Autonomous Transport Protocol
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Basics
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 acknowledgment to the source regardless of their current location

Features II
- Reliable transmission between users not end-hosts
- Data transfer by a combination of active and passive operations
- 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 application state migration
- TCP-like interface
- Reliable transmission over IBM
- Transparent mobility
- Network of "contents"
  - Location-independent addressing
  - Communication infrastructure
  - DynaNet

Instance-Based Network (IBN)
- Content publishing
  - Reliability, latency
  - Content Communication
  - Active Contents
- Instance-based routing
  - Reliable routing for each content
  - Routes to specific instance

More Details
Naming Semantics
- IBM Content/Instance Addressing
- Contents are the communication endpoints
- Instances are agents working on behalf of mobile entities
- AS: Active ATP agent for the source S with index
  - PSA: Passive ATP agent for the source S with index
- Index means the agent is responsible for sending packets starting from sequence number

Active/Passive Agents
- Active Agent: pushes packets to the destination
- Passive Agent: waits until packets are pulled from it
- Advantages:
  - Resource Management: active agents may push on demand for resource limitations
  - Performance: passive agents may push on demand for better performance
- Policy
  - Based on network resources: buffer length, CPU load, available bandwidth, remaining energy
  - Local (agent decision) or global (cooperative)
- Challenges
  - Who, when, and how to take the switching decision

Source Migration Scenario
- IBM Content/Instance Addressing
- Contents are the communication endpoints
- Instances are agents working on behalf of mobile entities
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Destination Migration Scenario
- IBM Content/Instance Addressing
- Contents are the communication endpoints
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Applications
- User Mobility
- Tracking in Sensor Networks

Discussion
Design Issues
- Reclaiming Network Resources
  - Enhancing a delivery or using a load-sharing mechanism for publishing in the IBN
  - Address management mechanism
  - Congestion in Range Area
- Fault tolerance
  - Rely on IBN route discovery service and/or on ATP mechanisms to tolerate the node failure and the failure problem
- Security
  - How to handle privacy, authenticity, and trust?
- End-to-End Semantics
  - Devises the burden of retransmitting from the source endpoint which allows the source to terminate earlier

Related Work
- TCP over Mobile IP
  - TCP Connection Migration
  - ETCP
  - E3
  - Mobile Tapestry
- Limitations
  - 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 P2P
- 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