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Peer-to-peer network invites drivers to get connected

CarTorrent could smarten up our daily commute, reducing accidents and bringing multimedia journey data to our fingertips

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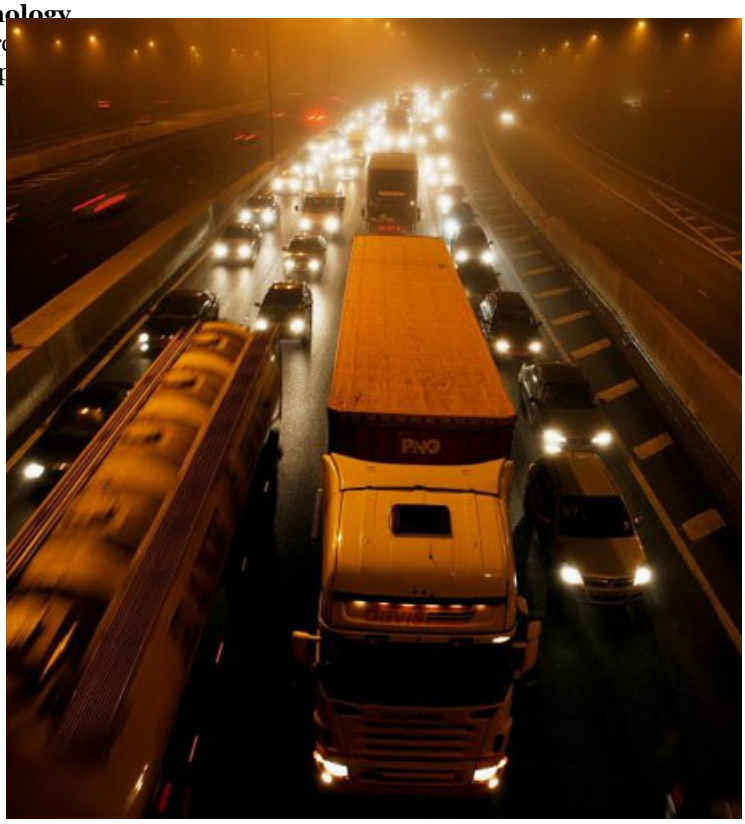

The name BitTorrent has become part of most people's day-to-day vernacular, synonymous with downloading every kind of content via the internet's peer-to-peer networks. But if a team of US researchers have their way, we may all be talking about CarTorrent in the not too distant future.

Researchers from the University of California Los Angeles are working on a wireless communication network that will allow cars to talk to each other, simultaneously downloading information in the shape of road safety warnings, entertainment content and navigational tools.

The UCLA Engineering's Network Research Lab team, led by Mario Gerla

and Giovanni Pau, hit upon the idea in 2004, when peer-to-peer networking took off fuelled by applications such as BitTorrent. "We had the idea from BitTorrent, and decided to extend BitTorrent to cars under the name of CarTorrent. One of our dreams had always been to apply the technology to civilian applications," says Gerla. "Imagine you're driving to a beach resort and want to find out what the best beaches are. You could stop at a gas station and download several video clips from an internet access point, but that's not very convenient."

Wireless at the wheel

Gerla and his team instead propose to connect cars to one another using the wireless networking platform they're developing, which could be up and running by as early as 2012.

The wireless network would allow moving vehicles within 100 metres and 300 metres of each other to connect and create a network with a wide range. The network would then allow drivers to download information from internet access points simply by driving by, and then share that information with other cars on the road.

Gerla says the benefits of such a network are numerous: "There will be immediate benefits in driving safety as well as in content distribution. Car-to-car communications can be used to avoid accidents by alerting the drivers of imminent danger. To prevent a crash we must act in fractions of a second. We are currently collaborating with vehicle manufacturers to help reduce accidents and fatalities on the road. For this latter application, vehicles are equipped with sensing devices, such as radars and video cameras."

The network uses standard radio protocols such as Digital Short Range Communication, or DSRC, combined with wireless LAN technology at 5.9GHz (not Wi-Fi's 2.4GHz) to create networks between vehicles equipped with onboard sensing devices. These devices can gather safety-related information as well as other complex multimedia data.

By far the most essential aspect of this network, though, is that it is not subject to memory, processing, storage and energy limitations like traditional sensor networks. Instead, it relies on the resources of the vehicle itself, along with those vehicles around it.

Under the scheme, cars would be able to use their onboard radios to exchange three categories of information: safe navigation (such as reporting on icy road conditions, traffic jams and possible collisions ahead), content distribution (locally relevant information, advertisements and videos of upcoming attractions) and urban surveillance (collecting information which could be used later by police for forensic investigations).

Gerla and his team are already collaborating with car manufacturers such as Toyota and BMW on bringing the project to life. However, costs and industry standards are the more important hurdles that this network will have to jump before it can become feasible. Gerla says the network can be slowly implemented, just as GPS navigation systems and Wi-Fi-style radios have slowly started to become standard equipment.

"What will turn the tide will be the approval and widespread adoption of the emerging standards for car-to-car communications sponsored by the IEEE 802.11p Working Committee of the IEEE [the professional association for the advancement of technology]," says Gerla.

"A few years ago, leading car manufacturers decided to join forces with national government agencies in the Vehicle Information Infrastructure Consortium, which works closely with the IEEE 802.11p Committee, to develop communications architecture to help drivers anticipate hazardous events or avoid bad traffic areas."

However, Gerla says the network is not without faults: "The two most critical aspects that could go wrong if the network is implemented are location privacy, because drivers do not want others to know where they are; and attacks where a driver could maliciously inject wrong traffic congestion information to persuade other drivers to get out of its way."

Defensive drivers

With costs currently estimated at around $500 (£255) per car for the implementation of the equipment required to connect to the network, drivers probably won't be clamouring to get the kit.

"Most likely, there will be at least initially two types of drivers," Gerla says. "The drivers enamoured with high-tech features will immediately embrace this technology. But it's true that less aggressive drivers, probably a sizeable fraction of the population, will be reluctant to embrace the technology at first."

That, of course, could present a problem for the growth of CarTorrent: for as anyone who has tried using BitTorrent will know, there's no point in being the only person on a peer-to-peer network. Being the first car to use CarTorrent will be an expensive and pointless exercise. But like a telephone - and the internet - it's the sort of technology whose benefits will multiply rapidly as long as more people use it.