London's Bus Priority at Traffic Signals in a Worldwide Context

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Overview

- Introduction
- UITP study
- Bus priority at traffic signals
- Worldwide context
- London's bus priority at traffic signals
- Concluding Comments

UITP study

- UITP Working group on Interaction of buses and signals at road crossings
- Goals:
  - Review of worldwide systems and general practice
  - Identify best practice
  - Lessons learned from existing installations

- **Website**

http://www.tfl.gov.uk/businessandpartners/busoperators/1236.aspx

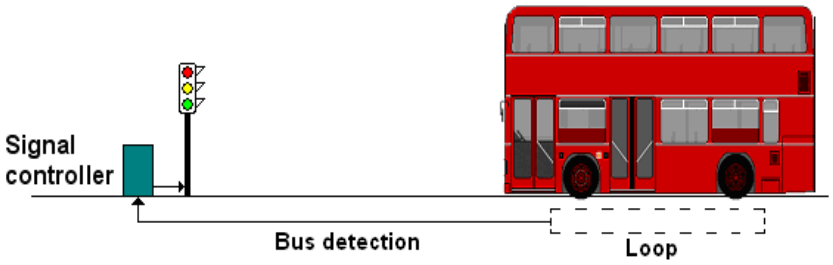
Bus Priority at Traffic Signals

- Traffic signals
  - Fixed time/ Vehicle actuated
  - Isolated/Co-ordinated systems
- Bus priority
  - Buses detected at the approach of a traffic signal
  - Green extension or green recalls
  - Priority to buses with minimal impact on other road traffic

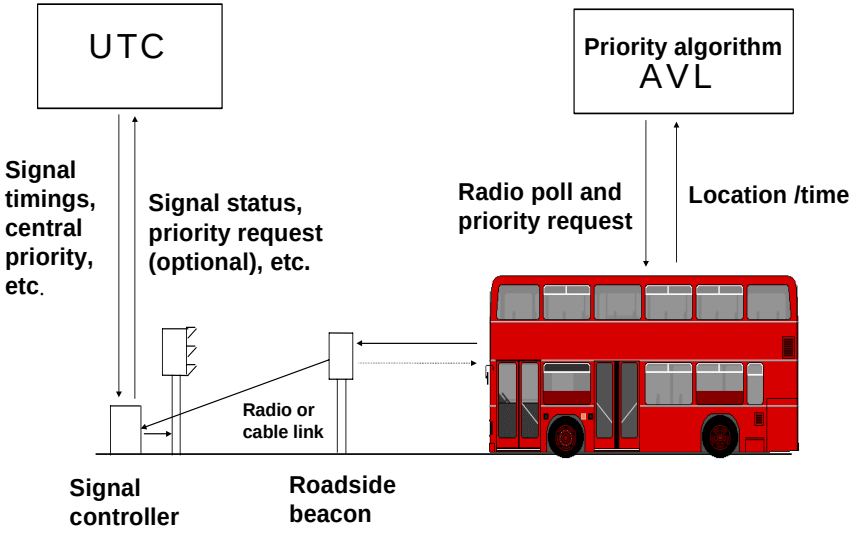
Worldwide context

- Bus priority at traffic signals is widespread across the world
- Substantial variations in the systems
  - Bus detection technology
  - Priority request communication
  - Priority architecture
  - Priority benefits

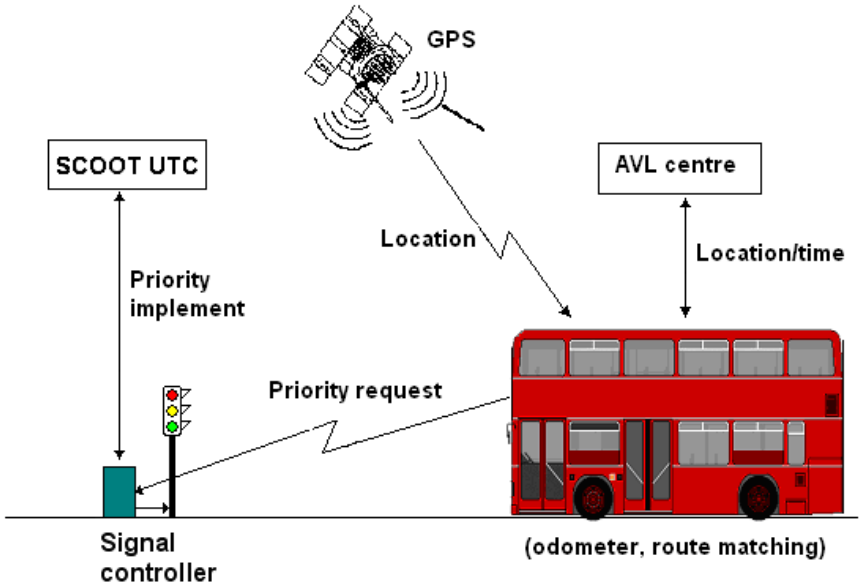
Technologies used for Bus Priority



Loop

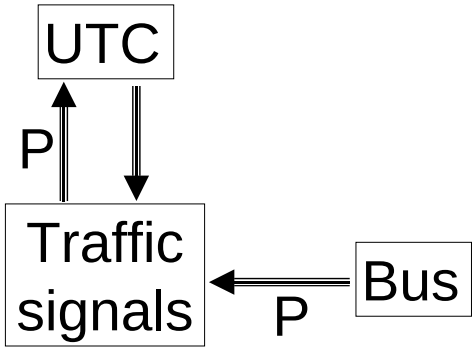


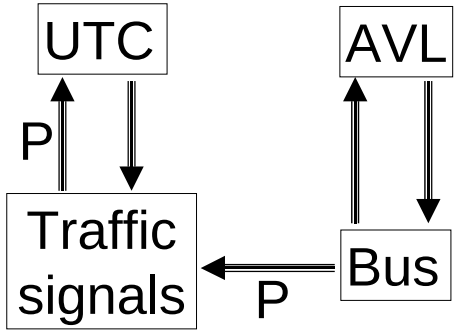
Beacon

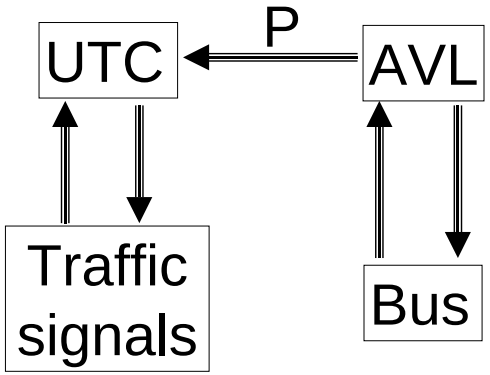


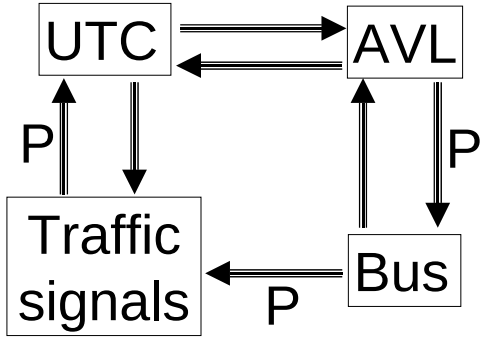
GPS

Architecture examples

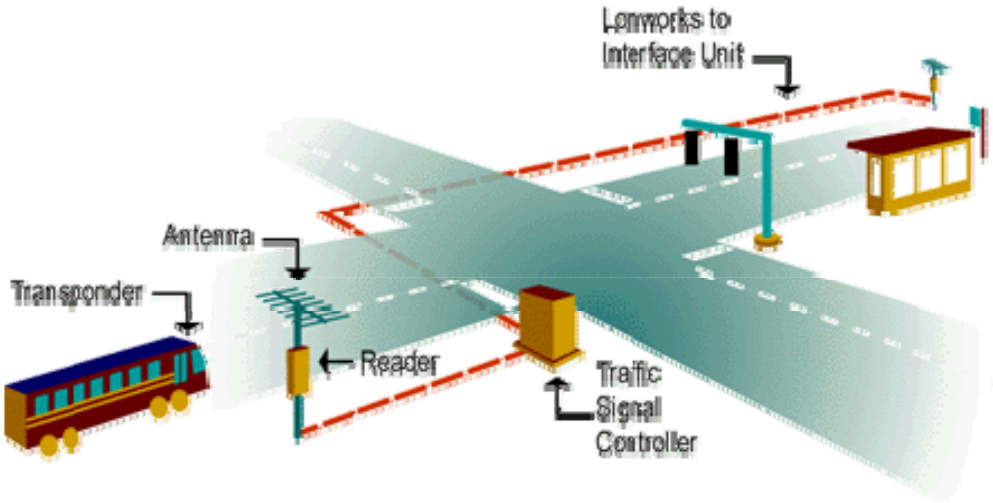




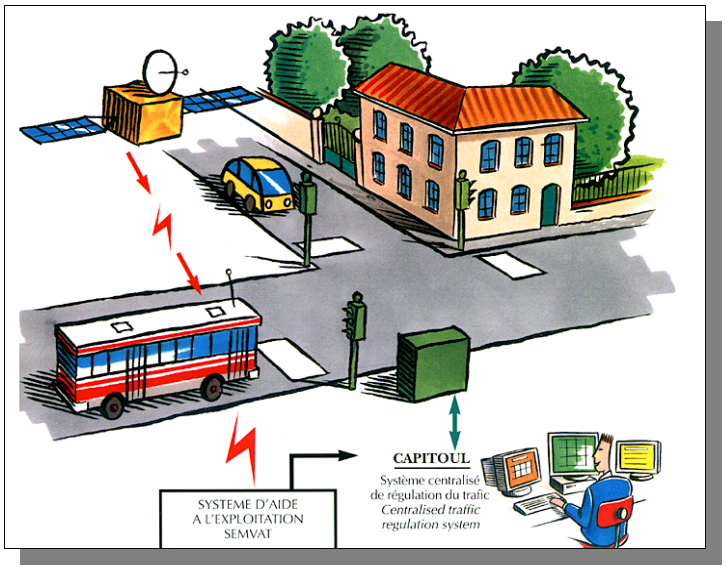




Architectures used for Bus Priority



King County – Decentralised



Toulouse – Centralised

Source: metro.kingcounty.gov/up/archives/2001/tsp.html
Source: www.trg.soton.ac.uk/priscilla/deliverables.htm

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Example of cities & bus priority facilities

City	No. of signal equipped	No. of equipped buses	Bus detection technology	Priority request communication
Aalborg	51	249	GPS + Odometer	Centralised
Cardiff	46	191	GPS	Decentralised
Genoa	84	500	GPS	Decentralised
Geneva	263	420	GPS + Odometer	Decentralised
Glasgow	241	500	GPS	Centralised
London	3200	8000	GPS + Odometer + map matching	Decentralised
Prague	65	352	Beacon	Decentralised
Stuttgart	34		Beacon and GPS	Decentralised
Toulouse		160	GPS + Odometer	Centralised
Auckland	174	734	GPS	Centralised
Brisbane	11	205	Loop	Decentralised
Portland	250	650	Beacon (Opticom)	Decentralised
Los Angeles	654	283	Loop & transponder	Decentralised

Example of reported benefits

City	Priority benefits and impacts				
	Bus delay savings	Travel time	Variability	Patronage	General traffic
Aalborg	5.8 sec/jun	4% reduction in average			
Cardiff		3-4% reduction	Reduced		1-2% increase
Genoa		7-10% reduction			
Gothenburg		13-15% decrease			5-10% savings
Helsinki		11% reduction		11% up	
London	9 sec/jun (isolated) 3-5 sec/jun (SCOOT)				
Prague		2% reduction			
Southampton	9.5 sec/jun				Increased by 3.8 sec/veh/jun
Stockholm		10% savings			
Turin		12% reduction			
King County	25-34%	Reduced by 5.5-8%	Reduced by 35-40%		Minimal effect
Los Angeles		Reduced by 6-8%		Up by 1-13%	Increased by 1 sec/veh/jun

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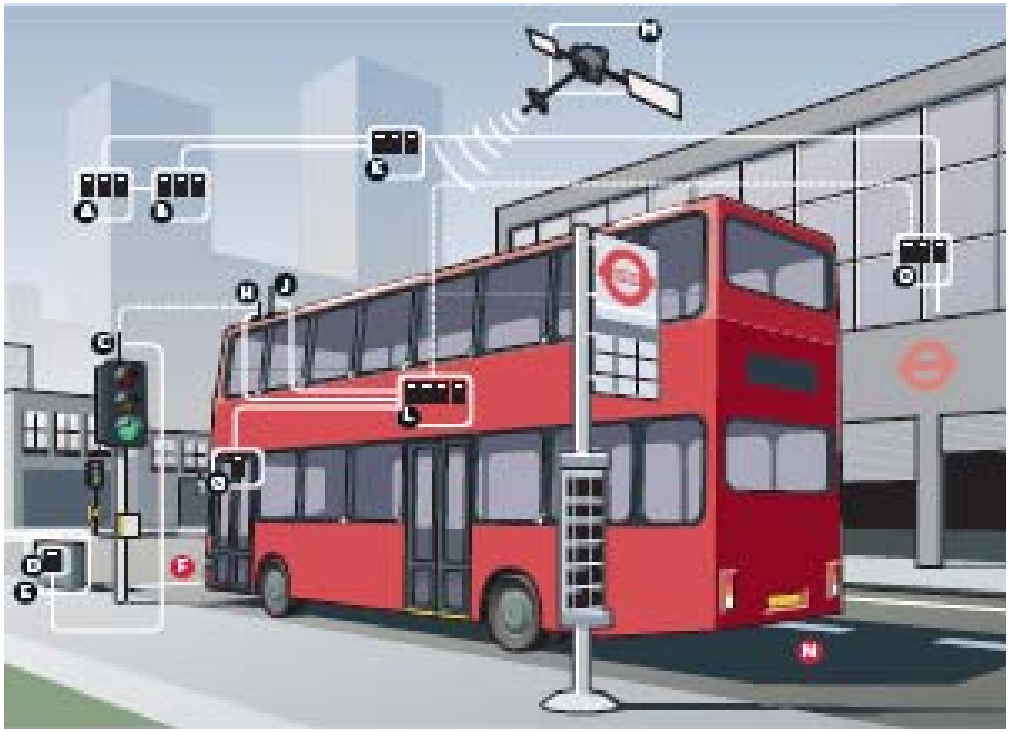
Some Lessons Learned

- Bus priority cost effective from small towns to big metropolitan cities
- Use technology appropriate to requirements, with potential for upgrading
- Include policy-responsive strategies
- Most effective with traffic responsive control.
- Bus priority implementation seems most effective in regulated environments (security of investment and operations).

London's buses

- London bus network
  - over 8000 buses; 6 million passengers; over 700 routes every weekday
- Bus priority facilities: bus lanes, red routes, priority at traffic signals
- Recent initiatives
  - modern fleet; improved ticketing; congestion charging; new AVL system
- iBus system for fleet management, passenger information and **bus priority at traffic signals**

London’s iBus system



Key

- Bus priority fault detection and performance monitoring reports
- System databases
- Bus priority radio link
- Bus processor (contained within traffic signal controller)
- Traffic signal controller
- Bus detection points
- Bus door sensor
- GPS receiver
- Central system server (located remotely)
- iBIS plus unit
- GPS satellites
- Bus garage (when bus is in garage, it is linked to the central system server to send and receive bus priority data)

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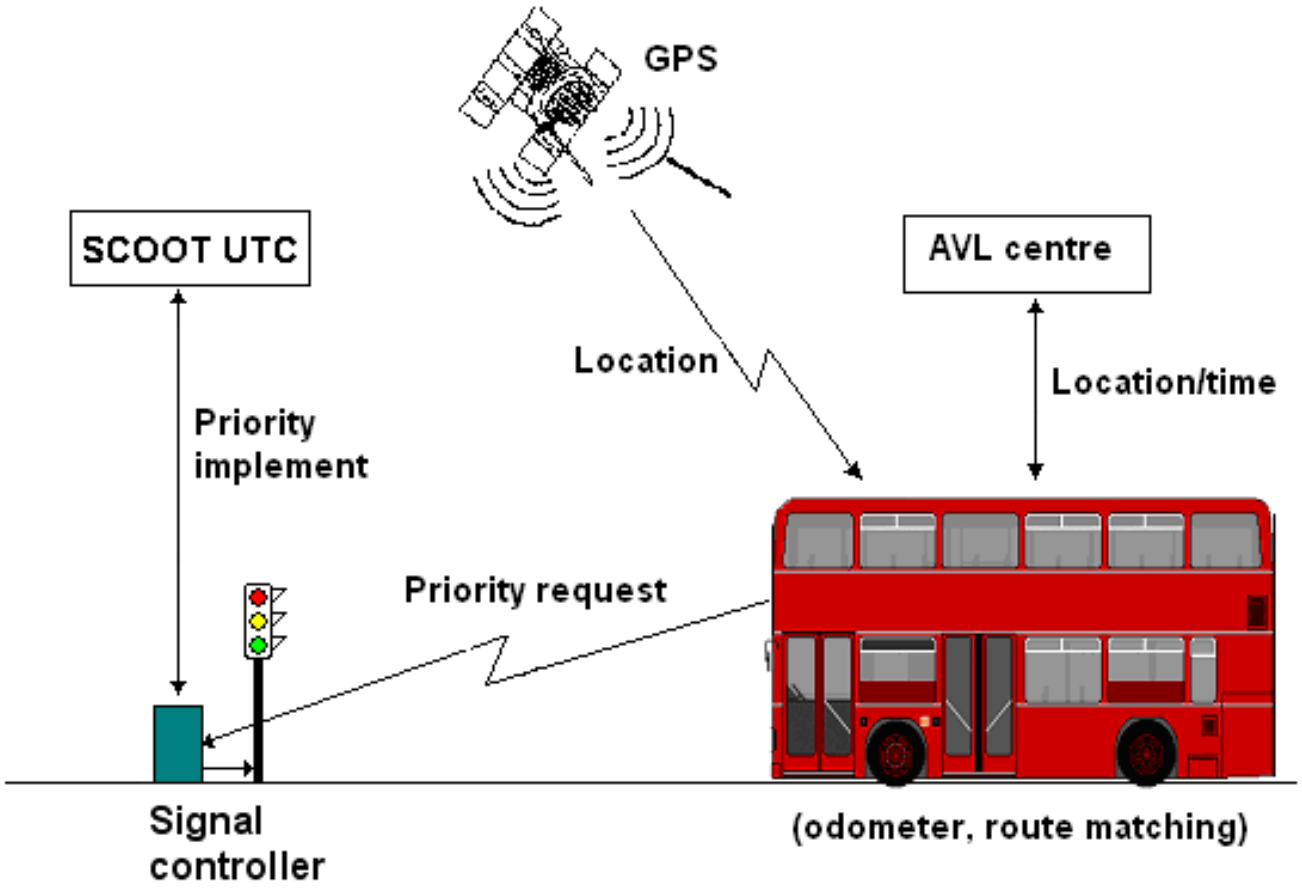
GPS based bus priority



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iBus project

- Replacement for existing beacon AVL, Radio and Loop systems
- Siemens VDO awarded contract
  - design
  - rollout
  - maintenance service
- GPS based AVL system supporting more than 8000 buses and 3200 signals

Advantages of using iBus

- Reduced cost of rollout per junction – most junctions cost-effective
  - Reduced roadside infrastructure requirement
  - Increased speed of rollout
- Increased reliability and decreased maintenance costs
- Future proofing the system
- Potential expansion to other modes of transport (e.g. freight, Olympic traffic, TRAMs)

Bus priority using iBus

- Bus detection using “virtual detector
  - No roadside equipment installation
  - More than one virtual detectors can be used
  - Easy relocation
  - Longer distances possible
- Priority based on schedule/headway information
- Next steps
  - Differential priority
  - Cancel detection
  - Predictive priority

Next steps - Differential priority

- Priority is given according to the individual requirements of buses
- Varying levels of priority given depending upon the need (e.g. late bus)
- To improve punctuality/regularity and reduce passenger waiting times
- Benefits

  - Higher priority to the buses in need

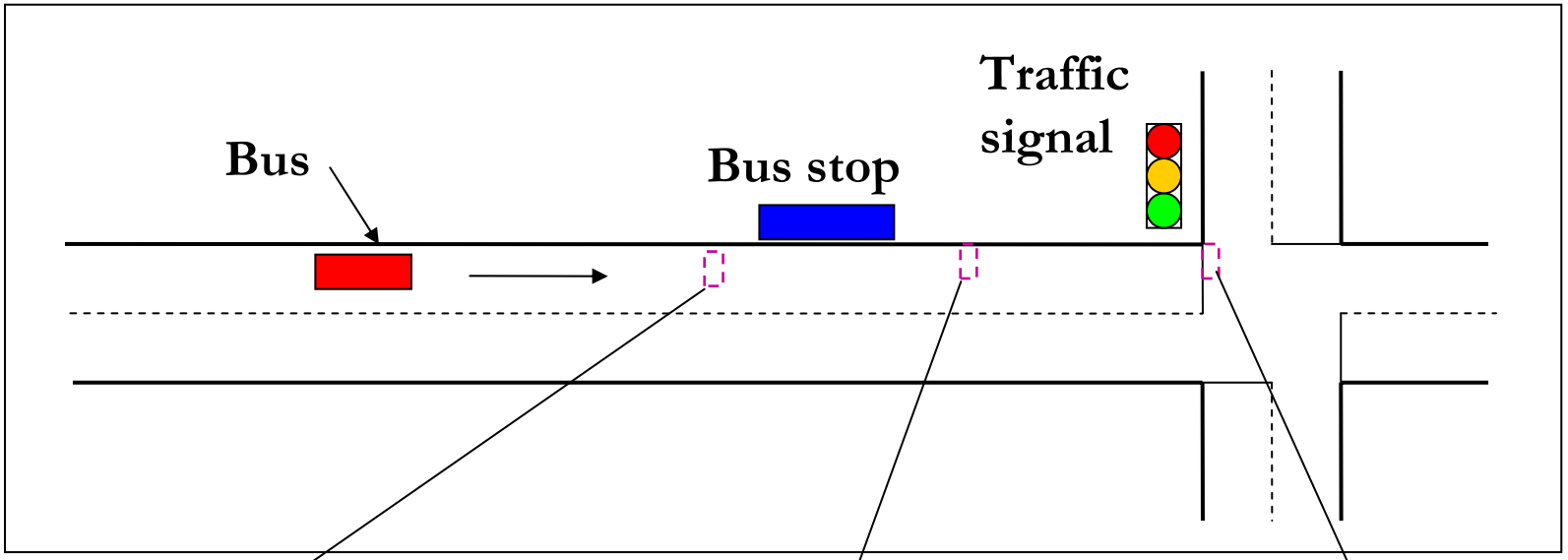
  - Improved performance criteria

  - Less disruption to non-priority traffic (as fewer buses awarded priority)

Next steps - Predictive priority

- An extra detector (secondary detector) in addition to a primary detector
- Extra priority may be cancelled using a cancel detector at the stopline
- The combination of primary, secondary and exit detectors found beneficial
- The combination is increasingly useful as bus journey time variability increases

Predictive priority



Primary detector (U)
- Estimates bus arrival at stopline
- Bus priority is given accordingly

Secondary detector (D)
- Re-estimates bus arrival at stopline
- Bus priority given earlier is amended accordingly

Exit Detector (E)
- Cancels any remaining priority extension

Concluding comments

- Transport is about the movement of people and goods, not just the movement of vehicles
- Bus priority at traffic signals adopted across the world
- Systems vary in size, technology and architecture
- Reported benefits - typical bus delay savings of 4-10 secs/junction, a 3-16 months payback period and environmental benefits
- Bus priority system outcome is influenced by policy objectives (journey savings, regularity)
- New technologies are supporting increasing levels of innovation - London's iBus is a prime example!

Thank You!