ATP: Autonomous Transport Protocol

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To conserve energy, target is tracked using only one camera.

Data is transmitted through a streaming application (Src) to a mobile command center (Dst).

Active camera changes as target moves (streaming application migrates).

Cannot tolerate data loss during camera change.
What is ATP?

- Autonomous Transport Protocol
- Why autonomous?
  - Decoupled from physical network
  - Decoupled from the physical location of application endpoints
- Provides reliable communication between mobile endpoints
Features I

- Application-specific naming
  - Connection endpoints are defined as contents in the P2P network

- Dynamic endpoints relocation on different end hosts without disrupting the connection
  - ATP is responsible for forwarding segments to the destination and acknowledgments to the source regardless of their current location
Features II

- Reliable transmission between users *not* end-hosts
- Established connections maintained independent of intermediate node availability
- TCP-like interface
  - Easy to write new ATP-aware applications
  - Current applications can be made ATP-aware with minor modification
System Architecture

- Mobile applications
- TCP-like interface
- Reliable transmission over IBN
- Transparent mobility
- Network of “contents”
- Location-independent addressing
- Communication infrastructure
- IP/MANET
Content-Based Network (CBN)

- Network of endpoint entities "Contents"
  - **Active Contents**
    - communicates together by messages
    - performs a lookup for other contents
    - e.g. application service, network connection agent, ..
  - **Passive Contents**
    - stored in the network
    - e.g. document, ..
- **Location-independent addressing**
  - Extends P2P lookup services (e.g. CAN, Chord,..)
  - Maps a content to a specific node
IBN=CBN++

- Allows different instances of same content
- Instance Publishing
  - Self (active) / Free (passive)
  - Reliable
  - Leased
- Instance Routing
  - Decoupled from instance physical location
  - Routes to specific or closest instance
- Replicates contents for fault-tolerance
- Caches info for future queries
IBN Routing Example

User request

Published file

Query request

Query response

User request
ATP over IBN

- IBN Content/Instance Addressing
- Contents are the communication endpoints
- Instances are agents working on behalf of mobile entities
- \textit{AS}:i : ATP agent for the source S with index \(i\)
- Index \(i\) means the agent is responsible for sending packets starting from sequence number \(i\)
Design Issues

- **Reclaiming Network Resources**
  - Enforcing a lifetime or using a leasing mechanism for publishing in the IBN

- **Acknowledgement Mechanism**
  - Cumulative vs Range Acks

- **Fault tolerance**
  - Relies on IBN route discovery service and/or on ATP mechanism to alleviate the node failure and link failure problems

- **Security**
  - How to handle privacy, authenticity, and trust?

- **End-to-End Semantics**
  - Shifts the burden of waiting from the source endpoint which allows the source to terminate earlier.
Related Work

- TCP over Mobile IP
- TCP Connection Migration
- I3
- Mobile Tapestry

Shortcomings

- User is bound to a single host during connection lifetime
- Communication endpoints must exist simultaneously
Current Status

- Implemented a Java prototype of the ATP protocol over Pastry
  - The prototype is deployed over a set of independent nodes at University of Maryland.
  - A simple ATP-aware application runs on each node of the network
- Simulation in progress
- Further information