Application-Aware Self-Optimization of Wireless Mesh Networks with AquareYoum and DES-SERT

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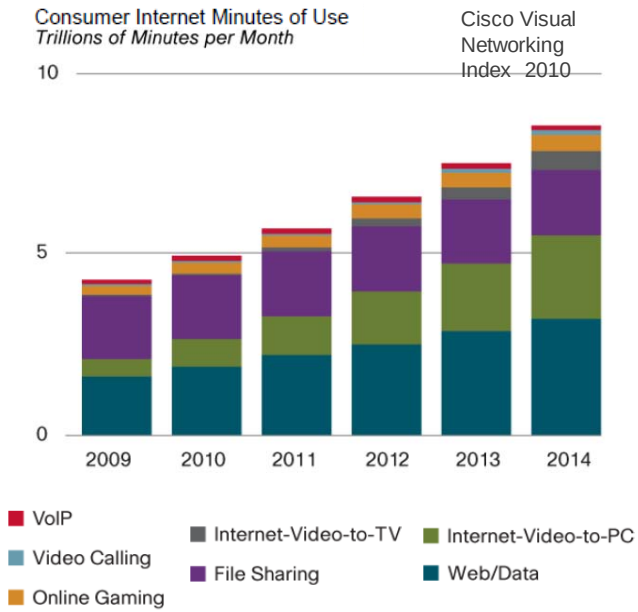
AquareYoum

Application and Quality of Experience Aware Resource Management for YouTube in Wireless Mesh Networks



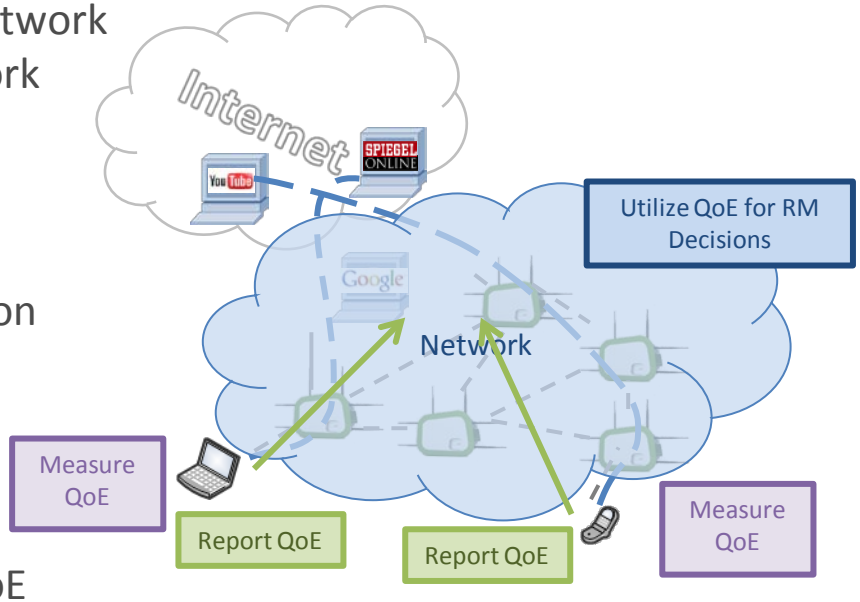
- Increasing heterogeneity on application layer
- Increasingly different application specific QoS requirements

  ⇨Application and QoE Aware RM necessary for ensuring user satisfaction

  ⇨ YouTube and WMNs as an example

QoE-based RRM

- Main idea
  - QoE assessment at the edge of the network
  - QoE based RRM decision in the network



- Advantage

  Dynamic resource adaptation to application quality feedback

- Problem

  QoE prediction necessary for avoiding QoE degradations

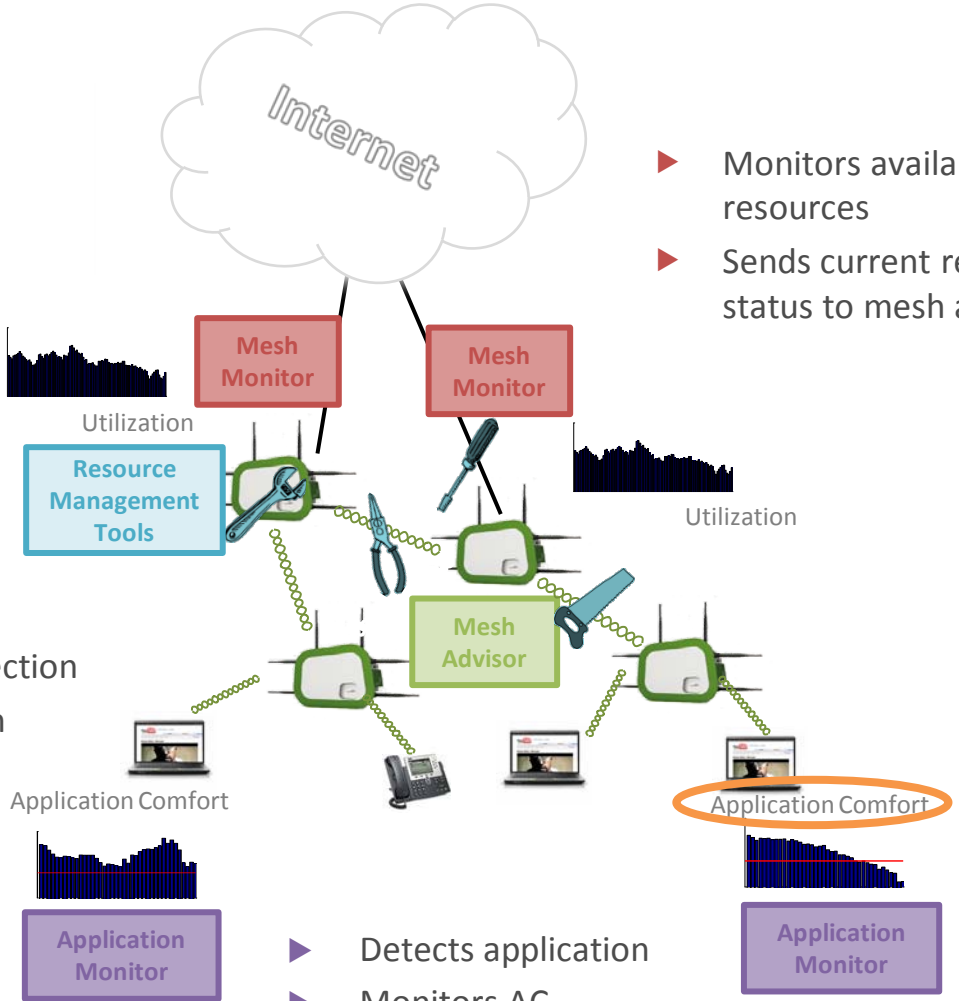
- Solution: Monitor application comfort
  - AC = application usage and condition
  - allows to predict QoE degradation

⇨ **Reaction**

BEFORE QoE is bad

The AquareYoum Architecture

- Obtains information on network resources and AC
- Decides upon application specific RM Tool



- Monitors available resources
- Sends current resource status to mesh advisor

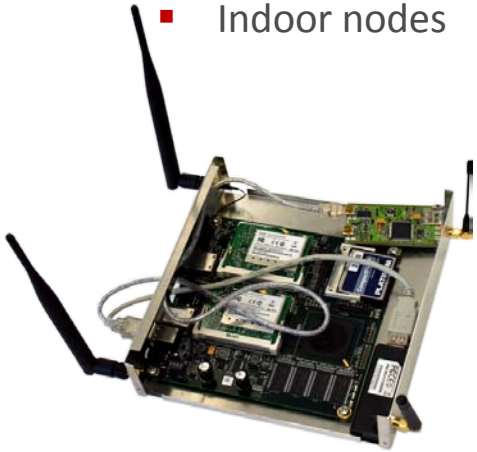
- Channel assignment
- Traffic shaping
- Dynamic gateway selection
- Routing path selection
- …

- AC = Application usage and condition
- Allows QoE prediction
- YouTube AC = buffered playtime

- Detects application
- Monitors AC
- Sends current AC to mesh advisor

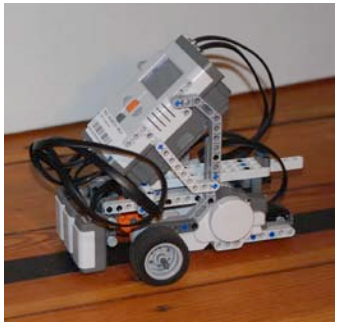
DES-Testbed

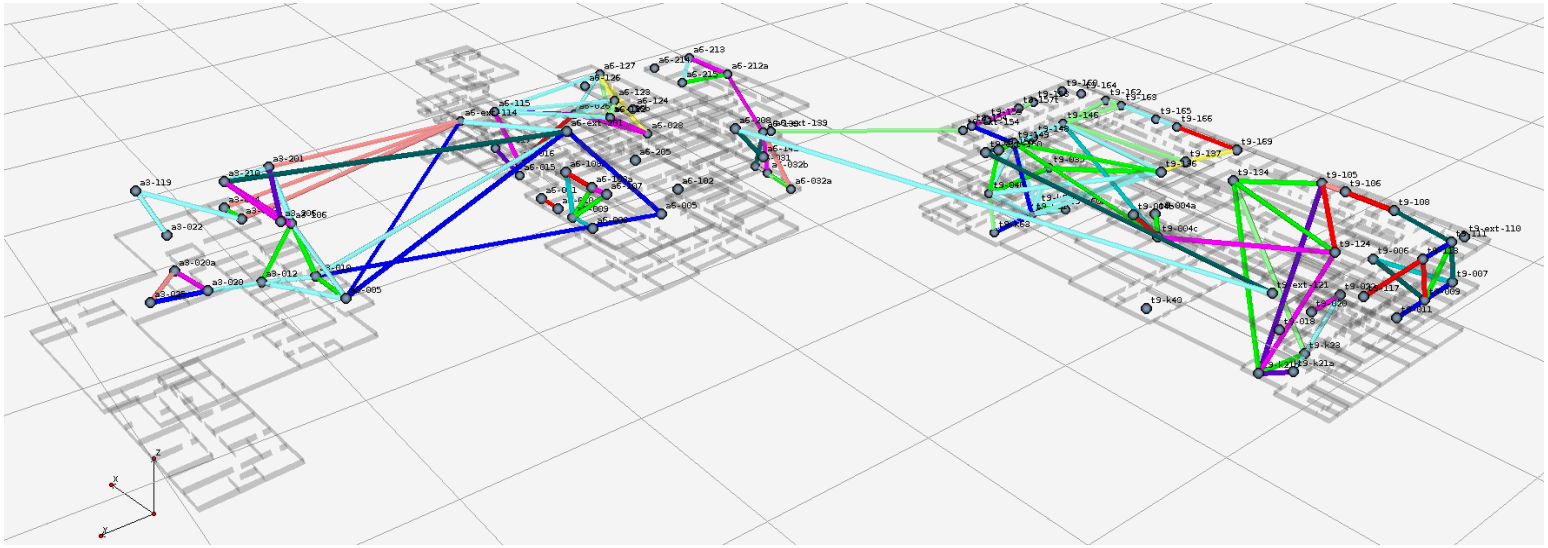
- Properties of the DES-Testbed
  - Persistent testbed
  - >100 hybrid nodes
  - Spanning ≥3 buildings
  - Wireless mesh nodes
  - Wireless sensor nodes
  - Indoor nodes



  - Outdoor nodes

  - Mobile nodes

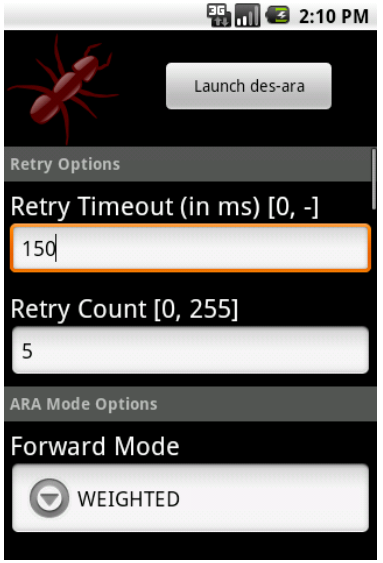




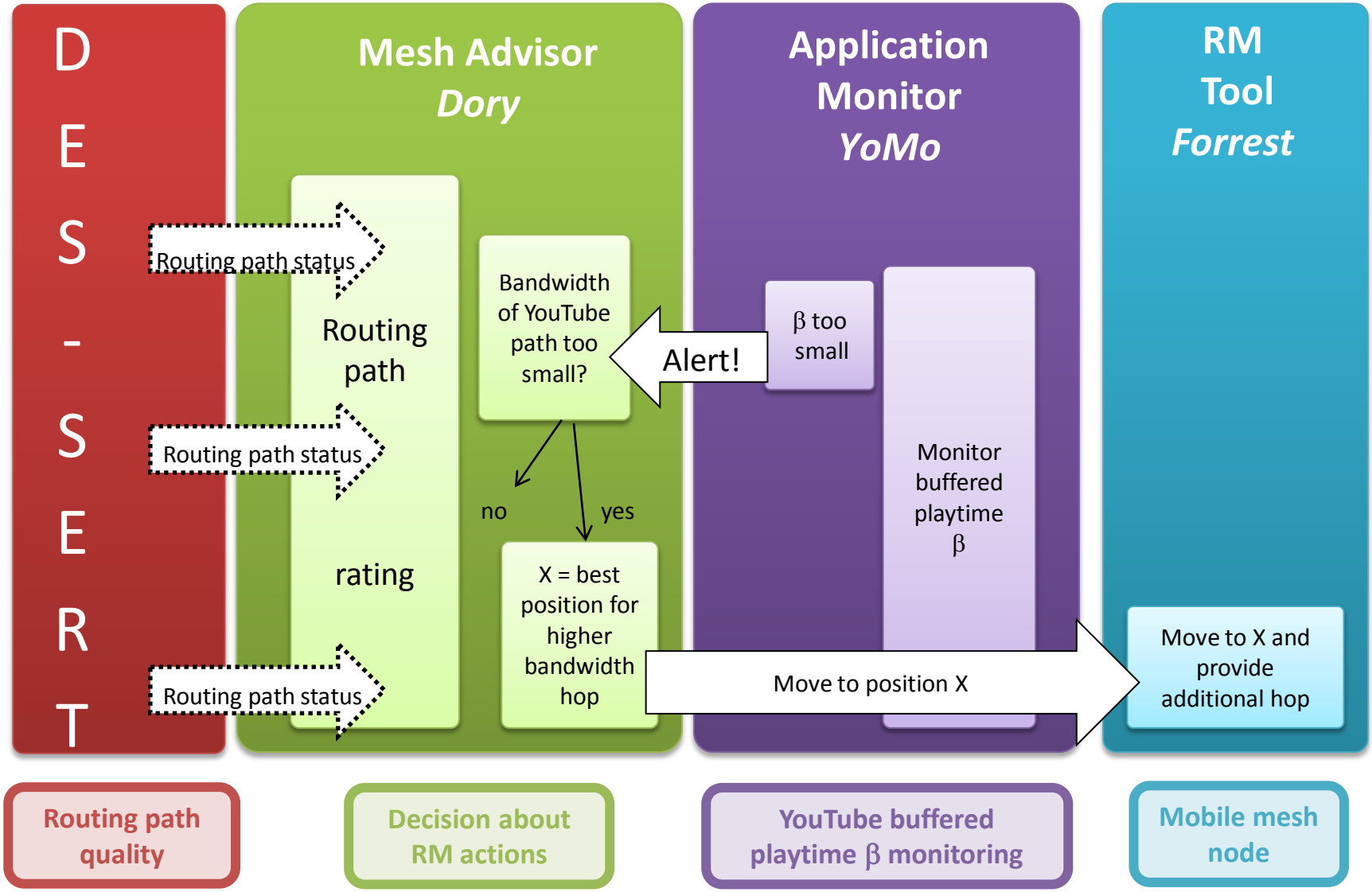
DES-SERT

Distributed Embedded Systems - Simple and Extensible Routing Framework for Testbeds

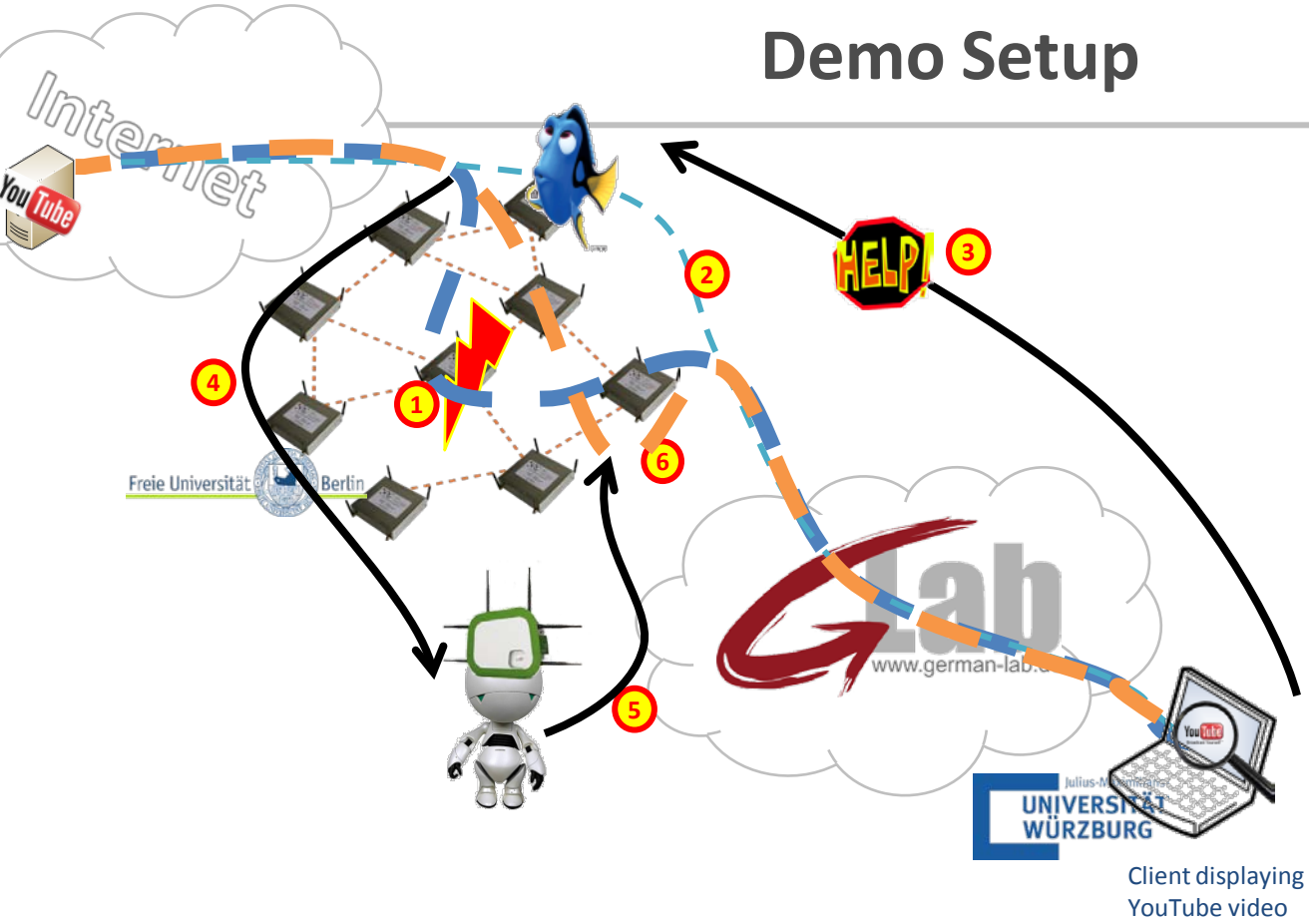
- ANSI-C library
- Underlay routing in user space
- Routing based on IP or MAC addresses
- Multiplexing and piggybacking of routing information
- Periodic task execution
- Runtime configuration and monitoring
  - Command line interface
  - SNMP via AgentX
- Logging (file, syslog, ring buffer, …)
- Monitor interface support



Interaction of Components



Demo Setup



Client displaying a YouTube video

1. A node failure happens.
2. The routing protocol replaces the broken route.
3. The bandwidth of the new route is not sufficient, β falls below the alarm threshold, YoMo alarms Dory.
4. Dory triggers Forrest to move.
5. Forrest moves to the place of the broken node to provide an additional hop.
6. The routing protocol moves the flow to the new route

- The AquareYoum Architecture supports the self-healing properties of the DES-SERT framework
- The two ideas complement one another to allow for a successful YouTube playback