Network Support for Personal Information Services to PCS Users

Ravi Jain and N. Krishnakumar
rjain@thumper.bellcore.com, nkk@bellcore.com
Introduction

Future networks for PCS will deliver a wide range of personalized stock and financial information, electronic magazines, traveler information services, mobile banking, sales, inventory... Services are provided by an Information Service and Applications Provider (ISAP) via the PCS network.
**Introduction contd.**

Sessions may be
- connectionless e.g. personalized traffic information
- connection-oriented e.g. mobile file access
Outline

- Introduction
- Alternative system architectures
- System model
- Virtual mobility and service handoffs
- Maintaining service profiles
- Concluding remarks
Centralized ISAP architecture

- Information stored and processed at a central site

- ISAP and users communicate and exchange data using the PCS network, simply by placing a PCS call
  - Usual handoff procedure maintains physical connection continuity
  - Common higher-level protocols can be used for error-recovery and maintaining service continuity

- May be adequate for low-volume services or for initial stages of service penetration, but may not scale up
Multiple independent servers

• Several geographically dispersed servers which are
  • logically autonomous
  • connected independently to the PCS network

• Particularly well-suited when the information is
  geographically localized
  • vehicle traffic information services
  • local weather, community news, ...

• May not be suitable if information is to be available over a
  wide area and is of general interest
  • NY stock exchange information
Distributed servers

- Information is (partially) replicated across multiple servers which
  - function as a single logical information base
  - are connected to the PCS network
  - interconnected either via PCS network or the ISAP’s private network

- This is the architecture assumed for the rest of the talk
Outline

- Introduction
- Alternative system architectures
- System model
- Virtual mobility and service handoffs
- Maintaining service profiles
- Concluding remarks
Network support for PISA

- Basic support
  - User and ISAP-initiated PCS calls
  - User location and call handoffs as the user moves
  - Billing, etc.

- Enhanced support
  - Service handoffs: Real mobility of user between service areas may result in virtual mobility of service from one server to a “closer” server
  - Single-number best-server (SNBS) service
  - Maintaining service profiles
Physical connection transfer

from old to new server

- Analogous to call handoff process, but performed between servers
Physical connection transfer contd.
Physical connection transfer contd.

Complete

PSTN

Server 2

Server 1
Physical connection transfer contd.

PSTN informs ISAP matchmaker that user has moved and a bridge set-up is initiated by the matchmaker.
Context information transfer

The new server needs to know the context of the user with respect to the service.

- User only reads information e.g. news or electronic magazine.
- User can read and write information as in a file system, context is simply page and issue or version number.
- User can read and write information as in a database.
- Context is the whole file (or list of changes to the file) and a timestamp.
- Context is transaction id (supplied by user), and locks and updates (supplied by old server).
User location information access

- ISAP matchmaker needs user location information to determine which is to be the new server
- PCS network provides the information about
  - every change of cell
    - ISAP needs locations of PCS cells
  - every change of location area
    - ISAP needs locations of PCS location areas
  - every change of service area
    - PCS network needs locations of ISAP service areas

- User equipment transparently sends location to ISAP e.g. using a GPS receiver
Call flow example

1. User moved
2. Send context
3. Context
4. Ready
5. Set up bridge
6. Application-specific protocol
7. Tear-down bridge
8. Tear-down bridge

ISAP matchmaker

Old Server

New Server

PSTN

Bellcore
Bell Communications Research
Single-number best-server (SNBS) redirection

Suppose the user originates the call to the ISAP.

Ideally, the user calls a single “worldwide” ISAP telephone number, which is mapped to an appropriate server depending upon the user’s location.

- Can be done by ISAP matchmaker after the call goes through.
- This can also be done by PCS network - SNBS service
  - ISAP provides locations of service areas and servers to the PCS network
  - PCS network decides which server to assign to the user depending upon user location
Outline

- Introduction
- Alternative system architectures
- System model
- Virtual mobility and service handoffs
- Maintaining service profiles
- Concluding remarks
Maintaining Service Profiles

• Just as PCS network maintains user profiles, ISAP will also need to maintain service profiles
  • e.g. for traffic information service, profile contains
    – roads, tunnels, bridges which user is interested in
    – communication mode (pager, fax, ...)

• Similar to PCS database hierarchy (HLR / VLR), we propose a hierarchy for service profiles:
  • Home Service Database (HSD), which could be centralized or distributed
  • Visitor Service Database (VSD), which is associated with each ISAP server
Service profile database management protocol

Similar to IS-41 protocol for managing user location, protocol needed for service profile database

- When user moves into new service area, HSD needs to be updated, the new VSD gets user’s service profile and old VSD purged of user’s profile
- Unlike IS-41, protocol might need exactly-one semantics: exactly one profile should be active at any time to prevent race conditions:
  - e.g. suppose user move causes two VSDs to contain service profile, which in turn causes both to initiate transactions on user database concurrently.
Concluding remarks

- Proposed a distributed server architecture for PISA, analogous to underlying PCS network architecture
- Outlined network support for virtual mobility and service handoffs
  - physical connection transfer analogous to call handoff
  - context information transfer for different applications
  - utilizing user location information to select servers
- Outlined network support for Single-number Best-server (SNBS) facility
- Proposed two-level HSD and VSD database hierarchy for service profiles, analogous to PCS network’s HLR and VLR
- Further work:
  - protocols for profile replica management
  - asymmetric protocols for user-ISAP interaction