


The Portolano/Workscape Expedition



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1st Expeditions PI Meeting
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www.cs.washington.edu/research/portolano

Distinguishing Themes

- * Invisibility
 - * not enough to be mobile, pervasive, ubiquitous, etc.
 - * user's attention is the valuable resource
 - * minimize user configuration/maintenance/interaction
 - * robust, reliable, safe, and trustworthy
 - * devices, middle-ware, and "applications" ⇒ services
- * Active fabric
 - * plug-and-play, discovery, composability
 - * data-centric, heterogeneous, active networking
 - * data and code mobility
 - * self-organizing, self-updating, self-monitoring systems
 - * active databases and information management
- * External user community

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World View

- * **What will be:**
 - * lots of task-specific devices
 - * rich connections to physical world
 - * world-wide information/computation utilities
 - * ever-increasing computation, storage, and bandwidth
 - * computing/communication capabilities in everything

- * **What won't be:**
 - * non-limiting power sources
 - * homogeneous connectivity
 - * continuous connectivity
 - * increased user mind-share devoted to computing concerns

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Expedition Goal 1

- * Connecting the physical world to the world-wide information fabric
 - * instrument the environment: sensors, locators, actuators
 - * universal plug-and-play at all levels: devices to services
 - * optimize for power: computation partitioning, comm. opt.
 - * intermittent communication: new networking strategies

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Expedition Goal 2

- * Get computers out of the way
 - * don't interfere with user's tasks
 - * diverse task-specific devices with optimized form-factors
 - * wide range of input/output modalities
 - * it's the services, not the devices, stupid!

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Expedition Goal 3

- * Robust, trustworthy services
 - * automatic configuration, maintenance, monitoring
 - * high-productivity software development
 - * self-organizing, active middleware
 - * higher-level, meaningful services

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Driving Applications

- * **Workspace:** an environment of many physical and virtual interactions between multiple people and many active and passive objects

Labscape: cell biology laboratory

experiment capture and dissemination

Commandscape: spontaneous command post

collection/distribution/making-sense of data



- * Achieve goals through realization and deployment in vertically integrated application domains with highly motivated users

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Research Nuggets

- * Low-power intermittently connected devices
- * Intentional user interfaces
- * Self-organizing information systems
- * Invisible software development/deployment
- * Seamless data/information management
- * Workspaces: radically increase productivity

services

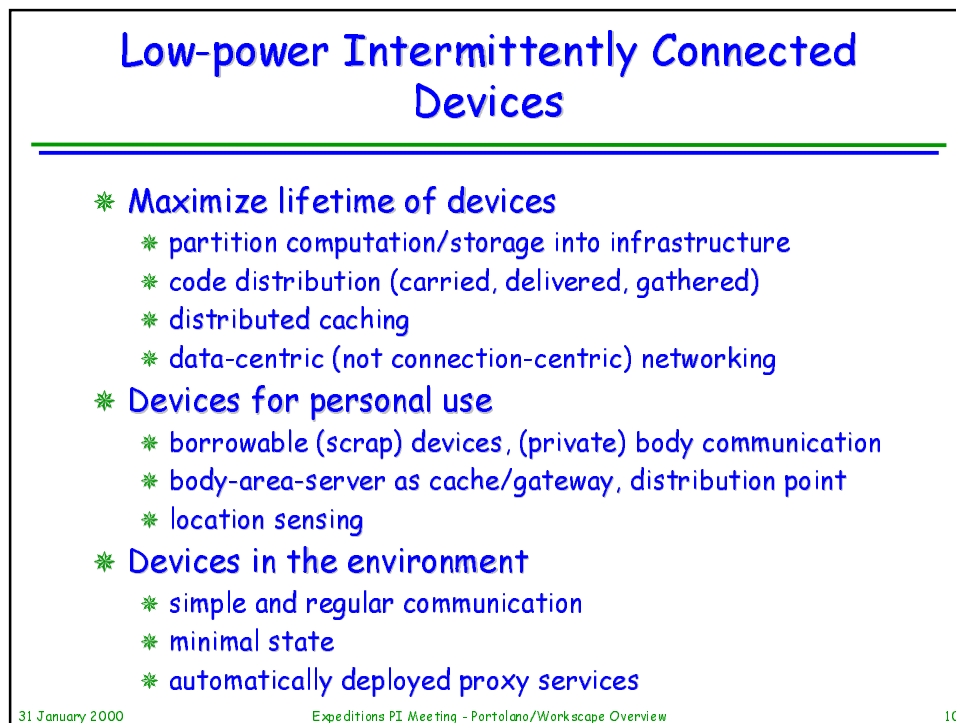
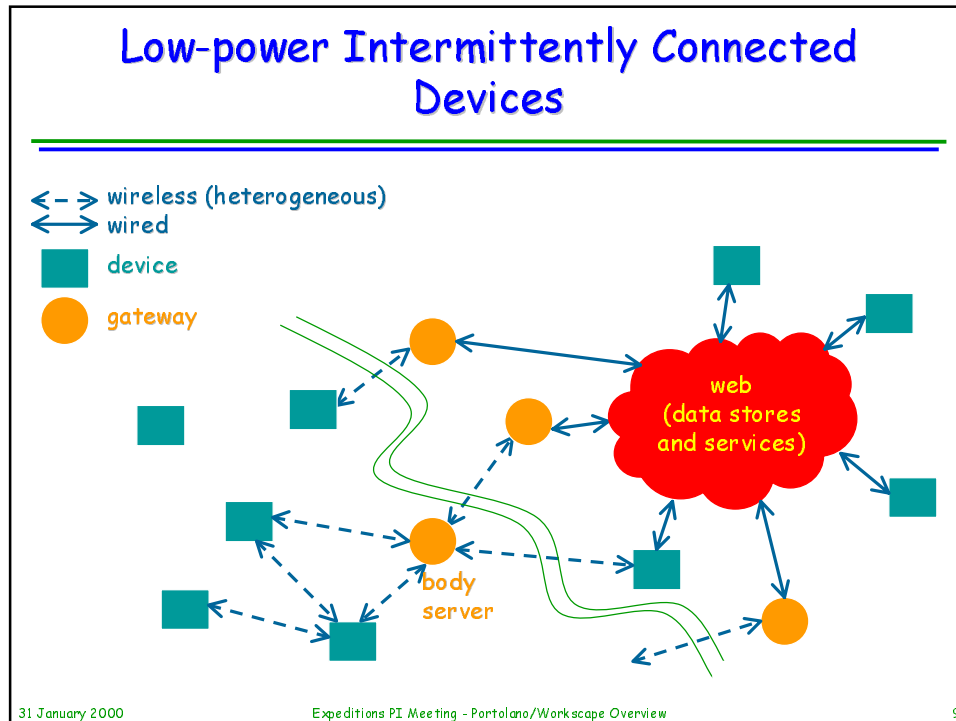
active fabric

devices

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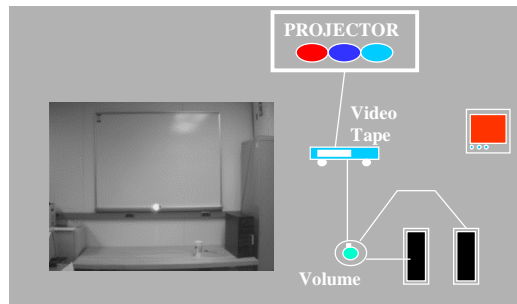
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Intentional user interfaces



- * Tags (RF cap, ind., bi-static)
- * Phycons (IR signalling, pos.)
- * Location sensing (RF sig. strength, timing)



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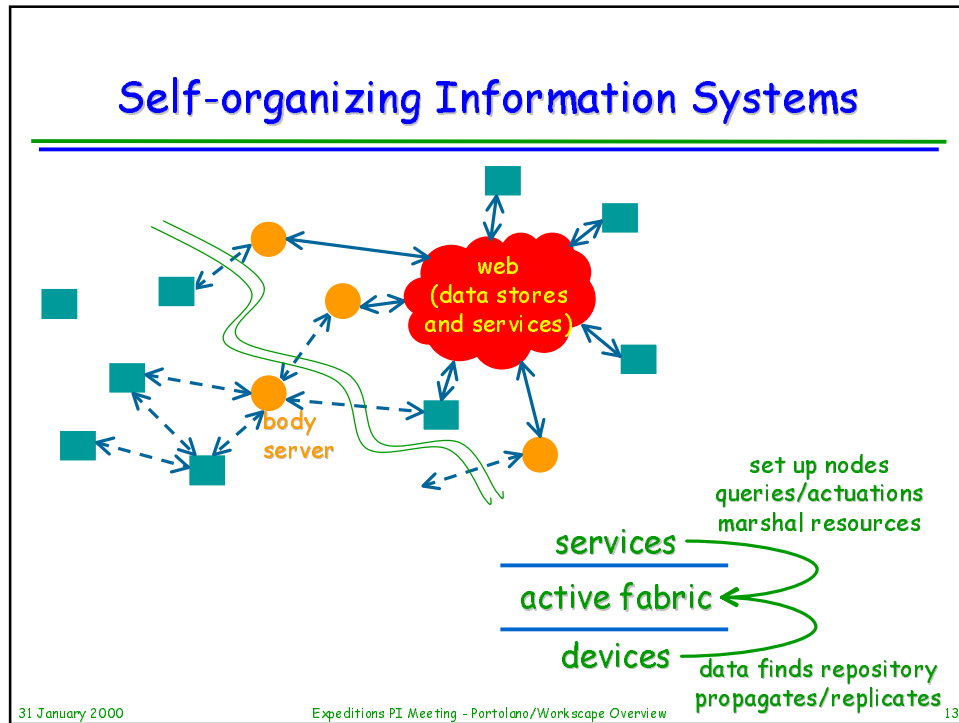
Intentional user interfaces

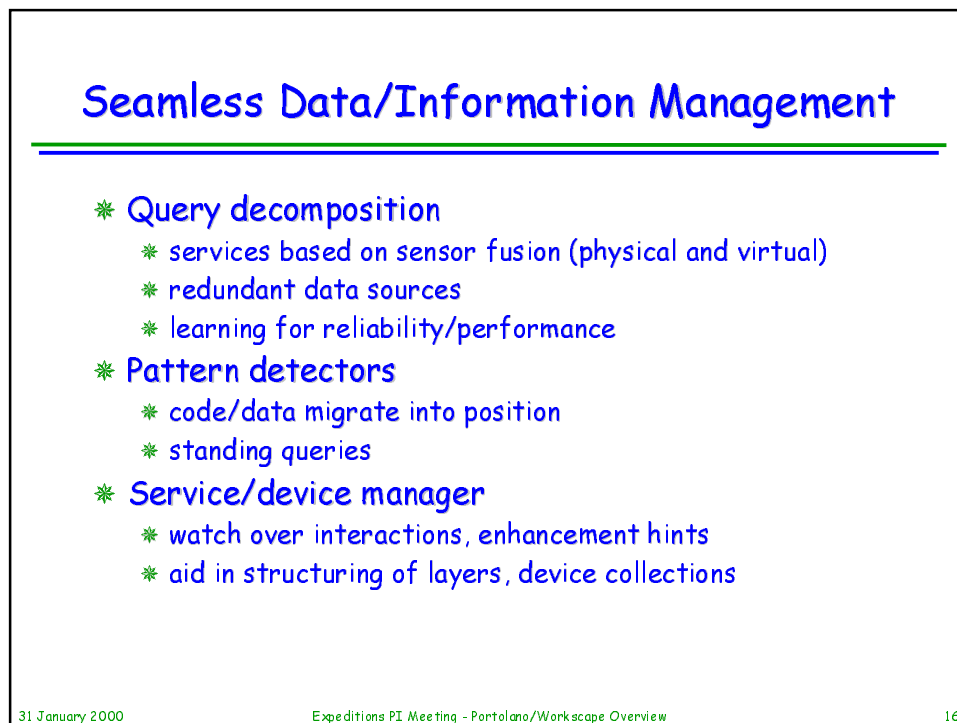
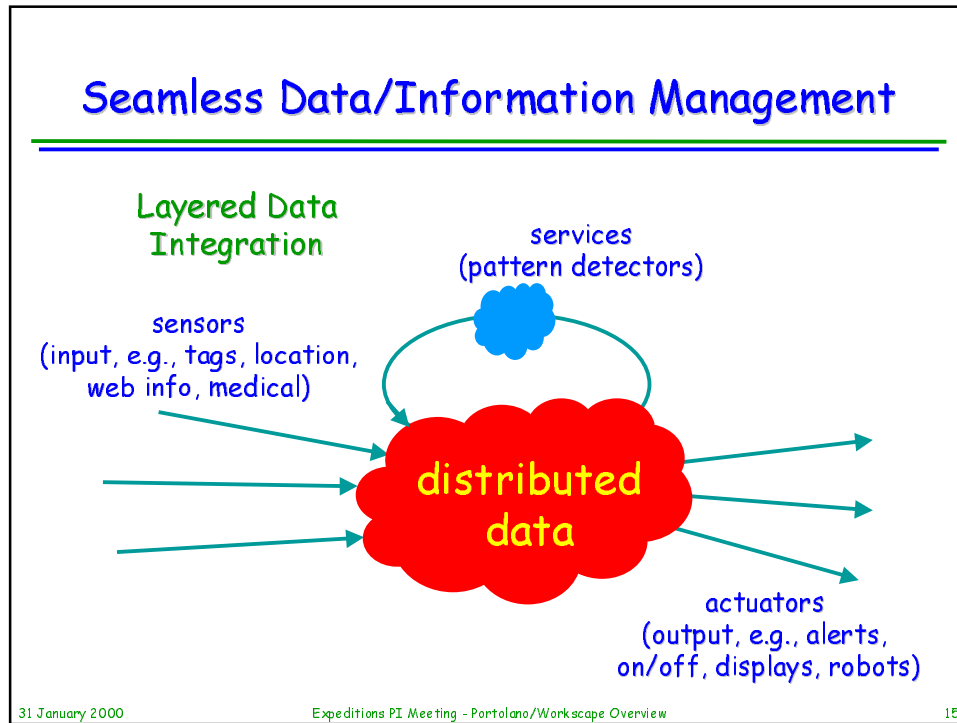
- * **Services**
 - * of the person
 - * of the space
 - * interactions between subscribers
- * **Sensors/actuators**
 - * tags, phycons, locators
 - * speech I/O
 - * video I/O
- * **User interactors post events, services react**
 - * self-describing elements, agreement on event semantics
 - * link to services through discovery, auto-configuration
 - * setting expectations: if its invisible, how to know its working?

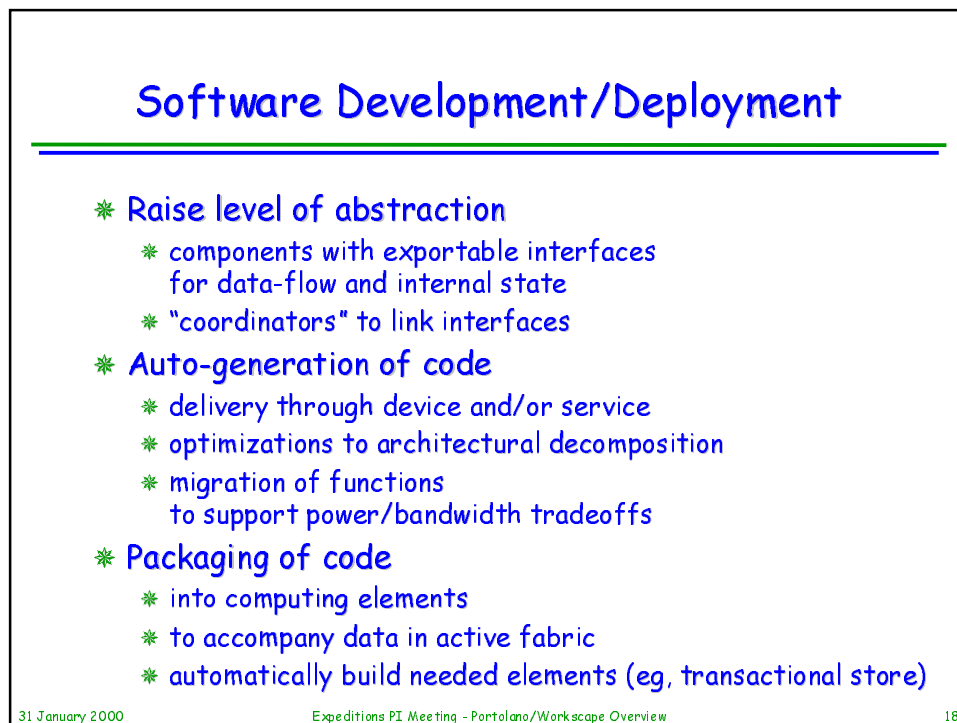
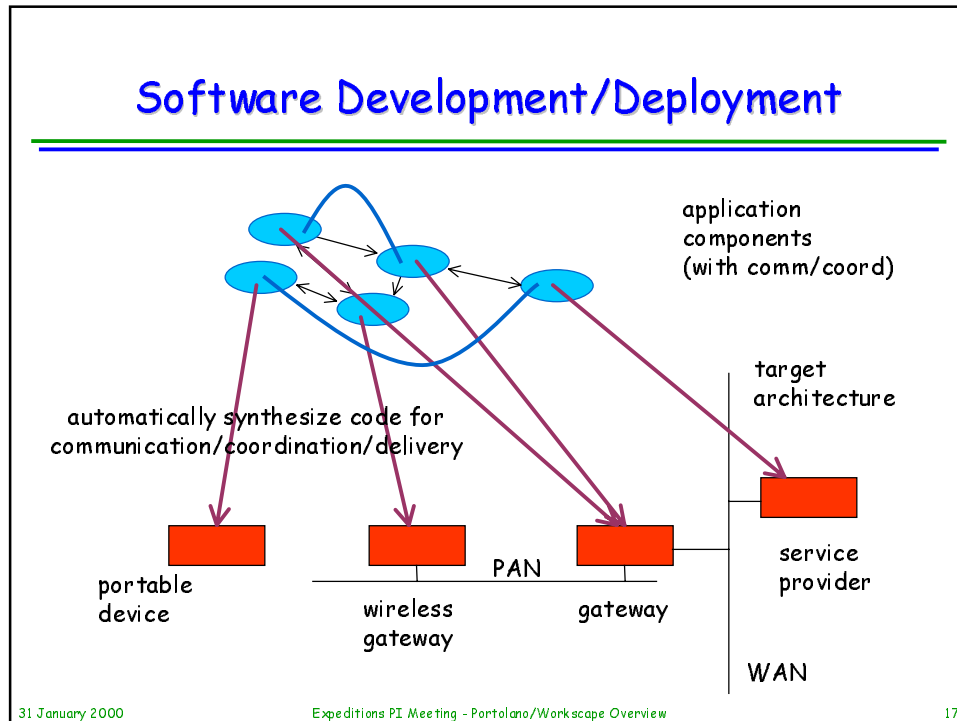
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Workspaces

- * External user community
 - * motivated technical users
 - * support scientific endeavours
- * Labscape - biological laboratory automation
 - * Cell System Initiative at UW Medical School
 - * experiment capture
 - * distribution of knowledge
 - * replay/reconstruction via data mining
 - * eventually lead to experiment design and execution
 - * rich sensor/actuator space
 - * rich user interaction modes
 - * task-specific with well-defined ontology

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Current Exploratory Projects

- * Body-area networking and body server/protocols
- * Borrowable (or scrap) devices
- * In-building/room fine-grain location tracking
- * Modular heterogeneous sensor/actuator architecture
- * Embedded web servers/gateways
- * Generalized Jini-style proxy services
- * Software partitioning/mapping: app. dev. and depl.
- * Active networks enhancements
- * Self-organizing network overlays
- * Active names
- * Labscape infrastructure
- * Physical icons, tags, and sensors
- * Integrating speech with sensors/tags
- * Speech/conversation/meeting browser
- * Speaker/language modeling/identification

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Base Program

- * User Interfaces
 - * sensors, intentional UIs, multi-modal, invisible
- * Network Infrastructure
 - * data-centric networking, active data/networks
- * Distributed Services
 - * distributed data stores, horizontal service organization
- * Support initial investigations/feasibility studies
- * Lay the infrastructure on which to build experiments
- * Limited test-beds/applications

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Program options

- * Portolano infrastructure and its distribution
- * User and usage studies of wide deployment
- * Ubiquitous large displays
- * Application development environment
- * Creation of a set of workscape application/device suites
- * Modular sensor system
- * Location sensor technologies
- * Novel automatic identification technologies
- * Flexible active network infrastructures
- * Applied demonstrations of sensor fusion
- * Extended information-space management infrastructure
- * A new user experience for distributed information flows
- * Making sense of complex information from distributed information sources

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Summary

- * Creating a new world of invisible computing
 - * where computing fades into the background (Weiser'91)
 - * low cognitive load

- * Integrated approach from applications to I/O devices with an active middle-ware, database, and networking fabric in between

- * Application domains to drive vertically integrated research with strong collaborators/users

- * www.cs.washington.edu/research/portolano