



## **PLOG: Easily Create Digital Picture Stories through Cell Phone Cameras**

Rich Gossweiler, Joshua Tyler  
HP Laboratories Palo Alto  
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E-mail: {rich.gossweiler, joshua.tyler}@hp.com

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browsing

With a cell phone camera a person can take pictures and immediately transmit them to larger repositories using telecommunication channels. This provides the potential for anywhere, anytime picture sharing and story telling. It can also increase awareness among peers within a social network. But while we enjoy telling stories around this informal content, the necessary act of downloading, organizing and then presenting the digital media is tedious and can discourage frequent use. We present PLOG, an application that stresses ease-of-use story telling through cell phone photography. The user simply takes pictures and performs simple click-and-send uploads using their phone. From a local machine, PLOG automatically downloads the images; time clusters the pictures together and then presents them as story vignettes. These vignettes can be viewed different ways and at home, shared with friends or posted in public places. We describe the implementation of PLOG and discuss issues related to this light-weight method of story telling and awareness.

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Rich Gossweiler, Joshua Tyler  
{rich.gossweiler, joshua.tyler}@hp.com

### **Abstract**

With a cell phone camera a person can take pictures and immediately transmit them to larger repositories using telecommunication channels. This provides the potential for anywhere, anytime picture sharing and story telling. It can also increase awareness among peers within a social network. But while we enjoy telling stories around this informal content, the necessary act of downloading, organizing and then presenting the digital media is tedious and can discourage frequent use. We present PLOG, an application that stresses ease-of-use story telling through cell phone photography. The user simply takes pictures and performs simple click-and-send uploads using their phone. From a local machine, PLOG automatically downloads the images; time clusters the pictures together and then presents them as story vignettes. These vignettes can be viewed different ways and at home, shared with friends or posted in public places. We describe the implementation of PLOG and discuss issues related to this light-weight method of story telling and awareness.

**Keywords:** digital story-telling, awareness, cell phone, rss, weblog, time-clustering, ease-of-use, author-by-playing, ubiquitous computing, browsing



## 1 Introduction

People enjoy telling stories through photographs. [BALA00] references [CHAL87], stating "one of the most common and enjoyable uses for photographs is to share stories about experiences, travels, friends and family." By using cell phones equipped with digital camera technologies, it is easy and convenient for people already carrying phones to snap informal, interesting pictures and immediately transmit these pictures. People do not have to carry a camera as another device along with the phone, people do not have to deal with cables and downloading images to computers and people can directly target members of their social network with interesting pictures.

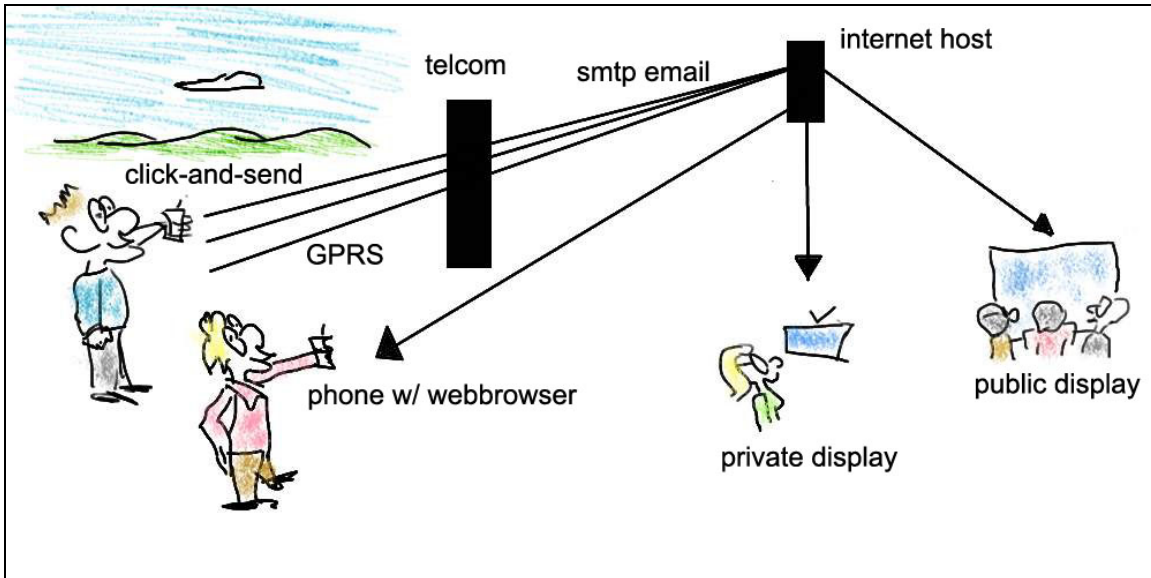
At the other end of this digital photography channel we are seeing an increasing number of appliances that allow people to receive and view these pictures. Everything from commercially available digital picture frames [FRAME00] to exciting research in new devices for storytelling [BALA00], [SHEN02]. Cell phone cameras present the opportunity to not only take and transmit pictures easily, but a deeper, richer opportunity to tell stories and pass on interesting vignettes that strengthen social networks.

But while we can imagine taking a short series of pictures on the ubiquitous cell phone (e.g. "My day at the beach" or "funny thing at the park") and then beaming the set to a friend, the actual process can be tedious and discouraging. It is not uncommon that I have to:

- 1) Take the picture and preview it to make sure it is reasonable
- 2) Type an email address on a cell phone keypad (or navigate contact list menus) and attach the picture
- 3) Press send and wait for the transmission to complete
- 4) Repeat for each picture

This becomes more difficult when I want to string together several pictures as a group, want to show them to several people and/or want to send them to myself for future storytelling. If the cognitive load for these tasks is sufficiently high, then pictures don't get taken, pictures don't get sent, or pictures are sent and shown once and then rarely viewed again. More generally, this is a systemic problem that we often observe in many distributed systems: Getting the Data In, Information Management, getting the Data Out.

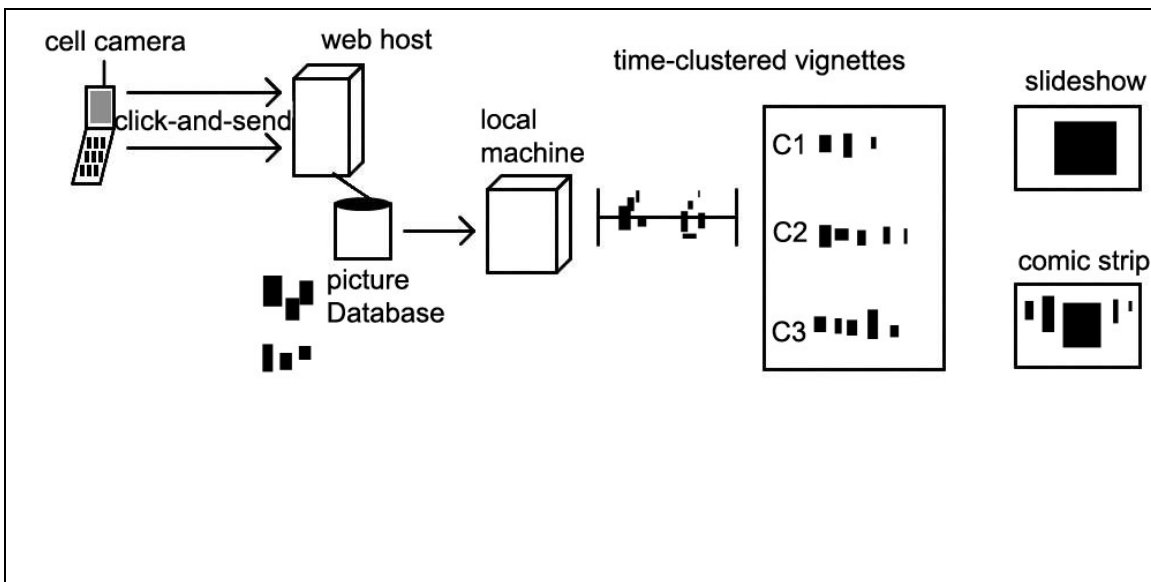
Our solution, PLOG, is based on the belief that we want a simple, end-to-end mechanism that allows us to easily create short stories (picture vignettes) while we are going about our daily lives. These vignettes should be presented to interested viewers with minimal effort on either the creator's or viewer's part. PLOG allows the photographer/story teller to click and one-button-send pictures (a shoot-and-forget model) to an internet repository. PLOG employs back end software to automatically and continuously gather new pictures from the repository onto the interested viewer's local machine, time-cluster them into vignettes and present them as story sequences.



**Figure 1: PLOG uses simple click-and-send, then clusters and shows vignettes on local devices**

For the creators, they simply take and send pictures, using the internet repository as their infinite "film roll" without worrying about running out of memory or what email addresses to type in. For the people viewing on the other end, they can simply watch or be aware of new vignettes as they come in. These vignettes can be saved, distributed and shown again as small stories at later times.

Since the presentation uses templates, different templates can control how the story is revealed (for example, in our implementation we have both a slideshow presentation and a comic strip presentation). Not only does this model support various creative presentations, but it also allows devices with different capabilities to present the story optimized to the device's capabilities. For example, viewing the images from another cell phone with a web browser might use a slideshow model due to the small screen real estate, while a large plasma display might present several pictures as a comic strip.



**Figure 2: PLOG from picture capture to presentation**

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PLOG makes it easy for people to tell digital picture stories, from the process of getting the picture into the system (data in), to low-maintenance organizing via implicit time-clustering (data organization) to presenting and potentially printing the story (data out).

## 2 RELATED WORK

In [FROH02], Frohlich et al outlined requirements for Photoware based on ethnographic studies. In their discussion they make recommendations, including the ability to perform instant photo sharing. While not instant, PLOG significantly shortens the gap. Based on the speed of the digital repository, viewers may be able to see updates within a minute. Frohlich also suggests the requirement of "sending miscellaneous collections of reprints to particular people with a personalized message" which PLOG attempts to do. The sender could personalize a story, perhaps by typing in a message on the phone. PLOG allows, but does not require people to annotate their photos. Another button option opens up a text box to allow photo annotation.

FotoFile [KUCH99] is a consumer multimedia organization and retrieval system. It supports "scraplets" which are small groupings of photos which can be arranged chronologically. PLOG and FotoFile both share the capability to create small groupings for story telling. FotoFile however was developed to improve the organization process of existing photos while PLOG attempts to create a simple story telling process.

KAN-G [LIEC00] is much closer to PLOG, informing recipients when new photos are available. KAN-G was described as a framework with emphasis on awareness through digital pictures in the home and shares many of the high level goals that PLOG has (e.g. ease-of-use, implicit interaction and awareness). PLOG could be categorized as a specific implementation within the spirit of the KAN-G framework. PLOG specifically differs from KAN-G by focusing on the story telling aspect, time clustering and use of a camera cell phone.

Another area of related work deals with the process of auto-albuming [LOUI99] [RODD03]. PLOG uses a simple time-clustering algorithm. This allows PLOG to create vignettes based on the premise that people take pictures in tight groups around a particular story. Other systems also use various clustering and content-based information to group digital images. For example, Graham et al [GRAH02] compares time-clustered photo browsers to measure how temporal grouping improves finding images. [LOUI99] uses time-clustering and histogram (image comparison) to create a software system for automatic albuming. Others have commented [GRAH02] that k-means clustering, which pre-defines the number of slots, is questionable, since knowing that number is difficult. Using histogram or image-content information may not be accurate, since a given vignette may have very different pictures in it (e.g. a picture of a cake followed by a picture of a child at a dinner table). Another example of time-clustering is [COOP03].

In addition to automatic organization, there has been ample work in presentation, not only in albums and on the web, but with new devices that incorporate the story telling process into helping organize the photos [SHEN02], [BALA00].

We use Text America ([www.textamerica.com](http://www.textamerica.com)) to store our pictures. It is a photo weblog site. Weblogs are an example of presenting lists of annotated links, logs and stories using the internet [BLOO02]. Unlike typical web pages that require an editing tool and a publishing process to upload pages, blogs attempt to make it easy to edit and link information together. Novel "trackback" links allow people to see who has linked to their weblog links.

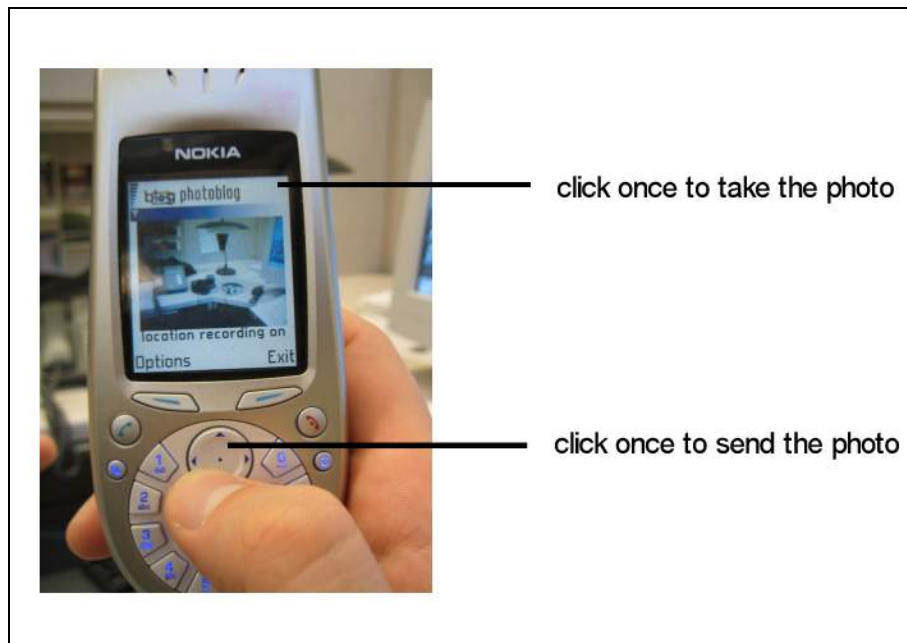
## 3 IMPLEMENTATION

PLOG uses two pieces of software, one that is installed on your phone to make the picture sending simpler, and one that is installed on your local machine to receive, time-cluster and present the vignettes. In between we use a commercial World Wide Web service ([www.textamerica.com](http://www.textamerica.com)) to store the photography and associated meta-data. Since the software is modular, you can replace and configure different elements (such as the time clustering, the web service, etc.) based on your needs. The following describes the click-

and-send phone application, the internet repository and the PLOG application on your local machine. The PLOG application is broken down into initialization, time-clustering and presentation.

### 3.1 Click-And-Send: Cell Phone Software

While cell phone cameras let you take pictures, often you need to type in an email address or navigate through an options menu and contact list to deliver each picture. On a cell phone this is tedious and takes away from the otherwise fluid process of taking the picture. It potentially limits the number of photos one takes, and therefore the depth of the experience captured. To reduce this cognitive load, we wrote a small application that let's you set up the email address initially. From then on, it is only two or three clicks to send the image. Picture taking and sending moves to a click-and-send model where you can just quickly send the picture off to a repository and then go take another picture. Our implementation was developed for and runs on Nokia Series 60 Symbian OS phones, which include the Nokia 3650, 7650, and 6600 models.



**Figure 3: click-and-send simplicity**

### 3.2 Internet Repository

The primary role of the internet repository is to hold the images so that we can deliver them from anywhere and also receive them from anywhere. Since the cell phone uses email over the telecommunication channel (either SMTP or MMS over GPRS), the web hosting site needs to be able to receive this protocol. In our implementation, we used TextAmerica ([www.textamerica.com](http://www.textamerica.com)), a photo weblog site that provides an email upload interface for photos. One advantage to this site was that it creates a Really Simple Syndication (RSS) feed [RSS02]. RSS is an XML protocol that is growing in popularity as a delivery mechanism for information. This RSS allows us to write specific viewers based on a well-known and defined XML syntax instead of trying to "scrape" HTML syntax. Generally, one can use any internet hosting site that supports an email server mechanism. Generating well-formed RSS XML from the set of pictures is relatively easy.

For our implementation, we used the meta-data: unique-id (guid), title, pubDate, imageURL. An example of the RSS is:

```
...  
<item>  
  <title>My Lunch</title>  
  <link>http://someone.textamerica.com/default.asp?r=215513</link>
```

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```

<description>
  <![CDATA[
    ]>
</description>
<guid isPermaLink="false">215513</guid>
<pubDate>Fri, 05 Dec 2003 22:31:46 PST</pubDate>
<textamerica:fullimg>http://mlog.textamerica.com/IMG_341879/IMG_someone_0_1205223126140.j
pg</textamerica:fullimg>
<textamerica:thumbimg>http://mlog.textamerica.com/IMG_341879/Thumb/IMG_someone_0_12052231
26140.jpg</textamerica:thumbimg>
  <textamerica:replycount>0</textamerica:replycount>
</item>

```

### 3.3 PLOGViewer

PLOGViewer is the local "browser" or player for the people viewing the stories on their local machines/display devices. It is a single software application that periodically checks for new content from the website using the RSS feed, downloads the new images, time clusters them into vignettes and then displays them (e.g. slideshow or comic book).

#### 3.3.1 Initialization XML

PLOGViewer uses an initialization XML file to configure where to go for the RSS feed and how frequently to check for updates to the RSS XML file. This initialization file also describes a mapping from the RSS tags to the fields PLOG uses. This is necessary because there is no <IMAGE> tag in RSS, so different feeds provide images different ways. For example, textamerica uses <textamerica:fullimage> while another feed might simply put the image URL in the <DESCRIPTION> field.

Once started, PLOGViewer periodically downloads the RSS, checks for new image URLs not already locally stored (based on the unique-id or GUID) and downloads the new pictures. The complete set of images is then time-clustered into vignettes and presented.

#### 3.3.2 Time-Clustering

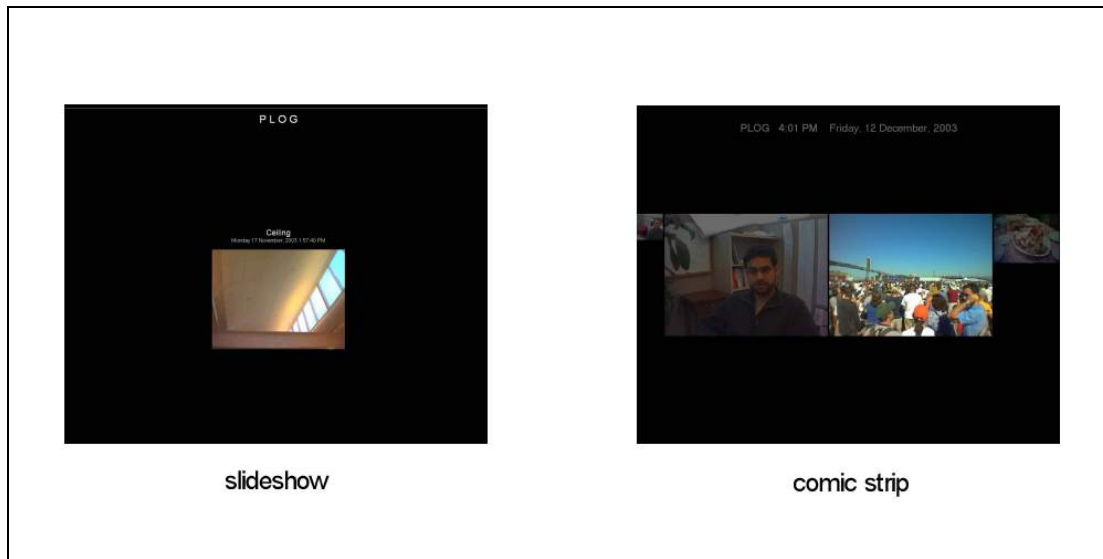
We use clustering algorithms based on the premise that people take closely related pictures together in time. Clustering is the process of trying to identify groups of data within a larger set. This seems relatively easy when the clusters are well defined, but there can be many cases where the clustering is ambiguous. Some clustering algorithms define a fixed number of clusters (e.g. k-means) while others create clusters as needed (e.g. some heirarchical clustering). We refer you to [MANN99] for more information on clustering.

Time-Clustering is an ease-of-use example for the PLOG viewer. We use it to allow the system to automatically create vignettes based on usage patterns (we assume a property of temporal locality for pictures). The trade-off is that the clustering may be inaccurate. One can imagine using different clustering algorithms, learning heuristics, etc. to improve the accuracy of the stories the creator intended to make.

#### 3.3.3 Presentation

Once clustered, the PLOG viewer rotates through each cluster (a cluster is a photo vignette). Each cluster can then be presented in a variety of ways and we have implemented two. The first is as a slide-show. Each image is saved out with an associated HTML file. The PLOG viewer uses an IE COM object to show the HTML page, then fade to the next HTML-enveloped image.

In addition to PLOG being a self-contained presenter, this presentation model allows the creator to bundle the HTML together and present it anywhere an HTML browser exists. The second template lays out the images of a cluster into a "comic strip." and then animates through each frame of the comic (highlighting one frame while leaving the other cells in the background). Again, this is accomplished using a series of HTML files for each animation section. One can imagien creating other presentation templates (e.g. a collage).



**Figure 4: screenshots of slideshow and comic presentation**

In both cases, since HTML is used, it is relatively easy to create a "Print" button that will print out the slide set or comic strip for offline use (e.g. a storybook). Once through the complete set of vignettes and after a configurable time has passed, the PLOG viewer rescans for new images.

## 4 DISCUSSION

PLOG makes it easy to click-and-send pictures on the front-end and automatically cluster them into stories or vignettes on the back end. But PLOG is not without its issues and future work.

### 4.1 Issues

PLOG relies on the telecommunication channel to send the pictures. If the channel is not available, then the pictures need to be batched up and trickled down (or downloaded through another channel, such as bluetooth or a cable connection).

PLOG uses a very simple time-clustering algorithm. We are considering more sophisticated alternatives (another topic of research). Even the best automatic time-clustering algorithm cannot predict the story you were trying to tell in your head (much less, deal with interleaved stories). Mechanisms for fluidly tuning and post-production editing might further improve the stories and vignette value. For example as the author sits down and later tells the story to a friend, he or she might adjust the vignette.

### 4.2 Future Work

PLOG uses the cell-phone for data in, but other sources can also feed into PLOG (such as batch downloads from Bluetooth, from web pages). Advanced story telling might allow the author to tell the story and tune the vignettes. Other meta-data such as location and environmental conditions might enhance the story.

We would also like to support categorization on at least two levels. One is to create friend categories -- send these to my friends and my family, or send these only to my private space. Second, stories themselves may be categorized (work-related, vacation-related).

While PLOG focused on story telling, other derivatives may be useful. For example, medical examiners, police investigators, anyone dealing with field operations and temporally related pictures might want to cluster a collection of data together.

Frohlich [FROH00] has several suggestions that would be interesting to implement to extend PLOG. They suggest photo-conferencing tools. PLOG might be able to support this, not only phone-to-machine,



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but phone-to-phone. They also suggest multi-user album software. Extending PLOG to allow users to re-weave the vignettes or combine them might be fluid if done as part of the story telling process. They also suggest feedback mechanisms and audio-annotation. It would be interesting research to see if people take more or different pictures based on social network effects and whether they would annotate the pictures with voice.

### 4.3 Conclusion

We believe that we have implemented a very easy-to-use system for creating and distributing stories through cell phones. We hope that this will improve the process of cell phone camera story telling and strengthen social networks. We also believe that there is an opportunity for continued research and exploration in this area of anywhere, anytime story telling.

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