

UNIVERSITY OF
Southampton

When virtual networks meet physical networks



Web Science and Transport Systems

Ben Waterson
B.J.Watson@southampton.ac.uk

UNIVERSITY OF
Southampton

The importance of location.....

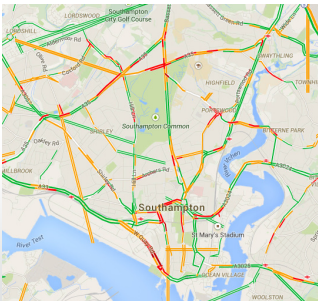
In virtual networks (of people or systems) physical location is not important
In transport networks however precise physical location is often critical

© Sam Kelly © Tommi Nummelin

UNIVERSITY OF
Southampton

Question 1 – What is going on ?



The best source of real time traffic conditions is the vehicles that are actually experiencing it


The problem is that **one** vehicle does not represent typical conditions

But it is **NOT** just a big-data number crunching question

© Google Maps

UNIVERSITY OF
Southampton

Question 2 – What do people THINK is going on ?



© Basil Artemouev

UNIVERSITY OF
Southampton

#Congestion

The GOOD
@RHALtd
Overnight closures on A1 at Black Cat starting 17 October 2014 #Roads #Congestion

The BAD
@afrojunkman
Busy watching tail-lights #congestion #trafficjam

The Just Strange
@SinusBuster
To help clear your #congestion, try this Grilled Stuffed Jalapeno Chiles with Grilled Red Pepper-Tomato Sauce recipe http://buzz.mw/bcz1o_f

UNIVERSITY OF
Southampton

#delays / #delayed

The GOOD
@TheProspect1
Everyday this week @crosscountryuk the 18.16 Taunton to Exeter has been #delayed

The BAD
@jenwilsonTO
Hey commuting friends, the subway is super, super broken this morning #delays

The Just Strange
@keepingupwithky
OMG! I want to freak out and be all, "I KNOW #WHOKILLED SAM!" but...I'm on dvr. So you guys all freaked out a half hour ago. #delayed
@JonnyMcGarrigle
Based on a car ride with mum earlier she approves of the new @ThoseGhosts EP #delays and the @WonderVillains debut #rocky

UNIVERSITY OF
Southampton

From Virtual to Physical

There are things that transport networks can (should ?) learn from the way in which online communities form and operate.

Virtual networks of people are very good at

- Being flexible and self organising
- Being creative and responding to others' ideas
- Allowing different roles and levels of engagement to coexist
- Working together to solve problems

UNIVERSITY OF
Southampton

How Traffic Lights Work

Each junction is controlled by a roadside computer.
Separate junction controllers can be coordinated in one of two ways.



(a) Central Command and Control



(b) Everyone for Themselves !

Neither of these approaches work very well any more

How Traffic Lights Could Work

A single person can control traffic by standing in the middle of the junction.
Their aim is to minimise the delays for vehicles at that junction.

**How Traffic Lights Could Work**

A single person can control traffic by standing in the middle of the junction.
Their aim is to minimise the delays for vehicles at that junction.

What happens if we want to minimise total delay across the whole road network ?

- How to define 'nearby junctions' (and is it a constant group)?
- How do coordination decisions get made (consensus ?)
- What information needs to be transferred between controllers
- Are some controllers more critical to success than others ?
- Is it best to have a small number of core controllers and many followers or a more balanced set of roles?

Will it Work ?

The problem is that each junction needs to minimise delay....
.... but if they all do that we don't get what is best for the system as a whole.

Can we get controllers to sacrifice some of their individual performance....
.... for the good of the group ?

Can we get people to work together to on a common goal
.... even if that conflicts with their own best interests?

