when you are lost in your car.

In fact, the personal digital divide severely limits how we can use the things we buy. Often time we revert to physically carrying those things with us we might need. A checkbook substitutes for Quicken in keeping track of our bank accounts. A paper map substitutes for MapQuest to try and figure out where we are. We carry around a few CDs with music on them, even though we have large CD collections or digital collections of music at our homes.

The personal digital divide limits our communications with others. When a recipe comes up in conversation at the mall, it can't be exchanged when it is on a computer at home. That URL a friend wanted to see is on a bookmark at work. The photo we wanted to give grandma is on the computer at home. The information we would like to exchange in real time is just out of our reach.

The personal digital divide limits our interaction with our environment. There are several questions we just can't answer due to our digital divide:

- Where is the cheapest place to get gas near here?
- Has that used car ever been in an accident?
- Do I have to wait in line for tickets?
- Where is the nearest restroom?
- How is that DVD player rated?
- What is store X's ad for this week?
- Where in the store is ad item Y?
- Where is the remote?
- Where is the users manual?
- Why are there so many remotes?
- Do I really have to install that software on every PC to use it on every one?

Again the information and services are just out of our reach. Again our personal digital divide forces us to do without information and services we know exist and sometimes *even own*. In summary, the personal digital divide inhibits:

- Using our stuff.
- Communicating with others.
- Interacting with our environment.

3. The Vision – “Your World, Your Stuff, All the Time”

What if the digital information and services you owned were available to you anywhere? What if your cell phone could get a contact off your computer at home or PDA? What if you could collaborate with others at any time and exchange digital information? What if the new video camera you bought could stream video anywhere in your world to anyone you wanted? What if your digital world was not divided? What could be possible in such a world?

There are three enabling elements in this vision, as seen in Figure 4:

1. **Broadband Access** – Secure access to services hosted at your home space, work space, etc.
2. **Service Discovery** – The capability of devices to discovery each other and exchange services.

3. **Wireless Connectivity** – Ability to form wireless networks to enable connectivity on the go back to your home servers and to participate in locality based service discovery.

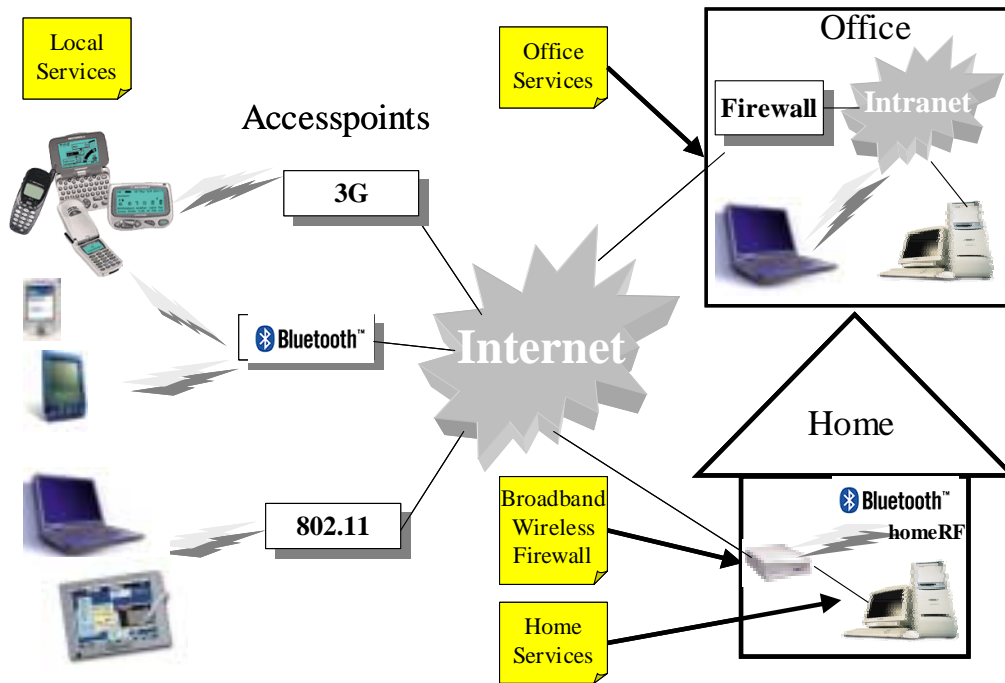


Figure 4: Enabling Technology

3.1 The Portal

The way the user will access the services in their homes, work, and environment will be through portal devices. These portals all have different capabilities and require different kinds of user interfaces. Phones provide voice interfaces, handhels provide pen-based interfaces, and desktop computers provide full keyboards, display, and sound. This means that the software providing services will have to adapt to the type of portal available. Handheld computers, telephones, and wireless networking devices are beginning to converge.

One of the largest growing computer markets is the handheld computer market. The ability to take volumes of information and programs with you in your pocket is very useful. These devices become even more useful when they are able to access the information and services of the Internet. Even more value is added when the device can understand locality and interact with the environment directly around it, including other devices. To be able to achieve this ad-hoc interaction service discovery is needed.

Any portal device can become a world remote. It can be used to control lights anything in one's environment. There is no longer a need to have several remotes to control the devices and your world. Through network connectivity and technologies such as Jini™ and Openwings™ interfaces to these devices can be delivered to these portals as software.

When devices have network connectivity and a concept of locality, controlling ones environment becomes a whole new experience. Imagine being able to take photos on your camera and instantly have them show up on your computer at home or web page. They could even be queued for printing and be available when you get home. The ability to exchange pictures with parents at your children's sporting events becomes possible.

- Discovery of devices, services, and interaction by locality
 - Finding family members at the mall
 - Finding out information about sales in a store
 - Finding directions to certain products in a large store
 - Exchanging information with people on the move
- Wireless network connectivity and access to spaces on the web
 - Secure access back to your home space or workspace.
 - Ability to send and publish photos as you take them.
 - Ability to use services in your home directly, for instance automatically adding purchases into quicken as you make them.
 - Ability to forward communications of any type to you where you are.
 - Ability to use web services

Consumers are acquiring more devices that contain processing capabilities. These devices become more powerful when they can communicate together over a network, or wireless network.

3.2 At Home

Openwings™ enables the free flow of information and services in the networked home. If all of the services that came into your home were placed on the network immediately, they could be utilized and controlled anywhere in your home or even remotely. This includes services such as telephony, multi-media sources (television, web broadcasts, movie libraries), audio sources (fm/am radio, net radio broadcasters, audio libraries), email, instant messaging, net collaboration tools, etc. In fact the handheld portal becomes a universal remote to control all of the devices in your household. By doing this any radio, TV, desktop computer, or wireless device becomes a control and communication medium. The TV tells you when there is an incoming phone call, someone at the door, new email, or other event. Any kind of audio content can be delivered to any audio device, including your mp3 player, car, or neighbors. In addition all of these services can be accessed over any network connection. There is no need for dozens of remotes, when you can control any device in the home from a handheld computer or telephone.

Finding the users manual for devices in your home is as simple as getting your portal in proximity of the device. Additionally, by installing software as services they become available to you on every device in the home. Anyone who has had to load software over and over on computers throughout their office or home knows how time consuming this can be.

3.3 On The Move

3.3.1 In the Car

Services available to you in your home can now be available in your car. Audio information and music can be delivered from your home to the vehicle. Web-based services such as maps can be easily delivered to your vehicle and in conjunction with GPS can be used track your progress. Finding the nearest restaurant or gas station can utilize web services your location and your preferences. All of these services can be hosted on the Internet, even in your home.

3.3.2 At the Store

At the store Mobile Commerce (M-Commerce) becomes a possibility. Entering a store you can discover the in store ads, specials, and store map. These can be used to find items in the store. This in conjunction with web services allow you to do comparison shopping while you are in the store, in auctions, online sales, and physical sales. Demo items in the store can actually broadcast product information

Finding out information about things you would like to buy becomes easy. Seeing the users manual, consumer ratings, or history of used items such as cars is now at your fingertips.

Many lines can be eliminated entirely by providing ways of purchasing things wirelessly, such as tickets. This can make the movie going experience much more enjoyable.

3.3.3 At the Game

Interaction at a sporting even can add a new dimension to the game. You will be able to get information about players, statistics, and plays. In fact, this same capability will exist in your home watching any kind of television. You will be able to augment and even interact in real time with the action on the field or on your TV. Again information and communication barriers are greatly lowered.

3.3.4 At the Conference

Wireless network connectivity and locality can provide really innovative capabilities for trade shows. Exchange of contact information is instantaneous. The same is true for exchange of product information, and demonstrations. Locating products will be easy also. Your handheld device can tell you where your companions are and where the next thing you want to see is. Just by being near a booth you could install, run, and test a vendor's product from your handheld. Collecting statistics of how many people were interested in your booth is instantaneous. Again this removes barriers to our digital world.

3.4 At Work

Services of the office you are in become available to guests when they arrive. They can discover and use your printers, projectors, lights, and even wireless network access. As

capabilities are added to the work environment, everyone can use these services. Service discovery will allow one to do a web like query and find someone who can burn CDs or someone with expertise in a technology.

4. The Technology Behind the Vision

4.1 Services Everywhere

The distributed computing model is moving towards a service-oriented paradigm. This means services are becoming available everywhere:

- Services Hosted on the Internet – This includes things like internet telephony, location based information (weather, maps), telephone directories, music, audio streams, video streams, auctions, file sharing, instant messaging, email, etc.
- Services Hosted in their house – This includes things like quicken accounts, music files, data files, voice recognition, printers, cameras, security, programs, etc.
- Services Hosted at their work – This includes things like files, programs, printers, etc.
- Services Between Devices – This include communications between devices for instance using a PDA contact to dial your phone.
- Services Between the User and their environment – This includes services hosted at the store, M-commerce, etc.

For more information on Service-Oriented Programming (SOP) refer to the white papers at the Openwings website, <http://www.openwings.org>.

4.2 Wireless Networking and Locality Awareness

Wireless networking technologies are key to providing access to services hosted in the home, office, internet, and within the immediate environment. Locality awareness is essential for environmental access. Several technologies exist to achieve these wireless network bridges: Bluetooth, 802.11, HomeRF, and 3G cellular. In addition, GPS and Bluetooth provide locality information.

The goal is to provide seamless access to networks and locality awareness. Several things are inhibiting this:

- Standards that cannot co-exist.
- Lack of wireless interoperability

These issues are currently being worked in standards bodies and industry.

4.3 Broadband and The Home Gateway

There is a growing need to be able to host services in the home that can be securely accessed over the web. This requires broadband, firewalls, VPN, and service technologies to achieve. Several Internet companies would like to host many of these

services for us, such as bill payment and data storage. User's are being asked to pay for and entrust web service providers with their personal information, when they can control and host these services on their home computers. In fact, peer-to-peer technology promises to eliminate the middleman in many instances. Hosting services in the home is simply an extension of these trends.

A home gateway device will be able to provide television, phone, Internet, and wireless access in the home. Today's devices already combine cable modems, firewalls, and access points. A home server to control and provide these services is a vision that is not far away. This is very similar to how businesses their infrastructure. However, for the consumer this needs to be a zero-admin system. Convergence of telephone, cable, Internet, home services is beginning to occur in the form of a home gateway server.

5. Conclusion

Through exploitation of network technology and service-oriented technology throughout the consumer's world, we can make great strides in closing the personal digital divide. For the consumer, the concept of a home gateway server is an enabling technology. This means that the flow of services and information between people, devices, home, office, and the environment will be greatly enhanced. By removing these barriers the user will be able to have the vision of: "Your World, Your Stuff, All the Time".