Shockwave Traffic Jams A58

Results and lessons learned

This brochure discusses the key results and lessons learned from the Shockwave Traffic Jams A58 project, which started in early 2014 and ended in late 2016. The underlying documents, factsheets, evaluation reports and videos can be found at www.spookfiles.nl/kennisbank.

Shockwave Traffic Jams A58

Results and lessons learned

2014 - 2016

The harvest from three years of collaboration

About Shockwave Traffic Jams A58

From early 2014 through late 2016, thirty parties collaborated in the development, implementation and testing of a cooperative vehicle-roadside system, including a first service, in the project *Shockwave Traffic Jams A58*. In the process of realising this result, a wealth of experience was gained – about behaviour, data, security, organisation, and more. The cooperative system, the application and the lessons learned constitute a bountiful harvest from three years of Shockwave Traffic Jams A58.

In 2013, the Ministry of Infrastructure and the Environment, Rijkswaterstaat [1] and the Province of Noord-Brabant began with the initial market consultations for a new pilot project in the Province of Noord-Brabant: *Shockwave Traffic Jams A58*. [2] The objective of the project was the accelerated introduction of cooperative systems in the Netherlands. The means for achieving that objective was the development of a shockwave traffic jam service: an in-car service that – after upscaling – would prevent or reduce shockwave traffic jams. This approach is not only practical, but also relevant to accessibility and the quality of life. Shockwave traffic jams – the waves of congested traffic that materialise virtually out of thin air when traffic is heavy – are responsible for 22% of all traffic jams in the Netherlands. On the A58 motorway, this percentage is even 30-40%.

Filling in the details of a shockwave traffic jam service is a challenge in itself. The bar for Shockwave Traffic Jams A58 was raised particularly high, however, by requiring *cooperative technology*. In a cooperative system, vehicles and roadside systems are continually connected, via long-distance communication (3G/4G), but often also via short-distance communication (WiFi-P, for example). This enables them to exchange information and cooperate. The promise of cooperative technology had been on the horizon for quite some time, but real applications had not yet been developed. The Shockwave Traffic Jams A58 project was to change all that.

[1] The organisation responsible for the design, construction, management and maintenance of the main infrastructure facilities in the Netherlands.

[2] The Shockwave Traffic Jams A58 project was a sequel to Brabant In-car I, II and III. It is part of the Beter Benutten (Optimising Use) programme, in which the government, regions and businesses work together to improve accessibility in the busiest regions in the Netherlands.

The project

The market consultations yielded positive results. In early 2014, eleven consortia – representing 27 market partners and knowledge institutions – set to work in collaboration with the Province, the Ministry and Rijkswaterstaat. It was agreed that the market partners would take the lead. This allowed all parties involved to gain valuable experience with a possible new division of roles between the market and the authorities.

The project was divided into three phases, with all of the consortia participating in phase 1 and some in phases 2 and 3, on the basis of a transparent selection procedure.

During the first phase, the participating parties collectively determined the architecture and specifications of the cooperative vehicle-roadside system. Special attention was devoted to the viability of the system: how could it be set up in such a way that the system would be easy to roll out and expand, *and* commercially attractive? In phase 2, seven consortia built a prototype of the cooperative system. Finally, in phase three, two consortia of six businesses delivered a shockwave traffic jam service and conducted field tests, with the 17-kilometer section of the A58 motorway between Eindhoven and Tilburg as the testing ground. The resulting system and service were tested using long-distance communication (3G/4G) and with "cooperative" roadside-vehicle communication via WiFi-P. For this testing, the A58 testing ground was equipped with 34 WiFi-P beacons.

The results

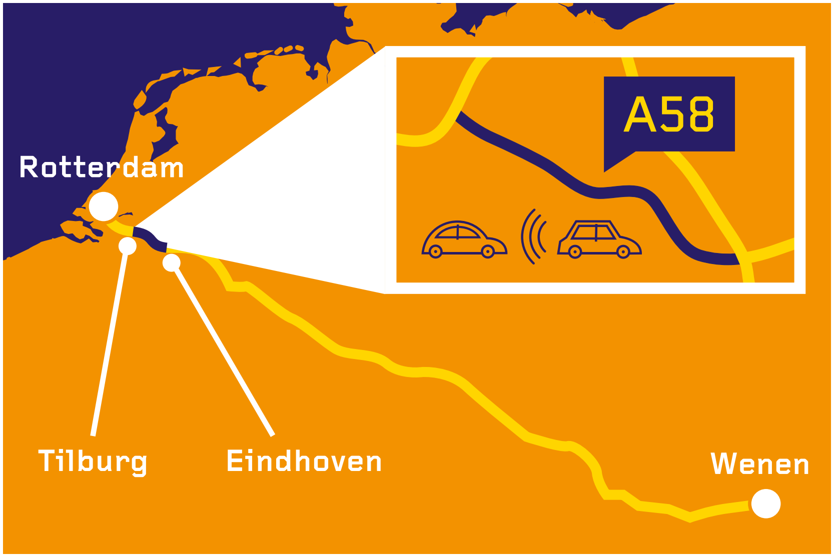
Shockwave Traffic Jams A58 was concluded in late 2016. The tests have demonstrated that the system as delivered works and that the shockwave traffic jam service does offer the potential of reducing shockwave traffic jams. Equally relevant, however, is the fact that the system can be scaled up, continued and transferred, and has also proven to be "privacy-proof". This is because, thanks to its smart architecture, the Shockwave Traffic Jams A58 system ended up being not a bespoke system that can only prove its worth on the A58, but an *open* and *generic* system that can be easily expanded both geographically (suitable for other regions) and functionally (suitable for other services).

However, this does not mean that cooperative technology will be available throughout the Netherlands as early as tomorrow. Development will continue in, for example, the public-private Talking Traffic Partnership, in order to strengthen the ties between roadside and vehicles. It is nevertheless clear that, thanks to Shockwave Traffic Jams A58, the Dutch business sector has gained a wealth of knowledge and experience.

Importance

The importance of these cooperative steps forward should not be underestimated. People are increasingly connected online. Together with developments in the telecommunications and automotive industries, this offers huge opportunities to improve our traffic system. Talking Traffic – technologies enabling the real-time exchange of information between road users and traffic systems – plays a key role in that regard. It allows people and goods to travel faster and safer, with improved comfort, efficiency and sustainability.

Before this solution can be put into practice, the authorities and the market still have much technical and organisational work to do. Thanks to Shockwave Traffic Jams A58, a solid foundation has been created that we can build on, bringing Talking Traffic closer than ever.



Results and lessons learned

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Shockwave Traffic Jams A58

30 participating parties

3 years of knowledge and experience

120 project staff members

150,000 hours of work and research

Investments totalling **15 mln** euros

17 kilometres of testing ground

34 roadside beacons

1 cooperative roadside-vehicle system

in figures

99% uptime of the cooperative system

2 shockwave traffic jam services

More than **5,500** app downloads

A peak of **600** active users on a single day

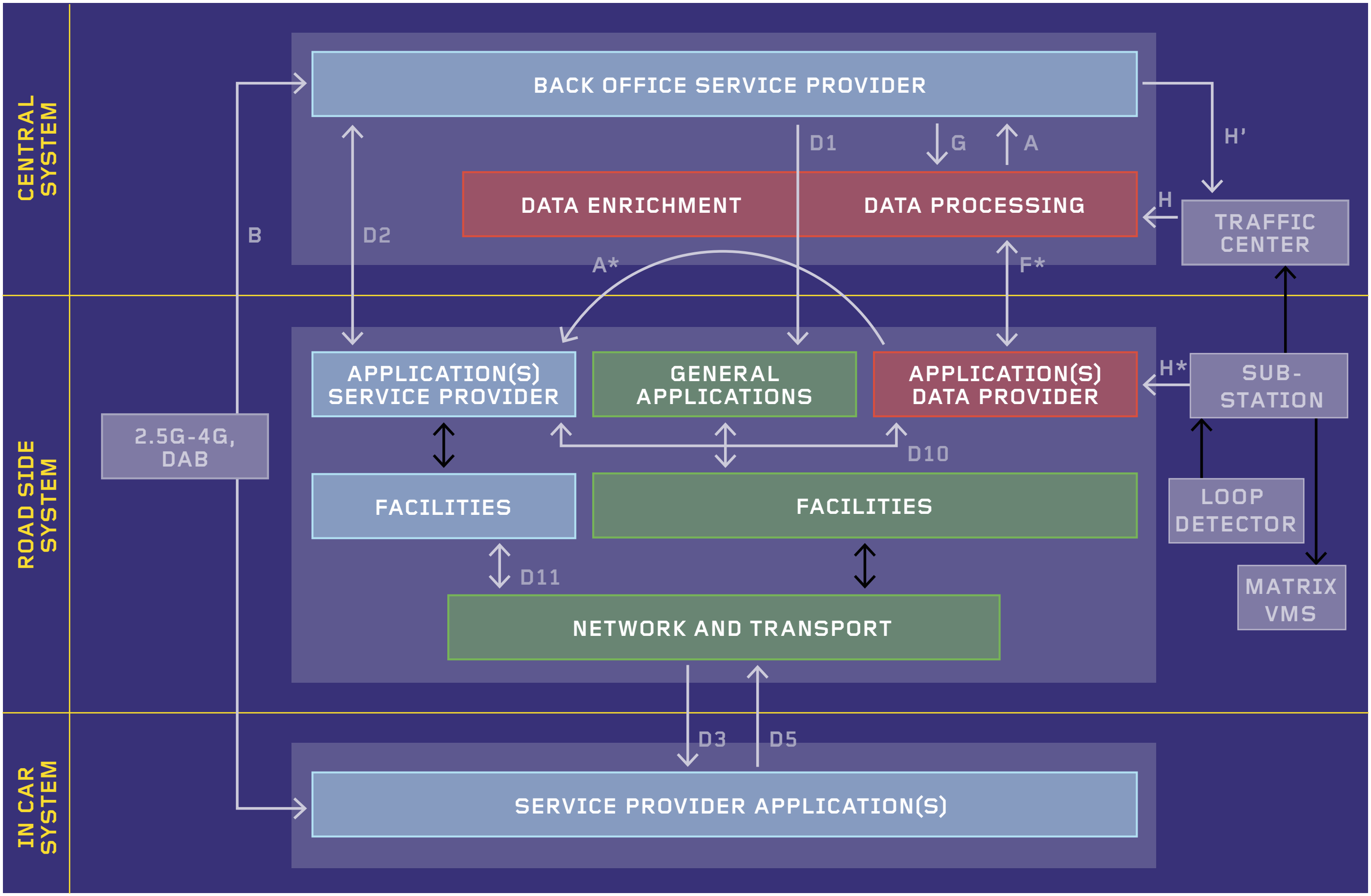
100,000 test trips logged

A compliance percentage of **40%**

1600 completed questionnaires


310
SAMSUNG
Hallo Ingeborg
Waar gaat je rit naartoe?
Voer hier je bestemming in
AUTO
VRACHTWAGEN
BUS
Kies je bestemming
HOME
TRIP
SHOP
PROFIEL

The architecture of the cooperative system



The architecture of the cooperative system from Shockwave Traffic Jams A58, with a schematic diagram of the subsystems (components) and interfaces. The colours indicate which provider is at work: the data provider (red), the service provider (blue), or the communications provider (green). Each role can be played by different parties, which can collaborate and compete.

A new method for innovation-oriented cooperation

Thirty parties contributed to Shockwave Traffic Jams A58, ranging from small- and medium-sized enterprises to multinational corporations, and from universities to the government. To enable optimum use of the know-how and innovative force of such a diverse group, a new method of cooperation was tried and tested.

The challenge

From the onset, the ambitions of the Shockwave Traffic Jams A58 project were high: developing a cooperative system and laying the foundations for a cooperative services market. Its success was dependent on the help and support from a broad cross-section of the field. For Shockwave Traffic Jams A58, that cross-section comprised eleven consortia involving thirty market partners and knowledge institutions. The Ministry of

Infrastructure and the Environment, Rijkswaterstaat and the Province of Noord-Brabant were also involved. The question, however, was how to facilitate optimum use of the know-how and innovative force of such a diverse group.

The solution

If one is to utilise the ideas and innovative force of all of the parties, they must all be given free rein. During the essential first phase of the project, the initiative and responsibility were therefore assigned to the *joint consultation*. In that consultation, the project partners shared their expectations, needs and ideas. These were primarily voiced from the perspective of their own position and expertise: road manager, system developer, service provider, etc. After these exploratory talks, but still across the entire spectrum, the project partners fleshed out the *architecture* and *specifications* of the cooperative system. This solid foundation was the "product" of phase 1. In phases 2 and 3, working this out into (sub)systems and a first service was awarded to some of the partners on the basis of a transparent selection procedure.

Results and lessons learned

By involving all of the partners in the development of the architecture and specifications, this phase-1 "product" was automatically widely supported.

The thirty partners also included competitors, who could nevertheless openly consult and cooperate in the first phase because no effort was being devoted to specific products at that time.

Thanks to this collective consultation, mutual understanding grew: between the public and private sectors, between data and service providers, between system and app builders, etc. The partners learned to understand and recognise one another's desires and specific challenges. They also learned quite a bit from one another.

In phase 1, good results were achieved in a short period of time. Because all of the partners were involved, the architecture and specifications delivered had no gaps or major shortcomings, avoiding costly start-overs in later phases.

With the selections performed at the thresholds to phases 2 and 3, expenditures were limited because only the best (most cost-effective) proposals were approved. But this did not in any way detract from the collective nature of the ultimate system, which was built in accordance with the architecture and specifications determined collectively.

Travelling the route of "involving all of the partners" is time consuming. In any event, strict arrangements must be agreed regarding when and how to consult in order to keep the time involved in consultation reasonable.

Healthy competition and standardisation as the foundation for a cooperative business case

Getting a cooperative system to technically work is one thing. Building a cooperative system that also works commercially is something else. With a few smart modifications to the system design, Shockwave Traffic Jams A58 succeeded in creating a basis for viable business cases.

The challenge

In-car information, advice and assistance for road users is already in the market domain. Moreover, a transition is taking place that is also shifting the more traditional "road management tasks" to the market. One of the key premises of Shockwave Traffic Jams A58, therefore, was that the cooperative system to be delivered had to be *commercially viable*.

The solution

When developing the cooperative system, the Shockwave Traffic Jams A58 partners divided the system into logical components to be connected physically (fibre optic) or wirelessly (WiFi-P or cellular) by means of interfaces. Both the components and the interfaces are in accordance with European standards. This means that the components are interoperable and always exchangeable, and can be supplied by various parties, as

long as they meet the standard. Incidentally, an appropriate standard was not available for all of the interfaces. These gaps were filled with new standards or with protocols based on existing standards.
In addition to this more technical division, a functional division was made that was oriented towards operation. The roles of data provider, communications provider and service provider were chosen for Shockwave Traffic Jams A58. These providers are not necessarily the builders of the components themselves; they primarily focus on developing and offering applications. The cooperative system can house applications from various providers.

Results and lessons learned

Thanks to the division into components, a supplier is not required to provide a complete system: each party can concentrate on a single component. This makes building and rolling out cooperative technology an appealing field for a wide range of specialised companies, both large and small.

The division also facilitates technological innovation. If a new communications technology emerges, this will only affect the component that provides the communication.

Various new standards and protocols were developed based on existing standards – the existing set of (European) cooperative standards proved insufficient. These new "Shockwave Traffic Jams A58" standards have been tested in practice and are available to other parties. However, finding the appropriate national and international platforms to formally propose new standards is a point of concern.

In terms of operation, market partners may assume and concentrate on different roles. Service providers do not need to process their own data, implement their own roadside systems, or install antennae. Rather, they can add cooperative services, like apps, to the cooperative system, with the applications utilising the generic services provided by the components.

Thanks to the open approach, the roles can be played by multiple, competing parties, for example by multiple data providers – each with its own sources and enrichment methods – and multiple service providers, which provide services to road users.

Compliance with international standards offers both the hardware suppliers and the app developers economies of scale: the systems or subsystems and applications delivered are also used in other national or European projects.

An open architecture with broad support makes it easy and predictable for other parties to join in and/or utilise technologies and services.

The first large-scale cooperative vehicle-roadside system

Shockwave Traffic Jams A58 built the Netherlands' first cooperative vehicle-roadside system on the A58 between the cities of Eindhoven and Tilburg. A remarkable achievement in international terms, as well: never before has a cooperative system gone live on a public road on this scale.

The challenge

The 17-km section of the A58 motorway between Eindhoven and Tilburg was designated as the practical testing ground. Never before had a cooperative vehicle-roadside system been built on this scale, let alone tested in practice, in the Netherlands. The additional challenge was to prove the promises made only on paper to date – accessible to all and in accordance with international standards, suitable for multiple providers and multiple applications – in actual practice.

The solution

Based on the architecture and specifications, six consortia built prototypes of the key components of the cooperative system. These were then assembled to create a single, working system, which was tested using the existing 3G and 4G communications technologies. Parallel with these first trials with services based on cellular technology, 34 WiFi-P beacons for extremely rapid short-distance communication with vehicles were installed along the A58 test section. A first cooperative service was tested: the shockwave traffic jam service. In addition, using the Road Works Warning, Probe Vehicle Data and other services, the parties validated the ease with which third-party applications can be implemented.

Results and lessons learned

It has been demonstrated that cooperative technology works. The system as a whole had an uptime of 99%.

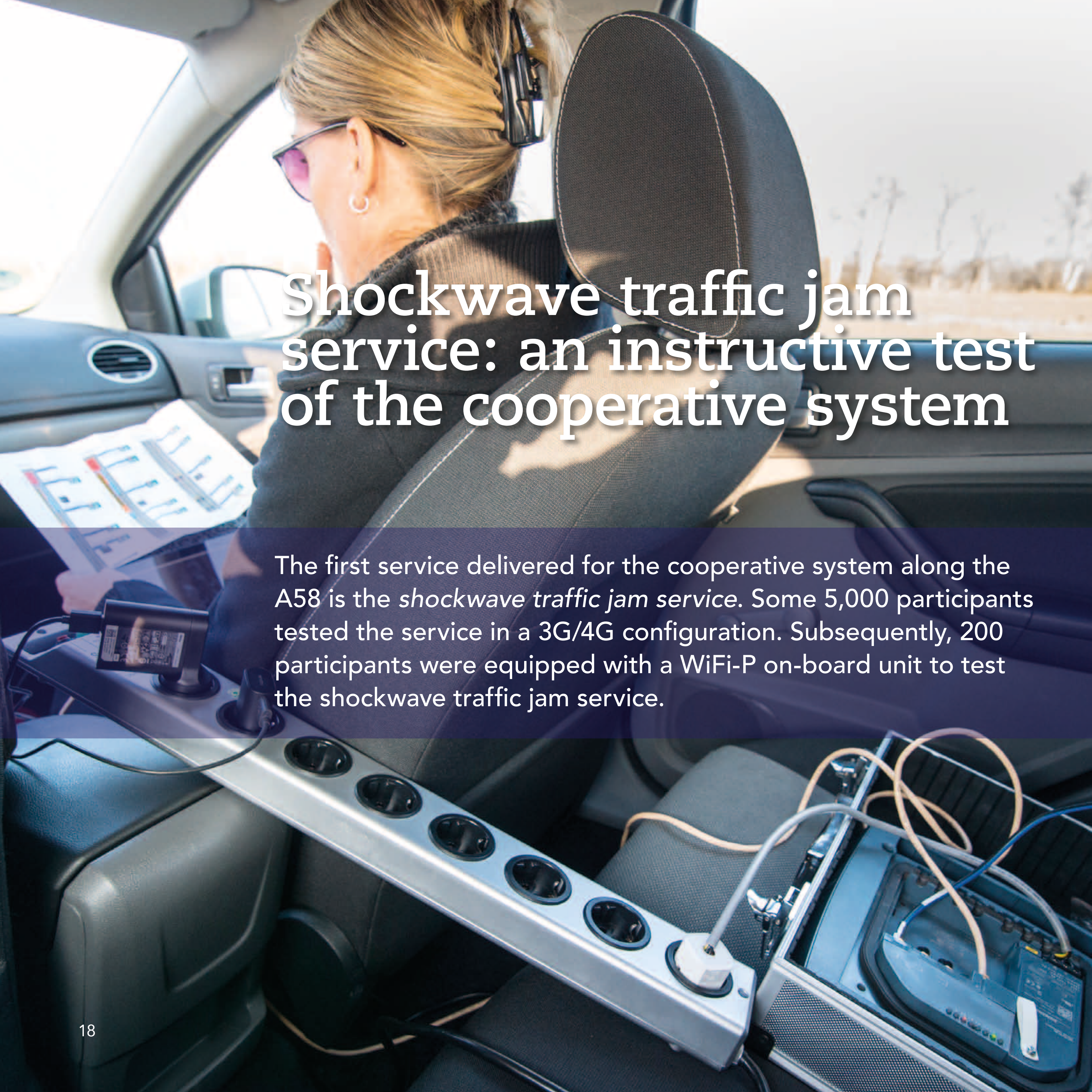
Running a pre-deployment project with technology that is not yet fully developed seriously challenges the process and the organisation. For example, only prototypes were available of some of the chips, and by far not all of the software was compatible. That required a considerable amount of improvisation.

The elected approach – open, in accordance with European standards, directed towards commercialisation – works. The technology has now proven its suitability for (commercial) roll-out, both in the Netherlands and elsewhere.

It has been demonstrated that new applications can be easily implemented into the system delivered. For example, only two weeks were needed to implement the Road Works Warning service – developed within the European project Cooperative ITS Corridor – into the cooperative system.

Road managers and market partners gained valuable experience with building and rolling out both hardware (the system, vehicle equipment, WiFi-P beacons) and software (the applications).

Because prototypes were used of roadside beacons and on-board units, combined with strict data security using PKI, the maximum number of transmissions that the system could process was limited. This caused no problems within the small-scale project environment. This is a point requiring further investigation upon large-scale roll-out.



Shockwave traffic jam service: an instructive test of the cooperative system

The first service delivered for the cooperative system along the A58 is the *shockwave traffic jam service*. Some 5,000 participants tested the service in a 3G/4G configuration. Subsequently, 200 participants were equipped with a WiFi-P on-board unit to test the shockwave traffic jam service.

The challenge

The shockwave traffic jam service warns users in good time about traffic jams ahead, showing tailored speed advice that enables users to calmly approach the traffic jam and to get through it more smoothly. This made the service an appropriate and especially instructive test for the Shockwave Traffic Jams A58 system: could the right message be displayed to the right test driver at the right time?

The solution

Two consortia developed shockwave traffic jam services: ZOOF and FlowPatrol. Their functionality and interaction with road users were tested at an early stage in the 3G/4G variant: some 5,000 participants downloaded a smartphone app that retrieved advice and warnings from the back office using 3G and 4G technology. However, starting in April 2016, 200 participants were also equipped with a WiFi-P on-board unit. This unit rapidly receives the advice using the roadside systems, and also feeds back valuable information such as location and speed.
Various data sources were used for both the 3G/4G and the WiFi-P advice. In order to transmit communications in good time, the A58 traffic data obtained by means of detection loops were extracted particularly rapidly. Rijkswaterstaat also shared the dynamic maximum speeds that it communicates via the variable message signs, thus preventing the shockwave traffic jam service from advising a speed higher than the speed displayed on the variable message signs.

Results and lessons learned

It has been proven that 3G/4G- and WiFi-P-based services can be provided with the system delivered.

The fact that two apps ran in tandem without difficulty during the pilot demonstrates that the cooperative system is ready for applications from multiple data and service providers.

In technical terms, the entire process, from collecting data to displaying communications, runs without error. The log data show that the communications were distributed in a manner that is geographically correct: if a communication was intended for a certain part of the A58, that is also where it was displayed on screen. Attention must continue to be devoted to latency, however. Some of the users surveyed indicated that the traffic jam warnings were sometimes displayed too late. Much time was won during the project, but reducing latency in the chain will continue to demand attention when it comes to time-critical services.

Valuable experience has been gained in the area of recruiting pilot-project participants. An important lesson learned: only communicate what you can actually deliver. Another lesson is that a single service that is not integrated into other systems and that only works in a small geographic area will produce only a limited number of pilot participants, no matter the intensity of the recruitment efforts.

Data security and privacy raised to a higher level

Wherever data are exchanged, the challenge of data security and privacy is involved. Shockwave Traffic Jams A58 was the first in Europe to implement the prescribed data security measures for WiFi-P – and immediately raised them to a higher level.

The challenge

When users of a cooperative service receive advice or a warning on their display, they must be able to trust that the communication does, in fact, come from their trusted service provider. Conversely, data providers must be able to trust that the communications (data) generated by vehicles with a WiFi-P on-board unit have not been manipulated.
And then there is the challenge of protecting privacy. How, for example, can third parties be prevented from using the communication from the vehicles with a WiFi-P on-board unit to follow those vehicles?

The solution

The European WiFi-P technology standards prescribe a *public key infrastructure* (PKI), an approach in which devices "sign" their transmissions with a digital signature. In itself, PKI is a known technology, but in transport and traffic circles this approach is scarcely used in combination with WiFi-P. Shockwave Traffic Jams A58 was the first in Europe to implement this technology in the WiFi-P environment. A few "blanks" were filled in while doing so. For example, the standard does not prescribe how the necessary certificates are to be generated and distributed. Shockwave Traffic Jams A58 built a tool for this purpose, and specified and documented the work process.
In terms of privacy protection, the cooperative system is prepared for a safe roll-out. This is because the system has been structured such that the ID sent by a vehicle's WiFi-P unit with its transmissions can be refreshed every few minutes. This makes following specific vehicles practically impossible.

Results and lessons learned

The European standard for the data protection of a system based on WiFi-P has now been applied and validated for the first time.

The "gaps" in the paper PKI regulations were identified and filled with tools and work processes.

Primarily market partners have PKI expertise. Thanks to Shockwave Traffic Jams A58, road managers have also gained experience with the technology and have used it in projects such as C-ITS Corridor.

As a "component" of the WiFi-P-based system, the PKI solution delivered is suitable for upscaling.

Solutions were also found in the area of privacy protection. The system was tested technically and functionally in terms of the frequent exchange of the ID (= the MAC address) of the WiFi-P-based vehicle systems.

Adding PKI is necessary, but also imposes an additional burden on the system: communications traffic increases significantly.

Proven: in-car speed advice influences driving behaviour

With the cooperative technology, in-car services can be realised that smartly supplement and support traffic management measures. The tests in Shockwave Traffic Jams A58 show, for example, that in-car speed advice actually influences driving behaviour.

The challenge

The shockwave traffic jam service developed within the context of Shockwave Traffic Jams A58 is a typical traffic management service. An advantage of the shockwave traffic jam service is that the warning or advice is not bound to fixed locations, as is the case with variable message signs. A possible disadvantage is that on-screen advice in the car has no legal status, unlike a communication on a variable message sign, and is therefore experienced as being “free of obligation”.

The solution

In order to draw conclusions about the effect of in-car messages, all relevant information about the driving behaviour of the 5,000 users of the 3G/4G shockwave traffic jam service and the 200 test drivers using the WiFi-P variant had to be logged and evaluated. Several hundred participants were also surveyed.

It was clear in advance that the pilot as such would not produce any measurable macro effects. After all, the number of participants was relatively small, and not all of those participants travelled on the A58 at the same time, meaning that the mass would readily be insufficient to influence the flow of traffic as a whole. The objective of the project, therefore, was to demonstrate that upscaling makes it possible to tackle shockwave traffic jams. Effects *were* observed on the micro and meso levels. An analysis of the traffic data showed that 40% of the recommendations to adjust speed were complied with. This also affected the immediate surroundings: a slightly favourable effect was observed on the meso level.

Also interesting was that two shockwave traffic jam services were tested, ZOOF and FlowPatrol, each with its own approach, its own algorithms (when to transmit which advice) and its own user interface. The users of the two apps showed different compliance behaviour. This fact in itself shows that in-car communication affects driving behaviour: otherwise, no difference would have been observed between the two services.

Results and lessons learned

When many road users with in-car speed advice are travelling on a section of road, they approach the traffic jam more calmly.

A large share of the participants complied with the in-car speed advice: one-third to more than half, depending on the type of advice (slow down, speed up) and the service (ZOOF or FlowPatrol).

It is methodically complicated to isolate compliance behaviour from the environmental factors.

The participants' compliance behaviour influences the behaviour of fellow road users around them: small effects were measured on the meso level.

Experience was gained with the right method of providing advice. It was learned, for example, that participants do not like to slow down when the traffic around them is travelling at a higher speed. The algorithm was therefore adjusted based on the participants' responses: the advice now deviates from the flow of traffic by a maximum of 40 km/hour. Experiments were also conducted with context information. For example, one of the parties displayed a bar in the screen with colours indicating the location of the traffic jams in relation to the vehicle.

Smart arrangements for a complex organisation

Building and maintaining a complex product such as the cooperative system requires due care. This is why Shockwave Traffic Jams A58 set up an organisational structure to safely deliver, expand and update the system.

The challenge

The cooperative system consists of various components from various suppliers. This offers benefits for both the government and the market, but also makes the building and management of the system a major challenge. Because how can the individual components be assembled into a single, functional whole?

The solution

The following building and management organisation was built and tested for Shockwave Traffic Jams A58.

During the *building phase*, a group of experts ensures that the various suppliers precisely comply with the architecture and specifications defined collectively. The expert group also determi-

nes the product deadlines. Once a supplier has finished its (sub)product, it first tests the product based on pre-determined test protocols. Next collective testing is conducted, in particular to determine whether the various subsystems work together as intended. After the expert group's approval, the system is ready to go live.
Then comes *management*. When a problem occurs, the "identifying party" first attempts to resolve the problem by itself (if it caused the problem) or bilaterally (with the party that caused the problem). If no rapid result is achieved, the Change Control Board – a team comprising representatives of all parties involved – is engaged. The Board determines the party responsible and the impact of the repairs needed. Minor changes are dealt with by the relevant supplier. With larger modifications, the Board assigns the responsibilities, and the suppliers involved follow the procedure from the building phase.

Results and lessons learned

The approach for the smart organisation of the building and management process was validated in actual practice.

The test protocols determined collectively proved to be extremely useful. Based on the tests, it was determined not only whether a product even worked, but also how it functioned under pressure. For all parts of the system, the factors influencing their performance and the relevant risks were identified. The tests were set up on that basis.

In the tests, the Traffic Innovation Centre (*Innovatiecentrale*) – an experimental and development area within the South Netherlands traffic centre – played a major role. This was the coordination point for conducting controlled and supervised testing on the public road.

To monitor the status of the handling of an issue or an update, the parties used a central (open-source) ticketing system. This system can be used to report, assign and monitor an issue.

The team of experts and the Change Control Board do not appear to be the appropriate party for *monitoring* or *driving* the arrangements agreed for building and management (deadline, responsibilities, etc.). During the project, this role was assumed by two project supervisors. When the system is rolled out and actually put into operation, an issue manager may be appointed.

The elected approach makes it easy to increase the scale of the cooperative system. Whether this involves geographic (roll-out) or functional expansion (new services), the changes can be implemented transparently and safely.

Continuity in the project's staff is important.

Rapid and raw traffic data made available

For cooperative services, it is important for traffic data to be rapidly available. In collaboration with Rijkswaterstaat, the Shockwave Traffic Jams A58 data providers made their “data flows” even more efficient for that reason. The data providers were even given access to the raw data from the loop detectors.

The challenge

The strength of the cooperative system primarily lies in the rapid communication between roadside systems and vehicle systems. But in order to utilise this in a useful manner, the *traffic data* must also be rapidly available. Take the shockwave traffic jam service, for example: the more quickly the traffic data are available, the more quickly a shockwave traffic jam can be detected and targeted advice can be transmitted.

The solution

Shockwave Traffic Jams A58 embroidered upon the results achieved in the Amsterdam Practical Trial. The services *Meetraaimanager* and *Matrixsignaalinformatie* (Variable Message Information) were delivered in that project. The first service provides per-minute averages of traffic speed and intensity (based on data from loop detectors); the second service shows the speed displayed on variable message signs. That information was already available, but the new services made it accessible more quickly than usual. The data flows were further optimised in Shockwave Traffic Jams A58. The result of the efforts made in the Amsterdam Practical Trial and Shockwave Traffic Jams A58 is that the vehicle speeds (per-minute averages) are now transmitted in ten seconds instead of four minutes. The speeds displayed on the variable message signs are available within four seconds. The latency has therefore been reduced significantly.

However, another step was taken in Shockwave Traffic Jams A58: Rijkswaterstaat made the *raw* data from the loop detectors available to the data providers. The relevant latency is virtually nil. The raw data furthermore provide information about the speeds of individual vehicles, and thus about the speed spread (for each lane).

Results and lessons learned

Following the roll-out of the Meetraaimanager to the A58, it was decided in the Beter Benutten (Optimising Use) programme to have the “rapid per-minute data” made available throughout the country via the National Data Warehouse for Traffic Information, NDW.

The raw loop data, when applied properly, provide a highly accurate picture of the situation on the road, and therefore supplement and validate the data obtained from vehicles well. As long as the penetration of cooperative vehicles is modest, these data are a key supplement that make smart and rapid services possible.

Non-cooperative services also benefit from the rapid data.

The cooperative data need improvement if they are to generate the right speed advice under all circumstances.

Experience with a new division of roles between market and government

In the Shockwave Traffic Jams A58 project, the market partners were allowed to play a large role in respect of the technological substance. The government set the relevant social frameworks in areas including safety and accessibility, while assuming the role of initiator and facilitator in particular.

The challenge

"From direction by the government to public-private partnerships and alliances". This is one of the transitions that road managers expect to be facing in the years to come. The exact form of this interaction between authorities and market partners, however, remains to be seen. Experience needs to be gained while working towards a feasible mode.

The solution

In order to explore the limits of the new division of roles, the initiative was assigned in full to the (private) partners in the Shockwave Traffic Jams A58 project. The market was given the lead, developing its own systems and retaining ownership of those systems. Rijkswaterstaat limited its role to facilitator, making it possible, for example, to install the 34 beacons and roadside systems along the side of the road and to house a central system in the traffic control centre.
The Province of Noord-Brabant was the party responsible for process guidance.
This took some getting used to on both sides: for example, what can and may the government facilitate? Importantly, improved insight has been gained into the issues involved when authorities play a smaller role. For example: if market partners are facilitated in placing equipment above roads and on roadsides (as occurred within the project), what requirements should be imposed? What about management and maintenance? Who is responsible if something goes wrong? What about the continuity of a service or a technology when market partners take the initiative? Is a model imaginable in which the government owns and bears responsibility for the "cooperative infrastructure"? Etcetera.

Results and lessons learned

It has been demonstrated that success is not dependent on authorities assuming their traditional role as principal. It even seems that giving the market more leeway is beneficial to innovation. The (large and diverse) market has more innovative strength than the government – and that strength truly comes into its own in the new division of roles.

Improved insight has been gained into the issues involved in the transition towards different roles for the government and the market: the rules of play, management, responsibility, continuity, etc.

Road managers and businesses had to progress through a (lengthy) acclimatisation process to learn to understand each other's language and culture, and to align expectations. This requires targeted attention and effort.

A larger role and more responsibility for the market does not obstruct the government in its role as road manager: the government can adequately perform its tasks in respect of safety and flow. Collaborating as equals provides both parties with an abundance of reciprocal knowledge and insight.

Shockwave Traffic Jams A58 project partners:

Andes
Beijer (Automotive)
Be-Mobile
Cygnify
Dynniq
Fantazm
Fourtress
Get Hooked
Goudappel
Innovactory
Locatienet
Ministry of Infrastructure and the Environment
NXP
Organiq
Prime Data/Vision
Province of Noord-Brabant
Rijkswaterstaat
Siemens
Simacan
Sioux
Spring Innovation
Tass
Technolution
TNO
TomTom
Traxpert
Delft University of Technology
Eindhoven University of Technology
Vialis
V-Tron

Shockwave Traffic Jams A58

March 2017

Provincie Noord-Brabant

Ministerie van Infrastructuur en Milieu