Tech-a-Palooza

Standards, Initiatives & Select Intel Research

Andrew Chien
Vice President
Director, Intel Research

Research At Intel

IT

Systems

Communications

Microprocessors

Manufacturing

Si Devices & Processes

Research

Exploratory Research

Directed Research

intel

Exp

Expanding the boundaries of computing and communications technology through an open collaborative research model.

Technology for Developing Regions

New Usage Models for Ubiquitous Computing

Networks & Distributed Systems

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Intel Research Network

Seattle

Cambridge

Pittsburgh

Berkeley

An Open Collaboration
With Leading Universities

intel

Research At Intel

- Over 1100 researchers
- 18 locations world-wide
- 1500+ US patents in 2005
- Innovative research models

Tech-a-Palooza Topics

Standards & Initiatives:

- UDI
- HomePlug
- Certified Wireless USB
- UWB
- 802.21
- ONFI
- CE-ATA

Intel Research:

- Wireless Identification and Sensing Platform (WISP)
- Distributed Detection & Inference (DDI)
- Distributed Communication (DC)

Q&A: Panel Q&A at end of presentation

(also panelists will stay around for a short while after the event)

Today's Presenters

Standards and Technology Initiative Updates:

- **Simon Ellis (UDI) – Intel UDI Program Manager**
- **Matt Theall (Homeplug) -- President, HomePlug Alliance and member of the HomePlug Board of Directors**
- **Jeff Ravencraft (Certified Wireless USB & UWB) -- Technology Strategist, Intel; President and Chairman USB-IF**
- **Mathew Eszenyi (802.21) -- Technology Strategist, Intel**
- **Knut Grimsrud (ONFI and CE-ATA) - Intel Fellow & Director of Storage Architecture**

Intel Research Highlights:

- **Joshua Smith (WISP) -- Senior Researcher**
- **Eve Schooler (DDI) -- Senior Researcher**
- **Sumeet Sandhu (DC) -- Senior Researcher**

Unified Display Interface (UDI): Program Update

Single connector to replace VGA

- HDMI optimized for PC
  - Additional performance modes
  - Embedded interface to replace LVDS
- Carries HDCP for content protection

UDI SIG

- Focus on developing technology for mass market
- Promoter companies; Apple, Intel, LG Electronics, National Semiconductor, Samsung, Silicon Image
- Invite industry to join SIG

- **UDI SPEC**
  - 0.8 published
  - MRD refresh based off member feedback
  - 1.0 target is Q2 2006

Compliance and Interoperability

- Rev 1 program defined
- Required for product registration

HomePlug Alliance News

HomePlug Alliance Membership Growth

Total HomePlug Units Shipped

HomePlug AV Silicon Providers

HomePlug AV Products Announced

Other HomePlug News

Over 4.5M HomePlug Products Shipped

HomePlug BroadBand over Powerline

Expect to be Ratified in Q406

HomePlug Command and Control

Bakeoff Complete, Spec Expected in Q3'06

Yitran

Compliance, Interoperability & Coexistence Efforts

IEEE

HOMEPLUG CERTIFIED BPL 1 AV CC

ETSI

HomePlug Worldwide Market Traction Accelerating

- HomePlug membership at Fall'05 IDF = 43 members
- HomePlug membership at Spring '06 IDF = 65 member
- Membership growth expected to continue to accelerate

HomePlug Ecosystem Thriving

- 4.5M HomePlug chipsets deployed
- Volumes increasing at >1M units/qtr
- Volume deployment at >20 Service Providers worldwide
- Only organization driving true open PLC standards

HomePlug AV Chipsets Available Now

- Si Vendors: Arkados, Conexant, Intellon, Spidcom
- HomePlug AV 200Mbps PHY (HomePlug 1.0, 14Mbps PHY)

HomePlug AV Products Announcements

- Devolo & Aztech first to announce products. More to follow soon
- Dozens of end-user products in 2006

HomePlug Broadband over Powerline News

- HomePlug BPL spec expected to be ratified in Q4'06

HomePlug Command and Control News

- Bakeoff completed. Ratified spec expected in Q3'06
- Yitran selected as baseline technology

HomePlug Alliance Announces Global Compliance, Coexistence and Interoperability Efforts

- BOD has approved robust C&I certification program
- HomePlug AV spec includes coexistence mechanism for HP1.0
- This mechanism is available for public use
- Actively participating in IEEE and ETSI workgroups to define global coexistence mechanisms

IDF: Intel's Tech-a-Palooza Spring '06
March 6, 2006.

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Certified Wireless USB Certification Program
Ensures Interoperability and Enhances Security
COMPANION SPEC ENABLES FIRST TIME DEVICE ASSOCIATION

The USB-IF announced the completion of the Certified Wireless USB Association Models Specification 1.0, a companion specification to Wireless USB 1.0 that will help developers more securely connect hosts and devices

The association models specification is a key differentiator from other wireless technologies

- It provides a method for first-time product association
- It helps ensure a more secure connection between products from any vendor that complies with the Certified Wireless USB certification requirements.
- Certified Wireless USB supports the same ease-of-use, plug-and-play and interoperability features consumers love and know from wired USB.

Association, security features and interoperability will be enforced through the USB-IF certification program

- The program allows companies to test compliance to the Certified Wireless USB specifications.
- Companies must pass compliance testing and execute a logo license in order to use the Certified Wireless USB logo on their products.
- Through this process, the Certified Wireless USB logo will continue to communicate the brand promise to the consumer.

UWB Update

UltraWideband (UWB) is a technology to enable very high speed wireless data rates over short distances

Standards Progress:

- ECMA approval in December 05
- Standard submitted for ISO approval in January 06
- ISO approval expected in Q3

Interoperability progress:

- First interoperability testing event held with 5 companies
- Next interoperability event in the next few weeks

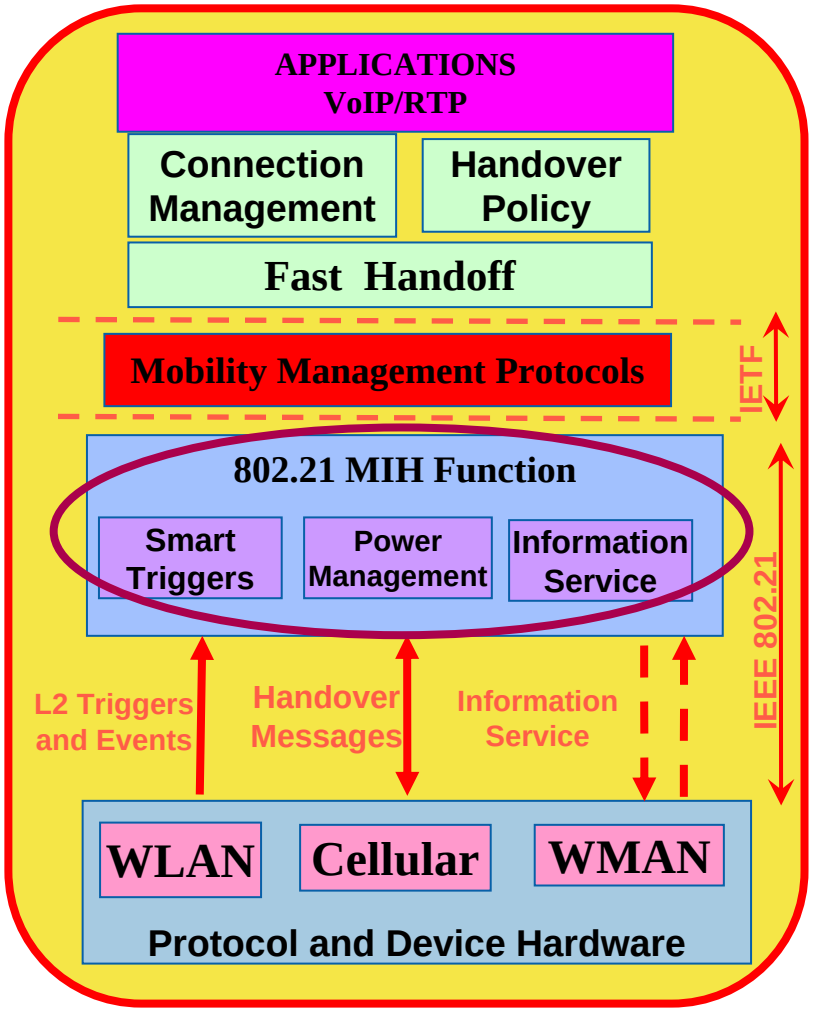
Regulations:

- Europe and Japan likely to issue rules in June/July timeframe

WiMedia Progress:

- Work beginning on modifications for regulatory changes, faster speeds, handset optimization, etc

802.21 - Media Independent Handover Services



Value Proposition:

- Facilitate "anytime, anywhere" connectivity by enabling people to stay connected while roaming between different networks
- Lower power

Focus of this standard:

- Optimize Heterogeneous Handovers (WiFi<>WiMax<>Cellular)
- Network Discovery and Selection
- Session and Service continuity
- Device <> Network co-operation

Current Status:

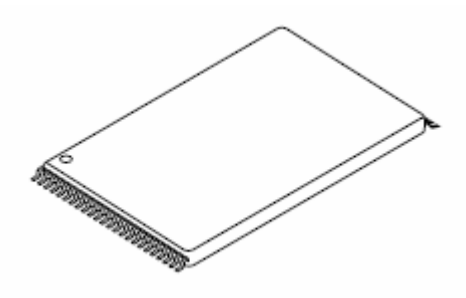
- Latest draft of spec released; IEEE expected to submit to members for any comments in the next few weeks
- Updates to Wi-Fi and WiMax specs will be needed to implement handover (being handled in IEEE groups)
- Changes to Mobility Management Protocol layer to be done through IETF

For more info: www.ieee802.org/21

Open NAND Flash Interface (ONFI) Initiative

Intel & partners in process of launching ONFI initiative to define uniform NAND flash component interface

- Raw NAND component interface for embedded use (***not*** a card standard)
- Reduces needless component behavior variation that complicates integration
- Improves integration of NAND in Robson and similar compute applications
- Avoids design pre-association with specific NAND devices to accelerate product cycles
- Improves ability for host products to make timely use of new generation NAND components



Related classes

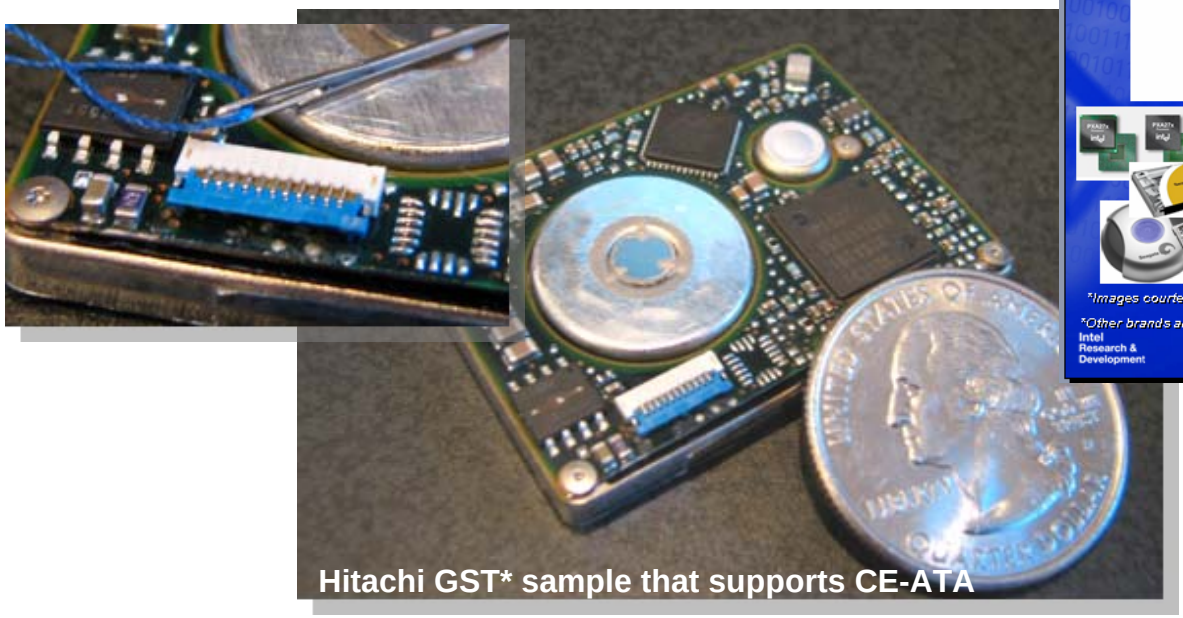
MEMS004: Platform NV Memory Solutions for Storage Enhancement (Robson)

MEMS005: A Standard Interface for NAND Flash (ONFI details)

CE-ATA Initiative

CE-ATA interface tailored to needs of small-formfactor disk drives in handheld applications is on industry fast track

- Initiative launched at IDF Fall '04
- 1.0 Spec published 6 months later
- Products in showcase now



From Fall IDF 2004

See Sean Maloney's keynote on Tue March 7th for related new Intel announcement

Intel Research Highlights

WISP

Wireless Identification and Sensing Platform

Challenge

The properties that make sensor nodes attractive —small size, un-tethered operation, long-term radio communication—make powering them a challenge

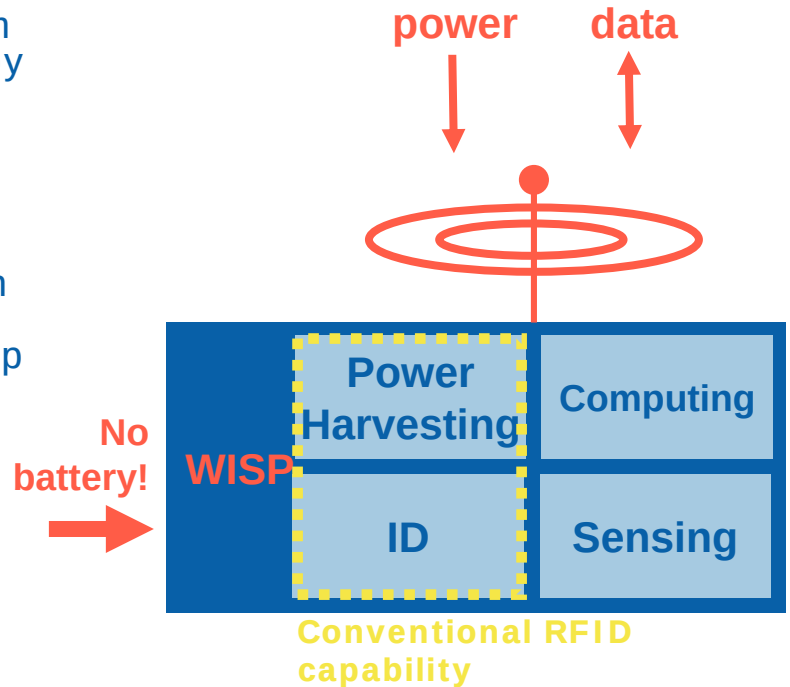
Solution

A battery-free sensing & computing platform from Intel Research Seattle that is powered and read by a standards-compliant RFID reader

Potential Impact

WISP enables perpetual wireless sensing.

One application: monitoring hydration of elders in home healthcare settings can prevent problems and save billions. WISP on a water bottle can help solve this problem

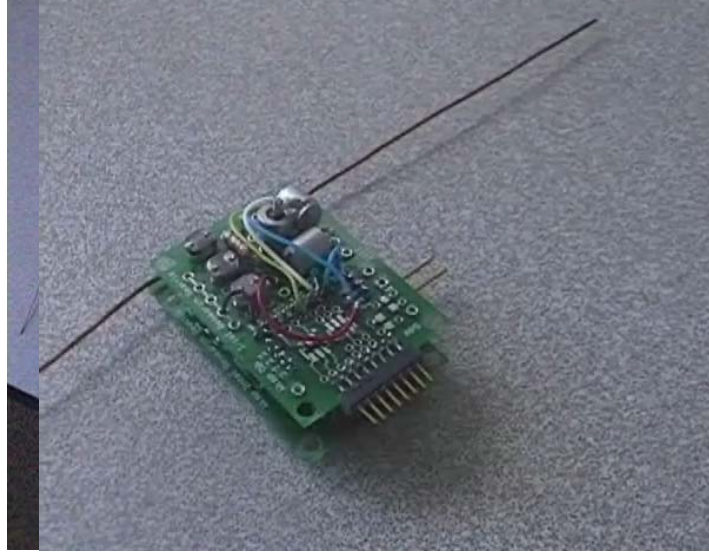


Principal Investigator

Joshua R. Smith – Intel Research Seattle

WISP

Wireless Identification and Sensing Platform



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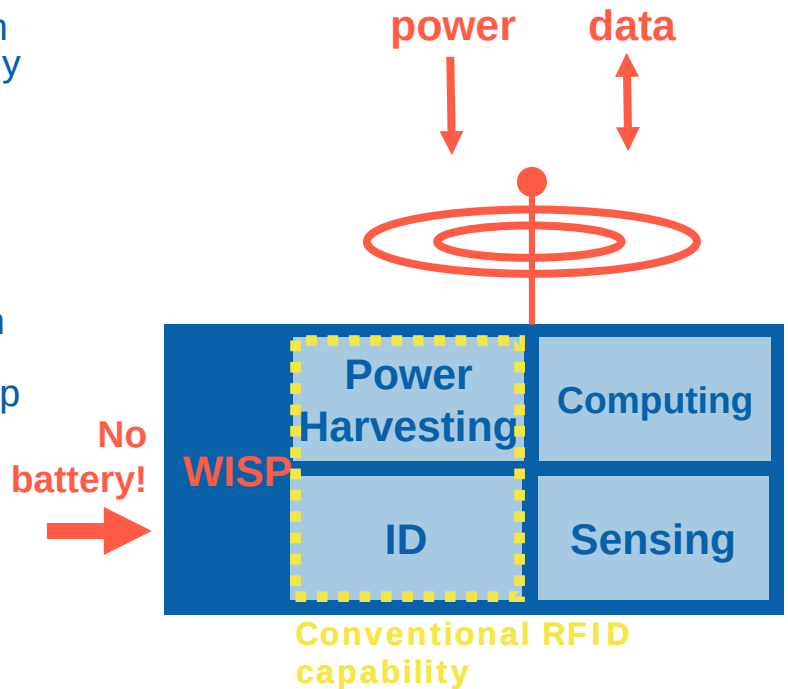


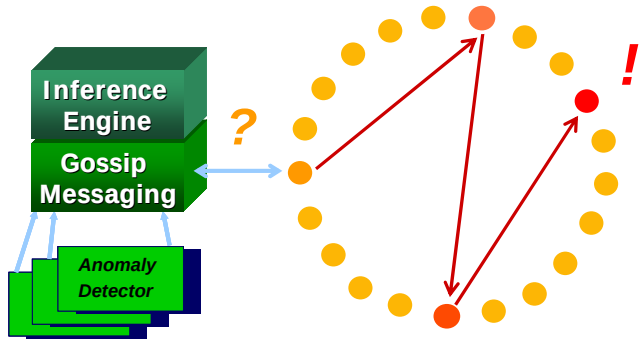
Principal Investigator

Joshua R. Smith – Intel Research Seattle

Distributed Detection & Inference

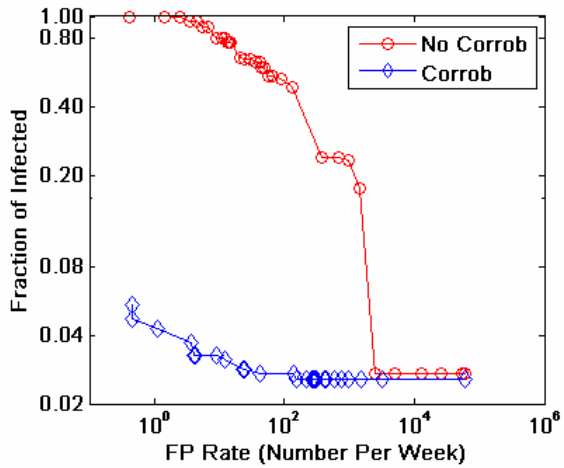
Challenge

Current network intrusion detection systems have a high incidence of ***false alarms*** and are relatively ineffective at detecting ***stealthy, day-zero attacks***.



Approach

Employ ***machine learning algorithms*** to correlate weak beliefs generated at individual hosts into strong evidence of network-wide attacks, and use efficient messaging to disseminate these beliefs among ***corroborating nodes*** throughout the network.



Potential Impact

In a fully distributed environment, accurately detect anomalies, contain worms before they cause widespread damage to the network, and allow scale to work to our benefit.

Can apply to many network health issues

Principal Investigator

Eve Schooler

Distributed Communication

Cooperation by *independent* wireless devices

Challenge

Wireless networks are becoming denser every day, increasingly crowded with cell-phones, handhelds, laptops, blue-tooth devices... Will dense networks scale up with Moore's law or will they collapse under Murphy's law?

Solution:

Leverage network density as a new resource

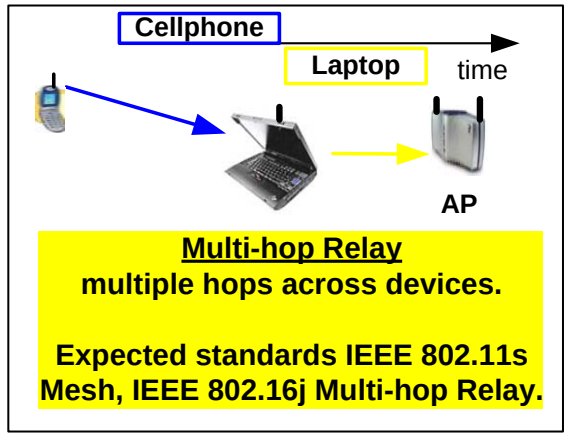
- Sparse, uniform networks: multi-hop relaying ("Mesh")
  - O. Oyman and S. Sandhu**, "A Shannon-theoretic perspective on fading multi-hop networks",** Proceedings of the 40th Annual Conference on Information Sciences and Systems (CISS), Princeton, NJ, March 2006.
  - For a given source-destination range, there exists an optimal number of hops depending on transmit power and channel fading
- Dense, non-uniform networks: ensemble relaying ("virtual MIMO")
  - New results: simple amplify and forward protocols can double throughput when relays are close to source

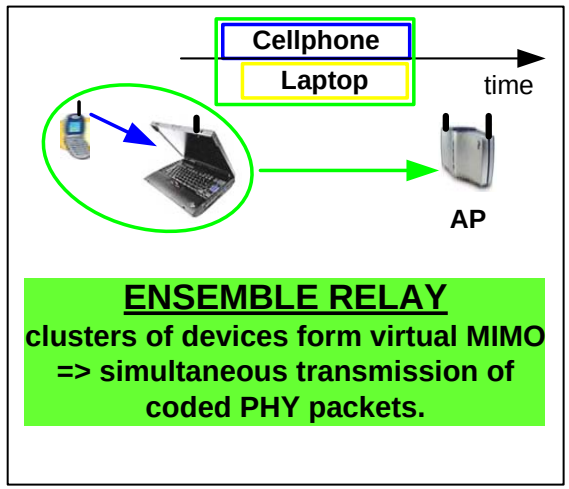
Potential Impact

- Infrastructure cooperation: supplement or replace large, expensive cellular base stations with many smaller, cheaper relay stations
- Client cooperation: enhanced range and coverage, fewer dropped calls, longer battery life, longer sensornet lifetime

Principal Investigator

Sumeet Sandhu – Strategic Research Project in CTG/CTL/RCL (funded by Intel Research)





Q&A

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