An Application-Aware Overlay Networks Architecture & API

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Outline

• CASA
• Application aware networks
• Overlay networks
• AWON architecture & API
• What’s ahead
Collaborative Adaptive Sensing of the Atmosphere (CASA)

- **Concept**
  - A set of networked small radars instead of a large radar
  - Sense lower 3 km of atmosphere
  - Collaborating radars:
    - Improved sensing, detection, & prediction

- **Goal**
  - Improve warning time & forecast accuracy for hazardous weather
CASA Oklahoma Test-bed

- Multiple high bandwidth streams
- Real-time communication
- Heterogeneous infrastructure & end users
- Simultaneous observations by multiple radars
- Multi-sensor data fusion
- Hostile weather conditions
Challenges

• Distributed Collaborative Adaptive Sensing (DCAS)
  – Sensing, processing, & storage elements are interconnected via the Internet
  – High bandwidth data streams
  – Real-time communication
  – End users rely on different subsets of data

• Adapting to varying network conditions

• QoS perceived by end users depends on
  – Timeliness & usefulness of received data
  – Jitter, excessive delay, & random packet loss

• End-host based correction/adaption is not effective

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Application Aware Networks (AANs)

- Networks that implicitly or explicitly learn about the application characteristics & adapt their forwarding strategy to meet the application requirements in the best possible way

- Possibilities
  - Application aware packet forwarding
  - In-network application aware processing & storage
  - Enhance the adaptability of applications
  - Enhanced QoS provided to end users

- Current networks are not application aware
  - Lack of hardware & architectural support

- Overlay networks are a viable solution
Overlay Networks

• A computer network built on top of another network
  – e.g., dial-up Internet, P2P
• Application layer solution
• Virtual links between overlay nodes
• Overlay routing
  – Control path/link selection
  – QoS enhancement
• Application-aware processing at intermediate nodes
Application-Aware Overlay Networks (AWON) Architecture

- An architectural framework to deploy AAN services
  - ASP - Application-specific Service Plug-in
  - ASPs inject application specific functionality into overlay nodes
  - API for easy deployment of ASPs
    - www.cnrl.colostate.edu/Projects/AWON/awon-api.0.1.tar.gz
- ASPs regulate flow of data through overlay nodes
  - Taking application specific constrains into account
  - Extract, select, fuse, & repack data
- Overlay routing protocol provide desired QoS support

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• Different AAN services
• Application specific content delivery under varying network conditions
• Better quality in content delivered to end users
What’s Ahead

• Basic functions of overlay networks will eventually be migrated into network elements
• Potential for in-network processing & storage
  – However, resources per application will still be limited
• Renewed interest in AANs
  – Vendors are interested in architectural support
• AWON architecture would be a suitable reference framework in realizing the AAN paradigm
  – Overlay networks, AANs → P2P based in-network fusion
• How to distribute ASPs?
  – Online installation, micro-programs in packets, etc.
  – Need programming & protocol description languages