

# Emerging Research Opportunities in Ubiquitous Service Discovery

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## Overview

- Mobile computing opportunities
- Service discovery
  - Local
  - Wide
- Ubiquitous service discovery
- The USD platform
- A USD application example
- Summary
  - USD challenges

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2

## Mobile Computing Opportunities

- Mobile devices multiply the opportunities to utilize services
  - Creates entirely new service market segments
  - Enhances user experience with existing services
    - Point of sale
    - Diagnostic: car phone calls service center
- Service offerings change dynamically
  - Beneficial to client and service owner
  - Opportunities exist for
    - Service owners/providers
    - Network providers
    - Infrastructure builders
    - Clients

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3

## Service Discovery

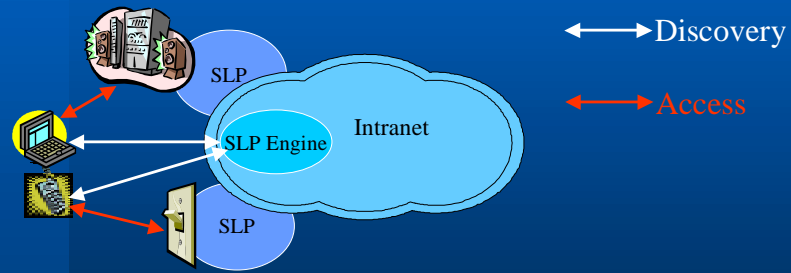
- What's service?
  - Any entity (HW/SW) that can perform an action for the benefit of another entity
- Service Discovery
  - A process of learning about services
  - Examples:
    - Cooltown
    - Jini
    - Salutation
    - SLP
    - UPnP
    - ...

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4

## A Typical Use Case

- Controlling a light switch/stereo



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5

## A Service Discovery Process

- To manage ever increasing number of services, information about services typically resides in a **service directory**
- Registration
  - A process by which a service registers its attributes in a service directory
- Query
  - A process by which an entity inquiries about services
- The registration and query processes may occur independently of each other (e.g., using different protocols)

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6

## Local Area Service Discovery

- Local area service discovery:
  - Number of (logical) service directories = 1
    - For purposes of efficiency, local area systems typically exist within a small geographical area
- State of the art systems support local area discovery exclusively with very few exceptions

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7

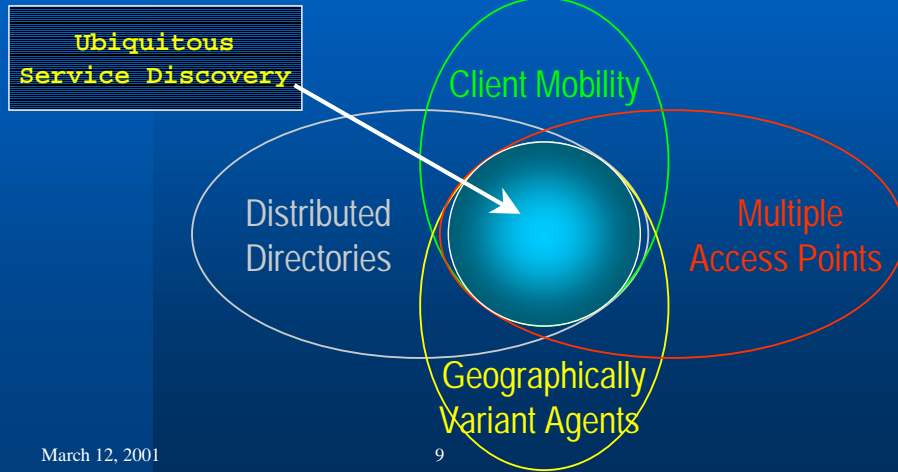
## Wide Area Service Discovery

- Wide area service discovery:
  - Number of (logical) service directories > 1
- In practice wide area systems address some of the following issues:
  - Client Mobility
  - Large Scale Distributed Directories
  - Multiple Access Points
  - Geographically Variant Agents

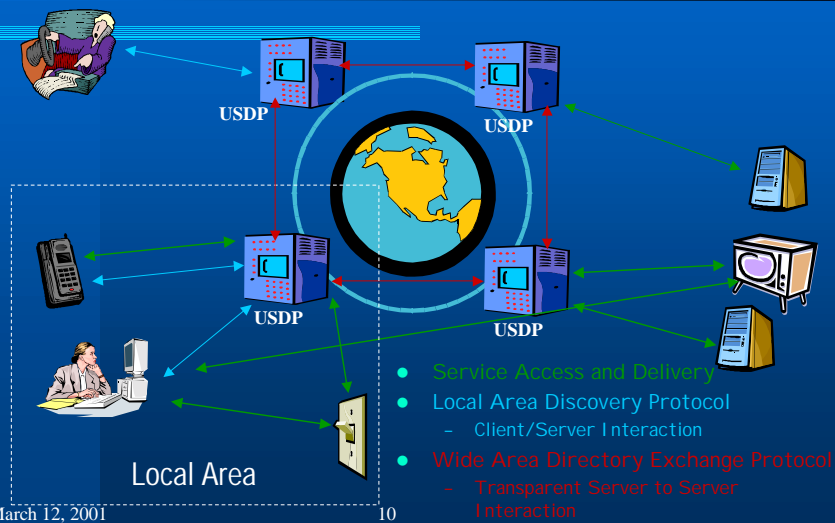
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8

# Ubiquitous Service Discovery



# A USDP Use Case



# USDP System Overview

value-added services

Customization Service Composition Security .....

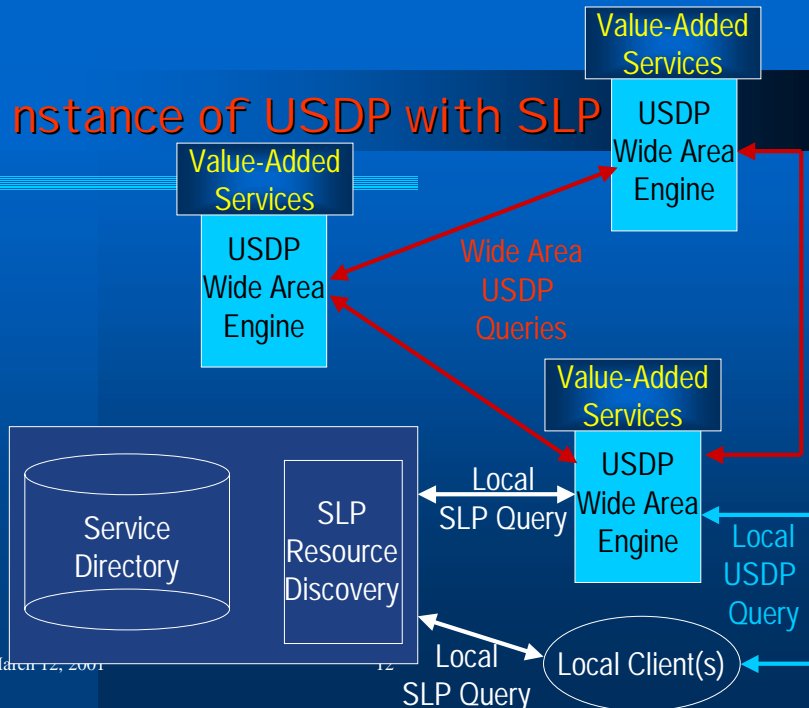
Core Distributed Directory Services

Wide Area Extension

USDP

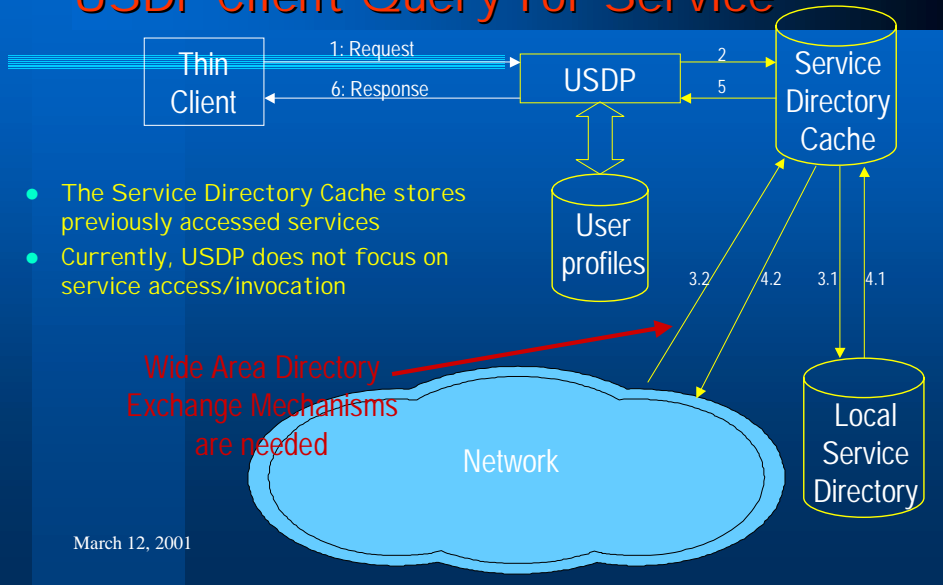
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# Instance of USDP with SLP



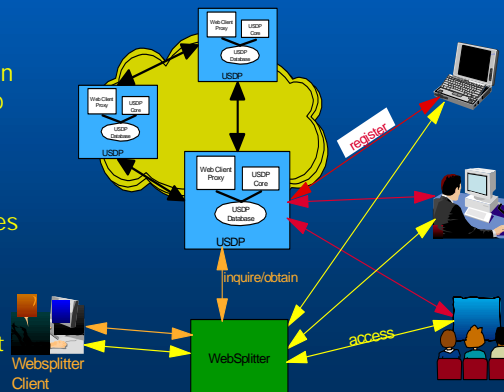
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## USDP Client Query for Service



## USDP Application Example: WebSplitter

- USDP facilitates applications that require access to dynamically updated and customizable (personalized) data
- WebSplitter creates a framework for collaboration of devices in rendering web content
- Provides web content adaptation and distribution based on devices capabilities and user preferences
- With USDP
  - cooperates with USDP in locating legitimate content players



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14

## USDP challenges

- Need to address challenges of distributed systems
- Associate physical topology with network topology
- Security, topology/routing, performance
- Formalize customization and environmental awareness
  - user profile, customizable policies (event triggering), ...
- Network of USDP servers
  - USDP servers need ability to inquire and obtain service from remote servers for local clients

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15

## Summary

- USDP Facilitates Wide Area Service Discovery
- USDP provides value-added services to Service Discovery:
  - Customization
  - Service Composition
  - Security

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16

## USDP: A Value-Added Ubiquitous Service Discovery Platform

- USDP is a management platform that brings heterogeneous clients and service providers together
  - Services register availability to provide service
  - Allows for clients locate desired services
    - log-on to "http://www.usdp.com"
- Provides value-added service discovery
  - enhances service discovery with personalization & customization of services access opportunities

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17

## USDP Design Points

- Servers comprise a USDP network
- Local services register with local servers
- Thin Client Support
- Client access
  - Provide web access with remote service execution
    - Web is the de-facto standard user interface
  - Provide network APIs to allow for programs to access services
- Clients inquire for service at local server
  - Based on inquiry attributes, the discovery process will resolve locally or systematically expand to additional servers

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18