

# Steps Towards Web Ubiquitous Computing

Manu Ram Pandit, Tushar Bhardwaj and Vikas Khatri

**Abstract** With evasion of digital convergence [1], computing has by and large pervaded into our environment. WWW has enhanced day-to-day life by utilizing information such as Location awareness, User-context awareness; touch API, mutation observer [2], and many more. The future [3] trends in ubiquitous computing [4] provide a great scope for innovation and value-added services. With approach of “computing being embedded,” the future sees its usage more pervasive and appealing. Web is evolving and so are supporting technologies (in terms of hardware technologies). Many real-life examples including augmented-reality, wearable technologies, gesture-based recognition systems, etc., are already in place illustrating its high-end usage. Such diverse future targeting billions of people and devices need streamlined approach. Some steps have already been taken care by World Wide Web consortium (W3C) to provide standards relating to API usage. In this paper, we highlight various aspects of web-ubiquitous computing and how they can be dealt w.r.t to their implementation.

**Keywords** Web ubiquitous computing · Ubiquitous computing recommendation · WWW pervasive computing · Future trends in web ubiquitous computing

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M. R. Pandit (✉)  
Pursuing M.S. from BITS, Pilani, India  
e-mail: manupandit123@gmail.com

T. Bhardwaj  
Pursuing M.Tech, Pilani, India  
e-mail: tusharbhardwaj19@gmail.com

V. Khatri  
M.Tech(K.U.), Pilani, India  
e-mail: khatrivikas.mit@gmail.com

## 1 Introduction

With evasion of digital convergence [1] computing has by and large pervaded into our environment. WWW has enhanced day-to-day life by utilizing information such as Location awareness, User-context awareness; touch API, mutation observer [2] and many more. The future [3] trends in ubiquitous computing [4] provide a great scope for innovation and value-added services. With approach of “computing being embedded,” the future sees its usage more pervasive and appealing.

Today, much of user data can be seen on internet. This provides an opportunity for better services in ubiquitous computing domain. Some strategic approach is already taken in this prospect by World Wide Web consortium (W3c) to make standards for upcoming devices. This paper provides insight of web usage of ubiquitous computing domain. We first describe classifying requirements for enforcement of web ubiquitous domain followed by in-depth strategies to be taken care off during their implementation.

## 2 Context Scenarios and Recommendations

In lieu of the same, requirements of ubiquitous systems may be categorized into- (Fig. 1)

- (a) Need of high-end computing devices
- (b) Seamless network integration
- (c) Contextual awareness(User, Social, cultural and location-specific)
- (d) Security
- (e) Policy enforcement

### 2.1 Need of Computing Devices

Computing devices are important ingredient of this system. Devices may be hand-held devices or might be embedded in others like cloth. Some recommendation for making them suitable w.r.t. web-ubiquitous computing are:

- (a) They should conform to Device API specification.
- (b) Should expose themselves through *<meta>* [5] tag. This will help in self-discovery of the devices. We recommend every device to have a local information server at its ephemeral port (called as discovery port). Other devices within the device ‘X’ periphery would discover with help of : <http://www.device-x:portNo/> Similar page would turn up:
- (c) Data transfer format should be preferably HTTP.
- (d) Conformance to W3.org API specification [6].

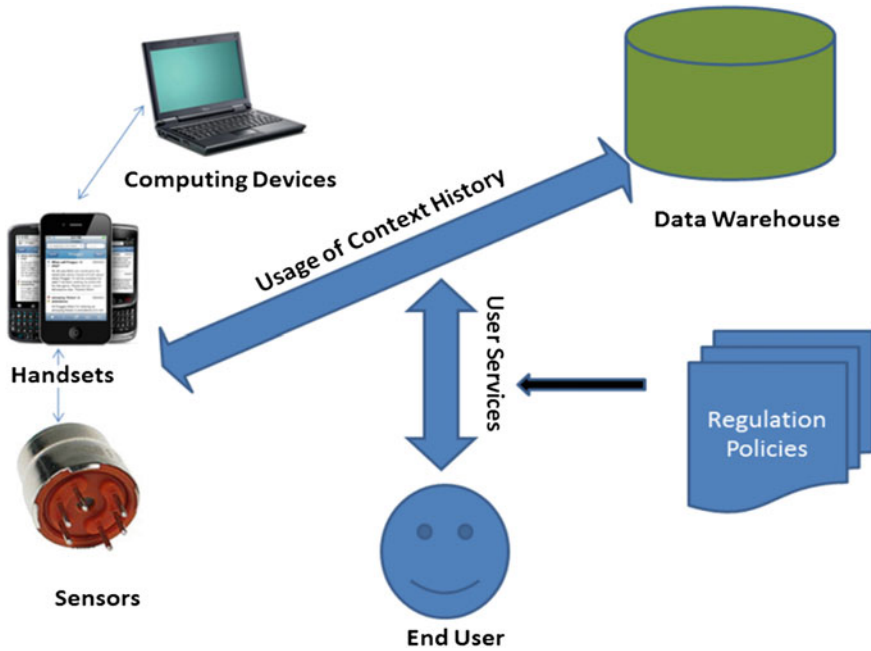


Fig. 1 The complete picture of ubiquitous computing

### 2.2 Seamless Network Integration

Underlying network technologies should be seamlessly accessible whether it is Bluetooth, wireless, connected or RF-based, etc. Frequency interference should be taken care of which are typically catered by some regulation committee such as FCC (Fig. 2).

### 2.3 Contextual Awareness

Contextual awareness is one of the most sighted features in ubiquitous computing with the help of which surrounding devices (environment) makes decision thereby adding value services to the subject. This contextual data has to be stored and regularly updated. Since contextual data will be huge, we recommend use of data warehousing technique. To add a further step, we recommend use of *data-warehousing as a service* ('daas') [7] for particular user. This service can be categorized into particular subsections like user travel information, health information, hobbies information, etc. As it involves complex performance requirements, a centralized cloud-based server typically fit into this context (Fig. 3).

```
Service_Discovery.html 88
1 <!DOCTYPE html>
2 <html lang="en">
3 <head>
4 <title>Service Discovery Page</title>
5 <meta name="description" value="Android smart phone">
6 <meta name="id" value="And_Sams_114x">
7 </head>
8 <body>
9 <<!--Content Home Page-->
10 </body>
11 </html>
```

Fig. 2 Service discovery page

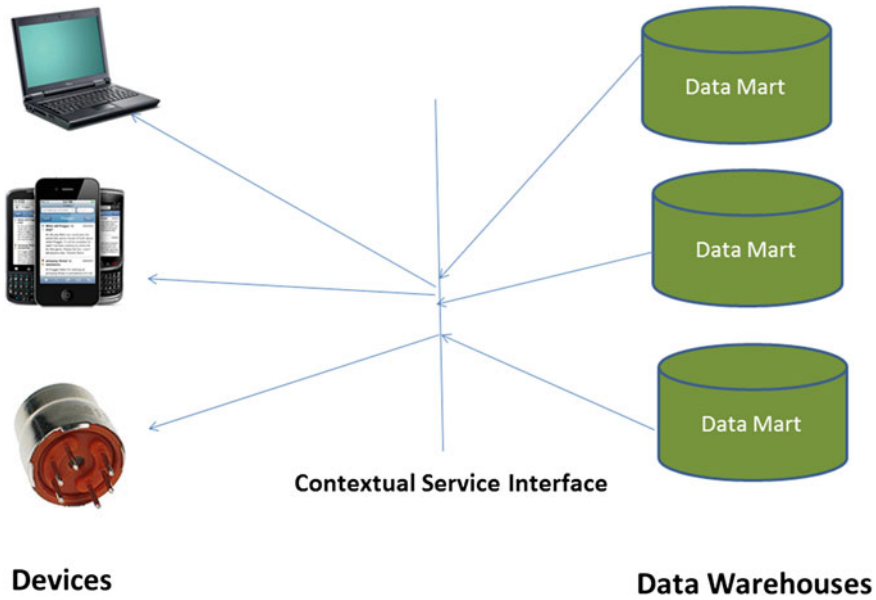


Fig. 3 Contextual service scenario

For fast performance, the data warehouse repository and underlying web-service can be deployed on cloud based server.

### 2.4 Security

While the above-mentioned services provide lucrative services, it provides vulnerabilities to personal life. User data can be hacked and details may be compromised. Basic cryptographic property viz. confidentiality, integrity, and nonrepudiation needs

to be dealt with. One possible recommended strategy to deal with is to allow user data to be shared only with devices/environment which user trust. This may be based on preconfigured security certificates or user passed tokens based on RFID [8] /other master configurable interface (e.g., Open Id-based authentication [9], Facebook/twitter/Google authentication, etc.)

## 2.5 Regulatory Policies

We highly recommend enforcement of environment policies before the devices provides user some contextual service. For instance, recommending medical aid (drugs that may be banned in some geographies), automatic software downloads (handling IP issues), purchasing some product from customer e-wallet (automatically cater new sales/revenue tax), etc. This can be easily achieved by having some centralized web-service exposed to the devices. Based on the parameters achieved, the devices can make valuable decisions. With the help of a centralized policy server, it will be effective for government/regulatory bodies to make/change decision on-the-fly.

## 3 Conclusion

With a huge user data on web, web ubiquitous computing provides a great deal of scope for innovation and development. Supporting technologies and standards will provide smoother gateway for its success. We propose some changes in classical model of ubiquitous domain (viz. intelligent devices, network, and contextual information) to suit web followed by two new parameters of security and regulatory policies.

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