



Convergent Services for IP and Telco Networks: “The Move from POTS to PANS”

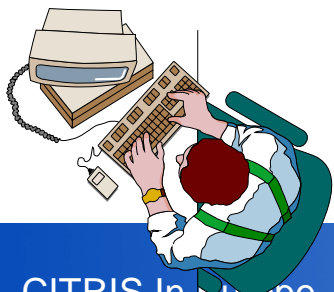
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University of California, Berkeley
CITRIS in Europe June 20, 2006

Motivation and Challenges



- Mobile workers/users want on-the-fly info and services access
- Integrated communication and computation devices
- Demand for rapid arbitrary comm service creation / customization
- Telecom network: Engineered with one app/device in mind (POTS)
- IP network: Easy svc creation, but insufficient reliability

Example Convergent Service: Transparent Information Access



Speech-to-Text
Speech-to-Voice Attached-Email
Call-to-SMS/Email Notification
Email-to-Speech
All compositions
of the above!



Universal Inbox
Policy-based
Location-based
Activity-based
Empower users!

Some Critical Trends

- More multimedia / Voice over IP traffic over IP networks
 - Low cost, flexible (delay sensitive/insensitive flows via MPLS)
- More multimedia traffic over telecommunications networks
 - SMS/MMS, ringtone downloads, push/pull e-mail,...
- Intelligence shifting to the network edges:
 - Powerful, always connected information appliances
 - PDAPhone, SmartPhone, BlackBerry...
 - Downloadable functionality and content
- Programmable intelligence inside the network
 - Supports rapid new service development/deployment
 - Proxy servers intermixed with switching infrastructure
 - Extensible functionality, e.g., JAVA: “write once, run anywhere”

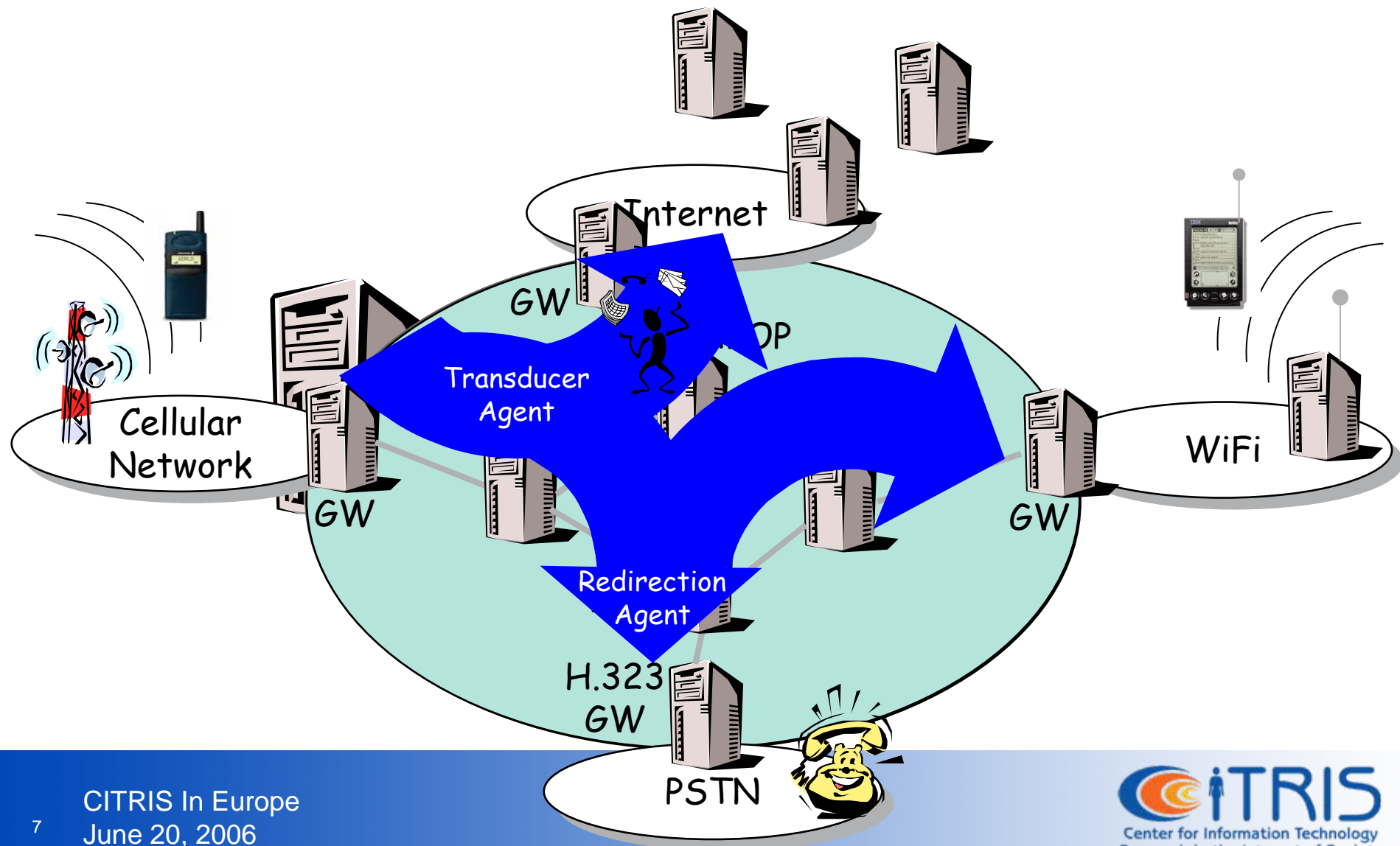
Convergent Services Goals

- Any-to-any communication
 - Universal access to people / services across diverse networks
 - *Potentially Any Network Services (PANS)*
- Service dev. and deployment on Internet (not Telco) time
 - *Support innovative, composable services and new devices*
- Personal / Live Service mobility:
 - Cross device/network service handoff
 - *Person as communication endpoint*
- Scalable, robust, secure architecture
 - *Support for third-party service providers*

ICEBERG Research Strategy

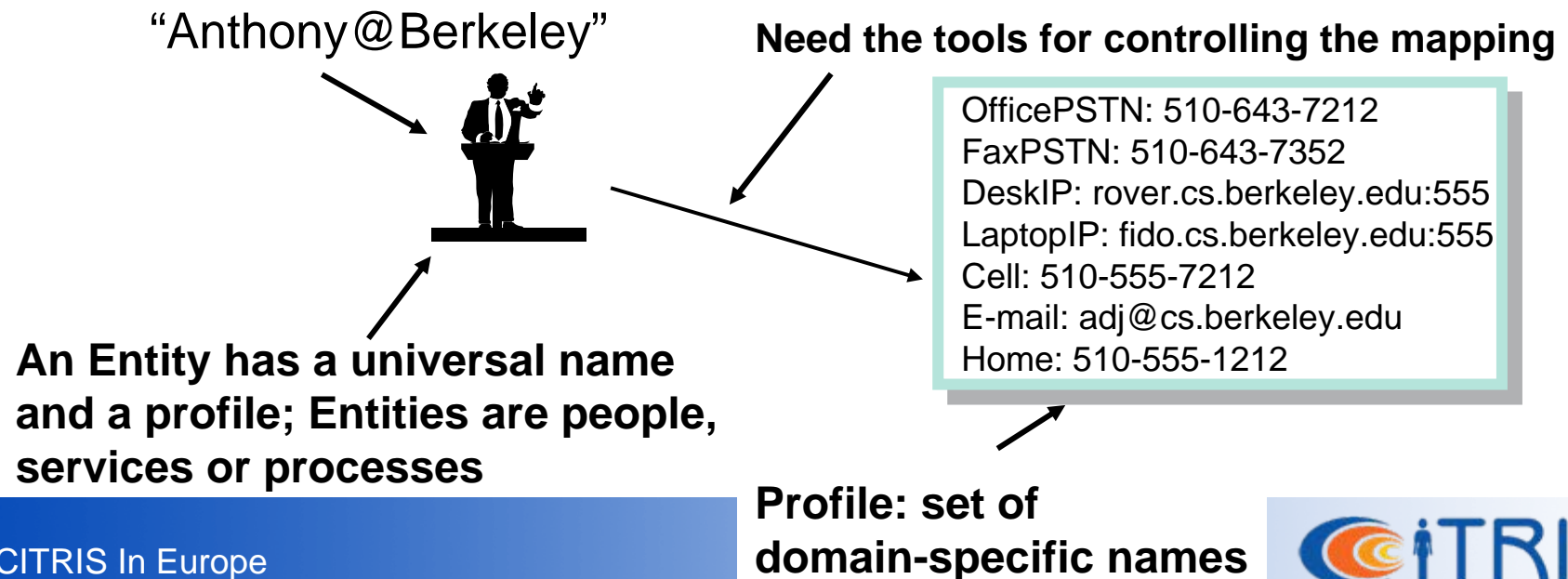
- **ICEBERG**: Internet-based core for **CE**llular networks **BE**yond the thiRd **G**eneration (1999-2001, 2001-2004)
- Explored several key research areas
 - Core signaling protocol, Service mobility, Multi-modal svcs
 - User activity tracking, Universal Inbox, Location-based svcs
- Collaborations with:
 - Ericsson, Sprint, Lucent, IBM, Motorola, Nokia, AT&T, Siemens
 - TU Berlin, UNSW
- Approach: make it real with a large-scale testbed
 - Time travel: bring the future to the present
 - Collect “real” information about system
 - Users (students) developed new/interesting applications

Dynamic on-the-fly Redirection and Data Transcoding



Personal and Live Service Mobility

- Person as *single* communications endpoint
 - Leverage infrastructure to “track” users’ activities/location
 - Dynamic user/svc-specified redirection policies
- Live service mobility as a first class object
 - Cross device and network handoff of live services



Experimental HW/SW Testbed

Wireless simulation and monitoring software

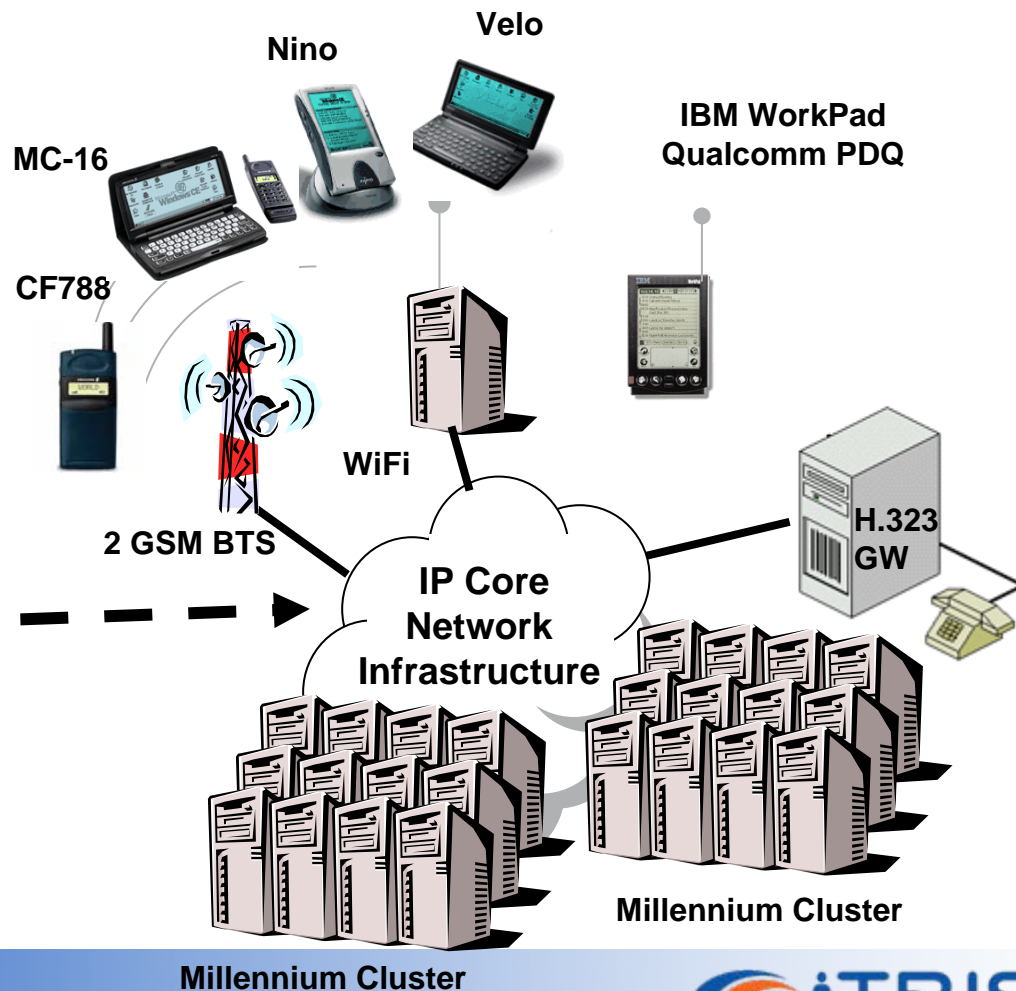


306 Soda

405 Soda

326 Soda "Colab"

Smart Spaces
(sensors & actuators)



Millennium Cluster

Millennium Cluster

ICEBERG Signaling Protocol (SIP++): Capturing Session State with Soft State

Naming Svc

510-642-8248
UID: hohltb@cs.berkeley.edu

1

2

3

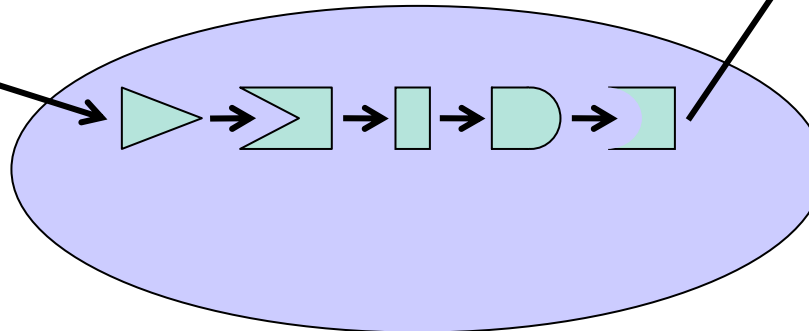
Pref Registry

hohltb: Prefers Desktop

Barbara's
Desktop



Bhaskar's
Cell-Phone



Automatic
Path Creation
Service

Naming Svc

SIP++

510-642-8248
UID: hohltb@cs.berkeley.edu

2

Pref Registry

hohltb: Prefers Desktop

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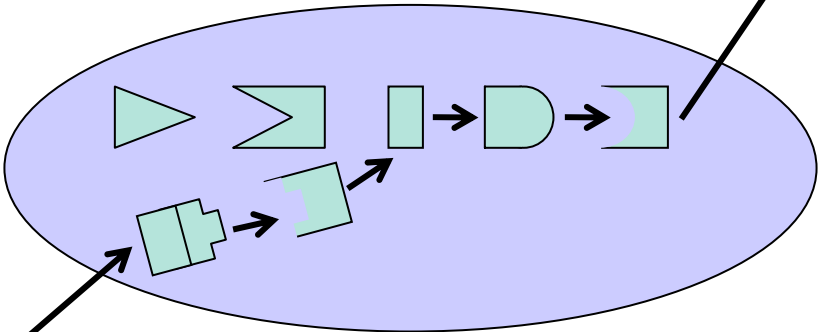


Barbara's Desktop



Bhaskar's Cell-Phone

1



Automatic Path Creation Service



Bhaskar's PSTN Phone

Our Convergent Services Results

- Convergent services deployed at UCB, TU Berlin, & UNSW
- Applications – approximately 80 users at UCB
 - *Universal Inbox* – callee-controlled access to people/services across networks/devices
 - *VoIP* – callee-controlled telephony services, congestion-based pricing experiments
 - *Ninja Jukebox* – access to MP3 jukebox from web, phone, ...
 - *Sanctio* – cross-network instant messaging with phone access
 - *Public web kiosks* – secure access using multiple devices
- Protocols
 - ICEBERG UID mapping using LDAP
 - Core signaling protocol as extensions to SIP

Some Lessons Learned

- Soft-state-based multi-endpoint call signaling protocol
 - *Distributed* protocol can provide correctness and robustness
 - Tolerates transient component failures, network partitions, ...
 - *Wide-area questions remain*
 - Simple prototype: ~25 PCs = 1 Class 4 switch (250 calls/s)
- Dynamic data transcoding
 - Enables source/target data format independence & isolation
 - Rapid support for new devices (new device in 2 hrs!)
- Continuous access to information and services
 - Positives: Easy to remain “in-the-loop”
 - Negatives: Expected to remain “in-the-loop”

Some Open Challenges

- Dynamic data transcoding
 - *How to deal with interface semantics?*
- True convergence requires deep cooperation
 - Many different, untrusting parties!
 - How to balance against competitive market requirements?
- User interface challenges
 - Automatic interface creation is hard
 - Preference specification is complex
- How to track users without invading their privacy?
 - Personal Activity Tracker → Personal Activity Coordinator
 - Who has access to information? Owner, spouse, parents, ...?
 - Can information be stored in a decentralized manner?

Thank You
Questions?