

# Research@Intel 2010

## Technology Zone and Demo Guide

### User Experience Zone

The User Experience Zone showcases research into how humans and computers will interact in the future. Unique environments where computing can take on a new presence such as the classroom, home, car and on-the-go do not always lend themselves to the traditional keyboard and mouse. In this zone you will see new ways to interact with technology, from cameras to speech to your brain.

### Cloud and Internet Zone

Every year a tremendous amount of useful consumer, business, and scientific data becomes available online. This zone features research aimed at scaling the capabilities of the cloud computing engines and data warehouses behind the Internet, and channeling all this data into enhanced online experiences. This includes projects on social media tools and 3D web experiences, as well as the processing, data routing and storage technologies that will do the work behind the scenes.

### Transportation Zone

The Transportation Zone showcases research into the future of the connected and sustainable car. The next major innovation in transportation is going to be driven by Information Technology. Whether advanced

entertainment, safety, security, efficiency or sustainability, our on-the-go lives will be greatly enriched through IT. In this zone, you will see the future of the safe, sustainable, connected car.

### Platform Innovation Zone

Intel processors and technologies form the basis of platforms that span the computing continuum, from mobile and embedded devices to high-performance workstations and servers. This zone features platform innovations such as faster electrical and optical I/O for moving massive amounts of data, circuits to make data exchanges more secure, clever techniques to reduce platform power consumption, and innovations that break down traditional barriers between the devices you use for work and those used in your personal life.

### Energy Zone

The Energy Zone showcases research into the future of energy harvesting, conservation and distribution. Though ITC consumes approximately 3% of global energy usage, it is important to both reduce the energy consumption of ITC as well as use ITC to help reduce the consumption of the other 97%. In this zone you will see how Intel Labs is addressing energy management at a personal as well as at a more global scale.

# User Experience Zone

## Mobile2PC Collaboration Based on I/O Redirection

*U1* – This research is an innovative resource sharing solution to connect mobile devices with traditional PCs so that users can leverage advantages of both platforms. Through the dedicated I/O redirection logic, a new usage model is enabled in which applications running on mobile devices can be migrated to other IA platforms to leverage their more powerful hardware (CPU/GPU/Memory/Storage) and more convenient UI (motion sensor/accelerometer). The applications can be migrated back for mobility with the context synchronized automatically.

## Mobile Augmented Reality

*U2* – We demonstrate our Mobile Augmented Reality World Browser application on Intel's latest Atom™ platform. Our World Browser enriches the way users understand their world on an Intel® Atom™ powered Smart Phone. Users can instantly access the huge reservoir of information on the web, by simple click of the camera shutter. Our system identifies landmarks on the fly, using compute-intensive visual search in concert with power-efficient sensors, taking advantage of unique IA platform features.

## Persistent Audio Interfaces

*U3* – This demo shows an always-available audio-based mobile interface. The technology can take content, such as a web page or news article, summarize it, and create an audio file of the summary, so people can listen to it on the go and without the need for a display. The summarization and speech synthesis is done by a small mobile device and the audio is played on headsets thus showing a step towards advanced interactions to support mobile users.

## HERB: The Home Exploring Robot Butler

*U4* – As the population of the world becomes older, there is a growing need for assistive technologies in the home. Intel's Personal Robotics project is developing algorithms for perception, planning, and learning that enable robots to perform useful tasks in dynamic and cluttered home environments. In collaboration with the Quality of Life Technology Center and Carnegie Mellon University, we have developed HERB, a fully autonomous mobile manipulator that uses its sensors to build models of the world and its planning algorithms.

## Mobile Augmented Reality for Maintenance

*U5* - Mobile Augmented Reality (MAR) moves indoors. In this demo, computer vision and MAR are used to help guide a homeowner during a PC repair project using a device with Intel's latest Atom™ processor. The device identifies the model of the PC and provides graphical instructions to the user for repair. In a related demo, when MAR is combined with projection, the user can also see the effects of different styles and colors on a model car.

## Portico: Tangible Surface Interaction with Tablet Computers

*U6* - Despite many benefits of physical manipulation, tangible user interfaces are often less practical than graphical user interfaces because they are built in a particular location, and depend on a large physical surface. By using cameras mounted on a tablet computer, Portico is portable, yet is not limited by the small size of the tablet screen. Portico recognizes and reacts to objects placed on the tablet screen as well as objects manipulated on the surface around the tablet.

## Smart Computing Islands on Everyday Surfaces

*U7* – OASIS (Object-Aware Situated Interactive System) combines real time computer vision algorithms, 3D cameras, and micro-projection for fast recognition and tracking of everyday physical objects and gestures. This demo uses projected displays on everyday household surfaces to create interactive "islands" for in-home applications. This is easy to retrofit to any home, any room, and almost any horizontal or vertical surface. This project anticipates new capabilities for the future home and the implications for home server applications and functions.

## The Human Brain: The Ultimate Interface to Computers

*U8* – People want to access information stored on their PCs and mobile devices in a more natural, convenient way. Through the Human Brain project, Intel's aim is to enable people to use their thoughts to directly interact with computers and mobile devices. In a joint project with Carnegie Mellon University and the University of Pittsburgh, Intel Labs is investigating what can be inferred about a person's cognitive state from their pattern of neural activity.

## Making Technology Socially Viable

*U9* – The Social Viability Measure (SVM) is a metric and process to enable governments, businesses, and non government organizations to gauge the social acceptability of their technology and development programs. The SVM is a result of a 2 year ethnographic study, conducted by Intel Labs, of people and their social connections to technology programs around the world that were promoting technologies for economic and social development. To learn more, go to [www.socialviabilitymeasure.info](http://www.socialviabilitymeasure.info) for the full report.

## The Meeting Diarist

*U10* – The Meeting Diarist enables browsing, searching, and indexing of meetings in real time on your own laptop or smartphone. It computes what was said and who said it, and allows users to search for relevant section without having to review the entire meeting. Currently, the best systems in the world can take 50 hours to process a one hour meeting. By exploiting recent advances in parallel hardware and software, we are able to dramatically reduce this number.

## SENS: Socially Enabled Services

*U11* – SENS represents a new wave of social networking that provides the ability to hook into real-time activities and display these activities live and directly to networked friends and family. SENS brings together design, social science and technology research to create a vision for the next generation of mobile devices and shows how context awareness from sensors onboard a device can translate into completely new user experiences that build on new trends in sharing of presence and media

## Computer Vision and Augmented Education

*U12* – The advent of 1:1 computing in the classroom opens the door for teachers to set up individualized learning for their students who have a wide spectrum of interests and skills. ClassmateAssist technology uses computer vision and image projection to assist and guide students in a 1:1 learning environment, helping them to independently accomplish tasks at their own pace, while at the same time allowing teachers to be apprised of student progress.

## Personal Vacation Assistant

*U13* – The Mobile Context Aware Software and Services project investigates ways to capture and share contextual information while protecting the user's privacy and the security of the user's collected data. This demo showcases a partnership with Fodor's through which we deployed a Personal Vacation Assistant to more than 25 tourists visiting New York City. The users' experiences were captured in the device, uploaded to the cloud and, at the user's discretion, a blog was posted.

# Cloud and Internet Zone

## 3D Internet

*C1* – This exhibition features a collection of projects aimed at expanding the web to include interactive 3D applications. *Creating and Visualizing 3D Content* showcases projects from the Intel Visual Computing Institute in Saarbruecken, Germany. This includes software to facilitate the creation, integration and visualization of 3D content for both personal and professional applications. *Gaming for Water Resources on ScienceSim.com* demonstrates progress in scaling the capabilities of the ScienceSim virtual world created for immersive science and education. We feature an exciting research project from ScienceSim called "Water Wars." This project explores the use of 3D computer games in environmental policymaking, allowing members of a community to help simulate water management issues to provide insight into better policy. Try it for yourself!

## Enabling Online Updates in Data Warehouses via SSDs

*C2* – Today's data warehouses operate on stale (day-old) snapshots of the data, in order to achieve efficient data access. The rise of e-commerce and the need for 24x7 operations for global markets make online updates increasingly desirable. This research from Intel Labs Pittsburgh exploits Solid State Drives (SSDs) for enabling fast data access on up-to-the-minute data. We demonstrate a prototype data warehouse that caches recent updates in a SSD, and combines cached updates on-the-fly in query answers while preserving the queries' good sequential disk access patterns.

## 48-core Single-chip Cloud Computer

*C3* – The experimental Single-chip Cloud Computer concept vehicle is a many-core research microprocessor containing the most Intel Architecture cores ever integrated on a silicon CPU chip: 48 cores. It integrates features found in today's cloud datacenters into silicon, such as a packet-based mesh network and support for message-passing programming models. Fine-grain power management takes advantage of 8 voltage and 28 frequency "islands" across the chip to allow dynamic voltage and frequency scaling of the cores and mesh. The project is a collaboration among Intel Labs in the U.S., Germany, and India.

## Dispute Finder: Is There Another Point of View?

C4 – The web contains a huge amount of information, but some of this information is incorrect or presents only one side of an issue. Dispute Finder aims to help people navigate the mass of disputed and biased information that they encounter in their lives by informing them when information that they encounter is disputed by another source. A browser extension highlights disputed information that you read on the web, a search engine interface tells you when a search result contains a disputed claim. A prototype voice interface tells you when you hear something disputed.

## RouterBricks: Enabling High-speed, Software-based Networks

C5 – The RouterBricks project from Intel Labs, Berkeley aims to enable the processing of network packets in software distributed across clusters of standard servers using IA CPUs, rather than fixed-function processors used in traditional router designs. The RouterBricks approach is the next step towards flexible network infrastructures that are simpler and cheaper to evolve using familiar programming environments and decoupling network software from hardware. Networks would inherit the benefits of Moore's Law and the PC ecosystem such as low-cost, high-volume manufacturing, widespread supply/support, and enhanced power management.

## Cloud Central

C6 – Cloud computing is a technology and a business model wherein software applications are run from Internet data centers and provided as web-based services to customers. This exhibit features a collection of projects aimed at making cloud computing more efficient and useful. *The OpenCirrus Project*, is a collaboration led by Intel, HP, and Yahoo to create an open, Internet-scale testbed for advancing cloud computing research, with ten sites worldwide. *Making Big Data Interactive* uses the OpenCirrus testbed to develop new software tools to make interactive, scalable analysis of massive data sets as simple as using a spreadsheet. *Low-power Mobile Computer Vision* shows how cloud computing can make cutting-edge computer vision applications practical on mobile devices by offloading computation to processors in your home, office, or in the cloud.

# Transportation Zone

## Intelligent Energy Management for Electric Vehicles

T1 – Intel Lab's energy systems research aims to ensure that intelligent management of electric vehicle (EV) charging, benefits both consumers--by minimizing the cost of electricity-- and the electric distribution grid--by shaping the power demand. This demo shows a simulation of an electric distribution network with high EV penetration. Results with and without the proposed solution will be displayed, and attendees will be able to interact with the simulation where they can manipulate key parameters.

## Connected Car

T2 – To keep pace with consumer's rapidly developing connected digital lifestyles and expectations, In-Vehicle-Infotainment platform developers and auto manufactures need platforms that provide seamless integration of home, office and on-the-go consumer experiences in their cars. This demo showcases research to enhance user experiences leveraging open platform-based application development, building blocks for on-board Intel® Atom™ based platforms, and the synergy between in-vehicle platforms, mobile devices and cloud computing.

## Location Awareness and Ranging with LED Visible Lighting

T3 – As energy efficient light emitting diodes (LEDs) replace incandescent lighting in applications such as automotive safety illumination, we'll see secondary LED base applications that leverage LED's useful light modulation bandwidth. In this demo we illustrate how to use vehicular safety lighting to do relative ranging and location awareness between vehicles. This feature would allow numerous applications based upon collision avoidance, such as predicting when a vehicle will move into a drivers "blind spot."

# Platform Innovation Zone

## Blending My Worlds on Any Device

*P1* – Today people have to keep track of an increasing number of computing devices: Their personal laptops and smartphones, as well as a separate set of the same devices for work to adhere to corporate policies. We demonstrate two innovative projects that aim to give people and IT managers new ways to mitigate this “device overload” by blending these two worlds. Device Independent Mobility abstracts IT applications and data for consumption by any number of devices, giving users freedom to access corporate information on any personal device throughout their day. Virtual WiFi for Virtualized Mobile Devices addresses the challenge of isolating personal Internet access on a corporate network environment by enabling virtual machines to autonomously locate and connect to separate wireless access points and establish independent network connections.

## Dynamic Platform Power Management with Wireless WAN

*P2* – This energy efficiency research shows how Intel Labs is reducing overall platform power demands while maintaining high performance. Our research takes a holistic approach to power management from the network to the platform for extended battery life. This technology aligns various wireless I/O events, executing them at once to create longer idle periods. During these breaks, the platform quickly switches to a low power state and stays there longer. This synergistic approach results in a 30% CPU power savings for various applications.

## Energy Efficient, Scalable I/O

*P3* – Moving data like photos, movies and music in a computer system doesn't just take time, it also takes energy. Today's methods of moving data are beginning to “hit the wall” in terms of speed because faster data rates require disproportionate amounts of energy. Energy Efficient, Scalable I/O is a silicon prototype that highlights significant improvements in energy efficiency, reducing the I/O power by 10x. It allows for scalable bandwidth by demonstrating more energy-efficient I/O transmitters and receivers that take advantage of new materials for the interconnects used to carry data between chips.

## Light Peak: Low Cost 10Gbps Connectivity

*P4* – Light Peak is a new optical interconnect technology that will be shown transferring data at 10Gbps speeds, connecting to devices a person would utilize in their daily lives. Light Peak contains 4 ports of 10Gbps, which could enable computers to quickly move enormous amounts of data over an optical connection.

## Reconfigurable Near Threshold Voltage Encryption Accelerator

*P5* – Media content protection and real-time memory encryption are important security capabilities but can become power/performance bottlenecks on microprocessor platforms. To this end, Intel's Westmere platform recently added new instructions to improve performance of computations based on the popular Advanced Encryption Standard (AES). We show a prototype hardware accelerator that takes this performance to the next level. Our research test chip runs at 53Gbps, 5x better than the best reported work, while providing the capability to scale to ultra-low voltages for mobile and embedded applications.

## Resilient Microprocessor for Improved Performance and Power

*P6* – Today's microprocessors leave performance and power on the table by building in clock frequency and voltage safety margins (called guardbands) to ensure correct functionality in the presence of noise caused by variations in voltage, temperature, etc. In this demo, a 45nm resilient research microprocessor employs error-detection and recovery circuits to detect and correct errors to eliminate these guardbands, enabling the processor to run at 40% higher performance or 20% lower energy. Furthermore, the resilient processor adapts to the operating environment to deliver maximum efficiency.

# Energy Zone

## **Wireless Energy Resonant Link: Efficient Wireless Power**

*E1* – Wireless power transfer based on coupled resonators offers the possibility to transfer significant power over appreciable distances without any cables. This has the potential to free mobile devices from cords, docks and surfaces to enable more convenient on-the-go charging. This demo showcases our latest advancements in this research, which includes the ability to tune the system to make power transfer efficiency high (70%-90%) and nearly uniform over a range of transmitter-to-receiver distances and orientations.

## **Eco-Sense Buildings: Energy Efficiency in Office Buildings**

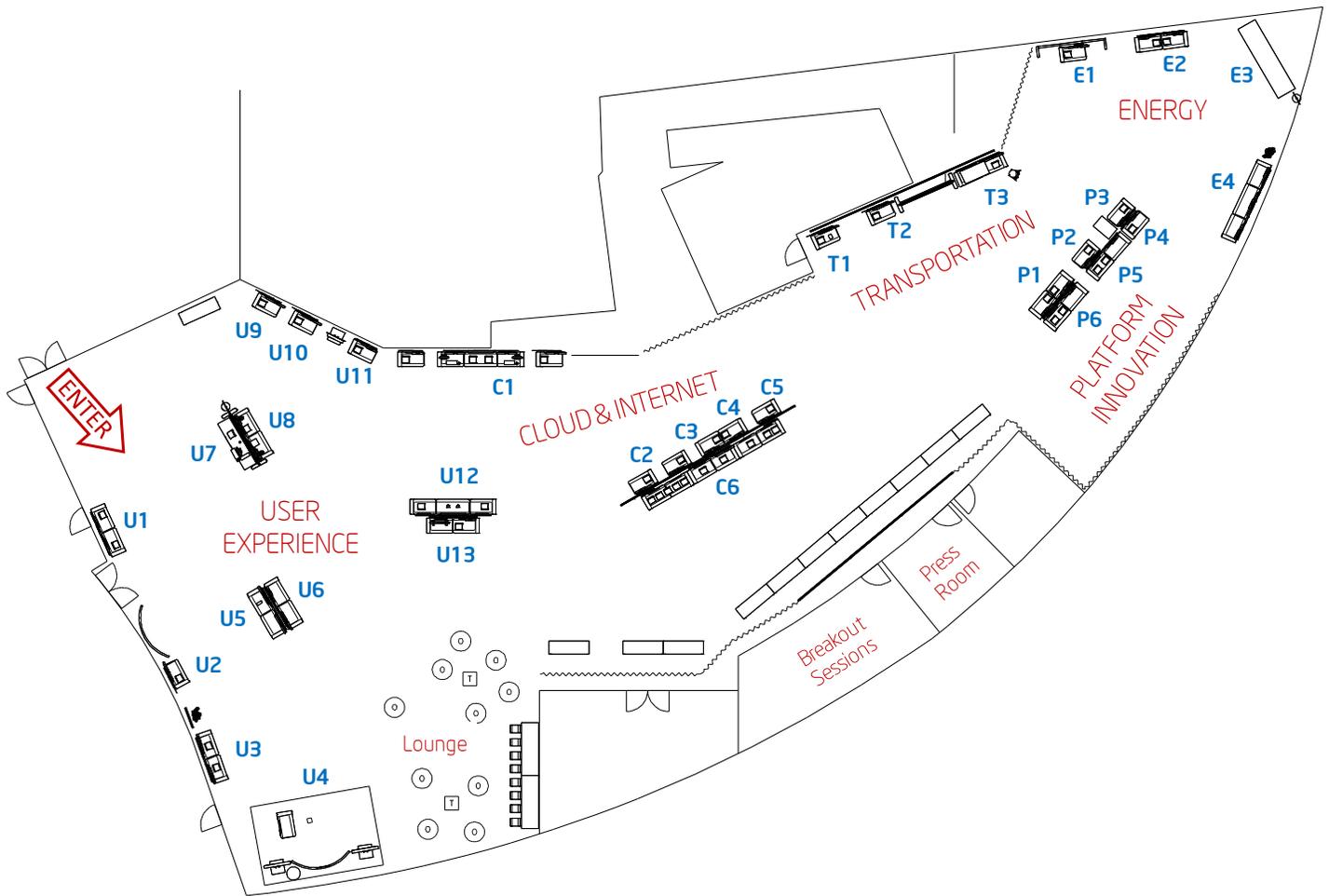
*E2* – The Eco-Sense Buildings project aims to increase energy efficiency and people comfort in offices, while exceeding aggressive EU and worldwide targets for new construction (zero-energy buildings). It does so by relying on pervasive ambient and people sensing used to drive coordinated power behaviors of building control systems, including office IT equipment, lighting, heating and cooling. This demo showcases power consumption monitoring, analysis and control as well as the capability to remotely control power states.

## **Simple Energy Sensing**

*E3* – This research demonstrates easy to use energy monitoring in the home. With a simple plug-in device, electrical appliance operation is detected as well as power consumption, without complex current transformers or individual appliance monitoring. The information from this technology can be integrated into a home energy management system in your home or on the Internet to give people more control over the power they consume.

## **Zero Net Energy Personal Devices**

*E4* – The Zero Net Energy project is addressing the ever frustrating challenge of keeping our mobile devices charged, like Bluetooth headsets, mobile phones and even chest heart rate monitors. Researchers are designing a wearable, portable personal network platform that is always on, assisting users to reduce carbon footprints, facilitate continuous health monitoring and rarely run out of power. The technique works by using energy harvesting techniques and intelligent planning for recommendations in power and computation.



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