

Embedded Systems: Strategic importance for the Swedish society - where should Sweden be going?

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What's an embedded system?

- Once designed, implemented, and “embedded” into an application, it remains there unchanged until it's replaced or the app life ends
- Very long lifetime of an embedded application.
- **Dominant** (in the post-PC market)
- Differences from non-ESs:
 - Constrained by cost, weight, size and resources
 - Excessive volume
 - Limited in scope, but needs to be more predictable and resilient



Where are the needs for embedded systems?

- More basic research relevant to real world apps
- More efforts in transitioning existing results and knowledge to industry, and industry telling its ES needs to researchers
- Many new applications are emerging, e.g., Internet and home appliances, entertainment and other gizmos => they are becoming **omnipresent!**
- Research needs
 - Holistic approaches, e.g., HW, OS, middleware, apps
 - Layperson-friendly interfaces



Packaging

Networking



What needs to be done

- Broader questions
 - Applied vs. basic research? **both**
 - Applications vs. systems? **more apps and systs the better**
 - Focused vs. broad efforts? **depends**
- What needs to be done to improve the current situation: **visible impacts and marketing, human resource development, research2business, ...**



Problems and possible remedies

Problems: Shrinking research funds, short-sightedness, fragmented and fine-grained funding, and gap between research and practice, ...

Potential remedies:

- Learn from other countries/continents
- Coordination among industry-academia-government
- Stronger and larger research centers?
Multidisciplinary research?
- Transfer of research results and **education**



An Example: How has the US been doing?

- Spearheaded by DARPA with a large number of BAAs: QORUM, SenseIT, PAC/C, MoBIES, NEST, PECES, SEC, ARMS,...
- NSF: new hybrid/embedded systems program, sensor networks
- Industry: Intel, Motorola,....
- Academia: almost all institutions
- Any coordination?



What about Sweden?

- Doing great in many ways !!!
 - Lots of funding from government and industry
 - Many researchers, likely to have the largest percentage of the population

