Abstract

There are many high-bandwidth applications with potential utility in mobile environments. However, such applications are often difficult to implement due to the challenges posed by infrastructure-less wireless networking. These impediments include limited bandwidth and varying connectivity.

We study a variant of these applications in which various events trigger nodes to begin short periods of high data rate transmission. The ns-2 network simulator is used to study the effects of various parameters, such as event length, event arrival rate, and data rate.

Simulation

• Ns-2 network simulator [1]
• ‘Cars on highway’
  • Node mobility is relative motion
• Advantages over physical experiments
  • Low requirements
  • Equipment
  • People
  • Fast
  • Reconfigurable
  • Can test hypothetical hardware
• Limitations
  • Uncertainty of results
  • No analytical results
  • Lack of traces for real traffic patterns
  • Modern hardware not yet implemented

Applications and Settings

Video, High Resolution Images
Transmitting high quality visual data requires large transmissions, so we want to limit the resulting network resource consumption when it’s not necessary.

Fast Sampling Sensors
Many sensors can output megabytes, or even gigabytes, of data every second, but that data may only be useful at critical moments, such as when the measured system changes drastically.

Military
On the typical battlefield, communications infrastructure is non-existent, hostile, or damaged. Satellite radios don’t make up for this, due to their very limited bandwidth.

Emergency Response
More data for incident commanders
Fire commander can watch ‘over the shoulder’ of firefighters entering a building, possibly with post-processed or false color imagery to aid and direct the front-line.

Remote medical triage
First responders, such as police officers, to a major disaster scene may only have basic first aid training, but if they can send video or high-resolution images to paramedics either on-scene or en-route, an earlier, more accurate evaluation can be made and preparation for treatment can begin before the victim is removed from the affected area.

Analysis

• Graph flows from every node
  • Instantaneous throughput
  • Total data transferred
• Modifications of pre-existing scripts [2] used to parse packet traces produced by ns-2, sort the recorded events into flows between distinct endpoints, and compute relevant statistics
  • Ignore loss rates, as we’re concerned with the data eventually arriving. The idea is to transmit an accurate record, so a delay for retransmits is acceptable
  • Look for ‘never-ending events’ in which the total transfer for the nodes climbs continuously and never levels off

Methodology

• Row of 5 nodes, representing cars on highway
  • Each simulates TCP/IP over IEEE 802.11b
  • Dynamic Source Routing (DSR)
  • All send to one node, initially at one end
  • Constant bit rate traffic from each node
  • Random (exponential) transmissions and intervals
• Three experimental variables:
  • Traffic rate while on
  • Length of transmission (event)
  • Interval between simulated events
• Mobility:
  • One car passes up the line
  • Another follows

References

1. http://www.isi.edu/nsnam/ns/

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Future work:
Clear opportunities to improve on this work include new wireless models, such as 802.11n, in ns-2, different types of event-based traffic models, and simulating other mobility scenarios.