**Proactive Urban Documentation System**

- **VCAPS** is a system to capture, archive and navigate through a video corpus. ([http://tomography.usc.edu](http://tomography.usc.edu))
- It provides automatic video transfer, and is usable by non-experts
- High quality video, together with audio, adds rich detail.
- Deployed at:
  - Major transportation hub in Los Angeles.
  - Research project at Ohio State documenting Mississippi Gulf Coast reconstruction.
  - May others.

**Energy Delay Tradeoffs**

- Nominal data rates differ significantly
  - From hundreds of Kbps for GPRS, to a few Mbps for 3G, to ten or more Mbps for WiFi.
- WiFi is more energy-efficient in terms of energy/bit
  - On cellphones, instantaneous energy consumption may be similar, but the energy usage for transmitting a fixed amount of data can differ an order of magnitude or more.
- Availability characteristics of networks can vary significantly.
  - Cellular networks availability is much higher than WiFi availability.

**Example Scenario**

- Greedy approaches such as min-delay and min-energy might waste significant amount of energy, or incur high delay.
- It is possible to achieve significant energy savings with only a slightly increase in delay.

**Proposed Solution: SALSA – Stable and Adaptive Link Selection Algorithm**

**Algorithm Design (SALSA)**

- Principled approach - Lyapunov Optimization framework
  - Can design stable algorithm in the queueing system with a certain penalty or reward.
  - If the system is in the capacity region, the theory guarantees the system’s stability.
- **How to choose the appropriate network interface?**

\[
\hat{l}^* = \arg\max_l \left( U[c] \times |E\{\mu[t] \mid I_S[t] = l, P_t^*[l] \} - V \times P_t[l]\right)
\]

**Reference Algorithms**

- **Intended to achieve minimum delay (Min-Delay)**
  - Simplest approach to achieve minimum delay.
  - Greedily choose the best available access point at every decision slot.
- **Intended to consume minimum energy (WiFi-only)**
- Static balancing algorithm (Static-Delay)
  - Try to balance between energy and delay in a static way.
  - Combine Min-delay and Min-energy algorithm with fixed amount of time parameter T.
  - May be hard to decide the optimal parameter T.
- **Omniscient algorithm (Know-WiFi)**
  - Assumes that we already know future WiFi availability and do the best.

**Trace-driven Simulation**

- Adaptation across parameter α.
- Comparison to simple strategies.
- Comparison to balanced strategies.

**Experiments using Nokia N95**