Seamless Communications for Mobile Emergency Services

- In UK the ambulance have a « statutory obligation » to arrive within 7 (50%) to 14 (90%) minutes after a call
- Life survival rate is decreasing by about 4% each extra minutes after the 8 minutes response time of ambulances
- If that time could be decreased to 5 minutes 10 to 11 % of life could be saved
- Over the last 5 years the demand on emergency call have grown of 47 percent while the respond grew of 30 %

Project Objectives

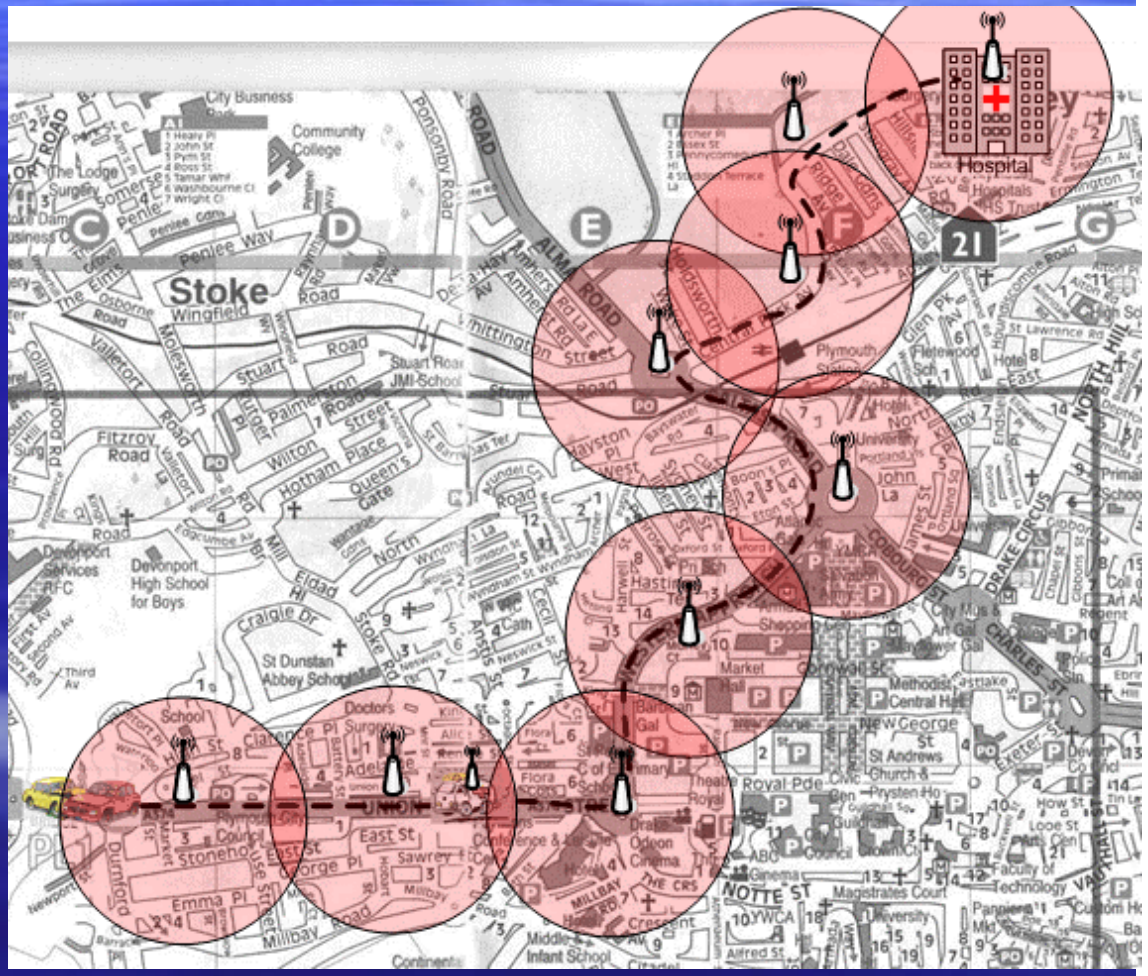
- Provide a communication system according to these principles:
  - ✓ Reliability: real time data will be exchanged
  - ✓ Efficiency: high bandwidth consuming data like Video will be exchanged
  - ✓ Security: personal data exchanged must be kept private

Background

- The ambulance radio network is 15 years old
- Use PMR analogue technology and are proprietary systems sharing 32 national frequencies in the 148-174Mhz frequency band
- A further 6 UHF national radio channels are allocated for Ambulance applications
- Some research have already been done using 2G and 3G but they face some bandwidth limitation

Network Architecture

- Mobile IP
- 802.11 Wireless on each ambulance + GPS
- Base Stations installed in all the city
- Gigabyte buried network linked to the hospital and the ACC



Scenario (1)

1. A witness of an accident calls the 999
2. He asks the Ambulance Control Centre (ACC) and gives all the details (location, information about people,...)
3. Thanks to a database mapping the GPS coordinates and the Base Station location the ACC broadcast a signal in the accident area seeking for free ambulances
4. If no ambulance is available the radius of the broadcast message is extended

Scenario (cont)

5. When an ambulance is founded all the information are transmitted

6. When the ambulance arrives on the scene a report done by the paramedics is send to the ACC which chose the corresponding hospital

7. During all the journey data are exchanged with the destination medical centre

Info Transmitted

- Real time data:
  - ✓ Video (H.621, H.623 codec)
  - ✓ Audio (Full Duplex Transition - G.723.1, G.729 codec)
  - ✓ Patients records (ECG)
- Non Real time Data:
  - ✓ Pictures (JPEG)
  - ✓ Patient Records / Doctor Instructions

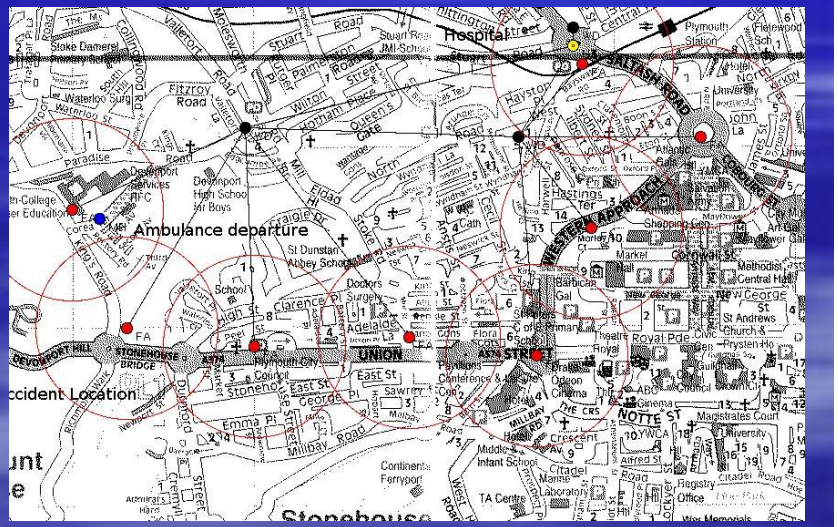
Simulation tools

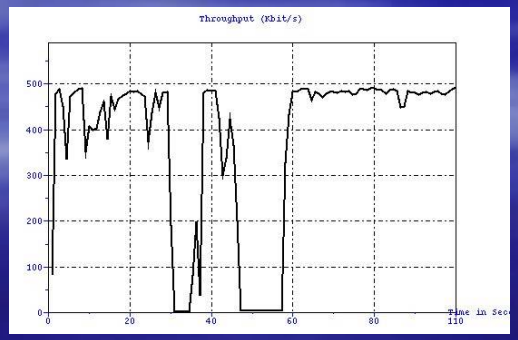
- Network Simulator 2: generates trace files

  s -t 0.000339577 -Hs 2 -Hd -1 -Ni 2 -Nx 1.00 -Ny 2.00 -Nz 0.00 -Ne -1.000000 -Nl AGT -Nw --- -Ma 0 -Md 0 -Ms 0 -Mt 0 -Is 4194304.0 -Id -1.0 -It udp -Il 48 -If 0 -Ii 0 -Iv 32

- Ad-Hockey: graphic simulation interface

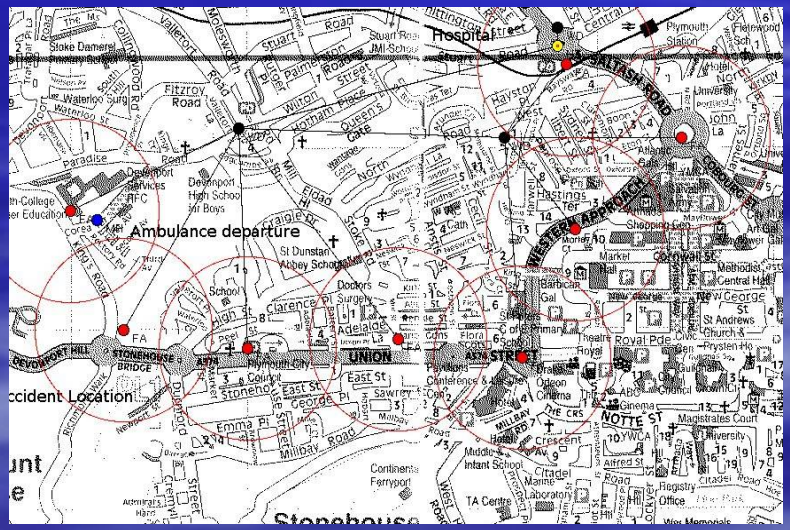
- Scilab: plots graphics (Matlab clone)





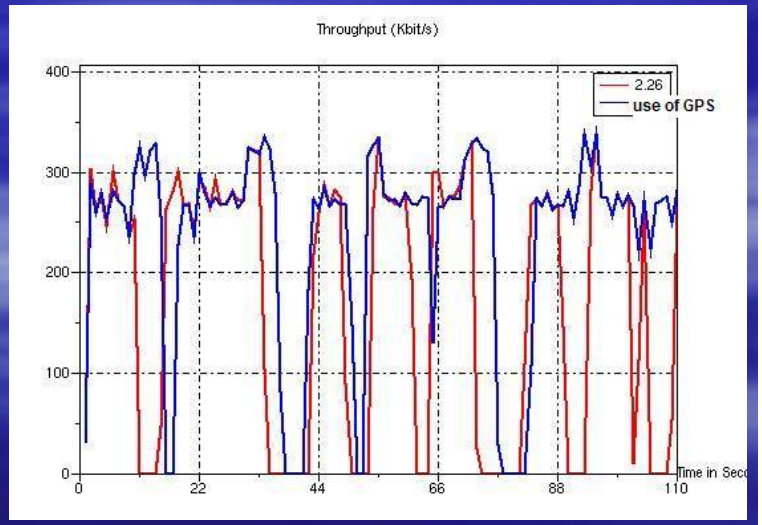
Simulation based on a Plymouth map

- A simulation based on Plymouth topology as been realized with a 274.2 Kbps data rate :
- H.263 video codec (256Kbps)
- G.729 audio codec
- Telemetry messages (ECG,BP,...)
- Pictures (60KB)
- Medical messages



Simulation results

Version	*ns-2.26*	*Use of GPS*
Packets loss	42%	21%
Throughput Kbps	164.53	220.25
Idle time in sec	39 (31.8%)	18 (11.8%)
Mean delay (ms)	37	36
Max delay (ms)	160	158



Picture comparing the 2.26 MIP implementation (red) and the new one using GPS coordinates (blue)

Conclusion

- The idea of this project is to provide a good communication system in order to minimize patient waiting time
- Wireless network used has better bandwidth than 2G and 3G
- Remaining work:
  - ✓ Assess the real time communication
  - ✓ Enhance the registration algorithm
  - ✓ Work on real duplex communication