

Home Entertainment: At the intersection of Smart Homes & Ambient Entertainment

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Abstract

New technology trends of the ubiquitous computing era foster substantial changes in all application domains. With respect to home entertainment (HE), the most important change is not what new hard- and software can provide *inside* this domain but *across* hyperdomains to which HE will belong. We emphasize the two most important such hyperdomains, namely smart homes and ambient entertainment. For HE research, it is crucial to understand and participate in these domains, as opposed to continuing to consider HE a self-contained domain. The following article revises the technological developments and discusses the two hyperdomains.

1. Introduction

The post PC era of ubiquitous computing (aka pervasive computing, aka ambient intelligence) provides technology trends that will heavily influence the future of IT application domains. The single most important trend is the *pulverization* of hard- and software, which in turn enables an opposite i.e. amalgamating trend towards large application hyperdomains, where the pulverized devices and functions are dynamically federated for various purposes. In the remainder, we will summarize the main threat of technology development, together with examples of the immediate consequences for HE hardware and software. For an investigation of mid term consequences, we will investigate the application hyperdomains *smart homes* and *ambient entertainment*. The main statements of the present article are depicted in the enclosed figure.

2. Ubiquitous Computing Technology and Consequences for HE

The convergence of consumer electronics (CE) and IT can be considered almost completed, marking the passing-on from generation I (CE devices) to generation II as depicted; thereby, the difference between media centers (a CE term) and multimedia PCs (an IT term) became blurred, HE demands pushed powerful graphics into CE and PCs, and IT technology made PCs and networks available in the

living room. The latter trend brought along additional features and tore down protectionist walls (sometimes illegally, cf. content piracy).

Generation III approached with the advent of ubiquitous computing, thereby, more substantial and far reaching changes occurred. Recent product news show early but clear signs; three devices shall therefore be listed here, all meeting at the concept of “federation-enabled business/entertainment nodes” (FedNodes, for short):

- the Sony *Playstation Portable PSP*TM was acclaimed for its wLAN and Internet capabilities, making it appear like a versatile micro-notebook with excellent graphics and compute power;
- Apple’s *iPod*TM is discovered for serious information dissemination (CRM news, lecture videos, etc.)
- the *Personal Server*TM from Intel, prototype of a wearable WebServer with full media capabilities, enters the business-entertainment bridge from the “serious” end.

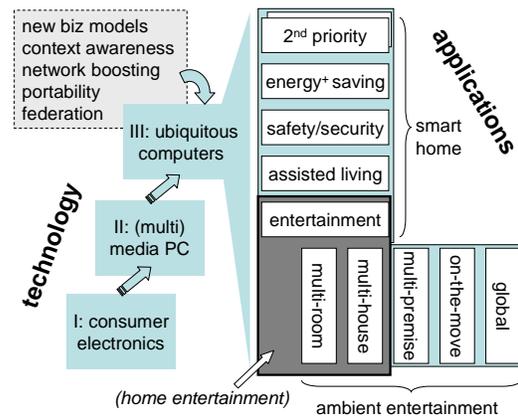


Fig. 1. Ubiquitous Computing Technology and Applications

The latter two, in particular, provide some insight into the role of such nodes in a federated world. The iPod has brought forth an entire industry of “peripherals” for docking or networking; the Personal Server has, on one hand, been shown with a wrist watch as display and as a twin with a MotorolaTM cell phone; on the other hand, it is more

or less compatible with Intel's Stargate™ platform intended, among others, as a hub in MICA2™ based sensor networks from Crossbow. In addition, dynamic, zero-configuration federation with ambient peripherals (publicly available wall LCDs, kiosks, car sound systems, etc.) is currently investigated in research (cf. [1]) and will complement FedNode functionality.

The above examples substantiate the claim that ubiquitous computing nodes will, in the future, draw much power from being federated, whether or not they serve special purposes; instead of dedicated HE hardware, we will see "HE-inclined" devices, which will be a) used for other purposes, too, and b) dynamically federated with various other devices. Major features and consequences are depicted in the figure (upper left): i) new business models emerge: e.g., devices and services can be offered for users on the move, less profitable areas can benefit from hardware and features "cross-subsidized" from other application domains; ii) context awareness hard- and software can be offered across domains; iii) whenever network connectivity is available/affordable, added functionality can be provided ("network boosting"); iv) portability and business models have mutual influence and trigger application hyperdomains as described below; and v) dynamic federation of (rather special-purpose) devices – still a research domain as mentioned – will speed up the trends mentioned before.

3. Ambient Entertainment

A study by Intel [2] shows that wearable entertainment devices lead to a seamless integration of home and nomadic use cases. *Video sharing in the digital home* (hardly interactive), *photograph sharing* (interactive in small groups), *music sharing* (interactive in larger groups) and *sharing with the environment* spread from very personal to increasingly public areas and introduce new roles like contributor and proprietor (e.g., a café owner), which complement the provider / consumer stereotype. In a more general perspective, we see that HE scenarios have no reason to stop at the distribution level reached in generation II: **multi-room** networking (cf. Philips Streamium™). The iPod provides for easy multi-house distribution (at friends' houses, from home to office, etc.); legal and standards issues rather than technology issues hamper **multi-premise** sharing of content, with new business models arising, e.g., for the proprietors mentioned above. Computer science researchers have investigated a next degree, **on-the-move**, where content can be shared even without intervention of the human whose devices "encounter each other" (cf. iClouds [3]). The

largest, **global** scale has already seen a tremendous boost with the deployment of peer-to-peer technology since the advent of Napster; new resource sharing models for (free-rider-preventing) mobile use and the incorporation of FedNodes will be added.

All in one, HE R&D must be carefully lead in order not to restrict itself to multi-room/-house scenarios; the wider the distribution range, the more important the consideration of computer science recent research.

4. Smart Home

It has been argued above that the pulverization of hard- and software and the amalgamation into application hyperdomains go hand in hand. This applies to the different degrees of distribution in ambient entertainment as above, but it also applies to different goals of "Smart Home" technology; again, it is important to a) draw upon the potential synergies and overcome hurdle on the way to using them; b) understand complementary research contributions. Quite a number of smart home related research projects were terminated without immediate business impact. A dominating reason is the (perceived) unattractive cost-benefit ratio of corresponding devices and scenarios for average users. It is therefore crucial to concentrate on – and integrate – areas where this ratio can be trusted to improve in the foreseeable future (called 1st priority areas). In terms of needs and potential cost savings, **assisted living** is most promising, especially for the elderly and handicapped. Areas of immediate **saving**, such as fine grained energy optimization, and areas of high perceived need, as well as **safety/security**, make an ideal complement if re-use can be stressed. At first sight, HE (**entertainment**) is at the other side of the spectrum: desire rather than need dominates spending. Two arguments support the quest for integrating this Smart-home subdomain with the others mentioned: i) the *combined* value of desire- and need-driven consumption justifies prices (and therefore, technology sophistication levels) that would otherwise be inhibitory; ii) each subdomain contributes to overall solutions with unique strengths; for instance, the UI expertise built up in HE is definitely beneficial for areas like safety/security where UIs were underemphasized in the past. Based on the advancements i.e. declining prices to be expected from such a synergy in the 1st priority areas mentioned above, 2nd priority areas may finally gain market acceptance. This way, the often-discussed smart fridges and smart microwave ovens may finally hit the mass market and communicate with our grocery store – but that

remains a long way to go, as opposed to newspaper visions.

5. Conclusion

The article above was meant as a quest for integrated, large-span research in Home Entertainment – a quest for considering it an integral element of both smart homes and ambient entertainment. If R&D in HE do not face the challenges of these application hyperdomains, the other subdomains may one day cannibalize HE.

References

- [1] E. Braun, M. Mühlhäuser: *Interacting with Federated Devices*. In: Advances in Pervasive Computing, Adjunct Proc. 3rd Intl. Conf. Pervasive Computing. A. Ferscha et al. (Hrsg.). pp. 153-160, Austrian Computer Society, 2005.
- [2] T. Pering et al.: *Face-to-Face Media Sharing Using Wireless Mobile Devices*; Proc. 7th Intl. Symp. on Multimedia, Irvine, CA, USA. IEEE Computer Society Press, Los Alamitos, CA, USA, 2005, pp. 269-276.
- [3] A. Heinemann, T. Straub: *An Anonymous Bonus Point System For Mobile Commerce Based On Word-Of-Mouth Recommendation*. In: Proc. 19th ACM Symp. Applied Computing, Nicosia, Cyprus. pp. 766-773, ACM Press, NY, 2004.