

An Application-Aware Overlay Networks Architecture & API

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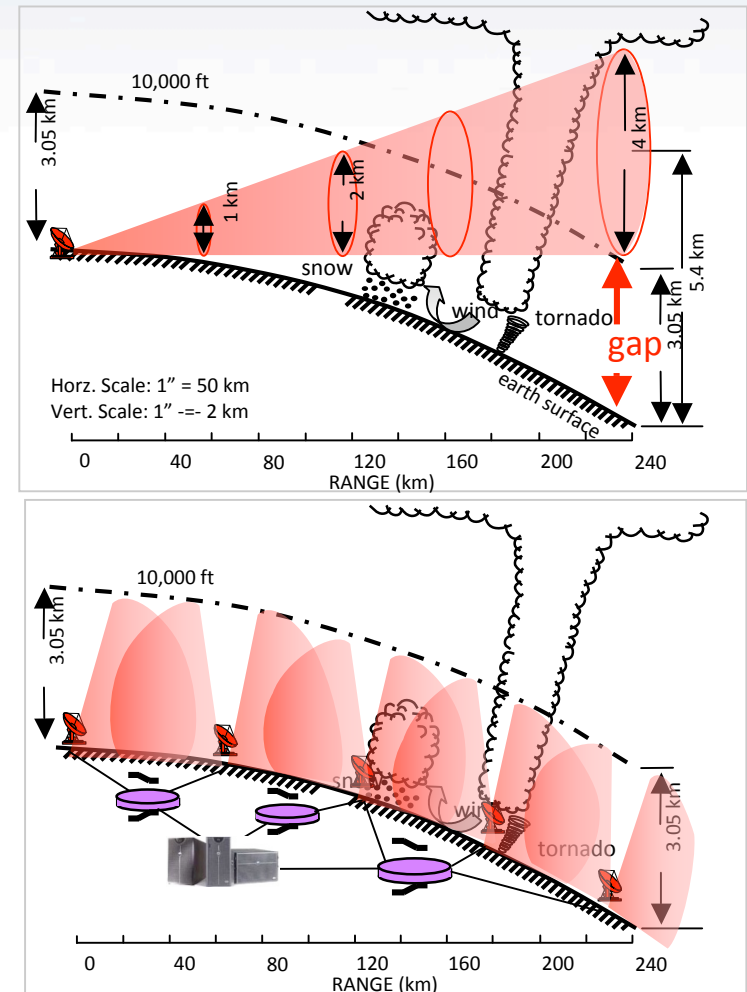
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Outline

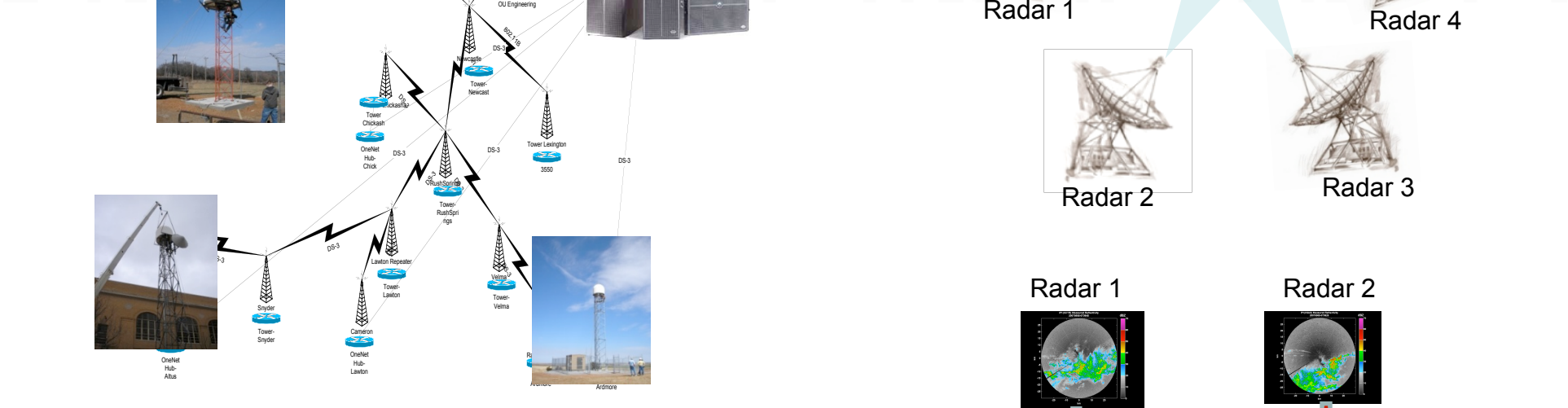
- CASA
- Application aware networks
- Overlay networks
- AWON architecture & API
- What's ahead

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

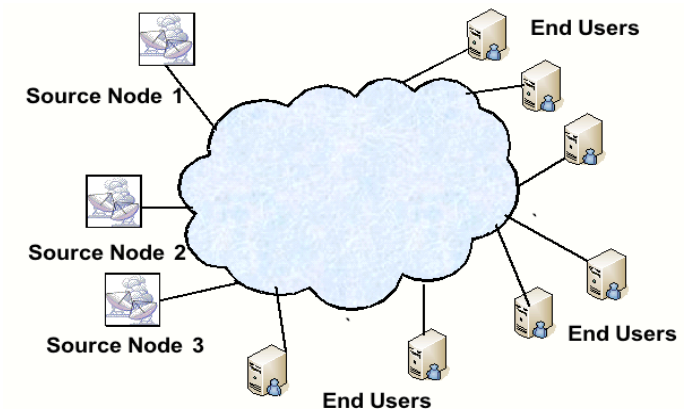


- Multiple high bandwidth streams
 - Real-time communication
 - Heterogeneous infrastructure & end users
 - Simultaneous observations by multiple radars
 - Multi-sensor data fusion
 - Hostile weather conditions
- The diagram illustrates a multi-sensor data fusion system. Three radar units, labeled Radar 1, Radar 2, and Radar 3, are shown. Each radar unit displays a weather map. Red arrows indicate data flow from the radars to a central processing unit and back, representing real-time communication and data fusion.
- FRACTAL 2009
- casa**
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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

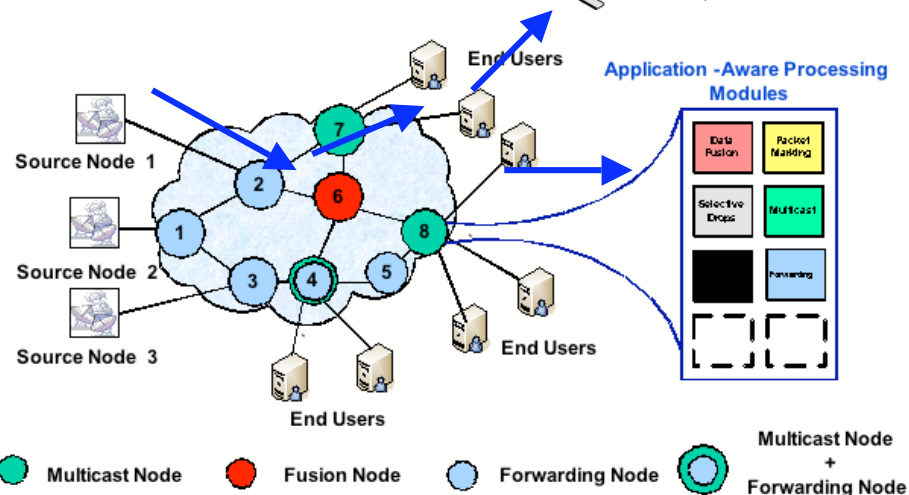
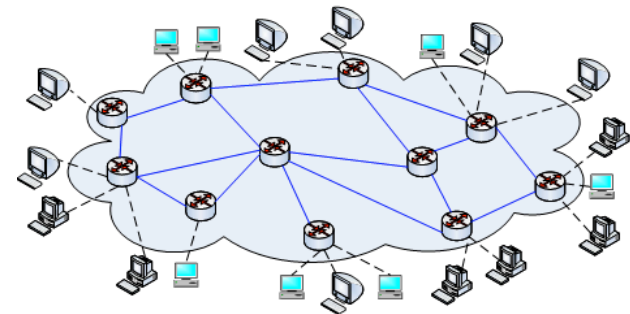
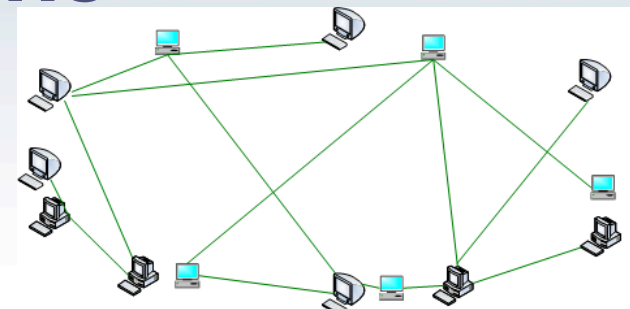


Application Aware Networks (AANs)

- 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

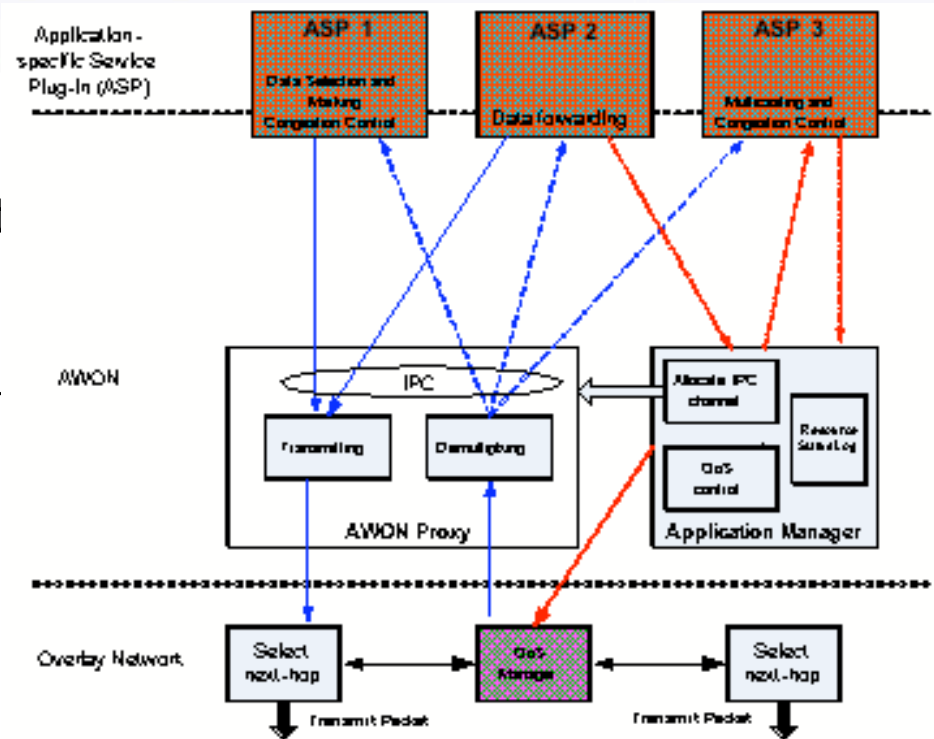
Overlay Networks

- 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

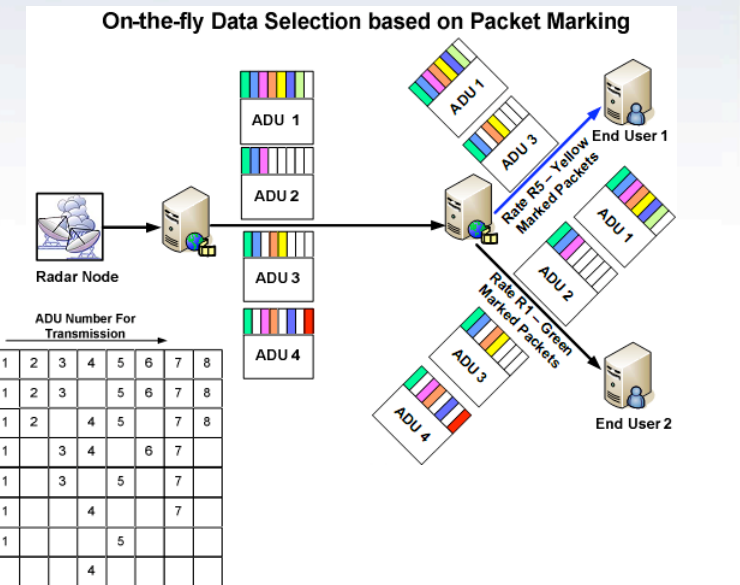
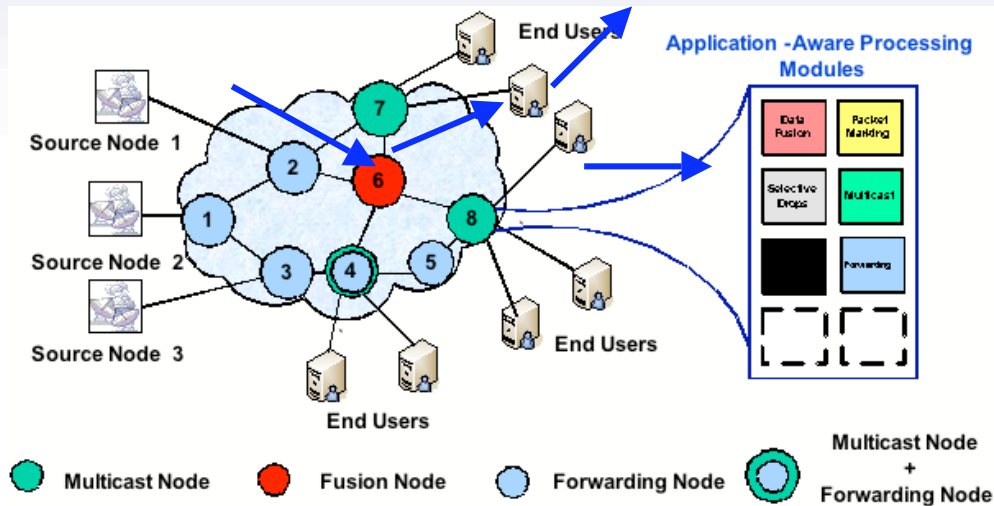


Application-Aware Overlay Networks (AWON) Architecture

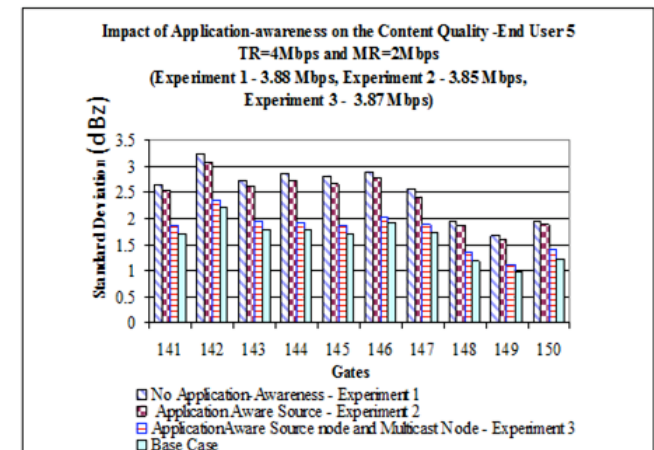
- An architectural framework to deploy AAN services
 - ASP - Application-specific Service Plug-in
 - ASPs inject application specific functionality into overlay nodes
 - API for easy deployment of ASPs
 - www.cnrl.colostate.edu/Projects/AWON/awonapi.0.1.tar.gz
- ASPs regulate flow of data through overlay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



AWON (cont.)



- 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