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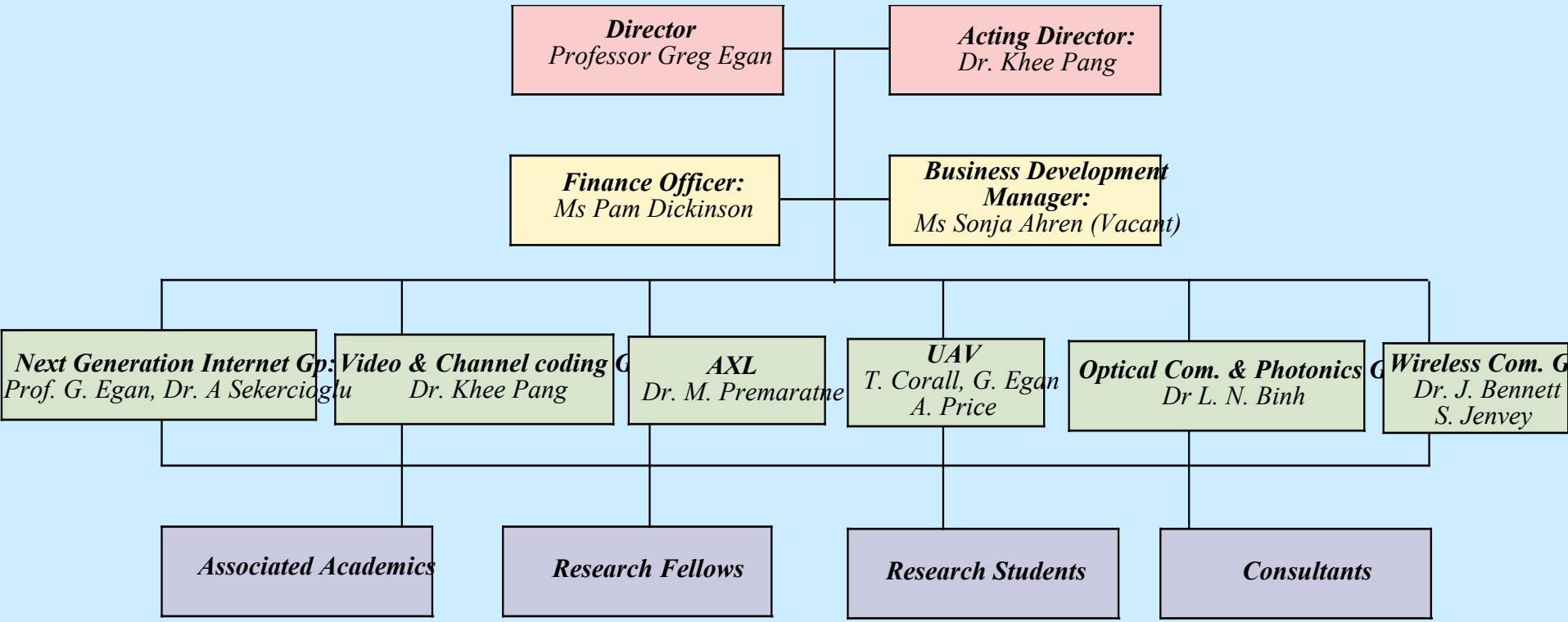
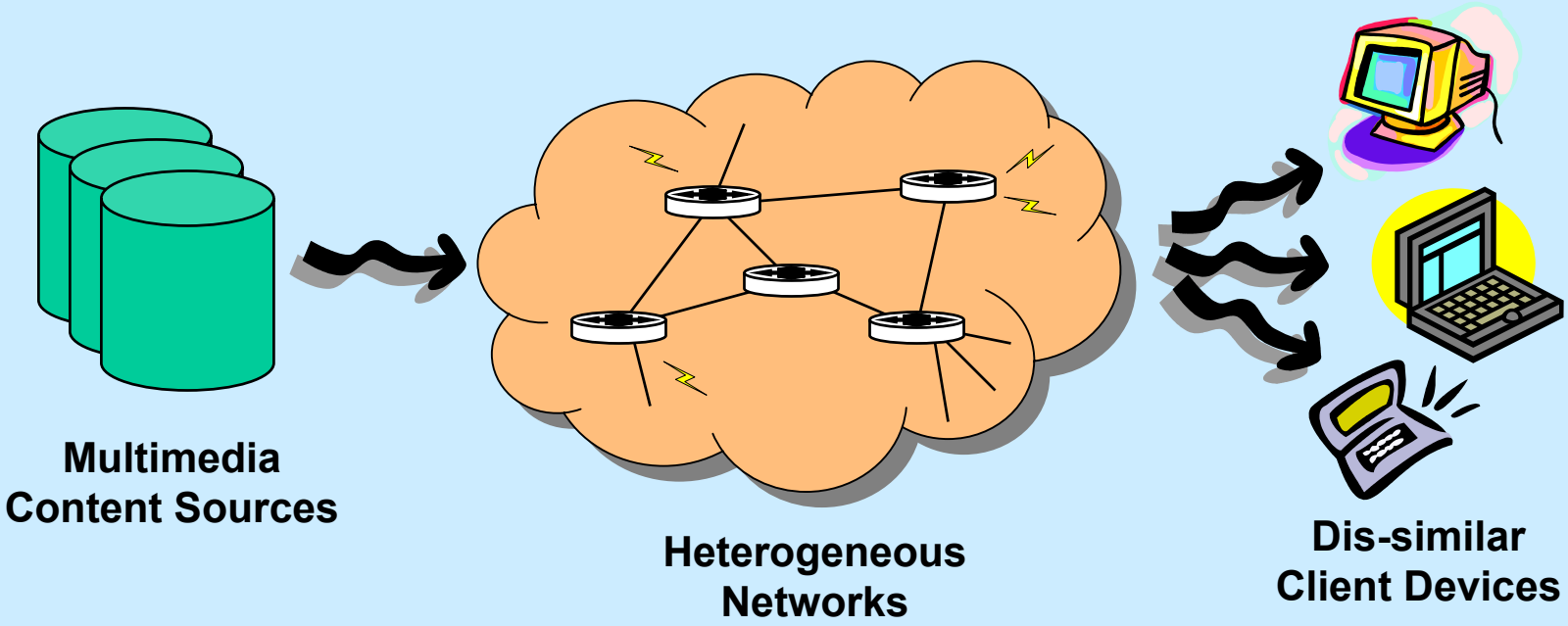
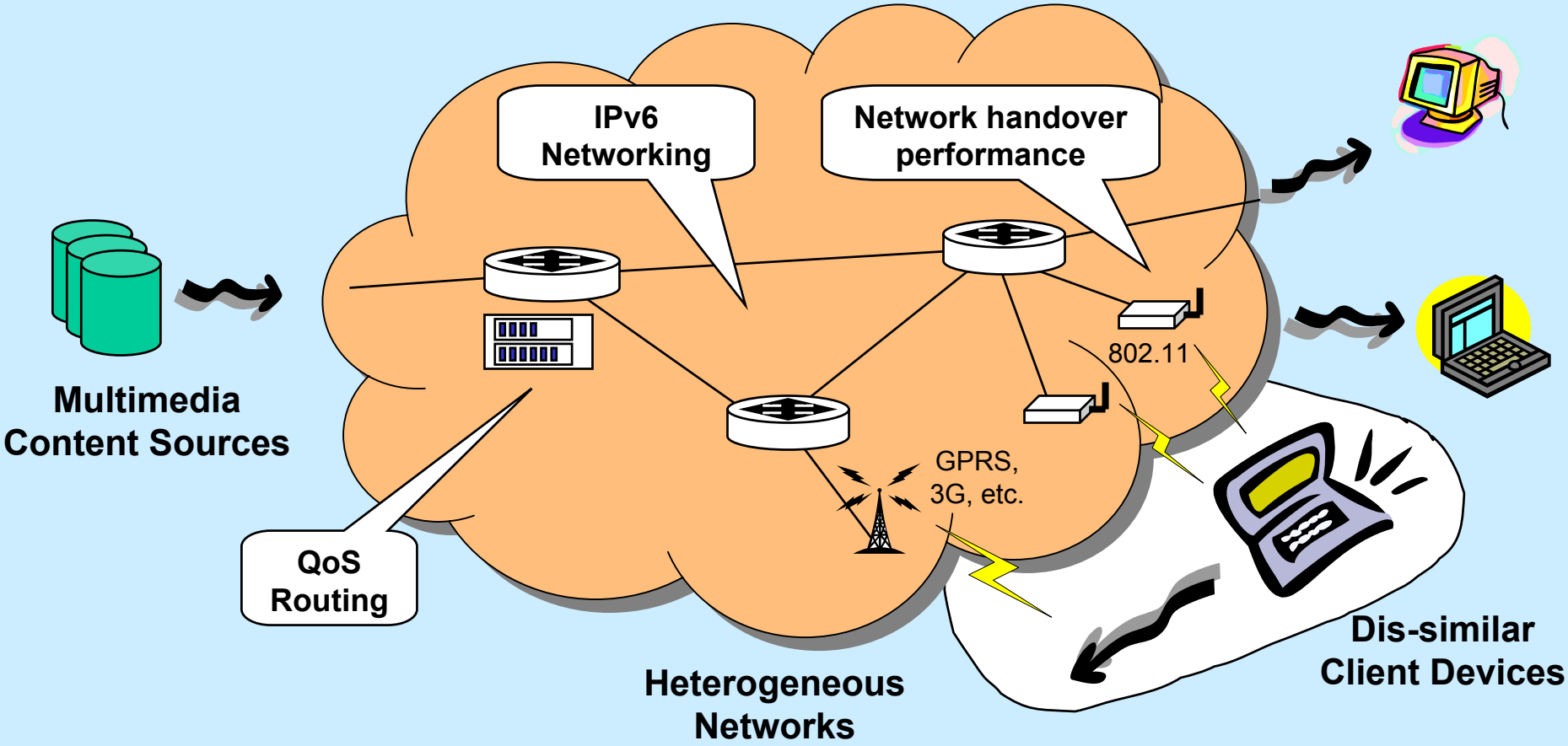


Problem Space



Realtime Interactive Multimedia Service Delivery

Project 1.1



Next Generation Internet

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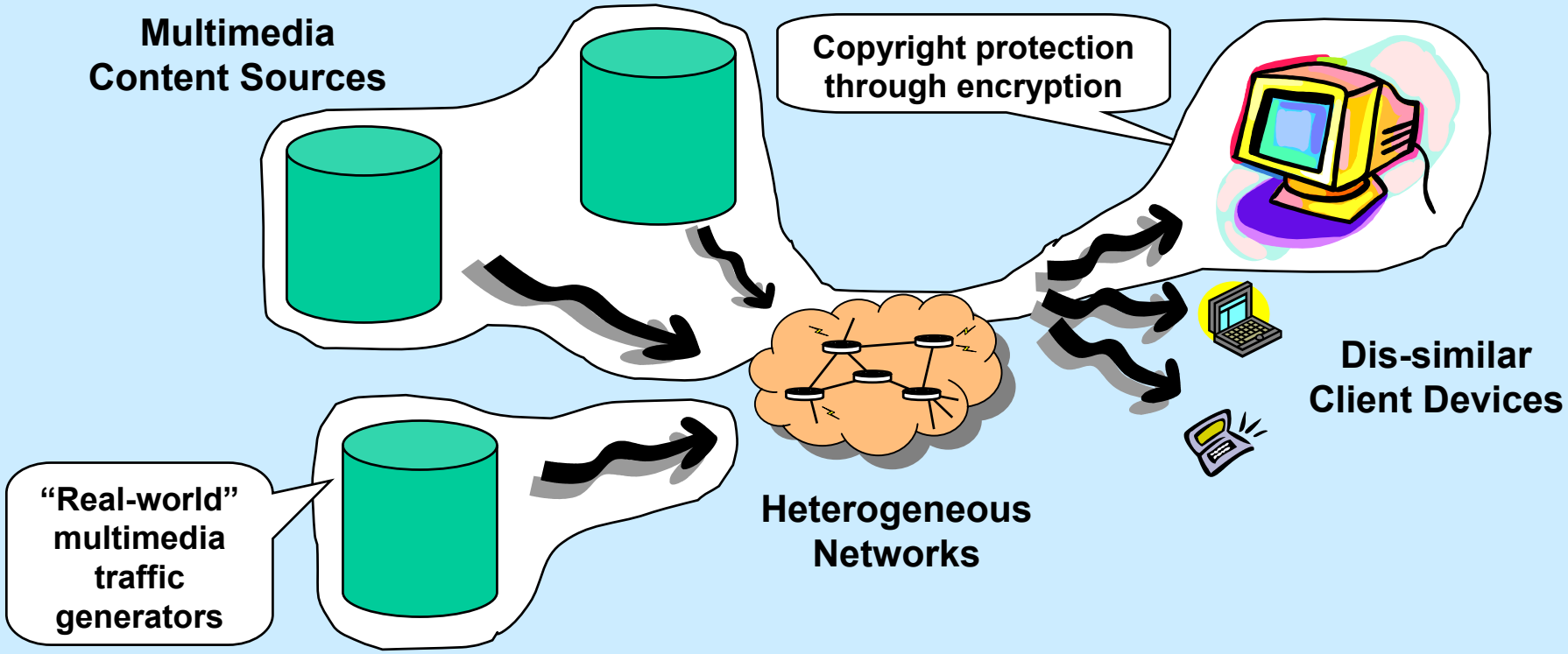
Project 1.2



Advanced Video Retrieval Services

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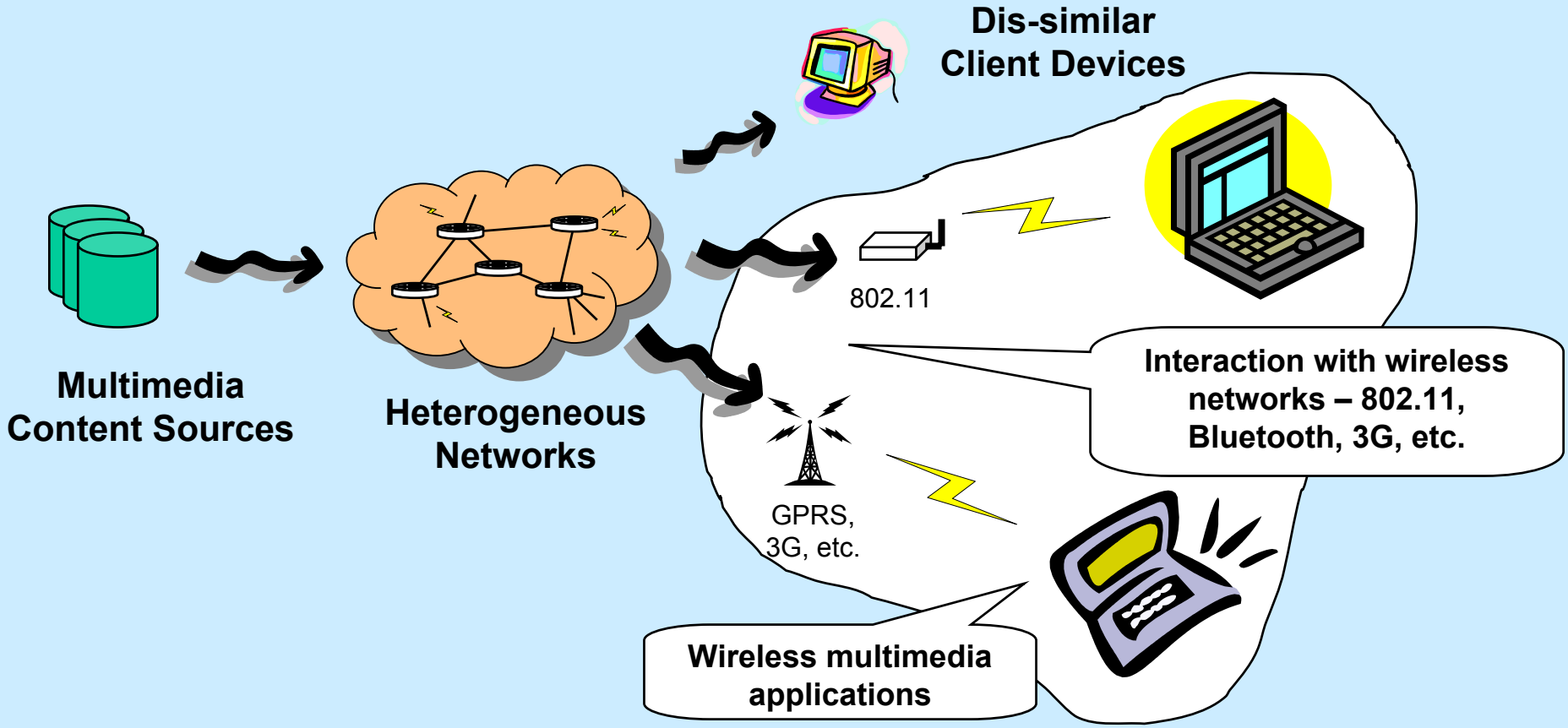
Project 1.3


Dis-similar
Client Devices
802.11
Multimedia
Content Sources
Heterogeneous
Networks
Interaction with wireless networks – 802.11, Bluetooth, 3G, etc.
GPRS,
3G, etc.
Wireless multimedia applications

Advanced Computing and Simulation Laboratory (AXL)

Research Overview

Malin Premaratne

Center for Telecommunications and Information Engineering

Researchers in AXL

- Dr Malin Premaratne (Research Director)
- Dr Ahmet Sekercioglu
- Professor Greg Egan
- Dr Khee Pang
- Dr Mani Nallasamy
- Dr Andrew Price

AXL Research Outline

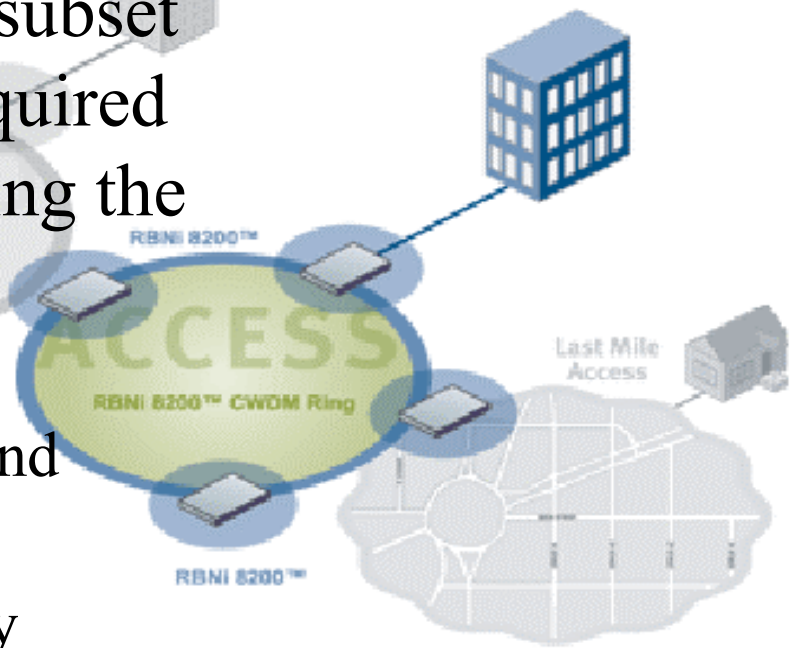
- Parallel and Distributed Simulation of Optical Communications Systems
- Constrained Design and Optimization Techniques for Optical Communications Systems
- Device Modeling, Simulation and Optimization
- Modeling and Simulation of Bio-Photonics Processes
- Theoretical Study on Quantum and Optical Computing

Parallel and Distributed Simulation of Networks

- Parallel/distributed implementation of pulse propagation in optical fiber and other devices
- Approximate black-box models for devices and networks
- Non-uniform sampling techniques for speeding up simulations
- Efficient data representation techniques

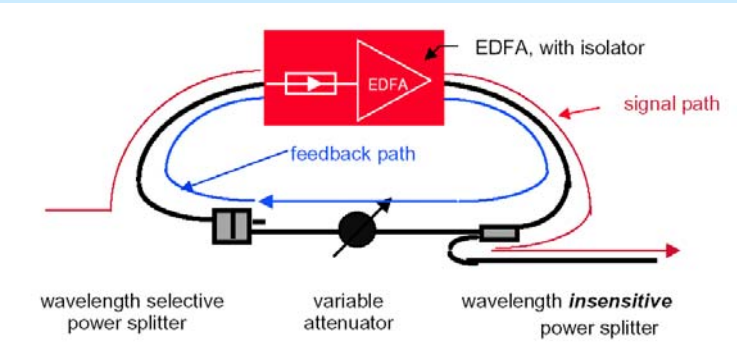
Constrained Design and Optimization of Networks

- *Problem Statement:* Given a set of available equipments and a connection topology, find a subset of equipments that meets required performance while minimizing the cost.
  - NP – Hard problem (i.e. solutions can only be found using clever heuristics!!)
  - Very much interest in industry

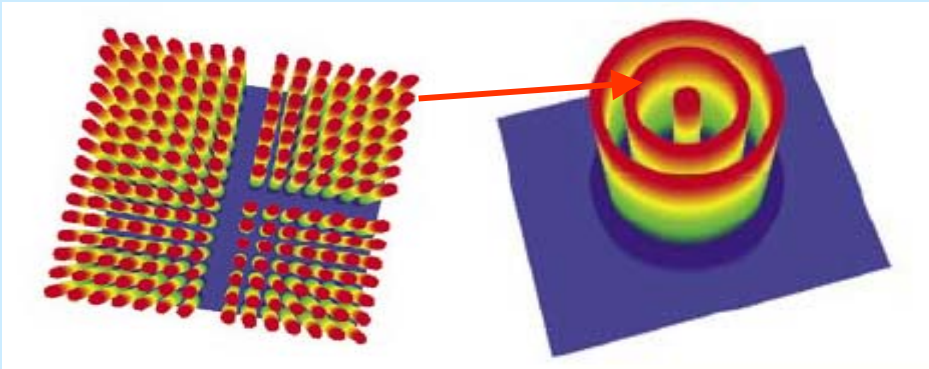


Device Optimization

- Transient analysis of Raman and EDFA amplifiers
- Distributed characterization of optical fiber
- Analysis of quantum well/wire/dots based lasing structures



Gain Clamped EDFA



Modified Quantum Wire Structure

Modeling and Simulation of Bio-Photonic Processors

- Photo-acoustic methods - Noninvasive detection of glucose in blood
- Optical coherence tomography techniques for noninvasive detection of substances in humans
- Scattering and absorption dynamics in tissue
- Monte Carlo inversion techniques

Theoretical Study on Quantum and Optical Computing

- Algorithm Development for NP-hard problems such as device placement problems in optical networks
- Simulation algorithms for optical devices and networks in quantum and optical computers
- Study of photon flux through optical devices as birth-death-immigration processes

Next Generation Internet Research @ CTIE

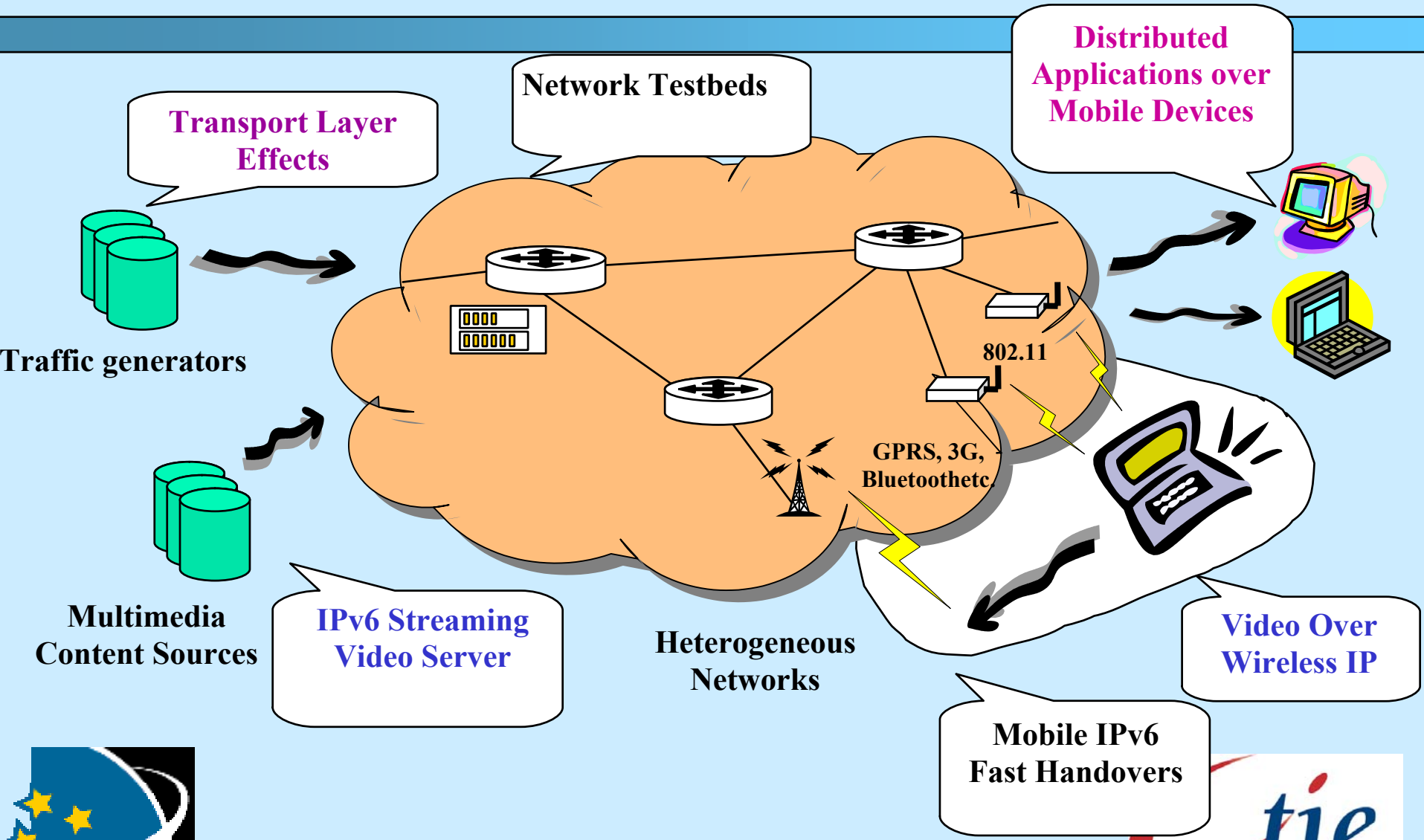
Gopi Kurup

ECSE Research Forum, Feb 2004

IPv6 'anywhere' & 'everywhere'

- Fusion of technologies: fixed-mobile-wireless-cellular-satellite.
- Integration of services: data-voice-video.
- Complete mobility of the end nodes.
- Widespread coverage without requiring expensive network management.
- “always-on” connections for mobile devices at the edge of a fixed core network.

Interactive Realtime Multimedia Delivery



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Research @ CTIE

- Protocol Research and Standardisation Activity
  - Fast Handovers for time sensitive traffic.
  - Duplicate Address Detection (DAD) for IPv6 devices.
  - Link Triggers for smooth handovers.
  - HMIPv6
  - Detecting Network Attachment (DNA).
  - Multicast Mobility Requirements, etc.
- Network Performance Analysis by Simulation
  - Developed full IPv6 Suite
  - MIPv6 / HMIPv6 Models
  - 802.11 Wireless LAN Models

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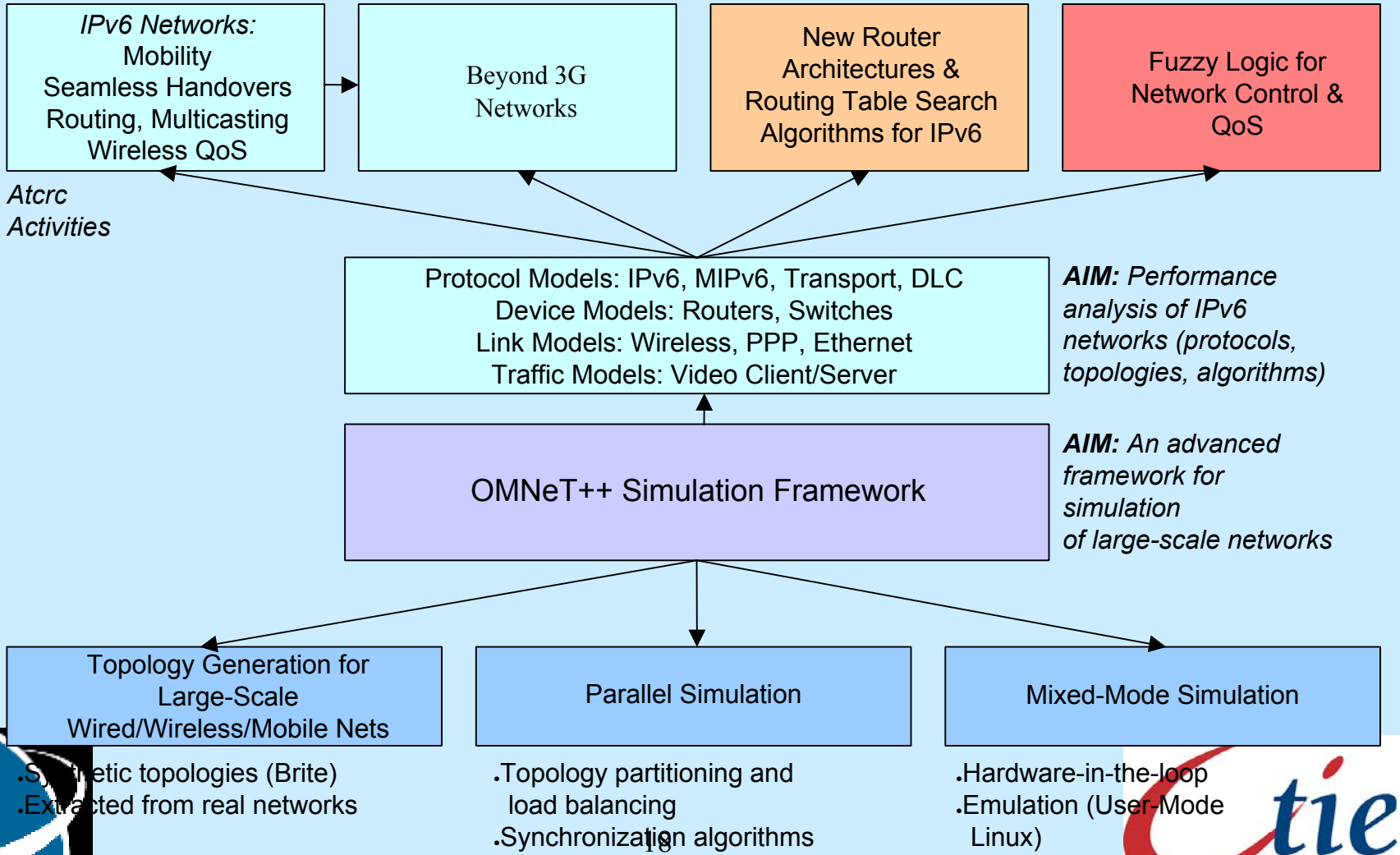
Simulation Activities



Research & Industry Partners

- Australian Telecommunication Cooperative Research Centre (ATcrc)
  - Program 1 : Applications
- Samsung Advanced Institute of Technology
  - Fast Handover and Configuration for IPv6
- Toshiba
  - Detecting Network Attachment issues.
- Clarinox
  - Integration of Bluetooth to wireless LAN handover protocols.
- Louis Pasteur University (LSIIT), Strasburg
- WIDE at Keio University, Jun Murai Labs.

Some Recent Publications

- G. Daley, B. Pentland and R. Nelson ``Effects of Fast Router Advertisement on Mobile IPv6 Handovers", The Eighth IEEE Symposium on Computers and Communications (ISCC'2003)
- S. Woon, E. Wu and A. Sekercioglu ``A Simulation Model of IEEE802.11b for Performance Analysis of Wireless LAN Protocols" ATNAC 2003.
- G. Kurup, A. Sekercioglu``Source Specific Multicast (SSM) for MIPv6: A Survey of Current State of Standardisation and Research." ATNAC 2003.
- N. Moore.``Optimistic Duplicate Address Detection", Work in progress: draft-moore-ipv6-optimistic-dad-03.txt, September 2003
- S. Thirukkumaran, Khee Pang.``Extending the code search for optimum Space-Time Trellis Coded Modulation.", ATNAC 2003.

Unmanned Air Vehicles

Terry Cornall

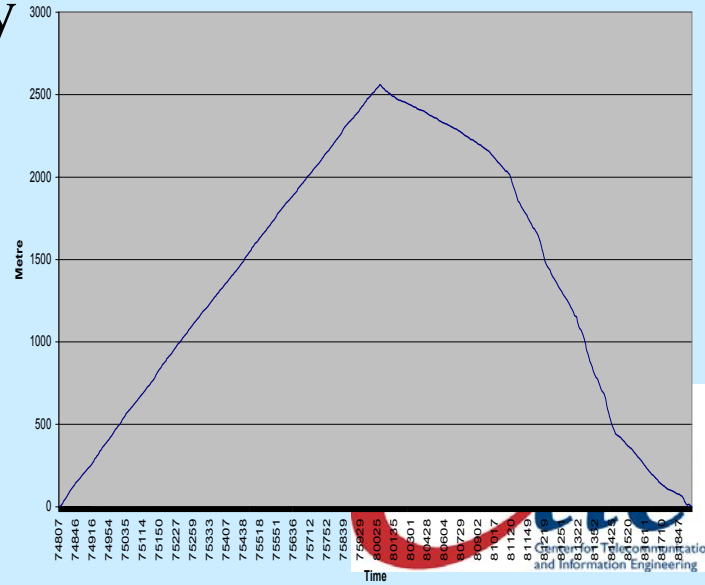
Who, what, why

- Research: Greg Egan, Andrew Price, Terry Cornall
- Associates: John Bird, Brian Taylor
- Technical: Ray Cooper, Paul Jenkins, Ian Reynolds
- Telemetry, sensors, computer vision, power systems, autonomous control for unmanned aircraft
- Rapidly increasing military and civilian interest in UAV applications and capabilities

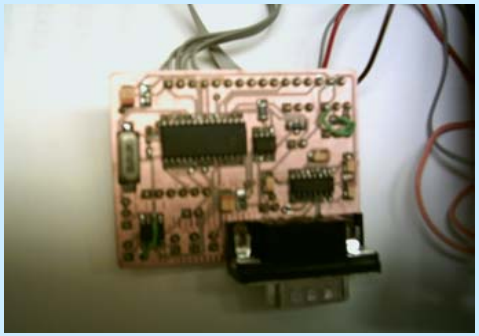
Platform development

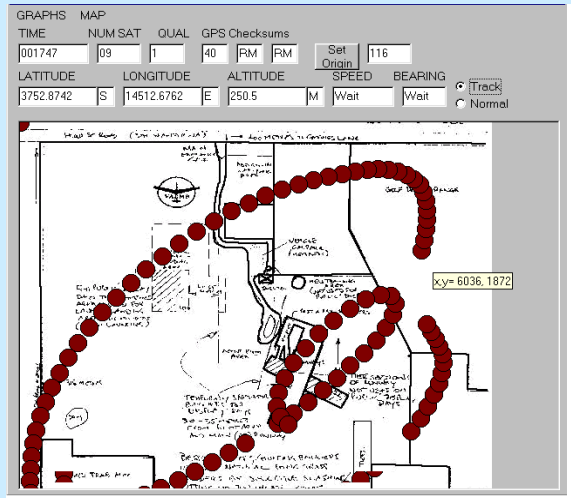
- Payload capacity
- Power system
- Stability
- Duration
- Maintainability
- Controllability
- Cost
- Manufacturability
- Portability
- Low speed
- High speed
- Altitude
- Distance
- Materials

Altitude Gain



Telemetry

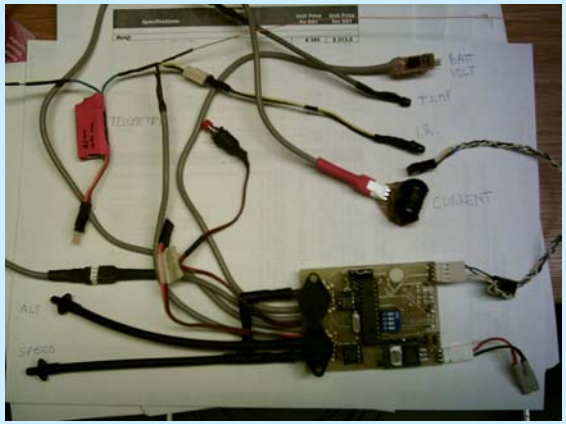




Transmitter, power, band
Receiver ground, satellite
Channel coding
Video, raw, compressed
Still image, high resolution
Altitude and airspeed
Battery condition
Motor condition
Performance
Attitude, position
Telemetry range
Bandwidth
Ground station antennas
Tracking
Security

Payload

Vision processing
Barometric sensors
Airspeed, altitude
Motor monitoring
Temperature
Battery monitoring
Voltage, current
GPS receiver
Telemetry transmitter
Still camera
Video camera
Inertial measurements-
Non inertial alternatives



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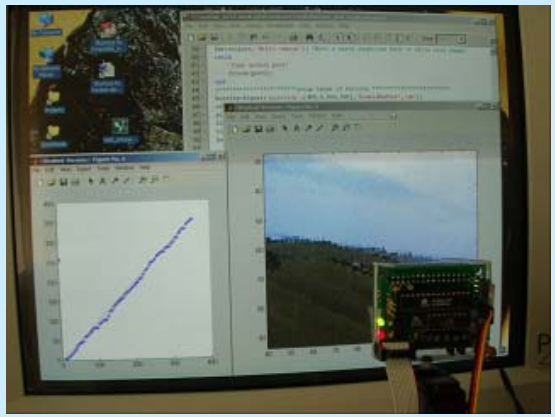
Computer Vision

Horizon angle measurement
Horizon detection
Pitch angle measurement
Feature detection and tracking
Speed from image flow
Time to impact from image flow
Altitude from feature size



Vision capture
Vision processing
Algorithms
System integration

Control

- The control of a UAV involves the use and integration of the onboard and ground sensors, mission definition, control systems, power systems, emergency systems, launch and recovery, telemetry, remote and autonomous control
- Energy management, mission duration, robust control, computational power, failsafe operation, safety, platform flight characteristics, stability, mission strategy, autonomous landing, autonomous flight, autonomous navigation, telemetry and remote control
  - range

Other research topics

- Cooperative missions - swarming, sensor fusion, reliability
- Antennas, ad hoc networks
- Navigation - GPS denial, dead reckoning, cooperative, feature based
- Electric propulsion - motor and propeller materials
- Energy storage - new battery technologies, solar augmentation, fuel- cells
- Energy management - low energy flight stabilisation, mission planning,