

Providing an Improved and Integrated Home Entertainment Experience

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Methodology

Observational Study

To determine specific needs, desires, and problems that users face while using multimedia devices at home.

To help narrow down our design space, and form specific ideas on where the design was headed.

Prototyping

Build initial throw-away prototypes quickly, to be used in the evaluation phase.

Evaluation and Iteration

Testing the prototype with users, asking them to perform a set of tasks, and measuring their performance while using the prototype against pre-determined metrics.

Recruitment and User Demographics

Recruitment was done using email, word of mouth, mailing lists, social networks like Facebook.

Inclusion criteria was ownership of (at least) a TV and a video game console.

- 11 participants
- 3 females, 8 males
- 10 students – 4 undergrads, 6 graduate students
- 3 home owners (1 couple)
- 4 living in a rented house
- 4 living in dorms

Observational Study

- Users were first interviewed about their current setup, preferences, problems, wish lists, usage patterns etc. Interviews helped in getting at individual-specific needs better than other methods like surveys, questionnaires etc.
- Users were then asked to demonstrate some of their most frequent tasks in order to find issues that did not come up during the interview.
- This data was recorded (video) and analyzed for gesture and sequence patterns.
- User feedback was sought on initial design concepts, using low fidelity mock ups and storyboards. These initial ideas helped in focusing participants' responses on things that might be done to meet their needs.
- Modifications were made to the initial designs after each user interview, based on user input

Questions asked

- What do you do with your home entertainment system?
- What equipment do you have?
- What do you do most?
- How many hours a day/week on average with various systems?
- Is there any equipment that you don't use?
- Do you do these activities alone or with a friend/family? If kids, how does that work?
- If you could add one thing to your setup (that's currently on the market), what might that be?
- If there was one thing that you would like to get rid of, what might that be?
- Discuss fit and arrangement issues.
- Tell me about some specific problems you've had with the television, game console, stereo, etc.
- In what order did you acquire your systems, and how did they affect your habits?

Typical Tasks Demonstrated

- Turn on TV to watch CNN (or other network)
- Watch a DVD
- Play a game
- Listen to music
- Pause
- Change DVDs, CDs, Games
- Change display mode

These tasks helped show things that users actually do with their equipment that might not come up during the interview.

Findings - Users' Equipment

- TV
- HDTV
- Laptop
- Cable
- PlayStation 3
- Xbox 360
- Wireless game controllers
- Guitar and drum controllers
- Boombox
- Satellite radio
- Desktop computer
- Nintendo Wii
- Other, older game consoles
- Speakers
- Remotes
- iPod
- iPod speakers
- DVD Player

Findings - Tentative User Types

- People with no space and money restrictions
- People with restricted space and money
- **Enthusiasts:** People who emphasize quality & advanced features
- **Pragmatists:** People who are not inclined to look for & set up advanced features

Findings - Key User Needs

- Ease of use for person who has not set up the equipment
 - The system owner may know what “Input 1” is, but visitors won't
- Reduction in wires – space, aesthetics, cleanliness
 - Several participants apologized to us about the messy wires
 - Often people made an effort to hide the wires behind furniture—to varying degrees of success depending on space and the equipment
 - Home owners expressed interest in running their own wires through the walls and ceilings, but this is not possible in apartments and dorms
 - More of a problem for users with limited space

Findings - Key User Needs

- Easy installation
 - “If I knew how to, I think I'd do it”
 - Users may not even realize some tasks are possible, like connecting the better set of speakers for the iPod or the boom box to the TV or the laptop
 - Most important for the Pragmatists.
- Convergence of media – universal media device
 - “If my TV were able to play video games I guess that would be convenient. I'm not sure where the video game ports and memory cards would go, but that would be cool”
 - Not very important for people without any space and monetary restrictions.

Findings - Key User Needs

- More comfort – reduced effort, cognitive and memory load.
 - It can be hard to remember what all the inputs are, or that the “VCR” button on an older piece of equipment actually means “XM Radio”
 - Important for all users
- Ease of troubleshooting & understanding the causes of errors, malfunction, reducing errors
 - If the cause of a problem is hard to fathom, users may give up, push buttons randomly, and avoid related actions in the future.
 - Important for all users. Enthusiasts can probably figure it out, but they don't really want to.

Findings - Key User Needs

- **Affordability**
 - "I want to wire the whole house with speakers... But not until after I'm done being a student."
 - Most important for people with limited finances
- **Privacy/security and control**
 - "I don't want to know what my brother is watching all the time"
 - Important for all users

Findings - Key User Needs

- Things shouldn't distract from the experience (e.g. Vision for remote, voice or typing for chat)
 - “When I'm watching a movie, I'm pretty focused on what I'm watching.”
 - For some users, though, chit-chat is part of the experience—but not necessarily typing or having to look away
 - Most important for the Enthusiasts
- Getting relevant information as needed
 - Participants said they occasionally want to look up an actor in the middle of a show or movie, but they may not remember by the end
 - Important for all users.

Initial Concepts

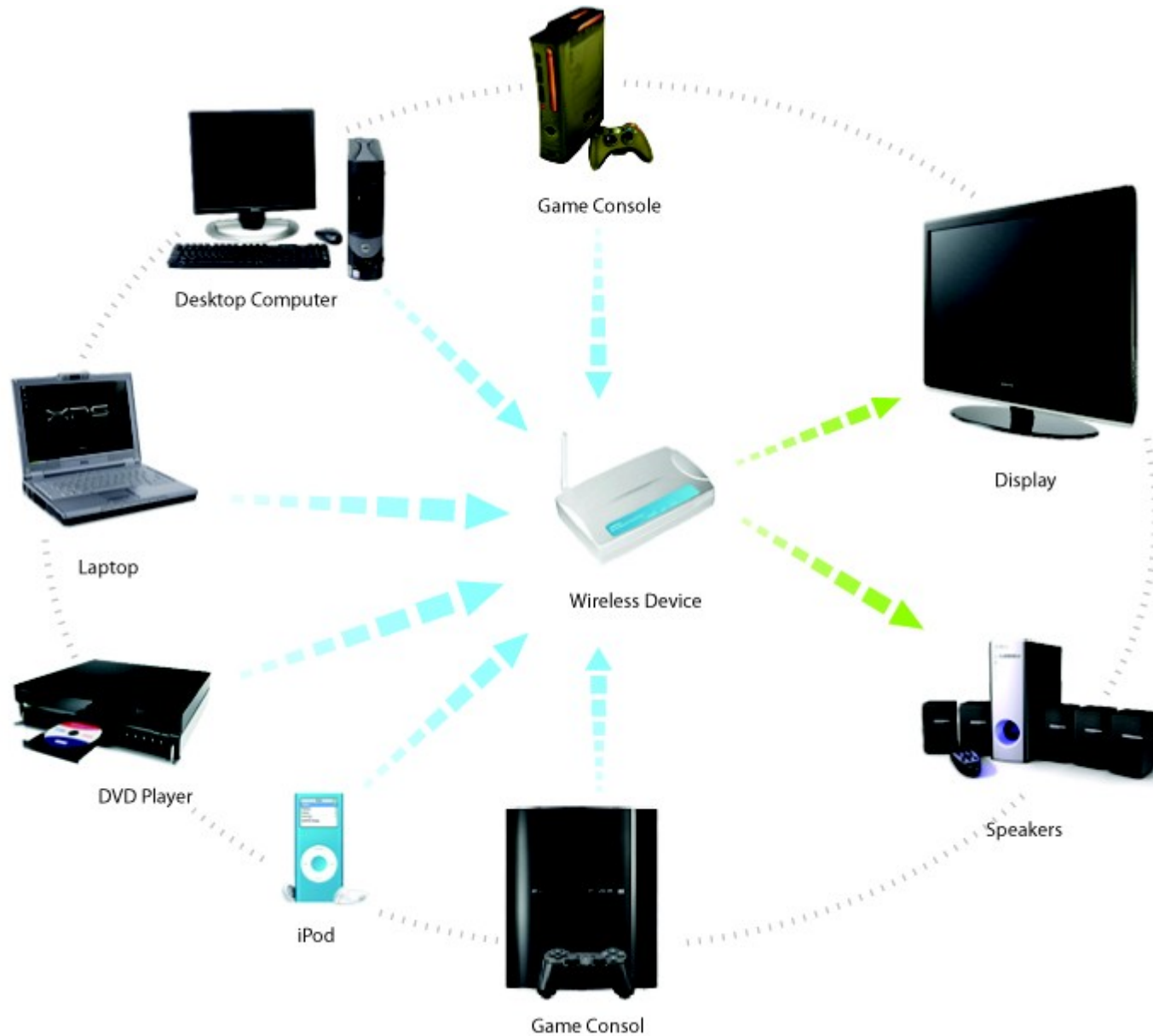
Out of many initial concepts, we gradually narrowed down through interview feedback to the ones below

- Central Wireless Device
- Context Sensitive Touchscreen Universal Remote
- Social TV
- T Commerce
- Game TV
- Detachable screen laptop

Concepts - Central Wireless Device

- Central Visual and Auditory output from many input devices
- All devices connected wirelessly – computers, laptops, cable, game consoles, music players, DVD players
- Space efficient, clean, aesthetic
- Active device displayed
- Control can be transferred to the various input devices through a display menu or a remote device
- Removes the need for multiple display/speaker systems.

Concepts - Central Wireless Device



Concepts - Central Wireless Device



Concepts - Central Wireless Device

- User needs satisfied
 - Reduction in wires – space, aesthetics, cleanliness
 - Convergence of media
 - More comfort – reduced effort, cognitive and memory load.
- User feedback
 - All users immediately liked this idea, particularly people with space restrictions
 - Enthusiasts were concerned about a loss in quality
 - There were concerns about interference with other neighboring networks

Concepts - Context Sensitive Touchscreen Universal Remote

- Touchscreen-based, controlled with gestures
- Interacts with entire media center, controls sound, TV, DVD player, CD player, etc.
- Contextual functions, doesn't have zillions of buttons most of which don't apply at any given moment (like iPhone)
- Can interact with on-screen content (e.g. retrieves info about movies from the web)
- Able to catalog CD and DVD collection, retrieve info from the web

Concepts - Context Sensitive Touchscreen Universal Remote



Normal TV view

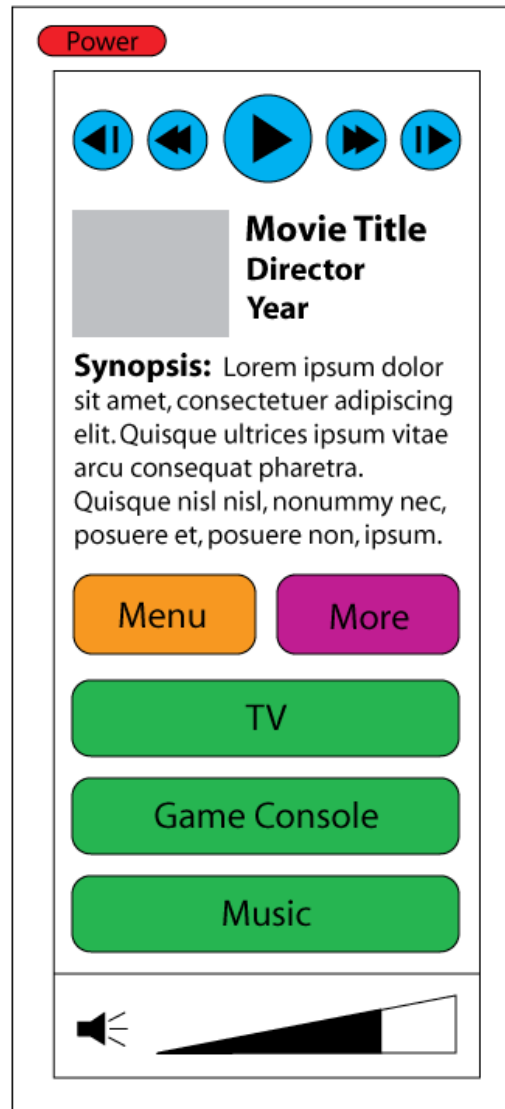


TV view with info



TV view with more info

Concepts - Context Sensitive Touchscreen Universal Remote

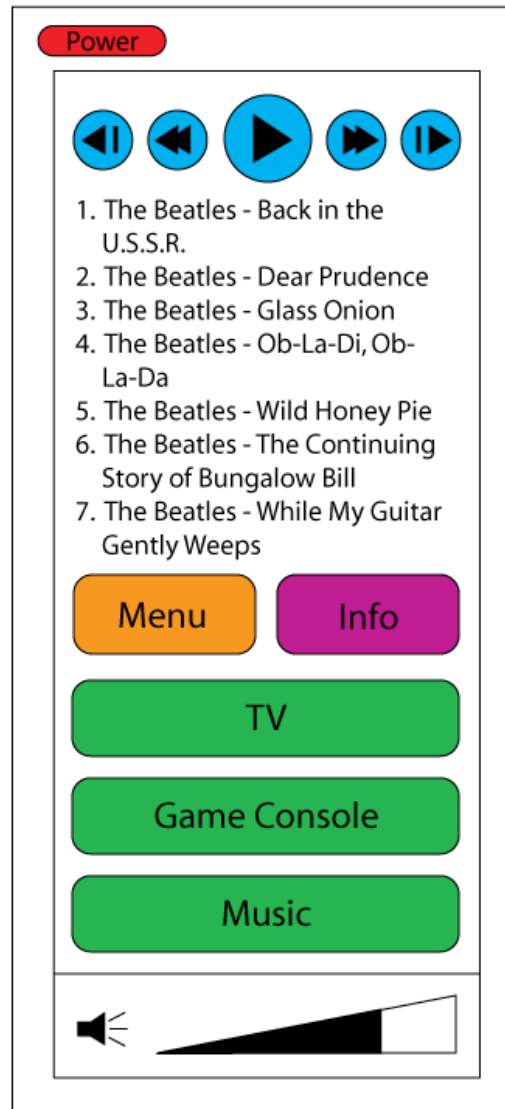


Normal DVD view

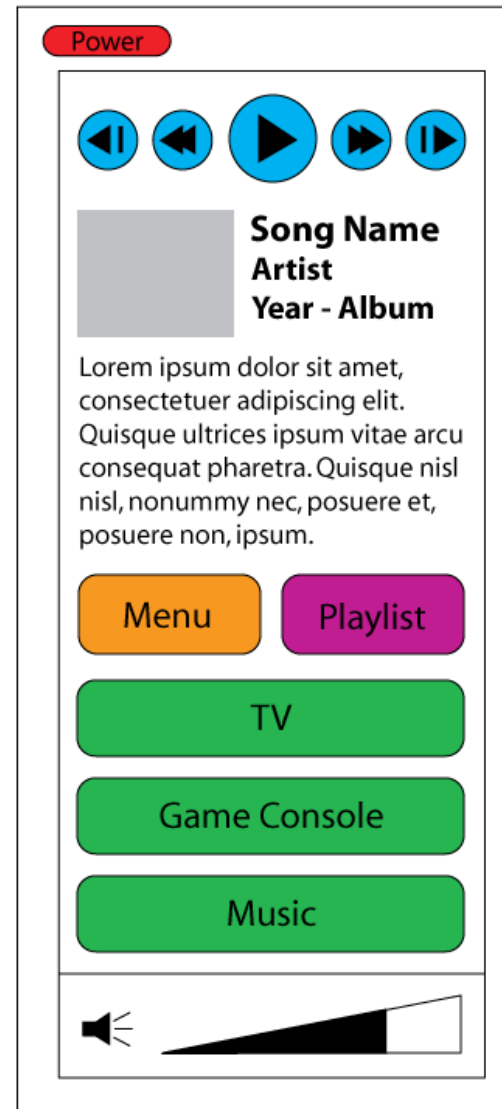


DVD view with info

Concepts - Context Sensitive Touchscreen Universal Remote



Normal music view



Music view with info

Concepts - Context Sensitive Touchscreen Universal Remote

- User needs satisfied
 - Reduction in irrelevant functions displayed
 - Convergence of Media
 - Comfort
 - Getting relevant information as needed
- User feedback
 - Generally well liked
 - Concerns about interference, recognition of device status
 - Concerns about difficulty in programming - Pragmatists

Concepts - Social TV

- Enables social activities like chatting, talking, discussions, recommendations etc in the context of watching Television
- Interactive TV – Input devices like mouse, keyboard, integrated remote (containing keyboard and mouse functionalities)
- Users have accounts, profiles, preferences etc
- Users are able to chat (text, audio, video) with other users
- Viewers can maintain friends lists
- Users can view/broadcast recommendations for programs, channels etc
- All users watching a particular program can participate in discussions.
- Users can subscribe to various alerts, like friends coming on line, change in favorite show timings, scheduling etc. These alerts can also be transferred to their mobile phones.

Concepts - Social TV



Concepts - Social TV



Concepts - Social TV



Concepts - Social TV



Concepts - Social TV



Concepts - Social TV

- User needs satisfied
 - More comfort – reduced effort, cognitive and memory load
 - Getting relevant information as needed
 - Convergence of media
- User Feedback
 - Mixed response – some users liked some features, no fixed patterns emerged
 - There were concerns about privacy – users don't want to broadcast what they are watching
 - The enthusiasts were concerned about being distracted from their experience
- Much of this has already been done by Sergio Goldenberg (<http://dm.lcc.gatech.edu/~sgoldenberg/msproject/>)

Concepts - T Commerce and Game TV

- T Commerce
 - Users can order/purchase products being advertised directly, without needing to call/message.
 - Users can discuss with other viewers who are interested in the product or have used it before
 - Users can download more information about advertised products (movie trailers etc) to their mobile phones
- Game TV
 - Dedicated game channels allow viewers to log in and play with other viewers
 - Users don't need to buy games

Concepts - T Commerce



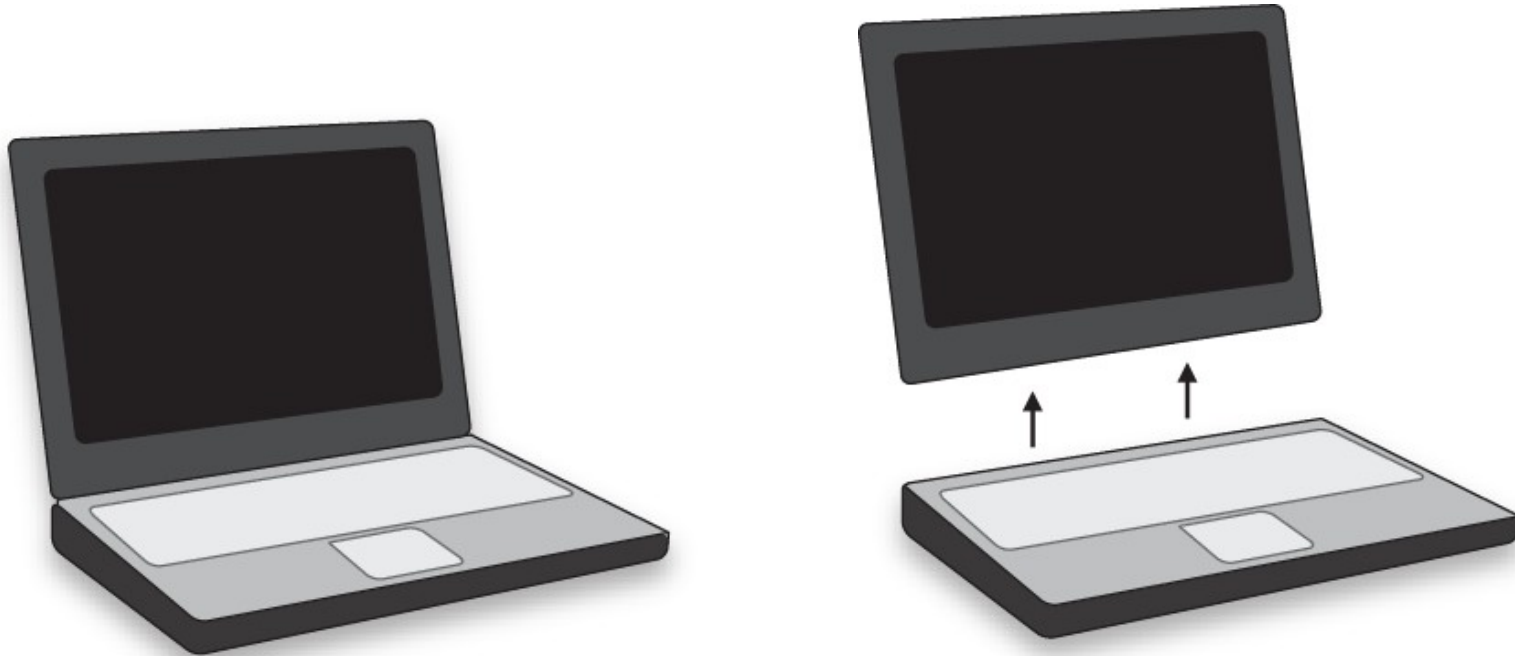
Concepts - Game TV



Concepts - T Commerce and Game TV

- User needs satisfied
 - More comfort – reduced effort, cognitive and memory load
 - Convergence of media
 - Getting relevant information as needed
 - Affordability
- User feedback
 - Mixed response for the T commerce idea, Game TV generally well liked
 - Concerns about spending too much (it being too easy), impulse buying
 - Questionable effectiveness - are ads actually able to persuade users to buy?
 - Concerns about game quality, and personal data storage - Enthusiasts

Concepts - Laptop with Detachable Screen



Users can detach/attach the screen to the keyboard quickly and easily.

Concepts - Laptop with Detachable Screen



- The detached screen has an inbuilt stand
- The screen can be connected to cable, game console, computer, DVD player
- Eliminates the need of a TV

Concepts - Laptop with Detachable Screen

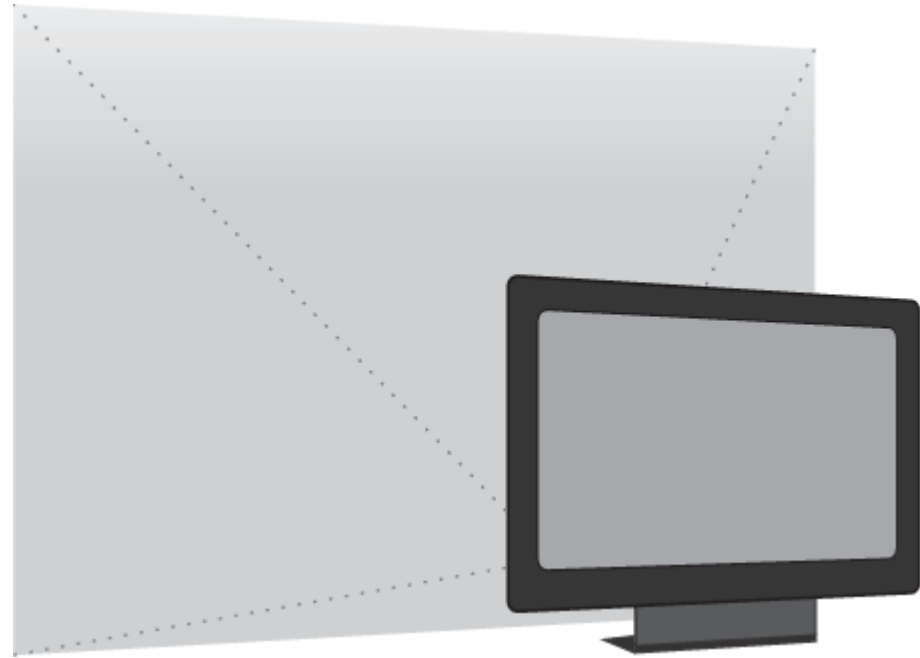


- The screen is expandable.
- Multi-tasking between different devices is enabled. e.g. users can chat while watching TV.

Concepts - Laptop with Detachable Screen



Projection Lens



Projection on Wall

- The screen has an embedded projection lens, which users can use to project video on a flat surface.
- A remote control and a projection screen can be sold as accessories.

Concepts - Laptop with Detachable Screen

- User needs satisfied
 - More comfort – reduced effort, cognitive and memory load
 - Affordability
 - Convergence of media
- User Feedback
 - Mixed response
 - Personal screen – other household members will be unable to watch if the laptop is not at home
 - Liked by people with space and money restrictions

Narrowing it down further

- Based on concepts, we came up with scenarios to describe novel and unique user experiences for users living in an 'ecosystem' containing the following devices:
 - Laptop with detachable screen
 - Central wireless device
 - Universal remote
- They devices in the ecosystem are synchronized with each other and communicate seamlessly

Persona - Dave

- Male, 25 years old
Computer Science PhD student at GA Tech.
- Dave lives with a room-mate in a 2 bedroom apartment located off-campus in midtown.
He has the following equipment:

Shared Equipment (located in living room)	Personal Equipment
<ul style="list-style-type: none">• 26" HDTV• Xbox 360• Playstation 2• Nintendo Wii• DVD Player• Surround Sound Speakers• Cable TV• Broadband Internet• Universal Remote• Wireless Device	<ul style="list-style-type: none">• Laptop with detachable screen• Projector screen• iPod• Cell Phone

Dave - Likes, Preferences

- Dave is an active gamer, and plays a lot of First Person Shooters and Role Playing Games
- Dave likes action movies, and watches 2-3 movies a week when he's not in school
- He likes listening to Metal, Punk and Alternative music
- He doesn't watch a lot of cable. When he does, its mostly sports, reality shows or action dramas
- He uses his laptop mostly for work

Dave - Routine

- During weekdays, Dave generally gets up at around 8:30 in the morning. He reaches campus by 10:00 am. He has 2 classes, and spends the rest of the time doing research work in the lab. He gets back home by 6 pm. Some days he has to stay back late. He does more work during the evenings. He then spends some time playing a game, watching TV etc, and goes to sleep around midnight.
- During weekends, he wakes up at around 11 am. Sometimes he goes to campus, but most of the times he works at home. On weekends he spends less time working and more time going out with friends, watching movies, cable, listening to music, playing games etc.

Laptop with Detachable Screen - Scenario 1



Laptop with Detachable Screen - Scenario 1

Dave is sitting at his room working on his laptop. He has just finished working on a paper. He has no more to do this evening for tomorrow, so he decides to play World of Warcraft. Dave doesn't mind using a small screen for typing since the paper width doesn't take up the whole screen width, but for games he likes having as big a screen as possible so he can see the world better. He only has a laptop, which has a relatively small screen so it is easy to carry in a bag. Fortunately, this laptop has an expanding screen that gives him more screen space just when he needs it.

He starts the game, pulls out the screen, slides out the panels to enlarge it, and places the screen on its stand. When the screen is detached, a menu comes up displaying available inputs. The screen can take wireless signal from any device in the house, which is handy when he wants to use it with a game console or other device. Right now he selects the signal from the computer base. The World of Warcraft control panels slide into the expanded screen panels, and the gap between the screen and the expanded panels does not interfere with game-play.

Sometimes he watches TV on the detachable screen portion puts the keyboard section somewhere out of the way so he has more room in front of him for a drink or a snack. Right now, though, he needs the keyboard to play the game, so he keeps it on the desk and starts playing.

Laptop with Detachable Screen - Scenario 2



Laptop with Detachable Screen - Scenario 2

It's Super Bowl weekend and some of Dave's and his roommate's friends have planned to come over to watch the game. When it's just the two of them and maybe one or two friends the 26 inch TV in the living room is big enough, but they plan to have a lot of people over so they need something bigger. They decide to use Dave's laptop screen, which has a built-in projector to project the game onto one of the living room walls. The projection will be plenty big enough for everyone to see the game.

The laptop screen takes both wireless and wired input from input devices and the cable. Dave just plugs in the cable cord and tells the screen to use the cable input, then tells it to project and the television image is projected onto the opposite wall. Dave is now able to use his remote to select the right channel as though it were an ordinary TV.

The projector also automatically adjusts itself to the surface that it is being projected on. It quickly adjusts the focus, angle, and color balance. Dave could fine-tune the projected image himself, but generally he chooses not to; the automatic adjustments are good enough for him.

Central Wireless Device



Central Wireless Device

Dave is listening to music in his iPod while walking home from campus. He arrives at his apartment in the middle of his favorite song, and he decides to finish playing it on the living room speakers. He walks into the living room, removes the ear buds and sets the iPod into a dock on a shelf. The dock receives the audio output from the iPod and starts transmitting it to a wireless hub near the TV. Dave doesn't have to deal with wires from the iPod dock to the speakers or do anything else, the wireless hub just picks up the audio signal from the dock and automatically sends it to the speakers, which immediately start playing the song.

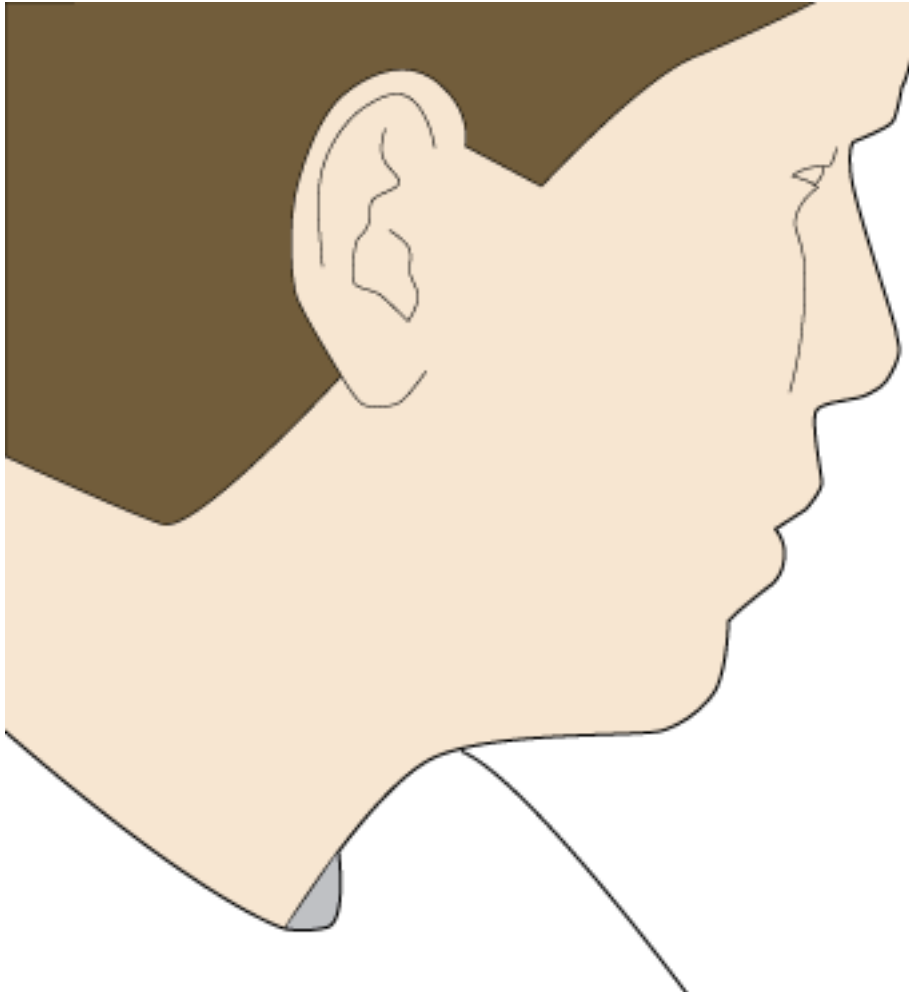
Dave adjusts the volume directly on the iPod, then walks across the room and switches on the TV and the Xbox, which are also connected to the wireless hub. He picks up the Xbox controller and sits down on the couch, grabs the remote, and presses a button to bring up the wireless hub menu. The menu displays a list of available audio and video inputs and outputs. The TV is still good quality, but it's on the older side and doesn't have very many inputs. Dave and his roommate used to have to switch back and forth between the different game consoles and the DVD player, half-climbing behind the TV to get at the wires, which could get really messy, tangled, and dusty. He doesn't have to deal with all those wires anymore—now they just have a wireless device plugged into one of the inputs that can switch between any number of wireless inputs that could come from anywhere in the apartment.

Central Wireless Device

Right now there are two video inputs available for the TV: 'Cable', which is currently selected, and 'Xbox'. Dave selects the Xbox and exits the menu. The Halo 3 game menu now appears on the screen, and Dave starts playing.

After a while Dave's roommate comes home with some friends. They want to watch a movie. Dave doesn't want to stop playing his game, but he doesn't have to—he can just move the game onto the screen in the bedroom without even turning off the console. The bedroom screen can also receive wireless input from the hub in the living room, and the wireless Xbox controller has a 30-foot range and works through the wall of his bedroom. Dave offers to move his game into the bedroom so they can watch the movie in the living room. All he has to do to move the game is pause it, take the controller and go. He accesses the same wireless input menu from the bedroom TV and picks the Xbox input and his paused game comes up on the screen. He sits down on his bed, unpauses the game and continues playing.

Central Wireless Device



Universal Remote

It's Dave's turn to make dinner tonight, and he is in the kitchen chopping up an onion and some peppers for chili. He has music playing from his iPod on the living room speakers. He gets everything in the pot and then it has to simmer for a while, so he decides to see what's on TV. He goes into the living room and picks up the remote off the couch. Right now the remote is displaying the playlist from his iPod and some buttons that let him switch to TV, DVD, or each of the several game consoles.

He touches the TV button. The TV comes on and the music is replaced by the sound of a woman enthusing about her wonderful new dish detergent. A number panel, channel up/down buttons, and a TV Guide button replace the playlist on the remote. He doesn't know what's on right now, so he touches the TV Guide button and a list of shows replaces the channel buttons on the remote. The guide on the remote always has the most current schedule and it allows him to change easily to a show he wants to watch. He slides his finger down the side of the screen to scroll through the list until something catches his eye. He sees Chuck, a show he likes, so he touches the show's name and it starts playing.

Universal Remote

There's a guest actress on the show today, Dave thinks that she was in a movie that he saw last week. Dave could look her up online, but he doesn't want to get up and miss part of the show. Instead, he looks her up on the remote. He touches the 'Info' button on the remote and some information about the show, today's plot, and a cast list including guest actors comes up where the show listing had been. Dave scrolls down and finds her name--Rachel Bilson--then touches the screen to bring up her IMDB profile. Dave looks at the movies and shows she has appeared in and discovers that she wasn't in the movie Dave had been thinking of but she was in *The O.C.*, which he used to watch.

Dave sets down the remote and goes back to watching the show until the kitchen timer goes off. He can't see the TV from the kitchen, so he puts the music back on. The actress's profile is still at the top of the remote, but the buttons to switch between devices are always available on the remote so he just touches the 'Music' button and the music, which had paused when he switched to the TV, starts playing again from the living room speakers.

All Devices - Ecosystem

Dave is at home playing Bioshock in the living room. After a while Dave's roommate comes home with some friends. They want to watch a movie. Dave doesn't want to stop playing his game, but he doesn't have to—he can just move the game onto the screen in the bedroom without even turning off the console. The bedroom screen can also receive wireless input from the hub in the living room, and the wireless Xbox controller has a 30-foot range and works through the wall of his bedroom. Dave offers to move his game into the bedroom so they can watch the movie in the living room. All he has to do to move the game is pause it, take the controller and go.

For games he likes having as big a screen as possible so he can see the world better. He takes out his laptop, detaches the screen, slides out the panels to enlarge it, and places the screen on its stand. When the screen is detached, a menu comes up displaying available inputs. The screen can take wireless signal from any device in the house, which is handy when he wants to use it with a game console or other device. He selects the Xbox from the list and the paused game appears on the screen. He unpauses the game and starts playing.

All Devices - Ecosystem

Meanwhile, in the living room, Dave's roommate, Joe and his friends are setting up the TV to watch Sin City. Since the DVD player is already wirelessly connected to the central hub, he only needs to put the DVD in. He picks up the remote and presses the DVD button. The paused Bioshock game disappears from the screen and movie previews from the DVD start playing.

During the movie, Joe's friends start arguing about whether or not Jessica Alba was also in Rise of the Silver Surfer. They could look her up online to solve the argument, but they don't want to pause the movie and look her up on a computer. Instead, it's easy for them to use the remote to look up actors' profiles. One of them grabs the remote and touches the 'Info' button to bring up information about the movie on the remote. The movie summary is expanded to show a list of cast members. He then touches Jessica Alba's name to bring up her IMDB profile. He slides his finger down the side of the remote to scroll down to the filmography section. He sees that the movie's listed in there, just like he thought, so he gloats that he was right and passes the remote around.