
DorianTV: A User-centered Approach to Designing Internet Television

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Abstract

In this paper, a system will be presented that takes a user-centered approach to the design of an Internet television system. The system, called DorianTV, provides a “soft convergence” between television and the Internet. The system exploits the networked environment of the web, while replicating the ease of use and familiarity of traditional television.

Keywords

IPTV, Internet TV, Web 2.0, Media, HCI, Design, User-centered, Usability, User Research, WebTV, Tagging, Visualization, Long Tail, Niche, Folksonomy

Introduction

With millions of dollars being invested into the development of web-based television[1], the Internet television revolution is clearly on the horizon. That is not to say, however, that Internet television is not without its challenges.

Although Internet TV provides many advantages over traditional television, such as a highly reduced cost of distribution[2], problems do exist. For example: a household with cable or satellite could have access to 300 channels or more, providing over 7,000 hours of programming options per day[3]. That might seem like a lot, but consider this: Internet television will allow for an *unlimited* amount of programming[3]. Finding relevant content will pose a challenge for viewers of Internet TV.

In addition, there is a clear disconnect between a computer and a television; they simply do not function in the same manner. This creates many unfamiliar task flows for novice computer users attempting to watch television on the web. In order to move viewers from their living rooms to their desks, these and other issues must be addressed.

In this paper, a system will be presented that aims to solve these, and other problems brought on by Internet television. The system, called DorianTV, is currently in development and is based on in-depth design studies including user research and explorations of the Internet television problem space. The goal of DorianTV is to provide a “soft convergence” between television and the Internet. The system attempts to exploit the advantages that web-based content distribution provides, while replicating the ease of use and familiarity of traditional television.

It should be noted that the term *Internet television* in this paper refers to video content viewed through an Internet browser. This type of television circumvents traditional distribution platforms such as cable, satellite, or over-air broadcast which are referred to as *traditional television* throughout this paper.

There is also a movement to broadcast television through traditional distribution platforms using the internet as a protocol. This is commonly referred to as Internet Protocol Television (IPTV) and will not be addressed in this paper.

Background

The research and design of DorianTV was conducted by P. Brian Dils as a part of a Master’s Thesis for the

Human-Computer Interaction Design program at Indiana University. Professor Youn-kyung Lim advised Brian throughout the process.

Development Process

The development process of DorianTV is based on a variety of user-centered design frameworks, user research techniques, iterative prototyping methods, and usability testing procedures. The process includes three phases: a research phase, a design phase (including testing), and an implementation phase. At the current time, DorianTV is in the early phases of development and has not been implemented.

Research Phase

Multiple methods of user research, including field usability tests and ethnographic study, were conducted in order to extrapolate insights from target users. In addition, an exploration of the problem space was conducted in order to determine technology constraints, industry trends, copyright limitations, and other issues that would affect the design. The research methods were conducted in the order in which they are presented in this paper.

Exploration of Space

During this first phase of research, several informal explorations were conducted in order to gain an overall understanding of the technical, cultural, and political aspects surrounding the problem space. This included an analysis of current Internet television products and services, a literature review of related academic and professional work, and informal interviews with industry professionals.

Questionnaire

An online questionnaire was distributed to 100 participants, 69 of which completed it. Participants were asked a variety of questions that helped the researcher learn about television viewing habits and Internet browsing behavior. Participants were also asked about the number of televisions in their homes, as well as the number of computers in their homes.

Participants were also given a list of television shows and were asked to mark the shows that they regularly watched. This part of the questionnaire was included so that the researcher could identify potential viewing patterns.

The responses to the questionnaire led to two major findings. The first finding was that participants tended to watch a wide variety of programming. It was uncommon for participants to watch shows from only one genre, and they generally did not watch a large number of shows from the same genre. The second finding was that the majority of participants had more televisions in their home than computers. The average ratio of televisions to computers was almost 3-to-1.

Self-reporting Log Study

In addition to the questionnaire, a self-reporting log study was conducted with a family in their home. This study allowed the researcher to gain knowledge of viewing habits without the presence of an observer. The participating family consisted of five people and was conducted over a period of five days.

Originally, the purpose of the log study was to determine whether participants used their TVs primarily to channel surf or to watch a specific show. This

information would be used to determine what kind of system to design, a discovery system or a browsing system.

Questions were also asked regarding users' patterns of channel surfing. These questions included the number of times the participant cycled through the channel lineup, what show they stopped to watch, and whether the participant had watched that show and/or episode before.

In addition, participants were asked to estimate the amount of time they planned on watching television, and then asked to record the amount of time they actually watched during that session.

As it turned out, the results about channel surfing versus watching a specific show were not significant. Participants turned on their TVs to watch specific shows just about as often as they did just to channel surf. However, responses to the other questions yielded unexpected insights.

Firstly, participants watched more television than they originally planned. It was reported in nearly every log that the amount of time the participants planned on watching television was exceeded by the amount of time they actually watched.

Secondly, viewers reported that they watched episodes of television shows that they had already seen. This effect was only observed in sessions of channel surfing however.

Field Usability Tests

Field usability tests were conducted on a traditional television system and Internet television systems. It was the goal of the researcher to identify any usability problems associated with current television technology. The format of the studies was very structured, unlike the ethnographic studies that would follow. Participants were given specific tasks to complete, though no particular instructions were given on *how* to accomplish each task.

Participants were also asked to narrate their experience by talking about what steps they were taking and why. The observer paid particular attention to how participants interacted with the physical objects (televisions, remotes, computers, etc), user interfaces, and the environment in which they were in, including other viewers.

In the first usability test, a participant was given tasks to complete using the satellite TV system in his home. The participant was asked to channel surf until he found a show that caught his attention. The participant instead used the digital program guide provided by the satellite receiver.

The participant took 24 minutes to cycle through the program guide before deciding on a show. Throughout the process, the participant verbally acknowledged when a show interested him. When researcher and participant reviewed these shows, the participant admitted to forgetting some of the shows from the beginning of the cycle. The participant concluded that his eventual choice might not have been the best choice given his interests.

Furthermore, many of shows reviewed by the participant were 30 minutes in length. Therefore, many of the shows reviewed from the beginning of the cycle were no longer showing by the end of the 24-minute cycle.

In the second usability test [fig. 1], participants were given tasks related to Internet television and asked to perform them using their web browser. These tasks included finding national news, finding local news, and finding current episodes of a favorite show. The usability of Internet TV players from mainstream networks were also tested, including those from CNN, ESPN, MTV, and VH1.

None of the participants had difficulty finding national news videos. However only one participant was able find local news video. The participant searched for several minutes before finding very low quality video, then was required to open Windows Media Player, an external application. When this occurred, the participant reported that she only preferred watching videos in her web browser and reported that she would not visit this site again.

Participants also had difficulty finding episodes of television shows, especially new episodes. Most participants resorted to search engines to try to find these shows. Some participants were able to find only clips of television shows, while others failed the task altogether. None of the participants were able to find full-length episodes of the shows they were looking for.

When testing the network players, participants did not exhibit any major usability problems. Participants did, however, report difficulty with switching between

players because of the inconsistency between interfaces. Each player had a different look and feel and there were clear differences in the playback controls [fig. 2]. This problem is not seen in traditional television, which provides the same interface for every channel and show.

Ethnographic Study

The field usability tests were a structured form of user observations, but a more open-ended study was necessary. To further understand how viewers used television in their homes, ethnographic field observations were conducted.

Once again, the observer was studying how participants interacted with user interfaces, physical artifacts, other viewers, and the environment. The goal of the study was to observe users in a natural setting over a longer amount of time. No particular instructions were given to participants in this study, but questions were asked by the observer when appropriate. The observer was also looking for replication of observations found in previous research phases.

In general, it was observed that participants did not associate their computers with watching television. The television was considered a dedicated-use device, while the computer was able to do many other things. If a television show was being played on the computer, the computer could not be used for tasks such as word processing and web surfing. For this reason, participants reported that they preferred to watch only clips or shows shorter in length.

Responses from the questionnaire showed that the majority of participants had more televisions in their

home than computers. This was also noticed in the homes of the participants of the ethnographic study.

The television system used by the participants allowed them to browse through shows based on genre. It was observed that participants tried to use these systems to find new shows, but were largely unsuccessful. The participants usually closed the application without finding a show to watch.

Participants reported that they found these applications to be complicated and that the categories used were not effective. For example, many genres were either too broad, such as "Comedy", or too narrow, such as "Gymnastics". Allowing users to participate in the categorization of content, while filtering out content they were not interested in, could improve the categorization of content on an Internet television system.

While observing interactions with web-based video, participants tended to watch amateur videos and so-called "viral videos". Although participants expressed a desire to watch TV content online, they reported that only these amateur videos were readily available. Participants expressed the desire to see more professional content online, along with a filtering system that would allow them to browse professional content and amateur content separately.

Follow-up Interviews

Once the findings from previous stages of research were analyzed, some of the participants were interviewed about the findings and asked to elaborate on them.

In the log study and the field usability tests, it was found that participants watched episodes of shows that they had already seen. In the follow-up interviews, participants were asked about this phenomenon and confirmed that it did occur. One participant gave the interviewer further insight on the subject however: when the participant used a Digital Video Recorder (DVR), he never watched the same episode twice. According to the participant, this allowed him more time to watch new shows. The other participant present during the interview reported the same effect. Participants attributed this to the non-time constrained nature of such devices and the lack of channel surfing that occurred when using them. However, participants reported that they often forgot to set these devices to record shows.

Although these devices allowed participants to watch more new content, they would have to know which shows they want to record ahead of time. Ironically, the discovery of these shows was accomplished through channel surfing when *not* using a DVR, according to the participants. A discovery system for new content that allowed for on-demand playback would solve this problem.

Users also reported that they discovered new shows from friends who would recommend them. This admission further strengthens the need for a content recommendation system.

Design Phase

The design of DorianTV was conducted in an iterative process which entailed continual redesign of prototypes. Usability testing and inspection were used at various points of the prototyping process in order to

ensure usability. The feature set of the system is based on design requirements, which were based on the findings of the research.

DorianTV is actively being developed at this time, and the functionality and technical details of the system are constantly changing. For this reason, only a brief overview of the system features is reported. A more complete and up-to-date description of the system, including a demo, can be accessed at <http://www.doriantv.com>.

Design Requirements

After reviewing the qualitative finding from the research, design requirements were formulated in order to meet user needs. In addition, the requirements were developed to adhere to technical constraints.

- **TV-like interactions** - in order to replicate the experience of watching television, the user interface needs to feel comfortable to viewers while still taking advantage of the features that an Internet system provides. It was found that users had difficulty adapting to the multitude of video players online. Providing a video player with the system would allow users to have consistency in the interface similar to traditional television.
- **Centralization** – unlike traditional television, which is organized into channels, there is no centralized location to find television on the Internet. Tests showed that users had difficulty locating Internet TV content, and a centralized repository could help solve this problem.

- **Recommendation system** – there needs to be a system in place that makes show suggestions to viewers. Such a system could be implemented by profiling what users watch and then making recommendations based on viewing history. Recommendations based solely on genre would be ineffective because the viewing patterns of users are very diverse. Furthermore, current implementations of genre-based discovery systems were found to be ineffective for finding new content.
- **Non-time constrained programming** – a system is needed that allows for content to be played without the constrain of a time schedule. This kind of programming is also known as “on-demand” programming. The idea is that users can watch a show at any time. This system should allow any show to be played back, not just shows that the user predetermines, as with DVR systems.
- **Improved categorization** - a categorization scheme is needed that more appropriately reflects the essence of the shows being categorized, as well as allowing users to take part in the categorization process.
- **Signal-to-noise filtering** – video content that is not considered “television”, such as amateur video and non-repeating professional video, should be filtered out of the system.

System Overview

DorianTV is an application that allows users to experience television through their browser. Unlike other video websites, such as Google Video or YouTube,

DorianTV supports only video content that is considered professional television. This means the video content must be produced at a high quality level and have a regular release schedule.

Media Player

DorianTV features an embedded media player [fig. 4] that allows for on-demand playback of content. All shows are stored on the DorianTV servers and can be accessed at any time. Users are not burdened with downloading shows to their local machine, nor do they have to subscribe to RSS feeds.

Intelligent Filtering

In order to insure professional quality video, DorianTV allows only video content with a bit rate of 500 kilobits/sec or higher. This is the level of quality that is considered the minimum number of bits per second to be considered professional grade.

Tagging System

Instead of keyword-based metadata, DorianTV uses a tagging system that allows users to “tag” the content. Not only does this allow for a metadata system based on user preferences, but popular tags can act as genre labels, effectively creating an emergent categorization scheme not seen in traditional television. Allowing users to create the metadata will also improve search results[4], as well as aid in content discovery through the recommendation engine.

Recommendation Engine

It was observed that users needed improved ways of reaching content that interested them. DorianTV meets this need through a recommendation engine. Recommendations are made based on two

relationships: similar viewership and shared tags. Because the system tracks the history of each user, the shows that are recommended are either watched by other viewers with similar viewing habits, or they share similar tags to shows that the viewer watches on a regular basis. In future iterations of DorianTV, a system will be designed to allow users to tweak the settings of recommendations.

Visualization Tool

Users also need a way to discover new content that is not closely related to they shows they regularly watch. For this reason, DorianTV employs a discovery engine in the form of a visualization tool [fig. 5]. This tool allows users to visualize relationships between shows in the DorianTV database. For every show on DorianTV, a visualization can be created showing how that show and other shows are related based on viewership.

Testing

When the DorianTV prototype was completed, a formal usability test was conducted. In addition to the usability test described in this paper, informal usability inspections were conducted at various points in the prototyping process, in order to ensure usability.

Goals of Study

The goal of this study was to improve the user experience for DorianTV. It was the objective of the tester to discover usability issues associated with information architecture, navigation, and visual layout of the website's user interface. For this study, a formal usability test was conducted with target users to reach these goals.

Test Setup

The tester assigned tasks to be completed and the participants were interviewed after the test was completed. Participants were tested independently, but were given similar tasks. The goal of the DorianTV system was briefly explained, but measures were taken not to influence the way in which participants would interact with the interface.

The interface was mocked up using Macromedia Fireworks and the PNG files were exported into HTML files for the purpose of testing. Dummy content was used in places where shows would be populated dynamically. Hotspots were applied in the HTML code to allow linkage to other pages where it was logical to do so. However, functions like text input boxes for searches and signing up for accounts were disabled because there was not a database linked to the pages.

Tasks

The following tasks were given to the participants in order to test the interactions that the user had with the system:

- Assume that you have an account already, please sign into the system.
- Now let's go back to the opening page and now assume that you DO NOT have an account. Please sign up for an account.
- Please navigate to what you believe to be the main page or the next logical step after signing up or signing in (which is the community page).
- Once on the community page, please find shows about technology in whichever way you feel appropriate.

- Once you have found shows about technology, please go to the page dedicated to that show.
 - Once on the show page, please play an unseen episode of the show.
 - Please switch to full screen mode for this show.
 - Now you want to add tags to this show, please do that now.
 - Scroll down the page. Can you explain to me what you think the “shows with similar viewership” and “shows with similar tags” are?
 - Now navigate back to the community page. From here, navigate to your personal page.
 - Once on the personal page, where would you click if you wanted to learn how your recommendations are calculated?
- Is there a need for a navigation bar at the top? Is it clear where you are in the system and how to get back?
 - What do you think of the overall look and feel? Do you enjoy using the system? Do you have any suggestions to improve it?
 - Is it clear why some tags in the tag cloud are larger than others?
 - If you wanted to find a show about a specific topic, would you search first or browse through the tag cloud?
 - If you didn't know what you wanted to watch and just wanted to “channel surf”, would you do that on the community page or personal page and why?
 - Would you browse using tag or the show listings (either recommended shows or most popular)?
 - Would you like to see a feature in future iterations where you could add “friends” to the system (similar to other social networking sites)? Why or why not?
 - If available, would you use this system for traditional TV?

Interview Questions

The following questions were asked of the participants after the tasks were completed:

- When you look at the opening page, can you discern what the system does?
- Is it clear that this system is for IPTV shows only?
- Can you see yourself using this system?
- Would you expect the first page after the opening page to be the community page or the personal page?

Findings & Redesign

Participants generally had no problems with navigating through the interface, with a few exceptions. Most problems were associated with the missing user interface components not available in this iteration of the design.

Participants did not have any trouble with the lack of a navigation bar. They mentioned that it was clear where they were in the interface. When probed about the subject, all participants believed that it was the kind of system where clearly defined pages were not necessary, as dorianTV is a dynamically populated site instead of a static informational site.

It was not clear to participants why they were given shows with similar viewership AND shows with similar tags on show pages. Instead, participants suggested that they simply were given "related shows" based on a combination viewership and tags.

The participants tested were not familiar with tagging, but they quickly were able to learn how tags worked. When asked, all participants understood that the size of the tags were associated with their popularity. One participant preferred the first page to be the community page, while another participant preferred the first page to be their personal page. This could be something that could be changed in the user settings.

When finding new content, some participants preferred to search through the tags clouds, while other preferred to look through the most popular shows and their recommended shows. This confirms the need to keep both show lists and tag clouds on the same page.

Participants noticed inconsistencies between rounded boxes and squared off boxes. If at all possible, all boxes will have rounded edges. When browsing the personal page, participants saw no need to see a history of what shows you've watched, and also recommended show. One participant did not know the show recommendations were available because they

were too low on the page. In the redesign, the recommended shows box will be expanded and the browsing history has been removed. In future iterations, there will be a profile page for each participant where they can customize their recommendations and view their show history.

Most participants enjoyed their experience using DorianTV and reported they would use the system if available. The need for such a system was confirmed when participants reported they did not watch Internet TV shows because they did not how to find them.

Participants also reported that they would use this system to discover new traditional television shows, but only if they could watch and/or record the shows directly from their browser. This kind of functionality is currently not available for traditional television because of Digital Rights Managements (DRM) protection.

During the post-testing interview sessions, many insightful suggestions were given by the participants about both user-system interaction and the look and feel which will also be considered for future iterations.

Implementation Phase

As previously mentioned, DorianTV is still in the early phases of development and therefore has not been implemented at this time. However, it is the goal of the designer to continue to develop DorianTV up to the point of implementation. High-fidelity prototypes will be created to act as design specification documents for future programmers of the system.

Discussion

Internet television technologies are being developed very quickly and are helping to advance the television industry. Quick adoption of these technologies by users, however, may not occur if technologies are not developed in a user-centric manner. Employing user-centered development frameworks will be of utmost importance for the future of TV.

The development of DorianTV was grounded firmly in user research, but this is only the first step for any user-centered project. Insights gained from research needs to be carried into every phase of development and users need to be the most important stakeholder in any decision.

DorianTV was designed to meet the needs of its users. This does not imply, however, that it will always be able to meet these needs. Inevitably, the technologies that the system relies upon will change, and so too will the users.

Although the solution that this system presents may not be timeless, the lessons learned from creating it are. DorianTV involves the users in every step of the design process, a technique that can improve the development of any product.

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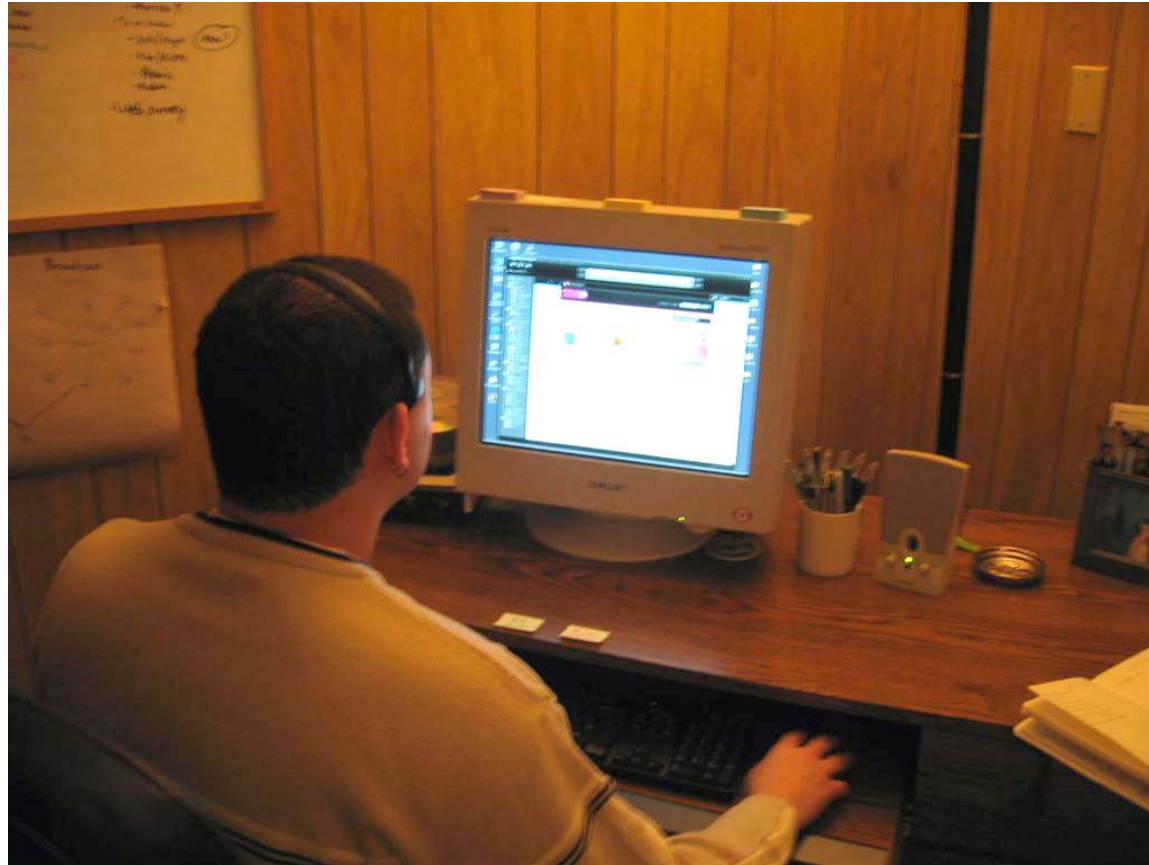


Figure 1. A participant from the field usability test helps the researcher discover usability problems. The session was recorded using screen recording software.



Figure 2. Shown are the players from CNN, MTV, VH1, and ESPN. When tested, users had difficulty adapting to the various different user interfaces.

alex@hotmail.com | [Settings](#) | [Sign Out](#)

dorianTV

The Internet TV Discovery Engine

[Community Page](#) | [Your Page](#)

Most Viewed Show



Ask a Ninja
A wacky call in show featuring a ninja giving all the advice. Regularly the highest rated show on dorianTV.
Tags: advice, weird, favorite, ninja



RocketBoom
Amanda Congdon delivers her daily geek-out with brains, beauty, and goofy humor. Low-budget production only enhances the show's DIY charm.
Tags: news, amanda, daily, liberal, politics



Odd Todd
Todd Rosenberg's Comedy Central pitch crashed and burned, but donations from fans of his hilarious toons about the indignities of unemployment keep him in Pringles.
Tags: cartoon, animated, hilarious, todd



TikiBar TV
Trouble stalks the upscale Tiki Bar. Bartender Johnny Johnny frets. Voluptuous patron Lala swoons. Dr. Tiki sets things right with a prescription: a drink recipe, natch.
Tags: funny, quirky, bar, alcohol, sexy

Most Popular Tags:

absurd **action** animation avantGarde
awkward baseball basketball **blog** boring
cartoon **comedy** competition
computers controversial cool court crazy
creative crime crimeScene diary
discoveryChannel documentary drama
drinking drugs family fashion football fox
funny gangs helpful history howTo humor
japanimation kids manga marriage
military music narrated networkTV
news politics **reality** sitcom science
software sports suspenseful talkShow
technology violence vlog

Search for shows about...

[Sign Up](#) | [About dorianTV](#) | [Terms of Use](#) | [Privacy Policy](#)

Figure 3. Shown is the DorianTV community page. This page shows users what the most popular shows are, as well as the most popular tags.

alex@hotmail.com | [Settings](#) | [Sign Out](#)

dorianTV

The Internet TV Discovery Engine



DIGNATION

Episode 43: April 27, 2006

Episode Guide

- Episode 43: April 27, 2006
Show description: Nintendo Wii, Pro football player beats us nerd, Apple blocking MySpace, DiggUpdate 2.0, Boing 797, Howto get into Yahoo mail beta, SCIFI Caprica
- Episode 42: April 20, 2006 (playing)
Show description: Save \$200 in 2 minutes and have the worlds best writing pen, Ticket for changing lights, Second ice chunk falls in SF area.
- Episode 41: April 13, 2006
Show description: Vista won't show fancy graphics to pirates, Google Calendar launched, PS3 not playable at E3, Duke Nukem Forever

Now Playing

Dignation
Episode 43: April 27, 2006

Add Tags to this show

Tags for this Show:

access action apparently **apple** asks
autopia **bbc** bialik **blog** blogs bugs
case **cellphones** **chriskohler**
community computer **consumers** cult
discovery **drm** earth **engine** firefox
fuel fun games life **geek** giant
global google help hope **ibm** idea
intel ipod japan **joanna** glasner kohler
leander **linux** lot lynn **mac** mail
mars media **microsoft** mobile money
nasa newYork openSource
operatingsystem performance
popular **regina** **running**
scientists **search** service singel slashdot
sony space speed state story
unitedstates university vista
wallstreet journal wi fi **wired** magazine
xbox360

Search for shows about...

Figure 4. Shown is an example of a show page in DorianTV, featuring the embedded media player. Users can play episodes straight from their browser, tag the show, search within the show's tags, or get recommended shows from this page.

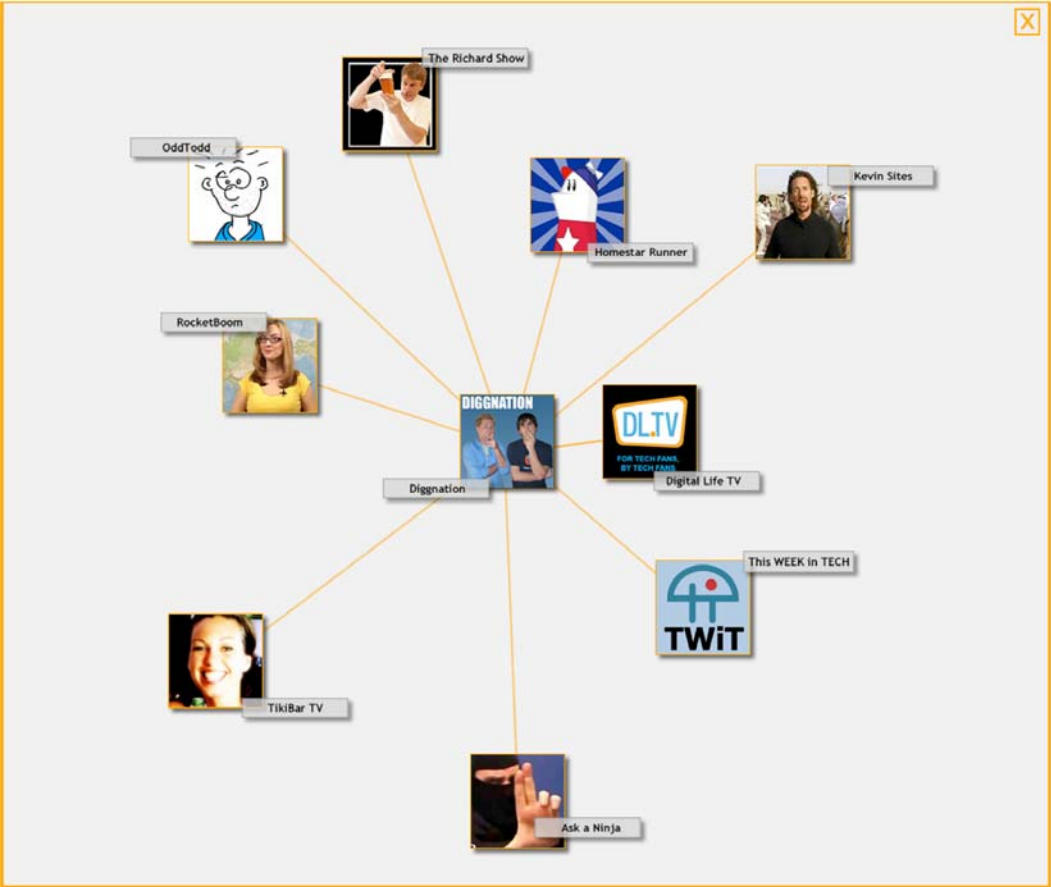


Figure 5. Shown is an example of the visualization tool in DorianTV. Any show in the DorianTV database can be visualized to show the relationships between content.