Pervasive Computing: Opportunities and Challenges

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The Vision for Pervasive Computing (PC)

- "The essence of this vision is the creation of environments **saturated** with **computing** and wireless **communication**, yet gracefully integrated with **human users.** Many key building blocks needed for this vision are now viable commercial technologies: wearable and handheld computers, high bandwidth wireless communication, location sensing mechanisms, and so on. The challenge is to **combine** these technologies into a **seamless whole.**" [IEEE Pervasive Computing]
- "Bringing **abundant computation** and **communication**, as pervasive and free as air, naturally into **people's lives.**" [MIT Project Oxygen]
- An **abundance** of **computing** and **networking** resources enables **people** and **machines** to discover and collaborate with each other and their environment in a **seamless** and **effortless** manner. The pieces of the world of pervasive computing will exist 'de-facto'. **No single entity** building infrastructure.

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Components of Pervasive Computing

- Proximity wireless (e.g. Bluetooth, UWB, WLAN, low-power radios, IrDA, optical, non-RF)
- Near field access (e.g. RFID's, NFC)
- Sensors and related networking (e.g. wearable sensors, environmental sensors, small-scale sensors, biometrics)
- Pervasive networking (e.g. self-organization, self-healing, Peer-2-Peer, ad-hoc, communications middleware)
- Proximity-cellular interactions (e.g. vertical roaming, multiple interface terminals)
- Distributed Application Middleware (e.g. UPnP, Jini, Web-services, service discovery)
- Pervasive Security (e.g. distributing trust, ease-of-use, ad-hoc and visitor scenarios, virus protection, platform security)

Components of Pervasive Computing (cont.)

- Building distributed applications (e.g. tools, languages, scripting, composable applications, tasks, goals)
- Location & context awareness (e.g. location technologies, location middleware, applications, presence, preferences)
- User interfaces (e.g. real-world UI, UI technologies, multi-modal, GUI design, graphics)
- Terminals and enabling hardware (e.g. device architectures, OS, hardware technologies, processor architectures)
- PC Applications & Services: consumer & enterprise
- PC market opportunities (e.g. market research, forecasts, new business models and cases)
- Standardization activities (e.g. UPnP, DLNA, BTH SIG, MBOA, NFC Forum, IEEE, OMA, ...)

A Mobile Device Perspective of PC

MBOA
MultiBand OFDM Alliance

oma
Open Mobile Alliance

DLNA
Digital Living Network Alliance

MIPC

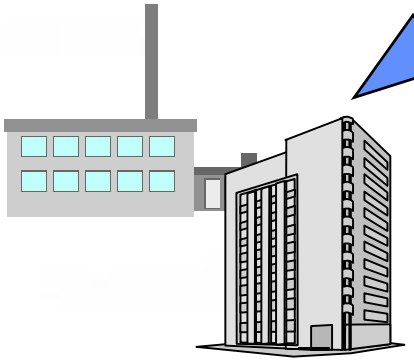
nfc forum

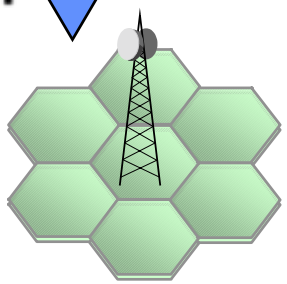
UPnP

symbian
Symbian OS - the mobile operating system

Bluetooth

Wi Fi ALLIANCE





Java

and many more....

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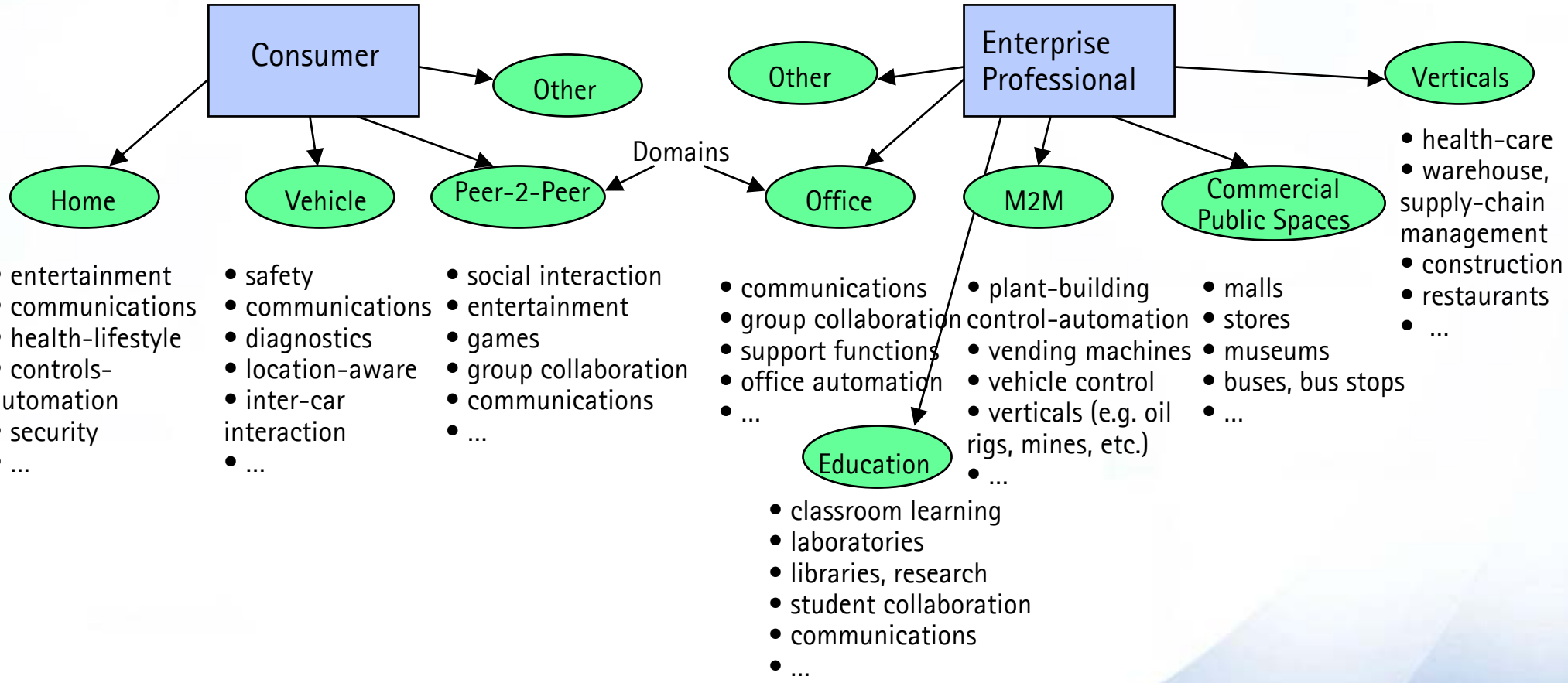
Areas of PC Applications & Services (A&S)

Consumers mostly responsible of buying, setting-up, maintaining all equipment, self-educate on usage

Professionals mostly responsible of buying, setting-up, maintaining all equipment, educate on usage



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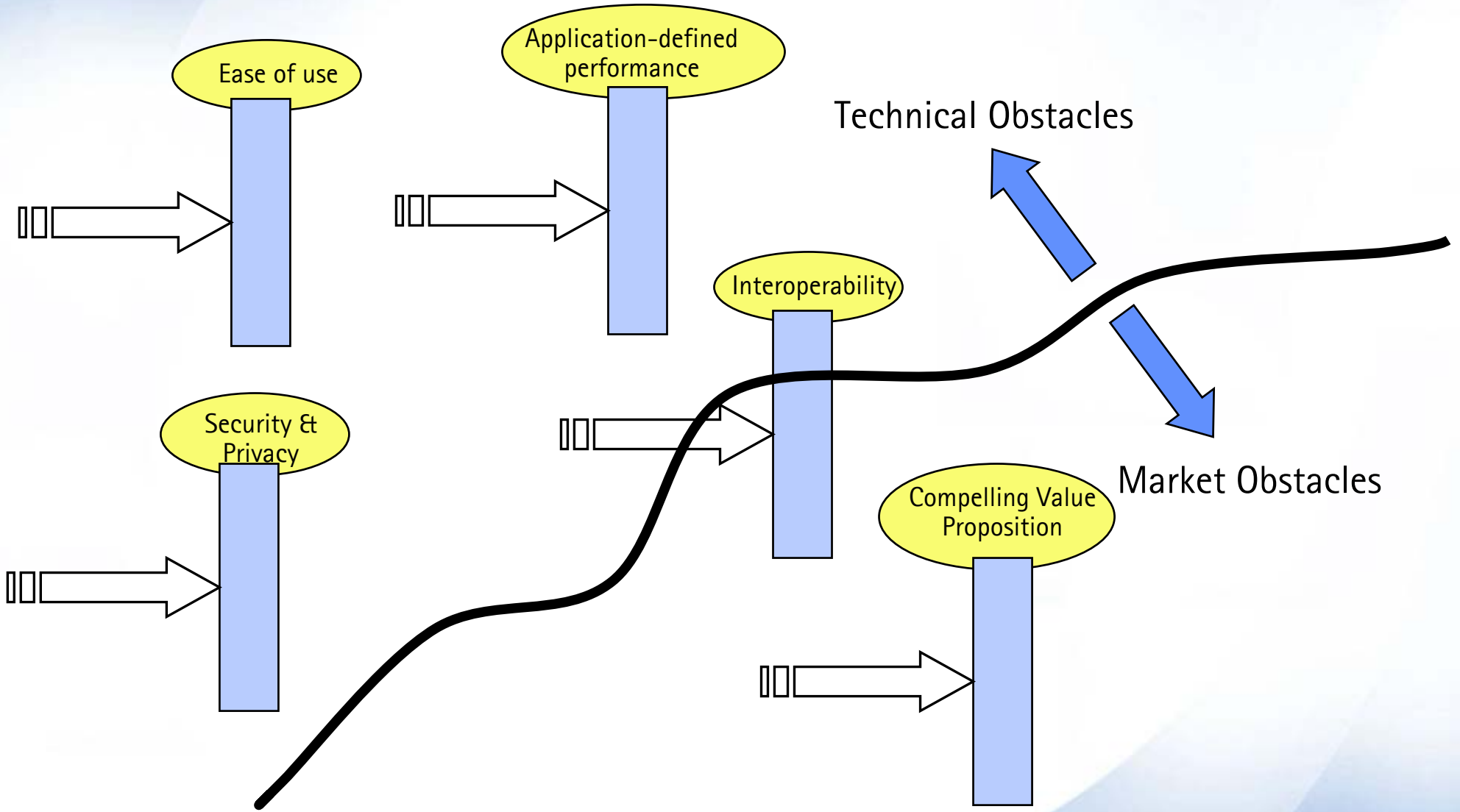
Obstacles for Wide Adoption of PC A&S



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Examples of Emerging Compelling PC A&S

- DLNA: Digital Living Network Alliance
  - An industry alliance of leading companies in the consumer electronics, mobile domain and personal computers
  - Goal to promote interoperability of home-centered networked services (e.g. home entertainment) by issuing guidelines
  - Creating a PC ecosystem for the digital living of tomorrow. A step towards the vision of Pervasive Computing

- PC A&S in Health-Care and Lifestyle
  - PC technologies to enhance lifestyle and promote the well-being
  - An area where technology can bring real-value in everyday life
  - Can create compelling business propositions

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Critical Factors for PC Success

- Interoperability of technologies
  - Things just work transparent to the user
  - Promotes wider adoption of PC technologies
- User experience
  - Technology easy-to-use by non-experts
  - Technology becomes 'invisible' to the user, blending with everyday life
- PC A&S need to offer real value to people's lives